STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION

ADDENDUM NO. 2
FOR
HAWAII BELT ROAD
NANUE STREAM BRIDGE REHABILITATION
VICINITY OF HILO
DISTRICT OF HILO, ISLAND OF HAWAII
FEDERAL-AID PROJECT NO. BR-019-2(077)

December 13, 2024

This Addendum shall make the following amendment(s) to the Solicitations.

A. TABLE OF CONTENTS

1. Delete **TABLE OF CONTENTS** in its entirety and replace with attached **TABLE OF CONTENTS** dated r12/13/24.

B. SPECIAL PROVISIONS

1. Delete **SECTION 501 STEEL STRUCTURES** dated 10/31/24, in its entirety, and replace with attached **SECTION 501 STEEL STRUCTURES** dated r12/13/24.

2. Delete **SECTION 627 MANAGEMENT OF CONTAMINATED MATERIALS** dated 10/31/24, in its entirety, and replace with attached **SECTION 627 MANAGEMENT OF CONTAMINATED MATERIALS** dated r12/13/24.

3. Delete **SECTION 666 BLAST, CLEAN, AND PAINT EXISTING BRIDGE STEEL** dated 10/31/24, in its entirety, and replace with attached **SECTION 666 BLAST, CLEAN, AND PAINT EXISTING BRIDGE STEEL** dated r12/13/24.

4. Delete **SECTION 667 PREPARATION AND COATING OF GALVANIZED BRIDGE STEEL** dated 10/31/24, in its entirety, and replace with attached **SECTION 667 PREPARATION AND COATING OF GALVANIZED BRIDGE STEEL** dated r12/13/24.

5. Delete **SECTION 677 PENETRATING SEALER FOR BRIDGE DECKS** dated 10/31/24, in its entirety, and replace with attached **SECTION 677 PENETRATING SEALER FOR BRIDGE DECKS** dated r12/13/24.

6. Delete **SECTION 678 HYBRID POLYMER CONCRETE (HPC)** dated 10/31/24, in its entirety, and replace with attached **SECTION 678 HYBRID POLYMER CONCRETE (HPC)** dated r12/13/24.

C. PLANS

1. Delete **PLANS SHEET NO. 30 INDEX TO STRUCTURAL DRAWINGS** and replace it with the attached **PLANS SHEET NO. ADD. 30 INDEX TO STRUCTURAL DRAWINGS**.
2. Delete **PLANS SHEET NO. 34 STRUCTURAL GENERAL NOTES** and replace it with the attached **PLANS SHEET NO. ADD. 34 STRUCTURAL GENERAL NOTES**.
3. Delete **PLANS SHEET NO. 51 ABUTMENT NO. 2 ABUTMENT SECTIONS** and replace it with the attached **PLANS SHEET NO. ADD. 51 ABUTMENT NO. 2 ABUTMENT SECTIONS**.
4. Delete **PLANS SHEET NO. 55 BENT NO.1/TRESTLE NO. 1 MEMBER ELEVATIONS** and replace it with the attached **PLANS SHEET NO. ADD. 55 BENT NO.1/TRESTLE NO. 1 MEMBER ELEVATIONS**.
5. Delete **PLANS SHEET NO. 56 BENT NO.2/TRESTLE NO. 2 MEMBER ELEVATIONS** and replace it with the attached **PLANS SHEET NO. ADD. 56 BENT NO.2/TRESTLE NO. 2 MEMBER ELEVATIONS**.
6. Delete **PLANS SHEET NO. 85 DIAGONAL BRACE SCHEDULE** and replace it with the attached **PLANS SHEET NO. ADD. 85 DIAGONAL BRACE SCHEDULE**.
7. Delete **PLANS SHEET NO. 86 DIAGONAL BRACE SCHEDULE** and replace it with the attached **PLANS SHEET NO. ADD. 86 DIAGONAL BRACE SCHEDULE**.
8. Delete **PLANS SHEET NO. 88 DIAGONAL BRACE SCHEDULE** and replace it with the attached **PLANS SHEET NO. ADD. 88 DIAGONAL BRACE SCHEDULE**.
9. Delete **PLANS SHEET NO. 91 HORIZONTAL BRACE PLAN, ELEVATION AND SECTION** and replace it with the attached **PLANS SHEET NO. ADD. 91 HORIZONTAL BRACE PLAN, ELEVATION AND SECTION**.
10. Delete **PLANS SHEET NO. 92 HORIZONTAL BRACE SCHEDULE** and replace it with the attached **PLANS SHEET NO. ADD. 92 HORIZONTAL BRACE SCHEDULE.**
11. Delete **PLANS SHEET NO. 94 HORIZONTAL BRACE SCHEDULE** and replace it with the attached **PLANS SHEET NO. ADD. 94 HORIZONTAL BRACE SCHEDULE.**
12. Delete **PLANS SHEET NO. 99 DIAGONAL BRACE SCHEDULE** and replace it with the attached **PLANS SHEET NO. ADD. 99 DIAGONAL BRACE**

SCHEDULE.

13. Delete **PLANS SHEET NO. 108 COLUMN TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 108 COLUMN TO BRACE CONNECTION DETAILS.**

14. Delete **PLANS SHEET NO. 109 COLUMN TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 109 COLUMN TO BRACE CONNECTION DETAILS.**

15. Delete **PLANS SHEET NO. 110 COLUMN TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 110 COLUMN TO BRACE CONNECTION DETAILS.**

16. Delete **PLANS SHEET NO. 111 COLUMN TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 111 COLUMN TO BRACE CONNECTION DETAILS.**

17. Delete **PLANS SHEET NO. 112 COLUMN TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 112 COLUMN TO BRACE CONNECTION DETAILS.**

18. Delete **PLANS SHEET NO. 113 COLUMN TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 113 COLUMN TO BRACE CONNECTION DETAILS.**

19. Delete **PLANS SHEET NO. 114 COLUMN TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 114 COLUMN TO BRACE CONNECTION DETAILS.**

20. Delete **PLANS SHEET NO. 115 COLUMN TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 115 COLUMN TO BRACE CONNECTION DETAILS.**

21. Delete **PLANS SHEET NO. 116 BASE COLUMN TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 116 BASE COLUMN TO BRACE CONNECTION DETAILS.**

22. Delete **PLANS SHEET NO. 117 BASE COLUMN TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 117 BASE COLUMN TO BRACE CONNECTION DETAILS.**

23. Delete **PLANS SHEET NO. 118 BASE COLUMN TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 118 BASE COLUMN TO BRACE CONNECTION DETAILS.**

24. Delete **PLANS SHEET NO. 119 BASE COLUMN TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 119 BASE**

COLUMN TO BRACE CONNECTION DETAILS.

25. Delete **PLANS SHEET NO. 120 TOP COLUMN TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 120 TOP COLUMN TO BRACE CONNECTION DETAILS.**

26. Delete **PLANS SHEET NO. 121 BRACE TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 121 BRACE TO BRACE CONNECTION DETAILS.**

27. Delete **PLANS SHEET NO. 122 BRACE TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 122 BRACE TO BRACE CONNECTION DETAILS.**

28. Delete **PLANS SHEET NO. 123 BRACE TO BRACE CONNECTION DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 123 BRACE TO BRACE CONNECTION DETAILS.**

29. Delete **PLANS SHEET NO. 124 CONNECTION REFERENCE SCHEDULE** and replace it with the attached **PLANS SHEET NO. ADD. 124 CONNECTION REFERENCE SCHEDULE.**

30. Delete **PLANS SHEET NO. 125 CONNECTION REFERENCE SCHEDULE** and replace it with the attached **PLANS SHEET NO. ADD. 125 CONNECTION REFERENCE SCHEDULE.**

31. Delete **PLANS SHEET NO. 126 CONNECTION REFERENCE SCHEDULE** and replace it with the attached **PLANS SHEET NO. ADD. 126 CONNECTION REFERENCE SCHEDULE.**

32. Delete **PLANS SHEET NO. 127 CONNECTION REFERENCE SCHEDULE** and replace it with the attached **PLANS SHEET NO. ADD. 127 CONNECTION REFERENCE SCHEDULE.**

33. Delete **PLANS SHEET NO. 128 CONNECTION REFERENCE SCHEDULE** and replace it with the attached **PLANS SHEET NO. ADD. 128 CONNECTION REFERENCE SCHEDULE.**

34. Delete **PLANS SHEET NO. 165 GIRDER FRAMING PLAN – SPAN NOS. 1 AND 2** and replace it with the attached **PLANS SHEET NO. ADD. 165 GIRDER FRAMING PLAN – SPAN NOS. 1 AND 2.**

35. Delete **PLANS SHEET NO. 168 GIRDER FRAMING PLAN – SPAN NOS. 7 AND 8** and replace it with the attached **PLANS SHEET NO. ADD. 168 GIRDER FRAMING PLAN – SPAN NOS. 7 AND 8.**

36. Delete **PLANS SHEET NO. 170 GIRDER LINE G-1 DOWNSTREAM ELEVATION** and replace it with the attached **PLANS SHEET NO. ADD. 170**

GIRDER LINE G-1 DOWNSTREAM ELEVATION.

37. Delete **PLANS SHEET NO. 171 GIRDER LINE G-1 DOWNSTREAM ELEVATION** and replace it with the attached **PLANS SHEET NO. ADD. 171 GIRDER LINE G-1 DOWNSTREAM ELEVATION.**

38. Delete **PLANS SHEET NO. 172 GIRDER LINE G-1 DOWNSTREAM ELEVATION** and replace it with the attached **PLANS SHEET NO. ADD. 172 GIRDER LINE G-1 DOWNSTREAM ELEVATION.**

39. Delete **PLANS SHEET NO. 173 GIRDER LINE G-2 DOWNSTREAM ELEVATION** and replace it with the attached **PLANS SHEET NO. ADD. 173 GIRDER LINE G-2 DOWNSTREAM ELEVATION.**

40. Delete **PLANS SHEET NO. 174 GIRDER LINE G-2 DOWNSTREAM ELEVATION** and replace it with the attached **PLANS SHEET NO. ADD. 174 GIRDER LINE G-2 DOWNSTREAM ELEVATION.**

41. Delete **PLANS SHEET NO. 175 GIRDER LINE G-2 DOWNSTREAM ELEVATION** and replace it with the attached **PLANS SHEET NO. ADD. 175 GIRDER LINE G-2 DOWNSTREAM ELEVATION.**

42. Delete **PLANS SHEET NO. 176 GIRDER LINE G-3 DOWNSTREAM ELEVATION** and replace it with the attached **PLANS SHEET NO. ADD. 176 GIRDER LINE G-3 DOWNSTREAM ELEVATION.**

43. Delete **PLANS SHEET NO. 177 GIRDER LINE G-3 DOWNSTREAM ELEVATION** and replace it with the attached **PLANS SHEET NO. ADD. 177 GIRDER LINE G-3 DOWNSTREAM ELEVATION.**

44. Delete **PLANS SHEET NO. 178 GIRDER LINE G-3 DOWNSTREAM ELEVATION** and replace it with the attached **PLANS SHEET NO. ADD. 178 GIRDER LINE G-3 DOWNSTREAM ELEVATION.**

45. Delete **PLANS SHEET NO. 179 GIRDER LINE G-4 DOWNSTREAM ELEVATION** and replace it with the attached **PLANS SHEET NO. ADD. 179 GIRDER LINE G-4 DOWNSTREAM ELEVATION.**

46. Delete **PLANS SHEET NO. 180 GIRDER LINE G-4 DOWNSTREAM ELEVATION** and replace it with the attached **PLANS SHEET NO. ADD. 180 GIRDER LINE G-4 DOWNSTREAM ELEVATION.**

47. Delete **PLANS SHEET NO. 181 GIRDER LINE G-4 DOWNSTREAM ELEVATION** and replace it with the attached **PLANS SHEET NO. ADD. 181 GIRDER LINE G-4 DOWNSTREAM ELEVATION.**

48. Delete **PLANS SHEET NO. 188 IN-SPAN CROSS FRAME DEMOLITION SECTIONS** and replace it with the attached **PLANS SHEET NO. ADD. 188 IN-**

SPAN CROSS FRAME DEMOLITION SECTIONS.

49. Delete **PLANS SHEET NO. 189 IN-SPAN CROSS FRAME DEMOLITION SECTIONS** and replace it with the attached **PLANS SHEET NO. ADD. 189 IN-SPAN CROSS FRAME DEMOLITION SECTIONS.**

50. Delete **PLANS SHEET NO. 190 EXPANSION BEARING CROSS FRAME DEMOLITION SECTIONS** and replace it with the attached **PLANS SHEET NO. ADD. 190 EXPANSION BEARING CROSS FRAME DEMOLITION SECTIONS.**

51. Delete **PLANS SHEET NO. 191 FIXED BEARING CROSS FRAME DEMOLITION SECTIONS** and replace it with the attached **PLANS SHEET NO. ADD. 191 FIXED BEARING CROSS FRAME DEMOLITION SECTIONS.**

52. Delete **PLANS SHEET NO. 194 EXTERIOR BAY STRUT SECTIONS** and replace it with the attached **PLANS SHEET NO. ADD. 194 EXTERIOR BAY STRUT SECTIONS.**

53. Delete **PLANS SHEET NO. 195 INTERIOR BAY STRUT SECTIONS AND DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 195 INTERIOR BAY STRUT SECTIONS AND DETAILS.**

54. Delete **PLANS SHEET NO. 196 IN-SPAN, ELEVATION, AND FIXED BEARING CROSS FRAME SECTIONS** and replace it with the attached **PLANS SHEET NO. ADD. 196 IN-SPAN, ELEVATION, AND FIXED BEARING CROSS FRAME SECTIONS.**

55. Delete **PLANS SHEET NO. 203 LATERAL DIAGONAL BRACING DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 203 LATERAL DIAGONAL BRACING DETAILS.**

56. Delete **PLANS SHEET NO. 204 LATERAL DIAGONAL BRACING DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 204 LATERAL DIAGONAL BRACING DETAILS.**

57. Delete **PLANS SHEET NO. 205 LATERAL DIAGONAL BRACING DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 205 LATERAL DIAGONAL BRACING DETAILS.**

58. Delete **PLANS SHEET NO. 206 LATERAL DIAGONAL BRACING DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 206 LATERAL DIAGONAL BRACING DETAILS.**

59. Delete **PLANS SHEET NO. 207 TIE PLATE ELEVATIONS AND DETAILS AT BEARINGS** and replace it with the attached **PLANS SHEET NO. ADD. 207 TIE PLATE ELEVATIONS AND DETAILS AT BEARINGS.**

60. Delete **PLANS SHEET NO. 212 PAINT/CAULKING DETAILS** and replace it with the attached **PLANS SHEET NO. ADD. 212 PAINT/CAULKING DETAILS.**

61. Add and make a part of the **PLANS** the attached **PLANS SHEET NO. 123S-1 PAINT BLOCKING DETAILS AT BOLTED CONNECTIONS**.

The following is provided for information.

A. PRE-BID MEETING MINUTES

1. The attached **PRE-BID MEETING MINUTES** and **ATTENDANCE LIST** are provided for information.

B. RESPONSES TO REQUEST FOR INFORMATION (RFIs/QUESTIONS)

1. The attached **RESPONSES TO REQUEST FOR INFORMATION** are provided for information.

C. PERMITS

1. The attached "U.S. Army Corps of Engineers (USACE), Nationwide Permit Pre-construction Notification (PCN) with attachments" is provided for information. Permit was submitted to the USACE, and is pending.

2. The attached draft "Storm Water Pollution Prevention Plan (SWPPP) and In-Water Pollution Prevention Plan (IWPPP), Nanue Stream Bridge Rehabilitation, with attachments" is provided for information, and shall be completed by the selected Contractor during preconstruction.

D. REPORTS

1. The attached "Monitor Bridge Inspection Nanue Stream Bridge, March 18, 20, and 23, 2024" report is provided for information.

2. The attached "Routine Bridge Inspection Report, Nanue Stream, March 1 and 2, 2023" and additional photographs are provided for information.

3. The attached "Underwater Bridge Inspection Report, Nanue Stream Bridge, March 1, 2023" and additional photographs are provided for information.

4. The attached "Hawaii Department of Transportation Bridge Load Rating Summary" for Nanue Stream Bridge, dated May 5, 2015, is provided for information.

5. The attached Remedial Alternatives Analysis Report for Lead Impacted Soil at Nanue Bridge, Ninole, HI, August 2024" is provided for information.

Please acknowledge receipt of this **ADDENDUM NO. 2** by recording the date of its receipt in the space provided on **PAGE P-4** of the Proposal.

Henry Kennedy

Henry Kennedy
Engineering Program Manager

TABLE OF CONTENTS

DIVISION 200 - EARTHWORK

DIVISION 400 - PAVEMENTS

DIVISION 500 - STRUCTURES

DIVISION 600 - INCIDENTAL CONSTRUCTION

DIVISION 700 - MATERIALS

Sample Forms

END OF TABLE OF CONTENTS

Amend Section 501 – Steel Structures to read as follows:

“SECTION 501 - STEEL STRUCTURES

501.01 Description. This section describes construction of new steel structures and rehabilitation to existing bridge structures.

501.02 Materials

Organic Zinc Primer Paint	666.02(B) and 667.02(B)B)
Epoxy Paint	666.02(B) and 667.02(B)B)
Fluoropolymer Top Coat Paint	666.02(B) and 667.02(B)B)
Bearing Devices and Related Materials	712.09
Zinc Coating	712.10 and
Structural Steel	713.01
Standard Fasteners	718.01
High-Strength Bolts and Studs	718.02

501.03 Construction.

(A) Preliminary Submittal Requirements. Prior to the preparation of structural steel shop drawings, the following preliminary documentation shall be submitted to the Engineer for review and approval a minimum of 45-days prior to initial preparation of the structural steel shop drawings.

(1) Survey. Survey results for foundation pedestals and soffit of girders at bearing locations. See Contract Drawings for additional information.

(2) Steel Detailer Certification. National Institute of Steel Detailing (NISD) Senior Detailer – Class I Bridge Certification

(3) Steel Fabricator Certification. AISC Intermediate (IBR) Bridge Fabricator Certification for the shop that will be fabricating the trestle structure.

(4) Welding Distortion Control Program. Acknowledgement letter stating that the fabrication shop has an in place and current welding distortion control program.

(B) Pre-Fabrication Submittal Requirements. After review and approval of the preliminary submittals, the following documentation shall be submitted to the Engineer for review and approval a minimum of 45 days prior to fabrication taking place.

(1) Shop Drawings. Submit detailed shop drawings required for steel fabrication.

Prepare shop drawings on sheets 36 inches long by 22 inches wide. Make 2-inch margin on left side of sheet and 1/2-inch margin on other three sides. Locate title block in lower right hand corner of each sheet. Title includes statement of contents of sheet, location of structure, project name, and project number, if any.

Submit shop drawings for review. The Engineer will return comments and corrections. Make corrections and resubmit all sheets for additional review until Engineer accepts shop drawings. Prepare and submit shop drawings at no increase in contract price or contract time. Changes to accepted shop drawings without written consent from the Engineer will not be allowed. Steel fabrication before shop drawing acceptance by the Engineer will not be allowed.

(a) Initial Centerline Drawings. Initial drawings showing the centerline of all columns and braces and their associated work points, brace level elevations, WP elevations and dimensions at top of column, elevation of top of column seat, WP elevations and dimensions at bottom of column, elevations at top of concrete foundation pedestal and any other pertinent information to establish the framework for what the developed shop drawings will be based on.

(b) Detailed Shop Drawings. Following approval of the initial drawings, prepare detailed shop drawings that will be required for steel fabrication. Due to the complexity of the structural elements and the battered column arrangement, the shop drawings shall be developed using both 2-dimensional and 3-dimensional software programs. The submittal packages shall be discretized into 5 different packages (based on the 5 different trestles) to make the review process more manageable. Additional shop drawings for other ancillary elements shall be submitted separately. Submit shop drawings to the Engineer for review and approval. The shop drawings shall include the following:

(1) Details for connections not dimensioned in the contract documents.

(2) Direction of rolling of plates where the contract documents require specific orientation.

(3) Procedures for creating holes in plates.

(4) Dimensions and details of erection plate (including placement of holes) in accordance with the requirements of the Contractor's Engineer.

(5) Dimensions for all gusset plates.

(6) Details that affect the shop drawings based on the specifics of the Erection Plan. Drilling/Welding to fabricated/painted members will not be allowed.

(7) Pretension connections and Slip-critical connections (if applicable) and connections subject to direct tension.

(8) Weld types, sizes, and details.

(9) Hardware types, size, grade, and tensioning requirements.

(10) Specification and grade of all structural elements including CVN testing requirements.

(11) Matchmark labeling and diagrams for all members.

(12) Surface Specifications and finish.

(13) Drainage holes (if needed) for galvanizing process.

The nominal width dimensions for the built-up trestle brace members are based on the dimensions between the double gusset plates welded to the trestle columns. The actual width dimensions for the built-up trestle brace members, as detailed on the shop drawings, shall be slightly less to account for the dry film thickness (DFT) of the hot-dip galvanized and painted members. Otherwise, painted surfaces of trestle brace may not fit between opening of painted double gusset plates during field erection. The steel detailer shall account for the mil thickness of galvanizing and maximum potential DFT of the final paint system when determining appropriate dimensions.

(2) **Welder Certifications.** AWS D1.5 Current Welder Certifications qualifying the welder for each type of weld, unless otherwise qualified by accompanying PQR.

(3) **WPS.** AWS D1.5 Welding Procedure Specifications (WPS)

(4) **PQR.** AWS D1.5 Procedure Qualification Records (PQR) to qualify necessary welding procedures, as required

(5) Welding Distortion Control Plan. Current and documented plan that details and specifies how to minimize or prevent distortion of welded assemblies for the trestle structure elements.

(6) Hardware Order List and Diagrams. Type, grade, size, finish, length, grip, etc. for all bolt assemblies.

(7) DTI Washer. Submit product literature for the DTI washer and any specific installation instructions and inspection criteria to follow.

(8) Acknowledgement Letter. Acknowledgement letter from galvanizing shop that dipping process includes centrifugally spun hardware and that threads are not chased.

(C) Pre-Fabrication/Construction Submittal Requirements. Before any fabrication or construction is to take place, the following documentation shall be submitted to the Engineer for review and approval.

(1) Mill Certs. Mill Certifications and Test Reports (including CVN testing) for steel shapes, plates, and hardware while indicating lot traceability numbers.

(2) Galvanizing Records. Galvanizing certification including lot traceability numbers.

(3) Rivet Removal Plan. The Contractor shall submit a work plan for how the rivets on the existing bridge superstructure will be removed. This plan must adequately describe and demonstrate the removal of a rivet without damaging the base metal. Use of torches will not be allowed.

(4) HS Bolting QC Inspector. Provide the name, contact information, and credentials for the designated Structural Bolting Inspector.

(5) QC Certified Welding Inspector (Shop). Provide the name, contact information, and credentials for the designated Certified Welding Inspector performing work at the fabrication shop.

(6) QC Certified Welding Inspector (Field). Provide the name, contact information, and credentials for the designated Certified Welding Inspector performing work in the field.

(7) Report of Full Size Trestle Trial Erection. Trial erection shall be performed in the fabrication shop using the complete Trestle No.1/Bent No. 1 structure. Assemble the entirety of the structure to ensure fit-up and geometry can be achieved. The report should include sufficient photos and measurements of key components to ensure that overall geometry of the structure is maintained. Additionally, note clearance between trestle brace members and double gusset connection plates.

(8) Trestle Erection Plan. The Contractor is required to retain the services of a Structural Engineer licensed in the State of Hawaii, herein referred to as the Contractor's Engineer. The Contractor's Engineer is responsible for providing a detailed plan for the replacement of the steel trestles. The Contractor's Engineer shall be involved throughout the duration of the project and shall be responsible for ensuring construction is in accordance with their design.

The Contractor's Engineer is responsible for providing a detailed erection plan for the replacement of the steel structures. The erection plan and procedures shall provide complete details of the erection process including but not limited to:

(a) Temporary Falsework. Temporary falsework supports/bypass columns, bracing, guys, deadmen, overhead lifting gantry/trolley system and attachments to existing steel structure and concrete foundations.

(b) Sequence. Procedures and operations showing the sequencing of the element replacement.

(c) Lifting Points. Details showing how members will be picked including lift points and lifting devices. Lifting plan shall consider individual member masses and center of mass. Indicate how members will be lifted without damaging the finish coating.

(d) Lifting Equipment. Crane(s) make and model, mass, geometry, lift capacity, outrigger size, and reactions. Additionally, any overhead rolling gantry/trolley system used to maneuver bridge elements beneath the superstructure shall be detailed including their attachment to existing members.

(e) Crane Locations. Locations of cranes and trucks delivering material from bridge deck. Include structural analysis/load rating of existing bridge or temporary falsework to validate capacity for any specialty vehicles.

(f) Traffic Control Plan. Indicate what traffic control closure plan will be implemented during the different stages of trestle member replacement.

(D) During Fabrication/Construction Submittal Requirements. During fabrication and construction of the project, the following documentation shall be submitted to the Engineer for review and approval on a consistent and timely basis.

(1) QC Welding Inspection Reports. Daily inspection reports summarizing the inspection activities for the different welding operations. Reports shall include any NDT that was performed, including acceptance criteria. Reports shall indicate which structural members the welding work was performed on and the quantity of work completed.

(2) QC High Strength Bolting Inspection Reports. Daily inspection reports summarizing the inspection activities for the different bolting operations. Reports shall indicate the location where bolting work was performed and the quantity of work completed.

(E) Fabrication Shop Inspections. Give advanced notice of fabrication shop work, and work locations to the Engineer so QA testing and inspectional procedures may be arranged and prepared.

The fabrication shop shall be made available to the Engineer for QA inspection of material and workmanship. Allow inspectors free access to necessary parts of the work.

The Contractor shall provide a QC certified welding inspector (CWI). The CWI shall be responsible for inspection of materials, WPS qualification, equipment, welders/weld operator qualifications, production weld work, and any non-destructive testing (NDT) as required by AWS D1.5.

When the Engineer requires test specimens, certifications, or QC records the Contractor shall furnish specimens and certifications at no increase in contract price or contract time.

NDT shall be performed on specific welded elements in accordance with and at frequency intervals as indicated in Table 8.1 of AWS D1.5.

The QC CWI shall prepare daily welding inspection reports and NDT reports and submit them to the Engineer on a timely basis.

(F) Shop Work and Fabrication. Keep structural material clean and free from damage caused by improper handling during loading, transporting, and storage.

Furnish and follow methods and procedures for preparation, handling and inspection, shop assembly of material, and details of fabrication conforming to Section 6 – Steel Structures, in AASHTO LRFD Bridge Design Specifications.

Furnish and perform methods and procedures for shop welding in accordance with AWS D1.5 and AASHTO LRFD Bridge Design Specifications.

Electro-slag welding will not be allowed.

Steel plates for columns shall be cut and fabricated so that the primary direction of rolling is parallel to the column length. For column splice plates, the direction shall be parallel to the direction of the splice. For base plates, the direction shall be parallel to the centerline of the bent.

Abutting ends of compression members shall be faced accurately so that they bear evenly when in the Structure. On built-up column members, the ends shall be faced or milled after fabrication and prior to galvanizing.

The various pieces forming one built-up member shall be straight and close fitting, true to detailed dimensions, and free from twists, bends, open joints, or other defects.

Unless otherwise indicated, the ends of the lacing bars shall be rounded to a uniform radius as shown on the plans.

All welded connections shall receive full seal welding along all edges of faying surfaces to prevent moisture intrusion. Skip welding will not be allowed.

(G) Hot-Dip Galvanizing.

(1) General. Steel elements shall be hot-dip galvanized after fabrication is complete in accordance with ASTM A123 and Subsection 712.10 – Zinc Coating. Fabrication shall include shearing, punching, forming, bending, and welding. If sections need to be straightened after galvanizing, straighten without damaging spelter coating. Protect elements against hydrogen embrittlement in conformance with ASTM A143. Post-galvanizing quenching/passivation shall not be utilized for steel since it is going to paint.

Prior to hot-dip galvanizing, all welding flux and slag shall be completely removed using mechanical methods to ensure proper zinc adhesion. Vent holes may be provided in members for hot-dip zinc galvanized operation. Size and location of holes shall be determined by galvanizing contractor, unless otherwise shown on the drawings. Vent hole sizes and locations shall be included on the structural steel shop drawings. All holes, other than base plates, and where noted shall be filled with zinc plugs following galvanizing operation.

The galvanizer shall be responsible for visually examining all galvanized members after cooling and performing surface smoothing prior to the members leaving the shop. The surfaces shall be free of all bumps, runs, drips, and dross particles that would otherwise affect the coating process.

(2) Repairing Damaged Zinc-Coated Surfaces. Repair zinc coating that has chipped off or been damaged in handling, transporting or welding. Thoroughly clean damaged zinc-coated surfaces by wire brushing damaged area. Remove sags, welds, and loose and cracked spelter coating. Paint cleaned area after completing the following procedures:

Apply coating material conforming to Federal Specification O-G-93, stick form, in accordance with method conforming to Annex A1 of ASTM A780. Prepare the surface of steel and heat coated surface with torch at sufficient temperature to melt repair material without damaging the surrounding zinc coating.

(3) Galvanized Hardware. All hardware, including bolts, anchor bolts, nuts and hardened washers shall be ASTM F2329 hot-dip zinc galvanized. Hardware shall be centrifugally cleaned post galvanizing. Nut threads shall be tapped oversized prior to galvanizing in accordance with ASTM A563 and are prohibited from being chased following the galvanizing process. DTI washers shall be mechanically zinc galvanized in accordance with ASTM B695, Class 55.

(H) Erection

(1) General. The Engineer will inspect erection work. The Contractor shall provide access to work site/facilities for thorough inspection of erection work

(2) Tools. The appropriate tools, machinery, and appliances, including drift pins, spud wrenches, fitting-up bolts, and hydraulic tension calibrators necessary for handling of work shall be on-site.

(3) Handling and Storing Materials. Place materials on skids above ground. Keep storage area clean and properly drained. Support long members such as columns and braces on skids. Place skids close enough together to prevent damage from deflection. Store kegs of bolts so that they are sealed and placed under cover out of the elements when not in use.

(4) Falsework. Design, construct, and maintain falsework to handle required loads. Submit plans and calculations for falsework stamped and signed by Hawaii Licensed Structural Engineer. Acceptance of the Contractor's plans by the Engineer does not relieve the Contractor or their Engineer responsibility for correctness and completeness of drawings and for fit of shop and field connections.

Support falsework off of existing concrete foundations and not the surrounding soil.

(5) Methods and Equipment. Before erection begins, submit proposed method of erection and proposed number and character of equipment. Submit erection procedures prepared, stamped, and signed by a Hawaii Licensed Structural Engineer who is familiar with heavy rigging. Do not begin work until written acceptance is received from the Engineer.

(6) Bearing and Anchorages. Do not place bearing plates upon bridge seat bearing areas that are improperly finished, deformed, or irregular. Set bearing plates level in exact positions with full and even bearing upon masonry. Place bearing plates on fabric or elastomeric pads as indicated in the Contract Documents.

(7) Straightening Bent Materials. Straighten plates, stiffeners, angles, and other shapes (as indicated on the contract drawings) by methods that will not produce fracture or other damage. Do not heat metal unless permitted by the Engineer. Submit proposed straightening procedures to the Engineer for review and approval.

After straightening bends or buckles, inspect metal carefully for fractures, by method other than visual, that is acceptable to the Engineer.

(8) Removal of Rivets. Any existing riveted connection with unacceptable section loss (see contract drawings for details) shall be replaced with an ASTM F3125, Grade A325, Type 1 pretensioned bolt with approval from the Engineer. Prior to insertion of the bolt, the existing hole shall be drilled to 15/16” diameter and cleaned with a wire brush.

(9) Assembling Steel. Assemble parts accurately, following match-marks. Handle material carefully so as not to bend, break, or damage the coating on members. Hammering that may damage or distort members will not be allowed. Clean bearing surfaces, as well as surfaces in permanent contact, before assembling members.

(10) Field Welding. Field welding for substructure erection shall not be permitted. Field welding of superstructure elements shall only be permitted as explicitly shown on the contract drawings. All welding shall conform to the latest ANSI/AASHTO/AWS D1.5 Bridge Welding Code. Welding shall be performed in accordance with a Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) as required in AWS D1.5. The WPS variables shall be within the parameters established by the filler-metal manufacturer.

All welding shall be done by certified welders in conformance with the Bridge Welding Code AWS D1.5 of the American Welding Society. All Welder Certifications, WPS's and supporting PQR's shall be submitted to the Engineer for review and approval prior to any welding being performed.

Welding shall be performed in such a manner to minimize warping and distortion of steel pieces being joined. Excessive concentrated heat being applied to steel pieces shall be avoided. All welded connections shall receive full seal welding along all edges of faying surfaces to prevent moisture intrusion.

All existing open holes left in the bridge superstructure shall be plug welded.

The Contractor shall provide a QC certified welding inspector (CWI). The CWI shall be responsible for inspection of materials, WPS qualification, equipment, welders/weld operator qualifications, production weld work, and any non-destructive testing (NDT) as required by AWS D1.5.

When the Engineer requires test specimens, certifications, or QC records the Contractor shall furnish specimens and certifications at no increase in contract price or contract time.

NDT shall be performed on specific welded elements in accordance with and at frequency intervals as indicated in Table 8.1 of AWS D1.5.

The QC CWI shall prepare welding inspection reports and NDT reports and submit them to the Engineer on a timely basis.

(11) Bolted Connections. Do not use bolted connection, except for field splices or as detailed in the contract documents. Use high-strength bolts, nuts, and washers of type and dimensions specified at locations indicated in the contract documents.

Matched Bolt Assemblies shall contain bolt, nut, and washer provided by the same supplier. Bolts shall be high-strength steel bolts conforming to ASTM F3125, Grade A325, Type 1. Use bolts that are long enough to extend entirely through nut, but not by more than 1/2 thickness of nut. Use two nuts for bolts in tension.

Bolts shall be ordered such that threads are excluded from the shear plane (i.e. outside of the grip). Diameter of bolt shall be as indicated on the contract drawings. Diameter of bolt holes shall be standard size, unless slotted or oversized holes are otherwise shown/permitted on the contract drawings.

Furnish bolted connections using the following provisions:

(a) General. Installation of all bolted assemblies shall be in accordance with the latest Research Council on Structural Connections (RCSC) Specification for Structural Joints Using High-Strength Bolts.

(b) Cleanliness. Clean contact surfaces for high-strength bolted connections of dirt, grease, paint, lacquer, and other material foreign to steel, before assembly.

(c) Washers. All bolt assemblies shall contain a hardened washer and only pretensioned bolt assemblies shall contain both a hardened washer and direct tension indicating (DTI) washer. Refer to contract drawings for the arrangement of hardened washer and DTI. If no direction is provided, refer to the RCSC guidelines.

(d) Snug-Tightened Joints. Where joints on the contract drawings are not specified as pretensioned or slip-critical, the bolted connection shall be brought to a snug-tightened condition where all of the plies in a connection have been pulled into firm contact by the bolts in the joint and all of the bolts in the joint have been tightened sufficiently to prevent the removal of the nuts without the use of a wrench. All bolt holes shall be aligned to permit insertion of the bolts without undue damage to the threads. Bolts shall be placed in all holes with washers positioned beneath the nut. Installation and tightening of the bolts shall progress in a systematic manner starting from the most rigid part of the joint until all bolts are completed.

(e) Pretensioned Joints. Where joints on the contract drawings are specified as pretensioined, the bolted connection shall utilize direct tension indicating (DTI) washers. (DTIs) shall be placed with the protrusions facing the bolt head when under the bolt head, or with the protrusions facing the nut when under the nut. DTIs shall be installed by a two person crew with one individual preventing the stationary element from turning and measuring the gap of the DTI to determine the proper tension of the bolt. All bolts in a connection shall be snug tightened prior to bringing any DTIs in the connection to a full load. Pretensioned bolts shall not be reused. Touching up or retightening previously tightened bolts which may have been loosened by the tightening of adjacent bolts shall not be considered as reuse, provided the snugging up continues from the initial position.

(1) Submit procedures for installation and specific inspection requirements for the direct tension indicator washers, as recommended by the manufacturer, to the Engineer.

(f) Other Tightening Procedures. Tightening of ASTM F3125 bolts by the calibrated wrench method will not be allowed. Tightening of ASTM F1554, Grade 105 anchor bolts shall be pretensioned by turn-of-nut method. See contract drawings for anchor bolt pretensioning.

(g) Nut Positioning. Locate nuts wherever practicable on side of member that will not be visible from the outside, or as otherwise shown in the contract drawings.

(h) Bolting Inspector. The Contractor shall provide a QC High Strength Bolting Inspector to ensure that all field bolted connection work in progress is in accordance with the specifications and standards. All inspection work, including material inspection, pre-installation verification testing, visual inspection, and tension checks shall be in strict accordance with RCSC's Specification for Structural Joints Using High-Strength Bolts.

The QC High Strength Bolting Inspector shall prepare daily inspection reports and submit them to the Engineer on a timely basis.

The work site shall be made available and accessible to the Engineer performing QA inspection, including any necessary work platforms or manlifts needed to access the joint locations.

(i) Material Inspection. The inspector shall verify the bolting materials and that they have proper markings and proper documentation. Verify that materials are properly stored. Verify adequate lubrication is present for the fastener components (if other than DTI methods are specified).

(j) Rotational Capacity Testing. The inspector shall observe the Rotational Capacity Testing. High strength bolt assemblies (bolt, nut, washer) shall be subjected to a rotational capacity test (AASHTO High Strength Bolts Procedures for Performing Rotational Capacity Test A325) prior to any erection activity. Each bolt size and length combination within a production lot shall be tested as an assembly. All tests shall be performed by the Contractor in the presence of the Inspector. Two specimens per lot shall be tested at the erection site immediately prior to installation, or whenever the Engineer deems it necessary.

(k) Pre-Installation Verification Testing. The inspector shall observe the pre-installation verification testing for each bolt size and length combination within a production lot.

(l) **Snugging and Pretensioning.** The inspector shall be present to observe that the bolted joints have been properly snugged tight and pretensioned such that the DTI has compressed to within acceptable range of the manufacturer and specification requirements.

(12) Assembling and Bolting. To begin bolting any field connection or splice, the Contractor shall install and tighten to snug-tight enough bolts to bring all parts into full contact with each other prior to tightening these bolts to the specified minimum tension. “Snug-tight” means either the tightness reached by (1) a few blows from an impact wrench or (2) the full effort of an ironworker using a spud wrench.

As erection proceeds, all field connections and splices for each member shall be securely drift pinned and bolted in accordance with the provisions described below before the weight of the member can be released. Field erection drawings shall specify pinning and bolting requirements that meet or exceed the following:

(a) Fifty percent of the holes in a single field connection and 50-percent of the holes on each side of a single joint in a splice plate shall be filled with drift pins and bolts. Thirty-percent of the filled holes shall be pinned. Seventy-percent of the filled holes shall be bolted and tightened to snug-tight. Once all these bolts are snug-tight, each bolt shall be systematically tightened to the specified minimum tension. “Systematically tightened” means beginning with bolts in the most rigid part, which is usually the center of the joint, and working out to its free edges. The fully tensioned bolts shall be located near the middle of a single field connection or a single splice plate. Drift pins shall be placed throughout each field connection and each field joint with the greatest concentration in the outer edges of a splice plate or member being bolted.

Prior to placement of any additional weight or adding of the next member, the joint must be completed by filling all remaining holes of the field connection or splice plate with bolts and tighten to snug-tight. Once all of these bolts are snug-tight, each bolt shall be systematically tightened to the specified minimum tension. After these bolts are tightened to the specified minimum tension, the Contractor shall replace the drift pins with bolts tightened to the specified minimum tension.

In lieu of the aforementioned method, the Contractor may opt to complete a field bolted connection or splice in a continuous operation before releasing the mass of the member or adding the next member. The Contractor shall utilize drift pins to align the connection. The alignment drift pins shall fill between 15 and 30-percent of the holes in a single field connection and 15 to 30-percent of the holes on each side of a single joint in a splice plate. Once the alignment drift pins are in place, all remaining holes shall be filled with bolts and tightened to snug-tight, starting from near the middle and proceeding toward the outer gage lines. Once all of these bolts are snug-tight, the Contractor shall systematically tighten all these bolts to the specified minimum tension. The Contractor shall then replace the drift pins with bolts. Each of these bolts shall be tightened to the specified minimum tension.

The Contractor shall not perform touch-up painting of joints until the Engineer has inspected and accepted field bolting.

(I) **Painting.**

See Special Provisions Section 666 – Clean and Paint Existing Bridge Steel.

See Special Provisions Section 667 – Preparation and Coating of Galvanized Bridge Steel.

(J) **Removal of Falsework.** Upon completion of the erection process and before final acceptance of the structure by the Engineer, remove all falsework, temporary works items, extra materials, and rubbish.

501.04 Measurement.

(A) Steel will be paid on a lump sum basis. Measurement for payment will not apply.

(B) Refurbish Lifeline System will be paid on a lump sum basis. Measurement for payment will not apply.

(C) The Engineer will measure High Strength Bolt Assembly to Replace Corroded Rivets on a force account basis in accordance with Subsection 109.06 – Force Account Provisions and Compensation and as ordered by the Engineer.

(D) The Engineer will measure Additional Steel Repairs on a force account basis in accordance with Subsection 109.06 – Force Account Provisions and Compensation and as ordered by the Engineer."

501.05 **Payment.** The Engineer will pay for the accepted pay items listed below as shown on the proposal schedule. Payment shall be full compensation for furnishing, fabricating, galvanizing, delivering, erecting, and fastening steel bridge components and for materials, hardware, labor, inspection, equipment, tools, temporary works (including falsework), Engineering design services, and incidentals necessary to complete the work.

Pay Item	**Pay Unit**
Steel for ____________________	Lump Sum
Refurbish Lifeline System	Lump Sum
High Strength Bolt Assembly to Replace Corroded Rivets	Force Account
Additional Steel Repairs	Force Account

The Engineer will pay for bridge bearings in accordance with and under Section 506 – Bridge Bearings.

The Engineer will consider galvanizing of structural steel, including hardware, forgings and castings, and the cost connected incidental to “Steel”. The Engineer will not make separate payment.”

END OF SECTION 501

Make the following section a part of the Standard Specifications:

“SECTION 627 – MANAGEMENT OF CONTAMINATED MATERIALS

627.01 Description. This section describes the following:

The soil investigation at the project area was conducted to identify the presence of the potential contaminants that may be encountered during the construction activities associated with the Nanue Bridge Repairs, Ninole, Hamakua, Hawaii project. Lead was detected at concentrations above the State of Hawaii, Department of Health (DOH) Tier 1 EAL for construction/industrial land use (800 mg/kg) in samples collected from 0-3”, 3-6”, and 6-9” below ground surface (bgs). Arsenic was also detected in concentrations that exceeded the HDOH Tier I EALs of 24 mg/kg. While the residential direct exposure is set to 23 mg/kg the highest exceedance was 32 mg/kg in DU8 at 6 to 9 inches bgs. Refer to the Nanue Bridge Remedial Alternative Analysis, dated August, 2024, prepared by EnviroQuest, Inc.

Soils impacted by lead may be encountered during the bridge rehabilitation project and shall be handled in accordance with this specification and State and Federal Regulations.

627.02 Materials. Not applicable.

627.03 Construction.

(A) Submittals Prior to Construction. Submit the following submittals a minimum of ten (10) working days prior to beginning the work:

(1) Construction – Environmental Hazard Management Plan (C-EHMP): A plan shall be submitted for review that describes the procedures, engineering controls and methods the Contractor will use during the excavation, temporary storage, handling, treatment, backfilling and disposal of soil at the project site. The plan should also include soil stockpiling, testing, backfilling procedures, personal protection requirements, work area isolation, construction barriers, wetting methods, decontamination procedures, and emergency procedures.

The plan shall include the names and qualifications of personnel who will be managing soil activities at the site. The plan should also include copies of current training and certification of all workers by an EPA-approved Hazardous Waste Operations and Emergency Response course, respirator fit testing documentation, and medical clearances.

(2) Proposed schedule of work and performance schedule.

(3) A sketch identifying the location of temporary soil stockpiling.

(B) Construction Requirements. Do not begin work until submittals detailed in **627.03(A)(1)** - **Construction – Environmental Hazard Management Plan (C-EHMP)** are completed and accepted in writing by the Engineer.

The Contractor shall examine the project site to understand conditions that may affect work and performance.

The Contractor shall supply all labor, materials, and equipment necessary for the removal, temporary storage, testing, handling, soil backfilling and management of soil to carry out the work in accordance with applicable Federal, State, and local regulations, and these specifications. On-site management and reuse of soil will be the main approach for dealing with soil that must be relocated during the construction of repairs to the bridge. Soil below the bridge is contaminated with lead and any excavation required to complete the construction activities will require workers to be trained and to follow the guidelines set forth in 40CFR 1910.

The anticipated remedial alternative for the lead impacted soil is to leave it in place under land use controls with periodic inspections and posting signs describing the hazard. Soil is assumed to contaminated with lead to a depth of at least 12 inches below the surface in the entire area of the DOT right-of-way. Soil disturbed during this activity is not required to be removed from the site in anticipation of the preferred remedial alternative for this site.

Soil excavation activities, trenching and any disturbance of lead containing soil may cause a potential exposure to Contractor's employees and the general public to fugitive dust. The routes of exposure of dusts are by inhalation, ingestion and dermal contact. The Contractor shall use engineering controls such as water spraying and wind barriers to control fugitive dust.

The Contractor shall provide a Qualified Environmental Professional (QEP) with at least 5 years of experience in the handling and management of soils impacted by hazardous chemicals to manage the project. Contractor shall be responsible for implementation of the engineering controls and conformance with the requirements of this specification. The QEP shall be responsible for monitoring and documentation of the engineering controls and conformance with the requirements of this specification.

(C) Submittals After the Construction. Submit the following submittals within 30 days after work is completed.

(1) Close-out Report shall include the following:

i. Laboratory results for any soils or groundwater subject to sampling.

ii. The Waste Manifest signed by the Contractor, waste transporter, and landfill operator. The total quantity of waste should also be included.

iii. A signed certificate stating that the removal and disposal of contaminated items were completed in accordance with the Contractor's approved Work Plan and all applicable rules and regulations.

iv. If required, any results from project air monitoring.

(D) References.

(1) Quality Standards. All work under this contract shall be performed in strict accordance with all applicable Federal, State, and local regulations, standards, and codes governing lead-impacted soil.

(2) The most recent editions of any relevant regulation, standard, document, or code shall be in effect. When conflict regarding the requirements or with these specifications arises, the most stringent requirements shall apply. Such documents include, but are not limited to, the following:

i. 29 CFR 1910, "Occupational Safety and Health Standards" (General Industry Standards)

ii. 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response"

iii. 29 CFR 1910.134, "Respiratory Protection"

iv. 29 CFR 1910.1000, "Air Contaminants"

v. 29 CFR 1910.1020, "Access to Employee Exposure and Medical Records"

vi. 29 CFR 1910.1200, "Hazard Communication"

vii. 29 CFR 1926, "Safety and Health Regulations for Construction" (Construction Industry Standards)

viii. 40 CFR 50, "National Primary and Secondary Ambient Air Quality Standards A"

ix. 40 CFR 122, "EPA Administered Permit Program: The National Pollutant Discharge Elimination System"

x. 40 CFR 261, "Identification and Listing of Hazardous Waste"

xi. 40 CFR 263, "Standards Applicable to Transporters of Hazardous Waste"

xii. 40 CFR 302, "Designation, Reportable Quantities, and Notification"

xiii. 49 CFR 172, Subpart E, "Labeling"

xiv. 49 CFR 172 Subpart F, "Placarding"

xv. 12-8-3-148.1, "State of Hawaii, Safety and Health Regulation for Construction" (Construction Industry Standard)

xvi. 12-202-33, "A Hawaii Occupational Safety and Health Standards"

xvii. HDOH, 2012. Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater, Volume 2: Background Documentation for the Development of Tier 1 Environmental Action Levels, Appendices 2-9. Fall 2011. Prepared by: Hawaii Department of Health, Environmental Management Division. Fall 2011 (Revised Fall 2017).

xviii. TGM, 2008, Technical Guidance Manual for the Implementation of the Hawaii State Contingency Plan, State of Hawaii Department of Health Hazard Evaluation and Emergency Response Office, Interim Final - in Effect October 31, 2018.

(E) Excavation and Disturbance of Soil. During the excavation and disturbance of lead-containing soil, all workers, supervisory personnel, subcontractors and consultants must take precautionary measures as necessary to prevent exposure of Contractor's employees and the general public to the resulting soil dust.

(F) Contractor Training. Each employee shall be instructed for a minimum of 40 hours by a trained professional in hazardous materials operations and emergency response, awareness and work practices, safety and health precautions and the use and requirements for protective clothing, respirators, and equipment in accordance with 40CFR1910.120. A certificate of training, signed and dated by the trainer, shall be provided for each worker. The Contractor shall designate a competent person(s) to perform or supervise soil excavation and disturbance.

(G) Personal Protective Equipment.

(1) Protective Clothing. Furnish personnel involved in removal, handling, disposal of soil and contaminated items with impervious, disposable, whole body protective covering, face shields with goggles and impervious gloves. All the protective clothing shall be worn throughout the removal of contaminated items and shall be replaced as necessary.

(2) Respirators. Provide as a minimum, half-face respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, with filters approved for use in atmospheres that contain lead.

(3) Warning Signs and Labels. Provide warning signs at approaches to the work area. Locate signs at such a distance that personnel may read the sign and take necessary precautions before entering the area. Provide and affix labels to Department of Transportation (DOT) approved waste drums and other containers of containing contaminated materials. The caution label must display the **following in bold print: Caution: May Contain Lead**. "No Smoking" signs, warning signs and labels shall be provided throughout the entire project and as deemed necessary by the QC.

(H) Polyethylene Sheeting. Sheet plastic shall be new, clear or black with at least 20-mil thickness. 6-mil plastic can be used to cover the stockpiles.

(I) General Work Procedures.

(1) Prior to beginning work, the Contractor and the QC shall discuss the approved Plan, including work procedures and safety precautions. At the conclusion of the project, the Contractor shall submit a signed certificate stating that the removal and disposal of contaminated items were completed in accordance with the Contractor's approved Plan and all applicable rules and regulations.

(2) Contractor is responsible for providing their personnel with appropriate training and protective equipment while they are performing work and shall ensure compliance with any and all regulations concerning safety and health of their employees.

(3) Boundaries shall be established at each area where soil excavation/disturbance is to be performed. The area should be clearly identified to prevent unauthorized entry. Establish a control area by completely enclosing/roping-off the area where lead contaminated soil excavation, removal, stockpiling and disposal operations will be performed.

(4) Provide physical boundaries around the lead control area by roping off the area to ensure that airborne concentrations of contaminants will not reach their action levels and/or permissible exposure limits outside the control area.

(5) Caution signs shall be placed at the entrances to each work area, located such that approaching personnel may read the signs and take necessary precautions before entering the work area. No one will be permitted in the work area unless the person is provided with appropriate training and protective equipment and their presence is necessary to the removal work.

(6) There shall be no eating, smoking, drinking, or storing of food or drink within work areas.

(7) Select and conduct the removal procedure to minimize the potential spread of contamination. Handle contaminated items such that no skin contact occurs. Contaminated materials shall not be exposed to open flames or other high temperatures.

(8) Before exiting the controlled area and before food breaks, each worker will remove all personal protective equipment, place disposable items in a labeled, impermeable disposal bag, and then exit the area. Workers shall wash their hands thoroughly with a detergent soap to remove contamination. Boots shall be cleaned to minimize tracking of contaminated material from the work area.

(9) At the completion of work in an area, the work area shall be cleaned as necessary and all contaminated clothing, disposable personal protective equipment surface coverings, and waste material shall be disposed of with the contaminated items.

(J) **Soil Disturbance/Excavation**. The Contractor shall notify the Engineer at least 10 working days prior to the start of excavation of lead impacted soil. Stage operations to minimize the amount of time lead impacted soil are exposed to the weather. Provide protection measures around the area of lead impacted soil to divert runoff of water from within the excavation boundaries. Runoff that comes in contact with lead impacted soil shall be retained onsite and shall not be allowed to drain off-site or into storm water conveyances systems.

(1) The Contractor's QEP shall be continuously on-site to inspect excavated soil to expedite the work.

(2) Prior to any disturbance/excavation activities, locate the area identified in the approved Work Plan where excavated soil will be stockpiled.

(3) Soil stockpiles shall be placed onto 20-mil plastic sheeting and covered with 6-mil plastic sheeting and secure the edges of the liner with a soil berm, stakes, or equivalent to contain potential surface water runoff.

(4) After the completion of construction activities, it may be necessary to relocate the excavated soil back to its original position to prevent future mobilization or slipping down the steep slope under the Nanue Bridge.

(5) Consideration of the way soil is removed from its current location (e.g., around the base of the concrete bent supports) and stockpiled is important. Measures must be taken to ensure that both temporarily and permanently relocated soil does not slip down the side of the slope and end entering the Nanue stream. Soil stockpiles shall be placed on 20-mil plastic sheeting and covered to protect from rain, wind, etc. Soil stockpiles shall be kept a maximum height of 12 inches to prevent slumping and drift due to the steep slope. In addition, stockpiles of contaminated soils shall be bermed on upper and lower edges to keep rainwater from entering the stockpile and from migrating away from the stockpiles and ultimately off-site

(6) If the soil removal exceeds a depth of 12 inches deep in any excavation, ideally this soil below this depth would be segregated from the soil from the upper 12 inches and replaced over the soil removed from the upper 12 inches at the end of the project to prevent future exposure. Records of the areas that this type of soil replacement reverse stratigraphy must be kept and included in a final close-out report prepared by the QEP as identified in the C-EHMP.

(7) Removed soil shall be re-used or spread out at the site following completion of subsurface soil excavation activities.

(K) Final Cleanup.

(1) Maintain surfaces in the work area to be free of accumulations of contaminated materials. Restrict the spread of dust and debris, and to keep waste from being distributed over the work area.

(2) When work which disturbs contaminated soil has been completed, the Engineer will visually inspect the work area for evidence of contaminated materials and direct the Contractor to clean and remove remaining contaminated materials. The Contractor shall not dismantle the work area boundaries prior to authorization by the Engineer.

(3) Earthmoving equipment which contacts contaminated subgrade materials shall be cleaned with a water spray immediately upon completion of work. The wash location shall be located immediately adjacent to the contaminated soil excavation and all wash water shall be directed into the excavation.

(4) Green waste that is free of soil shall be removed offsite. Green waste with soil shall be managed onsite.

(L) Transportation and Disposal.

(1) Transportation or disposal of soil is not anticipated to be required as part of this project. Excess soil will be cleaned off of steel structural material before being removed from the site. No loose soil will be moved off the site with the steel members being hauled away for disposal. The steel members will be hauled away in lined roll-off's and shipped to the recycler on Oahu (e.g., Schnitzer Steel which has rebranded to Radius Recycling).

(2) Upon transportation and disposal, the Contractor shall submit copies of the waste shipping papers for both hazardous and non-hazardous wastes and Certificates of Disposal to the Engineer. The Contractor shall also include all waste shipping papers and Certificates of Disposal in the Completion Report.

(M) Air Monitoring.

(1) Air monitoring shall be conducted for at least three (3) full 8-hour shifts to establish a negative exposure assessment for worker's exposure to airborne lead. After the establishment of the negative workers exposure, periodic personal monitoring shall be conducted once every seven days to document worker exposure for the duration of the lead-contaminated soil work. Perimeter air monitoring shall be conducted throughout the entire duration of contaminated soil work.

(2) Submit air sampling results to the Engineer within five (5) working days after the samples are collected, signed by the testing laboratory employee performing the analysis.

(3) Perform personal and area monitoring during the contaminated soil work operation. Sufficient area monitoring shall be conducted at the physical boundary to ensure unprotected personnel are not exposed above action level (AL) and/or permissible exposure limit (PEL) at all times. If the outside boundary levels are at or exceed AL and/or PEL, work shall be stopped, and the Contractor and the Qualified Consultant shall immediately correct the condition(s) causing the increased levels and notify the Engineer immediately.

627.04 Measurement. The Engineer will measure clearing and grubbing, excavation, testing, and disposing of unsuitable material from work site in accordance with the applicable Sections.

Work under this section, excluding clearing and grubbing, excavation, testing, and disposing of unsuitable material, will be paid on a lump sum basis. Measurement for payment will not apply.

The Engineer will measure additional management of contaminated materials required and requested by the Engineer on a force account basis in accordance with Subsection 109.06 – Force Account Provisions and Compensation.

627.05 Payment. The Engineer will pay for the accepted clearing and grubbing, excavation, testing, and disposing of unsuitable material from work site under the applicable Sections.

The Engineer will pay for accepted pay items listed below at contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for work prescribed in this section and contract documents.

The Engineer will pay for following pay item when included in proposal schedule:

Pay Item	Pay Unit
Management of Contaminated Materials	Lump Sum
Additional Management of Contaminated Materials	Force Account

An estimated amount for force account is allocated in proposal schedule under ‘Additional Management of Contaminated Materials’, but actual amount to be paid will be the sum shown on accepted force account records, whether this sum be more or less than estimated amount allocated in proposal schedule. The Engineer will pay for measures requested by the Engineer that are beyond scope of accepted Construction – Environmental Hazard Management Plan (C-EHMP) on a force account basis.”

END OF SECTION 627

Make the following Section a part of the Standard Specifications:

“SECTION 666– BLAST, CLEAN, AND PAINT EXISTING BRIDGE STEEL

666.01 Description. This section describes the materials and execution requirements for the field preparation and field coating work of the existing steel bridge superstructure. The work shall encompass all steel elements from concrete backwall at abutment no. 1 to concrete backwall at abutment no. 2.

The bridge superstructure will require containment to prevent the escape of construction debris to the surrounding air, soil, stream, and ocean. Bridge superstructure will require waterjet cleaning of all elements to be painted, near white metal blasting, and painting of the steel girders, cross frames, and other retained elements. The existing structure shall be initially blasted to a commercial blast clean condition to aid in visual evaluation of the retained steel and aid in removal of members marked for replacement. The near white metal blasting may commence once the new members are installed and all repair work has been completed. Painting of the retained superstructure steel will include the use of organic zinc primer, epoxy stripe coat, epoxy intermediate, and a fluoropolymer topcoat. In some cases, new girder cross frames and struts will be shop galvanized and shop painted with organic zinc primer. After installation in the field, they will be finish coated with a fluoropolymer topcoat in accordance with these specifications.

The Contractor awarded the work will be required to schedule, arrange and conduct a pre-job conference to discuss the pertinent issues of the work. The Contractor shall be able to address the work schedule, containment, staffing, and discuss their understanding of the specification. A walk-thru of the work site, if required, will be part of the pre-job conference. At a minimum, the painting Contractor’s field foreman and Certified Coating Inspector (CCI) QC representative, the Engineer and any representatives of the Engineer shall be present.

REFERENCE STANDARDS

American Society for Testing and Materials (ASTM International)

ASTM A123/123M	“Zinc (Hot Dip Galvanized) on Iron and Steel Products”
ASTM C920	“Standard Specification for Elastomeric Joint Sealants”
ASTM D3276	“Standard Guide for Painting Inspectors (Metal Substrates)”
ASTM D4285	“Standard Test Method for Indicating Oil and Water in Compressed Air”
ASTM D4417	“Standard Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel”
ASTM D7091	Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous

	Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals”
ASTM D4940	“Standard Test Method for Conductimetric Analysis of Blasting Media”
ASTM F21	“Standard Test Method for Hydrophobic Surface Films by the Atomizer Test”

Association for Materials Protection and Performance (AMPP), previously The Society for Protective Coatings (SSPC)

SSPC Painting Manual Volume 1	“Good Painting Practice”
SSPC-PA 1	“Shop, Field, and Maintenance Coating of Metals”
SSPC-PA 2	“Procedure for Determining Conformance to Dry Coating Thickness Requirements”
SSPC-PA 17	“Procedure for Determining Conformance to Steel Profile/Surface Roughness/Peak Count Requirements”
SSPC-SP 1	“Solvent Cleaning”
SSPC-SP 2	“Hand Tool Cleaning”
SSPC-SP 3	“Power Tool Cleaning”
SSPC-SP 6	“Commercial Blast Cleaning”
SSPC-SP 10	“Near-White Metal Blast Cleaning”
SSPC-SP 11	“Power Tool Cleaning to Bare Metal”
SSPC-SP WJ-2	“Waterjet Cleaning of Metals – Very Thorough Cleaning (WJ-2)”
AMPP-QP 1	“Accreditation Program for Field Application of Coatings to Complex Industrial and Marine Structures”
SSPC-Guide 6	“Guide for Containing Surface Preparation Debris Generated during Paint Removal Operations.”
SSPC-TG 15	“Field Methods for Extraction and Analysis of Soluble Salts on Steel and Other Nonporous Substrates”

666.02 Materials.

(A) General. In this text, the words: coat; paint; coating; painting; coated; and painted are interchangeable. The word “system”, when referencing coat or paint, means final product of several different, compatible coatings of paint.

(1) Coating Overview. The coating system for all steel surfaces of the bridge superstructure (to include girders, struts, cross frames, deck drain pipes, crane rails, cable restrainer anchors/brackets, and other attached items not specified for removal) shall incorporate a custom system consisting of the following. Existing steel will be SSPC-SP 10 blast cleaned, and coated with an Organic Zinc Primer, Epoxy Stripe Coat, Epoxy Intermediate, and Fluoropolymer Topcoat. New cross frames and struts will be Hot Dip Galvanized (HDG), SSPC-SP 16 blast cleaned, and will be shop coated with organic zinc primer, epoxy stripe coat, and epoxy intermediate prior to being shipped to the field. After installation, they will be coated in the field with the remaining Fluoropolymer topcoat.

(2) Color. Final topcoat color shall be in accordance with Federal Standard 595B Color 26493. Each coat of paint shall have distinctly contrasting color shades with subsequent coats to be applied to aid in application and inspection. The Contractor shall submit color selection to the Engineer for review and final approval before ordering paint system products.

(3) Sheen. Final topcoat sheen shall have a gloss finish, according to the manufacturer’s product data sheets.

(4) Environmental Parameters. If there is a difference in application parameters (temperature, relative humidity, dew point) from the manufacturer of the coatings and those listed in this specification; this specification shall take precedence.

(5) Additives. The Coating Manufacturer shall prepare the paint at the factory, tinted, and ready for application. No tinting will be allowed after shipping the paint.

(6) Labeling. Labels on containers shall show the exact title of the paint, the manufacturer's name, date of manufacture, date of expiration, the manufacturer's batch number, and product code. Package the paint in new and approved containers. Precautions concerning the handling and application of paint shall be shown on the label of all paint and clean-up solvent containers.

(7) VOC. All coatings used shall have a mixed VOC at or under 450 g/l (3.8 lbs/gal).

(B) Coatings Specified. Unless otherwise specified, coatings used shall be in accordance with the following coating system:

<u>Existing Steel to Remain for Bridge Superstructure</u>

Surface Preparation shall be SSPC-SP 10 Near-White Metal Blast Cleaned with a 2.0-4.0 mil anchor tooth profile.

Primer:	Zingametall Zinga 420 (organic zinc rich film galvanizing primer) @ 2.5-3.5 mils DFT

Mist Coat:	Tnemec Epoxoline II Series V69 (polyamidoamine epoxy) @ 1.0-1.5 mils DFT
Stripe Coat:	Tnemec Epoxoline II Series V69 (polyamidoamine epoxy) @ 2-3 mils DFT
Intermediate:	Tnemec Epoxoline II Series V69 (polyamidoamine epoxy) @ 4-6 mils DFT
Topcoat:	Tnemec Fluoronar Series 1070V (FEVE Fluoropolymer) @ 2-3 mils DFT

(C) Thinners, Cleaning Solvents, and Additives. Thinners, cleaning solvents, and additives shall be those recommended by the coating manufacturer. Cleaning solvents shall be used for cleaning of equipment. Thinners may not be added in amounts exceeding the limits set forth in the manufacturer's product data sheets (PDS).

(D) Substitutions.

(1) Substitutions. In the event the supplier cannot provide the aforementioned coating system or individual coating product, the Contractor shall submit for approval a proposed alternate zinc-epoxy-fluoropolymer coating system or equivalent individual product for review. The submittal shall include signed documentation that the currently specified product(s) cannot be obtained. Additionally, the Submittal shall include the manufacturer's literature/PDS of the alternate product(s) detailing percent volume solids, application parameters, recommended thickness, and VOC. This literature shall include a reference list of equivalent structural projects where the proposed paint system was used, detailing dates, facility owner and coating applicator. No request for substitution will be considered that would decrease film thickness and/or number of coats or offer a change in the generic type of coating specified.

(a) Do not mix manufacturers. Proposed paint product(s) shall be from the same manufacturer.

(b) When the proposed product(s) manufacturer's literature requires a higher degree of surface preparation or a greater film thickness than specified herein, that degree of surface preparation and film thickness shall apply, at no additional cost to the State.

(c) The proposed product(s) shall have a minimum of two years field exposure on similar structures.

(d) No substitution will be considered unless a request for approval has been submitted by the bidder and has been approved by the Engineer at least 10 days prior to close of bids. The burden of proof of the merit of the proposed substitute is upon the proposer. The Engineer's decision of approval or disapproval of the proposed substitution shall be final.

666.03 Construction.

(A) General.

(1) Environmental Protection. The coating Contractor shall comply with the current Federal, State, and County laws and regulations pertaining to the protection of the environment in the performance of this type of work. These include but are not limited to regulations required by the State Department of Health (DOH) and Federal Environmental Protection Agency (EPA) rules and regulations.

(2) Worker Safety. The coating Contractor shall comply with the current Federal Occupational Safety and Health Administration (OSHA) and Hawaii Occupational Safety and Health (HIOSH) requirements for worker protection and safety equipment during all work on this project.

(3) Accreditation. The field painting Contractor shall be accredited to AMPP-QP 1 – Field Application to Complex Industrial and Marine Structures.

(4) Best Practices. The Contractor shall paint the bridge according to the best practices of the trade, in conformance with the recommendations of the coating manufacturer as delineated in the Product Data Sheets, observing all recommended environmental conditions, recoat windows, wet and dry film thicknesses, and in conformance with applicable portions of AMPP's Specification SSPC-PA 1, except where superseded by these specifications. If no recoat window is specified in the PDS, a minimum of 12 hours and maximum of 24 hours shall be observed as the applicable window.

(5) Quality of Finish. All coats shall be applied to a smooth even finish that is free of runs, drips, sags, dry-spray, overspray, and orange-peel. Pinholes, bubbles, and holidays are not acceptable.

(6) Environmental Conditions. All coats of paint shall be applied between ambient conditions of 50°F – 90°F and substrate temperatures under 100°F. Relative humidity shall not exceed 85% during application and cure. During painting, substrate temperature must be at least 5°F above the dew-point and rising. Do not paint when the air adjacent to the surface contains a fog, mist, dust, or other particulate matter. Do not perform coating operations during winds exceeding 15 mph. Adequate dust collection, containment and/or dust removal is required for this project. Proper ventilation shall be maintained during surface preparation, coating application, and cure. If environmental restrictions of the coating PDS differ from the specification requirements, the specification requirements shall take precedence.

(7) QC Inspection. All field performed surface preparation and painting operations shall be inspected by an AMPP CIP Level 2 (formerly NACE CIP Level 2) Certified Coating Inspector, to be supplied by the Contractor. At a minimum, the inspector shall be present for all checkpoints listed in this specification. Inspections shall detail continual environmental conditions throughout the working day (environmental conditions shall be measured via a data logger with readings taken at maximum 4 hour intervals), coating processes used, surface preparation processes used, DFT coating thicknesses of each coat for existing steel, recoat windows, discrepancies, corrective actions, coatings applied, and any other pertinent information listed on PDS and inspection forms.

(8) QC Checkpoints. The coating Contractor shall inform the Engineer at least 48 hours prior to QC Checkpoint operations. In the event the Engineer is not present at the requested time, the Contractor may proceed to the next evolution so long as written approval has been obtained by the Engineer and the Contractor documents all required QC data.

(9) Paint Manufacturer's Representative. At the start of production work, a technically competent representative from Zingametall, supplied by the Contractor, shall be on site to observe all operations of cleaning, surface preparation, and application of primer and mist coat. The representative needs only be present for these operations during the coating of the first work zone which encompasses one bay and one span of the bridge.

(B) Site Preparations.

(1) Accessibility. The Contractor's work shall be made accessible to the Engineer at all times. Contractor shall provide all safety, fall protection, access and scaffolding needs for the Engineer. The Contractor shall provide access to all superstructure and substructure components using man-lifts, ladders, scaffolding, or stairs.

(2) Wood Removal. Contractor will be responsible for removal of existing wood board inspection planks supported on cross frame bottom chords and struts.

(3) Lifelines. The stainless steel lifeline anchors and wire rope which runs along each girder span (upstream side and downstream side of each girder) shall be removed prior to surface preparation, and re-installed with new hardware in their same locations after final girder painting has cured. Lifeline anchors shall be abrasive blast cleaned, galvanized, and painted with the full coat system. Lifeline cables shall be abrasive blast cleaned.

(C) Containment of Work and Protection of the Environment.

(1) Underdeck Platform. The underdeck platform, that will be used to provide access to the necessary work areas within each superstructure span, shall be incorporated as a part of the overall containment system. This underdeck platform may be used to provide access to the bridge superstructure to perform other various contract repair work items, as needed.

(2) Containment. To protect the surrounding natural environment and work environment, the Contractor will be required to contain the superstructure (existing steel girder spans) work area so that there is no escape of wash water effluent, paint debris, abrasive blast media or dust, and any other construction debris to the surrounding area. In addition, care should be taken to contain any overspray to escape into the surrounding environment, above and under the structure. Containment material shall be water impermeable and with a rigid floor construction to aid in collection of spent wash water and accumulated abrasives.

(3) Class. The contractor shall construct the containment, or multiple containments, capable of containing all material as described above. The contractor shall incorporate SSPC-Guide 6, containment Class 1A or 2A into their design submittals.

(4) Maintenance. Wash water effluent and discharged abrasives shall be removed on an ongoing basis throughout the project as to not interfere with ongoing operations. Containment of the work area shall be maintained and repaired as needed throughout the duration of construction and shall remain in place until the final coat of paint has been cured, inspected, and accepted by the Engineer.

(D) Surface Cleaning and Preparation. All sources of compressed air used for cleaning, blow down, or painting shall be tested daily and verified to be clean, dry, and oil free per ASTM D4285 blotter test.

(1) Cleaning. Before any surface preparation, remove all visible and non-visible contaminants (oil, grease, wax, weld slag, flux residue, dirt, dust, biological growth, etc.) by methods specified in SSPC-SP 1 Solvent Cleaning and SSPC-SP WJ-2/NACE WJ-2 Low Pressure Water Cleaning (LPWC) at minimum working pressures of 1,000 psi, not to exceed 3,000 psi using fresh water. For the purposes of this specification, fresh water shall be defined as local potable water quality. Water break tests, per ASTM F21, shall be performed only if inspector/owner suspects that certain areas of the bridge may still be contaminated by non-visible contaminants. Locations near grease-filled cable restrainers at expansion joints shall be investigated.

(a) For tight crevices, additional means above LPWC may be necessary to remove tightly adherent pack rust, dirt and biological growth. Hand tools such as scrapers and Greenie pads, in accordance with SSPC-SP 2, may be necessary to achieve a contaminant-free surface.

(2) Blow Down. Blow with compressed air or vacuum the cleaned surfaces to remove any standing water and to aid in drying surfaces prior to mechanical methods of surface preparation.

(3) Initial Blast Cleaning. Blast the entire superstructure steel clean to an SSPC-SP 6 Commercial Blast Clean condition to aid in visual evaluation of the remaining steel. Inform the Engineer if any exposed steel locations need additional assessment due to observable defects.

(a) If after blast cleaning, areas of weld spatter remain on any surface of the steel, the Contractor shall remove it in accordance with SSPC-SP 3.

(4) Steel Repairs. Perform all contract specified steel repairs, including cross-frame/strut replacement, lateral diagonal bracing removal, tie plate removal, drainpipe repairs, rivet/bolt replacement, plug welding all open holes, etc.

(a) The steel repair work shall be done in a timely manner to avoid significant rust-back of the bare steel. Rust back shall not be allowed to progress beyond Rust Grade C, when referencing SSPC-VIS 1. However, any form of pitting of the base metal is unacceptable. If the Contractor allows significant rust-back to occur, the Engineer may require the Contractor to reblast and/or modify future blasting schedules to encompass a smaller work area.

(5) Edge Treatment. Some edges of existing steel to remain may show signs of "knife edge corrosion" where the steel has thinned due to corrosion. Where such sharp edges occur, the Contractor shall radius them with power tools to a 2-3 mm radius edge.

(6) Final Blast Cleaning. Blast the entire superstructure steel clean in accordance with SSPC-SP 10 Near White Metal Blast Clean condition immediately prior to paint. The final blast profile shall have an anchor tooth profile of 2.0 – 4.0 mils, and shall be accomplished with an approved abrasive of sufficient grit size and Moh's Hardness to achieve the proper profile. Profile shall be in conformance with SSPC-PA 17 and checked per ASTM D4417 Method C at random locations to ensure proper technique. At least 5 profile measurements shall be taken per 1,000 ft^2 of surface blasted.

(a) Final blasting shall not be performed when the relative humidity in the work area exceeds 85%. The surface temperature of the steel shall be at least 5^{o}F above the dew point temperature of the surrounding air during surface preparation.

(b) Final blasting shall be performed to stay within pre-determined work zones. Work zones shall be established based on the phasing requirements of the contract documents and the time constraint/limitations of the Contractor. Between bays, zone boundaries shall occur along the soffit of the interior girders. Between spans, zone boundaries shall occur at the ends of the girder or at the tie plates.

(c) During final blasting, the Contractor shall take care to provide sufficient taping/masking/shielding to newly installed

HDG bolts, HDG drain pipe outlets, and cross frames/struts with HDG, primer, and epoxy intermediate finish. Shielding shall prevent any damage to the coated finish from grit rebound or errant blast streams.

(d) The surfaces of all galvanized bolt assemblies (nuts, washers, and bolts) shall be prepared via a light hand wire brushing.

QC Checkpoint – SSPC-SP 10 and Profile

(7) **Workspace Cleanup.** The Contractor shall clean the work space within the work zone of all dust, debris, spent abrasives, wash water, and other deleterious materials that could contaminate the work area and affect coating operations.

(8) **Blow-Down.** Blow with compressed air or vacuum the blasted surfaces to ensure all dust is removed prior to painting.

(9) **Check Cleanliness.** After SSPC-SP 10 cleaning, verify substrate cleanliness immediately prior to primer application. Ensure all lubrication on high strength pretensioned nut assemblies is removed. Ensure no abrasive blast media remains embedded in the surface of the steel. Clean in accordance with SSPC-SP 1 if not clean prior to application of primer.

QC Checkpoint – Cleanliness

(10) **Test Chlorides.** All surfaces to be prepared shall meet the requirements of SSPC-SP 1 Solvent Cleaning. Surfaces shall be cleaned so that chloride measurements taken on the washed steel measure under 5 µg/cm^2 chlorides as measured with any method detailed in SSPC-Technology Guide 15. A minimum of 1 measurement shall be made for each 1,000 ft^2 of surface washed. Surface conductivity may be substituted for chlorides. Conductivity shall measure less than 42 µS/cm.

QC Checkpoint – Chlorides/Conductivity

(E) **Application of Primer.** Application of primer shall begin no later than 4 hours from the finish of the SSPC-SP 10 blasting and profiling operation.

(1) Concrete Masking. Mask adjacent edges where steel comes in contact with concrete deck, abutments, and creep blocks so as to avoid paint overspray onto concrete. Maintain masking throughout entire painting operation.

(2) Application Method. Apply primer via conventional spray or airless spray utilizing approved equipment that is standard to the industry and according to the instruction of the paint manufacturer. Only for areas deemed inaccessible via spray (such as bearing assemblies and girder soffit at abutments), the Contractor is permitted to utilize brush coating via extension brushes if needed.

(3) Break Lines. Primer coat break lines shall be located at the boundaries of the work zones. Subsequent primer coats shall be applied flush to the previously applied break lines. The Contractor shall take care to prevent overspray from subsequent primer coats onto previously painted and cured intermediate and topcoats.

(4) Measurements. Coating applicators shall use wet film thickness (WFT) gages periodically during application to ensure proper application thicknesses. After sufficient cure time, dry film thickness readings shall be taken with a calibrated electronic gage in accordance with SSPC-PA 2. Where DFT thickness measurements fall below the specified minimum, make additional application of paint, as necessary, to meet the thickness required, at no additional cost to the State.

(5) Holiday Inspection. After cure of primer, accomplish a visual holiday inspection and rectify any discrepancies as directed by the Engineer.

QC Checkpoint – Primer

(F) Application of Mist Coat. Application of mist coat shall begin a minimum of 4 hours after primer is touch-dry but no more than 24 hours after primer is touch-dry.

(1) Application Method. Apply mist coat via conventional spray or airless spray utilizing approved equipment that is standard to the industry and according to the instruction of the paint manufacturer. Only for areas deemed inaccessible via spray (such as bearing assemblies and girder soffit at abutments), the Contractor is permitted to utilize brush coating via extension brushes if needed.

(2) **Break Lines.** Mist coat break lines shall be located along the same break lines as the primer.

(3) **Measurements.** Coating applicators shall use wet film thickness (WFT) gages periodically during application to ensure proper application thicknesses. After sufficient cure time, dry film thickness readings shall be taken with a calibrated electronic gage in accordance with SSPC-PA 2. Where DFT thickness measurements fall below the specified minimum, make additional application of paint, as necessary, to meet the thickness required, at no additional cost to the State.

(4) **Holiday Inspection.** After cure of mist coat, accomplish a visual holiday inspection and rectify any discrepancies as directed by the Engineer.

QC Checkpoint – Mist Coat

(G) Application of Caulking and Surfacing Epoxy.

(1) **Caulking.** After applicable dry-to-recoat time of the mist coat, as described in its PDS, all faying surfaces including but not limited to: girder bottom flange cover plate to bottom flange, girder bottom/top flange to web, girder splice plates, riveted stiffener to girder web, and cross frame/strut gusset plate connections to the stiffener shall be caulked. See contract drawings for additional details pertaining to caulk application.

(a) Caulk shall be a compatible, paintable, flexible, industrial grade, moisture cured, single-component, urethane or hybrid based caulking compound in accordance with ASTM C920, Type S, Grade NS, Class 50. Caulk shall be able to be applied without the need for an additional primer. Acceptable material is Sherwin Williams Loxon H1 Sealant.

(b) Caulk shall be applied from a gun and tooled into the joint to create a ¼” min and ½” maximum thick bead.

(c) Caulk must reach full cure according to the manufacturer’s cure schedule prior to application of the stripe coat of paint. Cure time shall be based on actual temperatures and relative humidity measured at the bridge site.

(d) Caulk shall have a distinctly contrasting color to the epoxy intermediate coat.

(2) Surfacing Epoxy. After applicable dry-to recoat time of the mist coat, as described in its PDS, all steel elements to remain that exhibit moderate to heavy surface pitting, as determined by the Engineer, shall be filled with a surfacing epoxy.

(a) Surfacing Epoxy shall be a compatible, paintable, industrial grade, two-component, modified polyamine epoxy produced by the same manufacturer of the intermediate coat. Acceptable material is Tnemec Series 215.

(b) Surfacing Epoxy shall be applied using trowels so that the finish surface is even with the face of the base metal. Finish material using rubber floats to produce a smooth and uniform looking surface.

(c) Surfacing Epoxy shall not be allowed to exceed maximum to recoat window time prior to application of the intermediate coat of paint.

(d) Surfacing Epoxy shall have a distinctly contrasting color to the intermediate coat.

QC Checkpoint – Caulking and Surfacing Epoxy

(H) Application of Stripe Coat.

(1) Cleaning. Prior to stripe coating, verify all surfaces are clean and contaminant free according to SSPC-SP 1.

(2) Application Method. All stripe coating shall be accomplished by brush using the unthinned material and according to the best practices of the trade, in conformance with the recommendations of the coating manufacturer as delineated in the Product Data Sheets, observing all recommended environmental conditions, recoat windows, wet and dry film thicknesses, and in conformance with applicable portions of AMPP's Specification SSPC-PA 1, except where superseded by these specifications.

(3) Locations. Striping shall be applied to ALL edges, corners, crevices, rivets, nuts, bolts, caulk lines, weld seams, faces of pitted steel, areas that have been resurfaced with epoxy, and tight metal-to-metal joints. Stripe coat shall have a distinctly contrasting color to mist coat and intermediate coat to aid in determining coverage. During application, immediately brush out any runs, drips, sags, or puddles. Stripe coating shall cover all edges of the steel members, extending approximately ½” on either side of the edge. Stripe coating shall be uniform in appearance.

(4) Holiday Inspection. Verify stripe coat is applied to all required surfaces. After cure, accomplish a visual holiday inspection and rectify any discrepancies as directed by the Engineer.

QC Checkpoint – Stripe Coat

(I) Application of Intermediate and Topcoat.

(1) Cleaning. Prior to application of both the intermediate and topcoat, verify all surfaces are clean and contaminant free according to SSPC-SP 1.

(2) Application Method. Apply intermediate coat via conventional spray or airless spray. Apply topcoat via conventional spray only. All techniques shall utilize approved equipment that is standard to the industry and according to the instruction of the paint manufacturer. Only for areas deemed inaccessible via spray (such as bearing assemblies and girder soffit at abutments), the Contractor is permitted to utilize brush coating via extension brushes if needed.

(3) Break Lines and Step Backs. Intermediate coat break lines shall be located along the same break lines as the primer/mist coat. Topcoat break lines shall be stepped back from the break lines of the intermediate coat. Topcoat step back distance shall be sufficient enough to allow for paint overlap when applying subsequent intermediate coats from adjacent work zones. The Contractor shall take care to prevent overspray from subsequent intermediate coats onto previously painted and cured topcoats.

(4) Measurements. Coating applicators shall use wet film thickness (WFT) gages periodically during application to ensure proper application thicknesses. After sufficient cure time, dry film thickness readings shall be taken with a calibrated electronic gage, of each coat, in accordance with SSPC- PA 2. DFT measurements shall not be made in areas of stripe coat, as these will be higher than specified ranges. Where DFT thickness measurements fall below the specified minimum, make additional application of paint, as necessary, to meet the thickness required, at no additional cost to the State.

(5) Cure/Recoat Times. Sufficient cure time shall elapse between successive coats to permit them to dry properly for recoating. Consult specific Product Data Sheet (PDS) for proper cure times. If any appreciable time elapses between painting operations, as judged by the Engineer or coating manufacturer, the Contractor shall re-clean surfaces before restarting painting operations.

(6) Holiday Inspection. After cure of both the intermediate and topcoat, accomplish separate visual holiday inspections and rectify any discrepancies as directed by the Engineer.

QC Checkpoints – Intermediate and Topcoat

(J) Surface Preparation and Coating Application for Repair Areas. A repair area is any area on the steel which includes a surface defect such as a gouge, scrape, or any area that has been damaged due to torching, welding, cutting, handling, transportation, or ongoing bridge construction that has adversely affected the applied primer, intermediate, or topcoat.

(1) Surface Preparation. Prepare damaged area(s) to sound coating/steel. If any single repair area is under 4 in^2 or has not exposed the bare steel beneath, utilize methods in accordance with SSPC-SP 2 Hand Tool Cleaning, SSPC-SP 3 Power Tool Cleaning as approved by the Engineer. If any single repair area is greater than or equal to 4 in^2 or has exposed bare steel, utilize methods in accordance with SSPC-SP 11 Power Tool Cleaning to Bare metal with a surface profile of 2.0 – 4.0 mils. Note that rotary disc sanding will destroy existing galvanizing or profile on the steel, so establishment of a profile by mechanical impact tooling such as needle guns, Bristle Blasters^{TM}, or roto-peens will be necessary.

(2) Feathered Edges. Ensure that the surrounding area is tightly adhered intact coating and feathered (beveled) smooth to eliminate rough edges. Coatings are considered tightly adhered if an edge cannot be lifted with a dull putty knife.

(3) Cleaning. Remove any dust, residue, or debris prior to application of paint repairs according to SSPC-SP 1.

(4) Paint Application. Apply touch-up coats of the entire selected coating system if the damage exposes bare substrate steel.

Application shall be by brush to specified thicknesses, in accordance with these specifications. Care shall be taken to apply coatings within the confines of the repair area and to ensure coatings are layered in the correct order. Application of primer over previously applied intermediate/topcoat or intermediate over previously applied topcoat will lead to adhesive bond failure.

(a) Adhere to Subsections 666.03(E) – Application of Primer and 666.03(I) – Application of Intermediate and Topcoat, where applicable for all areas.

(5) Inspection. All areas repaired shall be verified for completeness by the Engineer prior to final acceptance.

QC Checkpoint – Repairs

(K) Cleanup and Disposal. Any existing components that were removed prior to blasting (such as superstructure lifelines) shall be reinstalled in their original locations. The Contractor shall clean up the entire project site of painting, cleaning debris, containment, masking material, BMP's and other debris caused by the Contractor's operations, before receiving final payment. This work shall be considered incidental to the various contract items.

QC Checkpoint – Final Acceptance

The Engineer shall have the right to reject all work which is not in compliance with the contract documents.

(J) Submittals.

(1) Product Data Sheets (PDS). The Contractor shall submit paint, caulking (joint sealant), and surfacing epoxy manufacturer's PDS including the selected color of each product. Additionally, submit the manufacturer's written warranty for each individual product including the conditions limiting the warranty.

(2) Safety Data Sheets (SDS). The Contractor shall submit the corresponding manufacturer's SDS for each material supplied, including the thinning/cleaning solvents.

(3) Certificate of Conformance (COC). The Contractor shall submit signed COC's for all materials used under this specification. COC's for abrasive media shall list abrasive cleanliness testing results per ASTM D4940. COC’s for coatings shall include a letter from the manufacturer stating that their product must be applied between temperatures of 50^{o}-100^{o}F, and at a relative humidity of no greater than 85%.

(4) Abrasive. The Contractor shall submit the type and size of abrasive, along with any pertinent documentation indicating the Moh’s Hardness values for the abrasive used in blasting operations.

(5) Coating Contractor’s AMPP-QP 1 Accreditation. The Contractor shall submit a copy of their current, up-to date AMPP-QP 1 Accreditation.

(6) Coating Contractor’s Quality Control (QC) Reports. The Contractor shall maintain daily surface preparation and coating inspection reports in accordance with details of the AMPP QP 1 Contractor Accreditation. The reports shall indicate every item inspected at each required QC checkpoint and detail the work performed, noting areas prepared/painted, environmental conditions throughout the day (Including Substrate Temperature, Ambient Temperature, Dew Point, and Relative Humidity), product applied, batch numbers, date of manufacture, acceptance criteria, QC data, notes and any problems encountered. Photos detailing general work area and any applicable details shall be included in daily reports. A weekly report shall be compiled from the daily reports and submitted to the Engineer on a weekly basis.

(7) Sample QC Report. A sample blank copy of the daily inspection report to be used shall be submitted to the Engineer prior to the start of production work. This sample report shall be formatted specifically for this project with all required inspection fields contained herein.

(8) Coating Contractor’s Work Plan. No more than eight weeks from the start of production work, the contractor shall submit a Coating Work Plan, detailing a timetable of significant events for the entire bridge painting process. The work plan, at a minimum, will detail coating contractor’s name and location, days and working hours, traffic control sequences utilized, dates of mobilization, dates of underdeck platform and containment erection, preparation and coating activities, specific equipment and methods used, final acceptance and demobilization. Work Plan shall be in keeping with the phasing requirements as stipulated in the contract plans.

(9) AMPP CCI Credentials. Submit the name and resume of the designated AMPP Certified Coating Inspector – Level 2, detailing their past work history, durations, and inspection activities.

(10) Underdeck Platform and Containment Design. Submit plans showing the details for the underdeck platform and containment structure that will be used for access, cleaning, and painting operations of the bridge superstructure. Plans shall indicate the details for how the underdeck platform will be supported from the existing bridge, the class of containment (per SSPC-Guide 6), details of materials, construction, framing, penetrability, joints, ventilation, air-handling equipment, and lighting. Provide calculations for the structural adequacy of the underdeck platform and containment structure. Furthermore, the existing bridge structure shall be checked for any concentrated loads imposed by the underdeck platform that may cause weak axis plate bending, torsion, punching shear, or other behaviors that the bridge does not typically experience during normal operation. The design shall take into consideration all dead loads, live loads (due to personnel, materials, equipment, spent wash water, accumulated abrasives, etc.), and all potential environmental loads. Imposed loads shall be in keeping with an appropriate and nationally recognized design guide or specification approved by the Engineer. The plans and calculations shall be stamped by a Professional Structural Engineer licensed in the State of Hawaii.

666.04 Measurement.

(A) Clean and Paint Existing Bridge Steel Superstructure Members will be paid on a lump sum basis. Measurement for payment will not apply. Removal and disposal of pressure washing water, abrasive debris, and the use of an AMPP Certified Coating Inspector shall be considered incidental.

(B) The Engineer will measure Radius Edges of Existing Steel Bridge Members to Remain per liner foot in accordance with the contract documents.

(C) The Engineer will measure Caulk Edges of Faying Surfaces and Application of Surfacing Epoxy on a force account basis in accordance with Subsection 109.06 – Force Account Provisions and Compensation and as ordered by the Engineer.

666.05 Payment. The Engineer will pay for the accepted pay item listed below at contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for work prescribed in this section and contract documents.

The Engineer will pay for the following pay item when included in the proposal schedule:

Pay Item	**Pay Unit**
Clean and Paint Existing Bridge Steel Superstructure Members	Lump Sum
Radius Edges of Existing Steel Bridge Members to Remain	Linear Foot
Caulk Edges of Faying Surfaces and Application of Surfacing Epoxy	Force Account

The requirements of Specification Section **104.07 Variations in Estimate Quantities** is not applicable to the pay item for Radius Edges of Existing Steel Bridge Members to Remain. This quantity may vary by as much as 40% before an adjustment in the contract price can be made.

Payment for work under this Specification does not cover installation, maintenance, and removal of underdeck work platform beneath the bridge superstructure. Underdeck work platform shall be covered under Section 209.

END OF SECTION 666”

Make the following Section a part of the Standard Specifications:

“SECTION 667 - PREPARATION AND COATING OF GALVANIZED BRIDGE STEEL

667.01 Description. This section describes the materials and execution requirements for the shop preparation and shop coating work of new hot-dip galvanized (HDG) bridge components.

The substructure trestles, tie plates, bearing assemblies, lateral diagonal bracing, and plaque shall be new galvanized steel, brush-off blasted, and painted with an organic zinc primer, epoxy stripe coat, epoxy intermediate, and a fluoropolymer topcoat completely in the shop. After installation in the field, bolted connections shall be touch-up painted.

Struts and cross-frames connected to the superstructure (marked for replacement) shall be new galvanized steel, brush-off blasted, and painted with an organic zinc primer, epoxy stripe coat, and epoxy intermediate in the shop. After installation in the field, the members shall be coated with the remaining fluoropolymer topcoat system at the same time that the bridge girders are painted.

The Contractor awarded the work will be required to schedule, arrange, and conduct a pre-job conference to discuss the pertinent issues of the work. The Contractor shall be able to address the work schedule, staffing, and discuss their understanding of the specification. At a minimum, the painting Contractor’s QC Manager, Certified Coating Inspector (CCI) QC Representative, the Engineer and any representatives of the Engineer shall be present.

REFERENCE STANDARDS

American Society for Testing and Materials (ASTM International)

ASTM A123/123M	“Zinc (Hot Dip Galvanized) on Iron and Steel Products”
ASTM A153	“Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware”
ASTM D3276	“Standard Guide for Painting Inspectors (Metal Substrates)”
ASTM D4285	“Standard Test Method for Indicating Oil and Water in Compressed Air”
ASTM D4417C	“Standard Test Method for Field Measurement of Surface Profile of Blast Cleaned Steel”
ASTM D4940	“Standard Test Method for Conductometric Analysis of Blasting Media.
ASTM D6386	“Preparation of Zinc (Hot Dip Galvanizing) Coated Iron and Steel Product and Hardware Surfaces for Painting”
ASTM D7091	“Standard Practice for Nondestructive Measurement of Dry

	Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals”
ASTM E376	“Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy Current (Electromagnetic) Testing Methods.”
ASTM F21	“Standard Test Method for Hydrophobic Surface Films by the Atomizer Test”
ASTM F2329	“Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.”

Association for Materials Protection and Performance (AMPP), previously The Society of Protective Coatings (SSPC)

SSPC Painting Manual Volume 1	“Good Painting Practice”
SSPC-PA 1	“Shop, Field, and Maintenance Coating of Metals”
SSPC-PA 2	“Procedure for Determining Conformance to Dry Coating Thickness Requirements”
SSPC-SP 1	“Solvent Cleaning”
SSPC-SP 2	“Hand Tool Cleaning”
SSPC-SP 3	“Power Tool Cleaning”
SSPC-SP 10	“Near-White Metal Blast Cleaning”
SSPC-SP 11	“Power Tool Cleaning to Bare Metal”
SSPC-SP 16	“Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals”
AMPP-QP 1	“Accreditation Program for Field Application of Coatings to Complex Industrial and Marine Structures”
AMPP-QP 3,	“Accreditation Program for Shop Application of Complex Protective Coatings”

667.02 Materials.

(A) General. In this text, the words: coat; paint; coating; painting; coated; and painted are interchangeable. The word “system”, when referencing coat or paint, means final product of several different, compatible coatings of paint.

(1) Coating Overview. The coating system for all new steel (to include the entire substructure, bearing assemblies, cross frames, struts, tie plates, and anchor bolts) shall incorporate a custom system consisting of the following: New steel will be galvanized, SSPC-SP 16 blast cleaned, and coated with an Organic Zinc Primer, Epoxy Stripe Coat, Epoxy Intermediate, and Fluoropolymer Topcoat.

(2) Color. Final topcoat color shall be in accordance with Federal Standard 595B Color 26493. Each coat of paint shall have distinctly contrasting color shades with subsequent coats to be applied to aid in application and inspection. The Contractor shall submit color selection to the Engineer for review and final approval before ordering paint system products.

(3) Sheen. Final topcoat sheen shall have a gloss finish, according to the manufacturer's product data sheets.

(4) Environmental Parameters. If there is a difference in application parameters (temperature, relative humidity, dew point) from the manufacturer of the coatings and those listed in this specification; this specification shall take precedence.

(5) Additives. The Coating Manufacturer shall prepare the paint at the factory, tinted, and ready for application. No tinting will be allowed after shipping the paint.

(6) Labeling. Labels on containers shall show the exact title of the paint, the manufacturer's name, date of manufacture, date of expiration, the manufacturer's batch number, and product code. Package the paint in new and approved containers. Precautions concerning the handling and application of paint shall be shown on the label of all paint and clean-up solvent containers.

(7) VOC. All coatings used shall have a mixed VOC at or under 450 g/l (3.8 lbs/gal).

(B) Coatings Specified. Unless otherwise specified, coatings used shall be in accordance with the following coating system:

<u>HDG Steel Substructure and New Superstructure Steel</u>

All new pieces shall be Hot-Dip Galvanized at a certified galvanizer. Surface Preparation shall be SSPC-SP 16 Brush-Off Blast Cleaned with a 1.5-3.0 mil anchor tooth profile. Coatings shall be shop-applied.

Primer:	Zingametall Zinga 420 (organic zinc rich film galvanizing primer) @ 2.5-3.5 mils DFT
Mist Coat:	Tnemec Epoxoline II Series V69 (polyamidoamine epoxy) @ 1.0-1.5 mils DFT

Stripe Coat:	Tnemec Epoxoline II Series V69 (polyamidoamine epoxy) @ 2-3 mils DFT
Intermediate:	Tnemec Epoxoline II Series V69 (polyamidoamine epoxy) @ 4-6 mils DFT
Topcoat:	Tnemec Fluoronar Series 1070V (FEVE Fluoropolymer) @ 2-3 mils DFT

(C) Thinners, Cleaning Solvents, and Additives. Thinners, cleaning solvents, and additives shall be those recommended by the coating manufacturer. Cleaning solvents shall be used for cleaning of equipment. Thinner may not be added in amounts exceeding the limits set forth in the manufacturer's product data sheets (PDS).

(D) Hot-Dip Galvanizing.

(1) Standards. Hot-dip galvanizing practices shall be in accordance with ASTM A123/A123M, A153/A153M, and F2329.

(2) Quenching. Water quenching or chromate conversion coating shall not be used as these processes interfere with paint adhesion and surface preparation.

(E) Substitutions.

(1) Substitutions. In the event the supplier cannot provide the aforementioned coating system or individual coating product, the Contractor shall submit for approval a proposed alternate zinc-epoxy-fluoropolymer coating system or equivalent individual product for review. The submittal shall include signed documentation that the currently specified product(s) cannot be obtained. Additionally, the Submittal shall include the manufacturer's literature/PDS of the alternate product(s) detailing percent volume solids, application parameters, recommended thickness, and VOC. This literature shall include a reference list of equivalent structural projects where the proposed paint system was used, detailing dates, facility owner and coating applicator. No request for substitution will be considered that would decrease film thickness and/or number of coats or offer a change in the generic type of coating specified.

(a) Do not mix manufacturers. Proposed paint product(s) shall be from the same manufacturer.

(b) When the proposed product(s) manufacturer's literature requires a higher degree of surface preparation or a greater film thickness than specified herein, that degree of surface preparation and film thickness shall apply, at no additional cost to the State.

(c) The proposed product(s) shall have a minimum of two years field exposure on similar structures.

(d) No substitution will be considered unless a request for approval has been submitted by the bidder and has been approved by the Engineer at least 10 days prior to close of bids. The burden of proof of the merit of the proposed substitute is upon the proposer. The Engineer's decision of approval or disapproval of the proposed substitution shall be final.

667.03 Construction. The work of this section shall comply with ASTM D6386.

(A) General.

(1) Environmental Protection. The coating Contractor shall comply with the current Federal, State, and County laws and regulations pertaining to the protection of the environment in the performance of this type of work. These include but are not limited to regulations required by the State Department of Health (DOH) and Federal Environmental Protection Agency (EPA) rules and regulations.

(2) Worker Safety. The coating Contractor shall comply with the current Federal Occupational Safety and Health Administration (OSHA) and the local State Occupational Safety and Health requirements in which the shop is located for worker protection and safety equipment during all work on this project.

(3) Accreditation. The shop painting Contractor shall have their facility accredited to AMPP-QP 3 (Enclosed Shop) – Accreditation Program for Application of Complex Protective Coatings at the time of work. All procedures and documentations performed with regards to the coating of galvanized pieces shall be in accordance with the facility's established procedures documented as part of their QP 3 accreditation. The field painting Contractor responsible for touch-up painting of bridge elements after they have left the shop and for touch-up painting of field bolted connections shall be accredited to AMPP-QP 1 – Accreditation Program for Field Application of Coatings to Complex Industrial and Marine Structures.

(4) Best Practices. The Contractor shall paint the bridge components according to the best practices of the trade, in conformance with the recommendations of the coating manufacturer as delineated in the Product Data Sheets, observing all recommended environmental conditions, recoat windows, wet and dry film thicknesses, and in conformance with applicable portions of AMPP's Specification SSPC-PA 1, except where superseded by these specifications. If no recoat window is specified in the PDS, a minimum of 12 hours and maximum of 24 hours shall be observed as the applicable window.

(5) Quality of Finish. All coats shall be applied to a smooth even finish that is free of runs, drips, sags, dry-spray, overspray, and orange-peel. Pinholes, bubbles, and holidays are not acceptable.

(6) Environmental Conditions. All coats of paint shall be applied in a controlled shop environment between ambient conditions of 50°F – 90°F and substrate temperatures under 100°F. Relative humidity shall not exceed 85% during application and cure. During painting, substrate temperature must be at least 5°F above the dew-point and rising. Do not paint when the air adjacent to the surface contains a fog, mist, dust, or other particulate matter. Adequate dust collection, containment and/or dust removal is required for this project. Proper ventilation shall be maintained during surface preparation, coating application, and cure. If environmental restrictions of the coating PDS differ from the specification requirements, the specification requirements shall take precedence. Bridge components shall remain in the controlled shop environment for the duration of surface preparation, coating and cure.

(7) QC Inspection. All shop/field performed surface preparation and painting operations shall be inspected by an AMPP CIP Level 2 (formerly NACE CIP Level 2) Certified Coating Inspector, to be supplied by the Contractor. At a minimum, the inspector shall be present for all checkpoints listed in this specification. Inspections shall detail continual environmental conditions throughout the working day, coating processes used, surface preparation processes used, DFT coating thicknesses of each coat applied to galvanized steel, recoat windows, discrepancies, corrective actions, coatings applied, and any other pertinent information listed on PDS and inspection forms.

(8) QC Checkpoints. The coating Contractor shall inform the Engineer at least 48 hours prior to QC Checkpoint operations. In the event the Engineer is not present at the requested time, the Contractor may proceed to the next evolution so long as written approval has been obtained by the Engineer and the Contractor documents all required QC data.

(9) Paint Manufacturer's Representative. At the start of production work, a technically competent representative from Zingametall, supplied by the Contractor, shall be present at the shop to observe all operations of cleaning, surface preparation, and application of primer and mist coat. The representative needs only be present for these operations during the coating of the first several bridge components.

(10) Accessibility. The Contractor's shop shall be made accessible to the Engineer at all times.

(B) Surface Inspection and Smoothing.

(1) Inspection. Upon initial arrival of steel to the shop, the coating Contractor shall inspect members to verify suitability of the galvanized surfaces to receive paints prior to the commencement of surface preparation and paint application. Measure and document the initial average dry film thickness (DFT) of the galvanizing using a calibrated electronic gage in accordance with SSPC-PA 2. Report, in writing, to the Engineer or his designated representative any conditions or deficiencies with the base galvanizing that may affect proper application or overall performance.

(2) Surface Smoothing. Perform surface smoothing of zinc. Zinc high spots, such as metal drip lines, shall be removed by cleaning with hand tools or power tools as described in SSPC Surface Preparation Specification SSPC-SP 2 or SSPC-SP 3. The zinc shall be removed until it is level with the surrounding area, taking care that the base galvanized layer is not damaged.

QC Checkpoint – Surface Smoothing

(C) Surface Cleaning and Preparation. All sources of compressed air used for cleaning, blow down, or painting shall be tested daily and verified to be clean, dry, and oil free per ASTM D4285 blotter test.

(1) Cleaning. Before any surface preparation, remove all visible and non-visible contaminants (oil, grease, wax, dirt, dust, or residue left from galvanizing process, etc.) by methods specified in SSPC-SP 1 Solvent Cleaning. Water break tests, per ASTM F21, shall be performed to ensure removal of contaminants prior to surface preparation and coating. Tests shall be performed at random locations covering no less than 10% of the surface.

(2) Blasting. Blast all galvanized steel surfaces clean in accordance with SSPC-SP 16 Brush Off Blast Clean condition immediately prior to paint. The final blast profile of the galvanizing shall have an anchor tooth profile of 1.5 – 3.0 mils.

(a) Use rapid nozzle movement to roughen the HDG texture, as per ASTM D6386.

(b) Abrasive size and nozzle pressure shall be adequate to achieve the desired profile without damaging or eroding the HDG coating. No more than 0.8 mils of galvanizing is permitted to be removed in the process which exceeds the requirements of ASTM D6386. This parameter shall be closely monitored throughout the blasting process with periodic DFT readings of the galvanizing to ensure proper blasting technique and conformance to these specifications.

(c) Abrasives used shall be clean and uniformly graded, free of oil, soluble salts, and other similar substances.

(d) Abrasives shall have a hardness less than 5.0 on the Mohs scale and a particle size that falls within the mesh range of 50 - 100 unless other acceptable blast media is indicated within these specifications.

(e) Acceptable blast media shall be Jetmag 35-70 (Synthetic Olivine Pyroxene Sand), Starblast AlZiBlast 60/100 (Aluminosilicate Mineral Sand), or Barton 100 HPA Fine (Garnet).

(f) Due to the intricate assembly of the steel components, adjusting stand-off distance will prove difficult. It is important that the appropriate abrasive is selected that will allow the blaster to achieve the intended results.

(g) Steel components with difficult access, such as the interior of built-up column and bracing elements with closely spaced lacing or batten plates should consider blast cleaning using an internal pipe centrifugal blasting tool.

(h) All abrasives shall be tested for cleanliness per ASTM D4940 prior to use.

(i) Submit abrasive material, indicating type, size, and Moh's hardness to the Engineer for review and approval.

(j) Visually examine all blasted surfaces to ensure completeness of surface preparation. Random profile measurements shall be made according to ASTM D4417 Method C at random locations. At least 5 profile measurements shall be taken per 1,000 ft^2 of surface blasted.

(k) Measure and document the average DFT of the galvanizing using a calibrated electronic gage in accordance with SSPC-PA 2 to ensure preservation of the original galvanized thickness and to establish a baseline thickness to be used for evaluating the final coating system.

(l) Small areas that have been over blasted to bare steel or have removed more than 0.8 mils of galvanizing shall be touch-up repaired per ASTM A780 using zinc based solders. Application of a zinc rich paint will not be an acceptable repair procedure. The limits of what constitutes a small area shall be set forth by the requirements of ASTM A123. Repair areas shall be brush-off blasted again to reprofile the surface.

(m) Any areas that have been over blasted to bare steel or have removed more than 0.8 mils of galvanizing and exceed the tolerances of a small area (as defined by ASTM A123) shall not be accepted. The coating Contractor shall repair the steel element as directed by the Engineer at no increase in cost to the State.

QC Checkpoint – SSPC-SP 16 and Profile

(3) Blow Down. Blow with compressed air or vacuum the blasted surfaces to ensure all dust is removed prior to painting.

(4) Check Cleanliness. After SSPC-SP 16 cleaning, verify substrate cleanliness immediately prior to primer application. Ensure no abrasive blast media remains embedded in the surface of the galvanizing. Clean in accordance with SSPC-SP 1 if not clean prior to application of primer.

QC Checkpoint – Cleanliness

(D) Application of Primer. Application of Primer shall be made within 24 hours of beginning the SSPC-SP 16 blasting and profiling operation.

(1) Application Method. Apply primer via conventional or airless spray utilizing approved equipment that is standard to the industry and according to the instruction of the paint manufacturer.

(2) Areas with Difficult Access. The interior of the steel components with difficult access, such as built-up column and bracing elements with closely spaced lacing or batten plates shall be painted using an internal pipe centrifugal coater. For other areas, such as bearing assemblies or between stiffeners of column seats, the Contractor is permitted to utilize brush coating via extension brushes if needed.

(3) Measurements. Coating applicators shall use wet film thickness (WFT) gages periodically during application to ensure proper application thicknesses. After sufficient cure time, dry film thickness readings shall be taken with a calibrated electronic gage in accordance with SSPC-PA 2. Where DFT thickness measurements fall below the specified minimum, make additional application of paint, as necessary, to meet the thickness required, at no additional cost to the State.

(4) Holiday Inspection. After cure of primer, accomplish a visual holiday inspection and rectify any discrepancies as directed by the Engineer.

QC Checkpoint – Primer

(E) Application of Mist Coat. Application of mist coat shall begin a minimum of 4 hours after primer is touch-dry but no more than 24 hours after primer is touch-dry.

(1) Application Method. Apply mist coat via conventional spray or airless spray utilizing approved equipment that is standard to the industry and according to the instruction of the paint manufacturer.

(2) Areas with Difficult Access. The interior of the steel components with difficult access, such as built-up column and bracing elements with closely spaced lacing or batten plates shall be painted using an internal pipe centrifugal coater. For other areas, such as bearing assemblies or between stiffeners of column seats, the

Contractor is permitted to utilize brush coating via extension brushes if needed.

(3) Measurements. Coating applicators shall use wet film thickness (WFT) gages periodically during application to ensure proper application thicknesses. After sufficient cure time, dry film thickness readings shall be taken with a calibrated electronic gage in accordance with SSPC-PA 2. Where DFT thickness measurements fall below the specified minimum, make additional application of paint, as necessary, to meet the thickness required, at no additional cost to the State.

(4) Holiday Inspection. After cure of mist coat, accomplish a visual holiday inspection and rectify any discrepancies as directed by the Engineer.

QC Checkpoint – Mist Coat

(F) Application of Stripe Coat.

(1) Cleaning. Prior to stripe coating, verify all surfaces are clean and contaminant free according to SSPC-SP 1.

(2) Application Method. All stripe coating shall be accomplished by brush using the unthinned material and according to the best practices of the trade, in conformance with the recommendations of the coating manufacturer as delineated in the Product Data Sheets, observing all recommended environmental conditions, recoat windows, wet and dry film thicknesses, and in conformance with applicable portions of AMPP’s Specification SSPC-PA 1, except where superseded by these specifications.

(3) Locations. Striping shall be applied to ALL edges, corners, crevices, weld seams, and tight metal-to-metal joints. Do not stripe coat bolt holes. Stripe coat shall have a distinctly contrasting color to mist coat and intermediate coat to aid in determining coverage. During application, immediately brush out any runs, drips, sags, or puddles. Stripe coating shall cover all edges of the steel members, extending approximately ½” on either side of the edge. Stripe coating shall be uniform in appearance.

(4) Holiday Inspection. Verify stripe coat is applied to all required surfaces. After cure, accomplish a visual holiday inspection and rectify any discrepancies as directed by the Engineer.

QC Checkpoint – Stripe Coat

(G) Application of Intermediate and Topcoat.

(1) Cleaning. Prior to application of both the intermediate and topcoat, verify all surfaces are clean and contaminant free according to SSPC-SP 1.

(2) Application Method. Apply intermediate coat via conventional spray or airless spray. Apply topcoat via conventional spray only, except as otherwise allowed in these specifications. All techniques shall utilize approved equipment that is standard to the industry and according to the instruction of the paint manufacturer.

(3) Areas with Difficult Access. The interior of the steel components with difficult access, such as built-up column and bracing elements with closely spaced lacing or batten plates shall be painted using an internal pipe centrifugal coater. For other areas, such as bearing assemblies or between stiffeners of column seats, the Contractor is permitted to utilize brush coating via extension brushes if needed.

(4) Blocking/Masking. After the application of the intermediate coat, block paint surfaces at the ends of the components where field bolted connections occur so as to prevent application of the topcoat. Blocking shall be done using suitable means that will not damage the underlying intermediate coat upon removal. Masking material shall be removed from the painted surface within 48 hours of topcoat application. Refer to the contract drawings for details pertaining to paint blocking. After erection, the paint blocked surface and galvanized bolts shall be touch-up painted with the remaining topcoat in accordance with this specification.

(5) Measurements. Coating applicators shall use wet film thickness (WFT) gages periodically during application to ensure proper application thicknesses. After sufficient cure time, dry film thickness readings shall be taken with a calibrated electronic gage in accordance with SSPC-PA 2. Where DFT thickness measurements fall below the specified minimum, make additional application of paint, as necessary, to meet the thickness required, at no additional cost to the State.

(6) Cure/Recoat Times. Sufficient cure time shall elapse between successive coats to permit them to dry properly for recoating. Consult specific Product Data Sheet (PDS) for proper cure times. If any appreciable time elapses between painting operations, as judged by the Engineer or coating manufacturer, the Contractor shall re-clean surfaces before restarting painting operations.

(7) Holiday Inspection. After cure of both the intermediate and topcoat, accomplish separate visual holiday inspections and rectify any discrepancies as directed by the Engineer.

QC Checkpoints – Intermediate and Topcoat

(H) Shipping and Transportation. Prior to leaving the shop, each painted piece shall be sufficiently wrapped and padded to protect the components from ocean-borne chloride contamination and damage due to rubbing/impact with other transported components.

(I) Surface Preparation and Coating Application for Repair Areas. A repair area is any area on the steel which includes a surface defect such as a gouge, scrape, or any area that has been damaged due to handling, transportation, ongoing bridge construction, or Engineer approved in-field modification to steel element that has adversely affected the applied hot-dip galvanizing, primer, intermediate, or topcoat.

(1) Surface Preparation. Prepare damaged area(s) to sound coating/galvanizing using methods described in SSPC-SP 2 Hand Tool Cleaning, SSPC-SP 3 Power Tool Cleaning. Ensure that the galvanized layer beneath the paint is not damaged during preparation. Damaged galvanizing will need to be repaired per ASTM A780 using zinc-based solders.

(2) Feathered Edges. Ensure that the surrounding area is tightly adhered intact coating and feathered (beveled) smooth to eliminate rough edges. Coatings are considered tightly adhered if an edge cannot be lifted with a dull putty knife.

(3) Cleaning. Remove any dust, residue, or debris prior to application of paint repairs according to SSPC-SP 1.

(4) Paint Application. Apply touch-up coats of the entire selected coating system if the damage exposes the galvanized substrate. Application shall be by brush to specified thicknesses, in accordance with these specifications. Care shall be taken to apply coatings within the confines of the repair area and to ensure coatings are layered in the correct order. Application of primer over previously applied intermediate/topcoat or intermediate over previously applied topcoat will lead to adhesive bond failure.

(a) Adhere to Subsections 667.03(D) – Application of Primer and 667.03(G) – Application of Intermediate and Topcoat, where applicable for all areas.

(5) Inspection. All areas repaired shall be verified for completeness by the Engineer prior to final acceptance.

QC Checkpoint – Repairs

(J) Surface Preparation and Touch-Up Painting of Field Bolted Joints. Immediately prior to touch-up application of paint to any field bolted connection, all galvanized bolt assemblies (nuts, washers, and bolts) shall be prepared via a light hand wire brushing taking care not to damage surrounding paint. Follow brushing, clean all surfaces of existing paint within the blocked/masked area and any surfaces of bolt assemblies in accordance with SSPC-SP 1. Ensure all lubrication on high strength pretensioned nut assemblies is removed. The surface of the bolted joint shall be dry prior to coating.

(1) Bolted Connections at Bridge Superstructure, Bearings, and Anchor Bolts.

(a) Following installation of cross frames and struts at bridge superstructure (but prior to field application of spray applied topcoat), paint via brush, all galvanized bolted connections with one coat of the epoxy intermediate.

(b) Following installation of lateral diagonal bracing, tie plates, cable restrainer anchors, and plaque at bridge superstructure and bridge bearings, paint via brush, all galvanized bolted connections with one coat of the epoxy intermediate and one coat of the fluoropolymer topcoat. The Contractor shall take care when applying the intermediate coat to avoid overcoating with the previously applied topcoat as this will lead to adhesive bond failure.

(c) Following installation of trestle columns, paint via brush, all damaged ends of the threaded connections for the anchor bolts at the concrete pedestals. Depending on severity of damage, the Contractor shall apply either individual coats or the entire specified system. Contractor shall take care when applying the coats to avoid overcoating with the previously applied topcoat as this will lead to adhesive bond failure.

(2) Bolted Connections at Substructure Trestle Joints.

(a) Following bolt installation at column splice and brace to column gusset connections, mask the edges of the previously applied topcoat to ensure application remains within the confines of the blocked area. No overspray onto the previously applied topcoat shall be allowed.

(b) If previously applied epoxy intermediate is less than 60 days old, apply one coat of the epoxy intermediate and one coat of the fluoropolymer topcoat via spray application. Ensure complete coverage of the entire paint blocked area and the surface of all bolts, nuts, washers.

(c) If previously applied epoxy intermediate is greater than 60 days old, the surface of the previously applied intermediate epoxy will need to be sanded back to sound coating but shall not damage the underlying primer coat. Edges of sanded surface shall be feathered back (beveled) to create a smooth transition. Apply one coat of the epoxy intermediate and one coat of the fluoropolymer topcoat via spray application. Ensure complete coverage of the entire paint blocked area and the surface of all bolts, nuts, and washers.

(d) Adhere to Subsection 667.03(G) – Application of Intermediate and Topcoat, where applilcable for all areas.

QC Checkpoint – Touch-Up Field Bolted Connections

(K) Submittals.

(1) Product Data Sheets (PDS). The Contractor shall submit paint manufacturer’s PDS including the selected color of each product. Additionally, submit the manufacturer’s written warranty for each individual product including the conditions limiting the warranty.

(2) Safety Data Sheets (SDS). The Contractor shall submit the corresponding manufacturer’s SDS for each material supplied, including the thinning/cleaning solvents.

(3) Certificate of Conformance (COC). The Contractor shall submit signed COC's for all materials used under this specification. COC's for abrasive media shall list abrasive cleanliness testing results per ASTM D4940. COC's for coatings shall include a letter from the manufacturer stating that their product must be applied between temperatures of 50°-100°F, and at a relative humidity of no greater than 85%.

(4) Galvanizing. The Contractor shall submit a letter from the hot-dip galvanizer that post- treatment quenching will not be used in the galvanizing process.

(5) Abrasive. The Contractor shall submit the type and size of abrasive, along with any pertinent documentation indicating the Moh's Hardness values for the abrasive used in blasting operations.

(6) Coating Contractor's AMPP-QP 3 Shop Accreditation. The Contractor shall submit a copy of their current, up-to date AMPP-QP 3 Accreditation.

(7) Field Coating Contractor's AMPP-QP 1 Accreditation. The Contractor performing the field touch-up work for bolted joints and field repairs shall submit a copy of their current, up-to date AMPP-QP 1 Accreditation.

(8) Coating Contractor's Quality Control (QC) Reports. The Contractor shall maintain daily surface preparation and coating inspection reports in accordance with details of the AMPP QP 3 Contractor Accreditation. The reports shall indicate every item inspected at each required QC checkpoint and detail the work performed, noting areas prepared/painted, environmental conditions throughout the day (Including Substrate Temperature, Ambient Temperature, Dew Point, and Relative Humidity), product applied, batch numbers, date of manufacture, acceptance criteria, QC data, notes and any problems encountered. Photos detailing general work area and any applicable details shall be included in daily reports. A weekly report shall be compiled from the daily reports and submitted to the Engineer on a weekly basis.

(9) Sample QC Report. A sample blank copy of the daily inspection report to be used shall be submitted to the Engineer prior to the start of production work. This sample report shall be formatted specifically for this project with all required inspection fields contained herein.

(10) Coating Contractor's Work Plan. No more than eight weeks from the start of production work, the contractor shall submit a Coating Work Plan. The work plan, at a minimum, will detail coating contractor's name and location, preparation and coating activities, specific equipment and methods used, how work pieces will be supported in the shop during painting operation and how these areas will be sufficiently coated after support removal, how abrasive blasting operation will be accomplished so as to minimize damage to galvanized surface, how operations will take place in areas of difficult access, and final acceptance.

(11) Blast Operator Resume. The Contractor shall submit a resume of blast operators that will be working on the job and a list of ten projects that they have successfully completed for SSPC-SP 16 surface preparation in the past 5 years.

(12) AMPP CCI Credentials. Submit the name and resume of the designated AMPP Certified Coating Inspector – Level 2, detailing their past work history, durations, and inspection activities.

667.04 Measurement.

(A) Clean and Paint New Bridge Steel Trestles will be paid on a lump sum basis. Measurement for payment will not apply. Paint Blocking, use of an AMPP Certified Coating Inspector, and preparation of components for shipping shall be considered incidental.

(B) Clean and Paint New Bridge Steel Cross Frames, Struts, Tie Plates, and Lateral Diagonal Bracing will be paid on a lump sum basis. Measurement for payment will not apply. Touch-up painting of field bolted connections for these components, use of an AMPP Certified Coating Inspector, and preparation of components for shipping shall be considered incidental.

(C) Touch-Up Paint Bolted Connections at Trestles After Erection shall be in accordance with Subsection 667.03 Construction (J) (2) and will be paid on a lump sum basis. Measurement for payment will not apply. Equipment/Work platforms needed to gain access to the bolted connection locations shall be considered incidental.

667.05 Payment. The Engineer will pay for the accepted pay item listed below at contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

The Engineer will pay for the following pay items when included in the proposal schedule:

Pay Item	Pay Unit
Clean and Paint New Bridge Steel Trestles	Lump Sum
Clean and Paint New Bridge Steel Cross Frames, Struts, Tie Plates, and Lateral Diagonal Bracing	Lump Sum
Touch-Up Paint Bolted Connections at Trestles After Erection	Lump Sum

END OF SECTION 667”

Make this Section a part of the Standard Specifications:

"SECTION 677 – PENETRATING SEALER FOR BRIDGE DECKS

677.01 Description. This work consists of providing all labor, materials, and equipment required to prepare, clean, and apply a penetrating epoxy sealer system to concrete bridge decks.

677.02 Materials.

(A) Penetrating Sealer. All materials shall be virgin; free of secondary components, volatile solvents, and external/conventional flexibilizers. Component batches shall be interchangeable. Epoxy sealer shall be a solvent-free 0-VOC, two-component, 100% solids, moisture insensitive, low viscosity, low modulus epoxy penetrating sealer. Epoxy shall meet the current ASTM C881 and AASHTO M235, Type III, Grade 1, Classes B & C specifications and the requirements listed in Table 1 below.

Table 1 – Two-Component Resin Binder Requirements

Property	Requirement	Test Method
Viscosity	<150 cps	ASTM D2393
Tensile Properties, 7 day cure	Tensile Strength >1,000 psi (12.4 MPa)	ASTM D638
	Tensile Elongation: 50%	
Compressive Properties, 7 day cure	Compressive Strength: >2,500 psi (20.9 MPa)	ASTM D695
	Compressive Modulus: <130,000 psi (620 MPa)	
Bond Strength	250 psi (2.0 MPa)	ASTM C1583/ACI 503R
Thermal Compatibility	Pass	ASTM C884
Water Absorption	0.2% (24 hr)	ASTM D570
Chloride Ion Permeability	0.0 coulomb	AASHTO T277
Gel Time (60 g mass)	>15 minutes	
Tack Free Time (73º F or 23º C)	2 to 5 hours	

- A test report* consisting of a certification by an *AASHTO resource/CCRL* accredited independent testing laboratory showing compliance with the requirements of this specification and material properties. Include the laboratory's accreditation and the certification of the technician that performed the test for the test method performed with the test results.

- Product data sheets and specifications from the manufacturer showing instructions, application recommendations, methods, and product properties.

*Dated within 90 days of contract award.

Table 2 - Working Time

Surface Temperature (ºF)	Maximum Working Time* (minutes)
50	50
60	40
70	30
80	20
90	10
100	8
110	6
120	4

*Includes mix time, resin binder and aggregate placement.
Note: Consult manufacturer for surface temperatures exceeding 120ºF.

(B) Topping Aggregate. Furnish aggregate meeting the requirements listed in Table 3 – Topping Aggregate Properties and Table 4 – Gradation for Topping Aggregate below unless otherwise specified by the Engineer. Deliver the aggregate to the construction site in unopened bags or super sacks labeled clearly for identification. Provide aggregate that is virgin, clean, dry, and free from foreign matter. Ensure aggregate meets the requirements in Table 3 – Topping Aggregate Properties and Table 4 – Gradation for Topping Aggregate. Ensure aggregate is angular, consists of natural silica sand, basalt, or other nonfriable aggregate, and contains less than 0.5 percent moisture when tested in accordance with ASTM C 566. A sample of the aggregate lot/batch shall be supplied upon request.

Table 3 – Topping Aggregate Properties

Property	Test Method	Requirements
Gradation	ASTM C136	See Table 4
Moisture	ASTM C566	<0.5%
MOHS Hardness	MOHS Scale	≥7.0
Micro-Deval, maximum	AASHTO T327	<10%
Absorption	ASTM C127	<2.0%

Table 4 – Gradation for Topping Aggregate

Armorstone	992-3 - #14 x #50
Sieve size	Individual % Retained
No. 12	0 – 0.1
No. 14	0 – 10
No. 16	0 – 25
No. 20	10 – 70
No. 30	10 – 90
No. 40	0 – 40
No. 50	0 – 5
No. 60	0 – 0.5
No. 100	0 – 0.5
Pan	0

(C) **Storage and Handling.** All materials shall be delivered in their original unopened containers bearing the manufacturer’s label, specifying date of manufacturing, batch number, trade name, and quantity. Each shipment of resin binder shall be accompanied by a Safety Data Sheet (SDS).

The material shall be stored to prevent damage by the elements and to ensure the preservation of their quality and fitness for the work. The storage space shall be kept clean, cool, covered, and dry per manufacturer’s recommendations.

Stored materials shall be inspected prior to their use, and shall meet the requirements of this Specification at the time of use.

Any material which is rejected based on failure to meet the required tests or that has been damaged to a point where it is unsuitable for use shall be immediately replaced at no additional cost to the State.

The Contractor shall arrange to have the material supplier furnish technical service related to application of material and health and safety training for personnel who are to handle the penetrating sealer.

Any recycled topping aggregates shall meet the same requirements listed in Table 3 – Topping Aggregate Properties and Table 4 – Gradation for Topping Aggregate. Recycled topping aggregates shall be stored separately from new topping aggregates.

677.03 Construction.

(A) Submittal Requirements. Prior to the Just-In-Time Training (JITT) and the start of this work, provide 6 copies (2 copies for Highways Division Materials Testing and Research Branch (HWY-L)) of the following submittals in one complete set for acceptance. Clearly indicate the section the material is being submitted for, including the test method identification, table it is located on in the section, name of the product and its manufacturer on pertinent submittals. No work that is related to these submittals shall be performed until written acceptance has been received.

(1) Name and contact information of the resin binder and aggregate manufacturer's technical representative and other key personnel.

(2) A warranty on the products provided by the epoxy binder manufacturer. Warranty shall be for a minimum of 10 years.

(B) Quality Control (QC) Plan. Submit a QC Plan to the Engineer for acceptance a minimum of 30 days prior to the installation and the Just-In-Time Training (JITT). Resubmittal of the document will require another 30 days for each resubmittal. Discuss the QC Plan requirements at the JITT and progress meetings. The JITT shall not be held unless the QC Plan is accepted 30 days before the scheduled JITT date. Work shall not start on the penetrating sealer, including the test application, until the JITT has been completed and the QC Plan and the Work Plan have both been accepted. The QC Plan shall contain at a minimum the following information:

(1) Names and contact information for key personnel, project superintendent, and lead technician responsible for field quality control sampling and testing.

(2) Location of resin binder production plants and batch production records.

(3) Location of aggregate production plants and batch production records.

(4) Proposed method of installation at each location identified to receive surfacing.

(5) Resin binder and aggregate manufacturer's material information including:

(a) Recommended placement instructions with adjustments for Hawaii's ambient weather conditions.

(b) Mixing instructions.

(c) Recommended installation temperatures.

(d) Anticipated gel and cure times at various expected ambient temperatures for all sites.

(e) Methods of safe storage and handling.

(f) Applicable installation and material limitations.

(g) Disposable methods for excess mixed resin binder and associated components.

(h) Means and methods for recycling of aggregates. QC/QA testing to ensure recycled aggregates meet requirements listed in Table 3 – Topping Aggregate Properties and Table 4 – Gradation for Topping Aggregate.

(i) Production plant location contact information for the quality control/quality assurance (QC/QA) personnel where additional information can be requested concerning record keeping methods, inspection methods, equipment calibration records, and accreditation certificates.

(j) Test reports of bond strengths shall be submitted once every 2 weeks.

The QC Plan shall designate a QC Manager, who shall be present at the jobsite and have full authority to request any action necessary for the operation of the QC Plan providing it complies with the contract documents and acceptance of the Engineer.

The QC Manager shall be certified in all test methods used and be responsible for the required field quality control in sampling and testing in conformance with the accepted quality control plan, test methods and contract documents. All sampling shall be performed in the presence of the Engineer. All testing must be performed by certified personnel. The certification must be for the test methods used. The Engineer is not responsible and shall not be regarded as part of the Contractor's QC team. It is the responsibility of the Contractor and the QC Manager to ensure that the test procedure being used is compliant with the test method standard. Inspections are performed for the exclusive benefit of the State. The inspection of or the failure to inspect the work shall not relieve the Contractor of obligations to fulfill the contract as prescribed, to correct defective work, and to replace unsuitable or rejected materials regardless of whether payment for such work has been made. The

Engineer has the right to reject the test if the Engineer feels that it is non-compliant, e.g., the technician who performed the test is not certified or the material testing laboratory is not accredited to perform the required tests. Maintain and have available upon request, the current test standard methods documentation being used, referenced documents, complete records of sampling, testing, corrective actions, and quality control inspection results.

A technical representative from the resin binder manufacturer shall be present at the JITT, Test Application, e.g., deck repair, surface preparation, installation and acceptance of the penetrating sealer, and at the construction site for at least the first two days of the penetrating sealer installation.

(C) Work Plan. Submit a Work Plan to the Engineer for approval 30 days prior to the JITT. No installation work shall start until the Work Plan is accepted and discussed in the JITT. Discuss the Work Plan requirements at the progress meetings. The Work Plan shall contain at a minimum the following information:

(1) Detailed information on all equipment and materials that will be used for all aspects of the work.

(2) Method of surface preparation and required surface condition for adequate bonding.

(3) Method of crack repair and defective concrete repair of existing concrete deck.

(4) Construction during inclement weather. Plan for the occurrence of rain, moisture in the pavement, and temperature requirements for the materials being used.

(5) Mixing ratio and application rates for resin binder and aggregate. Refer to Table 2 – Working Time.

(6) Paving Plan (Jointing Plan, Installation sequence, Direction of Paving, etc.).

(7) Application Method.

(8) Curing time and requirements for opening to traffic.

(9) Testing for bond.

(10) Corrective actions that will be taken for unsatisfactory installation practices. Any corrective actions that have not been discussed in this submittal shall be submitted for approval by the Engineer.

If any work during the entirety of the project does not comply with or follow the approved work plan, a new work plan shall be submitted and approved prior to any work resuming.

(D) Just-In-Time-Training. JITT shall be held and shall conform to Section 695 – JUST IN TIME TRAINING.

(E) Equipment. For the epoxy penetrating sealer, provide a distribution system or distributor capable of accurately blending the epoxy resin and hardening agent, and uniformly and accurately applying the epoxy materials at the specified rate to the bridge deck in such a manner as to cover 100 percent of the work area. Provide a fine aggregate spreader capable of uniformly and accurately applying dry aggregate to cover 100 percent of the epoxy material. Provide a self-propelled vacuum truck to remove all loose aggregate.

(1) For hand applications, provide calibrated containers, a-Jiffy® type mixer for mixing, and equipment or tools suitable for applying the epoxy. Aggregate shall be broadcast by hand until refusal onto the wet epoxy.

(2) For mechanical applications, provide meter-mixing equipment that will automatically and accurately proportion the components in accordance with the manufacturer's recommendations and will mix and continuously place the penetrating sealer. Ensure the operation proceeds in such a manner that will not allow the mixed materials to segregate, dry, be exposed or otherwise harden in such a way as to impair the retention and bonding of broadcasted aggregate.

(F) Surface Preparation. Remove entire AC overlay on the existing bridge prior to starting surface preparation for the existing concrete bridge deck. Surface preparation shall conform to the following requirements:

(1) The existing concrete deck shall be roughened by shotblasting or approved equal. If HPC is not placed within 48 hours of shotblasting then the existing concrete deck will need to be shotblasted again at no extra cost to the State.

(2) Sweep the surface clean with a vacuum sweeper. Then blow the surface clean with oil-free compressed air to remove dust and laitance.

(3) Clean and prepare cracks greater than 0.010-inches wide per resin binder manufacturer's recommendations.

(4) Clean and prepare divots/depressions per resin binder manufacturer's recommendations.

(5) All laitance, contaminants, paint, markers, and foreign material that may be detrimental to the bonding of the new overlay must be removed from the existing concrete surface.

The Contractor shall take extra care not to damage the existing expansion joints during the surface preparation of the existing concrete deck.

An approved moisture meter shall be used to check the moisture in the existing substrate prior to application of any surface treatment. An equal or better method may be submitted to the Engineer for approval. A maximum moisture reading of under 3% will be allowed. If rain occurs for more than 10 minutes no application of penetrating sealer will be allowed for the remainder of the work shift.

During surface preparation and application, precaution shall be taken to assure that traffic is protected from rebound, dust and construction activities. Dust in the air at night may become an opaque vision barrier to motorists due to headlights and floodlights. The Contractor must not allow this to happen. Appropriate shielding shall be provided as required and as directed by the Engineer at no additional cost. The Contractor shall provide suitable protection as needed to protect all exposed areas not to receive penetrating sealer such as parapets, drains, etc. All damage and defacement resulting from the application shall be cleaned and, or repaired to the Engineer's satisfaction at no additional cost to the State.

(G) Test Application. The test application shall be a part of the production location before starting production work. Resin binder manufacturer's representative shall be present during the test application. The test application shall meet the following requirements:

(1) Install a minimum of 1000 square feet.

(2) Construct using the same method and equipment as the production work.

(3) Construct an additional test application for each method proposed for the production work.

(4) Replicate field conditions, including ambient and surface temperatures, time period, anticipated for production work.

(5) Demonstrate surface preparation method as outlined in the QC plan.

(6) Demonstrate that the data management system is capable of documenting ambient and surface temperatures, quantities of resin binder and aggregate, coverage rates and reporting application rates in real time.

(7) Determine the initial set time for the resin binder.

The Contractor shall perform three pull-off tests on the trial pour in accordance with ASTM C1583 Standard Test Method for Tensile Strength of Concrete Surfaces and Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method) and the manufacturer's recommendations. The pull-off tests shall have a minimum tensile bond strength of 250 psi at 24 hours or 100% substrate failure. The Contractor shall record the pull-off test results and the amount of any failure into the base concrete, and shall provide written documentation of the test results. The Engineer will designate the location of the pull-off tests. After the completion of the tests, repair all test areas using penetrating sealer and topping aggregate.

The Contractor shall not begin construction operations at the site receiving penetrating sealer until receiving approval of the completed test application. If the test application is rejected then the Contractor shall perform another test application at no additional cost or contract time to the State. Rejected test application shall be removed per Subsection 105.12 - Removal of Non-Conforming and Unauthorized Work.

(H) Placement.

(1) Mixing.

(a) Hand Mixing. Precondition material to 75°-85°F before using. Measure and mix one part by volume of Part A with one part by volume of Part B for three minutes with a low speed (< 450 rpm) drill using a jiffy mixer or paddle. Mix only as much material as can be used within the pot life. Air, material, and surface temperature must be a minimum of 50°F (10°C) prior to mixing or installation. The Contractor shall limit hand applications and only use it where absolutely necessary. Hand applications must be approved by the Engineer prior to starting work.

(b) Mechanical Mixing. Application equipment shall be calibrated, self-propelled, and capable of continuously and thoroughly blending the resin binder components to the ratio recommended by the manufacturer. For mechanical applications consult material manufacturer for proper mixing and dispensing equipment.

(2) Application. Expansion joints, drains and grates shall be adequately isolated to prevent any penetrating sealer from entering drainage and joint systems. The penetrating sealer discharged from the mixer shall be uniform in composition and consistency. Mixing capability shall be such that initial and final finishing operations can proceed at a steady pace.

Continuous application must be performed by approved, calibrated, self-propelled application equipment capable of continuously and thoroughly blending the resin binder components to the ratio recommended by the manufacturer. An equal or better method may be submitted to the Engineer for approval. After the epoxy mixture has been prepared, immediately distribute evenly and work into concrete with a squeegee or approved equal for a minimum of 5 minutes for maximum penetration. Keep ponding epoxy into cracks until refusal. Existing surface profile of substrate shall be factored into volume calculations. All tines and surface irregularities shall be filled with this material. Penetrating sealer shall have a minimum thickness of 25-30 mils. Verify thickness using a Wet-Mil film thickness gauge for each placement at 700 square feet intervals and at the discretion of the Engineer. Thickness measurements shall not be taken in the tines, but on the surface of the concrete (top of the tines).

The continuous application equipment shall have an aggregate distribution system capable of mechanically placing aggregate into the wet resin binder evenly across the full width of the installation. The application equipment shall install the penetrating sealer at a minimum application rate of 240 square feet per minute. An equal or better method may be submitted to the Engineer for approval. Ensure the topping aggregate is applied uniformly within the working time.

Ensure handling and mixing of the epoxy resin and hardening agent is performed in a safe manner to achieve the desired results in accordance with the manufacturer's recommendations or as directed by the Engineer. Do not place penetrating sealer when the concrete surface is less than 50 degrees Fahrenheit (F) or ambient air temperature is forecast to fall below 50 degrees F within 8 hours of application. Do not place penetrating sealer materials if weather or surface conditions are such that the material cannot be properly handled, placed, and cured according to the manufacturer's requirements and the specified requirements for traffic control. Penetrating sealer shall only be placed after the existing concrete is cleaned according to Subsection 677.03 (F) - Surface Preparation.

Ensure no bleed through or wet spots are visible once the topping aggregate is applied. Minimize all foot traffic on the uncured epoxy and ensure any foot traffic will only be done with steel spiked shoes approved by the Engineer. Do not allow traffic or equipment on the penetrating sealer surface during the curing period. Remove all loose aggregate after the curing period with a vacuum or broom without tearing or damaging the surface. Perform a final sweep of loose aggregates and debris from the areas adjacent to the applied penetrating sealer within end of work shift. Ensure all expansion joints are free of loose aggregate, epoxy and other debris.

For repairing individual cracks follow manufacturer's recommendations on mixing and placement.

(3) Curing. Traffic and construction equipment shall not be permitted on the completed penetrating sealer for 3 hours after placement or until the penetrating sealer is tack free whichever is later.

(I) Testing. Test for any raveling, delamination, streaking, or bond test failure according to the manufacturer's recommendations. A minimum of three pull-off tests at locations selected by the Engineer shall be performed for each placement. Testing will be performed in accordance with ASTM C1583 Standard Test Method for Tensile Strength of Concrete Surfaces and Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method) and the manufacturer's recommendations. A passing test occurs when the failure of the concrete substrate or bond strength is above 250 psi at 24 hours. Fill cored holes with penetrating sealer material approved by the Engineer. A passing substrate failure is when more than 50% of the substrate covers the specimen being tested. Fill cored holes with material approved by the Engineer.

(J) Acceptance and Corrective Action. The completed penetrating sealer shall be free of any smooth or wet areas such as those resulting from insufficient quantities of topping aggregate. Completed surface must smooth out the existing deck to achieve a uniform thickness, texture and appearance.

Correct all defects in material and work, as directed, at no additional cost to the Engineer, according to the following:

(1) Remove and replace any penetrating sealer that the Engineer determines has any raveling, delamination, streaking, or bond test failure. Removal and replacement shall be in accordance with the manufacturer's recommendations and accepted by the Engineer.

(2) Ensure the minimum replacement is the full lane width and the length of the defect plus five lane feet on the up-station and down-station side of the edge of the defect area and as accepted by the Engineer.

Replaced areas will be retested and evaluated for acceptance or further corrective action.

(3) Any roadway features disturbed, damaged or defaced by the work or the Contractor's operations shall be restored with the same materials and design as directed by the Engineer at no additional cost to the State.

The Engineer shall have the right to reject all work which is not in compliance with the requirements of the drawings and specifications. Rejected work shall be removed per Subsection 105.12 – Removal of Non-Conforming and Unauthorized work.

677.04 Measurement. Penetrating sealer will be measured per square foot as shown on the plans and contract documents.

Crack Repair will be paid on a force account basis in accordance with subsection 109.06 – Force Account Provisions and Compensation.

677.05 Payment. The Engineer will pay for the accepted quantities of penetrating sealer complete in place at the contract unit price per square foot. Payment for JITT shall be considered as incidental for this section. The Engineer will pay for the accepted crack repairs on a force account basis in accordance with subsection 109.06 – Force Account Provisions and Compensation. Payment will be full compensation for the work prescribed in this section and the contract documents.

Payment will be full compensation for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for preparing road surface, placing materials in final position, sweeping or for the minimum testing of the materials and placement as defined in this specification.

No separate or additional payment will be made for reinstallation and retesting of penetrating sealer where the initial installation was determined to be defective.

The Engineer will pay for the following pay items when included in the proposal schedule:

Pay Item	**Pay Unit**
Penetrating Sealer ______	Square Foot
Additional Penetrating Sealer for Filling Top of Deck Cracks	Force Account"

END OF SECTION 677

Make the following Section a part of the Standard Specifications:

"SECTION 678 – HYBRID POLYMER CONCRETE (HPC)

678.01 Description. The work shall include the furnishing of all labor, materials, equipment and any other related miscellaneous items necessary to completely construct all HPC as shown on the plans and as specified herein.

HPC shall be 100% solids, thermosetting hybrid polymer concrete and composed of the following four components: two-component reactive hybrid polymer resin binder, a blend of specified aggregates to be mixed with the resin binder, and topping aggregate.

678.02 Materials.

(A) Two-component Resin Binder. The resin binder shall be solvent-free, 0-VOC, moisture-insensitive, two-component reactive thermoset polymer binder conforming to the following requirements in Table 1 – Physical Requirements for HPC Resin Binder:

Table 1 – Physical Requirements for HPC Resin Binder

Quality Characteristic	**Test Method**	**Requirement**
Viscosity (RV2 @ 20 RPM)	ASTM C881 / AASHTO M 235	1000 – 1500 cP
Flash Point	ASTM D3278	>250° F
VOC Content	ASTM D2369*	<10 g/L
Gel Time	C881 / AASHTO M 235	10 minutes minimum
Tensile Strength (7 days)	ASTM D638, Type I Specimen	1500 – 2500 psi
Tensile Elongation	ASTM D638	40% minimum at 7 days
Adhesion to Concrete	ASTM C1583 (ACI 503R)	250 psi or 100%
		substrate failure at 24 hrs
Water Absorption (24 hrs.)	ASTM D570	0.5% maximum
Type D Hardness	ASTM D2240	60 – 80
Thermal Compatibility	ASTM C884	PASS
Chloride Ion Permeability	AASHTO T277	<10.0 Coulombs
Compressive Modulus	ASTM C579	<450,000 psi
(7 day)	(Extended)	

*Method E, 55-60 mil thickness

-No volatile chemical odors
-No explosive catalysts or ingredients allowed
-Material must be MADE IN THE USA

(B) Aggregates. The aggregate for the HPC shall conform to this section and conform to the following:

(1) Gradation shall be in accordance with Table 2 – Gradation for HPC Aggregate.

Table 2 – Gradation for HPC Aggregate

Sieve size	Percentage passing
1/2"	100
3/8"	98-100
No. 4	77-100
No. 8	60-82
No. 16	34-56
No. 30	5-25
No. 50	0-15
No. 100	0–7
No. 200	0–3

(2) The aggregate absorption shall not exceed 1.5% as determined by AASHTO T 85 or as otherwise approved by the Engineer.

(3) At the time of mixing with the resin, the moisture content of the aggregate, as determined by AASHTO T 255, shall not exceed one half of the aggregate absorption.

(4) The HPC aggregate temperature must be between 45 deg. F and 100 deg. F at the time of mixing.

(C) Topping Aggregate. Furnish aggregate meeting the requirements listed in Table 3 – Topping Aggregate Properties and Table 4 – Gradation for Topping Aggregate unless otherwise specified by the Engineer. Aggregate shall be a dull black in color. Deliver the aggregate to the construction site in bags or super sacks labeled clearly for identification. Provide aggregate that is virgin, clean, dry, and free from foreign matter. A sample of the aggregate lot/batch shall be supplied upon request.

Table 3 – Topping Aggregate Properties

Test Data Description	Test Procedure	Requirements
Gradation	ASTM C136	See Table 4
Moisture	ASTM C566	<0.5%
MOHS Hardness	MOHS Scale	≥7.0
Micro-Deval, maximum	ASTM D6928	<10%
Absorption	ASTM C128	<2%

Table 4 – Gradation for Topping Aggregate

Armorstone	9800-2 - #4 x #16
Sieve size	Percentage passing
No. 4	100
No. 8	30-75
No. 16	0-5

(D) Storage and Handling. All materials shall be delivered in their original unopened containers in new undamaged condition, bearing the manufacturer's label, specifying date of manufacturing, batch number, trade name, and quantity. Each shipment of resin binder shall be accompanied by a Safety Data Sheet (SDS).

The material shall be stored to prevent damage by the elements and to ensure the preservation of their quality and fitness for the work. The storage space shall be kept clean, covered, cool and dry.

Stored materials shall be inspected prior to their use, and shall meet the requirements of this Specification at the time of use.

Any material which is rejected because of failure to meet the required tests or that has been damaged so as to cause rejection shall be immediately replaced at no additional expense to the State.

The Contractor shall arrange to have the material supplier furnish technical service related to application of material and health and safety training for personnel who are to handle the HPC.

Any recycled topping aggregates shall meet the same requirements listed in Table 3 – Topping Aggregate Properties and Table 4 – Gradation for Aggregate Topping. Recycled topping aggregates shall be stored separately from new topping aggregates.

678.03 Construction Requirements. Conform to the requirements of Section 503 – Concrete Structures and Section 601 – Structural Concrete in these specifications.

(A) Submittal Requirements. Prior to the Just-In-Time Training (JITT) and the start of this work, provide 6 copies (2 copies for Highways Division Materials Testing and Research Branch (HWY-L)) of the following submittals in one complete set for acceptance. Indicate clearly the name of the product and its manufacturer on pertinent submittals. No work that is related to these submittals shall be performed until written acceptance has been received. Submit all items listed to the Engineer for approval 30 days prior to installation.

(1) A warranty on the entire overlay system provided by the manufacturer. Warranty shall be for a minimum of 10 years.

(2) Work Plan. Submit a Work Plan to the Engineer for approval 30 days prior to the JITT, pre-construction meeting, and pre-installation meeting, whichever is earliest. No installation work shall start until the Work Plan is accepted and discussed in the JITT, pre-construction meeting, and pre-installation meeting. Discuss the Work Plan requirements at the pre-construction, pre-installation, and progress meetings. The Work Plan shall contain detailed step by step procedures for all aspects of the work and at a minimum the following information:

(a) Detailed information on all equipment, materials, and staging areas that will be used for all aspects of the work.

(b) Method of surface preparation and required surface condition for adequate bonding. The procedure shall include the method and materials used to contain, collect, and dispose of the concrete debris generated by the scarifying process, including provisions for protecting adjacent traffic from flying debris.

(c) Method of crack repair/defective concrete repair of existing concrete deck prior to placement of HPC.

(d) Method of determining surface profiles.

(e) The HPC mix design and the estimated curing time based on anticipated temperatures.

(f) Paving plan (Jointing Plan, Installation sequence, Direction of Paving, etc.). Construction joints shall be located away from the wheel path.

(g) Method of placement (handling, mixing, consolidating, finishing, curing, and texturing) of HPC. This includes placing topping aggregate.

(h) Detailed step by step procedures for testing bond, compressive strengths, and delaminations.

(i) Construction during inclement weather. Plan for the occurrence of rain, moisture and temperature requirements for the materials being used.

(j) Corrective actions shall be taken for unsatisfactory installation practices. Any corrective actions that have not been discussed in this submittal shall be submitted for approval by the Engineer.

If any work during the entirety of the project does not comply with or follow the approved Work Plan, a new work plan shall be submitted and approved prior to any work resuming.

(3) **Quality Control (QC) Plan.** Submit a QC Plan to the Engineer for acceptance a minimum of 30 days prior to the installation and the JITT. Resubmittal of the document will require another 30 days for each resubmittal. Discuss the QC Plan requirements at the JITT, pre-construction, pre-installation, and progress meetings. The JITT shall not be held unless the QC Plan is accepted 30 days before the scheduled JITT date. Work shall not start on the HPC overlay test application, until the JITT has been completed and the QC Plan and the Work Plan have both been accepted. The QC Plan shall contain at a minimum the following information:

(a) Names and contact information for key personnel, project superintendent, and lead technician responsible for field quality control sampling and testing. Submit the laboratory's accreditation for the test method used and the technician's and the QC Manager's certification for all the test methods used.

(b) The name of the manufacturer of the HPC materials including the name and phone number of the Manufacturer's Technical Representative.

(c) Certificates of compliance and test reports for all materials used in the HPC mix.

(d) Manufacturer's written instructions for the installation of the overlay system and the storage of all overlay materials.

This shall include means and methods for recycling of aggregates. Quality Control (QC)/Quality Assurance (QA) testing to ensure recycled aggregates meet requirements listed in Table 3 – Topping Aggregate Properties and Table 4 – Gradation for Aggregate Topping.

(e) Information on the HPC including shelf life, working times, pot life (at anticipated ambient temperatures) and placement rates.

(f) Detailed plans and procedures to be in compliance with Section 107 - Legal Relations and Responsibility to Public including complying to noise variances, and controlling of work to appropriately minimize dust and air borne debris from cleaning and roughening the substrata, mixing and placing HPC, and cleaning operations, and to prevent water runoffs.

(g) Planned actions to maintain adherence to limitations and requirements of the following variables with regards to HPC work:

(1) Equipment and traffic control near or on work areas during placement and curing operations

(2) Inclement weather

(3) Moisture and temperature requirements for the materials being used

(h) Produce test reports of compressive strengths and bond strengths, during the progress of the work. Reports shall be submitted once every 2 weeks.

The QC Plan shall designate a QC Manager, who shall be present at the jobsite and have full authority to request any action necessary for the operation of the QC Plan providing it complies with the contract documents and acceptance of the Engineer.

The QC Manager shall be certified in all test methods used and be responsible for the required field quality control in sampling and testing in conformance with the accepted quality control plan, test methods and contract documents. All sampling shall be performed in the presence of the Engineer. All testing must be done at an accredited material testing laboratory performed by certified technicians. The accreditation and certification must be for the test methods used. The Engineer is not responsible and shall not be regarded as part of the Contractor's QC team. It is the responsibility of the Contractor and the QC Manager to ensure that the test procedure being used is compliant with the test method standard. Inspections are performed for the exclusive benefit of the State. The inspection of or the failure to inspect the work shall not relieve the Contractor of obligations to fulfill the contract as prescribed, to correct defective work, and to replace unsuitable or rejected materials regardless of whether payment for such work has been made. The Engineer has the right to reject the test if the Engineer feels that it is non-compliant, e.g., the technician who performed the test is not certified or the material testing laboratory is not accredited to perform the required tests. Maintain and have available upon request, the current test standard methods documentation being used, referenced documents, complete records of sampling, testing, corrective actions, and quality control inspection results.

A technical representative from the resin binder manufacturer shall be present at the JITT, Test Application, e.g., deck repair, surface preparation, installation and acceptance of the HPC overlay, and at the construction site for at least the first two days of the HPC overlay installation.

(B) General. The HPC manufacturer shall have a representative on the job site for the startup of the project. The HPC representative must report any work or materials that may result in non-compliant work to the Engineer, who may suspend any item of work that is suspect and does not meet the requirements of this specification. Resumption of work will occur only after the manufacturer's representative and the Engineer are satisfied that appropriate remedial action has been taken by the Contractor. No work shall proceed and materials will not be accepted if manufacturer's technical representative is not on site for the startup of the project.

During surface preparation and application, precaution shall be taken to assure that traffic is protected from rebound, dust and construction activities. Dust in the air at night may become an opaque vision barrier to motorists due to headlights and floodlights. The Contractor must not allow this to happen. Appropriate shielding shall be provided as required and as directed by the Engineer at no additional cost. The Contractor shall provide suitable protection as needed to protect all exposed areas not to receive HPC such as parapets, drains, etc. All damage and defacement resulting from the application shall be cleaned and, or repaired to the Engineer's satisfaction at no additional cost to the State.

(C) Equipment. Use a continuous automated volumetric mixer. Mechanically operated mixers or hand mixing may only be used as a backup during repairs, or for applications less than a cubic yard. Follow manufacturer's recommendations. The Contractor must submit all mechanical and hand application methods for approval by the Engineer prior to starting any work.

When mixing and applying manually, mix only the amount of material that can be used within its pot life. Proportion each liquid component carefully into a clean pail or drum. Mix thoroughly for 3 minutes with a Jiffy mixer on low speed (400-600rpm). To prepare HPC, slowly add 200-250 lbs. of the engineered aggregate to every 4-gal of mixed polymer. Mix only until all aggregate is wetted out. Manufacturer's representative shall be present during hand mixing operations.

(D) Just -In-Time Training. JITT shall conform to Section 695 – JUST IN TIME TRAINING.

(E) Pre-Operational Conference. Schedule a meeting with the Contractor, and supplier's representatives involved in the construction operation of the HPC and the Engineer, at a mutually agreed time, to discuss and verify the methods of accomplishing all phases of the HPC operations, contingency planning, and standards of workmanship for the completed items of work. Include the Contractor's superintendents, foremen, subcontractors, and supplier's technical representatives, and all key personnel involved with the HPC work as attendees of the pre-operation conference. Do not begin placement of HPC before the Engineer accepts the pre-operational conference as completed.

(F) Surface Preparation. Use the procedures of ICRI (International Concrete Repair Institute) Guideline No. 03730 "Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcement Steel Corrosion" and ICRI Guideline 03732 "Selecting and Specifying Concrete Surface, Surface Preparation for Sealers, Coatings and Polymer Overlays" sections of ACI 546.14 "Guide for Concrete Repair". The Contractor shall be responsible for any falsework requirements, debris, noise and pollution control on and below the repair area.

The concrete surface shall be prepared by removing all material which may act as a bond breaker between the existing surface and the HPC.

The textured or scarified pavement preparation method shall remove all dirt, oil and other foreign materials, as well as any unsound concrete or laitance from the surface and edges against which new HPC is to be placed. The concrete surface may require retexturing where penetration of foreign material is evident. No contamination of the retextured or scarified concrete surface shall be permitted.

The surface preparation shall meet the following requirements:

(1) New Pavement. On new concrete, the surface shall be given a very rough texture while still plastic by use of a wire comb or other approved texturing device which will produce a bondable surface acceptable to the engineer.

(2) Existing Pavement or Bridge Deck. On existing concrete, the surface shall be prepared by shot blasting or approved equal. Pneumatic chipping tools weighing 15 pounds or less or an approved equal may be used for areas where the Contractor is unable to shot blast upon approval of the Engineer. Produce a concrete substrate surface with a minimum roughness of approximately ¼-inch amplitude or an ICRI concrete surface profile (CSP) of 7. The preparation method shall not produce a polished or slick surface.

(3) Existing concrete containing previously placed repair materials. On existing concrete with previously placed unsound or magnesium phosphate repair products, these materials shall be removed prior to placing the HPC. The Contractor shall follow Section 680 – Defective Concrete Repairs. The exposed concrete surface shall meet the requirements contained in Subsection 678.03(F)(2) of this specification.

(4) Existing Concrete with Penetrating Sealer and aggregate topping. Remove all loose sand/aggregate. Clean surface to be free of any dust, dirt, oil, and debris prior to placing any HPC. Penetrating sealer with aggregate topping shall be considered unclean and contaminated if the surface has not been shotblasted within 48 hours. Surface shall be cleaned prior to placing HPC overlay.

The Contractor shall take extra care not to damage the existing expansion joints during the surface preparation of the existing concrete deck.

An approved moisture meter shall be used to check the moisture in the existing substrate prior to application of any surface treatment. An equal or better method may be submitted to the Engineer for approval. A maximum moisture reading of under 3% will be allowed. If rain occurs for more than 10 minutes no application of penetrating sealer will be allowed for the remainder of the work shift.

During surface preparation and application, precaution shall be taken to assure that traffic is protected from rebound, dust and construction activities. Dust in the air at night may become an opaque vision barrier to motorists due to headlights and floodlights. The Contractor must not allow this to happen. Appropriate shielding shall be provided as required and as directed by the Engineer at no additional cost. The Contractor shall provide suitable protection as needed to protect all exposed areas not to receive penetrating sealer such as parapets, drains, etc. All damage and defacement resulting from the application shall be cleaned and, or repaired to the Engineer's satisfaction at no additional cost to the State.

(G) **Trial Pour.** The Contractor shall place a trial pour of HPC using the approved equipment and procedures as detailed in the approved work plan. The Contractor shall notify the Engineer of the time and location of the trial pour at least seven (7) calendar days prior to the scheduled trial pour.

The trial pour may be a part of the production location before starting production work. HPC manufacturer's representative shall be present during the trial pour. The trial pour shall meet the following requirements:

(1) Install a minimum of 11 ft (lane width) x 112 ft (length) x 1½ inch (thickness) trial overlay. 112 foot length is based off of typical length between expansion joints. Trial overlay shall be from expansion joint to expansion joint.

(2) Shall be constructed using the same method and equipment as the production work.

(3) Shall construct an additional trial pour for each method proposed for the production work.

(4) Shall replicate field conditions, including ambient and surface temperatures, time period, anticipated for production work.

(5) Shall demonstrate surface preparation method as outlined in the Work Plan.

(6) Shall demonstrate that the data management system is capable of documenting ambient and surface temperatures, quantities of resin binder and aggregate, coverage rates and reporting application rates in real time.

(7) Determine the initial set time for the HPC overlay.

The Contractor shall perform three pull-off tests on the trial pour in accordance with ASTM C1583 Standard Test Method for Tensile Strength of Concrete Surfaces and Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method) and the manufacturer’s recommendations. The pull-off tests shall have a minimum tensile bond strength of at least 250 psi at 24 hours or a substrate failure. A passing substrate failure is when more than 50% of the substrate covers the specimen being tested. The Contractor shall record the pull-off test results and the amount of any failure into the base concrete, and shall provide written documentation of the test results. The Engineer will designate the location of the pull-off tests. After the completion of the tests, repair all test areas using HPC and aggregate topping.

The Contractor shall perform three compressive strength tests on the trial pour in accordance with ASTM C579 Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes and manufacturer’s recommendations. The HPC samples shall have a minimum compressive strength of 1000 psi at 24 hours and 3000 psi at 7 days. The Contractor shall record the strengths for each sample and shall provide written documentation of the results.

The Contractor shall not begin construction operations at the site receiving the HPC until receiving approval of the completed trial pour. If the trial pour is rejected then the Contractor shall perform another trial pour at no additional cost or contract time to the State. Rejected trial pour shall be removed per Subsection 105.12 - Removal of Non-Conforming and Unauthorized Work.

(H) Traffic and Equipment Control on Bridge.

(1) Equipment, vehicles, and personnel, etc. shall not contaminate the prepared deck surface.

(2) Equipment shall not be located on spans undergoing deck HPC work unless approved by the Engineer.

(3) The Contractor shall not permit compressors or other equipment that produce vibrations on the span undergoing deck HPC work.

(4) Vehicular traffic shall not exceed a 35-mph speed limit on the bridge span during HPC placement and curing.

(5) The bridge deck shall not be used as a storage area for equipment or for stockpiling materials. Loads exceeding eight tons shall not be used on the bridge unless approved by the Engineer.

(I) Placement of HPC. After surface preparation, concrete surfaces shall be structurally sound, clean, free of dirt, powdered concrete, loose mortar particles, paint, film, protective coatings, efflorescence, laitance, and other matter detrimental to proper adhesion of the new HPC. The Contractor shall ensure proper cleanliness. Work surfaces must be free of ridges, fins or sharp projections. All reinforcing bars in the repair area shall be made free of all scale and loose rust by using either powered rotary wire bristle brush or abrasive blasting. Needle gunning may be used as preliminary step for removal of loose rust. Do not overly vibrate the reinforcing bars.

Expansion joints, drains and grates shall be adequately isolated prior to placing the HPC as approved. HPC shall not affect the design and function of the expansion joints, drains, and grates. Do not place HPC within 6 feet of another area where the deck surface is being prepared.

The HPC discharged from the mixer shall be uniform in composition and consistency. Mixing capability shall be such that initial and final finishing operations can proceed at a steady pace.

The hybrid polymer resin binder in the HPC shall be 12-15 percent by weight of the dry aggregate. The Contractor shall determine the exact percentage as approved by the Engineer.

The HPC overlay shall be placed at a minimum thickness of 3/4 inch.

Any falsework and formwork required shall be considered incidental to this work.

(J) Hot Weather Concreting. Do not place HPC where ambient temperature is above 90 degrees F unless design mix and placement method conform to ACI 305 R-20 Hot Weather Concreting. When ambient temperature is above 90 degrees F, cool reinforcing steel, forms, and other surfaces to below 90 degrees F with approved methods by the Engineer before placing of HPC.

(K) Finishing HPC. Finishing equipment shall be capable of consolidating the HPC, striking off the HPC to the final grade, and providing the thickness and cross-sections as shown in the contract documents.

For repairs or placements of less than 2 cubic yards or areas inaccessible to self-propelled finishing equipment, finish while the HPC is plastic and workable using a roller screed, air screed, or approved equal. The Contractor has the option of using other methods of finishing HPC as long as the selected method leaves a uniform, level finish, free of slick or puddled resin areas. Engineer must approve methods prior to constructing trial overlay. Finish the HPC to meet the requirements of Subsection 678.03(N) Surface Testing.

Topping aggregate. The Contractor shall use methods and equipment for broadcasting the surface topping aggregate on to the plastic, in-place HPC overlay material in accordance with the manufacturer's recommendations. Aggregate topping shall be initiated immediately after final finishing operations of the HPC overlay and while the HPC surface is still wet to ensure proper embedment of the aggregate topping. Sweep, vacuum, or blow excess aggregate topping from surface after the HPC is tack-free.

(L) Curing. Traffic and construction equipment shall not be permitted on the HPC for at least 3 hours after placement and until the HPC surface is tack free. Refer to HPC technical data sheet curing schedule for estimated cure times.

(M) Construction Joints. Use construction joints only with the acceptance of the Engineer and in accordance with the Contract documents.

(N) Surface Testing. The finished HPC shall conform to the following requirements when tested by the Contractor in the presence of the Engineer within 14 days following the placement of HPC:

(1) Surface Flatness. The surface of the HPC shall not vary more than 1/8 inch under a 10-foot straightedge placed parallel to the traffic lanes. Construction joints shall not vary more than 1/8 inch under a 10-foot straight edge.

(2) Surface Condition. The surface of the HPC shall be sound and free from delaminations and cracks greater than 0.01 inch in width.

(O) Testing HPC.

(1) A minimum of three compressive strength tests shall be performed for each LOT. A LOT shall be one day's production per mixing and placement method and once every maximum of 10 cubic yards of HPC. When more than one production facility or continuous volumetric mixers is used for the same mix design, apply the sampling and testing frequency per production facility or per continuous volumetric mixer, e.g., two continuous volumetric mixers equal a minimum of two LOTS. Testing shall be performed in accordance with ASTM C579 Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing's, and Polymer Concretes and the manufacturer's recommendations. The compressive strength shall be a minimum of 1000 psi at 24 hours and 3000 psi at 7 days.

(2) A minimum of three pull-off tests at locations selected by the Engineer shall be performed for each LOT. Testing shall be performed in accordance with ASTM C1583 Standard Test Method for Tensile Strength of Concrete Surfaces and Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method) and the manufacturer's recommendations. A passing test is the failure of the concrete substrate or bond strength above 250 psi at 24 hours. A passing substrate failure is when more than 50% of the substrate covers the specimen being tested. Fill cored holes with HPC approved by the Engineer.

The pull off tests shall also be used as a means to verify thickness. A minimum of ¾" thickness for the HPC overlay is required.

(P) Quality Control (QC):

(1) HPC Sampling and Testing. Perform QC HPC sampling and testing in accordance with the QC plan and following requirements:

(a) QC tests shall include temperature and preparing compressive strength cubes for testing at later dates. Perform HPC tests on the initial delivery for each mix each day. Ensure that QC technicians are certified, and the materials testing laboratory are accredited in the test method being used and in accordance with the HDOT's Quality Assurance Manual for Materials dated October 2001. Ensure all technicians that are performing the sampling and performing the testing are certified in the test placement operation at each placement site and the testing is done in an accredited material testing laboratory. Cast a set of cubes representing the LOT from the same sample of HPC.

(b) Maintain a logbook with records of relevant details of all tests. Provide a copy of new entries at the end of each work day. Make available for inspection by the Engineer during the normal working hours of construction. At the end of the project, deliver the original logbook to the Engineer. The original logbook will become property of the Engineer.

(Q) Acceptance and Corrective Action. The completed HPC overlay surface with topping aggregate must be uniform in texture and appearance. HPC shall meet the compressive strength and bond strength requirements. The Contractor shall repair or replace all HPC that does not meet the approval of the Engineer at no additional cost to the State. Repair methods shall be submitted to the Engineer for approval.

Correct all defects in material and work, as directed, at no additional cost to the Engineer, according to the following:

(1) Remove and replace HPC overlay that the Engineer determines has any raveling, delamination, streaking, compressive strength test failure, or bond test failure.

(2) Replace with acceptable HPC overlay at the Contractor's expense. Ensure the minimum replacement is the full lane width and the length of the defect plus five lane feet on the up-station and down-station side of the edge of the defect area and as accepted by the Engineer. Replaced areas will be retested and evaluated for acceptance or further corrective action.

(3) Any roadway features disturbed by the work or the Contractor's operations shall be restored with the same materials and design as directed by the Engineer at no additional cost to the State.

The Engineer shall have the right to reject all work which is not in compliance with the requirements of the drawings and specifications. Rejected work shall be removed per Subsection 105.12 – Removal of Non-Conforming and Unauthorized work.

(R) Verification and Independent Assurance. HDOT may perform verification sampling and testing for its own use for internal assurance and acceptance testing. Furnish sufficient quantity of each mix for verification and independent assurance sampling and testing as required by the Engineer. When the Engineer performs verification, the Contractor may perform the same tests on the HPC at the same time. HDOT's Independent Assurance Program will be conducted to evaluate all sampling and testing used in the acceptance material.

678.04 Measurement. The Engineer will measure HPC overlay per square foot in accordance with the contract documents.

678.05 Payment. The Engineer will pay for accepted HPC overlay on a square foot basis. Payment for JITT shall be considered as incidental for this section. Payment will be full compensation for the work prescribed in this section and the contract documents.

Payment will be full compensation for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for preparing road surface, placing materials in final position, sweeping or for the minimum testing of materials and placement as defined in this specification.

No separate or additional payment will be made for reinstallation and retesting of HPC where the initial installation was determined to be defective.

The Engineer will pay for the accepted pay items when included in the proposal schedule:

Pay Item	**Pay Unit**
Hybrid Polymer Concrete (HPC) Overlay _____	Square Foot”

END OF SECTION 678

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
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DATE	REVISION
12/6/24	△1 Revised Index

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION.

Stephen Peters 4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

INDEX TO STRUCTURAL DRAWINGS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: None Date: Oct. 2024

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	DRAWN BY ____ " ____
	TRACED BY ____ " ____
NOTE BOOK	DESIGNED BY ____ " ____
	QUANTITIES BY ____ " ____
No. ____	CHECKED BY ____ " ____

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-S0001 INDEX ADD2.DWG PLOT TIME: 12-03-24, 9:48 PM)

STRUCTURAL GENERAL NOTES

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HAWAII	HAW.	BR-019-2(077)	2024	ADD. 34	280

5. Structural Steel (Cont.)

B. All new steel structures shall be ASTM A123 hot-dip zinc galvanized after all fabrication is complete. Protect elements against hydrogen embrittlement in conformance with ASTM A143. Post-galvanizing quenching/passivation shall not be utilized for steel going to paint. Coordinate with coating Contractor.

C. The steel detailer of the trestle structures shall hold a current National Institute of Steel Detailing (NISD) Senior Detailer - Class I Bridge Certification and shall be submitted to the Engineer for review and approval.

△1 D. The steel fabricator of the trestle structures shall hold a current AISC Intermediate (IBR) Bridge Fabricator Certification and shall be submitted to the Engineer for review and approval.

E. Prior to hot-dip galvanizing, all welding flux and slag shall be completely removed using mechanical methods to ensure proper zinc adhesion.

F. Vent holes may be provided in members for hot-dip zinc galvanized operation. Size and location of holes shall be determined by galvanizing contractor, unless otherwise shown on the drawings. Vent hole sizes and locations shall be included on the structural steel shop drawings. All holes, other than base plates, and where noted shall be filled with zinc plugs following galvanizing operation.

G. All damage done to galvanized steel surfaces shall be repaired in accordance with ASTM A780 using the zinc solder method. Zinc rich paint shall not be an acceptable repair procedure

H. Structural parts designated for CVN Testing shall meet the longitudinal Charpy V-Notch requirements for a non-fracture critical member in Zone 1.

I. Steel plates for columns shall be cut and fabricated so that the primary direction of rolling is parallel to the column length. For column splice plates, the direction shall be parallel to the direction of the splice. For base plates, the direction shall be parallel to the centerline of the bent.

J. All holes in steel members shall be be sub-punched and reamed or full size drilled.

K. All holes for bolted connections shall be standard size unless otherwise shown on the contract drawings.

L. Bolt assemblies which connect steel to steel shall utilize 7/8" dia. high-strength bolts conforming to ASTM F3125, Grade A325, Type 1, unless otherwise noted. Bolts shall be ordered such that threads are excluded from the shear plane. Bolts shall be snug tightened unless otherwise shown on plans. All pretensioned/ slip-critical bolts shall utilize Direct Tension Indicating (DTI) washers to ensure proper bolt tension. Bolts shall be inspected.

M. Steel-to-steel bolted joints designated as slip-critical shall be pretensioned bolt assemblies with additional paint masking requirements between the faying surfaces. Provide paint masking details as shown in the contract documents.

5. Structural Steel (Cont.)

N. All nuts shall be ASTM A563 DH heavy-hex and all hardened washers shall be ASTM F436. All hardened washers shall have a hardness of Rc 38-45. DTI Washer shall be ASTM F959 and shall be installed under the bolt head or nut as shown on the Contract drawings.

O. Matched Bolt Assemblies shall contain bolt, nut, and washer provided by the same supplier.

P. Installation of all bolted assemblies shall be in accordance with the latest Research Council of Structural Connections (RCSC) Specifications for Structural Joints Using High-Strength Bolts.

Q. Anchor bolts which connect steel to concrete shall be high-strength threaded rods conforming to ASTM F1554, Grade 105 and shall be straight rod with anchor plate details at the embedded end as shown in the contract drawings. Anchor bolts shall have CVN Testing performed. Anchor bolts shall be pretensioned by the turn of the nut method. See anchor bolt pretensioning schedule.

R. All hardware, including bolts, anchor bolts, nuts and hardened washers shall be ASTM F2329 hot-dip zinc galvanized. Hardware shall be centrifugally cleaned post galvanizing. Nut threads shall be tapped oversized prior to galvanizing in accordance with ASTM A563 and are prohibited from being chased following the galvanizing process. DTI washers shall be mechanically zinc galvanized in accordance with ASTM B695, Class 55.

S. All welding shall conform to the latest ANSI/AASHTO/AWS D1.5 Bridge Welding Code. Welding shall be performed in accordance with a Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) as required in AWS D1.5. The WPS variables shall be within the parameters established by the filler-metal manufacturer.

T. All welding, whether shop or field, shall be done by certified welders in conformance with the Bridge Welding Code AWS D1.5 of the American Welding Society.

U. All Welder Certifications, WPS's and supporting PQR's shall be submitted to the Engineer for review and approval prior to any welding being performed.

V. Welding shall be performed in such a manner so as to minimize warping and distortion of steel pieces being joined. Excessive concentrated heat being applied to steel pieces shall be avoided.

W. All welded connections shall receive full seal welding along all edges of faying surfaces to prevent moisture intrusion.

X. All weld sizes are shown in inches. No fillet weld (including seal welds) or PJP weld shall be less than 1/4" and 3/16", respectively.

6. Structural Steel (Cont.)

Y. All welds shall utilize E70XX Electrodes where Shielded Metal Arc Welding (SMAW) is utilized. Where other welding processes are used, filler metal shall have matching strength to base metal.

Z. Field welding shall not be permitted unless explicitly shown on the contract drawings.

AA. All welding arc strikes, whether shop or field performed, shall be ground flush to the base metal. Any arc strikes made to the bottom flange of the plate girder shall additionally have magnetic particle inspection and hardness testing performed in accordance with AWS D1.5.

AB. All existing deformed girder stiffeners shall be cold straightened to bring them back in original alignment over their full height. Cost for this work shall be incidental to the various pay items.

AC. See Standard Specifications and Special Provisions Section 501 - STEEL STRUCTURES for additional requirements.

6. Concrete:

A. All concrete strengths shall be as noted below:

Item No.	Structural Parts	Compressive Strength, f'c (28 Days)	Maximum Water/ Cementitious (W/C)	Maximum Cementitious Material Content (lbs./cy)	Included Admixtures (See Notes Below in This Section)
(1)	Foundation Pedestals, Grade Beams, and Cheek Walls	6,000 psi	0.40	720	C, D, E
(2)	Underwater Concrete	(See Special Provisions Section 615)			
(3)	VESLMC	(See Special Provisions Section 679)			

B. The use of calcium chloride in any concrete is prohibited.

C. A migrating amine carboxylate water-based corrosion inhibiting admixture such as Cortec MCI 2005 NS or approved equal shall be added to the concrete mix. The dosage requirements shall be 24 fluid ounces per cubic yard of concrete.

12/6/24	△1 Revised Note
DATE	REVISION

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

STRUCTURAL GENERAL NOTES

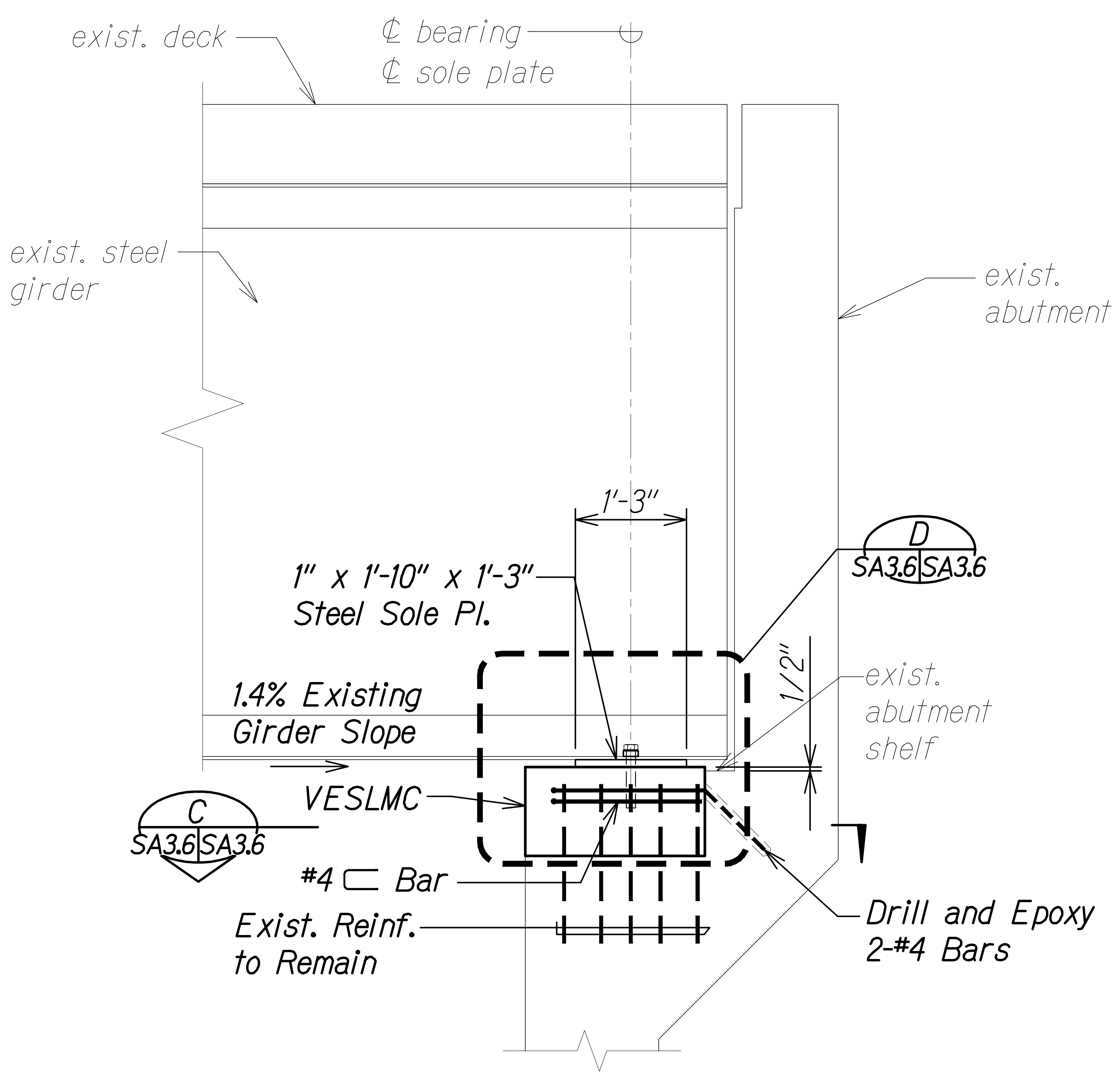
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: None Date: Oct. 2024

SHEET No. S0.5 OF 9 SHEETS

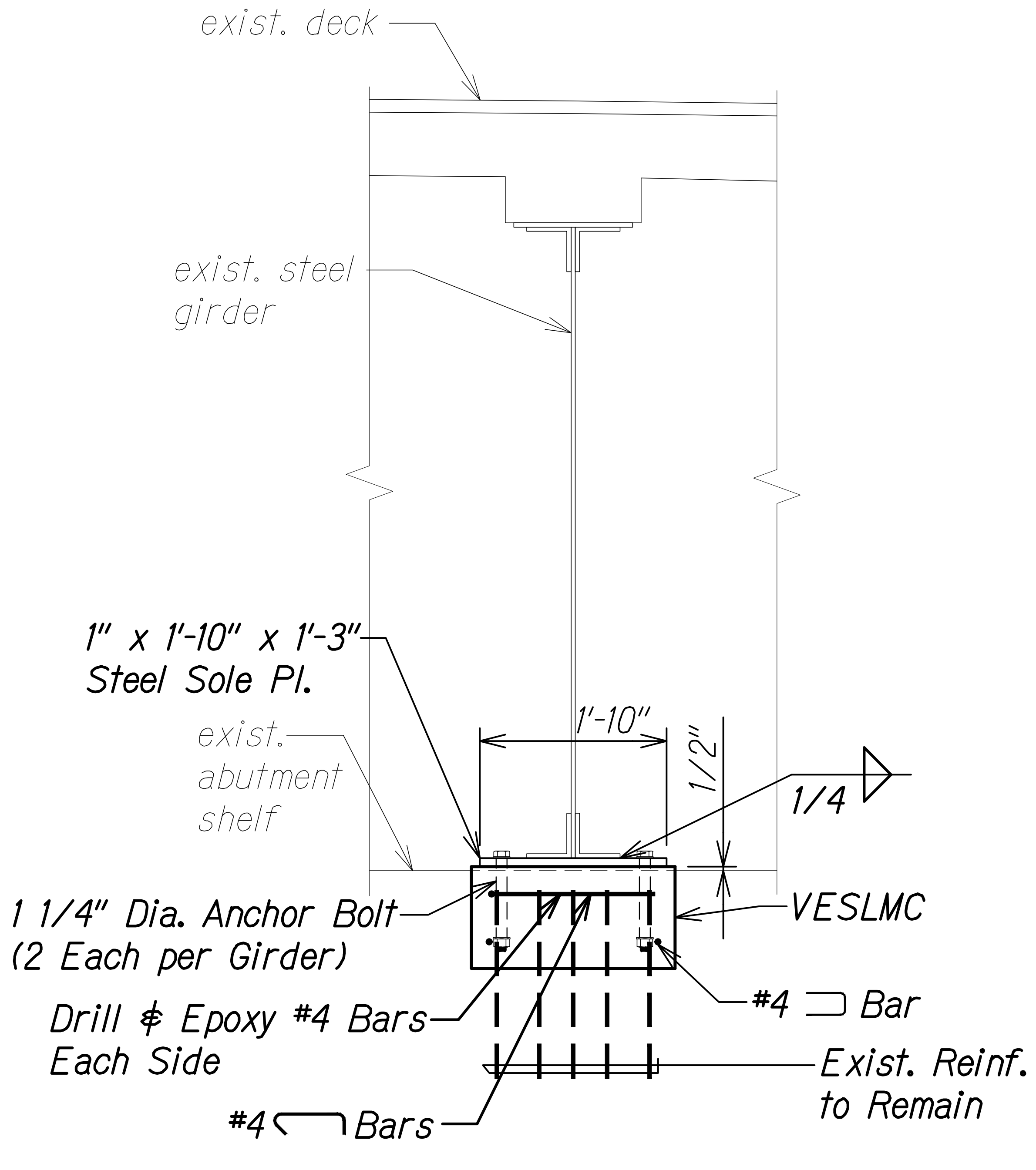
ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
NOTE BOOK	TRACED BY	"
	DESIGNED BY	"
	QUANTITIES BY	"
No.	CHECKED BY	"

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-S0004 GENNOTES.DWG PLOT TIME: 12-05-24, 12:29 PM)

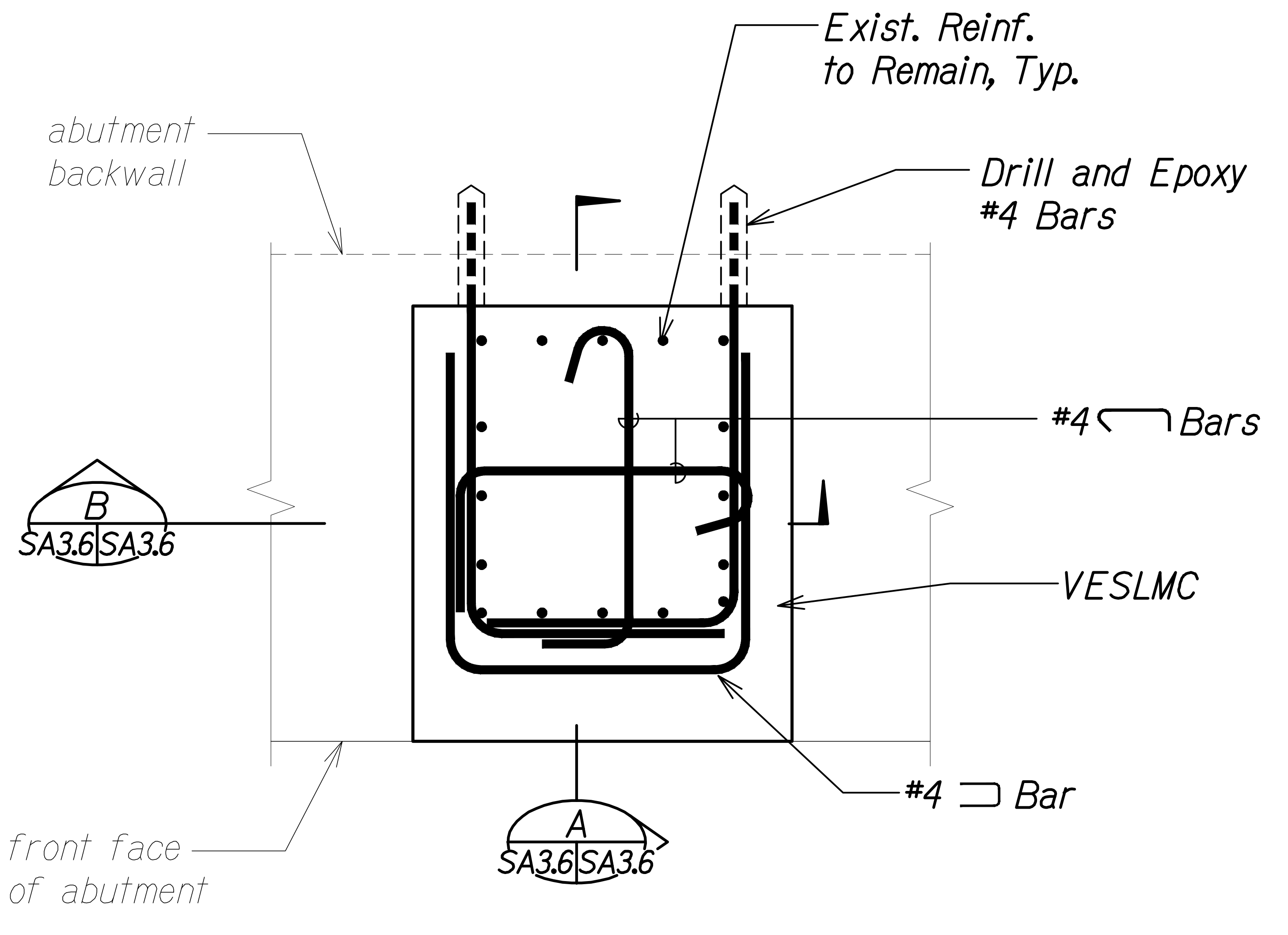
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 51	280



SECTION A
Scale: 3/4" = 1'-0" SA3.1 SA3.6

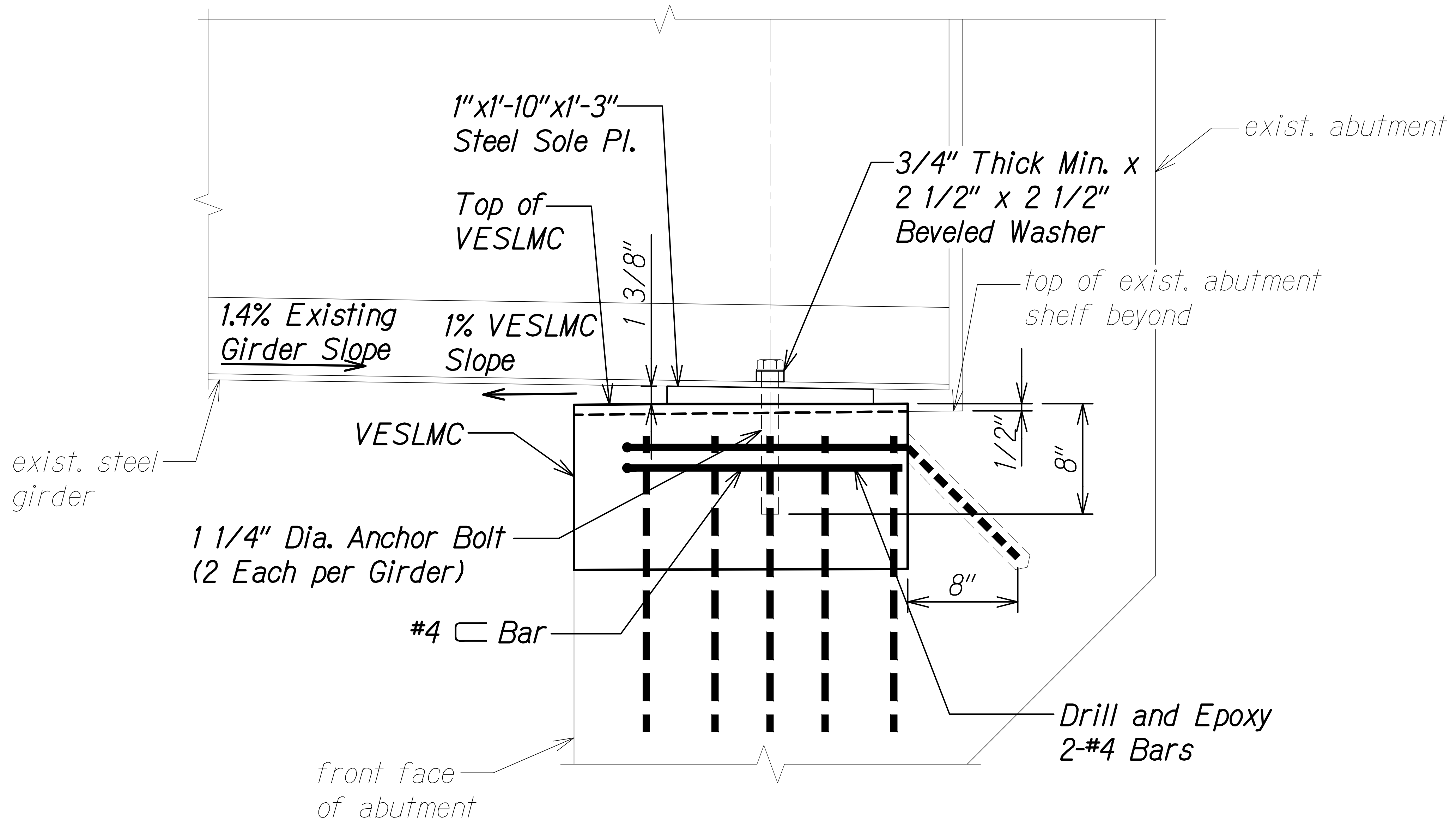


SECTION B
Scale: 3/4" = 1'-0" SA3.1 SA3.6



PLAN C
Scale: 1 1/2" = 1'-0" SA3.6 SA3.6

△1



SECTION D
Scale: 1 1/2" = 1'-0" SA3.6 SA3.6

NOTES:

1. Verify all dimensions and slopes in field before fabricating any members.
2. △1 Repair all welds to bearing plates with zinc solder in accordance with ASTM A780, Painting of all bearings shall be incidental to Pay Item 666.1000.

STEPHEN T. PETERS
NO. 17097-S

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DATE		REVISION
12/6/24	△1	Revised Scale and Added Note

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ABUTMENT NO. 2
ABUTMENT SECTIONS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

Scale: As Noted Date: Oct. 2024

SHEET No. SA3.6 OF 7 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY ____ DATE ____
	DRAWN BY ____ " ____
	TRACED BY ____ " ____
NOTE BOOK	DESIGNED BY ____ " ____
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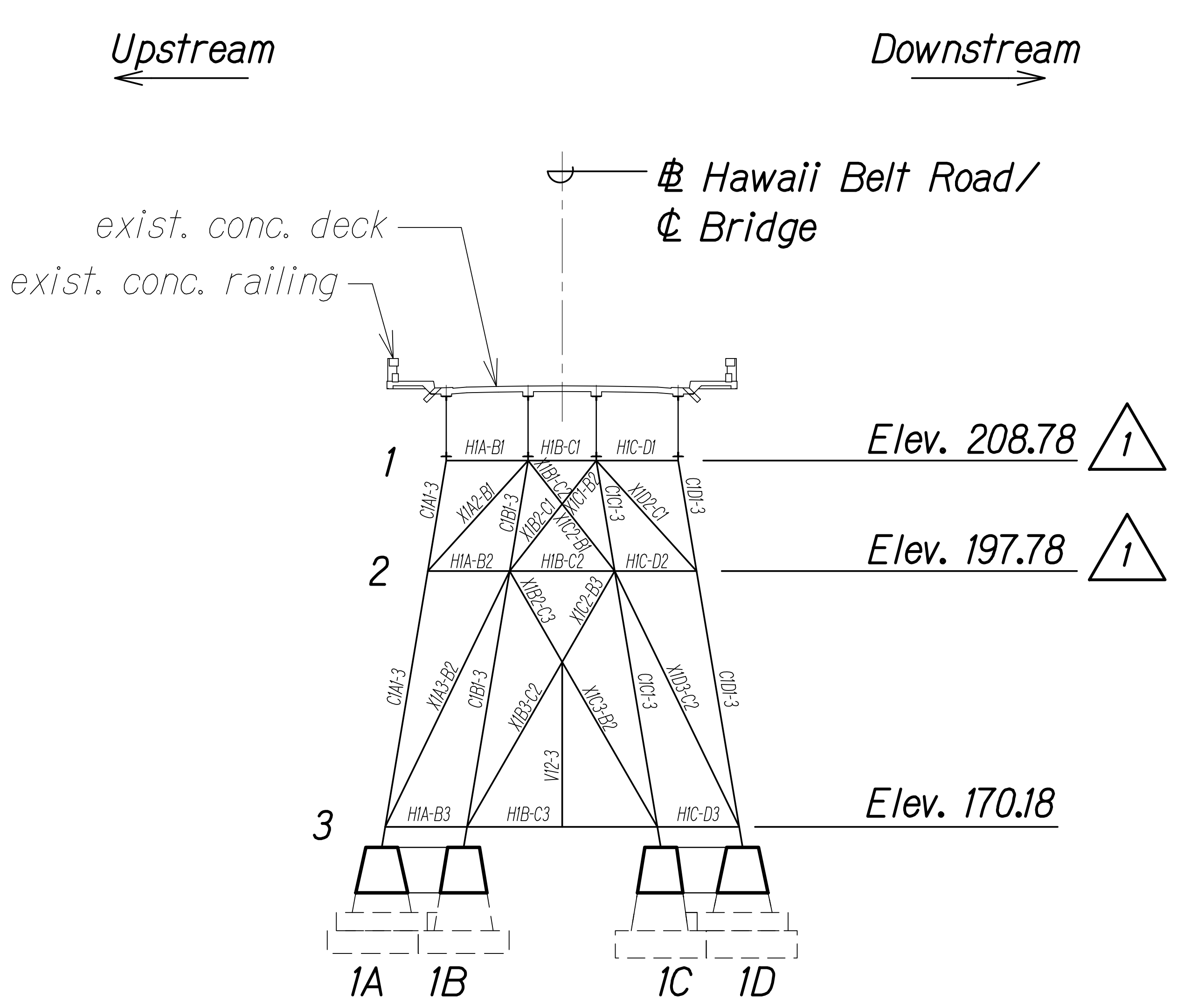
No. ____	CHECKED BY ____ " ____

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0301-SA0307 ABUT.DWG PLOT TIME: 12-05-24, 2:28 PM)

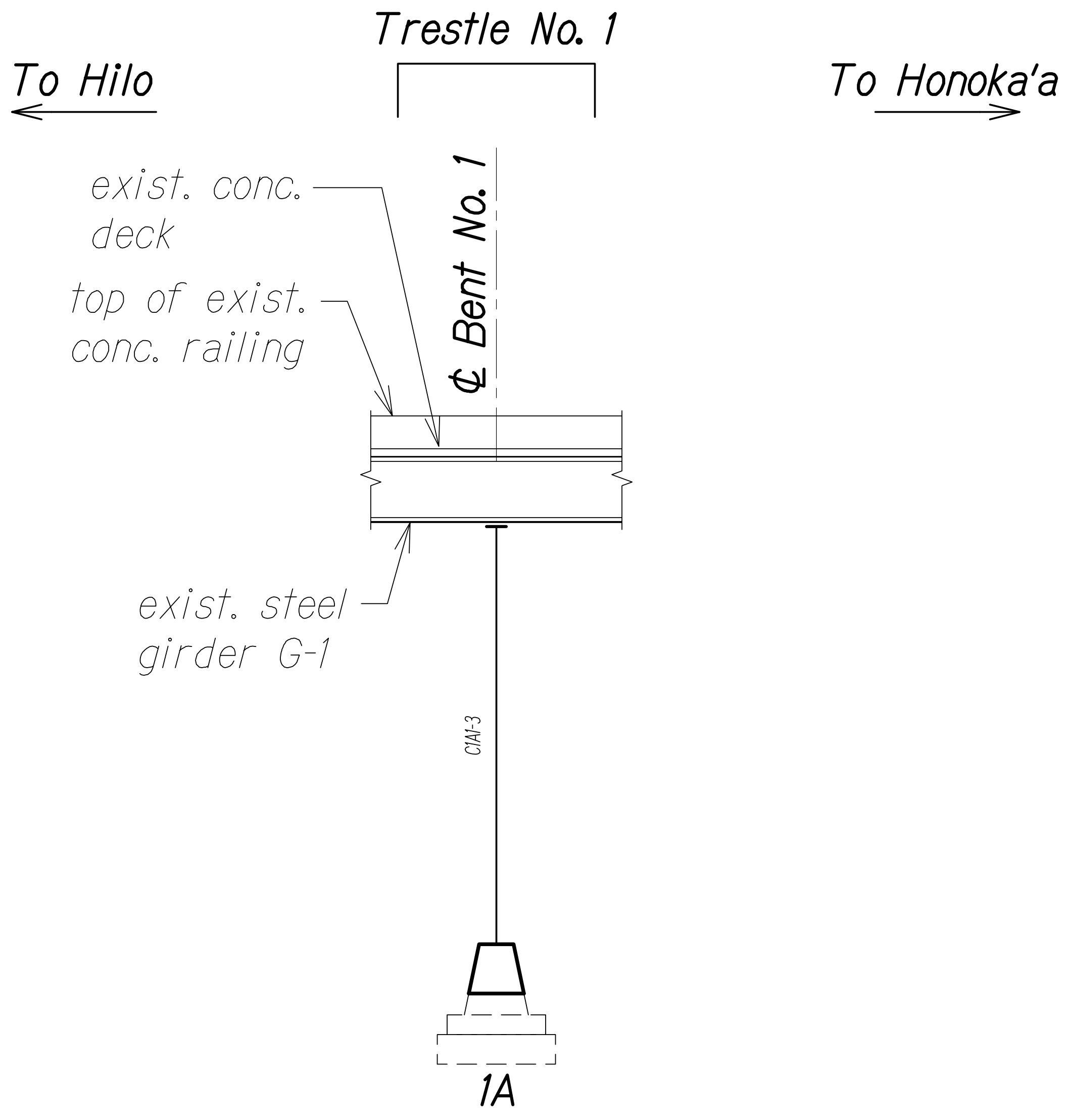
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 55	280



BENT NO. 1 ELEVATION

Scale: 1/16" = 1'-0"

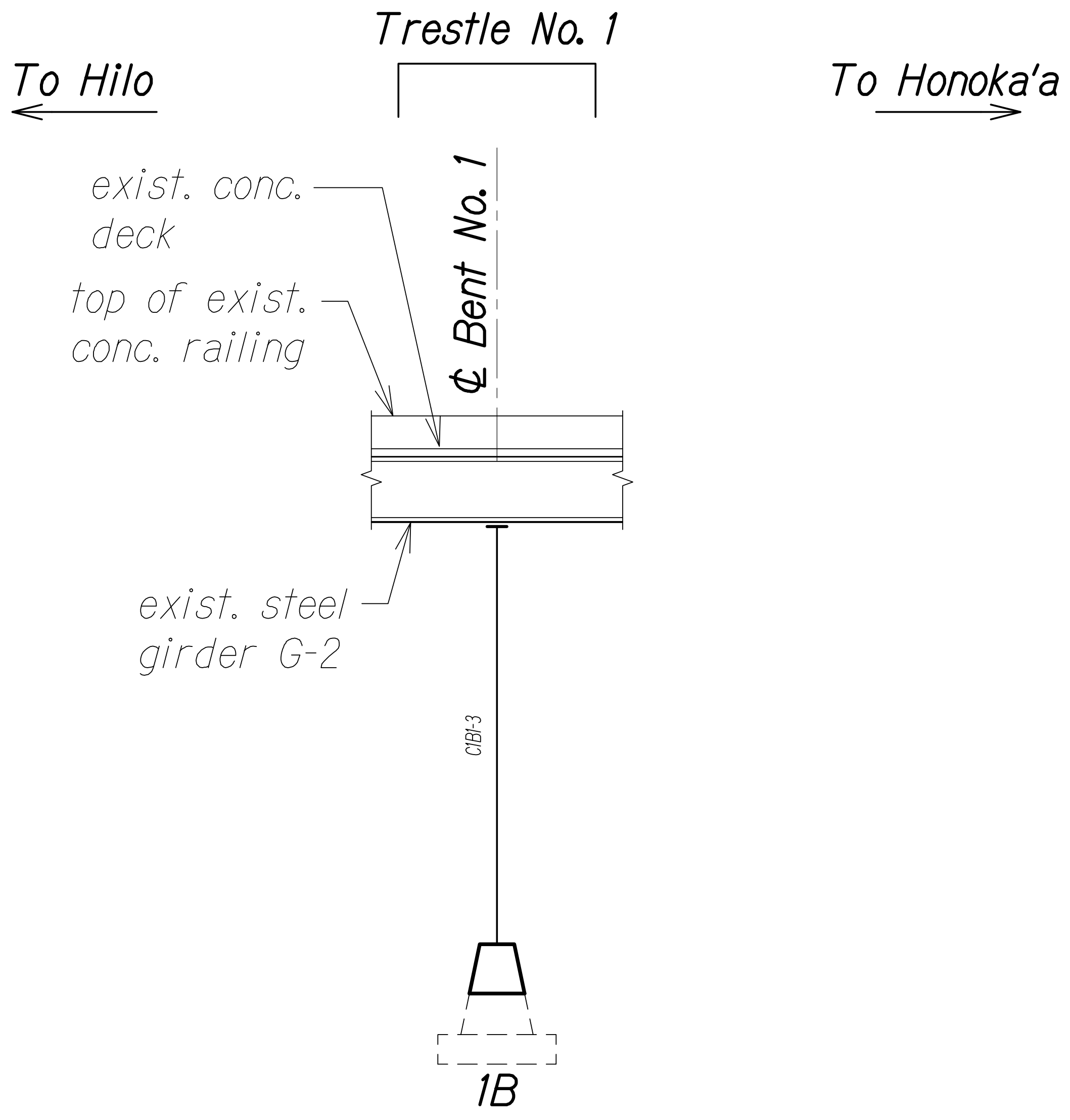
A
SA4.3 | SA4.3



TRESTLE NO. 1 ELEVATION - COLUMN LINE "A"

Scale: 1/16" = 1'-0"

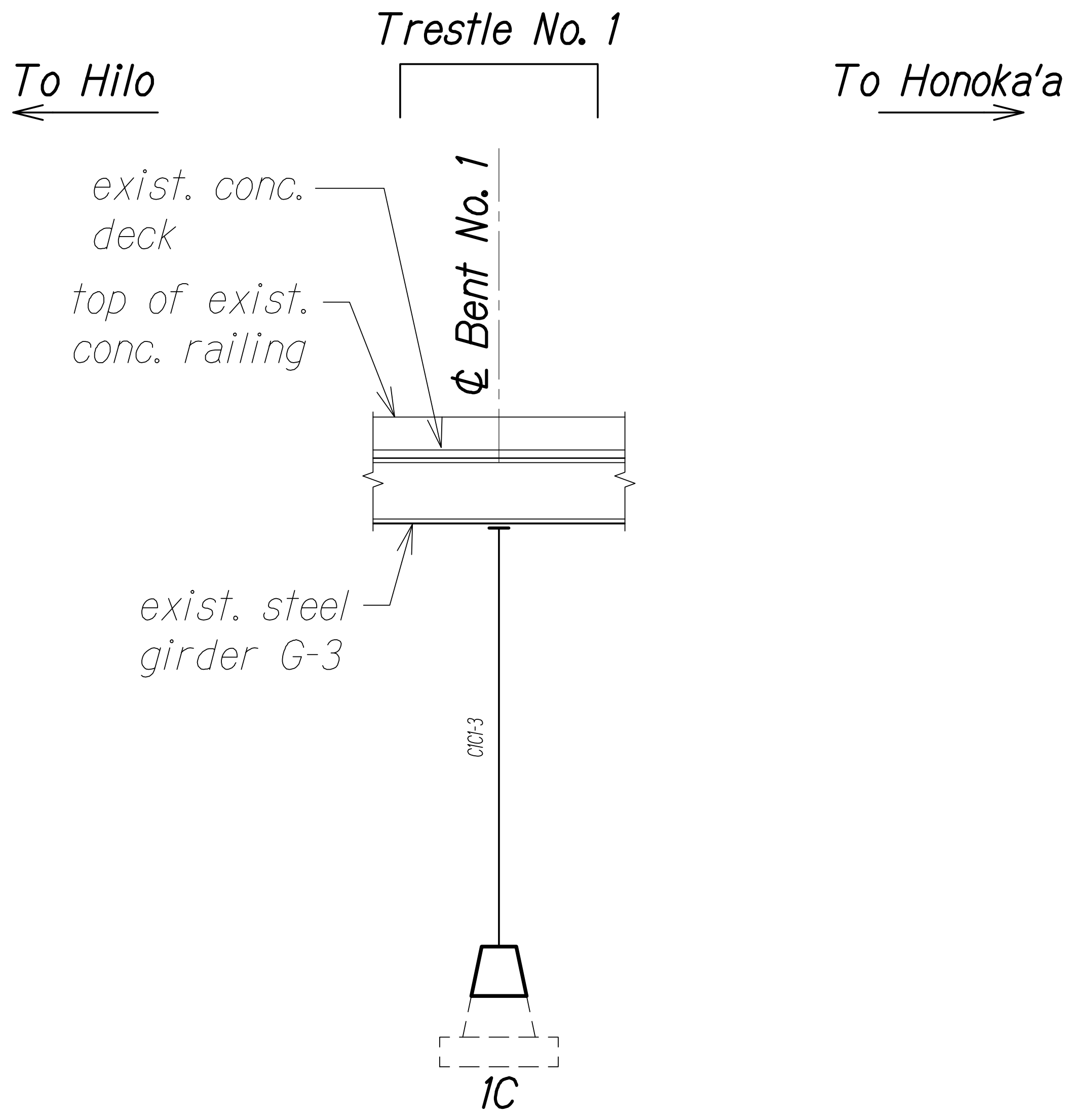
B
SA4.3 | SA4.3



TRESTLE NO. 1 ELEVATION - COLUMN LINE "B"

Scale: 1/16" = 1'-0"

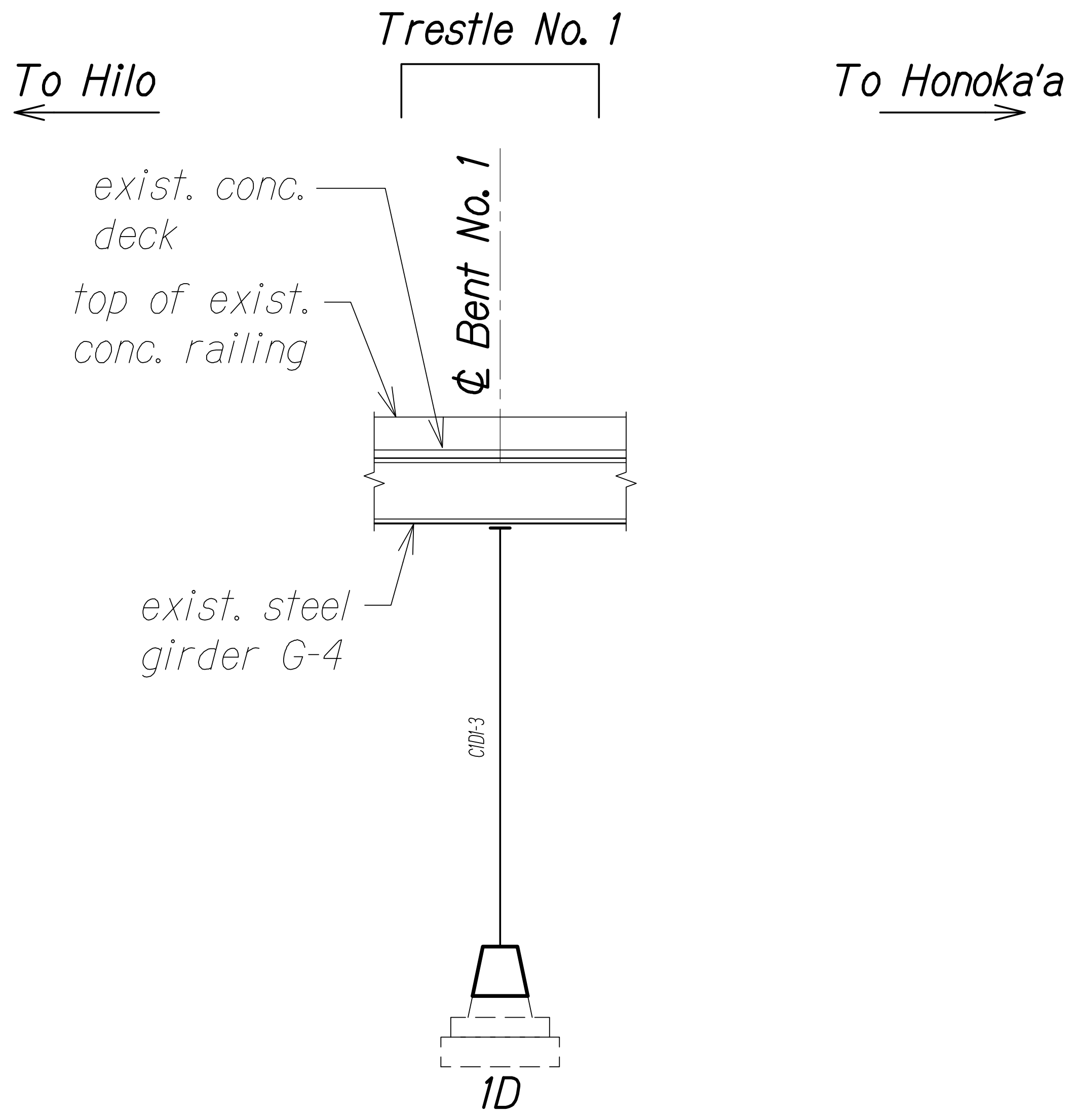
C
SA4.3 | SA4.3



TRESTLE NO. 1 ELEVATION - COLUMN LINE "C"

Scale: 1/16" = 1'-0"

D
SA4.3 | SA4.3



TRESTLE NO. 1 ELEVATION - COLUMN LINE "D"

Scale: 1/16" = 1'-0"

E
SA4.3 | SA4.3

DATE	REVISION
12/6/24	1 Revised Elevations

STEPHEN T. PETERS
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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BENT NO. 1/TRESTLE NO. 1 MEMBER ELEVATIONS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

Scale: As Noted
Date: Oct. 2024

SHEET No. SA4.3 OF 20 SHEETS

ADD. 55

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
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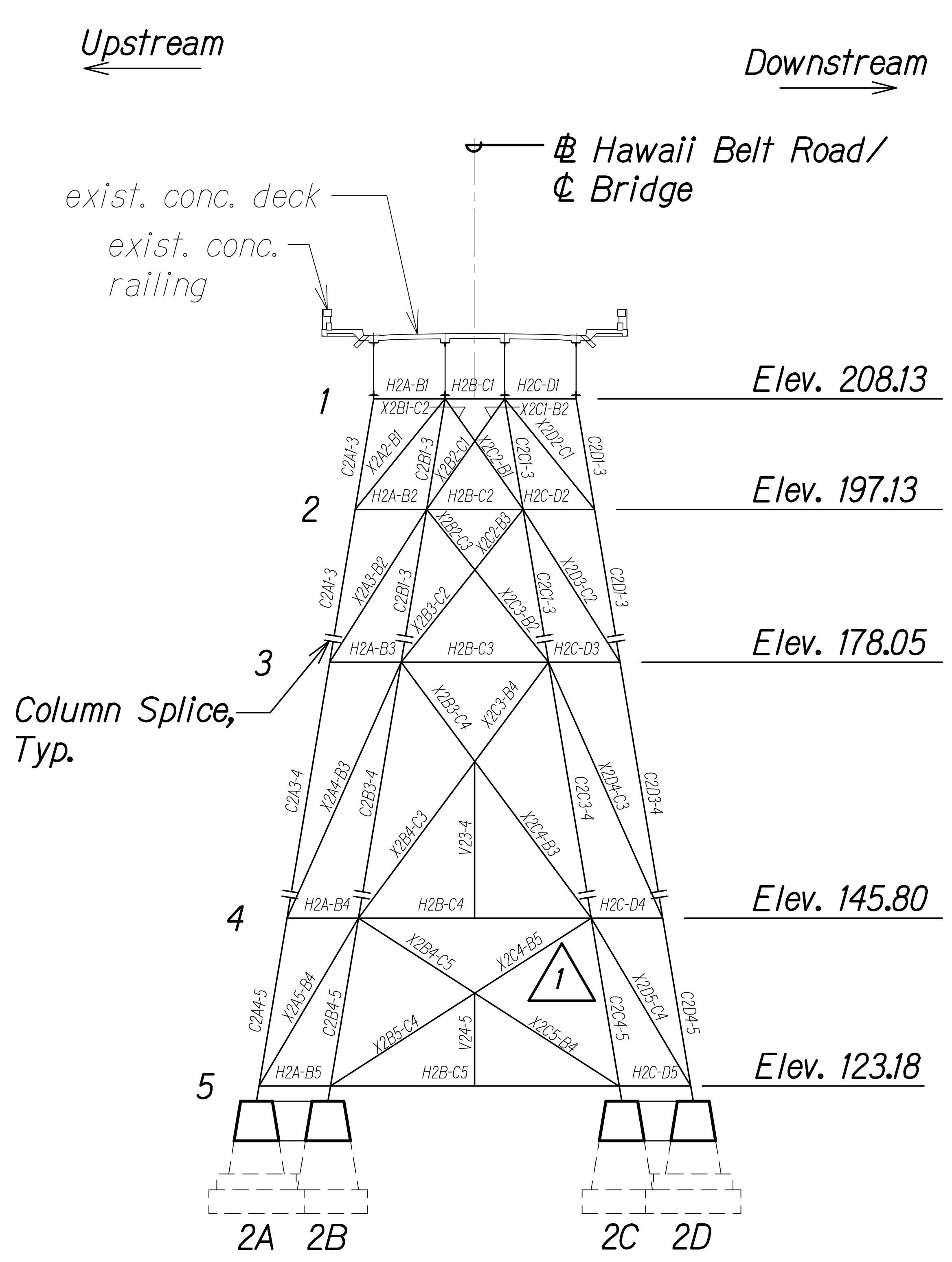
NOTE BOOK	DESIGNED BY	"
	QUANTITIES BY	"
No.	CHECKED BY	"

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0401-SA410 BENT-TRESTLES ADD2.DWG PLOT TIME: 12-05-24, 3:20 PM)

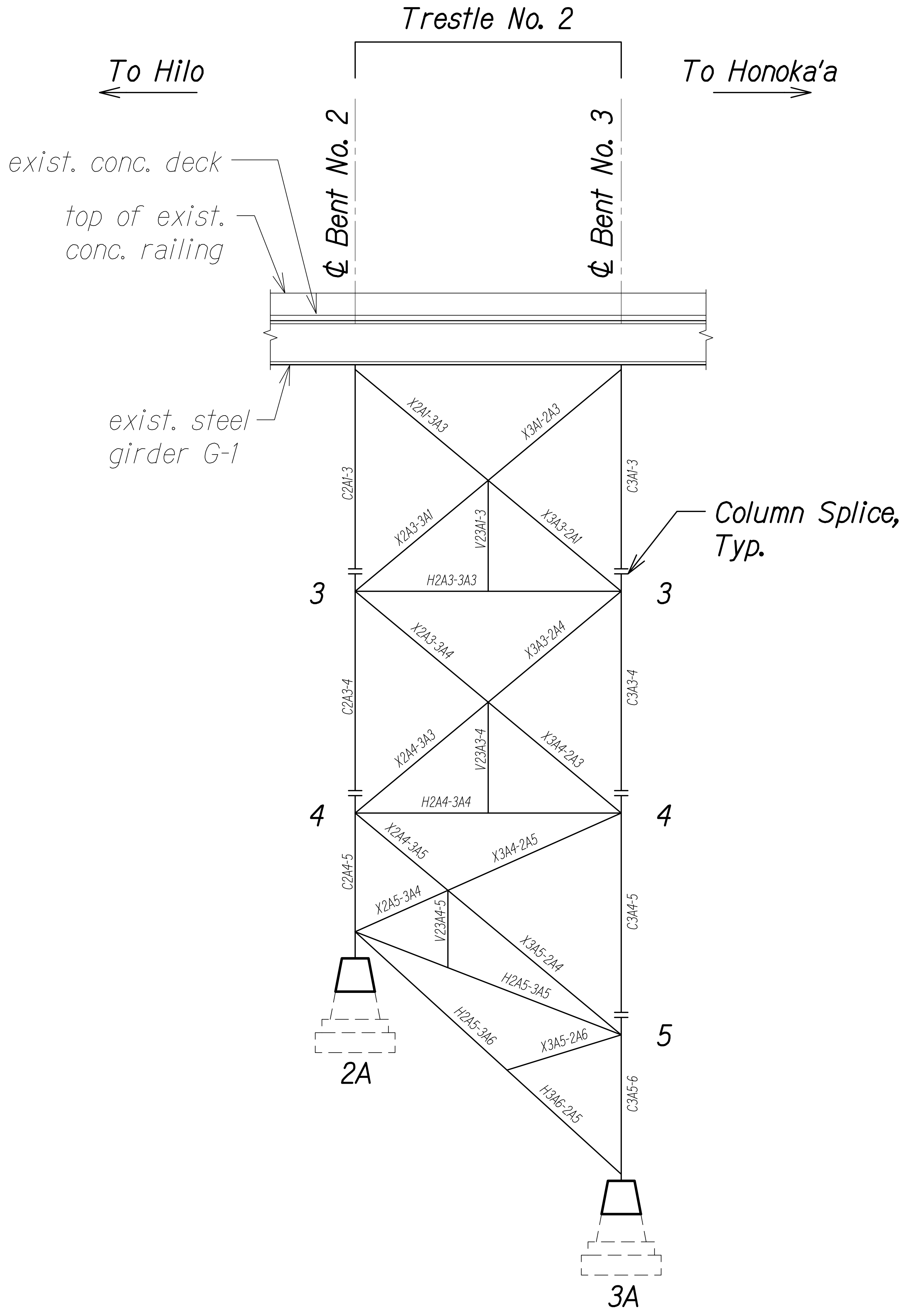
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 56	280



BENT NO. 2 ELEVATION

Scale: 1/16" = 1'-0"

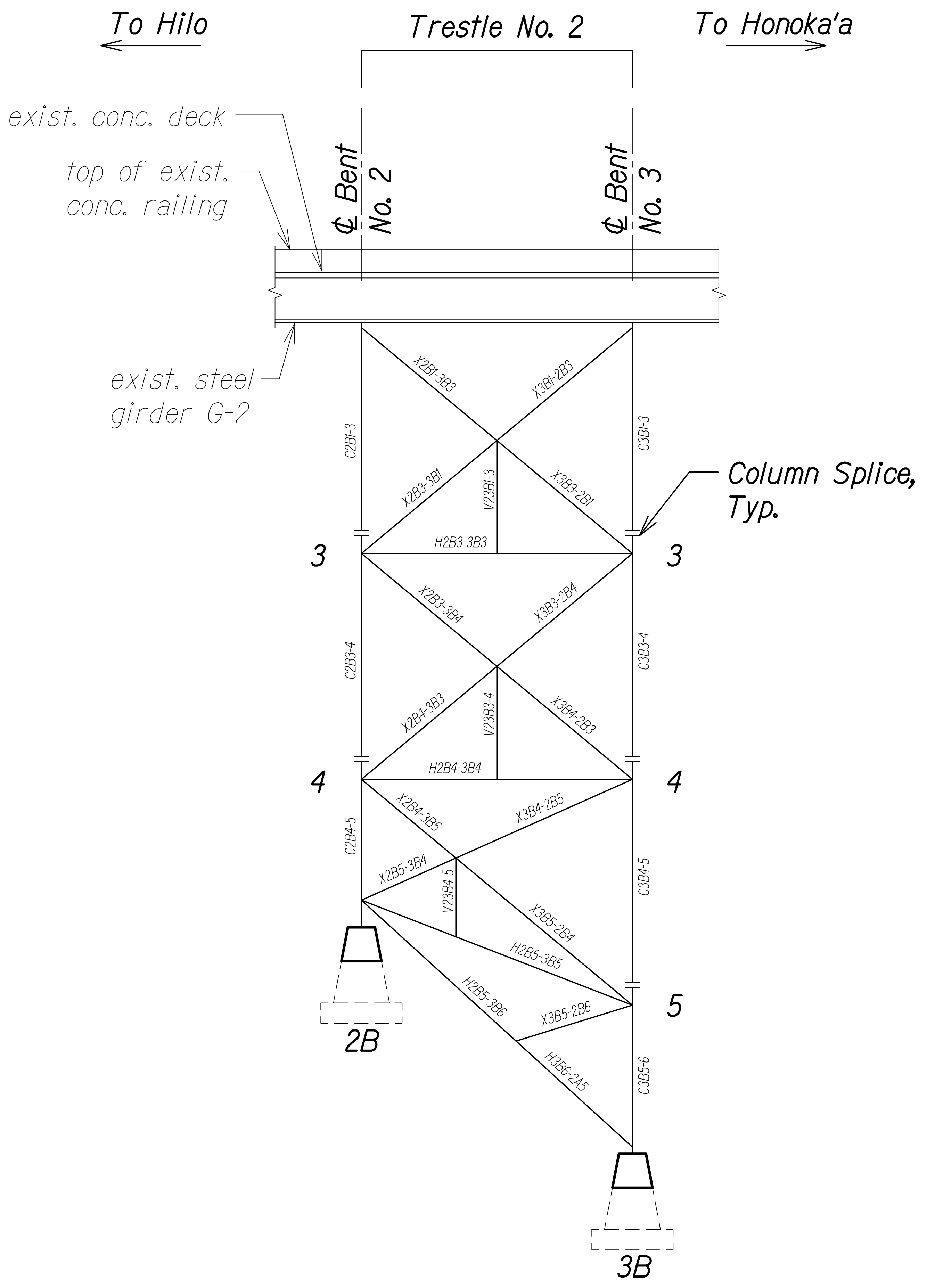
A
SA4.4 SA4.4



TRESTLE NO. 2 ELEVATION - COLUMN LINE "A"

Scale: 1/16" = 1'-0"

B
SA4.4 SA4.4



TRESTLE NO. 2 ELEVATION - COLUMN LINE "B"

Scale: 1/16" = 1'-0"

C
SA4.4 SA4.4

DATE	REVISION
12/6/24	1 Revised Label

STEPHEN T. PETERS
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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BENT NO. 2/TRESTLE NO. 2 MEMBER ELEVATIONS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA4.4 OF 20 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
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NOTE BOOK	TRACED BY	
	DESIGNED BY	
No.	QUANTITIES BY	
	CHECKED BY	

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0401-SA410 BENT-TRESTLES ADD2.DWG PLOT TIME: 12-03-24, 9:52 PM

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 85	280

BENT UPPER INTERIOR DIAGONAL BRACE SCHEDULE

	MEMBER ID	"A"	BATTEN PLATE SPACES
BENT NO. 1	X1B1-C2	1'-6"	1 Eq. Spaces △1
	X1C1-B2	1'-6"	1 Eq. Spaces △1
	X1B2-C1	1'-6"	2 Eq. Spaces △1
	X1C2-B1	1'-6"	2 Eq. Spaces △1
	X1B2-C3	1'-6"	4 Eq. Spaces
	X1C2-B3	1'-6"	4 Eq. Spaces
	X1B3-C2	1'-6"	9 Eq. Spaces
	X1C3-B2	1'-6"	9 Eq. Spaces
BENT NO. 2	X2B1-C2	1'-6"	1 Eq. Spaces △1
	X2C1-B2	1'-6"	1 Eq. Spaces △1
	X2B2-C1	1'-6"	2 Eq. Spaces △1
	X2C2-B1	1'-6"	2 Eq. Spaces △1
	X2B2-C3	1'-6"	3 Eq. Spaces
	X2C2-B3	1'-6"	3 Eq. Spaces
	X2B3-C2	1'-6"	6 Eq. Spaces
	X2C3-B2	1'-6"	6 Eq. Spaces
	X2B3-C4	1'-6"	6 Eq. Spaces
	X2C3-B4	1'-6"	6 Eq. Spaces
	X2B4-C3	1'-6"	11 Eq. Spaces
	X2C4-B3	1'-6"	11 Eq. Spaces
	X2B4-C5	1'-6"	7 Eq. Spaces
	X2C4-B5	1'-6"	7 Eq. Spaces △1
	X2B5-C4	1'-6"	10 Eq. Spaces
	X2C5-B4	1'-6"	10 Eq. Spaces
BENT NO. 3	X3B1-C2	1'-6"	1 Eq. Spaces △1
	X3C1-B2	1'-6"	1 Eq. Spaces △1
	X3B2-C1	1'-6"	2 Eq. Spaces △1
	X3C2-B1	1'-6"	2 Eq. Spaces △1
	X3B2-C3	1'-6"	3 Eq. Spaces
	X3C2-B3	1'-6"	3 Eq. Spaces
	X3B3-C2	1'-6"	6 Eq. Spaces
	X3C3-B2	1'-6"	6 Eq. Spaces
	X3B3-C4	1'-6"	6 Eq. Spaces
	X3C3-B4	1'-6"	6 Eq. Spaces
	X3B4-C3	1'-6"	11 Eq. Spaces
	X3C4-B3	1'-6"	11 Eq. Spaces
	X3B4-C5	1'-6"	9 Eq. Spaces
	X3C4-B5	1'-6"	9 Eq. Spaces
	X3B5-C4	1'-6"	12 Eq. Spaces
	X3C5-B4	1'-6"	12 Eq. Spaces
	X3B4-C6	1'-6"	10 Eq. Spaces
	X3C5-B6	1'-6"	10 Eq. Spaces
	X3B6-C5	1'-6"	12 Eq. Spaces
	X3C6-B5	1'-6"	12 Eq. Spaces

BENT UPPER INTERIOR DIAGONAL BRACE SCHEDULE

	MEMBER ID	"A"	BATTEN PLATE SPACES
BENT NO. 4	X4B1-C2	1'-6"	1 Eq. Spaces △1
	X4C1-B2	1'-6"	1 Eq. Spaces △1
	X4B2-C1	1'-6"	2 Eq. Spaces △1
	X4C2-B1	1'-6"	2 Eq. Spaces △1
	X4B2-C3	1'-6"	3 Eq. Spaces
	X4C2-B3	1'-6"	3 Eq. Spaces
	X4B3-C2	1'-6"	6 Eq. Spaces
	X4C3-B2	1'-6"	6 Eq. Spaces
	X4B3-C4	1'-6"	6 Eq. Spaces
	X4C3-B4	1'-6"	6 Eq. Spaces
	X4B4-C3	1'-6"	11 Eq. Spaces
	X4C4-B3	1'-6"	11 Eq. Spaces
	X4B4-C5	1'-6"	9 Eq. Spaces
	X4C4-B5	1'-6"	9 Eq. Spaces
	X4B5-C4	1'-6"	12 Eq. Spaces
	X4C5-B4	1'-6"	12 Eq. Spaces
	X4B5-C6	1'-6"	11 Eq. Spaces
	X4C5-B6	1'-6"	11 Eq. Spaces
	X4B6-C5	1'-6"	14 Eq. Spaces
	X4C6-B5	1'-6"	14 Eq. Spaces
BENT NO. 5	X5B1-C2	1'-6"	1 Eq. Spaces △1
	X5C1-B2	1'-6"	1 Eq. Spaces △1
	X5B2-C1	1'-6"	2 Eq. Spaces △1
	X5C2-B1	1'-6"	2 Eq. Spaces △1
	X5B2-C3	1'-6"	3 Eq. Spaces
	X5C2-B3	1'-6"	3 Eq. Spaces
	X5B3-C2	1'-6"	6 Eq. Spaces
	X5C3-B2	1'-6"	6 Eq. Spaces
	X5B3-C4	1'-6"	6 Eq. Spaces
	X5C3-B4	1'-6"	6 Eq. Spaces
	X5B4-C3	1'-6"	11 Eq. Spaces
	X4C4-B3	1'-6"	11 Eq. Spaces
	X5B4-C5	1'-6"	9 Eq. Spaces
	X5C4-B5	1'-6"	9 Eq. Spaces
	X5B5-C4	1'-6"	12 Eq. Spaces
	X5C5-B4	1'-6"	12 Eq. Spaces
	X5B5-C6	1'-6"	11 Eq. Spaces
	X5C5-B6	1'-6"	11 Eq. Spaces
	X5B6-C5	1'-6"	14 Eq. Spaces
	X5C6-B5	1'-6"	14 Eq. Spaces

DATE	REVISION
12/6/24	△1 Revised Table Value

STEPHEN T. PETERS
NO. 17097-S

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Stephen Peters 4-30-26
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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DIAGONAL BRACE SCHEDULE

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA5.13 OF 34 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY____ DATE____
	DRAWN BY____ "
NOTE BOOK	TRACED BY____ "
	DESIGNED BY____ "
	QUANTITIES BY____ "
No.____	CHECKED BY____ "

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0512 DIAG BRACE DTLS ADD2.DWG PLOT TIME: 12-03-24, 10:03 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 86	280

BENT UPPER INTERIOR DIAGONAL BRACE SCHEDULE

	MEMBER ID	"A"	BATTEN PLATE SPACES
BENT NO. 6	X6B1-C2	1'-6"	1 Eq. Spaces △1
	X6C1-B2	1'-6"	1 Eq. Spaces △1
	X6B2-C1	1'-6"	2 Eq. Spaces △1
	X6C2-B1	1'-6"	2 Eq. Spaces △1
	X6B2-C3	1'-6"	3 Eq. Spaces
	X6C2-B3	1'-6"	3 Eq. Spaces
	X6B3-C2	1'-6"	6 Eq. Spaces
	X6C3-B2	1'-6"	6 Eq. Spaces
	X6B3-C4	1'-6"	6 Eq. Spaces
	X6C3-B4	1'-6"	6 Eq. Spaces
	X6B4-C3	1'-6"	11 Eq. Spaces
	X6C4-B3	1'-6"	11 Eq. Spaces
	X6B4-C5	1'-6"	9 Eq. Spaces
	X6C4-B5	1'-6"	9 Eq. Spaces
	X6B5-C4	1'-6"	12 Eq. Spaces
	X6C5-B4	1'-6"	12 Eq. Spaces
	X6B5-C6	1'-6"	11 Eq. Spaces
	X6C5-B6	1'-6"	11 Eq. Spaces
	X6B6-C5	1'-6"	14 Eq. Spaces
	X6C6-B5	1'-6"	14 Eq. Spaces
BENT NO. 7	X7B1-C2	1'-6"	1 Eq. Spaces △1
	X7C1-B2	1'-6"	1 Eq. Spaces △1
	X7B2-C1	1'-6"	2 Eq. Spaces △1
	X7C2-B1	1'-6"	2 Eq. Spaces △1
	X7B2-C3	1'-6"	3 Eq. Spaces
	X7C2-B3	1'-6"	3 Eq. Spaces
	X7B3-C2	1'-6"	6 Eq. Spaces
	X7C3-B2	1'-6"	6 Eq. Spaces
	X7B3-C4	1'-6"	6 Eq. Spaces
	X7C3-B4	1'-6"	6 Eq. Spaces
	X7B4-C3	1'-6"	11 Eq. Spaces
	X7C4-B3	1'-6"	11 Eq. Spaces
	X7B4-C5	1'-6"	9 Eq. Spaces
	X7C4-B5	1'-6"	9 Eq. Spaces
	X7B5-C4	1'-6"	12 Eq. Spaces
	X7C5-B4	1'-6"	12 Eq. Spaces
	X7B5-C6	1'-6"	11 Eq. Spaces
	X7C5-B6	1'-6"	11 Eq. Spaces
	X7B6-C5	1'-6"	14 Eq. Spaces
	X7C6-B5	1'-6"	14 Eq. Spaces

BENT UPPER INTERIOR DIAGONAL BRACE SCHEDULE

	MEMBER ID	"A"	BATTEN PLATE SPACES
BENT NO. 8	X8B1-C2	1'-6"	1 Eq. Spaces △1
	X8C1-B2	1'-6"	1 Eq. Spaces △1
	X8B2-C1	1'-6"	2 Eq. Spaces △1
	X8C2-B1	1'-6"	2 Eq. Spaces △1
	X8B2-C3	1'-6"	3 Eq. Spaces
	X8C2-B3	1'-6"	3 Eq. Spaces
	X8B3-C2	1'-6"	6 Eq. Spaces
	X8C3-B2	1'-6"	6 Eq. Spaces
	X8B3-C4	1'-6"	6 Eq. Spaces
	X8C3-B4	1'-6"	6 Eq. Spaces
	X8B4-C3	1'-6"	11 Eq. Spaces
	C8C4-B3	1'-6"	11 Eq. Spaces
BENT NO. 9	X9B1-C2	1'-6"	1 Eq. Spaces △1
	X9C1-B2	1'-6"	1 Eq. Spaces △1
	X9B2-C1	1'-6"	2 Eq. Spaces △1
	X9C2-B1	1'-6"	2 Eq. Spaces △1
	X9B2-C3	1'-6"	4 Eq. Spaces
	X9C2-B3	1'-6"	4 Eq. Spaces
	X9B3-C2	1'-6"	7 Eq. Spaces
	X9C3-B2	1'-6"	7 Eq. Spaces

DATE	REVISION
12/6/24	△1 Revised Table Value

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DIAGONAL BRACE SCHEDULE

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA5.14 OF 34 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
NOTE BOOK	TRACED BY	"
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No.	QUANTITIES BY	"
	CHECKED BY	"

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0512 DIAG BRACE DTLS ADD2.DWG PLOT TIME: 12-03-24, 10:05 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 88	280

BENT LOWER INTERIOR DIAGONAL BRACE SCHEDULE

	MEMBER ID	"A"	BATTEN PLATE SPACES
BENT NO. 4	X4B6-C7	1'-6"	14 Eq. Spaces
	X4C6-B7	1'-6"	14 Eq. Spaces
	X4B7-C6	1'-6"	18 Eq. Spaces
	X4C7-B6	1'-6"	18 Eq. Spaces
BENT NO. 5	X5B6-C7	1'-6"	20 Eq. Spaces △1
	X5C6-B7	1'-6"	20 Eq. Spaces △1
	X5B8-C7	1'-6"	18 Eq. Spaces
	X5C8-B7	1'-6"	18 Eq. Spaces
BENT NO. 6	X6B6-C7	1'-6"	20 Eq. Spaces △1
	X6C6-B7	1'-6"	20 Eq. Spaces △1
	X6B8-C7	1'-6"	18 Eq. Spaces
	X6C8-B7	1'-6"	18 Eq. Spaces

DATE	REVISION
12/6/24	△1 Revised Table Value

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

DIAGONAL BRACE SCHEDULE

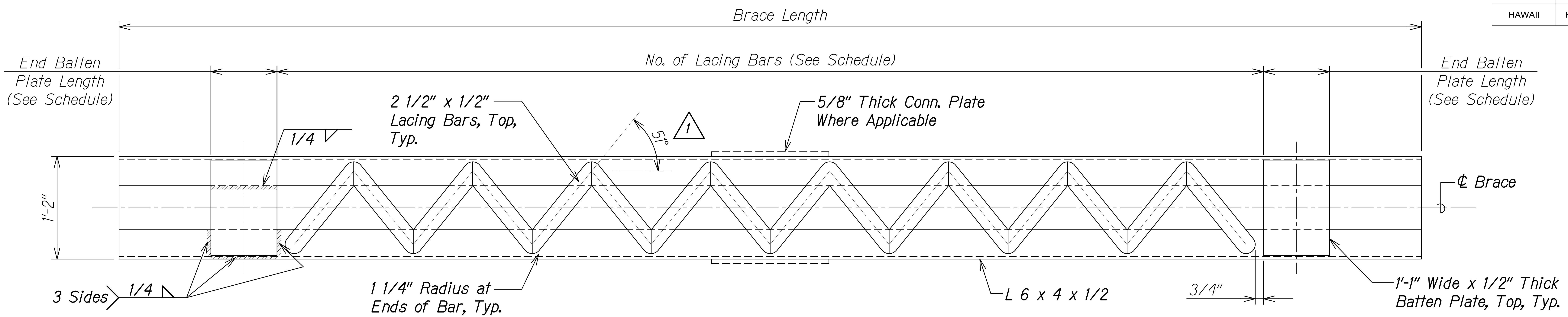
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA5.16 OF 34 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY ______	DATE ______
	DRAWN BY ______	" ______
NOTE BOOK	TRACED BY ______	" ______
	DESIGNED BY ______	" ______
	QUANTITIES BY ______	" ______
No. ______	CHECKED BY ______	" ______

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0512 DIAG BRACE DTLS ADD2.DWG PLOT TIME: 12-03-24, 10:04 PM)

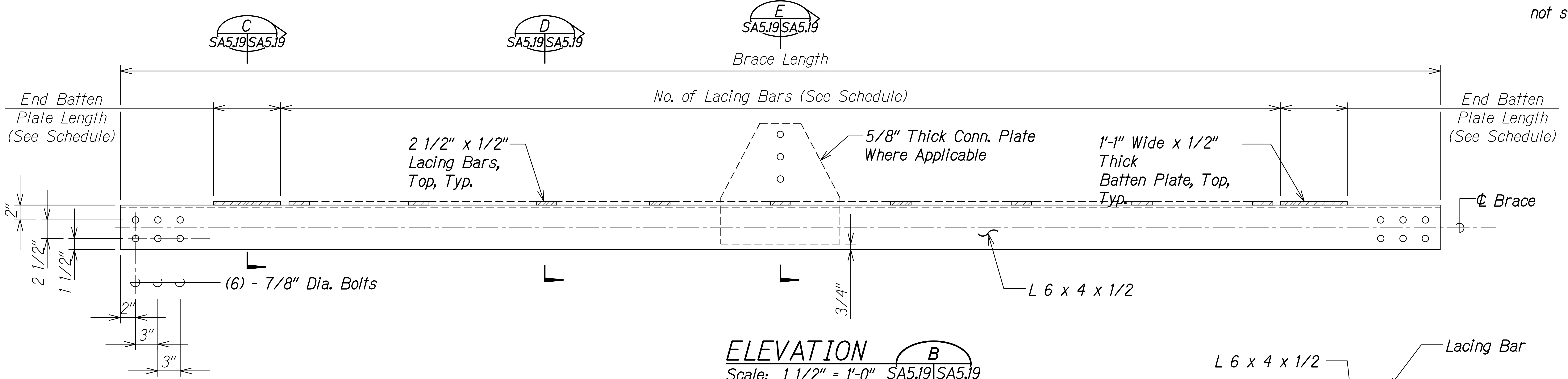
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 91	280



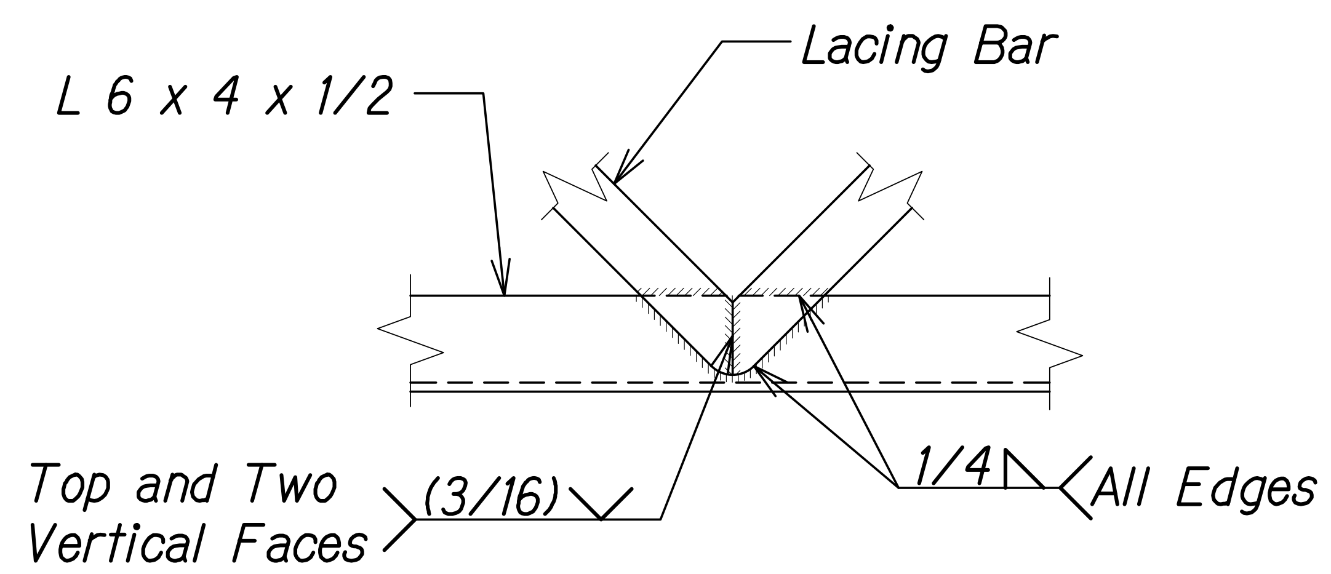
PLAN
Scale: 1 1/2" = 1'-0" A SA5.19 SA5.19

NOTE:

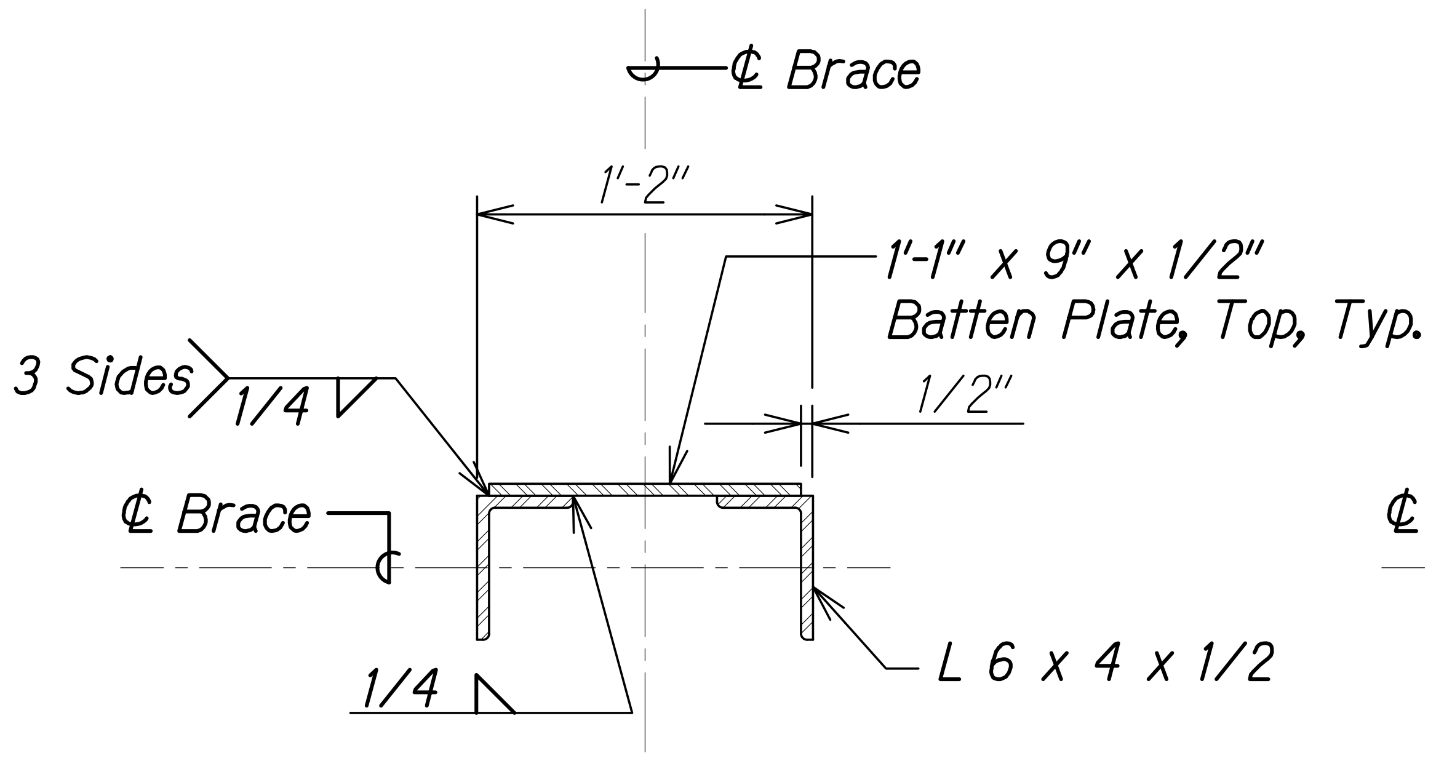
Steel detailer to determine all lengths not shown on brace plans and schedule.



ELEVATION
Scale: 1 1/2" = 1'-0" B SA5.19 SA5.19



DETAIL
Scale: 1 1/2" = 1'-0" 1 SA5.19 SA5.19



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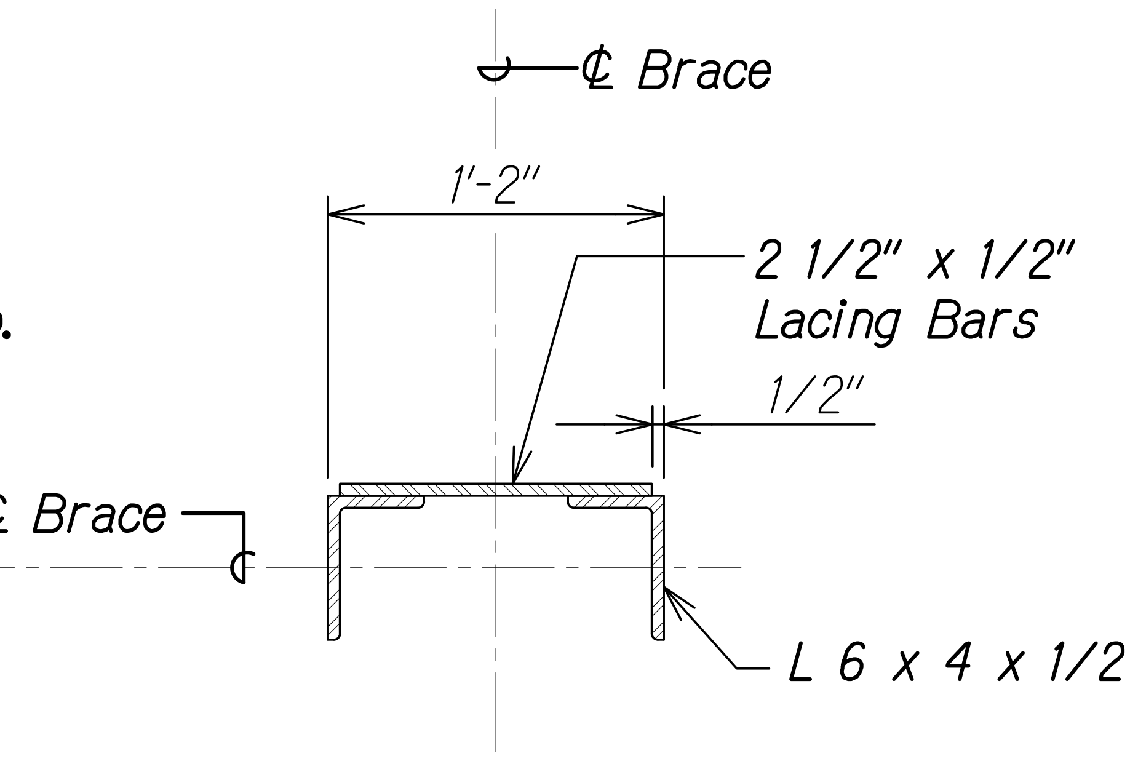
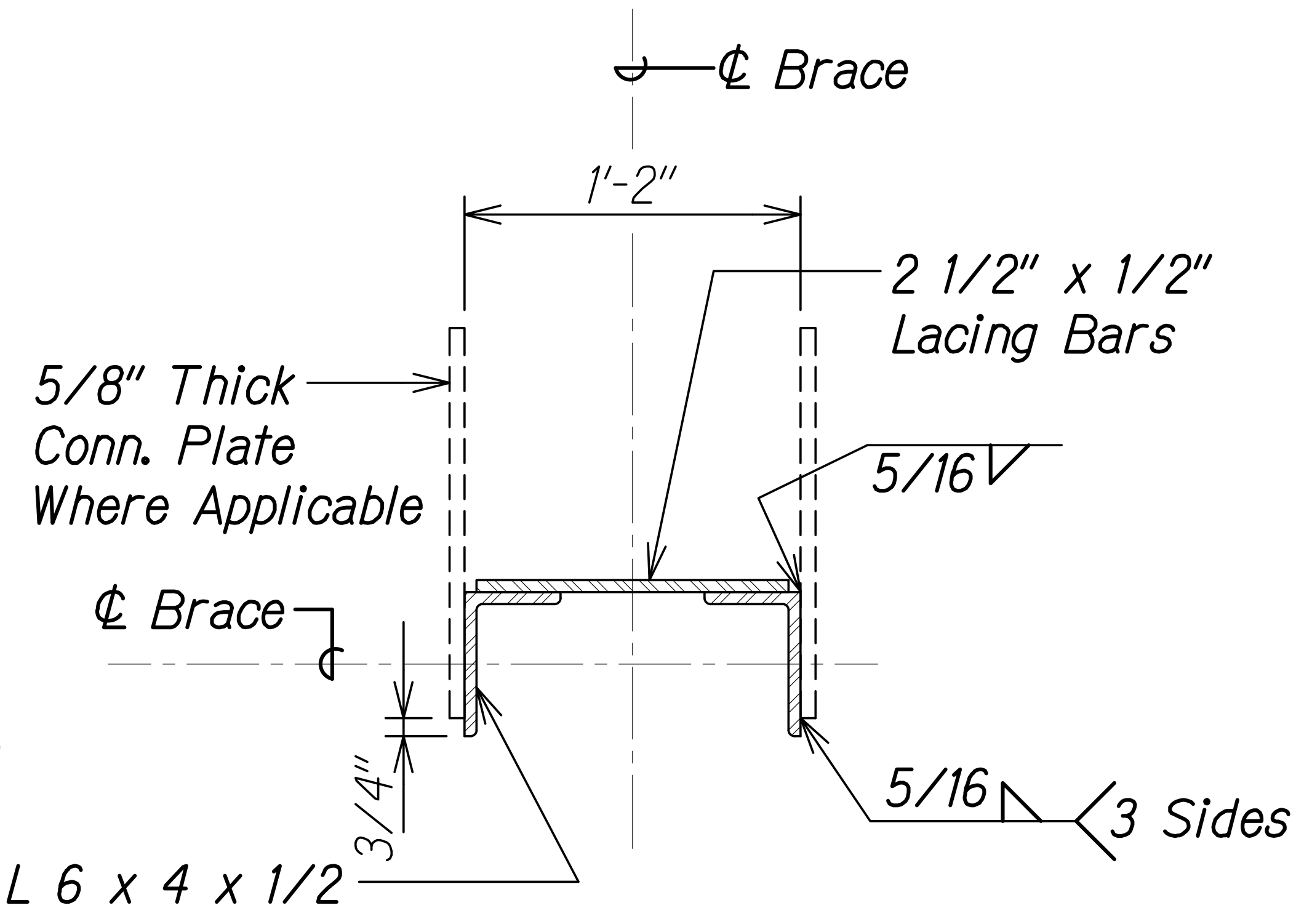
Scale: 1 1/2" = 1'-0" C SA5.19 SA5.19



SECTION
Scale: 1 1/2" = 1'-0" D SA5.19 SA5.19



SECTION
Scale: 1 1/2" = 1'-0" E SA5.19 SA5.19

BENT UPPER HORIZONTAL BRACE

DATE	REVISION
12/6/24	1 Revised Dimension

STEPHEN T. PETERS
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HAWAII, U.S.A.

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4-30-26
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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

HORIZONTAL BRACE PLAN, ELEVATION AND SECTION

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA5.19 OF 34 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0512 DIAG BRACE DTLS ADD2.DWG PLOT TIME: 12-05-24, 12:33 PM

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 92	280

BENT UPPER HORIZONTAL BRACE SCHEDULE

	MEMBER ID	End Batten Plate Length	No. of Lacing Bars
BENT NO. 1	H1A-B1	0'-10"	4
	H1B-C1	0'-9"	2 △1
	H1C-D1	0'-10"	4
	H1A-B2	0'-10"	4
	H1B-C2	1'-5" △1	4 △1
	H1C-D2	0'-10"	4
BENT NO. 2	H2A-B1	0'-10"	4
	H2B-C1	0'-8" △1	2 △1
	H2C-D1	0'-10"	4
	H2A-B2	0'-9" △1	6 △1
	H2B-C2	0'-10"	8
	H2C-D2	0'-10"	4
	H2A-B3	0'-10"	4
	H2B-C3	0'-8" △1	14 △1
	H2C-D3	0'-10"	4
	H2A-B4	0'-10"	4
	H2B-C4	0'-9" △1	26 △1
	H2C-D4	0'-10"	4
BENT NO. 3	H3A-B1	0'-10"	4
	H3B-C1	0'-9"	2 △1
	H3C-D1	0'-10"	4
	H3A-B2	0'-10"	4
	H3B-C2	1'-5" △1	4 △1
	H3C-D2	0'-10"	4
	H3A-B3	0'-10"	4
	H3B-C3	1'-3" △1	12 △1
	H3C-D3	0'-10"	4
	H3A-B4	0'-10"	4
	H3B-C4	0'-10" △1	26 △1
	H3C-D4	0'-10"	4
	H3A-B5	0'-10"	4
	H3B-C5	1'-2" △1	38 △1
	H3C-D5	0'-10"	4
BENT NO. 4	H4A-B1	0'-10"	4
	H4B-C1	0'-8" △1	2 △1
	H4C-D1	0'-10"	4
	H4A-B2	0'-10"	4
	H4B-C2	0'-9" △1	6 △1
	H4C-D2	0'-10"	4
	H4A-B3	0'-10"	4
	H4B-C3	0'-8" △1	14 △1
	H4C-D3	0'-10"	4

	MEMBER ID	End Batten Plate Length	No. of Lacing Bars
BENT NO. 4	H4A-B4	0'-10"	4
	H4B-C4	0'-9" △1	26 △1
	H4C-D4	0'-10"	4
	H4A-B5	0'-10"	4
	H4B-C5	1'-3" △1	38 △1
	H4C-D5	0'-10"	4
BENT NO. 5	H5A-B1	0'-10"	4
	H5B-C1	0'-9"	2 △1
	H5C-D1	0'-10"	4
	H5A-B2	0'-10"	4
	H5B-C2	1'-5" △1	4 △1
	H5C-D2	0'-10"	4
	H5A-B3 △1	0'-10"	4
	H5B-C3 △1	1'-3" △1	12 △1
	H5C-D3 △1	0'-10"	4
	H5A-B4 △1	0'-10"	4
	H5B-C4	0'-10" △1	26 △1
	H5C-D4	0'-10"	4
	H5A-B5	0'-10"	4
	H5B-C5	1'-5" △1	38 △1
	H5C-D5	0'-10"	4
BENT NO. 6	H6A-B1	0'-10"	4
	H6B-C1	0'-8" △1	2 △1
	H6C-D1	0'-10"	4
	H6A-B2	0'-10"	4
	H6B-C2	0'-9" △1	6 △1
	H6C-D2	0'-10"	4
	H6A-B3	0'-10"	4
	H6B-C3	0'-8" △1	14 △1
	H6C-D3	0'-10"	4
	H6A-B4	0'-10"	4
	H6B-C4	0'-9" △1	26 △1
	H6C-D4	0'-10"	4
	H6A-B5	0'-10"	4
	H6B-C5	1'-3" △1	38 △1
	H6C-D5	0'-10"	4
BENT NO. 7	H7A-B1	0'-10"	4
	H7B-C1	0'-9"	2 △1
	H7C-D1	0'-10"	4
	H7A-B2	0'-10"	4
	H7B-C2	1'-5" △1	4 △1
	H7C-D2	0'-10"	4
	H7A-B3	0'-10"	4

	MEMBER ID	End Batten Plate Length	No. of Lacing Bars
BENT NO. 7	H7B-C3	1'-3" △1	12 △1
	H7C-D3	0'-10"	4
	H7A-B4	0'-10"	4
	H7B-C4	0'-10" △1	26 △1
	H7C-D4	0'-10"	4
	H7A-B5	0'-10"	4
	H7B-C5	0'-9"	40 △1
	H7C-D5	0'-10"	4
BENT NO. 8	H8A-B1	0'-10"	4
	H8B-C1	0'-8" △1	2 △1
	H8C-D1	0'-10"	4
	H8A-B2	0'-10"	4
	H8B-C2	0'-9" △1	6 △1
	H8C-D2	0'-10"	4
	H8A-B3	0'-10"	4
	H8B-C3	1'-2"	12 △1
	H8C-D3	0'-10"	4
BENT NO. 9	H9A-B1	0'-10"	4
	H9B-C1	0'-9"	2 △1
	H9C-D1	0'-10"	4
	H9A-B2	0'-10"	4
	H9B-C2	1'-5" △1	4 △1
	H9C-D2	0'-10"	4

DATE	REVISION
12/6/24	△1 Revised Table Value

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
No. 17097-S
HAWAII, U.S.A.

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Stephen Peters
4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

HORIZONTAL BRACE SCHEDULE

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No SA5.20 OF 34 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0512 DIAG BRACE DTLS ADD2.DWG PLOT TIME: 12-03-24, 10:07 PM

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 94	280

BENT LOWER HORIZONTAL BRACE SCHEDULE

	MEMBER ID	End Batten Plate Length	No. of Lacing Bars
BENT NO. 1	H1A-B3	0'-8"	4
	H1B-C3	1'-4" △1	16
	H1C-D3	0'-8"	4
BENT NO. 2	H2A-B5	0'-8"	4
	H2B-C5	1'-6" △1	34
	H2C-D5	0'-8"	4
BENT NO. 3	H3A-B6	0'-8"	4
	H3B-C6	0'-9" △1	22 △1
	H3C-B6	0'-9" △1	22 △1
	H3C-D6	0'-8"	4
BENT NO. 4	H4A-B6	0'-8"	4
	H4B-C6	1'-3" △1	22
	H4C-B6	1'-3" △1	22
	H4C-D6	0'-8"	4
	H4A-B7	0'-8"	4
	H4B-C7	1'-5" △1	30
	H4C-B7	1'-5" △1	30
	H4C-D7	0'-8"	4
BENT NO. 5	H5A-B6	0'-8"	4
	H5B-C6	1'-2" △1	22
	H5C-B6	1'-2" △1	22
	H5C-D6	0'-8"	4
	H5A-B7	0'-8"	4
	H5B-C7	1'-3" △1	28
	H5C-B7	1'-3" △1	28
	H5C-D7	0'-8"	4
	H5A-B8	0'-8"	4
	H5B-C8	1'-5" △1	32
	H5C-B8	1'-5" △1	32
	H5C-D8	0'-8"	4
BENT NO. 6	H6A-B6	0'-8"	4
	H6B-C6	1'-1" △1	22
	H6C-B6	1'-1" △1	22
	H6C-D6	0'-8"	4
	H6A-B7	0'-8"	4
	H6B-C7	1'-5" △1	28
	H6C-B7	1'-5" △1	28
	H6C-D7	0'-8"	4
	H6A-B8	0'-8"	4
	H6B-C8	0'-11"	34 △1
	H6C-B8	0'-11"	34 △1
	H6C-D8	0'-8"	4
BENT NO. 7	H7A-B6	0'-8"	4
	H7B-C6	1'-2" △1	22
	H7C-B6	1'-2" △1	22
	H7C-D6	0'-8"	4
BENT NO. 8	H8A-B4	0'-8"	4
	H8B-C4	1'-2" △1	26
	H8C-D4	0'-8"	4
BENT NO. 9	H9A-B3	0'-8"	4
	H9B-C3	1'-4" △1	14
	H9C-D3	0'-8"	4

DATE	REVISION
12/6/24	△1 Revised Table Value

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

HORIZONTAL BRACE SCHEDULE

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No SA5.22 OF 34 SHEETS

ADD. 94

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOT\A\01 CAD\12-06-24 ADD2\NSR-SA0512 DIAG BRACE DTLS ADD2.DWG PLOT TIME: 12-03-24, 10:08 PM

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 99	280

TRESTLE NO. 5 DIAGONAL BRACE SCHEDULE

	MEMBER ID	"A"	BATTEN PLATE SPACES	
TRESTLE NO. 5	X8A1-9A3	1'-6"	12 Eq. Spaces	△1
	X8B1-9B3	1'-6"	12 Eq. Spaces	△1
	X8C1-9C3	1'-6"	12 Eq. Spaces	△1
	X8D1-9D3	1'-6"	12 Eq. Spaces	△1
	X9A1-8A3	1'-6"	12 Eq. Spaces	
	X9B1-8B3	1'-6"	12 Eq. Spaces	
	X9C1-8C3	1'-6"	12 Eq. Spaces	
	X9D1-8D3	1'-6"	12 Eq. Spaces	
	X8A3-9A1	1'-6"	10 Eq. Spaces	
	X8B3-9B1	1'-6"	10 Eq. Spaces	
	X8C3-9C1	1'-6"	10 Eq. Spaces	
	X8D3-9D1	1'-6"	10 Eq. Spaces	
	X9A3-8A1	1'-6"	12 Eq. Spaces	
	X9B3-8B1	1'-6"	12 Eq. Spaces	
	X9C3-8C1	1'-6"	12 Eq. Spaces	
	X9D3-8D1	1'-6"	12 Eq. Spaces	
	X8A4-9A3	1'-6"	12 Eq. Spaces	△1
	X8B4-9B3	1'-6"	12 Eq. Spaces	△1
	X8C4-9C3	1'-6"	12 Eq. Spaces	△1
	X8D4-9D3	1'-6"	12 Eq. Spaces	△1
	X9A3-8A4	1'-6"	12 Eq. Spaces	
	X9B3-8B4	1'-6"	12 Eq. Spaces	
	X9C3-8C4	1'-6"	12 Eq. Spaces	
	X9D3-8D4	1'-6"	12 Eq. Spaces	

DATE	REVISION
12/6/24	△1 Revised Table Value

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NO. 17097-S

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

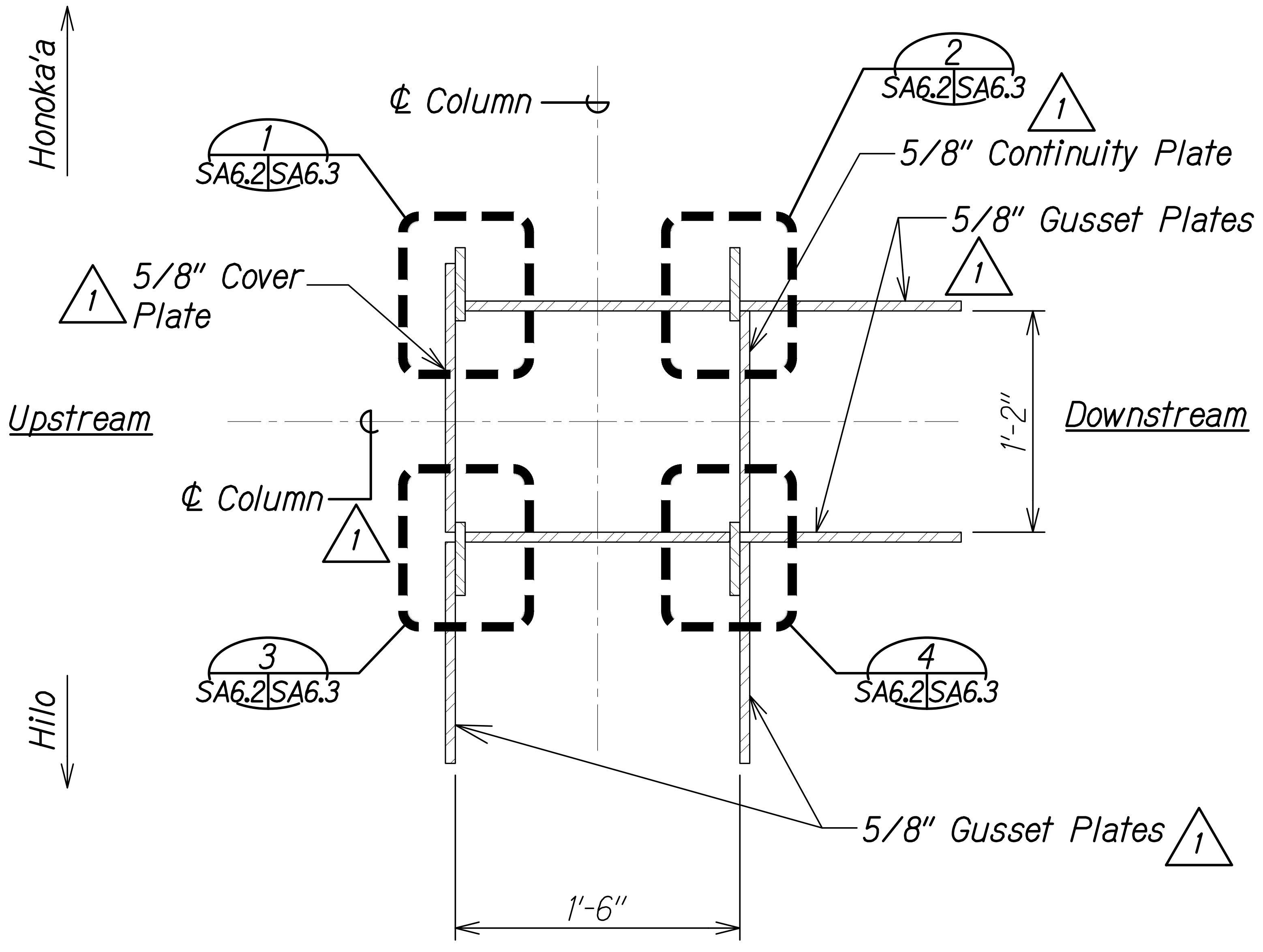
DIAGONAL BRACE SCHEDULE

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024
SHEET No SA5.27 OF 34 SHEETS

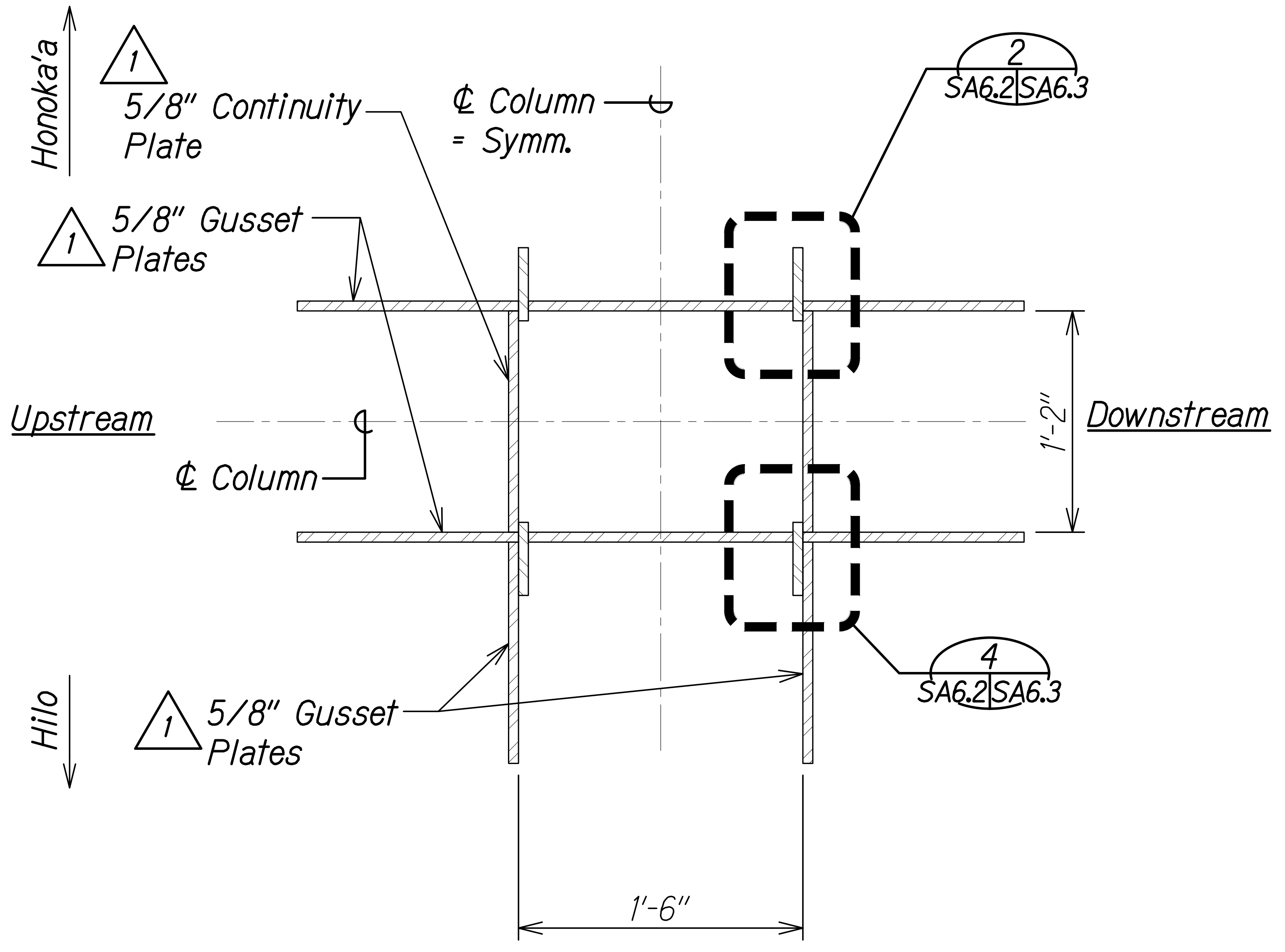
ORIGINAL PLAN	SURVEY PLOTTED BY ______ DATE ______
	DRAWN BY ______ " ______
NOTE BOOK	TRACED BY ______ " ______
	DESIGNED BY ______ " ______
	QUANTITIES BY ______ " ______
No. ______	CHECKED BY ______ " ______

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0512 DIAG BRACE DTLS ADD2.DWG PLOT TIME: 12-03-24, 10:09 PM)

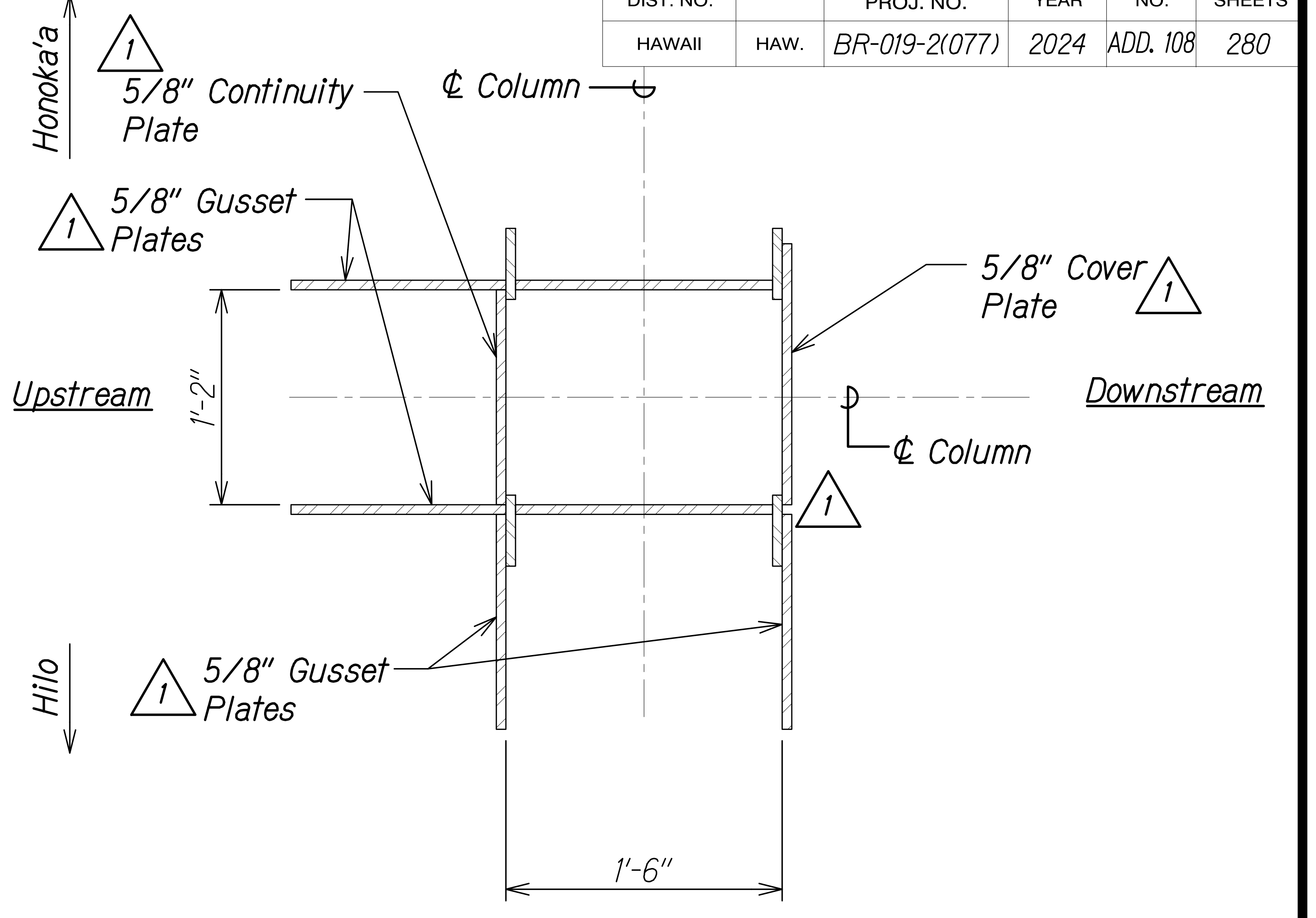
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 108	280



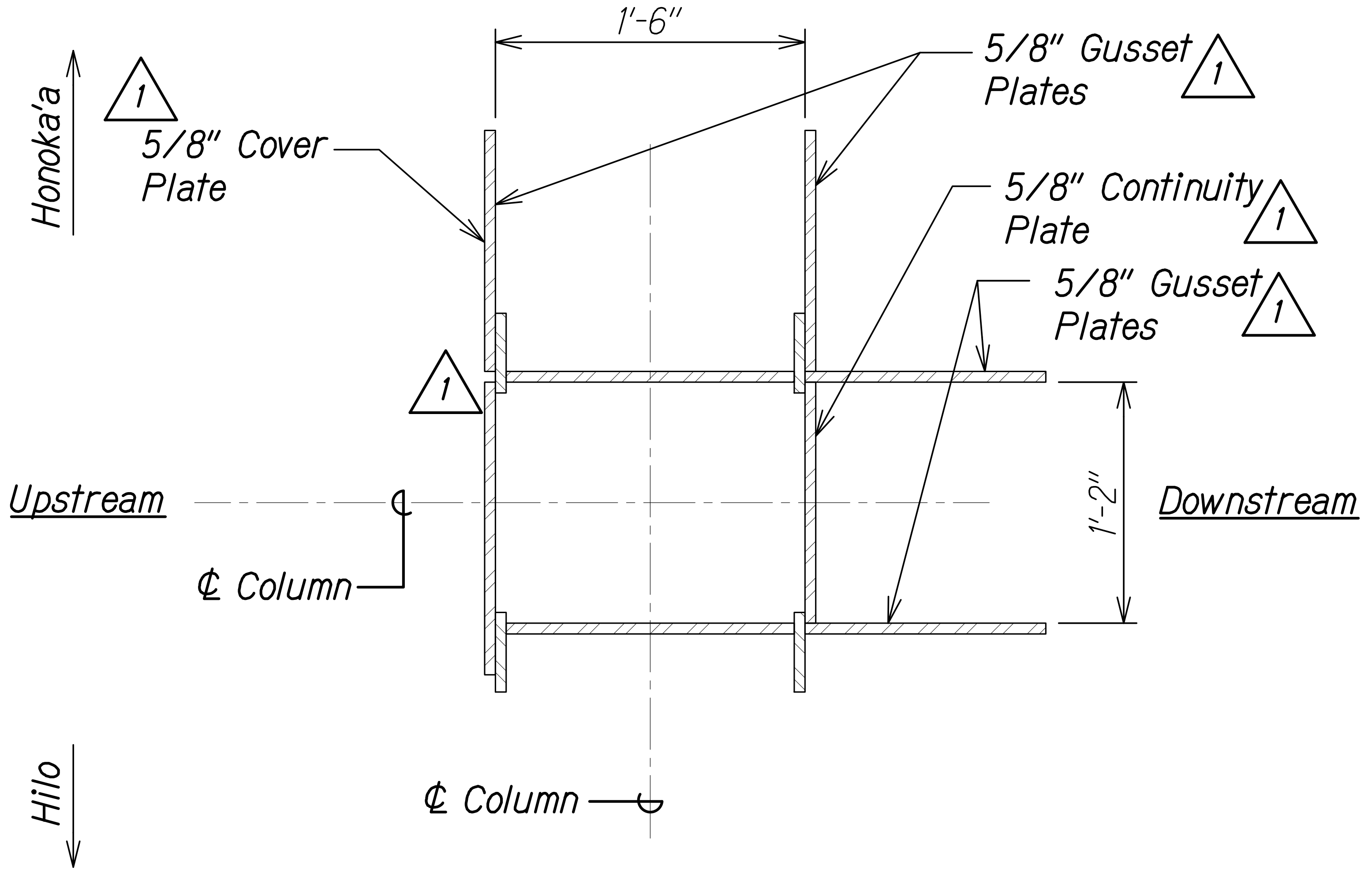
PLAN DETAIL A SA6.2 | SA6.2
Scale: 1 1/2" = 1'-0"



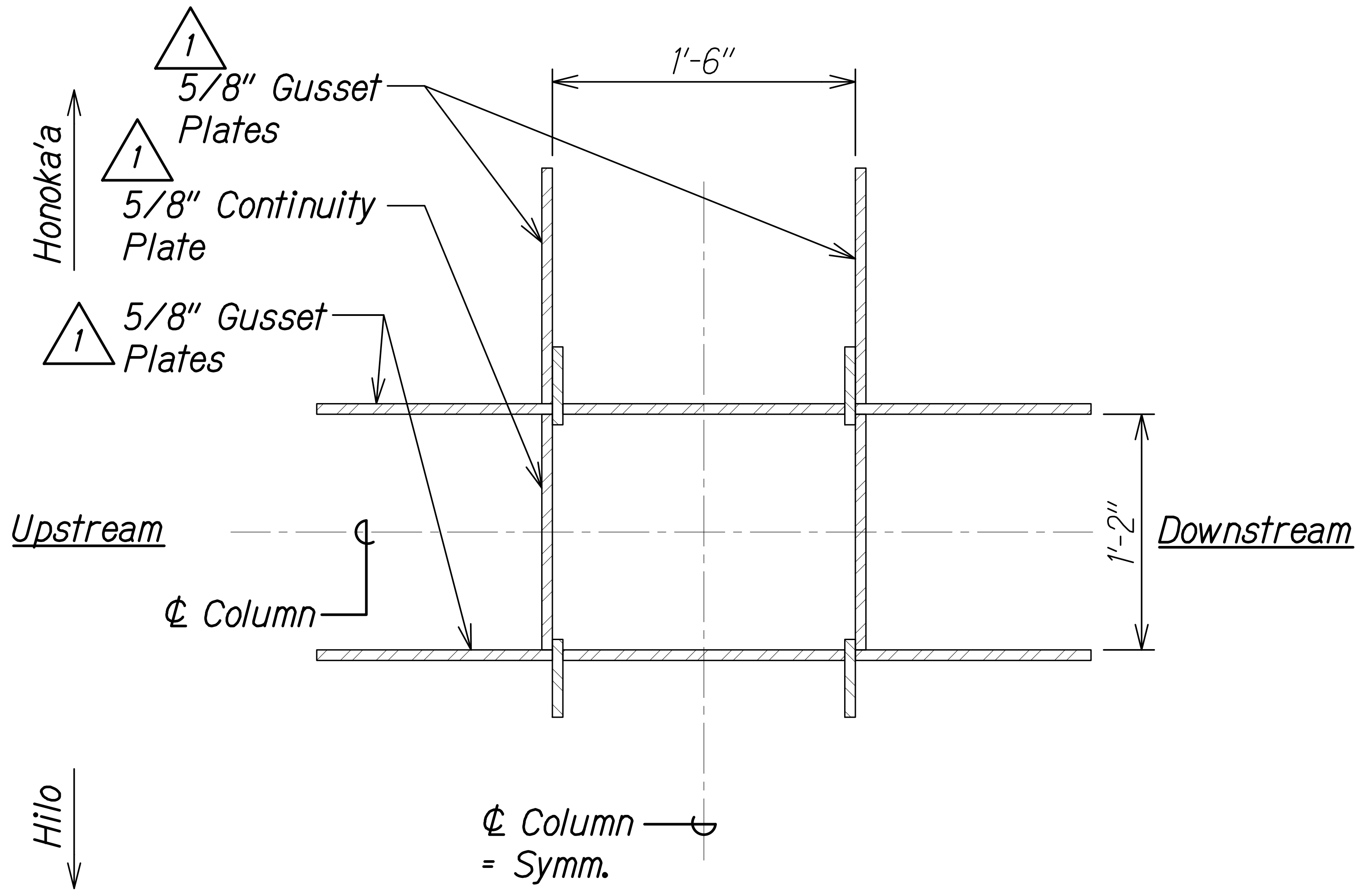
PLAN DETAIL B SA6.2 | SA6.2
Scale: 1 1/2" = 1'-0"



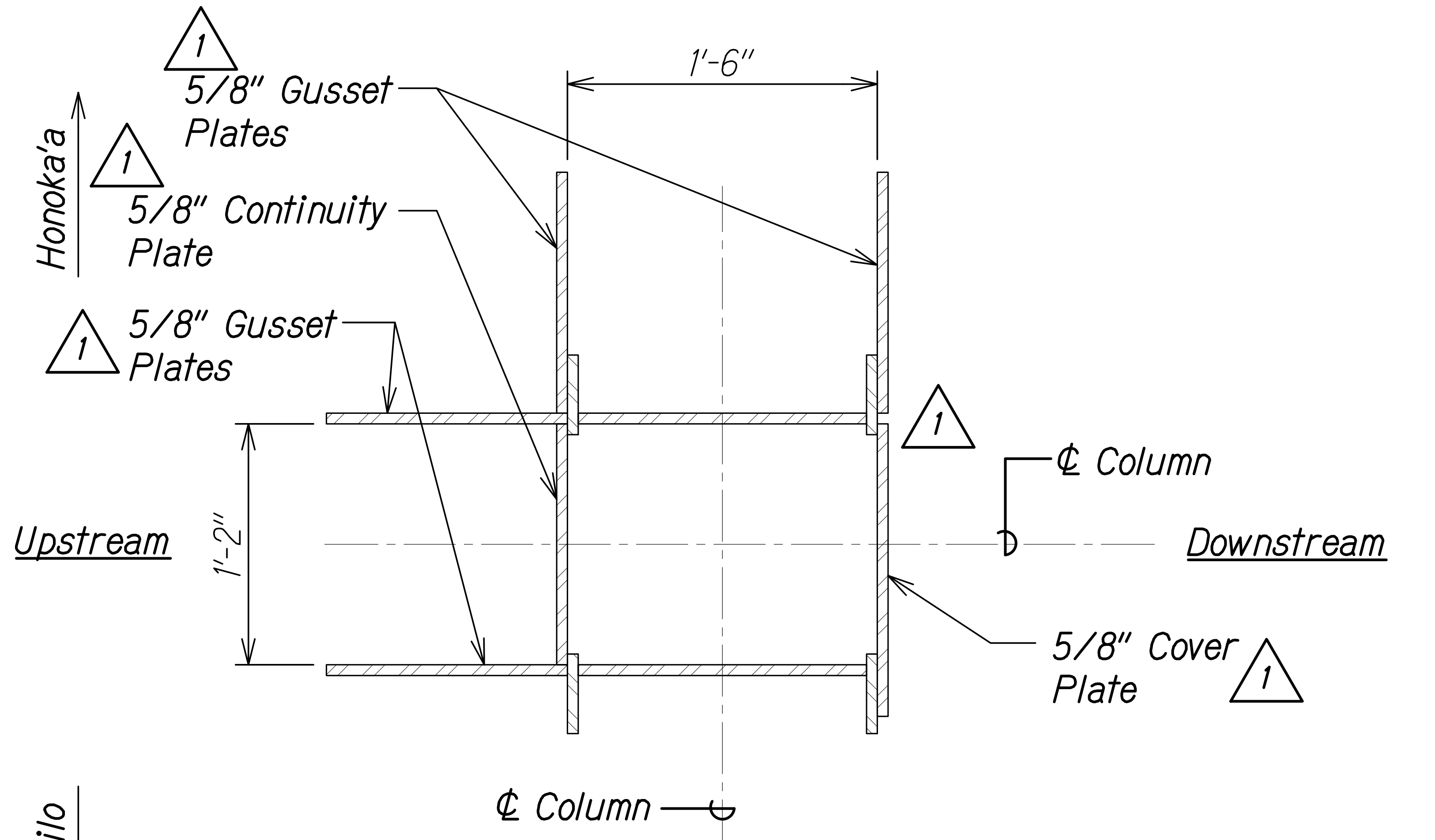
PLAN DETAIL C SA6.2 | SA6.2
Scale: 1 1/2" = 1'-0"



PLAN DETAIL D SA6.2 | SA6.2
Scale: 1 1/2" = 1'-0"



PLAN DETAIL E SA6.2 | SA6.2
Scale: 1 1/2" = 1'-0"



PLAN DETAIL F SA6.2 | SA6.2
Scale: 1 1/2" = 1'-0"

NOTE:

Brace not shown for clarity.

DATE	REVISION
12/6/24	1 Revised Callouts

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
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HAWAII, U.S.A.

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4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

COLUMN TO BRACE
CONNECTION DETAILS

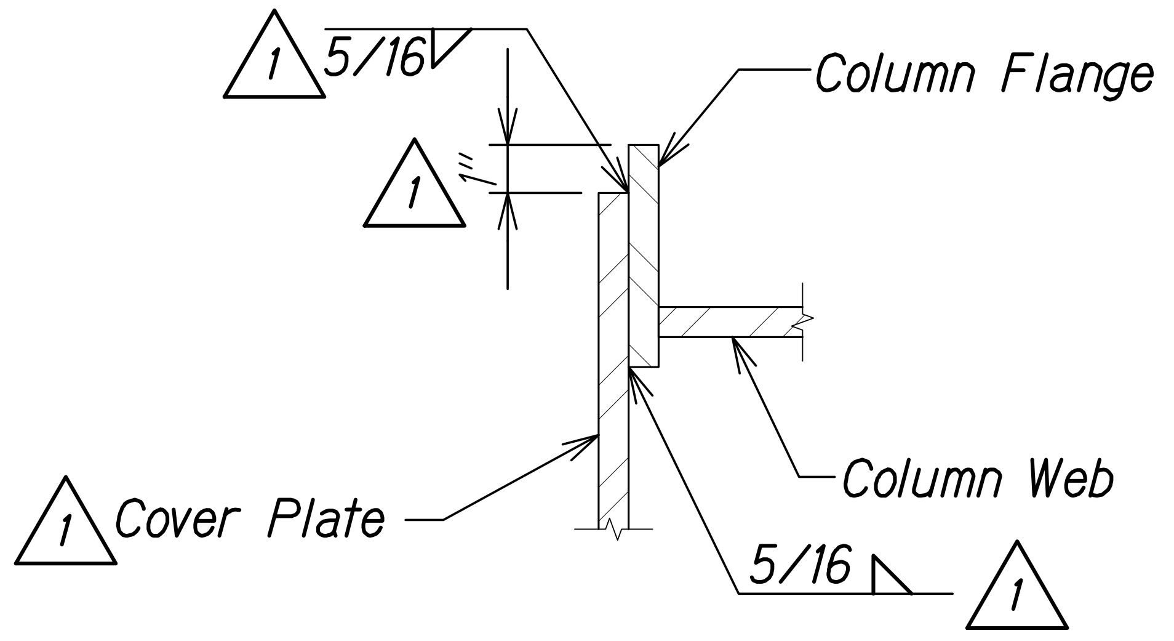
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024
SHEET No. SA6.2 OF 22 SHEETS

ADD. 108

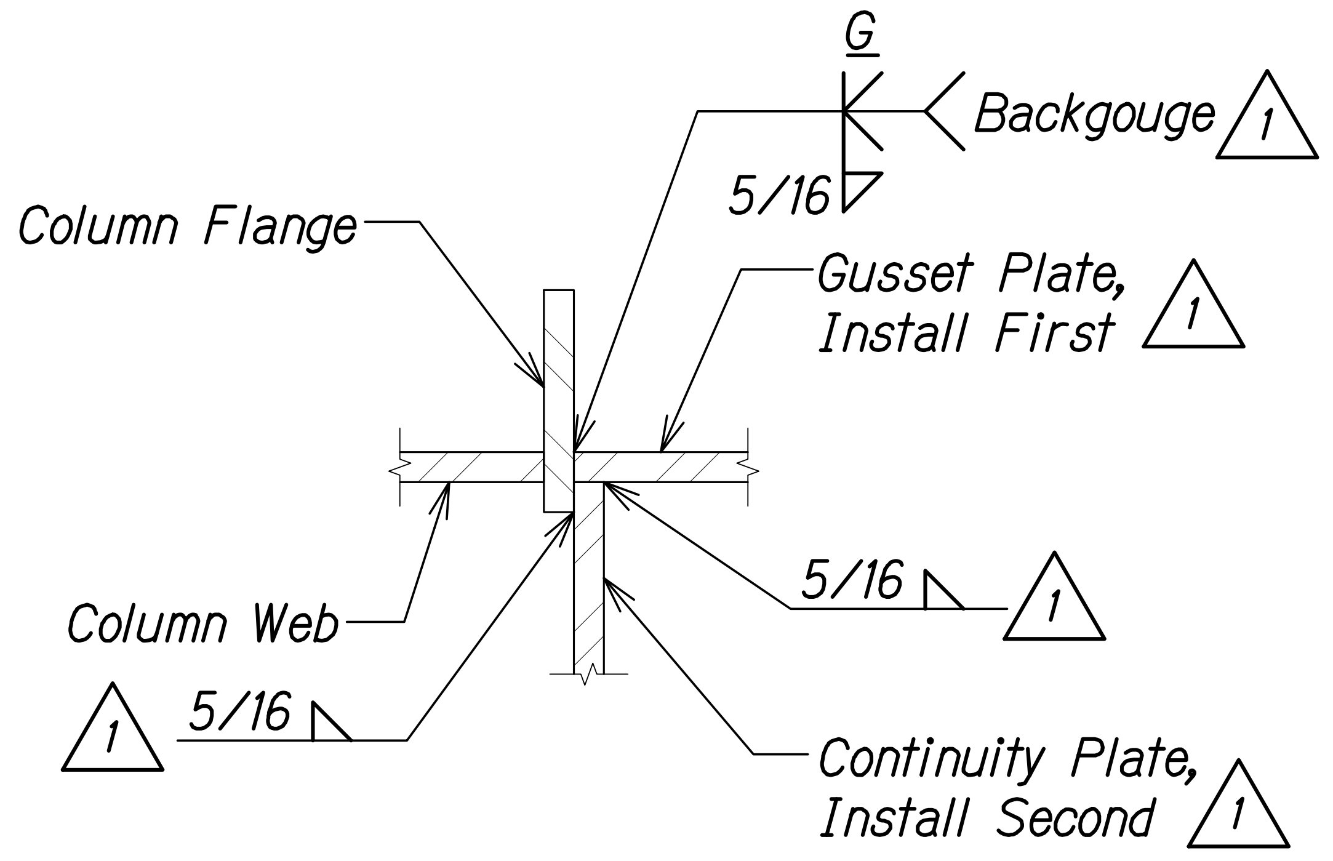
ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTHA\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-03-24, 10:12 PM

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 109	280



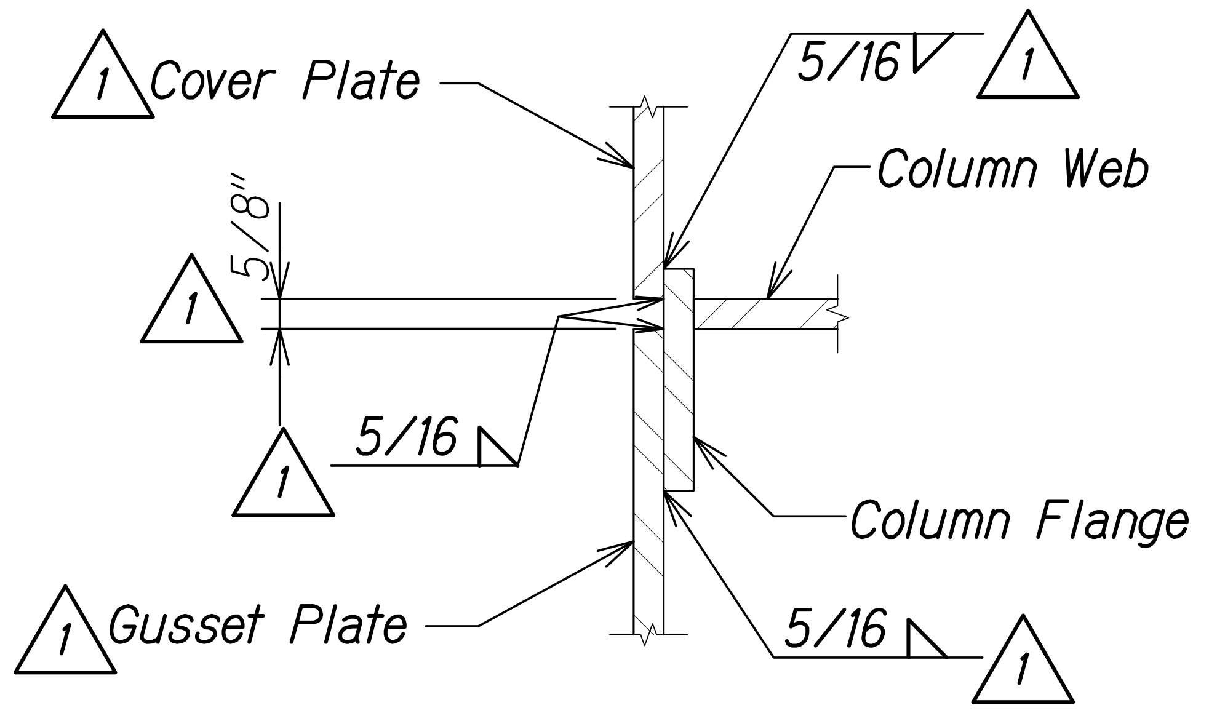
DETAIL 1 SA6.2 | SA6.3
Scale: 3" = 1'-0"



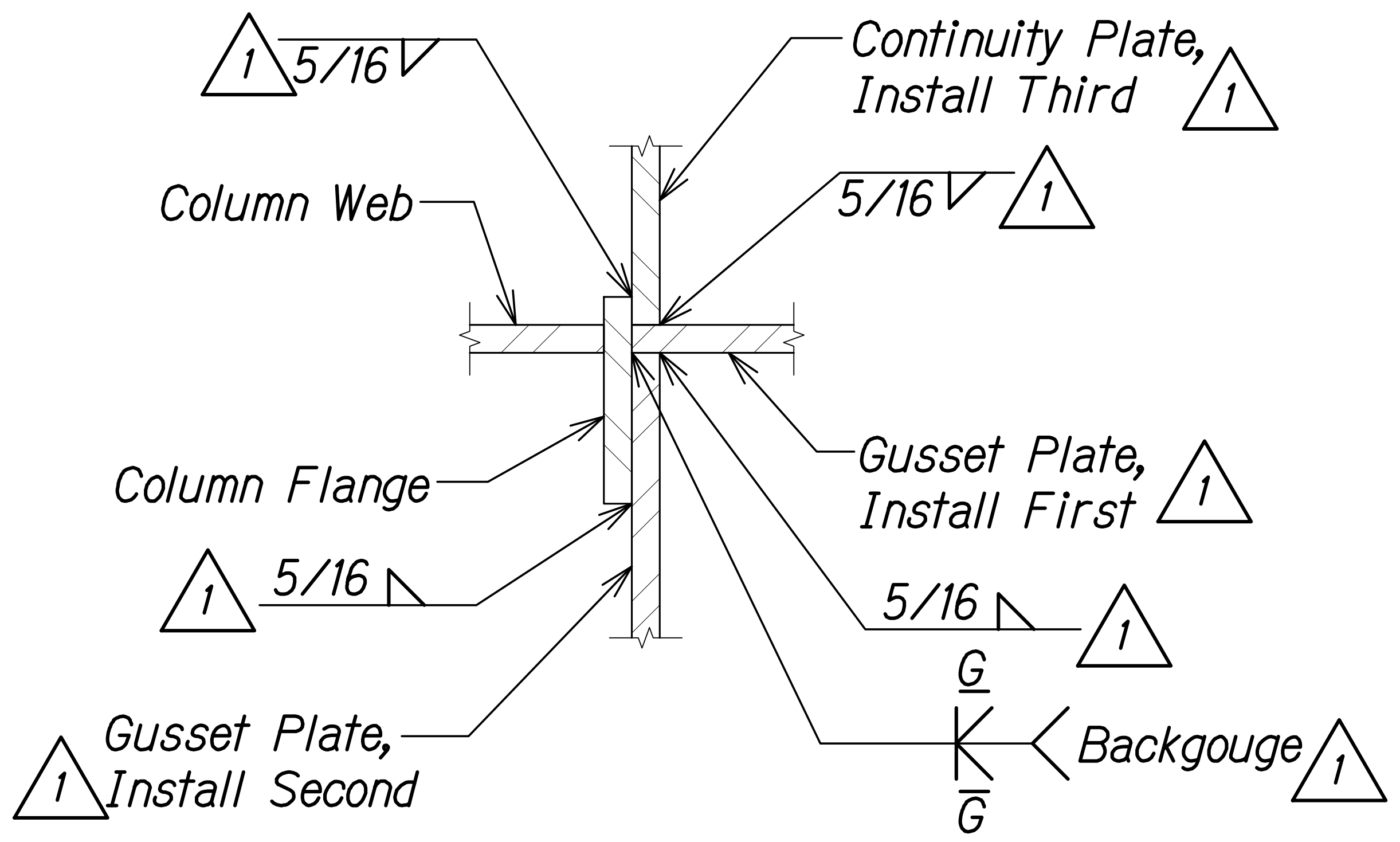
DETAIL 2 SA6.2 | SA6.3
Scale: 3" = 1'-0"

1 NOTE:

All gusset/cover/continuity/stiffener plates shall receive return fillet welds across the top and bottom connection at faying edge with column flange and column seat to provide a full seal weld to prevent moisture intrusion.



DETAIL 3 SA6.2 | SA6.3
Scale: 3" = 1'-0"



DETAIL 4 SA6.2 | SA6.3
Scale: 3" = 1'-0"

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
NOTE BOOK	TRACED BY	"
	DESIGNED BY	"
No.	QUANTITIES BY	"
	CHECKED BY	"

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-05-24, 1:11 PM)

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

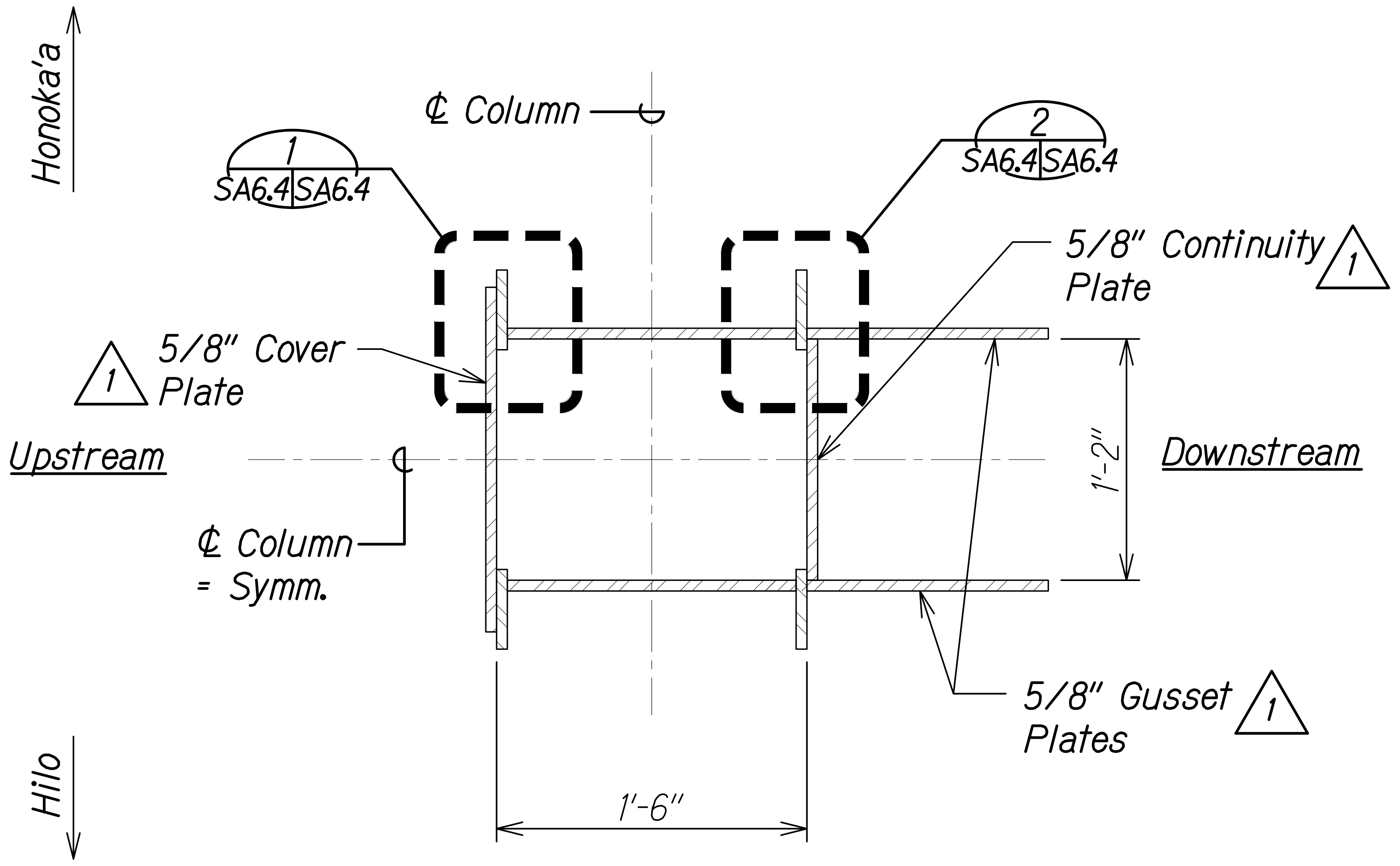
DATE	REVISION
12/6/24	1 Revised Callouts and Added Note

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

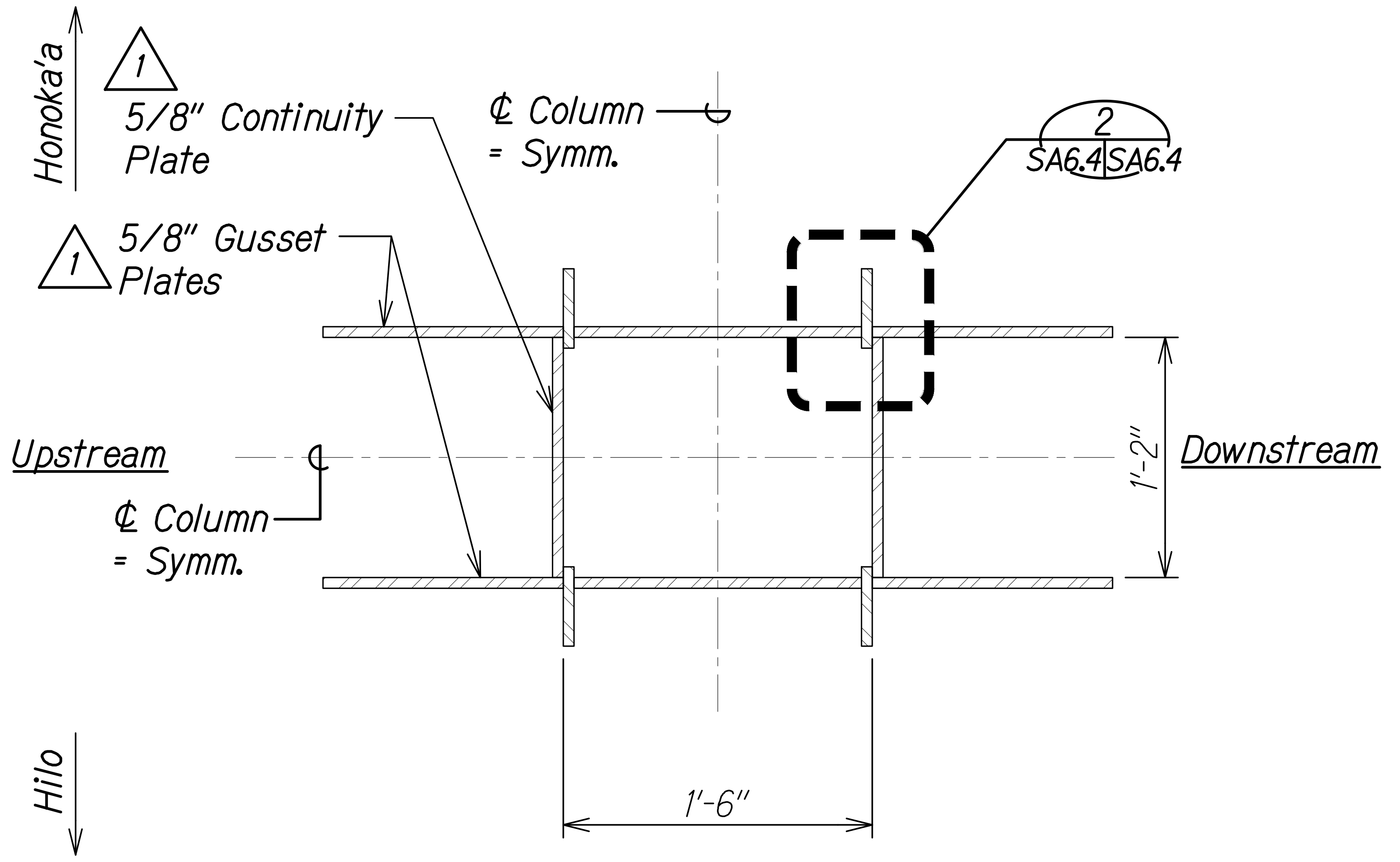
COLUMN TO BRACE CONNECTION DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024
SHEET No. SA6.3 OF 22 SHEETS

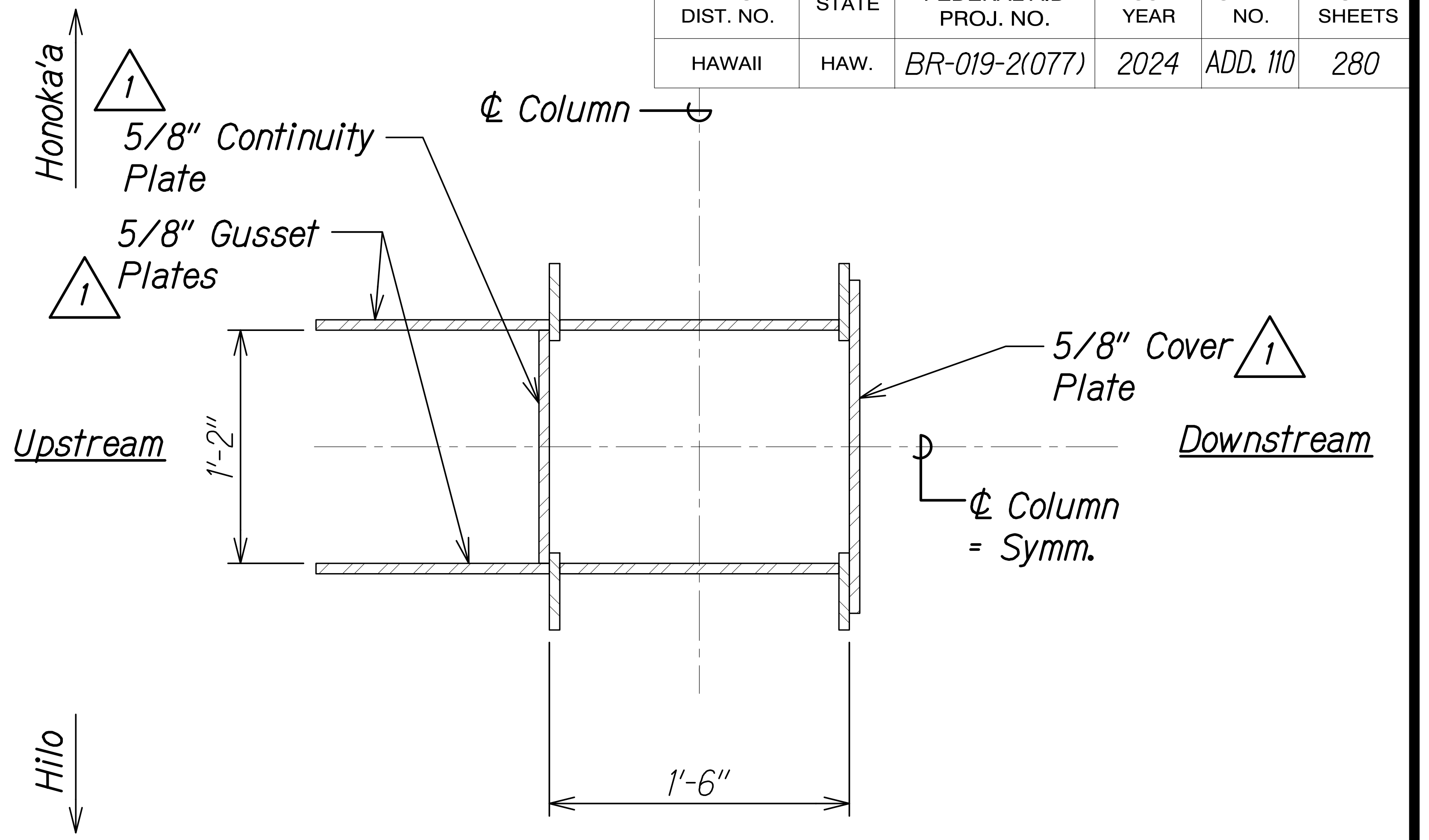
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 110	280



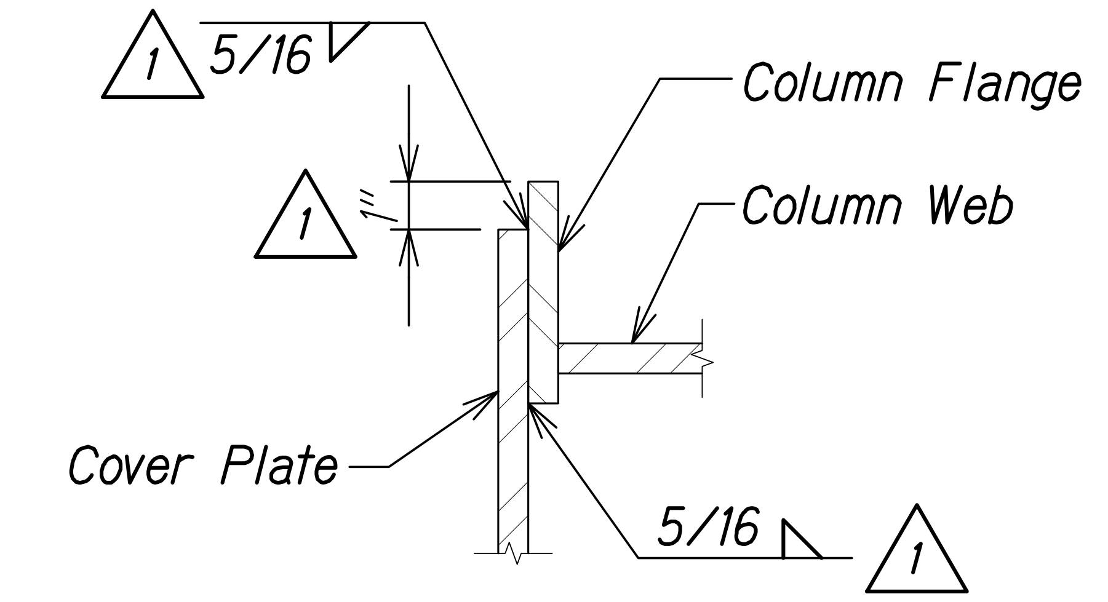
PLAN DETAIL A SA6.4|SA6.4
Scale: 1 1/2" = 1'-0"



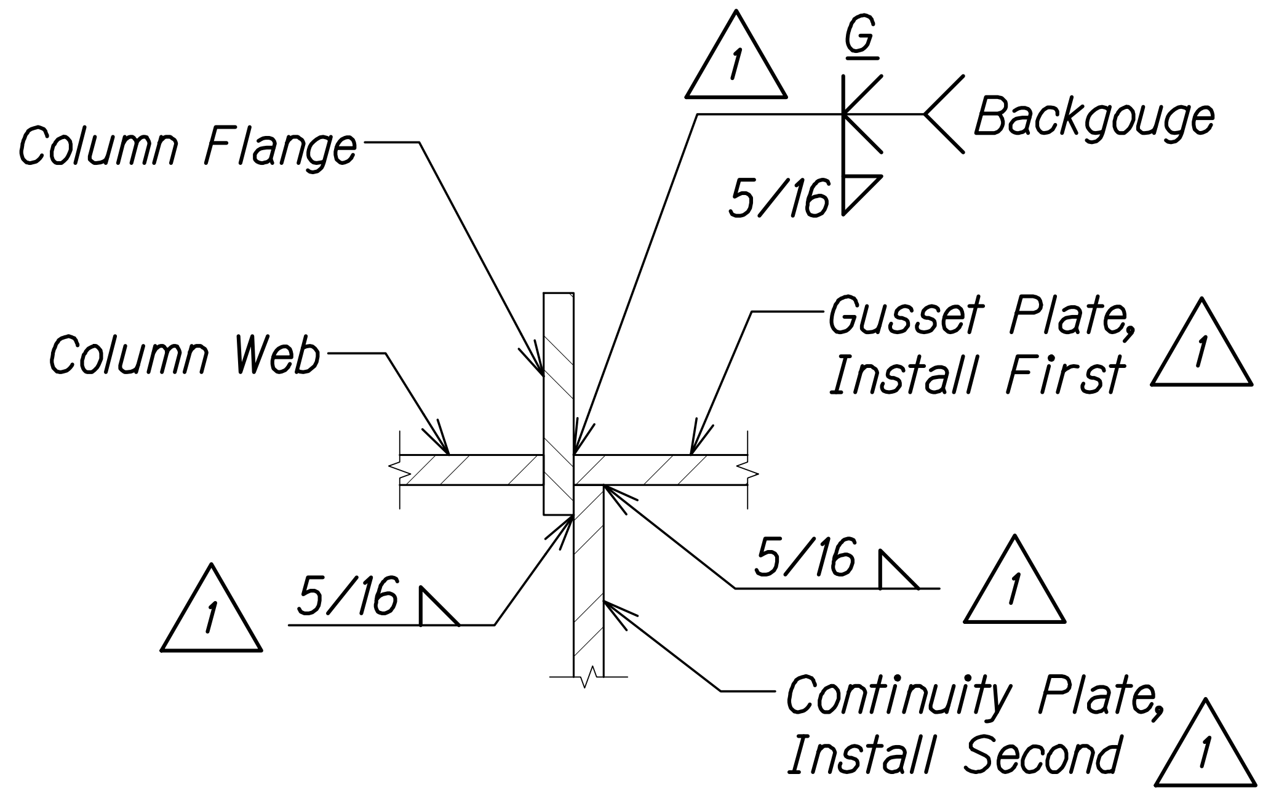
PLAN DETAIL B SA6.4|SA6.4
Scale: 1 1/2" = 1'-0"



PLAN DETAIL C SA6.4|SA6.4
Scale: 1 1/2" = 1'-0"



DETAIL 1 SA6.4|SA6.4
Scale: 3" = 1'-0"



DETAIL 2 SA6.4|SA6.4
Scale: 3" = 1'-0"

1 NOTE:

All gusset/cover/continuity/stiffener plates shall receive return fillet welds across the top and bottom connection at faying edge with column flange and column seat to provide a full seal weld to prevent moisture intrusion.

DATE	REVISION
12/6/24	1 Revised Callouts and Added Dimensions & Notes

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

COLUMN TO BRACE CONNECTION DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted   Date: Oct. 2024
SHEET No. SA6.4 OF 22 SHEETS

STEPHEN T. PETERS
NO. 17097-S

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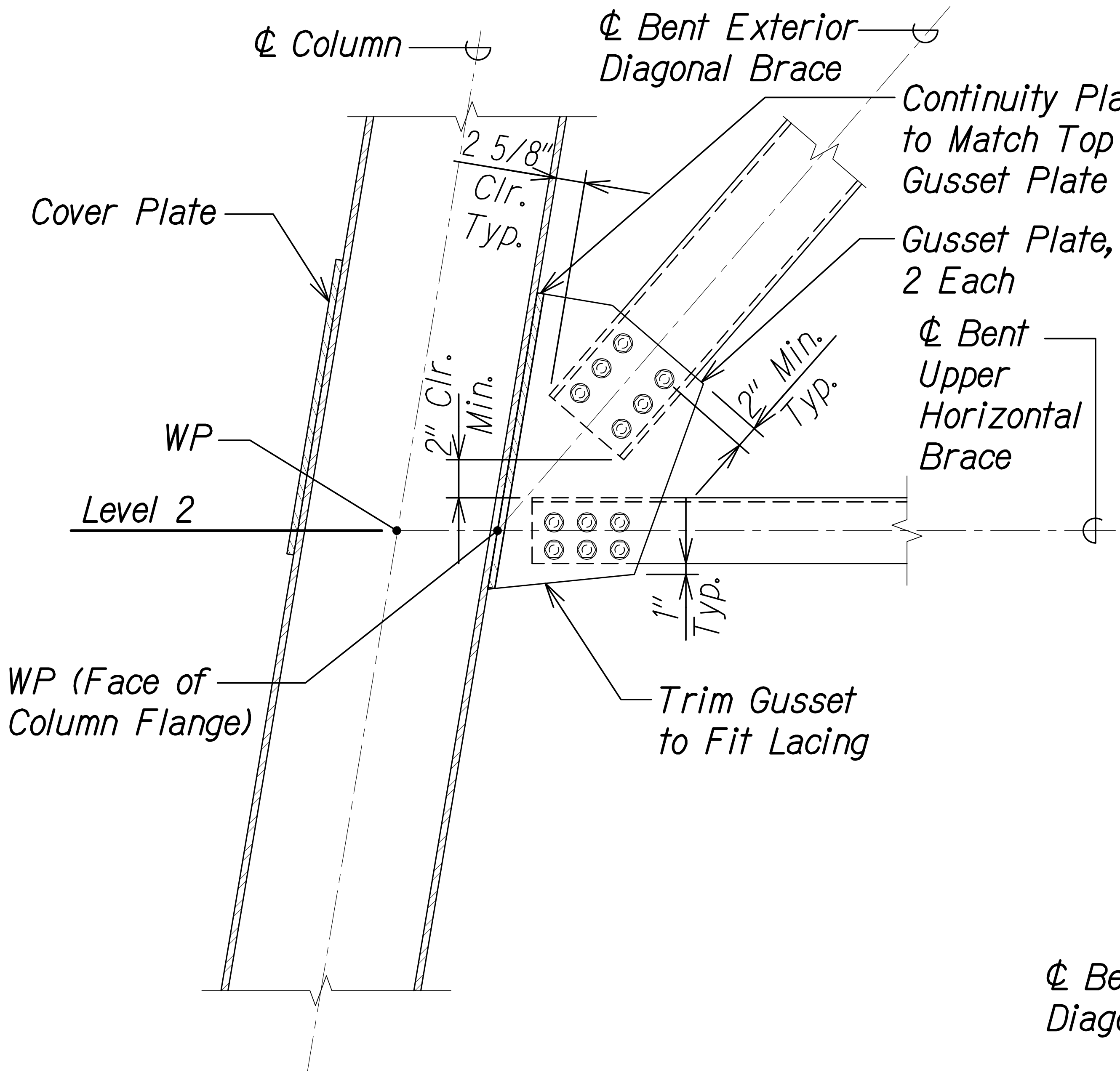
4-30-26
SIGNATURE   EXPIRATION DATE OF THE LICENSE

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
NOTE BOOK	TRACED BY	"
	DESIGNED BY	"
	QUANTITIES BY	"
No.	CHECKED BY	"

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG   PLOT TIME: 12-05-24, 1:11 PM)

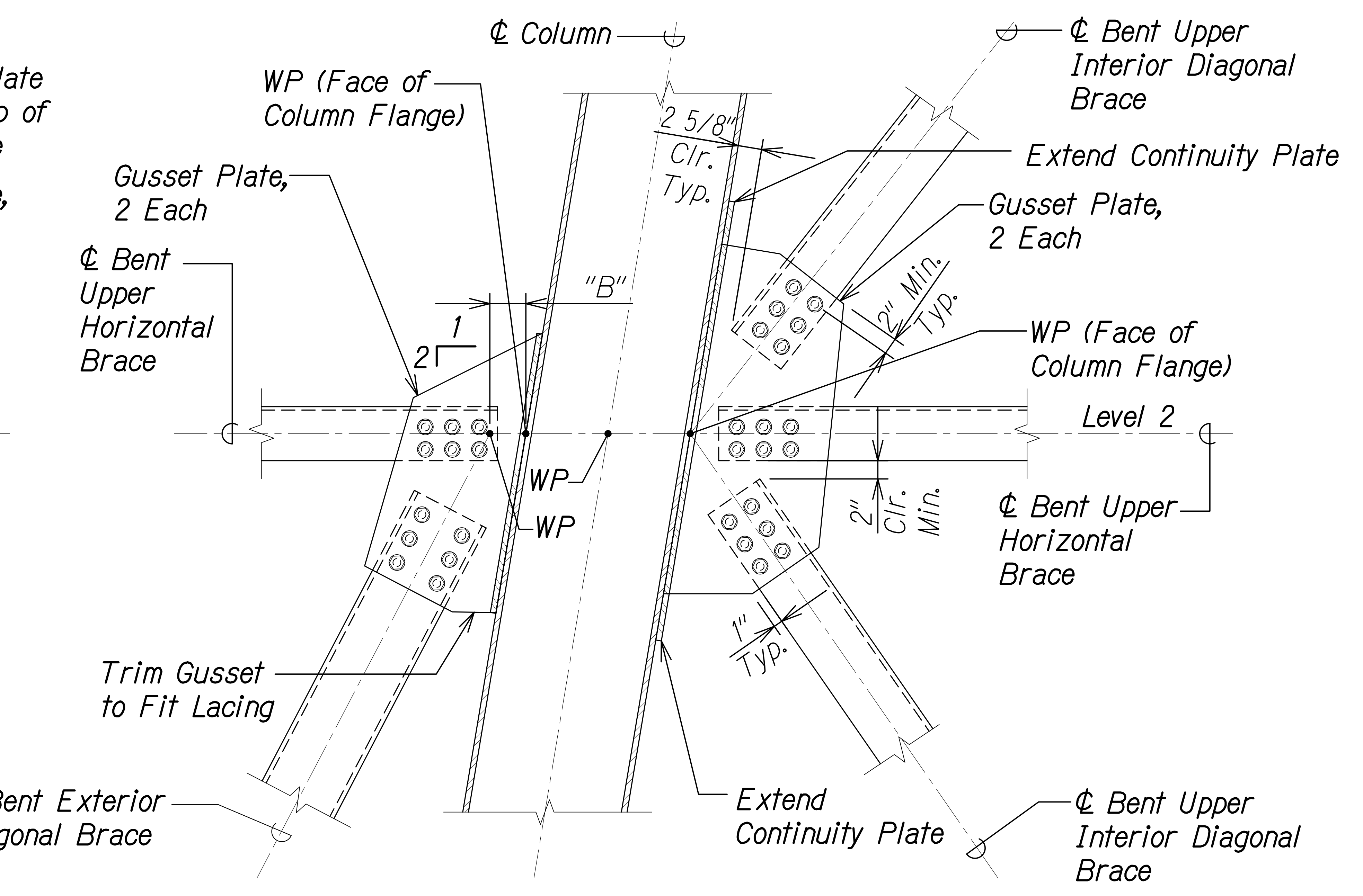
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 111	280



EXTERIOR COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

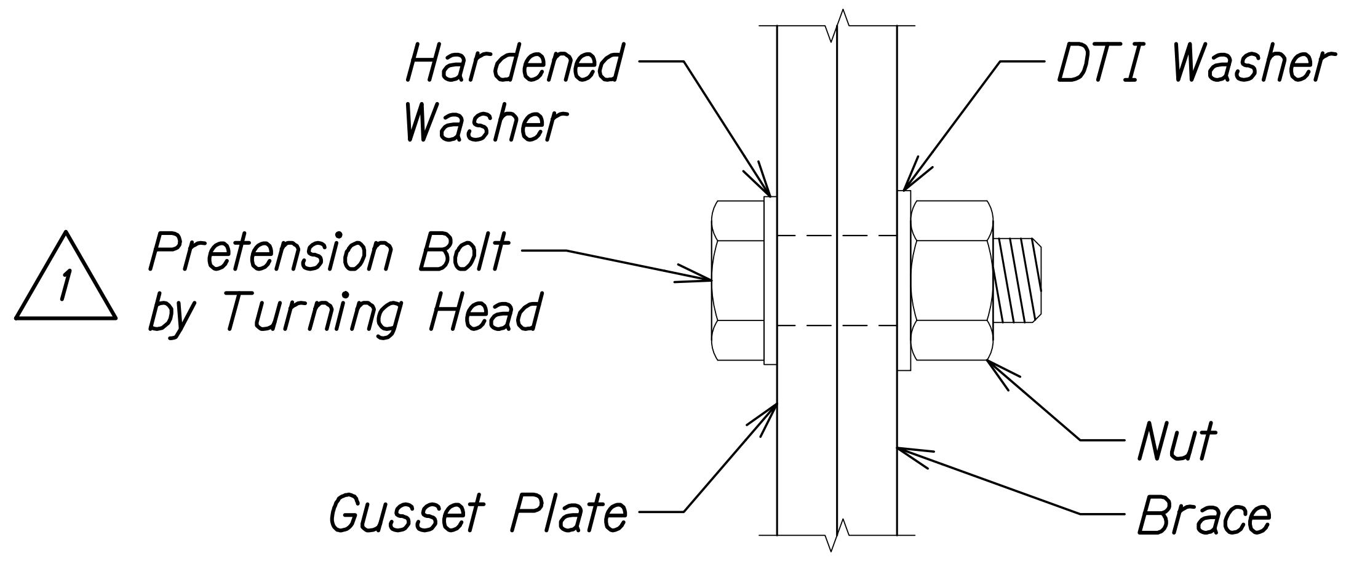
1 SA6.5 | SA6.5 △1



INTERIOR COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

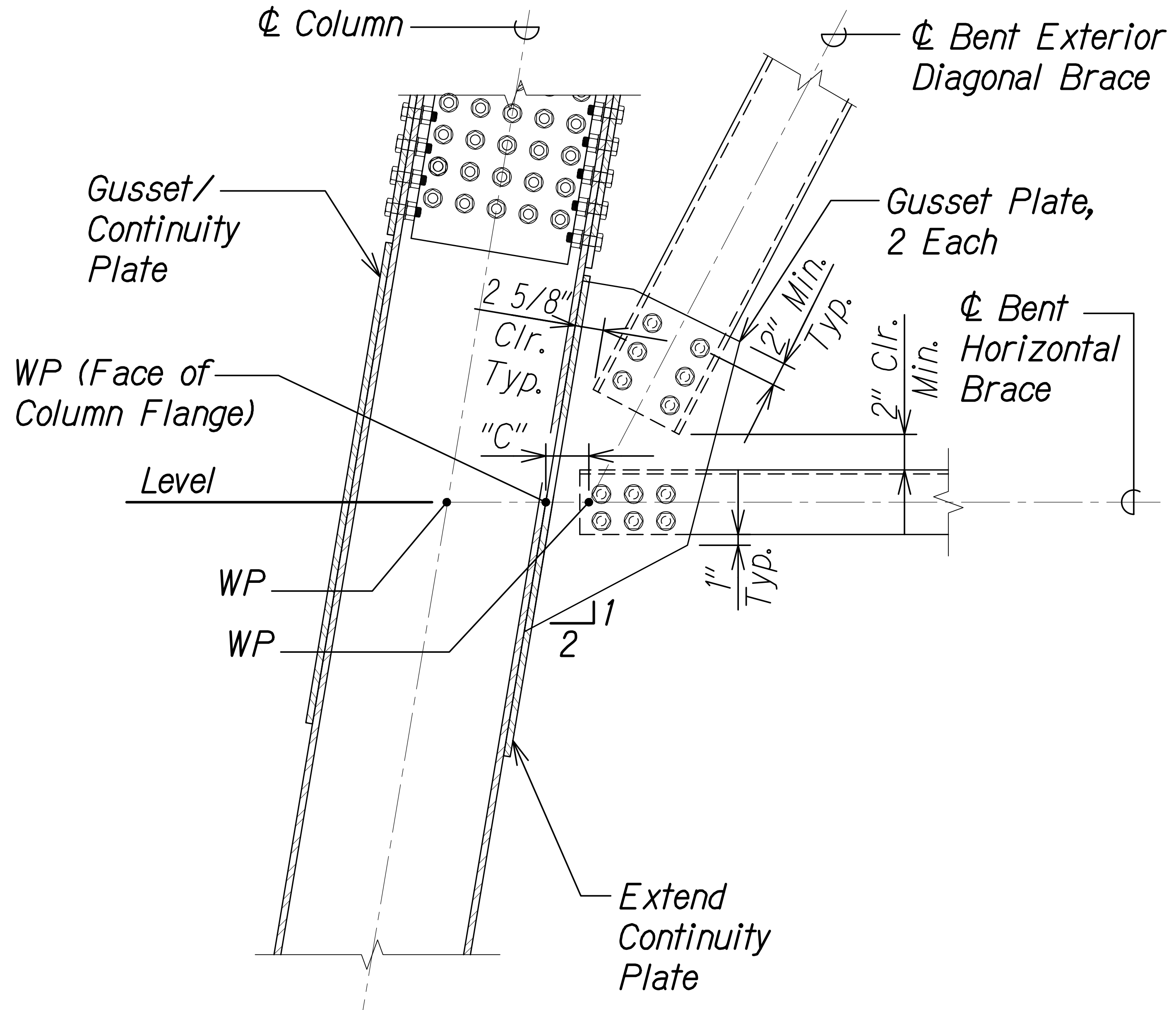
2 SA6.5 | SA6.5 △1



TYPICAL BRACE BOLT CONNECTION DETAIL

Scale: 6" = 1'-0"

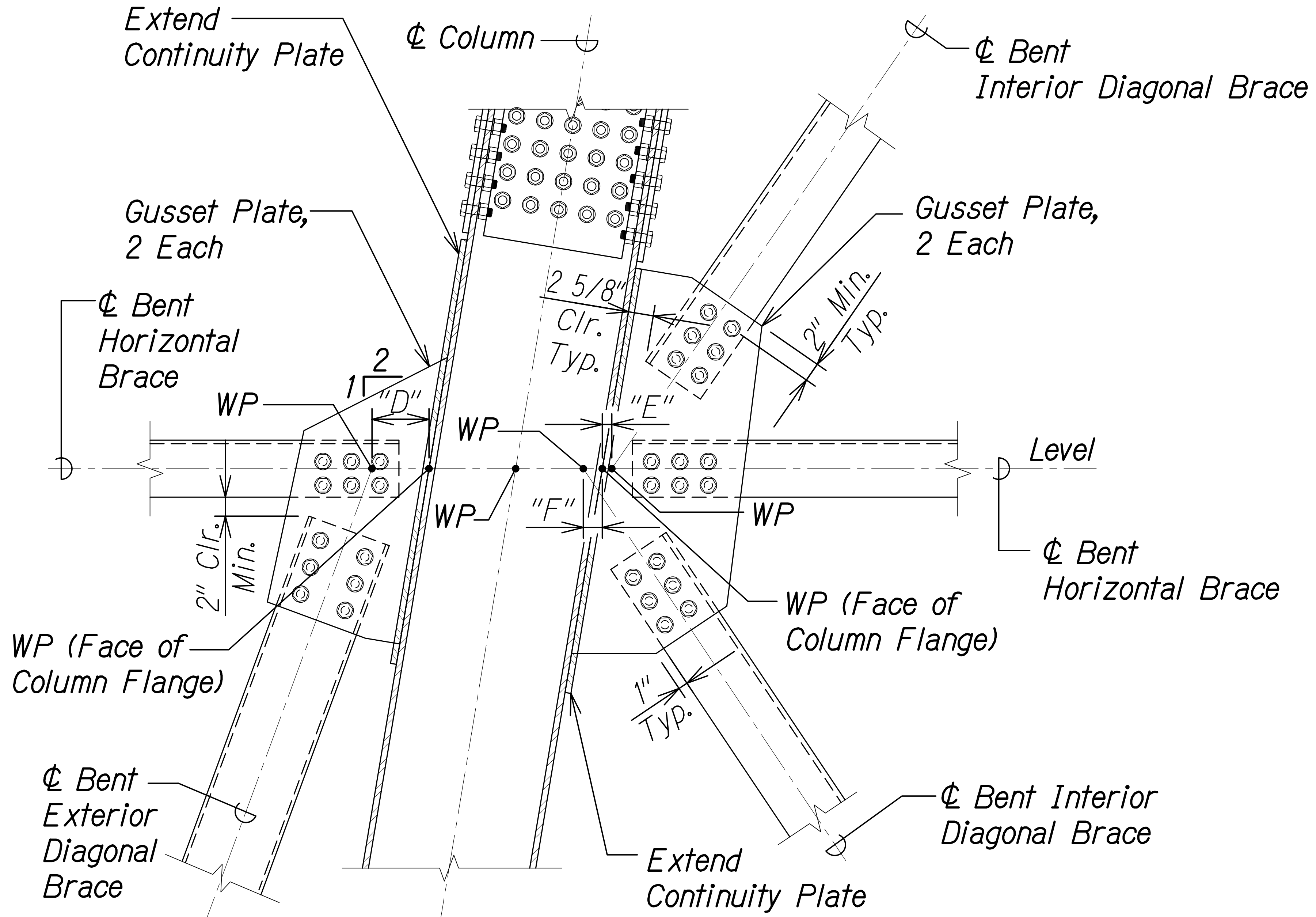
5 SA6.5 | SA6.5



EXTERIOR COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

3 SA6.5 | SA6.5 △1



INTERIOR COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

4 SA6.5 | SA6.5 △1

NOTES:

1. The Contractor's Steel Detailer is responsible for determining the actual size of each gusset/continuity/cover plate based on the information provided in the Contract Drawings.
2. △1 All bolted connections for horizontal and diagonal braces, as detailed on this sheet, shall be pretensioned.
3. △1 After erection, touch-up paint the ends of all bolts/nuts/washers.
4. △1 Batten plates and lacing not shown for clarity.
5. △1 See Schedule on sheet SA6.6 for WP offsets.

DATE		REVISION
12/6/24	△1	Revised Details & Added Notes

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE 4-30-26 EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

COLUMN TO BRACE CONNECTION DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

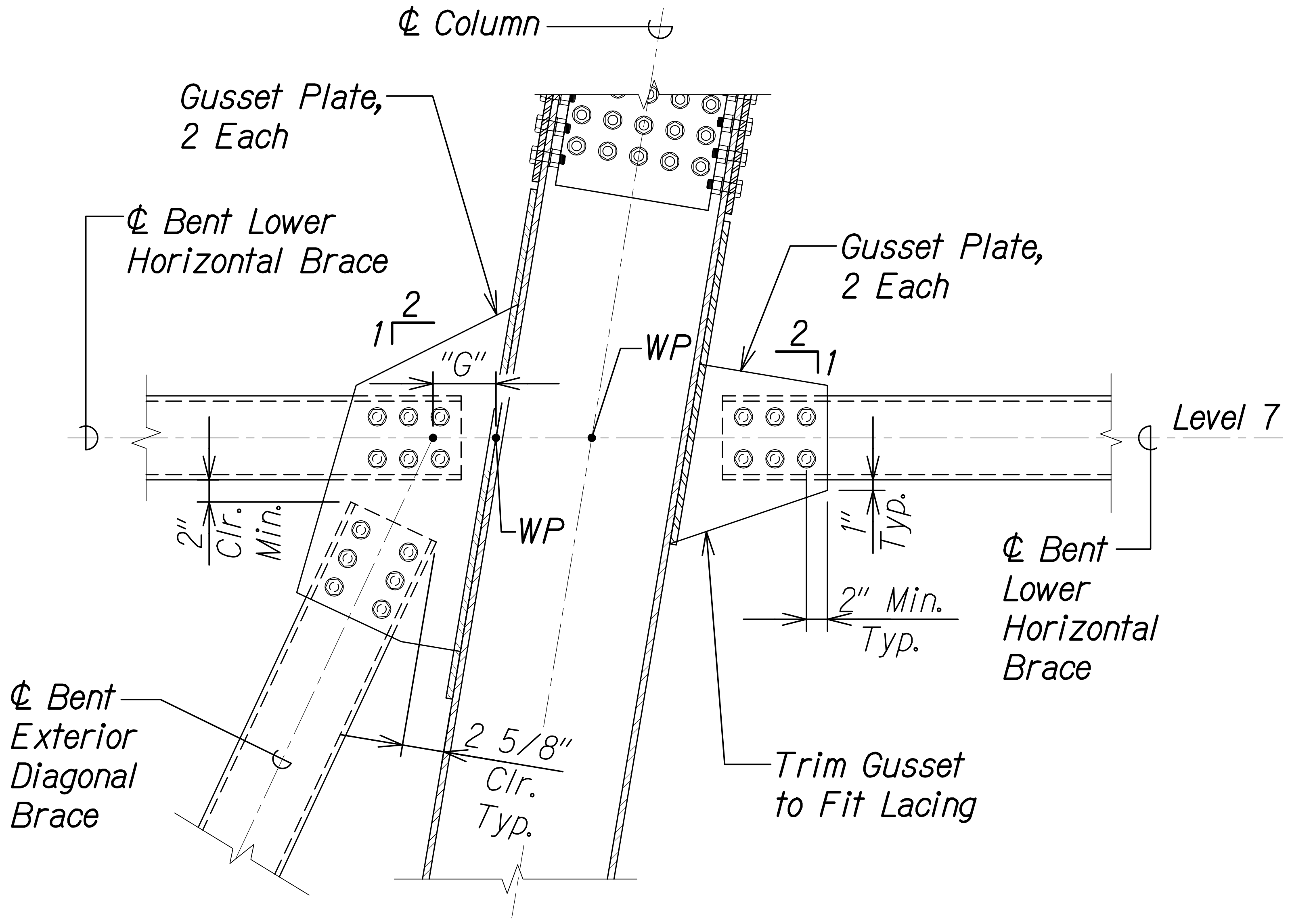
SHEET No. SA6.5 OF 22 SHEETS

ADD. 111

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-03-24, 10:14 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 112	280



INTERIOR COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

1
SA6.6 SA6.6 1

1

WP OFFSET SCHEDULE							
LOCATION		"B"	"C"	"D"	"E"	"F"	"G"
Level 2	Bent Nos. 1 ⅋ 9	6"	-	-	-	-	-
	Bent Nos. 2, 3, 4, 5, 6, 7, ⅋ 8	4"	-	-	-	-	-
Level 3	Bent Nos. 2, 3, 4, 5, 6, 7, ⅋ 8	-	4"	6"	1"	0"	-
Level 4	Bent Nos. 2, 3, 4, 5, 6, ⅋ 7	-	6"	6"	3"	0"	-
Level 5	Bent Nos. 3, 4, 5, 6, ⅋ 7	-	6"	6"	0"	8"	-
Level 6	Bent No. 4	-	6"	6"	-5"	8"	-
	Bent Nos. 5 ⅋ 6	-	6"	6"	-5"	2"	-
Level 7	Bent Nos. 5, ⅋ 6	-	6"	-	-	-	6"

1 NOTES:

1. The Contractor's Steel Detailer is responsible for determining the actual size of each gusset/continuity/cover plate based on the information provided in the Contract Drawings.

2. All bolted connections for horizontal and diagonal braces, as detailed on this sheet, shall be pretensioned.

3. After erection, touch-up paint the ends of all bolts/nuts/washers.

4. Batten plates and lacing not shown for clarity.

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
NOTE BOOK	TRACED BY	"
	DESIGNED BY	"
	QUANTITIES BY	"
No.	CHECKED BY	"

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-05-24, 1:12 PM)

DATE	REVISION
12/6/24	1 Revised Detail ⅋ Schedule, and Added Notes

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

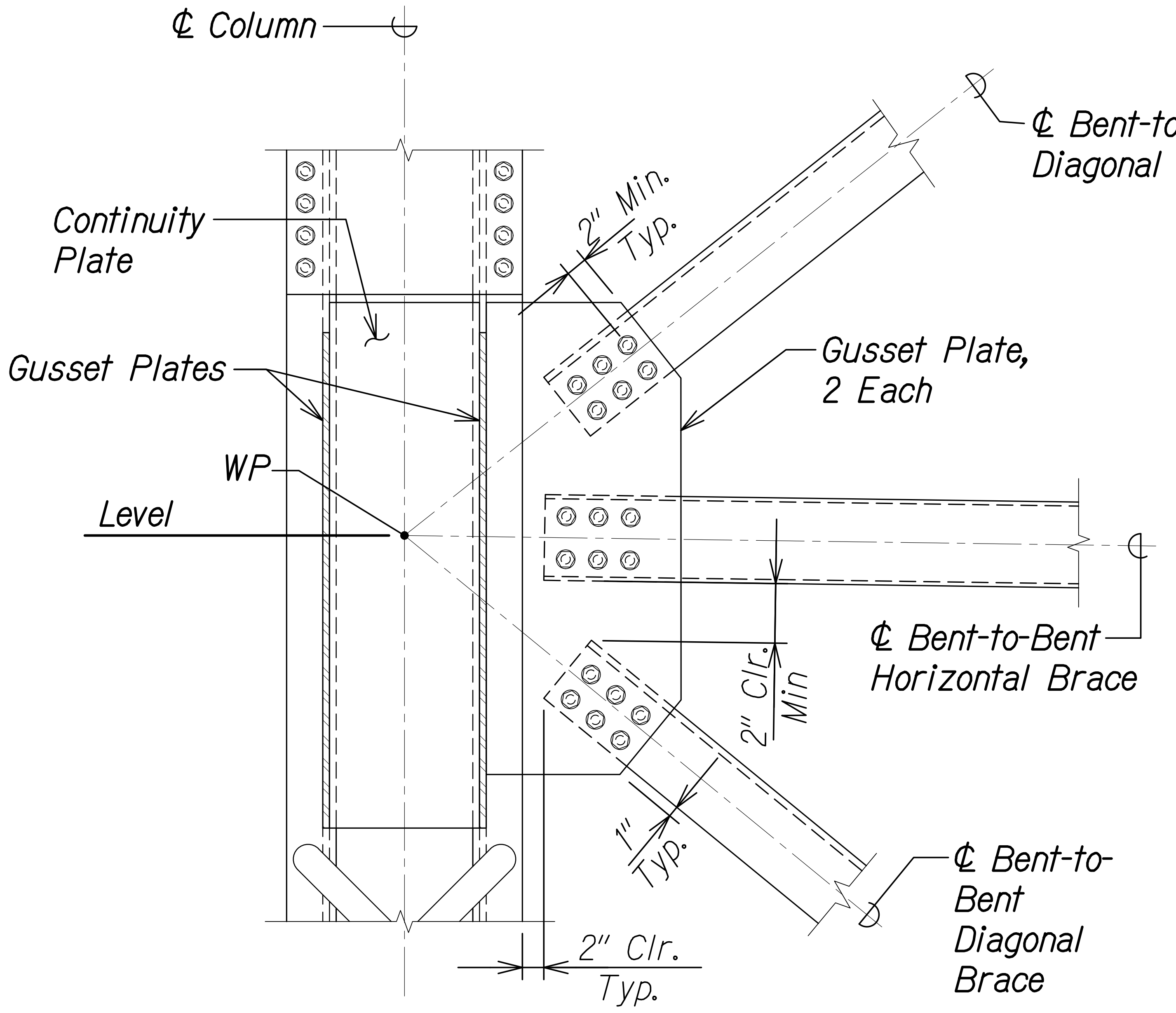
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

COLUMN TO BRACE CONNECTION DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA6.6 OF 22 SHEETS

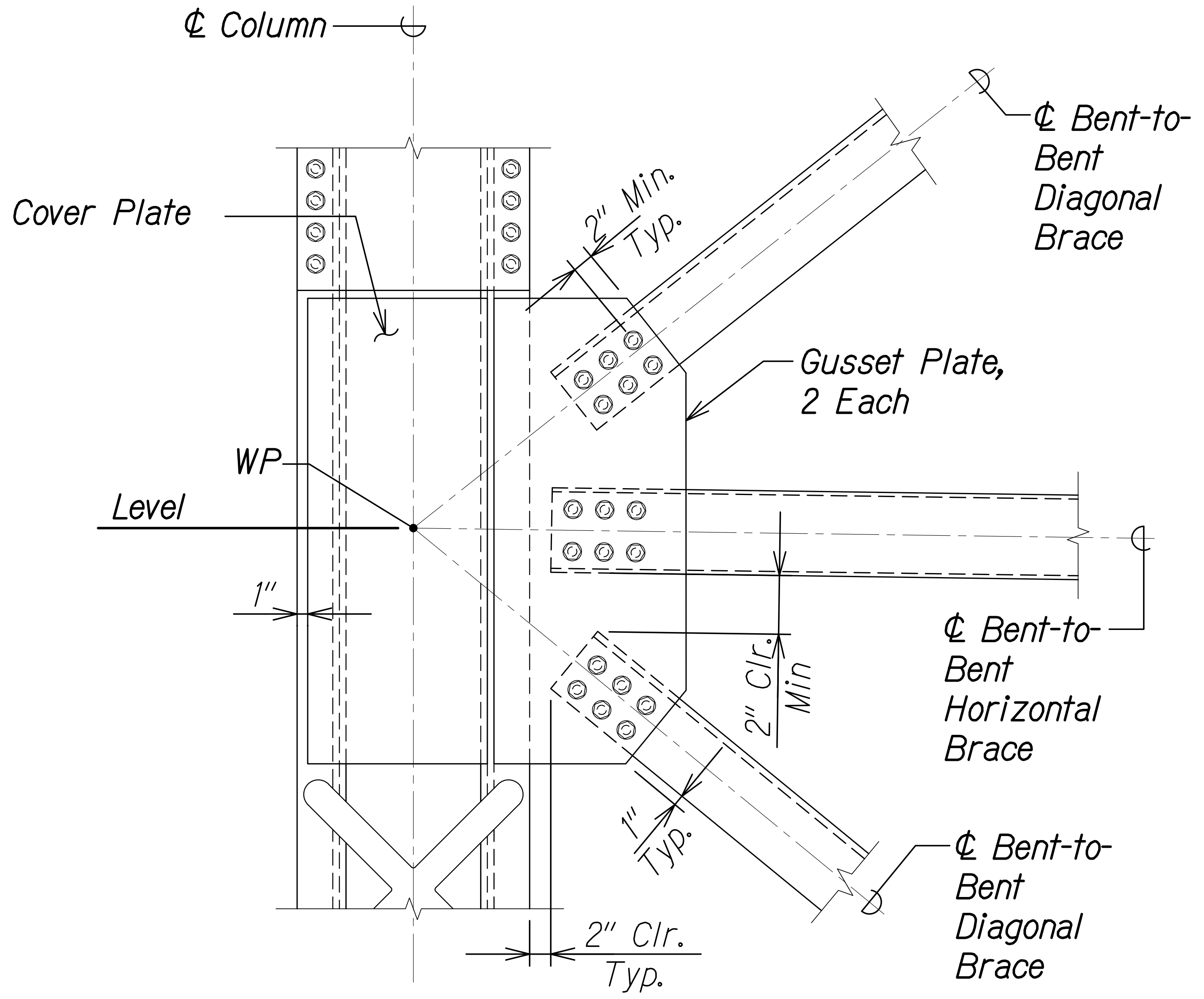
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 113	280



COLUMN TO BRACE CONNECTION DETAIL

1 SA6.7 | SA6.7 △1

Scale: 1" = 1'-0"



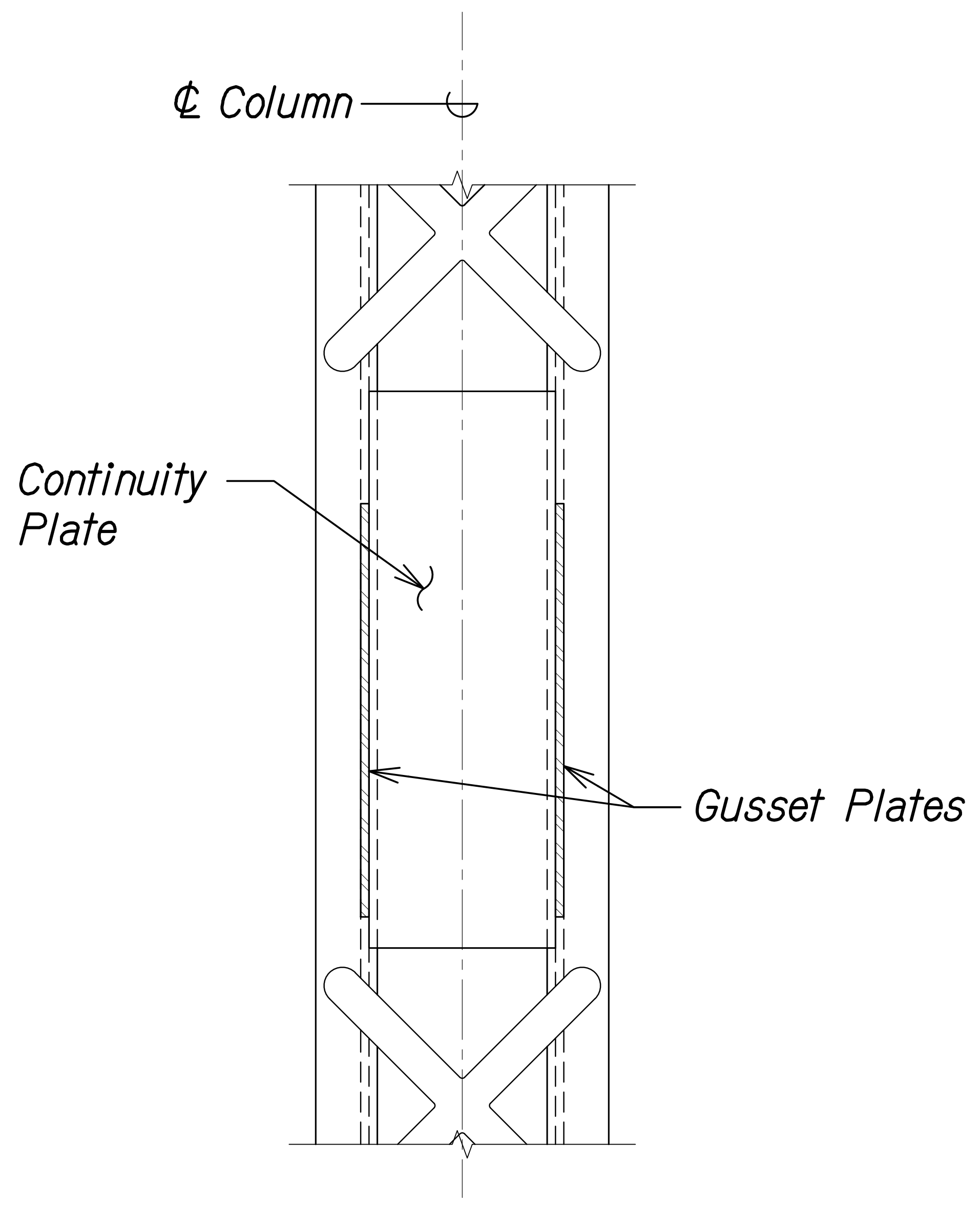
COLUMN TO BRACE CONNECTION DETAIL

2 SA6.7 | SA6.7 △1

Scale: 1" = 1'-0"

△1 NOTES:

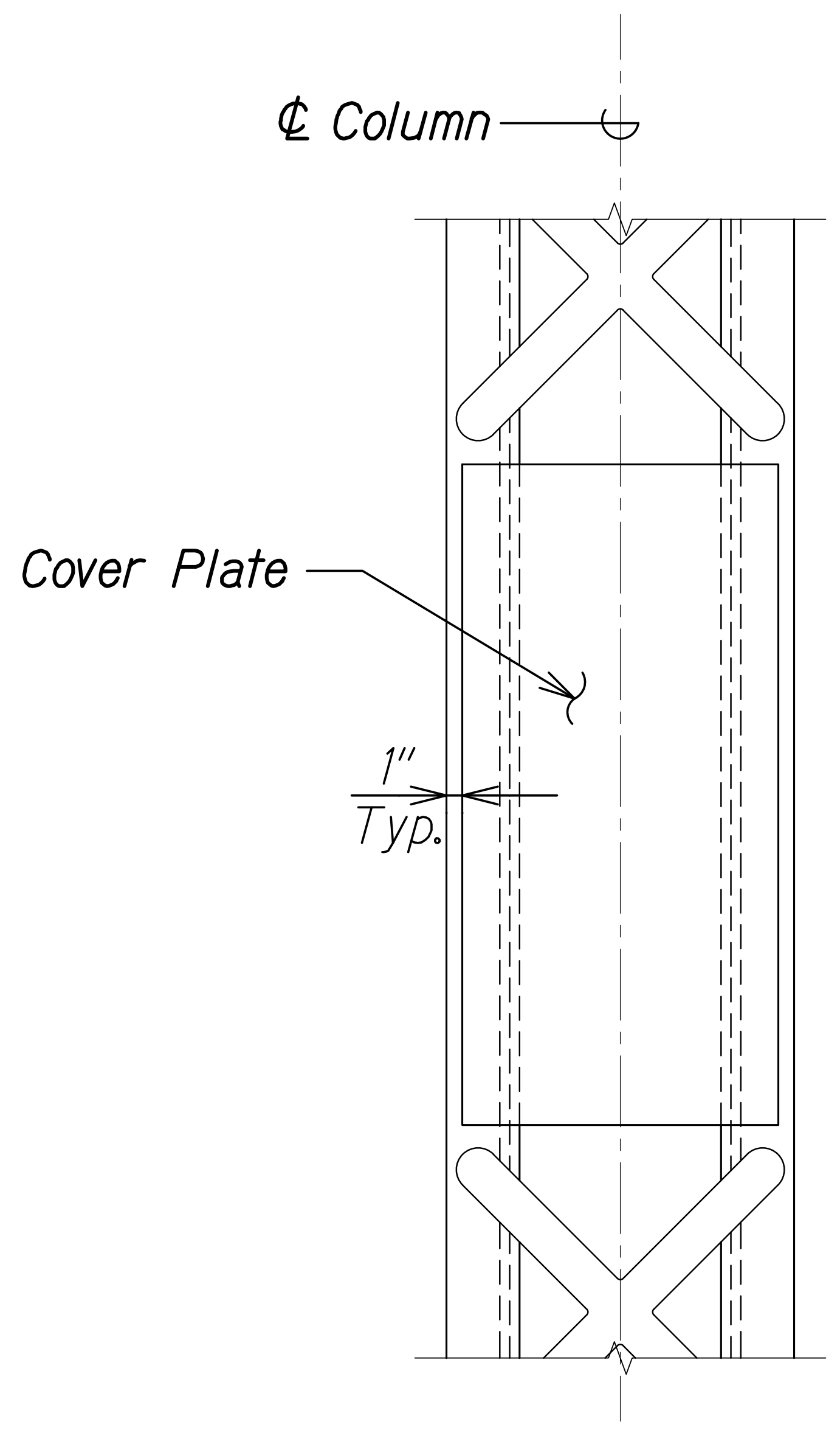
1. The Contractor's Steel Detailer is responsible for determining the actual size of each gusset/continuity/cover plate based on the information provided in the Contract Drawings.
2. All bolted connections for horizontal and diagonal braces, as detailed on this sheet, shall be pretensioned.
3. After erection, touch-up paint the ends of all bolts/nuts/washers.
4. Batten plates and lacing on braces not shown for clarity.



COLUMN TO BRACE CONNECTION DETAIL

3 SA6.7 | SA6.7 △1

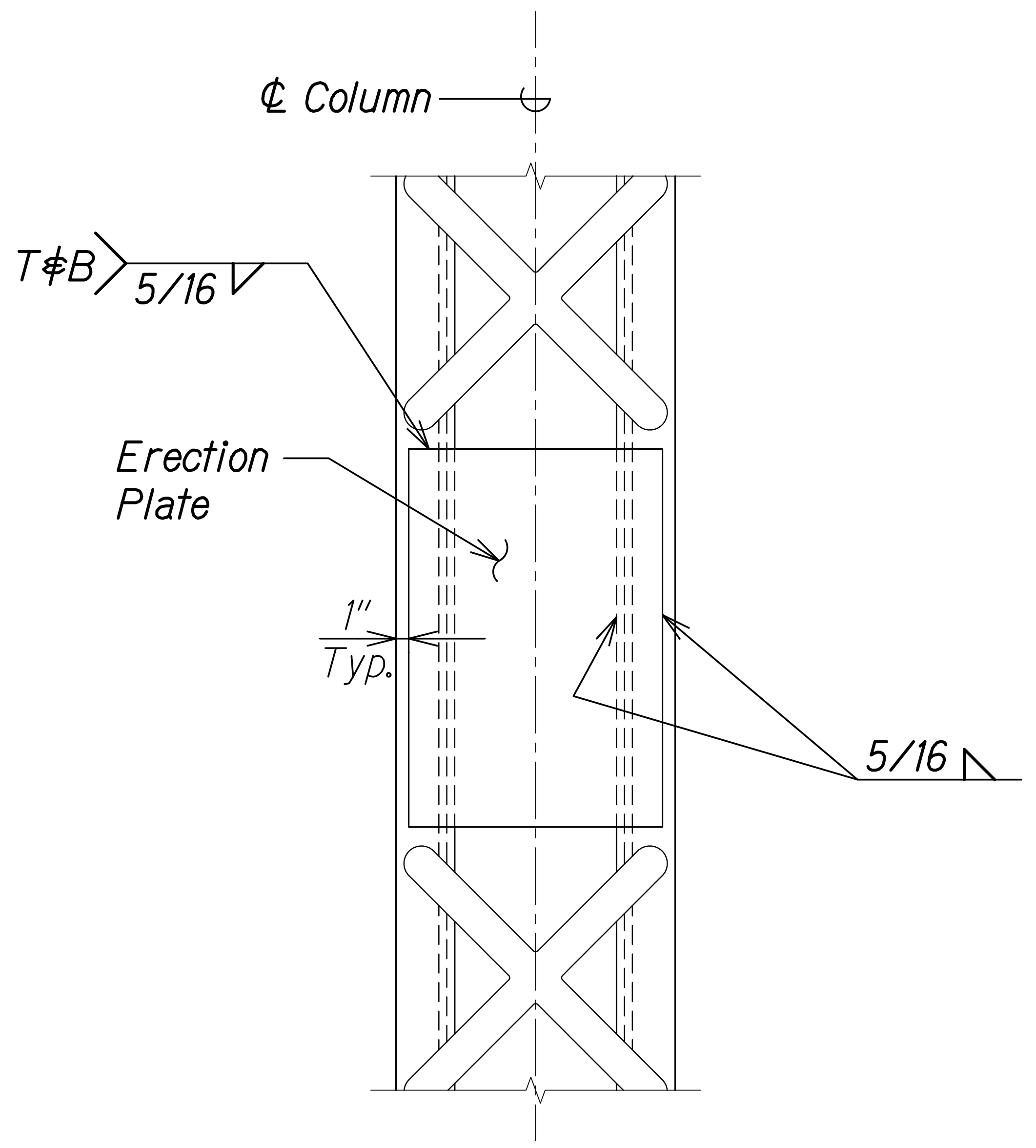
Scale: 1" = 1'-0"



COVER PLATE CONNECTION DETAIL

4 SA6.7 | SA6.7 △1

Scale: 1" = 1'-0"



ERECTION PLATE CONNECTION DETAIL

5 SA6.7 | SA6.7 △1

Scale: 1" = 1'-0"

DATE		REVISION
12/6/24	△1	Revised Details & Added Notes

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

Stephen Peters 4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

COLUMN TO BRACE
CONNECTION DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

Scale: As Noted Date: Oct. 2024

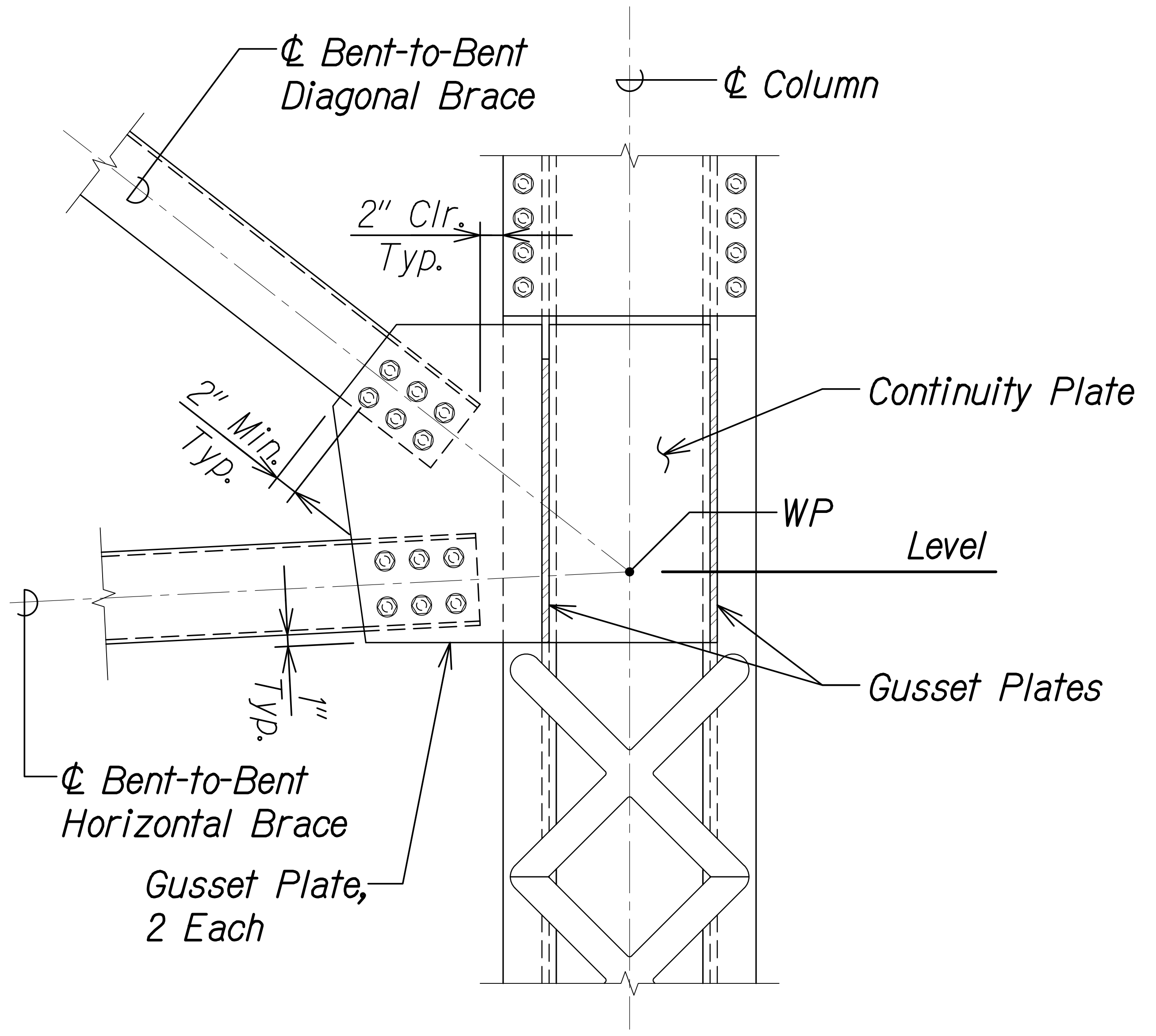
SHEET No. SA6.7 OF 22 SHEETS

ADD. 113

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

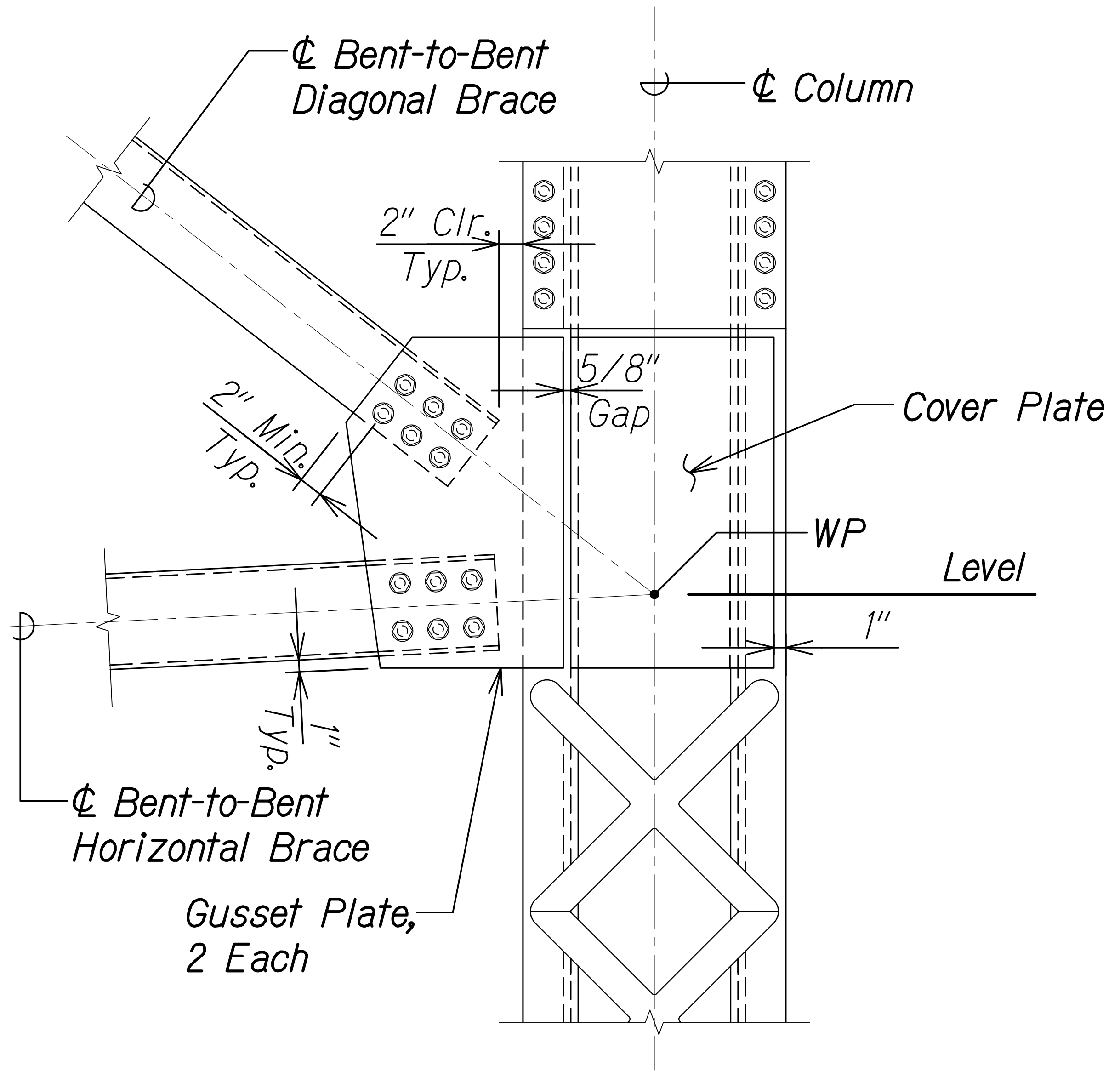
DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-05-24, 3:33 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 114	280



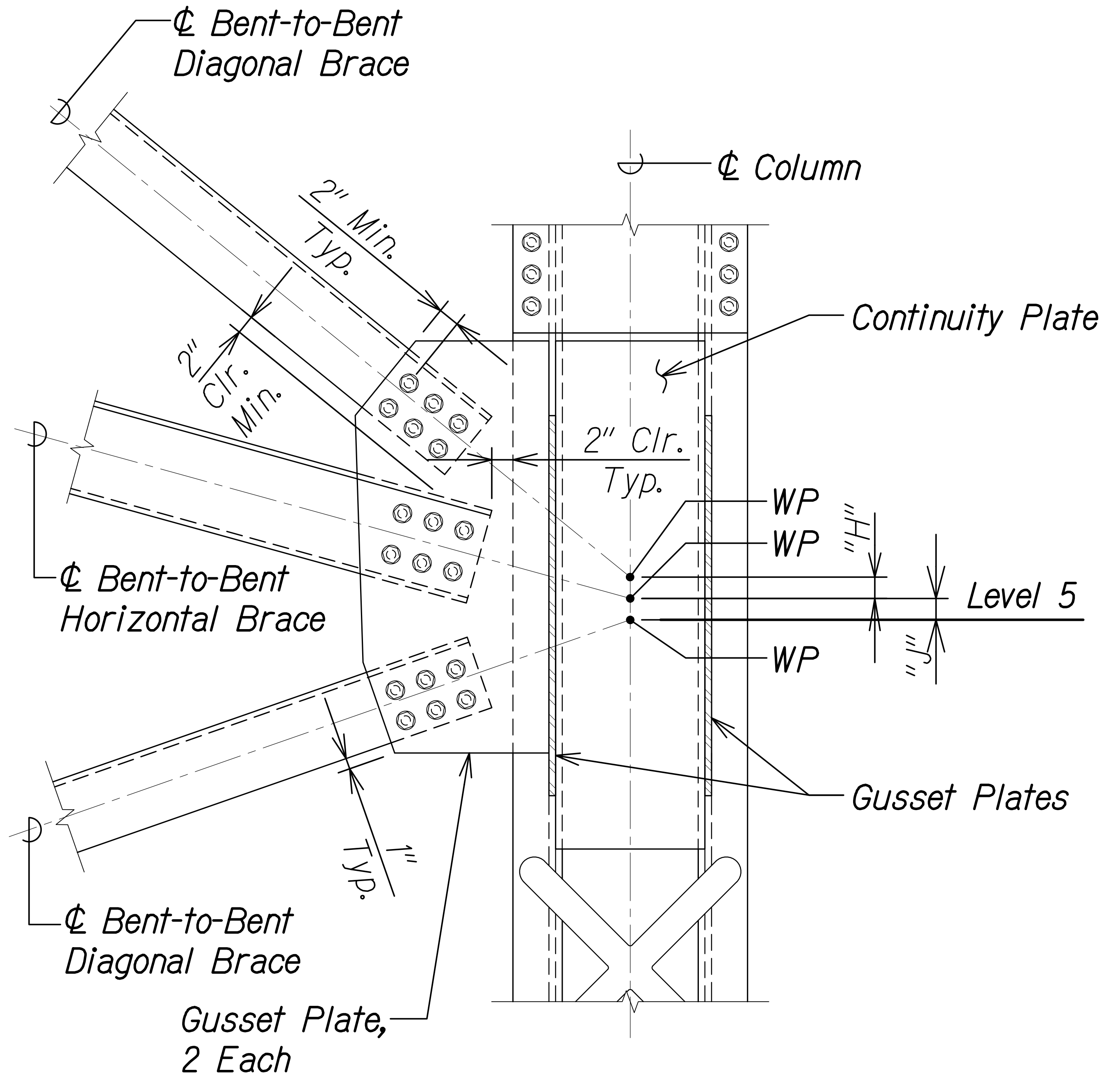
COLUMN TO BRACE CONNECTION DETAIL 1 SA6.8 | SA6.8 △1

Scale: 1" = 1'-0"



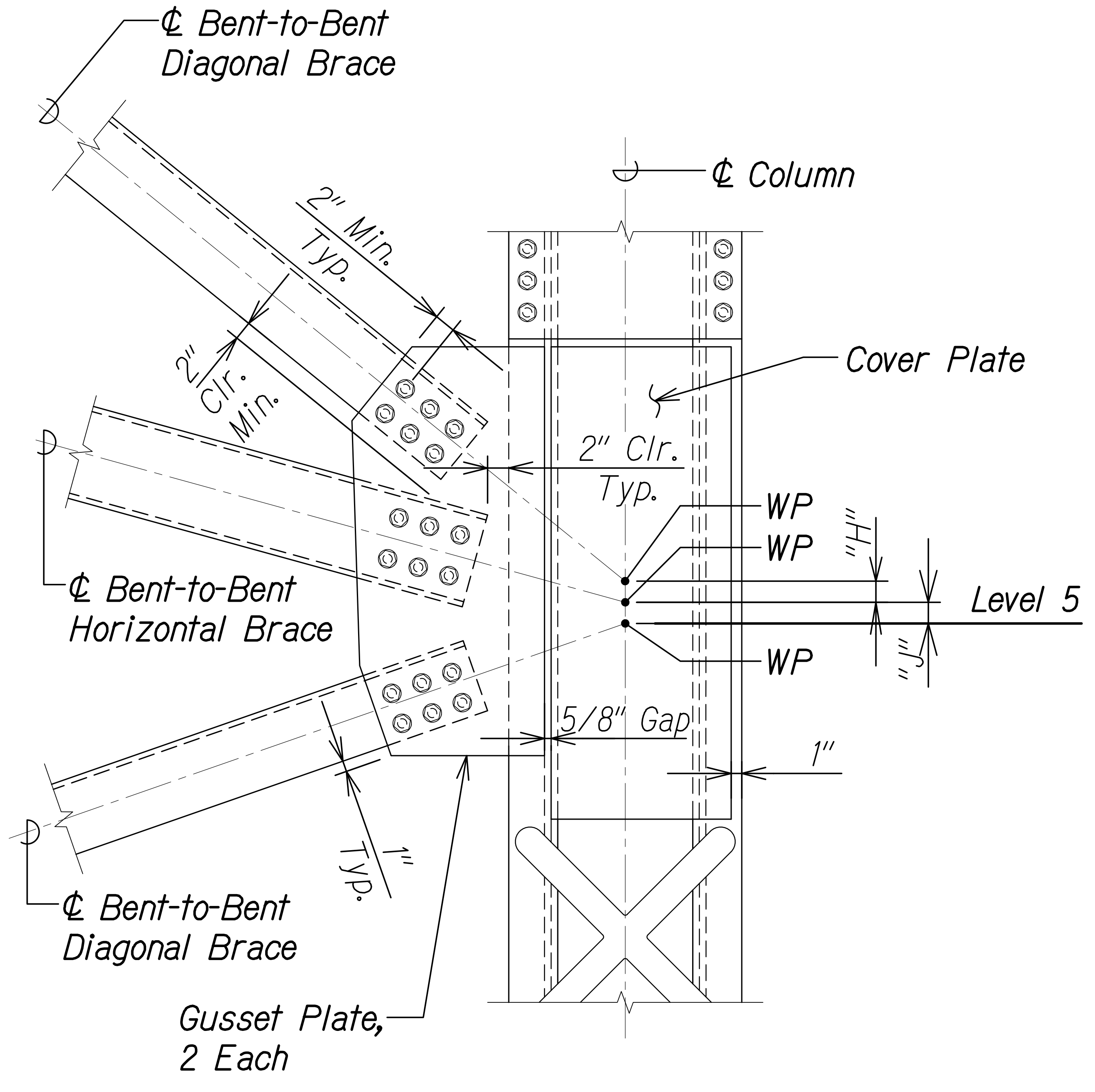
COLUMN TO BRACE CONNECTION DETAIL 2 SA6.8 | SA6.8 △1

Scale: 1" = 1'-0"



COLUMN TO BRACE CONNECTION DETAIL 3 SA6.8 | SA6.8 △1

Scale: 1" = 1'-0"



COLUMN TO BRACE CONNECTION DETAIL 4 SA6.8 | SA6.8 △1

Scale: 1" = 1'-0"

△1 NOTES:

1. The Contractor's Steel Detailer is responsible for determining the actual size of each gusset/continuity/cover plate based on the information provided in the Contract Drawings.
2. All bolted connections for horizontal and diagonal braces, as detailed on this sheet, shall be pretensioned.
3. After erection, touch-up paint the ends of all bolts/nuts/washers.
4. Batten plates and lacing on bracing not shown for clarity.

△1

WP OFFSET SCHEDULE			
LOCATION		"H"	"J"
Level 5	Bent No. 3	4"	2"

12/6/24	△1	Revised Details & Added Notes & Schedule
DATE		REVISION

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.
4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

COLUMN TO BRACE
CONNECTION DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

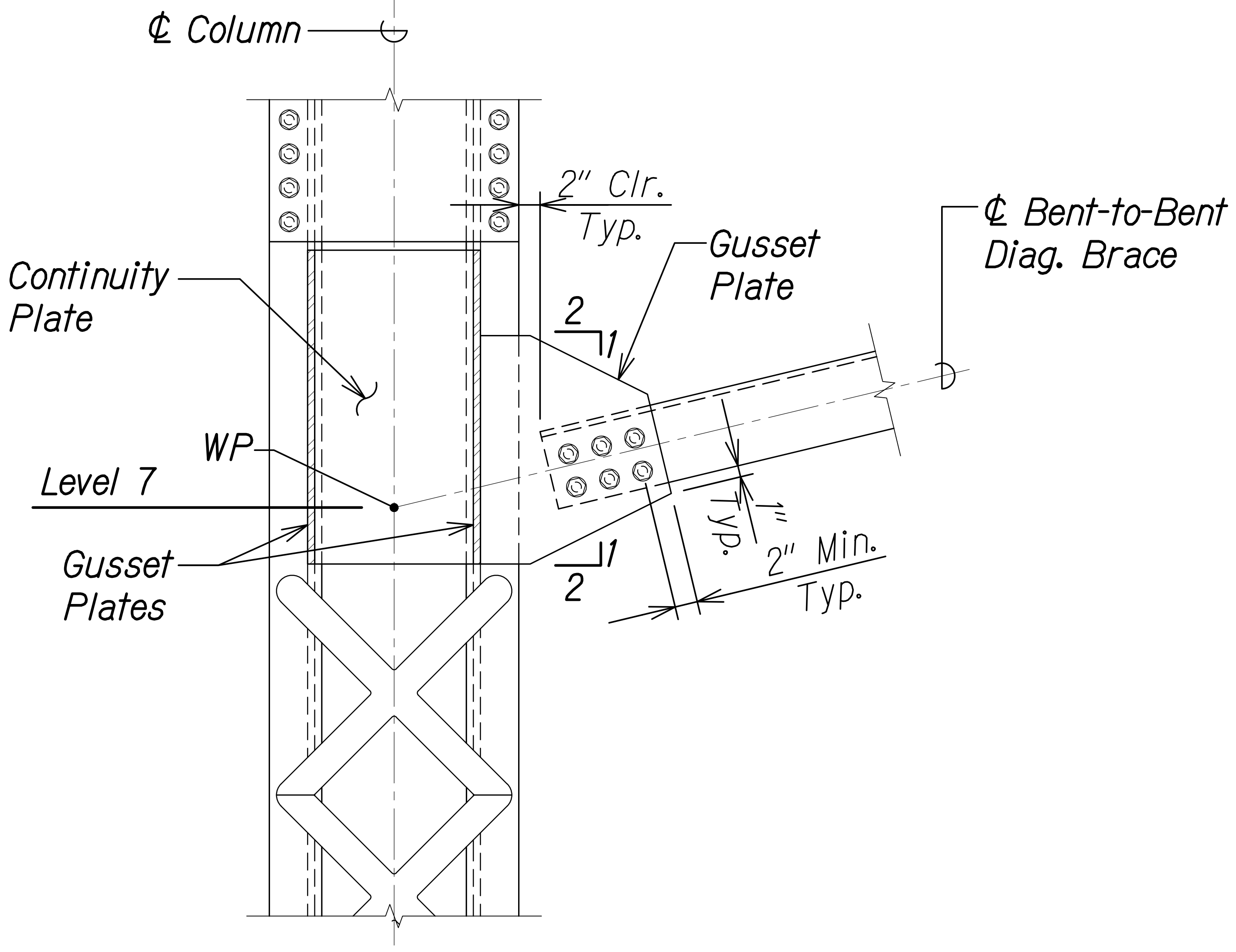
Scale: As Noted Date: Oct. 2024

SHEET No. SA6.8 OF 22 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY "
TRACED BY "
DESIGNED BY "
QUANTITIES BY "
CHECKED BY "
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-05-24, 3:35 PM)

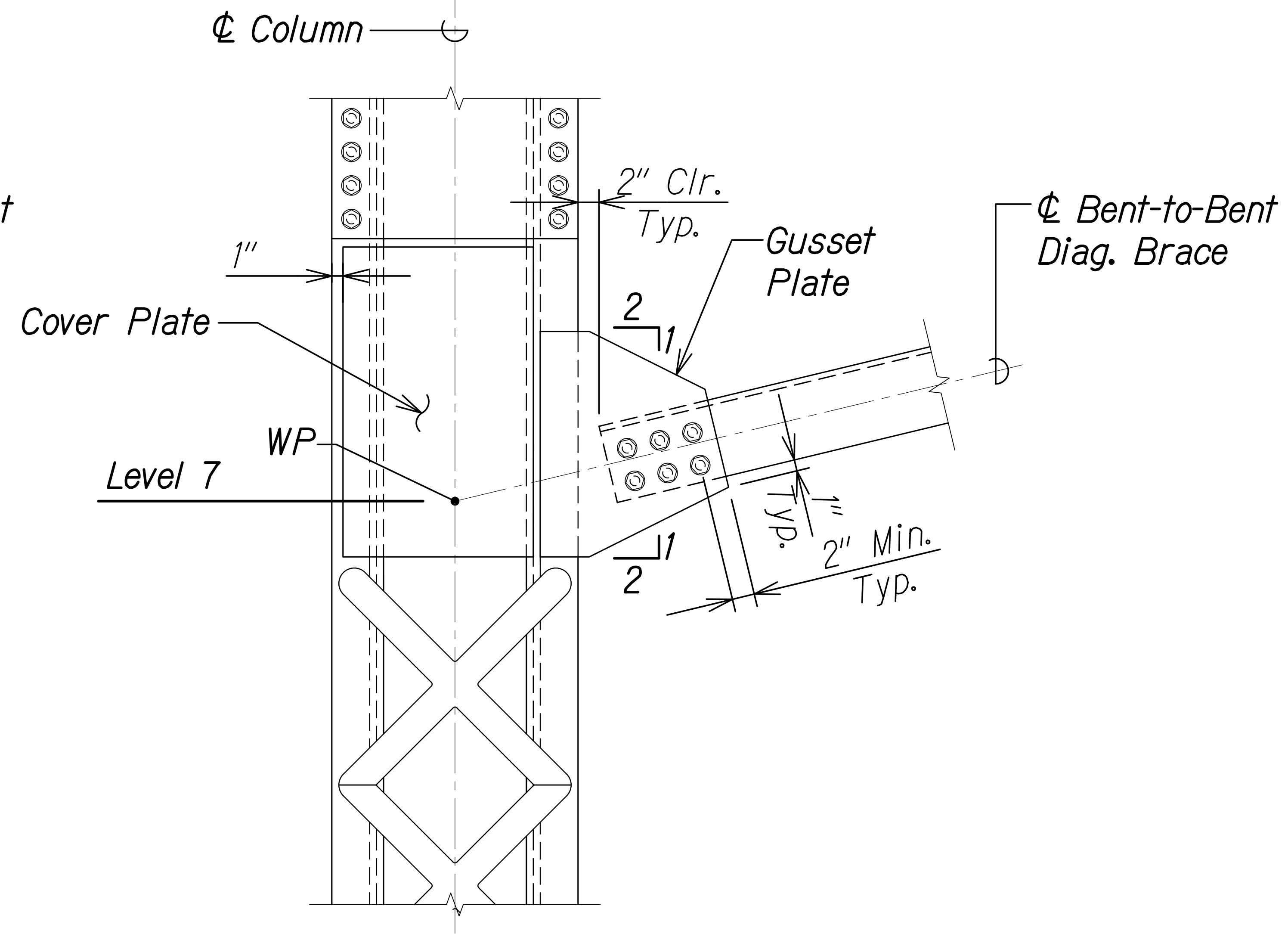
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 115	280



COLUMN TO BRACE CONNECTION DETAIL

1 SA6.9 | SA6.9 △1

Scale: 1" = 1'-0"



COLUMN TO BRACE CONNECTION DETAIL

2 SA6.9 | SA6.9 △1

Scale: 1" = 1'-0"

△1 NOTES:

1. The Contractor's Steel Detailer is responsible for determining the actual size of each gusset/continuity/cover plate based on the information provided in the Contract Drawings.
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4. Batten plates and lacing on braces not shown for clarity.

DATE	REVISION
12/6/24	△1 Revised Details and Added Notes

STEPHEN T. PETERS
NO. 17097-S

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4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

COLUMN TO BRACE CONNECTION DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

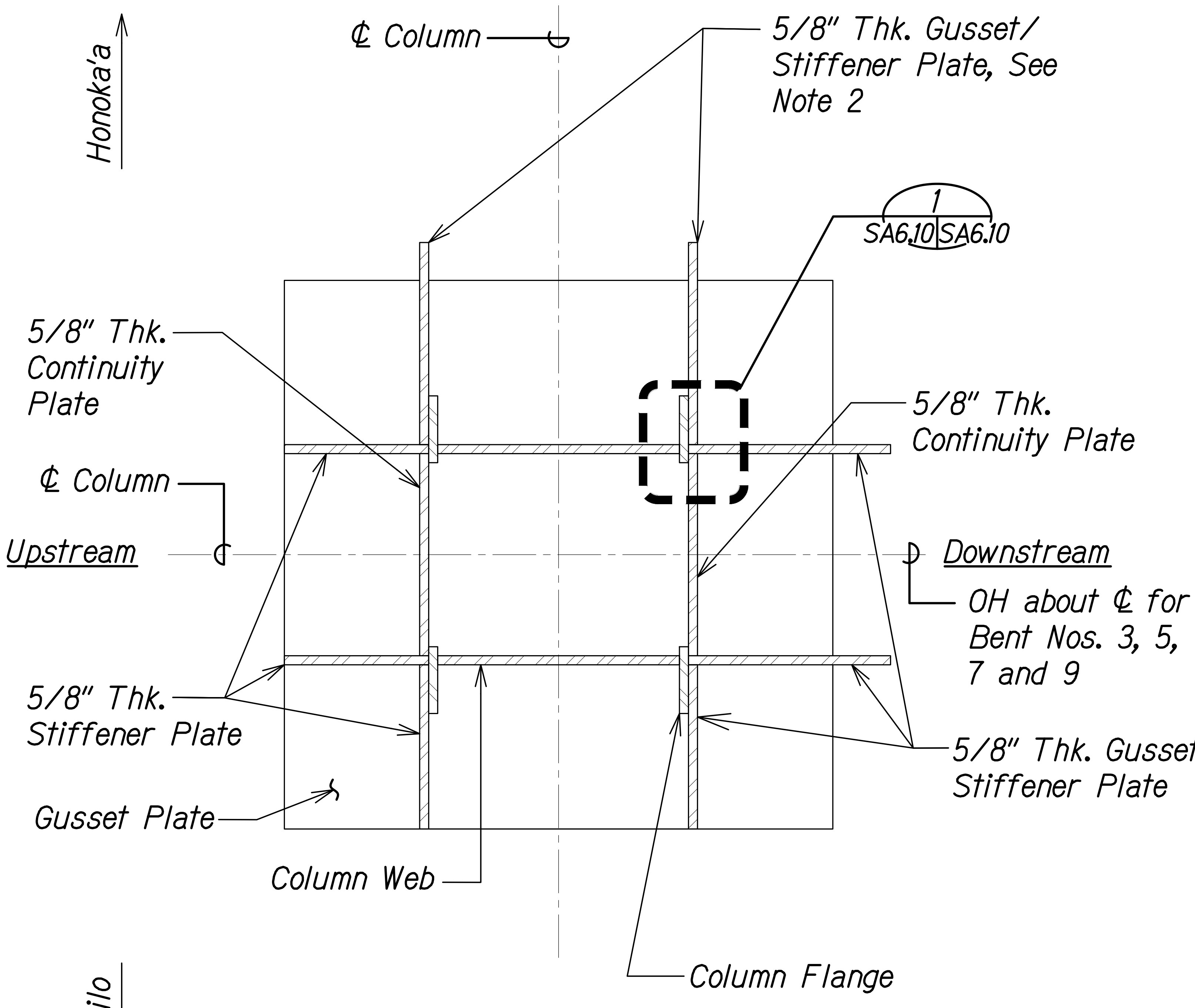
Scale: As Noted Date: Oct. 2024

SHEET No. SA6.9 OF 22 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

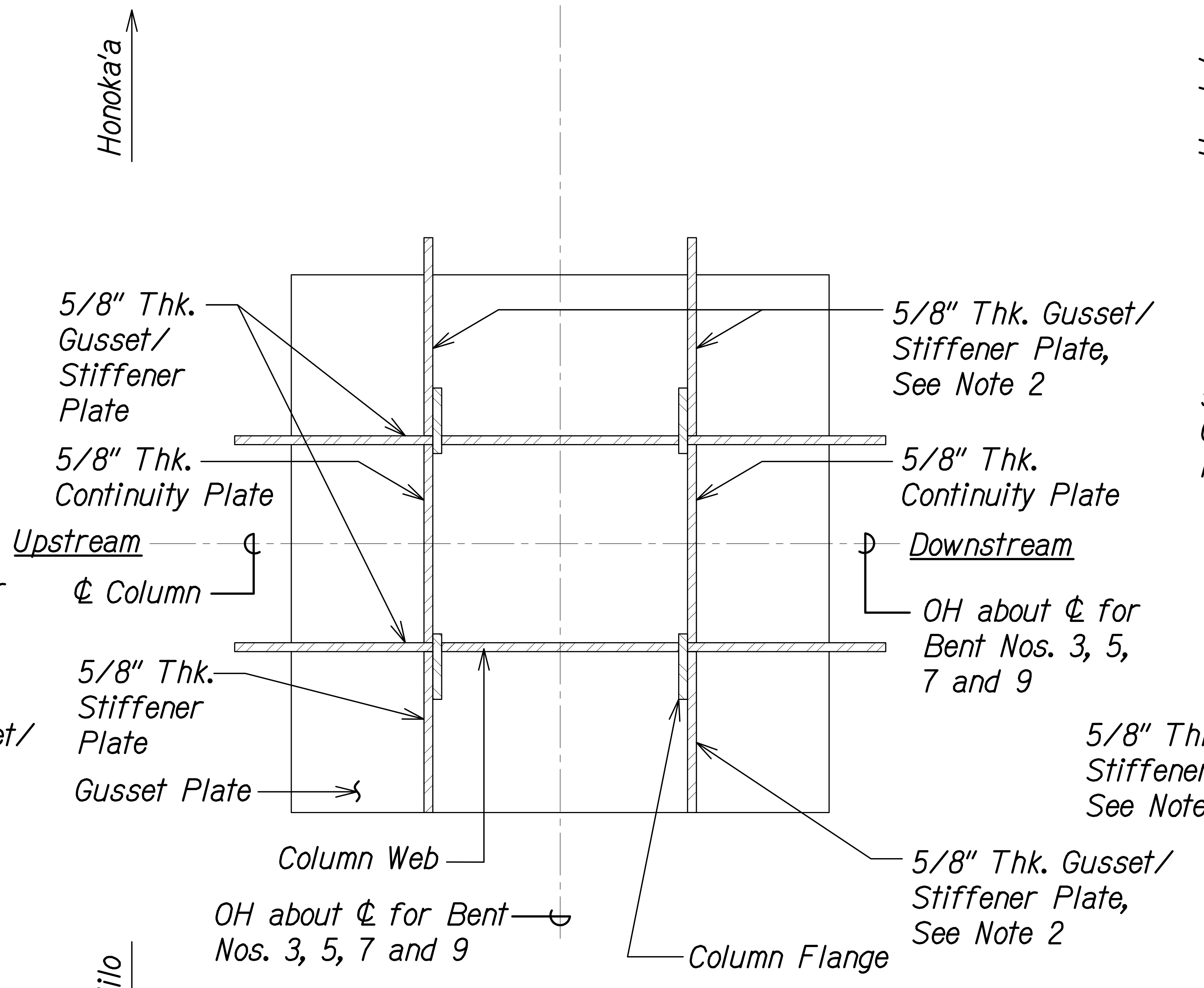
DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-03-24, 10:16 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 116	280



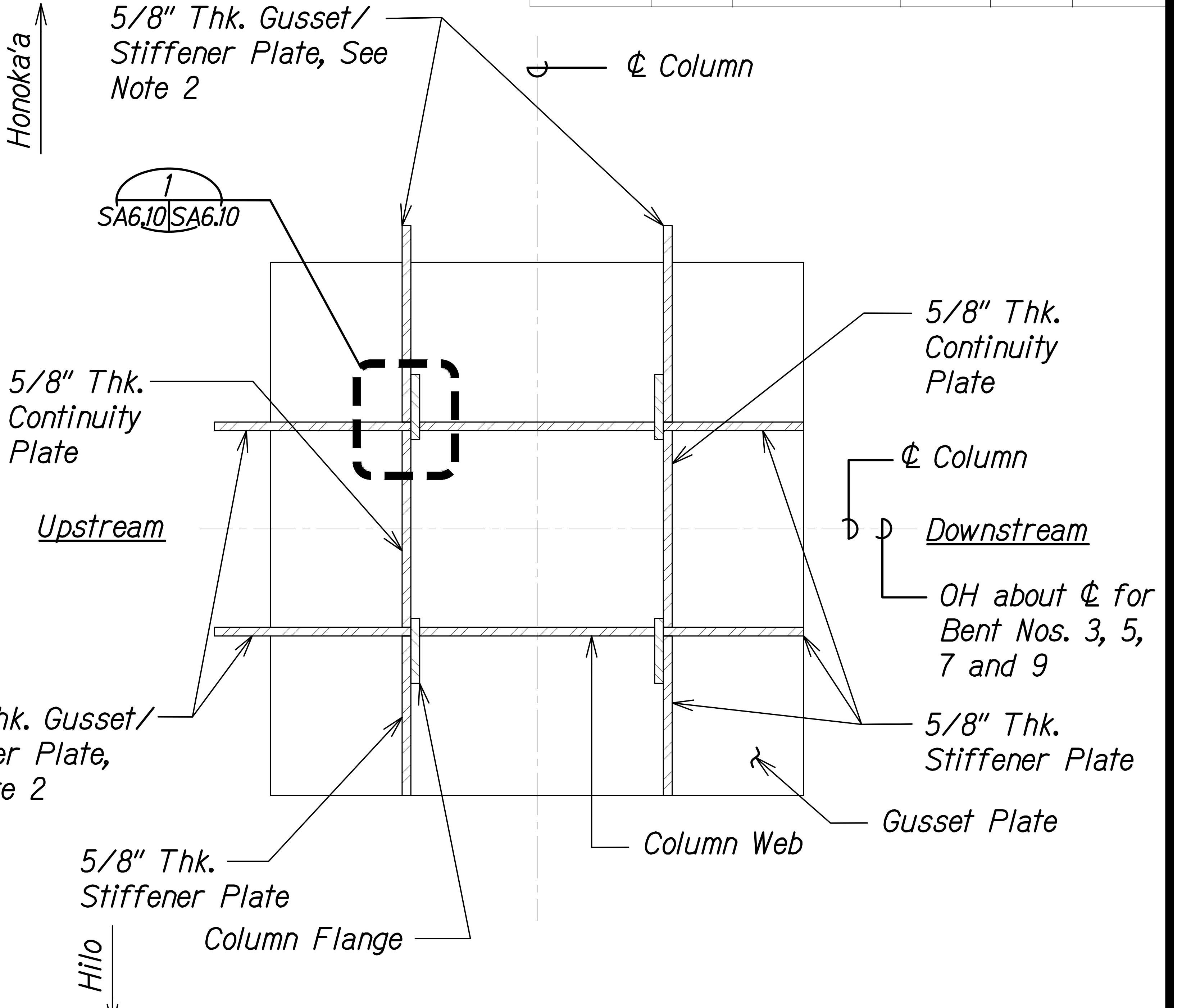
BASE COLUMN TO BRACE PLAN AT BENT EXTERIOR A SA6.10 SA6.10 1

Scale: 1 1/2" = 1'-0"



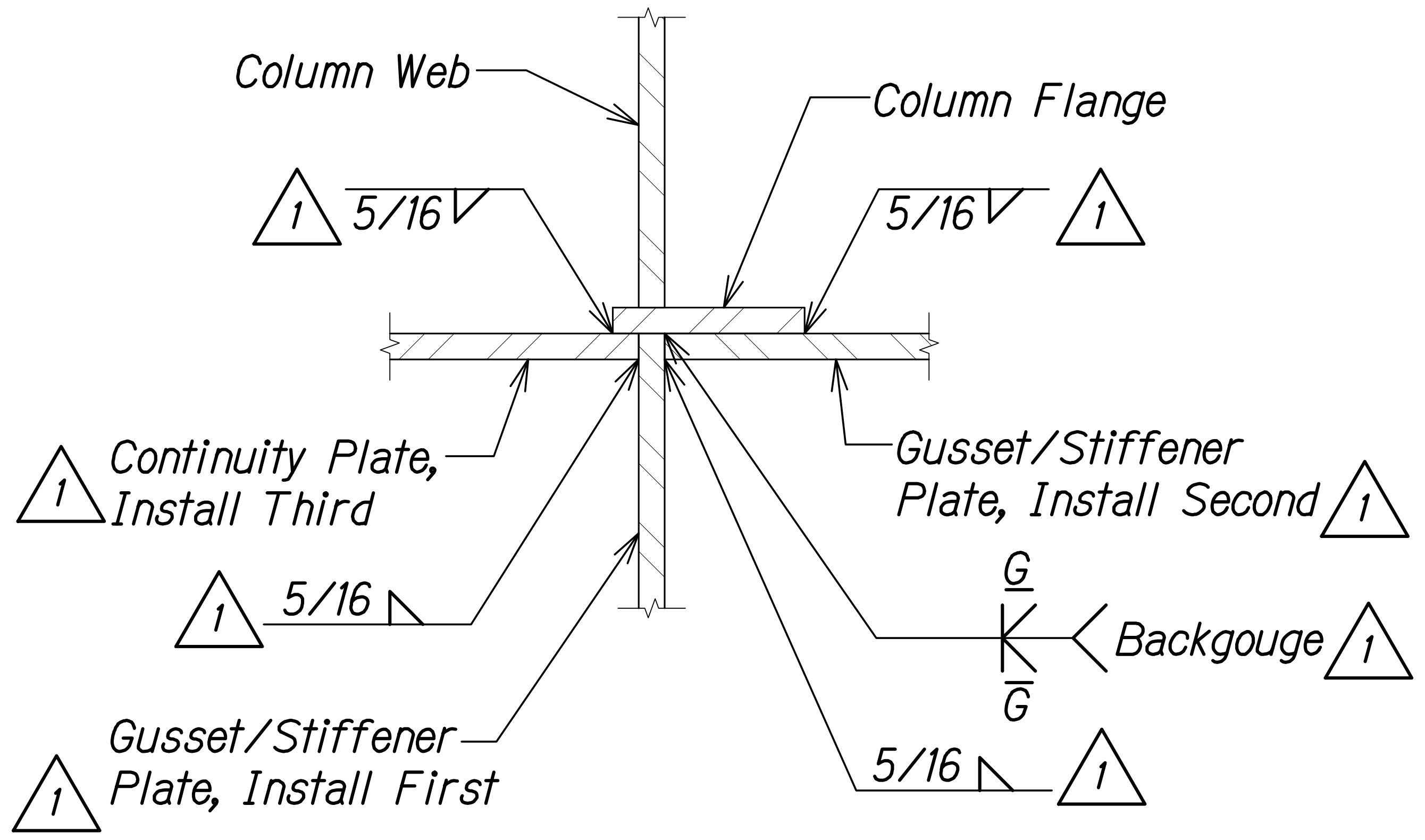
BASE COLUMN TO BRACE PLAN AT BENT INTERIOR B SA6.10 SA6.10 1

Scale: 1 1/2" = 1'-0"



BASE COLUMN TO BRACE PLAN AT BENT EXTERIOR C SA6.10 SA6.10 1

Scale: 1 1/2" = 1'-0"



DETAIL 1 SA6.10 SA6.10

Scale: 3" = 1'-0"

1 NOTES:

1. All gusset/cover/continuity/stiffener plates shall receive return fillet welds across the top and bottom connection at faying edge with column flange and base plate to provide a full seal weld to prevent moisture intrusion.

2. 5/8" thick stiffener Plate at Bent No. 1.

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

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4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

DATE		REVISION
12/6/24	1	Revised Details & Added Notes

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BASE COLUMN TO BRACE
CONNECTION DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

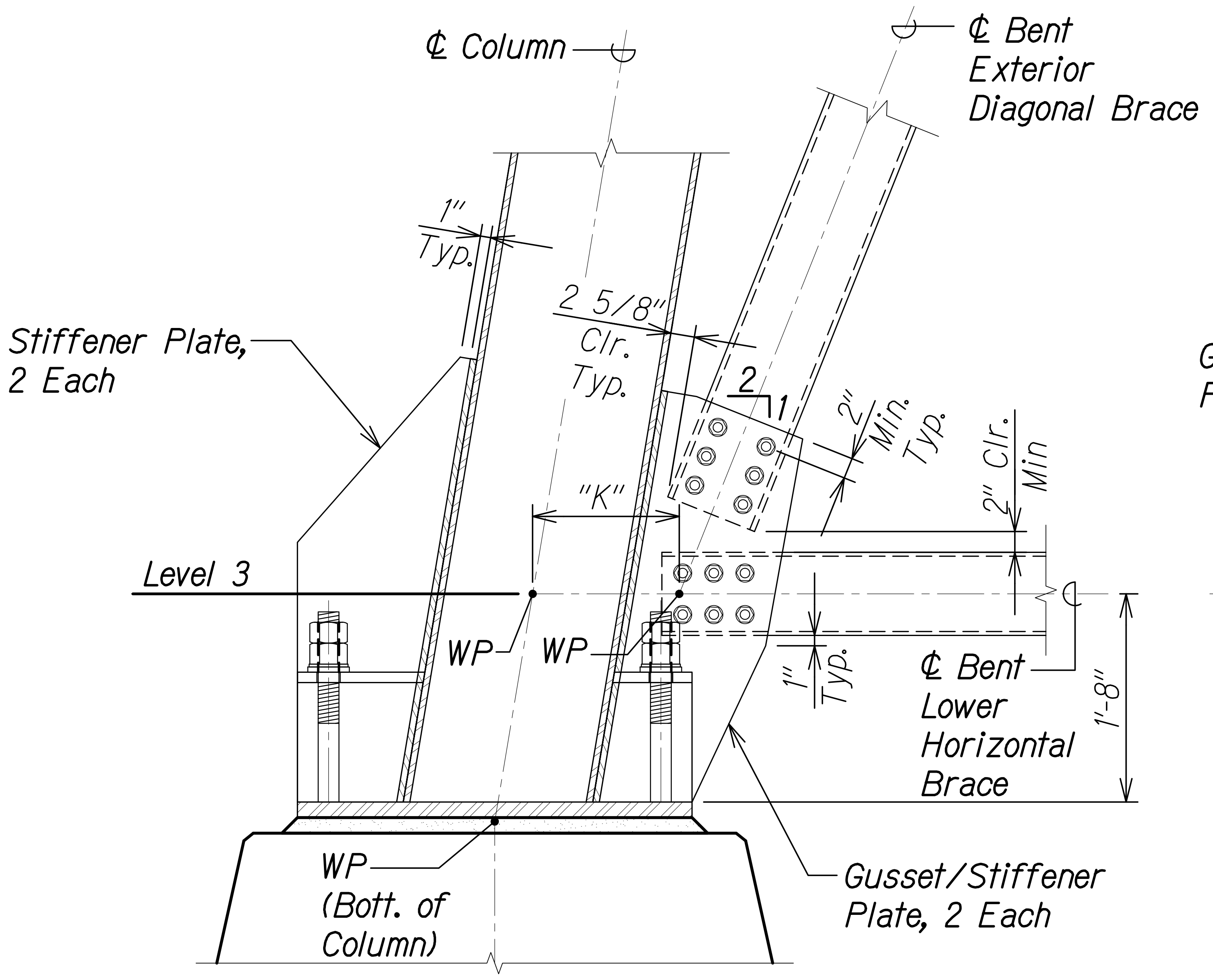
SHEET No. SA6.10 OF 22 SHEETS

ADD. 116

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

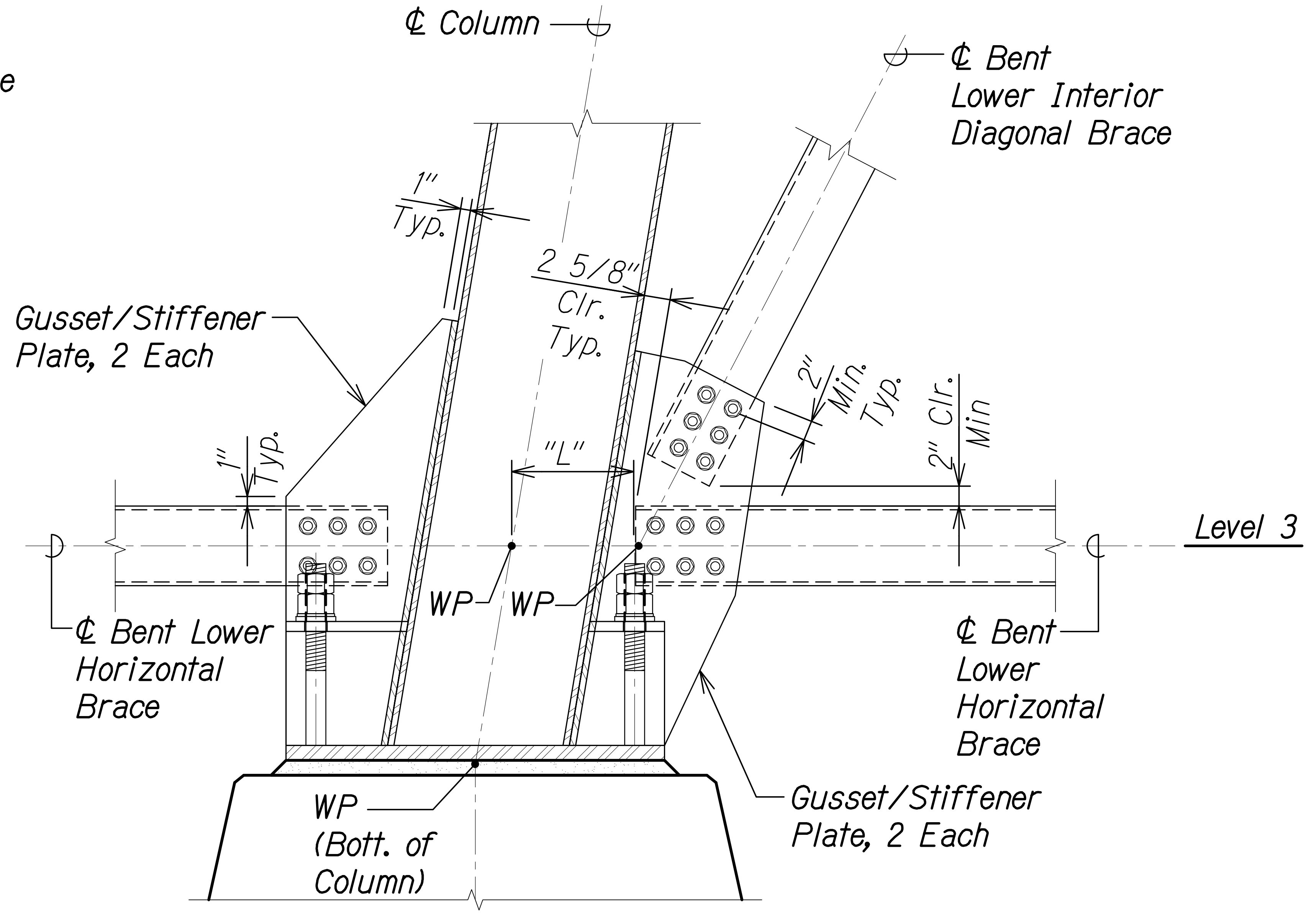
DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-05-24, 1:30 PM

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 117	280



EXT. BASE COLUMN TO BRACE CONNECTION DETAIL 1 SA6.11 | SA6.11 1

Scale: 1" = 1'-0"



INT. BASE COLUMN TO BRACE CONNECTION DETAIL 2 SA6.11 | SA6.11 1

Scale: 1" = 1'-0"

1 NOTES:

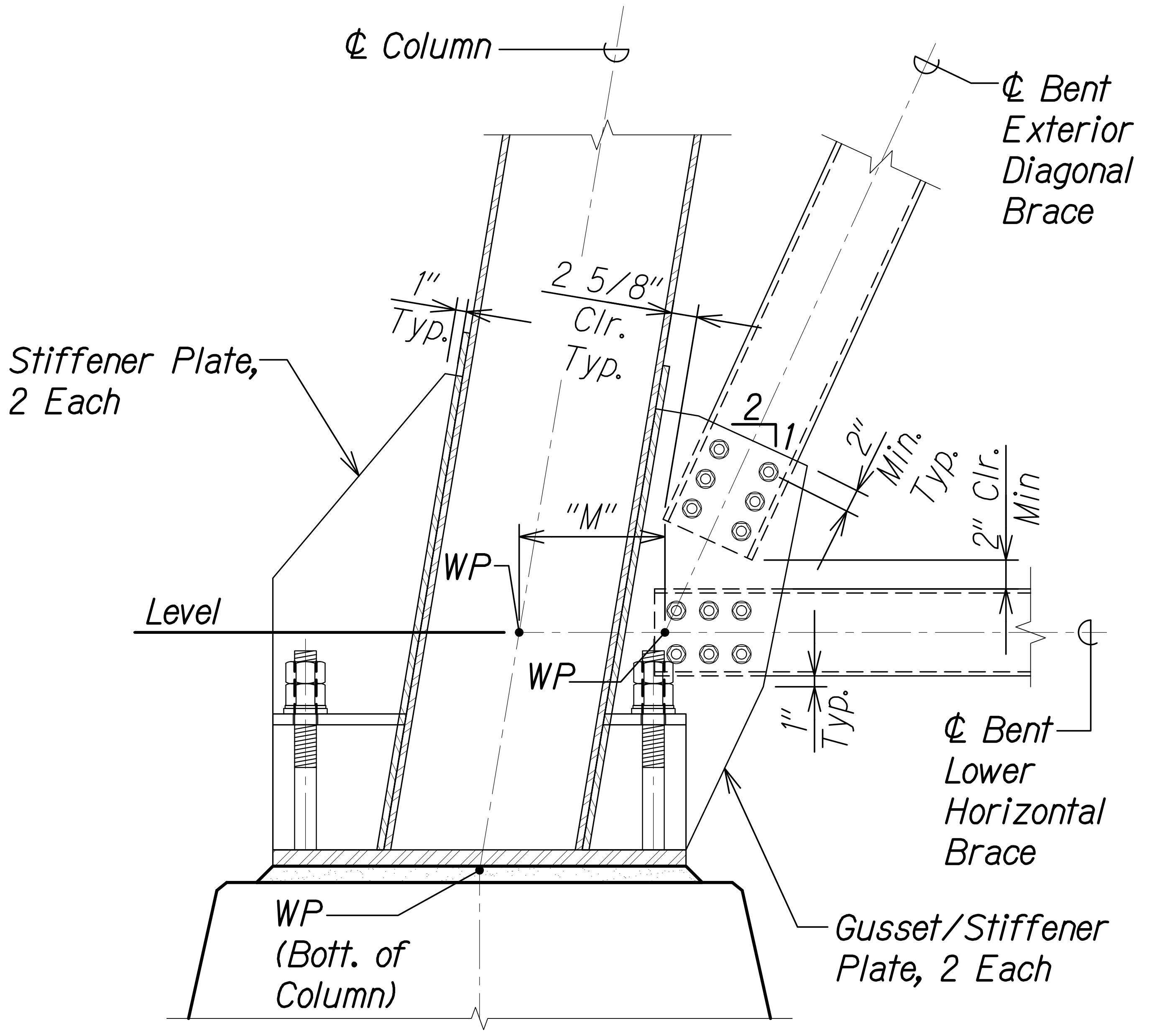
1. The Contractor's Steel Detailer is responsible for determining the actual size of each gusset/continuity/cover plate based on the information provided in the Contract Drawings.

2. All bolted connections for horizontal and diagonal braces, as detailed on this sheet, shall be pretensioned.

3. After erection, touch-up paint the ends of all bolts/nuts/washers.

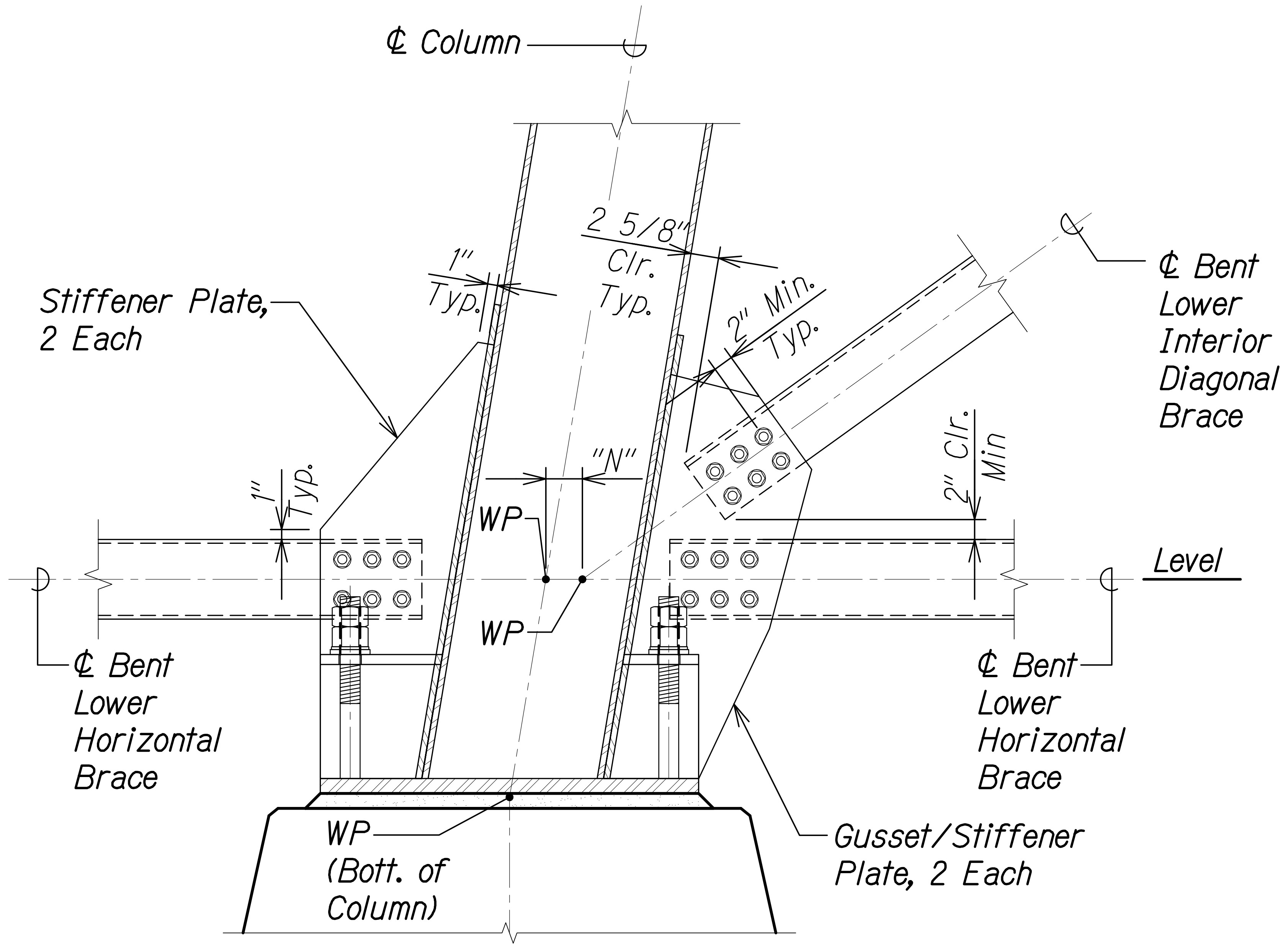
4. Batten plates and lacing not shown for clarity.

5. See Schedule on sheet SA6.12 for WP offsets.



EXT. BASE COLUMN TO BRACE CONNECTION DETAIL 3 SA6.11 | SA6.11 1

Scale: 1" = 1'-0"



INT. BASE COLUMN TO BRACE CONNECTION DETAIL 4 SA6.11 | SA6.11 1

Scale: 1" = 1'-0"

DATE	REVISION
12/6/24	1 Revised Details & Added Notes

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

Stephen Peters 4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BASE COLUMN TO BRACE CONNECTION DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

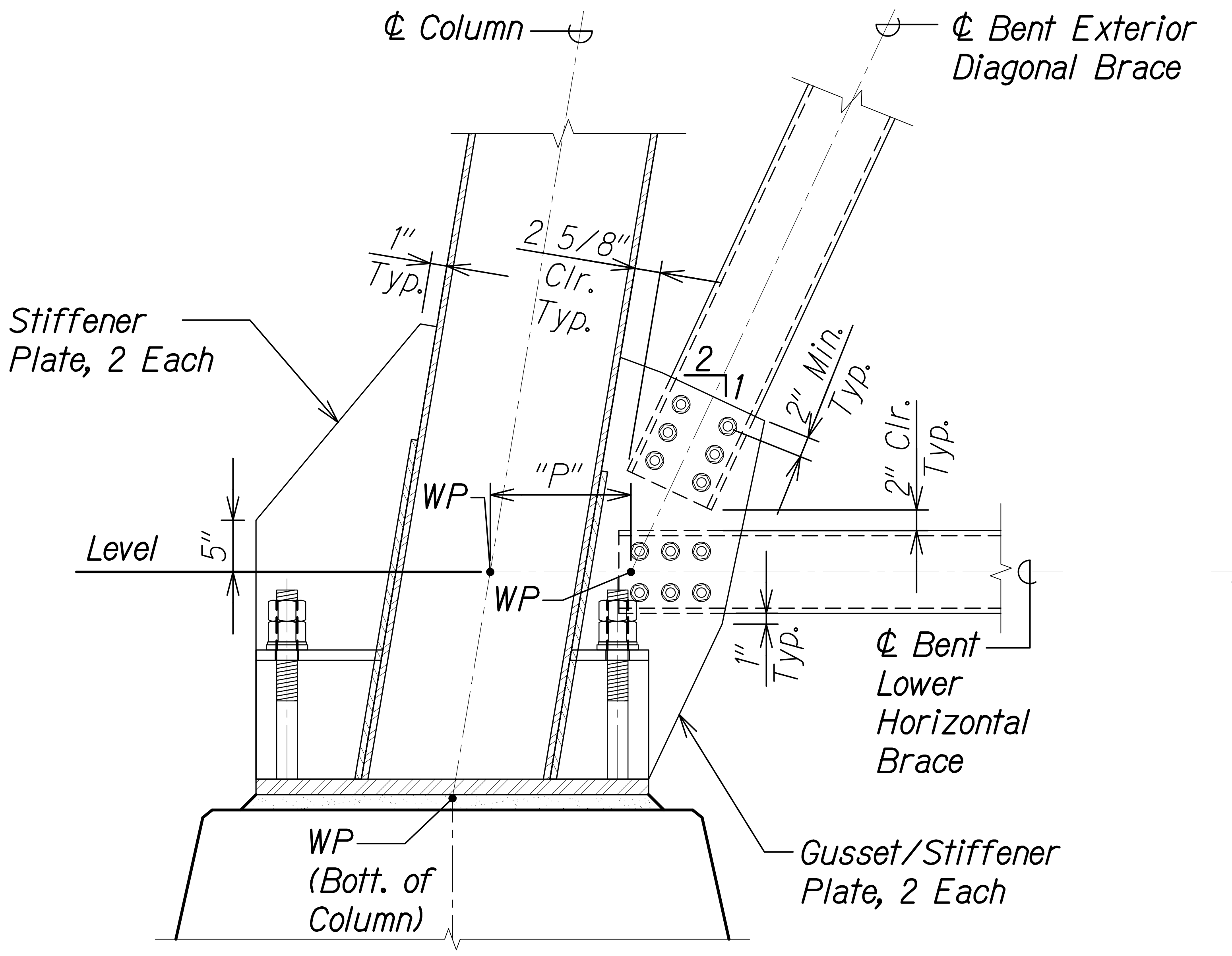
SHEET No. SA6.11 OF 22 SHEETS

ADD. 117

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-05-24, 1:27 PM)

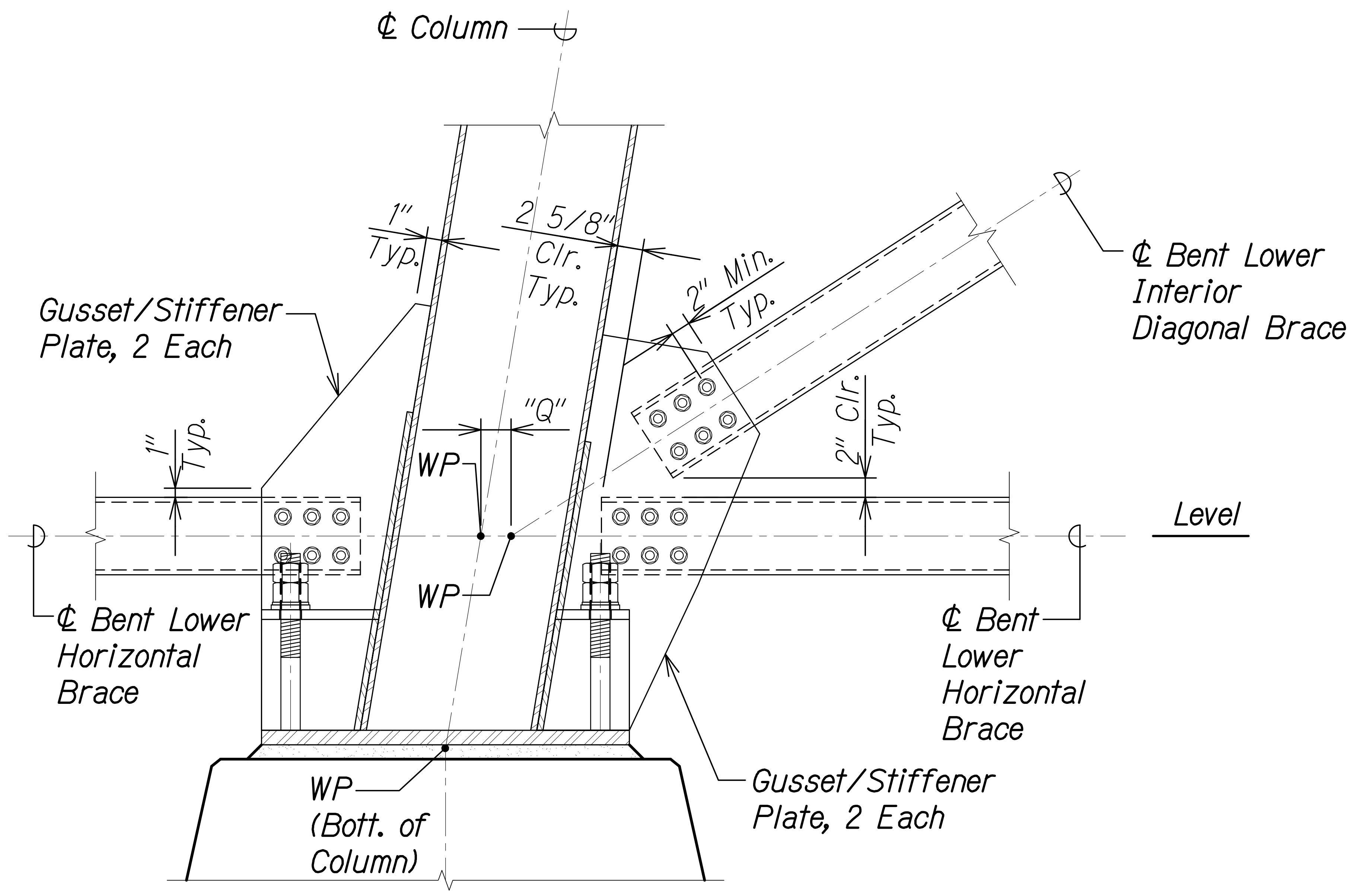
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 118	280



EXT. BASE COLUMN TO BRACE CONNECTION DETAIL

1 SA6.12 | SA6.12 △1

Scale: 1" = 1'-0"



INT. BASE COLUMN TO BRACE CONNECTION DETAIL

2 SA6.12 | SA6.12 △1

Scale: 1" = 1'-0"

△1 NOTES:

1. The Contractor's Steel Detailer is responsible for determining the actual size of each gusset/continuity/cover plate based on the information provided in the Contract Drawings.
2. All bolted connections for horizontal and diagonal braces, as detailed on this sheet, shall be pretensioned.
3. After erection, touch-up paint the ends of all bolts/nuts/washers.
4. Batten plates and lacing not shown for clarity.

△1

WP OFFSET SCHEDULE

LOCATION	"K"	"L"	"M"	"N"	"P"	"Q"
Bent No. 1	14 1/4"	12 3/4"	-	-	-	-
Bent No. 2	-	-	13 1/2"	3 3/4"	-	-
Bent No. 3	-	-	-	-	14"	0"
Bent No. 4	-	-	15 1/2"	2 1/2"	-	-
Bent No. 5	-	-	-	-	13 1/2"	3"
Bent No. 6	-	-	-	-	13 1/2"	3"
Bent No. 7	-	-	15"	4"	-	-
Bent No. 8	-	-	-	-	15 1/4"	12 1/2"
Bent No. 9	-	-	13 1/2"	11 3/4"	-	-

DATE	REVISION
12/6/24	△1 Revised Details and Added Notes & Schedule

STEPHEN T. PETERS
NO. 17097-S

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SIGNATURE 4-30-26 EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BASE COLUMN TO BRACE CONNECTION DETAILS

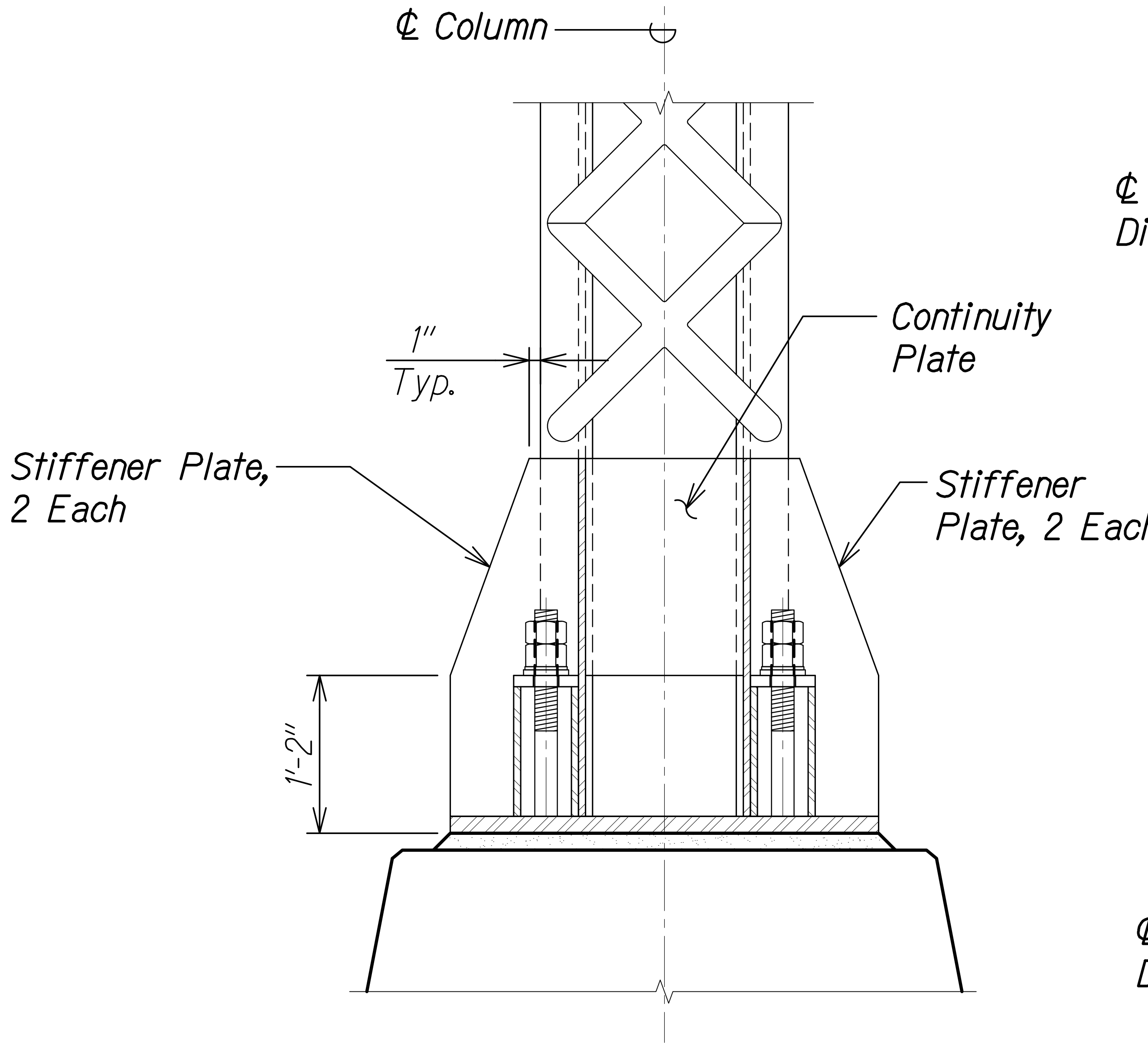
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA6.12 OF 22 SHEETS

ORIGINAL PLAN
SURVEY PLOTTED BY ___ DATE ___
DRAWN BY ___ "
TRACED BY ___ "
DESIGNED BY ___ "
QUANTITIES BY ___ "
CHECKED BY ___ "
NOTE BOOK
No. ___

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-05-24, 1:31 PM)

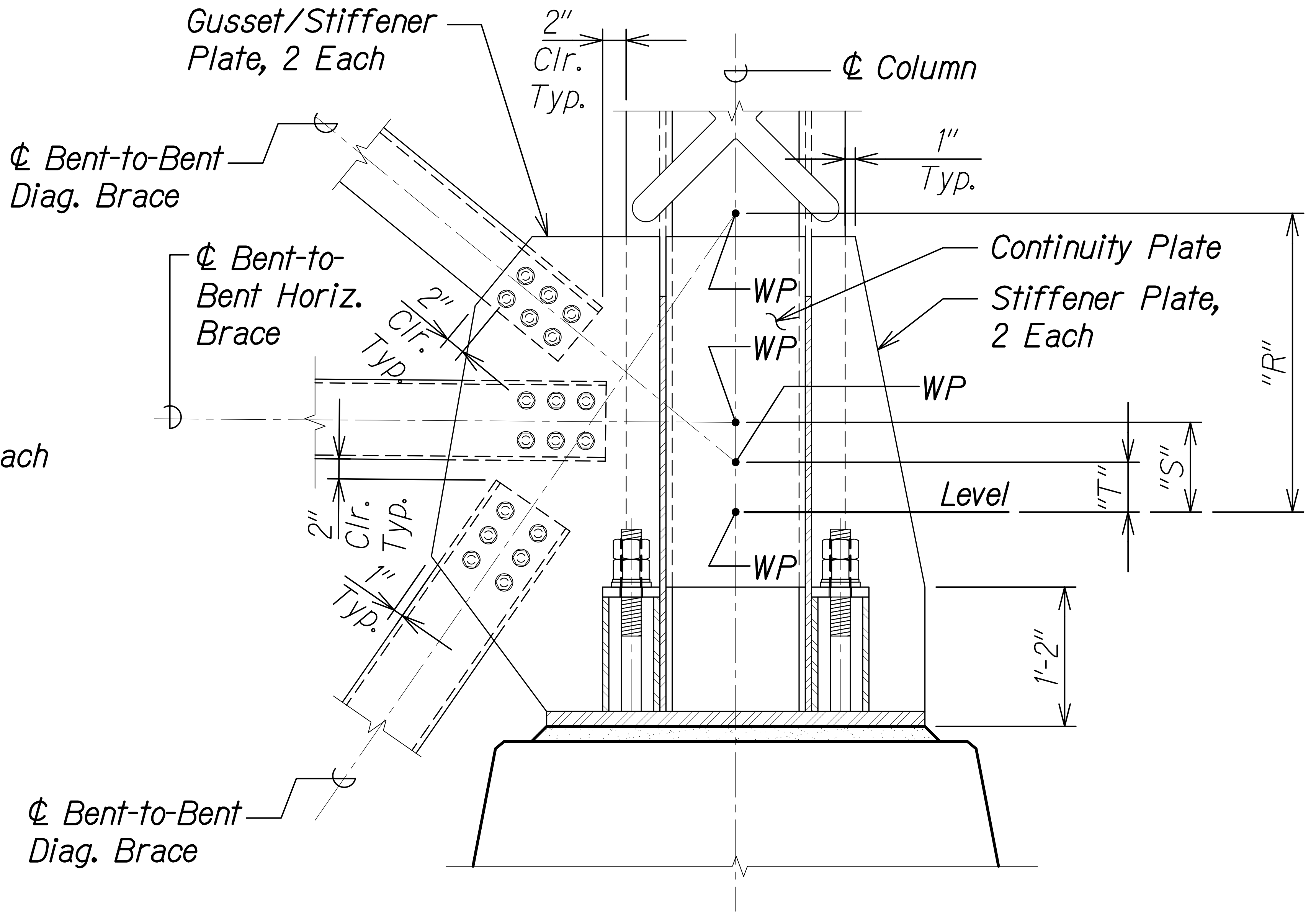
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 119	280



BASE COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

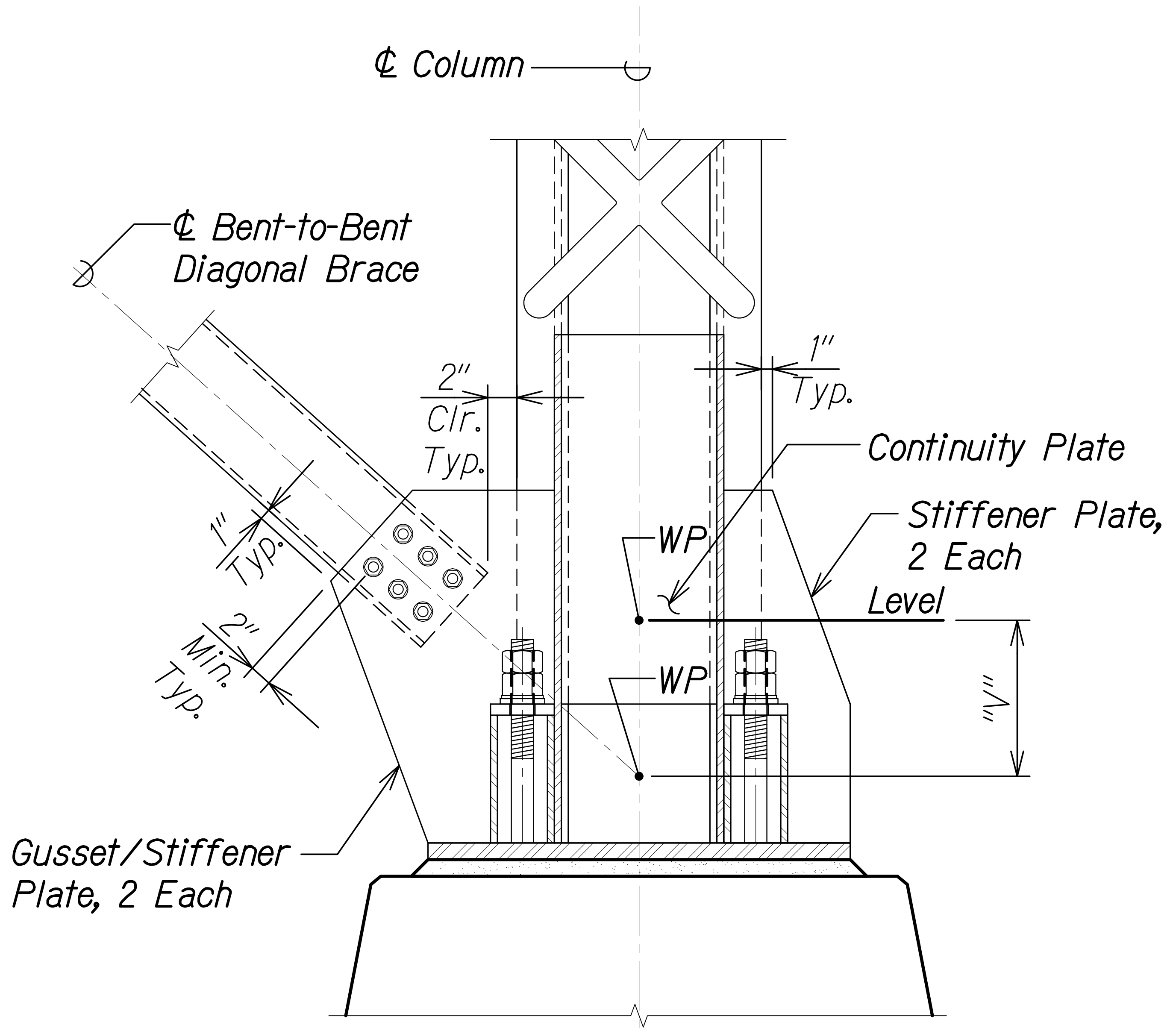
1 SA6.13 SA6.13 1



BASE COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

2 SA6.13 SA6.13 1



BASE COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

3 SA6.13 SA6.13 1

1

WP OFFSET SCHEDULE				
LOCATION	"R"	"S"	"T"	"V"
Bent No. 2	10"	12"	10"	-
Bent No. 3	-	-	-	14"
Bent No. 4	0"	2"	2"	-
Bent No. 5	-	-	-	5"
Bent No. 6	-	-	-	20"
Bent No. 7	30"	9"	5"	-
Bent No. 8	-	-	-	15"
Bent No. 9	7"	3"	0"	-

1 NOTES:

1. The Contractor's Steel Detailer is responsible for determining the actual size of each gusset/continuity/cover plate based on the information provided in the Contract Drawings.
2. All bolted connections for horizontal and diagonal braces, as detailed on this sheet, shall be pretensioned.
3. After erection, touch-up paint ends of all bolts/nuts/washers.
4. Batten plates and lacing on bracing not shown for clarity.

DATE	REVISION
12/6/24	1 Revised Details and Added Notes & Schedule

NO. 17097-S

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SIGNATURE 4-30-26 EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BASE COLUMN TO BRACE CONNECTION DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

Scale: As Noted Date: Oct. 2024

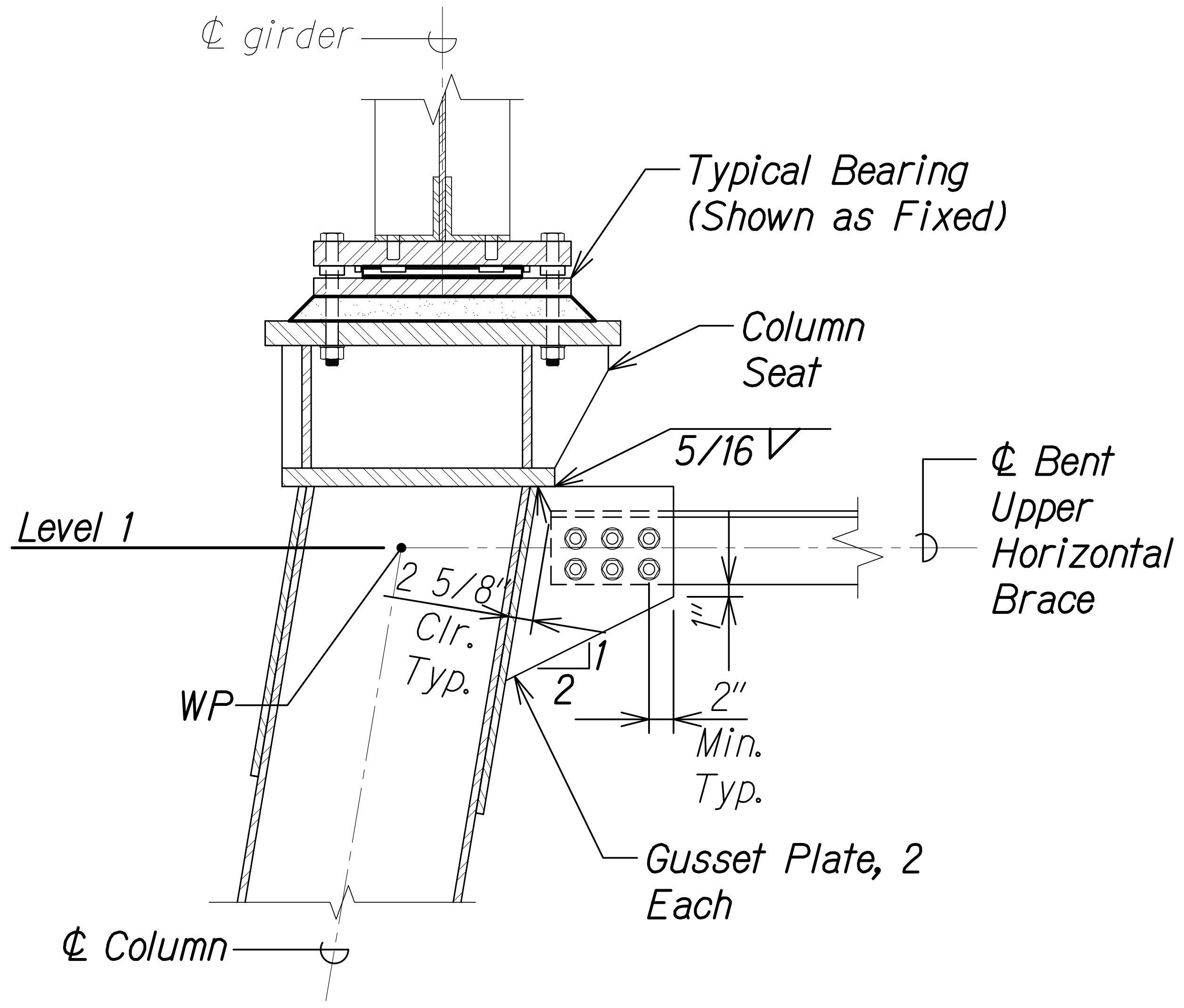
SHEET No. SA6.13 OF 22 SHEETS

ADD. 119

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOT\4.01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-03-24, 10:18 PM

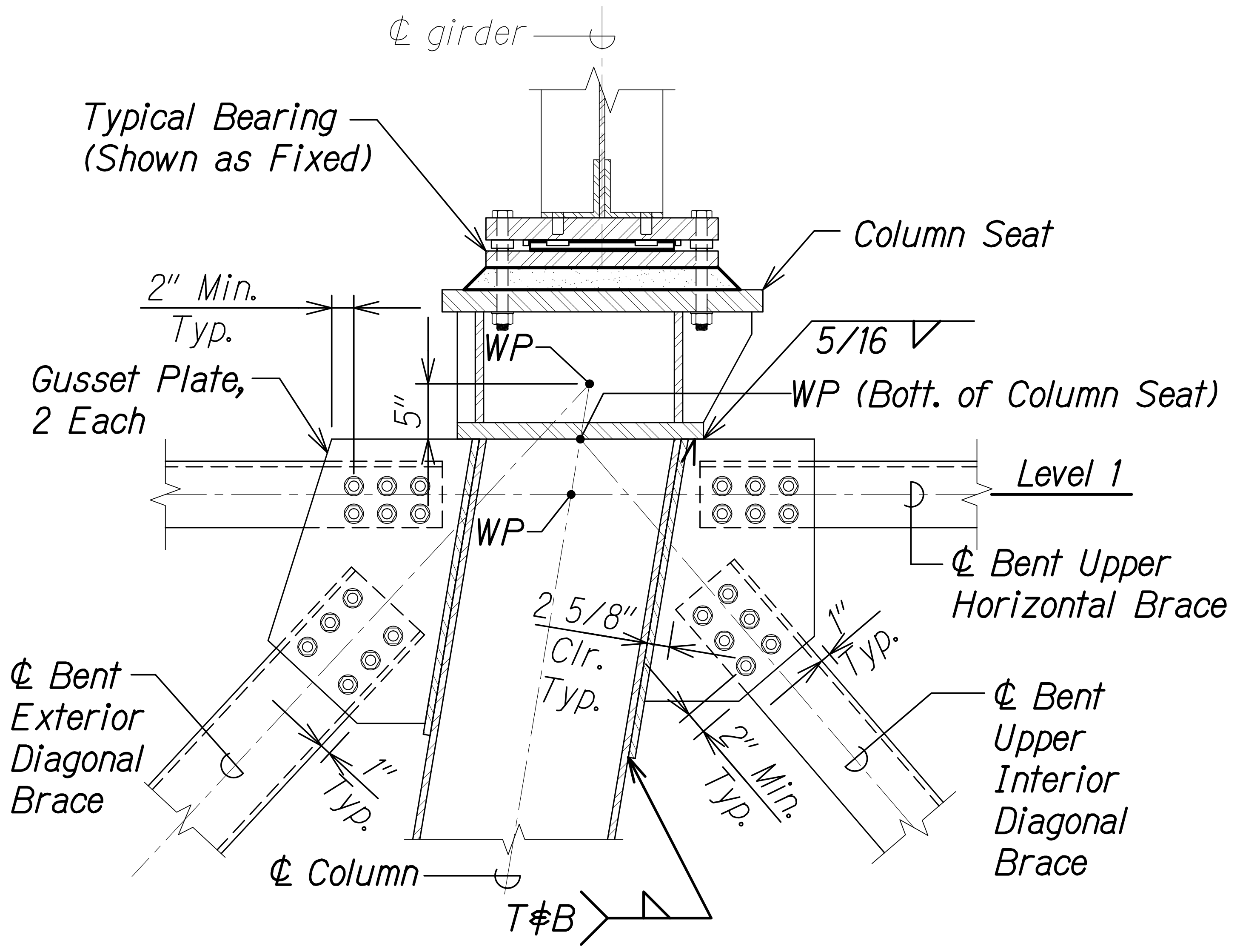
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 120	280



EXT. TOP COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

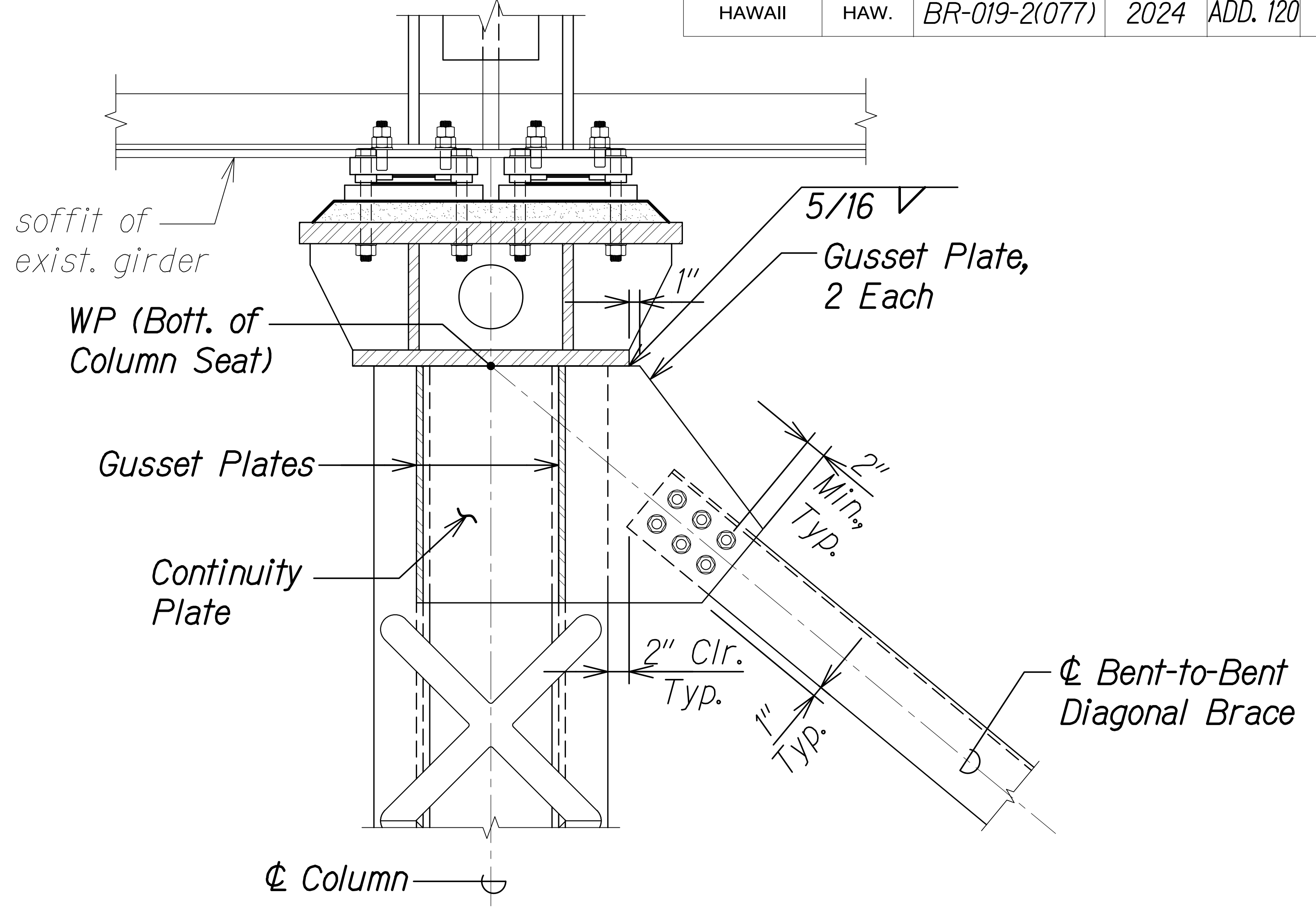
1 SA6.14 | SA6.14 △1



INT. TOP COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

2 SA6.14 | SA6.14 △1



TOP COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

3 SA6.14 | SA6.14 △1

△1 NOTES:

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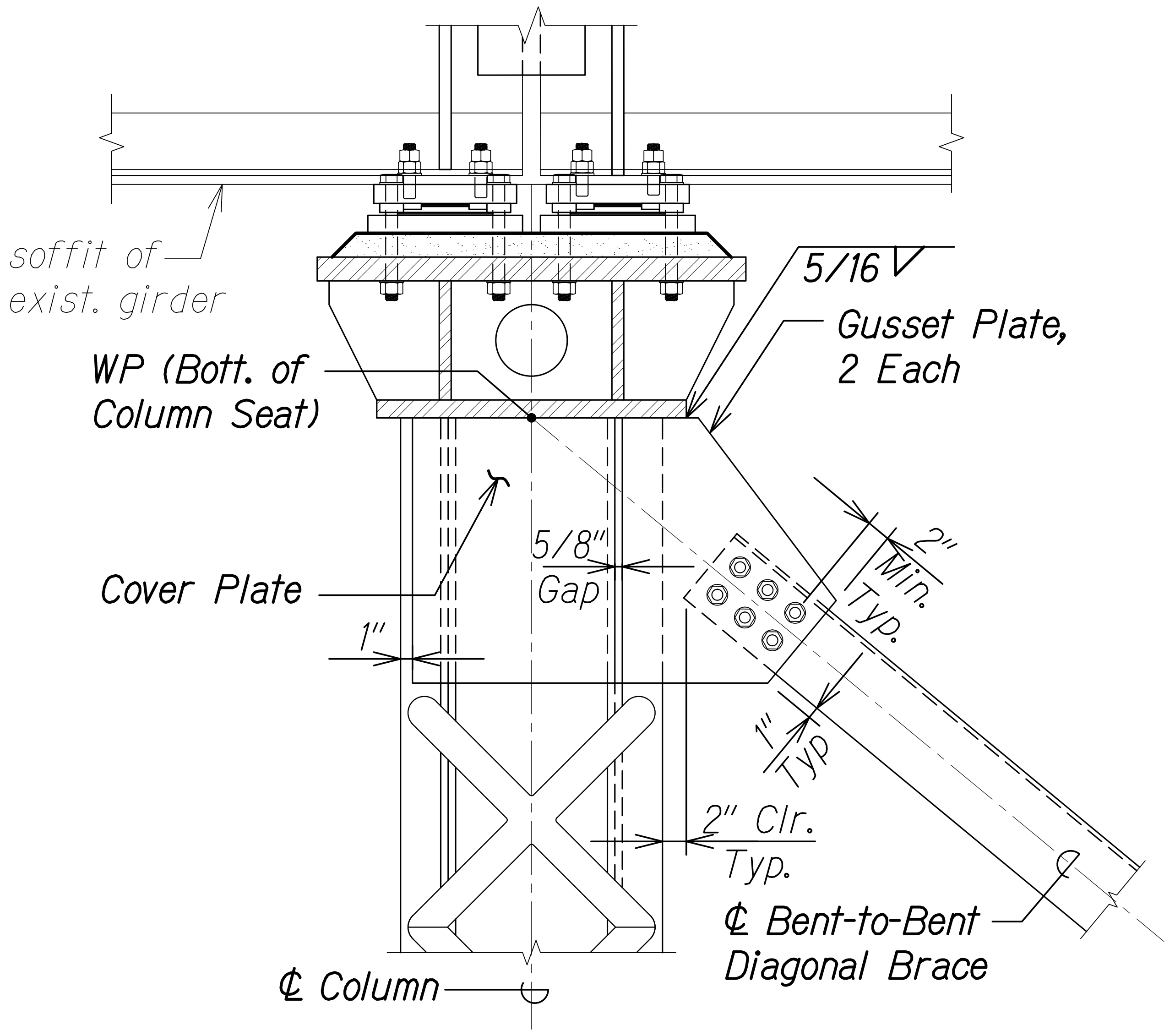
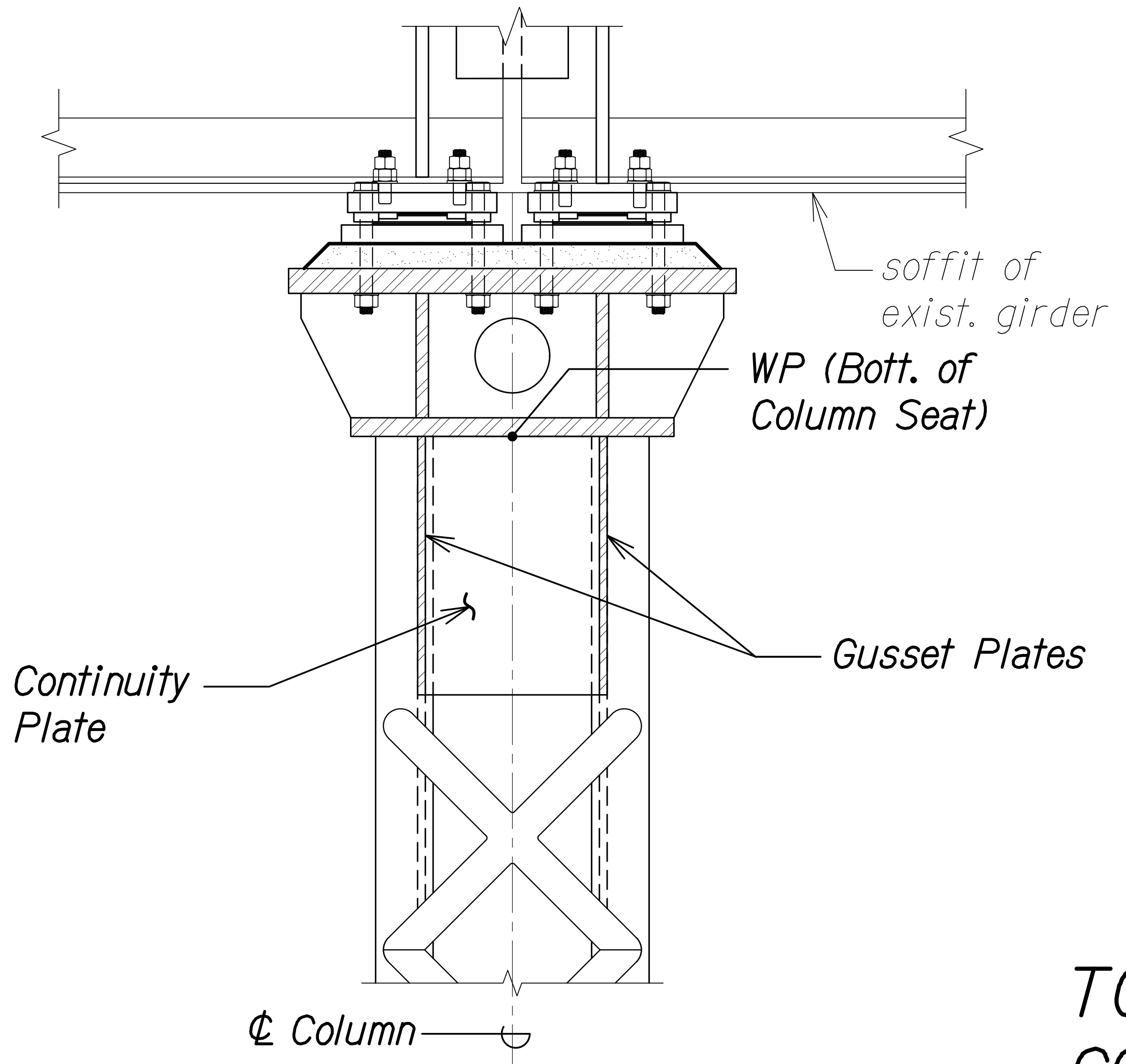


TOP COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

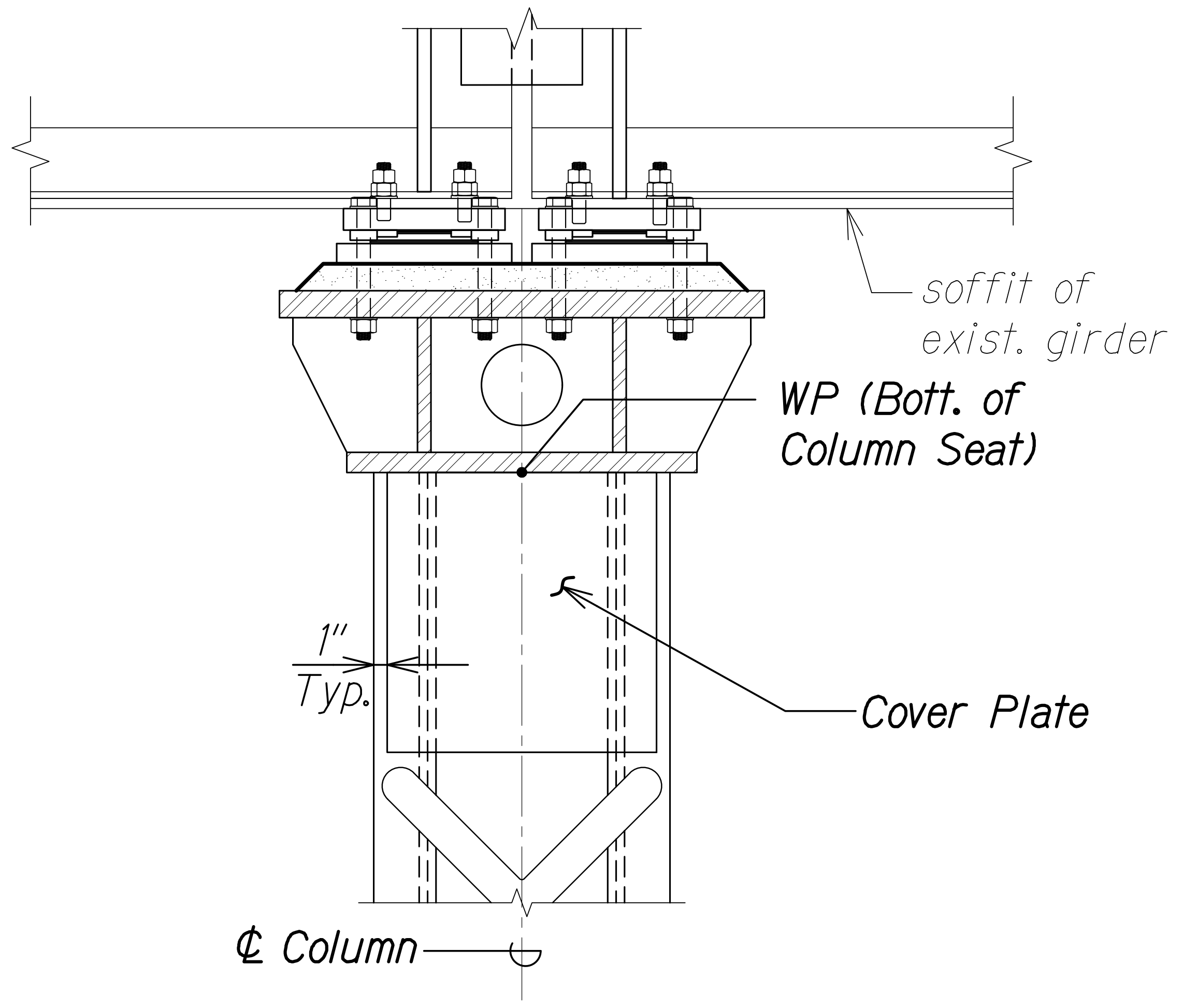
4 SA6.14 | SA6.14 △1



TOP COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

5 SA6.14 | SA6.14 △1



TOP COLUMN TO BRACE CONNECTION DETAIL

Scale: 1" = 1'-0"

6 SA6.14 | SA6.14 △1

DATE		REVISION
12/6/24	△1	Revised Details & Added Notes

STEPHEN T. PETERS
NO. 17097-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

TOP COLUMN TO BRACE CONNECTION DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

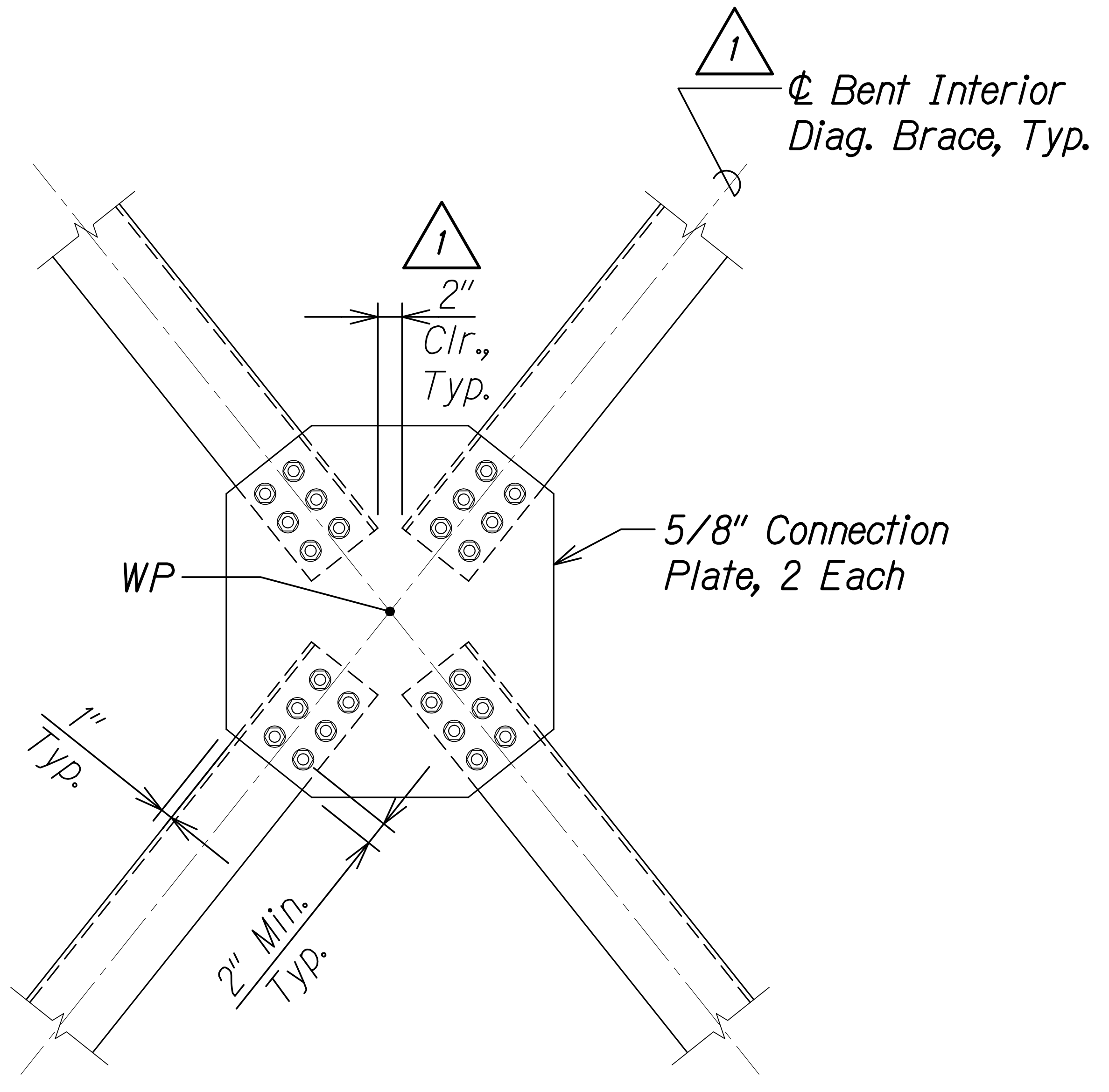
SHEET No. SA6.14 OF 22 SHEETS

ADD. 120

ORIGINAL PLAN	SURVEY PLOTTED BY ___ DATE ___
	DRAWN BY ___ " ___
NOTE BOOK	TRACED BY ___ " ___
	DESIGNED BY ___ " ___
No. ___	QUANTITIES BY ___ " ___
	CHECKED BY ___ " ___

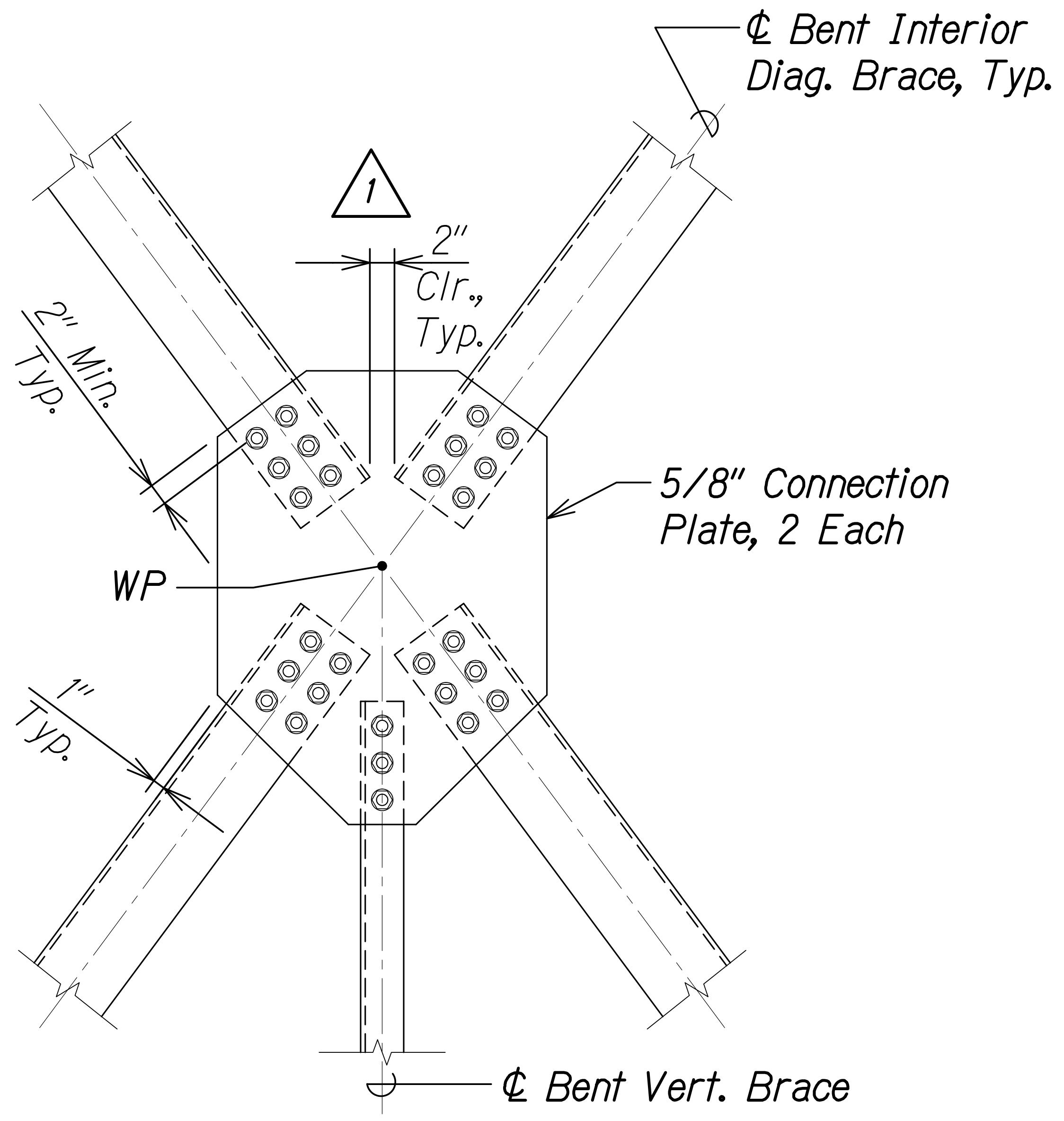
DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-05-24, 3:36 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 121	280



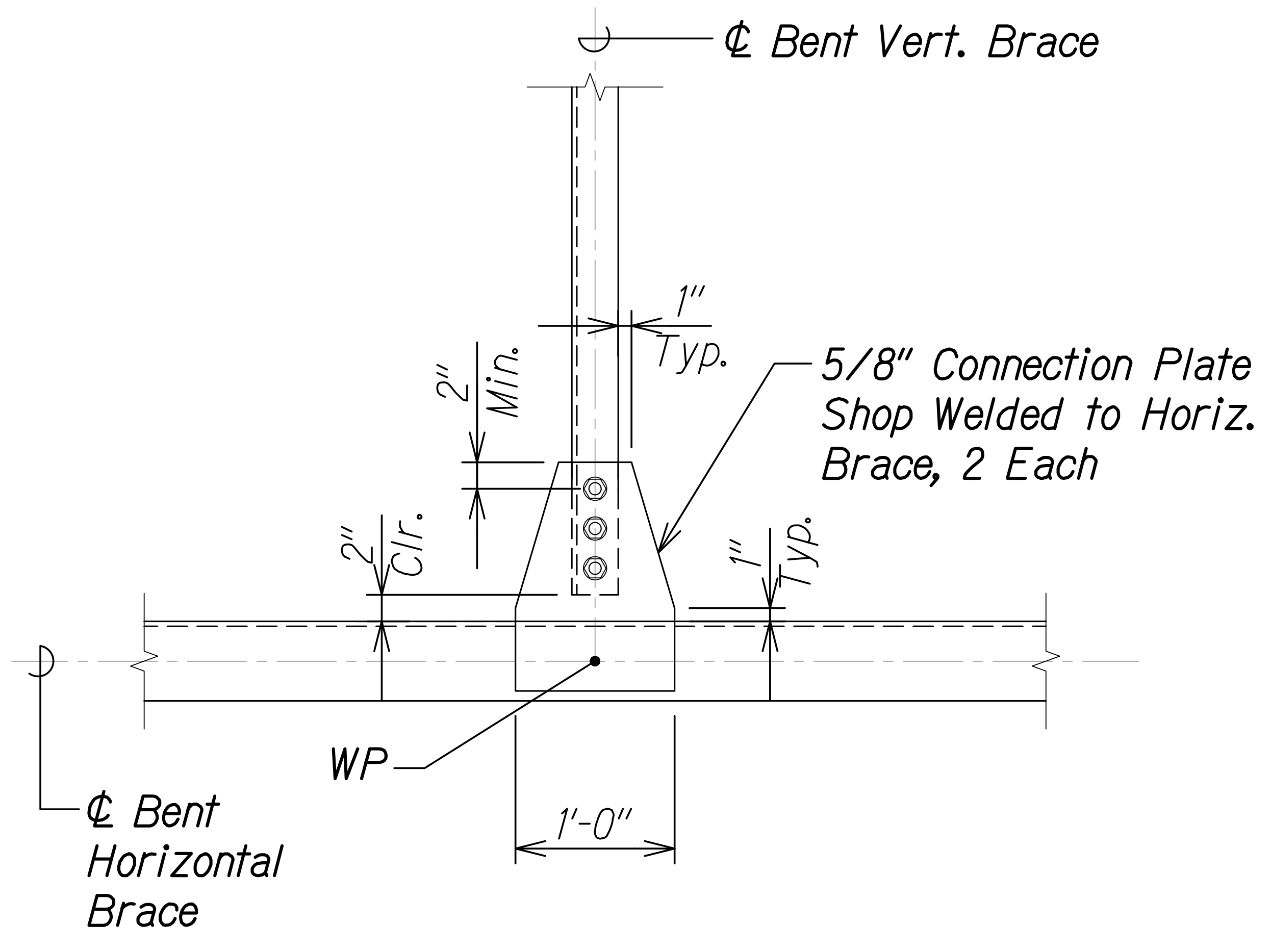
BRACE TO BRACE CONNECTION DETAIL 1 SA6.15 | SA6.15

Scale: 1" = 1'-0"



BRACE TO BRACE CONNECTION DETAIL 2 SA6.15 | SA6.15

Scale: 1" = 1'-0"



BRACE TO BRACE CONNECTION DETAIL 3 SA6.15 | SA6.15

Scale: 1" = 1'-0"

1 NOTES:

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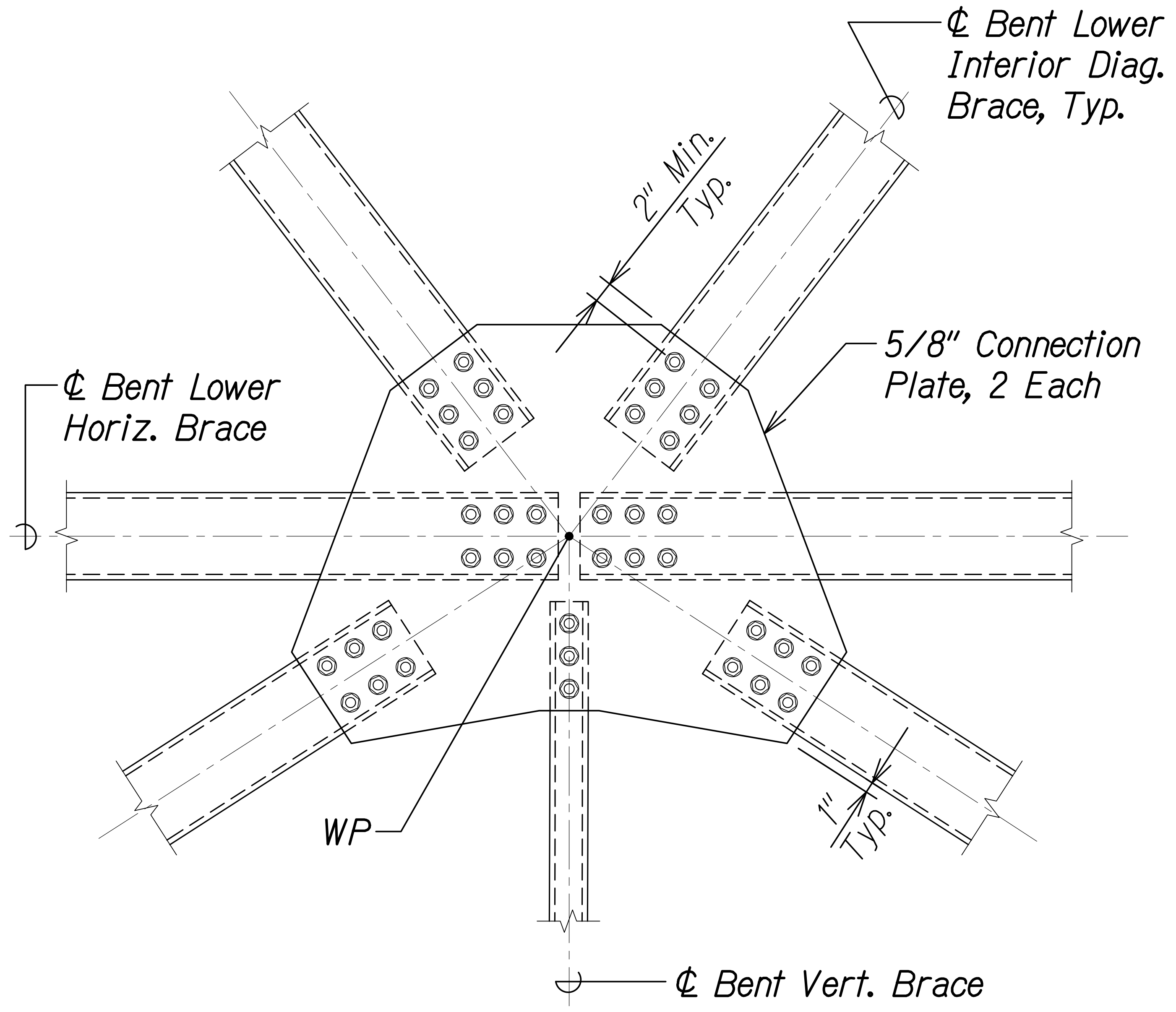
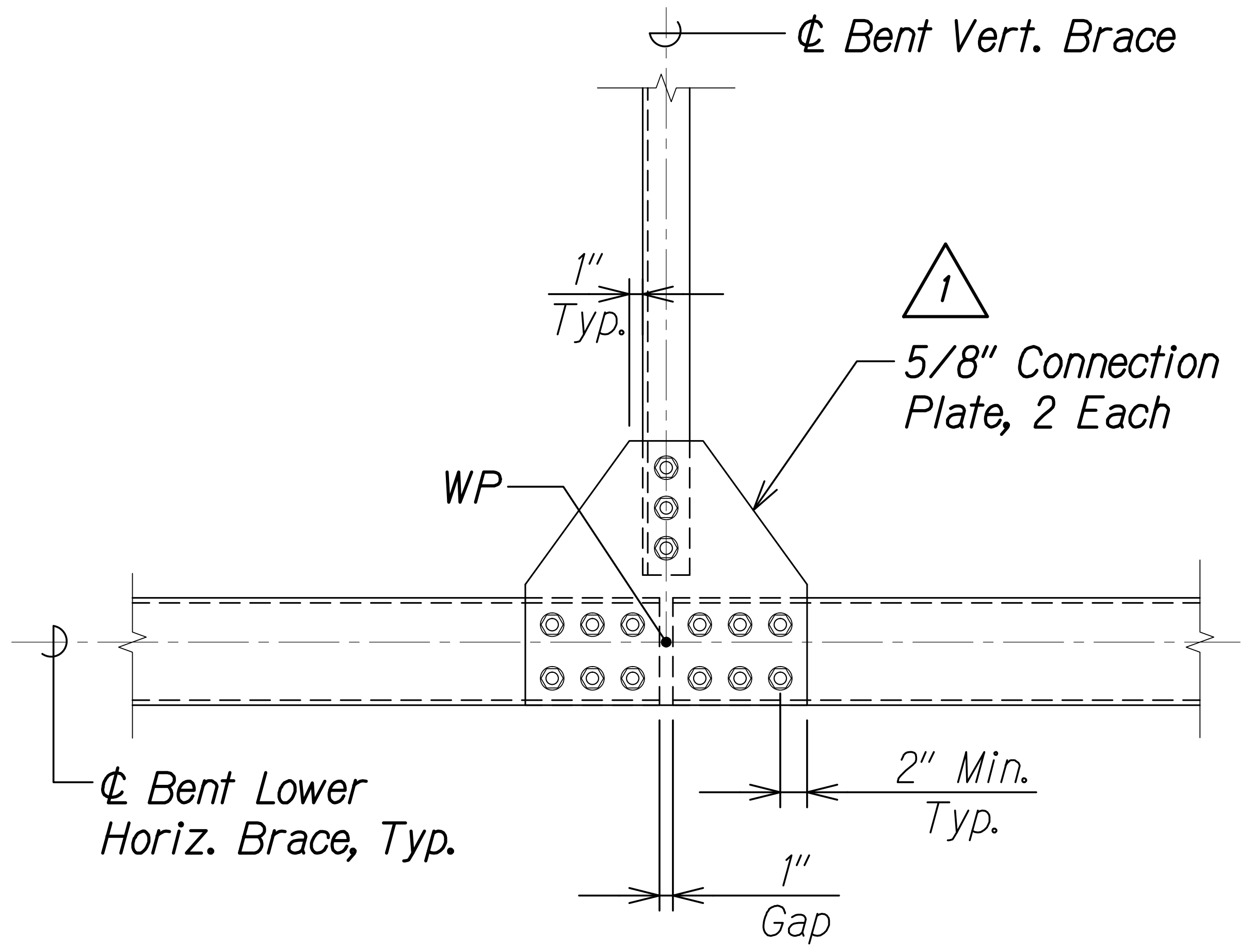
2. All bolted connections for horizontal and diagonal braces, as detailed on this sheet, shall be pretensioned.
3. After erection, touch-up paint the ends of all bolts/nuts/washers.
4. Batten plates and lacing on braces not shown for clarity.



BRACE TO BRACE CONNECTION DETAIL 4 SA6.15 | SA6.15 1

Scale: 1" = 1'-0"



BRACE TO BRACE CONNECTION DETAIL 5 SA6.15 | SA6.15

Scale: 1" = 1'-0"

DATE		REVISION
12/6/24	1	Revised Details & Added Notes

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE 4-30-26 EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BRACE TO BRACE CONNECTION DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

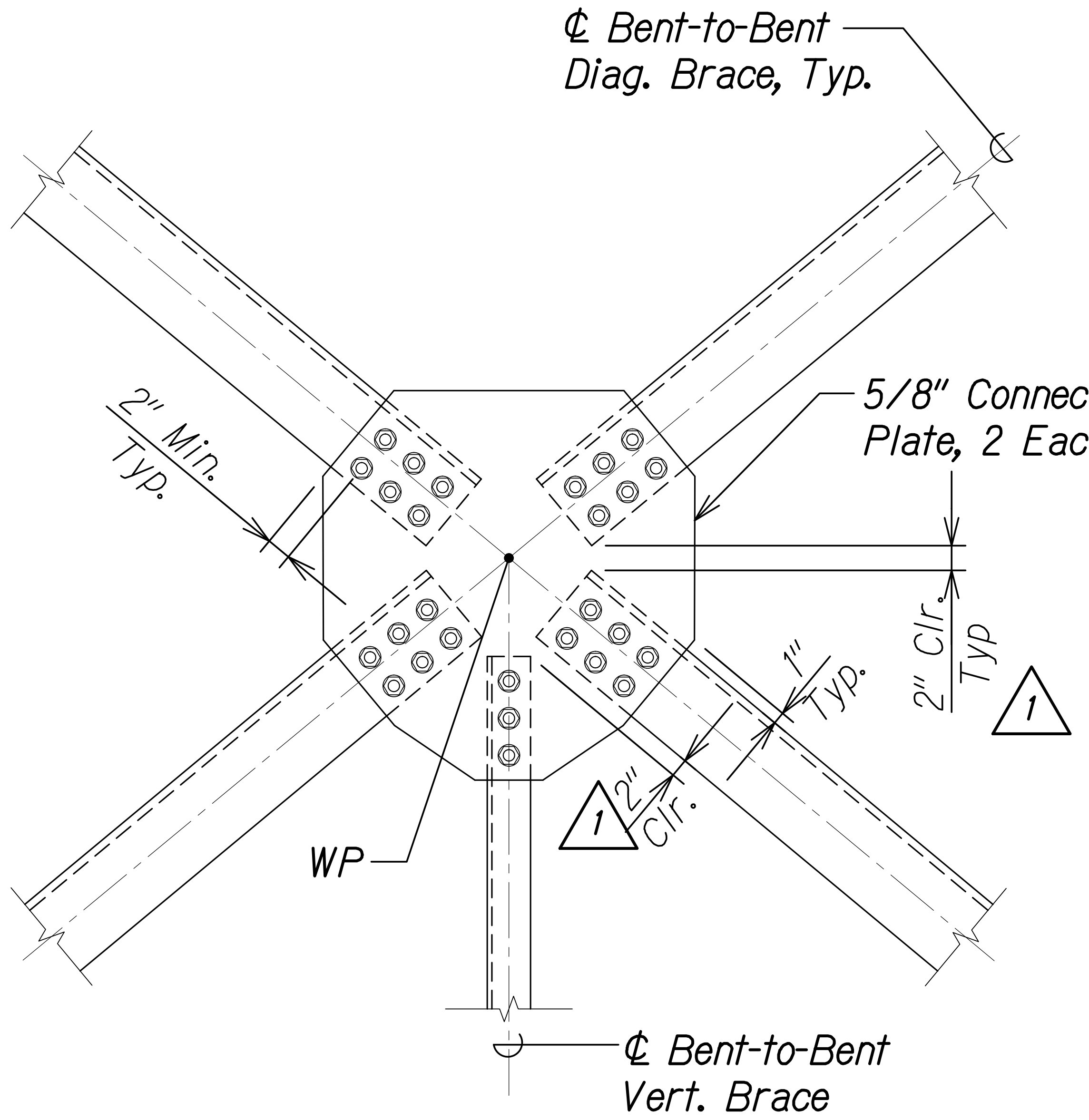
SHEET No. SA6.15 OF 22 SHEETS

ADD. 121

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

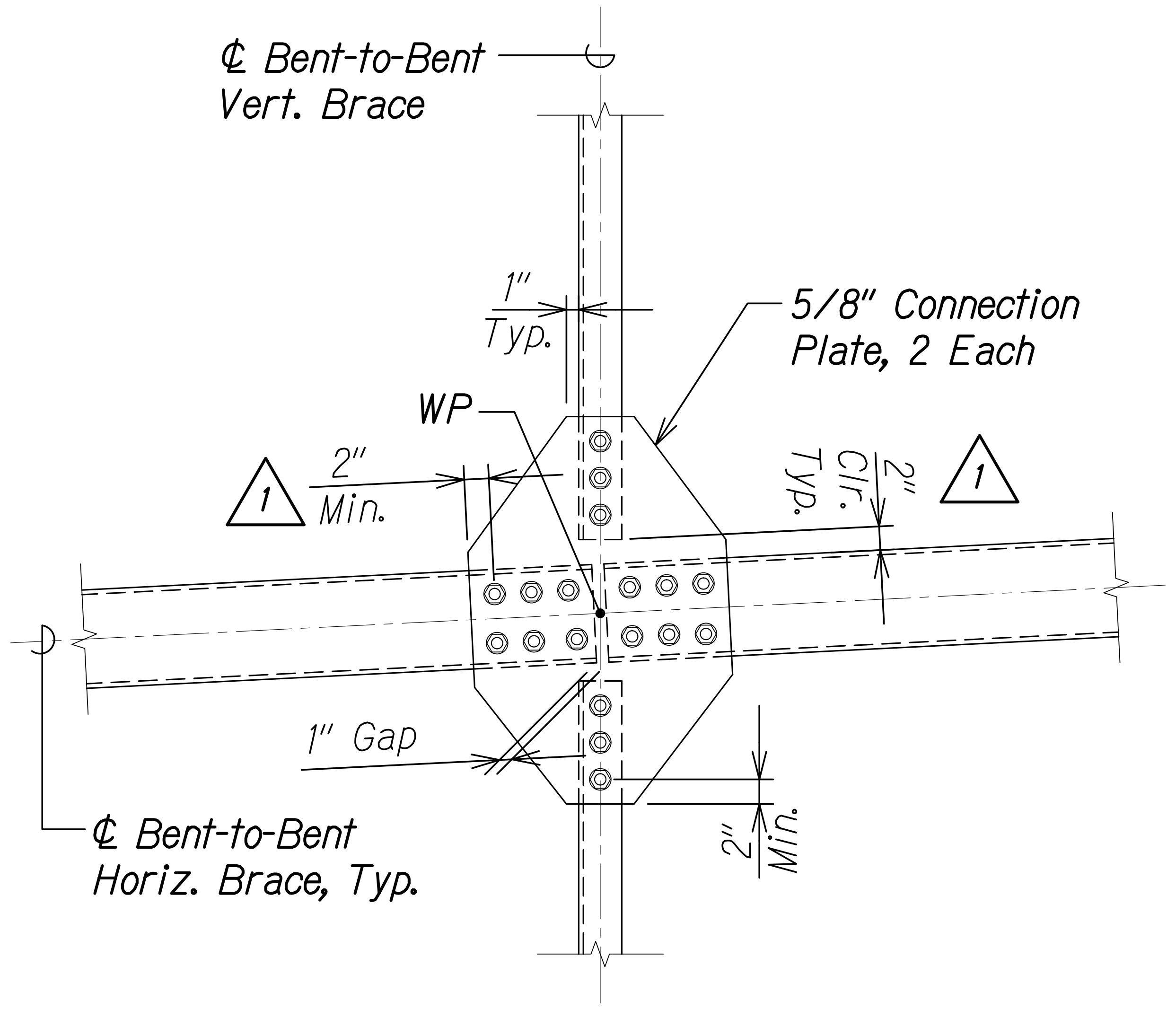
DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOT\4.01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-05-24, 1:31 PM

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 122	280



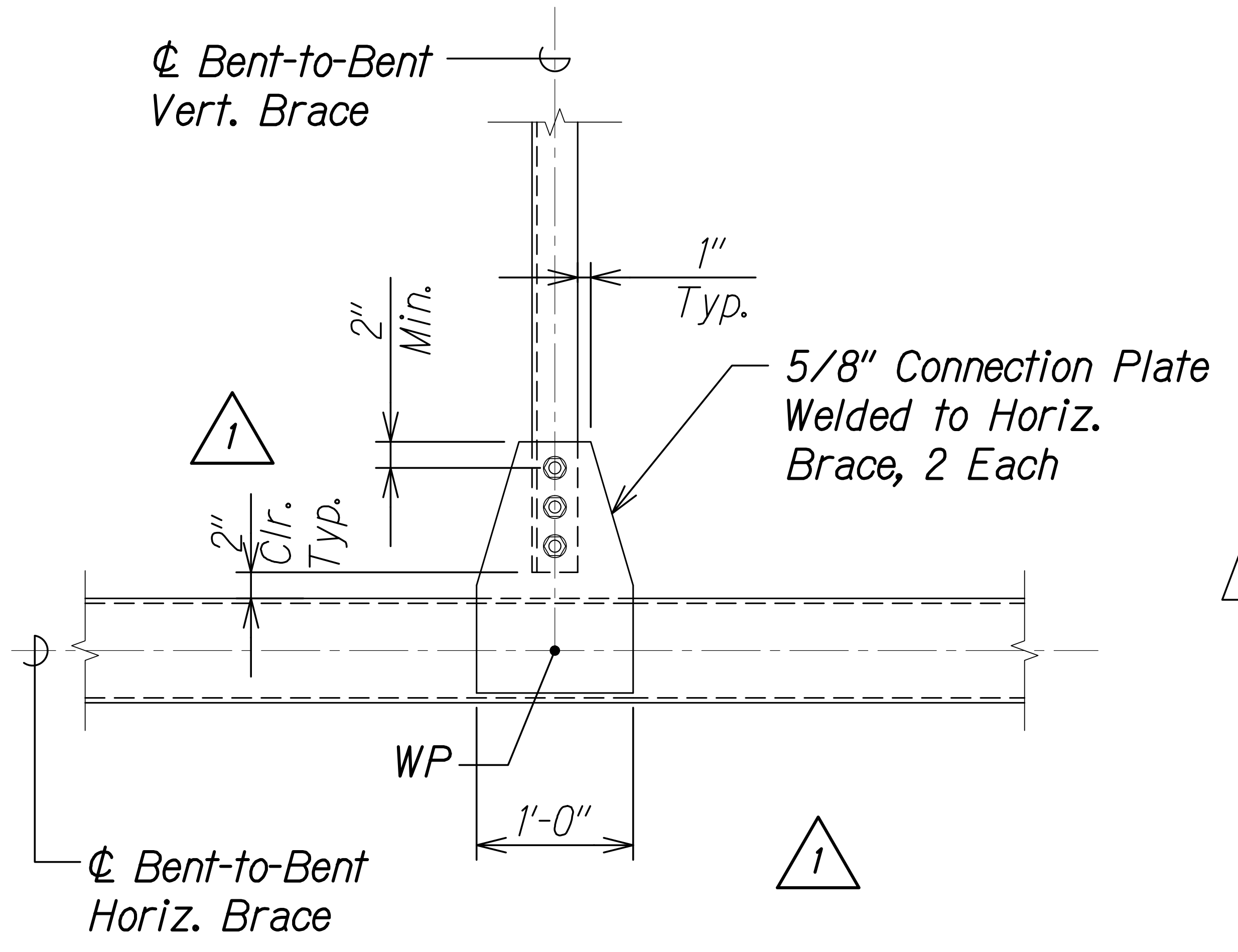
BRACE TO BRACE CONNECTION DETAIL 1

Scale: 1" = 1'-0" SA6.16 | SA6.16



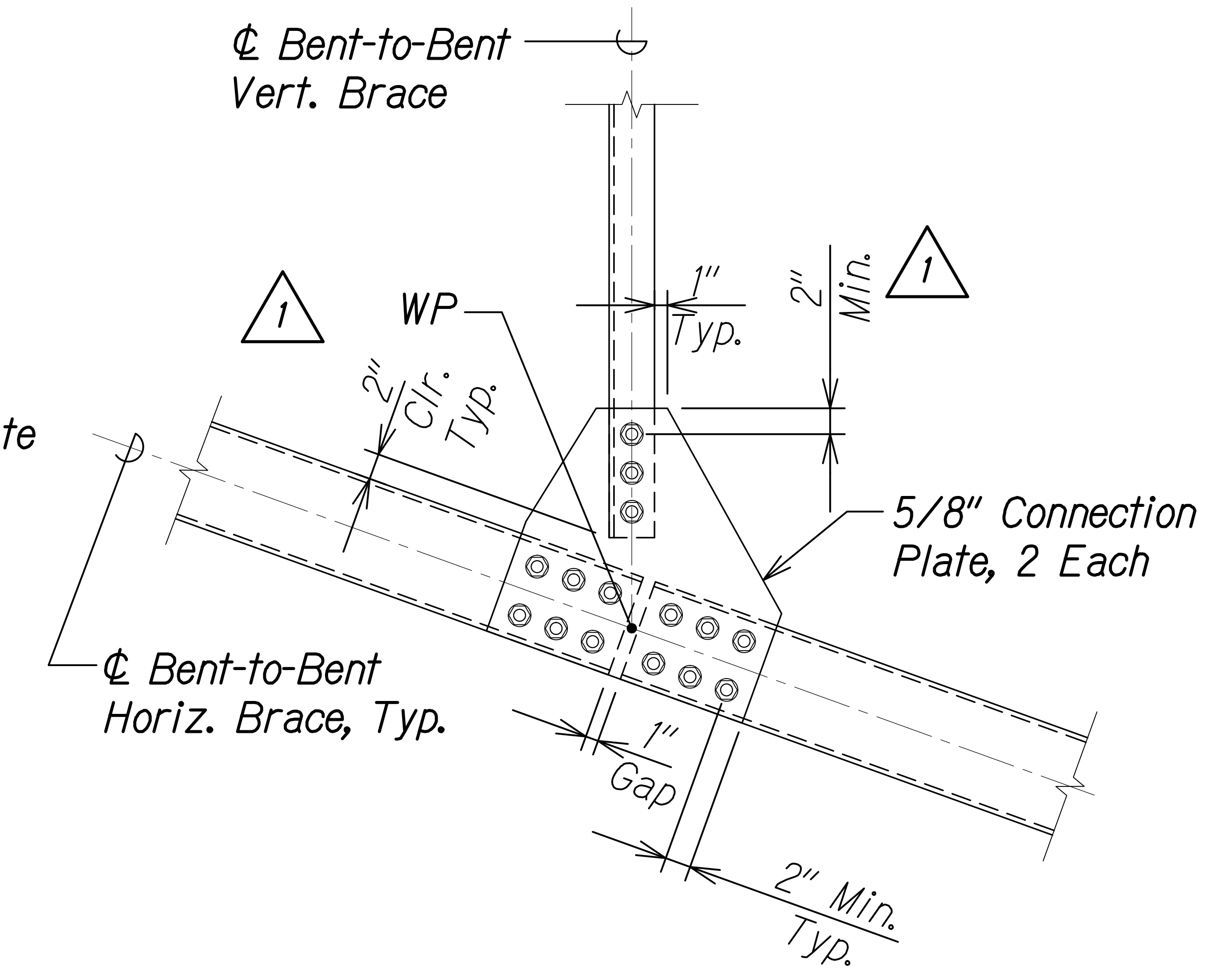
BRACE TO BRACE CONNECTION DETAIL 2

Scale: 1" = 1'-0" SA6.16 | SA6.16



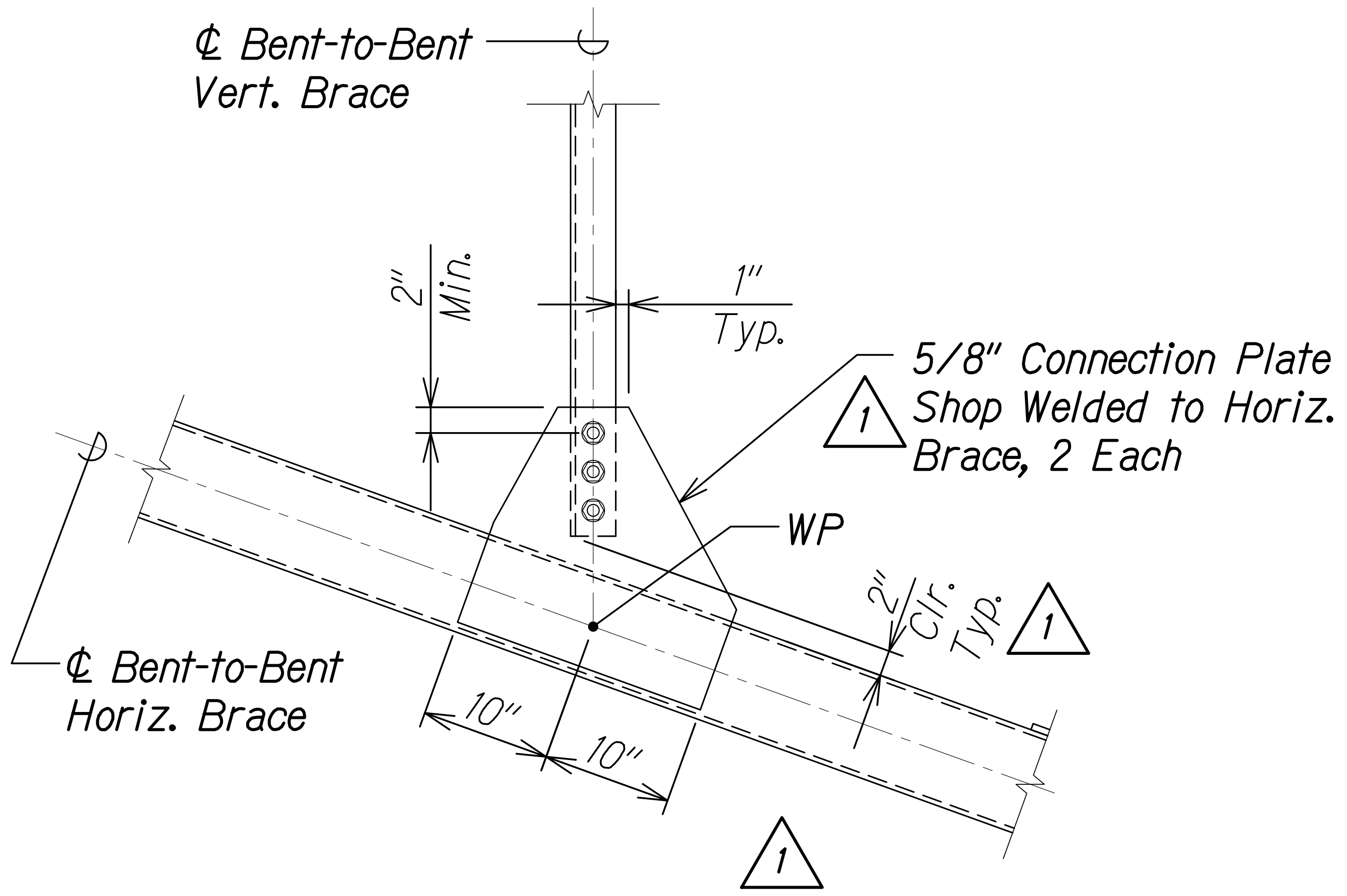
BRACE TO BRACE CONNECTION DETAIL 3

Scale: 1" = 1'-0" SA6.16 | SA6.16



BRACE TO BRACE CONNECTION DETAIL 4

Scale: 1" = 1'-0" SA6.16 | SA6.16



BRACE TO BRACE CONNECTION DETAIL 5

Scale: 1" = 1'-0" SA6.16 | SA6.16

1 NOTES:

1. The Contractor's Steel Detailer is responsible for determining the actual size of each connection plate based on the information provided in the Contract Drawings.
2. All bolted connections for horizontal and diagonal braces, as detailed on this sheet, shall be pretensioned.
3. After erection, touch-up paint the ends of all bolts/nuts/washers.
4. Batten plates and lacing on braces not shown for clarity.

12/6/24	1	Revised Details & Added Notes
DATE		REVISION

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE 4-30-26 EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BRACE TO BRACE CONNECTION DETAILS

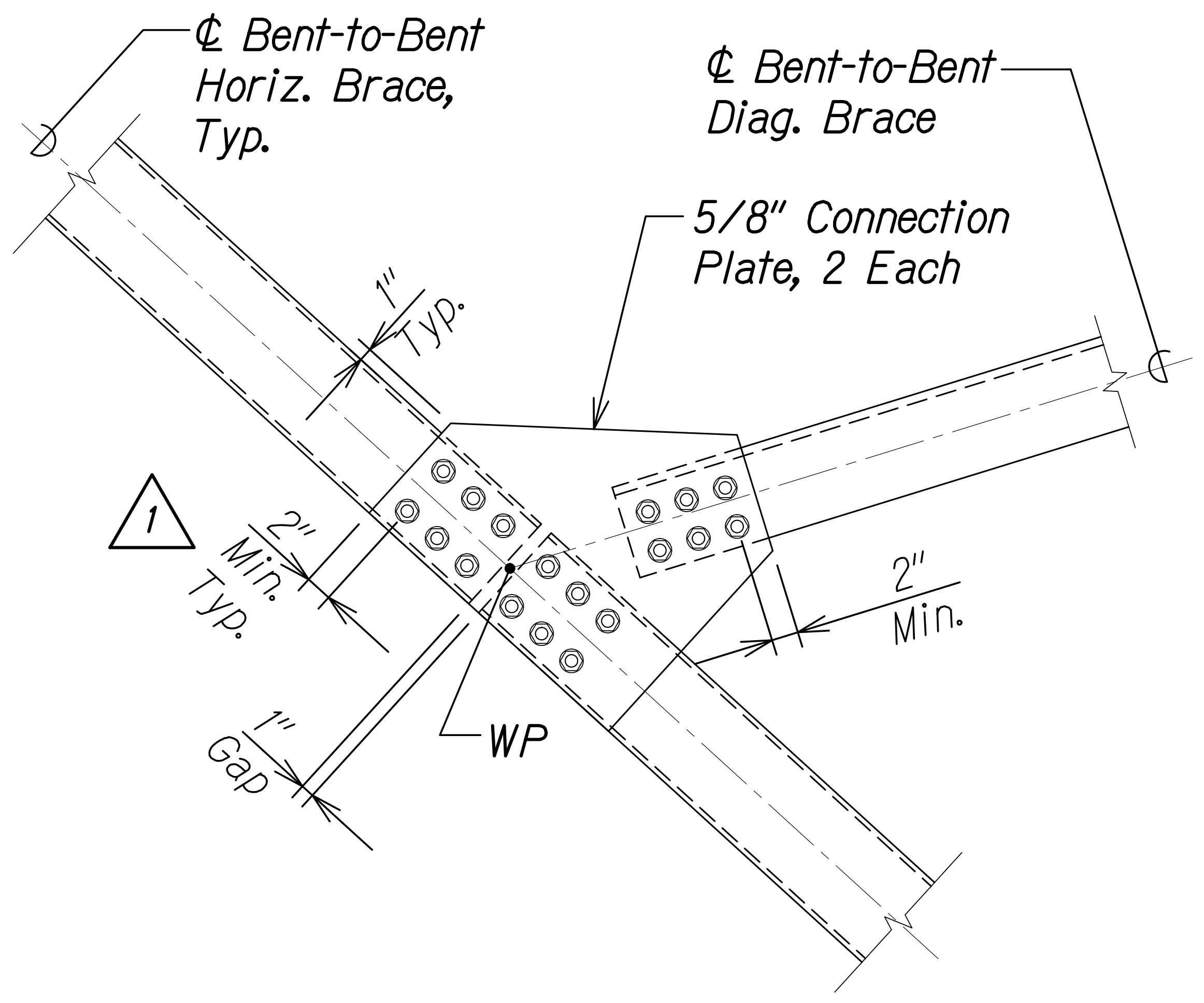
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA6.16 OF 22 SHEETS

ORIGINAL PLAN
SURVEY PLOTTED BY ____ DATE ____
DRAWN BY ____ "
TRACED BY ____ "
DESIGNED BY ____ "
QUANTITIES BY ____ "
CHECKED BY ____ "
NOTE BOOK
No. ____

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-05-24, 2:41 PM)

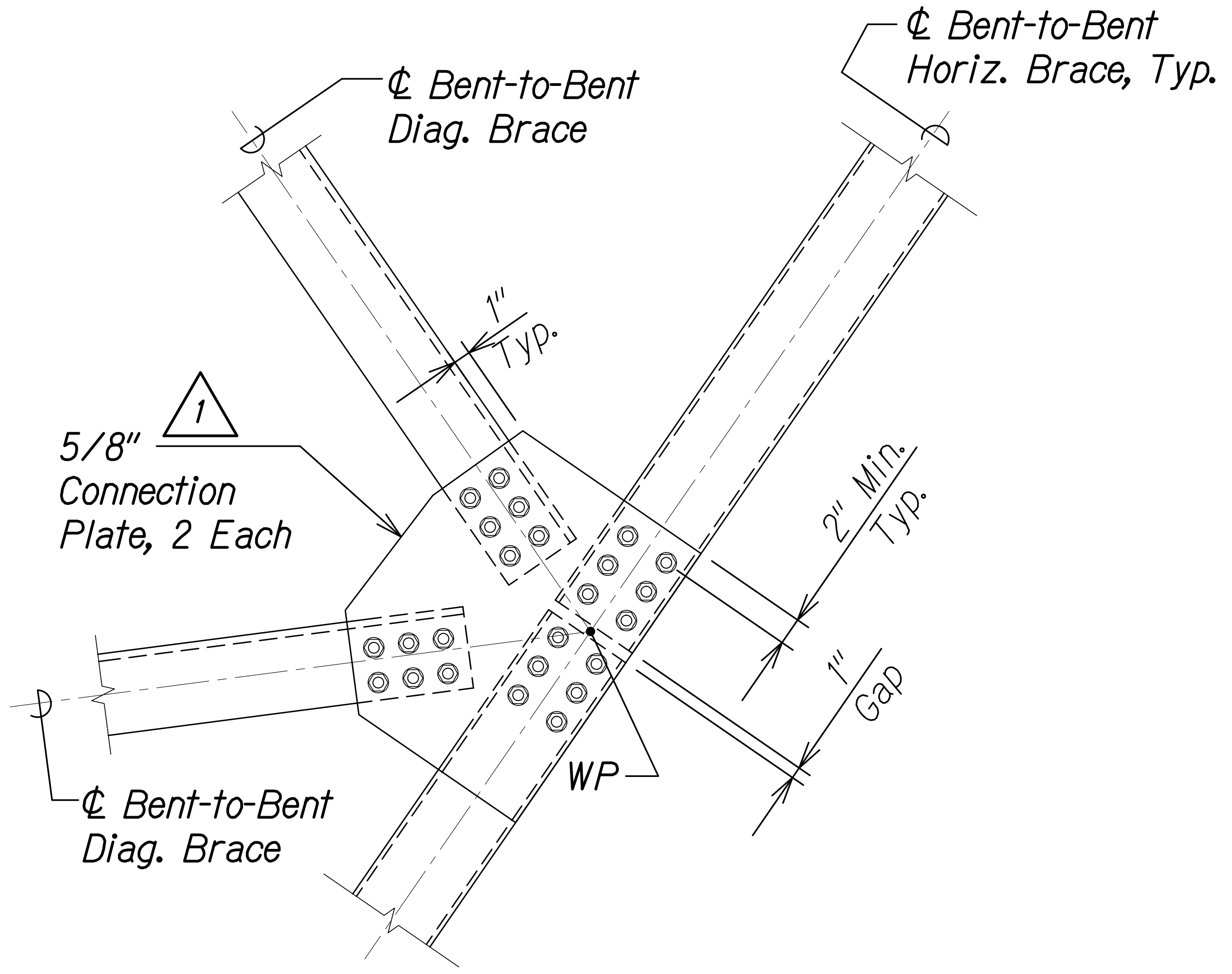
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 123	280



BRACE TO BRACE CONNECTION DETAIL 1

Scale: 1" = 1'-0"

SA6.17 | SA6.17



BRACE TO BRACE CONNECTION DETAIL 2

Scale: 1" = 1'-0"

SA6.17 | SA6.17

△1 *NOTES:*

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DATE		REVISION
12/6/24	1	Revised Details & Added Notes

STEPHEN T. PETERS
NO. 17097-S

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4-30-26
SIGNATURE
EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

BRACE TO BRACE CONNECTION DETAILS

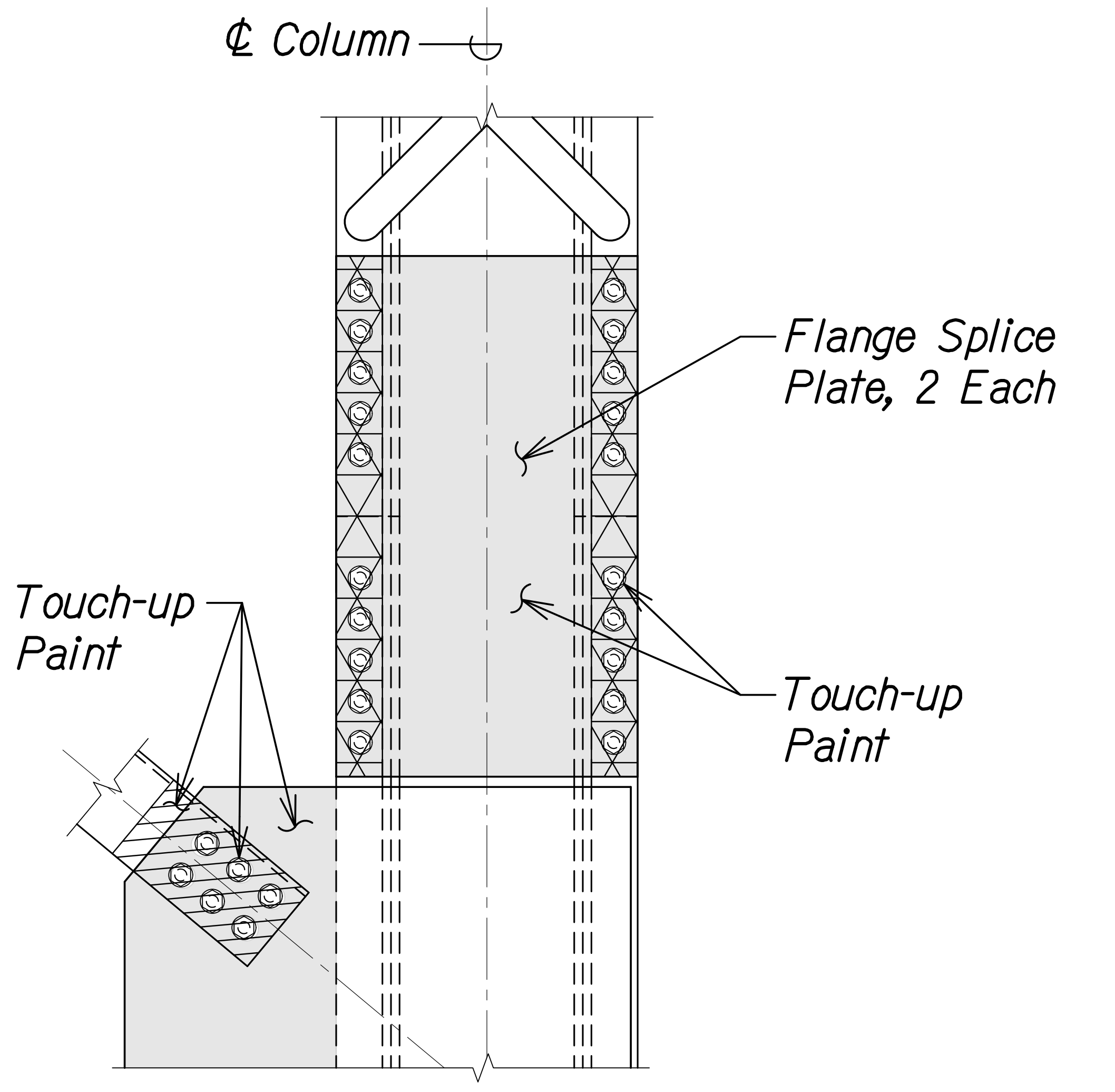
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted
Date: Oct. 2024

SHEET No. SA6.17 OF 22 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-05-24, 1:33 PM

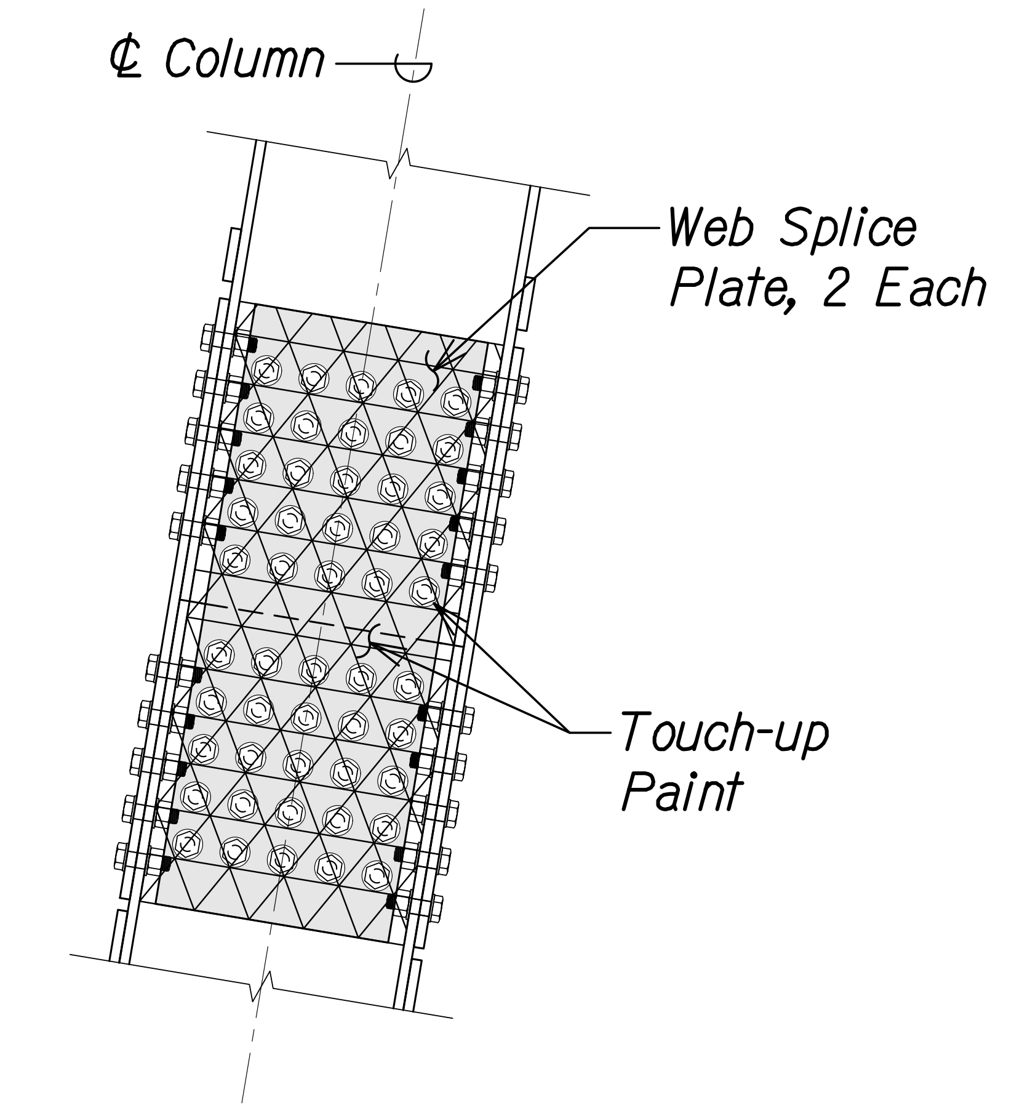
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 123S-1	280



COLUMN FLANGE SPLICE PAINT BLOCKING DETAIL

1 SA6.17A | SA6.7A

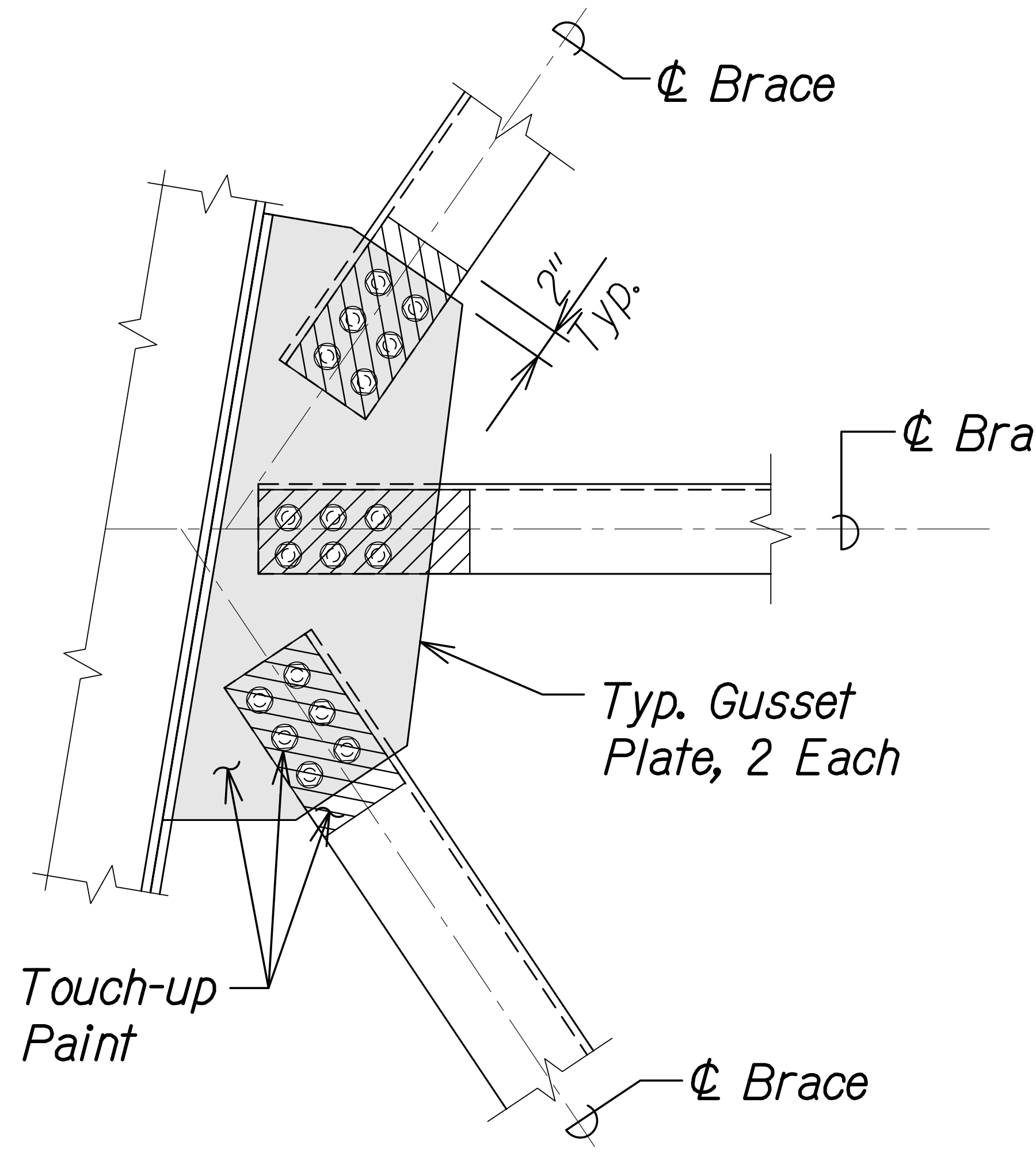
Scale: 1" = 1'-0"



COLUMN WEB SPLICE PAINT BLOCKING DETAIL

2 SA6.17A | SA6.7A

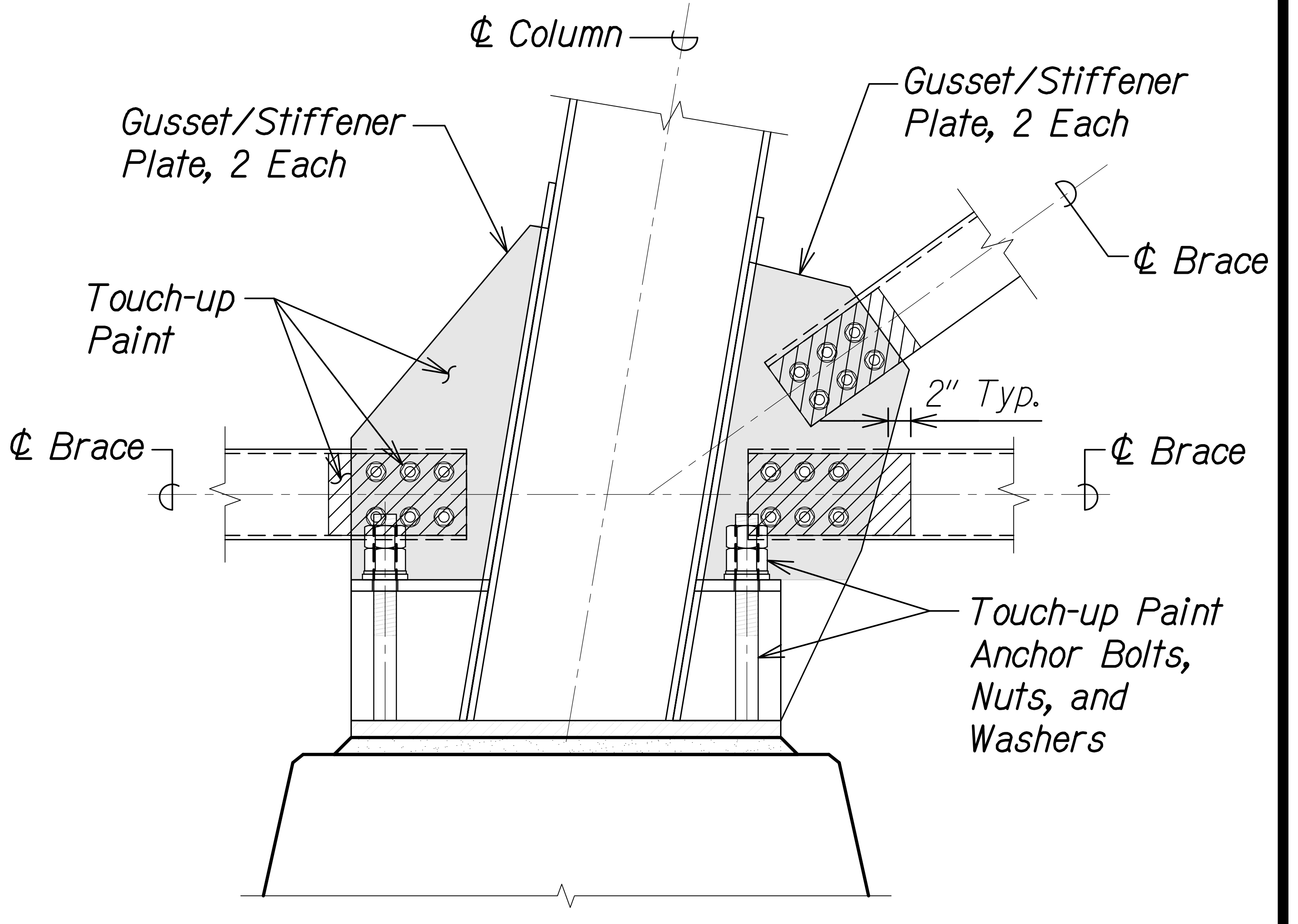
Scale: 1" = 1'-0"



TYP. GUSSET PLATE PAINT BLOCKING DETAIL

3 SA6.17A | SA6.7A

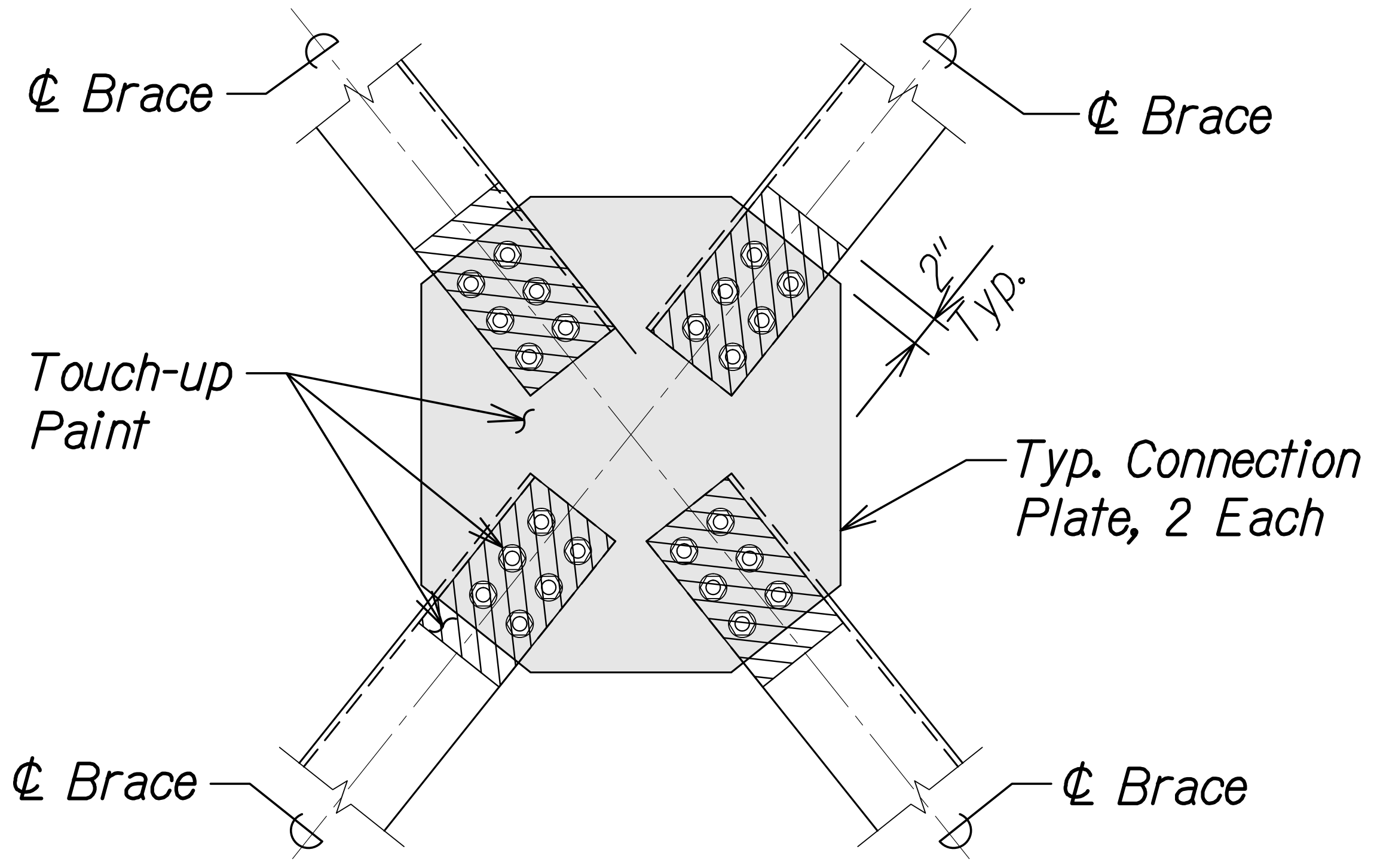
Scale: 1" = 1'-0"



BASE COLUMN GUSSET PLATE PAINT BLOCKING DETAIL

4 SA6.17A | SA6.17A

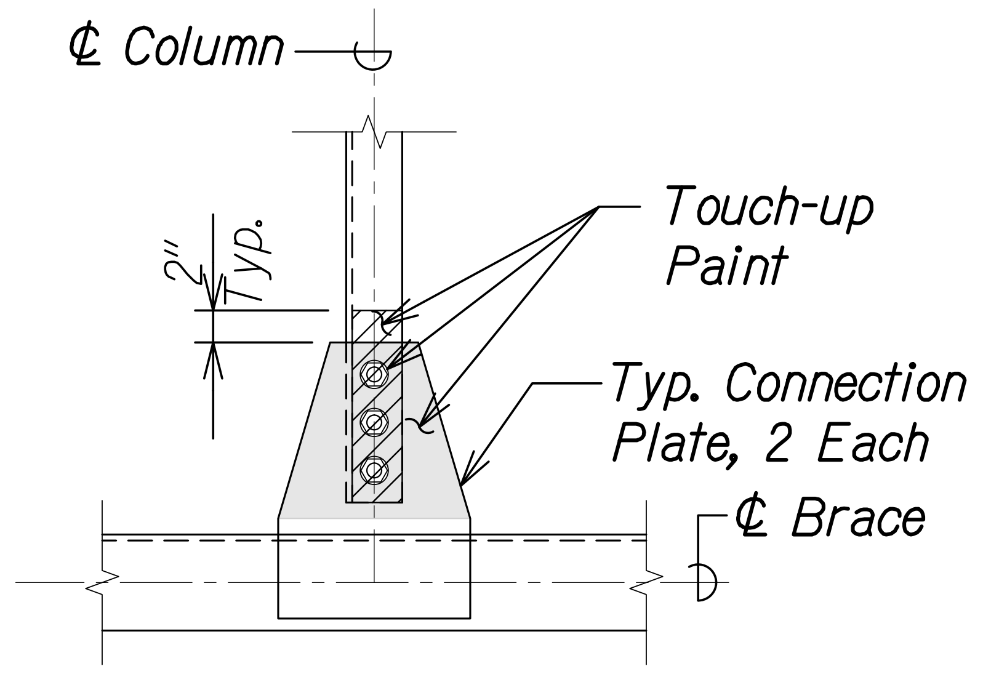
Scale: 1" = 1'-0"



TYP. CONNECTION PLATE PAINT BLOCKING DETAIL

5 SA6.17A | SA6.17A

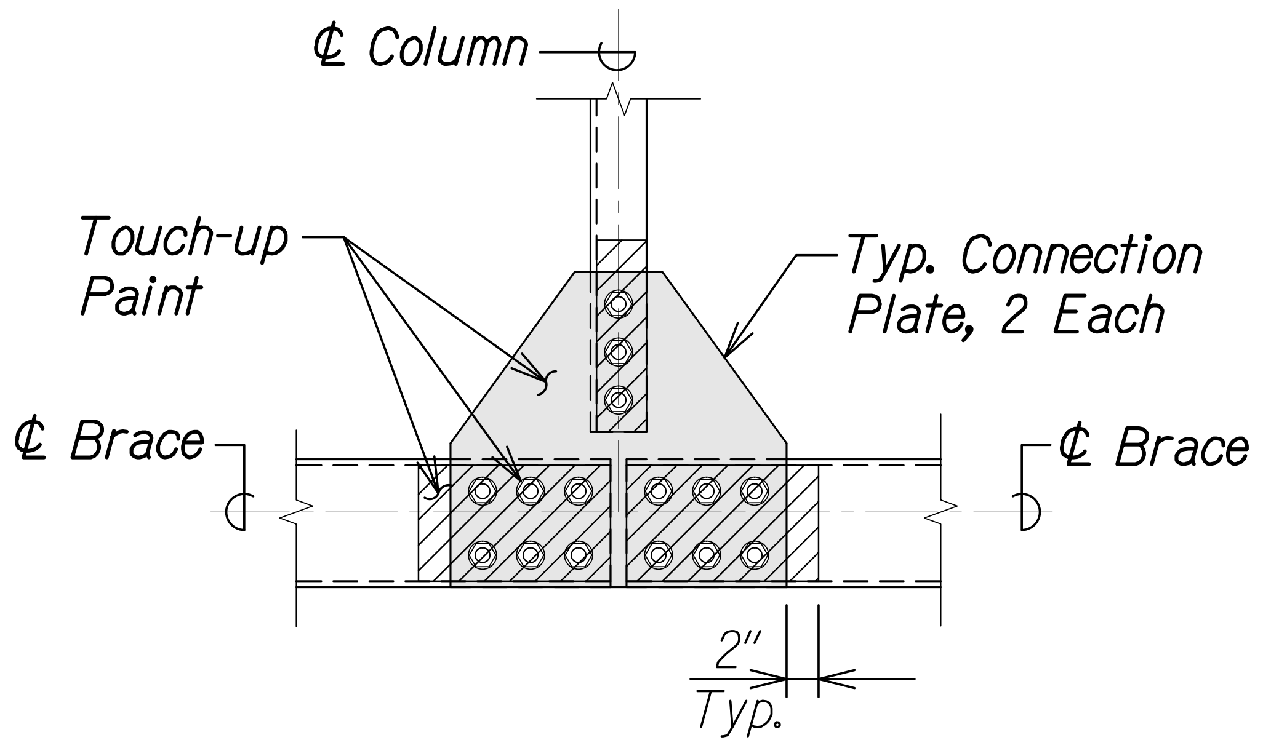
Scale: 1" = 1'-0"



CONNECTION PLATE PAINT BLOCKING DETAIL

6 SA6.17A | SA6.17A

Scale: 1" = 1'-0"



CONNECTION PLATE PAINT BLOCKING DETAIL

7 SA6.17A | SA6.17A

Scale: 1" = 1'-0"

PAINT BLOCKING LEGEND

░	Mask Outside Face of Splice/Gusset/Connection Plate Only. No Shop Application of Topcoat. Field Touch-up Paint Intermediate and Topcoat After Bolt Installation
▨	Mask Inside Face of Brace Only. No Shop Application of Topcoat. Field Touch-up Paint Intermediate and Topcoat After Bolt Installation
⊠	Mask Inside Face of Column Flange and Column Web Only. No Shop Application of Topcoat. Field Touch-up Paint Intermediate and Topcoat After Bolt Installation

NOTES:

1. Paint blocking details are typical for all bolted connections at bridge trestle.
2. See Special Provisions Section 667 - PREPARATION AND COATING OF GALVANIZED BRIDGE STEEL for requirements pertaining to touch-up painting of field bolted connections at trestles.
3. Work for touch-up painting of field bolted connections at trestles shall be covered under Pay Item 667.3000.

DATE	REVISION
12/6/24	1 New Sheet

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

PAINT BLOCKING DETAILS
AT BOLTED CONNECTIONS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA6.17A OF 22 SHEETS

ADD. 123S-1 1

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
	TRACED BY	"
NOTE BOOK	DESIGNED BY	"
	QUANTITIES BY	"
No.	CHECKED BY	"

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0602-SA0617 CONN DTLS ADD2.DWG PLOT TIME: 12-05-24, 2:05 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 124	280

CONNECTION REFERENCE SCHEDULE

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
BENT NO. 1	TP1A1-C	A/SA6.4	1/SA6.14
	TP1B1-C	B/SA6.4	2/SA6.14
	TP1C1-C	B/SA6.4	2/SA6.14 (OH)
	TP1D1-C	C/SA6.4	1/SA6.14 (OH)
	SP1B1-C2	-	1/SA6.15
	GP1A2-C	A/SA6.4	1/SA6.5
	GP1B2-C	B/SA6.4	2/SA6.5
	GP1C2-C	B/SA6.4	2/SA6.5 (OH)
	GP1D2-C	C/SA6.4	1/SA6.5 (OH)
	SP1B2-C3	-	2/SA6.15
	BP1A3-C	△1 A/SA6.10	1/SA6.11
	BP1B3-C	△1 B/SA6.10	2/SA6.11
	SP13	-	3/SA6.15
	BP1C3-C	△1 B/SA6.10	2/SA6.11 (OH)
	BP1D3-C	△1 C/SA6.10	1/SA6.11 (OH)
BENT NO. 2	TP2A1-C	D/SA6.2	1/SA6.14
	TP2B1-C	E/SA6.2	2/SA6.14
	TP2C1-C	E/SA6.2	2/SA6.14 (OH)
	TP2D1-C	F/SA6.2	1/SA6.14 (OH)
	SP2B1-C2	-	1/SA6.15
	GP2A2-C	A/SA6.4	1/SA6.5
	GP2B2-C	B/SA6.4	2/SA6.5
	GP2C2-C	B/SA6.4	2/SA6.5 (OH)
	GP2D2-C	C/SA6.4	1/SA6.5 (OH)
	SP2B2-C3	-	1/SA6.15
	GP2A3-C	D/SA6.2	△1 3/SA6.5
	GP2B3-C	E/SA6.2	△1 4/SA6.5
	GP2C3-C	E/SA6.2	△1 4/SA6.5 (OH)
	GP2D3-C	F/SA6.2	△1 3/SA6.5 (OH)
	SP2B3-C4	-	△1 2/SA6.15
	GP2A4-C	D/SA6.2	△1 3/SA6.5
	GP2B4-C	E/SA6.2	△1 4/SA6.5
	SP24	-	3/SA6.15
	GP2C4-C	E/SA6.2	△1 4/SA6.5 (OH)
	GP2D4-C	F/SA6.2	△1 3/SA6.5 (OH)
	SP2B4-C5	-	2/SA6.15

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
BENT NO. 2	BP2A5-C	A/SA6.10	3/SA6.11
	BP2B5-C	B/SA6.10	4/SA6.11
	SP25	-	3/SA6.15
	BP2C5-C	B/SA6.10	4/SA6.11 (OH)
	BP2D5-C	△1 C/SA6.10	3/SA6.11 (OH)
BENT NO. 3	TP3A1-C	A/SA6.2	1/SA6.14
	TP3B1-C	B/SA6.2	2/SA6.14
	TP3C1-C	B/SA6.2	2/SA6.14 (OH)
	TP3D1-C	C/SA6.2	1/SA6.14 (OH)
	SP3B1-C2	-	1/SA6.15
	GP3A2-C	A/SA6.4	1/SA6.5
	GP3B2-C	B/SA6.4	2/SA6.5
	GP3C2-C	B/SA6.4	2/SA6.5 (OH)
	GP3D2-C	C/SA6.4	1/SA6.5 (OH)
	SP3B2-C3	-	1/SA6.15
	GP3A3-C	A/SA6.4	△1 3/SA6.5
	GP3B3-C	B/SA6.4	△1 4/SA6.5
	GP3C3-C	B/SA6.4	△1 4/SA6.5 (OH)
	GP3D3-C	C/SA6.4	△1 3/SA6.5 (OH)
	SP3B3-C4	-	△1 2/SA6.15
	GP3A4-C	A/SA6.2	△1 3/SA6.5
	GP3B4-C	B/SA6.2	△1 4/SA6.5
	SP34	-	3/SA6.15
	GP3C4-C	B/SA6.2	△1 4/SA6.5 (OH)
	GP3D4-C	C/SA6.2	△1 3/SA6.5 (OH)
	SP3B4-C5	-	2/SA6.15
	GP3A5-C	A/SA6.2	△1 3/SA6.5
	GP3B5-C	B/SA6.2	△1 4/SA6.5
	SP35	-	3/SA6.15
	GP3C5-C	B/SA6.2	△1 4/SA6.5 (OH)
	GP3D5-C	C/SA6.2	△1 3/SA6.5 (OH)
	SP3B5-C6	-	2/SA6.15
	BP3A6-C	A/SA6.10 (OH)	1/SA6.12
	BP3B6-C	B/SA6.10 (OH)	2/SA6.12
	SP36	-	5/SA6.15
	BP3C6-C	B/SA6.10 (OH)	2/SA6.12 (OH)
	BP3D6-C	△1 C/SA6.10 (OH)	1/SA6.12 (OH)

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
BENT NO. 4	TP4A1-C	D/SA6.2	1/SA6.14
	TP4B1-C	E/SA6.2	2/SA6.14
	TP4C1-C	E/SA6.2	2/SA6.14 (OH)
	TP4D1-C	F/SA6.2	1/SA6.14 (OH)
	SP4B1-C2	-	1/SA6.15
	GP4A2-C	A/SA6.4	1/SA6.5
	GP4B2-C	B/SA6.4	2/SA6.5
	GP4C2-C	B/SA6.4	2/SA6.5 (OH)
	GP4D2-C	C/SA6.4	1/SA6.5 (OH)
	SP4B2-C3	-	1/SA6.15
	GP4A3-C	D/SA6.2	△1 3/SA6.5
	GP4B3-C	E/SA6.2	△1 4/SA6.5
	GP4C3-C	E/SA6.2	△1 4/SA6.5 (OH)
	GP4D3-C	F/SA6.2	△1 3/SA6.5 (OH)
	SP4B3-C4	-	2/SA6.15
	GP4A4-C	D/SA6.2	△1 3/SA6.5
	GP4B4-C	E/SA6.2	△1 4/SA6.5
	SP44	-	3/SA6.15
	GP4C4-C	E/SA6.2	△1 4/SA6.5 (OH)
	GP4D4-C	F/SA6.2	△1 3/SA6.5 (OH)
	SP4B4-C5	-	2/SA6.15
	GP4A5-C	D/SA6.2	△1 3/SA6.5
	GP4B5-C	E/SA6.2	△1 4/SA6.5
	SP45	-	3/SA6.15
	GP4C5-C	E/SA6.2	△1 4/SA6.5 (OH)
	GP4D5-C	F/SA6.2	△1 3/SA6.5 (OH)
	SP4B5-C6	-	2/SA6.15
	GP4A6-C	D/SA6.2	3/SA6.5
	GP4B6-C	E/SA6.2	4/SA6.5
	SP46	-	5/SA6.15
	GP4C6-C	E/SA6.2	4/SA6.5 (OH)
	GP4D6-C	F/SA6.2	3/SA6.5 (OH)
	SP4B6-C7	-	2/SA6.15
	BP4A7-C	A/SA6.10	3/SA6.11
	BP4B7-C	B/SA6.10	4/SA6.11
	SP47	-	5/SA6.15
	BP4C7-C	B/SA6.10	4/SA6.11 (OH)
	BP4D7-C	△1 C/SA6.10	3/SA6.11 (OH)

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
BENT NO. 5	TP5A1-C	A/SA6.2	1/SA6.14
	TP5B1-C	B/SA6.2	2/SA6.14
	TP5C1-C	B/SA6.2	2/SA6.14 (OH)
	TP5D1-C	C/SA6.2	1/SA6.14 (OH)
	SP5B1-C2	-	1/SA6.15
	GP5A2-C	A/SA6.4	1/SA6.5
	GP5B2-C	B/SA6.4	2/SA6.5
	GP5C2-C	B/SA6.4	2/SA6.5 (OH)
	GP5D2-C	C/SA6.4	1/SA6.5 (OH)
	SP5B2-C3	-	1/SA6.15
	GP5A3-C	A/SA6.2	△1 3/SA6.5
	GP5B3-C	B/SA6.2	△1 4/SA6.5
	GP5C3-C	B/SA6.2	△1 4/SA6.5 (OH)
	GP5D3-C	C/SA6.2	△1 3/SA6.5 (OH)
	SP5B3-C4	-	2/SA6.15
	GP5A4-C	A/SA6.2	△1 3/SA6.5
	GP5B4-C	B/SA6.2	△1 4/SA6.5
	SP54	-	3/SA6.15
	GP5C4-C	B/SA6.2	△1 4/SA6.5 (OH)
	GP5D4-C	C/SA6.2	△1 3/SA6.5 (OH)
	SP5B4-C5	-	2/SA6.15
	GP5A5-C	A/SA6.2	△1 3/SA6.5
	GP5B5-C	B/SA6.2	△1 4/SA6.5
	SP55	-	3/SA6.15
	GP5C5-C	B/SA6.2	△1 4/SA6.5 (OH)
	GP5D5-C	C/SA6.2	△1 3/SA6.5 (OH)
	SP5B5-C6	-	2/SA6.15

DATE	REVISION
12/6/24	△1 Revised Table Values

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

CONNECTION REFERENCE SCHEDULE

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA6.18 OF 22 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0618-SA0622 CON DTLS SCHD ADD2.DWG PLOT TIME: 12-03-24, 10:26 PM

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 125	280

CONNECTION REFERENCE SCHEDULE

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
BENT NO. 5	GP5A6-C	A/SA6.2	3/SA6.5
	GP5B6-C	B/SA6.2	4/SA6.5
	SP56	-	5/SA6.15
	GP5C6-C	B/SA6.2	4/SA6.5 (OH)
	GP5D6-C	C/SA6.2	3/SA6.5 (OH)
	GP5A7-C	A/SA6.2	3/SA6.5
	GP5B7-C	B/SA6.2	1/SA6.6
	SP5B7-C8	-	4/SA6.15
	GP5C7-C	B/SA6.2	1/SA6.6 (OH)
	GP5D7-C	C/SA6.2	3/SA6.5 (OH)
	BP5A8-C	A/SA6.10 (OH)	1/SA6.12
	BP5B8-C	B/SA6.10 (OH)	2/SA6.12
	SP58	-	5/SA6.15
	BP5C8-C	B/SA6.10 (OH)	2/SA6.12 (OH)
	BP5D8-C	△1 C/SA6.10 (OH)	1/SA6.12 (OH)
BENT NO. 6	TP6A1-C	D/SA6.2	1/SA6.14
	TP6B1-C	E/SA6.2	2/SA6.14
	TP6C1-C	E/SA6.2	2/SA6.14 (OH)
	TP6D1-C	F/SA6.2	1/SA6.14 (OH)
	SP6B1-C2	-	1/SA6.15
	GP6A2-C	A/SA6.4	1/SA6.5
	GP6B2-C	B/SA6.4	2/SA6.5
	GP6C2-C	B/SA6.4	2/SA6.5 (OH)
	GP6D2-C	C/SA6.4	1/SA6.5 (OH)
	SP6B2-C3	-	1/SA6.15
	GP6A3-C	D/SA6.2	△1 3/SA6.5
	GP6B3-C	E/SA6.2	△1 4/SA6.5
	GP6C3-C	E/SA6.2	△1 4/SA6.5 (OH)
	GP6D3-C	F/SA6.2	△1 3/SA6.5 (OH)
	SP6B3-C4	-	2/SA6.15
	GP6A4-C	D/SA6.2	△1 3/SA6.5
	GP6B4-C	E/SA6.2	△1 4/SA6.5
	SP64	-	3/SA6.15
	GP6C4-C	E/SA6.2	△1 4/SA6.5 (OH)
	GP6D4-C	F/SA6.2	△1 3/SA6.5 (OH)
	SP6B4-C5	-	2/SA6.15

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
BENT NO. 6	GP6A5-C	D/SA6.2	△1 3/SA6.5
	GP6B5-C	E/SA6.2	△1 4/SA6.5
	SP65	-	3/SA6.15
	GP6C5-C	E/SA6.2	△1 4/SA6.5 (OH)
	GP6D5-C	F/SA6.2	△1 3/SA6.5 (OH)
	SP6B5-C6	-	2/SA6.15
	GP6A6-C	D/SA6.2	3/SA6.5
	GP6B6-C	E/SA6.2	4/SA6.5
	SP66	-	5/SA6.15
	GP6C6-C	E/SA6.2	4/SA6.5 (OH)
	GP6D6-C	F/SA6.2	3/SA6.5 (OH)
	GP6A7-C	D/SA6.2	3/SA6.5
	GP6B7-C	E/SA6.2	1/SA6.6
	SP6B7-C8	-	4/SA6.15
	GP6C7-C	E/SA6.2	1/SA6.6 (OH)
	GP6D7-C	F/SA6.2	3/SA6.5 (OH)
	BP6A8-C	A/SA6.10	1/SA6.12
	BP6B8-C	B/SA6.10	2/SA6.12
	SP68	-	5/SA6.15
	BP6C8-C	B/SA6.10	2/SA6.12 (OH)
	BP6D8-C	△1 C/SA6.10	1/SA6.12 (OH)
BENT NO. 7	TP7A1-C	A/SA6.2	1/SA6.14
	TP7B1-C	B/SA6.2	2/SA6.14
	TP7C1-C	B/SA6.2	2/SA6.14 (OH)
	TP7D1-C	C/SA6.2	1/SA6.14 (OH)
	SP7B1-C2	-	1/SA6.15
	GP7A2-C	A/SA6.4	1/SA6.5
	GP7B2-C	B/SA6.4	2/SA6.5
	GP7C2-C	B/SA6.4	2/SA6.5 (OH)
	GP7D2-C	C/SA6.4	1/SA6.5 (OH)
	SP7B2-C3	-	1/SA6.15
	GP7A3-C	A/SA6.2	△1 3/SA6.5
	GP7B3-C	B/SA6.2	△1 4/SA6.5
	GP7C3-C	B/SA6.2	△1 4/SA6.5 (OH)
	GP7D3-C	C/SA6.2	△1 3/SA6.5 (OH)
	SP7B3-C4	-	2/SA6.15

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
BENT NO. 7	GP7A4-C	A/SA6.2	△1 3/SA6.5
	GP7B4-C	B/SA6.2	△1 4/SA6.5
	SP74	-	3/SA6.15
	GP7C4-C	B/SA6.2	△1 4/SA6.5 (OH)
	GP7D4-C	C/SA6.2	△1 3/SA6.5 (OH)
	SP7B4-C5	-	2/SA6.15
	GP7A5-C	A/SA6.2	△1 3/SA6.5
	GP7B5-C	B/SA6.2	△1 4/SA6.5
	SP75	-	3/SA6.15
	GP7C5-C	B/SA6.2	△1 4/SA6.5 (OH)
	GP7D5-C	C/SA6.2	△1 3/SA6.5 (OH)
	SP7B5-C6	-	2/SA6.15
	BP7A6-C	A/SA6.10 (OH)	3/SA6.11
	BP7B6-C	B/SA6.10 (OH)	4/SA6.11
	SP76	-	5/SA6.15
	BP7C6-C	B/SA6.10 (OH)	4/SA6.11 (OH)
	BP7D6-C	△1 C/SA6.10 (OH)	3/SA6.11 (OH)
BENT NO. 8	TP8A1-C	D/SA6.2	1/SA6.14
	TP8B1-C	E/SA6.2	2/SA6.14
	TP8C1-C	E/SA6.2	2/SA6.14 (OH)
	TP8D1-C	F/SA6.2	1/SA6.14 (OH)
	SP8B1-C2	-	1/SA6.15
	GP8A2-C	A/SA6.4	1/SA6.5
	GP8B2-C	B/SA6.4	2/SA6.5
	GP8C2-C	B/SA6.4	2/SA6.5 (OH)
	GP8D2-C	C/SA6.4	1/SA6.5 (OH)
	SP8B2-C3	-	1/SA6.15
	GP8A3-C	D/SA6.2	△1 3/SA6.5
	GP8B3-C	E/SA6.2	△1 4/SA6.5
	GP8C3-C	E/SA6.2	△1 4/SA6.5 (OH)
	GP8D3-C	F/SA6.2	△1 3/SA6.5 (OH)
	SP8B3-C4	-	2/SA6.15
	BP8A4-C	A/SA6.10	1/SA6.12
	BP8B4-C	B/SA6.10	2/SA6.12
	SP84	-	3/SA6.15
	BP8C4-C	B/SA6.10	2/SA6.12 (OH)
	BP8D4-C	△1 C/SA6.10	1/SA6.12 (OH)

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
BENT NO. 9	TP9A1-C	A/SA6.2	1/SA6.14
	TP9B1-C	B/SA6.2	2/SA6.14
	TP9C1-C	B/SA6.2	2/SA6.14 (OH)
	TP9D1-C	C/SA6.2	1/SA6.14 (OH)
	SP9B1-C2	-	1/SA6.15
	GP9A2-C	A/SA6.4	1/SA6.5
	GP9B2-C	B/SA6.4	2/SA6.5
	GP9C2-C	B/SA6.4	2/SA6.5 (OH)
	GP9D2-C	C/SA6.4	1/SA6.5 (OH)
	SP9B2-C3	-	1/SA6.15
	BP9A3-C	A/SA6.10 (OH)	3/SA6.11
	BP9B3-C	B/SA6.10 (OH)	4/SA6.11
	BP9C3-C	B/SA6.10 (OH)	4/SA6.11 (OH)
	BP9D3-C	△1 C/SA6.10 (OH)	3/SA6.11 (OH)

DATE	REVISION
12/6/24	△1 Revised Table Values

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

CONNECTION REFERENCE SCHEDULE

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA6.19 OF 22 SHEETS

ADD. 125

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0618-SA0622 CON DTLS SCHD ADD2.DWG PLOT TIME: 12-03-24, 10:27 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 126	280

CONNECTION REFERENCE SCHEDULE

TRESTLE NO. 1 - COL. LINE "A", "B", "C" AND "D"

CONNECTION ID	PLAN DETAILS	ELEV. DETAILS	
		UPSTREAM	DOWNSTREAM
TP1A1-B	A/SA6.4	6/SA6.14	5/SA6.14
BP1A3-B	△1 A/SA6.10	1/SA6.13	1/SA6.13
TP1B1-B	B/SA6.4	5/SA6.14	5/SA6.14
BP1B3-B	△1 B/SA6.10	1/SA6.13	1/SA6.13
TP1C1-B	B/SA6.4	5/SA6.14	5/SA6.14
BP1C3-B	△1 B/SA6.10	1/SA6.13	1/SA6.13
TP1D1-B	C/SA6.4	5/SA6.14	6/SA6.14
BP1D3-B	△1 C/SA6.10	1/SA6.13	1/SA6.13

TRESTLE NO. 2 - COLUMN LINE "A"

TP2A1-B	D/SA6.2	4/SA6.14	3/SA6.14
TP3A1-B	A/SA6.2	4/SA6.14 (OH)	3/SA6.14 (OH)
SP23A1-3	-	1/SA6.16	1/SA6.16
GP2A3-B	D/SA6.2	2/SA6.7	1/SA6.7
SP23A3	-	3/SA6.16	3/SA6.16
GP3A3-B	A/SA6.2	2/SA6.7 (OH)	1/SA6.7 (OH)
SP23A3-4	-	1/SA6.16	1/SA6.16
GP2A4-B	D/SA6.2	2/SA6.7	1/SA6.7
SP23A4	-	3/SA6.16	3/SA6.16
GP3A4-B	A/SA6.2	2/SA6.7 (OH)	1/SA6.7 (OH)
SP23A4-5	-	1/SA6.16	1/SA6.16
BP2A5-B	A/SA6.10	2/SA6.13 (OH)	2/SA6.13 (OH)
SP23A5	-	5/SA6.16	5/SA6.16
GP3A5-B	A/SA6.2	4/SA6.8	3/SA6.8
SP23A5-6	-	1/SA6.17	1/SA6.17
BP3A6-B	A/SA6.10 (OH)	3/SA6.13	3/SA6.13

TRESTLE NO. 2 - COL. LINE "B"

CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
TP2B1-B	E/SA6.2	3/SA6.14
TP3B1-B	B/SA6.2	3/SA6.14 (OH)
SP23B1-3	-	1/SA6.16
GP2B3-B	E/SA6.2	1/SA6.7
SP23B3	-	3/SA6.16
GP3B3-B	B/SA6.2	1/SA6.7 (OH)
SP23B3-4	-	1/SA6.16

TRESTLE NO. 2 - COLUMN LINE "B"

CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
GP2B4-B	E/SA6.2	1/SA6.7
SP23B4	-	3/SA6.16
GP3B4-B	B/SA6.2	1/SA6.7 (OH)
SP23B4-5	-	1/SA6.16
BP2B5-B	B/SA6.10	2/SA6.13 (OH)
SP23B5	-	5/SA6.16
GP3B5-B	B/SA6.2	3/SA6.8
SP23B5-6	-	1/SA6.17
BP3B6-B	B/SA6.10 (OH)	3/SA6.13

TRESTLE NO. 2 - COLUMN LINE "C"

TP2C1-B	E/SA6.2	3/SA6.14
TP3C1-B	B/SA6.2	3/SA6.14 (OH)
SP23C1-3	-	1/SA6.16
GP2C3-B	E/SA6.2	1/SA6.7
SP23C3	-	3/SA6.16
GP3C3-B	B/SA6.2	1/SA6.7 (OH)
SP23C3-4	-	1/SA6.16
GP2C4-B	E/SA6.2	1/SA6.7
SP23C4	-	3/SA6.16
GP3C4-B	B/SA6.2	1/SA6.7 (OH)
SP23C4-5	-	1/SA6.16
BP2C5-B	B/SA6.10	2/SA6.13 (OH)
SP23C5	-	5/SA6.16
GP3C5-B	B/SA6.2	3/SA6.8
SP23C5-6	-	1/SA6.17
BP3C6-B	B/SA6.10 (OH)	3/SA6.13

TRESTLE NO. 2 - COL. LINE "D"

CONNECTION ID	PLAN DETAILS	ELEV. DETAILS	
		UPSTREAM	DOWNSTREAM
TP2D1-B	F/SA6.2	3/SA6.14	4/SA6.14
TP3D1-B	C/SA6.2	3/SA6.14 (OH)	4/SA6.14 (OH)
SP23D1-3	-	1/SA6.16	1/SA6.16
GP2D3-B	F/SA6.2	1/SA6.7	2/SA6.7
SP23D3	-	3/SA6.16	3/SA6.16
GP3D3-B	C/SA6.2	1/SA6.7 (OH)	2/SA6.7 (OH)
SP23D3-4	-	1/SA6.16	1/SA6.16

TRESTLE NO. 2 - COLUMN LINE "D"

CONNECTION ID	PLAN DETAILS	ELEV. DETAILS	
		UPSTREAM	DOWNSTREAM
GP2D4-B	F/SA6.2	1/SA6.7	2/SA6.7
SP23D4	-	3/SA6.16	3/SA6.16
GP3D4-B	C/SA6.2	1/SA6.7 (OH)	2/SA6.7 (OH)
SP23D4-5	-	1/SA6.16	1/SA6.16
BP2D5-B	△1 C/SA6.10	2/SA6.13 (OH)	2/SA6.13 (OH)
SP23D5	-	5/SA6.16	5/SA6.16
GP3D5-B	C/SA6.2	3/SA6.8	4/SA6.8
SP23D5-6	-	1/SA6.17	1/SA6.17
BP3D6-B	△1 C/SA6.10 (OH)	3/SA6.13	3/SA6.13

TRESTLE NO. 3 - COLUMN LINE "A"

TP4A1-B	D/SA6.2	4/SA6.14	3/SA6.14
TP5A1-B	A/SA6.2	4/SA6.14 (OH)	3/SA6.14 (OH)
SP45A1-3	-	1/SA6.16	1/SA6.16
GP4A3-B	D/SA6.2	2/SA6.7	1/SA6.7
SP45A3	-	3/SA6.16	3/SA6.16
GP5A3-B	A/SA6.2	2/SA6.7 (OH)	1/SA6.7 (OH)
SP45A3-4	-	1/SA6.16	1/SA6.16
GP4A4-B	D/SA6.2	2/SA6.7	1/SA6.7
SP45A4	-	3/SA6.16	3/SA6.16
GP5A4-B	A/SA6.2	2/SA6.7 (OH)	1/SA6.7 (OH)
SP45A4-5	-	1/SA6.16	1/SA6.16
GP4A5-B	D/SA6.2	2/SA6.7	1/SA6.7
SP45A5	-	3/SA6.16	3/SA6.16
GP5A5-B	A/SA6.2	2/SA6.7 (OH)	1/SA6.7 (OH)
SP45A5-6	-	1/SA6.16	1/SA6.16
GP4A6-B	D/SA6.2	2/SA6.7	1/SA6.7
SP45A6	-	3/SA6.16	3/SA6.16
GP5A6-B	A/SA6.2	2/SA6.7 (OH)	1/SA6.7 (OH)
SP45A6-7	-	1/SA6.16	1/SA6.16
BP4A7-B	A/SA6.10	2/SA6.13 (OH)	2/SA6.13 (OH)
SP45A7	-	2/SA6.16	2/SA6.16
GP5A7-B	A/SA6.2	2/SA6.8	1/SA6.8
SP45A7-8	-	4/SA6.16	4/SA6.16
BP5A8-B	A/SA6.10 (OH)	3/SA6.13	3/SA6.13

TRESTLE NO. 3 - COLUMN LINE "B"

CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
TP4B1-B	E/SA6.2	3/SA6.14
TP5B1-B	B/SA6.2	3/SA6.14 (OH)
SP45B1-3	-	1/SA6.16
GP4B3-B	E/SA6.2	1/SA6.7
SP45B3	-	3/SA6.16
GP5B3-B	B/SA6.2	1/SA6.7 (OH)
SP45B3-4	-	1/SA6.16
GP4B4-B	E/SA6.2	1/SA6.7
SP45B4	-	3/SA6.16
GP5B4-B	B/SA6.2	1/SA6.7 (OH)
SP45B4-5	-	1/SA6.16
GP4B5-B	E/SA6.2	1/SA6.7
SP45B5	-	3/SA6.16
GP5B5-B	B/SA6.2	1/SA6.7 (OH)
SP45B5-6	-	1/SA6.16
GP4B6-B	E/SA6.2	1/SA6.7
SP45B6	-	3/SA6.16
GP5B6-B	B/SA6.2	1/SA6.7 (OH)
SP45B6-7	-	1/SA6.16
BP4B7-B	B/SA6.10	2/SA6.13 (OH)
SP45B7	-	△1 2/SA6.16
GP5B7-B	B/SA6.2	1/SA6.8
SP45B7-8	-	4/SA6.16
BP5B8-B	B/SA6.10 (OH)	3/SA6.13

12/6/24	△1 Revised Table Values
DATE	REVISION

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

CONNECTION REFERENCE SCHEDULE

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No SA6.20 OF 22 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY ____ DATE
DRAWN BY ____ "
TRACED BY ____ "
DESIGNED BY ____ "
QUANTITIES BY ____ "
CHECKED BY ____ "

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0618-SA0622 CON DTLS SCHD ADD2.DWG PLOT TIME: 12-03-24, 10:28 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 127	280

CONNECTION REFERENCE SCHEDULE

TRESTLE NO. 3 - COLUMN LINE "C"

CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
TP4C1-B	E/SA6.2	3/SA6.14
TP5C1-B	B/SA6.2	3/SA6.14 (OH)
SP45C1-3	-	1/SA6.16
GP4C3-B	E/SA6.2	1/SA6.7
SP45C3	-	3/SA6.16
GP5C3-B	B/SA6.2	1/SA6.7 (OH)
SP45C3-4	-	1/SA6.16
GP4C4-B	E/SA6.2	1/SA6.7
SP45C4	-	3/SA6.16
GP5C4-B	B/SA6.2	1/SA6.7 (OH)
SP45C4-5	-	1/SA6.16
GP4C5-B	E/SA6.2	1/SA6.7
SP45C5	-	3/SA6.16
GP5C5-B	B/SA6.2	1/SA6.7 (OH)
SP45C5-6	-	1/SA6.16
GP4C6-B	E/SA6.2	1/SA6.7
SP45C6	-	3/SA6.16
GP5C6-B	B/SA6.2	1/SA6.7 (OH)
SP45C6-7	-	1/SA6.16
BP4C7-B	B/SA6.10	2/SA6.13 (OH)
SP45C7	-	2/SA6.16
GP5C7-B	B/SA6.2	1/SA6.8
SP45C7-8	-	4/SA6.16
BP5C8-B	B/SA6.10 (OH)	3/SA6.13

TRESTLE NO. 3 - COLUMN LINE "D"

CONNECTION ID	PLAN DETAILS	ELEV. DETAILS	
		UPSTREAM	DOWNSTREAM
TP4D1-B	F/SA6.2	3/SA6.14	4/SA6.14
TP5D1-B	C/SA6.2	3/SA6.14 (OH)	4/SA6.14 (OH)
SP45D1-3	-	1/SA6.16	1/SA6.16
GP4D3-B	F/SA6.2	1/SA6.7	2/SA6.7
SP45D3	-	3/SA6.16	3/SA6.16
GP5D3-B	C/SA6.2	1/SA6.7 (OH)	2/SA6.7 (OH)
SP45D3-4	-	1/SA6.16	1/SA6.16
GP4D4-B	F/SA6.2	1/SA6.7	2/SA6.7
SP45D4	-	3/SA6.16	3/SA6.16
GP5D4-B	C/SA6.2	1/SA6.7 (OH)	2/SA6.7 (OH)
SP45D4-5	-	1/SA6.16	1/SA6.16
GP4D5-B	F/SA6.2	1/SA6.7	2/SA6.7
SP45D5	-	3/SA6.16	3/SA6.16
GP5D5-B	C/SA6.2	1/SA6.7 (OH)	2/SA6.7 (OH)
SP45D5-6	-	1/SA6.16	1/SA6.16
GP4D6-B	F/SA6.2	1/SA6.7	2/SA6.7
SP45D6	-	3/SA6.16	3/SA6.16
GP5D6-B	C/SA6.2	1/SA6.7 (OH)	2/SA6.7 (OH)
SP45D6-7	-	1/SA6.16	1/SA6.16
BP4D7-B	△1 C/SA6.10	2/SA6.13 (OH)	2/SA6.13 (OH)
SP45D7	-	2/SA6.16	2/SA6.16
GP5D7-B	C/SA6.2	1/SA6.8	2/SA6.8
SP45D7-8	-	4/SA6.16	4/SA6.16
BP5D8-B	△1 C/SA6.10 (OH)	3/SA6.13	3/SA6.13

TRESTLE NO. 4 - COLUMN LINE "A"

CONNECTION ID	PLAN DETAILS	ELEV. DETAILS	
		UPSTREAM	DOWNSTREAM
TP6A1-B	D/SA6.2	4/SA6.14	3/SA6.14
TP7A1-B	A/SA6.2	4/SA6.14 (OH)	3/SA6.14 (OH)
SP67A1-3	-	1/SA6.16	1/SA6.16
GP6A3-B	D/SA6.2	2/SA6.7	1/SA6.7
SP67A3	-	3/SA6.16	3/SA6.16
GP7A3-B	A/SA6.2	2/SA6.7 (OH)	1/SA6.7 (OH)
SP67A3-4	-	1/SA6.16	1/SA6.16
GP6A4-B	D/SA6.2	2/SA6.7	1/SA6.7
SP67A4	-	3/SA6.16	3/SA6.16
GP7A4-B	A/SA6.2	2/SA6.7 (OH)	1/SA6.7 (OH)
SP67A4-5	-	1/SA6.16	1/SA6.16
GP6A5-B	D/SA6.2	2/SA6.7	1/SA6.7
SP67A5	-	3/SA6.16	3/SA6.16
GP7A5-B	A/SA6.2	2/SA6.7 (OH)	1/SA6.7 (OH)
SP67A5-6	-	1/SA6.16	1/SA6.16
GP6A6-B	D/SA6.2	2/SA6.7	1/SA6.7
SP67A6	-	3/SA6.16	3/SA6.16
BP7A6-B	A/SA6.10 (OH)	2/SA6.13	2/SA6.13
GP6A7-B	D/SA6.2	2/SA6.9	1/SA6.9
SP67A6-7	-	2/SA6.17	2/SA6.17
BP6A8-B	A/SA6.10	3/SA6.13 (OH)	3/SA6.13 (OH)

TRESTLE NO. 4 - COLUMN LINE "B"

CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
TP6B1-B	E/SA6.2	3/SA6.14
TP7B1-B	B/SA6.2	3/SA6.14 (OH)
SP67B1-3	-	1/SA6.16
GP6B3-B	E/SA6.2	1/SA6.7
SP67B3	-	3/SA6.16
GP7B3-B	B/SA6.2	1/SA6.7 (OH)
SP67B3-4	-	1/SA6.16
GP6B4-B	E/SA6.2	1/SA6.7
SP67B4	-	3/SA6.16
GP7B4-B	B/SA6.2	1/SA6.7 (OH)
SP67B4-5	-	1/SA6.16
GP6B5-B	E/SA6.2	1/SA6.7
SP67B5	-	3/SA6.16
GP7B5-B	B/SA6.2	1/SA6.7 (OH)
SP67B5-6	-	1/SA6.16
GP6B6-B	E/SA6.2	1/SA6.7
SP67B6	-	3/SA6.16
BP7B6-B	B/SA6.10 (OH)	2/SA6.13
GP6B7-B	E/SA6.2	1/SA6.9
SP67B6-7	-	2/SA6.17
BP6B8-B	B/SA6.10	3/SA6.13 (OH)

DATE	REVISION
12/6/24	△1 Revised Table Values

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE   EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

CONNECTION REFERENCE SCHEDULE

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted   Date: Oct. 2024

SHEET No. SA6.21 OF 22 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0618-SA0622 CON DTLS SCHD ADD2.DWG   PLOT TIME: 12-03-24, 10:28 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 128	280

CONNECTION REFERENCE SCHEDULE

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
TRESTLE NO. 4 - COLUMN LINE "C"	TP6C1-B	E/SA6.2	3/SA6.14
	TP7C1-B	B/SA6.2	3/SA6.14 (OH)
	SP67C1-3	-	1/SA6.16
	GP6C3-B	E/SA6.2	1/SA6.7
	SP67C3	-	3/SA6.16
	GP7C3-B	B/SA6.2	1/SA6.7 (OH)
	SP67C3-4	-	1/SA6.16
	GP6C4-B	E/SA6.2	1/SA6.7
	SP67C4	-	3/SA6.16
	GP7C4-B	B/SA6.2	1/SA6.7 (OH)
	SP67C4-5	-	1/SA6.16
	GP6C5-B	E/SA6.2	1/SA6.7
	SP67C5	-	3/SA6.16
	GP7C5-B	B/SA6.2	1/SA6.7 (OH)
	SP67C5-6	-	1/SA6.16
	GP6C6-B	E/SA6.2	1/SA6.7
	SP67C6	-	3/SA6.16
	BP7C6-B	B/SA6.10 (OH)	2/SA6.13
	GP6C7-B	E/SA6.2	1/SA6.9
	SP67C6-7	-	2/SA6.17
	BP6C8-B	B/SA6.10	3/SA6.13 (OH)

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS	
			UPSTREAM	DOWNSTREAM
TRESTLE NO. 4 - COLUMN LINE "D"	TP6D1-B	F/SA6.2	3/SA6.14	4/SA6.14
	TP7D1-B	C/SA6.2	3/SA6.14 (OH)	4/SA6.14 (OH)
	SP67D1-3	-	1/SA6.16	1/SA6.16
	GP6D3-B	F/SA6.2	1/SA6.7	2/SA6.7
	SP67D3	-	3/SA6.16	3/SA6.16
	GP7D3-B	C/SA6.2	1/SA6.7 (OH)	2/SA6.7 (OH)
	SP67D3-4	-	1/SA6.16	1/SA6.16
	GP6D4-B	F/SA6.2	1/SA6.7	2/SA6.7
	SP67D4	-	3/SA6.16	3/SA6.16
	GP7D4-B	C/SA6.2	1/SA6.7 (OH)	2/SA6.7 (OH)
	SP67D4-5	-	1/SA6.16	1/SA6.16
	GP6D5-B	F/SA6.2	1/SA6.7	2/SA6.7
	SP67D5	-	3/SA6.16	3/SA6.16
	GP7D5-B	C/SA6.2	1/SA6.7 (OH)	2/SA6.7 (OH)
	SP67D5-6	-	1/SA6.16	1/SA6.16
	GP6D6-B	F/SA6.2	1/SA6.7	2/SA6.7
	SP67D6	-	3/SA6.16	3/SA6.16
	BP7D6-B	△1 C/SA6.10 (OH)	2/SA6.13	2/SA6.13
	GP6D7-B	F/SA6.2	1/SA6.9	2/SA6.9
	SP67D6-7	-	2/SA6.17	2/SA6.17
	BP6D8-B	△1 C/SA6.10	3/SA6.13 (OH)	3/SA6.13 (OH)

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS	
			UPSTREAM	DOWNSTREAM
TRESTLE NO. 5 - COLUMN LINE "A"	TP8A1-B	D/SA6.2	4/SA6.14	3/SA6.14
	TP9A1-B	A/SA6.2	4/SA6.14 (OH)	3/SA6.14 (OH)
	SP89A1-3	-	1/SA6.16	1/SA6.16
	GP8A3-B	D/SA6.2	2/SA6.8 (OH)	1/SA6.8 (OH)
	SP89A3	-	△1 2/SA6.16 (OH)	△1 2/SA6.16 (OH)
	BP9A3-B	A/SA6.10 (OH)	2/SA6.13	2/SA6.13
	SP89A3-4	-	4/SA6.16 (OH)	4/SA6.16 (OH)
	BP8A4-B	A/SA6.10	3/SA6.13 (OH)	3/SA6.13 (OH)

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
TRESTLE NO. 5 - COLUMN LINE "B"	TP8B1-B	E/SA6.2	3/SA6.14
	TP9B1-B	B/SA6.2	3/SA6.14 (OH)
	SP89B1-3	-	1/SA6.16
	GP8B3-B	E/SA6.2	1/SA6.8 (OH)
	SP89B3	-	△1 2/SA6.16 (OH)
	BP9B3-B	B/SA6.10 (OH)	2/SA6.13
	SP89B3-4	-	4/SA6.16 (OH)
	BP8B4-B	B/SA6.10	3/SA6.13 (OH)

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS
TRESTLE NO. 5 - COLUMN LINE "C"	TP8C1-B	E/SA6.2	3/SA6.14
	TP9C1-B	B/SA6.2	3/SA6.14 (OH)
	SP89C1-3	-	1/SA6.16
	GP8C3-B	E/SA6.2	1/SA6.8 (OH)
	SP89C3	-	△1 2/SA6.16 (OH)
	BP9C3-B	B/SA6.10 (OH)	2/SA6.13
	SP89C3-4	-	4/SA6.16 (OH)
	BP8C4-B	B/SA6.10	3/SA6.13 (OH)

	CONNECTION ID	PLAN DETAILS	ELEV. DETAILS	
			UPSTREAM	DOWNSTREAM
TRESTLE NO. 5 - COLUMN LINE "D"	TP8D1-B	F/SA6.2	3/SA6.14	4/SA6.14
	TP9D1-B	C/SA6.2	3/SA6.14 (OH)	4/SA6.14 (OH)
	SP89D1-3	-	1/SA6.16	1/SA6.16
	GP8D3-B	F/SA6.2	1/SA6.8 (OH)	2/SA6.8 (OH)
	SP89D3	-	△1 2/SA6.16 (OH)	△1 2/SA6.16 (OH)
	BP9D3-B	△1 C/SA6.10 (OH)	2/SA6.13	2/SA6.13
	SP89D3-4	-	4/SA6.16 (OH)	4/SA6.16 (OH)
	BP8D4-B	△1 C/SA6.10	3/SA6.13 (OH)	3/SA6.13 (OH)

ORIGINAL PLAN	
	SURVEY PLOTTED BY ______ DATE ______
NOTE BOOK	DRAWN BY ______ " ______
	TRACED BY ______ " ______
	DESIGNED BY ______ " ______
No. ______	QUANTITIES BY ______ " ______
	CHECKED BY ______ " ______

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0618-SA0622 CON DTLS SCHD ADD2.DWG PLOT TIME: 12-03-24, 10:29 PM)

12/6/24	△1 Revised Table Values
DATE	REVISION

STEPHEN T. PETERS
NO. 17097-S

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

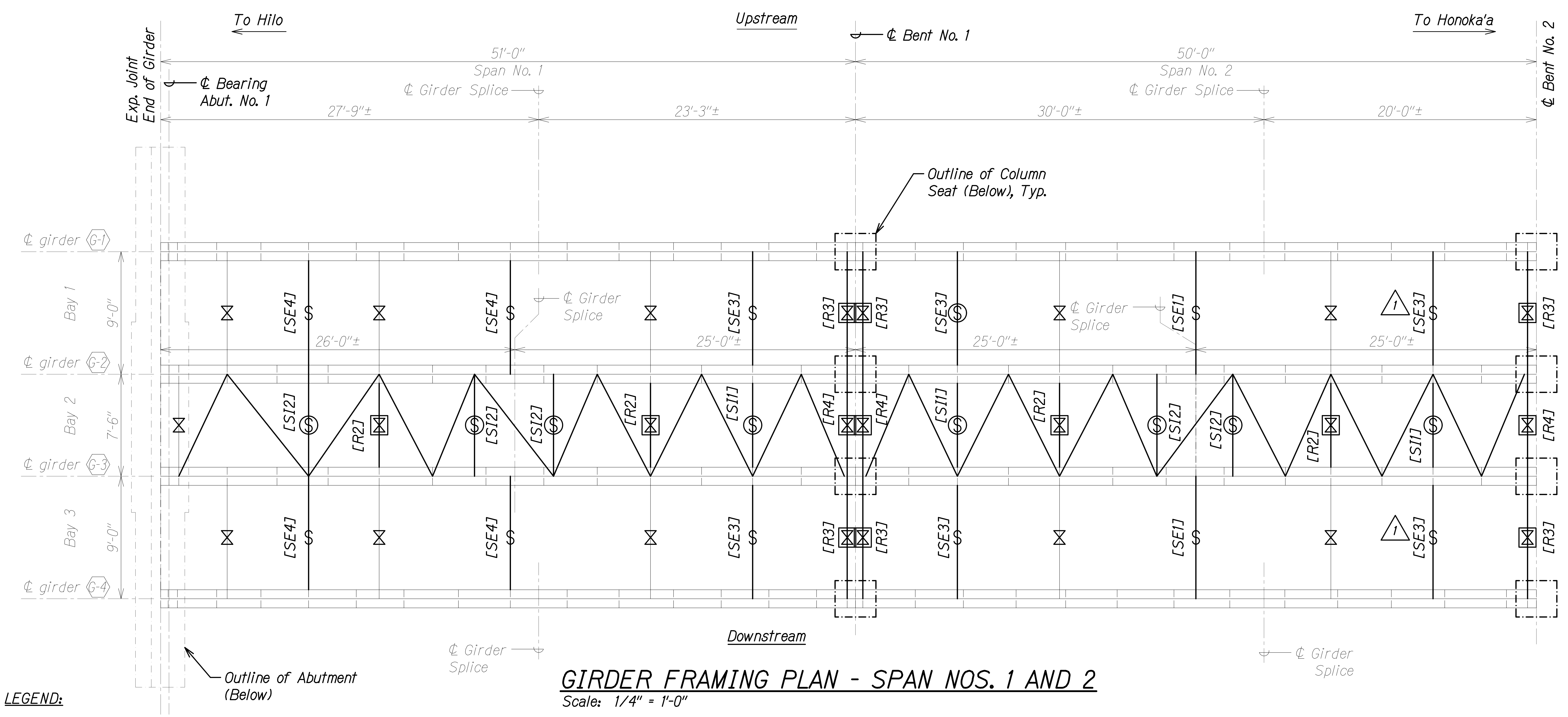
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

CONNECTION REFERENCE SCHEDULE

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No SA6.22 OF 22 SHEETS

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 165	280



GIRDER FRAMING PLAN - SPAN NOS. 1 AND 2

Scale: 1/4" = 1'-0"

LEGEND:

⧖	Exist. Cross Frame to Remain
⊠	Exist. Cross Frame to be Removed and Replaced
$	Exist. Strut to be Removed and Replaced
Ⓢ	New Strut
∧	New Lateral Diagonal Bracing at Bottom Flange, See Sheet SA10.21 through SA10.24
[ ]	Cross Frame or Strut Mark, See Table

NOTES:

1. Cross Frames, Struts, Stiffeners and Lateral Bracing locations to be verified by Contractor.
2. Provided dimensions are based on As-Built plans.

INSTALLATION OF MEMBERS AND CONNECTIONS

MARK	REFERENCE	MARK	REFERENCE
SE1	Section A / SA10.12	R3	Section C / SA10.14
SE3	Section C / SA10.12	R4	Section D / SA10.14
SE4	Section D / SA10.12	-	-
SI1	Section A / SA10.13	-	-
SI2	Section B / SA10.13	-	-
R2	Section B / SA10.14	-	-

DATE		REVISION
12/6/24	1	Revised Callouts

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

Stephen Peters
4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER FRAMING PLAN -
SPAN NOS. 1 AND 2

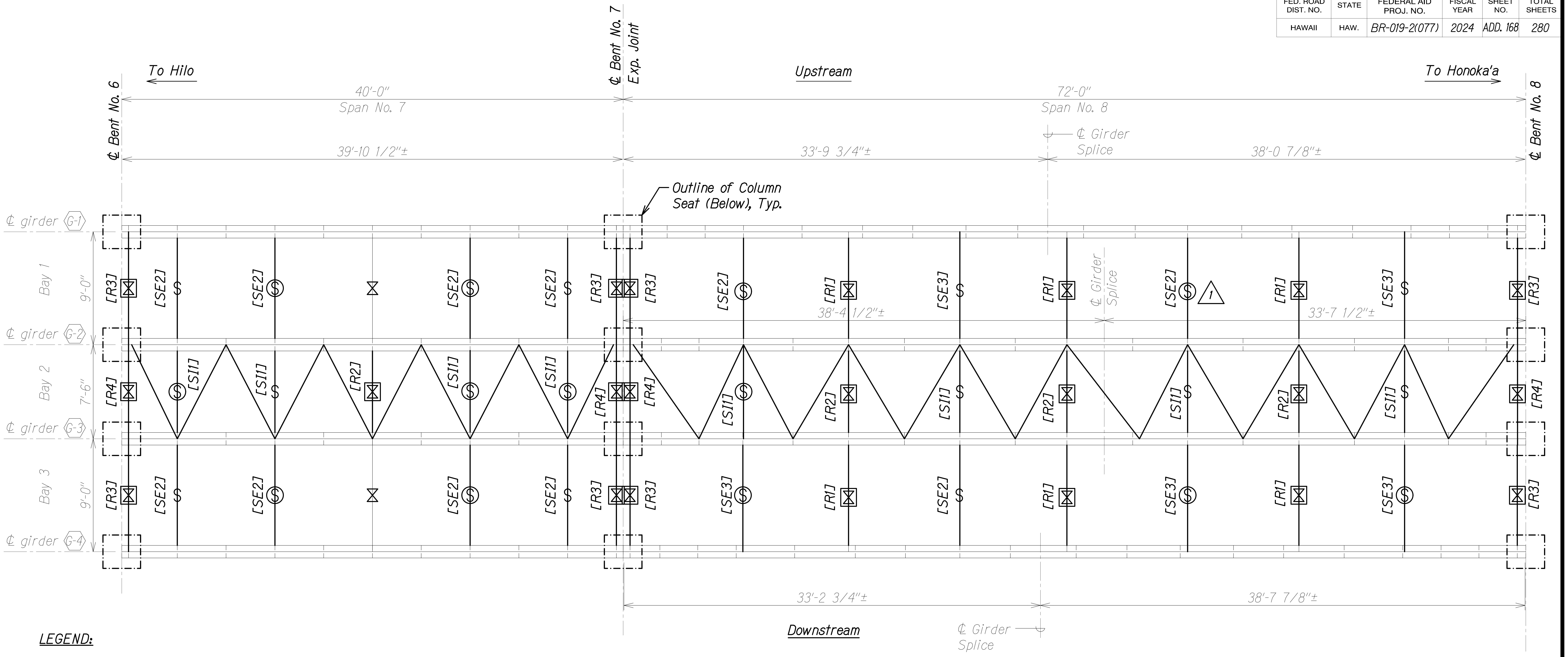
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA9.6 OF 23 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
NOTE BOOK	TRACED BY	"
	DESIGNED BY	"
	QUANTITIES BY	"
No.	CHECKED BY	"

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0906 GIRDER SPAN 1 & 2 PLN ADD2.DWG PLOT TIME: 12-04-24, 3:30 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 168	280



GIRDER FRAMING PLAN - SPAN NOS. 7 AND 8

Scale: 1/4" = 1'-0"

LEGEND:

⧖ Exist. Cross Frame to Remain

☒ Exist. Cross Frame to be Removed and Replaced

$ Exist. Strut to be Removed and Replaced

Ⓢ New Strut

∧ New Lateral Diagonal Bracing at Bottom Flange, See Sheet SA10.21 through SA10.24

[ ] Cross Frame or Strut Mark, See Table

NOTES:

1. Cross Frames, Struts, Stiffeners and Lateral Bracing locations to be verified by Contractor.
2. Provided dimensions are based on As-Built plans.

INSTALLATION OF MEMBERS AND CONNECTIONS

MARK	REFERENCE	MARK	REFERENCE
SE2	Section B / SA10.12	R1	Section A / SA10.14
SE3	Section C / SA10.12	R2	Section B / SA10.14
SI1	Section A / SA10.13	R3	Section C / SA10.14
-	-	R4	Section D / SA10.14

STEPHEN T. PETERS
NO. 17097-S

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4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

DATE	REVISION
12/6/24	1 Revised Callouts

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER FRAMING PLAN -
SPAN NOS. 7 AND 8

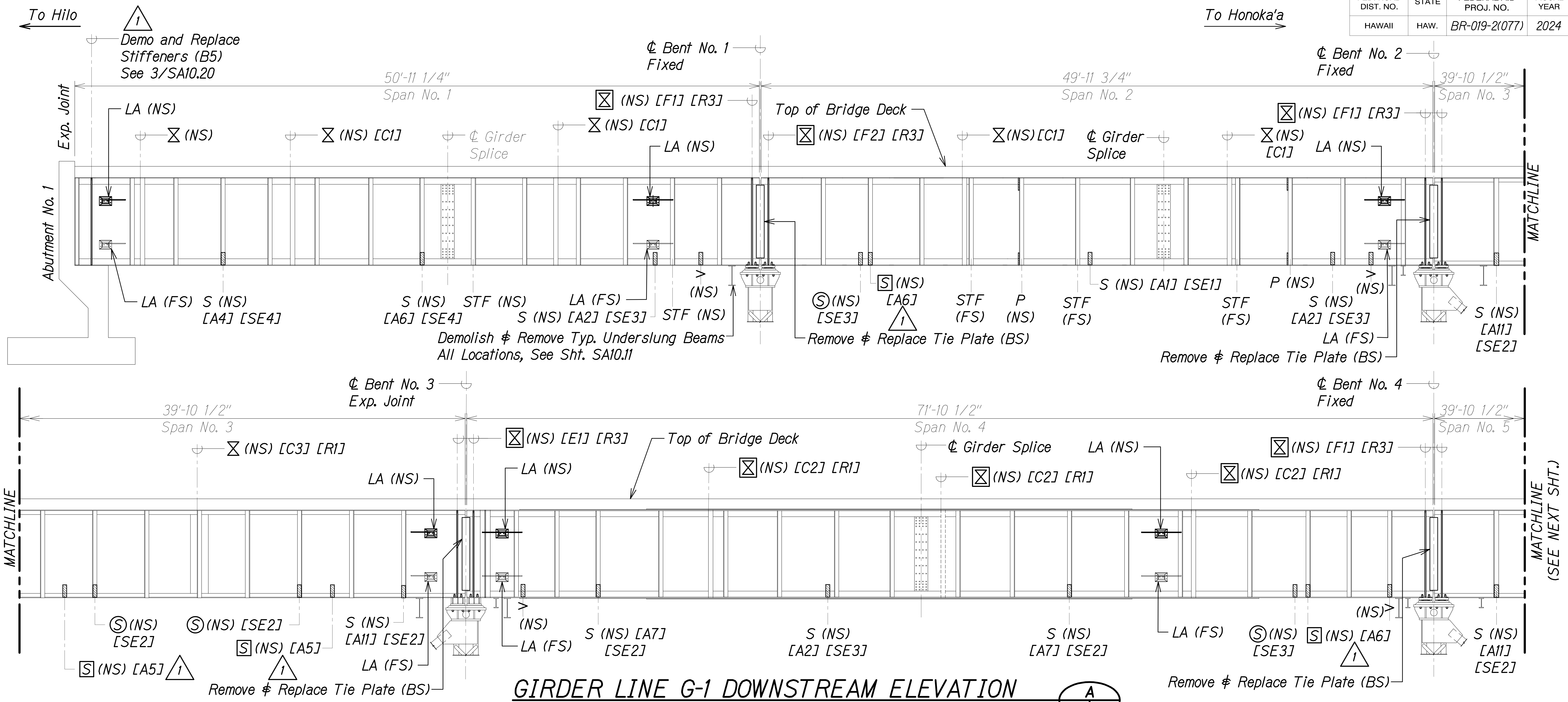
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024
SHEET No. SA9.9 OF 23 SHEETS

ADD. 168

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0909 GIRDER SPAN 7 & 8 PLN ADD2.DWG PLOT TIME: 12-04-24, 3:31 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 170	280



GIRDER LINE G-1 DOWNSTREAM ELEVATION

Scale: 1/4" = 1'-0"

A
SA9.11 | SA9.11

LEGEND:

LA	Lifeline Anchor, See Sheet SA10.27
⊠	Cross Frame
BS	Both Sides
FS	Far Side
NS	Near Side
Ⓢ	New Strut
S	Exist. Strut to be Removed and Replaced
🅂	Exist. Strut to be Removed
☒	Cross Frame to be Removed and Replaced
STF	Deformed Stiffener to be Repaired, See Structural General Note 5.AB.
P	Plates to be Removed from Stiffener Location. Plug Weld Resulting Holes
⊁	Exist. Angle Iron to be Removed, See Detail 1/SA10.11
△	Exist. Ancillary Flange Tab to be Removed, See Detail 3/SA10.11

DEMOLITION OF MEMBERS & CONNECTIONS	
MARK	REFERENCE
A1	Section A / SA10.1
A2	Section B / SA10.1
A4	Section D / SA10.1
A5	Section A / SA10.2
A6	Section B / SA10.2
A7	Section C / SA10.2
A11	Section C / SA10.3
C1	Section A / SA10.6
C2	Section B / SA10.6
C3	Section C / SA10.6
E1	Section A / SA10.8
F1	Section A / SA10.9
F2	Section B / SA10.9

INSTALLATION OF MEMBERS & CONN.	
MARK	REFERENCE
SE1	Section A / SA10.12
SE2	Section B / SA10.12
SE3	Section C / SA10.12
SE4	Section D / SA10.12
R1	Section A / SA10.14
R3	Section C / SA10.14

NOTES:

1. The gap between the ends of the girders at the bents is 1 1/2" according to As-Built drawings. See Sheets SA10.10 and SA10.25 for tie plate details.
2. Struts are shown hatched for clarity.
3. Replace bearing stiffeners at all locations EF of girder. See Sheet SA10.20.

DATE	REVISION
12/6/24	1 Revised Callouts

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.
SIGNATURE
4-30-26
EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER LINE G-1
DOWNSTREAM ELEVATION

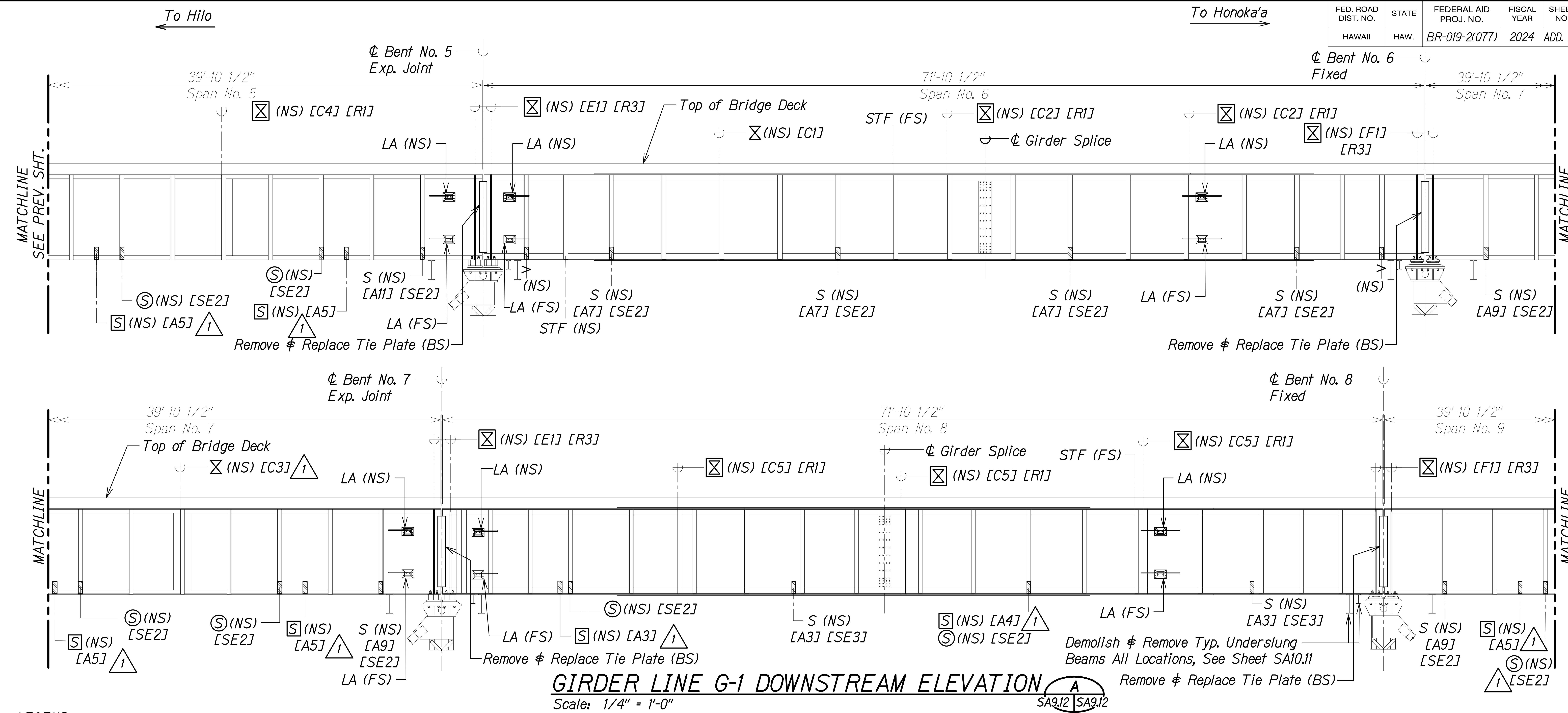
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted
Date: Oct. 2024

SHEET No. SA9.11 OF 23 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0911-SA0922 GIRDER ELEV ADD2.DWG PLOT TIME: 12-05-24, 2:45 PM

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 171	280



GIRDER LINE G-1 DOWNSTREAM ELEVATION

A SA9.12 | SA9.12

Scale: 1/4" = 1'-0"

LEGEND:

LA	Lifeline Anchor, See Sheet SA10.27
⌛	Cross Frame
BS	Both Sides
FS	Far Side
NS	Near Side
Ⓢ	New Strut
S	Exist. Strut to be Removed and Replaced
🅂	Exist. Strut to be Removed
☒	Cross Frame to be Removed and Replaced
STF	Deformed Stiffener to be Repaired, See Structural General Note 5.AB.
P	Plates to be Removed from Stiffener Location. Plug Weld Resulting Holes
⊁	Exist. Angle Iron to be Removed, See Detail 1/SA10.11
△	Exist. Ancillary Flange Tab to be Removed, See Detail 3/SA10.11

DEMOLITION OF MEMBERS & CONNECTIONS	
MARK	REFERENCE
A3	Section C / SA10.1
A4	Section D / SA10.1
A5	Section A / SA10.2
A7	Section C / SA10.2
A9	Section A / SA10.3
A11	Section C / SA10.3
C1	Section A / SA10.6
C2	Section B / SA10.6
C3	Section C / SA10.6
C4	Section D / SA10.6
C5	Section E / SA10.6
E1	Section A / SA10.8
F1	Section A / SA10.9

INSTALLATION OF MEMBERS & CONN.	
MARK	REFERENCE
SE1	Section A / SA10.12
SE2	Section B / SA10.12
SE3	Section C / SA10.12
SE4	Section D / SA10.12
R1	Section A / SA10.14
R2	Section B / SA10.14
R3	Section C / SA10.14

NOTES:

1. The gap between the ends of the girders at the bents is 1 1/2" according to As-Built drawings. See Sheets SA10.10 and SA10.25 for tie plate details.
2. Struts are shown hatched for clarity.
3. Replace bearing stiffeners at all locations EF of girder. See Sheet SA10.20.

12/6/24	1	Revised Callouts
DATE		REVISION

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER LINE G-1
DOWNSTREAM ELEVATION

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

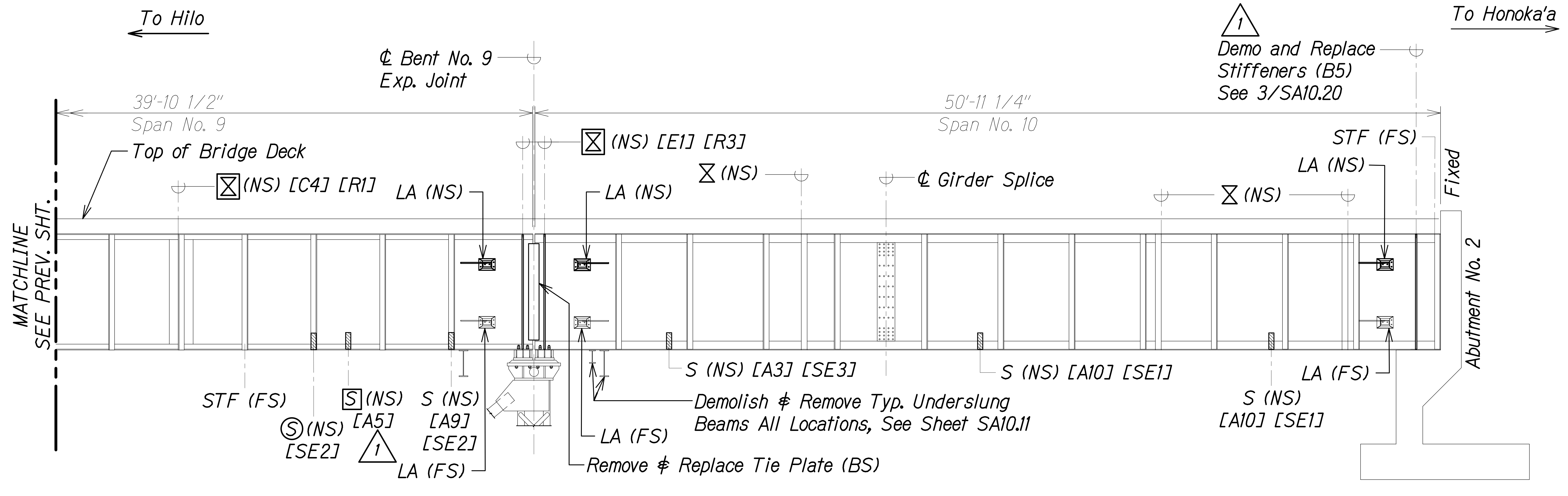
SHEET No. SA9.12 OF 23 SHEETS

ADD. 171

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0911-SA0922 GIRDER ELEV ADD2.DWG PLOT TIME: 12-04-24, 3:25 PM)

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
NOTE BOOK	DRAWN BY	
No.	TRACED BY	
	DESIGNED BY	
	QUANTITIES BY	
	CHECKED BY	

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 172	280



GIRDER LINE G-1
DOWNSTREAM ELEVATION

A
SA9.13 | SA9.13

Scale: 1/4" = 1'-0"

LEGEND:

LA	Lifeline Anchor, See Sheet SA10.27
⧖	Cross Frame
BS	Both Sides
FS	Far Side
NS	Near Side
Ⓢ	New Strut
S	Exist. Strut to be Removed and Replaced
S (boxed)	Exist. Strut to be Removed
☒	Cross Frame to be Removed and Replaced
STF	Deformed Stiffener to be Repaired, See Structural General Note 5.AB.
P	Plates to be Removed from Stiffener Location. Plug Weld Resulting Holes
⊁	Exist. Angle Iron to be Removed, See Detail 1/SA10.11
△	Exist. Ancillary Flange Tab to be Removed, See Detail 3/SA10.11

DEMOLITION OF MEMBERS & CONNECTIONS

MARK	REFERENCE
A3	Section C / SA10.1
A5	Section A / SA10.2
A9	Section A / SA10.3
A10	Section B / SA10.3
C4	Section D / SA10.6
E1	Section A / SA10.8

INSTALLATION OF MEMBERS & CONN.

MARK	REFERENCE
SE1	Section A / SA10.12
SE2	Section B / SA10.12
SE3	Section C / SA10.12
R1	Section A / SA10.14
R3	Section C / SA10.14
R4	Section D / SA10.14

NOTES:

1. The gap between the ends of the girders at the bents is 1 1/2" according to As-Built drawings. See Sheets SA10.10 and SA10.25 for tie plate details.
2. Struts are shown hatched for clarity.
3. Replace bearing stiffeners at all locations EF of girder. See Sheet SA10.20.

DATE	REVISION
12/6/24	1 Revised Callouts

STEPHEN T. PETERS
NO. 17097-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER LINE G-1
DOWNSTREAM ELEVATION

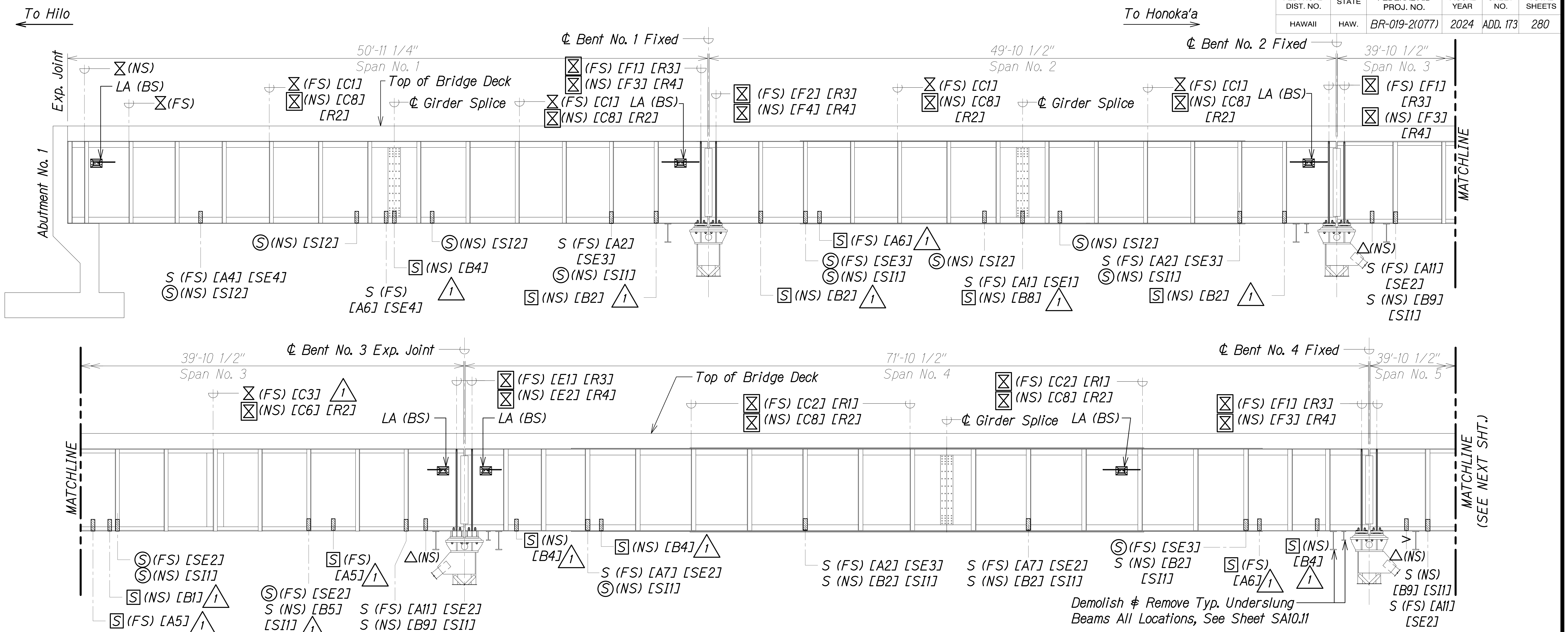
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA9.13 OF 23 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0911-SA0922 GIRDER ELEV ADD2.DWG PLOT TIME: 12-05-24, 2:46 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 173	280



GIRDER LINE G-2 DOWNSTREAM ELEVATION

Scale: 1/4" = 1'-0"

A
SA9.14 | SA9.14

LEGEND:

LA	Lifeline Anchor, See Sheet SA10.27	FS	Far Side
⧖	Cross Frame	NS	Near Side
BS	Both Sides	Ⓢ	New Strut
S	Exist. Strut to be Removed and Replaced		
🅂	Exist. Strut to be Removed		
☒	Cross Frame to be Removed and Replaced		
STF	Deformed Stiffener to be Repaired, See Structural General Note 5.AB.		
P	Plates to be Removed from Stiffener Location. Plug Weld Resulting Holes		
⊥	Exist. Angle Iron to be Removed, See Detail 1/SA10.11		
△	Exist. Ancillary Flange Tab to be Removed, See Detail 3/SA10.11		

DEMOLITION OF MEMBERS & CONNECTIONS

MARK	REFERENCE	MARK	REFERENCE
A1	Section A / SA10.1	B9	Section E / SA10.5
A2	Section B / SA10.1	C1	Section A / SA10.6
A4	Section D / SA10.1	C2	Section B / SA10.6
A5	Section A / SA10.2	C3	Section C / SA10.6
A6	Section B / SA10.2	C6	Section A / SA10.7
A7	Section C / SA10.2	C8	Section C / SA10.7
A11	Section C / SA10.3	E1	Section A / SA10.8
B1	Section A / SA10.4	E2	Section B / SA10.8
B2	Section B / SA10.4	F1	Section A / SA10.9
B4	Section D / SA10.4	F2	Section B / SA10.9
B5	Section A / SA10.5	F3	Section C / SA10.9
B8	Section D / SA10.5	F4	Section D / SA10.9

INSTALLATION OF MEMBERS & CONN.

MARK	REFERENCE
SE1	Section A / SA10.12
SE2	Section B / SA10.12
SE3	Section C / SA10.12
SE4	Section D / SA10.12
SI1	Section A / SA10.13
SI2	Section B / SA10.13
R1	Section A / SA10.14
R2	Section B / SA10.14
R3	Section C / SA10.14
R4	Section D / SA10.14

NOTES:

1. The gap between the ends of the girders at the bents is 1 1/2" according to As-Built drawings.
2. Struts are shown hatched for clarity.
3. Replace bearing stiffeners at all locations EF of girder. See Sheet SA10.20.

DATE	REVISION
12/6/24	△1 Revised Callouts

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE   EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER LINE G-2
DOWNSTREAM ELEVATION

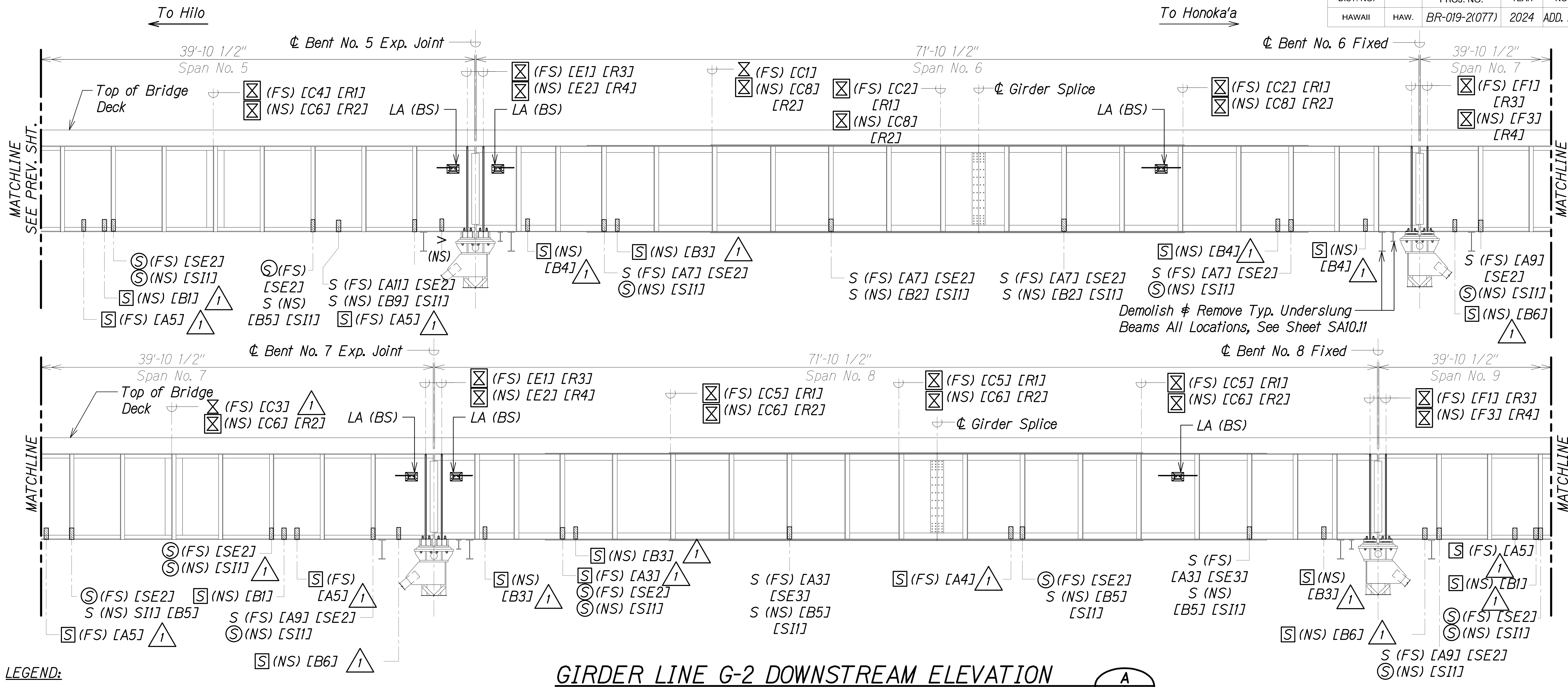
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted   Date: Oct. 2024

SHEET No. SA9.14 OF 23 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY   DATE
DRAWN BY   "
TRACED BY   "
DESIGNED BY   "
QUANTITIES BY   "
CHECKED BY   "

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0911-SA0922 GIRDER ELEV ADD2.DWG   PLOT TIME: 12-04-24, 3:26 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 174	280



GIRDER LINE G-2 DOWNSTREAM ELEVATION

Scale: 1/4" = 1'-0"

A SA9.15 | SA9.15

LEGEND:

LA	Lifeline Anchor, See Sheet SA10.27
⌛	Cross Frame
BS	Both Sides
S	Exist. Strut to be Removed and Replaced
☐S	Exist. Strut to be Removed
☒	Cross Frame to be Removed and Replaced
STF	Deformed Stiffener to be Repaired, See Structural General Note 5.AB.
P	Plates to be Removed from Stiffener Location. Plug Weld Resulting Holes
⊥	Exist. Angle Iron to be Removed, See Detail 1/SA10.11
△	Exist. Ancillary Flange Tab to be Removed, See Detail 3/SA10.11
FS	Far Side
NS	Near Side
Ⓢ	New Strut

DEMOLITION OF MEMBERS & CONNECTIONS

MARK	REFERENCE	MARK	REFERENCE
A3	Section C / SA10.1	B9	Section E / SA10.5
A4	Section D / SA10.1	C1	Section A / SA10.6
A5	Section A / SA10.2	C2	Section B / SA10.6
A7	Section C / SA10.2	C3	Section C / SA10.6
A9	Section A / SA10.3	C4	Section D / SA10.6
A11	Section C / SA10.3	C5	Section E / SA10.6
B1	Section A / SA10.4	C6	Section A / SA10.7
B2	Section B / SA10.4	C8	Section C / SA10.7
B3	Section C / SA10.4	E1	Section A / SA10.8
B4	Section D / SA10.4	E2	Section B / SA10.8
B5	Section A / SA10.5	F1	Section A / SA10.9
B6	Section B / SA10.5	F3	Section C / SA10.9

INSTALLATION OF MEMBERS & CONN.

MARK	REFERENCE
SE1	Section A / SA10.12
SE2	Section B / SA10.12
SE3	Section C / SA10.12
SE4	Section D / SA10.12
SI1	Section A / SA10.13
SI2	Section B / SA10.13
R1	Section A / SA10.14
R2	Section B / SA10.14
R3	Section C / SA10.14
R4	Section D / SA10.14

NOTES:

1. The gap between the ends of the girders at the bents is 1 1/2" according to As-Built drawings.
2. Struts are shown hatched for clarity.
3. Replace bearing stiffeners at all locations EF of girder. See Sheet SA10.20.

DATE	REVISION
12/6/24	1 Revised Callouts

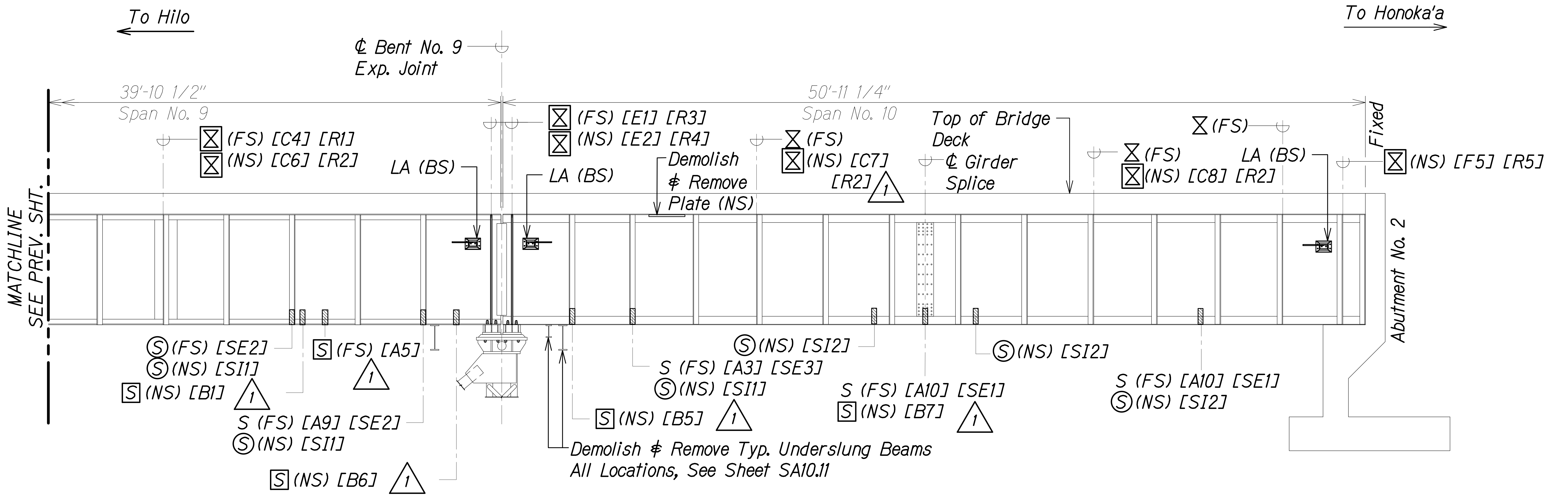
STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.
4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER LINE G-2
DOWNSTREAM ELEVATION

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024
SHEET No. SA9.15 OF 23 SHEETS

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 175	280



GIRDER LINE G-2 DOWNSTREAM ELEVATION

A SA9.16 | SA9.16

Scale: 1/4" = 1'-0"

LEGEND:

LA	Lifeline Anchor, See Sheet SA10.27
⧖	Cross Frame
BS	Both Sides
S	Exist. Strut to be Removed and Replaced
🅂	Exist. Strut to be Removed
⊠	Cross Frame to be Removed and Replaced
STF	Deformed Stiffener to be Repaired, See Structural General Note 5.AB.
P	Plates to be Removed from Stiffener Location. Plug Weld Resulting Holes
≻	Exist. Angle Iron to be Removed, See Detail 1/SA10.11
△	Exist. Ancillary Flange Tab to be Removed, See Detail 3/SA10.11
FS	Far Side
NS	Near Side
Ⓢ	New Strut

DEMOLITION OF MEMBERS & CONNECTIONS

MARK	REFERENCE
A3	Section C / SA10.1
A5	Section A / SA10.2
A9	Section A / SA10.3
A10	Section B / SA10.3
B1	Section A / SA10.4
B5	Section A / SA10.5
B6	Section B / SA10.5
B7	Section C / SA10.5
C4	Section D / SA10.6
C6	Section A / SA10.7

INSTALLATION OF MEMBERS & CONN.

MARK	REFERENCE
SE1	Section A / SA10.12
SE2	Section B / SA10.12
SE3	Section C / SA10.12
SI1	Section A / SA10.13
SI2	Section B / SA10.13
R1	Section A / SA10.14
R2	Section B / SA10.14
R3	Section C / SA10.14
R4	Section D / SA10.14
R5	Section A / SA10.15

NOTES:

1. The gap between the ends of the girders at the bents is 1 1/2" according to As-Built drawings.
2. Struts are shown hatched for clarity.
3. Replace bearing stiffeners at all locations EF of girder. See Sheet SA10.20.

STEPHEN T. PETERS
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NO. 17097-S

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DATE	REVISION
12/6/24	△1 Revised Callouts

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER LINE G-2
DOWNSTREAM ELEVATION

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

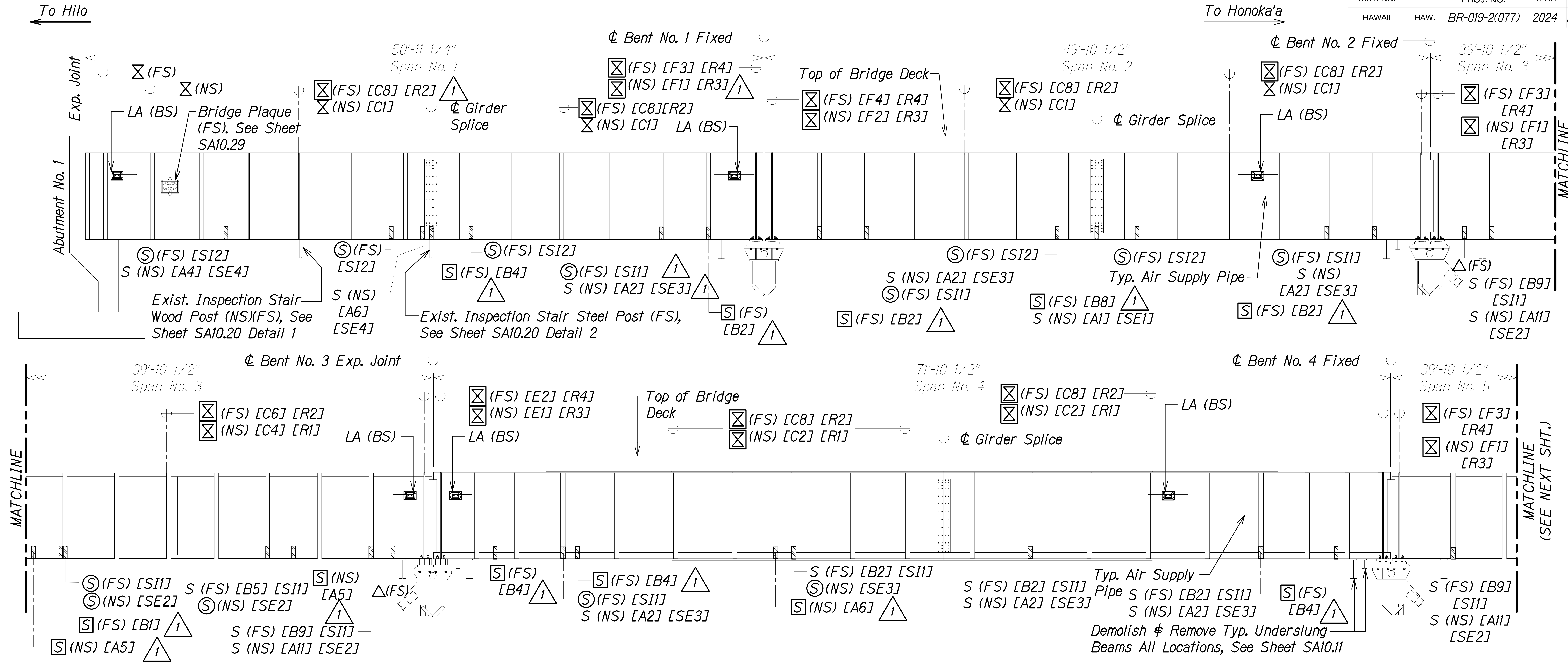
Scale: As Noted Date: Oct. 2024

SHEET No. SA9.16 OF 23 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY ___ DATE ___
	DRAWN BY ___ "
NOTE BOOK	TRACED BY ___ "
	DESIGNED BY ___ "
	QUANTITIES BY ___ "
No. ___	CHECKED BY ___ "

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0911-SA0922 GIRDER ELEV ADD2.DWG PLOT TIME: 12-04-24, 12:22 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 176	280



GIRDER LINE G-3 DOWNSTREAM ELEVATION

A SA9.17 SA9.17

Scale: 1/4" = 1'-0"

LEGEND:

LA	Lifeline Anchor, See Sheet SA10.27
⧖	Cross Frame
BS	Both Sides
S	Exist. Strut to be Removed and Replaced
[S]	Exist. Strut to be Removed
☒	Cross Frame to be Removed and Replaced
STF	Deformed Stiffener to be Repaired, See Structural General Note 5.AB.
P	Plates to be Removed from Stiffener Location. Plug Weld Resulting Holes
⊣⊢	Exist. Angle Iron to be Removed, See Detail 1/SA10.11
△	Exist. Ancillary Flange Tab to be Removed, See Detail 3/SA10.11
FS	Far Side
NS	Near Side
Ⓢ	New Strut

DEMOLITION OF MEMBERS & CONNECTIONS

MARK	REFERENCE	MARK	REFERENCE
A1	Section A / SA10.1	C1	Section A / SA10.6
A2	Section B / SA10.1	C2	Section B / SA10.6
A4	Section D / SA10.1	C4	Section D / SA10.6
A5	Section A / SA10.2	C6	Section A / SA10.7
A6	Section B / SA10.2	C8	Section C / SA10.7
A11	Section C / SA10.3	E1	Section A / SA10.8
B1	Section A / SA10.4	E2	Section B / SA10.8
B2	Section B / SA10.4	F1	Section A / SA10.9
B4	Section D / SA10.4	F2	Section B / SA10.9
B5	Section A / SA10.5	F3	Section C / SA10.9
B8	Section D / SA10.5	F4	Section D / SA10.9
B9	Section E / SA10.5	-	-

INSTALLATION OF MEMBERS & CONN.

MARK	REFERENCE
SE1	Section A / SA10.12
SE2	Section B / SA10.12
SE3	Section C / SA10.12
SE4	Section D / SA10.12
SI1	Section A / SA10.13
SI2	Section B / SA10.13
R1	Section A / SA10.14
R2	Section B / SA10.14
R3	Section C / SA10.14
R4	Section D / SA10.14

NOTES:

1. The gap between the ends of the girders at the bents is 1 1/2" according to As-Built drawings.
2. Struts are shown hatched for clarity.
3. Replace bearing stiffeners at all locations EF of girder. See Sheet SA10.20.

DATE	REVISION
12/6/24	1 Revised Callouts

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER LINE G-3
DOWNSTREAM ELEVATION

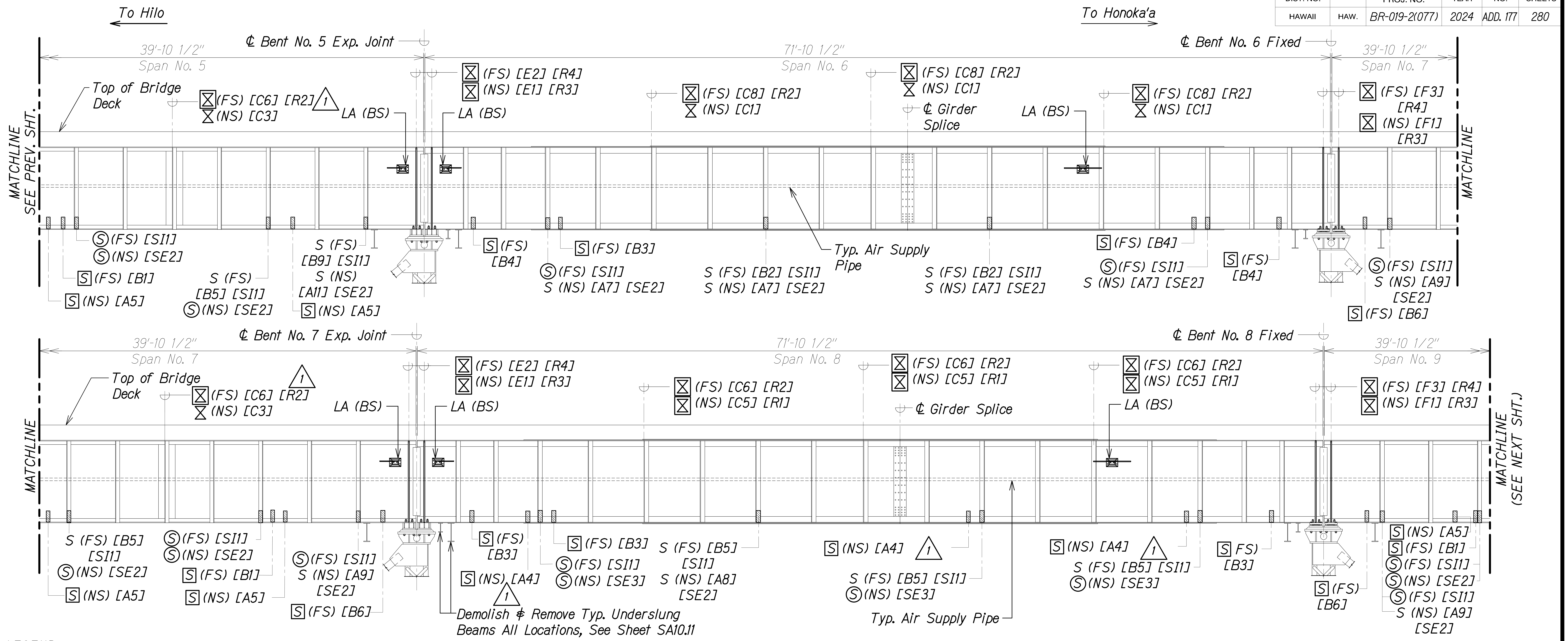
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA9.17 OF 23 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
	TRACED BY	"
NOTE BOOK	DESIGNED BY	"
	QUANTITIES BY	"
No.	CHECKED BY	"

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0911-SA0922 GIRDER ELEV ADD2.DWG PLOT TIME: 12-04-24, 12:22 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 177	280



GIRDER LINE G-3 DOWNSTREAM ELEVATION

A SA9.18 | SA9.18

Scale: 1/4" = 1'-0"

LEGEND:

LA	Lifeline Anchor, See Sheet SA10.27
⧖	Cross Frame
BS	Both Sides
S	Exist. Strut to be Removed and Replaced
☐S	Exist. Strut to be Removed
☒	Cross Frame to be Removed and Replaced
STF	Deformed Stiffener to be Repaired, See Structural General Note 5.AB.
P	Plates to be Removed from Stiffener Location. Plug Weld Resulting Holes
⊁	Exist. Angle Iron to be Removed, See Detail 1/SA10.11
△	Exist. Ancillary Flange Tab to be Removed, See Detail 3/SA10.11
FS	Far Side
NS	Near Side
Ⓢ	New Strut

DEMOLITION OF MEMBERS & CONNECTIONS			
MARK	REFERENCE	MARK	REFERENCE
A4	Section D / SA10.1	B9	Section E / SA10.5
A5	Section A / SA10.2	C1	Section A / SA10.6
A7	Section C / SA10.2	C3	Section C / SA10.6
A8	Section D / SA10.2	C5	Section E / SA10.6
A9	Section A / SA10.3	C6	Section A / SA10.7
A11	Section C / SA10.3	C8	Section C / SA10.7
B1	Section A / SA10.4	E1	Section A / SA10.8
B2	Section B / SA10.4	E2	Section B / SA10.8
B3	Section C / SA10.4	F1	Section A / SA10.9
B4	Section D / SA10.4	F3	Section C / SA10.9
B5	Section A / SA10.5	-	-
B6	Section B / SA10.5	-	-

INSTALLATION OF MEMBERS & CONN.	
MARK	REFERENCE
SE2	Section B / SA10.12
SE3	Section C / SA10.12
SE4	Section D / SA10.12
SI1	Section A / SA10.13
SI2	Section B / SA10.13
R1	Section A / SA10.14
R2	Section B / SA10.14
R3	Section C / SA10.14
R4	Section D / SA10.14

NOTES:

1. The gap between the ends of the girders at the bents is 1 1/2" according to As-Built drawings.
2. Struts are shown hatched for clarity.
3. Replace bearing stiffeners at all locations EF of girder. See Sheet SA10.20.

12/6/24	1	Revised Callouts
DATE		REVISION

STEPHEN T. PETERS
NO. 17097-S

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER LINE G-3
DOWNSTREAM ELEVATION

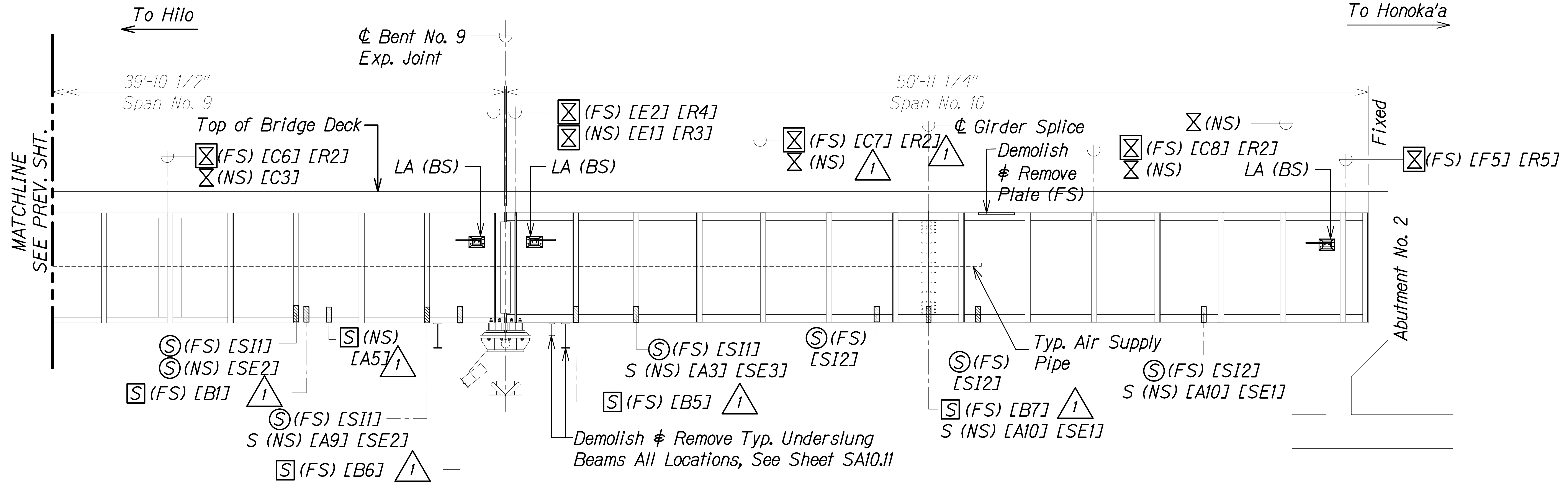
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA9.18 OF 23 SHEETS

ADD. 177

ORIGINAL PLAN	SURVEY PLOTTED BY / DRAWN BY / TRACED BY / DESIGNED BY / QUANTITIES BY / CHECKED BY
NOTE BOOK	DATE
No.	

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 178	280



GIRDER LINE G-3
DOWNSTREAM ELEVATION

A
SA9.19 | SA9.19

Scale: 1/4" = 1'-0"

LEGEND:

LA	Lifeline Anchor, See Sheet SA10.27
⧖	Cross Frame
BS	Both Sides
S	Exist. Strut to be Removed and Replaced
🅂	Exist. Strut to be Removed
⌧	Cross Frame to be Removed and Replaced
STF	Deformed Stiffener to be Repaired, See Structural General Note 5.AB.
P	Plates to be Removed from Stiffener Location. Plug Weld Resulting Holes
⊁	Exist. Angle Iron to be Removed, See Detail 1/SA10.11
△	Exist. Ancillary Flange Tab to be Removed, See Detail 3/SA10.11
FS	Far Side
NS	Near Side
Ⓢ	New Strut

DEMOLITION OF MEMBERS & CONNECTIONS

MARK	REFERENCE	MARK	REFERENCE
A3	Section C / SA10.1	C7	Section C / SA10.7
A5	Section A / SA10.2	C8	Section C / SA10.7
A9	Section A / SA10.3	E1	Section A / SA10.8
A10	Section B / SA10.3	E2	Section B / SA10.8
B1	Section A / SA10.4	F5	Section E / SA10.9
B5	Section A / SA10.5	-	-
B6	Section B / SA10.5	-	-
B7	Section C / SA10.5	-	-
C3	Section C / SA10.6	-	-
C6	Section A / SA10.7	-	-

INSTALLATION OF MEMBERS & CONN.

MARK	REFERENCE
SE1	Section A / SA10.12
SE2	Section B / SA10.12
SE3	Section C / SA10.12
SI1	Section A / SA10.13
SI2	Section B / SA10.13
R1	Section A / SA10.14
R2	Section B / SA10.14
R3	Section C / SA10.14
R4	Section D / SA10.14
R5	Section A / SA10.15

NOTES:

1. The gap between the ends of the girders at the bents is 1 1/2" according to As-Built drawings.
2. Struts are shown hatched for clarity.
3. Replace bearing stiffeners at all locations EF of girder. See Sheet SA10.20.

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

DATE	REVISION
12/6/24	1 Revised Callouts

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER LINE G-3
DOWNSTREAM ELEVATION

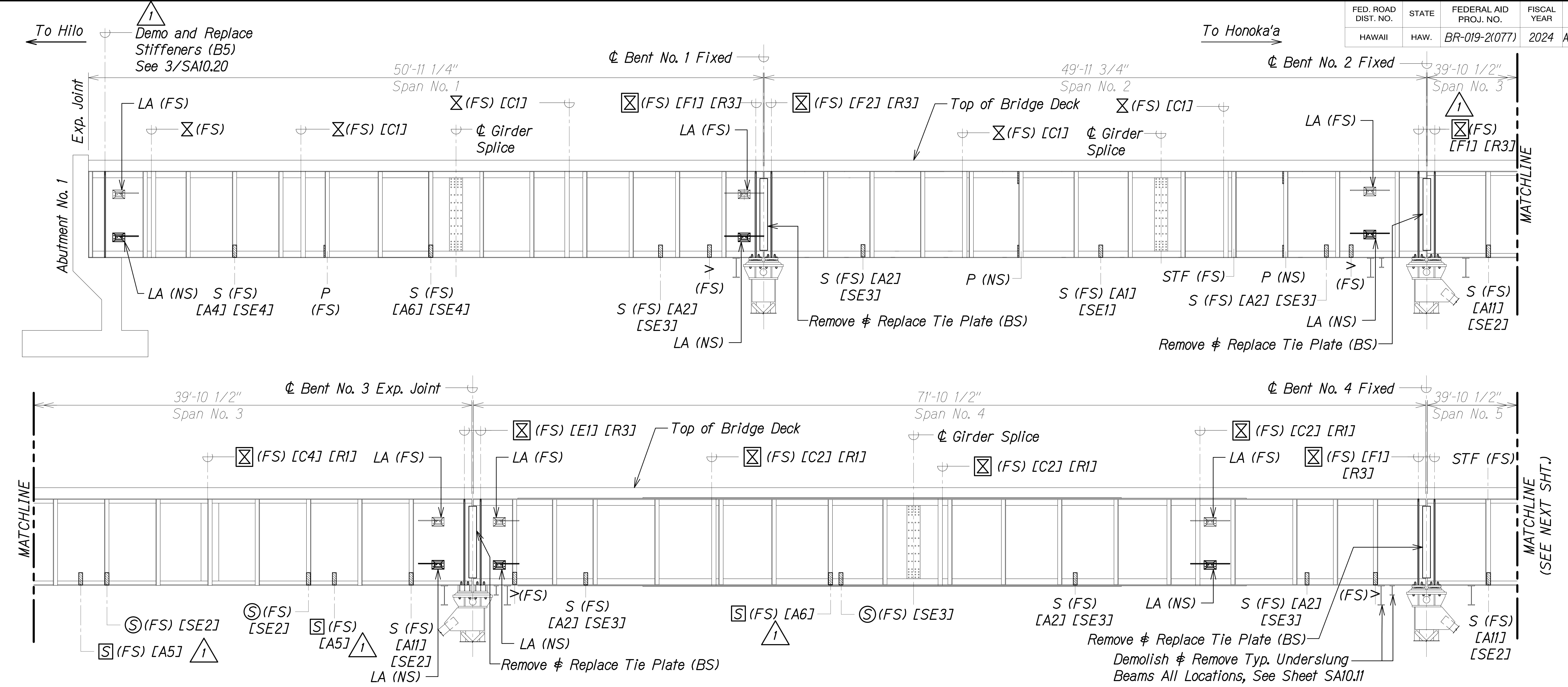
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA9.19 OF 23 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
NOTE BOOK	TRACED BY	"
	DESIGNED BY	"
	QUANTITIES BY	"
No.	CHECKED BY	"

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0911-SA0922 GIRDER ELEV ADD2.DWG PLOT TIME: 12-04-24, 3:28 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 179	280



GIRDER LINE G-4 DOWNSTREAM ELEVATION

A
SA9.20 SA9.20

Scale: 1/4" = 1'-0"

LEGEND:

LA	Lifeline Anchor, See Sheet SA10.27
⧖	Cross Frame
BS	Both Sides
S	Exist. Strut to be Removed and Replaced
S⃞	Exist. Strut to be Removed
⊠	Cross Frame to be Removed and Replaced
STF	Deformed Stiffener to be Repaired, See Structural General Note 5.AB.
P	Plates to be Removed from Stiffener Location. Plug Weld Resulting Holes
⊣	Exist. Angle Iron to be Removed, See Detail 1/SA10.11
△	Exist. Ancillary Flange Tab to be Removed, See Detail 3/SA10.11
FS	Far Side
NS	Near Side
Ⓢ	New Strut

DEMOLITION OF MEMBERS & CONNECTIONS	
MARK	REFERENCE
A1	Section A / SA10.1
A2	Section B / SA10.1
A4	Section D / SA10.1
A5	Section A / SA10.2
A6	Section B / SA10.2
A11	Section C / SA10.3
C1	Section A / SA10.6
C2	Section B / SA10.6
C4	Section D / SA10.6
E1	Section A / SA10.8
F1	Section A / SA10.9
F2	Section B / SA10.9

INSTALLATION OF MEMBERS & CONN.	
MARK	REFERENCE
SE1	Section A / SA10.12
SE2	Section B / SA10.12
SE3	Section C / SA10.12
SE4	Section D / SA10.12
R1	Section A / SA10.14
R3	Section C / SA10.14

NOTES:

1. The gap between the ends of the girders at the bents is 1 1/2" according to As-Built drawings. See Sheets SA10.10 and SA10.25 for tie plate details.
2. Struts are shown hatched for clarity.
3. Replace bearing stiffeners at all locations EF of girder. See Sheet SA10.20.

DATE		REVISION
12/6/24	1	Revised Callouts

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

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4-30-26
EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER LINE G-4
DOWNSTREAM ELEVATION

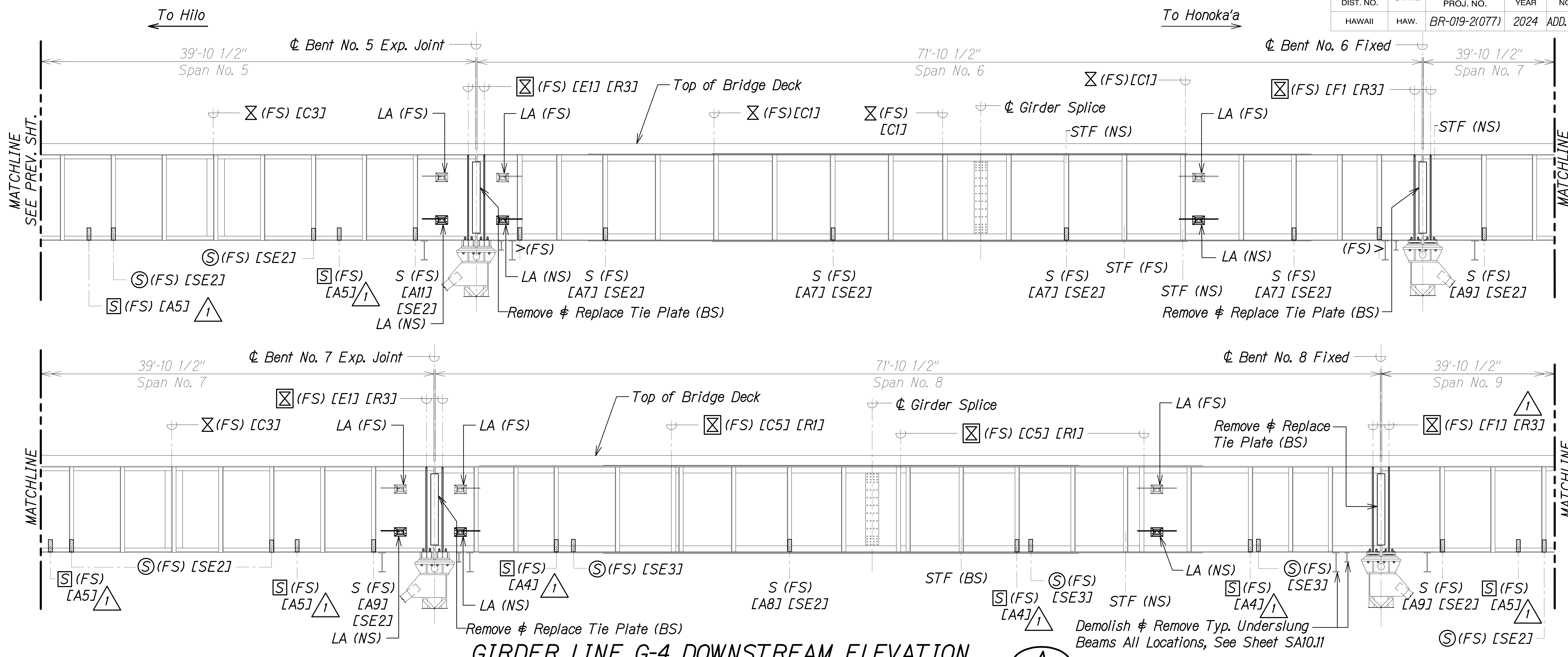
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA9.20 OF 23 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
NOTE BOOK	TRACED BY	"
	DESIGNED BY	"
No.	QUANTITIES BY	"
	CHECKED BY	"

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0911-SA0922 GIRDER ELEV ADD2.DWG PLOT TIME: 12-05-24, 2:47 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 180	280



GIRDER LINE G-4 DOWNSTREAM ELEVATION

Scale: 1/4" = 1'-0"

A SA9.21 | SA9.21

LEGEND:

LA	Lifeline Anchor, See Sheet SA10.27
⌛	Cross Frame
BS	Both Sides
S	Exist. Strut to be Removed and Replaced
☐S	Exist. Strut to be Removed
☒	Cross Frame to be Removed and Replaced
STF	Deformed Stiffener to be Repaired, See Structural General Note 5.AB.
P	Plates to be Removed from Stiffener Location. Plug Weld Resulting Holes
⊣	Exist. Angle Iron to be Removed, See Detail 1/SA10.11
△	Exist. Ancillary Flange Tab to be Removed, See Detail 3/SA10.11
FS	Far Side
NS	Near Side
Ⓢ	New Strut

DEMOLITION OF MEMBERS & CONNECTIONS	
MARK	REFERENCE
A4	Section D / SA10.1
A5	Section A / SA10.2
A7	Section C / SA10.2
A8	Section D / SA10.2
A9	Section A / SA10.3
A11	Section C / SA10.3
C1	Section A / SA10.6
C3	Section C / SA10.6
C5	Section E / SA10.6
E1	Section A / SA10.8
F1	Section A / SA10.9

INSTALLATION OF MEMBERS & CONN.	
MARK	REFERENCE
SE1	Section A / SA10.12
SE2	Section B / SA10.12
SE3	Section C / SA10.12
SE4	Section D / SA10.12
R1	Section A / SA10.14
R3	Section C / SA10.14

NOTES:

1. The gap between the ends of the girders at the bents is 1 1/2" according to As-Built drawings. See Sheets SA10.10 and SA10.25 for tie plate details.
2. Struts are shown hatched for clarity.
3. Replace bearing stiffeners at all locations EF of girder. See Sheet SA10.20.

DATE	REVISION
12/6/24	1 Revised Callouts

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.
4-30-26
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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER LINE G-4
DOWNSTREAM ELEVATION

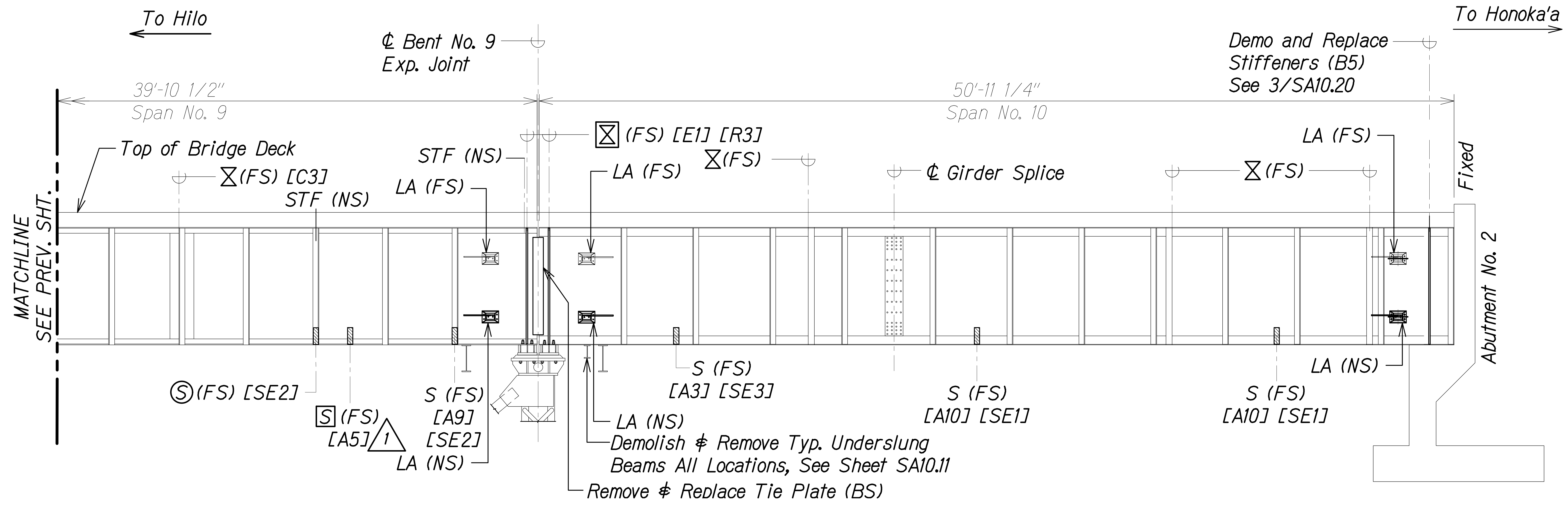
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No. SA9.21 OF 23 SHEETS

ORIGINAL PLAN
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
NOTE BOOK
No.
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0911-SA0922 GIRDER ELEV ADD2.DWG PLOT TIME: 12-04-24, 12:24 PM

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 181	280



GIRDER LINE G-4
DOWNSTREAM ELEVATION (A / SA9.22 | SA9.22)

Scale: 1/4" = 1'-0"

LEGEND:

LA	Lifeline Anchor, See Sheet SA10.27
⧖	Cross Frame
BS	Both Sides
S	Exist. Strut to be Removed and Replaced
[S]	Exist. Strut to be Removed
☒	Cross Frame to be Removed and Replaced
STF	Deformed Stiffener to be Repaired, See Structural General Note 5.AB.
P	Plates to be Removed from Stiffener Location. Plug Weld Resulting Holes
⊁	Exist. Angle Iron to be Removed, See Detail 1/SA10.11
△	Exist. Ancillary Flange Tab to be Removed, See Detail 3/SA10.11
FS	Far Side
NS	Near Side
Ⓢ	New Strut

DEMOLITION OF MEMBERS & CONNECTIONS	
MARK	REFERENCE
A3	Section C / SA10.1
A5	Section A / SA10.2
A9	Section A / SA10.3
A10	Section B / SA10.3
C3	Section C / SA10.6
E1	Section A / SA10.8

INSTALLATION OF MEMBERS & CONN.	
MARK	REFERENCE
SE1	Section A / SA10.12
SE2	Section B / SA10.12
SE3	Section C / SA10.12
R3	Section C / SA10.14

NOTES:

1. The gap between the ends of the girders at the bents is 1 1/2" according to As-Built drawings. See Sheets SA10.10 and SA10.25 for tie plate details.
2. Struts are shown hatched for clarity.
3. Replace bearing stiffeners at all locations EF of girder. See Sheet SA10.20.

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

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4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

DATE	REVISION
12/6/24	△1 Revised Callout

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

GIRDER LINE G-4
DOWNSTREAM ELEVATION

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

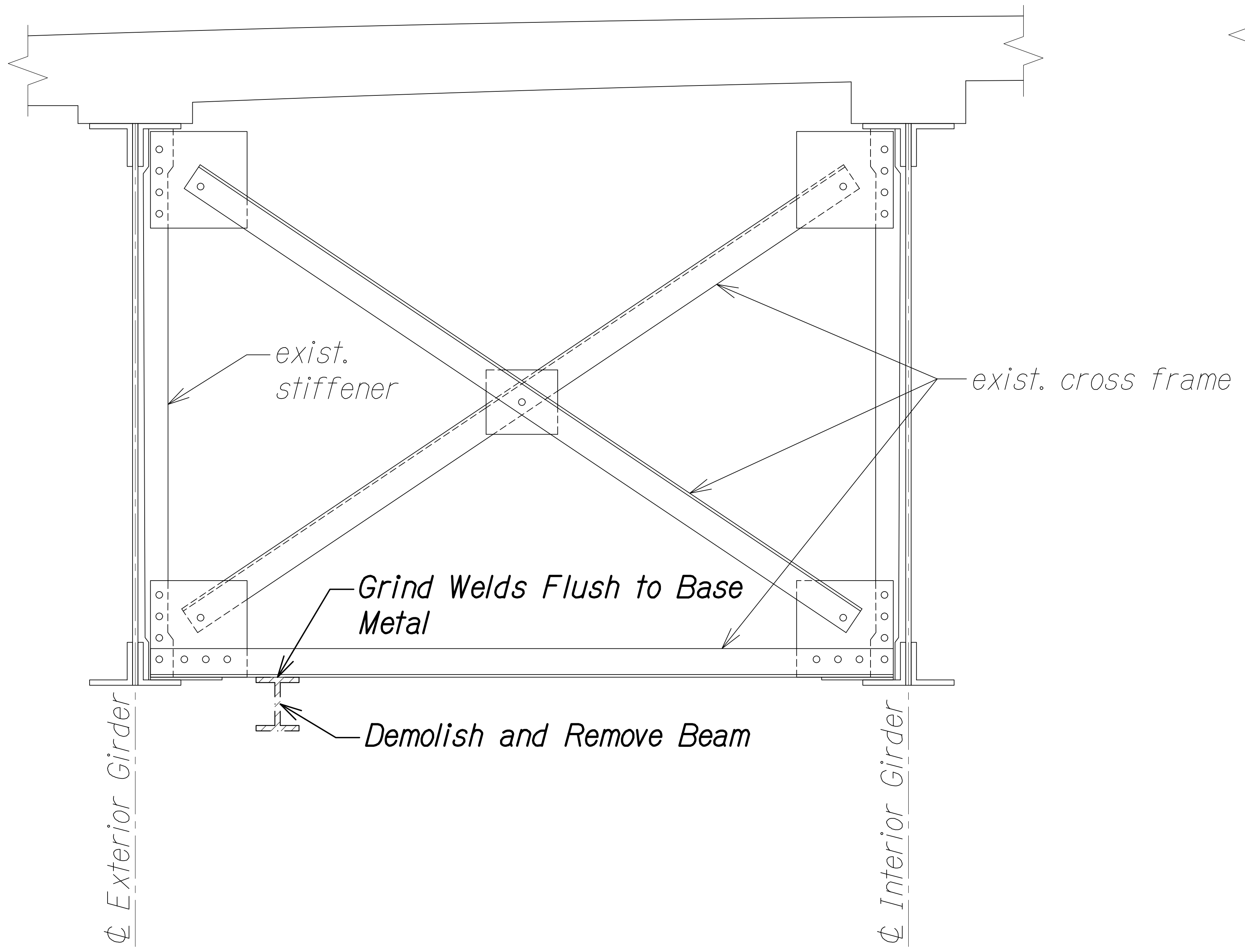
SHEET No. SA9.22 OF 23 SHEETS

ADD. 181

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
NOTE BOOK	TRACED BY	"
	DESIGNED BY	"
No.	QUANTITIES BY	"
	CHECKED BY	"

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA0911-SA0922 GIRDER ELEV ADD2.DWG PLOT TIME: 12-05-24, 2:47 PM)

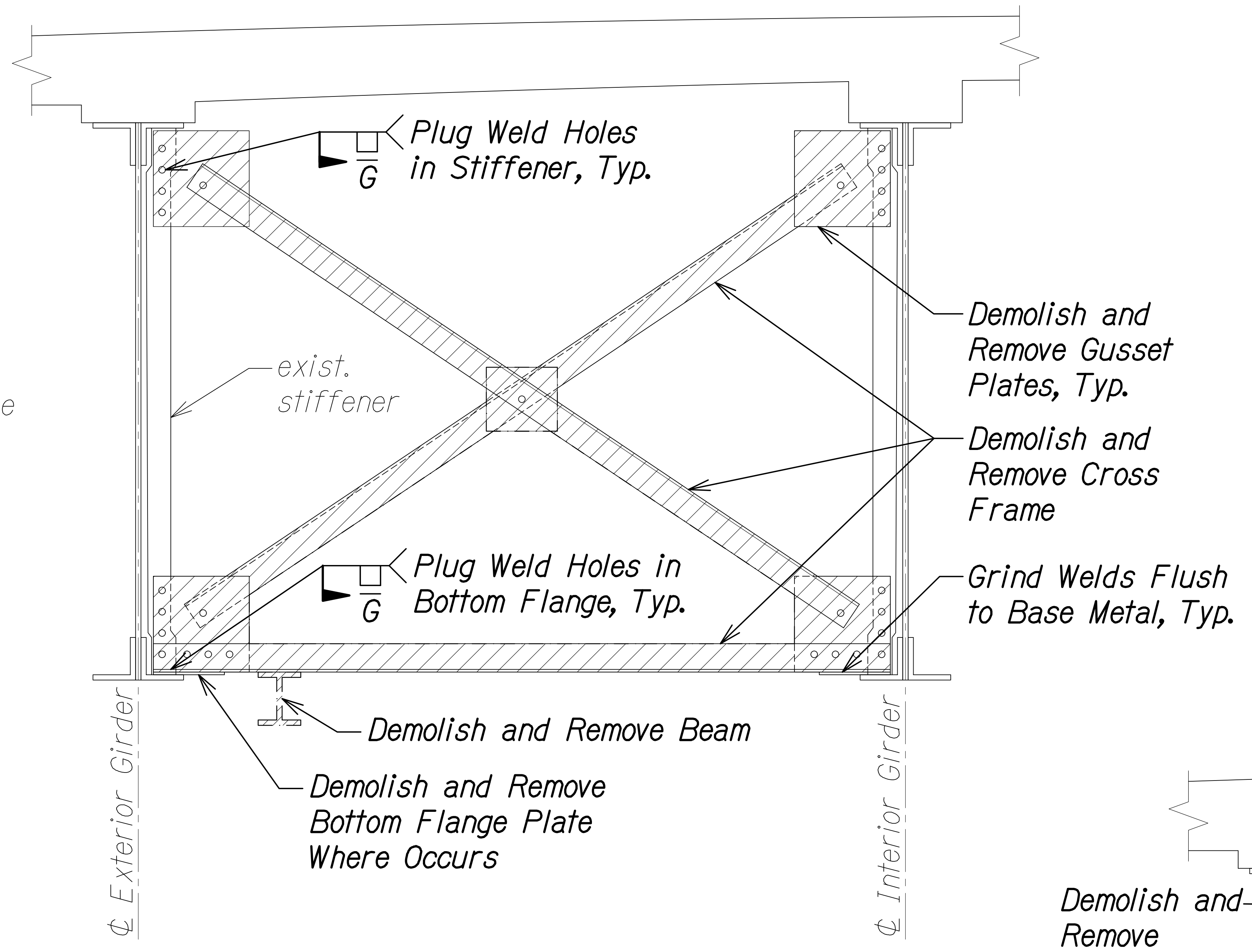
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 188	280



[C1] EXTERIOR BAY DEMO SECTION AT IN-SPAN CROSS FRAME

A SA10.6 | SA10.6

Scale: 3/4" = 1'-0"



[C2] EXTERIOR BAY DEMO SECTION AT IN-SPAN CROSS FRAME

B SA10.6 | SA10.6

Scale: 3/4" = 1'-0"

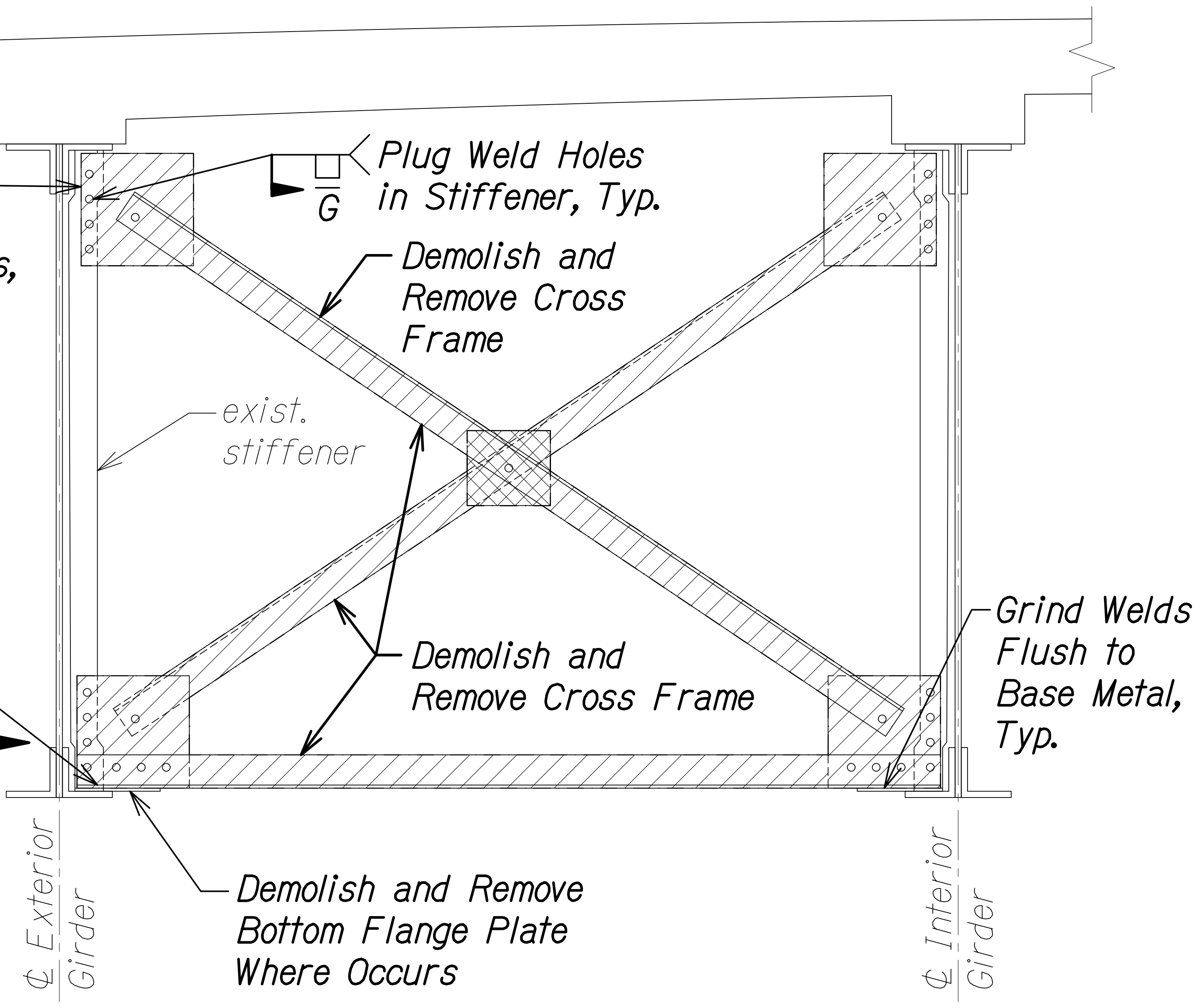
LEGEND:

▨ Demolish and Remove

△1 [XX] Cross Frame Mark, See SA9.1 through SA9.5 for locations

NOTES:

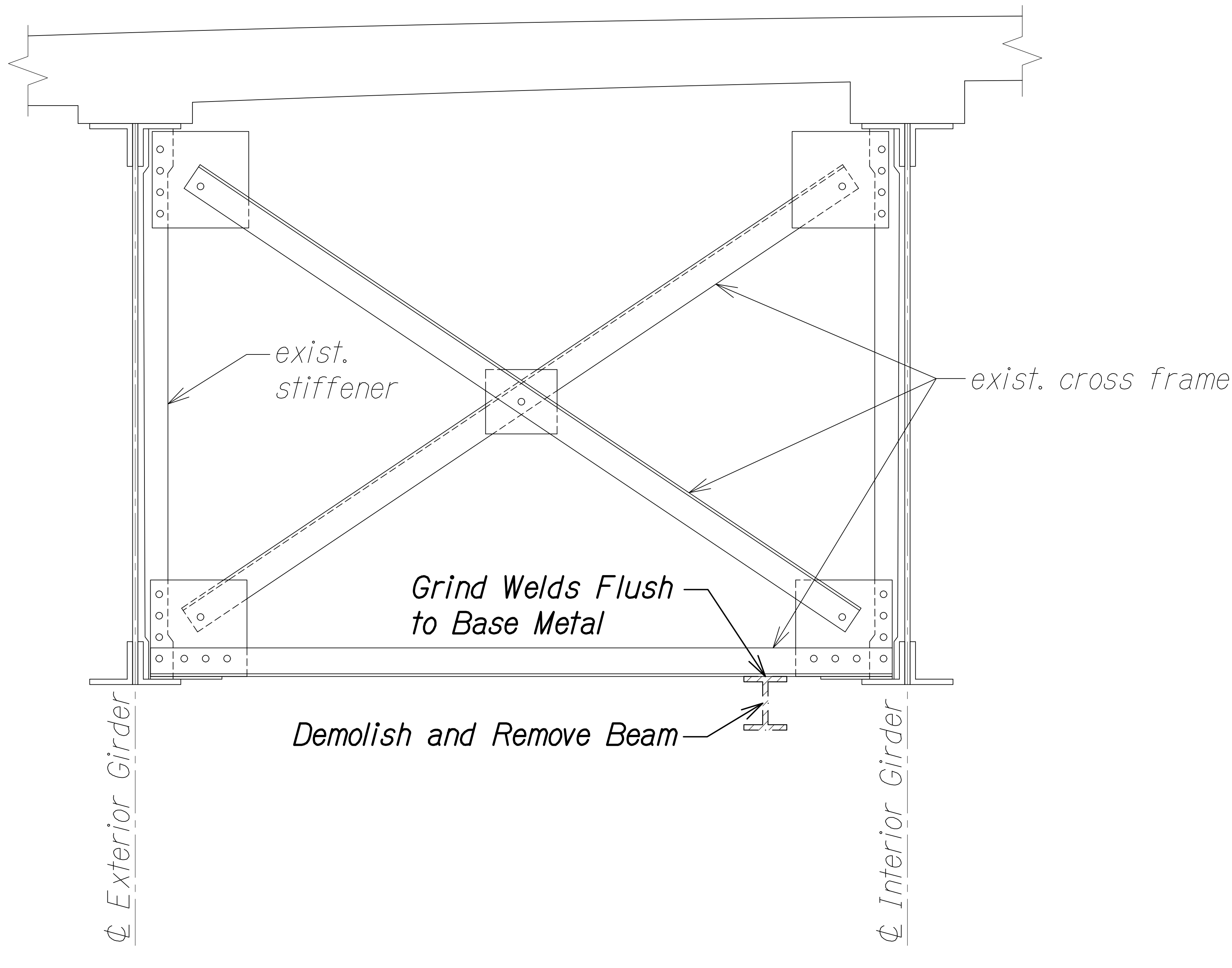
1. The Contractor shall take care when removing existing steel members so as not to damage the existing steel members to remain.
2. Remove all exist. wood board inspection planks (not shown) and deliver to HDOT maintenance yard.
3. Details beyond shown bay are not provided.
4. See Sheet SA10.11 for miscellaneous demolition details



[C5] EXTERIOR BAY DEMO SECTION AT IN-SPAN CROSS FRAME

E SA10.6 | SA10.6

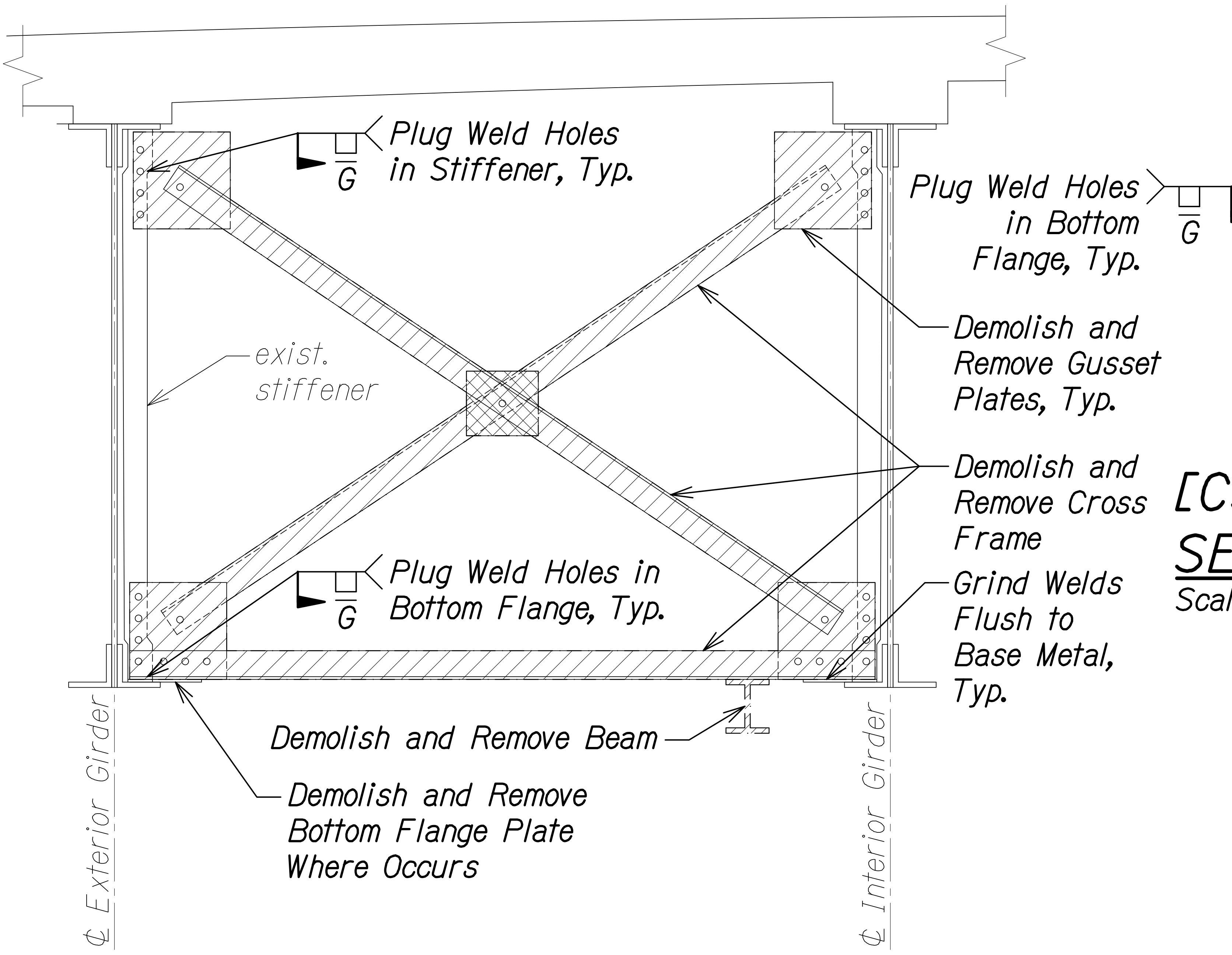
Scale: 3/4" = 1'-0"



[C3] EXTERIOR BAY DEMO SECTION AT IN-SPAN CROSS FRAME

C SA10.6 | SA10.6

Scale: 3/4" = 1'-0"



[C4] EXTERIOR BAY DEMO SECTION AT IN-SPAN CROSS FRAME

D SA10.6 | SA10.6

Scale: 3/4" = 1'-0"

DATE	REVISION
12/6/24	△1 Revised Note

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

IN-SPAN CROSS FRAME DEMOLITION SECTIONS

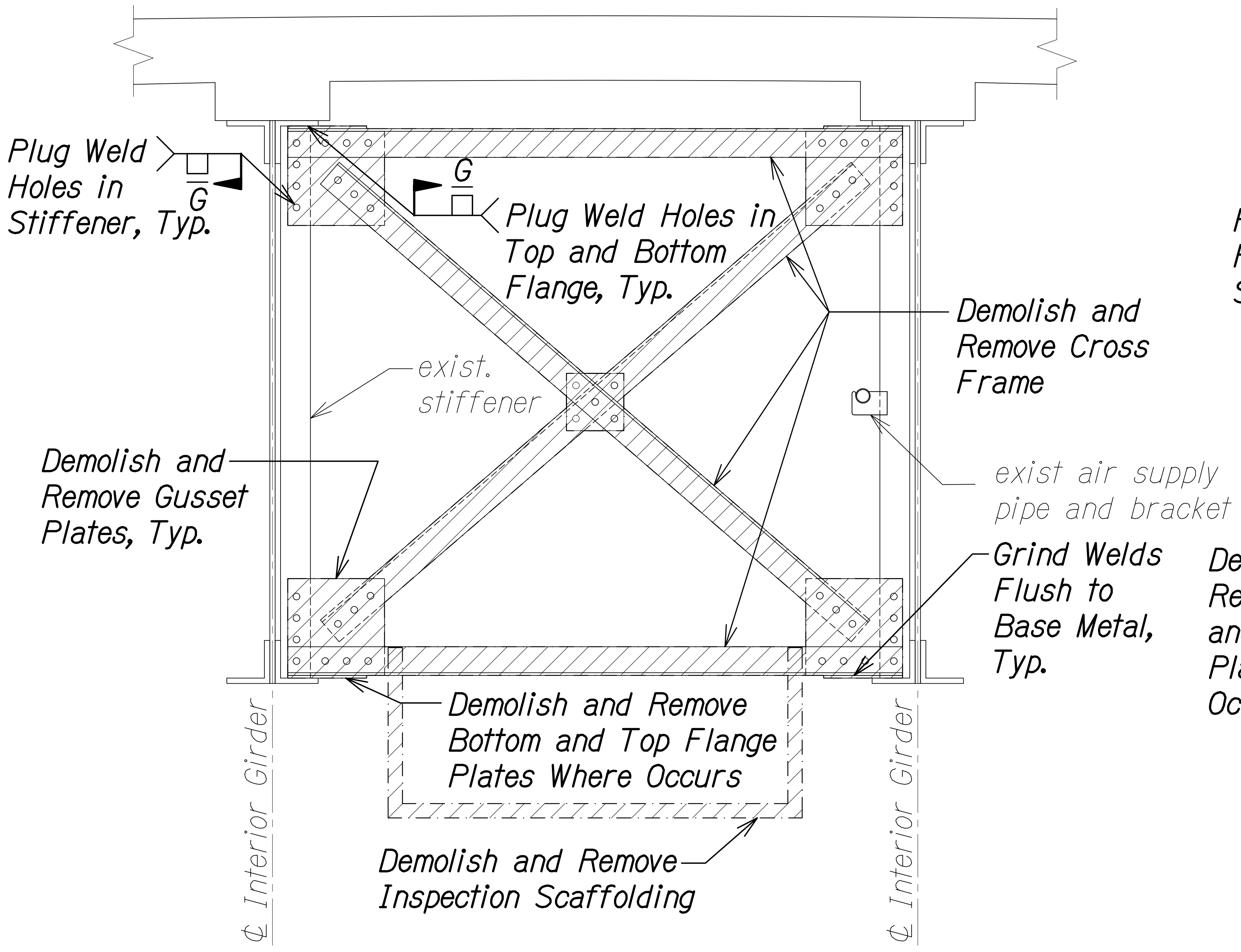
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No SA10.6 OF 30 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH.01 CAD\12-06-24 ADD2\NSR-SA1001-SA1009 STRUT DEMO SECT ADD2.DWG PLOT TIME: 12-03-24, 10:32 PM

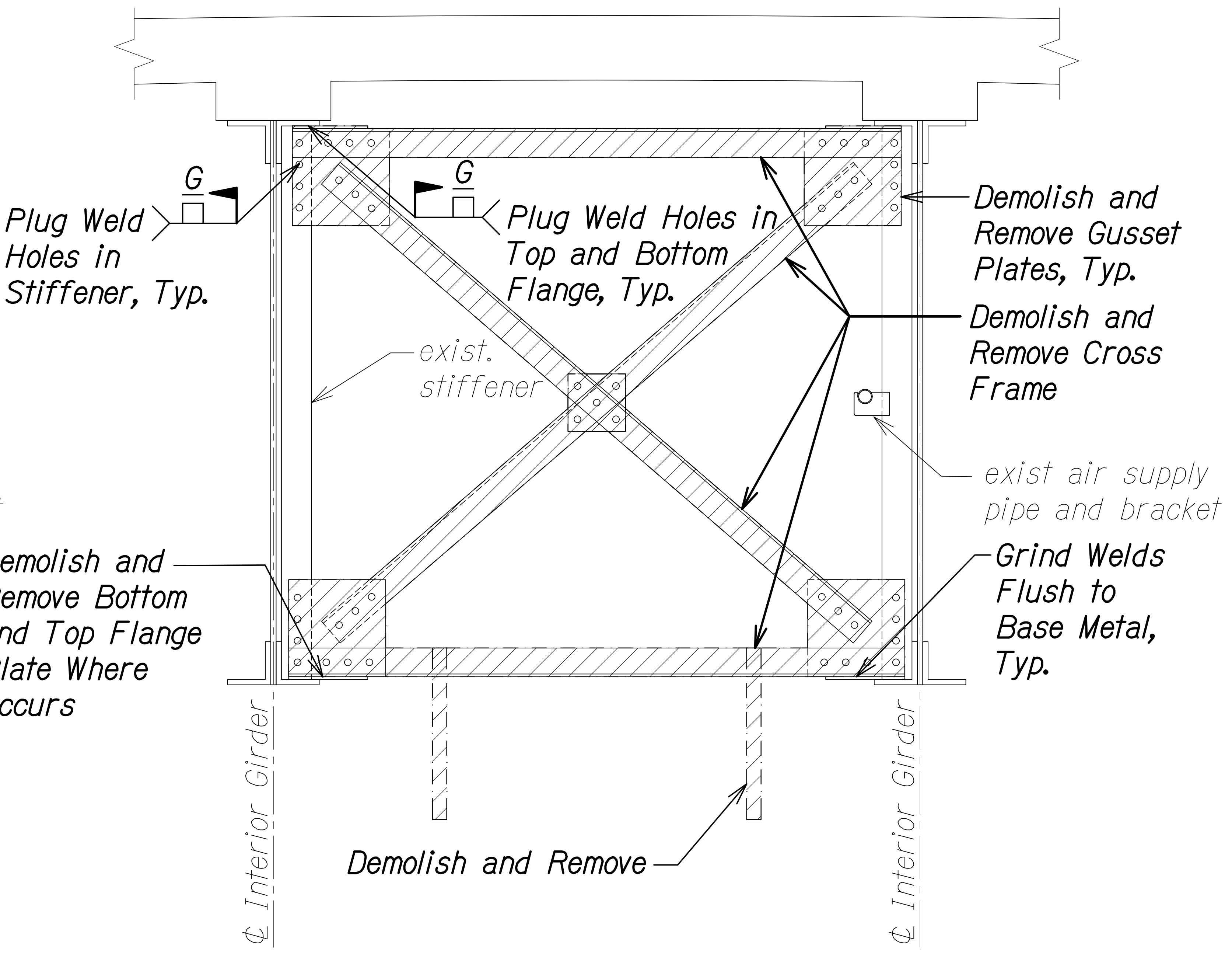
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 189	280



[C6] INTERIOR BAY DEMO SECTION AT IN-SPAN CROSS FRAME

A SA10.7 | SA10.7

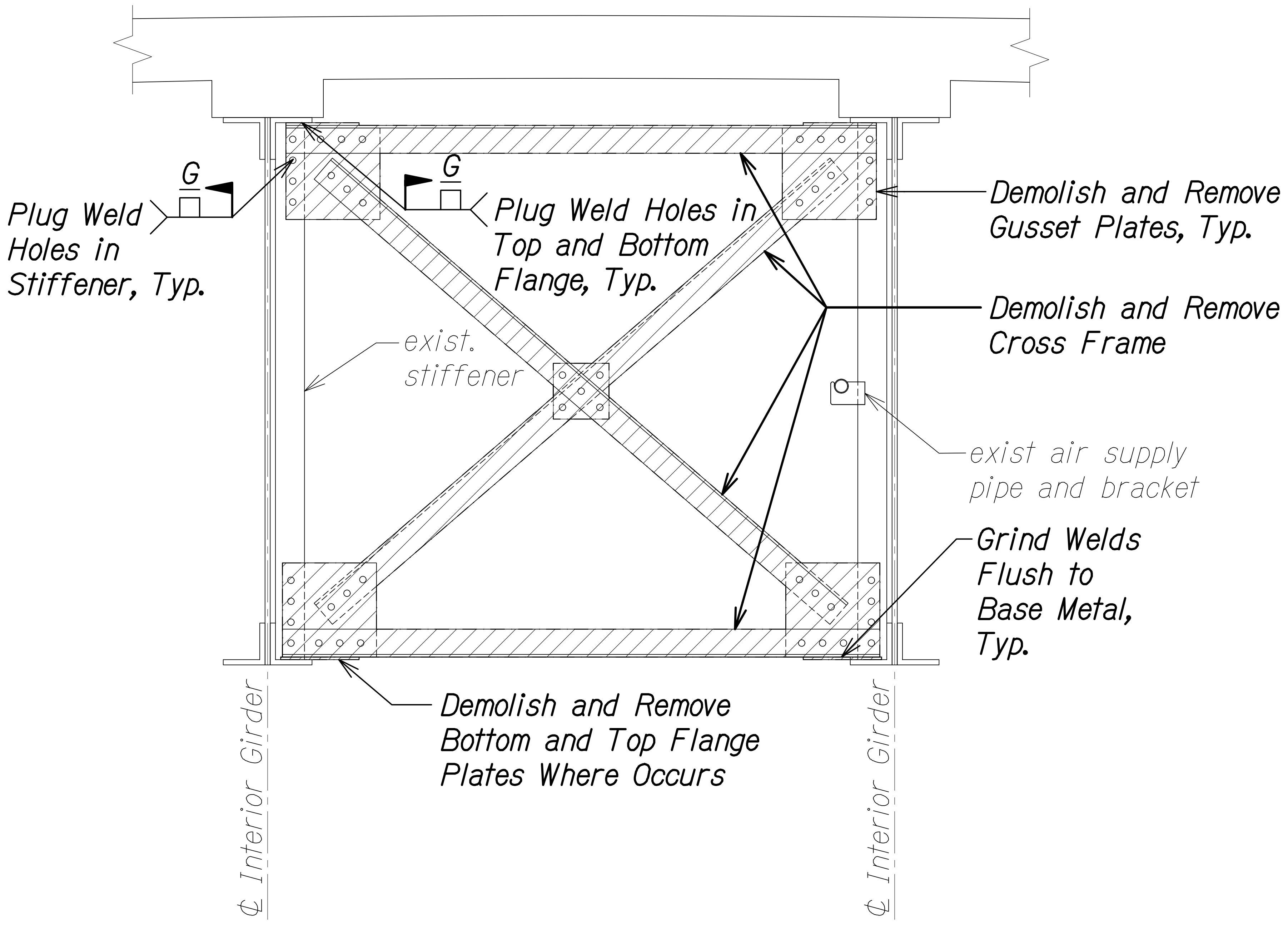
Scale: 3/4" = 1'-0"



[C7] INTERIOR BAY DEMO SECTION AT IN-SPAN CROSS FRAME

B SA10.7 | SA10.7

Scale: 3/4" = 1'-0"



[C8] INTERIOR BAY DEMO SECTION AT IN-SPAN CROSS FRAME

C SA10.7 | SA10.7

Scale: 3/4" = 1'-0"

LEGEND:

▨	Demolish and Remove
△1 [XX]	Cross Frame Mark, See SA9.1 through SA9.5 for locations

NOTES:

1. The Contractor shall take care when removing existing steel members so as not to damage the existing steel members to remain.
2. Remove all exist. wood board inspection planks (not shown) and deliver to HDOT maintenance yard.
3. Details beyond shown bay are not provided.
4. See Sheet SA10.11 for miscellaneous demolition details

DATE	REVISION
12/6/24	△1 Revised Note

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

Stephen Peters
4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

IN-SPAN CROSS FRAME
DEMOLITION SECTIONS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

SHEET No SA10.7 OF 30 SHEETS

ADD. 189

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	
	TRACED BY	
NOTE BOOK No.	DESIGNED BY	
	QUANTITIES BY	
	CHECKED BY	

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTHA\01 CAD\12-06-24 ADD2\NSR-SA1001-SA1009 STRUT DEMO SECT ADD2.DWG PLOT TIME: 12-03-24, 11:34 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 190	280

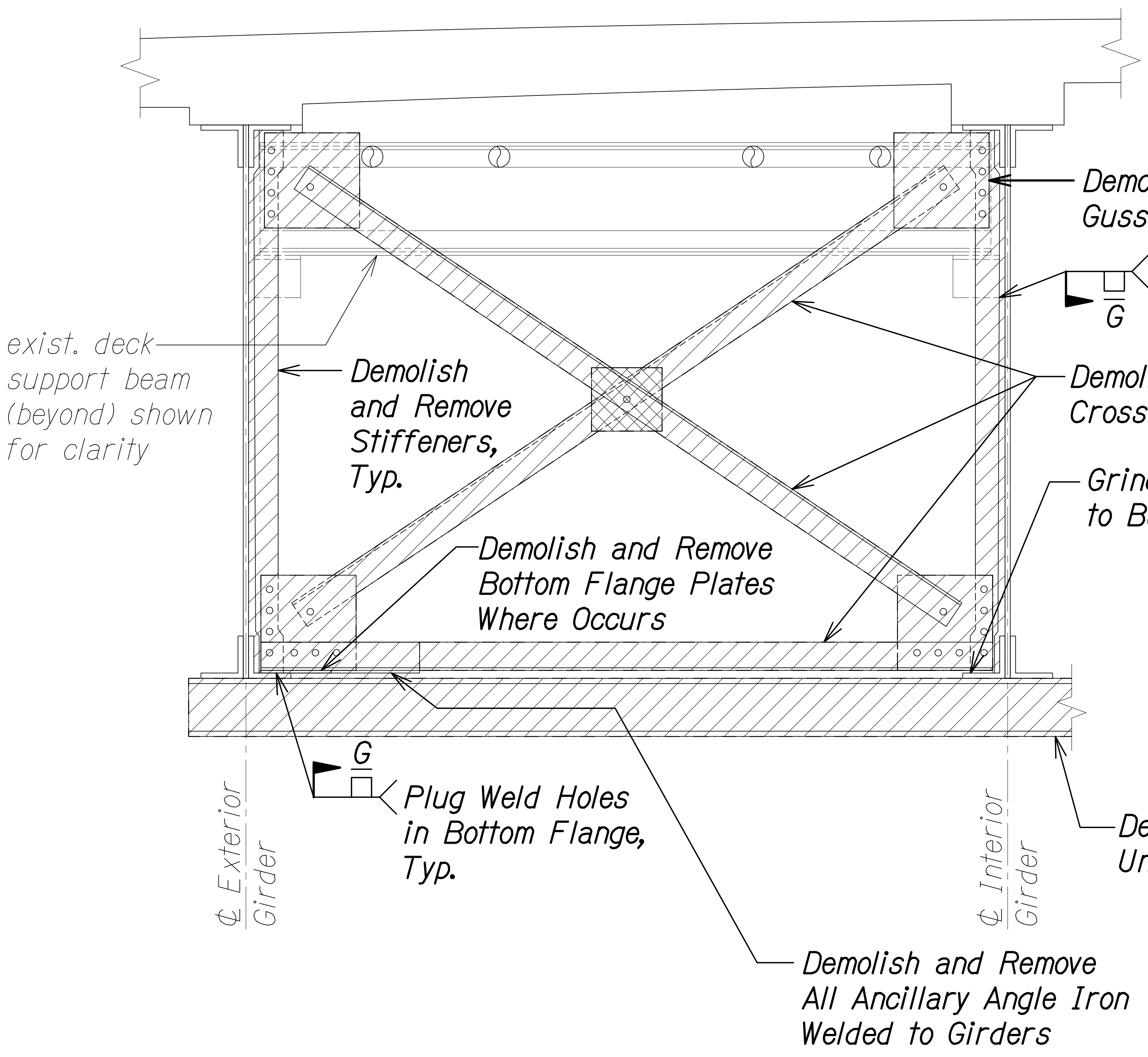
LEGEND:

▨ Demolish and Remove

△1 [XX] Cross Frame Mark, See SA9.1 through SA9.5 for locations

NOTES:

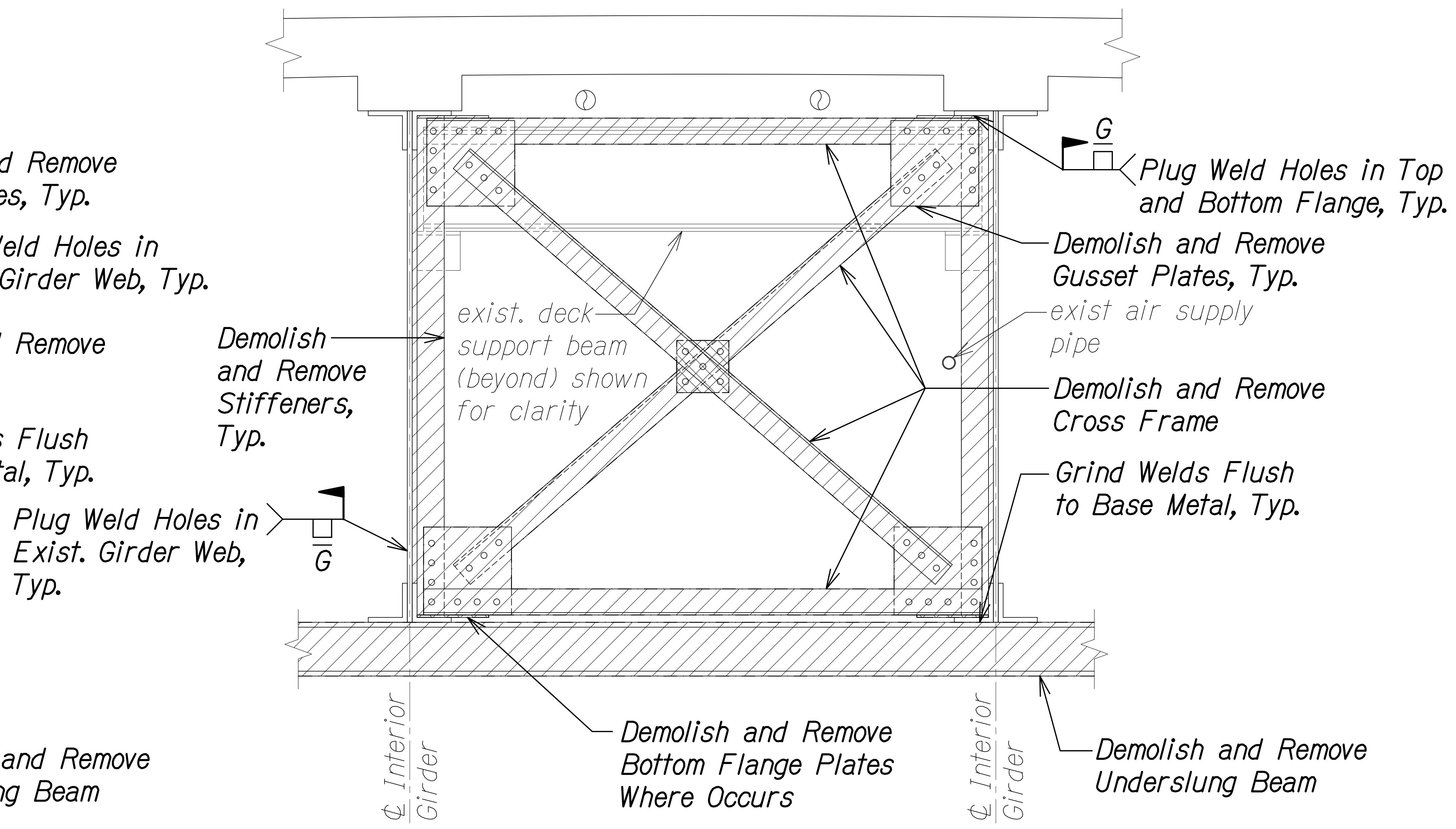
1. The Contractor shall take care when removing existing steel members so as not to damage the existing steel members to remain.
2. Remove all exist. wood board inspection planks (not shown) and deliver to HDOT maintenance yard.
3. Details beyond shown bay are not provided.
4. See Sheet SA10.11 for miscellaneous demolition details



[E1] EXTERIOR BAY DEMO SECTION AT EXPANSION BEARING

Scale: 3/4" = 1'-0"

A
SA10.8 | SA10.8



[E2] TYPICAL INTERIOR BAY DEMO SECTION AT EXPANSION BEARING

Scale: 3/4" = 1'-0"

B
SA10.8 | SA10.8

DATE	REVISION
12/6/24	△1 Revised Note

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

EXPANSION BEARING CROSS FRAME DEMOLITION SECTIONS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

Scale: As Noted Date: Oct. 2024

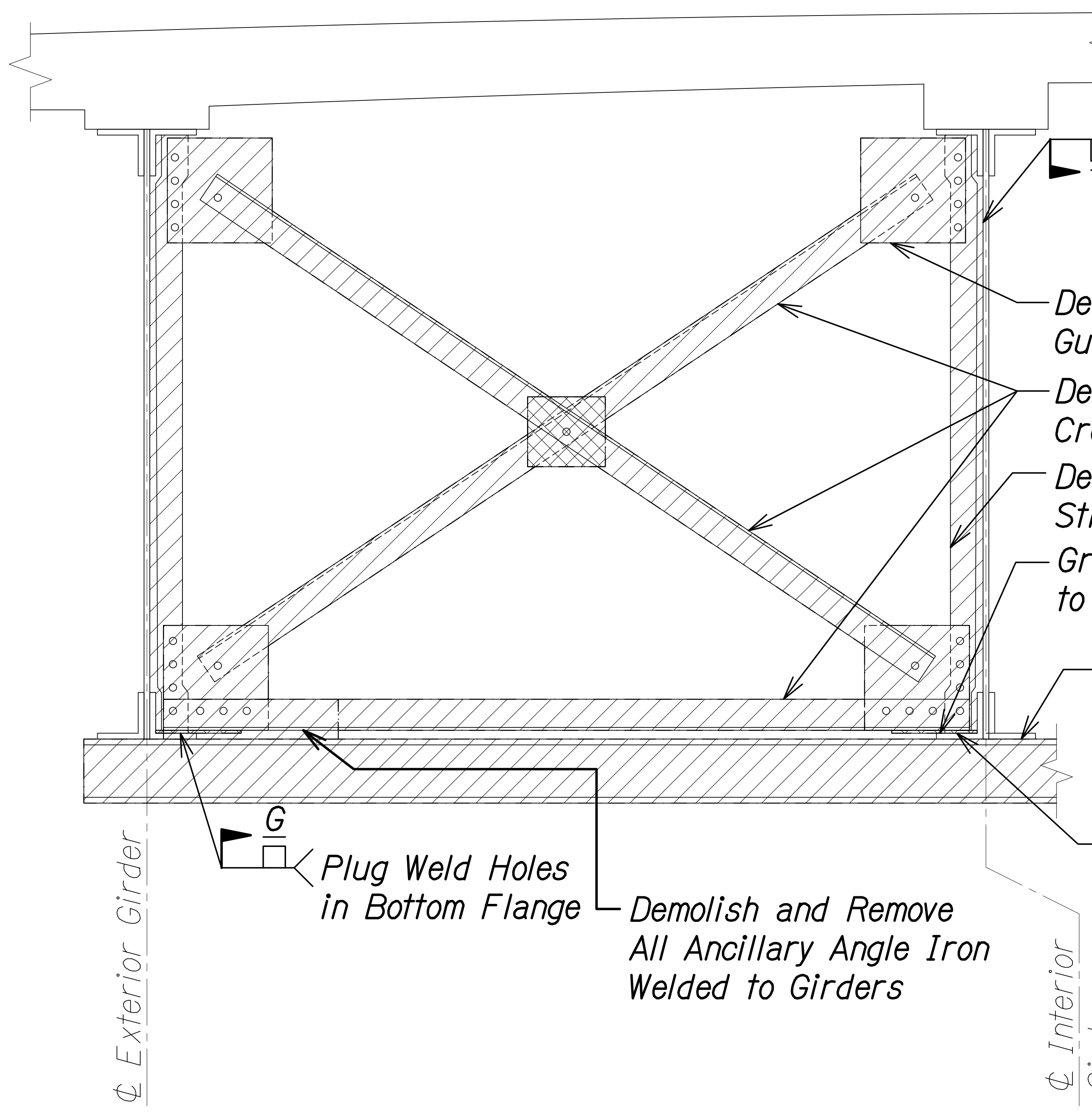
SHEET No SA10.8 OF 30 SHEETS

ADD. 190

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY "
TRACED BY "
DESIGNED BY "
QUANTITIES BY "
CHECKED BY "
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA1001-SA1009 STRUT DEMO SECT ADD2.DWG PLOT TIME: 12-03-24, 10:33 PM)

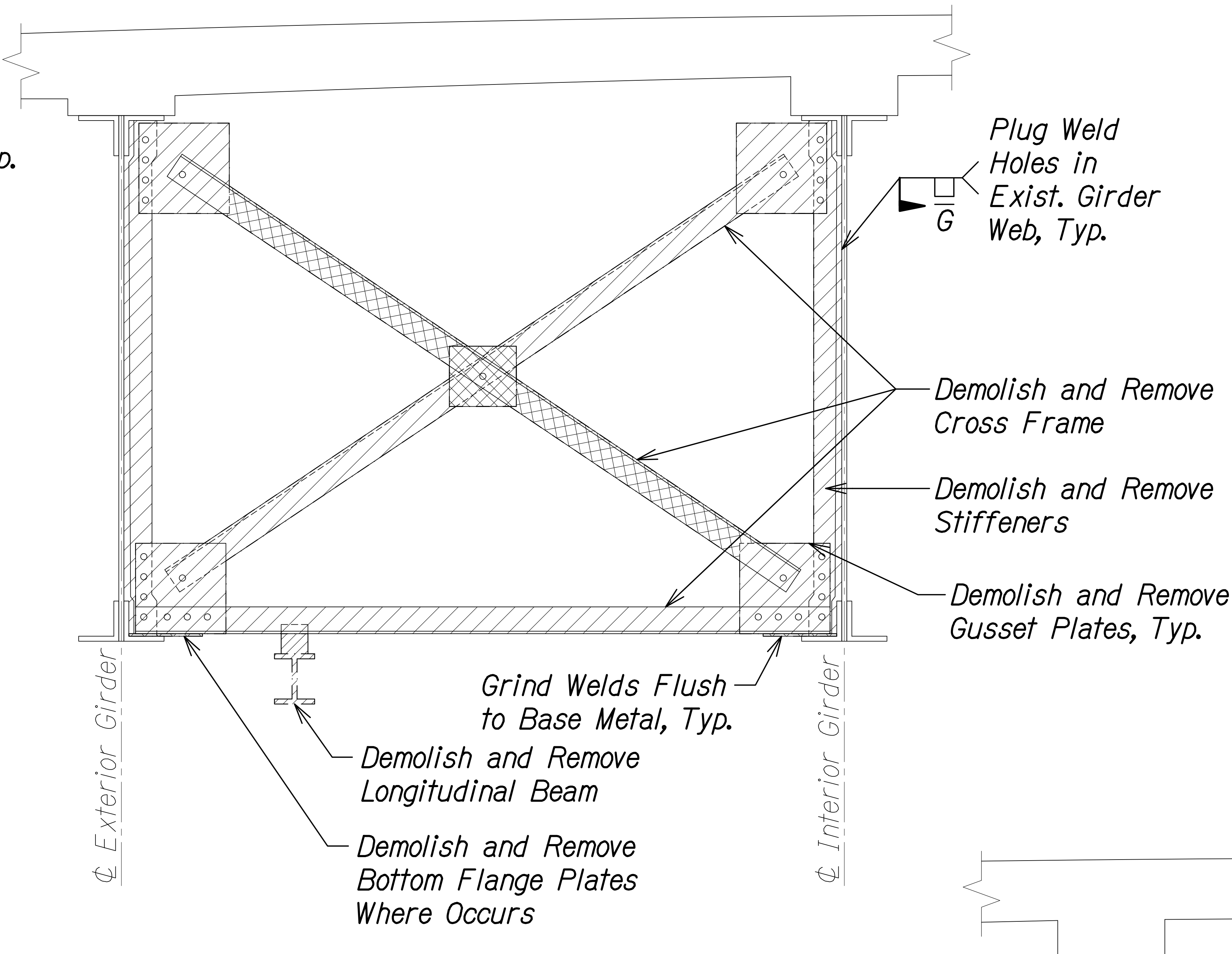
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 191	280



[F1] EXTERIOR BAY DEMO SECTION AT FIXED BEARING

Scale: 3/4" = 1'-0"

A
SA10.9 | SA10.9



[F2] EXTERIOR BAY DEMO SECTION AT FIXED BEARING

Scale: 3/4" = 1'-0"

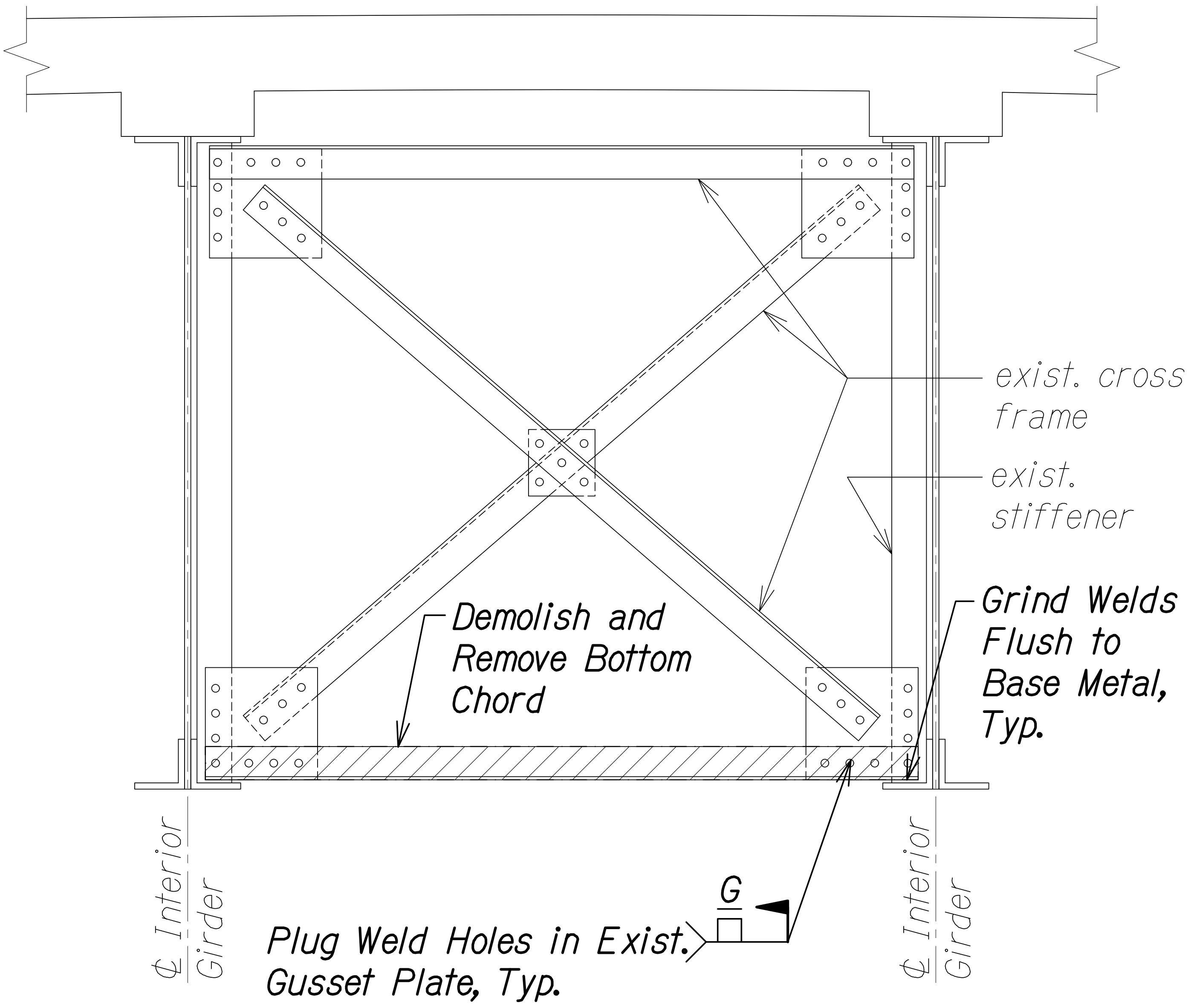
B
SA10.9 | SA10.9

LEGEND:

▨	Demolish and Remove
△1 [XX]	Cross Frame Mark, See SA9.1 through SA9.5 for locations

NOTES:

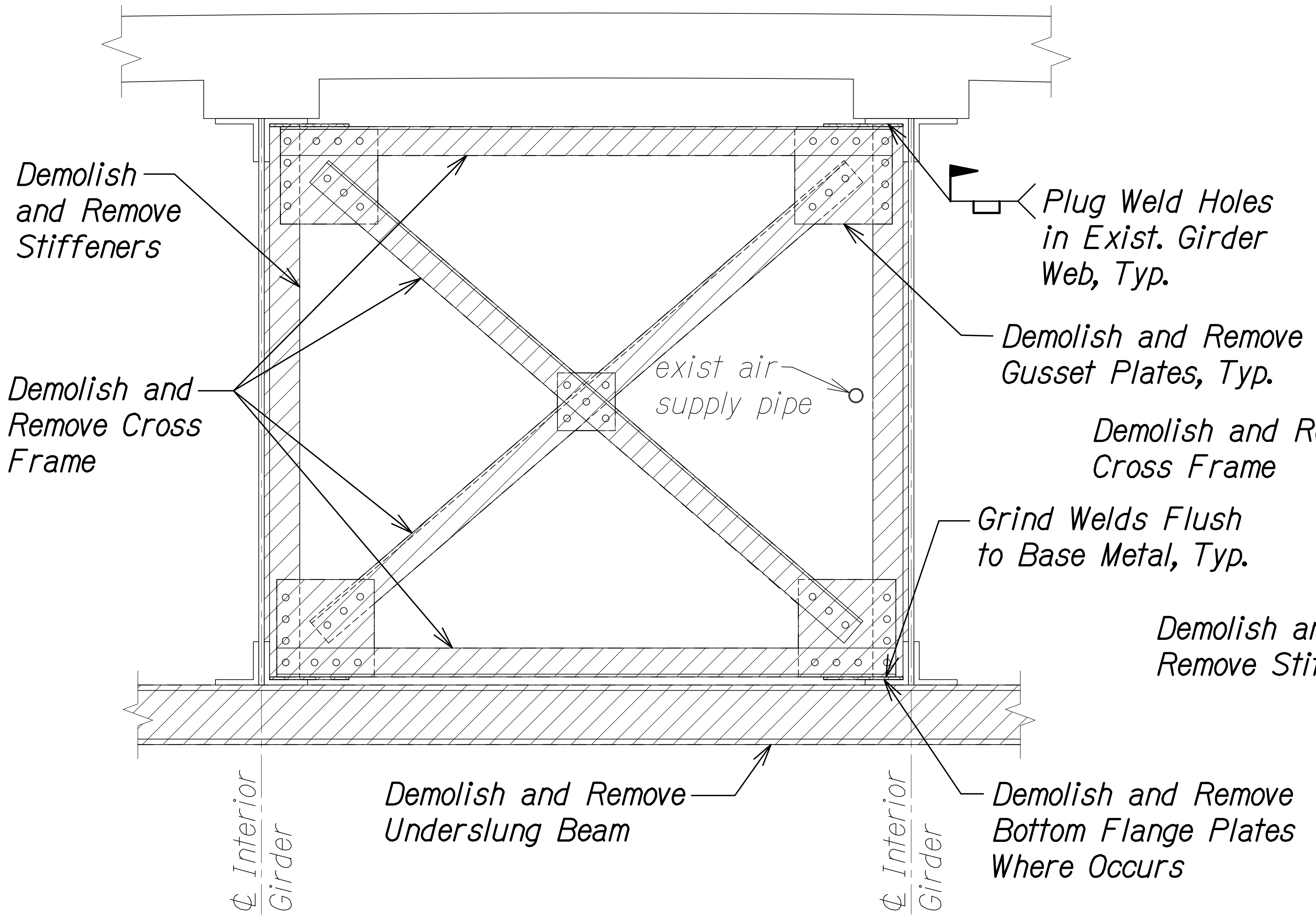
1. The Contractor shall take care when removing existing steel members so as not to damage the existing steel members to remain.
2. Remove all exist. wood board inspection planks (not shown) and deliver to HDOT maintenance yard.
3. Details beyond shown bay are not provided.
4. See Sheet SA10.11 for miscellaneous demolition details.



[F5] INTERIOR BAY DEMO SECTION AT FIXED ABUTMENT

Scale: 3/4" = 1'-0"

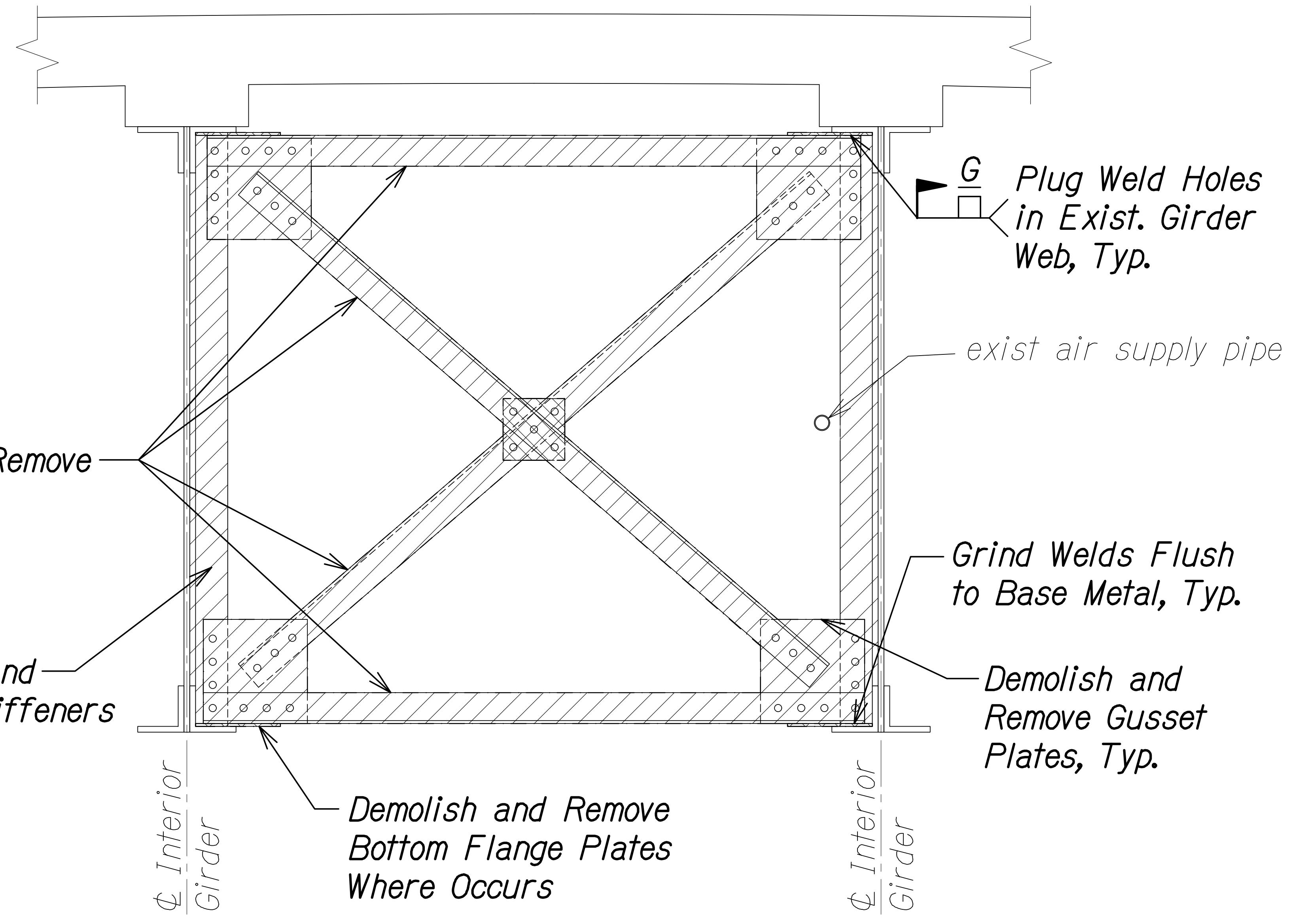
E
SA10.9 | SA10.9



[F3] INTERIOR BAY DEMO SECTION AT FIXED BEARING

Scale: 3/4" = 1'-0"

C
SA10.9 | SA10.9



[F4] INTERIOR BAY DEMO SECTION AT FIXED BEARING

Scale: 3/4" = 1'-0"

D
SA10.9 | SA10.9

12/6/24	△1	Revised Note
DATE		REVISION

STEPHEN T. PETERS
NO. 17097-S

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Stephen Peters 4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

FIXED BEARING CROSS FRAME DEMOLITION SECTIONS

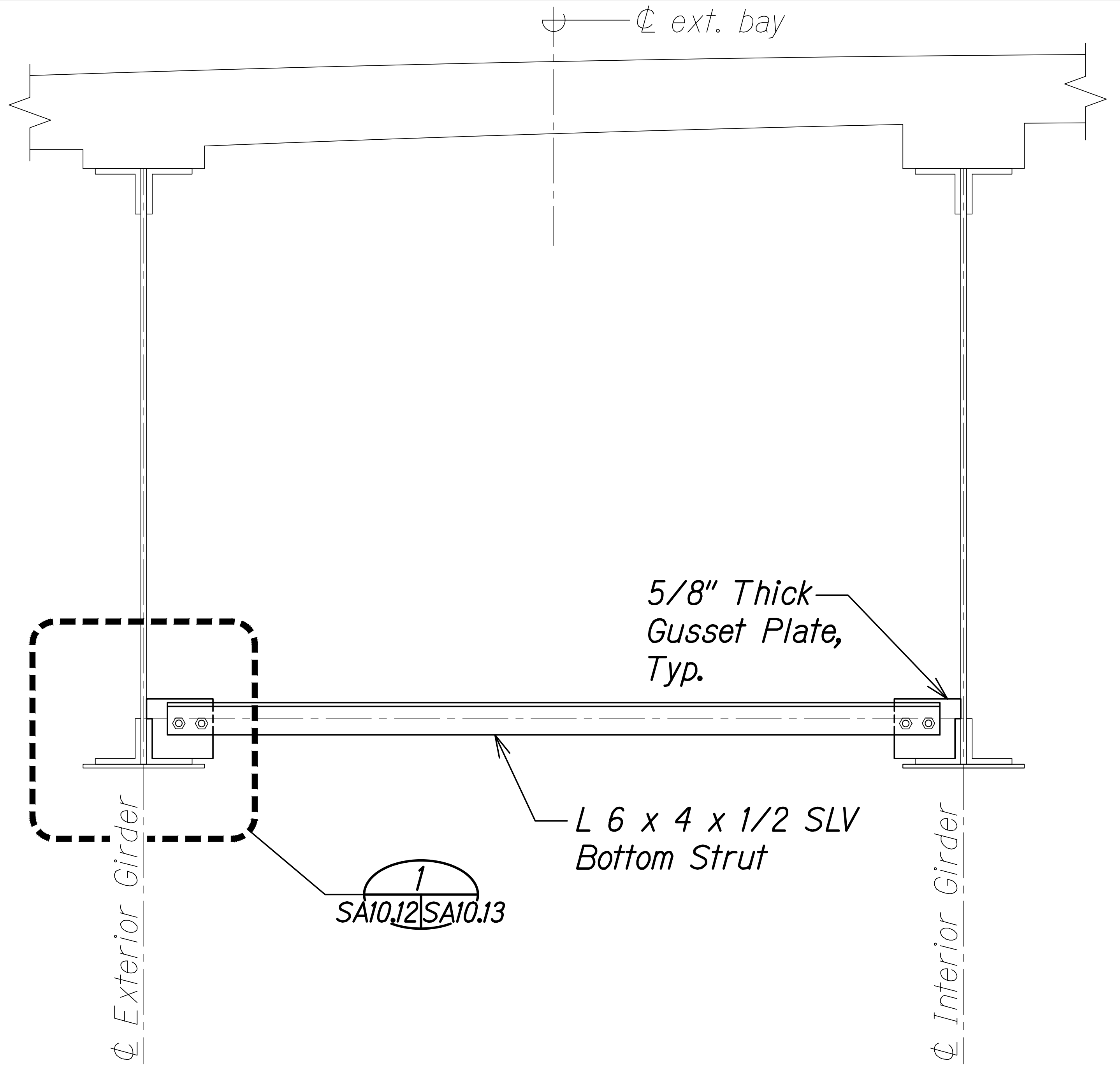
HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024
SHEET No SA10.9 OF 30 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA1001-SA1009 STRUT DEMO SECT ADD2.DWG PLOT TIME: 12-03-24, 10:34 PM)

ADD. 191

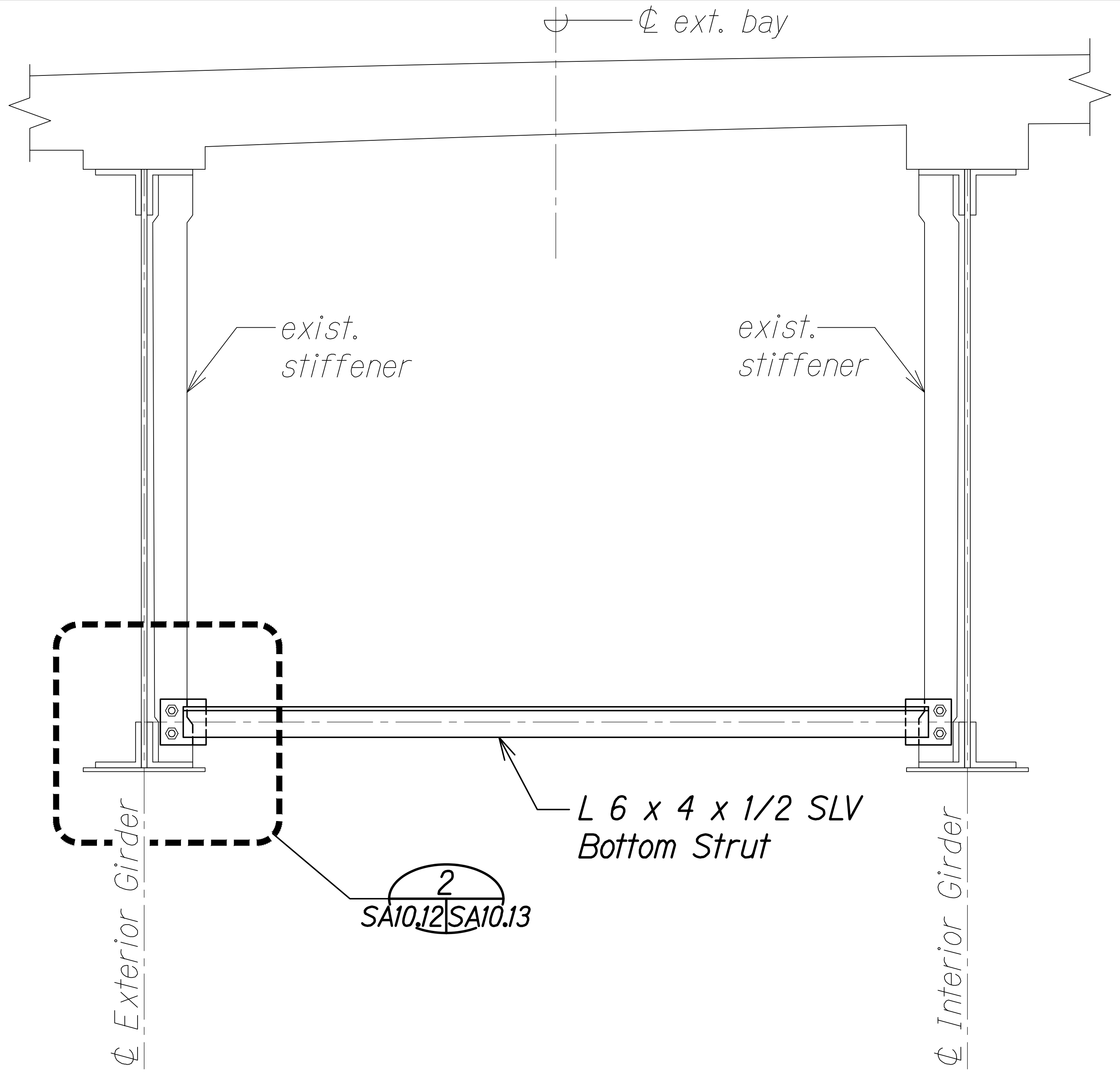
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 194	280



[SE1] EXTERIOR BAY STRUT SECTION

A SA10.12 SA10.12

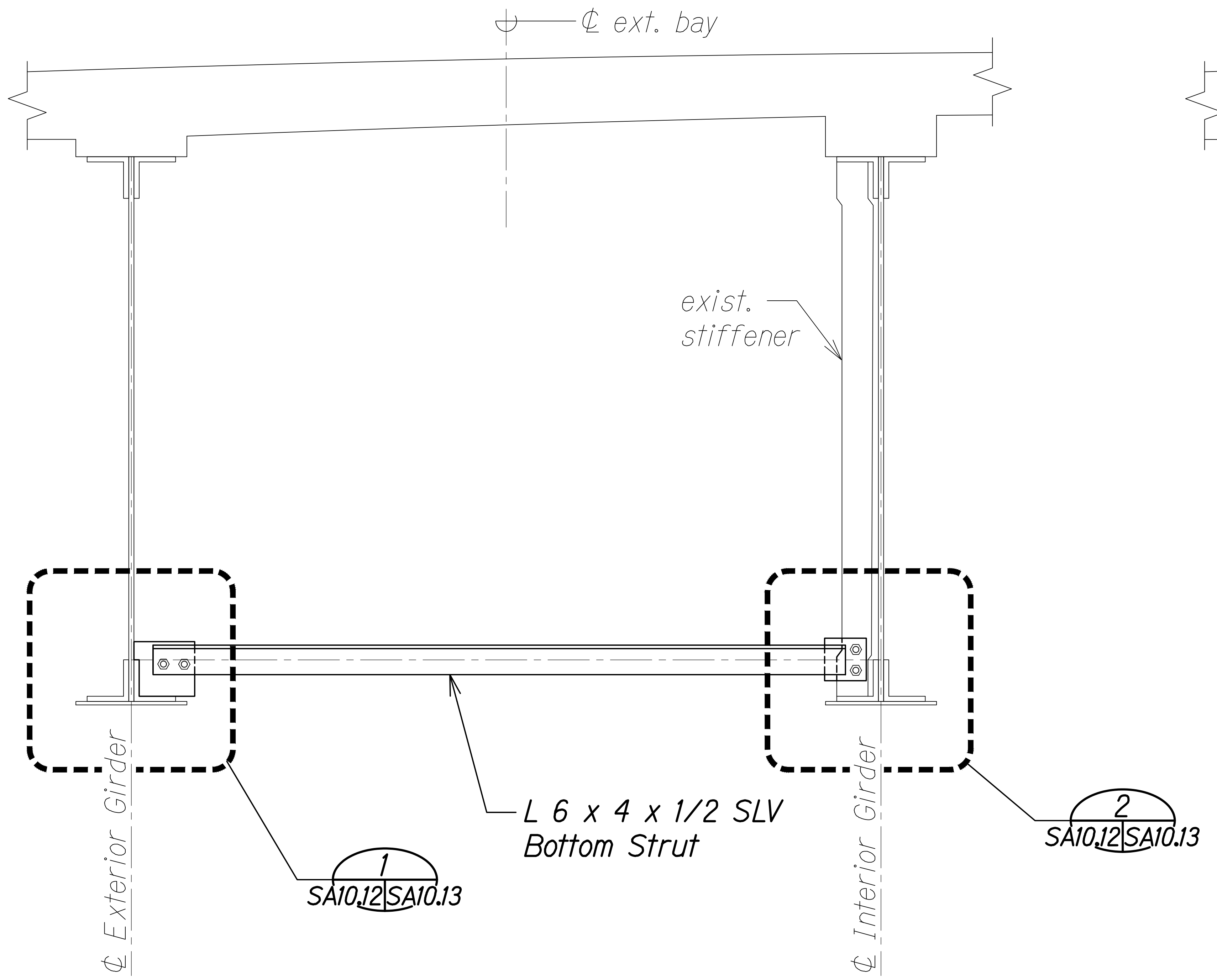
Scale: 3/4" = 1'-0"



[SE2] EXTERIOR BAY STRUT SECTION

B SA10.12 SA10.12

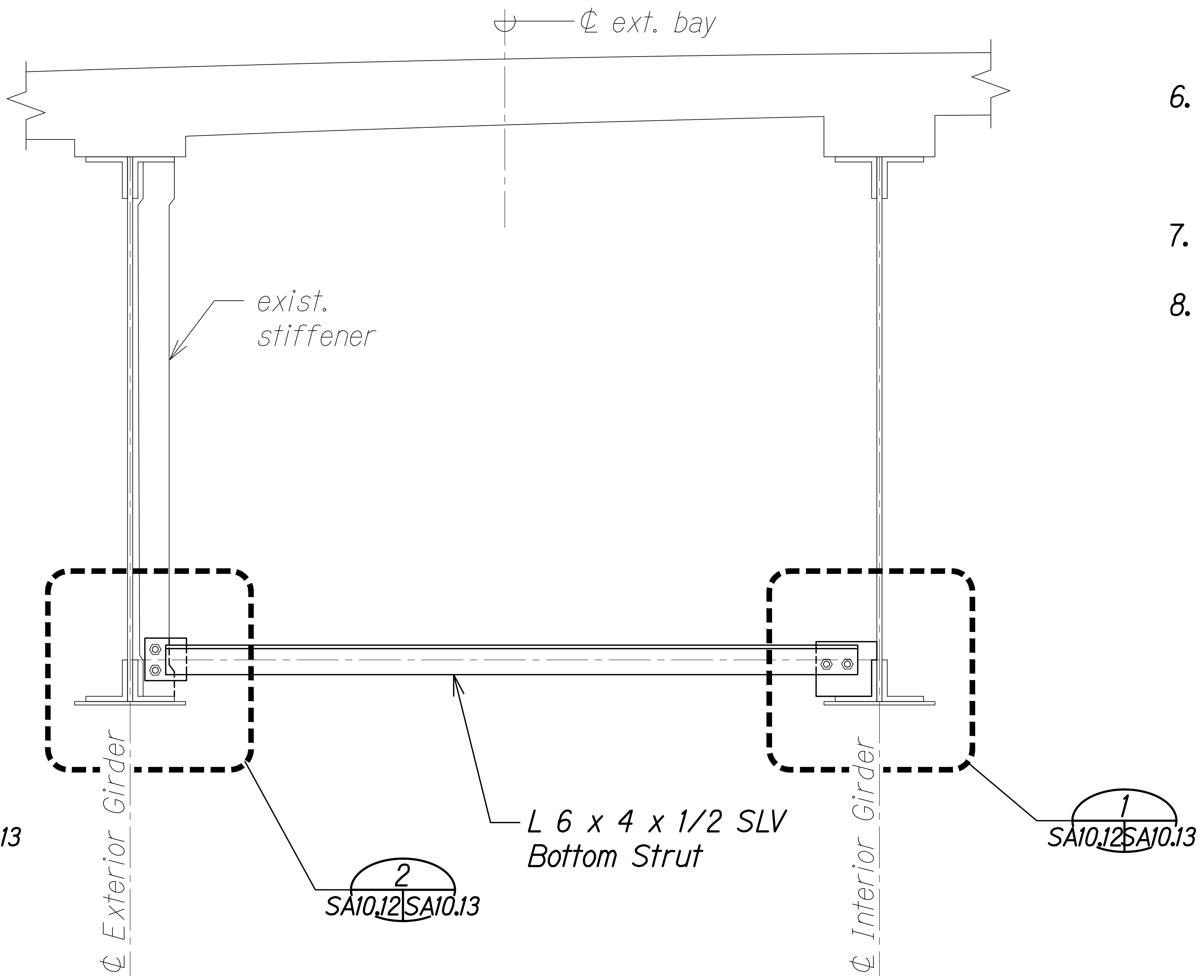
Scale: 3/4" = 1'-0"



[SE3] EXTERIOR BAY STRUT SECTION

C SA10.12 SA10.12

Scale: 3/4" = 1'-0"



[SE4] EXTERIOR BAY STRUT SECTION

D SA10.12 SA10.12

Scale: 3/4" = 1'-0"

LEGEND:

[XXX]	Strut Mark, See SA9.6 through SA9.10 for locations

NOTES:

1. The Contractor shall field fit strut members and gussets prior to welding and galvanizing assemblies.
2. New gussets welded directly to exist. plate girders shall be provided ungalvanized. Field drill standard size holes in exist. girder stiffeners and new welded gusset plates to match bolt pattern in new strut assembly.
3. △1 Strut assemblies shall be delivered to the site fully assembled, hot-dip zinc galvanized per ASTM A123 and shop painted with primer, seal, stripe coat, and intermediate in accordance with Section 667 - PREPARATION AND COATING OF GALVANIZED BRIDGE STEEL of the Special Provisions.
4. Just prior to installation of strut assemblies, the immediate surrounding faying surfaces of existing girder web, flange, and stiffeners as well as new welded gusset plates shall be cleaned in accordance with SSPC-SP 10 or SSPC-SP 11 and painted, by brush, with two coats of the specified primer.
5. Perform final abrasive blast cleaning to all girders, stiffeners, etc. Strut assemblies shall be sufficiently shielded from damage during blasting operation and masked from overspray during primer application. △1
6. Strut assemblies shall receive field applied top coat in accordance with Section 666 - BLAST, CLEAN, AND PAINT EXISTING BRIDGE STEEL of the Special Provisions.
7. Details from adjacent bays not shown for clarity.
8. See Sheet SA9.23 for required sequence regarding strut replacement and corresponding traffic control requirements.

DATE	REVISION
12/6/24	△1 Revised Notes

STEPHEN T. PETERS
NO. 17097-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

EXTERIOR BAY STRUT SECTIONS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

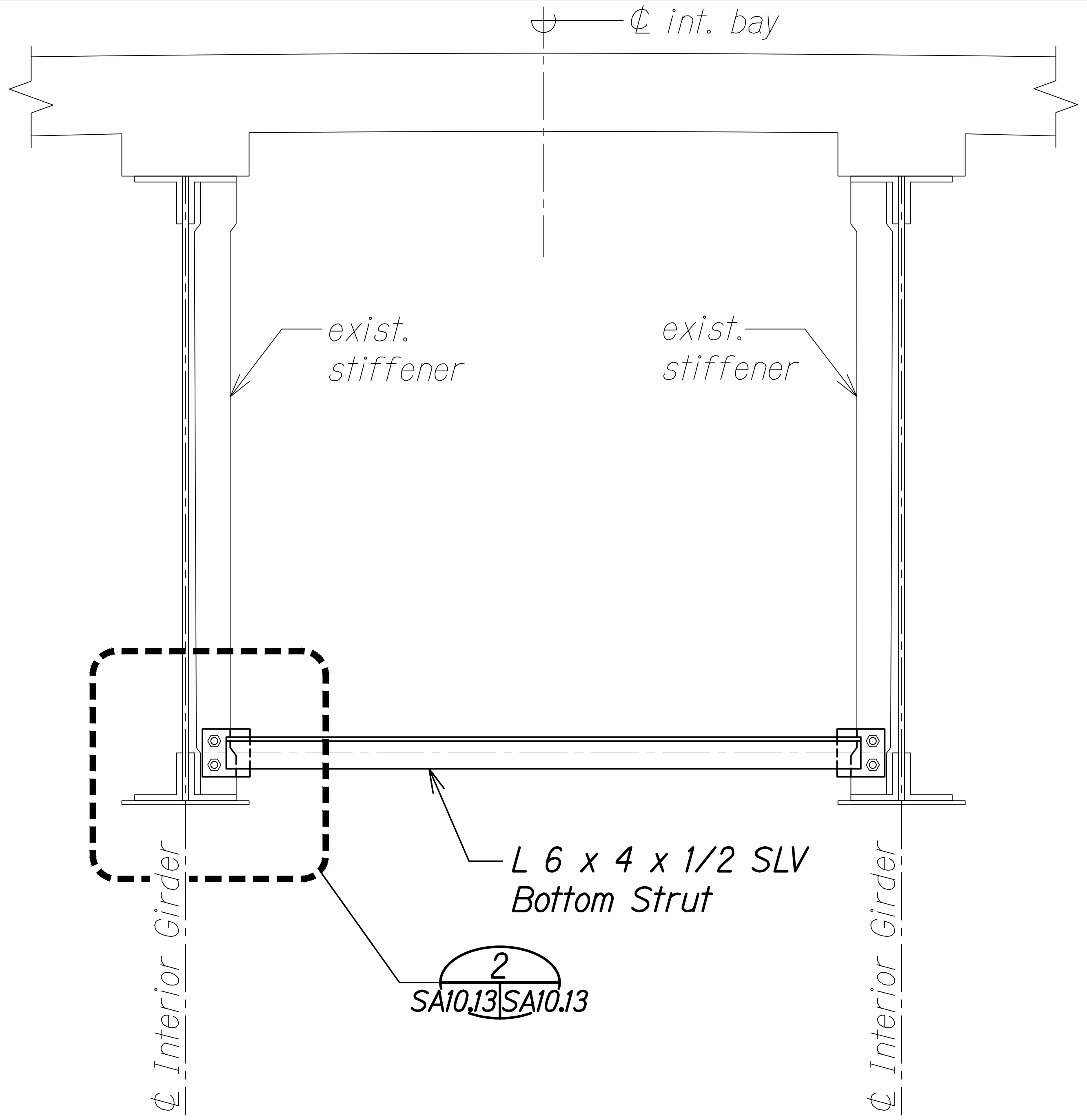
Scale: As Noted   Date: Oct. 2024

SHEET No SA10.12 OF 30 SHEETS

ORIGINAL PLAN
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE
NOTE BOOK
No.

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA1012-SA1024 STRUT X-FRMG ADD2.DWG PLOT TIME: 12-03-24, 10:39 PM)

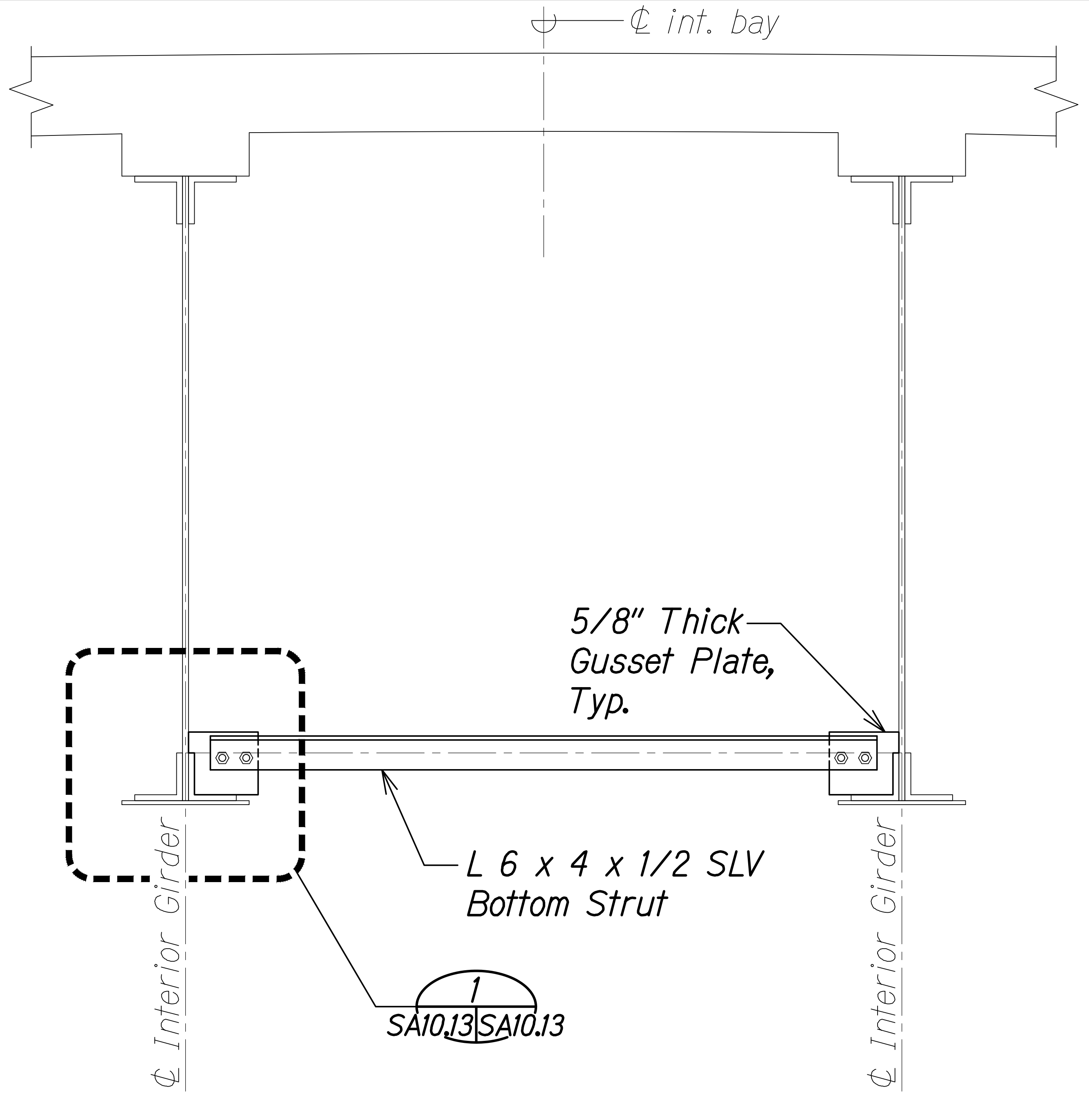
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 195	280



[SI1] INTERIOR BAY STRUT SECTION

A SA10.13 | SA10.13

Scale: 3/4" = 1'-0"



[SI2] INTERIOR BAY STRUT SECTION

B SA10.13 | SA10.13

Scale: 3/4" = 1'-0"

LEGEND:

[XXX] Strut Mark, See SA9.6 through SA9.10 for locations

NOTES:

1. The Contractor shall field fit strut members and gussets prior to welding and galvanizing assemblies.
2. New gussets welded directly to exist. plate girders shall be provided ungalvanized. Field drill standard size holes in exist. girder stiffeners and new welded gusset plates to match bolt pattern in new strut assembly.
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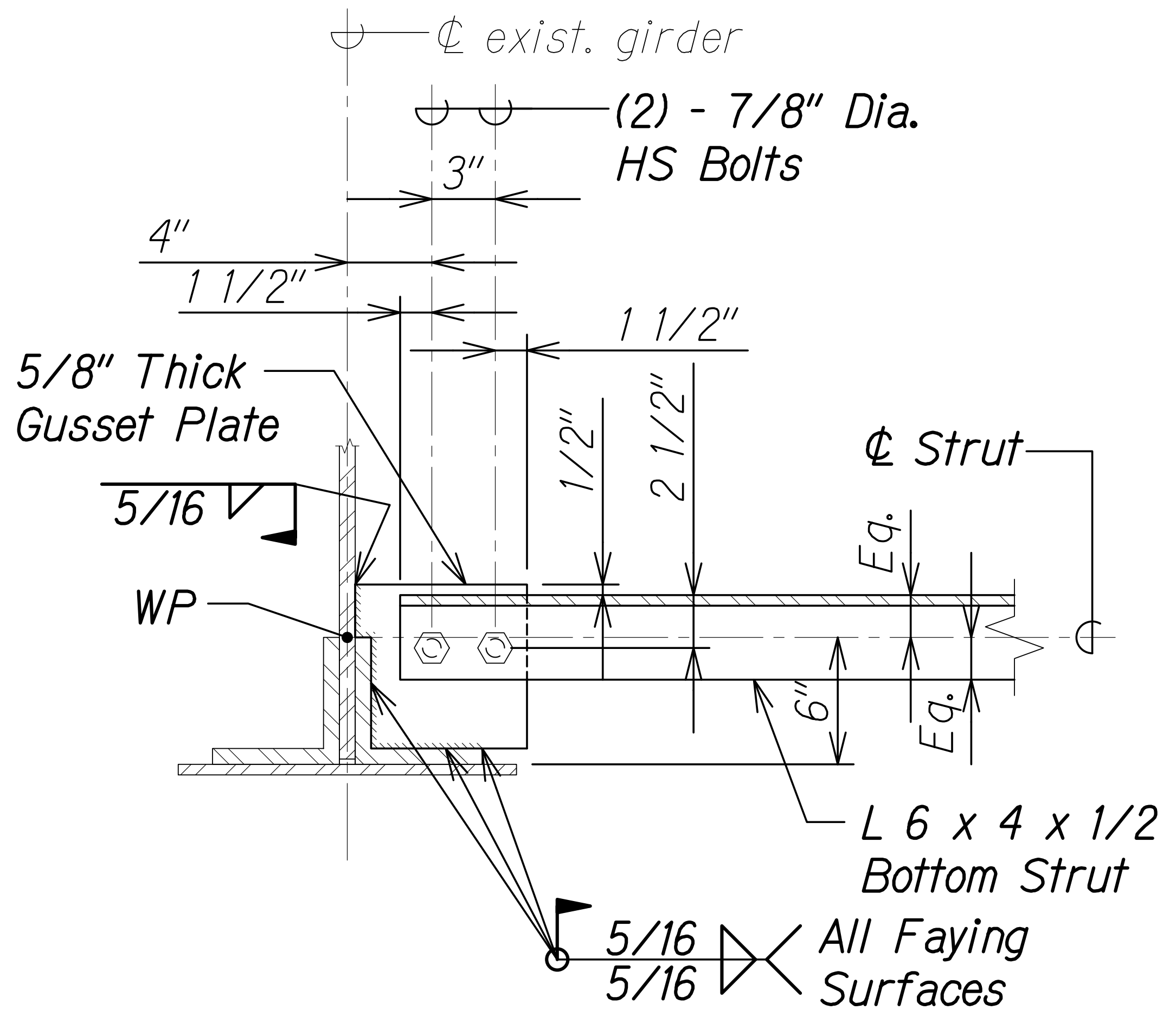
4. Just prior to installation of strut assemblies, the immediate surrounding faying surfaces of existing girder web, flange, and stiffeners as well as new welded gusset plates shall be cleaned in accordance with SSPC-SP 10 or SSPC-SP 11 and painted, by brush, with two coats of the specified primer.
5. Perform final abrasive blast cleaning to all girders, stiffeners, etc. Strut assemblies shall be sufficiently shielded from damage during blasting operation and masked from overspray during primer application. 1
6. Strut assemblies shall receive field applied top coat in accordance with Section 666 - BLAST, CLEAN, AND PAINT EXISTING BRIDGE STEEL of the Special Provisions.
7. Details from adjacent bays not shown for clarity.
8. See Sheet SA9.23 for required sequence regarding strut replacement and corresponding traffic control requirements.

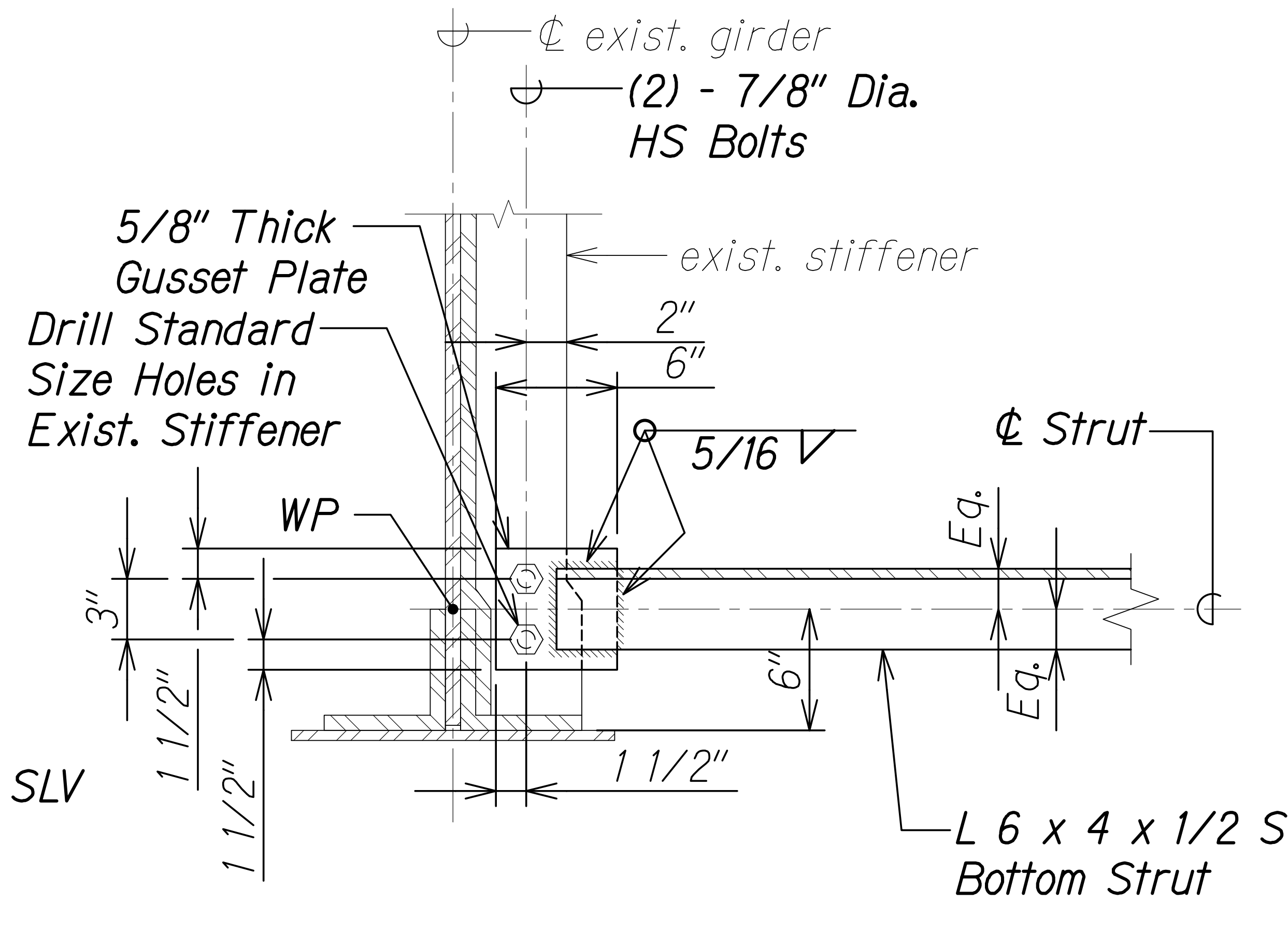


DETAIL

1 SA10.12 | SA10.13

Scale: 1 1/2" = 1'-0"

SA10.13

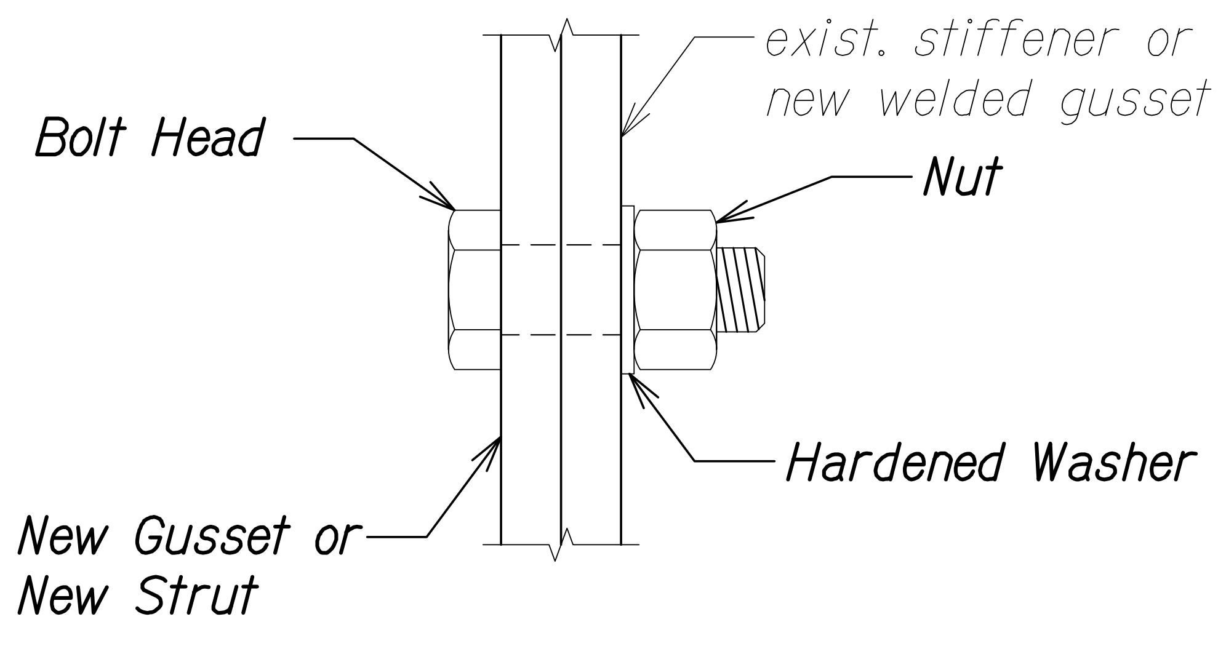


DETAIL

2 SA10.12 | SA10.13

Scale: 1 1/2" = 1'-0"

SA10.13



BOLT CONNECTION DETAIL

3 SA10.13 | SA10.13

Scale: 6" = 1'-0"

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

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4-30-26

SIGNATURE EXPIRATION DATE OF THE LICENSE

DATE	REVISION
12/6/24	1 Revised Notes

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

INTERIOR BAY STRUT
SECTIONS AND DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

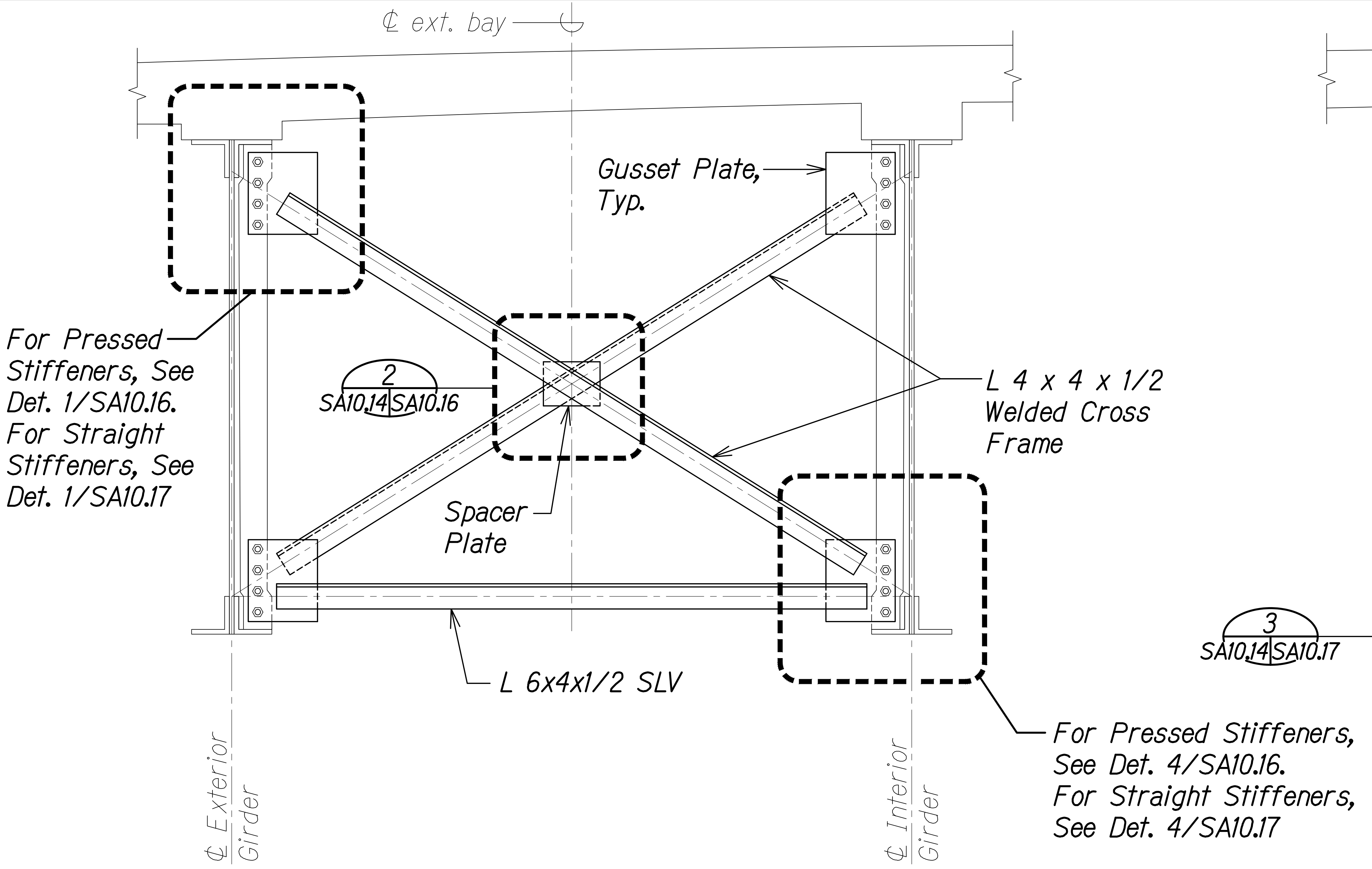
Scale: As Noted Date: Oct. 2024

SHEET No SA10.13 OF 30 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
NOTE BOOK	TRACED BY	"
	DESIGNED BY	"
No.	QUANTITIES BY	"
	CHECKED BY	"

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA1012-SA1024 STRUT X-FRMG ADD2.DWG PLOT TIME: 12-03-24, 8:57 PM)

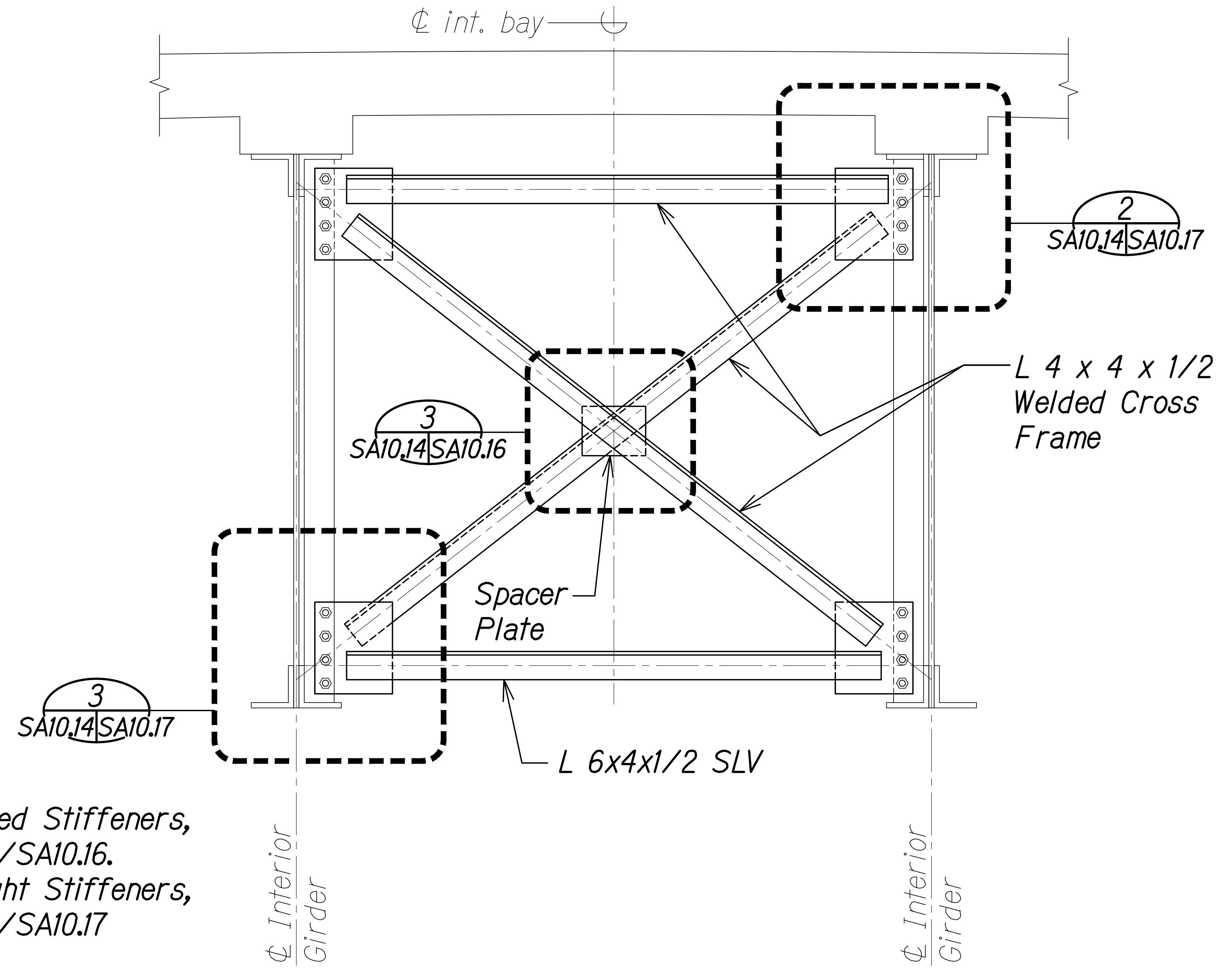
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 196	280



[R1] EXTERIOR BAY SECTION AT IN-SPAN CROSS FRAME

A SA10.14 SA10.14

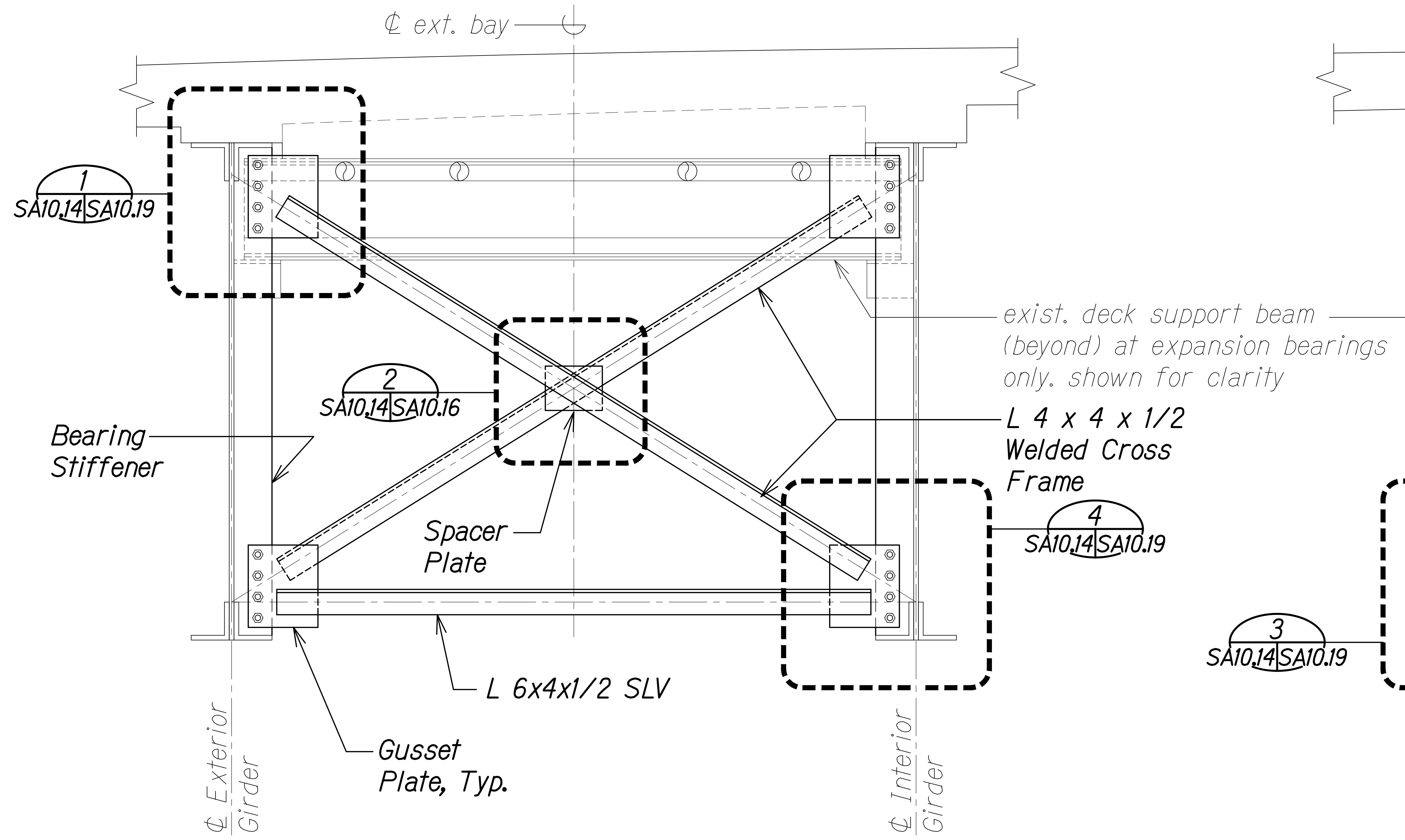
Scale: 3/4" = 1'-0"



[R2] INTERIOR BAY SECTION AT IN-SPAN CROSS FRAME

B SA10.14 SA10.14

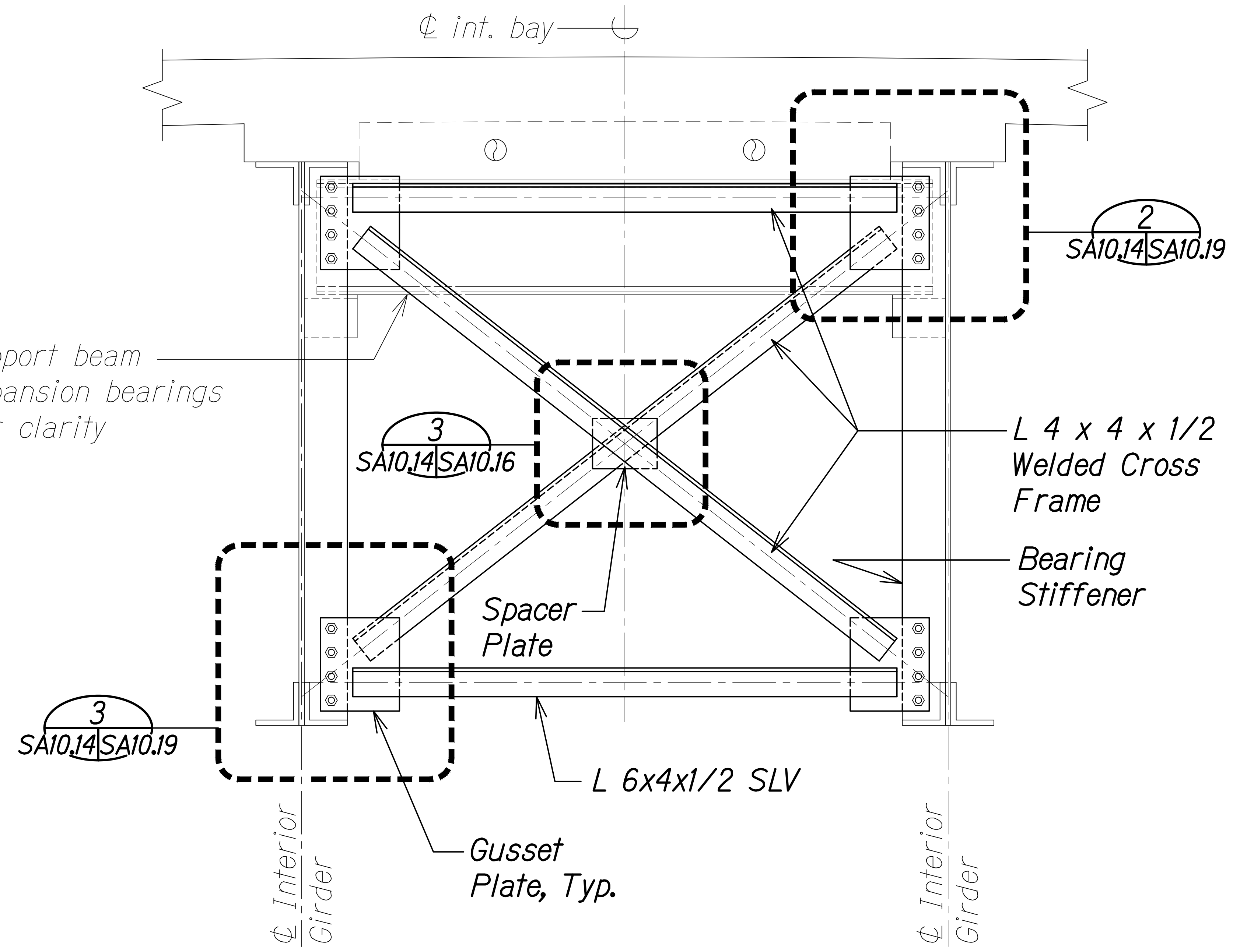
Scale: 3/4" = 1'-0"



[R3] EXTERIOR BAY SECTION AT FIXED & EXPANSION BEARING CROSS FRAMES

C SA10.14 SA10.14

Scale: 3/4" = 1'-0"



[R4] INTERIOR BAY SECTION AT FIXED & EXPANSION BEARING CROSS FRAMES

D SA10.14 SA10.14

Scale: 3/4" = 1'-0"

LEGEND: △1

[XXX] Cross Frame Mark, See SA9.6 through SA9.10 for locations

NOTES:

1. The Contractor shall field fit frame members and gussets prior to welding and galvanizing assemblies.
2. New girder stiffeners shall be provided ungalvanized and field welded to existing plate girders. Field drill standard size holes in existing/new girder stiffeners to match bolt pattern in new cross frame assembly.
3. Existing stiffeners at in-span cross frames shall remain. Existing bearing stiffeners at fixed and expansion bearing cross frames shall be replaced. See Sheet SA10.20 for stiffener replacement details.
4. Cross frame assemblies shall be delivered to the site fully assembled, hot-dip zinc galvanized per ASTM A123, and shop painted with primer, seal coat, stripe coat, and intermediate in accordance with Section 667 - PREPARATION AND COATING OF GALVANIZED BRIDGE STEEL of the Special Provisions. △1
5. Just prior to installation of cross frame assemblies, the immediate surrounding faying surfaces of existing/new girder stiffeners shall be cleaned in accordance with SSPC-SP 10 or SSPC-SP 11 and painted, by brush, with two coats of the specified primer.
6. Perform final abrasive blast cleaning to all girders, stiffeners, etc. Cross frame assemblies shall be sufficiently shielded from damage during blasting operation and masked from overspray during primer application.
7. Cross frame assemblies shall receive field applied top coat in accordance with Section 666 - BLAST, CLEAN, AND PAINT EXISTING BRIDGE STEEL of the Special Provisions. △1
8. Details from adjacent bays not shown for clarity.
9. See Sheet SA9.23 for required sequence regarding cross frame replacement and corresponding traffic control requirements.

DATE	REVISION
12/6/24	△1 Revised Notes

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

IN-SPAN, ELEVATION, AND FIXED BEARING CROSS FRAME SECTIONS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

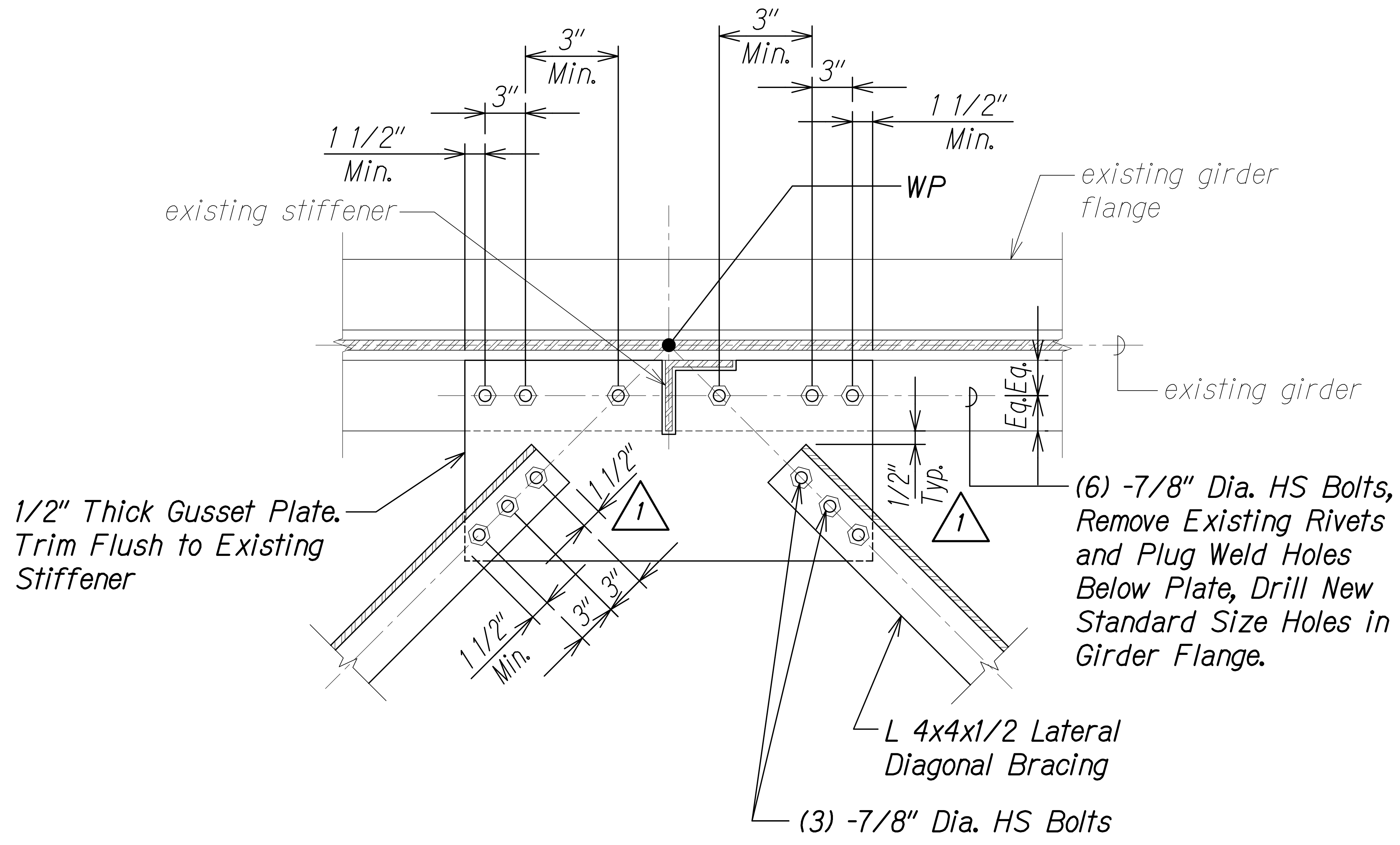
Scale: As Noted Date: Oct. 2024

SHEET No SA10.14 OF 30 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

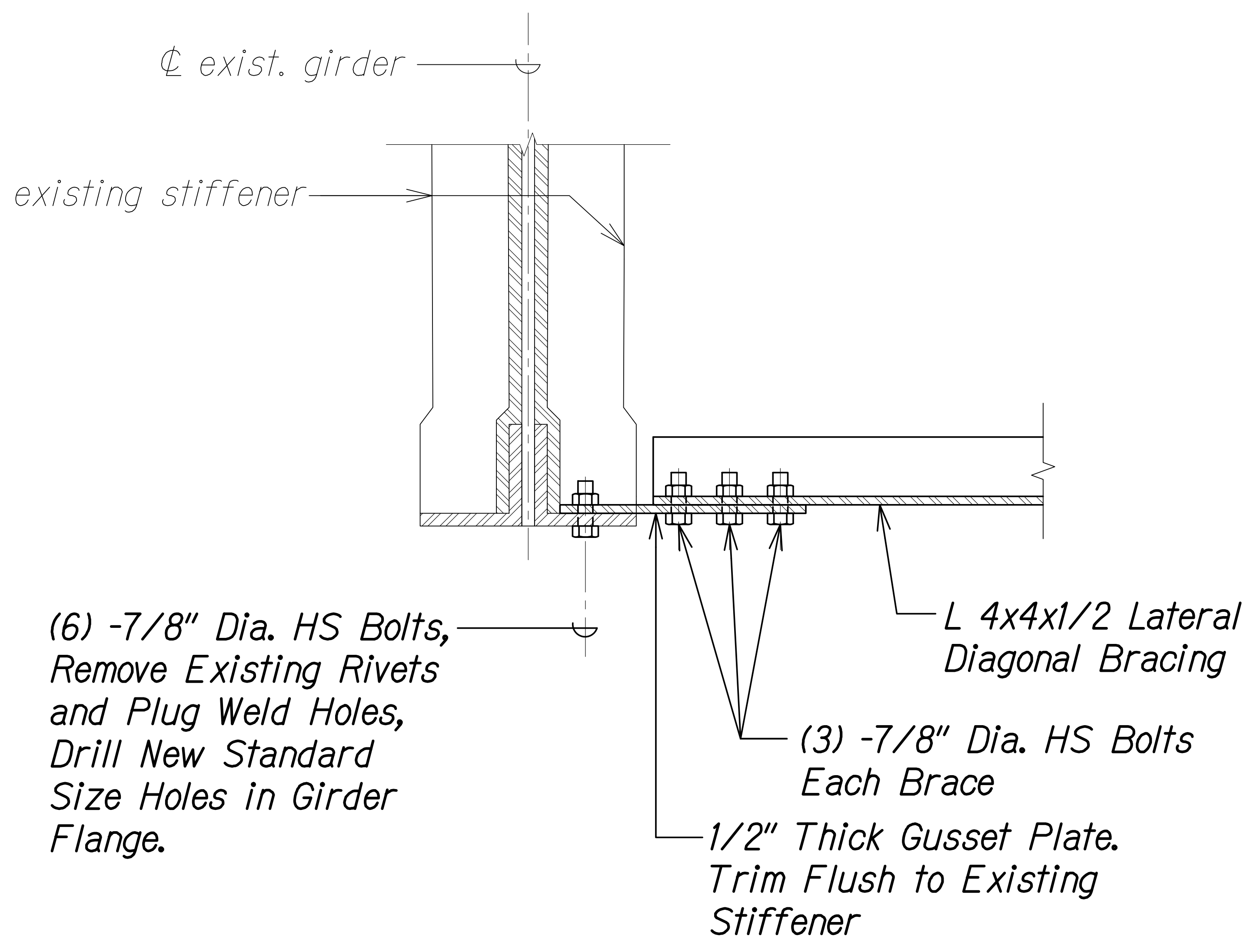
DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA1012-SA1024 STRUT X-FRMG ADD2.DWG PLOT TIME: 12-03-24, 8:58 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 203	280



PLAN AT EXISTING WEB STIFFENER A SA10.21 SA10.21

Scale: 1 1/2" = 1'-0"



SECTION AT EXISTING WEB STIFFENER B SA10.21 SA10.21

Scale: 1 1/2" = 1'-0"

INTERIOR BAY LATERAL DIAGONAL BRACING DETAILS

NOTES:

1. The Contractor shall field fit lateral diagonal bracing and gussets prior to galvanizing. Predrill holes in the field, including those through the bottom flange of the girder.

2. Lateral diagonal bracing and gussets shall be delivered to the site hot-dip zinc galvanized per ASTM A123, and shop painted with the complete coating system in accordance with Special Provisions Section 667-PREPARATION AND COATING OF GALVANIZED BRIDGE STEEL.

3. Install lateral diagonal bracing and gussets following completion of painting in Bay 2. Touch up paint △1 ends of bolts, nuts and washers. Payment for work under Pay Item 667.3000 does not apply.

△1

△1

DATE	REVISION
12/6/24	△1 Removed Details "C" & "D" Revised Notes and Added/ Revised Dimensions

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26

SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

LATERAL DIAGONAL
BRACING DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024

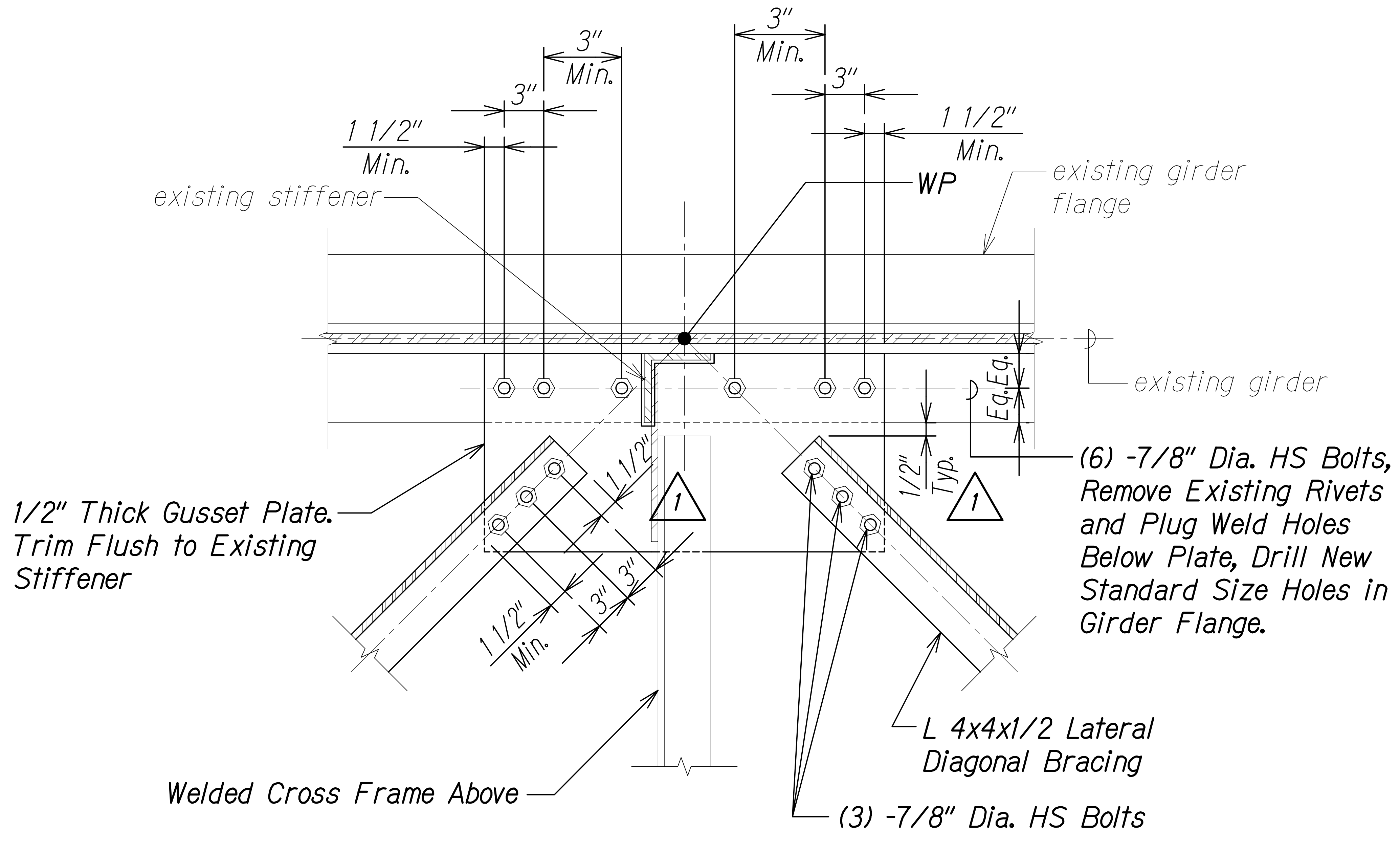
SHEET No SA10.21 OF 30 SHEETS

ADD. 203

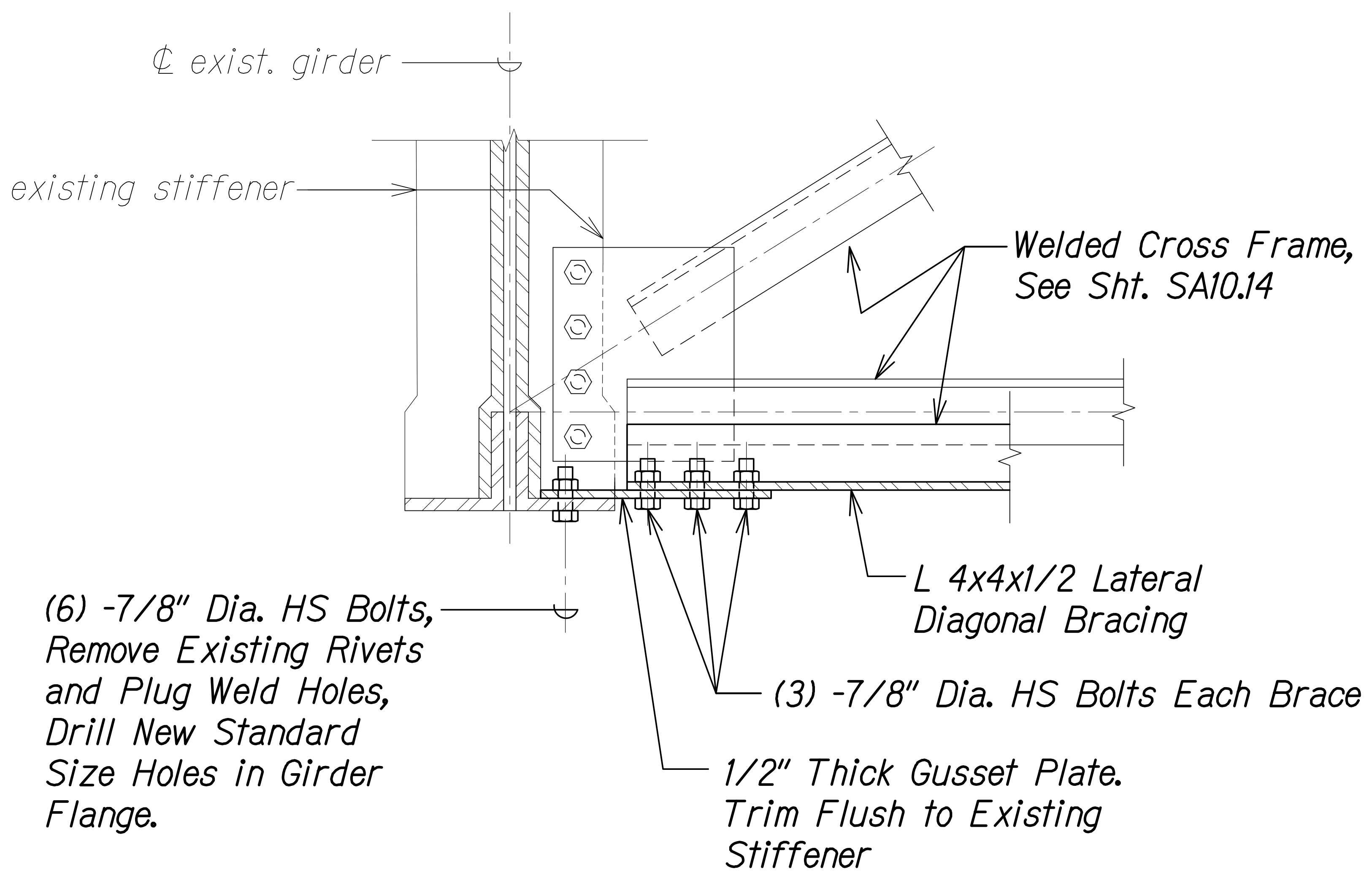
ORIGINAL PLAN	SURVEY PLOTTED BY ____ DATE ____
NOTE BOOK	DRAWN BY ____ " ____
	TRACED BY ____ " ____
	DESIGNED BY ____ " ____
	QUANTITIES BY ____ " ____
No. ____	CHECKED BY ____ " ____

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA1012-SA1024 STRUT X-FRMG ADD2.DWG PLOT TIME: 12-03-24, 8:55 PM)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 204	280



PLAN AT CROSS FRAME (A)
Scale: 1 1/2" = 1'-0" SA10.22 | SA10.22



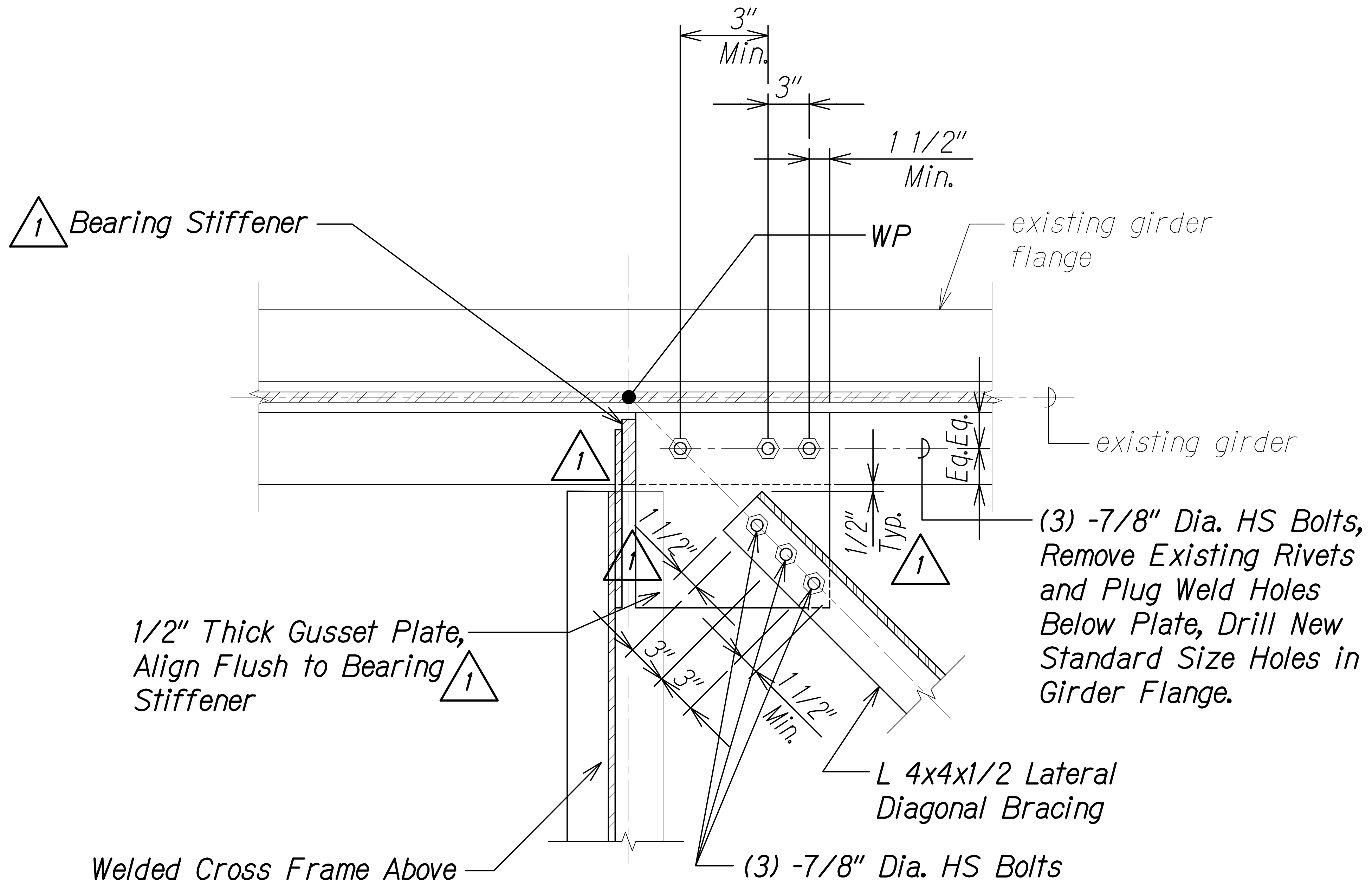
SECTION AT CROSS FRAME (B)
Scale: 1 1/2" = 1'-0" SA10.22 | SA10.22

NOTES:

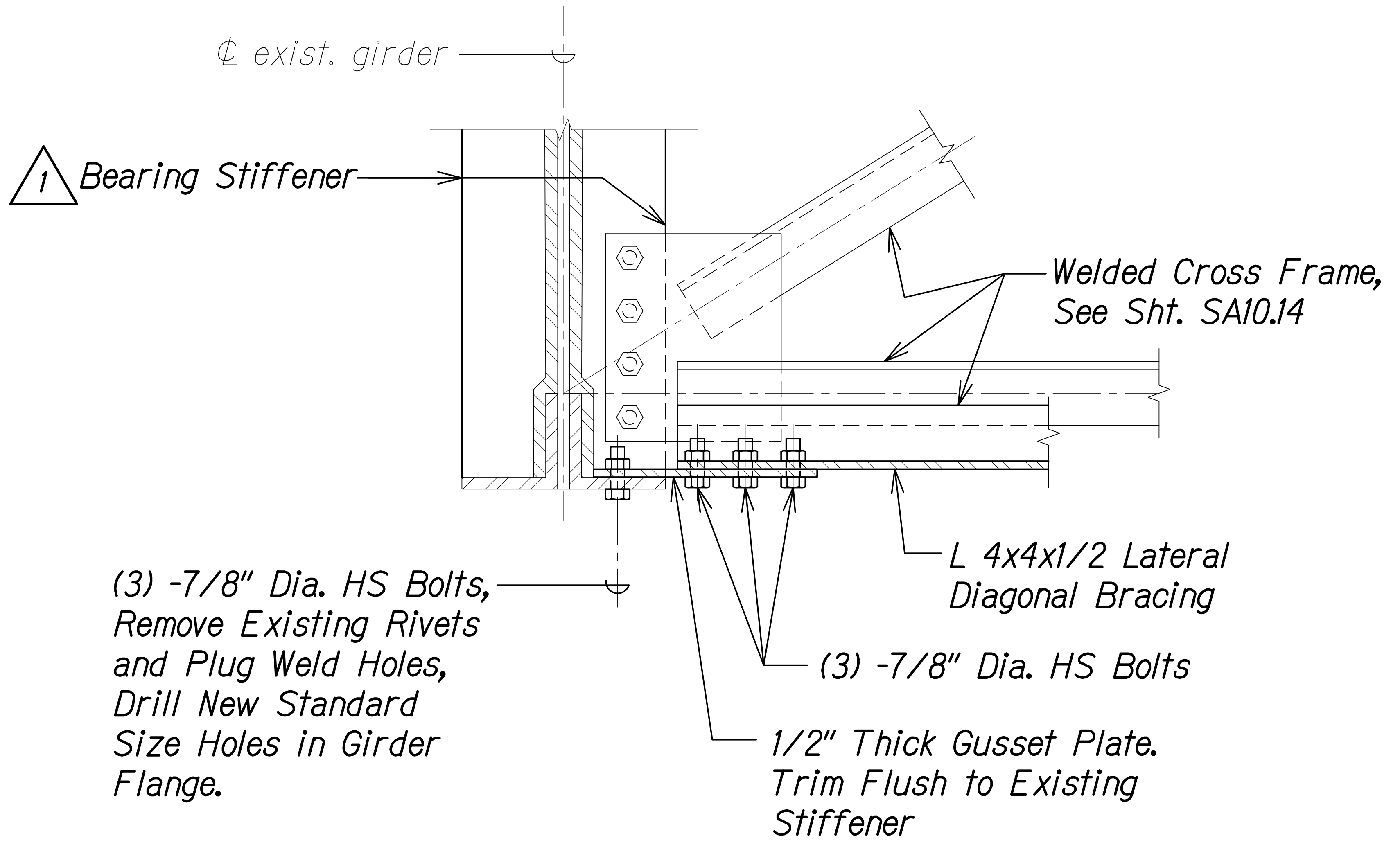
1. The Contractor shall field fit lateral diagonal bracing and gussets prior to galvanizing. Predrill holes in the field, including those through the bottom flange of the girder.

2. Lateral diagonal bracing and gussets shall be delivered to the site hot-dip zinc galvanized per ASTM A123, and shop painted with the complete coating system in accordance with Special Provisions Section 667-PREPARATION AND COATING OF GALVANIZED BRIDGE STEEL.

3. Install lateral diagonal bracing and gussets following completion of painting in Bay 2. Touch up paint ends of bolts, nuts and washers.
△1 Payment for work under Pay Item 667.3000 does not apply.



PLAN AT BEARING CROSS FRAME (C)
Scale: 1 1/2" = 1'-0" SA10.22 | SA10.22



SECTION AT
BEARING CROSS FRAME (D)
Scale: 1 1/2" = 1'-0" SA10.22 | SA10.22

INTERIOR BAY LATERAL DIAGONAL BRACING DETAILS

DATE	REVISION
12/6/24	△1 Revised Details Revised Notes and Added/ Revised Dimensions

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S
HAWAII, U.S.A.
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.
Stephen Peters
SIGNATURE 4-30-26 EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

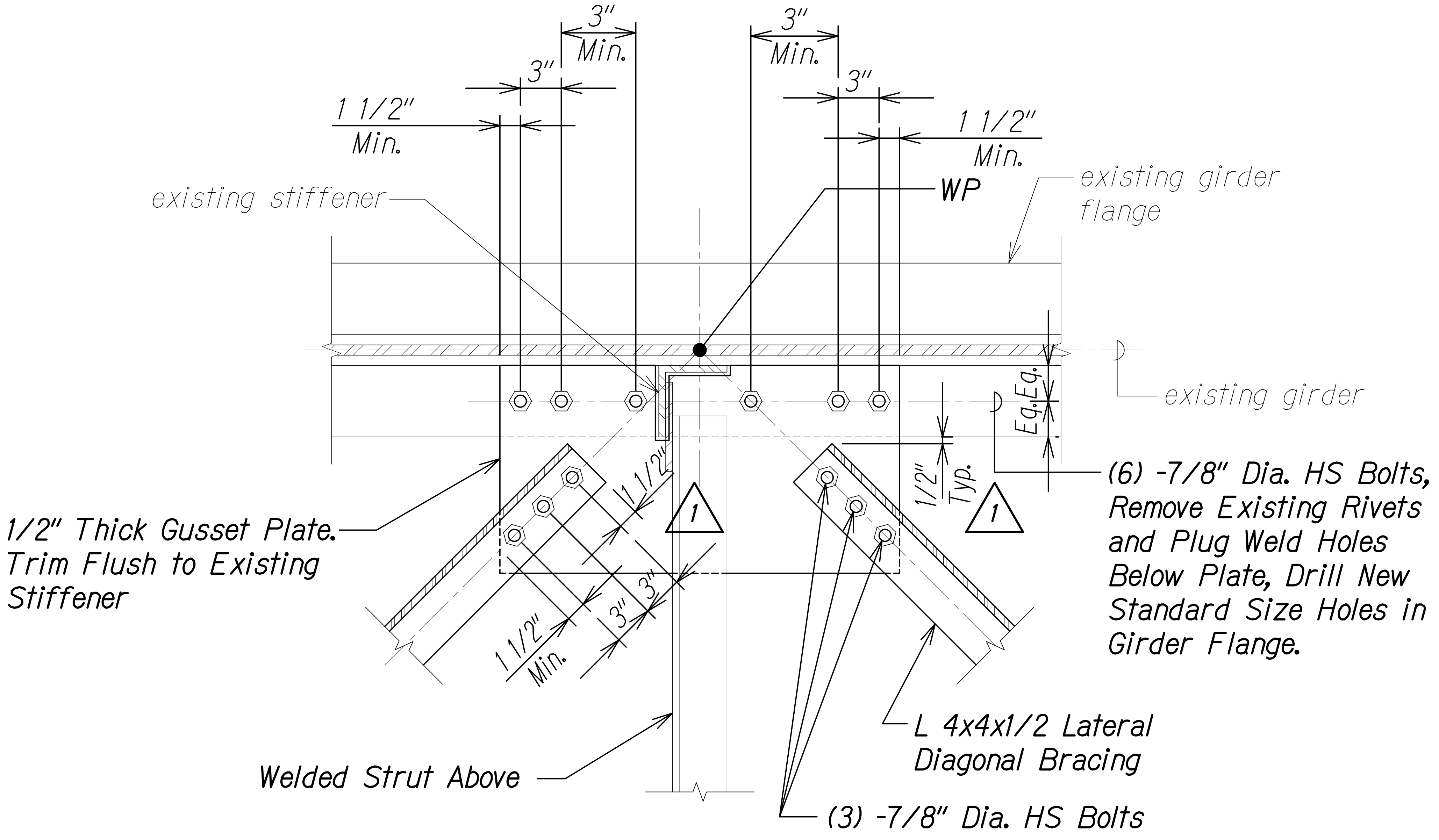
LATERAL DIAGONAL
BRACING DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024
SHEET No. SA10.22 OF 30 SHEETS

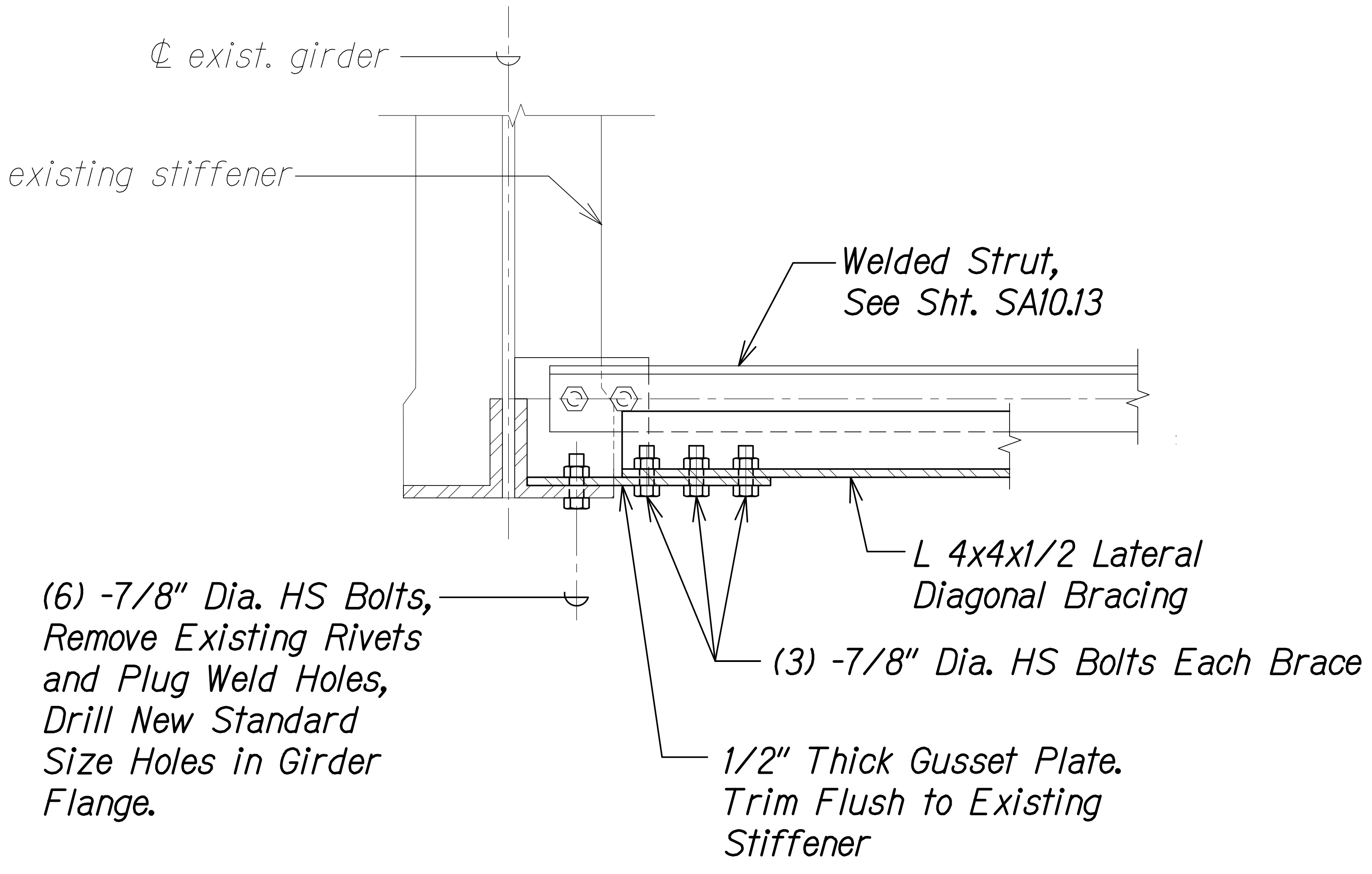
ADD. 204

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 205	280



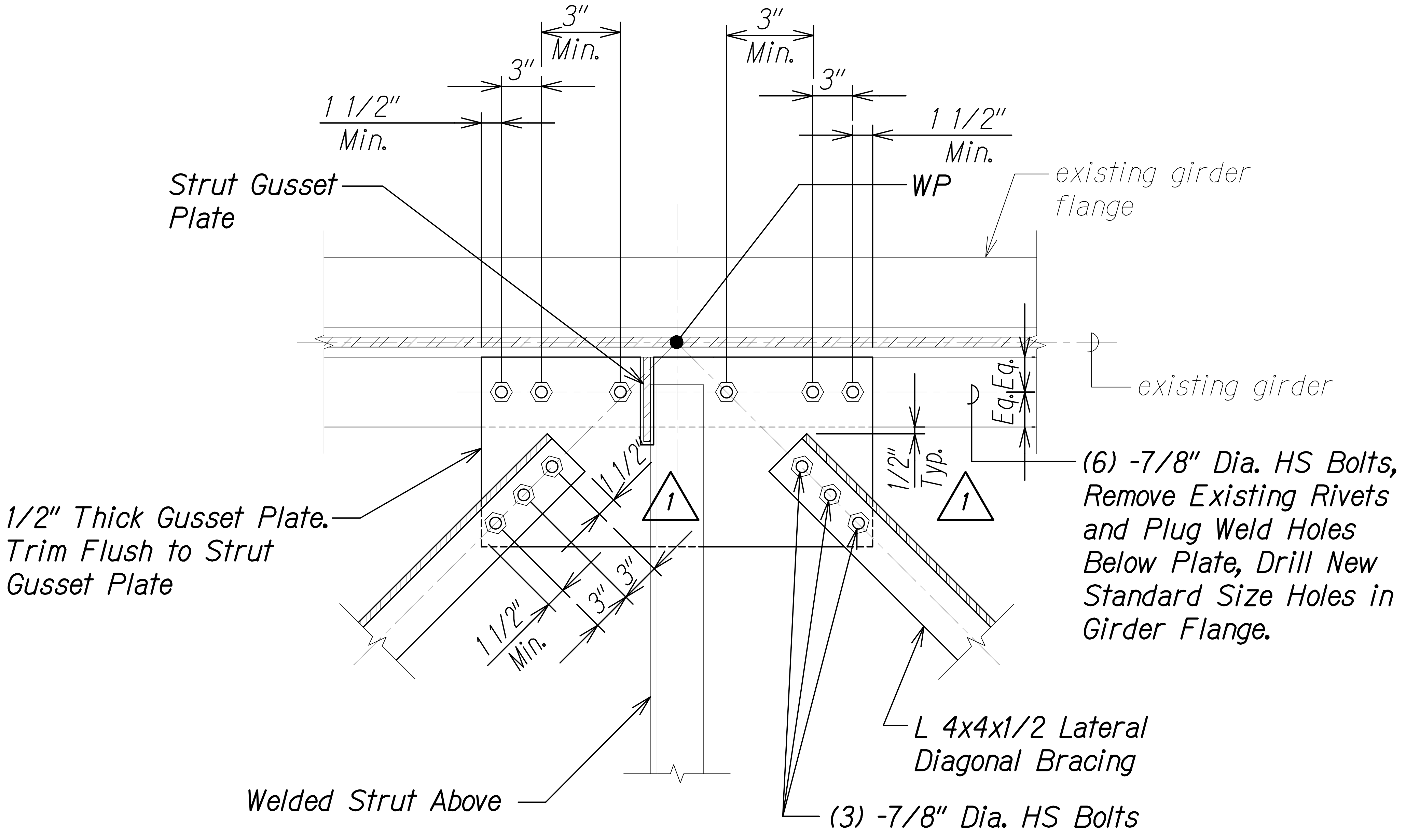
PLAN AT STRUT (A)
Scale: 1 1/2" = 1'-0" SA10.23|SA10.23



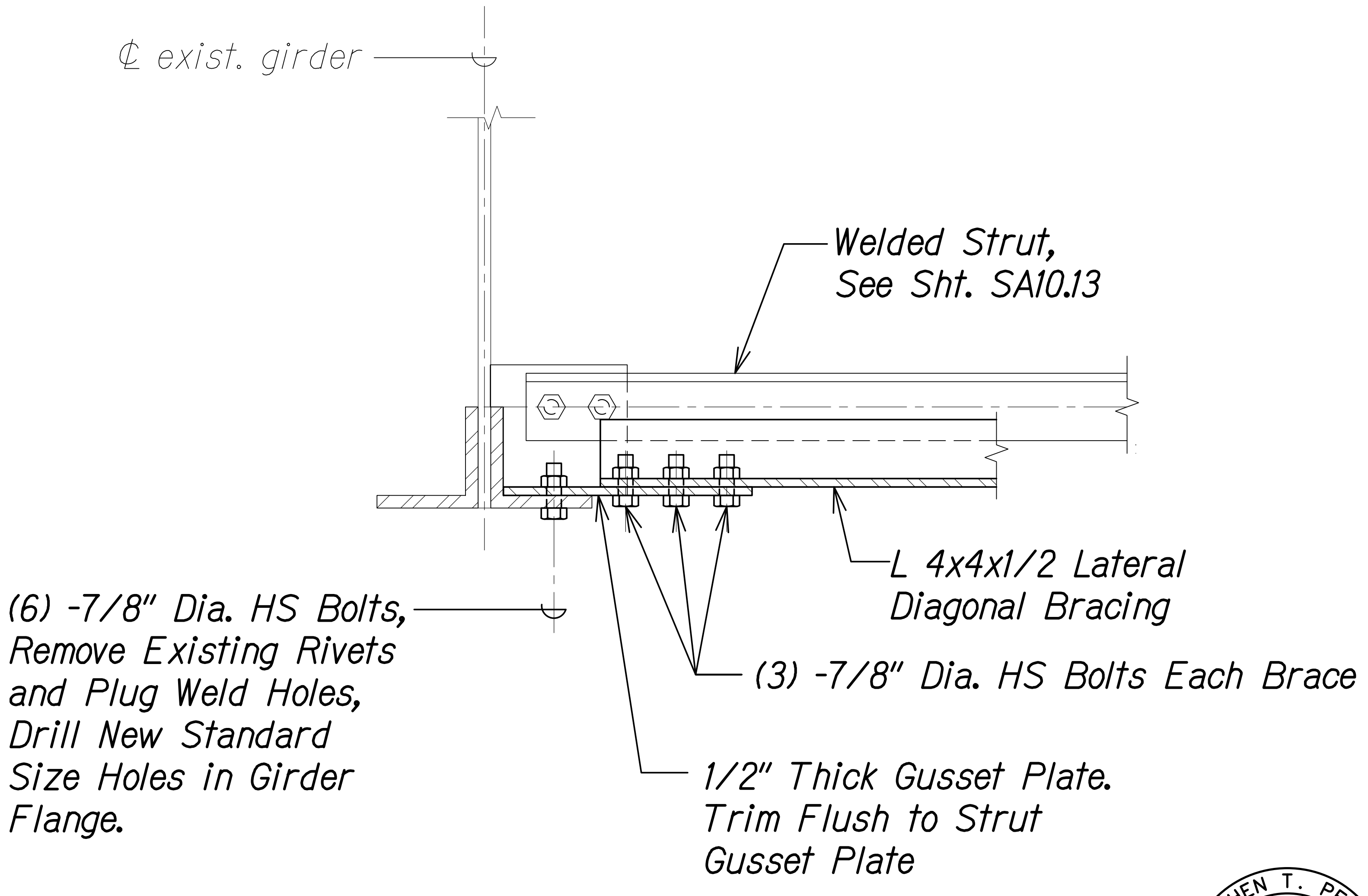
SECTION AT STRUT (B)
Scale: 1 1/2" = 1'-0" SA10.23|SA10.23

NOTES:

1. The Contractor shall field fit lateral diagonal bracing and gussets prior to galvanizing. Predrill holes in the field, including those through the bottom flange of the girder.
2. Lateral diagonal bracing and gussets shall be delivered to the site hot-dip zinc galvanized per ASTM A123, and shop painted with the complete coating system in accordance with Special Provisions Section 667-PREPARATION AND COATING OF GALVANIZED BRIDGE STEEL.
3. Install lateral diagonal bracing and gussets following completion of painting in Bay 2. Touch up paint ends of bolts, nuts and washers. Payment for work under Pay Item 667.3000 does not apply. △1



PLAN AT STRUT (C)
Scale: 1 1/2" = 1'-0" SA10.23|SA10.23



SECTION AT STRUT (D)
Scale: 1 1/2" = 1'-0" SA10.23|SA10.23

INTERIOR BAY LATERAL DIAGONAL BRACING DETAILS

DATE	REVISION
12/6/24	△1 Revised Notes and Added/Revised Dimensions

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

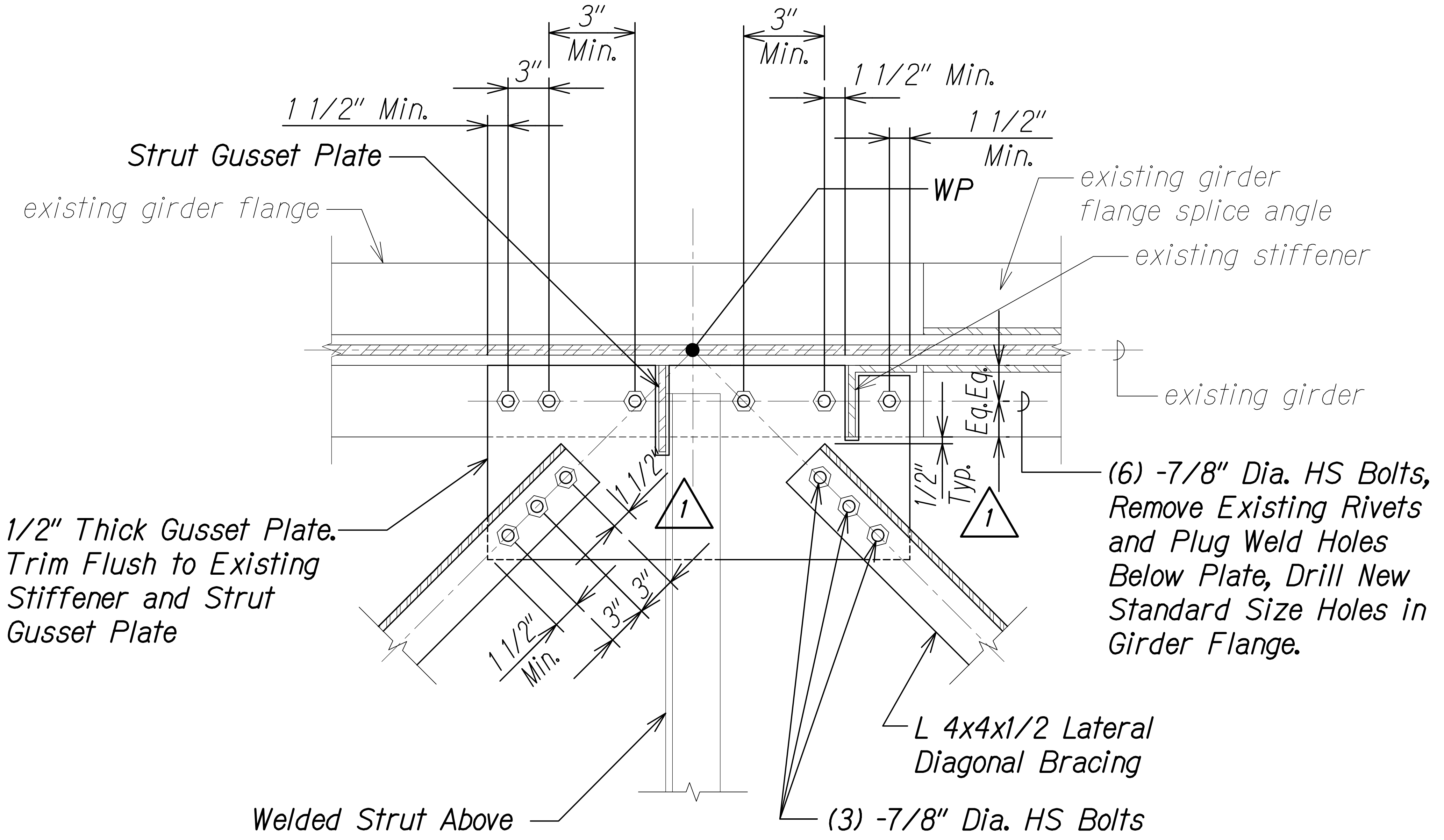
LATERAL DIAGONAL BRACING DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024
SHEET No. SA10.23 OF 30 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
NOTE BOOK	DRAWN BY	
No.	TRACED BY	
	DESIGNED BY	
	QUANTITIES BY	
	CHECKED BY	

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOT\4.01 CAD\12-06-24 ADD2\NSR-SA1012-SA1024 STRUT X-FRMG ADD2.DWG PLOT TIME: 12-05-24, 12:34 PM

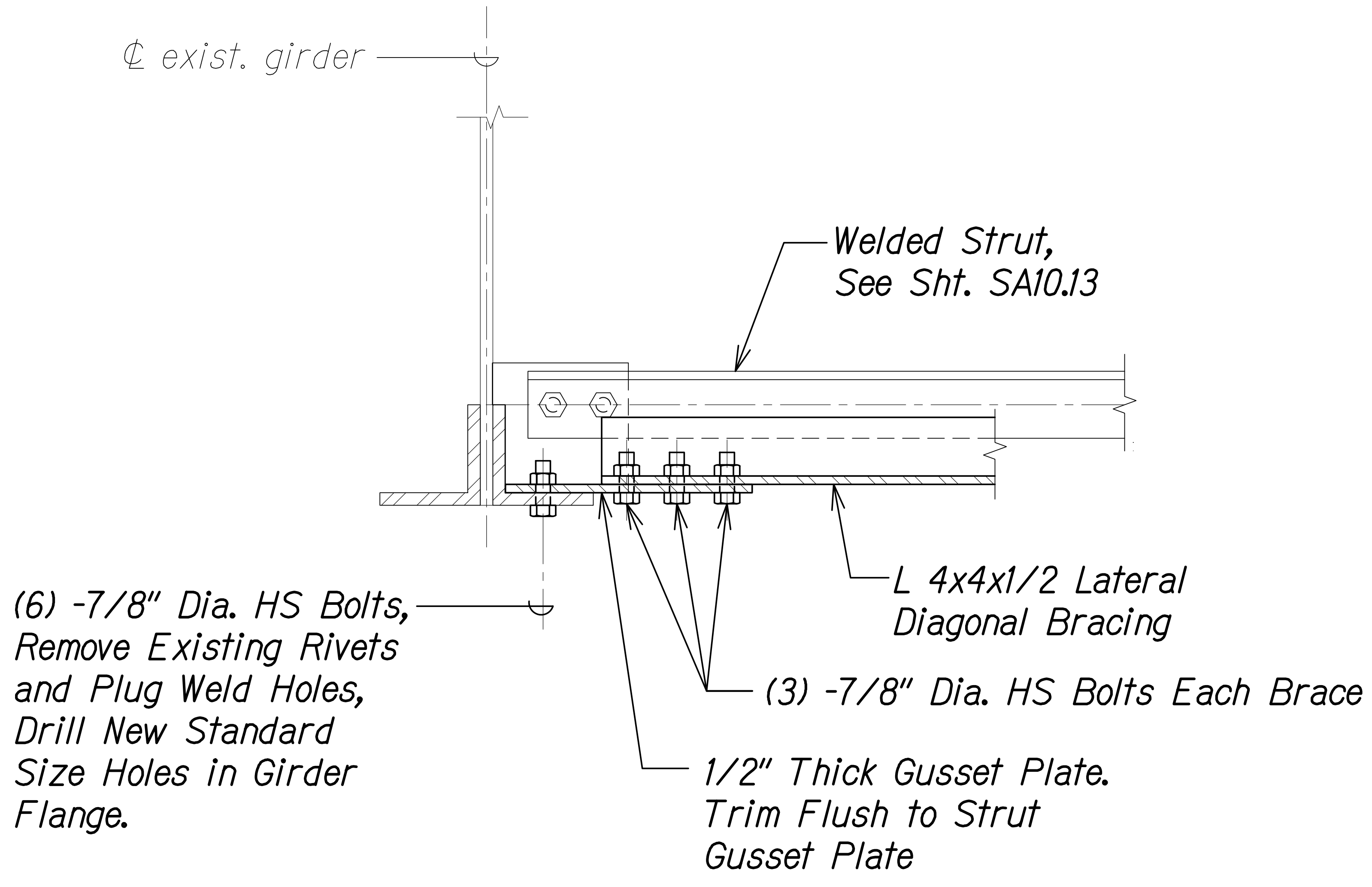
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 206	280



PLAN NEAR GIRDER SPLICE

Scale: 1 1/2" = 1'-0"

A
SA10.24 | SA10.24



SECTION NEAR GIRDER SPLICE

Scale: 1 1/2" = 1'-0"

B
SA10.24 | SA10.24

INTERIOR BAY LATERAL DIAGONAL BRACING DETAILS

NOTES:

1. The Contractor shall field fit lateral diagonal bracing and gussets prior to galvanizing. Predrill holes in the field, including those through the bottom flange of the girder.

2. Lateral diagonal bracing and gussets shall be delivered to the site hot-dip zinc galvanized per ASTM A123, and shop painted with the complete coating system in accordance with Special Provisions Section 667-PREPARATION AND COATING OF GALVANIZED BRIDGE STEEL.

3. Install lateral diagonal bracing and gussets following completion of painting in Bay 2. Touch up paint ends of bolts, nuts and washers. Payment for work under Pay Item 667.3000 does not apply. △1

DATE	REVISION
12/6/24	△1 Revised Notes and Added/ Revised Dimensions

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE   EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

LATERAL DIAGONAL
BRACING DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

Scale: As Noted   Date: Oct. 2024

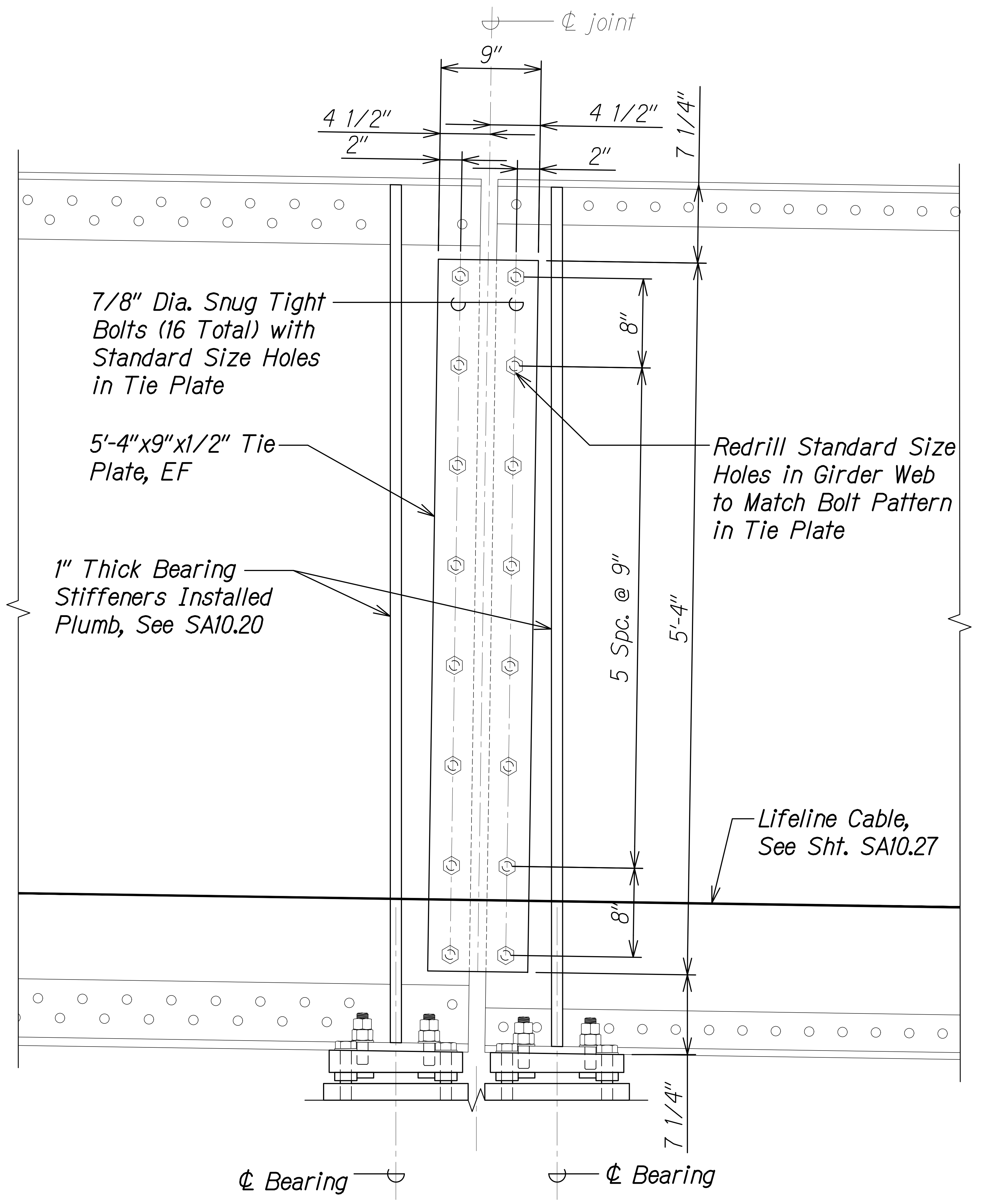
SHEET No SA10.24 OF 30 SHEETS

ADD. 206

ORIGINAL PLAN
SURVEY PLOTTED BY ____ DATE ____
DRAWN BY ____ "
TRACED BY ____ "
NOTE BOOK
DESIGNED BY ____ "
QUANTITIES BY ____ "
No. ____
CHECKED BY ____ "

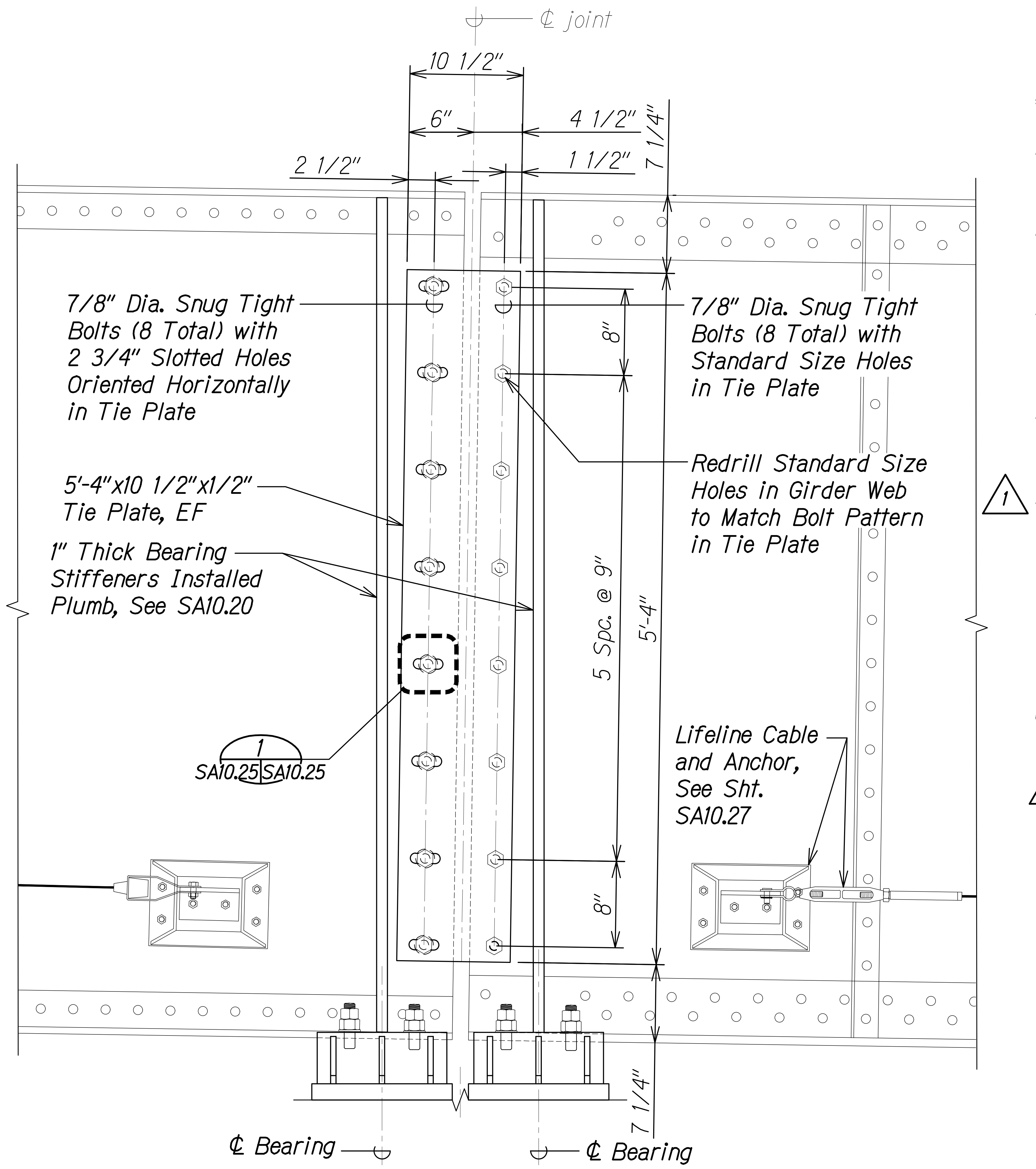
DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA1012-SA1024 STRUT X-FRMG ADD2.DWG   PLOT TIME: 12-03-24, 9:01 PM

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 207	280



TIE PLATE ELEVATION - FIXED BEARING A SA10.25 | SA10.25

Scale: 1 1/2" = 1'-0"



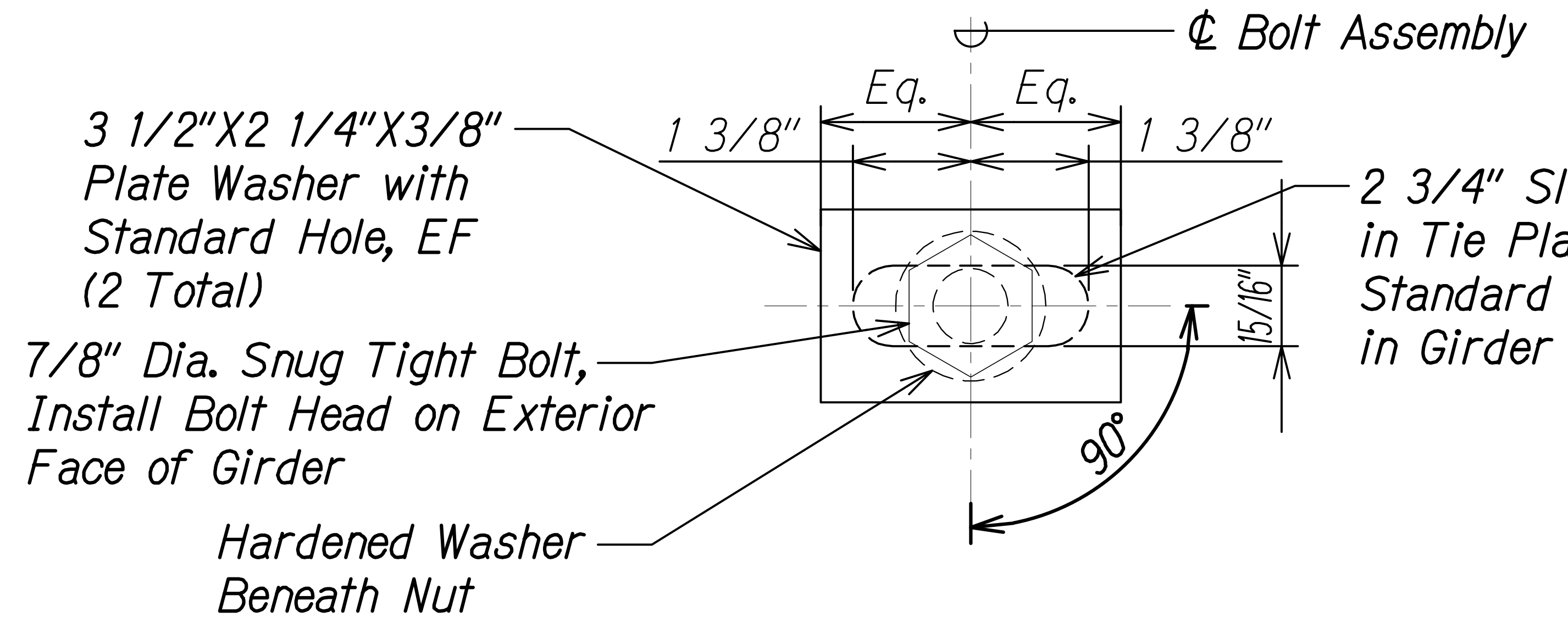
TIE PLATE ELEVATION - EXPANSION BEARING B SA10.25 | SA10.25

Scale: 1 1/2" = 1'-0"

NOTES:

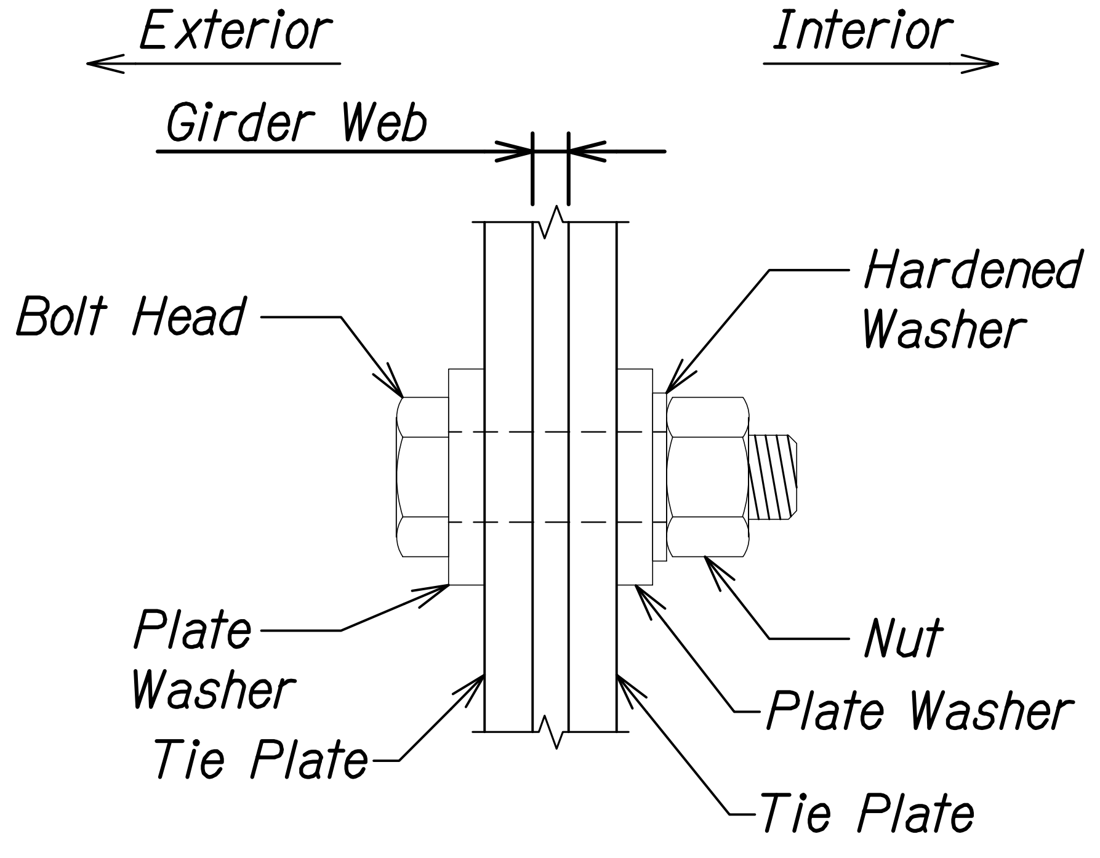
1. Bolt assembly at tie plate connection must not be pretensioned.
2. See girder line elevations for location of tie plate replacement.
3. Redrill standard size holes at the ends of girder web to match bolt pattern in tie plate prior to painting.
4. Clean and paint girders prior to installation of tie plates.
5. △1 Tie plates shall be delivered to the site hot-dip zinc galvanized per ASTM A123 and shop painted with the complete coating system in accordance with Special Provisions Section 667 - PREPARATION AND COATING OF GALVANIZED BRIDGE STEEL.
6. Touch-up paint ends of all hardware (bolt, nut, washers) after installation. △1 Payment for work under Pay Item 667.3000 does not apply.

DATE	REVISION
12/6/24	△1 Revised Notes



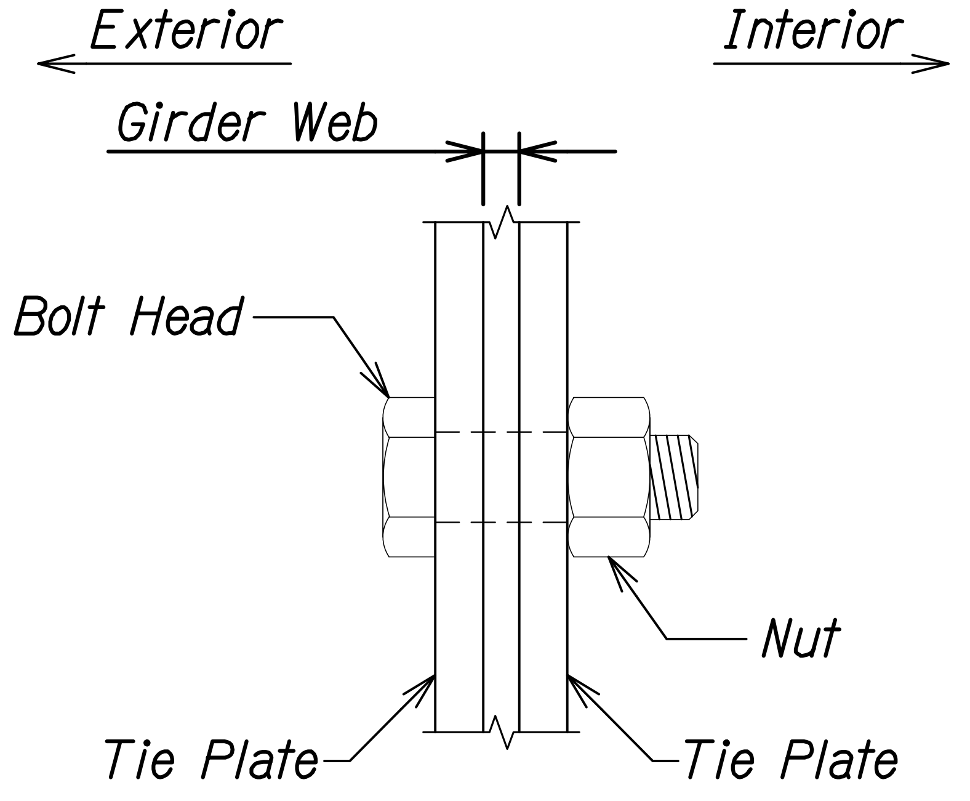
BOLT CONNECTION DETAIL AT SLOTTED HOLE 1 SA10.25 | SA10.25

Scale: 6" = 1'-0"



BOLT CONNECTION DETAIL AT SLOTTED HOLE 2 SA10.25 | SA10.25

Scale: 6" = 1'-0"



TYP. BOLT CONNECTION DETAIL 3 SA10.25 | SA10.25

Scale: 6" = 1'-0"

STEPHEN T. PETERS
LICENSED PROFESSIONAL ENGINEER
NO. 17097-S

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4-30-26

SIGNATURE EXPIRATION DATE OF THE LICENSE

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

TIE PLATE
ELEVATIONS AND DETAILS AT BEARINGS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

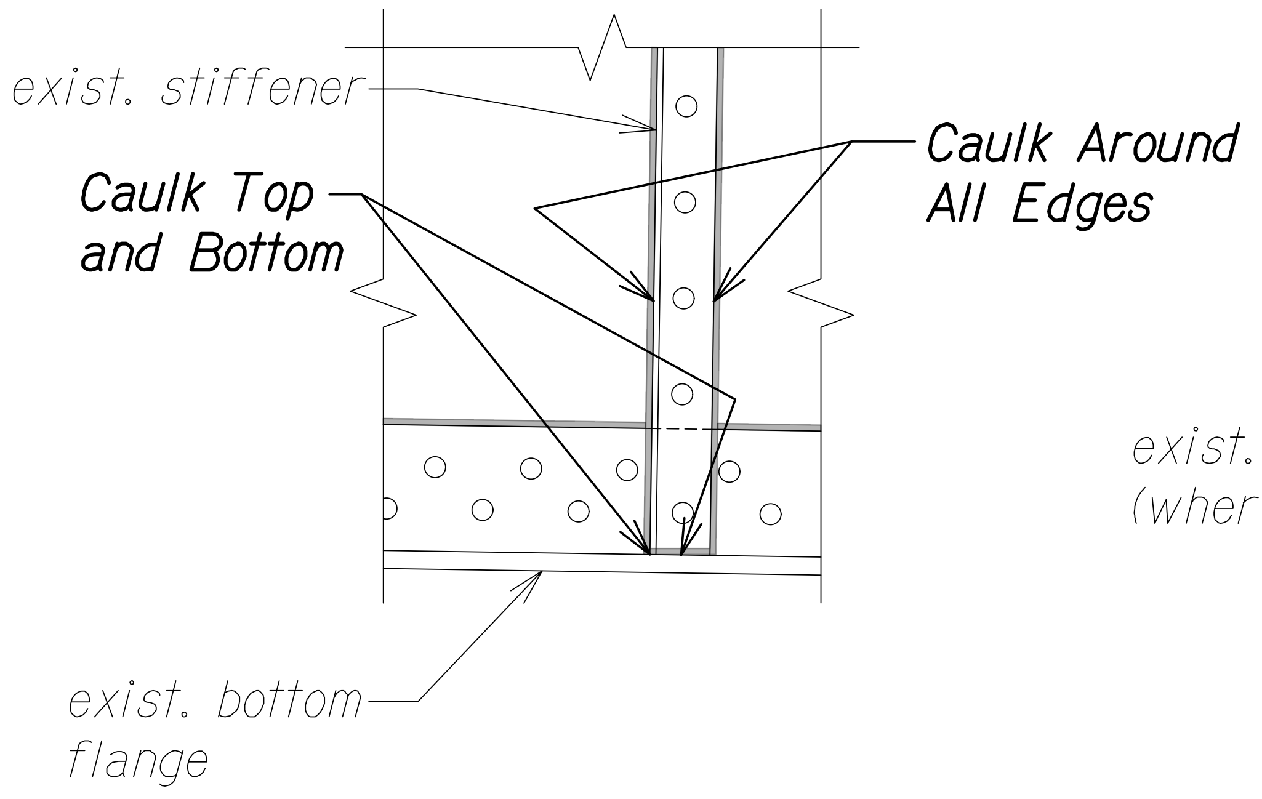
Scale: As Noted Date: Oct. 2024

SHEET No. SA10.25 OF 30 SHEETS

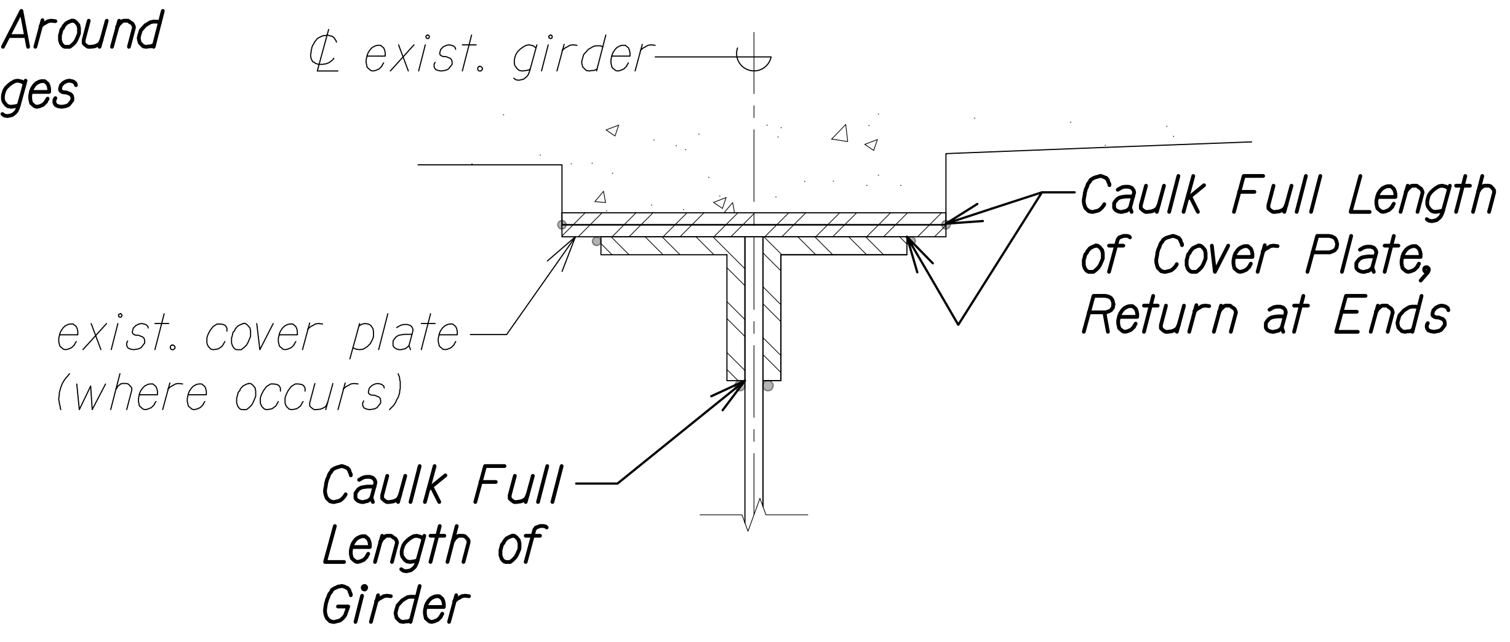
ORIGINAL PLAN | SURVEY PLOTTED BY | DRAWN BY | TRACED BY | DESIGNED BY | QUANTITIES BY | CHECKED BY | DATE
NOTE BOOK No.

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA1025 TIE PLATE ADD2.DWG PLOT TIME: 12-03-24, 11:04 PM)

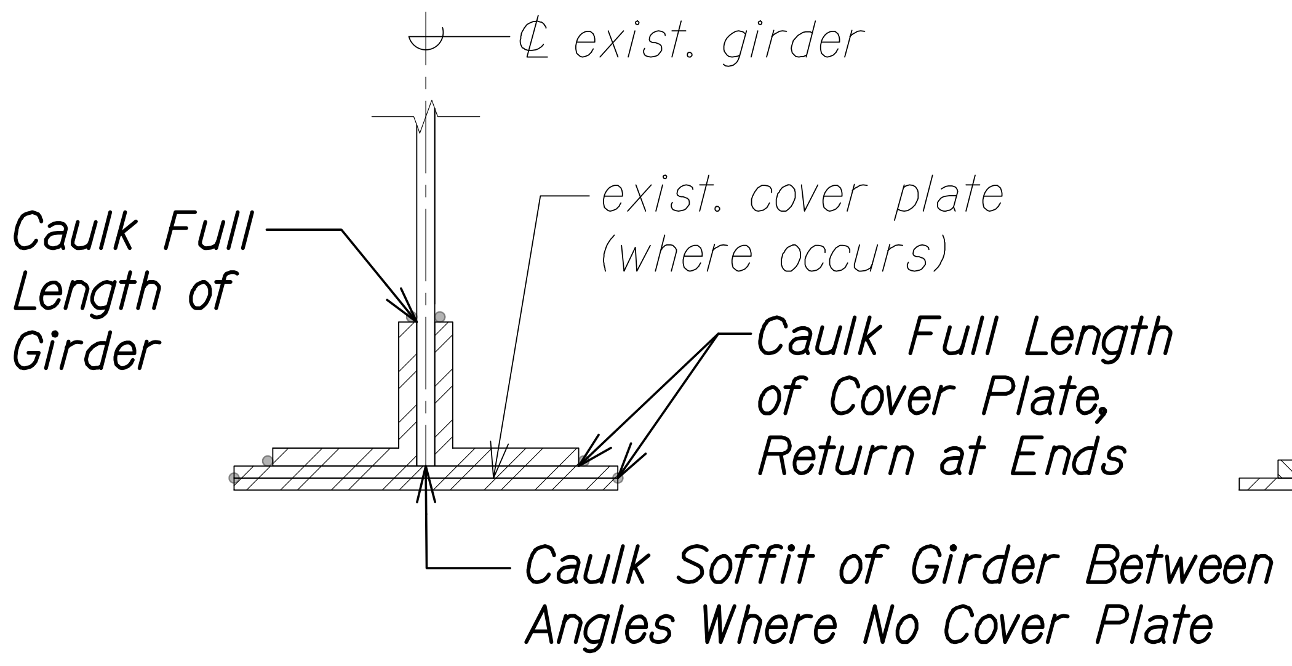
FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	ADD. 212	280



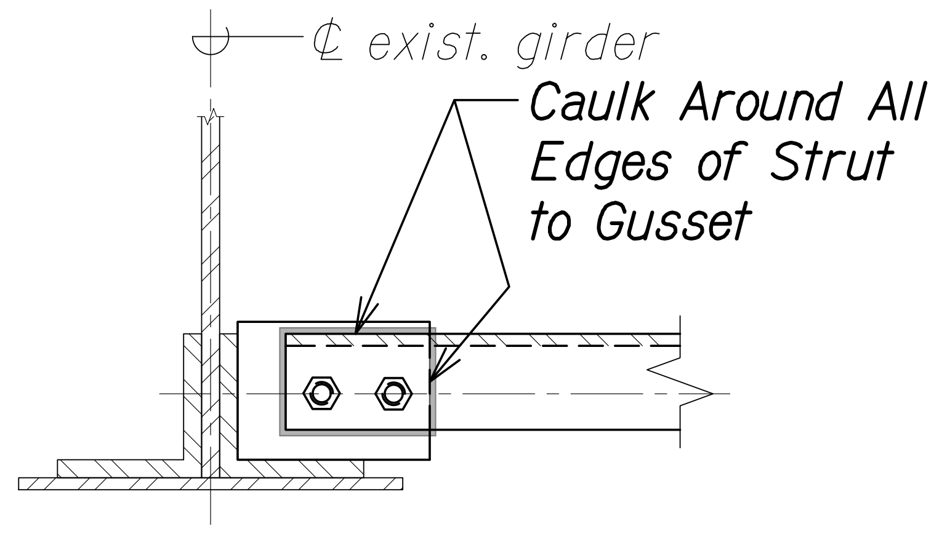
STIFFENER CONNECTION 1 SA10.30 SA10.30 1
Scale: 1 1/2" = 1'-0"



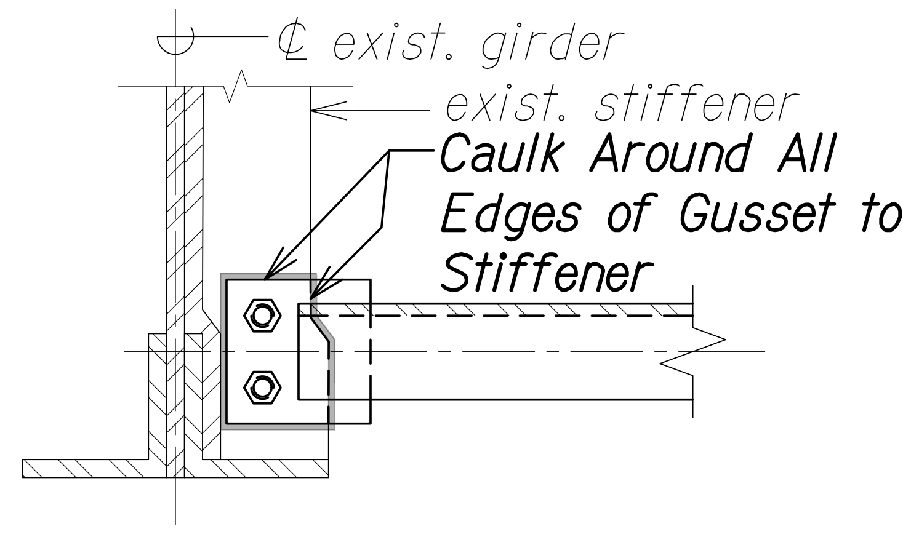
TOP FLANGE CONNECTION 2 SA10.30 SA10.30 1
Scale: 1 1/2" = 1'-0"



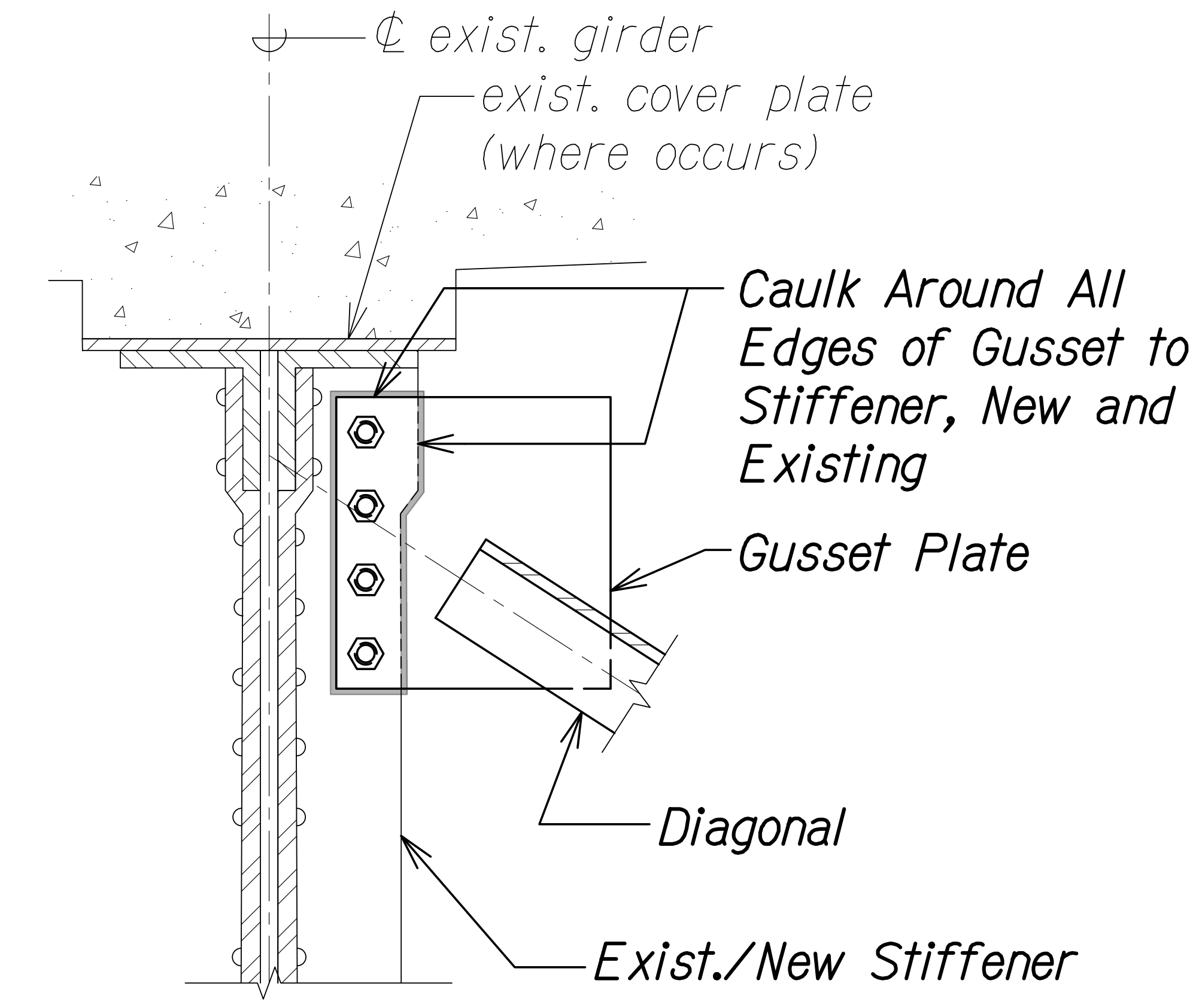
BOTTOM FLANGE CONNECTION 3 SA10.30 SA10.30 1
Scale: 1 1/2" = 1'-0"



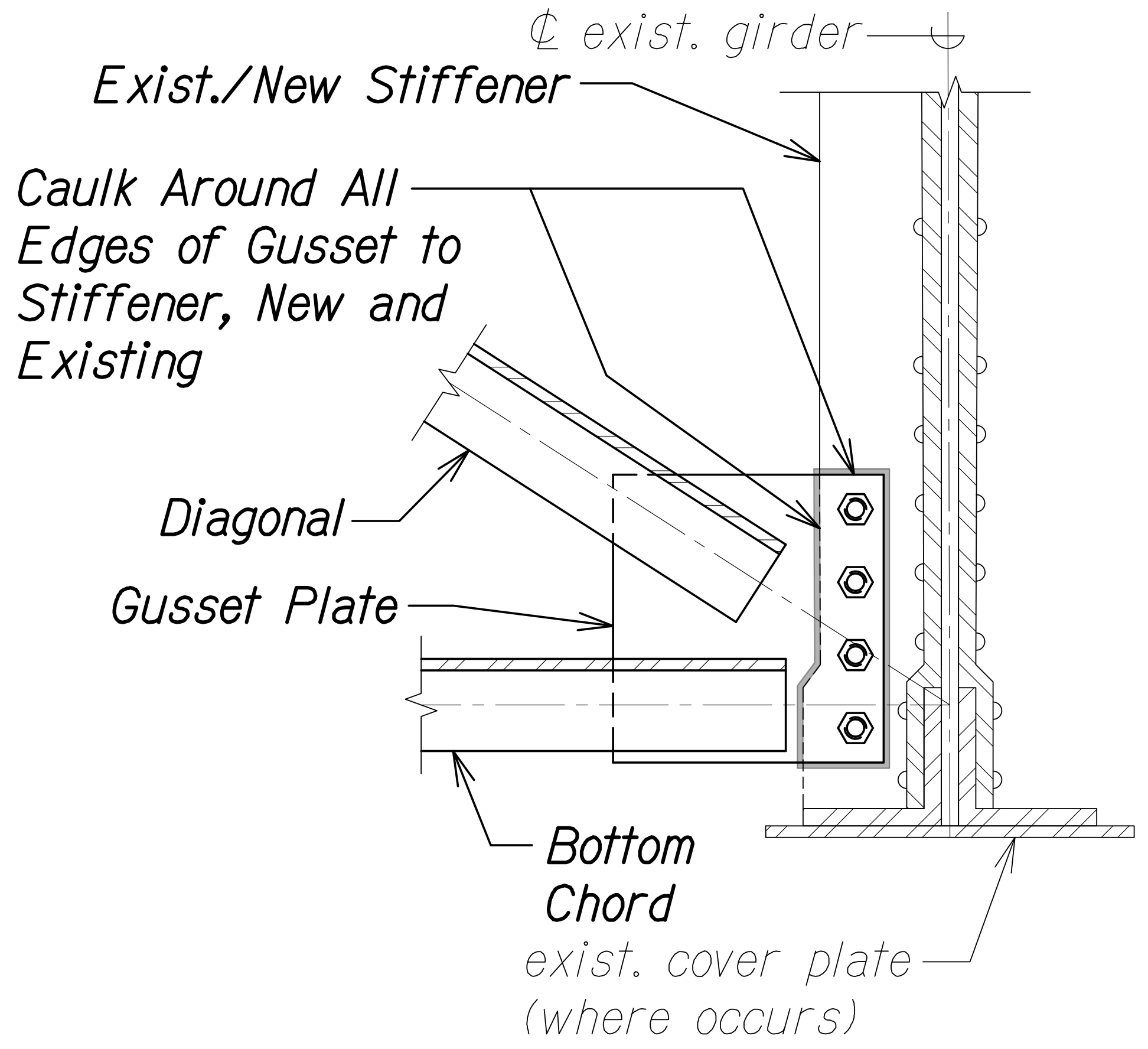
STRUT CONNECTION 4 SA10.30 SA10.30 1
Scale: 1 1/2" = 1'-0"



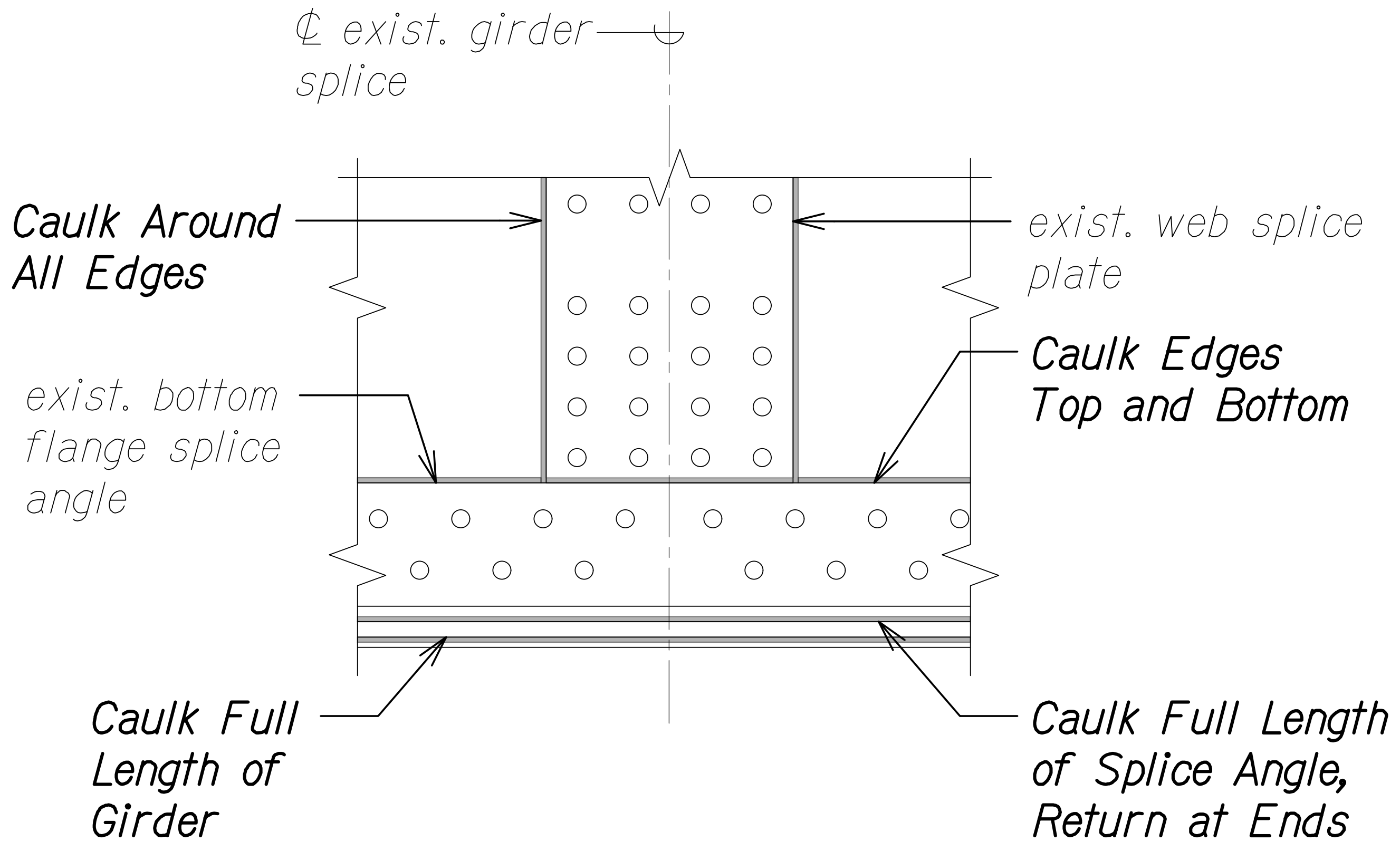
STRUT CONNECTION 5 SA10.30 SA10.30 1
Scale: 1 1/2" = 1'-0"



CROSS-FRAME CONNECTION 6 SA10.30 SA10.30 1
Scale: 1 1/2" = 1'-0"



CROSS-FRAME CONNECTION 7 SA10.30 SA10.30 1
Scale: 1 1/2" = 1'-0"



GIRDER SPLICE CONNECTION 8 SA10.30 SA10.30 1
Scale: 1 1/2" = 1'-0"

NOTES:

1. All details are shown as typical and shall be applied at all locations throughout the bridge.
2. 1 Caulk shall be applied after applicable dry-to recoat time of the epoxy mist coat, as described in its product data sheet.
3. The cost for caulking shall be covered under Pay Item 666.3000.

STEPHEN T. PETERS
NO. 17097-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

4-30-26
SIGNATURE EXPIRATION DATE OF THE LICENSE

DATE	REVISION
12/6/24	1 Added Detail and Revised Details & Notes

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

PAINT/CAULKING DETAILS

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Oct. 2024
SHEET No SA10.30 OF 30 SHEETS

ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY DATE
DRAWN BY ,,
TRACED BY ,,
DESIGNED BY ,,
QUANTITIES BY ,,
CHECKED BY ,,

DRAWING NAME: Z:\00 ONGOING\23-022.9-NANUE STR BR PE2-DOTH\01 CAD\12-06-24 ADD2\NSR-SA1030 PAINT ADD2.DWG PLOT TIME: 12-05-24, 3:37 PM)

PRE-BID MEETING MINUTES

Hawaii Belt Road,
Rehabilitation of Nanue Stream Bridge
Island of Hawaii
FEDERAL-AID PROJECT NO. BR-019-2(077)

Date, Time & Place: Wednesday, November 13, 2024; 1:00 P.M. HST, Pre-bid meeting was held virtually via Microsoft TEAMS.

Attendees:

Name	Company/Office	Email
Sunahara, Amy	HDOT	amy.my.sunahara@hawaii.gov
Jeremy Lee	HDCC	jtlee@hdcc.com
Shane Pasion	HDCC	spasion@hdcc.com
Corbin Morisada	KSF Inc.	corbinm@ksfinc.us
Leo Farnsworth	W.W. Clyde & Co.	lfarnsworth@wwclyde.net
Glenn Kobayashi	Isemoto Contracting Company Ltd.	GlennK@isemotocontracting.com
Nick Schmid, ASI		
Choon Kee Lee	Nan Inc.	cklee@nanhawaii.com
Navarro, Jesus	HDOT	Jesus.Navarro@hawaii.gov
Ho, Hansen	HDOT	hansen.ho@hawaii.gov
Urasaki, Randall	WSP USA Inc.	Randall.Urasaki@wsp.com
Williams, Daniel K	HDOT	Daniel.K.Williams@hawaii.gov
Stephen Peters	KSF Inc.	
David Tracy		dtracy@mooreainvestments.com
Silva Jr, Dennis	WSP USA Inc.	Dennis.SilvaJr@wsp.com
Greg.Uyematsu	Kiewit Corporation	Greg.Uyematsu@kiewit.com
James Svoboda		
Lau, Ethan	WSP USA Inc.	Ethan.Lau@wsp.com
Sueda, Aisha M	HDOT	aisha.m.sueda@hawaii.gov
Signe Naeole		snaeole@intlcoreinc.com
Tyson McClellan	W.W. Clyde & Co.	tmcclellan@wwclyde.net
Rob Lee	HDOT	
Harold Archer	W.W. Clyde & Co.	harcher@wwclyde.net
Jesse Ballow	W.W. Clyde & Co.	jballow@wwclyde.net
Taylor Byington	W.W. Clyde & Co.	tbyington@wwclyde.net

Items of Discussion:

Project Manager Amy Sunahara opened the meeting at 1:01 P.M. The following reminders were announced:

- This meeting is being recorded. The recording will not be part of the addendum.
- Please identify yourself, the company you are representing, and your e-mail address in the chat or this information can be emailed to Amy.my.sunahara@hawaii.gov.
- Anything said at this meeting is for clarification only. The bid documents shall govern over anything said today and discrepancies shall be clarified by addendum.
- The scope of work for this project consists of replacing steel truss members, bearings, gusset plates, etc.…that have corrosion and section loss, fixing spalls and delamination in the concrete deck, abutments, bridge railing and column pedestals, cleaning and painting the steel members following the repairs, addressing scour deficiencies for the bridge formations, removal and disposal of bridge sections and parts, painting and paving with asphalt and hybrid polymer concrete, management of contaminated materials, installation of pavement markings, installation of bmp measures for erosion control and hazardous materials, and traffic control.

Office of Civil Rights, Jesus Navarro & Dan Williams, presented the Hawaii DOT DBE bidding process to ensure equal opportunity and nondiscrimination in the award and administration of United States DOT assisted contracts.

- Contractors shall take all necessary steps in accordance with the regulations FAR part 26 to ensure that DBEs are having an opportunity to compete for and perform on the contract.
- The DBE goal for this project is 2.4%.
- Document all discussions, phone calls, faxes, memos related to your efforts, and meetings with the DBE.
- DBEs must be certified by the bid opening date.
- DBE forms are due to the Project Manager (Amy Sunahara) by 4:30 PM. HST, five (5) calendar days after bid opening.
- A bidder registration form needs to be completed or updated by each company.

Amy Sunahara announced the following:

- All questions need to be uploaded to HIePro by November 20, 2024 by 4:30 P.M.
- Bid opening is currently scheduled for December 12, 2024 at 2:00 P.M.

Contractor questions:

- Is there a construction manager for this project?
    - Amy Sunahara responded with “HWY-H will be in charge on the HDOT side.”

Meeting was adjourned when prospective bidders had no further questions at 2:17 P.M.

Questions for solicitation: B25000902 BR-019-2(077) Rehabilitation of Nanue Stream Bridge

11/20/2024

1. **Will laser rust ablation / removal by Hawaiian Protective Solutions be an acceptable alternate to shot blasting the existing steel structure that is to remain.**

Laser Ablation will not be an acceptable alternate to abrasive blasting of the existing steel structure. While there are many reasons why this is not acceptable, the main reason being that the laser ablation will not produce the anchor tooth profile that is needed for coating adhesion.

2. **While Sect 666.02, (A), (2) states that the same manufacturer shall furnish the primer, intermediate, stripe and topcoat, the coatings specified in Sect. 666.02, (B) are not furnished by the same manufacturer. Will the Engineer delete the requirement of the former, or will the Engineer revise the latter and call for materials from the same manufacturer?**

See revised Special Provision Sections 666 and 667 for clarification. The Bidder shall follow the paint system as specified in the Special Provisions.

3. **Sect 666.02, (B) calls for the use of materials from two (2) different manufacturer's (ie. primer vs, intermediate, stripe and finish). Shall the Bidders assume that the Engineer accepts responsibility for warranting that the materials are compatible?**

The bidder may assume that the contract imposes no requirements on the bidder to assume responsibility for the compatibility of coatings produced by different manufacturers.

4. **Sect 666.02, (B) calls for the use of materials from two (2) different manufacturer's (ie. primer vs, intermediate, stripe and finish). Shall the Bidders assume that the Engineer accepts responsibility for warranting the performance of this custom system?**

The bidder may assume that the contract imposes no requirements on the bidder to assume responsibility for the performance of the system as specified, but rather that the bidder provides written warranties for the individual products to perform as intended by the standards of the manufacturer and to cover replacement of the product in the event of a discovered defective condition.

5. **Sect. 666.02, (B) calls for Zingametall Zinga to be applied as a primer, followed directly by Tnemec Epoxoline II as the stripe coat and the intermediate coat. While reviewing the Zinga TDS, we noticed that the manufacturer says that "To avoid any problems with application of topcoats, we advise the use of a sealer. Zingametall offers two compatible sealers which have been tested according ISO 12944: Zingalufer (PU sealer) and Zingaceram HS (EP sealer)". Shall**

the Bidders assume that a sealer shall be applied, in accordance with manufacturer's directions, or that no sealer shall be applied, in accordance with Sect. 666.02, (B)?

See revised Special Provisions Sections 666 and 667 for clarification. A mist coat of the Epoxoline II Series V69 has been added to the specified system to act as the sealer.

6. **Specification Section 501 – Steel Structures: Contract documents reference Advanced (ABR) Bridge Fabricator Certification for the fabrication of the trestle structure. However, after reviewing the scope of work, it seems that a higher level of certification might not be appropriate for the complexity and scope of this bridge rehabilitation project. Would it be acceptable to allow Intermediate (IBR) Bridge Fabricator Certification? This would allow a larger pool of contractors to bid and provide a more competitive bidding process.**

With consideration, an Intermediate (IBR) Bridge Fabricator Certification is acceptable so long as the fabricator has a documented procedure for welding that includes a distortion control program.

7. **Referencing Plan Sheet EC-3, Water Pollution and Erosion Control Note 2: Please provide the status of these permits.**

E.2.a. NPDES Permit for Construction Activities – See Note. E.1. on Plan Sheet EC-3.

E.2.b. Water Quality Certification – will be issued with the Section 404 Army Corps Permit.

E.2.c. Section 404 Army Corps of Engineer Permit – Pending U.S. Army Corps of Engineers issuance.

8. **Referencing Plan Sheet S0.4, General Notes 3E, F: Please provide As-Build drawings to all bidders.**

The Contractor may obtain the as-built drawings from the HDOT Highways Division at the location noted on Structural General Notes, 3. General: E. or at the following website location: http://162.221.244.142:8080/As-Built/plan/all/page/1?sortField=id&sortDir=asc

9. **Referencing Plan Sheet S0.7, Construction Note 10B: Please provide the bridge load rating and inspection reports to all bidders.**

The latest Bridge Inspection Reports and Load Rating Report will be provided.

10. **Due to the complexity of this project, we would like to request a 4-week extension to the bid date.**

Extension provided in Addendum 1. Bid date extended to January 9, 2025.

11. **Is there a list of prospective bidders available for this contract?**

No

12. **Note 10. Construction Note A. " Contractor shall be entirely responsible for the stability of the bridge…". Please make available for all bidders the Bridge Inspection Report.**

The latest Bridge Inspection Reports will be provided.

13. **Note 10. Construction Note B. "Contractor's Engineer shall determine the structural adequacy of the bridge throughout all phases of construction…". With the different options and approvals needed for temporary bracing, please create a Force account item to not only track the design but installation and procurement of the temporary bracing. This will allow for more aligned and comparable bids.**

Force account item for design and installation of temporary bracing will not be created.

14. **Note 10. Construction Note C. "Contractor shall field verify all existing site conditions, dimensions and member sizes prior to fabrication of any bridge elements". For estimating purposes, confirm that the bidders are to scale the drawings to assume the member lengths. Which drawings should the bidders use for estimating length of the bracing members.**

It is unclear if the bidder is inquiring about the member lengths of the existing steel or new steel. For existing steel, the bidder should refer to the as-built drawings. For new steel members, all dimensions needed for estimating takeoffs are shown on the plans. By "bracing members" it is assumed that the bidder is inquiring about the substructure trestle bracing members and not any of the members for the superstructure. The Contractor should reference plan sheets SA2.1, SA2.3, SA2.4, and SA4.1 through SA4.10 for information in helping to determine bracing member lengths.

15. **Due to the complexity, magnitude and the amount of temporary engineering and structural checks needed for this bid, Contractors request bid to be pushed out 2 months.**

HDOT believes that the 4-week extension provided in addendum 1 is acceptable enough to put together a bid. No further extensions will be considered at this time.

16. **Please provide the Bridge Load Rating Report with calculations.**

The latest Load Rating Report will be provided.

17. **Please provide As-Built Drawings and calculations**

The Contractor may obtain the as-built drawings from the HDOT Highways Division at the location noted on Structural General Notes, 3. General: E. or at the following website location: http://162.221.244.142:8080/As-Built/plan/all/page/1?sortField=id&sortDir=asc

18. **Due to the complexity of the project, suggest making the Steel Bid Items Unit Price by the lbs.**

Pay Item for Steel work will remain Lump Sum. The Contractor shall perform their own takeoffs for estimation.

19. **Please confirm that any defects etc. to the existing bridge that is not part of the Bridge Load Rating and Inspection report will be a Change**

Any defects to the existing bridge substructure that are not part of the Bridge Inspection Report may be considered a change condition so long as the defects are of a significant enough nature that affect the Contractor's methods of construction. To qualify, defects would need to be measurably worse than the other documented defects and the effect on the methods of construction would need to be quantified by the Contractor's Engineer.

20. **Due to the unknown factors of the As-Built drawings and Bridge Loading Report, it is difficult to estimate the effort needed to design the temporary supports. IE existing damage of the structure in other locations separate from the failure need to to be analyzed.. Recommend that, like other projects, this be a force account price item.**

Force account item for designing the temporary supports will not be created.

21. **With amount of temp engineering needed to bid this project, please issue a stipend to account for bidders costs that we being expended to analyze and confirm that a viable plan works and can be constructed.**

No stipend will be provided. See sheets SB1.1 to SB3.9 for an example of a viable plan that can be constructed.

22. **Please confirm that Builders Risk to include the full Contract value only for the perils of Named Windstorm and Earthquake**

No, Builders Risk shall comply with Specification Section 107.01(B)(4) in its entirety.

23. **Per Section 7.2 of the C-EHMP: Soil that is disturbed will remain on-site per the recommendations of RAA. It will be reused and managed in place. All soil on site is considered to be lead-impacted soil in excess of the HDOH Tier 1 EALs for unrestricted land use and at or in excess of construction/trench worker EALs for lead. Off-site disposal is not planned for soil on-site. Additional sampling is not anticipated as all soil will remain on-site and handled as lead impacted. However, specification section 627, page 2a, states: The Contractor shall separate soil into two soil piles. Pile 1 will consist of soil excavated from the depth found to be contaminated (surface to 36" bags). Pile 2 will consist of soil excavated from 36" bags and deeper. The intent of separating the soil is to utilize potentially unimpacted soil as backfill**

and/or to remove and dispose of impacted soils from the site. Soil from Piles 1 and 2 will be tested for RCRA metals and chlorinated pesticides. If soil concentrations are below the Department of Health (DOH) Environmental Action Levels (EAL), then the soil may be used with no restrictions as long as it meets other specification requirements. The Contractor shall also test any residual soils not used as backfill for Toxicity Characteristic Leaching Procedure (TCLP) for metals and chlorinated pesticides. Soils with concentrations above the regulatory limit shall be disposed of in accordance with regulatory requirements. Questions: Will excavated lead-impacted soil be allowed to be reused onsite, without additional sampling/testing? Also, please confirm that offsite disposal of contaminated soil is not required.

On-site management and reuse of soil on-site will be the approach. Removed soil shall be temporarily stored on-site before being re-used or spread out at the site following subsurface soil excavation activities. Sampling/testing of soil is not required. Soil shall not be disposed of off-site.

24. **Is there an agreement between HELCO and HDOT for relocating the existing overhead utility lines?**

There is no agreement between HELCO and HDOT. The Contractor shall coordinate with HELCO for temporary relocation(s) required and pay for all costs associated with the relocation(s).

25. **When is the anticipated construction start date?**

The anticipated construction start date is in March/April 2025.

26. **Referencing Spec Section 627.03 (L) and the C-EHMP Report page 23, 7.1.3 Excavation: Please clarify how to handle excess soil. Specs Section says to dispose at the landfill while the Report says to keep all soils on-site.**

On-site management of all excavated soil shall be the approach. Excess soil will be cleaned off of steel structural material before being removed from the site. No loose soil will be moved off the site with the steel members being disposed of. The steel members will be hauled away in lined roll-off's.

27. **Referencing C-EHMP Report page 23, 7.2 Soil Reuse: Please clarify if green waste can be left on-site.**

Green waste that is free of soil shall be removed off-site. Payment for removal of green waste off-site shall be considered incidental to the various contract items. Green waste with soil shall be managed on-site.

28. **Note 3 on SA9.23 (pg. 182) states "Only one cross frame may be removed per span during each phase." Since these members also have to be field fit prior to welding and galvanizing, is it acceptable to reinstall the original members or install temporary members so that Multiple cross frames can be sent for galvanizing and painting at the same time?**

There are many different possibilities for how the Contractor can "field fit" the cross frames. The purpose of the field fitting is to ensure that the cross frames can be bolted up to the stiffener and still maintain all the required clearances and dimensions shown on the contract drawings. Bolt holes do not need to be drilled at this time as they will be drilled after initial abrasive blasting. Field fitting could be performed on an identical adjacent pair of stiffeners that are not occupied by a cross frame. The proposal by the Contractor to reinstall the original members to the stiffeners would be acceptable but would need to be installed with pretensioned HS bolts. If temporary cross frames are installed, they would need to have equivalent strength and stiffness to existing cross frame.

It is not the intention of the Engineer to require the Contractor to remove one cross frame, fabricate the new cross frame, install new cross frame, and then continue the sequence. It is the intention of the Engineer that the Contractor will prefabricate all cross frames (see suggested steps discussed above for how "field fitting" may be accomplished) and then proceed with removal and replacement one at a time.

29. **In spec section 666 on page 2a line 89 it states, "Do not mix manufacturers. The same manufacturer shall furnish the primer, intermediate, stripe, and topcoat." The products called out on page 4a of the spec lines 161 - 168 have Zingametall for the primer and Tnemec for the stripe, intermediate and topcoat. Tnemec does not manufacture the Zingametall prime. Is it the designer's intent to mix manufacturers and is there an issue if Tnemec only warranties the intermediate and finish coats but not the primer or how the primer interacts with the intermediate and Finish coat?**

The specified paint system does utilize products from different manufacturers. See revised Special Provisions Section 666 and 667. It is not intended for the paint manufacturer to warrant any product other than the ones they produce. Therefore, Tnemec is not required to provide a warranty for Zinga or their products interaction with Zinga.

30. **In spec section 667 on page 2a line 63 they call out SSPC-QP-3, "Standard Procedure for. Evaluating the Qualifications of Industrial / Marine Painting Contractors" Is this meant to be SSPC QP-3 Shop Painting Contractor Certification Program?**

Yes. See revised Special Provisions Section 667.

31. **Would it be acceptable for the shop coating applicator to have the AISC-Complex Coatings Endorsement (AISC 420-10) in lieu of the AMPP/SSPC QP-3 Shop Painting Certification?**

No. For this project, the AISC Complex Coatings Endorsement is not considered equivalent to the AMPP/SSPC QP 3 Shop Certification/Accreditation.

32. **In spec section 666 on page 4a line 149 it states, "All coating used shall have a mixed VOC at or under 340 g/l (2.8 lbs/gal)". Will the Zingametall coating called out in this specification be approved even though it has a VOC content 3.96 lbs/gal?**

See revised Special Provision Section 666 for clarification.

33. **In spec section 666 on page 3a line 109 it states, "The Coating Manufacturer shall prepare the paint at the factory ready for application. No field thinning or tinting will be allowed after shipping the paint. The Tnemec Fluoronar Series 1070V manufacturer's product data sheets (PDS) says "Thinning is required for proper application. For brush, roller, and air spray, thin up to 10% per gallon with No. 63 Thinner. Note: In areas that require lower VOC, use No. 65 Thinner. Caution: Do not add thinner if more than thirty (30) minutes have elapsed after mixing." Will the Coating Contractor be allowed to follow the Manufacturers PDS?**

See revised Special Provision Section 666 for clarification. Thinning will be allowed in accordance with the Manufacturer's PDS, however, stripe coating shall be made using unthinned paint.

34. **Can a QP-1 Certified Coating Contractor perform shop coating per the AMPP/SSPC QP-1 standard in lieu of all shop coating by a QP-3 shop? The AMPP/SSPC QP-1 and QP-3 standards are equal in their quality requirements. The only difference is the location at which the work is performed. A QP-1 contractor has established that it can produce the same level of quality required for QP-3, but in much more difficult field applications.**

No. AMPP QP-3 Enclosed Shop accreditation is required for any steel prepared in accordance with Special Provisions Section 667.

35. **SA 11.1 Defective Concrete Repair Quantities Chart. Please provide locations of each spall and quantity of each location of the spalls or confirm that that are only 4 locations of spalls.**

There are not only 4 locations of spalls, but there are only 4 locations where the spalls may occur. The soffit of concrete deck has multiple spall locations. Due to such a low quantity of spall repairs, a location map was not deemed necessary. Work access to soffit of deck is being provided under Pay Item 209.0300 so location should not affect price.

36. **Sheet SA11.2. Please provide a Repair quantity table (like Sheet SA11.1) for the horizontal defective concrete to show how many locations and quantity at each location.**

The horizontal defective concrete repair locations are unknown as the top of the concrete deck is covered in AC pavement. Only after the AC is removed will any horizontal defective concrete repair areas be made known.

37. **Sheet SA 11.2, 11.2. For estimating purposes, please clarify the average depth of spalls contractors are to assume.**

See as-built plans for depths of reinforcing steel from the surface of the concrete. The defective concrete is to be repaired to a depth of ½" minimum beyond the reinforcing steel as shown on the contract drawings.

38. **Spec 679.03(K). Can maturity meters be utilized in lieu of 3-hour breaks for the VESLMC?**

Maturity meters may not be used in lieu of the 3-hour breaks. Please follow the Contract Requirements in Special Provisions Section 679.

39. **Spec 679.03(K). What is the required strength for a 7 day break for VESLMC? Is this necessary if there is no requirements?**

There is no required compressive strength for the 7-day breaks. The Contract Requirements still require the Contractor to conduct 7-day breaks.

40. **Spec 680.03(F)(e). Please provide a quantity of corroded rebar repairs for defective areas or consider making it a Force Account Item**

See Note 7 on Sheet SA11.3

41. **Sheet SA 14.1. Note 1 states that the construction sequence shall not be changed unless approved by the Engineer. Note 2 states … Engineer sole judge of whether a sequence stage is completed or not. Without the Bridge Inspection Report and Load Rating Report it is difficult to analyze the critical portions of the structure. The current sequence will add significant time and cost to the Bid. Please outline the concerns that the Engineer has and critical members that should be analyzed when Contractors are planning and resequencing the Work.**

The latest Bridge Inspection Reports and Load Rating Report will be provided. It is unclear what in particular about the current sequence is adding significant time and cost.

1. The suggested schematic erection (SB Series) drawings show all columns (A, B, C, and D) within a level being replaced simultaneously at each bent/trestle. This is to avoid complicated sequencing of trestle bracing installation. The Engineer doesn't see any benefit or time savings by changing this sequence.

2. The overall construction sequence is phased so that the replacement of the trestles precedes the cleaning and painting of the adjacent superstructure spans. The Engineer does not want the cleaning and painting of the superstructure spans to precede the trestle replacement. The reason for this is that the replacement of the trestles will require installation of temporary girder supports just outside the bearing locations, installation of temporary bearing stiffeners at support locations, removal and replacement of permanent bearing stiffeners and cross frames, and installation of new bearings. All this work will require bolting/welding to the superstructure and would damage any new coating placed.
3. The overall construction sequence is phased so that the weight of the underdeck work platform (including superimposed dead loads and live loads) installed beneath the superstructure will be supported by new steel trestles and not the existing ones. Changing this would add additional responsibilities onto the Contractor's Engineer.
4. The overall construction sequence is phased so that the soffit of deck crack/defective concrete repairs occur in close proximity with the superstructure repair/cleaning/painting work since it is assumed that the underdeck work platform would be utilized to cover all of this work.
5. The overall construction sequence is phased to show the top of deck work to be performed at the end of all other construction. This work was shown as the last phase due to any potential issues that may arise with the placement of overweight equipment may impose on the bridge that would be needed may be conducted at any time after the abutment bearing replacement has been performed so long as the Contractor's Engineer is responsible for checking that the bridge structure can support the weight of any equipment needed to remove AC and place the HPC overlay.

42. **Sheet SA 14.1 Similar to previous question number 41. Can multiple locations be completed simultaneously and what are the restrictions for working on multiple locations. IE multiple bents/trestles, girder bracing, and foundation concrete work.**

Multiple trestles may be worked on simultaneously if the Contractor has the man power to accommodate. See response to RFI 28 for discussion addressing multiple girder cross frame replacements.

STORM WATER POLLUTION PREVENTION PLAN (SWPPP)
AND
IN-WATER POLLUTION PREVENTION PLAN (IWPPP)

Project Title: Nanue Stream Bridge Rehabilitation

Project No.: BR-019-2(077)

DOH WQC1092.FNL.22
DA File No. POH-XXX-XXXX
DOH NGPC File No. N/A

Prepared by: Department of Transportation, Highways, Design Branch
Date: October 30, 2024

Storm Water Pollution Prevention Plan (SWPPP) and In-Water Pollution Prevention Plan (IWPPP)

DOH WQC1092.FLN.22

DA File No. POH-XXX-XXXXX

Notice of General Permit Coverage (NGPC) File No. *N/A*
Preparation Date 10/30/24

Table of Contents

7.0 Preface

The following documents are referenced throughout the SWPPP/IWPPP:

1) *Hawaii Administrative Rules, Chapter 11-55*

2) *HDOT Construction Best Management Practices Field Manual*

3) *Hawaii Standard Specifications for Road and Bridge Construction dated 2005 and applicable special provisions.*

4) *An Integrated Storm Water Management Approach and a Summary of Clear Water Diversion and Isolation Best Management Practices for Use in the State of Hawaii,*

by the Department of Transportation and Federal Highway Administration, Practitioners Guide (Practitioners Guide), April 2016 (Version 1, Draft)

7.0.1 Notes for Contractor/HDOT Construction Personnel

- *Items in red need to be updated by the Contractor once the project is awarded prior to construction. The Contractor shall be responsible for updating the SWPPP/IWPPP during construction.*

The Contractor shall implement or modify structural BMPs identified by designer in site plan. The Contractor shall design and implement the in water isolation and confinement BMPs for areas within the Army Corps Jurisdiction.

The Contractor shall keep an accurate account of the type(s) and estimated quantities (in cubic yards) of the BMPs placed and/or installed within the in-water work area (i.e. canal, stream, river), particularly any type of dredged and/or fill material (e.g., sand, soil, rock, gravel, concrete, etc.) discharged below the HTL/MHHW elevation used to divert flow/tidal waters away from in-water work areas, or to construct temporary access ramps, or for any other purpose in-water work areas.

Contractor Staging/Storage Areas

- *HDOT has permitted all outfalls and disturbed potential Contractor Staging/Storage Areas within the project limits.*
- *The Contractor may use any disturbed area acceptable to the Engineer for Staging/Storage.*
- *Staging/Storage Areas outside disturbed areas or outside the project limits may require a new National Pollutant Discharge Elimination System (NPDES) Permit submittal. See permitting requirements in Section 209 of the Specifications and applicable Special Provisions.*

The following applies to construction areas discharging to all outfalls:

1) *Construction BMPs shall be inspected weekly, and within 24 hours of any rainfall event of 0.25 inches or greater in a 24 hour period and daily during periods of prolonged rainfall. For more details see Section 7.2.12 of this SWPPP/IWPPP.*

2) *Immediately initiate and complete stabilization within 7 calendar days on areas of the site in which earth-disturbing activities have temporarily or permanently ceased. For more details See section 7.2.10.2 of the SWPPP/IWPPP.*

The following applies to construction areas discharging to Nanue Stream:

A variety of best management practices (BMPs) will be implemented to protect Waters of the U.S. from stormwater and non-stormwater related discharge or discharge from the construction site. In addition to the BMPs listed below, refer to BMPs identified in the Practitioners Guide. BMPs will be detailed in the storm water pollution prevention plan (SWPPP) and updated In-water pollution prevention plan (IWPPP) processes. These include:

1) *Comply with all requirements of the water quality standards in the Hawaii Administrative Rules (HAR), Chapter 11-54, and the Section 401 Water Quality Criteria (WQC) and all information submitted to the State of Hawaii Department of Health-Clean Water Brank (DOH-CWB) for compliance with the Notification and Reporting Requirements. Ensure that the activity will not result in non-compliance or violations to the applicable State WQS. Discharges associated with the proposed construction activities will be conducted in a manner that complies with "Basic Water Quality Criteria Applicable to All Waters" as specified in HAR, Chapter 11-54-4.*

2) *Obtain NPDES permit for storm water discharges associated with construction activities when the proposed construction activities will disturb one (1) or more acres of land area before initiating any construction activities.*

3) *Apply best degree of treatment or control measures to the potential water pollutant discharges associated with the proposed construction activity (ies) that assures the discharges will meet requirements compatible with the basic water quality criteria applicable to all waters, uses and specific water quality criteria and recreational criteria established for the class of the receiving State waters. Best Management Practices (BMPs) shall be properly implemented and maintained during the entire construction period. Isolate and confine all in-water work areas throughout the entire water column (surface to bottom) such that all potential water pollutants will not leave or enter the work area. The entire volume of water in the in-water work area needs to be isolated and confined. Utilize BMPs that are inert and not themselves sources of pollution. (Examples of inappropriate in-water BMPs include, but are not limited to: compost biosocks since it is a source of nutrients; silt fence since the material is porous; and a soil berm since the soil particles will erode away). Ensure that all material(s) placed or to be placed in State waters are free of waste material,*

heavy metals, organic materials, debris and ay water pollutants at toxic or potentially hazardous concentrations to aquatic life as specified in HAR, 11-54-4(b).

4) *Deploy all BMPs around the perimeter of the project prior to the commencement of any construction work. These BMPs will be properly maintained throughout the entire period of in-water work and will not be removed until the in-water work is completed and the water quality in the in-water work area has returned to its pre-construction condition as demonstrated by the monitoring results (if applicable).*

5) *Isolate and confine in-channel construction activities using a of stream diversion method chosen by the contractor using the Practitioners Guide.*

6) *Isolate and confine all upland activity to contain and retain water pollutants upland and not allow them to enter State waters, including the designated in-water work area. When it is necessary to conduct stream work, the workspace shall be isolated to avoid construction activities in flowing water in compliance with Practitioners Guide. The proposed project shall maintain aquatic organism passage (AOP) through the project area. Adequate water depth and channel width must be maintained at all times for passing design flood discharges. Prior to construction activities, isolate the workspace from flowing water to prevent sedimentation and turbidity and avoid impacts to aquatic organisms and water quality. The diversion or isolation BMPs shall remain in place during the life of the project and be removed immediately after work is completed in a manner that would allow flow to resume with the least disturbance to the substrate.*

7) *For a stream, ditch, or gulch allow unimpeded flow around the isolated and confined in-water work area to allow for aquatic animal migration and/or to prevent downstream flooding situations. The unimpeded flow shall be equivalent to the 2-year 24-hour duration storm event and/or the existing flow capacity of the waterbody, whichever is smaller.*

8) *Collect water pollutants from localized work areas and do not allow these water pollutants to enter or re-enter State waters, including the in-water work area. Examples of water pollutants include, but are not limited to, airborne particulate, dust, concrete slurry, concrete chips, concrete surface preparation washing effluent, construction debris, etc.*

9) *Construction debris will be contained and prevented from entering or re-entering State waters. During bridge removal, construct structurally adequate debris shields to contain debris. Do not permit debris to enter waterways, travel lanes open to public traffic, or areas designated not to be disturbed. If portions of the existing*

bridge do fall into a stream during demolition, they will be removed from the stream without dragging the material along the streambed.

10) *Immediately cease construction work if water quality monitoring or daily inspection or observation results indicate that noncompliance to HAR, Chapter 11-54-4(a) or Chapter 11-54-4(b), will occur or is occurring. The construction activity shall not resume until adequate measures are implemented and appropriate corrective actions are taken and water quality monitoring demonstrates that the non-compliance has ceased. Note: These actions shall not preclude the DOH-CWB from taking enforcement action authorized by law.*

11) *Do not disturb the area beyond the construction limits. Trees, shrubs or vegetated areas temporarily damaged by construction operations will be re-vegetated.*

12) *Apply permanent soil stabilization as soon as practicable after final grading but no later than 14 days, or 7 days for impaired waters, after completion of earth disturbing activities.*

13) *Apply turf establishment to finished slopes and ditches immediately but no later than 7 days after completion of earth disturbing activities.*

14) *Provide certified weed free permanent and temporary erosion control measures to minimize erosion and sedimentation during and after construction according to the contract erosion control plan, contract permits, and Special Provision Sections 209, 619 and 641.*

15) *Protect and care for seeded areas, including watering when needed until final acceptance. Repair all damages to seeded areas by reseeding, re-fertilizing and re-mulching.*

16) *Ensure that all temporarily constructed structures, such as the silt containment device(s), floating oil and grease as well as construction debris containment device(s), berm, cofferdam, sheet pile, stream flow diversion structure(s), and/or sediment and soil erosion control structure(s), etc., are properly removed immediately after the completion of the construction work and when the affected water body has returned to its pre-construction condition or better, as demonstrated by the monitoring results, including color photographs.*

17) *Ensure that the proposed construction activities related discharges not covered under the NWPs will also comply with State water pollution control permitting requirements under NPDES as established in HAR, Chapter 11-55.*

18) *Pesticide application in State waters shall comply with HAR, §§11-54-4(a), 11-54-4(b), 11-54-4(c), 11-54-4(f) and/or Chapter 11-55, Appendix M - NPDES General Permit Authorizing Point Source Discharges from the Application of Pesticides.*

19) *Ensure that no concrete truck wash water is disposed by percolation into the ground.*

20) *Maintain and require all of their contractor(s) and the subcontractor(s) that are performing work covered under this Section 401 WQC, to maintain at the construction site or in the nearby field office, a copy of this letter, all Notification and Compliance Reporting Requirements, and all records demonstrating that every requirement of this Section 401 WQC has been complied with.*

21) *Ensure that all areas temporarily impacted, either directly or indirectly, by the project construction activities are fully restored to its pre-construction conditions. For example: Incidental construction debris is cleaned up prior to removal of BMPs.*

22) *Discontinue work during storm events or during flood condition.*

23) *Modify environmental protection measures, including BMPs and monitoring requirements, when instructed by the DOH-CWB for corrective action/remedial actions.*

24) *Allow the DOH-CWB to conduct routine inspections of the construction site in accordance with Hawaii Revised Statutes (HRS) §342D-8.*

25) *Complete and submit a Solid Waste Disclosure Form for Construction Sites to the DOH, Solid and Hazardous Waste Branch, Solid Waste Section. The form can be downloaded at: http://health.hawaii.gov/shwb/files/2013/06/swdiscformnov2008.pdf.*

26) *Do not stockpile, store, or place construction material or construction activity-related materials in State waters or in ways that will disturb or adversely impact the aquatic environment.*

27) *Dispose of construction debris, waste products, vegetation and/or dredged material removed from the construction site at upland State and County approved sites.*

28) *Contain on land and not allow to enter or re-enter State waters any runoff, return flow, or airborne particulate pollutants, if any, from the excavated/dredged material dewatering process or from the stockpiling site.*

29) *Ensure that their discharge activity shall not interfere with or become injurious to any designated uses (HAR, §11-54-1 and HAR, §11-54-3), or existing uses (HAR, §*

11-54-1 and HAR, § 11-54-1 .1). The owner of the discharge shall maintain and protect all designated and existing uses.

30) *Do not discharge any effluent associated with the proposed construction activities, such as dewatering effluent, effluent resulting from hydroblasting, saw cutting, concrete surface preparation, rock washing, concrete and rock truck washing effluent or any other similar regulated activity(ies) shall be properly contained, collected and prevented from entering, either directly or indirectly, State waters, except for those discharges that have received authorization issued by the DOH-CWB under the NPDES Permit as applicable.*

31) *Implement appropriate and effective measure(s) to properly contain/collect the potential water pollutant discharges resulting from the application of concrete corrosion inhibitor; or from the scrubbing, chipping, cutting, rebar reinforcing, grouting, filling activities needed for the permitted construction activity (ies).*

32) *In Hawaii, the Commission on Water Resource Management (CWRM) issues permits regulating withdrawals of surface and groundwater. If water drafting is necessary, the Contractor will ensure this water use is approved in accordance with a stormwater use permit obtained from the CWRM (HRS §174C-48(1987)).*

33) *Structures designed to minimize sediment and pollutant runoff from sensitive areas such vehicle and fuel storage areas, hazardous materials storage sites, and erosion control structures shall be visually monitored daily, especially following precipitation events to ensure these structures are functioning properly.*

34) *Maintain temporary erosion control measures in working condition until the project is complete or the measures are no longer needed as outlined in Special Provision Section 209 and the SWPPP/IWPPP.*

35) *For dewatering that may be required during excavation or construction of the project, a NPDES General Permit for Construction Activity Dewatering would be required for discharging dewatering effluent into waters of the US. The permit will require appropriate BMPs, an erosion control plan, and a water quality monitoring plan to mitigate any impacts on receiving waters.*

36) *Develop a Rain Event Action Plan (REAP) prior to Notice to Proceed. The REAP will be reviewed and structured to address project specific actions that are needed to prevent pollutants from reaching the creeks and rivers during the rain event. The REAP will be executed within 48 hours prior to a forecast rain event of 50% chance of precipitation or more. BMPs in the REAP include:*

a. *When the trees are cleared, the slash will be chipped and placed as mulch on the area that has been cleared to prevent raindrop erosion.*

b. *Any area that has soil disturbances will be stabilized prior to rain events with mulch, wood chips, or other protective covers.*

c. *Sediment traps will be placed to collect the water and allow sediment to settle out. If sediment traps are not possible, other settling and filtering devices will be used to slow water down and remove sediments.*

d. *Operations will shut down during extreme rain events.*

e. *Fueling and repair areas will be covered and surrounded by a berm.*

f. *Exposed soil will be covered and stabilized.*

g. *Treated materials will be covered or placed in a shed.*

h. *Dumpsters will be covered at all times.*

i. *Drain holes will be plugged.*

j. *Control perimeters will be established around stockpiles of material.*

37) *Submit a Spill Prevention, Control, and Countermeasure (SPCC) Plan with the Water Pollution, Dust, and Erosion Control Submittals.*

38) *Any spill of petroleum products, hazardous materials, or other chemical or biological products released from stationary sources or construction, fleet, or other support vehicles shall be properly cleaned, mitigated, and remedied, if necessary. Any spill of petroleum products or a hazardous material shall be reported to the appropriate federal, state, and local authorities, if the spill is a reportable quantity. Response shall occur in accordance with federal, state, and local regulations.*

39) *In general, when gasoline, diesel fuel, antifreeze, hydraulic fluid or any other chemical contained within the vehicle is released to the pavement or the ground, proper, corrective, clean-up and safety actions specified in the SPCC and SWPPP will be immediately implemented. All vehicles with load rating of two tons or greater will carry, at minimum, enough absorbent materials to effectively immobilize the total volume of fluids contained within the vehicle.*

40) *Repair leaks immediately on discovery. Equipment that leaks will not be used. Oil pans and absorbent material will be in place prior to beginning repair work. The contractor will be required to provide the "on-scene" capability of catching and*

absorbing leaks or spillage of petroleum products including antifreeze from breakdowns or repair actions with approved absorbent materials. A supply of acceptable absorbent materials at the job site in the vent of spills, as defined in the SWPPP will be available. Sand and soil are not approved absorbent materials. Soils contaminated with fluids will be removed, placed in appropriate safety containers, and disposed of according to state and/or federal regulations.

41) *Collect and dispose of all waste fuels, lubricating fluids, and other chemicals in a manner that ensures that no adverse environmental impact will occur. Construction equipment will be inspected daily to ensure hydraulic, fuel and lubrication systems are in good condition and free of leaks to prevent these materials from entering any stream. Vehicle servicing and refueling areas, fuel storage areas, and construction staging and materials storage areas will be sited a minimum of (50 feet) 15 meters from ordinary high water, typically referred to as the Q2 elevation, wetlands, and contained properly to ensure that spilled fluids or stored materials do not enter any stream or wetland.*

42) *Attachment A shows the locations of sediment and erosion control features. The Contractor shall add additional BMPs to facilitate different phases of construction or to accommodate Contractor's means and methods. These BMPs shall be tracked on the projects SWPPP/IWPPP.*

7.2.1A (WQC Section 5) - Emergency Contacts

Provide the name and two (2) phone numbers of at least two persons who may be contacted in case of emergency regarding "discharges" into the navigable waters. The Contractor shall include their personnel information once the project is awarded.

1) Name: Annette Matsuda

Company: Hawaii Department of Transportation

Position: Acting HDOT Acting Hawaii District Engineer

Contact Number: (808) 446-4586 Contact Alternate (Cell) Phone number: (808) xxx-xxxx

2) Name: Contractor Representative

Company: Contractor

Position: Contractor

Contact Number: (808)692-XXXX Contact Alternate (Cell) Phone number: (808)xxx-xxxx

7.2.1 Storm Water Team

The permittee shall assemble and oversee a "storm water team," which is responsible for the development of the SWPPP/IWPPP, any later modifications to it, and for compliance with the requirements in HAR 11-55.

The SWPPP/IWPPP must identify the personnel (by name or position) that are part of the storm water team, as well as their individual responsibilities. Each member of the storm water team must have ready access to an electronic or paper copy of applicable portions of this permit, the most updated copy of the SWPPP/IWPPP, and other relevant documents or information that must be kept with the SWPPP/IWPPP.

The Contractor shall include their personnel information once the project is awarded.

1) Name: Amy Sunahara
Company: Hawaii Department of Transportation
Position: HDOT Design Project Manager
Contact Number: (808) 692-7575
Responsibilities: Develop SWPPP/IWPPP during the design process

2) Name: Larissa Sato
Company: WSP USA
Position: Sr. Supervising Engineer
Contact Number: (808)566-2246
Responsibilities: Develop SWPPP/IWPPP during the design process

3) Name:
Company: Hawaii Department of Transportation
Position: HDOT Resident Engineer
Contact Number: (808)xxx-xxxx
Responsibilities:

4) Name:
Company: Hawaii Department of Transportation
Position: HDOT Construction Project Engineer

Contact Number: (808)xxx-xxxx

Responsibilities:

5) Name:

Company: Hawaii Department of Transportation

Position: HDOT Construction Project Engineer

Contact Number: (808)xxx-xxxx

Responsibilities:

6) Name:

Company: Contractor

Position: Contractor Designated Representative

Contact Number: (808)xxx-xxxx

Responsibilities:

7) Name:

Company: Contractor

Position: Contractor

Contact Number: (808)xxx-xxxx

Responsibilities:

8) Name:

Company: Contractor

Position: Contractor

Contact Number: (808)xxx-xxxx

Responsibilities:

7.2.2A (WQC Section 1) - Army Corps Pre-Construction Notification

Check all NWP or Federal Authorization Applicable for this project:

☒ *NWP 3 - Maintenance*
☐ *NWP 5 – Scientific Measurement Devices*
☐ *NWP 6 – Survey Activities*
☐ *NWP 12 – Utility Line Activities*
☐ *NWP 13 – Bank Stabilization Activities*
☐ *NWP 14 – Linear Transportation Projects*
☐ *NWP 23 – Approved Categorical Exclusions*
☐ *NWP 33 – Temporary Construction Access and Dewatering*
☐ *Section 10 Rivers and Harbors Act Authorizations*
☐ *Individual 404 Permit Authorizations*
☐ *Other* ______________________________

See Attachment K for PCN

Are there any Special Conditions?
☐ *Yes (See Attachment K for Special Conditions)*
☒ *No*

7.2.2 Nature of Construction Activities NOI Form C.6

What is the function of the construction activity (Please check all applicable activity(ies))?
☐ *Residential* ☐ *Commercial* ☐ *Industrial* ☐ *Road Construction* ☐ *Linear Utility*
☒ *Other (please specify): Bridge Repair*

For construction site estimates, see NOI Form C, Section C.3.

What is being constructed? The project consists of rehabilitating the Nanue Stream Bridge by repairing various deteriorating items as follows: 1) Superstructure Repairs including replacing steel truss members, bearings, gusset plates; (2) repair spalls and delamination in the concrete deck, abutments, bridge railings and column pedestals; (3) cleaning and painting steel members (4) addressing scour deficiencies for the bridge foundations by cleaning out silt and loose debris prior to filling voids under the bridge foundation with concrete.

Describe the scope of work and major construction activities covered in this NOI, including baseyards and staging areas. Include only project areas where the locations of impervious structures are known; project areas where the final grades are known; and work areas that will be performed by one (1) general contractor. A separate NOI will be required for all other project areas. (Note: Per Section 209 of the specifications and applicable special provisions, the maximum surface area of earth material which may be exposed at any time is 300,000 square feet.)

This project does not require a Notice of Intent as it does not meet the 1 acre disturbed area threshold. The locations of the staging and storage areas may be changed by the Contractor depending on his construction means and methods. The Contractor shall submit to the Engineer the locations of his staging and storage areas once the project is awarded for review and acceptance.

7.2.2B (WQC Section 10 and Section 12) – Receiving State Water(s) Information

a. Identify the receiving State water which the project will be conducted in. The receiving State water must be a surface water. This should include only the coordinates of the work subject to the Army Corps 404 Permit/Section 10 Rivers and Harbors Act Authorization. Use Section B below for the coordinates of discharges from areas not associated with the federal permit or license (Staging and Storage Areas, other work such as resurfacing, etc.) or refer to the NPDES Documents if there is a NPDES Permit/NGPC.

Latitude: **19.927399° N** *Longitude:* **-155.156366° E**

Receiving Water Name: **Nanue Stream**

Receiving State Waters Classification: **Class 2, Inland**

Is the receiving State Water on the Section 303(d) List?:
☐ *Yes* ☒ *No*

If the Receiving Water is on the Section 303(d) List, provide the impairment pollutants:

b. Provide the Outfall coordinates of any outfalls for work outside of the Army Corps 404 Permit/Section 10 Rivers and Harbors Act Authorization. Indicate if the Receiving State Water is on the Section 303(d) list and the impairment pollutants if any.

1) Discharge Point Label: **DP #1A**

Latitude: **19.927059° N** *Longitude:* **-155.156522° E**

Receiving Water Name: **Nanue Stream**

Is the receiving State Water on the Section 303(d) List?:
☐ *Yes* ☒ *No*

If the Receiving Water is on the Section 303(d) List, provide the impairment pollutants:

2) Discharge Point Label: **DP #1B**

Latitude: **19.927523° N** **Longitude**: **-155.156125° E**

Receiving Water Name: **Nanue Stream**

Is the receiving State Water on the Section 303(d) List?:
☐ *Yes* ☒ *No*

If the Receiving Water is on the Section 303(d) List, provide the impairment pollutants:

☒ *The Topographic Map showing the Locations of the Outfalls is included in Attachment A*

7.2.2C (WQC Section 12) – Project Scope

Describe the overall project scope and activities.
a. The overall project description should include: the project activities both in and out of the navigable waters, the construction or operation of facilities which may result in any direct and/or indirect "discharges" into State waters.

The project consists of rehabilitating the Nanue Stream Bridge by repairing various deteriorating items as follows: 1) Superstructure Repairs including replacing steel truss members, bearings, gusset plates; (2) repair spalls and delamination in the concrete deck, abutments, bridge railings and column pedestals; (3) cleaning and painting steel members (4) addressing scour deficiencies for the bridge foundations by cleaning out silt and loose debris prior to filling voids under the bridge foundation with concrete.

7.2.3 Emergency Related Projects

Note: This Section is only applicable to Construction Activities NPDES/NGPC Permits

☒ *Not Applicable*

☐ *Applicable (If this box is checked, provide additional information as described below)*

If conducting earth-disturbing activities in response to a public emergency (see section 1.3.), the permittee shall document the cause of the public emergency (e.g., natural disaster, extreme flooding conditions, etc.), information substantiating its occurrence (e.g., state disaster declaration or similar state declaration), and a description of the construction necessary to reestablish effected public services. The declaration of emergency or imminent threat to public health is required to be from the state governor or the director. See Attachment H for additional information.

7.2.4 Identification of Prime Contractor and Other Site Contractors

The SWPPP/IWPPP must include a list of both the prime contractor and all other contractors (e.g., sub-contractors) who will be engaged in construction activities at the site, and the areas of the site over which each contractor has control. List prime contractor and sub-contractors below and attach map showing areas of control in ***Attachment A. Complete and attach a Subcontractor Certification/Agreement in Attachment D.***

(General Contractor Company Name) The general contractor information will be submitted at least 30 calendar days before the start of construction activities.	
(General Contractor Contact Person Name)	
(General Contractor Mailing Address)	
(General Contractor Mailing City)	*(General Contractor Mailing State and Zip*
(General Contractor Telephone Number)	
(General Contractor Email Address)	

(Sub-Contractor #1 Company Name, as needed)	
(Sub-Contractor Contact Person Name)	
(Sub-Contractor Mailing Address)	
(Sub-Contractor Mailing City)	*(Sub-Contractor Mailing State and Zip Code)*

(Sub-Contractor Telephone Number)
(Sub-Contractor Email Address)

(Sub-Contractor #2 Company Name, as needed)	
(Sub-Contractor Contact Person Name)	
(Sub-Contractor Mailing Address)	
(Sub-Contractor Mailing City)	*(Sub-Contractor Mailing State and Zip Code)*
(Sub-Contractor Telephone Number)	
(Sub-Contractor Email Address)	

(Sub-Contractor #3 Company Name, as needed)	
(Sub-Contractor Contact Person Name)	
(Sub-Contractor Mailing Address)	
(Sub-Contractor Mailing City)	*(Sub-Contractor Mailing State and Zip Code)*
(Sub-Contractor Telephone Number)	
(Sub-Contractor Email Address)	

☐ *Attach maps showing areas of Contractor/Subcontractor Control in Attachment A.*

☐ *Complete and attach a Subcontractor Certification/Agreement in Attachment D.*

7.2.5 Sequence and Estimated Dates of Construction Activities

Separate the schedule for In-Water and Land-Based work. In Attachment C, attach the proposed construction schedule which shall include, at a minimum:
The Contractor shall submit to the Engineer an update of the dates once the project is awarded for inclusion in the SWPPP.

Land Based (HAR 11-55)

☒ *Installation of storm water control measures, and when they will be made operational, including an explanation of how the sequence and schedule for installation of storm water control measures complies with section 5.1.1.3.1. and of any departures from manufacturer specifications pursuant to section 5.1.1.3.2., including removal procedures of the storm water control measures after construction has ceased.*

☒ *Commencement and duration of earth-disturbing activities, including clearing and grubbing, mass grading, site preparation (i.e., excavating, cutting and filling), final grading, and creation of soil and vegetation stockpiles requiring stabilization.*

☒ *Cessation, temporarily or permanently, of construction activities on the site, or in designated portions of the site.*

☒ *Final or temporary stabilization of areas of exposed soil. The dates for stabilization must reflect the applicable deadlines to which the permittee is subject to in section 5.2.1.*

☒ *Removal of temporary storm water conveyances/channels and other storm water control measures, removal of construction equipment and vehicles, and cessation of any pollutant-generating activities.*

In-Water (CWA Section 404 and Section 401 WQC and HAR 11-54)

☒ *Date BMP measures to isolate and contain work areas are installed.*

☒ *Commencement and duration of In-Water construction activities.*

☒ *Cessation, temporarily or permanently, of construction activities on the site, or in designated portions of the site.*

☒ *Removal of temporary storm water conveyances/channels and other storm water control measures, removal of construction equipment and vehicles, and cessation of any pollutant-generating activities.*

7.2.6.1 Property Boundary Maps

Boundaries of the property and of the locations where construction activities will occur. Attach, title, and identify all maps (pdf - minimum 300 dpi) listed below, in Attachment A.

a. Legal boundaries of the project. See SWPPP/IWPPP Attachment A

b. Locations where earth-disturbing activities will occur, noting any sequencing of construction activities. See SWPPP/IWPPP Attachment A

c. Pre-Construction Topography including approximate slopes and drainage patterns for the entire Facility/Project site to the receiving storm water drainage system (if applicable) or to the receiving State water(s) (with flow arrows). Note areas of steep slopes (15% or greater in grade). See SWPPP/IWPPP Attachment A

d. During-Construction Topography (after major grading activities) including approximate slopes and drainage patterns for the entire Facility/Project site to the receiving storm water drainage system (if applicable) or to the receiving State water(s) (with flow arrows) Note areas of steep slopes (15% or greater in grade). See SWPPP/IWPPP Attachment A

e. Post-Construction Topography including approximate slopes and drainage patterns for the entire Facility/Project site to the receiving storm water drainage system (if applicable) or to the receiving State water(s) (with flow arrows). Note areas of steep slopes (15% or greater in grade). See SWPPP/IWPPP Attachment A

f. Locations where sediment, soil, or other construction materials will be stockpiled 7.2.6.1c.

See SWPPP/IWPPP Attachment A. The Contractor shall submit to the Engineer for his review and acceptance the locations of stockpiles once the project is awarded and will be included in the SWPPP/IWPPP. The Contractor shall submit to the Engineer for his review and acceptance stockpile areas during construction for inclusion in the SWPPP/IWPPP.

g. Locations of any contaminated soil or contaminated soil stockpiles 7.2.6.1d. No areas of contaminated soil are expected to be encountered in the area. If any areas are encountered, the locations will be included in the SWPPP/IWPPP.

h. Locations of any crossings of state waters 7.2.6.1e. See SWPPP/IWPPP Attachment A-4.

i. Designated points on the site where vehicles will exit onto paved roads 7.2.6.1f. See SWPPP/IWPPP Attachment A. The Contractor shall submit to the Engineer the locations of stabilized entrances once the project is awarded for his review and acceptance and will be included in the SWPPP/IWPPP. The Contractor shall submit to the Engineer for his review and acceptance any updates/changes to stabilized entrances during construction for inclusion in the SWPPP/IWPPP.

j. *Location(s) of impervious structures (including buildings, roads, parking lots, etc.) after construction is completed 7.2.6.1g.* *See SWPPP/IWPPP Attachment A*

k. *Locations of construction support activity areas covered by this permit 7.2.6.1h.* *See SWPPP/IWPPP Attachment A. The Contractor shall submit to the Engineer the locations of his staging and storage areas for his review and acceptance once the project is awarded and will be included in the SWPPP/IWPPP. The Contractor shall submit to the Engineer any updates/changes to staging and storage areas during construction for his review and acceptance and inclusion in the SWPPP/IWPPP.*

7.2.6.1A (WQC Section 1) - Jurisdictional Waters of the U.S. (Army Corps Jurisdiction) Boundary Maps

Boundaries of the property and of the locations where construction activities will occur. Attach, title, and identify all maps (pdf - minimum 300 dpi) listed below, in Attachment A.

Map showing the Jurisdiction Line between In-Water and Land Based BMPs *See Attachment A-2 Army Corps Jurisdictional Boundary Map* ____________________

Note: The Army Corps Jurisdiction Boundary distinguishes where In-Water and Land-Based BMPs (and the associated Inspection, Stabilization Schedules, etc.) apply.

Prior to commencement of the authorized work in wetlands, other special aquatic sites and other waters, the Contractor shall clearly identify (demarcate) in the field the geographic limits of such waters (i.e., High Tide Line, Mean High Water Mark, Ordinary High Water Mark, approved wetland boundary) affected by the authorized work and as approved by the Army Corps and demarcated above. The delineation of these geographic bounds shall be accomplished by staking, flagging, painting, silt fencing, signage, buoys, etc. and in all cases shall be maintained and remain observable throughout the construction period. The Contractor shall also demarcate in the field the project limits of the Corps-authorized fill footprint to ensure that dredged or fill material is not discharged beyond the authorized limits. The permittee is prohibited from conducting any activity occurring in or affecting wetlands, other special aquatic sites and other waters that requires prior authorization from the Corps, outside of the permitted limits of disturbance (as shown on the permit drawings).

7.2.6.2 to 7.2.6.8 State Waters and BMP Maps

Attach, title, and identify all maps (pdf - minimum 300 dpi) listed below, in Attachment A.

Please reference which maps account for the features listed below.

a. *Locations of all state waters, including wetlands, that exist within or in the immediate vicinity of the site and indicate which waterbodies are listed as impaired 7.2.6.2. See SWPPP/IWPPP Attachment A.*

b. *The boundary lines of any natural buffers provided consistent with section 5.1.2.1.1, 7.2.6.3.*

Natural buffers are not feasible in the vicinity of Nanue Stream. See Section 7.2.9.

c. *Topography of the site, existing vegetative cover (e.g., forest, pasture, pavement, structures), and drainage pattern(s) of storm water onto, over, and from the site property before and after major grading activities 7.2.6.4. See SWPPP/IWPPP Attachment A.*

d. *Storm water discharge locations, including: a) Locations of any storm drain inlets on the site and in the immediate vicinity of the site to receive storm water runoff from the project; See SWPPP/IWPPP Attachment A.*

and b) Locations where storm water will be discharged to state waters (including wetlands) 7.2.6.5. See SWPPP/IWPPP Attachment A-4.

e. *Locations of all potential pollutant-generating activities identified in section 7.2.7, 7.2.6.6.*

See SWPPP/IWPPP Attachment A.

f. *Locations of storm water control measures 7.2.6.7. See SWPPP/IWPPP Attachment A. The Contractor shall submit to the Engineer for his review and acceptance the locations of storm water control measures by construction activity and construction sequence once the project is awarded and will be included in the SWPPP/IWPPP. The Contractor shall submit a separate map for each phase of construction which changes the drainage pattern. The Contractor shall submit to the Engineer for his review and acceptance any updates/changes to storm water control measures during construction for inclusion in the SWPPP/IWPPP. (Include maps by Construction Activity and Construction Sequence).*

g. *Locations where chemicals will be used and stored 7.2.6.8. For locations where chemicals will be used, see SWPPP/IWPPP Attachment A Construction Activity BMP Map. The table below shows possible chemicals which may be used on site and which construction activity they are associated with. The Contractor shall submit to the Engineer for his review and acceptance locations where chemicals may be used and stored once the project is awarded and will be included in the SWPPP/IWPPP. The Contractor shall submit to the Engineer for his review* *and acceptance any updates/changes to locations where chemicals will be used and stored during construction for inclusion in the SWPPP/IWPPP.*

Chemical	***Location***	***Major Construction Activity***
Hydraulic oils/ fluids	*Vehicle Refueling area* *Leaks from broken hoses on equipment* *Vehicles shall be maintained off site. If a maintenance area is necessary on-site, the Contractor shall submit to the Engineer the locations and BMPs for his review and acceptance for inclusion in the SWPPP/IWPPP.*	*Bridge Demolition and Construction*
Antifreeze/Coolants	*Vehicle Refueling area* *Leaks from broken hoses on equipment* *Vehicles shall be maintained off site. If a maintenance area is necessary on-site, the Contractor shall submit to the Engineer the locations and BMPs for his review and acceptance for inclusion in the SWPPP/IWPPP.*	*Bridge Demolition and Construction*
Glue, Adhesives	*Roadway construction*	*Bridge Demolition and Construction*
Concrete Curing Compounds/ Form Release Oils	*Roadway construction involving concrete*	*Bridge Demolition and Construction*
Pesticides	*Landscaping areas*	*Landscaping*
Herbicides	*Landscaping areas*	*Landscaping*
Insecticides	*Landscaping areas*	*Landscaping*
Fertilizers	*Landscaping areas*	*Landscaping*

7.2.7 Construction Site Pollutants

For each pollutant-generating activity, an inventory of pollutants or pollutant constituents (e.g., sediment, fertilizers and/or pesticides, paints, solvents, fuels) associated with that activity, which could be exposed to rainfall and could be discharged from the construction site. The Contractor shall take into account where potential spills and leaks could occur that contribute pollutants to storm water discharges. The Contractor shall also document for the Engineer's review and acceptance any departures from the manufacturer's specifications for applying fertilizers containing nitrogen and phosphorus, as required in Section 5.3.5.1 under Attachment H.

All solid waste shall be disposed of at DOH, Solid and Hazardous Waste Branch (SHWB), Solid Waste Section (SWS) permitted facilities. If not, contact the SHWB-SWS at (808) 586-4226 as additional permits may be required.

Source/Material	***Description of How Potential Pollutant Source will be Prevented from Discharging with Storm Water Runoff***	***Major Construction Activity***
Construction debris, green waste, general litter	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Materials associated with the operation and maintenance of equipment, such as oil, fuel, and hydraulic fluid leakage	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Soil erosion from the disturbed areas	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Sediment from soil stockpiles	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Emulsified asphalt or prime/tack coat	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*

Materials associated with painting, such as paint and paint wash solvent	- *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Industrial chemicals, fertilizers, and/or pesticides	- *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Hazardous waste (Batteries, Solvents, Treated Lumber, etc.)	- *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Metals and Building Materials	- *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Existing Pollution Sources	- *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Other (Contaminated Soil)	- *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*

7.2.8 –Sources of Non-Storm Water

The SWPPP/IWPPP must also identify all sources of non-storm water and information, including, but not limited to, the design, installation, and maintenance of the control measures to prevent its discharge.

All solid waste shall be disposed of at DOH, Solid and Hazardous Waste Branch (SHWB), Solid Waste Section (SWS) permitted facilities. If not, the Contractor shall contact the SHWB-SWS at (808) 586-4226 and notify the Engineer for his agreement the disposal locations. Additional permits may be required.

Source	***Description of How Potential Non-Storm Water Pollution Source will not be Discharged to State Waters***	***Major Construction Activity***
Dust Control Water	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Concrete Truck Wash Water	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Sediment Track Out	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Irrigation Water	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Hydrotesting Effluent	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Dewatering Effluent	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Saw-cutting Slurry	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Concrete Curing Water	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Plaster Waste Water	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Water-Jet Wash Water	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*
Sanitary/Septic Waste	• *See Section 7.2.10 for Site Specific BMPs*	*Bridge Demolition and Construction*

7.2.9 –Buffer Documentation

If required to comply with section 5.1.2.1. because a state water is located within 50 feet of the project's earth disturbances, describe which compliance alternative has been selected for the site, and comply with any additional requirements to provide documentation in Section 5.1.2.1. Delineate, and clearly mark off, with flags, tape, or other similar marking device all natural buffer areas. Use velocity dissipation devices if necessary to prevent erosion caused by storm water within the buffer. Ensure all discharges are first treated by erosion and sediment controls. Note: Buffer compliance requirements must be maintained until construction on the area discharging to the buffer is complete, and the area is restored and stabilized (as applicable).

☐ Option 1

Provide and maintain a 50-foot undisturbed natural buffer and sediment control.
Note: If the earth disturbances are located 50 feet or further from a state water and have installed sediment control, then the permittee has complied with this alternative. If the buffer is located outside State Highways Right of Way, include written permission from the owner of the land in SWPPP/IWPPP Attachment H.

Width of Buffer__________________________feet

☐ Option 2

Provide and maintain an undisturbed natural buffer that is less than 50 feet and double sediment control (e.g., double perimeter control) spaced a minimum of 5 feet apart.

Width of Buffer__________________________feet

☐ Option 3

If it is infeasible to provide and maintain an undisturbed natural buffer of any size, the permittee shall provide and maintain double sediment control (e.g., perimeter control) spaced a minimum of 5 feet apart and complete stabilization within 7 calendar days of the temporary or permanent cessation of earth-disturbing activities. Provide documentation why it is infeasible to provide buffer of any size in Attachment H.

☐ Exception 1

There is no discharge of storm water to state waters through the area between the site and any state waters located within 50 feet of the site, the permittee is not required to comply with the *requirements in this section. This includes situations where control measures have been implemented, such as a berm or other barrier, that will prevent such discharges.*

☐ *Exception 2*

For "linear construction projects" where "linear construction projects" means the construction of roads, bridges, conduits, substructures, pipelines, sewer lines, towers, poles, cables, wires, connectors, switching, regulating and transforming equipment and associated ancillary facilities in a long, narrow area, the permittee is not required to comply with the requirements in this section if site constraints (e.g., limited right-of-way) prevent the permittee from meeting any of the compliance alternatives in section 5.1.2.1.1., provided that, to the extent practicable, the permittee limit disturbances within 50 feet of state waters and/or the permittee provide erosion and sediment controls to treat storm water discharges from earth disturbances within 50 feet of the state water. The permittee shall also document below the rationale as to why it is infeasible to comply with the requirements in section 5.1.2.1.1., and describe any buffer width retained and/or erosion and sediment controls installed below.

☒ *Exception 3*

The following disturbances within 50 feet of a state water are exempt from the requirements in this Part: construction approved under a CWA 404 permit; or construction of a water-dependent structure or water access area (e.g., pier, boat ramp, trail).

The removal of silt and debris and installation of underwater concrete to fill the voids in the bridge foundations and associated In-Water work below the Mean High High Water Mark is covered by the Army Corps 404 Permit.

The permittee shall document in the SWPPP/IWPPP if any of the above disturbances will occur within the buffer area on the site below.
N/A

7.2.10 Storm Water Control Measures

Please refer to Hawaii Department of Transportation Construction Best Management Practices Field Manual dated January 2008 and Supplemental Sheets. For any conflicting requirements between the Manual and applicable bid documents, the applicable bid documents will govern. Should a requirement not be clearly described within the applicable bid documents, the Contractor shall notify the Engineer immediately for interpretation. For the purposes of clarification under "applicable bid documents" include the construction plans, standard specifications, Special Provisions, Permits, and the SWPPP/IWPPP.

Land Based BMP Details

Complete the table below. Note: Bold text in the table are requirements of HAR 11-55. The Designer will provide an installation detail of all proposed BMPs (From HDOT Construction BMP Field Manual) identified in Section 7.2.6.7, including the proposed BMPs that will be used to mitigate the potential pollutants identified in Sections 7.2.7 and 7.2.8. Attach the details and design calculations, if applicable, in SWPPP/IWPPP Attachment A (7.2.10.1a). The Contractor shall include the specific product sheets (e.g. Tru-Dam or Gutter Buddy, etc.) and any changes to the proposed BMPs above for the Engineer's review and acceptance.

Check the appropriate boxes below verifying the following requirements are met. If not applicable indicate on the blank lines below (7.2.10.1):

☒ The specific perimeter sediment controls will be installed and made operational prior to conducting earth-disturbing activities in any given portion of the site that will receive storm water from earth-disturbing activities are described below (7.2.10.1b). Will be made operational or see below. Perimeter sediment control devices are impracticable on all sections of the project. They will be made operational where possible.

☒ If contaminated soil exists on-site, control measures will be taken to either prevent the contact of storm water with the contaminated soil, including any contaminated soil stockpiles, or prevent the discharge of any storm water runoff which has contacted contaminated soil or any contaminated soil stockpiles are described below (7.210.1.c). N/A Soil contamination is not anticipated on site. The Contractor shall add the BMP measures and locations if any contamination is found on-site for the Engineer's review and acceptance.

☒ For exit points on the site (or any areas which exit onto a paved street), stabilization techniques and any additional controls that are planned to remove sediment prior to vehicle exit consistent with Section 5.1.2.3 will be taken and are described below (7.2.10.1d). Stabilized entrance locations may be changed by the Contractor depending on his construction means and methods. The Contractor shall submit to the Engineer for his review and acceptance the locations of stabilized entrances once the project is awarded for inclusion in the

SWPPP/IWPPP. The Contractor shall submit to the Engineer for his review and acceptance any updates/changes to stabilized entrances during construction for inclusion in the SWPPP/IWPPP.

☐ *The project is linear, and the use of perimeter controls on portions of the site is impracticable for the following reasons (7.2.10.1e): N/A*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Construction debris, green waste, general litter	• *Separate contaminated clean up materials from construction and demolition (C&D) wastes.* • ***Provide waste containers (e.g., dumpster or trash receptacle) of sufficient size and number to contain construction and domestic wastes.*** • *Inspect construction waste and recycling areas regularly.* • *Schedule solid waste collection regularly.* • *Schedule recycling activities based on construction/demolition phases.* • *Empty waste containers weekly or when they are two-thirds full, whichever is sooner.* • ***Do not allow containers to overflow. Clean up immediately if they do.*** • ***On work days, clean up and dispose of waste in designated waste containers.*** • *See Solid Waste Management Section SM-6 for additional requirements.* • *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.* • *Collect and dispose of all waste materials in trash dumpsters. Place dumpsters, with secure watertight lids, away from storm water conveyances and drains, in a covered materials storage area.* • *Dispose of construction and non-construction solid waste in accordance with State DOH regs.* • *Load removed non- recyclable vegetation directly onto trucks;*	*See Solid Waste Management Section SM-6. Protect Storm Drain Inlets SC-1, and Perimeter Sediment Controls where applicable.* *See Litter Management Plan.*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
	cover and transport to a licensed facility	

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Materials associated with the operation and maintenance of equipment, such as oil, fuel, and hydraulic fluid leakage	• *Use off-site wash racks, repair and maintenance facilities, and fueling sites when practical.* • ***Designate bermed wash area if cleaning on site is necessary.*** • ***Place drip pans or drop cloths under vehicles and equipment to absorb spills or leaks.*** • ***Provide an ample supply of readily available spill cleanup materials.*** • ***Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly.*** • ***Do not clean surfaces or spills by hosing the area down.*** • ***Eliminate the source of the spill to prevent a discharge or a continuation of an ongoing discharge.*** • *Inspect on-site vehicles and equipment regularly and immediately repair leaks.* • *Regularly inspect fueling areas and storage tanks.* • *Train employees on proper maintenance and spill practices and procedures and fueling and cleanup procedures.* • ***Store diesel fuel, oil, hydraulic fluid, or other petroleum products or other chemicals in water-tight containers and provide cover or secondary containment.*** • *Do not remove original product labels and* ***comply with manufacturer's labels for proper disposal.*** • *Dispose of containers only after*	*See Vehicle and Equipment Cleaning, Maintenance, and Refueling, Sections SM-11, SM-12, and SM-13, and Material Storage and Handling Section SM-2, and* ***Spill Prevention and Control SM-10.***

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
	all the product has been used. • ***Dispose of or recycle oil or oily wastes according to Federal, State, and Local requirements.*** • ***Store soaps, detergents, or solvents under cover or other means to prevent contact with rainwater.*** • *See Vehicle and Equipment Cleaning, Maintenance, and Refueling, Sections SM-11, SM-12, and SM-13 and Material Storage and Handling SM-2 for additional requirements.*	

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Soil erosion from the disturbed areas	• ***Provide Soil Stabilization, Slope Protection, Storm Drain Inlet Protection SC-1, Perimeter Controls and Sediment Barriers, Sediment Basins and Detention Ponds, Check Dams SC-3 ,Level Spreader EC-6, Paving Operations SM-20, Construction Roads and Parking Area SC-10, Controlling Storm Water Flowing Onto and Through the Project, Post-Construction BMPs, and Non-Structural BMPs (Construction BMP Training SM-1, Scheduling SM-14, Location of Potential Sources of Sediment SM-15, Preservation of Existing Vegetation SM-17) .*** • ***Delineate, and clearly mark off, with flags, tape, or other similar marking device all natural buffer areas defined in the SWPPP.*** • ***Preserve native topsoil where practicable.*** • ***In areas where vegetative stabilization will occur, restrict vehicle/equipment use in areas to avoid soil compaction or condition soil to promote vegetative growth.*** • ***For Storm Drain Inlet Protection, clean, or remove and replace, the protection measures as sediment accumulates, the filter becomes clogged, and/or***	*Soil Stabilization* 1. *SM-22 Topsoil Management* 2. *EC-12 Seeding and Planting* 3. *EC-14 Mulching* 4. *EC-11 Geotextiles and Mats* *Slope Protection* 1. *EC-12 Seeding and Planting* 2. *EC-14 Mulching* 3. *EC-11 Geotextiles and Mats* 4. *EC-4 Slope Roughening, Terracing, and Rounding* 5. *EC-7 Slope Drains and Subsurface Drains* 6. *EC-9 Slope Interceptor or Diversion Ditches/Berms* *SC-1 Storm Drain Inlet Protection* *Perimeter Controls and Sediment Barriers* 1. *SC-7 Silt Fence or Filter Fabric Fence* 2. *SC-2 Vegetated Filter Strips and Buffers*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
	performance is compromised. • ***Where there is evidence of sediment accumulation adjacent to the inlet protection measure, remove the deposited sediment by the end of the same day in which it is found or by the end of the following work day if removal by the same day is not feasible.*** • ***Sediment basins shall be designed and maintained in accordance with HAR Chapter 11-55.*** • ***Minimize disturbance on steep slopes (Greater than 15% in grade).*** • ***If disturbance of steep slopes are unavoidable, phase disturbances and use stabilization techniques designed for steep grades.*** • ***For temporary drains and swales use velocity dissipation devices within and at the outlet to minimize erosive flow velocities.***	*3. SC-6 Compost Filter Berm/Sock* *4. SC-8 Sandbag Barrier* *5. SC-9 Brush or Rock Filter* *Sediment Basins and Detention Ponds* *1. SC-4 Sediment Trap* *2. SC-5 Sediment Basin* *SC-3 Check Dams* *EC-6 Level Spreader* *SM-20 Paving Operations* *SC-10 Construction Roads and Parking Area Stabilization* *Controlling Storm Water Flowing onto and Through the Project* *1. EC-3 Run-On Diversion* *2. EC-5 Earth Dike, Swales and Ditches* *Post Construction*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
		BMPs *1. EC-2 Flared Culvert End Sections* *2. EC-10 Rip-Rap and Gabion Inflow Protection* *3. EC-8 Outlet Protection and Velocity Dissipation Devices* *4. SM-22 Topsoil Management* *Non-Structural BMPs* *1. SM-1 Construction BMP Training* *2. SM-14 Scheduling* *3. SM-15 Location of Potential Sources of Sediment* *4. SM-17 Preservation of Existing Vegetation*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Sediment from soil stockpiles	• *Locate stockpiles a minimum of 50 feet or as far as practicable from concentrated runoff* ***or outside of any natural buffers identified on the SWPPP.*** • *Place bagged materials on pallets and under cover.* • *Provide physical diversion to protect stockpiles from concentrated runoff.* • ***Cover stockpiles with plastic or comparable material when practicable.*** • ***Place silt fence, fiber filtration tubes, or straw wattles around stockpiles.*** • ***Do not hose down or sweep soil or sediment accumulated on pavement or other impervious surfaces into any storm water conveyance (unless connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or state water.*** • ***Unless infeasible, contain and securely protect stockpiles from the wind.*** • *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.* • *See Stockpile Management Section SM-3 for additional requirements.*	*See Stockpile Management Section SM-3. Protect Storm Drain Inlet Protection SC-1, and Perimeter Sediment Controls where applicable.*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Emulsified asphalt or prime/tack coat	• *Provide training for employees and contractors on proper material delivery and storage practices and procedures.* • *Restrict paving operations during wet weather to prevent paving materials from being discharged.* • *Use asphalt emulsions such as prime coat when possible.* • *Protect drain inlet structures and manholes during application of tack coat, seal coat, slurry seal, and fog seal.* • ***Keep ample supplies of drip pans and absorbent materials on site.*** • *Inspect inlet protection devices.* • *See Material Storage and Handling Section SM-2 and Paving Operations Section SM-20 for additional requirements.* • *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.*	*See Material Storage and Handling SM-2, and Stockpile Management Section SM-3, Paving Operations Section SM-20, Inlet Protection SC-1, and Perimeter Sediment Controls where applicable.*
Materials associated with painting, such as paint and paint wash solvent	• *Hazardous chemicals shall be well-labeled and stored in original containers.* • ***Keep ample supply of cleanup materials on site.*** • *Dispose container only after all of the product has been used.* • *Remove as much paint from brushes on painted surface.* • *Rinse from water-based paints shall be discharged into the sanitary sewer system where possible. If not, direct all* ***washwater into a leak-proof container or leak-proof pit. The container or pit must be designed so that no overflows can occur***	*See Material Storage and Handling Section SM-2, Stockpile Management Section SM-3, and Hazardous Materials and Waste Management Section SM-9, and Spill Prevention and Control SM-10, and Structure Construction and Painting Section SM-21, Inlet Protection SC-1, and Perimeter Sediment Controls*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
	due to inadequate sizing or precipitation. • ***Locate on-site wash area a minimum of 50 feet away or as far as practicable from storm drain inlets, open drainage facilities, or water bodies.*** • ***Do not dump liquid wastes into the storm drainage system.*** • *Filter and re-use solvents and thinners.* • *Dispose of oil-based paints and residue as a hazardous waste.* • *Ensure collection, removal, and disposal of hazardous waste complies with regulations.* • ***Immediately clean up spills and leaks.*** • *Properly store paints, solvents, and epoxy compounds.* • *Properly store and dispose waste materials generated from painting and structure repair and construction activities.* • *Mix paints in a covered and contained area when possible to minimize adverse impacts from spills.* • *Do not apply traffic paint or thermoplastic if rain is forecasted.* • *See Material Storage and Handling SM-2, Waste Management, Hazardous Materials and Waste Management Section SM-9, Waste Management, Spill Prevention and Control Section SM-10, and Structure Construction and Painting Section SM-21 for additional requirements.* • *Provide Storm Drain Inlet*	*where applicable.*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
	Protection and/or Perimeter Sediment Controls as applicable.	
Industrial chemicals, fertilizers, and/or pesticides	• *Hazardous chemicals shall be well-labeled and stored in original containers.* • ***Keep ample supply of cleanup materials on site.*** • ***Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly.*** • ***Do not clean surfaces or spills by hosing the area down.*** • ***Eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge.*** • *Dispose container only after all of the product has been used.* • *Retain a complete set of safety data sheets (formerly MSDS) on site.* • ***Store industrial chemicals in water-tight containers and provide either cover or secondary containment.*** • ***Provide cover when storing fertilizers or pesticides to prevent these chemicals from coming into contact with rainwater.*** • *Restrict amount of pesticide prepared to quantity necessary for the current application.* • ***Do not apply fertilizers or pesticides during or just before a rain event.*** • ***Do not apply to stormwater conveyance channels with flowing water*** • ***Comply with fertilizer and pesticide manufacturer's recommended usage and disposal***	*See Material Storage and Handling Section SM-2, Stockpile Management Section SM-3, and Hazardous Materials and Waste Management Section SM-9, and* ***Spill Prevention and Control SM-10***

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
	instructions. Document departures from manufacturer's specifications in Attachment J. • ***Apply fertilizers at the appropriate time of year for the location, and preferably timed to coincide as closely as possible to the period of maximum vegetation uptake and growth.*** • ***Follow federal, state, and local laws regarding fertilizer application.*** • ***Do not dispose of toxic liquid wastes (solvents, used oils, and paints) or chemicals (additives, acids, and curing compounds) in dumpsters allocated for construction debris.*** • ***Ensure collection, removal, and disposal of hazardous waste complies with regulations. Hazardous waste that cannot be reused or recycled shall be disposed of by a licensed hazardous waste hauler.*** • *See Material Delivery, Storage, and Material Use SM-2, and Waste Management, Hazardous Waste Management Section SM-9 for additional requirements.*	
Hazardous waste (Batteries, Solvents, Treated Lumber, etc.)	• *Do not dispose of toxic materials in dumpsters allocated for construction debris.* • ***Ensure collection, removal, and disposal of hazardous waste complies with regulations.*** • ***Hazardous waste that cannot be reused or recycled shall be disposed of by a licensed hazardous waste hauler.*** • *Segregate and recycle wastes from vehicle/equipment*	*See Hazardous Waste Management Section SM-9 and Vehicle and Equipment Maintenance SM-12*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
	maintenance activities such as used oil or oil filters, greases, cleaning solutions, antifreeze, automotive batteries, and hydraulic and transmission fluids. • ***Store waste in sealed containers, which are constructed of suitable materials to prevent leakage and corrosion, and which are labeled in accordance with applicable Resource Conservation and Recovery Act (RCRA) requirements and all other applicable federal, state, and local requirements.*** • ***All containers stored outside shall be kept away from surface waters and within appropriately-sized secondary containment (e.g., spill berms, decks, spill containment pallets). Provide cover if possible.*** • ***Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly.*** • ***Do not clean surfaces or spills by hosing the area down.*** • ***Eliminate the source of the spill to prevent a discharge or a continuation of an ongoing discharge.*** • ***Ensure collection, removal, and disposal of hazardous waste complies with manufacturer's recommendations and is in compliance with federal, state, and local requirements.*** • *See Hazardous Materials and Waste Management Section SM-9 and Vehicle and Equipment Management, Vehicle and*	

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
	Equipment Maintenance SM-12 for additional requirements.	
Metals and Building Materials	• *Inspect construction waste and recycling areas regularly.* • *Schedule solid waste collection regularly.* • ***If building materials or metals are stored on site (such as rebar or galvanized poles) store under cover under tarps or in containers.*** • *Minimize the amount of material stored on site.* • ***Do not stockpile uncovered metals or other building materials in close proximity to discharge points.*** • *See Solid Waste Management Section SM-6 for additional requirements.*	*See Solid Waste Management Section SM-6*
Contaminated Soil	• *See Waste Management, Contaminated Soil Management Section SM-8 and/or Hazardous Materials and Waste Management Section SM-9 for additional requirements.* • ***At minimum contain contaminated material soil by surrounding with impermeable lined berms or cover exposed contaminated material with plastic sheets.***	*See Waste Management, Contaminated Soil Management Section SM-8 and/or Hazardous Materials and Waste Management Section SM-9*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Fugitive Dust Control and Dust Control Water	• *Do not over spray water for dust control purposes which will result in runoff from the area.* • ***Apply water as conditions require.*** • *Washing down of debris or dirt into drainage, sewage systems, or State waters is not allowed.* • *Minimize exposed areas through the schedule of construction activities.* • *Utilize vegetation, mulching, sprinkling, and stone/gravel layering to quickly stabilize exposed soil.* • *Direct construction vehicle traffic to stabilized roadways.* • *Cover dump trucks hauling material from the site with a tarpaulin.* • *See Dust Control Section SM-19 for additional requirements.*	*See Dust Control Section SM-19*
Concrete Truck Wash Water	• *Disposal of concrete truck wash water via percolation is prohibited.* • *Wash concrete-coated vehicles or equipment off-site or in the designated wash area.* • *Locate on-site wash area a minimum of 50 feet away* ***or as far as practicable*** *from storm drain inlets, open drainage facilities, or water bodies.*	*See Waste Management, Concrete Wash and Waste Management Section SM-4*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
	• *Runoff from the on-site concrete wash area shall be contained in a temporary pit or level bermed area where the concrete can set.* • ***Design the area so that no overflow can occur due to inadequate wash area sizing or precipitation.*** • *The temporary pit shall be lined with plastic to prevent seepage of wash water into the ground.* • *Allow wash water to evaporate or collect wash water and all concrete debris in a concrete washout system bin.* • ***Do not dump liquid wastes into storm drainage system.*** • ***Dispose of liquid and solid concrete wastes in compliance with federal, state, and local standards.*** • *See Waste Management, Concrete Wash and Waste Management Section SM-4 for additional requirements.*	

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Sediment Track-Out	• ***Include Stabilized Construction Entrance at all points that exit onto paved roads.*** • *A sediment trapping device is required if a wash rack is used in conjunction with the stabilized construction entrance/exit.* • *The pavement shall not be cleaned by washing down the street.* • *If sweeping is ineffective or it is necessary to wash the streets, wash water must be contained either by construction of a sump, diverting the water to an acceptable disposal area, or vacuuming the wash water.* • *Use BMPs for adjacent drainage structures.* • ***Remove sediment tracked onto the street by the end of the day in which the track-out occurs.*** • ***Restrict vehicle use to properly designated exit points.*** • *Include additional BMPs that remove sediment prior to exit when minimum dimensions can not be met.* • *See Stabilized Construction Entrance/Exit Section SC-11 for additional requirements.*	*See Stabilized Construction Entrance/Exit Section SC-11*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Irrigation Water	• *Consider irrigation requirements.* • *Where possible, avoid species which require irrigation.* • *Design timing and application methods of irrigation water to eliminate the runoff of excess irrigation water into the storm water drainage system.* • *See Seeding and Planting Section EC-12 and California Stormwater BMP Handbook SD-12 Efficient Irrigation included in SWPPP Attachment A for additional requirements.*	*See Seeding and Planting Section EC-12 and California Stormwater BMP Handbook SD-12 Efficient Irrigation*
Hydrotesting Effluent	• *If work includes removing, relocation or installing waterlines, and Contractor elects to flush waterline or discharge hydrotesting effluent into State waters or drainage systems, the Contractor shall prepare and obtain HDOT acceptance of a NOI/NPDES Permit Form F application for HDOT submittal to DOH CWB at least 30 calendar days prior to the start of Hydrotesting Activities if necessary. Site specific BMPs will be included in the NOI/NPDES Permit Form F submittal.*	*Site specific BMPs will be included in the NOI/NPDES Permit Form F submittal.*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Dewatering Effluent	• *If excavation or backfilling operations require dewatering, and Contractor elects to discharge dewatering effluent into State waters or existing drainage systems, Contractor shall prepare and obtain HDOT acceptance of a NOI/NPDES Permit Form G application for HDOT submittal to DOH CWB at least 30 calendar days prior to the start of Dewatering Activities if necessary. See Site Planning and General Practices, Dewatering Operations Section SM-18 for additional requirements.*	*See Dewatering Operations SM-18. Site specific BMPs will be included in the NOI/NPDES Permit Form G submittal.*
Saw-cutting Slurry	• *Saw cut slurry shall be removed from the site by vacuuming.* • *Provide storm drain protection during saw cutting. See Paving Operations Section SM-20 for additional requirements.* • *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.*	*See Paving Operations Section SM-20, Storm Drain Inlet Protection SC-1, Perimeter sediment controls where applicable*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Concrete Curing Water	• *Avoid overspraying of curing compounds.* • *Apply an amount of compound that covers the surface, but does not allow any runoff of the compound.* • *See California Stormwater BMP Handbook NS-12 Concrete Curing included in SWPPP Attachment A for additional requirements.*	*See California Stormwater BMP Handbook NS-12 Concrete Curing*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Plaster Waste Water	• ***Direct all washwater into a leak-proof container or leak-proof pit. The container or pit must be designed so that no overflows can occur due to inadequate sizing or precipitation.*** • ***Locate on-site wash area a minimum of 50 feet away or as far as practicable from storm drain inlets, open drainage facilities, or water bodies.*** • *Any significant residual materials remaining on the ground after the completion of construction shall be removed and properly disposed. If the residual materials contaminate the soil, then the contaminated soil shall also be removed and properly disposed of.* • ***Plaster waste water shall not be allowed to flow into drainage structures or State waters.*** • *See Material Storage and Handling, SM-2, Stockpile Management SM-3 and Hazardous Materials and Waste Management Section SM-9 for additional requirements.*	*See Material Storage and Handling Section SM-2, Stockpile Management Section SM-3, and Hazardous Materials and Waste Management Section SM-9*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Water-Jet Wash Water	• *For Water-Jet Wash Water used to clean vehicles, use off site wash racks or commercial washing facilities when practical.* • *See Vehicle and Equipment Cleaning Section SM-11 for additional information.* • *For Water-Jet Wash Water used to clean impervious surfaces, the runoff shall not be allowed to flow into drainage structures or State Waters.*	*See Vehicle and Equipment Cleaning Section SM-11*
Sanitary/Septic Waste	• *Locate Sanitary facilities in a convenient place away from drainage facilities.* • ***Position sanitary facilities so they are secure and will not be tipped over or knocked down.*** • *Wastewater shall not be discharged to the ground or buried.* • *A licensed service provider shall maintain sanitary/septic facilities in good working order.* • *Schedule regular waste collection by a licensed transporter.* • *See Sanitary/Septic Waste Section SM-7 for additional requirements.*	*See Sanitary/Septic Waste Section SM-7.*

In-Water BMP Details (WQC)

Complete the table below.

These BMPs are meant to be used in areas within the Army Corps Jurisdiction. These BMPs include operations over State Waters.

The Contractor shall include the Site-Specific BMP Plan for the Engineer's review and acceptance. The plan should be based on the approved BMPs listed in the "An Integrated Storm Water Management Approach and a Summary of Clear Water Diversion and Isolation Best Management Practices for Use in the State of Hawaii, by the Department of Transportation and the Federal Highways Administration Practitioners Guide and applicable sections of the latest HDOT Construction Best Management Practices Field Manual. Submit BMPs not included in the Practitioners Guide to the HDOT Engineer for acceptance.

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Construction debris (including demolition debris), general litter	• *Keep work area clean of all trash and potential pollutants.* • *Use containment systems which prevent pollutants from reaching State Waters* • *Stockpile accumulated debris and waste generated during demolition away from watercourses.*	*See Section 5.1- Working on or Over Water; Including Material and Equipment Use on Water, and Section 5.2 - Demolition Over or Adjacent to Water*
Materials associated with the operation and maintenance of equipment, such as oil, fuel, and hydraulic fluid leakage	• *Heavy equipment driven in wet portions of a water body to accomplish work should be completely clean of petroleum residue, and water levels should be below the fuel tanks, gearboxes, and axles of the equipment unless lubricants and fuels are sealed such that inundation by water will not result in discharges of fuels, oils, greases, or hydraulic fluids.* • *Excavation equipment buckets may reach out into the water for the purpose of removing or placing fill materials. Only the*	*See Section 5.1 – Working on or Over Water; Including Material and Equipment Use on Water and Sections 5.5.5 and 5.5.6 - Clear Water Diversions (Standards and Specifications and General Considerations)*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
	bucket of the crane/ excavator/backhoe may operate in a water body. The main body of the crane/excavator/backhoe should not enter the water body except as necessary to cross the stream to access the work site. • *Stationary equipment such as motors and pumps located within or adjacent to a water body, should be positioned over drip pans.* • *The exterior of vehicles and equipment that will encroach on a water body within the project should be maintained free of grease, oil, fuel, and residues and may require vegetable based hydraulic oil.* • *Equipment should not be parked below the high water mark unless allowed by a permit.* • *See Clear Water Diversion (Limitations) for additional requirements.*	

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Soil and sediment from the disturbed areas including dredged spoils and rock/sand fill	• *Streambank Stabilization Techniques* • *Clear Water Diversion and Isolation Techniques* • *Stream Diversion Techniques* • *In-Stream Construction Sediment Control*	*See:* *Section 5.4 - Streambank Stabilization* *Section 5.6 – Filter Fabric Isolation Technique* *Section 5.7 – Turbidity Curtain Isolation Technique* *Section 5.8 – K-Rail (Jersey Barrier) River Isolation Technique* *Section 5.9 – Cofferdam and/or Sheet Pile Isolation technique* *Section 5.10 - Gravel/Rock Berm with Impermeable Membrane Isolation Technique* *Section 5.11 – Gravel bag or Sandbag Isolation Technique* *Section 5.12 – Pipe Piles and Caisson Isolation Technique* *Section 5.13 - Stream Diversion Techniques: Pumped, Pipe/Flume, and Excavated* *Section 5.14 – In-stream Construction*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
		Sediment Control *Section 5.15 – Washing Fines (Streambed Restoration Technique)*

Pollutant Source	**Appropriate Site-Specific BMP to be Implemented**	**BMP Requirements**
Materials associated with painting, such as paint and paint wash solvent	• *Properly design and install containment systems prior to work* • *Shrouds of appropriate material should be used to prevent paint overspray from entering surface waters* • *Special attention should be given to existing and forecasted wind and weather conditions to prevent pollutant discharges to surface waters*	*See Section 5.1 – Working On or Over Water; Including Material and Equipment Use on Water*
Concrete	• *Clear Water Diversion and Isolation Techniques* • *Stream Diversion Techniques*	*Section 5.6 – Filter Fabric Isolation Technique* *Section 5.7 – Turbidity Curtain Isolation Technique* *Section 5.8 – K-Rail (Jersey Barrier) River Isolation Technique* *Section 5.9 – Cofferdam and/or Sheet Pile Isolation technique* *Section 5.10 - Gravel/Rock Berm with Impermeable Membrane Isolation Technique* *Section 5.11 – Gravel bag or Sandbag Isolation Technique* *Section 5.12 – Pipe Piles and Caisson Isolation Technique* *Section 5.13 - Stream Diversion Techniques:*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
		Pumped, Pipe/Flume, and Excavated

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Hydrotesting Effluent	• *If work includes removing, relocation or installing waterlines, and Contractor elects to flush waterline or discharge hydrotesting effluent into State waters or drainage systems, the Contractor shall prepare and obtain HDOT acceptance of a NOI/NPDES Permit Form F application for HDOT submittal to DOH CWB at least 30 calendar days prior to the start of Hydrotesting Activities if necessary. Site specific BMPs will be included in the NOI/NPDES Permit Form F submittal.*	*Site specific BMPs will be included in the NOI/NPDES Permit Form F submittal.*
Dewatering Effluent	• *If excavation or backfilling operations require dewatering, and Contractor elects to discharge dewatering effluent into State waters or existing drainage systems, Contractor shall prepare and obtain HDOT acceptance of a NOI/NPDES Permit Form G application for HDOT submittal to DOH CWB at least 30 calendar days prior to the start of Dewatering Activities if necessary. See Site Planning and General Practices, Dewatering Operations Section SM-17 for additional requirements.*	*See Dewatering Operations SM-17. Site specific BMPs will be included in the NOI/NPDES Permit Form G submittal.*
Other Pollutants (Including Chemicals and Pesticides)	• *If the Contractor elects to apply pesticides directly over water, Contractor shall prepare and*	*Site specific BMPs will be included in the NOI/NPDES Permit*

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
	obtain HDOT acceptance of a NOI/NPDES Permit Form M application for HDOT submittal to DOH CWB at least 30 days prior to the start of pesticide application activities.	*Form M submittal.*

7.2.10.2 – Stabilization Practices

Note: See Army Corps 2021 Nationwide Permit Honolulu District, Regional and General Conditions, Post-Construction BMPs regarding use of native plants appropriate for current site conditions to be used for re-vegetation for the purposes of restoring areas temporarily disturbed by the authorized work.

Describe the specific vegetative and/or non-vegetative practices that will be used to comply with the requirements in HAR 11-55, section 5.2., including if the permittee will be complying with the stabilization deadlines specified in HAR 11-55, section 5.2.1.3.2. Document the circumstances that prevent the permittee from meeting the deadlines specified in sections 5.2.1.1. and/or 5.2.1.2.

The term "immediately" is used to define the deadline for initiating stabilization measures. In the context of this SWPPP/IWPPP section, "immediately" means as soon as practicable, but no later than the end of the next work day, following the day when the earth-disturbing activities have temporarily or permanently ceased (5.2.1.1).

For the purposes of this SWPPP/IWPPP section, any of the following types of activities constitutes initiation of stabilization (5.2.1.1):

a) Prepping the soil for vegetative or non-vegetative stabilization;
b) Applying mulch or other non-vegetative product to the exposed area;
c) Seeding or planting the exposed area;
d) Starting any of the activities in a) – c) on a portion of the area to be stabilized, but not on the entire area; and
e) Finalizing arrangements to have stabilization product fully installed in compliance with the applicable deadline for completing initial stabilization activities.

For the purposes of this SWPPP/IWPPP section, any of the following types of activities constitutes completion of initial stabilization activities (5.2.1.1):

a) For vegetative stabilization, all activities necessary to initially seed or plant the area to be stabilized; and/or
b) For non-vegetative stabilization, the installation or application of all such non-vegetative measures.

If the Contractor is unable to meet the deadlines above due to circumstances beyond the Contractor's control, and the Contractor is using vegetative cover for temporary or permanent stabilization, the Contractor may comply with the following stabilization deadlines instead as agreed to by the Engineer (5.2.1.3.1):

5.2.1.3.1.1.
Immediately initiate, and complete within the timeframe shown below, the installation of temporary non-vegetative stabilization measures to prevent erosion;

5.2.1.3.1.2.
Complete all soil conditioning, seeding, watering or irrigation installation, mulching, and other required activities related to the planting and initial establishment of vegetation as soon as conditions or circumstances allow it on the site; and

5.2.1.3.1.3.
The Contractor shall notify and provide documentation to the Engineer the circumstances that prevent the Contractor from meeting the deadlines required in sections 5.2.1.1. and/or 5.2.1.2. and the schedule the Contractor will follow for initiating and completing initial stabilization and as agreed to by the Engineer. Include this information in the SWPPP/IWPPP below.

The Contractor shall follow the applicable requirements of the specifications and special provisions including Sections 209, 619 and 641.

Final Stabilization
To be considered adequately stabilized, the permittee shall meet the criteria below depending on the type of cover the permittee is using, either vegetative or non-vegetative.

5.2.2.1. Vegetative stabilization.

5.2.2.1.1.1.
If the permittee is vegetatively stabilizing any exposed portion of the site through the use of seed or planted vegetation, the permittee shall provide established uniform vegetation (e.g., evenly distributed without large bare areas), which provides 70 percent or more of the density of coverage that was provided by vegetation prior to commencing earth-disturbing activities. The permittee should avoid the use of invasive species; (HDOT requires 98% coverage for permanent hydromulch per specification and special provision sections 619 and 641.) The

Designer needs to meet the 70% requirement above when designing plantings and ground cover which do not involve hydromulch. If the Designer uses a soil test to determine amounts, rates, and type of fertilizer, and the amount and rate is not consistent with manufacturer's specifications, the Designer should document this in the SWPPP/IWPPP in Attachment H.

5.2.2.1.1.2.
For final stabilization, vegetative cover must be perennial; and

5.2.2.1.1.3.
Immediately after seeding or planting the area to be vegetatively stabilized, to the extent necessary to prevent erosion on the seeded or planted area, the Contractor shall install non-vegetative erosion controls that provide cover (e.g., mulch, rolled erosion control products) to the area while vegetation is becoming established.

5.2.2.2. Non-Vegetative Stabilization.
If the permittee is using non-vegetative controls to stabilize exposed portions of the site, or if the Contractor is using such controls to temporarily protect areas that are being vegetatively stabilized, the Contractor shall provide effective non-vegetative cover.

The stabilization schedule for this project is:

> *Immediately initiate and complete stabilization within 7 calendar days on areas of the site in which earth-disturbing activities have temporarily or permanently ceased.*

HDOT will be complying with the deadlines in HAR Section 5.2.1.3.2, with completion of initial plantings within 7 calendar days of completion of prepping the soil for planting. Mulch will be applied to the exposed areas. The Contractor shall notify the Engineer for his agreement if any stabilization practices or timetables to complete stated above will not be followed and document the reasons in the SWPPP/IWPPP below.

The deadlines for initiating and completing stabilization in sections 5.2.1.1. and/or 5.2.1.2. cannot be met because of the following (Note: Document location(s,) reasons, and schedule)

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7.2.10.3 – Post Construction Measures

Descriptions of measures that will minimize the discharge of pollutants via storm water discharges after construction operations have been finished. Examples include: open, vegetated swales and natural depressions; structures for storm water retention, detention, or recycle; velocity dissipation devices to be placed at the outfalls of detention structures or along with the length of outfall channels; and other appropriate measures. All projects require post construction BMPs to minimize the discharge of pollutants via storm water discharges after construction operations have been finished. Examples include: open, vegetated swales and natural depressions; structures for storm water retention, detention, or recycle; velocity dissipation devices to be placed at the outfalls of detention structures or along with the length of outfall channels; and other appropriate measures. All projects require post-construction BMPs to minimize the discharges of pollutants via storm water discharges after construction operations have finished.

All unstabilized areas will be stabilized within 7 calendar days of completion of construction activities. There will be little disturbed areas outside of construction staging and stockpiling (if there are any)

7.2.11.1 – Spill Prevention and Response Procedures

The SWPPP/IWPPP must describe procedures that the permittee will follow to prevent and respond to spills and leaks consistent with section 5.3., including:

a. Procedures for expeditiously stopping, containing, and cleaning up spills, leaks, and other releases. Identify the name or position of the employee(s) responsible for detection and response of spills or leaks; and

b. Procedures for notification of appropriate facility personnel, emergency response agencies, and regulatory agencies where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity consistent with section 5.3.4. and established under either 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302, occurs during a 24-hour period. The Contractor shall post contact information in locations that are readily accessible and available.

Where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part

117, or 40 CFR Part 302 occurs during a 24-hour period, the Contractor shall notify the National Response Center (NRC) at (800) 424-8802, the Clean Water Branch during regular business hours at 586-4309, and the Hawaii State Hospital Operator at 247-2191, the Clean Water Branch (DOH-CWB) via email at cleanwaterbranch@doh.hawaii.gov during non-business hours immediately, and the Engineer. The Contractor shall also provide to the Engineer, within 7 calendar days of knowledge of the release, a description of the release, the circumstances leading to the release, and the date of the release. The Engineer will provide this information to the DOH-CWB. The Engineer will provide information to the NRC if requested. State and local requirements may necessitate additional reporting of spills or discharges to local emergency response, public health, or drinking water supply agencies (HAR 11-55 5.3.4). The Contractor shall submit to the Engineer information necessary to complete the reporting requirements.

☒ *The Spill Prevention and Response Procedures are included in SWPPP/IWPPP Attachment F.*
The Contractor shall update the Spill Prevention and Response Procedures in the SWPPP/IWPPP once the project is awarded for the Engineer's review and acceptance.

7.2.11.2 – Waste Management Procedures

The SWPPP/IWPPP must describe procedures for how the permittee will handle and dispose of all wastes generated at the site, including, but not limited to, clearing and demolition debris, sediment removed from the site, construction and domestic waste, hazardous or toxic waste, and sanitary waste.
☒ *The Waste Management Procedures are included in SWPPP/IWPPP Attachment G.*
The Contractor shall update the Waste Management Procedures in the SWPPP/IWPPP once the project is awarded for the Engineer's review and acceptance.

7.2.12 – Procedures for Inspection, Maintenance, and Corrective Action for Land-Based Work Areas

The SWPPP/IWPPP must describe the procedures the permittee will follow for maintaining the storm water control measures, conducting site inspections, and, where necessary, taking corrective actions, in accordance with section 5.1.1.4., section 5.3.2., section 9, and section 10 of the permit. The following information must also be included in the SWPPP/IWPPP:

a. Personnel responsible for conducting inspections: Field Office Engineer and/or Inspector, and Contractor Representatives. Field Office Engineer and/or Inspector, and Contractor Representatives will be included in the SWPPP/IWPPP once the contract is awarded.

Qualifications: HDOT construction staff and HDOT Contractors attend Stormwater BMP Classes annually. Contractor representatives selected for the inspection and maintenance responsibilities shall receive training from the Contractor. The Contractor's Representatives shall be trained in all the inspection and maintenance practices necessary for keeping the erosion and sediment controls used onsite in good working order. The Contractor's Representative(s) inspecting the site shall be knowledgeable in the principles and practice of erosion and sediment controls and pollution prevention, who possesses the skills to assess conditions at the construction site that could impact storm water quality, and the skills to assess the effectiveness of any storm water controls selected and installed to meet the requirements of this permit.

b. The inspection schedule the permittee will be as follows, which is based on whether the site is subject to section 9.1.2. or section 9.1.3., and whether the site qualifies for any of the allowances for reduced inspection frequencies in 9.1.4. If the permittee will be conducting inspections in accordance with the inspection schedule in section 9.1.2.a. or section 9.1.2.b., the location of the rain gauge on the site or the address of the weather station the permittee will be using to obtain rainfall data;
Describe the inspection schedules and procedures you have developed for the site. Include the maintenance requirements for each BMP (e.g., level of sediment buildup allowed):
All Construction BMPs shall be inspected weekly, and within 24 hours of any rainfall event of 0.25 inches or greater in a 24 hour period. The Contractor shall submit a copy of the SWPPP/IWPPP Inspection and Maintenance Report Form to the Engineer within 24 hours of the inspection.

Maintenance requirements for specific BMPs are included in the HDOT Construction BMP Field Manual, Practitioner's Guide, and/or manufacturers specification. The Contractor shall initiate work to fix the problem immediately after discovering the problem, and complete such work by the close of the next work day, if the problem does not require significant repair or replacement, or if the problem can be corrected through routine maintenance. In this section, immediately means the Contractor shall take all reasonable measures to minimize or prevent discharge of pollutants until a permanent solution is installed and made operational. If a problem is identified at a time in the day in which it is too late to initiate repair, initiation of repair shall begin on the following work day. When installation of a new pollution prevention control or a significant repair is needed, the Contractor shall install the new or modified control and make it operational, or complete the repair, by no later than 7 calendar days from the time *of discovery. If it is infeasible to complete the installation or repair within 7 calendar days, the Contractor shall provide notice to the Engineer and document why it is infeasible to complete the installation or repair within the 7 calendar day timeframe and document the schedule for installing the storm water control(s) and making it operational as soon as practicable after the 7 calendar day timeframe and as agreed to by the Engineer. Where these actions result in changes to any of the pollution prevention controls or procedures documented in the SWPPP/IWPPP, modify the SWPPP/IWPPP accordingly. The Contractor will attach product specific maintenance practices in the SWPPP/IWPPP once the project is awarded.*

c. Use the Corrective Action Report Form for any the following (10.2.1 and 10.4.1):

- *A required storm water control was never installed, was installed incorrectly, or not in accordance with the requirements in HAR sections 5 and/or 6.*
- *The Contractor/Engineer becomes aware that the storm water controls installed and being maintained are not effective enough for the discharge to meet applicable water quality standards or applicable requirements in HAR section 6.1.*
- *One of the prohibited discharges below is occurring or has occurred:*
    - *Wastewater from washout of concrete*
    - *Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials*
    - *Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance*
    - *Soaps, solvents, or detergents used in vehicle and equipment washing*
    - *Toxic or hazardous substances from a spill or other release*
- *Corrective actions required by the Department of Health or EPA*

Note: Corrective actions must be included with the monthly compliance report in Attachment J.

d. Any inspection or maintenance checklists or other forms that will be used.

☒ *The Inspection Report Form provided in SWPPP/IWPPP Attachment E-1 will be used.*

☒ *The Corrective Action Report Form provided in SWPPP/IWPPP Attachment I will be used for projects on Kauai, Maui District, and Hawaii Island.*

7.2.12A (WQC) – Procedures for Inspection, Maintenance, and Corrective Action for In-Water Work Areas

Maintenance requirements for specific BMPs are included in the Practitioners Guide and/or manufacturer specification.

a. Personnel responsible for conducting inspections: Field Office Engineer and/or Inspector, and/or Contractor Representatives. Field Office Engineer and/or Inspector, and/or Contractor Representatives will be included in the SWPPP/IWPPP once the contract is awarded.

Qualifications: HDOT construction staff and HDOT Contractors attend Stormwater BMP Classes annually. Contractor representatives selected for the inspection and maintenance responsibilities shall receive training from the Contractor. The Contractor's Representatives shall be trained in all the inspection and maintenance practices necessary for keeping the erosion and sediment controls used onsite in good working order. The Contractor's Representative(s) inspecting the site shall be knowledgeable in the principles and practice of erosion and sediment controls and pollution prevention, who possesses the skills to assess conditions at the construction site that could impact storm water quality, and the skills to assess the effectiveness of any storm water controls selected and installed to meet the requirements of this permit.

b. Schedule for Inspection of In-Water work.

1) Inspect In-Water areas Daily using the Inspection Form in Attachment E-2.

c. Procedures for Corrective Actions for In-Water Work

Procedures for Action When a Plume is Observed

1) If a Plume is observed outside the confined work area, the Contractor shall stop work immediately and investigate the cause of the problem.

2) If possible, isolate and contain the area where the plume is emanating from.

3) If the discharge poses an immediate threat to the public or environment call 911 immediately and follow the procedures in the project's Emergency Spill Response Plan.

4) HDOT will notify DOH CWB within 24 hours on the E-permitting Portal any instance of non-compliance.

5) The Contractor shall initiate work to fix the problem immediately after discovering the problem, and complete such work by the close of the next work day, if the problem does not require significant repair or replacement, or if the problem can be corrected through routine maintenance. In this section, immediately means the Contractor shall take all reasonable measures to minimize or prevent discharge of pollutants until a permanent solution is installed and made operational. If a problem is identified at a time in the day in which it is too late to initiate repair, initiation of repair shall begin on the following work day. When installation of a

new pollution prevention control or a significant repair is needed, the Contractor shall install the new or modified control and make it operational, or complete the repair, by no later than 7 calendar days from the time of discovery. If it is infeasible to complete the installation or repair within 7 calendar days, the Contractor shall provide notice to the Engineer and document why it is infeasible to complete the installation or repair within the 7 calendar day timeframe and document the schedule for installing the storm water control(s) and making it operational as soon as practicable after the 7 calendar day timeframe and as agreed to by the Engineer. Where these actions result in changes to any of the pollution prevention controls or procedures documented in the IWPPP, modify the IWPPP accordingly. In-Water work shall not resume until repairs are completed. The Contractor will attach product specific maintenance practices in the IWPPP once the project is awarded.
Note: A plume is defined as an event in which a project discharge violates the State Water Quality Standards. See the Practitioner's Guide Sections 2.5 and 2.6 for further guidance.

Procedures for Action When a Storm Water Control or BMP is damaged or needs maintenance

1) If a discharge is occurring, follow the course of action above for when a plume is observed.

2) If no discharge is occurring, the Contractor shall initiate work to fix the problem immediately after discovering the problem, and complete such work by the close of the next work day, if the problem does not require significant repair or replacement, or if the problem can be corrected through routine maintenance. In this section, immediately means the Contractor shall take all reasonable measures to minimize or prevent discharge of pollutants until a permanent solution is installed and made operational. If a problem is identified at a time in the day in which it is too late to initiate repair, initiation of repair shall begin on the following work day. When installation of a new pollution prevention control or a significant repair is needed, the Contractor shall install the new or modified control and make it operational, or complete the repair, by no later than 7 calendar days from the time of discovery. If it is infeasible to complete the installation or repair within 7 calendar days, the Contractor shall provide notice to the Engineer and document why it is infeasible to complete the installation or repair within the 7 calendar day timeframe and document the schedule for installing the storm water control(s) and making it operational as soon as practicable after the 7 calendar day timeframe and as agreed to by the Engineer. Where these actions result in changes to any of the pollution prevention controls or procedures documented in the IWPPP, modify the IWPPP accordingly. The Contractor shall attach product specific maintenance practices in the IWPPP once the project is awarded.

d. Use the Corrective Action Report Form for any the following (HAR 10.2.1 and 10.4.1):

- *One of the prohibited discharges below is occurring or has occurred:*

  - *A plume is observed*
  - *Wastewater from washout of concrete*
  - *Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials*
  - *Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance*
  - *Soaps, solvents, or detergents used in vehicle and equipment washing*
  - *Toxic or hazardous substances from a spill or other release*
- *Corrective actions required by the Department of Health or EPA*

Note: Corrective actions must be included with the monthly compliance report in Attachment J and be submitted on the E-Permitting Portal.

e. Any inspection or maintenance checklists or other forms that will be used.

☒ *The Inspection Report Form provided in SWPPP/IWPPP Attachment E will be used.*

☒ *The Corrective Action Report Form provided in SWPPP/IWPPP Attachment I will be used.*

7.2.12B (WQC) – Procedures for In-Water Work Areas During High Flow and Stop Work Conditions

To be provided by the Contractor

7.2.13 – Staff Training

The SWPPP/IWPPP must include documentation that the required personnel were trained in accordance with the following:

Prior to the commencement of earth-disturbing activities or pollutant-generating activities, whichever occurs first, the permittee shall ensure that the following personnel understand the requirements of this permit and their specific responsibilities with respect to those requirements:

a. Personnel who are responsible for the design, installation, maintenance, and/or repair of storm water controls (including pollution prevention measures);

b. Personnel who are responsible for the application and storage of chemicals (if applicable);

c. Personnel who are responsible for conducting inspections as required in Part 4.1.1; and *d. Personnel who are responsible for taking corrective actions as required in Part 5.*

The Contractor is responsible for ensuring that all activities on the site comply with the requirements of this permit. The Contractor is not required to provide or document formal training for subcontractors or other outside service providers, but must ensure that such personnel understand any requirements of the permit that may be affected by the work they are subcontracted to perform.

At a minimum, personnel must be trained to understand the following if related to the scope of their job duties (e.g., only personnel responsible for conducting inspections need to understand how to conduct inspections):
a. The location of all storm water controls on the site required by this permit, and how they are to be maintained;
b. The proper procedures to follow with respect to the permit's pollution prevention requirements; and
c. When and how to conduct inspections, record applicable findings, and take corrective actions.

The Engineer will discuss the roles and responsibilities of HDOT and the Contractor in the SWPPP/IWPPP during the Water Pollution, Dust, and Erosion Control Meeting.

☒ *The Contractor Certification is included in Attachment B.*

7.2.14 – Documentation of Compliance with Safe Drinking Water Act Underground Injection Control (UIC) Requirements for Certain Subsurface Storm Water Controls

Document any contact with the DOH Safe Drinking Water Branch if any of the following storm water controls are used at the site:

☐ *Infiltration trenches (if storm water is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system);*

☐ *Commercially manufactured precast or pre-built proprietary subsurface detention vaults, chambers, or other devices designed to capture and infiltrate storm water flow;*

☐ *Drywells, seepage pits, or improved sinkholes (if storm water is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system).*

If any of the boxes above are checked, attach documentation in SWPPP/IWPPP Attachment H.

These devices are not part of the design plans. If the Contractor elects to install any of these devices for erosion control purposes, the Contractor shall attach the necessary documentation once the project is awarded.

7.2.15 –Other State, Federal, or County Permits

Note: Army Corps Permit and 401 WQC are included previously.

Include in SWPPP/IWPPP Attachment H any of the following permits or approvals:

☐ *Attach the Drainage System Owner(s) Approval to Discharge, in Attachment (See Below)___.*

☒ *Check this box if the Certifying Person is responsible for the overall operation and maintenance of the Separate Drainage System and approves of the storm water discharge into their drainage system.*

County-approved Erosion and Sediment Control Plan and/or Grading Permit

a. *Is a County-approved Erosion and Sediment Control Plan and/or Grading Permit, where applicable for the activity and schedule for implementing each control, required?*
   ☐ *Yes. Please complete Section b below and skip Section c.*
   ☒ *No. Please complete Section c below and skip Section b.*

b. *Is a copy County-approved Erosion and Sediment Control Plan and/or Grading Permit, as appropriate for the activity and schedule for implementing each control, attached?*
   ☐ *Yes, see Attachment ______________________________*
   ☐ *No, the County-approved Erosion and Sediment Control Plan and/or Grading Permit, as appropriate for the activity and schedule for implementing each control, will be submitted at least 30 calendar days before the start of construction activities.*

c. *Please select and complete at least one (1) of the following items to demonstrate that a County-approved Erosion and Sediment Control Plan and/or Grading Permit, as appropriate for the activity and schedule for implementing each control, is not required.*
   ☐ *See Attachment __________ for the County written determination.*
   ☐ *Provide the County contact person information (Name, Department, Phone Number, and Date Contacted): ______________________________*
   ☒ *Other (specify): A County-approved Erosion and Sediment Control Plan and/or Grading Permit is not required for this project.*

☐ *NPDES Permit or NGPC for Hydrotesting Activities (Form F)*

☐ *NPDES Permit or NGPC for Dewatering Activities (Form G)*

☐ *List other permits below (No copy necessary in Attachment H)*
  ☐ *Stream Channel Alteration Permit*

  ☐ *Conservation District Use Permit (CDUP)*

  ☒ *Other Permit(s) (List below)*

DA File No. POH-XXXX-XXXXX3

Modified Blanket Water Quality Certification (WQC) 1092

7.2.16 –Other Information As Requested by the Director

☒ *Does DOH require any additional information per section 7.2.16? If so attach in Attachment H.*

N/A

7.2.17 Certification of the CWB SWPPP/IWPPP

The certifying person and duly authorized representative shall meet the requirements of Hawaii Administrative Rules 11-55, Appendix A, Section 15.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: ________________ *Date:* ________________

Person Name: Lawrence J. Dill

Person Position Title: Highways Administrator

Person Company or Agency: Department of Transportation

Department: Department of Transportation, Highways

Phone Number: (808) 587-2220 *Fax No.:* ________________

Person Email: Lawrence.J.Dill@hawaii.gov

7.2.18 Post-Authorization Additions to the SWPPP/IWPPP

The following documents as part of the SWPPP/IWPPP in Attachment K:

a. A copy of the NOI submitted to the department along with any correspondence exchanged between HDOT and DOH related to coverage under this permit;

b. A copy of the NGPC and all attachments included with the NGPC (an electronic copy easily available to the storm water team is acceptable)

c. A copy of the email dated December 14, 2022 provided by Kristi Fluker (USACE) indicating that this project has been issued a non-reporting Nationwide Permit 3(a)

7.4 Required SWPPP/IWPPP Modifications

Modify the SWPPP/IWPPP, including the site map(s), in response to any of the following conditions:

7.4.1.1.
Whenever new contractors become active in construction activities on the site, or changes are made to the construction plans, storm water control measures, pollution prevention measures, or other activities at the site that are no longer accurately reflected in the SWPPP/IWPPP. This includes changes made in response to corrective actions triggered under section 10.

7.4.1.2.
To reflect areas on the site map where operational control has been transferred (and the date of transfer) since initiating permit coverage;

7.4.1.3.
If inspections or investigations by site staff, or by local, state, or federal officials determine that SWPPP/IWPPP modifications are necessary for compliance with this permit;

7.4.1.4.
Where DOH determines it is necessary to impose additional requirements on the discharge, the following must be included in the SWPPP/IWPPP:
- *a. A copy of any correspondence describing such requirements; and*
- *b. A description of the storm water control measures that will be used to meet such requirements.*

7.4.1.5.
To reflect any revisions to applicable federal, state, and local requirements that affect the storm water control measures implemented at the site; and

7.4.2. Deadlines for SWPPP/IWPPP modifications.

The permittee shall complete required revisions to the SWPPP/IWPPP within 7 calendar days following the occurrence of any of the conditions listed in section 7.4.1.

7.4.3. SWPPP/IWPPP modification records.
The permittee shall maintain records showing the dates of all SWPPP/IWPPP modifications. The records must include a signature of the person authorizing each change (see section 7.2.17), date, and a brief summary of all changes. Log all changes and include relevant attachments in Attachment L.

7.4.4. Certification requirements.
All modifications made to the SWPPP/IWPPP consistent with section 7.4. must be certified, signed, and dated by the Certifying Person that meets the requirements in section 15 of appendix A, chapter 11-55 or the duly authorized representative that meets the requirements of 11-55-07(b). (See section 7.2.17)

7.4.5. Required notice to other contractors.
Upon determining that a modification to the SWPPP/IWPPP is required, if there are multiple contractors covered under this permit, the Contractor shall immediately notify any contractors who may be impacted by the change to the SWPPP/IWPPP.

13.0 Monthly Compliance Report Submittal Requirements

Submit to the Engineer a monthly compliance report, which shall include but is not limited to information as required in the NGPC, any updates to NOI information already on file with DOH, and any incidences of non-compliance and corrective actions. Submit this information within 2 working days of the end of the month. The monthly compliance report shall be kept on-site and available by the end of the next business day when requested by DOH.

☒ *HDOT's form in Attachment J will be used for projects on Kauai, Maui District, or Hawaii Island.*

SWPPP/IWPPP Attachments

Attachment A – Contractor/Sub-Contractor Control Maps, Property Boundary Maps, State Waters and BMP Maps, and BMP Details (SWPPP/IWPPP Sections 7.2.4, 7.2.6.1,7.2.6.2 to 7.2.6.8 & 7.2.10)

MAPS SHOWING LOCATIONS OF CONTRACTOR/SUB-CONTRACTOR CONTROL, PROJECT SITE MAPS, CONSTRUCTION PLANS/DRAWINGS, BMP LOCATION MAPS, AND BMP DETAILS

Project and State Waters Map – A-1

Army Corps Jurisdictional Boundary Map and Temporary Impact Area Map – A-2

Property Boundary Maps – A-3

Drainage Maps – A-4

Contractor/Sub-Contractor Control Map – A-5

Site-Specific Best Management Plan and Phasing Plans – A-6

Staging Area Plans – A-7

Catalog Pages and Information on Storm Water Control Materials – A-8

Attachment B – HDOT SWPPP/IWPPP Training Log (SWPPP/IWPPP Section 7.2.13)

Instructions

Check Appropriate Box and Include Additional Sheet for Each of the Training Classes Listed Below on the Training Log Form:

A) Attendance at Department of Transportation, Highways Annual Construction Site Runoff Control, Pollution Prevention, and Good Housekeeping Training for Contractors.

B) Attendance at Non-HDOT sponsored Stormwater BMP Training Courses.

C) Participation in viewing Annual HDOT Construction Site Runoff Control, Pollution Prevention, and Good Housekeeping Training for Contractors on DVD provided by HDOT.

TRAINING LOG

☐ *Department of Transportation, Highways Annual Construction Site Runoff Control, Pollution Prevention, and Good Housekeeping Training for Contractors*
☐ *Non-HDOT Sponsored Stormwater BMP Training Courses*
*Name of Course/Sponsor*____
☐ *Annual HDOT Construction Site Runoff Control, Pollution Prevention, and Good Housekeeping Training for Contractors on DVD Provided by HDOT*

Project Name: Nanue Stream Bridge Rehabilitation
Project Location:
Instructor's Name(s):
Instructor's Title(s):

Course Location: ____________________________________ *Date:* ____________________

Course Length (hours): _______________________________

Stormwater Training Topic: (check as appropriate)

☐ *Erosion Control BMPs*
☐ *Sediment Control BMPs*
☐ *Non-Stormwater BMPs*
☐ *Emergency Procedures*
☐ *Good Housekeeping BMPs*

*Specific Training Objective:*____
____

Attendee Roster:

No.	***Name of Attendee***	***Company***
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Add rows as needed

Attachment C - Construction Schedule (SWPPP/IWPPP Section 7.2.5)

CONSTRUCTION SCHEDULE

Schedule for Land-Based Construction Activities

The date when the SWPPP/IWPPP, including erosion control measures will be implemented:

All Inlet Protection BMPs will be installed prior to construction. These BMPs meet Section 5.1.1.3.1 as the inlets protected and the perimeter control BMPs are downstream of the paving work. These BMPs will be installed per the manufacturer's recommendations.

The date when the general contractor will begin the earth-disturbing activities:

Cessation, temporarily or permanently, of construction activities on the site:

Final or temporary stabilization of areas of exposed soil:

The date when the general contractor will end site disturbance:

The date when erosion control measures will be removed:

The date when the Notice of Cessation form will be submitted:

Schedule for In-Water Construction Activities

The date when BMP Measures to isolate and contain the work areas will be implemented:

The date when the general contractor will begin in-water construction activities:

Cessation, temporarily or permanently, of construction activities on the site:

Removal of temporary storm water conveyances/channels and other storm water control measures, removal of construction equipment and vehicles, and cessation of any pollutant-generating activities:

The date when the Notice of Cessation form will be submitted:

Attachment D – Subcontractor Certifications/Agreements (SWPPP/IWPPP Section 7.2.4)

SUBCONTRACTOR CERTIFICATION

NGPC File No: ______________________________

Project Title: **Nanue Stream Bridge Rehabilitation**

Operator(s): ______________________________

As a subcontractor, you are required to comply with the Storm Water Pollution Prevention Plan (SWPPP)/In-Water Pollution Prevention Plan (IWPPP) for any work that you perform on-site. Any person or group who violates any condition of the SWPPP/IWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP/IWPPP. A copy of the SWPPP/IWPPP is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact storm water must be identified and sign the following certification statement:

I certify under the penalty of law that I have read and understand the terms and conditions of the SWPPP/IWPPP for the above designated project and agree to follow the BMPs and practices described in the SWPPP/IWPPP.

This certification is hereby signed in reference to the above named project:

Company: ______________________________

Address: ______________________________

Telephone Number: ______________________________

Type of construction service to be provided: ______________________________

____

Signature: ______________________________

Title: ______________________________

Date: ______________________________

Attach copies, retain originals on-site.

Kauai/Maui/Hawaii Attachment E1 – HDOT SWPPP Inspection Report for Kauai, Maui, and Big Island Land-Based BMPS

HDOT INSPECTION REPORT FORM

*Date:*__________________ *Project/Site:*____ *Permit No.: HI*____________________

*Inspector's Name:*____

*Inspector's Title:*____

*Weather:*____

*Rain Gauge Site and Amount in Inches (If applicable)*____ ________________*inches*

The Following Areas Have been Inspected	***Yes***	***No***	***N/A***	***Notes***
9.1.5a All areas that have been cleared, graded, or excavated and that have not yet completed stabilization consistent with section 5.2				
9.1.5b All storm water controls (including pollution prevention measures) installed at the site to comply with this permit				
9.1.5c Material, waste, borrow, or equipment storage and maintenance areas that are covered by this permit				
9.1.5d All areas where storm water typically flows within the site, including drainageways designed to divert, convey, and/or treat storm water				
9.1.5e All points of discharge from the site				
9.1.5f All locations where stabilization measures have been implemented				

9.1.5 Were any portions of the site not inspected due to unsafe conditions? *YES* ☐ *NO* ☐

If answering yes above, provide reasons why inspection of the site (or portions thereof) were unsafe and locations not inspected

____

____

Site Specific Best Management Practices (BMPs) Plan	***Yes***	***No***	***N/A***	***Date Corrected***	***Notes***
Is a copy of the Site Specific BMPs plan available at the site?					
Is the Site Specific BMPs plan certified, signed, and dated?					
Is the Site Specific BMPs plan current and up-to-date?					
Are accompanying erosion and sediment control (ESC) drawings available at the site?					
Are the Erosion and Sediment Control (ESC) drawings up-to-date?					
Are all NPDES permits available at the site?					
Are inspection records available at the site?					

Insert or removes rows, fill in blanks to tailor to your site.

Best Management Practices	**Location**	**Installed Per Specifications (Y/N)**	**Adequate**	**Needs Maintenance**	**N/A**	**Date Corrected**	**Notes**
Controlling Storm Water Flowing onto and through the Project (run-on diversion, silt fence, vegetated filter strips and buffers, etc.							
Soil Stabilization (topsoil management, seeding and planting, mulching, geotextiles and mats, etc.)							
Slope Protection (seeding and planting; mulching; geotextiles and mats; slope roughening, terracing and rounding, etc.)							
Storm Drain Inlet Protection							
Perimeter Controls and Sediment Barriers (silt fence, vegetated filer strips and buffers, etc.)							
Sediment Basins and Detention Ponds (sediment traps, sediment basins, etc.)							
Stabilized Ingress/Egress Structures							
Additional Erosion and Sediment Control BMPs							

Best Management Practices	***Location***	***Installed Per Specifications (Y/N)***	***Adequate***	***Needs Maintenance***	***N/A***	***Date Corrected***	***Notes***
Material Handling and Waste Management (hazardous waste management, concrete waste management, etc.)							
Material Storage							
Spill Prevention/Control							
Baseyards/Staging Areas							
Washout Areas							
Concrete Washout/Waste							
Paint Washout/Waste							
Proper Equipment/Vehicle Fueling and Maintenance Practices							
Equipment/Vehicle Fueling							
Equipment/Vehicle Cleaning							
Equipment/Vehicle Maintenance							
Additional Non-Erosion or Sediment Control BMPs							
Post Construction BMPs (flared culvert end sections, rip-rap and gabion inflow protection, outlet protection and velocity dissipation devices, etc.)							

Best Management Practices	***Location***	***Installed Per Specifications (Y/N)***	***Adequate***	***Needs Maintenance***	***N/A***	***Date Corrected***	***Notes***
Other							
Sawcutting							
Dust Control							
Dewatering							

Insert or removes rows, fill in blanks to tailor to your site.

Site Conditions	***Yes***	***No***	***N/A***	***Notes and Corrective Actions***
9.1.6.1 Do all erosion and sediment controls and pollution prevention controls installed, appear to be operational, and working as intended to minimize pollutants discharges?				
9.1.6.1 Any controls need to be replaced, repaired, or maintained in accordance with HAR Ch. 11-55 sections 5.1.1.4 and 5.3.2?				
9.1.6.2 Any conditions present that could lead to spills, leaks, or other accumulations of pollutants on the site?				
9.1.6.3 Any locations where new or modified storm water controls are necessary to meet the requirements of HAR Ch. 11-55 sections 5 and/or 6?				
9.1.6.5 Any incidents of noncompliance observed?				
Are off-site flows entering the construction site?				
9.1.6.4 At points of discharge are there signs of visible erosion and sedimentation that have occurred and are attributable to the discharge?				

Site Conditions	***Yes***	***No***	***N/A***	***Notes and Corrective Actions***
9.1.6.4 On the banks of any state waters flowing within the property boundaries are there signs of visible erosion and sedimentation that have occurred and are attributable to the discharge?				
9.1.6.4 On the banks of any state waters flowing adjacent to the property are there signs of visible erosion and sedimentation that have occurred and are attributable to the discharge?				
Are construction materials/debris/trash/soil stored or disposed of properly at the site?				
Is there vehicle tracking from the site to receiving streets?				
Do locations exist where additional or revised BMPs are needed?				
Do locations exist where BMPs may no longer be necessary and may be removed?				
Does your site evaluation indicate a need to update or revise the current Site Specific BMPs plan and/or accompanying erosion and sediment control drawings?				

9.1.6.6 Discharges Observed During Inspection

Is a discharge occurring during the inspection? *YES* ☐ *NO* ☐

If answering YES above answer the following:

*9.1.6.6a Identify all points of the property from which there is a discharge*____

9.1 Is there a potential for downstream erosion? YES ☐ NO ☐

*If YES continue to the next question. If NO go to 9.1.6.6b and inspect at the **Discharge Point**.*

9.1 Does the discharge enter an MS4 or separate drainage system prior to the receiving water? YES ☐ NO ☐

*If YES go to 9.1.6.6b and inspect **Where it Enters the Drainage System**. If NO continue to the next question.*

9.1 Does the effluent comingle with offsite water or pollutant sources prior to discharging to the receiving water? YES ☐ NO ☐

*If YES go to 9.1.6.6b and inspect at a **Location Representative of the Discharge Quality Prior to Comingling**.*

*If NO go to 9.1.6.6b and inspect at the **Receiving Water**.*

*9.1.6.6b What color is the discharge?*____

*9.1.6.6b Is there an odor? Describe if possible.*____________________________________

*9.1.6.6b Are there floating, settled, or suspended solids? If so, describe?*________________________

*9.1.6.6b Is there foam?*____

*9.1.6.6b Does the discharge contain an oil sheen?*____________________________________

9.1.6.6b Are there any other obvious indicators of storm water pollutants in the discharge? ____________________

____

9.1.6.6c Is the suspected reason for the discharge that a storm water control is clearly not operating as intended or is in need of maintenance?

____

____

Photos

Photos taken during the BMP inspection documented above are:

- ☐ *Attached*
- ☐ *Inserted*
- ☐ *Not taken, attached, or inserted.*

(Insert photos in this section if you so choose.)

I certify that I am the person who performed the inspection documented above and that all information recorded on this form is a true and accurate representation of what was observed at the construction site recorded above. Any photographs attached that were taken during the inspection are a true, accurate, and unaltered representation of what was observed during the inspection documented above.

Inspector's Printed Name: ______________________________ *Title:* ______________________________

Inspector's Signature: ______________________________ *Date of Inspection:* ______________________

Inspector's Printed Name: ______________________________ *Title:* ______________________________

Inspector's Signature: ______________________________ *Date of Inspection:* ______________________

The certifying person and duly authorized representative shall meet the requirements of Hawaii Administrative Rules 11-55, Appendix A, Section 15.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: ______________________ *Date:* ______________________

Duly Authorized Person's Name: Annette Matsuda

Duly Authorized Person's Position Title: Acting Hawaii District Engineer

Duly Authorized Person's Company or Agency: Department of Transportation

Department: Department of Transportation

Division: Department of Transportation, Highways Division

Phone Number: (808) 446-4586 *Fax No.: (808) 933-8869*

Person Email: Annette.dh.Matsuda@hawaii.gov

Attachment E2 – HDOT Inspection Report for In-Water Work (IWPPP Section 7.2.12A)

spection report for daily in-water visual inspections. The questions below apply to the area outside the isolated and confined w

HDOT IN-WATER INSPECTION REPORT FORM

_____________ *Project/Site:*______________________________________ *Permit No.: HI*________________

*Name:*____

*Title:*____

____

*Site and Amount in Inches (If applicable)*____________________________________ ______________*inches* *wing at the site?   YES ☐   NO ☐*

urbidity Plume?   YES ☐   NO ☐

work immediately and investigate the source of the plume. Follow the procedures in Section 7.2.12A Procedures for Inspectio ce, and Corrective Actions for In-Water Work Areas.

ny other indicators of a discharge? YES ☐   NO ☐

ibe? ____

____

ected reason for the discharge that a storm water control is clearly not operating as intended or is in need of maintenance?

NO ☐

*ibe?*____

____

en during the BMP inspection documented above are:

ached

erted

t I am the person who performed the inspection documented above and that all information recorded on this form is a true and tion of what was observed at the construction site recorded above. Any photographs attached that were taken during the inspec ate, and unaltered representation of what was observed during the inspection documented above.

Printed Name: ______________________ *Title:* ______________________

Signature: ______________________ *Date of Inspection:* ______________________

Printed Name: ______________________ *Title:* ______________________

Signature: ______________________ *Date of Inspection:* ______________________

ing person and duly authorized representative shall meet the requirements of Hawaii Administrative Rules 11-55, Appendix A, S

rtify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordan
igned to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the pe
o manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the b
and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, inclu
of fine and imprisonment for knowing violations.

Date:

orized Person's Name: Annette Matsuda

orized Person's Position Title: Acting Hawaii District Engineer

orized Person's Company or Agency: Department of Transportation

t: Department of Transportation, Highways

ber: (808) 446-4586 *Fax No.: (808) 933-8869*

ail: Annette.dh.Matsuda@hawaii.gov

Attachment F – Spill Prevention and Response Procedures (SWPPP/IWPPP Section 7.2.11.1)

Spill Prevention and Control Plan (SM-10)

Description

Practices and procedures to reduce or prevent leaks or spills of fuels, oil, and other chemicals which may be discharged into the storm drain system or adjacent water bodies.

Applications

Construction projects involving the storage of chemicals or hazardous substances.

Installation and Implementation Requirements

General Requirements include the following:
- Store hazardous materials and wastes in covered containers and protect containers from vandalism;
- Maintain an ample supply of cleanup materials for spills shall be readily accessible;
- Train employees on proper spill prevention and cleanup; and
- Review spill response requirements at all applicable work sites.

Cleanup Requirements include the following:
- Immediately clean up leaks and spills;
- Use minimal water to clean up spills on paved surfaces. For small spills, use a rag. For general cleanup, use a damp mop. For larger spills, use absorbent materials. Properly dispose of materials used to clean up hazardous materials;
- Do not hose down or bury spills; and
- Eliminate the source of the spill to prevent a discharge or continuation of an ongoing discharge.

Reporting includes the following:
- Report significant spills to the U.S. coast Guard, DOH Clean Water Branch, Hawaii State Office of Hazard Evaluation and Emergency Response, and City and County of Honolulu agencies, such as the Fire Department and
- Per federal regulations, report significant spills of oil onto an adjoining shoreline or into a water body to the National Response Center at 800-424-8802 (24 hour).

Vehicle and equipment maintenance activities requirements include the following:
- Use a designated area and/or secondary containment for on-site repair or maintenance activities. These areas shall be located away from drainage courses;
- Complete regular inspections of on-site vehicles and equipment, including delivery trucks and employees' vehicles, for leaks. Do not allow vehicles or equipment with leaks on-site. Provide Vehicle and Equipment Maintenance BMPs in SM-12 if repair must be made on site.
- Secondary containment devices such as drop cloths and drain pans shall be used to catch leaks or spills while removing or changing fluids from vehicles or equipment;
- Place drip pans or absorbent materials under paving equipment not in use;
- Use absorbent materials on small spills. Do not hose down or bury spills. Remove and properly dispose of cleanup materials;

Installation and Implementation Requirements (Continued)	*• Immediately transfer used fluids to the appropriate waste or recycling containers. Avoid leaving full drip pans and open containers on-site;* *• Drain excess oil from oil filters prior to disposal by placing filter in a funnel over a waste oil recycling drum. Recycle oil filters if this service is available or dispose in accordance with Federal, State, and Local requirements;* *• Store all cracked batteries in a non-leaking secondary container with cover even if the acid appears to have drained out. Handle dropped batteries as cracked batteries until assured it is not leaking.* *• Dispose of or recycle oil in accordance with Federal, State, and Local requirements. Store in water-tight container and provide cover to prevent containers from coming into contact with rainwater or secondary containment.* *Vehicle and equipment fueling activities requirements include the following:* *• Use designated areas for required on-site fueling. Fueling areas shall be located away from drainage courses;* *• Avoid “topping off” of fuel tanks; and* *• Use secondary containment devices such as drain pans to catch spills or leaks while fueling.*
Limitations	*Use of a private spill cleanup company may be necessary.*
Inspections and Maintenance	*• Update spill prevention and control plans and stock necessary cleanup materials as the chemicals used or stored on-site change.* *• Ample supplies of materials for spill control and cleanup shall be located on-site near maintenance and material storage or unloading areas.*

Emergency Spill Response Plan

Procedures for expeditiously stopping, containing, and cleaning up spills, leaks, and other releases (7.2.11.1a).

Spill Coordinator
The Contractor shall appoint a Primary and Secondary Emergency Spill Response Coordinator who will be responsible for the reporting of spills, coordinating contractor personnel for spill cleanup, subsequent site investigations, and associated reports. In the event of a spill, the Emergency Spill Response Coordinator will be responsible for determining the extent of the containment/isolation area and cleanup methods. Include Names, positions, and emergency contact information.
The Contractor shall make contact with a Spill Cleanup Emergency Response Contractor prior to start of construction to provide sufficient information for the spill contractor to be prepared should they receive a call in the event of an emergency.

Immediate Response
All spills regardless of size must be reported to the Emergency Spill Response Coordinator and the (HDOT Construction Resident Engineer/Project Engineer/Construction Inspector). The person observing the incident will take the following actions:
- *Assess the safety of the situation (including the risk to the surrounding public).*
- *Alert nearby personnel and secure the immediate area for safety.*

If the person is aware the chemical spilled is not toxic or a known petroleum product do the following:
- *Make every effort to remove potential ignition sources and stop the source of the spill.*
- *Clean the spill using absorbent materials available on-site. Do not hose down or bury spills. Remove and properly dispose of cleanup materials.*
- *Promptly notify the Emergency Spill Response Coordinator. Report name, the spill location, material spilled, and the extent of the incident.*

Upon learning of the spill, the Emergency Spill Response Coordinator will implement the following measures:
- *Assess the safety of the situation (including the risk to the surrounding public).*
- *If the source of the spill is toxic or unknown, immediately notify the Fire Department and ask for assistance from the HAZMAT team.*
- *Secure the area by stopping traffic if necessary and install barricades or safety fencing around the area.*
- *If safe to do so, prevent hazardous material from entering the stormwater or sewer system or any waterbodies by covering/blocking any drains in the spill area, and providing containment BMPs to either prevent stormwater from contacting hazardous material or contain commingled stormwater.*
- *If safe to do so, absorbent materials will be applied to the spill area. Contaminated soils and vegetation will be excavated and temporarily placed on and covered by plastic sheeting or in an appropriate container or surrounded by impermeable lined berms in a containment area a minimum of 100 feet away from any wetland or waterbody, until proper disposal is arranged.*
- *Notify appropriate agencies as required by Federal, State, and local regulations.*
- *For petroleum spills, provide notification if the release meets any of conditions the below:*
  - *a) Greater than 25 gallons*
  - *b) Not cleaned within 72 hours*
  - *c) Enters a storm drainage system or state waters*
- *Arrange for proper disposal (including contaminated personal protective equipment and/or cleanup supplies) in accordance with Federal, State, and local regulations and Manufacturer’s instructions if known.*
- *If a spill is beyond the scope of on-site equipment and personnel, contact the Spill Cleanup Emergency Response Contractor to further contain and clean up the spill.*
- *Notify the (HDOT Construction Resident Engineer/Project Engineer/Construction Inspector).*

Contents of the Spill kits shall be determined by the Contractor based on the anticipated type and quantity of hazardous material to be stored/used on-site. The kit should contain at minimum:

- *55 gallon drum with lid*
- *absorbent pads (50)*
- *absorbent socks (12)*
- *absorbent pillows (5)*
- *1 pair goggles or faceshield*
- *1 pair elbow length gloves*
- *1 disposable apron*
- *disposable bags with ties (3)*
- *Include additional materials such as Absorbent Skimmers or Booms for work adjacent or over State Waters as needed.*
- *Include additional materials as necessary to secure the spill area.*

Procedures for notification of appropriate facility personnel, emergency response agencies, and regulatory agencies where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity consistent with HAR 11-55 subsection 5.3.4. and established under either 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302, occurs during a 24-hour period (7.2.11.1.b).

- *Contact information must be in locations that are readily accessible and available.*

- *The Contractor shall take all reasonable measures to protect human health and the environment.*

- *For emergencies or life-threatening situations, call 911 first.*

- *Notify responsible parties listed below as required and immediately notify DOH Clean Water Branch and the National Response Center of the incident. The notification shall also include the identity of the pollutant sources and the implemented control or mitigation measures. Notify other agencies as required by Federal/State/Local laws. List additional agencies or personnel below as required.*

1. Owner Contact/Emergency Contact Number: (HDOT Construction Resident Engineer/Project Engineer/Construction Inspector)

2. Authorized Representative/ Emergency Contact Number: (HDOT District Engineer or designated representative who can contact Authorized Representative)

3. Contractor/ Emergency Contact Number: (Contractor Emergency Contact)

4. Department of Health
Clean Water Branch (During regular working hours): ………………………..808-586-4309
Hawaii State Hospital Operator (After hours):……………………………….. 808-247-2191

AND E-mail Clean Water Branch via email at cleanwaterbranch@doh.hawaii.gov

5. Hawaii Hazard Evaluation and Emergency Response (HEER) ………….808-586-4249
(After Hours) ……………………...808-247-2191
AND

Appropriate Local Emergency Planning Committee (LEPC)

For projects on Hawaii Island
Henry Silva, Hawaii County LEPC……………….………….808-936-0858

For projects on Oahu

Leland Nakai Department of Emergency Management	*808-723-8958*
LEPC	*808-723-8960*
(After Hours)	*911*
For projects on Kauai	
Clifford Ikeda, Kauai Civil Defense	*808-241-1800*
(After Hours)	*808-241-6711*
For projects in Maui County	
Scott Kekuewa, Maui Fire Department	*808-270-7911*
(After Hours)	*911*
6. National Response Center (NRC)	*(800)424-8802*
7. Coast Guard Operations Center, Honolulu (working hours)	*808-522-8246*
(After hours)	*808-247-2191*
8. County Fire Department/Police	*911*
9. HDOT Tunnels Emergency Contact Number (After Hours)	*808-485-6200*
10. Contractor’s Spill Cleanup Emergency Response Contractor	*xxx-xxx-xxxx*

- *If required, fill in and follow the requirements of the HDOT Corrective Action Report.*

Attachment G – Waste Management Procedures (SWPPP/IWPPP Section 7.2.11.2)

Waste Management Procedures

The Contractor shall submit the DOH "Solid Waste Disclosure Form for Construction Sites" to the Engineer within 30 calendar days of contract execution. The form can be downloaded at: *http://health.hawaii.gov/shwb/files/2013/06/swdiscformnov2008.pdf* ***Attach signed copy, including solid waste generated by sub-contractors, in Attachment G.***

Provide a copy of all the disposal receipts from the facility permitted by the Department of Health to receive solid waste to the Engineer monthly, this should also include documentation from any intermediary facility where solid waste is handled or processed, or as directed by the Engineer.

Solid Waste Management (SM-6)

Description

Practices and procedures to prevent or reduce the discharge of pollutants from construction site wastes to the drainage system or adjacent water bodies.

Applications

Construction projects generating non-hazardous solid wastes from construction and demolition (C&D) activities. These wastes include C&D wastes, inert fill material, and recycle/reuse material.

C&D wastes include materials originating from the demolition of roads, buildings, or other structures. Materials generated from these activities include concrete, brick, bituminous concrete, wood, masonry, composition roofing, roofing paper, steel, plaster, and minor amounts of metals.

Inert fill materials are wastes that are not contaminated with hazardous materials such as asbestos or lead-based paint. Inert fill materials do not decompose or produce leachate or other products harmful to the environment. Inert fill materials include earth, soil, rock, cured asphalt, brick, and clean concrete (no exposed steel-reinforcing rod) with no dimension greater than eight inches.

Recycle/reuse materials include but are not limited to: asphalt pavement, cardboard, concrete aggregate (no LBP, asbestos-free), electronic equipment, excavated rock, soil (uncontaminated), Freon from appliances, glass, green waste, metals, ferrous/non-ferrous, used tires, wood and lumbers, furniture, etc.

Installation and Implementation Requirements

- *Separate contaminated clean up materials from C&D wastes. Contamination may be from hazardous substances, friable asbestos, waste paint, solvents, sealers, or adhesives. (See Section SM-9 Hazardous Waste Management)*
- *Inert fill material shall not contain vegetation, organic material, or other solid waste.*
- *Inert fill materials shall not be mixed with other C&D waste.*
- *Provide waste containers of sufficient size and number to contain construction and domestic waste. Dumpsters should be securely lidded. Roll off containers should have a cover to keep rain out or loss of waste during windy conditions. Waste containers shall meet all local and State solid waste management regulations*
- *Clean up and dispose of waste in designated waste containers.*
- *The Contractor's supervisory personnel shall be instructed regarding the correct practices for waste disposal. Post notices stating these practices in the office*

trailer and the Contractor shall be responsible for seeing that these practices are followed.

Limitations	*None*
Inspections and Maintenance	*• Inspect construction waste and recycling areas regularly.* *• Schedule solid waste collection regularly. Empty waste containers weekly or when they are two-thirds full, whichever is sooner.* *• Schedule recycling activities based on construction/demolition phases.* *• Do not allow containers to overflow and clean up immediately if they do.*

Sanitary/Septic Waste Management (SM-7)

Description	Practices and procedures to reduce or prevent the discharge of sanitary wastes from construction sites into the storm drain system or adjacent water bodies.
Applications	Construction sites with temporary or portable sanitary/septic waste systems.
Installation and Implementation Requirements	• Locate sanitary facilities in a convenient place away from drainage facilities and State Waters. • Untreated wastewater shall not be discharged into the drainage system, State waters, to the ground or buried. • Position sanitary facilities where they are secure and will not be knocked down. • Comply with the State of Hawaii, Department of Health requirements when using an on-site disposal system such as a septic system. • Avoid illicit discharges by properly connecting temporary sanitary facilities to the sanitary sewer system. • Sanitary/septic systems discharging to the sanitary sewer shall comply with the local wastewater treatment plant requirements. • A licensed service provider shall maintain sanitary/septic facilities in good working order. • Schedule regular waste collection by a licensed transporter at least once a week or as required.
Limitations	None
Inspections and Maintenance	• Inspect and maintain facilities regularly. • Schedule regular waste collection. • Prevent illicit discharges.

Hazardous Waste Management (SM-9)

Description

Practices and procedures to prevent the discharge of hazardous waste to the land, storm drain system, sewer system, or adjacent water bodies.

Applications

Handling procedures on construction sites involving one of the following hazardous wastes:
- Paints and solvents;
- Petroleum products such as oils, fuels, and grease;
- Herbicides;
- Acids for cleaning masonry;
- Concrete curing and repair compounds; and
- Contaminated waste material.

Hazardous waste management shall also be implemented for wastes from existing structures including:
- Sandblasted material such as grit or chips containing lead, cadmium, or chromium-based paints;
- Asbestos; and
- Polychlorinated Biphenyls (PCBs). Older transformers are a common source of PCBs.

Installation and Implementation Requirements

Recognize potentially hazardous waste by implementing the following:
- Review product label and shipping papers;
- Identify key words such as flammable or ignitable (able to catch fire); carcinogenic (causes cancer); toxic or poisonous (injures or harms people or animals); and hazardous, danger, caustic or corrosive (burns through chemical action). Hawaii Administrative Rules (HAR) Title 11, Chapter 261 includes a list of hazardous waste and criteria;
- Review safety data sheets (SDS), formerly material safety data sheets (MSDS) from the manufacturer and supplier of the product; and
- Contact DOH, Hazardous Waste Program Office at 586-4226 for additional questions and information.

Material use practices and procedures for hazardous waste management include the following:
- Dispose container only after all of the product has been used;
- Keep the original product label on the container since it includes important safety and disposal information;
- Restrict amount of herbicide prepared to quantity necessary for the current application. Comply with the recommended usage instructions. Do not apply herbicides during or just before a rain event; and
- Remove as much paint from brushes on painted surface. Do not clean or rinse water-based paint brushes in soil, streets, gutters, storm drains, or streams. Rinse from water-based paints shall be discharged into the sanitary sewer system. Filter and re-use solvents and thinners. Dispose of oil-based paints and residue as a hazardous waste.
- See SM-2 Material Delivery and Storage and SM-3 Material Use for other requirements.

Waste recycling and disposal practices and procedures for hazardous waste management include the following:

- *Designate areas for collection of hazardous wastes;*
- *Store hazardous materials and wastes in covered containers and label according to applicable Resource Conservation and Recovery Act (RCRA) requirements and all other applicable federal, state, and local requirements;*
- *Provide appropriately-sized secondary containment for hazardous waste containers or cover to prevent from contact with rainwater and stormwater runoff;*
- *Keep wastes separate to prevent chemical reactions which make recycling and disposal difficult;*
- *Recycle useful materials such as oil or water-based paint;*
- *Do not dispose of toxic liquid wastes (solvents, used oils, and paints) or chemicals (additives, acids, and curing compounds) in dumpsters allocated for construction debris;*
- *Schedule periodic waste collection to prevent overflow of containers; and*
- *Ensure collection, removal, and disposal of hazardous waste complies with manufacturer's recommendations and in compliance with federal, state, and local requirements.*
- *Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly.*
- *Do not clean surfaces or spills by hosing the area down.*
- *Eliminate the source of the spill to prevent a discharge or a continuation of an ongoing discharge.*

Hazardous waste management training shall include the following:

- *Awareness of potential dangers from hazardous wastes;*
- *Identifying hazardous wastes;*
- *Proper hazardous waste storage and disposal procedures;*
- *Safety procedures for hazardous wastes;*
- *Placement of warning signs in areas recently treated with chemicals;*
- *Use of cleanup materials for spills.*

Limitations	*Hazardous waste that cannot be reused or recycled shall be disposed of by a licensed hazardous waste hauler.*
Inspections and Maintenance	*• Regularly inspect hazardous waste collection and storage areas and containers.* *• Schedule hazardous waste collection regularly.*

Litter Management Plan

Nanue Stream Bridge Rehabilitation

A. *Construction site preparations.*

Before the start of construction activities, during the mobilization process, proper litter waste receptacles will be located at the construction site. Litter receptacles will be placed within the boundaries of the project right-of-way or within a project related vehicle on-site. Construction debris receptacles that accept mixed reuse may also act as litter control receptacles.

B. *Daily Construction Site Litter Prevention Activities.*

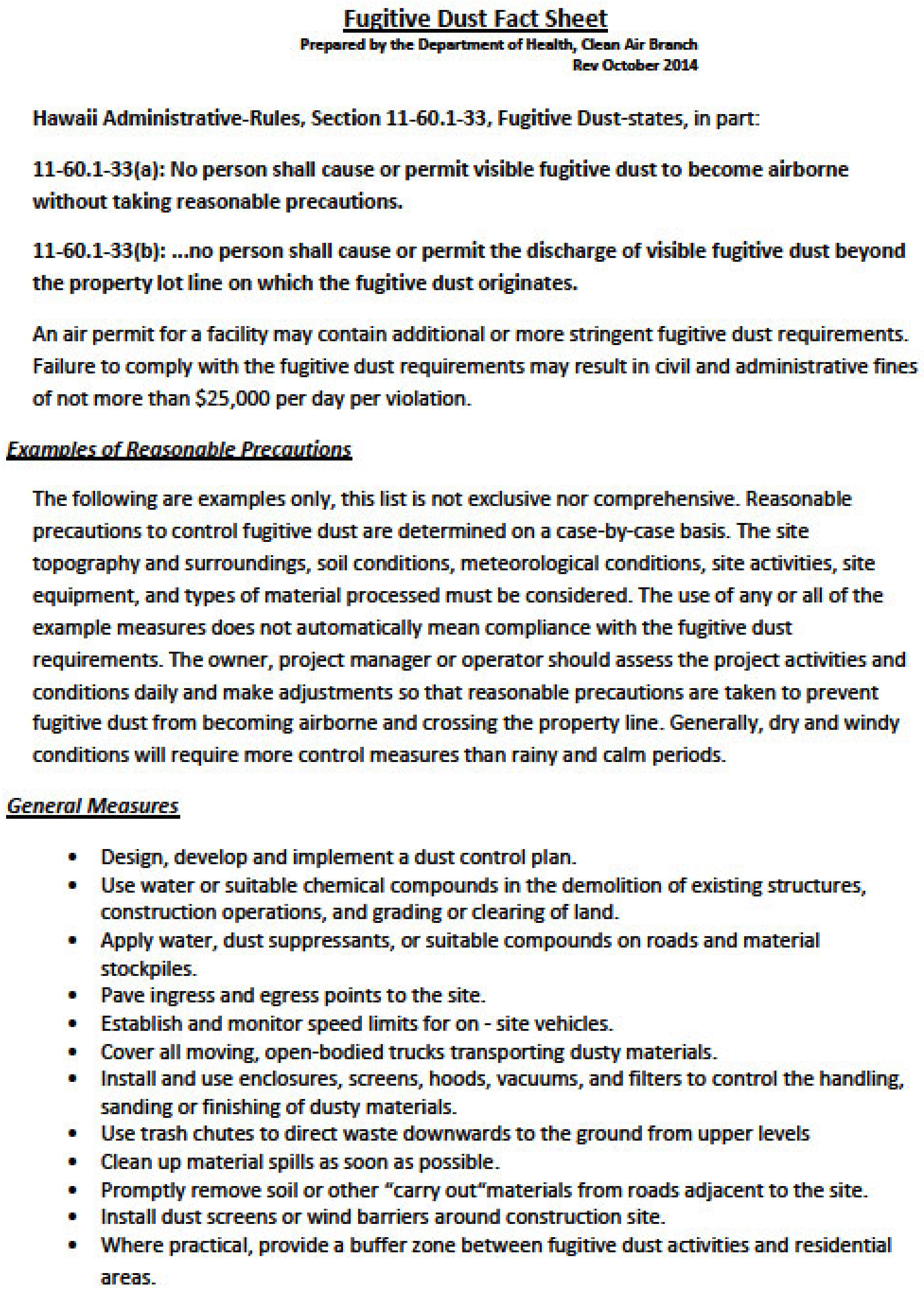
- *Pre-Construction activities litter prevention and control activities.*
  - *At the start of each work day, the active work areas of the construction site(s) will be inspected for litter debris.*
  - *Litter debris found will be collected and properly sorted into the proper debris receptacle.*
  - *Litter will be collected whether or not it was sourced from the job site and construction related activities.*
  - *After collection, litter will be disposed of in appropriate waste containers and all practices outlined in the Waste Management Plan will be followed.*
  - *Waste containers will be inspected regularly to prevent overfilling.*

- *Post-Construction Site Litter Prevention Activities*
  - *At the end of each work day, the active work areas of the construction site(s) will be inspected for litter debris.*
  - *Litter debris found will be collected a property sorted into the proper debris receptacle.*
  - *Litter will be collected whether or not it was sourced from the job site and construction related activities.*
  - *After collection, litter will be disposed of in appropriate waste containers and all practices outlined in the Waste Management Plan will be followed.*
  - *Waste containers will be inspected regularly to prevent overfilling.*

- *BMPs and Litter Control*

- *Construction Site BMPs will be inspected for litter debris when conducted weekly BMP inspection or after a significant rain event as litter debris may reduce the performance of BMPs.*

Attachment H – Emergency Related Projects, Departures from Manufacturer's Specifications for Fertilizers Containing Nitrogen or Phosphorus, Buffer Documentation, Documentation of Compliance with UIC Requirements, Other State/Federal/County Permits, Fugitive Dust Control Plan & Other Information as Requested by the Director (SWPPP/IWPPP Sections 7.2.3, 7.2.9, 7.2.14, 7.2.15, and 7.2.16)



Fugitive Dust Fact Sheet

Prepared by the Department of Health, Clean Air Branch
Rev October 2014

Hawaii Administrative-Rules, Section 11-60.1-33, Fugitive Dust-states, in part:

11-60.1-33(a): No person shall cause or permit visible fugitive dust to become airborne without taking reasonable precautions.

11-60.1-33(b): ...no person shall cause or permit the discharge of visible fugitive dust beyond the property lot line on which the fugitive dust originates.

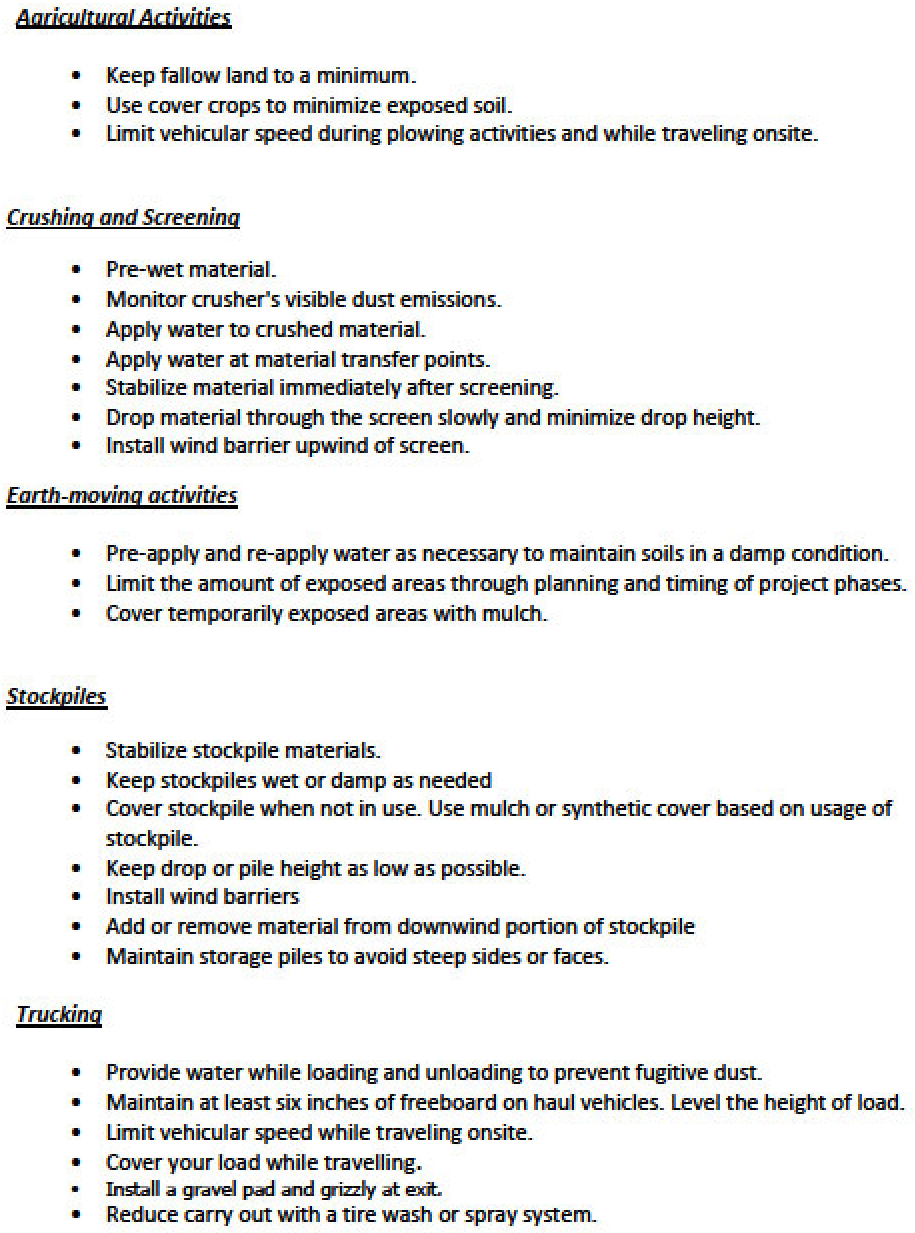
An air permit for a facility may contain additional or more stringent fugitive dust requirements. Failure to comply with the fugitive dust requirements may result in civil and administrative fines of not more than $25,000 per day per violation.

Examples of Reasonable Precautions

The following are examples only, this list is not exclusive nor comprehensive. Reasonable precautions to control fugitive dust are determined on a case-by-case basis. The site topography and surroundings, soil conditions, meteorological conditions, site activities, site equipment, and types of material processed must be considered. The use of any or all of the example measures does not automatically mean compliance with the fugitive dust requirements. The owner, project manager or operator should assess the project activities and conditions daily and make adjustments so that reasonable precautions are taken to prevent fugitive dust from becoming airborne and crossing the property line. Generally, dry and windy conditions will require more control measures than rainy and calm periods.

General Measures

- Design, develop and implement a dust control plan.
- Use water or suitable chemical compounds in the demolition of existing structures, construction operations, and grading or clearing of land.
- Apply water, dust suppressants, or suitable compounds on roads and material stockpiles.
- Pave ingress and egress points to the site.
- Establish and monitor speed limits for on - site vehicles.
- Cover all moving, open-bodied trucks transporting dusty materials.
- Install and use enclosures, screens, hoods, vacuums, and filters to control the handling, sanding or finishing of dusty materials.
- Use trash chutes to direct waste downwards to the ground from upper levels
- Clean up material spills as soon as possible.
- Promptly remove soil or other "carry out"materials from roads adjacent to the site.
- Install dust screens or wind barriers around construction site.
- Where practical, provide a buffer zone between fugitive dust activities and residential areas.



Agricultural Activities

- Keep fallow land to a minimum.
- Use cover crops to minimize exposed soil.
- Limit vehicular speed during plowing activities and while traveling onsite.

Crushing and Screening

- Pre-wet material.
- Monitor crusher's visible dust emissions.
- Apply water to crushed material.
- Apply water at material transfer points.
- Stabilize material immediately after screening.
- Drop material through the screen slowly and minimize drop height.
- Install wind barrier upwind of screen.

Earth-moving activities

- Pre-apply and re-apply water as necessary to maintain soils in a damp condition.
- Limit the amount of exposed areas through planning and timing of project phases.
- Cover temporarily exposed areas with mulch.

Stockpiles

- Stabilize stockpile materials.
- Keep stockpiles wet or damp as needed
- Cover stockpile when not in use. Use mulch or synthetic cover based on usage of stockpile.
- Keep drop or pile height as low as possible.
- Install wind barriers
- Add or remove material from downwind portion of stockpile
- Maintain storage piles to avoid steep sides or faces.

Trucking

- Provide water while loading and unloading to prevent fugitive dust.
- Maintain at least six inches of freeboard on haul vehicles. Level the height of load.
- Limit vehicular speed while traveling onsite.
- Cover your load while travelling.
- Install a gravel pad and grizzly at exit.
- Reduce carry out with a tire wash or spray system.

Attachment I – Corrective Action Report

Hawaii Department of Transportation Corrective Action Report

Section 10.1 "Corrective Actions" Defined

Corrective actions are actions taken in compliance with this section to:

a. Repair, modify, or replace any storm water control used at the site
b. Clean up and properly dispose of spills, releases, or other deposits
c. Remedy a permit violation

Section 10.2.1. Triggering Events

The following are triggers that require corrective action be taken (this triggering condition is to be documented within 24 hours of discovering the occurrence):

- ☐ *A required storm water control was never installed, was installed incorrectly, or not in accordance with the requirements in HAR Chapter 11-55, sections 5 and/or 6.*
- ☐ *The Contractor/Engineer becomes aware that the storm water controls installed and being maintained are not effective enough for the discharge to meet applicable water quality standards or applicable requirements in HAR Chapter 11-55, section 6.1. The Contractor shall notify the Engineer immediately. The Engineer will notify the Department of Health by the end of the next work day.*

  *Date/time Engineer notified by Contractor*______________________________

  *Date/time DOH notified by Engineer*__________________________________

- ☐ *One of the prohibited discharges below is occurring or has occurred:*
  - ☐ *Wastewater from washout of concrete*
  - ☐ *Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials*
  - ☐ *Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance*
  - ☐ *Soaps, solvents, or detergents used in vehicle and equipment washing*
  - ☐ *Toxic or hazardous substances from a spill or other release*

Section 10.2. Requirements for Taking Corrective Actions

The Contractor shall complete corrective actions in accordance with the deadlines specified below. In all circumstances, the Contractor shall immediately take all reasonable steps to minimize or prevent the discharge of pollutants until a permanent solution is installed and made operational, including cleaning up any contaminated surfaces so that the material will not discharge in subsequent storm events. Immediately means the same day the condition is discovered, unless it is too late in the day, in which initiation of corrective action must begin on the following work day.

Following any of the above triggering events, the Contractor shall install a new or modified control and make it operational, or complete the repair, by no later than 7 calendar days from *the time of discovery. If it is infeasible to complete the installation or repair within 7 calendar days, the Contractor shall document and submit to the Engineer, for his agreement, why it is infeasible to complete the installation or repair within the 7 calendar day timeframe and document a schedule for installing the storm water control(s) and making it operational as soon as practicable after the 7-day timeframe.*

*Date installation/repair completed or date/time prohibited discharge ceased*__________________

Reason it is infeasible to complete installation or repair within 7 calendar days and proposed schedule (if applicable) __________________

10.4.1. Initial Report (24 Hours)

Within 24 hours of discovering the occurrence of one of the triggering conditions in HAR Chapter 11-55, section 10.2.1. at the site, the Contractor must complete the following:

- *The nature of the condition identified*__________________
- *The date and time of the condition identified and how it was identified* __________________

10.4.2. Final Report (7 Days)

Within 7 calendar days of discovering the occurrence of one of the triggering conditions in HAR Chapter 11-55, section 10.2.1. at the site, the Contractor must complete a report of the following:

- *Any follow-up actions taken to review the design, installation, and maintenance of storm water controls, including the dates such actions occurred*__________________
- *A summary of storm water control modifications taken or to be taken, including a schedule of activities necessary to implement changes, and the date the modifications are completed or expected to be completed*__________________
- *Notice of whether SWPPP/IWPPP modifications are required as a result of the condition identified or corrective action*__________________

Section 10.2.2. SWPPP/IWPPP Modification Due to Corrective Actions

Where corrective actions result in changes to any of the storm water controls or procedures documented in the SWPPP/IWPPP, modify the SWPPP/IWPPP accordingly within 7 calendar days of completing corrective action work.

☐ *Date SWPPP/IWPPP modified*____

Section 10.3 Corrective Actions Required by the Department of Health (DOH)

The Contractor shall comply with any corrective actions required by the department as a result of permit violations found during an inspection by DOH or EPA.

Was the Corrective Action triggered by a DOH/EPA inspection?

☐ *Yes* ☐ *No*
☐ *Date of DOH/EPA Inspection*__________________________

Section 10.4.3. Certification

The certifying person and duly authorized representative shall meet the requirements of Hawaii Administrative Rules 11-55, Appendix A, Section 15.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

*Signature:*________________________ *Date:*________________________

Person Name: Annette Matsuda

Person Position Title: Acting Hawaii District Engineer

Person Company or Agency: State of Hawaii

Department: Department of Transportation, Highways

Phone Number: (808) 446-4586 *Fax No.: (808) 933-8869*

Person Email: Annette.dh.Matsuda@hawaii.gov

Attachment J – Monthly Compliance Report

Hawaii Department of Transportation Monthly Compliance Report

*DOH NGPC File No.*____________________
*Project Name:*____________________
*Project No:*____________________
*Reporting Month and Year:*____________________
*Date Prepared:*____________________

Complete this form within 2 working days of the end of the month. This report must be kept on-site and made available by the end of the next business day when requested by DOH. Check the applicable boxes below and include attachments when necessary.

☐ *Corrective Action Reports for this month are attached.*

☐ *Changes to the information on file with DOH for the past month are attached.*

☐ *No changes, updates, or any incidences of non-compliance to report.*

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

*Signature:*________________ *Date:*________________

Person Name: Annette Matsuda

Person Position Title: Acting Hawaii District Engineer

Person Company or Agency: State of Hawaii

Department: Department of Transportation, Highways

Phone Number: (808) 446-4586 *Fax No.: (808) 933-8869*

Person Email: Annette.dh.Matsuda@hawaii.gov

Attachment K – Post-Authorization Additions to the SWPPP/IWPPP (Including Army Corps PCN, 401 WQC, and Special Conditions)

Attachment L – SWPPP/IWPPP Modification Log

MODIFICATION LOG

Each Modification must be signed by the authorized representative authorizing the changes in Section 7.2.17 within 7 calendar days following the occurrence of any of the conditions listed in section 7.4.1.

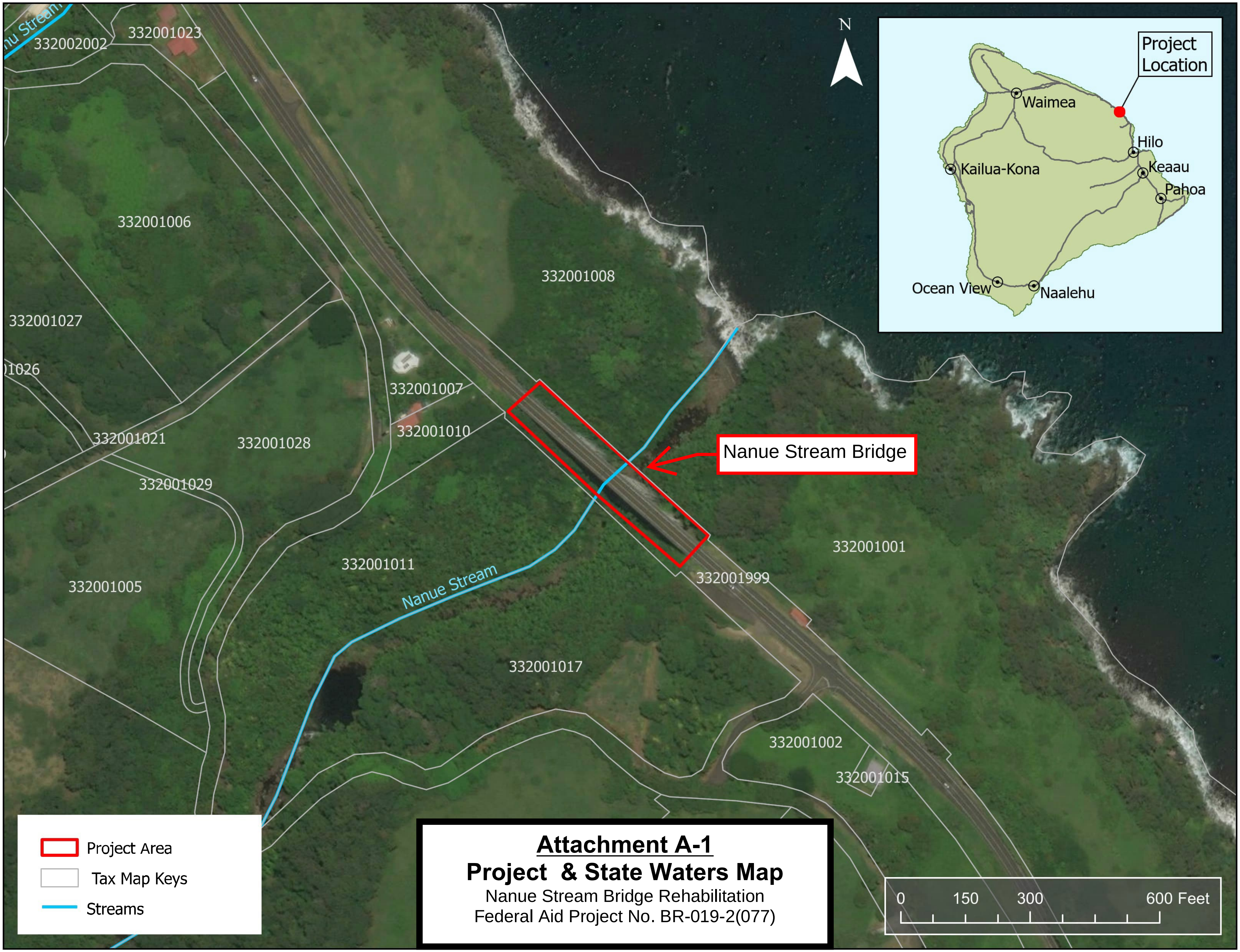
Project Name: **Nanue Stream Bridge Rehabilitation**

SWPPP/IWPPP Contact:

Modification No.	***Description of the Modification***	***Date of Modification***	***Modification Prepared by [Name(s) and Title]***

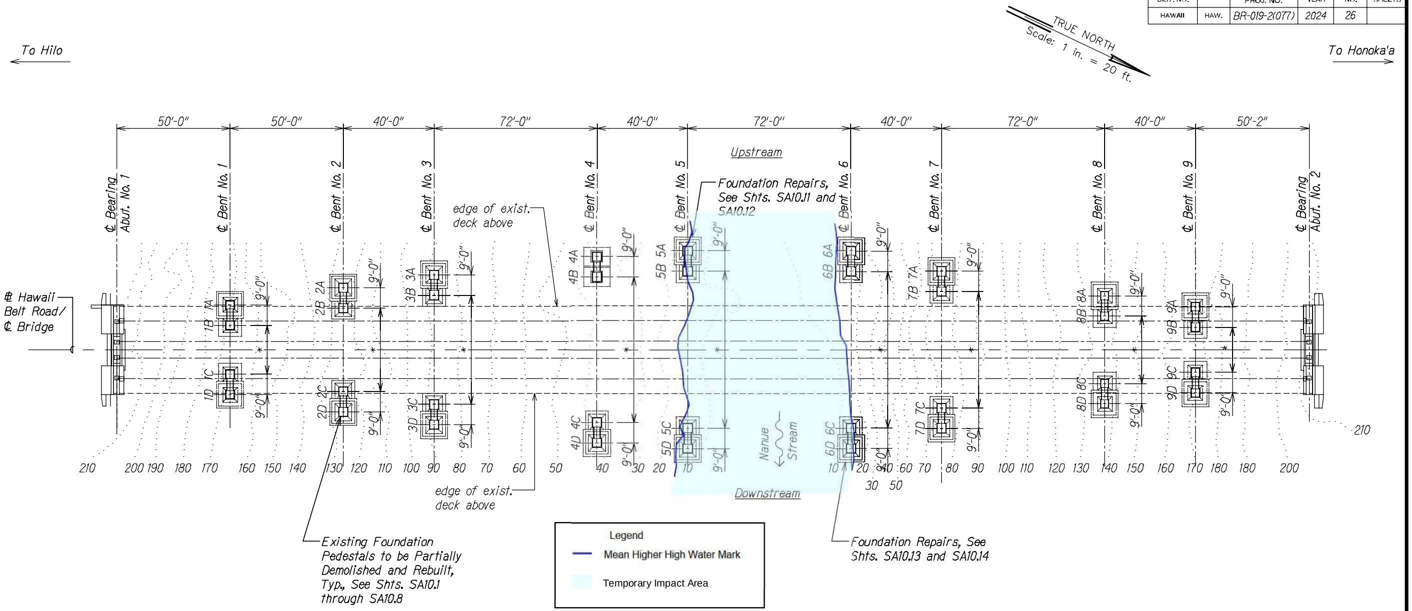
Add rows as needed.

Include any attachments on the following pages.



Attachment A-1
Project & State Waters Map
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(077)	2024	26	



FOUNDATION PLAN

Scale: 1" = 20'-0"

NOTE:

* Dimensions will be finalized after in-depth survey information has been obtained at foundation pedestal locations.

Attachment A-2
Army Corps Jurisdictional Boundary Map and Temporary Impact Area

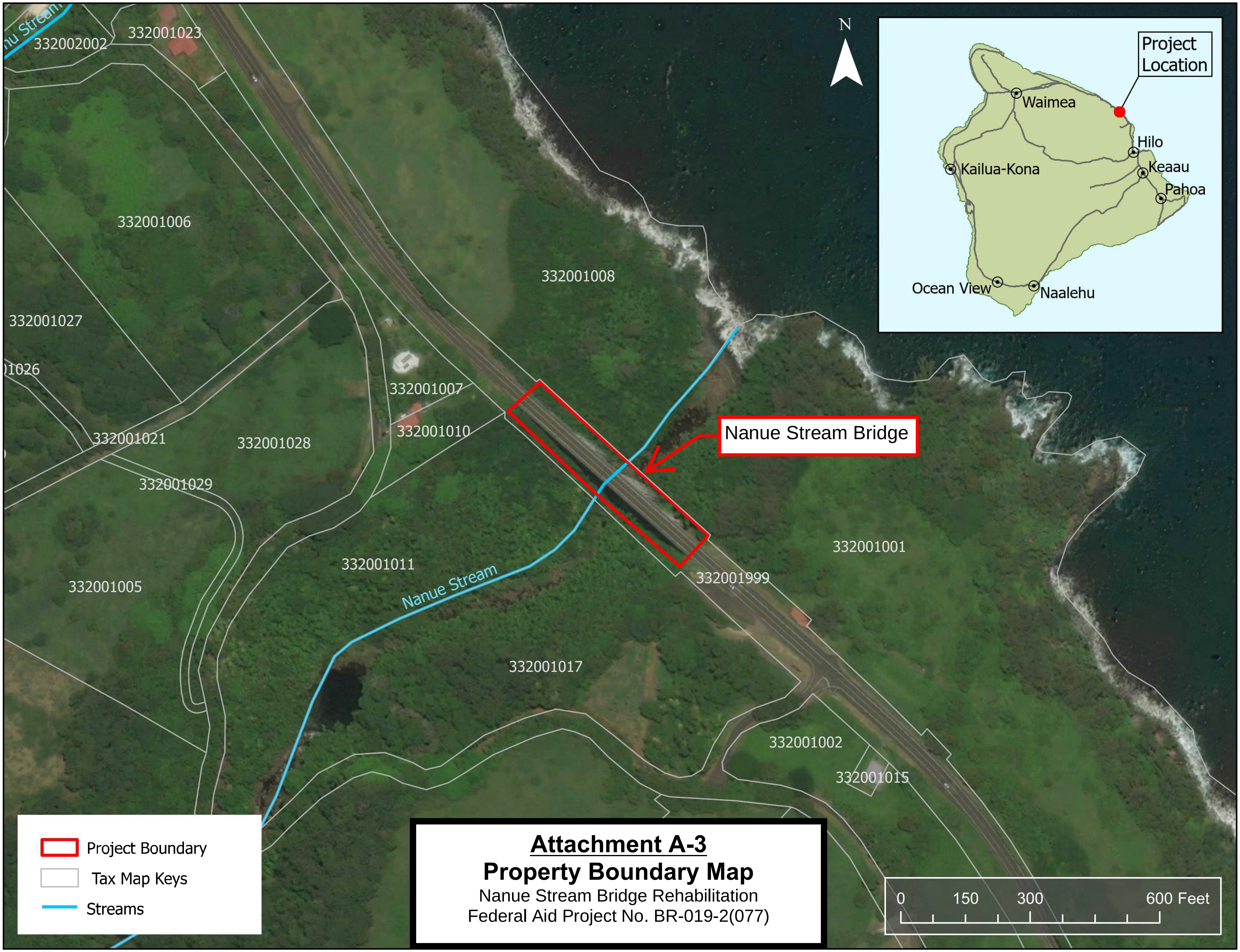
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

FOUNDATION PLAN

HAWAII BELT ROAD
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)
Scale: As Noted Date: Mar. 2024
SHEET No. SA1.2 OF 2 SHEETS

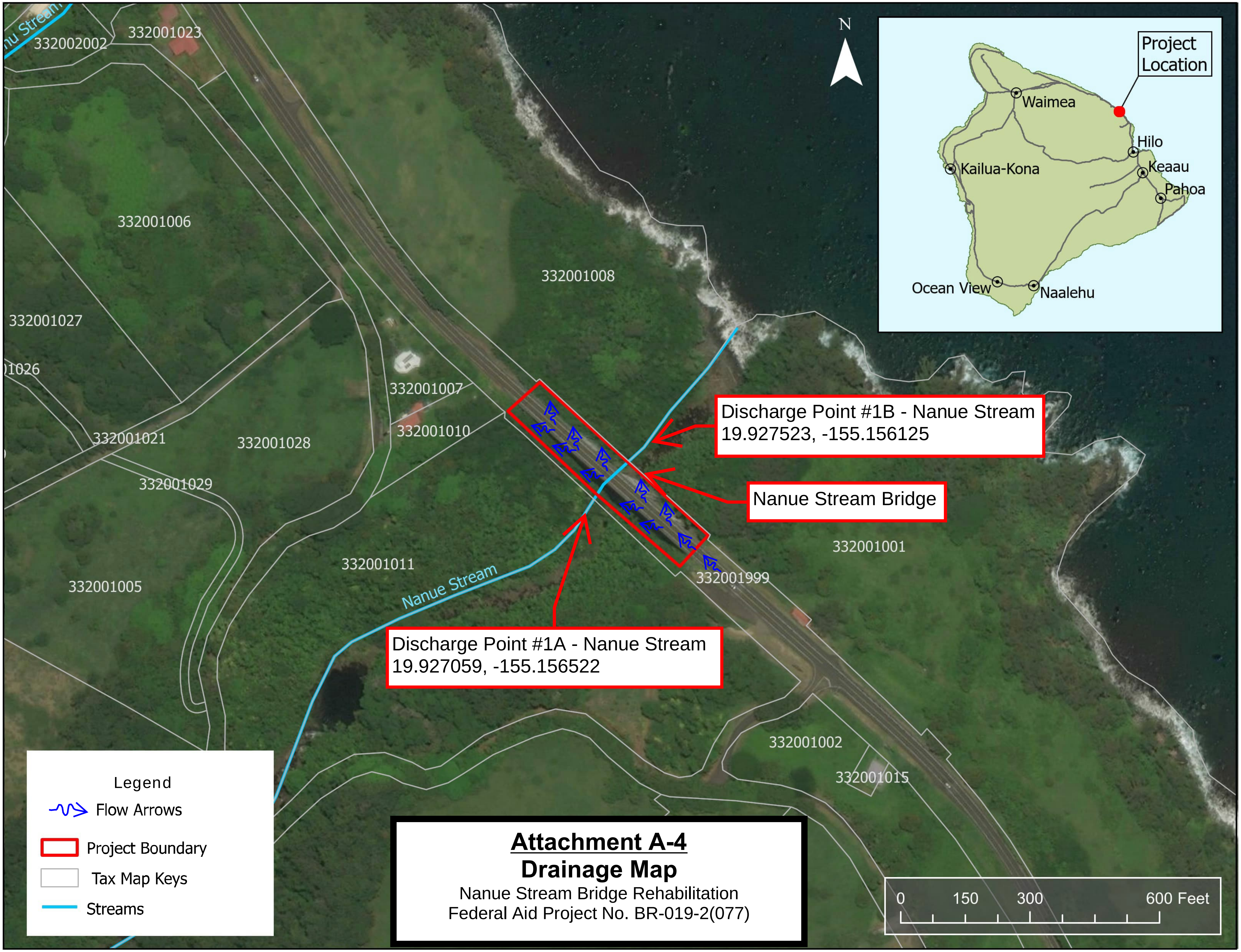
ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE



Attachment A-3

Property Boundary Map

Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)



Discharge Point #1B - Nanue Stream
19.927523, -155.156125

Nanue Stream Bridge

Discharge Point #1A - Nanue Stream
19.927059, -155.156522

Attachment A-4
Drainage Map
Nanue Stream Bridge Rehabilitation
Federal Aid Project No. BR-019-2(077)

PREPARED FOR: State of Hawaii Department of Transportation
District of Oahu

Monitor Bridge Inspection NANUE STRM

Bridge ID: 001000190308146

March 18, 20, and 23, 2024

PREPARED BY:
Consor Engineers, LLC
737 Bishop Street, Suite 2700
Honolulu, HI 96813
p: 888.451.6822

1/18/2024

Team Leader – Jacob Dahlgren, PE   Certification Date

GPS Coordinates

N: 19° 55’ 38.30”
W: 155° 09’ 22.55”

Table of Contents

Hawaii Department of Transportation
Bridge Load Rating Summary

Existing Bridge Data

Bridge Number:	001000190308146	Last Load Rating Date:	N/A
Bridge Name:	Nanue Stream Bridge	Last Inspection Date:	5-May-15
Route:	00019 Hawaii Belt Road	Inspected By:	WV and LL
District:	Hawaii	Fracture Critical Member (Y/N):	N/A
Span Type:	Steel Plate Girder	Item 58, Deck Rating:	7
Bridge Plans Available (Y/N):	Y	Item 59, Superstructure Rating:	7
Design Loading:	H20-44	Item 60, Substructure Rating:	7
Past Inventory Rating (HS20):	N/A	Bridge Load Posted (Y/N):	N
Past Operating Rating (HS20):	N/A	Posted Weight Limit:	N/A

Bridge Load Rating Summary

Dead Load Data

Overlay Type:	Asphalt
Overlay Depth (IN):	1.5 (assumed)
Was Overlay Depth Measured (Y/N):	N
Weight of Utilities:	0.224 klf
Weight of other Non-Structural Attachments:	Monorail 0.016 klf

LRFR Evaluation Factors

Surface Roughness Rating:	3 (asumed)
Condition Factor:	1.00
System Factor:	1.00
ADTT (one way):	N/A

Superstructure/Deck Rating Summary

	Vehicle Type	Vehicle GVW (Kips)	Rating Factor	Controlling Member	Controlling Load Effect	IM	Live Load Distribution Factor
Design Load	HL-93 (INV)	N/A	1.49	G4-2	Shear	33%	0.717 (M)
	HL-93 (OPR)	N/A	1.93	G4-2	Shear	33%	0.717 (M)
Legal Load	Type 3	50.0	2.97	G4-2	Shear	33%	0.717 (M)
	Type 3S2	72.0	2.82	G4-2	Shear	33%	0.717 (M)
	Type 3-3	80.0	2.95	G4-2	Shear	33%	0.717 (M)
	NRL	80.0	2.19	G4-2	Shear	33%	0.717 (M)
	SU4	54.0	2.69	G4-2	Shear	33%	0.717 (M)
	SU5	62.0	2.42	G4-2	Shear	33%	0.717 (M)
	SU6	69.5	2.30	G4-2	Shear	33%	0.717 (M)
	SU7	77.5	2.21	G4-2	Shear	33%	0.717 (M)
	EV2	57.5	2.51	G4-2	Shear	33%	0.717 (M)
	EV3	86.0	1.70	G4-2	Shear	33%	0.717 (M)
Permit Load	HP1	120.0	2.54	G4-4	Shear	33%	0.534 (0.641/1.2)
	HP2	157.0	2.34	G4-4	Shear	33%	0.534 (0.641/1.2)
	HP3	209.9	3.02	G4-4	Shear	33%	0.534 (0.641/1.2)

Substructure Rating Summary

Substructure Rated (Y/N): N

Vehicle Type	Vehicle GVW (Kips)	Rating Factor	Controlling Member	Controlling Load Effect	IM	Live Load Distribution Factor
HL-93 (INV)	N/A					
HL-93 (OPR)	N/A					
Legal Load						
Permit Load						

Posting Analysis Summary

Governing Legal Load Rating Factor:	1.70
Governing Legal Load Model:	EV3
Posting Recommended (Y/N):	N
Recommended Posting Load:	N/A

Please check the following boxes that apply:

- ☐ Bridge load rating is not governed by deck rating
- ☐ Bridge load rating is not governed by substructure rating
- ☒ Connections do not control the bridge load rating
- ☒ Exterior girder controls the bridge load rating
- ☒ Bridge plans do not exist - Rating based on judgement and current loading

Quality Control/Quality Assurance

Load Rating Engineer

- Name:	Dean Kokubun, S.E.
- License No.:	10973-S
- Signature:	
Load Rating Checked By:	Christina Thung, P.E.
Quality Assurance By:	Gary Smith, P.E.
Load Rating Date:	8/19/2017

Remarks/Recommendations for Bridges without Plans

Deck was not rated due to unavailable information and was assumed not to control the bridge load rating.
Substructure Rating was not load rated.
Where existing girder information was not provided, simliar girder section properties from other girders were used.

State of Hawaii
Department of Transportation
Structure Inventory and Appraisal Sheet (English Units)

Name: **NANUE STRM** Bridge No: **001000190308146** Inspection Date: 03/18/2024

IDENTIFICATION

Rte.(On/Under)	5A:	Route On Structure	**State**	1:	15 Hawaii
Rte. Signing Prefix	5B:	2 U.S. Numbered Hwy	**Facility Carried**	7:	HAWAII BELT RD
Level of Service	5C:	1 Mainline	**Place Code**	4:	Laupahoehoe
Route Number	5D:	00019	**SHD District**	2:	10 Hawaii
Directional Suffix	5E:	2 East	**Feature Intersected**	6:	NANUE STRM
Border Bridge Code	98:	Unknown (P)	**County Code**	3:	Hawaii
Border Bridge Number	99:		**Location**	9:	1.66MI W/KAUNIHO RD
Mile Post	11:	18.002 mi	**Latitude**	16:	19° 55' 38"
Struc Num	8:	001000190308146	**Longitude**	17:	155° 09' 23"

INSPECTION

Inspection Date	90:	3/1/2023	**Frequency**	91:	24 months	**Next Inspection:**	3/1/2025
FC Inspection Date	93A:	NA	**FC Frequency**	92A:		**Next FC Inspection:**	NA
UW Inspection Date	93B:	3/1/2023	**UW Frequency**	92B:	48 months	**Next UW Inspection:**	3/1/2027

CONDITION

Deck	58:	7 Good	**Super**	59:	5 Fair	**Sub**	60: 3 Serious	**SD/FO:**	SD
Culvert	62:	N N/A (NBI)	**Channel/Channel Protection**				61: 7 Minor Damage	**SUFF RATE:**	35.5

LOAD RATING AND POSTING

Inventory Rating Method	65:	8 LRFR (HL93)	**Operating Rating Method**	63:	8 LRFR (HL93)
Inventory Rating	66:	1.49	**Operating Rating**	64:	1.93
Design Load	31:	4 M 18 (H 20)	**Posting**	70:	5 At/Above Legal Loads
Posting Status	41:	A - Open, no restriction			

GEOMETRIC DATA

Length Max Span	48:	72.00 ft	**Structure Length**	49:	531.30 ft
Width Curb to Curb	51:	28.00 ft	**Curb/Sdwlk Width L**	50A:	4.00 ft
Approach Roadway width (w/ shoulders)	32:	34.12 ft	**Curb/Sidewalk Width R**	50B:	4.00 ft
			Width Out to Out	52:	38.50 ft
Deck Area:		20,412.70 sq. ft	**Median**	33:	0 No median
Skew	34:	0.00°	**Structure Flared**	35:	0 No flare
Vertical Clearance	10:	99.99 ft	**Horizontal Clearance**	47:	28.00 ft
Min. Vert. Cl. Over Bridge	53:	99.99 ft	**Min. Lat. Undercl. Ref. R**	55A:	N Feature not hwy or RR
Min. Vert. Undercl. Ref.	54A:	N Feature not hwy	**Min. Lat. Undercl. R**	55:	0.00 ft
Min. Vert. Undercl.	54B:	0.00 ft	**Min. Lat. Undercl. L**	56:	

AGE AND SERVICE

Year Built	27:	1952	**ADT**	29:	6,700
Type of Service on	42A:	5 Highway-pedestrian	**Year Reconstructed**	106:	
Type of Service under	42B:	5 Waterway	**Detour Length**	19:	1.2 mi
Lanes on	28A:	2	**Truck ADT**	109:	9%
Lanes under	28B:	0	**Year of ADT**	30:	2019

STRUCTURE TYPE AND MATERIALS

Deck Type	107:	1 Concrete-Cast-in-Place	**Number of Spans Main Unit**	45:	10
Wearing Surface	108A:	6 Bituminous	**Main Span Material Design**	43A:	3 Steel
Membrane	108B:	0 None	**Main Span Material Design**	43B:	02 Stringer/Girder
Deck protection	108C:	None	**Number of Approach Spans**	46:	0

State of Hawaii
Department of Transportation
Structure Inventory and Appraisal Sheet (English Units)

APPRAISAL

Bridge Rail	36A:	0 Substandard	**Approach Rail**	36C:	1 Meets Standards
Transition	36B:	1 Meets Standards	**Approach Rail Ends**	36D:	1 Meets Standards
Str Evaluation	67:	3 Intolerable - Correct	**Deck Geometry**	68:	4 Tolerable
Waterway Adequacy	71:	9 Above Desirable	**Approach Alignment**	72:	5 Above Tolerable
Scour Critical	113:	8 Stable Above Footing	**Vert. & Horiz. Undercl.**	69:	N Not applicable (NBI)

CLASSIFICATION

Defense Highway	100:	0 Not a STRAHNET hwy	**Parallel Structure**	101:	No || bridge exists
Direction of Traffic	102:	2 2-way traffic	**Temporary Structure**	103:	[blank] Not temporary
Highway System	104:	3 On free road	**NBIS Length**	112:	Long Enough
Defense Hwy	110:	1 On the NHS	**Functional Class**	26:	06 Rural Minor Arterial
Toll Facility	20:	0 Not a STRAHNET hwy	**Historical Significance**	37:	5 Not eligible for NRHP
Owner	22:	State Highway Agency	**Custodian**	21:	State Highway Agency

PROPOSED IMPROVEMENTS

Bridge Cost	94:	$0	**Type of Work**	75:	38 Other Structural
Roadway Cost	95:	$0	**Length of Improvement**	76:	558.1 ft
Total Cost	96:	$21,528,000	**Future ADT**	114:	6,781
Year of Cost Estimate	97:	1999	**Year of Future ADT**	115:	2025

NAVIGATION DATA

Navigation Control	38:	Permit Not Required	**Horizontal Clearance**	40:	0.0 ft
Vertical Clearance	39:	0.0 ft	**Lift Bridge Vert. Cl.**	116:	
Pier Protection	111:	Unknown (NBI)			

Inspection Report

001000190308146
NANUE STRM
Inspector: Sang Yoon Kim
03/18/2024

IDENTIFICATION

Bridge Key:	001000190308146
NBI Number:	NANUE STRM
Structure Name:	NANUE STRM
Location (9):	1.66MI W/KAUNIHO RD
Carries (7):	HAWAII BELT RD
Type of Service (42A):	5 Highway-pedestrian
Feature Crossed (6):	NANUE STRM
Type of Service (42B):	5 Waterway
Placecode (4):	Laupahoehoe
County (3):	Hawaii
State (1):	15 Hawaii
Station:	
Region (2):	10 Hawaii
Latitude (16):	19.93
Longitude (17):	-155.16
Owner (22):	State Highway Agency
Custodian (21):	State Highway Agency

Year Built (27):	1952	Border State:	Unknown (P)
Year Recon (106):		Border Number:	
Historical (37):	5 Not eligible for NRHP	% Responsibility:	0

INSPECTION

Date of Inspection (90):	3/18/2024
Frequency (91):	24
Next Inspection:	2/9/2026

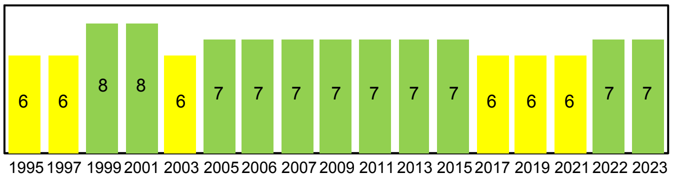
Inspection Type	Freq (92)	Last Insp (93)	Next Insp
Element	24	02/09/2024	02/09/2026
Fracture Critical (A)		N/A	N/A
Underwater (B)	48	03/01/2023	03/01/2027
Special Insp (C)		03/18/2024	N/A

LOAD RATING AND POSTING

Posting Status (41):	A - Open, no restriction
Posting % (70):	5 At/Above Legal Loads
Rating Date:	8/19/2017
Design Load (31):	4 M 18 (H 20)
Opr Method (63):	8 LRFR (HL93)
Opr Rating (64):	0.00 Tons
Inv Method (65):	8 LRFR (HL93)
Inv Rating (66):	0.00 Tons

DECK GEOMETRY

Deck Geometry (68):	4 Tolerable
Deck Area:	20,455.05
Deck Type (107):	1 Concrete-Cast-in-Place
Wearing Surface (108A):	6 Bituminous
Membrane (108B):	0 None
Deck Protection (108C):	None
O. to O. Width (52):	38.50
Curb / Sidewalk Width L (50A):	4.00
Curb / Sidewalk Width R (50B):	4.00
Median (33):	0 No median

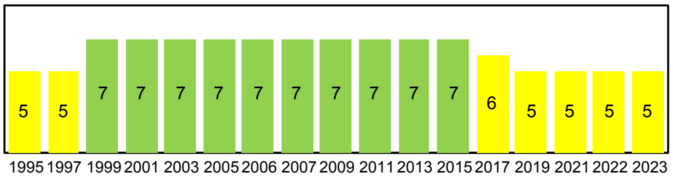


DECK CONDITION

Deck Rating (58):	7 Good
Bridge Rail (36A):	0 Substandard
Transition (36B):	1 Meets Standards
Approach Rail (36C):	1 Meets Standards
Approach Rail Ends (36D):	1 Meets Standards

SUPERSTRUCTURE GEOMETRY

# of Main Spans (45):	10
# of Approach Spans (46):	0
Main Material (43 A):	3 Steel
Main Design (43 B):	02 Stringer/Girder
Max Span Length (48):	72.00
Structure Length (49):	531.30
NBIS Length (37):	Long Enough
Temp Structure (103):	[blank] Not temporary
Skew (34):	0
Structure Flared (35):	0 No flare
Parallel Structure (101):	No || bridge exists
Approach Alignment (72):	5 Above Tolerable

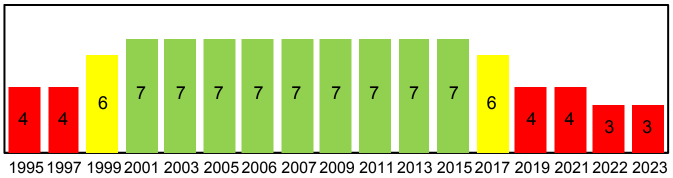


SUPERSTRUCTURE CONDITION

Superstructure Rating (59):	5 Fair
Structure Evaluation (67):	3 Intolerable - Correct

SUBSTRUCTURE GEOMETRY

Navigation Control (38):	Permit Not Required
Nav Vert Clearance (39):	0.00
Nav Horiz Clearance (40):	0.00
Pier Protection (111):	Unknown (NBI)
Lift Bridge Vertical Clearance (116):	
Scour Rating (113):	8 Stable Above Footing
Waterway Adequacy (71):	9 Above Desirable



SUBSTRUCTURE CONDITION

Substructure Rating (60):	3 Serious
Channel Rating (61):	7 Minor Damage

ROUTE ON STRUCTURE: Hawaii Belt Rd (HI Route 19)

ROADWAY LOCATION

Pos Prefix (5A):	Route On Structure
Kind of Hwy (5B):	2 U.S. Numbered H
Route Num (5D):	00019
LRS Route (13A/B):	0000000019/00
Milepost (11):	18.00 mi (28.97 km)
Suffix (5E):	2 East
Lanes On (28A):	2
Detour Length (19):	1.24 mi (2.00 km)

ROADWAY CLASSIFICATION

Funct Class (26):	06 Rural Minor Arterial
Level Service (5C):	1 Mainline
NHS (104):	1 On the NHS
Defense Hwy (100):	0 Not a STRAHNET hwy
Toll Facility (20):	3 On free road
ADT (29):	6,700 Cars/Day
Pct Trucks (109):	9.00%
ADT Year (30):	2019

CLEARANCES

Vertical (10):	99.99	
Min Vert Over (53):	99.99	0.00
Vert Ref (54A):	N Feature not hwy or RR	
Horizontal (47):	28.00	
Min Lat Left (56):		
Min Lat Right (55B):	0.00	
Horiz Ref (55A):	N Feature not hwy or RR	
Underclearance (69):	N Not applicable (NBI)	

PROPOSED IMPROVEMENTS

Bridge Cost (94):		**Year of Cost Estimate (97):**	1999	**Future ADT (114):**	6,781
Roadway Cost (95):		**Type of Work (75):**	38 Other Structural		
Total Cost (96):	$21,528,000	**Length of Improvement (76):**	1,830.9 ft	**Year of Future ADT (115):**	2025

BRIDGE NOTES

Structure Description:
NANUE STRM was built in 1952 and carries two (2) lanes of traffic on Hawaii Belt Road (Hawaii Route 19) over Nanue Stream. The structure has ten (10) spans with four (4) built-up steel plate girders with a reinforced concrete deck. The superstructure is supported by one (1) steel bent, four (4) steel trestle towers, and two (2) reinforced concrete abutments. Each trestle tower consists of two (2) steel bents and all bents are made up of four (4) steel columns founded on reinforced concrete footings.

Orientation:
The structure is oriented from south to north, in the direction of advancing milepost (see attached excerpt from 2020 HDOT Straight Line Diagrams). The channel flows from west (upstream) to east (downstream). Girders are numbered from east (G1) to west (G4). The trestle tower and bent columns are numbered from east (Column A) to west (Column D).

INSPECTION NOTES

Inspection Summary:
On March 18 and 23, 2024, Consor Engineers, LLC, performed a monitoring bridge inspection for NANUE STRM. The inspection consisted of a visual examination of the steel trestle towers only.

Inspection Methods and Access:
The towers were accessed through industrial rope access techniques. A drone was used to take elevation photos.

Load Rating:
Based on the current condition of the structure, an updated load rating is warranted. The current load rating from 8/19/2017 was completed using a rating of; Item 58, Deck: 7, Item 59, Superstructure: 7, and Item 60, Substructure: 7 with a condition factor of: 1.00. Based on the current inspection and current ratings of; Item 58, Deck: 7, Item 59, Superstructure: 5, and Item 60, Substructure: 3 an updated load rating is recommended. The current load rating summary sheet from 8/19/2017 is included in this report.

Bridge Access:
Parking was in a large shoulder on the southwest corner of the bridge, behind the guardrail.

Safety Issues:
Known safety related issues during the inspection include: working adjacent to live traffic, potential fall hazard, slips, trips and falls, steep vegetated embankment while accessing the bottom of the tower, insect bites, and dehydration due to hot weather.

Item 61:
The rating for Item 61 Channel and Channel Protection is a 7 - Minor Damage.

Item 71:
The rating for Item 71 Waterway Adequacy is a 9 - Above Desirable.

Item 113:
The Scour Critical Bridge Rating for Item 113 is an 8 - Stable Above Footing.

ELEMENT CONDITION SUMMARY

Str Unit	Elm/Env	Description	Total Qty	% in 1	Qty. St. 1	% in 2	Qty. St. 2	% in 3	Qty. St. 3	% in 4	Qty. St. 4
0	**12/1**	**Re Concrete Deck**	**20,501.00**	**98%**	**20,153.00**	**1%**	**135.00**	**1%**	**213.00**	**0%**	**0.00**
0	510/1	Wearing Surfaces	14,867.00	85%	12,560.00	0%	18.00	15%	2,288.00	0%	1.00
0	*3210/1*	*Del/Spall/Patch/Pot(Wear Surf)*	*51.00*	*0%*	*0.00*	*35%*	*18.00*	*63%*	*32.00*	*2%*	*1.00*
0	*3220/1*	*Crack (Wearing Surface)*	*2,256.00*	*0%*	*0.00*	*0%*	*0.00*	*100%*	*2,256.00*	*0%*	*0.00*
0	1080/1	Delamination/Spall/Patched Area	7.00	0%	0.00	100%	7.00	0%	0.00	0%	0.00
0	1120/1	Efflorescence/Rust Staining	149.00	0%	0.00	43%	64.00	57%	85.00	0%	0.00
0	1130/1	Cracking (RC and Other)	192.00	0%	0.00	33%	64.00	67%	128.00	0%	0.00
0	**107/1**	**Steel Opn Girder/Beam**	**2,268.00**	**23%**	**517.00**	**3%**	**60.00**	**75%**	**1,691.00**	**0%**	**0.00**
0	515/1	Steel Protective Coating	25,344.00	0%	0.00	85%	21,542.00	15%	3,802.00	0%	0.00
0	*3420/1*	*Peel/Bub/Crack(Stl Protect Coat)*	*3,802.00*	*0%*	*0.00*	*0%*	*0.00*	*100%*	*3,802.00*	*0%*	*0.00*
0	*3440/1*	*Eff (Stl Protect Coat)*	*21,542.00*	*0%*	*0.00*	*100%*	*21,542.00*	*0%*	*0.00*	*0%*	*0.00*
0	1000/1	Corrosion	1,688.00	0%	0.00	0%	0.00	100%	1,688.00	0%	0.00
0	1020/1	Connection	6.00	0%	0.00	50%	3.00	50%	3.00	0%	0.00
0	7000/1	Damage	57.00	0%	0.00	100%	57.00	0%	0.00	0%	0.00
0	**207/1**	**Stl Tower**	**591.00**	**0%**	**0.00**	**0%**	**0.00**	**75%**	**445.00**	**25%**	**146.00**
0	515/1	Steel Protective Coating	8,149.00	0%	0.00	73%	5,966.00	27%	2,183.00	0%	0.00
0	*3410/1*	*Chalk(Steel Protect Coatings)*	*204.00*	*0%*	*0.00*	*0%*	*0.00*	*100%*	*204.00*	*0%*	*0.00*
0	*3440/1*	*Eff (Stl Protect Coat)*	*7,944.00*	*0%*	*0.00*	*75%*	*5,966.00*	*25%*	*1,978.00*	*0%*	*0.00*
0	1000/1	Corrosion	587.00	0%	0.00	0%	0.00	75%	442.00	25%	145.00
0	1020/1	Connection	4.00	0%	0.00	0%	0.00	75%	3.00	25%	1.00
0	**215/1**	**Re Conc Abutment**	**104.00**	**57%**	**59.00**	**38%**	**40.00**	**5%**	**5.00**	**0%**	**0.00**
0	1080/1	Delamination/Spall/Patched Area	4.00	0%	0.00	0%	0.00	100%	4.00	0%	0.00
0	1190/1	Abrasion(PSC/RC)	41.00	0%	0.00	98%	40.00	2%	1.00	0%	0.00
0	**220/1**	**Re Conc Pile Cap/Ftg**	**80.00**	**74%**	**59.00**	**11%**	**9.00**	**15%**	**12.00**	**0%**	**0.00**
0	1080/1	Delamination/Spall/Patched Area	6.00	0%	0.00	0%	0.00	100%	6.00	0%	0.00
0	1190/1	Abrasion(PSC/RC)	3.00	0%	0.00	0%	0.00	100%	3.00	0%	0.00
0	6000/1	Scour	12.00	0%	0.00	75%	9.00	25%	3.00	0%	0.00
0	**301/1**	**Pourable Joint Seal**	**269.00**	**88%**	**237.00**	**1%**	**3.00**	**11%**	**29.00**	**0%**	**0.00**
0	2310/1	Leakage	28.00	0%	0.00	0%	0.00	100%	28.00	0%	0.00
0	2330/1	Seal Damage	1.00	0%	0.00	0%	0.00	100%	1.00	0%	0.00
0	**311/1**	**Moveable Bearing**	**20.00**	**0%**	**0.00**	**40%**	**8.00**	**60%**	**12.00**	**0%**	**0.00**
0	515/1	Steel Protective Coating	40.00	0%	0.00	100%	40.00	0%	0.00	0%	0.00
0	*3420/1*	*Peel/Bub/Crack(Stl Protect Coat)*	*40.00*	*0%*	*0.00*	*100%*	*40.00*	*0%*	*0.00*	*0%*	*0.00*
0	1000/1	Corrosion	14.00	0%	0.00	57%	8.00	43%	6.00	0%	0.00
0	1020/1	Connection	6.00	0%	0.00	0%	0.00	100%	6.00	0%	0.00
0	**313/1**	**Fixed Bearing**	**24.00**	**0%**	**0.00**	**63%**	**15.00**	**38%**	**9.00**	**0%**	**0.00**
0	515/1	Steel Protective Coating	48.00	0%	0.00	100%	48.00	0%	0.00	0%	0.00
0	*3420/1*	*Peel/Bub/Crack(Stl Protect Coat)*	*48.00*	*0%*	*0.00*	*100%*	*48.00*	*0%*	*0.00*	*0%*	*0.00*
0	1000/1	Corrosion	23.00	0%	0.00	65%	15.00	35%	8.00	0%	0.00
0	1020/1	Connection	1.00	0%	0.00	0%	0.00	100%	1.00	0%	0.00
0	**331/1**	**Re Conc Bridge Railing**	**1,073.00**	**0%**	**0.00**	**100%**	**1,073.00**	**0%**	**0.00**	**0%**	**0.00**
0	7000/1	Damage	1,073.00	0%	0.00	100%	1,073.00	0%	0.00	0%	0.00

ELEMENT NOTES

STRUCTURE UNIT: 0

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
12	**Re Concrete Deck**	**1**	**20,501.00**	**sq.ft**	**20,153.00**	**135.00**	**213.00**	**0.00**

NOTE: Ratings for element 12 reflect conditions observed during the previous routine and element inspections performed.

Total quantity changed from 20382 SF to 20502 SF due to 536.7' structure length x 38.2' out-to-out per field measurements.

-The deck has 16 drains on each side, 32 total; all deck drains are clear with minor corrosion on the grating.
-Span 2, east overhang, 1st scupper south of Bent 2, vegetation growth and almost full of debris.
-The sidewalks are scaled throughout, typically 1/8” deep.

POSTE Note 09/02/24:
-No observed signs of stress or noted defects at the time of inspection.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
510	Wearing Surfaces	1	14,867.00	sq.ft	12,560.00	18.00	2,288.00	1.00

Total quantity changed from 14809 SF to 14867 SF due to 536.7' structure length x 27.7' curb-to-curb per field measurements.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
3210	*Del/Spall/Patch/Pot(We*	*1*	*51.00*	*sq.ft*	*0.00*	*18.00*	*32.00*	*1.00*

-South Abutment Joint, NB lane, 6” diameter x 1” deep spall adjacent to crack, 1 SF CS3, (See Photo 15).
-Bent 3 Joint, both lanes, 2' 4” L x 4' W area of settled patches with a 6" Dia. x 1" D spall within. The rest of the paved over joint is rutted up to 1” deep, 8 SF CS3, (See Photo 16).
-Span 4, NB lane, 20’ north of Bent 3, 3’ L x 3’ W area of gouges (largest is 1’ 1” L x 2’ W x 1/2" deep), 5 SF CS3, (See Photo 17).
-Bent 5 Joint, NB lane, 2' 4" L x 4' W x 1/2" deep cracked and settled pothole with ponding water, 8 SF CS3, (See Photo 18).
-Bent 5 Joint, SB lane, 2' L x 4' 5" W x 2" deep settled patch with a 11" L x 11" W x 1" deep spall within with exposure of deck and joint, 2 SF CS3, (See Photo 19).
-Span 8, NB lane, 15' north of Bent 7 Joint, 8” L x 15" W x 1/2" deep patched pothole that is failing and has ponding water, 1 SF CS3, (See Photo 20).
-Bent 7 Joint, SB lane, previous cracked and settled patch has been re-patched, 8 SF CS2, (See Photo 51).
-Bent 9 Joint, SB lane, wearing surface, 16" L x 21" W x 1" deep cracked and settled patch with 5" L x 11" W x 1" deep pothole within with exposure of steel plate and joint material, 4 SF CS2, 1 SF CS4, (See Photo 21).
-Bent 9 Joint, NB right wheel line, cracked and settled potholes with ponding water, 6 SF CS3, (See Photo 22).
-North Abutment Joint, SB lane, (3) potholes, (2) are patched 2’ L x up to 4’ W and (1) is 8” diameter x 1” deep, 8 SF CS2, 1 SF CS3, (Similar to Photo 21).
-North Abutment Joint, NB lane, left wheel line, 2’ L x 3’ W patch, 6 SF CS2.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
3220	*Crack (Wearing Surfac*	*1*	*2,256.00*	*sq.ft*	*0.00*	*0.00*	*2,256.00*	*0.00*

-Wearing surface, full length cracking with associated map cracking and rutting in the wheel lines of both NB and SB lanes throughout approximately 15% of the entire wearing surface, typically 1/8" W to 1/4"W, 2230 SF CS3, (Similar to Photo 15).
-South Abutment Joint, NB lane, 12’ L x up to 1/8” W transverse crack with adjacent spall, 11 SF CS3, (See Photo 15).
-North Abutment Joint, transverse cracking up to 1/8” W throughout, 15 SF CS3, (Similar to Photo 15).

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1080	Delamination/Spall/Patche	1	7.00	sq.ft	0.00	7.00	0.00	0.00

Underside of Deck:
-West overhang at Bent 3 Joint, edge spalling along the joint with (1) exposed reinforcing bar above Girder 4, 7 SF CS2.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1120	Efflorescence/Rust Stainin	1	149.00	sq.ft	0.00	64.00	85.00	0.00

STRUCTURE UNIT: **0**

Underside of Deck:
-All spans, both overhangs, transverse cracking with efflorescence throughout, typically 3’-4’ apart x up to 1/8” W, 85 SF CS3.
-All spans, Bays 1 and 3, transverse cracking with efflorescence throughout, typically 2'-3' apart x up to 1/32” W, 64 SF CS2.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1130	Cracking (RC and Other)	1	192.00	sq.ft	0.00	64.00	128.00	0.00

Underside of Deck:
-All spans, Bays 1 and 3, transverse cracking throughout, typically 2'-3' apart x up to 1/32” W, with and without efflorescence, 64 SF CS2.
-All spans, Bay 2, map cracking throughout, up to 1/16” W, 128 SF CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
107	**Steel Opn Girder/Beam**	**1**	**2,268.00**	**ft**	**517.00**	**60.00**	**1,691.00**	**0.00**

NOTE: Ratings for element 107 reflect conditions observed during the previous routine and element inspections performed.

Four (4) built-up steel girders, numbered from east (downstream) to west (upstream).

-The cross frames typically have painted over pitting 1/16” deep with isolated areas up to 1/4” deep and areas of reactivating corrosion.
-Bent 3, Bay 2, both cross frames, laminar corrosion throughout with up to 25% section loss of member.
-Span 4, Bay 2, 2nd diaphragm, lower horizontal member, 3" diameter corrosion hole at both girder connections and impact damage to angle 1 1/2" over 10” L.
-Span 4, Bay 2, lateral bracing, lower gusset plates at 2nd and 3rd cross frames have pack rust and corrosion holes up to 6” L x 2” W adjacent to Girder 3.
-Span 4, Bay 2, lower gusset plates at 2nd and 3rd cross frames, pack rust and corrosion holes up to 6" L x 2" W adjacent to Girder 3.
-Span 6, Bay 1 at Bent 5, adjacent to Girder 1, lower bracing, 100% section loss on bottom flange over 10” L x up to 1 1/2" deep.
-Span 6, Bay 2, 2nd cross frame lower strut adjacent to Girder 3, (2) corrosion holes up to 3" diameter and there are small corrosion holes adjacent to Girder 2 at the 2nd and 3rd cross frame.
-Span 8, Bay 2, 2nd lower strut, (2) missing bolts and (1) corrosion hole, 5” L x 2” W.
-Span 8, Bay 2, 3rd lower strut, missing bolts and (1) corrosion hole, 4” L x 1 1/2” W.
-Span 9, Bay 1 at Bent 9, adjacent to Girder 1, lower bracing, 100% section loss on bottom flange over 1’ L x up to 1” W.
-North Abutment, Girder 3, Bay 2, lateral bracing has (3) missing/ loose anchor bolts and a deformed gusset plate.

POSTE Note 09/02/24:
-No observed signs of stress or noted defects at the time of inspection.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
515	Steel Protective Coating	1	25,344.00	sq.ft	0.00	21,542.00	3,802.00	0.00
3420	*Peel/Bub/Crack(Stl Prc*	*1*	*3,802.00*	*sq.ft*	*0.00*	*0.00*	*3,802.00*	*0.00*

Approximately 15% of the steel protective coating exhibits peeling/ bubbling, 3802 SF CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
3440	*Eff (Stl Protect Coat)*	*1*	*21,542.00*	*sq.ft*	*0.00*	*21,542.00*	*0.00*	*0.00*

The steel protective coating is substantially effective throughout, 21542 SF CS2.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1000	Corrosion	1	1,688.00	ft	0.00	0.00	1,688.00	0.00

STRUCTURE UNIT: 0

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4

-The bottom flange (top and bottom faces) of the exterior girders have peeling paint and moderate corrosion along the ends in each span, typically 4' L x 5” W, with up to 3/16" deep section loss, 160 LF CS3.

-The interior girder webs exhibit peeling paint and laminar corrosion randomly throughout (roughly 40%) with isolated areas of pitting up to 1/8” deep. The interior girder webs are similarly affected for 5% of it's area, 478 LF CS3.

-The exterior webs of the exterior girders have intermittent areas (roughly 15%) of painted over pitting up to 1/8" deep, 160 LF CS3,.

-The rivets along the bottom of the girder webs have painted over section loss and areas of peeling paint with moderate corrosion and section loss, typically up to 15%, 840 LF CS3.

-Span 2, Bay 1, top flange plate of Girder 1, intermittent areas of up to 2' L x 2" W x 1/2" deep painted over pitting, 10 LF CS3.

-Span 2, Girder 1, west face, 25’ L section of painted over pitting up to 1/8” deep, 25 LF CS3.

-Span 2, Girder 3, east face bottom flange, (2) missing rivets in 1' L area of up to 1" thick pack rust, 1 LF CS3.

-Bent 3, Bay 1, Girder 1 and 2 bottom flange connection, rivet heads have corrosion with up to 50% section loss, 2 LF CS3.

-Bent 3, Bay 1, Girder 2, web sliding plate, (3) missing bolts with heavy laminar corrosion, 1 LF CS3.

-Bent 3, Girder 1, top of sliding web plate, 5” H x 2” W area of 1/8” to 100% section loss, area of 100% loss is 1” W, 1 LF CS3, (See Photo 35).

-Span 4, Girder 3 splice and bottom flange, 3' L x up to 1/8" W pitting and rivet head corrosion with up to 25% section loss, as well as peeling paint, 3 LF CS3.

-Span 4, Girder 4 east face, near Bent 3, bearing stiffener, pack rust up to 1" thick at the base with four missing rivets, 1 LF CS3.

-Bent 5, Girder 1 web sliding plate, corrosion induced crack at the top 1” with heavy laminar corrosion around the crack, 1 LF CS3.

-Span 6, Bent 5, web stiffener above Girder 1 bearing, 3/16” thick pack rust causing a 1'-11” H x 1” deflection, 1 LF CS3.

-Span 8, Girder 3 at Bent 7, east face bearing stiffener, pack rust up to 3/4” and 100% section loss for bottom 5” x 1/2” W, 1 LF CS3.

-Span 10, Girder 1, east face at North Abutment, 3” L x 1/2” W area of 100% section loss, 1 LF CS3.

-Span 10, Girder 1, east face at North Abutment, (2) bearing stiffeners have effectively no remaining section at the lower 2" at the base. The eastern bottom flange has 2" L knife edging. This condition is similar at the Girder 4 East face, 2 LF CS3.

1020	Connection	1	6.00	ft	0.00	3.00	3.00	0.00

-Span 2, Girder 4, east face stiffeners, (3) abandoned plates with missing connection bolts, 3 LF CS2.

-Bent 3, Girder 2 web sliding plate, missing bolts and nuts and heavy laminar corrosion, 1 LF CS3.

-Bent 3, Girder 4 web sliding plate, heavy corrosion at the bolt slots and (2) missing bolts at the bottom, with a 2" H x 3" W area of 100% section loss, 1 LF CS3.

-Bent 5, Girder 2 web sliding plate, (1) missing connection bolt, 1 LF CS3.

7000	Damage	1	57.00	ft	0.00	57.00	0.00	0.00

-There are approximately 30 bent transverse stiffeners throughout the structure (see below for specific locations), 30 LF CS2.

-South and North Abutment girder seats, all the girder bottom flanges have deformations up to 1' 6" L x 1" deflection, 16 LF CS2.

-Span 1, Girder 4, east face, between 2nd and 3rd cross frame, (1) stiffener has a 1" deflection to the south, 1 LF CS2.

-Bent 8, Girder 1 exterior web stiffener, 2' 6” H x 1” deflection and the third stiffener to the north has a 8” H x 1” deflection, 4 LF CS2.

-Bent 9, Girder 1 exterior stiffeners, deflections, up to 1” in intermittent locations, 5 LF CS2.

-Span 9, Girder 4, east top flange near midspan, deformation, 6" L x 1" H, 1 LF CS2.

207	**Stl Tower**	**1**	**591.00**	**ft**	**0.00**	**0.00**	**445.00**	**146.00**

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4

NOTE: Ratings for element 207 reflect conditions observed during the previous routine and element inspections performed.

Typical defects for all Towers (unless otherwise noted, refer to the attached drawings for specific defects and their locations):

All original members typically have failing paint and laminar corrosion throughout with knife edging and section loss up to 10% of total cross-sectional area. Gusset plates typically have laminar corrosion around the incoming members with 1/8” deep section loss to the plate and incoming member. There is also pack rust up to 3/8” thick between the gusset plates and incoming members. Isolated rivet heads exhibit up to 25% section loss. There are random instances of distorted members, typically up to 1”.

All trestle towers typically have more advanced deterioration at the top level (Level 1) and throughout the lower levels from Towers 2 through 4. There is light to moderate vegetation throughout the bottom of Towers 2 through 4. All trestle towers have been retrofitted with bolted bracing members.

NOTE: The following are original section of the tower members:
-North and South face:
- **Columns:**
  - **All columns have 7/16" lacing bars, batten plates, and splice plates unless otherwise noted.**
  - **Bent 1: 11/16" web, 11/16" angle flanges, 1/2" batten plates/splice plates.**
  - **Bent 2, Levels 1 and 3: 7/16" web, 1/2" angle flanges, 7/16" - 1/2" batten plates/splice plates.**
  - **Bent 2, Level 2: 7/16" web, 9/16" angle flanges.**
  - **Bent 3, Level 1: 7/16" web, 7/16" angle flanges.**
  - **Bent 3, Level 2: 7/16" web, 9/16" angle flanges.**
  - **Bent 3, Level 3: 7/16" web, 3/4" angle flanges.**
  - **Bent 3, Level 4: 11/16" web, 3/4" angle flanges.**
  - **Bent 4, Level 1: 7/16" web, 7/16" angle flanges.**
  - **Bent 4, Levels 2 (all) and 3 (A&D): 7/16" web, 9/16" angle flanges.**
  - **Bent 4, Levels 3 (B&C) and 4 (A&D): 7/16" web, 3/4" angle flanges.**
  - **Bent 4, Level 4 (B&C): 9/16" web, 5/8" angle flanges.**
  - **Bent 4, Level 5: 11/16" web, 3/4" angle flanges.**
  - **Bent 5, Level 1: 7/16" web, 7/16" angle flanges.**
  - **Bent 5, Levels 2 (all) and 3 (A&D): 7/16" web, 9/16" angle flanges.**
  - **Bent 5, Levels 3 (B&C) and 4 (A&D): 7/16" web, 3/4" angle flanges.**
  - **Bent 5, Levels 4 (B&C) and 5 (A&D): 9/16" web, 5/8" angle flanges.**
  - **Bent 5, Level 5 (B&C): 5/8" web, 3/4" angle flanges.**
  - **Bent 5, Level 6 (A&D): 7/16" web, 1/2" angle flanges.**
  - **Bent 5, Level 6 (B&C): 5/8" web, 3/4" angle flanges.**
  - **Bent 6, Level 1 (A&D): 7/16" web, 1/2" angle flanges.**
  - **Bent 6, Level 1 (B&C): 7/16" web, 7/16" angle flanges.**
  - **Bent 6, Level 2: 7/16" web, 9/16" angle flanges.**
  - **Bent 6, Level 3: 7/16" web, 3/4" angle flanges.**
  - **Bent 6, Levels 4 (all) and 5 (A&D): 9/16" web, 5/8" angle flanges.**
  - **Bent 6, Levels 5 (B&C) and 6 (all): 5/8" web, 3/4" angle flanges.**
  - **Bent 7, Level 1: 7/16" web, 7/16" angle flanges.**
  - **Bent 7, Level 2: 7/16" web, 9/16" angle flanges.**
  - **Bent 7, Level 3: 7/16" web, 3/4" angle flanges.**
  - **Bent 7, Level 4 (A&D): 7/16" web, 1/2" angle flanges.**
  - **Bent 7, Level 4 (B&C): 5/8" web, 3/4" angle flanges.**
  - **Bent 8, Level 1: 7/16" web, 7/16" angle flanges.**
  - **Bent 8, Level 2 (A&B): 7/16" web, 3/4" angle flanges.**
  - **Bent 8, Level 2 (B&C): 7/16" web, 1/2" angle flanges.**
  - **Bent 9: 7/16" web, 7/16" angle flanges.**

STRUCTURE UNIT: 0

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4

•Horizontal bracing between Columns: 3/8" angles (top and bottom level) and 5/16" angles (middle levels), 5/16" lacing bars, 5/16" - 3/8" batten plates.
•Diagonal bracing between Columns: 5/16" angle flanges, 5/16" - 3/8" lacing bars and batten plates.
•Vertical bracing between Columns B & C: 5/16" angle flanges and batten plates.

-East and West face:
•Horizontal bracing between Bents: (2) channels 8X13.75, 7/16" lacing bars.
•Diagonal bracing between Bents: 3/8" angle flanges, 3/8" batten plates.
•Vertical bracing between Bents: 5/16" angle flanges and batten plates.

-All gusset plates at the very top and very bottom levels are assumed to be 1/2", the rest are 3/8".

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
515	Steel Protective Coating	1	8,149.00	sq.ft	0.00	5,966.00	2,183.00	0.00
3410	*Chalk(Steel Protect Co*	*1*	*204.00*	*sq.ft*	*0.00*	*0.00*	*204.00*	*0.00*

The towers exhibit chalking in isolated locations throughout, 204 SF CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
3440	*Eff (Stl Protect Coat)*	*1*	*7,944.00*	*sq.ft*	*0.00*	*5,966.00*	*1,978.00*	*0.00*

The steel protective coating on the trestle tower members range from substantially effective to limited effectiveness, 5966 SF CS2, 1978 SF CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1000	Corrosion	1	587.00	ft	0.00	0.00	442.00	145.00

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4

MON Note 18/03/24:

Priority 2 (High) Findings (repair within 3 years) (Total 145 LF CS4):

-Bent 4, Level 2, Column C: 50% of lacing bars on west face have 100% section loss, remaining bars on both faces have average 30% section loss, 32 LF=CS4.

-Tower 3, Level 2, Column A, horizontal bracing, near Bent 4: 50% section loss to entire member with holes throughout,1 LF=CS4.

-Bent 5, Level 1, lower section, Column D, horizontal bracing, gusset plate: North gusset plate has 9" H x up to 3" W area of 100% section loss at connection to Column D, 1 LF=CS4.

-Bent 5, Level 2, between Columns B and C, lower west diagonal bracing, connection to Column C: North angle exhibits (2) 10" L x up to 4" H holes with 1" x 3" remaining section. Remaining length of diagonal exhibits knife edging and pitting up to 3/16" deep, 16 LF=CS4.

-Bent 5, Level 2, Column D, horizontal bracing gusset plates: Heavy laminar corrosion with up to 100% section loss with 15% section remaining of the north gusset plate and repair plates becoming ineffective. The gusset plate is completely detached from the column 1 LF=CS4.

-Bent 5, Level 3, between Columns C and D, diagonal bracing, outboard angles: 10" L x up to full height section loss with adjacent corrosion holes, extreme deterioration up to 90% cross section reduction having no change from previous inspection, 30 LF=CS4.

-Bent 6, Level 4, between Columns B and C, vertical bracing: Severe corrosion throughout this member with up to 60% cross sectional loss, 9 LF=CS4.

-Bent 6, Level 4 and 5, Column C: All top lacing bars on the west side have 100% section loss. Remaining lacing bars on this column from here to the bottom have severe laminar corrosion with an average 75% section loss, 23 LF=CS4. (41 LF overlapping)

-Bent 6, Level 5, Column B: Almost all lacing bars on the west side of the column have 100% section loss; (6) bars with section loss remaining intact at time of inspection, 28 LF=CS4.

-Tower 4, Level 1, Column B, lower south diagonal bracing: Exterior angle of diagonal has 100% section loss to vertical leg and only 2-1/2" of section remaining on horizontal leg; angle is deformed 1/4" over 10" near section loss; gusset plate has 3" diameter corrosion hole, 1 LF=CS4.

-Tower 4, Level 1, Column B, upper north diagonal bracing: Interior angle of diagonal has 3" diameter corrosion hole in vertical leg of angle at connection, 1 LF=CS4.

-Tower 4, Level 1, Column B, upper south diagonal bracing: Exterior angle of diagonal has 100% section loss to vertical leg and only 2" of section remaining on horizontal leg; angle is deformed 1/4" over 10" near section loss, CS4. (overlapping)

-Tower 4, Level 3, Column C, lower north diagonal bracing: West angle has 4” H x 2” L area of 100% section loss adjacent to the gusset plate, and the east angle has 1/4” loss in same location. Combined for 50% loss of member cross sectional area, 1 LF=CS4.

-Bent 7, Level 2, Column D, gusset plates: Corrosion, heavy laminar corrosion with diagonal lateral bracing corroded away and detached, 1 LF=CS4.

NOTE: The defects in the attached drawings account for 473 LF CS3. This quantity typically includes laminar corrosion and knife edging throughout the members.

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1020	Connection	1	4.00	ft	0.00	0.00	3.00	1.00

NOTE: The defects in the attached drawings account for 3 LF CS3, 1 LF CS4. This quantity typically includes deteriorated or missing rivet heads at connections throughout the towers.

215	**Re Conc Abutment**	**1**	**104.00**	**ft**	**59.00**	**40.00**	**5.00**	**0.00**

NOTE: Ratings for element 215 reflect conditions observed during the previous routine and element inspections performed.

-South Abutment has moss growth on both east and west ends.
-The stone masonry wingwalls are covered in vegetation.

POSTE Note 09/02/24:
-No observed signs of stress or noted defects at the time of inspection.

1080	Delamination/Spall/Patche	1	4.00	ft	0.00	0.00	4.00	0.00

-South Abutment, Bay 3, center section, spall, 1' 4” H x 8” W x 1” deep, 1 LF CS3.
-North Abutment, Girder 3 seat, failed repair, 2' 11” L x 10” H x 3” deep exposing (2) reinforcing bars with no section loss, 3 LF CS3.

1190	Abrasion(PSC/RC)	1	41.00	ft	0.00	40.00	1.00	0.00

-North Abutment, center section, up to 1/4” deep scaling throughout, 40 LF CS2.
-North Abutment, west end of center section, honeycombing, up to 2’ H x 1” W x 1” deep, 1 LF CS3.

220	**Re Conc Pile Cap/Ftg**	**1**	**80.00**	**ft**	**59.00**	**9.00**	**12.00**	**0.00**

NOTE: Ratings for element 220 reflect conditions observed during the previous routine and element inspections performed.

Four (4) tower columns that are labeled from downstream (Column A) to upstream (Column D).

UWI Notes 01/03/2023:
Bent 5, Column A, Footing - Exposed, up to 4' H, founded on rock (See Photo 9).
Bent 5, Column B, Footing - Exposed up to 1.4' H and a bottom rock layer of 1.6' H (See Photo 10).
Bent 5, Column D, Footing - Exposed, up to 1' W X 3' H x 1.5' D.

POSTE Note 09/02/24:
-No observed signs of stress or noted defects at the time of inspection.

1080	Delamination/Spall/Patche	1	6.00	ft	0.00	0.00	6.00	0.00

-Bent 4, Column D, footing, southeast corner, 11" W x 1' 7" H x 2 1/2" deep corner spall, 1 LF CS3.
-Bent 5, Column C, footing, southwest corner, 5' W x 1' 4" H x 1' deep spall, 5 LF CS3.

1190	Abrasion(PSC/RC)	1	3.00	ft	0.00	0.00	3.00	0.00

-Bent 5, Column C, footing, base of pedestal on west side, 3' x 2' abrasion with course aggregate exposed and missing, 3 LF CS3.

6000	Scour	1	12.00	ft	0.00	9.00	3.00	0.00

UWI Notes 01/03/2023:
Bent 5, Column D, Footing - Void, 8'W x 3' H x 4.8' D on upstream end and 3' D at exposed footing, 8 LF CS2.
Bent 6, Column A, Footing - Undermined, 3' L x 2' H x 1.5' D, 3 LF CS3 (See Photo 14).
Bent 6, Column A, Footing - Void below southwest corner, 8" L x 6" H x 9" D, 1 LF Cs2 (See Photo 15).
Bent 6, Column B, Footing - Undermined, up to 4" H x 6" D, 1 LF CS2 (See Photo 16).

301	**Pourable Joint Seal**	**1**	**269.00**	**ft**	**237.00**	**3.00**	**29.00**	**0.00**

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4

NOTE: Ratings for element 301 reflect conditions observed during the previous routine and element inspections performed.

-All deck joints have been paved over for the full-length of the travel lanes, the condition of these joints from the top of deck was unobservable during the inspection (excluding the areas of metal exposure due to potholes in the asphalt overlay).
-Bent 3, center joint, vegetation growth into the joint from the underdeck at the east overhang.
-North Abutment Joint, NB lane, exposure of steel plate with minor corrosion through pothole has been patched. (3 LF overlapping).

POSTE Note 09/02/24:
-No observed signs of stress or noted defects at the time of inspection.

2310	Leakage	1	28.00	ft	0.00	0.00	28.00	0.00

-Both abutments, below the joints, moisture staining, 20 LF CS3.
-Bent 3 Joint, Bay 2, active leakage, 8 LF CS3, (See Photo 46).

2330	Seal Damage	1	1.00	ft	0.00	0.00	1.00	0.00

-Bent 9 Joint, SB lane, exposure of partially pulled out joint material through pothole, 1 LF CS3, (See Photo 21).

311	**Moveable Bearing**	**1**	**20.00**	**each**	**0.00**	**8.00**	**12.00**	**0.00**

NOTE: Ratings for element 311 reflect conditions observed during the previous routine and element inspections performed.

Moveable Bearing Locations (Based on Design Plans): South Abutment, Bent 3, Bent 5, Bent 7, Bent 9

POSTE Note 09/02/24:
-No observed signs of stress or noted defects at the time of inspection.

515	Steel Protective Coating	1	40.00	sq.ft	0.00	40.00	0.00	0.00
3420	*Peel/Bub/Crack(Stl Prc*	*1*	*40.00*	*sq.ft*	*0.00*	*40.00*	*0.00*	*0.00*

The steel protective coating of all moveable bearings is in satisfactory condition, 40 SF CS2.

1000	Corrosion	1	14.00	each	0.00	8.00	6.00	0.00

-All moveable bearings typically have light to moderate peeling paint with minor corrosion at the exposed surfaces and typically negligible section loss throughout, 8 EA CS2.
-South Abutment bearings, moderate corrosion with minor section loss, 4 EA CS3.
-Bent 3, Span 4, Girder 2 bearing, four bolts with 100% section loss, 1 EA CS3.
-Bent 3, Span 4, Girder 4 bearing, peeling paint and heavy corrosion throughout. The bottom plate has 10% section loss along the edges and pack rust on the north side, 1 EA CS3.

1020	Connection	1	6.00	each	0.00	0.00	6.00	0.00

-Bent 3, Span 4, Girder 2 bearing, missing southeast and northwest anchor bolts, 1 EA CS3.
-Bent 3, Span 4, Girder 3 bearing, missing northeast anchor bolt, 1 EA CS3.
-Bent 3, Span 4, Girder 4 bearing, missing west anchor bolt, 1 EA CS3.
-Bent 7, Span 8, Girder 2 bearing, missing southeast anchor bolt, 1 EA CS3.
-Bent 7, Span 8, Girder 3 bearing, missing SE, SW & NW anchor bolts, missing NE anchor nut, 1 EA CS3,.
-Bent 7, Span 8, Girder 4 bearing, missing east anchor bolt, 1 EA CS3.

313	**Fixed Bearing**	**1**	**24.00**	**each**	**0.00**	**15.00**	**9.00**	**0.00**

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4

NOTE: Ratings for element 313 reflect conditions observed during the previous routine and element inspections performed.

Fixed Bearing Locations (Based on Design Plans): Bent 1, Bent 2, Bent 4, Bent 6, Bent 8, North Abutment

POSTE Note 09/02/24:
-No observed signs of stress or noted defects at the time of inspection.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
515	Steel Protective Coating	1	48.00	sq.ft	0.00	48.00	0.00	0.00
3420	*Peel/Bub/Crack(Stl Prc*	*1*	*48.00*	*sq.ft*	*0.00*	*48.00*	*0.00*	*0.00*

The steel protective coating of all fixed bearings is in satisfactory condition, 48 SF CS2.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1000	Corrosion	1	23.00	each	0.00	15.00	8.00	0.00

-All fixed bearings typically have light to moderate peeling paint with minor corrosion at the exposed surfaces and typically negligible section loss throughout, 14 EA CS2.
-Bent 4, Span 5, Girder 1 bearing, peeling paint and heavy corrosion throughout. The bottom plates have 10% section loss, 1 EA CS3.
-Bent 4, Girder 4 bearing, heavy corrosion on the anchor bolts with up to 30% section loss, 1 EA CS3.
-Bent 8, Girder 1 bearing, minor surface corrosion around the bearing and anchor bolts, 1 EA CS2.
-Bent 8, Girder 4 bearing, up to 1/8” laminar corrosion, 1 EA CS3.
-Bent 9, Span 9, Girder 1 bearing, up to 1/4" thick laminar corrosion, 1 EA CS3.
-North Abutment bearings, up to 1/8” thick laminar corrosion, 4 EA CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1020	Connection	1	1.00	each	0.00	0.00	1.00	0.00

-Bent 3, Span 3, Girder 2 bearing, missing south anchor bolt, 1 EA CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
331	**Re Conc Bridge Railing**	**1**	**1,073.00**	**ft**	**0.00**	**1,073.00**	**0.00**	**0.00**

NOTE: Ratings for element 331 reflect conditions observed during the previous routine and element inspections performed.

Total quantity changed from 1062 LF to 1074 SF due to 536.7' structure length x 2 railings per field measurements.

The bridge railings are composed of concrete and are 30” H, failing to meet FHWA minimum height requirements.

POSTE Note 09/02/24:
-No observed signs of stress or noted defects at the time of inspection.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
7000	Damage	1	1,073.00	ft	0.00	1,073.00	0.00	0.00

NOTE: The following note should be coded under 1190 Abrasion, however this defect type is not included in Element 331. It is coded here as 7000 Damage instead.

The railings are scaled throughout, typically 1/8” D, and are covered with moss on the vertical faces, 1062 LF CS2.

Work Candidates

Assigned to In-House Maintenance

Status	Priority	Action	Date Proposed	Notes
Unknown	3 - Medium		03/01/2023	Replace/repair missing or heavily weathered delineators at the top of the bridge railing.
Unknown	3 - Medium		03/22/2022	Resurface approach roadways.

Assigned to Maintenance Contract

Status	Priority	Action	Date Proposed	Notes
Unknown	3 - Medium		03/19/2021	Fill voids and undermined areas at Bent 5 and Bent 6 foundations.
Unknown	3 - Medium		03/21/2022	Replace missing/decayed inspection/maintenance access planks.
Unknown	3 - Medium		03/19/2021	Repair deck joints.

Assigned to Project(not Maintenance)

Status	Priority	Action	Date Proposed	Notes
Unknown	2 - High		03/21/2022	Conduct a load rating and seismic load rating analysis on the steel tower to determine the current capacity and the susceptibility of the bridge under seismic conditions.
Unknown	2 - High		03/01/2023	The current load rating from 8/19/2017 was completed using rating of; Item 58, Deck: 7, Item 59, Superstructure: 7, and Item 60, Substructure: 7 with a condition factor of: 1.00. Based on the current inspection and current ratings of; Item 58, Deck: 7, Item 59, Superstructure: 5, and Item 60, Substructure: 3 an updated load rating is recommended. The current load rating summary sheet from 8/19/2017 is included in this report.

WORK DONE SINCE LAST INSPECTION

NOTES RTN 03/18/2024:

Towers:
Bent 4, Level 3, Column A above lower connection, looking west. Retrofit, four interior and three exterior lacing bars cut or removed, (CS3). - Repaired
-Bent 4, Level 3, horizontal bracing at gusset plates at Column A, horizontal bracing gusset plate has 100% section loss on all sides. This member is not connected to column A anymore, (CS4). - Repaired

TRAFFIC SAFETY FEATURES NOTES

NOTE: Ratings for traffic safety features reflect conditions observed during the previous routine and element inspections performed.

36A - Bridge Railings: 2'-6" H bridge railings and a 10" H curb.
36B - Transitions: W-beam with 3' post spacing and metal offsets.
36C - Approach Guardrail: 28.5" H W-beams with 6'-3" post spacing and metal offsets.
36D - Approach Guardrail Ends: Southwest, northwest, and northeast ends are flared and anchored into the embankment. Southeast end is a FLEAT end terminal.

-North and south approach roadways, depressed and worn surface in wheel lines of both lanes; up to 1/2" wide map cracks throughout, some with vegetation growth, (See Photo 52).

-East railing, south end, (2) reinforcing bars sticking out of concrete towards NB traffic, (See Photo 53).
-Southwest, northwest, and northeast approach guardrails, minor corrosion throughout.
-Southwest guardrail, (3) areas of impact damage, typically 1' 1” L x 1” deflection.
-Southeast guardrail, (1) rotated post.
-Northwest guardrail, 2’ L x 1” deflection area of impact damage at the abutment.
-Northeast guardrail, (2) areas of impact damage, (1) 10’ L x 3” deflection and (1) 2’ L x 2” deflection, (See Photo 54).
-Delineators at the top of the bridge rail are heavily weathered or missing.

Inspector: **Signature:** Sang Yoon Kim **Phone:** 888-451-6822

Inspector: **Signature:** **Phone:**

Team Leader: **Signature:** Jac[illegible] Dahlgren **Phone:** 888-451-6822

Office: Consor Engineers, LLC **Certification Date:** 05/19/2022

BIP Leader: **Signature:** **QC Date:**

Office:


3/23/2024

Photograph 1. East (downstream) elevation, looking west.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Photograph 2. West (upstream) elevation, looking east.

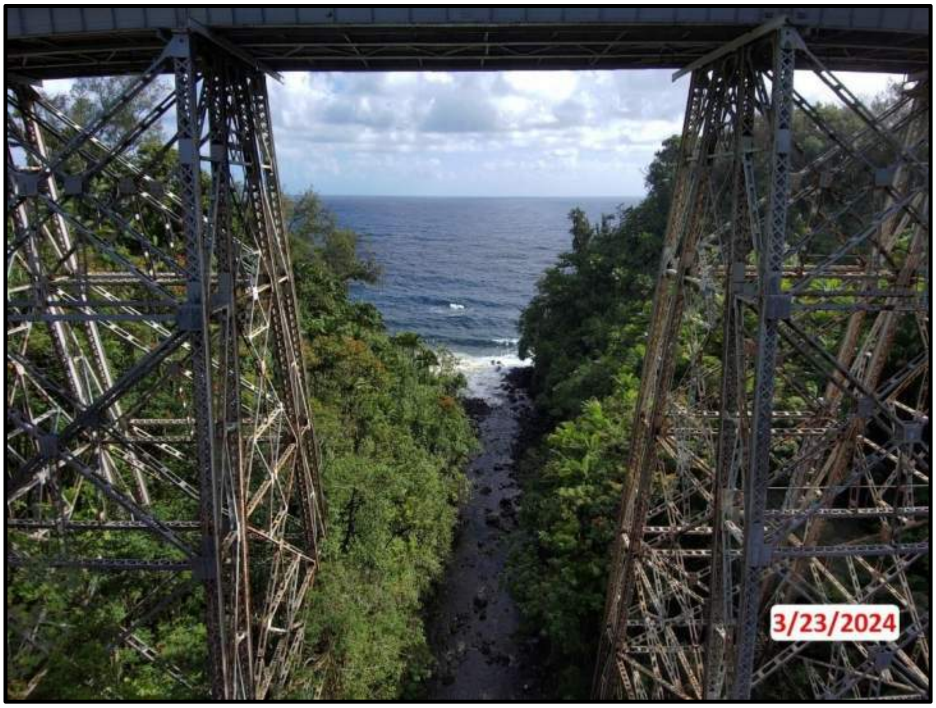
Photograph 3. South approach, looking north.

Photograph 4. North approach, looking south.

Photograph 5. Upstream channel, looking west.

Photograph 6. Downstream channel, looking east.

Photograph 7. Bent 1 at Tower 1 (north face shown), looking south.



Photograph 8. Typical towers (Bents 5 and 6 at Towers 3 and 4 shown, respectively), looking east.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Photograph 9. Bent 1, Level 1, lower section, Column A, looking northwest. Typical pitting, pack rust and laminar corrosion, CS3.


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Photograph 10. Bent 1, Level 1, lower section, Column D, west face, lacing bars, looking east. (2) with corrosion holes, up to 2" diameter, CS3.


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Photograph 11. Bent 1, Level 1, Column D, south face, looking north. Scattered rivets with up to 100% section loss, CS3.


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Photograph 12. Bent 2, Level 1, upper section, between Columns A and B, diagonal bracing, both cover plates at mid-length, looking north. Pack rust up to 3/4" thick causing separation of plate and one broken rivet on both cover plates, CS3.

Photograph 13. Bent 2, Level 1, upper section, between Columns B and C, horizontal bracing, west face, lacing bars, looking north. (3) with 50% section loss and (1) with 90% section loss, CS3.

Photograph 14. Bent 2, Level 1, lower section, between Columns A and B, horizontal bracing, south face of angle, looking north. 1' 8” L x 1” H area of up to 100% section loss, with (3) lacing bars up to 75% section loss. The south angle has approximately 30% section loss near Column A. Angle original section is 3” x 4-1/2”, remaining is 1-1/2” x 3-3/4”, CS3.

Photograph 15. Bent 2, Level 1, lower section, Column D, lower horizontal gusset plate, looking south. Laminar corrosion up to 100% section loss with knife edging, painted over pitting, and 4” corrosion hole, CS3.

Photograph 16. Bent 2, Level 2, Column D, 7' from Level 1, east face, lacing bar, center rivet head, looking west. 100% section loss, CS3.

Photograph 17. Bent 2, Level 2, between Columns C and D, diagonal bracing, near short horizontal, batten plate, interior rivet heads, looking west. All have 100% section loss, CS3.

Photograph 18. Bent 2, Level 2, between Columns B and C, horizontal bracing near Column B, along flanges, looking north. Knife-edging with up to 1-1/2" L x 1" W corrosion holes, CS3.

Photograph 19. Bent 2, Level 2, east of Column D, horizontal and diagonal bracing gusset plates, looking northwest. Typical heavy laminar corrosion and knife edging, CS3.

Photograph 20. Bent 2, Level 3, north of Column A, west gusset plate, looking south. Pack rust up to 1/4" thick, CS3.


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Photograph 21. Tower 2, Level 1, north of Column A, diagonal bracing gusset plate, looking southwest. (1) missing rivet with pack rust up to 1/2" thick, CS3.


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Photograph 22. Tower 2, Level 1, Column A , upper north diagonal bracing, near Bent 3, looking north. Vertical leg of interior angle near Column A connection, 6" L x 2" H corrosion hole. Exterior leg has area of pack rust causing separation of gusset plate up to 1". Rest of this member has multiple areas of knife-edging along interior angle over 8' length with individual areas up to 1" x 6" exhibiting 100% section loss, CS3.

Photograph 23. Tower 2, Level 1, Column B, lower north diagonal bracing, both angle legs, looking west. Up to 1' L x 1-1/2" W isolated areas of 100% section loss along full member length, CS3.

Photograph 24. Tower 2, Level 2, Column A, upper south diagonal and gusset plate at Column A connection, looking west. Interior angle, 8" L x 3" W area of 100% section loss, CS3.

Photograph 25. Tower 2, Level 3, Column B, horizontal bracing, looking northeast. Numerous rivet heads with up to 100% section loss, CS3.

Photograph 26. Tower 2, Level 3, Column B, horizontal bracing, looking northwest. Multiple up to 3/4" diameter corrosion holes throughout, and covered in vegetation, CS3.

Photograph 27. Tower 2, Level 1, Column C, both center gusset plates, looking northeast. Pack rust at the incoming angles up to 1/2” thick; Laminar corrosion adjacent to angles throughout with up to 1" diameter x 100% section loss, CS3.

Photograph 28. Tower 2, Level 1, Column D, upper north diagonal bracing, top face of batten plate, west rivet heads, looking north. (1) of (3) missing, CS3.

Photograph 29. Tower 2, Level 1, Column D, center west gusset plate, looking north. (1) missing rivet, CS3.

Photograph 30. Tower 2, Level 1, Column D, upper north diagonal bracing, looking west. Heavy knife-edging and up to 6" L x 2" H corrosion holes, CS3.

Photograph 31. Tower 2, Level 2, Column D, vertical bracing, looking north. Up to 1/8" deep pitting with scattered areas of knife-edging, CS3.

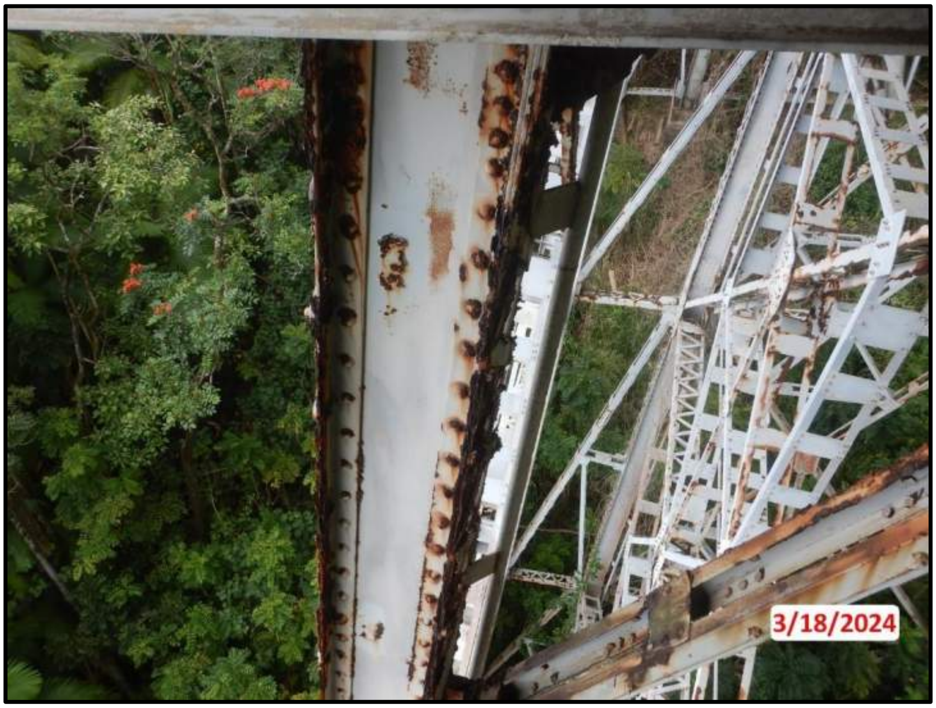
Photograph 32. Tower 2, Level 2, Column D, horizontal bracing, looking north. Pinholes (corrosion holes) throughout the length, CS3.

Photograph 33. Tower 2, Level 4, Column D, lower diagonal bracing, looking south. Heavy growth with trees growing through the members.

Photograph 34. Bent 3, Level 1, upper section, Column B, top gusset plate and longitudinal bracing, looking southeast. Laminar corrosion and areas of section loss on members and rivet heads due to active water leakage from the bridge, CS3.

Photograph 35. Bent 3, Level 1, upper section, west of Column A, north gusset plate, looking south. Knife edging and corrosion holes up to 3” x 2” along bottom edge of gusset plate, CS3.

Photograph 36. Bent 3, Level 1, upper section, between Columns B and C, center gusset plates, looking southeast. Laminar corrosion on plates and transverse bracing members, CS3.



Photograph 37. Bent 3, Level 1, upper section, Column A, exterior face edges over top 12', looking south. Widespread laminar corrosion, CS3.

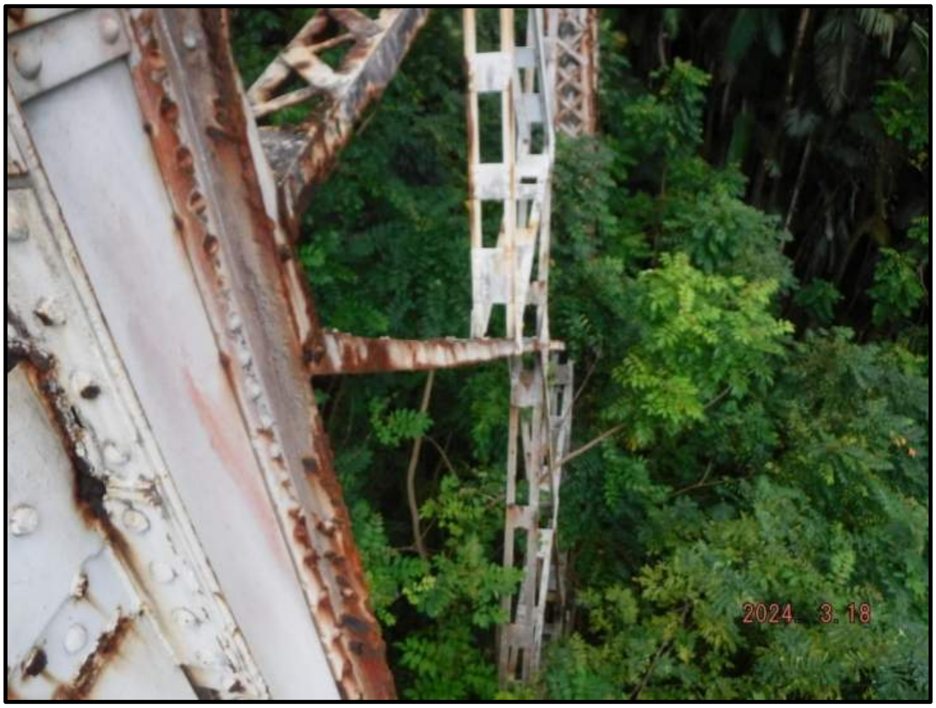
Photograph 38. Bent 3, Level 1, lower section, between Columns B and C, lower east diagonal bracing near Column B, adjacent to batton plates top flange of angles, looking west. Knife-edging with areas of 4" L x 2" W of up to 100% section loss, CS3.

Photograph 39. Bent 3, Level 1, lower section, Columns A and B, horizontal bracing, looking east. Pack rust up to 1-1/2" thick with section loss up to 30% to gusset plates and 100% loss to rivet heads of batten plate, CS3.

Photograph 40. Bent 3, Level 2, Column B, looking west. 2-1/2" diameter corrosion hole in southeast angle above horizontal brace connection, CS3.

Photograph 41. Bent 3, Level 2, between Columns B and C, horizontal bracing, looking south. Knife-edging with up to 1-1/2" diameter corrosion holes on both flanges, CS3.

Photograph 42. Bent 3, Level 2, between Columns A and B, horizontal bracing, south flange, horizontal leg, looking north. 9" L x full-width of angle area of 100% section loss, CS3.



Photograph 43. Bent 3, Level 3, between Columns B and C, upper east diagonal, looking west. Bowed up to 1" out of plane over full length, CS3.

Photograph 44. Bent 3, Level 4, Column B, (1) lacing bar, looking east. 100% section loss on both ends on the west column face, CS3.

Photograph 45. Bent 3, Level 4, Column A, just above bearing, gusset plates, looking east. Plates have minor distortion and bowed to the south less than 1/8" due to laminar corrosion, CS3.

Photograph 46. Bent 4, Level 1, upper section, Column D, upper gusset plates, looking northwest. Heavy laminar corrosion and approximately 1/4" to 3/8" remaining section on gusset plate between diagonal and horizontal bracing member, CS3.

Photograph 47. Bent 4, Level 1, lower section, between Columns A and B, horizontal bracing, looking west. Vertical legs have knife-edging with areas of up to 100% section loss and corrosion holes up to 1" diameter. (1) lacing bar has 100% section loss and batten plate has area of 100% loss, CS3.

Photograph 48. Bent 4, Level 2, Column A, exterior gusset plate, looking northeast. Corrosion, pack rust up to 1" thick with areas of up to 100% loss and only retrofit gusset plate remaining, CS3.

Photograph 49. Bent 4, Level 2, Column C, looking north. 50% of lacing bars on west face have 100% section loss, remaining bars on both faces have average 30% section loss, CS4.

Photograph 50. Bent 4, Level 2, between Columns B and C, horizontal bracing adjacent to Column C, vertical connection, interior top flange along member, looking east. (7) corrosion holes, up to full width of top flange x 5" L, CS3.

Photograph 51. Bent 4, Level 3, Column A above lower connection, looking west. Retrofit, four interior and three exterior lacing bars cut or removed, (CS3). - Repaired.

Photograph 52. Bent 4, Level 3, between Columns C and D, diagonal bracing, looking northeast. 3' L x full width of angle area of up to 100% section loss to top flanges, CS3. -Note this member has been retrofitted and retrofit is in good condition.

Photograph 53. Bent 4, Level 4, Column B, west face, cover plate, looking east. Corrosion hole, 8" W x 5" H, CS3.

Photograph 54. Bent 4, Level 4, Column C, flanges, looking east. Knife-edging, CS3.

Photograph 55. Bent 4, Level 5, Column C, west face, (6) lacing bars, looking east. 100% section loss, CS3.

Photograph 56. Tower 3, Level 1, Column A, horizontal and vertical bracing gusset plate, looking southeast. Up to 85% section loss, full length x 2" H, CS3.

Photograph 57. Tower 3, Level 1, Column A, horizontal bracing, lower batten plate, looking south. Corrosion hole, 5" L x 10" W, CS3.

Photograph 58. Tower 3, Level 1, Column A, horizontal bracing, looking south. Heavy pitting and laminar corrosion with up to 80% section loss. Few lacing bars exhibit 100% section loss and knife-edging. Channel legs exhibit scattered knife-edging, CS3.

Photograph 59. Tower 3, Level 1, Column B, lower north diagonal bracing, looking southwest. Worst case is a 4" diameter corrosion hole near center gusset plate. Approximately 40% loss in cross sectional area, CS3.

Photograph 60. Tower 3, Level 2, Column A, horizontal bracing, near Bent 4, looking northwest. 50% section loss to entire member with holes throughout, CS4.

Photograph 61. Tower 3, Level 2, Column A, upper south to lower north diagonal bracing, looking north. Global distortion to the diagonal members within level. Upper south diagonal bracing, east leg has corrosion holes, up to 1” diameter, CS3.

Photograph 62. Tower 3, Level 2, Column B, horizontal bracing, looking southwest. Numerous corrosion holes, up to 6" L x 3" H throughout full length of both channels, CS3.

Photograph 63. Tower 3, Level 3, Column A, lower south diagonal, and vertical bracing, looking southeast. Repair in good condition.

Photograph 64. Tower 3, Level 3, Column A, Bent 5, interior and exterior gusset plates, between horizontal and lower diagonal bracing, looking west. Pack rust with section loss, CS3.

Photograph 65. Tower 3, Level 4, Column B, center gusset plate, looking northwest. Numerous corrosion holes on both gusset plates, CS3.

Photograph 66. Tower 3, Level 1, Column C, upper south to lower north diagonal bracing, looking northeast. Up to 6" L x 2" H corrosion holes with knife edging throughout both angles, CS3.

Photograph 67. Tower 3, Level 3, Column D, Bent 4 gusset plate, looking south. Heavy laminar corrosion with up to 50% section loss, CS3.

Photograph 68. Tower 3, Level 4, Column C, vertical bracing, looking east. Heavy corrosion of angles and batten plates on vertical with knife-edging, pitting up to 3/16" deep and corrosion holes up to 5" diameter, CS3.

Photograph 69. Tower 3, Level 6, Column D, upper horizontal bracing, looking northwest. Vegetation, tree growing through members.

Photograph 70. Bent 5, Level 1, upper section, Column C, north gusset plate, looking southeast. (1) 1" diameter and (1) 2" diameter corrosion hole, CS3.

Photograph 71. Bent 5, Level 1, lower section, between Columns A and B, lower horizontal bracing, looking west. Column A lower gusset plates exhibit up to 100% section loss above and below horizontal member with 5" L segments of 25% section left holding members. - Repaired

Photograph 72. Bent 5, Level 1, lower section, Column D, horizontal bracing, gusset plate, looking south. North gusset plate has 9" H x up to 3" W area of 100% section loss at connection to Column D, CS4. South gusset plate (6) corrosion holes up to 2" diameter and (1) on north gusset plate, CS3.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Photograph 73. Bent 5, Level 2, Column B, exterior gusset plate, looking south. Multiple corrosion holes up to 5" x 2-1/2" and pitting up to 1/16" deep in exterior gusset plate; interior rivet heads at connection to column typically have up to 100% section loss in this location, CS3.


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Photograph 74. Bent 5, Level 2, between Columns B and C, lower west diagonal bracing, connection to Column C, looking south. North angle exhibits (2) 10" L x up to 4" H holes with 1" x 3" remaining section. Remaining length of diagonal exhibits knife-edging and pitting, CS4.

Photograph 75. Bent 5, Level 2, Column D, horizontal bracing gusset plates, looking south. Heavy laminar corrosion with up to 100% section loss with 15% section remaining of the north gusset plate and repair plates becoming ineffective. The gusset plate is completely deteached from the column, CS4.

Photograph 76. Bent 5, Level 3, Column A, (9) lacing bars, looking west. Removed from column, CS3.

Photograph 77. Bent 5, Level 3, between Columns C and D, diagonal bracing, outboard angles, looking south. 10" L x up to full height section loss with adjacent corrosion holes, extreme deterioration up to 90% cross section reduction having no change from previous inspection, CS4.

Photograph 78. Bent 5, Level 4, Column B, vertical at southeast flange splice, looking north. Column is deformed, 1' 10" L x 1" deflection, CS3.

Photograph 79. Bent 5, Level 4, Column B, west cover plate, looking east. Corrosion hole, 9" diameter, CS3.

Photograph 80. Bent 5, Level 5, Column B interior splice plate rivets, looking northwest. Up to 100% section loss, corrosion, CS3.

Photograph 81. Bent 5, Level 5, between Columns B and C, horizontal bracing, top and bottom lacing bars, looking east. Up to 100% section loss, CS3.

Photograph 82. Bent 5, Level 6, between Columns B and C, vertical bracing, looking east. Up to 25% section loss and pitting up to 1/8" deep, CS3.

Photograph 83. Bent 5, Level 6, Column C, footing, southwest corner, looking east. Spall, 5' H x 1' 4" W x up to 10" deep, CS3.

Photograph 84. Bent 5, Level 6, Column C, footing, base of pedestal on west side, looking east. 6' x 2' area of abrasion with course aggregate exposed and missing up to 4" deep, CS3.

Photograph 85. Bent 6, Level 1, upper section, between Columns C and D, horizontal bracing, looking north. Heavy pitting with 1' 6" L x 2" H area of 100% section loss, CS3.

Photograph 86. Bent 6, Level 2, between Columns B and C, lower west diagonal bracing near Column C, north angle vertical leg, looking southeast. Corrosion hole, 3” L x 2” H, CS3.

Photograph 87. Bent 6, Level 2, between Columns C and D, horizontal bracing, all (4) lacing bars, looking southeast. 100% section loss, CS3.

Photograph 88. Bent 6, Level 3, west of Column B, south gusset plate, looking north. 1-1/2" W x 8" H area of 100% section loss, CS3.

Photograph 89. Bent 6, Level 3, Column C, south face cover plate, looking north. 50% of rivet heads have up to 20% remaining section, CS3.

Photograph 90. Bent 6, Level 4, Column B, exterior gusset plate at horizontal bracing, looking south. 3-1/2" diameter corrosion hole, CS3.

Photograph 91. Bent 6, Level 4, between Columns B and C, vertical bracing, looking east. Severe corrosion throughout this member with up to 60% cross sectional loss, CS4.

Photograph 92. Bent 6, Level 4, between Columns B and C, lower west diagonal adjacent to Column C, looking northwest. Corrosion holes and knife-edging at exterior vertical flange and section of missing vertical flange at lower end for 1' 6" L, CS3.

Photograph 93. Bent 6, Level 4, between Columns B and C, lower east diagonal bracing, looking west. Large tree leaning heavily on bracing, CS3.

Photograph 94. Bent 6, Level 5, Column B, looking east. Almost all lacing bars on the west side of the column have 100% section loss; (6) bars remaining intact at time of inspection, CS4.

Photograph 95. Bent 6, Level 5, between Columns A and B, horizontal bracing web members, looking southeast. Up to 75% section loss throughout, CS4.

Photograph 96. Bent 6, Level 5, Column A, gusset plate at horizontal bracing, looking northeast. 75% section loss with corrosion holes, CS3.

Photograph 97. Bent 6, Level 6, between Columns A and B, horizontal bracing, looking northeast. Damage, member impacted by falling rocks, CS3.

Photograph 98. Bent 6, Level 6, between Columns B and C, lower east diagonal at third point closest to Column B, looking east. Missing batten plate, CS3.

Photograph 99. Bent 6, Level 6, between Columns B and C, mid-length vertical bracing above crossing horizontal, looking west. Detached batten plate, CS3.

Photograph 100. Tower 4, Level 1, Column B, lower south diagonal bracing, looking northwest. Exterior angle of diagonal has 100% section loss to vertical leg and only 2-1/2" of section remaining on horizontal leg; angle is deformed 1/4" over 10" near section loss; gusset plate has 3" diameter corrosion hole, CS4.

Photograph 101. Tower 4, Level 1, Column B, upper north diagonal bracing, looking southwest. Interior angle of diagonal has 3" diameter corrosion hole in vertical leg of angle at connection, CS4.

Photograph 102. Tower 4, Level 1, Column B, upper south diagonal bracing, looking west. Exterior angle of diagonal has 100% section loss to vertical leg and only 2" of section remaining on horizontal leg; angle is deformed 1/4" over 10" near section loss, CS4.

Photograph 103. Tower 4, Level 3, Column A, vertical bracing, looking southeast. Section loss, exterior leg with 80% loss. - Repaired. Top connection bolts of repaired section is not painted and exhibits surface corrosion, CS2.

Photograph 104. Tower 4, Level 4, Column B, looking south. All bracing in this level bowed up to 6" inwards (west); vertical member angles have deformations up to 1" over 2', CS3.

Photograph 105. Tower 4, Level 5, Column B, mid-diagonal bracing, interior angle, looking south. Twisted over full length with deformation up to 6" over 2' 6", CS3.

Photograph 106. Tower 4, Level 6, Column B, looking west. 3' diameter boulder on top of diagonal member at bottom connection; member appears to be deformed as a result.

Photograph 107. Tower 4, Level 2, Column C, vertical bracing, looking south. East angles bent out-of-plane 1/2" and west angle, (3) rivets have 90% section loss, CS3.

Photograph 108. Tower 4, Level 3, Column C, gusset plate connecting bracing to Bent 6, looking west. (14) of (18) rivet heads connecting the gusset plate to the column have 20% remaining on the inside face. East channel of bracing has more severe section loss at this location with (5) corrosion holes in the web up to 1" diameter, CS4.

Photograph 109. Tower 4, Level 3, Column C, lower north diagonal bracing, looking southeast. West angle has 4” H x 2” L area of 100% section loss adjacent to the gusset plate, and the east angle has 1/4” loss in same location. Combined for 50% loss of member cross sectional area, CS4.

Photograph 110. Tower 4, Level 4, Column C, gusset plate at Bent 6, looking east. (9) of (18) rivet heads connecting the gusset plate to the column have 10% remaining on the inside face, CS3.


03 18 2024

Photograph 111. Tower 4, Level 4, Column C, horizontal bracing, near center, looking south. Large tree growing though the structure (incidental).


03 18 2024

Photograph 112. Tower 4, Level 5, Column C, mid-diagonal mid-length, interior top angle, looking north. 100% section loss for most of length of horizontal flange. Approximately 20% loss of cross sectional area, CS3.

Photograph 113. Tower 4, Level 6, Column C, adjacent to Bent 6 pedestal, interior channel, looking north. 3" downward deformation over 1' 6" L, CS3.

Photograph 114. Bent 7, Level 1, upper section, Column A, gusset plate, looking south. (2) corrosion holes up to 1” diameter, CS3.

Photograph 115. Bent 7, Level 2, between Columns A and B, horizontal bracing and gusset plate at Column A, looking east. - Repaired and repair is in good condition.

Photograph 116. Bent 7, Level 2, between Columns B and C, lower west diagonal bracing, south angle, looking southwest. Heavy laminar corrosion and knife-edging over 4' L, CS3.

Photograph 117. Bent 7, Level 2, Column D, gusset plates, looking south. Corrosion, heavy laminar corrosion with diagonal lateral bracing corroded away and detached, CS4.

Photograph 118. Bent 7, Level 3, between Columns C and D, lower east diagonal, looking west. Tree growing against structure.

2024. 3. 18

Photograph 119. Bent 7, Level 3, Column B splice plate, looking south. Majority of connection rivets for Column B have section loss and corrosion, CS3.

2024. 3. 18

Photograph 120. Bent 7, Level 3, Column A, south horizontal bracing angle, looking northeast. 3" W x 4" H corrosion hole in vertical angle, CS3.

Photograph 121. Bent 7, Level 3, between Columns C and D, horizontal bracing, looking west. Up to 100% section loss to batten plates, knife edging on top flange angles, and missing lacing bars, CS3.

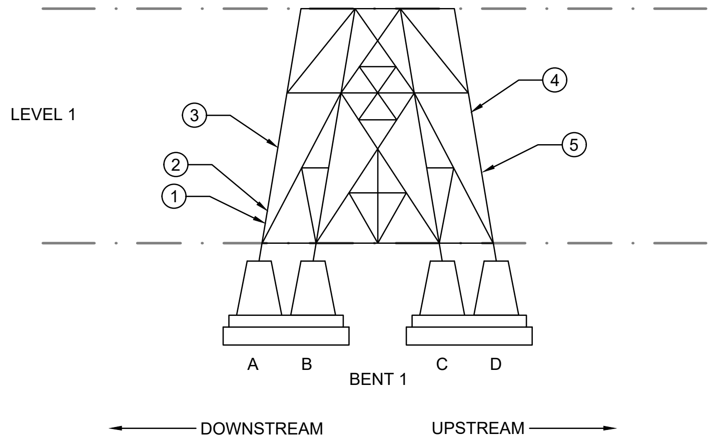
Photograph 122. Bent 8, Level 1, lower section, Column C, west face, (2) lacing bars, looking east. 100% section loss, CS3.

Photograph 123. Bent 8, Level 2, Column A, bottom section, north face angles and web, looking southeast. Painted over pitting, full height x up to 3/16" deep, CS3.

Photograph 124. Tower 5, Level 1, Columns C and D, center gusset, looking northeast. Pack rust up to 1" thick, CS3.

Photograph 125. Tower 5, Level 2, Column D, digonal bracing, lacing bars, looking east. Heavy laminar corrosion (similar ast Bent 8, Column D), CS3.

Photograph 126. Bent 9, Level 1, lower section, between Columns B and C, lower horizontal bracing center gusset plate, looking west. Heavy laminar corrosion, up to 1-1/4" W with up to 50% section loss, CS3.



Defect ID	Caption
1	Bent 1, Level 1, lower section, Column A, southwest flange, inside face, lacing bar rivet heads: (2) heads with 100% section loss, CS3, (Similar to Photo 11).
2	Bent 1, Level 1, lower section, Column A, east face, cover plate, north rivet head: (1) with 75% section loss, CS3, (Similar to Photo 89).
3	Bent 1, Level 1, lower section, Column A: Typical pitting, pack rust and laminar corrosion, CS3, (See Photo 9).
4	Bent 1, Level 1, lower section, Column D, west face, lacing bars: (2) with corrosion holes, up to 2" diameter, CS3, (See Photo 10).
5	Bent 1, Level 1, Column D, south face: Scattered rivets with up to 100% section loss, CS3, (See Photo 11).

NOTE:
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SCALE: 1/32" = 1'

MARCH, 2024

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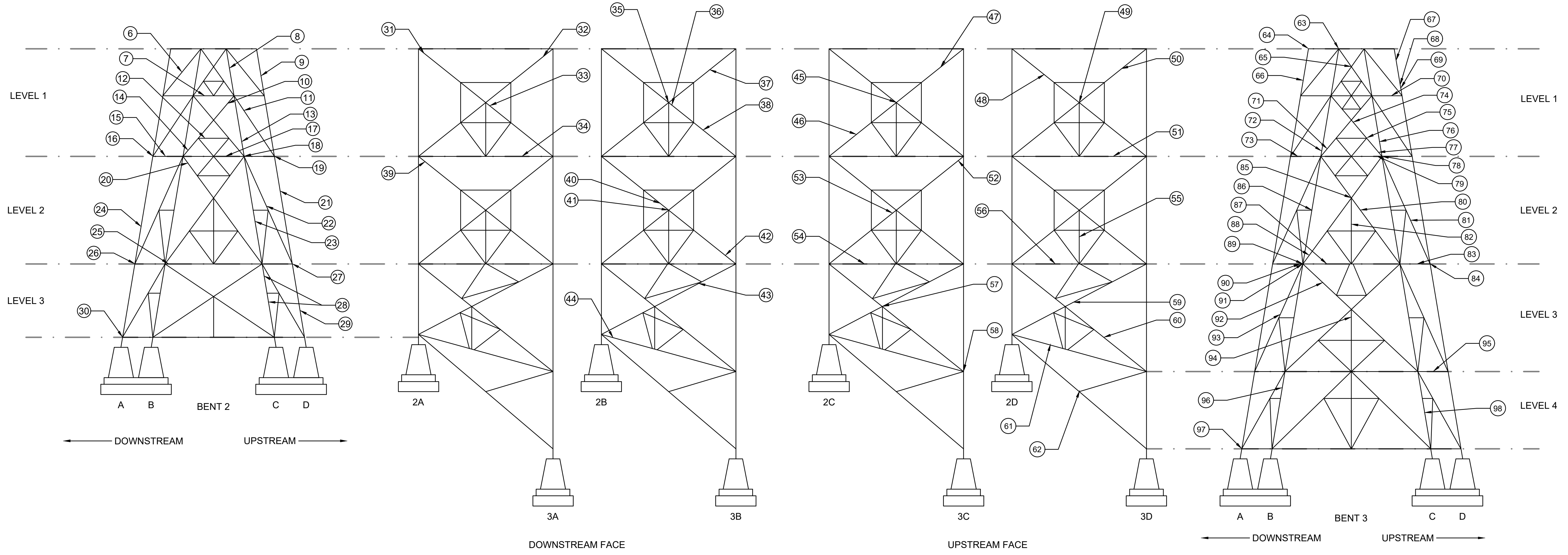
STATE OF HAWAII D.O.T

NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

TOWER 1 (BENT 1)



Defect ID	Caption
6	Bent 2, Level 1, upper section, between Columns A and B, diagonal bracing, both cover plates at mid-length: Pack rust up to 3/4" thick causing separation of plate and one broken rivet on both cover plates, CS3, (See Photo 12).
7	Bent 2, Level 1, upper section, between Columns B and C, horizontal bracing, west face, lacing bars: (3) with 50% section loss and (1) with 90% section loss, CS3, (See Photo 13).
8	Bent 2, Level 1, upper section, Column C, west face, (1) lacing bar: (1) area of 90% section loss, CS3, (Similar to Photo 55).
9	Bent 2, Level 1, upper section, Column D, west face, (2) lacing bars: Completely severed with areas of laminar corrosion and pack rust throughout, CS3, (Similar to Photo 55).
10	Bent 2, Level 1, lower section, between Columns B and C, upper west diagonal bracing near Column C, north angle: 3” L x up to 1” W area of 100% section loss, CS3, (Similar to Photo 116).
11	Bent 2, Level 1, lower section, between Columns C and D, diagonal bracing near Column C, (2) batten plates: (3) of (6) rivet heads with up to 80% section loss, CS3, (Similar to Photo 17).
12	Bent 2, Level 1, lower section, between Columns B and C diagonals, mid-horizontal bracing: Members have 1” knife-edging typical along entire length, CS3, (Similar to Photo 41).
13	Bent 2, Level 1, lower section, Column C, cover plate: Up to 2" diameter corrosion holes, CS3, (Similar to Photo 79).
14	Bent 2, Level 1, lower section, between Columns B and C, horizontal and diagonal bracing, south face, adjacent to Column B: Knife edging and holes in flanges throughout, CS3, (Similar to Photo 50).
15	Bent 2, Level 1, lower section, between Columns A and B, horizontal bracing, south face of angle: 1' 8” L x 1” H area of up to 100% section loss, with (3) lacing bars up to 75% section loss. The south angle has approximately 30% section loss near Column A. Angle original section is 3” x 4-1/2”, remaining is 1-1/2” x 3-3/4”, CS3, (See Photo 14).
16	Bent 2, Level 1, lower section, Column A, interior gusset plates: Up to 1" W x full length section loss where all members frame in, CS3, (Similar to Photo 19).
17	Bent 2, Level 1, lower section, between Columns B and C, horizontal bracing, lacing bars: (2) with 75% section loss, CS3, (Similar to Photo 81).
18	Bent 2, Level 1, lower section, Column C, interior face of south web cover plate: Painted-over pitting up to 3” diameter x 1/4” deep, CS3, (Similar to Photo 123).
19	Bent 2, Level 1, lower section, Column D, lower horizontal gusset plate: Laminar corrosion up to 100% section loss with knife edging, painted over pitting, and 4” corrosion hole, CS3, (See Photo 15).
20	Bent 2, Level 2, between Columns B and C, horizontal bracing angles, near Column B: Both angles, bottom 1" has knife-edging up to 100% section loss; South angle, area of 90% section loss, CS3, (Similar to Photo 41).
21	Bent 2, Level 2, Column D, 7' from Level 1, east face, lacing bar, center rivet head: 100% section loss, CS3, (See Photo 16).
22	Bent 2, Level 2, between Columns C and D, diagonal bracing, near short horizontal, batten plate, interior rivet heads: All have 100% section loss, CS3, (See Photo 17).
23	Bent 2, Level 2, Column C, west face, (1) lacing bar: (1) area of 100% section loss, CS3, (Similar to Photo 55).
24	Bent 2, Level 2, Column A, below midheight, (1) lacing bar: (1) area of 100% section loss, CS3, (Similar to Photo 55).
25	Bent 2, Level 2, between Columns B and C, horizontal bracing near Column B, along flanges: Knife-edging with up to 1-1/2" L x 1" W corrosion holes, CS3, (See Photo 18).
26	Bent 2, Level 2, between Columns A and B, horizontal bracing near Column B, along flanges: Knife-edging with up to 1-1/2" L x 1" W corrosion holes, CS3, (Similar to Photo 18).
27	Bent 2, Level 2, east of Column D, horizontal and diagonal bracing gusset plates: Typical heavy laminar corrosion and knife edging, CS3, (See Photo 19).

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SCALE: 1/32" = 1'

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DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII
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NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

TOWER 2 (BENTS 2 & 3)

PAGE
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Defect ID	Caption
28	Bent 2, Level 3, Column C, west face, (1) lacing bar: (1) with 100% section loss, CS3, (Similar to Photo 55).
29	Bent 2, Level 3, Column D, web, north face: Typical painted-over pitting with pack rust and corroded rivet heads, CS3, (Similar to Photo 11).
30	Bent 2, Level 3, north of Column A, west gusset plate: Pack rust up to 1/4" thick, CS3, (See Photo 20).
31	Tower 2, Level 1, north of Column A, diagonal bracing gusset plate: (1) missing rivet with pack rust up to 1/2" thick, CS3, (See Photo 21).
32	Tower 2, Level 1, Column A , upper north diagonal bracing, near Bent 3: Vertical leg of interior angle near Column A connection, 6" L x 2" H corrosion hole. Exterior leg has area of pack rust causing separation of gusset plate up to 1". Rest of this member has multiple areas of knife-edging along interior angle over 8' length with individual areas up to 1" x 6" exhibiting 100% section loss, CS3, (See Photo 22).
33	Tower 2, Level 1, Column A, lower north diagonal bracing, east face of diagonal, interior center gusset plate: 9" W x 3" H area of 100% section loss and areas of laminar corrosion, CS3, (Similar to Photo 27).
34	Tower 2, Level 1, Column A, horizontal bracing: Areas of 100% section loss, up to 1-1/2" W x 6" L on interior channel top/bottom flanges near Bent 3 with up to 1" W x 6" L areas of 100% section loss, on interior channel bottom flange near bracing mid point, CS3, (Similar to Photo 62).
35	Tower 2, Level 1, Column B, diagonal bracing, center gusset plates: Pack rust up to 1-1/2" thick causing distortion of gusset plates, with moderate laminar corrosion at the corners and knife-edging on angle legs and batten plates, CS3., (Similar to Photo 27).
36	Tower 2, Level 1, Column B, lower north diagonal bracing, both angle legs: Up to 1' L x 1-1/2" W isolated areas of 100% section loss along full member length, CS3, (See Photo 23).
37	Tower 2, Level 1, Column B, upper north diagonal bracing, interior vertical angle leg over 3' near center connection: Up to 1' L x 1-1/2" H areas of 100% section loss, CS3, (Similar to Photo 23).
38	Tower 2, Level 1, Column B, lower north diagonal bracing and center gusset plate: Up to 1/8" section loss at connection, 1" diameter corrosion hole in diagonal near center connection, CS3, (Similar to Photo 23).
39	Tower 2, Level 2, Column A, upper south diagonal and gusset plate at Column A connection: Interior angle, 8" L x 3" W area of 100% section loss, CS3, (See Photo 24).
40	Tower 2, Level 2, Column B, upper south diagonal bracing, inner west angle vertical flange: 1' L x 3" W of 100% loss, CS3, (Similar to Photo 23).
41	Tower 2, Level 2, Column B, diagonal gusset plate connection, lower diagonals: Corrosion holes, up to 4" L x 2" H, CS3, (Similar to Photo 30).
42	Tower 2, Level 2, Column B, lower north diagonal and gusset plate at Column B connection: Exterior angle, up to 3/16" loss to full section and a 1" diameter corrosion hole at gusset plate, CS3, (Similar to Photo 24).
43	Tower 2, Level 3, Column B, horizontal bracing: Numerous rivet heads with up to 100% section loss, CS3, (See Photo 25).
44	Tower 2, Level 3, Column B, horizontal bracing: Multiple up to 3/4" diameter corrosion holes throughout, and covered in vegetation, CS3, (See Photo 26).
45	Tower 2, Level 1, Column C, both center gusset plates: Pack rust at the incoming angles up to 1/2" thick; Laminar corrosion adjacent to angles throughout with up to 1" diameter x 100% section loss, CS3, (See Photo 27).
46	Tower 2, Level 1, Column C, lower south diagonal bracing, east angle: Corrosion holes and approximately 15% loss of cross sectional area, CS3, (Similar to Photo 23).
47	Tower 2, Level 1, Column C, upper north diagonal bracing, near Bent 3, west angle: Deformation, 3' L x 1" out-of-plane with laminar corrosion throughout and section loss along member up to approximately 15% loss of total cross sectional area, CS3, (Similar to Photo 66).
48	Tower 2, Level 1, Column D, upper north diagonal bracing, top face of batten plate, west rivet heads: (1) of (3) missing, CS3, (See Photo 28).
49	Tower 2, Level 1, Column D, center west gusset plate: (1) missing rivet, CS3, (See Photo 29).
50	Tower 2, Level 1, Column D, upper north diagonal bracing: Heavy knife-edging and up to 6" L x 2" H corrosion holes, CS3, (See Photo 30).
51	Tower 2, Level 1, Column D, horizontal bracing, near Bent 3, east face: Interior flanges have up to 70% section loss, CS3, (Similar to Photo 26).
52	Tower 2, Level 2, Column C, upper north diagonal bracing near Bent 3: Laminar corrosion with section loss along member up to 10% loss of total cross sectional area, CS3, (Similar to Photo 23).
53	Tower 2, Level 2, Column C, lower south diagonal bracing near center gusset plate, east angle: Laminar corrosion with 40% loss of cross sectional area, CS3, (Similar to Photo 124).
54	Tower 2, Level 2, Column C, horizontal bracing, near mid-length slightly closer to Bent 2: Up to 3/16" deep pitting throughout with areas of knife-edging to original members of interior west face and isolated corrosion holes up to 1/2" diameter, CS3, (Similar to Photo 26).
55	Tower 2, Level 2, Column D, vertical bracing: Up to 1/8" deep pitting with scattered areas of knife-edging, CS3, (See Photo 31).
56	Tower 2, Level 2, Column D, horizontal bracing: Pinholes (corrosion holes) throughout the length, CS3, (See Photo 32).
57	Tower 2, Level 3, Column C, center gusset plate, 50% of rivet heads on the inside of panel point: Typically have 50-90% section loss, CS3, (Similar to Photo 27).
58	Tower 2, Level 3, Column C, lower diagonal bracing, east top angle and east center gusset plate: Bent out-of-plane 3/4", CS3, (Similar to Photo 45).
59	Tower 2, Level 3, Column D, upper north diagonal bracing: Pitting and knife-edging with up to 1/16" section loss, CS3, (Similar to Photo 66).
60	Tower 2, Level 3, Column D, lower north diagonal bracing: Pitting, CS3, (Similar to Photo 66).
61	Tower 2, Level 3, Column D, lower horizontal bracing: Painted over pitting up to 1/8" deep and areas of and knife-edging, CS3, (Similar to Photo 26).
62	Tower 2, Level 4, Column D, lower diagonal bracing: Heavy growth with trees growing through the members, (See Photo 33).
63	Bent 3, Level 1, upper section, Column B, top gusset plate and longitudinal bracing: Laminar corrosion and areas of section loss on members and rivet heads due to active water leakage from the bridge, CS3, (See Photo 34).
64	Bent 3, Level 1, upper section, west of Column A, north gusset plate: Knife edging and corrosion holes up to 3" x 2" along bottom edge of gusset plate, CS3, (See Photo 35).
65	Bent 3, Level 1, upper section, between Columns B and C, center gusset plates: Laminar corrosion on plates and transverse bracing members, CS3, (See Photo 36).
66	Bent 3, Level 1, upper section, Column A, exterior face edges over top 12': Widespread laminar corrosion, CS3, (See Photo 37).
67	Bent 3, Level 1, upper section, Column D, vertical near top: Typical laminar corrosion at upper levels, CS3, (Similar to Photo 37).
68	Bent 3, Level 1, upper section, Column D: Southeast angle, corrosion hole up to 2" diameter and (2) adjacent lacing bars with 100% section loss near the top, CS3, (Similar to Photo 55).
69	Bent 3, Level 1, upper section, Column D, southeast flange: (1) 2-1/2" diameter corrosion hole, CS3, (Similar to Photo 40).
70	Bent 3, Level 1, upper section, between Columns C and D, horizontal bracing: Heavy laminar corrosion throughout with (1) lacing bar with 100% section loss near Column D, CS3, (Similar to Photo 87).
71	Bent 3, Level 1, lower section, between Columns B and C, lower east diagonal bracing near Column B, adjacent to batton plates top flange of angles: Knife-edging with areas of 4" L x 2" W of up to 100% section loss, CS3, (See Photo 38).
72	Bent 3, Level 1, lower section, Column B, southeast flange: Corrosion hole,1-1/2" W x 1" H, CS3, (Similar to Photo 40).
73	Bent 3, Level 1, lower section, Columns A and B, horizontal bracing: Pack rust up to 1-1/2" thick with section loss up to 30% to gusset plates and 100% loss to rivet heads of batten plate, CS3, (See Photo 39).
74	Bent 3, Level 1, lower section, between Columns B and C, lower west diagonal bracing: Laminar corrosion with knife-edging and holes up to 1" diameter near center gusset plate, CS3, (Similar to Photo 116).
75	Bent 3, Level 1, lower section, between Columns B and C, lower west diagonal bracing, just above and below lower mid-horizontal on Column C side: Diagonals and horizontals on north face have knife-edging and corrosion holes throughout, CS3, (Similar to Photo 38).
76	Bent 3, Level 1, lower section, Column C, bottom quarter point cover plate: Up to 1-1/2" diameter corrosion holes, CS3, (Similar to Photo 57).
77	Bent 3, Level 1, lower section, between Columns B and C, lower west diagonal bracing just above lower horizontal on Column C side: Diagonals and horizontals on north face have knife-edging and corrosion holes throughout, CS3, (Similar to Photo 86).
78	Bent 3, Level 1, lower section, Column C: (3) lacing bars with 100% section loss in lower section, CS3, (Similar to Photo 55).
79	Bent 3, Level 1, lower section, between Columns B and C, horizontal bracing: Corrosion holes up to 1" diameter in top channel flanges, batten plate, and lacing bar near Column C, CS3, (Similar to Photo 50).
80	Bent 3, Level 2, between Columns B and C, lower west diagonal bracing: Multiple corrosion holes up to 2" diameter in exterior flange, CS3, (Similar to Photo 86).
81	Bent 3, Level 2, between Columns C and D, diagonal bracing, west face near short horizontal: 3' L x full width of angle area of up to 100% section loss to top flanges, CS3. -Note this member has been retrofitted and retrofit is in good condition., (Similar to Photo 52).
82	Bent 3, Level 2, between Columns C and D, vertical bracing: Knife-edging and severe laminar corrosion with up to 50% loss of flanges over 4' of length, and area of up to 1-1/2" W x 1" H corrosion holes, CS3, (Similar to Photo 68).
83	Bent 3, Level 2, between Columns C and D, horizontal bracing: Heavy laminar corrosion with areas of up to 100% section loss throughout, CS3, (Similar to Photo 47).
84	Bent 3, Level 2, between Column D, gusset plates: Heavy laminar corrosion throughout, CS3, (Similar to Photo 19).
85	Bent 3, Level 2, between Columns B and C, north center gusset plate: 2" diameter corrosion hole, CS3, (Similar to Photo 65).
86	Bent 3, Level 2, Column B: 2-1/2" diameter corrosion hole in southeast angle above horizontal brace connection, CS3, (See Photo 40).
87	Bent 3, Level 2, between Columns B and C, horizontal bracing: Knife-edging with up to 1-1/2" diameter corrosion holes on both flanges, CS3, (See Photo 41).
88	Bent 3, Level 2, between Columns B and C, lower east diagonal bracing near Column B: Knife-edging and up to 1-1/2" diameter holes in both flanges of both angles, CS3, (Similar to Photo 86).

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TOWER 2 (BENTS 2 & 3)

PAGE
3

Defect ID	Caption
89	Bent 3, Level 2, Column B, east gusset plate: 6" L x 2" H area of 100% section loss at top corner and 2" W x 6" H area of 100% section loss at the horizontal bracing connection with pack rust up to 1" thick, CS3, (Similar to Photo 24).
90	Bent 3, Level 2, between Columns A and B, horizontal bracing, south flange, horizontal leg: 9" L x full-width of angle area of 100% section loss, CS3, (See Photo 42).
91	Bent 3, Level 2, Column B, west gusset: Painted-over pitting up to 3/16" deep and rivet heads with up to 100% section loss, CS3, (Similar to Photo 88).
92	Bent 3, Level 3, between Columns B and C, upper east diagonal: Bowed up to 1" out of plane over full length, CS3, (See Photo 43).
93	Bent 3, Level 3, between Columns A and B, diagonal bracing above interior connection: 3' L x full-width of angle area of up to 100% section loss on top flanges, CS3. - Note this member has been retrofitted and retrofit is in good condition, (Similar to Photo 52).
94	Bent 3, Level 3, between Columns B and C, vertical bracing: Knife-edging and severe laminar corrosion with up to 50% section loss of flanges and corrosion hole up to 1-1/2" diameter in interior flange, CS3, (Similar to Photo 68).
95	Bent 3, Level 3, between Columns C and D, horizontal bracing: Knife-edging and multiple corrosion holes up to 2" diameter across full member length, CS3, (Similar to Photo 47).
96	Bent 3, Level 4, Column B, (1) lacing bar: 100% section loss on both ends on the west column face, CS3, (See Photo 44).
97	Bent 3, Level 4, Column A, just above bearing, gusset plates: Plates have minor distortion and bowed to the south less than 1/8" due to laminar corrosion, CS3, (See Photo 45).
98	Bent 3, Level 4, Column C: Typical painted-over pitting, laminar corrosion, knife-edging, and corroded rivet heads, CS3, (Similar to Photo 123).

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NANUE STREAM BRIDGE
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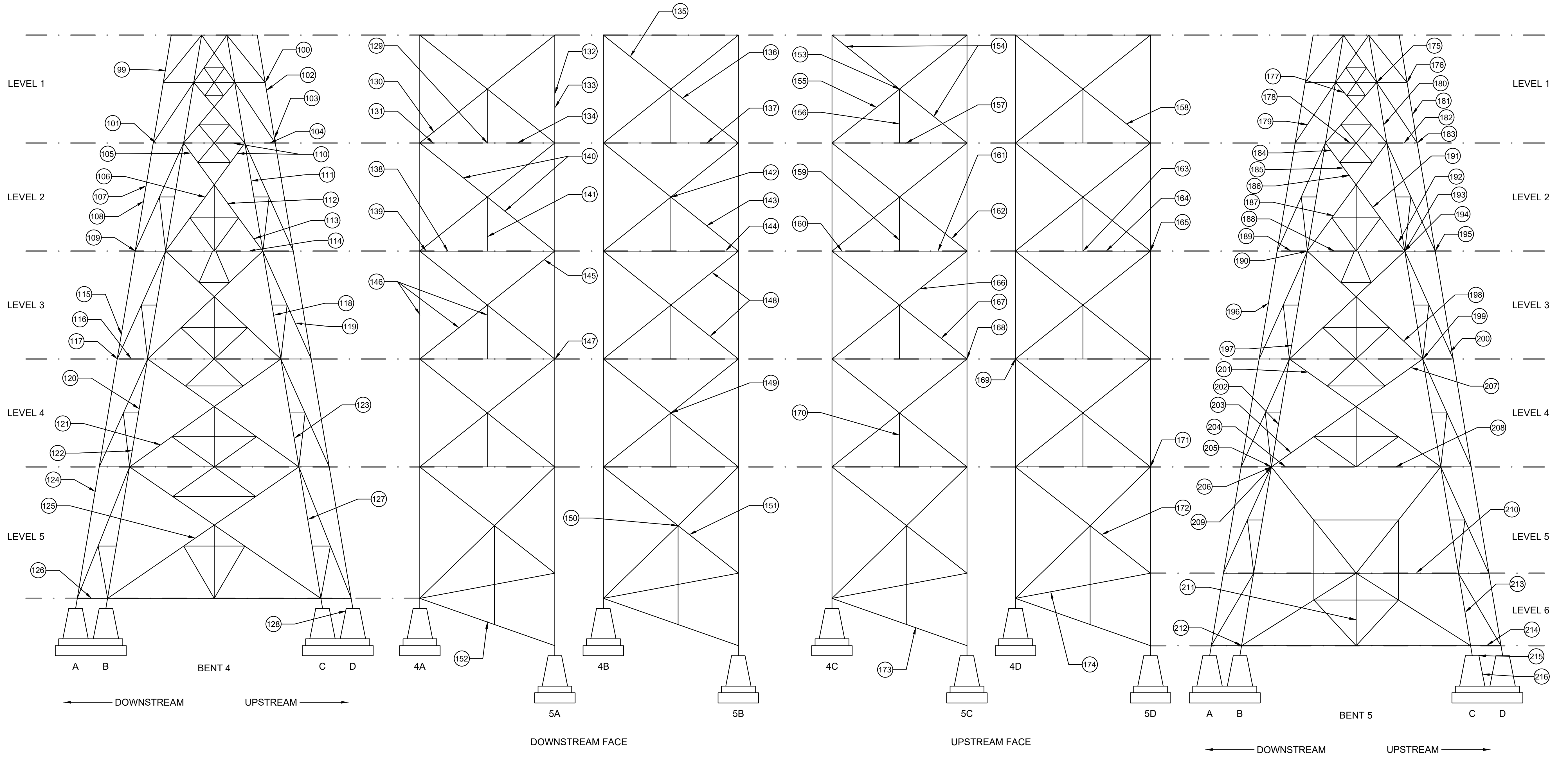
TOWER 2 (BENTS 2 & 3)



Defect ID	Caption
99	Bent 4, Level 1, upper section, Column A, above lower connection, (1) lacing bar: 100% section loss, CS3, (Similar to Photo 55).
100	Bent 4, Level 1, upper section, Column D, upper gusset plates: Heavy laminar corrosion and approximately 1/4" to 3/8" remaining section on gusset plate between diagonal and horizontal bracing member, CS3, (See Photo 46).
101	Bent 4, Level 1, lower section, between Columns A and B, horizontal bracing: Vertical legs have knife-edging with areas of up to 100% section loss and corrosion holes up to 1" diameter. (1) lacing bar has 100% section loss and batten plate has area of 100% loss, CS3, (See Photo 47).
102	Bent 4, Level 1, Column D, north face, west rivet heads: Up to 50% section loss, CS3, (Similar to Photo 11).
103	Bent 4, Level 1, lower section, Column D, lower gusset plates: Pack rust up to 1" thick with areas of 100% section loss and only retrofit gusset plate remaining, no change from previous inspection, CS3, (Similar to Photo 46).
104	Bent 4, Level 1, lower section, between Columns C and D, horizontal bracing: (1) missing lacing bar and multiple disconnected. Multiple corrosion holes along bottom edge of both angles up to 2" H x 6" W, CS3, (Similar to Photo 87).
105	Bent 4, Level 2, between Columns B and C, upper east diagonal bracing near Column C between top two horizontals: (2) 1-3/4" L x 1" W corrosion holes in exterior top flange and gusset plate, CS3, (Similar to Photo 24).
106	Bent 4, Level 2, between Columns B and C, lower east diagonal bracing, vertical exterior flange: 11" L section missing, CS3, (Similar to Photo 86).
107	Bent 4, Level 2, Column A: Lacing bar has 2" diameter corrosion hole and 100% section loss at adjacent connection, CS3, (Similar to Photo 55).
108	Bent 4, Level 2, Column A, east side lacing bar: 90% section loss, CS3, (Similar to Photo 55).
109	Bent 4, Level 2, Column A, exterior gusset plate: Corrosion, pack rust up to 1" thick with areas of up to 100% loss and only retrofit gusset plate remaining, CS3, (See Photo 48).
110	Bent 4, Level 2, between Columns B and C, upper west diagonal and horizontal bracing near Column C: Heavy laminar corrosion throughout with up to 25% section loss, CS3, (Similar to Photo 116).
111	Bent 4, Level 2, Column C: 50% of lacing bars on west face have 100% section loss, remaining bars on both faces have average 30% section loss, CS4, (See Photo 49).
112	Bent 4, Level 2, between Columns B and C, lower west diagonal bracing: Heavy laminar corrosion throughout with up to 25% section loss, CS3, (Similar to Photo 116).

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TOWER 3 (BENTS 4 & 5)

PAGE
5

Defect ID	Caption
113	Bent 4, Level 2, between Columns B and C, lower west diagonal bracing, near Column C: Knife-edging and 80% section loss to the interior angle, CS3, (Similar to Photo 116).
114	Bent 4, Level 2, between Columns B and C, horizontal bracing adjacent to Column C, vertical connection, interior top flange along member: (7) corrosion holes, up to full width of top flange x 5" L, CS3, (See Photo 50).
115	Bent 4, Level 3, Column A above lower connection: Retrofit, four interior and three exterior lacing bars cut or removed, (CS3). - Repaired, (See Photo 51).
116	Bent 4, Level 3, between Columns A and B, horizontal bracing, (4) lacing bars: 100% section loss, CS3, (Similar to Photo 87).
117	Bent 4, Level 3, horizontal bracing at gusset plates at Column A: Horizontal bracing gusset plate has 100% section loss on all sides. This member is not connected to Column A anymore, (CS4). - Repaired
118	Bent 4, Level 3, Column C, lacing bars: Average 75% section loss in this section of column, except for top 10' of west face which are in good condition, CS3, (Similar to Photo 55).
119	Bent 4, Level 3, between Columns C and D, diagonal bracing: 3' L x full width of angle area of up to 100% section loss to top flanges, CS3. -Note this member has been retrofitted and retrofit is in good condition, (See Photo 52).
120	Bent 4, Level 4, Column B, lacing bars: (6) with 100% section loss on west face, (12) on east face, CS3, (Similar to Photo 55).
121	Bent 4, Level 4, between Columns B and C, lower east diagonal bracing near Column B: Member bent slightly out of plane approximately 1”. Likely due to 2022 impact incident, CS3, (Similar to Photo 43).
122	Bent 4, Level 4, Column B, west face, cover plate: Corrosion hole, 8" W x 5" H, CS3, (See Photo 53).
123	Bent 4, Level 4, Column C, flanges: Knife-edging, CS3, (See Photo 54).
124	Bent 4, Level 5, Column A: (3) lacing bars with 100% section loss, CS3, (Similar to Photo 55).
125	Bent 4, Level 5, between Columns B and C, lower east diagonal bracing: Member bent slightly out-of-plane approximately 1” downward, CS3, (Similar to Photo 104).
126	Bent 4, Level 5, between Columns A and B, horizontal bracing, all (4) lacing bars on top and bottom: 100% section loss, CS3, (Similar to Photo 87).
127	Bent 4, Level 5, Column C, west face, (6) lacing bars: 100% section loss, CS3, (See Photo 55).
128	Bent 4, Level 5, Column D, footing, southeast corner: Corner spall, 11" W x 1' 7" H x 2-1/2" deep, CS3, (Similar to Photo 83).
129	Tower 3, Level 1, Column A, horizontal and vertical bracing gusset plate: Up to 85% section loss, full length x 2" H, CS3, (See Photo 56).
130	Tower 3, Level 1, Column A, lower south diagonal bracing: Several corrosion holes along the west and east angle legs up to 2" diameter; 3' L x 2" H area of 100% section loss on west angle near Bent 4, CS3, (Similar to Photo 30).
131	Tower 3, Level 1, Column A, horizontal bracing, lower batten plate: Corrosion hole, 5" L x 10" W, CS3, (See Photo 57).
132	Tower 3, Level 1, Column A: 1-1/2" diameter corrosion hole in lacing bar and southeast angle leg, CS3, (Similar to Photo 40).
133	Tower 3, Level 1, Column A, lacing bars: (2) severed; Lacing bars exhibit heavy pack rust between lacing bars and angle legs, CS3, (Similar to Photo 55).
134	Tower 3, Level 1, Column A, horizontal bracing: Heavy pitting and laminar corrosion with up to 80% section loss. Few lacing bars exhibit 100% section loss and knife-edging. Channel legs exhibit scattered knife-edging, CS3, (See Photo 58).
135	Tower 3, Level 1, Column B, upper south diagonal bracing, north angle, near Bent 4: 40% section loss, CS3, (Similar to Photo 23).
136	Tower 3, Level 1, Column B, lower north diagonal bracing: Worst case is a 4” diameter corrosion hole near center gusset plate. Approximately 40% loss in cross sectional area, CS3, (See Photo 59).
137	Tower 3, Level 1, Column B, horizontal bracing, near Bent 5: Average 20% section loss to member with corrosion holes throughout the channels up to 1” diameter, CS3, (Similar to Photo 62).
138	Tower 3, Level 2, Column A, horizontal bracing, near Bent 4: 50% section loss to entire member with holes throughout, CS4, (See Photo 60).
139	Tower 3, Level 2, Column A, horizontal bracing, lower batten plate: 9" diameter corrosion hole with 3" W x 1/8" section remaining, CS3, (Similar to Photo 57).
140	Tower 3, Level 2, Column A, upper south to lower north diagonal bracing: Global distortion to the diagonal members within level. Upper south diagonal bracing, east leg has corrosion holes, up to 1” diameter, CS3, (See Photo 61).
141	Tower 3, Level 2, Column A, vertical bracing, batten plates: Typically exhibit pitting up to 1/8" deep with corrosion holes up to 5" diameter, CS3, (Similar to Photo 68).
142	Tower 3, Level 2, Column B, longitudinal bracing, center gusset plate: Up to 2" diameter corrosion holes around members and at bottom edge of panels, CS3, (Similar to Photo 65).
143	Tower 3, Level 3, Column B, lower north diagonal bracing, looking southwest. Numerous corrosion holes, up to 6" L x 3" H throughout with up to 75% section loss, CS3, (Similar to Photo 30).
144	Tower 3, Level 2, Column B, horizontal bracing: Numerous corrosion holes, up to 6" L x 3" H throughout full length of both channels, CS3, (See Photo 62).
145	Tower 3, Level 3, Column A, upper north diagonal bracing, at connection: Heavy corrosion and laminar corrosion up to 50% section loss, CS3, (Similar to Photo 59).
146	Tower 3, Level 3, Column A, lower south diagonal, and vertical bracing: Repair in good condition, (See Photo 63).
147	Tower 3, Level 3, Column A, Bent 5, interior and exterior gusset plates, between horizontal and lower diagonal bracing: Pack rust with section loss, CS3, (See Photo 64).
148	Tower 3, Level 3, Column A, upper and lower north diagonal bracing, east angle, vertical leg: Multiple corrosion holes up to 2-1/2" diameter, CS3, (Similar to Photo 30).
149	Tower 3, Level 4, Column B, center gusset plate: Numerous corrosion holes on both gusset plates, CS3, (See Photo 65).
150	Tower 3, Level 5, Column B, center gusset plate, exterior: 3" L x 1" W corrosion hole, CS3; (2) additional corrosion holes up to 3" x 2", CS3, (Similar to Photo 65).
151	Tower 3, Level 5, Column B, longitudinal bracing, lower north diagonal: Out-of-plane deformation to diagonal member over the full length, CS3, (Similar to Photo 104).
152	Tower 3, Level 6, Column A, lower horizontal bracing: Knife-edging with 4" L x 1-1/2" H section loss, CS3. Note this area was covered in moss, (Similar to Photo 26).
153	Tower 3, Level 1, Column C, longitudinal bracing, west face center gusset plate, looking east. Up to 5" x 3" area of corrosion holes around members and at bottom edge of panels, CS3, (Similar to Photo 65).
154	Tower 3, Level 1, Column C, upper south to lower north diagonal bracing: Up to 6" L x 2" H corrosion holes with knife edging throughout both angles, CS3, (See Photo 66).
155	Tower 3, Level 1, Column C, lower south diagonal bracing: Corrosion holes and edge section loss up to 3' L on both angles of diagonal, CS3, (Similar to Photo 30).
156	Tower 3, Level 1, Column C, vertical bracing: Multiple corrosion holes up to 2" diameter in interior angle of vertical, CS3., (Similar to Photo 68).
157	Tower 3, Level 1, Column C, lower horizontal bracing, east and west channels: Multiple corrosion holes up to 6" diameter, CS3, (Similar to Photo 62).
158	Tower 3, Level 1, Column D, lower north diagonal bracing near Column D, inside of angles: Heavy laminar corrosion, CS3, (Similar to Photo 66).
159	Tower 3, Level 2, Column C, vertical bracing: 100% section loss to east angle leg on vertical over a 8" x 2" area, CS3, (Similar to Photo 68).
160	Tower 3, Level 2, Column C, horizontal bracing, east channel: 8" L x 2" H corrosion hole, CS3, (Similar to Photo 50).
161	Tower 3, Level 2, Column C, horizontal bracing, closer to Bent 5: Up to 6" L x 2" H holes throughout and several areas of full flange loss, CS3; bottom batten plate is heavily corroded with multiple corrosion holes up to 4" diameter, CS3, (Similar to Photo 62).
162	Tower 3, Level 2, Column C, lower north diagonal bracing near Bent 5: Up to 2" diameter corrosion holes, CS3, (Similar to Photo 30).
163	Tower 3, Level 2, Column D, vertical bracing: East angle of vertical is bent slightly to the east with the gusset plate, and angle has approximately 40% section loss. Gusset plate is welded along the horizontal member, CS3, (Similar to Photo 68).
164	Tower 3, Level 2, Column D, horizontal bracing, exterior channel inside face: Heavy laminar corrosion, CS3, (Similar to Photo 58).
165	Tower 3, Level 2, Column D, Bent 5, gusset plates: Moderate to heavy laminar corrosion, CS3, (Similar to Photo 67).
166	Tower 3, Level 3, Column C, upper north diagonal bracing: Knife-edging with small areas of edge loss full length and up to 2" diameter holes, CS3, (Similar to Photo 66).
167	Tower 3, Level 3, Column C, lower north diagonal bracing: Knife-edging with small areas of edge loss full length and small corrosion holes, CS3, (Similar to Photo 66).
168	Tower 3, Level 3, Column C, Bent 5, gusset plate: Up to 100% section loss over 8" x 5" area, CS3, (Similar to Photo 48).
169	Tower 3, Level 3, Column D, Bent 4 gusset plate: Heavy laminar corrosion with up to 50% section loss, CS3, (See Photo 67).
170	Tower 3, Level 4, Column C, vertical bracing: Heavy corrosion of angles and batten plates on vertical with knife-edging, pitting up to 3/16" deep and corrosion holes up to 5" diameter, CS3, (See Photo 68).
171	Tower 3, Level 4, Column D, Bent 5 gusset plate: Heavy laminar corrosion with up to 50% section loss, CS3, (Similar to Photo 67).
172	Tower 3, Level 5, Column D, lower north diagonal bracing, near center gusset plate, batten plates: Missing, CS3, (Similar to Photo 98).
173	Tower 3, Level 6, Column C, lower horizontal bracing: Typical pitting up to 3/16" deep in webs of bottom horizontal member, CS3, (Similar to Photo 26).
174	Tower 3, Level 6, Column D, upper horizontal bracing: Vegetation, tree growing through members, (See Photo 69).

SCALE: 1/32" = 1'

MARCH, 2024

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STATE OF HAWAII D.O.T

NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

TOWER 3 (BENTS 4 & 5)

PAGE
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Defect ID	Caption
175	Bent 5, Level 1, upper section, Column C, north gusset plate: (1) 1" diameter and (1) 2" diameter corrosion hole, CS3, (See Photo 70).
176	Bent 5, Level 1, upper section, Column D, lower gusset plates: Heavy laminar corrosion with up to 100% section loss, CS3, (Similar to Photo 19).
177	Bent 5, Level 1, lower section, between Columns B and C, upper east diagonal bracing, north angle leg: Scattered corrosion holes (8" L total up to 1" H), CS3, (Similar to Photo 86).
178	Bent 5, Level 1, lower section, between Columns B and C, lower horizontal bracing, along interior angle: Multiple corrosion holes up to 3-1/2" L x full width, CS3, (Similar to Photo 50).
179	Bent 5, Level 1, lower section, between Columns A and B, lower horizontal bracing: Column A lower gusset plates exhibit up to 100% section loss above and below horizontal member with 5" L segments of 25% section left holding members. - Repaired, (See Photo 71).
180	Bent 5, Level 1, lower section, Column C, batten plate: Pitting up to 1/4" deep and two corrosion holes ((1) 8" L x 3" H and (1) 1" diameter), CS3, (Similar to Photo 57).
181	Bent 5, Level 1, lower section, Column D: (2) lacing bars removed on west face, CS3, (Similar to Photo 76).
182	Bent 5, Level 1, lower section, between Columns C and D, horizontal bracing, lacing bars: Up to 100% section loss, CS3, (Similar to Photo 87).
183	Bent 5, Level 1, lower section, Column D, horizontal bracing, gusset plate: North gusset plate has 9" H x up to 3" W area of 100% section loss at connection to Column D, CS4. South gusset plate (6) corrosion holes up to 2" diameter and (1) on north gusset plate, CS3, (See Photo 72).
184	Bent 5, Level 2, between Columns B and C, upper east diagonal bracing, along exterior angle, near Column B: (1) corrosion hole 4" L x full angle leg width, CS3, (Similar to Photo 86).
185	Bent 5, Level 2, between Columns B and C, upper east diagonal bracing, vertical flange of exterior angle: Typical corrosion holes up to 1" x 2", CS3, (Similar to Photo 86).
186	Bent 5, Level 2, between Columns B and C, upper east diagonal bracing, north angle: Scattered corrosion holes, CS3, (Similar to Photo 86).
187	Bent 5, Level 2, between Columns B and C, lower east diagonal bracing, both angles: Multiple corrosion holes up to 1" diameter and pitting up to 3/16" deep, CS3, (Similar to Photo 86).
188	Bent 5, Level 2, between Columns B and C, horizontal bracing, (2) lacing bars: 100% section loss, CS3, (Similar to Photo 81).
189	Bent 5, Level 2, between Columns A and B, horizontal bracing: Areas of 100% section loss throughout, CS3, (Similar to Photo 14).
190	Bent 5, Level 2, Column B, exterior gusset plate: Multiple corrosion holes up to 5" x 2-1/2" and pitting up to 1/16" deep in exterior gusset plate; interior rivet heads at connection to column typically have up to 100% section loss in this location, CS3, (See Photo 73).
191	Bent 5, Level 2, between Columns B and C, lower west diagonal bracing, mid-length: Up to 1" diameter holes, CS3, (Similar to Photo 86).
192	Bent 5, Level 2, between Columns B and C, lower west diagonal bracing, connection to Column C: North angle exhibits (2) 10" L x up to 4" H holes with 1" x 3" remaining section. Remaining length of diagonal exhibits knife-edging and pitting, CS4, (See Photo 74).
193	Bent 5, Level 2, Column C, connection outboard channel: 2" diameter corrosion hole, CS3, (Similar to Photo 70).
194	Bent 5, Level 2, Column C, horizontal bracing plugboard gusset plate: (1) 3" diameter and (1) 1" diameter corrosion holes, CS3, (Similar to Photo 70).
195	Bent 5, Level 2, Column D, horizontal bracing gusset plates: Heavy laminar corrosion with up to 100% section loss with 15% section remaining of the north gusset plate and repair plates becoming ineffective. The gusset plate is completely detached from the column, CS4, (See Photo 75).
196	Bent 5, Level 3, Column A, (9) lacing bars: Removed from column, CS3, (See Photo 76).
197	Bent 5, Level 3, Column B, west face, (6) lacing bars: 100% section loss at south rivet, CS3, (Similar to Photo 55).
198	Bent 5, Level 3, between Columns B and C, lower west diagonal near Column C: 10" of top flange missing on both angles, CS3, (Similar to Photo 38).
199	Bent 5, Level 3, between Columns C and D, connection to Column C, east face, batten plate at top: Corrosion hole, 10" L x 6" H, CS3, (Similar to Photo 47).
200	Bent 5, Level 3, between Columns C and D, diagonal bracing, outboard angles: 10" L x up to full height section loss with adjacent corrosion holes, extreme deterioration up to 90% cross section reduction having no change from previous inspection, CS4, (See Photo 77).
201	Bent 5, Level 4, between Columns B and C, upper east diagonal, exterior angle: Multiple sections of heavy section loss; 1/4 sq. in total remaining in of L4x4x5/16, CS3, (Similar to Photo 86).
202	Bent 5, Level 4, Column B: Many lacing bars exhibit 100% section loss on the west side of column, CS3, (Similar to Photo 55).
203	Bent 5, Level 4, between Columns B and C, lower east diagonal bracing, vertical leg of interior angle: Corrosion hole, up to 3" diameter, CS3, (Similar to Photo 86).
204	Bent 5, Level 4, between Columns B and C, horizontal bracing: Typical pitting up to 1/8" deep and up to 1/2" section loss along the horizontal strut flanges, CS3, (Similar to Photo 41).
205	Bent 5, Level 4, Column B, vertical at southeast flange splice: Column is deformed, 1' 10" L x 1" deflection, CS3, (See Photo 78).
206	Bent 5, Level 4, Column B, west cover plate: Corrosion hole, 9" diameter, CS3, (See Photo 79).
207	Bent 5, Level 4, between Columns B and C, upper west diagonal bracing near Column C, outboard angle: 4" L x full width area of missing top flange, CS3, (Similar to Photo 86).
208	Bent 5, Level 4, between Columns B and C, horizontal bracing at third point closest to Column C: Bottom lacing bars mostly missing, CS3, (Similar to Photo 81).
209	Bent 5, Level 5, Column B interior splice plate rivets: Up to 100% section loss, corrosion, CS3, (See Photo 80).
210	Bent 5, Level 5, between Columns B and C, horizontal bracing, top and bottom lacing bars: Up to 100% section loss, CS3, (See Photo 81).
211	Bent 5, Level 6, between Columns B and C, vertical bracing: Up to 25% section loss and pitting up to 1/8" deep, CS3, (See Photo 82).
212	Bent 5, Level 6, Column B, west cover plate: Corrosion hole, 9" W x 3" H, CS3, (Similar to Photo 79).
213	Bent 5, Level 6, Column C, north face: Heavy lamiar corrosion along angles and up to 25% section loss to rivet heads, CS3, (Similar to Photo 37).
214	Bent 5, Level 6, between Columns C and D, horizontal bracing: Typical corrosion holes, knife edging, laminar corrosion, and section loss to bottom lacing bars, CS3, (Similar to Photo 87).
215	Bent 5, Level 6, Column C, footing, southwest corner: Spall, 5' H x 1' 4" W x up to 10" deep, CS3, (See Photo 83).
216	Bent 5, Level 6, Column C, footing, base of pedestal on west side: 6' x 2' area of abrasion with course aggregate exposed and missing up to 4" deep, CS3, (See Photo 84).

SCALE: 1/32" = 1'

MARCH, 2024

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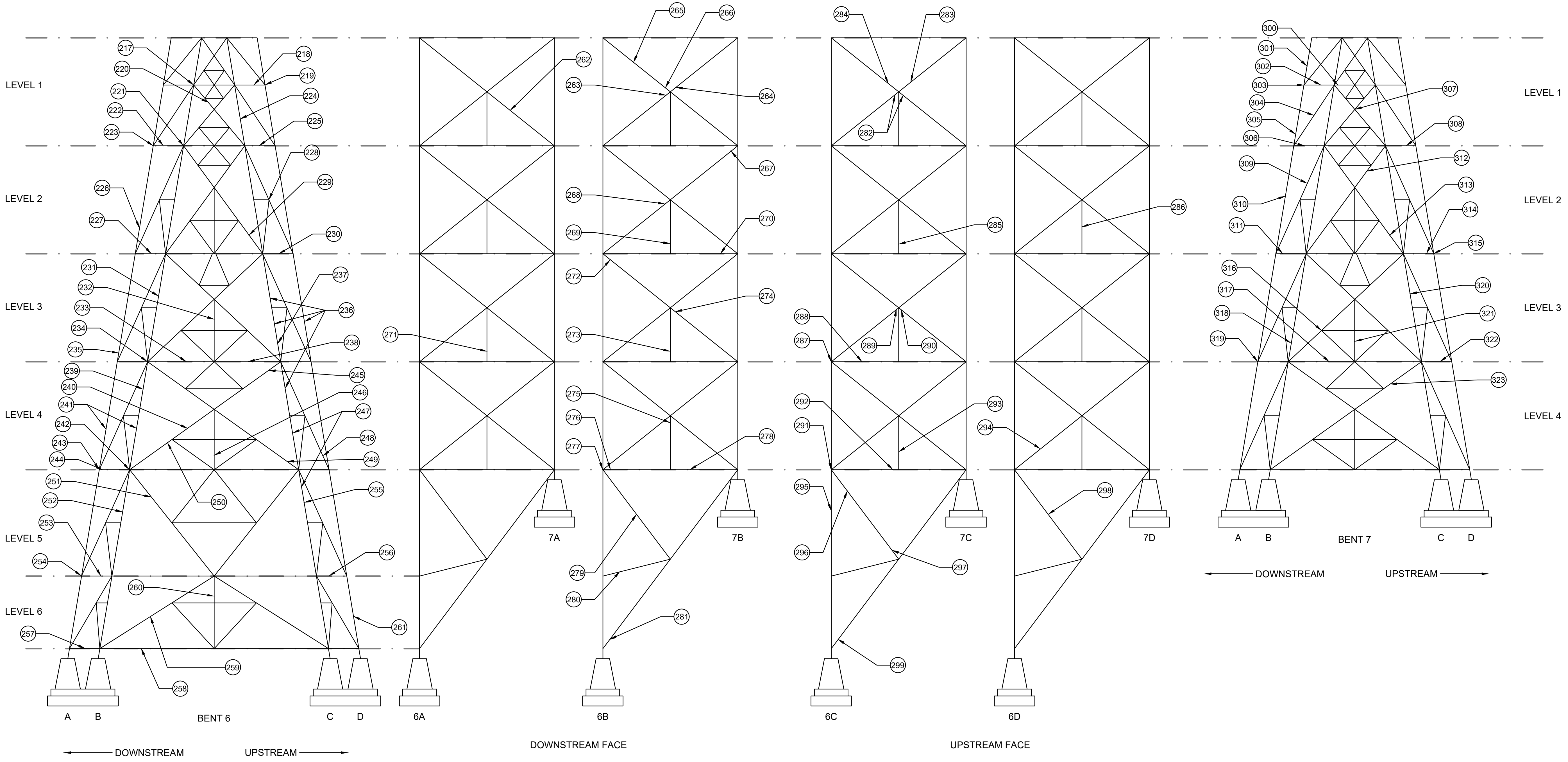
STATE OF HAWAII
STATE OF HAWAII D.O.T

NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

TOWER 3 (BENTS 4 & 5)



Defect ID	Caption
217	Bent 6, Level 1, upper section, Column B, lower gusset plates west of Column B: Knife-edging with areas of 100% section loss up to 1" W x 2" H, CS3, (Similar to Photo 88).
218	Bent 6, Level 1, upper section, between Columns C and D, horizontal bracing: Heavy pitting with 1' 6" L x 2" H area of 100% section loss, CS3, (See Photo 85).
219	Bent 6, Level 1, upper section, Column D, lower gusset plates: Heavy laminar corrosion with repair plates present, CS3, (Similar to Photo 19).
220	Bent 6, Level 1, lower section, between Columns B and C, upper east diagonal bracing, vertical leg of exterior angle: 1-1/2" W area of 100% section loss, typical along full length, CS3, (Similar to Photo 66).
221	Bent 6, Level 1, lower section, Column B, west side bottom north diagonal between angle and gusset plate: Corrosion hole, 3" L x 2" W, with pack rust up to 1/2" thick, CS3, (Similar to Photo 70).
222	Bent 6, Level 1, lower section, between Columns A and B, horizontal bracing, (5) of (6) lacing bars: 100% section loss, CS3, (Similar to Photo 87).
223	Bent 6, Level 1, lower section, west of Column A, gusset plate at horizontal bracing: 75% section loss with corrosion holes, CS3, (Similar to Photo 120).
224	Bent 6, Level 1, lower section, Column C: Typical flaking laminar corrosion on upper two levels throughout, up to 1/4" section loss to interior web on east 3", CS3, (Similar to Photo 37).

Defect ID	Caption
225	Bent 6, Level 1, lower section, between Columns C and D, horizontal bracing: 25% section loss with knife-edging on south angle; Column D gusset plate has severe laminar corrosion between the horizontal and diagonal and appears to be failing at that location (deformation to the north), CS3, (Similar to Photo 19).
226	Bent 6, Level 2, Column A, west face, (1) lacing bar: 100% section loss, CS3, (Similar to Photo 55).
227	Bent 6, Level 2, between Columns A and B, horizontal bracing, all (7) lacing bars: 100% section loss, CS3, (Similar to Photo 87).
228	Bent 6, Level 2, between Columns C and D, near mid-length of longest diagonal bracing, outer flanges: Up to 5-1/2" long corrosion holes, CS3. -Note this member has been retrofitted and retrofit is in good condition, (Similar to Photo 52).
229	Bent 6, Level 2, between Columns B and C, lower west diagonal bracing near Column C, north angle vertical leg: Corrosion hole, 3” L x 2” H, CS3, (See Photo 86).

NOTE:
THE BRIDGE IS ORIENTED FROM SOUTH (TO HILO) TO NORTH (TO HONOKAA) ACCORDING TO THE BRIDGE PLANS. THE GIRDERS ARE NUMERICALLY LABELED "1" TO "4", FROM DOWNSTREAM (MAKAI) TO UPSTREAM (MAUKA). THE SUBSTRUCTURE COLUMNS ARE LABELED ALPHABETICALLY "A" TO "D", FROM DOWNSTREAM (MAKAI) TO UPSTREAM (MAUKA)

SCALE: 1/32" = 1'

MARCH, 2024

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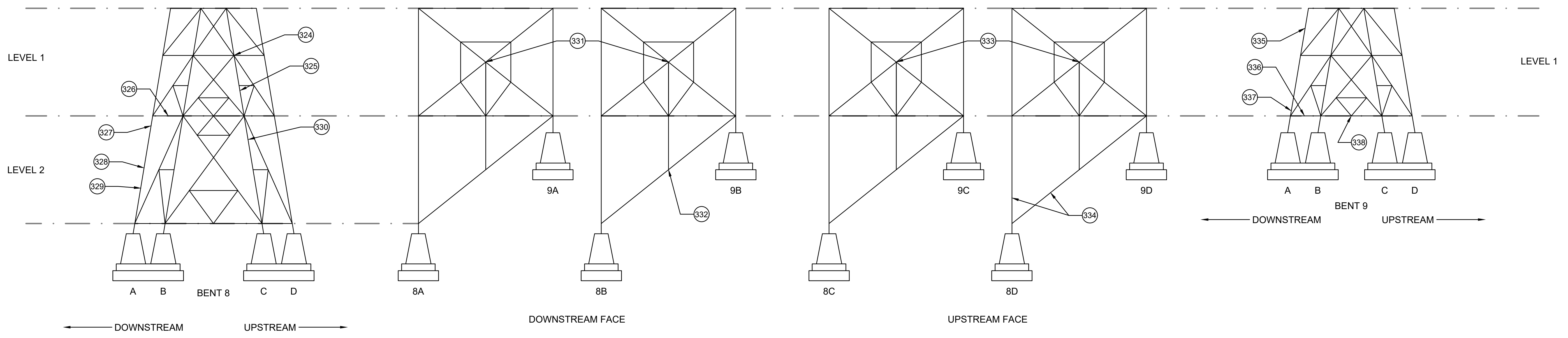
STATE OF HAWAII D.O.T

NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

TOWER 4 (BENTS 6 & 7)

Defect ID	Caption
230	Bent 6, Level 2, between Columns C and D, horizontal bracing, all (4) lacing bars: 100% section loss, CS3, (See Photo 87).
231	Bent 6, Level 3, Column B, mid-height, west face: Multiple lacing bars with 100% section loss, CS3; Similar condition on west face of Level 3, west face of Level 2, both faces of Level 4, and east face of Level 5; West face of Level 5 only has (5) bars total intact, (Similar to Photo 55).
232	Bent 6, Level 3, between Columns B and C, vertical bracing, exterior angle: Corrosion holes, up to 3" x 1 1/2", CS3, (Similar to Photo 68).
233	Bent 6, Level 3, between Columns B and C, horizontal bracing, 1/4 point from Column B: 1" section loss typical along full length of vertical legs of interior and exterior angles, CS3, (Similar to Photo 41).
234	Bent 6, Level 3, west of Column B, south gusset plate: 1-1/2" W x 8" H area of 100% section loss, CS3, (See Photo 88).
235	Bent 6, Level 3, Column A, all flanges: 4' L area of heavy section loss with laminar corrosion and knife-edging, CS3, (Similar to Photo 123).
236	Bent 6, Level 3, Column C, south face cover plate: Heavy laminar corrosion on the lacing bars up to 100% section loss, with typically more than 50% section loss on west face of Column D and east face of Column C, CS3, (Similar to Photo 55).
237	Bent 6, Level 3, Column C, south face cover plate: 50% of rivet heads have up to 20% remaining section, CS3, (See Photo 89).
238	Bent 6, Level 3, between Columns B and C, horizontal bracing, 1/4 point from Column C: (6) lacing bars have 90% to 100% section loss; Edge of angles typically have knife-edging with 100% section loss of all edges, CS3, (Similar to Photo 81).
239	Bent 6, Level 4, Column B, southeast flange: Corrosion hole up to 2" diameter throughout upper half of level, CS3, (Similar to Photo 40).
240	Bent 6, Level 4, between Columns B and C, lower east diagonal bracing: Global distortion to the diagonal bracing due to tree, CS2.
241	Bent 6, Level 4 through 6, Columns A and B vertical, lacing bars: Laminar corrosion with up to 100% loss, CS3, (Similar to Photo 55).
242	Bent 6, Level 4, Column B, exterior gusset plate at horizontal bracing: 3-1/2" diameter corrosion hole, CS3, (See Photo 90).
243	Bent 6, Level 4, Column A, gusset plate at horizontal bracing: 75% section loss with corrosion holes, CS3, (Similar to Photo 120).
244	Bent 6, Level 4, between Columns A and B, horizontal bracing adjacent to Column A, both channels: Up to 2" diameter corrosion holes throughout, CS3, (Similar to Photo 14).
245	Bent 6, Level 4, between Columns B and C, upper west diagonal bracing near Column C: 2-1/2” diameter corrosion hole on south vertical leg of angle, CS3, (Similar to Photo 86).
246	Bent 6, Level 4, between Columns B and C, vertical bracing: Severe corrosion throughout this member with up to 60% cross sectional loss, CS4, (See Photo 91).
247	Bent 6, Level 4 and 5, Column C: All top lacing bars on the west side have 100% section loss. Remaining lacing bars on this column from here to the bottom have severe laminar corrosion with an average 75% section loss, CS4, (Similar to Photo 55).
248	Bent 6, Level 4, between Columns C and D, main diagonal bracing, batten plate: Pitting and knife-edging, CS3, (Similar to Photo 47).
249	Bent 6, Level 4, between Columns B and C, lower west diagonal adjacent to Column C: Corrosion holes and knife-edging at exterior vertical flange and section of missing vertical flange at lower end for 1' 6" L, CS3, (See Photo 92).
250	Bent 6, Level 4, between Columns B and C, lower east diagonal bracing: Large tree leaning heavily on bracing, CS3, (See Photo 93).
251	Bent 6, Level 5, between Columns B and C, upper east diagonal adjacent to Column B, batten plates: Up to 40% section loss, CS3, (Similar to Photo 47).
252	Bent 6, Level 5, Column B: Almost all lacing bars on the west side of the column have 100% section loss; (6) bars remaining intact at time of inspection, CS4, (See Photo 94).
253	Bent 6, Level 5, between Columns A and B, horizontal bracing web members: Up to 75% section loss throughout, CS4, (See Photo 95).
254	Bent 6, Level 5, Column A, gusset plate at horizontal bracing: 75% section loss with corrosion holes, CS3, (See Photo 96).
255	Bent 6, Level 5, Column C, east face, lacing bars: (2) missing bars, CS3, (Similar to Photo 76).
256	Bent 6, Level 5, between Columns C and D, horizontal bracing: 25% section loss to angles and lacing bars, CS3, (Similar to Photo 87).
257	Bent 6, Level 6, between Columns A and B, horizontal bracing: Damage, member impacted by falling rocks, CS3, (See Photo 97).
258	Bent 6, Level 6, between Columns B and C, horizontal bracing: (1) deformed batten plate on top side of horizontal, CS2.
259	Bent 6, Level 6, between Columns B and C, lower east diagonal at third point closest to Column B: Missing batten plate, CS3, (See Photo 98).
260	Bent 6, Level 6, between Columns B and C, mid-length vertical bracing above crossing horizontal: Detached batten plate, CS3, (See Photo 99).
261	Bent 6, Level 6, Column D: Pitting up to 3/8” deep adjacent to lacing bars previously cleaned and painted, CS3, (Similar to Photo 55).
262	Tower 4, Level 1, Column A, lower north diagonal: Localized pitting over 4' L with (3) corrosion holes up to 1" diameter in the vertical leg of the east angle, CS3, (Similar to Photo 30).
263	Tower 4, Level 1, Column B, lower south diagonal bracing: Exterior angle of diagonal has 100% section loss to vertical leg and only 2-1/2" of section remaining on horizontal leg; angle is deformed 1/4" over 10" near section loss; gusset plate has 3" diameter corrosion hole, CS4, (See Photo 100).
264	Tower 4, Level 1, Column B, upper north diagonal bracing: Interior angle of diagonal has 3" diameter corrosion hole in vertical leg of angle at connection, CS4, (See Photo 101).
265	Tower 4, Level 1, Column B, upper south diagonal bracing: Exterior angle of diagonal has 100% section loss to vertical leg and only 2" of section remaining on horizontal leg; angle is deformed 1/4" over 10" near section loss, CS4, (See Photo 102).
266	Tower 4, Level 1, Column B, upper south diagonal: Typical coating failure and surface rust with minor laminar corrosion at upper level, CS2.
267	Tower 4, Level 2, Column B, upper north diagonal bracing, vertical leg of exterior angle and gusset plate: 100% section loss, CS3, (Similar to Photo 24).
268	Tower 4, Level 2, Column B, lower south diagonal bracing at center gusset plate, both interior and exterior angle vertical legs: Corrosion holes, 3" diameter, CS3, (Similar to Photo 30).
269	Tower 4, Level 2, Column B, vertical bracing: 1/2" over 1' distortion to east leg of vertical angle, CS2.
270	Tower 4, Level 2, Column B, lower horizontal bracing: 2" diameter corrosion hole in interior channel web, CS3, (Similar to Photo 62).
271	Tower 4, Level 3, Column A, vertical bracing: Section loss, exterior leg with 80% loss. - Repaired. Top connection bolts of repaired section is not painted and exhibits surface corrosion, (See Photo 103).
272	Tower 4, Level 3, Column B, upper south diagonal bracing, vertical leg of interior angle: 100% section loss, CS3, (Similar to Photo 23).
273	Tower 4, Level 3, Column B, vertical bracing, batten plate connection: (2) missing rivets and knife-edging at open holes, CS3, (Similar to Photo 68).
274	Tower 4, Level 3, Column B, lower north diagonal bracing, vertical leg of exterior angle and gusset plate: 3" x 4" corrosion hole, CS3, (Similar to Photo 24).
275	Tower 4, Level 4, Column B: All bracing in this level bowed up to 6" inwards (west); vertical member angles have deformations up to 1" over 2', CS3, (See Photo 104).
276	Tower 4, Level 4, Column B, horizontal bracing, west channel: Corrosion hole, 9" W x 6" H, CS3, (Similar to Photo 62).
277	Tower 4, Level 4, Column B, gusset plate connection, inner lower diagonal bracing: Corrosion holes with up to 50% section loss, CS3, (Similar to Photo 70).
278	Tower 4, Level 4, Column B, horizontal bracing near Bent 7: Corrosion holes, up to 1" diameter along length, CS3, (Similar to Photo 62).
279	Tower 4, Level 5, Column B, mid-diagonal bracing, interior angle: Twisted over full length with deformation up to 6" over 2' 6", CS3, (See Photo 105).
280	Tower 4, Level 5, Column B, horizontal bracing: Soil and vegetation buildup on horizontal member top side.
281	Tower 4, Level 6, Column B: 3' diameter boulder on top of diagonal member at bottom connection; member appears to be deformed as a result, (See Photo 106).
282	Tower 4, Level 1, Column C, exterior channel: Deformed and bent inward 3" over 2' L, CS3, (Similar to Photo 104).
283	Tower 4, Level 1, Column C, upper north diagonal: Interior angle has deformation, bent downward 2" over 2' L; Exterior angle has areas of knife edging and corrosion near the top, CS3, (Similar to Photo 23).
284	Tower 4, Level 1, Column C, upper south diagonal, exterior angle: Deformed, angle bent downward 1" over 1' length, CS3, (Similar to Photo 66).
285	Tower 4, Level 2, Column C, vertical bracing: East angles bent out-of-plane 1/2” and west angle, (3) rivets have 90% section loss, CS3, (See Photo 107).
286	Tower 4, Level 2, Column D, vertical bracing, batten plate: Pitting up to 1/8" deep with scattered corrosion holes, CS3, (Similar to Photo 57).
287	Tower 4, Level 3, Column C, gusset plate connecting bracing to Bent 6: (14) of (18) rivet heads connecting the gusset plate to the column have 20% remaining on the inside face. East channel of bracing has more severe section loss at this location with (5) corrosion holes in the web up to 1” diameter, CS4, (See Photo 108).
288	Tower 4, Level 3, Column C, horizontal bracing, (2) lacing bars: Disconnected on the bottom, CS3, (Similar to Photo 81).
289	Tower 4, Level 3, Column C, lower south diagonal bracing: Both angles have 2” diameter corrosion holes at the base of the vertical legs, CS3, (Similar to Photo 30).
290	Tower 4, Level 3, Column C, lower north diagonal bracing: West angle has 4” H x 2” L area of 100% section loss adjacent to the gusset plate, and the east angle has 1/4” loss in same location. Combined for 50% loss of member cross sectional area, CS4, (See Photo 109).
291	Tower 4, Level 4, Column C, gusset plate at Bent 6: (9) of (18) rivet heads connecting the gusset plate to the column have 10% remaining on the inside face, CS3, (See Photo 110).
292	Tower 4, Level 4, Column C, horizontal bracing, near center: Large tree growing though the structure (incidental), (See Photo 111).

Defect ID	Caption
293	Tower 4, Level 4, Column C, vertical bracing, bottom edge of batten plate: Up to 1” H x full-width area of 100% section loss, CS3, (Similar to Photo 47).
294	Tower 4, Level 4, Column D, lower south diagonal bracing: Pitting and knife-edging with two corrosion holes in lower half (1" and 2" diameter), CS3, (Similar to Photo 66).
295	Tower 4, Level 5, Column C: Heavy pitting up to 3/16" deep, CS3, (Similar to Photo 123).
296	Tower 4, Level 5, Column C, mid-diagonal mid-length, interior top angle: 100% section loss for most of length of horizontal flange. Approximately 20% loss of cross sectional area, CS3, (See Photo 112).
297	Tower 4, Level 5, Column C, mid-diagonal adjacent to lower diagonal connection, exterior channel, looking north. Bent inward 3" over 2' L, CS3, (Similar to Photo 113).
298	Tower 4, Level 5, Column D, mid-diagonal: Up to 3/16" deep pitting throughout angles and lacing bars, CS3, (Similar to Photo 26).
299	Tower 4, Level 6, Column C, adjacent to Bent 6 pedestal, interior channel: 3" downward deformation over 1' 6" L, CS3, (See Photo 113).
300	Bent 7, Level 1, upper section, between Columns B and C, horizontal bracing, near Column B, looking south. 5” L x 1” H area of 100% section loss, CS3, (Similar to Photo 41).
301	Bent 7, Level 1, upper section, Column A, northwest flange angle: Corrosion hole, 2" diameter, CS3, (Similar to Photo 40).
302	Bent 7, Level 1, upper section, between Columns A and B, horizontal bracing, exterior angle: Corrosion hole, 7" L x 1" H, CS3, (Similar to Photo 18).
303	Bent 7, Level 1, upper section, Column A, gusset plate: (2) corrosion holes up to 1” diameter, CS3, (See Photo 114).
304	Bent 7, Level 1, lower section, between Columns A and B, diagonal bracing, top angle: Up to 100% section loss for 2' 4" L, CS3. -Note this member has been retrofitted and retrofit is in good condition, (Similar to Photo 52).
305	Bent 7, Level 1, lower section, Column A: 2" diameter corrosion hole in northeast flange angle, CS3, (Similar to Photo 40).
306	Bent 7, Level 1, lower section, between Columns A and B, horizontal bracing, multiple lacing bars: 100% section loss, CS3, (Similar to Photo 87).
307	Bent 7, Level 1, lower section, between Columns B and C, center gusset plate: Heavy pitting, laminar corrosion, and knife-edging with 2" and 1" diameter corrosion holes, CS3, (Similar to Photo 36).
308	Bent 7, Level 1, lower section, between Columns C and D, horizontal bracing, (1) lacing bar: 100% section loss, CS3, (Similar to Photo 87).
309	Bent 7, Level 2, between Columns A and B, diagonal bracing top angle: Up to 100% section loss for 2' 4" L, CS3. -Note this member has been retrofitted and retrofit is in good condition, (Similar to Photo 52).
310	Bent 7, Level 2, Column A, west face, numerous lacing bars: 100% section loss and several areas of heavy corrosion, CS3, (Similar to Photo 55).
311	Bent 7, Level 2, between Columns A and B, horizontal bracing and gusset plate at Column A: Repaired and repair is in good condition, (See Photo 115).
312	Bent 7, Level 2, between Columns B and C, upper west diagonal, near center gusset plate: Heavy laminar corrosion and knife-edging over 2' L, CS3, (Similar to Photo 116).
313	Bent 7, Level 2, between Columns B and C, lower west diagonal bracing, south angle: Heavy laminar corrosion and knife-edging over 4' L, CS3, (See Photo 116).
314	Bent 7, Level 2, between Columns C and D, horizontal bracing: Corrosion holes below horizontal, with (1) lacing bar with 100% section loss, CS3, (Similar to Photo 18).
315	Bent 7, Level 2, Column D, gusset plates: Corrosion, heavy laminar corrosion with diagonal lateral bracing corroded away and detached, CS4, (See Photo 117).
316	Bent 7, Level 3, between Columns C and D, lower east diagonal: Tree growing against structure, (See Photo 118).
317	Bent 7, Level 3, between Columns B and C, horizontal bracing: Corrosion with up to 100% section loss to lacing bars. Horizontal angle legs have heavy pitting up to 1/8" deep and laminar corrosion throughout, CS3, (Similar to Photo 87).
318	Bent 7, Level 3, Column B splice plate: Majority of connection rivets for Column B have section loss and corrosion, CS3, (See Photo 119).
319	Bent 7, Level 3, Column A, south horizontal bracing angle: 3" W x 4" H corrosion hole in vertical angle, CS3, (See Photo 120).
320	Bent 7, Level 3, Column C, east face, lacing bars: Heavy laminar corrosion and 100% section loss, CS3, (Similar to Photo 55).
321	Bent 7, Level 3, between Columns B and C, vertical bracing: Laminar corrosion and knife-edging throughout with scattered areas of 100% section loss, CS3, (Similar to Photo 68).
322	Bent 7, Level 3, between Columns C and D, horizontal bracing: Up to 100% section loss to batten plates, knife edging on top flange angles, and missing lacing bars, CS3, (See Photo 121).
323	Bent 7, Level 4, between Columns B and C, diagonal bracing: Heavy pitting, laminar corrosion and knife-edging with isolated corrosion holes on angle legs throughout, CS3, (Similar to Photo 86).



Defect ID	Caption
324	Bent 8, Level 1, upper section, west of Column C, lower horizontal bracing, south angle adjacent to gusset plate: Corrosion hole, 3” H x 1” W, CS3, (Similar to Photo 18).
325	Bent 8, Level 1, lower section, Column C, west face, (2) lacing bars: 100% section loss, CS3, (See Photo 122).
326	Bent 8, Level 1, lower section, between Columns A and B, horizontal bracing, lacing bars: Heavy laminar corrosion up to 20% section loss, CS3, (Similar to Photo 87).
327	Bent 8, Level 2, Column A, southeast flange: Corrosion hole, 2" diameter, CS3, (Similar to Photo 40).
328	Bent 8, Level 2, Column A, batten plates and lacing bars: Typically bent to the east on the east side, CS3, (Similar to Photo 113).
329	Bent 8, Level 2, Column A, bottom section, north face angles and web: Painted over pitting, full height x up to 3/16" deep, CS3, (See Photo 123).
330	Bent 8, Level 2, Column C, lacing bars: (4) on west face have 100% section loss; (1) on east face has 100% section loss, CS3, (Similar to Photo 55).
331	Tower 5, Level 1, Columns A and B center gusset: Pack rust up to 1" thick, CS3, (Similar to Photo 124).
332	Tower 5, Level 2, Column B, bottom horizontal, bottom batten plate: Severe laminar corrosion and is not connected to the channels anymore, CS3, (Similar to Photo 57).
333	Tower 5, Level 1, Columns C and D, center gusset: Pack rust up to 1" thick, CS3, (See Photo 124).
334	Tower 5, Level 2, Column D, digonal bracing, lacing bars: Heavy laminar corrosion (similar ast Bent 8, Column D), CS3, (See Photo 125).
335	Bent 9, Level 1, upper section, Column A, batten plates and lacing bars: Typically bent to the east on the east side. Similar on lower section, CS2.
336	Bent 9, Level 1, lower section, between Columns A and B, lower horizontal bracing, lacing bars: 50% section loss throughout, CS3, (Similar to Photo 87).
337	Bent 9, Level 1, lower section, Column A, at bottom, north face, east rivet heads: Laminar corrosion with up to 50% section loss, CS3, (Similar to Photo 11).
338	Bent 9, Level 1, lower section, between Columns B and C, lower horizontal bracing center gusset plate: Heavy laminar corrosion, up to 1-1/4" W with up to 50% section loss, CS3, (See Photo 126).

NOTE:
THE BRIDGE IS ORIENTED FROM SOUTH (TO HILO) TO NORTH (TO HONOKAA) ACCORDING TO THE BRIDGE PLANS. THE GIRDERS ARE NUMERICALLY LABELED "1" TO "4", FROM DOWNSTREAM (MAKAI) TO UPSTREAM (MAUKA). THE SUBSTRUCTURE COLUMNS ARE LABELED ALPHABETICALLY "A" TO "D", FROM DOWNSTREAM (MAKAI) TO UPSTREAM (MAUKA)

SCALE: 1/32" = 1'

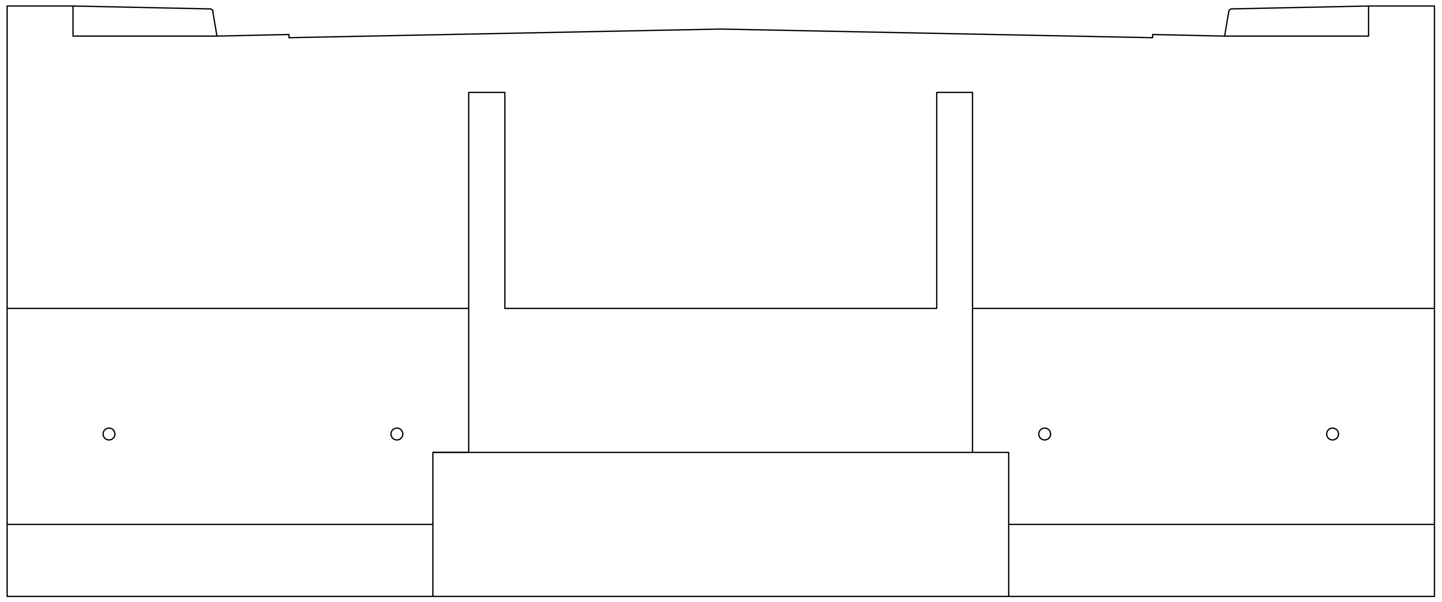
MARCH, 2024

737 Bishop St. Ste. 2700
Honolulu, HI 96813
PH.: 888.451.6822
FAX: 808.726.2909
consor

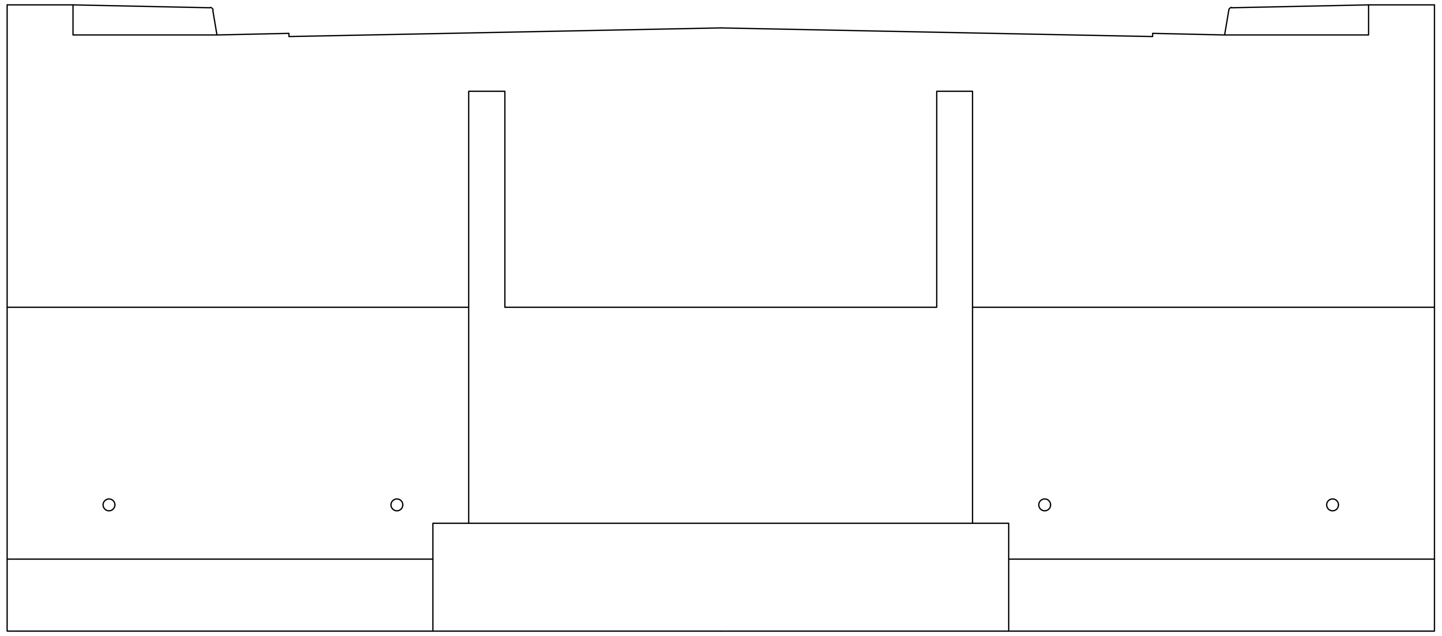
STATE OF HAWAII D.O.T

NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

TOWER 5 (BENTS 8 & 9)



SOUTH ABUTMENT



NORTH ABUTMENT

SCALE: 3/16" = 1'

MARCH, 2024

737 Bishop St. Ste. 2700
Honolulu, HI 96813
PH.: 888.451.6822
FAX: 808.726.2909

consor

STATE OF HAWAII D.O.T

NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

ABUTMENT ELEVATION

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Hawaii Department of Transportation
Bridge Load Rating Summary

Existing Bridge Data

Bridge Number:	001000190308146	Last Load Rating Date:	N/A
Bridge Name:	Nanue Stream Bridge	Last Inspection Date:	5-May-15
Route:	00019 Hawaii Belt Road	Inspected By:	WV and LL
District:	Hawaii	Fracture Critical Member (Y/N):	N/A
Span Type:	Steel Plate Girder	Item 58, Deck Rating:	7
Bridge Plans Available (Y/N):	Y	Item 59, Superstructure Rating:	7
Design Loading:	H20-44	Item 60, Substructure Rating:	7
Past Inventory Rating (HS20):	N/A	Bridge Load Posted (Y/N):	N
Past Operating Rating (HS20):	N/A	Posted Weight Limit:	N/A

Bridge Load Rating Summary

Dead Load Data

Overlay Type:	Asphalt
Overlay Depth (IN):	1.5 (assumed)
Was Overlay Depth Measured (Y/N):	N
Weight of Utilities:	0.224 klf
Weight of other Non-Structural Attachments:	Monorail 0.016 klf

LRFR Evaluation Factors

Surface Roughness Rating:	3 (asumed)
Condition Factor:	1.00
System Factor:	1.00
ADTT (one way):	N/A

Superstructure/Deck Rating Summary

	Vehicle Type	Vehicle GVW (Kips)	Rating Factor	Controlling Member	Controlling Load Effect	IM	Live Load Distribution Factor
Design Load	HL-93 (INV)	N/A	1.49	G4-2	Shear	33%	0.717 (M)
	HL-93 (OPR)	N/A	1.93	G4-2	Shear	33%	0.717 (M)
Legal Load	Type 3	50.0	2.97	G4-2	Shear	33%	0.717 (M)
	Type 3S2	72.0	2.82	G4-2	Shear	33%	0.717 (M)
	Type 3-3	80.0	2.95	G4-2	Shear	33%	0.717 (M)
	NRL	80.0	2.19	G4-2	Shear	33%	0.717 (M)
	SU4	54.0	2.69	G4-2	Shear	33%	0.717 (M)
	SU5	62.0	2.42	G4-2	Shear	33%	0.717 (M)
	SU6	69.5	2.30	G4-2	Shear	33%	0.717 (M)
	SU7	77.5	2.21	G4-2	Shear	33%	0.717 (M)
	EV2	57.5	2.51	G4-2	Shear	33%	0.717 (M)
	EV3	86.0	1.70	G4-2	Shear	33%	0.717 (M)
Permit Load	HP1	120.0	2.54	G4-4	Shear	33%	0.534 (0.641/1.2)
	HP2	157.0	2.34	G4-4	Shear	33%	0.534 (0.641/1.2)
	HP3	209.9	3.02	G4-4	Shear	33%	0.534 (0.641/1.2)

Substructure Rating Summary

Substructure Rated (Y/N): N

Vehicle Type	Vehicle GVW (Kips)	Rating Factor	Controlling Member	Controlling Load Effect	IM	Live Load Distribution Factor
HL-93 (INV)	N/A					
HL-93 (OPR)	N/A					
Legal Load						
Permit Load						

Posting Analysis Summary

Governing Legal Load Rating Factor:	1.70
Governing Legal Load Model:	EV3
Posting Recommended (Y/N):	N
Recommended Posting Load:	N/A

Please check the following boxes that apply:

☐ Bridge load rating is not governed by deck rating
☐ Bridge load rating is not governed by substructure rating
☒ Connections do not control the bridge load rating
☒ Exterior girder controls the bridge load rating
☒ Bridge plans do not exist - Rating based on judgement and current loading

Quality Control/Quality Assurance

Load Rating Engineer
- Name: Dean Kokubun, S.E.
- License No.: 10973-S
- Signature:

Load Rating Checked By: Christina Thung, P.E.
Quality Assurance By: Gary Smith, P.E.
Load Rating Date: 8/19/2017

Remarks/Recommendations for Bridges without Plans

Deck was not rated due to unavailable information and was assumed not to control the bridge load rating.
Substructure Rating was not load rated.
Where existing girder information was not provided, simliar girder section properties from other girders were used.

Routine Bridge Inspection Report

NANUE STRM

Bridge ID: 001000190308146

March 1 and 2, 2023


03/01/2023

Developed For: State of Hawaii Department of Transportation
District of Hawaii

Prepared By:

consor

Job No. S220128HI.02

Team Leader – Jason Gilliam, EIT

Quality Assurance/Quality Control – Thomas Howell, PE

Location Map

Bridge Name: NANUE STRM

Bridge ID: 001000190308146

GPS Coordinates

N: 19° 55’ 38.30”

W: 155° 09’ 22.55”

Table of Contents

Inspection Report

001000190308146
NANUE STRM
Inspector: Jason Gilliam
03/01/2023

IDENTIFICATION

Bridge Key:	001000190308146
NBI Number:	NANUE STRM
Structure Name:	NANUE STRM
Location (9):	1.66MI W/KAUNIHO RD
Carries (7):	HAWAII BELT RD
Type of Service (42A):	5 Highway-pedestrian
Feature Crossed (6):	NANUE STRM
Type of Service (42B):	5 Waterway
Placecode (4):	
County (3):	Hawaii
State (1):	15 Hawaii
Station:	
Region (2):	10 Hawaii
Latitude (16):	19.93
Longitude (17):	-155.16
Owner (22):	State Highway Agency
Custodian (21):	State Highway Agency

Year Built (27):	1952
Year Recon (106):	
Historical (37):	5 Not eligible for NRHP

Border State: Unknown (P)
Border Struct No (99): -2
% Responsibility: 0
Border FHWA Reg (98): Not Applicable

INSPECTION

Date of Inspection (90):	3/1/2023
Frequency (91):	24
Next Inspection:	3/1/2025

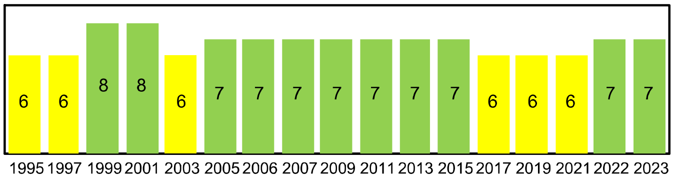
Inspection Type	Freq (92)	Last Insp (93)	Next Insp
Element	24	03/01/2023	03/01/2025
Fracture Critical (A)		N/A	N/A
Underwater (B)	48	03/01/2023	03/01/2027
Special Insp (C)		02/07/2022	N/A

LOAD RATING AND POSTING

Posting Status (41):	A - Open, no restriction
Posting % (70):	5 At/Above Legal Loads
Rating Date:	8/19/2017
Design Load (31):	4 M 18 (H 20)
Opr Method (63):	8 LRFR (HL93)
Opr Rating (64):	41.00 Tons
Inv Method (65):	8 LRFR (HL93)
Inv Rating (66):	25.00 Tons

DECK GEOMETRY

Deck Geometry (68):	4 Tolerable
Deck Area:	20,501.90
Deck Type (107):	1 Concrete-Cast-in-Place
Wearing Surface (108A):	6 Bituminous
Membrane (108B):	0 None
Deck Protection (108C):	None
O. to O. Width (52):	38.20
Curb / Sidewalk Width L (50A):	4.00
Curb / Sidewalk Width R (50B):	4.00
Median (33):	0 No median

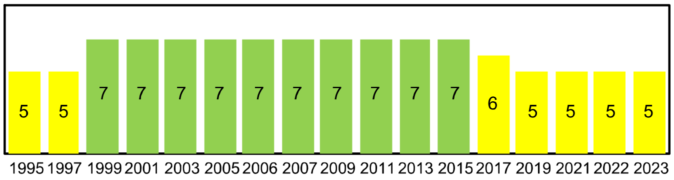


DECK CONDITION

Deck Rating (58):	7 Good
Bridge Rail (36A):	0 Substandard
Transition (36B):	1 Meets Standards
Approach Rail (36C):	1 Meets Standards
Approach Rail Ends (36D):	1 Meets Standards

SUPERSTRUCTURE GEOMETRY

# of Main Spans (45):	10
# of Approach Spans (46):	0
Main Material (43 A):	3 Steel
Main Design (43 B):	02 Stringer/Girder
Max Span Length (48):	72.00
Structure Length (49):	536.70
NBIS Length (112):	Long Enough
Temp Structure (103):	[blank] Not temporary
Skew (34):	0
Structure Flared (35):	0 No flare
Parallel Structure (101):	No || bridge exists
Approach Alignment (72):	5 Above Tolerable

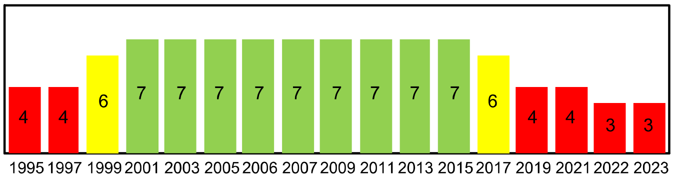


SUPERSTRUCTURE CONDITION

Superstructure Rating (59):	5 Fair
Structure Evaluation (67):	3 Intolerable - Correct

SUBSTRUCTURE GEOMETRY

Navigation Control (38):	Permit Not Required
Nav Vert Clearance (39):	0.00
Nav Horiz Clearance (40):	0.00
Pier Protection (111):	Unknown (NBI)
Lift Bridge Vertical Clearance (116):	
Scour Rating (113):	8 Stable Above Footing
Waterway Adequacy (71):	9 Above Desirable

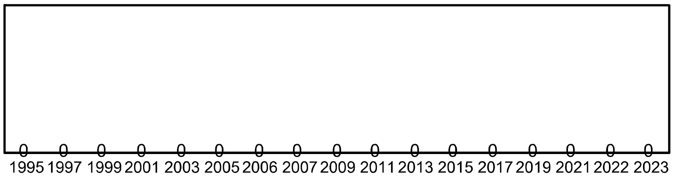


SUBSTRUCTURE CONDITION

Substructure Rating (60):	3 Serious
Channel Rating (61):	7 Minor Damage

CULVERT CONDITION

Culvert Rating (62):	N N/A (NBI)



ROUTE ON STRUCTURE: Hawaii Belt Rd (HI Route 19)

ROADWAY LOCATION

Pos Prefix (5A):	Route On Structure
Kind of Hwy (5B):	2 U.S. Numbered H
Route Num (5D):	00019
LRS Route (13A/B):	0000000019/00
Milepost (11):	17.99 mi (28.95 km)
Suffix (5E):	2 East
Lanes On (28A):	2
Detour Length (19):	1.24 mi (2.00 km)

ROADWAY CLASSIFICATION

Funct Class (26):	06 Rural Minor Arterial
Level Service (5C):	1 Mainline
NHS (104):	1 On the NHS
Defense Hwy (100):	0 Not a STRAHNET hwy
Toll Facility (20):	3 On free road
ADT (29):	6,700 Cars/Day
Pct Trucks (109):	9.00%
ADT Year (30):	2019
Traffic Dir (102):	2 2-way traffic
Nat. Truck Net(110):	0 Not part of natl netwo

CLEARANCES

Vertical (10):	99.99
Min Vert Over (53):	99.99
Vert Ref (54A):	N Feature not hwy or RR
Under Clear (54B):	0.00
Horizontal (47):	28.00
Min Lat Left (56):	1,075.31
Min Lat Right (55B):	0.00
Horiz Ref (55A):	N Feature not hwy or RR
Underclearance (69):	N Not applicable (NBI)
Appr Rd Width (32):	34.12
Roadway Width (51):	27.89

PROPOSED IMPROVEMENTS

Bridge Cost (94):		**Year of Cost Estimate (97):**	1999	**Future ADT (114):**	6,781
Roadway Cost (95):		**Type of Work (75):**	38 Other Structural		
Total Cost (96):	$21,528,000	**Length of Improvement (76):**	1,830.9 ft	**Year of Future ADT (115):**	2025

BRIDGE NOTES

NANUE STRM was built in 1952. The bridge carries two-lanes of traffic on Hawaii Belt Road (Hawaii Route 19) over Nanue Stream. The structure is a ten-span, reinforced concrete deck bridge on four built-up steel plate girders supported by two reinforced concrete abutments, four steel trestle towers, and one steel bent.

The structure is oriented from south to north, in the direction of advancing milepost. The channel flows from west (upstream) to east (downstream). Girders are numbered from east (Girder 1) to west (Girder 4). The trestle tower and bent columns are numbered from east (Column 1) to west (Column 4).

INSPECTION NOTES

Inspection Method:
On March 1 and 2, 2023, Consor Engineers, LLC, performed a routine bridge inspection for NANUE STRM. The inspection consisted of a visual examination of primary components of the bridge including the deck, girders, abutments, towers, and bent, as well as traffic safety related elements (bridge and approach railings). Due to the recent repairs and current inspection findings, the routine inspection will return to a 24 month frequency and the substructure will be inspected on a 12-month frequency as a special inspection on the non-routine year.

Access Method:
The underdeck was accessed on foot from the southeast and northwest approach embankments and using a state owned and operated underbridge inspection unit (UBIU). Single lane flagging was used during snooper operation with the remaining lane configured as single lane alternating to keep the roadway open to traffic . Industrial rope access was used to access the steel trestle towers and steel bent.

Load Rating:
The current load rating from 8/19/2017 was completed using rating of; Item 58, Deck: 7, Item 59, Superstructure: 7, and Item 60, Substructure: 7 with a condition factor of: 1.00. Based on the current inspection and current ratings of; Item 58, Deck: 7, Item 59, Superstructure: 5, and Item 60, Substructure: 3 an updated load rating is recommended. The current load rating summary sheet from 8/19/2017 is included in this report.

Item 61:
The rating for Item 61 Channel and Channel Protection is 7 - Minor Damage. The banks are stable and well vegetated. There is occasional timber debris strewn around the upstream and downstream banks.

Item 71:
The rating for Item 71 Waterway Adequacy is 9 - Above Desirable. The bridge deck and roadway approaches are above flood water elevations (high water). The chance of overtopping is remote.

Item 113
The current rating for Item 113 - Scour Critical Bridge is an 8 - Stable Above Footing. However, based on the 2023 Underwater Inspection Report, the recommended Scour Critical Bridge Rating for Item 113 a 5. The bridge foundations are determined to be stable for the assessed or calculated scour conditions. Scour is determined to be within the limits of the footing or piles. At Bent 5, the Column D footing is exposed, full height (29") with lava rock outcrop visible sticking out 2' from footing x 4' H and outcrop undermined up to 5' L x 42" H x up to 36" penetration. The Column Pedestals A, B, and C of Bent 5 and all the Column Pedestals of Bent 6 are not exposed to the flow of the channel. The void in Column Pedestal D should be filled/repaired and monitored during future inspections.

ELEMENT CONDITION SUMMARY

Str Unit	Elm/Env	Description	Total Qty	% in 1	Qty. St. 1	% in 2	Qty. St. 2	% in 3	Qty. St. 3	% in 4	Qty. St. 4
0	**12/1**	**Re Concrete Deck**	**20,502.00**	**98%**	**20,154.00**	**1%**	**135.00**	**1%**	**213.00**	**0%**	**0.00**
0	510/1	Wearing Surfaces	15,028.00	85%	12,712.00	0%	22.00	15%	2,292.00	0%	2.00
0	*3210/1*	*Del/Spall/Patch/Pot(Wear Surf)*	*60.00*	*0%*	*0.00*	*37%*	*22.00*	*60%*	*36.00*	*3%*	*2.00*
0	*3220/1*	*Crack (Wearing Surface)*	*2,256.00*	*0%*	*0.00*	*0%*	*0.00*	*100%*	*2,256.00*	*0%*	*0.00*
0	1080/1	Delamination/Spall/Patched Area	7.00	0%	0.00	100%	7.00	0%	0.00	0%	0.00
0	1120/1	Efflorescence/Rust Staining	64.00	0%	0.00	100%	64.00	0%	0.00	0%	0.00
0	1130/1	Cracking (RC and Other)	277.00	0%	0.00	23%	64.00	77%	213.00	0%	0.00
0	**107/1**	**Steel Opn Girder/Beam**	**2,268.00**	**23%**	**517.00**	**3%**	**60.00**	**75%**	**1,691.00**	**0%**	**0.00**
0	515/1	Steel Protective Coating	25,344.00	0%	0.00	85%	21,542.00	15%	3,802.00	0%	0.00
0	*3420/1*	*Peel/Bub/Crack(Stl Protect Coat)*	*3,802.00*	*0%*	*0.00*	*0%*	*0.00*	*100%*	*3,802.00*	*0%*	*0.00*
0	*3440/1*	*Eff (Stl Protect Coat)*	*21,542.00*	*0%*	*0.00*	*100%*	*21,542.00*	*0%*	*0.00*	*0%*	*0.00*
0	1000/1	Corrosion	1,688.00	0%	0.00	0%	0.00	100%	1,688.00	0%	0.00
0	1020/1	Connection	6.00	0%	0.00	50%	3.00	50%	3.00	0%	0.00
0	7000/1	Damage	57.00	0%	0.00	100%	57.00	0%	0.00	0%	0.00
0	**207/1**	**Stl Tower**	**591.00**	**0%**	**0.00**	**0%**	**0.00**	**81%**	**476.00**	**19%**	**115.00**
0	515/1	Steel Protective Coating	8,149.00	0%	0.00	73%	5,966.00	27%	2,183.00	0%	0.00
0	*3410/1*	*Chalk(Steel Protect Coatings)*	*204.00*	*0%*	*0.00*	*0%*	*0.00*	*100%*	*204.00*	*0%*	*0.00*
0	*3440/1*	*Eff (Stl Protect Coat)*	*7,944.00*	*0%*	*0.00*	*75%*	*5,966.00*	*25%*	*1,978.00*	*0%*	*0.00*
0	1000/1	Corrosion	587.00	0%	0.00	0%	0.00	81%	473.00	19%	114.00
0	1020/1	Connection	4.00	0%	0.00	0%	0.00	75%	3.00	25%	1.00
0	**215/1**	**Re Conc Abutment**	**104.00**	**57%**	**59.00**	**38%**	**40.00**	**5%**	**5.00**	**0%**	**0.00**
0	1080/1	Delamination/Spall/Patched Area	4.00	0%	0.00	0%	0.00	100%	4.00	0%	0.00
0	1190/1	Abrasion(PSC/RC)	41.00	0%	0.00	98%	40.00	2%	1.00	0%	0.00
0	**220/1**	**Re Conc Pile Cap/Ftg**	**80.00**	**60%**	**48.00**	**16%**	**13.00**	**24%**	**19.00**	**0%**	**0.00**
0	1080/1	Delamination/Spall/Patched Area	6.00	0%	0.00	0%	0.00	100%	6.00	0%	0.00
0	1190/1	Abrasion(PSC/RC)	3.00	0%	0.00	0%	0.00	100%	3.00	0%	0.00
0	6000/1	Scour	23.00	0%	0.00	57%	13.00	43%	10.00	0%	0.00
0	**301/1**	**Pourable Joint Seal**	**269.00**	**88%**	**237.00**	**1%**	**3.00**	**11%**	**29.00**	**0%**	**0.00**
0	2310/1	Leakage	28.00	0%	0.00	0%	0.00	100%	28.00	0%	0.00
0	2330/1	Seal Damage	1.00	0%	0.00	0%	0.00	100%	1.00	0%	0.00
0	7000/1	Damage	3.00	0%	0.00	100%	3.00	0%	0.00	0%	0.00
0	**311/1**	**Moveable Bearing**	**20.00**	**0%**	**0.00**	**40%**	**8.00**	**60%**	**12.00**	**0%**	**0.00**
0	515/1	Steel Protective Coating	40.00	30%	12.00	40%	16.00	0%	0.00	30%	12.00
0	*3420/1*	*Peel/Bub/Crack(Stl Protect Coat)*	*40.00*	*30%*	*12.00*	*40%*	*16.00*	*0%*	*0.00*	*30%*	*12.00*
0	1000/1	Corrosion	14.00	0%	0.00	57%	8.00	43%	6.00	0%	0.00
0	1020/1	Connection	6.00	0%	0.00	0%	0.00	100%	6.00	0%	0.00
0	**313/1**	**Fixed Bearing**	**24.00**	**0%**	**0.00**	**63%**	**15.00**	**38%**	**9.00**	**0%**	**0.00**
0	515/1	Steel Protective Coating	48.00	4%	2.00	0%	0.00	4%	2.00	92%	44.00
0	*3420/1*	*Peel/Bub/Crack(Stl Protect Coat)*	*48.00*	*4%*	*2.00*	*0%*	*0.00*	*4%*	*2.00*	*92%*	*44.00*
0	1000/1	Corrosion	23.00	0%	0.00	65%	15.00	35%	8.00	0%	0.00
0	1020/1	Connection	1.00	0%	0.00	0%	0.00	100%	1.00	0%	0.00
0	**331/1**	**Re Conc Bridge Railing**	**1,074.00**	**0%**	**0.00**	**100%**	**1,074.00**	**0%**	**0.00**	**0%**	**0.00**
0	7000/1	Damage	1,074.00	0%	0.00	100%	1,074.00	0%	0.00	0%	0.00

ELEMENT NOTES

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
12	**Re Concrete Deck**	**1**	**20,502.00**	**sq.ft**	**20,154.00**	**135.00**	**213.00**	**0.00**
	Total quantity changed from 20382 SF to 20502 SF due to 536.7' structure length x 38.2' out-to-out per field measurements. **-The deck has 16 drains on each side, 32 total; most deck drains are clear with minor corrosion on the grating.** **-Span 2, east overhang, 1st scupper south of Bent 2, vegetation growth and almost full of debris, (See Photo 14).** **-The sidewalks are scaled throughout, typically 1/8” deep.**							
510	Wearing Surfaces	1	15,028.00	sq.ft	12,712.00	22.00	2,292.00	2.00
	Total quantity changed from 14809 SF to 15028 SF due to 536.7' structure length x 28' curb-to-curb per field measurements.							
3210	*Del/Spall/Patch/Pot(W*	*1*	*60.00*	*sq.ft*	*0.00*	*22.00*	*36.00*	*2.00*
	-South Abutment Joint, NB lane, 6” diameter x 1” deep spall adjacent to crack, 1 SF CS3, (See Photo 15). *-Bent 3 Joint, both lanes, 2' 4” L x 4' W area of settled patches with a 6" Dia. x 1" D spall within. The rest of the paved over joint is rutted up to 1” deep, 8 SF CS3, (See Photo 16).* *-Span 4, NB lane, 20’ north of Bent 3, 3’ L x 3’ W area of gouges (largest is 1’ 1” L x 2’ W x 1/2" deep), 5 SF CS3, (See Photo 17).* *-Bent 5 Joint, NB lane, 2' 4" L x 4' W x 1/2" deep cracked and settled pothole with ponding water, 8 SF CS3, (See Photo 18).* *-Bent 5 Joint, SB lane, 2' L x 4' 5" W x 2" deep settled patch with a 11" L x 11" W x 1" deep spall within with exposure of deck and joint, 1 SF CS3, 1 SF CS4 (See Photo 19).* *-Span 8, NB lane, 15' north of Bent 7 Joint, 8” L x 15" W x 1/2" deep patched pothole that is failing and has ponding water, 1 SF CS3, (See Photo 20).* *-Bent 7 Joint, SB lane, previous cracked and settled patch has been re-patched, 8 SF CS2, (See Photo 51).* *-Bent 9 Joint, SB lane, wearing surface, 16" L x 21" W x 1" deep cracked and settled patch with 5" L x 11" W x 1" deep pothole within with exposure of steel plate and joint material, 4 SF CS3, 1 SF CS4, (See Photo 21).* *-Bent 9 Joint, NB right wheel line, cracked and settled potholes with ponding water, 6 SF CS3, (See Photo 22).* *-North Abutment Joint, SB lane, (3) potholes, (2) are patched 2’ L x up to 4’ W and (1) is 8” diameter x 1” deep, 8 SF CS2, 1 SF CS3, (Similar to Photo 21).* *-North Abutment Joint, NB lane, left wheel line, 2’ L x 3’ W patch, 6 SF CS2.*							
3220	*Crack (Wearing Surfac*	*1*	*2,256.00*	*sq.ft*	*0.00*	*0.00*	*2,256.00*	*0.00*
	-Wearing surface, full length cracking with associated map cracking and rutting in the wheel lines of both NB and SB lanes throughout approximately 15% of the entire wearing surface, typically 1/8" W to 1/4"W, 2230 SF CS3, (Similar to Photo 23). *-South Abutment Joint, NB lane, 12’ L x up to 1/8” W transverse crack with adjacent spall, 11 SF CS3, (See Photo 23).* *-North Abutment Joint, transverse cracking up to 1/8” W throughout, 15 SF CS3, (Similar to Photo 23).*							
1080	Delamination/Spall/Patche	1	7.00	sq.ft	0.00	7.00	0.00	0.00
	Underside of Deck: -West overhang at Bent 3 Joint, edge spalling along the joint with (1) exposed reinforcing bar above Girder 4, 7 SF CS2.							
1120	Efflorescence/Rust Stainin	1	64.00	sq.ft	0.00	64.00	0.00	0.00
	Underside of Deck: -All spans, Bays 1 and 3, transverse cracking with efflorescence throughout, typically 2'-3' apart x up to 1/32” W, 64 SF CS2.							
1130	Cracking (RC and Other)	1	277.00	sq.ft	0.00	64.00	213.00	0.00

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4

Underside of Deck:
-All spans, Bays 1 and 3, transverse cracking throughout, typically 2'-3' apart x up to 1/32” W, with and without efflorescence, 64 SF CS2.
-All spans, both overhangs, transverse cracking with efflorescence throughout, typically 3’-4’ apart x up to 1/8” W, 85 SF CS3, (See Photo 24).
-All spans, Bay 2, map cracking throughout, up to 1/16” W, 128 SF CS3, (See Photo 25).

107	**Steel Opn Girder/Beam**	**1**	**2,268.00**	**ft**	**517.00**	**60.00**	**1,691.00**	**0.00**

Four (4) built-up steel girders, numbered from east (downstream) to west (upstream).

-The cross frames typically have painted over pitting 1/16” deep with isolated areas up to 1/4” deep and areas of corrosion, (See Photo 26).
-Bent 3, Bay 2, both cross frames, laminar corrosion throughout with up to 25% section loss of member.
-Span 4, Bay 2, 2nd diaphragm, lower horizontal member, 3" diameter corrosion hole at both girder connections and impact damage to angle 1 1/2" over 10” L.
-Span 4, Bay 2, lateral bracing, lower gusset plates at 2nd and 3rd cross frames have pack rust and corrosion holes up to 6” L x 2” W adjacent to Girder 3.
-Span 4, Bay 2, lower gusset plates at 2nd and 3rd cross frames, pack rust and corrosion holes up to 6" L x 2" W adjacent to Girder 3.
-Span 6, Bay 1 at Bent 5, adjacent to Girder 1, lower lateral bracing (wind bracing), 100% section loss on bottom flange over 10” L x up to 1 1/2" deep, (See Photo 27).
-Span 6, Bay 2, 2nd cross frame lower strut adjacent to Girder 3, (2) corrosion holes up to 3" diameter and there are small corrosion holes adjacent to Girder 2 at the 2nd and 3rd cross frame.
-Span 8, Bay 2, 2nd lower strut, (2) missing bolts and (1) corrosion hole, 5” L x 2” W, (See Photo 28).
-Span 8, Bay 2, 3rd lower strut, missing bolts and (1) corrosion hole, 4” L x 1 1/2” W, (Similar to Photo 28).
-Span 9, Bay 1 at Bent 9, adjacent to Girder 1, lower bracing, 100% section loss on bottom flange over 1’ L x up to 1” W, (Similar to Photo 27).
-North Abutment, Girder 3, Bay 2, lateral bracing has (3) missing/ loose anchor bolts and a deformed gusset plate.

515	Steel Protective Coating	1	25,344.00	sq.ft	0.00	21,542.00	3,802.00	0.00
3420	*Peel/Bub/Crack(Stl Prc*	*1*	*3,802.00*	*sq.ft*	*0.00*	*0.00*	*3,802.00*	*0.00*

Approximately 15% of the steel protective coating exhibits peeling/ bubbling, 3802 SF CS3, (See Photo 41).

3440	*Eff (Stl Protect Coat)*	*1*	*21,542.00*	*sq.ft*	*0.00*	*21,542.00*	*0.00*	*0.00*

The steel protective coating is substantially effective throughout, 21542 SF CS2.

1000	Corrosion	1	1,688.00	ft	0.00	0.00	1,688.00	0.00

STRUCTURE UNIT: 0

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4

-The bottom flange (top and bottom faces) of the exterior girders have peeling paint and moderate corrosion along the ends in each span, typically 4' L x 5” W, with up to 3/16" deep section loss, 160 LF CS3, (See Photo 29).
-The interior girder webs exhibit peeling paint and laminar corrosion randomly throughout (roughly 40%) with isolated areas of pitting up to 1/8” deep. The interior girder webs are similarly affected for 5% of it's area, 478 LF CS3, (Similar to Photo 31).
-The exterior webs of the exterior girders have intermittent areas (roughly 15%) of painted over pitting up to 1/8" deep, 160 LF CS3, (Similar to Photo 31).
-The rivets along the bottom of the girder webs have painted over section loss and areas of peeling paint with moderate corrosion and section loss, typically up to 15%, 840 LF CS3, (Similar to Photo 36).
-Span 2, Bay 1, top flange plate of Girder 1, intermittent areas of up to 2' L x 2" W x 1/2" deep painted over pitting, 10 LF CS3, (See Photo 30).
-Span 2, Girder 1, west face, 25’ L section of painted over pitting up to 1/8” deep, 25 LF CS3, (See Photo 31).
-Span 2, Girder 3, east face bottom flange, (2) missing rivets in 1' L area of up to 1" thick pack rust, 1 LF CS3, (See Photo 32).
-Bent 3, Bay 1, Girder 1 and 2 bottom flange connection, rivet heads have corrosion with up to 50% section loss, 2 LF CS3, (See Photo 33).
-Bent 3, Bay 1, Girder 2, web sliding plate, (3) missing bolts with heavy laminar corrosion, 1 LF CS3, (See Photo 34).
-Bent 3, Girder 1, top of sliding web plate, 5” H x 2” W area of 1/8” to 100% section loss, area of 100% loss is 1” W, 1 LF CS3, (See Photo 35).
-Span 4, Girder 3 splice and bottom flange, 3' L x up to 1/8" W pitting and rivet head corrosion with up to 25% section loss, as well as peeling paint, 3 LF CS3, (See Photo 36).
-Span 4, Girder 4 east face, near Bent 3, bearing stiffener, pack rust up to 1" thick at the base with four missing rivets, 1 LF CS3, (Similar to Photo 37).
-Bent 5, Girder 1 web sliding plate, corrosion induced crack at the top 1” with heavy laminar corrosion around the crack, 1 LF CS3, (Similar to Photo 35).
-Span 6, Bent 5, web stiffener above Girder 1 bearing, 3/16” thick pack rust causing a 1’-11” H x 1” deflection, 1 LF CS3, (See Photo 37).
-Span 8, Girder 3 at Bent 7, east face bearing stiffener, pack rust up to 3/4” and 100% section loss for bottom 5” x 1/2” W, 1 LF CS3, (Similar to Photo 37).
-Span 10, Girder 1, east face at North Abutment, 3” L x 1/2” W area of 100% section loss, 1 LF CS3, (See Photo 38).
-Span 10, Girder 1, east face at North Abutment, (2) bearing stiffeners have effectively no remaining section at the lower 2" at the base. The eastern bottom flange has 2" W knife edging. This condition is similar at the Girder 4 East face, 2 LF CS3, (See Photo 39).

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1020	Connection	1	6.00	ft	0.00	3.00	3.00	0.00

-Span 2, Girder 4, east face stiffeners, (3) abandoned plates with missing connection bolts, 3 LF CS2.
-Bent 3, Girder 2 web sliding plate, missing bolts and nuts and heavy laminar corrosion, 1 LF CS3, (Similar to Photo 40).
-Bent 3, Girder 4 web sliding plate, heavy corrosion at the bolt slots and (2) missing bolts at the bottom, with a 2" H x 3" W area of 100% section loss, 1 LF CS3, (See Photo 40).
-Bent 5, Girder 2 web sliding plate, (1) missing connection bolt, 1 LF CS3, (Similar to Photo 40).

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
7000	Damage	1	57.00	ft	0.00	57.00	0.00	0.00

-There are approximately 30 bent transverse stiffeners in isolated locations throughout the structure, 30 LF CS2.
-South and North Abutment girder seats, all the girder bottom flanges have deformations up to 1' 6" L x 1" deflection, 16 LF CS2.
-Span 1, Girder 4, east face, between 2nd and 3rd cross frame, (1) stiffener has a 1" deflection to the south, 1 LF CS2.
-Bent 8, Girder 1 exterior web stiffener, 2' 6” H x 1” deflection and the third stiffener to the north has a 8” H x 1” deflection, 4 LF CS2.
-Bent 9, Girder 1 exterior stiffeners, deflections, up to 1” in intermittent locations, 5 LF CS2.
-Span 9, Girder 4, east top flange near midspan, deformation, 6" L x 1" H, 1 LF CS2.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
207	**Stl Tower**	**1**	**591.00**	**ft**	**0.00**	**0.00**	**476.00**	**115.00**

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4

Typical defects for all Towers (unless otherwise noted, refer to the attached drawings for specific defects and their locations):

All original members typically have failing paint and laminar corrosion throughout with knife edging and section loss up to 10% of total cross-sectional area. Gusset plates typically have laminar corrosion around the incoming members with 1/8” deep section loss to the plate and incoming member. There is also pack rust up to 3/8” thick between the gusset plates and incoming members. Isolated rivet heads exhibit up to 25% section loss. There are random instances of distorted members, typically up to 1”.

All trestle towers typically have more advanced deterioration at the top level (Level 1) and throughout the lower levels from Towers 2 through 4. There is light to moderate vegetation throughout the bottom of Towers 2 through 4. All trestle towers have been retrofitted with bolted bracing members.

High Priority Findings:

-Tower 3, Bent 4 to 5, Column A, Level 3 - Vertical in Level 3 is completely detached from the upper horizontal member of Level 4. - Repaired, (See Photo 98).

The following "Damage" defects have been repaired (See Photo 98):

Tower 3, Bent 4, Column A, Level 3 was impacted by a vehicle and exhibits the following:
-Up to 4" out of plane distortion to the north over the full height of Level 3 and up to 1" to the west over the lower 10' of Level 3.
-Lower two previously cut lacing bars on the makai face have been bent towards makai up to 12".
-62" above the top edge of the bottom batten plate is a 1 7/8" L crack in the northwest flange.
-There is a deformed lacing bar pair which exhibits a cracked weld at the northeast flange in the upper half of the column on the makai face.
-The connection plates to Bent 4, Column A from the diagonal bracing are bowing outward.
-The diagonal bracing is bucked at the Bent 4, Column A connection plate and is damaged and severed near midspan.
-The vertical bracing at midspan that connects to the diagonal bracing exhibits two severed connection plates at the base connection to a horizontal bracing.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
515	Steel Protective Coating	1	8,149.00	sq.ft	0.00	5,966.00	2,183.00	0.00
3410	*Chalk(Steel Protect Co*	*1*	*204.00*	*sq.ft*	*0.00*	*0.00*	*204.00*	*0.00*
	The towers exhibit chalking in isolated locations throughout, 204 SF CS3.							
3440	*Eff (Stl Protect Coat)*	*1*	*7,944.00*	*sq.ft*	*0.00*	*5,966.00*	*1,978.00*	*0.00*
	The steel protective coating on the trestle tower members range from substantially effective to limited effectiveness, 5966 SF CS2, 1978 SF CS3.							
1000	Corrosion	1	587.00	ft	0.00	0.00	473.00	114.00

STRUCTURE UNIT: 0

Priority 2 (High) Findings (repair within 3 years) (Total 114 LF CS4):

-Bent 4, Level 2, Column C, 50% of lacing bars on west face have 100% section loss, remaining bars on both faces have average 30% section loss, 32 LF CS4, (See Photo 88).

-Bent 4, Level 3, horizontal bracing at gusset plates at Column A, horizontal bracing gusset plate has 100% section loss on all sides. This member is not connected to Column A anymore, 1 LF CS4, (See Photo 90).

-Bent 5, Level 2, between Columns B and C, lower west diagonal bracing, connection to Column C, north angle exhibits two 10" L x up to 4" H holes with 1" x 3" remaining section. Remaining length of diagonal exhibits knife-edging and pitting, 16 LF CS4, (See Photo 109).

-Bent 5, Level 2, Column D, horizontal bracing gusset plates, heavy laminar corrosion with up to 100% section loss with 15% section remaining of the north gusset plate and repair plates becoming ineffective, 1 LF CS4, (See Photo 111).

-Bent 6, Level 4, between Columns B and C, vertical bracing, severe corrosion throughout this member with up to 60% loss, 9 LF CS4, (See Photo 128).

-Bent 6, Level 5, Column B, almost all lacing bars on the west side of the column have 100% section loss; (6) bars with section loss intact at time of inspection, 28 LF CS4, (See Photo 131).

-Bent 6, Level 4 and 5, Column C, all top lacing bars on the west side have 100% section loss. Remaining lacing bars on this column from here to the bottom have severe laminar corrosion with an average 75% section loss, 23 LF CS4, (Similar to Photo 131). (41 LF overlapping)

-Tower 4, Level 1, lower south diagonal bracing, exterior angle of diagonal has 100% section loss to vertical leg and only 2 1/2" of section remaining on horizontal leg; angle is deformed 1/4" over 10" near section loss, 1 LF CS4, (See Photo 133).

-Tower 4, Level 1, Column B, upper north diagonal bracing, 3" diameter corrosion hole in vertical leg of angle at connection, 1 LF CS4.

-Tower 4, Level 1, Column B, upper south diagonal bracing, exterior angle of diagonal has 100% section loss to vertical leg and only 2" of section remaining on horizontal leg; angle is deformed 1/4" over 10" near section loss, CS4.

-Tower 4, Level 3, Column C, lower south diagonal bracing, west angle has 4" H x 2" L area of 100% section loss adjacent to the gusset plate, and the east angle has 1/4" loss in same location. Combined for 50% loss of member cross sectional area, 1 LF CS4, (See Photo 138).

-Bent 7, Level 2, Column D, gusset plates, corrosion, heavy laminar corrosion with diagonal lateral bracing corroded away and detached, 1 LF CS4, (See Photo 148).

NOTE: The defects in the attached drawings account for 473 LF CS3. This quantity typically includes laminar corrosion and knife-edging throughout the members.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1020	Connection	1	4.00	ft	0.00	0.00	3.00	1.00

NOTE: The defects in the attached drawings account for 3 LF CS3, 1 LF CS4. This quantity typically includes deteriorated or missing rivet heads at connections throughout the towers.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
215	**Re Conc Abutment**	**1**	**104.00**	**ft**	**59.00**	**40.00**	**5.00**	**0.00**

-South Abutment has moss growth on both east and west ends.
-The stone masonry wingwalls are covered in vegetation.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1080	Delamination/Spall/Patche	1	4.00	ft	0.00	0.00	4.00	0.00

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
	-South Abutment, Bay 3, center section, spall, 1' 4" H x 8" W x 1" deep, 1 LF CS3, (See Photo 42). -North Abutment, Girder 3 seat, failed repair, 2' 11" L x 10" H x 3" deep exposing (2) reinforcing bars with no section loss, 3 LF CS3, (See Photo 43).							
1190	Abrasion(PSC/RC)	1	41.00	ft	0.00	40.00	1.00	0.00
	-North Abutment, center section, up to 1/4" deep scaling throughout, 40 LF CS2. -North Abutment, west end of center section, honeycombing, up to 2' H x 1" W x 1" deep, 1 LF CS3, (See Photo 44).							
220	**Re Conc Pile Cap/Ftg**	**1**	**80.00**	**ft**	**48.00**	**13.00**	**19.00**	**0.00**
	Four (4) tower columns that are labeled from downstream (Column A) to upstream (Column D).							
1080	Delamination/Spall/Patche	1	6.00	ft	0.00	0.00	6.00	0.00
	-Bent 4, Column D, footing, southeast corner, 11" W x 1' 7" H x 2 1/2" deep corner spall, 1 LF CS3, (Similar to Photo 118). -Bent 5, Column C, footing, southwest corner, 5' W x 1' 4" H x 1' deep spall, 5 LF CS3, (See Photo 118).							
1190	Abrasion(PSC/RC)	1	3.00	ft	0.00	0.00	3.00	0.00
	-Bent 5, Column C, footing, base of pedestal on west side, 3' x 2' abrasion with course aggregate exposed and missing, 3 LF CS3, (See Photo 117).							
6000	Scour	1	23.00	ft	0.00	13.00	10.00	0.00
	UWI Notes 01/03/2023: Bent 5, Column D, Footing - Void, 8'W x 3' H x 4.8' D on upstream end and 3' D at exposed footing, 8 LF CS2. Bent 6, Column A, Footing - Undermined, 3' L x 2' H x 1.5' D, 3 LF CS3. Bent 6, Column A, Footing - Void below southwest corner, 8" L x 6" H x 9" D, 1 LF Cs2. Bent 6, Column B, Footing - Undermined, up to 4" H x 6" D, 1 LF CS2.							
301	**Pourable Joint Seal**	**1**	**269.00**	**ft**	**237.00**	**3.00**	**29.00**	**0.00**
	-All deck joints have been paved over for the full-length of the travel lanes, the condition of these joints from the top of deck was unobservable during the inspection (excluding the areas of metal exposure due to potholes in the asphalt overlay). **-Bent 3, center joint, vegetation growth into the joint from the underdeck at the east overhang, (See Photo 45).**							
2310	Leakage	1	28.00	ft	0.00	0.00	28.00	0.00
	-Both abutments, below the joints, moisture staining, 20 LF CS3. -Bent 3 Joint, Bay 2, active leakage, 8 LF CS3, (See Photo 46).							
2330	Seal Damage	1	1.00	ft	0.00	0.00	1.00	0.00
	-Bent 9 Joint, SB lane, exposure of partially pulled out joint material through pothole, 1 LF CS3, (See Photo 21).							
7000	Damage	1	3.00	ft	0.00	3.00	0.00	0.00
	-North Abutment Joint, NB lane, exposure of steel plate with minor corrosion through pothole has been patched, 3 LF CS2.							
311	**Moveable Bearing**	**1**	**20.00**	**each**	**0.00**	**8.00**	**12.00**	**0.00**
	Moveable Bearing Locations (Based on Design Plans): South Abutment, Bent 3, Bent 5, Bent 7, Bent 9							
515	Steel Protective Coating	1	40.00	sq.ft	12.00	16.00	0.00	12.00
3420	*Peel/Bub/Crack(Stl Prc*	*1*	*40.00*	*sq.ft*	*12.00*	*16.00*	*0.00*	*12.00*
	-The steel protective coatings of (8) moveable bearings are in satisfactory condition, 16 SF CS2. *-The steel protective coatings of (6) moveable bearings have various states of corrosion, 12 SF CS4.*							
1000	Corrosion	1	14.00	each	0.00	8.00	6.00	0.00

STRUCTURE UNIT: 0

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4

-All moveable bearings typically have light to moderate peeling paint with minor corrosion at the exposed surfaces and typically negligible section loss throughout, 8 EA CS2.
-South Abutment bearings, moderate corrosion with minor section loss, 4 EA CS3, (See Photo 47).
-Bent 3, Span 4, Girder 2 bearing, (4) bolts with 100% section loss, 1 EA CS3.
-Bent 3, Span 4, Girder 4 bearing, peeling paint and heavy corrosion throughout. The bottom plate has 10% section loss along the edges and pack rust on the north side, 1 EA CS3, (See Photo 48).

1020	Connection	1	6.00	each	0.00	0.00	6.00	0.00

-Bent 3, Span 4, Girder 2 bearing, missing southeast and northwest anchor bolts, 1 EA CS3, (Similar to Photo 49).
-Bent 3, Span 4, Girder 3 bearing, missing northeast anchor bolt, 1 EA CS3, (Similar to Photo 49).
-Bent 3, Span 4, Girder 4 bearing, missing west anchor bolt, 1 EA CS3, (Similar to Photo 49).
-Bent 7, Span 8, Girder 2 bearing, missing southeast anchor bolt, 1 EA CS3, (Similar to Photo 49).
-Bent 7, Span 8, Girder 3 bearing, missing SE, SW & NW anchor bolts, missing NE anchor nut, 1 EA CS3, (See Photo 49).
-Bent 7, Span 8, Girder 4 bearing, missing east anchor bolt, 1 EA CS3, (Similar to Photo 49).

313	**Fixed Bearing**	**1**	**24.00**	**each**	**0.00**	**15.00**	**9.00**	**0.00**

Fixed Bearing Locations (Based on Design Plans): Bent 1, Bent 2, Bent 4, Bent 6, Bent 8, North Abutment

515	Steel Protective Coating	1	48.00	sq.ft	2.00	0.00	2.00	44.00
3420	*Peel/Bub/Crack(Stl Prc*	*1*	*48.00*	*sq.ft*	*2.00*	*0.00*	*2.00*	*44.00*

The steel protective coatings have corrosion, 2 SF CS3, 46 SF CS4

1000	Corrosion	1	23.00	each	0.00	15.00	8.00	0.00

-All fixed bearings typically have light to moderate peeling paint with minor corrosion at the exposed surfaces and typically negligible section loss throughout, 14 EA CS2.
-Bent 4, Span 5, Girder 1 bearing, peeling paint and heavy corrosion throughout. The bottom plates have 10% section loss, 1 EA CS3, (Similar to Photo 50).
-Bent 4, Girder 4 bearing, heavy corrosion on the anchor bolts with up to 30% section loss, 1 EA CS3.
-Bent 8, Girder 1 bearing, minor surface corrosion around the bearing and anchor bolts, 1 EA CS2.
-Bent 8, Girder 4 bearing, up to 1/8” laminar corrosion, 1 EA CS3, (Similar to Photo 50).
-Bent 9, Span 9, Girder 1 bearing, up to 1/4" thick laminar corrosion, 1 EA CS3, (See Photo 50).
-North Abutment bearings, up to 1/8” thick laminar corrosion, 4 EA CS3, (Similar to Photo 50).

1020	Connection	1	1.00	each	0.00	0.00	1.00	0.00

-Bent 3, Span 3, Girder 2 bearing, missing south anchor bolt, 1 EA CS3.

331	**Re Conc Bridge Railing**	**1**	**1,074.00**	**ft**	**0.00**	**1,074.00**	**0.00**	**0.00**

Total quantity changed from 1062 LF to 1074 SF due to 536.7' structure length x 2 railings per field measurements.

7000	Damage	1	1,074.00	ft	0.00	1,074.00	0.00	0.00

NOTE: The following note should be coded under 1190 Abrasion, however this defect type is not included in Element 331. It is coded here as 7000 Damage instead.

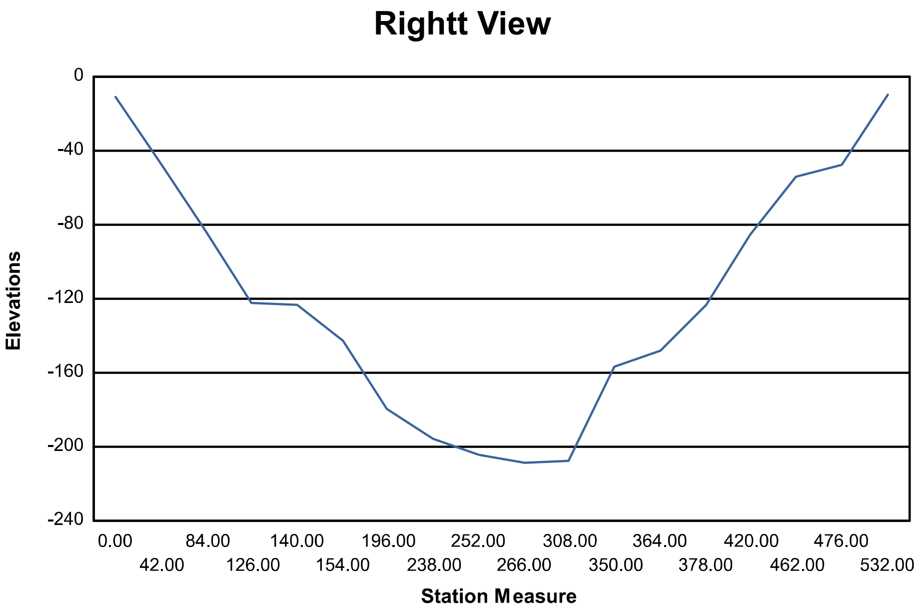
The railings are scaled throughout, typically 1/8” deep, and are covered with moss on the vertical faces, 1074 LF CS2.

Cross Sections

Rightt View Month/Year: **03 / 2023** Offset: **0.00**

Station EQ: 0 + 0.00 = 0 + 0.00
Elevation EQ: 0.00 = 0.00
Snd/Elev Indicator: Elevations
Location of Base Measure: Top of Railing
Offset Remark:
Elevation Basis: Assumption
Water Surface:

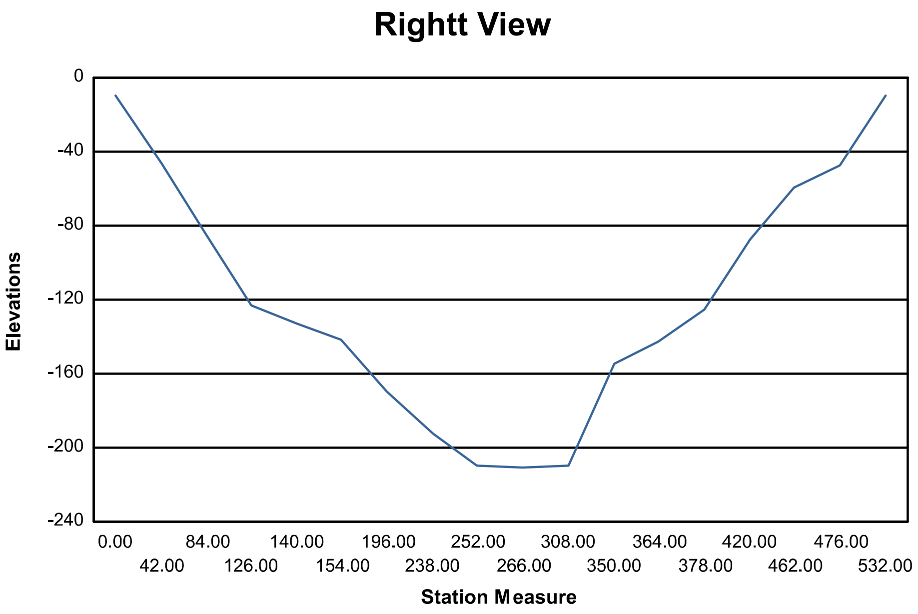
Station Measure	Elevations	Remarks
0 + 0	-10.70	South Abutment
0 + 42	-47.80	
0 + 84	-83.50	
1 + 26	-122.00	
1 + 40	-123.60	Bent 3 and Deck Joint
1 + 54	-143.20	
1 + 96	-180.00	
2 + 38	-195.50	
2 + 52	-204.90	Bent 5 and Deck Joint
2 + 66	-208.90	
3 + 8	-207.10	
3 + 50	-157.00	
3 + 64	-148.00	Bent 7 and Deck Joint
3 + 78	-123.70	
4 + 20	-85.70	
4 + 62	-54.50	
4 + 76	-47.50	Bent 9 and Deck Joint
5 + 32	-9.70	North Abutment



Rightt View Month/Year: **03 / 2022** Offset: **0.00**

Station EQ: 0 + 0.00 = 0 + 0.00
Elevation EQ: 0.00 = 0.00
Snd/Elev Indicator: Elevations
Location of Base Measure: Top of Railing
Offset Remark:
Elevation Basis: Assumption
Water Surface:

Station Measure	Elevations	Remarks
0 + 0	-10.30	South Abutment
0 + 42	-46.90	
0 + 84	-84.50	
1 + 26	-123.60	
1 + 40	-133.00	Bent 3 and Deck Joint
1 + 54	-141.40	
1 + 96	-170.40	
2 + 38	-193.10	
2 + 52	-209.70	Bent 5 and Deck Joint
2 + 66	-211.20	
3 + 8	-209.40	
3 + 50	-155.20	
3 + 64	-143.20	Bent 7 and Deck Joint
3 + 78	-126.10	
4 + 20	-87.60	
4 + 62	-59.30	
4 + 76	-47.80	Bent 9 and Deck Joint
5 + 32	-9.70	North Abutment


Rightt View

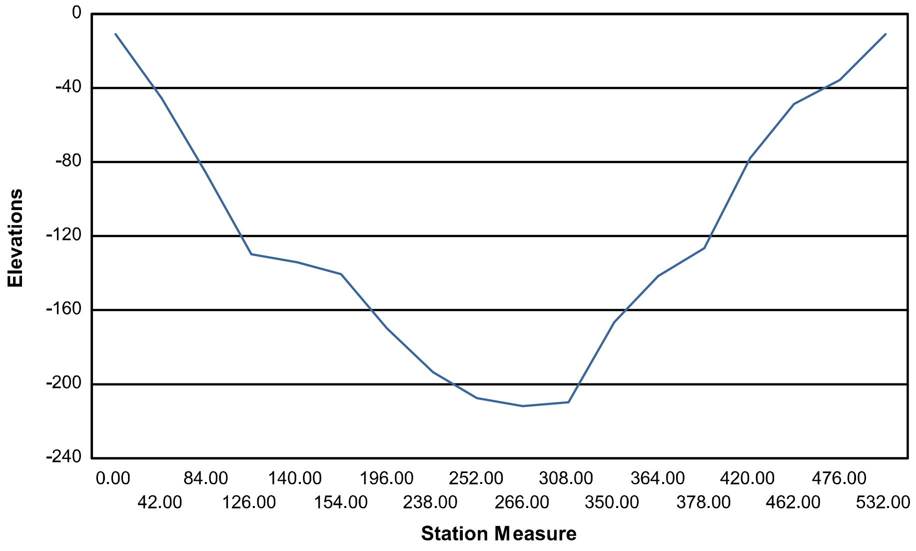
Rightt View Month/Year: **03 / 2021** Offset: **0.00**

Station EQ: 0 + 0.00 = 0 + 0.00
Elevation EQ: 0.00 = 0.00
Snd/Elev Indicator: Elevations
Location of Base Measure: top of railing
Offset Remark:
Elevation Basis: Assumption
Water Surface: -208.30

Station Measure Elevations Remarks

0 + 0	-11.00	South Abutment
0 + 42	-45.10	
0 + 84	-84.90	
1 + 26	-129.40	
1 + 40	-133.50	Bent 3 and Deck Joint
1 + 54	-141.00	
1 + 96	-169.70	
2 + 38	-193.40	
2 + 52	-208.00	Bent 5 and Deck Joint
2 + 66	-212.00	
3 + 8	-209.50	
3 + 50	-167.00	
3 + 64	-141.70	Bent 7 and Deck Joint
3 + 78	-126.40	
4 + 20	-78.10	
4 + 62	-48.10	
4 + 76	-35.00	Bent 9 and Deck Joint
5 + 32	-10.40	North Abutment

Rightt View



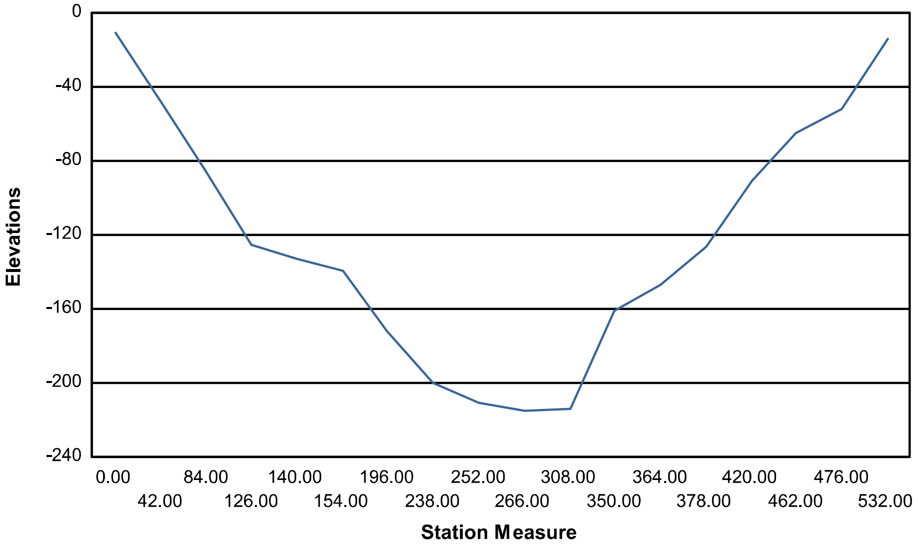
Rightt View Month/Year: **03 / 2019** Offset: **0.00**

Station EQ: 0 + 0.00 = 0 + 0.00
Elevation EQ: 0.00 = 0.00
Snd/Elev Indicator: Elevations
Location of Base Measure: top of railing
Offset Remark:
Elevation Basis: Assumption
Water Surface: -214.80

Station Measure	Elevations	Remarks
0 + 0	-10.70	South Abutment
0 + 42	-48.70	
0 + 84	-85.20	
1 + 26	-126.00	
1 + 40	-133.10	Pier 3 and Deck Joint
1 + 54	-140.00	

1 + 96	-171.80	
2 + 38	-200.50	
2 + 52	-211.30	Pier 5 and Deck Joint
2 + 66	-215.00	Water Level = 210.4
3 + 8	-213.90	
3 + 50	-161.40	
3 + 64	-147.00	Bent 7 and Deck Joint
3 + 78	-127.10	
4 + 20	-91.40	
4 + 62	-64.60	
4 + 76	-52.20	Bent 9 and Deck Joint
5 + 32	-14.40	North Abutment

Rightt View



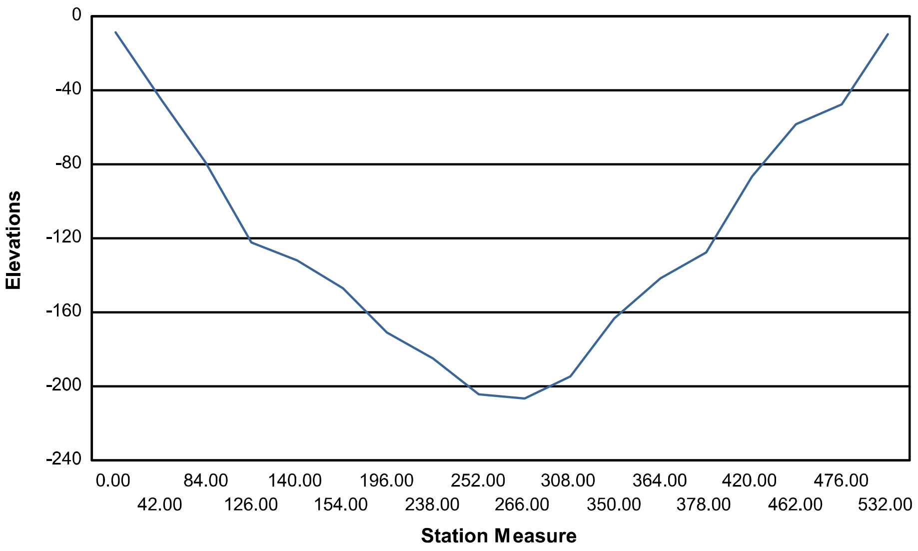
Left View Month/Year: **03 / 2023** Offset: **0.00**

Station EQ: 0 + 0.00 = 0 + 0.00
Elevation EQ: 0.00 = 0.00
Snd/Elev Indicator: Elevations
Location of Base Measure: Top of Railing
Offset Remark:
Elevation Basis: Assumption
Water Surface:

Station Measure	Elevations	Remarks
0 + 0	-9.10	South Abutment
0 + 42	-45.50	
0 + 84	-79.60	
1 + 26	-122.40	
1 + 40	-132.10	Bent 3 and Deck Joint
1 + 54	-146.80	
1 + 96	-171.50	
2 + 38	-185.00	
2 + 52	-204.50	Bent 5 and Deck Joint
2 + 66	-206.80	

3 + 8	-195.20	
3 + 50	-164.00	
3 + 64	-142.20	Bent 7 and Deck Joint
3 + 78	-127.40	
4 + 20	-87.20	
4 + 62	-58.90	
4 + 76	-47.60	Bent 9 and Deck Joint
5 + 32	-10.00	North Abutment

Left View



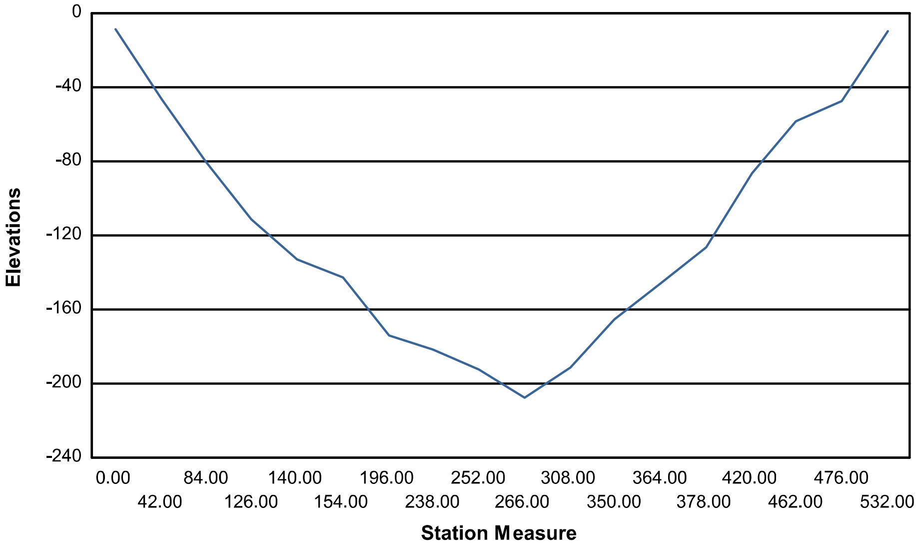
Left View Month/Year: **03 / 2022** Offset: **0.00**

Station EQ: 0 + 0.00 = 0 + 0.00
Elevation EQ: 0.00 = 0.00
Snd/Elev Indicator: Elevations
Location of Base Measure: Top of Railing
Offset Remark:
Elevation Basis: Assumption
Water Surface:

Station Measure	Elevations	Remarks
0 + 0	-9.50	South Abutment
0 + 42	-47.40	
0 + 84	-80.70	
1 + 26	-112.00	
1 + 40	-133.90	Bent 3 and Deck Joint
1 + 54	-142.80	
1 + 96	-174.00	
2 + 38	-181.50	
2 + 52	-193.30	Bent 5 and Deck Joint
2 + 66	-207.70	
3 + 8	-191.50	
3 + 50	-165.80	
3 + 64	-145.90	Bent 7 and Deck Joint
3 + 78	-127.30	
4 + 20	-86.60	
4 + 62	-59.00	

4 + 76	-47.80	Bent 9 and Deck Joint
5 + 32	-9.90	North Abutment

Left View



Left View Month/Year: **03 / 2021** Offset: **0.00**

Station EQ: 0 + 0.00 = 0 + 0.00

Elevation EQ: 0.00 = 0.00

Snd/Elev Indicator: Elevations

Location of Base Measure: top of railing

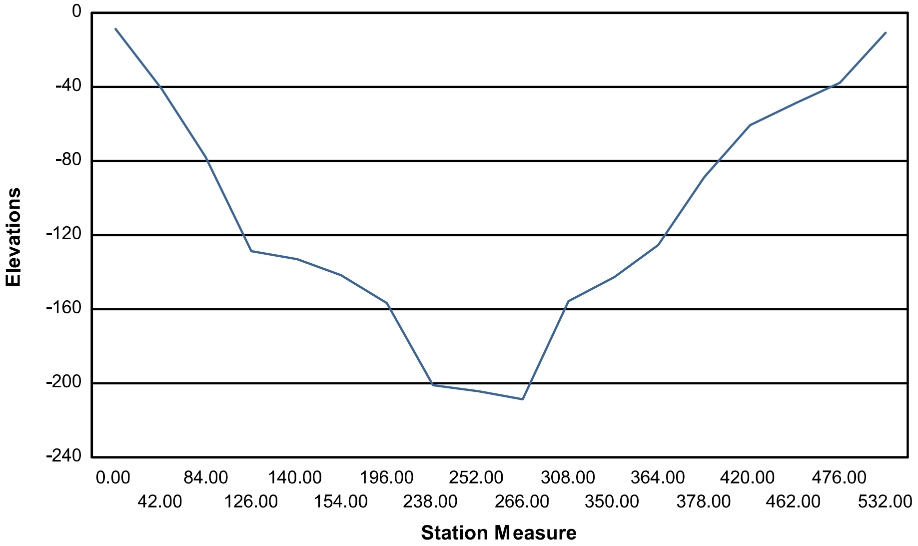
Offset Remark:

Elevation Basis: Assumption

Water Surface: -208.30

Station Measure	Elevations	Remarks
0 + 0	-8.90	South Abutment
0 + 42	-41.60	
0 + 84	-78.30	
1 + 26	-128.80	
1 + 40	-133.70	Bent 3 and Deck Joint
1 + 54	-141.70	
1 + 96	-156.70	
2 + 38	-201.80	
2 + 52	-204.90	Bent 5 and Deck Joint
2 + 66	-209.30	
3 + 8	-156.00	
3 + 50	-143.20	
3 + 64	-125.90	Bent 7 and Deck Joint
3 + 78	-88.40	
4 + 20	-60.40	
4 + 62	-48.50	
4 + 76	-37.40	Bent 9 and Deck Joint
5 + 32	-10.60	North Abutment

Left View



Left View	Month/Year:	**03 / 2019**	Offset:	**0.00**

Station EQ: 0 + 0.00 = 0 + 0.00

Elevation EQ: 0.00 = 0.00

Snd/Elev Indicator: Elevations

Location of Base Measure: top of railing

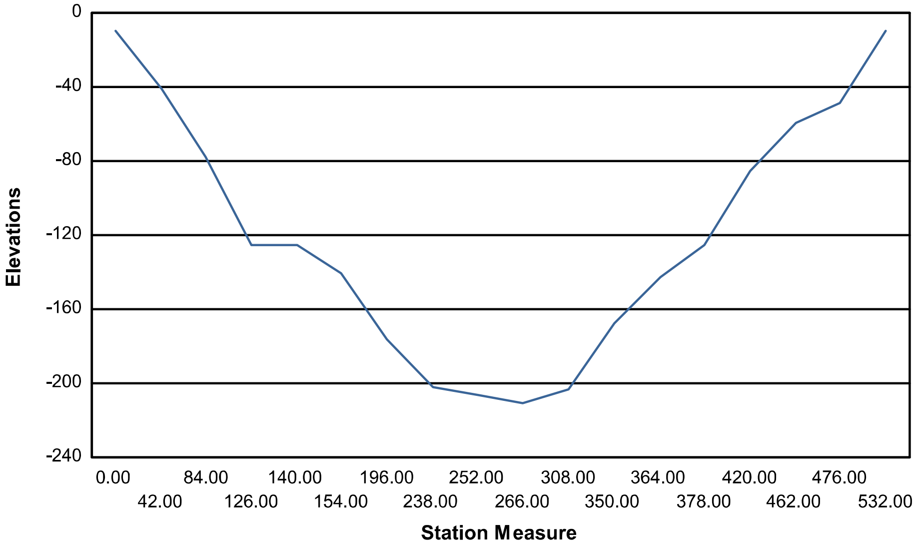
Offset Remark:

Elevation Basis: Assumption

Water Surface: -210.40

Station Measure	Elevations	Remarks
0 + 0	-9.70	South Abutment
0 + 42	-41.30	
0 + 84	-78.30	
1 + 26	-125.90	
1 + 40	-125.30	Bent 3 and Deck Joint
1 + 54	-141.00	
1 + 96	-176.60	
2 + 38	-202.70	
2 + 52	-206.60	Bent 5 and Deck Joint
2 + 66	-211.40	Water Level = 210.4
3 + 8	-203.30	
3 + 50	-167.60	
3 + 64	-142.70	Bent 7 and Deck Joint
3 + 78	-125.50	
4 + 20	-85.60	
4 + 62	-60.10	
4 + 76	-48.50	Bent 9 and Deck Joint
5 + 32	-10.40	North Abutment

Left View


0
-40
-80
-120
-160
-200
-240
Elevations
0.00
42.00
84.00
126.00
140.00
154.00
196.00
238.00
252.00
266.00
308.00
350.00
364.00
378.00
420.00
462.00
476.00
532.00
Station Measure

8

Work Candidates

Assigned to In-House Maintenance

Status	Priority	Action	Date Proposed	Notes
Unknown	3 - Medium		03/01/2023	Replace/repair missing or heavily weathered delineators at the top of the bridge railing.
Unknown	3 - Medium		03/22/2022	Resurface approach roadways.

Assigned to Maintenance Contract

Status	Priority	Action	Date Proposed	Notes
Unknown	3 - Medium		03/19/2021	Fill voids and undermined areas at Bent 5 and Bent 6 foundations.
Unknown	3 - Medium		03/21/2022	Replace missing/decayed inspection/maintenance access planks.
Unknown	3 - Medium		03/19/2021	Repair deck joints.

Assigned to Project(not Maintenance)

Status	Priority	Action	Date Proposed	Notes
Unknown	2 - High		03/21/2022	Conduct a load rating and seismic load rating analysis on the steel tower to determine the current capacity and the susceptibility of the bridge under seismic conditions.
Unknown	2 - High		03/01/2023	The current load rating from 8/19/2017 was completed using rating of; Item 58, Deck: 7, Item 59, Superstructure: 7, and Item 60, Substructure: 7 with a condition factor of: 1.00. Based on the current inspection and current ratings of; Item 58, Deck: 7, Item 59, Superstructure: 5, and Item 60, Substructure: 3 an updated load rating is recommended. The current load rating summary sheet from 8/19/2017 is included in this report.

WORK DONE SINCE LAST INSPECTION

Top of deck:
-Bent 7 Joint, SB lane, previous cracked and settled patch has been re-patched, (See Photo 51).
-North Abutment Joint, NB lane, exposure of steel plate with minor corrosion through pothole has been patched.

Towers:
-Bent 5, Level 1, lower section, between Columns A and B, lower horizontal bracing, Column A lower gusset plates exhibit up to 100% section loss above and below horizontal member with 5" L segments of 25% section left holding members. - Repaired, (See Photo 107).
-Tower 4, Level 3, Column A, vertical bracing, section loss, exterior leg with 80% loss. - Repaired, (See Photo 135).
-Bent 7, Level 2, between Columns A and B, horizontal bracing and gusset plate at Column A, no longer attached with multiple corrosion holes up to 2" x 3" in horizontal bracing interior gusset plate. - Repaired, (See Photo 147).
-Tower 3, Level 3, Column A, lower south diagonal, and vertical bracing, 2022 damages - Repaired, (See Photo 98).

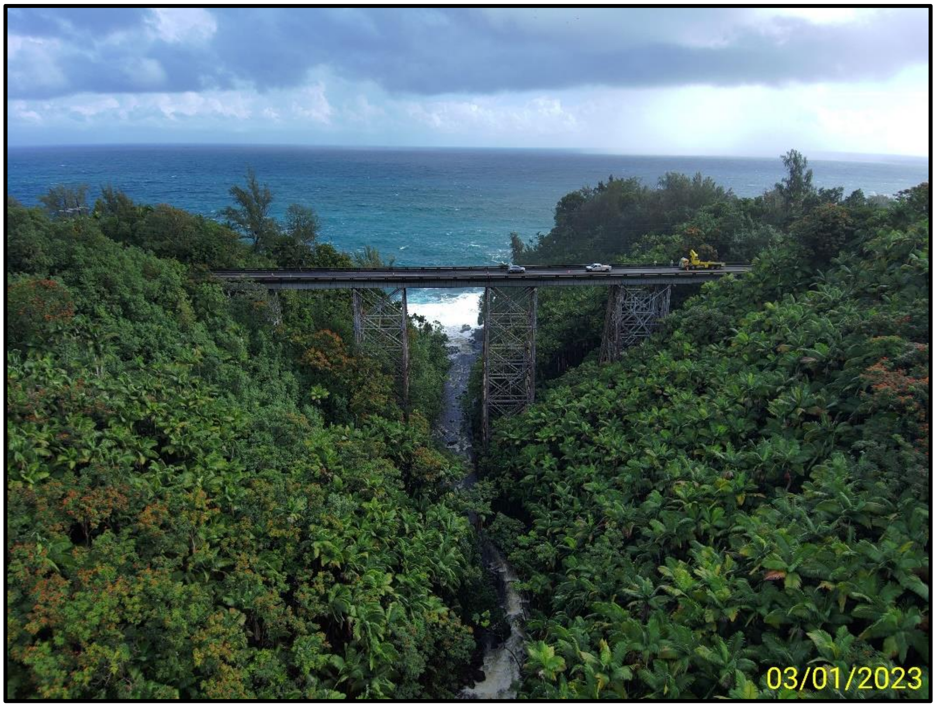
TRAFFIC SAFETY FEATURES NOTES

36A - Bridge Railings: 2'-6" H bridge railings and a 10" H curb.
36B - Transitions: W-beam with 3' post spacing and metal offsets.
36C - Approach Guardrail: 28.5" H W-beams with 6'-3" post spacing and metal offsets.
36D - Approach Guardrail Ends: Southwest, northwest, and northeast ends are flared and anchored into the embankment. Southeast end is a flared energy absorbing terminal (FLEAT) end terminal.

-North and south approach roadways, depressed and worn surface in wheel lines of both lanes; up to 1/2" wide map cracks throughout, some with vegetation growth, (See Photo 52).

-East railing, south end, (2) reinforcing bars sticking out of concrete towards NB traffic, (See Photo 53).
-Southwest, northwest, and northeast approach guardrails, minor corrosion throughout.
-Southwest guardrail, (3) areas of impact damage, typically 1' 1" L x 1" deflection.
-Southeast guardrail, (1) rotated post.
-Northwest guardrail, 2' L x 1" deflection area of impact damage at the abutment.
-Northeast guardrail, (2) areas of impact damage, (1) 10' L x 3" deflection and (1) 2' L x 2" deflection, (See Photo 54).
-Delineators at the top of the bridge rail are heavily weathered or missing.

Inspector:	**Signature:**	Sang Yoon Kim	**Phone:**	888-451-6822
Inspector:	**Signature:**	John Russ	**Phone:**	888-451-6822
Team Leader:	**Signature:**	Jason Gilliam	**Phone:**	888-451-6822
	Office:	Consor Engineers, LLC	**Certification Date:**	03/07/2019
BIP Leader:	**Signature:**		**QC Date:**	
	Office:			



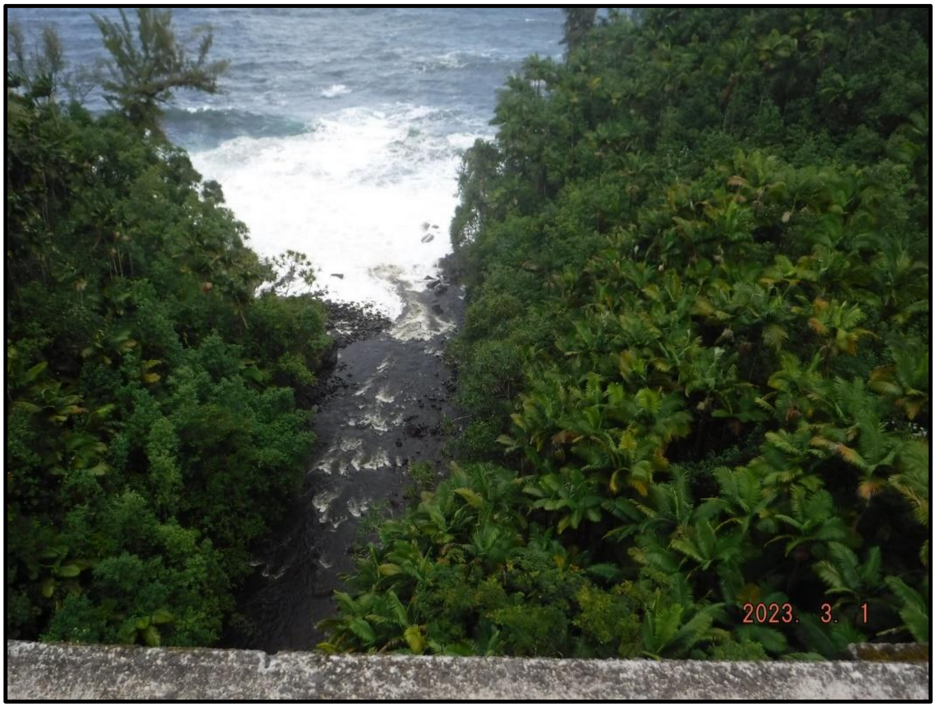
Photograph 1. West (upstream) elevation, looking east.

Photograph 2. East (downstream) elevation, looking west.

Photograph 3. South approach, looking north.

Photograph 4. North approach, looking south.

Photograph 5. Upstream channel, looking west.



Photograph 6. Downstream channel, looking east.

Photograph 7. Top of deck/wearing surface (Spans 8 to 9 shown), looking southwest.

Photograph 8. Typical bridge railing (east railing shown), looking southeast.

Photograph 9. Typical superstructure (Span 4 shown), looking north.

Photograph 10. North Abutment, looking north.

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Photograph 11. South Abutment, looking south.

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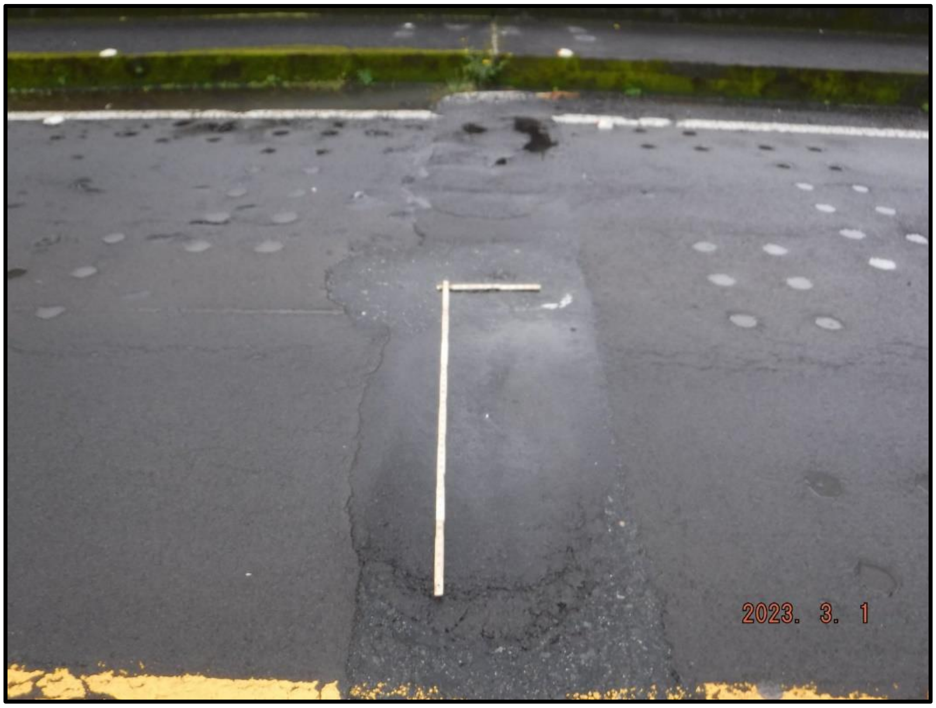
Photograph 12. Bent 1 at Tower 1 (south face shown), looking north.

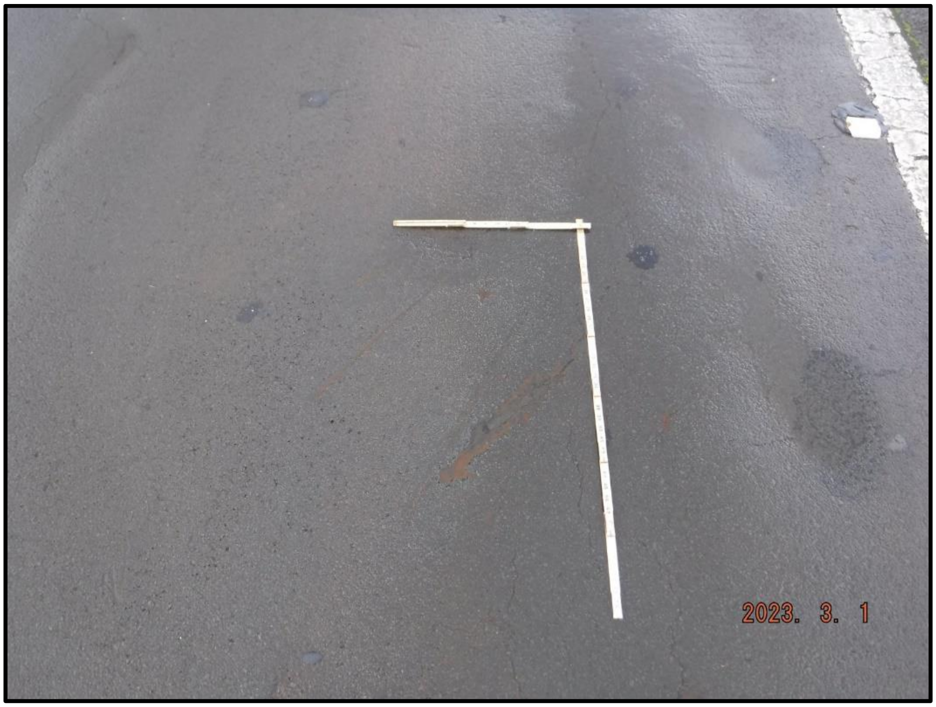
Photograph 13. Bent 6 at Tower 4 (south face shown), looking north.

Photograph 14. Span 2, east overhang, 1st scupper south of Bent 2, looking west. Vegetation growth and almost full of debris.

Photograph 15. South Abutment Joint, NB Lane, looking west. 6” diameter x 1” deep spall adjacent to crack, CS3.



Photograph 16. Bent 3 Joint, both lanes, looking west. 2' 4” L x 4' W area of settled patches with a 6" Dia. x 1" D spall within. The rest of the paved over joint is rutted up to 1” deep, CS3



Photograph 17. Span 4, NB Lane, 20’ north of Bent 3, looking north. 3’ L x 3’ W area of gouges (largest is 1’ 1” L x 2’ W x 1/2" deep), CS3.

Photograph 18. Bent 5 Joint, NB lane, looking southwest. 2' 4" L x 4' W x 1/2" deep cracked and settled pothole with ponding water, CS3.

Photograph 19. Bent 5 Joint, SB lane, looking southwest. 2' L x 4' 5" W x 2" deep settled patch with a 11" L x 11" W x 1" deep spall within with exposure of deck and joint, CS3, CS4.

Photograph 20. Span 8, NB lane, 15' north of Bent 7 joint, looking north. 8” L x 1’ 3" W x 1/2" deep patched pothole that is failing and has ponding water, CS3.

Photograph 21. Bent 9 Joint, SB lane, wearing surface, looking west. 1’ 4" L x 1’ 9" W x 1" deep cracked and settled patch with 5" L x 11" W x 1" deep pothole within with exposure of steel plate and joint material, CS2, CS4.

Photograph 22. Bent 9 Joint, NB right wheel line, looking west. Cracked and settled potholes with ponding water, CS3.

Photograph 23. South Abutment Joint, NB Lane, looking west. 12' L x up to 1/8" W transverse crack with adjacent spall, CS3.

Photograph 24. Span 1, underside of deck, east overhang, 5' south of Bent 1, looking south. Transverse cracking with efflorescence throughout, typically 3'-4' apart x up to 1/8" W, CS3.

Photograph 25. Span 2, underside of deck, Bay 2, looking north. Map cracking throughout up to 1/16” W, CS3.

Photograph 26. Span 6, Bay 1, near Bent 6, looking north. Cross frames typically have painted over pitting 1/16” D with isolated areas up to 1/4” D and areas of reactivating corrosion.

Photograph 27. Span 6, Bay 1 at Bent 5, adjacent to Girder 1, lower bracing (wind bracing), looking north. 100% section loss on bottom flange over 10” L x up to 1 1/2" deep.

Photograph 28. Span 8, Bay 2, 2nd lower strut, looking south. (2) missing bolts and (1) corrosion hole, 5” L x 2” W.

Photograph 29. Span 1, Girder 4 bottom flange (top and bottom faces), at midspan, looking east. Typical peeling paint and moderate corrosion along the ends of all exterior girders , typically 4' L x 5” W, with up to 3/16" deep section loss, CS3.

Photograph 30. Span 2, Bay 1, top flange plate of Girder 1, looking northeast. Intermittent areas of up to 2' L x 2" W x 1/2" deep painted over pitting, CS3.

Photograph 31. Span 2, Girder 1, west face, looking east. 25’ L section of painted over pitting up to 1/8” deep, CS3.

Photograph 32. Span 2, Girder 3, east face bottom flange, 5' north of Bent 1, looking west. (2) missing rivets in 1' L area of up to 1" thick pack rust, CS3.

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Photograph 33. Bent 3, Bay 1, Girder 1 and 2 bottom flange connection, looking northwest. Rivet heads have corrosion with up to 50% section loss, CS3.

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Photograph 34. Bent 3, Bay 1, Girder 2, web sliding plate, looking west. (3) missing bolts with heavy laminar corrosion, CS3.

Photograph 35. Bent 3, Girder 1, top of sliding web plate, looking east. 5” H x 2” W area of 1/8” to 100% section loss, area of 100% loss is 1” W, CS3.

Photograph 36. Span 4, Girder 3 splice and bottom flange, looking west. 3' L x up to 1/8" W pitting and rivet head corrosion with up to 25% section loss, as well as peeling paint, CS3.

Photograph 37. Span 6, Bent 5, web stiffener above Girder 1 bearing, looking east. 3/16" thick pack rust causing a 1' 11" H x 1" deflection, CS3.

Photograph 38. Span 10, Girder 1, east face at North Abutment, looking west. 3" L x 1/2" W area of 100% section loss, CS3.

Photograph 39. Span 10, Girder 1, east face at North Abutment, looking northwest. (2) bearing stiffeners have effectively no remaining section at the lower 2" at the base. The eastern bottom flange has 2" W knife-edging, CS3.

Photograph 40. Bent 3, Girder 4 web sliding plate, looking east. Heavy corrosion at the bolt slots and (2) missing bolts at the bottom, with a 2" H x 3" W area of 100% section loss, CS3.

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Photograph 41. Span 5, Bent 4, Girder 2, looking west. Steel protective coating exhibits peeling/ bubbling, CS3.

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Photograph 42. South Abutment, Bay 3, center section, looking south. Spall, 1' 4” H x 8” W x 1” deep, CS3.

Photograph 43. North Abutment, Girder 3 seat, looking north. Failed repair, 2' 11" L x 10" H x 3" deep exposing (2) reinforcing bars with no section loss, CS3.

Photograph 44. North Abutment, west end of center section, looking northeast. Honeycombing, up to 2' H x 1" W x 1" deep, CS3.

Photograph 45. Bent 3, center joint, looking west. Vegetation growth into the joint from the underdeck at the east overhang.

Photograph 46. Bent 3 Joint, Bay 2, looking southeast. Active leakage, CS3.


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Photograph 47. South Abutment, Girder 3 bearing, looking southwest. Moderate corrosion with minor section loss, CS3.


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Photograph 48. Bent 3, Span 4, Girder 4 bearing, looking west. Peeling paint and heavy corrosion throughout. The bottom plate has 10% section loss along the edges and pack rust on the north side, CS3.

Photograph 49. Bent 7, Span 8, Girder 3 Bearing, looking northwest. Missing southeast, southwest, and northwest anchor bolts, missing northeast anchor nut, CS3.

Photograph 50. Bent 9, Span 9, Girder 1 bearing, looking east. Up to 1/4" thick laminar corrosion, CS3.


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Photograph 51. Bent 7 Joint, SB lane, looking west. Previous cracked and settled patch has been re-patched.


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Photograph 52. North and south approach roadways, looking northwest. Depressed and worn surface in wheel lines of both lanes, up to 1/2" wide map cracks throughout, some with vegetation growth.

Photograph 53. East railing, south end, looking north. (2) reinforcing bars sticking out of concrete towards NB traffic.

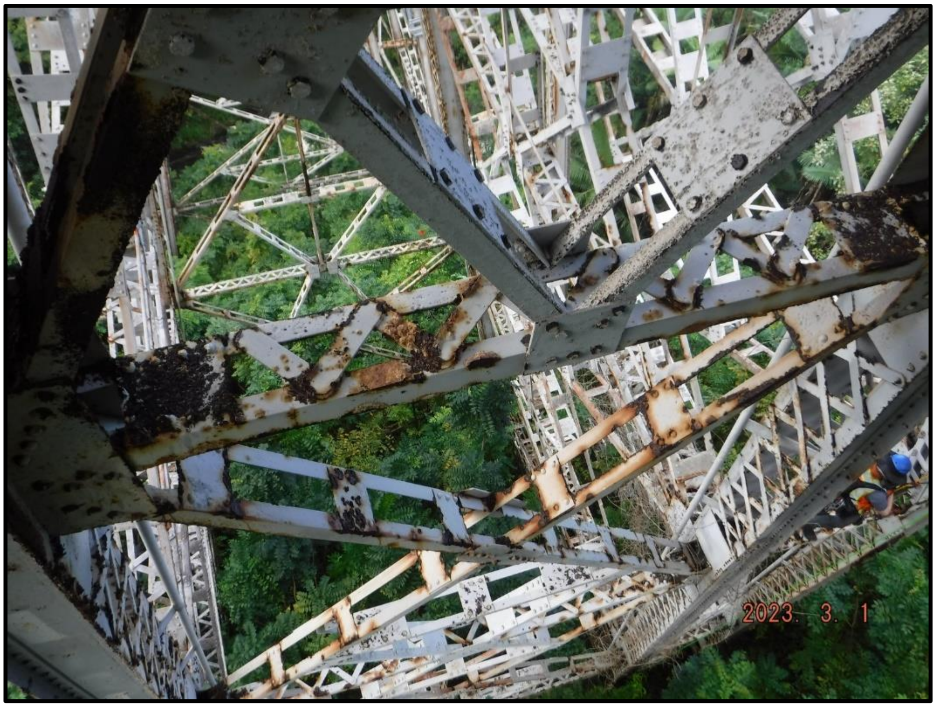
Photograph 54. Northeast guardrail, looking northeast. (2) areas of impact damage, (1) 10’ L x 3” deflection and (1) 2’ L x 2” deflection.

Photograph 55. Bent 1, Level 1, Column A, looking northwest. Typical pitting, pack rust and laminar corrosion, CS3.

Photograph 56. Bent 1, Level 1, Column D, east face, near mid height horizontal, looking west. Missing batten plate, CS3.

Photograph 57. Bent 1, Level 1, Column D, south face, looking east. Scattered rivets with up to 100% section loss, CS3.

Photograph 58. Bent 2, Level 1, upper section, between Columns A and B, diagonal bracing, both cover plates at mid-length, looking north. Pack rust up to 3/4" thick causing separation of plate and one broken rivet on north cover plate, CS3.



Photograph 59. Bent 2, Level 1, upper section, between Columns B and C, horizontal bracing, looking north. West face has (3) lacing bars with 50% section loss and (1) with 90% section loss, CS3.

Photograph 60. Bent 2, Level 1, lower section, between Columns A and B, horizontal bracing, looking north. South face of angle has 1' 8” L x 1” H x up to 100% section loss with (3) lacing bars up to 75% section loss. The south angle has approximately 30% section loss

Photograph 61. Bent 2, Level 1, lower section, Column A, interior gusset plates, looking east. Up to 1" W x full length section loss where all members frame in, CS3.

Photograph 62. Bent 2, Level 1, lower section, Column C, interior face of south web cover plate, looking southeast. Painted-over pitting up to 3” diameter x 1/4” deep, CS3.

Photograph 63. Bent 2, Level 2, between Columns B and C, horizontal bracing near Column B, looking north. The bottom 1" of both angles have knife-edging to 100% section loss. There is an area of 90% section loss to the south angle, CS3.

Photograph 64. Bent 2, Level 2, Column D, transverse bracing gusset plates, looking northwest. Typical heavy laminar corrosion, CS3.

Photograph 65. Bent 2, Level 3, Column A, horizontal bracing, gusset plate, looking south. Pack rust up to 1/4" thick, CS3.

Photograph 66. Tower 2, Level 1, Column A , upper north diagonal bracing, near Bent 3, looking north. 6" x 2" corrosion hole in vertical leg of interior angle near Column A connection. Exterior leg has area of pack rust causing separation of gusset plate up to 1", CS3

Photograph 67. Tower 2, Level 1, Column A, Bent 2, gusset plate to diagonal connection, looking west. (1) missing rivet with pack rust up to 1/2" thick, CS3.

Photograph 68. Tower 2, Level 1, Column A, lower north diagonal bracing, east face of diagonal, interior center gusset plate, looking west. 9" W x 3" H area of 100% section loss and areas of laminar corrosion, CS3.

Photograph 69. Tower 2, Level 3, Column B, horizontal bracing, looking north. Numerous rivet heads in horizontal strut with up to 100% section loss, CS3.

Photograph 70. Tower 2, Level 3, Column B, looking west. Multiple up to 3/4" diameter corrosion holes throughout, and covered in vegetation, CS3.

Photograph 71. Tower 2, Level 1, Column D, center gusset plate, looking north. (1) missing rivet, CS3.

Photograph 72. Tower 2, Level 1, Column D, upper north diagonal bracing, near Bent 3, looking east. Heavy knife-edging and 6" L x 2" H corrosion holes, CS3.

Photograph 73. Tower 2, Level 2, Column C, horizontal bracing, near mid-length slightly closer to Bent 2, looking north. Up to 3/16" deep pitting throughout with areas of knife-edging to original members of interior west face and isolated corrosion holes up to 1/2" diameter.

Photograph 74. Tower 2, Level 4, Column D, lower diagonal bracing, looking north. Heavy growth with trees growing through the members.

Photograph 75. Bent 3, Level 1, upper section, Column B, top gusset plate and longitudinal bracing, looking southeast. Laminar corrosion and areas of section loss on members and rivet heads due to active water leakage from the bridge, CS3.

Photograph 76. Bent 3, Level 1, upper section, between Columns B and C, center gusset plates, looking south. Laminar corrosion on plates and transverse bracing members, CS3.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Photograph 77. Bent 3, Level 1, upper section, Column D, vertical near top, looking north. Typical laminar corrosion at upper levels, CS3.


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Photograph 78. Bent 3, Level 1, lower section, Columns A and B, horizontal bracing, looking east. Pack rust up to 1 1/2" thick with section loss up to 30% to gusset plates and 100% loss to rivet heads of batten plate, CS3.

Photograph 79. Bent 3, Level 2, Column B, horizontal bracing, south flange, looking north. 9" L x full width of angle area of 100% section loss, CS3.

Photograph 80. Bent 3, Level 3, between Columns C and D, horizontal bracing, looking west. Knife-edging and multiple corrosion holes up to 2" diameter across full member length, CS3.

Photograph 81. Bent 3, Level 3, between Columns A and B, diagonal bracing above interior connection, looking east. 3' L x full width of angle area of section loss on top flanges (CS3). Note this member has been retrofitted and retrofit is in good condition.

Photograph 82. Bent 3, Level 4, Column A, just above bearing, gusset plates, looking east. Plates are distorted and bowed to the south up to 1/8" for the horizontal bracing member, CS3.

Photograph 83. Bent 3, Level 4, Column C, looking northeast. Typical painted over pitting, laminar corrosion, knife-edging, and corroded rivet heads, CS3.

Photograph 84. Bent 4, Level 1, upper section, Column D, upper gusset plates, looking northwest. Heavy laminar corrosion and approximately 1/4" to 3/8" remaining section on gusset plate between diagonal and horizontal bracing member, CS3.

Photograph 85. Bent 4, Level 1, lower section, Column D, lower gusset plates, looking northwest. Pack rust up to 1" thick with areas of 100% section loss and only retrofit gusset plate remaining, no change from previous inspection, CS3.

Photograph 86. Bent 4, Level 2, between Columns B and C, horizontal bracing adjacent to Column C, vertical connection, looking northeast. (7) 2" diameter corrosion holes in interior top flange along member, CS3.

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Photograph 87. Bent 4, Level 2, between Columns B and C, lower west diagonal bracing, near Column C, looking northwest. Knife-edging and 80% section loss to the interior angle, CS3.

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Photograph 88. Bent 4, Level 2, Column C, looking northeast. 50% of lacing bars on west face have 100% section loss, remaining bars on both faces have average 30% section loss, CS4.

Photograph 89. Bent 4, Level 3, Column C, looking east. Lacing bars have an average 75% section loss in this section of column. Except for top 10’ of west face which are in good condition, CS3.

Photograph 90. Bent 4, Level 3, horizontal bracing at gusset plates at Column A, looking north. Horizontal bracing gusset plate has 100% section loss on all sides. This member is not connected to Column A anymore, CS4.

Photograph 91. Bent 4, Level 4, Column C, looking northeast. Knife-edging of flanges, CS3.

Photograph 92. Tower 3, Level 1, Column A, lower south diagonal bracing, looking west. Several corrosion holes along the west and east angle legs up to 2" diameter, 3' L x 2" H area of 100% section loss on west angle near Bent 4, CS3.

Photograph 93. Tower 3, Level 1, Column B, lower north diagonal bracing, looking west. Worst case is a 4" diameter corrosion hole near center gusset plate. Approximately 60% section remaining, CS3.

Photograph 94. Tower 3, Level 2, Column A, horizontal bracing, looking south. 9" diameter corrosion hole in lower batten plate with 3" W x 1/8" section remaining, CS3.

Photograph 95. Tower 3, Level 2, Column A, horizontal bracing, near Bent 4, looking northeast. 50% section loss to entire member with holes throughout, CS4.

Photograph 96. Tower 3, Level 2, Column A, upper south to lower north diagonal bracing, looking south. Global distortion to the diagonal members within level, CS3.

Photograph 97. Tower 3, Level 2, Column A, vertical bracing, looking north. Batten plates typically exhibit pitting up to 1/8" deep with corrosion holes up to 5" diameter, CS3.

Photograph 98. Tower 3, Level 3, Column A, lower south diagonal, and vertical bracing, looking southeast. Repaired.


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Photograph 99. Tower 3, Level 4, Column B, center gusset plate, looking southwest. Numerous corrosion holes on both gusset plates, CS3.


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Photograph 100. Tower 3, Level 6, Column A, lower horizontal bracing, looking northwest. Knife-edging with 4" L x 1-1/2" H section loss, CS3.

Photograph 101. Tower 3, Level 1, Column C, lower horizontal bracing, looking east. Multiple corrosion holes up to 6" diameter in east and west channels, CS3.

Photograph 102. Tower 3, Level 2, Column C, horizontal bracing, east channel, looking west. 8" L x 2" H corrosion hole, CS3.

Photograph 103. Tower 3, Level 2, Column D, horizontal bracing, exterior channel side face, looking south. Heavy laminar corrosion, CS3.

Photograph 104. Tower 3, Level 5, Column D, lower north diagonal bracing, at center gusset plate, looking south. Batten plates missing, CS3.

Photograph 105. Tower 3, Level 6, Column D, upper horizontal bracing, looking northwest. Vegetation, tree growing through members.

Photograph 106. Bent 5, Level 1, upper section, Column D, lower gusset plates, looking southwest. Heavy laminar corrosion with up to 100% section loss, CS3.

Photograph 107. Bent 5, Level 1, lower section, between Columns A and B, lower horizontal bracing, looking south. Column A lower gusset plates exhibit up to 100% section loss above and below horizontal member with 5" L segments of 25% section left holding members. – Repaired.


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Photograph 108. Bent 5, Level 1, lower section, Column D, horizontal bracing, gusset plate, looking south. North gusset plate has 8" L area of 100% section loss at connection to Column D, CS4. South gusset plate (4) corrosion holes up to 2" diameter and (1) on north gusset plate, CS3.

Photograph 109. Bent 5, Level 2, between Columns B and C, lower west diagonal bracing, connection to Column C, looking south. North angle exhibits two 10" L x up to 4" H holes with 1" x 3" remaining section. Remaining length of diagonal exhibits knife-edging and pitting, CS4.

Photograph 110. Bent 5, Level 2, Column B, exterior gusset plate, looking south. Multiple corrosion holes up to 5" x 2 1/2" and pitting up to 1/16" deep in exterior gusset plate; interior rivet heads at connection to column typically have 10% section remaining in this location, CS3.

Photograph 111. Bent 5, Level 2, Column D, horizontal bracing gusset plates, looking south. Heavy laminar corrosion with up to 100% section loss with 15% section remaining of the north gusset plate and repair plates becoming ineffective, CS4.

Photograph 112. Bent 5, Level 3, Column A, looking west. (9) lacing bars removed from column, CS3.

Photograph 113. Bent 5, Level 3, between Columns B and C, lower west diagonal near Column C, looking east. 10" of top flange missing on both angles, CS3.

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Photograph 114. Bent 5, Level 3, between Columns C and D, diagonal bracing, outboard angles, looking west. 10" L x up to Full Height section loss with adjacent corrosion holes, extreme deterioration up to 90% cross section reduction having no change from previous inspection, CS4.

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Photograph 115. Bent 5, Level 4, Column B, vertical at southeast flange splice, looking north. Column is deformed, 1' 10" L x 1" deflection, CS3.

Photograph 116. Bent 5, Level 4, Column B, west batten plate, looking east. 9" diameter corrosion hole, CS3.

Photograph 117. Bent 5, Level 6, Column C, footing, base of pedestal on west side, looking northeast. 3' x 2' abrasion with course aggregate exposed and missing, CS3.

Photograph 118. Bent 5, Level 6, Column C, footing, southwest corner, looking east. 5' W x 1' 4" H x 1' deep spall, CS3.

Photograph 119. Bent 6, Level 1, upper section, between Columns C and D, horizontal bracing, looking south. Heavy pitting with 1' 6" L x 2" H area of 100% section loss, CS3.

Photograph 120. Bent 6, Level 1, lower section, between Columns A and B, horizontal bracing, looking east. 100% section loss; (5) of (6) bars, CS3.

Photograph 121. Bent 6, Level 1, lower section, between Columns C and D, horizontal bracing, looking north. 25% section loss with knife-edging on south angle. Column D gusset plate has severe laminar corrosion between the horizontal and diagonal and appears to be failing at that location (deformation to the north), CS3.

Photograph 122. Bent 6, Level 2, between Columns C and D, lower west diagonal bracing near Column D, looking southeast. 3" L x 2" H corrosion hole on north angle vertical leg, CS3.

Photograph 123. Bent 6, Level 2, between Columns C and D, near mid-length of longest diagonal bracing, outer flanges, looking southeast. Up to 5" long corrosion holes, CS3.

Photograph 124. Bent 6, Level 2, between Columns C and D, horizontal bracing, looking southwest. All (4) lacing bars have 100% section loss, CS3.

Photograph 125. Bent 6, Level 3, Column B, mid-height, west face, looking east. Multiple lacing bars with 100% section loss, CS3; similar condition on west face of Level 3, Level 2, west face, Level 4 both faces, and Level 5 east face. The west face of Level 5 only has five bars total intact.

Photograph 126. Bent 6, Level 3, Column B, south gusset plate, west side, looking east. 1 1/2" W x 8" H area of 100% section loss, CS3.

Photograph 127. Bent 6, Level 4, between Columns B and C, lower west diagonal adjacent to Column C, looking north. Corrosion holes and knife edging at exterior vertical flange and section of missing vertical flange at lower end for 1' 6" L, CS3.

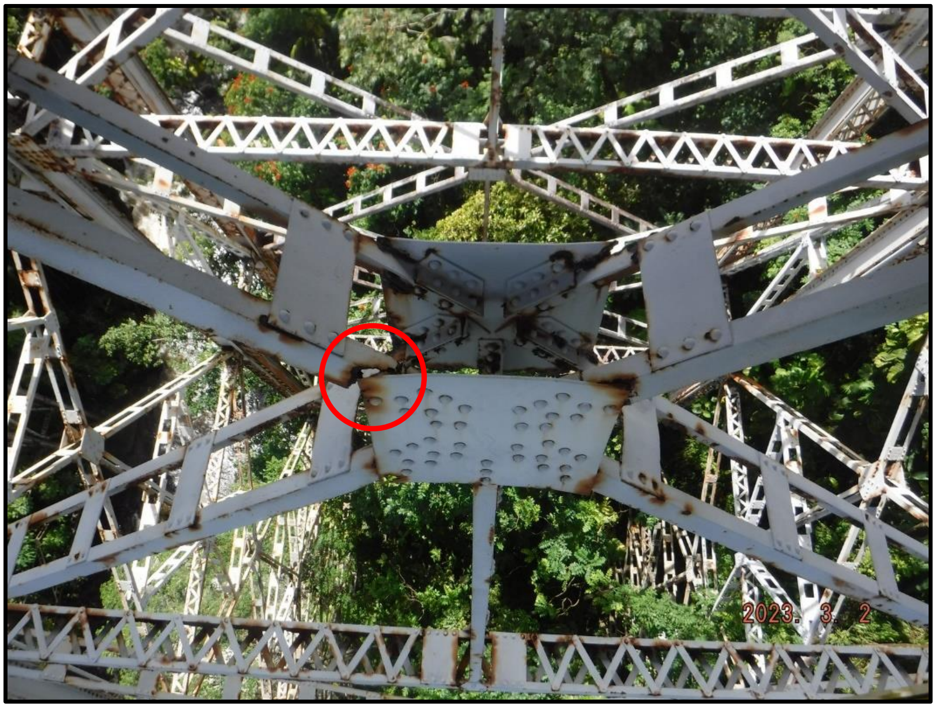
Photograph 128. Bent 6, Level 4, between Columns B and C, vertical bracing, looking north. Severe corrosion throughout this member with 40% section remaining, CS4.

Photograph 129. Bent 6, Level 4, Column A, gusset plate at horizontal bracing, looking northeast. 75% section loss with corrosion holes, CS3.

Photograph 130. Bent 6, Level 4, Column B, exterior gusset plate at horizontal bracing, looking south. 3 1/2" diameter corrosion hole, CS3.

Photograph 131. Bent 6, Level 5, Column B, looking northeast. Almost all lacing bars on the west side of the column have 100% section loss; (6) bars with section loss remaining intact at time of inspection, CS4.

Photograph 132. Bent 6, Level 6, between Columns A and B, horizontal bracing, looking northeast. Member impacted by falling rocks, CS3.



Photograph 133. Tower 4, Level 1, lower south diagonal bracing, looking west. Exterior angle of diagonal has 100% section loss to vertical leg and only 2 1/2" of section remaining on horizontal leg; angle is deformed 1/4" over 10" near section loss, CS4.

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Photograph 134. Tower 4, Level 2, Column B, upper north diagonal bracing, looking west. Exterior angle of diagonal has 100% section loss to vertical leg, CS3.

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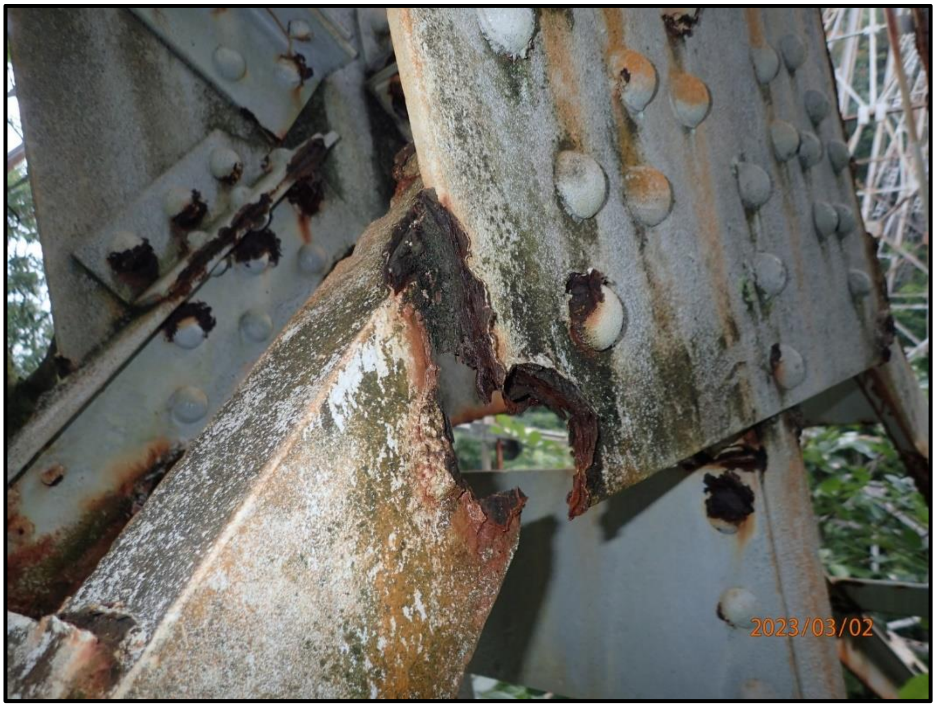
Photograph 135. Tower 4, Level 3, Column A, vertical bracing, looking east. Exterior leg with 80% section loss has been replaced.

Photograph 136. Tower 4, Level 6, Column B, looking west. 3' diameter boulder on top of diagonal member at bottom connection; member appears to be deformed as a result.

Photograph 137. Tower 4, Level 3, Column C, gusset plate connecting bracing to Bent 6, looking east. 14 of 18 rivet heads connecting the gusset plate to the column have 20% remaining on the inside face. East channel of bracing has more severe section loss at this location with five corrosion holes in the web up to 1” diameter, CS4.



Photograph 138. Tower 4, Level 3, Column C, lower south diagonal bracing, looking east. West angle has 4” H x 2” L area of 100% section loss adjacent to the gusset plate, and the east angle has 1/4” loss in same location. Combined for 50% loss of member cross sectional area, CS4.

Photograph 139. Tower 4, Level 4, Column D, vetical bracing, looking north. Up to 1” H x full wldth area of 100% section loss across bottom edge of batten plate, CS3.

Photograph 140. Tower 4, Level 5, Column C, mid-diagonal mid-length, interior top angle, looking south. 100% section loss for most of length of horizontal flange. Approximately 20% loss of cross sectional area, CS3.

Photograph 141. Tower 4, Level 6, Column C, adjacent to Bent 6 pedestal, interior channel, looking east. 3" downward deformation over 1' 6", CS3.

Photograph 142. Bent 7, Level 1, upper section, Column A, gusset plate, looking south. (2) corrosion holes up to 1” diameter and horizontal bracing connection to Column B has a 5” L x 1” H area of 100% section loss.

Photograph 143. Bent 7, Level 1, lower section, between Columns A and B, diagonal bracing top angle, looking southwest. section loss, 100% loss for 2' 4" L, CS3.

Photograph 144. Bent 7, Level 1, lower section, between Columns B and C, center gusset plate, looking southwest. Heavy pitting, laminar corrosion, and knife-edging with 2" and 1" diameter corrosion holes, CS3.

Photograph 145. Bent 7, Level 1, lower section, Column A, looking southeast. 2" diameter corrosion hole in northeast flange angle, CS3.

Photograph 146. Bent 7, Level 2, between Columns A and B, diagonal bracing top angle, looking west. Section loss, 100% loss for 2' 4" L, CS3.

Photograph 147. Bent 7, Level 2, between Columns A and B, horizontal bracing and gusset plate at Column A, looking southeast. Previous detached bracing and gusset plate has been replaced.

Photograph 148. Bent 7, Level 2, Column D, gusset plates, looking south. Corrosion, heavy laminar corrosion with diagonal lateral bracing corroded away and detached, CS4.

Photograph 149. Bent 7, Level 3, Column A, south horizontal bracing angle, looking north. 3" W x 4" H corrosion hole in vertical angle, CS3.

Photograph 150. Bent 7, Level 3, Column B splice plate, looking south. Majority of connection rivets for Column B have section loss and corrosion, CS3.

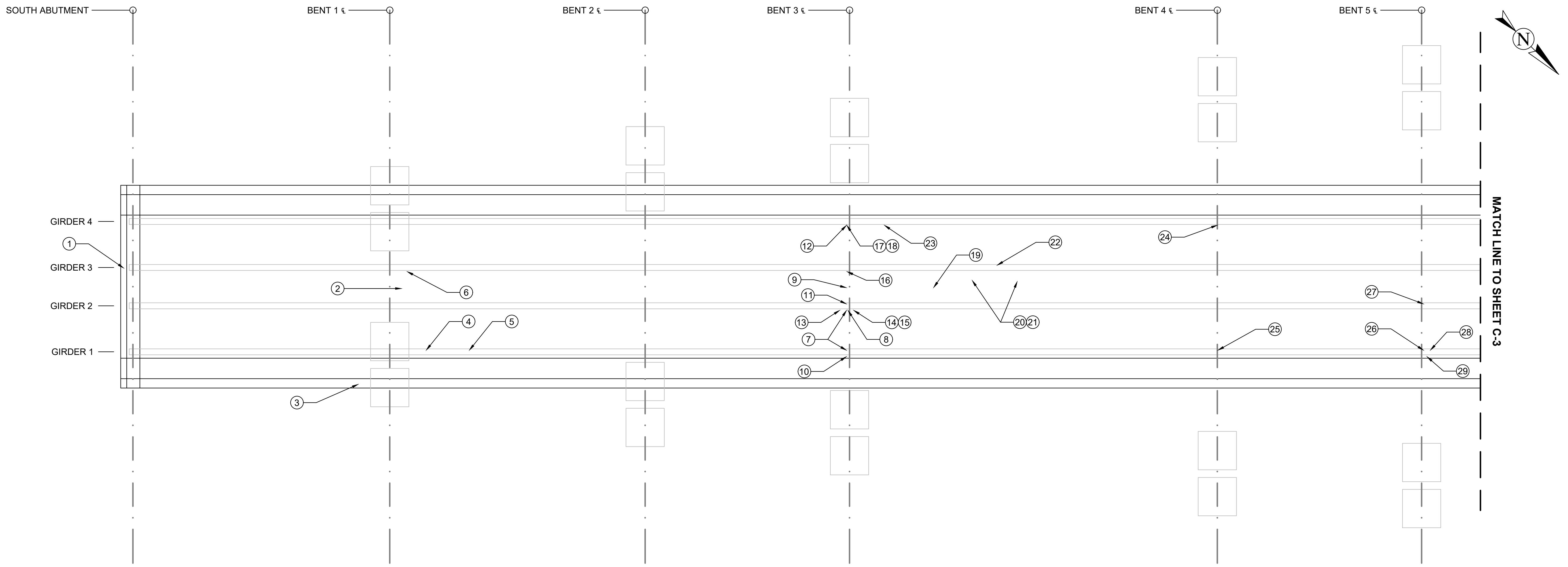
Photograph 151. Bent 8, Level 1, upper section, Column C, lower horizontal bracing, looking northeast. South angle has 3” H x 1” W corrosion hole adjacent to the gusset plate, CS3.

Photograph 152. Bent 8, Level 1, lower section, Column C, looking east. (2) lacing bars on west face have 100% section loss, CS3.

Photograph 153. Bent 8, Level 2, Column A, looking north. Batten plates and lacing bars are typically bent to the east on the east side, CS3.

Photograph 154. Bent 8, Level 2, Column C, looking east. (3) lacing bars on west face have 100% section loss. (1) lacing bar on east face has 100% section loss, CS3.

Photograph 155. Tower 5, Level 2, Column B, bottom horizontal, looking north. Underside batten plate has severe laminar corrosion and is not connected to the channels, CS3.



Defect ID	Caption
1	South Abutment bearings, moderate corrosion with minor section loss, 4 EA CS3, (See Photo 47).
2	All spans, Bay 2, map cracking throughout, up to 1/16” W, 128 SF CS3, (See Photo 25).
3	All spans, both overhangs, transverse cracking with efflorescence throughout, typically 3’-4’ apart x up to 1/8” W, 85 SF CS3, (See Photo 24).
4	Span 2, Bay 1, top flange plate of Girder 1, intermittent areas of up to 2' L x 2" W x 1/2" deep painted-over pitting, 10 LF CS3, (See Photo 30).
5	Span 2, Girder 1, west face, 25’ L section of painted-over pitting up to 1/8” deep, 25 LF CS3, (See Photo 31).
6	Span 2, Girder 3, east face bottom flange, 5' north of Bent 1, (2) missing rivets in 1' L area of up to 1" thick pack rust, 1 LF CS3, (See Photo 32).
7	Bent 3, Bay 1, Girder 1 and 2 bottom flange connection, rivet heads have corrosion with up to 50% section loss, 2 LF CS3, (See Photo 33).
8	Bent 3, Bay 1, Girder 2, web sliding plate, (3) missing bolts with heavy laminar corrosion, 1 LF CS3, (See Photo 34).
9	Bent 3, Bay 2, both cross frames, laminar corrosion throughout with up to 25% section loss of member.
10	Bent 3, Girder 1, top of sliding web plate, 5” H x 2” W area of 1/8” to 100% section loss, area of 100% loss is 1” W, 1 LF CS3, (See Photo 35).
11	Bent 3, Girder 2 web sliding plate, missing bolts and nuts and heavy laminar corrosion, 1 LF CS3, (Similar to Photo 40).
12	Bent 3, Girder 4 web sliding plate, heavy corrosion at the bolt slots and (2) missing bolts at the bottom, with a 2" H x 3" W area of 100% section loss, 1 LF CS3, (See Photo 40).
13	Bent 3, Span 3, Girder 2 bearing, missing south anchor bolt, 1 EA CS3.

Defect ID	Caption
14	Bent 3, Span 4, Girder 2 bearing, four bolts with 100% section loss, 1 EA CS3.
15	Bent 3, Span 4, Girder 2 bearing, missing southeast and northwest anchor bolts, 1 EA CS3, (Similar to Photo 49).
16	Bent 3, Span 4, Girder 3 bearing, missing northeast anchor bolt, 1 EA CS3, (Similar to Photo 49).
17	Bent 3, Span 4, Girder 4 bearing, missing west anchor bolt, 1 EA CS3, (Similar to Photo 49).
18	Bent 3, Span 4, Girder 4 bearing, peeling paint and heavy corrosion throughout. The bottom plate has 10% section loss along the edges and pack rust on the north side, 1 EA CS3, (See Photo 48).
19	Span 4, Bay 2, 2nd diaphragm, lower horizontal member, 3" diameter corrosion hole at both girder connections and impact damage to angle 1 1/2" over 10” L.
20	Span 4, Bay 2, lateral bracing, lower gusset plates at 2nd and 3rd cross frames have pack rust and corrosion holes up to 6” L x 2” W adjacent to Girder 3.
21	Span 4, Bay 2, lower gusset plates at 2nd and 3rd cross frames, pack rust and corrosion holes up to 6" L x 2" W adjacent to Girder 3.
22	Span 4, Girder 3 splice and bottom flange, 3' L x up to 1/8" W pitting and rivet head corrosion with up to 25% section loss, as well as peeling paint, 3 LF CS3, (See Photo 36).

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SCALE: 1" = 20'

MARCH, 2023

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DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII
STATE OF HAWAII D.O.T

NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

REFLECTED DECK SOUTH

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Defect ID	Caption
23	Span 4, Girder 4 east face, near Bent 3, bearing stiffener, pack rust up to 1" thick at the base with four missing rivets, 1 LF CS3, (Similar to Photo 37).
24	Bent 4, Girder 4 bearing, heavy corrosion on the anchor bolts with up to 30% section loss, 1 EA CS3.
25	Bent 4, Span 5, Girder 1 bearing, peeling paint and heavy corrosion throughout. The bottom plates have 10% section loss, 1 EA CS3, (Similar to Photo 50).
26	Bent 5, Girder 1 web sliding plate, corrosion induced crack at the top 1” with heavy laminar corrosion around the crack, 1 LF CS3, (Similar to Photo 35).
27	Bent 5, Girder 2 web sliding plate, (1) missing connection bolt, 1 LF CS3, (Similar to Photo 40).
28	Span 6, Bay 1 at Bent 5, adjacent to Girder 1, lower bracing, 100% section loss on bottom flange over 10” L x up to 1-1/2" deep, (See Photo 27).
29	Span 6, Bent 5, web stiffener above Girder 1 bearing, 3/16” thick pack rust causing a 1’ 11” H x 1” deflection, 1 LF CS3, (See Photo 37).

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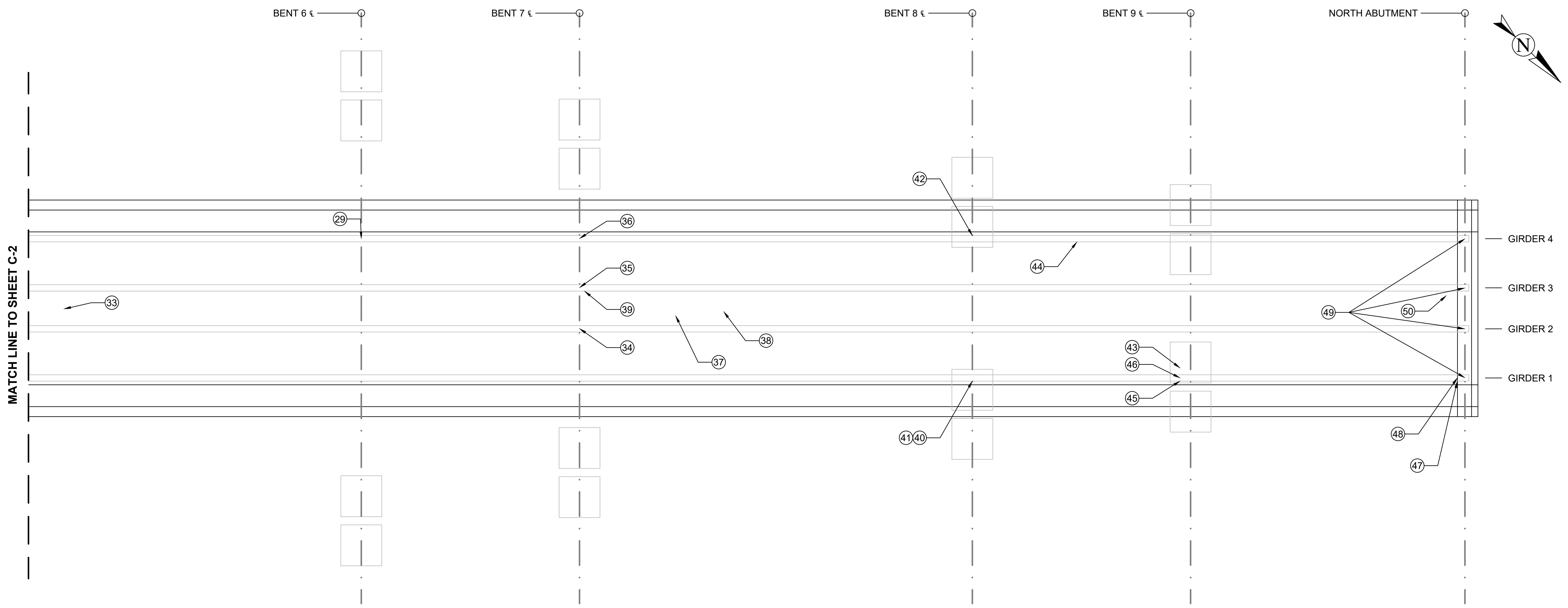
NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

REFLECTED DECK SOUTH

PAGE
C-2



Defect ID	Caption
30	Span 6, Bay 2, 2nd cross frame lower strut adjacent to Girder 3, (2) corrosion holes up to 3" diameter and there are small corrosion holes adjacent to Girder 2 at the 2nd and 3rd cross frame.
31	Bent 7, Span 8, Girder 2 bearing, missing southeast anchor bolt, 1 EA CS3, (Similar to Photo 49).
32	Bent 7, Span 8, Girder 3 bearing, missing SE, SW & NW anchor bolts, missing NE anchor nut, 1 EA CS3, (See Photo 49).
33	Bent 7, Span 8, Girder 4 bearing, missing east anchor bolt, 1 EA CS3, (Similar to Photo 49).
34	Span 8, Bay 2, 2nd lower strut, (2) missing bolts and (1) corrosion hole, 5” L x 2” W, (See Photo 28).
35	Span 8, Bay 2, 3rd lower strut, missing bolts and (1) corrosion hole, 4” L x 1-1/2” W, (Similar to Photo 28).
36	Span 8, Girder 3 at Bent 7, east face bearing stiffener, pack rust up to 3/4” and 100% section loss for bottom 5” x 1/2” W, 1 LF CS3, (Similar to Photo 37).
37	Bent 8, Girder 4 bearing, up to 1/8” laminar corrosion, 1 EA CS3, (Similar to Photo 50).
38	Span 9, Bay 1 at Bent 9, adjacent to Girder 1, lower bracing, 100% section loss on bottom flange over 1’ L x up to 1” W, (Similar to Photo 27).
39	Bent 9, Span 9, Girder 1 bearing, up to 1/4" thick laminar corrosion, 1 EA CS3, (See Photo 50).

Defect ID	Caption
40	Span 10, Girder 1, east face at North Abutment, (2) bearing stiffeners have effectively no remaining section at the lower 2" at base. The eastern bottom flange has 2" W knife-edging. This condition is similar at the Girder 4 East face, 2 LF CS3, (See Photo 39).
41	Span 10, Girder 1, east face at North Abutment, 3” L x 1/2” W area of 100% section loss, 1 LF CS3, (See Photo 38).
42	North Abutment bearings, up to 1/8” thick laminar corrosion, 4 EA CS3, (Similar to Photo 50).
43	North Abutment, Girder 3, Bay 2, lateral bracing has (3) missing/ loose anchor bolts and a deformed gusset plate.

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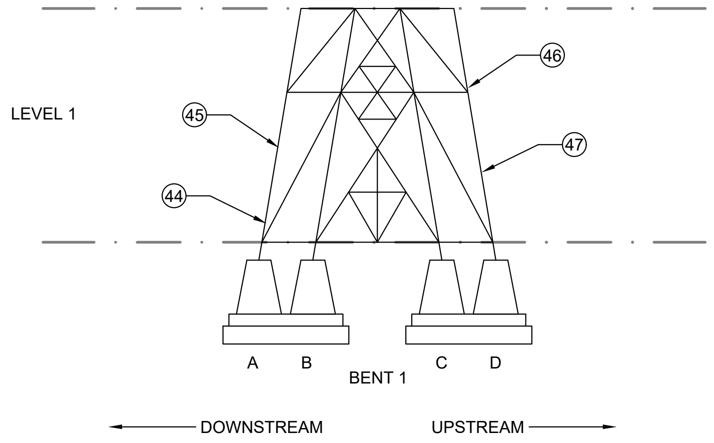
NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

REFLECTED DECK NORTH

PAGE
C-3



Defect ID	Caption
44	Bent 1, Level 1, Column A. (2) adjacent lacing bar rivets on south interior face of Column D with 100% section loss to heads, CS3. (Similar to Photo 57)
45	Bent 1, Level 1, Column A. Typical pitting, pack rust and laminar corrosion, CS3. (See Photo 55)
46	Bent 1, Level 1, Column D, east face, near midheight horizontal. Missing batten plate, CS3. (See Photo 56)
47	Bent 1, Level 1, Column D, south face. Scattered rivets with up to 100% section loss, CS3. (See Photo 57)

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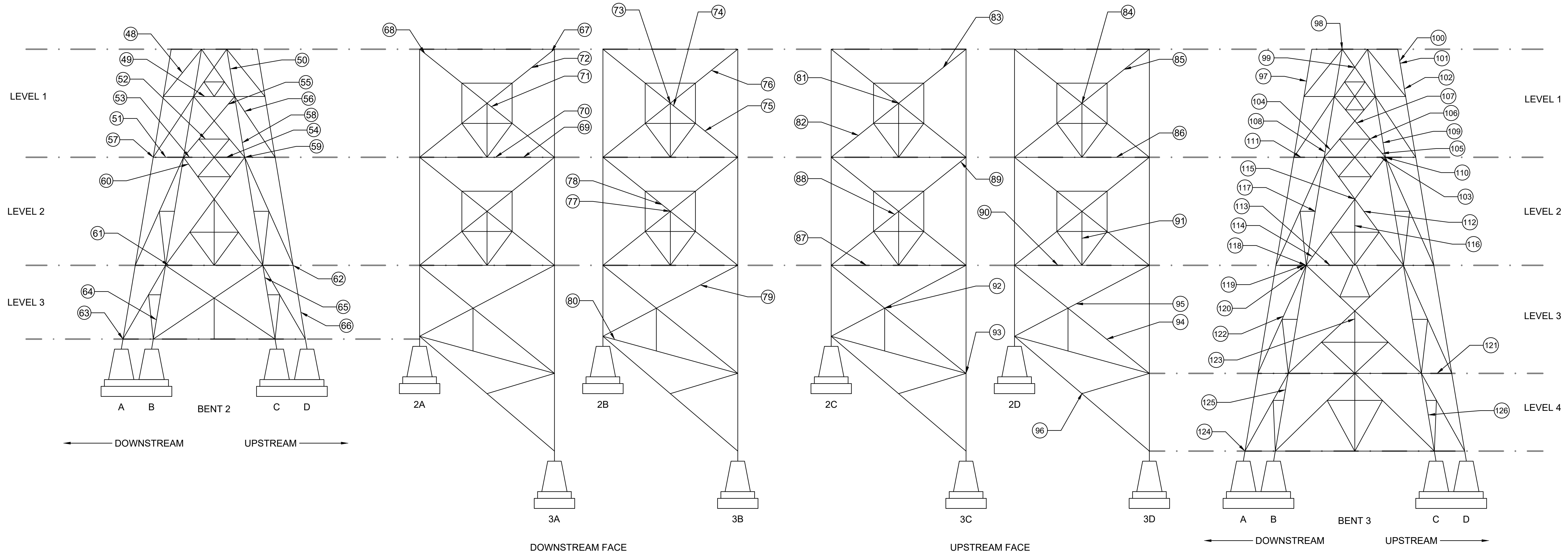
NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146
TOWER 1 (BENT 1)

PAGE
C-4



Defect ID	Caption
48	Bent 2, Level 1, upper section, between Columns A and B, diagonal bracing, both cover plates at mid-length. Pack rust up to 3/4" thick causing separation of plate and one broken rivet on north cover plate, CS3. (See Photo 58)
49	Bent 2, Level 1, upper section, between Columns B and C, horizontal bracing. West face has (3) lacing bars with 50% section loss and (1) with 90% section loss, CS3. (See Photo 59)
50	Bent 2, Level 1, upper section, Column C. (1) lacing bar has 90% section loss, CS3. (Similar to Photo 125)
51	Bent 2, Level 1, lower section, between Columns A and B, horizontal bracing. South face of angle has 1' 8” L x 1” H x up to 100% section loss with (3) lacing bars up to 75% section loss. The south angle has approximately 30% section loss near Column A. Angle original section is 3” x 4-1/2”, remaining is 1-1/2” x 3-3/4”, CS3. (See Photo 60)
52	Bent 2, Level 1, lower section, between Columns B and C diagonals, mid-horizontal bracing. Members have 1” knife-edging typical along entire length, CS3. (Similar to Photo 63)
53	Bent 2, Level 1, lower section, between Columns B and C, horizontal bracing, adjacent to Column B. Diagonals and horizontals on south face have knife-edging and holes in flanges throughout, CS3. (Similar to Photo 86)
54	Bent 2, Level 1, lower section, between Columns B and C, horizontal bracing. (2) lacing bars have 75% section loss, CS3. (Similar to Photo 125)
55	Bent 2, Level 1, lower section, between Columns B and C, upper west diagonal bracing near Column C. North angle has 3” L x up to 1” W x 100% section loss, CS3. (Similar to Photo 72)
56	Bent 2, Level 1, lower section, between Columns C and D, diagonal bracing near Column C. (2) batten plates have (3) of (6) rivet heads with up to 80% section loss, CS3. (Similar to Photo 57)
57	Bent 2, Level 1, lower section, Column A, interior gusset plates. Up to 1" W x full length section loss where all members frame in, CS3. (See Photo 61)
58	Bent 2, Level 1, lower section, Column C, cover plate. Up to 2" diameter corrosion holes, CS3. (Similar to Photo 130)
59	Bent 2, Level 1, lower section, Column C, interior face of south web cover plate. painted-over pitting up to 3” diameter x 1/4” deep CS3. (See Photo 62)

Defect ID	Caption
60	Bent 2, Level 2, between Columns B and C, horizontal bracing near Column B. The bottom 1" of both angles have knife-edging to 100% section loss. There is an area of 90% section loss to the south angle, CS3. (See Photo 63)
61	Bent 2, Level 2, between Columns B and C, upper east diagonal bracing near Column B. Knife-edging along flanges with up to 1-1/2" L x 1" W corrosion holes, CS3. (Similar to Photo 87)
62	Bent 2, Level 2, Column D, transverse bracing gusset plates. Typical heavy laminar corrosion, CS3. (See Photo 64)
63	Bent 2, Level 3, Column A, horizontal bracing, gusset plate. Pack rust up to 1/4" thick, CS3. (See Photo 65)
64	Bent 2, Level 3, Column B. (1) lacing bar on east face has 100% section loss, CS3. (Similar to Photo 125)
65	Bent 2, Level 3, Column C. (1) lacing bar on west face has 100% section loss, CS3. (Similar to Photo 125)
66	Bent 2, Level 3, Column D web, north face. Typical painted-over pitting with pack rust and corroded rivet heads, CS3. (Similar to Photo 83)
67	Tower 2, Level 1, Column A , upper north diagonal bracing, near Bent 3. 6" x 2" corrosion hole in vertical leg of interior angle near Column A connection. Exterior leg has area of pack rust causing separation of gusset plate up to 1", CS3. (See Photo 66)

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NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

TOWER 2 (BENTS 2 & 3)

PAGE
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Defect ID	Caption
68	Tower 2, Level 1, Column A, Bent 2, gusset plate to diagonal connection. (1) missing rivet with pack rust up to 1/2" thick, CS3. (See Photo 67)
69	Tower 2, Level 1, Column A, horizontal bracing. Areas of 100% section loss, up to 1-1/2" W x 6" L on interior channel top/bottom flanges near Bent 3, CS3. (Similar to Photo 101)
70	Tower 2, Level 1, Column A, horizontal bracing. Up to 1" W x 6" L areas of 100% section loss, on interior channel bottom flange near bracing mid point, CS3. (Similar to Photo 101)
71	Tower 2, Level 1, Column A, lower north diagonal bracing, east face of diagonal, interior center gusset plate. 9" W x 3" H area of 100% section loss and areas of laminar corrosion, CS3. (See Photo 68)
72	Tower 2, Level 1, Column A, upper north diagonal bracing. Multiple areas of knife-edging along interior angle over 8' length with individual areas up to 1" x 6" exhibiting 100% section loss, CS3. (Similar to Photo 72)
73	Tower 2, Level 1, Column B, diagonal bracing at center gusset plates. Pack rust up to 1-1/2" thick with moderate laminar corrosion at the corners and knife-edging on angle legs and batten plates, CS3. (Similar to Photo 72)
74	Tower 2, Level 1, Column B, lower north diagonal bracing. Areas of 100% section loss up to 1-1/2" W x 1' L on both angle legs at isolated locations along full member length, CS3. (Similar to Photo 134)
75	Tower 2, Level 1, Column B, lower north diagonal bracing. Up to 1/8" section loss to gusset plate and diagonal at connection, 1" diameter corrosion hole in diagonal near center connection, CS3. (Similar to Photo 134)
76	Tower 2, Level 1, Column B, upper north diagonal bracing, near Bent 3. Areas of 100% section loss up to 1-1/2" x 1' L on interior vertical angle leg over 3' near center connection, CS3. (Similar to Photo 134)
77	Tower 2, Level 2, Column B, diagonal gusset plate connection, lower diagonals. Up to 4" L x 2" H corrosion holes, CS3. (Similar to Photo 92)
78	Tower 2, Level 2, Column B, upper south diagonal bracing. 1' L x 3" W of 100% loss on inner west angle vertical flange, CS3. (Similar to Photo 134)
79	Tower 2, Level 3, Column B, horizontal bracing. Numerous rivet heads in horizontal strut with up to 100% section loss, CS3. (See Photo 69)
80	Tower 2, Level 3, Column B. Multiple up to 3/4" diameter corrosion holes throughout, and covered in vegetation, CS3. (See Photo 70)
81	Tower 2, Level 1, Column C, center gusset plate. Both gusset plates have pack rust at the incoming angles up to 1/2” thick. Laminar corrosion adjacent to angles throughout with up to 1" diameter x 100% section loss, CS3. (Similar to Photo 99)
82	Tower 2, Level 1, Column C, lower south diagonal bracing, near Bent 2. East angle with corrosion holes and approximately 15% loss of cross sectional area, CS3. (Similar to Photo 134)
83	Tower 2, Level 1, Column C, upper north diagonal bracing near Bent 3. West angle has deformation 3' L x 1” out-of-plane. Laminar corrosion throughout with section loss along member up to approximately 15% loss of total cross sectional area, CS3. (Similar to Photo 72)
84	Tower 2, Level 1, Column D, center gusset plate. (1) missing rivet, CS3. (See Photo 71)
85	Tower 2, Level 1, Column D, upper north diagonal bracing, near Bent 3. Heavy knife-edging and 6" L x 2" H corrosoin holes, CS3. (See Photo 72)
86	Tower 2, Level 1, Column D, horizontal bracing, near Bent 3 east face. Interior flanges have up to 70% section loss, CS3. (Similar to Photo 134)
87	Tower 2, Level 2, Column C, horizontal bracing, near mid-length slightly closer to Bent 2. Up to 3/16" deep pitting throughout with areas of knife-edging to original members of interior west face and isolated corrosion holes up to 1/2" diameter, CS3. (See Photo 73)
88	Tower 2, Level 2, Column C, lower south diagonal bracing near center gusset plate. East angle has laminar corrosion with 40% loss of cross sectional area, CS3. (Similar to Photo 68)
89	Tower 2, Level 2, Column C, upper north diagonal bracing near Bent 3. Laminar corrosion with section loss along member up to 10% loss of total cross sectional area, CS3. (Similar to Photo 134)
90	Tower 2, Level 2, Column D, horizontal bracing. Pinholes (corrosion holes) throughout the length, CS3. (Similar to Photo 101)
91	Tower 2, Level 2, Column D, vertical bracing. Up to 1/8" deep pitting with scattered areas of knife-edging, CS3. (Similar to Photo 97)
92	Tower 2, Level 3, Column C, center gusset plate. 50% of rivet heads on the inside of panel point typically have 50-90% section loss, CS3. (Similar to Photo 99)
93	Tower 2, Level 3, Column C, lower diagonal bracing near Bent 3. East gusset plate and east top angle coming into gusset plate are bent out-of-plane 3/4”, CS3. (Similar to Photo 82)
94	Tower 2, Level 3, Column D, lower north diagonal bracing. Typical pitting on angle legs, CS3. (Similar to Photo 72)
95	Tower 2, Level 3, Column D, upper north diagonal bracing. Pitting and knife-edging with up to 1/16" section loss, CS3. (Similar to Photo 72)
96	Tower 2, Level 4, Column D, lower diagonal bracing. Heavy growth with trees growing through the members. (See Photo 74)
97	Bent 3, Level 1, upper section, Column A, exterior face. Widespread laminar corrosion on edges over top 12', CS3. (Similar to Photo 77)
98	Bent 3, Level 1, upper section, Column B, top gusset plate and longitudinal bracing. Laminar corrosion and areas of section loss on members and rivet heads due to active water leakage from the bridge, CS3. (See Photo 75)
99	Bent 3, Level 1, upper section, between Columns B and C, center gusset plates. Laminar corrosion on plates and transverse bracing members, CS3. (See Photo 76)
100	Bent 3, Level 1, upper section, Column D, vertical near top. Typical laminar corrosion at upper levels, CS3. (See Photo 77)
101	Bent 3, Level 1, upper section, Column D. Corrosion hole up to 2" diameter in southeast angle with (2) adjacent lacing bars with 100% section loss near the top, CS3. (Similar to Photo 145)
102	Bent 3, Level 1, upper section, Column D, southeast flange. (1) 2-1/2" diameter corrosion hole, CS3. (Similar to Photo 145)
103	Bent 3, Level 1, lower section, between Columns B and C, horizontal bracing. Corrosion holes up to 1" diameter in top channel flanges, batten plate, and lacing bar near Column C, CS3. (Similar to Photo 86)
104	Bent 3, Level 1, lower section, between Columns B and C, lower east diagonal bracing near Column B, adjacent to batton plates top flange of angles. knife-edging with areas of 4" L x 2" W of up to 100% section loss, CS3. (Similar to Photo 87)
105	Bent 3, Level 1, lower section, between Columns B and C, lower west diagonal bracing just above lower horizontal on Column C side. Diagonals and horizontals on north face have knife-edging and corrosion holes throughout, CS3. (Similar to Photo 122)
106	Bent 3, Level 1, lower section, between Columns B and C, lower west diagonal bracing, just above and below lower mid-horizontal on Column C side. Diagonals and horizontals on north face have knife-edging and corrosion holes throughout, CS3. (Similar to Photo 87)
107	Bent 3, Level 1, lower section, between Columns B and C, lower west diagonal bracing. Laminar corrosion with knife-edging and holes up to 1" diameter near center gusset plate, CS3. (Similar to Photo 87)
108	Bent 3, Level 1, lower section, Column B, southwest flange. 1-1/2" W x 1" H corrosion hole, CS3. (Similar to Photo 145)
109	Bent 3, Level 1, lower section, Column C, bottom quarter point cover plate. Up to 1-1/2" diameter corrosion holes, CS3. (Similar to Photo 94)
110	Bent 3, Level 1, lower section, Column C. (3) lacing bars with 100% section loss in lower section, CS3. (Similar to Photo 125)
111	Bent 3, Level 1, lower section, Columns A and B, horizontal bracing. Pack rust up to 1-1/2" thick with section loss up to 30% to gusset plates and 100% loss to rivet heads of batten plate, CS3. (See Photo 78)
112	Bent 3, Level 2, between Columns B and C, lower west diagonal bracing. Multiple corrosion holes up to 2" diameter in exterior flange, CS3. (Similar to Photo 122)
113	Bent 3, Level 2, between Columns B and C, horizontal bracing. knife-edging with up to 1-1/2" diameter corrosion holes on both flanges, CS3. (Similar to Photo 86)
114	Bent 3, Level 2, between Columns B and C, lower east diagonal bracing near Column B. knife-edging and up to 1-1/2" diameter holes in both flanges of both angles, CS3. (Similar to Photo 122)
115	Bent 3, Level 2, between Columns B and C, north center gusset plate. 2" diameter corrosion hole, CS3. (Similar to Photo 144)
116	Bent 3, Level 2, between Columns B and C, vertical bracing. Knife-edging and severe laminar corrosion with up to 50% loss of flanges over 4' of length, and area of up to 1-1/2" W x 1" H corrosion holes, CS3. (Similar to Photo 128)

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NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

TOWER 2 (BENTS 2 & 3)

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Defect ID	Caption
117	Bent 3, Level 2, Column B. 2-1/2" diameter corrosion hole in southeast angle above horizontal brace connection, CS3. (Similar to Photo 145)
118	Bent 3, Level 2, Column B, east gusset plate. 6" L x 2" H area of 100% section loss at top corner and 2" W x 6" H area of 100% section loss at the horizontal bracing connection with pack rust up to 1" thick, CS3. (Similar to Photo 126)
119	Bent 3, Level 2, Column B, horizontal bracing, south flange. 9" L x full-width of angle area of 100% section loss, CS3. (See Photo 79)
120	Bent 3, Level 2, Column B, west gusset. Painted-over pitting up to 3/16" deep and rivet heads with up to 100% section loss, CS3. (Similar to Photo 126)
121	Bent 3, Level 3, between Columns C and D, horizontal bracing. Knife-edging and multiple corrosion holes up to 2" diameter across full member length, CS3. (See Photo 80)
122	Bent 3, Level 3, between Columns A and B, diagonal bracing above interior connection. 3' L x full-width of angle area of section loss on top flanges (CS3). - Note this member has been retrofitted and retrofit is in good condition. (See Photo 81)
123	Bent 3, Level 3, between Columns B and C, vertical bracing. Knife-edging and severe laminar corrosion with up to 50% section loss of flanges and corrosion hole up to 1-1/2" diameter in interior flange, CS3. (Similar to Photo 128)
124	Bent 3, Level 4, Column A, just above bearing, gusset plates. Plates are distorted and bowed to the south up to 1/8" for the horizontal bracing member, CS3. (See Photo 82)
125	Bent 3, Level 4, Column B. (1) lacing bar exhibits 100% section loss on both ends on the west column face, CS3. (Similar to Photo 125)
126	Bent 3, Level 4, Column C, typical painted-over pitting, laminar corrosion, knife-edging, and corroded rivet heads, CS3. (See Photo 83)

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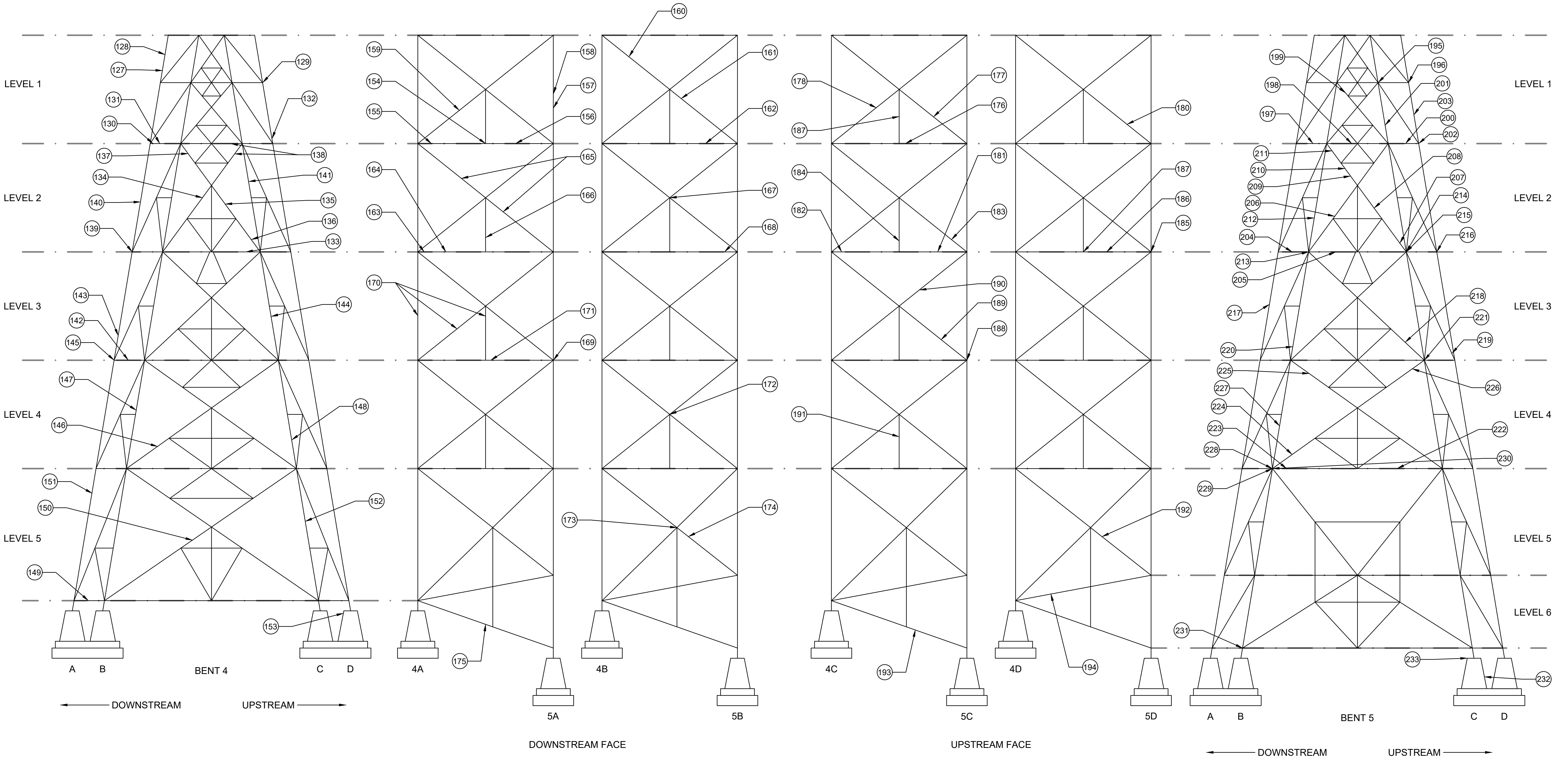
NANUE STREAM BRIDGE

BRIDGE NO. 001000190308146

TOWER 2 (BENTS 2 & 3)



Defect ID	Caption
127	Bent 4, Level 1, upper section, Column A, above lower connection. (1) lacing bar has 100% section loss, CS3. (Similar to Photo 125)
128	Bent 4, Level 1, upper section, Column A. West side lacing bar with 100% section loss, CS3. (Similar to Photo 125)
129	Bent 4, Level 1, upper section, Column D, upper gusset plates. Heavy laminar corrosion and approximately 1/4" to 3/8" remaining section on gusset plate between diagonal and horizontal bracing member, CS3. (See Photo 84)
130	Bent 4, Level 1, lower section, between Columns A and B, horizontal bracing. Vertical legs have knife-edging and areas of up to 100% section loss, CS3. (Similar to Photo 80)
131	Bent 4, Level 1, lower section, between Columns A and B, horizontal bracing. (1) lacing bar has 100% section loss and batten plate has 50% loss, CS3. (Similar to Photo 120)
132	Bent 4, Level 1, lower section, Column D, lower gusset plates. Pack rust up to 1" thick with areas of 100% section loss and only retrofit gusset plate remaining, no change from previous inspection, CS3. (See Photo 85)
133	Bent 4, Level 2, between Columns B and C, horizontal bracing adjacent to Column C, vertical connection. (7) 2" diameter corrosion holes in interior top flange along member, CS3. (See Photo 86)
134	Bent 4, Level 2, between Columns B and C, lower east diagonal bracing. 11" L section of vertical exterior flange missing, CS3. (Similar to Photo 122)

Defect ID	Caption
135	Bent 4, Level 2, between Columns B and C, lower west diagonal bracing. Heavy laminar corrosion throughout with up to 25% section loss, CS3. (Similar to Photo 122)
136	Bent 4, Level 2, between Columns B and C, lower west diagonal bracing, near Column C. Knife-edging and 80% section loss to the interior angle, CS3. (See Photo 87)
137	Bent 4, Level 2, between Columns B and C, upper east diagonal bracing near Column C between top two horizontals. (2) 1-3/4" L x 1" W corrosion holes in exterior top flange, CS3. (Similar to Photo 122)

NOTE:
THE BRIDGE IS ORIENTED FROM SOUTH (TO HILO) TO NORTH (TO HONOKAA) ACCORDING TO THE BRIDGE PLANS. THE GIRDERS ARE NUMERICALLY LABELED "1" TO "4", FROM DOWNSTREAM (MAKAI) TO UPSTREAM (MAUKA). THE SUBSTRUCTURE COLUMNS ARE LABELED ALPHABETICALLY "A" TO "D", FROM DOWNSTREAM (MAKAI) TO UPSTREAM (MAUKA)

SCALE: 1/32" = 1'

MARCH, 2023

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STATE OF HAWAII D.O.T

NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

TOWER 3 (BENTS 4 & 5)

PAGE
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Defect ID	Caption
138	Bent 4, Level 2, between Columns B and C, upper west diagonal and horizontal bracing near Column C. Heavy laminar corrosion throughout with up to 25% section loss, CS3. (Similar to Photo 106)
139	Bent 4, Level 2, Column A, exterior gusset plate. Corrosion, pack rust up to 1" thick with areas of up to 100% loss and only retrofit gusset plate remaining, CS3. (Similar to Photo 61)
140	Bent 4, Level 2, Column A. East side lacing bar with 90% section loss, CS3. (Similar to Photo 125)
141	Bent 4, Level 2, Column C. 50% of lacing bars on west face have 100% section loss, remaining bars on both faces have average 30% section loss, CS4. (See Photo 88)
142	Bent 4, Level 3, between Columns A and B, horizontal bracing. (4) lacing bars have 100% section loss, CS3. (Similar to Photo 120)
143	Bent 4, Level 3, Column A above lower connection. Retrofit, four interior and three exterior lacing bars cut or removed, CS3. (Similar to Photo 112)
144	Bent 4, Level 3, Column C. Lacing bars have an average 75% section loss in this section of column. Except for top 10’ of west face which are in good condition, CS3. (See Photo 89)
145	Bent 4, Level 3, horizontal bracing at gusset plates at Column A. Horizontal bracing gusset plate has 100% section loss on all sides. This member is not connected to Column A anymore, CS4. (See Photo 90)
146	Bent 4, Level 4, between Columns B and C, lower east diagonal bracing near Column B. Member bent slightly out of plane approximately 1”. Likely due to 2022 impact incident, CS3. (Similar to Photo 96)
147	Bent 4, Level 4, Column B. (6) lacing bars with 100% section loss on west face. (12) on east face, CS3. (Similar to Photo 125)
148	Bent 4, Level 4, Column C. Knife-edging of flanges, CS3. (See Photo 91)
149	Bent 4, Level 5, between Columns A and B, horizontal bracing. All (4) lacing bars on top and bottom of member have 100% section loss, CS3. (Similar to Photo 124)
150	Bent 4, Level 5, between Columns B and C, lower east diagonal bracing. Member bent slightly out-of-plane approximately 1” downward, CS3. (Similar to Photo 96)
151	Bent 4, Level 5, Column A. (3) lacing bars with 100% section loss, CS3. (Similar to Photo 125)
152	Bent 4, Level 5, Column C. (6) lacing bars on west face have 100% section loss, CS3. (Similar to Photo 125)
153	Bent 4, Level 5, Column D, footing, southeast corner. 11" W x 1' 7" H x 2-1/2" deep corner spall, CS3. (Similar to Photo 118)
154	Tower 3, Level 1, Column A, horizontal and vertical bracing gusset plate. Up to 85% section loss, FL x 2" H, CS3. (Similar to Photo 97)
155	Tower 3, Level 1, Column A, horizontal bracing. 5" L x 10" W corrosion hole in lower batten plate, CS3. (Similar to Photo 94)
156	Tower 3, Level 1, Column A, horizontal bracing. Heavy pitting and laminar corrosion with up to 80% section loss. Few lacing bars exhibit 100% section loss and knife-edging. Channel legs exhibit scattered knife-edging, CS3. (Similar to Photo 103)
157	Tower 3, Level 1, Column A. (2) severed lacing bars. Lacing bars exhibit heavy pack rust between lacing bars and angle legs, CS3. (Similar to Photo 125)
158	Tower 3, Level 1, Column A. 1-1/2" diameter corrosion hole in lacing bar and southeast angle leg, CS3. (Similar to Photo 145)
159	Tower 3, Level 1, Column A, lower south diagonal bracing. Several corrosion holes along the west and east angle legs up to 2" diameter ; 3' L x 2" H area of 100% section loss on west angle near Bent 4, CS3. (See Photo 92)
160	Tower 3, Level 1, Column B, upper south diagonal bracing, near Bent 4. 40% section loss to north angle, CS3. (Similar to Photo 134)
161	Tower 3, Level 1, Column B, lower north diagonal bracing. Worst case is a 4” diameter corrosion hole near center gusset plate. Approximately 40% loss in cross sectional area, CS3. (See Photo 93)
162	Tower 3, Level 1, Column B, horizontal bracing, near Bent 5. Average 20% section loss to member with corrosion holes throughout the channels up to 1” diameter, CS3. (Similar to Photo 101)
163	Tower 3, Level 2, Column A, horizontal bracing. 9" diameter corrosion hole in lower batten plate with 3" W x 1/8" section remaining, CS3. (See Photo 94)
164	Tower 3, Level 2, Column A, horizontal bracing, near Bent 4. 50% section loss to entire member with holes throughout, CS4. (See Photo 95)
165	Tower 3, Level 2, Column A, upper south to lower north diagonal bracing. Global distortion to the diagonal members within level, CS3. (See Photo 96)
166	Tower 3, Level 2, Column A, vertical bracing. Batten plates typically exhibit pitting up to 1/8" deep with corrosion holes up to 5" diameter, CS3. (See Photo 97)
167	Tower 3, Level 2, Column B, longitudinal bracing, center gusset plate. Up to 2" diameter corrosion holes around members and at bottom edge of panels, CS3. (Similar to Photo 92)
168	Tower 3, Level 3, Column C, horizontal bracing. Numerous corrosion holes throughout full length of both channels, CS3. (Similar to Photo 101)
169	Tower 3, Level 3, Column A, Bent 5, interior and exterior gusset plates, between horizontal and lower diagonal bracing. Pack rust with section loss, CS3. (Similar to Photo 65)
170	Tower 3, Level 3, Column A, lower south diagonal, and vertical bracing. Repaired. (See Photo 98)
171	Tower 3, Level 3, Column A, vertical bracing east face. Corrosion throughout with isolated corrosion holes, CS3. (Similar to Photo 97)
172	Tower 3, Level 4, Column B, center gusset plate. Numerous corrosion holes on both gusset plates, CS3. (See Photo 99)
173	Tower 3, Level 5, Column B, center gusset plate, exterior. 3" L x 1" W corrosion hole, CS3; (2) additional corrosion holes up to 3" x 2", CS3. (Similar to Photo 99)
174	Tower 3, Level 5, Column B, longitudinal bracing, lower north diagonal. Out-of-plane deformation to diagonal member over the full length. (CS2) (Similar to Photo 96)
175	Tower 3, Level 6, Column A, lower horizontal bracing. Knife-edging with 4" L x 1-1/2" H section loss, CS3. (See Photo 100)
176	Tower 3, Level 1, Column C, lower horizontal bracing. Multiple corrosion holes up to 6" diameter in east and west channels, CS3. (See Photo 101)
177	Tower 3, Level 1, Column C, lower north diagonal bracing. Up to 6" L x 1" H corrosion holes throughout both angles, CS3. (Similar to Photo 92)
178	Tower 3, Level 1, Column C, lower south diagonal bracing. Corrosion holes and edge section loss up to 1" H x 1' L on both angles of diagonal, CS3. (Similar to Photo 92)
179	Tower 3, Level 1, Column C, vertical bracing. Multiple corrosion holes up to 2" diameter in interior angle of vertical, CS3. (Similar to Photo 97)
180	Tower 3, Level 1, Column D, lower north diagonal bracing near Column D, inside of angles. Heavy laminar corrosion, CS3. (Similar to Photo 72)
181	Tower 3, Level 2, Column C, horizontal bracing, closer to Bent 5. Up to 6" L x 2" H holes throughout and several areas of full flange loss, CS3; bottom batten plate is heavily corroded with multiple corrosion holes up to 4" diameter, CS3. (Similar to Photo 101)
182	Tower 3, Level 2, Column C, horizontal bracing, east channel. 8" L x 2" H corrosion hole, CS3. (See Photo 102)
183	Tower 3, Level 2, Column C, lower north diagonal bracing near Bent 5. Up to 2" diameter corrosion holes, CS3. (Similar to Photo 92)
184	Tower 3, Level 2, Column C, vertical bracing. 100% section loss to east angle leg on vertical over a 8" x 2" area, CS3. (Similar to Photo 97)
185	Tower 3, Level 2, Column D, Bent 5, gusset plates. Moderate to heavy laminar corrosion, CS3. (Similar to Photo 106)
186	Tower 3, Level 2, Column D, horizontal bracing, exterior channel inside face. Heavy laminar corrosion, CS3. (See Photo 103)
187	Tower 3, Level 2, Column D, vertical bracing. East angle of vertical is bent slightly to the east with the gusset plate and angle has approximately 40% section loss. gusset plate is welded along the horizontal member, CS3. (Similar to Photo 97)
188	Tower 3, Level 3, Column C, Bent 5, gusset plate. Up to 100% section loss over 3" x 2" area, CS3. (Similar to Photo 61)
189	Tower 3, Level 3, Column C, lower north diagonal bracing. Knife-edging with small areas of edge loss full length and small corrosion holes, CS3. (Similar to Photo 72)
190	Tower 3, Level 3, Column C, upper north diagonal bracing. Knife-edging with small areas of edge loss full length and up to 2" diameter holes, CS3. (Similar to Photo 72)
191	Tower 3, Level 4, Column C, vertical bracing. Heavy corrosion of angles and batten plates on vertical with knife-edging, pitting up to 3/16" deep and corrosion holes up to 5" Dia, CS3. (Similar to Photo 97)
192	Tower 3, Level 5, Column D, lower north diagonal bracing, at center gusset plate. Batten plates missing, CS3. (See Photo 104)
193	Tower 3, Level 6, Column C, lower horizontal bracing. Typical pitting up to 3/16" deep in webs of bottom horizontal member, CS3. (Similar to Photo 100)
194	Tower 3, Level 6, Column D, upper horizontal bracing. Vegetation, tree growing through members. (See Photo 105)

Defect ID	Caption
195	Bent 5, Level 1, upper section, Column C, north gusset plate. (1) 1" diameter and (1) 2" diameter corrosion hole, CS3. (Similar to Photo 130)
196	Bent 5, Level 1, upper section, Column D, lower gusset plates. Heavy laminar corrosion with up to 100% section loss, CS3. (See Photo 106)
197	Bent 5, Level 1, lower section, between Columns A and B, lower horizontal bracing. Column A lower gusset plates exhibit up to 100% section loss above and below horizontal member with 5" L segments of 25% section left holding members. - Repaired. (See Photo 107)
198	Bent 5, Level 1, lower section, between Columns B and C, lower horizontal bracing. Multiple corrosion holes up to 3-1/2" L x full width along interior angle of horizontal, CS3. (Similar to Photo 86)
199	Bent 5, Level 1, lower section, between Columns B and C, upper east diagonal bracing. Scattered corrosion holes on north angle leg (8" L total up to 1" H), CS3. (Similar to Photo 122)
200	Bent 5, Level 1, lower section, between Columns C and D, horizontal bracing, lacing bars. Up to 100% section loss, CS3. (Similar to Photo 120)
201	Bent 5, Level 1, lower section, Column C, batten plate. Pitting up to 1/4" deep and two corrosion holes ((1) 8" L x 3" H and (1) 1" diameter), CS3. (Similar to Photo 94)
202	Bent 5, Level 1, lower section, Column D, horizontal bracing, gusset plate. North gusset plate has 8" L area of 100% section loss at connection to Column D, CS4. South gusset plate (4) corrosion holes up to 2" diameter and (1) on north gusset plate, CS3. (See Photo 108)
203	Bent 5, Level 1, lower section, Column D. (2) lacing bars removed on west face, CS3. (Similar to Photo 112)
204	Bent 5, Level 2, between Columns A and B, horizontal bracing. Areas of 100% section loss throughout, CS3. (Similar to Photo 60)
205	Bent 5, Level 2, between Columns B and C, horizontal bracing. (2) lacing bars with 100% section loss, CS3. (Similar to Photo 120)
206	Bent 5, Level 2, between Columns B and C, lower east diagonal bracing. Multiple corrosion holes up to 1" diameter and pitting up to 3/16" deep in both angles of diagonal, CS3. (Similar to Photo 122)
207	Bent 5, Level 2, between Columns B and C, lower west diagonal bracing, connection to Column C. North angle exhibits two 10" L x up to 4" H holes with 1" x 3" remaining section. Remaining length of diagonal exhibits knife-edging and pitting, CS4. (See Photo 109)
208	Bent 5, Level 2, between Columns B and C, lower west diagonal bracing, mid-length. Up to 1" diameter holes, CS3. (Similar to Photo 122)
209	Bent 5, Level 2, between Columns B and C, upper east diagonal bracing. Scattered corrosion holes in north angle, CS3. (Similar to Photo 122)
210	Bent 5, Level 2, between Columns B and C, upper east diagonal bracing. Typical corrosion holes up to 1" x 2" in vertical flange of exterior angle of diagonal, CS3. (Similar to Photo 122)
211	Bent 5, Level 2, between Columns B and C, upper east diagonal bracing, near Column B. (1) corrosion hole 4" L x full angle leg width along exterior angle of diagonal, CS3. (Similar to Photo 122)
212	Bent 5, Level 2, Column B, cover plate. Up to 4" diameter holes, CS3. (Same at Bent 4) (Similar to Photo 116)
213	Bent 5, Level 2, Column B, exterior gusset plate. Multiple corrosion holes up to 5" x 2-1/2" and pitting up to 1/16" deep in exterior gusset plate; interior rivet heads at connection to column typically have 90% section loss in this location, CS3. (See Photo 110)
214	Bent 5, Level 2, Column C, connection outboard channel. 2" diameter corrosion hole, CS3. (Similar to Photo 130)
215	Bent 5, Level 2, Column C, horizontal bracing plugboard gusset plate. (1) 3" diameter and (1) 1" diameter corrosion holes, CS3. (Similar to Photo 130)
216	Bent 5, Level 2, Column D, horizontal bracing gusset plates. Heavy laminar corrosion with up to 100% section loss with 15% section remaining of the north gusset plate and repair plates becoming ineffective, CS4. (See Photo 111)
217	Bent 5, Level 3, Column A. (9) lacing bars removed from column, CS3. (See Photo 112)
218	Bent 5, Level 3, between Columns B and C, lower west diagonal near Column C. 10" of top flange missing on both angles, CS3. (See Photo 113)
219	Bent 5, Level 3, between Columns C and D, diagonal bracing, outboard angles. 10" L x up to full height section loss with adjacent corrosion holes, extreme deterioration up to 90% cross section reduction having no change from previous inspection, CS4. (See Photo 114)
220	Bent 5, Level 3, Column B. (6) lacing bars on west side of column with 100% section loss at south rivet, CS3. (Similar to Photo 125)
221	Bent 5, Level 3, between Columns C and D, connection to Column C. Batten plate on east face at top exhibits a 10" L x 6" H corrosion hole, CS3. (Similar to Photo 139)
222	Bent 5, Level 4, between Columns B and C, horizontal bracing at third point closest to Column C. Bottom lacing bars mostly missing, CS3. (Similar to Photo 124)
223	Bent 5, Level 4, between Columns B and C, horizontal bracing. Typical pitting up to 1/8" deep and up to 1/2" section loss along the horizontal strut flanges, CS3. (Similar to Photo 63)
224	Bent 5, Level 4, between Columns B and C, lower east diagonal bracing. Up to 3" diameter corrosion hole in vertical leg of interior angle, CS3. (Similar to Photo 122)
225	Bent 5, Level 4, between Columns B and C, upper east diagonal. Multiple sections of heavy section loss to exterior angle of diagonal; 1/4 sq. in total remaining in of L4x4x5/16, CS3. (Similar to Photo 122)
226	Bent 5, Level 4, between Columns B and C, upper west diagonal bracing near Column C, outboard angle. 4" L x full width area of missing top flange, CS3. (Similar to Photo 122)
227	Bent 5, Level 4, Column B. Many lacing bars exhibit 100% section loss on the west side of column, CS3. (Similar to Photo 125)
228	Bent 5, Level 4, Column B, vertical at southeast flange splice. Column is deformed, 1' 10" L x 1" deflection, CS3. (See Photo 115)
229	Bent 5, Level 4, Column B, west batten plate. 9" diameter corrosion hole, CS3. (See Photo 116)
230	Bent 5, Level 5, Column B interior splice plate rivets. Section loss, corrosion, CS3. (Similar to Photo 126)
231	Bent 5, Level 6, Column B, west batten plate. 9" W x 3" H corrosion hole, CS3. (Similar to Photo 116)
232	Bent 5, Level 6, Column C, footing, base of pedestal on west side. 3' x 2' abrasion with course aggregate exposed and missing, CS3. (See Photo 117)
233	Bent 5, Level 6, Column C, footing, southwest corner. 5' W x 1' 4" H x 1' deep spall, CS3. (See Photo 118)

SCALE: 1/32" = 1'

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NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

TOWER 3 (BENTS 4 & 5)

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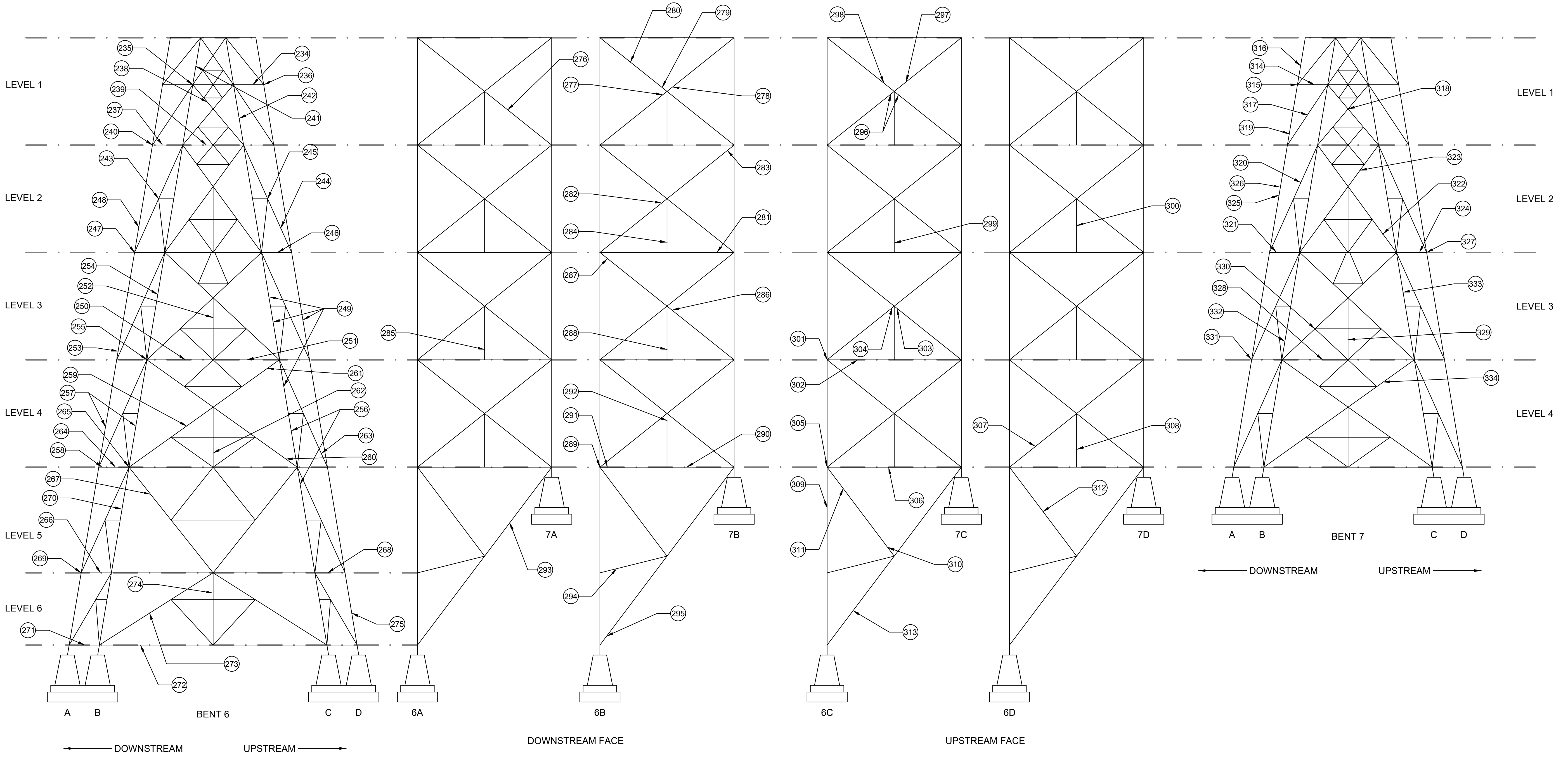

Defect ID	Caption
234	Bent 6, Level 1, upper section, between Columns C and D, horizontal bracing. Heavy pitting with 1' 6" L x 2" H area of 100% section loss, CS3. (See Photo 119)
235	Bent 6, Level 1, upper section, Column B, lower gusset plates. Knife-edging with areas of 100% section loss up to 1" W x 2" H, CS3. (Similar to Photo 126)
236	Bent 6, Level 1, upper section, Column D, lower gusset plates. Heavy laminar corrosion with repair plates present, CS3. (Similar to Photo 106)
237	Bent 6, Level 1, lower section, between Columns A and B, horizontal bracing. 100% section loss; (5) of (6) bars, CS3. (See Photo 120)
238	Bent 6, Level 1, lower section, between Columns B and C, upper east diagonal bracing. 1-1/2" W area of 100% section loss, typical along full length of vertical leg of exterior angle, CS3. (Similar to Photo 72)
239	Bent 6, Level 1, lower section, between Columns C and D, horizontal bracing. 25% section loss with knife-edging on south angle. Column D gusset plate has severe laminar corrosion between the horizontal and diagonal and appears to be failing at that location (deformation to the north), CS3. (See Photo 121)
240	Bent 6, Level 1, lower section, Column A, gusset plate at horizontal bracing. 75% section loss with corrosion holes, CS3. (Similar to Photo 129)

Defect ID	Caption
241	Bent 6, Level 1, lower section, Column B, west side bottom north diagonal between angle and gusset plate. 3" L x 2" W corrosion hole with pack rust up to 1/2" thick, CS3. (Similar to Photo 130)
242	Bent 6, Level 1, lower section, Column C. Typical flaking laminar corrosion on upper two levels throughout, up to 1/4" section loss to interior web on east 3", CS3. (Similar to Photo 77)
243	Bent 6, Level 2, between Columns A and B, horizontal bracing. All (7) lacing bars have 100% section loss, CS3. (Similar to Photo 124)

NOTE:
THE BRIDGE IS ORIENTED FROM SOUTH (TO HILO) TO NORTH (TO HONOKAA) ACCORDING TO THE BRIDGE PLANS. THE GIRDERS ARE NUMERICALLY LABELED "1" TO "4", FROM DOWNSTREAM (MAKAI) TO UPSTREAM (MAUKA). THE SUBSTRUCTURE COLUMNS ARE LABELED ALPHABETICALLY "A" TO "D", FROM DOWNSTREAM (MAKAI) TO UPSTREAM (MAUKA)

SCALE: 1/32" = 1'

MARCH, 2023

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STATE OF HAWAII D.O.T

NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

TOWER 4 (BENTS 6 & 7)

Defect ID	Caption
244	Bent 6, Level 2, between Columns C and D, lower west diagonal bracing near Column D. 3” L x 2” H corrosion hole on north angle vertical leg, CS3. (See Photo 122)
245	Bent 6, Level 2, between Columns C and D, near mid-length of longest diagonal bracing, outer flanges. Up to 5" long corrosion holes, CS3. (See Photo 123)
246	Bent 6, Level 2, between Columns C and D, horizontal bracing. All (4) lacing bars have 100% section loss, CS3. (See Photo 124)
247	Bent 6, Level 2, Column A, gusset plate at horizontal bracing. 75% section loss with corrosion holes, CS3. (Similar to Photo 129)
248	Bent 6, Level 2, Column A. (1) lacing bar with 100% section loss on west face of column, CS3. (Similar to Photo 125)
249	Bent 6, Level 3 and 4, Columns C and D. Heavy laminar corrosion on the lacing bars with typically more than 50% section loss on west face of Column D and east face of Column C, CS3. (Similar to Photo 125)
250	Bent 6, Level 3, between Columns B and C, horizontal bracing, 1/4 point from Column B. 1" section loss typical along full length of vertical legs of interior and exterior angles, CS3. (Similar to Photo 63)
251	Bent 6, Level 3, between Columns B and C, horizontal bracing, 1/4 point from Column C. (6) lacing bars have 90 to 100% section loss. Edge of angles typically have knife-edging with 100% section loss of all edges, CS3. (Similar to Photo 120)
252	Bent 6, Level 3, between Columns B and C, vertical bracing. Corrosion holes in exterior angle up to 3" x 1 1/2", CS3. (Similar to Photo 97)
253	Bent 6, Level 3, Column A. All flanges have a 4' L area of heavy section loss with laminar corrosion and knife-edging, CS3. (Similar to Photo 83)
254	Bent 6, Level 3, Column B, mid-height, west face. Multiple lacing bars with 100% section loss, CS3; with a similar condition on west face of Level 3, Level 2, west face, Level 4 both faces, and Level 5 east face. The west face of Level 5 only has five bars total intact. (See Photo 125)
255	Bent 6, Level 3, Column B, south gusset plate, west side. 1-1/2" W x 8" H area of 100% section loss, CS3. (See Photo 126)
256	Bent 6, Level 4 and 5, Column C. All top lacing bars on the west side have 100% section loss. Remaining lacing bars on this column from here to the bottom have severe laminar corrosion with an average 75% section loss, CS4. (Similar to Photo 131)
257	Bent 6, Level 4 through 6, Columns A and B vertical. Laminar corrosion with up to 100% loss on lacing bars, CS3. (Similar to Photo 125)
258	Bent 6, Level 4, between Columns A and B, horizontal bracing adjacent to Column A. Up to 2" diameter corrosion holes throughout both channels, CS3. (Similar to Photo 60)
259	Bent 6, Level 4, between Columns B and C, lower east diagonal bracing. Global distortion to the diagonal bracing due to tree, CS2.
260	Bent 6, Level 4, between Columns B and C, lower west diagonal adjacent to Column C. Corrosion holes and knife-edging at exterior vertical flange and section of missing vertical flange at lower end for 1' 6" L, CS3. (See Photo 127)
261	Bent 6, Level 4, between Columns B and C, upper west diagonal bracing near Column C. 2” diameter corrosion hole on south vertical leg of angle, CS3. (Similar to Photo 122)
262	Bent 6, Level 4, between Columns B and C, vertical bracing. Severe corrosion throughout this member with up to 60% cross sectional loss, CS4. (See Photo 128)
263	Bent 6, Level 4, between Columns C and D, main diagonal bracing. Pitting and knife-edging on batten plate, CS3. (Similar to Photo 139)
264	Bent 6, Level 4, Column A, gusset plate at horizontal bracing. 75% section loss with corrosion holes, CS3. (See Photo 129)
265	Bent 6, Level 4, Column B, exterior gusset plate at horizontal bracing. 3-1/2" diameter corrosion hole, CS3. (See Photo 130)
266	Bent 6, Level 5, between Columns A and B, horizontal bracing web members. Up to 75% section loss throughout, CS4. (Similar to Photo 60)
267	Bent 6, Level 5, between Columns B and C, upper east diagonal adjacent to Column B, batten plates. Up to 40% section loss, CS3. (Similar to Photo 139)
268	Bent 6, Level 5, between Columns C and D, horizontal bracing. 25% section loss to angles and lacing bars, CS3. (Similar to Photo 89)
269	Bent 6, Level 5, Column A, gusset plate at horizontal bracing. 75% section loss with corrosion holes, CS3. (Similar to Photo 129)
270	Bent 6, Level 5, Column B. Almost all lacing bars on the west side of the column have 100% section loss; (6) bars remaining intact at time of inspection, CS4. (See Photo 131)
271	Bent 6, Level 6, between Columns A and B, horizontal bracing. Damage, member impacted by falling rocks, CS3. (See Photo 132)
272	Bent 6, Level 6, between Columns B and C, horizontal bracing. (1) deformed batten plate on top side of horizontal, CS2.
273	Bent 6, Level 6, between Columns B and C, lower east diagonal at third point closest to Column B. Missing batten plate, CS3. (Similar to Photo 104)
274	Bent 6, Level 6, between Columns B and C, mid-length vertical bracing above crossing horizontal. Detached batten plate, CS3. (Similar to Photo 104)
275	Bent 6, Level 6, Column D. Pitting up to 3/8” deep adjacent to lacing bars previously cleaned and painted, CS3. (Similar to Photo 125)
276	Tower 4, Level 1, Column A, lower north diagonal. Localized pitting over 4' L with (3) corrosion holes up to 1" diameter in the vertical leg of the east angle, CS3. (Similar to Photo 92)
277	Tower 4, Level 1, Column B, lower south diagonal bracing. Exterior angle of diagonal has 100% section loss to vertical leg and only 2-1/2" of section remaining on horizontal leg; angle is deformed 1/4" over 10" near section loss, CS4. (See Photo 133)
278	Tower 4, Level 1, Column B, upper north diagonal bracing. 3" diameter corrosion hole in vertical leg of angle at connection, CS4. (See Photo 133)
279	Tower 4, Level 1, Column B, upper south diagonal bracing. Exterior angle of diagonal has 100% section loss to vertical leg and only 2" of section remaining on horizontal leg; angle is deformed 1/4" over 10" near section loss, CS4. (See Photo 133)
280	Tower 4, Level 1, Column B, upper south diagonal. Typical coating failure and surface rust with minor laminar corrosion at upper level, CS2.
281	Tower 4, Level 2, Column B, lower horizontal bracing. 2" diameter corrosion hole in interior channel web, CS3. (Similar to Photo 101)
282	Tower 4, Level 2, Column B, lower south diagonal bracing at center gusset plate. Both interior and exterior angles have 3" diameter corrosion holes in vertical legs, CS3. (Similar to Photo 92)
283	Tower 4, Level 2, Column B, upper north diagonal bracing. Exterior angle of diagonal has 100% section loss to vertical leg, CS3. (See Photo 134)
284	Tower 4, Level 2, Column B, vertical bracing. 1/2" over 12" distortion to east leg of vertical angle, CS2.
285	Tower 4, Level 3, Column A, vertical bracing. Section loss, exterior leg with 80% loss. - Repaired. (See Photo 135)
286	Tower 4, Level 3, Column B, lower north diagonal bracing. 3" x 4" corrosion hole in vertical leg of exterior angle and gusset plate, CS3. (Similar to Photo 92)
287	Tower 4, Level 3, Column B, upper south diagonal bracing. Interior angle of diagonal has 100% section loss to the vertical leg, CS3. (Similar to Photo 134)
288	Tower 4, Level 3, Column B, vertical bracing. (2) missing rivets and knife-edging at open holes in vertical batten plate connection, CS3. (Similar to Photo 97)
289	Tower 4, Level 4, Column B, gusset plate connection, inner lower diagonal bracing. Corrosion holes with up to 50% section loss, CS3. (Similar to Photo 130)
290	Tower 4, Level 4, Column B, horizontal bracing near Bent 7. Corrosion, up to 1" diameter holes along length, CS3. (Similar to Photo 101)
291	Tower 4, Level 4, Column B, horizontal bracing, west channel. Corrosion hole, 9" W x 6" H, CS3. (Similar to Photo 101)
292	Tower 4, Level 4, Column B. All bracing in this level bowed 2-3" inwards (west); vertical member angles have deformations up to 1" over 2', CS3. (Similar to Photo 96)
293	Tower 4, Level 5, Column A, mid-diagonal bracing. Inner angle twisted over full length with deformation up to 6" over 2' 6", CS3. (Similar to Photo 141)
294	Tower 4, Level 5, Column B, horizontal bracing. Soil and vegetation buildup on horizontal member top side.
295	Tower 4, Level 6, Column B. 3' diameter boulder on top of diagonal member at bottom connection; member appears to be deformed as a result. (See Photo 136)
296	Tower 4, Level 1, Column C. Exterior channel has deformation and is bent inward 3" over 2' of length, CS3. (Similar to Photo 96)
297	Tower 4, Level 1, Column C, upper north diagonal, interior angle. Deformation, angle bent downward 2" over 2' length, CS3. (Similar to Photo 96)
298	Tower 4, Level 1, Column C, upper south diagonal, exterior angle. Deformation, angle bent downward 1" over 1' length, CS3. (Similar to Photo 96)
299	Tower 4, Level 2, Column C, vertical bracing. East angles bent out-of-plane 1/2” and west angle, (3) rivets have 90% section loss, CS3. (Similar to Photo 97)

SCALE: 1/32" = 1'

MARCH, 2023

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consor

STATE OF HAWAII D.O.T

NANUE STREAM BRIDGE
BRIDGE NO. 001000190308146

TOWER 4 (BENTS 6 & 7)

Defect ID	Caption
300	Tower 4, Level 2, Column D, vertical bracing. Batten plate exhibits pitting up to 1/8" deep with scattered corrosion holes, CS3. (Similar to Photo 94)
301	Tower 4, Level 3, Column C, gusset plate connecting bracing to Bent 6. 14 of 18 rivet heads connecting the gusset plate to the column have 20% remaining on the inside face. east channel of bracing has more severe section loss at this location with five corrosion holes in the web up to 1” diameter, CS4. (See Photo 137)
302	Tower 4, Level 3, Column C, horizontal bracing. (2) lacing bars are not connected on the bottom, CS3. (Similar to Photo 120)
303	Tower 4, Level 3, Column C, lower north diagonal bracing. Both angles have 2” diameter corrosion holes at the base of the vertical legs, CS3. (Similar to Photo 92)
304	Tower 4, Level 3, Column C, lower south diagonal bracing. West angle has 4” H x 2” L area of 100% section loss adjacent to the gusset plate, and the east angle has 1/4” loss in same location. Combined for 50% loss of member cross sectional area, CS4. (See Photo 138)
305	Tower 4, Level 4, Column C, gusset plate at Bent 6. 9 of 18 rivet heads connecting the gusset plate to the column have 10% remaining on the inside face, CS3. (Similar to Photo 137)
306	Tower 4, Level 4, Column C, horizontal bracing, near center. Large tree growing though the structure (incidental). (Similar to Photo 105)
307	Tower 4, Level 4, Column D, lower south diagonal bracing. Pitting and knife-edging with two corrosion holes in lower half (1" and 2" diameter), CS3. (Similar to Photo 72)
308	Tower 4, Level 4, Column D, vertical bracing. Up to 1” H x full-width area of 100% section loss across bottom edge of batten plate, CS3. (See Photo 139)
309	Tower 4, Level 5, Column C. Heavy pitting up to 3/16" deep, CS3. (Similar to Photo 83)
310	Tower 4, Level 5, Column C, mid-diagonal adjacent to lower diagonal connection, exterior channel. Bent inward 3" over a 2' length, CS3. (Similar to Photo 141)
311	Tower 4, Level 5, Column C, mid-diagonal mid-length, interior top angle. 100% section loss for most of length of horizontal flange. Approximately 20% loss of cross sectional area, CS3. (See Photo 140)
312	Tower 4, Level 5, Column D, mid-diagonal. Up to 3/16" deep pitting throughout angles and lacing bars, CS3. (Similar to Photo 100)
313	Tower 4, Level 6, Column C, adjacent to Bent 6 pedestal, interior channel. 3" downward deformation over 1' 6", CS3. (See Photo 141)
314	Bent 7, Level 1, upper section, between Columns A and B, horizontal bracing. 7" L x 1" H corrosion hole, CS3. (Similar to Photo 151)
315	Bent 7, Level 1, upper section, Column A, gusset plate. (2) corrosion holes up to 1” diameter and horizontal bracing connection to Column B has a 5” L x 1” H area of 100% section loss. (See Photo 142)
316	Bent 7, Level 1, upper section, Column A. 2" diameter corrosion hole in northwest flange angle, CS3. (Similar to Photo 145)
317	Bent 7, Level 1, lower section, between Columns A and B, diagonal bracing top angle. section loss, 100% loss for 2' 4" L, CS3. (See Photo 143)
318	Bent 7, Level 1, lower section, between Columns B and C, center gusset plate. Heavy pitting, laminar corrosion, and knife-edging with 2" and 1" diameter corrosion holes, CS3. (See Photo 144)
319	Bent 7, Level 1, lower section, Column A. 2" diameter corrosion hole in northeast flange angle, CS3. (See Photo 145)
320	Bent 7, Level 2, between Columns A and B, diagonal bracing top angle. section loss, 100% loss for 2' 4" L, CS3. (See Photo 146)
321	Bent 7, Level 2, between Columns A and B, horizontal bracing and gusset plate at Column A. No longer attached with multiple corrosion holes up to 2" x 3" in horizontal bracing interior gusset plate. - Repaired. (See Photo 147)
322	Bent 7, Level 2, between Columns B and C, lower west diagonal bracing. South angle has heavy laminar corrosion and knife-edging over 4', CS3. (Similar to Photo 87)
323	Bent 7, Level 2, between Columns B and C, upper west diagonal. Heavy laminar corrosion and knife-edging over 2' near center gusset plate, CS3. (Similar to Photo 87)
324	Bent 7, Level 2, between Columns C and D, horizontal bracing. Corrosion holes below horizontal, CS3. (Similar to Photo 151)
325	Bent 7, Level 2, Column A. Numerous lacing bars with 100% section loss on the west face of the column, CS3. (Similar to Photo 125)
326	Bent 7, Level 2, Column A. Several lacing bars exhibit heavy corrosion and are severed, CS3. (Similar to Photo 125)
327	Bent 7, Level 2, Column D, gusset plates. Corrosion, heavy laminar corrosion with diagonal lateral bracing corroded away and detached, CS4. (See Photo 148)
328	Bent 7, Level 3, between Columns B and C, horizontal bracing, lacing bars. Corrosion with up to 100% section loss, CS3. Horizontal angle legs have heavy pitting up to 1/8" deep and laminar corrosion throughout, CS3. (Similar to Photo 120)
329	Bent 7, Level 3, between Columns B and C, vertical bracing. Laminar corrosion and knife-edging throughout with scattered areas of 100% section loss, CS3. (Similar to Photo 128)
330	Bent 7, Level 3, between Columns C and D, lower east diagonal. Tree growing against structure. (Similar to Photo 105)
331	Bent 7, Level 3, Column A, south horizontal bracing angle. 3" W x 4" H corrosion hole in vertical angle, CS3. (See Photo 149)
332	Bent 7, Level 3, Column B splice plate. Majority of connection rivets for Column B have section loss and corrosion, CS3. (See Photo 150)
333	Bent 7, Level 3, Column C, east face. Heavy laminar corrosion and 100% section loss to lacing bars, CS3. (Similar to Photo 125)
334	Bent 7, Level 4, between Columns B and C, diagonal bracing. Heavy pitting, laminar corrosion and knife-edging with isolated corrosion holes on angle legs throughout, CS3. (Similar to Photo 122)

SCALE: 1/32" = 1'

MARCH, 2023

consor
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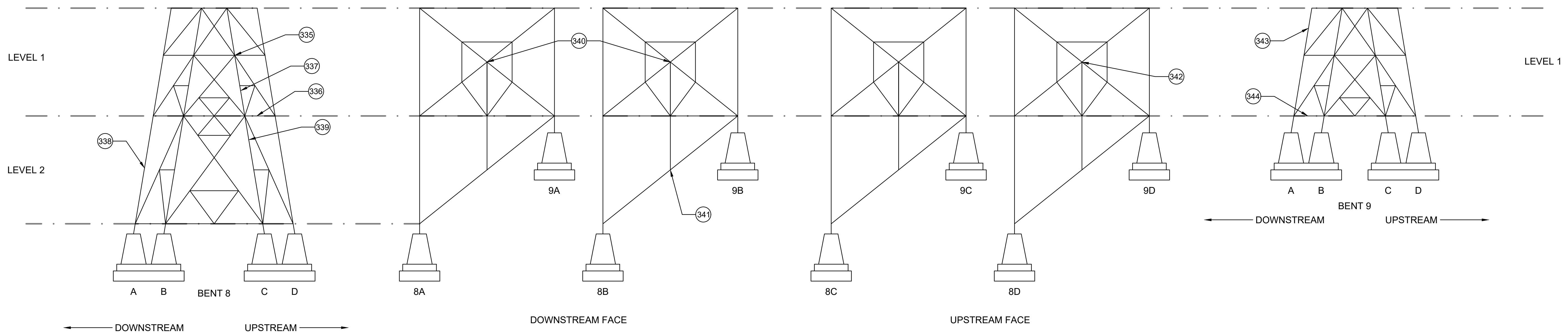
STATE OF HAWAII D.O.T

NANUE STREAM BRIDGE

BRIDGE NO. 001000190308146

TOWER 4 (BENTS 6 & 7)



Defect ID	Caption
335	Bent 8, Level 1, upper section, Column C, lower horizontal bracing. South angle has 3” H x 1” W corrosion hole adjacent to the gusset plate, CS3. (See Photo 151)
336	Bent 8, Level 1, lower section, between Columns C and D, horizontal bracing at Column C. 3" H x 1" W corrosion hole adjacent to the gusset plate, CS3. (Similar to Photo 151)
337	Bent 8, Level 1, lower section, Column C. (2) lacing bars on west face have 100% section loss, CS3. (See Photo 152)
338	Bent 8, Level 2, Column A. Batten plates and lacing bars are typically bent to the east on the east side, CS3. (See Photo 153)
339	Bent 8, Level 2, Column C. (3) lacing bars on west face have 100% section loss. (1) lacing bar on east face has 100% section loss, CS3. (See Photo 154)
340	Tower 5, Level 1, Columns A and B center gusset. Pack rust up to 1" thick, CS3. (Similar to Photo 68)
341	Tower 5, Level 2, Column B, bottom horizontal. Underside batten plate has severe laminar corrosion and is not connected to the channels anymore, CS3. (See Photo 155)
342	Tower 5, Level 1, Column D, center gusset. Pack rust up to 1" thick, CS3. (Similar to Photo 68)
343	Bent 9, Level 1, upper section, Column A. Batten plates and lacing bars are typically bent to the east on the east side. Similar on lower section, CS2.
344	Bent 9, Level 1, lower section, between Columns A and B, lower horizontal bracing. 50% section loss to all lacing bars on horizontal bracing, CS3. (Similar to Photo 60)

NOTE:
THE BRIDGE IS ORIENTED FROM SOUTH (TO HILO) TO NORTH (TO HONOKAA) ACCORDING TO THE BRIDGE PLANS. THE GIRDERS ARE NUMERICALLY LABELED "1" TO "4", FROM DOWNSTREAM (MAKAI) TO UPSTREAM (MAUKA). THE SUBSTRUCTURE COLUMNS ARE LABELED ALPHABETICALLY "A" TO "D", FROM DOWNSTREAM (MAKAI) TO UPSTREAM (MAUKA)

SCALE: 1/32" = 1'

MARCH, 2023

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STATE OF HAWAII D.O.T

NANUE STREAM BRIDGE

BRIDGE NO. 001000190308146

TOWER 5 (BENTS 8 & 9)

PAGE
C-14

Hawaii Department of Transportation
Bridge Load Rating Summary

Existing Bridge Data

Bridge Number:	001000190308146	Last Load Rating Date:	N/A
Bridge Name:	Nanue Stream Bridge	Last Inspection Date:	5-May-15
Route:	00019 Hawaii Belt Road	Inspected By:	WV and LL
District:	Hawaii	Fracture Critical Member (Y/N):	N/A
Span Type:	Steel Plate Girder	Item 58, Deck Rating:	7
Bridge Plans Available (Y/N):	Y	Item 59, Superstructure Rating:	7
Design Loading:	H20-44	Item 60, Substructure Rating:	7
Past Inventory Rating (HS20):	N/A	Bridge Load Posted (Y/N):	N
Past Operating Rating (HS20):	N/A	Posted Weight Limit:	N/A

Bridge Load Rating Summary

Dead Load Data

Overlay Type:	Asphalt
Overlay Depth (IN):	1.5 (assumed)
Was Overlay Depth Measured (Y/N):	N
Weight of Utilities:	0.224 klf
Weight of other Non-Structural Attachments:	Monorail 0.016 klf

LRFR Evaluation Factors

Surface Roughness Rating:	3 (asumed)
Condition Factor:	1.00
System Factor:	1.00
ADTT (one way):	N/A

Superstructure/Deck Rating Summary

	Vehicle Type	Vehicle GVW (Kips)	Rating Factor	Controlling Member	Controlling Load Effect	IM	Live Load Distribution Factor
Design Load	HL-93 (INV)	N/A	1.49	G4-2	Shear	33%	0.717 (M)
	HL-93 (OPR)	N/A	1.93	G4-2	Shear	33%	0.717 (M)
Legal Load	Type 3	50.0	2.97	G4-2	Shear	33%	0.717 (M)
	Type 3S2	72.0	2.82	G4-2	Shear	33%	0.717 (M)
	Type 3-3	80.0	2.95	G4-2	Shear	33%	0.717 (M)
	NRL	80.0	2.19	G4-2	Shear	33%	0.717 (M)
	SU4	54.0	2.69	G4-2	Shear	33%	0.717 (M)
	SU5	62.0	2.42	G4-2	Shear	33%	0.717 (M)
	SU6	69.5	2.30	G4-2	Shear	33%	0.717 (M)
	SU7	77.5	2.21	G4-2	Shear	33%	0.717 (M)
	EV2	57.5	2.51	G4-2	Shear	33%	0.717 (M)
	EV3	86.0	1.70	G4-2	Shear	33%	0.717 (M)
Permit Load	HP1	120.0	2.54	G4-4	Shear	33%	0.534 (0.641/1.2)
	HP2	157.0	2.34	G4-4	Shear	33%	0.534 (0.641/1.2)
	HP3	209.9	3.02	G4-4	Shear	33%	0.534 (0.641/1.2)

Substructure Rating Summary

Substructure Rated (Y/N): N

Vehicle Type	Vehicle GVW (Kips)	Rating Factor	Controlling Member	Controlling Load Effect	IM	Live Load Distribution Factor
HL-93 (INV)	N/A					
HL-93 (OPR)	N/A					
Legal Load						
Permit Load						

Posting Analysis Summary

Governing Legal Load Rating Factor:	1.70
Governing Legal Load Model:	EV3
Posting Recommended (Y/N):	N
Recommended Posting Load:	N/A

Please check the following boxes that apply:

☐ Bridge load rating is not governed by deck rating
☐ Bridge load rating is not governed by substructure rating
☒ Connections do not control the bridge load rating
☒ Exterior girder controls the bridge load rating
☒ Bridge plans do not exist - Rating based on judgement and current loading

Quality Control/Quality Assurance

Load Rating Engineer
- Name: Dean Kokubun, S.E.
- License No.: 10973-S
- Signature:

Load Rating Checked By: Christina Thung, P.E.
Quality Assurance By: Gary Smith, P.E.
Load Rating Date: 8/19/2017

Remarks/Recommendations for Bridges without Plans

Deck was not rated due to unavailable information and was assumed not to control the bridge load rating.
Substructure Rating was not load rated.
Where existing girder information was not provided, simliar girder section properties from other girders were used.

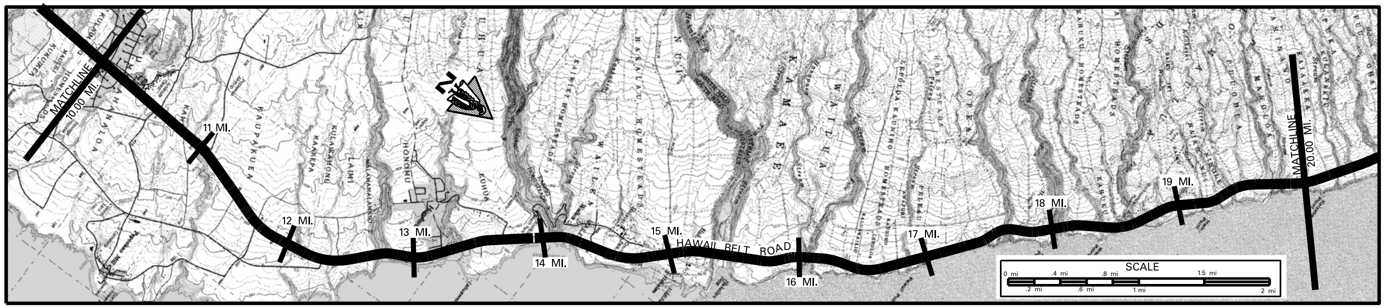
ROAD INVENTORY
HAWAII RTE 19
HAWAII BELT ROAD

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

PREPARED BY THE
HIGHWAYS PLANNING BRANCH

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

Total Route Length: 99.526 miles
a. Survey Length: 99.526 miles
b. Proposed Length: 0.00 miles
c. Other Length: * 0.00 miles
*

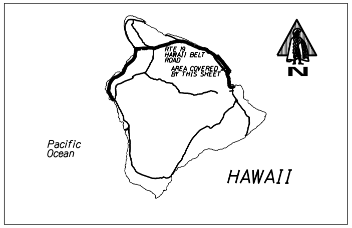


SCALE: (In Miles) 2" = 1 mile

	10	11	12	13	14	15	16	17	18	19	20

Item	Entries along route (10.00 – 20.00 MI.)
Maintenance Control Sections: Length and Description	19J (10.76 MI.); 14.96 END 19H – BEGIN 19J AT THE CENTERLINE OF HAKALAU ROAD; 19H (14.26 MI.)
Structure Carrying Road – Bridges (Over 20'): Length, Type, Capacity and Year Constructed	STEEL MULTI–STRINGER 195, H–20 225' (13.30); STEEL GIRDER AND FLOORBEAM 1950, H–20 497' (13.96); STEEL MULTI–STRINGER: H–20, 1953 775' (15.30); H–20, 1952 281' (16.02); H–20, 1952 225' (17.61); H–20, 1952 53' (17.98); HS–20, 1952 297' (18.57); TEE BEAM 34' H–15, 1934; H–20, 1951 112' (19.40); TEE BEAM 1951, H–20 50' (19.73)
Structure Carrying Road – Vertical Clearance	
Structure Carrying Road – Horizontal Clearance	28' (13.30); 28' (13.96); 28' (15.30); 28' (16.02); 28' (17.61); 28' (17.98); 28' (18.57); 24' (19.16); 28' (19.40); 28' (19.73)
Structure Over Road – Vertical Clearance	16'–04" (11.42); 16'–03" (14.93); 25'–08" (15.27)
Structure Over Road – Horizontal Clearance	42' (11.42); 42' (14.93); 38' (15.27)
Right of Way Width (min.–max.) if varies	80'–135'; 11.65; 100'–430'; 14.88; 100'–230'; 15.89; 85'–225'; 18.99; 90'–200'; 19.91 ←(70'–160')
Available Right of Way Width (Needs Study)	(RESIDENTIAL)→ 10.05; CLEAR 1000' – SUGAR CANE 10'–20' FROM PAVEMENT; 17.46; LARGE TREES & HEAVY BRUSH; 18.46; RESIDENTIAL; 19.36; LARGE TREES; 19.65; (BRUSH AND LARGE TREES)
Right of Way Fence: Type – Right and Left	
Control of Access: 1–None, 2–Partial, 3–Full	NONE; 25+00
Jurisdiction, Transfer Phase No. and Date (C to S or S to C)	STATE; 8+24.21; 35+00
Project No., Type of Construction, and Year Constructed	(19J–02–85, TRUCK. CLIMB LN., 1987); NH–019–2(067) RESURFACE 2017; (19H–01–70, (R), 1971); .319; (NH–019—1(37), GRD RAIL & SHLDR IMP.,2009); 19.61; 19.80
Project No., Type of Construction, and Year Constructed	STP–019–2(35), RESURFACE, 1997; 12.43; 12.45; 19J–02–97M, RESURFACE, 2000; 14.04; 14.05; STP–019–2(36), (R), 1998; 17.18; 17.49 (19H–01–00M, REALIGNMENT, 2002); STP–019–2(36), (R), 1998

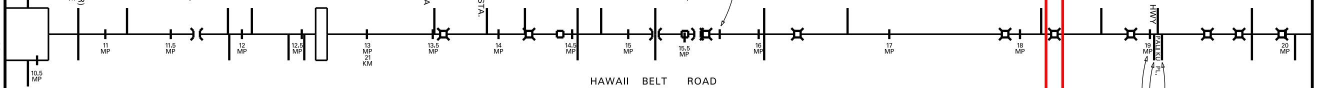
▨ Indicates Grass & / or Physical Barrier on Median.



Road Diagram

* MP=Milepost Signage

CONTINUED FROM SHEET #2 10.00 MI.



CONTINUED ON SHEET #4 20.00 MI.

Feature	Milepoint
KA'AKEPA ST.	10.175 MI. 10.245 MI.
END DIV. HWY	10.332 MI.
SUGAR MILL RD. (R) KAUPAKUEA HOME STD. ROAD (L)	10.560 MI.
OLD MAMALAHOA HWY	10.767 MI.
	10.933 MI.
PEPEEKEO PLANTATION O.P.	11.268 MI.
ROADS	11.441 MI.
PAVED ROAD	11.705 MI. 11.715 MI. 11.812 MI.
PAVED ROAD	11.888 MI.
PAVED ROAD	12.169 MI.
PAVED ROAD	12.270 MI. 12.289 MI.
BEG. DIVIDED HWY	12.376 MI.
END DIVIDED HWY	12.464 MI.
	12.768 MI.
HONOMU ROAD (ROAD TO AKAKA FALLS, RTE 220)	13.272 MI. 13.284 MI.
PAHEEHEE BRIDGE	13.328 MI.
HONOMU SOLID WASTE TRANSFER STA.	13.686 MI.
RD. TO KOLEKOLE BEACH PARK	13.775 MI. 13.977 MI.
KOLEKOLE BRIDGE	13.983 MI.
CULVERT	14.221 MI.
ROAD	14.338 MI. 14.380 MI.
ROAD	14.560 MI.
	14.767 MI.
RD. TO HAKALAU (R) CHIN CHUCK RD (L)	14.951 MI.
CHIN CHUCK PEDESTRIAN O.P.	14.974 MI.
HAKALAU PLANTATION O.P. CULVERT	15.176 MI. 15.198 MI. 15.297 MI.
HAKALAU BRIDGE	15.320 MI.
DISTRICT OF N. HILO (+) DISTRICT OF S. HILO (–) SIGNS	15.467 MI.
LEOPOLINO RD.	15.765 MI. 15.807 MI.
UMAUMA BRIDGE	16.036 MI.
KAUNIHO ROAD	16.445 MI.
	16.764 MI.
OPEA BRIDGE	17.625 MI.
PAVED ROAD	17.764 MI.
NANUE BRIDGE	17.926 MI. 18.002 MI.
PAVED ROAD	18.386 MI.
WAIKAUMALO BR.	18.587 MI.
OLD MAMALAHOA HWY (ROAD TO PARK)	18.758 MI. 18.790 MI. 18.818 MI.
HANAMALO LN.	18.850 MI.
WAIKOLU BRIDGE	19.173 MI.
NINOLE BRIDGE	19.415 MI.
PAVED ROAD	19.538 MI.
MANOLOA BR.	19.742 MI. 19.762 MI.
ROAD	19.868 MI.

SCALE: (In Miles) 2" = 1 mile

Item	Entries along route (10.00 – 20.00 MI.)
Divided Highway – Undivided – Shoulder: Width and Type	(2'–4' AC)→ 15' GRV.; 10.42 ←(7' GRV.); 2'–6' AC; 10.89; 6'–12' GRV.; 11.53; 5'–8' AC; 7' AC; 11.87; 11.96; (6'–12' GRS.); 12.04; 4'–6' DIRT; 5' AC; 6' AC
Divided Highway – Undivided – Pavement: Width and Type	12' AC; 22' AC; 10.46; 28' AC; 11.21; 24' AC; 11.58; 36' AC; 12' AC; 24' AC
Divided Highway – Undivided – Shoulder: Width and Type	0; 8'–18' GRV; 10.55; 4'–15' GRASS; 11.37; 6'–8' GRV.; 11.53; 5'–12' GRS.; 11.96; 7' AC; 0; 6' AC
Median: Width and Type	0'–12' PAINTED MEDIAN; .332; (0'–7' PAINT)→; .376; .464
Median Barriers:	
Shoulder: Width and Type	0; 0
Pavement: Width and Type	12' AC; 12' AC
Shoulder: Width and Type	8'–18' GRV.; 7' AC
Number of Traffic Lanes	2–12'; 2–11'; 10.50; 2–14'; 11.21; 2–12'
Auxiliary Lanes and Parking Lanes: No. of Lanes and Width (Left Side)	.031; .175; .296; .580 TRUCK CLIMBING LANE – 12' .368
(Right Side)	.299
Frontage Road: No. of Lanes, and Width (Right and Left)	.054; .175; .215
Sidewalk: Width and Type (Right and Left)	3' C. SW .326–.378; 3' C. SW .325–.378; 4' C. SW .981–.079; 3' C. SW .979–.079; .316–.469 4' C. SW; .317–.467 3' C. SW; 4' C. SW .625–.673; 3' C. SW .625–.673; .105 3' C. SW; 3' C. SW; .585–.646 4' C. SW; 3' C. SW; 4' C. SW .414–.440; 3' C. SW .414–.443
Curb and/or Gutter: Type (Right and Left)	AC G. .349–.398; C. C.&G. .326–.378; C. C. .325–.378; C. C. .981–.079; C. C. .979–.079; .316–.469 C. C.&G.; .317–.467 C. C.; C. C.&G.; C. C.; .105 C. C.&G.; C. C.; .585–.646 C. C.&G.; C. C.; C. C.&G. .414–.440; C. C. .414–.443
Protective Devices: Type, Location and Number — ALL METAL ON METAL (UNLESS NOTED OTHERWISE)	.187; .260; .426; .503; .606; .644; .749; .773; .889; .933; .951; .999; .050; .105; .139; .381; .536; .606; .892; .129; .325; .349; .398; .476; .706; .803; .099; .123; .575; .681; .077; .450; .481; .667; .877; .099; .123; .168; .183; .309; .319; .748; .792; .321; .387; .497; .531; .649; .711; .806; .905; .297; .359; .472; .505; .615; .680; .115; .337; .380; .510; .730; .818; .851; .304; .416; .700; .777; .788; .869; .984
Illumination: Type, Location and Number	.015; .163; .175; .252; .427; .504; .619; .659; .736; .781; .908; .042; .053; .393; .535; .877; .979; .285; .322; .411; .721; .775; .097; .171; .317; .327; .570; .724; .968; .982; .087; .155; .209; .230; .447; .476; .564; .934; .083; .134; .147; .182; .466; .476; .756; .800; .286; .957; .991; .145; .185; .467; .486; .534; .604; .627; .670; .683; .839; .921; .002; .133; .339; .384; .511; .587; .644; .753; .820; .846; .942; .008; .077; .107; .294; .339; .343; .387; .416; .442; .461; .538; .573; .765; .781; .864; .964
Curves Class: +/– Degree (A(0–3.45) B(3.45–5.44) C(5.44–8.48) D(8.48–13.85) E(13.85–28.62) F(<28.62)	.350; A; 17.53 B 17.74; A; 19.19 B 19.33; A
Superelevation (Range)	
Grades Class: +/– % (A(0–.45) B(.45–2.45) C(2.45–4.45) D(4.45–6.45) E(6.45–8.45) F(<8.45)	B; 10.35; A; 10.69; D; 10.84; C; 11.79; D; 12.02; B; 12.26; C; 12.67; B; 12.84; C; 12.95; A; 13.14; C; 13.23; B; 14.19; C; 14.40; B; 14.58; A; 14.82; C; 14.94; A; 15.22; B; 15.33; A; 15.47; B; 15.95; A; 16.20; B; 16.53; A; 16.87; B; 17.18; A; 17.85; B; 18.22; A; 18.44; B; 19.19; A; 19.45; B; 19.83; C
Vertical Curve: Crest or Sag, Curve Limits	
Area and Development:	RURAL (99999)
Terrain: 1–Flat, 2–Rolling, 3–Mountainous	ROLLING (2)
Speed: 1–Design, 2–Posted	55 MPH (2) – MINIMUM 40 MPH; .172; 45 MPH (2); .478; 55 MPH (2); (45 MPH (2) (40 MPH MINIMUM)); .679; .724; 45 MPH (2); (55 MPH (2) (40 MPH MIN.); .358; 55 MPH (2)
Intersection Control Devices: Type, Location and Cycle Timing	
Traffic Stations (Current Year)	B71 0019 00992; 13.29; B71 0019 03987
HPMS Sections – AADT 2019	9,300; 6,700
HPMS Sections – AADT 2018	9,439; 7,387
HPMS Sections – AADT 2017	9,200; 7,150
DOD Sections	
Census Tracts	
Functional Classification	PRINCIPAL ARTERIAL (3)
National Highway System (NHS)	ON NHS (1)
Previous Projects: Project No., Date and Limits	(19H–01–70, (R), 1971)→ 14.05 (19J–02–87M, (R), 1987; STP–019–2(36), (R), 1998; (19H–02–87M (R), 1987)
	11.81; 19J–02–85, 1987; 12.45; 19J–01–88M, (R), 1988; (19H–01–70, 1971, (R))—13.97→ 14.06; 14.37; STP–0100(31), 1994; (19H–01–87M, (R), 1987)
	TRUCK CLIMB LANES→ 11.45; 19J–02–75, U–2, 1982; 12.08; (F–FR–019–2(21), RESURFACE, 1983)— 14.70→; 14.98; 15.22; F–FR–019–2(21), RESURFACE, 1983; 19.41; .43; .65; 19.77; (19GHJ–01–76M, (R), 1976)
	(19J–03–85M (R) 1985)→ 10.33; 19J–01–87M (R) 1987; 11.21; 19J–01–78M, RESURFACE, 1978; (19H–01–70, (R), 1971); 19H–01–70, RESURFACE, 1971; 19.41; 19H–01–70, (R), 1971
	FA–F14B(1), 1949; 10.74; SDR–3(2), 1951; (SDR–3(10), 1955)— 13.97→ 14.07; SDR–3(12), 1950; 14.99; SDR–3(13), 1950; 18.09; SDR–3(14), 1950; 19.00; SDR–3(3), 1948; 19.35; SDR–3(15), 1950
	198+00; 0+00; 170+68.16; 70+58.63; 65+00; 17+00; 0+48.83; 48+27.47; 0+00; 64+26; 82+26; 49+00

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SCALE: (In Miles) 2" = 1 mile

Date Released	
Feb 2006, D.B.	
Revised	
6/06	*D.B.*
9/10	*D.B.*
2/11	*D.B.*
2/12	*D.B.*
9/12	*E.P.J.*
1/13	*E.P.J.*
12/13	*E.P.J.*
7/14	*D.B.*
1/16	*E.P.J.*
1/17	*E.P.J.*
2/18	*D.B.*
11/18	*D.B.*
12/20	*E.P.J.*

Underwater Bridge Inspection Report
NANUE STRM Bridge
Bridge ID: 001000190308146

March 1, 2023


03/01/2023

Developed For: State of Hawai'i Department of Transportation

Prepared By:

This Work Has Been Prepared Under My Supervision

consor

Job No. 220128HI.03

Team Leader – Joshua Steiner, PE

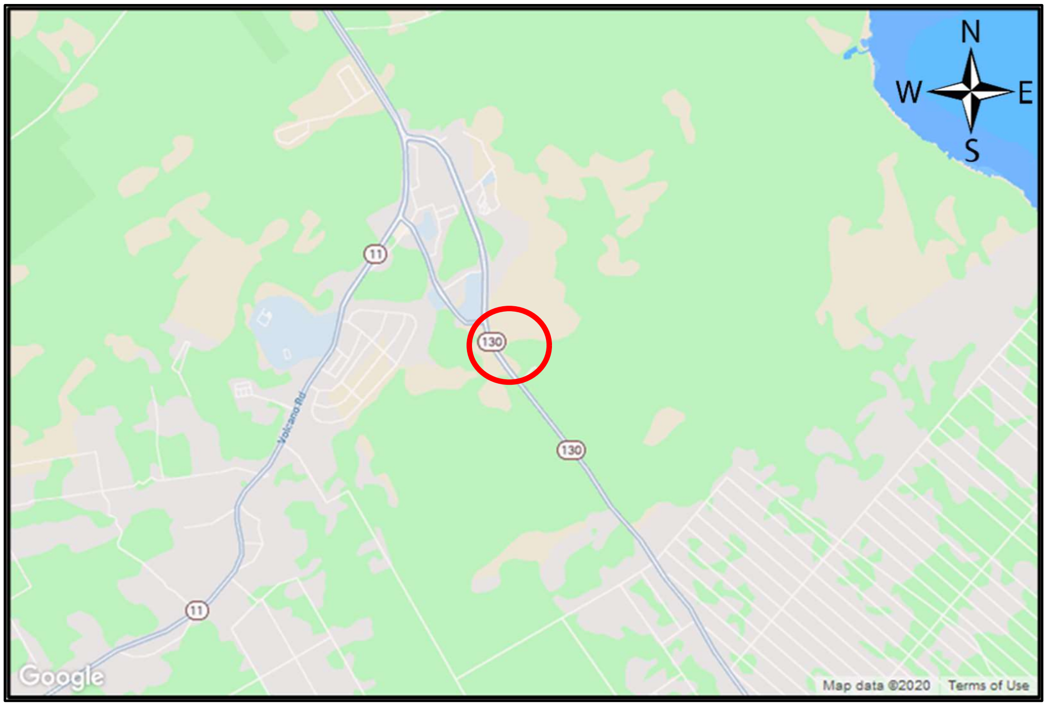
Location Map

Bridge Name: NANUE STRM Bridge

Bridge ID: 001000190308146

GPS Coordinates

N: 19° 55’ 38.30”
W: 155° 09’ 22.55”



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Inspection Report

001000190308146
NANUE STRM
Inspector: Josh Steiner
03/01/2023

IDENTIFICATION

Bridge Key:	001000190308146
NBI Number:	NANUE STRM
Structure Name:	NANUE STRM
Location (9):	1.66MI W/KAUNIHO RD
Carries (7):	HAWAII BELT RD
Type of Service (42A):	5 Highway-pedestrian
Feature Crossed (6):	NANUE STRM
Type of Service (42B):	5 Waterway
Placecode (4):	
County (3):	Hawaii
State (1):	15 Hawaii
Station:	
Region (2):	10 Hawaii
Latitude (16):	19.93
Longitude (17):	-155.16
Owner (22):	State Highway Agency
Custodian (21):	State Highway Agency

Year Built (27):	1952	Border State:	Unknown (P)
Year Recon (106):		Border Struct No (99):	-2
Historical (37):	5 Not eligible for NRHP	% Responsibility:	0
		Border FHWA Reg (98):	Not Applicable

INSPECTION

Date of Inspection (90):	3/1/2023
Frequency (91):	24
Next Inspection:	3/1/2025

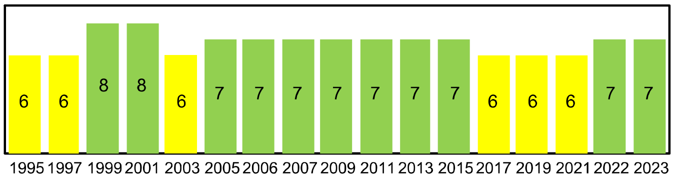
Inspection Type	Freq (92)	Last Insp (93)	Next Insp
Element	24	03/01/2023	03/01/2025
Fracture Critical (A)		N/A	N/A
Underwater (B)	48	03/01/2023	03/01/2027
Special Insp (C)		02/07/2022	N/A

LOAD RATING AND POSTING

Posting Status (41):	A - Open, no restriction
Posting % (70):	5 At/Above Legal Loads
Rating Date:	8/19/2017
Design Load (31):	4 M 18 (H 20)
Opr Method (63):	8 LRFR (HL93)
Opr Rating (64):	41.00 Tons
Inv Method (65):	8 LRFR (HL93)
Inv Rating (66):	25.00 Tons

DECK GEOMETRY

Deck Geometry (68):	4 Tolerable
Deck Area:	20,501.90
Deck Type (107):	1 Concrete-Cast-in-Place
Wearing Surface (108A):	6 Bituminous
Membrane (108B):	0 None
Deck Protection (108C):	None
O. to O. Width (52):	38.20
Curb / Sidewalk Width L (50A):	4.00
Curb / Sidewalk Width R (50B):	4.00
Median (33):	0 No median

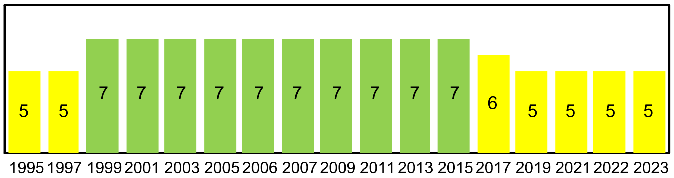


DECK CONDITION

Deck Rating (58):	7 Good
Bridge Rail (36A):	0 Substandard
Transition (36B):	1 Meets Standards
Approach Rail (36C):	1 Meets Standards
Approach Rail Ends (36D):	1 Meets Standards

SUPERSTRUCTURE GEOMETRY

# of Main Spans (45):	10
# of Approach Spans (46):	0
Main Material (43 A):	3 Steel
Main Design (43 B):	02 Stringer/Girder
Max Span Length (48):	72.00
Structure Length (49):	536.70
NBIS Length (112):	Long Enough
Temp Structure (103):	[blank] Not temporary
Skew (34):	0
Structure Flared (35):	0 No flare
Parallel Structure (101):	No || bridge exists
Approach Alignment (72):	5 Above Tolerable

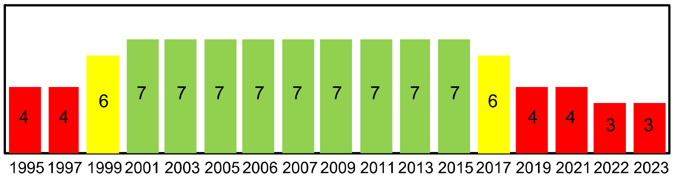


SUPERSTRUCTURE CONDITION

Superstructure Rating (59):	5 Fair
Structure Evaluation (67):	3 Intolerable - Correct

SUBSTRUCTURE GEOMETRY

Navigation Control (38):	Permit Not Required
Nav Vert Clearance (39):	0.00
Nav Horiz Clearance (40):	0.00
Pier Protection (111):	Unknown (NBI)
Lift Bridge Vertical Clearance (116):	
Scour Rating (113):	8 Stable Above Footing
Waterway Adequacy (71):	9 Above Desirable

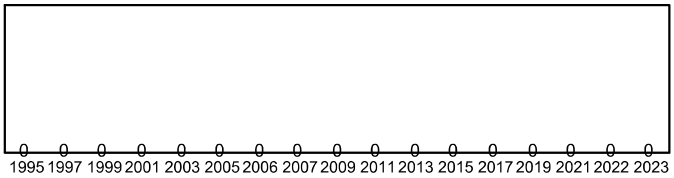


SUBSTRUCTURE CONDITION

Substructure Rating (60):	3 Serious
Channel Rating (61):	7 Minor Damage

CULVERT CONDITION

Culvert Rating (62):	N N/A (NBI)



ROUTE ON STRUCTURE: Hawaii Belt Rd (HI Route 19)

ROADWAY LOCATION

Pos Prefix (5A):	Route On Structure
Kind of Hwy (5B):	2 U.S. Numbered H
Route Num (5D):	00019
LRS Route (13A/B):	0000000019/00
Milepost (11):	17.99 mi (28.95 km)
Suffix (5E):	2 East
Lanes On (28A):	2
Detour Length (19):	1.24 mi (2.00 km)

ROADWAY CLASSIFICATION

Funct Class (26):	06 Rural Minor Arterial
Level Service (5C):	1 Mainline
NHS (104):	1 On the NHS
Defense Hwy (100):	0 Not a STRAHNET hwy
Toll Facility (20):	3 On free road
ADT (29):	6,700 Cars/Day
Pct Trucks (109):	9.00%
ADT Year (30):	2019
Traffic Dir (102):	2 2-way traffic
Nat. Truck Net(110):	0 Not part of natl netwo

CLEARANCES

Vertical (10):	99.99
Min Vert Over (53):	99.99
Vert Ref (54A):	N Feature not hwy or RR
Under Clear (54B):	0.00
Horizontal (47):	28.00
Min Lat Left (56):	1,075.31
Min Lat Right (55B):	0.00
Horiz Ref (55A):	N Feature not hwy or RR
Underclearance (69):	N Not applicable (NBI)
Appr Rd Width (32):	34.12
Roadway Width (51):	27.89

PROPOSED IMPROVEMENTS

Bridge Cost (94):		**Year of Cost Estimate (97):**	1999	**Future ADT (114):**	6,781
Roadway Cost (95):		**Type of Work (75):**	38 Other Structural		
Total Cost (96):	$21,528,000	**Length of Improvement (76):**	1,830.9 ft	**Year of Future ADT (115):**	2025

BRIDGE NOTES

NANUE STRM was built in 1952. The bridge carries two-lanes of traffic on Hawaii Belt Road (Hawaii Route 19) over Nanue Stream. The structure is a ten-span, reinforced concrete deck bridge on four built-up steel plate girders supported by two reinforced concrete abutments, four steel trestle towers, and one steel bent.

The structure is oriented from south to north, in the direction of advancing milepost. The channel flows from west (upstream) to east (downstream). Girders are numbered from east (Girder 1) to west (Girder 4). The trestle tower and bent columns are numbered from east (Column 1) to west (Column 4).

INSPECTION NOTES

On March 1, 2023, Consor Engineers, LLC performed an underwater inspection for NANUE STRM. A three person team of NBIS qualified bridge engineer-inspectors performed the inspection. Only Bent 5 (all columns) and Bent 6 (Columns 1 and 2 only) are in the water and were included in this underwater inspection. The water depth was approximately 6' at Bent 5. The visibility was 3 feet and the water velocity was approximately 2 feet per second.

Access Method:
The inspection team accessed the bridge on foot from the northwest and northeast embankments.

Item 220
Tops of Bent 5 and Bent 6 footings are intermittently exposed. Footings are keyed into hard bedrock and/ or protected by concrete overpour. At Bent 5, the Column D foundation has a void up to 8' W x 3' H x 4.8' D (compared to 6' W at last UW inspection in 2019). The Column D footer is exposed, 1' W x 3'H x 1.5' D in the voided area (compared to 1' H at last UW inspection). Bent 6 has undermining at Columns A and B.

Item 113
The current rating for Item 113 - Scour Critical Bridge is an 8 - Stable Above Footing. However, based on this current Underwater Inspection Report, the recommended Scour Critical Bridge Rating for Item 113 a 5. The bridge foundations are determined to be stable for the assessed or calculated scour conditions. Scour is determined to be within the limits of the footing or piles. At Bent 5, the Column D footing is exposed, full height (29") with lava rock outcrop visible sticking out 2' from footing x 4' H and outcrop undermined up to 5' L x 42" H x up to 36" penetration. The Column Pedestals A, B, and C of Bent 5 and all the Column Pedestals of Bent 6 are not exposed to the flow of the channel. The void in Column Pedestal D should be filled/repaired and monitored during future inspections.

ELEMENT CONDITION SUMMARY

Str Unit	Elm/Env	Description	Total Qty	% in 1	Qty. St. 1	% in 2	Qty. St. 2	% in 3	Qty. St. 3	% in 4	Qty. St. 4
0	**12/1**	**Re Concrete Deck**	**20,501.00**	**98%**	**20,153.00**	**1%**	**135.00**	**1%**	**213.00**	**0%**	**0.00**
0	510/1	Wearing Surfaces	14,867.00	85%	12,560.00	0%	18.00	15%	2,288.00	0%	1.00
0	*3210/1*	*Del/Spall/Patch/Pot(Wear Surf)*	*51.00*	*0%*	*0.00*	*35%*	*18.00*	*63%*	*32.00*	*2%*	*1.00*
0	*3220/1*	*Crack (Wearing Surface)*	*2,256.00*	*0%*	*0.00*	*0%*	*0.00*	*100%*	*2,256.00*	*0%*	*0.00*
0	1080/1	Delamination/Spall/Patched Area	7.00	0%	0.00	100%	7.00	0%	0.00	0%	0.00
0	1120/1	Efflorescence/Rust Staining	149.00	0%	0.00	43%	64.00	57%	85.00	0%	0.00
0	1130/1	Cracking (RC and Other)	192.00	0%	0.00	33%	64.00	67%	128.00	0%	0.00
0	**107/1**	**Steel Opn Girder/Beam**	**2,268.00**	**23%**	**517.00**	**3%**	**60.00**	**75%**	**1,691.00**	**0%**	**0.00**
0	515/1	Steel Protective Coating	25,344.00	0%	0.00	85%	21,542.00	15%	3,802.00	0%	0.00
0	*3420/1*	*Peel/Bub/Crack(Stl Protect Coat)*	*3,802.00*	*0%*	*0.00*	*0%*	*0.00*	*100%*	*3,802.00*	*0%*	*0.00*
0	*3440/1*	*Eff (Stl Protect Coat)*	*21,542.00*	*0%*	*0.00*	*100%*	*21,542.00*	*0%*	*0.00*	*0%*	*0.00*
0	1000/1	Corrosion	1,688.00	0%	0.00	0%	0.00	100%	1,688.00	0%	0.00
0	1020/1	Connection	6.00	0%	0.00	50%	3.00	50%	3.00	0%	0.00
0	7000/1	Damage	57.00	0%	0.00	100%	57.00	0%	0.00	0%	0.00
0	**207/1**	**Stl Tower**	**591.00**	**0%**	**0.00**	**0%**	**0.00**	**81%**	**476.00**	**19%**	**115.00**
0	515/1	Steel Protective Coating	8,149.00	0%	0.00	73%	5,966.00	27%	2,183.00	0%	0.00
0	*3410/1*	*Chalk(Steel Protect Coatings)*	*204.00*	*0%*	*0.00*	*0%*	*0.00*	*100%*	*204.00*	*0%*	*0.00*
0	*3440/1*	*Eff (Stl Protect Coat)*	*7,944.00*	*0%*	*0.00*	*75%*	*5,966.00*	*25%*	*1,978.00*	*0%*	*0.00*
0	1000/1	Corrosion	587.00	0%	0.00	0%	0.00	81%	473.00	19%	114.00
0	1020/1	Connection	4.00	0%	0.00	0%	0.00	75%	3.00	25%	1.00
0	**215/1**	**Re Conc Abutment**	**104.00**	**57%**	**59.00**	**38%**	**40.00**	**5%**	**5.00**	**0%**	**0.00**
0	1080/1	Delamination/Spall/Patched Area	4.00	0%	0.00	0%	0.00	100%	4.00	0%	0.00
0	1190/1	Abrasion(PSC/RC)	41.00	0%	0.00	98%	40.00	2%	1.00	0%	0.00
0	**220/1**	**Re Conc Pile Cap/Ftg**	**80.00**	**74%**	**59.00**	**11%**	**9.00**	**15%**	**12.00**	**0%**	**0.00**
0	1080/1	Delamination/Spall/Patched Area	6.00	0%	0.00	0%	0.00	100%	6.00	0%	0.00
0	1190/1	Abrasion(PSC/RC)	3.00	0%	0.00	0%	0.00	100%	3.00	0%	0.00
0	6000/1	Scour	12.00	0%	0.00	75%	9.00	25%	3.00	0%	0.00
0	**301/1**	**Pourable Joint Seal**	**269.00**	**88%**	**237.00**	**1%**	**3.00**	**11%**	**29.00**	**0%**	**0.00**
0	2310/1	Leakage	28.00	0%	0.00	0%	0.00	100%	28.00	0%	0.00
0	2330/1	Seal Damage	1.00	0%	0.00	0%	0.00	100%	1.00	0%	0.00
0	**311/1**	**Moveable Bearing**	**20.00**	**0%**	**0.00**	**40%**	**8.00**	**60%**	**12.00**	**0%**	**0.00**
0	515/1	Steel Protective Coating	40.00	0%	0.00	100%	40.00	0%	0.00	0%	0.00
0	*3420/1*	*Peel/Bub/Crack(Stl Protect Coat)*	*40.00*	*0%*	*0.00*	*100%*	*40.00*	*0%*	*0.00*	*0%*	*0.00*
0	1000/1	Corrosion	14.00	0%	0.00	57%	8.00	43%	6.00	0%	0.00
0	1020/1	Connection	6.00	0%	0.00	0%	0.00	100%	6.00	0%	0.00
0	**313/1**	**Fixed Bearing**	**24.00**	**0%**	**0.00**	**63%**	**15.00**	**38%**	**9.00**	**0%**	**0.00**
0	515/1	Steel Protective Coating	48.00	0%	0.00	100%	48.00	0%	0.00	0%	0.00
0	*3420/1*	*Peel/Bub/Crack(Stl Protect Coat)*	*48.00*	*0%*	*0.00*	*100%*	*48.00*	*0%*	*0.00*	*0%*	*0.00*
0	1000/1	Corrosion	23.00	0%	0.00	65%	15.00	35%	8.00	0%	0.00
0	1020/1	Connection	1.00	0%	0.00	0%	0.00	100%	1.00	0%	0.00
0	**331/1**	**Re Conc Bridge Railing**	**1,073.00**	**0%**	**0.00**	**100%**	**1,073.00**	**0%**	**0.00**	**0%**	**0.00**
0	7000/1	Damage	1,073.00	0%	0.00	100%	1,073.00	0%	0.00	0%	0.00

ELEMENT NOTES

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
12	**Re Concrete Deck**	**1**	**20,501.00**	**sq.ft**	**20,153.00**	**135.00**	**213.00**	**0.00**

NOTE: Ratings for element 12 reflect conditions observed during the previous routine and element inspections performed.

Total quantity changed from 20382 SF to 20502 SF due to 536.7' structure length x 38.2' out-to-out per field measurements.

-The deck has 16 drains on each side, 32 total; all deck drains are clear with minor corrosion on the grating.
-Span 2, east overhang, 1st scupper south of Bent 2, vegetation growth and almost full of debris.
-The sidewalks are scaled throughout, typically 1/8” deep.

510	Wearing Surfaces	1	14,867.00	sq.ft	12,560.00	18.00	2,288.00	1.00

Total quantity changed from 14809 SF to 14867 SF due to 536.7' structure length x 27.7' curb-to-curb per field measurements.

3210	*Del/Spall/Patch/Pot(We*	*1*	*51.00*	*sq.ft*	*0.00*	*18.00*	*32.00*	*1.00*

-South Abutment Joint, NB lane, 6” diameter x 1” deep spall adjacent to crack, 1 SF CS3, (See Photo 15).
-Bent 3 Joint, both lanes, 2' 4” L x 4' W area of settled patches with a 6" Dia. x 1" D spall within. The rest of the paved over joint is rutted up to 1” deep, 8 SF CS3, (See Photo 16).
-Span 4, NB lane, 20’ north of Bent 3, 3’ L x 3’ W area of gouges (largest is 1’ 1” L x 2’ W x 1/2" deep), 5 SF CS3, (See Photo 17).
-Bent 5 Joint, NB lane, 2' 4" L x 4' W x 1/2" deep cracked and settled pothole with ponding water, 8 SF CS3, (See Photo 18).
-Bent 5 Joint, SB lane, 2' L x 4' 5" W x 2" deep settled patch with a 11" L x 11" W x 1" deep spall within with exposure of deck and joint, 2 SF CS3, (See Photo 19).
-Span 8, NB lane, 15' north of Bent 7 Joint, 8” L x 15" W x 1/2" deep patched pothole that is failing and has ponding water, 1 SF CS3, (See Photo 20).
-Bent 7 Joint, SB lane, previous cracked and settled patch has been re-patched, 8 SF CS2, (See Photo 51).
-Bent 9 Joint, SB lane, wearing surface, 16" L x 21" W x 1" deep cracked and settled patch with 5" L x 11" W x 1" deep pothole within with exposure of steel plate and joint material, 4 SF CS2, 1 SF CS4, (See Photo 21).
-Bent 9 Joint, NB right wheel line, cracked and settled potholes with ponding water, 6 SF CS3, (See Photo 22).
-North Abutment Joint, SB lane, (3) potholes, (2) are patched 2’ L x up to 4’ W and (1) is 8” diameter x 1” deep, 8 SF CS2, 1 SF CS3, (Similar to Photo 21).
-North Abutment Joint, NB lane, left wheel line, 2’ L x 3’ W patch, 6 SF CS2.

3220	*Crack (Wearing Surfac*	*1*	*2,256.00*	*sq.ft*	*0.00*	*0.00*	*2,256.00*	*0.00*

-Wearing surface, full length cracking with associated map cracking and rutting in the wheel lines of both NB and SB lanes throughout approximately 15% of the entire wearing surface, typically 1/8" W to 1/4"W, 2230 SF CS3, (Similar to Photo 15).
-South Abutment Joint, NB lane, 12’ L x up to 1/8” W transverse crack with adjacent spall, 11 SF CS3, (See Photo 15).
-North Abutment Joint, transverse cracking up to 1/8” W throughout, 15 SF CS3, (Similar to Photo 15).

1080	Delamination/Spall/Patche	1	7.00	sq.ft	0.00	7.00	0.00	0.00

Underside of Deck:
-West overhang at Bent 3 Joint, edge spalling along the joint with (1) exposed reinforcing bar above Girder 4, 7 SF CS2.

1120	Efflorescence/Rust Stainin	1	149.00	sq.ft	0.00	64.00	85.00	0.00

Underside of Deck:
-All spans, both overhangs, transverse cracking with efflorescence throughout, typically 3’-4’ apart x up to 1/8” W, 85 SF CS3.
-All spans, Bays 1 and 3, transverse cracking with efflorescence throughout, typically 2'-3' apart x up to 1/32” W, 64 SF CS2.

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1130	Cracking (RC and Other)	1	192.00	sq.ft	0.00	64.00	128.00	0.00
	Underside of Deck: -All spans, Bays 1 and 3, transverse cracking throughout, typically 2'-3' apart x up to 1/32" W, with and without efflorescence, 64 SF CS2. -All spans, Bay 2, map cracking throughout, up to 1/16" W, 128 SF CS3.							
107	**Steel Opn Girder/Beam**	**1**	**2,268.00**	**ft**	**517.00**	**60.00**	**1,691.00**	**0.00**
	NOTE: Ratings for element 107 reflect conditions observed during the previous routine and element inspections performed. **Four (4) built-up steel girders, numbered from east (downstream) to west (upstream).** **-The cross frames typically have painted over pitting 1/16" deep with isolated areas up to 1/4" deep and areas of reactivating corrosion.** **-Bent 3, Bay 2, both cross frames, laminar corrosion throughout with up to 25% section loss of member.** **-Span 4, Bay 2, 2nd diaphragm, lower horizontal member, 3" diameter corrosion hole at both girder connections and impact damage to angle 1 1/2" over 10" L.** **-Span 4, Bay 2, lateral bracing, lower gusset plates at 2nd and 3rd cross frames have pack rust and corrosion holes up to 6" L x 2" W adjacent to Girder 3.** **-Span 4, Bay 2, lower gusset plates at 2nd and 3rd cross frames, pack rust and corrosion holes up to 6" L x 2" W adjacent to Girder 3.** **-Span 6, Bay 1 at Bent 5, adjacent to Girder 1, lower bracing, 100% section loss on bottom flange over 10" L x up to 1 1/2" deep.** **-Span 6, Bay 2, 2nd cross frame lower strut adjacent to Girder 3, (2) corrosion holes up to 3" diameter and there are small corrosion holes adjacent to Girder 2 at the 2nd and 3rd cross frame.** **-Span 8, Bay 2, 2nd lower strut, (2) missing bolts and (1) corrosion hole, 5" L x 2" W.** **-Span 8, Bay 2, 3rd lower strut, missing bolts and (1) corrosion hole, 4" L x 1 1/2" W.** **-Span 9, Bay 1 at Bent 9, adjacent to Girder 1, lower bracing, 100% section loss on bottom flange over 1' L x up to 1" W.** **-North Abutment, Girder 3, Bay 2, lateral bracing has (3) missing/ loose anchor bolts and a deformed gusset plate.**							
515	Steel Protective Coating	1	25,344.00	sq.ft	0.00	21,542.00	3,802.00	0.00
3420	*Peel/Bub/Crack(Stl Prc*	*1*	*3,802.00*	*sq.ft*	*0.00*	*0.00*	*3,802.00*	*0.00*
	Approximately 15% of the steel protective coating exhibits peeling/ bubbling, 3802 SF CS3.							
3440	*Eff (Stl Protect Coat)*	*1*	*21,542.00*	*sq.ft*	*0.00*	*21,542.00*	*0.00*	*0.00*
	The steel protective coating is substantially effective throughout, 21542 SF CS2.							
1000	Corrosion	1	1,688.00	ft	0.00	0.00	1,688.00	0.00

STRUCTURE UNIT: 0

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4

-The bottom flange (top and bottom faces) of the exterior girders have peeling paint and moderate corrosion along the ends in each span, typically 4' L x 5" W, with up to 3/16" deep section loss, 160 LF CS3.
-The interior girder webs exhibit peeling paint and laminar corrosion randomly throughout (roughly 40%) with isolated areas of pitting up to 1/8" deep. The interior girder webs are similarly affected for 5% of it's area, 478 LF CS3.
-The exterior webs of the exterior girders have intermittent areas (roughly 15%) of painted over pitting up to 1/8" deep, 160 LF CS3,.
-The rivets along the bottom of the girder webs have painted over section loss and areas of peeling paint with moderate corrosion and section loss, typically up to 15%, 840 LF CS3.
-Span 2, Bay 1, top flange plate of Girder 1, intermittent areas of up to 2' L x 2" W x 1/2" deep painted over pitting, 10 LF CS3.
-Span 2, Girder 1, west face, 25' L section of painted over pitting up to 1/8" deep, 25 LF CS3.
-Span 2, Girder 3, east face bottom flange, (2) missing rivets in 1' L area of up to 1" thick pack rust, 1 LF CS3.
-Bent 3, Bay 1, Girder 1 and 2 bottom flange connection, rivet heads have corrosion with up to 50% section loss, 2 LF CS3.
-Bent 3, Bay 1, Girder 2, web sliding plate, (3) missing bolts with heavy laminar corrosion, 1 LF CS3.
-Bent 3, Girder 1, top of sliding web plate, 5" H x 2" W area of 1/8" to 100% section loss, area of 100% loss is 1" W, 1 LF CS3, (See Photo 35).
-Span 4, Girder 3 splice and bottom flange, 3' L x up to 1/8" W pitting and rivet head corrosion with up to 25% section loss, as well as peeling paint, 3 LF CS3.
-Span 4, Girder 4 east face, near Bent 3, bearing stiffener, pack rust up to 1" thick at the base with four missing rivets, 1 LF CS3.
-Bent 5, Girder 1 web sliding plate, corrosion induced crack at the top 1" with heavy laminar corrosion around the crack, 1 LF CS3.
-Span 6, Bent 5, web stiffener above Girder 1 bearing, 3/16" thick pack rust causing a 1' 11" H x 1" deflection, 1 LF CS3.
-Span 8, Girder 3 at Bent 7, east face bearing stiffener, pack rust up to 3/4" and 100% section loss for bottom 5" x 1/2" W, 1 LF CS3.
-Span 10, Girder 1, east face at North Abutment, 3" L x 1/2" W area of 100% section loss, 1 LF CS3.
-Span 10, Girder 1, east face at North Abutment, (2) bearing stiffeners have effectively no remaining section at the lower 2" at the base. The eastern bottom flange has 2" L knife edging. This condition is similar at the Girder 4 East face, 2 LF CS3.

1020	Connection	1	6.00	ft	0.00	3.00	3.00	0.00

-Span 2, Girder 4, east face stiffeners, (3) abandoned plates with missing connection bolts, 3 LF CS2.
-Bent 3, Girder 2 web sliding plate, missing bolts and nuts and heavy laminar corrosion, 1 LF CS3.
-Bent 3, Girder 4 web sliding plate, heavy corrosion at the bolt slots and (2) missing bolts at the bottom, with a 2" H x 3" W area of 100% section loss, 1 LF CS3.
-Bent 5, Girder 2 web sliding plate, (1) missing connection bolt, 1 LF CS3.

7000	Damage	1	57.00	ft	0.00	57.00	0.00	0.00

-There are approximately 30 bent transverse stiffeners throughout the structure (see below for specific locations), 30 LF CS2.
-South and North Abutment girder seats, all the girder bottom flanges have deformations up to 1' 6" L x 1" deflection, 16 LF CS2.
-Span 1, Girder 4, east face, between 2nd and 3rd cross frame, (1) stiffener has a 1" deflection to the south, 1 LF CS2.
-Bent 8, Girder 1 exterior web stiffener, 2' 6" H x 1" deflection and the third stiffener to the north has a 8" H x 1" deflection, 4 LF CS2.
-Bent 9, Girder 1 exterior stiffeners, deflections, up to 1" in intermittent locations, 5 LF CS2.
-Span 9, Girder 4, east top flange near midspan, deformation, 6" L x 1" H, 1 LF CS2.

207	**Stl Tower**	**1**	**591.00**	**ft**	**0.00**	**0.00**	**476.00**	**115.00**

STRUCTURE UNIT: **0**

NOTE: Ratings for element 207 reflect conditions observed during the previous routine and element inspections performed.

Typical defects for all Towers (unless otherwise noted, refer to the attached drawings for specific defects and their locations):

All original members typically have failing paint and laminar corrosion throughout with knife edging and section loss up to 10% of total cross-sectional area. Gusset plates typically have laminar corrosion around the incoming members with 1/8” deep section loss to the plate and incoming member. There is also pack rust up to 3/8” thick between the gusset plates and incoming members. Isolated rivet heads exhibit up to 25% section loss. There are random instances of distorted members, typically up to 1”.

All trestle towers typically have more advanced deterioration at the top level (Level 1) and throughout the lower levels from Towers 2 through 4. There is light to moderate vegetation throughout the bottom of Towers 2 through 4. All trestle towers have been retrofitted with bolted bracing members.

High Priority Findings:

-Tower 3, Bent 4 to 5, Column A, Level 3 - Vertical in Level 3 is completely detached from the upper horizontal member of Level 4. - Repaired.

The following "Damage" defects have been repaired:

Tower 3, Bent 4, Column A, Level 3 was impacted by a vehicle and exhibits the following:
-Up to 4" out of plane distortion to the north over the full height of Level 3 and up to 1" to the west over the lower 10' of Level 3.
-Lower two previously cut lacing bars on the makai face have been bent towards makai up to 12".
-62" above the top edge of the bottom batten plate is a 1 7/8" L crack in the northwest flange.
-There is a deformed lacing bar pair which exhibits a cracked weld at the northeast flange in the upper half of the column on the makai face.
-The connection plates to Bent 4, Column A from the diagonal bracing are bowing outward.
-The diagonal bracing is bucked at the Bent 4, Column A connection plate and is damaged and severed near midspan.
-The vertical bracing at midspan that connects to the diagonal bracing exhibits two severed connection plates at the base connection to a horizontal bracing.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
515	Steel Protective Coating	1	8,149.00	sq.ft	0.00	5,966.00	2,183.00	0.00
3410	*Chalk(Steel Protect Co*	*1*	*204.00*	*sq.ft*	*0.00*	*0.00*	*204.00*	*0.00*
	The towers exhibit chalking in isolated locations throughout, 204 SF CS3.							
3440	*Eff (Stl Protect Coat)*	*1*	*7,944.00*	*sq.ft*	*0.00*	*5,966.00*	*1,978.00*	*0.00*
	The steel protective coating on the trestle tower members range from substantially effective to limited effectiveness, 5966 SF CS2, 1978 SF CS3.							
1000	Corrosion	1	587.00	ft	0.00	0.00	473.00	114.00

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4

Priority 2 (High) Findings (repair within 3 years) (Total 114 LF CS4):

-Bent 4, Level 2, Column C, 50% of lacing bars on west face have 100% section loss, remaining bars on both faces have average 30% section loss, 32 LF CS4.

-Bent 4, Level 3, horizontal bracing at gusset plates at Column A, horizontal bracing gusset plate has 100% section loss on all sides. This member is not connected to column A anymore, 1 LF CS4.

-Bent 5, Level 2, between Columns B and C, lower west diagonal bracing, connection to Column C, north angle exhibits two 10" L x up to 4" H holes with 1" x 3" remaining section. Remaining length of diagonal exhibits knife edging and pitting, 16 LF CS4.

-Bent 5, Level 2, Column D, horizontal bracing gusset plates, heavy laminar corrosion with up to 100% section loss with 15% section remaining of the north gusset plate and repair plates becoming ineffective, 1 LF CS4.

-Bent 6, Level 4, between Columns B and C, vertical bracing, severe corrosion throughout this member with up to 60% cross sectional loss, 9 LF CS4.

-Bent 6, Level 5, Column B, almost all lacing bars on the west side of the column have 100% section loss; (6) bars with section loss remaining intact at time of inspection, 28 LF CS4.

-Bent 6, Level 4 and 5, Column C, all top lacing bars on the west side have 100% section loss. Remaining lacing bars on this column from here to the bottom have severe laminar corrosion with an average 75% section loss, 23 LF CS4, (Similar to Photo 131). (41 LF overlapping)

-Tower 4, Level 1, Column B, lower south diagonal bracing, exterior angle of diagonal has 100% section loss to vertical leg and only 2 1/2" of section remaining on horizontal leg; angle is deformed 1/4" over 10" near section loss, 1 LF CS4, (See Photo 133).

-Tower 4, Level 1, Column B, upper north diagonal bracing, 3" diameter corrosion hole in vertical leg of angle at connection, 1 LF CS4.

-Tower 4, Level 1, Column B, upper south diagonal bracing, exterior angle of diagonal has 100% section loss to vertical leg and only 2" of section remaining on horizontal leg; angle is deformed 1/4" over 10" near section loss, CS4. (overlapping)

-Tower 4, Level 3, Column C, lower south diagonal bracing, west angle has 4” H x 2” L area of 100% section loss adjacent to the gusset plate, and the east angle has 1/4” loss in same location. Combined for 50% loss of member cross sectional area, 1 LF CS4.

-Bent 7, Level 2, Column D, gusset plates, corrosion, heavy laminar corrosion with diagonal lateral bracing corroded away and detached, 1 LF CS4.

NOTE: The defects in the attached drawings account for 473 LF CS3. This quantity typically includes laminar corrosion and knife edging throughout the members.

1020	Connection	1	4.00	ft	0.00	0.00	3.00	1.00

NOTE: The defects in the attached drawings account for 3 LF CS3, 1 LF CS4. This quantity typically includes deteriorated or missing rivet heads at connections throughout the towers.

215	**Re Conc Abutment**	**1**	**104.00**	**ft**	**59.00**	**40.00**	**5.00**	**0.00**

NOTE: Ratings for element 215 reflect conditions observed during the previous routine and element inspections performed.

-South Abutment has moss growth on both east and west ends.
-The stone masonry wingwalls are covered in vegetation.

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1080	Delamination/Spall/Patche	1	4.00	ft	0.00	0.00	4.00	0.00

-South Abutment, Bay 3, center section, spall, 1' 4” H x 8” W x 1” deep, 1 LF CS3.
-North Abutment, Girder 3 seat, failed repair, 2' 11” L x 10” H x 3” deep exposing (2) reinforcing bars with no section loss, 3 LF CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1190	Abrasion(PSC/RC)	1	41.00	ft	0.00	40.00	1.00	0.00

-North Abutment, center section, up to 1/4” deep scaling throughout, 40 LF CS2.
-North Abutment, west end of center section, honeycombing, up to 2' H x 1” W x 1” deep, 1 LF CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
220	**Re Conc Pile Cap/Ftg**	**1**	**80.00**	**ft**	**59.00**	**9.00**	**12.00**	**0.00**

NOTE: Ratings for element 220 reflect conditions observed during the previous routine and element inspections performed.

Four (4) tower columns that are labeled from downstream (Column A) to upstream (Column D).

UWI Notes 01/03/2023:
Bent 5, Column A, Footing - Exposed, up to 4' H, founded on rock (See Photo 9).
Bent 5, Column B, Footing - Exposed up to 1.4' H and a bottom rock layer of 1.6' H (See Photo 10).
Bent 5, Column D, Footing - Exposed, up to 1' W X 3' H x 1.5' D.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1080	Delamination/Spall/Patche	1	6.00	ft	0.00	0.00	6.00	0.00

-Bent 4, Column D, footing, southeast corner, 11" W x 1' 7" H x 2 1/2" deep corner spall, 1 LF CS3.
-Bent 5, Column C, footing, southwest corner, 5' W x 1' 4" H x 1' deep spall, 5 LF CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1190	Abrasion(PSC/RC)	1	3.00	ft	0.00	0.00	3.00	0.00

-Bent 5, Column C, footing, base of pedestal on west side, 3' x 2' abrasion with course aggregate exposed and missing, 3 LF CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
6000	Scour	1	12.00	ft	0.00	9.00	3.00	0.00

UWI Notes 01/03/2023:
Bent 5, Column D, Footing - Void, 8'W x 3' H x 4.8' D on upstream end and 3' D at exposed footing, 8 LF CS2.
Bent 6, Column A, Footing - Undermined, 3' L x 2' H x 1.5' D, 3 LF CS3 (See Photo 14).
Bent 6, Column A, Footing - Void below southwest corner, 8" L x 6" H x 9" D, 1 LF Cs2 (See Photo 15).
Bent 6, Column B, Footing - Undermined, up to 4" H x 6" D, 1 LF CS2 (See Photo 16).

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
301	**Pourable Joint Seal**	**1**	**269.00**	**ft**	**237.00**	**3.00**	**29.00**	**0.00**

NOTE: Ratings for element 301 reflect conditions observed during the previous routine and element inspections performed.

-All deck joints have been paved over for the full-length of the travel lanes, the condition of these joints from the top of deck was unobservable during the inspection (excluding the areas of metal exposure due to potholes in the asphalt overlay).
-Bent 3, center joint, vegetation growth into the joint from the underdeck at the east overhang.
-North Abutment Joint, NB lane, exposure of steel plate with minor corrosion through pothole has been patched. (3 LF overlapping).

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
2310	Leakage	1	28.00	ft	0.00	0.00	28.00	0.00

-Both abutments, below the joints, moisture staining, 20 LF CS3.
-Bent 3 Joint, Bay 2, active leakage, 8 LF CS3, (See Photo 46).

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
2330	Seal Damage	1	1.00	ft	0.00	0.00	1.00	0.00

-Bent 9 Joint, SB lane, exposure of partially pulled out joint material through pothole, 1 LF CS3, (See Photo 21).

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
311	**Moveable Bearing**	**1**	**20.00**	**each**	**0.00**	**8.00**	**12.00**	**0.00**

NOTE: Ratings for element 311 reflect conditions observed during the previous routine and element inspections performed.

Moveable Bearing Locations (Based on Design Plans): South Abutment, Bent 3, Bent 5, Bent 7, Bent 9

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
515	Steel Protective Coating	1	40.00	sq.ft	0.00	40.00	0.00	0.00
3420	*Peel/Bub/Crack(Stl Prc*	*1*	*40.00*	*sq.ft*	*0.00*	*40.00*	*0.00*	*0.00*

The steel protective coating of all moveable bearings is in satisfactory condition, 40 SF CS2.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1000	Corrosion	1	14.00	each	0.00	8.00	6.00	0.00

-All moveable bearings typically have light to moderate peeling paint with minor corrosion at the exposed surfaces and typically negligible section loss throughout, 8 EA CS2.
-South Abutment bearings, moderate corrosion with minor section loss, 4 EA CS3.
-Bent 3, Span 4, Girder 2 bearing, four bolts with 100% section loss, 1 EA CS3.
-Bent 3, Span 4, Girder 4 bearing, peeling paint and heavy corrosion throughout. The bottom plate has 10% section loss along the edges and pack rust on the north side, 1 EA CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1020	Connection	1	6.00	each	0.00	0.00	6.00	0.00

-Bent 3, Span 4, Girder 2 bearing, missing southeast and northwest anchor bolts, 1 EA CS3.
-Bent 3, Span 4, Girder 3 bearing, missing northeast anchor bolt, 1 EA CS3.
-Bent 3, Span 4, Girder 4 bearing, missing west anchor bolt, 1 EA CS3.
-Bent 7, Span 8, Girder 2 bearing, missing southeast anchor bolt, 1 EA CS3.
-Bent 7, Span 8, Girder 3 bearing, missing SE, SW & NW anchor bolts, missing NE anchor nut, 1 EA CS3,.
-Bent 7, Span 8, Girder 4 bearing, missing east anchor bolt, 1 EA CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
313	**Fixed Bearing**	**1**	**24.00**	**each**	**0.00**	**15.00**	**9.00**	**0.00**

NOTE: Ratings for element 313 reflect conditions observed during the previous routine and element inspections performed.

Fixed Bearing Locations (Based on Design Plans): Bent 1, Bent 2, Bent 4, Bent 6, Bent 8, North Abutment

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
515	Steel Protective Coating	1	48.00	sq.ft	0.00	48.00	0.00	0.00
3420	*Peel/Bub/Crack(Stl Prc*	*1*	*48.00*	*sq.ft*	*0.00*	*48.00*	*0.00*	*0.00*

The steel protective coating of all fixed bearings is in satisfactory condition, 48 SF CS2.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1000	Corrosion	1	23.00	each	0.00	15.00	8.00	0.00

-All fixed bearings typically have light to moderate peeling paint with minor corrosion at the exposed surfaces and typically negligible section loss throughout, 14 EA CS2.
-Bent 4, Span 5, Girder 1 bearing, peeling paint and heavy corrosion throughout. The bottom plates have 10% section loss, 1 EA CS3.
-Bent 4, Girder 4 bearing, heavy corrosion on the anchor bolts with up to 30% section loss, 1 EA CS3.
-Bent 8, Girder 1 bearing, minor surface corrosion around the bearing and anchor bolts, 1 EA CS2.
-Bent 8, Girder 4 bearing, up to 1/8” laminar corrosion, 1 EA CS3.
-Bent 9, Span 9, Girder 1 bearing, up to 1/4" thick laminar corrosion, 1 EA CS3.
-North Abutment bearings, up to 1/8” thick laminar corrosion, 4 EA CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
1020	Connection	1	1.00	each	0.00	0.00	1.00	0.00

-Bent 3, Span 3, Girder 2 bearing, missing south anchor bolt, 1 EA CS3.

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
331	**Re Conc Bridge Railing**	**1**	**1,073.00**	**ft**	**0.00**	**1,073.00**	**0.00**	**0.00**

NOTE: Ratings for element 331 reflect conditions observed during the previous routine and element inspections performed.

Total quantity changed from 1062 LF to 1074 SF due to 536.7' structure length x 2 railings per field measurements.

The bridge railings are composed of concrete and are 30” H, failing to meet FHWA minimum height requirements.

STRUCTURE UNIT: **0**

ELEM	ELEMENT NAME	ENV	QUANTITY	UNITS	CS1	CS2	CS3	CS 4
7000	Damage	1	1,073.00	ft	0.00	1,073.00	0.00	0.00

NOTE: The following note should be coded under 1190 Abrasion, however this defect type is not included in Element 331. It is coded here as 7000 Damage instead.

The railings are scaled throughout, typically 1/8” D, and are covered with moss on the vertical faces, 1062 LF CS2.

Photo 1. Upstream (west) elevation, looking east

Photo 2. Downstream (east) elevation, looking west

Photo 3. Looking upstream (west)

Photo 4. Looking downstream (east)

Photo 5. Typical channel overview

Photo 6. South embankment and channel alignment, looking south

Photo 7. North embankment and channel alignment, looking north

Photo 8. Bent 5, Columns C and D, looking south

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Photo 9. Bent 5, Column A footing, looking south. Exposure, up to 4' H

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Photo 10. Bent 5, Column B footing, looking south. Exposure with grouted rocks exposed below, up to 1.4' H and a bottom rock layer of 1.6' H

03/01/2023

Photo 11. Bent 5, Columns C and D, looking south

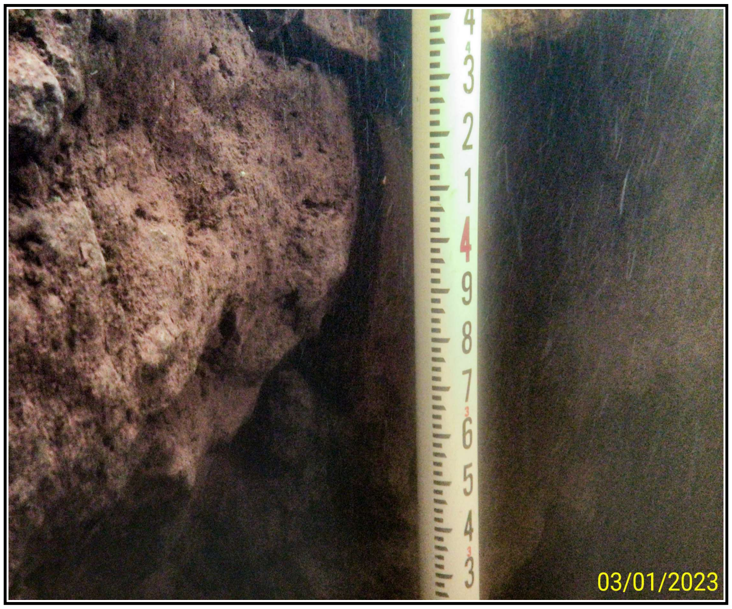

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Photo 12. Bent 5, Column D, looking south. Scour below rock formation, 3' H x 1.5" D, CS3

Photo 13. Bent 6, Columns A and B, looking north

Photo 14. Bent 6, Column A, looking north. Undermined, 3' L x 2' H x 1.5" D, CS3

Photo 15. Bent 6, Column A Footing, looking north. Void below southwest corner, 8" L x 6" H x 9" D, CS2

Photo 16. Bent 6, Column B footing, looking north. Undermined, up to 4" H x 6" D, CS2

Photo 17. Bent 6, Columns C and D, looking north

Work Candidates

Assigned to In-House Maintenance

Status	Priority	Action	Date Proposed	Notes
Unknown	3 - Medium		03/01/2023	Replace/repair missing or heavily weathered delineators at the top of the bridge railing.
Unknown	3 - Medium		03/22/2022	Resurface approach roadways.

Assigned to Maintenance Contract

Status	Priority	Action	Date Proposed	Notes
Unknown	3 - Medium		03/19/2021	Fill voids and undermined areas at Bent 5 and Bent 6 foundations.
Unknown	3 - Medium		03/21/2022	Replace missing/decayed inspection/maintenance access planks.
Unknown	3 - Medium		03/19/2021	Repair deck joints.

Assigned to Project(not Maintenance)

Status	Priority	Action	Date Proposed	Notes
Unknown	2 - High		03/21/2022	Conduct a load rating and seismic load rating analysis on the steel tower to determine the current capacity and the susceptibility of the bridge under seismic conditions.
Unknown	2 - High		03/01/2023	The current load rating from 8/19/2017 was completed using rating of; Item 58, Deck: 7, Item 59, Superstructure: 7, and Item 60, Substructure: 7 with a condition factor of: 1.00. Based on the current inspection and current ratings of; Item 58, Deck: 7, Item 59, Superstructure: 5, and Item 60, Substructure: 3 an updated load rating is recommended. The current load rating summary sheet from 8/19/2017 is included in this report.

WORK DONE SINCE LAST INSPECTION

NOTES RTN 03/01/2023:

Top of deck:
-Bent 7 Joint, SB lane, previous cracked and settled patch has been re-patched.
-North Abutment Joint, NB lane, exposure of steel plate with minor corrosion through pothole has been patched.

Towers:
-Bent 5, Level 1, lower section, between Columns A and B, lower horizontal bracing, Column A lower gusset plates exhibit up to 100% section loss above and below horizontal member with 5" L segments of 25% section left holding members. - Repaired.
-Tower 4, Level 3, Column A, vertical bracing, section loss, exterior leg with 80% loss. - Repaired.
-Bent 7, Level 2, between Columns A and B, horizontal bracing and gusset plate at Column A, no longer attached with multiple corrosion holes up to 2" x 3" in horizontal bracing interior gusset plate. - Repaired.
-Tower 3, Level 3, Column A, lower south diagonal, and vertical bracing, 2022 damages - Repaired.

TRAFFIC SAFETY FEATURES NOTES

NOTE: Ratings for traffic safety features reflect conditions observed during the previous routine and element inspections performed.

36A - Bridge Railings: 2'-6" H bridge railings and a 10" H curb.
36B - Transitions: W-beam with 3' post spacing and metal offsets.
36C - Approach Guardrail: 28.5" H W-beams with 6'-3" post spacing and metal offsets.
36D - Approach Guardrail Ends: Southwest, northwest, and northeast ends are flared and anchored into the embankment. Southeast end is a FLEAT end terminal.

-North and south approach roadways, depressed and worn surface in wheel lines of both lanes; up to 1/2" wide map cracks throughout, some with vegetation growth, (See Photo 52).

-East railing, south end, (2) reinforcing bars sticking out of concrete towards NB traffic, (See Photo 53).
-Southwest, northwest, and northeast approach guardrails, minor corrosion throughout.
-Southwest guardrail, (3) areas of impact damage, typically 1' 1" L x 1" deflection.
-Southeast guardrail, (1) rotated post.
-Northwest guardrail, 2' L x 1" deflection area of impact damage at the abutment.
-Northeast guardrail, (2) areas of impact damage, (1) 10' L x 3" deflection and (1) 2' L x 2" deflection, (See Photo 54).
-Delineators at the top of the bridge rail are heavily weathered or missing.

Inspector: **Signature:** Renz Aspacio **Phone:** 888-451-6822

Inspector: **Signature:** Chad Barga **Phone:**

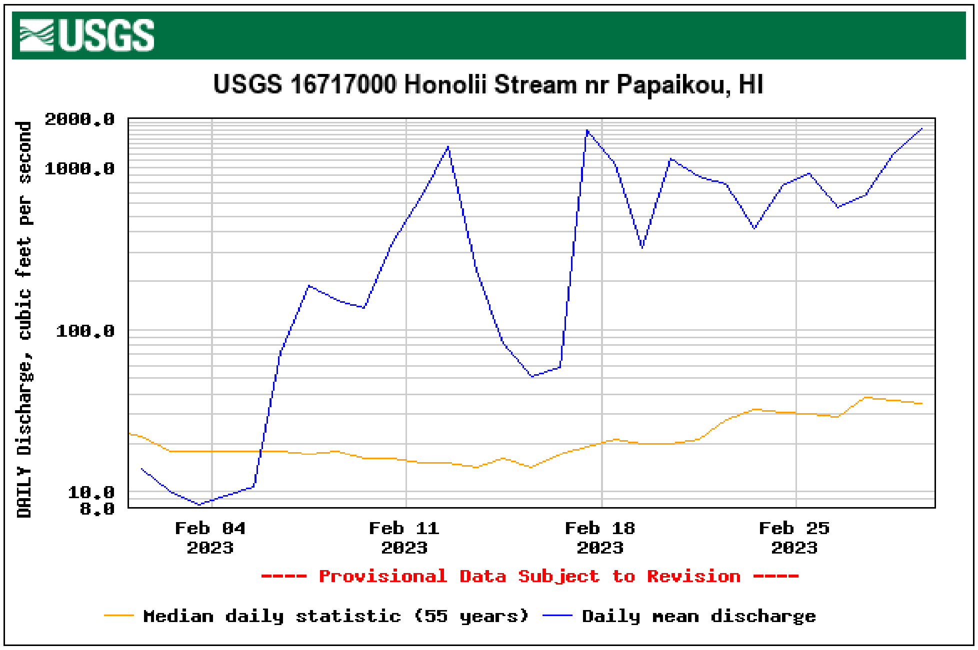
Team Leader: **Signature:** Joshua Steiner **Phone:** 888-451-6822

Office: Consor Engineers, LLC **Certification Date:** 05/19/2022

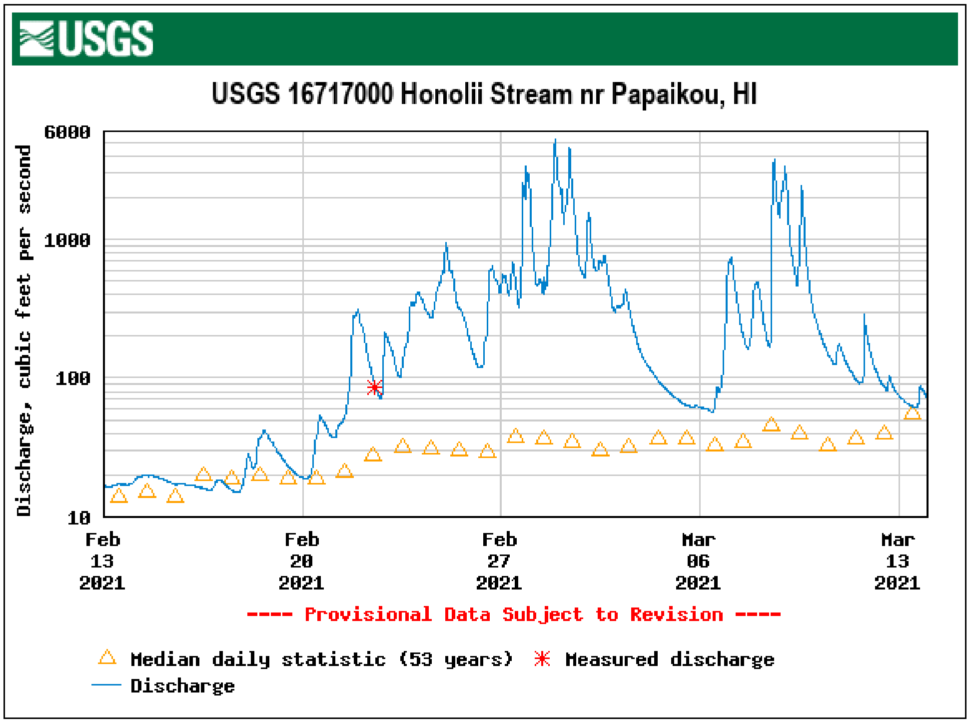
BIP Leader: **Signature:** **QC Date:**

Office:

HYDROGRAPH OF NEARBY STREAM



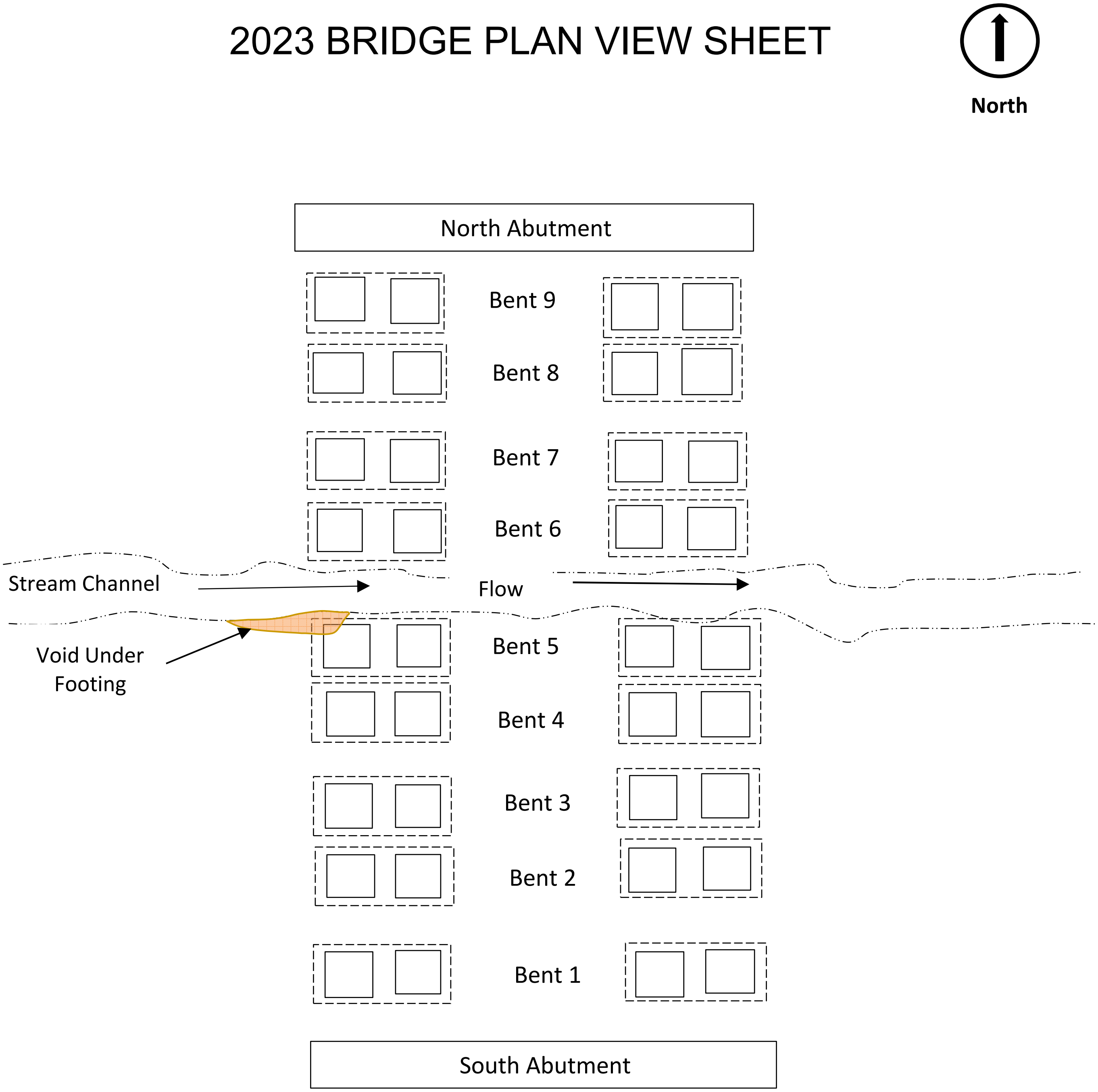
Stream Gauge Results from Feb 2023



Stream Gauge Results from Feb 2021

Bridge No. 001000190308146 - Nanue Stream Bridge

2023 BRIDGE PLAN VIEW SHEET



Streambed Composition:

Mainly hard rock with boulders, medium stones, and sediment. The banks upstream and downstream are heavily vegetated and stable.

Hawaii Department of Transportation
Bridge Load Rating Summary

Existing Bridge Data

Bridge Number:	001000190308146	Last Load Rating Date:	N/A
Bridge Name:	Nanue Stream Bridge	Last Inspection Date:	5-May-15
Route:	00019 Hawaii Belt Road	Inspected By:	WV and LL
District:	Hawaii	Fracture Critical Member (Y/N):	N/A
Span Type:	Steel Plate Girder	Item 58, Deck Rating:	7
Bridge Plans Available (Y/N):	Y	Item 59, Superstructure Rating:	7
Design Loading:	H20-44	Item 60, Substructure Rating:	7
Past Inventory Rating (HS20):	N/A	Bridge Load Posted (Y/N):	N
Past Operating Rating (HS20):	N/A	Posted Weight Limit:	N/A

Bridge Load Rating Summary

Dead Load Data

Overlay Type:	Asphalt
Overlay Depth (IN):	1.5 (assumed)
Was Overlay Depth Measured (Y/N):	N
Weight of Utilities:	0.224 klf
Weight of other Non-Structural Attachments:	Monorail 0.016 klf

LRFR Evaluation Factors

Surface Roughness Rating:	3 (asumed)
Condition Factor:	1.00
System Factor:	1.00
ADTT (one way):	N/A

Superstructure/Deck Rating Summary

	Vehicle Type	Vehicle GVW (Kips)	Rating Factor	Controlling Member	Controlling Load Effect	IM	Live Load Distribution Factor
Design Load	HL-93 (INV)	N/A	1.49	G4-2	Shear	33%	0.717 (M)
	HL-93 (OPR)	N/A	1.93	G4-2	Shear	33%	0.717 (M)
Legal Load	Type 3	50.0	2.97	G4-2	Shear	33%	0.717 (M)
	Type 3S2	72.0	2.82	G4-2	Shear	33%	0.717 (M)
	Type 3-3	80.0	2.95	G4-2	Shear	33%	0.717 (M)
	NRL	80.0	2.19	G4-2	Shear	33%	0.717 (M)
	SU4	54.0	2.69	G4-2	Shear	33%	0.717 (M)
	SU5	62.0	2.42	G4-2	Shear	33%	0.717 (M)
	SU6	69.5	2.30	G4-2	Shear	33%	0.717 (M)
	SU7	77.5	2.21	G4-2	Shear	33%	0.717 (M)
	EV2	57.5	2.51	G4-2	Shear	33%	0.717 (M)
	EV3	86.0	1.70	G4-2	Shear	33%	0.717 (M)
Permit Load	HP1	120.0	2.54	G4-4	Shear	33%	0.534 (0.641/1.2)
	HP2	157.0	2.34	G4-4	Shear	33%	0.534 (0.641/1.2)
	HP3	209.9	3.02	G4-4	Shear	33%	0.534 (0.641/1.2)

Substructure Rating Summary

Substructure Rated (Y/N): N

Vehicle Type	Vehicle GVW (Kips)	Rating Factor	Controlling Member	Controlling Load Effect	IM	Live Load Distribution Factor
HL-93 (INV)	N/A					
HL-93 (OPR)	N/A					
Legal Load						
Permit Load						

Posting Analysis Summary

Governing Legal Load Rating Factor:	1.70
Governing Legal Load Model:	EV3
Posting Recommended (Y/N):	N
Recommended Posting Load:	N/A

Please check the following boxes that apply:

- ☐ Bridge load rating is not governed by deck rating
- ☐ Bridge load rating is not governed by substructure rating
- ☒ Connections do not control the bridge load rating
- ☒ Exterior girder controls the bridge load rating
- ☒ Bridge plans do not exist - Rating based on judgement and current loading

Quality Control/Quality Assurance

Load Rating Engineer

- Name:	Dean Kokubun, S.E.
- License No.:	10973-S
- Signature:	
Load Rating Checked By:	Christina Thung, P.E.
Quality Assurance By:	Gary Smith, P.E.
Load Rating Date:	8/19/2017

Remarks/Recommendations for Bridges without Plans

Deck was not rated due to unavailable information and was assumed not to control the bridge load rating.
Substructure Rating was not load rated.
Where existing girder information was not provided, simliar girder section properties from other girders were used.

SUMMARY OF LOAD AND RESISTANCE FACTOR RATINGS (LRFR)

Structure Name: Nanue Stream Bridge
Bridge No.: 001000190308146
Route No.: 19 (Hawaii Belt Road)

Date: 8/19/2017

Load Type			Exterior Steel Girder Span 1 (Girder G4-1)	
			Strength Limit State	
			Rating Factor	Load Rating (Tons)
Design Load	Inventory Level	HL-93 Truck + HL-93 Lane	2.18	-
		HL-93 Tandem + HL-93 Lane	2.54	-
		HL-93 Fatigue Truck	5.91	-
	Operating Level	HL-93 Truck + HL-93 Lane	2.83	-
		HL-93 Tandem + HL-93 Lane	3.30	-
Legal Load	Type 3		3.92	97.98
	Type 3S2		4.19	150.97
	Type 3-3		4.44	177.64
	NRL		2.50	99.89
	SU4		3.42	92.27
	SU5		3.15	97.55
	SU6		2.83	98.33
	SU7		2.62	101.40
	EV2		3.42	98.33
	EV3		2.22	95.31
Permit Load	HP1		2.72	163.26
	HP2		2.89	227.15
	HP3		3.70	388.08

Load Type			Interior Steel Girder Span 1 (Girder G3-1)	
			Strength Limit State	
				Load Rating (Tons)
Design Load	Inventory Level	HL-93 Truck + HL-93 Lane	2.02	-
		HL-93 Tandem + HL-93 Lane	2.35	-
		HL-93 Fatigue Truck	6.87	-
	Operating Level	HL-93 Truck + HL-93 Lane	2.62	-
		HL-93 Tandem + HL-93 Lane	3.05	-
Legal Load	Type 3		4.01	100.20
	Type 3S2		3.93	141.32
	Type 3-3		4.14	165.52
	NRL		2.73	109.01
	SU4		3.61	97.59
	SU5		3.28	101.75
	SU6		3.09	107.32
	SU7		2.86	110.66
	EV2		3.37	97.00
	EV3		2.29	98.41
Permit Load	HP1		3.32	199.19
	HP2		3.24	254.50
	HP3		4.13	433.49

SUMMARY OF LOAD AND RESISTANCE FACTOR RATINGS (LRFR)

Load Type			Exterior Steel Girder Span 2 (Girder G4-2)	
			Strength Limit State	
			Rating Factor	Load Rating (Tons)
Design Load	Inventory Level	HL-93 Truck + HL-93 Lane	1.49	-
		HL-93 Tandem + HL-93 Lane	1.74	-
		HL-93 Fatigue Truck	8.35	-
	Operating Level	HL-93 Truck + HL-93 Lane	1.93	-
		HL-93 Tandem + HL-93 Lane	2.25	-
Legal Load	Type 3		2.97	74.24
	Type 3S2		2.82	101.54
	Type 3-3		2.95	117.95
	NRL		2.19	87.62
	SU4		2.69	72.52
	SU5		2.42	75.17
	SU6		2.30	80.08
	SU7		2.21	85.64
	EV2		2.51	72.16
	EV3		1.70	73.04
Permit Load	HP1		2.83	170.02
	HP2		3.24	254.60
	HP3		3.97	216.91

Load Type			Interior Steel Girder Span 2 (Girder G3-2)	
			Strength Limit State	
				Load Rating (Tons)
Design Load	Inventory Level	HL-93 Truck + HL-93 Lane	2.08	-
		HL-93 Tandem + HL-93 Lane	2.43	-
		HL-93 Fatigue Truck	11.02	-
	Operating Level	HL-93 Truck + HL-93 Lane	2.70	-
		HL-93 Tandem + HL-93 Lane	3.16	-
Legal Load	Type 3		3.99	99.83
	Type 3S2		3.95	142.31
	Type 3-3		4.13	165.31
	NRL		2.55	101.82
	SU4		3.47	93.77
	SU5		3.21	99.50
	SU6		2.88	100.21
	SU7		2.67	103.50
	EV2		3.48	99.91
	EV3		2.26	97.14
Permit Load	HP1		3.74	224.64
	HP2		4.28	336.40
	HP3		5.22	547.97

Load Type			Exterior Steel Girder Span 3 (Girder G4-3)	
			Strength Limit State	
			Rating Factor	Load Rating (Tons)
Design Load	Inventory Level	HL-93 Truck + HL-93 Lane	2.10	-
		HL-93 Tandem + HL-93 Lane	2.36	-
		HL-93 Fatigue Truck	11.56	-
	Operating Level	HL-93 Truck + HL-93 Lane	2.72	-
		HL-93 Tandem + HL-93 Lane	3.06	-
Legal Load	Type 3		4.05	101.28
	Type 3S2		4.22	151.88
	Type 3-3		4.50	180.18
	NRL		2.79	111.52
	SU4		3.62	97.61
	SU5		3.30	102.31
	SU6		3.14	109.05
	SU7		2.94	113.96
	EV2		3.39	97.58
	EV3		2.31	99.13
Permit Load	HP1		2.85	170.75
	HP2		2.89	226.70
	HP3		3.64	382.31

SUMMARY OF LOAD AND RESISTANCE FACTOR RATINGS (LRFR)

Load Type			Interior Steel Girder Span 3 (Girder G3-3)	
			Strength Limit State	
				Load Rating (Tons)
Design Load	Inventory Level	HL-93 Truck + HL-93 Lane	1.94	-
		HL-93 Tandem + HL-93 Lane	2.18	-
		HL-93 Fatigue Truck	12.58	-
	Operating Level	HL-93 Truck + HL-93 Lane	2.52	-
		HL-93 Tandem + HL-93 Lane	2.83	-
Legal Load	Type 3		3.75	93.66
	Type 3S2		3.90	140.45
	Type 3-3		4.17	166.62
	NRL		2.88	115.39
	SU4		3.34	90.27
	SU5		3.05	94.61
	SU6		2.96	102.90
	SU7		2.91	112.70
	EV2		3.14	90.24
	EV3		2.13	91.67
Permit Load	HP1		3.17	190.38
	HP2		3.22	252.76
	HP3		4.06	426.26

Load Type			Exterior Steel Girder Span 4 (Girder G4-4)	
			Strength Limit State	
			Rating Factor	Load Rating (Tons)
Design Load	Inventory Level	HL-93 Truck + HL-93 Lane	1.83	-
		HL-93 Tandem + HL-93 Lane	2.19	-
		HL-93 Fatigue Truck	4.41	-
	Operating Level	HL-93 Truck + HL-93 Lane	2.38	-
		HL-93 Tandem + HL-93 Lane	2.84	-
Legal Load	Type 3		3.79	94.64
	Type 3S2		3.37	121.34
	Type 3-3		3.52	140.61
	NRL		2.57	102.91
	SU4		3.45	93.24
	SU5		3.08	95.45
	SU6		2.91	101.24
	SU7		2.68	103.98
	EV2		3.24	93.07
	EV3		2.17	93.35
Permit Load	HP1		2.54	152.31
	HP2		2.34	183.51
	HP3		3.02	317.40

Load Type			Interior Steel Girder Span 4 (Girder G3-4)	
			Strength Limit State	
				Load Rating (Tons)
Design Load	Inventory Level	HL-93 Truck + HL-93 Lane	1.75	-
		HL-93 Tandem + HL-93 Lane	2.09	-
		HL-93 Fatigue Truck	5.42	-
	Operating Level	HL-93 Truck + HL-93 Lane	2.27	-
		HL-93 Tandem + HL-93 Lane	2.71	-
Legal Load	Type 3		3.61	90.16
	Type 3S2		3.21	115.60
	Type 3-3		3.35	133.95
	NRL		2.58	103.04
	SU4		3.29	88.83
	SU5		2.93	90.93
	SU6		2.78	96.45
	SU7		2.61	101.12
	EV2		3.08	88.66
	EV3		2.07	88.93
Permit Load	HP1		2.92	174.95
	HP2		2.68	210.79
	HP3		3.47	364.58

Design References:	AASHTO LRFD Bridge Design Specifications, 2014 with 2015 Interim Revisions	(LRFD)
	HDOT Design Criteria for Bridges and Structures, Second Edition, 2011	(HDOT)
	AASHTO Manual for Bridge Evaluation, 2014	(MBE)
	Nanue Bridge Record Drawings, April 1949	(RD 1949)
	Nanue Bridge Erection Drawings, January 1950	(ED 1950)
	Nanue Bridge Record Drawings, May 1996	(RD 1996)
	Nanue Bridge Record Drawings, August 1999	(RD 1999)
	Nanue Bridge Inspection Report, May 2015	(BIR 2015)
	Hawaii State Historic Bridge Inventory and Evaluation, November 2013	(SHBIE 2013)

Summary

The Nanue Stream Bridge is a steel girder bridge with reinforced concrete deck constructed circa 1949. The steel girders were salvaged from the Kaula Bridge, Kealahaka Bridge, Laupahoehoe Bridge, and Maile Bridge according to erection drawings dated 1950. Drawings for the bridges where the steel girders were salvaged from were not provided. According to the Hawaii State Historic Bridge Inventory and Evaluation, Kaula Bridge was constructed circa 1928. There are no records for the other bridges but it is assumed that they were built around the same timeframe due to similarities in the salvaged girders. From the 1949 Record Drawings, the Salvaged Girders were constructed out of the following members:

40 ft Girders A3, B3, G5, and G6
Top Flange: 2-L6x4x5/8; Web: PL 78x3/8; Bottom Flange: 2-L6x4x5/8
Girders G5 and G6 are indicated to have the same section properties as Girders A3 and B3.

50 ft Span Girders A2/A2X, A4/A4X, B2/B2X, B4/B4X;
51 ft Span Girders A1/A1X, B1/B1X, A1/A2, B1/B2, A5/A5X, B5/B5X
Top Flange: 2-L6x6x7/16; Web: PL 78x3/8; Bottom Flange: 2-L6x6x7/16
Top and Bottom Flange Cover Plates: PL 16x1/2 (The flange cover plates extend different lengths along both the top and bottom flanges.)
Section properties for girders A4/A4X and B4/B4X are provided in the 72 ft span girders.
Girders A1/A1X, A2X, A5/A5X, B1/B1X, B2X, and B5/B5X are indicated to have the same section properties as Girders A2 and B2.

72 ft Span Girders A4/A4X and B4/B4X
Top Flange: 2-L6x6x3/4; Web: PL 78x3/8; Bottom Flange: 2-L6x6x3/4
Top and Bottom Flange Cover Plates: 2-PL 16x1/2 (The flange cover plates extend different lengths along both the top and bottom flanges.)
Assumed section properties for A4X and B4X are the same as A4 and B4.

The drawings also indicate 7/8" diameter rivets were used for the connection in the salvaged girders.

The 2015 Bridge Inspection Report indictes a Superstructurer rating of 7 (GOOD CONDITION - no problems noted). The deficiencies noted are for the protective coatings. It was assumed that there is little to no section loss and full section properties were used.

The deck is not analyzed to be composite with the girders.

Two waterlines not indicated on the Record or Erection Drawings are visible in the 2015 Bridge Inspection Report. In past Load Ratings, HDOT has indicated that all utility pipes are assumed to be schedule 80 (thickness = 1/2 inch) steel pipes.

The substructure was not load rated. Per AASHTO MBE Section 6.1.5.2, Members of substructures need not be routinely checked for load capacity. Substructure elements such as pier caps and columns should be checked in situations where the Owner has reason to believe that their capacity may govern the load capacity of the entire bridge. The 2015 Bridge Inspection Report indicates a Substructure rating of 7 (GOOD CONDITION - no problems noted) with no comments on deficiences to the substructure. HDOT has not indicated the substructure requires a load rating.

The Load Rating assumed that the bridge was under a newly constructed condition adjusted by the NBI condition rating for the bridge superstructure. HDOT will need to adjust the bridge load rating as necessary to account for the current localized deterioration as reported in the provided Bridge Inspection Report and field observations.

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR 3(13)	1950	64	304

TYPICAL BENT ELEVATION
Scale: 1" = 30'-0"

PROFILE
Scale: 1" = 20'-0"

Note:

Figures on top of borings indicate ground surface elevation.

Minus figures indicate depth below ground surface.

Note!
See Sheet #6 for Estimated Quantities.
Refer to Hakalau Bridge for General Notes.

ORIGINAL PLAN		
	SURVEY PLOTTED BY	DATE
	DESIGNED BY W. R. Bartels	3-49
	DRAWN BY T. Umehara	4-49
	TRACED BY	
NOTE BOOK No.	QUANTITIES BY A. Van Dor Werff	" "
	QUANTITIES CHECKED BY	
	CHECKED BY E. Yamashita	4-49

TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII
NANUE BRIDGE
Sta. 0+48.83 to 5+80.16
HAWAII BELT ROAD SDR 3(13)
Apr. 1949

SHEET No. 1 OF 11 SHEETS

5468.64

BRASS-GIRDER™ Input Parameters

Version Information
Girder UI: 7.8.0.3001
Girder XML: 7.8.0.3001
BRASS™ XML: 1.8.0.3001

Administration

Project ID: 8780-06
Project Title: HDOT Statewide Bridge Load Ratings

Bridge ID: 1000190308146
Bridge Name: Nanue Stream
Route Name: 00019 Hawaii Belt Road
Reference Marker: 18

Title 1: Nanue Stream Bridge
Title 2: Load Rating for Steel Exterior Girder Span 1 (G4-1)
Date: 2017 4 21

Agency: HDOT Highways Division
Designer/Rater: Moffatt & Nichol (JU)
Reviewer:

Comments:

Bridge Notes

MATERIAL PROPERTIES
Concrete
Weight = 0.160 kcf (HDOT Design Criteria for Bridges and Structures [HDOT] 5.01)
Strength = 3 ksi (Record Drawings: Class A-1)
Elastic Modulus = 3,880 ksi (AASHTO LRFD [LRFD] Eqn 5.4.2.4-1, Use 0.150 kcf per HDOT 5.01)
Reinforcing Steel
Yield Strength = 33 ksi (Unknown, Manual for Bridge Evaluation [MBE] Table 6A.5.2.2-1)
Elastic Modulus = 29,000 ksi (LRFD 5.4.3.2)

BRIDGE PROPERTIES (RECORD DRAWINGS)
Span 1 = 51 ft
Span 2 = 50 ft
Span 3 = 40 ft
Span 4 = 72 ft
Span 5 = 40 ft
Span 6 = 72 ft
Span 7 = 40 ft
Span 8 = 72 ft
Span 9 = 40 ft
Span 10 = 51 ft
Width = 38.5 ft
Deck Thickness = 9 in min
No. of Griders = 4
Girder Spacing = 9 ft, 7.5 ft, 9 ft
Girder Width = 12 3/8"
Girder Depth = 6'-6 1/2"
Surface Roughness = 3.0 (2015 Bridge Inspectinon Report)
Condition Factor = 1.0 (HDOT 5.04, 2015 Bridge Inspection Report indicates Condition Rating of 7)
System Factor = 1.0 (HDOT 5.05,)

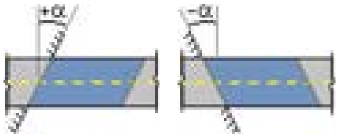
LIVE LOADS
LRFD Live Load (MBE Appendix C6A)
Truck and Tandem Lane Load = 0.64 klf
AASHTO Legal Loads (MBE Appendix D6A)
Type 3
Type 3S2
Type 3-3
Notional Rating Load [NRL]
Legal Lane Load = 0.2 klf
SU4
SU5
SU6
SU7
HDOT Hawaii Standard Single Trip Permit Loads (HDOT 5.06)
No lane load provided, vehicles allowed to trave in any lane
HP1
HP2
HP3
Dynamic Load Allowance (HDOT 5.03)
Spans > 40 ft
Wearing Surface: 3 (Assumed)
Design Loads: 33%
Legal Loads: 10%
Permit Loads: 10%
Scale Factor (HDOT 5.06)
Hawaii Standard Single Trip Permit Vehicle analysis assumes only one permit load on the bridge which allows the use of a single-lane distribution factor. When using the single-lane LRFD distribution factor, the 1.2 multiple prescence factor may shall be divided out from the distribtion factor equations.

Control

Structure

Structure Type: GirderLine
Define Deck Cross Section: Yes
Number of Members: 4

Skew Angle: 0 °



Analysis Model Type: Beam
Number of Top Spans: 1

Spans

Span	Length
1	51 ft

Structure Material: Steel
Beam Type: Builtup
Composite Structure: No
Deck Material: Concrete

Analysis

Unit System: US
Analysis Method: LRFD
Analysis Type: Rating
Number of Stages: 1
Member of Interest: 4
Model Element Type: Stepped
Point of Interest Generation Control: Tenth
Live-load Distribution Factor Application: AnalysisPoint

Interpolate Reinforcement: No
Calculate Effective Width: No

Input

Symmetry

Component	Symmetric
Beam Profile	No
Deck Profile	No
Shear Connectors	No
Transverse Stiffeners	No
Bearing Stiffeners	No
Longitudinal Stiffeners	No
Bracing (Member)	No
Lateral Support	No
Cb Factors (Std)	No
Cb Factors (LRFD)	No
Fatigue Stress (Std)	No
Beam Wheel Fractions (Std)	No
Reaction Wheel Fractions (Std)	No
Beam Distribution Factors (LRFD)	No
Reaction Distribution Factors (LRFD)	No

Simplified Standard Wheel Fractions: No
Merge Beam/Deck Profile Schedules: Yes

Distribution

Perform Dead Load Distribution: Yes
Calculate LRFD Live Load Distribution Factors: Yes

Dead Load Distribution Methods

Stage	Method
1	Tributary area

Live Load Distribution (LRFD)

Distribution Method: AASHTO LRFD
Cross Section Code: a1
Max. Number of Lanes Loaded: Computed

Consider Rigid Method: No
Slab Thickness Type: Structural

Set eg = 0 for Non-composite: Yes
Apply Skew to Lever Rule Override: Yes
Apply Skew to Ridgid Rule Override: No
Use Constants from Table 4.6.2.2.1-2: No

Libraries

Section Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Sections.bls
Vehicle Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Vehicles.blv

Output

Primary Output

Action Output Level: DL+LL+CONC
Action Locations: 10thPoints

General

Member Properties: Yes
Load Combinations: Yes
Load and Resistance Factors: Yes
Warnings: Yes
Camber: No
Critical Design Ratios / Rating Factors: Expanded

Live Load

Truck Positions: Yes
Variable Axle Spacing: Yes
Live Load Settings: Yes
Live Load Combinations: Yes
Live Load Details: Yes
Impact (LFD): No

Stage

Stage	Output
1	Yes

Dead Load

Member Self Load: Yes
Distributed Dead Loads: Yes
Concentrated Dead Loads: Yes
Temperature Change: No
Settlements: No

Load Distribution

Dead Load Distribution: Yes
Live Load Distribution: Yes

Intermediate Output

Intermediate Output Level: Full
Effective Width: Yes
Floorbeam Lane Position: Yes

Points of Interest

Specification Checks: Yes
Load Factoring/Combinations: No

Load Distribution

Dead Load: Yes
Live Load: Yes

Limit State Output (LRFD)

Limit State	Specification Check	Load Combination
Strength I	Yes	Yes
Strength II	Yes	Yes
Strength IV	No	No
Service I	No	No
Service II	No	No
Fatigue I	No	No
Fatigue II	No	No

Load Combination Output (LFD)

LFD Load Combo	Specification Check	Load Combination

Combo I	No	No
Combo IB	No	No
Combo I Overload	No	No
Combo IB Overload	No	No
Combo I Service	No	No
Combo IB Service	No	No
Combo Fatigue	Yes	Yes

Intermediate Output (cont.)

Steel

Transverse Stiffeners: No
Bearing Stiffeners: No
Longitudinal Stiffeners: No

Results Tables

X-Y Plot Action Tables: No
Specification Check Results Tables: No
Mesh Plot Files: No

BRASS-PAD™ Data Transfer File: No

Influence

Output influence lines for: None
Ordinate Divisor: 1

Factors

Load Factors (LRFD)

Limit State	DC		DW		DU		TU	
	max	min	max	min	max	min	max	min
Strength I	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength II	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength IV	-	-	-	-	-	-	-	-
Service I	-	-	-	-	-	-	-	-
Service II	1	1	1	1	1	1	-	-
Fatigue I	-	-	-	-	-	-	-	-
Fatigue II	-	-	-	-	-	-	-	-

Load Factors (LRFD) (continued)

Limit State	LL				SE		PS		DS	
	Design		Legal	Permit						
	Inventory	Operating			max	min	max	min	max	min
Strength I	1.75	1.35	1.45	0	-	-	-	-	-	-
Strength II	-		0	1.2	-	-	-	-	-	-
Strength IV	-		-	-	-	-	-	-	-	-
Service I	-		-	-	-	-	-	-	-	-
Service II	1.3	1	1.3	1	-	-	-	-	-	-
Fatigue I	0.75		-	-	-	-	-	-	-	-

Fatigue II	-	-	-	-	-	-	-	-	-

Load Modifiers (LRFD)

Limit State	Ductility	Redundancy	Importance	Combined Product	
				max	min
Strength I	1	1	1	-	-
Strength II	1	1	1	-	-
Strength IV	1	1	1	-	-
Service I	1	1	1	-	-
Service II	1	1	1	-	-
Fatigue I	1	1	1	-	-
Fatigue II	1	1	1	-	-

Resistance Factors (LRFD)

Resistance Factors

Type	Value
φ Flexure	1
φ Shear	1
φ Bearing	1
φ Compression	0.95
φ Shear Connectors	0.85
φ Fatigue	1

System/Total Modifiers

Limit State	Resistance Type	System	Total
Strength	Flexure	1	-
Strength	Shear	1	-
Strength	Bearing	1	-
Strength	Compression	1	-
Strength	Shear Connectors	1	-
Strength	Longitudinal Reinforcement	1	-
Service	Flexure	1	-
Fatigue	Fatigue	1	-

Condition Modifiers

Limit State	Condition
Strength	1
Service	1
Fatigue	1

Load Factors (LFD)

Load Combo	γ	LL	DC	DW	DU	TU	SE	PS	DS
I	-	-	-	-	-	-	-	1	1
IB	-	-	-	-	-	-	-	1	1
I-Overload	-	-	-	-	-	-	-	1	1

IB-Overload	-	-	-	-	-	-	-	1	1
I-Service	-	-	-	-	-	-	-	1	1
IB-Service	-	-	-	-	-	-	-	1	1
Fatigue	-	-	-	-	-	-	-	1	1

Capacity Reduction Factors (LFD)

Factor	Value
φ Flexure	-
φ Shear	-
φ Fatigue	-

Materials

Steel

ID	Name	Yield Stress	Tensile Strength	Modulus of Elasticity	Density	Thermal Expansion Coefficient
1	Salvaged Girder	30 ksi	60 ksi	29000 ksi	0.49 kcf	6.5E-06 °F^{-1}

Concrete

ID	Name	28 Day Compressive Strength	Modulus of Elasticity	Density	Modulus of Rupture	Modulus of Rupture (VCI Method)	Thermal Expansion Coefficient
1	1949 Class A-1	3 ksi	3880 ksi	0.16 kcf	-	-	6E-06 °F^{-1}

Dead Load Groups

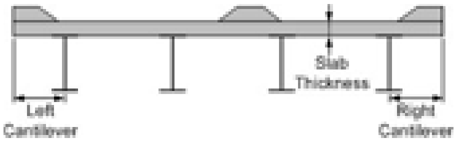
Groups

ID	Name	Stage	Type	Description
1	Concrete Railing	1	DC	Top Rail, Bottom Rail, Post
2	Sidewalk / Shoulder	1	DC	
3	AC Pavement	1	DW	
4	Girder Bracing	1	DC	X-Bracing with Steel Angles in the Outer Bays
5	Bottom Flange Bracing	1	DC	Steel Angles Diagonal Bracing in the Interior Bay
6	Vertical Web Angles	1	DC	Steel Angles Spaced at Intervals
7	Waterlines	1	DU	Assumed 8" Waterlines
8	Monorail	1	DC	6" Monorail
9	Bottom Flange Struts	1	DC	Bottom Flange Struts out of Steel Angles and Plates in Outer Bays

Deck Geometry

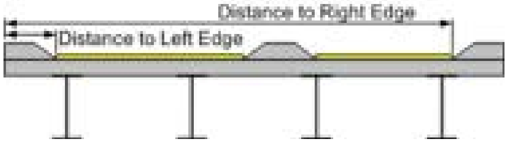
Deck

Deck Thickness: 9 in.
Left Cantilever Length: 6.5 ft
Right Cantilever Length: 6.5 ft
Equal Member Spacing: No



Travelway Locations

Distance to Left Edge: 5.25 ft
Distance to Right Edge: 33.25 ft

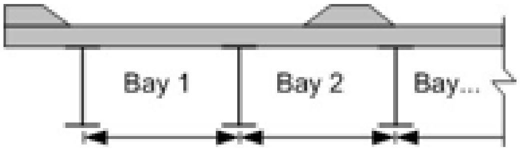


Sacrificial Topping

Thickness: -
Dead Load Type: DC

Member Spacing

Bay #	Spacing
1	9 ft
2	7.5 ft
3	9 ft



Soffits

No soffits have been defined.

Appurtenances

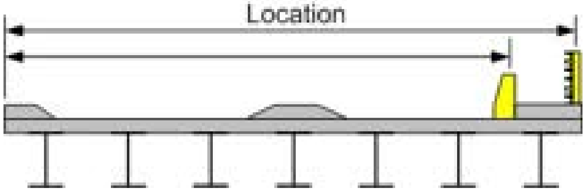
No appurtenances have been defined.

Deck Loads

Materials/Stages

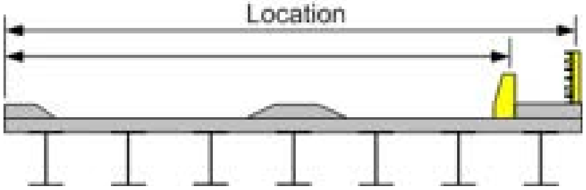
Deck Material: **1949 Class A-1**
Curb & Median Material: Not Assigned
Wearing Surface Weight: -
Slab Stage: 1
Curb Stage: 1
Median Stage: 1
Wearing Surface Stage: 1

Line Loads



Dead Load Group	Line Load	Load Location
Concrete Railing	0.319 kip / ft	0.923 ft
Concrete Railing	0.319 kip / ft	37.577 ft
Waterlines	0.224 kip / ft	38.5 ft
Monorail	0.016 kip / ft	34 ft

Uniform Loads



Dead Load Group	Uniform Load	Load Location	Load Width
Sidewalk / Shoulder	0.007 ksf	0 ft	5.25 ft
Sidewalk / Shoulder	0.003 ksf	5.25 ft	2 ft
AC Pavement	0.018 ksf	7.25 ft	24 ft
Sidewalk / Shoulder	0.003 ksf	31.25 ft	2 ft
Sidewalk / Shoulder	0.007 ksf	33.25 ft	5.25 ft

Live Loads

Live Load Control

Direction Control:	Up+Down
Standard Live Loads:	None
Wheel Advancement Denominator:	100
ADTT:	5000
ADTT for Single Lane:	2000
Multiple Presence Adjustment:	-
% of Dynamic Load Allowance (Impact):	100 %
Fixed Impact (STD):	-

Dynamic Load Allowance (LRFD)

Design/Rating Procedure	Truck	Lane	Fatigue
Design	33 %	0 %	15 %
Legal	33 %	0 %	0 %
Permit	33 %	0 %	0 %

Special Vehicles

Axle Vehicles

No axle vehicles have been defined.

Lane Vehicles

No lane vehicles have been defined.

Definitions (STD)

No standard live load definitions have been defined.

Definitions (LRFD)

Definition 1

Code:	HL-93-TRUCK
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 2

Code:	HL-93-TANDEM
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating

Scale Factor: -
Lanes Loaded: Critical
Notional Load: Yes
Fixed DLA: -

Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 3

Code: HL-93-LANE
Type: DesignLane
Design Rating: Design
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: Yes
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 4

Code: TYPE3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 5

Code: TYPE3S2
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 6

Code: TYPE3-3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-

Fatigue I	-	-
Fatigue II	-	-

Definition 7

Code: NRL-MIN
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 8

Code: NRL-MAX
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 9

Code: SU4
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 10

Code: SU5
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 11

Code: SU6

Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 12

Code:	SU7
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 13

Code:	HP1
Type:	PermitTruck
Design Rating:	Permit
% of Dynamic Load Allowance:	-
Scale Factor:	0.833
Lanes Loaded:	Single
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 14

Code:	HP2
Type:	PermitTruck
Design Rating:	Permit
% of Dynamic Load Allowance:	-
Scale Factor:	0.833
Lanes Loaded:	Single
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 15

Code:	HP3
Type:	PermitTruck
Design Rating:	Permit
% of Dynamic Load Allowance:	-
Scale Factor:	0.833
Lanes Loaded:	Single

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-

Notional Load: No
Fixed DLA: -

Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 16

Code: HL-93-FAT
Type: FatigueTruck
Design Rating: Design
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 17

Code: EV2
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 18

Code: EV3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

General Combinations (LRFD)

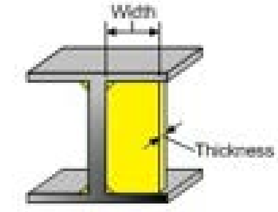
Standard Combo	Truck	Lane	Combination Factors	
			Truck	Lane
No	**HL-93-TRUCK**	**HL-93-LANE**	1	1
No	**HL-93-TANDEM**	**HL-93-LANE**	1	1

Deflection Combinations (LRFD)

No Deflection Combinations (LRFD) have been defined.

Component Groups

Transverse Stiffeners



ID	Name	Width	Thickness	Type	Type Factor	Material
1	Web Stiffeners	5 in.	0.375 in.	Single Angles	-	**Salvaged Girder**

Bearing Stiffeners

No bearing stiffener groups have been defined.

Longitudinal Stiffeners

No longitudinal stiffener groups have been defined.

Specification Control

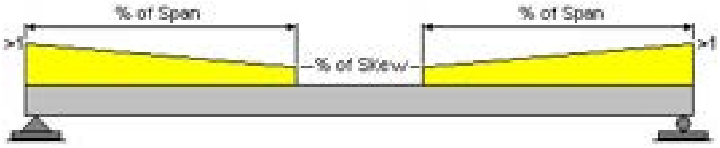
General

Lane Geometry

Design Vehicle Lane Width: 12 ft
Vehicle Width: 10 ft
Wheel Spacing: 6 ft
Encroachment Distance: -

Load Factors Control (LRFD): Use maximum and minimum load factors

Skew Factors



Span #	% of Span	% of Skew
1	-	-

Steel

Use Appendix A6 (LRFD): No
Allow Plastic Analysis: No
Override Longitudinal Stiffeners: No
Slab thickness for longitudinal shear force: Structural
Slab thickness for minimum negative flexure concrete deck reinforcement: Structural

Fatigue

AASHTO LRFD Table 6.6.1.2.5-2

% of Span: -
Span Length: 40 ft

Stress Range in Longitudinal Reinforcement Over the Piers: 10 ksi

Detail Categories (LRFD)

Detail Category	Constant, A x 10^8	Constant Amplitude Fatigue Threshold
A	-	-

B	-	-
B'	-	-
C	-	-
C'	-	-
D	-	-
E	-	-
E'	-	-

Limit State Map

Limit State Maps (LRFD)

Limit State	Design Review			Rating		
	Design Load	Legal Load	Permit Load	Design Load	Legal Load	Permit Load
Strength I	No	No	No	Inventory/Operating	Yes	No
Strength II	No	No	No	Exclude	No	Yes
Strength IV	No	No	No	Exclude	No	No
Service I	No	No	No	Exclude	No	No
Service II	No	No	No	Inventory/Operating	Yes	Yes
Service III	No	No	No	Exclude	No	No
Fatigue I	No	No	No	Inventory	No	No
Fatigue II	No	No	No	Exclude	No	No

Load Combo Maps (LFD)

Load Combo	Design Review	Rating
I	No	Inventory
IB	No	Operating
I-Overload	No	Exclude
IB-Overload	No	Exclude
I-Service	No	Exclude
IB-Service	No	Exclude
Fatigue	No	Exclude

Spec. Check Map (Strength)

LRFD Specification Check Maps

Design Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No

Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Design Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	No	No
Shear	Yes	No	No
Bearing	Yes	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	No	No
Shear	Yes	No	No
Bearing	Yes	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	Yes	No
Shear	No	Yes	No
Bearing	No	Yes	No
Flexural Stress In Longitudinal Stiffener	No	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		
Flexural Stress In Longitudinal Stiffener	No	No		

Rating

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		

Flexural Stress In Longitudinal Stiffener	No	No

Spec. Check Map (Service)

LRFD Specification Check Maps

Design Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Legal Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Permit Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Design Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Legal Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Permit Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

LFD Specification Check Maps

Design Review

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Rating

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Spec. Check Map (Fatigue)

LRFD Specification Check Maps

Design Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Legal Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Permit Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Design Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	Yes	No
Fatigue of Shear Connectors	Yes	No
Fatigue Shear Range of Shear Connectors	Yes	No
Fatigue of Special Points	Yes	No
Fatigue Shear	Yes	No

Legal Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No

Fatigue Shear	No	No

Permit Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Rating

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Member

Member Notes

No member notes have been defined.

Member Materials

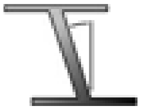
Beam

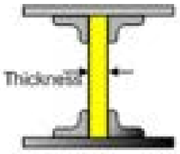
Beam Material: Salvaged Girder

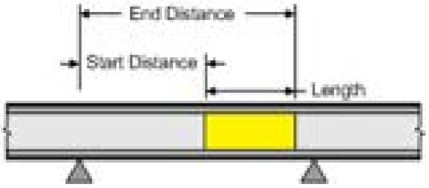
Beam Profile

Web

Apply to Entire Structure: Yes
Web Angle: -





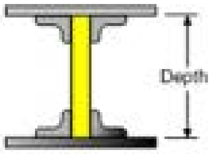


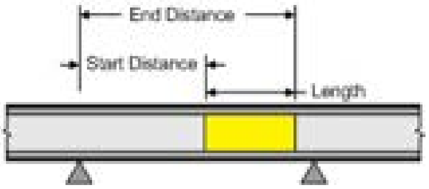
Thickness	Material	Support Number	Start Distance	Length

0.375 in.	**Salvaged Girder**	1	0 ft	51 ft

Web Depth

Apply to Entire Structure: Yes

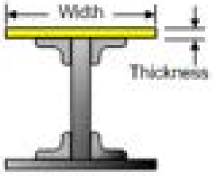


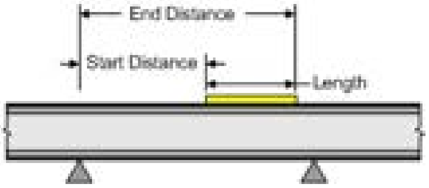


Start Depth	Web Variation	End Depth	Support Number	Start Distance	Length
78 in.	Linear	78 in.	1	0 ft	51 ft

Top Cover Plate

Apply to Entire Structure: No

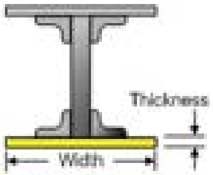




Start of Range			End of Range			Material	Support Number	Start Distance	Length
Width	Thickness	Gap Thickness	Width	Thickness	Gap Thickness				
16 in.	0.438 in.	-	-	-	-	**Salvaged Girder**	1	8.354 ft	35.417 ft

Bottom Cover Plate

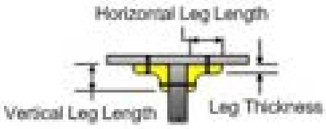
Apply to Entire Structure: No

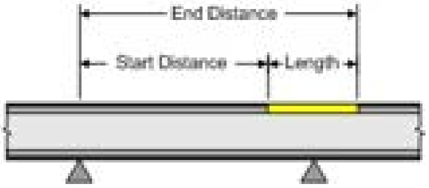


Start of Range			End of Range			Material	Support Number	Start Distance	Length
Width	Thickness	Gap Thickness	Width	Thickness	Gap Thickness				
16 in.	0.438 in.	-	-	-	-	**Salvaged Girder**	1	8.354 ft	35.417 ft

Top Angles

Apply to Entire Structure: Yes



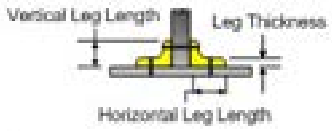


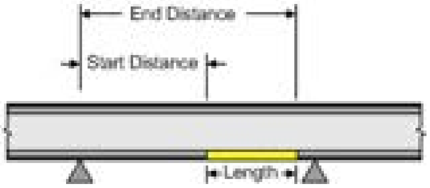
Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length

6 in.	6 in.	0.438 in.	**Salvaged Girder**	1	0 ft	51 ft

Bottom Angles

Apply to Entire Structure: Yes





Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length
6 in.	6 in.	0.438 in.	**Salvaged Girder**	1	0 ft	51 ft

Hinges

No hinges have been defined.

Special Locations

No special locations have been defined.

Supports

Support Conditions

Support	Support Restraint		
	Horizontal	Vertical	Rotational
1	Free	Restrained	Free
2	Restrained	Restrained	Free

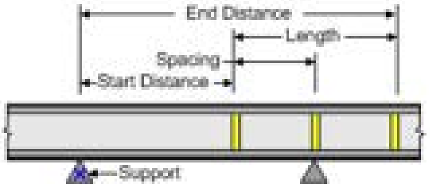
Spring Constants

Support	Spring Constants		
	Horizontal	Vertical	Rotational
1	-	-	-
2	-	-	-

Schedules

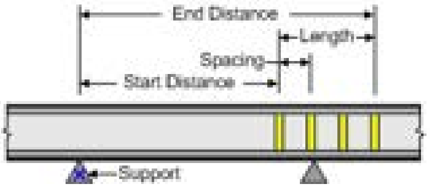
Bracing

Apply to Entire Structure: No



Spacing	Support	Start Distance	Length
11.167 ft	1	4.906 ft	11.167 ft
14.438 ft	1	35.99 ft	14.438 ft

Transverse Stiffeners



Stiffener Group	Spacing	Support	Start Distance	Length
Web Stiffeners	1.333 ft	1	0.031 ft	1.333 ft
Web Stiffeners	3.75 ft	1	8.573 ft	3.75 ft
Web Stiffeners	3.917 ft	1	19.99 ft	3.917 ft
Web Stiffeners	3.917 ft	1	28.156 ft	3.917 ft
Web Stiffeners	3.656 ft	1	39.74 ft	7.313 ft

Bearing Stiffeners

Apply to Entire Structure: No

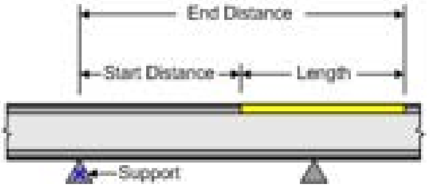
Support	Stiffener Group
1	Not Assigned
2	Not Assigned

Longitudinal Stiffeners

No longitudinal stiffener schedules have been defined.

Lateral Support

Apply to Entire Structure: Yes



Support	Start Distance	Length
1	0 ft	51 ft

Cb Factors (Standard)

No Cb factors (LRFD) have been defined.

Cb Factors (LRFD)

No Cb factors (LRFD) have been defined.

Fatigue Stress (Standard)

No fatigue stress (standard) schedules have been defined.

Member Control

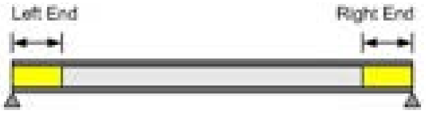
Steel

Flexural Resistance

Span	Compact Piers (Standard)	Ignore Eq. 6.10.7.1.2-3 (LRFD)
1	No	No

End Panel Distances

Top Span



Left of Top Span: -
Right of Top Span: -

Flange Local Buckling Resistance Adjustment

Standard Specifications: -
LRFD Specifications: -

Points of Interest

No points of interest have been defined.

Dead Loads

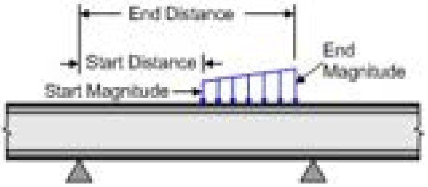
Uniform

Dead Load Type	Stage	Uniform Load
DC	1	-
DW	1	-
DU	1	-

Additional Self-weight

No additional self-weight dead loads have been defined.

Distributed



Dead Load Group	Support	Distributed Load (Start)		Distributed Load (End)	
		Distance	Magnitude	Distance	Magnitude
Vertical Web Angles	1	0.031 ft	0.019 kip / ft	50.938 ft	-

Concentrated

Dead Load Group	Support	Concentrated Load		
		Distance	Horizontal Force	Vertical Force
Girder Bracing	1	4.906 ft	-	0.17 kip
Girder Bracing	1	16.073 ft	-	0.164 kip

Girder Bracing	1	35.99 ft	-	0.164 kip
Girder Bracing	1	50.427 ft	-	0.169 kip
Bottom Flange Struts	1	5.583 ft	-	0.044 kip
Bottom Flange Struts	1	26.031 ft	-	0.046 kip
Bottom Flange Struts	1	43.208 ft	-	0.046 kip

Temperature

No temperature dead loads have been defined.

Settlement

Stage: 1

No settlement loads have been defined.

Pedestrian Load

Pedestrian Load: -

Wheel Fractions (Standard)

Moment

No moment wheel fractions have been defined.

Shear

No shear wheel fractions have been defined.

Deflection

No deflection wheel fractions have been defined.

Reaction

Apply to entire structure: No

Support	mg Single-Lane			mg Multi-Lane		
	Moment	Shear	Deflection	Moment	Shear	Deflection
1	-	-	-	-	-	-
2	-	-	-	-	-	-

```
                                             Nanue Stream Bridge
                                 Load Rating for Steel Exterior Girder Span 1 (G4-1)

CRITICAL RATING FACTOR SUMMARY: Design Load Inventory

 Live Load Combination                                     Total     Controlling    Limit State          Rating     Load
 No.       Description                                   Vehicle Wt.  Point of        Action             Factor    Rating
                                                           (tons)     Interest       Location                       (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)     36.00       101.0000       STRENGTH I            2.18       78.60
                                                                                    Shear
                                                                                    Maximum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)     25.00       105.0000       SERVICE II            2.54       63.40
                                                                                    Flange Stress
                                                                                    Maximum Effects
                                                                                    Top Flange

 15   HL-93-FAT                                (FAT)     36.00       101.0000       FATIGUE I             5.91      212.60
                                                                                    Shear Stress
                                                                                    Maximum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)     36.00       101.0000       STRENGTH I            2.18       78.60

CRITICAL RATING FACTOR SUMMARY: Design Load Operating

 Live Load Combination                                     Total     Controlling    Limit State          Rating     Load
 No.       Description                                   Vehicle Wt.  Point of        Action             Factor    Rating
                                                           (tons)     Interest       Location                       (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)     36.00       101.0000       STRENGTH I-O          2.83      101.89
                                                                                    Shear
                                                                                    Maximum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)     25.00       101.0000       STRENGTH I-O          3.30       82.38
                                                                                    Shear
                                                                                    Maximum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)     36.00       101.0000       STRENGTH I-O          2.83      101.89

CRITICAL RATING FACTOR SUMMARY: Legal Load

 Live Load Combination                                     Total     Controlling    Limit State          Rating     Load
 No.       Description                                   Vehicle Wt.  Point of        Action             Factor    Rating
                                                           (tons)     Interest       Location                       (tons)
=======================================================================================================================

  3   TYPE3                                    (TRK)     25.00       105.0000       SERVICE II            3.92       97.98
                                                                                    Flange Stress
                                                                                    Maximum Effects
                                                                                    Top Flange

  4   TYPE3S2                                  (TRK)     36.00       104.0000       SERVICE II            4.19      150.97
                                                                                    Flange Stress
                                                                                    Maximum Effects
                                                                                    Top Flange

  5   TYPE3-3                                  (TRK)     40.00       110.0000       STRENGTH I            4.44      177.64
                                                                                    Shear
                                                                                    Minimum Effects

  6   NRL-MIN                                  (TRK)     40.00       105.0000       SERVICE II            2.50       99.89
                                                                                    Flange Stress
                                                                                    Maximum Effects
                                                                                    Top Flange

  7   NRL-MAX                                  (TRK)     40.00       105.0000       SERVICE II            2.58      103.17
                                                                                    Flange Stress
                                                                                    Maximum Effects
                                                                                    Top Flange

  8   SU4                                      (TRK)     27.00       105.0000       SERVICE II            3.42       92.27
                                                                                    Flange Stress
                                                                                    Maximum Effects
                                                                                    Top Flange
```

```
  9   SU5                                      (TRK)    31.00       105.0000     SERVICE II           3.15       97.55
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 10   SU6                                      (TRK)    34.75       105.0000     SERVICE II           2.83       98.33
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 11   SU7                                      (TRK)    38.75       105.0000     SERVICE II           2.62      101.40
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 16   EV2                                      (TRK)    28.75       105.0000     SERVICE II           3.42       98.33
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 17   EV3                                      (TRK)    43.00       105.0000     SERVICE II           2.22       95.31
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange
........................................................................................................................

Crit  EV3                                      (TRK)    43.00       105.0000     SERVICE II           2.22       95.31

CRITICAL RATING FACTOR SUMMARY: Permit Load

 Live Load Combination                                  Total     Controlling    Limit State          Rating      Load
 No.       Description                                Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
========================================================================================================================

 12   HP1                                      (PTK)    60.00       105.0000     SERVICE II           2.72      163.26
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 13   HP2                                      (PTK)    78.55       110.0000     STRENGTH II          2.89      227.15
                                                                                 Shear
                                                                                 Minimum Effects

 14   HP3                                      (PTK)   104.95       101.0000     STRENGTH II          3.70      388.08
                                                                                 Shear
                                                                                 Maximum Effects
........................................................................................................................

Crit  HP1                                      (PTK)    60.00       105.0000     SERVICE II           2.72      163.26
```

BRASS™
Wyoming Department of
Transportation

BRASS-GIRDER™ Input Parameters

Version Information
Girder UI: 7.8.0.3001
Girder XML: 7.8.0.3001
BRASS™ XML: 1.8.0.3001

Administration

Project ID: 8780-06
Project Title: HDOT Statewide Bridge Load Ratings

Bridge ID: 1000190308146
Bridge Name: Nanue Stream
Route Name: 00019 Hawaii Belt Road
Reference Marker: 18

Title 1: Nanue Stream Bridge
Title 2: Load Rating for Steel Interior Girder Span 1 (G3-1)
Date: 2017 4 21

Agency: HDOT Highways Division
Designer/Rater: Moffatt & Nichol (JU)
Reviewer:

Comments:

Bridge Notes

MATERIAL PROPERTIES
Concrete
Weight = 0.160 kcf (HDOT Design Criteria for Bridges and Structures [HDOT] 5.01)
Strength = 3 ksi (Record Drawings: Class A-1)
Elastic Modulus = 3,880 ksi (AASHTO LRFD [LRFD] Eqn 5.4.2.4-1, Use 0.150 kcf per HDOT 5.01)
Reinforcing Steel
Yield Strength = 33 ksi (Unknown, Manual for Bridge Evaluation [MBE] Table 6A.5.2.2-1)
Elastic Modulus = 29,000 ksi (LRFD 5.4.3.2)

BRIDGE PROPERTIES (RECORD DRAWINGS)
Span 1 = 51 ft
Span 2 = 50 ft
Span 3 = 40 ft
Span 4 = 72 ft
Span 5 = 40 ft
Span 6 = 72 ft
Span 7 = 40 ft
Span 8 = 72 ft
Span 9 = 40 ft
Span 10 = 51 ft
Width = 38.5 ft
Deck Thickness = 9 in min
No. of Griders = 4
Girder Spacing = 9 ft, 7.5 ft, 9 ft
Girder Width = 12 3/8"
Girder Depth = 6'-6 1/2"
Surface Roughness = 3.0 (2015 Bridge Inspectinon Report)
Condition Factor = 1.0 (HDOT 5.04, 2015 Bridge Inspection Report indicates Condition Rating of 7)
System Factor = 1.0 (HDOT 5.05,)

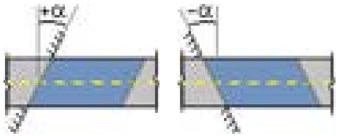
LIVE LOADS
LRFD Live Load (MBE Appendix C6A)
Truck and Tandem Lane Load = 0.64 klf
AASHTO Legal Loads (MBE Appendix D6A)
Type 3
Type 3S2
Type 3-3
Notional Rating Load [NRL]
Legal Lane Load = 0.2 klf
SU4
SU5
SU6
SU7
HDOT Hawaii Standard Single Trip Permit Loads (HDOT 5.06)
No lane load provided, vehicles allowed to trave in any lane
HP1
HP2
HP3
Dynamic Load Allowance (HDOT 5.03)
Spans > 40 ft
Wearing Surface: 3 (Assumed)
Design Loads: 33%
Legal Loads: 10%
Permit Loads: 10%
Scale Factor (HDOT 5.06)
Hawaii Standard Single Trip Permit Vehicle analysis assumes only one permit load on the bridge which allows the use of a single-lane distribution factor. When using the single-lane LRFD distribution factor, the 1.2 multiple prescence factor may shall be divided out from the distribtion factor equations.

Control

Structure

Structure Type: GirderLine
Define Deck Cross Section: Yes
Number of Members: 4

Skew Angle: 0 °



Analysis Model Type: Beam
Number of Top Spans: 1

Spans

Span	Length
1	51 ft

Structure Material: Steel
Beam Type: Builtup
Composite Structure: No
Deck Material: Concrete

Analysis

Unit System: US
Analysis Method: LRFD
Analysis Type: Rating
Number of Stages: 1
Member of Interest: 3
Model Element Type: Stepped
Point of Interest Generation Control: Tenth
Live-load Distribution Factor Application: AnalysisPoint

Interpolate Reinforcement: No
Calculate Effective Width: No

Input

Symmetry

Component	Symmetric
Beam Profile	No
Deck Profile	No
Shear Connectors	No
Transverse Stiffeners	No
Bearing Stiffeners	No
Longitudinal Stiffeners	No
Bracing (Member)	No
Lateral Support	No
Cb Factors (Std)	No
Cb Factors (LRFD)	No
Fatigue Stress (Std)	No
Beam Wheel Fractions (Std)	No
Reaction Wheel Fractions (Std)	No
Beam Distribution Factors (LRFD)	No
Reaction Distribution Factors (LRFD)	No

Simplified Standard Wheel Fractions: No
Merge Beam/Deck Profile Schedules: Yes

Distribution

Perform Dead Load Distribution: Yes
Calculate LRFD Live Load Distribution Factors: Yes

Dead Load Distribution Methods

Stage	Method
1	Tributary area

Live Load Distribution (LRFD)

Distribution Method: AASHTO LRFD
Cross Section Code: a1
Max. Number of Lanes Loaded: Computed
Slab Thickness Type: Structural
Set eg = 0 for Non-composite: Yes
Apply Skew to Lever Rule Override: Yes
Apply Skew to Ridgid Rule Override: No
Use Constants from Table 4.6.2.2.1-2: No

Libraries

Section Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Sections.bls
Vehicle Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Vehicles.blv

Output

Primary Output

Action Output Level: DL+LL+CONC
Action Locations: 10thPoints

General

Member Properties: Yes
Load Combinations: Yes
Load and Resistance Factors: Yes

Warnings: Yes
Camber: No
Critical Design Ratios / Rating Factors: Expanded

Live Load

Truck Positions: Yes
Variable Axle Spacing: Yes
Live Load Settings: Yes

Live Load Combinations: Yes
Live Load Details: Yes
Impact (LFD): No

Stage

Stage	Output
1	Yes

Dead Load

Member Self Load: Yes
Distributed Dead Loads: Yes
Concentrated Dead Loads: Yes

Temperature Change: No
Settlements: No

Load Distribution

Dead Load Distribution: Yes
Live Load Distribution: Yes

Intermediate Output

Intermediate Output Level: Full
Effective Width: Yes
Floorbeam Lane Position: Yes

Points of Interest

Specification Checks: Yes
Load Factoring/Combinations: No

Load Distribution

Dead Load: Yes
Live Load: Yes

Limit State Output (LRFD)

Limit State	Specification Check	Load Combination
Strength I	Yes	Yes
Strength II	Yes	Yes
Strength IV	No	No
Service I	No	No
Service II	No	No
Fatigue I	No	No
Fatigue II	No	No

Load Combination Output (LFD)

LFD Load Combo	Specification Check	Load Combination

Combo I	No	No
Combo IB	No	No
Combo I Overload	No	No
Combo IB Overload	No	No
Combo I Service	No	No
Combo IB Service	No	No
Combo Fatigue	Yes	Yes

Intermediate Output (cont.)

Steel

Transverse Stiffeners: No
Bearing Stiffeners: No
Longitudinal Stiffeners: No

Results Tables

X-Y Plot Action Tables: No
Specification Check Results Tables: No
Mesh Plot Files: No

BRASS-PAD™ Data Transfer File: No

Influence

Output influence lines for: None
Ordinate Divisor: 1

Factors

Load Factors (LRFD)

Limit State	DC		DW		DU		TU	
	max	min	max	min	max	min	max	min
Strength I	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength II	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength IV	-	-	-	-	-	-	-	-
Service I	-	-	-	-	-	-	-	-
Service II	1	1	1	1	1	1	-	-
Fatigue I	-	-	-	-	-	-	-	-
Fatigue II	-	-	-	-	-	-	-	-

Load Factors (LRFD) (continued)

Limit State	LL				SE		PS		DS	
	Design		Legal	Permit						
	Inventory	Operating			max	min	max	min	max	min
Strength I	1.75	1.35	1.45	0	-	-	-	-	-	-
Strength II	-		0	1.2	-	-	-	-	-	-
Strength IV	-		-	-	-	-	-	-	-	-
Service I	-		-	-	-	-	-	-	-	-
Service II	1.3	1	1.3	1	-	-	-	-	-	-
Fatigue I	0.75		-	-	-	-	-	-	-	-
Fatigue II	-		-	-	-	-	-	-	-	-

Load Modifiers (LRFD)

Limit State	Ductility	Redundancy	Importance	Combined Product	
				max	min
Strength I	1	1	1	-	-
Strength II	1	1	1	-	-
Strength IV	1	1	1	-	-
Service I	1	1	1	-	-
Service II	1	1	1	-	-
Fatigue I	1	1	1	-	-
Fatigue II	1	1	1	-	-

Resistance Factors (LRFD)

Resistance Factors

Type	Value
φ Flexure	1
φ Shear	1
φ Bearing	1
φ Compression	0.95
φ Shear Connectors	0.85
φ Fatigue	1

System/Total Modifiers

Limit State	Resistance Type	System	Total
Strength	Flexure	1	-
Strength	Shear	1	-
Strength	Bearing	1	-
Strength	Compression	1	-
Strength	Shear Connectors	1	-
Strength	Longitudinal Reinforcement	1	-
Service	Flexure	1	-
Fatigue	Fatigue	1	-

Condition Modifiers

Limit State	Condition
Strength	1
Service	1
Fatigue	1

Load Factors (LFD)

Load Combo	γ	LL	DC	DW	DU	TU	SE	PS	DS
I	-	-	-	-	-	-	-	1	1
IB	-	-	-	-	-	-	-	1	1
I-Overload	-	-	-	-	-	-	-	1	1
IB-Overload	-	-	-	-	-	-	-	1	1

I-Service	-	-	-	-	-	-	-	1	1
IB-Service	-	-	-	-	-	-	-	1	1
Fatigue	-	-	-	-	-	-	-	1	1

Capacity Reduction Factors (LFD)

Factor	Value
φ Flexure	-
φ Shear	-
φ Fatigue	-

Materials

Steel

ID	Name	Yield Stress	Tensile Strength	Modulus of Elasticity	Density	Thermal Expansion Coefficient
1	Salvaged Girder	30 ksi	60 ksi	29000 ksi	0.49 kcf	6.5E-06 °F^{-1}

Concrete

ID	Name	28 Day Compressive Strength	Modulus of Elasticity	Density	Modulus of Rupture	Modulus of Rupture (VCI Method)	Thermal Expansion Coefficient
1	1949 Class A-1	3 ksi	3880 ksi	0.16 kcf	-	-	6E-06 °F^{-1}

Dead Load Groups

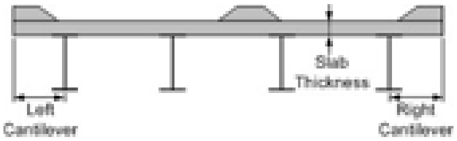
Groups

ID	Name	Stage	Type	Description
1	Concrete Railing	1	DC	Top Rail, Bottom Rail, Post
2	Sidewalk / Shoulder	1	DC	
3	AC Pavement	1	DW	
4	Girder Bracing	1	DC	X-Bracing with Steel Angles in the Outer Bays
5	Bottom Flange Bracing	1	DC	Steel Angles Diagonal Bracing in the Interior Bay
6	Vertical Web Angles	1	DC	Steel Angles Spaced at Intervals
7	Waterlines	1	DU	Assumed 8" Waterlines
8	Monorail	1	DC	6" Monorail
9	Bottom Flange Struts	1	DC	Bottom Flange Struts out of Steel Angles and Plates in Outer Bays

Deck Geometry

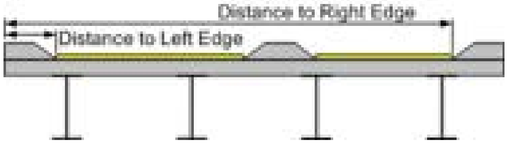
Deck

Deck Thickness:	9 in.
Left Cantilever Length:	6.5 ft
Right Cantilever Length:	6.5 ft
Equal Member Spacing:	No



Travelway Locations

Distance to Left Edge: 5.25 ft
Distance to Right Edge: 33.25 ft

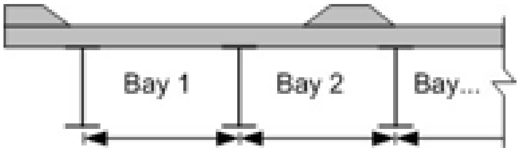


Sacrificial Topping

Thickness: -
Dead Load Type: DC

Member Spacing

Bay #	Spacing
1	9 ft
2	7.5 ft
3	9 ft



Soffits

No soffits have been defined.

Appurtenances

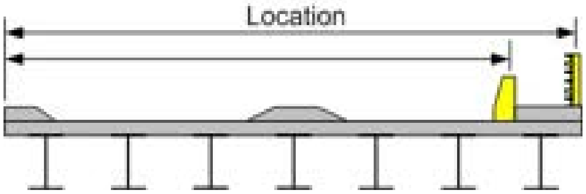
No appurtenances have been defined.

Deck Loads

Materials/Stages

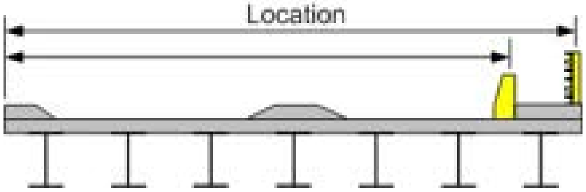
Deck Material: **1949 Class A-1**
Curb & Median Material: Not Assigned
Wearing Surface Weight: -
Slab Stage: 1
Curb Stage: 1
Median Stage: 1
Wearing Surface Stage: 1

Line Loads



Dead Load Group	Line Load	Load Location
Concrete Railing	0.319 kip / ft	0.923 ft
Concrete Railing	0.319 kip / ft	37.577 ft
Monorail	0.016 kip / ft	34 ft
Waterlines	0.224 kip / ft	38.5 ft

Uniform Loads



Dead Load Group	Uniform Load	Load Location	Load Width
Sidewalk / Shoulder	0.007 ksf	0 ft	5.25 ft
Sidewalk / Shoulder	0.003 ksf	5.25 ft	2 ft
AC Pavement	0.018 ksf	7.25 ft	24 ft
Sidewalk / Shoulder	0.003 ksf	31.25 ft	2 ft
Sidewalk / Shoulder	0.007 ksf	33.25 ft	5.25 ft

Live Loads

Live Load Control

Direction Control:	Up+Down
Standard Live Loads:	None
Wheel Advancement Denominator:	100
ADTT:	5000
ADTT for Single Lane:	2000
Multiple Presence Adjustment:	-
% of Dynamic Load Allowance (Impact):	100 %
Fixed Impact (STD):	-

Dynamic Load Allowance (LRFD)

Design/Rating Procedure	Truck	Lane	Fatigue
Design	33 %	0 %	15 %
Legal	33 %	0 %	0 %
Permit	33 %	0 %	0 %

Special Vehicles

Axle Vehicles

No axle vehicles have been defined.

Lane Vehicles

No lane vehicles have been defined.

Definitions (STD)

No standard live load definitions have been defined.

Definitions (LRFD)

Definition 1

Code:	HL-93-TRUCK
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 2

Code:	HL-93-TANDEM
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-

Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 3

Code:	HL-93-LANE
Type:	DesignLane
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 4

Code:	TYPE3
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 5

Code:	TYPE3S2
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 6

Code:	TYPE3-3
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-

Limit State	gamma LL	gamma LL Operating
Fatigue II	-	-

Definition 7

Code: NRL-MIN
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 8

Code: NRL-MAX
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 9

Code: SU4
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 10

Code: SU5
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 11

Code: SU6
Type: GeneralTruck

Live Load Factor Overrides

Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 12

Code: SU7
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 13

Code: HP1
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 14

Code: HP2
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 15

Code: HP3
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-

Fixed DLA: -

Limit State	gamma LL	gamma LL Operating
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 16

Code:	HL-93-FAT
Type:	FatigueTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 17

Code:	EV2
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 18

Code:	EV3
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

General Combinations (LRFD)

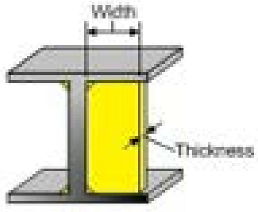
Standard Combo	Truck	Lane	Combination Factors	
			Truck	Lane
No	**HL-93-TRUCK**	**HL-93-LANE**	1	1
No	**HL-93-TANDEM**	**HL-93-LANE**	1	1

Deflection Combinations (LRFD)

No Deflection Combinations (LRFD) have been defined.

Component Groups

Transverse Stiffeners



ID	Name	Width	Thickness	Type	Type Factor	Material
1	Web Stiffeners	5 in.	0.375 in.	Single Angles	-	**Salvaged Girder**

Bearing Stiffeners

No bearing stiffener groups have been defined.

Longitudinal Stiffeners

No longitudinal stiffener groups have been defined.

Specification Control

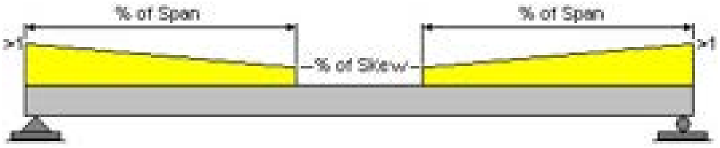
General

Lane Geometry

Design Vehicle Lane Width: 12 ft
Vehicle Width: 10 ft
Wheel Spacing: 6 ft
Encroachment Distance: -

Load Factors Control (LRFD): Use maximum and minimum load factors

Skew Factors



Span #	% of Span	% of Skew
1	-	-

Steel

Use Appendix A6 (LRFD): No
Allow Plastic Analysis: No
Override Longitudinal Stiffeners: No
Slab thickness for longitudinal shear force: Structural
Slab thickness for minimum negative flexure concrete deck reinforcement: Structural

Fatigue

AASHTO LRFD Table 6.6.1.2.5-2

% of Span: -
Span Length: 40 ft

Stress Range in Longitudinal Reinforcement Over the Piers: 10 ksi

Detail Categories (LRFD)

Detail Category	Constant, A x 10^8	Constant Amplitude Fatigue Threshold
A	-	-

B	-	-
B'	-	-
C	-	-
C'	-	-
D	-	-
E	-	-
E'	-	-

Limit State Map

Limit State Maps (LRFD)

Limit State	Design Review			Rating		
	Design Load	Legal Load	Permit Load	Design Load	Legal Load	Permit Load
Strength I	No	No	No	Inventory/Operating	Yes	No
Strength II	No	No	No	Exclude	No	Yes
Strength IV	No	No	No	Exclude	No	No
Service I	No	No	No	Exclude	No	No
Service II	No	No	No	Inventory/Operating	Yes	Yes
Service III	No	No	No	Exclude	No	No
Fatigue I	No	No	No	Inventory	No	No
Fatigue II	No	No	No	Exclude	No	No

Load Combo Maps (LFD)

Load Combo	Design Review	Rating
I	No	Inventory
IB	No	Operating
I-Overload	No	Exclude
IB-Overload	No	Exclude
I-Service	No	Exclude
IB-Service	No	Exclude
Fatigue	No	Exclude

Spec. Check Map (Strength)

LRFD Specification Check Maps

Design Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No

Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Design Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	No	No
Shear	Yes	No	No
Bearing	Yes	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	No	No
Shear	Yes	No	No
Bearing	Yes	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	Yes	No
Shear	No	Yes	No
Bearing	No	Yes	No
Flexural Stress In Longitudinal Stiffener	No	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		
Flexural Stress In Longitudinal Stiffener	No	No		

Rating

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		

Flexural Stress In Longitudinal Stiffener	No	No

Spec. Check Map (Service)

LRFD Specification Check Maps

Design Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Legal Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Permit Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Design Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Legal Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Permit Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

LFD Specification Check Maps

Design Review

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Rating

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Spec. Check Map (Fatigue)

LRFD Specification Check Maps

Design Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Legal Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Permit Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Design Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	Yes	No
Fatigue of Shear Connectors	Yes	No
Fatigue Shear Range of Shear Connectors	Yes	No
Fatigue of Special Points	Yes	No
Fatigue Shear	Yes	No

Legal Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No

Fatigue Shear	No	No

Permit Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Rating

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Member

Member Notes

No member notes have been defined.

Member Materials

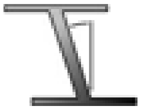
Beam

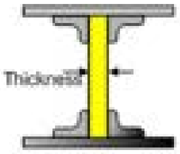
Beam Material: Salvaged Girder

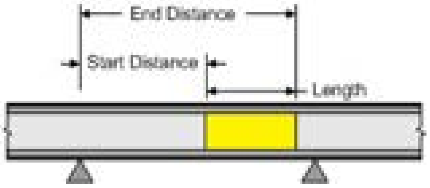
Beam Profile

Web

Apply to Entire Structure: Yes
Web Angle: -





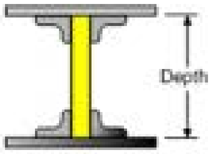


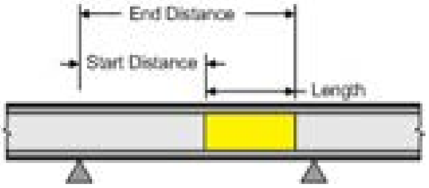
Thickness	Material	Support Number	Start Distance	Length

0.375 in.	**Salvaged Girder**	1	0 ft	51 ft

Web Depth

Apply to Entire Structure: Yes

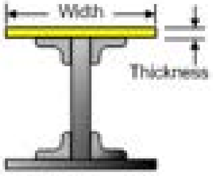


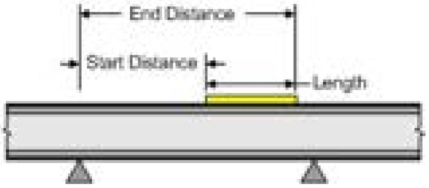


Start Depth	Web Variation	End Depth	Support Number	Start Distance	Length
78 in.	Linear	78 in.	1	0 ft	51 ft

Top Cover Plate

Apply to Entire Structure: No

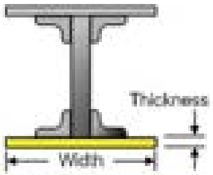




Start of Range			End of Range						
Width	Thickness	Gap Thickness	Width	Thickness	Gap Thickness	Material	Support Number	Start Distance	Length
16 in.	0.438 in.	-	-	-	-	**Salvaged Girder**	1	8.354 ft	35.417 ft

Bottom Cover Plate

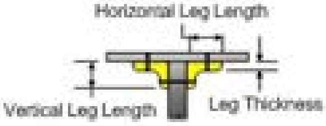
Apply to Entire Structure: No

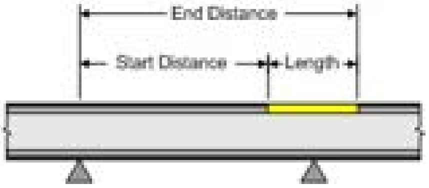


Start of Range			End of Range						
Width	Thickness	Gap Thickness	Width	Thickness	Gap Thickness	Material	Support Number	Start Distance	Length
16 in.	0.438 in.	-	-	-	-	**Salvaged Girder**	1	8.354 ft	35.417 ft

Top Angles

Apply to Entire Structure: Yes



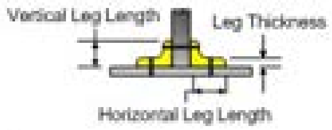


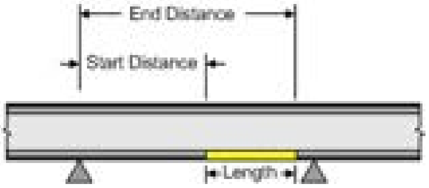
Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length

6 in.	6 in.	0.438 in.	**Salvaged Girder**	1	0 ft	51 ft

Bottom Angles

Apply to Entire Structure: Yes





Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length
6 in.	6 in.	0.438 in.	**Salvaged Girder**	1	0 ft	51 ft

Hinges

No hinges have been defined.

Special Locations

No special locations have been defined.

Supports

Support Conditions

Support	Support Restraint		
	Horizontal	Vertical	Rotational
1	Free	Restrained	Free
2	Restrained	Restrained	Free

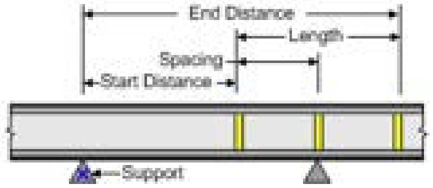
Spring Constants

Support	Spring Constants		
	Horizontal	Vertical	Rotational
1	-	-	-
2	-	-	-

Schedules

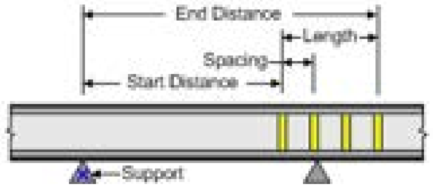
Bracing

Apply to Entire Structure: No



Spacing	Support	Start Distance	Length
11.167 ft	1	4.906 ft	11.167 ft
14.438 ft	1	35.99 ft	14.438 ft

Transverse Stiffeners



Stiffener Group	Spacing	Support	Start Distance	Length
Web Stiffeners	1.333 ft	1	0.031 ft	1.333 ft
Web Stiffeners	3.75 ft	1	8.573 ft	3.75 ft
Web Stiffeners	3.917 ft	1	19.99 ft	3.917 ft
Web Stiffeners	3.917 ft	1	28.156 ft	3.917 ft
Web Stiffeners	3.656 ft	1	39.74 ft	7.313 ft

Bearing Stiffeners

Apply to Entire Structure: No

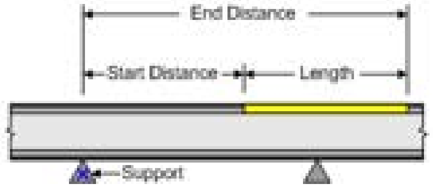
Support	Stiffener Group
1	Not Assigned
2	Not Assigned

Longitudinal Stiffeners

No longitudinal stiffener schedules have been defined.

Lateral Support

Apply to Entire Structure: Yes



Support	Start Distance	Length
1	0 ft	51 ft

Cb Factors (Standard)

No Cb factors (LRFD) have been defined.

Cb Factors (LRFD)

No Cb factors (LRFD) have been defined.

Fatigue Stress (Standard)

No fatigue stress (standard) schedules have been defined.

Member Control

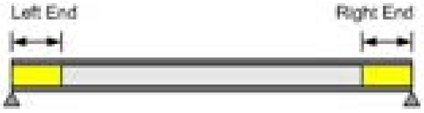
Steel

Flexural Resistance

Span	Compact Piers (Standard)	Ignore Eq. 6.10.7.1.2-3 (LRFD)
1	No	No

End Panel Distances

Top Span



Left of Top Span: -
Right of Top Span: -

Flange Local Buckling Resistance Adjustment

Standard Specifications: -
LRFD Specifications: -

Points of Interest

No points of interest have been defined.

Dead Loads

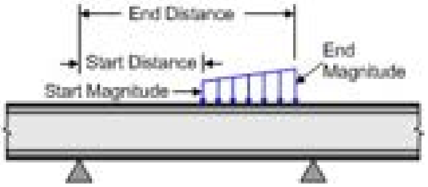
Uniform

Dead Load Type	Stage	Uniform Load
DC	1	-
DW	1	-
DU	1	-

Additional Self-weight

No additional self-weight dead loads have been defined.

Distributed



Dead Load Group	Support	Distributed Load (Start)		Distributed Load (End)	
		Distance	Magnitude	Distance	Magnitude
Bottom Flange Bracing	1	0.063 ft	0.009 kip / ft	50.938 ft	-
Vertical Web Angles	1	0.063 ft	0.019 kip / ft	50.938 ft	-

Concentrated

Dead Load Group	Support	Concentrated Load		
		Distance	Horizontal Force	Vertical Force
Girder Bracing	1	4.906 ft	-	0.17 kip

Girder Bracing	1	16.073 ft	-	0.164 kip
Girder Bracing	1	35.99 ft	-	0.164 kip
Girder Bracing	1	50.427 ft	-	0.169 kip
Bottom Flange Struts	1	5.583 ft	-	0.044 kip
Bottom Flange Struts	1	26.031 ft	-	0.044 kip
Bottom Flange Struts	1	43.208 ft	-	0.044 kip

Temperature

No temperature dead loads have been defined.

Settlement

Stage: 1

No settlement loads have been defined.

Pedestrian Load

Pedestrian Load: -

Wheel Fractions (Standard)

Moment

No moment wheel fractions have been defined.

Shear

No shear wheel fractions have been defined.

Deflection

No deflection wheel fractions have been defined.

Reaction

Apply to entire structure: No

Support	mg Single-Lane			mg Multi-Lane		
	Moment	Shear	Deflection	Moment	Shear	Deflection
1	-	-	-	-	-	-
2	-	-	-	-	-	-

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                                                       Untitled
                                            BRASS-GIRDER  Version 7.8.1
Agency     : HDOT Highways Division                                                                    Page:        553
Engineer   : Moffatt & Nichol (JU)                                                                     Date: 08/19/2017
Bridge Name: 1000190308146         Nanue Stream                                                        Time:    7:35 PM
Input File : ..bmittal (7-07-2017)\001000190308146_NanueStreamBridge\G3-1\001000190308146_G3-1_NanueStream.girder
Output File: .. Submittal (7-07-2017)\001000190308146_NanueStreamBridge\G3-1\001000190308146_G3-1_NanueStream.out
                                                 Nanue Stream Bridge
                                 Load Rating for Steel Interior Girder Span 1 (G3-1)

CRITICAL RATING FACTOR SUMMARY: Design Load Inventory

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.       Description                                Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       101.0000     STRENGTH I            2.02      72.82
                                                                                 Shear
                                                                                 Maximum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)    25.00       101.0000     STRENGTH I            2.35      58.87
                                                                                 Shear
                                                                                 Maximum Effects

 15   HL-93-FAT                                (FAT)    36.00       101.0000     FATIGUE I             6.87     247.50
                                                                                 Shear Stress
                                                                                 Maximum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       101.0000     STRENGTH I            2.02      72.82

CRITICAL RATING FACTOR SUMMARY: Design Load Operating

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.       Description                                Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       101.0000     STRENGTH I-O          2.62      94.40
                                                                                 Shear
                                                                                 Maximum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)    25.00       101.0000     STRENGTH I-O          3.05      76.32
                                                                                 Shear
                                                                                 Maximum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       101.0000     STRENGTH I-O          2.62      94.40

CRITICAL RATING FACTOR SUMMARY: Legal Load

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.       Description                                Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

  3   TYPE3                                    (TRK)    25.00       101.0000     STRENGTH I            4.01     100.20
                                                                                 Shear
                                                                                 Maximum Effects

  4   TYPE3S2                                  (TRK)    36.00       110.0000     STRENGTH I            3.93     141.32
                                                                                 Shear
                                                                                 Minimum Effects

  5   TYPE3-3                                  (TRK)    40.00       110.0000     STRENGTH I            4.14     165.52
                                                                                 Shear
                                                                                 Minimum Effects

  6   NRL-MIN                                  (TRK)    40.00       105.0000     SERVICE II            2.73     109.01
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

  7   NRL-MAX                                  (TRK)    40.00       105.0000     SERVICE II            2.81     112.59
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

  8   SU4                                      (TRK)    27.00       101.0000     STRENGTH I            3.61      97.59
                                                                                 Shear
                                                                                 Maximum Effects

  9   SU5                                      (TRK)    31.00       101.0000     STRENGTH I            3.28     101.75
                                                                                 Shear
                                                                                 Maximum Effects
```

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 10   SU6                                      (TRK)    34.75       105.0000     SERVICE II            3.09     107.32
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 11   SU7                                      (TRK)    38.75       105.0000     SERVICE II            2.86     110.66
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 16   EV2                                      (TRK)    28.75       101.0000     STRENGTH I            3.37      97.00
                                                                                 Shear
                                                                                 Maximum Effects

 17   EV3                                      (TRK)    43.00       101.0000     STRENGTH I            2.29      98.41
                                                                                 Shear
                                                                                 Maximum Effects
.......................................................................................................................

Crit  EV3                                      (TRK)    43.00       101.0000     STRENGTH I            2.29      98.41

CRITICAL RATING FACTOR SUMMARY: Permit Load

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.       Description                                Vehicle Wt.   Point of      Action              Factor    Rating
                                                        (tons)      Interest     Location                       (tons)
=======================================================================================================================

 12   HP1                                      (PTK)    60.00       101.0000     STRENGTH II           3.32     199.19
                                                                                 Shear
                                                                                 Maximum Effects

 13   HP2                                      (PTK)    78.55       101.0000     STRENGTH II           3.24     254.50
                                                                                 Shear
                                                                                 Maximum Effects

 14   HP3                                      (PTK)   104.95       101.0000     STRENGTH II           4.13     433.49
                                                                                 Shear
                                                                                 Maximum Effects
.......................................................................................................................

Crit  HP2                                      (PTK)    78.55       101.0000     STRENGTH II           3.24     254.50
```

BRASS™
Wyoming Department of
Transportation

BRASS-GIRDER™ Input Parameters

Version Information

Girder UI:	7.8.0.3001
Girder XML:	7.8.0.3001
BRASS™ XML:	1.8.0.3001

Administration

Project ID:	8780-06
Project Title:	HDOT Statewide Bridge Load Ratings
Bridge ID:	1000190308146
Bridge Name:	Nanue Stream
Route Name:	00019 Hawaii Belt Road
Reference Marker:	18
Title 1:	Nanue Stream Bridge
Title 2:	Load Rating for Steel Exterior Girder Span 2 (G4-2)
Date:	2017 4 21
Agency:	HDOT Highways Division
Designer/Rater:	Moffatt & Nichol (JU)
Reviewer:	
Comments:	

Bridge Notes

MATERIAL PROPERTIES
Concrete
Weight = 0.160 kcf (HDOT Design Criteria for Bridges and Structures [HDOT] 5.01)
Strength = 3 ksi (Record Drawings: Class A-1)
Elastic Modulus = 3,880 ksi (AASHTO LRFD [LRFD] Eqn 5.4.2.4-1, Use 0.150 kcf per HDOT 5.01)
Reinforcing Steel
Yield Strength = 33 ksi (Unknown, Manual for Bridge Evaluation [MBE] Table 6A.5.2.2-1)
Elastic Modulus = 29,000 ksi (LRFD 5.4.3.2)

BRIDGE PROPERTIES (RECORD DRAWINGS)
Span 1 = 51 ft
Span 2 = 50 ft
Span 3 = 40 ft
Span 4 = 72 ft
Span 5 = 40 ft
Span 6 = 72 ft
Span 7 = 40 ft
Span 8 = 72 ft
Span 9 = 40 ft
Span 10 = 51 ft
Width = 38.5 ft
Deck Thickness = 9 in min
No. of Griders = 4
Girder Spacing = 9 ft, 7.5 ft, 9 ft
Girder Width = 12 3/8"
Girder Depth = 6'-6 1/2"
Surface Roughness = 3.0 (2015 Bridge Inspectinon Report)
Condition Factor = 1.0 (HDOT 5.04, 2015 Bridge Inspection Report indicates Condition Rating of 7)
System Factor = 1.0 (HDOT 5.05,)

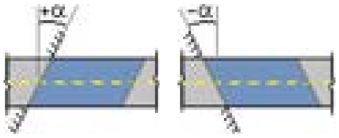
LIVE LOADS
LRFD Live Load (MBE Appendix C6A)
Truck and Tandem Lane Load = 0.64 klf
AASHTO Legal Loads (MBE Appendix D6A)
Type 3
Type 3S2
Type 3-3
Notional Rating Load [NRL]
Legal Lane Load = 0.2 klf
SU4
SU5
SU6
SU7
HDOT Hawaii Standard Single Trip Permit Loads (HDOT 5.06)
No lane load provided, vehicles allowed to trave in any lane
HP1
HP2
HP3
Dynamic Load Allowance (HDOT 5.03)
Spans > 40 ft
Wearing Surface: 3 (Assumed)
Design Loads: 33%
Legal Loads: 10%
Permit Loads: 10%
Scale Factor (HDOT 5.06)
Hawaii Standard Single Trip Permit Vehicle analysis assumes only one permit load on the bridge which allows the use of a single-lane distribution factor. When using the single-lane LRFD distribution factor, the 1.2 multiple prescence factor may shall be divided out from the distribtion factor equations.

Control

Structure

Structure Type: GirderLine
Define Deck Cross Section: Yes
Number of Members: 4

Skew Angle: 0 °



Analysis Model Type: Beam
Number of Top Spans: 1

Spans

Span	Length
1	50 ft

Structure Material: Steel
Beam Type: Builtup
Composite Structure: No
Deck Material: Concrete

Analysis

Unit System: US
Analysis Method: LRFD
Analysis Type: Rating
Number of Stages: 1
Member of Interest: 4
Model Element Type: Stepped
Point of Interest Generation Control: Tenth
Live-load Distribution Factor Application: AnalysisPoint

Interpolate Reinforcement: No
Calculate Effective Width: No

Input

Symmetry

Component	Symmetric
Beam Profile	No
Deck Profile	No
Shear Connectors	No
Transverse Stiffeners	No
Bearing Stiffeners	No
Longitudinal Stiffeners	No
Bracing (Member)	No
Lateral Support	No
Cb Factors (Std)	No
Cb Factors (LRFD)	No
Fatigue Stress (Std)	No
Beam Wheel Fractions (Std)	No
Reaction Wheel Fractions (Std)	No
Beam Distribution Factors (LRFD)	No
Reaction Distribution Factors (LRFD)	No

Simplified Standard Wheel Fractions: No
Merge Beam/Deck Profile Schedules: Yes

Distribution

Perform Dead Load Distribution: Yes
Calculate LRFD Live Load Distribution Factors: Yes

Dead Load Distribution Methods

Stage	Method
1	Tributary area

Live Load Distribution (LRFD)

Distribution Method: AASHTO LRFD
Cross Section Code: a1
Max. Number of Lanes Loaded: Computed

Consider Rigid Method: Yes
Slab Thickness Type: Structural

Set eg = 0 for Non-composite: No
Apply Skew to Lever Rule Override: Yes
Apply Skew to Ridgid Rule Override: Yes
Use Constants from Table 4.6.2.2.1-2: No

Libraries

Section Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Sections.bls
Vehicle Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Vehicles.blv

Output

Primary Output

Action Output Level: DL+LL+CONC
Action Locations: 10thPoints

General

Member Properties: Yes
Load Combinations: Yes
Load and Resistance Factors: Yes

Warnings: Yes
Camber: No
Critical Design Ratios / Rating Factors: Expanded

Live Load

Truck Positions: Yes
Variable Axle Spacing: Yes
Live Load Settings: Yes

Live Load Combinations: Yes
Live Load Details: Yes
Impact (LFD): No

Stage

Stage	Output
1	Yes

Dead Load

Member Self Load: Yes
Distributed Dead Loads: Yes
Concentrated Dead Loads: Yes

Temperature Change: No
Settlements: No

Load Distribution

Dead Load Distribution: Yes
Live Load Distribution: Yes

Intermediate Output

Intermediate Output Level: Full
Effective Width: Yes
Floorbeam Lane Position: Yes

Points of Interest

Specification Checks: Yes
Load Factoring/Combinations: Yes

Load Distribution

Dead Load: Yes
Live Load: Yes

Limit State Output (LRFD)

Limit State	Specification Check	Load Combination
Strength I	Yes	Yes
Strength II	Yes	Yes
Strength IV	No	No
Service I	No	No
Service II	Yes	Yes
Fatigue I	Yes	Yes
Fatigue II	No	No

Load Combination Output (LFD)

LFD Load Combo	Specification Check	Load Combination

Combo I	No	No
Combo IB	No	No
Combo I Overload	No	No
Combo IB Overload	No	No
Combo I Service	No	No
Combo IB Service	No	No
Combo Fatigue	No	No

Intermediate Output (cont.)

Steel

Transverse Stiffeners: No
Bearing Stiffeners: No
Longitudinal Stiffeners: No

Results Tables

X-Y Plot Action Tables: No
Specification Check Results Tables: No
Mesh Plot Files: No

BRASS-PAD™ Data Transfer File: No

Influence

Output influence lines for: None
Ordinate Divisor: 1

Factors

Load Factors (LRFD)

Limit State	DC		DW		DU		TU	
	max	min	max	min	max	min	max	min
Strength I	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength II	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength IV	-	-	-	-	-	-	-	-
Service I	-	-	-	-	-	-	-	-
Service II	1	1	1	1	1	1	-	-
Fatigue I	-	-	-	-	-	-	-	-
Fatigue II	-	-	-	-	-	-	-	-

Load Factors (LRFD) (continued)

Limit State	LL				SE		PS		DS	
	Design		Legal	Permit						
	Inventory	Operating			max	min	max	min	max	min
Strength I	1.75	1.35	1.45	0	-	-	-	-	-	-
Strength II	-		0	1.2	-	-	-	-	-	-
Strength IV	-		-	-	-	-	-	-	-	-
Service I	-		-	-	-	-	-	-	-	-
Service II	1.3	1	1.3	1	-	-	-	-	-	-
Fatigue I	0.75		-	-	-	-	-	-	-	-

Fatigue II	-	-	-	-	-	-	-	-	-

Load Modifiers (LRFD)

Limit State	Ductility	Redundancy	Importance	Combined Product	
				max	min
Strength I	1	1	1	-	-
Strength II	1	1	1	-	-
Strength IV	1	1	1	-	-
Service I	1	1	1	-	-
Service II	1	1	1	-	-
Fatigue I	1	1	1	-	-
Fatigue II	1	1	1	-	-

Resistance Factors (LRFD)

Resistance Factors

Type	Value
φ Flexure	1
φ Shear	1
φ Bearing	1
φ Compression	0.95
φ Shear Connectors	0.85
φ Fatigue	1

System/Total Modifiers

Limit State	Resistance Type	System	Total
Strength	Flexure	1	-
Strength	Shear	1	-
Strength	Bearing	1	-
Strength	Compression	1	-
Strength	Shear Connectors	1	-
Strength	Longitudinal Reinforcement	1	-
Service	Flexure	1	-
Fatigue	Fatigue	1	-

Condition Modifiers

Limit State	Condition
Strength	1
Service	1
Fatigue	1

Load Factors (LFD)

Load Combo	γ	LL	DC	DW	DU	TU	SE	PS	DS
I	-	-	-	-	-	-	-	1	1
IB	-	-	-	-	-	-	-	1	1
I-Overload	-	-	-	-	-	-	-	1	1

IB-Overload	-	-	-	-	-	-	-	1	1
I-Service	-	-	-	-	-	-	-	1	1
IB-Service	-	-	-	-	-	-	-	1	1
Fatigue	-	-	-	-	-	-	-	1	1

Capacity Reduction Factors (LFD)

Factor	Value
φ Flexure	-
φ Shear	-
φ Fatigue	-

Materials

Steel

ID	Name	Yield Stress	Tensile Strength	Modulus of Elasticity	Density	Thermal Expansion Coefficient
1	Salvaged Girder	30 ksi	60 ksi	29000 ksi	0.49 kcf	6.5E-06 °F^{-1}

Concrete

ID	Name	28 Day Compressive Strength	Modulus of Elasticity	Density	Modulus of Rupture	Modulus of Rupture (VCI Method)	Thermal Expansion Coefficient
1	1949 Class A-1	3 ksi	3880 ksi	0.16 kcf	-	-	6E-06 °F^{-1}

Dead Load Groups

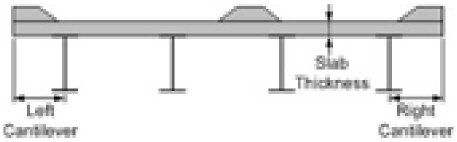
Groups

ID	Name	Stage	Type	Description
1	Concrete Railing	1	DC	Top Rail, Bottom Rail, Post
2	Sidewalk / Shoulder	1	DC	
3	AC Pavement	1	DW	
4	Girder Bracing	1	DC	X-Bracing with Steel Angles in the Outer Bays
5	Bottom Flange Bracing	1	DC	Steel Angles Diagonal Bracing in the Interior Bay
6	Vertical Web Angles	1	DC	Steel Angles Spaced at Intervals
7	Waterlines	1	DU	Assumed 8" Waterlines
8	Monorail	1	DC	6" Monorail
9	Bottom Flange Struts	1	DC	Bottom Flange Struts out of Steel Angles and Plates in Outer Bays

Deck Geometry

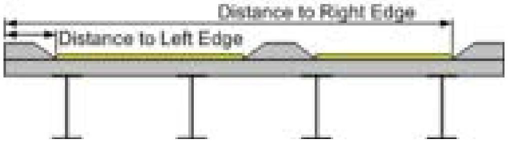
Deck

Deck Thickness:	9 in.
Left Cantilever Length:	6.5 ft
Right Cantilever Length:	6.5 ft
Equal Member Spacing:	No



Travelway Locations

Distance to Left Edge: 5.25 ft
Distance to Right Edge: 33.25 ft

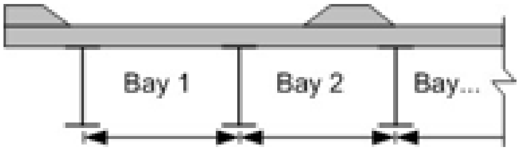


Sacrificial Topping

Thickness: -
Dead Load Type: DC

Member Spacing

Bay #	Spacing
1	9 ft
2	7.5 ft
3	9 ft



Soffits

No soffits have been defined.

Appurtenances

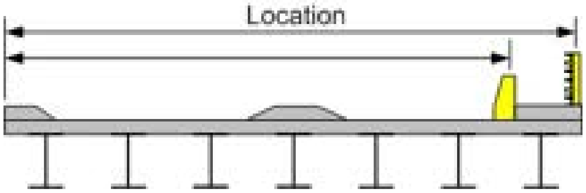
No appurtenances have been defined.

Deck Loads

Materials/Stages

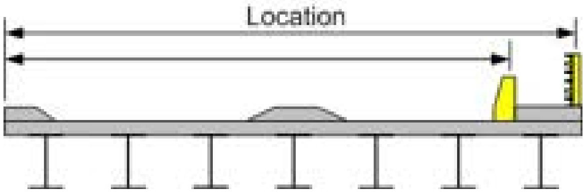
Deck Material: **1949 Class A-1**
Curb & Median Material: Not Assigned
Wearing Surface Weight: -
Slab Stage: 1
Curb Stage: 1
Median Stage: 1
Wearing Surface Stage: 1

Line Loads



Dead Load Group	Line Load	Load Location
Concrete Railing	0.319 kip / ft	0.923 ft
Concrete Railing	0.319 kip / ft	37.577 ft
Waterlines	0.224 kip / ft	38.5 ft
Monorail	0.016 kip / ft	34 ft

Uniform Loads



Dead Load Group	Uniform Load	Load Location	Load Width
Sidewalk / Shoulder	0.007 ksf	0 ft	5.25 ft
Sidewalk / Shoulder	0.003 ksf	5.25 ft	2 ft
AC Pavement	0.018 ksf	7.25 ft	24 ft
Sidewalk / Shoulder	0.003 ksf	31.25 ft	2 ft
Sidewalk / Shoulder	0.007 ksf	33.25 ft	5.25 ft

Live Loads

Live Load Control

Direction Control:	Up+Down
Standard Live Loads:	None
Wheel Advancement Denominator:	100
ADTT:	5000
ADTT for Single Lane:	2000
Multiple Presence Adjustment:	-
% of Dynamic Load Allowance (Impact):	100 %
Fixed Impact (STD):	-

Dynamic Load Allowance (LRFD)

Design/Rating Procedure	Truck	Lane	Fatigue
Design	33 %	0 %	15 %
Legal	33 %	0 %	0 %
Permit	33 %	0 %	0 %

Special Vehicles

Axle Vehicles

No axle vehicles have been defined.

Lane Vehicles

No lane vehicles have been defined.

Definitions (STD)

No standard live load definitions have been defined.

Definitions (LRFD)

Definition 1

Code:	HL-93-TRUCK
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 2

Code:	HL-93-TANDEM
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating

Scale Factor: -
Lanes Loaded: Critical
Notional Load: Yes
Fixed DLA: -

Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 3

Code: HL-93-LANE
Type: DesignLane
Design Rating: Design
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: Yes
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 4

Code: TYPE3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 5

Code: TYPE3S2
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 6

Code: TYPE3-3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-

Limit State	gamma LL	gamma LL Operating
Fatigue I	-	-
Fatigue II	-	-

Definition 7

Code: NRL-MIN
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 8

Code: NRL-MAX
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 9

Code: SU4
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 10

Code: SU5
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 11

Code: SU6

Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 12

Code: SU7
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 13

Code: HP1
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 14

Code: HP2
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 15

Code: HP3
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-

Notional Load: No
Fixed DLA: -

Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 16

Code: HL-93-FAT
Type: FatigueTruck
Design Rating: Design
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 17

Code: EV2
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 18

Code: EV3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

General Combinations (LRFD)

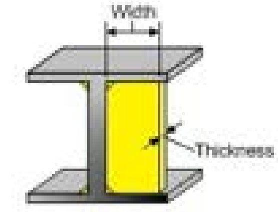
Standard Combo	Truck	Lane	Combination Factors	
			Truck	Lane
No	**HL-93-TRUCK**	**HL-93-LANE**	1	1
No	**HL-93-TANDEM**	**HL-93-LANE**	1	1

Deflection Combinations (LRFD)

No Deflection Combinations (LRFD) have been defined.

Component Groups

Transverse Stiffeners



ID	Name	Width	Thickness	Type	Type Factor	Material
1	Web Stiffeners	5 in.	0.375 in.	Single Angles	-	**Salvaged Girder**

Bearing Stiffeners

No bearing stiffener groups have been defined.

Longitudinal Stiffeners

No longitudinal stiffener groups have been defined.

Specification Control

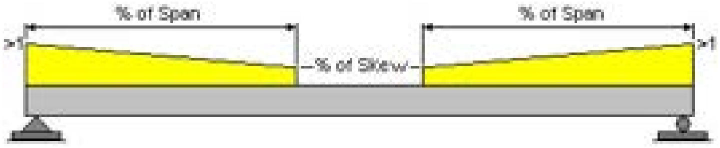
General

Lane Geometry

Design Vehicle Lane Width:	12 ft
Vehicle Width:	10 ft
Wheel Spacing:	6 ft
Encroachment Distance:	-

Load Factors Control (LRFD): Use maximum and minimum load factors

Skew Factors



Span #	% of Span	% of Skew
1	-	-

Steel

Use Appendix A6 (LRFD):	No
Allow Plastic Analysis:	No
Override Longitudinal Stiffeners:	No
Slab thickness for longitudinal shear force:	Structural
Slab thickness for minimum negative flexure concrete deck reinforcement:	Structural

Fatigue

AASHTO LRFD Table 6.6.1.2.5-2

% of Span:	-
Span Length:	40 ft

Stress Range in Longitudinal Reinforcement Over the Piers: 10 ksi

Detail Categories (LRFD)

Detail Category	Constant, A x 10^8	Constant Amplitude Fatigue Threshold
A	-	-

B	-	-
B'	-	-
C	-	-
C'	-	-
D	-	-
E	-	-
E'	-	-

Limit State Map

Limit State Maps (LRFD)

Limit State	Design Review			Rating		
	Design Load	Legal Load	Permit Load	Design Load	Legal Load	Permit Load
Strength I	No	No	No	Inventory/Operating	Yes	No
Strength II	No	No	No	Exclude	No	Yes
Strength IV	No	No	No	Exclude	No	No
Service I	No	No	No	Exclude	No	No
Service II	No	No	No	Inventory/Operating	Yes	Yes
Service III	No	No	No	Exclude	No	No
Fatigue I	No	No	No	Inventory	No	No
Fatigue II	No	No	No	Exclude	No	No

Load Combo Maps (LFD)

Load Combo	Design Review	Rating
I	No	Inventory
IB	No	Operating
I-Overload	No	Exclude
IB-Overload	No	Exclude
I-Service	No	Exclude
IB-Service	No	Exclude
Fatigue	No	Exclude

Spec. Check Map (Strength)

LRFD Specification Check Maps

Design Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No

Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Design Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	Yes	No
Shear	Yes	No	No
Bearing	Yes	Yes	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	Yes	No
Shear	Yes	No	No
Bearing	Yes	Yes	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	Yes	No
Shear	Yes	No	No
Bearing	Yes	Yes	No
Flexural Stress In Longitudinal Stiffener	No	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		
Flexural Stress In Longitudinal Stiffener	No	No		

Rating

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		

Flexural Stress In Longitudinal Stiffener	No	No

Spec. Check Map (Service)

LRFD Specification Check Maps

Design Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Legal Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Permit Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Design Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Legal Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Permit Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

LFD Specification Check Maps

Design Review

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Rating

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	Yes	Yes

Spec. Check Map (Fatigue)

LRFD Specification Check Maps

Design Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Legal Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Permit Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Design Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	Yes	No
Fatigue of Shear Connectors	Yes	No
Fatigue Shear Range of Shear Connectors	Yes	No
Fatigue of Special Points	Yes	No
Fatigue Shear	Yes	No

Legal Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No

Fatigue Shear	No	No

Permit Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Rating

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Member

Member Notes

No member notes have been defined.

Member Materials

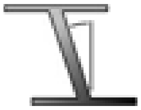
Beam

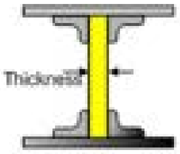
Beam Material: Salvaged Girder

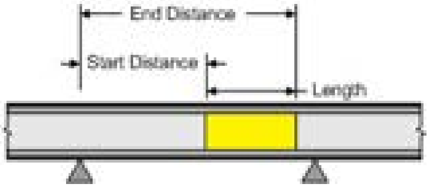
Beam Profile

Web

Apply to Entire Structure: Yes
Web Angle: -





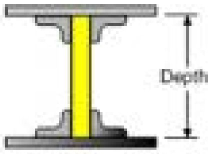


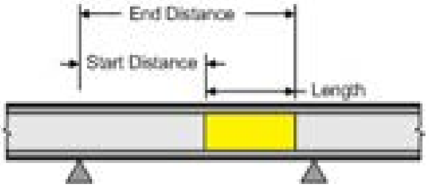
Thickness	Material	Support Number	Start Distance	Length

0.375 in.	**Salvaged Girder**	1	0 ft	50 ft

Web Depth

Apply to Entire Structure: Yes

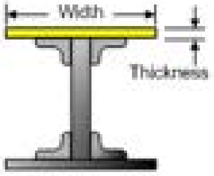


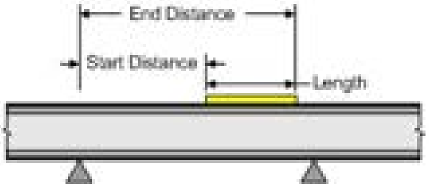


Start Depth	Web Variation	End Depth	Support Number	Start Distance	Length
78 in.	Linear	78 in.	1	0 ft	50 ft

Top Cover Plate

Apply to Entire Structure: No

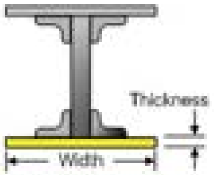




Start of Range			End of Range						
Width	Thickness	Gap Thickness	Width	Thickness	Gap Thickness	Material	Support Number	Start Distance	Length
16 in.	0.438 in.	-	-	-	-	**Salvaged Girder**	1	7.292 ft	35.417 ft

Bottom Cover Plate

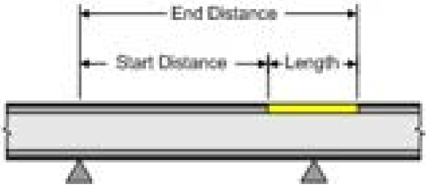
Apply to Entire Structure: No



Start of Range			End of Range						
Width	Thickness	Gap Thickness	Width	Thickness	Gap Thickness	Material	Support Number	Start Distance	Length
16 in.	0.438 in.	-	-	-	-	**Salvaged Girder**	1	7.292 ft	35.417 ft

Top Angles

Apply to Entire Structure: Yes

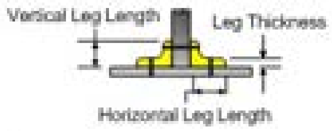


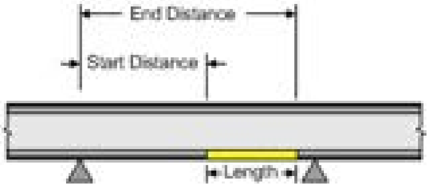
Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length

6 in.	6 in.	0.438 in.	**Salvaged Girder**	1	0 ft	50 ft

Bottom Angles

Apply to Entire Structure: Yes





Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length
6 in.	6 in.	0.438 in.	**Salvaged Girder**	1	0 ft	50 ft

Hinges

No hinges have been defined.

Special Locations

No special locations have been defined.

Supports

Support Conditions

Support	Support Restraint		
	Horizontal	Vertical	Rotational
1	Restrained	Restrained	Free
2	Restrained	Restrained	Free

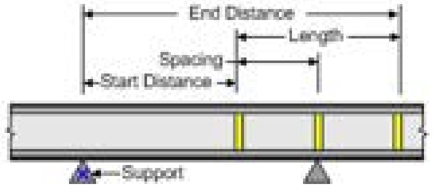
Spring Constants

Support	Spring Constants		
	Horizontal	Vertical	Rotational
1	-	-	-
2	-	-	-

Schedules

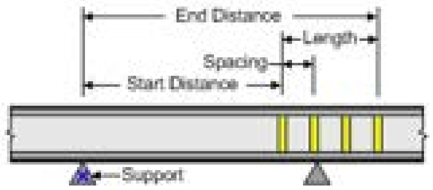
Bracing

Apply to Entire Structure: No



Spacing	Support	Start Distance	Length
14.438 ft	1	0.688 ft	14.438 ft
14.438 ft	1	34.875 ft	14.438 ft

Transverse Stiffeners



Stiffener Group	Spacing	Support	Start Distance	Length
Web Stiffeners	3 ft	1	3.104 ft	3 ft
Web Stiffeners	4 ft	1	6.604 ft	4 ft
Web Stiffeners	4.507 ft	1	18.042 ft	27.042 ft

Bearing Stiffeners

Apply to Entire Structure: No

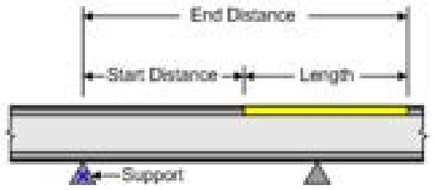
Support	Stiffener Group
1	Not Assigned
2	Not Assigned

Longitudinal Stiffeners

No longitudinal stiffener schedules have been defined.

Lateral Support

Apply to Entire Structure: Yes



Support	Start Distance	Length
1	0 ft	50 ft

Cb Factors (Standard)

No Cb factors (LRFD) have been defined.

Cb Factors (LRFD)

No Cb factors (LRFD) have been defined.

Fatigue Stress (Standard)

No fatigue stress (standard) schedules have been defined.

Member Control

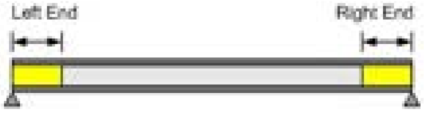
Steel

Flexural Resistance

Span	Compact Piers (Standard)	Ignore Eq. 6.10.7.1.2-3 (LRFD)
1	No	No

End Panel Distances

Top Span



Left of Top Span: -
Right of Top Span: -

Flange Local Buckling Resistance Adjustment

Standard Specifications: -
LRFD Specifications: -

Points of Interest

No points of interest have been defined.

Dead Loads

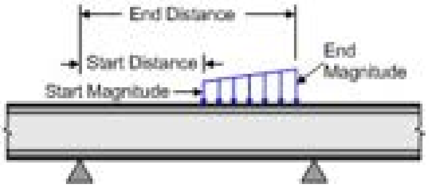
Uniform

Dead Load Type	Stage	Uniform Load
DC	1	-
DW	1	-
DU	1	-

Additional Self-weight

No additional self-weight dead loads have been defined.

Distributed



Dead Load Group	Support	Distributed Load (Start)		Distributed Load (End)	
		Distance	Magnitude	Distance	Magnitude
Vertical Web Angles	1	0.063 ft	0.019 kip / ft	49.875 ft	-

Concentrated

Dead Load Group	Support	Concentrated Load		
		Distance	Horizontal Force	Vertical Force
Girder Bracing	1	0.573 ft	-	0.169 kip
Girder Bracing	1	11.229 ft	-	0.169 kip
Girder Bracing	1	35.438 ft	-	0.169 kip

Girder Bracing	1	49.875 ft	-	0.169 kip
Bottom Flange Struts	1	5.328 ft	-	0.046 kip
Bottom Flange Struts	1	23.333 ft	-	0.046 kip
Bottom Flange Struts	1	42.656 ft	-	0.046 kip

Temperature

No temperature dead loads have been defined.

Settlement

Stage: 1

No settlement loads have been defined.

Pedestrian Load

Pedestrian Load: -

Wheel Fractions (Standard)

Moment

No moment wheel fractions have been defined.

Shear

No shear wheel fractions have been defined.

Deflection

No deflection wheel fractions have been defined.

Reaction

Apply to entire structure: No

Support	mg Single-Lane			mg Multi-Lane		
	Moment	Shear	Deflection	Moment	Shear	Deflection
1	-	-	-	-	-	-
2	-	-	-	-	-	-

```
CRITICAL RATING FACTOR SUMMARY: Design Load Inventory

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.        Description                               Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       110.0000     STRENGTH I            1.49      53.47
                                                                                 Shear
                                                                                 Minimum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)    25.00       110.0000     STRENGTH I            1.74      43.41
                                                                                 Shear
                                                                                 Minimum Effects

 15   HL-93-FAT                                (FAT)    36.00       110.0000     FATIGUE I             8.35     300.68
                                                                                 Shear Stress
                                                                                 Minimum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       110.0000     STRENGTH I            1.49      53.47

CRITICAL RATING FACTOR SUMMARY: Design Load Operating

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.        Description                               Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       110.0000     STRENGTH I-O          1.93      69.32
                                                                                 Shear
                                                                                 Minimum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)    25.00       110.0000     STRENGTH I-O          2.25      56.28
                                                                                 Shear
                                                                                 Minimum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       110.0000     STRENGTH I-O          1.93      69.32

CRITICAL RATING FACTOR SUMMARY: Legal Load

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.        Description                               Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

  3   TYPE3                                    (TRK)    25.00       110.0000     STRENGTH I            2.97      74.24
                                                                                 Shear
                                                                                 Minimum Effects

  4   TYPE3S2                                  (TRK)    36.00       110.0000     STRENGTH I            2.82     101.54
                                                                                 Shear
                                                                                 Minimum Effects

  5   TYPE3-3                                  (TRK)    40.00       110.0000     STRENGTH I            2.95     117.95
                                                                                 Shear
                                                                                 Minimum Effects

  6   NRL-MIN                                  (TRK)    40.00       110.0000     STRENGTH I            2.19      87.62
                                                                                 Shear
                                                                                 Minimum Effects

  7   NRL-MAX                                  (TRK)    40.00       110.0000     STRENGTH I            2.23      89.20
                                                                                 Shear
                                                                                 Minimum Effects

  8   SU4                                      (TRK)    27.00       110.0000     STRENGTH I            2.69      72.52
                                                                                 Shear
                                                                                 Minimum Effects

  9   SU5                                      (TRK)    31.00       110.0000     STRENGTH I            2.42      75.17
                                                                                 Shear
                                                                                 Minimum Effects

 10   SU6                                      (TRK)    34.75       110.0000     STRENGTH I            2.30      80.08
```

```
                                                                                 Shear
                                                                                 Minimum Effects

 11   SU7                                      (TRK)    38.75       110.0000     STRENGTH I            2.21      85.64
                                                                                 Shear
                                                                                 Minimum Effects

 16   EV2                                      (TRK)    28.75       110.0000     STRENGTH I            2.51      72.16
                                                                                 Shear
                                                                                 Minimum Effects

 17   EV3                                      (TRK)    43.00       110.0000     STRENGTH I            1.70      73.04
                                                                                 Shear
                                                                                 Minimum Effects
.......................................................................................................................

Crit  EV3                                      (TRK)    43.00       110.0000     STRENGTH I            1.70      73.04

CRITICAL RATING FACTOR SUMMARY: Permit Load

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.       Description                                Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

 12   HP1                                      (PTK)    60.00       105.0000     SERVICE II            2.83     170.02
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 13   HP2                                      (PTK)    78.55       105.0000     SERVICE II            3.24     254.60
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 14   HP3                                      (PTK)   104.95       104.0000     SERVICE II            3.97     416.91
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange
.......................................................................................................................

Crit  HP1                                      (PTK)    60.00       105.0000     SERVICE II            2.83     170.02
```

BRASS™
Wyoming Department of Transportation

BRASS-GIRDER™ Input Parameters

Version Information
Girder UI: 7.8.0.3001
Girder XML: 7.8.0.3001
BRASS™ XML: 1.8.0.3001

Administration

Project ID: 8780-06
Project Title: HDOT Statewide Bridge Load Ratings

Bridge ID: 1000190308146
Bridge Name: Nanue Stream
Route Name: 00019 Hawaii Belt Road
Reference Marker: 18

Title 1: Nanue Stream Bridge
Title 2: Load Rating for Steel Interior Girder Span 2 (G3-2)
Date: 2017 4 21

Agency: HDOT Highways Division
Designer/Rater: Moffatt & Nichol (JU)
Reviewer:

Comments:

Bridge Notes

MATERIAL PROPERTIES
Concrete
Weight = 0.160 kcf (HDOT Design Criteria for Bridges and Structures [HDOT] 5.01)
Strength = 3 ksi (Record Drawings: Class A-1)
Elastic Modulus = 3,880 ksi (AASHTO LRFD [LRFD] Eqn 5.4.2.4-1, Use 0.150 kcf per HDOT 5.01)
Reinforcing Steel
Yield Strength = 33 ksi (Unknown, Manual for Bridge Evaluation [MBE] Table 6A.5.2.2-1)
Elastic Modulus = 29,000 ksi (LRFD 5.4.3.2)

BRIDGE PROPERTIES (RECORD DRAWINGS)
Span 1 = 51 ft
Span 2 = 50 ft
Span 3 = 40 ft
Span 4 = 72 ft
Span 5 = 40 ft
Span 6 = 72 ft
Span 7 = 40 ft
Span 8 = 72 ft
Span 9 = 40 ft
Span 10 = 51 ft
Width = 38.5 ft
Deck Thickness = 9 in min
No. of Griders = 4
Girder Spacing = 9 ft, 7.5 ft, 9 ft
Girder Width = 12 3/8"
Girder Depth = 6'-6 1/2"
Surface Roughness = 3.0 (2015 Bridge Inspectinon Report)
Condition Factor = 1.0 (HDOT 5.04, 2015 Bridge Inspection Report indicates Condition Rating of 7)
System Factor = 1.0 (HDOT 5.05,)

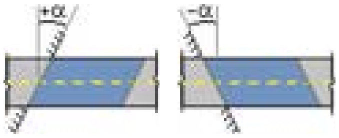
LIVE LOADS
LRFD Live Load (MBE Appendix C6A)
Truck and Tandem Lane Load = 0.64 klf
AASHTO Legal Loads (MBE Appendix D6A)
Type 3
Type 3S2
Type 3-3
Notional Rating Load [NRL]
Legal Lane Load = 0.2 klf
SU4
SU5
SU6
SU7
HDOT Hawaii Standard Single Trip Permit Loads (HDOT 5.06)
No lane load provided, vehicles allowed to trave in any lane
HP1
HP2
HP3
Dynamic Load Allowance (HDOT 5.03)
Spans > 40 ft
Wearing Surface: 3 (Assumed)
Design Loads: 33%
Legal Loads: 10%
Permit Loads: 10%
Scale Factor (HDOT 5.06)
Hawaii Standard Single Trip Permit Vehicle analysis assumes only one permit load on the bridge which allows the use of a single-lane distribution factor. When using the single-lane LRFD distribution factor, the 1.2 multiple prescence factor may shall be divided out from the distribtion factor equations.

Control

Structure

Structure Type: GirderLine
Define Deck Cross Section: Yes
Number of Members: 4

Skew Angle: 0 °



Analysis Model Type: Beam
Number of Top Spans: 1

Spans

Span	Length
1	50 ft

Structure Material: Steel
Beam Type: Builtup
Composite Structure: No
Deck Material: Concrete

Analysis

Unit System: US
Analysis Method: LRFD
Analysis Type: Rating
Number of Stages: 1
Member of Interest: 3
Model Element Type: Stepped
Point of Interest Generation Control: Tenth
Live-load Distribution Factor Application: AnalysisPoint

Interpolate Reinforcement: No
Calculate Effective Width: No

Input

Symmetry

Component	Symmetric
Beam Profile	No
Deck Profile	No
Shear Connectors	No
Transverse Stiffeners	No
Bearing Stiffeners	No
Longitudinal Stiffeners	No
Bracing (Member)	No
Lateral Support	No
Cb Factors (Std)	No
Cb Factors (LRFD)	No
Fatigue Stress (Std)	No
Beam Wheel Fractions (Std)	No
Reaction Wheel Fractions (Std)	No
Beam Distribution Factors (LRFD)	No
Reaction Distribution Factors (LRFD)	No

Simplified Standard Wheel Fractions: No
Merge Beam/Deck Profile Schedules: Yes

Distribution

Perform Dead Load Distribution: Yes
Calculate LRFD Live Load Distribution Factors: Yes

Dead Load Distribution Methods

Stage	Method
1	Tributary area

Live Load Distribution (LRFD)

Distribution Method: AASHTO LRFD
Cross Section Code: a1
Max. Number of Lanes Loaded: Computed
Slab Thickness Type: Structural
Set eg = 0 for Non-composite: No
Apply Skew to Lever Rule Override: Yes
Apply Skew to Ridgid Rule Override: Yes
Use Constants from Table 4.6.2.2.1-2: No

Libraries

Section Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Sections.bls
Vehicle Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Vehicles.blv

Output

Primary Output

Action Output Level: DL+LL+CONC
Action Locations: 10thPoints

General

Member Properties: Yes
Load Combinations: Yes
Load and Resistance Factors: Yes

Warnings: Yes
Camber: No
Critical Design Ratios / Rating Factors: Expanded

Live Load

Truck Positions: No
Variable Axle Spacing: No
Live Load Settings: Yes

Live Load Combinations: Yes
Live Load Details: Yes
Impact (LFD): No

Stage

Stage	Output
1	Yes

Dead Load

Member Self Load: Yes
Distributed Dead Loads: Yes
Concentrated Dead Loads: Yes

Temperature Change: No
Settlements: No

Load Distribution

Dead Load Distribution: Yes
Live Load Distribution: Yes

Intermediate Output

Intermediate Output Level: Full
Effective Width: Yes
Floorbeam Lane Position: No

Points of Interest

Specification Checks: Yes
Load Factoring/Combinations: Yes

Load Distribution

Dead Load: Yes
Live Load: Yes

Limit State Output (LRFD)

Limit State	Specification Check	Load Combination
Strength I	Yes	Yes
Strength II	Yes	Yes
Strength IV	No	No
Service I	No	No
Service II	Yes	Yes
Fatigue I	Yes	Yes
Fatigue II	No	No

Load Combination Output (LFD)

LFD Load Combo	Specification Check	Load Combination

Combo I	No	No
Combo IB	No	No
Combo I Overload	No	No
Combo IB Overload	No	No
Combo I Service	No	No
Combo IB Service	No	No
Combo Fatigue	No	No

Intermediate Output (cont.)

Steel

Transverse Stiffeners: No
Bearing Stiffeners: No
Longitudinal Stiffeners: No

Results Tables

X-Y Plot Action Tables: No
Specification Check Results Tables: No
Mesh Plot Files: No

BRASS-PAD™ Data Transfer File: No

Influence

Output influence lines for: None
Ordinate Divisor: 1

Factors

Load Factors (LRFD)

Limit State	DC		DW		DU		TU	
	max	min	max	min	max	min	max	min
Strength I	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength II	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength IV	-	-	-	-	-	-	-	-
Service I	-	-	-	-	-	-	-	-
Service II	1	1	1	1	1	1	-	-
Fatigue I	-	-	-	-	-	-	-	-
Fatigue II	-	-	-	-	-	-	-	-

Load Factors (LRFD) (continued)

Limit State	LL				SE		PS		DS	
	Design		Legal	Permit						
	Inventory	Operating			max	min	max	min	max	min
Strength I	1.75	1.35	1.45	0	-	-	-	-	-	-
Strength II	-		0	1.2	-	-	-	-	-	-
Strength IV	-		-	-	-	-	-	-	-	-
Service I	-		-	-	-	-	-	-	-	-
Service II	1.3	1	1.3	1	-	-	-	-	-	-
Fatigue I	0.75		-	-	-	-	-	-	-	-
Fatigue II	-		-	-	-	-	-	-	-	-

Load Modifiers (LRFD)

Limit State	Ductility	Redundancy	Importance	Combined Product	
				max	min
Strength I	1	1	1	-	-
Strength II	1	1	1	-	-
Strength IV	1	1	1	-	-
Service I	1	1	1	-	-
Service II	1	1	1	-	-
Fatigue I	1	1	1	-	-
Fatigue II	1	1	1	-	-

Resistance Factors (LRFD)

Resistance Factors

Type	Value
φ Flexure	1
φ Shear	1
φ Bearing	1
φ Compression	0.95
φ Shear Connectors	0.85
φ Fatigue	1

System/Total Modifiers

Limit State	Resistance Type	System	Total
Strength	Flexure	1	-
Strength	Shear	1	-
Strength	Bearing	1	-
Strength	Compression	1	-
Strength	Shear Connectors	1	-
Strength	Longitudinal Reinforcement	1	-
Service	Flexure	1	-
Fatigue	Fatigue	1	-

Condition Modifiers

Limit State	Condition
Strength	1
Service	1
Fatigue	1

Load Factors (LFD)

Load Combo	γ	LL	DC	DW	DU	TU	SE	PS	DS
I	-	-	-	-	-	-	-	1	1
IB	-	-	-	-	-	-	-	1	1
I-Overload	-	-	-	-	-	-	-	1	1
IB-Overload	-	-	-	-	-	-	-	1	1

I-Service	-	-	-	-	-	-	-	1	1
IB-Service	-	-	-	-	-	-	-	1	1
Fatigue	-	-	-	-	-	-	-	1	1

Capacity Reduction Factors (LFD)

Factor	Value
φ Flexure	-
φ Shear	-
φ Fatigue	-

Materials

Steel

ID	Name	Yield Stress	Tensile Strength	Modulus of Elasticity	Density	Thermal Expansion Coefficient
1	Salvaged Girder	30 ksi	60 ksi	29000 ksi	0.49 kcf	6.5E-06 °F^{-1}

Concrete

ID	Name	28 Day Compressive Strength	Modulus of Elasticity	Density	Modulus of Rupture	Modulus of Rupture (VCI Method)	Thermal Expansion Coefficient
1	1949 Class A-1	3 ksi	3880 ksi	0.16 kcf	-	-	6E-06 °F^{-1}

Dead Load Groups

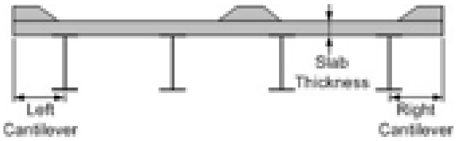
Groups

ID	Name	Stage	Type	Description
1	Concrete Railing	1	DC	Top Rail, Bottom Rail, Post
2	Sidewalk / Shoulder	1	DC	
3	AC Pavement	1	DW	
4	Girder Bracing	1	DC	X-Bracing with Steel Angles in the Outer Bays
5	Bottom Flange Bracing	1	DC	Steel Angles Diagonal Bracing in the Interior Bay
6	Vertical Web Angles	1	DC	Steel Angles Spaced at Intervals
7	Waterlines	1	DU	Assumed 8" Waterlines
8	Monorail	1	DC	6" Monorail
9	Bottom Flange Struts	1	DC	Bottom Flange Struts out of Steel Angles and Plates in Outer Bays

Deck Geometry

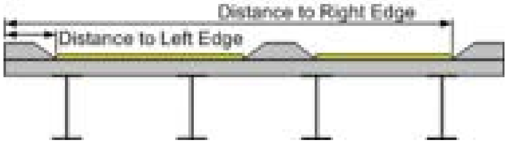
Deck

Deck Thickness: 9 in.
Left Cantilever Length: 6.5 ft
Right Cantilever Length: 6.5 ft
Equal Member Spacing: No



Travelway Locations

Distance to Left Edge: 5.25 ft
Distance to Right Edge: 33.25 ft

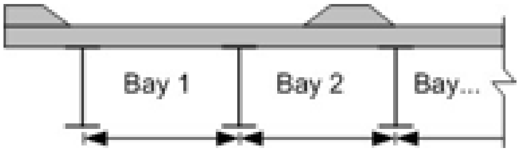


Sacrificial Topping

Thickness: -
Dead Load Type: DC

Member Spacing

Bay #	Spacing
1	9 ft
2	7.5 ft
3	9 ft



Soffits

No soffits have been defined.

Appurtenances

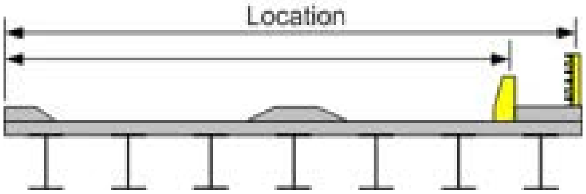
No appurtenances have been defined.

Deck Loads

Materials/Stages

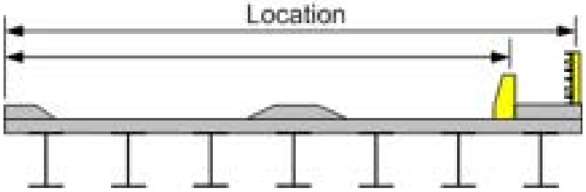
Deck Material: 1949 Class A-1
Curb & Median Material: Not Assigned
Wearing Surface Weight: -
Slab Stage: 1
Curb Stage: 1
Median Stage: 1
Wearing Surface Stage: 1

Line Loads



Dead Load Group	Line Load	Load Location
Concrete Railing	0.319 kip / ft	9.232 ft
Concrete Railing	0.319 kip / ft	37.577 ft
Waterlines	0.224 kip / ft	38.5 ft
Monorail	0.016 kip / ft	34 ft

Uniform Loads



Dead Load Group	Uniform Load	Load Location	Load Width
Sidewalk / Shoulder	0.007 ksf	0 ft	5.25 ft
Sidewalk / Shoulder	0.003 ksf	5.25 ft	2 ft
AC Pavement	0.018 ksf	7.25 ft	24 ft
Sidewalk / Shoulder	0.003 ksf	31.25 ft	2 ft
Sidewalk / Shoulder	0.007 ksf	33.25 ft	5.25 ft

Live Loads

Live Load Control

Direction Control:	Up+Down
Standard Live Loads:	None
Wheel Advancement Denominator:	100
ADTT:	5000
ADTT for Single Lane:	2000
Multiple Presence Adjustment:	-
% of Dynamic Load Allowance (Impact):	100 %
Fixed Impact (STD):	-

Dynamic Load Allowance (LRFD)

Design/Rating Procedure	Truck	Lane	Fatigue
Design	33 %	0 %	15 %
Legal	33 %	0 %	0 %
Permit	33 %	0 %	0 %

Special Vehicles

Axle Vehicles

No axle vehicles have been defined.

Lane Vehicles

No lane vehicles have been defined.

Definitions (STD)

No standard live load definitions have been defined.

Definitions (LRFD)

Definition 1

Code:	HL-93-TRUCK
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 2

Code:	HL-93-TANDEM
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-

Lanes Loaded: Critical
Notional Load: Yes
Fixed DLA: -

Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 3

Code: HL-93-LANE
Type: DesignLane
Design Rating: Design
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: Yes
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 4

Code: TYPE3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 5

Code: TYPE3S2
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 6

Code: TYPE3-3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-

Limit State	gamma LL	gamma LL Operating
Fatigue II	-	-

Definition 7

Code:	NRL-MIN
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 8

Code:	NRL-MAX
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 9

Code:	SU4
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 10

Code:	SU5
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 11

Code:	SU6
Type:	GeneralTruck

Live Load Factor Overrides

Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 12

Code: SU7
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 13

Code: HP1
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 14

Code: HP2
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 15

Code: HP3
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-

Fixed DLA: -

Limit State	gamma LL	gamma LL Operating
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 16

Code:	HL-93-FAT
Type:	FatigueTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 17

Code:	EV2
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 18

Code:	EV3
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

General Combinations (LRFD)

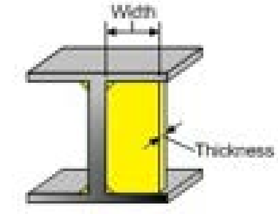
Standard Combo	Truck	Lane	Combination Factors	
			Truck	Lane
No	**HL-93-TRUCK**	**HL-93-LANE**	1	1
No	**HL-93-TANDEM**	**HL-93-LANE**	1	1

Deflection Combinations (LRFD)

No Deflection Combinations (LRFD) have been defined.

Component Groups

Transverse Stiffeners



ID	Name	Width	Thickness	Type	Type Factor	Material
1	Web Stiffeners	5 in.	0.375 in.	Single Angles	-	**Salvaged Girder**

Bearing Stiffeners

No bearing stiffener groups have been defined.

Longitudinal Stiffeners

No longitudinal stiffener groups have been defined.

Specification Control

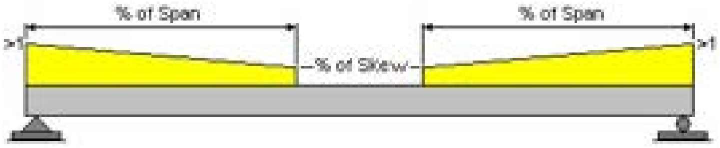
General

Lane Geometry

Design Vehicle Lane Width: 12 ft
Vehicle Width: 10 ft
Wheel Spacing: 6 ft
Encroachment Distance: -

Load Factors Control (LRFD): Use maximum and minimum load factors

Skew Factors



Span #	% of Span	% of Skew
1	-	-

Steel

Use Appendix A6 (LRFD): No
Allow Plastic Analysis: No
Override Longitudinal Stiffeners: No
Slab thickness for longitudinal shear force: Structural
Slab thickness for minimum negative flexure concrete deck reinforcement: Structural

Fatigue

AASHTO LRFD Table 6.6.1.2.5-2

% of Span: -
Span Length: 40 ft

Stress Range in Longitudinal Reinforcement Over the Piers: 10 ksi

Detail Categories (LRFD)

Detail Category	Constant, A x 10^8	Constant Amplitude Fatigue Threshold
A	-	-

B	-	-
B'	-	-
C	-	-
C'	-	-
D	-	-
E	-	-
E'	-	-

Limit State Map

Limit State Maps (LRFD)

Limit State	Design Review			Rating		
	Design Load	Legal Load	Permit Load	Design Load	Legal Load	Permit Load
Strength I	No	No	No	Inventory/Operating	Yes	No
Strength II	No	No	No	Exclude	No	Yes
Strength IV	No	No	No	Exclude	No	No
Service I	No	No	No	Exclude	No	No
Service II	No	No	No	Inventory/Operating	Yes	Yes
Service III	No	No	No	Exclude	No	No
Fatigue I	No	No	No	Inventory	No	No
Fatigue II	No	No	No	Exclude	No	No

Load Combo Maps (LFD)

Load Combo	Design Review	Rating
I	No	Exclude
IB	No	Exclude
I-Overload	No	Exclude
IB-Overload	No	Exclude
I-Service	No	Exclude
IB-Service	No	Exclude
Fatigue	No	Exclude

Spec. Check Map (Strength)

LRFD Specification Check Maps

Design Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No

Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Design Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	Yes	No
Shear	Yes	No	No
Bearing	Yes	Yes	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	Yes	No
Shear	Yes	No	No
Bearing	Yes	Yes	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	Yes	No
Shear	Yes	No	No
Bearing	Yes	Yes	No
Flexural Stress In Longitudinal Stiffener	No	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		
Flexural Stress In Longitudinal Stiffener	No	No		

Rating

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		

Flexural Stress In Longitudinal Stiffener	No	No

Spec. Check Map (Service)

LRFD Specification Check Maps

Design Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Legal Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Permit Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Design Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Legal Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Permit Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

LFD Specification Check Maps

Design Review

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Rating

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Spec. Check Map (Fatigue)

LRFD Specification Check Maps

Design Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Legal Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Permit Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Design Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	Yes	No
Fatigue of Shear Connectors	Yes	No
Fatigue Shear Range of Shear Connectors	Yes	No
Fatigue of Special Points	Yes	No
Fatigue Shear	Yes	No

Legal Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No

Fatigue Shear	No	No

Permit Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Rating

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Member

Member Notes

No member notes have been defined.

Member Materials

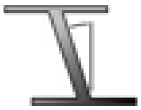
Beam

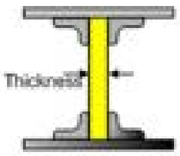
Beam Material: Salvaged Girder

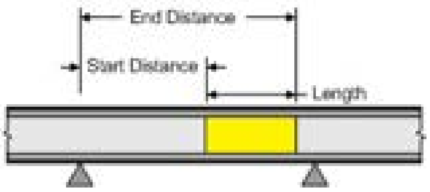
Beam Profile

Web

Apply to Entire Structure: Yes
Web Angle: -





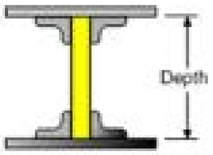


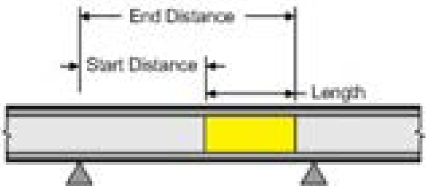
Thickness	Material	Support Number	Start Distance	Length

0.375 in.	**Salvaged Girder**	1	0 ft	50 ft

Web Depth

Apply to Entire Structure: Yes

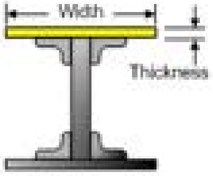


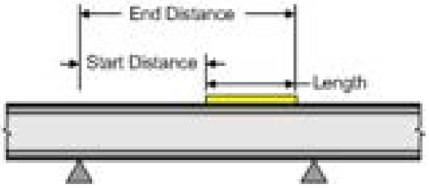


Start Depth	Web Variation	End Depth	Support Number	Start Distance	Length
78 in.	Linear	78 in.	1	0 ft	50 ft

Top Cover Plate

Apply to Entire Structure: No

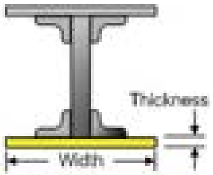




Start of Range			End of Range						
Width	Thickness	Gap Thickness	Width	Thickness	Gap Thickness	Material	Support Number	Start Distance	Length
16 in.	0.438 in.	-	-	-	-	**Salvaged Girder**	1	7.292 ft	35.417 ft

Bottom Cover Plate

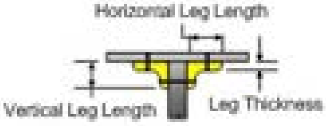
Apply to Entire Structure: No

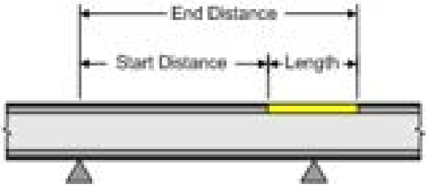


Start of Range			End of Range						
Width	Thickness	Gap Thickness	Width	Thickness	Gap Thickness	Material	Support Number	Start Distance	Length
16 in.	0.438 in.	-	-	-	-	**Salvaged Girder**	1	7.292 ft	35.417 ft

Top Angles

Apply to Entire Structure: Yes



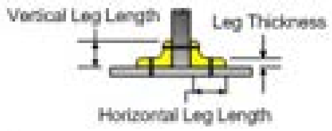


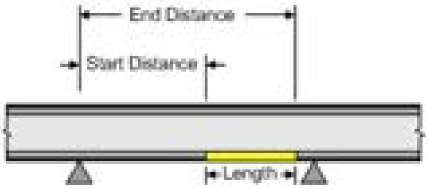
Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length

6 in.	6 in.	0.438 in.	**Salvaged Girder**	1	0 ft	50 ft

Bottom Angles

Apply to Entire Structure: Yes





Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length
6 in.	6 in.	0.438 in.	**Salvaged Girder**	1	0 ft	50 ft

Hinges

No hinges have been defined.

Special Locations

No special locations have been defined.

Supports

Support Conditions

Support	Support Restraint		
	Horizontal	Vertical	Rotational
1	Restrained	Restrained	Free
2	Restrained	Restrained	Free

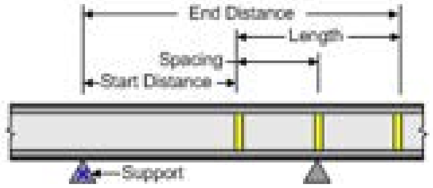
Spring Constants

Support	Spring Constants		
	Horizontal	Vertical	Rotational
1	-	-	-
2	-	-	-

Schedules

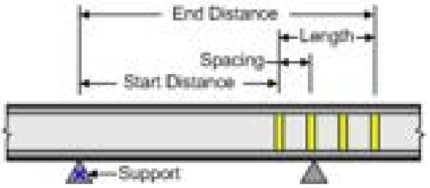
Bracing

Apply to Entire Structure: No



Spacing	Support	Start Distance	Length
14.438 ft	1	0.688 ft	14.438 ft
14.438 ft	1	34.875 ft	14.438 ft

Transverse Stiffeners



Stiffener Group	Spacing	Support	Start Distance	Length
Web Stiffeners	3.656 ft	1	3.979 ft	7.313 ft
Web Stiffeners	3.917 ft	1	18.958 ft	3.917 ft
Web Stiffeners	3.917 ft	1	27.125 ft	3.917 ft
Web Stiffeners	3.656 ft	1	38.708 ft	7.313 ft

Bearing Stiffeners

Apply to Entire Structure: No

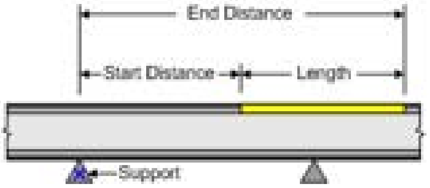
Support	Stiffener Group
1	Not Assigned
2	Not Assigned

Longitudinal Stiffeners

No longitudinal stiffener schedules have been defined.

Lateral Support

Apply to Entire Structure: Yes



Support	Start Distance	Length
1	0 ft	50 ft

Cb Factors (Standard)

No Cb factors (LRFD) have been defined.

Cb Factors (LRFD)

No Cb factors (LRFD) have been defined.

Fatigue Stress (Standard)

No fatigue stress (standard) schedules have been defined.

Member Control

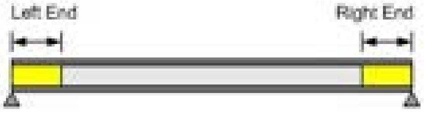
Steel

Flexural Resistance

Span	Compact Piers (Standard)	Ignore Eq. 6.10.7.1.2-3 (LRFD)
1	No	No

End Panel Distances

Top Span



Left of Top Span: -
Right of Top Span: -

Flange Local Buckling Resistance Adjustment

Standard Specifications: -
LRFD Specifications: -

Points of Interest

No points of interest have been defined.

Dead Loads

Uniform

Dead Load Type	Stage	Uniform Load
DC	1	-
DW	1	-
DU	1	-

Additional Self-weight

No additional self-weight dead loads have been defined.

Distributed

Dead Load Group	Support	Distributed Load (Start)		Distributed Load (End)	
		Distance	Magnitude	Distance	Magnitude
Bottom Flange Bracing	1	0.063 ft	0.009 kip / ft	49.875 ft	-
Vertical Web Angles	1	0.063 ft	0.019 kip / ft	49.875 ft	-
Bottom Flange Struts	1	0.063 ft	0.009 kip / ft	49.875 ft	-

Concentrated

Dead Load Group	Support	Concentrated Load		
		Distance	Horizontal Force	Vertical Force
Girder Bracing	1	0.573 ft	-	0.169 kip

Girder Bracing	1	11.229 ft	-	0.169 kip
Girder Bracing	1	35.438 ft	-	0.169 kip
Girder Bracing	1	49.875 ft	-	0.169 kip
Bottom Flange Struts	1	5.328 ft	-	0.046 kip
Bottom Flange Struts	1	23.333 ft	-	0.046 kip
Bottom Flange Struts	1	42.656 ft	-	0.046 kip

Temperature

No temperature dead loads have been defined.

Settlement

Stage: 1

No settlement loads have been defined.

Pedestrian Load

Pedestrian Load: -

Wheel Fractions (Standard)

Moment

No moment wheel fractions have been defined.

Shear

No shear wheel fractions have been defined.

Deflection

No deflection wheel fractions have been defined.

Reaction

Apply to entire structure: No

Support	mg Single-Lane			mg Multi-Lane		
	Moment	Shear	Deflection	Moment	Shear	Deflection
1	-	-	-	-	-	-
2	-	-	-	-	-	-

```
                                            BRASS-GIRDER  Version 7.8.1
Agency     : HDOT Highways Division                                                                    Page:        556
Engineer   : Moffatt & Nichol (JU)                                                                     Date: 08/19/2017
Bridge Name: 1000190308146         Nanue Stream                                                        Time:    7:43 PM
Input File : .. EVs\Nanue Stream Bridge (Bridge No. 001000190308146)\G3-2\001000190308146_G3-2_NanueStream.girder
Output File: ..S - EVs\Nanue Stream Bridge (Bridge No. 001000190308146)\G3-2\001000190308146_G3-2_NanueStream.out
                                                 Nanue Stream Bridge
                                 Load Rating for Steel Interior Girder Span 2 (G3-2)

CRITICAL RATING FACTOR SUMMARY: Design Load Inventory

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.        Description                               Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       100.0000     STRENGTH I             2.08       74.94
                                                                                 Shear
                                                                                 Maximum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)    25.00       110.0000     STRENGTH I             2.43       60.85
                                                                                 Shear
                                                                                 Minimum Effects

 15   HL-93-FAT                                (FAT)    36.00       103.0000     FATIGUE I             11.02      396.61
                                                                                 Shear Stress
                                                                                 Maximum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       100.0000     STRENGTH I             2.08       74.94

CRITICAL RATING FACTOR SUMMARY: Design Load Operating

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.        Description                               Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       100.0000     STRENGTH I-O           2.70       97.14
                                                                                 Shear
                                                                                 Maximum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)    25.00       110.0000     STRENGTH I-O           3.16       78.88
                                                                                 Shear
                                                                                 Minimum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       100.0000     STRENGTH I-O           2.70       97.14

CRITICAL RATING FACTOR SUMMARY: Legal Load

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.        Description                               Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

  3   TYPE3                                    (TRK)    25.00       105.0000     SERVICE II             3.99       99.83
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

  4   TYPE3S2                                  (TRK)    36.00       100.0000     STRENGTH I             3.95      142.31
                                                                                 Shear
                                                                                 Maximum Effects

  5   TYPE3-3                                  (TRK)    40.00       100.0000     STRENGTH I             4.13      165.31
                                                                                 Shear
                                                                                 Maximum Effects

  6   NRL-MIN                                  (TRK)    40.00       105.0000     SERVICE II             2.55      101.82
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

  7   NRL-MAX                                  (TRK)    40.00       105.0000     SERVICE II             2.63      105.02
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

  8   SU4                                      (TRK)    27.00       105.0000     SERVICE II             3.47       93.77
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

  9   SU5                                      (TRK)    31.00       105.0000     SERVICE II             3.21       99.50
```

```
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 10   SU6                                        (TRK)    34.75       105.0000     SERVICE II             2.88     100.21
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 11   SU7                                        (TRK)    38.75       105.0000     SERVICE II             2.67     103.50
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 16   EV2                                        (TRK)    28.75       106.0000     SERVICE II             3.48      99.91
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 17   EV3                                        (TRK)    43.00       105.0000     SERVICE II             2.26      97.14
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange
........................................................................................................................

Crit  EV3                                        (TRK)    43.00       105.0000     SERVICE II             2.26      97.14

CRITICAL RATING FACTOR SUMMARY: Permit Load

 Live Load Combination                                  Total     Controlling    Limit State           Rating     Load
 No.        Description                               Vehicle Wt.   Point of       Action              Factor    Rating
                                                        (tons)      Interest      Location                       (tons)
========================================================================================================================

 12   HP1                                        (PTK)    60.00       105.0000     SERVICE II             3.74     224.64
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 13   HP2                                        (PTK)    78.55       105.0000     SERVICE II             4.28     336.40
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 14   HP3                                        (PTK)   104.95       104.0000     SERVICE II             5.22     547.97
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange
........................................................................................................................

Crit  HP1                                        (PTK)    60.00       105.0000     SERVICE II             3.74     224.64
```

BRASS-GIRDER™ Input Parameters

Version Information

Girder UI:	7.8.0.3001
Girder XML:	7.8.0.3001
BRASS™ XML:	1.8.0.3001

Administration

Project ID:	8780-06
Project Title:	HDOT Statewide Bridge Load Ratings
Bridge ID:	1000190308146
Bridge Name:	Nanue Stream
Route Name:	00019 Hawaii Belt Road
Reference Marker:	18
Title 1:	Nanue Stream Bridge
Title 2:	Load Rating for Steel Exterior Girder Span 3 (G4-3)
Date:	2017 4 21
Agency:	HDOT Highways Division
Designer/Rater:	Moffatt & Nichol (JU)
Reviewer:	
Comments:	

Bridge Notes

MATERIAL PROPERTIES
Concrete
Weight = 0.160 kcf (HDOT Design Criteria for Bridges and Structures [HDOT] 5.01)
Strength = 3 ksi (Record Drawings: Class A-1)
Elastic Modulus = 3,880 ksi (AASHTO LRFD [LRFD] Eqn 5.4.2.4-1, Use 0.150 kcf per HDOT 5.01)
Reinforcing Steel
Yield Strength = 33 ksi (Unknown, Manual for Bridge Evaluation [MBE] Table 6A.5.2.2-1)
Elastic Modulus = 29,000 ksi (LRFD 5.4.3.2)

BRIDGE PROPERTIES (RECORD DRAWINGS)
Span 1 = 51 ft
Span 2 = 50 ft
Span 3 = 40 ft
Span 4 = 72 ft
Span 5 = 40 ft
Span 6 = 72 ft
Span 7 = 40 ft
Span 8 = 72 ft
Span 9 = 40 ft
Span 10 = 51 ft
Width = 38.5 ft
Deck Thickness = 9 in min
No. of Griders = 4
Girder Spacing = 9 ft, 7.5 ft, 9 ft
Girder Width = 12 3/8"
Girder Depth = 6'-6 1/2"
Surface Roughness = 3.0 (2015 Bridge Inspectinon Report)
Condition Factor = 1.0 (HDOT 5.04, 2015 Bridge Inspection Report indicates Condition Rating of 7)
System Factor = 1.0 (HDOT 5.05,)

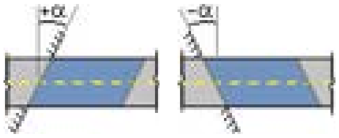
LIVE LOADS
LRFD Live Load (MBE Appendix C6A)
Truck and Tandem Lane Load = 0.64 klf
AASHTO Legal Loads (MBE Appendix D6A)
Type 3
Type 3S2
Type 3-3
Notional Rating Load [NRL]
Legal Lane Load = 0.2 klf
SU4
SU5
SU6
SU7
HDOT Hawaii Standard Single Trip Permit Loads (HDOT 5.06)
No lane load provided, vehicles allowed to trave in any lane
HP1
HP2
HP3
Dynamic Load Allowance (HDOT 5.03)
Spans > 40 ft
Wearing Surface: 3 (Assumed)
Design Loads: 33%
Legal Loads: 10%
Permit Loads: 10%
Scale Factor (HDOT 5.06)
Hawaii Standard Single Trip Permit Vehicle analysis assumes only one permit load on the bridge which allows the use of a single-lane distribution factor. When using the single-lane LRFD distribution factor, the 1.2 multiple prescence factor may shall be divided out from the distribtion factor equations.

Control

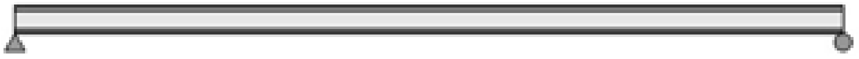
Structure

Structure Type: GirderLine
Define Deck Cross Section: Yes
Number of Members: 4

Skew Angle: 0 °



Analysis Model Type: Beam
Number of Top Spans: 1



Spans

Span	Length
1	40 ft

Structure Material: Steel
Beam Type: Builtup
Composite Structure: No
Deck Material: Concrete

Analysis

Unit System: US
Analysis Method: LRFD
Analysis Type: Rating
Number of Stages: 1
Member of Interest: 4
Model Element Type: Stepped
Point of Interest Generation Control: Tenth
Live-load Distribution Factor Application: AnalysisPoint

Interpolate Reinforcement: No
Calculate Effective Width: No

Input

Symmetry

Component	Symmetric
Beam Profile	No
Deck Profile	No
Shear Connectors	No
Transverse Stiffeners	No
Bearing Stiffeners	No
Longitudinal Stiffeners	No
Bracing (Member)	No
Lateral Support	No
Cb Factors (Std)	No
Cb Factors (LRFD)	No
Fatigue Stress (Std)	No
Beam Wheel Fractions (Std)	No
Reaction Wheel Fractions (Std)	No
Beam Distribution Factors (LRFD)	No
Reaction Distribution Factors (LRFD)	No

Simplified Standard Wheel Fractions: No
Merge Beam/Deck Profile Schedules: Yes

Distribution

Perform Dead Load Distribution: Yes
Calculate LRFD Live Load Distribution Factors: Yes

Dead Load Distribution Methods

Stage	Method
1	Tributary area

Live Load Distribution (LRFD)

Distribution Method: AASHTO LRFD
Cross Section Code: a1
Max. Number of Lanes Loaded: Computed
Consider Rigid Method: No
Slab Thickness Type: Structural
Set eg = 0 for Non-composite: Yes
Apply Skew to Lever Rule Override: Yes
Apply Skew to Ridgid Rule Override: No
Use Constants from Table 4.6.2.2.1-2: No

Libraries

Section Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Sections.bls
Vehicle Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Vehicles.blv

Output

Primary Output

Action Output Level: DL+LL+CONC
Action Locations: 10thPoints

General

Member Properties: Yes
Load Combinations: Yes
Load and Resistance Factors: Yes
Warnings: Yes
Camber: No
Critical Design Ratios / Rating Factors: Expanded

Live Load

Truck Positions: Yes
Variable Axle Spacing: Yes
Live Load Settings: Yes
Live Load Combinations: Yes
Live Load Details: Yes
Impact (LFD): No

Stage

Stage	Output
1	Yes

Dead Load

Member Self Load: Yes
Distributed Dead Loads: Yes
Concentrated Dead Loads: Yes
Temperature Change: No
Settlements: No

Load Distribution

Dead Load Distribution: Yes
Live Load Distribution: Yes

Intermediate Output

Intermediate Output Level: Full
Effective Width: Yes
Floorbeam Lane Position: Yes

Points of Interest

Specification Checks: Yes
Load Factoring/Combinations: No

Load Distribution

Dead Load: Yes
Live Load: Yes

Limit State Output (LRFD)

Limit State	Specification Check	Load Combination
Strength I	Yes	Yes
Strength II	Yes	Yes
Strength IV	No	No
Service I	No	No
Service II	No	No
Fatigue I	No	No
Fatigue II	No	No

Load Combination Output (LFD)

LFD Load Combo	Specification Check	Load Combination

Combo I	No	No
Combo IB	No	No
Combo I Overload	No	No
Combo IB Overload	No	No
Combo I Service	No	No
Combo IB Service	No	No
Combo Fatigue	Yes	Yes

Intermediate Output (cont.)

Steel

Transverse Stiffeners: No
Bearing Stiffeners: No
Longitudinal Stiffeners: No

Results Tables

X-Y Plot Action Tables: No
Specification Check Results Tables: No
Mesh Plot Files: No

BRASS-PAD™ Data Transfer File: No

Influence

Output influence lines for: None
Ordinate Divisor: 1

Factors

Load Factors (LRFD)

Limit State	DC		DW		DU		TU	
	max	min	max	min	max	min	max	min
Strength I	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength II	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength IV	-	-	-	-	-	-	-	-
Service I	-	-	-	-	-	-	-	-
Service II	1	1	1	1	1	1	-	-
Fatigue I	-	-	-	-	-	-	-	-
Fatigue II	-	-	-	-	-	-	-	-

Load Factors (LRFD) (continued)

Limit State	LL				SE		PS		DS	
	Design		Legal	Permit						
	Inventory	Operating			max	min	max	min	max	min
Strength I	1.75	1.35	1.45	0	-	-	-	-	-	-
Strength II	-		0	1.2	-	-	-	-	-	-
Strength IV	-		-	-	-	-	-	-	-	-
Service I	-		-	-	-	-	-	-	-	-
Service II	1.3	1	1.3	1	-	-	-	-	-	-
Fatigue I	0.75		-	-	-	-	-	-	-	-

Fatigue II	-		-	-	-	-	-	-	-	-

Load Modifiers (LRFD)

Limit State	Ductility	Redundancy	Importance	Combined Product	
				max	min
Strength I	1	1	1	-	-
Strength II	1	1	1	-	-
Strength IV	1	1	1	-	-
Service I	1	1	1	-	-
Service II	1	1	1	-	-
Fatigue I	1	1	1	-	-
Fatigue II	1	1	1	-	-

Resistance Factors (LRFD)

Resistance Factors

Type	Value
φ Flexure	1
φ Shear	1
φ Bearing	1
φ Compression	0.95
φ Shear Connectors	0.85
φ Fatigue	1

System/Total Modifiers

Limit State	Resistance Type	System	Total
Strength	Flexure	1	-
Strength	Shear	1	-
Strength	Bearing	1	-
Strength	Compression	1	-
Strength	Shear Connectors	1	-
Strength	Longitudinal Reinforcement	1	-
Service	Flexure	1	-
Fatigue	Fatigue	1	-

Condition Modifiers

Limit State	Condition
Strength	1
Service	1
Fatigue	1

Load Factors (LFD)

Load Combo	γ	LL	DC	DW	DU	TU	SE	PS	DS
I	-	-	-	-	-	-	-	1	1
IB	-	-	-	-	-	-	-	1	1
I-Overload	-	-	-	-	-	-	-	1	1

IB-Overload	-	-	-	-	-	-	-	1	1
I-Service	-	-	-	-	-	-	-	1	1
IB-Service	-	-	-	-	-	-	-	1	1
Fatigue	-	-	-	-	-	-	-	1	1

Capacity Reduction Factors (LFD)

Factor	Value
φ Flexure	-
φ Shear	-
φ Fatigue	-

Materials

Steel

ID	Name	Yield Stress	Tensile Strength	Modulus of Elasticity	Density	Thermal Expansion Coefficient
1	Salvaged Girder	30 ksi	60 ksi	29000 ksi	0.49 kcf	6.5E-06 °F^{-1}

Concrete

ID	Name	28 Day Compressive Strength	Modulus of Elasticity	Density	Modulus of Rupture	Modulus of Rupture (VCI Method)	Thermal Expansion Coefficient
1	1949 Class A-1	3 ksi	3880 ksi	0.16 kcf	-	-	6E-06 °F^{-1}

Dead Load Groups

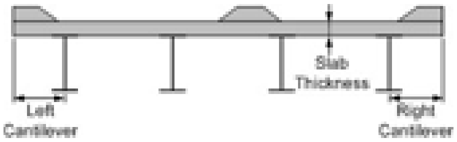
Groups

ID	Name	Stage	Type	Description
1	Concrete Railing	1	DC	Top Rail, Bottom Rail, Post
2	Sidewalk / Shoulder	1	DC	
3	AC Pavement	1	DW	
4	Girder Bracing	1	DC	X-Bracing with Steel Angles in the Outer Bays
5	Bottom Flange Bracing	1	DC	Steel Angles Diagonal Bracing in the Interior Bay
6	Vertical Web Angles	1	DC	Steel Angles Spaced at Intervals
7	Waterlines	1	DU	Assumed 8" Waterlines
8	Monorail	1	DC	6" Monorail
9	Bottom Flange Struts	1	DC	Bottom Flange Struts out of Steel Angles and Plates in Outer Bays

Deck Geometry

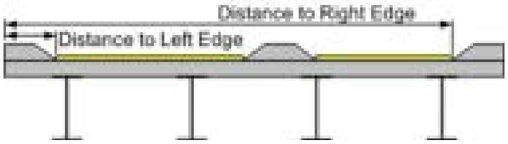
Deck

Deck Thickness: 9 in.
Left Cantilever Length: 6.5 ft
Right Cantilever Length: 6.5 ft
Equal Member Spacing: No



Travelway Locations

Distance to Left Edge: 5.25 ft
Distance to Right Edge: 33.25 ft

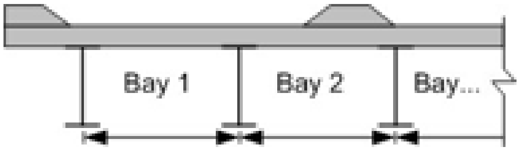


Sacrificial Topping

Thickness: -
Dead Load Type: DC

Member Spacing

Bay #	Spacing
1	9 ft
2	7.5 ft
3	9 ft



Soffits

No soffits have been defined.

Appurtenances

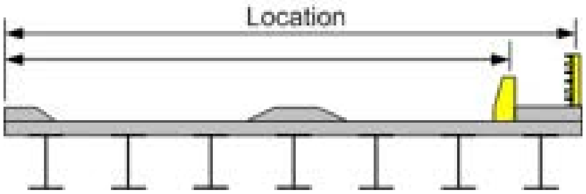
No appurtenances have been defined.

Deck Loads

Materials/Stages

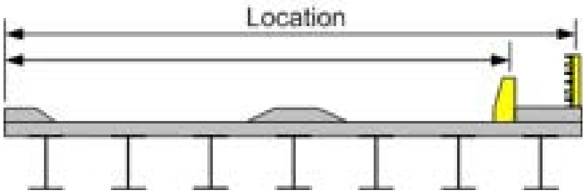
Deck Material: **1949 Class A-1**
Curb & Median Material: Not Assigned
Wearing Surface Weight: -
Slab Stage: 1
Curb Stage: 1
Median Stage: 1
Wearing Surface Stage: 1

Line Loads



Dead Load Group	Line Load	Load Location
Concrete Railing	0.319 kip / ft	0.923 ft
Concrete Railing	0.319 kip / ft	37.577 ft
Waterlines	0.224 kip / ft	38.5 ft
Monorail	0.016 kip / ft	34 ft

Uniform Loads



Dead Load Group	Uniform Load	Load Location	Load Width
Sidewalk / Shoulder	0.007 ksf	0 ft	5.25 ft
Sidewalk / Shoulder	0.003 ksf	5.25 ft	2 ft
AC Pavement	0.018 ksf	7.25 ft	24 ft
Sidewalk / Shoulder	0.003 ksf	31.25 ft	2 ft
Sidewalk / Shoulder	0.007 ksf	33.25 ft	5.25 ft

Live Loads

Live Load Control

Direction Control:	Up+Down
Standard Live Loads:	None
Wheel Advancement Denominator:	100
ADTT:	5000
ADTT for Single Lane:	2000
Multiple Presence Adjustment:	-
% of Dynamic Load Allowance (Impact):	100 %
Fixed Impact (STD):	-

Dynamic Load Allowance (LRFD)

Design/Rating Procedure	Truck	Lane	Fatigue
Design	33 %	0 %	15 %
Legal	33 %	0 %	0 %
Permit	33 %	0 %	0 %

Special Vehicles

Axle Vehicles

No axle vehicles have been defined.

Lane Vehicles

No lane vehicles have been defined.

Definitions (STD)

No standard live load definitions have been defined.

Definitions (LRFD)

Definition 1

Code:	HL-93-TRUCK
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 2

Code:	HL-93-TANDEM
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating

Scale Factor: -
Lanes Loaded: Critical
Notional Load: Yes
Fixed DLA: -

Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 3

Code: HL-93-LANE
Type: DesignLane
Design Rating: Design
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: Yes
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 4

Code: TYPE3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 5

Code: TYPE3S2
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 6

Code: TYPE3-3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-

Fatigue I	-	-
Fatigue II	-	-

Definition 7

Code: NRL-MIN
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 8

Code: NRL-MAX
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 9

Code: SU4
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 10

Code: SU5
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 11

Code: SU6

Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 12

Code: SU7
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 13

Code: HP1
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 14

Code: HP2
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 15

Code: HP3
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-

Notional Load: No
Fixed DLA: -

Limit State	gamma LL	gamma LL Operating
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 16

Code: HL-93-FAT
Type: FatigueTruck
Design Rating: Design
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 17

Code: EV2
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 18

Code: EV3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

General Combinations (LRFD)

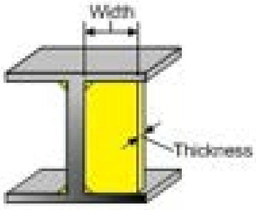
Standard Combo	Truck	Lane	Combination Factors	
			Truck	Lane
No	**HL-93-TRUCK**	**HL-93-LANE**	1	1
No	**HL-93-TANDEM**	**HL-93-LANE**	1	1

Deflection Combinations (LRFD)

No Deflection Combinations (LRFD) have been defined.

Component Groups

Transverse Stiffeners



ID	Name	Width	Thickness	Type	Type Factor	Material
1	Web Stiffeners	5 in.	0.375 in.	Single Angles	-	**Salvaged Girder**

Bearing Stiffeners

No bearing stiffener groups have been defined.

Longitudinal Stiffeners

No longitudinal stiffener groups have been defined.

Specification Control

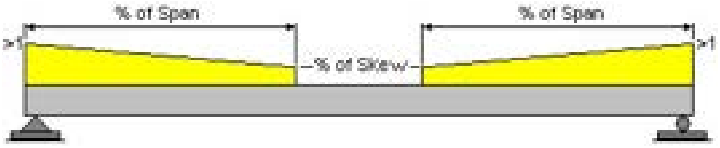
General

Lane Geometry

Design Vehicle Lane Width: 12 ft
Vehicle Width: 10 ft
Wheel Spacing: 6 ft
Encroachment Distance: -

Load Factors Control (LRFD): Use maximum and minimum load factors

Skew Factors



Span #	% of Span	% of Skew
1	-	-

Steel

Use Appendix A6 (LRFD): No
Allow Plastic Analysis: No
Override Longitudinal Stiffeners: No
Slab thickness for longitudinal shear force: Structural
Slab thickness for minimum negative flexure concrete deck reinforcement: Structural

Fatigue

AASHTO LRFD Table 6.6.1.2.5-2

% of Span: -
Span Length: 40 ft

Stress Range in Longitudinal Reinforcement Over the Piers: 10 ksi

Detail Categories (LRFD)

Detail Category	Constant, A x 10^8	Constant Amplitude Fatigue Threshold
A	-	-

B	-	-
B'	-	-
C	-	-
C'	-	-
D	-	-
E	-	-
E'	-	-

Limit State Map

Limit State Maps (LRFD)

Limit State	Design Review			Rating		
	Design Load	Legal Load	Permit Load	Design Load	Legal Load	Permit Load
Strength I	No	No	No	Inventory/Operating	Yes	No
Strength II	No	No	No	Exclude	No	Yes
Strength IV	No	No	No	Exclude	No	No
Service I	No	No	No	Exclude	No	No
Service II	No	No	No	Inventory/Operating	Yes	Yes
Service III	No	No	No	Exclude	No	No
Fatigue I	No	No	No	Inventory	No	No
Fatigue II	No	No	No	Exclude	No	No

Load Combo Maps (LFD)

Load Combo	Design Review	Rating
I	No	Inventory
IB	No	Operating
I-Overload	No	Exclude
IB-Overload	No	Exclude
I-Service	No	Exclude
IB-Service	No	Exclude
Fatigue	No	Exclude

Spec. Check Map (Strength)

LRFD Specification Check Maps

Design Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No

Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Design Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	No	No
Shear	Yes	No	No
Bearing	Yes	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	No	No
Shear	Yes	No	No
Bearing	Yes	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	Yes	No
Shear	No	Yes	No
Bearing	No	Yes	No
Flexural Stress In Longitudinal Stiffener	No	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		
Flexural Stress In Longitudinal Stiffener	No	No		

Rating

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		

Flexural Stress In Longitudinal Stiffener	No	No

Spec. Check Map (Service)

LRFD Specification Check Maps

Design Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Legal Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Permit Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Design Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Legal Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Permit Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

LFD Specification Check Maps

Design Review

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Rating

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Spec. Check Map (Fatigue)

LRFD Specification Check Maps

Design Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Legal Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Permit Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Design Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	Yes	No
Fatigue of Shear Connectors	Yes	No
Fatigue Shear Range of Shear Connectors	Yes	No
Fatigue of Special Points	Yes	No
Fatigue Shear	Yes	No

Legal Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No

Fatigue Shear	No	No

Permit Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Rating

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Member

Member Notes

No member notes have been defined.

Member Materials

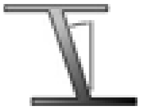
Beam

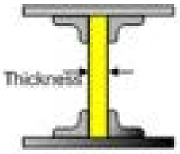
Beam Material: Salvaged Girder

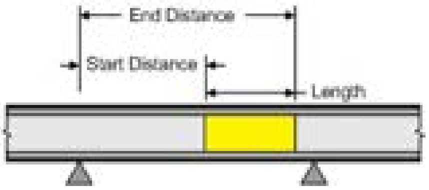
Beam Profile

Web

Apply to Entire Structure: Yes
Web Angle: -





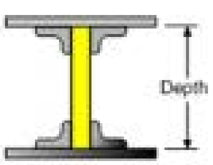


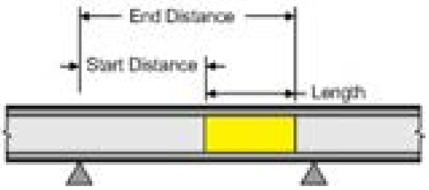
Thickness	Material	Support Number	Start Distance	Length

0.375 in.	**Salvaged Girder**	1	0 ft	40 ft

Web Depth

Apply to Entire Structure: Yes





Start Depth	Web Variation	End Depth	Support Number	Start Distance	Length
78 in.	Linear	78 in.	1	0 ft	40 ft

Top Cover Plate

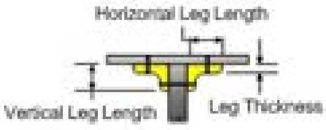
No top cover plate schedules have been defined.

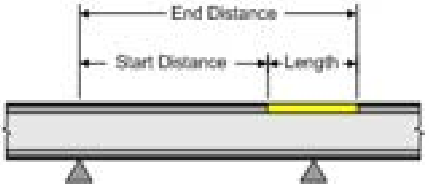
Bottom Cover Plate

No bottom cover plate schedules have been defined.

Top Angles

Apply to Entire Structure: Yes

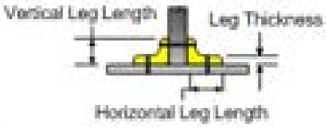


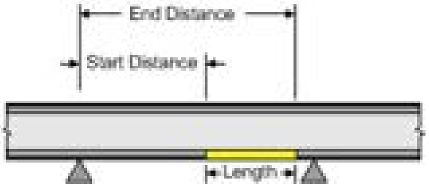


Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length
4 in.	6 in.	0.625 in.	**Salvaged Girder**	1	0 ft	40 ft

Bottom Angles

Apply to Entire Structure: Yes





Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length
4 in.	6 in.	0.625 in.	**Salvaged Girder**	1	0 ft	40 ft

Hinges

No hinges have been defined.

Special Locations

No special locations have been defined.

Supports

Support Conditions

Support	Support Restraint		
	Horizontal	Vertical	Rotational
1	Free	Restrained	Free
2	Restrained	Restrained	Free

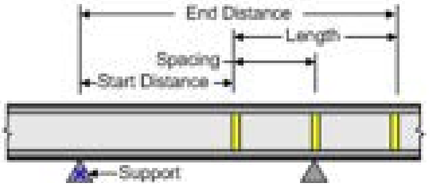
Spring Constants

Support	Spring Constants		
	Horizontal	Vertical	Rotational
1	-	-	-
2	-	-	-

Schedules

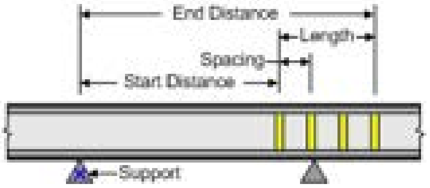
Bracing

Apply to Entire Structure: No



Spacing	Support	Start Distance	Length
19.417 ft	1	0.583 ft	38.833 ft

Transverse Stiffeners



Stiffener Group	Spacing	Support	Start Distance	Length
Web Stiffeners	3.875 ft	1	4.458 ft	11.625 ft
Web Stiffeners	3.875 ft	1	23.885 ft	11.625 ft

Bearing Stiffeners

Apply to Entire Structure: No

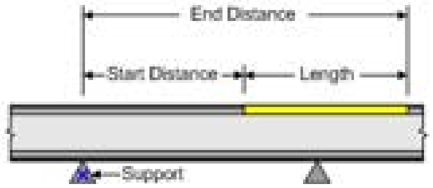
Support	Stiffener Group
1	Not Assigned
2	Not Assigned

Longitudinal Stiffeners

No longitudinal stiffener schedules have been defined.

Lateral Support

Apply to Entire Structure: Yes



Support	Start Distance	Length
1	0 ft	40 ft

Cb Factors (Standard)

No Cb factors (LRFD) have been defined.

Cb Factors (LRFD)

No Cb factors (LRFD) have been defined.

Fatigue Stress (Standard)

No fatigue stress (standard) schedules have been defined.

Member Control

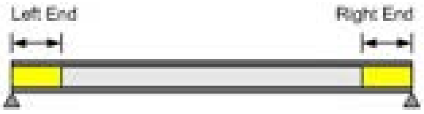
Steel

Flexural Resistance

Span	Compact Piers (Standard)	Ignore Eq. 6.10.7.1.2-3 (LRFD)
1	No	No

End Panel Distances

Top Span



Left of Top Span: -
Right of Top Span: -

Flange Local Buckling Resistance Adjustment

Standard Specifications: -
LRFD Specifications: -

Points of Interest

No points of interest have been defined.

Dead Loads

Uniform

Dead Load Type	Stage	Uniform Load
DC	1	-
DW	1	-
DU	1	-

Additional Self-weight

No additional self-weight dead loads have been defined.

Distributed

Dead Load Group	Support	Distributed Load (Start)		Distributed Load (End)	
		Distance	Magnitude	Distance	Magnitude
Vertical Web Angles	1	0.063 ft	0.019 kip / ft	39.875 ft	-

Concentrated

Dead Load Group	Support	Concentrated Load		
		Distance	Horizontal Force	Vertical Force
Girder Bracing	1	0.583 ft	-	0.131 kip
Girder Bracing	1	20 ft	-	0.131 kip
Girder Bracing	1	39.938 ft	-	0.131 kip
Bottom Flange Struts	1	9.708 ft	-	0.046 kip
Bottom Flange Struts	1	29.969 ft	-	0.046 kip

Temperature

No temperature dead loads have been defined.

Settlement

Stage: 1

No settlement loads have been defined.

Pedestrian Load

Pedestrian Load: -

Wheel Fractions (Standard)

Moment

No moment wheel fractions have been defined.

Shear

No shear wheel fractions have been defined.

Deflection

No deflection wheel fractions have been defined.

Reaction

Apply to entire structure: No

Support	mg Single-Lane	mg Multi-Lane

	Moment	Shear	Deflection	Moment	Shear	Deflection
1	-	-	-	-	-	-
2	-	-	-	-	-	-

```
CRITICAL RATING FACTOR SUMMARY: Design Load Inventory

 Live Load Combination                                  Total     Controlling    Limit State          Rating    Load
 No.        Description                               Vehicle Wt.   Point of      Action              Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       110.0000     STRENGTH I            2.10      75.54
                                                                                 Shear
                                                                                 Minimum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)    25.00       110.0000     STRENGTH I            2.36      59.07
                                                                                 Shear
                                                                                 Minimum Effects

 15   HL-93-FAT                                (FAT)    36.00       110.0000     FATIGUE I            11.56     416.31
                                                                                 Shear Stress
                                                                                 Minimum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       110.0000     STRENGTH I            2.10      75.54

CRITICAL RATING FACTOR SUMMARY: Design Load Operating

 Live Load Combination                                  Total     Controlling    Limit State          Rating    Load
 No.        Description                               Vehicle Wt.   Point of      Action              Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       110.0000     STRENGTH I-O          2.72      97.93
                                                                                 Shear
                                                                                 Minimum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)    25.00       110.0000     STRENGTH I-O          3.06      76.57
                                                                                 Shear
                                                                                 Minimum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       110.0000     STRENGTH I-O          2.72      97.93

CRITICAL RATING FACTOR SUMMARY: Legal Load

 Live Load Combination                                  Total     Controlling    Limit State          Rating    Load
 No.        Description                               Vehicle Wt.   Point of      Action              Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

  3   TYPE3                                    (TRK)    25.00       110.0000     STRENGTH I            4.05     101.28
                                                                                 Shear
                                                                                 Minimum Effects

  4   TYPE3S2                                  (TRK)    36.00       110.0000     STRENGTH I            4.22     151.88
                                                                                 Shear
                                                                                 Minimum Effects

  5   TYPE3-3                                  (TRK)    40.00       110.0000     STRENGTH I            4.50     180.18
                                                                                 Shear
                                                                                 Minimum Effects

  6   NRL-MIN                                  (TRK)    40.00       105.0000     SERVICE II            2.79     111.52
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

  7   NRL-MAX                                  (TRK)    40.00       105.0000     SERVICE II            2.82     112.98
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

  8   SU4                                      (TRK)    27.00       110.0000     STRENGTH I            3.62      97.61
                                                                                 Shear
                                                                                 Minimum Effects

  9   SU5                                      (TRK)    31.00       110.0000     STRENGTH I            3.30     102.31
                                                                                 Shear
                                                                                 Minimum Effects
```

```
 10   SU6                                      (TRK)    34.75       105.0000     SERVICE II           3.14     109.05
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 11   SU7                                      (TRK)    38.75       105.0000     SERVICE II           2.94     113.96
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 16   EV2                                      (TRK)    28.75       110.0000     STRENGTH I           3.39      97.58
                                                                                 Shear
                                                                                 Minimum Effects

 17   EV3                                      (TRK)    43.00       110.0000     STRENGTH I           2.31      99.13
                                                                                 Shear
                                                                                 Minimum Effects
.......................................................................................................................

Crit  EV3                                      (TRK)    43.00       110.0000     STRENGTH I           2.31      99.13

CRITICAL RATING FACTOR SUMMARY: Permit Load

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
No.        Description                                Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

 12   HP1                                      (PTK)    60.00       110.0000     STRENGTH II          2.85     170.75
                                                                                 Shear
                                                                                 Minimum Effects

 13   HP2                                      (PTK)    78.55       110.0000     STRENGTH II          2.89     226.70
                                                                                 Shear
                                                                                 Minimum Effects

 14   HP3                                      (PTK)   104.95       110.0000     STRENGTH II          3.64     382.31
                                                                                 Shear
                                                                                 Minimum Effects
.......................................................................................................................

Crit  HP1                                      (PTK)    60.00       110.0000     STRENGTH II          2.85     170.75
```

Wyoming Department of Transportation

BRASS-GIRDER™ Input Parameters

Version Information
Girder UI: 7.8.0.3001
Girder XML: 7.8.0.3001
BRASS™ XML: 1.8.0.3001

Administration

Project ID: 8780-06
Project Title: HDOT Statewide Bridge Load Ratings

Bridge ID: 1000190308146
Bridge Name: Nanue Stream
Route Name: 00019 Hawaii Belt Road
Reference Marker: 18

Title 1: Nanue Stream Bridge
Title 2: Load Rating for Steel Interior Girder Span 3 (G3-3)
Date: 2017 4 21

Agency: HDOT Highways Division
Designer/Rater: Moffatt & Nichol (JU)
Reviewer:

Comments:

Bridge Notes

MATERIAL PROPERTIES
Concrete
Weight = 0.160 kcf (HDOT Design Criteria for Bridges and Structures [HDOT] 5.01)
Strength = 3 ksi (Record Drawings: Class A-1)
Elastic Modulus = 3,880 ksi (AASHTO LRFD [LRFD] Eqn 5.4.2.4-1, Use 0.150 kcf per HDOT 5.01)
Reinforcing Steel
Yield Strength = 33 ksi (Unknown, Manual for Bridge Evaluation [MBE] Table 6A.5.2.2-1)
Elastic Modulus = 29,000 ksi (LRFD 5.4.3.2)

BRIDGE PROPERTIES (RECORD DRAWINGS)
Span 1 = 51 ft
Span 2 = 50 ft
Span 3 = 40 ft
Span 4 = 72 ft
Span 5 = 40 ft
Span 6 = 72 ft
Span 7 = 40 ft
Span 8 = 72 ft
Span 9 = 40 ft
Span 10 = 51 ft
Width = 38.5 ft
Deck Thickness = 9 in min
No. of Griders = 4
Girder Spacing = 9 ft, 7.5 ft, 9 ft
Girder Width = 12 3/8"
Girder Depth = 6'-6 1/2"
Surface Roughness = 3.0 (2015 Bridge Inspectinon Report)
Condition Factor = 1.0 (HDOT 5.04, 2015 Bridge Inspection Report indicates Condition Rating of 7)
System Factor = 1.0 (HDOT 5.05,)

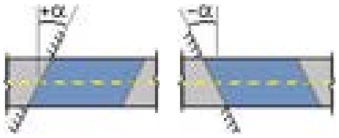
LIVE LOADS
LRFD Live Load (MBE Appendix C6A)
Truck and Tandem Lane Load = 0.64 klf
AASHTO Legal Loads (MBE Appendix D6A)
Type 3
Type 3S2
Type 3-3
Notional Rating Load [NRL]
Legal Lane Load = 0.2 klf
SU4
SU5
SU6
SU7
HDOT Hawaii Standard Single Trip Permit Loads (HDOT 5.06)
No lane load provided, vehicles allowed to trave in any lane
HP1
HP2
HP3
Dynamic Load Allowance (HDOT 5.03)
Spans > 40 ft
Wearing Surface: 3 (Assumed)
Design Loads: 33%
Legal Loads: 10%
Permit Loads: 10%
Scale Factor (HDOT 5.06)
Hawaii Standard Single Trip Permit Vehicle analysis assumes only one permit load on the bridge which allows the use of a single-lane distribution factor. When using the single-lane LRFD distribution factor, the 1.2 multiple prescence factor may shall be divided out from the distribtion factor equations.

Control

Structure

Structure Type: GirderLine
Define Deck Cross Section: Yes
Number of Members: 4

Skew Angle: 0 °



Analysis Model Type: Beam
Number of Top Spans: 1

Spans

Span	Length
1	40 ft

Structure Material: Steel
Beam Type: Builtup
Composite Structure: No
Deck Material: Concrete

Analysis

Unit System: US
Analysis Method: LRFD
Analysis Type: Rating
Number of Stages: 1
Member of Interest: 3
Model Element Type: Stepped
Point of Interest Generation Control: Tenth
Live-load Distribution Factor Application: AnalysisPoint

Interpolate Reinforcement: No
Calculate Effective Width: No

Input

Symmetry

Component	Symmetric
Beam Profile	No
Deck Profile	No
Shear Connectors	No
Transverse Stiffeners	No
Bearing Stiffeners	No
Longitudinal Stiffeners	No
Bracing (Member)	No
Lateral Support	No
Cb Factors (Std)	No
Cb Factors (LRFD)	No
Fatigue Stress (Std)	No
Beam Wheel Fractions (Std)	No
Reaction Wheel Fractions (Std)	No
Beam Distribution Factors (LRFD)	No
Reaction Distribution Factors (LRFD)	No

Simplified Standard Wheel Fractions: No
Merge Beam/Deck Profile Schedules: Yes

Distribution

Perform Dead Load Distribution: Yes
Calculate LRFD Live Load Distribution Factors: Yes

Dead Load Distribution Methods

Stage	Method
1	Tributary area

Live Load Distribution (LRFD)

Distribution Method: AASHTO LRFD
Cross Section Code: a1
Max. Number of Lanes Loaded: Computed
Slab Thickness Type: Structural
Set eg = 0 for Non-composite: Yes
Apply Skew to Lever Rule Override: Yes
Apply Skew to Ridgid Rule Override: No
Use Constants from Table 4.6.2.2.1-2: No

Libraries

Section Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Sections.bls
Vehicle Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Vehicles.blv

Output

Primary Output

Action Output Level: DL+LL+CONC
Action Locations: 10thPoints

General

Member Properties: Yes
Load Combinations: Yes
Load and Resistance Factors: Yes

Warnings: Yes
Camber: No
Critical Design Ratios / Rating Factors: Expanded

Live Load

Truck Positions: Yes
Variable Axle Spacing: Yes
Live Load Settings: Yes

Live Load Combinations: Yes
Live Load Details: Yes
Impact (LFD): No

Stage

Stage	Output
1	Yes

Dead Load

Member Self Load: Yes
Distributed Dead Loads: Yes
Concentrated Dead Loads: Yes

Temperature Change: No
Settlements: No

Load Distribution

Dead Load Distribution: Yes
Live Load Distribution: Yes

Intermediate Output

Intermediate Output Level: Full
Effective Width: Yes
Floorbeam Lane Position: Yes

Points of Interest

Specification Checks: Yes
Load Factoring/Combinations: No

Load Distribution

Dead Load: Yes
Live Load: Yes

Limit State Output (LRFD)

Limit State	Specification Check	Load Combination
Strength I	Yes	Yes
Strength II	Yes	Yes
Strength IV	No	No
Service I	No	No
Service II	No	No
Fatigue I	No	No
Fatigue II	No	No

Load Combination Output (LFD)

LFD Load Combo	Specification Check	Load Combination

Combo I	No	No
Combo IB	No	No
Combo I Overload	No	No
Combo IB Overload	No	No
Combo I Service	No	No
Combo IB Service	No	No
Combo Fatigue	Yes	Yes

Intermediate Output (cont.)

Steel

Transverse Stiffeners: No
Bearing Stiffeners: No
Longitudinal Stiffeners: No

Results Tables

X-Y Plot Action Tables: No
Specification Check Results Tables: No
Mesh Plot Files: No

BRASS-PAD™ Data Transfer File: No

Influence

Output influence lines for: None
Ordinate Divisor: 1

Factors

Load Factors (LRFD)

Limit State	DC		DW		DU		TU	
	max	min	max	min	max	min	max	min
Strength I	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength II	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength IV	-	-	-	-	-	-	-	-
Service I	-	-	-	-	-	-	-	-
Service II	1	1	1	1	1	1	-	-
Fatigue I	-	-	-	-	-	-	-	-
Fatigue II	-	-	-	-	-	-	-	-

Load Factors (LRFD) (continued)

Limit State	LL				SE		PS		DS	
	Design		Legal	Permit						
	Inventory	Operating			max	min	max	min	max	min
Strength I	1.75	1.35	1.45	0	-	-	-	-	-	-
Strength II	-		0	1.2	-	-	-	-	-	-
Strength IV	-		-	-	-	-	-	-	-	-
Service I	-		-	-	-	-	-	-	-	-
Service II	1.3	1	1.3	1	-	-	-	-	-	-
Fatigue I	0.75		-	-	-	-	-	-	-	-
Fatigue II	-		-	-	-	-	-	-	-	-

Load Modifiers (LRFD)

Limit State	Ductility	Redundancy	Importance	Combined Product	
				max	min
Strength I	1	1	1	-	-
Strength II	1	1	1	-	-
Strength IV	1	1	1	-	-
Service I	1	1	1	-	-
Service II	1	1	1	-	-
Fatigue I	1	1	1	-	-
Fatigue II	1	1	1	-	-

Resistance Factors (LRFD)

Resistance Factors

Type	Value
φ Flexure	1
φ Shear	1
φ Bearing	1
φ Compression	0.95
φ Shear Connectors	0.85
φ Fatigue	1

System/Total Modifiers

Limit State	Resistance Type	System	Total
Strength	Flexure	1	-
Strength	Shear	1	-
Strength	Bearing	1	-
Strength	Compression	1	-
Strength	Shear Connectors	1	-
Strength	Longitudinal Reinforcement	1	-
Service	Flexure	1	-
Fatigue	Fatigue	1	-

Condition Modifiers

Limit State	Condition
Strength	1
Service	1
Fatigue	1

Load Factors (LFD)

Load Combo	γ	LL	DC	DW	DU	TU	SE	PS	DS
I	-	-	-	-	-	-	-	1	1
IB	-	-	-	-	-	-	-	1	1
I-Overload	-	-	-	-	-	-	-	1	1
IB-Overload	-	-	-	-	-	-	-	1	1

I-Service	-	-	-	-	-	-	-	1	1
IB-Service	-	-	-	-	-	-	-	1	1
Fatigue	-	-	-	-	-	-	-	1	1

Capacity Reduction Factors (LFD)

Factor	Value
φ Flexure	-
φ Shear	-
φ Fatigue	-

Materials

Steel

ID	Name	Yield Stress	Tensile Strength	Modulus of Elasticity	Density	Thermal Expansion Coefficient
1	Salvaged Girder	30 ksi	60 ksi	29000 ksi	0.49 kcf	6.5E-06 °F^{-1}

Concrete

ID	Name	28 Day Compressive Strength	Modulus of Elasticity	Density	Modulus of Rupture	Modulus of Rupture (VCI Method)	Thermal Expansion Coefficient
1	1949 Class A-1	3 ksi	3880 ksi	0.16 kcf	-	-	6E-06 °F^{-1}

Dead Load Groups

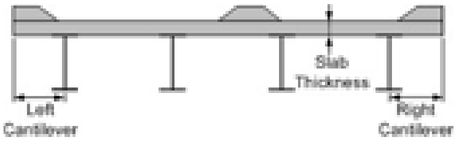
Groups

ID	Name	Stage	Type	Description
1	Concrete Railing	1	DC	Top Rail, Bottom Rail, Post
2	Sidewalk / Shoulder	1	DC	
3	AC Pavement	1	DW	
4	Girder Bracing	1	DC	X-Bracing with Steel Angles in the Outer Bays
5	Bottom Flange Bracing	1	DC	Steel Angles Diagonal Bracing in the Interior Bay
6	Vertical Web Angles	1	DC	Steel Angles Spaced at Intervals
7	Waterlines	1	DU	Assumed 8" Waterlines
8	Monorail	1	DC	6" Monorail
9	Bottom Flange Struts	1	DC	Bottom Flange Struts out of Steel Angles and Plates in Outer Bays

Deck Geometry

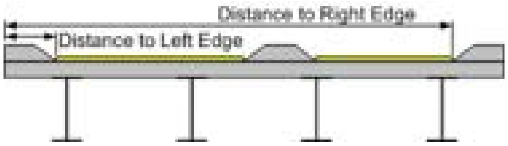
Deck

Deck Thickness: 9 in.
Left Cantilever Length: 6.5 ft
Right Cantilever Length: 6.5 ft
Equal Member Spacing: No



Travelway Locations

Distance to Left Edge: 5.25 ft
Distance to Right Edge: 33.25 ft

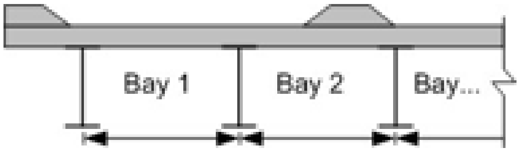


Sacrificial Topping

Thickness: -
Dead Load Type: DC

Member Spacing

Bay #	Spacing
1	9 ft
2	7.5 ft
3	9 ft



Soffits

No soffits have been defined.

Appurtenances

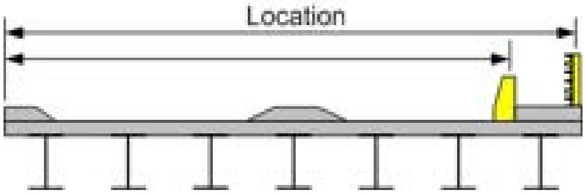
No appurtenances have been defined.

Deck Loads

Materials/Stages

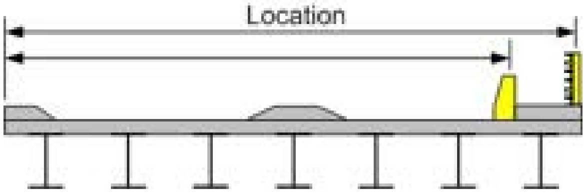
Deck Material: 1949 Class A-1
Curb & Median Material: Not Assigned
Wearing Surface Weight: -
Slab Stage: 1
Curb Stage: 1
Median Stage: 1
Wearing Surface Stage: 1

Line Loads



Dead Load Group	Line Load	Load Location
Concrete Railing	0.319 kip / ft	0.923 ft
Concrete Railing	0.319 kip / ft	37.577 ft
Waterlines	0.224 kip / ft	38.5 ft
Monorail	0.016 kip / ft	34 ft

Uniform Loads



Dead Load Group	Uniform Load	Load Location	Load Width
Sidewalk / Shoulder	0.007 ksf	0 ft	5.25 ft
Sidewalk / Shoulder	0.003 ksf	5.25 ft	2 ft
AC Pavement	0.018 ksf	7.25 ft	24 ft
Sidewalk / Shoulder	0.003 ksf	31.25 ft	2 ft
Sidewalk / Shoulder	0.007 ksf	33.25 ft	5 ft

Live Loads

Live Load Control

Direction Control:	Up+Down
Standard Live Loads:	None
Wheel Advancement Denominator:	100
ADTT:	5000
ADTT for Single Lane:	2000
Multiple Presence Adjustment:	-
% of Dynamic Load Allowance (Impact):	100 %
Fixed Impact (STD):	-

Dynamic Load Allowance (LRFD)

Design/Rating Procedure	Truck	Lane	Fatigue
Design	33 %	0 %	15 %
Legal	33 %	0 %	0 %
Permit	33 %	0 %	0 %

Special Vehicles

Axle Vehicles

No axle vehicles have been defined.

Lane Vehicles

No lane vehicles have been defined.

Definitions (STD)

No standard live load definitions have been defined.

Definitions (LRFD)

Definition 1

Code:	HL-93-TRUCK
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 2

Code:	HL-93-TANDEM
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-

Lanes Loaded: Critical
Notional Load: Yes
Fixed DLA: -

Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 3

Code: HL-93-LANE
Type: DesignLane
Design Rating: Design
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: Yes
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 4

Code: TYPE3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 5

Code: TYPE3S2
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 6

Code: TYPE3-3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-

Limit State	gamma LL	gamma LL Operating
Fatigue II	-	-

Definition 7

Code: NRL-MIN
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 8

Code: NRL-MAX
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 9

Code: SU4
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 10

Code: SU5
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 11

Code: SU6
Type: GeneralTruck

Live Load Factor Overrides

Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 12

Code:	SU7
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 13

Code:	HP1
Type:	PermitTruck
Design Rating:	Permit
% of Dynamic Load Allowance:	-
Scale Factor:	0.833
Lanes Loaded:	Single
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 14

Code:	HP2
Type:	PermitTruck
Design Rating:	Permit
% of Dynamic Load Allowance:	-
Scale Factor:	0.833
Lanes Loaded:	Single
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 15

Code:	HP3
Type:	PermitTruck
Design Rating:	Permit
% of Dynamic Load Allowance:	-
Scale Factor:	0.833
Lanes Loaded:	Single
Notional Load:	No

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-

Fixed DLA: -

Limit State	gamma LL	gamma LL Operating
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 16

Code: HL-93-FAT
Type: FatigueTruck
Design Rating: Design
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 17

Code: EV2
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 18

Code: EV3
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

General Combinations (LRFD)

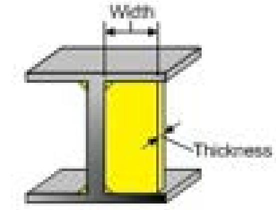
Standard Combo	Truck	Lane	Combination Factors Truck	Combination Factors Lane
No	**HL-93-TRUCK**	**HL-93-LANE**	1	1
No	**HL-93-TANDEM**	**HL-93-LANE**	1	1

Deflection Combinations (LRFD)

No Deflection Combinations (LRFD) have been defined.

Component Groups

Transverse Stiffeners



ID	Name	Width	Thickness	Type	Type Factor	Material
1	Web Stiffeners	5 in.	0.375 in.	Single Angles	-	**Salvaged Girder**

Bearing Stiffeners

No bearing stiffener groups have been defined.

Longitudinal Stiffeners

No longitudinal stiffener groups have been defined.

Specification Control

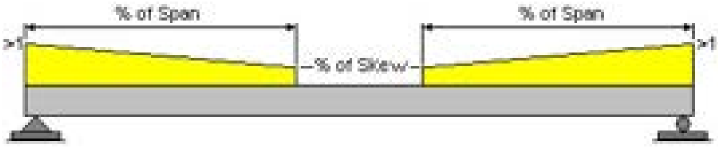
General

Lane Geometry

Design Vehicle Lane Width: 12 ft
Vehicle Width: 10 ft
Wheel Spacing: 6 ft
Encroachment Distance: -

Load Factors Control (LRFD): Use maximum and minimum load factors

Skew Factors



Span #	% of Span	% of Skew
1	-	-

Steel

Use Appendix A6 (LRFD): No
Allow Plastic Analysis: No
Override Longitudinal Stiffeners: No
Slab thickness for longitudinal shear force: Structural
Slab thickness for minimum negative flexure concrete deck reinforcement: Structural

Fatigue

AASHTO LRFD Table 6.6.1.2.5-2

% of Span: -
Span Length: 40 ft

Stress Range in Longitudinal Reinforcement Over the Piers: 10 ksi

Detail Categories (LRFD)

Detail Category	Constant, A x 10^8	Constant Amplitude Fatigue Threshold
A	-	-

B	-	-
B'	-	-
C	-	-
C'	-	-
D	-	-
E	-	-
E'	-	-

Limit State Map

Limit State Maps (LRFD)

Limit State	Design Review			Rating		
	Design Load	Legal Load	Permit Load	Design Load	Legal Load	Permit Load
Strength I	No	No	No	Inventory/Operating	Yes	No
Strength II	No	No	No	Exclude	No	Yes
Strength IV	No	No	No	Exclude	No	No
Service I	No	No	No	Exclude	No	No
Service II	No	No	No	Inventory/Operating	Yes	Yes
Service III	No	No	No	Exclude	No	No
Fatigue I	No	No	No	Inventory	No	No
Fatigue II	No	No	No	Exclude	No	No

Load Combo Maps (LFD)

Load Combo	Design Review	Rating
I	No	Inventory
IB	No	Operating
I-Overload	No	Exclude
IB-Overload	No	Exclude
I-Service	No	Exclude
IB-Service	No	Exclude
Fatigue	No	Exclude

Spec. Check Map (Strength)

LRFD Specification Check Maps

Design Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No

Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Design Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	No	No
Shear	Yes	No	No
Bearing	Yes	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	No	No
Shear	Yes	No	No
Bearing	Yes	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	Yes	No
Shear	No	Yes	No
Bearing	No	Yes	No
Flexural Stress In Longitudinal Stiffener	No	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		
Flexural Stress In Longitudinal Stiffener	No	No		

Rating

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		

Flexural Stress In Longitudinal Stiffener	No	No

Spec. Check Map (Service)

LRFD Specification Check Maps

Design Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Legal Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Permit Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Design Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Legal Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Permit Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

LFD Specification Check Maps

Design Review

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Rating

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Spec. Check Map (Fatigue)

LRFD Specification Check Maps

Design Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Legal Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Permit Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Design Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	Yes	No
Fatigue of Shear Connectors	Yes	No
Fatigue Shear Range of Shear Connectors	Yes	No
Fatigue of Special Points	Yes	No
Fatigue Shear	Yes	No

Legal Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No

Fatigue Shear	No	No

Permit Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Rating

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Member

Member Notes

No member notes have been defined.

Member Materials

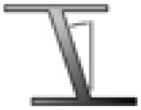
Beam

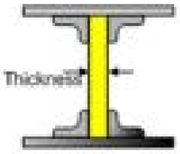
Beam Material: Salvaged Girder

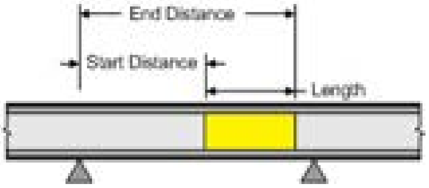
Beam Profile

Web

Apply to Entire Structure: Yes
Web Angle: -





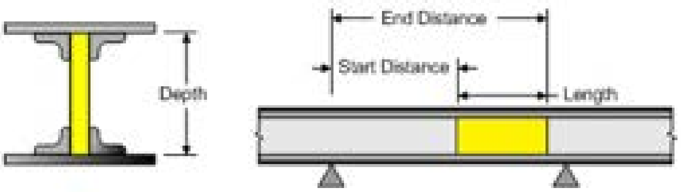


Thickness	Material	Support Number	Start Distance	Length

0.375 in.	**Salvaged Girder**	1	0 ft	40 ft

Web Depth

Apply to Entire Structure: Yes



Start Depth	Web Variation	End Depth	Support Number	Start Distance	Length
78 in.	Linear	78 in.	1	0 ft	40 ft

Top Cover Plate

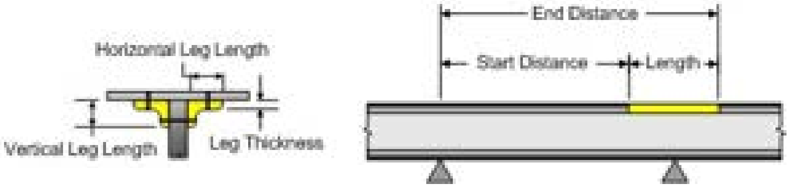
No top cover plate schedules have been defined.

Bottom Cover Plate

No bottom cover plate schedules have been defined.

Top Angles

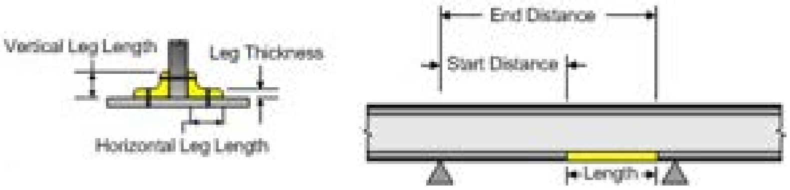
Apply to Entire Structure: Yes



Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length
4 in.	6 in.	0.625 in.	**Salvaged Girder**	1	0 ft	40 ft

Bottom Angles

Apply to Entire Structure: Yes



Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length
4 in.	6 in.	0.625 in.	**Salvaged Girder**	1	0 ft	40 ft

Hinges

No hinges have been defined.

Special Locations

No special locations have been defined.

Supports

Support Conditions

Support	Support Restraint		
	Horizontal	Vertical	Rotational
1	Free	Restrained	Free
2	Restrained	Restrained	Free

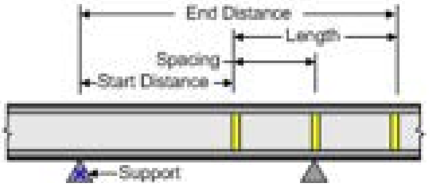
Spring Constants

Support	Spring Constants		
	Horizontal	Vertical	Rotational
1	-	-	-
2	-	-	-

Schedules

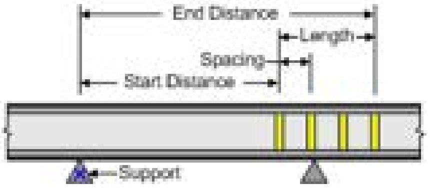
Bracing

Apply to Entire Structure: No



Spacing	Support	Start Distance	Length
19.417 ft	1	0.583 ft	38.333 ft

Transverse Stiffeners



Stiffener Group	Spacing	Support	Start Distance	Length
Web Stiffeners	3.875 ft	1	4.458 ft	11.625 ft
Web Stiffeners	3.875 ft	1	23.885 ft	11.625 ft

Bearing Stiffeners

Apply to Entire Structure: No

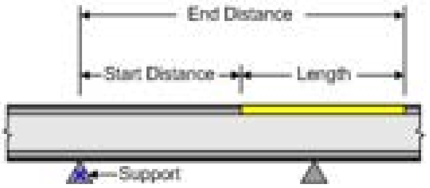
Support	Stiffener Group
1	Not Assigned
2	Not Assigned

Longitudinal Stiffeners

No longitudinal stiffener schedules have been defined.

Lateral Support

Apply to Entire Structure: Yes



Support	Start Distance	Length
1	0 ft	40 ft

Cb Factors (Standard)

No Cb factors (LRFD) have been defined.

Cb Factors (LRFD)

No Cb factors (LRFD) have been defined.

Fatigue Stress (Standard)

No fatigue stress (standard) schedules have been defined.

Member Control

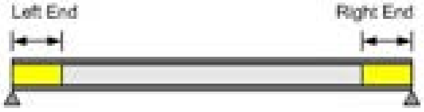
Steel

Flexural Resistance

Span	Compact Piers (Standard)	Ignore Eq. 6.10.7.1.2-3 (LRFD)
1	No	No

End Panel Distances

Top Span



Left of Top Span: -
Right of Top Span: -

Flange Local Buckling Resistance Adjustment

Standard Specifications: -
LRFD Specifications: -

Points of Interest

No points of interest have been defined.

Dead Loads

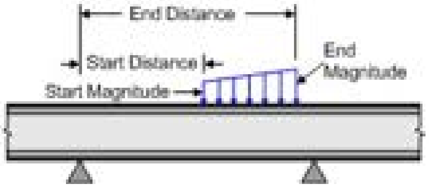
Uniform

Dead Load Type	Stage	Uniform Load
DC	1	-
DW	1	-
DU	1	-

Additional Self-weight

No additional self-weight dead loads have been defined.

Distributed



Dead Load Group	Support	Distributed Load (Start)		Distributed Load (End)	
		Distance	Magnitude	Distance	Magnitude
Bottom Flange Bracing	1	0.063 ft	0.008 kip / ft	39.875 ft	-
Vertical Web Angles	1	0.063 ft	0.019 kip / ft	39.875 ft	-

Concentrated

Dead Load Group	Support	Concentrated Load		
		Distance	Horizontal Force	Vertical Force
Girder Bracing	1	0.583 ft	-	0.131 kip
Girder Bracing	1	20 ft	-	0.131 kip
Girder Bracing	1	39.938 ft	-	0.131 kip
Bottom Flange Struts	1	9.708 ft	-	0.046 kip
Bottom Flange Struts	1	29.969 ft	-	0.046 kip

Temperature

No temperature dead loads have been defined.

Settlement

Stage: 1

No settlement loads have been defined.

Pedestrian Load

Pedestrian Load: -

Wheel Fractions (Standard)

Moment

No moment wheel fractions have been defined.

Shear

No shear wheel fractions have been defined.

Deflection

No deflection wheel fractions have been defined.

Reaction

Apply to entire structure: No

Support	mg Single-Lane			mg Multi-Lane		
	Moment	Shear	Deflection	Moment	Shear	Deflection
1	-	-	-	-	-	-
2	-	-	-	-	-	-

```
CRITICAL RATING FACTOR SUMMARY: Design Load Inventory

 Live Load Combination                                 Total     Controlling    Limit State          Rating    Load
 No.       Description                               Vehicle Wt.  Point of       Action              Factor   Rating
                                                       (tons)     Interest      Location                      (tons)
========================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE              (DTK)    36.00       110.0000     STRENGTH I            1.94      69.86
                                                                               Shear
                                                                               Minimum Effects

  2   HL-93-TANDEM + HL-93-LANE              (DTK)    25.00       110.0000     STRENGTH I            2.18      54.62
                                                                               Shear
                                                                               Minimum Effects

 15   HL-93-FAT                              (FAT)    36.00       110.0000     FATIGUE I            12.58     452.98
                                                                               Shear Stress
                                                                               Minimum Effects
........................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE              (DTK)    36.00       110.0000     STRENGTH I            1.94      69.86

CRITICAL RATING FACTOR SUMMARY: Design Load Operating

 Live Load Combination                                 Total     Controlling    Limit State          Rating    Load
 No.       Description                               Vehicle Wt.  Point of       Action              Factor   Rating
                                                       (tons)     Interest      Location                      (tons)
========================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE              (DTK)    36.00       110.0000     STRENGTH I-O          2.52      90.56
                                                                               Shear
                                                                               Minimum Effects

  2   HL-93-TANDEM + HL-93-LANE              (DTK)    25.00       110.0000     STRENGTH I-O          2.83      70.80
                                                                               Shear
                                                                               Minimum Effects
........................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE              (DTK)    36.00       110.0000     STRENGTH I-O          2.52      90.56

CRITICAL RATING FACTOR SUMMARY: Legal Load

 Live Load Combination                                 Total     Controlling    Limit State          Rating    Load
 No.       Description                               Vehicle Wt.  Point of       Action              Factor   Rating
                                                       (tons)     Interest      Location                      (tons)
========================================================================================================================

  3   TYPE3                                  (TRK)    25.00       110.0000     STRENGTH I            3.75      93.66
                                                                               Shear
                                                                               Minimum Effects

  4   TYPE3S2                                (TRK)    36.00       110.0000     STRENGTH I            3.90     140.45
                                                                               Shear
                                                                               Minimum Effects

  5   TYPE3-3                                (TRK)    40.00       110.0000     STRENGTH I            4.17     166.62
                                                                               Shear
                                                                               Minimum Effects

  6   NRL-MIN                                (TRK)    40.00       110.0000     STRENGTH I            2.89     115.72
                                                                               Shear
                                                                               Minimum Effects

  7   NRL-MAX                                (TRK)    40.00       110.0000     STRENGTH I            2.88     115.39
                                                                               Shear
                                                                               Minimum Effects

  8   SU4                                    (TRK)    27.00       110.0000     STRENGTH I            3.34      90.27
                                                                               Shear
                                                                               Minimum Effects

  9   SU5                                    (TRK)    31.00       110.0000     STRENGTH I            3.05      94.61
                                                                               Shear
                                                                               Minimum Effects

 10   SU6                                    (TRK)    34.75       110.0000     STRENGTH I            2.96     102.90
```

```
                                                                                 Shear
                                                                                 Minimum Effects

 11  SU7                                       (TRK)    38.75       110.0000     STRENGTH I            2.91     112.71
                                                                                 Shear
                                                                                 Minimum Effects

 16  EV2                                       (TRK)    28.75       110.0000     STRENGTH I            3.14      90.24
                                                                                 Shear
                                                                                 Minimum Effects

 17  EV3                                       (TRK)    43.00       110.0000     STRENGTH I            2.13      91.67
                                                                                 Shear
                                                                                 Minimum Effects
........................................................................................................................

Crit  EV3                                      (TRK)    43.00       110.0000     STRENGTH I            2.13      91.67

CRITICAL RATING FACTOR SUMMARY: Permit Load

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.        Description                               Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
========================================================================================================================

 12  HP1                                       (PTK)    60.00       110.0000     STRENGTH II           3.17     190.38
                                                                                 Shear
                                                                                 Minimum Effects

 13  HP2                                       (PTK)    78.55       110.0000     STRENGTH II           3.22     252.76
                                                                                 Shear
                                                                                 Minimum Effects

 14  HP3                                       (PTK)   104.95       110.0000     STRENGTH II           4.06     426.26
                                                                                 Shear
                                                                                 Minimum Effects
........................................................................................................................

Crit  HP1                                      (PTK)    60.00       110.0000     STRENGTH II           3.17     190.38
```

BRASS-GIRDER™ Input Parameters

Version Information

Girder UI:	7.8.0.3001
Girder XML:	7.8.0.3001
BRASS™ XML:	1.8.0.3001

Administration

Project ID:	8780-06
Project Title:	HDOT Statewide Bridge Load Ratings
Bridge ID:	1000190308146
Bridge Name:	Nanue Stream
Route Name:	00019 Hawaii Belt Road
Reference Marker:	18
Title 1:	Nanue Stream Bridge
Title 2:	Load Rating for Steel Exterior Girder Span 4 (G4-4)
Date:	2017 4 21
Agency:	HDOT Highways Division
Designer/Rater:	Moffatt & Nichol (JU)
Reviewer:	
Comments:	

Bridge Notes

MATERIAL PROPERTIES
Concrete
Weight = 0.160 kcf (HDOT Design Criteria for Bridges and Structures [HDOT] 5.01)
Strength = 3 ksi (Record Drawings: Class A-1)
Elastic Modulus = 3,880 ksi (AASHTO LRFD [LRFD] Eqn 5.4.2.4-1, Use 0.150 kcf per HDOT 5.01)
Reinforcing Steel
Yield Strength = 33 ksi (Unknown, Manual for Bridge Evaluation [MBE] Table 6A.5.2.2-1)
Elastic Modulus = 29,000 ksi (LRFD 5.4.3.2)

BRIDGE PROPERTIES (RECORD DRAWINGS)
Span 1 = 51 ft
Span 2 = 50 ft
Span 3 = 40 ft
Span 4 = 72 ft
Span 5 = 40 ft
Span 6 = 72 ft
Span 7 = 40 ft
Span 8 = 72 ft
Span 9 = 40 ft
Span 10 = 51 ft
Width = 38.5 ft
Deck Thickness = 9 in min
No. of Griders = 4
Girder Spacing = 9 ft, 7.5 ft, 9 ft
Girder Width = 12 3/8"
Girder Depth = 6'-6 1/2"
Surface Roughness = 3.0 (2015 Bridge Inspectinon Report)
Condition Factor = 1.0 (HDOT 5.04, 2015 Bridge Inspection Report indicates Condition Rating of 7)
System Factor = 1.0 (HDOT 5.05,)

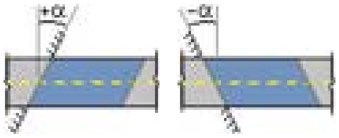
LIVE LOADS
LRFD Live Load (MBE Appendix C6A)
Truck and Tandem Lane Load = 0.64 klf
AASHTO Legal Loads (MBE Appendix D6A)
Type 3
Type 3S2
Type 3-3
Notional Rating Load [NRL]
Legal Lane Load = 0.2 klf
SU4
SU5
SU6
SU7
HDOT Hawaii Standard Single Trip Permit Loads (HDOT 5.06)
No lane load provided, vehicles allowed to trave in any lane
HP1
HP2
HP3
Dynamic Load Allowance (HDOT 5.03)
Spans > 40 ft
Wearing Surface: 3 (Assumed)
Design Loads: 33%
Legal Loads: 10%
Permit Loads: 10%
Scale Factor (HDOT 5.06)
Hawaii Standard Single Trip Permit Vehicle analysis assumes only one permit load on the bridge which allows the use of a single-lane distribution factor. When using the single-lane LRFD distribution factor, the 1.2 multiple prescence factor may shall be divided out from the distribtion factor equations.

Control

Structure

Structure Type: GirderLine
Define Deck Cross Section: Yes
Number of Members: 4

Skew Angle: 0 °



Analysis Model Type: Beam
Number of Top Spans: 1

Spans

Span	Length
1	72 ft

Structure Material: Steel
Beam Type: Builtup
Composite Structure: No
Deck Material: Concrete

Analysis

Unit System: US
Analysis Method: LRFD
Analysis Type: Rating
Number of Stages: 1
Member of Interest: 4
Model Element Type: Stepped
Point of Interest Generation Control: Tenth
Live-load Distribution Factor Application: AnalysisPoint

Interpolate Reinforcement: No
Calculate Effective Width: No

Input

Symmetry

Component	Symmetric
Beam Profile	No
Deck Profile	No
Shear Connectors	No
Transverse Stiffeners	No
Bearing Stiffeners	No
Longitudinal Stiffeners	No
Bracing (Member)	No
Lateral Support	No
Cb Factors (Std)	No
Cb Factors (LRFD)	No
Fatigue Stress (Std)	No
Beam Wheel Fractions (Std)	No
Reaction Wheel Fractions (Std)	No
Beam Distribution Factors (LRFD)	No
Reaction Distribution Factors (LRFD)	No

Simplified Standard Wheel Fractions: No
Merge Beam/Deck Profile Schedules: Yes

Distribution

Perform Dead Load Distribution: Yes
Calculate LRFD Live Load Distribution Factors: Yes

Dead Load Distribution Methods

Stage	Method
1	Tributary area

Live Load Distribution (LRFD)

Distribution Method: AASHTO LRFD
Cross Section Code: a1
Max. Number of Lanes Loaded: Computed

Consider Rigid Method: No
Slab Thickness Type: Structural

Set eg = 0 for Non-composite: Yes
Apply Skew to Lever Rule Override: Yes
Apply Skew to Ridgid Rule Override: No
Use Constants from Table 4.6.2.2.1-2: No

Libraries

Section Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Sections.bls
Vehicle Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Vehicles.blv

Output

Primary Output

Action Output Level: DL+LL+CONC
Action Locations: 10thPoints

General

Member Properties: Yes
Load Combinations: Yes
Load and Resistance Factors: Yes

Warnings: Yes
Camber: No
Critical Design Ratios / Rating Factors: Expanded

Live Load

Truck Positions: Yes
Variable Axle Spacing: Yes
Live Load Settings: Yes

Live Load Combinations: Yes
Live Load Details: Yes
Impact (LFD): No

Stage

Stage	Output
1	Yes

Dead Load

Member Self Load: Yes
Distributed Dead Loads: Yes
Concentrated Dead Loads: Yes

Temperature Change: No
Settlements: No

Load Distribution

Dead Load Distribution: Yes
Live Load Distribution: Yes

Intermediate Output

Intermediate Output Level: Full
Effective Width: Yes
Floorbeam Lane Position: Yes

Points of Interest

Specification Checks: Yes
Load Factoring/Combinations: No

Load Distribution

Dead Load: Yes
Live Load: Yes

Limit State Output (LRFD)

Limit State	Specification Check	Load Combination
Strength I	Yes	Yes
Strength II	Yes	Yes
Strength IV	No	No
Service I	No	No
Service II	No	No
Fatigue I	No	No
Fatigue II	No	No

Load Combination Output (LFD)

LFD Load Combo	Specification Check	Load Combination

Combo I	No	No
Combo IB	No	No
Combo I Overload	No	No
Combo IB Overload	No	No
Combo I Service	No	No
Combo IB Service	No	No
Combo Fatigue	Yes	Yes

Intermediate Output (cont.)

Steel

Transverse Stiffeners: No
Bearing Stiffeners: No
Longitudinal Stiffeners: No

Results Tables

X-Y Plot Action Tables: No
Specification Check Results Tables: No
Mesh Plot Files: No

BRASS-PAD™ Data Transfer File: No

Influence

Output influence lines for: None
Ordinate Divisor: 1

Factors

Load Factors (LRFD)

Limit State	DC		DW		DU		TU	
	max	min	max	min	max	min	max	min
Strength I	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength II	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength IV	-	-	-	-	-	-	-	-
Service I	-	-	-	-	-	-	-	-
Service II	1	1	1	1	1	1	-	-
Fatigue I	-	-	-	-	-	-	-	-
Fatigue II	-	-	-	-	-	-	-	-

Load Factors (LRFD) (continued)

Limit State	LL				SE		PS		DS	
	Design		Legal	Permit						
	Inventory	Operating			max	min	max	min	max	min
Strength I	1.75	1.35	1.45	0	-	-	-	-	-	-
Strength II	-		0	1.2	-	-	-	-	-	-
Strength IV	-		-	-	-	-	-	-	-	-
Service I	-		-	-	-	-	-	-	-	-
Service II	1.3	1	1.3	1	-	-	-	-	-	-
Fatigue I	0.75		-	-	-	-	-	-	-	-

Fatigue II	-	-	-	-	-	-	-	-	-

Load Modifiers (LRFD)

Limit State	Ductility	Redundancy	Importance	Combined Product	
				max	min
Strength I	1	1	1	-	-
Strength II	1	1	1	-	-
Strength IV	1	1	1	-	-
Service I	1	1	1	-	-
Service II	1	1	1	-	-
Fatigue I	1	1	1	-	-
Fatigue II	1	1	1	-	-

Resistance Factors (LRFD)

Resistance Factors

Type	Value
φ Flexure	1
φ Shear	1
φ Bearing	1
φ Compression	0.95
φ Shear Connectors	0.85
φ Fatigue	1

System/Total Modifiers

Limit State	Resistance Type	System	Total
Strength	Flexure	1	-
Strength	Shear	1	-
Strength	Bearing	1	-
Strength	Compression	1	-
Strength	Shear Connectors	1	-
Strength	Longitudinal Reinforcement	1	-
Service	Flexure	1	-
Fatigue	Fatigue	1	-

Condition Modifiers

Limit State	Condition
Strength	1
Service	1
Fatigue	1

Load Factors (LFD)

Load Combo	γ	LL	DC	DW	DU	TU	SE	PS	DS
I	-	-	-	-	-	-	-	1	1
IB	-	-	-	-	-	-	-	1	1
I-Overload	-	-	-	-	-	-	-	1	1

IB-Overload	-	-	-	-	-	-	-	1	1
I-Service	-	-	-	-	-	-	-	1	1
IB-Service	-	-	-	-	-	-	-	1	1
Fatigue	-	-	-	-	-	-	-	1	1

Capacity Reduction Factors (LFD)

Factor	Value
φ Flexure	-
φ Shear	-
φ Fatigue	-

Materials

Steel

ID	Name	Yield Stress	Tensile Strength	Modulus of Elasticity	Density	Thermal Expansion Coefficient
1	Salvaged Girder	30 ksi	60 ksi	29000 ksi	0.49 kcf	6.5E-06 °F^{-1}

Concrete

ID	Name	28 Day Compressive Strength	Modulus of Elasticity	Density	Modulus of Rupture	Modulus of Rupture (VCI Method)	Thermal Expansion Coefficient
1	1949 Class A-1	3 ksi	3880 ksi	0.16 kcf	-	-	6E-06 °F^{-1}

Dead Load Groups

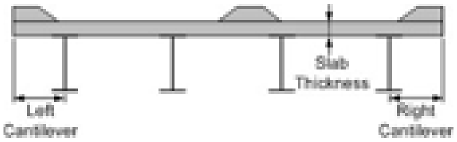
Groups

ID	Name	Stage	Type	Description
1	Concrete Railing	1	DC	Top Rail, Bottom Rail, Post
2	Sidewalk / Shoulder	1	DC	
3	AC Pavement	1	DW	
4	Girder Bracing	1	DC	X-Bracing with Steel Angles in the Outer Bays
5	Bottom Flange Bracing	1	DC	Steel Angles Diagonal Bracing in the Interior Bay
6	Vertical Web Angles	1	DC	Steel Angles Spaced at Intervals
7	Waterlines	1	DU	Assumed 8" Waterlines
8	Monorail	1	DC	6" Monorail
9	Bottom Flange Struts	1	DC	Bottom Flange Struts out of Steel Angles and Plates in Outer Bays

Deck Geometry

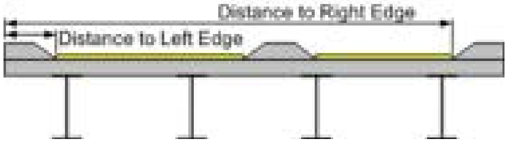
Deck

Deck Thickness:	9 in.
Left Cantilever Length:	6.5 ft
Right Cantilever Length:	6.5 ft
Equal Member Spacing:	No



Travelway Locations

Distance to Left Edge: 5.25 ft
Distance to Right Edge: 33.25 ft

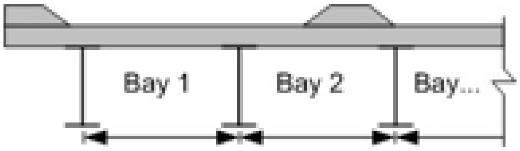


Sacrificial Topping

Thickness: -
Dead Load Type: DC

Member Spacing

Bay #	Spacing
1	9 ft
2	7.5 ft
3	9 ft



Soffits

No soffits have been defined.

Appurtenances

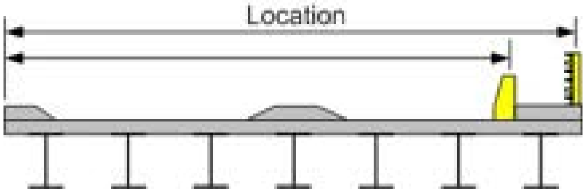
No appurtenances have been defined.

Deck Loads

Materials/Stages

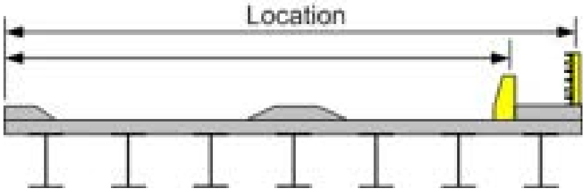
Deck Material: **1949 Class A-1**
Curb & Median Material: Not Assigned
Wearing Surface Weight: -
Slab Stage: 1
Curb Stage: 1
Median Stage: 1
Wearing Surface Stage: 1

Line Loads



Dead Load Group	Line Load	Load Location
Concrete Railing	0.319 kip / ft	0.923 ft
Concrete Railing	0.319 kip / ft	37.577 ft
Waterlines	0.224 kip / ft	38.5 ft
Monorail	0.016 kip / ft	34 ft

Uniform Loads



Dead Load Group	Uniform Load	Load Location	Load Width
Sidewalk / Shoulder	0.007 ksf	0 ft	5.25 ft
Sidewalk / Shoulder	0.003 ksf	5.25 ft	2 ft
AC Pavement	0.018 ksf	7.25 ft	24 ft
Sidewalk / Shoulder	0.003 ksf	31.25 ft	2 ft
Sidewalk / Shoulder	0.007 ksf	33.25 ft	5.25 ft

Live Loads

Live Load Control

Direction Control:	Up+Down
Standard Live Loads:	None
Wheel Advancement Denominator:	100
ADTT:	5000
ADTT for Single Lane:	2000
Multiple Presence Adjustment:	-
% of Dynamic Load Allowance (Impact):	100 %
Fixed Impact (STD):	-

Dynamic Load Allowance (LRFD)

Design/Rating Procedure	Truck	Lane	Fatigue
Design	33 %	0 %	15 %
Legal	33 %	0 %	0 %
Permit	33 %	0 %	0 %

Special Vehicles

Axle Vehicles

No axle vehicles have been defined.

Lane Vehicles

No lane vehicles have been defined.

Definitions (STD)

No standard live load definitions have been defined.

Definitions (LRFD)

Definition 1

Code:	HL-93-TRUCK
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 2

Code:	HL-93-TANDEM
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating

Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 3

Code:	HL-93-LANE
Type:	DesignLane
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 4

Code:	TYPE3
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 5

Code:	TYPE3S2
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 6

Code:	TYPE3-3
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-

Limit State	gamma LL	gamma LL Operating
Fatigue I	-	-
Fatigue II	-	-

Definition 7

Code: NRL-MIN
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 8

Code: NRL-MAX
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 9

Code: SU4
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 10

Code: SU5
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 11

Code: SU6

Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 12

Code: SU7
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 13

Code: HP1
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 14

Code: HP2
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 15

Code: HP3
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-

Notional Load:	No
Fixed DLA:	-

Limit State	gamma LL	gamma LL Operating
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 16

Code:	HL-93-FAT
Type:	FatigueTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 17

Code:	EV2
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 18

Code:	EV3
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

General Combinations (LRFD)

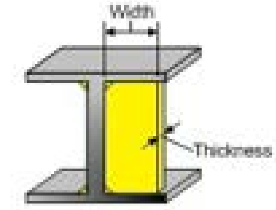
Standard Combo	Truck	Lane	Combination Factors Truck	Combination Factors Lane
No	**HL-93-TRUCK**	**HL-93-LANE**	1	1
No	**HL-93-TANDEM**	**HL-93-LANE**	1	1

Deflection Combinations (LRFD)

No Deflection Combinations (LRFD) have been defined.

Component Groups

Transverse Stiffeners



ID	Name	Width	Thickness	Type	Type Factor	Material
1	Web Stiffeners	5 in.	0.375 in.	Single Angles	-	**Salvaged Girder**

Bearing Stiffeners

No bearing stiffener groups have been defined.

Longitudinal Stiffeners

No longitudinal stiffener groups have been defined.

Specification Control

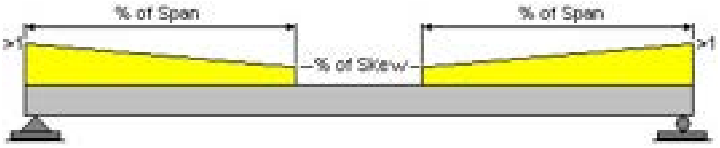
General

Lane Geometry

Design Vehicle Lane Width:	12 ft
Vehicle Width:	10 ft
Wheel Spacing:	6 ft
Encroachment Distance:	-

Load Factors Control (LRFD): Use maximum and minimum load factors

Skew Factors



Span #	% of Span	% of Skew
1	-	-

Steel

Use Appendix A6 (LRFD):	No
Allow Plastic Analysis:	No
Override Longitudinal Stiffeners:	No
Slab thickness for longitudinal shear force:	Structural
Slab thickness for minimum negative flexure concrete deck reinforcement:	Structural

Fatigue

AASHTO LRFD Table 6.6.1.2.5-2

% of Span: -
Span Length: 40 ft

Stress Range in Longitudinal Reinforcement Over the Piers: 10 ksi

Detail Categories (LRFD)

Detail Category	Constant, A x 10^8	Constant Amplitude Fatigue Threshold
A	-	-

B	-	-
B'	-	-
C	-	-
C'	-	-
D	-	-
E	-	-
E'	-	-

Limit State Map

Limit State Maps (LRFD)

Limit State	Design Review			Rating		
	Design Load	Legal Load	Permit Load	Design Load	Legal Load	Permit Load
Strength I	No	No	No	Inventory/Operating	Yes	No
Strength II	No	No	No	Exclude	No	Yes
Strength IV	No	No	No	Exclude	No	No
Service I	No	No	No	Exclude	No	No
Service II	No	No	No	Inventory/Operating	Yes	Yes
Service III	No	No	No	Exclude	No	No
Fatigue I	No	No	No	Inventory	No	No
Fatigue II	No	No	No	Exclude	No	No

Load Combo Maps (LFD)

Load Combo	Design Review	Rating
I	No	Inventory
IB	No	Operating
I-Overload	No	Exclude
IB-Overload	No	Exclude
I-Service	No	Exclude
IB-Service	No	Exclude
Fatigue	No	Exclude

Spec. Check Map (Strength)

LRFD Specification Check Maps

Design Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No

Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Design Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	No	No
Shear	Yes	No	No
Bearing	Yes	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	No	No
Shear	Yes	No	No
Bearing	Yes	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	Yes	No
Shear	No	Yes	No
Bearing	No	Yes	No
Flexural Stress In Longitudinal Stiffener	No	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		
Flexural Stress In Longitudinal Stiffener	No	No		

Rating

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		

Flexural Stress In Longitudinal Stiffener	No	No

Spec. Check Map (Service)

LRFD Specification Check Maps

Design Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Legal Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Permit Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Design Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Legal Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Permit Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

LFD Specification Check Maps

Design Review

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Rating

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Spec. Check Map (Fatigue)

LRFD Specification Check Maps

Design Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Legal Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Permit Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Design Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	Yes	No
Fatigue of Shear Connectors	Yes	No
Fatigue Shear Range of Shear Connectors	Yes	No
Fatigue of Special Points	Yes	No
Fatigue Shear	Yes	No

Legal Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No

Fatigue Shear	No	No

Permit Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Rating

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Member

Member Notes

No member notes have been defined.

Member Materials

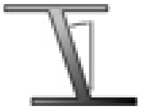
Beam

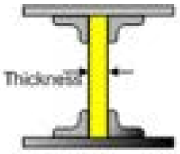
Beam Material: Salvaged Girder

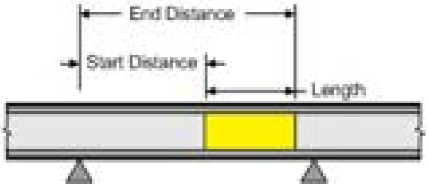
Beam Profile

Web

Apply to Entire Structure: Yes
Web Angle: -





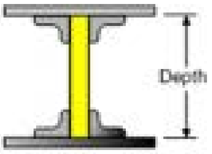


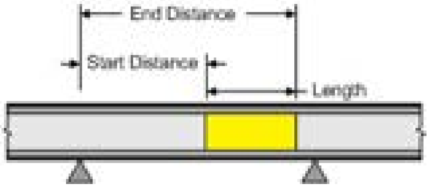
Thickness	Material	Support Number	Start Distance	Length

0.375 in.	Salvaged Girder	1	0 ft	72 ft

Web Depth

Apply to Entire Structure: Yes

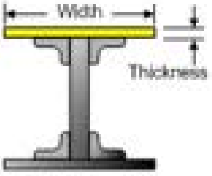


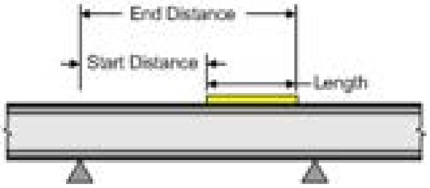


Start Depth	Web Variation	End Depth	Support Number	Start Distance	Length
78 in.	Linear	78 in.	1	0 ft	72 ft

Top Cover Plate

Apply to Entire Structure: No

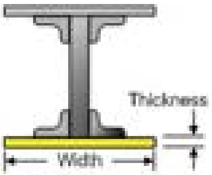


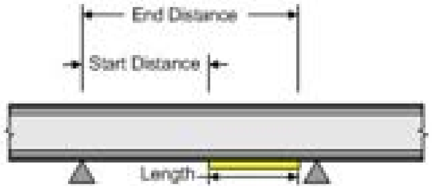


Start of Range			End of Range			Material	Support Number	Start Distance	Length
Width	Thickness	Gap Thickness	Width	Thickness	Gap Thickness				
16 in.	0.5 in.	-	-	-	-	Salvaged Girder	1	8.5 ft	9.438 ft
16 in.	1 in.	-	-	-	-	Salvaged Girder	1	17.938 ft	40.875 ft
16 in.	0.5 in.	-	-	-	-	Salvaged Girder	1	58.813 ft	4.688 ft

Bottom Cover Plate

Apply to Entire Structure: No

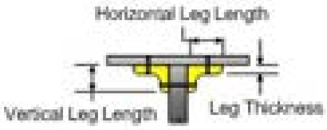


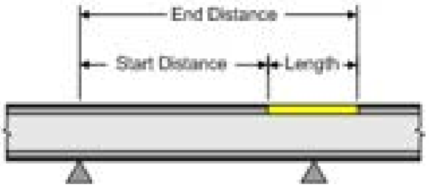


Start of Range			End of Range			Material	Support Number	Start Distance	Length
Width	Thickness	Gap Thickness	Width	Thickness	Gap Thickness				
16 in.	0.5 in.	-	-	-	-	Salvaged Girder	1	8.5 ft	9.438 ft
16 in.	1 in.	-	-	-	-	Salvaged Girder	1	17.938 ft	40.875 ft
16 in.	0.5 in.	-	-	-	-	Salvaged Girder	1	58.813 ft	4.688 ft

Top Angles

Apply to Entire Structure: Yes

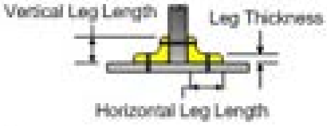


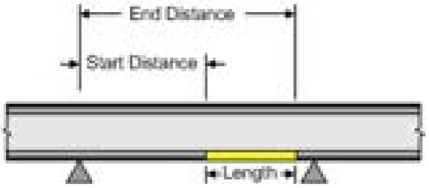


Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length
6 in.	6 in.	0.75 in.	**Salvaged Girder**	1	0 ft	72 ft

Bottom Angles

Apply to Entire Structure: Yes





Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length
6 in.	6 in.	0.75 in.	**Salvaged Girder**	1	0 ft	72 ft

Hinges

No hinges have been defined.

Special Locations

No special locations have been defined.

Supports

Support Conditions

Support	Support Restraint		
	Horizontal	Vertical	Rotational
1	Free	Restrained	Free
2	Restrained	Restrained	Free

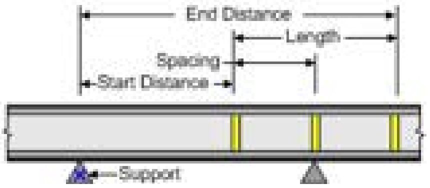
Spring Constants

Support	Spring Constants		
	Horizontal	Vertical	Rotational
1	-	-	-
2	-	-	-

Schedules

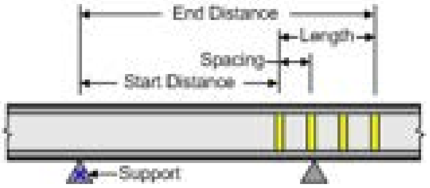
Bracing

Apply to Entire Structure: No



Spacing	Support	Start Distance	Length
17.427 ft	1	0.573 ft	34.854 ft
17.438 ft	1	53.958 ft	17.438 ft

Transverse Stiffeners



Stiffener Group	Spacing	Support	Start Distance	Length
Web Stiffeners	3 ft	1	3.104 ft	3 ft
Web Stiffeners	4 ft	1	9.573 ft	4 ft
Web Stiffeners	4.417 ft	1	22.469 ft	8.833 ft
Web Stiffeners	4.396 ft	1	40.677 ft	8.792 ft
Web Stiffeners	4 ft	1	58.365 ft	4 ft
Web Stiffeners	3 ft	1	65.865 ft	3 ft

Bearing Stiffeners

Apply to Entire Structure: No

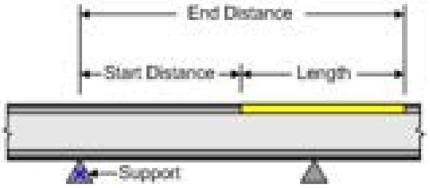
Support	Stiffener Group
1	Not Assigned
2	Not Assigned

Longitudinal Stiffeners

No longitudinal stiffener schedules have been defined.

Lateral Support

Apply to Entire Structure: Yes



Support	Start Distance	Length
1	0 ft	72 ft

Cb Factors (Standard)

No Cb factors (LRFD) have been defined.

Cb Factors (LRFD)

No Cb factors (LRFD) have been defined.

Fatigue Stress (Standard)

No fatigue stress (standard) schedules have been defined.

Member Control

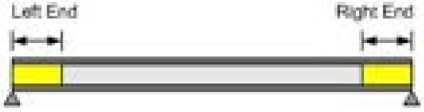
Steel

Flexural Resistance

Span	Compact Piers (Standard)	Ignore Eq. 6.10.7.1.2-3 (LRFD)
1	No	No

End Panel Distances

Top Span



Left of Top Span: -
Right of Top Span: -

Flange Local Buckling Resistance Adjustment

Standard Specifications: -
LRFD Specifications: -

Points of Interest

No points of interest have been defined.

Dead Loads

Uniform

Dead Load Type	Stage	Uniform Load
DC	1	-
DW	1	-
DU	1	-

Additional Self-weight

No additional self-weight dead loads have been defined.

Distributed

Dead Load Group	Support	Distributed Load (Start)		Distributed Load (End)	
		Distance	Magnitude	Distance	Magnitude
Vertical Web Angles	1	0.063 ft	0.018 kip / ft	71.875 ft	-

Concentrated

Dead Load Group	Support	Concentrated Load Distance	Horizontal Force	Vertical Force
Girder Bracing	1	0.573 ft	-	0.169 kip
Girder Bracing	1	18.01 ft	-	0.164 kip
Girder Bracing	1	35.427 ft	-	0.164 kip
Girder Bracing	1	53.927 ft	-	0.164 kip
Girder Bracing	1	71.365 ft	-	0.169 kip
Bottom Flange Struts	1	8.719 ft	-	0.045 kip
Bottom Flange Struts	1	26.719 ft	-	0.047 kip
Bottom Flange Struts	1	44.677 ft	-	0.047 kip
Bottom Flange Struts	1	62.646 ft	-	0.045 kip

Temperature

No temperature dead loads have been defined.

Settlement

Stage: 1

No settlement loads have been defined.

Pedestrian Load

Pedestrian Load: -

Wheel Fractions (Standard)

Moment

No moment wheel fractions have been defined.

Shear

No shear wheel fractions have been defined.

Deflection

No deflection wheel fractions have been defined.

Reaction

Apply to entire structure: No

Support	mg Single-Lane			mg Multi-Lane		
	Moment	Shear	Deflection	Moment	Shear	Deflection
1	-	-	-	-	-	-
2	-	-	-	-	-	-

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                                            BRASS-GIRDER  Version 7.8.1
Agency     : HDOT Highways Division                                                                Page:        556
Engineer   : Moffatt & Nichol (JU)                                                                 Date: 08/19/2017
Bridge Name: 1000190308146        Nanue Stream                                                     Time:     7:59 PM
Input File : .. EVs\Nanue Stream Bridge (Bridge No. 001000190308146)\G4-4\001000190308146_G4-4_NanueStream.girder
Output File: ..S - EVs\Nanue Stream Bridge (Bridge No. 001000190308146)\G4-4\001000190308146_G4-4_NanueStream.out
                                                 Nanue Stream Bridge
                                 Load Rating for Steel Exterior Girder Span 4 (G4-4)

CRITICAL RATING FACTOR SUMMARY: Design Load Inventory

 Live Load Combination                                  Total     Controlling    Limit State          Rating    Load
 No.       Description                                Vehicle Wt.   Point of      Action              Factor   Rating
                                                        (tons)      Interest      Location                     (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       102.0000     STRENGTH I            1.83     66.04
                                                                                 Shear
                                                                                 Maximum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)    25.00       102.0000     STRENGTH I            2.19     54.78
                                                                                 Shear
                                                                                 Maximum Effects

 15   HL-93-FAT                                (FAT)    36.00       108.0000     FATIGUE I             4.41    158.87
                                                                                 Shear Stress
                                                                                 Minimum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       102.0000     STRENGTH I            1.83     66.04

CRITICAL RATING FACTOR SUMMARY: Design Load Operating

 Live Load Combination                                  Total     Controlling    Limit State          Rating    Load
 No.       Description                                Vehicle Wt.   Point of      Action              Factor   Rating
                                                        (tons)      Interest      Location                     (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       102.0000     STRENGTH I-O          2.38     85.61
                                                                                 Shear
                                                                                 Maximum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)    25.00       102.0000     STRENGTH I-O          2.84     71.01
                                                                                 Shear
                                                                                 Maximum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       102.0000     STRENGTH I-O          2.38     85.61

CRITICAL RATING FACTOR SUMMARY: Legal Load

 Live Load Combination                                  Total     Controlling    Limit State          Rating    Load
 No.       Description                                Vehicle Wt.   Point of      Action              Factor   Rating
                                                        (tons)      Interest      Location                     (tons)
=======================================================================================================================

  3   TYPE3                                    (TRK)    25.00       108.0000     STRENGTH I            3.79     94.64
                                                                                 Shear
                                                                                 Minimum Effects

  4   TYPE3S2                                  (TRK)    36.00       108.0000     STRENGTH I            3.37    121.34
                                                                                 Shear
                                                                                 Minimum Effects

  5   TYPE3-3                                  (TRK)    40.00       108.0000     STRENGTH I            3.52    140.61
                                                                                 Shear
                                                                                 Minimum Effects

  6   NRL-MIN                                  (TRK)    40.00       105.0000     SERVICE II            2.57    102.91
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

  7   NRL-MAX                                  (TRK)    40.00       105.0000     SERVICE II            2.63    105.05
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

  8   SU4                                      (TRK)    27.00       108.0000     STRENGTH I            3.45     93.24
                                                                                 Shear
                                                                                 Minimum Effects

  9   SU5                                      (TRK)    31.00       108.0000     STRENGTH I            3.08     95.45
                                                                                 Shear
                                                                                 Minimum Effects
```

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 10   SU6                                      (TRK)    34.75       108.0000     STRENGTH I           2.91     101.24
                                                                                 Shear
                                                                                 Minimum Effects

 11   SU7                                      (TRK)    38.75       105.0000     SERVICE II           2.68     103.98
                                                                                 Flange Stress
                                                                                 Maximum Effects
                                                                                 Top Flange

 16   EV2                                      (TRK)    28.75       108.0000     STRENGTH I           3.24      93.07
                                                                                 Shear
                                                                                 Minimum Effects

 17   EV3                                      (TRK)    43.00       108.0000     STRENGTH I           2.17      93.35
                                                                                 Shear
                                                                                 Minimum Effects
.......................................................................................................................

Crit  EV3                                      (TRK)    43.00       108.0000     STRENGTH I           2.17      93.35

CRITICAL RATING FACTOR SUMMARY: Permit Load

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.       Description                                Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

 12   HP1                                      (PTK)    60.00       108.0000     STRENGTH II          2.54     152.31
                                                                                 Shear
                                                                                 Minimum Effects

 13   HP2                                      (PTK)    78.55       108.0000     STRENGTH II          2.34     183.51
                                                                                 Shear
                                                                                 Minimum Effects

 14   HP3                                      (PTK)   104.95       108.0000     STRENGTH II          3.02     317.40
                                                                                 Shear
                                                                                 Minimum Effects
.......................................................................................................................

Crit  HP2                                      (PTK)    78.55       108.0000     STRENGTH II          2.34     183.51
```

BRASS™
Wyoming Department of Transportation

BRASS-GIRDER™ Input Parameters

Version Information
Girder UI: 7.8.0.3001
Girder XML: 7.8.0.3001
BRASS™ XML: 1.8.0.3001

Administration

Project ID: 8780-06
Project Title: HDOT Statewide Bridge Load Ratings

Bridge ID: 1000190308146
Bridge Name: Nanue Stream
Route Name: 00019 Hawaii Belt Road
Reference Marker: 18

Title 1: Nanue Stream Bridge
Title 2: Load Rating for Steel Interior Girder Span 4 (G3-4)
Date: 2017 4 21

Agency: HDOT Highways Division
Designer/Rater: Moffatt & Nichol (JU)
Reviewer:

Comments:

Bridge Notes

MATERIAL PROPERTIES
Concrete
Weight = 0.160 kcf (HDOT Design Criteria for Bridges and Structures [HDOT] 5.01)
Strength = 3 ksi (Record Drawings: Class A-1)
Elastic Modulus = 3,880 ksi (AASHTO LRFD [LRFD] Eqn 5.4.2.4-1, Use 0.150 kcf per HDOT 5.01)
Reinforcing Steel
Yield Strength = 33 ksi (Unknown, Manual for Bridge Evaluation [MBE] Table 6A.5.2.2-1)
Elastic Modulus = 29,000 ksi (LRFD 5.4.3.2)

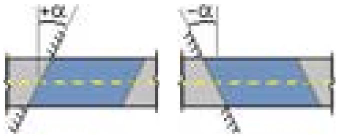
BRIDGE PROPERTIES (RECORD DRAWINGS)
Span 1 = 51 ft
Span 2 = 50 ft
Span 3 = 40 ft
Span 4 = 72 ft
Span 5 = 40 ft
Span 6 = 72 ft
Span 7 = 40 ft
Span 8 = 72 ft
Span 9 = 40 ft
Span 10 = 51 ft
Width = 38.5 ft
Deck Thickness = 9 in min
No. of Griders = 4
Girder Spacing = 9 ft, 7.5 ft, 9 ft
Girder Width = 12 3/8"
Girder Depth = 6'-6 1/2"
Surface Roughness = 3.0 (2015 Bridge Inspectinon Report)
Condition Factor = 1.0 (HDOT 5.04, 2015 Bridge Inspection Report indicates Condition Rating of 7)
System Factor = 1.0 (HDOT 5.05,)

LIVE LOADS
LRFD Live Load (MBE Appendix C6A)
Truck and Tandem Lane Load = 0.64 klf
AASHTO Legal Loads (MBE Appendix D6A)
Type 3
Type 3S2
Type 3-3
Notional Rating Load [NRL]
Legal Lane Load = 0.2 klf
SU4
SU5
SU6
SU7
HDOT Hawaii Standard Single Trip Permit Loads (HDOT 5.06)
No lane load provided, vehicles allowed to trave in any lane
HP1
HP2
HP3
Dynamic Load Allowance (HDOT 5.03)
Spans > 40 ft
Wearing Surface: 3 (Assumed)
Design Loads: 33%
Legal Loads: 10%
Permit Loads: 10%
Scale Factor (HDOT 5.06)
Hawaii Standard Single Trip Permit Vehicle analysis assumes only one permit load on the bridge which allows the use of a single-lane distribution factor. When using the single-lane LRFD distribution factor, the 1.2 multiple prescence factor may shall be divided out from the distribtion factor equations.

Control

Structure

Structure Type:	GirderLine
Define Deck Cross Section:	Yes
Number of Members:	4
Skew Angle:	0 °



Analysis Model Type:	Beam
Number of Top Spans:	1

Spans

Span	Length
1	72 ft

Structure Material:	Steel
Beam Type:	Builtup
Composite Structure:	No
Deck Material:	Concrete

Analysis

Unit System:	US
Analysis Method:	LRFD
Analysis Type:	Rating
Number of Stages:	1
Member of Interest:	3
Model Element Type:	Stepped
Point of Interest Generation Control:	Tenth
Live-load Distribution Factor Application:	AnalysisPoint

Interpolate Reinforcement: No
Calculate Effective Width: No

Input

Symmetry

Component	Symmetric
Beam Profile	No
Deck Profile	No
Shear Connectors	No
Transverse Stiffeners	No
Bearing Stiffeners	No
Longitudinal Stiffeners	No
Bracing (Member)	No
Lateral Support	No
Cb Factors (Std)	No
Cb Factors (LRFD)	No
Fatigue Stress (Std)	No
Beam Wheel Fractions (Std)	No
Reaction Wheel Fractions (Std)	No
Beam Distribution Factors (LRFD)	No
Reaction Distribution Factors (LRFD)	No

Simplified Standard Wheel Fractions: No
Merge Beam/Deck Profile Schedules: Yes

Distribution

Perform Dead Load Distribution: Yes
Calculate LRFD Live Load Distribution Factors: Yes

Dead Load Distribution Methods

Stage	Method
1	Tributary area

Live Load Distribution (LRFD)

Distribution Method: AASHTO LRFD
Cross Section Code: a1
Max. Number of Lanes Loaded: Computed
Slab Thickness Type: Structural
Set eg = 0 for Non-composite: Yes
Apply Skew to Lever Rule Override: Yes
Apply Skew to Ridgid Rule Override: No
Use Constants from Table 4.6.2.2.1-2: No

Libraries

Section Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Sections.bls
Vehicle Library: C:\BRASS\Girder_7.8\Girder\Libraries\BRASS-Vehicles.blv

Output

Primary Output

Action Output Level: DL+LL+CONC
Action Locations: 10thPoints

General

Member Properties: Yes
Load Combinations: Yes
Load and Resistance Factors: Yes

Warnings: Yes
Camber: No
Critical Design Ratios / Rating Factors: Expanded

Live Load

Truck Positions: Yes
Variable Axle Spacing: Yes
Live Load Settings: Yes

Live Load Combinations: Yes
Live Load Details: Yes
Impact (LFD): No

Stage

Stage	Output
1	Yes

Dead Load

Member Self Load: Yes
Distributed Dead Loads: Yes
Concentrated Dead Loads: Yes

Temperature Change: No
Settlements: No

Load Distribution

Dead Load Distribution: Yes
Live Load Distribution: Yes

Intermediate Output

Intermediate Output Level: Full
Effective Width: Yes
Floorbeam Lane Position: Yes

Points of Interest

Specification Checks: Yes
Load Factoring/Combinations: No

Load Distribution

Dead Load: Yes
Live Load: Yes

Limit State Output (LRFD)

Limit State	Specification Check	Load Combination
Strength I	Yes	Yes
Strength II	Yes	Yes
Strength IV	No	No
Service I	No	No
Service II	No	No
Fatigue I	No	No
Fatigue II	No	No

Load Combination Output (LFD)

LFD Load Combo	Specification Check	Load Combination

Combo I	No	No
Combo IB	No	No
Combo I Overload	No	No
Combo IB Overload	No	No
Combo I Service	No	No
Combo IB Service	No	No
Combo Fatigue	Yes	Yes

Intermediate Output (cont.)

Steel

Transverse Stiffeners: No
Bearing Stiffeners: No
Longitudinal Stiffeners: No

Results Tables

X-Y Plot Action Tables: No
Specification Check Results Tables: No
Mesh Plot Files: No

BRASS-PAD™ Data Transfer File: No

Influence

Output influence lines for: None
Ordinate Divisor: 1

Factors

Load Factors (LRFD)

Limit State	DC		DW		DU		TU	
	max	min	max	min	max	min	max	min
Strength I	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength II	1.25	0.9	1.5	0.65	1.5	0.65	-	-
Strength IV	-	-	-	-	-	-	-	-
Service I	-	-	-	-	-	-	-	-
Service II	1	1	1	1	1	1	-	-
Fatigue I	-	-	-	-	-	-	-	-
Fatigue II	-	-	-	-	-	-	-	-

Load Factors (LRFD) (continued)

Limit State	LL				SE		PS		DS	
	Design		Legal	Permit						
	Inventory	Operating			max	min	max	min	max	min
Strength I	1.75	1.35	1.45	0	-	-	-	-	-	-
Strength II	-		0	1.2	-	-	-	-	-	-
Strength IV	-		-	-	-	-	-	-	-	-
Service I	-		-	-	-	-	-	-	-	-
Service II	1.3	1	1.3	1	-	-	-	-	-	-
Fatigue I	0.75		-	-	-	-	-	-	-	-
Fatigue II	-		-	-	-	-	-	-	-	-

Load Modifiers (LRFD)

Limit State	Ductility	Redundancy	Importance	Combined Product	
				max	min
Strength I	1	1	1	-	-
Strength II	1	1	1	-	-
Strength IV	1	1	1	-	-
Service I	1	1	1	-	-
Service II	1	1	1	-	-
Fatigue I	1	1	1	-	-
Fatigue II	1	1	1	-	-

Resistance Factors (LRFD)

Resistance Factors

Type	Value
φ Flexure	1
φ Shear	1
φ Bearing	1
φ Compression	0.95
φ Shear Connectors	0.85
φ Fatigue	1

System/Total Modifiers

Limit State	Resistance Type	System	Total
Strength	Flexure	1	-
Strength	Shear	1	-
Strength	Bearing	1	-
Strength	Compression	1	-
Strength	Shear Connectors	1	-
Strength	Longitudinal Reinforcement	1	-
Service	Flexure	1	-
Fatigue	Fatigue	1	-

Condition Modifiers

Limit State	Condition
Strength	1
Service	1
Fatigue	1

Load Factors (LFD)

Load Combo	γ	LL	DC	DW	DU	TU	SE	PS	DS
I	-	-	-	-	-	-	-	1	1
IB	-	-	-	-	-	-	-	1	1
I-Overload	-	-	-	-	-	-	-	1	1
IB-Overload	-	-	-	-	-	-	-	1	1

I-Service	-	-	-	-	-	-	-	1	1
IB-Service	-	-	-	-	-	-	-	1	1
Fatigue	-	-	-	-	-	-	-	1	1

Capacity Reduction Factors (LFD)

Factor	Value
φ Flexure	-
φ Shear	-
φ Fatigue	-

Materials

Steel

ID	Name	Yield Stress	Tensile Strength	Modulus of Elasticity	Density	Thermal Expansion Coefficient
1	Salvaged Girder	30 ksi	60 ksi	29000 ksi	0.49 kcf	6.5E-06 °F^{-1}

Concrete

ID	Name	28 Day Compressive Strength	Modulus of Elasticity	Density	Modulus of Rupture	Modulus of Rupture (VCI Method)	Thermal Expansion Coefficient
1	1949 Class A-1	3 ksi	3880 ksi	0.16 kcf	-	-	6E-06 °F^{-1}

Dead Load Groups

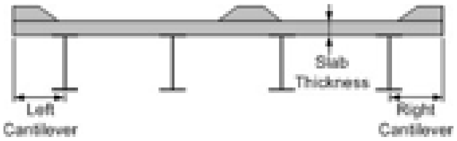
Groups

ID	Name	Stage	Type	Description
1	Concrete Railing	1	DC	Top Rail, Bottom Rail, Post
2	Sidewalk / Shoulder	1	DC	
3	AC Pavement	1	DW	
4	Girder Bracing	1	DC	X-Bracing with Steel Angles in the Outer Bays
5	Bottom Flange Bracing	1	DC	Steel Angles Diagonal Bracing in the Interior Bay
6	Vertical Web Angles	1	DC	Steel Angles Spaced at Intervals
7	Waterlines	1	DU	Assumed 8" Waterlines
8	Monorail	1	DC	6" Monorail
9	Bottom Flange Struts	1	DC	Bottom Flange Struts out of Steel Angles and Plates in Outer Bays

Deck Geometry

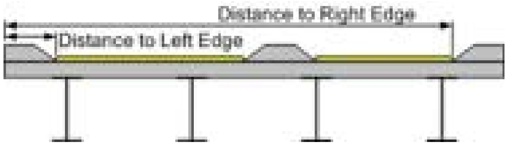
Deck

Deck Thickness: 9 in.
Left Cantilever Length: 6.5 ft
Right Cantilever Length: 6.5 ft
Equal Member Spacing: No



Travelway Locations

Distance to Left Edge: 5.25 ft
Distance to Right Edge: 33.25 ft

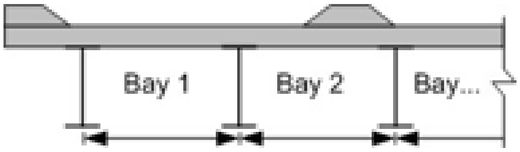


Sacrificial Topping

Thickness: -
Dead Load Type: DC

Member Spacing

Bay #	Spacing
1	9 ft
2	7.5 ft
3	9 ft



Soffits

No soffits have been defined.

Appurtenances

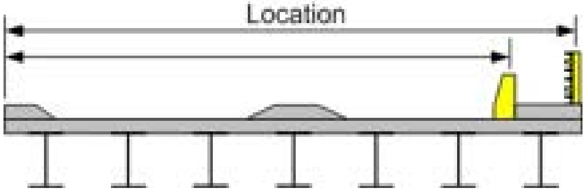
No appurtenances have been defined.

Deck Loads

Materials/Stages

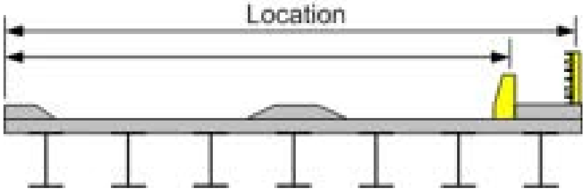
Deck Material: 1949 Class A-1
Curb & Median Material: Not Assigned
Wearing Surface Weight: -
Slab Stage: 1
Curb Stage: 1
Median Stage: 1
Wearing Surface Stage: 1

Line Loads



Dead Load Group	Line Load	Load Location
Concrete Railing	0.319 kip / ft	0.923 ft
Concrete Railing	0.319 kip / ft	37.577 ft
Waterlines	0.224 kip / ft	38.5 ft
Monorail	0.016 kip / ft	34 ft

Uniform Loads



Dead Load Group	Uniform Load	Load Location	Load Width
Sidewalk / Shoulder	0.007 ksf	0 ft	5.25 ft
Sidewalk / Shoulder	0.003 ksf	5.25 ft	2 ft
AC Pavement	0.018 ksf	7.25 ft	24 ft
Sidewalk / Shoulder	0.003 ksf	31.25 ft	2 ft
Sidewalk / Shoulder	0.007 ksf	33.25 ft	5.25 ft

Live Loads

Live Load Control

Direction Control:	Up+Down
Standard Live Loads:	None
Wheel Advancement Denominator:	100
ADTT:	5000
ADTT for Single Lane:	2000
Multiple Presence Adjustment:	-
% of Dynamic Load Allowance (Impact):	100 %
Fixed Impact (STD):	-

Dynamic Load Allowance (LRFD)

Design/Rating Procedure	Truck	Lane	Fatigue
Design	33 %	0 %	15 %
Legal	33 %	0 %	0 %
Permit	33 %	0 %	0 %

Special Vehicles

Axle Vehicles

No axle vehicles have been defined.

Lane Vehicles

No lane vehicles have been defined.

Definitions (STD)

No standard live load definitions have been defined.

Definitions (LRFD)

Definition 1

Code:	HL-93-TRUCK
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 2

Code:	HL-93-TANDEM
Type:	DesignTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-

Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 3

Code:	HL-93-LANE
Type:	DesignLane
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	Yes
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 4

Code:	TYPE3
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 5

Code:	TYPE3S2
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 6

Code:	TYPE3-3
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-

Fatigue II	-	-

Definition 7

Code: NRL-MIN
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 8

Code: NRL-MAX
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 9

Code: SU4
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 10

Code: SU5
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 11

Code: SU6
Type: GeneralTruck

Live Load Factor Overrides

Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 12

Code: SU7
Type: GeneralTruck
Design Rating: Legal
% of Dynamic Load Allowance: -
Scale Factor: -
Lanes Loaded: Critical
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 13

Code: HP1
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 14

Code: HP2
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No
Fixed DLA: -

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 15

Code: HP3
Type: PermitTruck
Design Rating: Permit
% of Dynamic Load Allowance: -
Scale Factor: 0.833
Lanes Loaded: Single
Notional Load: No

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-

Fixed DLA: -

Limit State	gamma LL	gamma LL Operating
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 16

Code:	HL-93-FAT
Type:	FatigueTruck
Design Rating:	Design
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 17

Code:	EV2
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

Definition 18

Code:	EV3
Type:	GeneralTruck
Design Rating:	Legal
% of Dynamic Load Allowance:	-
Scale Factor:	-
Lanes Loaded:	Critical
Notional Load:	No
Fixed DLA:	-

Live Load Factor Overrides

Limit State	gamma LL	gamma LL Operating
Strength I	-	-
Strength II	-	-
Strength IV	-	-
Service I	-	-
Service II	-	-
Service III	-	-
Fatigue I	-	-
Fatigue II	-	-

General Combinations (LRFD)

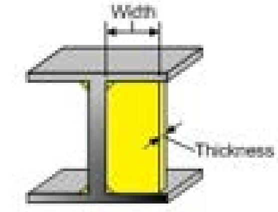
Standard Combo	Truck	Lane	Combination Factors Truck	Combination Factors Lane
No	**HL-93-TRUCK**	**HL-93-LANE**	1	1
No	**HL-93-TANDEM**	**HL-93-LANE**	1	1

Deflection Combinations (LRFD)

No Deflection Combinations (LRFD) have been defined.

Component Groups

Transverse Stiffeners



ID	Name	Width	Thickness	Type	Type Factor	Material
1	Web Stiffeners	5 in.	0.375 in.	Single Angles	-	**Salvaged Girder**

Bearing Stiffeners

No bearing stiffener groups have been defined.

Longitudinal Stiffeners

No longitudinal stiffener groups have been defined.

Specification Control

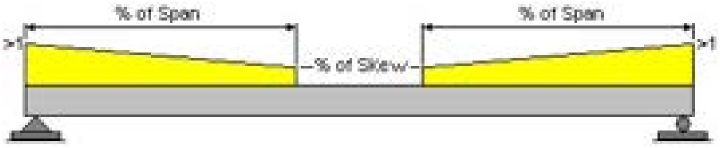
General

Lane Geometry

Design Vehicle Lane Width: 12 ft
Vehicle Width: 10 ft
Wheel Spacing: 6 ft
Encroachment Distance: -

Load Factors Control (LRFD): Use maximum and minimum load factors

Skew Factors



Span #	% of Span	% of Skew
1	-	-

Steel

Use Appendix A6 (LRFD): No
Allow Plastic Analysis: No
Override Longitudinal Stiffeners: No
Slab thickness for longitudinal shear force: Structural
Slab thickness for minimum negative flexure concrete deck reinforcement: Structural

Fatigue

AASHTO LRFD Table 6.6.1.2.5-2

% of Span: -
Span Length: 40 ft

Stress Range in Longitudinal Reinforcement Over the Piers: 10 ksi

Detail Categories (LRFD)

Detail Category	Constant, A x 10^8	Constant Amplitude Fatigue Threshold
A	-	-

B	-	-
B'	-	-
C	-	-
C'	-	-
D	-	-
E	-	-
E'	-	-

Limit State Map

Limit State Maps (LRFD)

Limit State	Design Review			Rating		
	Design Load	Legal Load	Permit Load	Design Load	Legal Load	Permit Load
Strength I	No	No	No	Inventory/Operating	Yes	No
Strength II	No	No	No	Exclude	No	Yes
Strength IV	No	No	No	Exclude	No	No
Service I	No	No	No	Exclude	No	No
Service II	No	No	No	Inventory/Operating	Yes	Yes
Service III	No	No	No	Exclude	No	No
Fatigue I	No	No	No	Inventory	No	No
Fatigue II	No	No	No	Exclude	No	No

Load Combo Maps (LFD)

Load Combo	Design Review	Rating
I	No	Inventory
IB	No	Operating
I-Overload	No	Exclude
IB-Overload	No	Exclude
I-Service	No	Exclude
IB-Service	No	Exclude
Fatigue	No	Exclude

Spec. Check Map (Strength)

LRFD Specification Check Maps

Design Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No

Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Review

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	No	No
Shear	No	No	No
Bearing	No	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Design Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	No	No
Shear	Yes	No	No
Bearing	Yes	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Legal Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	Yes	No	No
Shear	Yes	No	No
Bearing	Yes	No	No
Flexural Stress In Longitudinal Stiffener	No	No	No

Permit Load Rating

Spec Check	Strength I	Strength II	Strength IV
Flexure	No	Yes	No
Shear	No	Yes	No
Bearing	No	Yes	No
Flexural Stress In Longitudinal Stiffener	No	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		
Flexural Stress In Longitudinal Stiffener	No	No		

Rating

LFD Spec Check	I	IB	I-Overload	IB-Overload
Flexure	No	No	No	No
Shear	No	No		
Bearing	No	No		

Flexural Stress In Longitudinal Stiffener	No	No

Spec. Check Map (Service)

LRFD Specification Check Maps

Design Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Legal Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Permit Load Review

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	No
Live Load Deflection	No	No

Design Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Legal Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

Permit Load Rating

Spec Check	Service I	Service II
Crack Control	No	No
Flexural Stress In Flanges	No	Yes
Live Load Deflection	No	Yes

LFD Specification Check Maps

Design Review

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Rating

LFD Spec Check	I-Overload	IB-Overload
Flexural Stress In Flanges	No	No

Spec. Check Map (Fatigue)

LRFD Specification Check Maps

Design Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Legal Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Permit Load Review

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

Design Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	Yes	No
Fatigue of Shear Connectors	Yes	No
Fatigue Shear Range of Shear Connectors	Yes	No
Fatigue of Special Points	Yes	No
Fatigue Shear	Yes	No

Legal Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No

Fatigue Shear	No	No

Permit Load Rating

Spec Check	Fatigue I	Fatigue II
Fatigue of Reinforcement	No	No
Fatigue of Shear Connectors	No	No
Fatigue Shear Range of Shear Connectors	No	No
Fatigue of Special Points	No	No
Fatigue Shear	No	No

LFD Specification Check Maps

Design Review

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Rating

LFD Spec Check	Fatigue
Fatigue of Special Points	No

Member

Member Notes

No member notes have been defined.

Member Materials

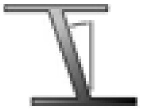
Beam

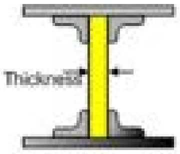
Beam Material: Salvaged Girder

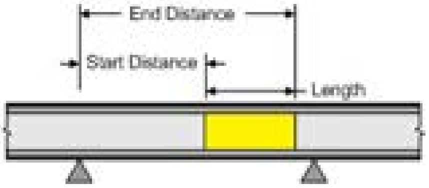
Beam Profile

Web

Apply to Entire Structure: Yes
Web Angle: -





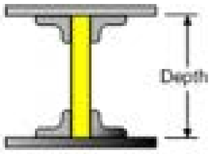


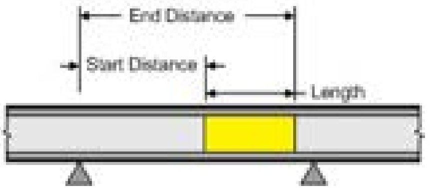
Thickness	Material	Support Number	Start Distance	Length

0.375 in.	**Salvaged Girder**	1	0 ft	72 ft

Web Depth

Apply to Entire Structure: Yes

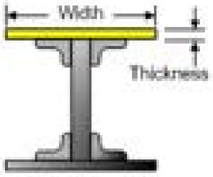


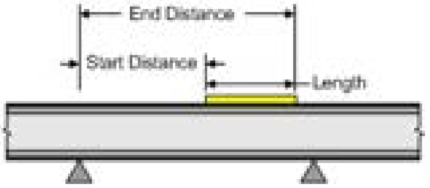


Start Depth	Web Variation	End Depth	Support Number	Start Distance	Length
78 in.	Linear	78 in.	1	0 ft	72 ft

Top Cover Plate

Apply to Entire Structure: No

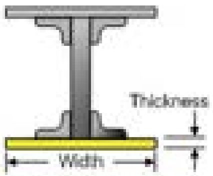


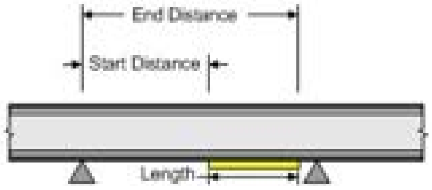


Start of Range			End of Range						
Width	Thickness	Gap Thickness	Width	Thickness	Gap Thickness	Material	Support Number	Start Distance	Length
16 in.	0.5 in.	-	-	-	-	Salvaged Girder	1	8.5 ft	9.438 ft
16 in.	1 in.	-	-	-	-	Salvaged Girder	1	17.938 ft	40.875 ft
16 in.	0.5 in.	-	-	-	-	Salvaged Girder	1	58.813 ft	4.688 ft

Bottom Cover Plate

Apply to Entire Structure: No

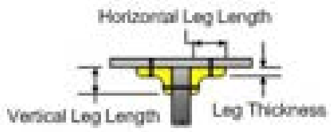


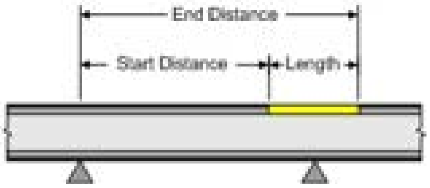


Start of Range			End of Range						
Width	Thickness	Gap Thickness	Width	Thickness	Gap Thickness	Material	Support Number	Start Distance	Length
16 in.	0.5 in.	-	-	-	-	Salvaged Girder	1	8.5 ft	9.438 ft
16 in.	1 in.	-	-	-	-	Salvaged Girder	1	17.938 ft	40.875 ft
16 in.	0.5 in.	-	-	-	-	Salvaged Girder	1	58.813 ft	4.688 ft

Top Angles

Apply to Entire Structure: Yes

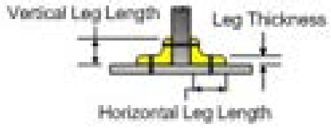


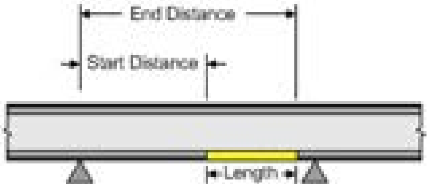


Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length
6 in.	6 in.	0.75 in.	**Salvaged Girder**	1	0 ft	72 ft

Bottom Angles

Apply to Entire Structure: Yes





Vertical Leg Length	Horizontal Leg Length	Leg Thickness	Material	Support Number	Start Distance	Length
6 in.	6 in.	0.75 in.	**Salvaged Girder**	1	0 ft	72 ft

Hinges

No hinges have been defined.

Special Locations

No special locations have been defined.

Supports

Support Conditions

Support	Support Restraint		
	Horizontal	Vertical	Rotational
1	Free	Restrained	Free
2	Restrained	Restrained	Free

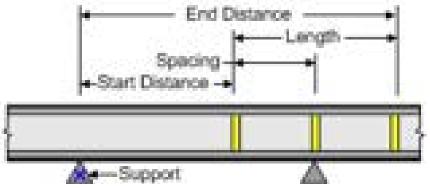
Spring Constants

Support	Spring Constants		
	Horizontal	Vertical	Rotational
1	-	-	-
2	-	-	-

Schedules

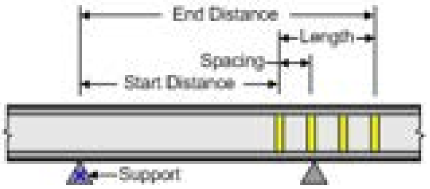
Bracing

Apply to Entire Structure: No



Spacing	Support	Start Distance	Length
17.427 ft	1	0.573 ft	34.854 ft
17.438 ft	1	53.958 ft	17.438 ft

Transverse Stiffeners



Stiffener Group	Spacing	Support	Start Distance	Length
Web Stiffeners	3 ft	1	3.104 ft	3 ft
Web Stiffeners	4 ft	1	9.573 ft	4 ft
Web Stiffeners	4.417 ft	1	22.469 ft	8.833 ft
Web Stiffeners	4.396 ft	1	40.677 ft	8.792 ft
Web Stiffeners	4 ft	1	58.365 ft	4 ft
Web Stiffeners	3 ft	1	65.865 ft	3 ft

Bearing Stiffeners

Apply to Entire Structure: No

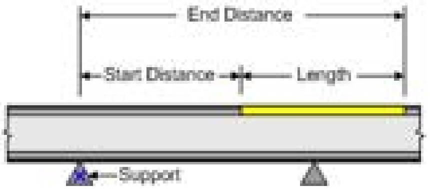
Support	Stiffener Group
1	Not Assigned
2	Not Assigned

Longitudinal Stiffeners

No longitudinal stiffener schedules have been defined.

Lateral Support

Apply to Entire Structure: No



Support	Start Distance	Length
1	0 ft	72 ft

Cb Factors (Standard)

No Cb factors (LRFD) have been defined.

Cb Factors (LRFD)

No Cb factors (LRFD) have been defined.

Fatigue Stress (Standard)

No fatigue stress (standard) schedules have been defined.

Member Control

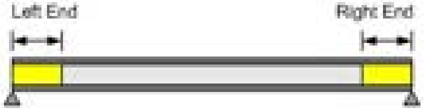
Steel

Flexural Resistance

Span	Compact Piers (Standard)	Ignore Eq. 6.10.7.1.2-3 (LRFD)
1	No	No

End Panel Distances

Top Span



Left of Top Span: -
Right of Top Span: -

Flange Local Buckling Resistance Adjustment

Standard Specifications: -
LRFD Specifications: -

Points of Interest

No points of interest have been defined.

Dead Loads

Uniform

Dead Load Type	Stage	Uniform Load
DC	1	-
DW	1	-
DU	1	-

Additional Self-weight

No additional self-weight dead loads have been defined.

Distributed

Dead Load Group	Support	Distributed Load (Start)		Distributed Load (End)	
		Distance	Magnitude	Distance	Magnitude
Bottom Flange Bracing	1	0.063 ft	0.009 kip / ft	71.875 ft	-
Vertical Web Angles	1	0.063 ft	0.018 kip / ft	71.875 ft	-

Concentrated

Dead Load Group	Support	Concentrated Load		
		Distance	Horizontal Force	Vertical Force
Girder Bracing	1	0.573 ft	-	0.169 kip
Girder Bracing	1	18.01 ft	-	0.164 kip
Girder Bracing	1	35.427 ft	-	0.164 kip
Girder Bracing	1	53.927 ft	-	0.164 kip
Girder Bracing	1	71.365 ft	-	0.169 kip
Bottom Flange Struts	1	8.719 ft	-	0.045 kip
Bottom Flange Struts	1	26.719 ft	-	0.047 kip
Bottom Flange Struts	1	44.677 ft	-	0.047 kip
Bottom Flange Struts	1	62.646 ft	-	0.045 kip

Temperature

No temperature dead loads have been defined.

Settlement

Stage: 1

No settlement loads have been defined.

Pedestrian Load

Pedestrian Load: -

Wheel Fractions (Standard)

Moment

No moment wheel fractions have been defined.

Shear

No shear wheel fractions have been defined.

Deflection

No deflection wheel fractions have been defined.

Reaction

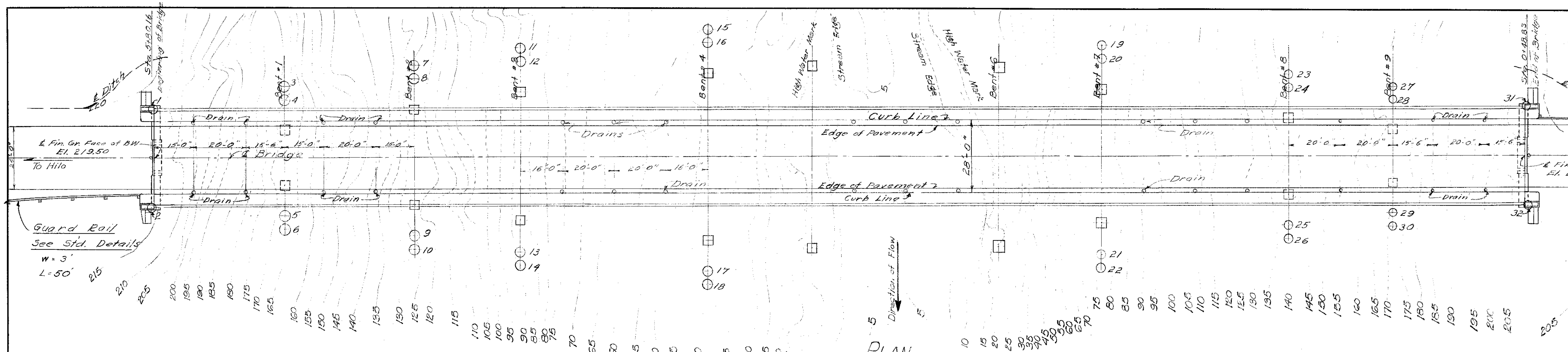
Apply to entire structure: No

Support	mg Single-Lane			mg Multi-Lane		
	Moment	Shear	Deflection	Moment	Shear	Deflection
1	-	-	-	-	-	-
2	-	-	-	-	-	-

```
CRITICAL RATING FACTOR SUMMARY: Design Load Inventory

 Live Load Combination                                  Total     Controlling    Limit State          Rating    Load
 No.       Description                                Vehicle Wt.   Point of       Action             Factor   Rating
                                                        (tons)      Interest      Location                     (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       102.0000     STRENGTH I            1.75      62.91
                                                                                 Shear
                                                                                 Maximum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)    25.00       102.0000     STRENGTH I            2.09      52.18
                                                                                 Shear
                                                                                 Maximum Effects

 15   HL-93-FAT                                (FAT)    36.00       108.0000     FATIGUE I             5.42     195.13
                                                                                 Shear Stress
                                                                                 Minimum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       102.0000     STRENGTH I            1.75      62.91

CRITICAL RATING FACTOR SUMMARY: Design Load Operating

 Live Load Combination                                  Total     Controlling    Limit State          Rating    Load
 No.       Description                                Vehicle Wt.   Point of       Action             Factor   Rating
                                                        (tons)      Interest      Location                     (tons)
=======================================================================================================================

  1   HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       102.0000     STRENGTH I-O          2.27      81.55
                                                                                 Shear
                                                                                 Maximum Effects

  2   HL-93-TANDEM + HL-93-LANE                (DTK)    25.00       102.0000     STRENGTH I-O          2.71      67.64
                                                                                 Shear
                                                                                 Maximum Effects
.......................................................................................................................

Crit  HL-93-TRUCK  + HL-93-LANE                (DTK)    36.00       102.0000     STRENGTH I-O          2.27      81.55

CRITICAL RATING FACTOR SUMMARY: Legal Load

 Live Load Combination                                  Total     Controlling    Limit State          Rating    Load
 No.       Description                                Vehicle Wt.   Point of       Action             Factor   Rating
                                                        (tons)      Interest      Location                     (tons)
=======================================================================================================================

  3   TYPE3                                    (TRK)    25.00       108.0000     STRENGTH I            3.61      90.16
                                                                                 Shear
                                                                                 Minimum Effects

  4   TYPE3S2                                  (TRK)    36.00       108.0000     STRENGTH I            3.21     115.60
                                                                                 Shear
                                                                                 Minimum Effects

  5   TYPE3-3                                  (TRK)    40.00       108.0000     STRENGTH I            3.35     133.95
                                                                                 Shear
                                                                                 Minimum Effects

  6   NRL-MIN                                  (TRK)    40.00       108.0000     STRENGTH I            2.58     103.04
                                                                                 Shear
                                                                                 Minimum Effects

  7   NRL-MAX                                  (TRK)    40.00       108.0000     STRENGTH I            2.61     104.47
                                                                                 Shear
                                                                                 Minimum Effects

  8   SU4                                      (TRK)    27.00       108.0000     STRENGTH I            3.29      88.83
                                                                                 Shear
                                                                                 Minimum Effects

  9   SU5                                      (TRK)    31.00       108.0000     STRENGTH I            2.93      90.93
                                                                                 Shear
                                                                                 Minimum Effects

 10   SU6                                      (TRK)    34.75       108.0000     STRENGTH I            2.78      96.45
```

```
                                                                                 Shear
                                                                                 Minimum Effects

 11   SU7                                      (TRK)    38.75       108.0000     STRENGTH I            2.61     101.12
                                                                                 Shear
                                                                                 Minimum Effects

 16   EV2                                      (TRK)    28.75       108.0000     STRENGTH I            3.08      88.66
                                                                                 Shear
                                                                                 Minimum Effects

 17   EV3                                      (TRK)    43.00       108.0000     STRENGTH I            2.07      88.93
                                                                                 Shear
                                                                                 Minimum Effects
.......................................................................................................................

Crit  EV3                                      (TRK)    43.00       108.0000     STRENGTH I            2.07      88.93

CRITICAL RATING FACTOR SUMMARY: Permit Load

 Live Load Combination                                  Total     Controlling    Limit State          Rating     Load
 No.        Description                               Vehicle Wt.   Point of       Action             Factor    Rating
                                                        (tons)      Interest      Location                      (tons)
=======================================================================================================================

 12   HP1                                      (PTK)    60.00       108.0000     STRENGTH II           2.92     174.95
                                                                                 Shear
                                                                                 Minimum Effects

 13   HP2                                      (PTK)    78.55       108.0000     STRENGTH II           2.68     210.79
                                                                                 Shear
                                                                                 Minimum Effects

 14   HP3                                      (PTK)   104.95       108.0000     STRENGTH II           3.47     364.58
                                                                                 Shear
                                                                                 Minimum Effects
.......................................................................................................................

Crit  HP2                                      (PTK)    78.55       108.0000     STRENGTH II           2.68     210.79
```

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR 3(13)	1950	64	304



PLAN

Scale: 1" = 20'-0"

BORING LEGEND

▒ Ash

○ Boulders

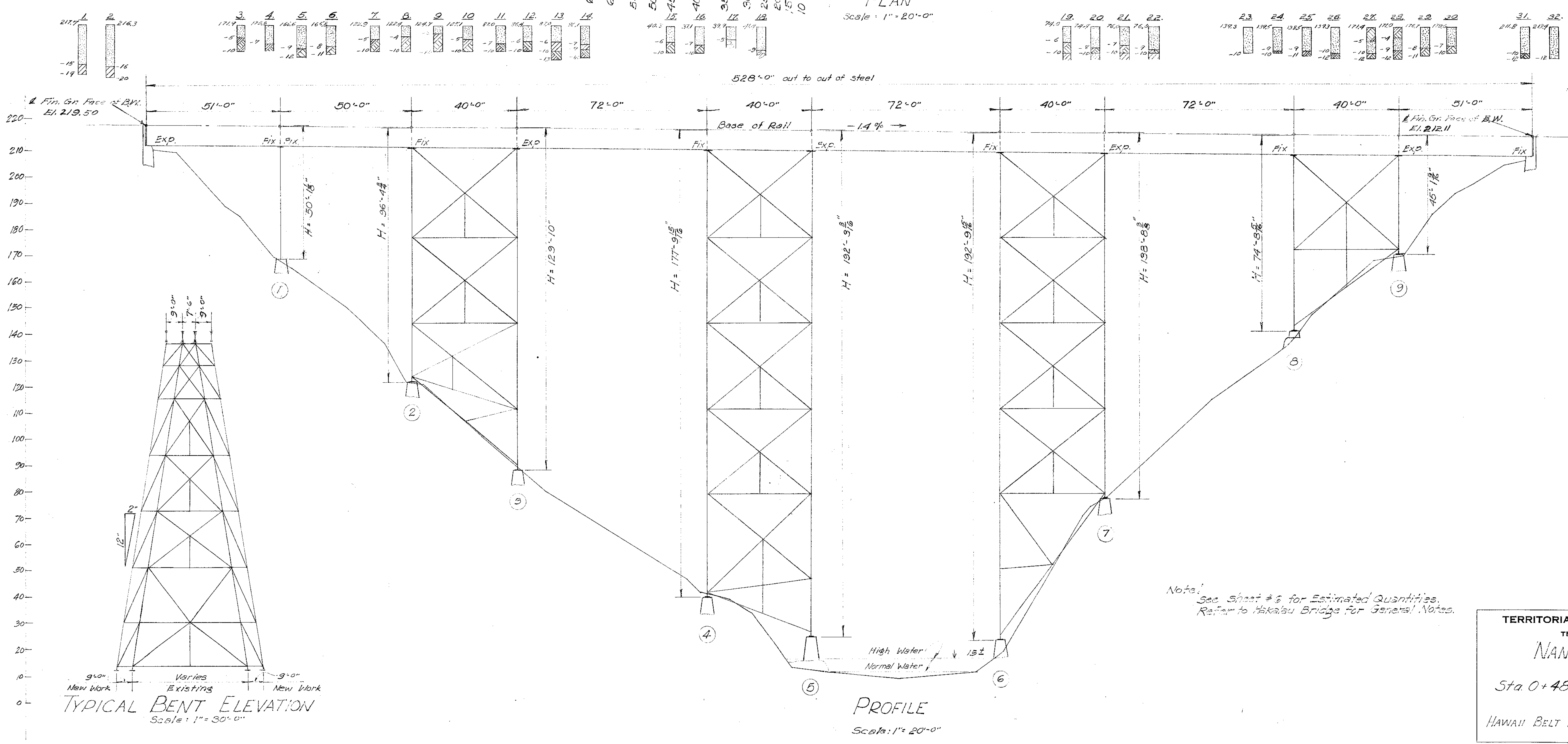
▧ Soft Rock

▨ Blue Rock

Note:

Figures on top of borings indicate ground surface elevation.

Minus figures indicate depth below ground surface.



TYPICAL BENT ELEVATION

Scale: 1" = 30'-0"

PROFILE

Scale: 1" = 20'-0"

Note:
See Sheet #6 for Estimated Quantities.
Refer to Hakalau Bridge for General Notes.

ORIGINAL PLAN	
NOTE BOOK No.	

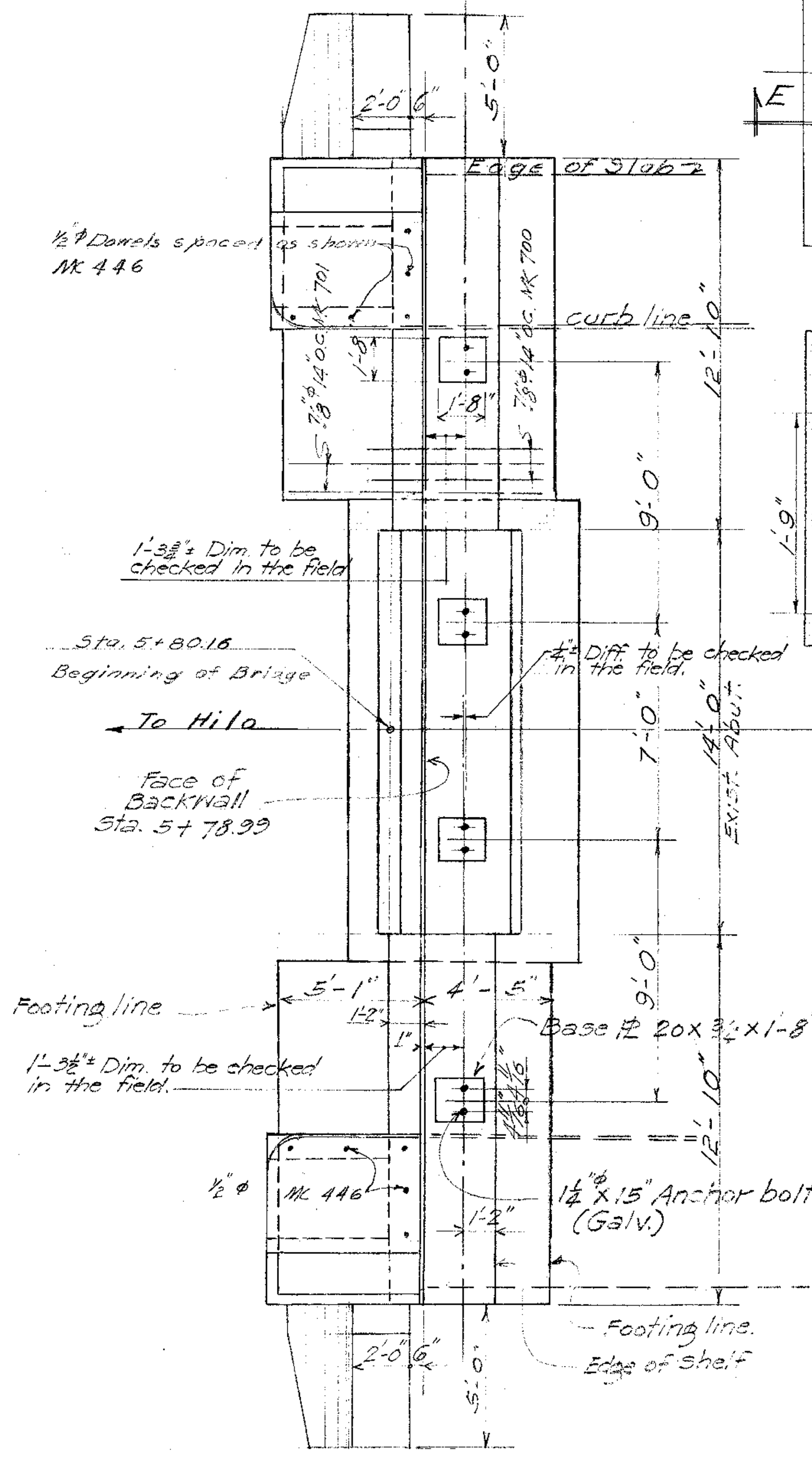
SURVEY PLOTTED BY ________ DATE
DESIGNED BY W. R. Bartels " 3-49
DRAWN BY T. Umehara " 4-49
TRACED BY ________ "
QUANTITIES BY A. Van Der Werff " " "
QUANTITIES CHECKED BY ________ "
CHECKED BY B. Yamashita " 4-49

TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII
NANUE BRIDGE
Sta. 0+48.83 to 5+80.16
HAWAII BELT ROAD SDR 3(13)
Apr. 1949

SHEET No. 1 OF 11 SHEETS

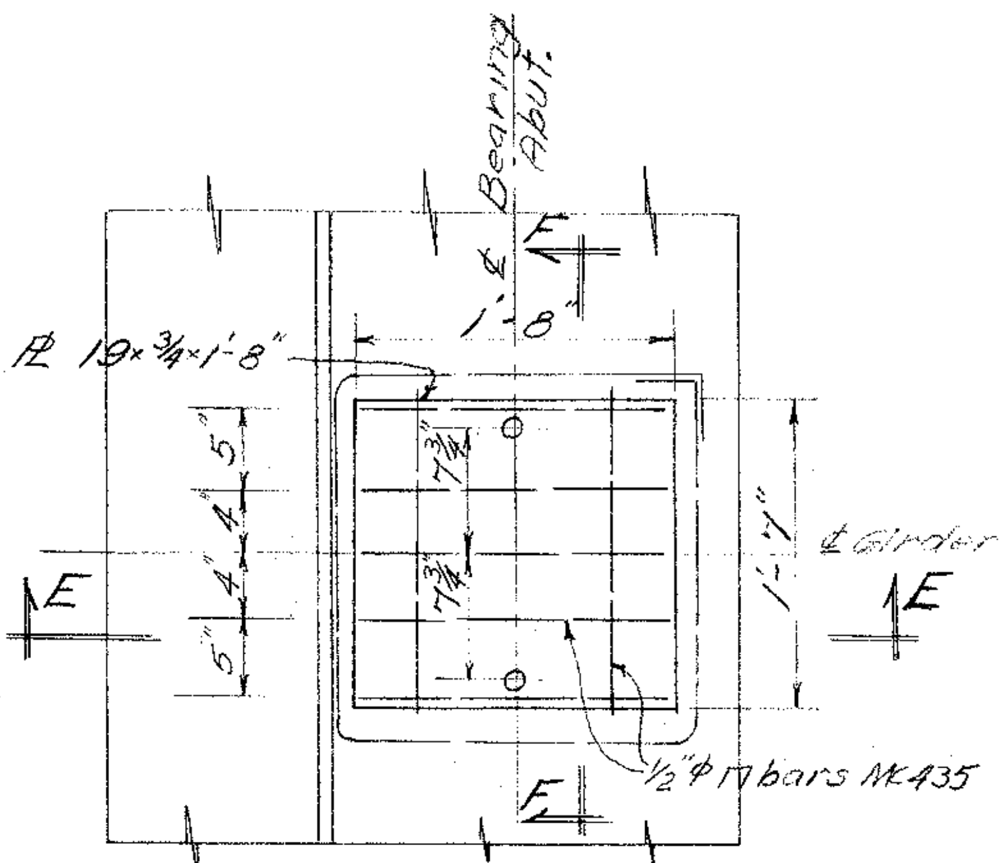
5468.64

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDL 3(13)	1950	65	304

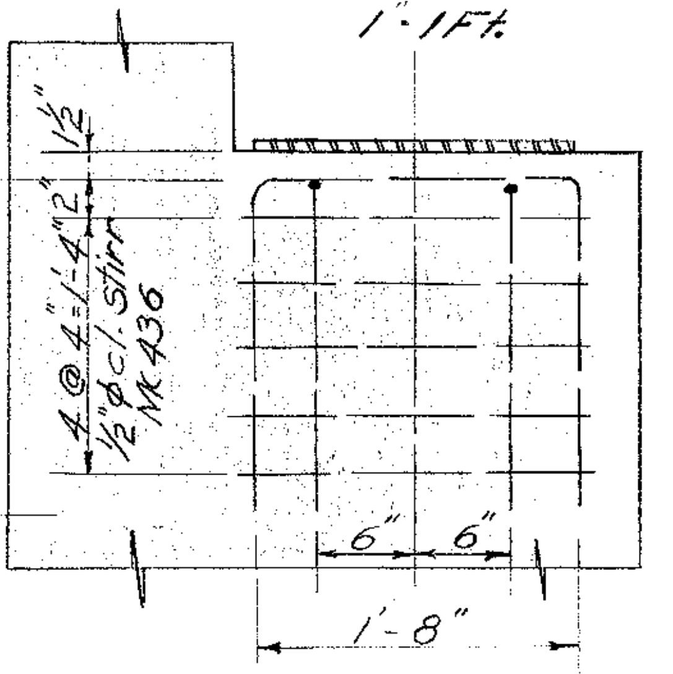


ABUTMENT NO1 HILO END
PLAN
¼" = 1 Ft.

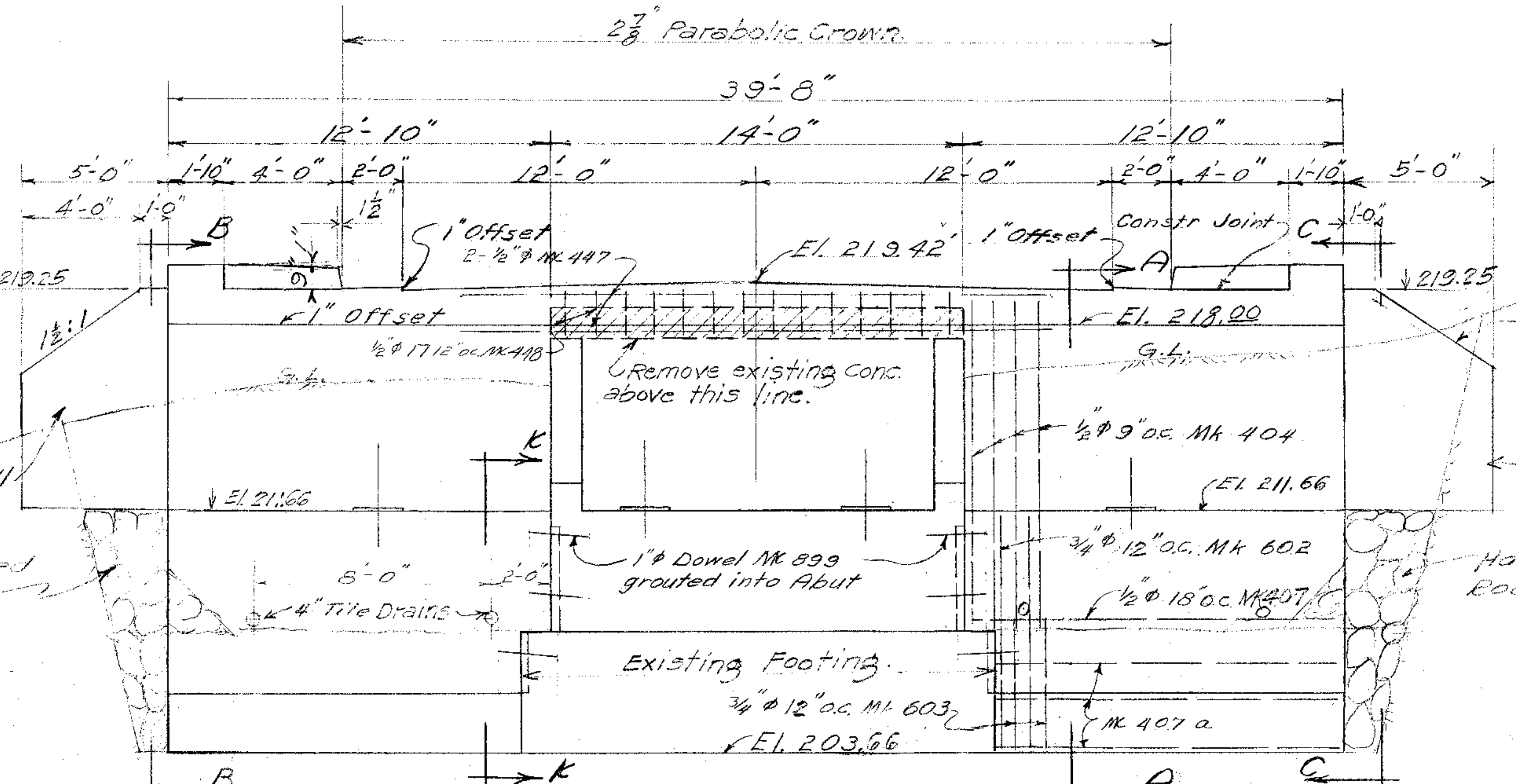
Base PL 19 x ¾ x 1'-8"



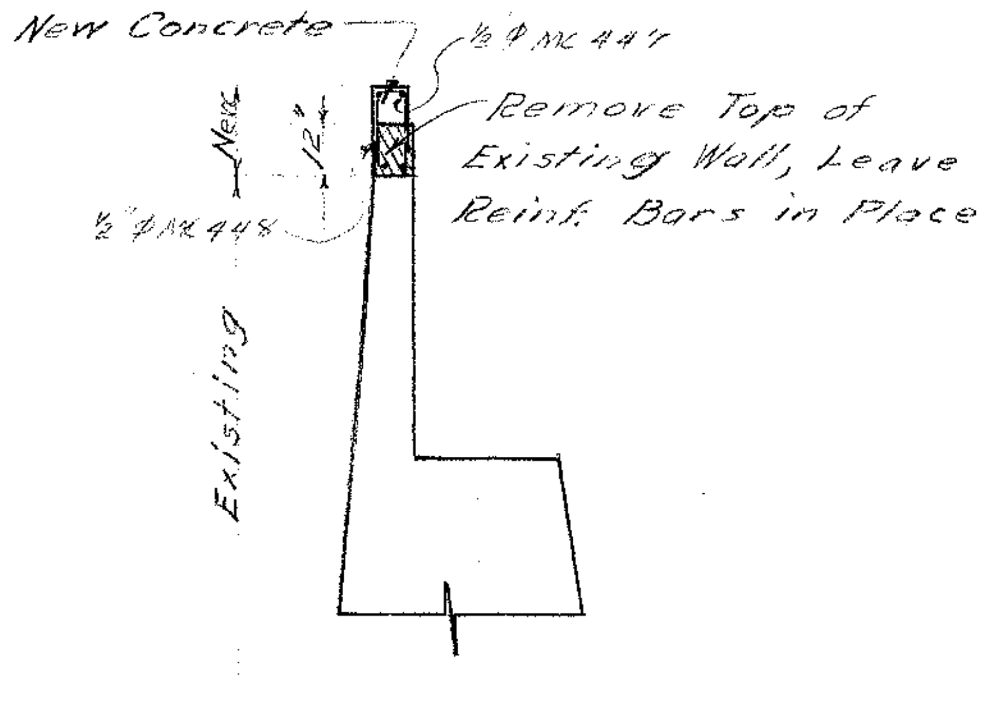
PLAN-BEARING SEAT
1' - 1 Ft.



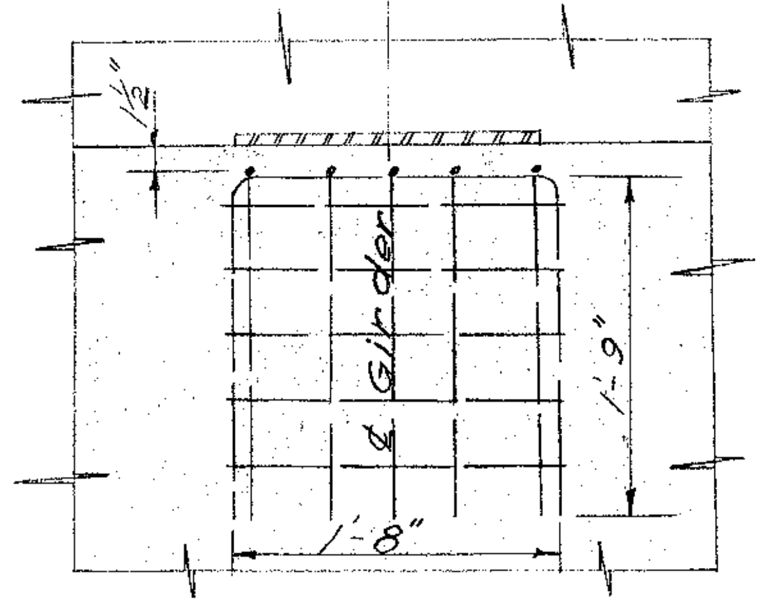
SECTION (E-E)
1" = 1'-0"



ABUTMENT NO1 HILO END
FRONT ELEVATION
¼" = 1 Ft.

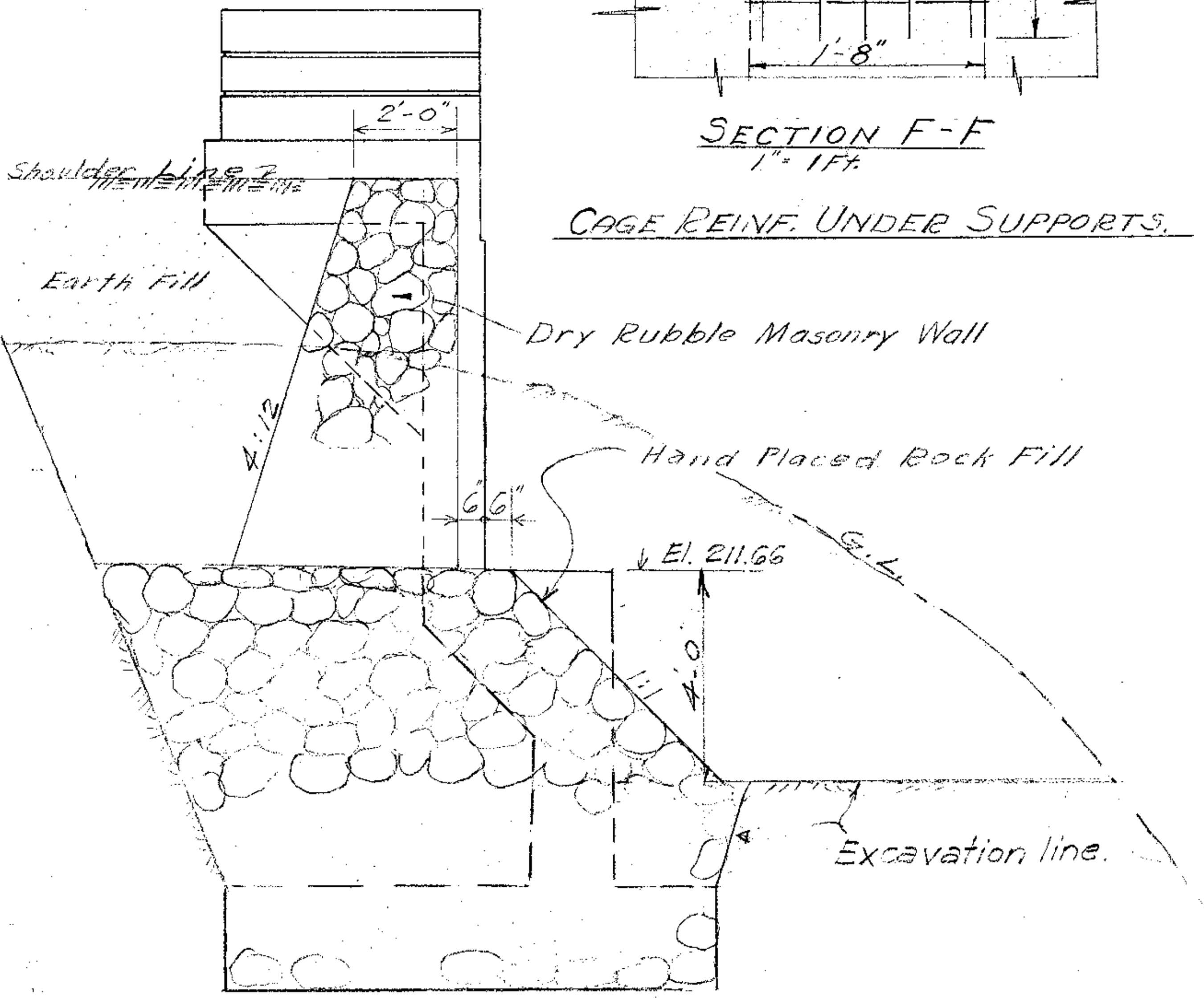


SECTION AT ℄
¼" = 1 Ft.

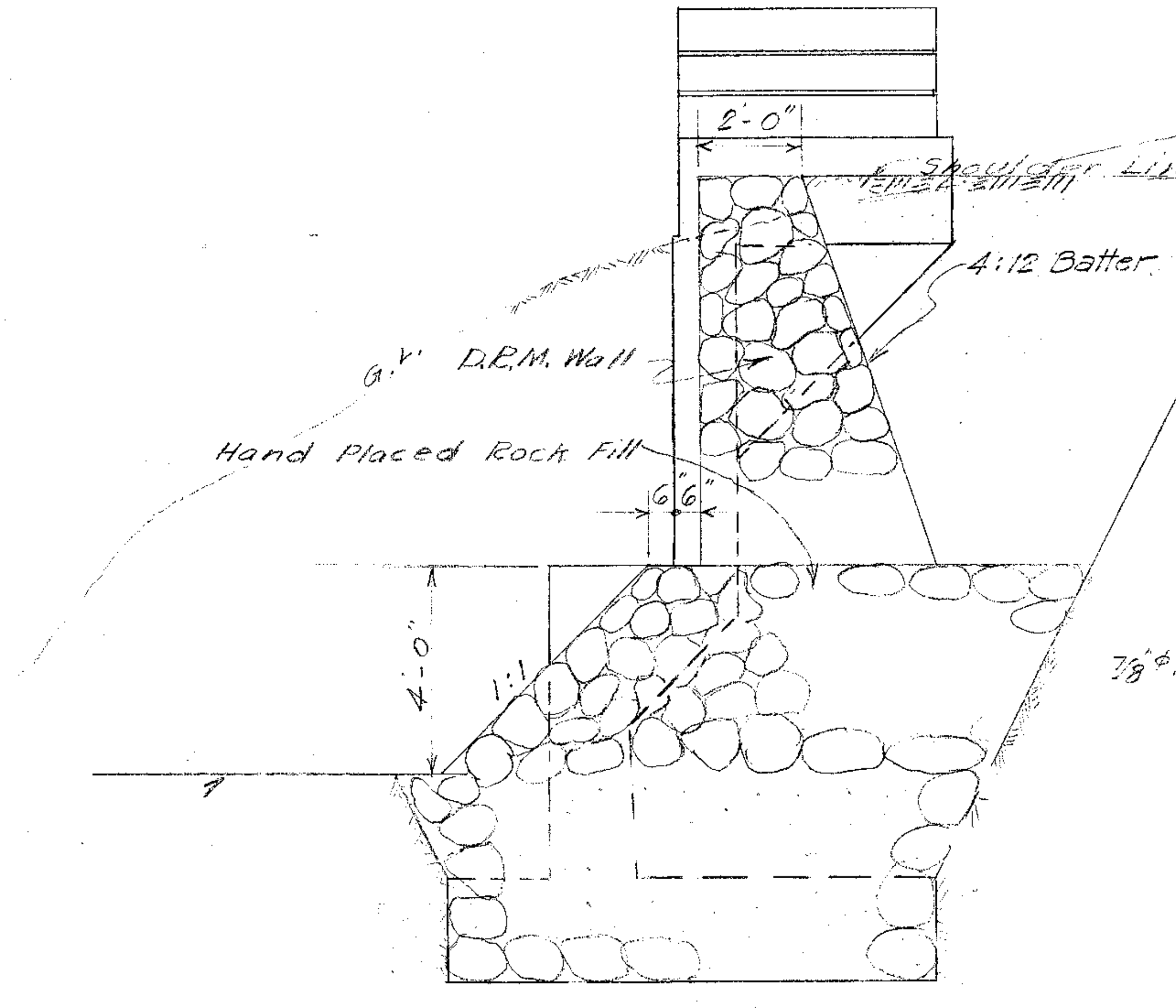


SECTION F-F
1" = 1 Ft.

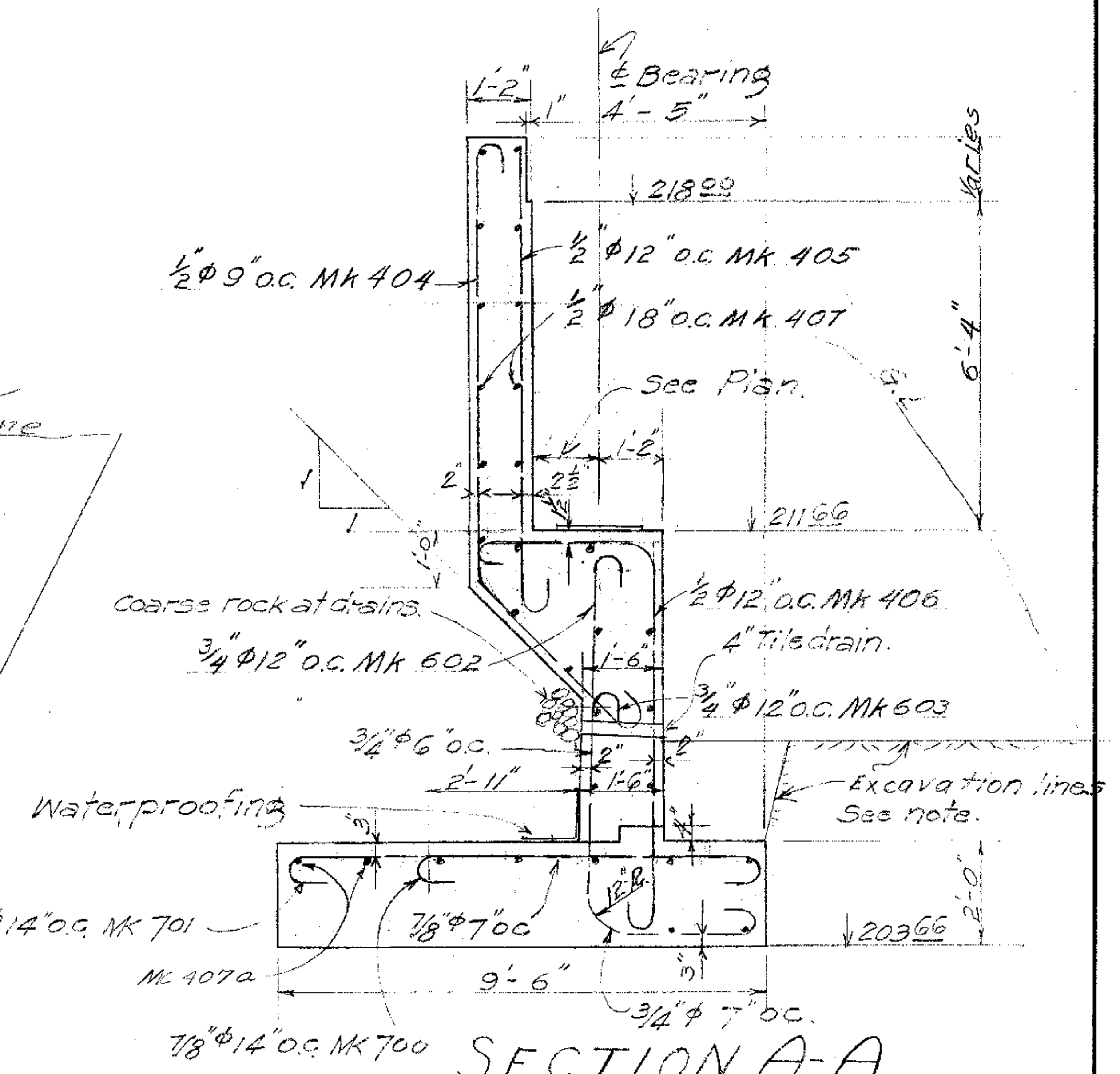
CAGE REINF. UNDER SUPPORTS.



SECTION B-B
3/8" = 1 Ft.

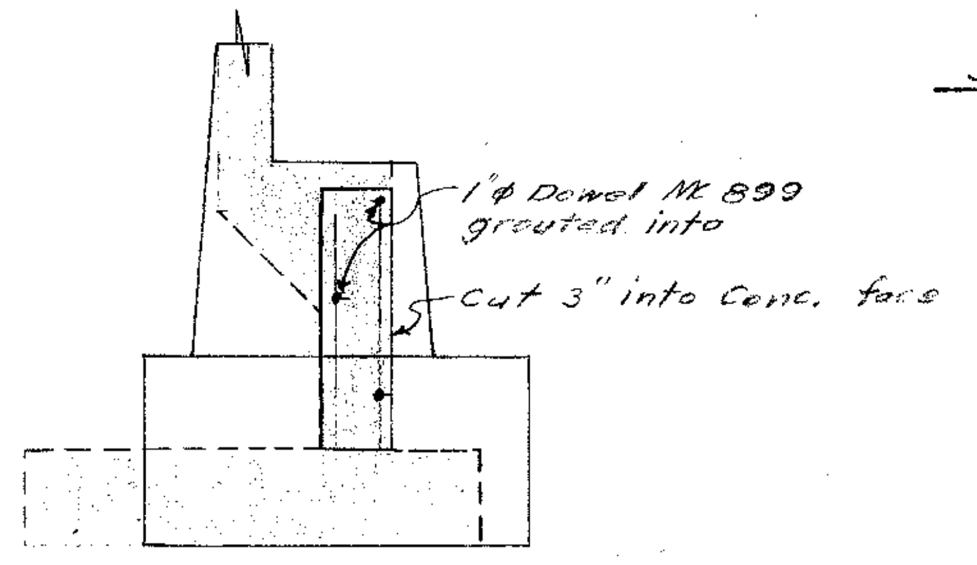


SECTION C-C
3/8" = 1 Ft.



SECTION A-A
3/8" = 1 Ft.

Note! See Std. Details for treatment at constr. joint and method of applying waterproofing.
Original Ground Outside Excavation Lines Not to be Removed.
All concrete in Abutments to be Class A-1.



SECTION K-K
¼" = 1 Ft.

ORIGINAL PLAN
NOTE BOOK No.
SURVEY PLOTTED BY
DESIGNED BY W. R. Bartels DATE 4-49
DRAWN BY A. Van Den Wandt "
TRACED BY "
QUANTITIES BY "
QUANTITIES CHECKED BY "
CHECKED BY "

TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII

NANUE BRIDGE
Sta. 0+48.83 to 5+80.16

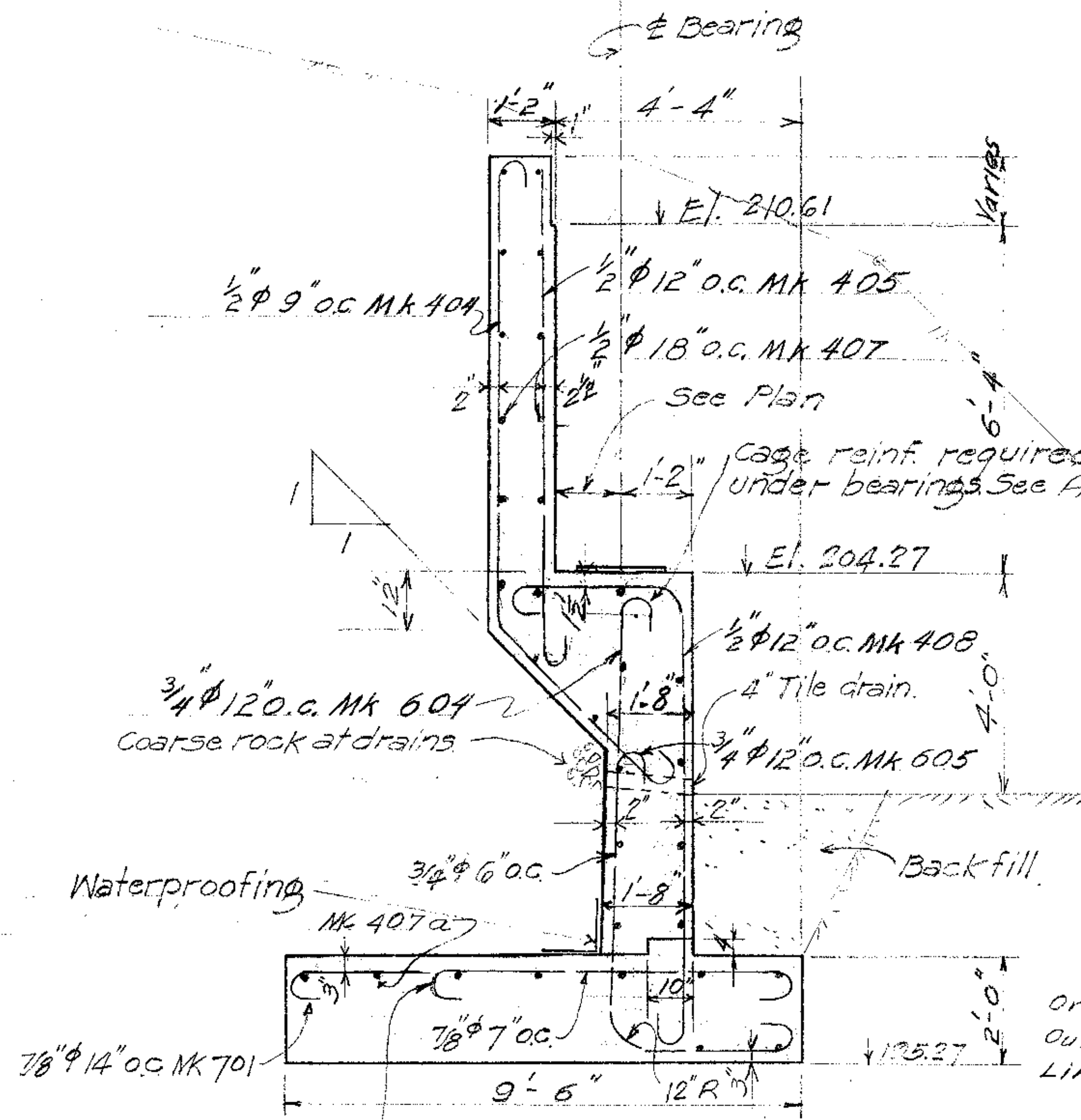
Hawaii Belt Road SDR-3(13)

May 1949

SHEET No. 2 OF 11 SHEETS

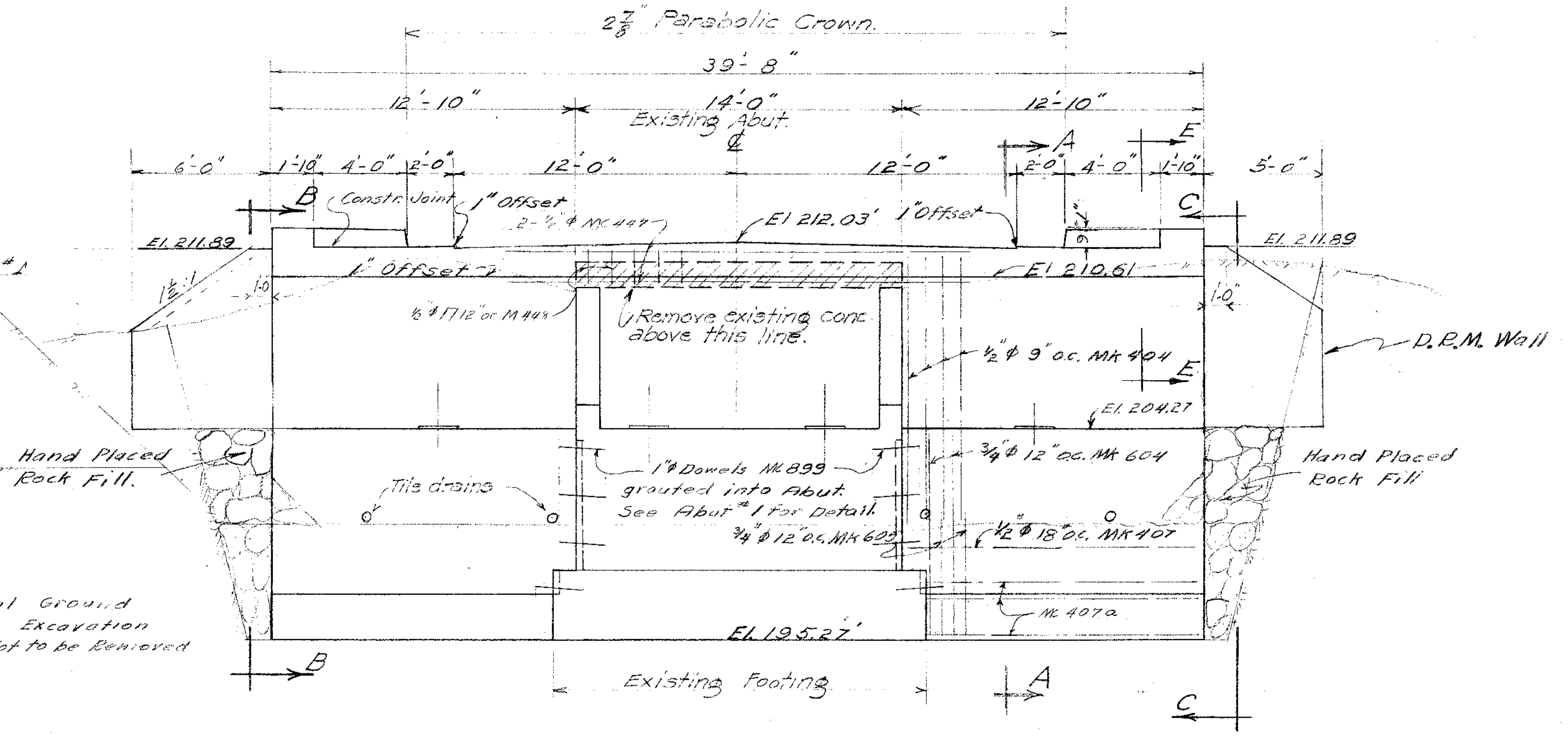
5468.65

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	66	304



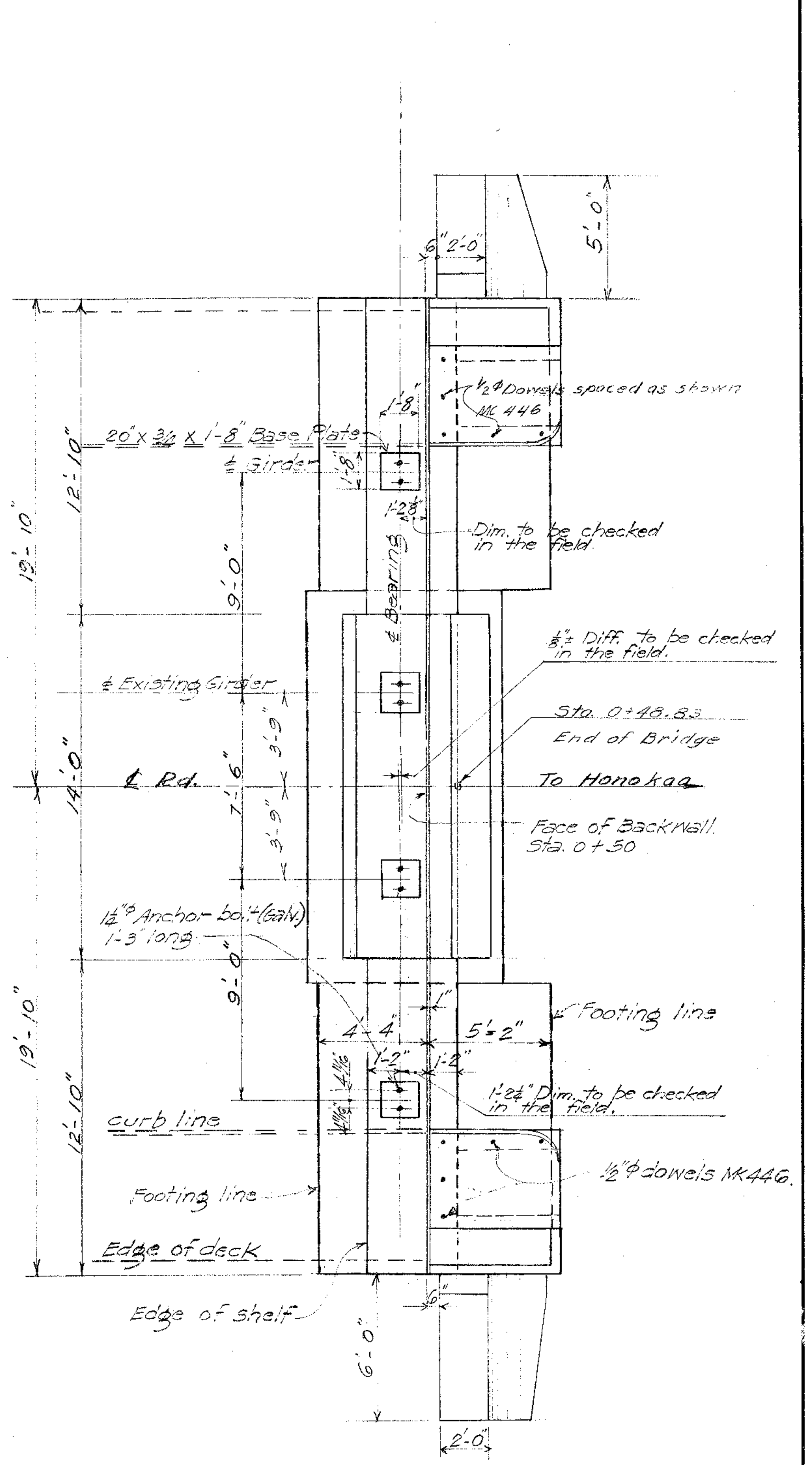
SECTION A-A

3/8" = 1 Ft.



ABUTMENT NO 2 HONOKAA END FRONT ELEVATION

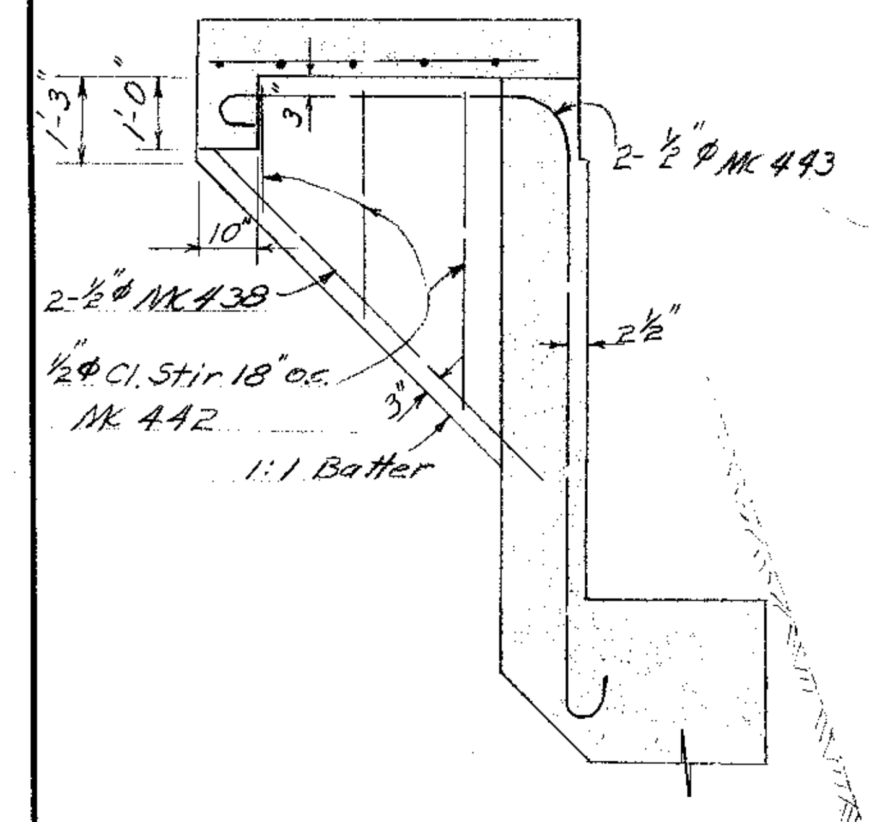
1/4" = 1 Ft.



ABUTMENT NO 2 HONOKAA END PLAN

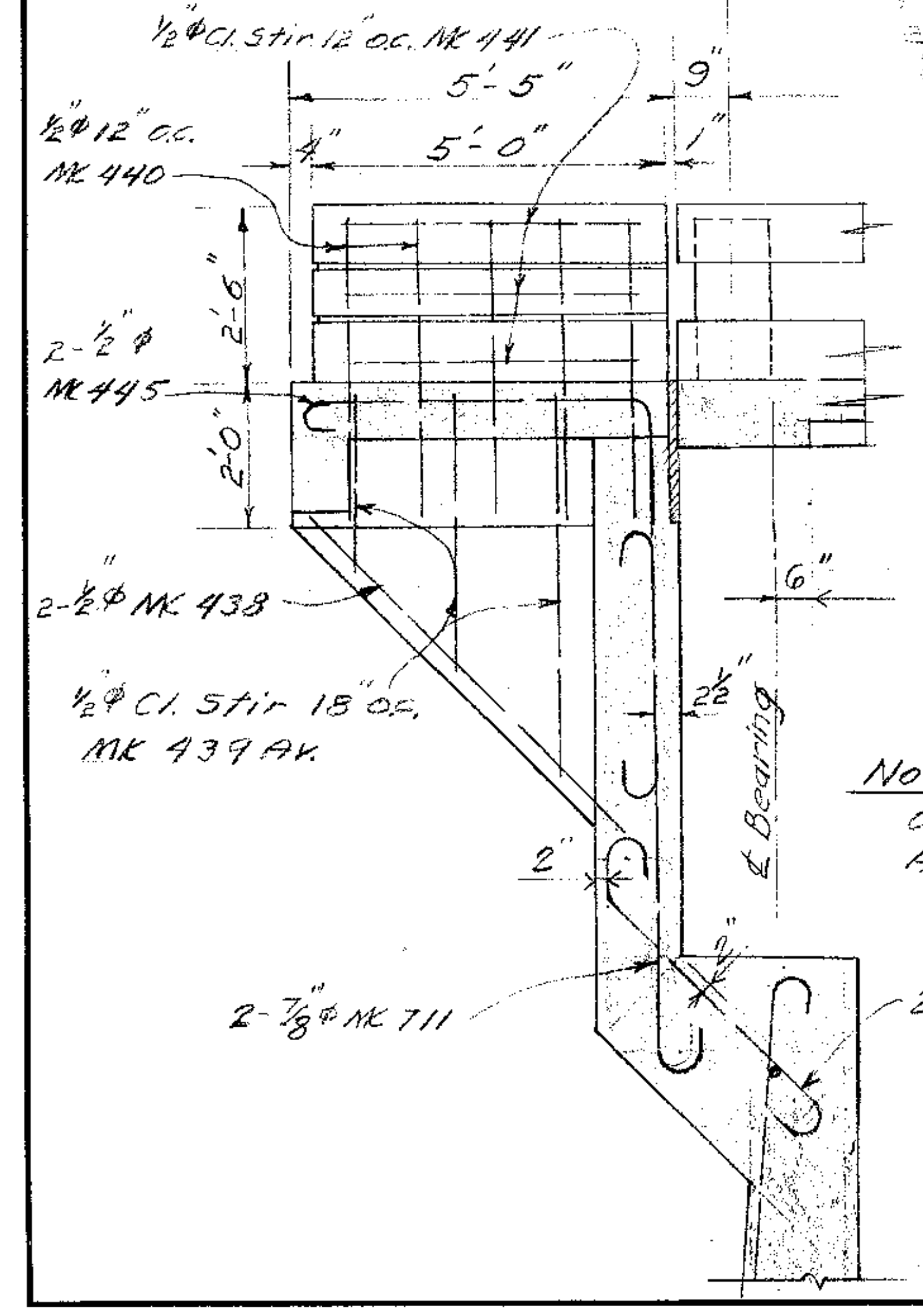
1/4" = 1 Ft.

Note: All concrete in Abutments to be Class A-1.

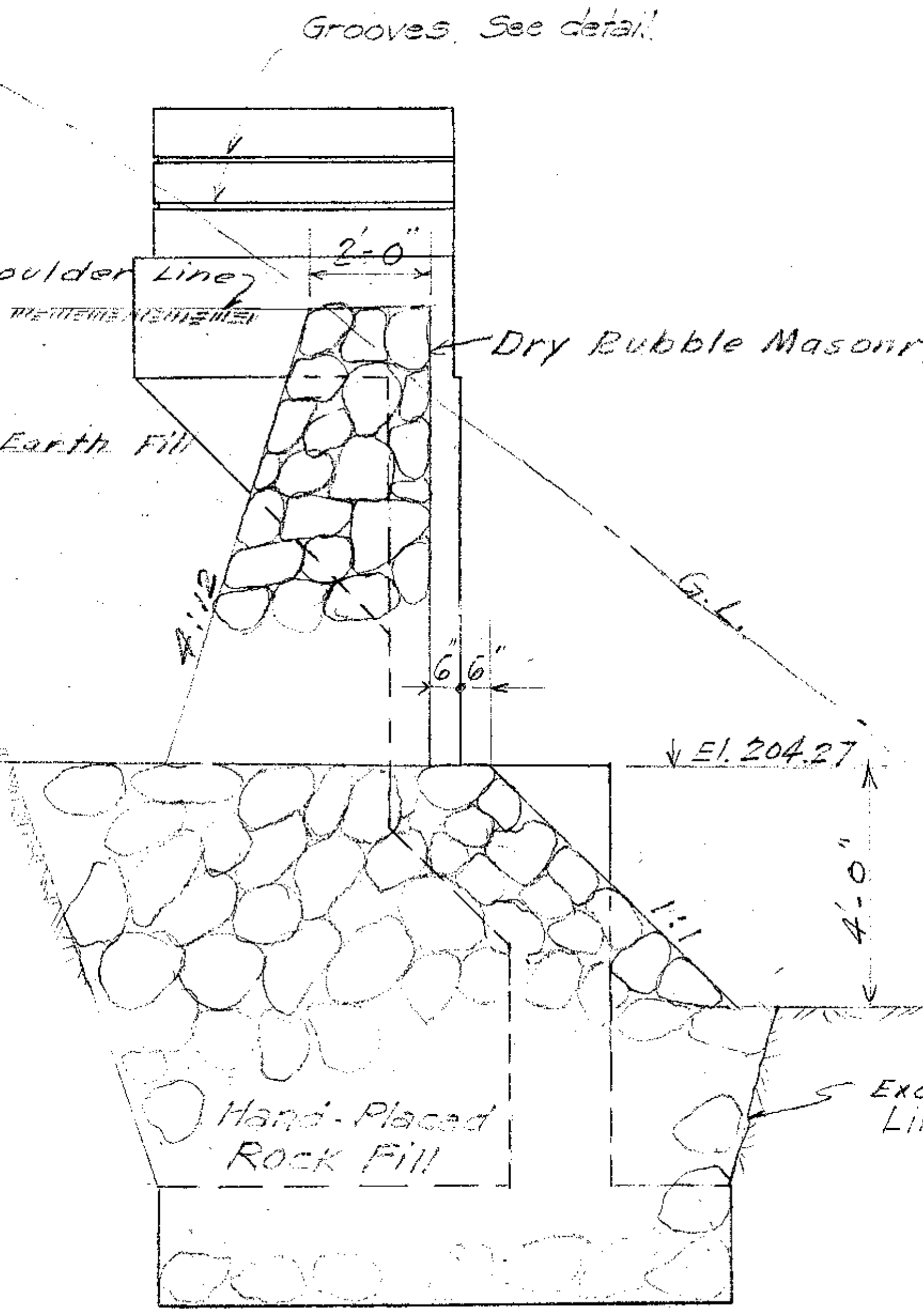


SECTION G-G

3/8" = 1 Ft.

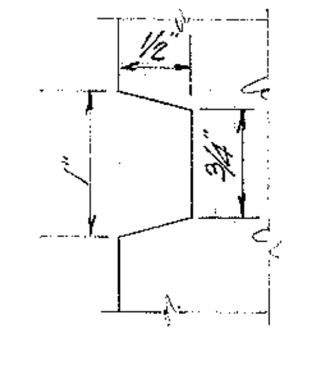


Note:
Omit Bar 405
At This Section



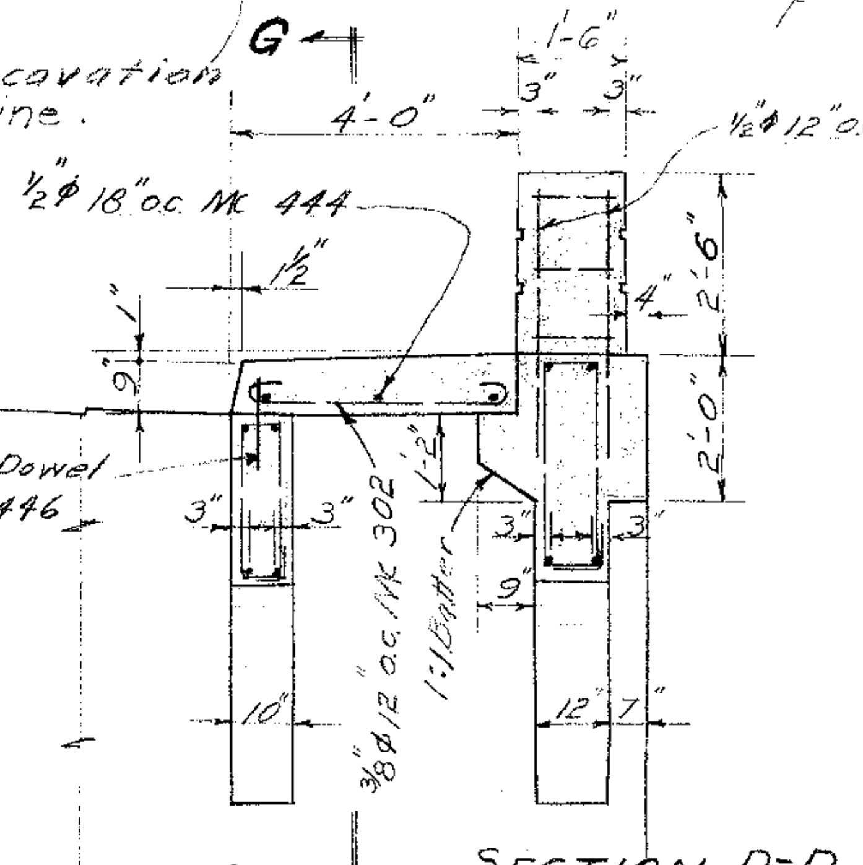
SECTION B-B

3/8" = 1 Ft.



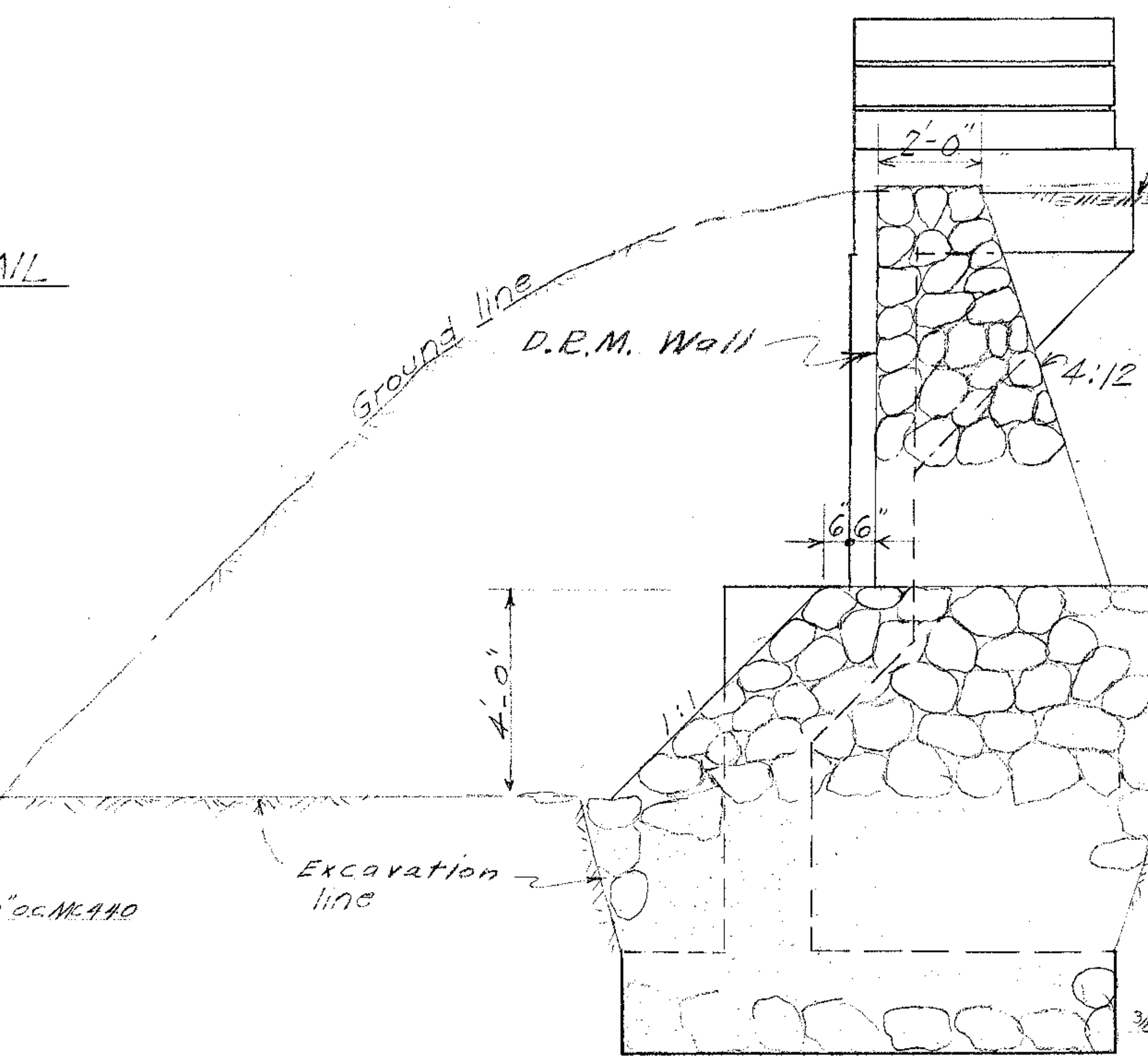
GROOVE DETAIL

3/4" = 1'-0"



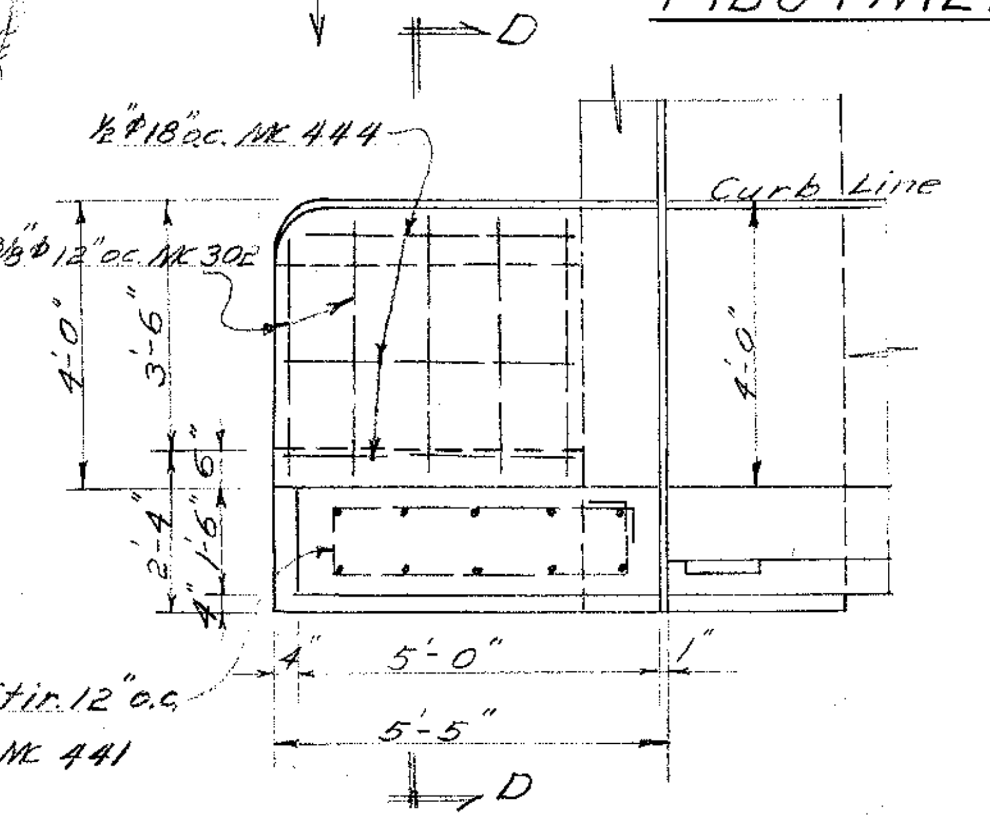
SECTION D-D

3/8" = 1 Ft.



SECTION C-C

3/8" = 1 Ft.



PLAN - END POST DETAIL

3/8" = 1 Ft.

TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII

NANUE BRIDGE
Sta. 0+48.83 to 5+80.16

Hawaii Belt Road SDR-3(13)

June 1949

SHEET No. 3 OF 11 SHEETS

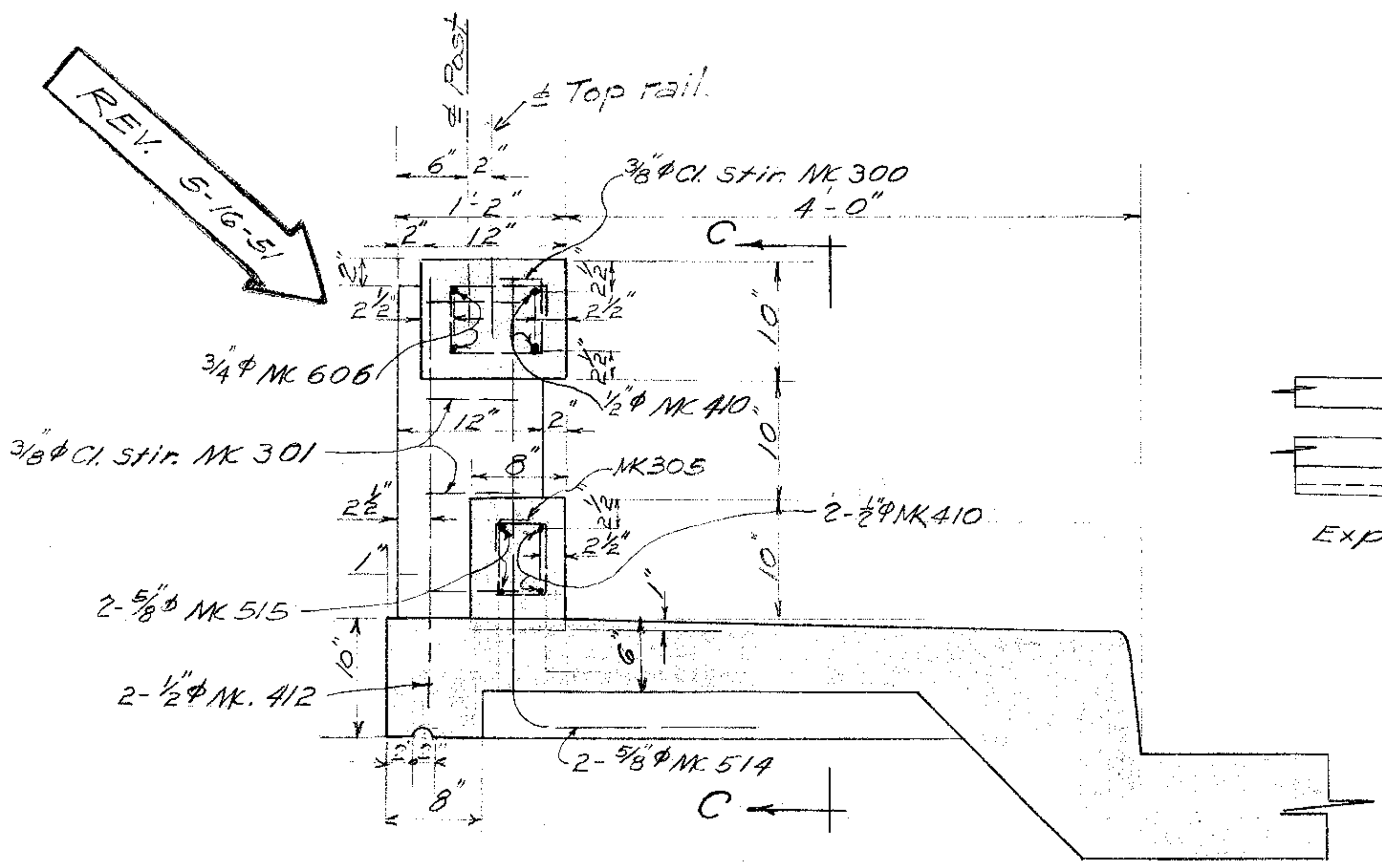
ORIGINAL PLAN	
	SURVEY PLOTTED BY ________ DATE ____
	DESIGNED BY ________ "
	DRAWN BY ________ "
	TRACED BY ________ "
NOTE BOOK No.	QUANTITIES BY ________ "
	QUANTITIES CHECKED BY ________ "
	CHECKED BY ________ "

5468.66

66

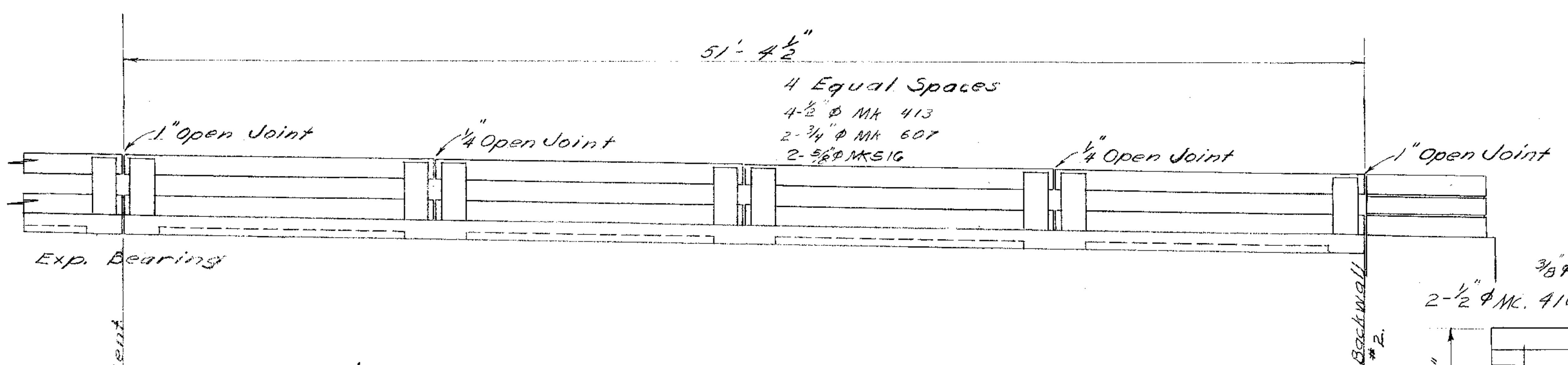
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	67	104

REV. 5-16-51 : Railing Posts shortened 2".
Bottom Rail revised.

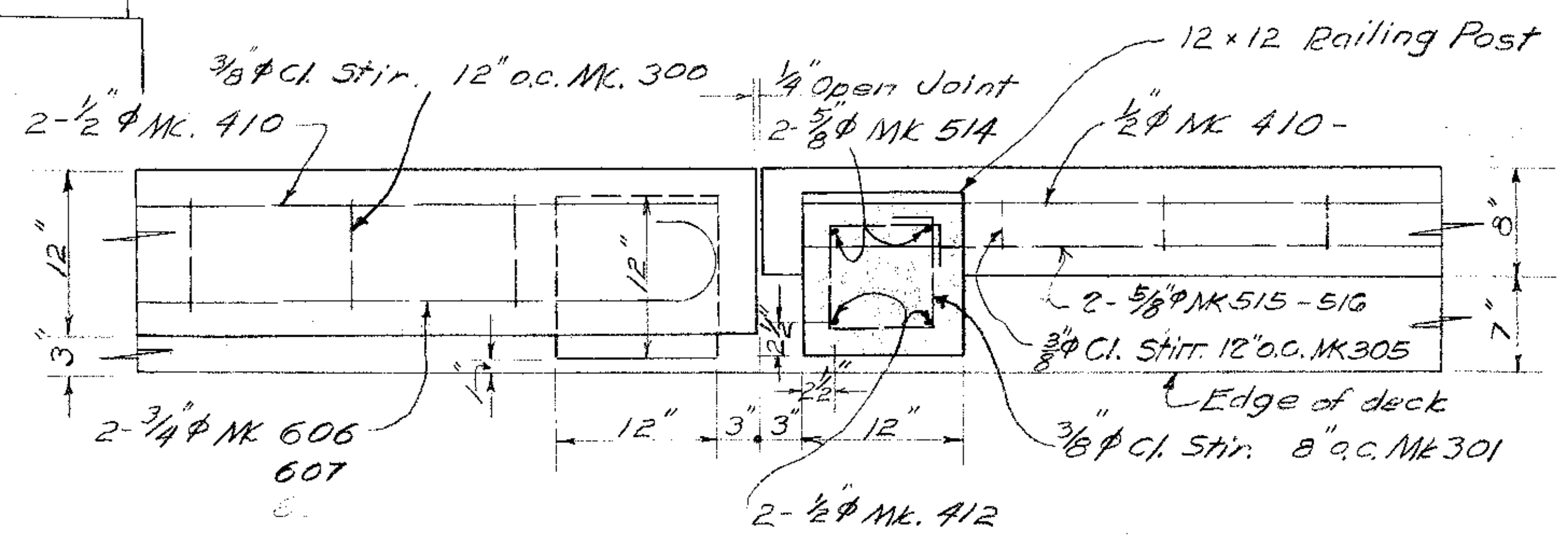


SECTION A-A

1" = 1 Ft

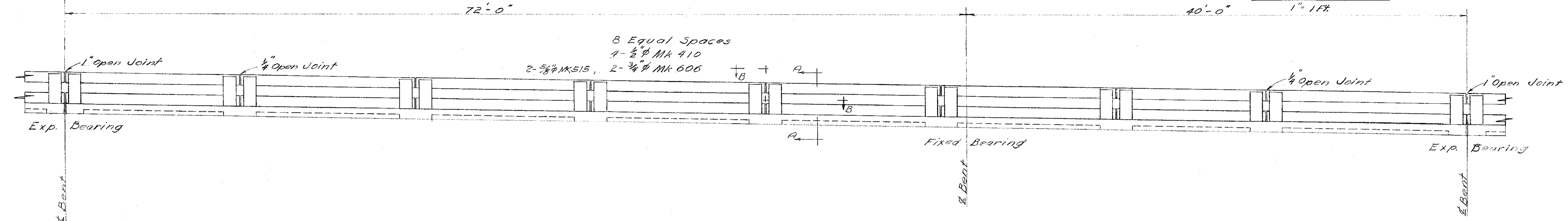


51' SECTION HONOKAA END OF BRIDGE

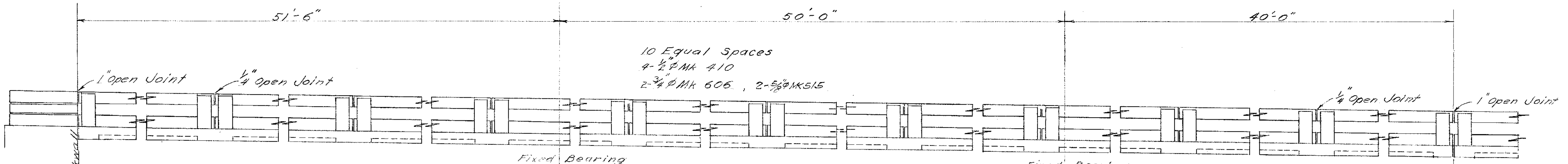


SECTION B-B

1" = 1 Ft.

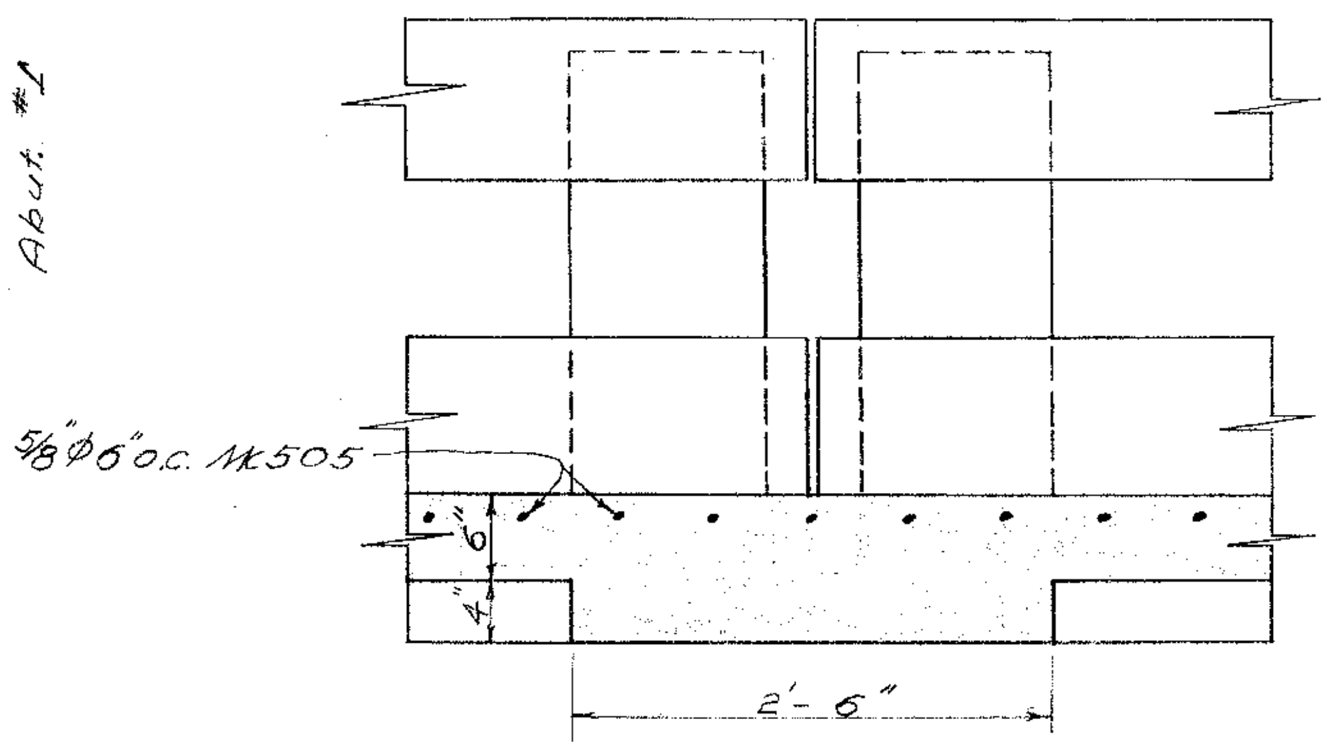


112' INTERMEDIATE SECTION



141' SECTION HILO END OF BRIDGE

Note: All concrete in Handrails and Posts to be Class A-1.



RAILING LAYOUT (RIGHT)

1/4" = 1 Ft.

LEFT RAILING SIMILAR

SECTION C-C

1" = 1 Ft.

TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII
NANUE BRIDGE
Sta. 0+48.83 to 5+80.16
Hawaii Belt Road SDR-3(13)
June 1949

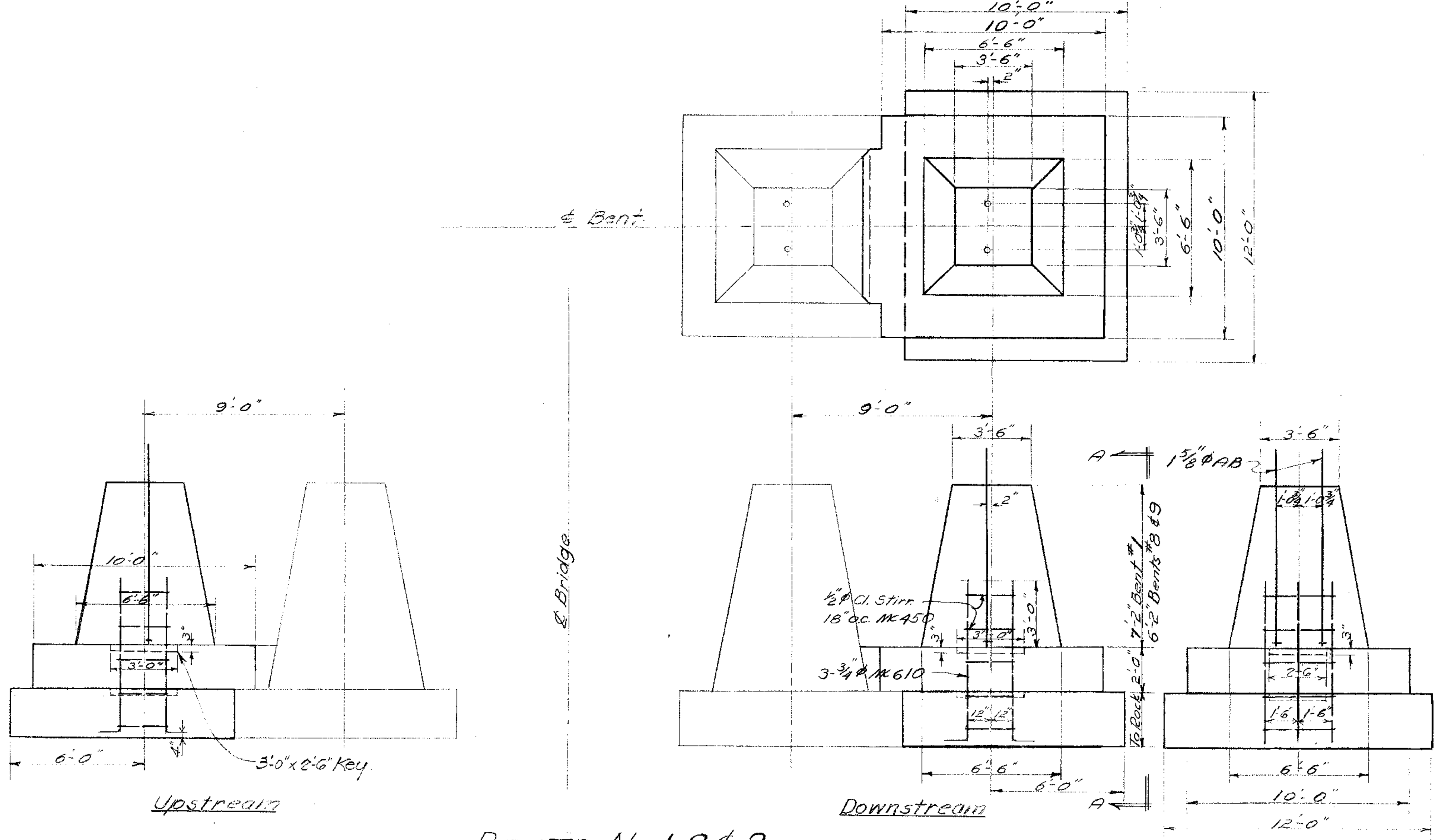
SHEET No. 4 OF 11 SHEETS

5468.67

67

ORIGINAL
PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY ... DATE
DESIGNED BY
DRAWN BY
TRACED BY
QUANTITIES BY
QUANTITIES CHECKED BY
CHECKED BY

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	68	304

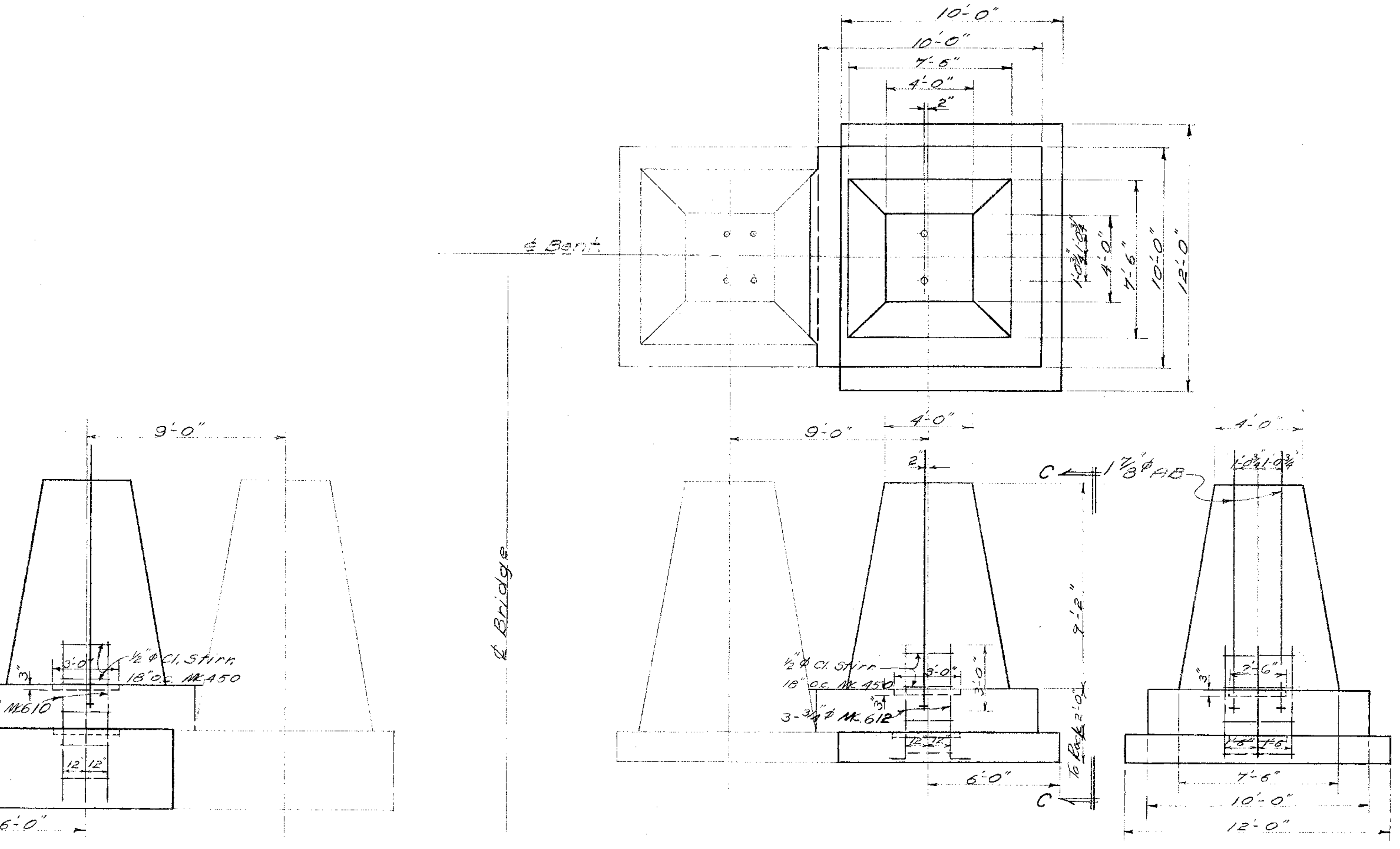


Upstream

Downstream

ELEV. A-A

BENTS No 1, 8 & 9

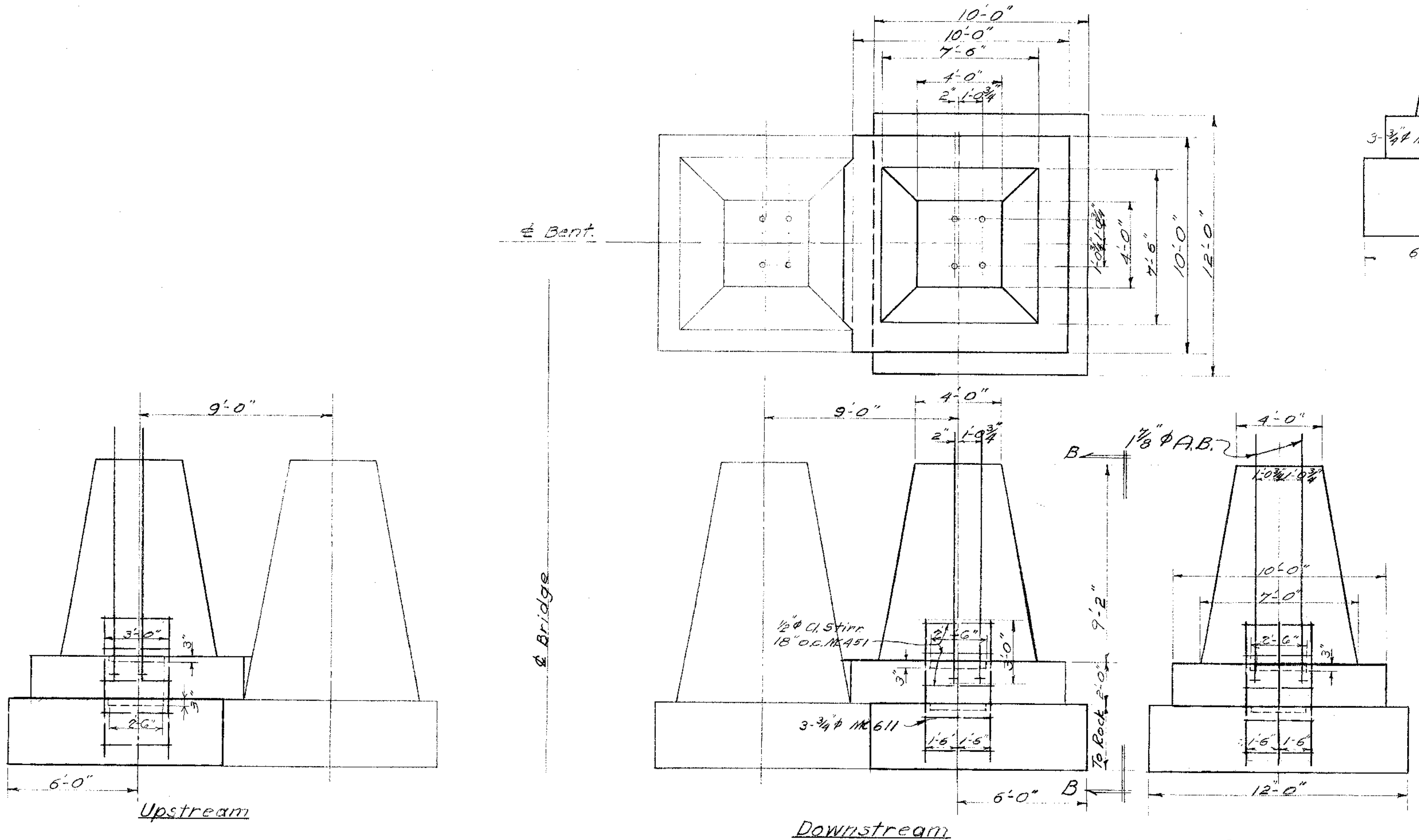


Upstream

Downstream

ELEV. C-C

BENT No. 7



Upstream

Downstream

ELEV. B-B

BENTS No. 2, 3 & 5

Note: All concrete in Piers to be Class B-2

TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII

NANUE BRIDGE
Sta. 0+48.83 to 5+80.16

Hawaii Belt Road SDR-3(13)

March 1950

SHEET No. 5 OF 11 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY .... DATE .... DESIGNED BY .... " .... DRAWN BY .... " .... TRACED BY .... " ....
NOTE BOOK No.	QUANTITIES BY .... " .... QUANTITIES CHECKED BY .... " .... CHECKED BY .... " ....

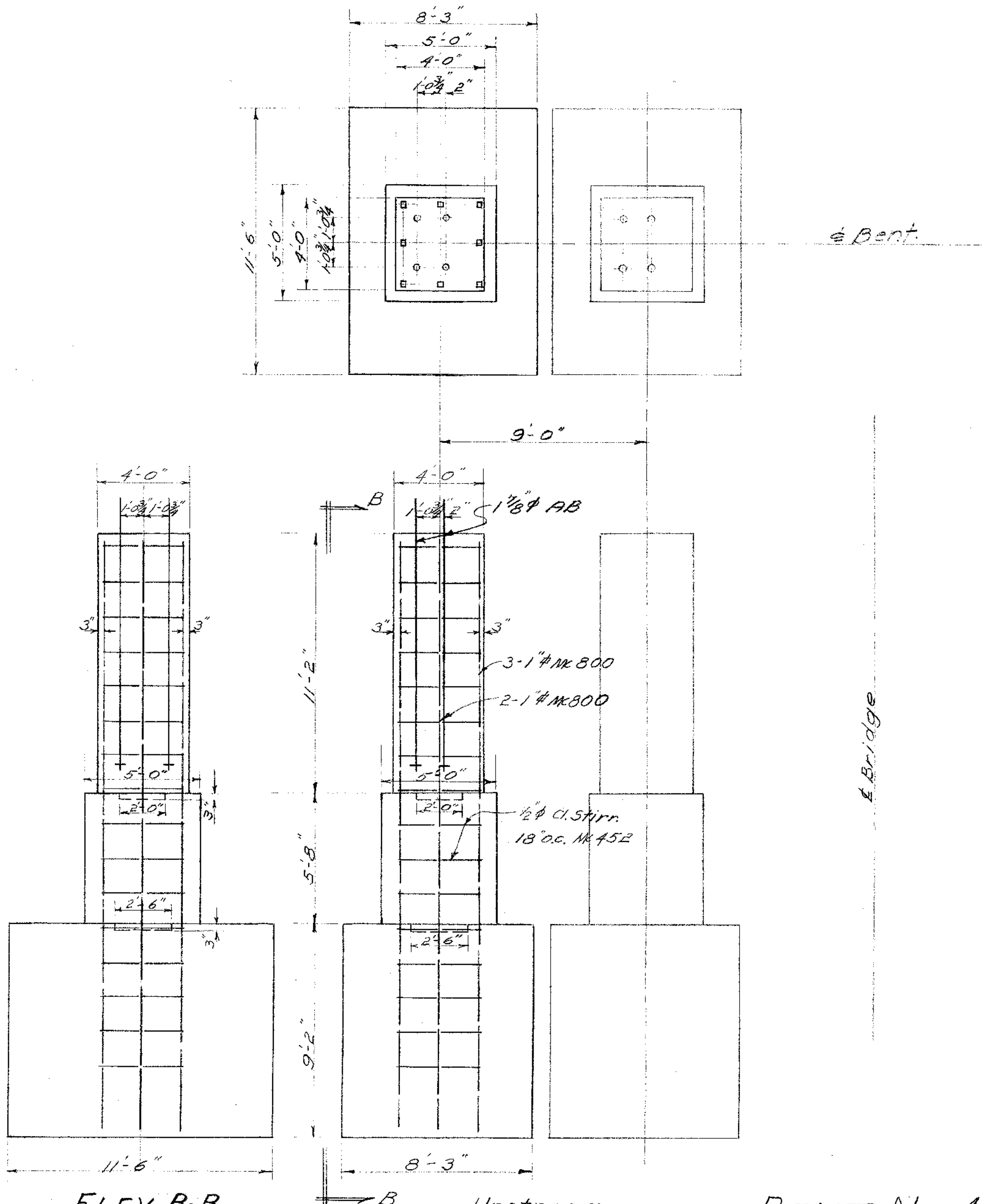
5468.68

68

1 8

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR-3(13)	1950	69	304

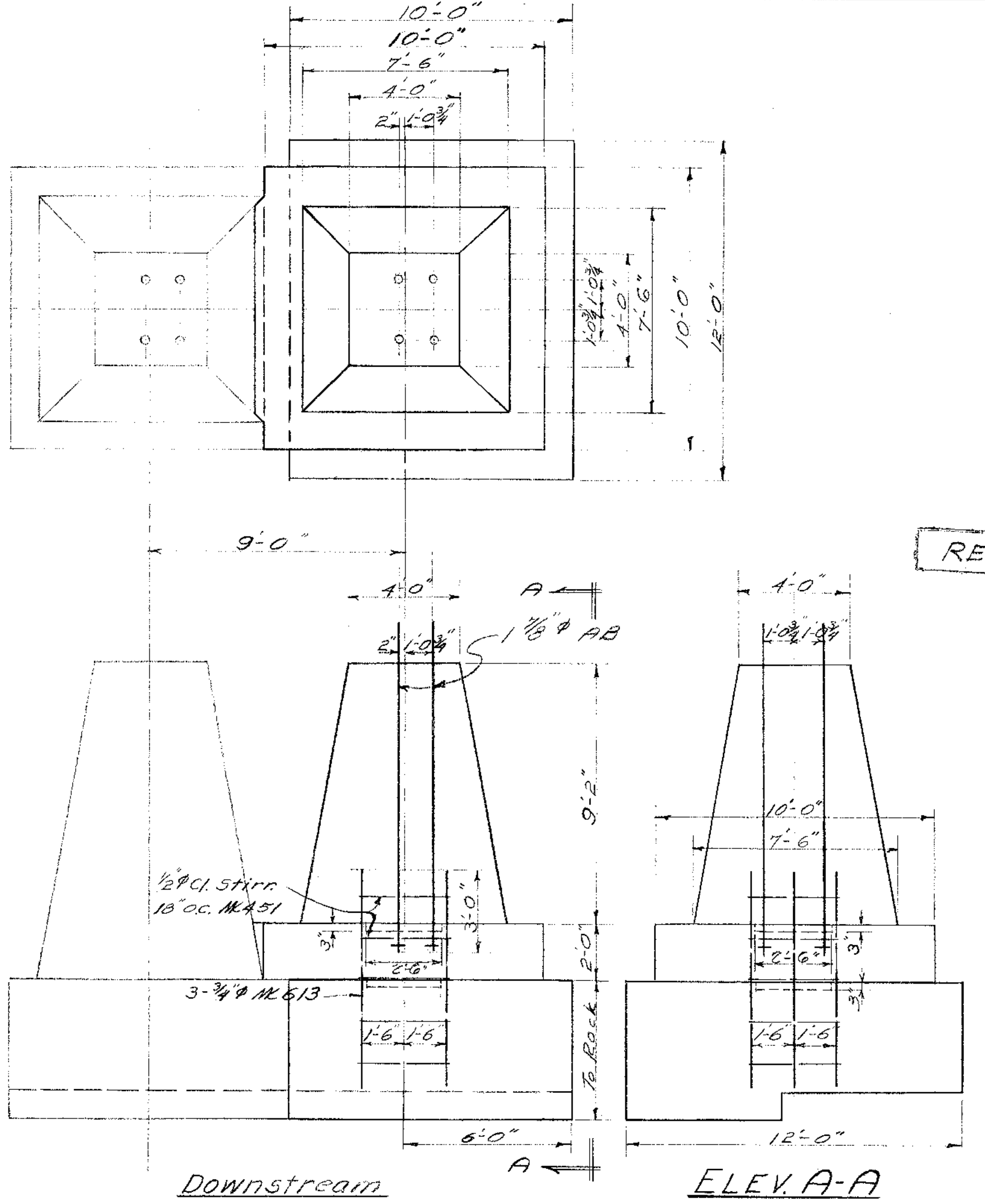
REV. 5-16-51 : Reinf Steel Quant. changed. Hooks eliminated. Bottom rail reinf. revised. All bar deformations must conform to ASTM-A305 12/15/50 1-5-51



ELEV. B-B

Upstream

BENT NO. 4



Downstream

ELEV. A-A

REV. 5-16-51

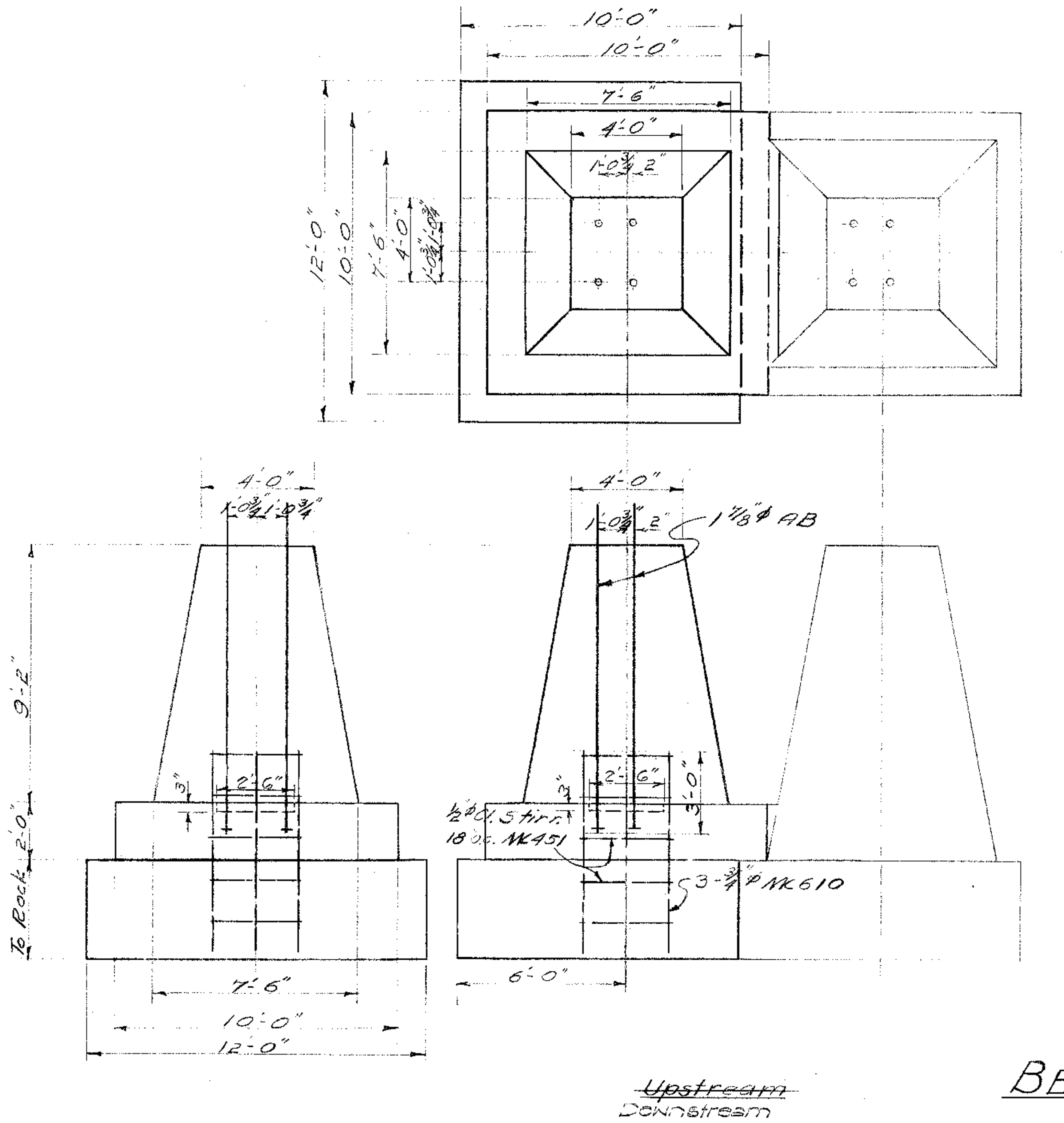
ESTIMATED QUANTITIES

Item	Super-Structure	Railing & End Posts	Abutments No. 1	Abutments No. 2	PIERS	TOTAL
Class A-1 Conc.	580 cu. yds	69 cu. yds	42 cu. yds	42 cu. yds		733 cu. yds
Class B-2 Conc.					547 cu. yds	547 cu. yds
Struct. Excav.			200 cu. yds	265 cu. yds	1134 cu. yds	1599 cu. yds
~~Reinf. Steel.~~	~~110,707 lbs~~	~~13,065 lbs.~~	~~3366 lbs.~~	~~3496 lbs.~~	~~2,520 lbs.~~	~~133,154 lbs.~~
Dry Rubble Mas.			7.5 cu. yds	8 cu. yds		15.5 cu. yds
Hand placed Rock Fill.			13 cu. yds	12 cu. yds		25 cu. yds
A. C. Pavement	82.21 Tons					82.21 Tons
REINF. STEEL	105,801 Lbs.	12,992 Lbs.	2,985 Lbs.	3,046 Lbs.	2,520 Lbs.	127,344 Lbs.

ESTIMATED QUANTITIES (Continued)

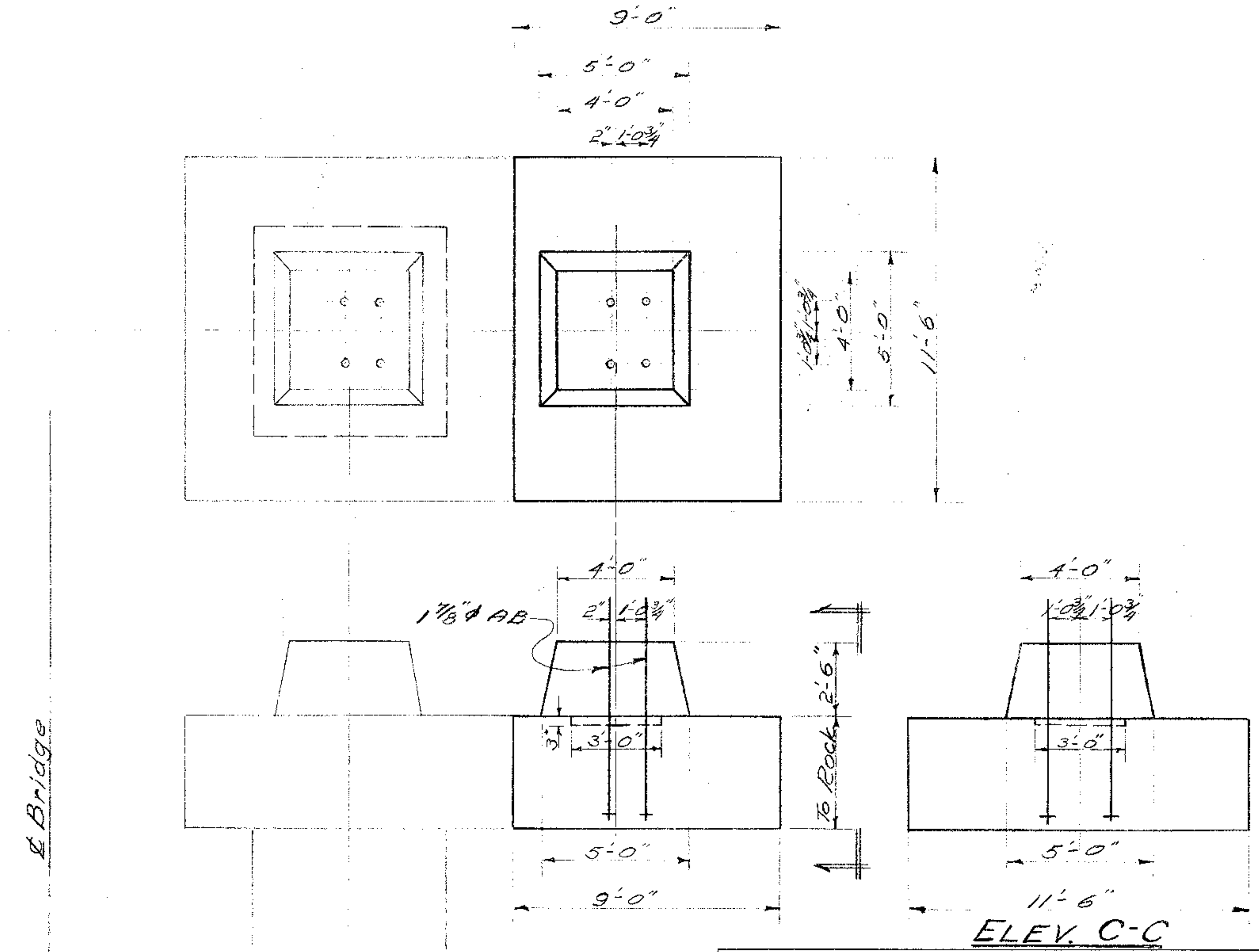
Item	Total
Furnishing, fabricating and erecting new steel.	122,870 #
Cleaning, fabricating and erecting salvaged steel.	969,250 #
Cleaning and applying 1st. coat of paint to steel in existing R. R. Bridge	1,046,000 #
Painting entire structure with two field coats of paint.	Lump sum
Removing and replacing ¾"φ × 2⅜" (Ave) rivets in tower bracing system	2000 pc's.
Removing and replacing ⅞"φ × 3⅜" (Ave) rivets	9200 pc's.
Removing damaged members from towers.	700 #

1-5-51



~~Upstream~~
Downstream

BENT NO. 6



ELEV. C-C

~~Downstream~~
Upstream

TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII

NANUE BRIDGE
Sta. 0+48.83 to 5+80.16

Hawaii Belt Road SDR-3(13)

March 1950

SHEET No. 6 OF 11 SHEETS

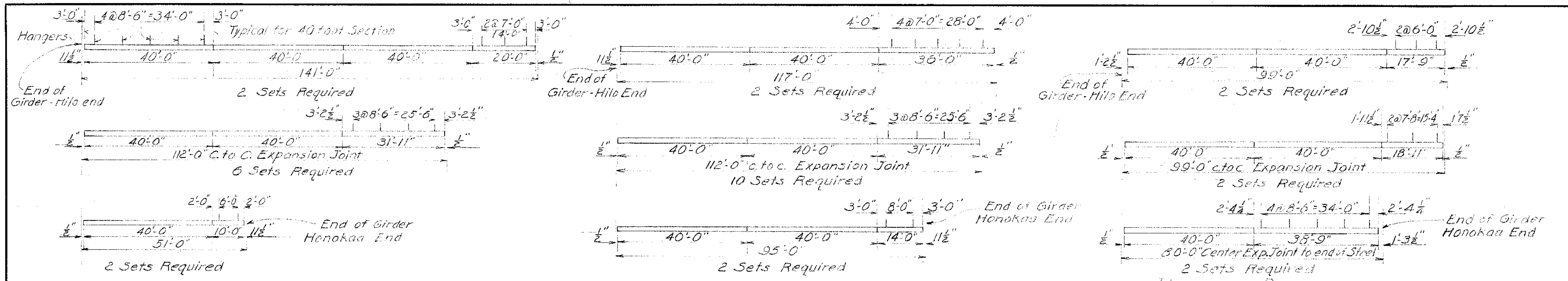
5468.69

64

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR 3(13)	1950	70	304

11/8/50
1/5/51

LIST OF 6"I 12.5#				HANGERS	
BRIDGE	NO.	LENGTH	TOTAL LENGTH	NO.	NO.
UMAUMA	10	40'-0"	400'-0"		
"	2	18'-11"	37'-10"		
"	2	38'-9"	77'-6"		
"	2	17'-9"	35'-6"	72	
NANUE	20	40'-0"	800'-0"		
"	2	20'-0"	40'-0"		
"	6	31'-11"	191'-6"		
"	2	10'-0"	20'-0"		134
HAKALAU	28	40'-0"	1120'-0"		
"	2	36'-0"	72'-0"		
"	10	31'-11"	319'-2"		
	2	14'-0"	28'-0"		194



NANUE BRIDGE
Scale 1"=20'-0"

HAKALAU BRIDGE
Scale 1"=20'-0"

UMAUMA BRIDGE
Scale 1"=20'

MONORAIL LENGTHS AND LOCATION OF HANGERS

PLAN "L-L"
Scale 1"=1'-0"

DETAIL X
1 1/2"=1'-0"

MONORAIL DETAIL (NANUE HAKALAU)
See Sheet 5468.55
Scale 1"=1'-0"

ELEV. S-S
1 1/2"=1'-0"

SECT. T-T
3"=1'-0"

ELEVATION K-K
Scale 1"=1'-0"

ELEVATION - LOOKING UP STREAM

Condition survey of Bridge

MONORAIL DETAIL - UMAUMA
See Sheet 5468.55
Scale 1"=1'-0"

ELEVATION "J-J"
Scale 1"=1'-0"

SECTION "M-M"
Scale 1"=1'-0"

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DESIGNED BY	
	DRAWN BY I. Fujinaka	Aug 1950
	TRACED BY	
NOTE BOOK No.	QUANTITIES BY H Dieckmann	
	QUANTITIES CHECKED BY	
	CHECKED BY W.B. Farquhar	1/24/50

TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII
NANUE BRIDGE
Sta. 0+48.83 to 5+80.16
Hawaii Belt Road SDR 3(13)
May 1950

SHEET No. 7 OF 11 SHEETS

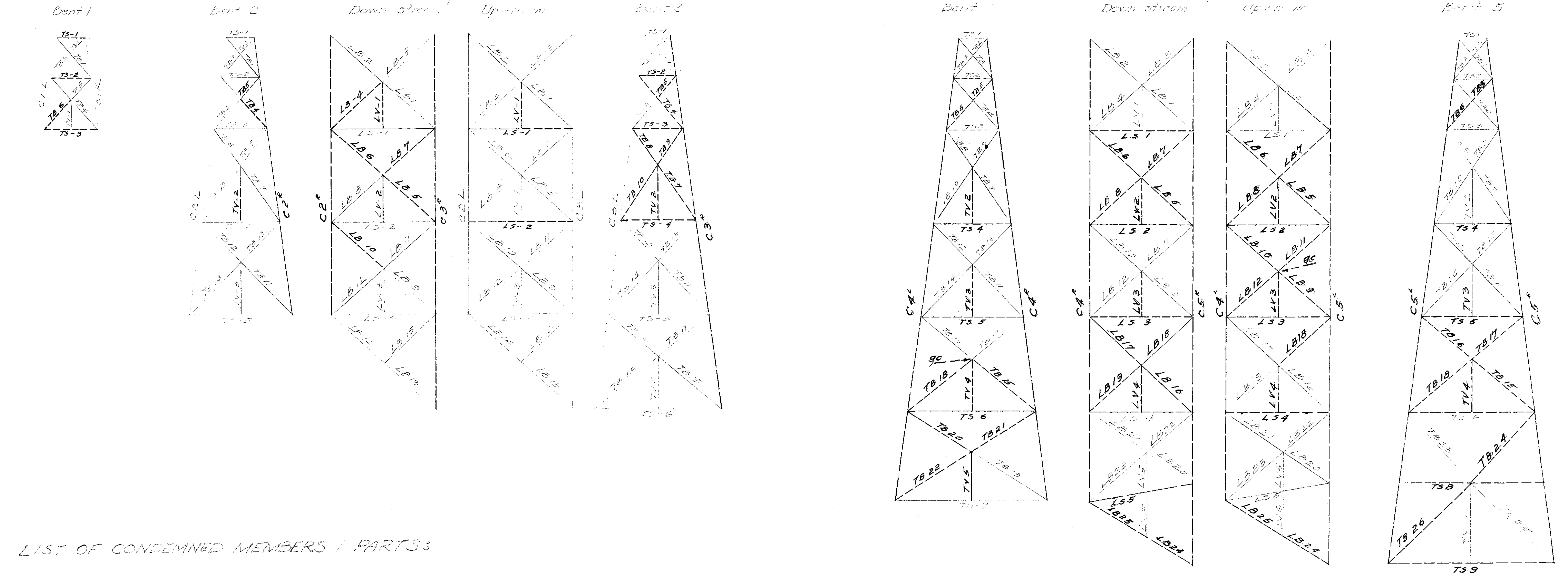
5468.70

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Hawn	SDR3(13)	1950	71	304

← To Hilo

Bents: View looking Honokaa

[illegible]: looking up stream



LIST OF CONDEMNED MEMBERS & PARTS:

Bent 1

TS-1 {3 rivets 3/4" – 1" grip
{15 rivets 3/4" – [illegible] grip
TS-2 3 " 3/4" – 1" "
TS-3 10 " " "
TB-6 3 " " "

Bent 2

TB-4 2 rivets 3/4" – 3/4" grip
TB-5 6 " " "
TV-2 2 " " "
C2R 6 " 7/8" – 1" grip

Down stream

LB-4 9 rivets 3/4" – [illegible] grip
LB-5 4 " " "
LB-6 4 " " "
LB-7 30 " " "
LB-10 4 " " "
LV-1 4 " " "
LV-2 4 " " "

Up stream

LV-1 5 rivets 3/4" – 3/4" grip
LS-1 32 " 3/4" – 1" grip
LS-2 20 " " "

Bent 3

TS-2 {4 rivets 3/4" – 1" grip
{4 " 3/4" – 3/4" "
TS-3 5 " 3/4" – 1" grip
TS-4 10 " " "
TB-4 6 " 3/4" – 3/4" grip
TB-5 4 " " " "
TB-7 5 " " "
TB-8 [illegible] " " "
TB-9 7 " " "
TB-10 2 " " "
TV-2 3 " " "
C3L 6 " 7/8" 1 1/4" grip

Bent 4

TS4 20 rivets 3/4" – 1" grip
TS-5 30 " " "
TS-6 30 " " "
TB-5 12 " 3/4" – 3/4" grip
TB-6 10 " " "
TB-15 5 " " "
TB-18 10 " " "
TB-20 10 " " "
TB-21 10 " " "
TB-22 [illegible] Bent
TV-2 12 rivets 3/4" 3/4" grip
TV-3 10 " " "
TV-4 2 " " "
TV-5 Replace entire member
C4R 50 – rivets 7/8" – 1 1/4" grip
C4L {66 " 7/8" – 3" grip
{20 " 3/4" – 1 1/4" grip

Down stream

LS-1 30 rivets 3/4" – 1" grip
LS-2 40 " " "
LS-3 50 " " "
LS-4 30 " " "
LS-5 3 " " "
LB-5 30 " 3/4" – 3/4" grip
LB-6 20 " " "
LB-7 22 " " "
LB-8 30 " " "
LB-16 15 " " "
LB-17 15 " " "
LB-19 15 " " "
LB-24 10 " " 1 1/4" grip
LB-25 10 " " 1 1/4" grip
LV-2 10 " " 3/4" grip
LV-3 16 " " "
LV-4 12 " " "
9c replace gusset plates

Up stream

LB-1 8 rivets 3/4" – [illegible] grip
LB-5 22 " " "
LB-6 18 " " "
LB-7 15 " " "
LB-8 22 " " "
LB-9 10 " " "
LB-10 13 " " "
LB-11 23 " " "
LB-12 9 " " "
LB-18 4 " " "
[illegible] " 3/4" – 1 1/4" grip
[illegible]
LS-2 40 " " 1" grip
LS-3 40 " " "
LS-4 40 " " "
LV-3 7 " " "
LV-4 6 " " "
9c replace gusset plates

Bent 5

TB-5 6 rivets 3/4" – 3/4" grip
TB-8 6 rivets " "
TB-15 10 rivets " "
TB-16 6 " " "
TB-17 [illegible] " " "
TB-18 10 " " "
TB-24 5 " " "
TB-2[illegible] 4 " "
TS-4 12 " [illegible]
TS-5 {20 " "
{8 [illegible]
TS-[illegible] [illegible] rivets 3/4" – 1" grip
TS-8 30 " " "
TS-9 26 " " "
C5L {16 " 7/8" – 3" grip
{20 " 7/8" – 1 1/4" grip
C5R {88 " 7/8" "
{20 " 7/8" – 3" grip

Condition survey of Bridge

TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII

NANUE BRIDGE
Sta. 0+48.83 to 5+80.16

Hawaii Belt Road SDR 3(13)

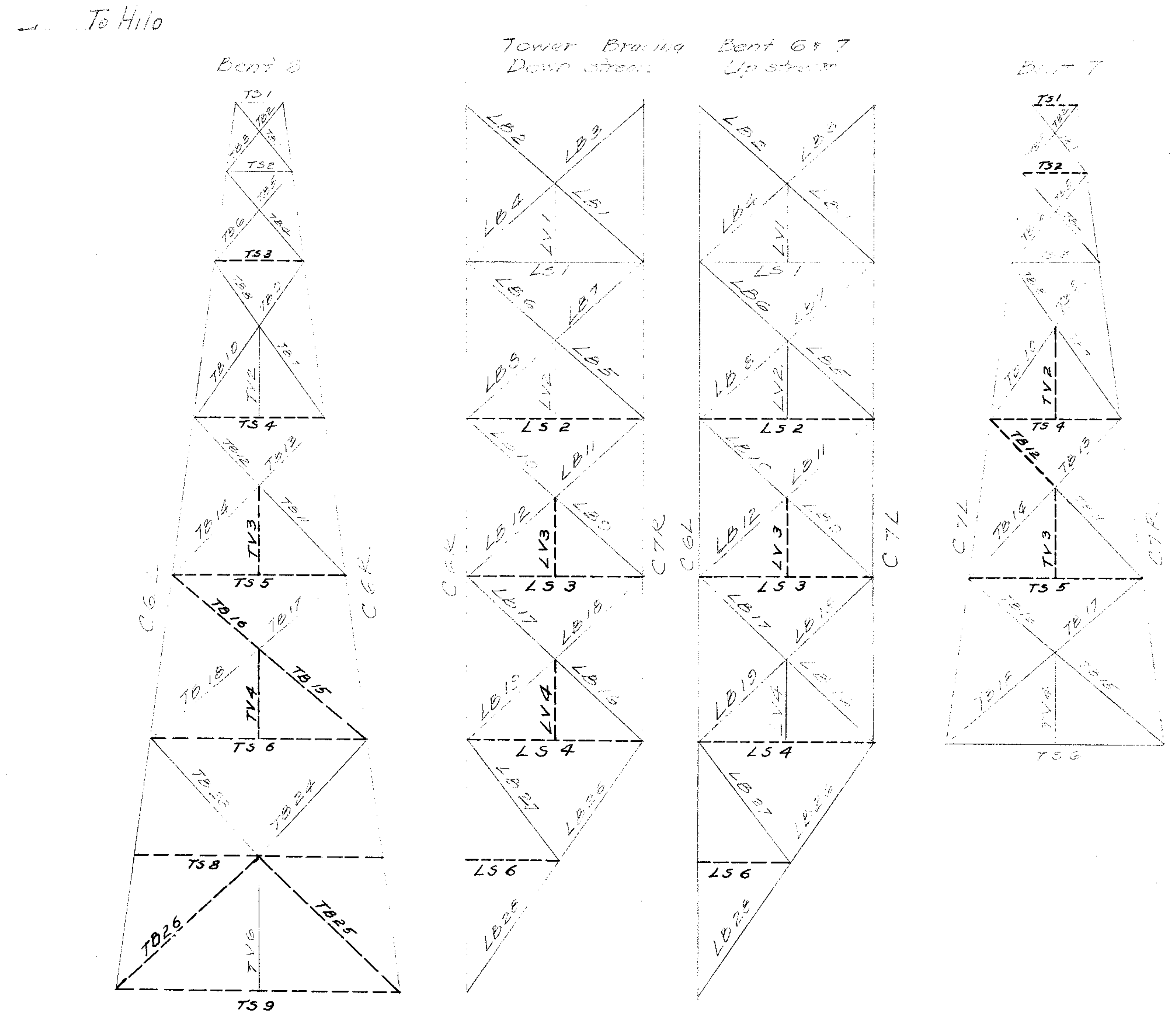
May 1950

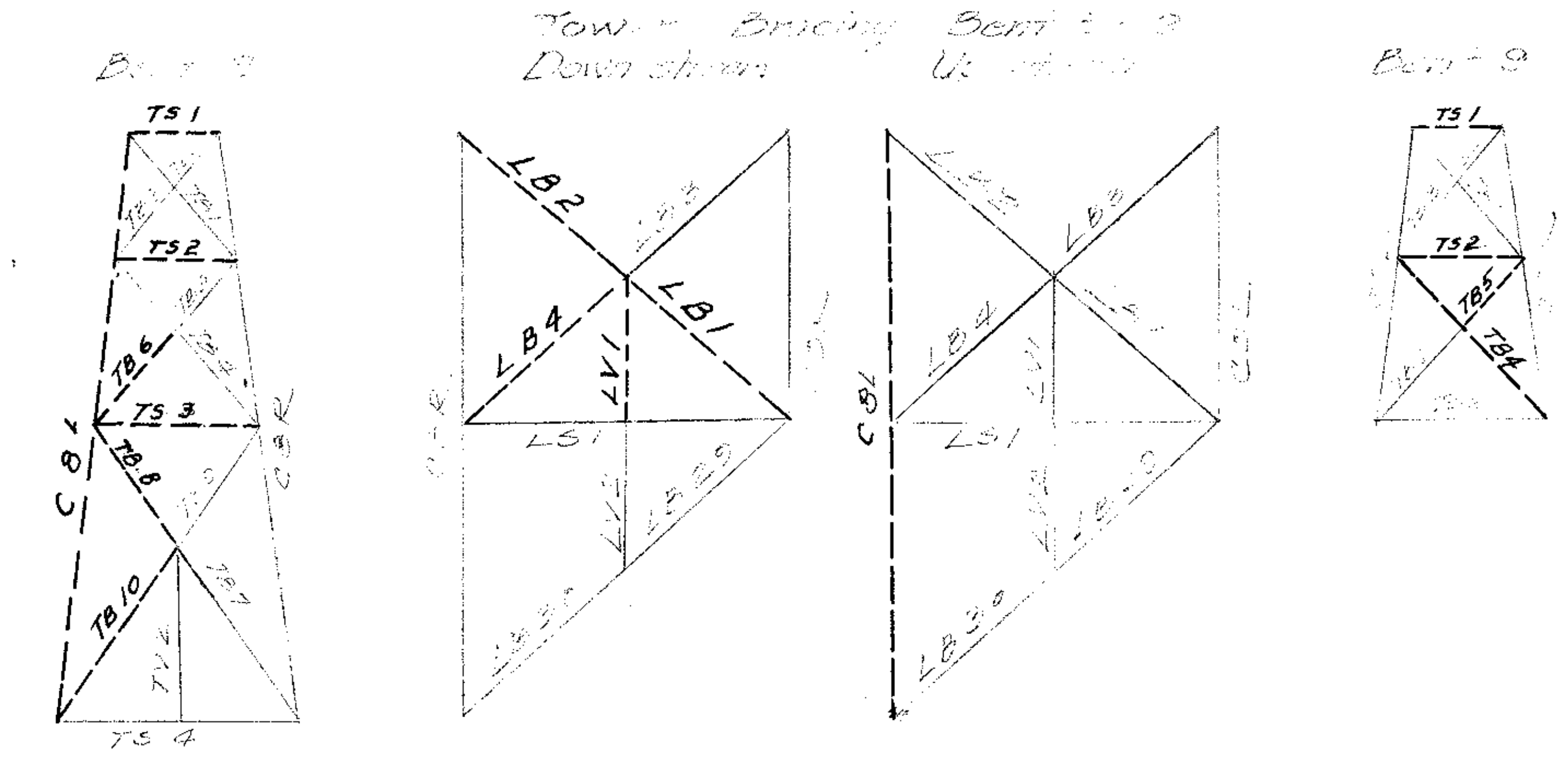
SHEET No. 8 OF 11 SHEETS

ORIGINAL PLAN
NOTE BOOK NO.
SURVEY PLOTTED BY.................DATE
DESIGNED BY "
DRAWN BY "
TRACED BY "
QUANTITIES BY "
QUANTITIES CHECKED BY "
CHECKED BY "

5468.71

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw.	SDR3(13)	1950	72	704





Bent 6

TS - 3 6 rivets 3/4" - 1" grip
TS - 4 20 " " "
TS - 5 12 " " "
TS - 6 60 " " "
TS - 8 75 " " "
TS - 9 40 " " "
TB - 15 slightly bent
TB - 16 " "
TB - 25 4 rivets 3/4" - 3/4" grip
TB - 26 6 " " "
TV - 3 4 " " "
TV - 4 6 " " "

Down stream

LS-2 16 rivets 1" grip
LS-3 24 " "
LS-4 24 " "
LS-6 12 " "
LV-3 6 " 3/4 grip
LV-4 6 " "

Up stream

LS-2 8 rivets 1" grip
LS-3 20 " "
LS-4 20 " "
LS-6 12 " "
LV-3 6 " 3/4" grip

Bent 7

TS - 1 4 rivets 3/4" - 1" grip
TS - 2 6 " " "
TS - 4 30 " " "
TS - 5 12 " " "
TV - 2 4 " 3/4" - 3/4" grip
TV - 3 3 " " "

Bent 8

TS-1 6 rivets 3/4" - 1" grip
TS-2 12 rivets " "
TS-3 10 " " "
TB-6 6 " 3/4" - 3/4" grip
TB-8 10 " " "
TB-10 4 " " "
C8L 10 - 7/8 - 1 1/2" grip

Down stream

LB-1 6 rivets 3/4" - 3/4" grip
LB-2 4 " " "
LB-4 6 " " "
LV-1 4 " " "

Up stream

None

Bent 9

TS-1 6 rivets 3/4" - 1" grip
TS-2 30 rivets " "
TB-4 18 " " 3/4" grip
TB-5 6 " " "

Condition survey of Bridge

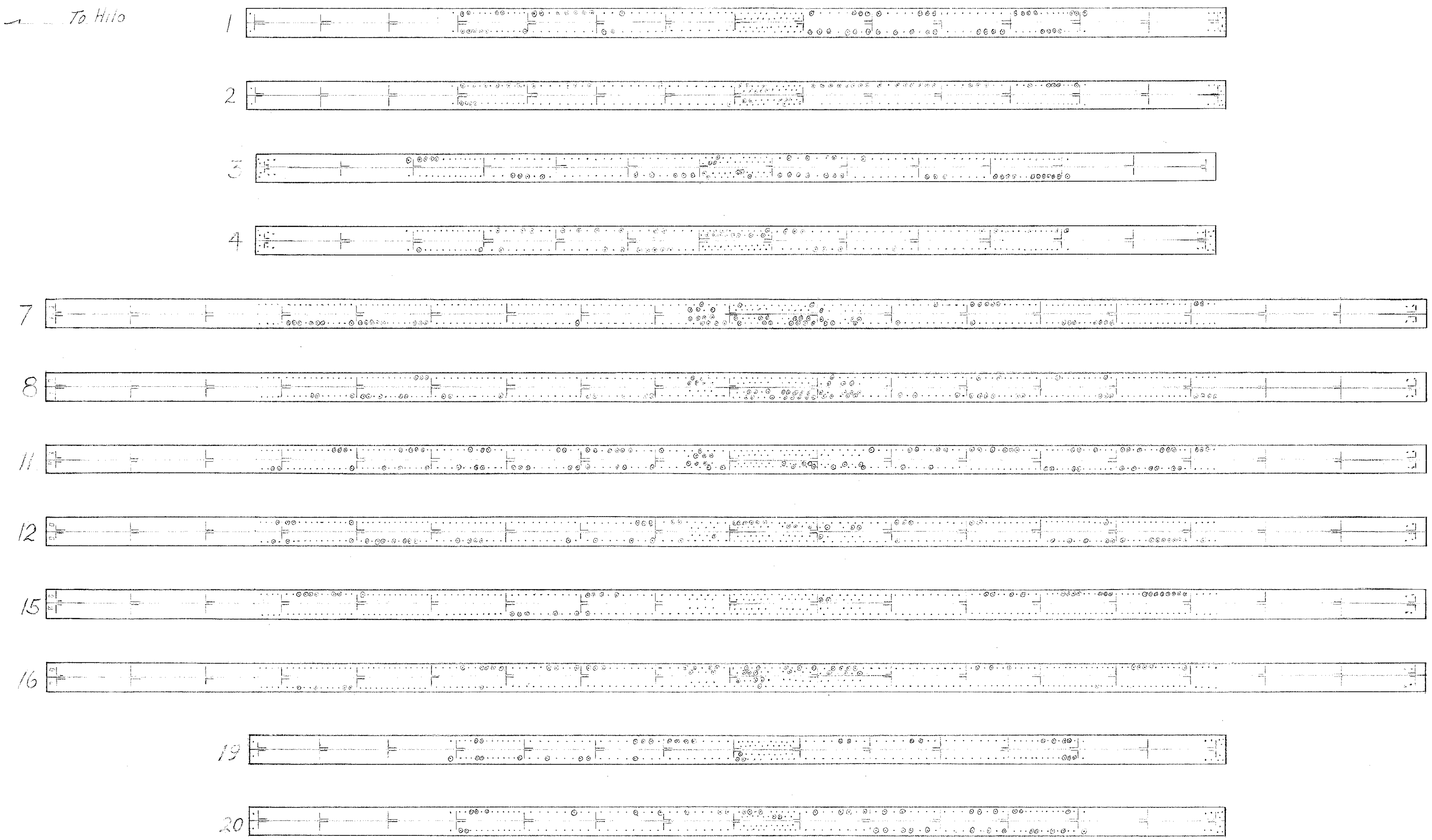
TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII
NANUE BRIDGE
Sta. 0+48.83 to 5+80.16
Hawaii Belt Road SDR 3(13)
May 1950
SHEET No. 9 OF 11 SHEETS

ORIGINAL PLAN
NOTE BOOK No.
SURVEY PLOTTED BY .... DATE ....
DESIGNED BY .... "
DRAWN BY .... "
TRACED BY .... "
QUANTITIES BY .... "
QUANTITIES CHECKED BY .... "
CHECKED BY .... "

5468.72

72

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SD 3(13)	1950	73	304



SUMMARY OF RIVETS TO BE REPLACED

Dia.	Length	Grip	No.	Say:
7/8"	2 5/8"	1 1/8"	328	410
7/8"	3 1/4"	1 5/8"	148	180
7/8"	3 7/8"	2 1/8"	71	90
7/8"	4"	2 1/4"	44	60
7/8"	5 1/8"	3 1/4"	58	70

Use Last Col. (say) for estimating in contract

All Rivets and Bolts at base plates of girders at Column connections on entire structure must be replaced. (these are not shown)

Approximate no of rivets for Col. to Girder Connection

Dia.	Length	Grip	No
7/8"	3"	1 5/8"	120

The top flanges rivets are not readily accessible to inspection but they are assumed to be entirely bad and should be figured on being replaced. approximate quantities are.

Dia.	Length	Grip	No
7/8"	2 5/8"	1 1/8"	1020
7/8"	3 1/4"	1 5/8"	1010
7/8"	3 7/8"	2 1/8"	230
7/8"	4	2 1/4"	120
7/8"	5 1/8	3 1/4"	290

- Legend -

• (Dot) indicates rivet

⊙ (circled dot) indicates condemned rivet

PLAN - BOTTOM FLANGE

GIRDERS NOT SHOWN HAVE NO
COVER PLATES - NO CHECKS -

Condition survey of Bridge

TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII
NANUE BRIDGE
Sta. 0+48.83 to 5+80.16

Hawaii Belt Road SDR 3(13)

May 1950

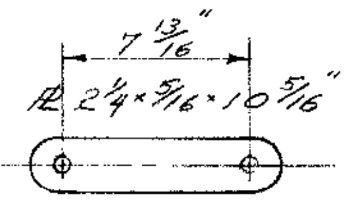
SHEET No. 10 OF 11 SHEETS

5468.73

65

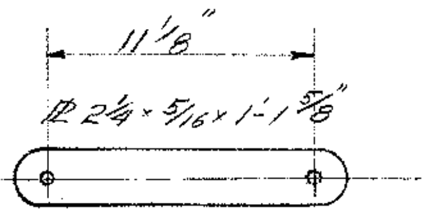
ORIGINAL PLAN
NOTE BOOK
No.
SURVEY PLOTTED BY.......DATE.......
DESIGNED BY....... " ....
DRAWN BY....... " ....
TRACED BY....... " ....
QUANTITIES BY....... " ....
QUANTITIES CHECKED BY....... " ....
CHECKED BY....... " ....

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR-3(13)	1950	74	304



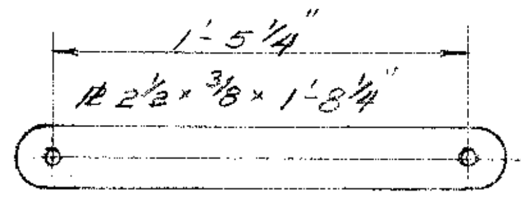
LATT. BAR-TRANS. BRACING UMAUMA

105 Required.



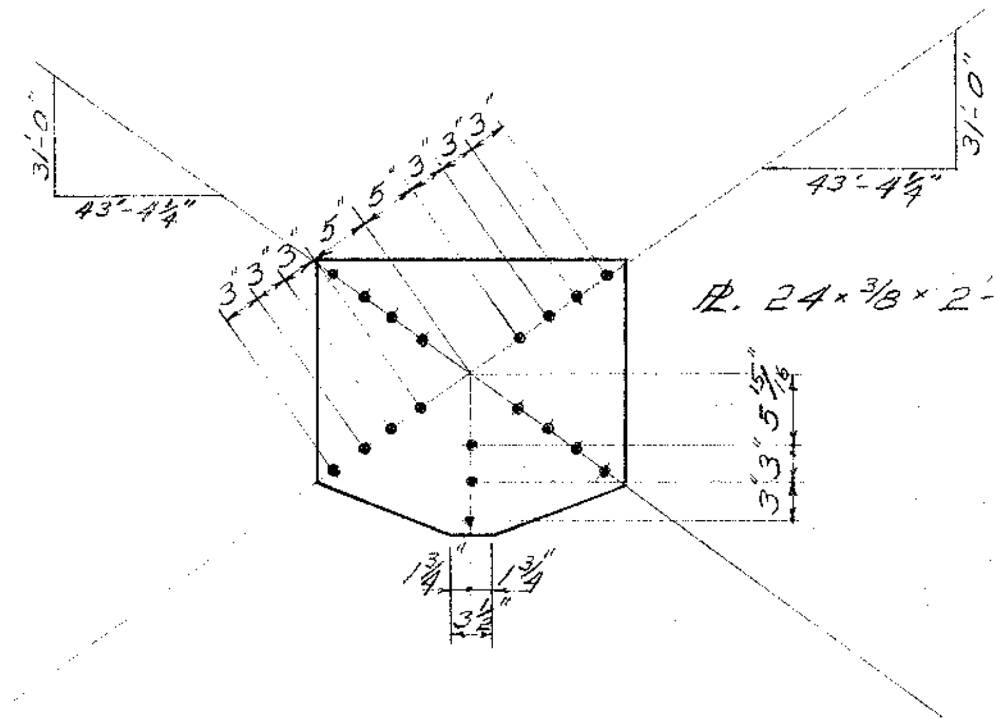
LATT BAR-TRANS. BRACING NANUE

3 Required



LATT. BAR-COLUMN. UMAUMA

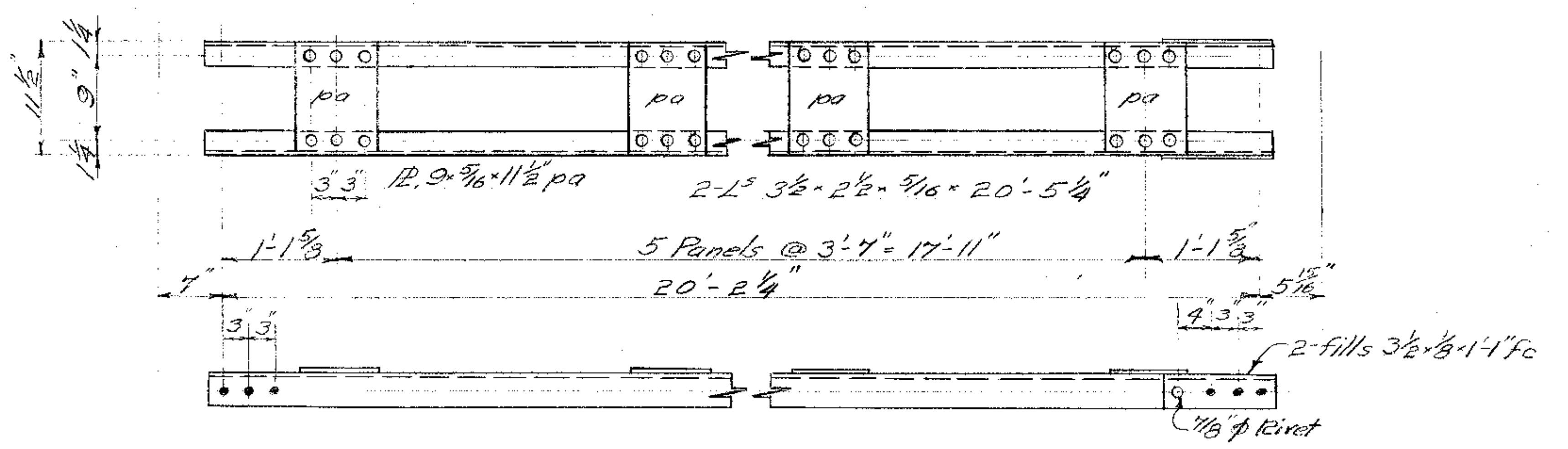
91 Required



PL. gc for Bent #4

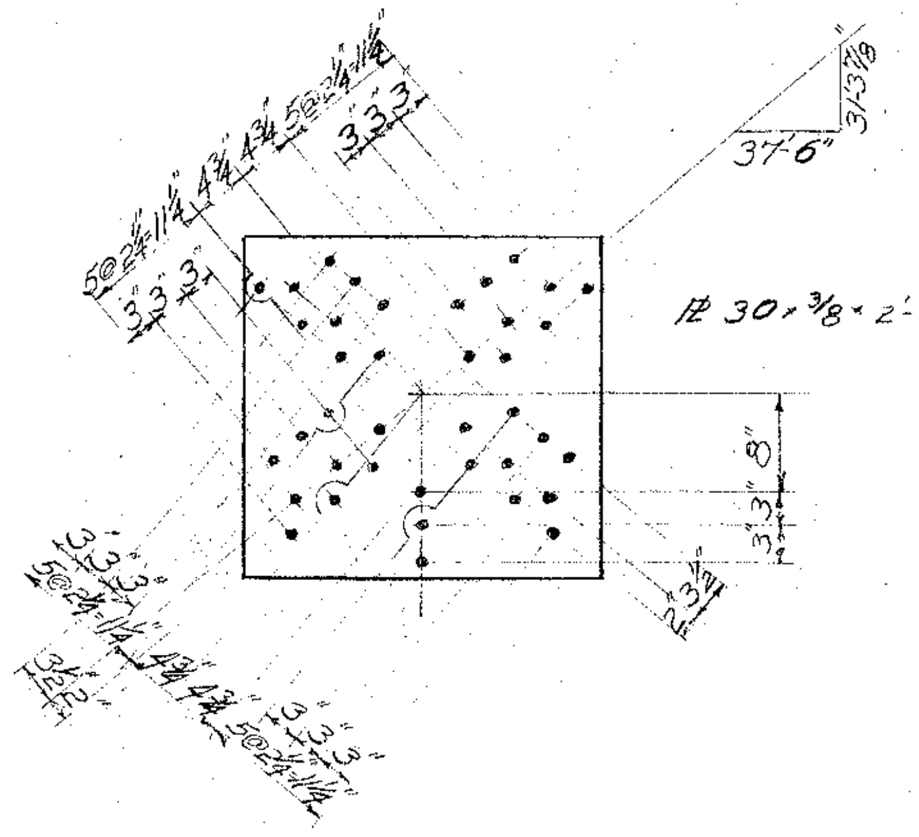
NANUE

2 Required



TV-5 NANUE

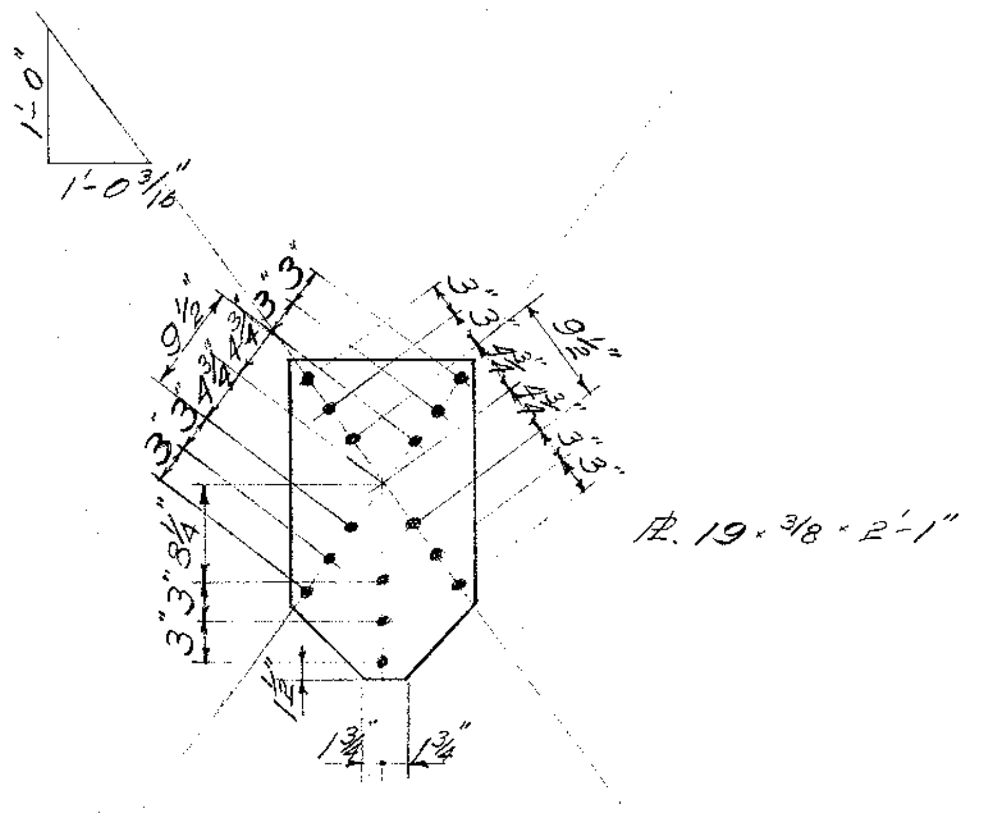
One Required



PL. gc for Tower Bents #4 & #5

NANUE

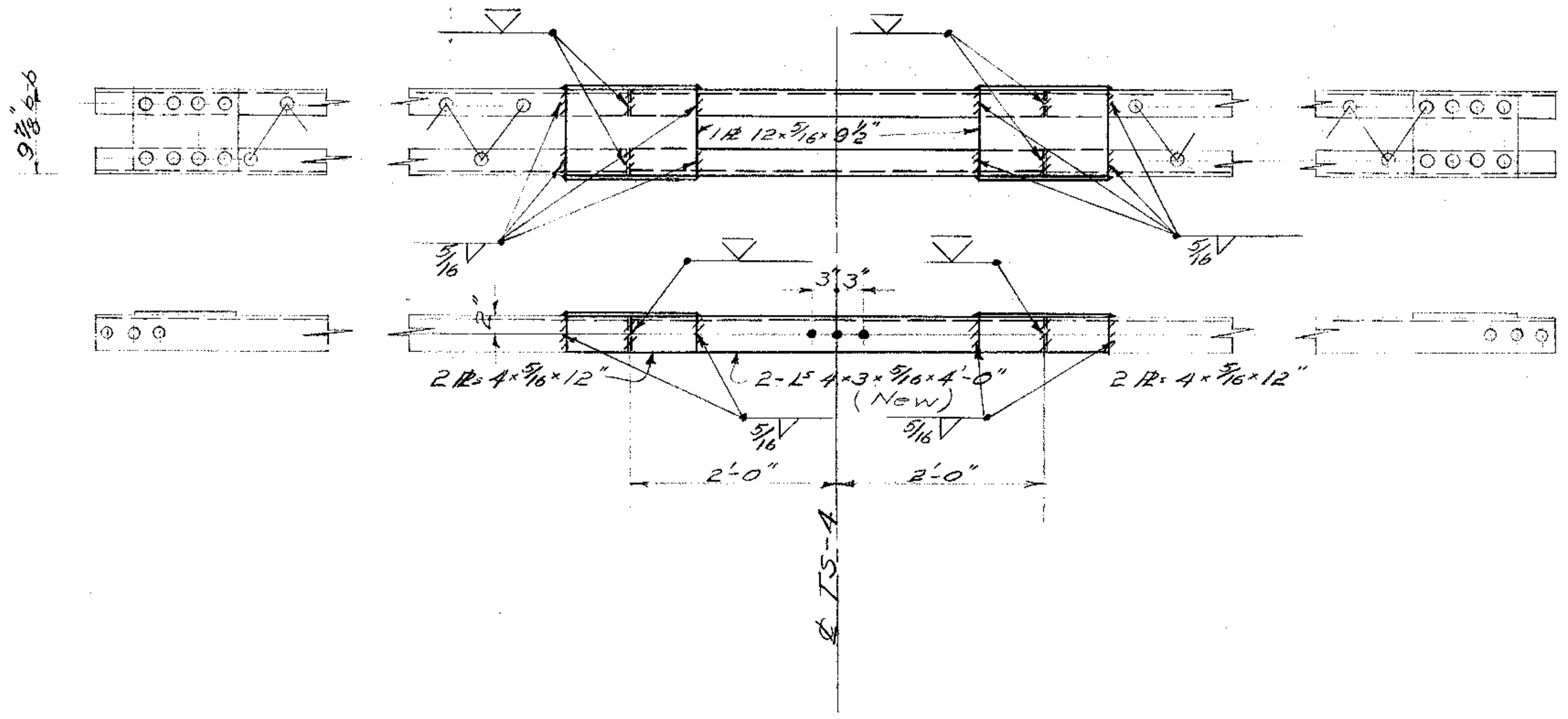
2 Required



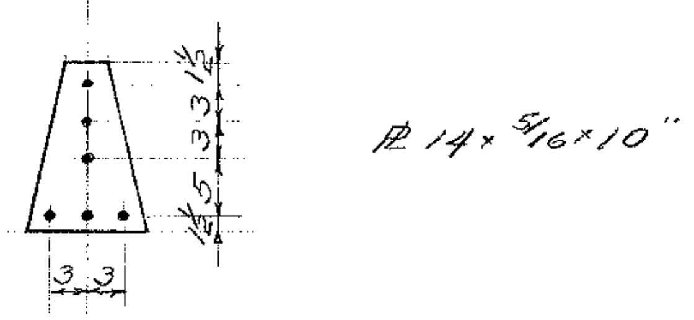
Gusset PL^s for Bents 1 & 3

UMAUMA

4 Required



DETAIL OF REPAIRS FOR TS-4 UMAUMA



PL gc for Bent #3

UMAUMA

2 Required

Note! All replacements for condemned pieces and members, and repairs shall be new steel.

TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII
NANUE BRIDGE
Sta. 0+48.83 to 5+80.16
UMAUMA BRIDGE
Sta. 100+46.73 to 103+25.38
Hawaii Belt Road SDR-3(13)
Feb. 1950

SHEET No. 11 OF 11 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY .... DATE ....
	DESIGNED BY .... " ....
	DRAWN BY .... " ....
	TRACED BY .... " ....
NOTE BOOK No.	QUANTITIES BY .... " ....
	QUANTITIES CHECKED BY .... " ....
	CHECKED BY .... " ....

5468.74

66

74

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	70R3(13)	1950	75	304

Nov. 1, 1950 12/15/50

Order No. 3807 **Sheet No.** E1E

NOTE: These pieces are not available. See sheets 5468.75A, 5468.75B and 5468.75C for details.

NOTE: BEAMS B1-E & B2-E ARE TO BE FIELD WELDED TO GIRDER AT EXPANSION JOINTS & AT ENDS OF BRIDGE ONLY.

NOTE: PIECES LISTED BELOW ARE LOCATED ON THE EAST & WEST SIDES OF THE TOWERS. NO REVAMPING IS REQ'D ON THIS MAT'L.

NO. REQ'D	PIECE MARK	BRIDGE TAKEN FROM:
48	LB4	32 - KEALAHAKA 16 - MAILE
12	LB5	4 - KEALAHAKA 8 - MAILE
12	LB5A	4 - KEALAHAKA 8 - MAILE
18	LS4	10 - KEALAHAKA 8 - MAILE
12	LH2	8 - KEALAHAKA 4 - MAILE
6	LH3	2 - KEALAHAKA 4 - MAILE
24	LP27	16 - KEALAHAKA 8 - MAILE
12	LP28	4 - KEALAHAKA 8 - MAILE
84	SP5	64 KEALAHAKA 20 MAILE
112	SP7	72 KEALAHAKA 40 MAILE
24	SP8	24 KEALAHAKA
32	SP9	32 KEALAHAKA

Rivets:
Holes:
Paint:

ERECTION PLAN
NANUE BRIDGE
HAWAII ISLAND, T. H.

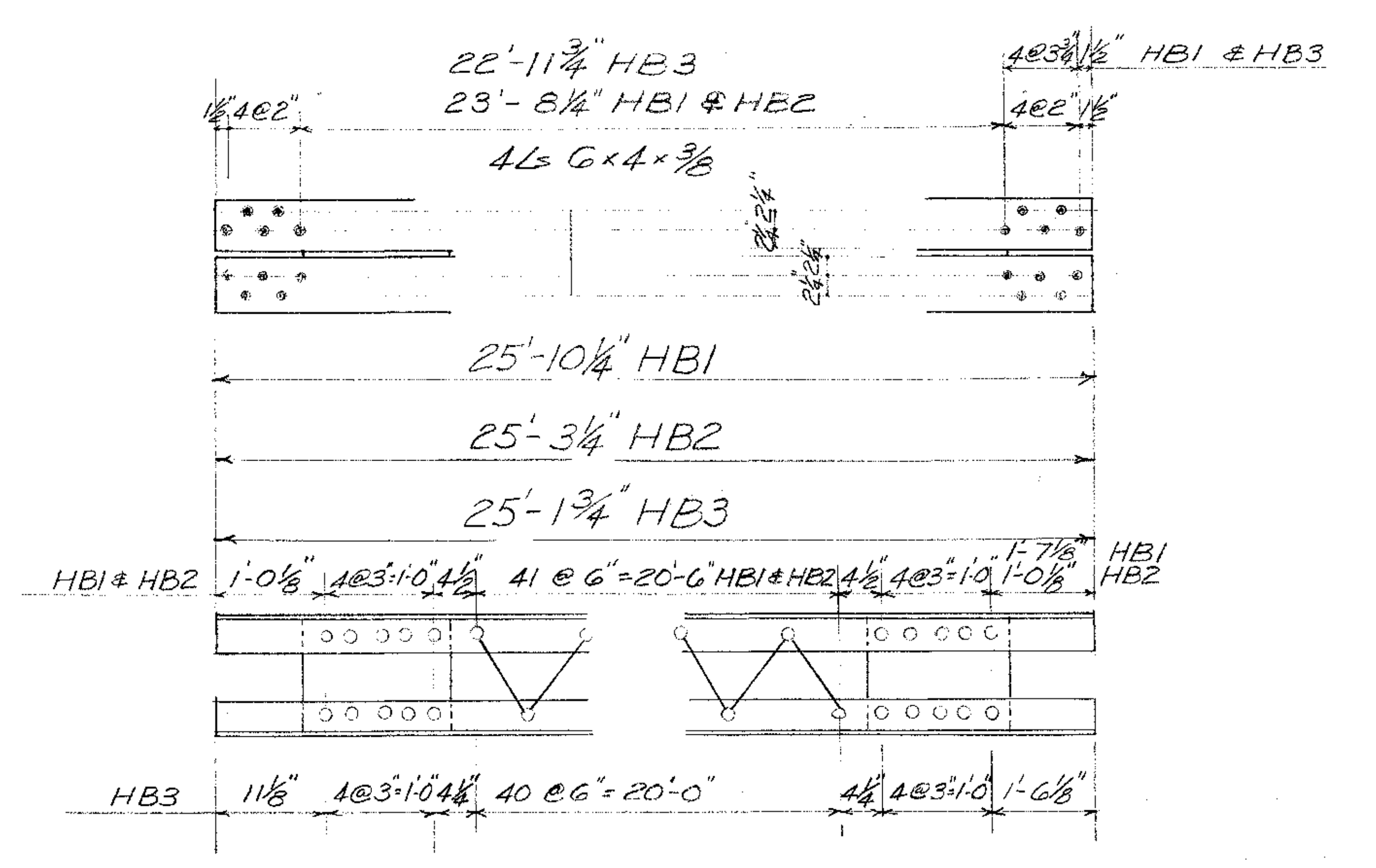
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	[illegible]	1-20-50	ORDER NO.	3807
CHECKED BY	RA	2-20-50	SHEET NO.	E1E

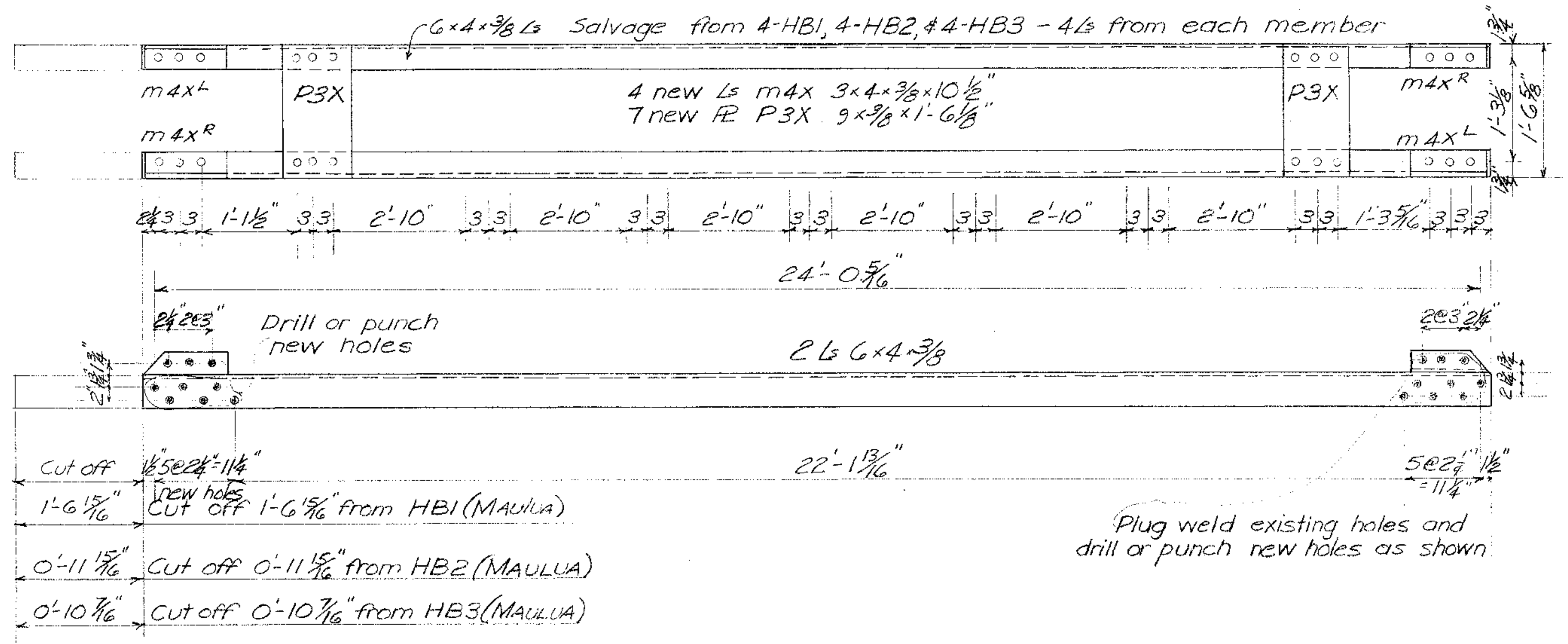
5468.75

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw.	SDR3(13)	1950	75A	304

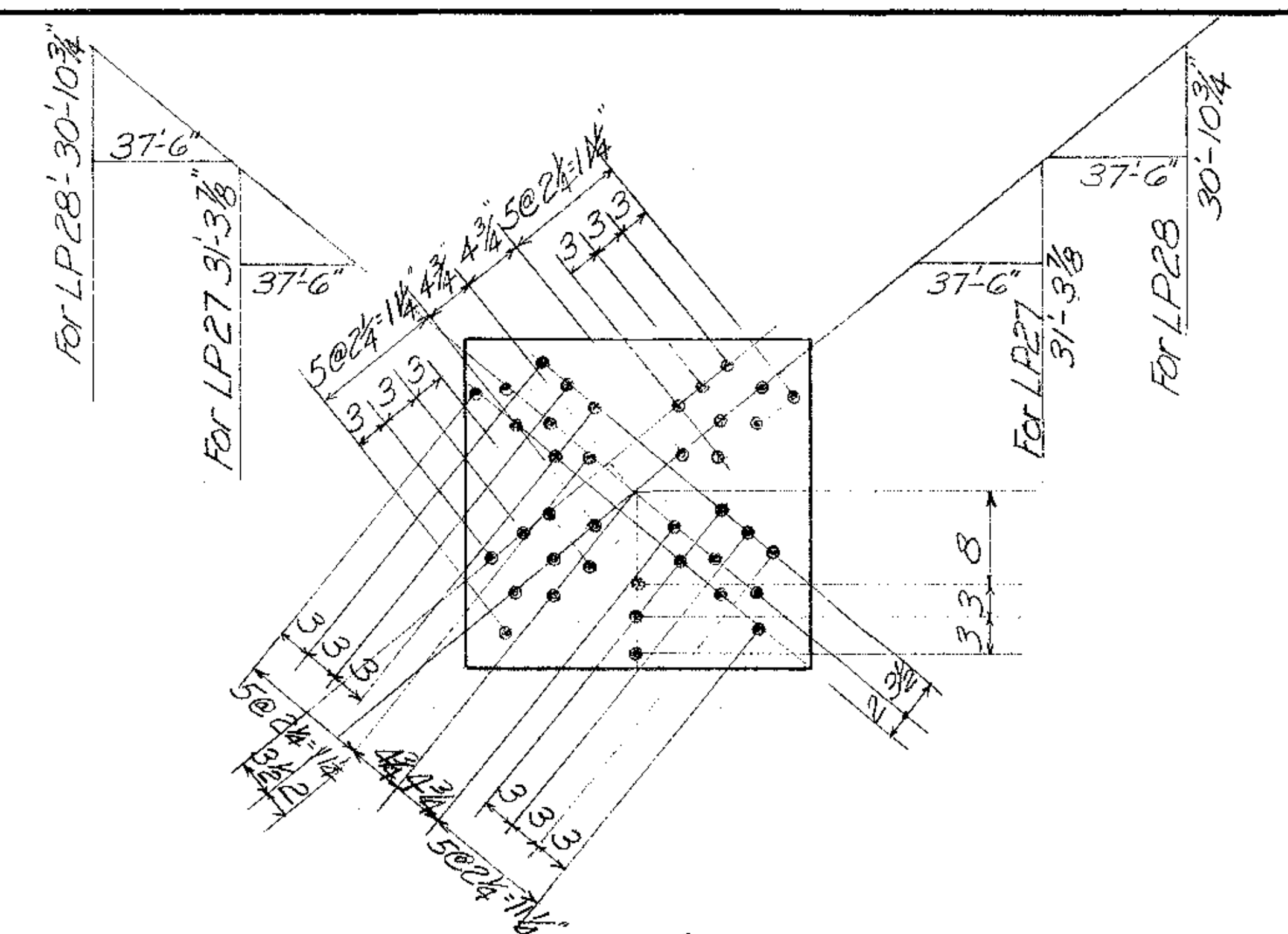
Inserted 12/19/50



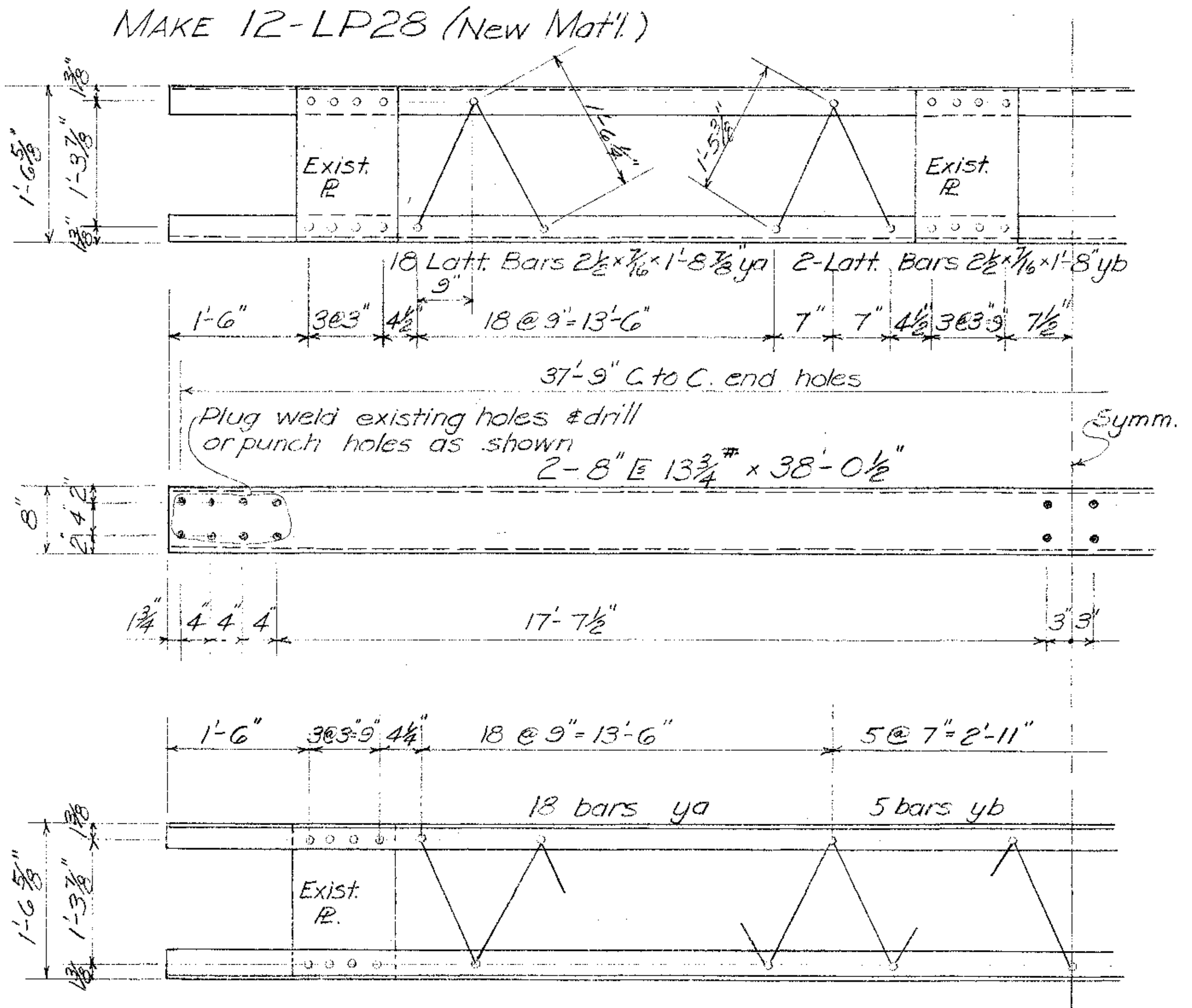
REVAMP 4-HB1, 4-HB2, 4-HB3 (MAULUA) AS SHOWN BELOW



REVAMP 4-HB1 (MAULUA)
REVAMP 4-HB2 (MAULUA) } MAKES-24- LB4
REVAMP 4-HB3 (MAULUA)



MAKE 24-LP27 (New Mat'l.)
MAKE 12-LP28 (New Mat'l.)

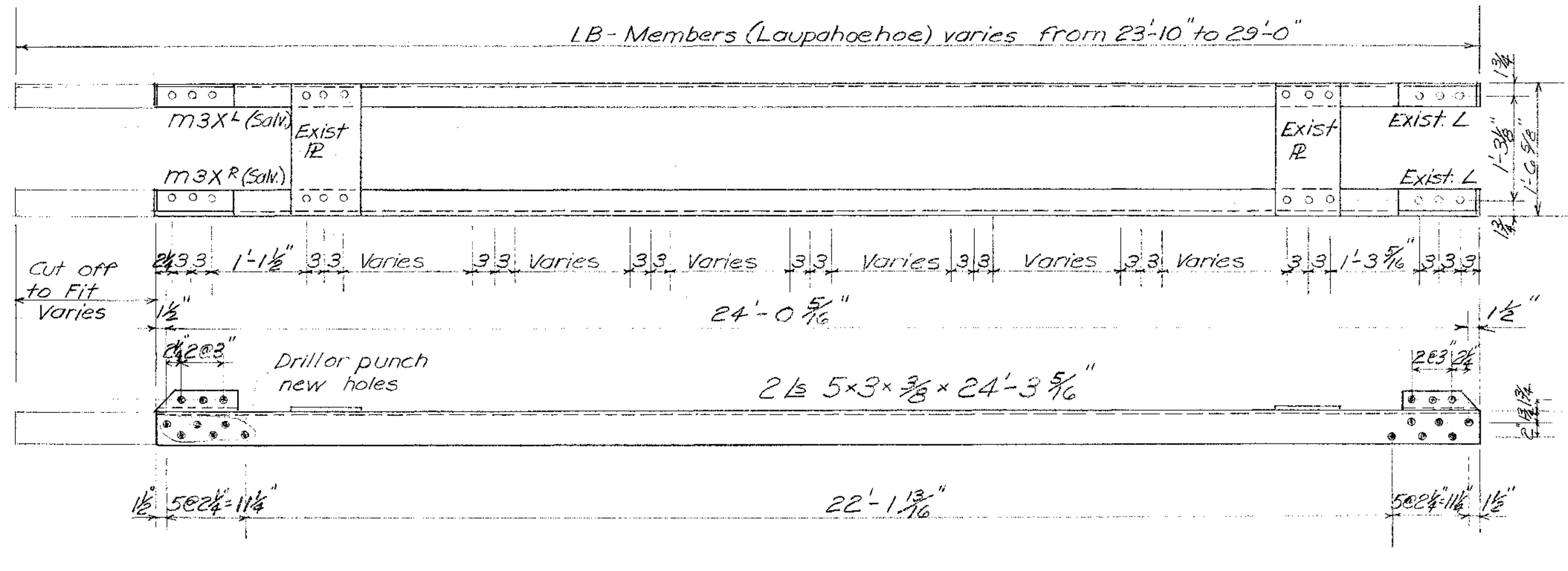


REVAMP 2 LS3 (MAULUA)
DO 2 LS7 (LAUPAHOEHOE) } MAKES 10 LS4
DO 6 LS3 (LAUPAHOEHOE)

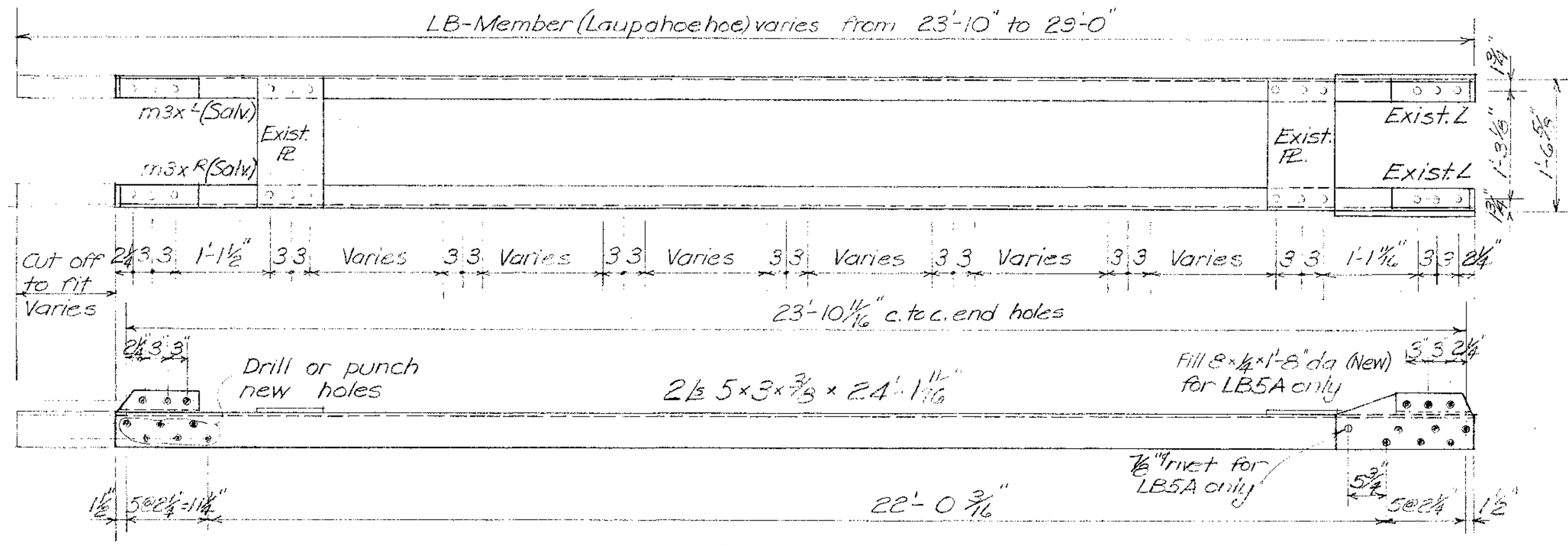
BILL OF MATERIAL

NO.	Description	Length Ft.	In.	Mark	Remarks
NOTE: REVAMP THE MATERIAL LISTED BELOW AS ON THE DETAILS					
4	BRACE	25	10¼	HB1	MAULUA
4	DO	25	3¼	HB2	
4	DO	25	1¾	HB3	
39	DO			LB Members (LAUP.)	
2	STRUT	40	0½	LS3	MAULUA
2	DO	40	0½	LS7	LAUPAHOEHOE
6	DO	40	0½	LS3	DO
78	L3×3×⅜	0	10½	m3X^L	
NEW MATERIAL IS LISTED BELOW					
168	PL 9×⅜	1	6⅛	P3X	
96	L3×4×⅜	0'	10½	m4X	
24	PL 8×¼	1	8	da	
24	PL 30×⅜	2	5	LP27	
12	PL 30×⅜	2	6	LP28	

THE FOLLOWING SALVAGED MATERIAL REQUIRES NO REVAMPING:
9 LB4 (KEALAKAHA) - MAKES 9-LB4
3 LS1 (MAULUA) - MAKES 3-LS4
5 LS4 (LAUPAHOEHOE) MAKES 5-LS4



REVAMP 15-LB-MEMBERS (LAUPAHOEHOE) MAKES 15-LB4



REVAMP 12 LB-MEMBERS (LAUPAHOEHOE) MAKES 12-LB5
DO DO DO DO DO MAKES 12-LB5A

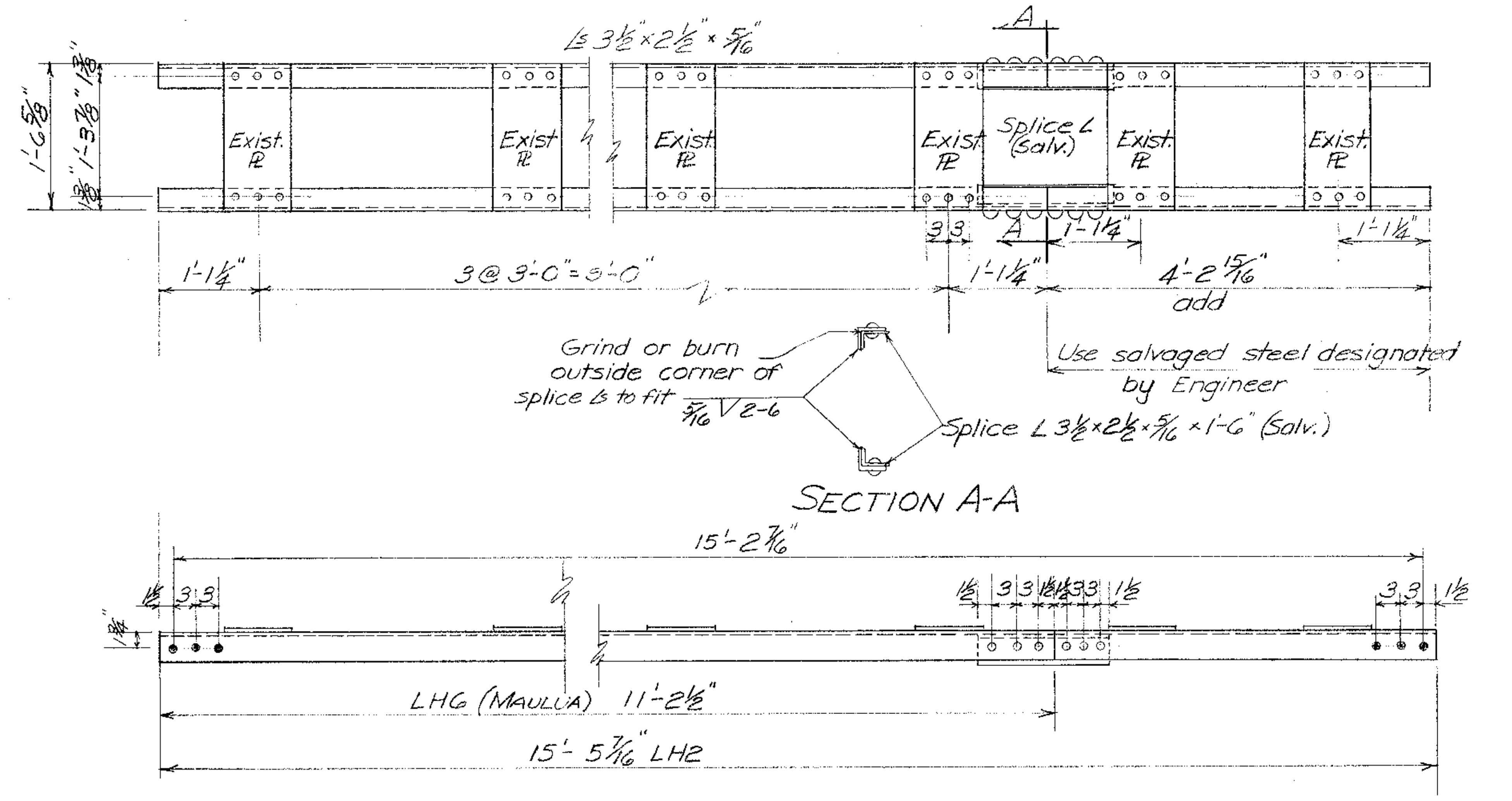
NOTE: For LB Members that are 23'-10" c. to c. end holes, butt-weld a required length of angle & revamp as shown.

NOTE:
Rivets ¾" ϕ
Holes ¹³⁄₁₆" ϕ
All open holes ¹³⁄₁₆" ϕ

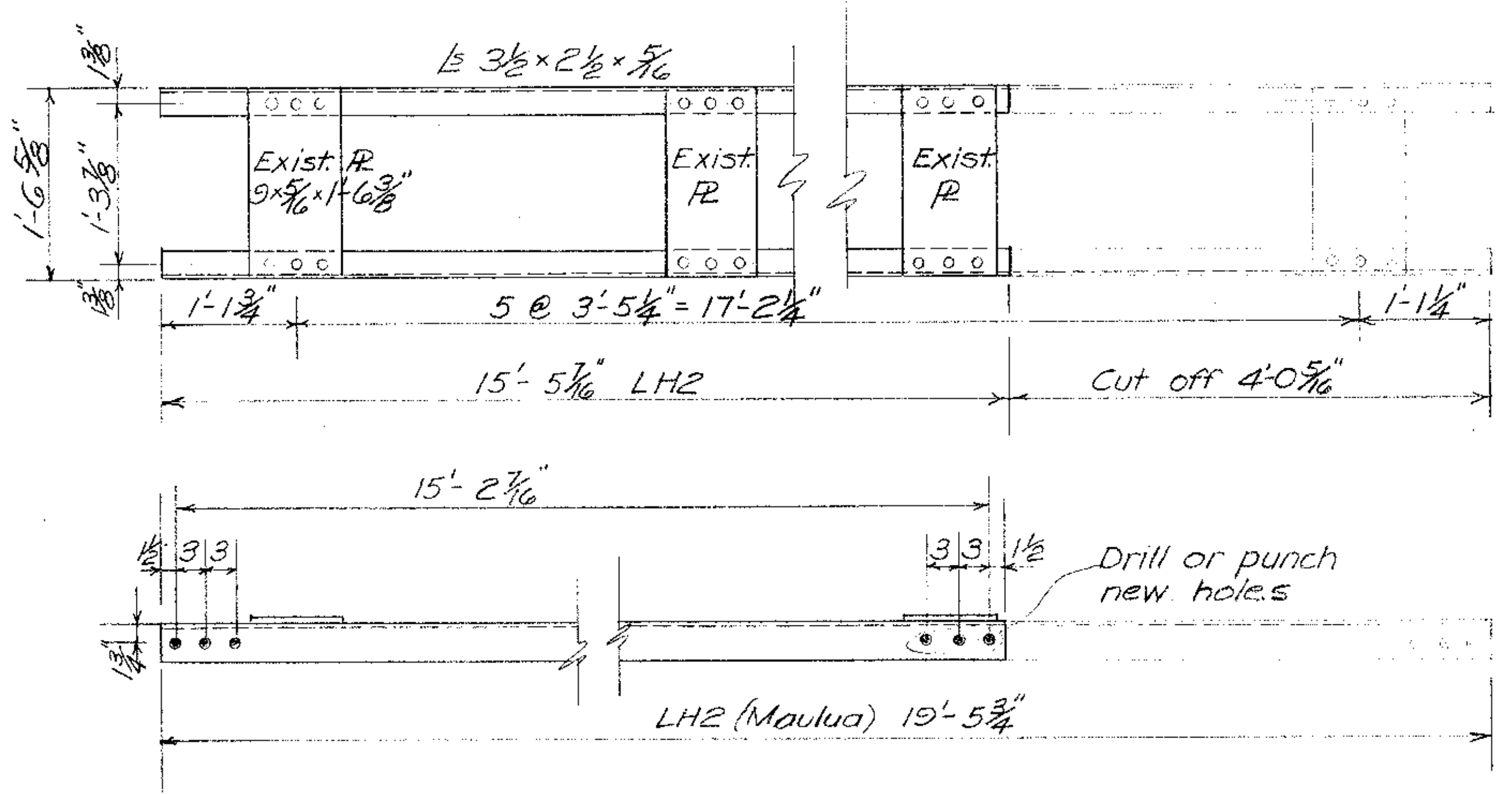
TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII
NANUE BRIDGE
STA. 0+48.83 TO 5+80.16
HAWAII BELT ROAD SDR 3(13)

SHEET No. OF SHEETS
5468.75A

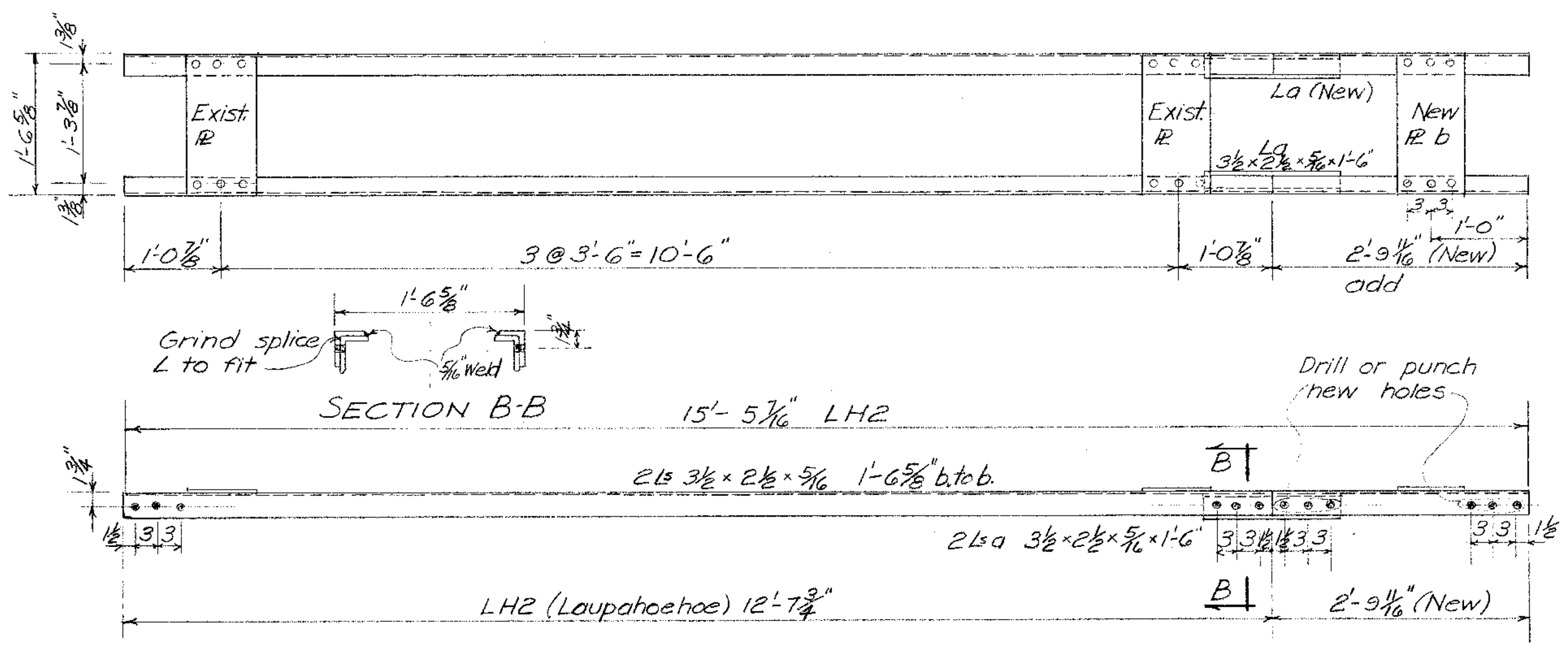
ORIGINAL PLAN
NOTE BOOK NO.
SURVEY PLOTTED BY
DESIGNED BY
DRAWN BY
TRACED BY
QUANTITIES BY
QUANTITIES CHECKED BY
CHECKED BY
DATE



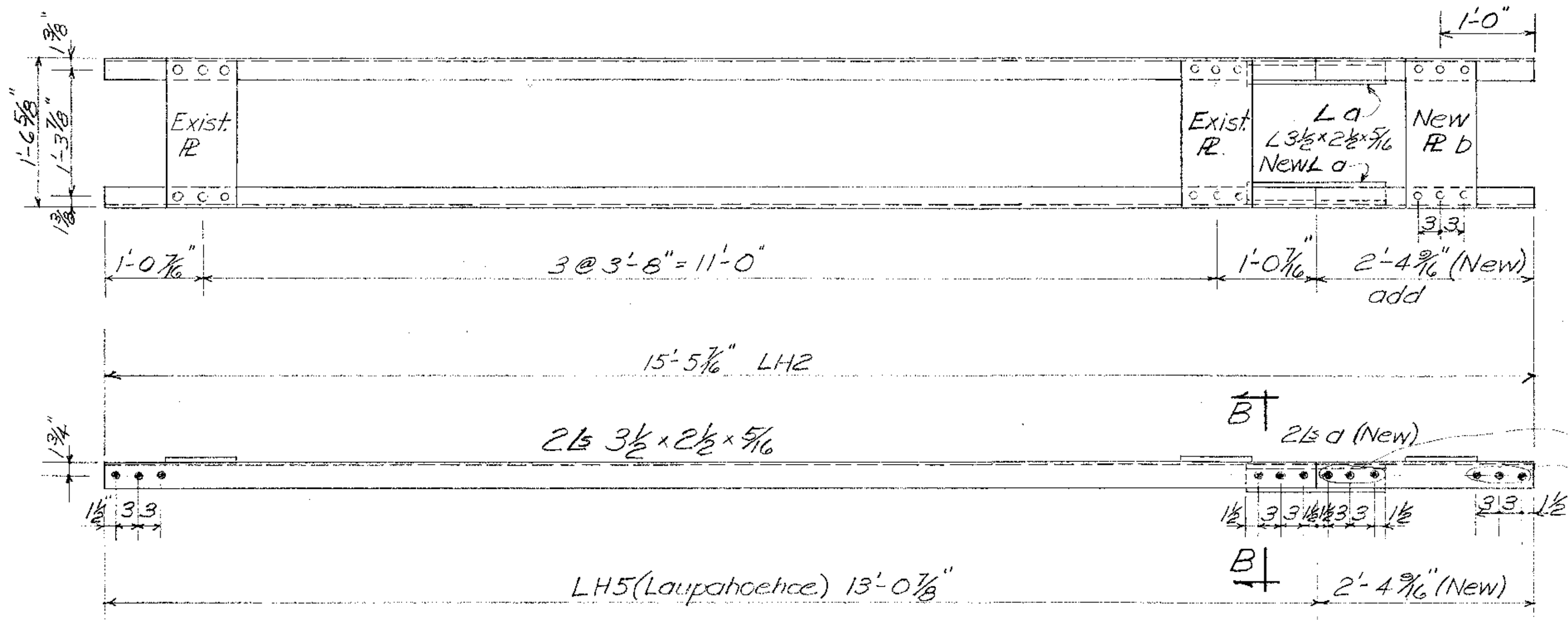
REVAMP 2 LHG (MAULUA) - MAKES 2-LH2



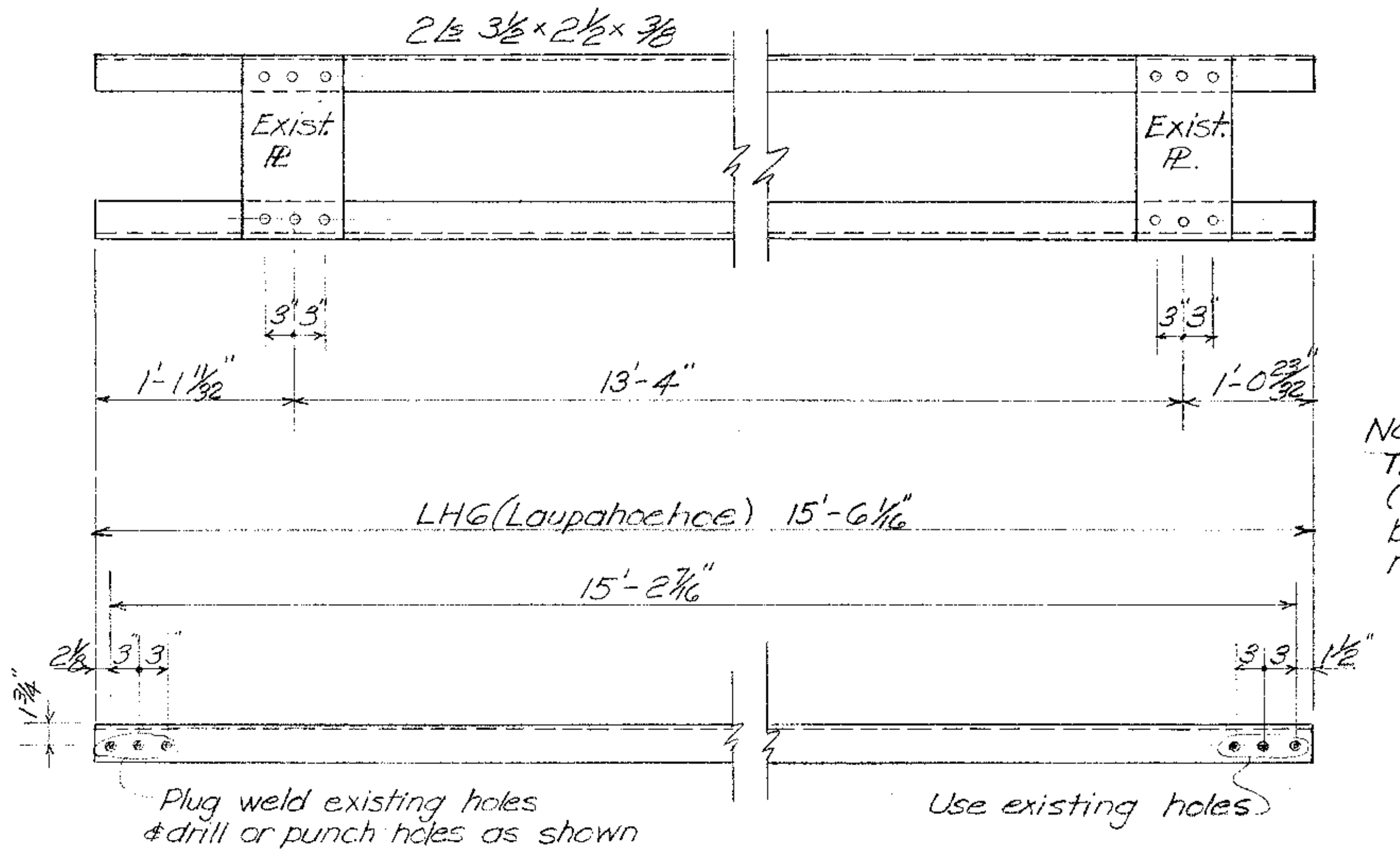
REVAMP 1 LH2 (MAULUA) - MAKES 1 LH2



REVAMP 6 LH2 (LAUPAHOEHOE) - MAKES 6-LH2

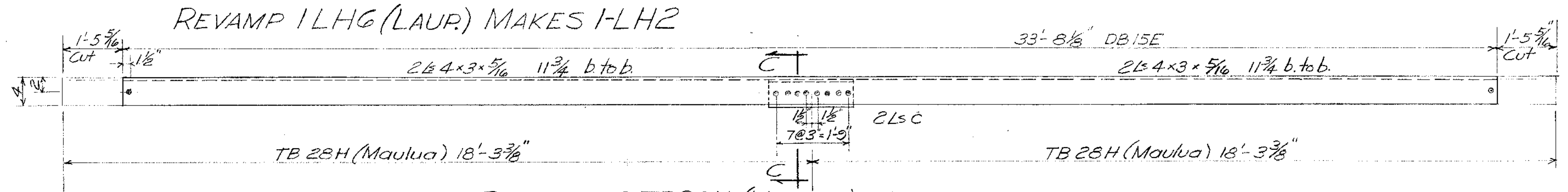


REVAMP 2-LH5 (LAUP.) - MAKES 2-LH2

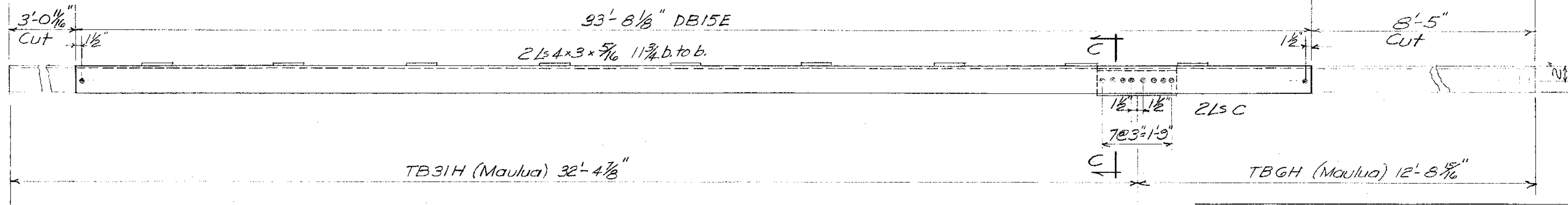


NOTE:
This member is longer (by ⅛") than required but it will fit hence no cutting is necessary.

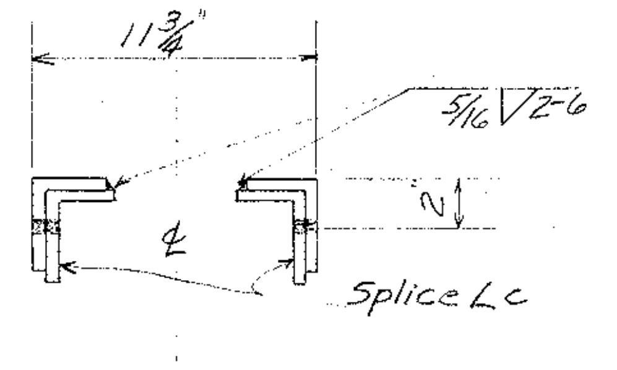
REVAMP 1 LHG (LAUP.) MAKES 1-LH2



REVAMP 2-TB28H (MAULUA) MAKES 1- DB15E



REVAMP 2-TB31H & TBGH (MAULUA) MAKES 2-DB15E



SECTION C-C

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw.	SDR3(13)	1950	75B	304

Inserted 12/19/50

BILL OF MATERIAL

NO.	DESCRIPTION	LENGTH FT.	LENGTH IN.	MARK	REMARKS
NOTE: REVAMP THE MATERIAL LISTED BELOW AS ON THE DETAILS					
2	HANGARS	11	2½	LHG	MAULUA
1	DO	19	5¾	LH2	DO
6	DO	12	7¾	LH2	LAUPAHOEHOE
2	DO	13	0⅞	LH5	DO
1	DO	15	6 1/16	LHG	DO
2	BRACE	18	3⅜	TB28H	MAULUA
2	DO	32	4⅞	TB31H	DO
2	DO	12	8 15/16	TBGH	DO
NEW MATERIAL IS LISTED BELOW:					
16	L 3½ × 2½ × 5/16	1	6	a	
8	PL 9 × 5/16	1	6⅜	b	
6	L 4 × 3 × 5/16	2	0	c	

Rivets ¾" ɸ
Holes 13/16" ɸ
All open holes 13/16" ɸ

ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DESIGNED BY	"
	DRAWN BY	"
	TRACED BY	"
NOTE BOOK No.	QUANTITIES BY	"
	QUANTITIES CHECKED BY	"
	CHECKED BY	"

TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII

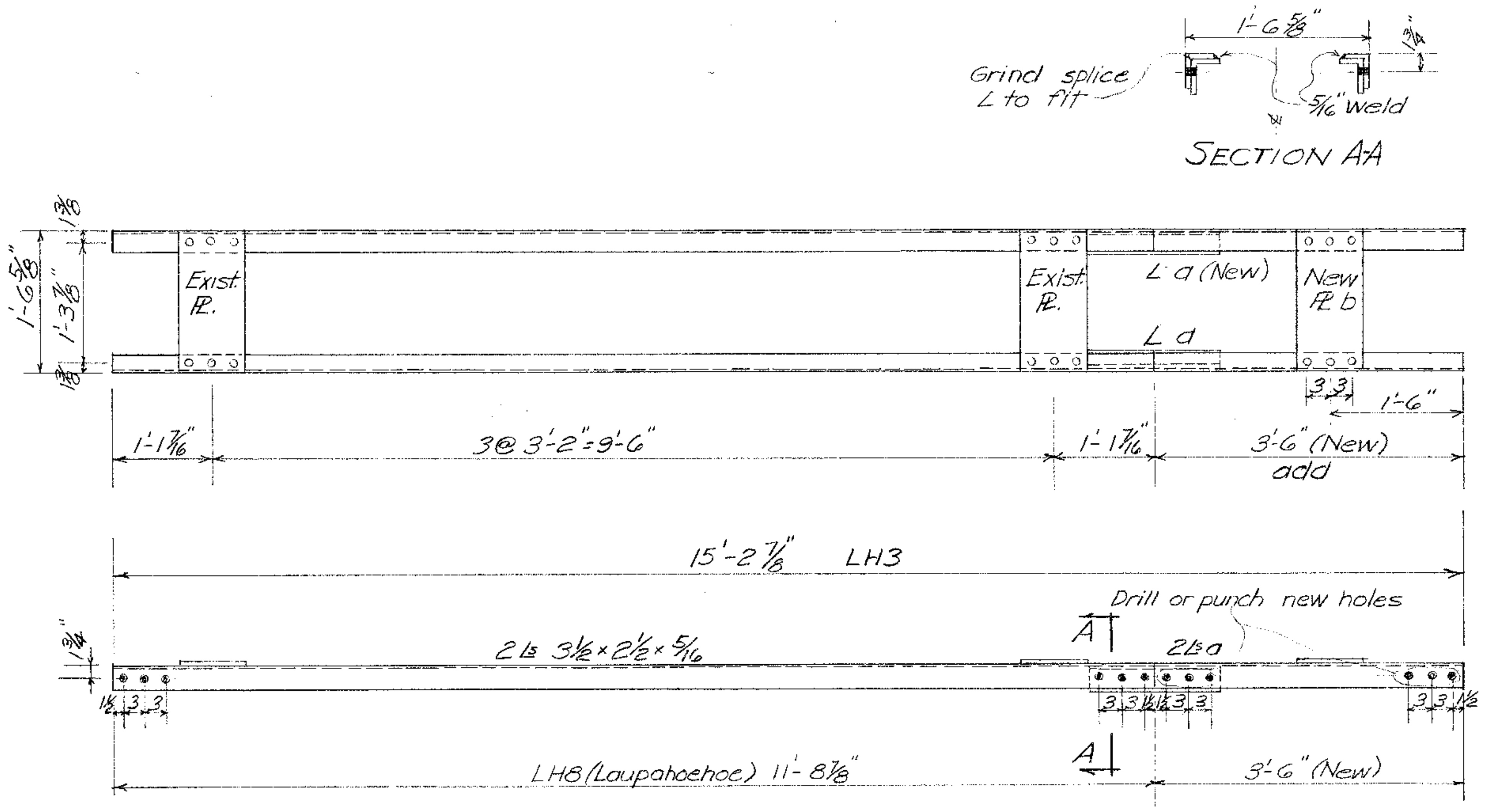
NANUE BRIDGE
STA. 0+48.83 TO 5+80.16
HAWAII BELT ROAD SDR3(13)

SHEET No. OF SHEETS

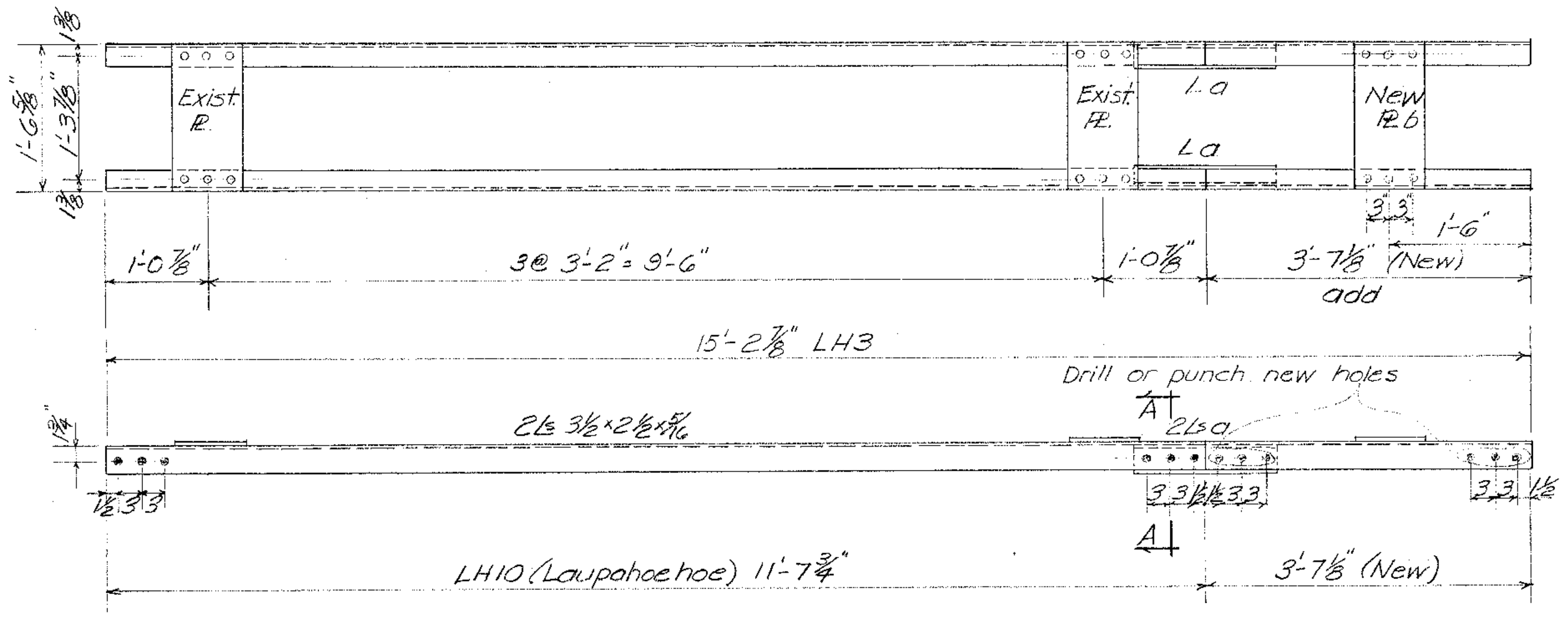
5468.75B

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw.	SDR3(13)	1950	75C	304

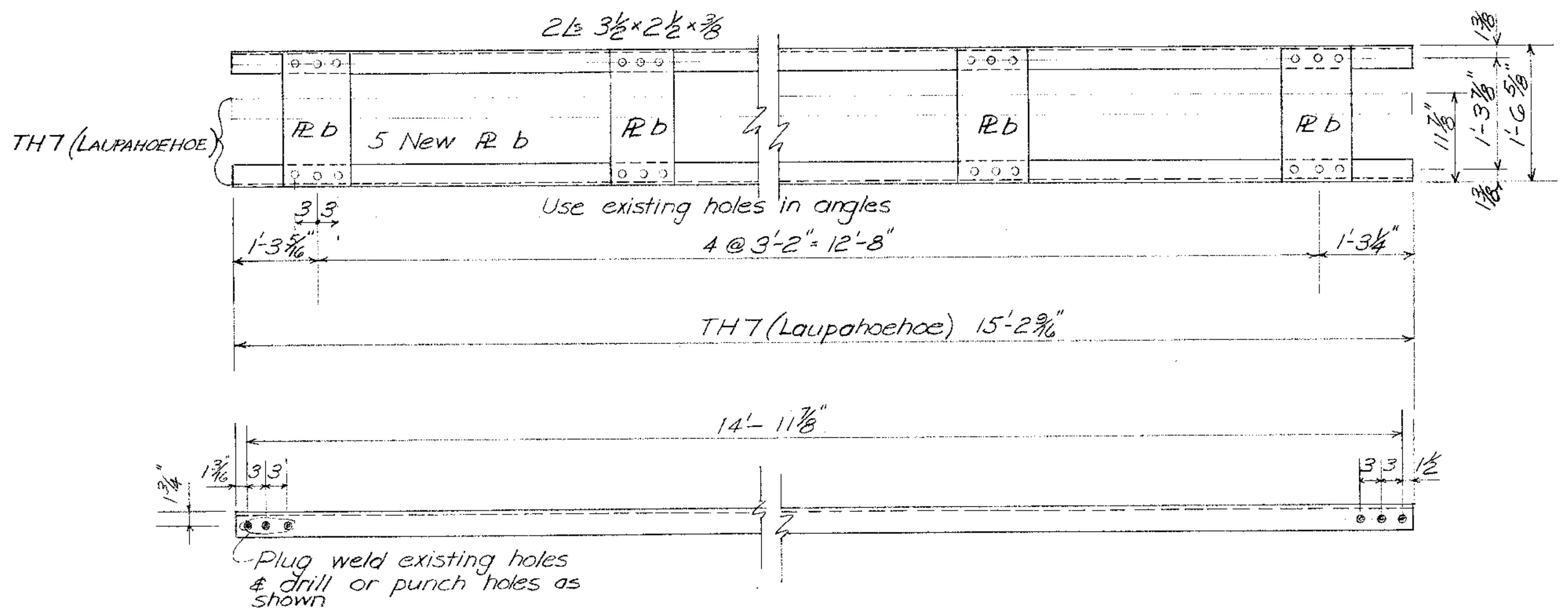
Inserted 12/19/50



REVAMP 1 LH8 (LAUPAHOEHOE) MAKES 1 - LH3

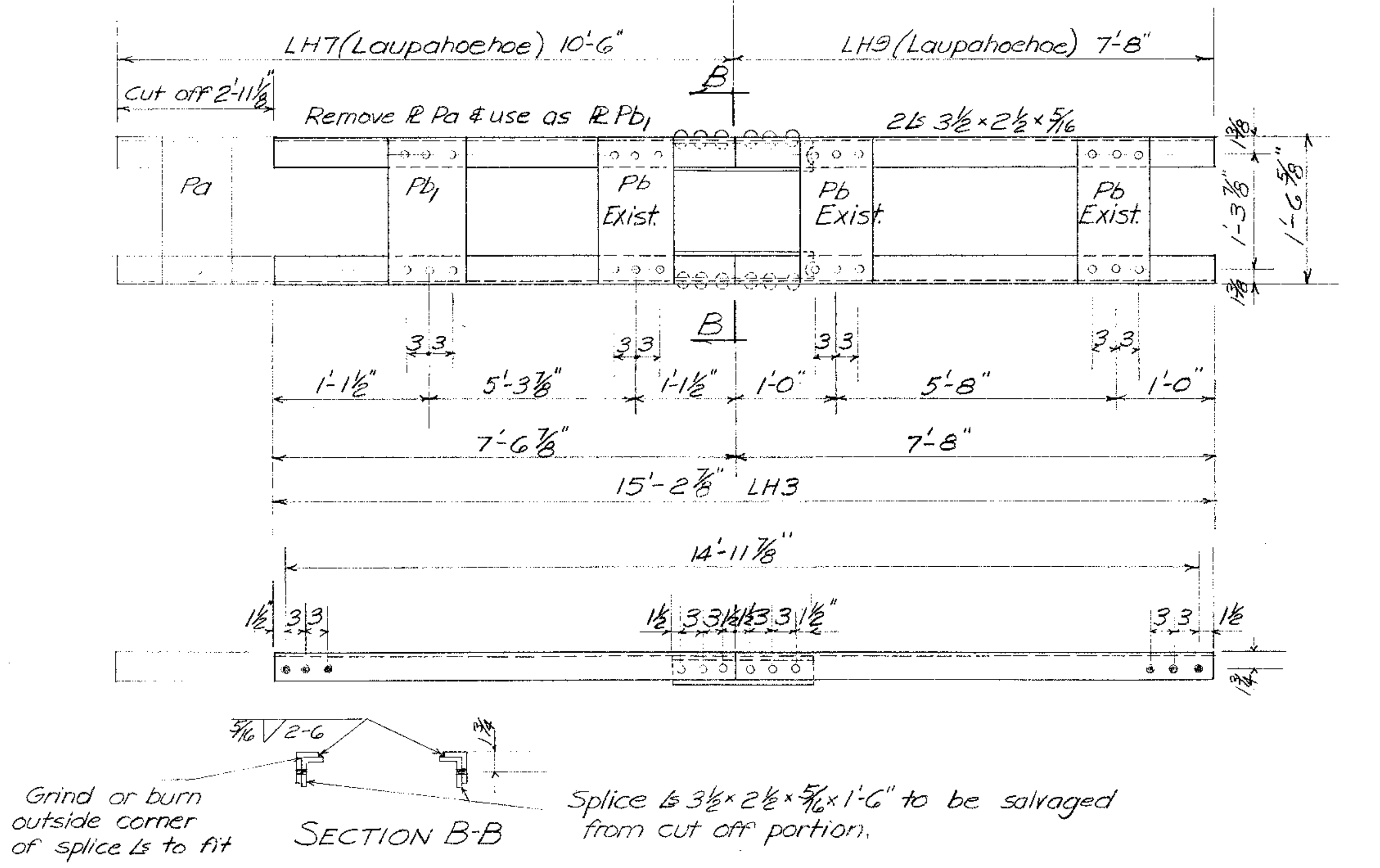


REVAMP 1-LH10 (LAUPAHOEHOE) MAKES 1-LH3

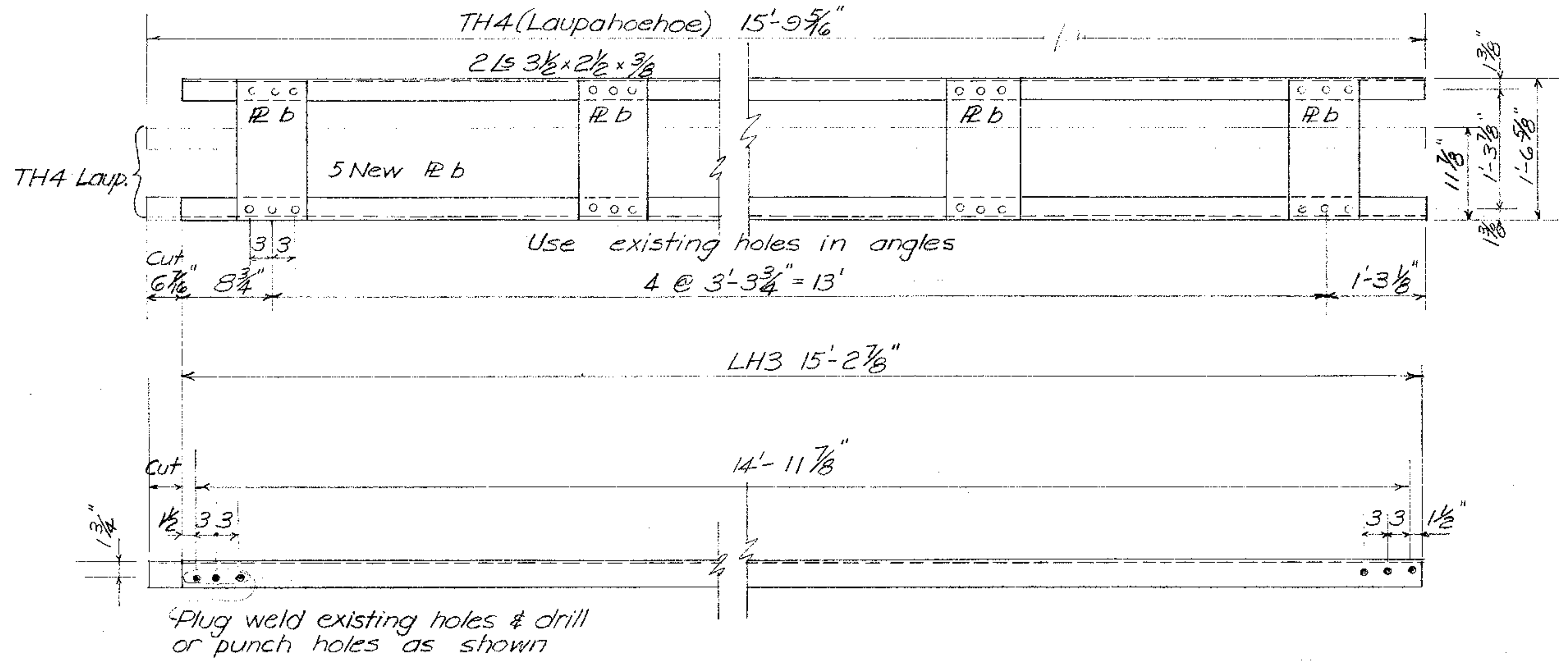


WORK TO BE DONE: Remove tie PL from TH7 (Laupahoehoe) & change b. to b. dist. as shown
Revamp end connection holes as shown
Add new tie plates

REVAMP 2-TH7 (LAUPAHOEHOE) MAKES 2-LH3

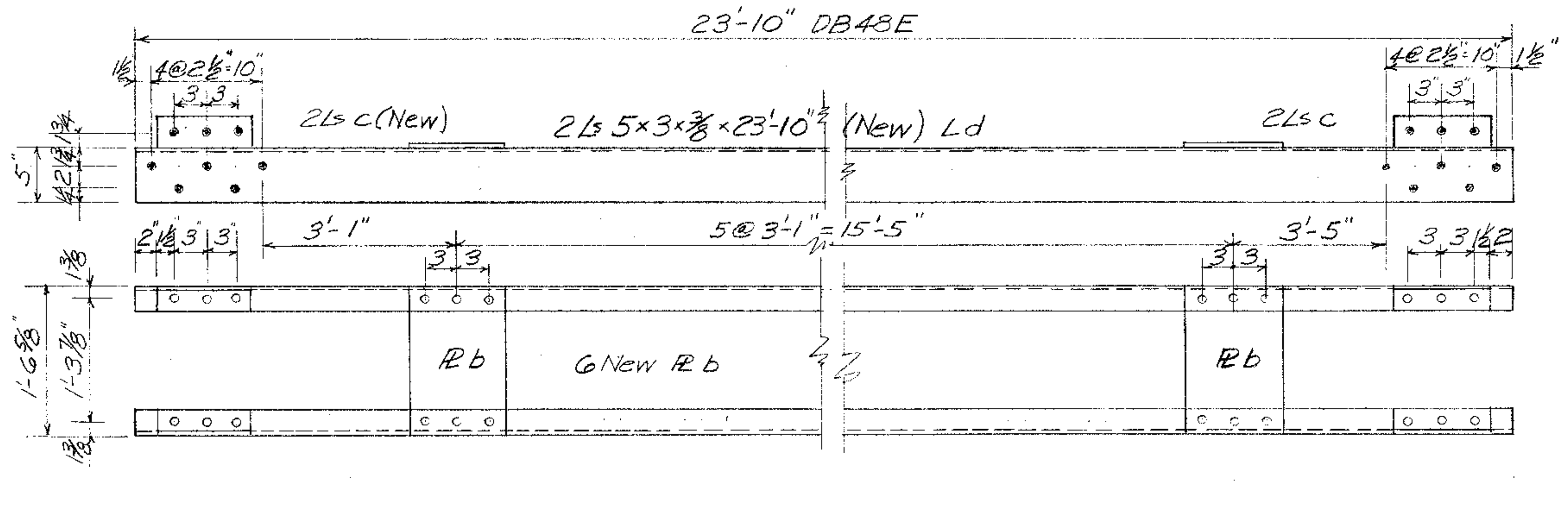


REVAMP 1LH7 & 1LH9 (LAUP.) MAKES 1-LH3



WORK TO BE DONE: Remove tie PL from TH4 (Laupahoehoe) & change b. to b. distance as shown
Cut off 6 7/16" from TH4 (Laupahoehoe) & revamp connection holes at cut end
Add new tie plates.

REVAMP 1-TH4 (LAUPAHOEHOE) MAKES 1-LH3



MAKE 2 BRACES MK DB48E (New Mat'l.)

BILL OF MATERIAL

No.	Description	Length Ft.	Length In.	Mark	Remarks
NOTE: REVAMP THE MATERIAL LISTED BELOW A.S. ON THE DETAILS					
1	HANGAR	11	8 7/8	LH8	LAUPAHOEHOE
1	DO	11	7 3/4	LH10	DO
2	DO	15	2 9/16	TH7	DO
1	DO	10	6	LH7	DO
1	DO	7	8	LH9	DO
1	DO	15	9 5/16	TH7	DO
NEW MATERIAL IS LISTED BELOW:					
4	∠3 1/2×2 1/2×5/16	1	6	a	
29	PL 9×5/16	1	6 3/8	b	
2	BRACE			DB48E	
8	∠3×3×3/8	0	9	c	
4	∠5×3×3/8	23	10	d	

Rivets 3/4" ϕ
Holes 13/16" ϕ
All open holes 13/16" ϕ

TERRITORIAL HIGHWAY DEPARTMENT
TERRITORY OF HAWAII
NANUE BRIDGE
STA. 0+48.83 TO 5+80.16
HAWAII BELT ROAD SDR3(13)

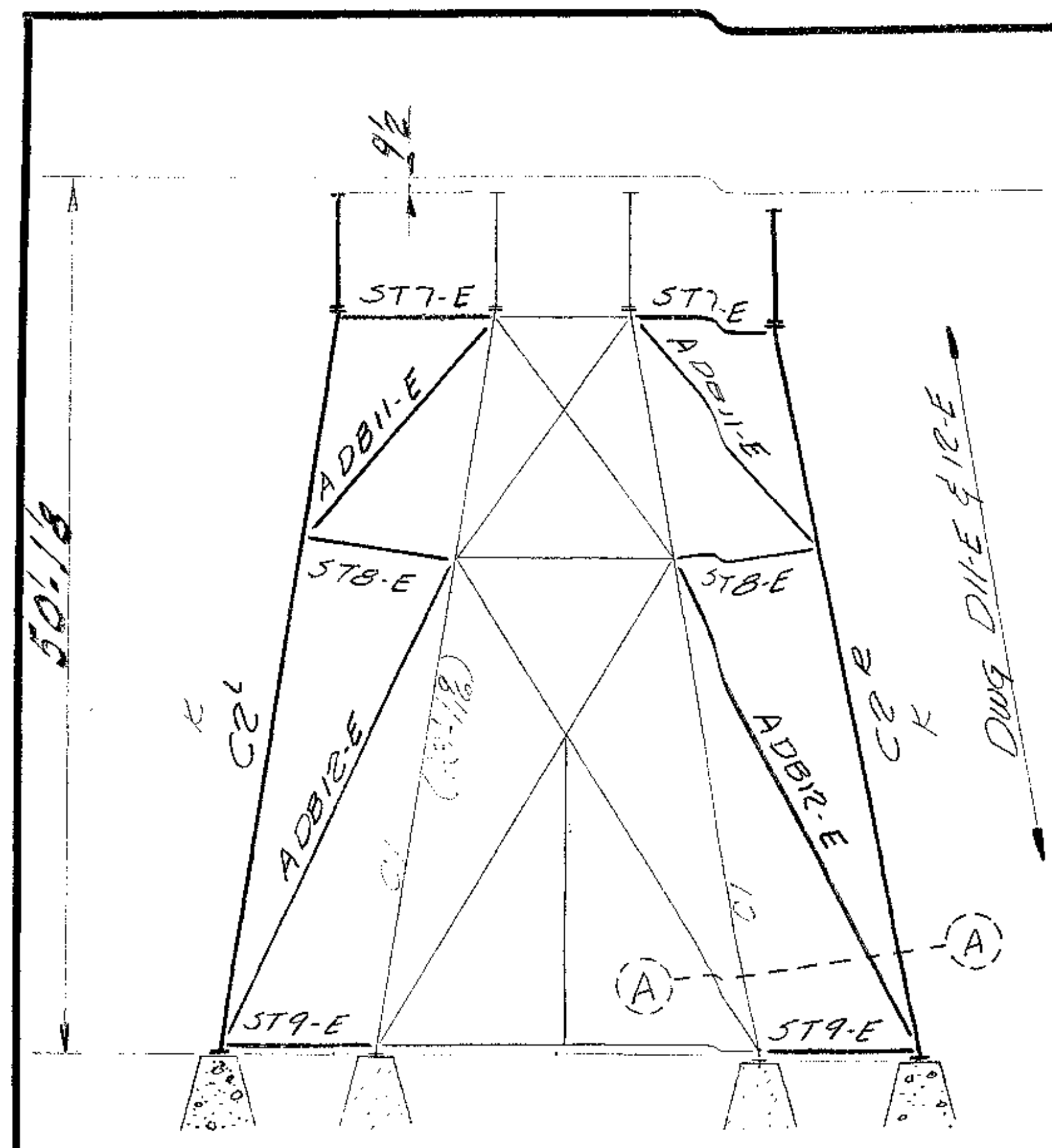
SHEET No. OF SHEETS

5468.75C

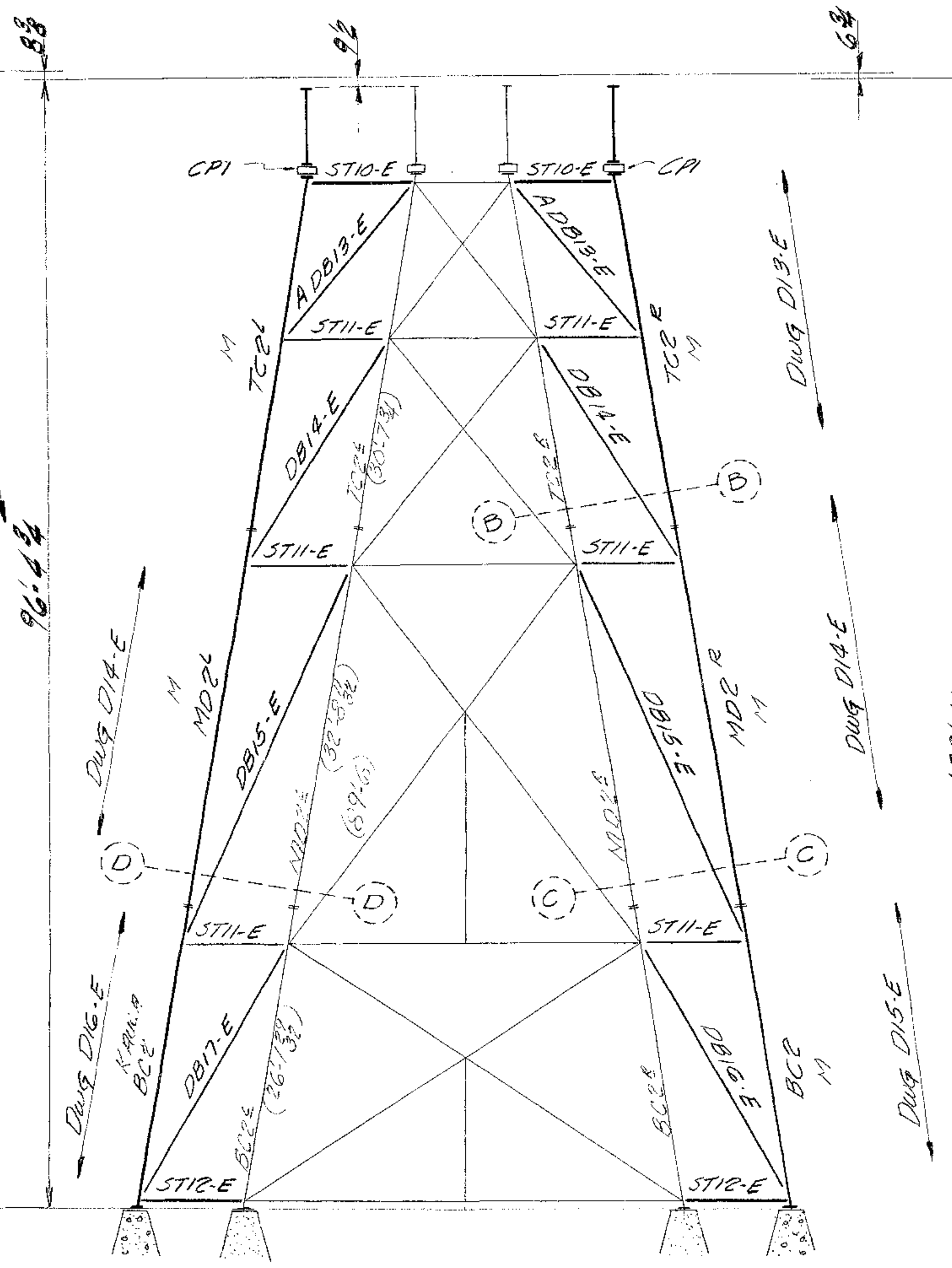
ORIGINAL PLAN
NOTE BOOK No.
SURVEY PLOTTED BY .... DATE ....
DESIGNED BY .... " ....
DRAWN BY .... " ....
TRACED BY .... " ....
QUANTITIES BY .... " ....
QUANTITIES CHECKED BY .... " ....
CHECKED BY ....

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	76	304

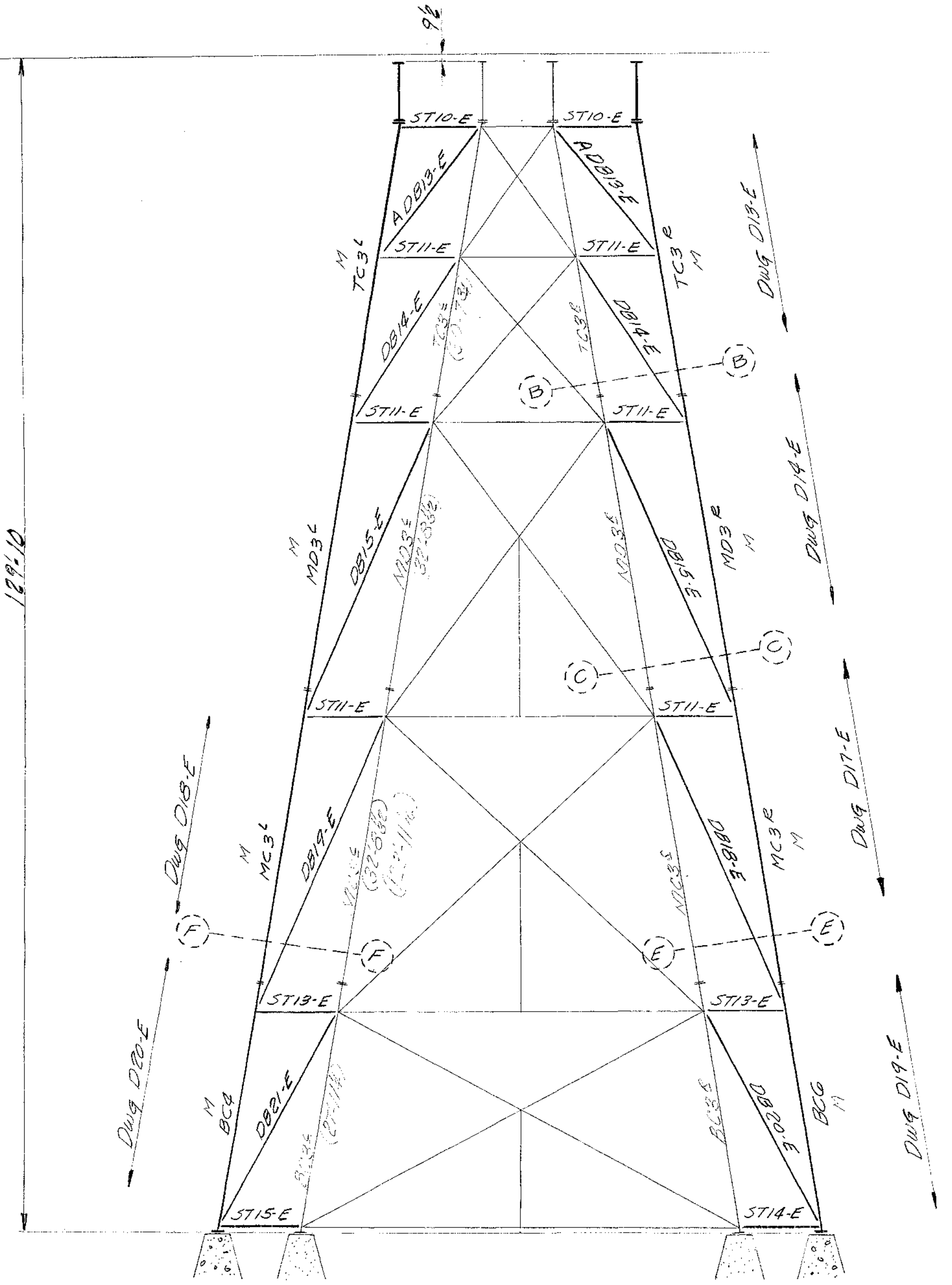
Order No. 3807 **Sheet No.** E2-E



BENT #①
(LOOKING NORTH)



BENT #②
(LOOKING NORTH)



BENT #③
(LOOKING SOUTH)

Rivets: ⅞"φ
Holes: 15/16"φ
Paint:

INDUSTRIAL DEV. CO.

ADDITION TO THE NANUE
BRIDGE - HAWAII -

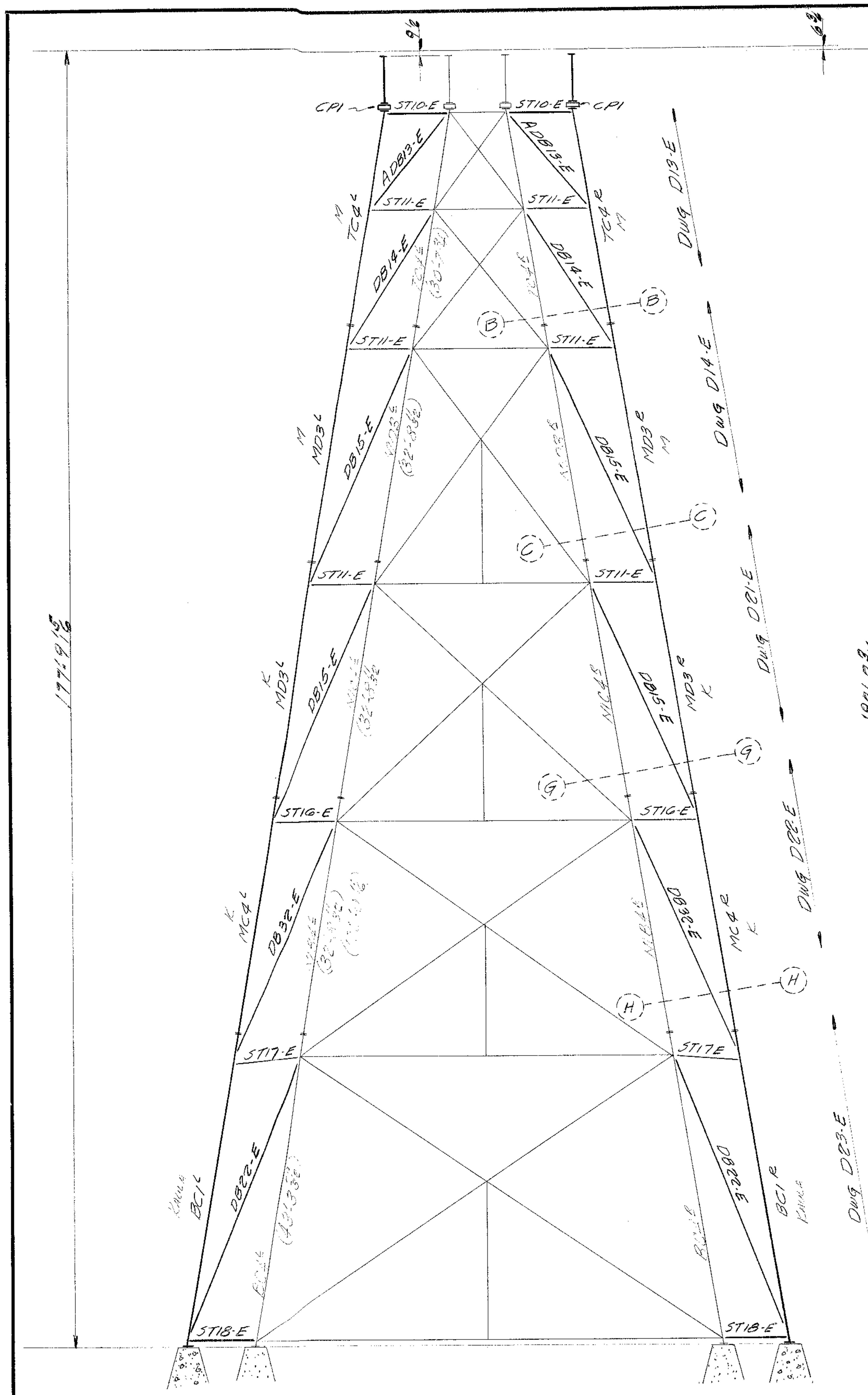
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	SEE DW	11-15-49	ORDER NO.	3807
CHECKED BY	RA	2-20-50	SHEET NO.	E2-E

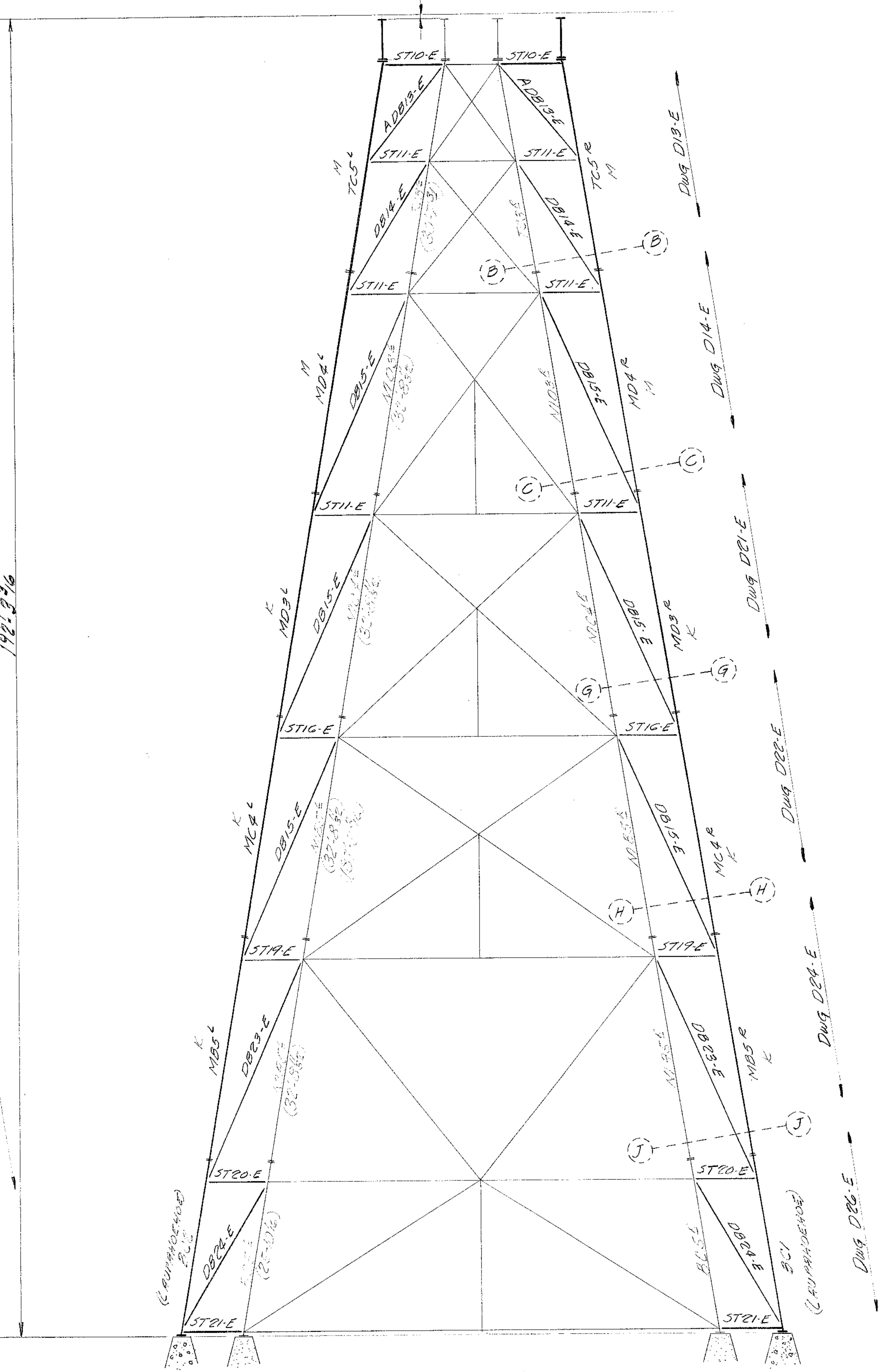
54 GS. 76

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(3)	1950	77	304

Order No. 3807 **Sheet No.** E3-E



BENT #4
(LOOKING NORTH)



BENT # 5
(LOOKING SOUTH)

Rivets: 7/8"φ

Holes: 15/16"φ

Paint:

INDUSTRIAL DEV. CO.

ADDITION TO THE NANUE
BRIDGE - HAWAII -

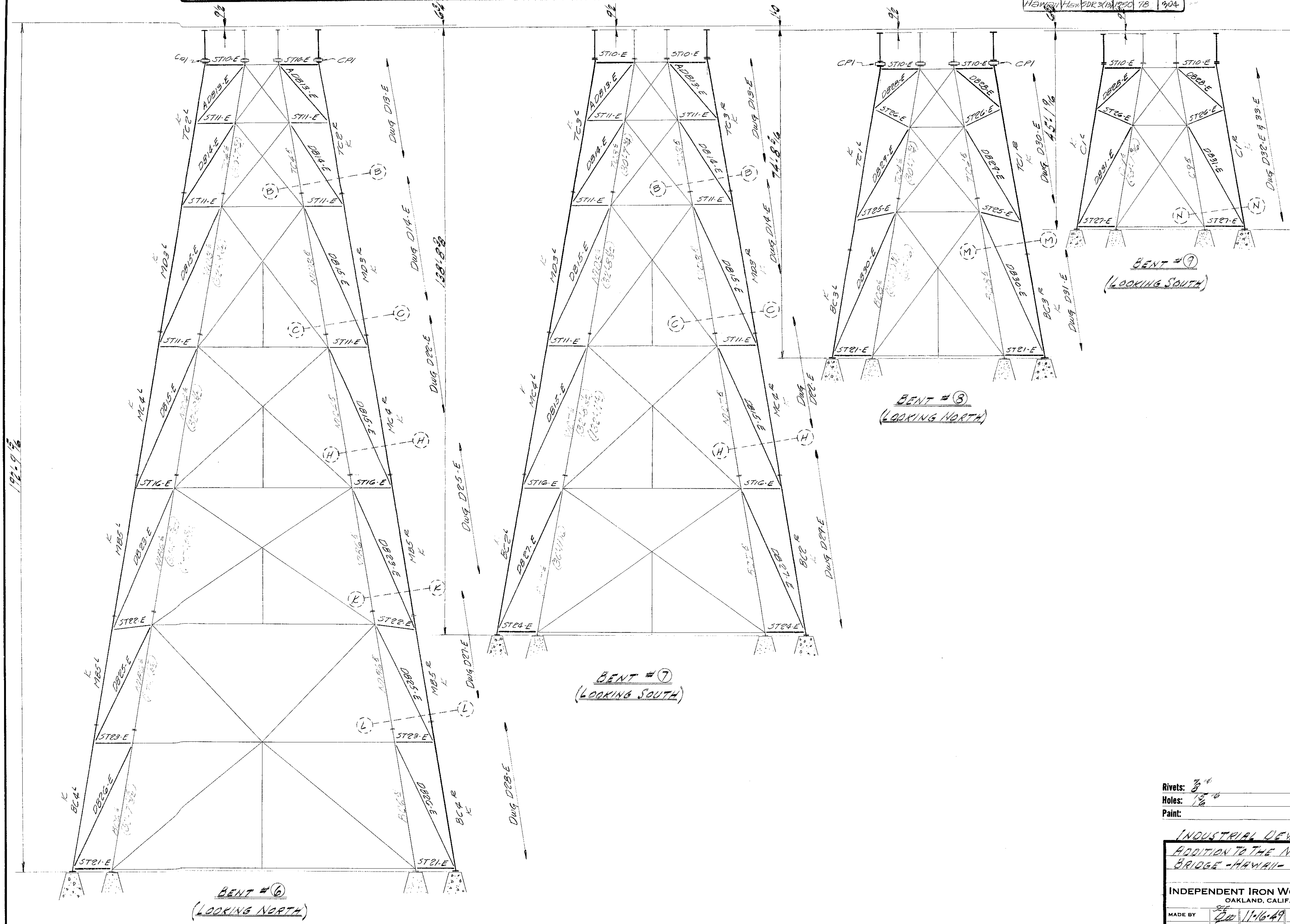
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	SEE DM	11-15-49	ORDER NO.	3807
CHECKED BY	RA	2-20-50	SHEET NO.	E3-E

54GS.77

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR 3(13)	1950	78	304

Order No. 3807 **Sheet No.** E4-E



BENT #6
(LOOKING NORTH)

BENT #7
(LOOKING SOUTH)

BENT #8
(LOOKING NORTH)

BENT #9
(LOOKING SOUTH)

Rivets: 7/8"ɸ

Holes: 15/16"ɸ

Paint:

INDUSTRIAL DEV. CO.

ADDITION TO THE NANUE
BRIDGE -HAWAII-

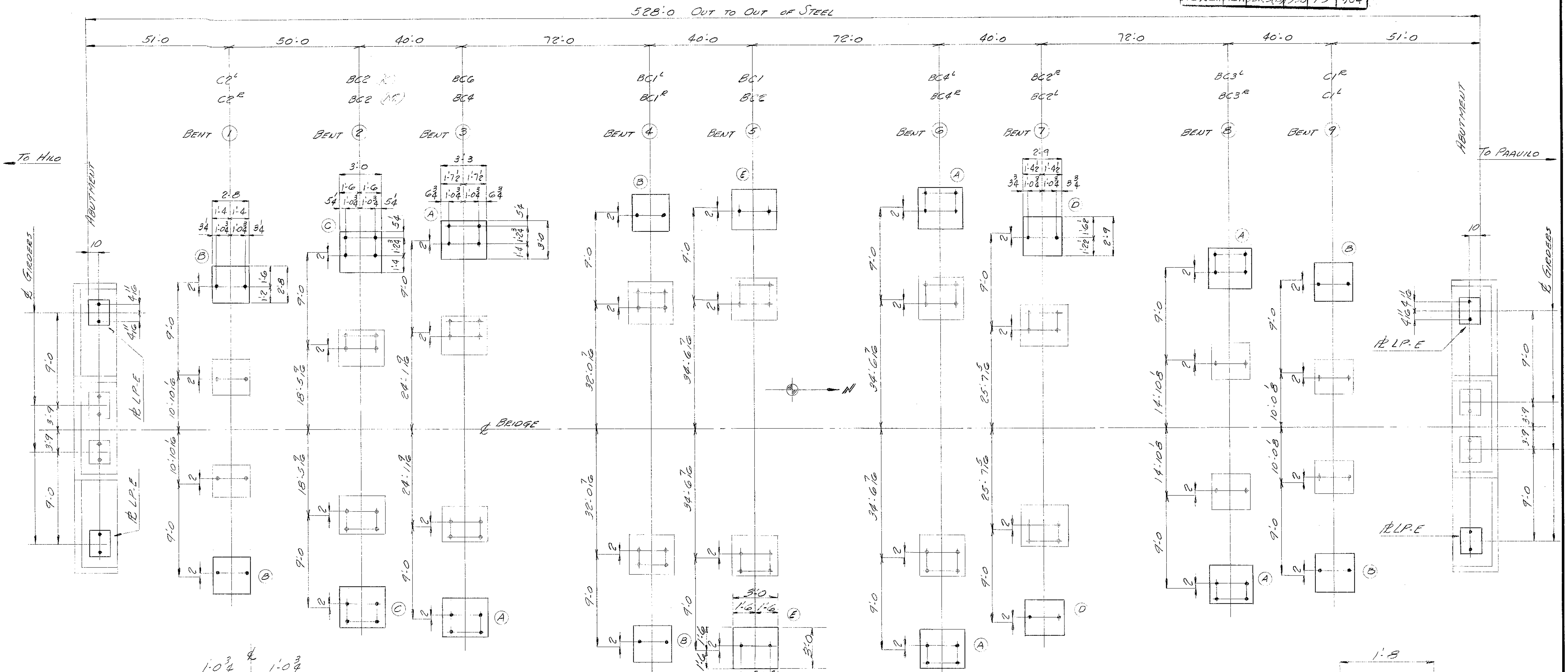
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

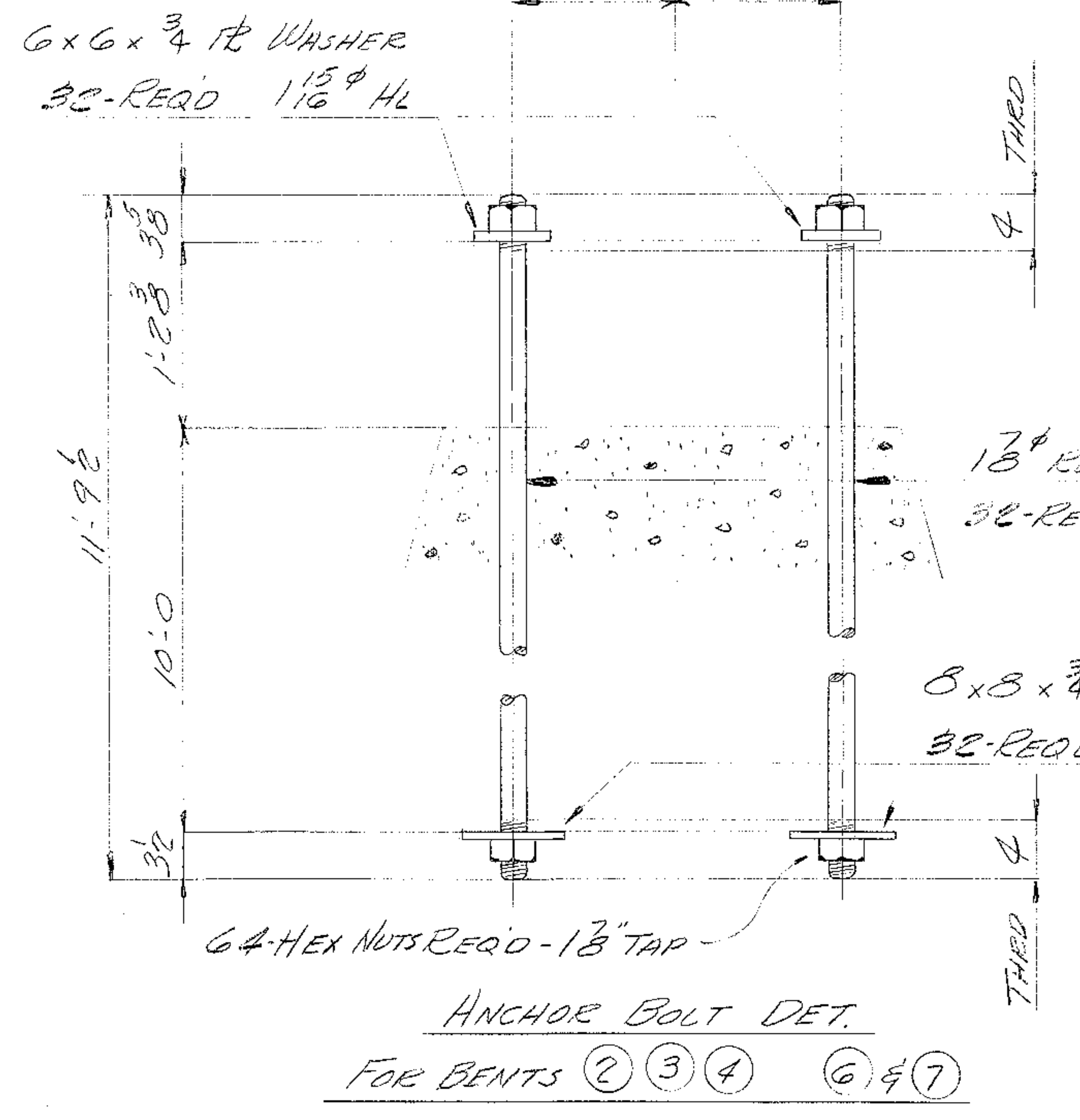
MADE BY	SEE DW	11-16-49	ORDER NO.	3807
CHECKED BY	RA	2-20-50	SHEET NO.	E4-E

5468.78 ZD 73

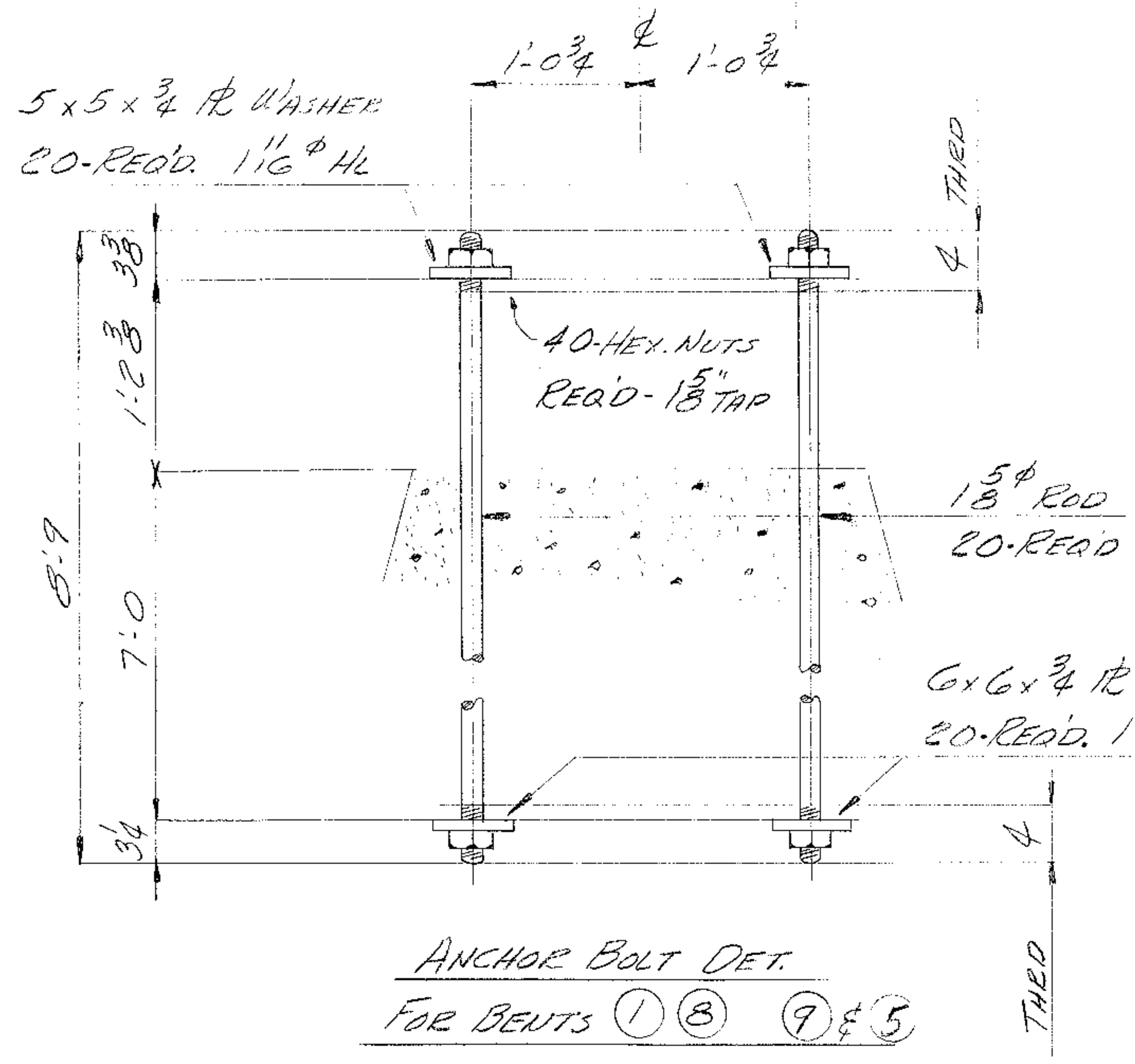
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	79	304

Order No. 3807 Sheet No. ES-E





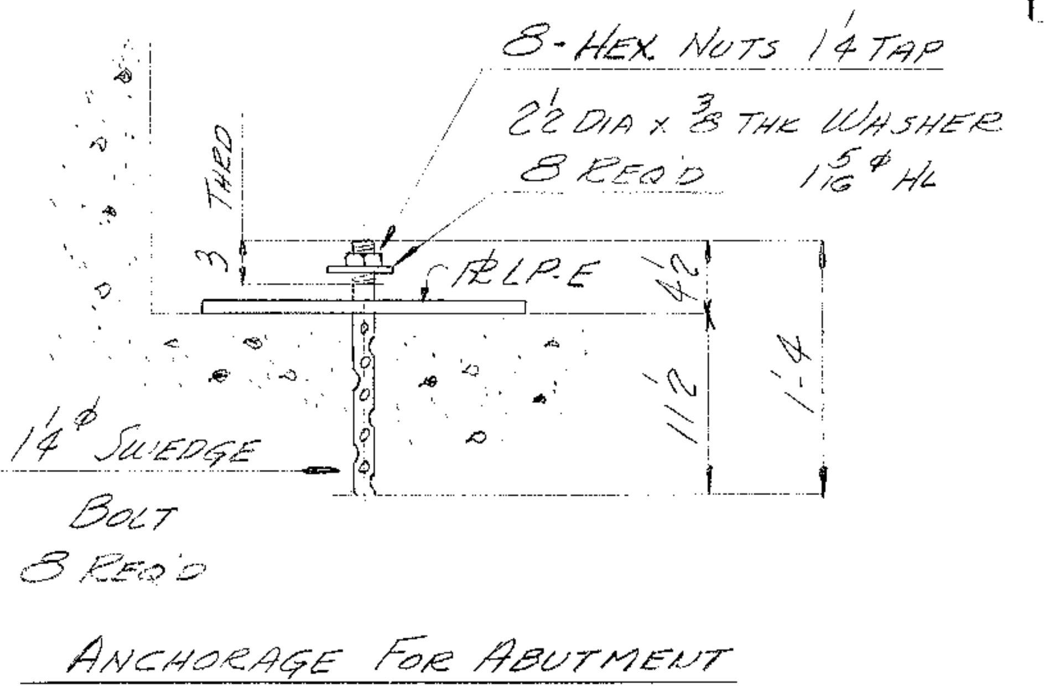
Anchor Bolt Det.
For Bents ② ③ ④ ⑥ & ⑦



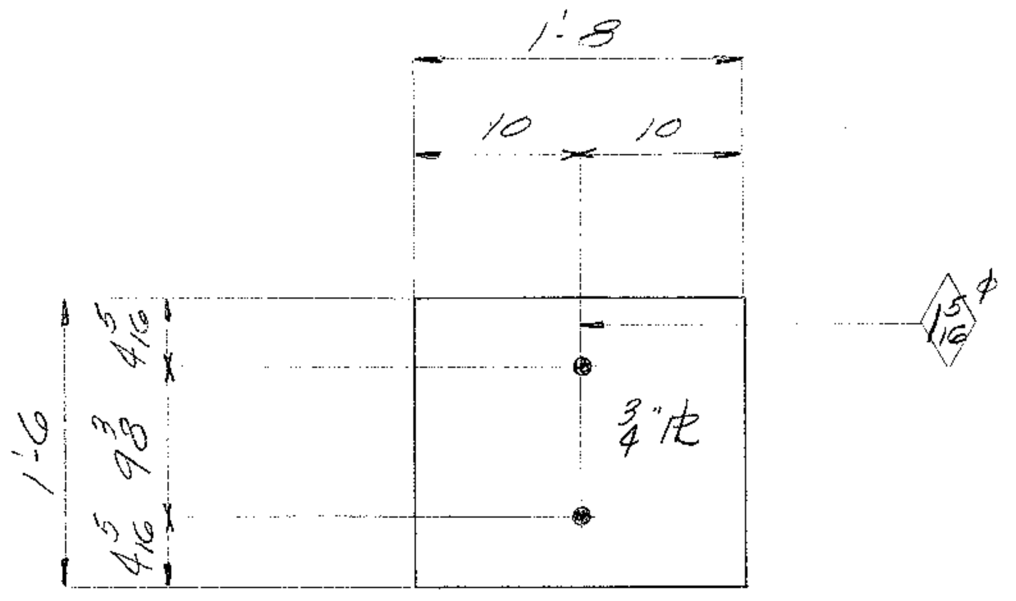
Anchor Bolt Det.
For Bents ① ⑧ ⑨ & ⑤

Note:

Dim's. Given on Plan Are For Col. Base PL's.



Anchorage For Abutment



4-PL's Req'd Mk LP-E

Rivets:
Holes:
Paint:

Industrial Development Co

Addition To Nanue Bridge
Hawaii

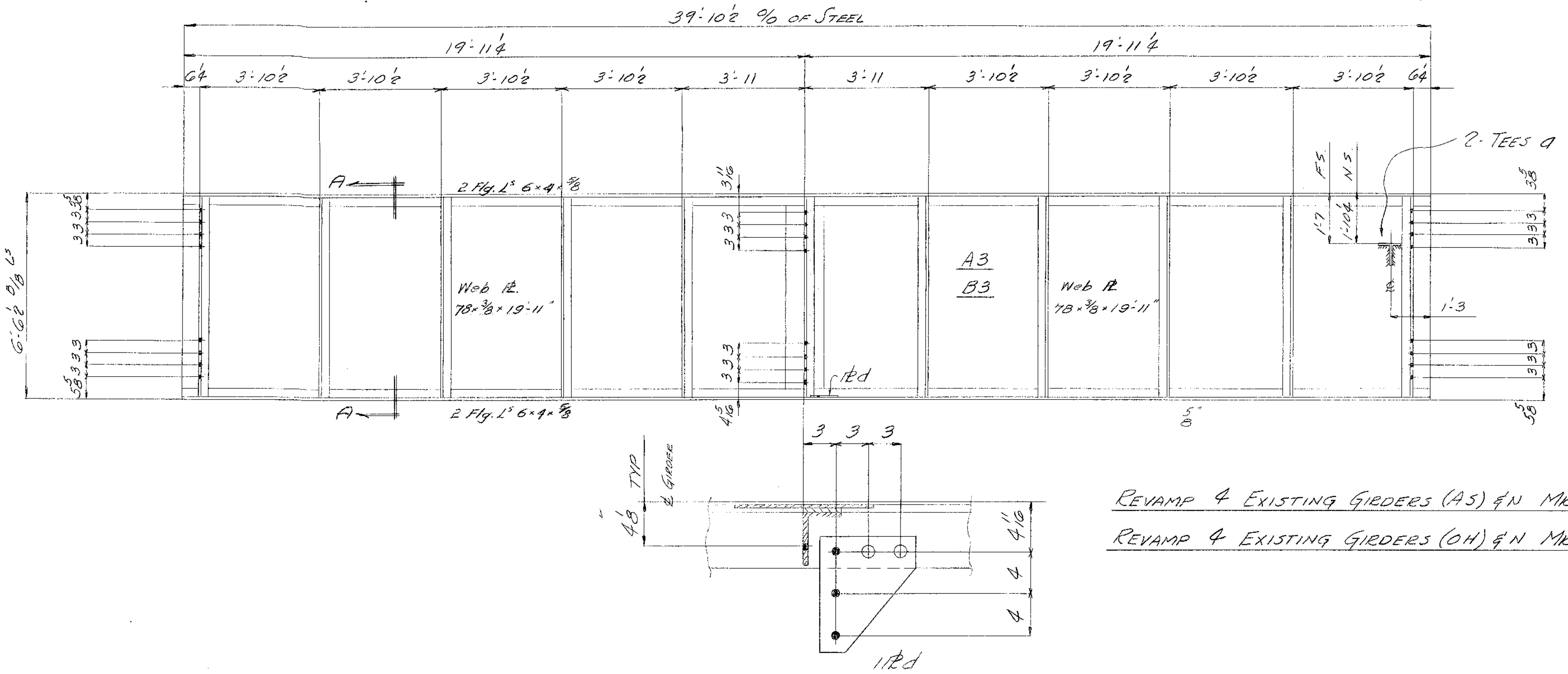
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		1-17-50	ORDER NO.	3807
CHECKED BY	RA	2-20-50	SHEET NO.	ES-E

5468.79

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	80	304

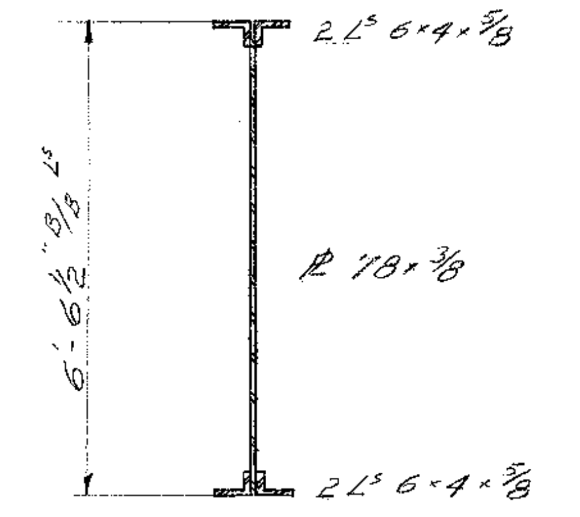
Order No. 3807 **Sheet No.** D1-E



REVAMP 4 EXISTING GIRDERS (AS) & N MK B3

REVAMP 4 EXISTING GIRDERS (OH) & N MK A3

PLAN VIEW OF BOTTOM CHORD

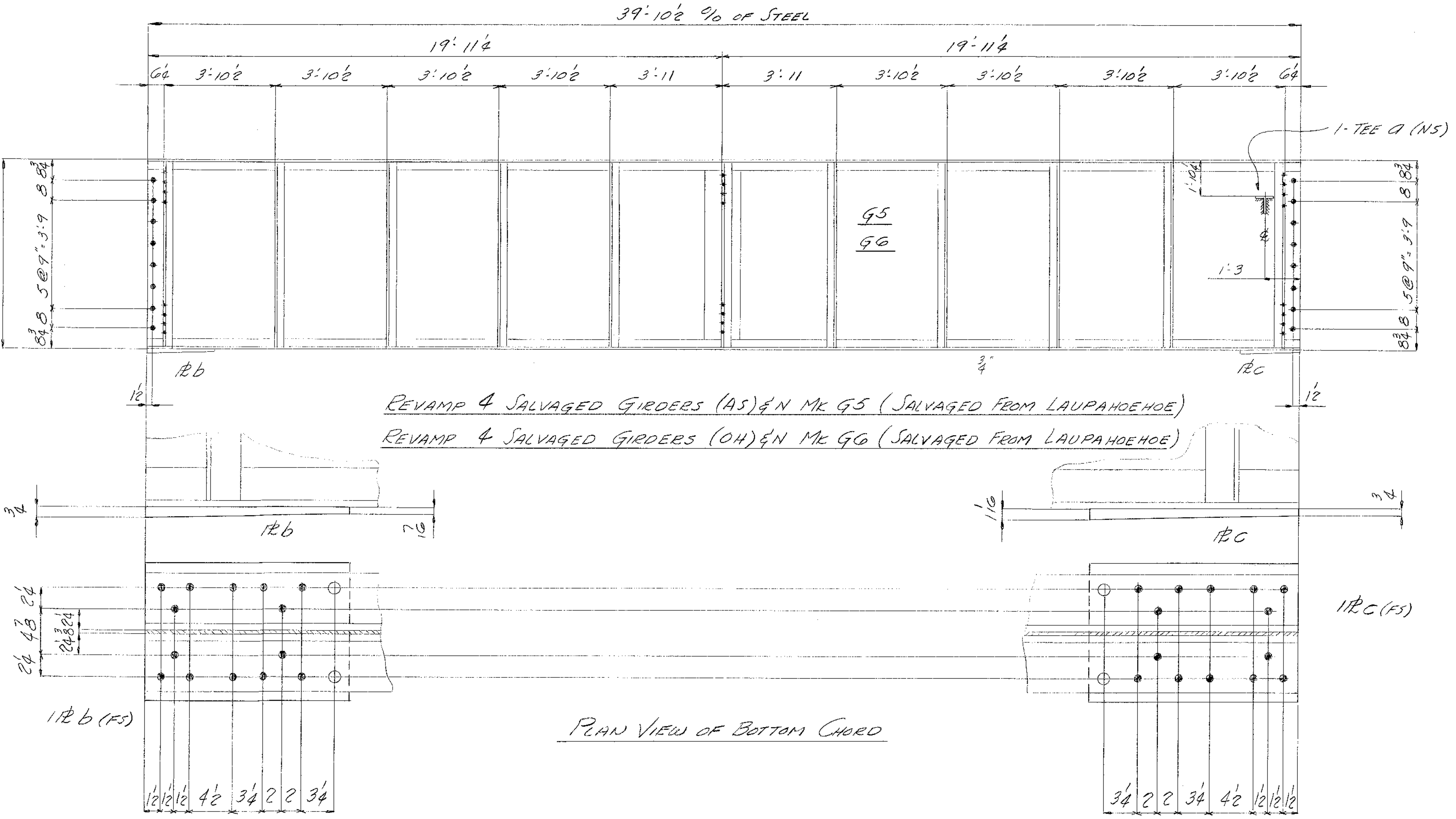


SECTION A-A

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
8	EXIST. GIRDERS			A3 & B3	
	REVAMP A.S. ON DETAIL				
8	SALV. GIRDERS			G5 & G6	
	REVAMP A.S. ON DETAIL				
	SALVAGE FROM LAUPAHOEHOE				
24	S.T. 6WF22.5		6	a	PLAIN
8	Pl 14 × 3/4	1	9	b	BEVEL TEMP
8	Pl 13 × 1 1/16	1	9	c	BEVEL TEMP
8	Pl 9 × 7/16		11	d	TEMP

NEW

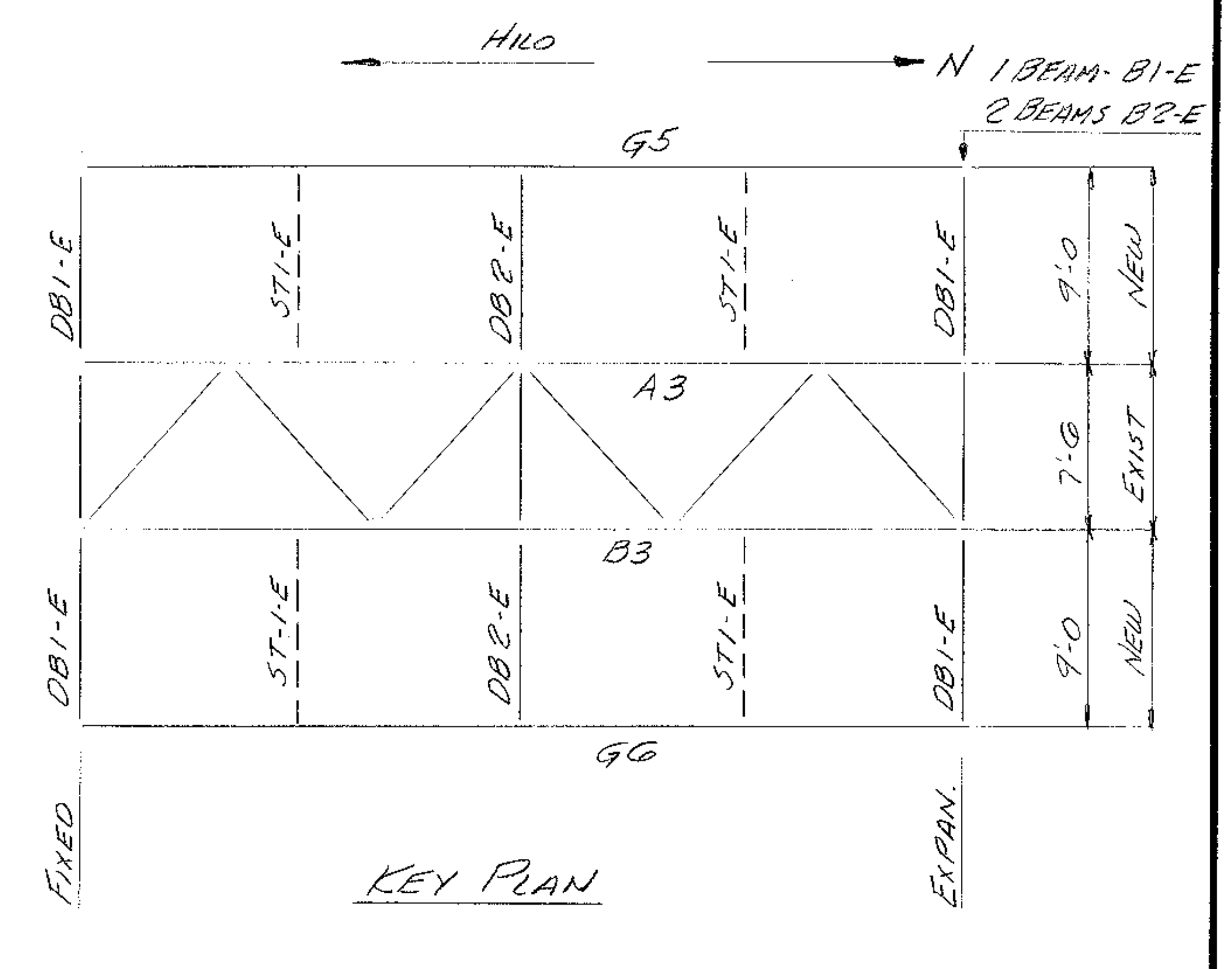
BILL OF MATERIAL INDUSTRIAL DEVELOPMENT COMPANY



REVAMP 4 SALVAGED GIRDERS (AS) & N MK G5 (SALVAGED FROM LAUPAHOEHOE)

REVAMP 4 SALVAGED GIRDERS (OH) & N MK G6 (SALVAGED FROM LAUPAHOEHOE)

PLAN VIEW OF BOTTOM CHORD



KEY PLAN

Rivets: 7/8 ϕ

Holes: 15/16 ϕ

Paint:

INDUSTRIAL DEVELOPMENT CO

ADDITION TO NANUE BRIDGE

HAWAII

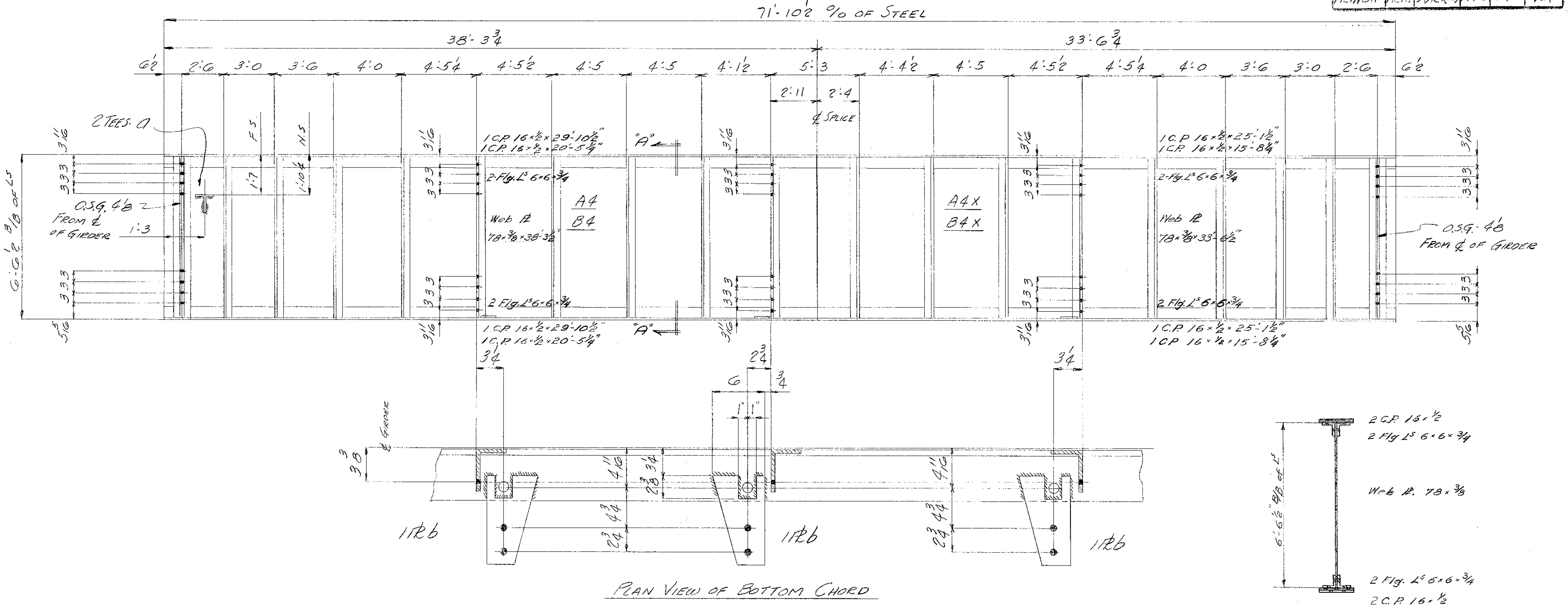
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		11-23-49	ORDER NO.	3807
CHECKED BY	Om	1-23-50	SHEET NO.	D1-E

5468.80 72

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDK 2(13)	1950	81	304

Order No. 3807 **Sheet No.** 02·E



PLAN VIEW OF BOTTOM CHORD

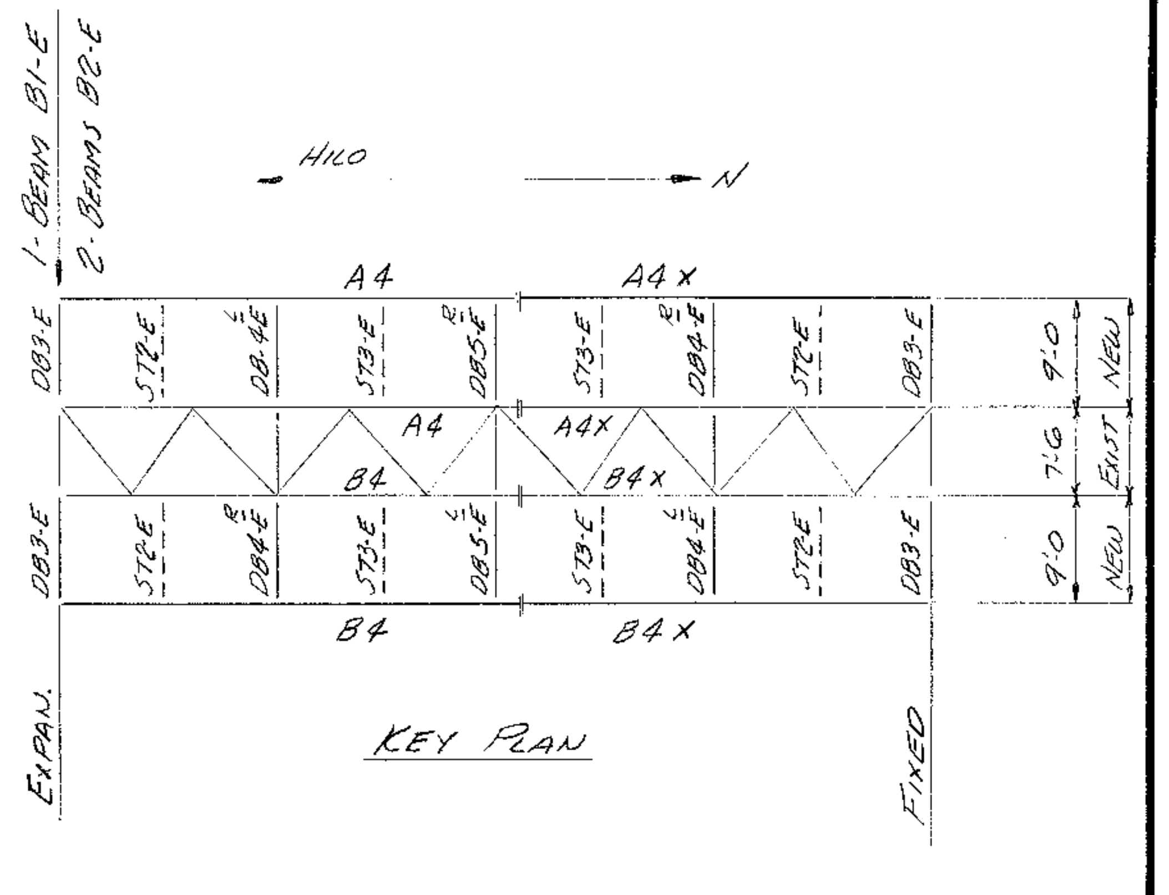
SECTION A-A

REVAMP 6 EXISTING GIRDERS (AS) & N MK B4 & B4X

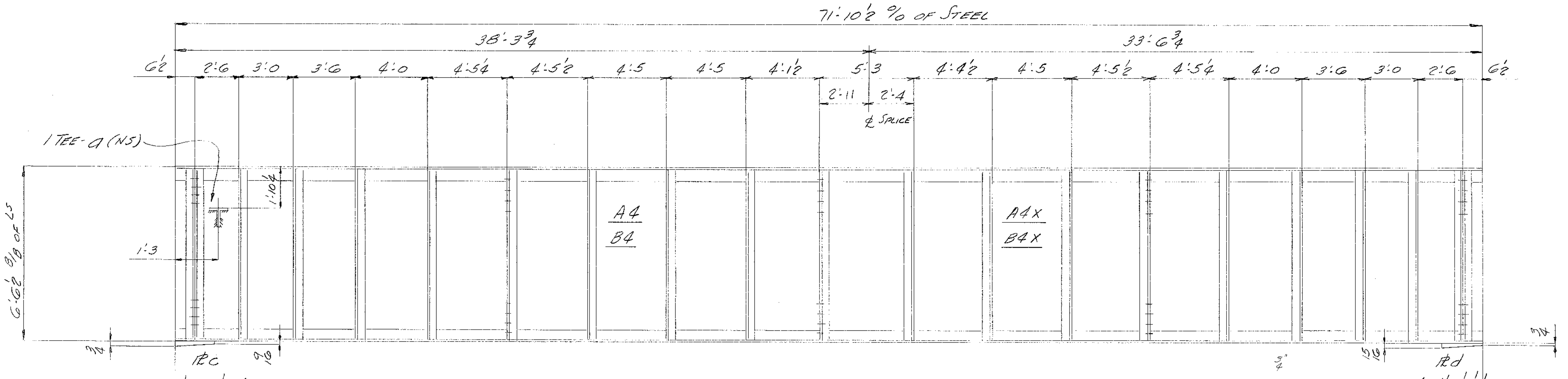
REVAMP 6 EXISTING GIRDERS (OH) & N MK A4 & A4X

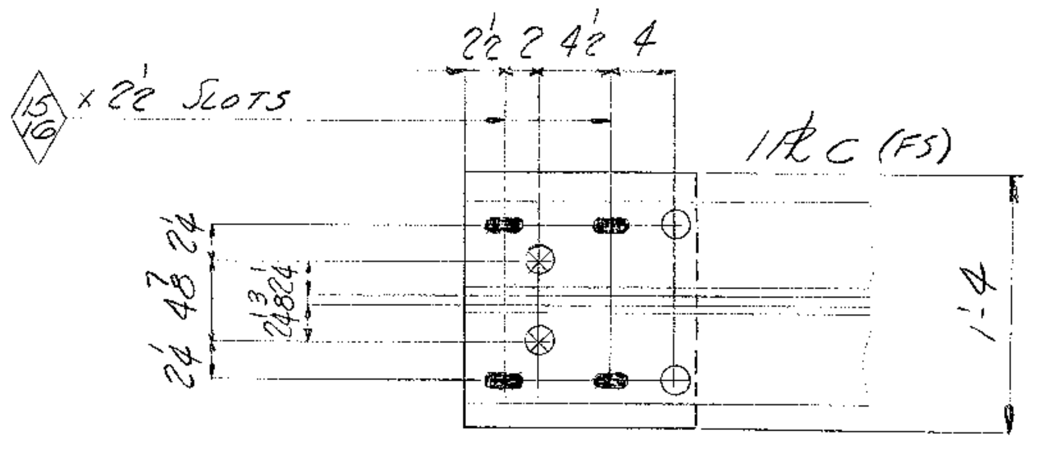
No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
6	EXIST. GIRDERS	B4 & B4X			
	REVAMP A.S. ON DET.				
6	EXIST. GIRDERS	A4 & A4X			
	REVAMP A.S. ON DET.				
2	SALV. GIRDER	A4 & A4X			
	REVAMP A.S. ON DET				
	SALVAGE FROM ~~MAILE~~ KAULA				
2	SALV GIRDER	B4 & B4X			
	REVAMP A.S. ON DET				
	SALVAGE FROM ~~MAILE~~ KAULA				
14	S.T. 6WF 22.5		6	a	PLAIN
18	PL 6×⁵⁄₁₆		10½	b	TEMP
2	PL 14½×¾	1	4	c	BEVEL TEMP
2	PL 14×¹⁵⁄₁₆	1	2½	d	BEVEL TEMP

NEW



KEY PLAN

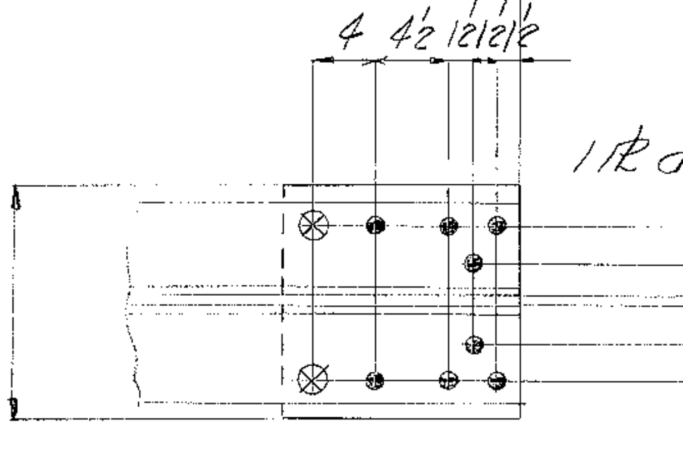




PLAN VIEW OF BOTT CHORD

REVAMP 2 SALVAGED GIRDERS (AS) & N MK A4 & A4X (SALVAGED FROM ~~MAILE~~ KAULA)

REVAMP 2 SALVAGED GIRDERS (OH) & N MK B4 & B4X (SALVAGED FROM ~~MAILE~~ KAULA)



PLAN VIEW OF BOTT CHORD

Rivets: ⅞ ϕ

Holes: ¹⁵⁄₁₆ ϕ U.N

Paint:

INDUSTRIAL DEVELOPMENT CO

ADDITION TO NANUE BRIDGE
HAWAII

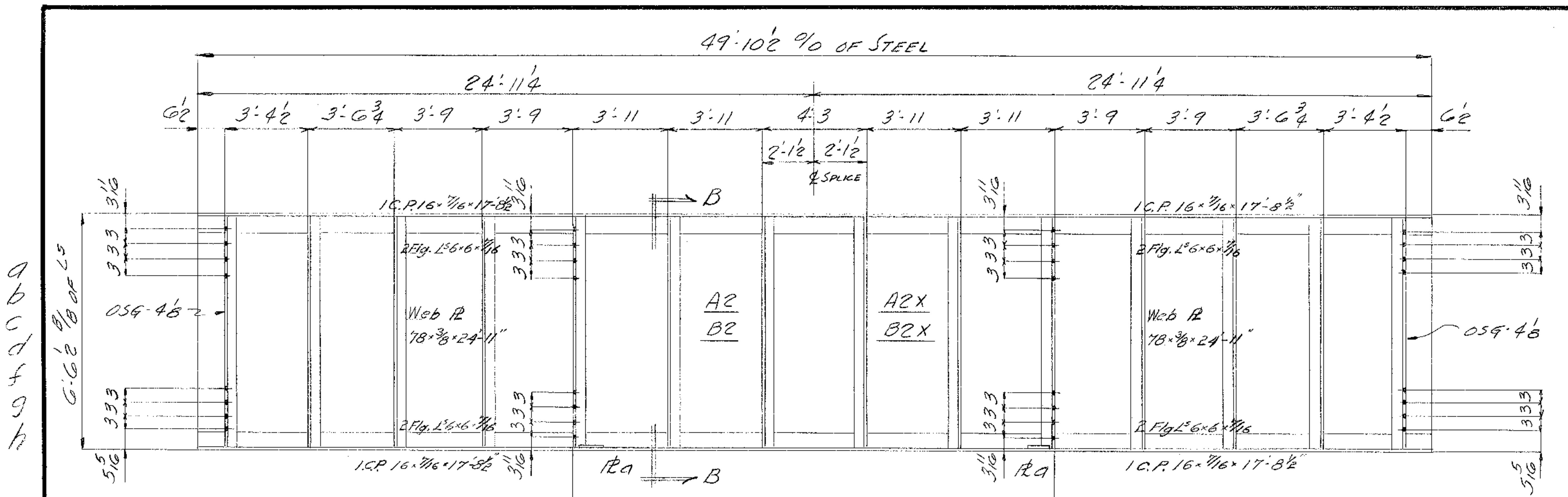
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

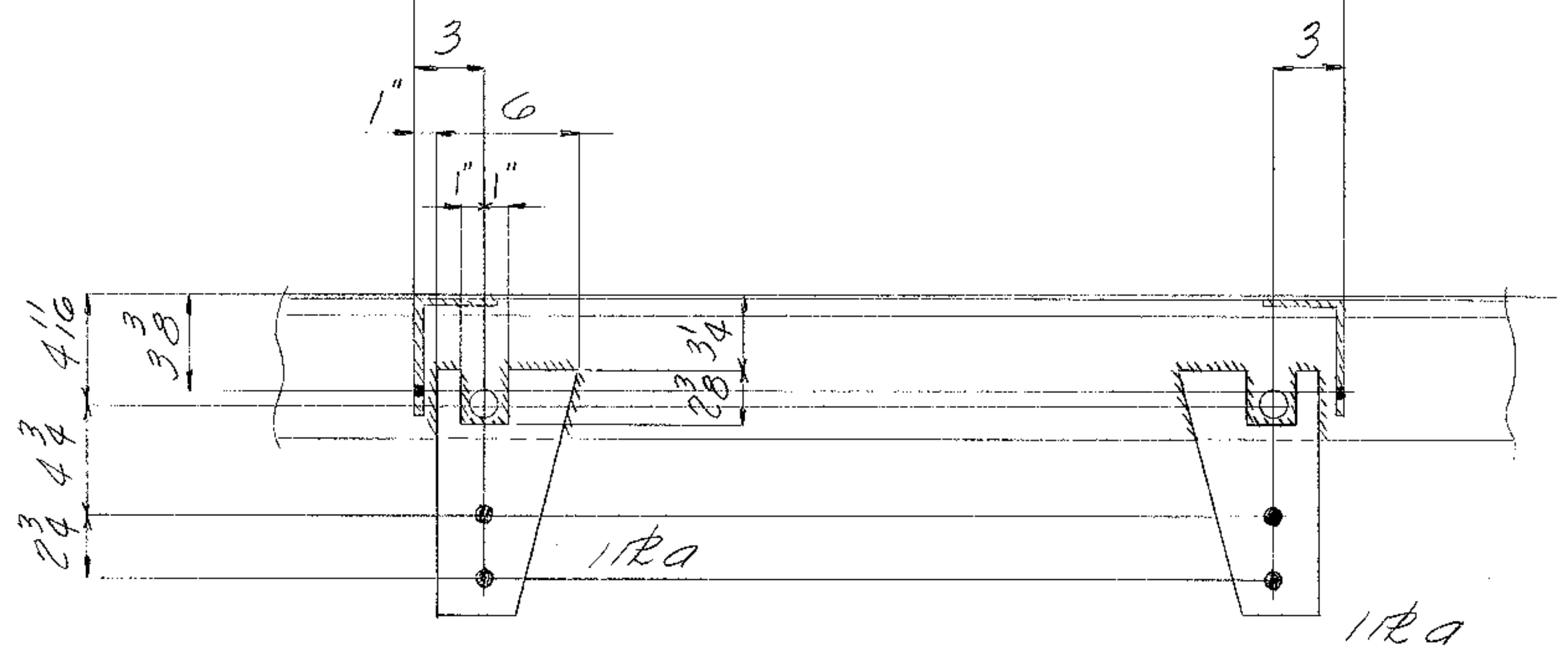
MADE BY		11-25-49	ORDER NO.	3807
CHECKED BY	DW	1-24-50	SHEET NO.	02·E

5468.81

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	9DR 3(3)	1950	82	304

Order No. 3807 **Sheet No.** 03-E

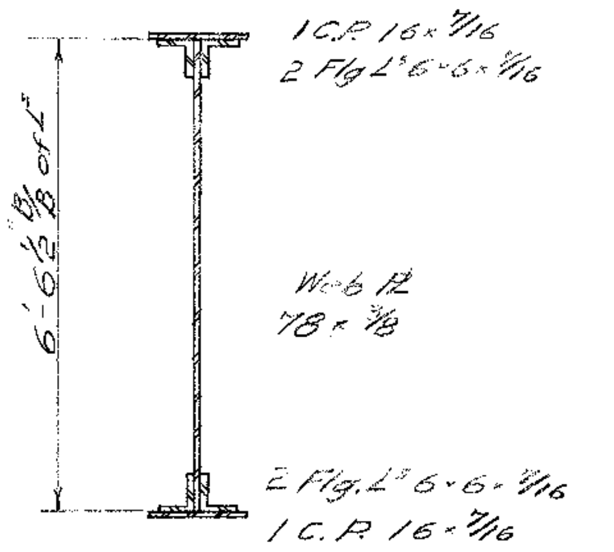




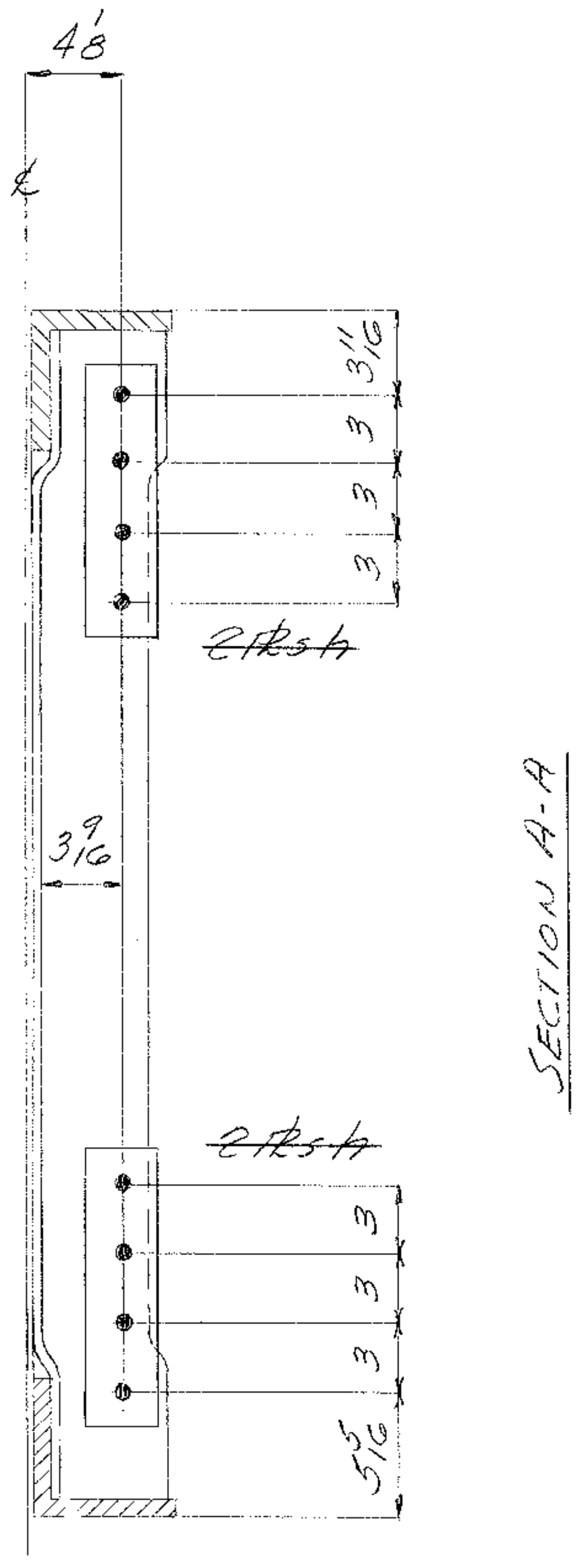
PLAN VIEW OF BOTTOM CHORD

REVAMP 2 EXISTING GIRDERS (AS) & N MK B2 & B2X

REVAMP 2 EXISTING GIRDERS (OH) & N MK A2 & A2X



SECTION B-B

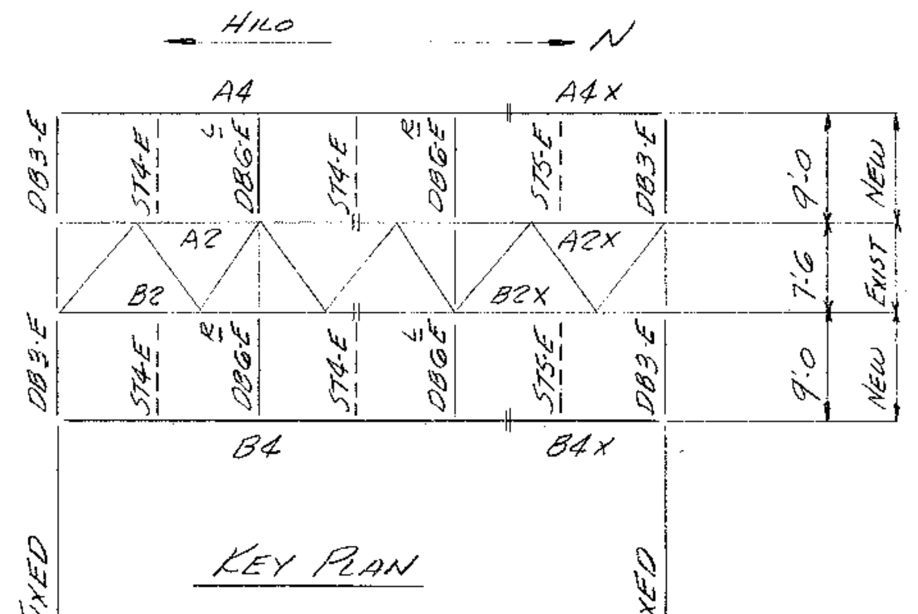


SECTION A-A

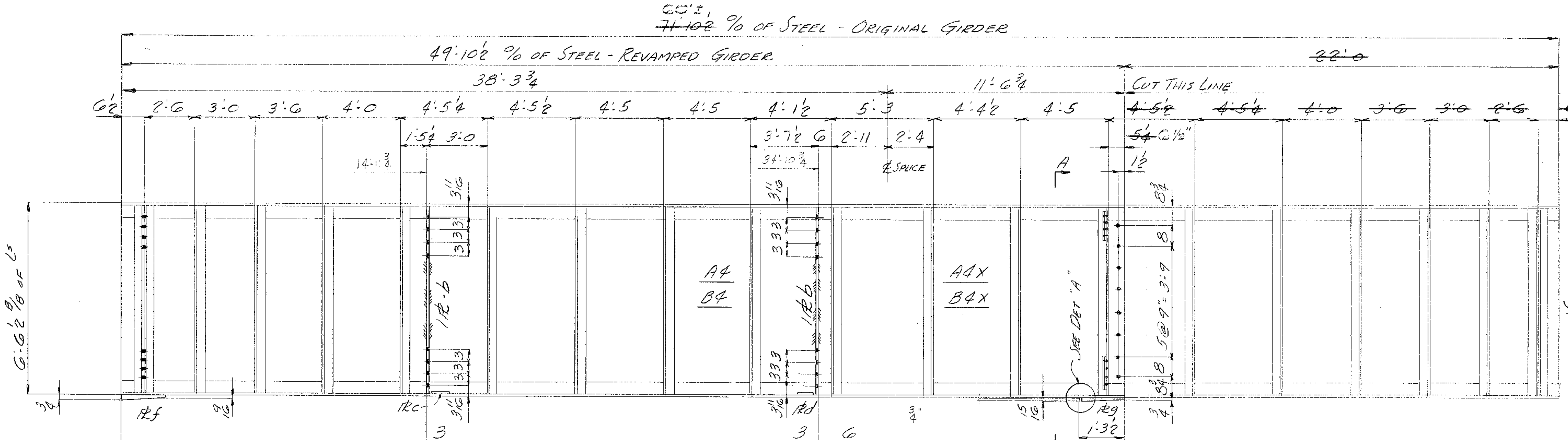
No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
2	EXIST. GIRDER		A2	& A2X	
	REVAMP A.S. ON DET				
2	EXIST. GIRDER		B2	& B2X	
	REVAMP A.S. ON DET				
2	SALV. GIRDER		A4	& A4X	
	REVAMP A.S. ON DET.				
	SALVAGE FROM ~~KEALAHAKA~~ MAILE				
2	SALV GIRDER		B4	& B4X	
	REVAMP A.S. ON DET				
	SALVAGE FROM ~~KEALAHAKA~~ MAILE				
4	PL 6 × 5/8		10½	a	TEMP
4	PL 5½ × 3/8	6	4¾	b	FITTED
2	PL 4 × 5/16		10½	c	TEMP
2	PL 5 × 5/16		10	d	TEMP
2	PL 14½ × 3/4	1	4	f	BEVEL TEMP
2	PL 14 × 15/16	1	2½	g	BEVEL TEMP
8	PL 3 × 5/8	1	0	h	TEMP

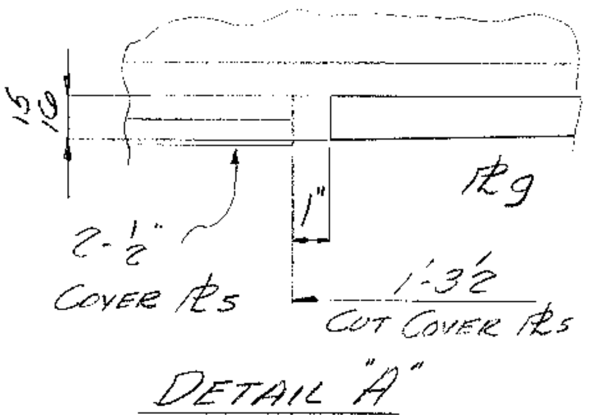
NEW

BILL OF MATERIAL — INDUSTRIAL DEVELOPMENT COMPANY

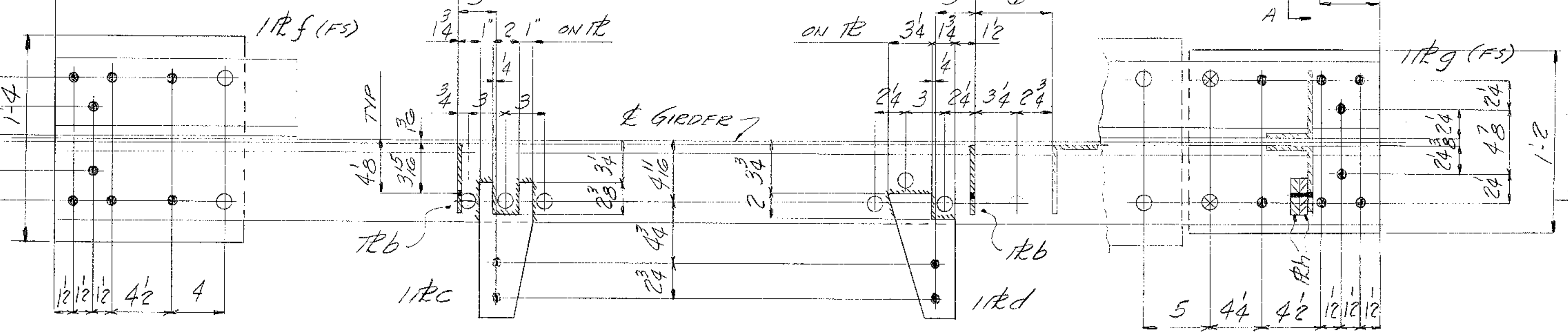


KEY PLAN





DETAIL "A"



PLAN VIEW OF BOTTOM CHORD

REVAMP 2 SALVAGED GIRDERS (A.S) & N MK A4 & A4X

(SALVAGE FROM ~~KEALAHAKA~~ MAILE)

REVAMP 2 SALVAGED GIRDERS (OH) & N MK B4 & B4X

(SALVAGE FROM ~~KEALAHAKA~~ MAILE)

Rivets: 7/8

Holes: 15/16

Paint:

INDUSTRIAL DEVELOPMENT CO

ADDITION TO NANUE BRIDGE

HAWAII

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

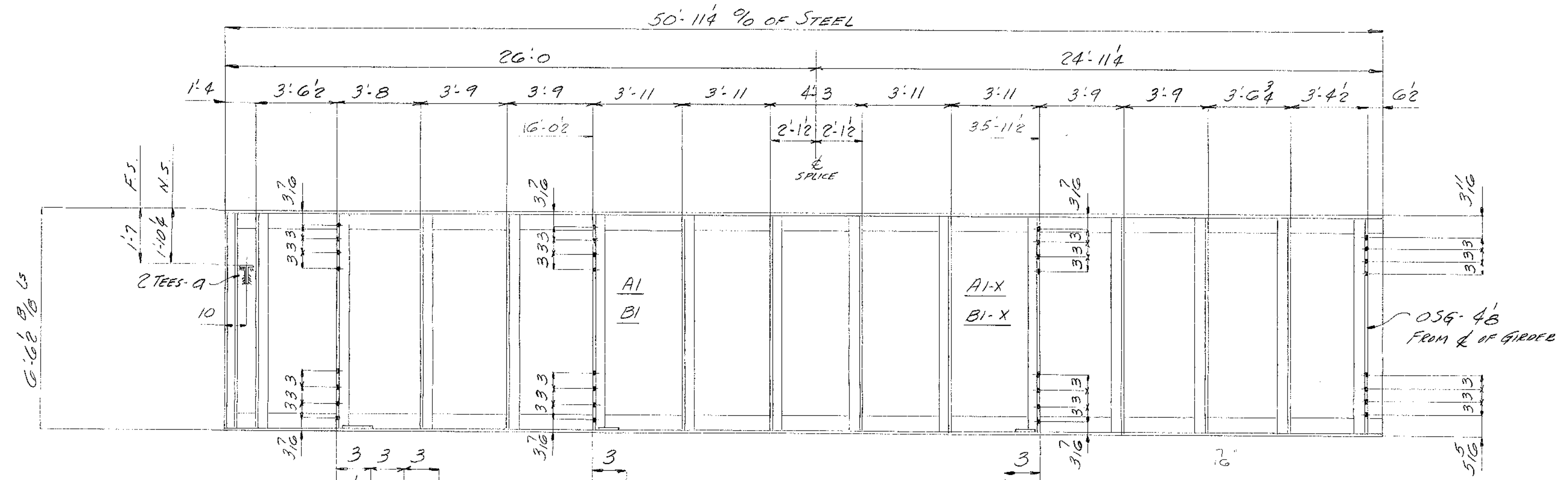
MADE BY	[illegible]	11-28-49	ORDER NO.	3807
CHECKED BY	OM	1-24-50	SHEET NO.	03-E

5468.82

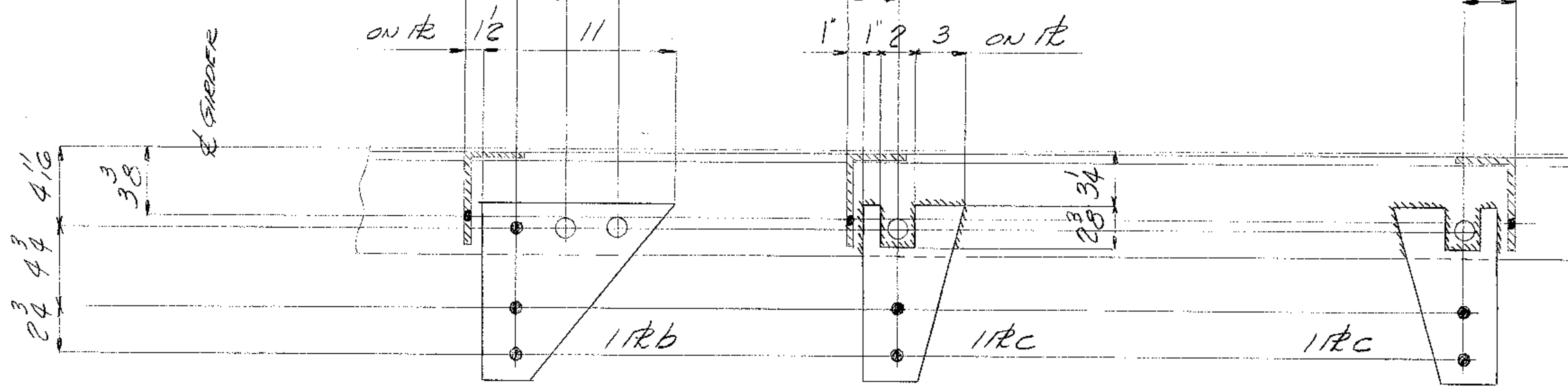
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR-2(3)	1950	83	304

Order No. 3807 **Sheet No.** 04-E

a
b
c
d
f
g
h
k
m
p
s
t



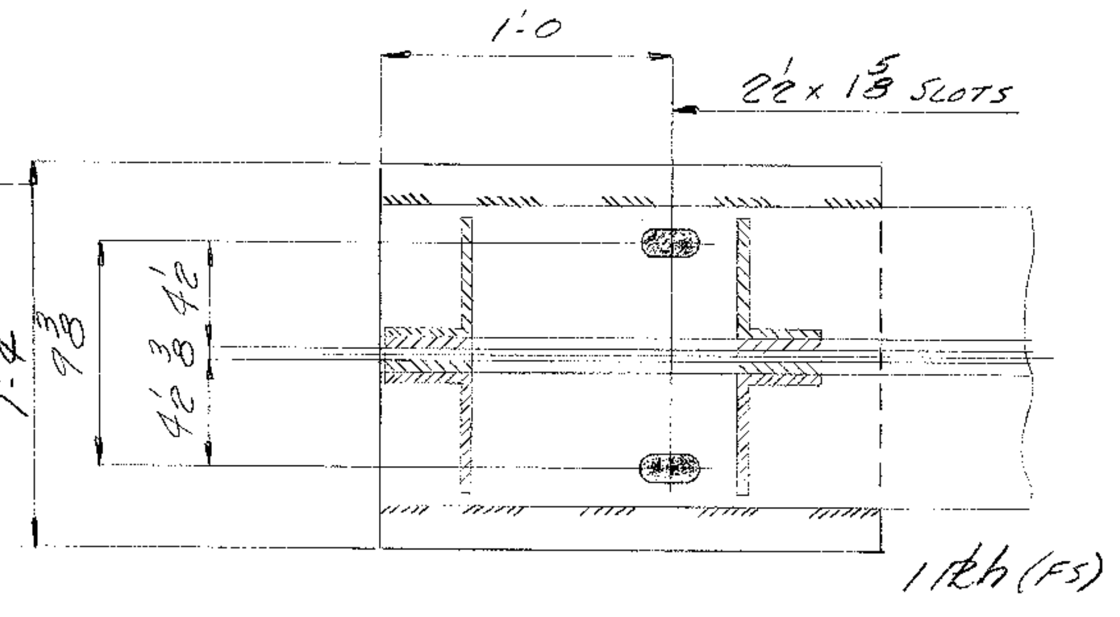
Note: section thru girder same as for 49'-10½" girder, section B-B Sht. D3-E.



PLAN VIEW OF BOTTOM CHORD

REVAMP 2 EXISTING GIRDERS(AS)&N MK B1 & B1X

REVAMP 2 EXISTING GIRDERS(OH)&N MK A1 & A1X

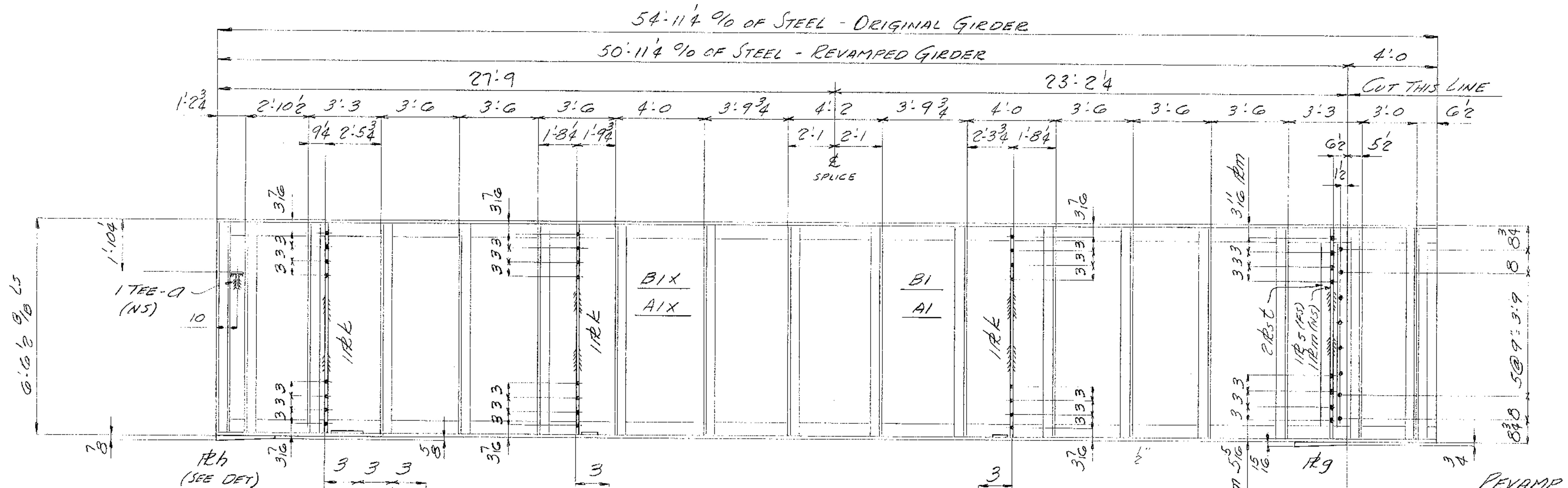


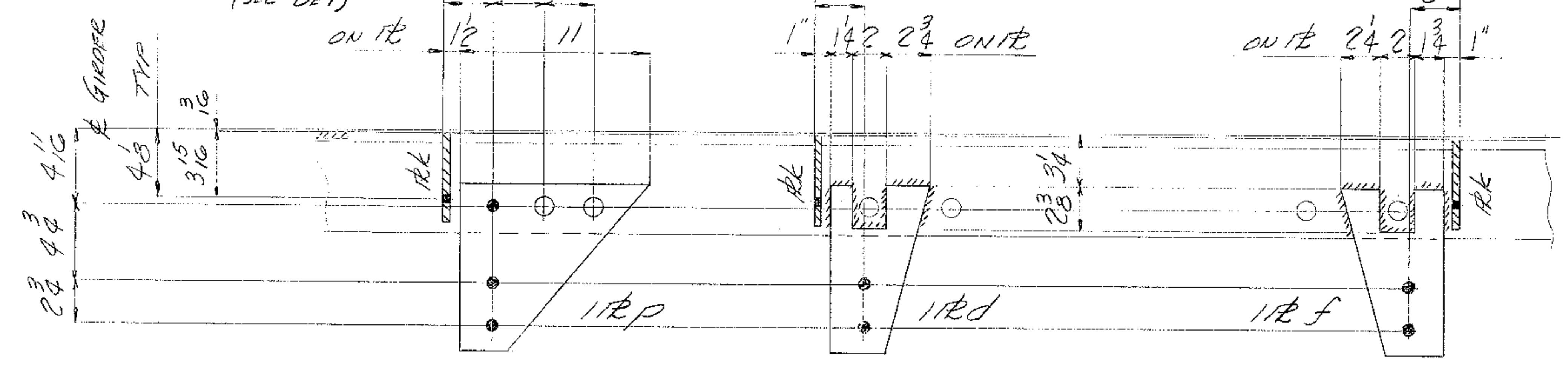
DETAIL OF PL h

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
2	EXIST. GIRDER			A1 & A1X	
	REVAMP AS ON DET.				
2	EXIST. GIRDER			B1 & B1X	
	REVAMP A.S. ON DET				
2	SALV. GIRDER			A1 & A1X	
	REVAMP A.S. ON DET				
	SALVAGE FROM KAULA				
2	SALV. GIRDER			B1 & B1X	
	REVAMP A.S. ON DET				
	SALVAGE FROM KAULA				
6	ST 6WF 22.5		6	a	PLAIN
2	PL 10½ x ⅜		11	b	TEMP
4	PL 6 x ⅜		10½	c	TEMP
2	PL 6 x 5/16		10½	d	TEMP
2	PL 6 x 5/16		10½	f	TEMP
2	PL 13 x 15/16	1	2½	g	BEVEL TEMP
2	PL 16 x ⅞	1	8¾	h	BEVEL TEMP
6	PL 5½ x ⅜	6	5¼	k	
2	PL 5½ x ⅜	6	5¼	m	
2	PL 10½ x 5/16		11	p	TEMP
2	PL 5½ x ⅜	6	5¼	s	
4	PL 4 x ½	5	6¼	t	PLAIN

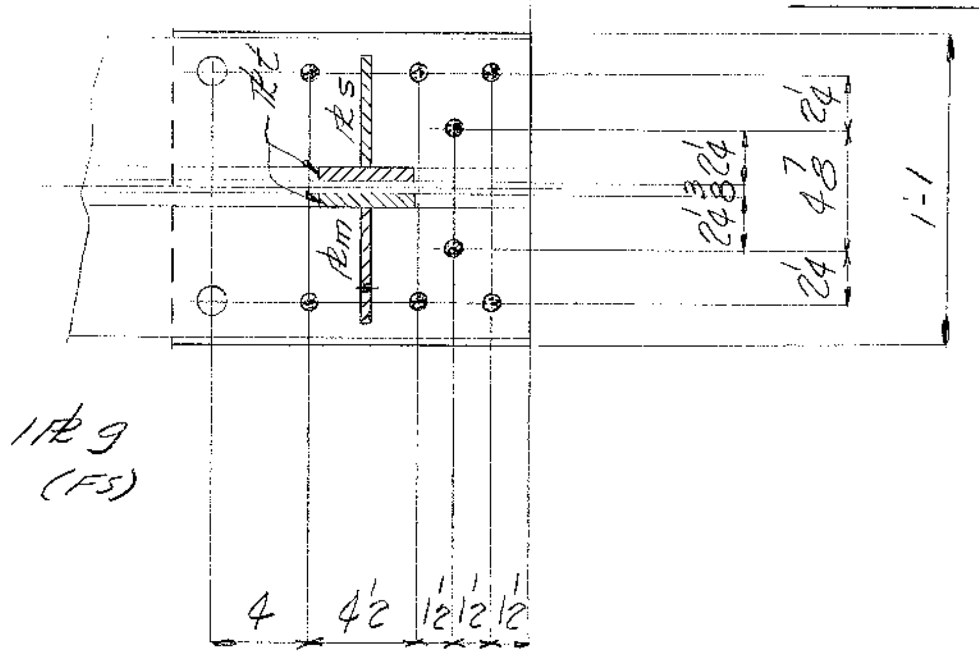
NEW

BILL OF MATERIAL INDUSTRIAL DEVELOPMENT COMPANY





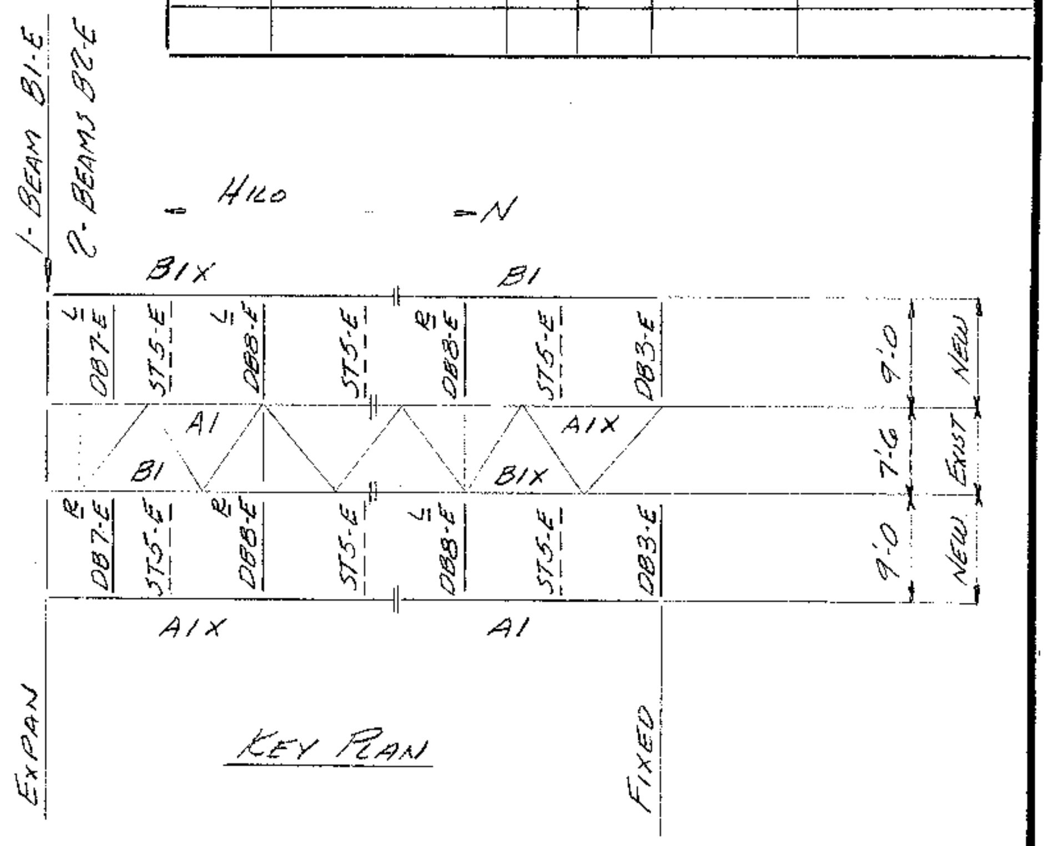
PLAN VIEW OF BOTTOM CHORD



1 PL g (FS)

REVAMP 2 SALVAGED GIRDERS(AS)&N) MK B1X & B1 (SALVAGE FROM KAULA)

REVAMP 2 SALVAGED GIRDERS(OH)&N MK A1X & A1 (SALVAGE FROM KAULA)



KEY PLAN

Rivets: ⅞ ϕ

Holes: 15/16 ϕ U.N.

Paint:

INDUSTRIAL DEVELOPMENT CO

ADDITION TO NANUE BRIDGE
HAWAII

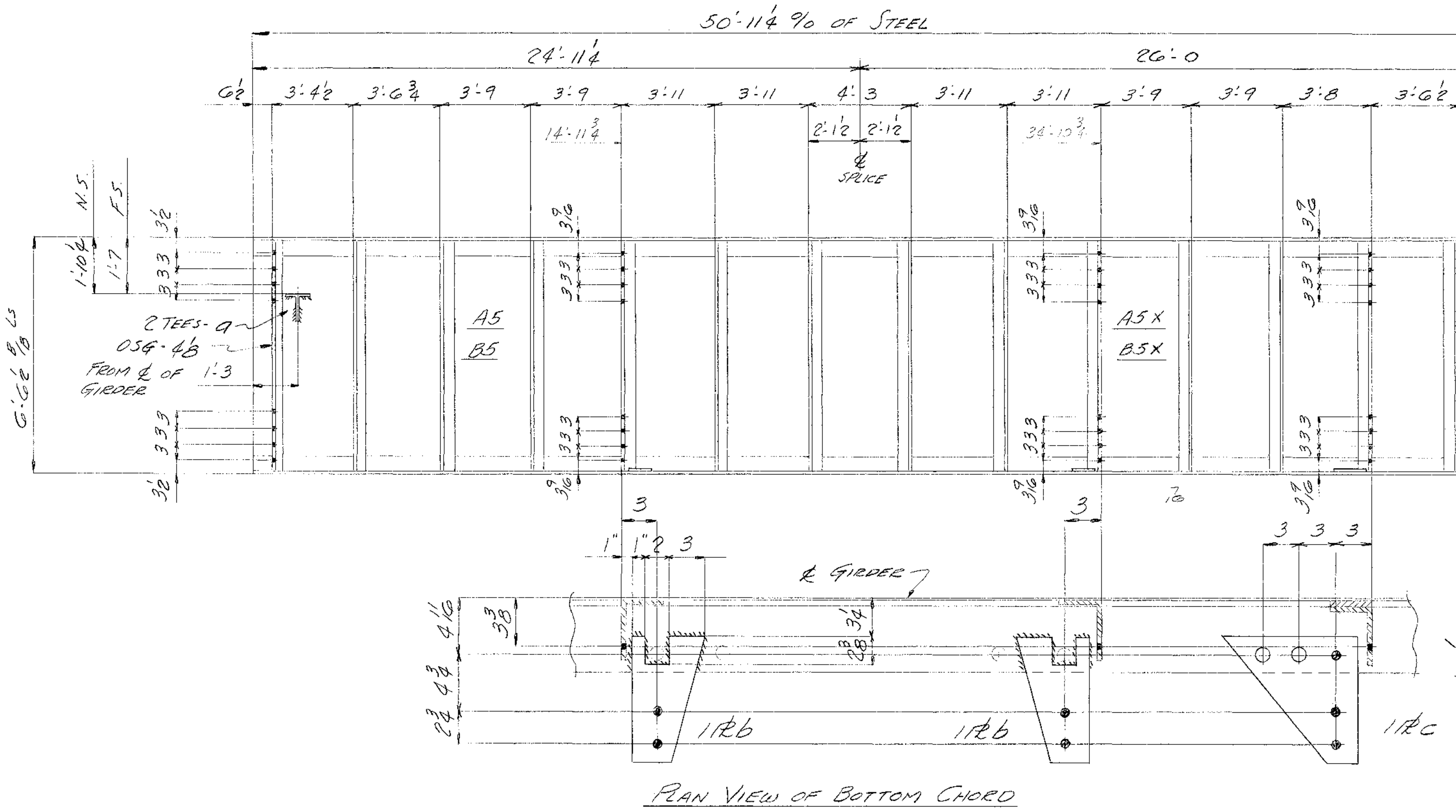
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		11-30-49	ORDER NO.	3807
CHECKED BY	DM	1-24-50	SHEET NO.	04-E

5468.83

Order No. 3807 **Sheet No.** D5-E

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDK3(13)	1950	84	404

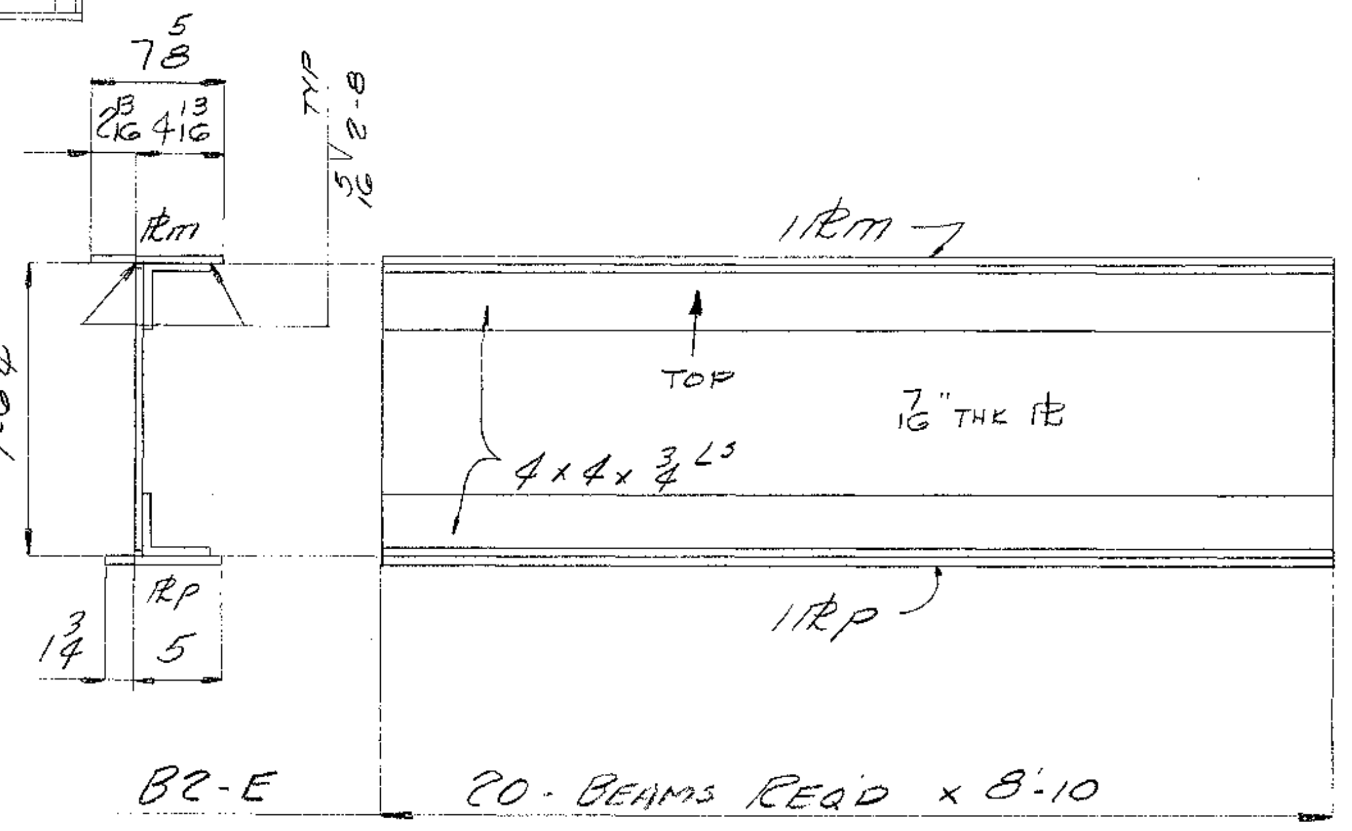


Plan View of Bottom Chord

Revamp 2 Existing Girders(AS) & N Mk B5 & B5X

Revamp 2 Existing Girders(OH) & N Mk A5 & A5X

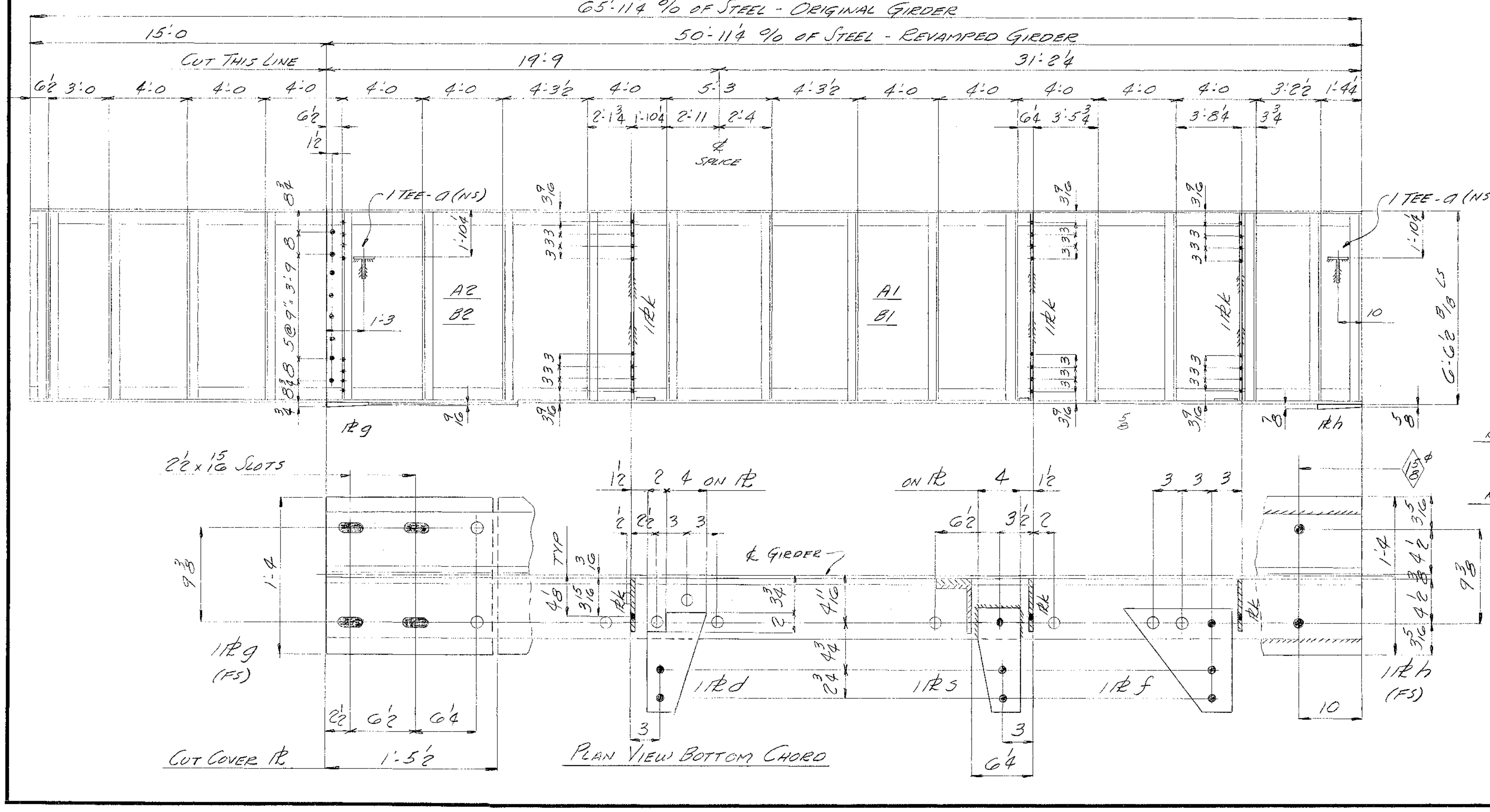
Note: Section thru girder same as for 49'-10½" girder, section B-B Sht. D3-E.



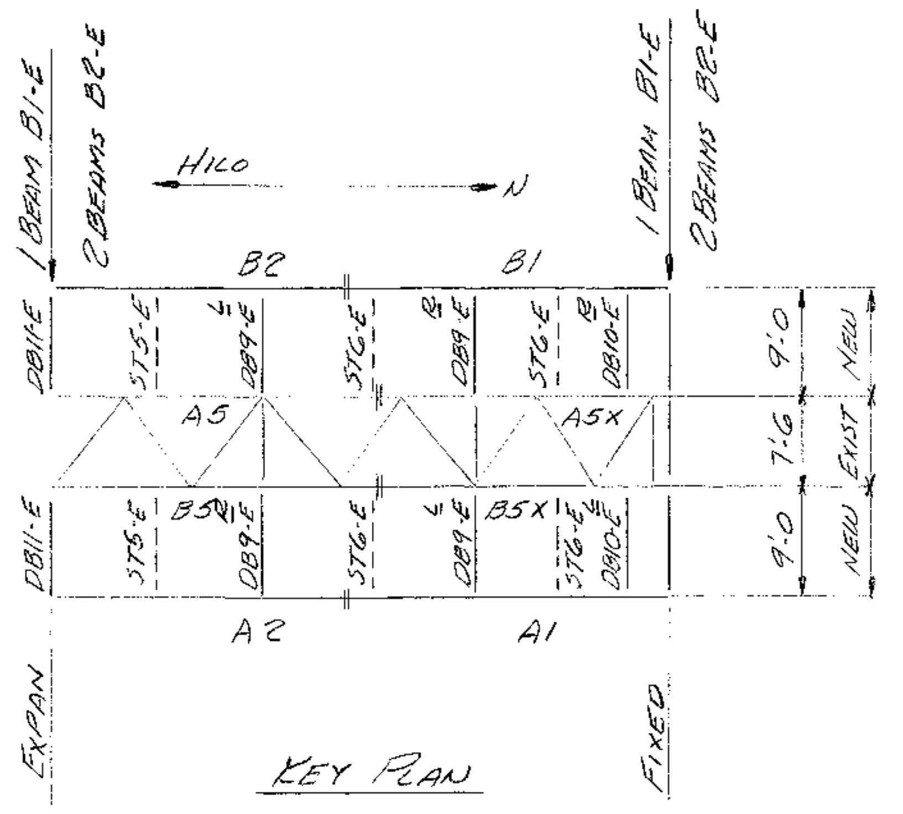
B2-E 20-Beams Req'd × 8'-10

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
2	Exist. Girder			B5 & B5X	
	Revamp A.S. on Det				
2	Exist Girder			A5 & A5X	
	Revamp A.S. on Det				
2	Salv. Girder			B2 & B1	
	Revamp A.S. on Det				
	Salvage From Kealahaka				
2	Salv. Girder			A2 & A1	
	Revamp A.S. on Det.				
	Salvage From Kealahaka				
20	Beams			B2E	
	Salv. From Kaula (See Sht D10E)				
12	ST6WF22.5		6	a	Plain
4	℞ 6 × ½		10½	b	Temp
2	℞ 10½ × ½		11	c	Temp
2	℞ 6 × 5/16		10	d	Temp
2	℞ 10½ × 5/16		11	f	Temp
2	℞ 16 × ¾	1	4¾	g	Bevel Temp
2	℞ 16 × ⅞	1	8¾	h	Bevel Temp
6	℞ 5½ × ⅜	6	5	k	
20	℞ 7⅝ × ⅜	8	10	m	Plain
20	℞ 6¾ × ⅜	8	10	p	Plain
2	℞ 4 × 5/16		10½	s	Temp

BILL OF MATERIAL Industrial Development Company — NEW



Plan View Bottom Chord



Key Plan

Revamp 2 Salvaged Girders(AS) & N Mk B2 & B1

(Salvage From Kealahaka)

Revamp 2 Salvaged Girders(OH) & N Mk A2 & A1

(Salvage From Kealahaka)

Rivets: ⅞⌀

Holes: 15/16⌀ U.N.

Paint:

Industrial Development Co

Addition To Nanue Bridge

Hawaii

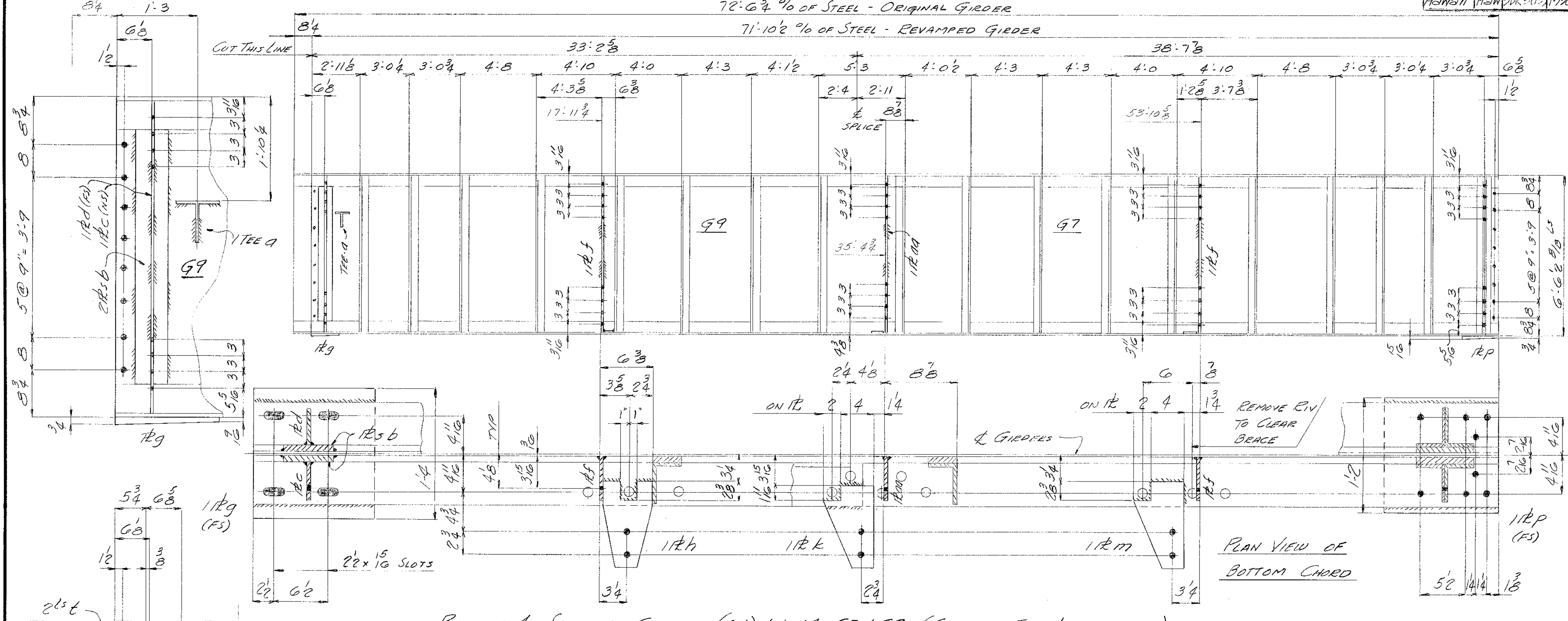
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	F.K.K.	12-1-49	ORDER NO.	3807
CHECKED BY	DM	1-25-50	SHEET NO.	D5-E

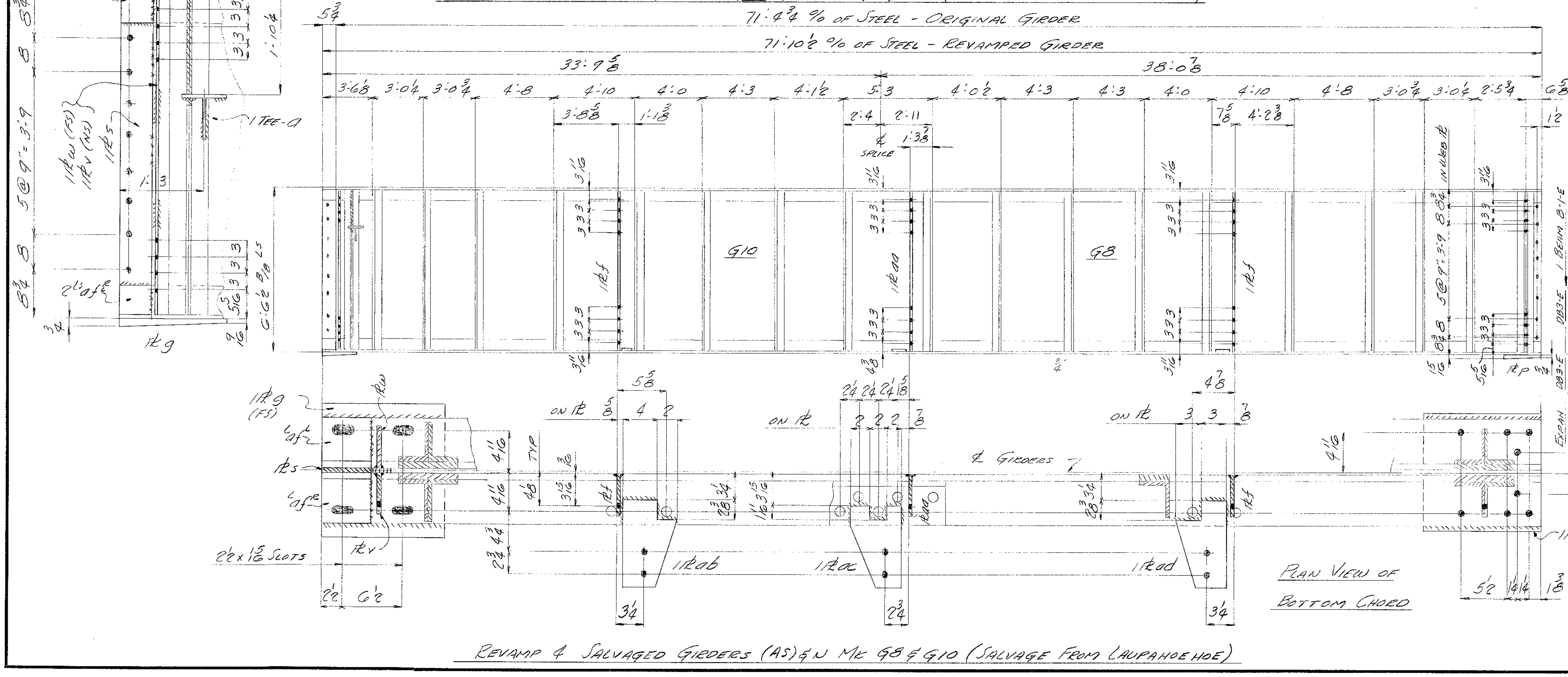
5468.84

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	85	304

Order No. 3807 **Sheet No.** DG-E



Revamp 4. Salvaged Girders (O.H) & N Mk G7 & G9 (Salvage From Laupahoehoe)



Revamp 4 Salvaged Girders (AS) & N Mk G8 & G10 (Salvage From Laupahoehoe)

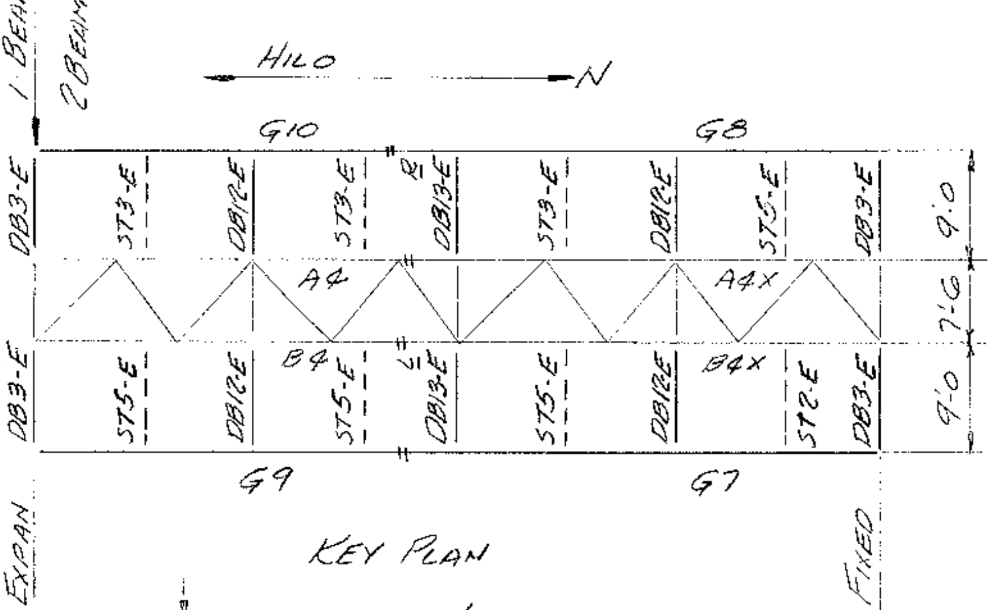
BILL OF MATERIAL

INDUSTRIAL DEVELOPMENT COMPANY

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
4	SALV GIRDERS		G7 & G9		
	REVAMP A.S. ON DET				
	SALVAGE FROM LAUPAHOEHOE				
4	SALV GIRDERS		G8 & G10		
	REVAMP A.S. ON DET				
	SALVAGE FROM LAUPAHOEHOE				
4	ST 6 WF 22.5		6	a	PLAIN
4	PL 6 x 3/4	5	6 3/8	b	PLAIN
2	PL 4 3/4 x 3/4	6	4 3/4	c	
2	PL 4 3/4 x 3/4	6	4 3/4	d	
8	PL 5 1/2 x 3/8	6	4 3/4	f	
4	PL 14 1/2 x 3/4	1	4	g	BEVEL TEMP
2	PL 5 7/8 x 5/16		10 1/2	h	TEMP
2	PL 6 x 5/16		9 3/4	k	TEMP
2	PL 6 x 5/16		10 1/2	m	TEMP
4	PL 14 x 15/16	1	2 1/2	p	BEVEL TEMP
2	PL 5 3/4 x 3/8	6	5	s	
4	∠ 6 x 6 x 3/4		5 3/4	t	PLAIN
2	PL 5 1/2 x 3/4	6	4 3/4	v	
2	PL 5 1/2 x 3/4	6	4 3/4	w	
4	PL 5 1/2 x 3/8	6	4 3/4	aa	
2	PL 6 x 5/16		10 1/2	ab	TEMP
2	PL 6 x 5/16		9 3/4	ac	TEMP
2	PL 6 x 5/16		10 1/2	ad	TEMP
4	∠ 6 x 6 x 3/4		5 3/4	af R L	TEMP

NEW

Note:
Section thru girder shown on sht D2-E



KEY PLAN

Rivets: 7/8 ϕ
Holes: 15/16 ϕ U.N.
Paint:

INDUSTRAIL DEVELOPMENT CO

ADDITION TO NANUE BRIDGE
HAWAII

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		12-6-49	ORDER NO.	3807
CHECKED BY	DM	1-25-50	SHEET NO.	DG-E

5468.85

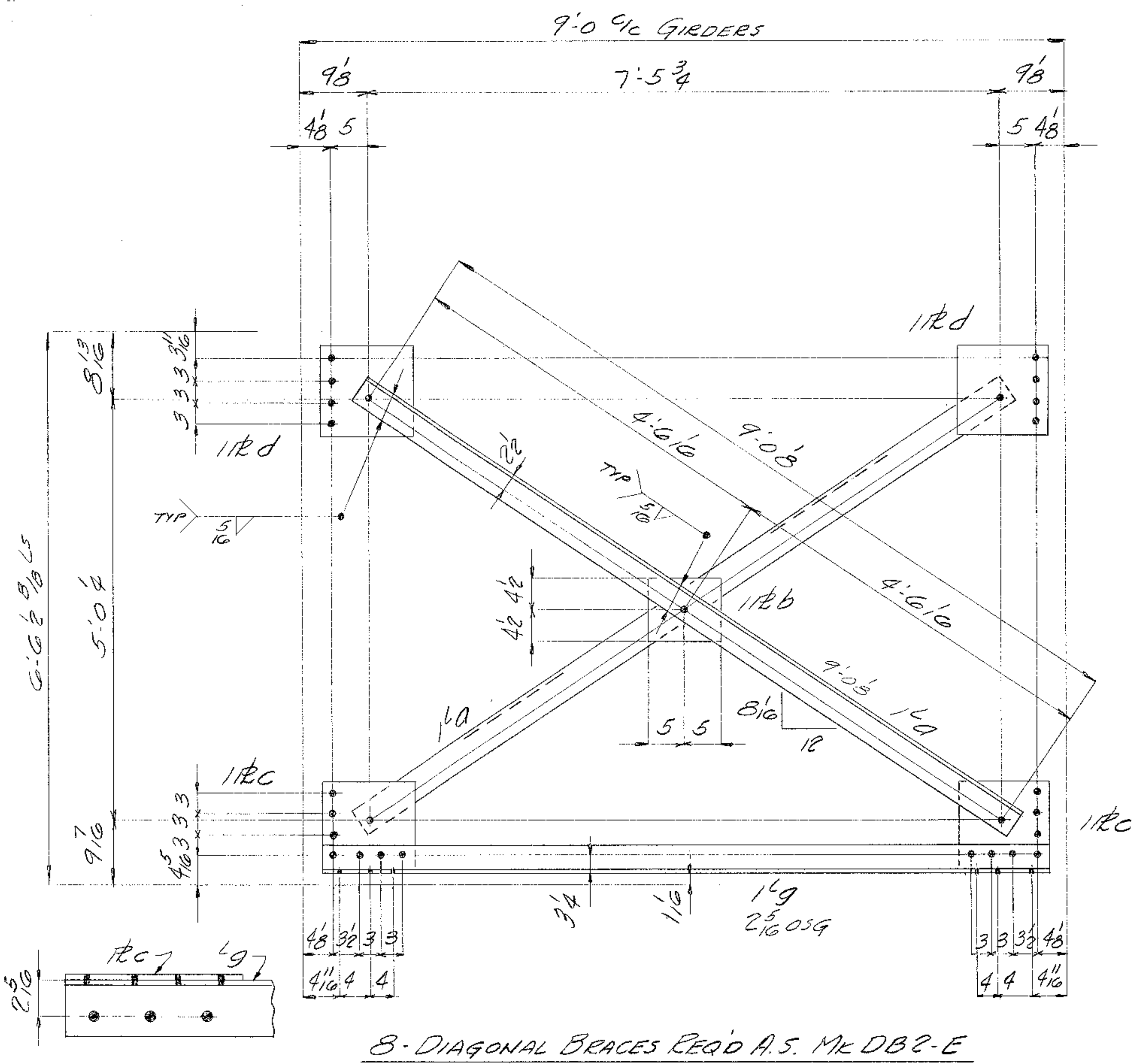
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDK 3(3)	1950	86	304

Order No. 3807 **Sheet No.** D7-E

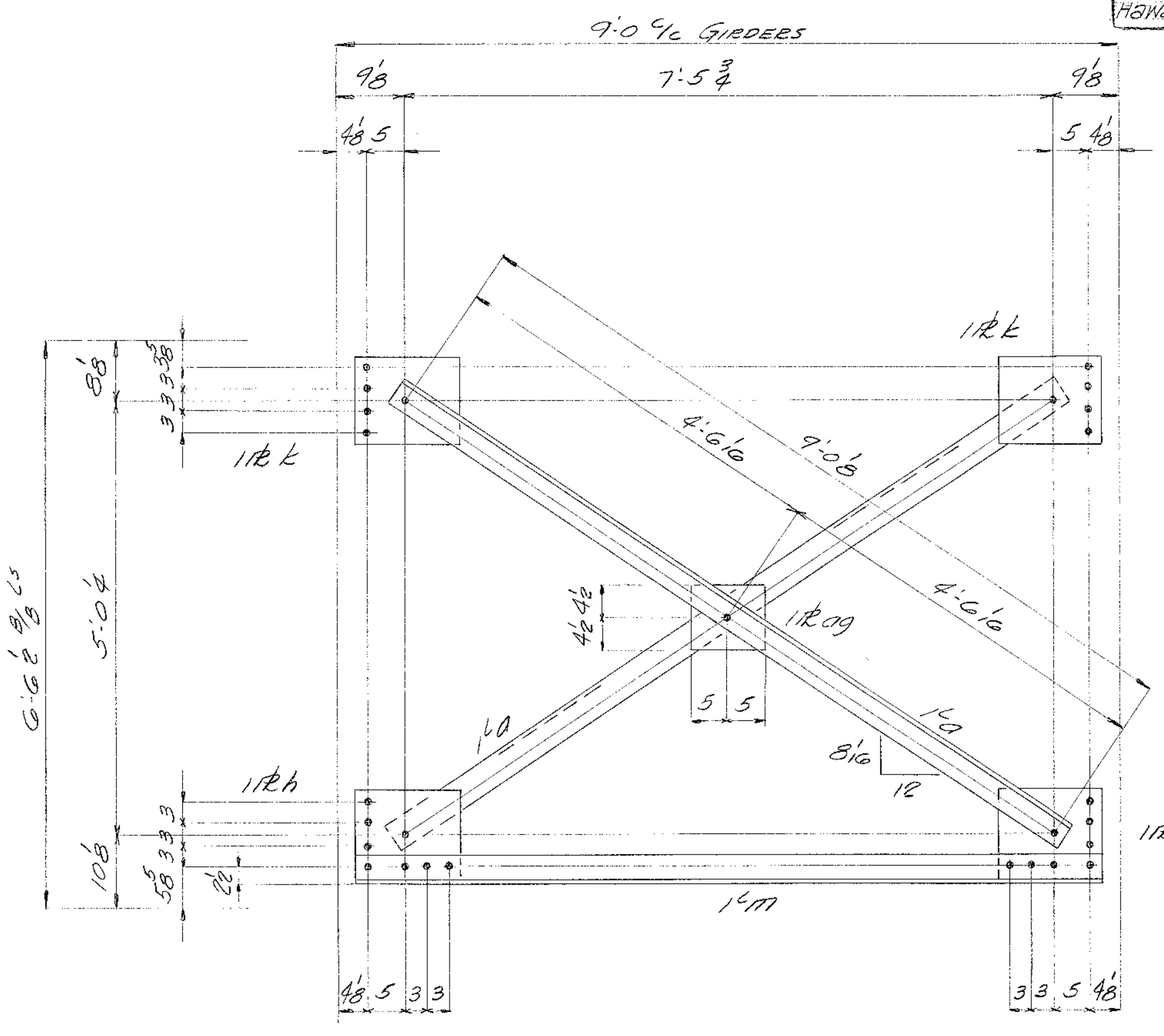
BILL OF MATERIAL
INDUSTRIAL DEVELOPMENT COMPANY

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
16	DIAG BRACES			DB1-E	
8	Do Do			DB2-E	
18	Do Do			DB3-E	
4	Do Do			DB4-E$^{R}_{L}$	
2	Do Do			DB5-E$^{R}_{L}$	
4	Do Do			DB6-E$^{R}_{L}$	
48	L 4 x 4 x 3/8	9	3 1/8	a	SALV. FROM TOWER BRACING SEE SHT. D10-E
8	L 4 x 4 x 3/8	8	6 3/4	g	
16	L 4 x 4 x 3/8	8	6 3/4	m	
20	L 4 x 4 x 3/8	9	3 3/4	t	
4	L 4 x 4 x 3/8	8	7 1/2	v$^{R}_{L}$	
2	L 4 x 4 x 3/8	8	7 1/2	w$^{R}_{L}$	
4	L 4 x 4 x 3/8	8	7 1/2	aa	
36	L 4 x 4 x 3/8	9	2 5/8	ad	
18	L 4 x 4 x 3/8	8	6 3/4	af	
18	PL 9 x 5/16		10	b	TEMP NEW MAT'L
16	PL 12 x 5/16	1	0 1/2	c	TEMP
16	PL 12 x 5/16	1	0 1/2	d	TEMP
32	PL 12 x 3/8	1	2	h	TEMP
32	PL 12 x 3/8	1	2	k	TEMP
10	PL 12 x 5/16	1	0 1/2	p	TEMP
10	PL 12 x 5/16	1	0 1/2	s	TEMP
36	PL 12 x 3/8	1	0 1/2	ab	TEMP
36	PL 12 x 3/8	1	0 1/2	ac	TEMP
34	PL 9 x 3/8		10	ag	TEMP
10	PL 12 x 5/16	1	0 1/2	ah	TEMP
10	PL 12 x 5/16	1	0 1/2	ak	TEMP

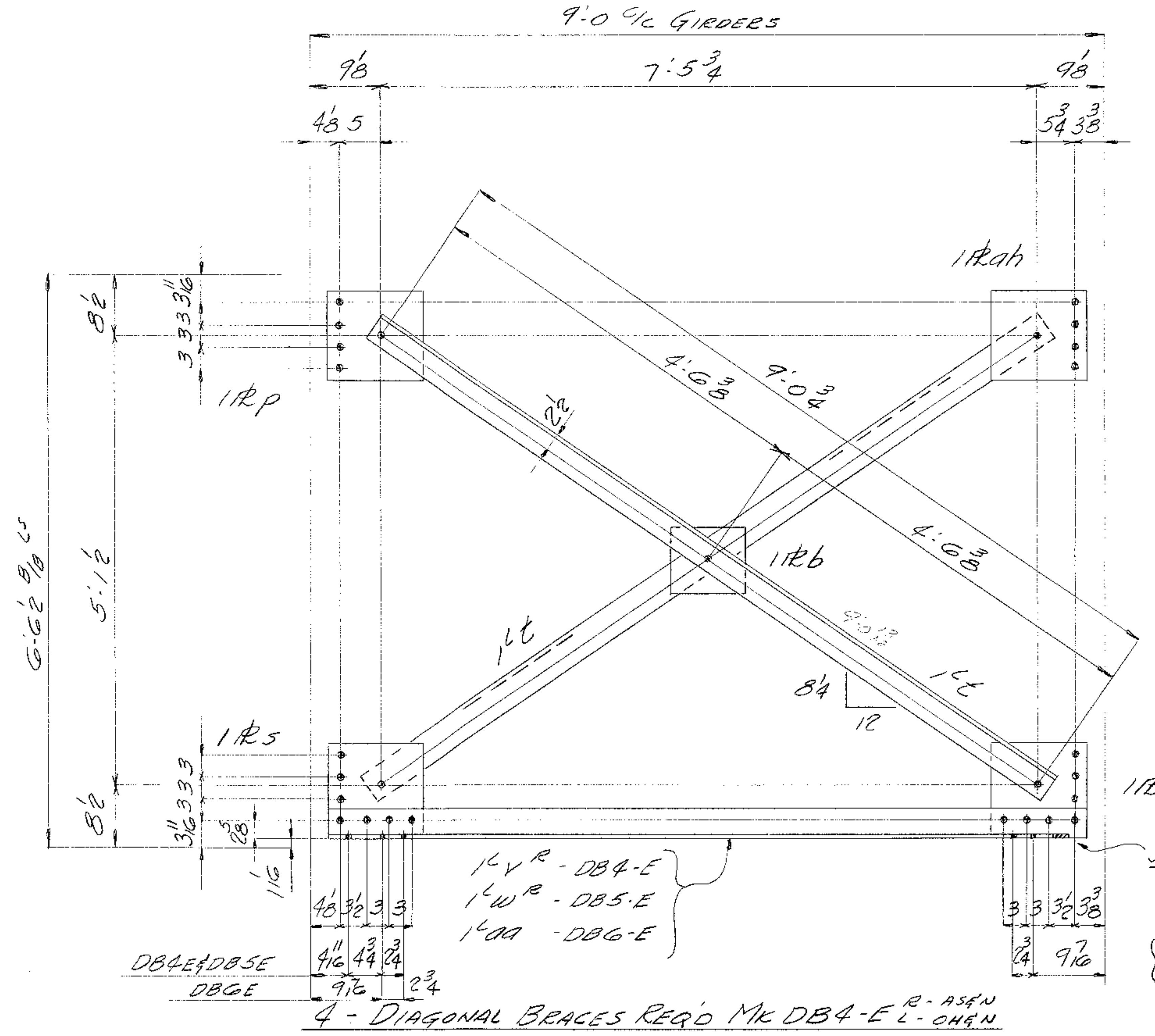
a b c d f g h k m p s t v w aa ab ac ad af ag

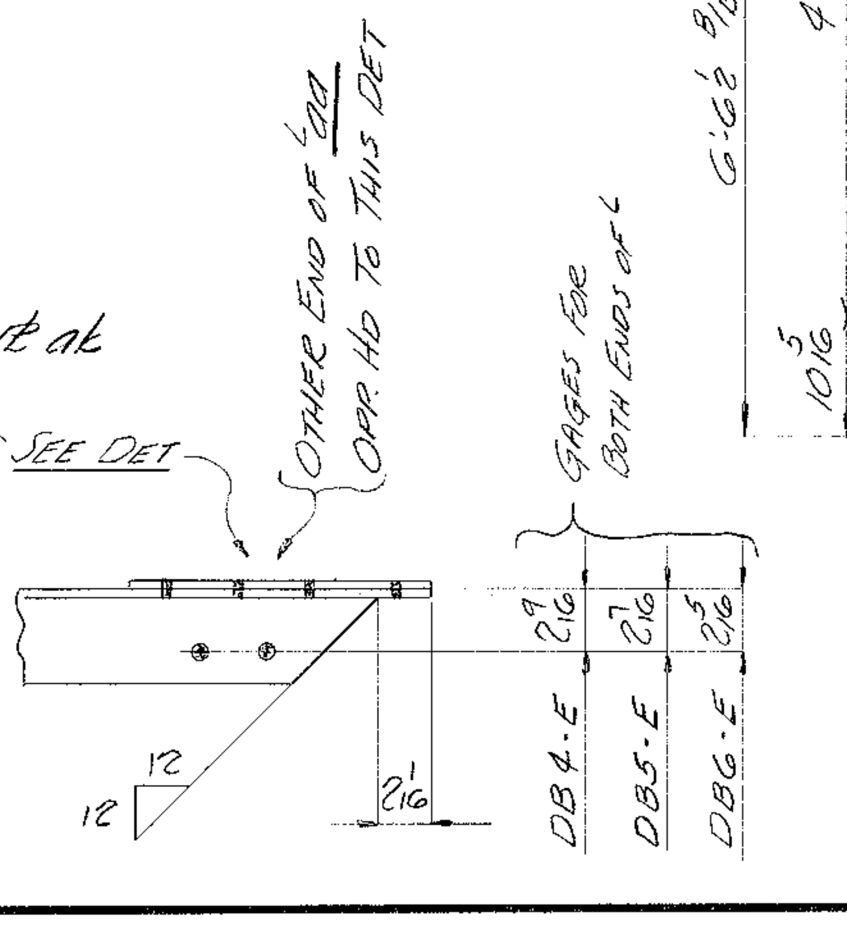


8 - DIAGONAL BRACES REQ'D A.S. MK DB2-E

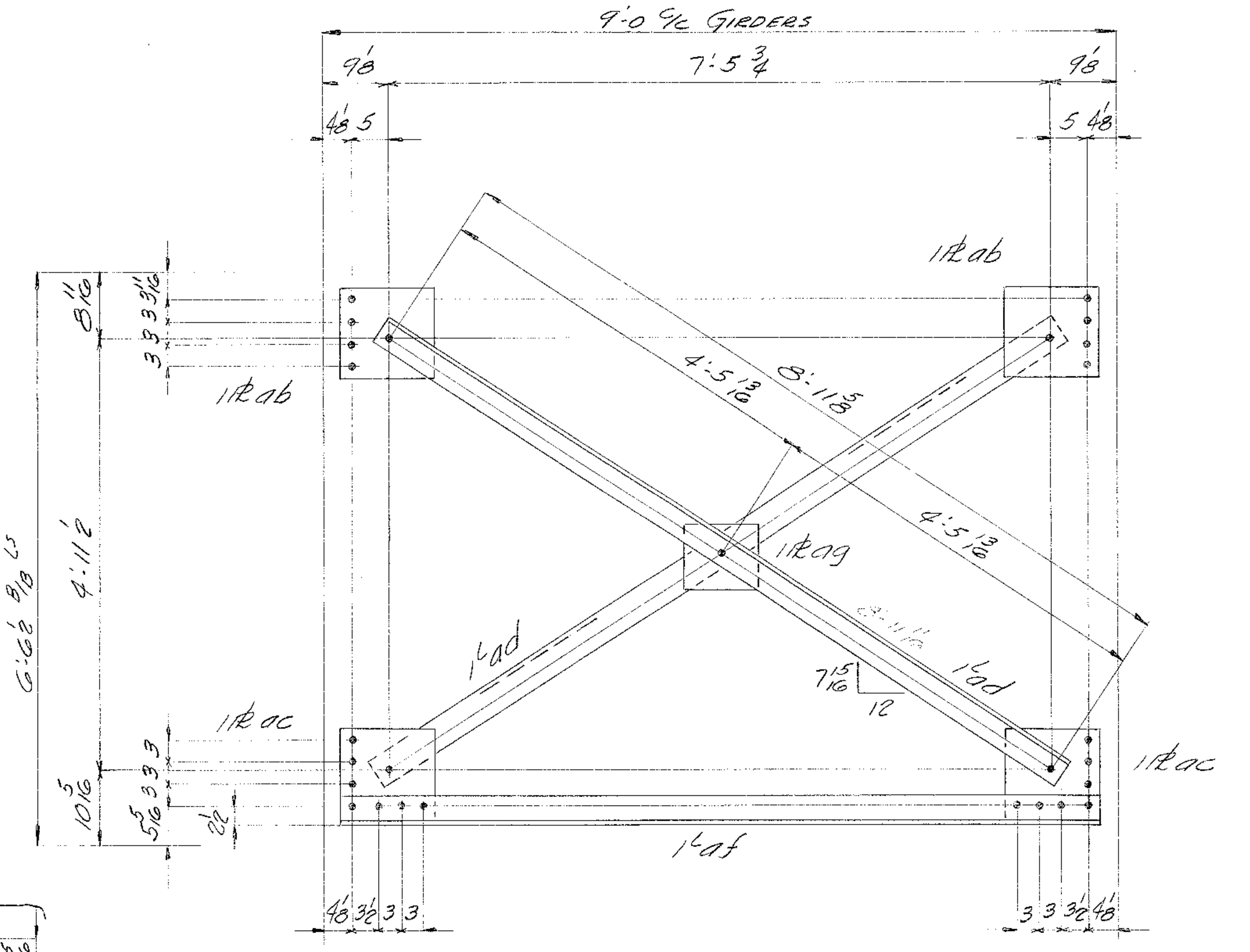


16 - DIAGONAL BRACES REQ'D A S MK DB1-E





4 - DIAGONAL BRACES REQ'D MK DB4-E $^{R - AS SH'N}_{L - OPP H'N}$
2 - Do Do Do MK DB5-E $^{R - AS SH'N}_{L - OPP H'N}$
4 - Do Do Do MK DB6-E $^{R - AS SH'N}_{L - OPP H'N}$



18 - DIAGONAL BRACES REQ'D A.S. MK DB3-E

Rivets: 7/8
Holes: 15/16 φ
Paint:

INDUSTRIAL DEVELOPMENT CO

ADDITION TO NANUE BRIDGE
HAWAII

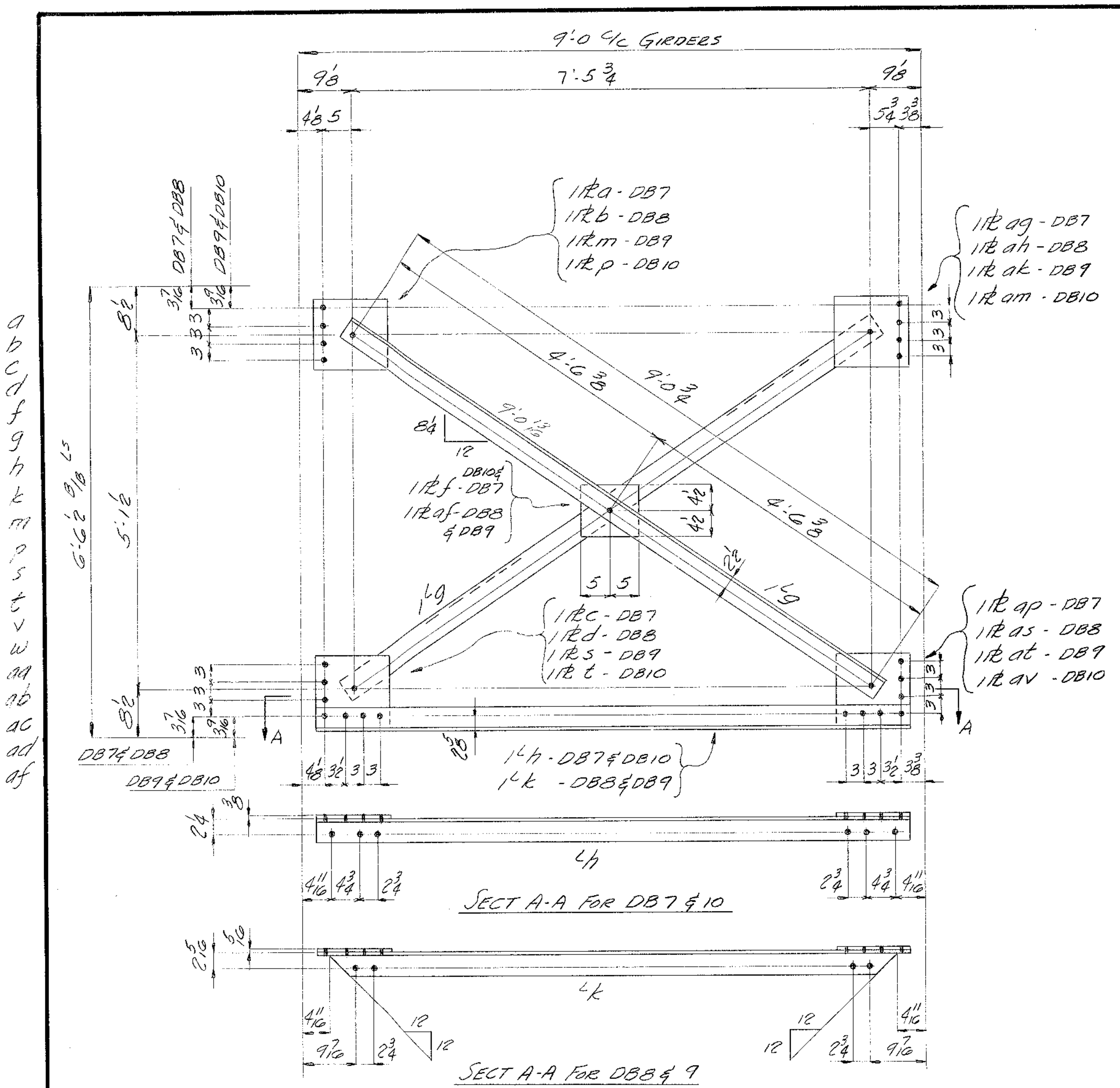
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		12-7-49	ORDER NO.	3807
CHECKED BY	DM	1-25-50	SHEET NO.	D7-E

5468.86

Order No. 3807 **Sheet No.** D8-E

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDK3(2)	1950	87	304

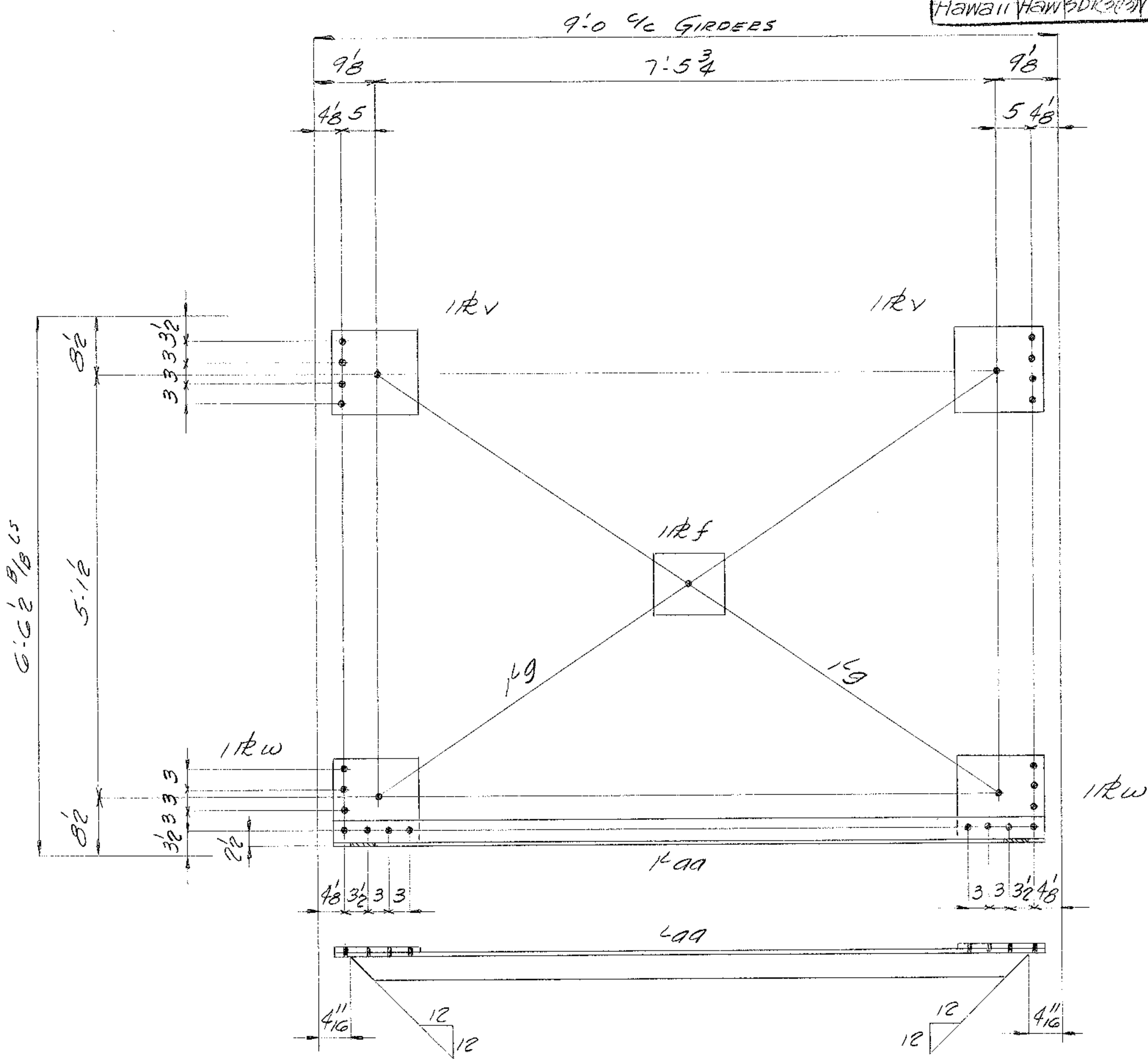


2 - DIAGONAL BRACES REQ'D MK DB7-E R-AS&N L-OH&N

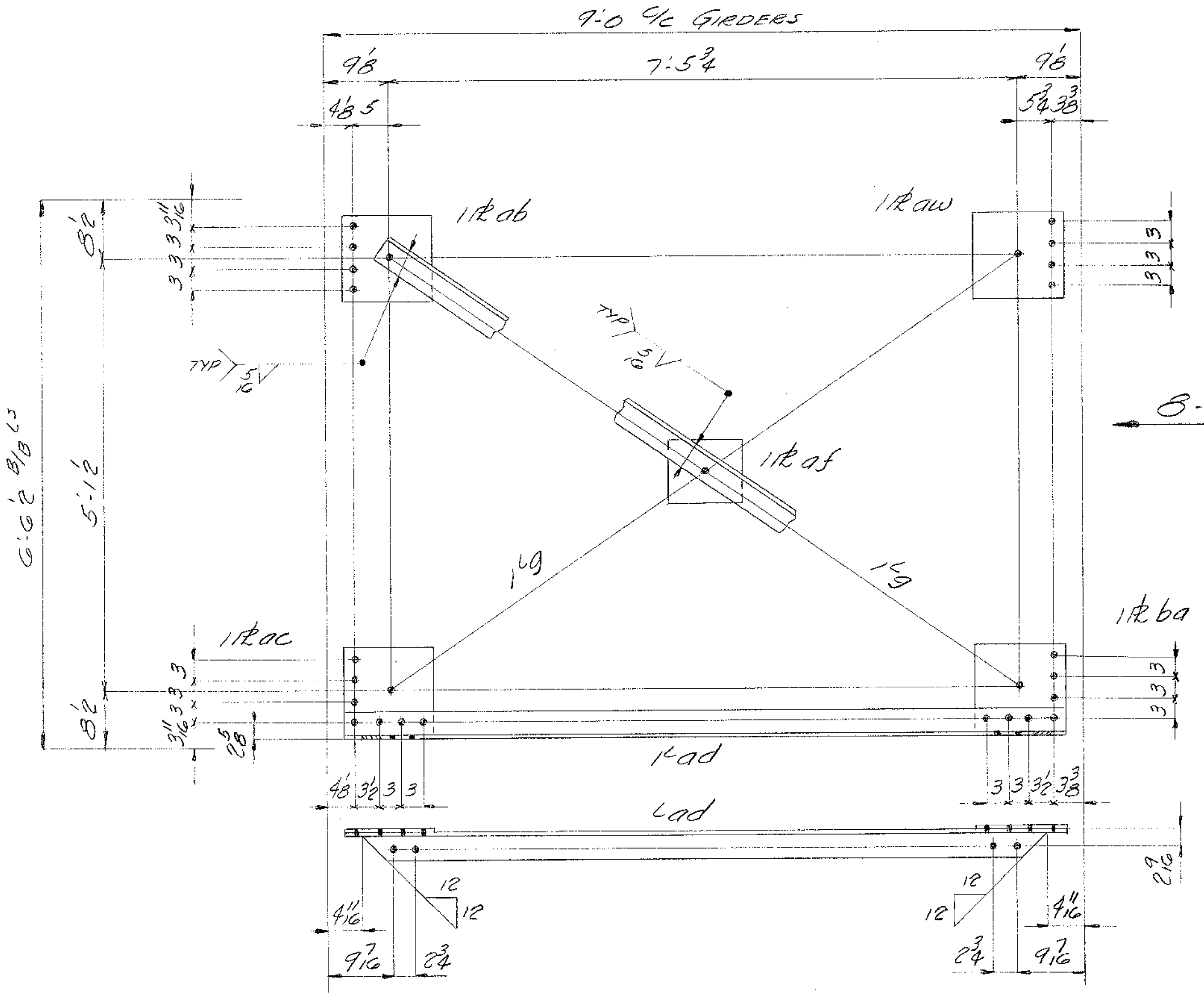
4 - Do Do Do MK DB8-E R-AS&N L-OH&N

4 - Do Do Do MK DB9-E R-AS&N L-OH&N

2 - Do Do Do MK DB10 E R-AS&N L-OH&N



2 - DIAGONAL BRACES REQ'D AS MK DB11-E



8 - DIAGONAL BRACES REQ'D AS MK DB12-E R-AS L-OH

BILL OF MATERIAL INDUSTRIAL DEVELOPMENT COMPANY

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
2	DIAG. BRACES			DB7-E R L	
4	Do Do			DB8-E R L	
4	Do Do			DB9-E R L	
2	Do Do			DB10-E R L	
2	Do Do			DB11-E	
8	Do Do			DB12-E R L	
44	L $4 \times 4 \times \frac{3}{8}$	9	$3\frac{3}{4}$	g	SALV. FROM TOWER BRACING SEE SHT D10-E
4	L $4 \times 4 \times \frac{3}{8}$	8	$7\frac{1}{2}$	h	
8	L $4 \times 4 \times \frac{3}{8}$	8	$7\frac{1}{2}$	k	
2	L $4 \times 4 \times \frac{3}{8}$	8	$6\frac{3}{4}$	aa	
8	L $4 \times 4 \times \frac{3}{8}$	8	$7\frac{1}{2}$	ad	
2	PL $12 \times \frac{3}{8}$	1	$0\frac{1}{2}$	a	TEMP NEW MAT'L
4	PL $12 \times \frac{5}{16}$	1	$0\frac{1}{2}$	b	
2	PL $12 \times \frac{3}{8}$	1	$0\frac{1}{2}$	c	
4	PL $12 \times \frac{5}{16}$	1	$0\frac{1}{2}$	d	
6	PL $9 \times \frac{3}{8}$		10	f	
4	PL $12 \times \frac{5}{16}$	1	$0\frac{1}{2}$	m	
2	PL $12 \times \frac{3}{8}$	1	$0\frac{1}{2}$	p	
4	PL $12 \times \frac{5}{16}$	1	$0\frac{1}{2}$	s	
2	PL $12 \times \frac{3}{8}$	1	$0\frac{1}{2}$	t	
4	PL $12 \times \frac{3}{8}$	1	$0\frac{1}{2}$	v	
4	PL $12 \times \frac{3}{8}$	1	$0\frac{1}{2}$	w	
8	PL $12 \times \frac{5}{16}$	1	$0\frac{1}{2}$	ab	
8	PL $12 \times \frac{5}{16}$	1	$0\frac{1}{2}$	ac	
16	PL $9 \times \frac{5}{16}$		10	af	
2	PL $12 \times \frac{3}{8}$	1	$0\frac{1}{2}$	ag	
4	PL $12 \times \frac{5}{16}$	1	$0\frac{1}{2}$	ah	
4	PL $12 \times \frac{5}{16}$	1	$0\frac{1}{2}$	ak	
2	PL $12 \times \frac{3}{8}$	1	$0\frac{1}{2}$	am	
2	PL $12 \times \frac{3}{8}$	1	$0\frac{1}{2}$	ap	
4	PL $12 \times \frac{5}{16}$	1	$0\frac{1}{2}$	as	
4	PL $12 \times \frac{5}{16}$	1	$0\frac{1}{2}$	at	
2	PL $12 \times \frac{3}{8}$	1	$0\frac{1}{2}$	av	
8	PL $12 \times \frac{5}{16}$	1	$0\frac{1}{2}$	aw	
8	PL $12 \times \frac{5}{16}$	1	$0\frac{1}{2}$	ba	

Rivets: $\frac{7}{8}$

Holes: $\frac{15}{16}$

Paint:

INDUSTRIAL DEVELOPMENT CO

ADDITION TO NANUE BRIDGE
HAWAII

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

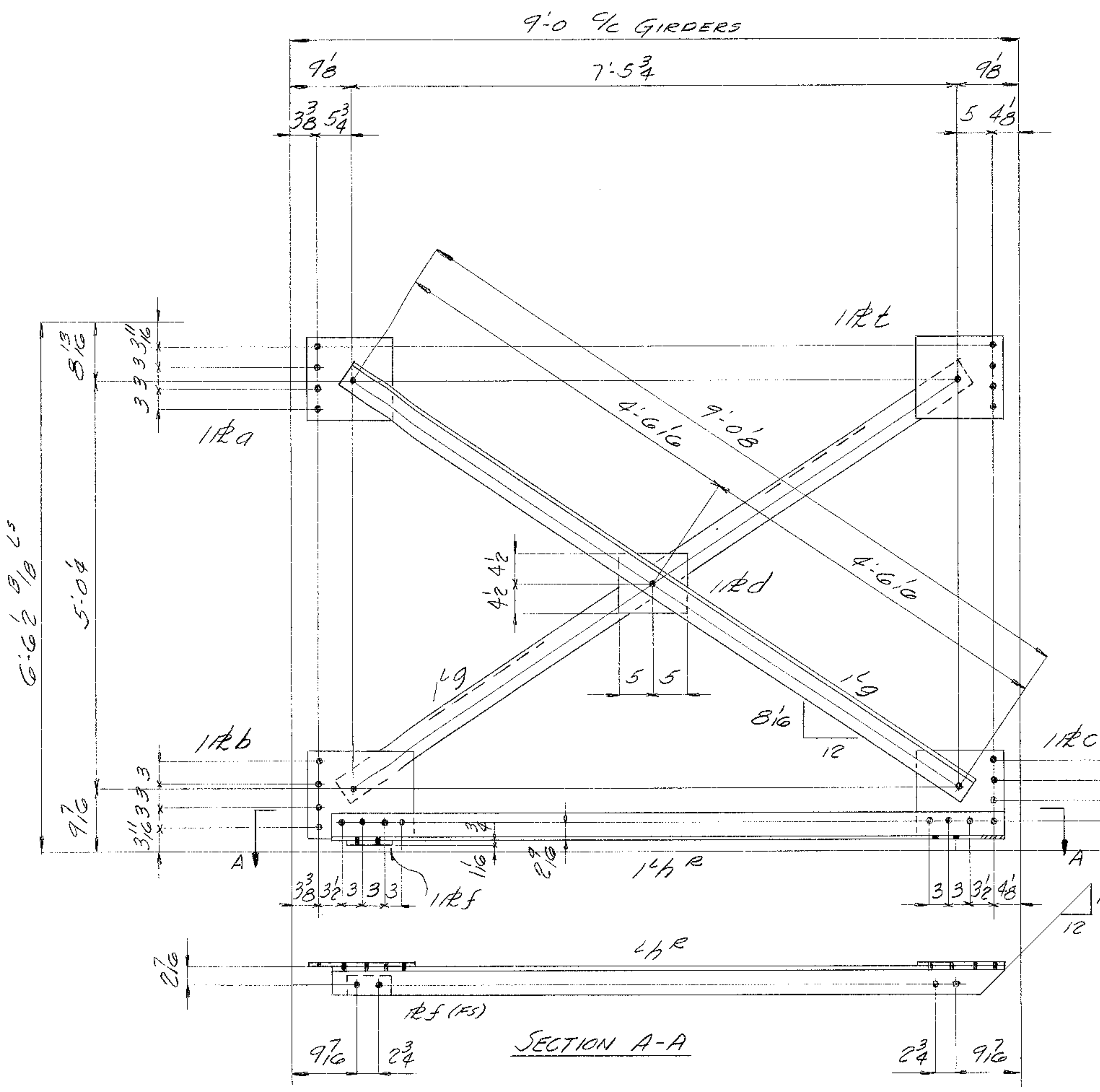
MADE BY		12-8-49	ORDER NO.	3807
CHECKED BY	DM	1-25-50	SHEET NO.	D8-E

5468.87

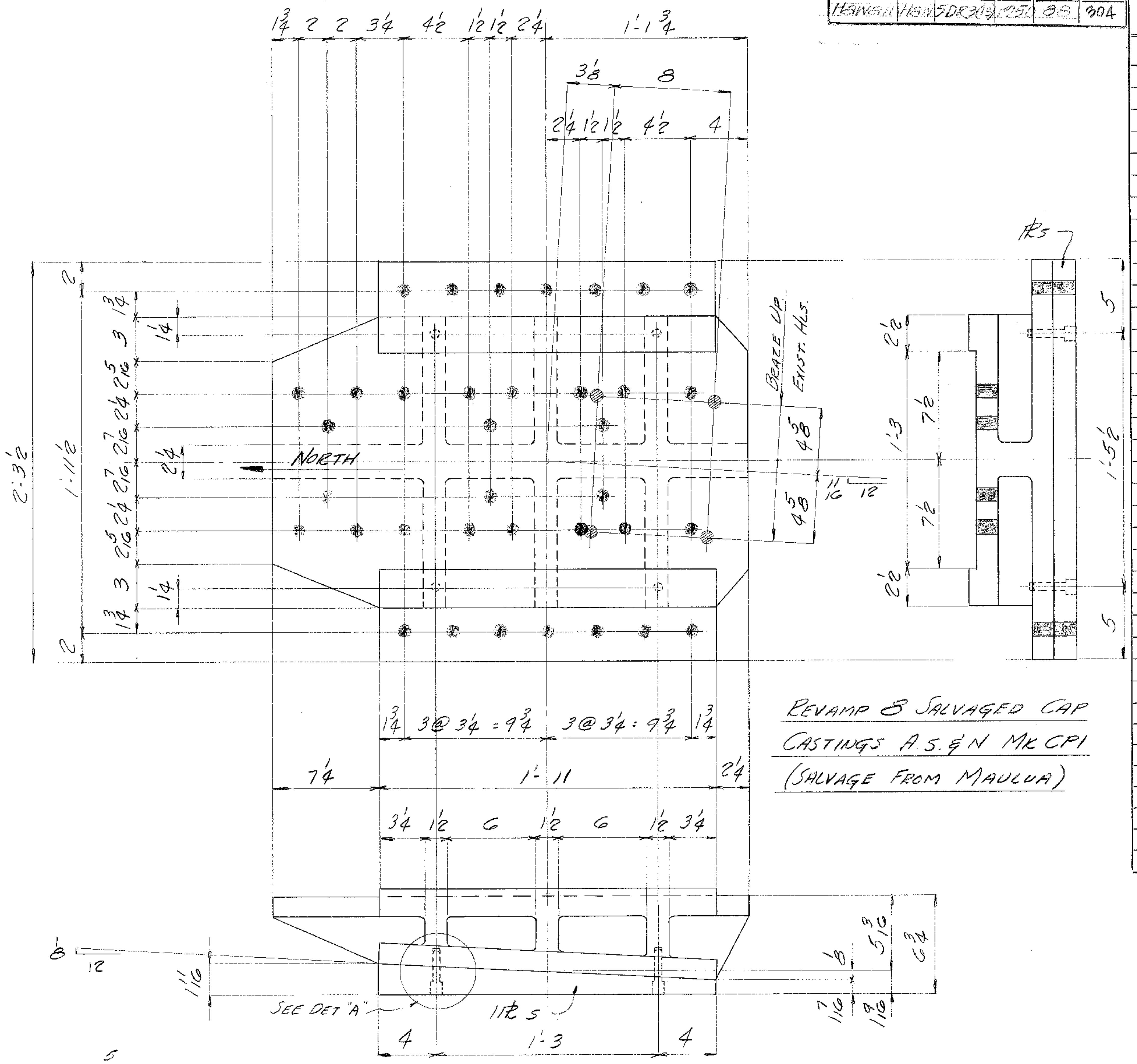
Order No. 3807 **Sheet No.** D9-E

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDC-30(9)	1950	88	304

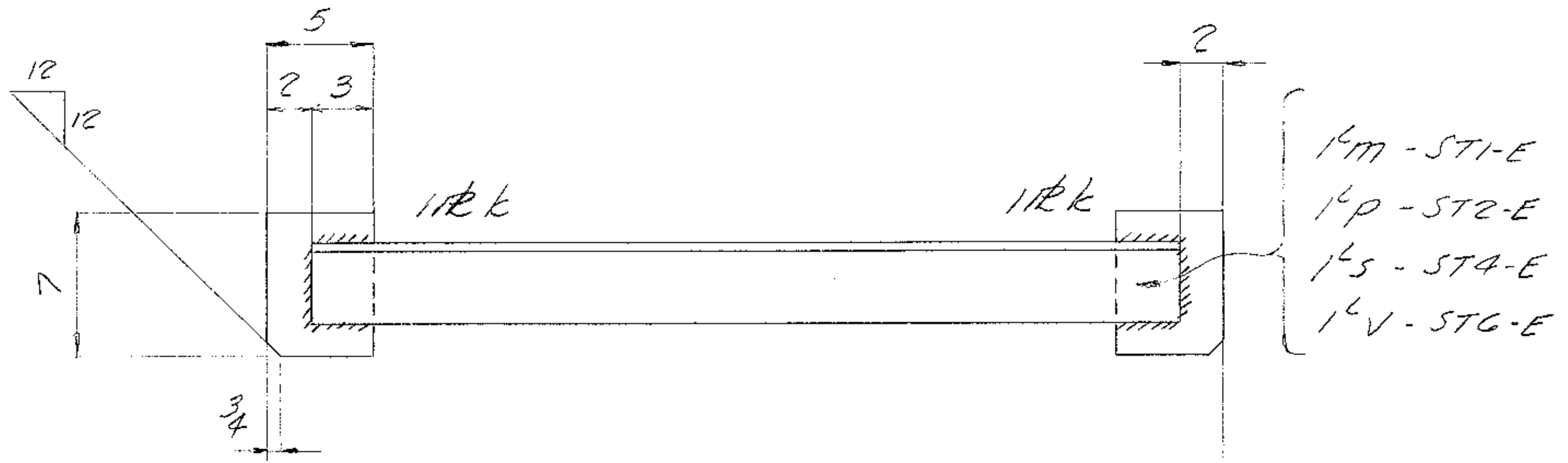
a b c d f g h k



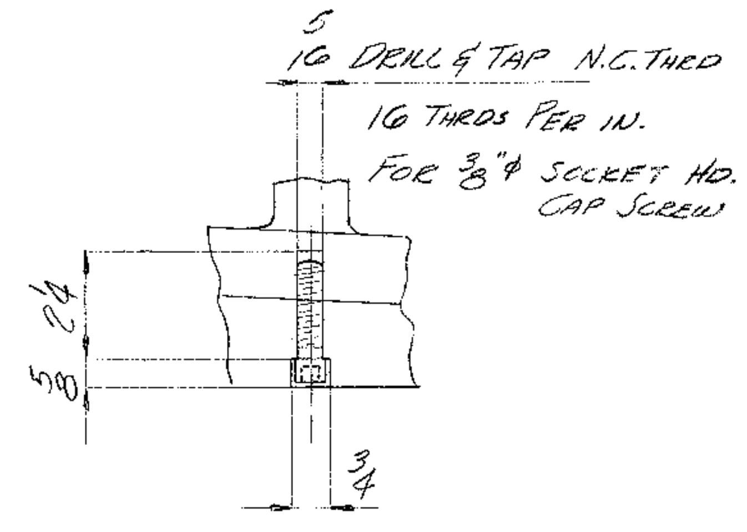
4- Diagonal Braces Req'd Mk DB13 R-AS L-OH



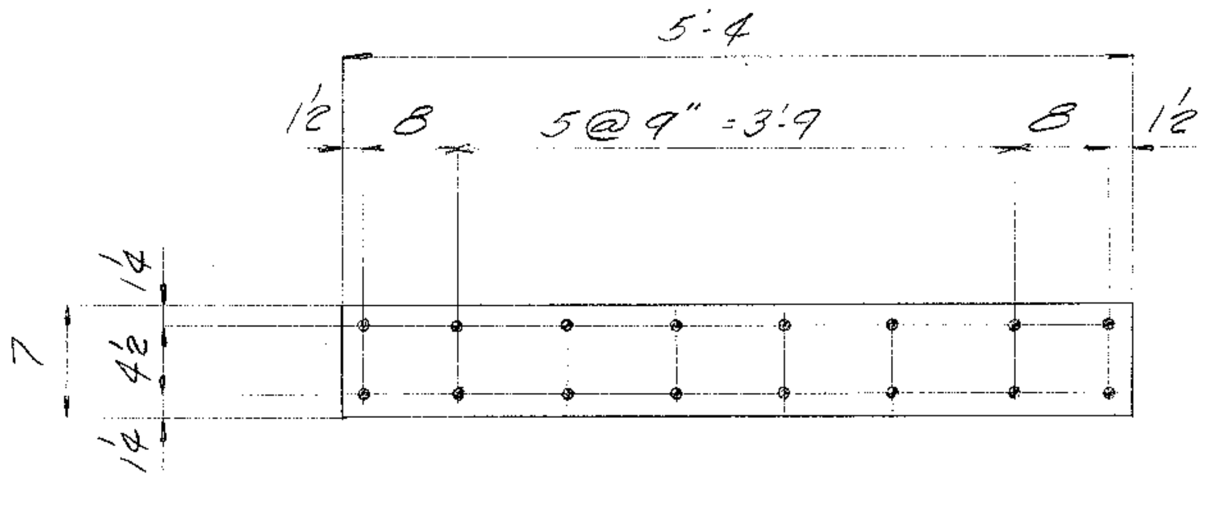
Revamp 8 Salvaged Cap Castings A.S. & N Mk CP1 (Salvage From Maulua)



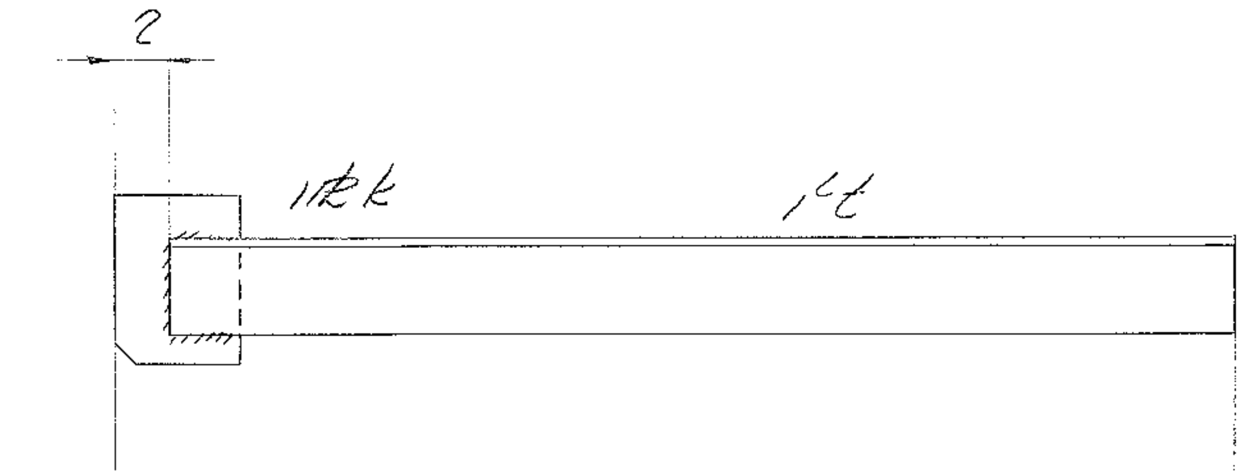
ST1-E 16 Struts Req'd × 8'-10 1/4
ST2-E 6 Do Do × 8'-10 1/8
ST4-E 4 Do Do × 8'-10 3/8
ST6-E 4 Do Do × 8'-10 1/2



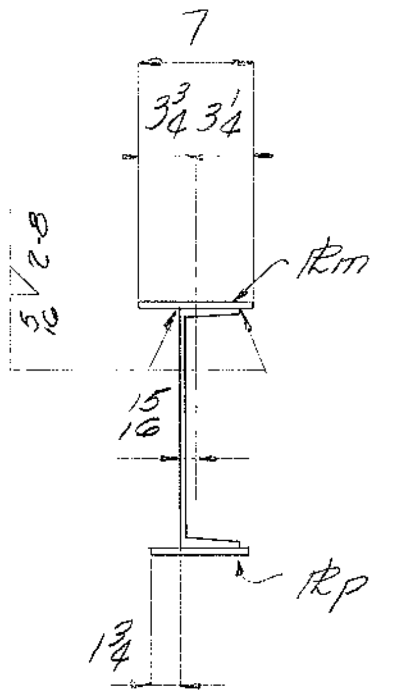
Detail "A" (Typ)

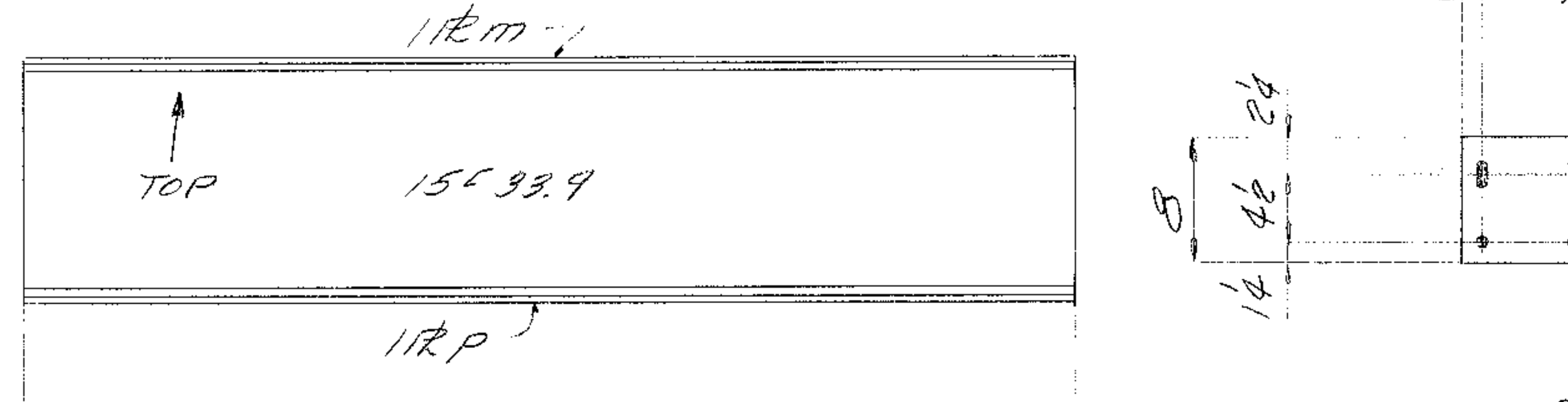


20- Salvaged PLs Req'd Mk FP & FP1

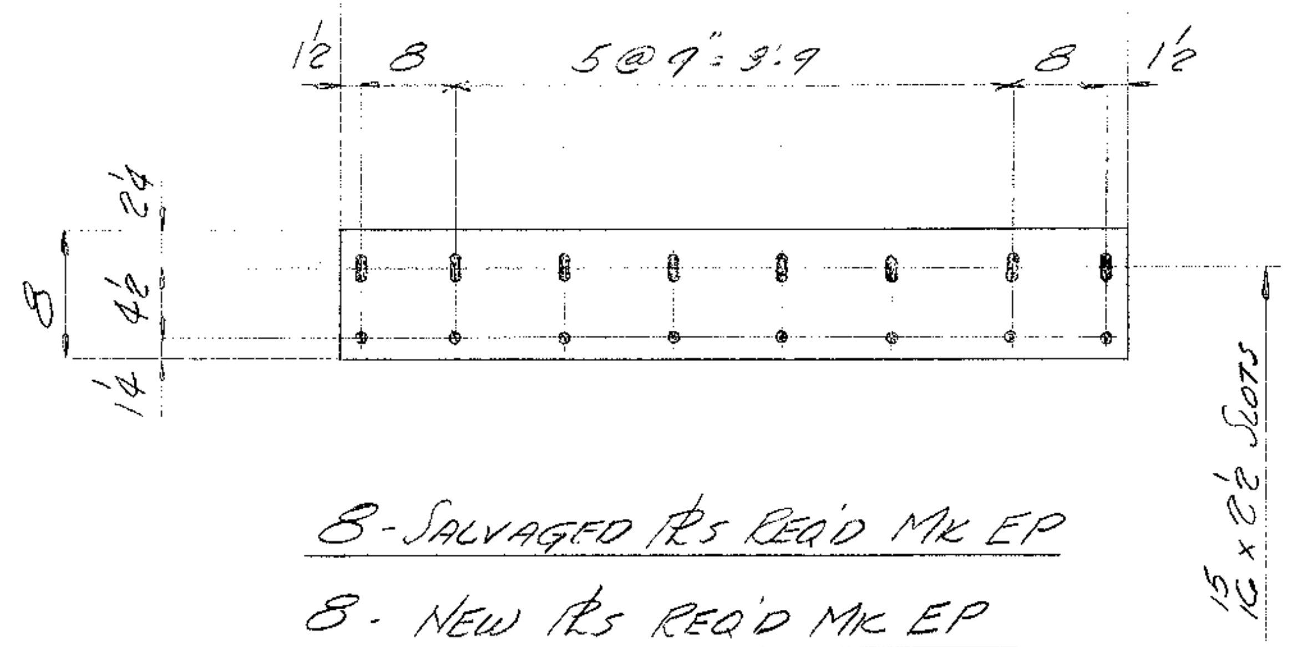


ST5-E 20 Struts Req'd × 8'-9 1/2





B1-E 10 Beams Req'd × 7'-4



8- Salvaged PLs Req'd Mk EP

8- New PLs Req'd Mk EP

BILL OF MATERIAL

Industrial Development Company

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
4	Diag Braces			DB13-E R L	Salv. From Col. Sections See Sht D10-E
16	Struts			ST1-E	
6	Struts			ST2-E	
8	L 4 × 4 × 3/8	8	9	ST3-E	Plain
4	Struts			ST4-E	
20	Struts			ST5-E	
4	Struts			ST6-E	
10	Beams	7	4	B1-E	
8	Cap Castings			CP1	Revamp AS & N on Det.
	(Salv. From Maulua)				
8	L 4 × 4 × 3/8	9	3 1/8	g	Salv From Tower Bracing See Sht D10-E
4	L 4 × 4 × 3/8	8	7 1/2	h R L	
16	L 4 × 4 × 3/8	8	6 1/4	m	
6	L 4 × 4 × 3/8	8	6 1/8	p	
4	L 4 × 4 × 3/8	8	6 3/8	s	
20	L 4 × 4 × 3/8	8	7 1/2	t	
4	L 4 × 4 × 3/8	8	6 1/2	v	
4	PL 12 × 5/16	1	0 1/2	a	Temp
4	PL 12 × 5/16	1	3 1/2	b	New
4	PL 12 × 5/16	1	0 1/2	c	
4	PL 9 × 5/16		10	d	
4	PL 3 × 3/4		5 3/4	f	
80	PL 5 × 3/8		7	k	
32	3/8" ϕ Socket Hd Cap Screws ×				2" (For CP1)
	N.C. Thrd 16 Thrds Per In.				
4	PL 7 × 3/8	5	4	FP1	
	(Salv. From Kealahaka)				
16	PL 7 × 3/8	5	4	FP	
	(Salv From Maile)				
8	PL 8 × 3/8	5	4	EP	
	(Salv From Maile)				
8	PL 8 × 3/8	5	4	EP	New
10	PL 7 × 3/8	7	4	m	Plain (New)
10	PL 6 × 3/8	7	4	p	Plain (New)
8	PL 23 × 1 11/16	2	3 1/2	s	Bevel Temp (New)
4	PL 12 × 5/16	1	0 1/2	t	Temp (New)

Rivets: 7/8 ϕ
Holes: 15/16 ϕ
Paint:

Industrial Development Co

Addition To Nanue Bridge
Hawaii

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		12-9-49	ORDER NO.	3807
CHECKED BY	DD	1-26-50	SHEET NO.	D9-E

5468.88

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDE3(13)	1950	89	304

Order No. 3807 Sheet No. 010E

MATERIAL REQD. FOR DIAG. BRACES & STRUTS LISTED BELOW						MATL. LISTED BELOW IS TO BE USED FOR STRUTS & DIAG. BRACES (ALL MATL. REVAMPED)						
No.	SIZE	LENGTH		MARK	SHT. NO.	No.	PC. MK.	SIZE	LENGTH		BRIDGE	SHT. NO.
38	Ls 4x4x3/8	9	3⅜	a	D7-E	2	TS2	2Ls 5x3½x5/16	11	2 1/16	LAUPAHOEHOE	36
						6	TS7	2Ls 5x3x5/16	10	1 5/16	Do.	36
						6	TS8	Do.	15	1 5/16	Do.	36
						1	TS22	2Ls 5x3½x3/8	10	1 5/16	Do.	36
						1	TS3	Do.	18	11/16	Do.	36
						2	TS9	2Ls 5x3x5/16	24	2 5/16	Do.	36
8	L 4x4x3/8	8	6¾	9		2	TS9	Do.	24	2 5/16	Do.	36
						1	TS16	Do.	23	3 3/8	Do.	36
20	L 4x4x3/8	9	3¾	t		1	TS18	Do.	28	3 3/8	Do.	36
						1	TS20	2Ls 5x3½x3/8	16	0 3/8	Do.	36
						3	LB5	2Ls 5x3x3/8	22	2 3/8	Do.	38
16	L 4x4x3/8	8	6¾	m		1	TS16	2Ls 5x3x5/16	23	3 3/8	Do.	36
						1	LB3	2Ls 5x3x3/8	22	5 3/8	Do.	38
						2	LB26	Do.	22	2 3/8	Do.	38
4	L 4x4x3/8	8	7½	vℓ		1	LB6	Do.	24	3	Do.	38
2	Do	8	7½	wℓ		1	LB7	Do.	22	8½	Do.	39
4	Do	8	7½	aa		1	LB6	Do.	24	3	Do.	38
36	Do	9	2⅝	ad		4	LB7	Do.	22	8½	Do.	39
						1	LB9	Do.	19	9¼	Do.	39
						4	LB16	Do.	21	9 7/16	Do.	40
18	L 4x4x3/8	8	6¾	af		1	LB18	Do.	12	2 11/16	Do.	40
						1	LB19	Do.	14	6 3/8	Do.	40
						1	LB20	Do.	28	11¾	Do.	40
						2	LB21	Do.	22	0 13/16	Do.	40
						1	LB22	Do.	21	7 3/16	Do.	40
44	L 4x4x3/8	9	3¾	9	D8-E	1	LB23	Do.	21	7 3/16	Do.	40
						1	TS11	2Ls 6x4x3/8	32	10 5/16	Do.	36
						2	TS13	Do.	33	3 15/16	Do.	36
						2	HB1	4Ls 6x4x3/8	24	4	Do.	43
						1	HB2	Do.	23	8¼	Do.	43
4	L 4x4x3/8	8	7½	h		1	HB2	Do.	23	8¼	Do.	43
8	Do	8	7½	k		1	HB3	Do.	24	6	Do.	43
2	Do	8	6¾	aa		1	HB4	Do.	23	10¼	Do.	43
8	Do	8	7½	ad		1	HB3	Do.	24	6	Do.	43
8	Do	9	3⅜	9	D9-E	1	HB4	Do.	23	10¼	Do.	43
2	Do	8	7½	hℓ		1	HB6	2Ls 5x3½x5/16	11	3	Do.	44
16	Do	8	6¼	m		8	HB6	Do.	11	3	Do.	44
6	Do	8	6⅜	p		3	HB6	Do.	11	3	Do.	44
8	Do	8	9		ST3-E	3	HB5	Do.	23	4¼	Do.	44
4	Do	8	6⅜	s		1	HB5	Do.	23	4¼	Do.	44
4	Do	8	6½	v		1	HB5	Do.	23	4¼	Do.	44
4	Do	8	7½	t		1	HB5	Do.	23	4¼	Do.	44
10	BEAMS	7	4	B1-E		2	C3ℓ	15" I Col.	33	11	MAILE	13
20	BEAMS	8	10	B2E	D5E	4	MC4ℓ	I-6¼ Deep Col.	32	8½	KAULA	16
2	L 4x4x3/8	8	7½	h	D9E	1	LB5H	2Ls 5x3x3/8	21	11½		
3	L 4x4x3/8	9	3⅜	a	D7E	2	LB8H	2Ls 5x3x3/8	23	7¼		
						1	LB10H	Do.	23	7¼		
10	L 4x4x3/8	8	7½	t	D9E	2	LB2H	2Ls 5x3x3/8	27	0½		
						1	LB4H	Do.	22	1½		
						1	LB11H	Do.	22	1½		

BILL OF MATERIAL

INDUSTRIAL DEV. CO.

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS

Rivets:

Holes:

Paint:

INDUSTRIAL DEV. CO.

ADDITION TO THE HANUE BRIDGE -HAWAII-

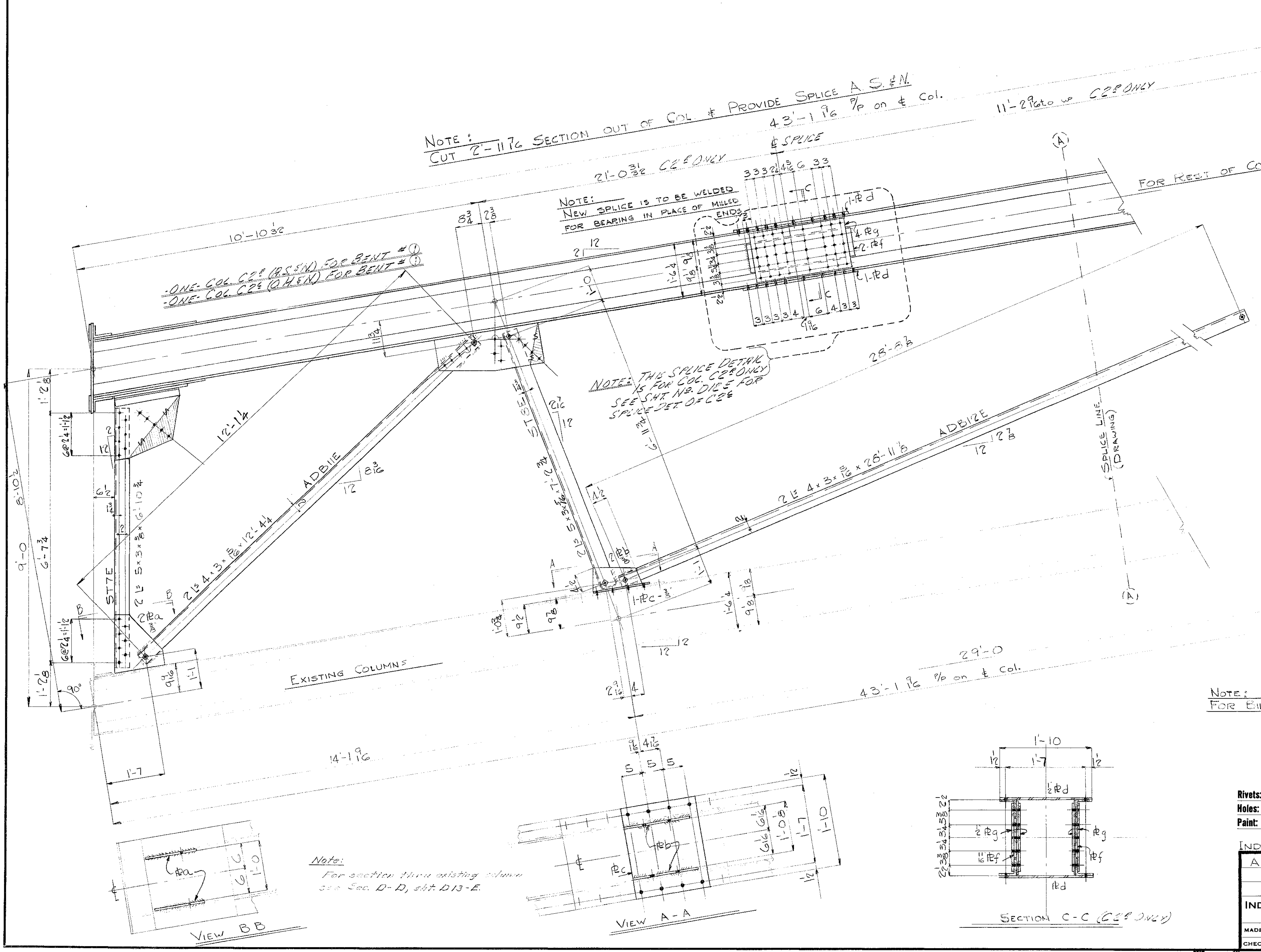
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	SEE DW	12-12-49	ORDER NO.	3807
CHECKED BY	✓	1-26-50	SHEET NO.	010-E

5468.89 → 89

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw.	SDR3(13)	1950	90	304

Order No. 3807 **Sheet No.** D11-E



ELEV AT RIGHT SIDE OF BENT #① LOOKING NORTH

NOTE:
FOR BILL OF MAT'L SEE D12E

Rivets: ⅞ φ
Holes: 15/16 φ
Paint:

INDUSTRIAL DEV. CO.

ADDITION TO NANUE BRIDGE
HAWAII

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

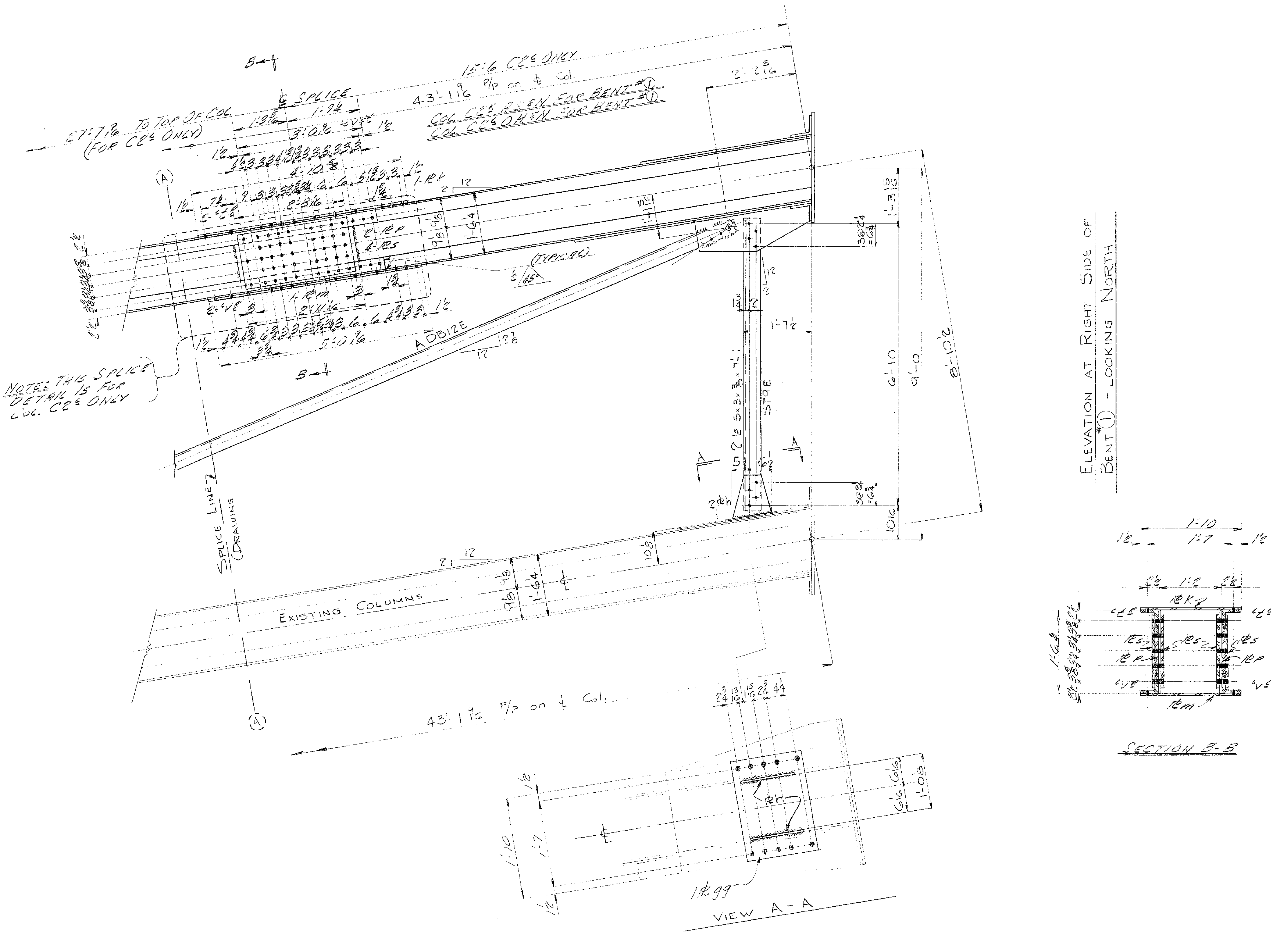
MADE BY	DAL	11-29-49	ORDER NO.	3807
CHECKED BY	RA	2-8-50	SHEET NO.	D11-E

5468.90

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	[illegible]	9D23(3)	1950	91	304

11/8/50

Order No. 3807 **Sheet No.** D12-E



BILL OF MATERIAL

INDUS. DEV. Co.

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
1	COLUMN			C2R	KEALAHAKA
	SHEET D11E & D12E				
1	COLUMN			C2L	Do
	SHEET D11E & D12E				
2	STRUTS	6	10 3/4	ST7E	
2	Do	7	2 3/4	ST8E	
2	Do	7	1	ST9E	
2	DIAG. BRACE	12	4 1/4	ADB11E	
2	Do	28	11 7/8	ADB12E	
4	℔ 16 1/2 × 3/8	1	6 1/2	a	Temp New
4	℔ 6 × 3/8	1	4	b	Do Do
2	℔ 18 × 3/8	1	10	c	
2	℔ 22 × 1/2	3	0 1/2	d	
2	℔ 9 1/2 × 11/16	2	9 1/2	f	
4	℔ 16 1/4 × 1/2	2	6 1/2	g	
4	℔ 11 1/2 × 1/2	1	1	h	
2	℔ 15 1/2 × 1/2	1	10	gg	
1	℔ 22 × 1/2	4	10 5/8	k	
1	℔ 22 × 1/2	5	0 1/2	m	
2	℔ 9 1/2 × 11/16	2	11	p	
4	℔ 16 1/4 × 1/2	2	8	s	
2	∠ 4 × 4 × 11/16	3	0 1/2	tL	
2	∠ 4 × 4 × 11/16	3	0 1/2	vL	
SEE SHT. D38E FOR DETAILS					
OF DIAG. BRACES & STRUTS					

Rivets: 7/8 ϕ

Holes: 15/16 ϕ

Paint:

INDUSTRIAL DEV. CO.

ADDITION TO NANUE BRIDGE
HAWAII

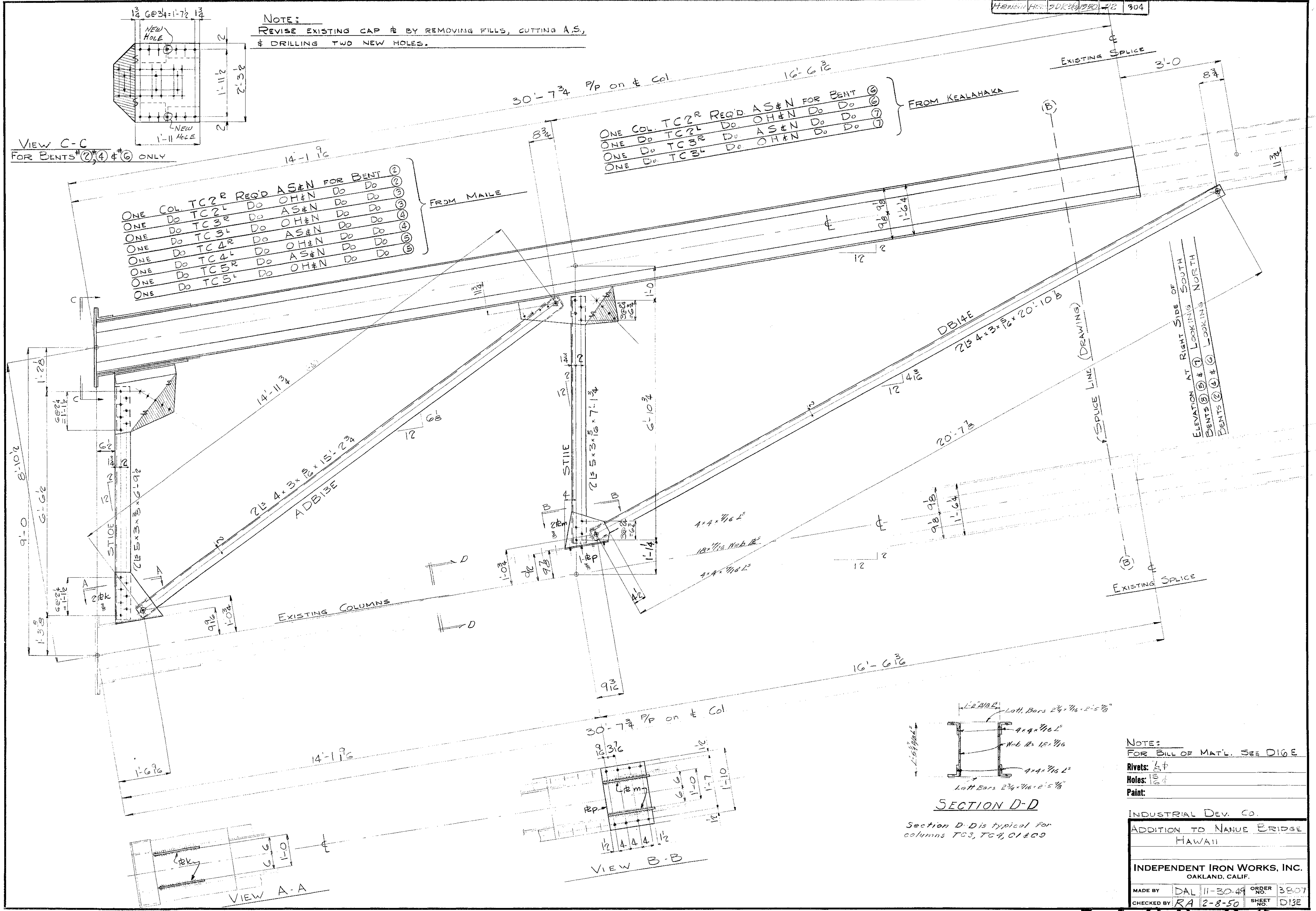
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	11-30-49	ORDER NO.	3807
CHECKED BY	RA	2-8-50	SHEET NO.	D12-E

5468.91

Order No. 3807 **Sheet No.** D13E

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw.	SDR2(3)	1950	72	304



Note:
Revise existing cap Pl by removing fills, cutting A.S., & drilling two new holes.

One Col. TC2R Req'd AS&N for Bent ②
One Do TC2L Do OH&N Do Do ②
One Do TC3R Do AS&N Do Do ③
One Do TC3L Do OH&N Do Do ③
One Do TC4R Do AS&N Do Do ④
One Do TC4L Do OH&N Do Do ④
One Do TC5R Do AS&N Do Do ⑤
One Do TC5L Do OH&N Do Do ⑤
From Maile

One Col. TC2R Req'd. AS&N for Bent ⑥
One Do TC2L Do OH&N Do Do ⑥
One Do TC3R Do AS&N Do Do ⑦
One Do TC3L Do OH&N Do Do ⑦
From Kealahaka

Section D-D

Section D-D is typical for columns TC3, TC4, C1 & C9

Note:
For Bill of Mat'l. See D16E

Rivets: ⅞ф
Holes: 15/16ф
Paint:

Industrial Dev. Co.

Addition to Nanue Bridge
Hawaii

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	11-30-49	ORDER NO.	3807
CHECKED BY	RA	2-8-50	SHEET NO.	D13E

5468.92 72.

Order No. 3807 **Sheet No.** D14E

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR 3(13)	1950	93	304

Note:
For Bill of Mat'l. See D16E

Rivets: 7/8 ϕ

Holes: 15/16 ϕ

Paint:

Industrial Dev. Co.

Addition to Nanue Bridge
Hawaii

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

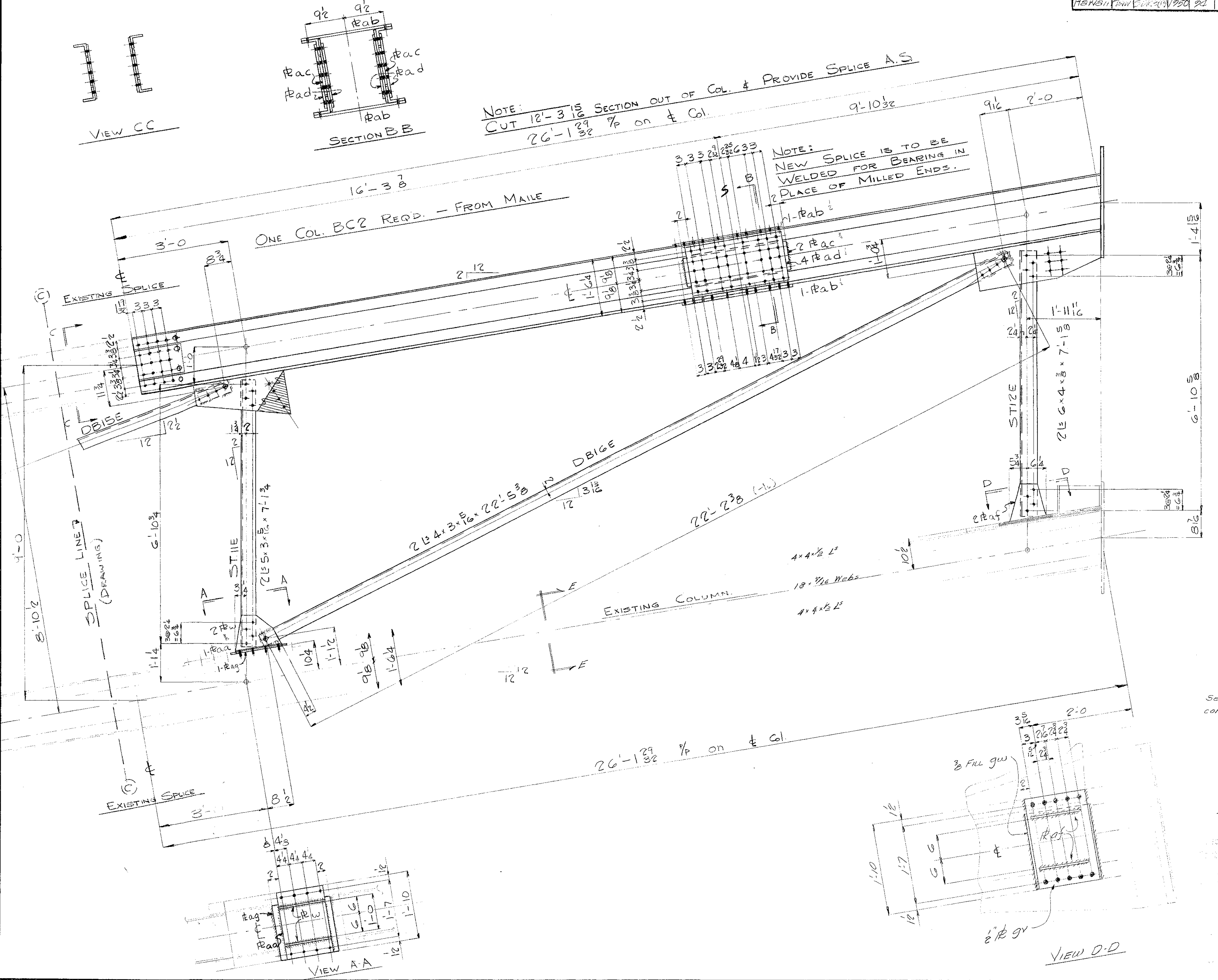
MADE BY	DAL	12-2-49	ORDER NO.	3807
CHECKED BY	RA	2-8-50	SHEET NO.	D14E

5468.93

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	S-0C-2(4)	1950	24	304

Order No. 3807 **Sheet No.** D15E

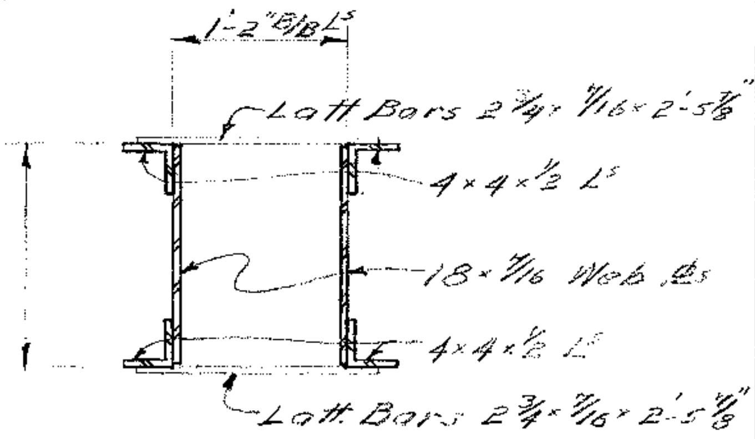
gv
gw



Note:
Cut 12'-3 15/16 Section out of Col. & Provide Splice A.S.

Note:
New Splice is to be Welded for Bearing in Place of Milled Ends.

Elev. at Right Side of Bent #2 Looking North



SECTION E-E

Section E-E is typical for columns BC2, BC8, MD2 & TC2

For Bill of Mat'l See D16-E

Rivets: ⅞ ϕ
Holes: 15/16 ϕ
Paint:

INDUSTRIAL DEVELOPMENT CO.

ADDITION TO NANUE BRIDGE
HAWAII

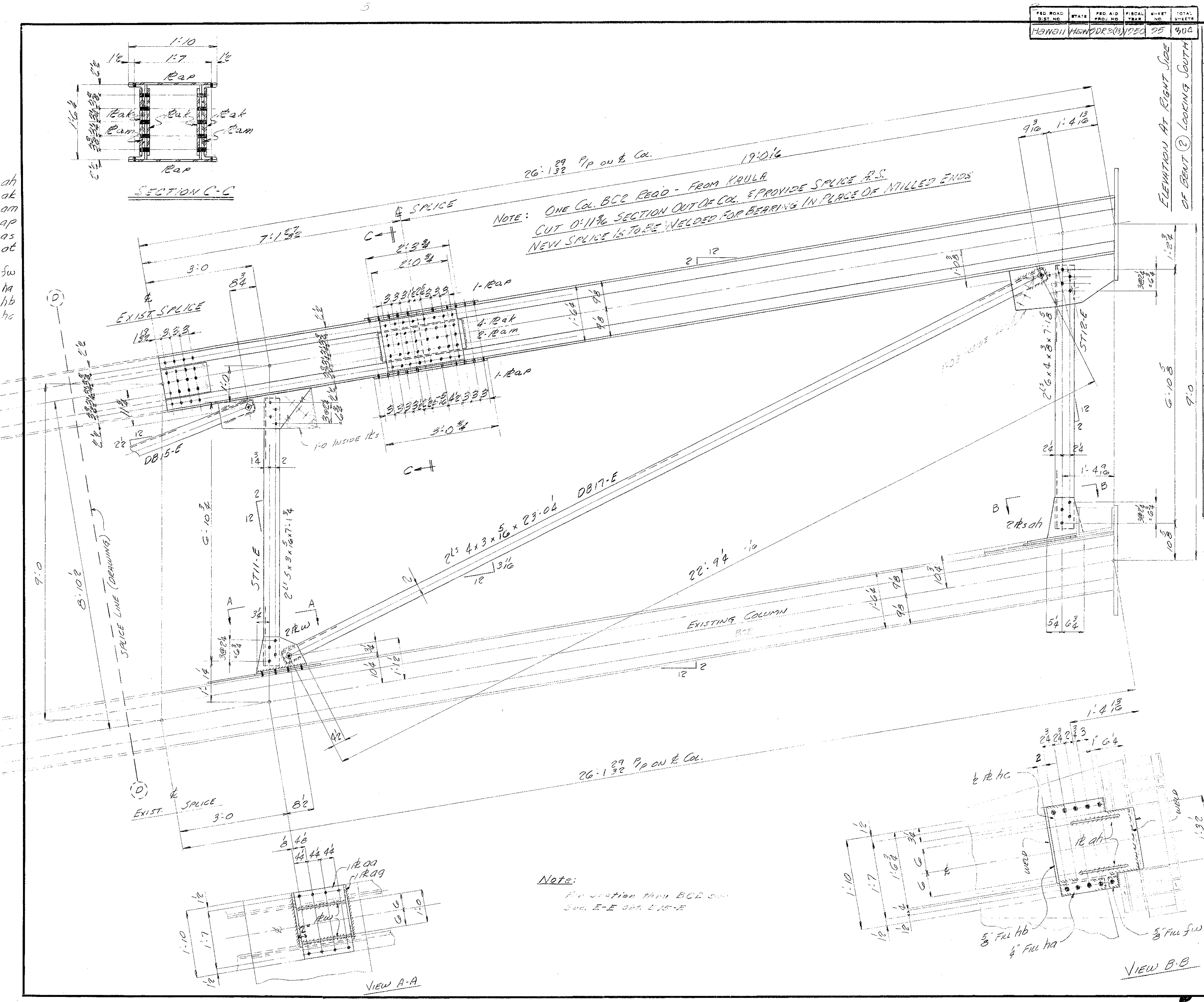
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	12-2-49	ORDER NO.	3807
CHECKED BY	RA	2-8-50	SHEET NO.	D15E

5468.94

Order No. 3807 **Sheet No.** D16E

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	DR3(3)	1950	25	304



NOTE: ONE COL. BC2 REQ'D - FROM KAULA
CUT 0'-11 5/16 SECTION OUT OF COL. & PROVIDE SPLICE R.S.
NEW SPLICE IS TO BE WELDED FOR BEARING IN PLACE OF MILLED ENDS

Note:
For section thru BC2 see Sec. E-E Sht. D15-E

BILL OF MATERIAL INDUS. DEV. CO.

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
1	COLUMN			$TC2^{R}$	MAILE D13-E
1				$TC2^{L}$	
1				$TC3^{R}$	
1				$TC3^{L}$	
1				$TC4^{R}$	
1				$TC4^{L}$	
1				$TC5^{R}$	
1				$TC5^{L}$	MAILE
1				$TC2^{R}$	KEALAHAKA
1				$TC2^{L}$	
1				$TC3^{R}$	
1				$TC3^{L}$	KEALAHAKA D13-E
1				$MD2^{R}$	MAILE D14-E
1				$MD2^{L}$	
2				$MD3^{R}$	
2				$MD3^{L}$	
1				$MD4^{R}$	
1				$MD4^{L}$	MAILE
2				$MD3^{R}$	KEALAHAKA
2				$MD3^{L}$	KEALAHAKA D14-E
1				BC2	MAILE D15-E
1	COLUMN			BC2	KAULA
16	STRUTS			ST10-E	
36	STRUTS			ST11-E	
2	STRUTS			ST12-E	
12	DIAG BRACE			ADB13-E	
12				DB14-E	
22				DB15-E	
1				DB16-E	
1	DIAG BRACE			DB17-E	
24	℞ 16½ × ⅜	1	6	k	TEMP
24	℞ 12 × ⅜	1	2½	m	
12	℞ 15 × ⅜	1	10	p	
12	℞ 15¾ × ⅜	1	10	s	
28	℞ 11½ × ⅜	1	3¾	w	
2	℞ 15¾ × ⅜	1	10	aa	
2	℞ 22 × ½	2	11½	ab	
2	℞ 9½ × ¾	2	6	ac	
4	℞ 16 × ½	2	5⅛	ad	
2	℞ 12 × ½	1	1	af	
14	℞ 16¾ × ⅜	1	6	ag	
2	℞ 12 × ½	1	3	ah	
4	℞ 16 × 7/16	2	0¾	ak	
2	℞ 9½ × ¾	2	3¾	am	
2	℞ 22 × 7/16	3	0¾	ap	
1	℞ 14¼ × ½	1	10	gv	
1	℞ 15¼ × ⅜	1	6	gw	
1	℞ 3 × ¼		11¼	ha	
1	℞ 18¾ × ⅝	1	6¾	hb	
1	℞ 20 × ½	1	10	hc	
1	℞ 1¾ × ⅝		3	fw	TEMP

NEW MAT'L

Rivets: ⅞ ɸ
Holes: 15/16 ɸ
Paint:

INDUSTRIAL DEVELOPMENT CO.

ADDITION TO NANUE BRIDGE
HAWAII

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		12-15-49	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D16E

5468.95

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	96	304

Order No. 3807 **Sheet No.** D17 E

Note:
For section thru existing column see Sec. B-B sht D22-E.

Note

For Bill of Mat'l See D20-E

Rivets: 7/8 ϕ
Holes: 15/16 ϕ
Paint:

Industrial Development Co

Addition To Nanue Bridge
Hawaii

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		12-16-49	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D17E

5468.96

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR 3(13)	1950	97	304

Order No. 3807 **Sheet No.** D18 E

Note:
For section thru existing column
see Sec. B-B sht D22-E

Note

For Bill of Mat'l See D20-E

Rivets: 7/8 ⌀
Holes: 15/16 ⌀
Paint:

Industrial Development Co

Addition To Nanue Bridge
Hawaii

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

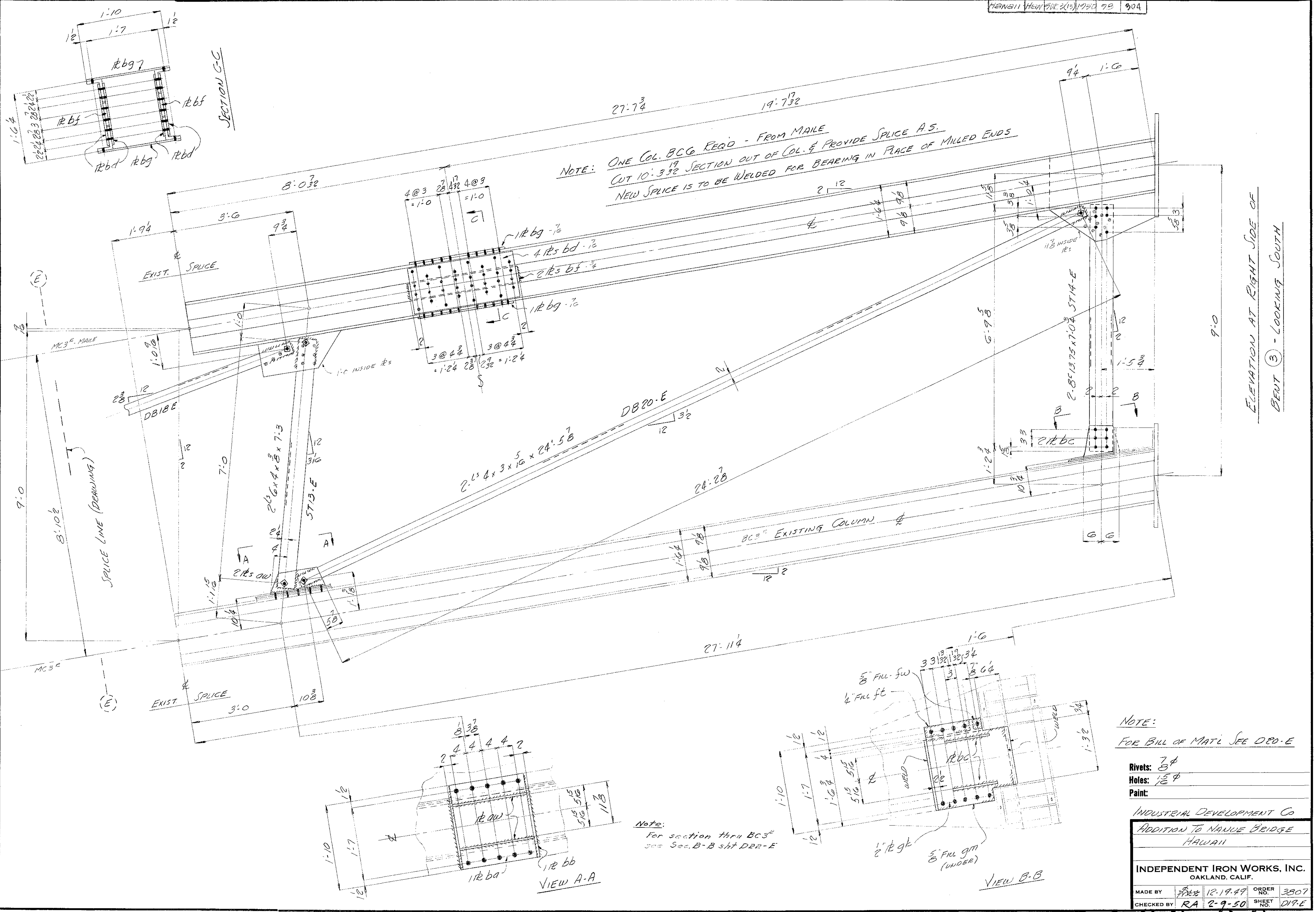
MADE BY		12-16-49	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D18E

5468.97

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	FDR 2(13)	1950	98	304

Order No. 3807 **Sheet No.** 019-E

aw
ba
bb
bc
bd
bf
bg
ft
fw
gk
gm



ELEVATION AT RIGHT SIDE OF BENT ③ - LOOKING SOUTH

NOTE: ONE COL. BC6 REQ'D - FROM MAILE
CUT 10'-3 19/32 SECTION OUT OF COL. & PROVIDE SPLICE A.S.
NEW SPLICE IS TO BE WELDED FOR BEARING IN PLACE OF MILLED ENDS

Note:
For section thru BC3C see Sec. B-B sht D22-E

NOTE:
FOR BILL OF MAT'L SEE D20-E

Rivets: 7/8 ⌀
Holes: 15/16 ⌀
Paint:

INDUSTRIAL DEVELOPMENT CO

ADDITION TO NANUE BRIDGE
HAWAII

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

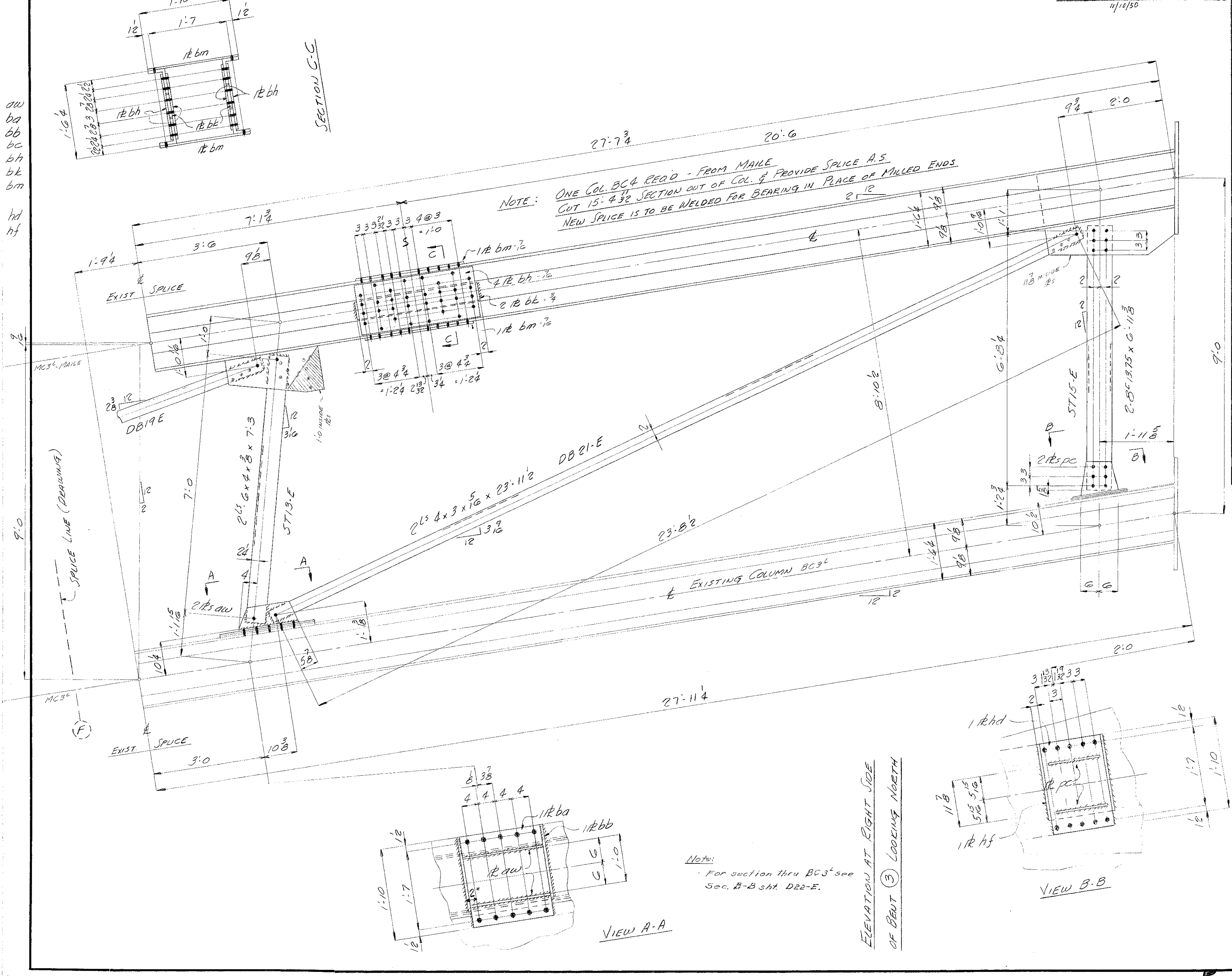
MADE BY		12-19-49	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	019-E

5468.98 98

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR 3(13)	1950	99	304

11/10/50

Order No. 3807 **Sheet No.** D20-E



SECTION C-C

NOTE: ONE COL. BC4 REQ'D - FROM MAILE
CUT 15'-4 11/32 SECTION OUT OF COL. & PROVIDE SPLICE A.S.
NEW SPLICE IS TO BE WELDED FOR BEARING IN PLACE OF MILLED ENDS

ELEVATION AT RIGHT SIDE
OF BENT ③ LOOKING NORTH

VIEW A-A

Note:
For section thru BC3L see Sec. B-B sht. D22-E.

VIEW B-B

BILL OF MATERIAL

INDUSTRIAL DEVELOPMENT COMPANY

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
1	COLUMN			MC3^{R}	MAILE D17E
1	COLUMN			MC3^{L}	MAILE D18E
1	COLUMN			BC6	MAILE D19E
1	COLUMN			BC4	MAILE
2	STRUTS			ST13E	
1	STRUT			ST14-E	
1	STRUT			ST15-E	
1	DIAG BRACE			DB18-E	
1	DO DO			DB19-E	
1	DO DO			DB20-E	
1	DO DO			DB21-E	
1	⅊ 15 x 1/2	1	10	hd	TEMP NEW MAT'L
1	⅊ 16 x 3/8	1	6 3/4	hf	
1	⅊ 3 x 1/4	1	0	ft	
1	⅊ 1 3/4 x 5/8		3	fw	
1	⅊ 20 7/8 x 1/2	1	10	gk	
4	⅊ 11 1/2 x 3/8	1	3 3/4	w	
2	⅊ 15 3/4 x 3/8	1	10	aa	
2	⅊ 16 3/4 x 3/8	1	6	ag	
4	⅊ 15 x 1/16	1	4	av	
4	⅊ 6 3/4 x 3/8	1	7	aw	
2	⅊ 19 x 3/8	1	10	ba	
2	⅊ 20 x 3/8	1	6	bb	
4	⅊ 16 x 7/16	3	0 1/4	bd	
2	⅊ 5 3/4 x 3/4	3	1 1/4	bf	
2	⅊ 22 x 7/16	2	10 1/2	bg	
4	⅊ 16 x 7/16	3	1 1/4	bh	
2	⅊ 5 3/4 x 3/4	3	2 1/4	bk	
2	⅊ 22 x 7/16	2	9 3/4	bm	
2	⅊ 12 x 1/2	1	0 1/4	pc	
1	⅊ 18 3/4 x 5/8	1	8	gm	TEMP
MATERIAL LISTED ABOVE IS FOR DWG'S- D17E, 18-E, & 19-E, D20-E					
MATERIAL LISTED BELOW IS FOR DWG'S D21-E, 22-E, & 23-E					
4	COLUMNS			MD3$^{R}_{L}$	KEALAHAKA D21-E
8	COLUMNS			MC4$^{R}_{L}$	KEALAHAKA D22-E
2	COLUMNS			BC1$^{R}_{L}$	KAULA D23-E
8	STRUTS			ST16-E	
2	STRUTS			ST17-E	
2	STRUTS			ST-18-E	
2	DIAG BRACE			DB22-E	
2	DIAG BRACE			DB32-E	
24	⅊ 11 1/2 x 3/8	1	3 3/4	w	TEMP NEW MAT'L
14	⅊ 15 3/4 x 3/8	1	10	aa	
14	⅊ 16 3/4 x 3/8	1	6	ag	
8	⅊ 12 x 3/8	1	4	bp	
4	⅊ 11 1/2 x 3/8	1	4	bs	
4	⅊ 22 x 7/16	2	10	pa	
8	⅊ 16 x 7/16	2	4	pb	
4	FILL 15 7/8 x 1/16	1	4	bw	
8	⅊ 3 15/16 x 11/16		4	ca	
4	⅊ 3 15/16 x 1/8	1	4 7/8	cb	
4	⅊ 12 x 1/2	1	1	gh	
2	⅊ 1 3/4 x 5/8		3	fw	
2	⅊ 3 x 1/4		11 1/4	ha	
2	⅊ 18 3/4 x 5/8	1	8	bb	
2	⅊ 20 x 1/2	1	10	hc	TEMP

Rivets: 7/8"
Holes: 15/16"
Paint:

INDUSTRIAL DEVELOPMENT CO

ADDITION TO NANUE BRIDGE
HAWAII

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		12-20-49	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D20-E

5468.99

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR 3(13)	1950	100	304

Order No. 3807 **Sheet No.** D21-E

Note

For Bill of Mat'l See D20-E

Note:

For section thru MC4 see Sec. B-B, sht. D22-E

Rivets: 7/8 ⌀

Holes: 15/16 ⌀

Paint:

Industrial Development Co

Addition To Nanue Bridge
Hawaii

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		12-21-49	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D21-E

5468.100

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	101	304

Order No. 3807 **Sheet No.** D22-E

SECTION B-B

Section B-B is typical for columns MC3, MC4, MC7 & BC3. For section thru columns MB4 & MB5 see Sec. B-B, sht. D25E.

NOTE

For Bill of Mat'l See D20-E

Rivets: 7/8 ⌀
Holes: 15/16 ⌀
Paint:

Industrial Development Co

Addition To Nanue Bridge
Hawaii

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		12-22-49	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D22-E

5468.101

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(1)	1950	102	704

NOTE: 2 Cols B.C1 R-AS L-OH - From Kaula
Add 3 13/16 Section To Top of Col. & Provide Splice A.S.
New Splice is to be Welded For Bearing in Place of Milled Ends

NOTE
For Bill of Mat'l See Dwg D20-E

REVISIONS

INDEPENDENT IRON WORKS Ltd.
OAKLAND, CALIFORNIA

ITEM Addition To Nanue Bridge Hawaii					
CUSTOMER Industrial Development Co				JOB NO. 3807	
DR'FTS'M'N	CHECKED	APPRV'D	NEXT ASSEMBLY	SCALE	DRWG. NO.
	RA				D23-E
1-13-50	2-9-50				

THIS PRINT MUST NOT BE COPIED IN WHOLE OR IN PART OR USED DETRIMENTALLY TO OUR INTEREST

5468.102

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR 2(13)	1950	103	304

Order No. 3807 **Sheet No.** D24-E

ELEVATION AT RIGHT SIDE OF BENT (5) - LOOKING SOUTH

Note:
For section thru MA5R see
Sec. B-B, sht. D24-E.

NOTE
FOR BILL OF MAT'L SEE D26-E

Rivets: 7/8 ϕ
Holes: 15/16 ϕ
Paint:

INDUSTRIAL DEVELOPMENT CO

ADDITION TO NANUE BRIDGE
HAWAII

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	Str	12-28-49	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D24-E

5468.103

FED. ROAD DIST. NO.	STATE	FED. AID PROJ NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	EDR 3(1)	1950	104	304

Order No. 3807 **Sheet No.** D25-E

aa
ag
cf

VIEW A-A

SECTION B-B

Section B-B is typical for columns MB4, MB5 & MB6

ELEVATION AT RIGHT SIDE OF BENT (6) - LOOKING NORTH

NOTE

FOR BILL OF MAT'L SEE D26-E

Rivets: 7/8 ϕ
Holes: 15/16 ϕ
Paint:

INDUSTRIAL DEVELOPMENT Co

ADDITION TO NANUE BRIDGE
HAWAII

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		12-28-49	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D25-E

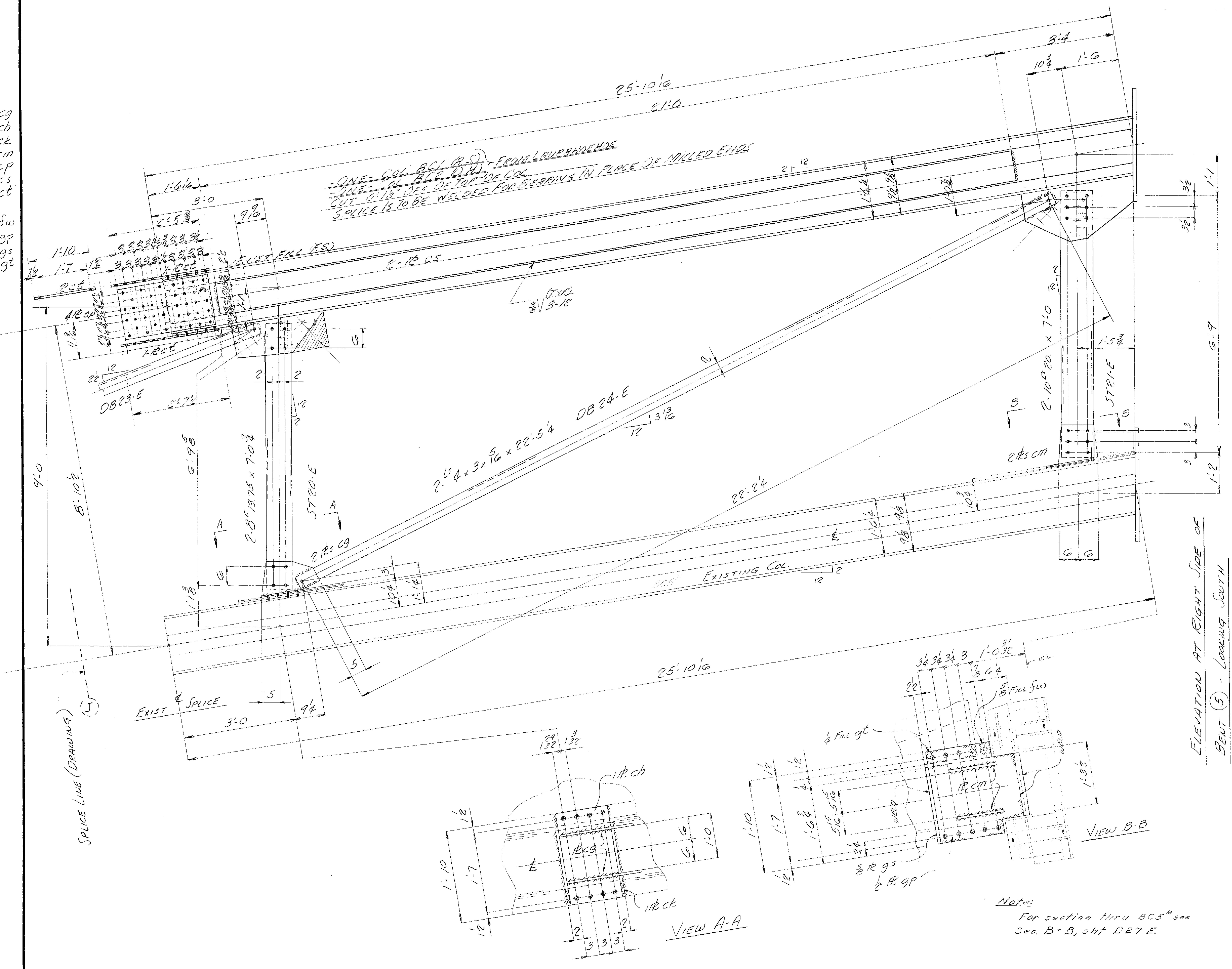
a

546S.104

96 4

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	FDR-2(12)	1950	105	304

Order No. 3807 **Sheet No.** D26-E



ELEVATION AT RIGHT SIDE OF BENT ⑤ - LOOKING SOUTH

Note:
For section thru BC5R see Sec. B-B, sht D27 E.

BILL OF MATERIAL INDUSTRIAL DEVELOPMENT COMPANY

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
2	COLUMNS			MB5 R/L	KEALAHAKA D24-E
1	COLUMN			BC1	LAUPAHOEHOE
2	STRUTS			ST19-E	
2	STRUTS			ST20-E	
6	STRUTS			ST21-E	
4	DIAG BRACE			DB23-E	
2	DIAG BRACE			DB24-E	
1	COLUMN			BC2	LAUPAHOEHOE
2	Pℓ 21 3/8 x 1/2	1	10	gp	TEMP
2	Pℓ 18 3/4 x 5/8	1	9	gs	
2	Pℓ 3 x 1/4	1	0 3/4	gt	
2	Pℓ 20 x 3/8	1	10	bt	
2	Pℓ 18 x 3/8	1	9	bv	
4	Pℓ 11 x 3/8	1	8	cd	
4	Pℓ 11 x 3/8	1	6 1/4	cg	
2	Pℓ 12 x 3/8	1	10	ch	NEW MAT'L
2	Pℓ 13 x 3/8	1	6	ck	
4	Pℓ 12 x 1/2	1	0	cm	
8	Pℓ 16 x 7/16	2	5 3/8	cp	
4	Pℓ 13 3/8 x 3/8	21	0	cs	
4	Pℓ 22 x 7/16	2	7 1/2	ct	TEMP
2	Pℓ 1 3/4 x 5/8		3	fw	TEMP
	MAT'L LISTED ABOVE ARE FOR				
	DWG'S-D24-E & D26-E				
	MAT'L LISTED BELOW ARE FOR				
	DWG'S-D25-E, D27-E & D28-E				
2	COLUMNS			MB5 R/L	KEALAHAKA D25-E
2	COLUMNS			MB5 R/L	Do D27-E
2	COLUMNS			BC4 R/L	Do D28-E
2	STRUTS			ST22-E	
2	STRUTS			ST23-E	
2	DIAG BRACE			DB25-E	
2	DIAG BRACE			DB26-E	
2	Pℓ 15 3/4 x 3/8	1	10	aa	TEMP
2	Pℓ 16 3/4 x 3/8	1	6	ag	
2	Pℓ 20 x 3/8	1	10	bt	
2	Pℓ 18 x 3/8	1	9	bv	
4	Pℓ 11 1/2 x 3/8	1	3 3/4	cf	
4	Pℓ 12 x 1/2	1	0	cm	
4	Pℓ 11 3/4 x 3/8	1	8	cv	NEW MAT'L
4	Pℓ 5 3/4 x 5/8	3	1 3/4	cw	
8	Pℓ 16 x 7/16	3	0 3/4	da	
4	Pℓ 22 x 7/16	2	9 5/8	db	
2	Pℓ 15 x 3/8	1	10	dc	
2	Pℓ 16 x 3/8	1	6	dd	
4	Pℓ 10 3/4 x 3/8	1	3	df	TEMP
2	Pℓ 5/8 x 1 3/4	0	3	fw	Do
2	Pℓ 1/4 x 3	1	0 3/4	ft	Do.
2	Pℓ 1/2 x 21 3/8	1	10	gk	Do.
2	Pℓ 5/8 x 18 3/4	1	10	gm	Do.

Rivets: 7/8 φ
Holes: 15/16 φ
Paint:

INDUSTRIAL DEVELOPMENT CO

ADDITION TO NANUE BRIDGE
HAWAII

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	R.L.S.	12-29-49	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D26-E

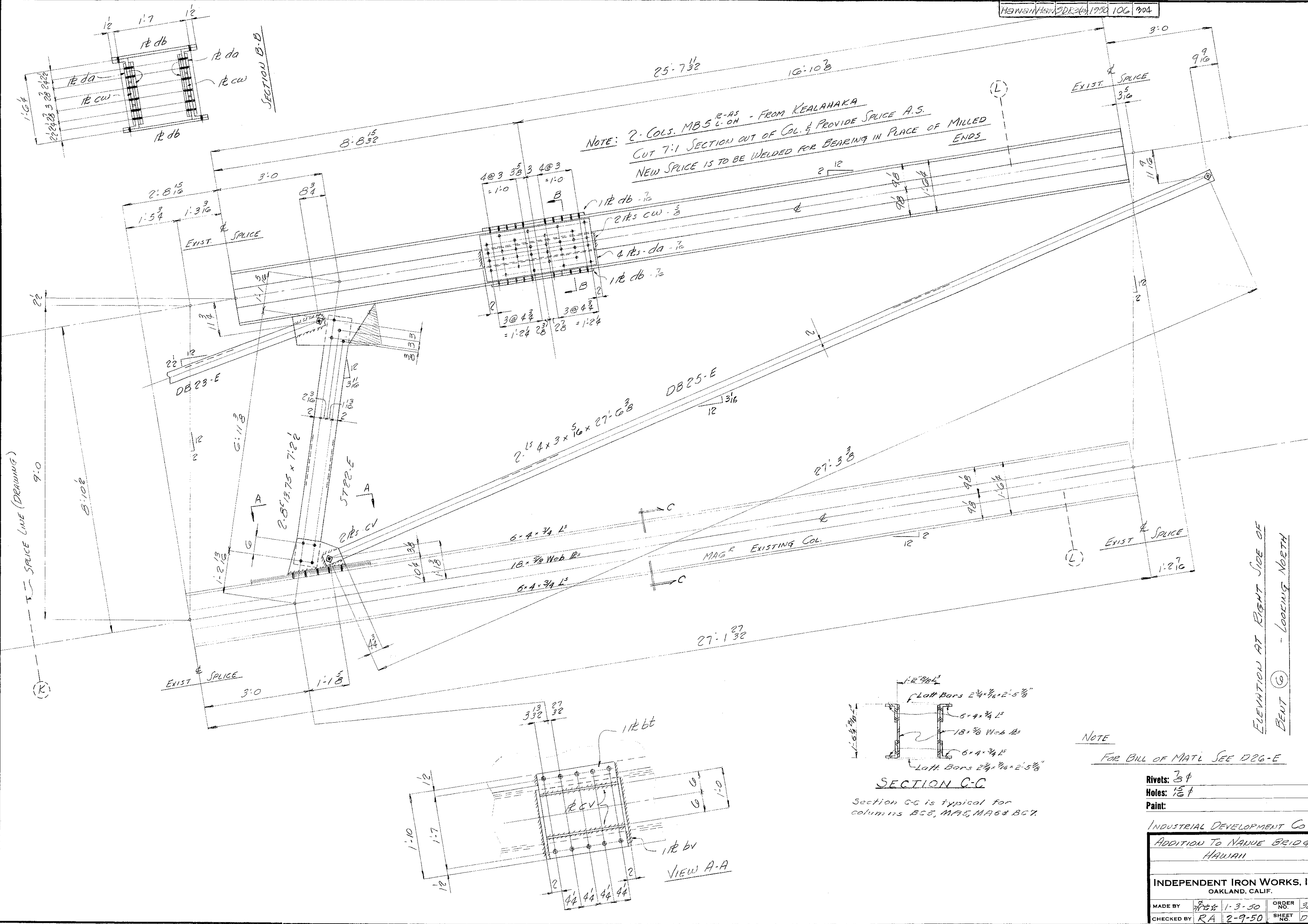
5468.105

11

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR-2(3)	1950	106	304

Order No. 3807 Sheet No. D27-E

bt
bv
cv
cw
da
db



NOTE: 2-COLS. MB5 R-AS L-OH - FROM KEALAHAKA
CUT 7:1 SECTION OUT OF COL. & PROVIDE SPLICE A.S.
NEW SPLICE IS TO BE WELDED FOR BEARING IN PLACE OF MILLED ENDS

SECTION C-C

Section C-C is typical for columns BC5, MA5, MA6 & BC7.

NOTE

FOR BILL OF MAT'L SEE D26-E

Rivets: 7/8 φ
Holes: 15/16 φ
Paint:

INDUSTRIAL DEVELOPMENT CO

ADDITION TO NANUE BRIDGE
HAWAII

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		1-3-50	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D27-E

546S.106

12

13

FED. ROAD DIST. NO	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO	TOTAL SHEETS
Hawaii	Haw	SDR 3(3)	1950	107	304

Order No. 3807 **Sheet No.** D28-E

cm
dc
dd
df
ft
fw
gk
gm

Elevation at Right Side of Bent ⑥ - Looking North

Note

For Bill of Mat'l See D26-E

Rivets: 7/8 ø

Holes: 15/16 ø

Paint:

Industrial Development Co

Addition To Nanue Bridge
Hawaii

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	[illegible]	1-4-50	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D28-E

54GS.107

14

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDE-2(2)	1950	108	304

Order No. 3807 **Sheet No.** D29-E

Note: 2 Cols. BC2 R-AS L-OH - From Kealahaka
Cut 3'-1 17/32 Section out of Col. & Provide Splice A.S.
New Splice is to be Welded for Bearing in Place of Milled Ends

Note: For section thru BC7R see Sec. B-B, sht. D27-E

Note:
For Bill of Mat'l See D33-E

Rivets: 7/8 ϕ
Holes: 15/16 ϕ
Paint:

Industrial Development Co.

Addition to Nanue Bridge
Hawaii

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		1-5-50	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D29-E

5468.108

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	[illegible]	[illegible]	1950	[illegible]	404

Order No. 3807 **Sheet No.** D30-E

ds
dt
dv
dw
fa
fb
fc
fd

Note:
For section thru TC4 see Sec. D-D, sht. D13-E.

Note:-
For Bill of Mat'l. See D33-E

Rivets: ⅞ ⌀
Holes: 15/16 ⌀
Paint:

Industrial Development Co

Addition to Nanue Bridge
Hawaii

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	[illegible]	1-6-50	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D30-E

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	9DR3(13)	1950	110	304

Order No. 3807 **Sheet No.** D31-E

NOTE: 2 COLS. BC3 R-AS L-OH - FROM KEALAHAKA
CUT 10 3/32 SECTION OUT OF COL. & PROVIDE SPLICE A.S.
NEW SPLICE IS TO BE WELDED FOR BEARING IN PLACE OF MILLED ENDS

Note:
For section thru BC8R see Sec. E-E, sht. D15-F.

ELEVATION AT RIGHT SIDE OF BENT ⑧ - LOOKING NORTH

NOTE
FOR BILL OF MAT'L SEE D33-E

Rivets: ⅞ ϕ
Holes: 15/16 ϕ
Paint:

INDUSTRIAL DEVELOPMENT CO.

ADDITION TO NANUE BRIDGE
HAWAII

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

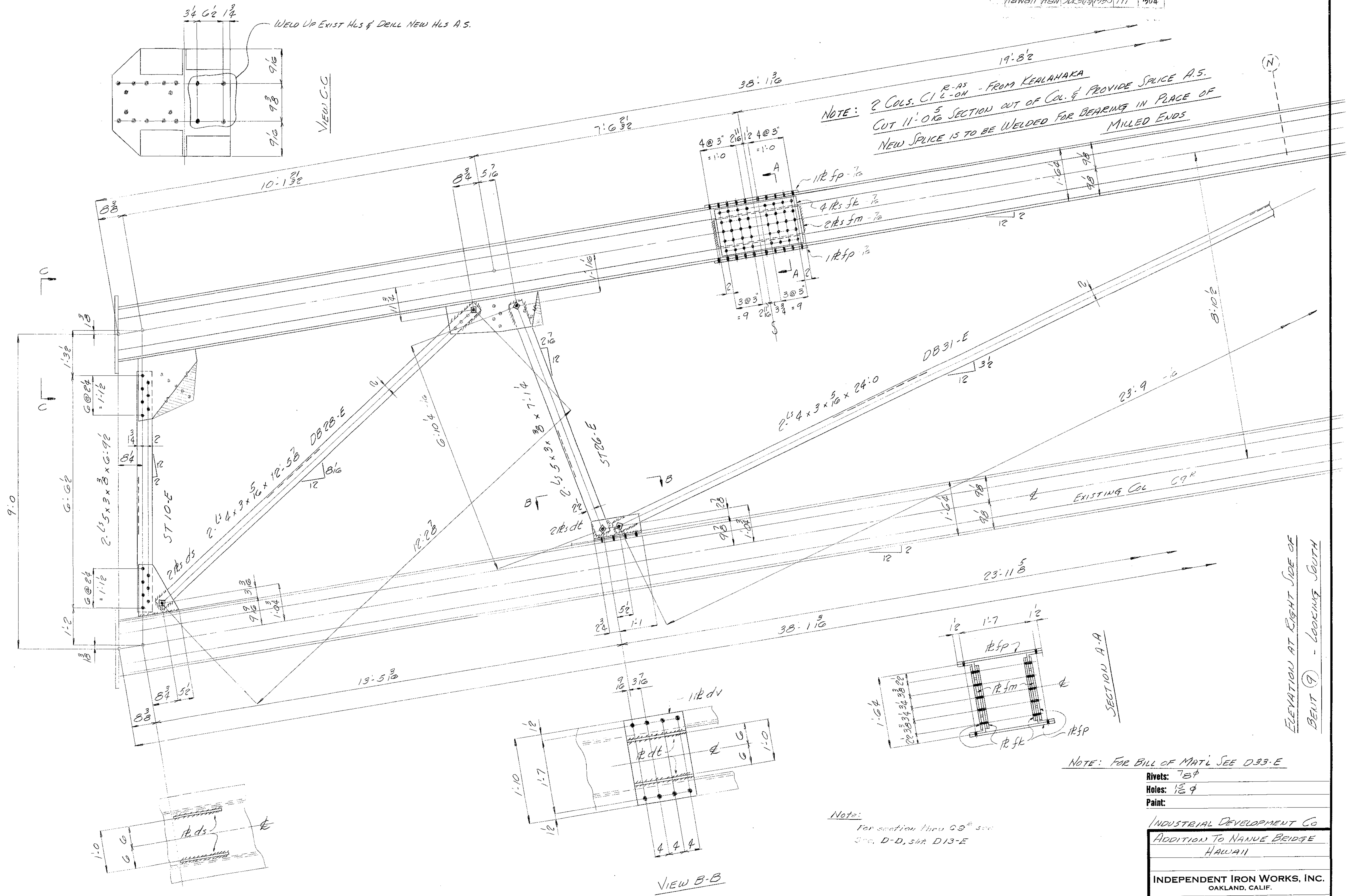
MADE BY		1-9-50	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D31-E

546S.110

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	111	304

Order No. 3807 **Sheet No.** D32-E

ds
dt
dv
fk
fm
fp



Note: 2 Cols. C1 $^{R-AS}_{L-OH}$ - From Kealahaka
Cut 11'-0 5/16 Section out of Col. & Provide Splice A.S.
New Splice is to be Welded for Bearing in Place of Milled Ends

Note:
For section thru C9R see
Sec. D-D, sht. D13-E

Note: For Bill of Mat'l See D33-E

Rivets: ⅞ ϕ
Holes: 15/16 ϕ
Paint:

Industrial Development Co

Addition To Nanue Bridge
Hawaii

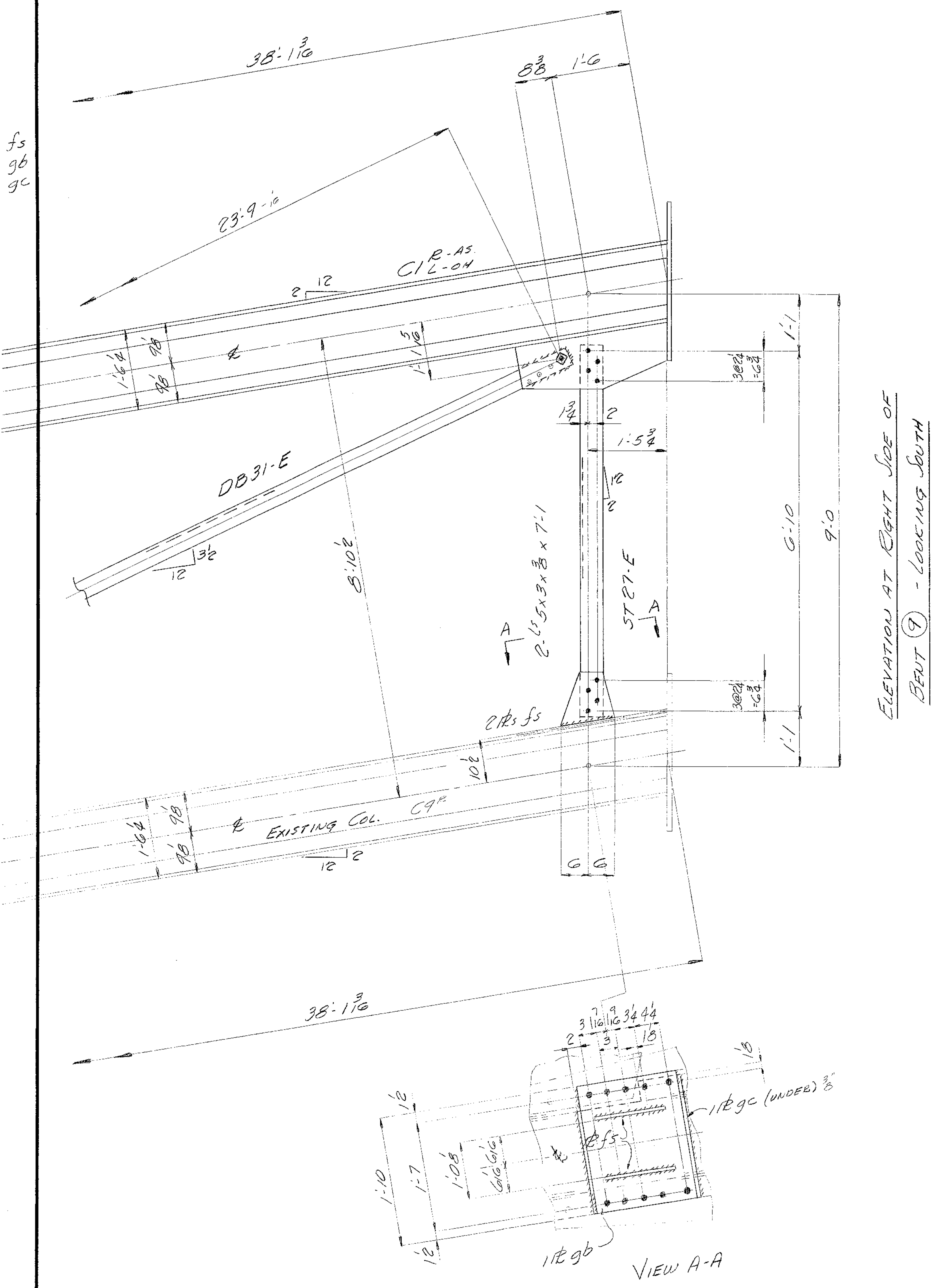
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY		1-10-50	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D32-E

5468.111

FED. ROAD DIST. NO	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO	TOTAL SHEETS
Hawaii	Haw	SOK3(13)	1950	112	704

Order No. 3807 Sheet No. D33-E



ELEVATION AT RIGHT SIDE OF BENT ⑨ - LOOKING SOUTH

BILL OF MATERIAL
INDUSTRIAL DEVELOPMENT COMPANY

No.	Description	Length		Mark	REMARKS
		Ft.	Ins.		
2	Columns			BC2 R L	Kealahaka D29-E
2	Do			TC1 R L	Do D30-E
2	Do			BC3 R L	Do D31-E
2	Do			C1 R L	Do D32-E D33-E
2	Struts			ST24-E	
2	Do			ST25-E	
4	Do			ST26-E	
2	Do			ST27-E	
2	Diag Braces			DB27-E	
4	Do			DB28-E	
2	Do			DB29-E	
2	Do			DB30-E	
2	Do			DB31-E	
Mat'l listed below is for					
Shts. D29-E thro D33-E					
4	PL 11 1/2 x 3/8	1	3 3/4	w	Temp
2	PL 15 3/4 x 3/8	1	10	aa	
2	PL 16 3/4 x 3/8	1	6	ag	
4	PL 12 x 1/2	1	0	dg	
8	PL 12 x 3/8	1	4	dh	
4	PL 22 x 7/16	2	9 1/2	dk	
4	PL 9 1/2 x 5/8	2	2 1/2	dm	
8	PL 16 x 7/16	2	1 1/2	dp	
8	PL 14 x 3/8	1	7 3/4	ds	
8	PL 6 x 3/8	1	3 3/4	dt	
4	PL 15 x 3/8	1	10	dv	
2	PL 16 x 3/8	1	10	dw	
2	PL 17 x 3/8	1	10	fa	
4	PL 12 1/2 x 3/8	1	4	fb	New Mat'l
4	PL 16 x 3/8	1	6	fc	
4	PL 3 x 3/16	1	6	fd	
8	PL 16 x 7/16	2	11 5/8	ff	
4	PL 6 x 3/4	3	0 1/2	fg	
4	PL 22 x 7/16	2	8 3/8	fh	
8	PL 16 x 7/16	2	3 1/2	fk	
4	PL 9 1/2 x 7/16	2	4 1/2	fm	
4	PL 22 x 7/16	2	7 1/4	fp	
4	PL 12 x 1/2	1	1	fs	
2	PL 3 x 1/4	1	0	ft	
2	PL 18 3/4 x 5/8	1	8 1/2	fv	
2	PL 1 3/4 x 5/8		3	fw	
2	PL 21 1/8 x 1/2	1	10	ga	
2	PL 16 1/2 x 1/2	1	10	gb	
2	PL 17 1/2 x 3/8	1	9 5/8	gc	
2	PL 16 1/4 x 1/2	1	10	gd	
2	PL 17 1/4 x 3/8	1	10	gf	
4	PL 12 x 1/2	1	0	pd	
8	PL 12 x 3/8	1	4	pf	Temp

Rivets: 7/8 ϕ

Holes: 15/16 ϕ

Paint:

Industrial Development Co

Addition to Nanue Bridge
Hawaii

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	[illegible]	1-10-50	ORDER NO.	3807
CHECKED BY	RA	2-9-50	SHEET NO.	D33-E

5468.112

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	113	304

NOTE
FOR BILL OF MAT'L SEE DWG D37-E

RIVS. ⅞ϕ HOLES 15/16ϕ U.N.

WEST ELEV. (AS) AT BENT ⑧ & ⑨
EAST ELEV. (O.H.) AT DO DO DO

REVISIONS

INDEPENDENT IRON WORKS LTD.
OAKLAND, CALIFORNIA

ITEM ADDITION TO NANUE BRIDGE
HAWAII

CUSTOMER INDUSTRIAL DEV. CO.

JOB NO. 3807

DR'FTS'M'N	CHECKED	APPRV'D	NEXT ASSEMBLY	SCALE	DRWG. NO.
Ritz 1-24-50	DW 1-15-50				D34-E

THIS PRINT MUST NOT BE COPIED IN WHOLE OR IN PART OR USED DETRIMENTALLY TO OUR INTEREST

546S.113

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(1)	1950	114	304

EAST ELEVATION (AS&N) AT BENTS ② & ③
WEST ELEVATION (OH&N) AT Do. Do Do

NOTE
FOR BILL OF MAT'L SEE DWG D37-E

RIVS. 7/8 ϕ HOLES 15/16 ϕ U.N.

REVISIONS

INDEPENDENT IRON WORKS LTD.
OAKLAND, CALIFORNIA

ITEM ADDITION TO NANUE BRIDGE HAWAII					
CUSTOMER INDUSTRIAL DEVELOPMENT CO					JOB NO. 3807
DR'FTS'M'N	CHECKED	APPRV'D	NEXT ASSEMBLY	SCALE	DRWG. NO.
1-27-50	DM 1-15-50				D35-E

THIS PRINT MUST NOT BE COPIED IN WHOLE OR IN PART OR USED DETRIMENTALLY TO OUR INTEREST

5468.114

FED. ROAD	STATE	FED. AID	FISCAL	SHEET	TOTAL
Hawaii	Haw	SDK.3(13)	1950	115	704

East Elevation A.S. – West Elevation O.H.

For Bill of Material see Sheet D37A-E

Rivets: 7/8 ϕ Holes: 15/16 ϕ

ITEM	Addition to the Nanue Bridge Hawaii
CUSTOMER	Industrial Development Co.
JOB NO.	3807

DR'FTS'M'N	CHECKED	APPRV'D	NEXT ASSEMBLY	SCALE	DRWG. NO.
Landauer 1-27-50	DP 1-15-50				D-36E

REVISIONS

INDEPENDENT IRON WORKS LTD.
OAKLAND, CALIFORNIA

5468.115

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SOK 2(1)	1950	116	304

Note: Work This Dwg With Dwg D37A-E

For Bill of Mat'l See Dwg D37A-E

Rivets: 7/8⌀ Holes: 15/16⌀ U.N.

REVISIONS

OAKLAND, CALIFORNIA

ITEM Addition To Nanue Bridge
Hawaii

CUSTOMER Industrial Dev. Co.

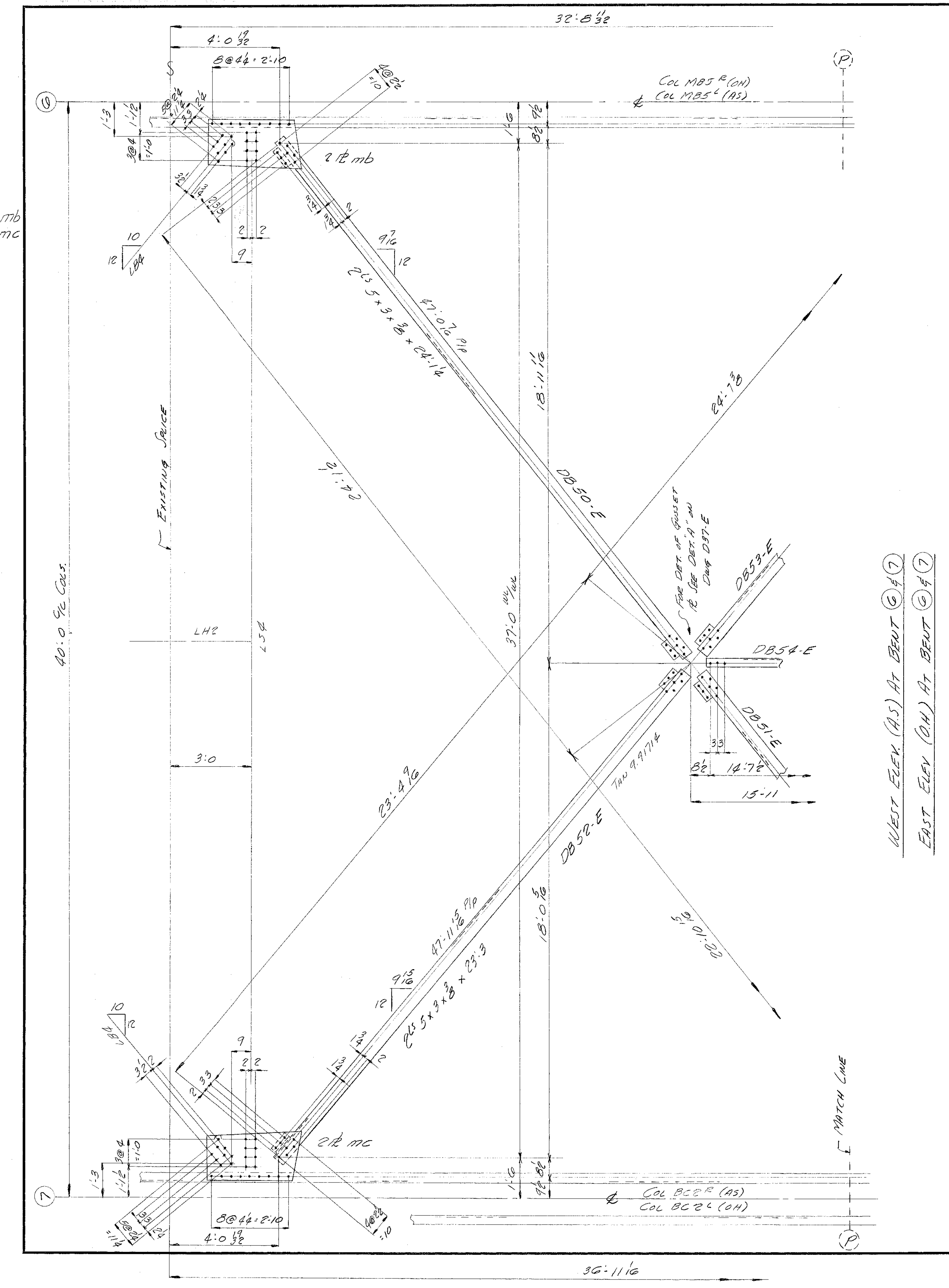
JOB NO. 3807

DR'FTS'M'N	CHECKED	APPRV'D	NEXT ASSEMBLY	SCALE	DRWG. NO.
2-1-50	DM 1-15-50				D37-E

THIS PRINT MUST NOT BE COPIED IN WHOLE OR IN PART OR USED DETRIMENTALLY TO OUR INTEREST

5468.116

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	[illegible]	[illegible]	117	304



WEST ELEV. (AS) AT BENT 6 & 7

EAST ELEV (OH) AT BENT 6 & 7

MATERIAL LISTED BELOW
DETAILED ON D34-E

No.	Description	Length Ft	Length Ins	Mark	Remarks
2	Diag Braces	19	6½	DB60-E	See Dwgs: D57-E, D58-E, D59-E, & D56-E For Details of Diag. Braces
2		29	6¾	DB61-E	
2		25	11	DB62-E	
2		16	10¾	DB63-E	
2		38	10	DB64-E	
2		13	3⅞	DB65-E	
2		23	8¼	DB66-E	
2		18	7¾	DB67-E	
2		28	3⅜	DB68-E	
4	PL 30 × ⅜	2	7	hg	Temp New Mat'l
4	PL 23 × ⅜	2	3	hh	
4	PL 25 × ⅜	3	1	hk	
4	PL 11 × ⅜	2	6	hm	
4	PL 24 × ½	3	4	hp	
4	PL 20 × ⅜	2	6½	hs	
4	PL 21 × ½	2	3	ht	
4	PL 23 × ⅜	2	3	mt	
4	Pc 10⊏20	2	6½	mv	

MATERIAL LISTED BELOW
DETAILED ON D35-E

No.	Description	Length Ft	Length Ins	Mark	Remarks
2	Diag Braces	25	6½	DB33-E	See Dwgs D60-E, D61-E & D64-E For Details of Diag. Braces
2		18	3¾	DB34-E	
2		29	9½	DB35-E	
2		11	7⅝	DB36-E	
2		39	3½	DB37-E	
2		18	5	DB38-E	
2		25	1¼	DB39-E	
2		24	6¼	DB40-E	
2		15	5	DB41-E	
4	PL 30 × ⅜	3	0	hv	Temp New Mat'l
4	PL 22 × ⅜	3	1	hw	
4	PL 21 × ⅜	3	2	ka	
4	PL 30 × ½	3	6	kb	
4	PL 3 × ½		10	kc	
4	PL 12 × ⅜	1	8	kd	
4	PL 24 × ⅜	3	2	kf	
4	PL 24 × ½	2	0	kg	
4	PL 21 × ⅜	2	6½	kh	
4	Pc 10⊏20	2	6½	mv	

MATERIAL LISTED BELOW
DETAILED ON D36-E (Dwn by [illegible])

No.	Description	Length Ft	Length Ins	Mark	Remarks
2	Diag Braces	16	11	DB42-E	See Dwgs D56-E D55-E For Det. of Diag Braces
2		37	7	DB43-E	
2		39	5⅝	DB44-E	
2		26	1	DB45-E	
2		22	0½	DB46-E	
2		28	0	DB47-E	
2		23	10	DB48-E	
2		9	11	DB49-E	
4	PL 19 × ⅜	3	1	kk	Temp New Mat'l
4	PL 19 × ⅜	3	2	km	
4	PL 28 × ⅜	2	6½	kp	
4	PL 21 × ⅜	3	1	ks	
4	PL 9 × ⅜	2	6	kt	
4	PL 25 × ½	3	7	kv	
4	PL 12 × ⅜	1	9	kw	
4	PL 22 × ½	2	3	ma	

MATERIAL LISTED BELOW
DET. ON D37-E & D37A-E

No.	Description	Length Ft	Length Ins	Mark	Remarks
2	Diag Braces	24	1¼	DB50-E	See Dwgs D59-E D62-E, D63-E & D64-E For Details of Diag Braces
2		22	7½	DB51-E	
2		23	3	DB52-E	
2		24	3⅝	DB53-E	
2		14	10½	DB54-E	
2		37	3⅜	DB55-E	
2		29	11	DB56-E	
2		17	11	DB57-E	
2		33	7½	DB58-E	
2		31	7	DB59-E	
4	PL 23 × ⅜	3	5	mb	Temp New Mat'l
4	PL 22 × ⅜	3	6	mc	
4	PL 21 × ⅜	3	11	md	
4	PL 11 × ⅜	1	8	mf	
4	PL 34 × ½	4	4	mg	
4	PL 3 × ½		9	mh	
4	PL 31 × ⅜	2	11	mk	
4	PL 20½ × ⅜	3	1	mm	
4	PL 27 × ½	2	7	mp	
4	PL 29 × ⅜	2	8	ms	
4	Pc 18⊏42.7	2	6½	mw	
4	PL 18 × 5/16	2	6½	my	
8	PL 3½ × 5/16	3	1	sa	

NOTE: Rivets ⅞ϕ Holes $\frac{15}{16}$ϕ

Work This Dwg With Dwg D37-E

REVISIONS

INDEPENDENT IRON WORKS Ltd.
OAKLAND, CALIFORNIA

ITEM Addition To Nanue Bridge
Hawaii

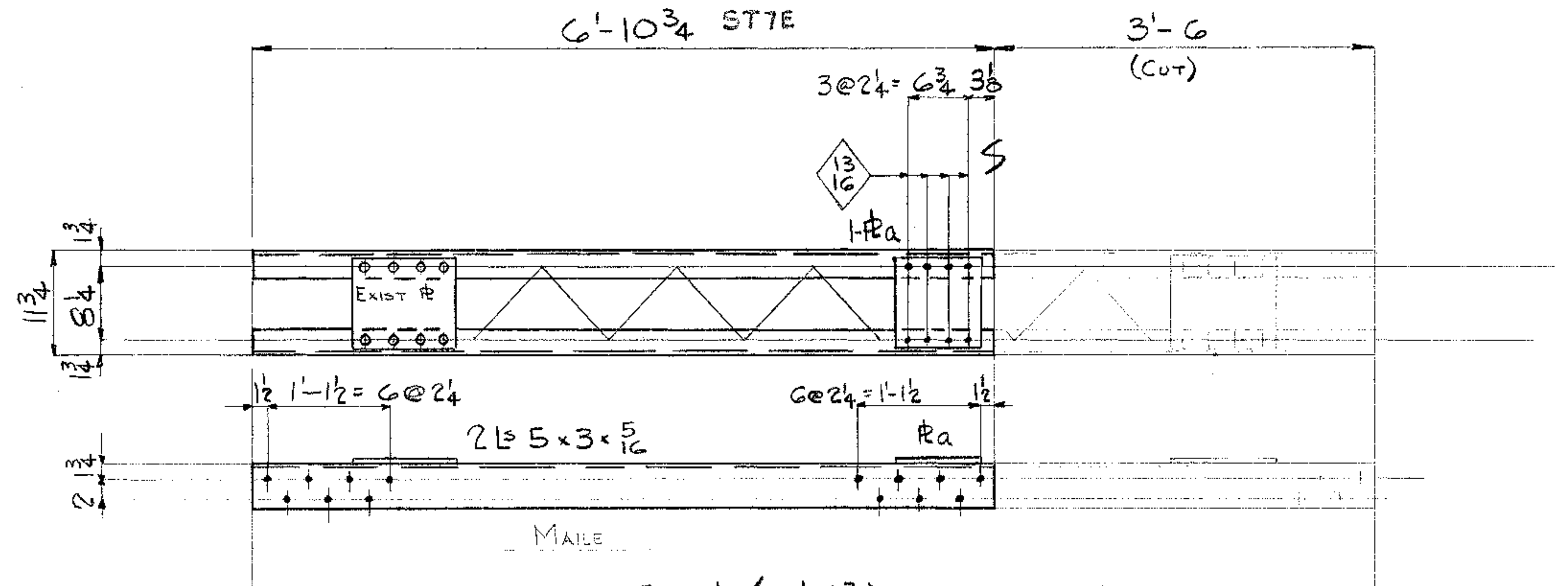
CUSTOMER Industrial Dev. Co. | JOB NO. 3807

DR'FTS'M'N	CHECKED	APPRV'D	NEXT ASSEMBLY	SCALE	DRWG. NO.
[illegible] 2-1-50	Dm 1-16-50				D37A-E

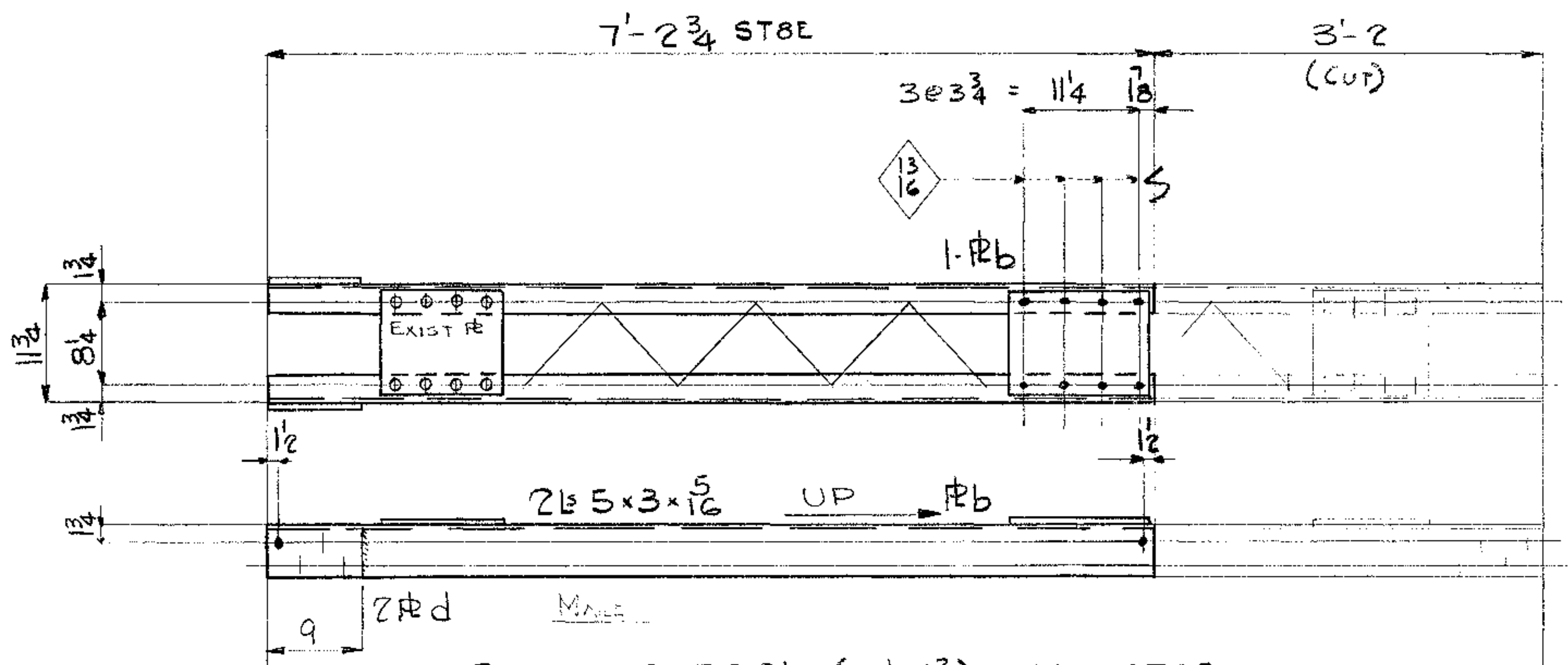
5468.117

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(1)	1950	118	304

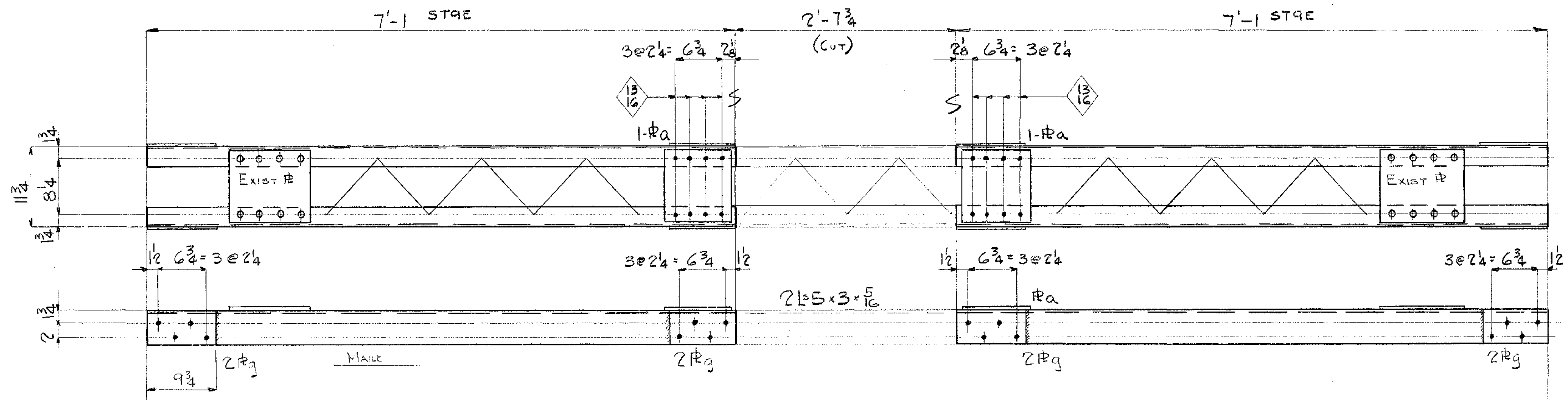
Order No. 3807 **Sheet No.** D38E



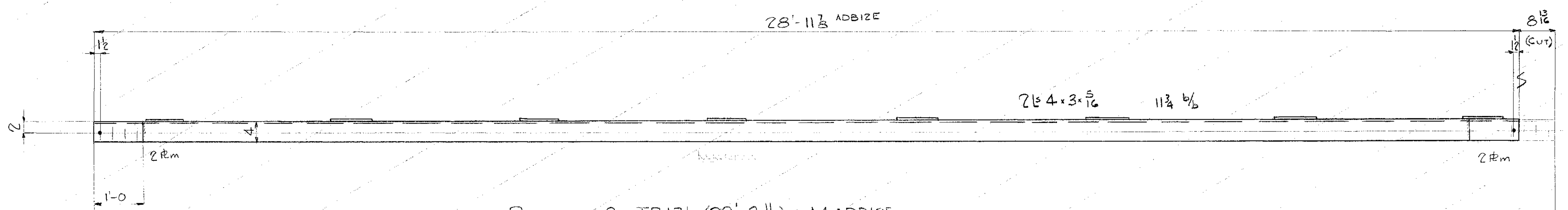
Revamp 2 TS2's (10'-4¾) & Mk. ST7E



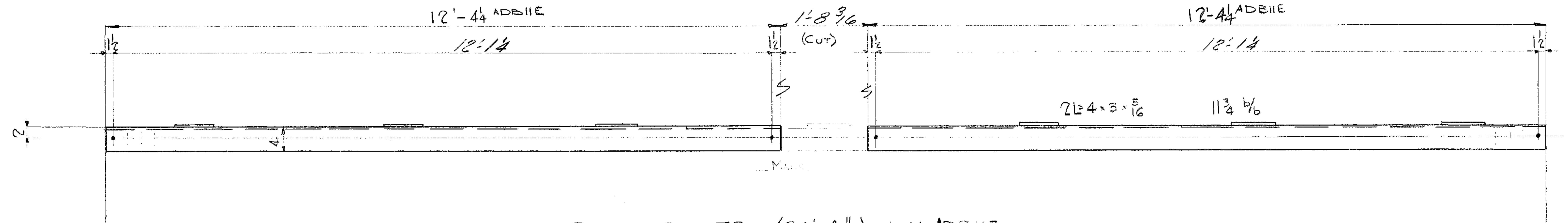
Revamp 2 TS2's (10'-4¾) & Mk ST8E



Revamp One TS3 (16'-9¾) & Mk. ST9E



Revamp 2 TB13's (29'-8 11/16) & Mk.ADBI2E



Revamp One TB10 (26'-4 1/16) & Mk.ADBIIE

BILL OF MATERIAL Industrial Development Co.

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
Note:	Braces Listed Below				are to be
Revamped	as	Shown		on	Details.
					Salv From:
4	Braces	10	4¾	TS2	Maile
1	Do	16	9¾	TS3	Maile
1	Do	26	4 1/16	TB10	Maile
4	℄ 9¼ × ⅜	0	10¾	a	Temp-New
2	℄ 10¾ × ⅜	1	1¾	b	Temp-New
4	℄ 5 × ⅛	0	9	d	Temp-New
8	℄ 5 × ⅛	0	9¾	g	Temp-New

Rivets: ¾ For 13/16 ∅ Holes

Holes: 15/16 ∅ UN.

Paint:

Industrial Development Company

Addition to Nanue Bridge
Hawaii

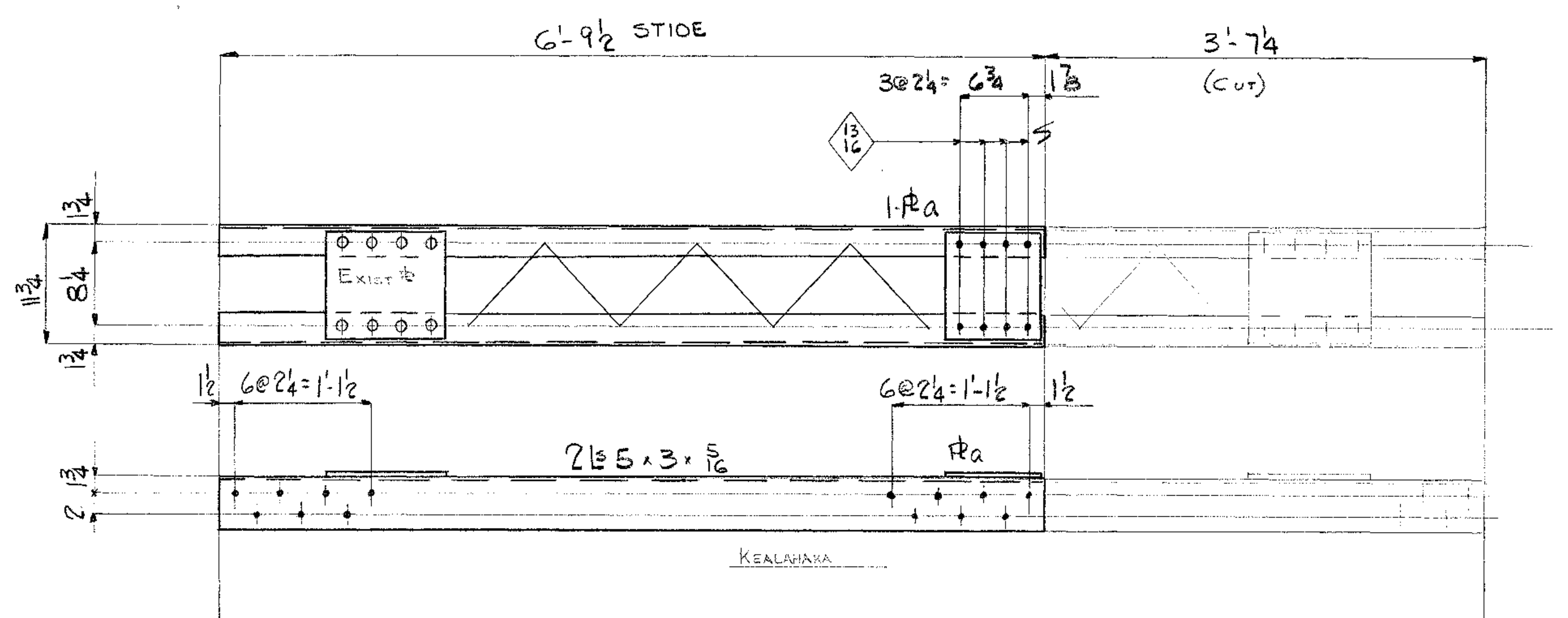
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	1-11-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	D38E

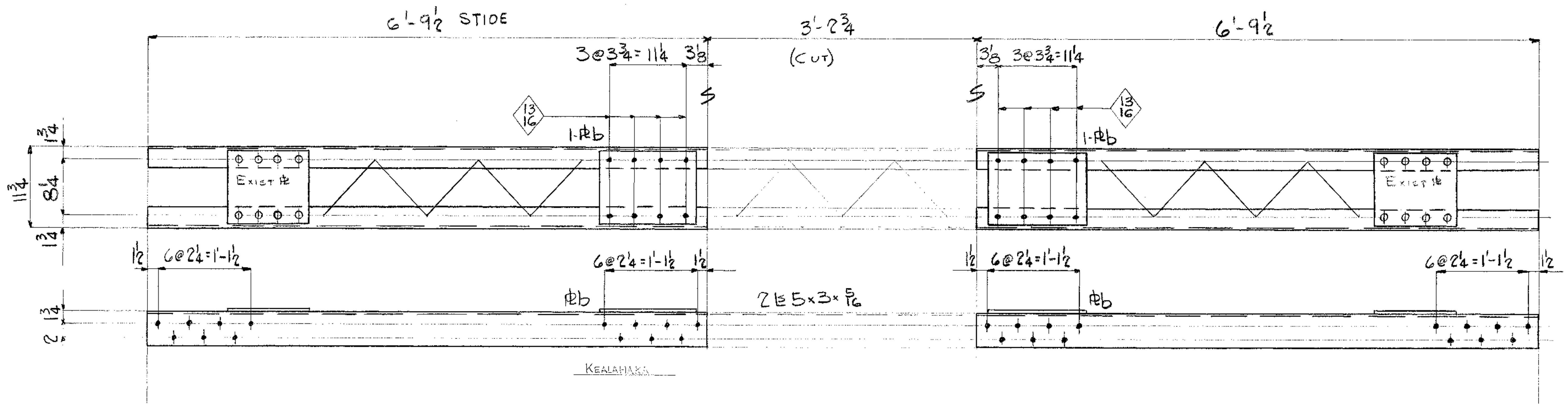
5468.118

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDK9(B)	1950	119	304

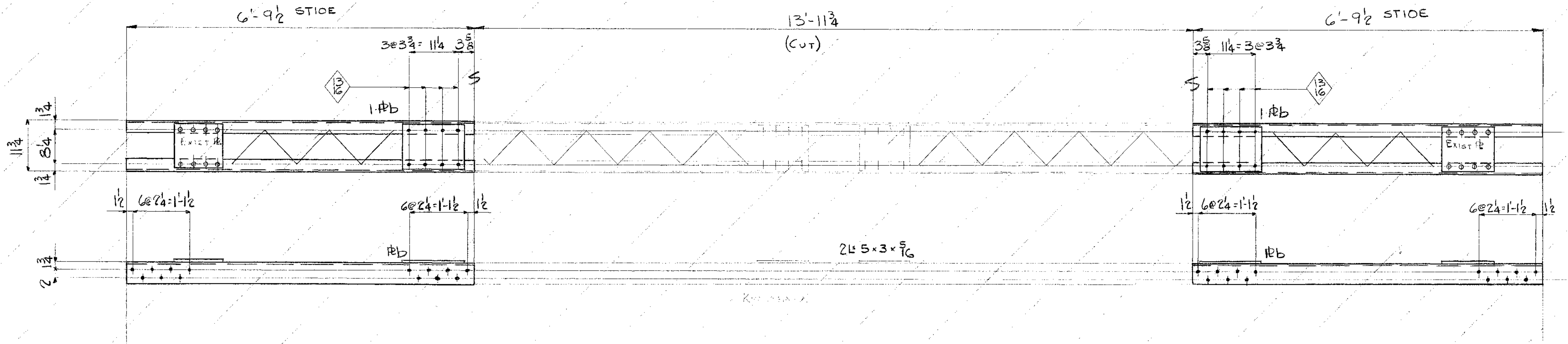
Order No. 3807 **Sheet No.** D39E



REVAMP 4 TS2's (10'-4$\frac{3}{4}$) & MK. STIOE



REVAMP 4 TS3's (16'-9$\frac{3}{4}$) & MK. STIOE



REVAMP 2 TS4's (27'-6$\frac{3}{4}$) & MK. STIOE

BILL OF MATERIAL

INDUSTRIAL DEVELOPMENT CO.

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
NOTE: BRACES LISTED BELOW ARE TO BE REVAMPED AS SHOWN ON DETAIL					
					SALV FROM:
4	BRACES	10	4$\frac{3}{4}$	TS2	KEALAHAKA
4	Do	16	9$\frac{3}{4}$	TS3	Do
4	Pℓ 9$\frac{1}{4}$ x $\frac{3}{8}$	0	10$\frac{3}{4}$	a	Temp- New
8	Pℓ 10$\frac{3}{4}$ x $\frac{3}{8}$	1	1$\frac{3}{4}$	b	Temp- New

Rivets: $\frac{3}{4}\phi$ FOR $\frac{13}{16}\phi$ Holes

Holes: $\frac{15}{16}\phi$ UN.

Paint:

INDUSTRIAL DEVELOPMENT COMPANY

ADDITION TO THE NANUE BRIDGE
HAWAII

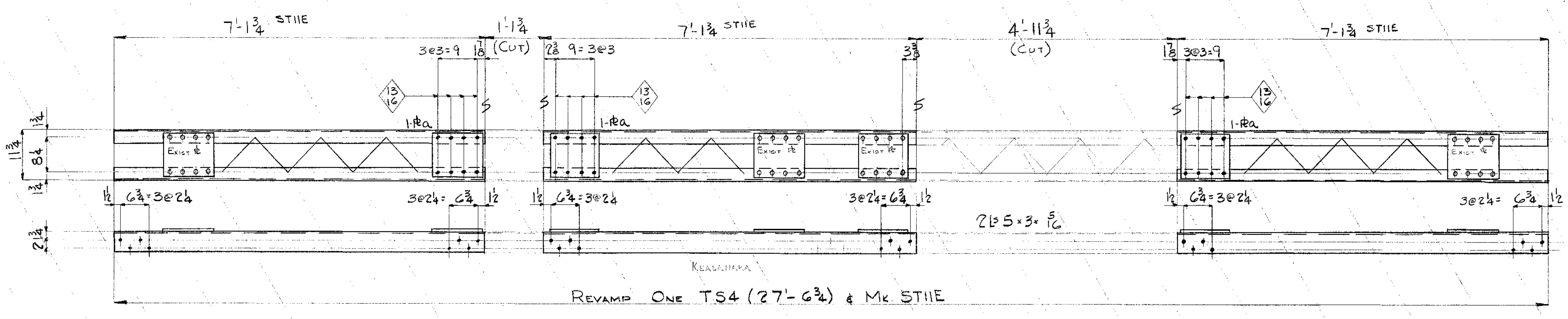
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	1-12-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	D39E

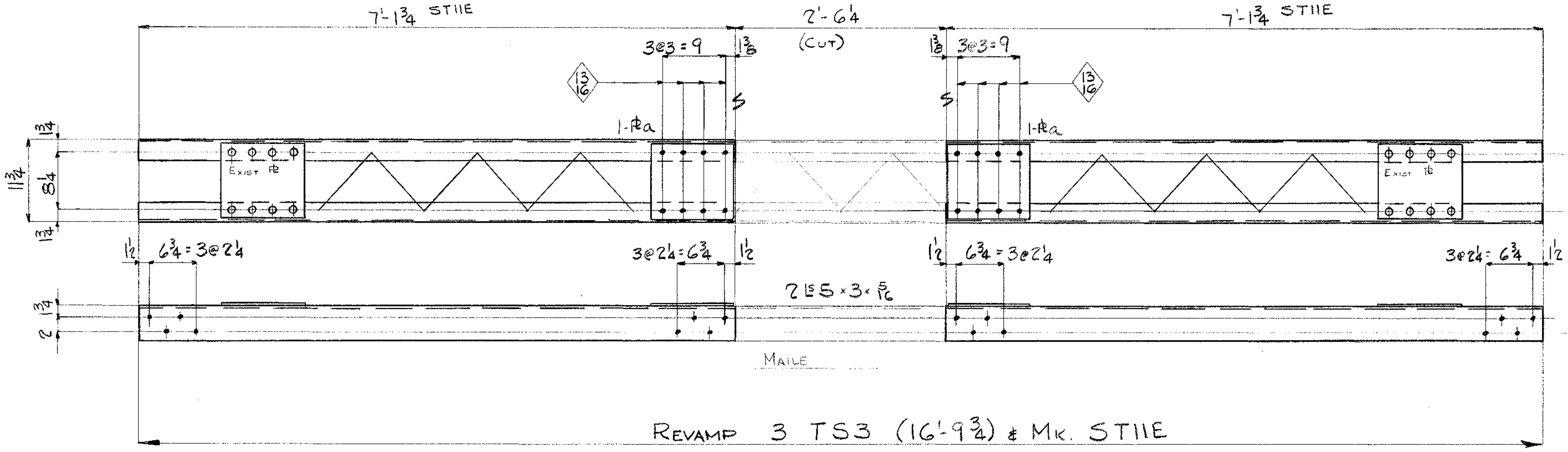
5468.119

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	FDR 4(13)	1950	120	704

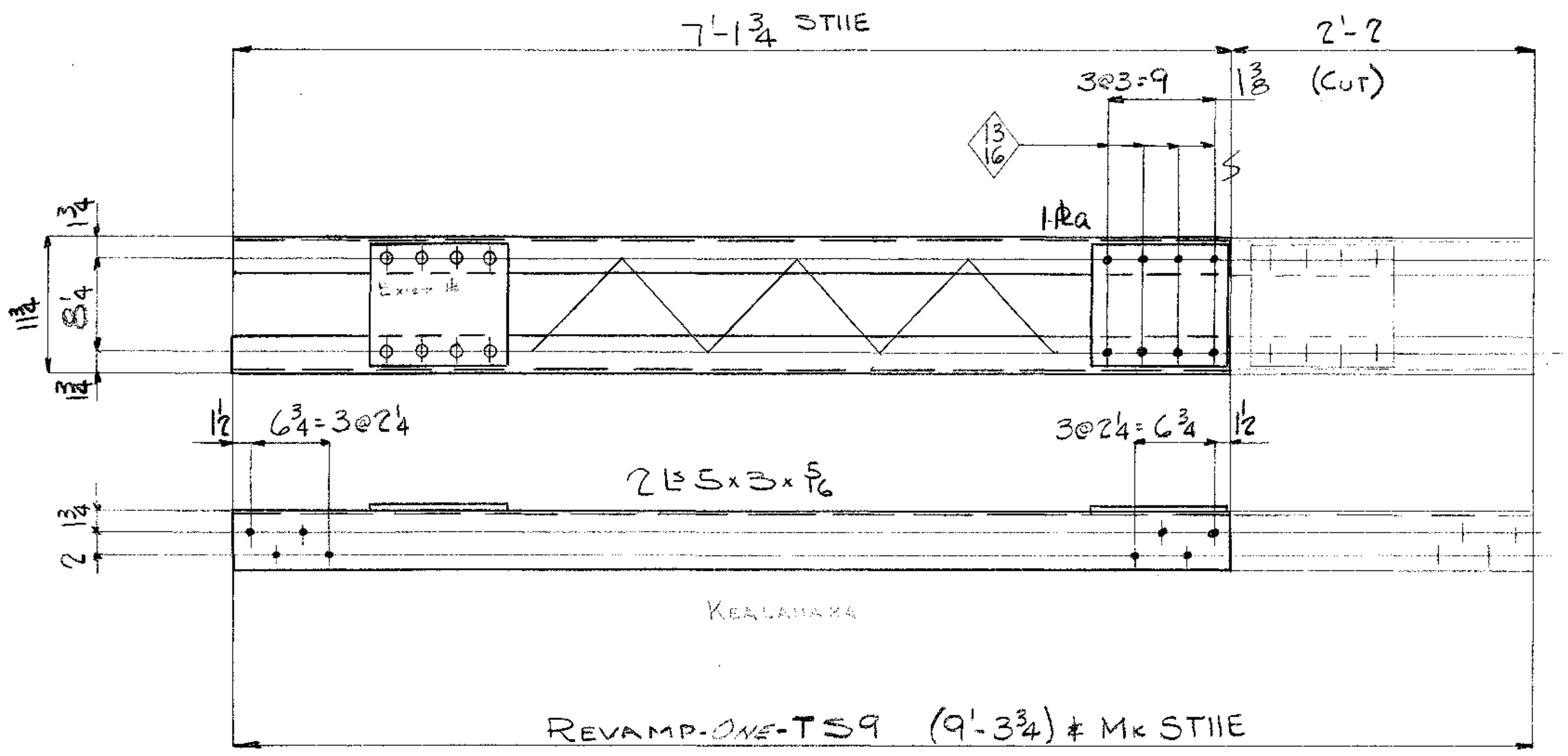
Order No. 3807 **Sheet No.** D40E



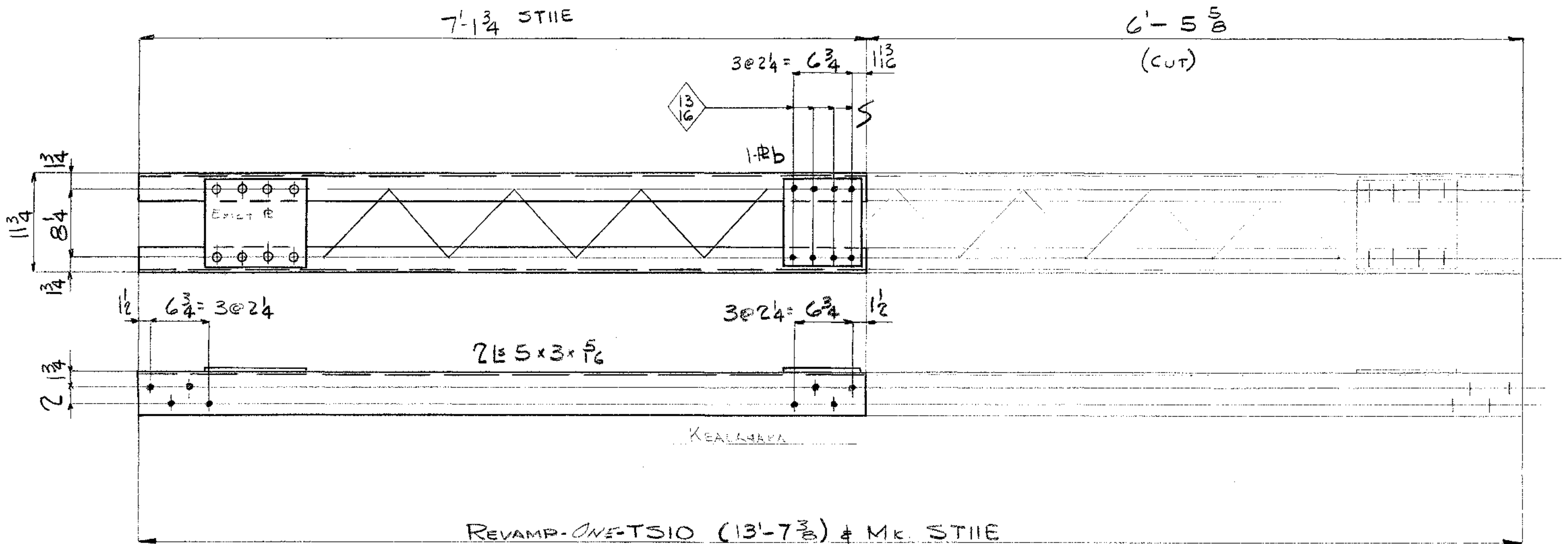
Revamp One TS4 (27'-6¾) & Mk. STIIE



Revamp 3 TS3 (16'-9¾) & Mk. STIIE



Revamp-One-TS9 (9'-3¾) & Mk STIIE



Revamp-One-TS10 (13'-7⅜) & Mk. STIIE

BILL OF MATERIAL Industrial Development Co.

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
Note:	Braces Listed Below are to be				
Revamped	as Shown on Details				
					Salv. From:
3	Braces	16	9¾	TS3	Maile
1	Do	9	3¾	TS9	Kealahaka
1	Do	13	7⅜	TS10	Do
7	Pl 10¾ × ⅜	0	11½	a	Temp-New
1	Pl 9¼ × ⅜	0	10¾	b	Temp-New

Rivets: ¾φ For 13/16φ Holes
Holes: 15/16φ UN
Paint:

Industrial Development Company

Addition to the Nanue Bridge
Hawaii

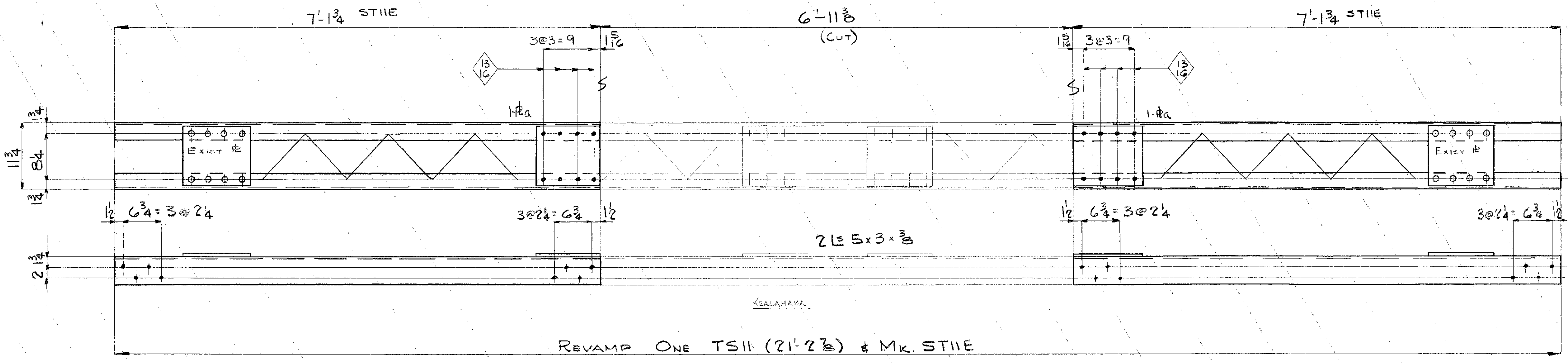
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	1-13-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	D40E

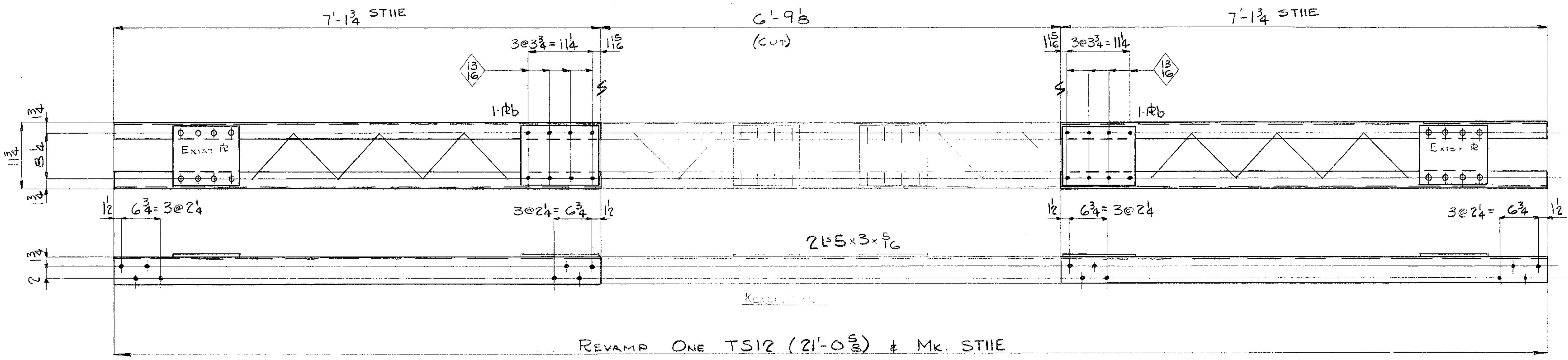
5468.120

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDK 3(3)	1950	121	304

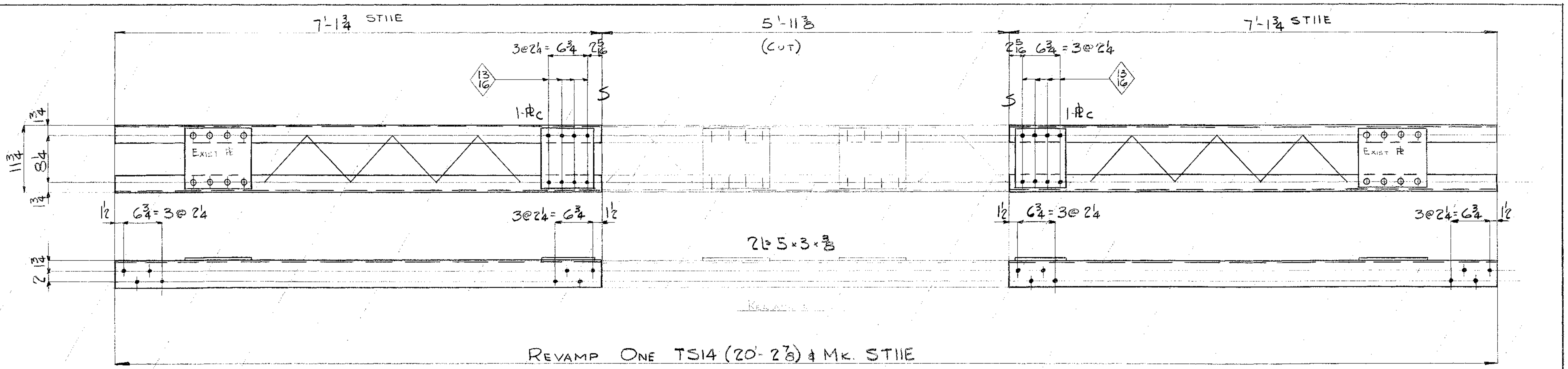
Order No. 3807 Sheet No. D41E



Revamp One TS11 (21'-2 7/8) & Mk. ST11E



Revamp One TS12 (21'-0 5/8) & Mk. ST11E



Revamp One TS14 (20'-2 7/8) & Mk. ST11E

BILL OF MATERIAL Industrial Development Co

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
Note:	Braces Listed	Below			are to be
Revamped as		Shown		on Details.	
					Salv. From.
1	Brace	21	0 5/8	TS12	Kealahaka
2	Pℓ 10 3/4 x 3/8	1	1 3/4	b	Temp-New

Rivets: 3/4 φ For 13/16 φ Holes

Holes: 15/16 φ U.N.

Paint:

Industrial Development Company

Addition to the Nanue Bridge

Hawaii

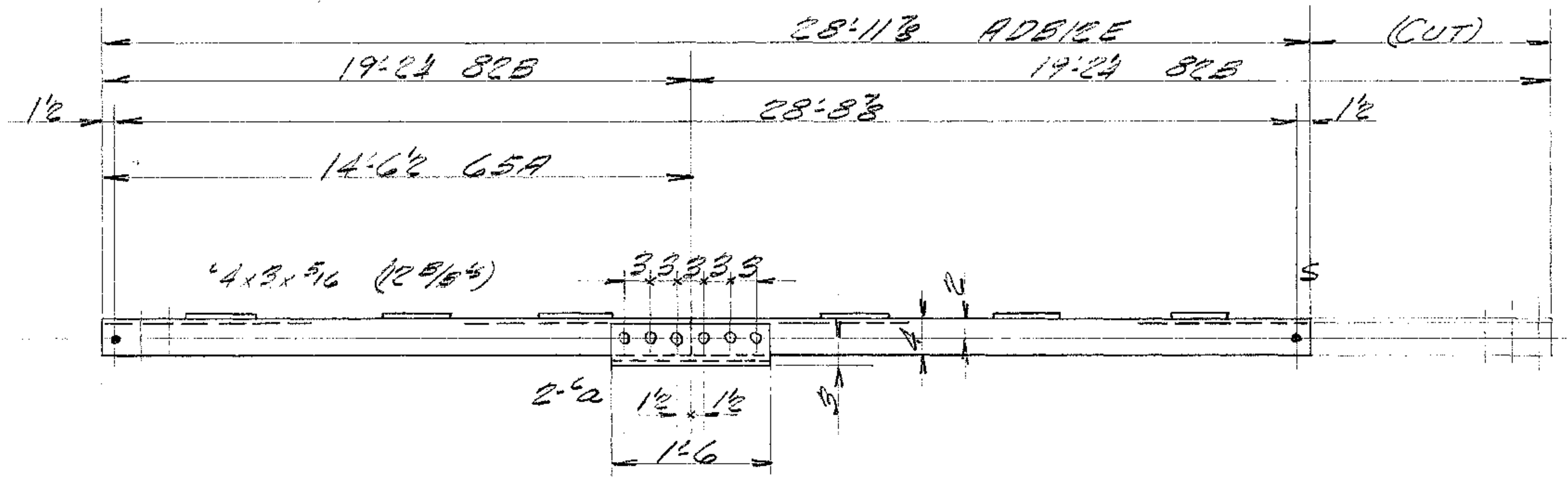
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	1-13-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	D41E

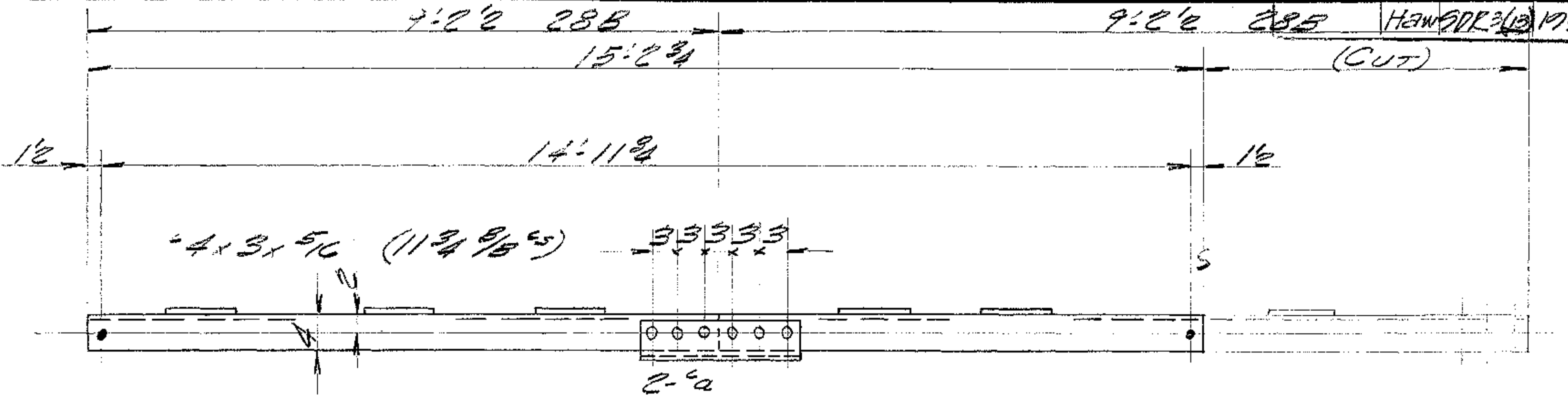
5468.121

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
	Haw	SDR 3(13)	1950	122	304

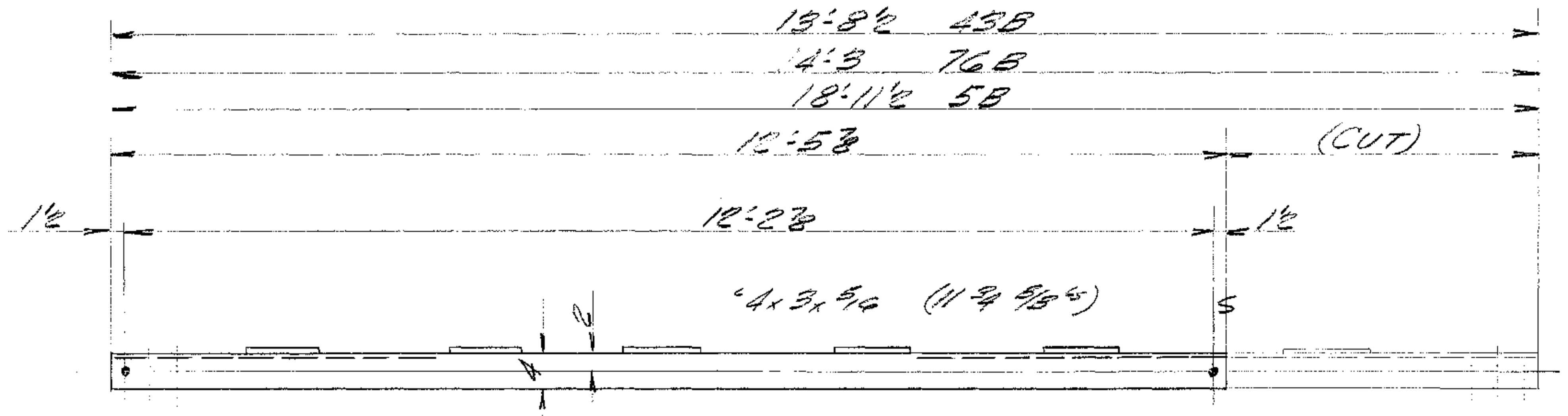
Order No. 3807 **Sheet No.** 042E



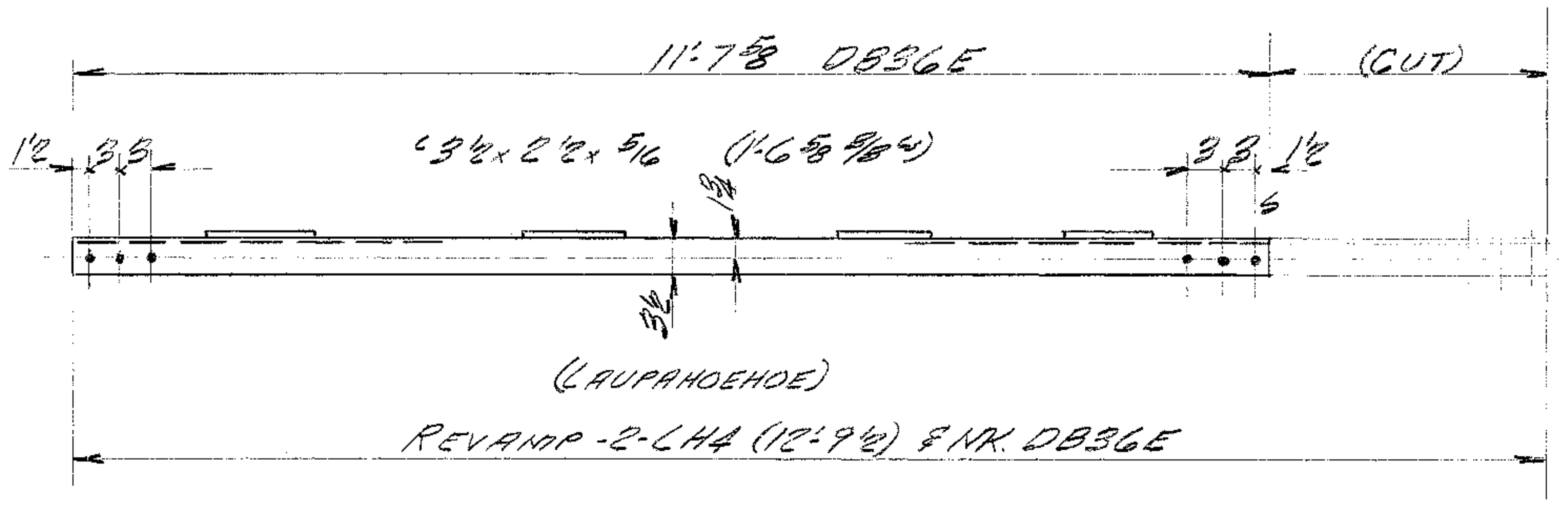
Revamp -3- 82B
Do. -One-65A
Makes-2-ADB12E

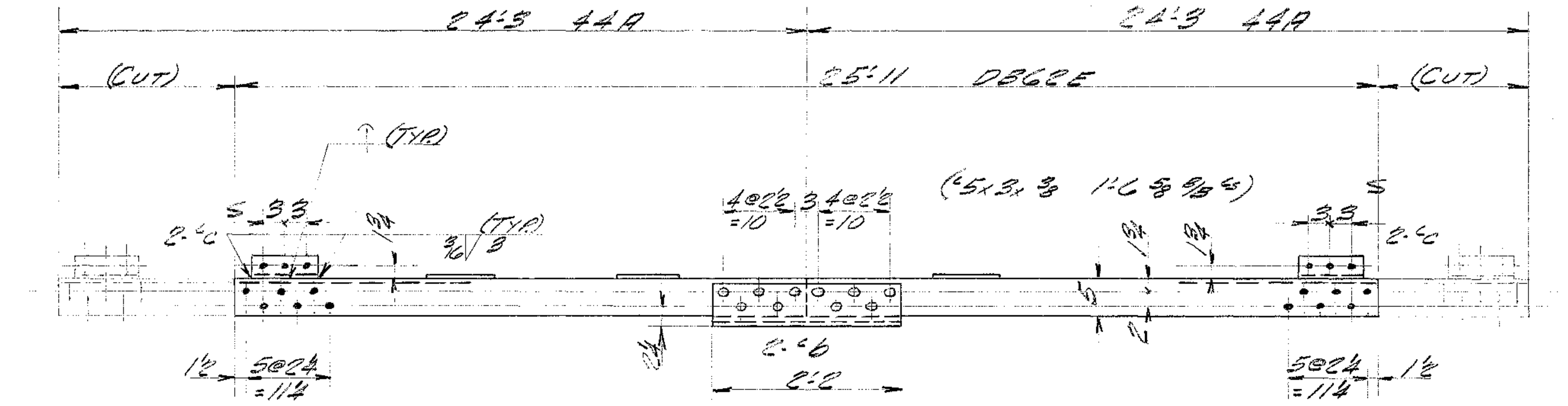


Revamp-2-28B (Makes-One-ADB13E)

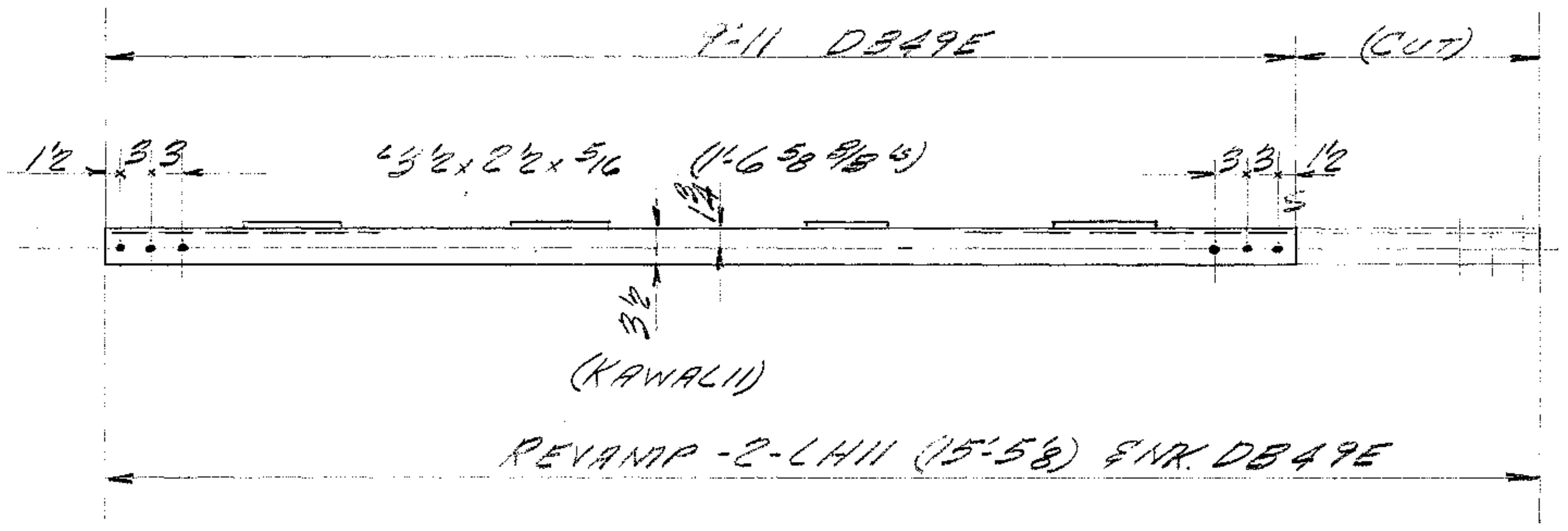


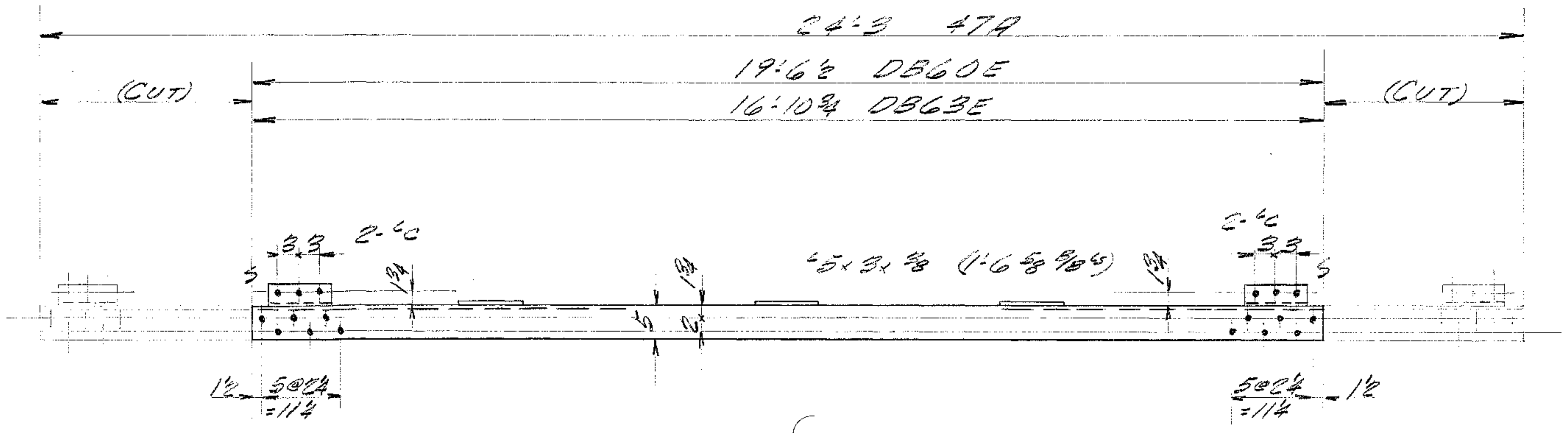
Revamp -One- 43B
Do. -One- 76B
Do. -One- 5B
Makes-3-DB28E





Revamp -4- 44A (Makes-2-DB62E)





Revamp-4-47A
Makes-2-DB60E
Makes-2-DB63E

BILL OF MATERIAL Nanue Bridge

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
Note: Revamp the braces listed below as shown on the details					
2	Braces			LH4	(Laupahoehoe)
2	Do.			LH11	(Kawalii)
3	Do.			82B	
1	Do.			65A	
2	Do.			28B	
1	Do.			43B	
1	Do.			76B	
1	Do.			5B	
4	Do.			44A	
4	Do.			47A	
New Mat'l. is listed below					
6	∠5x3x3/8	1	6	a	Temp.
4	∠6x3 1/2x3/8	2	2	b	Do.
24	∠3x3x3/8	0	9	c	Do.
76	3/4"⌀ Rivets				

Rivets: 7/8"⌀
Holes: 15/16"⌀s
Paint: (See Specs.)

Industrial Dev. Co.

Addition to the Nanue
Bridge - Hawaii -

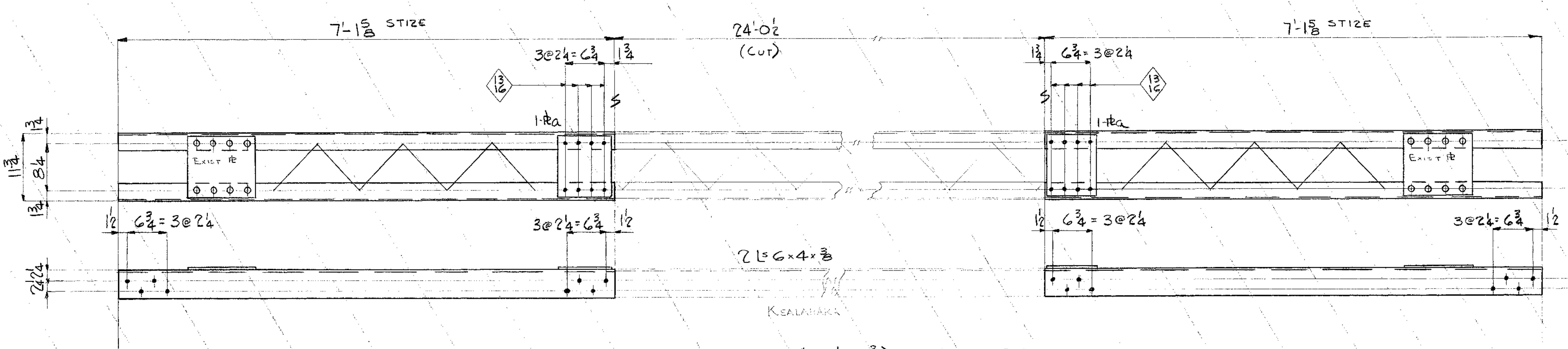
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DA	3-26-50	ORDER NO.	3807
CHECKED BY			SHEET NO.	042E

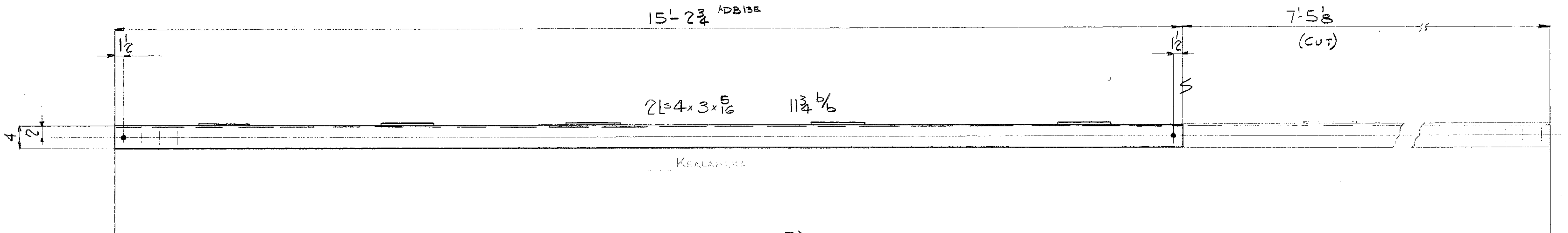
5468.122

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	123	304

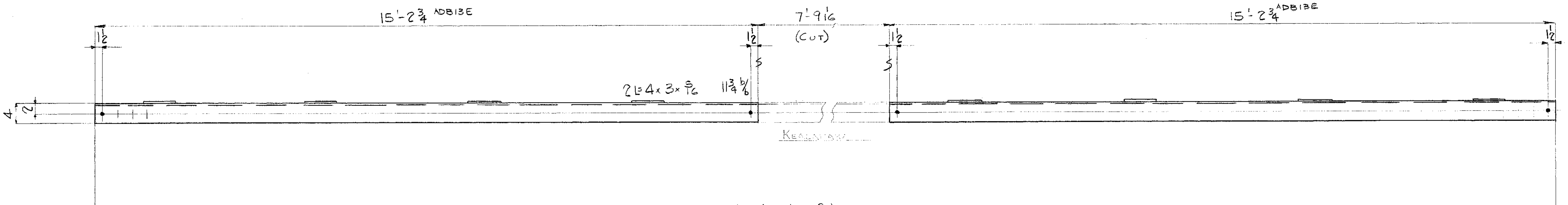
Order No. 3807 **Sheet No.** D43E



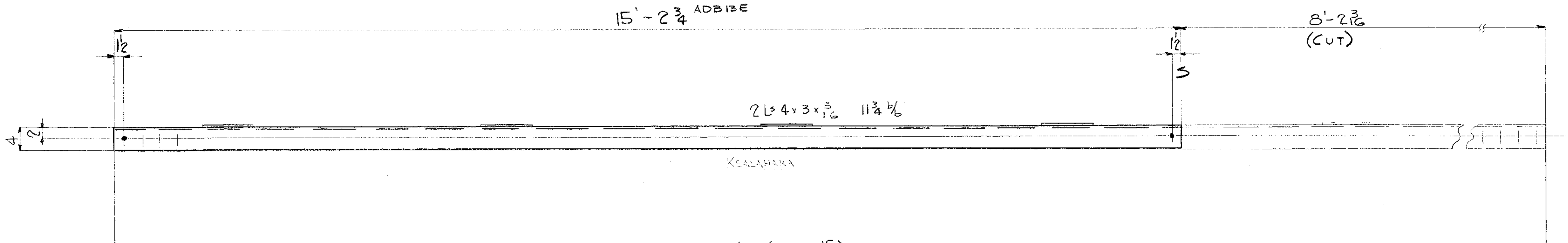
REVAMP ONE TS5 (38'-3 3/4) & MK. STI2E



REVAMP -3- TB4's (22'-7 7/8) & MK. ADB13E



REVAMP 2 TB7's (38'-2 9/16) & MK. ADB13E



REVAMP 4 TB8's (23'-4 15/16) & MK. ADB13E

BILL OF MATERIAL

INDUSTRIAL DEVELOPMENT CO.

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
NOTE:	BRACES	LISTED	BELOW		ARE TO BE
REVAMPED	AS	SHOWN		ON	DETAILS.
					SALV. FROM:
3	BRACES	22	7 7/8	TB4	KEALAHAKA
2	Do	38	2 9/16	TB7	Do
4	Do	23	4 15/16	TB8	Do

Rivets: 3/4 ⌀ FOR 13/16 ⌀ HOLES

Holes: 15/16 ⌀ UN

Paint:

INDUSTRIAL DEVELOPMENT COMPANY

ADDITION TO THE NANUE BRIDGE
HAWAII

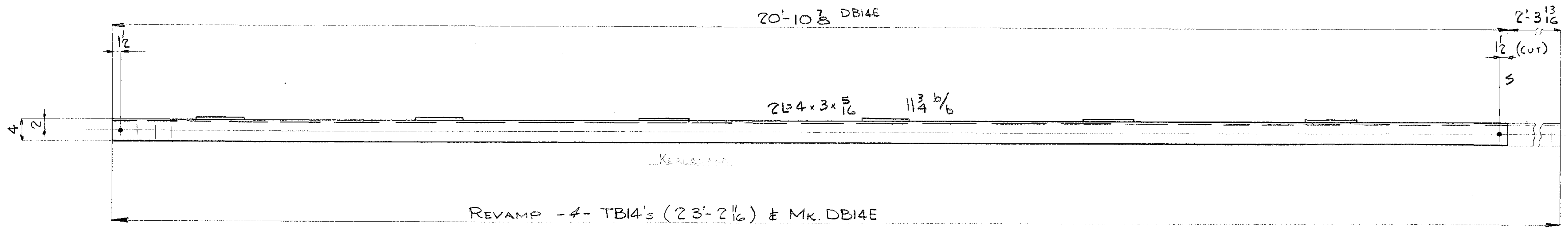
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	1-16-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	D43E

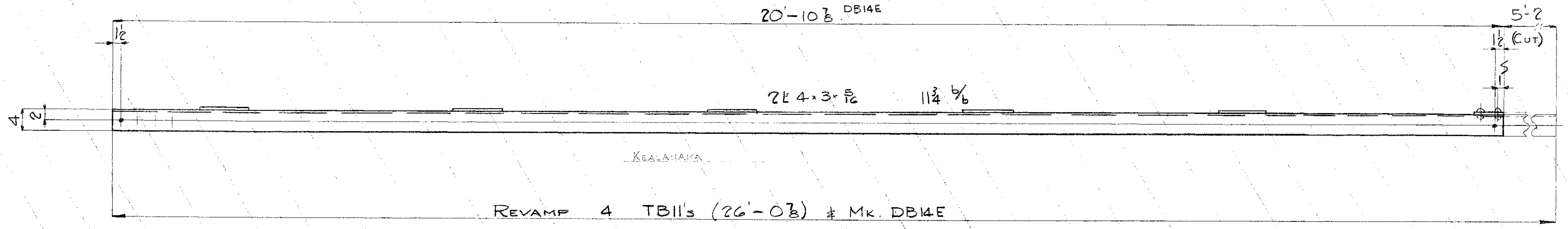
5468.123

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(3)	1950	124	304

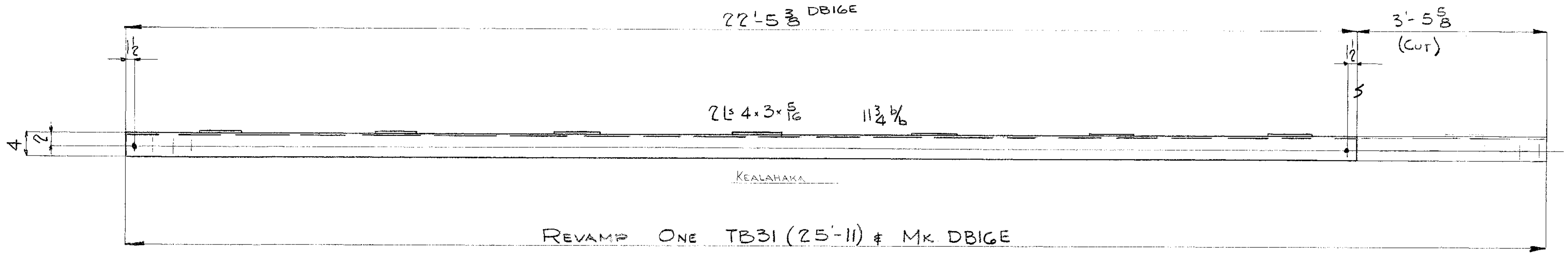
Order No. 3807 Sheet No. D44E



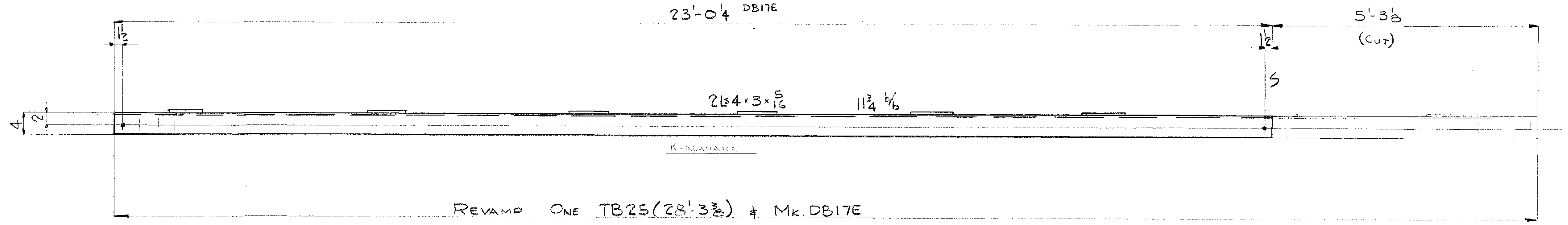
REVAMP -4- TB14's (23'-2 11/16) & MK. DB14E



REVAMP 4 TB11's (26'-0⅞) & MK. DB14E



REVAMP ONE TB31 (25'-11) & MK. DB16E



REVAMP ONE TB25 (28'-3⅜) & MK. DB17E

BILL OF MATERIAL

INDUSTRIAL DEVELOPMENT CO.

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
NOTE: BRACES LISTED BELOW ARE TO BE REVAMPED AS SHOWN ON DETAILS.					
					SALV. FROM:
4	BRACES	23	2 11/16	TB14	KEALAHAKA
1	Do	28	3⅜	TB25	Do
1	Do	25	11	TB31	Do

Rivets:

Holes: 15/16 ϕ

Paint:

INDUSTRIAL DEVELOPMENT COMPANY

ADDITION TO THE NANUE BRIDGE
HAWAII

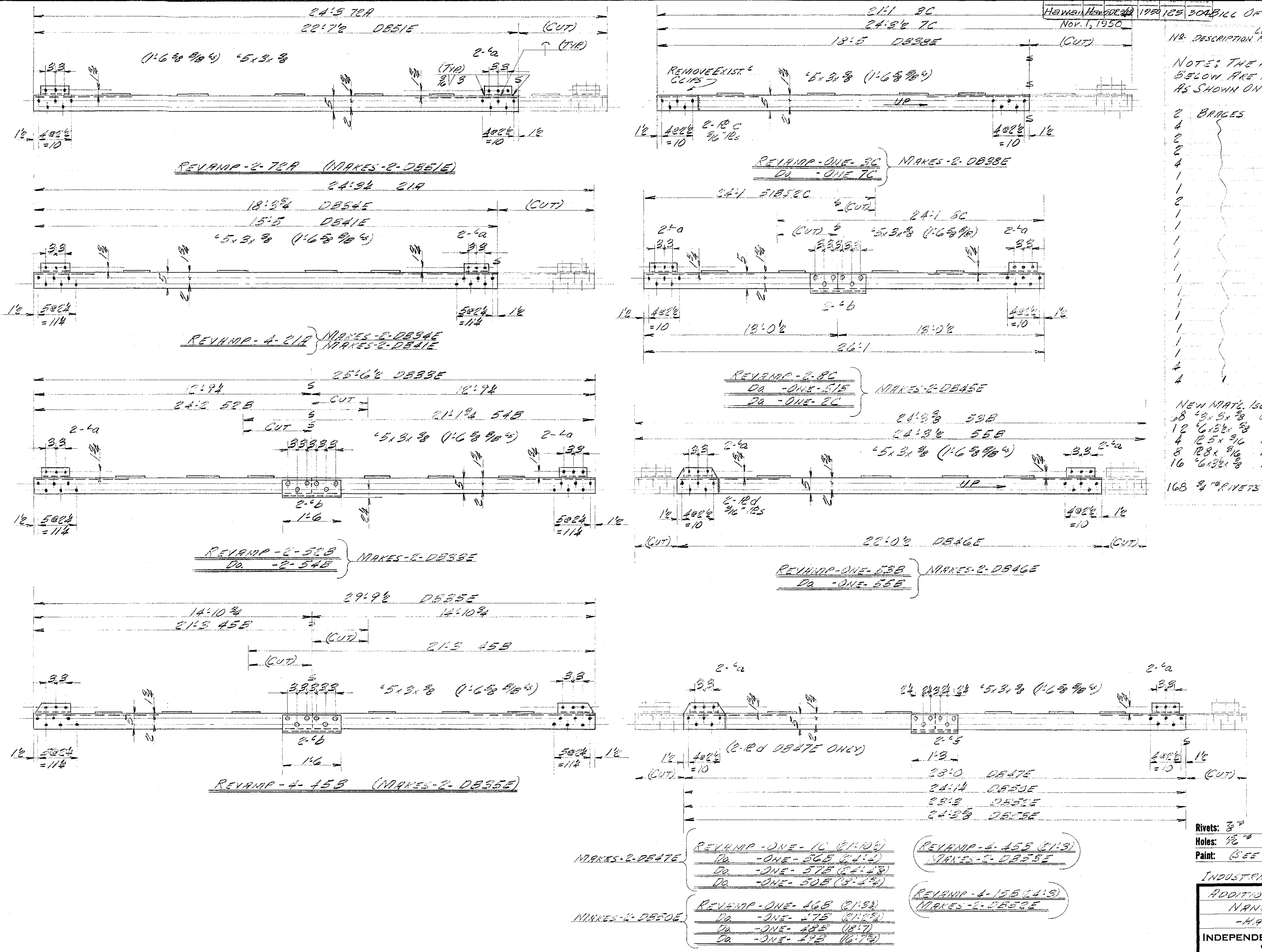
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	1-16-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	D44E

5468.124

FED. ROAD	STATE	FED. AID PROJECT NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw.	FDR 2(1)	1950	125	304

Nov. 1, 1950



BILL OF MATERIAL NANUE BRIDGE

NOTE: THE PIECES LISTED BELOW ARE TO BE REVAMPED AS SHOWN ON THE DETAILS

No.	DESCRIPTION	LENGTH Ft.	LENGTH Ins.	Pc. Mk.	REMARKS
2	BRACES			72A	
4				21A	
2				52B	
2				54B	
4				45B	
1				3C	
1				7C	
2				8C	
1				51B	
1				2C	
1				53B	
1				55B	
1				1C	
1				56B	
1				57B	
1				50B	
1				46B	
1				47B	
1				48B	
1				49B	
4				45B	
4				15B	

NEW MAT'L. IS LISTED BELOW

No.	DESCRIPTION	LENGTH Ft.	LENGTH Ins.	Pc. Mk.	REMARKS
68	∟3×3×3/8	0	9	a	TEMP.
12	∟6×3½×3/8	1	6	b	Do.
4	PL 5×3/16	1	1	c	Do.
8	PL 8×3/16	1	1	d	Do.
16	∟6×3½×3/8	1	3	5	Do.

168 3/4"⌀ RIVETS

Rivets: 7/8"⌀

Holes: 15/16"⌀

Paint: (SEE SPECS.)

INDUSTRIAL DEV. CO.

ADDITION TO THE
NANUE BRIDGE
-HAWAII-

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	2W	8-27-50	ORDER NO.	3807
CHECKED BY			SHEET NO.	D45E

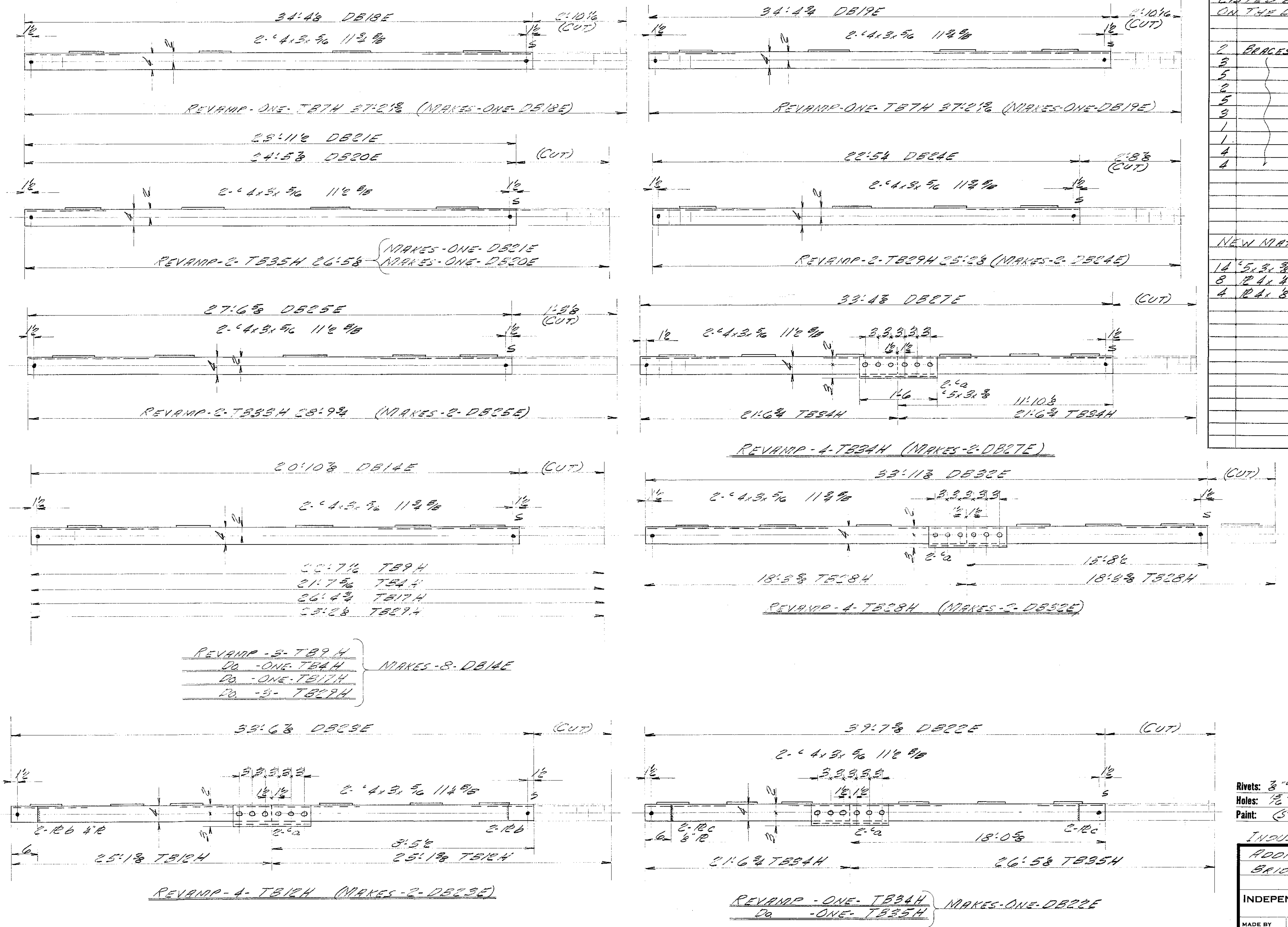
5468.125

Order No. 3807 **Sheet No.** 046E

FED. ROAD	STATE	FED. AID	FISCAL	SHEET	TOTAL
Hawaii	Haw	SDR 3(13)	1950	126	304

BILL OF MATERIAL NANUE BRIDGE

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
NOTE: REVAMP THE BRACES LISTED BELOW AS SHOWN ON THE DETAILS					
2	BRACES			TB7H	MAULUA
3				TB35H	
5				TB29H	
2				TB33H	
5				TB34H	
3				TB9H	
1				TB4H	
1				TB17H	
4				TB28H	
4				TB12H	
NEW MAT'L LISTED BELOW					
14	∟5x3x⅜	1	6	a	TEMP.
8	PL 4x¼	0	6	b	Do.
4	PL 4x⅜	0	6	c	Do.



Rivets: ⅞"⌀

Holes: 15/16"⌀

Paint: (SEE SPECS)

INDUSTRIAL DEV. CO.

ADDITION TO THE NANUE BRIDGE - HAWAII -

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DD	9-23-50	ORDER NO.	3807
CHECKED BY			SHEET NO.	046E

5468.126

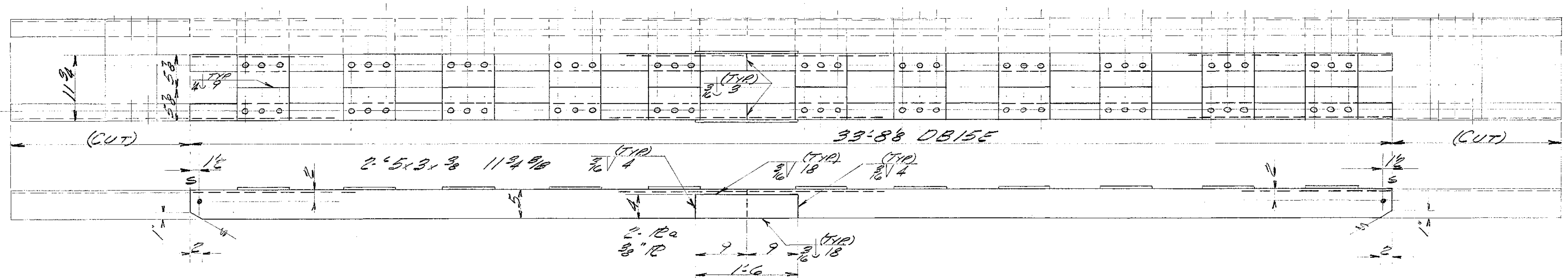
Order No. 3807 **Sheet No.** 047E

FED. ROAD DIST. NO.	STATE	FED. AID	FISCAL	SHEET	TOTAL
Hawaii	Haw	SDR 3(13)	1950	127	304

12/19/50

BILL OF MATERIAL NANUE BRIDGE

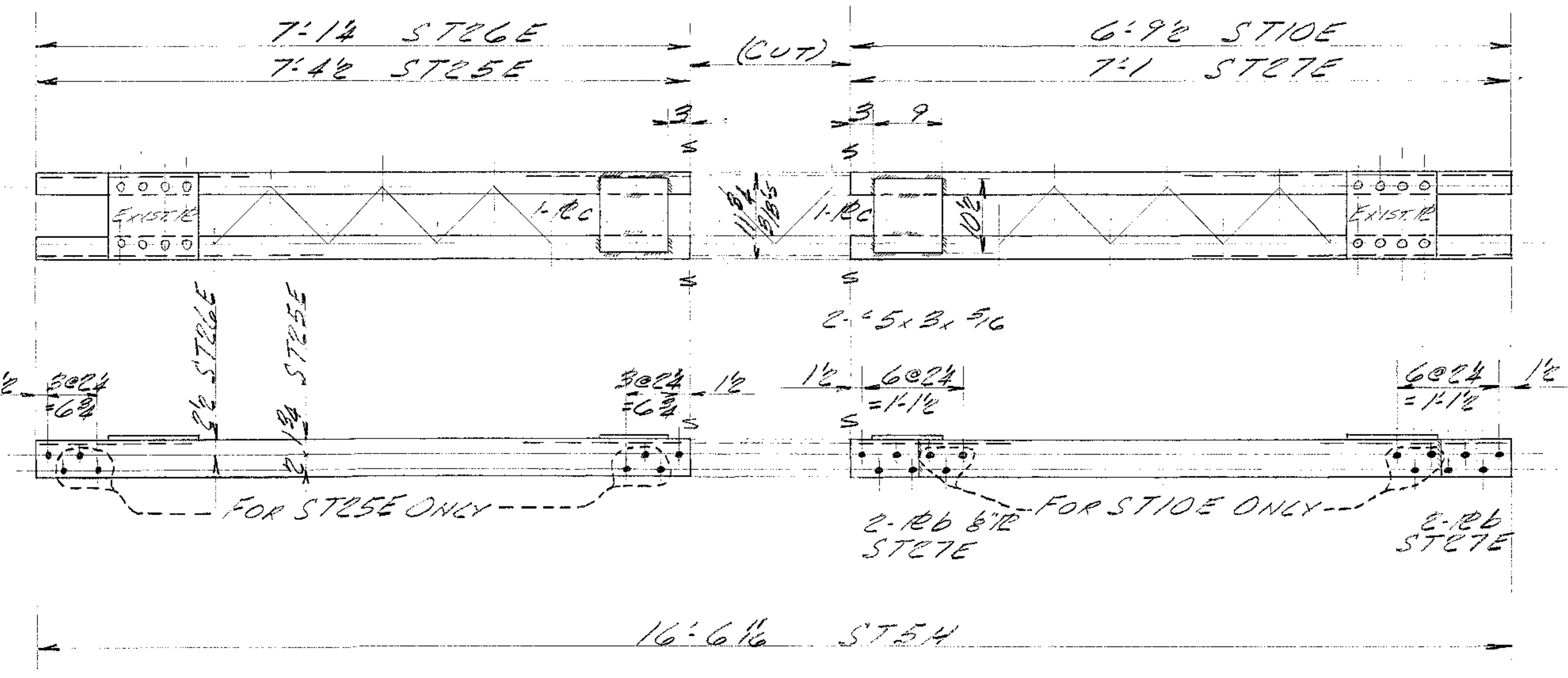
No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
NOTE: REVAMP THE BRACES LISTED BELOW AS SHOWN ON THE DETAILS					
1	BRACE			89A	
1				8B	
1				9B	
1				10B	
2				11B	
1				12B	
1				14B	
2				16B	
1				21B	
1				22B	
1				23B	
1				24B	
1				52B	
2				3A	
2				18A	
4				2A	
3				25A	
5				TS5H	MAULUA
2				TS4H	Do.
NEW MAT'L IS LISTED BELOW					
26	PL 4 x 3/8	1	6	a	PLAIN
4	PL 5 x 1/8	0	9¾	b	TEMP.
12	PL 9 x 3/8	0	10½	c	PLAIN



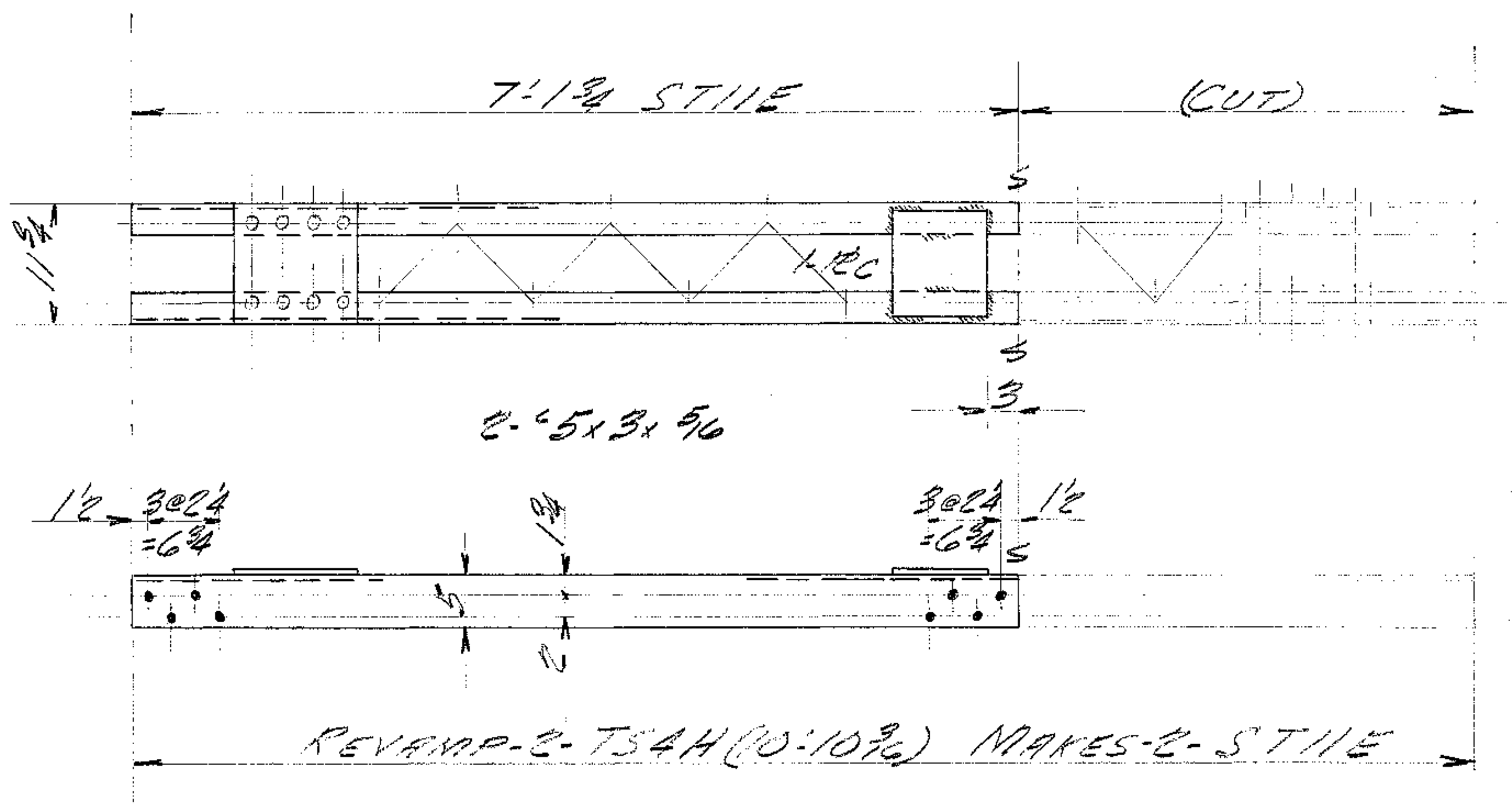
REVAMP	-ONE-	89A	24:2½
Do.	-ONE-	8B	24:4
Do.	-ONE-	9B	24:3
Do.	-ONE-	10B	24:2
Do.	-2-	11B	24:3½
Do.	-ONE-	12B	24:0
Do.	-ONE-	14B	24:3
Do.	-2-	16B	24:3¾
Do.	-ONE-	21B	21:5½
Do.	-ONE-	22B	24:4
Do.	-ONE-	23B	24:2
Do.	-ONE-	24B	24:11½
Do.	-ONE-	52B	24:2
Do.	-2-	3A	24:3¼
Do.	-2-	18A	24:3¾
Do.	-4-	2A	24:2
Do.	-3-	25A	24:3¾

MAKES -13- DB15E

See sheet 5468.75B for details of 3 more DB15E



REVAMP - 5 - TS5H
- MAKES - 4 - ST10E
- MAKES - ONE - ST27E
- MAKES - 3 - ST26E
- MAKES - 2 - ST25E



REVAMP-2-TS4H (0:10 7/16) MAKES-2-ST11E

~~**Rivets:**~~ WELD
Holes: 15/16"⌀
Paint: (SEE SPECS)

INDUSTRIAL DEV. CO.

ADDITION TO THE NANUE
BRIDGE - HAWAII -

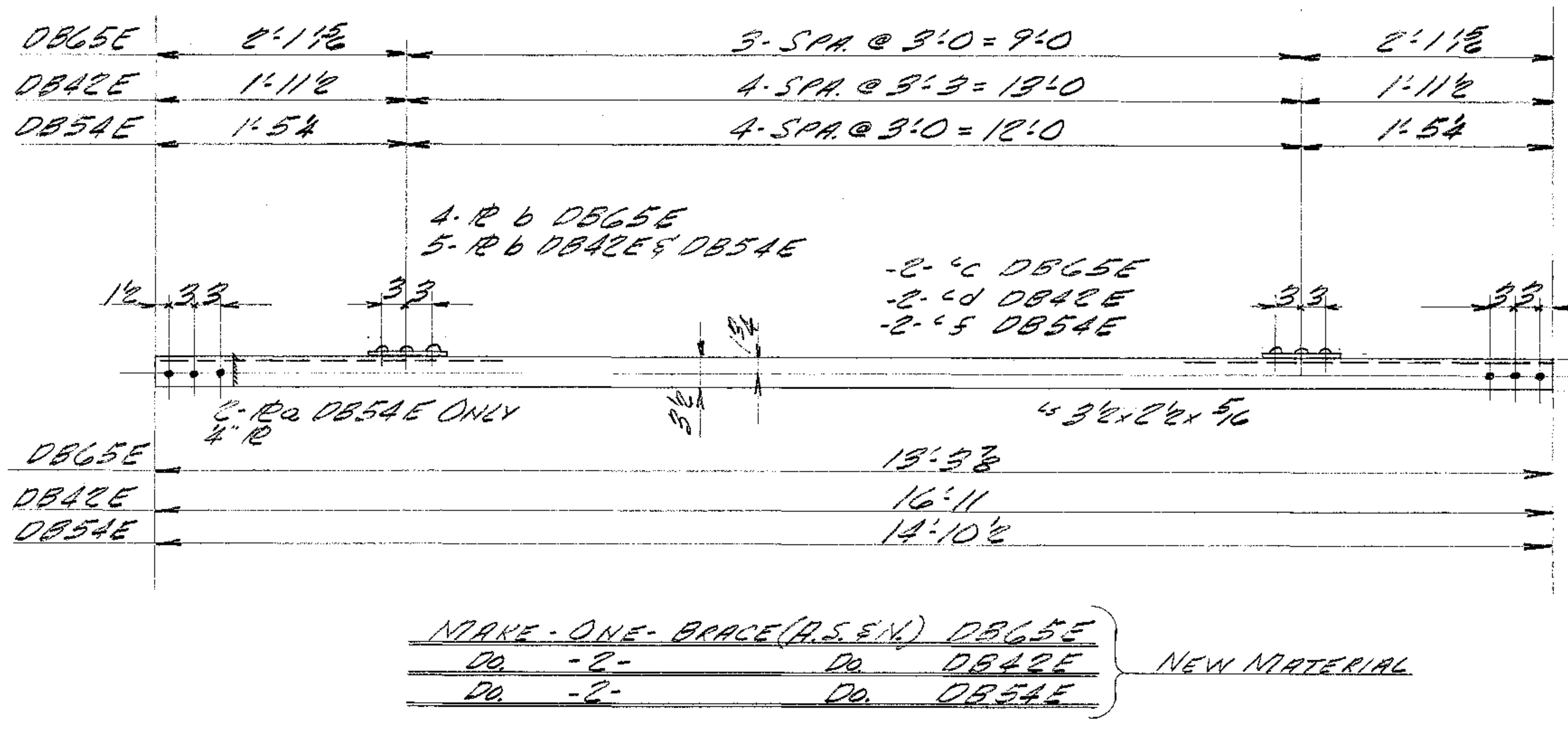
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

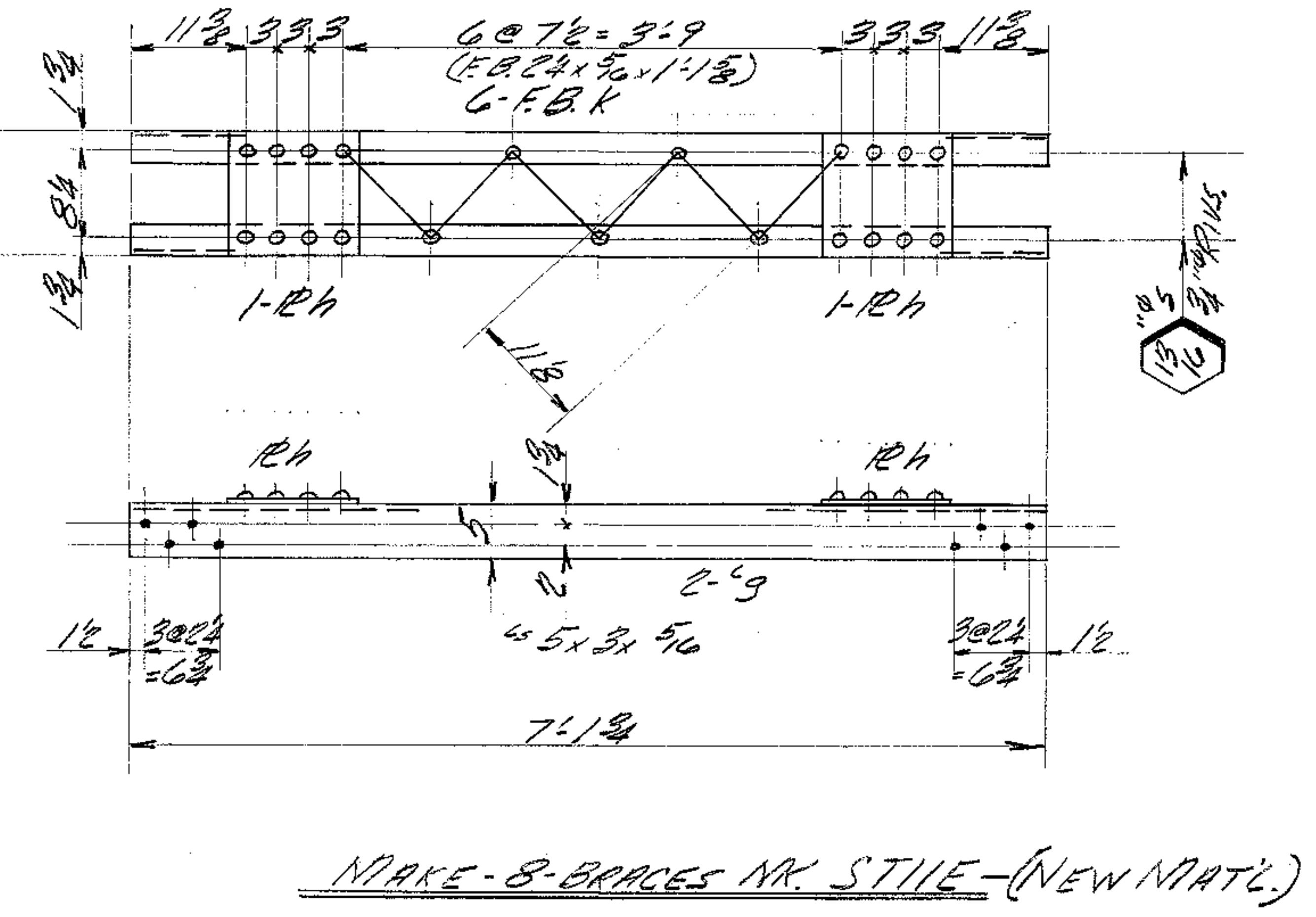
MADE BY	DM	9-24-50	ORDER NO.	3807
CHECKED BY			SHEET NO.	047E

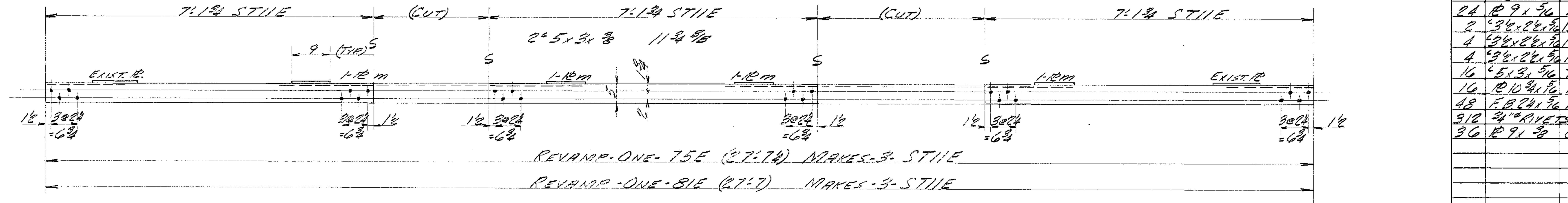
5468.127

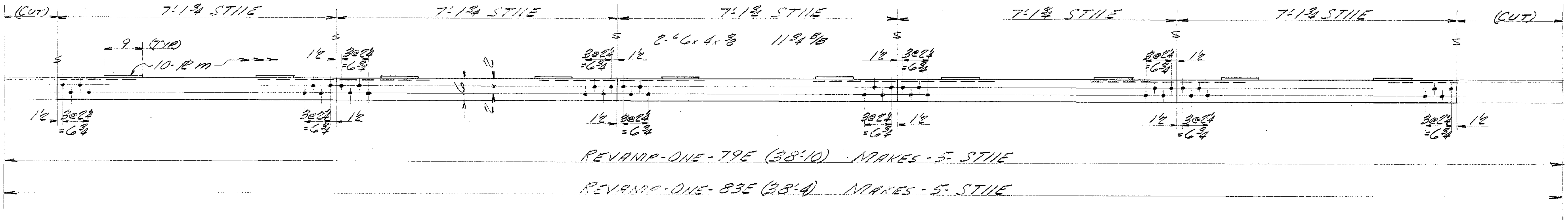
Order No. 3807 **Sheet No.** 048E

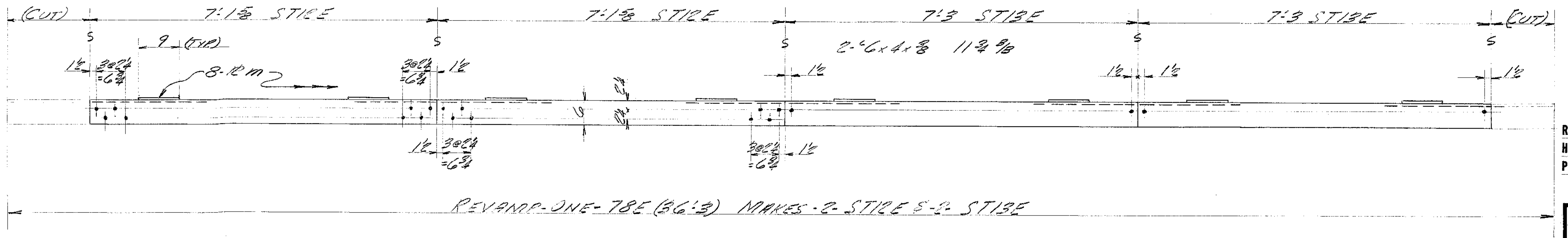
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	128	304











BILL OF MATERIAL NANUE BRIDGE

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
NOTE: REVAMP THE PIECES					
LISTED BELOW A.S. ON					
THE DETAILS					
1	BRACE			75E	
1				81E	
1				79E	
1				83E	
1				78E	
NEW MAT'L. IS LISTED BELOW					
1	BRACE			DB65E	
2				DB42E	
2				DB54E	
8				ST11E	
4	PL 3½x¼	0	9	a	TEMP.
24	PL 9x5/16	1	6⅜	b	DO.
2	∟3½x2½x5/16	13	3⅜	c	
4	∟3½x2½x5/16	16	11	d	
4	∟3½x2½x5/16	14	10½	f	
16	∟5x3x5/16	7	1¾	g	
16	PL 10¾x5/16	1	0	h	TEMP.
48	F.B.2¼x5/16	1	1⅝	k	DO.
312	¾"ɸ RIVETS				
36	PL 9x⅜	0	11	m	PLAIN

Rivets: ¾"ɸ FOR 13/16"ɸ HLS.
Holes: 13/16"ɸ U.N.
Paint: (SEE SPECS)

INDUSTRIAL DEV. CO.

ADDITION TO THE
NANUE BRIDGE
-HAWAII-

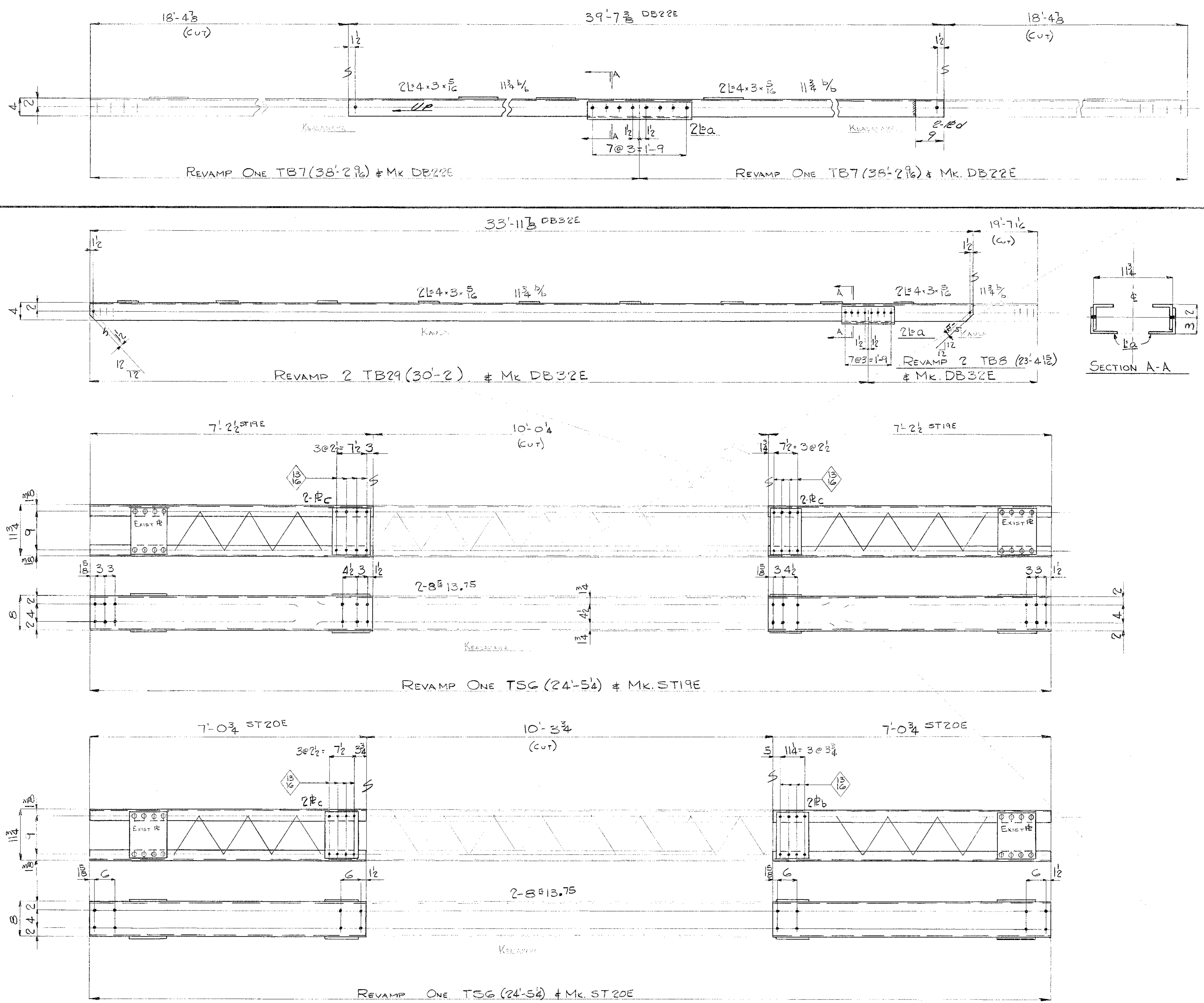
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	2W	10-8-50	ORDER NO.	3807
CHECKED BY			SHEET NO.	048E

5468.128

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR 3(3)	1950	129	304

Order No. 3807 **Sheet No.** D49E



BILL OF MATERIAL Industrial Development Co.

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
Note: Braces Listed Below are to be Revamped as Shown on Details.					
2	Braces	38	2 9/16	TB7	Kealahaka
2	L 5×3×1/2	2	0	a	Temp(New)
2	Pl 4×1/8	0	9	d	Do. Do.

Rivets: 3/4 ϕ For 13/16 ϕ Holes

Holes: 15/16 ϕ

Paint:

Industrial Development Company

Addition to the Nanue Bridge

Hawaii

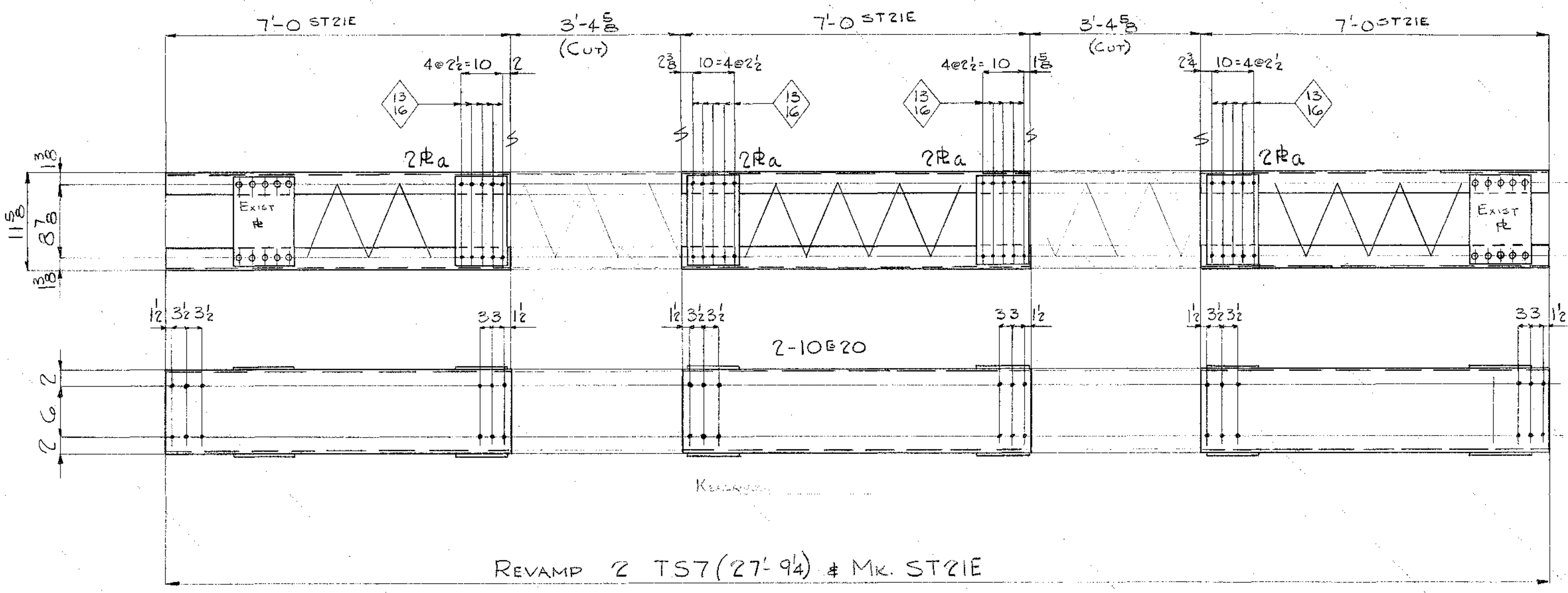
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	1-19-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	D49E

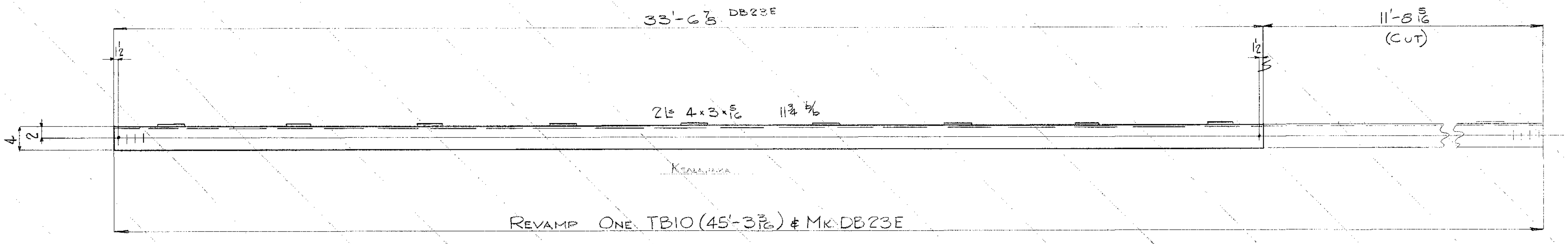
5468.129 129

Order No. 3807 Sheet No. D50E

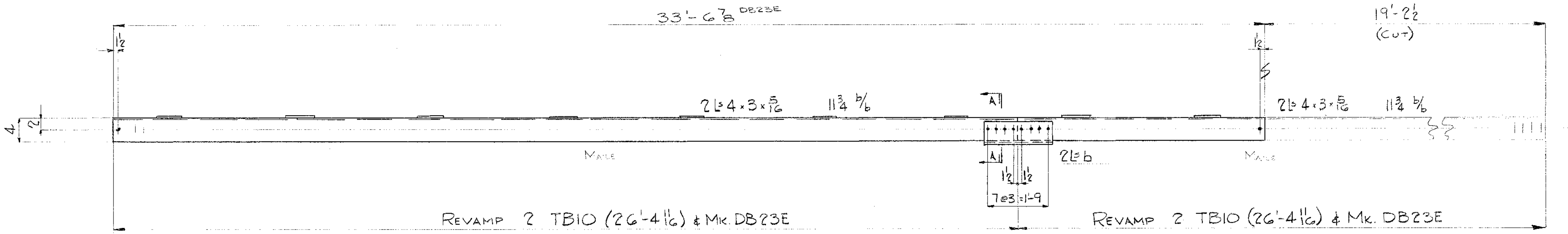
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR 2(13)	1950	130	304



Revamp 2 TS7 (27'-9¼) & Mk. ST21E

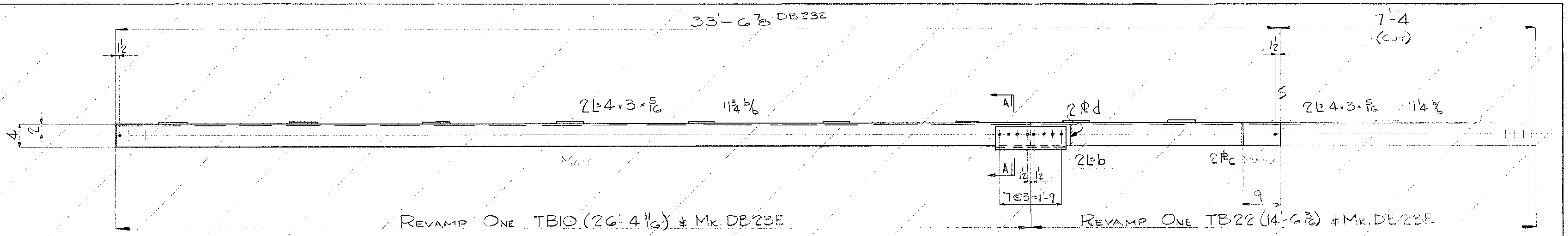


Revamp One TB10 (45'-3 3/16) & Mk. DB23E



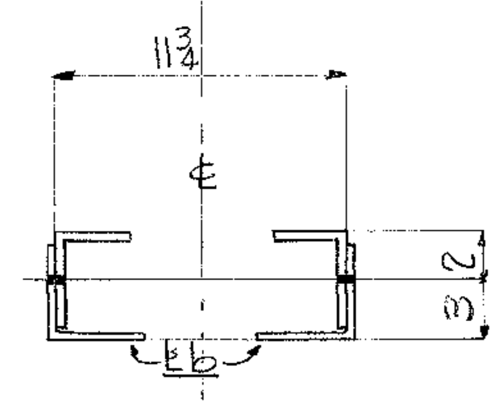
Revamp 2 TB10 (26'-4 11/16) & Mk. DB23E

Revamp 2 TB10 (26'-4 11/16) & Mk. DB23E



Revamp One TB10 (26'-4 11/16) & Mk. DB23E

Revamp One TB22 (14'-6 3/16) & Mk. DB23E



Section A-A

BILL OF MATERIAL Industrial Development Co.

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
Note: Braces Listed Below are to be Revamped as Shown on Details.					
4	Braces	26	4 11/16	TB10	Maile
4	L 5×3×½	2	0	b	Temp. New

Rivets: ¾ϕ For 13/16 Holes

Holes: 15/16ϕ UN

Paint:

Industrial Development Company

Addition to the Nanue Bridge

Hawaii

INDEPENDENT IRON WORKS, INC.

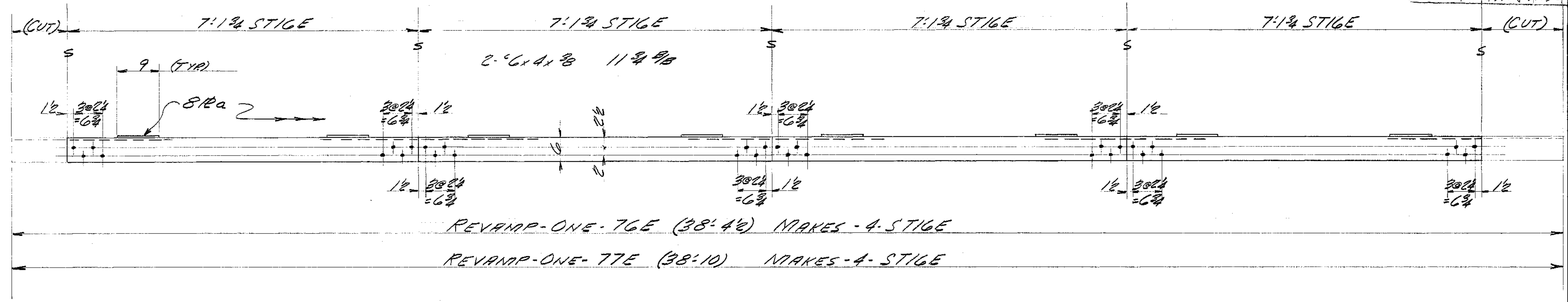
OAKLAND, CALIF.

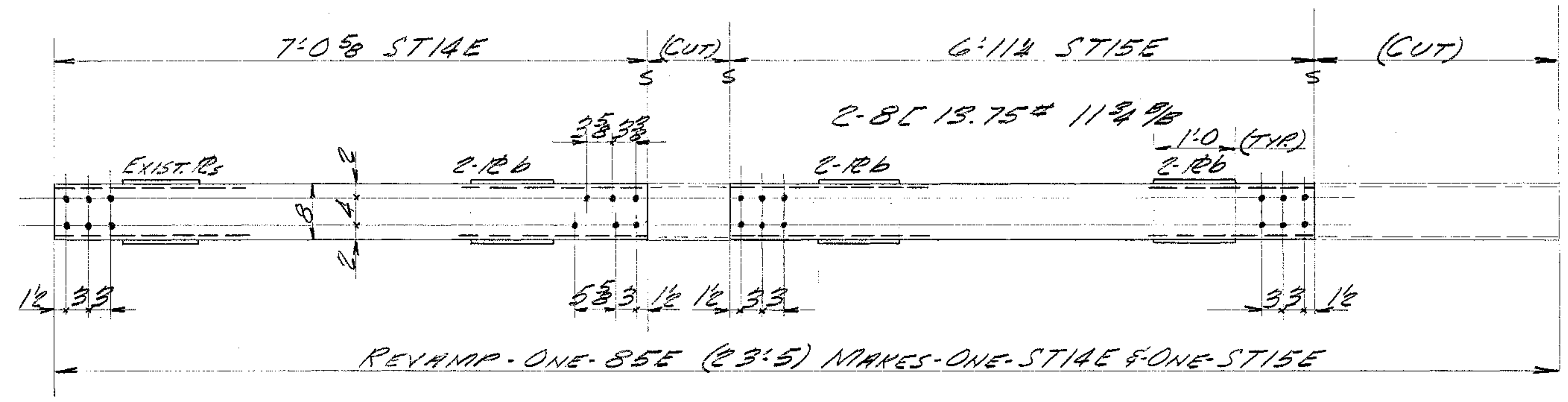
MADE BY	DAL	1-23-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	D50E

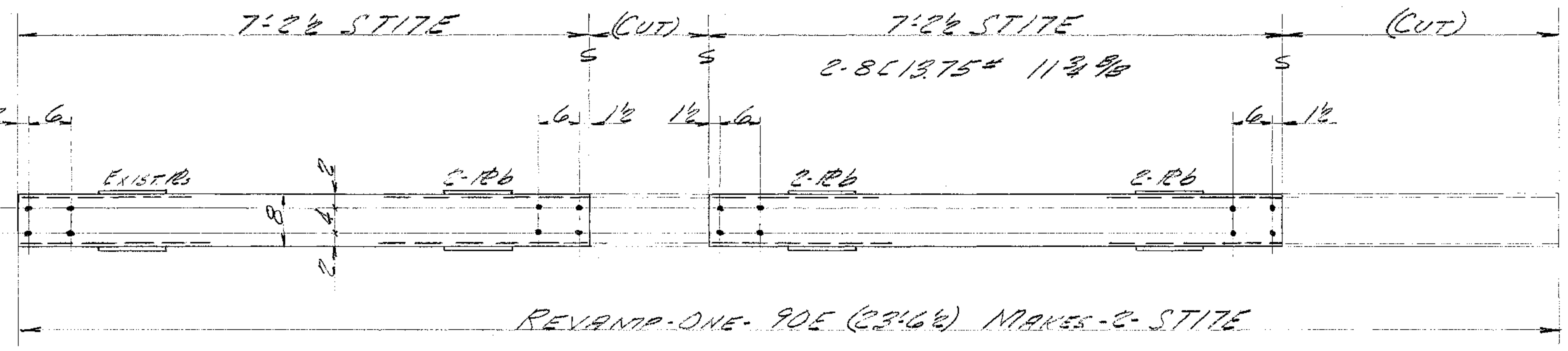
5468.130/30

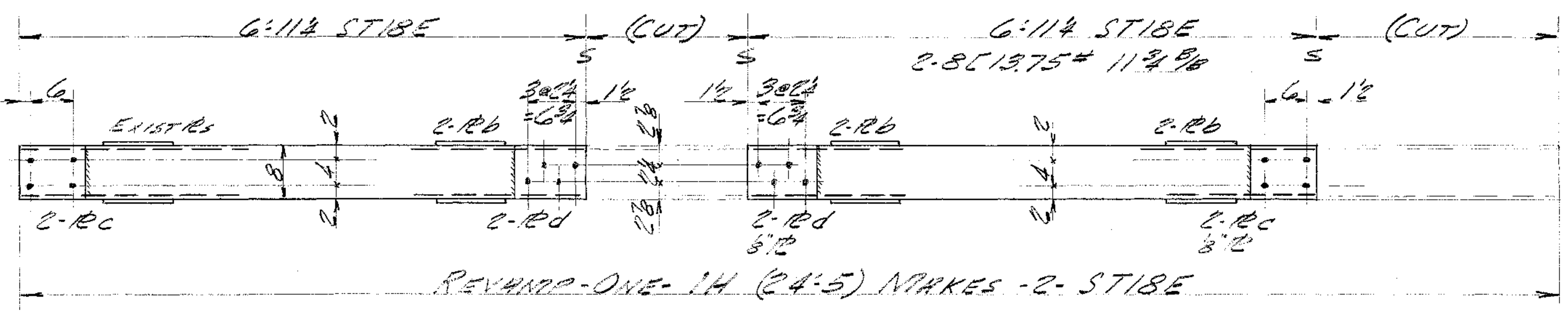
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	ΦDR 2(13)	1950	131	304

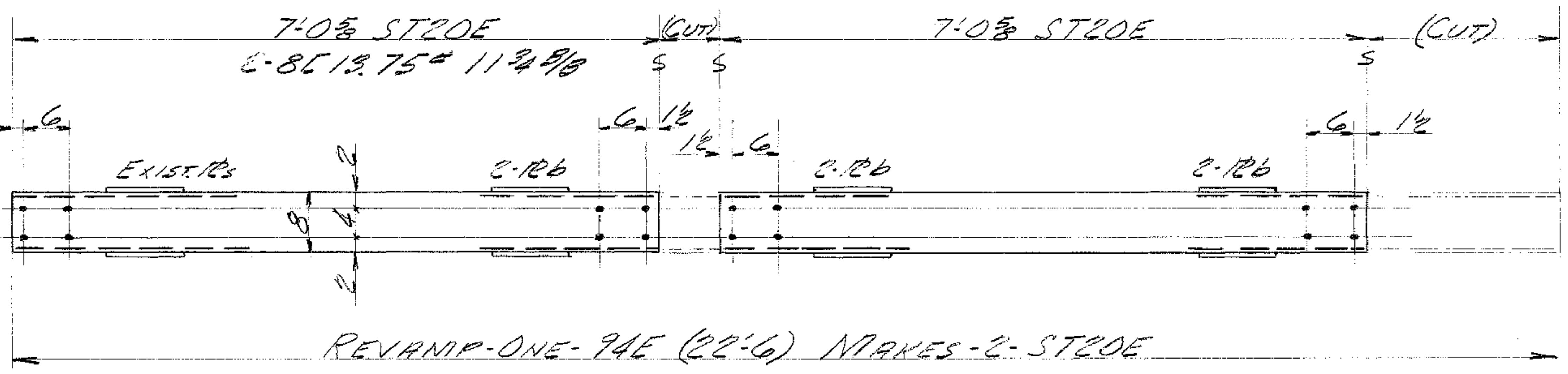
Order No. 3807 **Sheet No.** 051E

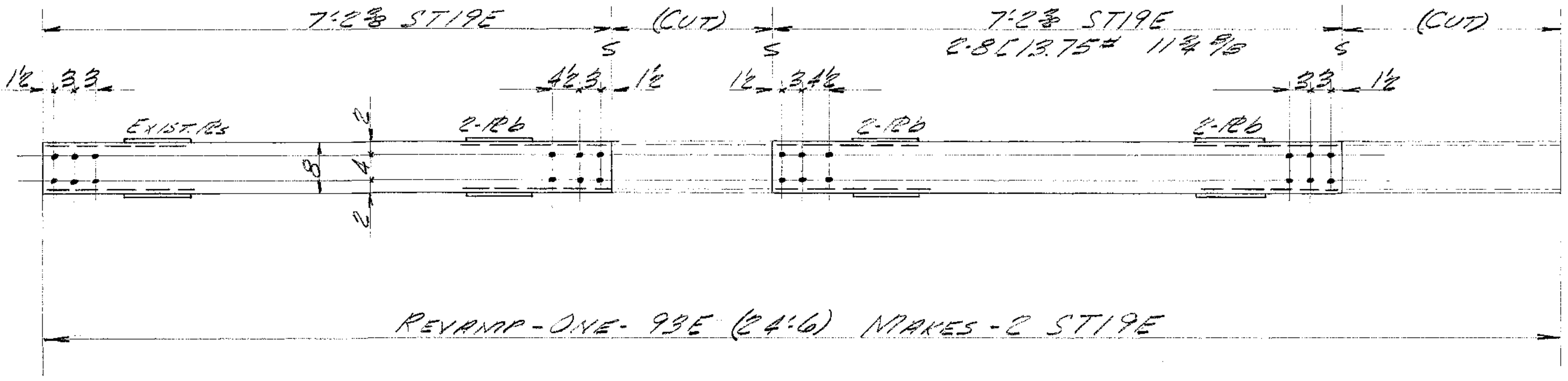












BILL OF MATERIAL NANUE BRIDGE

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
NOTE: THE MATERIAL LISTED BELOW IS TO BE REVAMPED AS ON THE DETAILS					
1	BRACE			76E	
1				77E	
1				85E	
1				90E	
1				1H	
1				93E	
1				94E	
NEW MAT'L IS LISTED BELOW					
16	℞ 9x ⅜	0	11	a	PLAIN
30	℞ 11x ⅜	1	0	b	Do.
4	℞ 8x ⅛	0	9	c	TEMP.
4	℞ 8x ⅛	0	9¾	d	Do.

~~Rivets~~: WELD
Holes: 15⁄16"Φ
Paint: (SEE SPECS)

INDUSTRIAL DEV. CO.

ADDITION TO THE
NANUE BRIDGE
-HAWAII-

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DW	10-9-50	ORDER NO.	3807
CHECKED BY			SHEET NO.	051E

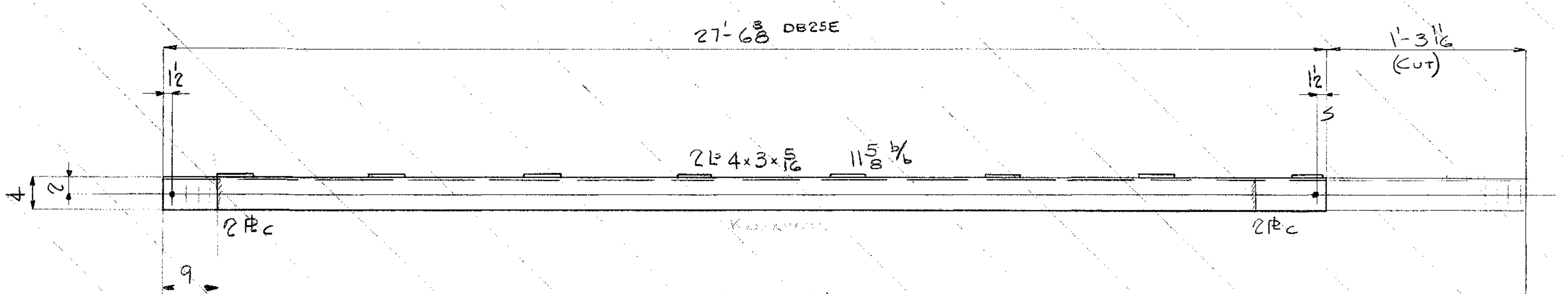
546S.131

Order No. 3807 **Sheet No.** D52E

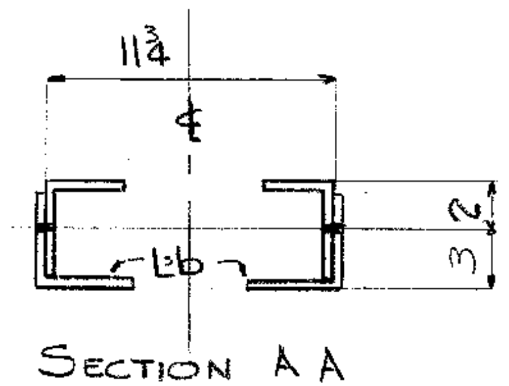
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(B)	1950	132	304

BILL OF MATERIAL Industrial Development Co.

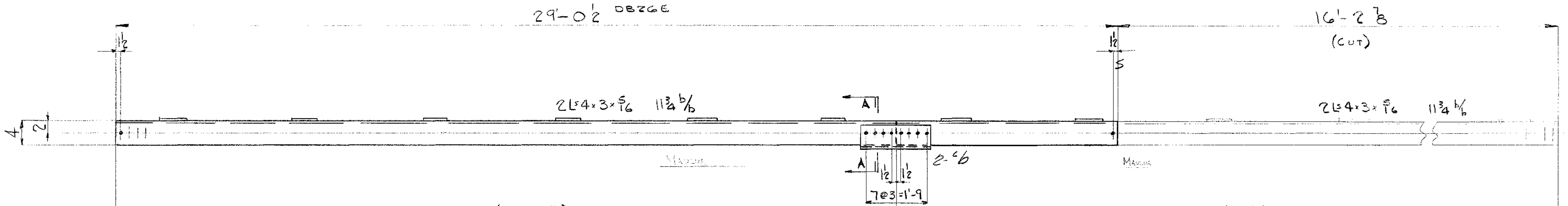
No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
Note: Braces Listed Below Are to be Revamped as Shown on Details.					
					Salv. From:
4	Braces	22	7 11/16	TB9	Maulua
1	Do	14	6 7/16	TB1	Kealahaka
4	L5×3×1/2	2	0	b	Temp. (New)



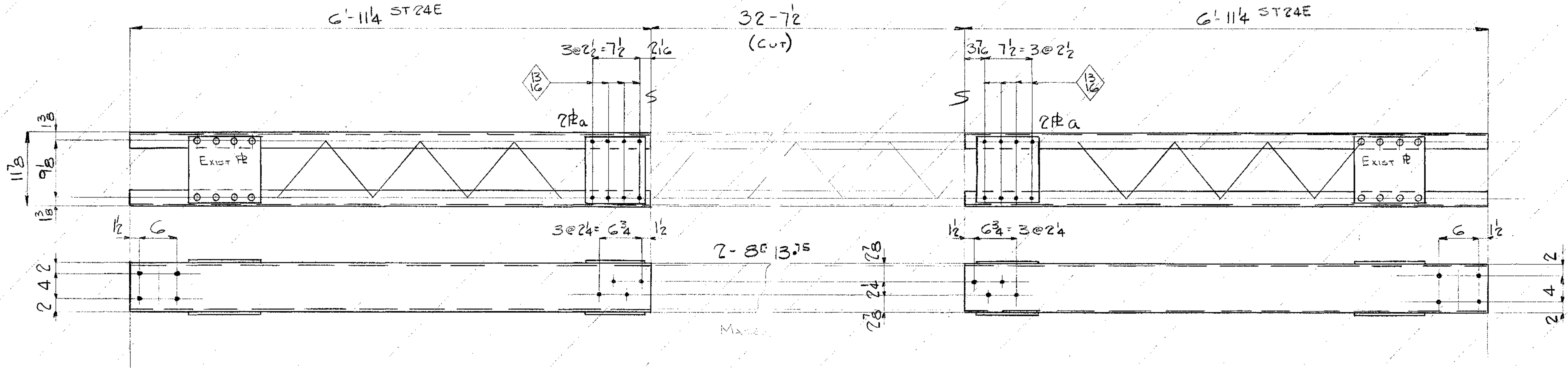
Revamp 2 TB15 (28'-10 1/16) & Mk. DB25E



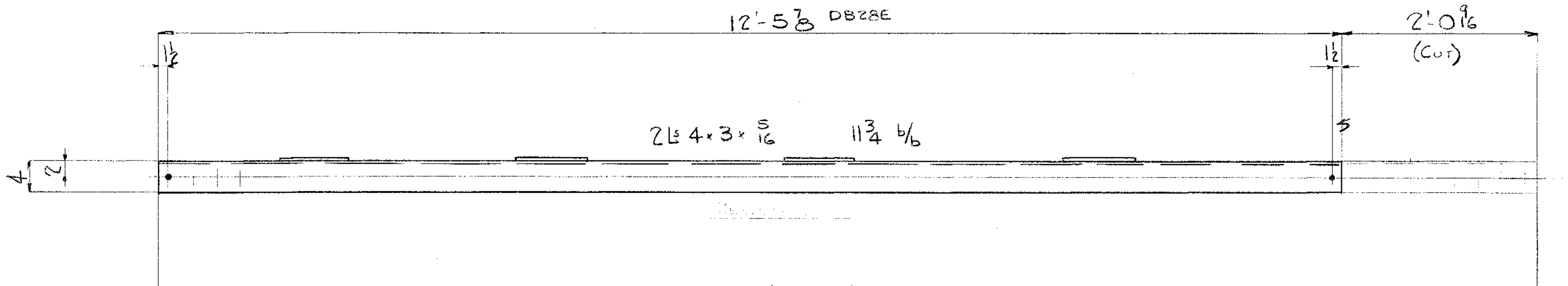
Section A A



Revamp 2 TB9 (22'-7 11/16) & Mk. DB26E   Revamp 2 TB9 (22'-7 11/16) & Mk. DB26E



Revamp One TS17 (46'-6) & Mk. ST24E



Revamp-One-TB1 (14'-6 7/16) & Mk. DB28E

Rivets: 3/4 φ For 13/16 φ Holes
Holes: 15/16 φ UN
Paint:

Industrial Development Company

Addition to the Nanue Bridge
Hawaii

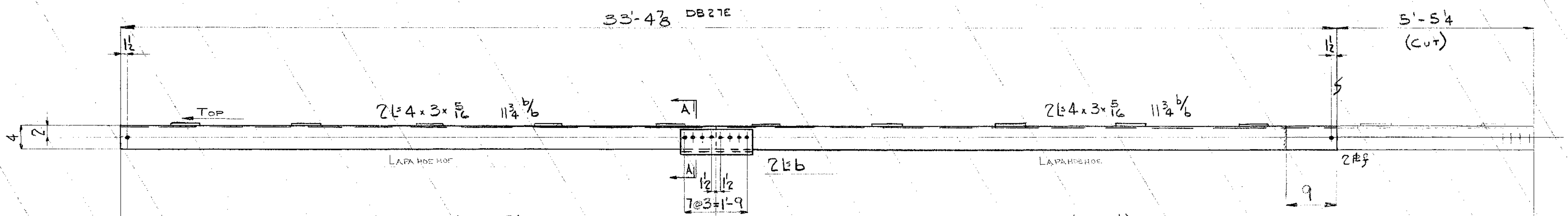
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	1-25-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	D52E

5468.132

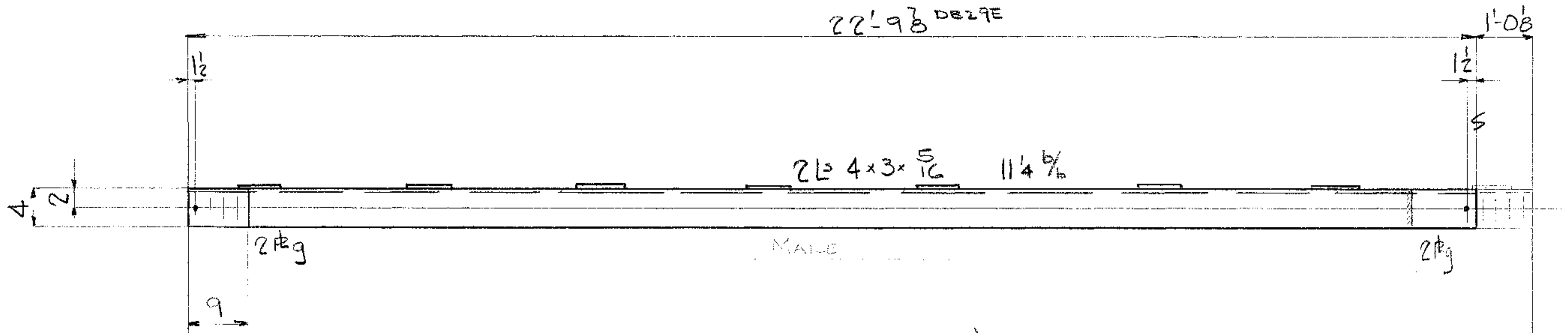
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	DDE3(12)	1950	133	304

Order No. 3807 **Sheet No.** D53E

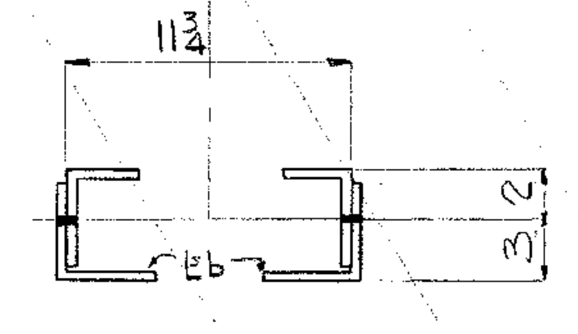


Revamp 2 TB23 (16'-4 5/8) & Mk. DB27E

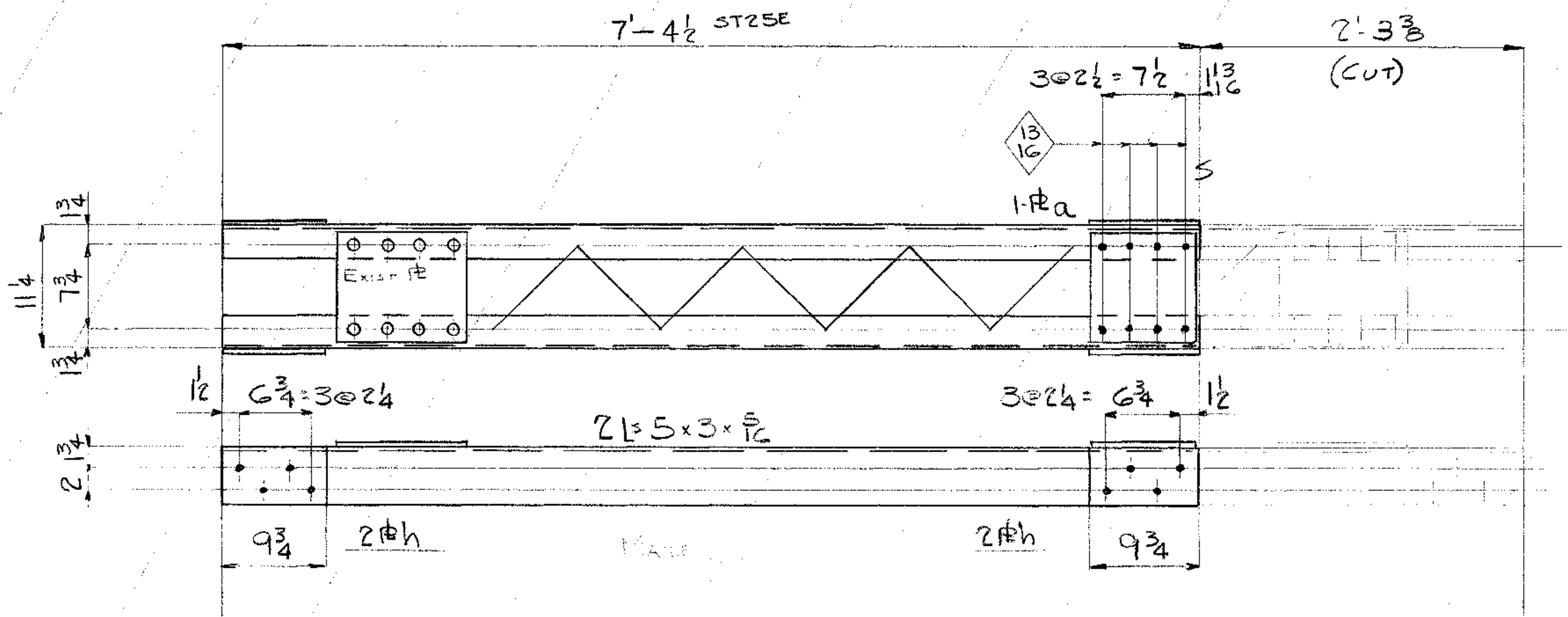
Revamp 2 TB24 (22'-5 1/2) & Mk. DB27E



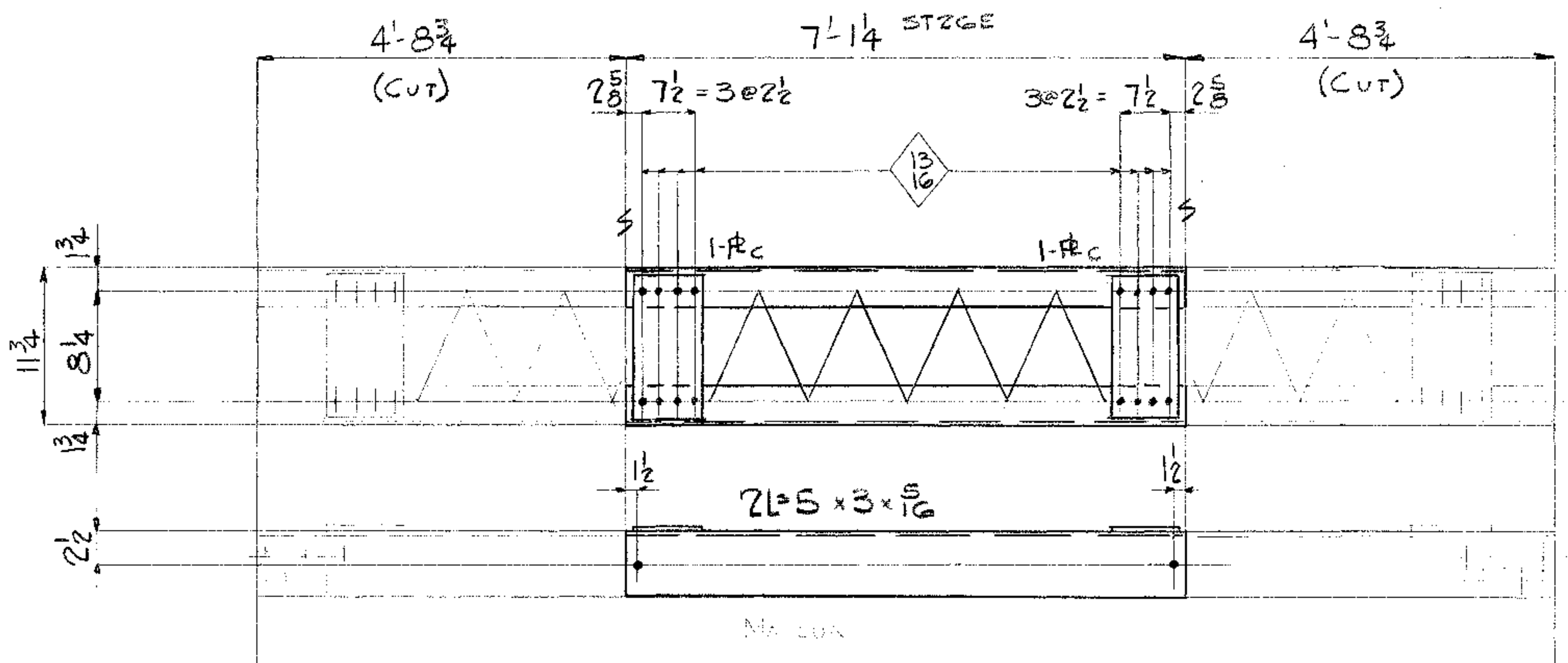
Revamp 2 TB21 (23'-10) & Mk. DB29E



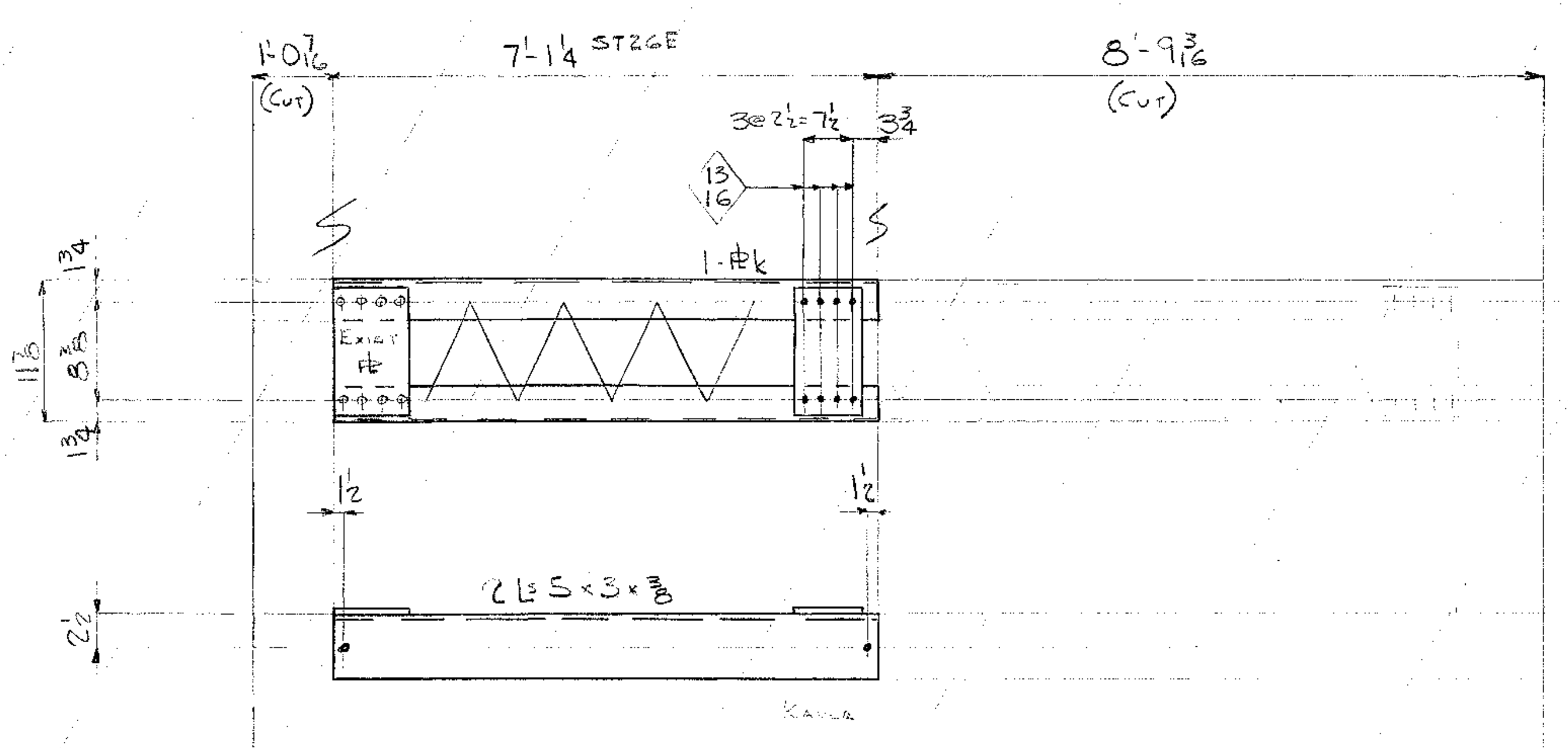
Section A-A



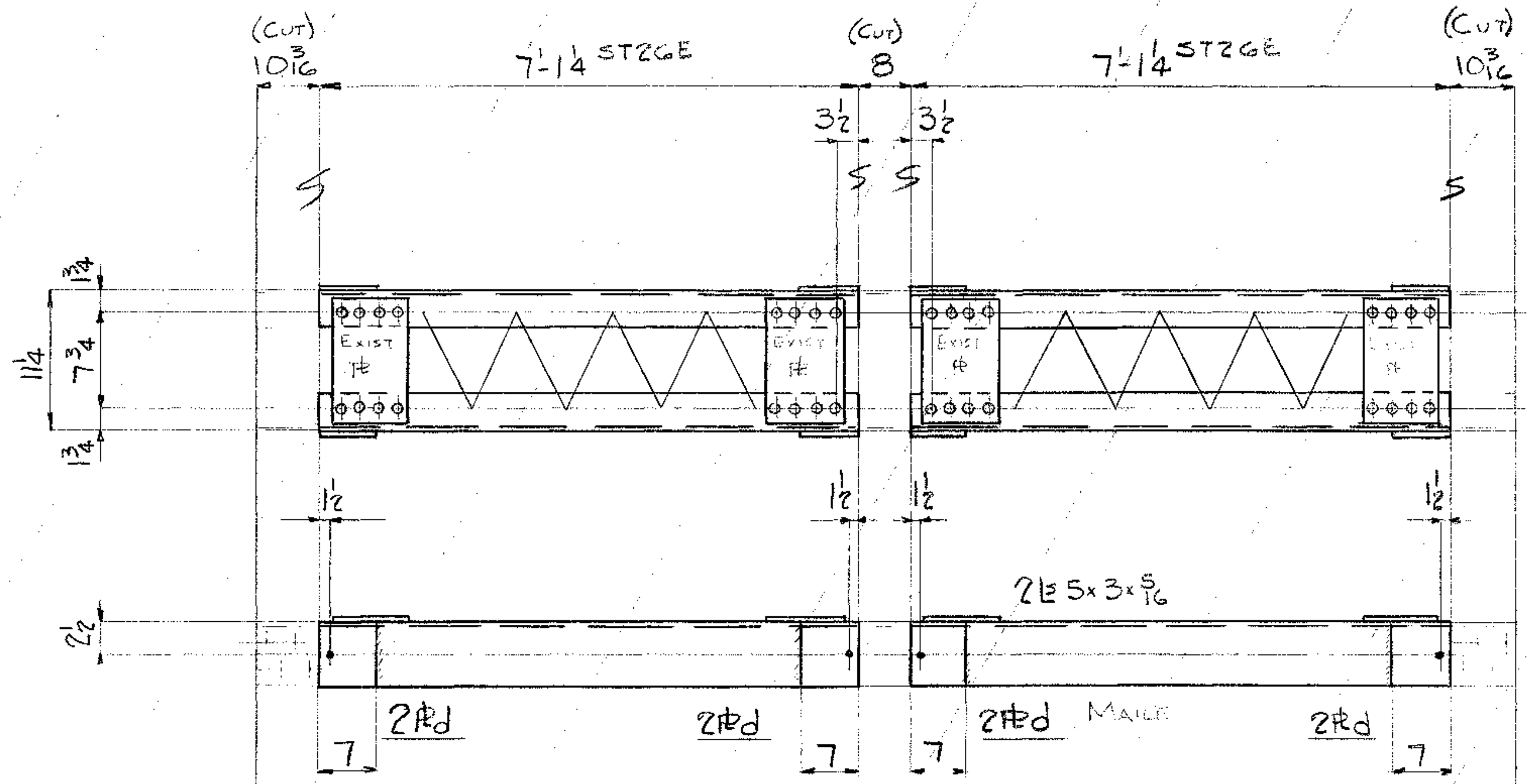
Revamp 2 TS9 (9'-7 3/8) & Mk. ST25E



Revamp One TS5 (16'-6 11/16) & Mk. ST26E



Revamp One TS16 (16'-10 3/8) & Mk. ST26E



Revamp One TS10 (16'-6 3/8) & Mk. ST26E

BILL OF MATERIAL Industrial Development Co.

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
Note:	Braces Listed Below are to be Revamped as Shown on Detail.				
					Salv. From
2	Braces	23	10	TB21	Maile
1	Do	16	6 11/16	TS5	Maulua
2	Ꝑ 10×3/8	0	10 3/4	c	Temp. (New)
8	Ꝑ 4×5/16	0	9	g	Do

Rivets: 3/4 φ For 13/16 φ Holes.

Holes: 15/16 φ UN

Paint:

Industrial Development Company

Addition to the Nanue Bridge
Hawaii

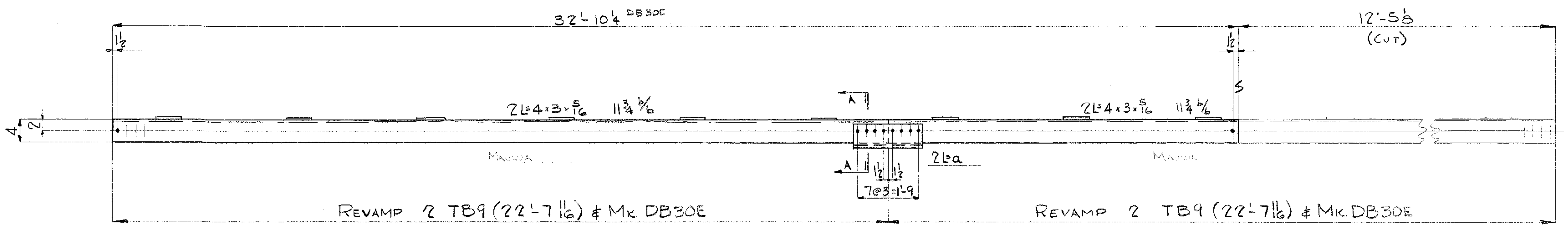
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	1-25-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	D53E

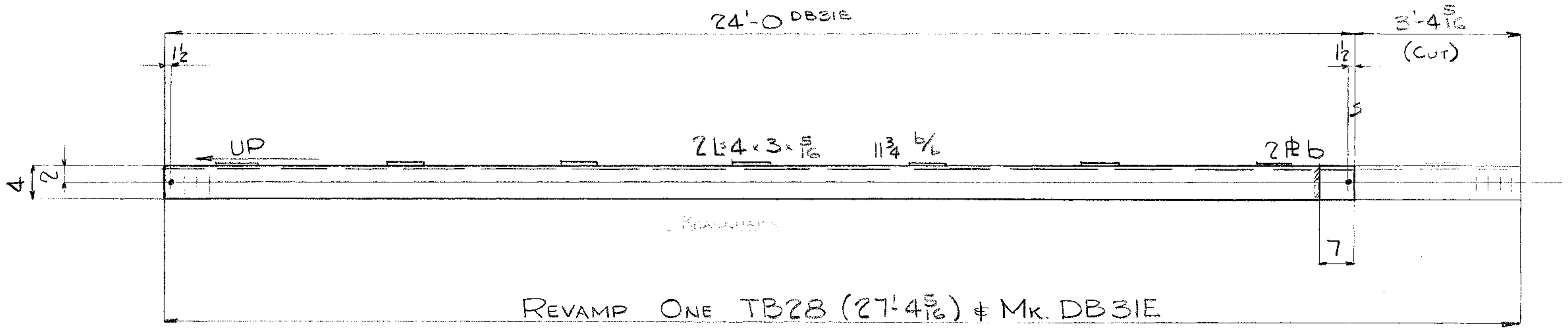
5468.133

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	50R3(13)	1950	134	304

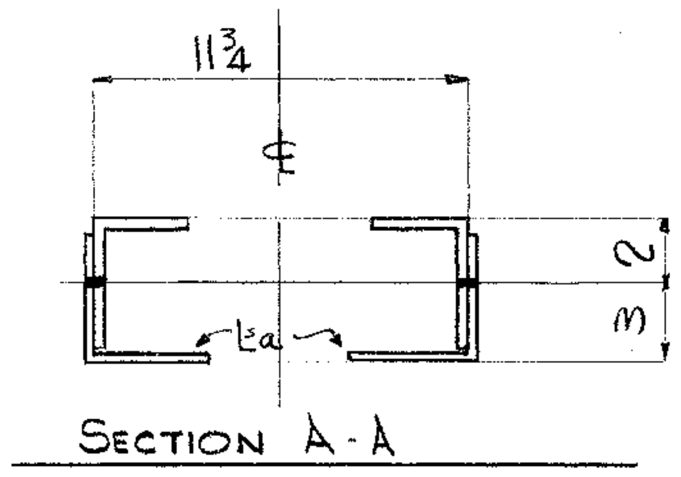
Order No. 3807 Sheet No. DS4E



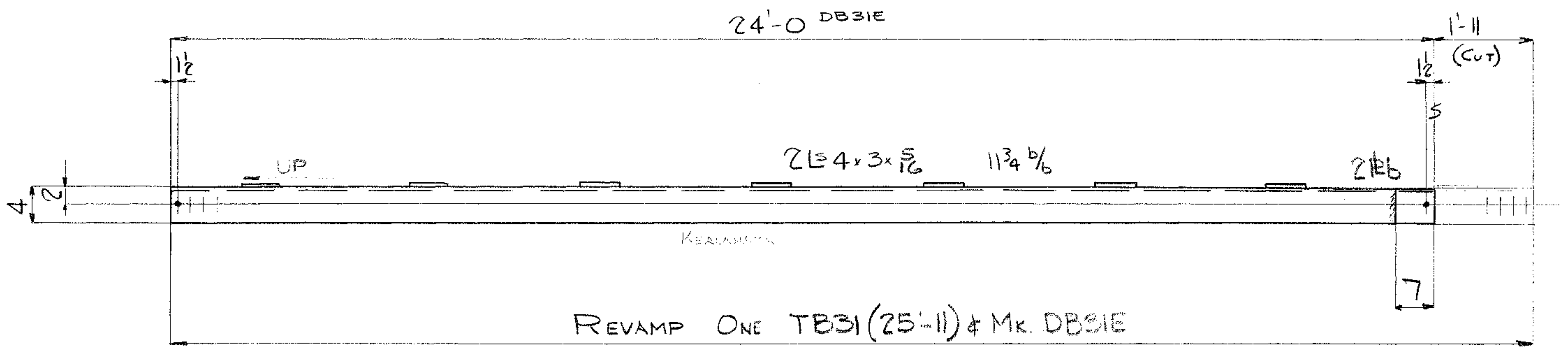
Revamp 2 TB9 (22'-7 11/16) & Mk. DB30E Revamp 2 TB9 (22'-7 11/16) & Mk. DB30E



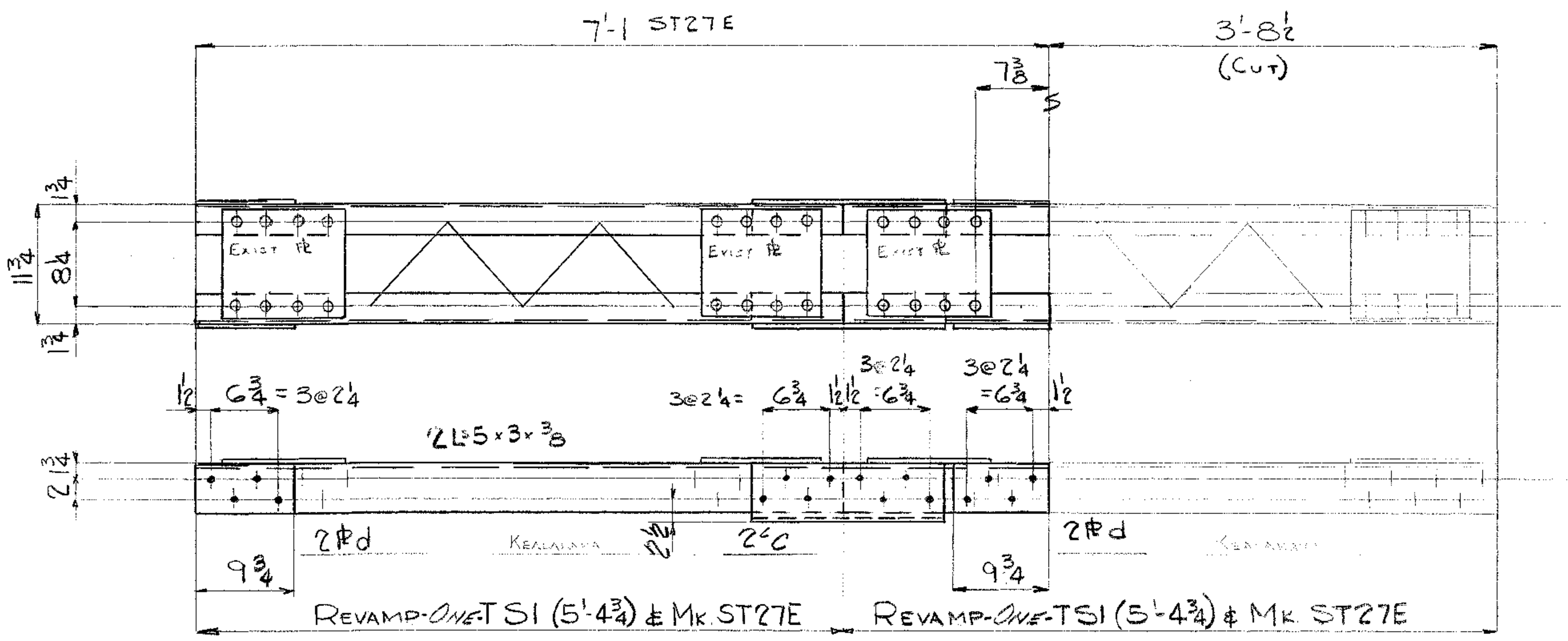
Revamp One TB28 (27'-4 5/16) & Mk. DB31E



Section A-A



Revamp One TB31 (25'-11) & Mk. DB31E



Revamp-One-TS1 (5'-4¾) & Mk. ST27E Revamp-One-TS1 (5'-4¾) & Mk. ST27E

BILL OF MATERIAL Industrial Development Co.

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
Note: Braces listed below are to be revamped as shown on details.					
					Salv. From:
4	Braces	22	7 11/16	TB9	Maulua
1	Do	27	4 5/16	TB28	Kealahaka
1	Do	25	11	TB31	Do
2	Do	5	4¾	TS1	Do
4	L 5×3×½	2	0	a	Temp-New
4	ℙ 4×⅛	0	7	b	Do Do
2	L 6×4×½	1	7½	c	Do Do
4	ℙ 5×⅛	0	9¾	d	Do Do

Rivets:

Holes: 15/16 ⌀

Paint:

Industrial Development Company

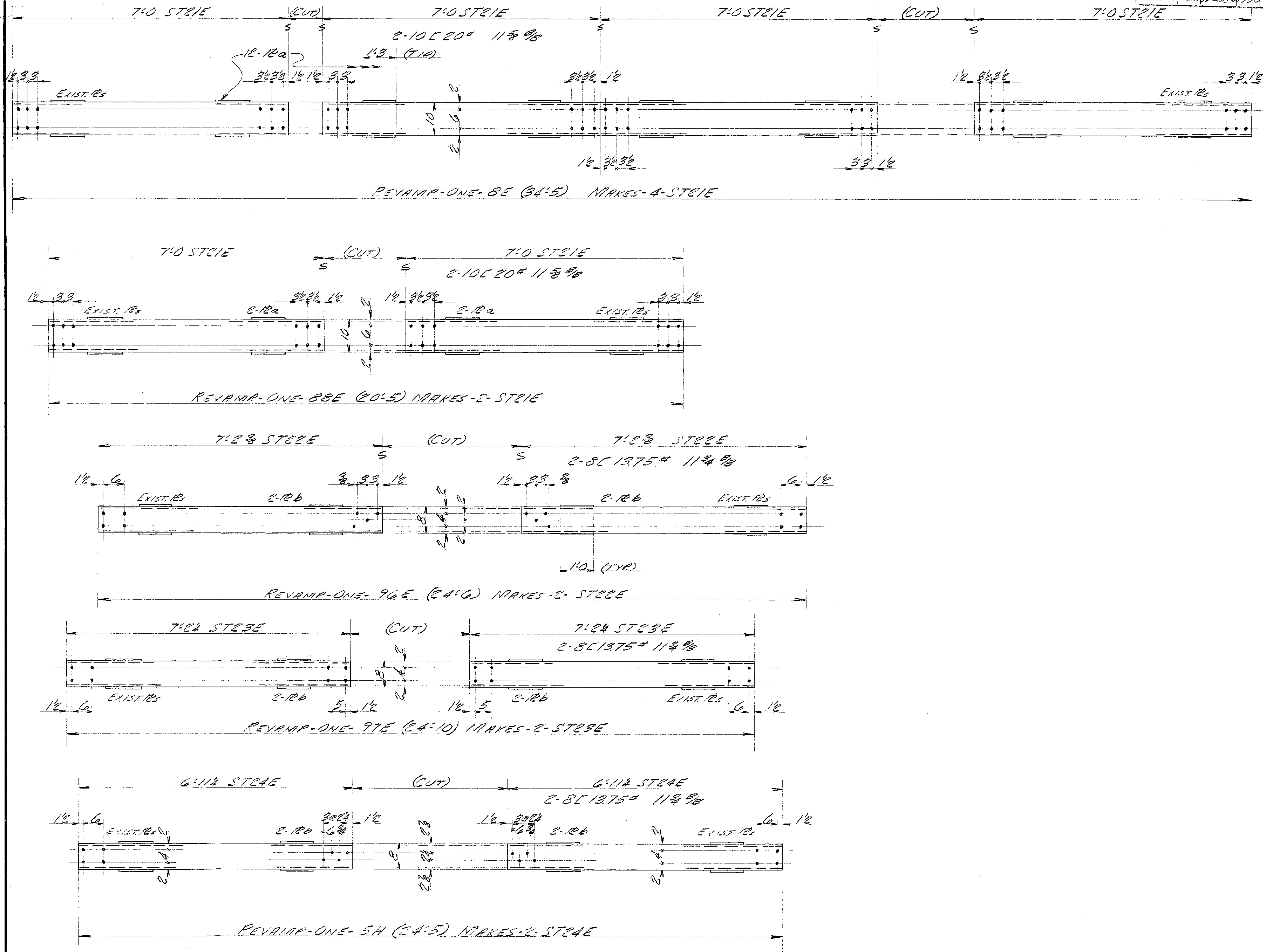
Addition to the Nanue Bridge
Hawaii

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	1-26-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	DS4E

Order No. 3807 **Sheet No.** D55E

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL
Hawaii	Haw	GDR 3(13)	1950	135	304



BILL OF MATERIAL Nanue Bridge

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
Note: Revamp The Material Listed Below A.S. On The Details					
1	Brace			8E	
1				88E	
1				96E	
1				97E	
1				5H	
New Mat'l. Is Listed Below					
16	℞ 11 x ⅜	1	3	a	Plain
12	℞ 11 x ⅜	1	0	b	Do.

~~Rivets:~~ Weld
Holes: 15/16"⌀
Paint: (See Specs.)

Industrial Dev. Co.

Addition To The
Nanue Bridge
-Hawaii-

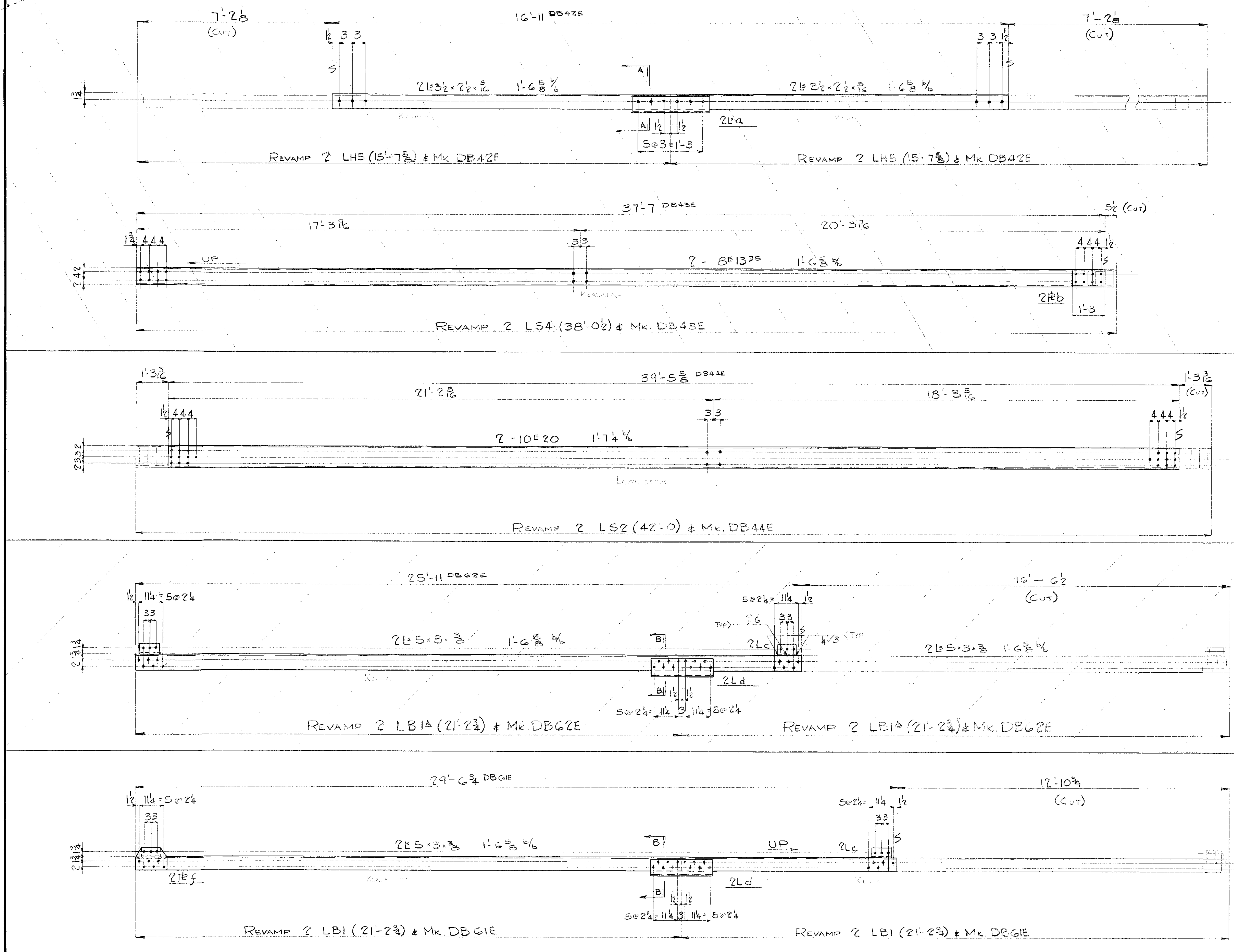
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DM	10-9-50	ORDER NO.	3807
CHECKED BY			SHEET NO.	D55E

5468.135

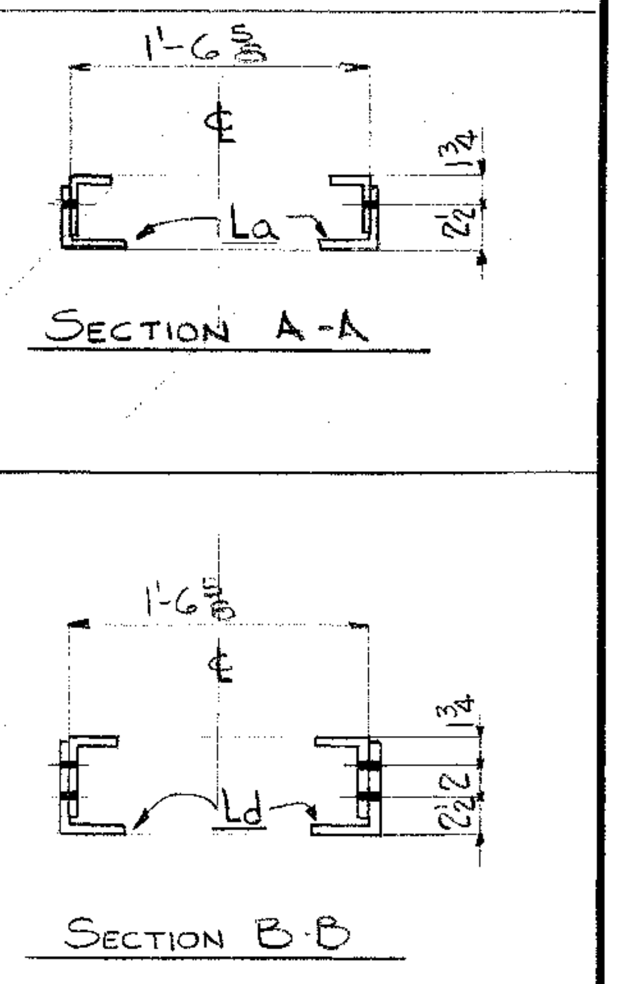
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR-2(13)	1950	136	304

Order No. 3807 **Sheet No.** D56E



BILL OF MATERIAL Industrial Development Co

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
Note: Braces Listed Below are to be Revamped as Shown on Details.					
					Salv. From:
2	Braces	42	0	LS2	Laupahoehoe
4	Do	21	2¾	LB1	Do
4	L6×4×½	2	4½	d	Temp (New)
4	ℙ 8×¼	1	2¼	f	Do Do



Rivets: ⅞ φ
Holes: 15/16 φ
Paint:

Industrial Development Company

Addition to the Nanue Bridge
Hawaii

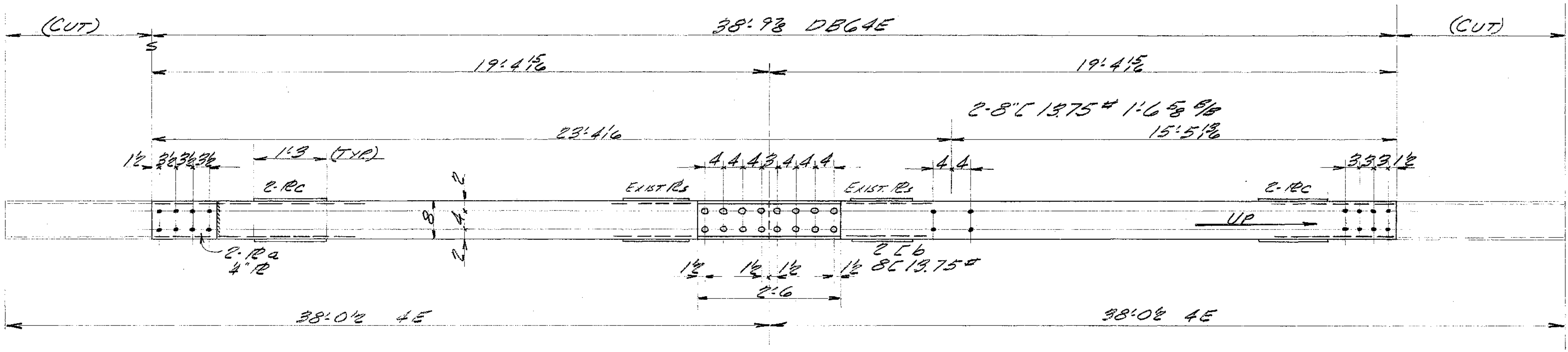
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	2-1-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	D56E

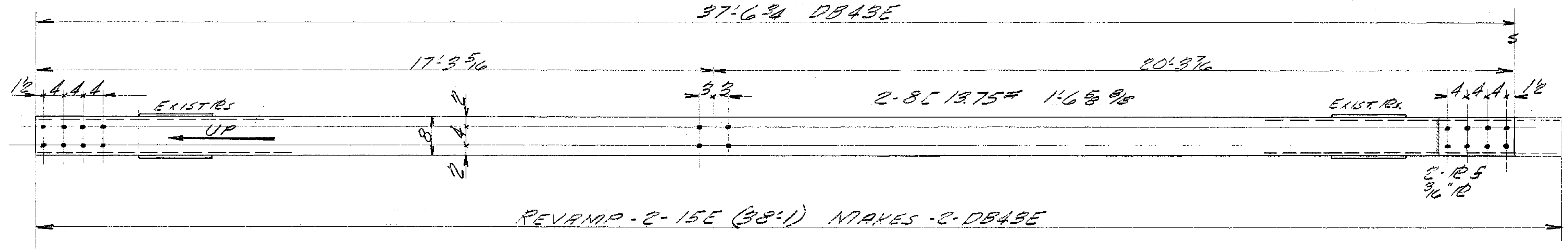
5468.136

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	DR-3(3)	1950	137	304

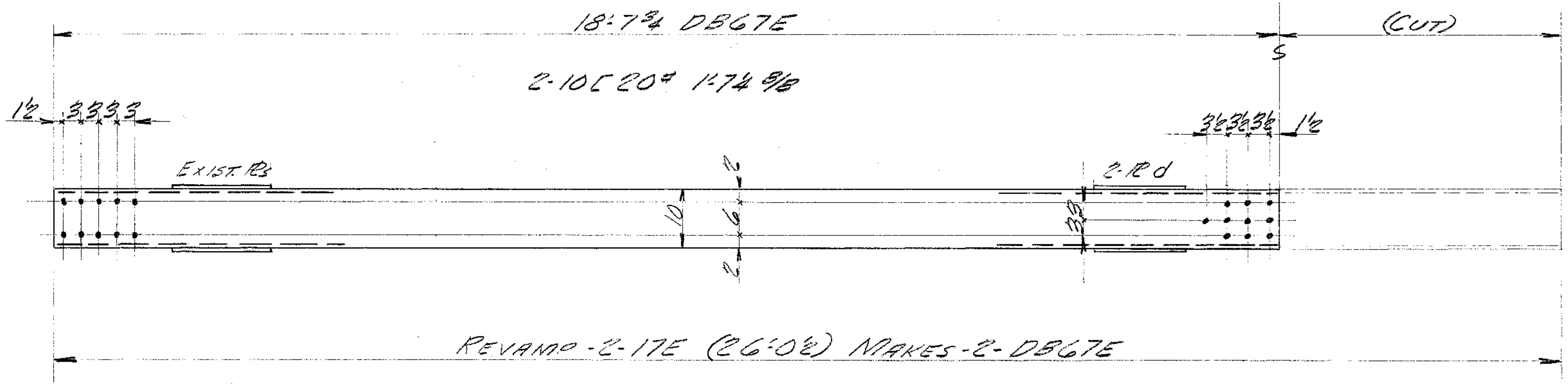
Order No. 3807 **Sheet No.** D57E



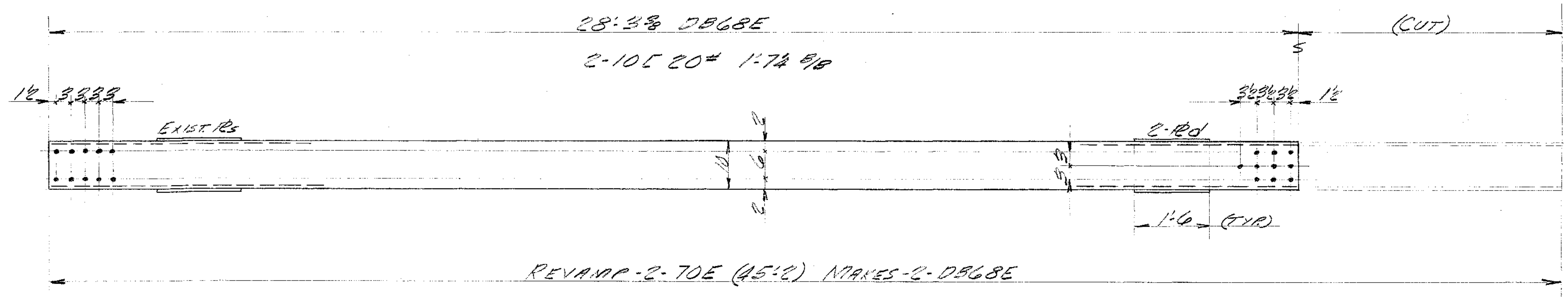
REVAMP - 4 - "4E" (38'-0½) MAKES - 2 - DB64E



REVAMP - 2 - 15E (38'-1) MAKES - 2 - DB43E



REVAMP - 2 - 17E (26'-0½) MAKES - 2 - DB67E



REVAMP - 2 - 70E (45'-2) MAKES - 2 - DB68E

BILL OF MATERIAL
NANUE BRIDGE

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
NOTE: REVAMP THE MATERIAL LISTED BELOW A.S. ON THE DETAILS					
4	BRACES			4E	
2	}			15E	
2				17E	
2				70E	
NEW MAT'L. IS LISTED BELOW					
4	PL 8 x ¼	1	1½	a	TEMP.
4	8[13.75#	2	6	b	Do.
8	PL 15 x ⅜	1	3	c	PLAIN
8	PL 18½ x ⅜	1	6	d	Do.
4	PL 8 x 3/16	1	3	S	TEMP.
64	¾"⌀ RIVETS				

Rivets: ⅞"⌀

Holes: 15/16"⌀S

Paint: (SEE SPECS.)

INDUSTRIAL DEV. CO.

ADDITION TO THE
NANUE BRIDGE
-HAWAII-

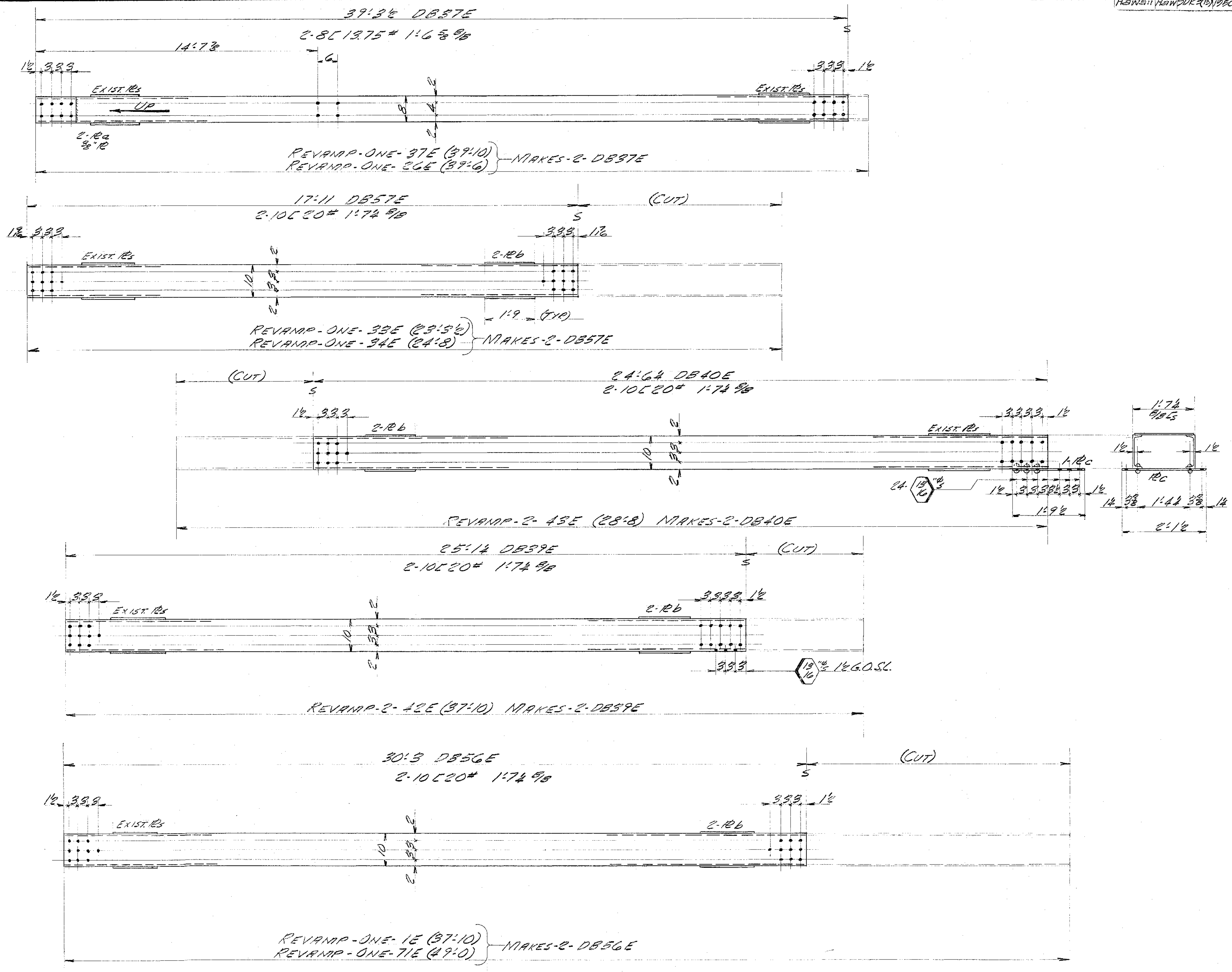
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DW	10-9-50	ORDER NO.	3807
CHECKED BY			SHEET NO.	D57E

5468.137

FED ROAD DIST NO	STATE	FED AID PROJ NO	FISCAL YEAR	SHEET NO	TOTAL SHEETS
Hawaii	Haw	DDR 2(B)	1950	138	304

Order No. 3807 **Sheet No.** D58E



BILL OF MATERIAL NANUE BRIDGE

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
NOTE: THE MATERIAL LISTED BELOW IS TO BE REVAMPED A.S. ON THE DETAILS					
1	BRACE			37E	
1				26E	
1				33E	
1				34E	
2				43E	
2				42E	
1				1E	
1				71E	
NEW MAT'L. IS LISTED BELOW					
4	℞8 x ⅜	1	0	a	TEMP.
16	℞18½ x ⅜	1	9	b	PLAIN
2	℞21½ x ⅜	2	1½	c	TEMP.
12	¾"⌀ RIVETS				

Rivets: ¾"⌀ FOR 13/16"⌀ HLS.
Holes: 15/16"⌀ U.N.
Paint: (SEE SPECS.)

INDUSTRIAL DEV. CO.

ADDITION TO THE
NANUE BRIDGE
-HAWAII-

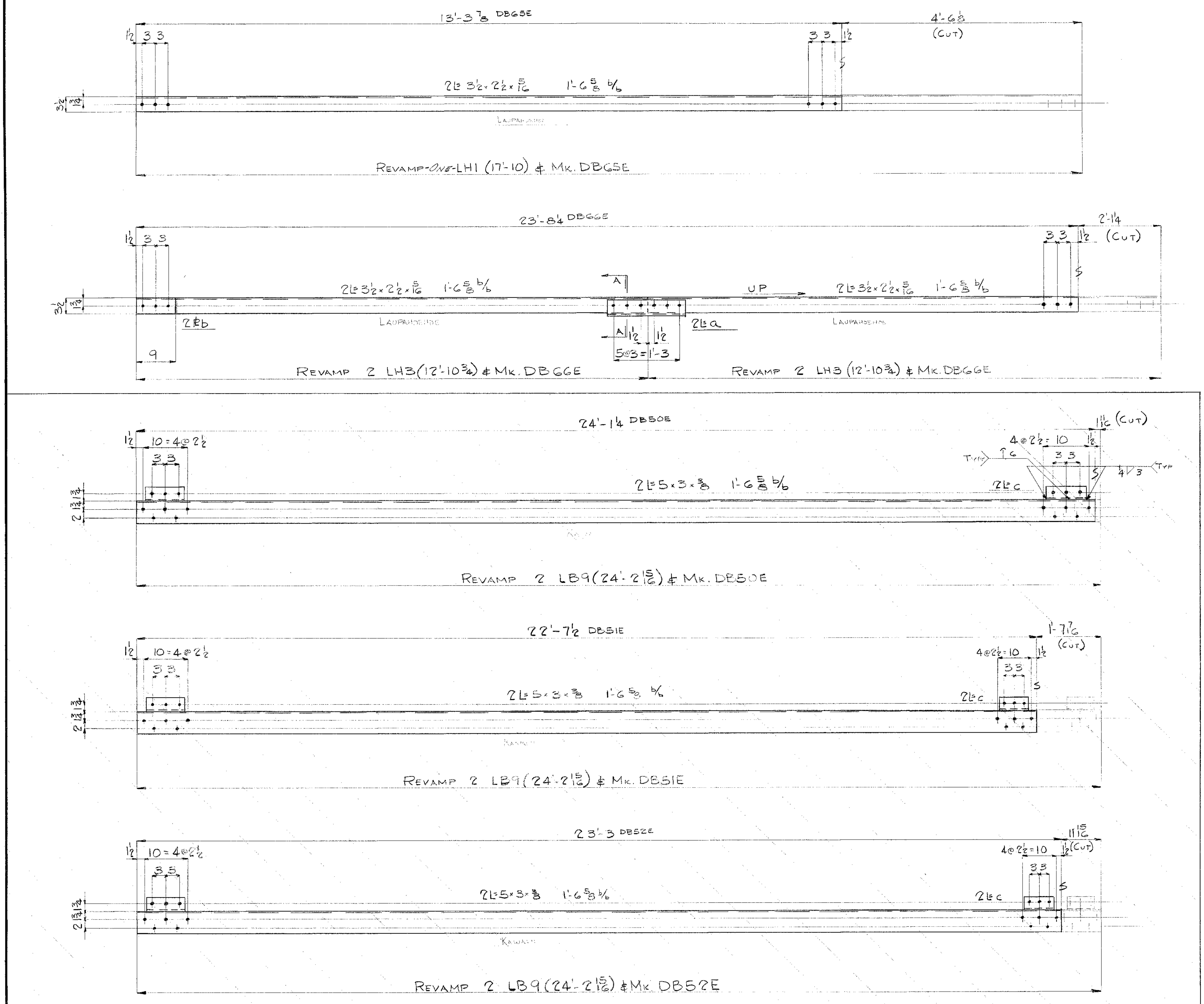
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	Dm	10-9-50	ORDER NO.	3807
CHECKED BY			SHEET NO.	D58E

5468.138

Order No. 3807 Sheet No. D59E

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	7DR 3(13)	1950	139	304

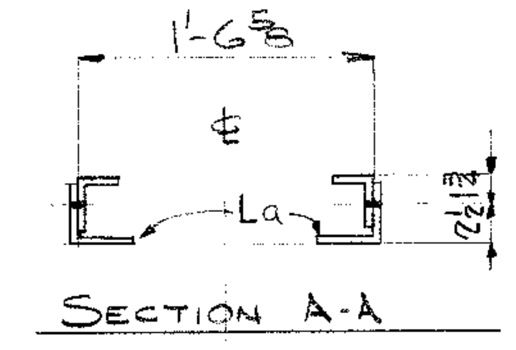


BILL OF MATERIAL

INDUSTRIAL DEVELOPMENT CO.

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
NOTE: BRACES LISTED BELOW ARE TO BE REVAMPED AS SHOWN ON DETAILS.					
					SALV. FROM:
1	BRACES	17	10	LH1	LAUPAHOEHOE
4	Do	12	10¾	LH3	Do
4	L4×4×⅜	1	6	a	Temp-New
4	₱ 3½ × ¼	0	9	b	Do Do

NOTE:
EXISTING ₱ & ∟ WHICH INTERFERE MAY BE REMOVED.



SECTION A-A

Rivets: ⅞ ϕ
Holes: 15/16 ϕ
Paint:

INDUSTRIAL DEVELOPMENT COMPANY

ADDITION TO THE NANUE BRIDGE
HAWAII

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DAL	2-3-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	D59E

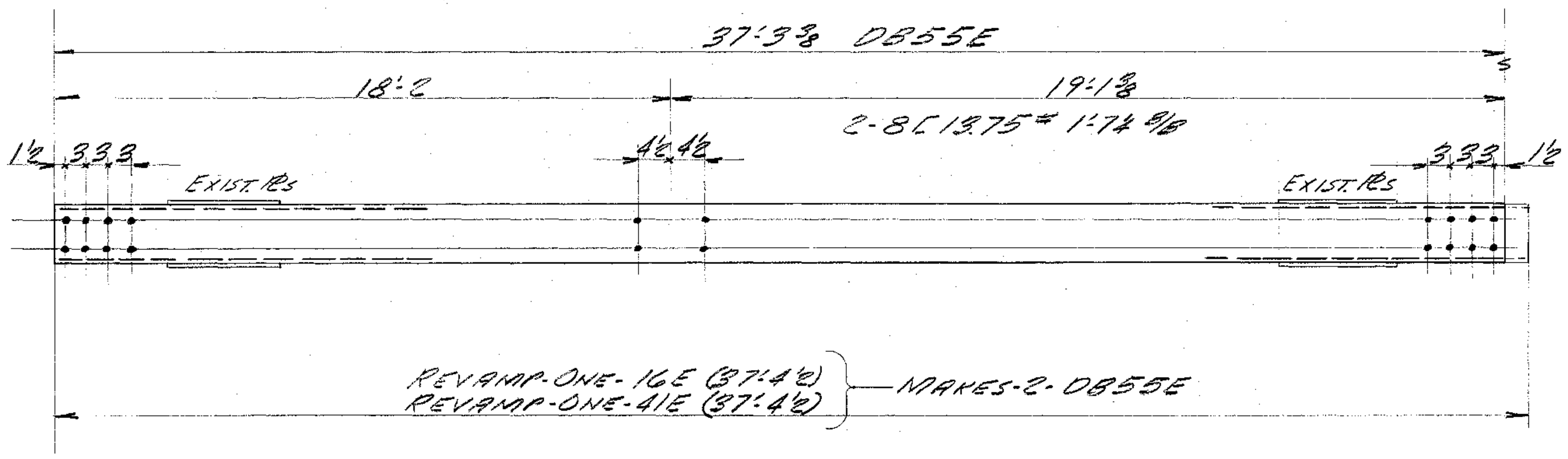
5468.139 139

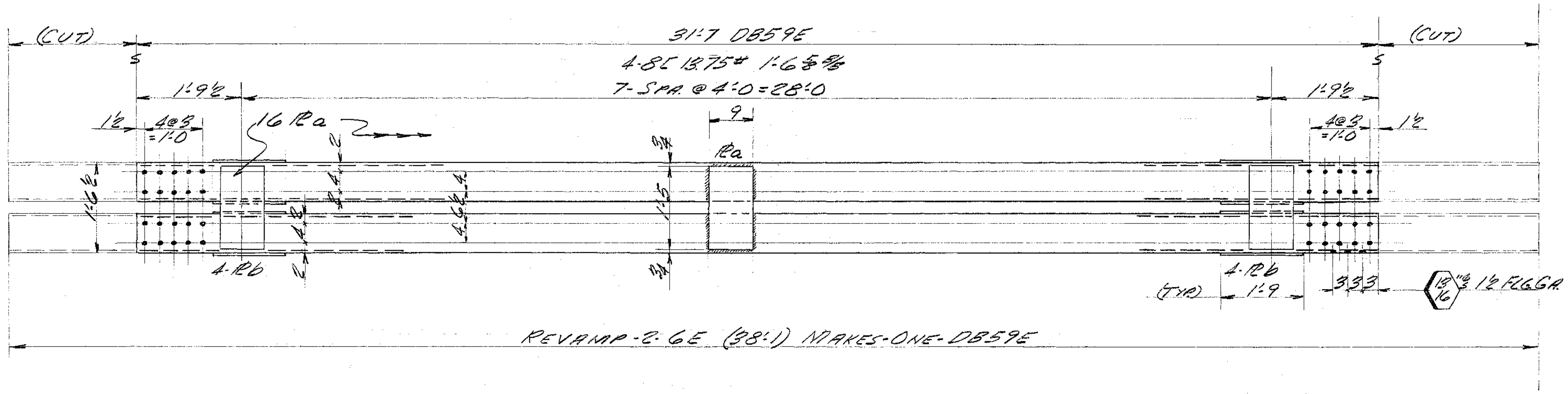
Order No. 3807 Sheet No. D60E

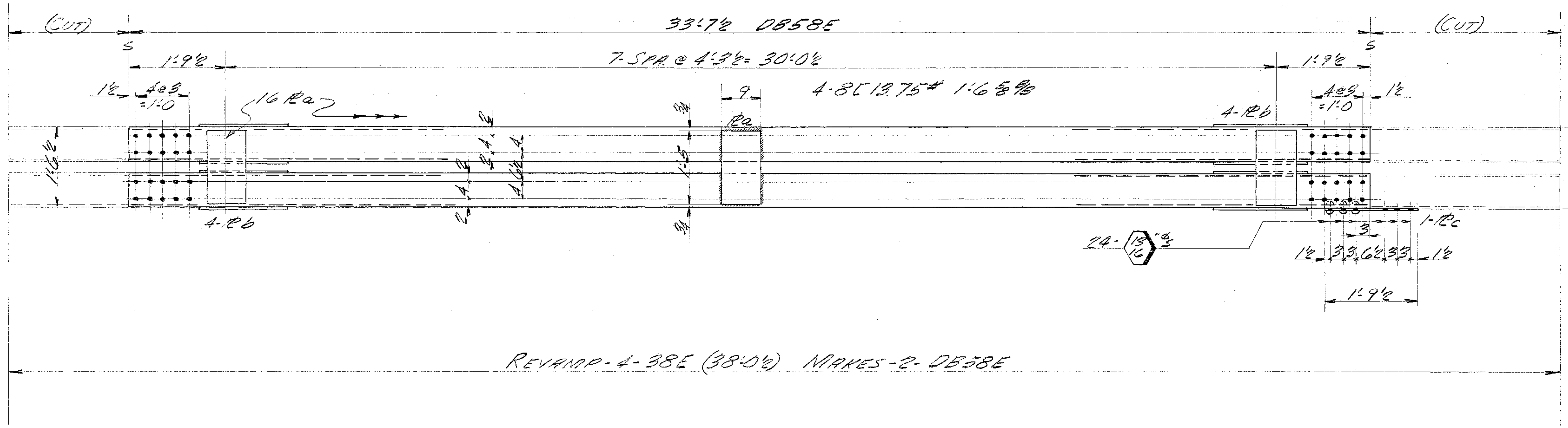
Hawaii | Haw SDR 3(13) | 1950 | 140 | 304

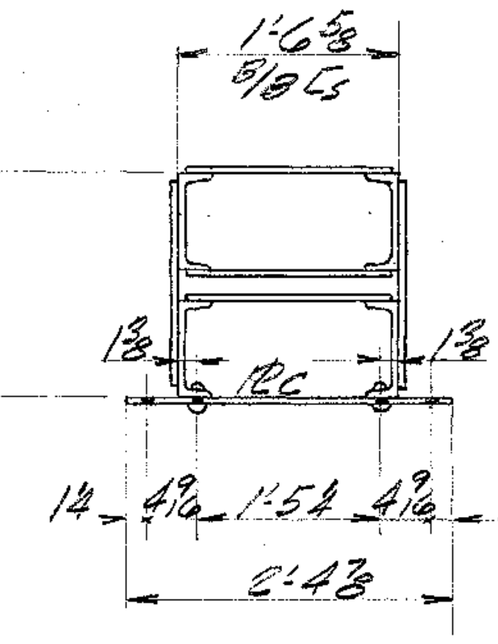
BILL OF MATERIAL NANUE BRIDGE

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
NOTE: THE MATERIAL LISTED BELOW IS TO BE REVAMPED AS ON THE DETAILS					
1	BRACE			16E	
1				41E	
2				6E	
4				38E	
NEW MAT'L IS LISTED BELOW					
48	PL 9 x ½	1	5	a	PLAIN
24	PL 18 x ⅜	1	9	b	Do.
2	PL 21½ x ⅜	2	4⅞	c	TEMP
12	¾"Φ RIVETS				









Rivets: ¾"Φ FOR 13/16"Φ HLS.
Holes: 13/16"Φ U.N.
Paint: (SEE SPECS)

INDUSTRIAL DEV. CO.

ADDITION TO THE
NANUE BRIDGE
-HAWAII-

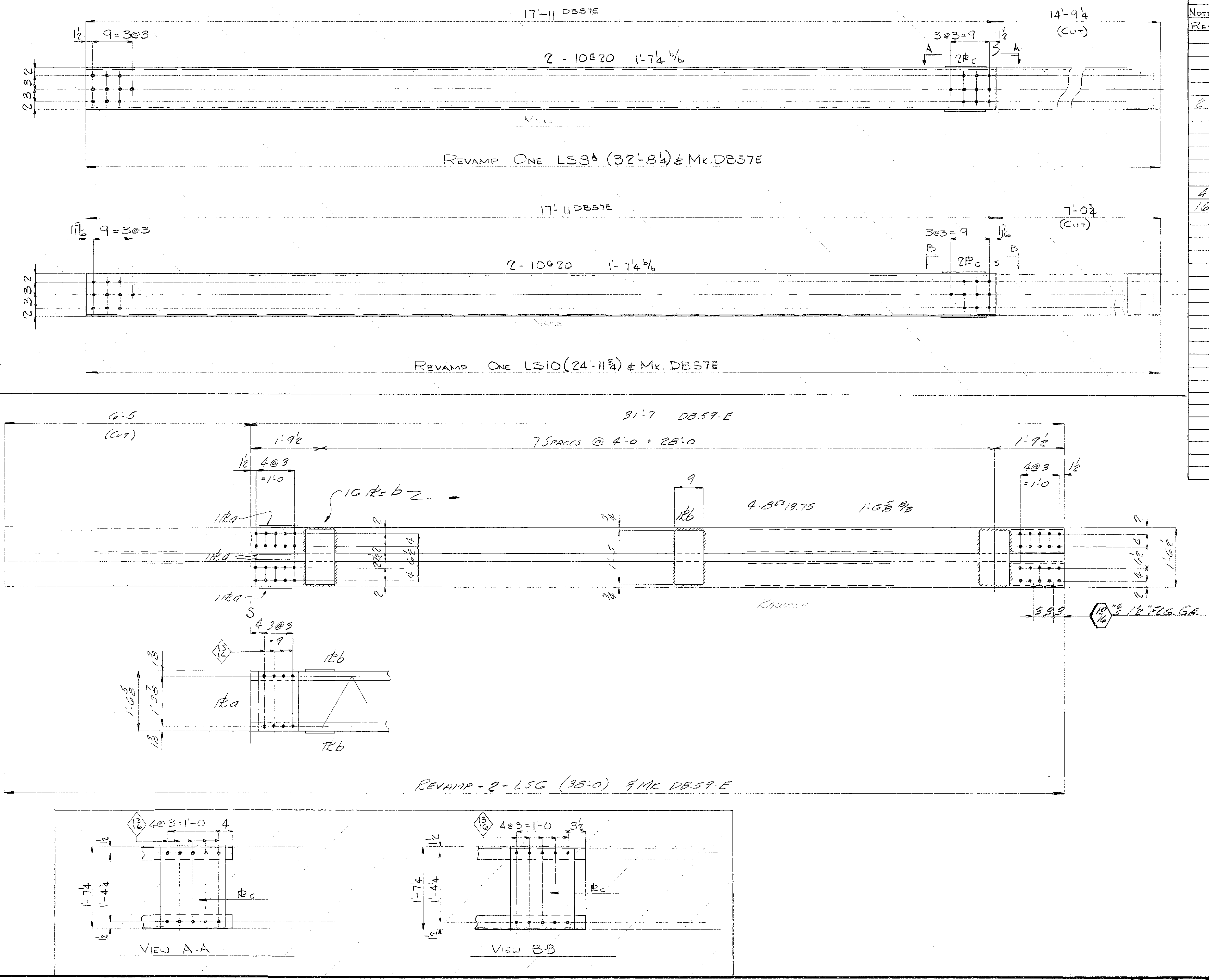
INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

MADE BY	DM	10-10-50	ORDER NO.	3807
CHECKED BY			SHEET NO.	D60E

5468.140

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR 3(13)	1950	141	304

Order No. 3807 **Sheet No.** D61E



BILL OF MATERIAL Industrial Development Co

No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
Note:	Braces listed below are to be revamped as shown on details.				
2	Braces	38	0	LS6	Kawaii
4	PL 11½ x ⅜	1	6⅜	a	Temp. - New
16	PL 9 x ½	1	5	b	Perm. - New

Rivets: ¾ ϕ For 13/16 ϕ Holes

Holes: 13/16 ϕ

Paint:

Industrial Development Company

Addition to the Nanue Bridge

Hawaii

INDEPENDENT IRON WORKS, INC.

OAKLAND, CALIF.

MADE BY	DAL SEE	2-3-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	D61E

5468.141

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
Hawaii	Haw	SDR3(13)	1950	142	304

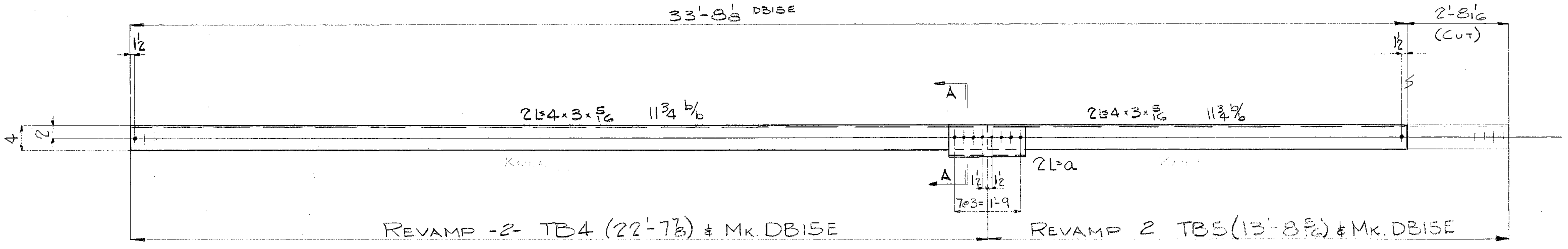
Nov. 1, 1950

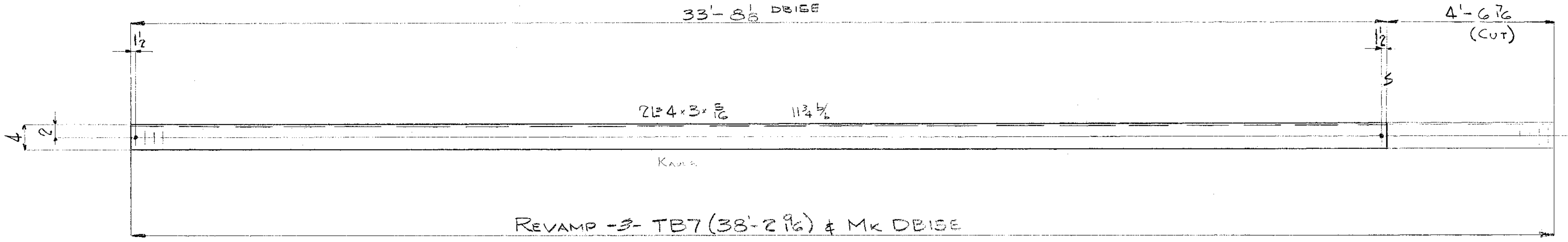
Order No. 3807 **Sheet No.** 062E

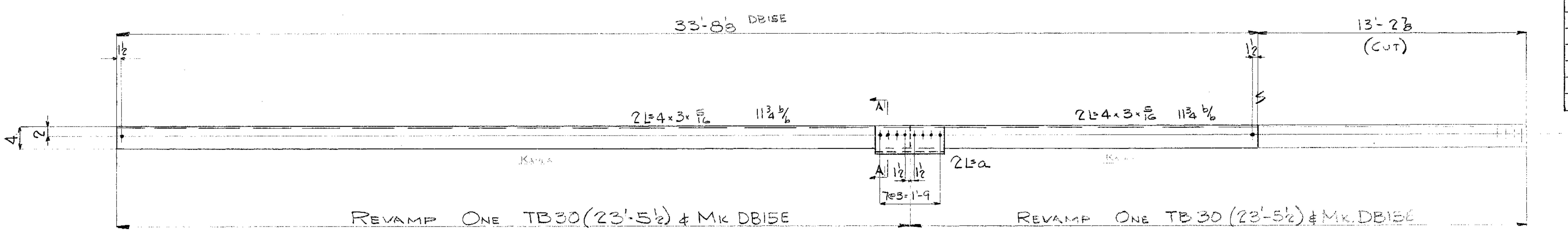
BILL OF MATERIAL Industrial Development Co.

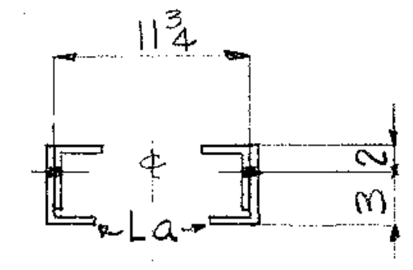
No.	Description	Length Ft.	Length Ins.	Mark	REMARKS
Note: Braces listed below are to be revamped as shown on Details					
					Salv. From:
2	Braces	22	7⅞	TB4	Kaula
5	}	13	8 5/16	TB5	Do
3	}	38	2 9/16	TB7	Do
2	}	23	5½	TB30	Do
6	L5×3×½	2	0	a	Temp-New

—Final Drawing—









Section A-A

Rivets:

Holes: 15/16 ⌀ UN

Paint:

Industrial Development Company

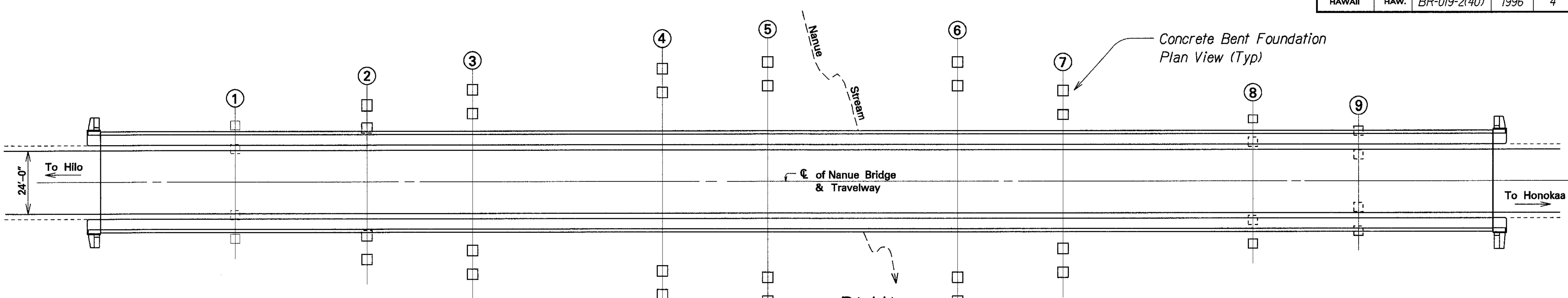
Addition to the Nanue Bridge
Hawaii

INDEPENDENT IRON WORKS, INC.
OAKLAND, CALIF.

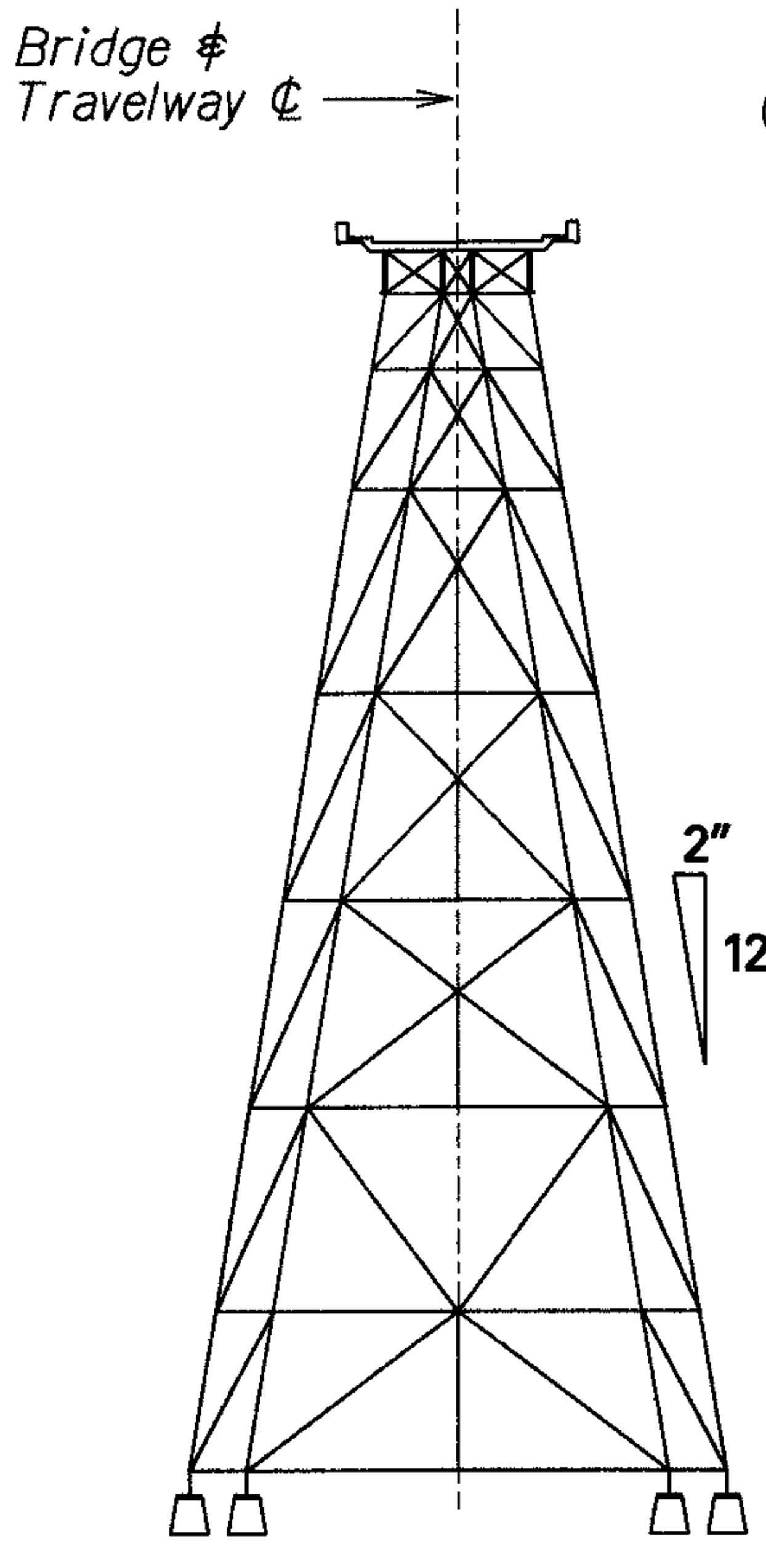
MADE BY	DAL	2-15-50	ORDER NO.	3807
CHECKED BY	RA	2-17-50	SHEET NO.	062E

5468.142 105

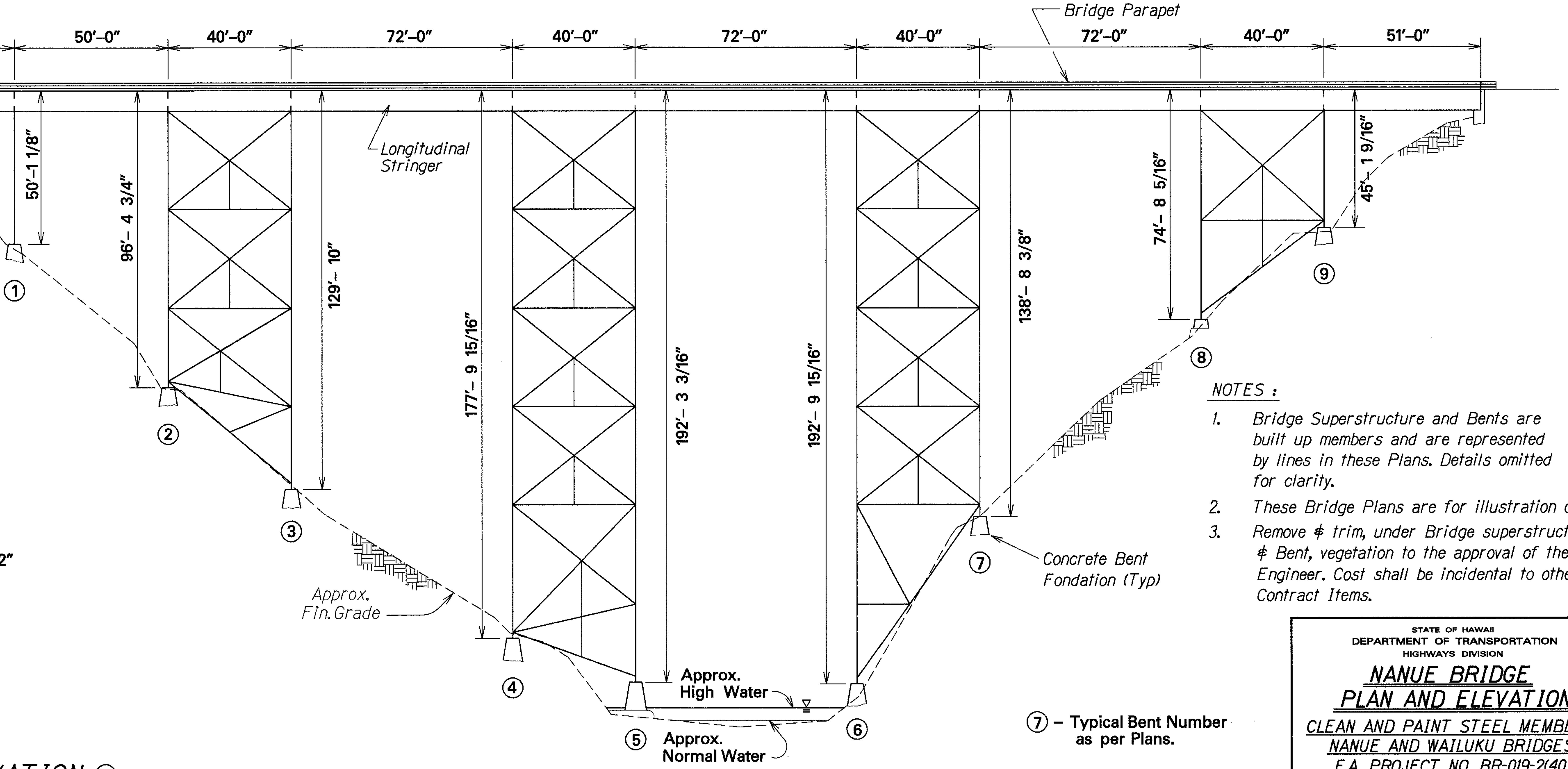
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(40)	1996	4	6



PLAN
Scale: 1"=20'



TYPICAL BENT ELEVATION ⑤
Scale: 1"=30'



ELEVATION
Scale: 1"=20'

⑦ – Typical Bent Number
as per Plans.

NOTES :

1. Bridge Superstructure and Bents are built up members and are represented by lines in these Plans. Details omitted for clarity.
2. These Bridge Plans are for illustration only.
3. Remove ℄ trim, under Bridge superstructure ℄ Bent, vegetation to the approval of the Engineer. Cost shall be incidental to other Contract Items.

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

NANUE BRIDGE
PLAN AND ELEVATION

CLEAN AND PAINT STEEL MEMBERS
NANUE AND WAILUKU BRIDGES
F.A. PROJECT NO. BR-019-2(40)

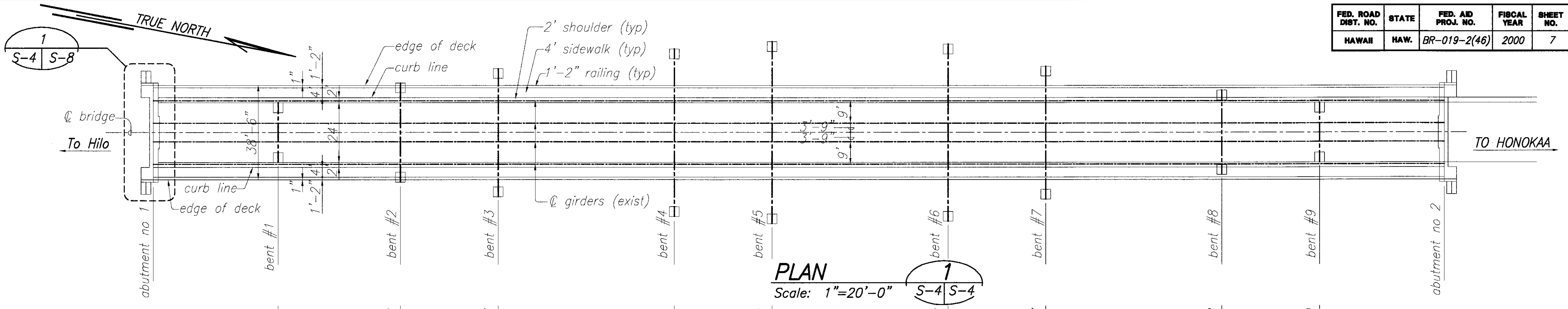
Scale: As Shown Date: May, 1996

SHEET No. 1 OF 1 SHEETS

ddl/mh

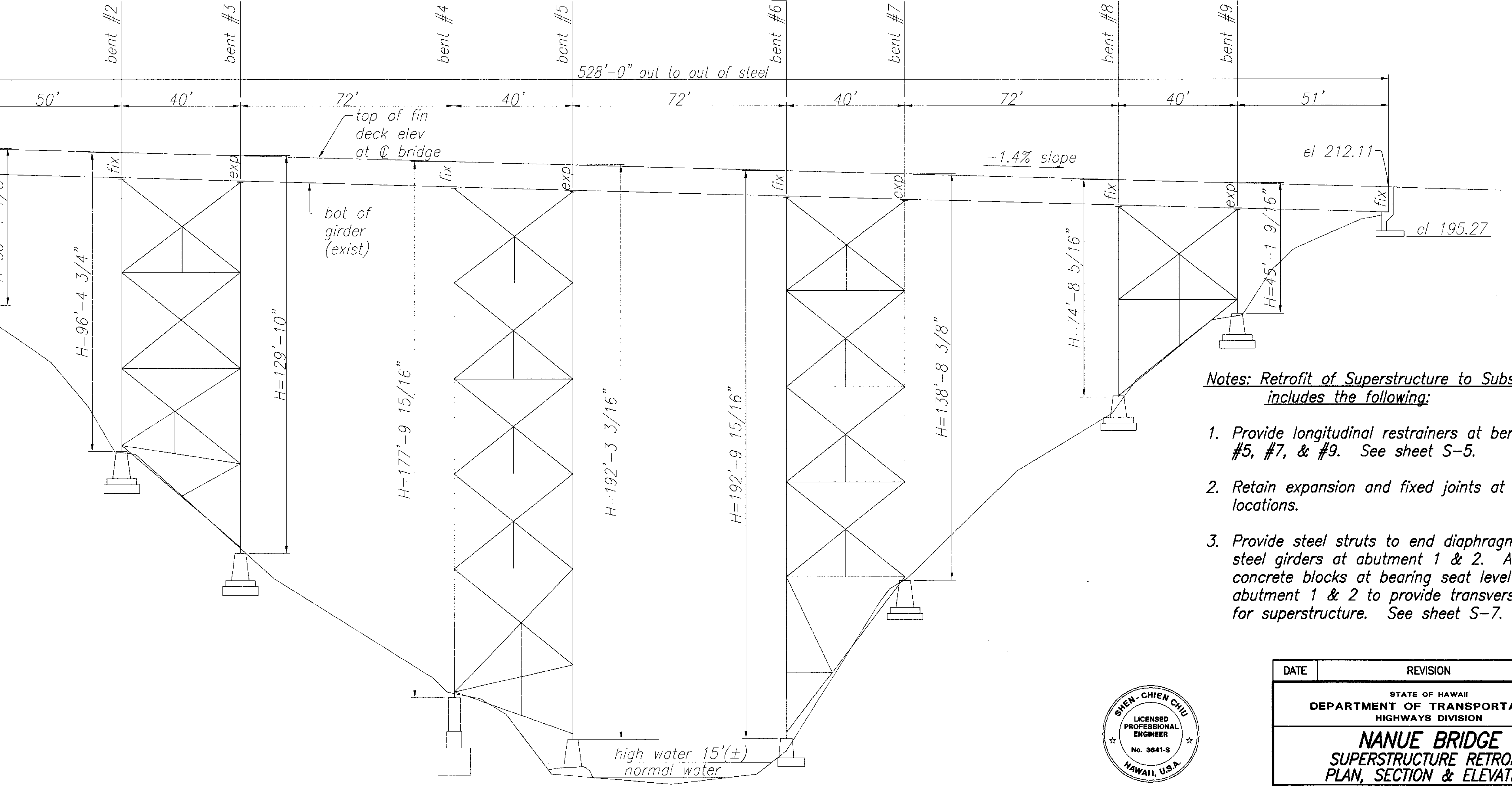
ORIGINAL PLAN
NOTE BOOK Lhbrapl .dgn
No.
SURVEY PLOTTED BY
DRAWN BY X
TRACED BY
DESIGNED BY X
QUANTITIES BY
CHECKED BY
DATE 5/12/96

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(46)	2000	7	26



PLAN ⌒1 S-4|S-4

Scale: 1"=20'-0"

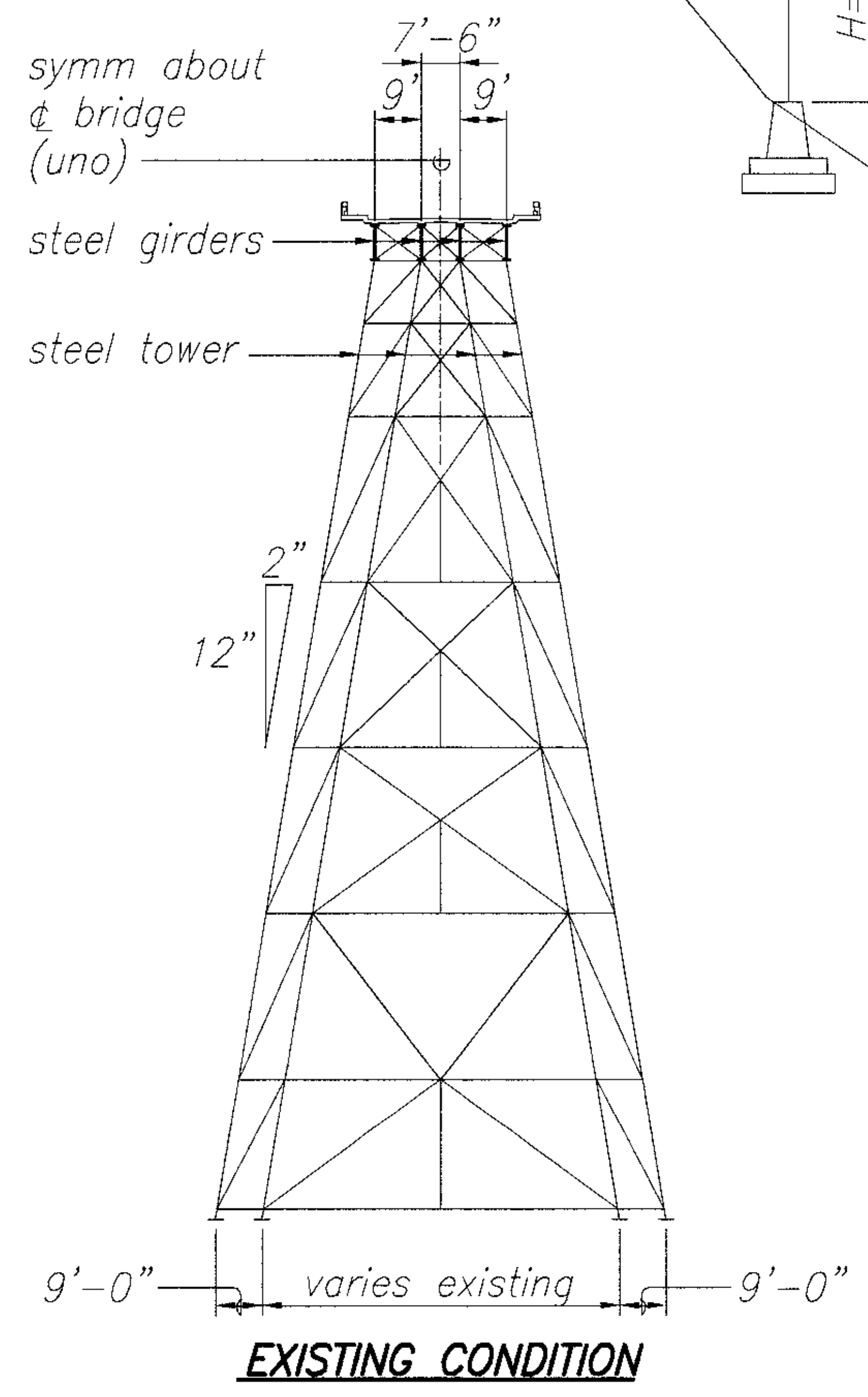


EXISTING CONDITION

SECTION ⌒A S-4|S-4

Scale: 1"=20'-0"

Note: Section Taken at ℄ of Bridge



EXISTING CONDITION

TYPICAL BENT ELEVATION ⌒B S-4|S-4

Scale: 1"=30'-0"

Note: Existing Condition Shown

Notes: Retrofit of Superstructure to Substructure includes the following:

1. Provide longitudinal restrainers at bents #3, #5, #7, & #9. See sheet S-5.
2. Retain expansion and fixed joints at existing locations.
3. Provide steel struts to end diaphragms of steel girders at abutment 1 & 2. Add concrete blocks at bearing seat level of abutment 1 & 2 to provide transverse restraint for superstructure. See sheet S-7.

SHEN-CHIEN CHIU
LICENSED PROFESSIONAL ENGINEER
No. 3641-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION

Shen-chien Chiu

DATE	REVISION

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

NANUE BRIDGE
SUPERSTRUCTURE RETROFIT
PLAN, SECTION & ELEVATION

SEISMIC RETROFIT OF VARIOUS BRIDGES
EAST OF NINOLE, HAWAII
F.A. PROJECT NO. BR-019-2(46)

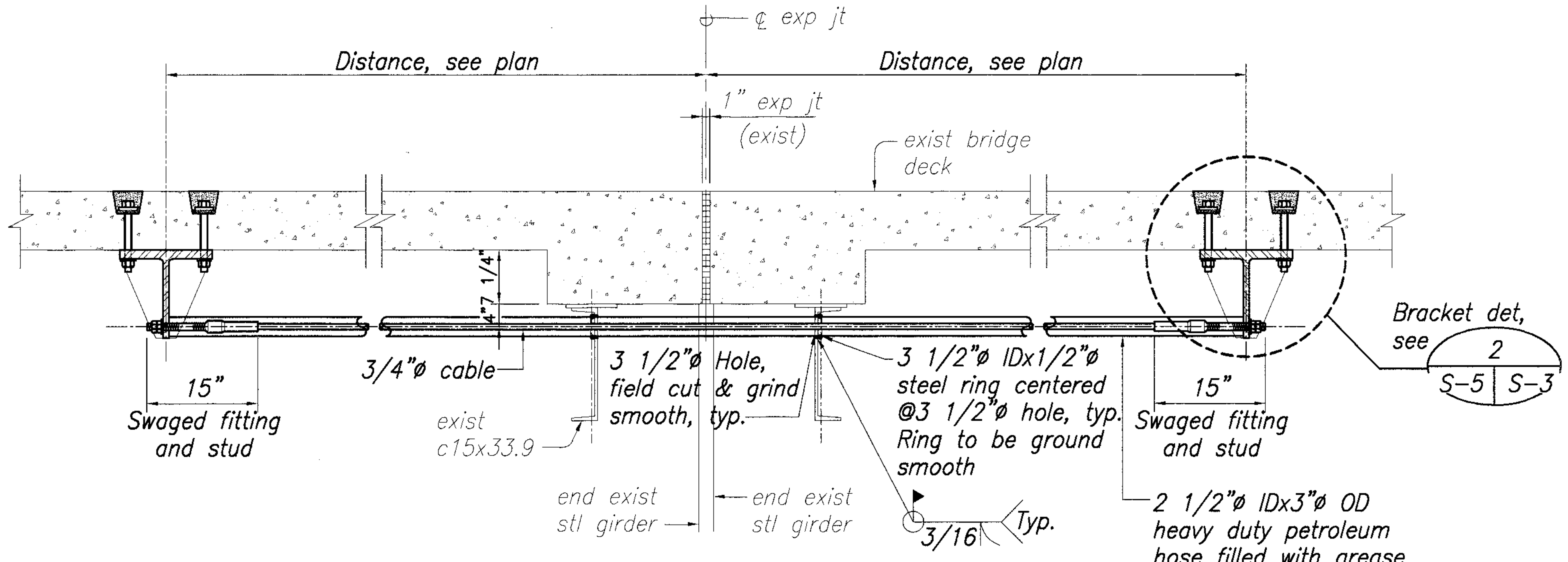
Scale: As Noted   Date: AUG. 17, 1999

SHEET No. S-4 OF 23 SHEETS

ORIGINAL PLAN
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
NOTEBOOK
DESIGNED BY
QUANTITIES BY
CHECKED BY
No.
DATE

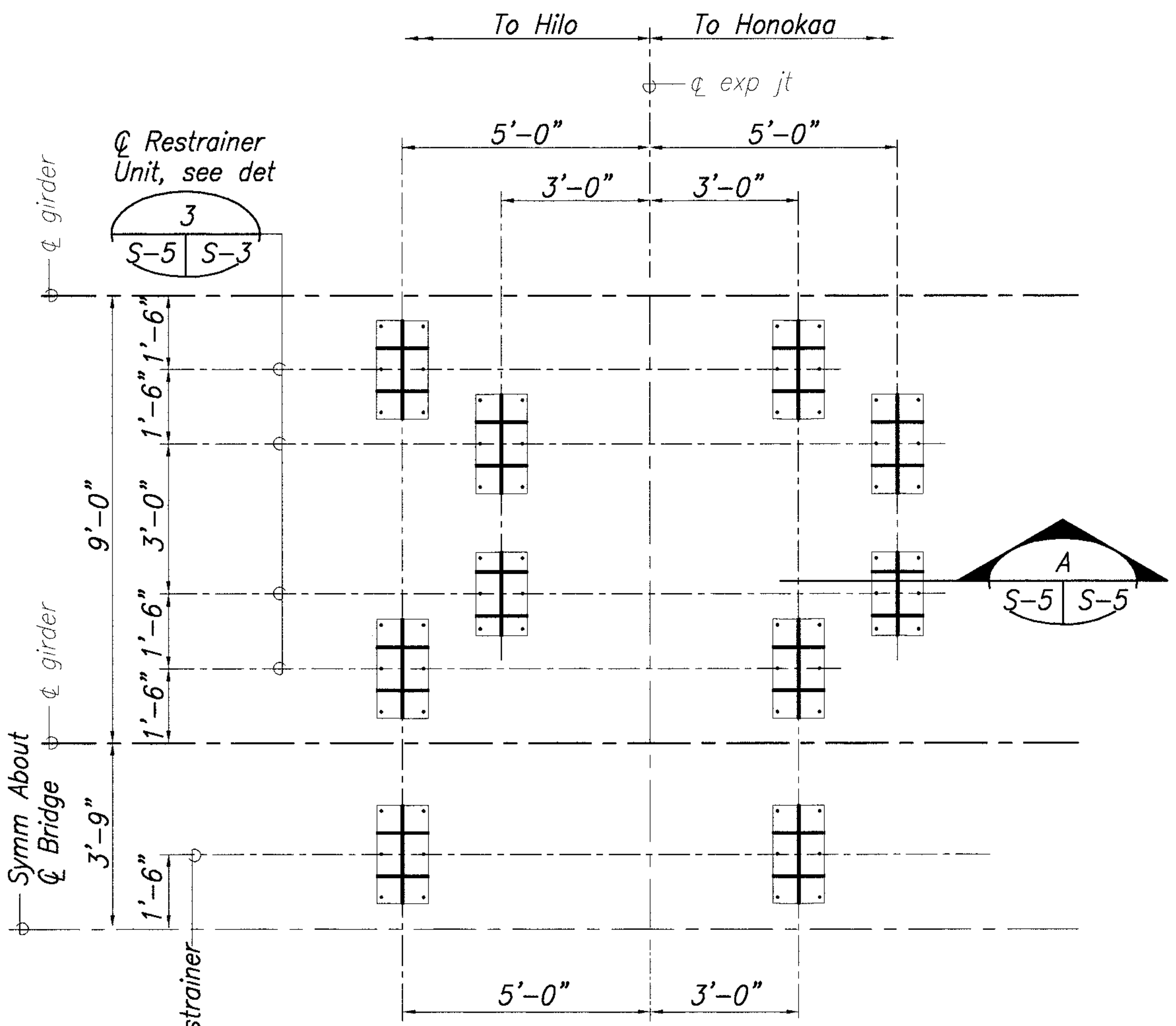
NS1-1.DWG 08/04/99 15:51 FINAL L:\DWG\6041-01\NEWSTRUCT\NANUE

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(46)	2000	8	26



SECTION A
S-5 | S-5

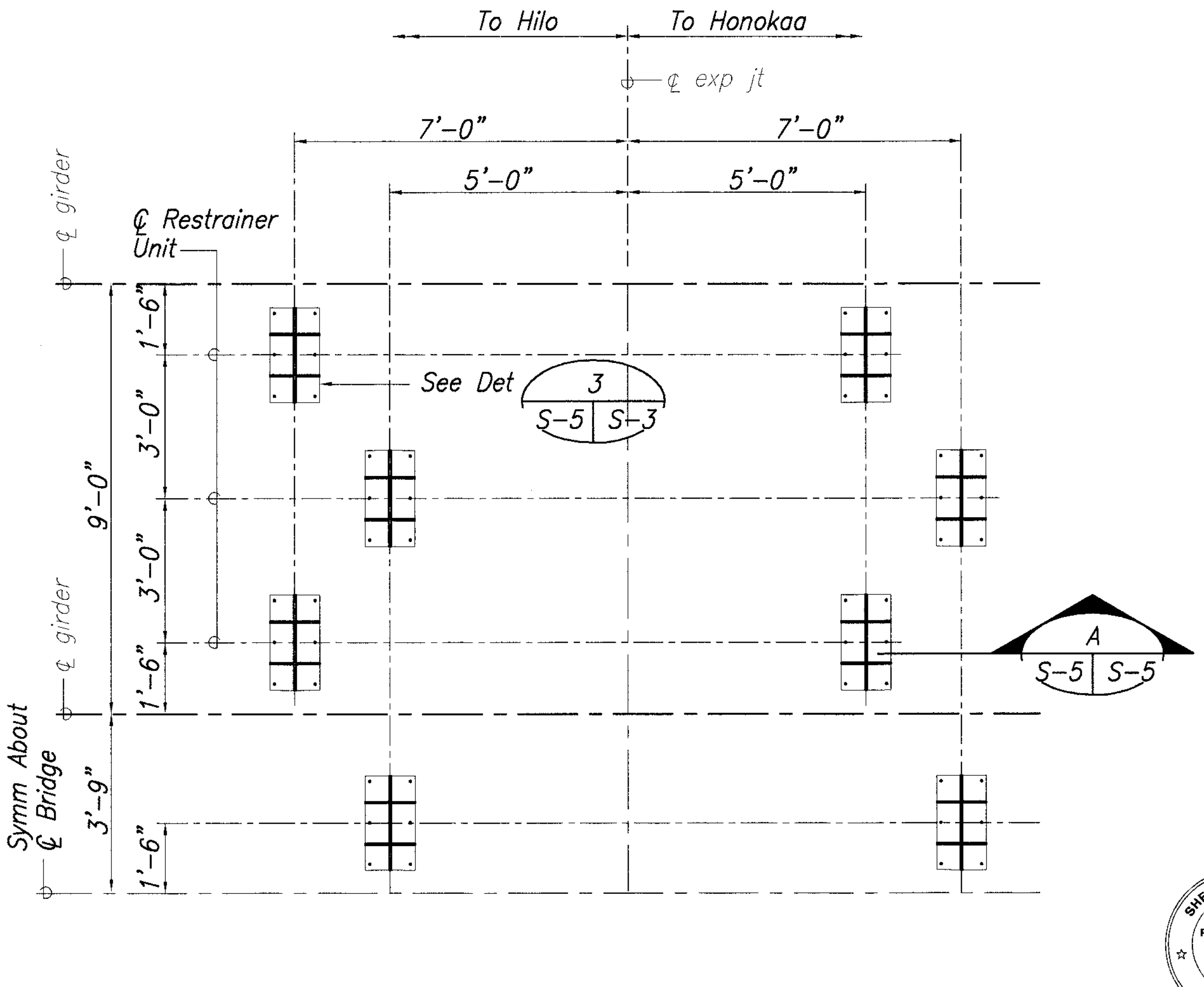
Scale : 1"=1'-0'



Notes:
1. 10 Restrainers required at Bents 3 & 5.
2. Cable Restrainers not shown.

REFLECTED DECK PLAN AT BENTS 3 & 5
1
S-5 | S-5

Scale: 1/2"=1'-0"



Notes:
1. 8 Restrainers required at Bents 7 & 9.
2. Cable Restrainers not shown.

REFLECTED DECK PLAN AT BENTS 7 & 9
2
S-5 | S-5

Scale: 1/2"=1'-0"

No. 3641-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

Shen-Chien Chiu

DATE	REVISION

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

NANUE BRIDGE
SUPERSTRUCTURE RETROFIT
PLAN OF LONGITUDINAL RESTRAINERS

SEISMIC RETROFIT OF VARIOUS BRIDGES
EAST OF NINOLE, HAWAII
F.A. PROJECT NO. BR-019-2(46)

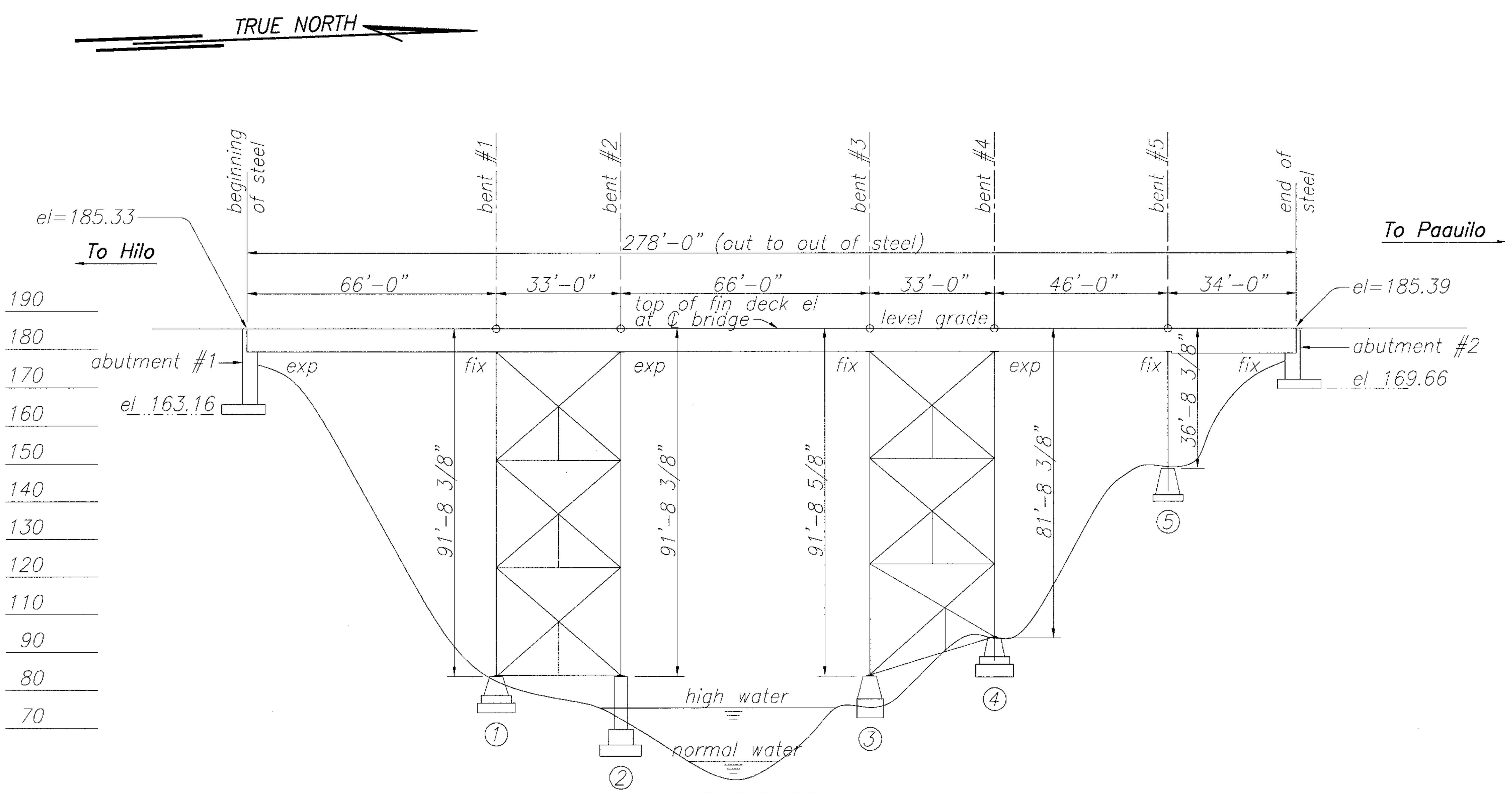
Scale: As Noted
Date: AUG. 17, 1999

SHEET No. S-5 OF 23 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY ____ DATE ____
	DRAWN BY ____ " ____
NOTEBOOK	TRACED BY ____ " ____
	DESIGNED BY ____ " ____
No. ____	QUANTITIES BY ____ " ____
	CHECKED BY ____ " ____

NS1-2.DWG 08/04/99 15:08 FINAL L:\DWG\6041-01\NEWSTRUCT\NANUE

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(46)	2000	9	26

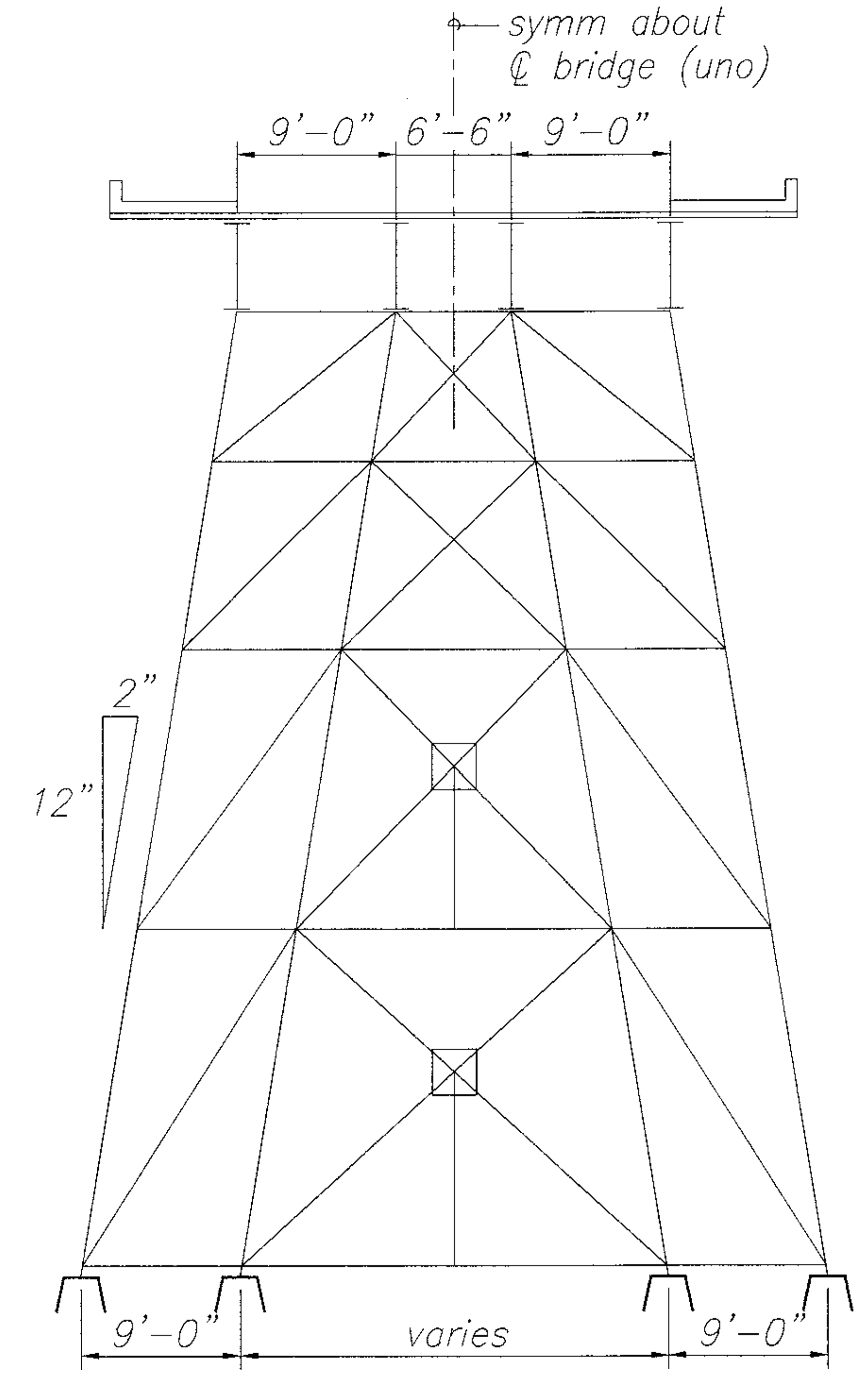


EXISTING CONDITION

PROFILE

Scale: 1"=20'

A
S-6 | S-6



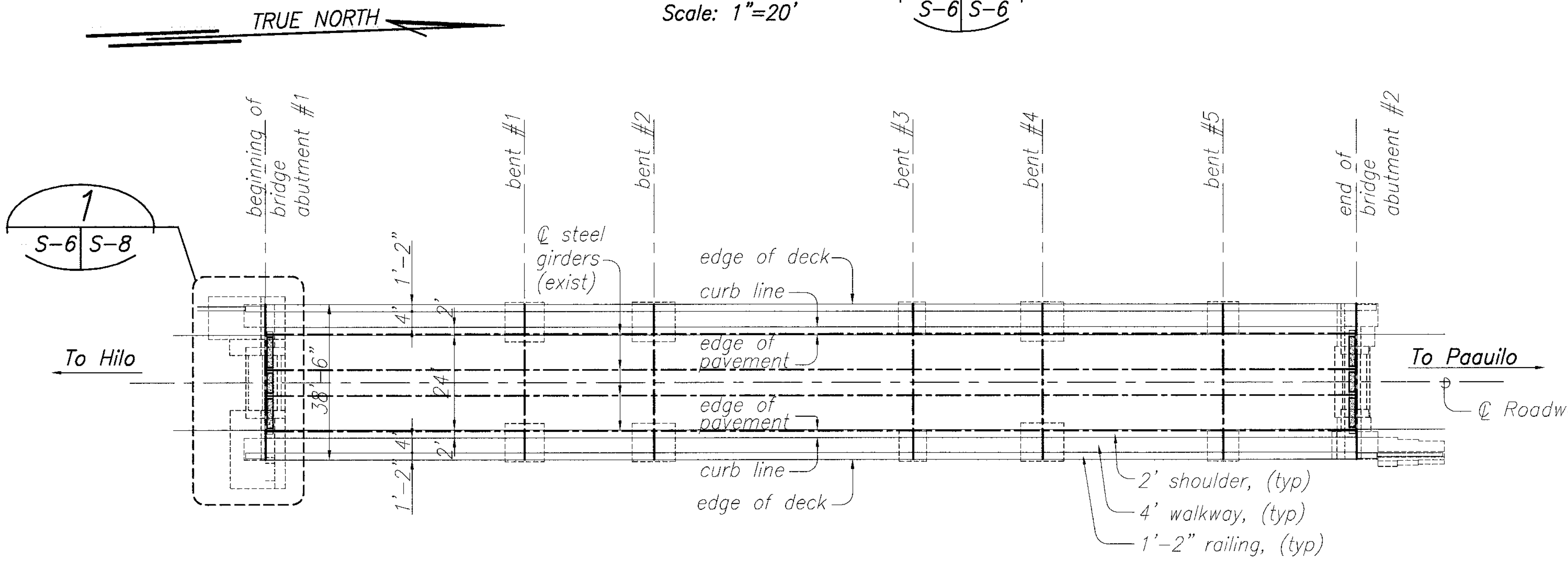
EXISTING CONDITION

TYPICAL BENT ELEVATION

Scale: 1/8"=1'-0"

Note: Existing Condition Shown.

B
S-6 | S-6



PLAN

Scale: 1"=20'

1
S-6 | S-6

Notes: Retrofit of Superstructure to Substructure include the following:

1. Provide longitudinal restrainers at bents #2 & #4, see sheet S-7.
2. Retain expansion and fixed joints at existing locations.
3. Provide steel struts to end diaphragms of steel girders at abutment 1 & 2 and add concrete blocks at bearing seat level of abutment 1&2 to provide transverse restraint for superstructure. See sheet S-8.

SHEN-CHIEN CHIU
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Shen-chien Chiu

DATE	REVISION

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

UMAUMA BRIDGE
SUPERSTRUCTURE RETROFIT
PLAN, SECTION & ELEVATION

SEISMIC RETROFIT OF VARIOUS BRIDGES
EAST OF NINOLE, HAWAII
F.A. PROJECT NO. BR-019-2(46)

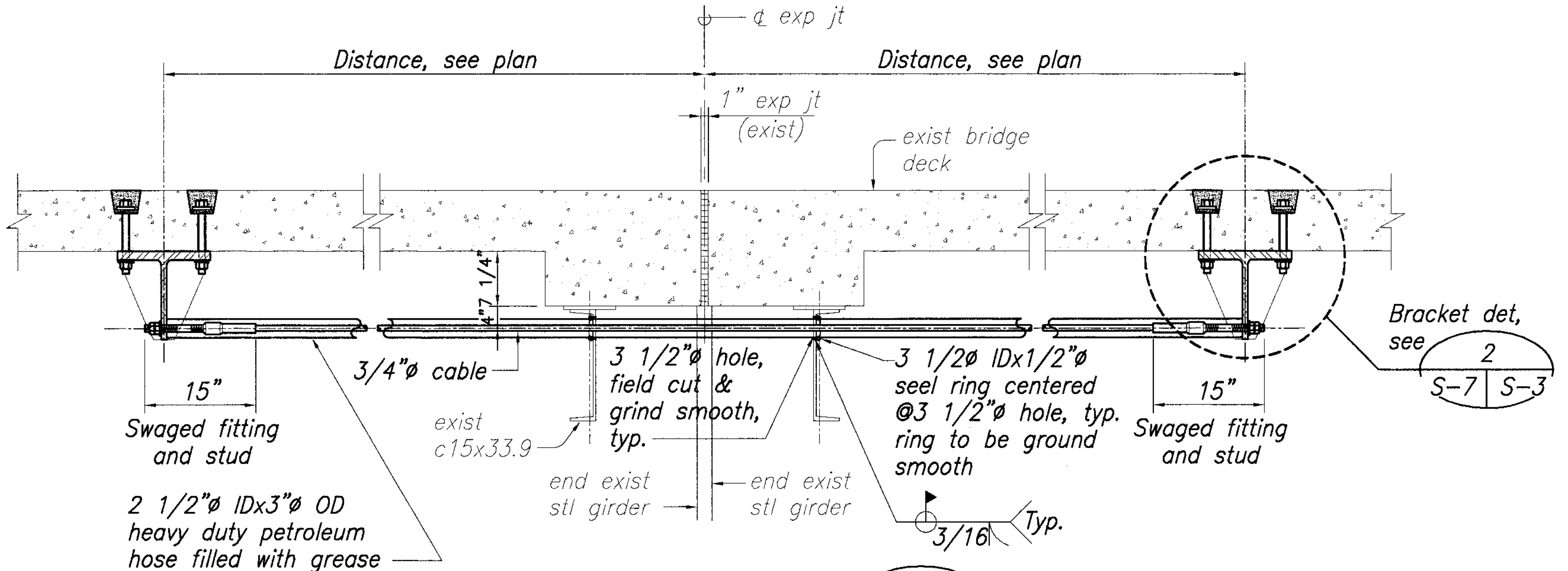
Scale: As Noted Date: AUG. 17, 1999

SHEET No. S-6 OF 23 SHEETS

ORIGINAL PLAN
NOTEBOOK
No. ____
SURVEY PLOTTED BY ____ DATE ____
DRAWN BY ____ " ____
TRACED BY ____ " ____
DESIGNED BY ____ " ____
QUANTITIES BY ____ " ____
CHECKED BY ____ " ____

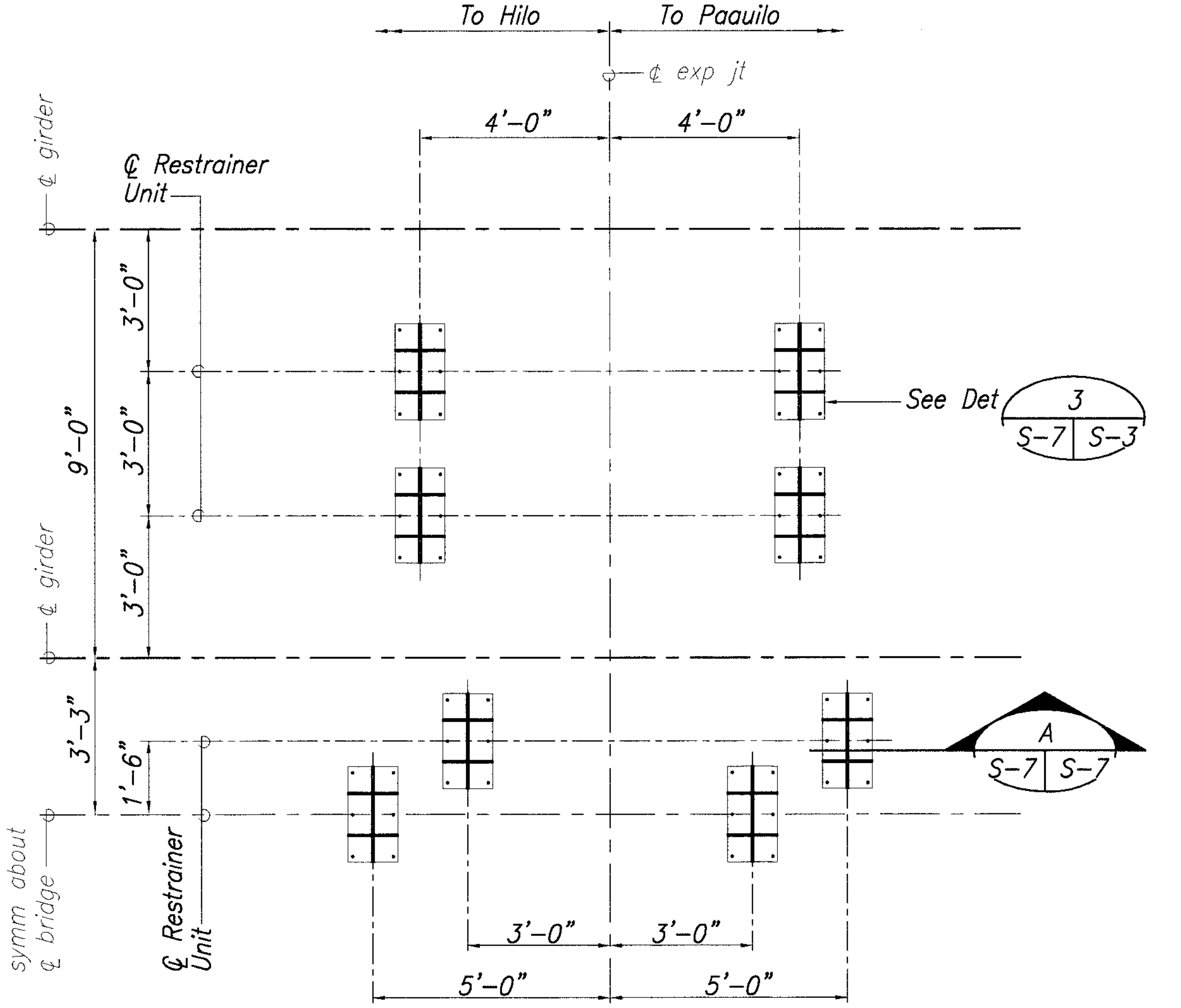
US1-1.DWG 08/04/99 15:55 FINAL L:\DWG\6041-01\NEWSTRUCT\UMA

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(46)	2000	10	26



SECTION A S-7 | S-7

Scale: 1"=1'-0"



Note:
1. Cable Restrainers not shown.

REFLECTED DECK PLAN AT BENTS 2 & 4 1 S-7 | S-7

Scale: 1/2'=1'-0"

SHEN-CHIEN CHIU
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No. 3641-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

Shen-Chien Chiu

DATE	REVISION

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

UMAUMA BRIDGE
SUPERSTRUCTURE RETROFIT
PLAN OF LONGITUDINAL RESTRAINERS
SEISMIC RETROFIT OF VARIOUS BRIDGES
EAST OF NINOLE, HAWAII
F.A. PROJECT NO. BR-019-2(46)

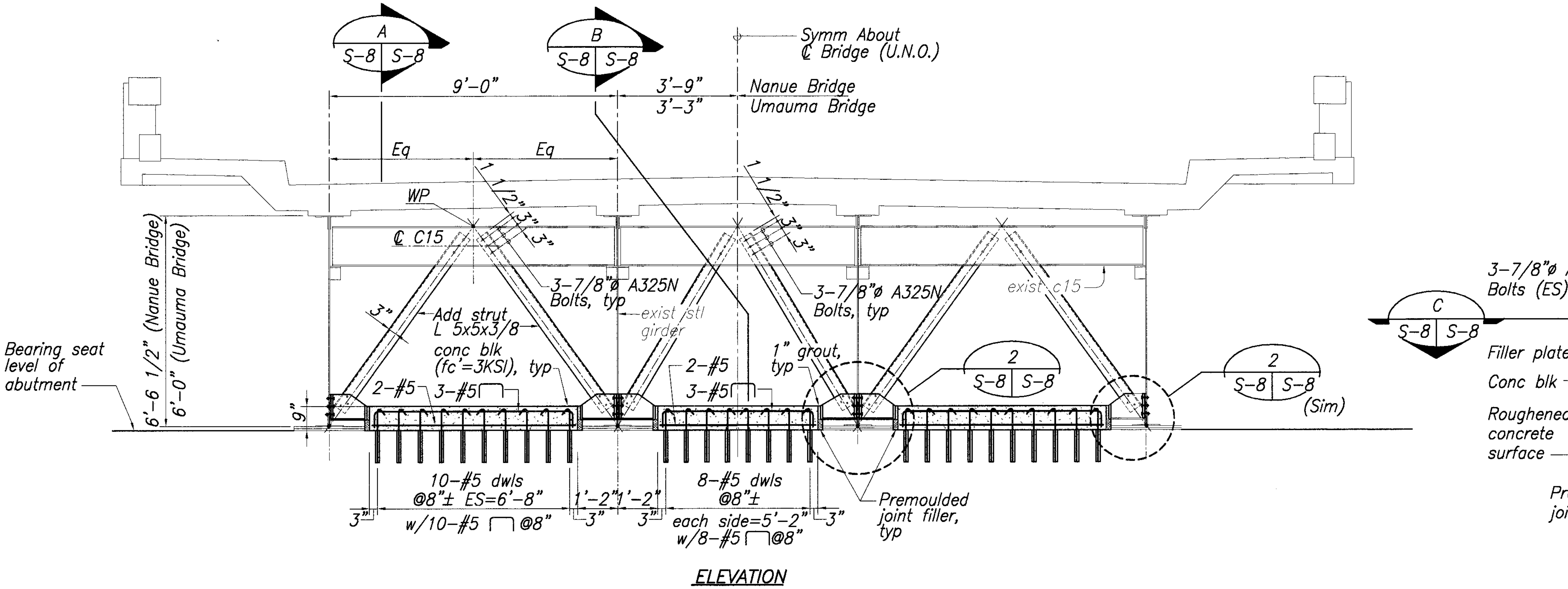
Scale: As Noted Date: AUG. 17, 1999

SHEET No. S-7 OF 23 SHEETS

ORIGINAL PLAN | SURVEY PLOTTED BY .... DATE
DRAWN BY
TRACED BY
NOTEBOOK | DESIGNED BY
QUANTITIES BY
No. | CHECKED BY

US1-2.DWG 08/04/99 15:13 FINAL L:\DWG\6041-01\NEWSTRUCT\UMA

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(46)	2000	11	26

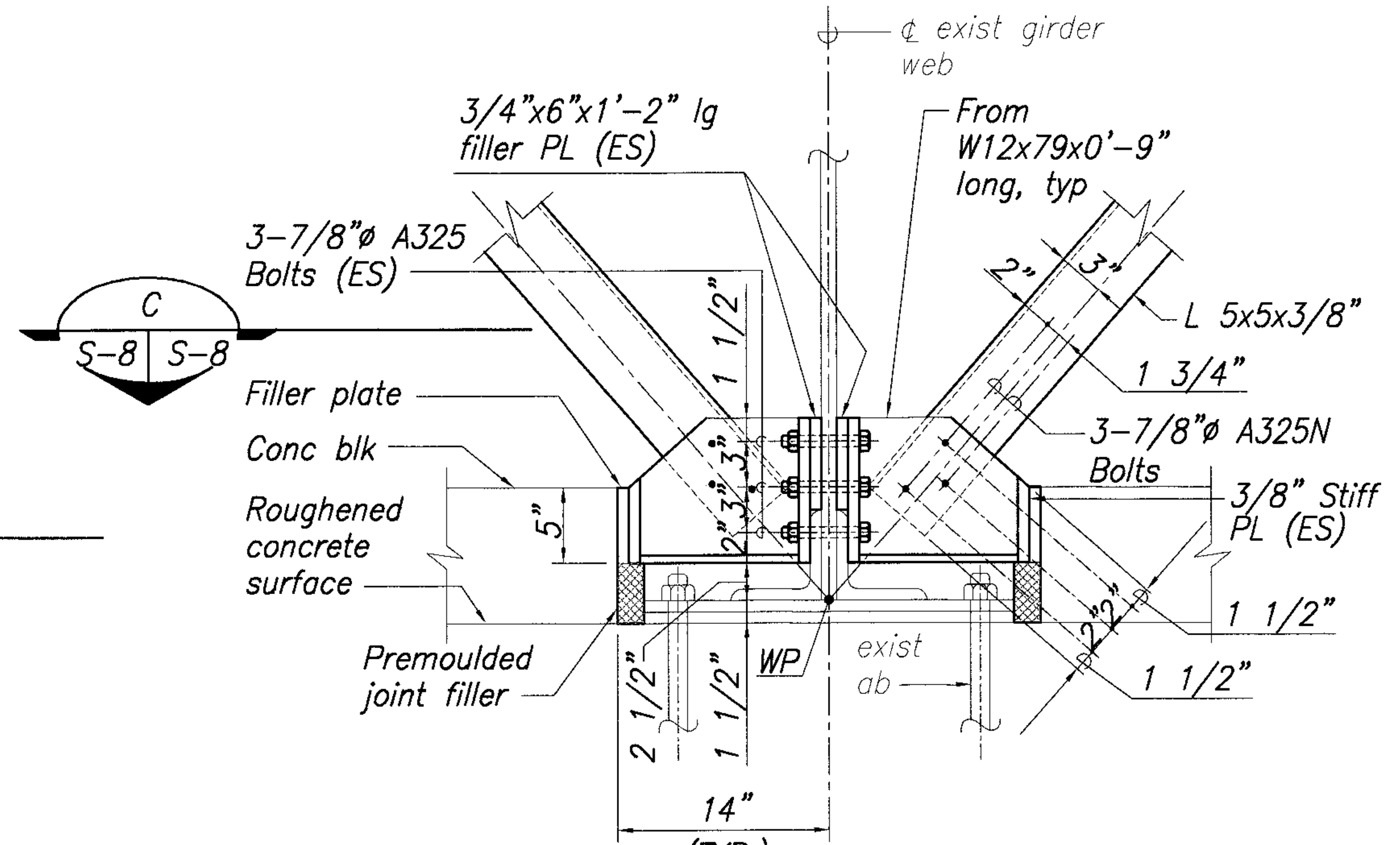


ELEVATION

DETAIL OF ADDITIONAL STRUT TO EXIST. END DIAPHRAGM & CONCRETE BLOCK RESTRAINT 1 S-8 S-8

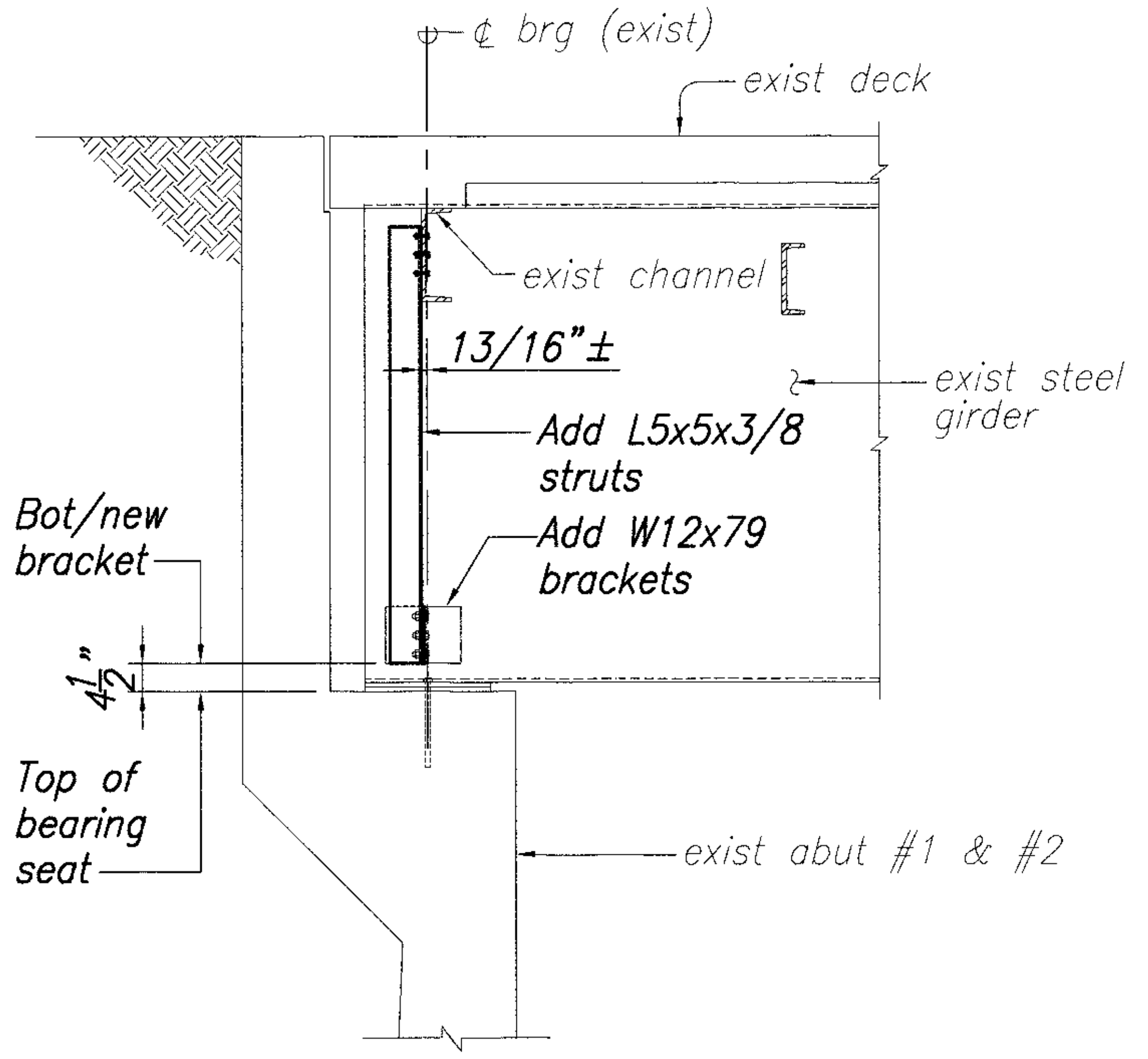
Scale: 1/2"=1'-0"

S-6



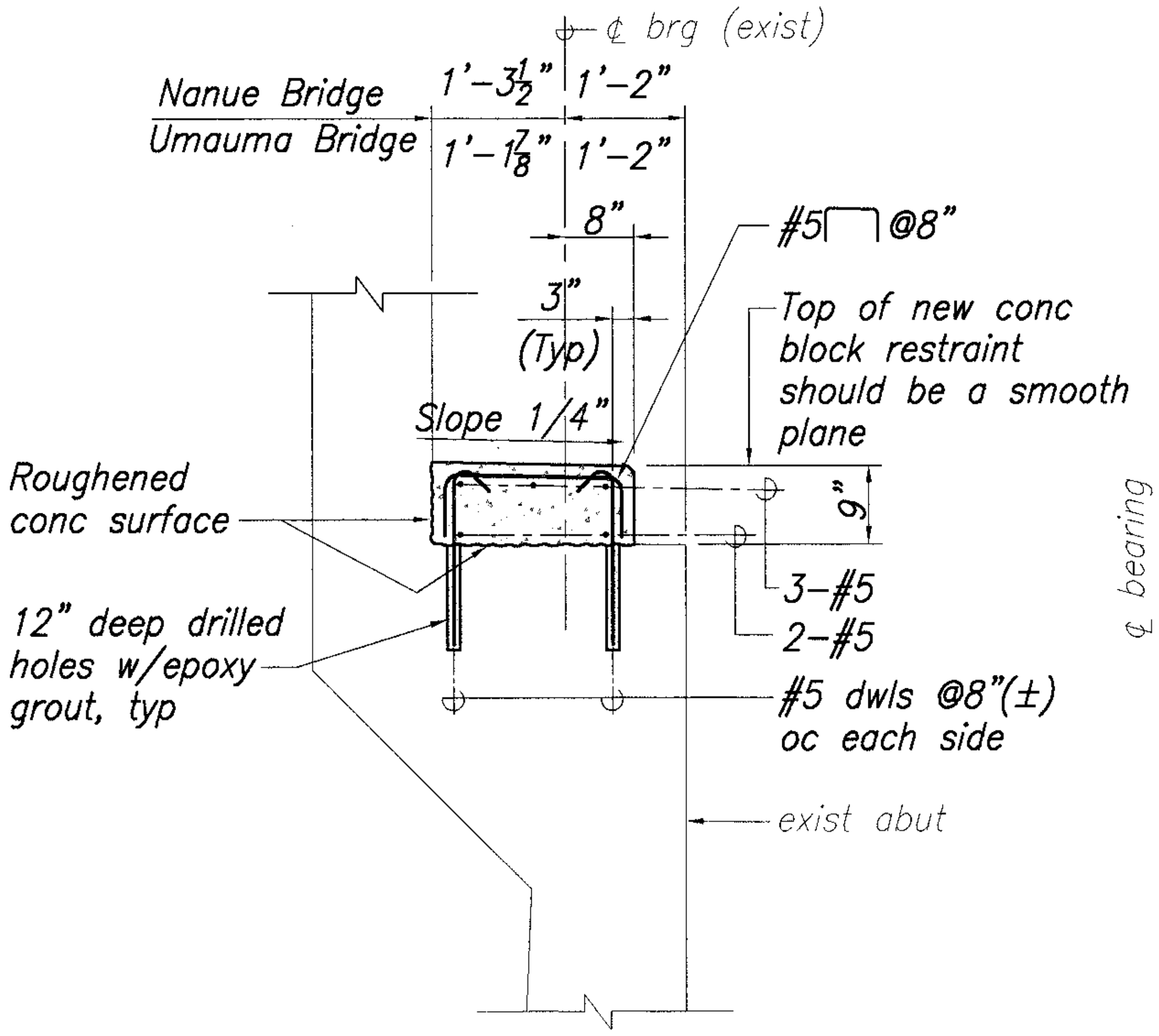
CONNECTION DETAIL 2 S-8 S-8

Scale: 1 1/2"=1'-0"



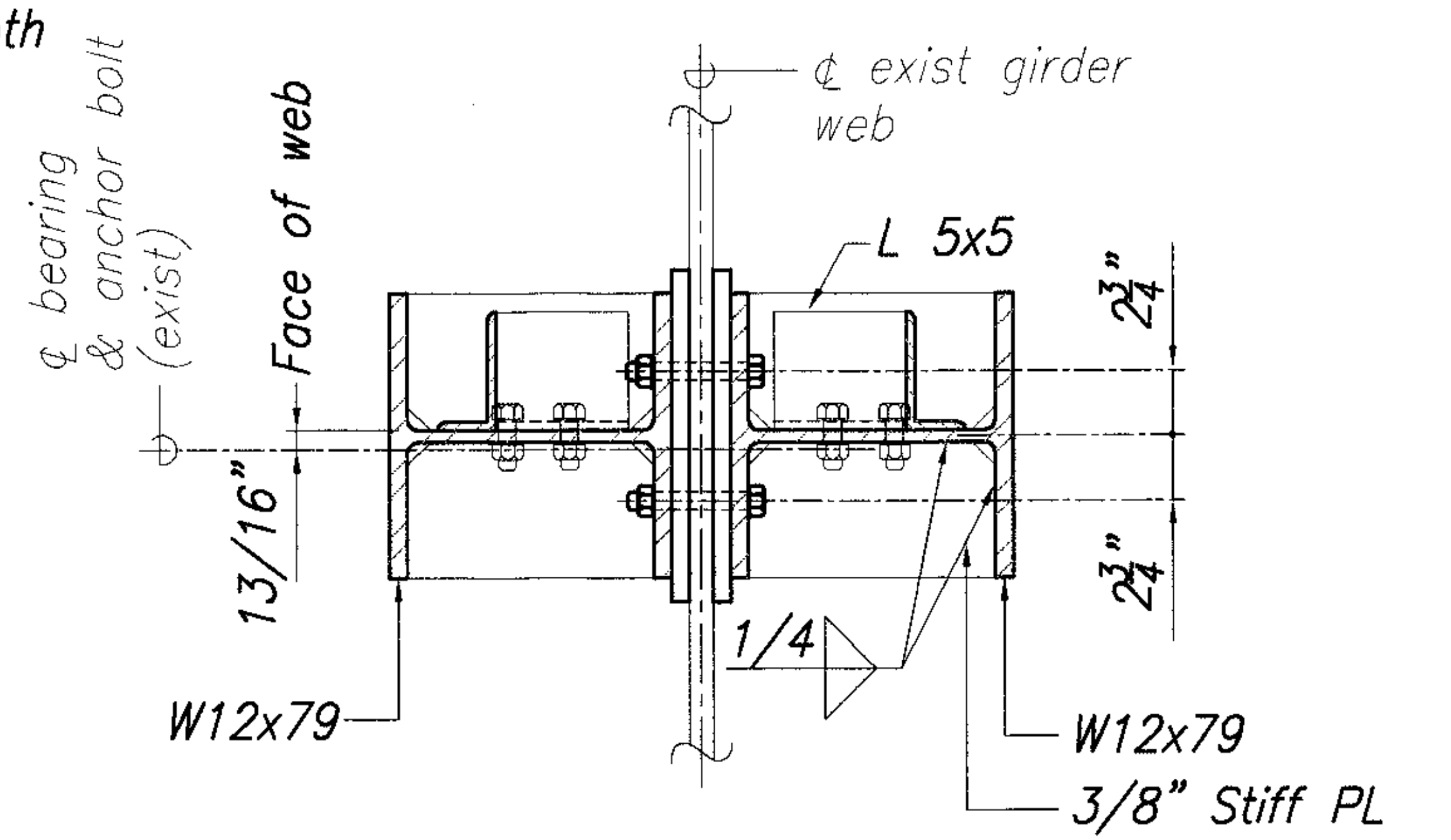
SECTION AT ABUTMENT A S-8 S-8

Scale: 1/2"=1'-0"



SECTION AT ABUTMENT B S-8 S-8

Scale: 3/4"=1'-0"



PLAN - SECTION

SECTION C S-8 S-8

Scale: 1 1/2"=1'-0"

SHEN-CHIEN CHIU
No. 3641-S

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION

Shen-Chien Chiu

DATE	REVISION

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

NANUE & UMAUMA BRIDGE
SUPERSTRUCTURE RETROFIT
SECTIONS AND DETAILS

SEISMIC RETROFIT OF VARIOUS BRIDGES
EAST OF NINOLE, HAWAII
F.A. PROJECT NO. BR-019-2(46)

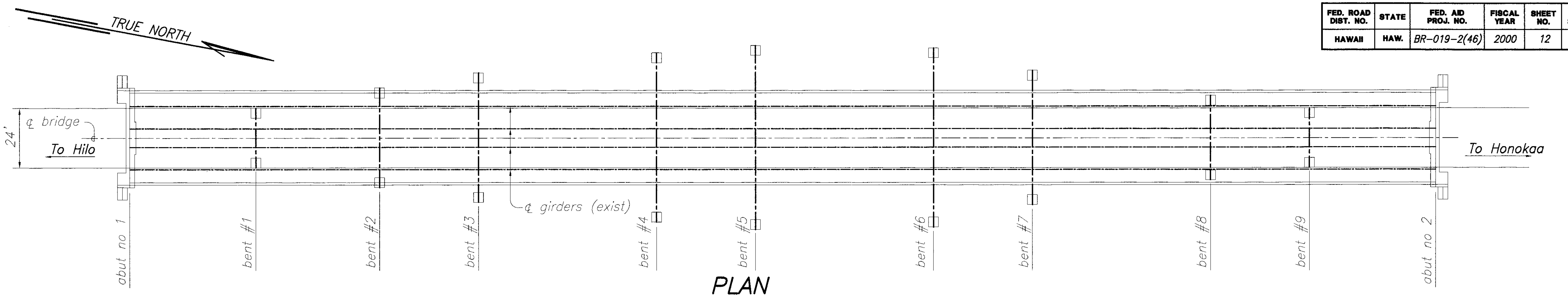
Scale: As Noted   Date: AUG. 17, 1999

SHEET No. S-8 OF 23 SHEETS

ORIGINAL PLAN
NOTEBOOK
No.
SURVEY PLOTTED BY ____ DATE
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY

NUS1-1.DWG08/06/99 15:13 FINAL L:\DWG\6041-01\NEWSTRUCT\NANUE

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(46)	2000	12	26



PLAN

Scale: 1"=20'-0"

EXISTING CONDITION

SECTION

Scale: 1"=20'-0"

TYPICAL BENT ELEVATION

Scale: 1"=30'-0"

RETROFIT LEGEND:

- (Light lines) existing steel members.
- (Heavy solid lines) new or added bracing members.

SHEN-CHIEN CHIU
No. 3641-S

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Shen-chien Chiu

DATE	REVISION

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

NANUE BRIDGE
SUBSTRUCTURE RETROFIT
PLAN, SECTION AND ELEVATION

SEISMIC RETROFIT OF VARIOUS BRIDGES
EAST OF NINOLE, HAWAII
F.A. PROJECT NO. BR-019-2(46)

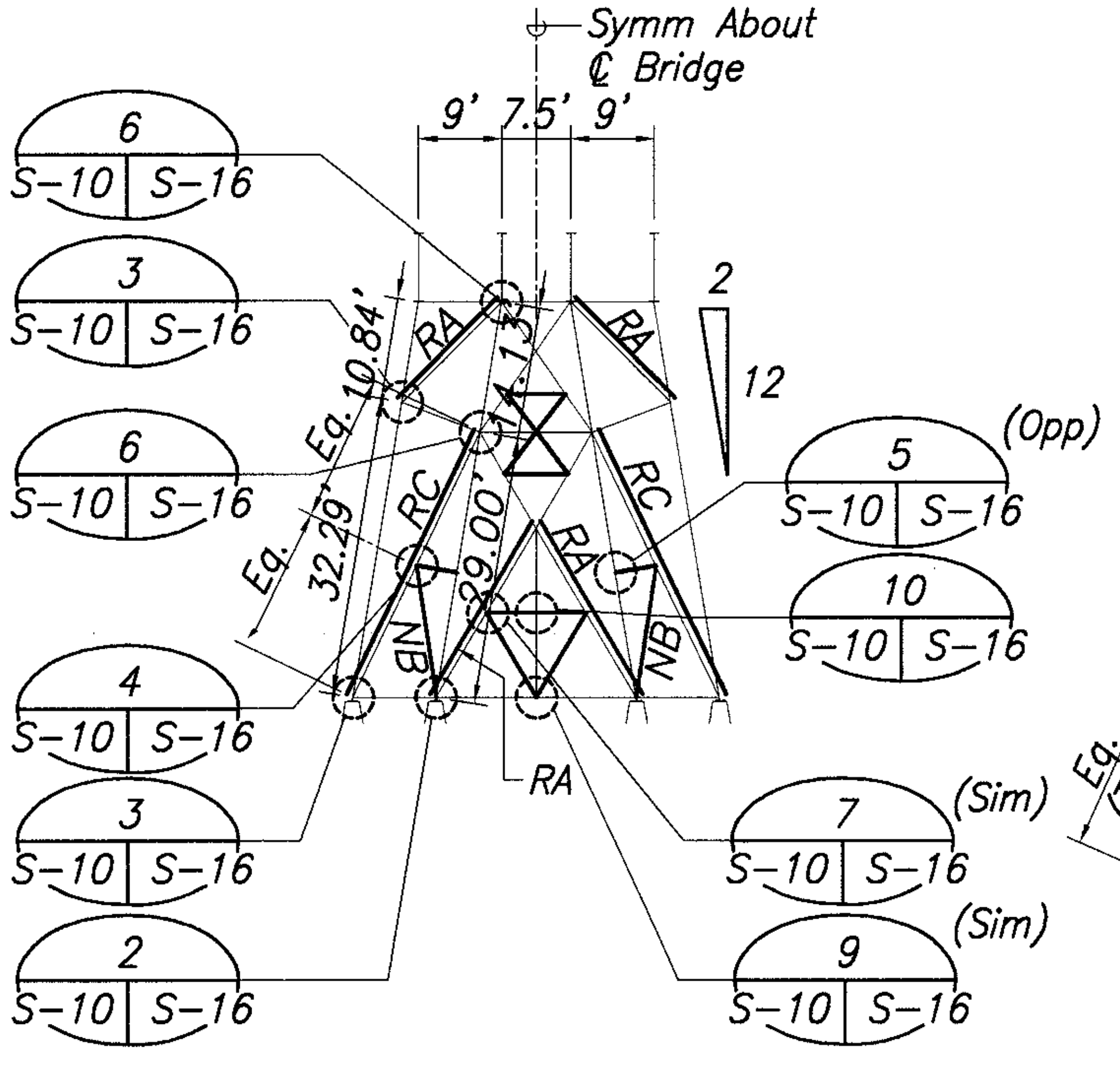
Scale: As Noted
Date: AUG. 17, 1999

SHEET No. S-9 OF 23 SHEETS

ORIGINAL PLAN	SURVEY PLOTTED BY ____ DATE ____
	DRAWN BY ____ "
	TRACED BY ____ "
NOTEBOOK	DESIGNED BY ____ "
	QUANTITIES BY ____ "
No. ____	CHECKED BY ____ "

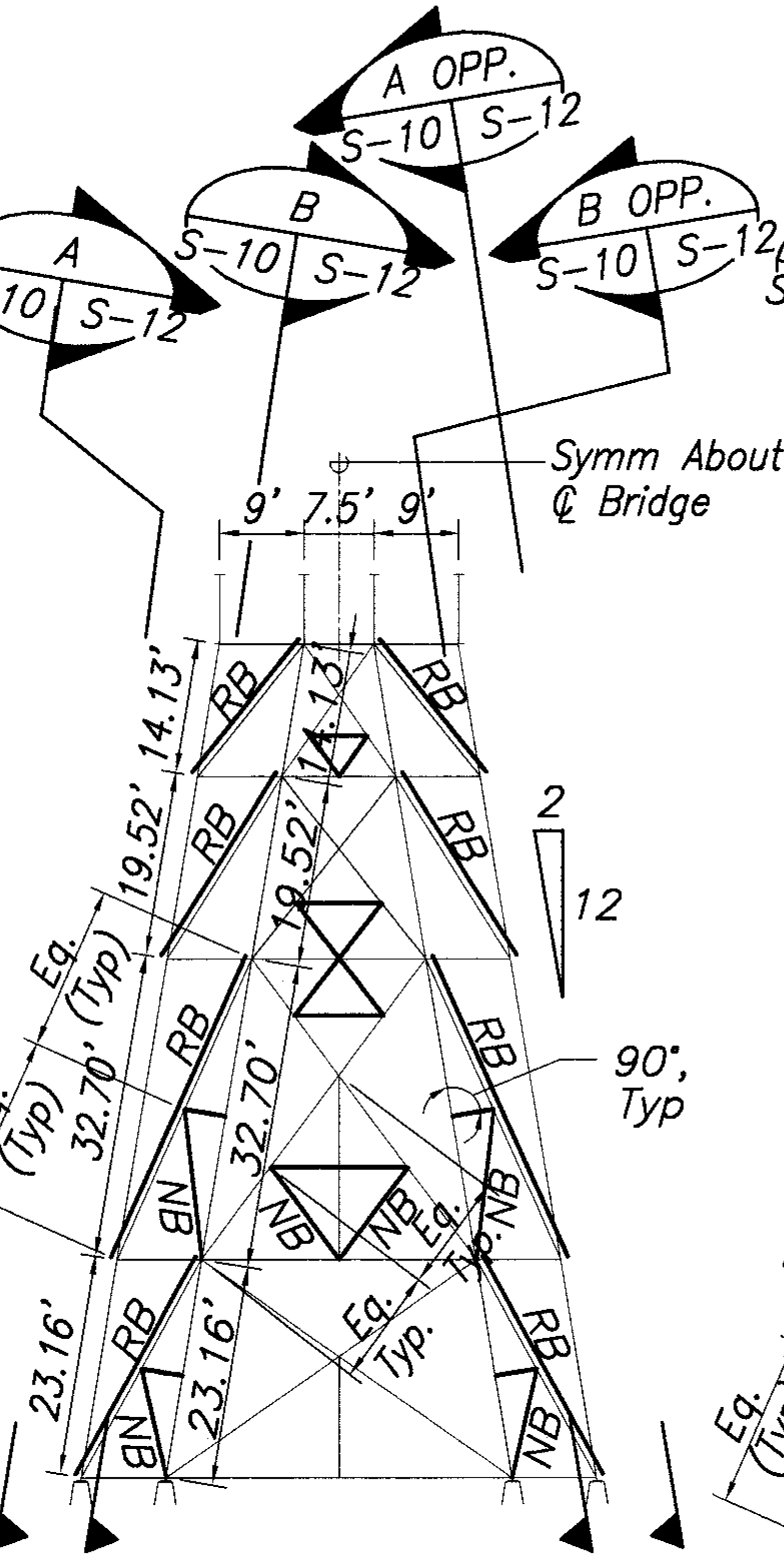
NS2-1.DWG 08/04/99 15:57 FINAL L:\DWG\6041-01\NEWSTRUCT\NANUE

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(46)	2000	13	26



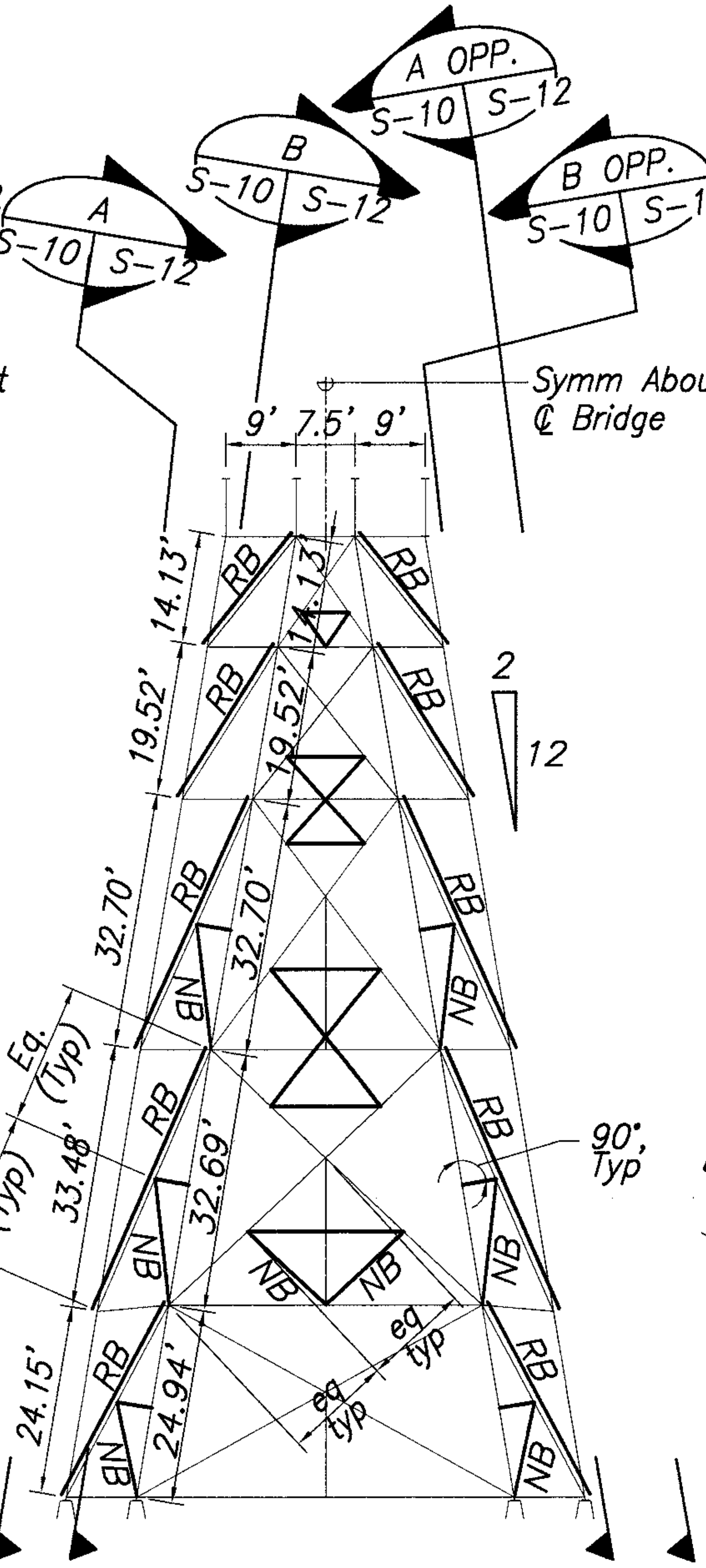
BENT #1

Scale: 1/16" = 1'-0"



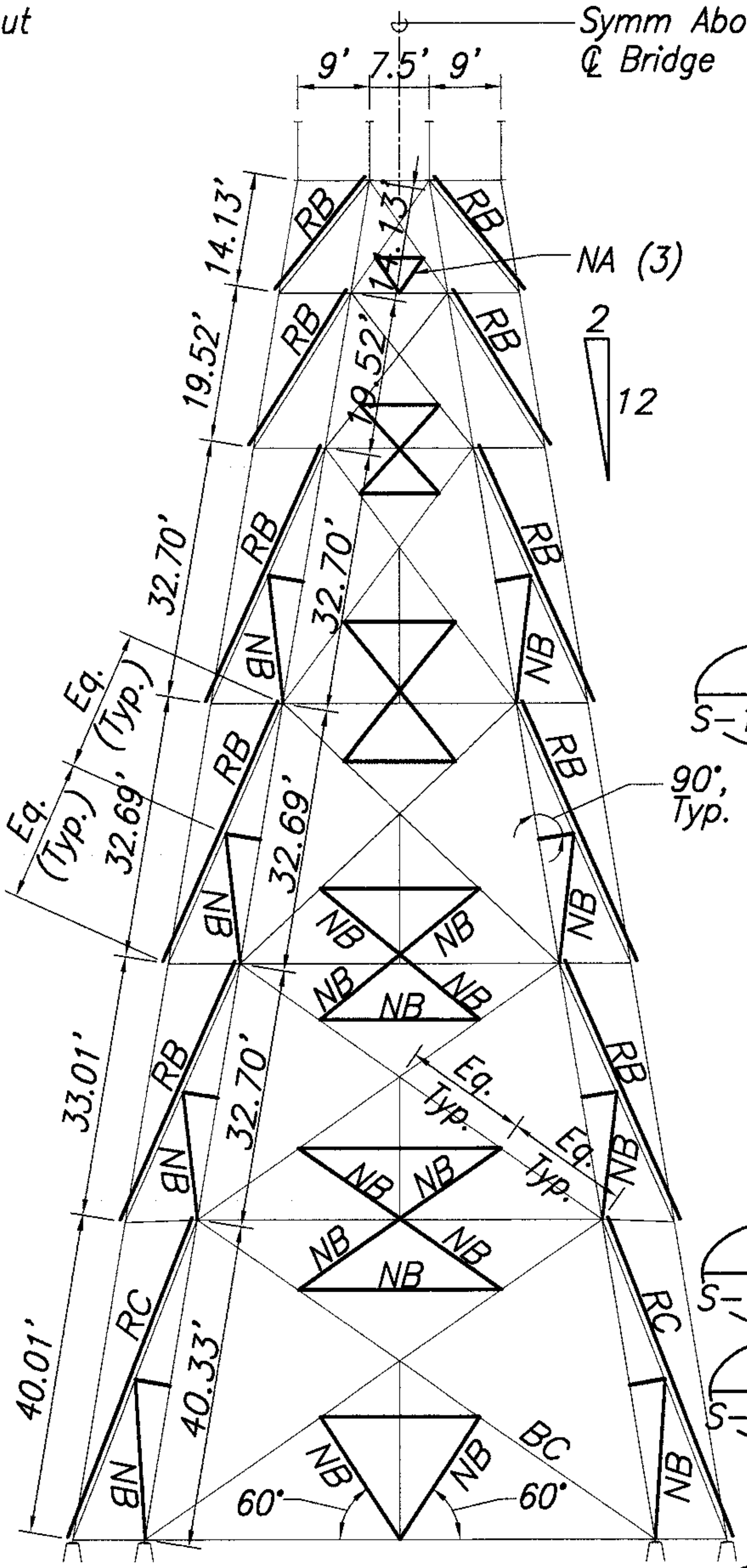
BENT #2

Scale: 1/16" = 1'-0"



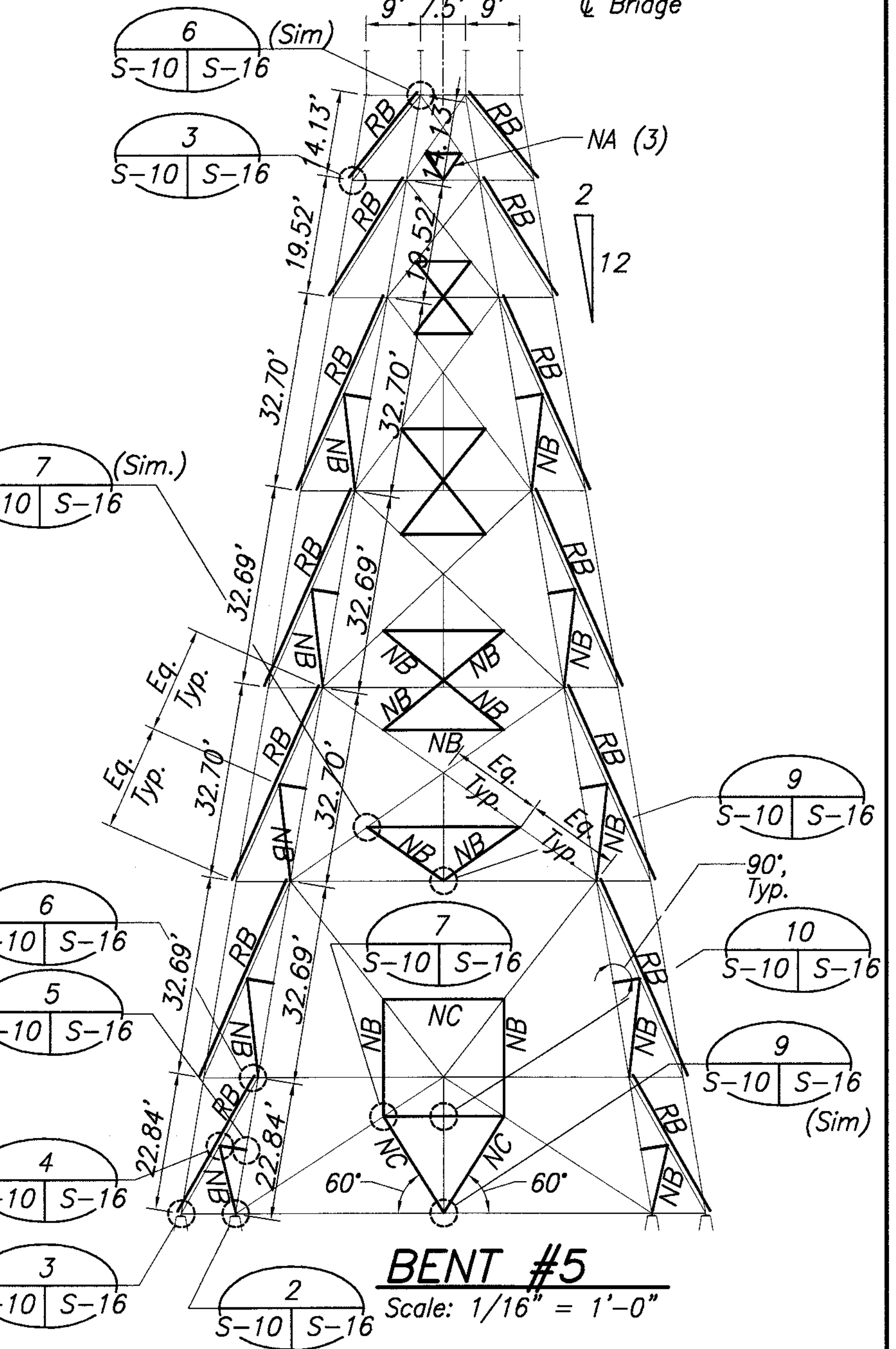
BENT #3

Scale: 1/16" = 1'-0"



BENT #4

Scale: 1/16" = 1'-0"



BENT #5

Scale: 1/16" = 1'-0"

NOTES:

1. All new add bracing members (___) are NA unless otherwise shown.

2. RA – Add 2-L 4x3x5/16 (w/ lacing) to existing diagonals.
   RC – Add 2-L 6x4x5/16 (w/ lacing) to existing diagonals.
   RB – Add 2-L 5x3x5/16 (w/ lacing) to existing diagonals.

3. NA – Add 2-L 3x2 1/2x5/16 (w/ lacing) new members.
   NB – Add 2-L 4x3x5/16 (w/ lacing) new members.
   NC – Add 2-L 5x3x5/16 (w/ lacing) new members.

4. Each steel bent and each tower shall be adequately shored and braced as required to accommodate the Contractor's construction method and sequence. The addition of members RA, RB, or RC to strengthen existing diagonals shall take place one member at a time. Construction bolts for each member shall be completely installed on one member before starting work on another member. The addition of members NA, NB, and NC for interior diagonals shall take place one member at a time, either during or after the addition of members RA, RB, or RC at each connection.

5. All surfaces of each existing diagonal to be strengthened by members RA, RB, or RC shall be cleaned and prepared to accept the paint system indicated in the Special Provisions. In addition the surface of each gusset plate and all surfaces of each member a minimum of 6 inches around the connections affected by the work shall be cleaned and prepared for painting. Areas cleaned shall receive the paint system indicated in the Special Provisions. Cleaning and painting shall be considered incidental to Structural Steel.

SHEN-CHIEN CHIU
No. 3641-S

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION

Shen-chien Chiu

DATE	REVISION

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

NANUE BRIDGE
SUBSTRUCTURE RETROFIT
TRANSV. BENTS #1,#2,#3,#4&#5

SEISMIC RETROFIT OF VARIOUS BRIDGES
EAST OF NINOLE, HAWAII
F.A. PROJECT NO. BR-019-2(46)

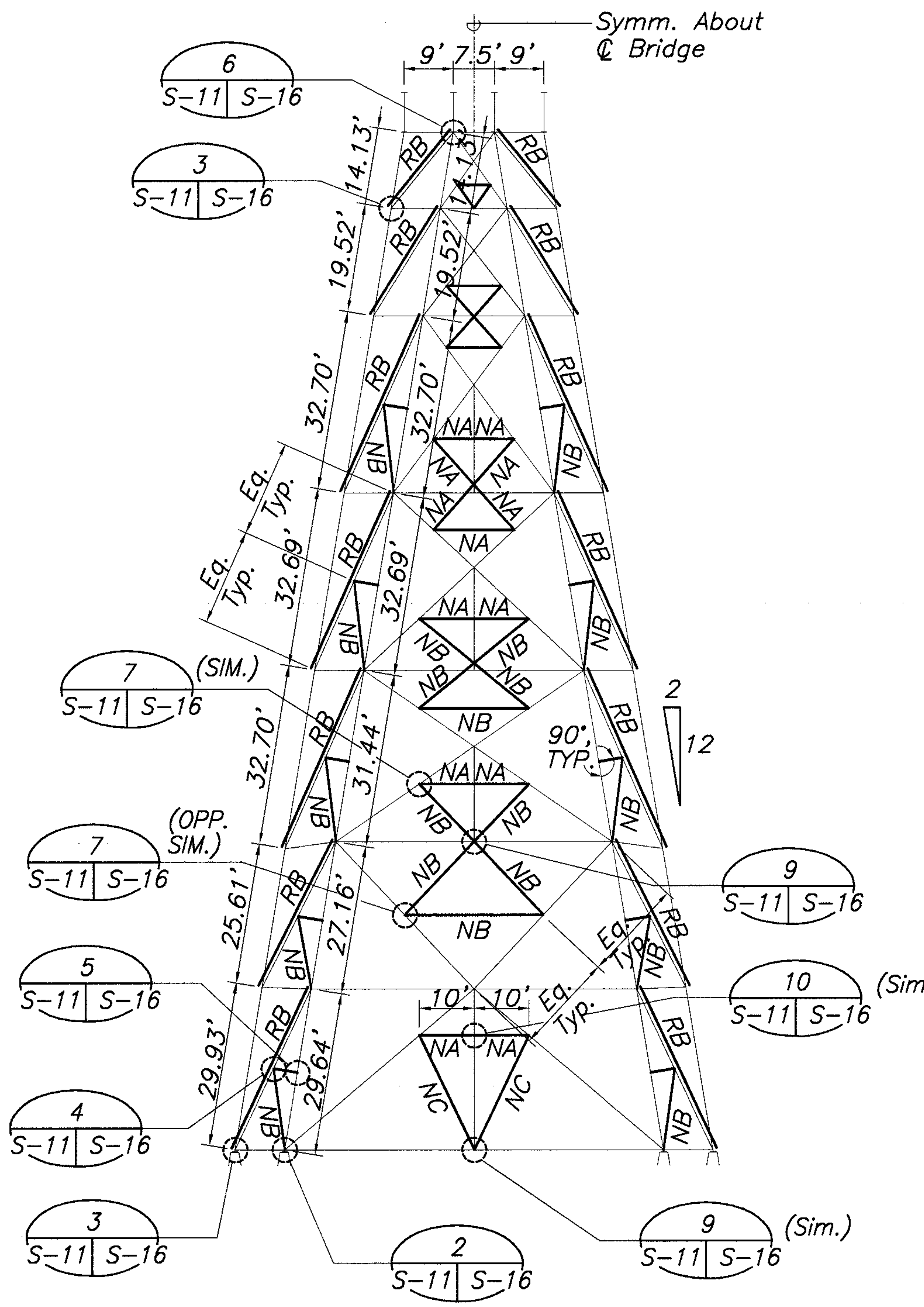
Scale: As Noted Date: AUG. 17, 1999

SHEET No. S-10 OF 23 SHEETS

ORIGINAL PLAN
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
NOTEBOOK
DESIGNED BY
QUANTITIES BY
No.
CHECKED BY
DATE

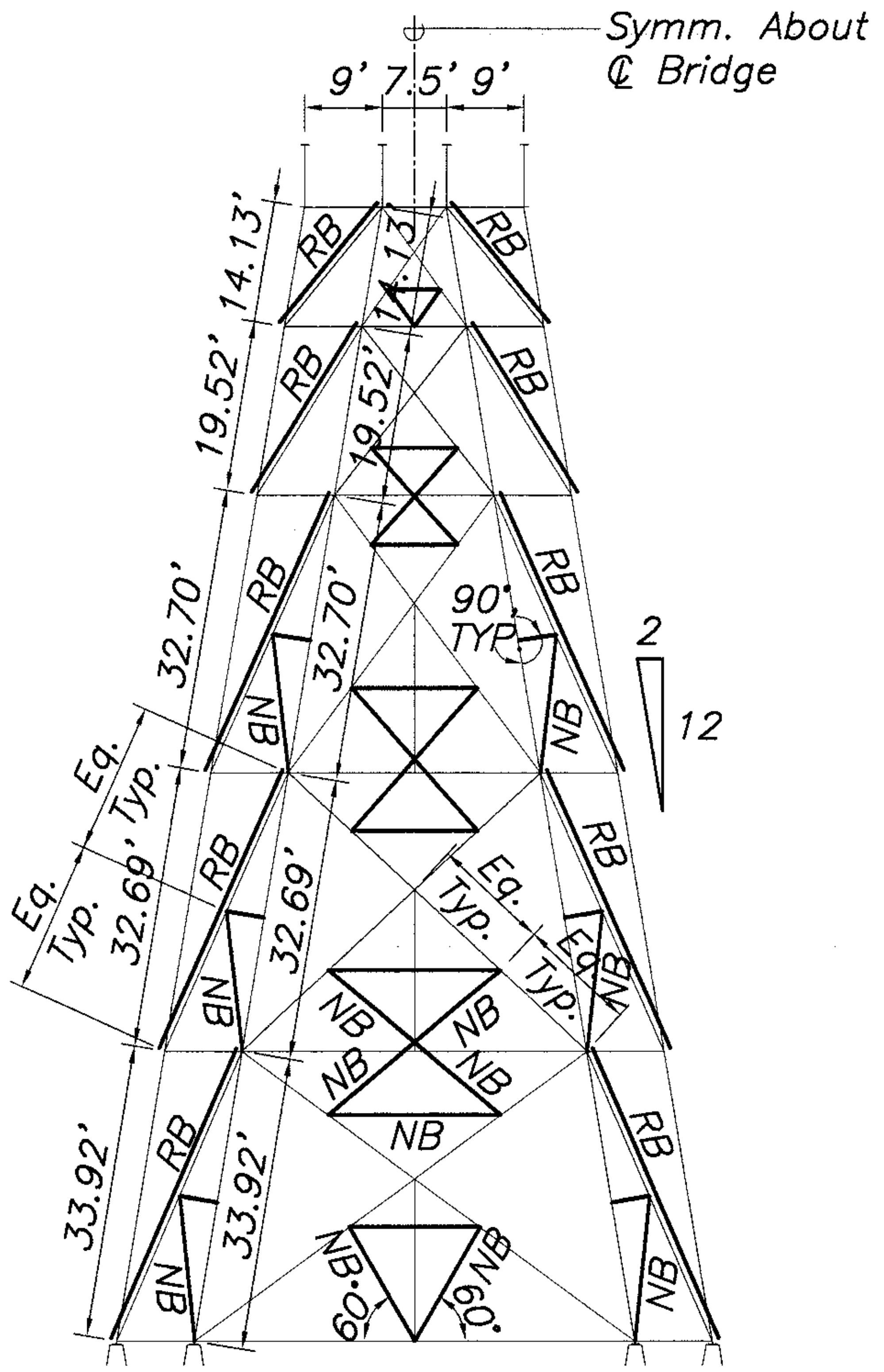
NS2-2.DWG 08/04/99 14:42 FINAL L:\DWG\6041-01\NEWSTRUCT\NANUE

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(46)	2000	14	26



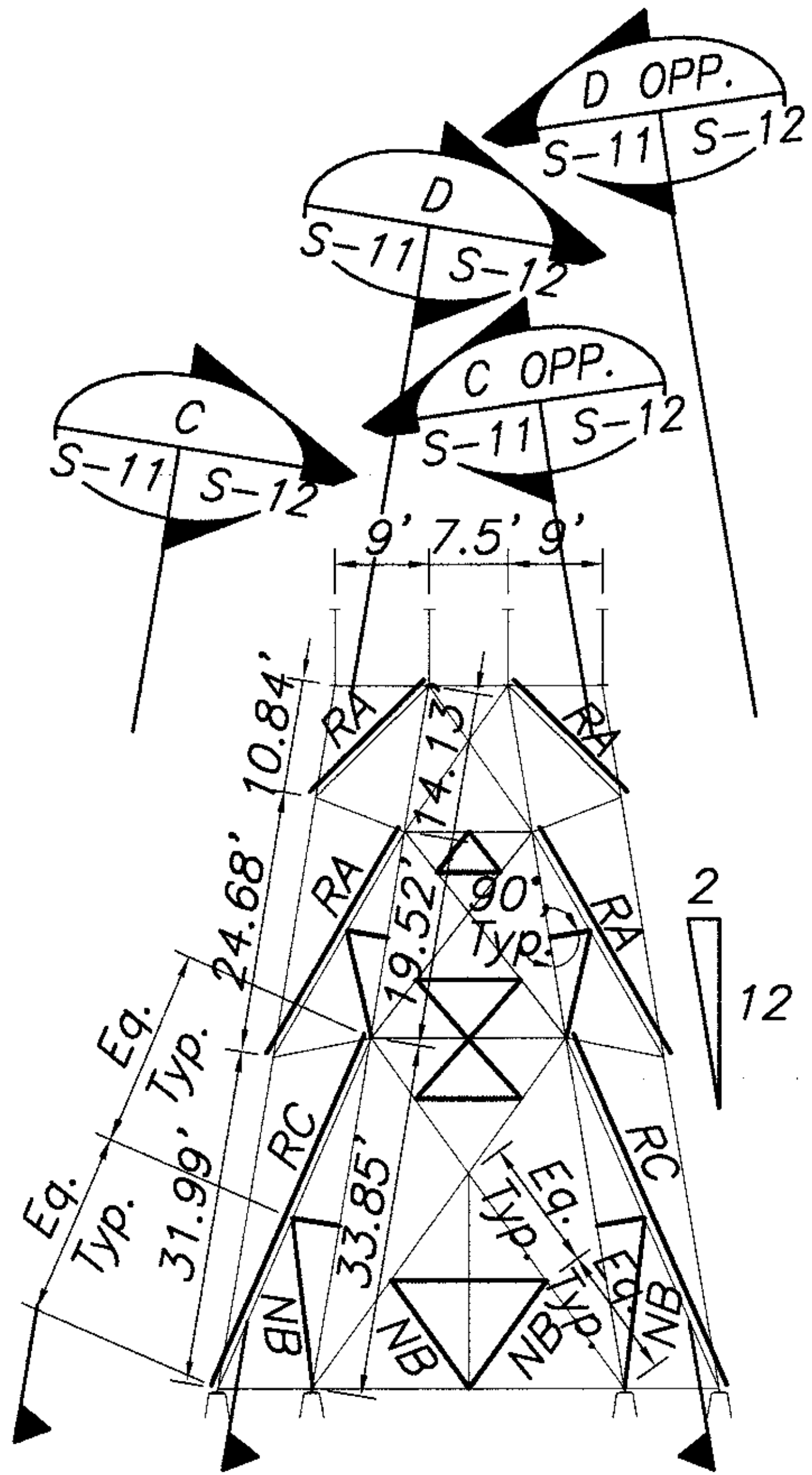
BENT #6

Scale: 1/16" = 1'-0"



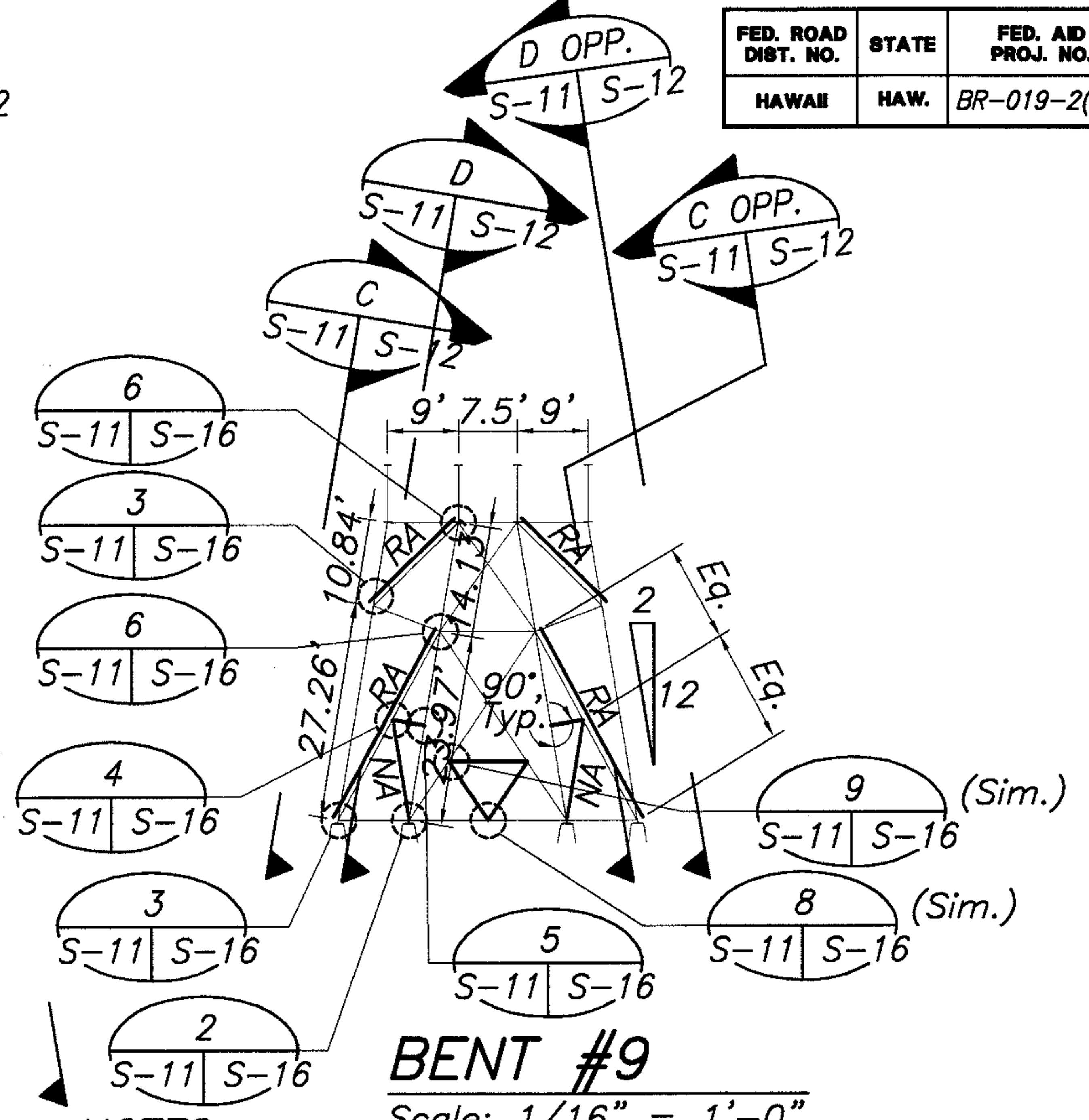
BENT #7

Scale: 1/16" = 1'-0"



BENT #8

Scale: 1/16" = 1'-0"



BENT #9

Scale: 1/16" = 1'-0"

NOTES:

1. All new add bracing members are NA unless otherwise shown.
2. RA – Add 2-L 4x3x5/16 (w/lacing) to existing diagonals.
   RC – Add 2-L 6x4x5/16 (w/lacing) to existing diagonals.
   RB – Add 2-L 5x3x5/16 (w/lacing) to existing diagonals.
3. NA – Add 2-L 3x2 1/2x5/16 (w/lacing) new members.
   NB – Add 2-L 4x3x5/16 (w/lacing) new members.
   NC – Add 2-L 5x3x5/16 (w/lacing) new members.
4. Each steel bent and each tower shall be adequately shored and braced as required to accommodate the Contractor's construction method and sequence. The addition of members RA, RB, or RC to strengthen existing diagonals shall take place one member at a time. Connection bolts for each member shall be completely installed on one member before starting work on another member. The addition of members NA, NB, and NC for interior diagonals shall take place one member at a time, either during or after the addition of members RA, RB, or RC at each connection.
5. All surfaces of each existing diagonal to be strengthened by members RA, RB, or RC shall be cleaned and prepared to accept the paint system indicated in the Special Provisions. In addition the surface of each gusset plate and all surfaces of each member a minimum of 6 inches around the connections affected by the work shall be cleaned and prepared for painting. Areas cleaned shall receive the paint system indicated in the Special Provisions. Cleaning and painting shall be considered incidental to Structural Steel.

SHEN-CHIEN CHIU
No. 3641-S

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION

Shen-chien Chiu

DATE	REVISION

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

NANUE BRIDGE
SUBSTRUCTURE RETROFIT
TRANSV. BENTS #6,#7,#8 & #9

SEISMIC RETROFIT OF VARIOUS BRIDGES
EAST OF NINOLE, HAWAII
F.A. PROJECT NO. BR-019-2(46)

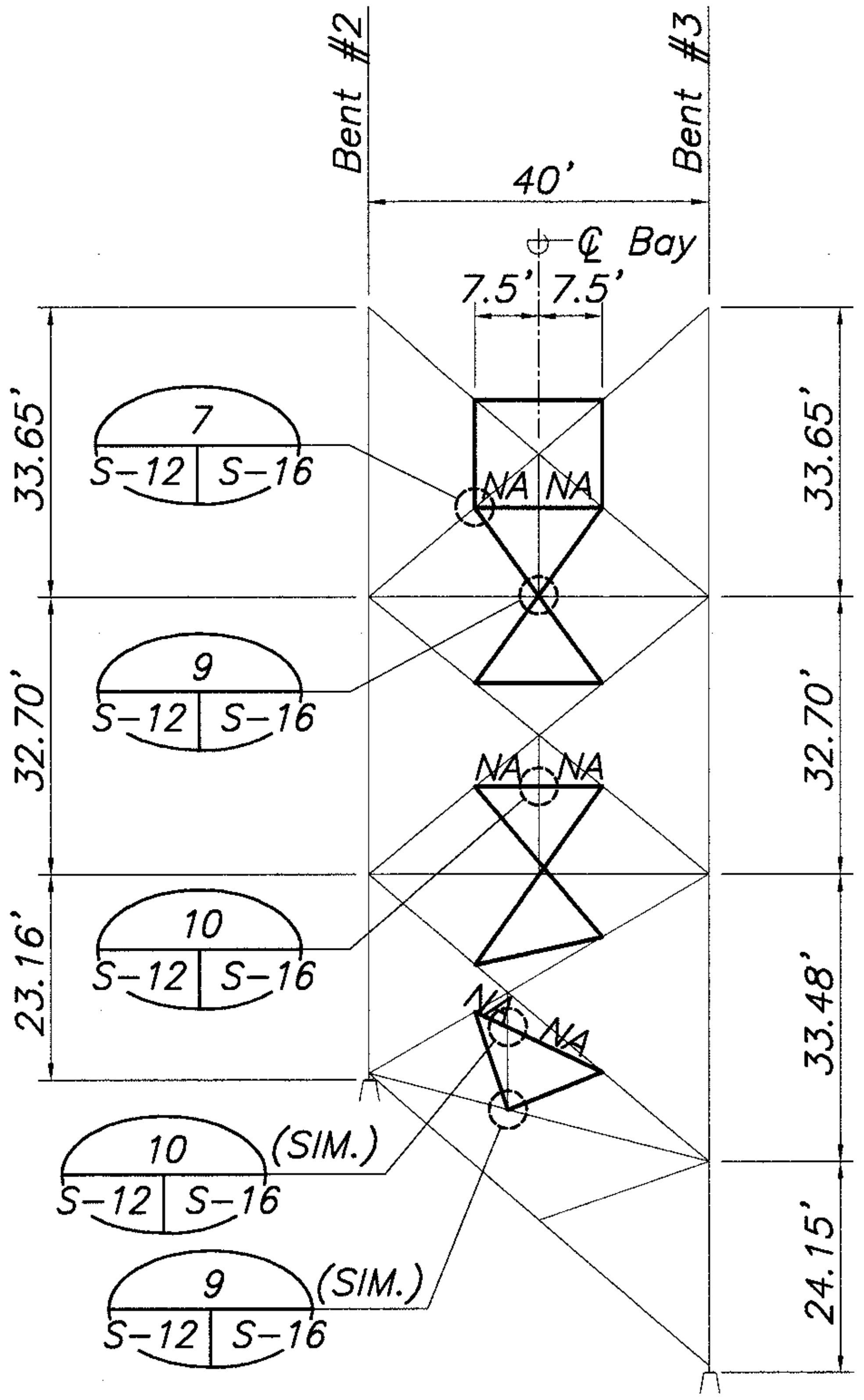
Scale: As Noted
Date: AUG. 17, 1999

SHEET No. S-11 OF 23 SHEETS

ORIGINAL PLAN
NOTEBOOK
No.
SURVEY PLOTTED BY
DRAWN BY
TRACED BY
DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

NS2-3.DWG 03/23/99 15:43 FINAL L:\DWG\6041-01\NEWSTRUCT\NANUE

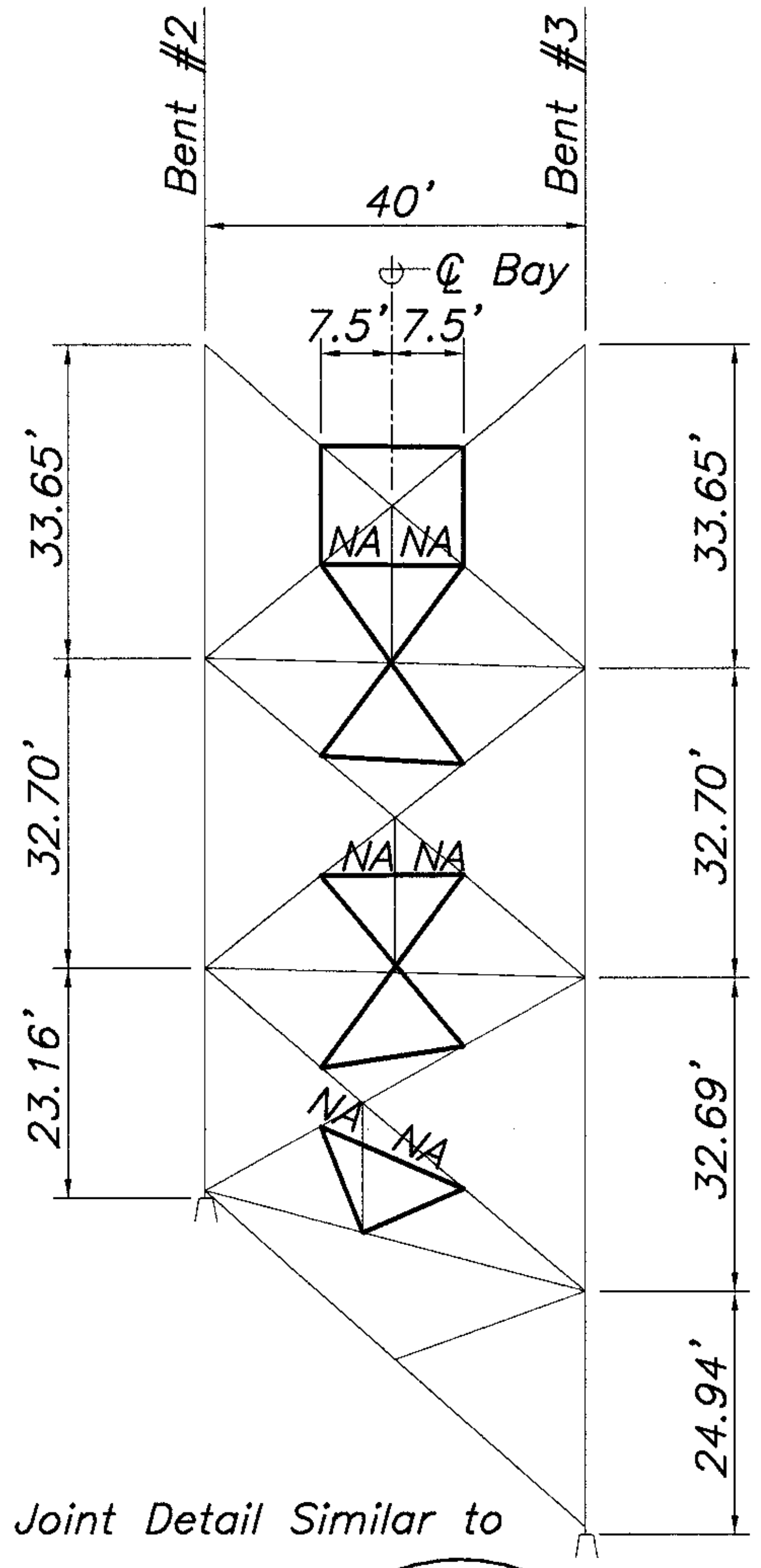
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(46)	2000	15	26



ELE.-TOWER A (A S-12|S-12)

Scale: 1/16"=1'-0"

S-10

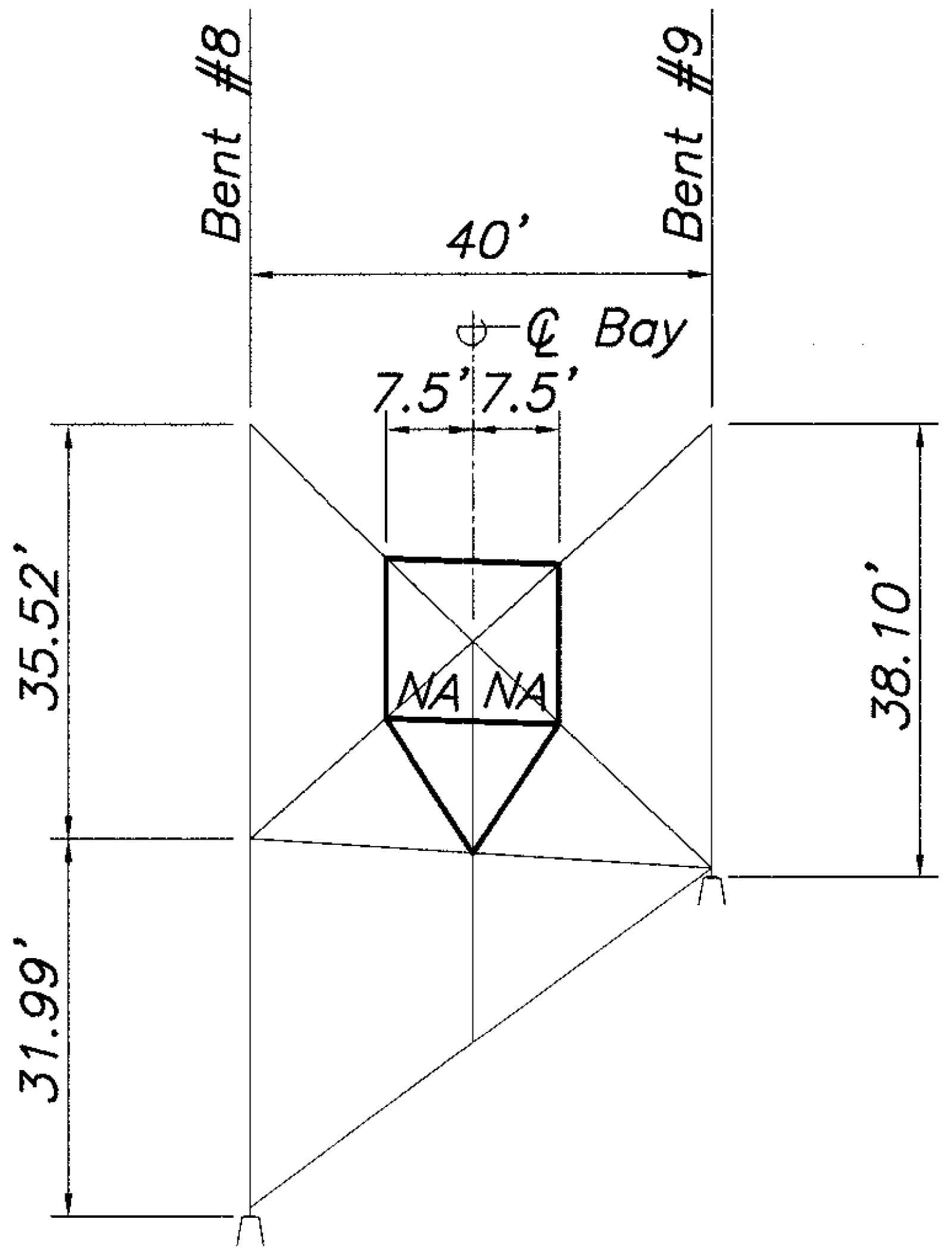


Note: Joint Detail Similar to (A S-12|S-12)

ELE.-TOWER B (B S-12|S-12)

Scale: 1/16"=1'-0"

S-10

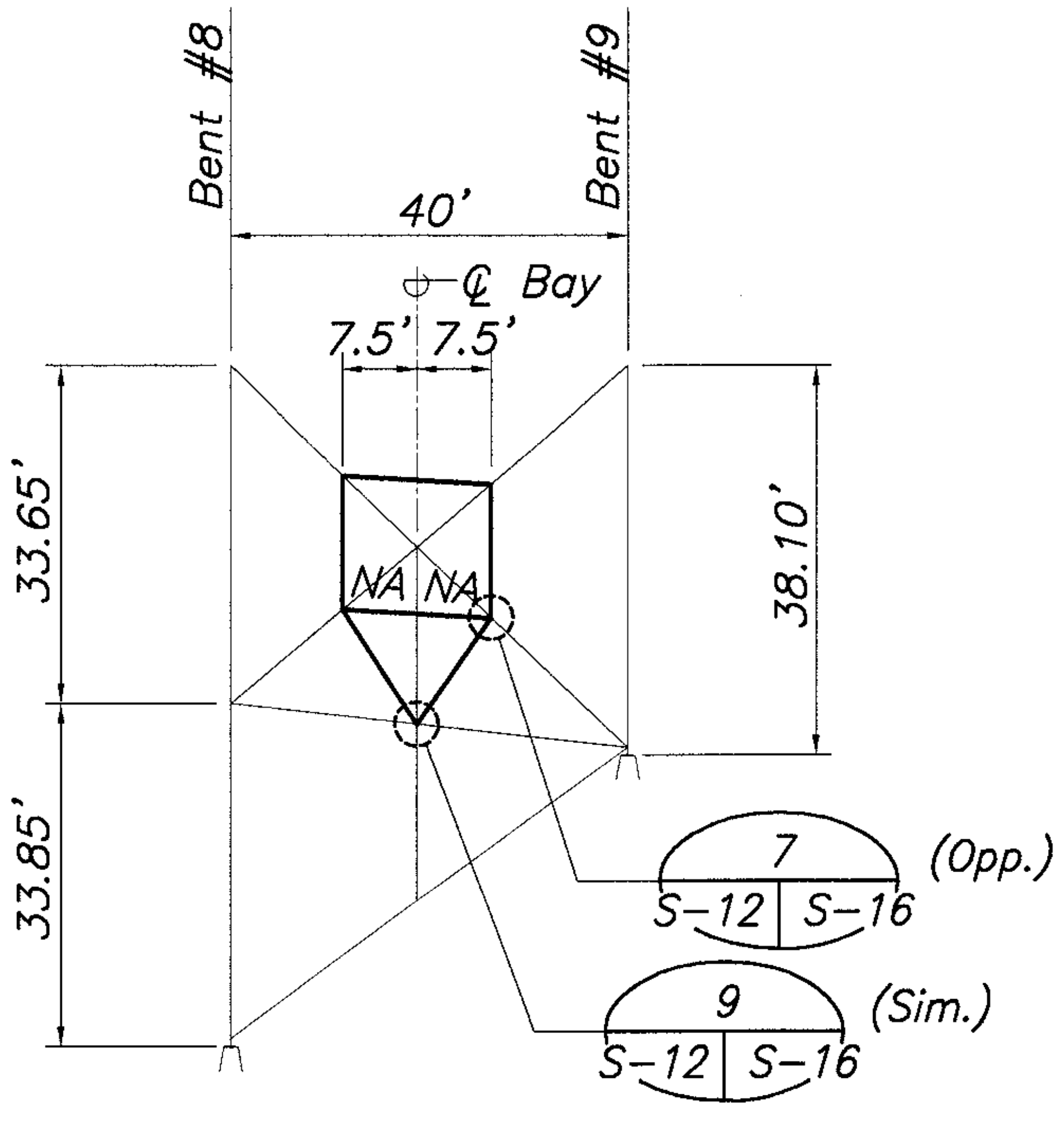


Note: Joint Detail Similar to (D S-12|S-12)

ELE.-TOWER C (C S-12|S-12)

Scale: 1/16"=1'-0"

S-11



ELE.-TOWER D (D S-12|S-12)

Scale: 1/16"=1'-0"

S-11

NOTES:

1. See Retrofit Legends on Sheet S-9
2. All new members are "NB", unless otherwise indicated.
3. See Note 3 on Sheet S-10 for size of new members.
4. Each steel bent and each tower shall be adequately shored and braced as required to accommodate the Contractor's construction method and sequence. The addition of members RA, RB, or RC to strengthen existing diagonals shall take place one member at a time. Connection bolts for each member shall be completely installed on one member before starting work on another member. The addition of members NA, NB, and NC for interior diagonals shall take place one member at a time, either during or after the addition of members RA, RB, or RC at each connection.
5. All surfaces of each existing diagonal to be strengthened by members RA, RB, or RC shall be cleaned and prepared to accept the paint system indicated in the Special Provisions. In addition the surface of each gusset plate and all surfaces of each member a minimum of 6 inches around the connections affected by the work shall be cleaned and prepared for painting. Areas cleaned shall receive the paint system indicated in the Special Provisions. Cleaning and painting shall be considered incidental to Structural Steel.

SHEN-CHIEN CHIU
LICENSED PROFESSIONAL ENGINEER
No. 3641-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

Shen-Chien Chiu

DATE	REVISION

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

NANUE BRIDGE
SUBSTRUCTURE RETROFIT
TRANSVERSE TOWERS A-D

SEISMIC RETROFIT OF VARIOUS BRIDGES
EAST OF NINOLE, HAWAII
F.A. PROJECT NO. BR-019-2(46)

Scale: As Noted Date: AUG. 17, 1999

SHEET No. S-12 OF 23 SHEETS

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		DATE
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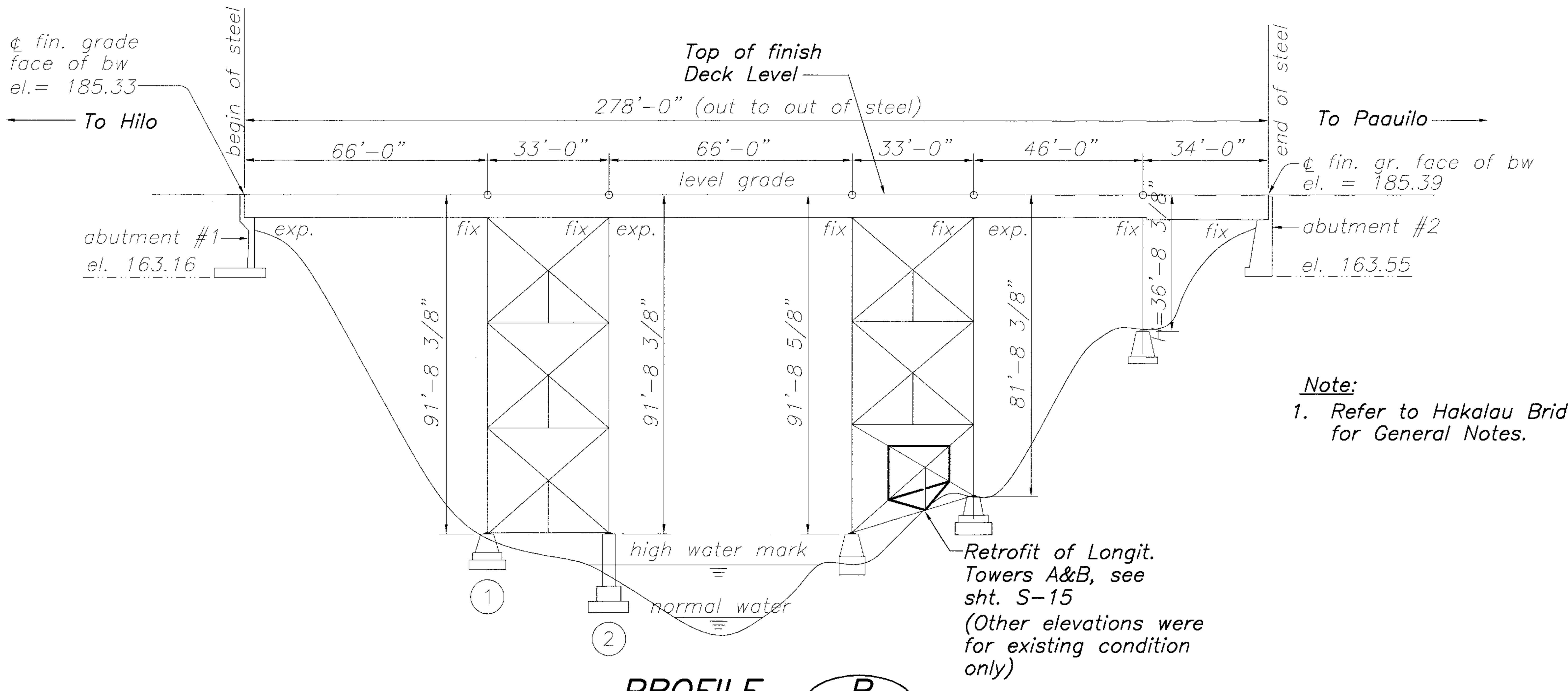
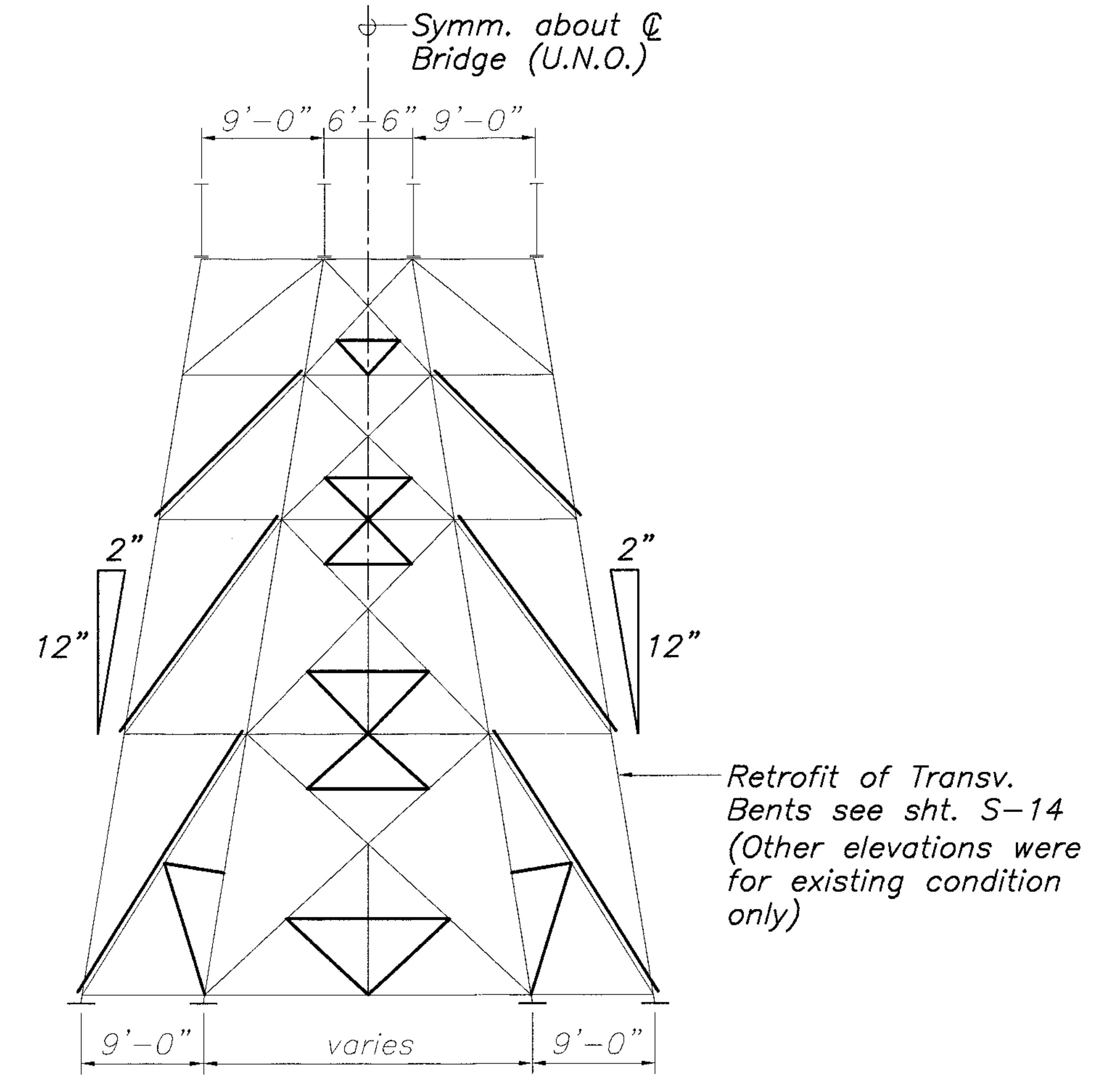
	TRACED BY	
NOTEBOOK	DESIGNED BY	
	QUANTITIES BY	
No.	CHECKED BY	

FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(46)	2000	16	26

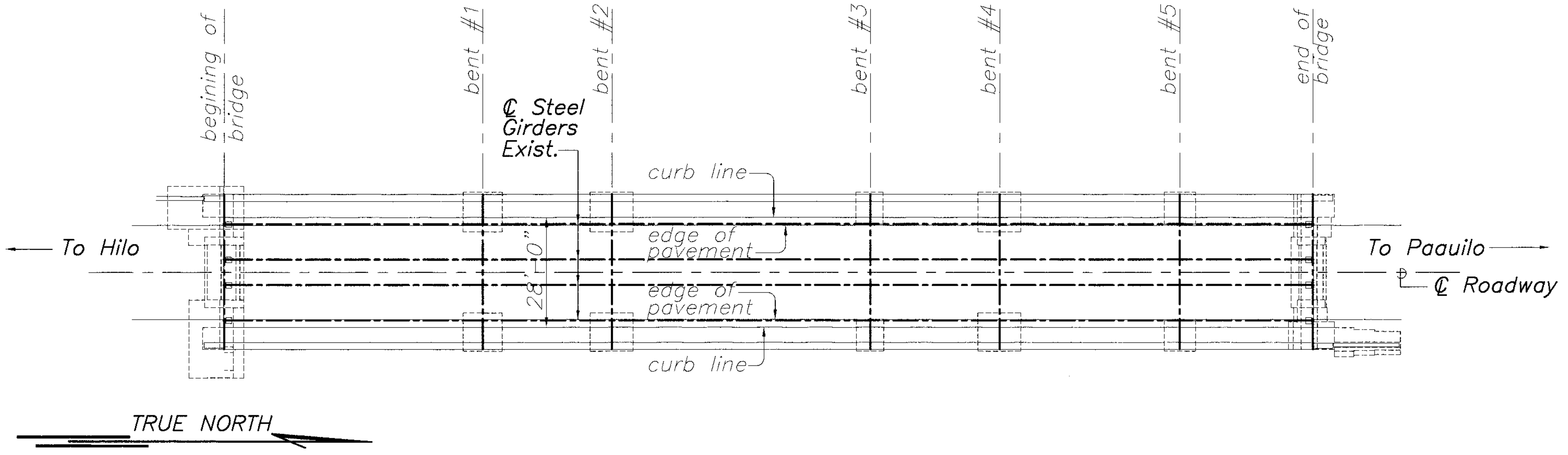


PROFILE B
Scale: 1"=20' S-13 | S-13

Note:
1. Refer to Hakalau Bridge for General Notes.



TYPICAL BENT ELEVATION C
Scale: 1/8"=1'-0" S-13 | S-13



DETAIL A
Scale: 1"=20' S-13 | S-13

RETROFIT LEGEND:

——	(Light lines) Existing steel members.
——	(Heavy solid lines) New or added bracing members.

SHEN-CHIEN CHIU LICENSED PROFESSIONAL ENGINEER No. 3641-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

Shen-chien Chiu

DATE	REVISION

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

UMAUMA BRIDGE
SUBSTRUCTURE RETROFIT
PLAN, SECTION AND ELEVATION

SEISMIC RETROFIT OF VARIOUS BRIDGES
EAST OF NINOLE, HAWAII
F.A. PROJECT NO. BR-019-2(46)

Scale: As Noted Date: AUG. 17, 1999

SHEET No. S-13 OF 23 SHEETS

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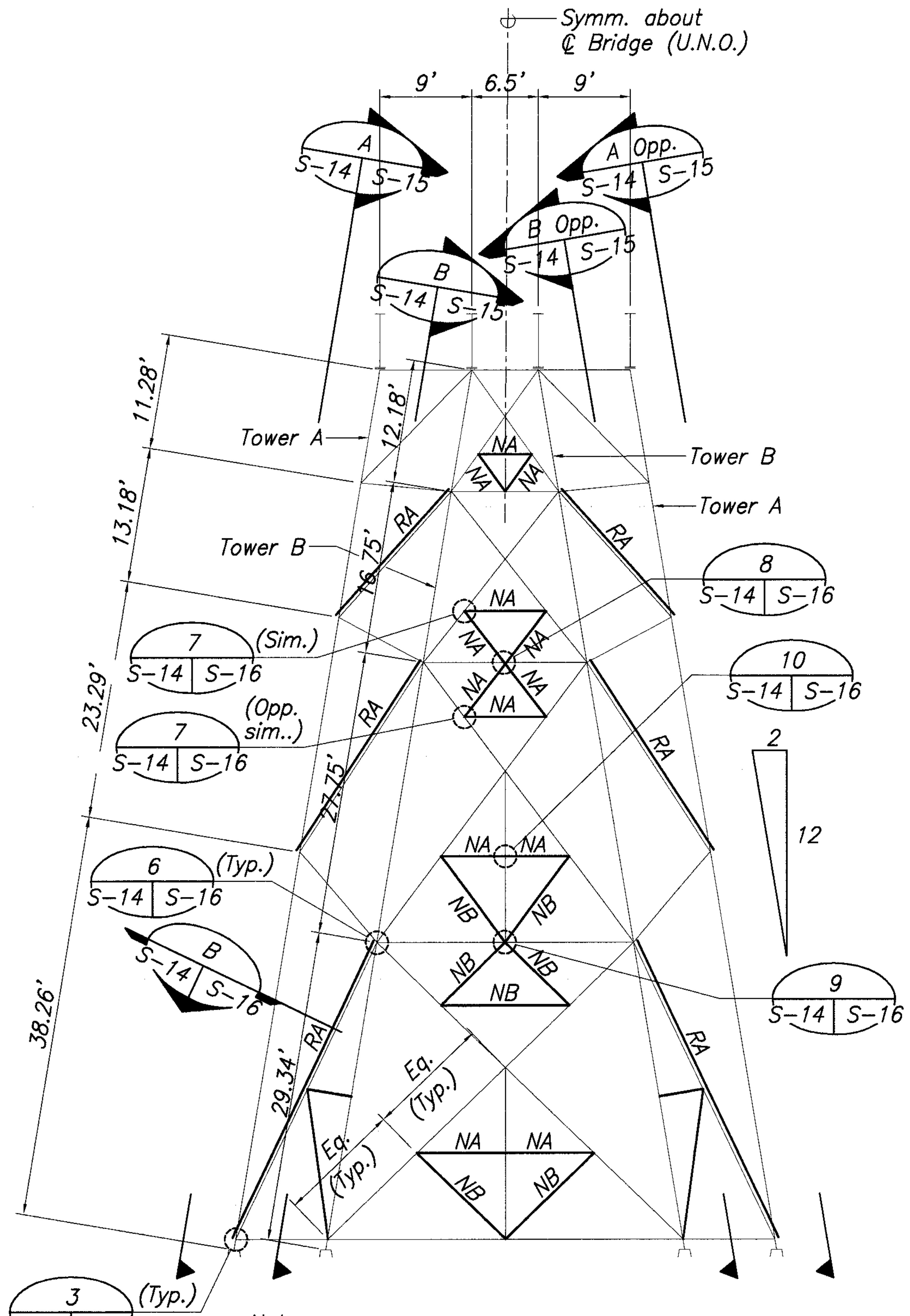
ORIGINAL PLAN	SURVEY PLOTTED BY	DATE
	DRAWN BY	"
NOTEBOOK	TRACED BY	"
	DESIGNED BY	"
	QUANTITIES BY	"
No.	CHECKED BY	"

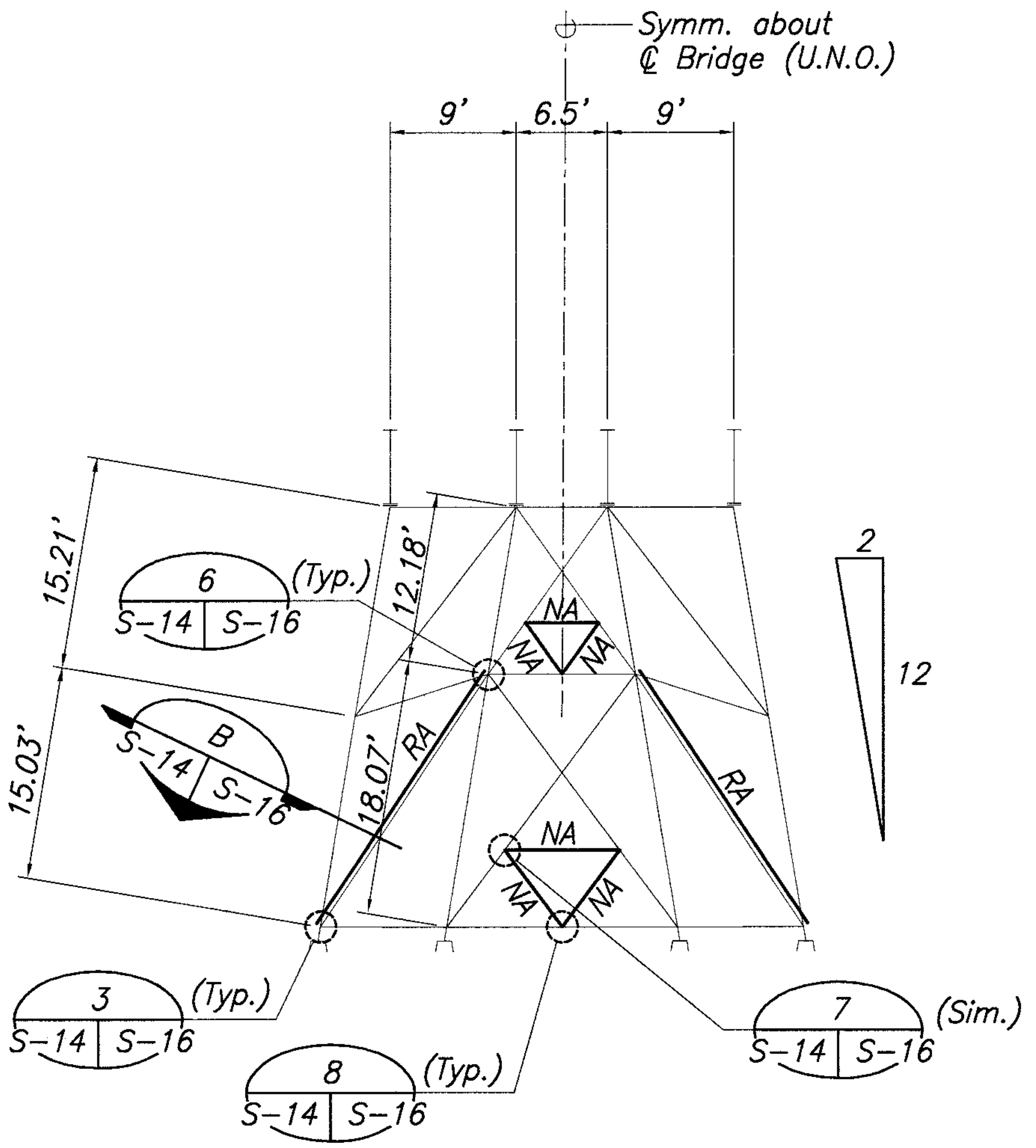
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(46)	2000	17	26



Note:
Section A&B apply to Bents #3 & #4 only.

ELEVATION – BENTS #1,#2,#3 & #4 (A, S-14 | S-14)

Scale: 1/8"=1'-0"



ELEVATION – BENT #5 (B, S-14 | S-14)

Scale: 1/8"=1'-0"

NOTES:

1. Each steel bent and each tower shall be adequately shored and braced as required to accommodate the Contractor's construction method and sequence. The addition of members RA, RB, or RC to strengthen existing diagonals shall take place one member at a time. Connection bolts for each member shall be completely installed on one member before starting work on another member. The addition of members NA, NB, and NC for interior diagonals shall take place one member at a time, either during or after the addition of members RA, RB, or RC at each connection.

2. All surfaces of each existing diagonal to be strengthened by members RA, RB, or RC shall be cleaned and prepared to accept the paint system indicated in the Special Provisions. In addition the surface of each gusset plate and all surfaces of each member a minimum of 6 inches around the connections affected by the work shall be cleaned and prepared for painting. Areas cleaned shall receive the paint system indicated in the Special Provisions. Cleaning and painting shall be considered incidental to Structural Steel.

RETROFIT LEGEND:

—	(Light lines) Existing steel members.
━	(Heavy solid lines) Add bracing members.
RA	Add 2-L 4x3x5/16 (w/lacing) to existing members.
NA	Add 2-L 3x2 1/2x5/16 (w/lacing) new members.
NB	Add 2-L 4x3x5/16 new members.

SHEN-CHIEN CHIU
No. 3641-S

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ME OR UNDER MY SUPERVISION

Shen-Chien Chiu

DATE	REVISION

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

UMAUMA BRIDGE
SUBSTRUCTURE RETROFIT
RETROFIT OF BENTS #1,#2,#3 & #4

SEISMIC RETROFIT OF VARIOUS BRIDGES
EAST OF NINOLE, HAWAII
F.A. PROJECT NO. BR-019-2(46)

Scale: As Noted Date: AUG. 17, 1999

SHEET No. S-14 OF 23 SHEETS

ORIGINAL PLAN
NOTEBOOK
No.
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DRAWN BY
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DESIGNED BY
QUANTITIES BY
CHECKED BY
DATE

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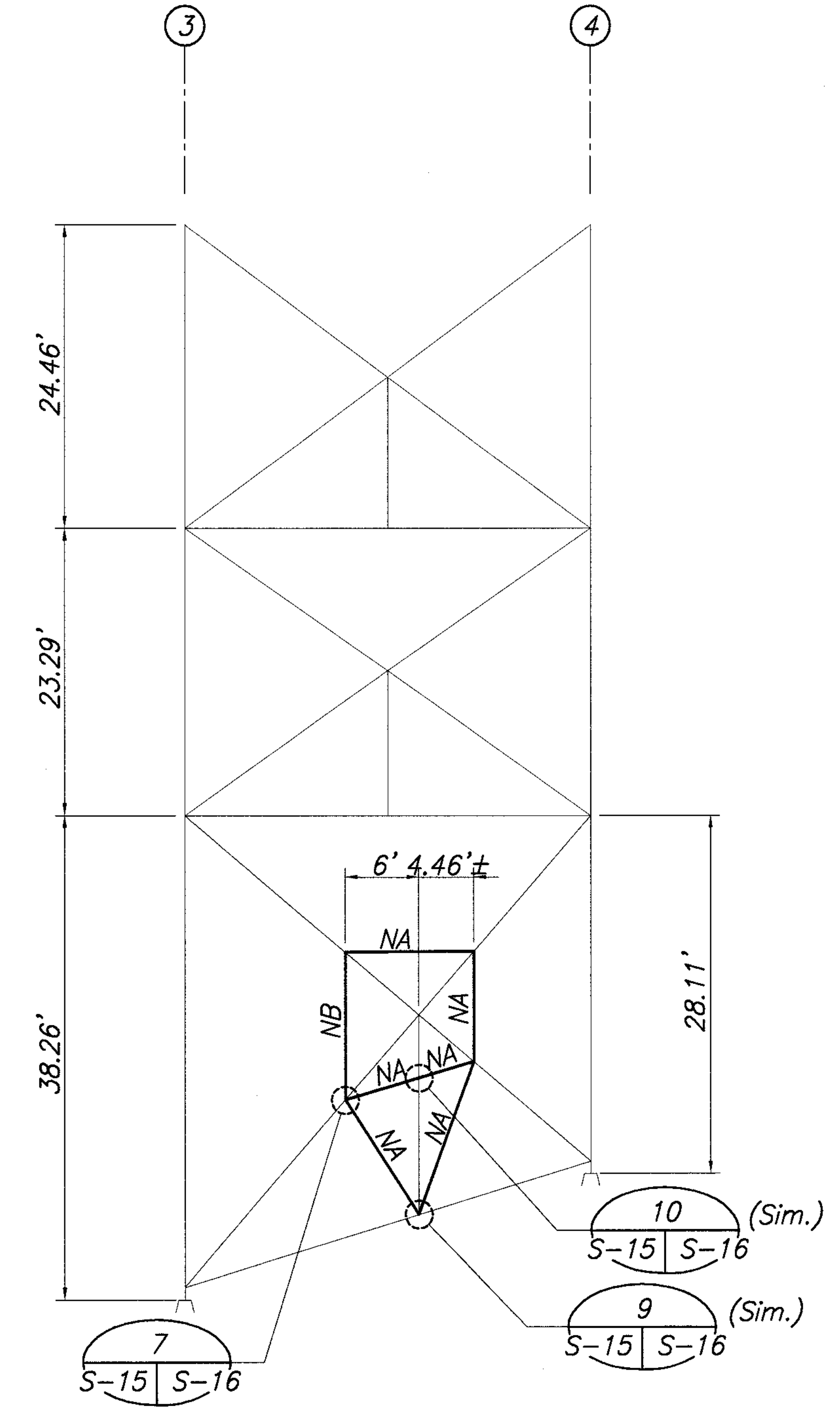
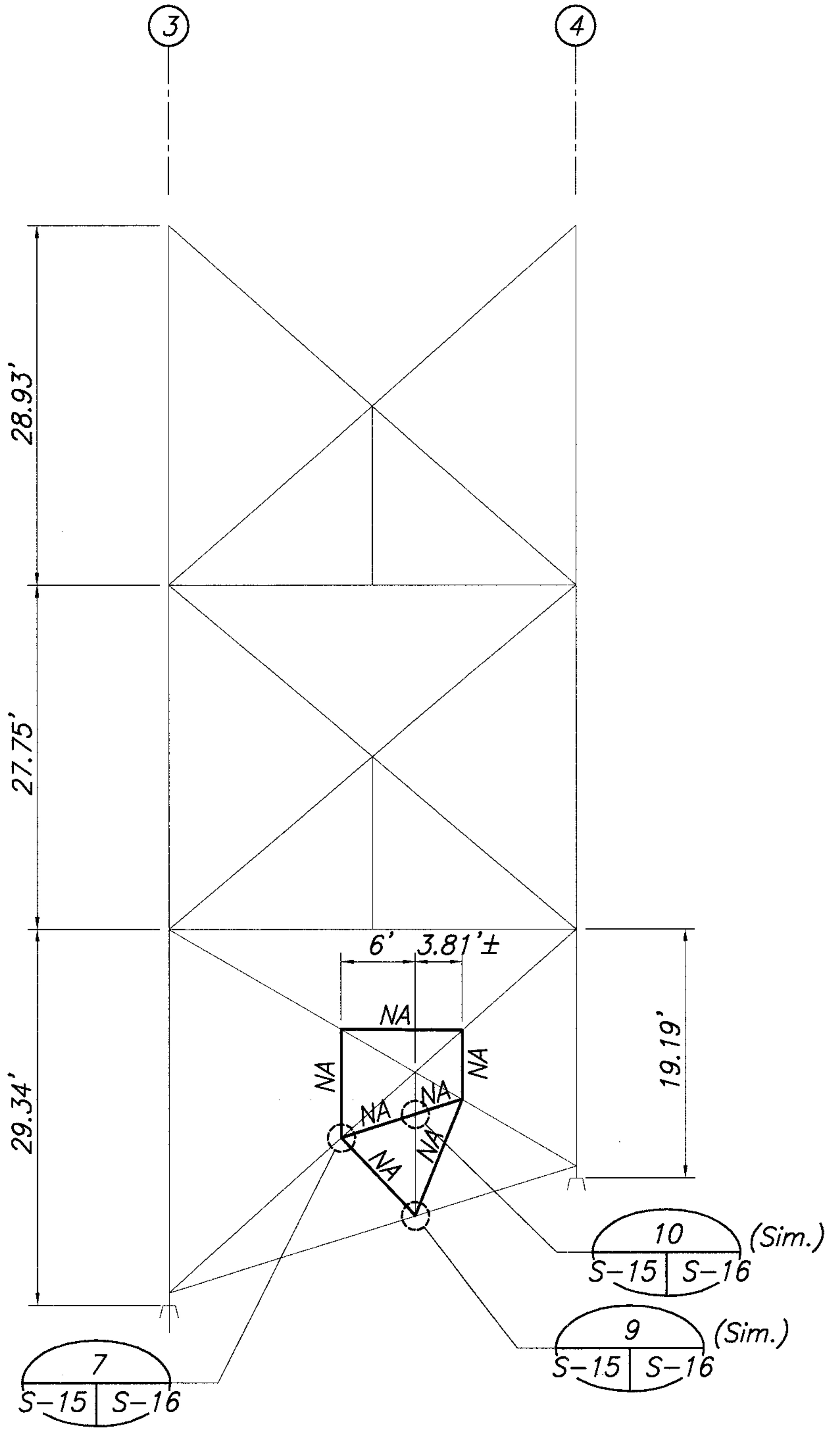
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(46)	2000	18	26



ELEVATION – TOWER A

A S-14 S-15

Scale: 1/8"=1'-0"



ELEVATION – TOWER B

B S-14 S-15

Scale: 1/8"=1'-0"

NOTES:

1. Each steel bent and each tower shall be adequately shored and braced as required to accommodate the Contractor's construction method and sequence. The addition of members RA, RB, or RC to strengthen existing diagonals shall take place one member at a time. Connection bolts for each member shall be completely installed on one member before starting work on another member. The addition of members NA, NB, and NC for interior diagonals shall take place one member at a time, either during or after the addition of members RA, RB, or RC at each connection.

2. All surfaces of each existing diagonal to be strengthened by members RA, RB, or RC shall be cleaned and prepared to accept the paint system indicated in the Special Provisions. In addition the surface of each gusset plate and all surfaces of each member a minimum of 6 inches around the connections affected by the work shall be cleaned and prepared for painting. Areas cleaned shall receive the paint system indicated in the Special Provisions. Cleaning and painting shall be considered incidental to Structural Steel.

RETROFIT LEGEND:

——— (Light lines) Existing steel members.
——— (Heavy solid lines) Add bracing members.
NA Add 2-L 3x2 1/2x5/16 (w/lacing) new members.
NB Add 2-L 4x3x5/16 (w/lacing) new members.

SHEN-CHIEN CHIU
No. 3641-S

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ME OR UNDER MY SUPERVISION

Shen-chien Chiu

DATE	REVISION

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

UMAUMA BRIDGE
SUBSTRUCTURE RETROFIT
RETROFIT OF TOWERS A,B,C & D

SEISMIC RETROFIT OF VARIOUS BRIDGES
EAST OF NINOLE, HAWAII
F.A. PROJECT NO. BR-019-2(46)

Scale: As Noted Date: AUG. 17, 1999

SHEET No. S-15 OF 23 SHEETS

ORIGINAL PLAN
SURVEY PLOTTED BY
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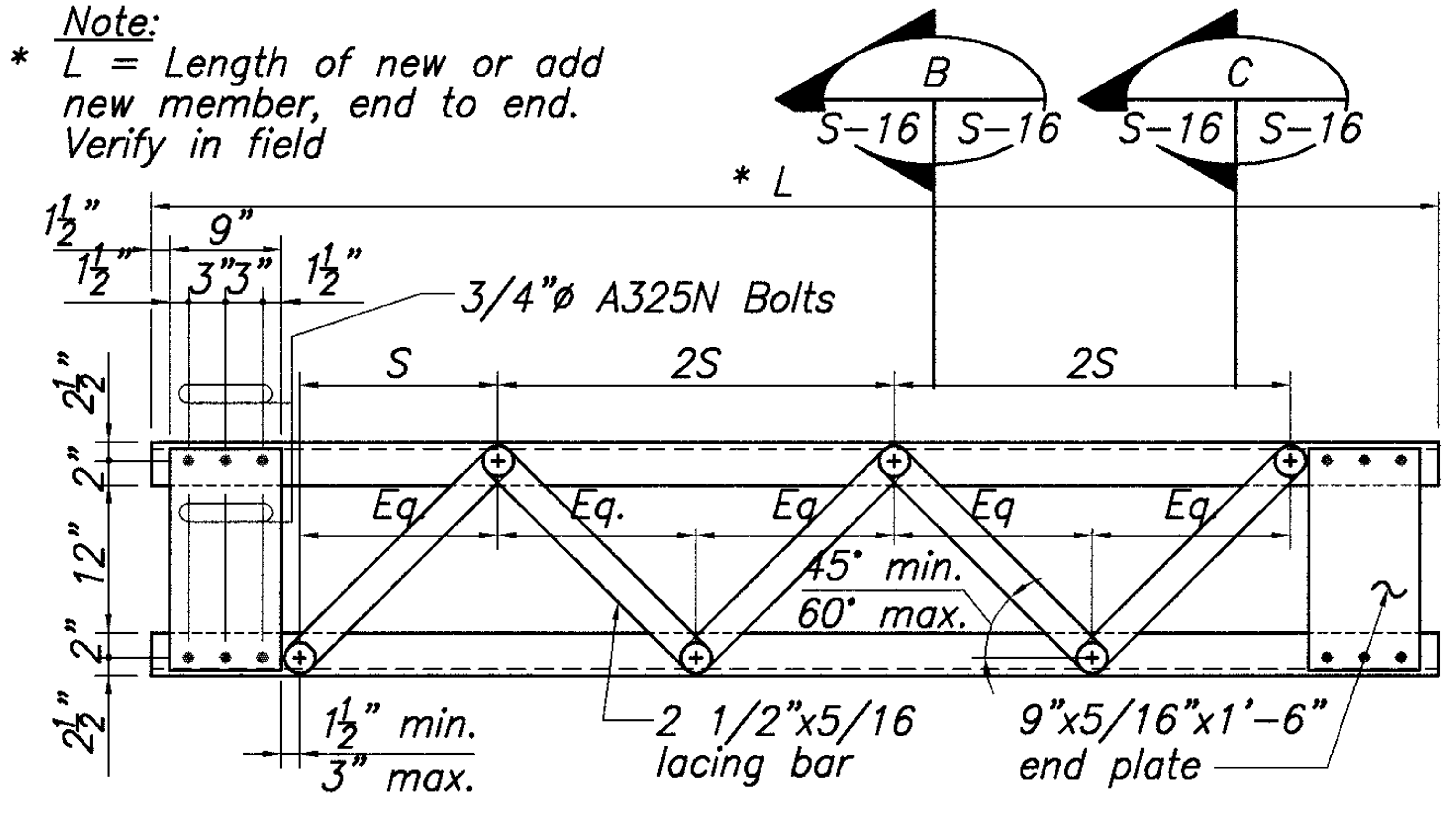
FED. ROAD DIST. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	BR-019-2(46)	2000	19	26

Note:
* L = Length of new or add new member, end to end. Verify in field

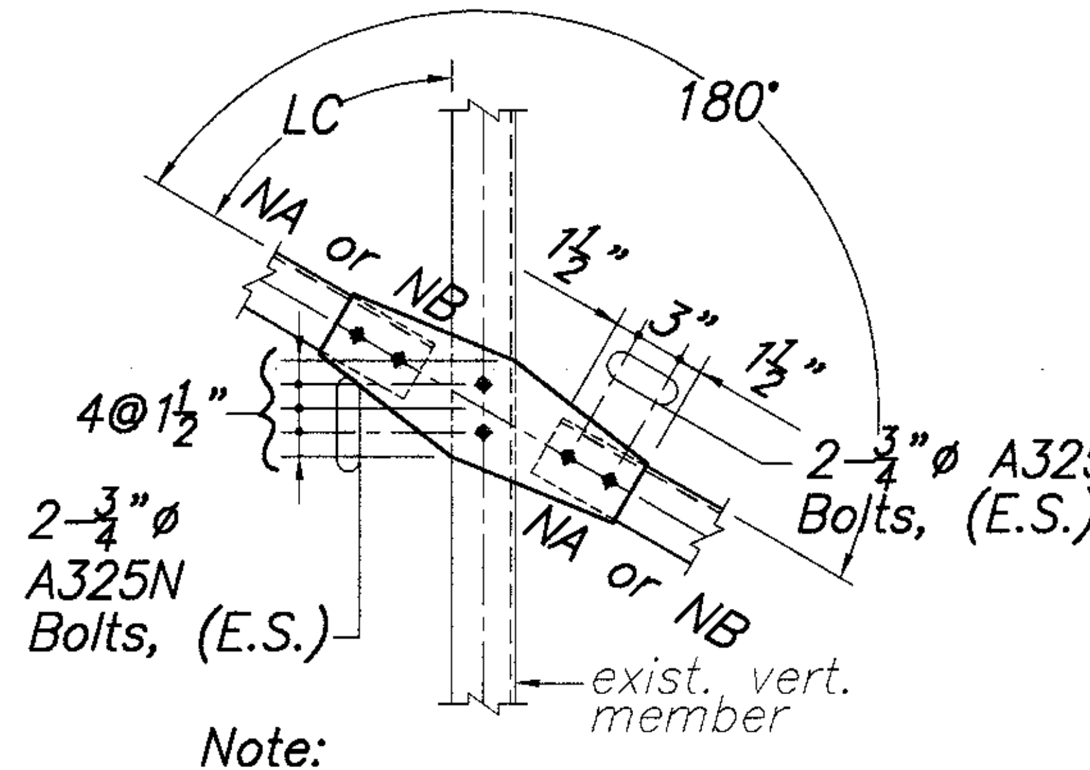


BOTTOM PLAN (Looking up)

LACING & STAY PLATE LAYOUT PLAN OF NA, NB, RA, RB, & RC

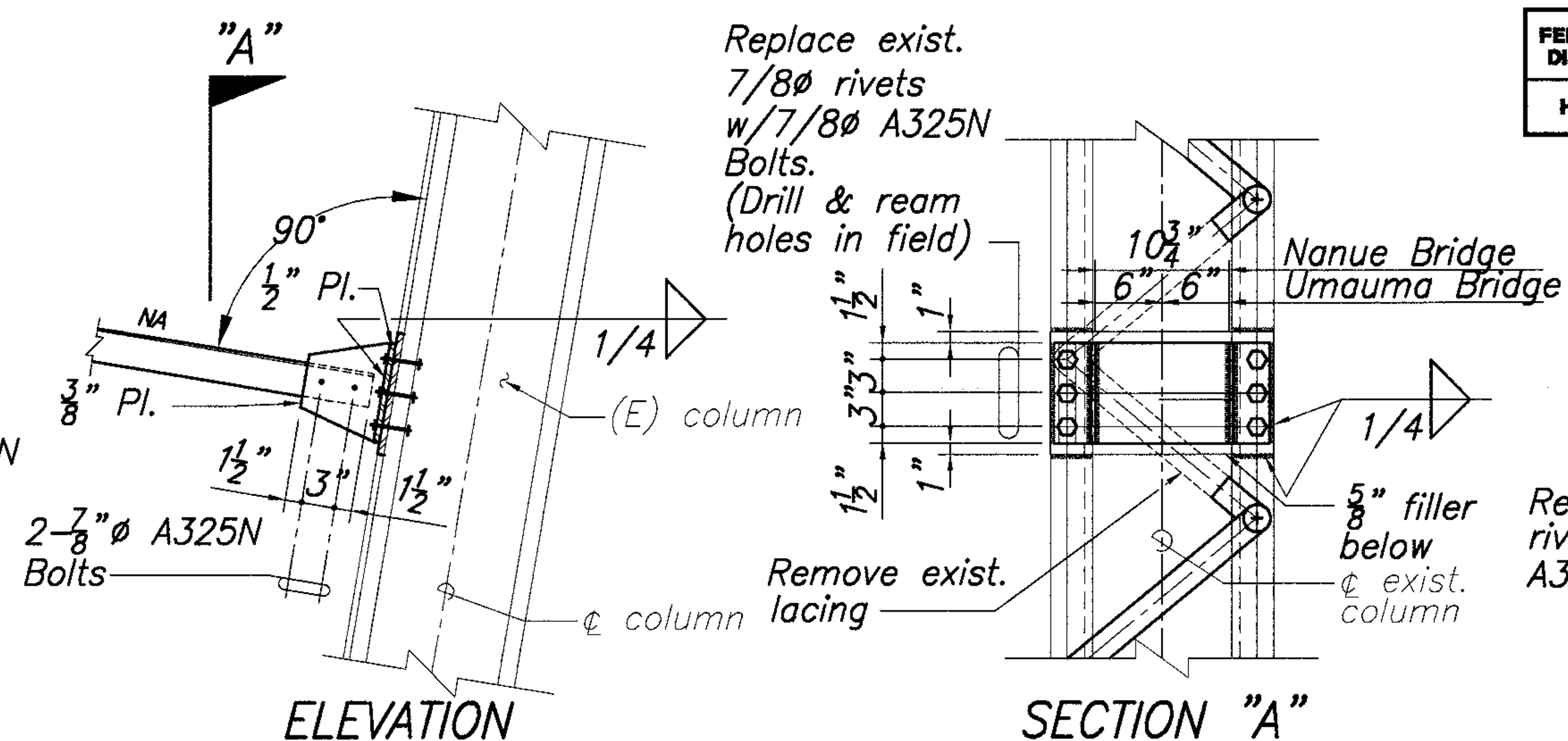
Scale: None

A S-16 S-16

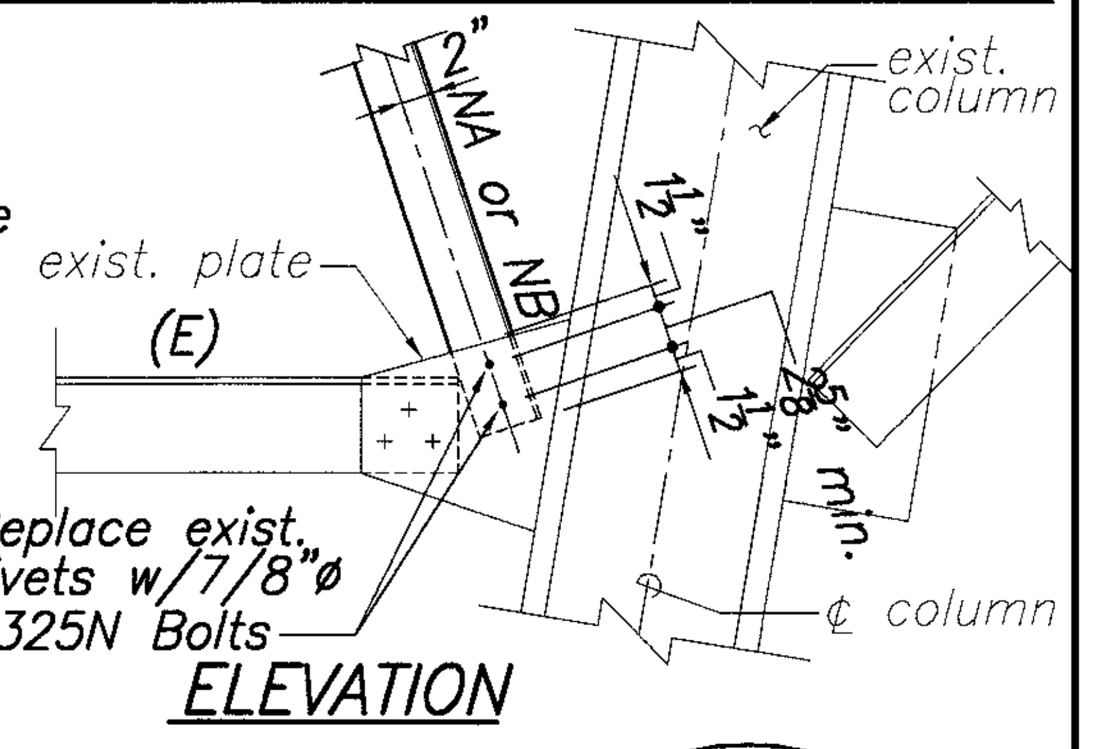


Note:
1. Determine angle "LC" from plans.
2. NA or NB, see plan.

DETAIL 10
Scale: 1"=1'-0" S-16 S-16
S-10, S-11, S-12
S-14, S-15

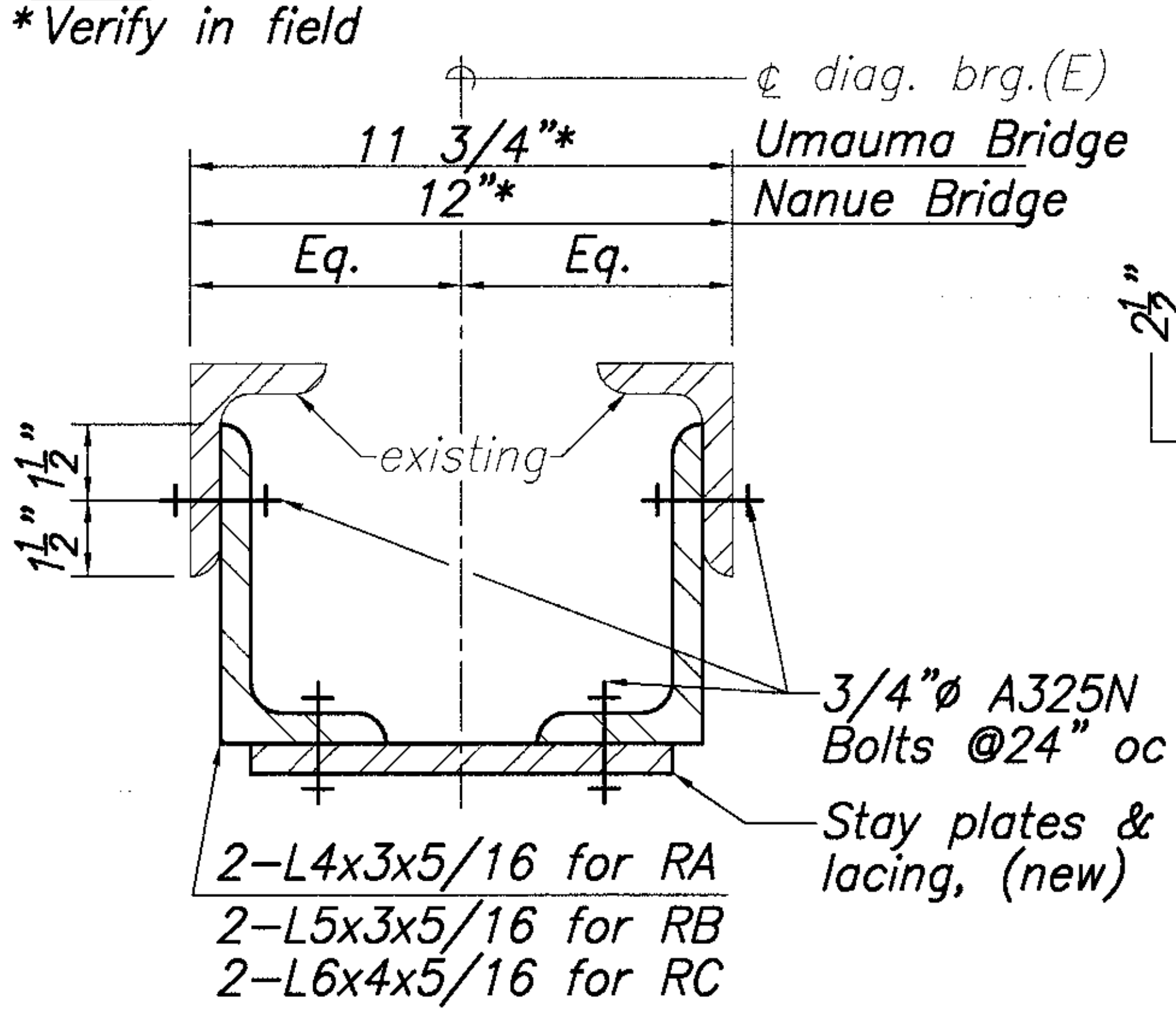


DETAIL 5
Scale: 1"=1'-0" S-16 S-16
S-10, S-11

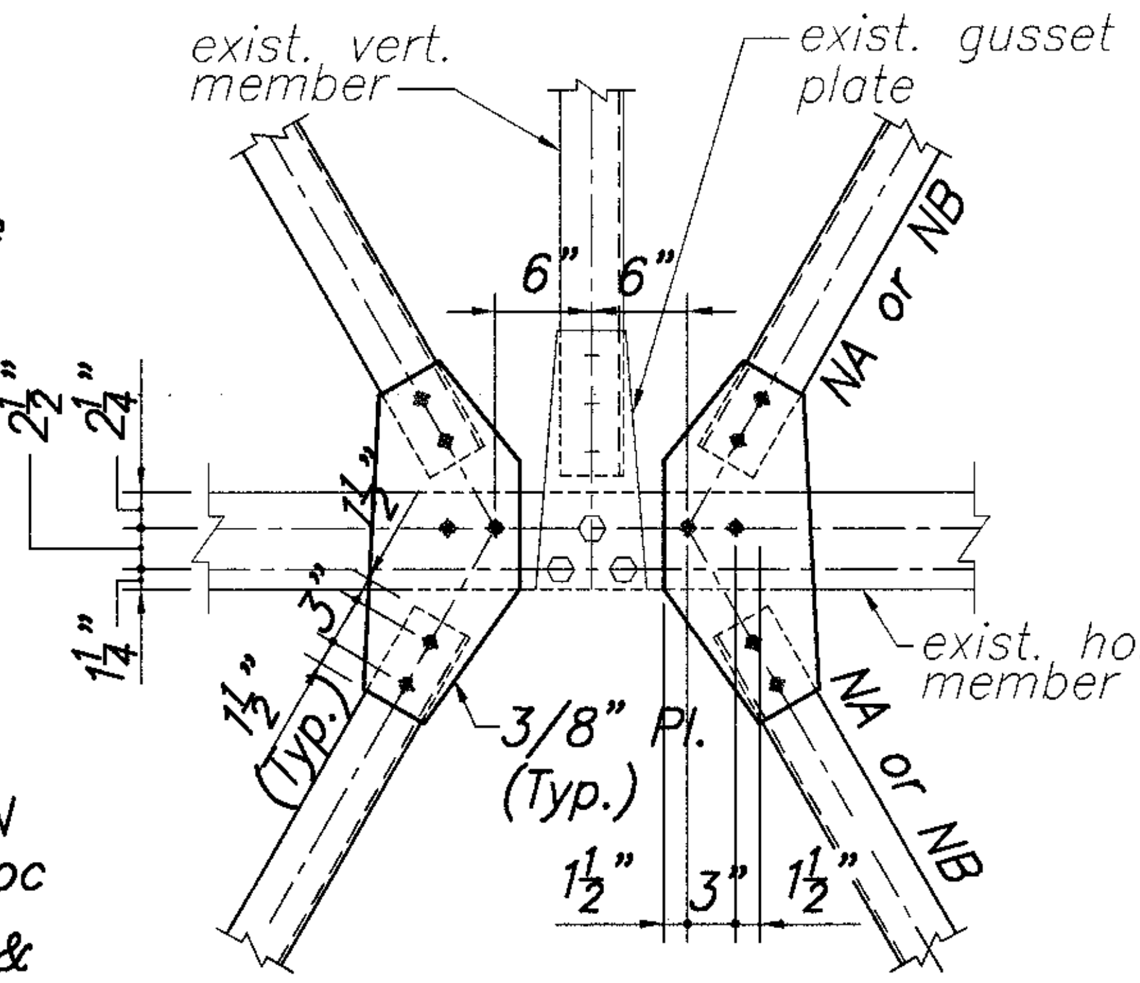


DETAIL 2
Scale: 1"=1'-0" S-15 S-15
S-9, S-10, S-11

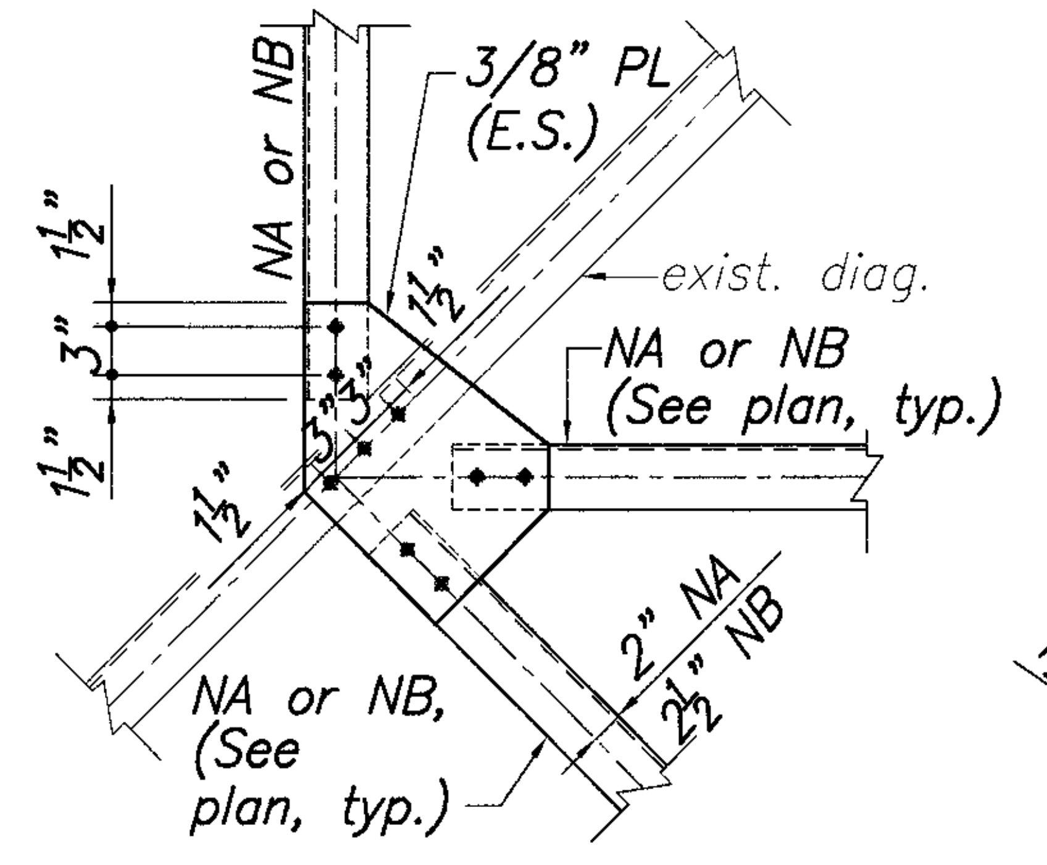
Note:
*Verify in field



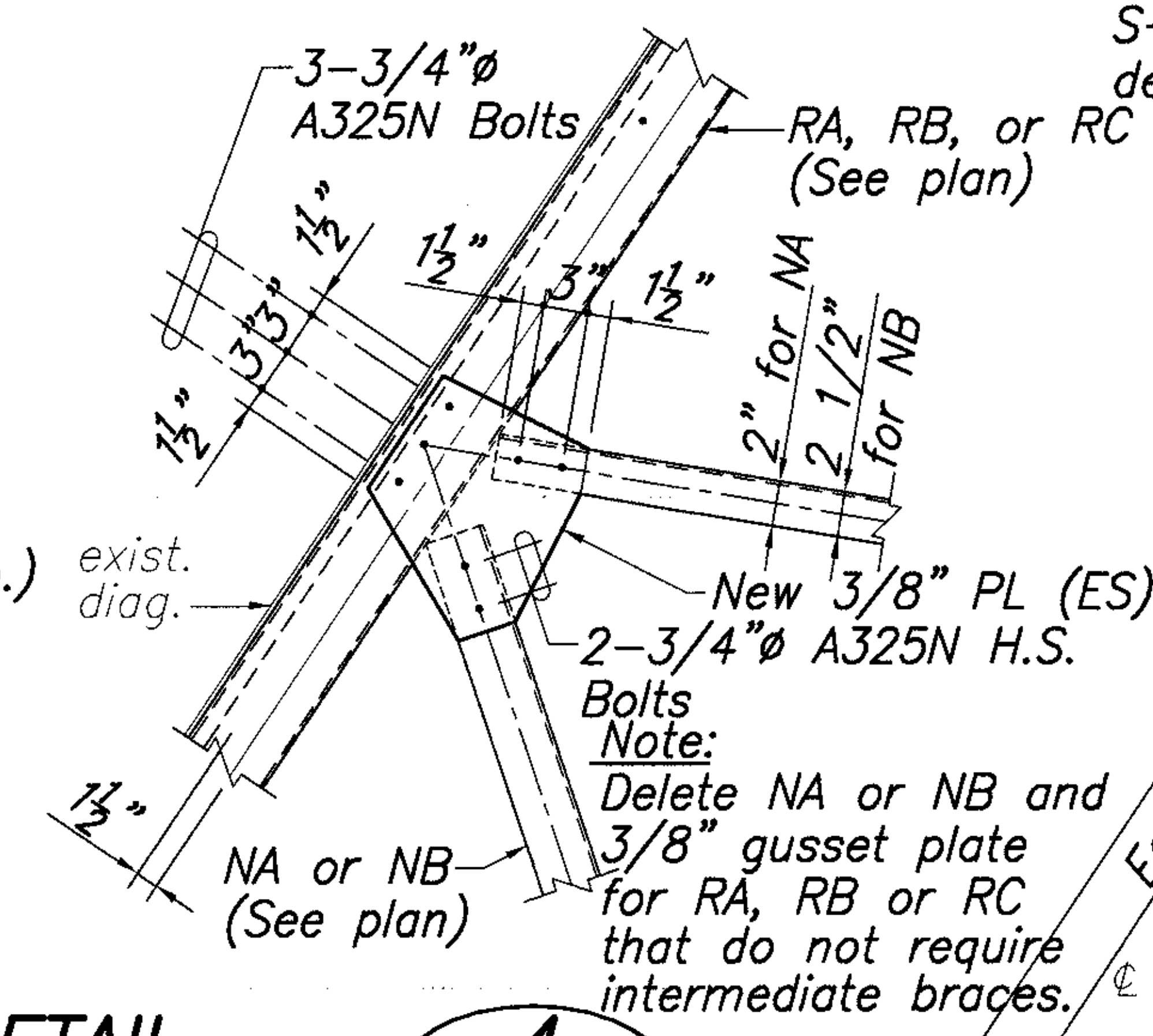
SECTION B
Scale: None S-16 S-16
S-14



DETAIL 9
Scale: 1"=1'-0" S-16 S-16
S-10, S-11, S-12
S-14, S-15



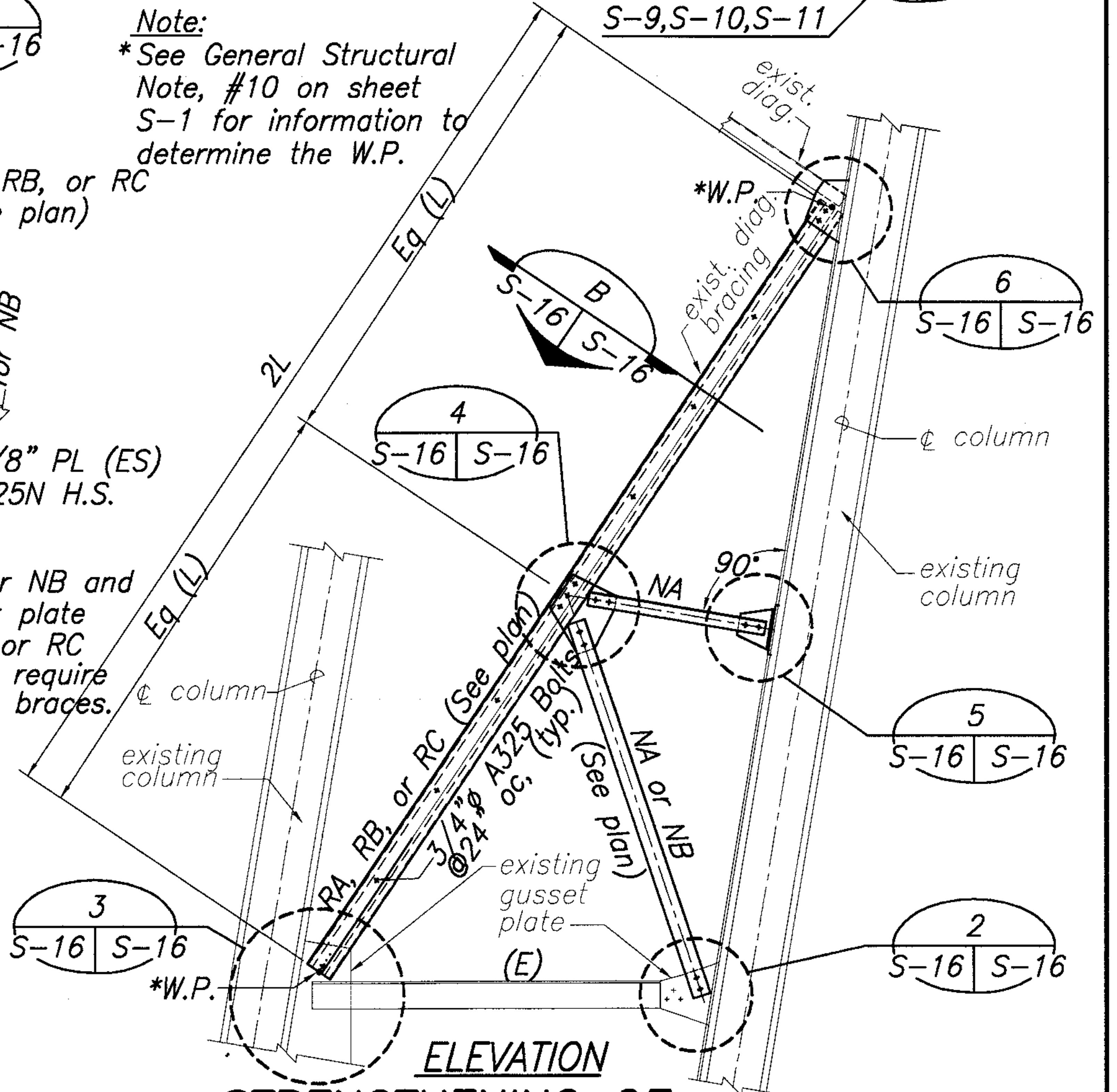
DETAIL 7
Scale: 1"=1'-0" S-16 S-16
S-10, S-11, S-12
S-14, S-15



Note:
Delete NA or NB and 3/8" gusset plate for RA, RB or RC that do not require intermediate braces.

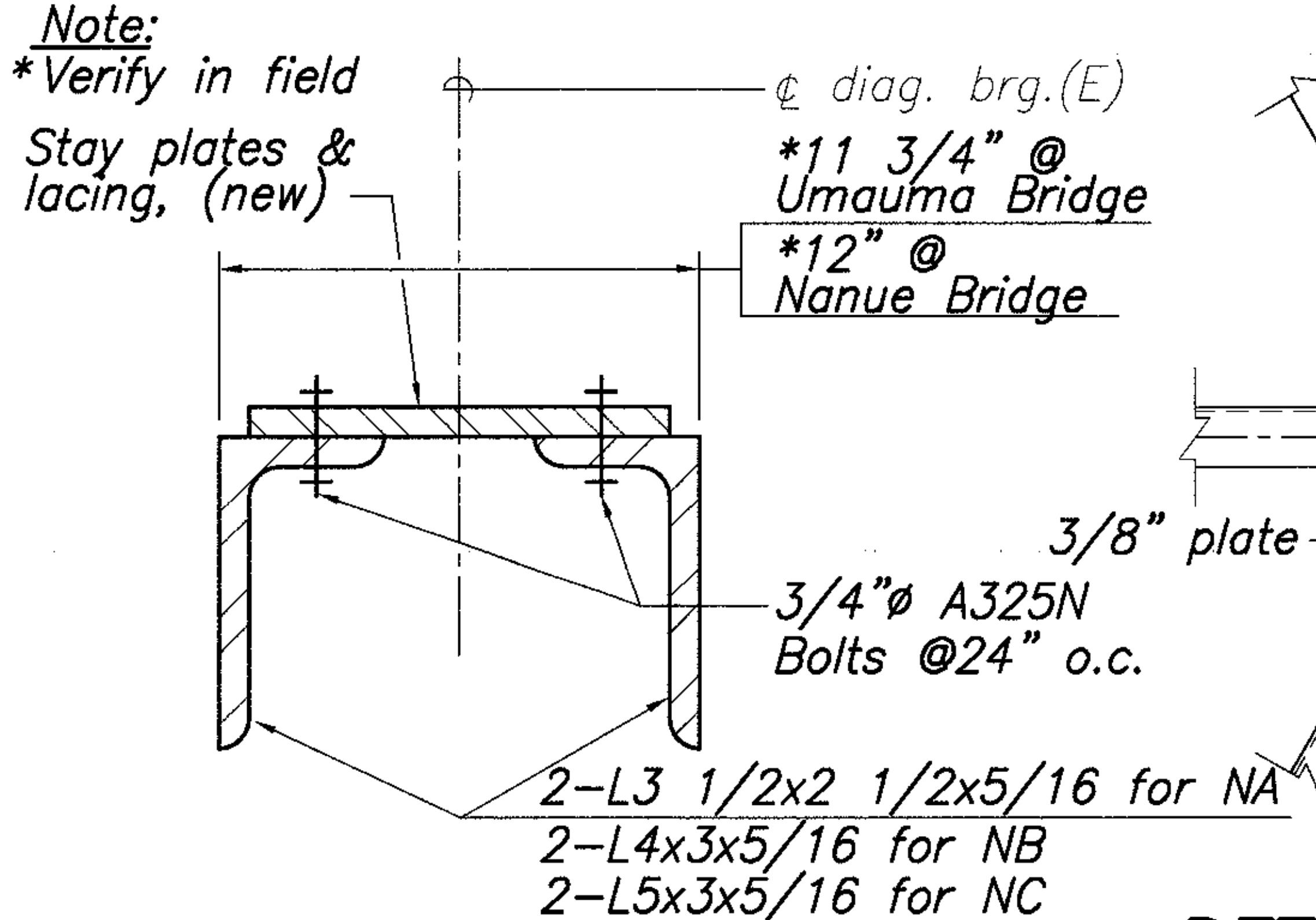
DETAIL 4
Scale: 1"=1'-0' S-16 S-16
S-10, S-11

Note:
*See General Structural Note, #10 on sheet S-1 for information to determine the W.P.

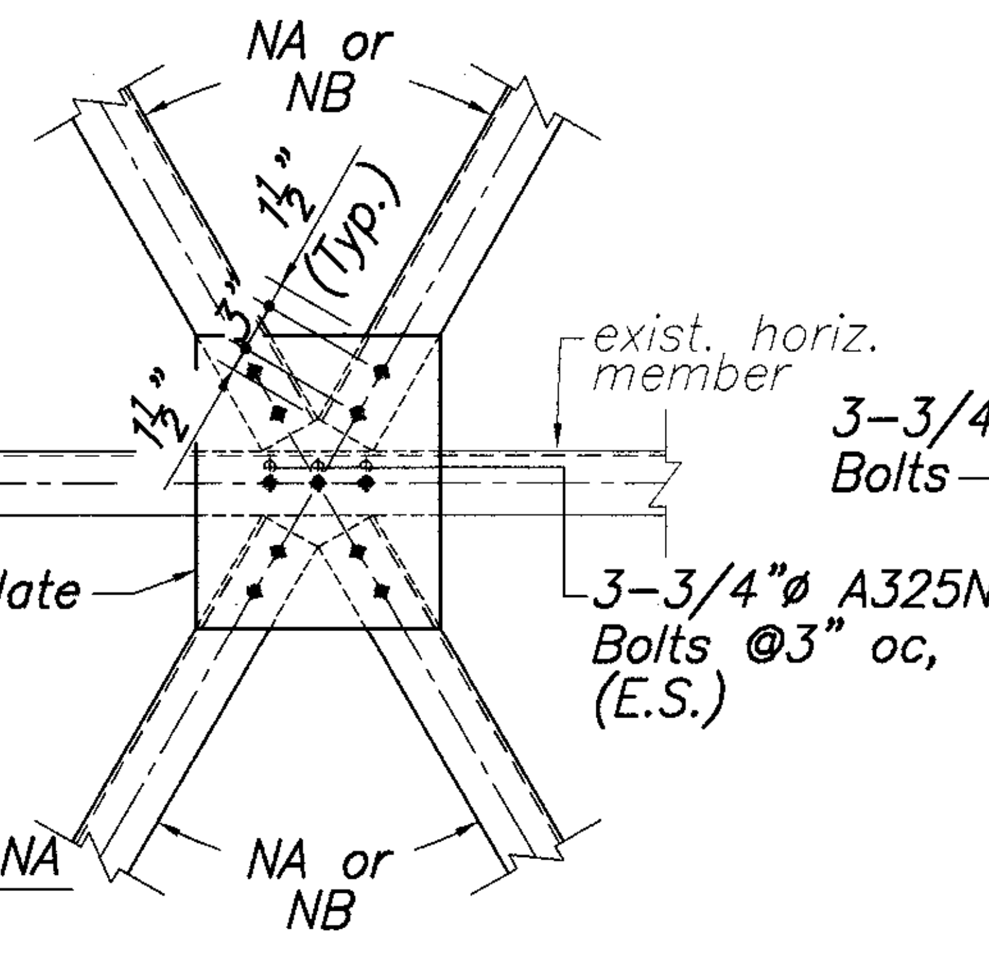


STRENGTHENING OF EXIST. DIAG. BRACING 1
Scale: 1/2"=1'-0" S-16 S-16

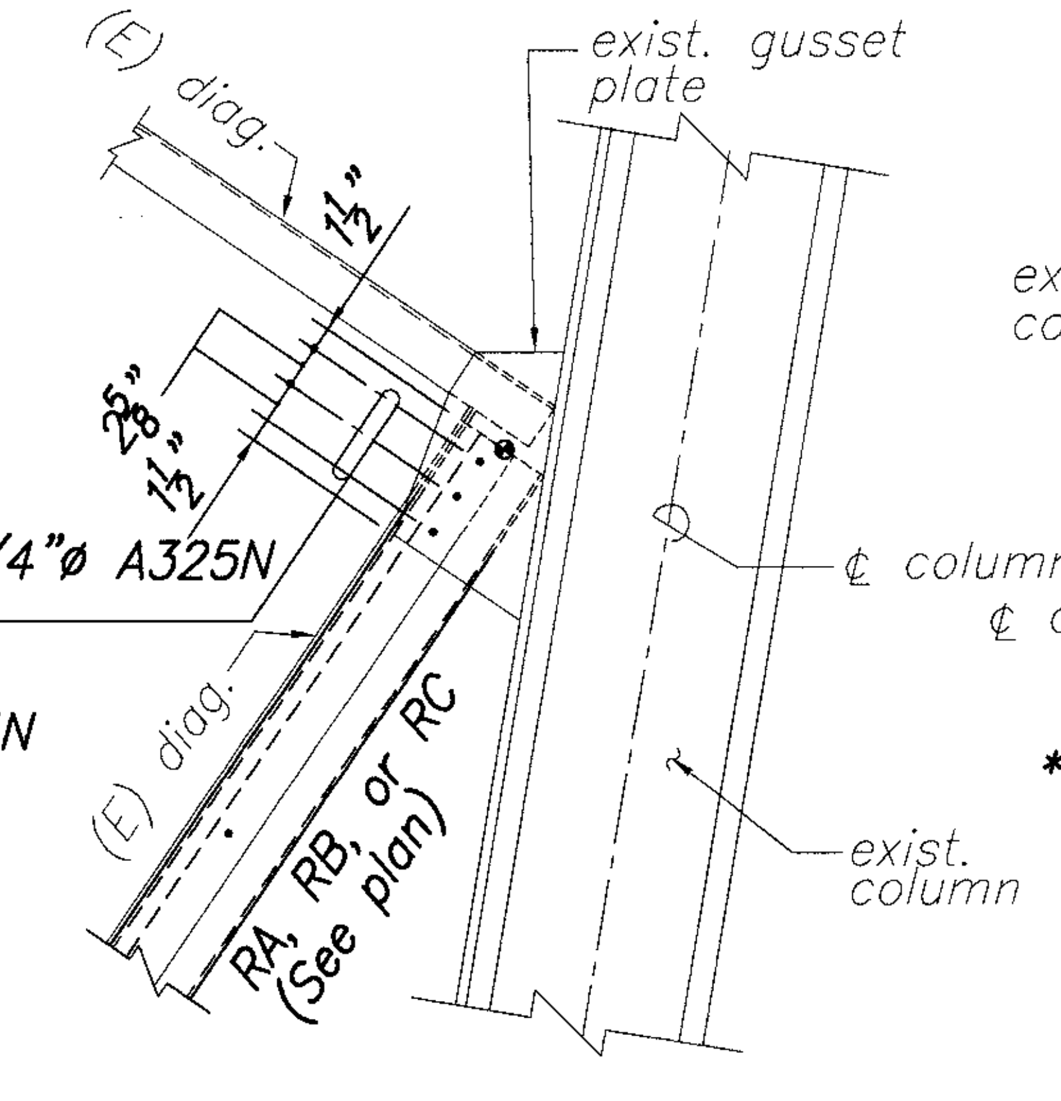
Note:
*Verify in field



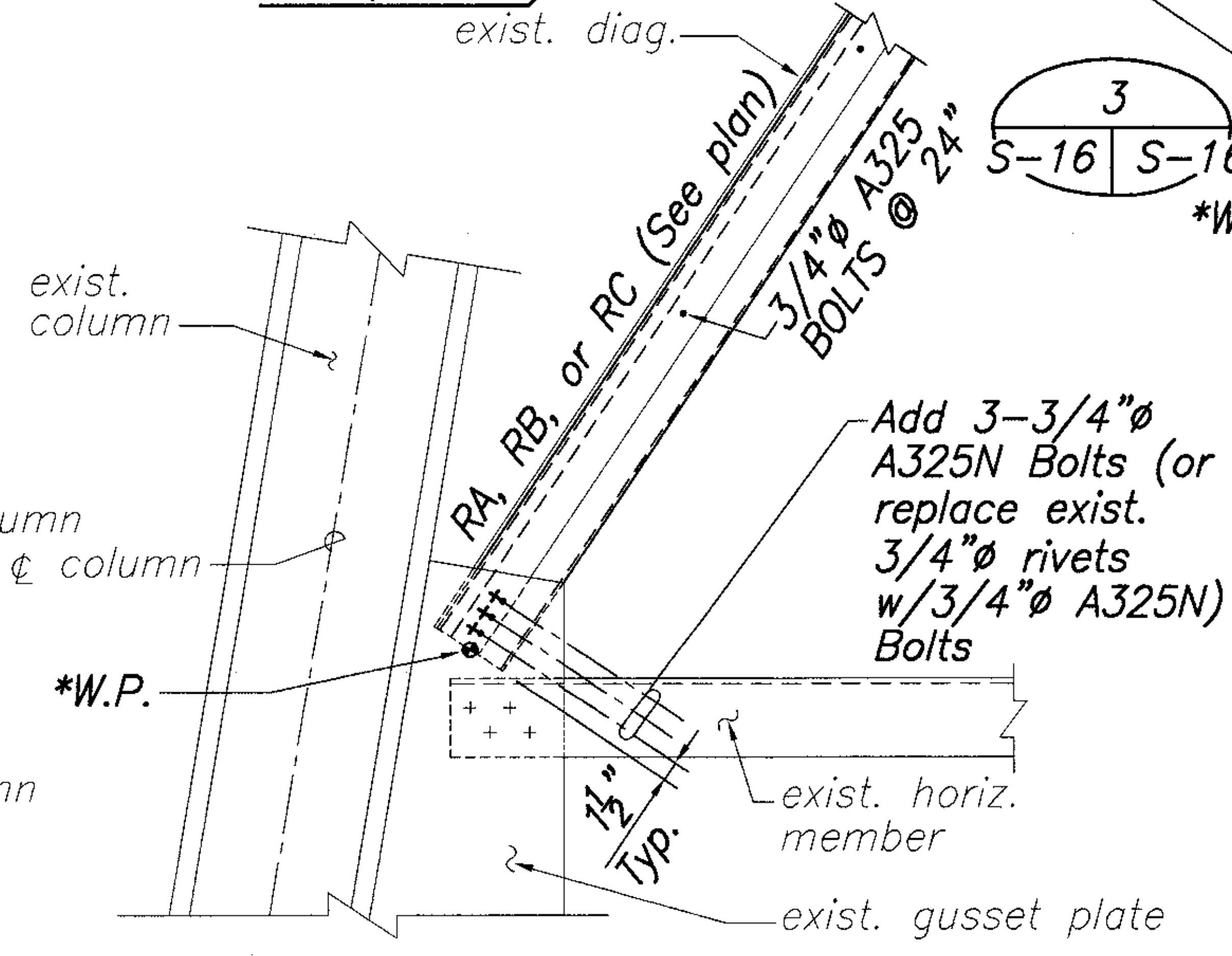
SECTION C
Scale: None S-16 S-16



DETAIL 8
Scale: 1"=1'-0" S-16 S-16
S-11, S-14



DETAIL 6
Scale: 1"=1'-0" S-16 S-16
S-10. S-11, S-14



DETAIL 3
Scale: 1"=1'-0" S-16 S-16
S-10, S-11, S-14

SHEN-CHIEN CHIU No. 3641-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

Shen-Chien Chiu

DATE	REVISION

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

NANUE AND UMAUMA BRIDGES
SUBSTRUCTURE RETROFIT
SECTIONS & DETAILS

SEISMIC RETROFIT OF VARIOUS BRIDGES
EAST OF NINOLE, HAWAII
F.A. PROJECT NO. BR-019-2(46)

Scale: As Noted Date: AUG. 17, 1999

SHEET No. S-16 OF 23 SHEETS

ORIGINAL PLAN
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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
NATIONAL BRIDGE ELEMENT
FINAL INSPECTION REPORT

Date of Inspection: May 06, 2015

Bridge Number: 001000190308146 Bridge Name: NANUE STRM

District Hawaii Route No: 00019 Milepost: 18 Facility: HAWAII BELT RD

NBI ITEM 36 - TRAFFIC SAFETY FEATURES			Indicate if feature meets currently acceptable standards. 0 - No 1 - Yes N - Not Applicable
36A	Bridge Railings	0	Bridge railing does not meet height requirement
36B	Transitions	1	
36C	Approach Guardrail	1	
36D	Approach Guardrail Ends	1	

ELEMENT INSPECTION

ELEM NO. DEFECT	ELEMENT / DEFECT DESCRIPTION	ENV.	TOTAL QUANTITY	UNIT	CS 1 (Good)	CS 2 (Fair)	CS 3 (Poor)	CS 4 (Severe)
13	Pre Concrete Deck	1	16,896	sq.ft	16,896	0	0	0
510	Wearing Surfaces		12,672	sq.ft	12,672	0	0	0
_North and South approach deck joints has some damage with potholes evident and leakage along abutment walls. Refer to picture report for details.								
107	Steel Opn Girder/Beam	1	2,124	ft	2,087	37	0	0
1000	Corrosion		37	ft	0	37	0	0
515	Steel Protective Coating		25,344	sq.ft	23,997	819	528	0
3410	Chalk(Steel Protect Coating		819	sq.ft	0	819	0	0
3440	Eff (Stl Protect Coat)		528	sq.ft	0	0	528	0
202	Steel Column	1	36	each	34	1	1	0
1000	Corrosion		1	each	0	1	0	0
7000	Damage		1	each	0	0	1	0
515	Steel Protective Coating		31,840	sq.ft	0	31,840	0	0
3410	Chalk(Steel Protect Coating		798	sq.ft	0	798	0	0
3440	Eff (Stl Protect Coat)		31,042	sq.ft	0	31,042	0	0
Steel columns are in fair condition with rust initiating, most corrosion is occurring on the east side of bridge and at the corners of the steel members. Bridge crews will continue to monitor any advancement.								
215	Re Conc Abutment	1	104	ft	104	0	0	0
301	Pourable Joint Seal	1	269	ft	0	193	76	0
2310	Leakage		26	ft	0	0	26	0
2330	Seal Damage		50	ft	0	0	50	0

311	Moveable Bearing	1	20	each	20	0	0	0
515	Steel Protective Coating		40	sq.ft	0	40	0	0
3440	Eff (Stl Protect Coat)		40	sq.ft	0	40	0	0
313	Fixed Bearing	1	24	each	24	0	0	0
515	Steel Protective Coating		48	sq.ft	0	48	0	0
3440	Eff (Stl Protect Coat)		48	sq.ft	0	48	0	0
331	Re Conc Bridge Railing	1	1,062	ft	1,062	0	0	0

NBI ITEM CONDITION RATINGS			Describe defects noted during bridge inspection. Provide sketches, diagrams, and photographs where possible.
58	Deck	7	
59	Superstructure	7	
60	Substructure	7	
61	Channel and Channel Protection	7	
62	Culvert	N	

NBI ITEM 93 - CRITICAL FEATURE INSPECTION		REQUIRED	FREQUENCY	LAST	DATE
93A	Fracture Critical Details	N			
93B	Underwater Inspection	Y	60	6/5/13	
93C	Other Special Inspection	N			

OTHER FEATURES			REMARKS
Bridge Posted?	(Provide Posted limit or 'N' if not applicable)	N	None
Signing for Posting Legible/Visible?	(Y or N)		
Riding Surface (Roughness) Rating	(3 - smooth, 2 - Avg, 1 - Poor)	3	
Bridge Requires Insp by Bridge Section Applies to in-house inspectors who aren't structural engineers	(Y or N)		

REPAIRS, IMPROVEMENTS AND RECOMMENDATIONS

List all work done to this bridge since last inspection (ie: structural repair work, cleaning, maintenance work, etc.)

None

List proposed and/or recommended work for this bridge including estimated cost (ie: structural repair work, cleaning, maintenance, etc.)

Repairs are recommended on the deck joints, which have deep impressions and web cracks due to reciprocal traffic.
Trees and shrubs are being cut under bridge and should be done to address vegetation overgrowth. Refer to picture report for deficiencies.

Other comments or observations.

None

Inspector:	**Name:**	Wendell Vincent	**Title:**	HMS-1
	Signature:		**Phone:**	808-933-0731
Inspector:	**Name:**	Lloyd Leslie	**Title:**	BMS-1
	Signature:		**Phone:**	808-933-0731
Team Leader:	**Name:**	Salvador Panem	**Title:**	District Engineer
	Signature:		**Phone:**	808-933-8866

STATE OF HAWAII ROUTINE BRIDGE REPORTS
Nanue BRIDGE STREAM
BR. N0. 001000190308146 RT.19 MP.18.23
INSPECTED BY: WENDELL VINCENT AND LLOYD LESLIE
DATE OF INSPECTION: 05/05/2015


Nanue Bridge approach looking south


Nanue Bridge approach looking north


Outlet end of Nanue Bridge.

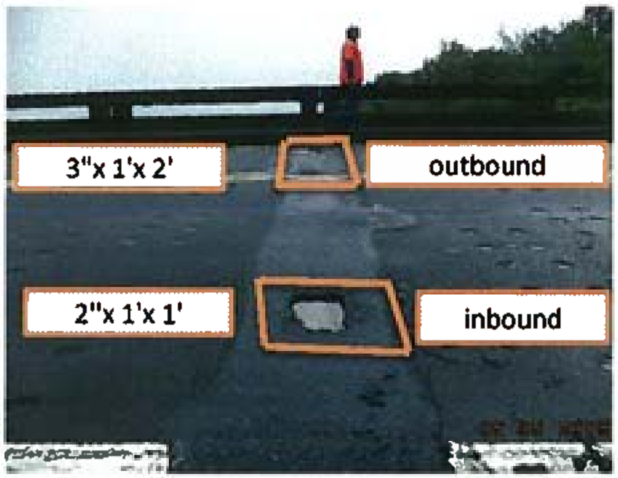

Intlet end of Nanue Bridge.


Nanue Bridge north abutment

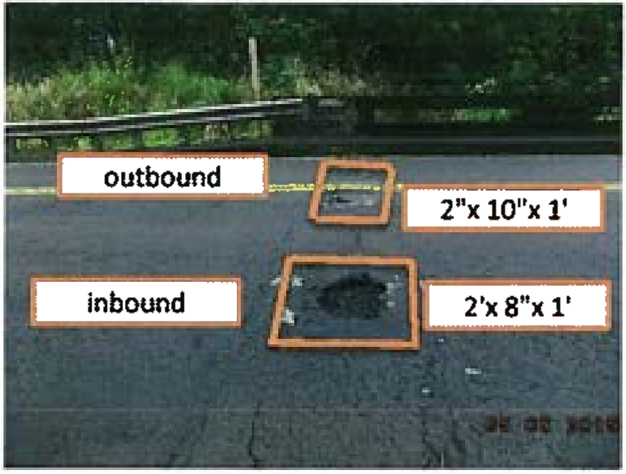

Nanue Bridge south abutment

STATE OF HAWAII ROUTINE BRIDGE REPORTS
Nanue BRIDGE STREAM
BR. N0. 001000190308146 RT.19 MP.18.23
INSPECTED BY: WENDELL VINCENT AND LLOYD LESLIE
DATE OF INSPECTION: 05/05/2015

Both inbound outbound lanes south approach has depression throughout expension joint.



Second expension joint from south approach has holes,both inbound outbound.



North approach has holes on expension joint.

Bottom of bent 7 outlet end, column brace plates and lacings has corrosions.

Center up right brace betwwen bent 6 and 7 has corrosion on lacings.

STATE OF HAWAII ROUTINE BRIDGE REPORTS

Nanue BRIDGE STREAM
BR. N0. 001000190308146 RT.19 MP.18.23
INSPECTED BY: WENDELL VINCENT AND LLOYD LESLIE
DATE OF INSPECTION: 05/05/2015

Picture 1.

Picture 2.

Picture 3.

Picture 4.

All four pictures shows damages done on angle brace between columns 6 & 7 were bolders.

Picture of bent 6 with a bolder wedged between piers.

Column 6 bottom brace has corrosion and missing lacings.

LIVE LOAD FACTORS AND DYNAMIC LOAD ALLOWANCE
LOAD RATING ANALYSIS (BRASS SOFTWARE)

LOADING TYPE	LL - CONDITIONS		LL - FACTOR
DESIGN LOADS:	Inventory Level		1.75
(HL-93)	Operating Level		1.35
LEGAL LOADS:	ADTT Unknown		1.45
(Type 3, Type 3S2, Type 3-3)	ADTT ≥ 5000		1.45 (1)
(NRL, SU4, SU5, SU6, SU7)	ADTT ≤ 1000		1.30 (1)
	Reinforced Concrete Box Culverts		2.00 (6)
PERMIT LOADS: (HP1, HP2, HP3)	Permit Type - Continuous Operation, All Structures except Reinforced Concrete Box Culverts Loading Condition - Mixed with Normal Traffic LRFD Distribution Factor - Two or More Lanes	ADTT > 5000 ADTT ≤ 1000	1.40 (1) 1.35 (1)
	Permit Type - Continuous Operation, Reinforced Concrete Box Culverts only Loading Condition - Mixed with Normal Traffic LRFD Distribution Factor - One Lane	All ADTTs	1.40 (2)
	Permit Type - Single Trip Loading Condition - Escorted with no other vehicles on the bridge LRFD Distribution Factor - One Lane		1.10 (2)
	Permit Type - Single Trip Loading Condition - Mixed with Normal Traffic LRFD Distribution Factor - One Lane	All ADTTs	1.20 (2)

LOADING TYPE	RIDING SURFACE CONDITIONS (5)	IM (3) (Spans ≤ 40 ft.)	IM (3) (Spans > 40 ft.)
DESIGN LOADS:	3	33%	33%
	2	33%	33%
	1	33%	33%
LEGAL LOADS:	3	33%	10%
	2	33%	20%
	1	33%	33%
PERMIT LOADS: (4)	3	33%	10%
	2	33%	20%
	1	33%	33%
REINFORCED CONCRETE BOX CULVERTS: (4)	IM = 33 (1.0 - 0.125D_E) ≥ 0%, where D_E is the minimum depth of earth cover above the structure (in feet).		

Notes:

(1) : Linear interpolate for ADTT values between 5,000 and 1,000.

(2) : When one-lane distribution factor is used, the built-in 1.20 multiple presence factor should be divided out.

(3) : Dynamic load allowance (IM) need not be applied to lane loads at the Design and Legal Load Rating and to wood components.

(4) : For slow moving (≤ 10 mph) permit vehicles, dynamic load allowance (IM) may be eliminated.

(5) : Riding surface conditions are defined as follows: 3 - smooth riding surface at approaches, bridge deck, and expansion joints; 2 - minor surface deviations or depressions; and 1 - approach and bridge deck conditions with bumps, sags, or other major surface deviations and discontinuities.

(6) : Multiple presence factor is not included and is not required for single-lane loading.

moffatt & nichol	CLIENT: Hawaii Department of Transportation	JOB NO.: 8780-06	
	PROJECT: HDOT Hwy Statewide Bridge Load Ratings	SHEET: OF	
	DESIGN FOR: Nanue Stream Bridge	DESIGNER: JU	DATE:
		CHECKER:	DATE:

Design References:		
	AASHTO LRFD Bridge Design Specifications, 2014 with 2015 Interim Revisions	(LRFD)
	HDOT Design Criteria for Bridges and Structures, Second Edition, 2011	(HDOT)
	AASHTO Manual for Bridge Evaluation, 2014	(MBE)
	Nanue Bridge Record Drawings, April 1949	(RD 1949)
	Nanue Bridge Erection Drawings, January 1950	(ED 1950)
	Nanue Bridge Record Drawings, May 1996	(RD 1996)
	Nanue Bridge Record Drawings, August 1999	(RD 1999)
	Nanue Bridge Inspection Report, May 2015	(BIR 2015)
	Hawaii State Historic Bridge Inventory and Evaluation, November 2013	(SHBIE 2013)

Summary

The Nanue Stream Bridge is a steel girder bridge with reinforced concrete deck constructed circa 1949. The steel girders were salvaged from the Kaula Bridge, Kealahaka Bridge, Laupahoehoe Bridge, and Maile Bridge according to erection drawings dated 1950. Drawings for the bridges where the steel girders were salvaged from were not provided. According to the Hawaii State Historic Bridge Inventory and Evaluation, Kaula Bridge was constructed circa 1928. There are no records for the other bridges but it is assumed that they were built around the same timeframe due to similarities in the salvaged girders.

From the 1949 Record Drawings, the Salvaged Girders were constructed out of the following members:

40 ft Girders A3, B3, G5, and G6
Top Flange: 2-L6x4x5/8
Web: PL 78x3/8
Bottom Flange: 2-L6x4x5/8
Girders G5 and G6 are indicated to have the same section properties as Girders A3 and B3.

50 ft Span Girders A2/A2X, A4/A4X, B2/B2X, B4/B4X;
51 ft Span Girders A1/A1X, B1/B1X, A1/A2, B1/B2, A5/A5X, B5/B5X
Top Flange: 2-L6x6x7/16
Web: PL 78x3/8
Bottom Flange: 2-L6x6x7/16
Top and Bottom Flange Cover Plates: PL 16x1/2 (The flange cover plates extend different lengths along both the top and bottom flanges.)
Section properties for girders A4/A4X and B4/B4X are provided in the 72 ft span girders.
Girders A1/A1X, A2X, A5/A5X, B1/B1X, B2X, and B5/B5X are indicated to have the same section properties as Girders A2 and B2.

72 ft Span Girders A4/A4X and B4/B4X
Top Flange: 2-L6x6x3/4
Web: PL 78x3/8
Bottom Flange: 2-L6x6x3/4
Top and Bottom Flange Cover Plates: 2-PL 16x1/2 (The flange cover plates extend different lengths along both the top and bottom flanges.)
Assumed section properties for A4X and B4X are the same as A4 and B4.

The drawings also indicate 7/8" diameter rivets were used for the connection in the salvaged girders.

The 2015 Bridge Inspection Report indictes a Superstructurer rating of 7 (GOOD CONDITION - no problems noted). The deficiencies noted are for the protective coatings. It was assumed that there is little to no section loss and full section properties were used.

The deck is not analyzed to be composite with the girders.

Two waterlines not indicated on the Record or Erection Drawings are visible in the 2015 Bridge Inspection Report. In past Load Ratings, HDOT has indicated that all utility pipes are assumed to be schedule 80 (thickness = 1/2 inch) steel pipes.

The substructure was not load rated. Per AASHTO MBE Section 6.1.5.2, Members of substructures need not be routinely checked for load capacity. Substructure elements such as pier caps and columns should be checked in situations where the Owner has reason to believe that their capacity may govern the load capacity of the entire bridge. The 2015 Bridge Inspection Report indicates a Substructure rating of 7 (GOOD CONDITION - no problems noted) with no comments on deficiences to the substructure. HDOT has not indicated the substructure requires a load rating.

Material Properties

Concrete Unit Weight		ω_c =	0.160	kcf	HDOT Sec. 2.04	P.8
Concrete Unit Weight to Calculate E_c		ω_c =	0.150	kcf	HDOT Sec. 2.04	P.8
Steel Unit Weight		ω_s =	0.490	kcf		
Class A-1 Concrete Strength	(Superstructure)	f'_c =	3.0	ksi	RD 1949	
Class B-2 Concrete Strength	(Piers)	f'_c =	2.5	ksi	RD 1949	
Steel Yield Strength	(No Grade Provided)	f_y =	30	ksi	MBE Tbl. 6A.6.2.1-1	P.6-34
Annual Average Ambient Relative Humidity		=	70	%	LRFD Fig. 5.4.2.3.3-1	P.5-18
Concrete Elastic Modulus	$E_c = 120{,}000K_1\omega_c^{2.0}(f'_c)^{0.33}$ =				LRFD Eqn. 5.4.2.4-1	P.5-18
Class A-1 Concrete		E_c =	3,880	ksi		
Class B-2 Concrete		E_c =	3,653	ksi		
Correction Factor for Source Aggregate		K_1 =	1		HDOT Sec. 2.09	P.9
Steel Elastic Modulus		E_s =	29,000	ksi	LRFD Sec. 5.4.3.2	P.5-20
Modular Ratio		$n = E_s/E_c$ =			LRFD Sec. 5.3	P.5-10
Class A-1 Concrete		n =	7.47			
Class B-2 Concrete		n =	7.94			

Condition Rating and System Factor

Superstructure Condition Rating (SI&A Item 59)	=	7	BIR 2015	
Condition Factor	ϕ_c =	1.00	HDOT Tbl 6A.4.2.3-1	P.18
System Factor	ϕ_s =	1.00	HDOT Tbl 6A.4.2.4-1	P.18

Control

Number of Spans	10	(Hilo End to Honokaa End)	ED 1950	P. E1E
Span 1	51.00 ft			
Span 2	50.00 ft			
Span 3	40.00 ft			
Span 4	72.00 ft			
Span 5	40.00 ft			
Span 6	72.00 ft			
Span 7	40.00 ft			
Span 8	72.00 ft			
Span 9	40.00 ft			
Span 10	51.00 ft			
Number of Girders	4			

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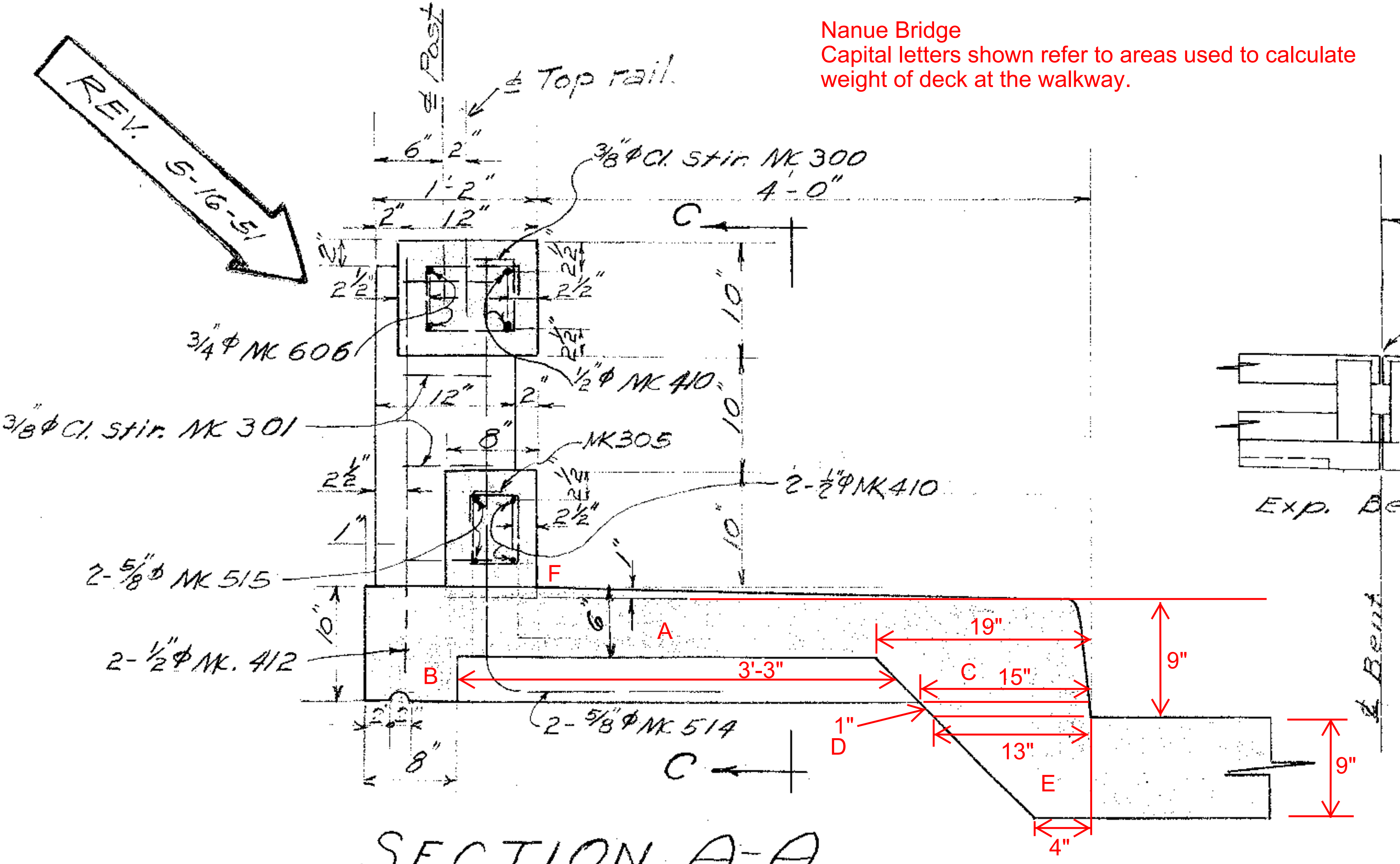
			CHECKER:		DATE:	

Deck Geometry

Slab Thickness	9.00 inches		RD 1949	P.3 of 11
Left Cantilever Length	6.50 ft	(Distance from End to Girder)		
Right Cantilever Length	6.50 ft			
Travelway Locations				
Distance to Left Edge	5.25 ft			
Distance to Right Edge	33.25 ft			
Sacrificial Topping	0.00 in			
Girder Spacing			RD 1949	P.3 of 11
Bay 1	9.00 ft			
Bay 2	7.50 ft			
Bay 3	9.00 ft			
Deck Width	38.50 ft		RD 1949	P.4 of 11

Deck Uniform Loads

Dead Load Group					ksf	Loc (ft)	Width (ft)
Assumed Uniform 9" Thickness		(1"/12 + 1'-2" + 4'-0") x 9"/12	3.938 sf				
Actual Weight		Total (Sum of Below)	4.167 sf				
	A	(1"/12 + 1'-2" + 4'-0") x 6"/12	2.625 sf				
	B	8"/12 x 4"/12	0.222 sf				
	C	(15"/12 + 19"/12)/2 x 4"/12	0.472 sf				
	D	(13"/12 + 15"/12)/2 x 1"/12	0.097 sf				
	E	(4"/12 + 13"/12)/2 x 9"/12	0.531 sf				
	F	0.5 x (1"/12 + 1'-2" + 4'-0") x 1"/12	0.219 sf				
Difference	Actual - Assumed		0.229 sf				
Additional Weight		0.160 kcf x Difference / (1"/12 + 1'-2" + 4'-0")	0.007 ksf				
Left Side Sidewalks		See Above		Class A-1 Concrete	0.0070	0.000	5.25
Left Side Shoulder		0.5 x 0.160 kcf x 0.5"/12		Class A-1 Concrete	0.0033	5.250	2.00
AC Pavement	(0.145 kcf)	0.145 x 1.5"/12		AC Pavement	0.0181	7.250	24.00
Right Side Shoulder		0.5 x 0.160 kcf x 0.5"/12		Class A-1 Concrete	0.0033	31.250	2.00
Right Side Sidewalks		0.160 kcf x 1"/12		Class A-1 Concrete	0.0070	33.250	5.25

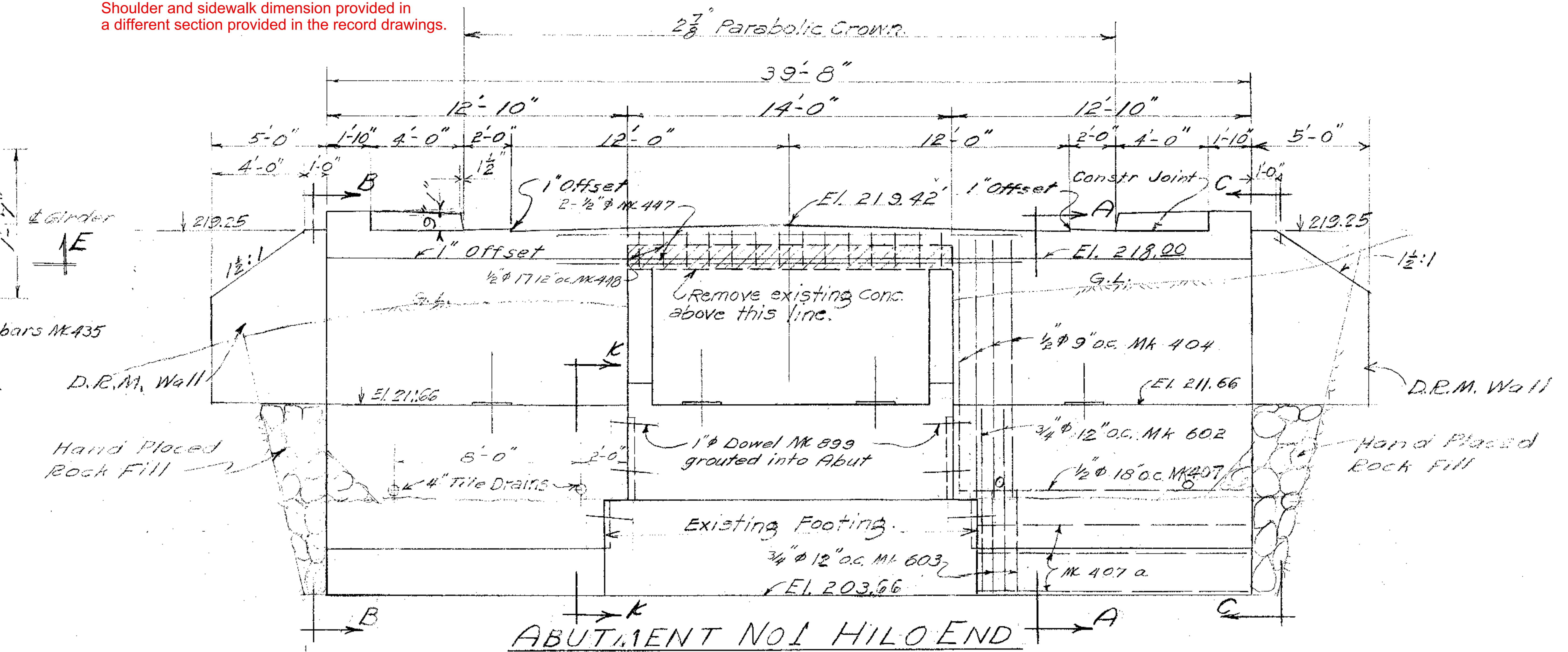


Nanue Bridge
Capital letters shown refer to areas used to calculate weight of deck at the walkway.

SECTION A-A

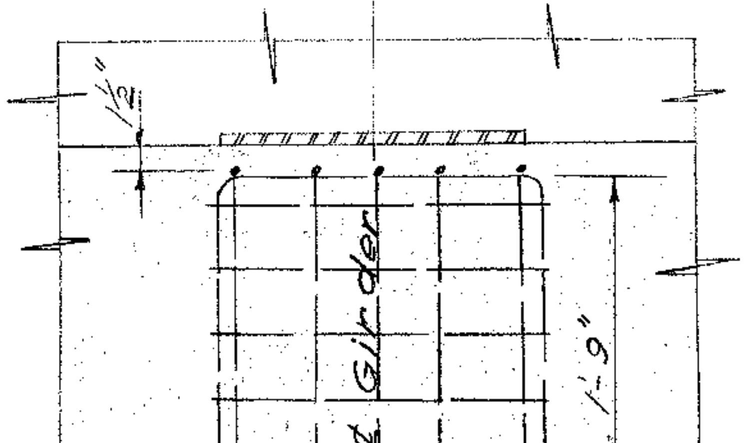
1" = 1Ft

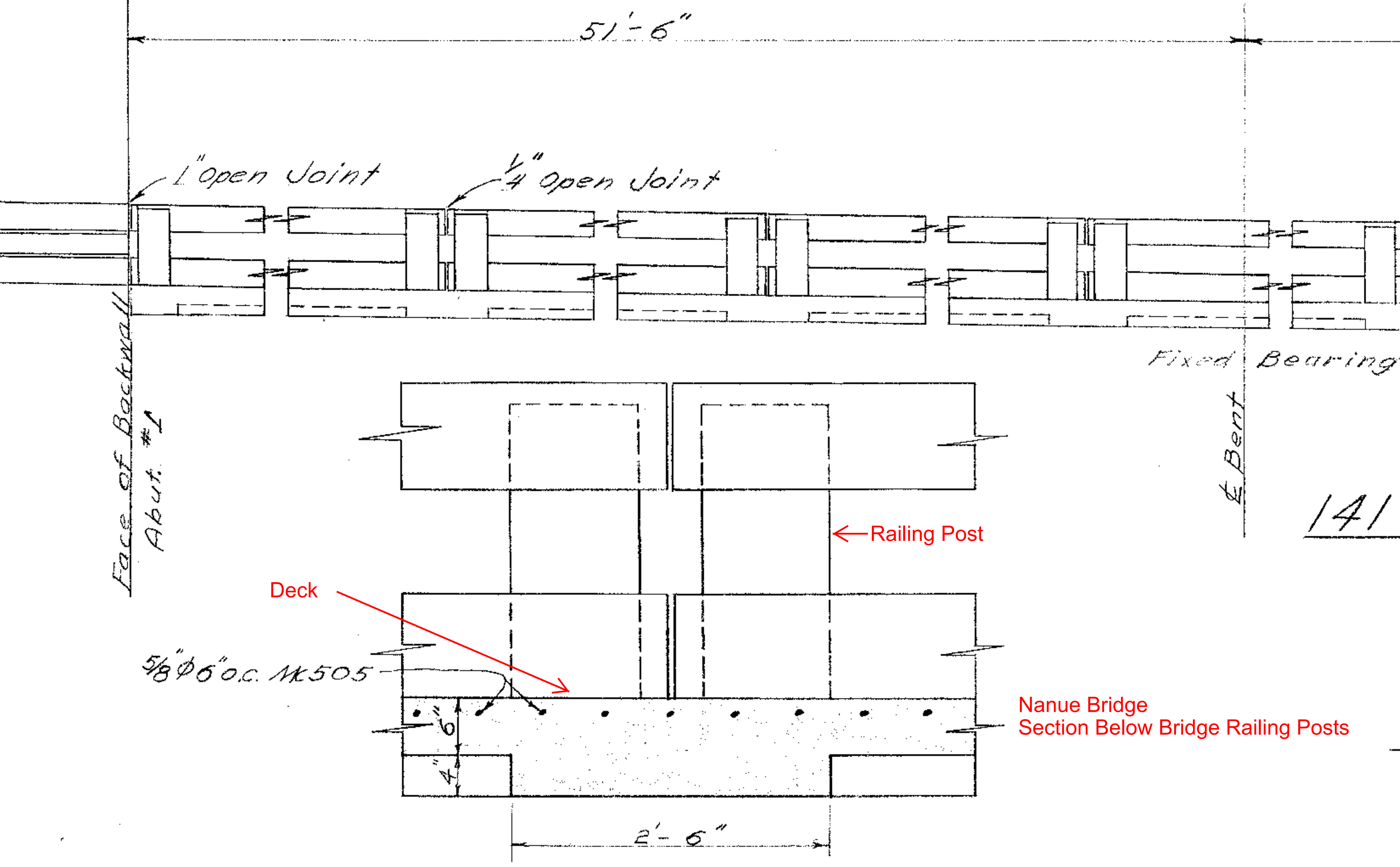
Nanue Bridge
No typical section of bridge deck was provided.
Used section at abutment for travelway width.
Shoulder and sidewalk dimension provided in
a different section provided in the record drawings.



ABUTMENT NO 1 HILO END
FRONT ELEVATION

1/4" = 1 Ft.





Railing Post

Deck

Nanue Bridge
Section Below Bridge Railing Posts

SECTION C-C

1" = 1 Ft.

Deck Line Loads

Dead Load Group				kips/ft	Loc. (ft)
Left Side Railing*	Load = ΣWeights	Location = Σ(Weight x Location) / ΣWeights		0.3190	0.9232
Top Rail	0.160 kcf x 10"/12 x 12"/12	0.133 kips/ft	0.750 ft		
Bot Rail	0.160 kcf x 10"/12 x 8"/12	0.089 kips/ft	0.917 ft		
Post	0.160 kcf x 12" x 12" x 30" x 11 / 1728 / 72 ft	0.064 kips/ft	0.583 ft		
Thk Slab	0.160 kcf x 2'-6" x 4" x 3'-3" x 5.5 / 72 ft	0.033 kips/ft	2.292 ft		
Right Side Railing*	Load = ΣWeights	Location = Σ(Weight x Location) / ΣWeights		0.3190	37.5768
Top Rail	(Weights see above)		37.75 ft		
Bot Rail	(Weights see above)		37.58 ft		
Post	(Weights see above)		37.92 ft		
Thk Slab	(Weights see above)		36.21 ft		
Monorail (9 Supports Over 72 feet)	Load = ΣWeights	Location = Σ(Weight x Location) / ΣWeights		0.0163	34.0000
Hanger	0.490 kcf x 3"/12 x 0.5"/12 x 1'-8.5" x 9 / 72'	0.0011 kips/ft	34.00 ft		
Embeds	2 x 0.490 kcf x0.75"x0.75"x1'-3" x9 / 144 / 72'	0.0006 kips/ft	34.00 ft		
Side PL	2 x 0.490 kcf x 3"x0.375"x6.25"x9 / 72' / 1728	0.0005 kips/ft	34.00 ft		
Stiff PL	2 x 0.490 kcf x 3" x 0.5" x 3.375"x9 /72' /1728	0.0004 kips/ft	34.00 ft		
Brace	0.490 kcf x 3" x 0.5" x 1'-10" x 9 / 72' / 144	0.0012 kips/ft	34.00 ft		
7/8" Bolts	2 x 0.490 kcf x 0.601 in2 x2"x9/72'/ 1728	0.0001 kips/ft	34.00 ft		
6x25	12.5 plf / 1000	0.0125 kips/ft	34.00 ft		
2- 8" Waterlines	Load = ΣWeights			0.2236	38.5000
Schedule 80 Steel Pipe		0.180 kips/ft	2 x 90 plf / 1000		
Water Volume		0.044 kips/ft	2 x 62.4 pcf x pi x 11.374" x 11.374"/ 4 / 144 / 1000		
(Size assumed, seen in Inspection Report photos, not documented in drawings)					

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51 ft Span Cover Plates

Member		Width (in)	Thick (in)	Support	Start (ft)	Length (ft)	End (ft)
Top Cover Plate		16	0.4375	1	8.3542	35.4167	43.7708
26'-0" - 17'-8 1/2"	8.2917						
24'-11 1/4" - 17'-8 1/2"	7.2292						
Bottom Cover Plate		16	0.4375	1	8.3542	35.4167	43.7708
26'-0" - 17'-8 1/2"	8.2917						
24'-11 1/4" - 17'-8 1/2"	7.2292						

51 ft Span Flanges

Member		V. Leg (in)	H. Leg (in)	Thick (in)	Support
Top Angle	2-L6x6x7/16	6.000	6.000	0.4375	1
Bottom Angle	2-L6x6x7/16	6.000	6.000	0.4375	1

50 ft Span Cover Plates

Member		Width (in)	Thick (in)	Support	Start (ft)	Length (ft)	End (ft)
Top Cover Plate		16	0.4375	1	7.2917	35.4167	42.7083
24'-11 1/4" - 17'-8 1/2"	7.2292						
24'-11 1/4" - 17'-8 1/2"	7.2292						
Bottom Cover Plate		16	0.4375	1	7.2917	35.4167	42.7083
24'-11 1/4" - 17'-8 1/2"	7.2292						
24'-11 1/4" - 17'-8 1/2"	7.2292						

50 ft Span Flanges

Member		V. Leg (in)	H. Leg (in)	Thick (in)	Support
Top Angle	2-L6x6x7/16	6.000	6.000	0.4375	1
Bottom Angle	2-L6x6x7/16	6.000	6.000	0.4375	1

40 ft Span Flanges

Member		V. Leg (in)	H. Leg (in)	Thick (in)	Support
Top Angle	2-L6x4x5/8	4.000	6.000	0.6250	1
Bottom Angle	2-L6x4x5/8	4.000	6.000	0.6250	1

72 ft Span Top Cover Plates

Member	Width (in)	Thick (in)	Support	Start (ft)	Length (ft)	End (ft)
Upper Top Cover Plate	16	0.50	1	17.9375	40.8750	58.8125
38'-3 3/4" - 20'-5 1/4" 17.875						
33'-6 3/4" - 20'-5 1/4" 13.125						
Lower Top Cover Plate (Touching Top Flange)	16	0.50	1	8.5000	55.0000	63.5000
38'-3 3/4" - 29'-10 1/2" 8.4375						
33'-6 3/4" - 25'-1 1/2" 8.4375						
Lower Top Cover Plate (Touching Top Flange)	16	0.5000	1	8.5000	9.4375	17.9375
Upper and Lower Top Plate	16	1.0000	1	17.9375	40.8750	58.8125
Lower Top Cover Plate (Touching Top Flange)	16	0.5000	1	58.8125	4.6875	63.5000

72 ft Span Bottom Cover Plates

Member	Width (in)	Thick (in)	Support	Start (ft)	Length (ft)	End (ft)
Upper Bottom Cover Plate (Touching Bottom Flange)	16	0.50	1	8.5000	55.0000	63.5000
38'-3 3/4" - 29'-10 1/2" 8.4375						
33'-6 3/4" - 25'-1 1/2" 8.4375						
Lower Bottom Cover Plate	16	0.50	1	17.9375	40.8750	58.8125
38'-3 3/4" - 20'-5 1/4" 17.875						
33'-6 3/4" - 20'-5 1/4" 13.125						
Upper Bottom Cover Plate (Touching Bottom Flange)	16	0.5000	1	8.5000	9.4375	17.9375
Upper and Lower Bottom Plate	16	1.0000	1	17.9375	40.8750	58.8125
Lower Bottom Cover Plate (Touching Bottom Flange)	16	0.5000	1	58.8125	4.6875	63.5000

72 ft Span Flanges

Member		V. Leg (in)	H. Leg (in)	Thick (in)	Support
Top Angle	2-L6x6x3/4	6.000	6.000	0.7500	1
Bottom Angle	2-L6x6x3/4	6.000	6.000	0.7500	1

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51 ft Span Member (A1, B1, A1X, B1X) - Schedules - Bracing

**Used these spacings for BRASS

Spacing	Support	Start Distance	Length	Notes
11.1667 ft	1	4.9063 ft	11.1667 ft	2 Members
14.4375 ft	1	35.9896 ft	14.4375 ft	2 Members

51 ft Span Member (A1, B1, A1X, B1X) - Schedules - Transverse Stiffeners

**Used these spacings for BRASS

Spacing	Support	Start Distance	Length	Notes
1.3333 ft	1	0.0313 ft	1.3333 ft	2 Members
3.7500 ft	1	8.5729 ft	3.7500 ft	2 Members
3.9167 ft	1	19.9896 ft	3.9167 ft	2 Members
3.9167 ft	1	28.1563 ft	3.9167 ft	2 Members
3.6563 ft	1	39.7396 ft	7.3125 ft	3 Members

51 ft Span Member (A1, A2, B1, B2) - Schedules - Bracing

**Did not use for BRASS

Spacing	Support	Start Distance	Length	Notes
11.1667 ft	1	4.9063 ft	11.1667 ft	2 Members
14.4375 ft	1	35.9896 ft	14.4375 ft	2 Members

51 ft Span Member (A1, A2, B1, B2) - Schedules - Transverse Stiffeners

**Did not use for BRASS

Spacing	Support	Start Distance	Length	Notes
1.3542 ft	1	0.0313 ft	1.3542 ft	2 Members
4.0000 ft	1	4.5938 ft	20.0000 ft	6 Members
5.2500 ft	1	28.8854 ft	5.2500 ft	2 Members
4.1458 ft	1	38.1354 ft	8.2917 ft	3 Members

51 ft Span Member (A5, B5, A5X, B5X) - Schedules - Bracing

**Did not use for BRASS

Spacing	Support	Start Distance	Length	Notes
14.4375 ft	1	0.6042 ft	14.4375 ft	2 Members
11.1667 ft	1	34.9583 ft	11.1667 ft	2 Members

51 ft Span Member (A5, B5, A5X, B5X) - Schedules - Transverse Stiffeners

**Did not use for BRASS

Spacing	Support	Start Distance	Length	Notes
3.6563 ft	1	3.9479 ft	7.3125 ft	3 Members
3.9167 ft	1	18.9271 ft	3.9167 ft	2 Members
3.9167 ft	1	27.0938 ft	3.9167 ft	2 Members
3.7500 ft	1	38.6771 ft	3.7500 ft	2 Members
1.3333 ft	1	49.6354 ft	1.3333 ft	2 Members

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50 ft Span Member (A2, A2X, B2, B2X) - Schedules - Bracing G3-2

Spacing	Support	Start Distance	Length	Notes
14.4375 ft	1	0.6875 ft	14.4375 ft	2 Members
14.4375 ft	1	34.8750 ft	14.4375 ft	2 Members

50 ft Span Member (A2, A2X, B2, B2X) - Schedules - Transverse Stiffeners G3-2

Spacing	Support	Start Distance	Length	Notes
3.6563 ft	1	3.9792 ft	7.3125 ft	3 Members
3.9167 ft	1	18.9583 ft	3.9167 ft	2 Members
3.9167 ft	1	27.1250 ft	3.9167 ft	2 Members
3.6563 ft	1	38.7083 ft	7.3125 ft	3 Members

50 ft Span Member (A4, A4X, B4, B4X) - Schedules - Bracing G4-2

Spacing	Support	Start Distance	Length	Notes
14.4375 ft	1	0.6875 ft	14.4375 ft	2 Members
14.4375 ft	1	34.8750 ft	14.4375 ft	2 Members

50 ft Span Member (A4, A4X, B4, B4X) - Schedules - Transverse Stiffeners G4-2 ***

Spacing	Support	Start Distance	Length	Notes
3.0000 ft	1	3.1042 ft	3.0000 ft	2 Members
4.0000 ft	1	6.6042 ft	4.0000 ft	2 Members
4.5069 ft	1	18.0417 ft	27.0417 ft	7 Members

40 ft Span Member (A3, B3, G5, G6) - Schedules - Bracing

Spacing	Support	Start Distance	Length	Notes
19.4167 ft	1	0.5833 ft	38.8333 ft	3 Members

40 ft Span Member (A3, B3, G5, G6) - Schedules - Transverse Stiffeners

Spacing	Support	Start Distance	Length	Notes
3.8750 ft	1	4.4583 ft	11.6250 ft	4 Members
3.8750 ft	1	23.8854 ft	11.6250 ft	4 Members

72 ft Span Member (A4, A4X, B4, B4X) - Schedules - Bracing

Spacing	Support	Start Distance	Length	Notes
17.4271 ft	1	0.5729 ft	34.8542 ft	3 Members
17.4375 ft	1	53.9583 ft	17.4375 ft	2 Members

72 ft Span Member (A4, A4X, B4, B4X) - Schedules - Transverse Stiffeners

Spacing	Support	Start Distance	Length	Notes
3.0000 ft	1	3.1042 ft	3.0000 ft	2 Members
4.0000 ft	1	9.5729 ft	4.0000 ft	2 Members
4.4167 ft	1	22.4688 ft	8.8333 ft	3 Members
4.3958 ft	1	40.6771 ft	8.7917 ft	3 Members
4.0000 ft	1	58.3646 ft	4.0000 ft	2 Members
3.0000 ft	1	65.8646 ft	3.0000 ft	2 Members

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		CHECKER:	DATE:	

51 ft Span Member - Dead Loads - Distributed

Distributed Load	Suppport	Start (ft)	Mag (klf)	End (ft)	Mag (klf)
Vertical Web Angles* (Summation of weight below) x 14 / 51	1	0.0313	0.0187	50.9375	0.0187
L5x3.5x3/8 x6'-6 1/2" 0.068 kips					.
(10.4 plf) x 6'-6 1/2" / 1000 (Angle Size Assumed)					

51 ft Span Member - Dead Loads - Distributed (Interior Girders Only)

Distributed Load	Suppport	Start (ft)	Mag (klf)	End (ft)	Mag (klf)
Bottom Flange Bracing* 9.80 plf x 7.5 ft x (√2/1) x 9 / 51 ft / 2 / 1000	1	0.0313	0.0092	50.9375	0.0092
*Assumed L4x4x3/8 at 45° angle, plans show 87 members,					
loads carried by interior girders					

51 ft Span Member (A1, A1X, B1, BX) - Dead Loads - Concentrated **Used for BRASS

Concentrated Load	Suppport	Dist (ft)	Vert (kips)
Girder Bracing DB7-E (Summation of weights below in kips) / 2	1	4.9063	0.1702
g, g 2 - L4x4x3/8 x9'-3 3/4" 0.183 kips 2 x (9.80 lb/ft) x 9'-3 3/4" / 1000			
a, ag 2-PL 12x3/8 x 1'-0.5" 0.032 kips 2 x 490 pcf x 12" x 3/8" x 1'-0.5" /1000/144			
c, ap 2-PL 12x3/8 x 1'-0.5" 0.032 kips See Above			
f PL 9x3/8 x10" 0.010 kips 490 pcf x 9" x 3/8" x 10"/12 / 1000 / 144			
h L4x4x3/8 x8'-7 1/2" 0.085 kips (9.80 lb/ft) x 8'-7 1/2" / 1000			
Girder Bracing DB8-E (Summation of weights below in kips) / 2	1	16.0729	0.1641
g, g 2 - L4x4x3/8 x9'-3 3/4" 0.183 kips 2 x (9.80 lb/ft) x 9'-3 3/4" / 1000			
b, ah 2 - PL 12x5/16 x1'-0.5" 0.027 kips 2 x 490 pcf x 12" x (5/16") x 1'-0.5" /1000/144			
d, as 2 - PL 12x5/16 x1'-0.5" 0.027 kips See Above			
af PL 9x5/16 x10" 0.008 kips 490 pcf x 9" x 5/16" x 10"/12 / 1000 / 144			
k L4x4x3/8 x8'-7 1/2" 0.085 kips (9.80 lb/ft) x 8'-7 1/2" / 1000			
Girder Bracing DB8-E See Above	1	35.9896	0.1641
Girder Bracing DB3-E (Summation of weights below in kips) / 2	1	50.4271	0.1690
ad, ad 2 - L4x4x3/8 x9'-2 5/8" 0.181 kips 2 x (9.80 lb/ft) x 9'-2 5/8" / 1000			
ab, ab 2 - PL 12x3/8 x1'-0.5" 0.032 kips 2 x 490 pcf x 12" x (3/8") x 1'-0.5" /1000/144			
ac, ac 2 - PL 12x3/8 x1'-0.5" 0.032 kips See Above			
ag PL 9x3/8 x10" 0.010 kips 490 pcf x 9" x (3/8") x 10"/12 / 1000 / 144			
af L4x4x3/8 x8'-6 3/4" 0.084 kips (9.80 lb/ft) x 8'-7 1/2" / 1000			
Strut ST5-E (Summation of weights below in kips) / 2	1	5.5833	0.0441
t L4x4x3/8 x 8'-7 1/2" 0.085 kips 9.80 lb/ft x 8'-7 1/2" / 1000			
k PL 5x3/8 x7" 0.004 kips 0.490 kcf x 5" x 0.375" x 7" / 1728			
Strut ST5-E See Above	1	26.0313	0.0441
Strut ST5-E See Above	1	43.2083	0.0441

51 ft Span Member (A1, A2, B1, B2, A5, A5X, B5, B5X) - Dead Loads - Concentrated **Not Used for BRASS

Concentrated Load				Suppport	Dist (ft)	Vert (kips)
Girder Bracing DB11-E	(Summation of weights below in kips) / 2			1	4.9063	0.1699
g, g	2 - L4x4x3/8 x9'-3 3/4"	0.183 kips	2 x (9.80 lb/ft) x 9'-3 3/4" / 1000			
v, v	2-PL 12x3/8 x 1'-0.5"	0.032 kips	2 x 490 pcf x 12" x 3/8" x 1'-0.5" /1000/144			
w, w	2-PL 12x3/8 x 1'-0.5"	0.032 kips	See Above			
f	PL 9x3/8 x10"	0.010 kips	490 pcf x 9" x 3/8" x 10"/12 / 1000 / 144			
aa	L4x4x3/8 x8'-6 3/4"	0.084 kips	(9.80 lb/ft) x 8'-6 3/4" / 1000			
Girder Bracing DB9-E	(Summation of weights below in kips) / 2			1	16.0729	0.1641
g, g	2 - L4x4x3/8 x9'-3 3/4"	0.183 kips	2 x (9.80 lb/ft) x 9'-3 3/4" / 1000			
m, ak	2 - PL 12x5/16 x1'-0.5"	0.027 kips	2 x 490 pcf x 12" x (5/16") x 1'-0.5" /1000/144			
s, at	2 - PL 12x5/16 x1'-0.5"	0.027 kips	See Above			
af	PL 9x5/16 x10"	0.008 kips	490 pcf x 9" x 5/16" x 10"/12 / 1000 / 144			
k	L4x4x3/8 x8'-7 1/2"	0.085 kips	(9.80 lb/ft) x 8'-7 1/2" / 1000			
Girder Bracing DB9-E	See Above			1	35.9896	0.1641
Girder Bracing DB10-E	(Summation of weights below in kips) / 2			1	50.4271	0.1702
g, g	2 - L4x4x3/8 x9'-3 3/4"	0.183 kips	2 x (9.80 lb/ft) x 9'-3 3/4" / 1000			
p, am	2 - PL 12x3/8 x1'-0.5"	0.032 kips	2 x 490 pcf x 12" x (3/8") x 1'-0.5" /1000/144			
t, av	2 - PL 12x3/8 x1'-0.5"	0.032 kips	See Above			
f	PL 9x3/8 x10"	0.010 kips	490 pcf x 9" x (3/8") x 10"/12 / 1000 / 144			
h	L4x4x3/8 x8'-7 1/2"	0.085 kips	(9.80 lb/ft) x 8'-7 1/2" / 1000			
Strut ST5-E	(Summation of weights below in kips) / 2			1	5.5833	0.0441
t	L4x4x3/8 x 8'-7 1/2"	0.085 kips	9.80 lb/ft x 8'-7 1/2" / 1000			
k	PL 5x3/8 x7"	0.004 kips	2 x 0.490 kcf x 5" x 0.375" x 7" / 1728			
Strut ST6-E	(Summation of weights below in kips) / 2			1	26.0313	0.0456
v	L4x4x3/8 x 8'-6 1/2"	0.084 kips	9.80 lb/ft x 8'-6 1/2" / 1000			
k	2-PL 5x3/8 x7"	0.007 kips	2 x 0.490 kcf x 5" x 0.375" x 7" / 1728			
Strut ST6-E	See Above			1	43.2083	0.0456

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			CHECKER:		DATE:

50 ft Span Member - Dead Loads - Distributed

Distributed Load			Suppport	Start (ft)	Mag (klf)	End (ft)	Mag (klf)
Vertical Web Angles*	(Summation of weight below) x 14 / 50		1	0.0625	0.0190	49.875	
L5x3.5x3/8 x6'-6 1/2"	0.068 kips						.
(10.4 plf) x 6'-6 1/2" / 1000	(Angle Size Assumed)						

50 ft Span Member - Dead Loads - Distributed (Interior Girders Only)

Distributed Load		Suppport	Start (ft)	Mag (klf)	End (ft)	Mag (klf)
Bottom Flange Bracing*	9.80 plf x 7.5 ft x (√2/1) x 9 / 50 ft / 2 / 1000	1	0.0625	0.0094	49.875	
*Assumed L4x4x3/8 at 45° angle, plans show 87 members,						
loads carried by interior girders						

50 ft Span Member - Dead Loads - Concentrated

Concentrated Load			Suppport	Dist (ft)	Vert (kips)
Girder Bracing DB3-E	(Summation of weights below in kips) / 2		1	0.5729	0.1690
ad,ad 2-L4x4x3/8 x9'-2 5/8"	0.181 kips	2 x (9.80 lb/ft) x 9'-2 5/8" / 1000			
ab,ab 2 - PL 12x3/8 x1'-0.5"	0.032 kips	2 x 490 pcf x 12" x (3/8") x 1'-0.5" /1000/144			
ac,ac 2 - PL 12x3/8 x1'-0.5"	0.032 kips	See Above			
ag PL 9x3/8 x10"	0.010 kips	490 pcf x 9" x (3/8") x 10"/12 / 1000 / 144			
af L4x4x3/8 x8'-6 3/4"	0.084 kips	(9.80 lb/ft) x 8'-6 3/4" / 1000			
Girder Bracing DB6-E	(Summation of weights below in kips) / 2		1	11.2292	0.1690
t,t 2-L4x4x3/8 x9'-3 3/4"	0.183 kips	2 x (9.80 lb/ft) x 9'-3 3/4" / 1000			
p,ah 2 - PL 12x5/16 x1'-0.5"	0.027 kips	2 x 490 pcf x 12" x (5/16") x 1'-0.5" /1000/144			
s,ak 2 - PL 12x5/16 x1'-0.5"	0.027 kips	See Above			
b PL 9x5/16 x10"	0.008 kips	490 pcf x 9"/12 x (5/16")/12 x 10"/12 / 1000			
aa L4x4x3/8 x8'-7 1/2"	0.085 kips	(9.80 lb/ft) x 8'-7 1/2" / 1000			
Girder Bracing DB6-E	See Above		1	35.4375	0.1690
Girder Bracing DB3-E	See Above		1	49.8750	0.1690
Strut ST4-E	(Summation of weights below in kips) / 2		1	5.3281	0.0455
s L4x4x3/8 x 8'-6.375"	0.084 kips	9.80 lb/ft x 8'-6.375" / 1000			
k,k 2-PL 5x3/8 x7"	0.007 kips	2 x 0.490 kcf x 5" x 0.375" x 7" / 1728			
Strut ST4-E	See Above		1	23.3333	0.0455
Strut ST5-E	(Summation of weights below in kips) / 2		1	42.6563	0.0460
t L4x4x3/8 x 8'-7 1/2"	0.085 kips	9.80 lb/ft x 8'-7 1/2" / 1000			
k PL 5x3/8 x7"	0.007 kips	2 x 0.490 kcf x 5" x 0.375" x 7" / 1728			

40 ft Span Member - Dead Loads - Distributed

Distributed Load		Suppport	Start (ft)	Mag (klf)	End (ft)	Mag (klf)
Vertical Web Angles*	(Summation of weight below) x 11 / 40	1	0.0625	0.0187	39.875	
L5x3.5x3/8 x6'-6 1/2"	0.068 kips					.
(10.4 plf) x 6'-6 1/2" / 1000	(Angle Size Assumed)					

40 ft Span Member - Dead Loads - Distributed (Interior Girders Only)

Distributed Load		Suppport	Start (ft)	Mag (klf)	End (ft)	Mag (klf)
Bottom Flange Bracing*	9.80 plf x 7.5 ft x (√2/1) x 6 / 40 ft / 2 / 1000	1	0.0625	0.0078	39.875	
*Assumed L4x4x3/8 at 45° angle, plans show 87 members,						
loads carried by interior girders						

40 ft Span Member - Dead Loads - Concentrated

Concentrated Load			Suppport	Dist (ft)	Vert (kips)
Girder Bracing DB1-E	(Summation of weights below in kips) / 2		1	0.5833	0.1313
a,a 2 - L4x4x3/8 x9'-3 1/8"	0.182 kips	2 x (9.80 lb/ft) x 9'-3 1/8" / 1000			
k,k 2 - PL 12x3/8 x1'-2"	0.036 kips	2 x 490 pcf x 12" x (3/8") x 1'-2" /1000/144			
h,h 2 - PL 12x3/8 x1'-2"	0.036 kips	See Above			
ag PL 9x3/8 x10"	0.010 kips	490 pcf x 9" x (3/8") x 10"/12 / 1000 / 144			
m L4x4x3/8 x 8'-6.75"	0.084 kips	(9.80 lb/ft) x 8'-6 3/4" / 1000			
Girder Bracing DB2-E			1	20.0000	0.1313
a,a 2 - L4x4x3/8 x9'-3 1/8"	0.182 kips	2 x (9.80 lb/ft) x 9'-3 1/8" / 1000			
d,d 2 - PL 12x5/16 x1'-2"	0.030 kips	2 x 490 pcf x 12" x 5/16" x 1'-2" /1000 / 144			
c,c 2 - PL 12x5/16 x1'-2"	0.030 kips	See Above			
b PL 9x3/8 x10"	0.010 kips	490 pcf x 9" x (3/8") x 10"/12 / 1000 / 144			
g L4x4x3/8 x 8'-6.75"	0.084 kips	(9.80 lb/ft) x 8'-6 3/4" / 1000			
Girder Bracing DB1-E	See Above		1	39.9375	0.1313
Struts ST1-E	(Summation of weights below in kips) / 2		1	9.7083	0.0455
m L4x4x3/8 x 8'-6.25"	0.084 kips	9.80 lb/ft x 8'-6.25" / 1000			
k,k 2-PL 5x3/8 x7"	0.007 kips	2 x 0.490 kcf x 5" x 0.375" x 7" / 1728			
Struts ST1-E	See Above		1	29.9688	0.0455

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72 ft Span Member - Dead Loads - Distributed

Distributed Load	Suppport	Start (ft)	Mag (klf)	End (ft)	Mag (klf)
Vertical Web Angles* (Summation of weight below) x 19 / 72	1	0.0625	0.0180	71.8750	
L5x3.5x3/8 x6'-6 1/2" 0.068 kips					.
(10.4 plf) x 6'-6 1/2" / 1000 (Angle Size Assumed)					

72 ft Span Member - Dead Loads - Distributed (Interior Girders Only)

Distributed Load	Suppport	Start (ft)	Mag (klf)	End (ft)	Mag (klf)
Bottom Flange Bracing* 9.80 plf x 7.5 ft x (√2/1) x 12 / 72 ft / 2 / 1000	1	0.0625	0.0087	71.8750	
*Assumed L4x4x3/8 at 45° angle, plans show 87 members,					
loads carried by interior girders					

72 ft Span Member - Dead Loads - Concentrated

Concentrated Load	Suppport	Dist (ft)	Vert (kips)
Girder Bracing DB3-E (Summation of weights below in kips) / 2	1	0.5729	0.1690
ad,ad 2 - L4x4x3/8 x9'-2 5/8" 0.181 kips 2 x (9.80 lb/ft) x 9'-2 5/8" / 1000			
ab,ab 2 - PL 12x3/8 x1'-0.5" 0.032 kips 2 x 490 pcf x 12" x (3/8") x 1'-0.5" /1000/144			
ac,ac 2 - PL 12x3/8 x1'-0.5" 0.032 kips See Above			
ag PL 9x3/8 x10" 0.010 kips 490 pcf x 9" x (3/8") x 10" / 1000 / 1728			
af L4x4x3/8 x8'-6 3/4" 0.084 kips (9.80 lb/ft) x 8'-7 1/2" / 1000			
Girder Bracing DB4-E (Summation of weights below in kips) / 2	1	18.0104	0.1641
t,t 2-L4x4x3/8 x9'-3 3/4" 0.183 kips 2 x (9.80 lb/ft) x 9'-3 3/4" / 1000			
p,ah 2 - PL 12x5/16 x1'-0.5" 0.027 kips 2 x 490 pcf x 12" x (5/16") x 1'-0.5" /1000/144			
s,ak 2 - PL 12x5/16 x1'-0.5" 0.027 kips See Above			
b PL 9x5/16 x10" 0.008 kips 490 pcf x 9"/12 x (5/16")/12 x 10"/12 / 1000			
v L4x4x3/8 x8'-7 1/2" 0.085 kips (9.80 lb/ft) x 8'-7 1/2" / 1000			
Girder Bracing DB5-E (Summation of weights below in kips) / 2	1	35.4271	0.1641
t,t 2-L4x4x3/8 x9'-3 3/4" 0.183 kips 2 x (9.80 lb/ft) x 9'-3 3/4" / 1000			
p,ah 2 - PL 12x5/16 x1'-0.5" 0.027 kips 2 x 490 pcf x 12" x (5/16") x 1'-0.5" /1000/144			
s,ak 2 - PL 12x5/16 x1'-0.5" 0.027 kips See Above			
b PL 9x5/16 x10" 0.008 kips 490 pcf x 9"/12 x (5/16")/12 x 10"/12 / 1000			
w L4x4x3/8 x8'-7 1/2" 0.085 kips (9.80 lb/ft) x 8'-7 1/2" / 1000			
Girder Bracing DB4-E See Above	1	53.9271	0.1641
Girder Bracing DB3-E See Above	1	71.3646	0.1690
Strut ST2-E (Summation of weights below in kips) / 2	1	8.7188	0.0454
p L4x4x3/8 x 8'-6 1/8" 0.083 kips 9.80 lb/ft x 8'-10.25" / 1000			
k,k 2-PL 5x3/8 x7" 0.007 kips 2 x 0.490 kcf x 5" x 0.375" x 7" / 1728			
Strut ST3-E (Summation of weights below in kips) / 2	1	26.7188	0.0471
ag L4x4x3/8 x 8'-10.25" 0.087 kips 9.80 lb/ft x 8'-10.25" / 1000			
m 2-PL 5x3/8 x7" 0.007 kips 2 x 0.490 kcf x 5" x 0.375" x 7" / 1728			
Strut ST3-E See Above	1	44.6771	0.0471
Strut ST2-E See Above	1	62.6458	0.0454

REMEDIAL ALTERNATIVES ANALYSIS REPORT
For LEAD IMPACTED SOIL
AT
NANUE BRIDGE, NINOLE, HAWAII

Credit: Consor Engineering, Inc.

Prepared For:
Hawaii State Department of Transportation

Prepared For:
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Prepared By:
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August 2024

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LIST OF ACRONYMS AND ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
c-EHMP	Project-specific Construction Environmental Hazard Management Plan
CFR	Code of Federal Regulations
COC	Contaminant of Concern
COPC	Contaminants of Potential Concern
CSM	Conceptual site model
CY	Cubic yard(s)
DU	Decision Unit
EAL	Environmental Action Level
EHMP	Environmental Hazard Management Plan
EPA	United States Environmental Protection Agency
EQI	Enviroquest Inc.
HAR	Hawaii Administrative Rules
HDOH	State of Hawaii Department of Health
HDOH TGM	State of Hawaii Department of Health Technical Guidance Manual
HDOT	State of Hawaii Department of Transportation
HEER	Hazardous Evaluation and Emergency Response
Kd	Desorption coefficient (SPLP test results)
KPC	Kealamahi Pacific Consultants
LBP	Lead-Based Paint
mg/kg	Milligram per kilogram
NPS	National Parks Service
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyls
PPE	personal protective equipment
RAA	Remedial Alternatives Analysis

RCRA	Resource Conservation and Recovery Act
ROW	right-of-way
RSL	Regional Screening Levels
SAP	Sampling and Analysis Plan
SCP	State Contingency Plan
SPLP	Synthetic Precipitation Leaching Procedure
TBC	to be considered
TBD	to be determined
TCLP	Toxicity Characteristic Leaching Procedure
TMK	Tax Map Key
TSP	trisodium phosphate
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USDA NRCS	United States Department of Agriculture National Resource Conservation Service-
USEPA	United States Environmental Protection Agency

1 Introduction and Purpose

The site is located below Nanue Bridge, Ninole, Hawaii on the Hamakua Coast approximately 16 miles north of Hilo HI. The site is a right of way for the County of Hawaii Department of Transportation (Figure 1). The site includes the Hawaii County Tax Map Key (TMK) (3) 3-2-001 Parcel 008, and (3) 3-2-001:001 which is owned by the Hawaii Department of Transportation.

The ROW is located below Nanue Bridge. This steel girder and trestle bridge lie 250+ feet above the stream. The bridge was originally constructed in 1911, and lead-based paints were frequently applied to the structure throughout the 20th Century (Historic Hawaii 2014). Lead-based paint flaked off and may have spilled during application. The lead paint was removed from the bridge in 1997 (Hawaii Tribune-Herald 1997), but the area below the bridge now has lead-impacted soil.

1.1 Purpose

Lead-impacted soil has been documented at other nearby bridges (Hakalau and Kolekole), and it was suspected that Nanue Bridge would have comparable results. The bridge requires maintenance, and workers will need to be on site to repair and replace girders and trusses shore up footings and remove vegetation. Soil disturbance during foundation work and access requirements will potentially expose workers to contaminants of potential concern (COPC)-impacted soils. If soil is found to exceed the Hawaii Department of Health (HDOH) Tier 1 Environmental Action Levels (EALs) for unrestricted land use, a Construction Environmental Hazard Management Plan (C-EHMP) will be completed prior to site work. A site investigation was conducted in March 2023 to identify and delineate the extent of lead-impacted soil within Decision Units (DUs) at the site.

This report evaluates existing data and associated human health and/or environmental hazards and provides an analysis of potential remedial alternatives at the site.

2 Background

2.1 Site Description

The site is located in a steep gulch and is bisected by Nanue Stream which opens to the Pacific Ocean approximately 500 ft east of the bridge. The terrain is steep with a 78% grade (ControlPoint 2023). Some areas a vertical drops of appriximxately 20 ft. A set of old wooden stairs allow access to the first set of footing along the southern embankment.

The area under Nanue Bridge is rocky with tall grasses and non-native trees. Overhead utility lines run along the western side of the ROW and vegetation in the area is knocked back regularly, but grows rapidly. The Hamakua area receives heavy and often torrential rainfall. A scoured natural swale on the western edge of the ROW clearly funnels water to the footings at DU12 on the southern embankment during heavy rains. This swale has caused significant erosion along the western side of the ROW.

The site is not an identified critical habitat by the United States Fish and Wildlife Service (USFWS). The project is within the Special Management Area for the State of Hawaii (KPC 2023).

Soils in the northern embankment were finer silt than the southern embankment. DUs closest to the bridge decks (DU1, DU2 and DU8 and DU9) were in general drier than the lower elevation DUs and had less vegetation.

The embankments are challenging to access due to significant slope and dense shrubs/trees. The vegetation below and around the bridge consists of thick stands of fast growing introduced species including African tulip, Australian tree fern (*Cyathea C$*), Pohole/Fiddlehead fern (*Diplazium esculentum*), Strawberry guava (*Psidium cattleianum, Myrtaceae*), Maile pilau (*Paederia foetida*), California grass (*Urochloa mutica*), and Octopus Tree (*Schefflera actinophylla*) depending on the slope location.

2.2 Climate

The site is located on the Hamakua Coast of Hawaii Island on the windward side of the island. This area experiences higher than average rainfall than most of Hawaii. The average annual rainfall for the site is approximately 138 inches. March is the wettest month with over 15 inches of rainfall and June is the driest with approximately 8 inches (Giambelluca et al 2013). Temperatures have minimal variances with an average low of 65 to 70 degrees Fahrenheit and average highs of 79 to 84 degrees Fahrenheit (NOAA 2019).

2.3 Soils/Geology

The site is located to the north and south of Nanue Stream. Soils are identified by the United States Department of Agriculture National Resource Conservation Service (USDA NRCS) as Hilo Rock outcrop, with slopes of 35 to 100 percent. These are typical of gulches in lava flows and consist of hydrous silty clay loam over basalt (United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) 2023).

2.4 Surface Water

Nanue Stream bisects the site. This is a perennial freshwater stream that is approximately 10 miles long with a rocky channel. It is part of a 5.5 square mile watershed (USGS 2019). The stream is not channelized and has steep embankments, but it could scour upstream and back scour.

2.5 Groundwater

The site is located above the Underground Injection Line according to the HDOH Safe Drinking Water Branch (HDOH SDWB 2019) as the coastline serves as the demarcation in this part of Hamakua. It is unlikely that groundwater at the bridge is a source of drinking water due to the proximity of the shoreline.

2.6 Historic Land Use

The parcel targeted for remedial action alternatives are located below Hawaii Belt Road. This particular tax map key (TMK) was never identified as an agricultural site on historic maps. The steep terrain makes access to Nanue Stream challenging.

The bridge itself spans approximately 531-feet and is 286-feet tall at the deck (Historic Hawaii 2014). It is the tallest one in Hawaii (NPS 2009). The bridge was originally constructed in 1911/1912 for the Hilo Railroad Company to access the sugar plantations along the coast. The former sugarcane camp town of Honohina was located southwest of the bridge (1910s – 1960s), but today only the cemetery remains west of the bridge (Hakalau Home 2023). A former dump site associated with Honohina was identified during site inspection. Rubbish from the upper elevation was found in the swale along the southwest bank of Nanue Bridge. Nanue Bridge survived the 1946 tsunami, and the railroad was rebuilt in 1953 as a highway (NPS 2009).

In the early 1950s, lead-red and black bridge paint were applied to the Nanue Bridge and all over bridges along the Hamakua Coast (Honolulu Advertiser 1953). Lead paint was removed from the bridge in 1997.

2.7 Current/Future Land Use

The site is a Hawaii Department of Transportation right-of-way with no public access, no private easements, and no identified users besides bridge maintenance crews. The site is anticipated to remain a right-of-way for the near future.

3 Magnitude and Extent of Contamination

Previous site investigations on bridges along the Hamakua Coast identified that lead-based paint flakes could be a concern in the Hawaii Department of Transportation (HDOT) Highways right of way below the bridges.

Fifty-increment multi-increment (MI) soil samples were collected by hand on the north side of the bridge on March 5 and March 6th, 2023, following the Sampling and Analysis Plan (SAP) (EQI 2023). Samples on the southern side of the bridge were collected by hand on March 9 and 10th 2023. Samples were analyzed for Resource Conservation and Recovery Act (RCRA) 8 metals and PCBs. PCB analysis was requested by the HDOH Hazard Evaluation and Emergency Response (HEER) office, who were concerned that it may have been used in the bridge expansion joints. Lab tables and reports are found in Appendix A1 and Appendix A2.

Samples were analyzed using the following test methods.

RCRA 8 Methods

Arsenic	EPA* 6020B
Barium	EPA 6020B
Cadmium	EPA 6020B
Chromium	EPA 6020B
Lead	EPA 6020B
Mercury	EPA 7471A
Selenium	EPA 6020B
Silver	EPA 6020B

* *United States Environmental Protection Agency*

Polychlorinated Biphenyls (PCBs)

PCB-1016	EPA 8082A/3546
PCB-1221	EPA 8082A/3546
PCB-1232	EPA 8082A/3546
PCB-1242	EPA 8082A/3546
PCB-1248	EPA 8082A/3546
PCB-1254	EPA 8082A/3546
PCB-1260	EPA 8082A/3546

Decision Units (DUs) were established on the north and south embankments of the site at three depth profiles, 0 to 3 inches below ground surface (bgs), 3 to 6 inches bgs and 6 to 9 inches bgs.

Initial DUs were assigned based on the survey, ROW dimensions and anticipated work areas around the bridge footings. Two “side” DUs for each embankment (mauka and makai) were planned to capture the edge of the anticipated work area to the edge of the HDOT

ROW. Expanding the DUs from the footing work area to the wider ROW would not reflect the majority of the worker exposure.

On the northern side of the bridge, heading towards Honokaa, DU1, DU2, DU3, DU4 and DU5 were planned to represent each bridge footing area. Two side DUs (DU6 and DU7) were planned to extend from the bridge to the edge of the ROW (Figure 2). Belaying equipment was necessary to collect samples from DU3.

On the southern side of the bridge, heading towards Hilo, DU8, DU9, DU10, DU11 and DU12 were planned to represent each bridge footing area. Two side DUs (DU13 and DU14) were planned to extend from the bridge to the edge of the ROW (Figure 2). Ropes and belaying equipment were necessary to access DU11 and DU12 and is recommended for DU10.

Generally, DUs areas sampled in the upper DUs extended up to the edge of the bridge deck. In the lower DUs, sampled areas used the edge of the pier footings as the primary outer edge. The DUs stayed roughly below the bridge deck (Figures 2 – 4).

However, field conditions required adjustments to the DU due to the steepness of the incline, a bare rock substrate, and heavy vegetation that blocked access to soil. In the SAP (EQI 2023), some DUs were planned for sampling, but with the caveat that “samples will not be collected where the steepness of the slope makes it inaccessible or dangerous or where adequate soil is not present”. The entirety of the site was not accessible during the initial site inspection as belaying equipment would be required to safely review the length of the ROW. The sampled DUs used the outer edge of the bridge deck as the overhead reference and/or the pier footings to reflect the most likely work areas.

On the northern side of the stream embankment, DU4 and DU5 (the lowest elevation) were not sampled. DU4 consisted of a heavily vegetated 70-degree face with many African tulip trees (*Spathodea campanulate*) preventing ingress/egress on the sloped area. DU 5 was a completely vertical face with exposed bare rock and inadequate soil to sample. The physical characteristics of both DUs provide a low potential for exposure to human receptors. The primary current/future human receptor scenario would be construction workers. Climbing gear would be necessary to access and work in the site, reducing significant contact with lead-impacted soil.

The “edge” DUs; DU6 and DU7 on the northern side and DU13 and DU14 on the southern side were not sampled as they were inaccessible due to thick vegetation and steep slopes (50% to 80% slopes) (Figure 2). Additionally, fresh green waste cuttings from the DOT's periodic vegetation control activities occurred one day prior to the sampling event. There were many freshly cut large limbs and dangling branches suspended in the trees. The terrain is so steep that clearing of brush along this border area takes place from the bridge deck using an articulating man-lift that extends down into the valley below and worker cut brush from this platform using pole saws. There is currently no direct pathway for current/future occasional users/trespassers. The slope and dense vegetation acts as a physical boundary preventing direct exposure. Even ROW vegetation clearance occurs from the bridge deck using a vertical trimmer, reducing the exposure of regular landscape maintenance workers.

Based on previous soil investigations at other Hamakua bridges (Hakalau and Kolekole) it is likely that lead flakes from the bridge drifted in proximity to the bridge, and lead concentrations in these DUs are well above the HDOH Tier 1 EAL for unrestricted land use. Sampling these adjacent DUs seems unnecessary due to the heavy vegetation preventing physical access to receptors needed for potential exposure to occur. Due to the likelihood that concentrations of lead in these areas do exceed unrestricted land use EALs, and likely exceed construction/industrial EALs, remedial alternatives evaluated in this RAA consider addressing the entire DOT right-of-way.

3.1 Total Lead Results

Every DU in the HDOT ROW exceeded both the HDOH Tier 1 EAL for unrestricted land use (200 mg/kg). Only one DU profile (DU1 at 6 to 9 inches below ground surface), did not exceed the construction/trench worker safety of 800 mg/kg of total lead. Almost all of the DUs exceeded gross contamination of 1000 mg/kg. The southern embankment HDOT ROW (DU10 at 3 to 6 inches bgs) contained the highest lead concentration sample results (Table 3-1/Appendix A2).

Levels that exceed the construction trench worker EAL require a Construction EHMP while working on the site and may require additional personal protective equipment (PPE) and monitoring equipment.

3.1.1 Total Lead: Northern Embankment

On the north (Honokaa side) lead levels decreased with depth in DU1, but levels increased with depth in DU2 and DU3. All of the sample results ranged between 1100 to 1200 mg/kg for lead in the first three inches (Figure 3a).

In DU1, the highest elevation DU, there was a drop-off in the depth profiles. The mean decreased from 1133 at 0 to 3 inches bgs to 577 mg/kg in 6 to 9 inches bgs. DU1 at 6 to 9 inches was the only DU where the total lead results did not exceed Construction/Trench Worker EALs. The surface soil was most heavily impacted by lead and the surface contamination was consistent across DUs. The lead impacted soil had clearly run off onto the lower elevation DUs over time, building up the soil on the lower elevation DUs to match the surface levels.

Within DU2 the lead results were consistent – between 1000 to 1400 from 0 to 9 inches bgs at the three profiles. At DU3 (the lowest elevation DU that was sampled on the north side) the top six inches were 1200 mg/kg and the 6-to-9-inch profile had was at 1500 mg/kg (Figure 3b and Figure 3c).

3.1.2 Total Lead: Southern Embankment

On the South (Hilo side) lead contamination increased at the 3 to 6 inches profile when compared the to the upper 0 to 3 inches soil profile. These soils contained more total lead than the surface layer (0 to 3 inches) likely due to runoff and soil creep (a mass wasting process where soil particles move downhill due to hundreds to thousands, of wetting and drying cycles occurring over decades).

DU8, the highest elevation DU, had the lowest total lead concentration on that side of the bridge and had a noticeable falloff in total lead concentration from 4300 mg/kg in the 0-to-3-inch layer dropping to 2900 mg/kg in the 6-to-9-inch depth profile. This mirrors the results in DU1 in the northern embankment. However, the results at DU8 are all greatly elevated compared to DU1. DU8 has sheer exposed rocks and soil that differs from the lower elevation DUs.

DU9 included a mixture of sheer cliff and plateau areas. Vegetation cover varied from dense fern and California grass to bare weathered, nearly vertical, rock face. Results between the depth units were consistent varying from 6400 to 6000 mg/kg total lead with the lowest results at the 6-to-9-inch depth profile.

DU10 had the highest concentration of total at 3 to 6 inches bgs and a total lead result of 9700 mg/kg. This DU is steep, but heavily vegetated with grasses and had a greater amount of soil in the DU compared to some of the rockier DUs (DU9 and DU11). It is likely that this area had more soil build up, and somewhat less erosion.

DU11 was steep enough to require belaying equipment. It also had more exposed rocks, and a sheer drop at the end of the DU. Total lead surface results varied from 4300 to 6400 mg/kg. Results were lower than the 0-to-3-inch profile indicating that soil likely runs off.

DU12 was the stream level channel, and it is primarily level and slightly elevated from the stream. This area had higher results than DU11 varying from 6300 mg/kg of total lead at 0 to 3 inches bgs, 7900 mg/kg at 3 to 6 inches bgs, and 6500 at 6 to 9 bgs. Water from the swale is funneled to this DU on the western corner and it is obvious that the area is eroding during heavy rains.

3.2 Total Arsenic Results

Arsenic was the only other COPC that exceeded the HDOH Tier 1 EALs in the site investigation. However, only six DUs were at or above the HDOH Tier I EALs of 24 mg/kg. While the residential direct exposure is set to 23 mg/kg, this site is not now, nor will be become residential in the foreseeable future due to slope and land use. The highest exceedance was 32 mg/kg in DU8 at 6 to 9 inches bgs (Figure 4).

The highest exceedances were at the highest elevation DUs, in the areas that were drier and protected from runoff due to the proximity to the bridge deck. The DUs with arsenic exceedances also had wooden access ladders onsite. The DUs may have had arsenic pesticides applied which remained in the soil and did not runoff to lower DUs due to better rain coverage from the bridge.

Due to the low total results, bioaccessible arsenic was not analyzed as the results were primarily at the EAL for unrestricted land use.

All results were well below the construction/trench worker EAL of 95 mg/kg and are not identified as a site-specific contaminant of concern (COC) for the EHMP. ‘

3.2.1 Total Arsenic: Northern Embankment

DU1 was the only DU with arsenic exceedances. Total arsenic results were 26 mg/kg at 0 to 3 inches bgs. No other DUs were above 24 mg/kg.

3.2.2 Total Arsenic: Southern Embankment

At DU8 total arsenic in the surface soil (0 to 6 inches bgs) was 20 mg/kg. However, at 6 to 9 inches bgs total arsenic results were 32 mg/kg. This was the highest sample result.

At DU9 all three depth profiles were at 24 to 25 mg/kg. No other DUs downslope had any exceedances for arsenic greater than 24 mg/kg.

Table 3-1: Nanue Bridge Total Lead Summary Table

🟨	Lead results above HDOH Tier 1 EAL Unrestricted Land Use (200 mg/kg), but below Construction/Trench Worker Scenario (800 mg/kg) (HDOH 2012)
🟥	Lead results above HDOH Tier 1 EAL above Construction/Trench Worker Scenario (800 mg/kg), but below gross contamination (1,000 mg/kg)
🟫	Lead results above gross contamination (1,000 mg/kg)

DU ID	Depth (in)	Lead Results (mg/kg)	Sq. Ft	CY	Description
DU1	0-3	1133	1722	16	Northern Embankment highest elevation
	3-6	930	1722	16	
	6-9	577	1722	16	
DU2	0-3	1200	1985	18.4	Northern Embankment Mid elevation
	3-6	1000	1985	18.4	
	6-9	1400	1985	18.4	
DU3	0-3	1200	4413	41	Northern Embankment Lowest DU on north, very steep.
	3-6	1200	4413	41	
	6-9	1500	4413	41	
DU8	0-3	4300	2161	20	Southern Embankment Highest elevation
	3-6	3100	2161	20	
	6-9	2900	2161	20	
DU9	0-3	6400	2843	26	Southern Embankment Second Highest elevation
	3-6	6200	2843	26	
	6-9	6000	2843	26	
DU10	0-3	8500	3848	37	Southern Embankment Steep slope, heavily vegetated
	3-6	9700	3848	37	
	6-9	8100	3848	37	
DU11	0-3	4300	3498	32	Southern Embankment Steepest slope
	3-6	6400	3498	32	
	6-9	6000	3498	32	
DU12	0-3	6300	7185	67	Southern Embankment Lowest elevation – at stream. Relatively flat
	3-6	7900	7185	67	
	6-9	6500	7185	67	

**DU1 results are the mean of the primary sample, duplicate, and triplicate.*

3.3 Contaminant Fate and Transport

It was anticipated that lead impacted soil would have run off from the upper elevation DUs to the lower elevation DUs and this was confirmed by the sampling. Erosion from upper elevation to the stream channel was obvious during sampling.

The data suggests that in some of the DU areas (DU2, DU3, DU10, DU11, and DU12) the higher concentrations at depth are possibly due to the slope being steep enough that soil from higher up area may have sloughed downslope. The earlier and deeper layers of soil were more heavily impacted by the 20th century lead paint application versus the more recent topsoil layers.

Visible paint flakes were seen in multiple DUs in soil 6-9 inches below the subsurface indicating that the soil higher on the valley wall had mobilized via sheet flow or soil creep (horizontal and vertical action from repeated wetting and drying cycles). The conditions are fair for this process since there is a developed soil horizon up to two feet thick over a weathered saprolite rock with slopes under the bridge up to 88 percent slope commonly over 70 percent in most of the DUs (Table 3-3). During cyclic wetting and drying the soil particles move out as they expand during the wetting cycle and are then pulled downward by gravity and drying out only to have this process repeat itself again during the next wetting cycle. Any rainwater sheet flowing on this surface causes soil to cover the soil below it.

Table 3-3: Nanue Bridge DU Slope Estimates

	Top Elevation	Bottom Elevation	Rise	Run	Slope
N. ROW	Feet	Feet	Feet	Feet	%
DU1	201	180	20	41	49%
DU2	180	148	32	40	80%
DU3	148	90	58	73	79%
S. ROW					
DU8	212	170	42	48	88%
DU9	170	130	40	50	80%
DU10	130	85	45	56	80%
DU11	85	48	37	53	70%
DU12	48	0	48	67	72%

Source: Survey ControlPoint Surveying 2023

3.4 PCB Results

Additionally, HDOH requested that EnviroQuest analyze some of the samples for PCBs, particularly in samples with the highest lead hits. PCBs have a shorter hold time (14 days from the sampling date) and due to transportation and sample analysis time, it was not possible to have all the total lead results in time to meet the hold time. Therefore, DUs with the highest lead levels were estimated.

In DU10 and DU11 orange paint flakes (anticipated to be lead-based or lead containing) was visible at the site in the 3-6 inches interval. These DUs were chosen for PCB analysis. The upper 0-3 inch layer at DU10 was also analyzed for PCBs to verify if the orange paint flakes correlated with higher lead levels.

The PCB congener PCB-1254 was present in all three samples at concentrations ranging from 0.037 mg/kg to 0.20 mg/kg, which are well below the HDOH Tier 1 EAL for unrestricted land use (Appendix A1). PCBs were not identified as a COPC at the site.

4 Environmental Hazard Evaluations

4.1 Chemicals of Potential Concern

Lead paint was used for decades on the Nanue Bridge until removed in 1997. Other bridges in the Hamakua Coast (Hakalau and Kolekole) have also been identified as sources of lead-based paint which have flaked off and been deposited below the structure on the valley floor.

Studies at other Hamakua bridges identified lead as the COC. Nanue Bridge is no different, as all the DUs were found to be above the HDOH Tier 1 EALs for unrestricted land use (200 mg/kg) and all but one DU was above the construction trench worker EAL (800 mg/kg) for lead.

Lead is persistent in the environment and accumulates in soils and sediments through deposition. Once absorbed into the body, lead may be stored for prolonged periods in mineralizing tissue (e.g., teeth, bones, etc.). The stored lead may be released again into the bloodstream, especially in times of calcium stress (e.g., pregnancy, lactation, osteoporosis, etc.) or calcium deficiency.

Depending on the level of exposure, lead can adversely affect the nervous system, kidney function, immune system, reproduction and developmental systems, and the cardiovascular system. Lead exposure also affects the oxygen-carrying capacity of the blood.

The most encountered lead impacts in current populations are neurological in children and cardiovascular effects (e.g., high blood pressure, heart disease, etc.) in adults. Infants and young children are especially sensitive to even low levels of lead, which may contribute to behavioral problems, learning deficits, and lowered IQ. No children access this site.

Ecosystems near point sources of lead demonstrate a wide range of adverse effects including losses in biodiversity, changes in community composition, decreased growth and reproductive rates in plants and animals, and neurological effects in vertebrates.

4.2 Exposure Setting

Nanue Bridge is a Hawaii Department of Transportation bridge and right of way. The entirety of the site is located within the HDOT tax parcel.

4.2.1 Potentially Complete Exposure Pathways

Potentially complete pathways to user trespasser/construction workers (trench and maintenance exposure scenario) and terrestrial and aquatic ecological receptors exist via direct exposure to soil and potentially fugitive dust if the grass cover was not maintained or a construction excavation project was conducted under the bridge and dust controls were not implemented correctly. This potential exposure route could be controlled using proper PPE and BMPs for construction/stormwater runoff and could limit this exposure pathway.

Currently, there is no complete pathway to any receptors via surface water runoff, but again, future construction activities could potentially complete this pathway if not conducted with care. Additionally, if there were a natural disaster such as a tsunami that could scour away the current stream bank and redistribute lead-impacted soils to the stream mouth and runoff could be a completed exposure pathway.

4.3 Conceptual Site Model

A conceptual site model (CSM) provides a framework regarding potential sources of contamination, types of contaminants, contaminated media, exposure and migration pathways, and receptors. The CSM (Table 4-1) was used in the preparation of the Remedial Alternatives Analysis (RAA). Based on the results of the document review, the following are identified as potential human receptors:

- On-site construction workers – including personnel involved in repair or construction/ trenching during future site activities; and
- On-site landscapers/site workers – personnel who may maintain landscaped areas and may trim/clear trees and brush from the ground or remove plants from the bridge supports and may mow, weed whack, and perform general site maintenance (stair access to lower footings).
- Trespassers– Including individuals of all ages, who may camp, recreate, or otherwise trespass on the site and may potentially dig, touch, drive, lie, or be exposed to lead-impacted soil or dust. There was no evidence of encampments under the bridge.
- Ecological Receptors – There was clear evidence that the site was used by pigs including wallows and trails crossing the ROW. Native and non-native birds may also nest, loaf, hunt, or transit across the site (AECOS, 2019).

4.4 Exposure Pathway Analysis

Direct exposure to lead-impacted soil is a potential exposure pathway to human receptors at the site via the following pathways:

- Direct Contact: Incidental ingestion or dermal contact with soil;
- Air: Inhalation of fugitive dust;
- Surface Runoff and Sediment Exposure: Contaminants bourn by water or revealed by erosion; and
- Groundwater Exposure: Contaminants leaching from soil or impacting flowing groundwater.

4.4.1 Direct Contact Pathways

Direct contact with soil may result in incidental oral ingestion and/or dermal absorption of lead. Dermal absorption is not considered a pathway at the site, as lead at the site is not organic. Direct contact exposure may occur for the following groups:

- *Construction/Trench Workers and Landscaping/Site Workers:* may experience direct contact with lead-impacted soils during trenching, construction, and landscaping activities.

  The HDOH construction/trench worker exposure scenarios are set equal to assumptions used in the United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for consistency with screening levels for occupational exposure assumptions. The exposure rate reflects projects that may require the same workers returning frequently to the same site (construction workers in utility trenches). The HDOH Technical Guidance Manual (TGM) uses a total exposure duration of seven years for both carcinogens and noncarcinogens. An exposure frequency of 20 days (4 weeks) per year for 7 years yields a total of 140 days total exposure. Construction workers may receive 140 days (roughly 6 months) of exposure in a single year and never visit the site again. The United States Environmental Protection Agency (EPA) evaluates lead exposure by using blood-lead modeling, such as the Integrated Exposure-Uptake Biokinetic Model which recommends that soil lead levels less than 400 mg/kg are generally safe for residential use (HDOH 2017). Residual dirt on hands after digging may contribute to lead exposure through accidental ingestion of soil particles. Direct contact with lead-impacted soil is a concern as 20% to 70% of ingested lead is absorbed.
- *Trespassers:* It is unlikely that trespassers will be onsite long enough to be impacted by a brief time transvering the site to hunt or fish.
- *Ecological Receptors:* Ecological receptors including birds, mammals, and aquatic species may come into contact with the impacted soil through walking, loafing, digging, or directly in sediments.

4.4.2 Air Exposure Pathways

Inhalation of lead dust is another route of exposure, and almost all inhaled lead is absorbed into the body (ATSDR 2005). Lead particles can be absorbed from fugitive dust particles. The generation of fugitive dust may occur through disturbance of affected soil; such as wind or construction activities. Dust particles may be inhaled, may settle on human skin, and be ingested (hand to mouth), and/or may settle on vegetation ingested by humans.

- *Construction/Trench Workers and Landscaping/Site Workers:* may inhale fugitive dust during normal construction, landscaping, or maintenance activities. Total lead results in the HDOT ROW exceed 1,000 mg/kg for lead. This level is above the construction/trench worker scenario of 800 mg/kg and only trained personnel familiar with risks associated with exposure to lead should be allowed to conduct activities such as trenching, grading, and drilling operations. If the soil in these areas is disturbed, site workers would potentially require respirators based on air monitoring results.
- *Ecological receptors:* Ecological receptors including birds, mammals, and aquatic species may come into contact with the dust through walking, loafing, nesting, or digging.

4.4.3 Surface Runoff and Sediment Exposure Pathway

Surface runoff is part of the current conceptual exposure site model. Upstream and ROW DUs had exceedances of the gross contamination EAL of 1,000 mg/kg.

The exposed shoreline area did not have enough soil to sample.

The stream bank on DU12 could shift or be flooded from the western swale during storms. If extensive flooding, scouring, or high waves (tsunami or hurricane) causes extensive erosion of surface soil from the impacted DUs they may migrate to Nanue Stream. Sediment may accumulate in the adjacent marine environment and be available for contact with various receptors. The area is not an identified or accessible recreation site, but it is possible that sediments could migrate, and users of the marine environment (swimmers, surfers, fishermen) could come into direct contact with sediment and be exposed through oral ingestion and/or dermal absorption. However, given the remoteness and difficult terrain, it is unlikely to be accessed with any frequency by recreational user/trespassers. Ecological receptors may live directly in the impacted sediment and may be exposed to COC through feeding within the sediment. As a secondary transport mechanism, lead may bioaccumulate in ecological receptors (i.e., fish, shellfish), then ingested by human receptors.

4.4.4 Groundwater Exposure Pathway

To assess the potential environmental/groundwater leaching pathway, the Synthetic Precipitation Leaching Procedure (SPLP) analysis was conducted on a soil sample collected from DU1 at 0 to 3 inches bgs, DU3 at 6 to 9 inches bgs, DU8 at 0 to 3 inches bgs, DU10 at 3 to 6 inches bgs, DU11 at 3 to 6 inches bgs and DU12 at 3 to 6 inches bgs. Total lead results varied from 1133 mg/kg at DU1 to the highest total lead result of 9700 mg/kg at DU10. The SPLP value varied from 0.08 mg/L to 8 mg/L respectively (Appendix B1). The limit of quantification is 0.030 mg/L.

The SPLP assists in the determination of the mobility of both organic and inorganic analytes present in liquids, solids, and wastes. The results of the SPLP test are used to determine the Desorption Partitioning Coefficient (Kd), which is important to understanding how mobile the lead in the soil is and whether it poses a potential risk to ecological receptors in the vicinity of the stream (e.g., vertebrate and invertebrate organisms). EPA Method 1312 SPLP West extraction procedure was used on the Nanue soil samples identified in Appendix B1. West refers to the pH of the extraction fluid that is made by adding 60/40 weight percent of sulfuric and nitric acids to reagent water until the pH is 5.00 +/- 0.05 used to determine the leachability of a site that is west of the Mississippi River. This method’s pH is higher than the EPA methods extraction fluid for sites east of the Mississippi River (4.20 +/- 0.05) (KPC 2023).

The result of the SPLP was inputted in the Batch Test Leaching Model (HDOH, 2007 revised 2011), and used to determine the relative mobility of lead in the soil. Batch tests involve placing a small amount of the soil in buffered, de-ionized water, agitating the mixture for a set period and measuring the fraction of the contaminant that desorbs from the soil and goes into solution. The ratio of the mass of a contaminant that remains sorbed to the mass that goes into solution, adjusted to the test method, is referred to the contaminant's "desorption coefficient" or "Kd" value (HDOH 2007 revised 2011).

If the calculated desorption coefficient is greater than 20 (Kd>20), the contaminant is considered not significantly mobile and is unlikely to pose a leaching hazard to groundwater. If it is less than 20, then an estimated concentration in groundwater should be calculated and compared to the HDOH Tier 1 EAL. The Kd value uses micrograms/L and when calculated by this model for the soil samples Kd coefficient varied from 1193 to 14,143, all significantly greater than a Kd value of 20 (Appendix B-1).

This result demonstrates that the lead present in the soil is strongly bound to the soil and is considered immobile (soil is weathered volcanic alluvial sediments including gravel, sand, and clay). Thus, there is a low likelihood that the lead concentrations in the soil at pose a risk to ecological receptors (e.g., aquatic organisms) as a result of lead leaching from the soil into rainwater and sediments or impacting the groundwater below the site.

4.5 Environmental Hazard Evaluation Summary

The exposure pathway analysis described in the previous section identifies various exposure pathways (direct and indirect) where lead-impacted soil may pose a risk to human and ecological receptors. The conceptual site exposure model provides a graphical comparison of release mechanism, pathways, and exposure routes to potential current and future receptors at the Site (Table 4-1).

4.5.1 COPC Sources and Release Mechanisms

The primary source of the COPC at Nanue Bridge is lead-impacted surface and subsurface soil from lead released into the environment from lead-based paint used in historical bridge maintenance activities.

Lead-impacted soil present at the site has been shown to exist at concentrations above the HDOH Tier EALs for gross contamination (1000 mg/kg). Total concentrations vary across the site and include portions that are at or below HDOH Tier 1 EALs for unrestricted land use. The secondary release mechanism, besides direct contact with soil, includes dust, surface water runoff, and leaching.

4.5.2 Pathways and Exposure Routes

Lead poses a hazard to potential receptors through direct exposure to contaminated media through pathways including surface soil, subsurface soil, ambient air, surface water and sediments, and groundwater. These pathways potentially expose receptors to lead via inhalation, ingestion, or dermal adsorption.

4.5.3 Potential Receptors Current and Future Land Use

The main human exposure scenarios identified under current land use as a Hawaii Dept of Transportation right of way are construction/maintenance workers and ecological receptors. The site's land use and steep, inaccessible terrain limits trespassing. It is not open or appealing to the public. The land use is not likely to change as it serves as a primary highway for the Hamakua Coast, and future land use includes these same human exposure scenarios. This is also true for avian and aquatic receptors.

4.5.4 Complete Exposure Pathways

Complete exposure pathways exist for all receptor scenarios exposed to surface and subsurface soil at this site under current and future conditions. Exposure to dust is a complete pathway to on-site maintenance and construction workers when the current grass cover is disturbed and there is potential for inhalation of dust under dry windy conditions when activities such as land mowing and excavation occur.

4.5.5 Exposure to Lead Leaching

There has not been an identified complete pathway to current and future receptors via leaching in subsurface soil or groundwater. A batch test leachability model based on SPLP analyses from soil collected from DUs with total lead results between 1133 mg/kg at DU1 to total lead results of 9700 mg/kg at DU10 demonstrated that the absorption coefficient is high enough to prevent contaminant mobilization from the soil to groundwater (Appendix B1). The DUs end at a steep drop off on the northern embankment, and a rocky embankment on the south.

Table 4-1: Conceptual Site Exposure Model

Primary Sources	Primary Release Mechanism	Secondary Sources	Secondary Release Mechanism	Pathway	Exposure Route	Potential Receptors							
						Current Land Use				Future Land Use*			
						On-site Landscape or Construction Workers	User Trespassers	Terrestrial Ecological	Aquatic Ecological	On-site Landscape or Construction Workers	User trespassers	Terrestrial Ecological	Aquatic Ecological
Lead Impacted Soil	Lead-Based Paint from Bridge	Lead Impacted Soil	None	Surface Soil	Ingestion	X	X	X	O	X	X	X	O
					Dermal	X	X	X	O	X	X	X	O
			None	Sub-Surface Soil	Ingestion	X	X	X	O	X	X	X	O
					Dermal	X	X	X	O	X	X	X	O
			Dust	Ambient Air	Inhalation	X	O	O	O	X	O	O	O
			Surface Water Runoff	Surface Water and Sediments	Ingestion	O	O	O	O	O	O	O	O
					Dermal	O	O	O	O	O	O	O	O
			Leaching	Subsurface Soil	Ingestion	I	I	I	I	I	I	I	I
					Dermal	I	I	I	I	I	I	I	I
				Ground- water	Ingestion	I	I	I	I	I	I	I	I
					Dermal	I	I	I	I	I	I	I	I
					Inhalation	I	I	I	I	I	I	I	I

Notes: X - Complete exposure pathway O – Potentially Complete   I - Incomplete
** - No significant change to the land use is planned in the near future*

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5 Establishing Alternatives

5.1 Introduction

Under amended Section 121(d) of CERCLA, remedial actions for hazardous substance cleanup must attain or waive federal environmental potentially applicable or relevant and appropriate requirements (ARARs), or more stringent state environmental ARARs, upon completion of the remedial action (EPA 2019).

ARARs include only federal and state environmental or facility-citing laws/regulations and do not include occupational safety or worker protection requirements. Compliance with Occupational Safety and Health Administration (OSHA) standards is required by 40 C.F.R. 300.150 and therefore the CERCLA requirement for compliance with or a waiver of ARARs does not apply to OSHA standards (EPA 2019). In addition to ARARs, non-promulgated criteria, advisories, guidance, or policies referred to as to-be-considered criteria (TBC) information may also apply to the conditions found at a site. Unlike ARARs, identification of and compliance with to be considered (TBC) information is not mandatory or legally binding; however, where TBC information is used as a cleanup level, its use for this purpose should be explained and justified.

See Appendix C for a table for ARARs and TBC criteria for remedial alternatives considered for Nanue Bridge. The alternatives evaluated to meet the ARARs, and compliance may require consultation with State and Federal Agencies.

5.2 Potential ARARs and TBC Criteria

5.2.1 Potential Chemical-Specific ARARs and TBCs

Chemical-specific ARARs include those environmental laws and regulations that regulate the release to the environment of materials with certain chemical or physical characteristics or that contain specified chemical compounds. These requirements generally set health- or risk-based concentration limits or discharge limits for specific hazardous substances by media. In this instance, the chemical of concern is lead. This contaminant is identified in the EPA RSLs, which identify industrial/non-residential soil screening levels at 800 ppm for soil. The RSLs are defined as TBCs as they are not promulgated.

5.2.2 Potential Location-Specific ARARs and TBCs

Location-specific ARARs govern activities in certain environmentally sensitive areas. The specific location and the proposed activity at the site trigger these requirements. The site is solely a right of way under a highway bridge with no public access, residential or commercial activities. The terrain is challenging due to its steepness and thick vegetation and limits trespassing. Wild pigs transverse the site. The primary site users would be bridge repair workers and maintenance/landscapers. The HDOH EALs for construction/trench workers have set a standard of 800 mg/kg for lead, the same as the lead RSL for industrial/non-residential use. The EALs are not promulgated.

Portions of the site are less than 150 meters from the water and within the Coastal Zone Management Special Management Area. It is above the Hawaii-designated underground injection control line but is not likely an area that will be developed as a source of drinking water. It is not located in a designated critical habitat or a designated wetland.

5.2.3 Potential Action-Specific ARARs and TBCs

Action-specific ARARs generally set performance, design, or other similar action-specified controls or restrictions on particular kinds of response activities. For example, action-specific ARARs may include restrictions that define acceptable treatment and disposal procedures for hazardous substances under 40 Code of Federal Regulations (CFR) Part 261 and 262. The EPA regulatory limit for lead is 5 mg/L. DUs at the site have been identified as exceeding this limit and would be classified as hazardous waste.

DUs were analyzed for Toxicity Characteristic Leaching Procedures (TCLP) using method 6010D for RCRA8 metals, and lead was the only analyte that failed TCLP (Table 5-1/Appendix B2). DUs were chosen to represent a range of total lead results. During the Hakalau Bridge TCLP assessment, "soil with total lead concentrations somewhere between 1410 mg/kg and 5080+ mg/kg (approximate range of total lead concentration 1500 - 5000 mg/kg) may likely have TCLP lead results greater than 5 mg/L." Soils from Hakalau at had total lead results above 5000 mg/kg failed TCLP (KPC 2023). It was anticipated that Nanue would have comparable results.

Three DU samples failed TCLP at Nanue; they were all at a depth of 3 to 6 inches and included DU10, DU11, and DU12. DU9 and DU11 had identical total lead results, but DU11 failed TCLP and DU9 did not (Table 5-1/Appendix B2). Lead release is influenced by the soil's natural pH, organic matter presence, soil cation exchange capacity, particle size, buffering capacity, and soil mineralogy (Pinto and Al-Abed 2017). DU8 and DU9 included a rocky cliff face with limited organic matter and drier conditions, whereas topsoil layers were thicker with dense vegetation in DU10, DU11, and DU12. Soils appeared siltier on the northern embankment and had limited vegetation in DU1 and DU2. There are no approved waste disposal sites in Hawaii authorized to accept this waste, it will need to be shipped out of state.

Table 5-1: TCLP Summary Results Nanue Bridge

	DU ID	**Total Lead**	**TCLP**
Northern Embankment		*mg/kg*	*mg/L*
	DU1_0-3_B	1200	0.6
	DU2_6-9	1400	0.69
	DU3_6-9	1200	1.1
Southern Embankment	DU8_0-3	4300	3.7
	DU9_0-3	6400	2.8
	DU10_3-6	9700	17
	DU11_3-6	6400	12
	DU12_3-6	7900	23

5.3 Remedial Action Objectives

The Remedial Action Objectives for Nanue Bridge as identified by the site owners and as recommended by the state guidance is to remove the direct contact pathway to human receptors (site workers) and ecological receptors to lead-impacted soil which exceeds concentrations of 800 mg/kg.

5.4 General Response Actions

Actions may include restricting access, fencing, administrative/institutional controls, reducing contact with lead-impacted soil through physical barriers, or removing the source of contamination.

6 Detailed Analysis of Alternatives

There are seven general categories of remedial alternatives to be considered in the State of Hawaii Department of Health Hazard Evaluation and Emergency Response Technical Guidance Manual. (HDOH TGM Section 16.2.2.2 and Hawaii Administrative Rules (HAR) 11-451-8(c)). The top five grayed-out ones were rejected due to not being feasible due to the site conditions and type of contaminant.

1. No Action
2. Recycle or reuse
3. Destruction or detoxification
4. Separation, concentration, or volume reduction
5. Immobilization of hazardous substances
6. On-site or off-site disposal, isolation, or containment_ Three options were considered
7. Institutional controls, fencing and long-term monitoring: Two options were considered.

6.1 Alternative 1: No Action

Under the no-action, no remediation activities will be performed. The site will remain as-is. Workers will still be exposed to lead-impacted soil that exceeds construction trench worker EALs during site work, and no EHMP will be completed. Trespassers and ecological receptors could still be exposed to lead contaminated soil, but trespassers are limited due to the terrain. Maintenance workers would continue to have a direct pathway to highly contaminated soil media. Lead is persistent in the environment and will not decay in the soil over time.

6.2 Alternative 2: Recycle or Reuse

The contaminant of concern is dispersed lead-paint flakes. The lead paint material is not dense enough to be separated from the soil to be recycled or reused. This alternative is not suitable to remove the contaminant from the site or reduce potential exposure pathways.

6.3 Alternative 3: Destruction or Detoxification

The lead at the site is also not organic, corrosive, or explosive and is relatively immobile. This alternative is not suitable to remove the contaminant from the site or reduce potential exposure pathways.

6.4 Alternative 4: Separation, concentration, or volume reduction

Under this alternative, contaminated material may be completely or partially separated from material that is not contaminated, or contamination may be reduced in a large volume of material by concentrating the contaminant in a smaller volume. Soil particle size separation is conducted to reduce contaminated soil volume. Soils at Nanue Bridge and lead paint flakes are not suitable for volume reduction in this form and contamination would not be reduced significantly.

6.5 Alternative 5: Immobilization of Hazardous Substances

Portions of the site exceed gross contamination and fail TCLP for lead (Appendix B2). The TCLP regulatory limit for lead is 5 mg/L. DUs which failed TCLP include DU 10, DU11 and DU12 at 3 to 6 inches bgs (and could include other depth profiles). TCLP results varied from 12 to 23 mg/L for lead.

The soil in DU10, DU11 and DU12 (approximately 14,535 sq. ft and 136 to 400 cubic yards (CY) of soil) would be classified as hazardous waste if removed for disposal. This soil cannot be disposed of in Hawaii as there are no facilities that are permitted to accept hazardous waste. In a previous project reducing bioavailability by stabilizing the lead with a strong buffering agent application was tested by HDOT to reduce the concentration which could allow for disposal in the state (e.g., through the application of triple superphosphate (TSP) as an amendment to the soil) (Kealamahi Pacific Consultants 2023). This would be in implemented in conjunction with soil excavation and removal and would not be used for in-situ stabilization (Fabian 2008). Treated soil would be hauled to RCRA subpart D permitted landfill (e.g., West Hawaii Sanitary Landfill). This would require extensive soil removal, handling, and processing and offer limited value due to the cost of excavation and handling. Successfully permitting a temporary hazardous waste treatment facility would be unlikely and may take years of effort before a decision for approval or non-approval could be made making this a poor remedial alternative.

6.6 Alternative 6: On-site or off-site disposal, isolation, or containment

This method offers a good option to prevent the site workers from coming into direct contact with lead-impacted soils.

There are three scenarios evaluated in the RAA that are considered effective presumptive remedies for addressing lead-impacted sites by the USEPA. Generally, if lead-impacted soil remains on-site it will be encapsulated, limiting exposure to site maintenance workers/construction worker. An Environmental Hazard Management Plan (EHMP) will need to be maintained and updated when future work activities are planned in areas where encapsulated contaminated soil is present. A project-specific construction EHMP (C-EHMP) will need to be prepared for each future repair and construction activity to manage lead-impacted soil and be protective of all potentially exposed receptors for the duration of the project. This alternative presents the remedial alternatives that reduce or remove contamination from direct contact with receptors at the site.

Swale/Drainage Channel Note

On the southwest portion of the DOT easement, an erosional channel has formed. This starts where runoff leaves the roadbed and then flows down the side of the valley forming is large gully adjacent to the bridge and has caused severe scour which has begun to undermine the last concrete bent on the southwest side of the bridge right before entering the stream. The soil containment and removal alternatives (6a, 6b, 6c) could address that erosion by incorporating flow velocity reduction measures into a concrete channel (rip rap). Design and construction costs associated with these design considerations are not included in the current remedial alternatives presented in this document.

6.6.1 Alternative 6a: On-site isolation and containment through a Tecco Mesh System

This method uses a combination of wire and HDPE plastic mesh and matting to control and define the lead impacted soil and prevent erosion. Tecco mesh allows for vegetation and has been used successfully on Kapue Bridge on the Hamakua Coast among other locations. This alternative is classified as an HDOH and EPA-acceptable soil encapsulation. The site would first be grubbed of all vegetation with chain saws and green waste would be removed. The bare soil would be covered with coconut matting or other geotextile. The Tecco wire mesh would be pinned in place up to the limits of the DOT easement. Spike plates and anchors may be used on bare rock (Table 6-1/Figure 5). An archaeological consultation and monitoring would be required during the excavation.

This option leaves the lead-impacted soil on site (including areas of Gross Contamination) and an EHMP would still be needed. Batch Test Leachability analysis demonstrated that lead is immobile and unlikely to affect groundwater and surface water. Although the need for future maintenance measures below the hard cap is unlikely, workers within the DOT ROW would need respirators when performing maintenance tasks where they are digging/trenching in soil below the mesh system.

Table 6-1: Alternative 6a: No Removal, Cap Only on ROW

Site	Sq. Ft
HDOT ROW (North) 800+ mg/kg	27,428
HDOT ROW (South) 800+ mg/kg	33,254
Total	**60,682**

**Minimum, the paved surface would likely require additional coverage.*

The Tecco system can fail during landslides or extreme weather that causes extensive erosion and rockfall. During landslides/erosional events there is a potential that impacted soil would flow directly to the stream despite the mesh. An annual inspection of this cap will be required per the EHMP and will be documented and submitted to HDOH. Annual operation and maintenance costs would need to reflect the potential for erosion due to the heavy rains and steep slopes.

6.6.2 Alternative 6b: On-site isolation and containment through a hard cap: shotcrete

This is an HDOH and EPA-acceptable mitigation measure to encapsulate the soil using a hard cap of wired meds and shotcrete. All but one of the DUs exceed HDOH construction/trench worker's EALs (800 mg/kg) (HDOH 2012) for total lead) and would be encapsulated along with the remaining HDOT ROW, not solely the known and sampled DUs. The site would first be grubbed of all vegetation with chain saws and green waste would be removed. A welded fabric with wire reinforcement would be installed up to the limits of the DOT easement. Shotcrete would be sprayed to form a hard cap over the site and minimize the potential for erosion. This is the same area as Alternative 6a (Table 6-2/Figure 5). An archaeological consultation and monitoring would be required during the excavation.

This option, like Alternative 6a, leaves the lead-impacted soil on site and requires an EHMP. The lead impacted soil has been demonstrated to be immobile under current environmental conditions and is unlikely to affect groundwater and surface water. General maintenance crews would be protected from lead-impacted soil, but any work which penetrates the cap would require respirators.

Table 6-2: Alternative 6b: No Removal, Shotcrete Cap Only on ROW

Site	Sq. Ft
HDOT ROW (North) 800+ mg/kg	27,428
HDOT ROW (South) 800+ mg/kg	33,254
Total	**60,682**

**Minimum, the paved surface would likely require additional coverage.*

Due to the steepness of the slope some areas may not be feasible to cap, however these are surface rock and would not require shotcrete.

The hard cap option may be undermined during large storms. Impacted soil could runoff despite the cap if water infiltrated from below. An annual inspection of this cap will be required per the EHMP and will be documented and submitted to HDOH. Annual operation and maintenance costs would need to reflect the potential for erosion due to the heavy rains and steep slopes. The EHMP would need to be updated four times over 30 years to reflect bridge maintenance changes.

6.6.3 Alternative 6c: Removal of all soil that exceeds 800 mg/kg for lead. Lead-impacted soil (greater than 800 mg/kg) which passes TCLP will be disposed of at West Hawaii Sanitary Landfill. Lead impacted soil which fails TCLP will be shipped off-island for disposal.

All but one of the DUs exceeded 800 mg/kg for lead and will require removal under this scenario. If the entirety of the ROW were to be tested and exceed 800 mg/kg, this would result in over 2200 CY of soil removal (Table 6-3). If DUs were below 800 mg/kg they would stay on site to minimize soil removal costs. Cleaning the site to unrestricted land use EALs of 200 mg/kg for total lead is not an identified priority as the site is only used by site workers/maintenance crews who can have access to EHMP information and PPE. Unlike Hakalau and Kolekole, the area is and is not a public site, accessible, or attractive for the public.

If only the DUs which were sampled were excavated and removed to a depth of 9 inches this would be 756.2 CY (Table 6-4). However, this would not address all of the areas that workers will be in and would be an incomplete alternative. It is presented here to identify and quantify the known risks in comparison to the total volume and give an idea of the percent of required removal volume.

Table 6-3: Estimated Soil Removal Area – Entire ROW

	Approx. Area	**Removal Depth**	**Cubic Yards**
	Sq. Ft.	*inches*	
North ROW	27,428	12	1016
South ROW	33,254	12	1232
Total ROW	**60,682**		**2,248**

Table 6-4: Known Soil Removal Area – Sampled DUs

	Approx. Area	**Removal Depth**	**Cubic Yards**
	Sq. Ft.	*inches*	
DU1	1722	6	32
DU2	1985	9	55.2
DU3	4413	9	123
Total Known North DUs	**8120**		**210.2**
DU8	2161	9	60
DU9	2843	9	78
DU10	3848	9	111
DU11	3498	9	96
DU12	7185	9	201
Total Known South DUs	**19,535**		**546**
Total Combined DUs	**27,655**		**756.2**

Soil would be hauled to different disposal sites depending on TCLP analysis. DUs which pass TCLP will be excavated (Figure 6) and hauled to West Hawaii Sanitary Landfill. DUs which fail TCLP will be shipped out of state. Not all depth profiles were analyzed for TCLP initially – an assessment was run to determine if total lead results had a relationship to TCLP. If this alternative is chosen, additional TCLP analysis will be necessary for other DUs to determine if some of the DUs can be scraped and disposed of at West Hawaii Landfill.

Costs would be high as soil which is classified as hazardous waste could not be disposed of at facilities in Hawaii. DU10, DU11 and DU12 failed TCLP at the 3 to 6-inch depth profile. Approximately 14,531 sq. ft. of the site failed TCLP, representing 136 cubic yards (Table 6-5). Not all DUs were analyzed, and it is possible that additional depth profiles would also fail TCLP in the known impacted areas or could be so difficult to remove in three-inch lifts that the entirety of the DU would end up being removed as it cannot be easily segregated on the steep slopes. This would increase the volume of out of state soil disposal to 400 cubic yards (Table 6-5 and Table 6-6).

Table 6-5: DUs which Failed TCLP and Require Mainland Disposal

DU	sq. ft	Depth* (inches)	CY	Total Lead mg/kg	TCLP
DU10_3-6	3848	3 to 6	37	9700	17
DU11_3-6	3498	3 to 6	32	6400	12
DU12_3-6	7185	3 to 6	67	7900	23
Total Identified	**14,531**	**3 inches**	**136**		

Soil removal would require hand digging in areas of the steepest slopes and removal to the bridge deck via lifts and hoists. Backhoes and excavation equipment would not be feasible or would require additional grading/temporary leveling in some of the DUs due to the slope. This activity would expose workers to lead soil and lead dust during excavation and removal.

Confirmation sampling will be conducted to ensure that all targeted soil is removed from each DU. All DUs would be excavated until reaching 1-foot depth or confirmation samples indicated that soil concentrations were below the HDOH EAL construction worker safety (800 mg/kg). This would impact the entire HDOT ROW: 60,682 sq. ft to various depths. The sampling depth went to 9 inches bgs, but it would potentially require 12” excavation or until rock is encountered. For this alternative, an estimated depth of 12 inches is possible, but the depth will likely be less on a site-wide average as surface rock is present in several DUs.

Typically, clean fill would then be brought in and overlaid across the impacted site at a depth of 18-24 inches to re-level the site for use and allow for revegetation, drainage, and grading. However, due to the steep slopes, this would not be an acceptable method to try to restore the site. Final stabilization for this alternative could include no cover, cover area with jute mats to encourage vegetation and minimize water scour that would be nailed down to the slope with soil nails. The current cost for this alternative does not include any finish other than no cover. Slope stability analysis would need to be considered further in a remedial design if this alternative were selected.

An archaeological consultation and monitoring would be required during the excavation. The lead-impacted soil would be left on site therefore an EHMP will be needed.

Depending on the confirmation sample results, an EHMP for the remaining lead-impacted soil on site would still be needed. The primary maintenance item would be addressing any erosional issues to the finished grade which would vary based on the selected alternative and could include matting installation and hydroseeding. Annual inspections would be needed to check slope stabilization. The EHMP would need to be updated periodically to reflect bridge maintenance changes.

Table 6-6: Alternative 6c, Soil Removal 800+ mg/kg, Summary Table: Known and Potential Disposal Sites

CY	Disposal Site
16	Left onsite: Meets Construction/Trench Worker EALs (below 800 mg/kg Total Lead)
136	TCLP Fail: Removal Out of State
272	Potential TCLP Fail: Removal Out of State
121.4	TCLP Passed: West Hawaii
226.8	Potential West Hawaii Landfill

DU ID	Depth (in)	Lead Results (mg/kg)	Sq. Ft	CY	Disposal Site
DU1	0-3	1133	1722	16	Passed TCLP: West Hawaii Landfill
	3-6	930	1722	16	Unknown: Likely West Hawaii Landfill
	6-9	577	1722	16	Can be left onsite
DU2	0-3	1200	1985	18.4	Unknown: Likely West Hawaii Landfill
	3-6	1000	1985	18.4	Unknown: Likely West Hawaii Landfill
	6-9	1400	1985	18.4	West Hawaii Landfill
DU3	0-3	1200	4413	41	Unknown: Likely West Hawaii Landfill
	3-6	1200	4413	41	Unknown: Likely West Hawaii Landfill
	6-9	1500	4413	41	Passed TCLP: West Hawaii Landfill
DU8	0-3	4300	2161	20	Passed TCLP: West Hawaii Landfill
	3-6	3100	2161	20	Unknown: Likely West Hawaii Landfill
	6-9	2900	2161	20	Unknown: Likely West Hawaii Landfill
DU9	0-3	6400	2843	26	Passed TCLP: West Hawaii Landfill
	3-6	6200	2843	26	Unknown: Likely West Hawaii Landfill
	6-9	6000	2843	26	Unknown: Likely West Hawaii Landfill
DU10	0-3	8500	3848	37	Unknown: Potential out of state
	3-6	9700	3848	37	TCLP Fail: Out of State
	6-9	8100	3848	37	Unknown: Potential out of state
DU11	0-3	4300	3498	32	Unknown: Potential out of state*
	3-6	6400	3498	32	TCLP Fail: Out of State

DU ID	Depth (in)	Lead Results (mg/kg)	Sq. Ft	CY	Disposal Site
	6-9	6000	3498	32	Unknown: Potential out of state
DU12	0-3	6300	7185	67	Unknown: Potential out of state
	3-6	7900	7185	67	TCLP Fail: Out of State
	6-9	6500	7185	67	Unknown: Potential out of state

**This DU may pass TCLP based on total lead results, but logistical difficulties in scraping only the 0 to 3 inches of surface soil on the steep slope may require it to be removed along with the 3-to-6-inch depth profile.*

6.7 Alternative 7 Institutional Controls, and Institutional Controls/ Fencing and Long-Term Monitoring

These options identify the risks but do not remove or reduce the lead-impacted soil. Workers are prevented from coming into direct contact with the soil using an EHMP, PPE, and decontamination methods.

There are two options available under these alternatives:

- Alternative 7a: A site-specific Environmental Hazard Management Plan (EHMP) would be prepared that would outline the areas where various lead concentrations are on the site to facilitate awareness about the risks to current and future workers. The EHMP would need to be updated periodically and the effectiveness of this alternative would be reviewed every 5 years. This alternative assumes two updates per 30-year period to accommodate bridge maintenance changes. Appropriate PPE would be identified and used to perform work on-site. Decontamination sites would be established and used by workers.

- Alternative 7b: This alternative would include the site-specific EHMP and PPE identified in Alternative 7a, and in addition, fencing and signage would be installed but no remediation activities will be performed. Signage and fencing would be installed to prevent access to the ROW and to warn workers and trespassers of the hazards (Figure 7).

  Periodic inspections of the fencing and signage would be required under Alternative 7b and will need to be documented in annual reports. Site workers may be required to wear respirators due to the high levels of lead in some areas.

  This alternative would include clearing all the vegetation along the perimeter of the DOT easement and installing a fence down a very steep slope from the top of the embankment down to the stream floor. Gates would need to be incorporated in the fence design to allow future maintenance workers to access the enclosed area.

  The fence would eventually be covered in vines and brush so periodic maintenance would need to be performed.

These alternatives meet the needs of the Hawaii Department of Transportation needs and costs. The site is highly challenging, steep, and is not used by the public. No outside users are anticipated on the site.

7 Comparative Analysis of Remedial Alternatives

7.1 Overall Protectiveness

The first four identified alternatives do not meet the overall protectiveness requirements as these alternatives would not remove, limit, or reduce the potential lead exposure pathways for receptors. Alternative 4 could potentially be used in conjunction with other remedial actions to reduce disposal costs.

- Alternative 1: No action, including no EHMP, would not protect the workers who must perform repairs at the bridge. Soil results exceed construction/trench worker EALs.
- Alternative 2: The lead paint material is not dense enough to be separated from the soil in order to be recycled or reused.
- Alternative 3: The lead at the site is also not organic, corrosive, or explosive and is relatively immobile.
- Alternative 4: Soils at Nanue and lead paint flakes are not suitable for volume reduction in this form and lead would not be reduced significantly.
- Alternative 5: Previous assessments at Hakalau Bridge using the Bench Test Treatability study had demonstrated that immobilization via treatment with trisodium phosphate (TSP) to reduce the mobility of lead is potentially feasible but would require extensive excavation and soil removal from the challenging terrain, which would expose many more workers to lead-impacted soil. This alternative would reduce the quantity of lead-impacted soil that would need to be disposed of at mainland US facilities but would require a permit to treat hazardous waste at the designated treatment location. This alternative also has additional costs associated with treatment (industrial machinery for mixing TSP or Portland Cement into the lead-impacted soil, grading, managing stormwater controls on site). The application of this alternative would be in conjunction with soil excavation and removal and would not be used for in-situ stabilization. However, regulatory approval for a temporary hazardous waste treatment facility would be unlikely for this location.

Alternatives 6a, 6b, 6c and 7a and 7b presented in Table 7-1 and summarized below vary in protectiveness. The following assumptions are made.

- The public obeys signage and restricted areas.
- Regular site workers (Landscapers) have infrequent exposure to surface soil as tree trimming is conducted from the bridge deck. Brush trimmers onsite primarily handle vegetation and do not excavate below the surface (0 to 3 inches).
- Construction/Trench Workers dig below surface soil (6+ inches bgs) and handle soil.
- Ecological receptors primarily wallow, nest, dig, loaf, or lie on the surface of the soil.
- The site remains primarily vegetated, as consistent rainfall in the area typically ensures vegetation growth.

Table 7-1: Alternatives Analysis - Protectiveness

	6a. On-site isolation and containment. Tecco Mesh cap on areas of 800 mg/kg Lead exceedances	6b. On-site isolation and containment. Shotcrete hard cap on areas of 800 mg/kg Lead exceedances	**6c.** Removal and disposal of all soil which exceeds 800 mg/kg for lead	**7a.** Institutional and Engineering Controls: PPE/EHMP – No Fencing	**7b.** Institutional and Engineering Controls: Fencing to Limit Access
Is Lead-Impacted Soil Still Present?	Yes	Yes	Reduced: above 200 mg/kg but below 800 mg/kg	Yes	Yes
	Direct Contact Does the site have a complete exposure pathway for the following users under the scenario?				
Public	No: but only trespassers present	No: but only trespassers present	Potential: Unlikely - only trespassers	Potential: Unlikely - only trespassers	No: but only trespassers present
Construction/ Bridge Workers	Potential if mesh is breached	Potential if cap is breached	No	Potential: Mitigated by EHMP and PPE	Potential: Mitigated by EHMP and PPE
Site Workers (Landscapers)	No	No	No	Potential: Mitigated by EHMP and PPE	Potential: Mitigated by EHMP and PPE
Ecological Receptors	No	No	Potential: Unlikely	Yes	Yes
	Air Exposure Does the site have a complete exposure pathway for the following users under the scenario?				
Public	No: but only trespassers present	No: but only trespassers present	No: but only trespassers present	No: but only trespassers present	No: but only trespassers present
Construction/ Trench Workers	Potential	Potential	Potential: If deeper than 12”	Potential: Mitigated by EHMP and PPE	Potential: Mitigated by EHMP and PPE
Site Workers (Landscapers)	No	No	No	Potential: Mitigated by EHMP and PPE	Potential: Mitigated by EHMP and PPE
Ecological Receptors	No	No	No	Yes	Yes
	Surface Water Runoff (Sediment) in River Does the site have a complete exposure pathway for the following users under the scenario?				
Public	No	No	No	Potential: Trespassers only	Potential: Trespassers only
Construction/ Trench Workers	No	No	No	Potential: Mitigated by EHMP and PPE	Potential: Mitigated by EHMP and PPE
Site Workers (Landscapers)	No	No	No	Potential: Mitigated by EHMP and PPE	Potential: Mitigated by EHMP and PPE
Ecological Receptors	No	No	No	Potential	Potential

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7.2 Compliance with ARARs

All the alternatives shall meet the requirements of the ARARs (Appendix C) and will use TBC as guidance (EPA RSLs, HDOH EALs). The actions are compatible with standard excavation and/or earth-moving activities and waste disposal in Hawaii. Depending on the chosen alternative, the site work plan will identify methods to prevent, mitigate, and respond to the conservation of cultural and ecological resources ARARs. ARARs evaluation is presented in Appendix C.

7.3 Reduction of Toxicity, Mobility, and Volume through Treatment

The degree to which the remedial alternative reduces toxicity, mobility, and reduction of volume is achieved, including how the treatment is used to address the COC at the site is presented below (Table 7-2). Factors considered, as appropriate, include the following:

- The number of hazardous substances, pollutants, or contaminants that will be destroyed, treated, or recycled;
- The degree of the expected reduction in toxicity, mobility, or volume of the waste due to treatment; and
- The degree to which the treatment is irreversible.

Alternative 6a - On-site isolation and containment would not remove the volume of contamination, but it would reduce the mobility through a robust mesh cap and vegetation. This cap is potentially vulnerable to landslides and rockfall. The toxicity would not be reduced but the potential for landscapers/site workers to encounter it would be reduced as long as the mesh system is in place. Treatment under this alternative may not protect against future seismic or climatic events (e.g., tsunami, flooding, or sea-level rise) Table 7-2).

Alternative 6b - On-site isolation and containment would not remove the volume of contamination, but it would reduce the mobility through a hard cap. This cap is potentially vulnerable to scouring from flooding and sloughing if water gets under the cap. The toxicity would not be reduced but the potential for landscapers/site workers to encounter it would be reduced as long as the cap is not penetrated. Treatment under this alternative may not protect against future seismic or climatic events (e.g., tsunami, flooding, or sea-level rise) Table 7-2).

Alternative 6c – Removal and disposal of all soil which exceeds the HDOH Tier 1 EAL for commercial/industrial land use for lead (800 mg/kg), offers a reduction in toxicity. Mobility will be reduced as the source is removed. The overall volume of lead-impacted soil would be reduced by over 2000 CY.

Alternative 7a: Use of an EHMP and PPE and identifying risks with appropriate decontamination areas for workers on the site will limit direct exposure for site workers. Lead-impacted soil could still runoff to the stream and Pacific Ocean. There is no reduction of contaminant volume under this option. (Table 7- 2). Signage would be installed but fencing would not be installed.

Alternative 7b: Use of an EHMP and PPE and identifying risks with appropriate decontamination areas for workers on the site will limit direct exposure for site workers. Fencing and signage will warn trespassers and will reduce opportunities for pigs, but not birds to be exposed. Lead-impacted soil could still runoff to the stream and Pacific Ocean. There is no reduction of contaminant volume under this option. (Table 7- 2).

Table 7-2: Reduction of Toxicity, Mobility, and Volume through Treatment Comparison

6a. On-site isolation and containment. Tecco Wire Mesh System on areas of soil at 800 mg/kg for lead	**6b.** On-site isolation and containment. Shotcrete Hard Cap on areas of soil at 800 mg/kg exceedances.	**6c.** Removal and disposal of all soil which exceeds 800 mg/kg for lead	**7a.** Institutional Controls: EHMP and PPE used for site workers. Signage, no fencing.	**7b.** Institutional and Engineering Controls: EHMP and PPE used for site workers, Entire ROW fenced, signage installed.
Toxicity: No change under cap - contaminants are still present for construction/site workers if work under the mesh system is needed. Impacts are reduced for maintenance crews, trespassers, and ecological receptors. **Mobility:** Lead impacted soil is limited from reaching the stream/ocean as long as system is present. **Volume:** No reduction in volume of contaminant.	Toxicity: No change under cap - contaminants are still present for construction/ site workers if work under the cap is needed. Impacts are reduced for maintenance crews, trespassers, and ecological receptors. **Mobility:** Lead impacted soil is limited from reaching the stream/ocean as long as the cap is present. **Volume:** No reduction in volume of contaminant.	**Toxicity:** Reduced. **Mobility:** Reduced but lead impacted soil below 800 mg/kg potentially mobile during extensive erosion due to scouring. **Volume:** Reduced – all soil above 800 mg/kg for lead removed	**Toxicity:** No Change - contaminants are still present for ecological receptors, maintenance crews and any potential construction/site workers. **Mobility:** No change - contaminant is potentially mobile through erosion and surface runoff. **Volume:** No reduction in volume of contaminant	**Toxicity:** No Change - contaminants are still present for ecological receptors. PPE is used for maintenance crews and any potential construction/site workers. Public/Trespassers are informed. Some ecological receptors may be limited by fencing. **Mobility:** No change - contaminant is potentially mobile through erosion and surface runoff. **Volume:** No reduction in volume of contaminant

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7.4 Long-Term and Short-Term Effectiveness

Alternative 6a: Offers short-term and long-term effectiveness. Sitework is still needed in terms of grubbing, applying matting and the Tecco stabilizing wire mesh system. Contaminant mobility will be reduced. The mesh will form a barrier to protect ecological receptors and limit runoff to the stream and Pacific Ocean. It will need to be inspected and maintained especially after significant storms and associated flooding. Landscapers and work crews who need to work below the system will need to wear appropriate PPE and follow the site specific EHMP.

Alternative 6b: Offers short-term and long-term effectiveness and potentially more stability than 6a, but can also crack and slough. Sitework is still needed in terms of grubbing, wire mesh base and shotcrete. Contaminant mobility will be reduced further than Alternative 6a. The hard cap will form a barrier to protect ecological receptors and limit runoff to the stream and Pacific Ocean. Like Alternative 6a, the hard cap will need to be maintained to ensure that it is not scoured or breached during torrential rains and associated flooding. Landscapers and work crews who need to work below the cap will need to wear appropriate PPE and follow the site specific EHMP

Alternative 6c: Repairs to the site will take longer and be more complicated due to the logistics of removing is much volume from the base of bridge footings. This alternative has long-term effectiveness. Sitework will include scraping soil and disposing of soil (off-island). There is an option for mirafi /jute matting and hydroseeding.

Site work will take longer than alternative 6a and 6b. Soil disposal costs and soil disposal work will remain high. An EHMP will also be required as lead-impacted soil (less than 800 mg/kg and greater than 200 mg/kg) will remain on-site. The removal of soils with total lead greater than 800 mg/kg will mean that construction/trench workers will not require additional PPE while working on the site. Lead-impacted soil may be present in the upper steep gulch slopes and could migrate to the stream below. However, the site is not used by the public and this alternative is by far the costliest scenario.

Institutional controls Alternative 7a and 7b offer short-term and effectiveness. The lead impacted soil would remain, but this could be managed with an EHMP and PPE for site and construction/trench workers. Ecological receptors will still access the site and be exposed. The site will need to be protected from erosion and washouts. Surface soil may wash into Nanue Stream and the Pacific Ocean. Site work will need to refer to recommendations in the EHMP.

Under Alternative 7b, the site would also be more restricted and warn potential trespassers and the fencing would limit the number of pigs that may cross the site (as long as the fence is maintained). This could offer a longer-term effectiveness than Alternative 7a.

7.5 Implementability

Alternative 6a is implementable using equipment and supplies from Hawaii County or shipped to Hawaii County. This alternative will require excavators, work crews, Tecco wire mesh system, and EHMP document production.

Alternative 6b is implementable using equipment and supplies from Hawaii County or shipped to Hawaii County. This alternative will require excavators, work crews, shotcrete/concrete (from Hawaii County), and EHMP document production.

Alternative 6c is implementable using equipment and supplies from Hawaii County or shipped to Hawaii County. However, this alternative requires at least 136 CY of off-island soil disposal and shipping. This alternative will require excavators, work crews and an EHMP. The steepness of the site will offer logistical challenges and expose workers to lead contaminated dust potentially in excess of normal site work.

Alternatives 7a and 7b will be the easiest and most affordable to implement. This alternative requires an EHMP document, and Alterative 7b adds fencing installation and signage. These alternatives will require the State of Hawaii to maintain an EHMP and conduct periodic inspections. The fencing will need to be maintained in Alternative 7b.

7.6 Estimated Cost

A complete cost table of the alternatives is found in Appendix D. A cost summary is found in Table 7-3. All alternatives are assumed to have the same costs for the planning component including project management, permitting, and public meeting support. This cost is estimated at $103,333 and is included in all alternative costs.

Table 7-3: Cost Comparison

Project Management, Permitting, Public Meeting Support	6a.Soil cover. Install Tecco Mesh System over entire area.	6b. Soil cover. Use wire mesh, soil nails and apply shotcrete slope armor.	6c. Soil Excavation and Off-Site Disposal for lead impacted soil greater than 800 mg/kg for total lead. If lead-impacted soil passes TCLP send to WHSL. If Lead impacted soil > 800 mg/kg fails TCLP, dispose of CONUS.	7a. Institutional Controls: No Action - Institutional Controls. Signage warning of Lead Risk.	7b. Institutional and Engineering Controls- Prepare EHMP and updated every 5 years. Install a fence around all areas under HDOT Right of Way. Fence to include gates. Signage warning of Lead Risk.
Assume all alternatives have a similar amount of planning effort. This cost would be in addition to each of the alternatives evaluated.	EHMP needed. Annual inspections of system. Assume four EHMP updates over 30 years. Clear and Grub and install BMPs. Cover contaminated areas over entire HDOT Right of Way with Tecco system. Coconut matting, soil anchors, and Tecco mesh (aluminum and HDPE mesh fabric). Archeological Consultation and Monitoring (5 weeks)	EHMP needed. Annual inspections of cap. Assume four EHMP updates over 30 years. Clear and Grub and install BMPs. Install soil nails, welded fabric and wire reinforcing tie downs. Cover with shotcrete. Archeological Consultation and Monitoring (5 weeks)	EHMP needed based on confirmation sampling. Annual inspections of stabilization. Assume four EHMP updates over 30 years to accommodate bridge maintenance changes Assume mirafi/geotextile/ jute matting placed over post excavation surface. No replacement fill. Matting will be nailed down with wood stakes. Archeological Consultation and Monitoring (5 weeks)	EHMP Needed. Land Use Controls and perform 5-year inspections. Assume four EHMP updates over 30 years to accommodate maintenance changes (Pre-construction EHMPs).	EHMP needed Assume LUC inspections every year, with brush removal along fence and periodic maintenance. Two weeks of clearing using a four-man crew. Assume four EHMP updates over 30 years to accommodate bridge maintenance changes (Pre-construction EHMPs).
$103,333	$7,328,238	$10,759,994	$7,956,089	$172,441	$666,983

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8 Preferred Alternative

The four remedial alternatives are compared to the nine evaluation criteria previously in Section 7 presented qualitatively in a summary comparison in Table 8-1.

Table 8-1: Evaluation of Cleanup Alternatives: Nanue Bridge RAA

	6a. On-site isolation and containment. Tecco Mesh	6b. On-site isolation and containment. Shotcrete	6c. Removal of all soil that exceeds 800 mg/kg.	7a. Institutional and Engineering Controls: EHMP, no fencing	7b. Institutional and Engineering Controls: EHMP, fencing
1. Overall protection of human health and the environment.	H	H	H	L	L
2. Compliance with applicable or relevant and appropriate requirements.	M	M	H	M	M
3. Long-term effectiveness and permanence	M	M	H	M	M
4. Reduction of toxicity, mobility, or volume through treatment.	M	M	H	L	L
5. Short-term effectiveness	H	H	L	H	H
6. Implementability	M	M	L	H	H
7. Cost.	L	L	L	H	H
8. State regulator acceptance.	H	H	H	H	H
9. Community acceptance.	H	H	H	M	M
L satisfies the criteria to a low degree or does not satisfy in a timely manner					
M satisfies the criteria to a moderate degree in a timely manner					
H satisfies the criteria to high degree in a timely manner					

Alternative 6a and 6b fully satisfies 4 out of 9 of the evaluation criteria to a high degree.

Alternatives 6c fully satisfies 6 of 9 evaluation criteria to a high degree, however the challenges and cost to implement would results in a much longer time to execute this plan and would also expose additional site remediation workers to lead-impacted dirt during site work. Concerns about slope stability are not completely addressed and would require further analysis.

Alternative 7a and 7b, Institutional and Engineering controls with an EHMP would be effective in the short term, straightforward to implement and affordable. Alternative 7a and 7b fully satisfies 4 out of 9 of the evaluation criteria to a high degree.

The site is not used by the public, only site workers, occasional trespassers, and some ecological receptors (pigs primarily). The plan would receive state and community acceptance, but it does not address overall protection to the environment, long-term effectiveness and permanence, or the reduction of toxicity, mobility, or volume through treatment.

Alternative 6c has a potentially prohibitive price point and would expose site workers to additional lead impacted soil while performing remediation work, potentially in excess of normal maintenance and work. Soil removal would require hand digging. This is ranked lower relative to alternative 6a and 6b at satisfying the other evaluation criteria.

Alternatives 7a and 7b are by far the most cost-effective and expedient to implement. Bridge repair workers that would potentially be exposed to lead impacted soil on-site during repairs would have appropriate PPE and site-specific training due to the EHMP. Alternative 7a and 7b would not remove the source of lead-impacted soil but leaving it place would minimize disturbance to the soil reducing the potential of any further exposure or release to the environment.

Alternative 7a: administrative controls; EHMP; and signage; has been selected as the preferred remedial alternative for addressing the risks posed by the lead-impacted below Nanue Bridge.

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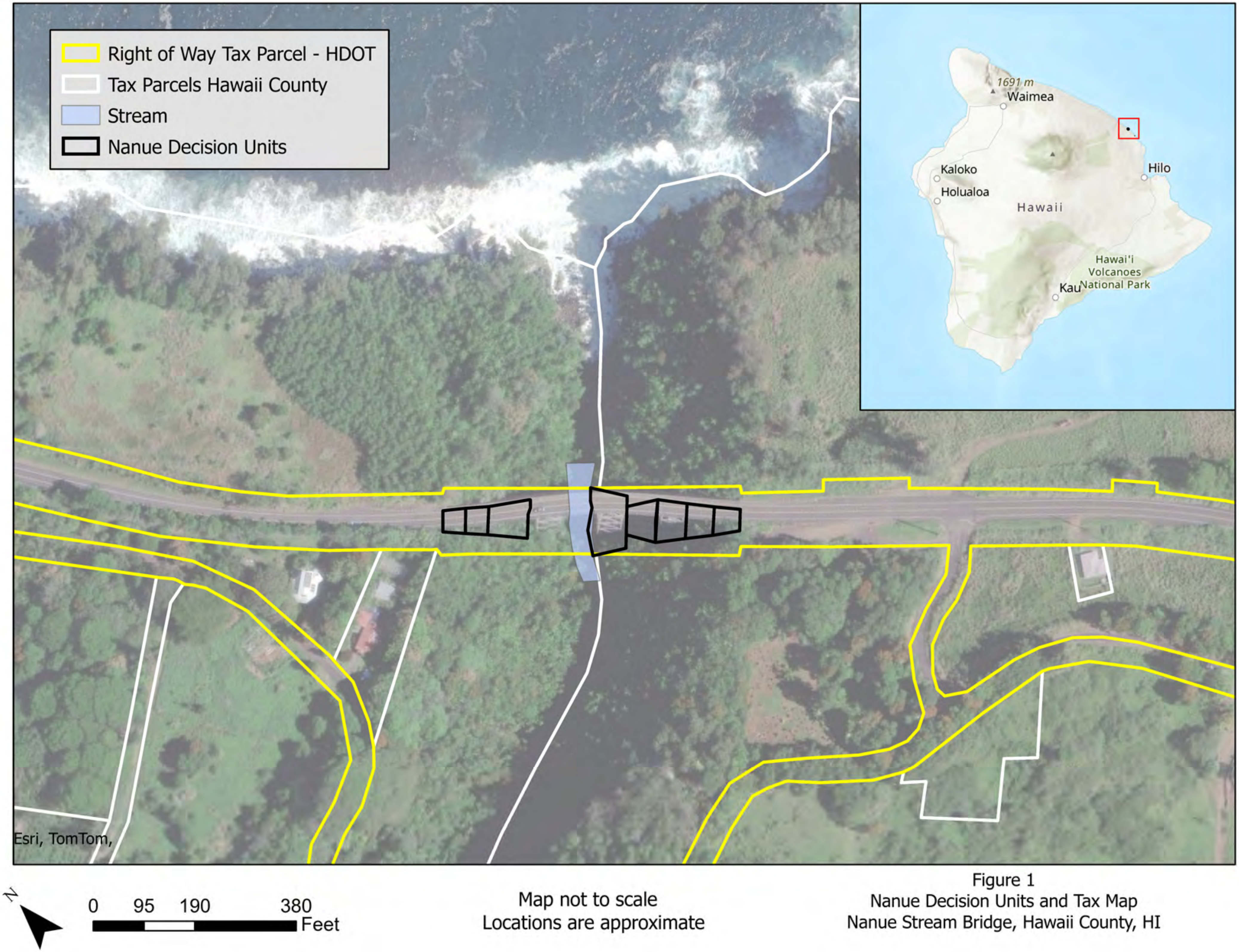
FIGURES



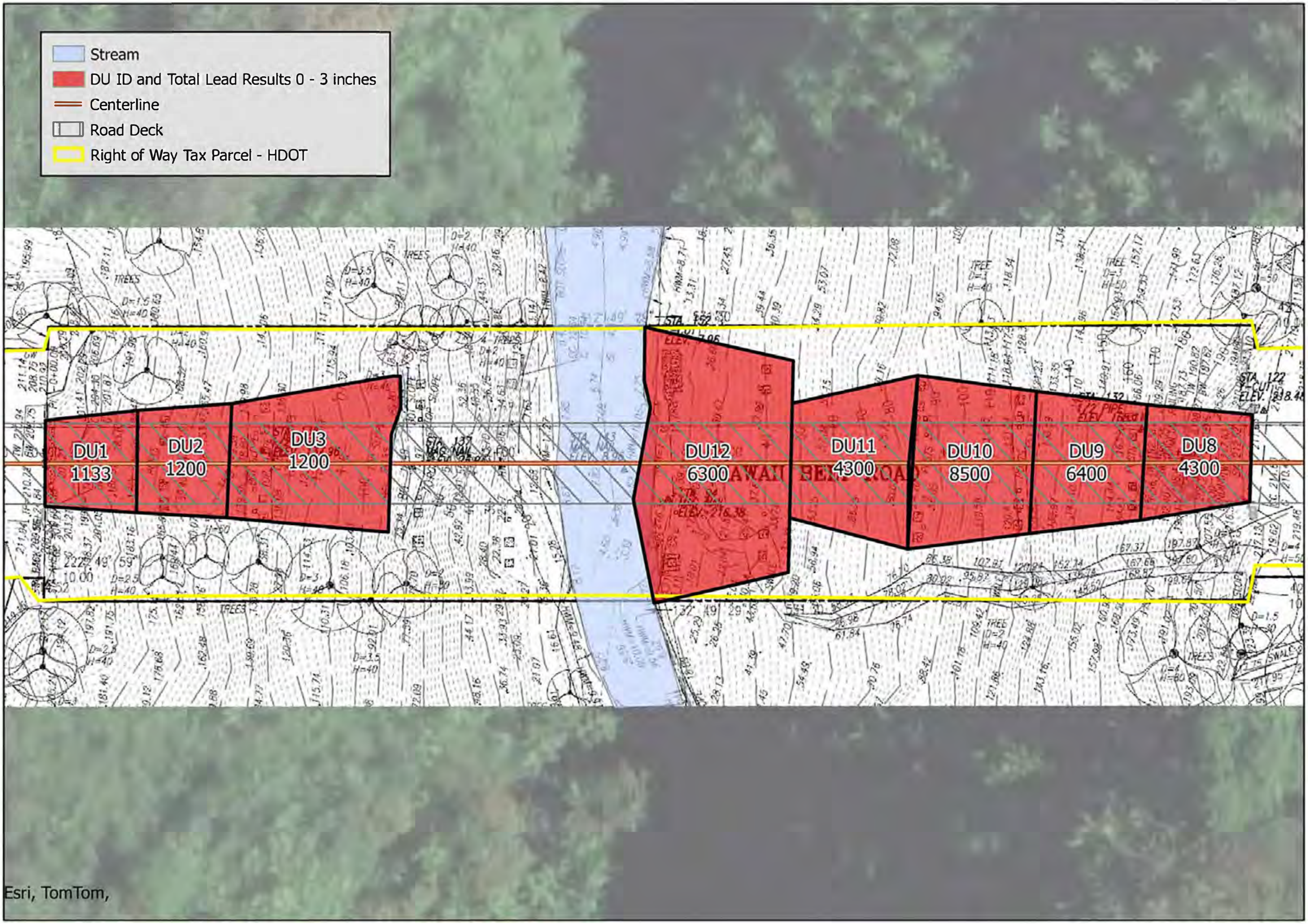
Map not to scale
Locations are approximate

Figure 1
Nanue Decision Units and Tax Map
Nanue Stream Bridge, Hawaii County, HI

bgs: below ground surface
HDOT: Hawaii Dept. of Transportation
mg/kg: milligram/kilogram

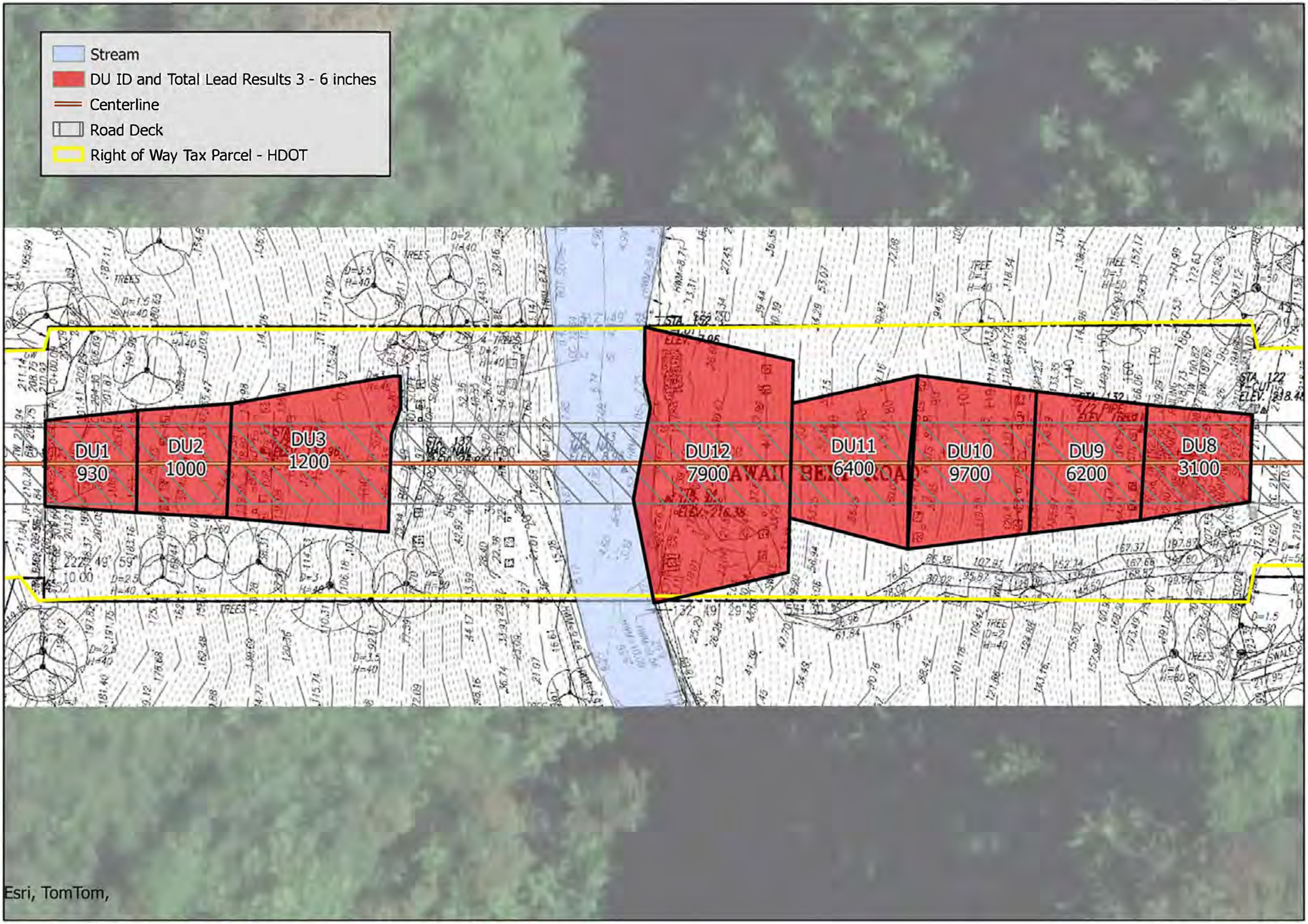
Map not to scale
Locations are approximate

Figure 2
Planned and Sampled DUs
Nanue Stream Bridge, Hawaii County, HI



Map not to scale
Locations are approximate

Figure 3a
Total Lead Results 0 - 3 Inches bgs
Nanue Stream Bridge, Hawaii County, HI



N

0 25 50 100
Feet

Map not to scale
Locations are approximate

Figure 3b
Total Lead Results 3 - 6 Inches bgs
Nanue Stream Bridge, Hawaii County, HI

Map not to scale
Locations are approximate

Figure 3c
Total Lead Results 6 - 9 inches bgs
Nanue Stream Bridge, Hawaii County, HI

DU2, DU3, DU10, DU11, and DU12 did not have any arsenic results above 24 mg/kg

	DU1
inches bgs	Total As mg/kg
0 to 3	26
3 to 6	23
6 to 9	17

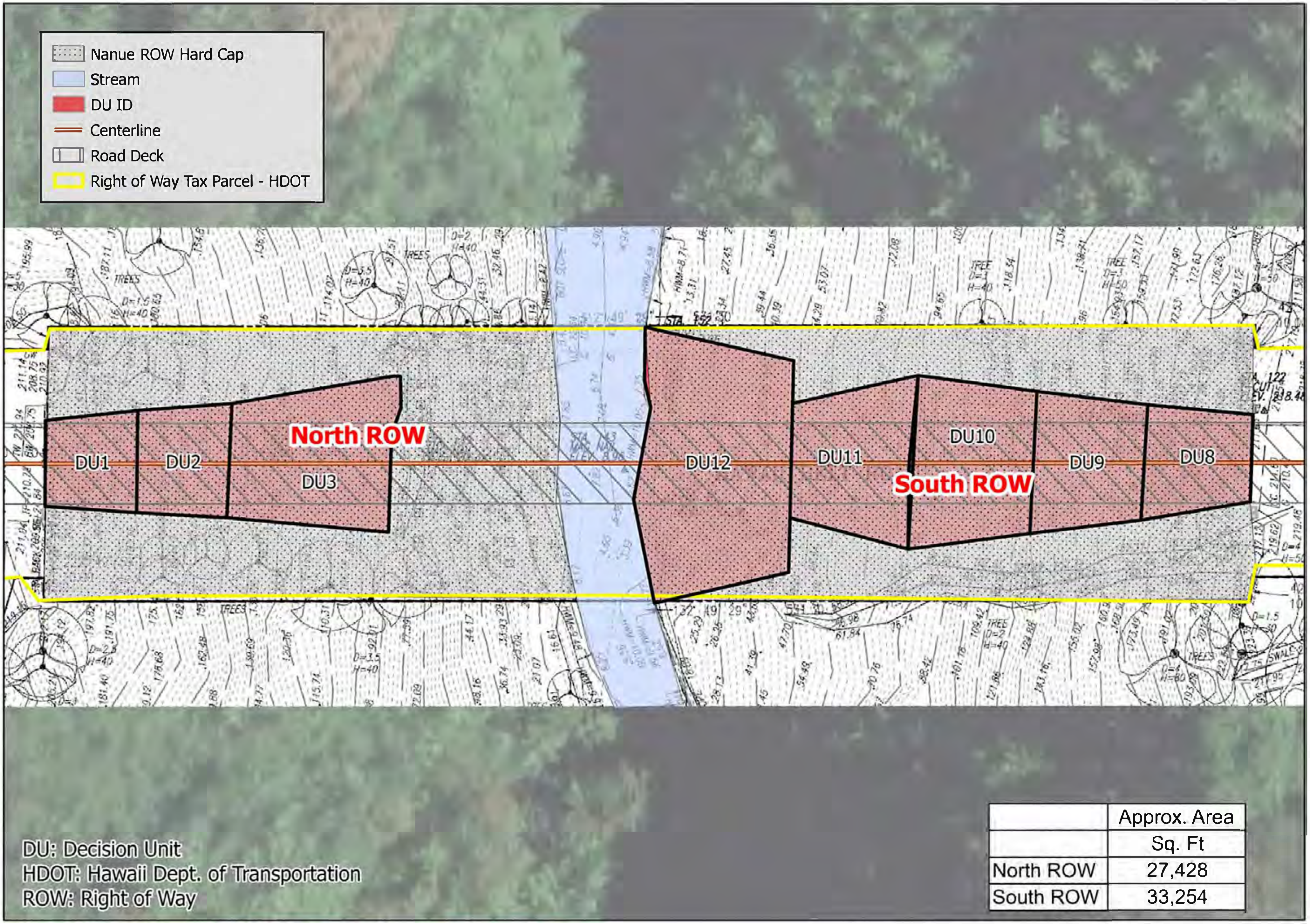
	DU9
inches bgs	Total As mg/kg
0 to 3	24
3 to 6	25
6 to 9	24

	DU8
inches bgs	Total As mg/kg
0 to 3	20
3 to 6	20
6 to 9	32

bgs: below ground surface
HDOT: Hawaii Dept. of Transportation
mg/kg: milligram/kilogram

Map not to scale
Locations are approximate

Figure 4
Total Arsenic Results 0 to 9 inches bgs
Nanue Stream Bridge, Hawaii County, HI

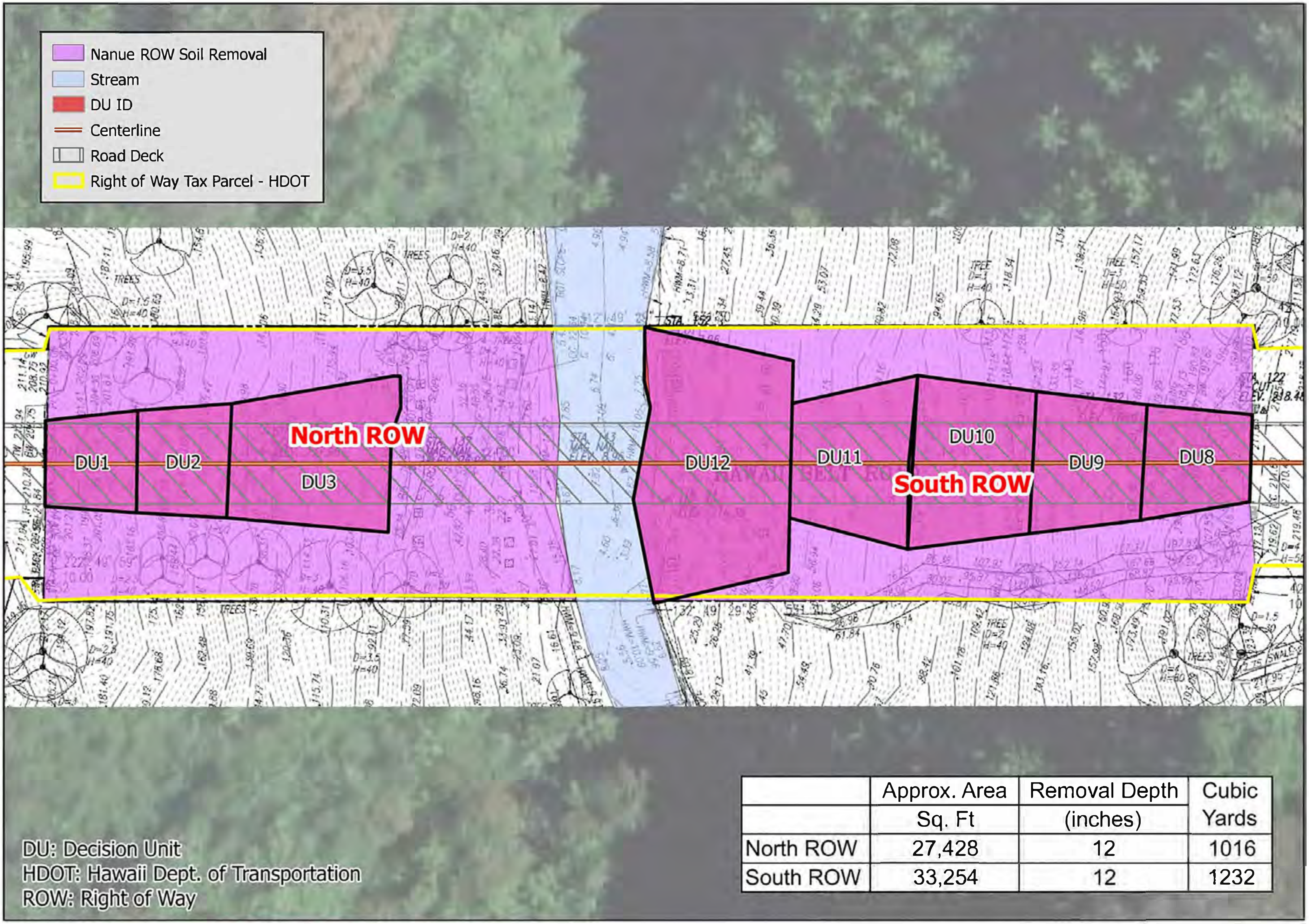


	Approx. Area
	Sq. Ft
North ROW	27,428
South ROW	33,254

DU: Decision Unit
HDOT: Hawaii Dept. of Transportation
ROW: Right of Way

Map not to scale
Locations are approximate

Figure 5
ROW Hard Cap Remedial Action
Nanue Stream Bridge, Hawaii County, HI



	Approx. Area Sq. Ft	Removal Depth (inches)	Cubic Yards
North ROW	27,428	12	1016
South ROW	33,254	12	1232

DU: Decision Unit
HDOT: Hawaii Dept. of Transportation
ROW: Right of Way

Map not to scale
Locations are approximate

Figure 6
ROW Soil Removal Remedial Action
Nanue Stream Bridge, Hawaii County, HI

	Approx. Area	Perimeter
	Sq. Ft	Feet
North ROW	27,428	704
South ROW	33,254	783

DU: Decision Unit
HDOT: Hawaii Dept. of Transportation
ROW: Right of Way

Map not to scale
Locations are approximate

Figure 7
ROW Fencing
Nanue Stream Bridge, Hawaii County, HI

APPENDIX A-1:

2024 SAMPLING RESULTS SUMMARY TABLES

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Table A-1a: Analytical Soil Profiling Results - Total RCRA Regulated Metals - Nanue Bridge (page 1 of 3)

Sample Identifier								NAN_DU1_0-3			NAN_DU1_3-6			NAN_DU1_6-9			NAN_DU2_0-3		
Sample Date								5-Mar-2024			5-Mar-2024			5-Mar-2024			6-Mar-2024		
Sample Depth (inches bgs)								0-3			3-6			6-9			0-3		
Analyte	Analytical Method	Units	**20 x Regulatory Limits for TCLP Metals+**	**HDOH Tier 1 EALs* (Unrestricted Use)**	**HDOH Tier 1 EALs (Residential Direct-Exposure)1**	**HDOH Tier 1 EALs (Commercial / Industrial Direct-Exposure)2**	**HDOH Tier 1 EALs (Construction Worker Direct-Exposure)3**	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL
Resource Conservation and Recovery Act (RCRA) Regulated Metals																			
Arsenic	EPA 6020B	mg/kg	**100**	**24**	**23**	**95**	**110**	**26**		0.47	**23**		0.49	**17**		0.48	**14**		0.47
Barium	EPA 6020B	mg/kg	**2000**	**1,000**	**3,100**	**4,300**	**4,300**	**263**		0.95	**287**		0.98	**307**		0.96	**200**		0.95
Cadmium	EPA 6020B	mg/kg	**20**	**14**	**14**	**72**	**72**	0.39	J	0.76	0.39	J	0.78	0.34	J	0.77	0.41	J	0.76
Chromium	EPA 6020B	mg/kg	**100**	**1,100**	**NS**	**NS**	**NS**	**190**		0.95	**190**		0.98	**187**		0.96	**180**		0.95
Lead	EPA 6020B	mg/kg	**100**	**200**	**200**	**800**	**800**	**1,133**		0.47	**840**		0.49	**577**		0.48	**1,200**		0.47
Mercury	EPA 7471A	mg/kg	**4**	**4.7**	**4.7**	**61**	**130**	**0.14**		0.020	**0.15**		0.021	**0.14**		0.021	**0.15**		0.022
Selenium	EPA 6020B	mg/kg	**20**	**78**	**78**	**1,000**	**2,200**	**7.7**		1.4	**8.9**		1.5	**9.4**		1.4	**8.3**		1.4
Silver	EPA 6020B	mg/kg	**100**	**78**	**78**	**1,000**	**2,200**	0.059	J	0.19	0.053	J	0.20	0.044	J	0.19	0.077	J	0.19

Sample Identifier								NAN_DU2_3-6			NAN_DU2_6-9			NAN_DU3_0-3			NAN_DU3_3-6		
Sample Date								6-Mar-2024			6-Mar-2024			6-Mar-2024			6-Mar-2024		
Sample Depth (feet bgs)								3-6			6-9			0-3			3-6		
Analyte	Analytical Method	Units	**20 x Regulatory Limits for TCLP Metals+**	**HDOH Tier 1 EALs* (Unrestricted Use)**	**HDOH Tier 1 EALs (Residential Direct-Exposure)1**	**HDOH Tier 1 EALs (Commercial / Industrial Direct-Exposure)2**	**HDOH Tier 1 EALs (Construction Worker Direct-Exposure)3**	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL
Resource Conservation and Recovery Act (RCRA) Regulated Metals																			
Arsenic	EPA 6020B	mg/kg	**100**	**24**	**23**	**95**	**110**	**12**		0.48	**14**		0.47	**13**		0.46	**15**		0.47
Barium	EPA 6020B	mg/kg	**2000**	**1,000**	**3,100**	**4,300**	**4,300**	**190**		0.95	**210**		0.95	**130**	J1	0.92	**140**		0.95
Cadmium	EPA 6020B	mg/kg	**20**	**14**	**14**	**72**	**72**	0.37	J	0.76	0.40	J	0.76	0.30	J	0.74	0.33	J	0.76
Chromium	EPA 6020B	mg/kg	**100**	**1,100**	**NS**	**NS**	**NS**	**170**		0.95	**190**		0.95	**130**	J1	0.92	**140**		0.95
Lead	EPA 6020B	mg/kg	**100**	**200**	**200**	**800**	**800**	**1,000**		0.48	**1,400**		0.47	**1,200**	J1	0.46	**1,200**		0.47
Mercury	EPA 7471A	mg/kg	**4**	**4.7**	**4.7**	**61**	**130**	**0.15**		0.021	**0.18**		0.020	**0.15**		0.024	**0.16**		0.022
Selenium	EPA 6020B	mg/kg	**20**	**78**	**78**	**1,000**	**2,200**	**7.8**		1.4	**9.2**		1.4	**6.6**		1.4	**6.8**		1.4
Silver	EPA 6020B	mg/kg	**100**	**78**	**78**	**1,000**	**2,200**	0.060	J	0.19	0.054	J	0.19	0.047	J	0.18	0.048	J	0.19

Notes:

+ If the total concentration of a RCRA metal exceeds 20 times the RCRA regulated toxicity characteristic concentrations then TCLP analysis is required for acceptance at a RCRA regulated waste disposal facility.

** This value represents the result of the Relative Percent Difference replicate comparison result (see Table 2-1a).

1 State of Hawaii Department of Health Tier I EALs, Residential Land-Use Scenario presented in Table I-1 of the Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2017 Edition).

2 State of Hawaii Department of Health Tier I EALs, Commercial / Industrial Land-Use Scenario presented in Table I-2 of the Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2017 Edition).

3 State of Hawaii Department of Health Tier I EALs, Construction/Trench Worker Exposure Scenario presented in Table I-3 of the Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2017 Edition).

bgs = below ground surface

mg/kg = milligram(s) per kilogram

RL = reporting limit

Q = qualifier

J = The analyte was positively identified; the quantitation is an estimation

J1 = The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria

Table A-1a: Analytical Soil Profiling Results - Total RCRA Regulated Metals - Nanue Bridge (page 2 of 3)

							Sample Identifier	NAN_DU3_6-9			NAN_DU8_0-3			NAN_DU8_3-6			NAN_DU8_6-9		
							Sample Date	6-Mar-2024			3-Mar-2024			3-Mar-2024			3-Mar-2024		
							Sample Depth (inches bgs)	6-9			0-3			3-6			6-9		
Analyte	Analytical Method	Units	**20 x Regulatory Limits for TCLP Metals+**	**HDOH Tier 1 EALs* (Unrestricted Use)**	**HDOH Tier 1 EALs (Residential Direct-Exposure)1**	**HDOH Tier 1 EALs (Commercial / Industrial Direct-Exposure)2**	**HDOH Tier 1 EALs (Construction Worker Direct-Exposure)3**	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL
Resource Conservation and Recovery Act (RCRA) Regulated Metals																			
Arsenic	EPA 6020B	mg/kg	**100**	**24**	**23**	**95**	**110**	**14**		0.48	**20**		0.47	**20**		0.48	**32**		0.47
Barium	EPA 6020B	mg/kg	**2000**	**1,000**	**3,100**	**4,300**	**4,300**	**140**		0.96	**150**		0.95	**200**		0.95	**180**		0.95
Cadmium	EPA 6020B	mg/kg	**20**	**14**	**14**	**72**	**72**	0.28	J	0.77	0.56	J	0.76	0.62	J	0.76	0.66	J	0.76
Chromium	EPA 6020B	mg/kg	**100**	**1,100**	**NS**	**NS**	**NS**	**130**		0.96	**170**		0.95	**180**		0.95	**180**		0.95
Lead	EPA 6020B	mg/kg	**100**	**200**	**200**	**800**	**800**	**1,500**		0.48	**4,300**		0.47	**3,100**		0.48	**2,900**		0.47
Mercury	EPA 7471A	mg/kg	**4**	**4.7**	**4.7**	**61**	**130**	**0.16**		0.022	**0.31**		0.022	**0.30**		0.021	**0.34**		0.020
Selenium	EPA 6020B	mg/kg	**20**	**78**	**78**	**1,000**	**2,200**	**7.3**		1.4	**5.8**		1.4	**6.8**		1.4	**7.1**		1.4
Silver	EPA 6020B	mg/kg	**100**	**78**	**78**	**1,000**	**2,200**	0.053	J	0.19	0.088	J	0.19	0.072	J	0.19	0.073	J	0.19

							Sample Identifier	NAN_DU9_0-3			NAN_DU9_3-6			NAN_DU9_6-9			NAN_DU10_0-3		
							Sample Date	9-Mar-2024			9-Mar-2024			9-Mar-2024			9-Mar-2024		
							Sample Depth (feet bgs)	0-3			3-6			6-9			0-3		
Analyte	Analytical Method	Units	**20 x Regulatory Limits for TCLP Metals+**	**HDOH Tier 1 EALs* (Unrestricted Use)**	**HDOH Tier 1 EALs (Residential Direct-Exposure)1**	**HDOH Tier 1 EALs (Commercial / Industrial Direct-Exposure)2**	**HDOH Tier 1 EALs (Construction Worker Direct-Exposure)3**	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL
Resource Conservation and Recovery Act (RCRA) Regulated Metals																			
Arsenic	EPA 6020B	mg/kg	**100**	**24**	**23**	**95**	**110**	**24**		0.48	**25**		0.48	**24**		0.48	**9.6**		0.46
Barium	EPA 6020B	mg/kg	**2000**	**1,000**	**3,100**	**4,300**	**4,300**	**100**		0.96	**110**		0.96	**110**		0.95	**120**	J1	0.92
Cadmium	EPA 6020B	mg/kg	**20**	**14**	**14**	**72**	**72**	0.67	J	0.77	0.67	J	0.77	0.59	J	0.76	0.4	J	0.74
Chromium	EPA 6020B	mg/kg	**100**	**1,100**	**NS**	**NS**	**NS**	**160**		0.96	**190**		0.96	**180**		0.95	**150**	J1	0.92
Lead	EPA 6020B	mg/kg	**100**	**200**	**200**	**800**	**800**	**6,400**		48	**6,200**		48	**6,000**		48	**8,500**	J1	46
Mercury	EPA 7471A	mg/kg	**4**	**4.7**	**4.7**	**61**	**130**	**0.28**		0.024	**0.26**		0.027	**0.26**		0.026	**0.12**		0.023
Selenium	EPA 6020B	mg/kg	**20**	**78**	**78**	**1,000**	**2,200**	**4.9**		1.4	**5.1**		1.4	**6.7**		1.4	**5.8**		1.4
Silver	EPA 6020B	mg/kg	**100**	**78**	**78**	**1,000**	**2,200**	0.085	J	0.19	0.089	J	0.19	0.095	J	0.19	0.088	J	0.18

Notes:

+ If the total concentration of a RCRA metal exceeds 20 times the RCRA regulated toxicity characteristic concentrations then TCLP analysis is required for acceptance at a RCRA regulated waste disposal facility.

** This value represents the result of the Relative Percent Difference replicate comparison result (see Table 2-1a).

1 State of Hawaii Department of Health Tier I EALs, Residential Land-Use Scenario presented in Table I-1 of the Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2017 Edition).

2 State of Hawaii Department of Health Tier I EALs, Commercial / Industrial Land-Use Scenario presented in Table I-2 of the Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2017 Edition).

3 State of Hawaii Department of Health Tier I EALs, Construction/Trench Worker Exposure Scenario presented in Table I-3 of the Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2017 Edition).

bgs = below ground surface

mg/kg = milligram(s) per kilogram

RL = reporting limit

Q = qualifier

J = The analyte was positively identified; the quantitation is an estimation

J1 = The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria

Table A-1a: Analytical Soil Profiling Results - Total RCRA Regulated Metals - Nanue Bridge (page 3 of 3)

							Sample Identifier **Sample Date** **Sample Depth (inches bgs)**	NAN_DU10_3-6 9-Mar-2024 3-6			NAN_DU10_6-9 9-Mar-2024 6-9			NAN_DU11_0-3 10-Mar-2024 0-3			NAN_DU11_3-6 10-Mar-2024 3-6		
Analyte	Analytical Method	Units	**20 x Regulatory Limits for TCLP Metals+**	**HDOH Tier 1 EALs* (Unrestricted Use)**	**HDOH Tier 1 EALs (Residential Direct-Exposure)1**	**HDOH Tier 1 EALs (Commercial / Industrial Direct-Exposure)2**	**HDOH Tier 1 EALs (Construction Worker Direct-Exposure)3**	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL
Resource Conservation and Recovery Act (RCRA) Regulated Metals																			
Arsenic	EPA 6020B	mg/kg	**100**	**24**	**23**	**95**	**110**	**8.7**		0.47	**7.9**		0.47	**11**		0.47	**10.0**		0.48
Barium	EPA 6020B	mg/kg	**2000**	**1,000**	**3,100**	**4,300**	**4,300**	**130**		0.95	**160**		0.94	**110**		0.95	**100**		0.95
Cadmium	EPA 6020B	mg/kg	**20**	**14**	**14**	**72**	**72**	0.39	J	0.76	0.35	J	0.76	0.37	J	0.76	0.40	J	0.76
Chromium	EPA 6020B	mg/kg	**100**	**1,100**	**NS**	**NS**	**NS**	**160**		0.95	**170**		0.94	**130**		0.95	**150**		0.95
Lead	EPA 6020B	mg/kg	**100**	**200**	**200**	**800**	**800**	**9,700**		47	**8,100**		47	**4,300**		47	**6,400**		48
Mercury	EPA 7471A	mg/kg	**4**	**4.7**	**4.7**	**61**	**130**	**0.16**		0.007	**0.13**		0.024	**0.10**		0.025	**0.12**		0.027
Selenium	EPA 6020B	mg/kg	**20**	**78**	**78**	**1,000**	**2,200**	**6.9**		1.4	**7.8**		1.4	**4.8**		1.4	**6.2**		1.4
Silver	EPA 6020B	mg/kg	**100**	**78**	**78**	**1,000**	**2,200**	0.10	J	0.19	0.078	J	0.19	0.081	J	0.19	0.086	J	0.19

							Sample Identifier **Sample Date** **Sample Depth (feet bgs)**	NAN_DU11_6-9 10-Mar-2024 6-9			NAN_DU12_0-3 10-Mar-2024 0-3			NAN_DU12_3-6 10-Mar-2024 3-6			NAN_DU12_6-9 10-Mar-2024 6-9		
Analyte	Analytical Method	Units	**20 x Regulatory Limits for TCLP Metals+**	**HDOH Tier 1 EALs* (Unrestricted Use)**	**HDOH Tier 1 EALs (Residential Direct-Exposure)1**	**HDOH Tier 1 EALs (Commercial / Industrial Direct-Exposure)2**	**HDOH Tier 1 EALs (Construction Worker Direct-Exposure)3**	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL
Resource Conservation and Recovery Act (RCRA) Regulated Metals																			
Arsenic	EPA 6020B	mg/kg	**100**	**24**	**23**	**95**	**110**	**8.7**		0.46	**16**		0.46	**11**		0.46	**10**		0.47
Barium	EPA 6020B	mg/kg	**2000**	**1,000**	**3,100**	**4,300**	**4,300**	**110**		0.92	**79**		0.92	**50**		0.92	**69**		0.94
Cadmium	EPA 6020B	mg/kg	**20**	**14**	**14**	**72**	**72**	0.39	J	0.74	0.4	J	0.74	0.29	J	0.74	0.30	J	0.75
Chromium	EPA 6020B	mg/kg	**100**	**1,100**	**NS**	**NS**	**NS**	**150**		0.92	**130**		0.92	**87**		0.92	**90**		0.94
Lead	EPA 6020B	mg/kg	**100**	**200**	**200**	**800**	**800**	**6,000**		0.46	**6,300**		0.46	**7,900**		0.46	**6,500**		0.47
Mercury	EPA 7471A	mg/kg	**4**	**4.7**	**4.7**	**61**	**130**	**0.16**		0.025	**0.09**		0.023	**0.12**		0.022	**0.12**		0.023
Selenium	EPA 6020B	mg/kg	**20**	**78**	**78**	**1,000**	**2,200**	**6.3**		1.4	**2.8**		1.4	**3.4**		1.4	**3.6**		1.4
Silver	EPA 6020B	mg/kg	**100**	**78**	**78**	**1,000**	**2,200**	0.083	J	0.18	0.088	J	0.18	0.086	J	0.18	0.068		0.19

Notes:

+ If the total concentration of a RCRA metal exceeds 20 times the RCRA regulated toxicity characteristic concentrations then TCLP analysis is required for acceptance at a RCRA regulated waste disposal facility.

** This value represents the result of the Relative Percent Difference replicate comparison result (see Table 2-1a).

1 State of Hawaii Department of Health Tier I EALs, Residential Land-Use Scenario presented in Table I-1 of the Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2017 Edition).

2 State of Hawaii Department of Health Tier I EALs, Commercial / Industrial Land-Use Scenario presented in Table I-2 of the Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2017 Edition).

3 State of Hawaii Department of Health Tier I EALs, Construction/Trench Worker Exposure Scenario presented in Table I-3 of the Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2017 Edition).

bgs = below ground surface

mg/kg = milligram(s) per kilogram

RL = reporting limit

Q = qualifier

J = The analyte was positively identified; the quantitation is an estimation

J1 = The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria

Table A-1b: Replicate Sample Results Comparison - Total RCRA Regulated Metals - Nanue Bridge (page 1 of 3)

Analyte	EPA Method	Sample Identification	Sample Type	Result (mg/kg)	Relative Percent Difference		Mean	Standard Deviation*	Relative Standard Deviation	Comment
					Primary and Duplicate	Primary and Triplicate				
Arsenic	EPA 6020B	NAN_DU1_0-3_A	Primary	28	0%	24%	26.0	3.5	13%	RSD is less than 50% so the mean concentration is used as the reported concentration. The result is less than 20 x regulatory limits for TCLP metals, but above HDOH Tier 1 EAL.
		NAN_DU1_0-3_B	Duplicate	28						
		NAN_DU1_0-3_C	Triplicate	22						
Barium	EPA 6020B	NAN_DU1_0-3_A	Primary	260	4%	7%	263.3	15.3	6%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_0-3_B	Duplicate	250						
		NAN_DU1_0-3_C	Triplicate	280						
Cadmium	EPA 6020B	NAN_DU1_0-3_A	Primary	0.37	13%	3%	0.390	0.026	7%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_0-3_B	Duplicate	0.42						
		NAN_DU1_0-3_C	Triplicate	0.38						
Chromium	EPA 6020B	NAN_DU1_0-3_A	Primary	180	5%	11%	190	10.0	5%	RSD is less than 50% so the mean concentration is used as the reported concentration. The result is above 20 x regulatory limits for TCLP metals. Mean concentration is below HDOH Tier 1 EAL.
		NAN_DU1_0-3_B	Duplicate	190						
		NAN_DU1_0-3_C	Triplicate	200						
Lead	EPA 6020B	NAN_DU1_0-3_A	Primary	1100	9%	0%	1,133	57.7	5%	RSD is less than 50% so the mean concentration is used as the reported concentration. The result is above 20 x regulatory limits for TCLP metal and above HDOH Tier 1 EAL.
		NAN_DU1_0-3_B	Duplicate	1200						
		NAN_DU1_0-3_C	Triplicate	1100						
Mercury	EPA 7471A	NAN_DU1_0-3_A	Primary	0.15	14%	0%	0.143	0.012	8%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_0-3_B	Duplicate	0.13						
		NAN_DU1_0-3_C	Triplicate	0.15						
Selenium	EPA 6020B	NAN_DU1_0-3_A	Primary	8.1	8%	9%	7.67	0.38	5%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_0-3_B	Duplicate	7.5						
		NAN_DU1_0-3_C	Triplicate	7.4						
Silver	EPA 6020B	NAN_DU1_0-3_A	Primary	0.064	17%	10%	0.0587	0.0050	9%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_0-3_B	Duplicate	0.054						
		NAN_DU1_0-3_C	Triplicate	0.058						

Notes:
* Standard Deviation: If < 50% use the arithmatic mean, if < 50% then use the max of the replicate group.

🟩	Result below HDOH Tier 1 EAL
🟥	Result above 20 x Regulatory Limits for TCLP Metals

Table A-1b: Replicate Sample Results Comparison - Total RCRA Regulated Metals - Nanue Bridge (page 2 of 3)

Analyte	EPA Method	Sample Identification	Sample Type	Result (mg/kg)	Relative Percent Difference		Mean	Standard Deviation*	Relative Standard Deviation	Comment
					Primary and Duplicate	Primary and Triplicate				
Arsenic	EPA 6020B	NAN_DU1_3-6_A	Primary	24	4%	9%	23.0	1.0	4%	RSD is less than 50% so the mean concentration is used as the reported concentration. The result is less than 20 x regulatory limits for TCLP, but above HDOH Tier 1 EAL.
		NAN_DU1_3-6_B	Duplicate	23						
		NAN_DU1_3-6_C	Triplicate	22						
Barium	EPA 6020B	NAN_DU1_3-6_A	Primary	270	11%	7%	286.7	15.3	5%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_3-6_B	Duplicate	300						
		NAN_DU1_3-6_C	Triplicate	290						
Cadmium	EPA 6020B	NAN_DU1_3-6_A	Primary	0.42	13%	13%	0.387	0.029	7%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_3-6_B	Duplicate	0.37						
		NAN_DU1_3-6_C	Triplicate	0.37						
Chromium	EPA 6020B	NAN_DU1_3-6_A	Primary	190	0%	0%	190	0.0	0%	RSD is less than 50% so the mean concentration is used as the reported concentration. The result is above 20 x regulatory limits for TCLP metals. Mean concentration is below HDOH Tier 1 EAL.
		NAN_DU1_3-6_B	Duplicate	190						
		NAN_DU1_3-6_C	Triplicate	190						
Lead	EPA 6020B	NAN_DU1_3-6_A	Primary	980	2%	14%	930	70.0	8%	RSD is less than 50% so the mean concentration is used as the reported concentration. The result is above 20 x regulatory limits for TCLP metal and above HDOH Tier 1 EAL.
		NAN_DU1_3-6_B	Duplicate	960						
		NAN_DU1_3-6_C	Triplicate	850						
Mercury	EPA 7471A	NAN_DU1_3-6_A	Primary	0.16	0%	21%	0.150	0.017	12%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_3-6_B	Duplicate	0.16						
		NAN_DU1_3-6_C	Triplicate	0.13						
Selenium	EPA 6020B	NAN_DU1_3-6_A	Primary	9.6	11%	12%	8.90	0.61	7%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_3-6_B	Duplicate	8.6						
		NAN_DU1_3-6_C	Triplicate	8.5						
Silver	EPA 6020B	NAN_DU1_3-6_A	Primary	0.057	19%	4%	0.0530	0.0053	10%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_3-6_B	Duplicate	0.047						
		NAN_DU1_3-6_C	Triplicate	0.055						

Notes:
* Standard Deviation: If < 50% use the arithmatic mean, if < 50% then use the max of the replicate group.

🟩	Result below HDOH Tier 1 EAL
🟥	Result above 20 x Regulatory Limits for TCLP Metals

Table A-1b: Replicate Sample Results Comparison - Total RCRA Regulated Metals - Nanue Bridge (page 3 of 3)

Analyte	EPA Method	Sample Identification	Sample Type	Result (mg/kg)	Relative Percent Difference		Mean	Standard Deviation*	Relative Standard Deviation	Comment
					Primary and Duplicate	Primary and Triplicate				
Arsenic	EPA 6020B	NAN_DU1_6-9_A	Primary	17	0%	6%	17.3	0.6	3%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_6-9_B	Duplicate	17						
		NAN_DU1_6-9_C	Triplicate	18						
Barium	EPA 6020B	NAN_DU1_6-9_A	Primary	340	3%	31%	306.7	49.3	16%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_6-9_B	Duplicate	330						
		NAN_DU1_6-9_C	Triplicate	250						
Cadmium	EPA 6020B	NAN_DU1_6-9_A	Primary	0.32	14%	0%	0.337	0.029	9%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_6-9_B	Duplicate	0.37						
		NAN_DU1_6-9_C	Triplicate	0.32						
Chromium	EPA 6020B	NAN_DU1_6-9_A	Primary	190	5%	11%	186.7	15.3	8%	RSD is less than 50% so the mean concentration is used as the reported concentration. The result is above 20 x regulatory limits for TCLP metals. Mean concentration is below HDOH Tier 1 EAL.
		NAN_DU1_6-9_B	Duplicate	200						
		NAN_DU1_6-9_C	Triplicate	170						
Lead	EPA 6020B	NAN_DU1_6-9_A	Primary	640	3%	31%	576.7	92.9	16%	RSD is less than 50% so the mean concentration is used as the reported concentration. The result is above 20 x regulatory limits for TCLP metal and above HDOH Tier 1 EAL.
		NAN_DU1_6-9_B	Duplicate	620						
		NAN_DU1_6-9_C	Triplicate	470						
Mercury	EPA 7471A	NAN_DU1_6-9_A	Primary	0.15	6%	22%	0.143	0.021	15%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_6-9_B	Duplicate	0.16						
		NAN_DU1_6-9_C	Triplicate	0.12						
Selenium	EPA 6020B	NAN_DU1_6-9_A	Primary	10.0	3%	16%	9.40	0.79	8%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_6-9_B	Duplicate	9.7						
		NAN_DU1_6-9_C	Triplicate	8.5						
Silver	EPA 6020B	NAN_DU1_6-9_A	Primary	0.043	13%	5%	0.0443	0.0042	9%	RSD is less than 50% so the mean concentration is used as the reported concentration.The mean concentration is below HDOH Tier 1 EAL and less than 20x regulatory limits for TCLP metals.
		NAN_DU1_6-9_B	Duplicate	0.049						
		NAN_DU1_6-9_C	Triplicate	0.041						

Notes:
* Standard Deviation: If < 50% use the arithmatic mean, if < 50% then use the max of the replicate group.

🟩	Result below HDOH Tier 1 EAL
🟥	Result above 20 x Regulatory Limits for TCLP Metals

Table A-1c: Analytical Soil Profiling Results - Polychlorinated Biphenyls - Nanue Bridge (page 1 of 1)

						Sample Identifier	NAN_DU10_0-3			NAN_DU10_3-6			NAN_DU11_3-6		
						Sample Date	9-Mar-2024			9-Mar-2024			10-Mar-2024		
						Sample Depth (inches bgs)	0-3			3-6			3-6		
Analyte	Analytical Method	Units	**HDOH Tier 1 EALs* (Unrestricted Use)**	**HDOH Tier 1 EALs (Residential Direct-Exposure)1**	**HDOH Tier 1 EALs (Commercial/Industrial Direct-Exposure)2**	**HDOH Tier 1 EALs (Construction Worker Direct-Exposure)3**	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL
Polychlorinated Biphenyls (PCBs)															
PCB-1016	EPA 8082A/3546	mg/kg	**1.2**	**1.2**	**8.6**	**25**	ND	M	0.019	ND		0.019	0.017	M	0.019
PCB-1221	EPA 8082A/3546	mg/kg	**1.2**	**1.2**	**8.6**	**25**	ND		0.019	ND		0.019	0.017		0.019
PCB-1232	EPA 8082A/3546	mg/kg	**1.2**	**1.2**	**8.6**	**25**	ND		0.019	ND		0.019	0.017		0.019
PCB-1242	EPA 8082A/3546	mg/kg	**1.2**	**1.2**	**8.6**	**25**	ND	M	0.019	ND		0.019	0.017	M	0.019
PCB-1248	EPA 8082A/3546	mg/kg	**1.2**	**1.2**	**8.6**	**25**	ND	M	0.019	ND		0.019	0.017	M	0.019
PCB-1254	EPA 8082A/3546	mg/kg	**1.2**	**1.2**	**8.6**	**25**	**0.055**	M	0.019	**0.037**	J1 M	0.019	**0.20**	M	0.019
PCB-1260	EPA 8082A/3546	mg/kg	**1.2**	**1.2**	**8.6**	**25**	ND	J1 M	0.019	ND	M	0.019	0.017	M	0.019

Notes:

* State of Hawaii Department of Health Tier I Environmental Action Levels (EALs), Groundwater is a Current or Potential Source of Drinking Water (<150 meter to surface water body) presented in Table A of the Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2017 Edition).

1 State of Hawaii Department of Health Tier I EALs, Residential Land-Use Scenario presented in Table I-1 of the Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2017 Edition).

2 State of Hawaii Department of Health Tier I EALs, Commercial / Industrial Land-Use Scenario presented in Table I-2 of the Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2017 Edition).

3 State of Hawaii Department of Health Tier I EALs, Construction/Trench Worker Exposure Scenario presented in Table I-3 of the Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2017 Edition).

M = Manual integrated compound.

mg/kg = milligram(s) per kilogram

ND = not detected in concentrations above the laboratories method reporting limit

RL = reporting limit

Q = qualifier

J1 = The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria

bgs = below ground surface

APPENDIX A-2:

2024 LABORATORY ANALYTICAL REPORTS

J137730-1: RCRA8 Metals and PCBs

J137730-1: Revision 1 TCLP and SPLP

Environment Testing

ANALYTICAL REPORT

PREPARED FOR

Attn: Scott Moncrief
EnviroQuest, Inc.
98-029 Hekaha Street
Suite 21
Aiea, Hawaii 96701

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JOB DESCRIPTION

Nanue Bridge

JOB NUMBER

580-137730-1

Eurofins Seattle
5755 8th Street East
Tacoma WA 98424

See page two for job notes and contact information.

Eurofins Seattle

Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing Northwest, LLC Project Manager.

Authorization

Tracy Dutton

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Authorized for release by
Tracy Dutton, Client Relations Manager
Tracy.Dutton@et.eurofinsus.com
(253)248-4970

Table of Contents

Case Narrative

Client: EnviroQuest, Inc.
Project: Nanue Bridge

Job ID: 580-137730-1

Job ID: 580-137730-1 Eurofins Seattle

Job Narrative
580-137730-1

Analytical test results meet all requirements of the associated regulatory program listed on the Accreditation/Certification Summary Page unless otherwise noted under the individual analysis. Data qualifiers are applied to indicate exceptions. Noncompliant quality control (QC) is further explained in narrative comments.

- Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD may be performed, unless otherwise specified in the method.
- Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.

Receipt
The samples were received on 3/14/2024 9:30 AM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperatures of the 2 coolers at receipt time were 13.2°C and 13.3°C.

Note: All samples which require thermal preservation are considered acceptable if the arrival temperature is within 2C of the required temperature or method specified range. For samples with a specified temperature of 4C, samples with a temperature ranging from just above freezing temperature of water to 6C shall be acceptable. Samples that are hand delivered immediately following collection may not meet these criteria, however they will be deemed acceptable according to NELAC standards, if there is evidence that the chilling process has begun, such as arrival on ice, etc.

Receipt Exceptions
All samples contained in this login were delayed in shipment by Federal Express.

Method 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography
Samples NAN_DU10_0-3 (580-137730-22), NAN_DU10_3-6 (580-137730-23) and NAN_DU11_3-6 (580-137730-26) were analyzed for Polychlorinated Biphenyls (PCBs) by Gas Chromatography. The samples were composited on 3/18/2024, prepared on 3/20/2024 and analyzed on 4/1/2024.

The matrix spike / matrix spike duplicate (MS/MSD) recoveries for preparation batch 580-454054 and 580-454340 and analytical batch 580-455366 were outside control limits for one or more analytes. See QC Sample Results for detail. Sample matrix interference and/or non-homogeneity are suspected because the associated laboratory control sample (LCS) recovery is within acceptance limits.

The %RPD between the primary and confirmation column exceeded 40% for PCB-1254 for the following sample: NAN_DU10_3-6 (580-137730-23). The lower value(s) has been reported and qualified in accordance with the laboratory's SOP.

The following samples required a TBA clean-up to reduce matrix interferences caused by sulfur TBA_00037:
NAN_DU10_0-3 (580-137730-22), NAN_DU10_3-6 (580-137730-23), NAN_DU11_3-6 (580-137730-26), (LCS 580-454340/2-A), (LCSD 580-454340/3-A), (MB 580-454340/1-A), (580-137730-A-22-D MS) and (580-137730-A-22-E MSD)
.

Method 6020B - Metals (ICP/MS)
Samples NAN_DU8_0-3 (580-137730-1), NAN_DU8_3-6 (580-137730-2), NAN_DU8_6-9 (580-137730-3), NAN_DU1_0-3_A (580-137730-4), NAN_DU1_3-6_A (580-137730-5), NAN_DU1_6-9_A (580-137730-6), NAN_DU1_0-3_B (580-137730-7), NAN_DU1_3-6_B (580-137730-8), NAN_DU1_6-9_B (580-137730-9), NAN_DU1_0-3_C (580-137730-10), NAN_DU1_3-6_C (580-137730-11), NAN_DU1_6-9_C (580-137730-12), NAN_DU3_0-3 (580-137730-13), NAN_DU3_3-6 (580-137730-14), NAN_DU3_6-9 (580-137730-15), NAN_DU2_0-3 (580-137730-16), NAN_DU2_3-6 (580-137730-17), NAN_DU2_6-9 (580-137730-18), NAN_DU9_0-3 (580-137730-19), NAN_DU9_3-6 (580-137730-20), NAN_DU9_6-9 (580-137730-21), NAN_DU10_0-3 (580-137730-22), NAN_DU10_3-6 (580-137730-23), NAN_DU10_6-9 (580-137730-24), NAN_DU11_0-3 (580-137730-25), NAN_DU11_3-6 (580-137730-26), NAN_DU11_6-9 (580-137730-27), NAN_DU12_0-3 (580-137730-28), NAN_DU12_3-6 (580-137730-29) and NAN_DU12_6-9 (580-137730-30) were analyzed for Metals (ICP/MS). The samples were composited on 3/18/2024, prepared on 3/28/2024 and 4/1/2024 and analyzed on 3/29/2024, 3/30/2024, 4/1/2024, 4/4/2024 and 4/5/2024.

Samples NAN_DU9_0-3 (580-137730-19)[2000x], NAN_DU9_3-6 (580-137730-20)[2000x], NAN_DU9_6-9 (580-137730-21)[2000x], NAN_DU10_0-3 (580-137730-22)[2000x], NAN_DU10_3-6 (580-137730-23)[2000x], NAN_DU10_6-9

Job ID: 580-137730-1 (Continued)

(580-137730-24)[2000x], NAN_DU11_0-3 (580-137730-25)[2000x], NAN_DU11_3-6 (580-137730-26)[2000x], NAN_DU11_6-9 (580-137730-27)[2000x], NAN_DU12_0-3 (580-137730-28)[2000x], NAN_DU12_3-6 (580-137730-29)[2000x] and NAN_DU12_6-9 (580-137730-30)[2000x] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

Method 7471A - Mercury (CVAA)

Samples NAN_DU8_0-3 (580-137730-1), NAN_DU8_3-6 (580-137730-2), NAN_DU8_6-9 (580-137730-3), NAN_DU1_0-3_A (580-137730-4), NAN_DU1_3-6_A (580-137730-5), NAN_DU1_6-9_A (580-137730-6), NAN_DU1_0-3_B (580-137730-7), NAN_DU1_3-6_B (580-137730-8), NAN_DU1_6-9_B (580-137730-9), NAN_DU1_0-3_C (580-137730-10), NAN_DU1_3-6_C (580-137730-11), NAN_DU1_6-9_C (580-137730-12), NAN_DU3_0-3 (580-137730-13), NAN_DU3_3-6 (580-137730-14), NAN_DU3_6-9 (580-137730-15), NAN_DU2_0-3 (580-137730-16), NAN_DU2_3-6 (580-137730-17), NAN_DU2_6-9 (580-137730-18), NAN_DU9_0-3 (580-137730-19), NAN_DU9_3-6 (580-137730-20), NAN_DU9_6-9 (580-137730-21), NAN_DU10_0-3 (580-137730-22), NAN_DU10_3-6 (580-137730-23), NAN_DU10_6-9 (580-137730-24), NAN_DU11_0-3 (580-137730-25), NAN_DU11_3-6 (580-137730-26), NAN_DU11_6-9 (580-137730-27), NAN_DU12_0-3 (580-137730-28), NAN_DU12_3-6 (580-137730-29) and NAN_DU12_6-9 (580-137730-30) were analyzed for Mercury (CVAA). The samples were composited on 3/18/2024, prepared on 3/25/2024 and 4/2/2024 and analyzed on 3/26/2024 and 4/2/2024.

Method 2540G - SM 2540G

Samples NAN_DU8_0-3 (580-137730-1), NAN_DU8_3-6 (580-137730-2), NAN_DU8_6-9 (580-137730-3), NAN_DU1_0-3_A (580-137730-4), NAN_DU1_3-6_A (580-137730-5), NAN_DU1_6-9_A (580-137730-6), NAN_DU1_0-3_B (580-137730-7), NAN_DU1_3-6_B (580-137730-8), NAN_DU1_6-9_B (580-137730-9), NAN_DU1_0-3_C (580-137730-10), NAN_DU1_3-6_C (580-137730-11), NAN_DU1_6-9_C (580-137730-12), NAN_DU3_0-3 (580-137730-13), NAN_DU3_3-6 (580-137730-14), NAN_DU3_6-9 (580-137730-15), NAN_DU2_0-3 (580-137730-16), NAN_DU2_3-6 (580-137730-17), NAN_DU2_6-9 (580-137730-18), NAN_DU9_0-3 (580-137730-19), NAN_DU9_3-6 (580-137730-20), NAN_DU9_6-9 (580-137730-21), NAN_DU10_0-3 (580-137730-22), NAN_DU10_3-6 (580-137730-23), NAN_DU10_6-9 (580-137730-24), NAN_DU11_0-3 (580-137730-25), NAN_DU11_3-6 (580-137730-26), NAN_DU11_6-9 (580-137730-27), NAN_DU12_0-3 (580-137730-28), NAN_DU12_3-6 (580-137730-29) and NAN_DU12_6-9 (580-137730-30) were analyzed for SM 2540G. The samples were composited on 3/18/2024 and analyzed on 3/26/2024.

Definitions/Glossary

Qualifiers

GC Semi VOA

Qualifier	Qualifier Description
J1	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
M	Manual integrated compound.
U	Undetected at the Limit of Detection.

Metals

Qualifier	Qualifier Description
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
J	Estimated: The analyte was positively identified; the quantitation is an estimation
J1	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Client Sample Results

Client Sample ID: NAN_DU8_0-3

Lab Sample ID: 580-137730-1

Date Collected: 03/03/24 10:00

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**20**		0.50	0.099	mg/Kg		03/28/24 09:38	03/29/24 06:51	20
Barium	**150**		0.99	0.23	mg/Kg		03/28/24 09:38	03/29/24 06:51	20
Cadmium	**0.56**	**J**	0.79	0.077	mg/Kg		03/28/24 09:38	03/29/24 06:51	20
Chromium	**170**		0.99	0.063	mg/Kg		03/28/24 09:38	03/29/24 06:51	20
Lead	**4300**		0.50	0.048	mg/Kg		03/28/24 09:38	03/29/24 06:51	20
Selenium	**5.8**		1.5	0.28	mg/Kg		03/28/24 09:38	03/29/24 06:51	20
Silver	**0.088**	**J**	0.20	0.020	mg/Kg		03/28/24 09:38	03/29/24 06:51	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**71.8**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**28.2**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU8_0-3
Date Collected: 03/03/24 10:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-1
Matrix: Solid
Percent Solids: 71.8

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.31**		0.022	0.0067	mg/Kg	☼	03/25/24 10:07	03/26/24 14:21	1

Client Sample Results

Client Sample ID: NAN_DU8_3-6
Lab Sample ID: 580-137730-2
Date Collected: 03/03/24 10:00
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	20		0.50	0.099	mg/Kg		03/28/24 09:38	03/29/24 06:57	20
Barium	200		0.99	0.23	mg/Kg		03/28/24 09:38	03/29/24 06:57	20
Cadmium	0.62	J	0.80	0.077	mg/Kg		03/28/24 09:38	03/29/24 06:57	20
Chromium	180		0.99	0.063	mg/Kg		03/28/24 09:38	03/29/24 06:57	20
Lead	3100		0.50	0.048	mg/Kg		03/28/24 09:38	03/29/24 06:57	20
Selenium	6.8		1.5	0.28	mg/Kg		03/28/24 09:38	03/29/24 06:57	20
Silver	0.072	J	0.20	0.020	mg/Kg		03/28/24 09:38	03/29/24 06:57	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	70.8		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	29.2		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU8_3-6 Lab Sample ID: 580-137730-2

Date Collected: 03/03/24 10:00 **Matrix: Solid**
Date Received: 03/14/24 09:30 **Percent Solids: 70.8**

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.30**		0.024	0.0071	mg/Kg	☼	03/25/24 10:07	03/26/24 14:28	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU8_6-9

Date Collected: 03/03/24 10:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-3
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**32**		0.47	0.095	mg/Kg		03/28/24 09:38	03/29/24 06:54	20
Barium	**180**		0.95	0.22	mg/Kg		03/28/24 09:38	03/29/24 06:54	20
Cadmium	**0.66**	**J**	0.76	0.073	mg/Kg		03/28/24 09:38	03/29/24 06:54	20
Chromium	**180**		0.95	0.060	mg/Kg		03/28/24 09:38	03/29/24 06:54	20
Lead	**2900**		0.47	0.046	mg/Kg		03/28/24 09:38	03/29/24 06:54	20
Selenium	**7.1**		1.4	0.27	mg/Kg		03/28/24 09:38	03/29/24 06:54	20
Silver	**0.073**	**J**	0.19	0.019	mg/Kg		03/28/24 09:38	03/29/24 06:54	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**69.0**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**31.0**		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU8_6-9
Lab Sample ID: 580-137730-3
Date Collected: 03/03/24 10:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 69.0

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.34**		0.024	0.0072	mg/Kg	☼	03/25/24 10:07	03/26/24 14:31	1

Client Sample ID: NAN_DU1_0-3_A

Lab Sample ID: 580-137730-4

Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	28		0.47	0.095	mg/Kg		03/28/24 09:38	03/29/24 06:49	20
Barium	260		0.95	0.22	mg/Kg		03/28/24 09:38	03/29/24 06:49	20
Cadmium	0.37	J	0.76	0.073	mg/Kg		03/28/24 09:38	03/29/24 06:49	20
Chromium	180		0.95	0.060	mg/Kg		03/28/24 09:38	03/29/24 06:49	20
Lead	1100		0.47	0.046	mg/Kg		03/28/24 09:38	03/29/24 06:49	20
Selenium	8.1		1.4	0.27	mg/Kg		03/28/24 09:38	03/29/24 06:49	20
Silver	0.064	J	0.19	0.019	mg/Kg		03/28/24 09:38	03/29/24 06:49	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	82.3		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	17.7		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU1_0-3_A
Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-4
Matrix: Solid
Percent Solids: 82.3

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.15**		0.020	0.0060	mg/Kg	☼	03/25/24 10:07	03/26/24 14:33	1

Client Sample ID: NAN_DU1_3-6_A

Lab Sample ID: 580-137730-5

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**24**		0.49	0.098	mg/Kg		03/28/24 09:38	03/29/24 06:23	20
Barium	**270**		0.98	0.22	mg/Kg		03/28/24 09:38	03/29/24 06:23	20
Cadmium	**0.42**	**J**	0.78	0.076	mg/Kg		03/28/24 09:38	03/29/24 06:23	20
Chromium	**190**		0.98	0.062	mg/Kg		03/28/24 09:38	03/29/24 06:23	20
Lead	**980**		0.49	0.047	mg/Kg		03/28/24 09:38	03/29/24 06:23	20
Selenium	**9.6**		1.5	0.28	mg/Kg		03/28/24 09:38	03/29/24 06:23	20
Silver	**0.057**	**J**	0.20	0.020	mg/Kg		03/28/24 09:38	03/29/24 06:23	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**78.6**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**21.4**		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU1_3-6_A

Lab Sample ID: 580-137730-5

Date Collected: 03/05/24 16:00

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 78.6

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.021	0.0063	mg/Kg	☼	03/25/24 10:07	03/26/24 14:36	1

Client Sample Results

Client: EnviroQuest, Inc. Job ID: 580-137730-1
Project/Site: Nanue Bridge

Client Sample ID: NAN_DU1_6-9_A

Lab Sample ID: 580-137730-6

Date Collected: 03/05/24 16:00

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	17		0.48	0.096	mg/Kg		03/28/24 09:38	03/29/24 07:37	20
Barium	340		0.96	0.22	mg/Kg		03/28/24 09:38	03/29/24 07:37	20
Cadmium	0.32	J	0.77	0.074	mg/Kg		03/28/24 09:38	03/29/24 07:37	20
Chromium	190		0.96	0.060	mg/Kg		03/28/24 09:38	03/29/24 07:37	20
Lead	640		0.48	0.046	mg/Kg		03/28/24 09:38	03/29/24 07:37	20
Selenium	10		1.4	0.27	mg/Kg		03/28/24 09:38	03/29/24 07:37	20
Silver	0.043	J	0.19	0.019	mg/Kg		03/28/24 09:38	03/29/24 07:37	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	75.2		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	24.8		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU1_6-9_A

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-6

Matrix: Solid
Percent Solids: 75.2

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.15**		0.021	0.0063	mg/Kg	☼	03/25/24 10:07	03/26/24 14:43	1

Client Sample ID: NAN_DU1_0-3_B

Lab Sample ID: 580-137730-7

Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	28		0.49	0.098	mg/Kg		03/28/24 09:38	03/29/24 07:40	20
Barium	250		0.98	0.22	mg/Kg		03/28/24 09:38	03/29/24 07:40	20
Cadmium	0.42	J	0.78	0.075	mg/Kg		03/28/24 09:38	03/29/24 07:40	20
Chromium	190		0.98	0.061	mg/Kg		03/28/24 09:38	03/29/24 07:40	20
Lead	1200		0.49	0.047	mg/Kg		03/28/24 09:38	03/29/24 07:40	20
Selenium	7.5		1.5	0.28	mg/Kg		03/28/24 09:38	03/29/24 07:40	20
Silver	0.054	J	0.20	0.020	mg/Kg		03/28/24 09:38	03/29/24 07:40	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	83.0		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	17.0		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU1_0-3_B
Lab Sample ID: 580-137730-7
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 83.0

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.13**		0.021	0.0062	mg/Kg	☼	03/25/24 10:07	03/26/24 14:45	1

Client Sample Results

Client Sample ID: NAN_DU1_3-6_B

Lab Sample ID: 580-137730-8

Date Collected: 03/05/24 16:00

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	23		0.49	0.099	mg/Kg		03/28/24 09:38	03/29/24 07:42	20
Barium	300		0.99	0.23	mg/Kg		03/28/24 09:38	03/29/24 07:42	20
Cadmium	0.37	J	0.79	0.076	mg/Kg		03/28/24 09:38	03/29/24 07:42	20
Chromium	190		0.99	0.062	mg/Kg		03/28/24 09:38	03/29/24 07:42	20
Lead	960		0.49	0.047	mg/Kg		03/28/24 09:38	03/29/24 07:42	20
Selenium	8.6		1.5	0.28	mg/Kg		03/28/24 09:38	03/29/24 07:42	20
Silver	0.047	J	0.20	0.020	mg/Kg		03/28/24 09:38	03/29/24 07:42	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	77.6		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	22.4		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU1_3-6_B

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-8

Matrix: Solid
Percent Solids: 77.6

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.020	0.0061	mg/Kg	☼	03/25/24 10:07	03/26/24 14:48	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU1_6-9_B

Lab Sample ID: 580-137730-9

Date Collected: 03/05/24 16:00

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**17**		0.47	0.095	mg/Kg		03/28/24 09:38	03/29/24 07:45	20
Barium	**330**		0.95	0.22	mg/Kg		03/28/24 09:38	03/29/24 07:45	20
Cadmium	**0.37**	**J**	0.76	0.073	mg/Kg		03/28/24 09:38	03/29/24 07:45	20
Chromium	**200**		0.95	0.060	mg/Kg		03/28/24 09:38	03/29/24 07:45	20
Lead	**620**		0.47	0.046	mg/Kg		03/28/24 09:38	03/29/24 07:45	20
Selenium	**9.7**		1.4	0.27	mg/Kg		03/28/24 09:38	03/29/24 07:45	20
Silver	**0.049**	**J**	0.19	0.019	mg/Kg		03/28/24 09:38	03/29/24 07:45	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**75.8**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**24.2**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU1_6-9_B
Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-9
Matrix: Solid
Percent Solids: 75.8

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.023	0.0068	mg/Kg	☼	03/25/24 10:07	03/26/24 14:50	1

Client Sample Results

Client Sample ID: NAN_DU1_0-3_C **Lab Sample ID: 580-137730-10**
Date Collected: 03/05/24 16:00 **Matrix: Solid**
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**22**		0.46	0.091	mg/Kg		03/28/24 09:38	03/29/24 07:48	20
Barium	**280**		0.91	0.21	mg/Kg		03/28/24 09:38	03/29/24 07:48	20
Cadmium	**0.38**	**J**	0.73	0.070	mg/Kg		03/28/24 09:38	03/29/24 07:48	20
Chromium	**200**		0.91	0.058	mg/Kg		03/28/24 09:38	03/29/24 07:48	20
Lead	**1100**		0.46	0.044	mg/Kg		03/28/24 09:38	03/29/24 07:48	20
Selenium	**7.4**		1.4	0.26	mg/Kg		03/28/24 09:38	03/29/24 07:48	20
Silver	**0.058**	**J**	0.18	0.018	mg/Kg		03/28/24 09:38	03/29/24 07:48	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**80.0**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**20.0**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU1_0-3_C
Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-10
Matrix: Solid
Percent Solids: 80.0

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.15**		0.022	0.0065	mg/Kg	☼	03/25/24 10:07	03/26/24 14:52	1

Client Sample Results

Client Sample ID: NAN_DU1_3-6_C

Lab Sample ID: 580-137730-11

Date Collected: 03/05/24 16:00

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	22		0.48	0.095	mg/Kg		03/28/24 09:38	03/29/24 07:08	20
Barium	290		0.95	0.22	mg/Kg		03/28/24 09:38	03/29/24 07:08	20
Cadmium	0.37	J	0.76	0.073	mg/Kg		03/28/24 09:38	03/29/24 07:08	20
Chromium	190		0.95	0.060	mg/Kg		03/28/24 09:38	03/29/24 07:08	20
Lead	850		0.48	0.046	mg/Kg		03/28/24 09:38	03/29/24 07:08	20
Selenium	8.5		1.4	0.27	mg/Kg		03/28/24 09:38	03/29/24 07:08	20
Silver	0.055	J	0.19	0.019	mg/Kg		03/28/24 09:38	03/29/24 07:08	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	77.6		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	22.4		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU1_3-6_C
Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-11
Matrix: Solid
Percent Solids: 77.6

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.13**		0.021	0.0064	mg/Kg	☼	03/25/24 10:07	03/26/24 14:55	1

Client Sample Results

Client Sample ID: NAN_DU1_6-9_C

Lab Sample ID: 580-137730-12

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**18**		0.47	0.094	mg/Kg		03/28/24 13:37	03/30/24 01:09	20
Barium	**250**		0.94	0.22	mg/Kg		03/28/24 13:37	03/30/24 01:09	20
Cadmium	**0.32**	**J**	0.75	0.073	mg/Kg		03/28/24 13:37	03/30/24 01:09	20
Chromium	**170**		0.94	0.059	mg/Kg		03/28/24 13:37	03/30/24 01:09	20
Lead	**470**		0.47	0.045	mg/Kg		03/28/24 13:37	03/30/24 01:09	20
Selenium	**8.5**		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 01:09	20
Silver	**0.041**	**J**	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 01:09	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**73.7**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**26.3**		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU1_6-9_C

Lab Sample ID: 580-137730-12

Date Collected: 03/05/24 16:00

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 73.7

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.12**		0.022	0.0067	mg/Kg	☼	03/25/24 10:07	03/26/24 14:57	1

Client Sample Results

Client Sample ID: NAN_DU3_0-3
Lab Sample ID: 580-137730-13
Date Collected: 03/06/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	13		0.46	0.092	mg/Kg		03/28/24 13:37	03/30/24 00:46	20
Barium	130	J1	0.92	0.21	mg/Kg		03/28/24 13:37	03/30/24 00:46	20
Cadmium	0.30	J	0.74	0.071	mg/Kg		03/28/24 13:37	03/30/24 00:46	20
Chromium	130	J1	0.92	0.058	mg/Kg		03/28/24 13:37	03/30/24 00:46	20
Lead	1200	J1	0.46	0.044	mg/Kg		03/28/24 13:37	03/30/24 00:46	20
Selenium	6.6		1.4	0.26	mg/Kg		03/28/24 13:37	03/30/24 00:46	20
Silver	0.047	J	0.18	0.018	mg/Kg		03/28/24 13:37	03/30/24 00:46	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	69.3		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	30.7		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU3_0-3
Date Collected: 03/06/24 12:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-13
Matrix: Solid
Percent Solids: 69.3

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.15**		0.024	0.0073	mg/Kg	☼	03/25/24 10:07	03/26/24 14:59	1

Client Sample Results

Client Sample ID: NAN_DU3_3-6 **Lab Sample ID: 580-137730-14**
Date Collected: 03/06/24 12:30 **Matrix: Solid**
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	15		0.47	0.095	mg/Kg		03/28/24 13:37	03/30/24 02:33	20
Barium	140		0.95	0.22	mg/Kg		03/28/24 13:37	03/30/24 02:33	20
Cadmium	0.33	J	0.76	0.073	mg/Kg		03/28/24 13:37	03/30/24 02:33	20
Chromium	140		0.95	0.060	mg/Kg		03/28/24 13:37	03/30/24 02:33	20
Lead	1200		0.47	0.045	mg/Kg		03/28/24 13:37	03/30/24 02:33	20
Selenium	6.8		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 02:33	20
Silver	0.048	J	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 02:33	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	70.7		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	29.3		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU3_3-6

Lab Sample ID: 580-137730-14

Date Collected: 03/06/24 12:30
Date Received: 03/14/24 09:30

Matrix: Solid
Percent Solids: 70.7

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.022	0.0067	mg/Kg	☼	03/25/24 10:07	03/26/24 15:02	1

Client Sample Results

Client Sample ID: NAN_DU3_6-9
Date Collected: 03/06/24 12:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-15
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**14**		0.48	0.096	mg/Kg		03/28/24 13:37	03/30/24 02:30	20
Barium	**140**		0.96	0.22	mg/Kg		03/28/24 13:37	03/30/24 02:30	20
Cadmium	**0.28**	**J**	0.77	0.074	mg/Kg		03/28/24 13:37	03/30/24 02:30	20
Chromium	**130**		0.96	0.060	mg/Kg		03/28/24 13:37	03/30/24 02:30	20
Lead	**1500**		0.48	0.046	mg/Kg		03/28/24 13:37	03/30/24 02:30	20
Selenium	**7.3**		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 02:30	20
Silver	**0.053**	**J**	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 02:30	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**72.9**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**27.1**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU3_6-9

Date Collected: 03/06/24 12:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-15

Matrix: Solid
Percent Solids: 72.9

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.022	0.0067	mg/Kg	☼	03/25/24 10:07	03/26/24 15:04	1

Client Sample Results

Client Sample ID: NAN_DU2_0-3
Date Collected: 03/06/24 15:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-16
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**14**		0.47	0.095	mg/Kg		03/28/24 13:37	03/30/24 01:34	20
Barium	**200**		0.95	0.22	mg/Kg		03/28/24 13:37	03/30/24 01:34	20
Cadmium	**0.41**	**J**	0.76	0.073	mg/Kg		03/28/24 13:37	03/30/24 01:34	20
Chromium	**180**		0.95	0.060	mg/Kg		03/28/24 13:37	03/30/24 01:34	20
Lead	**1200**		0.47	0.045	mg/Kg		03/28/24 13:37	03/30/24 01:34	20
Selenium	**8.3**		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 01:34	20
Silver	**0.077**	**J**	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 01:34	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**75.8**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**24.2**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU2_0-3

Date Collected: 03/06/24 15:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-16
Matrix: Solid
Percent Solids: 75.8

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.15**		0.022	0.0067	mg/Kg	☼	03/25/24 10:07	03/26/24 15:11	1

Client Sample Results

Client Sample ID: NAN_DU2_3-6
Lab Sample ID: 580-137730-17
Date Collected: 03/06/24 15:00
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	12		0.48	0.095	mg/Kg		03/28/24 13:37	03/30/24 01:48	20
Barium	190		0.95	0.22	mg/Kg		03/28/24 13:37	03/30/24 01:48	20
Cadmium	0.37	J	0.76	0.073	mg/Kg		03/28/24 13:37	03/30/24 01:48	20
Chromium	170		0.95	0.060	mg/Kg		03/28/24 13:37	03/30/24 01:48	20
Lead	1000		0.48	0.046	mg/Kg		03/28/24 13:37	03/30/24 01:48	20
Selenium	7.8		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 01:48	20
Silver	0.060	J	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 01:48	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	77.2		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	22.8		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU2_3-6

Date Collected: 03/06/24 15:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-17
Matrix: Solid
Percent Solids: 77.2

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.15**		0.021	0.0063	mg/Kg	☼	03/25/24 10:07	03/26/24 15:14	1

Client Sample Results

Client Sample ID: NAN_DU2_6-9
Lab Sample ID: 580-137730-18
Date Collected: 03/06/24 15:00
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	14		0.47	0.095	mg/Kg		03/28/24 13:37	03/30/24 02:22	20
Barium	210		0.95	0.22	mg/Kg		03/28/24 13:37	03/30/24 02:22	20
Cadmium	0.40	J	0.76	0.073	mg/Kg		03/28/24 13:37	03/30/24 02:22	20
Chromium	190		0.95	0.060	mg/Kg		03/28/24 13:37	03/30/24 02:22	20
Lead	1400		0.47	0.046	mg/Kg		03/28/24 13:37	03/30/24 02:22	20
Selenium	9.2		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 02:22	20
Silver	0.054	J	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 02:22	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	77.3		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	22.7		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU2_6-9
Date Collected: 03/06/24 15:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-18
Matrix: Solid
Percent Solids: 77.3

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.18**		0.020	0.0060	mg/Kg	☼	03/25/24 10:07	03/26/24 15:16	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU9_0-3

Date Collected: 03/09/24 12:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-19

Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**24**		0.48	0.096	mg/Kg		03/28/24 13:37	03/30/24 02:28	20
Barium	**100**		0.96	0.22	mg/Kg		03/28/24 13:37	03/30/24 02:28	20
Cadmium	**0.67**	**J**	0.77	0.074	mg/Kg		03/28/24 13:37	03/30/24 02:28	20
Chromium	**160**		0.96	0.060	mg/Kg		03/28/24 13:37	03/30/24 02:28	20
Lead	**6400**		48	4.6	mg/Kg		03/28/24 13:37	04/01/24 18:07	2000
Selenium	**4.9**		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 02:28	20
Silver	**0.085**	**J**	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 02:28	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**70.3**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**29.7**		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU9_0-3 **Lab Sample ID: 580-137730-19**
Date Collected: 03/09/24 12:30 **Matrix: Solid**
Date Received: 03/14/24 09:30 **Percent Solids: 70.3**

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.28**		0.024	0.0071	mg/Kg	☼	03/25/24 10:09	03/26/24 15:19	1

Client Sample Results

Client Sample ID: NAN_DU9_3-6
Lab Sample ID: 580-137730-20
Date Collected: 03/09/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**25**		0.48	0.096	mg/Kg		03/28/24 13:37	03/30/24 02:25	20
Barium	**110**		0.96	0.22	mg/Kg		03/28/24 13:37	03/30/24 02:25	20
Cadmium	**0.67**	**J**	0.77	0.074	mg/Kg		03/28/24 13:37	03/30/24 02:25	20
Chromium	**190**		0.96	0.060	mg/Kg		03/28/24 13:37	03/30/24 02:25	20
Lead	**6200**		48	4.6	mg/Kg		03/28/24 13:37	04/01/24 18:04	2000
Selenium	**5.1**		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 02:25	20
Silver	**0.089**	**J**	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 02:25	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**61.5**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**38.5**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU9_3-6

Date Collected: 03/09/24 12:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-20
Matrix: Solid
Percent Solids: 61.5

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.26**		0.027	0.0082	mg/Kg	☼	03/25/24 10:09	03/26/24 15:21	1

Client Sample ID: NAN_DU9_6-9

Date Collected: 03/09/24 12:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-21
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	24		0.48	0.095	mg/Kg		04/01/24 12:29	04/05/24 04:50	20
Barium	110		0.95	0.22	mg/Kg		04/01/24 12:29	04/05/24 04:50	20
Cadmium	0.59	J	0.76	0.073	mg/Kg		04/01/24 12:29	04/05/24 04:50	20
Chromium	180		0.95	0.060	mg/Kg		04/01/24 12:29	04/05/24 04:50	20
Lead	6000		48	4.6	mg/Kg		04/01/24 12:29	04/05/24 04:52	2000
Selenium	6.7		1.4	0.27	mg/Kg		04/01/24 12:29	04/05/24 04:50	20
Silver	0.095	J	0.19	0.019	mg/Kg		04/01/24 12:29	04/05/24 04:50	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	64.5		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	35.5		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU9_6-9

Date Collected: 03/09/24 12:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-21

Matrix: Solid
Percent Solids: 64.5

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.26**		0.026	0.0079	mg/Kg	☼	04/02/24 13:03	04/02/24 16:10	1

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Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU10_0-3

Date Collected: 03/09/24 14:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-22

Matrix: Solid

Method: SW846 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	0.017	U M	0.019	0.0070	mg/Kg		03/20/24 15:22	04/01/24 14:54	1
PCB-1221	0.017	U	0.019	0.011	mg/Kg		03/20/24 15:22	04/01/24 14:54	1
PCB-1232	0.017	U	0.019	0.0046	mg/Kg		03/20/24 15:22	04/01/24 14:54	1
PCB-1242	0.017	U M	0.019	0.0075	mg/Kg		03/20/24 15:22	04/01/24 14:54	1
PCB-1248	0.017	U M	0.019	0.0066	mg/Kg		03/20/24 15:22	04/01/24 14:54	1
PCB-1254	**0.055**	**M**	0.019	0.0085	mg/Kg		03/20/24 15:22	04/01/24 14:54	1
PCB-1260	0.017	U J1 M	0.019	0.0070	mg/Kg		03/20/24 15:22	04/01/24 14:54	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Tetrachloro-m-xylene	*89*		*44 - 130*	*03/20/24 15:22*	*04/01/24 14:54*	*1*
DCB Decachlorobiphenyl	*96*	*M*	*40 - 135*	*03/20/24 15:22*	*04/01/24 14:54*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**9.6**		0.46	0.092	mg/Kg		04/01/24 12:29	04/04/24 17:39	20
Barium	**120**	**J1**	0.92	0.21	mg/Kg		04/01/24 12:29	04/04/24 17:39	20
Cadmium	**0.35**	**J**	0.74	0.071	mg/Kg		04/01/24 12:29	04/04/24 17:39	20
Chromium	**150**	**J1**	0.92	0.058	mg/Kg		04/01/24 12:29	04/04/24 17:39	20
Lead	**8500**	**J1**	46	4.4	mg/Kg		04/01/24 12:29	04/04/24 18:01	2000
Selenium	**5.8**		1.4	0.26	mg/Kg		04/01/24 12:29	04/04/24 17:39	20
Silver	**0.088**	**J**	0.18	0.018	mg/Kg		04/01/24 12:29	04/04/24 17:39	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**71.0**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**29.0**		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU10_0-3
Date Collected: 03/09/24 14:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-22
Matrix: Solid
Percent Solids: 71.0

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.12**		0.023	0.0070	mg/Kg	☼	04/02/24 13:03	04/02/24 16:13	1

Client Sample ID: NAN_DU10_3-6
Lab Sample ID: 580-137730-23

Date Collected: 03/09/24 14:30
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	0.017	U	0.019	0.0070	mg/Kg		03/20/24 15:22	04/01/24 15:47	1
PCB-1221	0.017	U	0.019	0.011	mg/Kg		03/20/24 15:22	04/01/24 15:47	1
PCB-1232	0.017	U	0.019	0.0046	mg/Kg		03/20/24 15:22	04/01/24 15:47	1
PCB-1242	0.017	U	0.019	0.0076	mg/Kg		03/20/24 15:22	04/01/24 15:47	1
PCB-1248	0.017	U	0.019	0.0066	mg/Kg		03/20/24 15:22	04/01/24 15:47	1
PCB-1254	**0.037**	**J1 M**	0.019	0.0085	mg/Kg		03/20/24 15:22	04/01/24 15:47	1
PCB-1260	0.017	U M	0.019	0.0070	mg/Kg		03/20/24 15:22	04/01/24 15:47	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Tetrachloro-m-xylene	*92*		*44 - 130*	*03/20/24 15:22*	*04/01/24 15:47*	*1*
DCB Decachlorobiphenyl	*98*	*M*	*40 - 135*	*03/20/24 15:22*	*04/01/24 15:47*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**8.7**		0.47	0.095	mg/Kg		04/01/24 12:29	04/05/24 05:01	20
Barium	**130**		0.95	0.22	mg/Kg		04/01/24 12:29	04/05/24 05:01	20
Cadmium	**0.39**	**J**	0.76	0.073	mg/Kg		04/01/24 12:29	04/05/24 05:01	20
Chromium	**160**		0.95	0.060	mg/Kg		04/01/24 12:29	04/05/24 05:01	20
Lead	**9700**		47	4.5	mg/Kg		04/01/24 12:29	04/05/24 05:04	2000
Selenium	**6.9**		1.4	0.27	mg/Kg		04/01/24 12:29	04/05/24 05:01	20
Silver	**0.10**	**J**	0.19	0.019	mg/Kg		04/01/24 12:29	04/05/24 05:01	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**70.8**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**29.2**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU10_3-6
Date Collected: 03/09/24 14:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-23
Matrix: Solid
Percent Solids: 70.8

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.024	0.0071	mg/Kg	☼	04/02/24 13:03	04/02/24 15:45	1

Client Sample ID: NAN_DU10_6-9
Lab Sample ID: 580-137730-24
Date Collected: 03/09/24 14:30
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**7.9**		0.47	0.094	mg/Kg		04/01/24 12:29	04/04/24 17:52	20
Barium	**160**		0.94	0.22	mg/Kg		04/01/24 12:29	04/04/24 17:52	20
Cadmium	**0.35**	**J**	0.76	0.073	mg/Kg		04/01/24 12:29	04/04/24 17:52	20
Chromium	**170**		0.94	0.060	mg/Kg		04/01/24 12:29	04/04/24 17:52	20
Lead	**8100**		47	4.5	mg/Kg		04/01/24 12:29	04/04/24 18:14	2000
Selenium	**7.8**		1.4	0.27	mg/Kg		04/01/24 12:29	04/04/24 17:52	20
Silver	**0.078**	**J**	0.19	0.019	mg/Kg		04/01/24 12:29	04/04/24 17:52	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**68.6**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**31.4**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU10_6-9
Lab Sample ID: 580-137730-24
Date Collected: 03/09/24 14:30
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 68.6

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.13**		0.024	0.0072	mg/Kg	☼	04/02/24 13:03	04/02/24 15:54	1

Client Sample ID: NAN_DU11_0-3

Lab Sample ID: 580-137730-25

Date Collected: 03/10/24 12:20

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	11		0.47	0.095	mg/Kg		04/01/24 12:29	04/05/24 05:47	20
Barium	110		0.95	0.22	mg/Kg		04/01/24 12:29	04/05/24 05:47	20
Cadmium	0.37	J	0.76	0.073	mg/Kg		04/01/24 12:29	04/05/24 05:47	20
Chromium	130		0.95	0.060	mg/Kg		04/01/24 12:29	04/05/24 05:47	20
Lead	4300		47	4.5	mg/Kg		04/01/24 12:29	04/05/24 05:50	2000
Selenium	4.8		1.4	0.27	mg/Kg		04/01/24 12:29	04/05/24 05:47	20
Silver	0.081	J	0.19	0.019	mg/Kg		04/01/24 12:29	04/05/24 05:47	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	62.7		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	37.3		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU11_0-3 **Lab Sample ID: 580-137730-25**
Date Collected: 03/10/24 12:20 **Matrix: Solid**
Date Received: 03/14/24 09:30 **Percent Solids: 62.7**

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.10**		0.025	0.0076	mg/Kg	☼	04/02/24 13:03	04/02/24 15:36	1

Client Sample Results

Client Sample ID: NAN_DU11_3-6

Lab Sample ID: 580-137730-26

Date Collected: 03/10/24 12:20
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	0.017	U M	0.019	0.0070	mg/Kg		03/20/24 15:22	04/01/24 16:04	1
PCB-1221	0.017	U	0.019	0.011	mg/Kg		03/20/24 15:22	04/01/24 16:04	1
PCB-1232	0.017	U	0.019	0.0047	mg/Kg		03/20/24 15:22	04/01/24 16:04	1
PCB-1242	0.017	U M	0.019	0.0076	mg/Kg		03/20/24 15:22	04/01/24 16:04	1
PCB-1248	0.017	U M	0.019	0.0067	mg/Kg		03/20/24 15:22	04/01/24 16:04	1
PCB-1254	**0.20**	**M**	0.019	0.0086	mg/Kg		03/20/24 15:22	04/01/24 16:04	1
PCB-1260	0.017	U M	0.019	0.0070	mg/Kg		03/20/24 15:22	04/01/24 16:04	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Tetrachloro-m-xylene	*85*		*44 - 130*	*03/20/24 15:22*	*04/01/24 16:04*	*1*
DCB Decachlorobiphenyl	*89*	*M*	*40 - 135*	*03/20/24 15:22*	*04/01/24 16:04*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**10**		0.48	0.095	mg/Kg		04/01/24 12:29	04/05/24 04:44	20
Barium	**100**		0.95	0.22	mg/Kg		04/01/24 12:29	04/05/24 04:44	20
Cadmium	**0.40**	**J**	0.76	0.073	mg/Kg		04/01/24 12:29	04/05/24 04:44	20
Chromium	**150**		0.95	0.060	mg/Kg		04/01/24 12:29	04/05/24 04:44	20
Lead	**6400**		48	4.6	mg/Kg		04/01/24 12:29	04/05/24 04:47	2000
Selenium	**6.2**		1.4	0.27	mg/Kg		04/01/24 12:29	04/05/24 04:44	20
Silver	**0.086**	**J**	0.19	0.019	mg/Kg		04/01/24 12:29	04/05/24 04:44	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**65.0**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**35.0**		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU11_3-6

Lab Sample ID: 580-137730-26

Date Collected: 03/10/24 12:20
Date Received: 03/14/24 09:30

Matrix: Solid
Percent Solids: 65.0

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.12**		0.027	0.0081	mg/Kg	☼	04/02/24 13:03	04/02/24 15:56	1

Client Sample ID: NAN_DU11_6-9

Lab Sample ID: 580-137730-27

Date Collected: 03/10/24 12:20
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**8.7**		0.46	0.092	mg/Kg		04/01/24 12:29	04/05/24 05:41	20
Barium	**110**		0.92	0.21	mg/Kg		04/01/24 12:29	04/05/24 05:41	20
Cadmium	**0.39**	**J**	0.74	0.071	mg/Kg		04/01/24 12:29	04/05/24 05:41	20
Chromium	**150**		0.92	0.058	mg/Kg		04/01/24 12:29	04/05/24 05:41	20
Lead	**6000**		46	4.4	mg/Kg		04/01/24 12:29	04/05/24 05:44	2000
Selenium	**6.3**		1.4	0.26	mg/Kg		04/01/24 12:29	04/05/24 05:41	20
Silver	**0.083**	**J**	0.18	0.018	mg/Kg		04/01/24 12:29	04/05/24 05:41	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**66.2**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**33.8**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU11_6-9

Date Collected: 03/10/24 12:20
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-27
Matrix: Solid
Percent Solids: 66.2

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.025	0.0075	mg/Kg	☼	04/02/24 13:03	04/02/24 15:59	1

Client Sample ID: NAN_DU12_0-3

Lab Sample ID: 580-137730-28

Date Collected: 03/10/24 13:10

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	16		0.46	0.092	mg/Kg		04/01/24 12:29	04/05/24 04:55	20
Barium	79		0.92	0.21	mg/Kg		04/01/24 12:29	04/05/24 04:55	20
Cadmium	0.41	J	0.74	0.071	mg/Kg		04/01/24 12:29	04/05/24 04:55	20
Chromium	130		0.92	0.058	mg/Kg		04/01/24 12:29	04/05/24 04:55	20
Lead	6300		46	4.4	mg/Kg		04/01/24 12:29	04/05/24 04:58	2000
Selenium	2.8		1.4	0.26	mg/Kg		04/01/24 12:29	04/05/24 04:55	20
Silver	0.088	J	0.18	0.018	mg/Kg		04/01/24 12:29	04/05/24 04:55	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	68.0		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	32.0		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU12_0-3
Date Collected: 03/10/24 13:10
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-28
Matrix: Solid
Percent Solids: 68.0

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.086**		0.023	0.0069	mg/Kg	☼	04/02/24 13:03	04/02/24 16:02	1

Client Sample Results

Client Sample ID: NAN_DU12_3-6

Lab Sample ID: 580-137730-29

Date Collected: 03/10/24 13:10

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	11		0.46	0.092	mg/Kg		04/01/24 12:29	04/05/24 05:35	20
Barium	50		0.92	0.21	mg/Kg		04/01/24 12:29	04/05/24 05:35	20
Cadmium	0.29	J	0.74	0.071	mg/Kg		04/01/24 12:29	04/05/24 05:35	20
Chromium	87		0.92	0.058	mg/Kg		04/01/24 12:29	04/05/24 05:35	20
Lead	7900		46	4.4	mg/Kg		04/01/24 12:29	04/05/24 05:38	2000
Selenium	3.4		1.4	0.26	mg/Kg		04/01/24 12:29	04/05/24 05:35	20
Silver	0.086	J	0.18	0.018	mg/Kg		04/01/24 12:29	04/05/24 05:35	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	75.6		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	24.4		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU12_3-6
Date Collected: 03/10/24 13:10
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-29
Matrix: Solid
Percent Solids: 75.6

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.12**		0.022	0.0065	mg/Kg	☼	04/02/24 13:03	04/02/24 16:05	1

Client Sample ID: NAN_DU12_6-9

Date Collected: 03/10/24 13:10
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-30
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	10		0.47	0.094	mg/Kg		04/01/24 12:29	04/05/24 05:52	20
Barium	69		0.94	0.21	mg/Kg		04/01/24 12:29	04/05/24 05:52	20
Cadmium	0.30	J	0.75	0.073	mg/Kg		04/01/24 12:29	04/05/24 05:52	20
Chromium	90		0.94	0.059	mg/Kg		04/01/24 12:29	04/05/24 05:52	20
Lead	6500		47	4.5	mg/Kg		04/01/24 12:29	04/05/24 05:55	2000
Selenium	3.6		1.4	0.27	mg/Kg		04/01/24 12:29	04/05/24 05:52	20
Silver	0.068	J	0.19	0.019	mg/Kg		04/01/24 12:29	04/05/24 05:52	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	72.9		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	27.1		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU12_6-9
Date Collected: 03/10/24 13:10
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-30
Matrix: Solid
Percent Solids: 72.9

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.12**		0.023	0.0069	mg/Kg	☼	04/02/24 13:03	04/02/24 16:08	1

1
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11

Method: 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Lab Sample ID: MB 580-454340/1-A
Matrix: Solid
Analysis Batch: 455366

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 454340

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	0.018	U	0.020	0.0074	mg/Kg		03/20/24 15:22	04/01/24 14:01	1
PCB-1221	0.018	U	0.020	0.012	mg/Kg		03/20/24 15:22	04/01/24 14:01	1
PCB-1232	0.018	U	0.020	0.0049	mg/Kg		03/20/24 15:22	04/01/24 14:01	1
PCB-1242	0.018	U	0.020	0.0080	mg/Kg		03/20/24 15:22	04/01/24 14:01	1
PCB-1248	0.018	U	0.020	0.0070	mg/Kg		03/20/24 15:22	04/01/24 14:01	1
PCB-1254	0.018	U	0.020	0.0090	mg/Kg		03/20/24 15:22	04/01/24 14:01	1
PCB-1260	0.018	U	0.020	0.0074	mg/Kg		03/20/24 15:22	04/01/24 14:01	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Tetrachloro-m-xylene	*95*		*44 - 130*	*03/20/24 15:22*	*04/01/24 14:01*	*1*
DCB Decachlorobiphenyl	*85*	*M*	*40 - 135*	*03/20/24 15:22*	*04/01/24 14:01*	*1*

Lab Sample ID: LCS 580-454340/2-A
Matrix: Solid
Analysis Batch: 455366

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 454340

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
PCB-1016			0.100	0.102	M	mg/Kg		102	47 - 134
PCB-1260			0.100	0.0955	M	mg/Kg		96	53 - 140

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Tetrachloro-m-xylene	*91*	*M*	*44 - 130*
DCB Decachlorobiphenyl	*102*	*M*	*40 - 135*

Lab Sample ID: LCSD 580-454340/3-A
Matrix: Solid
Analysis Batch: 455366

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 454340

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
PCB-1016			0.100	0.101	M	mg/Kg		101	47 - 134	7	30
PCB-1260			0.100	0.105	M	mg/Kg		105	53 - 140	10	30

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
Tetrachloro-m-xylene	*99*		*44 - 130*
DCB Decachlorobiphenyl	*112*		*40 - 135*

Lab Sample ID: 580-137730-22 MS
Matrix: Solid
Analysis Batch: 455366

Client Sample ID: NAN_DU10_0-3
Prep Type: Total/NA
Prep Batch: 454340

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
PCB-1016	0.017	U M	0.0934	0.0948	M	mg/Kg		102	47 - 134
PCB-1260	0.017	U J1 M	0.0934	0.171	J1 M	mg/Kg		183	53 - 140

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Tetrachloro-m-xylene	*94*		*44 - 130*
DCB Decachlorobiphenyl	*101*	*M*	*40 - 135*

QC Sample Results

Method: 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography (Continued)

Lab Sample ID: 580-137730-22 MSD
Client Sample ID: NAN_DU10_0-3
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 455366
Prep Batch: 454340

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
PCB-1016	0.017	U M	0.0943	0.0908	M	mg/Kg		96	47 - 134	4	30
PCB-1260	0.017	U J1 M	0.0943	0.162	J1 M	mg/Kg		172	53 - 140	5	30

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
Tetrachloro-m-xylene	*88*		*44 - 130*
DCB Decachlorobiphenyl	*94*	*M*	*40 - 135*

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 580-455023/23-A
Client Sample ID: Method Blank
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 455179
Prep Batch: 455023

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.40	U	0.50	0.10	mg/Kg		03/28/24 09:38	03/29/24 05:58	20
Barium	0.40	U	1.0	0.23	mg/Kg		03/28/24 09:38	03/29/24 05:58	20
Cadmium	0.20	U	0.80	0.077	mg/Kg		03/28/24 09:38	03/29/24 05:58	20
Chromium	0.25	U	1.0	0.063	mg/Kg		03/28/24 09:38	03/29/24 05:58	20
Lead	0.19	U	0.50	0.048	mg/Kg		03/28/24 09:38	03/29/24 05:58	20
Selenium	1.0	U	1.5	0.29	mg/Kg		03/28/24 09:38	03/29/24 05:58	20
Silver	0.050	U	0.20	0.020	mg/Kg		03/28/24 09:38	03/29/24 05:58	20

Lab Sample ID: LCS 580-455023/24-A
Client Sample ID: Lab Control Sample
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 455179
Prep Batch: 455023

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	25.0	24.3		mg/Kg		97	82 - 118
Barium	25.0	26.5		mg/Kg		106	86 - 116
Cadmium	25.0	24.7		mg/Kg		99	84 - 116
Chromium	25.0	22.1		mg/Kg		89	83 - 119
Lead	25.0	22.1		mg/Kg		88	84 - 118
Selenium	25.0	24.3		mg/Kg		97	80 - 119
Silver	25.0	24.6		mg/Kg		98	83 - 118

Lab Sample ID: LCSD 580-455023/25-A
Client Sample ID: Lab Control Sample Dup
Matrix: Solid
Prep Type: Total/NA
Analysis Batch: 455179
Prep Batch: 455023

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	25.0	24.4		mg/Kg		97	82 - 118	0	20
Barium	25.0	26.9		mg/Kg		108	86 - 116	1	20
Cadmium	25.0	25.2		mg/Kg		101	84 - 116	2	20
Chromium	25.0	22.3		mg/Kg		89	83 - 119	1	20
Lead	25.0	22.3		mg/Kg		89	84 - 118	1	20
Selenium	25.0	25.2		mg/Kg		101	80 - 119	3	20
Silver	25.0	25.1		mg/Kg		101	83 - 118	2	20

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: MB 580-455073/23-A
Matrix: Solid
Analysis Batch: 455285

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 455073

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.40	U	0.50	0.10	mg/Kg		03/28/24 13:37	03/30/24 00:43	20
Barium	0.40	U	1.0	0.23	mg/Kg		03/28/24 13:37	03/30/24 00:43	20
Cadmium	0.20	U	0.80	0.077	mg/Kg		03/28/24 13:37	03/30/24 00:43	20
Chromium	0.25	U	1.0	0.063	mg/Kg		03/28/24 13:37	03/30/24 00:43	20
Lead	0.19	U	0.50	0.048	mg/Kg		03/28/24 13:37	03/30/24 00:43	20
Selenium	1.0	U	1.5	0.29	mg/Kg		03/28/24 13:37	03/30/24 00:43	20
Silver	0.050	U	0.20	0.020	mg/Kg		03/28/24 13:37	03/30/24 00:43	20

Lab Sample ID: LCS 580-455073/24-A
Matrix: Solid
Analysis Batch: 455285

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 455073

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	25.0	24.2		mg/Kg		97	82 - 118
Barium	25.0	24.2		mg/Kg		97	86 - 116
Cadmium	25.0	24.4		mg/Kg		98	84 - 116
Chromium	25.0	24.9		mg/Kg		100	83 - 119
Lead	25.0	22.8		mg/Kg		91	84 - 118
Selenium	25.0	26.6		mg/Kg		106	80 - 119
Silver	25.0	25.0		mg/Kg		100	83 - 118

Lab Sample ID: LCSD 580-455073/25-A
Matrix: Solid
Analysis Batch: 455285

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 455073

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	25.0	23.9		mg/Kg		96	82 - 118	1	20
Barium	25.0	23.9		mg/Kg		96	86 - 116	1	20
Cadmium	25.0	24.0		mg/Kg		96	84 - 116	2	20
Chromium	25.0	24.1		mg/Kg		96	83 - 119	3	20
Lead	25.0	22.6		mg/Kg		91	84 - 118	1	20
Selenium	25.0	26.0		mg/Kg		104	80 - 119	2	20
Silver	25.0	24.7		mg/Kg		99	83 - 118	2	20

Lab Sample ID: MB 580-455329/13-A
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 455329

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.40	U	0.50	0.10	mg/Kg		04/01/24 12:29	04/04/24 17:08	20
Barium	0.40	U	1.0	0.23	mg/Kg		04/01/24 12:29	04/04/24 17:08	20
Cadmium	0.20	U	0.80	0.077	mg/Kg		04/01/24 12:29	04/04/24 17:08	20
Chromium	0.25	U	1.0	0.063	mg/Kg		04/01/24 12:29	04/04/24 17:08	20
Lead	0.19	U	0.50	0.048	mg/Kg		04/01/24 12:29	04/04/24 17:08	20
Selenium	1.0	U	1.5	0.29	mg/Kg		04/01/24 12:29	04/04/24 17:08	20
Silver	0.050	U	0.20	0.020	mg/Kg		04/01/24 12:29	04/04/24 17:08	20

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: MB 580-455329/18-A
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 455329

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.40	U	0.50	0.10	mg/Kg		04/01/24 12:51	04/04/24 17:11	20
Barium	0.40	U	1.0	0.23	mg/Kg		04/01/24 12:51	04/04/24 17:11	20
Cadmium	0.20	U	0.80	0.077	mg/Kg		04/01/24 12:51	04/04/24 17:11	20
Chromium	0.25	U	1.0	0.063	mg/Kg		04/01/24 12:51	04/04/24 17:11	20
Lead	0.19	U	0.50	0.048	mg/Kg		04/01/24 12:51	04/04/24 17:11	20
Selenium	1.0	U	1.5	0.29	mg/Kg		04/01/24 12:51	04/04/24 17:11	20
Silver	0.050	U	0.20	0.020	mg/Kg		04/01/24 12:51	04/04/24 17:11	20

Lab Sample ID: MB 580-455329/19-A
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 455329

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.40	U	0.50	0.10	mg/Kg		04/01/24 12:51	04/04/24 17:14	20
Barium	0.40	U	1.0	0.23	mg/Kg		04/01/24 12:51	04/04/24 17:14	20
Cadmium	0.20	U	0.80	0.077	mg/Kg		04/01/24 12:51	04/04/24 17:14	20
Chromium	0.25	U	1.0	0.063	mg/Kg		04/01/24 12:51	04/04/24 17:14	20
Lead	0.19	U	0.50	0.048	mg/Kg		04/01/24 12:51	04/04/24 17:14	20
Selenium	1.0	U	1.5	0.29	mg/Kg		04/01/24 12:51	04/04/24 17:14	20
Silver	0.050	U	0.20	0.020	mg/Kg		04/01/24 12:51	04/04/24 17:14	20

Lab Sample ID: LCS 580-455329/16-A
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 455329

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	25.0	24.9		mg/Kg		100	82 - 118
Barium	25.0	23.9		mg/Kg		96	86 - 116
Cadmium	25.0	23.9		mg/Kg		95	84 - 116
Chromium	25.0	24.4		mg/Kg		98	83 - 119
Lead	25.0	24.2		mg/Kg		97	84 - 118
Selenium	25.0	25.6		mg/Kg		102	80 - 119
Silver	25.0	24.4		mg/Kg		98	83 - 118

Lab Sample ID: LCSD 580-455329/17-A
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 455329

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	25.0	24.8		mg/Kg		99	82 - 118	0	20
Barium	25.0	24.7		mg/Kg		99	86 - 116	3	20
Cadmium	25.0	24.8		mg/Kg		99	84 - 116	4	20
Chromium	25.0	24.7		mg/Kg		99	83 - 119	1	20
Lead	25.0	24.2		mg/Kg		97	84 - 118	0	20
Selenium	25.0	25.3		mg/Kg		101	80 - 119	1	20
Silver	25.0	24.9		mg/Kg		100	83 - 118	2	20

QC Sample Results

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: 580-137730-22 MS
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: NAN_DU10_0-3
Prep Type: Total/NA
Prep Batch: 455329

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	9.6		23.5	30.0		mg/Kg		87	82 - 118
Barium	120	J1	23.5	145	4	mg/Kg		117	86 - 116
Cadmium	0.35	J	23.5	23.1		mg/Kg		97	84 - 116
Chromium	150	J1	23.5	178	4	mg/Kg		121	83 - 119
Selenium	5.8		23.5	24.6		mg/Kg		80	80 - 119
Silver	0.088	J	23.5	22.5		mg/Kg		95	83 - 118

Lab Sample ID: 580-137730-22 MS
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: NAN_DU10_0-3
Prep Type: Total/NA
Prep Batch: 455329

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Lead	8500	J1	23.5	8620	4	mg/Kg		701	84 - 118

Lab Sample ID: 580-137730-22 MSD
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: NAN_DU10_0-3
Prep Type: Total/NA
Prep Batch: 455329

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	9.6		23.5	30.7		mg/Kg		90	82 - 118	2	20
Barium	120	J1	23.5	150	4	mg/Kg		140	86 - 116	4	20
Cadmium	0.35	J	23.5	22.6		mg/Kg		94	84 - 116	2	20
Chromium	150	J1	23.5	180	4	mg/Kg		127	83 - 119	1	20
Selenium	5.8		23.5	26.3		mg/Kg		87	80 - 119	7	20
Silver	0.088	J	23.5	22.6		mg/Kg		96	83 - 118	1	20

Lab Sample ID: 580-137730-22 MSD
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: NAN_DU10_0-3
Prep Type: Total/NA
Prep Batch: 455329

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Lead	8500	J1	23.5	8090	4	mg/Kg		-1541	84 - 118	6	20

Method: 7471A - Mercury (CVAA)

Lab Sample ID: MB 580-454663/23-A
Matrix: Solid
Analysis Batch: 454854

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 454663

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.010	U	0.018	0.0054	mg/Kg		03/25/24 10:09	03/26/24 14:14	1

Lab Sample ID: LCS 580-454663/24-A
Matrix: Solid
Analysis Batch: 454854

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 454663

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	0.100	0.119		mg/Kg		119	80 - 124

Method: 7471A - Mercury (CVAA) (Continued)

Lab Sample ID: LCSD 580-454663/25-A
Matrix: Solid
Analysis Batch: 454854

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 454663

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury			0.100	0.112		mg/Kg		112	80 - 124	6	20

Lab Sample ID: 580-137730-1 MS
Matrix: Solid
Analysis Batch: 454854

Client Sample ID: NAN_DU8_0-3
Prep Type: Total/NA
Prep Batch: 454663

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Mercury	0.31		0.127	0.431		mg/Kg	☼	97	80 - 124		

Lab Sample ID: 580-137730-1 MSD
Matrix: Solid
Analysis Batch: 454854

Client Sample ID: NAN_DU8_0-3
Prep Type: Total/NA
Prep Batch: 454663

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury	0.31		0.128	0.418		mg/Kg	☼	85	80 - 124	3	20

Lab Sample ID: MB 580-455462/13-A
Matrix: Solid
Analysis Batch: 455504

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 455462

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.010	U	0.018	0.0054	mg/Kg		04/02/24 13:03	04/02/24 15:27	1

Lab Sample ID: LCS 580-455462/14-A
Matrix: Solid
Analysis Batch: 455504

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 455462

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Mercury			0.100	0.116		mg/Kg		116	80 - 124		

Lab Sample ID: LCSD 580-455462/15-A
Matrix: Solid
Analysis Batch: 455504

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 455462

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury			0.100	0.111		mg/Kg		111	80 - 124	5	20

Lab Sample ID: 580-137730-25 MS
Matrix: Solid
Analysis Batch: 455504

Client Sample ID: NAN_DU11_0-3
Prep Type: Total/NA
Prep Batch: 455462

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Mercury	0.10		0.140	0.257		mg/Kg	☼	109	80 - 124		

Lab Sample ID: 580-137730-25 MSD
Matrix: Solid
Analysis Batch: 455504

Client Sample ID: NAN_DU11_0-3
Prep Type: Total/NA
Prep Batch: 455462

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury	0.10		0.143	0.249		mg/Kg	☼	101	80 - 124	3	20

QC Sample Results

Method: 2540G - SM 2540G

Lab Sample ID: 580-137730-1 DU
Matrix: Solid
Analysis Batch: 454764

Client Sample ID: NAN_DU8_0-3
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Percent Solids	71.8			76.4		%				6	20
Percent Moisture	28.2			23.6		%				18	20

Lab Chronicle

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU8_0-3

Lab Sample ID: 580-137730-1
Date Collected: 03/03/24 10:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 06:51
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU8_0-3

Lab Sample ID: 580-137730-1
Date Collected: 03/03/24 10:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 71.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:21

Client Sample ID: NAN_DU8_3-6

Lab Sample ID: 580-137730-2
Date Collected: 03/03/24 10:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 06:57
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU8_3-6

Lab Sample ID: 580-137730-2
Date Collected: 03/03/24 10:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 70.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:28

Client Sample ID: NAN_DU8_6-9

Lab Sample ID: 580-137730-3
Date Collected: 03/03/24 10:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 06:54
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Lab Chronicle

Client Sample ID: NAN_DU8_6-9

Lab Sample ID: 580-137730-3

Date Collected: 03/03/24 10:00
Date Received: 03/14/24 09:30
Matrix: Solid
Percent Solids: 69.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:31

Client Sample ID: NAN_DU1_0-3_A

Lab Sample ID: 580-137730-4

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 06:49
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_0-3_A

Lab Sample ID: 580-137730-4

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30
Matrix: Solid
Percent Solids: 82.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:33

Client Sample ID: NAN_DU1_3-6_A

Lab Sample ID: 580-137730-5

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 06:23
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_3-6_A

Lab Sample ID: 580-137730-5

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30
Matrix: Solid
Percent Solids: 78.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:36

Lab Chronicle

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU1_6-9_A

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-6
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 07:37
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_6-9_A

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-6
Matrix: Solid
Percent Solids: 75.2

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:43

Client Sample ID: NAN_DU1_0-3_B

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-7
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 07:40
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_0-3_B

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-7
Matrix: Solid
Percent Solids: 83.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:45

Client Sample ID: NAN_DU1_3-6_B

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-8
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 07:42
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_3-6_B
Lab Sample ID: 580-137730-8
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 77.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:48

Client Sample ID: NAN_DU1_6-9_B
Lab Sample ID: 580-137730-9
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 07:45
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_6-9_B
Lab Sample ID: 580-137730-9
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 75.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:50

Client Sample ID: NAN_DU1_0-3_C
Lab Sample ID: 580-137730-10
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 07:48
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_0-3_C
Lab Sample ID: 580-137730-10
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 80.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:52

Lab Chronicle

Client: EnviroQuest, Inc.
Job ID: 580-137730-1
Project/Site: Nanue Bridge

Client Sample ID: NAN_DU1_3-6_C
Lab Sample ID: 580-137730-11
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 07:08
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_3-6_C
Lab Sample ID: 580-137730-11
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 77.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:55

Client Sample ID: NAN_DU1_6-9_C
Lab Sample ID: 580-137730-12
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 01:09
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_6-9_C
Lab Sample ID: 580-137730-12
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 73.7

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:57

Client Sample ID: NAN_DU3_0-3
Lab Sample ID: 580-137730-13
Date Collected: 03/06/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 00:46
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Lab Chronicle

Client Sample ID: NAN_DU3_0-3

Lab Sample ID: 580-137730-13
Date Collected: 03/06/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 69.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:59

Client Sample ID: NAN_DU3_3-6

Lab Sample ID: 580-137730-14
Date Collected: 03/06/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 02:33
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU3_3-6

Lab Sample ID: 580-137730-14
Date Collected: 03/06/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 70.7

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:02

Client Sample ID: NAN_DU3_6-9

Lab Sample ID: 580-137730-15
Date Collected: 03/06/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 02:30
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU3_6-9

Lab Sample ID: 580-137730-15
Date Collected: 03/06/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 72.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:04

Lab Chronicle

Client Sample ID: NAN_DU2_0-3
Lab Sample ID: 580-137730-16

Date Collected: 03/06/24 15:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 01:34
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU2_0-3
Lab Sample ID: 580-137730-16

Date Collected: 03/06/24 15:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 75.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:11

Client Sample ID: NAN_DU2_3-6
Lab Sample ID: 580-137730-17

Date Collected: 03/06/24 15:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 01:48
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU2_3-6
Lab Sample ID: 580-137730-17

Date Collected: 03/06/24 15:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 77.2

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:14

Client Sample ID: NAN_DU2_6-9
Lab Sample ID: 580-137730-18

Date Collected: 03/06/24 15:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 02:22
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU2_6-9

Lab Sample ID: 580-137730-18

Date Collected: 03/06/24 15:00

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 77.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:16

Client Sample ID: NAN_DU9_0-3

Lab Sample ID: 580-137730-19

Date Collected: 03/09/24 12:30

Matrix: Solid

Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 02:28
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		2000	455425	FCW	EET SEA	04/01/24 18:07
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU9_0-3

Lab Sample ID: 580-137730-19

Date Collected: 03/09/24 12:30

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 70.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:09
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:19

Client Sample ID: NAN_DU9_3-6

Lab Sample ID: 580-137730-20

Date Collected: 03/09/24 12:30

Matrix: Solid

Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 02:25
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		2000	455425	FCW	EET SEA	04/01/24 18:04
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU9_3-6

Lab Sample ID: 580-137730-20
Date Collected: 03/09/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 61.5

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:09
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:21

Client Sample ID: NAN_DU9_6-9

Lab Sample ID: 580-137730-21
Date Collected: 03/09/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 04:50
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 04:52
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU9_6-9

Lab Sample ID: 580-137730-21
Date Collected: 03/09/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 64.5

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 16:10

Client Sample ID: NAN_DU10_0-3

Lab Sample ID: 580-137730-22
Date Collected: 03/09/24 14:30
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3546			454340	E1W	EET SEA	03/20/24 15:22
Total/NA	Analysis	8082A		1	455366	TL1	EET SEA	04/01/24 14:54
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/04/24 17:39
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/04/24 18:01
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Lab Chronicle

Client Sample ID: NAN_DU10_0-3

Lab Sample ID: 580-137730-22

Date Collected: 03/09/24 14:30

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 71.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 16:13

Client Sample ID: NAN_DU10_3-6

Lab Sample ID: 580-137730-23

Date Collected: 03/09/24 14:30

Matrix: Solid

Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3546			454340	E1W	EET SEA	03/20/24 15:22
Total/NA	Analysis	8082A		1	455366	TL1	EET SEA	04/01/24 15:47
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 05:01
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 05:04
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU10_3-6

Lab Sample ID: 580-137730-23

Date Collected: 03/09/24 14:30

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 70.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 15:45

Client Sample ID: NAN_DU10_6-9

Lab Sample ID: 580-137730-24

Date Collected: 03/09/24 14:30

Matrix: Solid

Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/04/24 17:52
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/04/24 18:14
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU10_6-9

Lab Sample ID: 580-137730-24
Date Collected: 03/09/24 14:30
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 68.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 15:54

Client Sample ID: NAN_DU11_0-3

Lab Sample ID: 580-137730-25
Date Collected: 03/10/24 12:20
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 05:47
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 05:50
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU11_0-3

Lab Sample ID: 580-137730-25
Date Collected: 03/10/24 12:20
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 62.7

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 15:36

Client Sample ID: NAN_DU11_3-6

Lab Sample ID: 580-137730-26
Date Collected: 03/10/24 12:20
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3546			454340	E1W	EET SEA	03/20/24 15:22
Total/NA	Analysis	8082A		1	455366	TL1	EET SEA	04/01/24 16:04
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 04:44
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 04:47
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU11_3-6

Lab Sample ID: 580-137730-26

Date Collected: 03/10/24 12:20

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 65.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 15:56

Client Sample ID: NAN_DU11_6-9

Lab Sample ID: 580-137730-27

Date Collected: 03/10/24 12:20

Matrix: Solid

Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 05:41
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 05:44
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU11_6-9

Lab Sample ID: 580-137730-27

Date Collected: 03/10/24 12:20

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 66.2

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 15:59

Client Sample ID: NAN_DU12_0-3

Lab Sample ID: 580-137730-28

Date Collected: 03/10/24 13:10

Matrix: Solid

Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 04:55
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 04:58
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Lab Chronicle

Client Sample ID: NAN_DU12_0-3

Lab Sample ID: 580-137730-28
Date Collected: 03/10/24 13:10
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 68.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 16:02

Client Sample ID: NAN_DU12_3-6

Lab Sample ID: 580-137730-29
Date Collected: 03/10/24 13:10
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 05:35
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 05:38
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU12_3-6

Lab Sample ID: 580-137730-29
Date Collected: 03/10/24 13:10
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 75.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 16:05

Client Sample ID: NAN_DU12_6-9

Lab Sample ID: 580-137730-30
Date Collected: 03/10/24 13:10
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 05:52
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 05:55
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU12_6-9
Date Collected: 03/10/24 13:10
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-30
Matrix: Solid
Percent Solids: 72.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 16:08

Laboratory References:

EET SEA = Eurofins Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Accreditation/Certification Summary

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Laboratory: Eurofins Seattle

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	**Program**	**Identification Number**	**Expiration Date**
ANAB	Dept. of Defense ELAP	L2236	01-19-25

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
2540G		Solid	Percent Moisture
2540G		Solid	Percent Solids

Sample Summary

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-137730-1	NAN_DU8_0-3	Solid	03/03/24 10:00	03/14/24 09:30
580-137730-2	NAN_DU8_3-6	Solid	03/03/24 10:00	03/14/24 09:30
580-137730-3	NAN_DU8_6-9	Solid	03/03/24 10:00	03/14/24 09:30
580-137730-4	NAN_DU1_0-3_A	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-5	NAN_DU1_3-6_A	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-6	NAN_DU1_6-9_A	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-7	NAN_DU1_0-3_B	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-8	NAN_DU1_3-6_B	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-9	NAN_DU1_6-9_B	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-10	NAN_DU1_0-3_C	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-11	NAN_DU1_3-6_C	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-12	NAN_DU1_6-9_C	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-13	NAN_DU3_0-3	Solid	03/06/24 12:30	03/14/24 09:30
580-137730-14	NAN_DU3_3-6	Solid	03/06/24 12:30	03/14/24 09:30
580-137730-15	NAN_DU3_6-9	Solid	03/06/24 12:30	03/14/24 09:30
580-137730-16	NAN_DU2_0-3	Solid	03/06/24 15:00	03/14/24 09:30
580-137730-17	NAN_DU2_3-6	Solid	03/06/24 15:00	03/14/24 09:30
580-137730-18	NAN_DU2_6-9	Solid	03/06/24 15:00	03/14/24 09:30
580-137730-19	NAN_DU9_0-3	Solid	03/09/24 12:30	03/14/24 09:30
580-137730-20	NAN_DU9_3-6	Solid	03/09/24 12:30	03/14/24 09:30
580-137730-21	NAN_DU9_6-9	Solid	03/09/24 12:30	03/14/24 09:30
580-137730-22	NAN_DU10_0-3	Solid	03/09/24 14:30	03/14/24 09:30
580-137730-23	NAN_DU10_3-6	Solid	03/09/24 14:30	03/14/24 09:30
580-137730-24	NAN_DU10_6-9	Solid	03/09/24 14:30	03/14/24 09:30
580-137730-25	NAN_DU11_0-3	Solid	03/10/24 12:20	03/14/24 09:30
580-137730-26	NAN_DU11_3-6	Solid	03/10/24 12:20	03/14/24 09:30
580-137730-27	NAN_DU11_6-9	Solid	03/10/24 12:20	03/14/24 09:30
580-137730-28	NAN_DU12_0-3	Solid	03/10/24 13:10	03/14/24 09:30
580-137730-29	NAN_DU12_3-6	Solid	03/10/24 13:10	03/14/24 09:30
580-137730-30	NAN_DU12_6-9	Solid	03/10/24 13:10	03/14/24 09:30

Eurofins Environmental Testing Northwest, LLC
5755 8th Street East
Tacoma, WA 98424

Chain of Custody Record

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Client Information	Sampler: KC, SM, RK	Lab PM: Tracy Dutton	Carrier Tracking No(s):	COC No:
Client Contact: Scott Moncrief	Phone: 808 2860222	E-Mail: scottmoncrief808@gmail.com	State of Origin: HI	Page: Page 1 of ~~1~~ KC 3
Company: Kealamahi Pacific	PWSID:	Analysis Requested		Job #:
Address: 103 S Kalaheo Ave	Due Date Requested: std TAT			
City: Kailua	TAT Requested (days): std			
State, Zip: HI 96734	Compliance Project: Δ Yes Δ No			
Phone: 808 2860222	PO #: Purchase Order not required			
Email: scottmoncrief808@gmail.com	WO #:			
Project Name: Nanue Bridge	Project #:			
Site:	SSOW#:			

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8 RCRA Metals	% moisture	Total Number of containers	Special Instructions/Note:
			Preservation Code:							
NAN-DU8-0-3	3/3/24	1000	MIS	S			X	X		50 increment DU
NAN_DU8_3-6		1000					X	X		
NAN-DU8_6-9	↓	1000					X	X		
NAN-DU1-0-3_A	3/5/24	1600					X	X		
NAN_DU~~9~~1KC-3-6-A		1600					X	X		
NAN-DU~~9~~1KC-6-9-A		1600					X	X		
NAN-DU~~9~~1KC-0-3-B		1600					X	X		
NAN-DU~~9~~1KC-3-6-B		1600					X	X		
NAN-DU~~9~~1KC-6-9-B		1600					X	X		
NAN-DU~~9~~1KC-0-3-C		1600					X	X		
NAN-DU~~9~~1KC-3-6-C	↓	1600	↓	↓			X	X		

580-137730 Chain of Custody

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ________ Months

Deliverable Requested: I, II, III, IV, Other (specify) std

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment: FedEx

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Scott Moncrief	3/11/24 · 1100 Am	KPC		3/14/24 0930	EETN
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Eurofins Environmental Testing Northwest, LLC
5755 8th Street East
Tacoma, WA 98424

Chain of Custody Record

eurofins | Environment Testing

Client Information

Client Contact:
Sampler:
Phone:
Lab PM:
E-Mail:
Carrier Tracking No(s):
State of Origin:
COC No:
Page: ~~Page 1 of 1~~ KC 2 of 3
Job #:
Company: Kealamahi Pacific
PWSID:
Address:
Due Date Requested:
City:
TAT Requested (days):
State, Zip:
Compliance Project: Δ Yes Δ No
Phone:
PO #: Purchase Order not required
Email:
WO #:
Project Name: Nanue Bridge
Project #:
Site:
SSOW#:

Analysis Requested

Preservation Codes:

A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA
M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2O3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - pH 4-5
Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8 RCRA Metals	% Moisture		Total Number of containers	Special Instructions/Note:
			Preservation Code:								
NAN-DU1-6-9-C KC	3/5/24	1600	MIS	S			X	X			50 increment DU
NAN-DU3-0-3	3/6/24	1230					X	X			
NAN-DU3-3-6		1230					X	X			
NAN-DU3-6-9		1230					X	X			
NAN-DU2-0-3		1500					X	X			
NAN-DU2-3-6		1500					X	X			
NAN-DU2-6-9	↓	1500					X	X			
NAN-DU9-0-3	3/9/24	1230					X	X			
NAN-DU9-3-6		1230					X	X			
NAN-DU9-6-9		1230					X	X			↓
NAN-DU10-0-3	↓	1430	↓	↓			X	X	X		

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ________ Months

Deliverable Requested: I, II, III, IV, Other (specify) std

Special Instructions/QC Requirements:

Empty Kit Relinquished by:
Date:
Time:
Method of Shipment: FedEx

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Scott Moncrief	3/11/24 11:00 Am			3/14/24 0930	EETN

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Eurofins Environmental Testing Northwest, LLC
5755 8th Street East
Tacoma, WA 98424

Chain of Custody Record

eurofins | Environment Testing

Client Information

Sampler:
Lab PM:
Carrier Tracking No(s):
COC No:

Client Contact:
Phone:
E-Mail:
State of Origin:
Page: KC
Page ~~1 of 1~~ 3 of 3

Company: Kealamahi Pacific
PWSID:
Job #:

Address:
Due Date Requested:

City:
TAT Requested (days):

State, Zip:
Compliance Project: Δ Yes Δ No

Phone:
PO #:
Purchase Order not required

Email:
WO #:

Project Name: Nanue Bridge
Project #:

Site:
SSOW#:

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8 RCRA Metals	% moisture	PCBs	Total Number of containers	Special Instructions/Note:
			Preservation Code:								
NAN_DU10_3-6	3/9/24	1430	MIS	S			X	X	X		50 increment DU
NAN_DU10_6-9	↓	1430					X	X			
NAN_DU11_0-3	3/10/24	1220					X	X			
NAN_DU11_3-6		1220					X	X	X		
NAN_DU11_6-9		1220					X	X			
NAN_DU12_0-3		1310					X	X			
NAN_DU12_3-6		1310					X	X			
NAN_DU12_6-9	↓	1310	↓	↓			X	X			↓
		LAST ENTRY									

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☒ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify) std

Special Instructions/QC Requirements:

Empty Kit Relinquished by:
Date:
Time:
Method of Shipment: FedEx

Relinquished by: Scott Moncrief	Date/Time: 3/11/24 11 00 AM	Company	Received by:	Date/Time: 3/14/24 0930	Company EETN
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Ver: 01/16/2019

#1 IR11 13,3/13.2 LB/Ice/no/FPO

#2 IB11 13.2/13.1 Lh/Ice/no/FPO

Login Sample Receipt Checklist

Client: EnviroQuest, Inc.

Job Number: 580-137730-1

Login Number: 137730
List Number: 1
Creator: Groves, Elizabeth

List Source: Eurofins Seattle

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	Cooler temperature outside limits,acceptable per client data quality objectives
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

ANALYTICAL REPORT

PREPARED FOR

Attn: Scott Moncrief
EnviroQuest, Inc.
98-029 Hekaha Street
Suite 21
Aiea, Hawaii 96701

Generated 5/6/2024 6:48:09 PM Revision 1

JOB DESCRIPTION

Nanue Bridge

JOB NUMBER

580-137730-1

Eurofins Seattle
5755 8th Street East
Tacoma WA 98424

See page two for job notes and contact information.

Eurofins Seattle

Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing Northwest, LLC Project Manager.

Authorization

Tracy Dutton

Authorized for release by
Tracy Dutton, Client Relations Manager
Tracy.Dutton@et.eurofinsus.com
(253)248-4970

Generated
5/6/2024 6:48:09 PM
Revision 1

Table of Contents

Job ID: 580-137730-1 — Eurofins Seattle

Job Narrative
580-137730-1

REVISION
The report being provided is a revision of the original report sent on 4/8/2024. The report (revision 1) is being revised due to client added TCLP RCRA metals and SPLP Lead analyses to several samples in the job (see narrative notes below).

Analytical test results meet all requirements of the associated regulatory program listed on the Accreditation/Certification Summary Page unless otherwise noted under the individual analysis. Data qualifiers are applied to indicate exceptions. Noncompliant quality control (QC) is further explained in narrative comments.

- Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD may be performed, unless otherwise specified in the method.
- Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.

Receipt
The samples were received on 3/14/2024 9:30 AM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperatures of the 2 coolers at receipt time were 13.2°C and 13.3°C.

Note: All samples which require thermal preservation are considered acceptable if the arrival temperature is within 2C of the required temperature or method specified range. For samples with a specified temperature of 4C, samples with a temperature ranging from just above freezing temperature of water to 6C shall be acceptable. Samples that are hand delivered immediately following collection may not meet these criteria, however they will be deemed acceptable according to NELAC standards, if there is evidence that the chilling process has begun, such as arrival on ice, etc.

Receipt Exceptions
All samples contained in this login were delayed in shipment.

NAN_DU8_0-3 (580-137730-1), NAN_DU8_3-6 (580-137730-2), NAN_DU8_6-9 (580-137730-3), NAN_DU1_0-3_A (580-137730-4), NAN_DU1_3-6_A (580-137730-5), NAN_DU1_6-9_A (580-137730-6), NAN_DU1_0-3_B (580-137730-7), NAN_DU1_3-6_B (580-137730-8), NAN_DU1_6-9_B (580-137730-9), NAN_DU1_0-3_C (580-137730-10), NAN_DU1_3-6_C (580-137730-11), NAN_DU1_6-9_C (580-137730-12), NAN_DU3_0-3 (580-137730-13), NAN_DU3_3-6 (580-137730-14), NAN_DU3_6-9 (580-137730-15), NAN_DU2_0-3 (580-137730-16), NAN_DU2_3-6 (580-137730-17), NAN_DU2_6-9 (580-137730-18), NAN_DU9_0-3 (580-137730-19), NAN_DU9_3-6 (580-137730-20), NAN_DU9_6-9 (580-137730-21), NAN_DU10_0-3 (580-137730-22), NAN_DU10_3-6 (580-137730-23), NAN_DU10_6-9 (580-137730-24), NAN_DU11_0-3 (580-137730-25), NAN_DU11_3-6 (580-137730-26), NAN_DU11_6-9 (580-137730-27), NAN_DU12_0-3 (580-137730-28), NAN_DU12_3-6 (580-137730-29) and NAN_DU12_6-9 (580-137730-30)

Method 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography
Samples NAN_DU10_0-3 (580-137730-22), NAN_DU10_3-6 (580-137730-23) and NAN_DU11_3-6 (580-137730-26) were analyzed for Polychlorinated Biphenyls (PCBs) by Gas Chromatography. The samples were composited on 3/18/2024, prepared on 3/20/2024 and analyzed on 4/1/2024.

The matrix spike / matrix spike duplicate (MS/MSD) recoveries for preparation batch 580-454054 and 580-454340 and analytical batch 580-455366 were outside control limits for one or more analytes. See QC Sample Results for detail. Sample matrix interference and/or non-homogeneity are suspected because the associated laboratory control sample (LCS) recovery is within acceptance limits.

The %RPD between the primary and confirmation column exceeded 40% for PCB-1254 for the following sample: NAN_DU10_3-6 (580-137730-23). The lower value(s) has been reported and qualified in accordance with the laboratory's SOP.

The following samples required a TBA clean-up to reduce matrix interferences caused by sulfur TBA_00037: NAN_DU10_0-3 (580-137730-22), NAN_DU10_3-6 (580-137730-23), NAN_DU11_3-6 (580-137730-26), (LCS 580-454340/2-A), (LCSD 580-454340/3-A), (MB 580-454340/1-A), (580-137730-A-22-D MS) and (580-137730-A-22-E MSD)
.

Method 6010D - Metals (ICP) - TCLP

Samples NAN_DU8_0-3 (580-137730-1), NAN_DU1_0-3_B (580-137730-7), NAN_DU3_6-9 (580-137730-15), NAN_DU2_6-9 (580-137730-18), NAN_DU9_0-3 (580-137730-19), NAN_DU10_3-6 (580-137730-23), NAN_DU11_3-6 (580-137730-26) and NAN_DU12_3-6 (580-137730-29) were analyzed for Metals (ICP) - TCLP. The samples were leached on 4/23/2024, prepared on 4/25/2024 and 4/26/2024 and analyzed on 4/25/2024 and 5/1/2024.

The following samples were prepared outside of preparation holding time due to the client activating TCLP 7470 analysis on 04/24/2024 after receiving the total 7471 mercury results: NAN_DU8_0-3 (580-137730-1), NAN_DU1_0-3_B (580-137730-7), NAN_DU3_6-9 (580-137730-15), NAN_DU2_6-9 (580-137730-18), NAN_DU9_0-3 (580-137730-19), NAN_DU10_3-6 (580-137730-23), NAN_DU11_3-6 (580-137730-26) and NAN_DU12_3-6 (580-137730-29).

Because the client activated both TCLP and SPLP methods after receiving results for total metals and mercury, insufficient samples were provided by ISM to perform both leaching procedures with the required 100g for the following samples: NAN_DU8_0-3 (580-137730-1), NAN_DU1_0-3_B (580-137730-7), NAN_DU3_6-9 (580-137730-15), NAN_DU2_6-9 (580-137730-18), NAN_DU9_0-3 (580-137730-19), NAN_DU10_3-6 (580-137730-23), NAN_DU11_3-6 (580-137730-26) and NAN_DU12_3-6 (580-137730-29). The volume of leaching fluid was adjusted proportionally to maintain a 20:1 ratio of leaching fluid to weight of sample. Reporting limits (RLs) are not affected.

Method 6020B - Metals (ICP/MS)
Samples NAN_DU8_0-3 (580-137730-1), NAN_DU8_3-6 (580-137730-2), NAN_DU8_6-9 (580-137730-3), NAN_DU1_0-3_A (580-137730-4), NAN_DU1_3-6_A (580-137730-5), NAN_DU1_6-9_A (580-137730-6), NAN_DU1_0-3_B (580-137730-7), NAN_DU1_3-6_B (580-137730-8), NAN_DU1_6-9_B (580-137730-9), NAN_DU1_0-3_C (580-137730-10), NAN_DU1_3-6_C (580-137730-11), NAN_DU1_6-9_C (580-137730-12), NAN_DU3_0-3 (580-137730-13), NAN_DU3_3-6 (580-137730-14), NAN_DU3_6-9 (580-137730-15), NAN_DU2_0-3 (580-137730-16), NAN_DU2_3-6 (580-137730-17), NAN_DU2_6-9 (580-137730-18), NAN_DU9_0-3 (580-137730-19), NAN_DU9_3-6 (580-137730-20), NAN_DU9_6-9 (580-137730-21), NAN_DU10_0-3 (580-137730-22), NAN_DU10_3-6 (580-137730-23), NAN_DU10_6-9 (580-137730-24), NAN_DU11_0-3 (580-137730-25), NAN_DU11_3-6 (580-137730-26), NAN_DU11_6-9 (580-137730-27), NAN_DU12_0-3 (580-137730-28), NAN_DU12_3-6 (580-137730-29) and NAN_DU12_6-9 (580-137730-30) were analyzed for Metals (ICP/MS). The samples were composited on 3/18/2024, prepared on 3/28/2024 and 4/1/2024 and analyzed on 3/29/2024, 3/30/2024, 4/1/2024, 4/4/2024 and 4/5/2024.

Samples NAN_DU9_0-3 (580-137730-19)[2000x], NAN_DU9_3-6 (580-137730-20)[2000x], NAN_DU9_6-9 (580-137730-21)[2000x], NAN_DU10_0-3 (580-137730-22)[2000x], NAN_DU10_3-6 (580-137730-23)[2000x], NAN_DU10_6-9 (580-137730-24)[2000x], NAN_DU11_0-3 (580-137730-25)[2000x], NAN_DU11_3-6 (580-137730-26)[2000x], NAN_DU11_6-9 (580-137730-27)[2000x], NAN_DU12_0-3 (580-137730-28)[2000x], NAN_DU12_3-6 (580-137730-29)[2000x] and NAN_DU12_6-9 (580-137730-30)[2000x] required dilution prior to analysis. The reporting limits have been adjusted accordingly.

Method 7470A - Mercury (CVAA) - TCLP
Samples NAN_DU8_0-3 (580-137730-1), NAN_DU1_0-3_B (580-137730-7), NAN_DU3_6-9 (580-137730-15), NAN_DU2_6-9 (580-137730-18), NAN_DU9_0-3 (580-137730-19), NAN_DU10_3-6 (580-137730-23), NAN_DU11_3-6 (580-137730-26) and NAN_DU12_3-6 (580-137730-29) were analyzed for Mercury (CVAA) - TCLP. The samples were leached on 4/23/2024, prepared on 4/25/2024 and analyzed on 4/30/2024.

The following samples were prepared outside of preparation holding time due to the client activating TCLP 7470 analysis on 04/24/2024 after receiving the total 7471 mercury results: NAN_DU8_0-3 (580-137730-1), NAN_DU1_0-3_B (580-137730-7), NAN_DU3_6-9 (580-137730-15), NAN_DU2_6-9 (580-137730-18), NAN_DU9_0-3 (580-137730-19), NAN_DU10_3-6 (580-137730-23), NAN_DU11_3-6 (580-137730-26) and NAN_DU12_3-6 (580-137730-29).

Because the client activated both TCLP and SPLP methods after receiving results for total metals and mercury, insufficient samples were provided by ISM to perform both leaching procedures with the required 100g for the following samples: NAN_DU8_0-3 (580-137730-1), NAN_DU1_0-3_B (580-137730-7), NAN_DU3_6-9 (580-137730-15), NAN_DU2_6-9 (580-137730-18), NAN_DU9_0-3 (580-137730-19), NAN_DU10_3-6 (580-137730-23), NAN_DU11_3-6 (580-137730-26) and NAN_DU12_3-6 (580-137730-29). The volume of leaching fluid was adjusted proportionally to maintain a 20:1 ratio of leaching fluid to weight of sample. Reporting limits (RLs) are not affected.

Method 7471A - Mercury (CVAA)
Samples NAN_DU8_0-3 (580-137730-1), NAN_DU8_3-6 (580-137730-2), NAN_DU8_6-9 (580-137730-3), NAN_DU1_0-3_A (580-137730-4), NAN_DU1_3-6_A (580-137730-5), NAN_DU1_6-9_A (580-137730-6), NAN_DU1_0-3_B (580-137730-7), NAN_DU1_3-6_B (580-137730-8), NAN_DU1_6-9_B (580-137730-9), NAN_DU1_0-3_C (580-137730-10), NAN_DU1_3-6_C (580-137730-11), NAN_DU1_6-9_C (580-137730-12), NAN_DU3_0-3 (580-137730-13), NAN_DU3_3-6 (580-137730-14), NAN_DU3_6-9 (580-137730-15), NAN_DU2_0-3 (580-137730-16), NAN_DU2_3-6 (580-137730-17), NAN_DU2_6-9 (580-137730-18), NAN_DU9_0-3 (580-137730-19), NAN_DU9_3-6 (580-137730-20), NAN_DU9_6-9 (580-137730-21),

Job ID: 580-137730-1 (Continued) Eurofins Seattle

NAN_DU10_0-3 (580-137730-22), NAN_DU10_3-6 (580-137730-23), NAN_DU10_6-9 (580-137730-24), NAN_DU11_0-3 (580-137730-25), NAN_DU11_3-6 (580-137730-26), NAN_DU11_6-9 (580-137730-27), NAN_DU12_0-3 (580-137730-28), NAN_DU12_3-6 (580-137730-29) and NAN_DU12_6-9 (580-137730-30) were analyzed for Mercury (CVAA). The samples were composited on 3/18/2024, prepared on 3/25/2024 and 4/2/2024 and analyzed on 3/26/2024 and 4/2/2024.

Method 2540G - SM 2540G

Samples NAN_DU8_0-3 (580-137730-1), NAN_DU8_3-6 (580-137730-2), NAN_DU8_6-9 (580-137730-3), NAN_DU1_0-3_A (580-137730-4), NAN_DU1_3-6_A (580-137730-5), NAN_DU1_6-9_A (580-137730-6), NAN_DU1_0-3_B (580-137730-7), NAN_DU1_3-6_B (580-137730-8), NAN_DU1_6-9_B (580-137730-9), NAN_DU1_0-3_C (580-137730-10), NAN_DU1_3-6_C (580-137730-11), NAN_DU1_6-9_C (580-137730-12), NAN_DU3_0-3 (580-137730-13), NAN_DU3_3-6 (580-137730-14), NAN_DU3_6-9 (580-137730-15), NAN_DU2_0-3 (580-137730-16), NAN_DU2_3-6 (580-137730-17), NAN_DU2_6-9 (580-137730-18), NAN_DU9_0-3 (580-137730-19), NAN_DU9_3-6 (580-137730-20), NAN_DU9_6-9 (580-137730-21), NAN_DU10_0-3 (580-137730-22), NAN_DU10_3-6 (580-137730-23), NAN_DU10_6-9 (580-137730-24), NAN_DU11_0-3 (580-137730-25), NAN_DU11_3-6 (580-137730-26), NAN_DU11_6-9 (580-137730-27), NAN_DU12_0-3 (580-137730-28), NAN_DU12_3-6 (580-137730-29) and NAN_DU12_6-9 (580-137730-30) were analyzed for SM 2540G. The samples were composited on 3/18/2024 and analyzed on 3/26/2024.

Definitions/Glossary

Qualifiers

GC Semi VOA

Qualifier	Qualifier Description
J1	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
M	Manual integrated compound.
U	Undetected at the Limit of Detection.

Metals

Qualifier	Qualifier Description
4	MS, MSD: The analyte present in the original sample is greater than 4 times the matrix spike concentration; therefore, control limits are not applicable.
H	Sample was prepped or analyzed beyond the specified holding time. This does not meet regulatory requirements.
J	Estimated: The analyte was positively identified; the quantitation is an estimation
J1	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU8_0-3

Date Collected: 03/03/24 10:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-1
Matrix: Solid

Method: SW846 6010D - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**0.59**		0.030	0.0027	mg/L		05/06/24 15:58	05/01/24 22:22	1

Method: SW846 6010D - TCLP Metals (ICP) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.029	U	0.060	0.0072	mg/L		04/25/24 11:48	04/25/24 19:56	1
Barium	**1.1**		0.020	0.0010	mg/L		04/25/24 11:48	04/25/24 19:56	1
Cadmium	**0.0025**	**J**	0.020	0.00090	mg/L		04/25/24 11:48	04/25/24 19:56	1
Chromium	0.0052	U	0.025	0.0027	mg/L		04/25/24 11:48	04/25/24 19:56	1
Lead	**3.7**		0.030	0.0027	mg/L		04/25/24 11:48	04/25/24 19:56	1
Selenium	0.035	U	0.10	0.0087	mg/L		04/25/24 11:48	04/25/24 19:56	1
Silver	0.034	U	0.050	0.0085	mg/L		04/25/24 11:48	04/25/24 19:56	1

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**20**		0.50	0.099	mg/Kg		03/28/24 09:38	03/29/24 06:51	20
Barium	**150**		0.99	0.23	mg/Kg		03/28/24 09:38	03/29/24 06:51	20
Cadmium	**0.56**	**J**	0.79	0.077	mg/Kg		03/28/24 09:38	03/29/24 06:51	20
Chromium	**170**		0.99	0.063	mg/Kg		03/28/24 09:38	03/29/24 06:51	20
Lead	**4300**		0.50	0.048	mg/Kg		03/28/24 09:38	03/29/24 06:51	20
Selenium	**5.8**		1.5	0.28	mg/Kg		03/28/24 09:38	03/29/24 06:51	20
Silver	**0.088**	**J**	0.20	0.020	mg/Kg		03/28/24 09:38	03/29/24 06:51	20

Method: SW846 7470A - TCLP Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0020	U H	0.0030	0.0015	mg/L		04/25/24 12:11	04/30/24 15:37	1

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**71.8**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**28.2**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU8_0-3

Date Collected: 03/03/24 10:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-1

Matrix: Solid
Percent Solids: 71.8

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.31**		0.022	0.0067	mg/Kg	☼	03/25/24 10:07	03/26/24 14:21	1

Client Sample Results

Client Sample ID: NAN_DU8_3-6

Lab Sample ID: 580-137730-2

Date Collected: 03/03/24 10:00
Date Received: 03/14/24 09:30
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	20		0.50	0.099	mg/Kg		03/28/24 09:38	03/29/24 06:57	20
Barium	200		0.99	0.23	mg/Kg		03/28/24 09:38	03/29/24 06:57	20
Cadmium	0.62	J	0.80	0.077	mg/Kg		03/28/24 09:38	03/29/24 06:57	20
Chromium	180		0.99	0.063	mg/Kg		03/28/24 09:38	03/29/24 06:57	20
Lead	3100		0.50	0.048	mg/Kg		03/28/24 09:38	03/29/24 06:57	20
Selenium	6.8		1.5	0.28	mg/Kg		03/28/24 09:38	03/29/24 06:57	20
Silver	0.072	J	0.20	0.020	mg/Kg		03/28/24 09:38	03/29/24 06:57	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	70.8		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	29.2		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU8_3-6

Lab Sample ID: 580-137730-2

Date Collected: 03/03/24 10:00
Date Received: 03/14/24 09:30

Matrix: Solid
Percent Solids: 70.8

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.30**		0.024	0.0071	mg/Kg	☼	03/25/24 10:07	03/26/24 14:28	1

Client Sample Results

Client Sample ID: NAN_DU8_6-9

Lab Sample ID: 580-137730-3

Date Collected: 03/03/24 10:00

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**32**		0.47	0.095	mg/Kg		03/28/24 09:38	03/29/24 06:54	20
Barium	**180**		0.95	0.22	mg/Kg		03/28/24 09:38	03/29/24 06:54	20
Cadmium	**0.66**	**J**	0.76	0.073	mg/Kg		03/28/24 09:38	03/29/24 06:54	20
Chromium	**180**		0.95	0.060	mg/Kg		03/28/24 09:38	03/29/24 06:54	20
Lead	**2900**		0.47	0.046	mg/Kg		03/28/24 09:38	03/29/24 06:54	20
Selenium	**7.1**		1.4	0.27	mg/Kg		03/28/24 09:38	03/29/24 06:54	20
Silver	**0.073**	**J**	0.19	0.019	mg/Kg		03/28/24 09:38	03/29/24 06:54	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**69.0**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**31.0**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU8_6-9

Lab Sample ID: 580-137730-3

Date Collected: 03/03/24 10:00

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 69.0

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.34**		0.024	0.0072	mg/Kg	☼	03/25/24 10:07	03/26/24 14:31	1

Client Sample ID: NAN_DU1_0-3_A

Lab Sample ID: 580-137730-4

Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	28		0.47	0.095	mg/Kg		03/28/24 09:38	03/29/24 06:49	20
Barium	260		0.95	0.22	mg/Kg		03/28/24 09:38	03/29/24 06:49	20
Cadmium	0.37	J	0.76	0.073	mg/Kg		03/28/24 09:38	03/29/24 06:49	20
Chromium	180		0.95	0.060	mg/Kg		03/28/24 09:38	03/29/24 06:49	20
Lead	1100		0.47	0.046	mg/Kg		03/28/24 09:38	03/29/24 06:49	20
Selenium	8.1		1.4	0.27	mg/Kg		03/28/24 09:38	03/29/24 06:49	20
Silver	0.064	J	0.19	0.019	mg/Kg		03/28/24 09:38	03/29/24 06:49	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	82.3		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	17.7		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU1_0-3_A

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-4

Matrix: Solid
Percent Solids: 82.3

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.15**		0.020	0.0060	mg/Kg	☼	03/25/24 10:07	03/26/24 14:33	1

Client Sample ID: NAN_DU1_3-6_A

Lab Sample ID: 580-137730-5

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**24**		0.49	0.098	mg/Kg		03/28/24 09:38	03/29/24 06:23	20
Barium	**270**		0.98	0.22	mg/Kg		03/28/24 09:38	03/29/24 06:23	20
Cadmium	**0.42**	**J**	0.78	0.076	mg/Kg		03/28/24 09:38	03/29/24 06:23	20
Chromium	**190**		0.98	0.062	mg/Kg		03/28/24 09:38	03/29/24 06:23	20
Lead	**980**		0.49	0.047	mg/Kg		03/28/24 09:38	03/29/24 06:23	20
Selenium	**9.6**		1.5	0.28	mg/Kg		03/28/24 09:38	03/29/24 06:23	20
Silver	**0.057**	**J**	0.20	0.020	mg/Kg		03/28/24 09:38	03/29/24 06:23	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**78.6**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**21.4**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU1_3-6_A

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-5

Matrix: Solid
Percent Solids: 78.6

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.021	0.0063	mg/Kg	☼	03/25/24 10:07	03/26/24 14:36	1

Eurofins Seattle

Client Sample ID: NAN_DU1_6-9_A
Lab Sample ID: 580-137730-6

Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**17**		0.48	0.096	mg/Kg		03/28/24 09:38	03/29/24 07:37	20
Barium	**340**		0.96	0.22	mg/Kg		03/28/24 09:38	03/29/24 07:37	20
Cadmium	**0.32**	**J**	0.77	0.074	mg/Kg		03/28/24 09:38	03/29/24 07:37	20
Chromium	**190**		0.96	0.060	mg/Kg		03/28/24 09:38	03/29/24 07:37	20
Lead	**640**		0.48	0.046	mg/Kg		03/28/24 09:38	03/29/24 07:37	20
Selenium	**10**		1.4	0.27	mg/Kg		03/28/24 09:38	03/29/24 07:37	20
Silver	**0.043**	**J**	0.19	0.019	mg/Kg		03/28/24 09:38	03/29/24 07:37	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**75.2**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**24.8**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU1_6-9_A

Lab Sample ID: 580-137730-6

Date Collected: 03/05/24 16:00

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 75.2

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.15**		0.021	0.0063	mg/Kg	☼	03/25/24 10:07	03/26/24 14:43	1

Eurofins Seattle

Client Sample ID: NAN_DU1_0-3_B

Lab Sample ID: 580-137730-7

Date Collected: 03/05/24 16:00

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6010D - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**0.080**		0.030	0.0027	mg/L		05/06/24 15:58	05/01/24 22:49	1

Method: SW846 6010D - TCLP Metals (ICP) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.029	U	0.060	0.0072	mg/L		04/25/24 11:48	04/25/24 20:00	1
Barium	**0.89**		0.020	0.0010	mg/L		04/25/24 11:48	04/25/24 20:00	1
Cadmium	0.0016	U	0.020	0.00090	mg/L		04/25/24 11:48	04/25/24 20:00	1
Chromium	0.0052	U	0.025	0.0027	mg/L		04/25/24 11:48	04/25/24 20:00	1
Lead	**0.60**		0.030	0.0027	mg/L		04/25/24 11:48	04/25/24 20:00	1
Selenium	0.035	U	0.10	0.0087	mg/L		04/25/24 11:48	04/25/24 20:00	1
Silver	0.034	U	0.050	0.0085	mg/L		04/25/24 11:48	04/25/24 20:00	1

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**28**		0.49	0.098	mg/Kg		03/28/24 09:38	03/29/24 07:40	20
Barium	**250**		0.98	0.22	mg/Kg		03/28/24 09:38	03/29/24 07:40	20
Cadmium	**0.42**	**J**	0.78	0.075	mg/Kg		03/28/24 09:38	03/29/24 07:40	20
Chromium	**190**		0.98	0.061	mg/Kg		03/28/24 09:38	03/29/24 07:40	20
Lead	**1200**		0.49	0.047	mg/Kg		03/28/24 09:38	03/29/24 07:40	20
Selenium	**7.5**		1.5	0.28	mg/Kg		03/28/24 09:38	03/29/24 07:40	20
Silver	**0.054**	**J**	0.20	0.020	mg/Kg		03/28/24 09:38	03/29/24 07:40	20

Method: SW846 7470A - TCLP Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0020	U H	0.0030	0.0015	mg/L		04/25/24 12:11	04/30/24 15:39	1

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**83.0**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**17.0**		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU1_0-3_B

Lab Sample ID: 580-137730-7

Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 83.0

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.13**		0.021	0.0062	mg/Kg	☼	03/25/24 10:07	03/26/24 14:45	1

Client Sample Results

Client Sample ID: NAN_DU1_3-6_B

Lab Sample ID: 580-137730-8
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**23**		0.49	0.099	mg/Kg		03/28/24 09:38	03/29/24 07:42	20
Barium	**300**		0.99	0.23	mg/Kg		03/28/24 09:38	03/29/24 07:42	20
Cadmium	**0.37**	**J**	0.79	0.076	mg/Kg		03/28/24 09:38	03/29/24 07:42	20
Chromium	**190**		0.99	0.062	mg/Kg		03/28/24 09:38	03/29/24 07:42	20
Lead	**960**		0.49	0.047	mg/Kg		03/28/24 09:38	03/29/24 07:42	20
Selenium	**8.6**		1.5	0.28	mg/Kg		03/28/24 09:38	03/29/24 07:42	20
Silver	**0.047**	**J**	0.20	0.020	mg/Kg		03/28/24 09:38	03/29/24 07:42	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**77.6**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**22.4**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU1_3-6_B
Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-8
Matrix: Solid
Percent Solids: 77.6

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.020	0.0061	mg/Kg	☼	03/25/24 10:07	03/26/24 14:48	1

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Client Sample ID: NAN_DU1_6-9_B

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-9
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**17**		0.47	0.095	mg/Kg		03/28/24 09:38	03/29/24 07:45	20
Barium	**330**		0.95	0.22	mg/Kg		03/28/24 09:38	03/29/24 07:45	20
Cadmium	**0.37**	**J**	0.76	0.073	mg/Kg		03/28/24 09:38	03/29/24 07:45	20
Chromium	**200**		0.95	0.060	mg/Kg		03/28/24 09:38	03/29/24 07:45	20
Lead	**620**		0.47	0.046	mg/Kg		03/28/24 09:38	03/29/24 07:45	20
Selenium	**9.7**		1.4	0.27	mg/Kg		03/28/24 09:38	03/29/24 07:45	20
Silver	**0.049**	**J**	0.19	0.019	mg/Kg		03/28/24 09:38	03/29/24 07:45	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**75.8**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**24.2**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU1_6-9_B

Lab Sample ID: 580-137730-9

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Matrix: Solid
Percent Solids: 75.8

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.023	0.0068	mg/Kg	☼	03/25/24 10:07	03/26/24 14:50	1

Client Sample ID: NAN_DU1_0-3_C **Lab Sample ID: 580-137730-10**
Date Collected: 03/05/24 16:00 **Matrix: Solid**
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	22		0.46	0.091	mg/Kg		03/28/24 09:38	03/29/24 07:48	20
Barium	280		0.91	0.21	mg/Kg		03/28/24 09:38	03/29/24 07:48	20
Cadmium	0.38	J	0.73	0.070	mg/Kg		03/28/24 09:38	03/29/24 07:48	20
Chromium	200		0.91	0.058	mg/Kg		03/28/24 09:38	03/29/24 07:48	20
Lead	1100		0.46	0.044	mg/Kg		03/28/24 09:38	03/29/24 07:48	20
Selenium	7.4		1.4	0.26	mg/Kg		03/28/24 09:38	03/29/24 07:48	20
Silver	0.058	J	0.18	0.018	mg/Kg		03/28/24 09:38	03/29/24 07:48	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	80.0		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	20.0		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU1_0-3_C

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-10

Matrix: Solid
Percent Solids: 80.0

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.15**		0.022	0.0065	mg/Kg	☼	03/25/24 10:07	03/26/24 14:52	1

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Client Sample Results

Client Sample ID: NAN_DU1_3-6_C

Lab Sample ID: 580-137730-11

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	22		0.48	0.095	mg/Kg		03/28/24 09:38	03/29/24 07:08	20
Barium	290		0.95	0.22	mg/Kg		03/28/24 09:38	03/29/24 07:08	20
Cadmium	0.37	J	0.76	0.073	mg/Kg		03/28/24 09:38	03/29/24 07:08	20
Chromium	190		0.95	0.060	mg/Kg		03/28/24 09:38	03/29/24 07:08	20
Lead	850		0.48	0.046	mg/Kg		03/28/24 09:38	03/29/24 07:08	20
Selenium	8.5		1.4	0.27	mg/Kg		03/28/24 09:38	03/29/24 07:08	20
Silver	0.055	J	0.19	0.019	mg/Kg		03/28/24 09:38	03/29/24 07:08	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	77.6		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	22.4		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU1_3-6_C
Lab Sample ID: 580-137730-11
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 77.6

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.13**		0.021	0.0064	mg/Kg	☼	03/25/24 10:07	03/26/24 14:55	1

Client Sample ID: NAN_DU1_6-9_C

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-12

Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**18**		0.47	0.094	mg/Kg		03/28/24 13:37	03/30/24 01:09	20
Barium	**250**		0.94	0.22	mg/Kg		03/28/24 13:37	03/30/24 01:09	20
Cadmium	**0.32**	**J**	0.75	0.073	mg/Kg		03/28/24 13:37	03/30/24 01:09	20
Chromium	**170**		0.94	0.059	mg/Kg		03/28/24 13:37	03/30/24 01:09	20
Lead	**470**		0.47	0.045	mg/Kg		03/28/24 13:37	03/30/24 01:09	20
Selenium	**8.5**		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 01:09	20
Silver	**0.041**	**J**	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 01:09	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**73.7**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**26.3**		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU1_6-9_C
Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-12
Matrix: Solid
Percent Solids: 73.7

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.12**		0.022	0.0067	mg/Kg	☼	03/25/24 10:07	03/26/24 14:57	1

Client Sample Results

Client Sample ID: NAN_DU3_0-3
Lab Sample ID: 580-137730-13
Date Collected: 03/06/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	13		0.46	0.092	mg/Kg		03/28/24 13:37	03/30/24 00:46	20
Barium	130	J1	0.92	0.21	mg/Kg		03/28/24 13:37	03/30/24 00:46	20
Cadmium	0.30	J	0.74	0.071	mg/Kg		03/28/24 13:37	03/30/24 00:46	20
Chromium	130	J1	0.92	0.058	mg/Kg		03/28/24 13:37	03/30/24 00:46	20
Lead	1200	J1	0.46	0.044	mg/Kg		03/28/24 13:37	03/30/24 00:46	20
Selenium	6.6		1.4	0.26	mg/Kg		03/28/24 13:37	03/30/24 00:46	20
Silver	0.047	J	0.18	0.018	mg/Kg		03/28/24 13:37	03/30/24 00:46	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	69.3		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	30.7		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU3_0-3
Date Collected: 03/06/24 12:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-13
Matrix: Solid
Percent Solids: 69.3

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.15**		0.024	0.0073	mg/Kg	☼	03/25/24 10:07	03/26/24 14:59	1

Client Sample ID: NAN_DU3_3-6

Date Collected: 03/06/24 12:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-14

Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	15		0.47	0.095	mg/Kg		03/28/24 13:37	03/30/24 02:33	20
Barium	140		0.95	0.22	mg/Kg		03/28/24 13:37	03/30/24 02:33	20
Cadmium	0.33	J	0.76	0.073	mg/Kg		03/28/24 13:37	03/30/24 02:33	20
Chromium	140		0.95	0.060	mg/Kg		03/28/24 13:37	03/30/24 02:33	20
Lead	1200		0.47	0.045	mg/Kg		03/28/24 13:37	03/30/24 02:33	20
Selenium	6.8		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 02:33	20
Silver	0.048	J	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 02:33	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	70.7		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	29.3		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU3_3-6

Lab Sample ID: 580-137730-14

Date Collected: 03/06/24 12:30

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 70.7

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.022	0.0067	mg/Kg	☼	03/25/24 10:07	03/26/24 15:02	1

Client Sample Results

Client Sample ID: NAN_DU3_6-9

Lab Sample ID: 580-137730-15

Date Collected: 03/06/24 12:30

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6010D - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**0.41**		0.030	0.0027	mg/L		05/06/24 15:58	05/01/24 22:53	1

Method: SW846 6010D - TCLP Metals (ICP) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.029	U	0.060	0.0072	mg/L		04/25/24 11:48	04/25/24 20:03	1
Barium	**1.0**		0.020	0.0010	mg/L		04/25/24 11:48	04/25/24 20:03	1
Cadmium	0.0016	U	0.020	0.00090	mg/L		04/25/24 11:48	04/25/24 20:03	1
Chromium	0.0052	U	0.025	0.0027	mg/L		04/25/24 11:48	04/25/24 20:03	1
Lead	**1.1**		0.030	0.0027	mg/L		04/25/24 11:48	04/25/24 20:03	1
Selenium	0.035	U	0.10	0.0087	mg/L		04/25/24 11:48	04/25/24 20:03	1
Silver	0.034	U	0.050	0.0085	mg/L		04/25/24 11:48	04/25/24 20:03	1

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**14**		0.48	0.096	mg/Kg		03/28/24 13:37	03/30/24 02:30	20
Barium	**140**		0.96	0.22	mg/Kg		03/28/24 13:37	03/30/24 02:30	20
Cadmium	**0.28**	**J**	0.77	0.074	mg/Kg		03/28/24 13:37	03/30/24 02:30	20
Chromium	**130**		0.96	0.060	mg/Kg		03/28/24 13:37	03/30/24 02:30	20
Lead	**1500**		0.48	0.046	mg/Kg		03/28/24 13:37	03/30/24 02:30	20
Selenium	**7.3**		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 02:30	20
Silver	**0.053**	**J**	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 02:30	20

Method: SW846 7470A - TCLP Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0020	U H	0.0030	0.0015	mg/L		04/25/24 12:11	04/30/24 15:42	1

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**72.9**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**27.1**		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU3_6-9
Lab Sample ID: 580-137730-15
Date Collected: 03/06/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 72.9

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.022	0.0067	mg/Kg	☼	03/25/24 10:07	03/26/24 15:04	1

Client Sample ID: NAN_DU2_0-3
Date Collected: 03/06/24 15:00
Date Received: 03/14/24 09:30
Lab Sample ID: 580-137730-16
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	14		0.47	0.095	mg/Kg		03/28/24 13:37	03/30/24 01:34	20
Barium	200		0.95	0.22	mg/Kg		03/28/24 13:37	03/30/24 01:34	20
Cadmium	0.41	J	0.76	0.073	mg/Kg		03/28/24 13:37	03/30/24 01:34	20
Chromium	180		0.95	0.060	mg/Kg		03/28/24 13:37	03/30/24 01:34	20
Lead	1200		0.47	0.045	mg/Kg		03/28/24 13:37	03/30/24 01:34	20
Selenium	8.3		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 01:34	20
Silver	0.077	J	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 01:34	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	75.8		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	24.2		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU2_0-3
Lab Sample ID: 580-137730-16
Date Collected: 03/06/24 15:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 75.8

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.15**		0.022	0.0067	mg/Kg	☼	03/25/24 10:07	03/26/24 15:11	1

Client Sample Results

Client Sample ID: NAN_DU2_3-6

Lab Sample ID: 580-137730-17

Date Collected: 03/06/24 15:00
Date Received: 03/14/24 09:30
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	12		0.48	0.095	mg/Kg		03/28/24 13:37	03/30/24 01:48	20
Barium	190		0.95	0.22	mg/Kg		03/28/24 13:37	03/30/24 01:48	20
Cadmium	0.37	J	0.76	0.073	mg/Kg		03/28/24 13:37	03/30/24 01:48	20
Chromium	170		0.95	0.060	mg/Kg		03/28/24 13:37	03/30/24 01:48	20
Lead	1000		0.48	0.046	mg/Kg		03/28/24 13:37	03/30/24 01:48	20
Selenium	7.8		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 01:48	20
Silver	0.060	J	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 01:48	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	77.2		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	22.8		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU2_3-6
Date Collected: 03/06/24 15:00
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-17
Matrix: Solid
Percent Solids: 77.2

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.15**		0.021	0.0063	mg/Kg	☼	03/25/24 10:07	03/26/24 15:14	1

Client Sample ID: NAN_DU2_6-9

Lab Sample ID: 580-137730-18

Date Collected: 03/06/24 15:00

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6010D - TCLP Metals (ICP) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.029	U	0.060	0.0072	mg/L		04/25/24 11:48	04/25/24 20:07	1
Barium	**0.98**		0.020	0.0010	mg/L		04/25/24 11:48	04/25/24 20:07	1
Cadmium	0.0016	U	0.020	0.00090	mg/L		04/25/24 11:48	04/25/24 20:07	1
Chromium	0.0052	U	0.025	0.0027	mg/L		04/25/24 11:48	04/25/24 20:07	1
Lead	**0.69**		0.030	0.0027	mg/L		04/25/24 11:48	04/25/24 20:07	1
Selenium	0.035	U	0.10	0.0087	mg/L		04/25/24 11:48	04/25/24 20:07	1
Silver	0.034	U	0.050	0.0085	mg/L		04/25/24 11:48	04/25/24 20:07	1

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**14**		0.47	0.095	mg/Kg		03/28/24 13:37	03/30/24 02:22	20
Barium	**210**		0.95	0.22	mg/Kg		03/28/24 13:37	03/30/24 02:22	20
Cadmium	**0.40**	**J**	0.76	0.073	mg/Kg		03/28/24 13:37	03/30/24 02:22	20
Chromium	**190**		0.95	0.060	mg/Kg		03/28/24 13:37	03/30/24 02:22	20
Lead	**1400**		0.47	0.046	mg/Kg		03/28/24 13:37	03/30/24 02:22	20
Selenium	**9.2**		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 02:22	20
Silver	**0.054**	**J**	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 02:22	20

Method: SW846 7470A - TCLP Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0020	U H	0.0030	0.0015	mg/L		04/25/24 12:11	04/30/24 15:45	1

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**77.3**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**22.7**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU2_6-9

Lab Sample ID: 580-137730-18

Date Collected: 03/06/24 15:00
Date Received: 03/14/24 09:30
Matrix: Solid
Percent Solids: 77.3

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.18**		0.020	0.0060	mg/Kg	☼	03/25/24 10:07	03/26/24 15:16	1

Client Sample ID: NAN_DU9_0-3

Lab Sample ID: 580-137730-19
Date Collected: 03/09/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 6010D - TCLP Metals (ICP) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.029	U	0.060	0.0072	mg/L		04/25/24 11:48	04/25/24 20:10	1
Barium	**0.64**		0.020	0.0010	mg/L		04/25/24 11:48	04/25/24 20:10	1
Cadmium	**0.0015**	**J**	0.020	0.00090	mg/L		04/25/24 11:48	04/25/24 20:10	1
Chromium	**0.0034**	**J**	0.025	0.0027	mg/L		04/25/24 11:48	04/25/24 20:10	1
Lead	**2.8**		0.030	0.0027	mg/L		04/25/24 11:48	04/25/24 20:10	1
Selenium	0.035	U	0.10	0.0087	mg/L		04/25/24 11:48	04/25/24 20:10	1
Silver	0.034	U	0.050	0.0085	mg/L		04/25/24 11:48	04/25/24 20:10	1

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**24**		0.48	0.096	mg/Kg		03/28/24 13:37	03/30/24 02:28	20
Barium	**100**		0.96	0.22	mg/Kg		03/28/24 13:37	03/30/24 02:28	20
Cadmium	**0.67**	**J**	0.77	0.074	mg/Kg		03/28/24 13:37	03/30/24 02:28	20
Chromium	**160**		0.96	0.060	mg/Kg		03/28/24 13:37	03/30/24 02:28	20
Lead	**6400**		48	4.6	mg/Kg		03/28/24 13:37	04/01/24 18:07	2000
Selenium	**4.9**		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 02:28	20
Silver	**0.085**	**J**	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 02:28	20

Method: SW846 7470A - TCLP Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0020	U H	0.0030	0.0015	mg/L		04/25/24 12:11	04/30/24 15:47	1

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**70.3**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**29.7**		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU9_0-3 **Lab Sample ID: 580-137730-19**

Date Collected: 03/09/24 12:30 **Matrix: Solid**

Date Received: 03/14/24 09:30 **Percent Solids: 70.3**

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.28**		0.024	0.0071	mg/Kg	☼	03/25/24 10:09	03/26/24 15:19	1

Client Sample ID: NAN_DU9_3-6

Lab Sample ID: 580-137730-20

Date Collected: 03/09/24 12:30
Date Received: 03/14/24 09:30

Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	25		0.48	0.096	mg/Kg		03/28/24 13:37	03/30/24 02:25	20
Barium	110		0.96	0.22	mg/Kg		03/28/24 13:37	03/30/24 02:25	20
Cadmium	0.67	J	0.77	0.074	mg/Kg		03/28/24 13:37	03/30/24 02:25	20
Chromium	190		0.96	0.060	mg/Kg		03/28/24 13:37	03/30/24 02:25	20
Lead	6200		48	4.6	mg/Kg		03/28/24 13:37	04/01/24 18:04	2000
Selenium	5.1		1.4	0.27	mg/Kg		03/28/24 13:37	03/30/24 02:25	20
Silver	0.089	J	0.19	0.019	mg/Kg		03/28/24 13:37	03/30/24 02:25	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	61.5		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	38.5		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU9_3-6

Date Collected: 03/09/24 12:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-20

Matrix: Solid
Percent Solids: 61.5

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.26**		0.027	0.0082	mg/Kg	☼	03/25/24 10:09	03/26/24 15:21	1

Client Sample Results

Client Sample ID: NAN_DU9_6-9
Date Collected: 03/09/24 12:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-21
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	24		0.48	0.095	mg/Kg		04/01/24 12:29	04/05/24 04:50	20
Barium	110		0.95	0.22	mg/Kg		04/01/24 12:29	04/05/24 04:50	20
Cadmium	0.59	J	0.76	0.073	mg/Kg		04/01/24 12:29	04/05/24 04:50	20
Chromium	180		0.95	0.060	mg/Kg		04/01/24 12:29	04/05/24 04:50	20
Lead	6000		48	4.6	mg/Kg		04/01/24 12:29	04/05/24 04:52	2000
Selenium	6.7		1.4	0.27	mg/Kg		04/01/24 12:29	04/05/24 04:50	20
Silver	0.095	J	0.19	0.019	mg/Kg		04/01/24 12:29	04/05/24 04:50	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	64.5		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	35.5		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU9_6-9
Date Collected: 03/09/24 12:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-21
Matrix: Solid
Percent Solids: 64.5

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.26**		0.026	0.0079	mg/Kg	☼	04/02/24 13:03	04/02/24 16:10	1

Client Sample ID: NAN_DU10_0-3

Date Collected: 03/09/24 14:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-22

Matrix: Solid

Method: SW846 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	0.017	U M	0.019	0.0070	mg/Kg		03/20/24 15:22	04/01/24 14:54	1
PCB-1221	0.017	U	0.019	0.011	mg/Kg		03/20/24 15:22	04/01/24 14:54	1
PCB-1232	0.017	U	0.019	0.0046	mg/Kg		03/20/24 15:22	04/01/24 14:54	1
PCB-1242	0.017	U M	0.019	0.0075	mg/Kg		03/20/24 15:22	04/01/24 14:54	1
PCB-1248	0.017	U M	0.019	0.0066	mg/Kg		03/20/24 15:22	04/01/24 14:54	1
PCB-1254	**0.055**	**M**	0.019	0.0085	mg/Kg		03/20/24 15:22	04/01/24 14:54	1
PCB-1260	0.017	U J1 M	0.019	0.0070	mg/Kg		03/20/24 15:22	04/01/24 14:54	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Tetrachloro-m-xylene	*89*		*44 - 130*	*03/20/24 15:22*	*04/01/24 14:54*	*1*
DCB Decachlorobiphenyl	*96*	*M*	*40 - 135*	*03/20/24 15:22*	*04/01/24 14:54*	*1*

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**9.6**		0.46	0.092	mg/Kg		04/01/24 12:29	04/04/24 17:39	20
Barium	**120**	**J1**	0.92	0.21	mg/Kg		04/01/24 12:29	04/04/24 17:39	20
Cadmium	**0.35**	**J**	0.74	0.071	mg/Kg		04/01/24 12:29	04/04/24 17:39	20
Chromium	**150**	**J1**	0.92	0.058	mg/Kg		04/01/24 12:29	04/04/24 17:39	20
Lead	**8500**	**J1**	46	4.4	mg/Kg		04/01/24 12:29	04/04/24 18:01	2000
Selenium	**5.8**		1.4	0.26	mg/Kg		04/01/24 12:29	04/04/24 17:39	20
Silver	**0.088**	**J**	0.18	0.018	mg/Kg		04/01/24 12:29	04/04/24 17:39	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**71.0**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**29.0**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU10_0-3

Date Collected: 03/09/24 14:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-22
Matrix: Solid
Percent Solids: 71.0

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.12**		0.023	0.0070	mg/Kg	☼	04/02/24 13:03	04/02/24 16:13	1

Client Sample Results

Client Sample ID: NAN_DU10_3-6

Lab Sample ID: 580-137730-23

Date Collected: 03/09/24 14:30
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	0.017	U	0.019	0.0070	mg/Kg		03/20/24 15:22	04/01/24 15:47	1
PCB-1221	0.017	U	0.019	0.011	mg/Kg		03/20/24 15:22	04/01/24 15:47	1
PCB-1232	0.017	U	0.019	0.0046	mg/Kg		03/20/24 15:22	04/01/24 15:47	1
PCB-1242	0.017	U	0.019	0.0076	mg/Kg		03/20/24 15:22	04/01/24 15:47	1
PCB-1248	0.017	U	0.019	0.0066	mg/Kg		03/20/24 15:22	04/01/24 15:47	1
PCB-1254	**0.037**	**J1 M**	0.019	0.0085	mg/Kg		03/20/24 15:22	04/01/24 15:47	1
PCB-1260	0.017	U M	0.019	0.0070	mg/Kg		03/20/24 15:22	04/01/24 15:47	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Tetrachloro-m-xylene	*92*		*44 - 130*	*03/20/24 15:22*	*04/01/24 15:47*	*1*
DCB Decachlorobiphenyl	*98*	*M*	*40 - 135*	*03/20/24 15:22*	*04/01/24 15:47*	*1*

Method: SW846 6010D - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**8.0**		0.030	0.0027	mg/L		05/06/24 15:58	05/01/24 22:56	1

Method: SW846 6010D - TCLP Metals (ICP) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.029	U	0.060	0.0072	mg/L		04/25/24 11:48	04/25/24 20:14	1
Barium	**1.1**		0.020	0.0010	mg/L		04/25/24 11:48	04/25/24 20:14	1
Cadmium	**0.0018**	**J**	0.020	0.00090	mg/L		04/25/24 11:48	04/25/24 20:14	1
Chromium	0.0052	U	0.025	0.0027	mg/L		04/25/24 11:48	04/25/24 20:14	1
Lead	**17**		0.030	0.0027	mg/L		04/25/24 11:48	04/25/24 20:14	1
Selenium	0.035	U	0.10	0.0087	mg/L		04/25/24 11:48	04/25/24 20:14	1
Silver	0.034	U	0.050	0.0085	mg/L		04/25/24 11:48	04/25/24 20:14	1

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**8.7**		0.47	0.095	mg/Kg		04/01/24 12:29	04/05/24 05:01	20
Barium	**130**		0.95	0.22	mg/Kg		04/01/24 12:29	04/05/24 05:01	20
Cadmium	**0.39**	**J**	0.76	0.073	mg/Kg		04/01/24 12:29	04/05/24 05:01	20
Chromium	**160**		0.95	0.060	mg/Kg		04/01/24 12:29	04/05/24 05:01	20
Lead	**9700**		47	4.5	mg/Kg		04/01/24 12:29	04/05/24 05:04	2000
Selenium	**6.9**		1.4	0.27	mg/Kg		04/01/24 12:29	04/05/24 05:01	20
Silver	**0.10**	**J**	0.19	0.019	mg/Kg		04/01/24 12:29	04/05/24 05:01	20

Method: SW846 7470A - TCLP Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0020	U H	0.0030	0.0015	mg/L		04/25/24 12:11	04/30/24 15:50	1

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**70.8**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**29.2**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU10_3-6
Date Collected: 03/09/24 14:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-23
Matrix: Solid
Percent Solids: 70.8

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.024	0.0071	mg/Kg	☼	04/02/24 13:03	04/02/24 15:45	1

Client Sample Results

Client Sample ID: NAN_DU10_6-9

Lab Sample ID: 580-137730-24

Date Collected: 03/09/24 14:30

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	7.9		0.47	0.094	mg/Kg		04/01/24 12:29	04/04/24 17:52	20
Barium	160		0.94	0.22	mg/Kg		04/01/24 12:29	04/04/24 17:52	20
Cadmium	0.35	J	0.76	0.073	mg/Kg		04/01/24 12:29	04/04/24 17:52	20
Chromium	170		0.94	0.060	mg/Kg		04/01/24 12:29	04/04/24 17:52	20
Lead	8100		47	4.5	mg/Kg		04/01/24 12:29	04/04/24 18:14	2000
Selenium	7.8		1.4	0.27	mg/Kg		04/01/24 12:29	04/04/24 17:52	20
Silver	0.078	J	0.19	0.019	mg/Kg		04/01/24 12:29	04/04/24 17:52	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	68.6		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	31.4		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU10_6-9
Date Collected: 03/09/24 14:30
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-24
Matrix: Solid
Percent Solids: 68.6

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.13**		0.024	0.0072	mg/Kg	☼	04/02/24 13:03	04/02/24 15:54	1

Client Sample ID: NAN_DU11_0-3

Lab Sample ID: 580-137730-25

Date Collected: 03/10/24 12:20

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	11		0.47	0.095	mg/Kg		04/01/24 12:29	04/05/24 05:47	20
Barium	110		0.95	0.22	mg/Kg		04/01/24 12:29	04/05/24 05:47	20
Cadmium	0.37	J	0.76	0.073	mg/Kg		04/01/24 12:29	04/05/24 05:47	20
Chromium	130		0.95	0.060	mg/Kg		04/01/24 12:29	04/05/24 05:47	20
Lead	4300		47	4.5	mg/Kg		04/01/24 12:29	04/05/24 05:50	2000
Selenium	4.8		1.4	0.27	mg/Kg		04/01/24 12:29	04/05/24 05:47	20
Silver	0.081	J	0.19	0.019	mg/Kg		04/01/24 12:29	04/05/24 05:47	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	62.7		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	37.3		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU11_0-3
Date Collected: 03/10/24 12:20
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-25
Matrix: Solid
Percent Solids: 62.7

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.10**		0.025	0.0076	mg/Kg	☼	04/02/24 13:03	04/02/24 15:36	1

Client Sample Results

Client: EnviroQuest, Inc. Job ID: 580-137730-1
Project/Site: Nanue Bridge

Client Sample ID: NAN_DU11_3-6

Lab Sample ID: 580-137730-26
Date Collected: 03/10/24 12:20
Matrix: Solid
Date Received: 03/14/24 09:30

Method: SW846 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	0.017	U M	0.019	0.0070	mg/Kg		03/20/24 15:22	04/01/24 16:04	1
PCB-1221	0.017	U	0.019	0.011	mg/Kg		03/20/24 15:22	04/01/24 16:04	1
PCB-1232	0.017	U	0.019	0.0047	mg/Kg		03/20/24 15:22	04/01/24 16:04	1
PCB-1242	0.017	U M	0.019	0.0076	mg/Kg		03/20/24 15:22	04/01/24 16:04	1
PCB-1248	0.017	U M	0.019	0.0067	mg/Kg		03/20/24 15:22	04/01/24 16:04	1
PCB-1254	**0.20**	**M**	0.019	0.0086	mg/Kg		03/20/24 15:22	04/01/24 16:04	1
PCB-1260	0.017	U M	0.019	0.0070	mg/Kg		03/20/24 15:22	04/01/24 16:04	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Tetrachloro-m-xylene	*85*		*44 - 130*	*03/20/24 15:22*	*04/01/24 16:04*	*1*
DCB Decachlorobiphenyl	*89*	*M*	*40 - 135*	*03/20/24 15:22*	*04/01/24 16:04*	*1*

Method: SW846 6010D - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**3.5**		0.030	0.0027	mg/L		05/06/24 15:58	05/01/24 22:59	1

Method: SW846 6010D - TCLP Metals (ICP) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.029	U	0.060	0.0072	mg/L		04/25/24 11:48	04/25/24 20:17	1
Barium	**0.92**		0.020	0.0010	mg/L		04/25/24 11:48	04/25/24 20:17	1
Cadmium	**0.0021**	**J**	0.020	0.00090	mg/L		04/25/24 11:48	04/25/24 20:17	1
Chromium	0.0052	U	0.025	0.0027	mg/L		04/25/24 11:48	04/25/24 20:17	1
Lead	**12**		0.030	0.0027	mg/L		04/25/24 11:48	04/25/24 20:17	1
Selenium	0.035	U	0.10	0.0087	mg/L		04/25/24 11:48	04/25/24 20:17	1
Silver	0.034	U	0.050	0.0085	mg/L		04/25/24 11:48	04/25/24 20:17	1

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**10**		0.48	0.095	mg/Kg		04/01/24 12:29	04/05/24 04:44	20
Barium	**100**		0.95	0.22	mg/Kg		04/01/24 12:29	04/05/24 04:44	20
Cadmium	**0.40**	**J**	0.76	0.073	mg/Kg		04/01/24 12:29	04/05/24 04:44	20
Chromium	**150**		0.95	0.060	mg/Kg		04/01/24 12:29	04/05/24 04:44	20
Lead	**6400**		48	4.6	mg/Kg		04/01/24 12:29	04/05/24 04:47	2000
Selenium	**6.2**		1.4	0.27	mg/Kg		04/01/24 12:29	04/05/24 04:44	20
Silver	**0.086**	**J**	0.19	0.019	mg/Kg		04/01/24 12:29	04/05/24 04:44	20

Method: SW846 7470A - TCLP Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0020	U H	0.0030	0.0015	mg/L		04/25/24 12:11	04/30/24 15:59	1

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**65.0**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**35.0**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU11_3-6
Date Collected: 03/10/24 12:20
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-26
Matrix: Solid
Percent Solids: 65.0

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.12**		0.027	0.0081	mg/Kg	☼	04/02/24 13:03	04/02/24 15:56	1

Client Sample Results

Client Sample ID: NAN_DU11_6-9

Lab Sample ID: 580-137730-27

Date Collected: 03/10/24 12:20
Date Received: 03/14/24 09:30
Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	8.7		0.46	0.092	mg/Kg		04/01/24 12:29	04/05/24 05:41	20
Barium	110		0.92	0.21	mg/Kg		04/01/24 12:29	04/05/24 05:41	20
Cadmium	0.39	J	0.74	0.071	mg/Kg		04/01/24 12:29	04/05/24 05:41	20
Chromium	150		0.92	0.058	mg/Kg		04/01/24 12:29	04/05/24 05:41	20
Lead	6000		46	4.4	mg/Kg		04/01/24 12:29	04/05/24 05:44	2000
Selenium	6.3		1.4	0.26	mg/Kg		04/01/24 12:29	04/05/24 05:41	20
Silver	0.083	J	0.18	0.018	mg/Kg		04/01/24 12:29	04/05/24 05:41	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	66.2		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	33.8		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU11_6-9
Date Collected: 03/10/24 12:20
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-27
Matrix: Solid
Percent Solids: 66.2

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.16**		0.025	0.0075	mg/Kg	☼	04/02/24 13:03	04/02/24 15:59	1

Client Sample ID: NAN_DU12_0-3

Lab Sample ID: 580-137730-28

Date Collected: 03/10/24 13:10

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	16		0.46	0.092	mg/Kg		04/01/24 12:29	04/05/24 04:55	20
Barium	79		0.92	0.21	mg/Kg		04/01/24 12:29	04/05/24 04:55	20
Cadmium	0.41	J	0.74	0.071	mg/Kg		04/01/24 12:29	04/05/24 04:55	20
Chromium	130		0.92	0.058	mg/Kg		04/01/24 12:29	04/05/24 04:55	20
Lead	6300		46	4.4	mg/Kg		04/01/24 12:29	04/05/24 04:58	2000
Selenium	2.8		1.4	0.26	mg/Kg		04/01/24 12:29	04/05/24 04:55	20
Silver	0.088	J	0.18	0.018	mg/Kg		04/01/24 12:29	04/05/24 04:55	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	68.0		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	32.0		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU12_0-3
Date Collected: 03/10/24 13:10
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-28
Matrix: Solid
Percent Solids: 68.0

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.086**		0.023	0.0069	mg/Kg	☼	04/02/24 13:03	04/02/24 16:02	1

Client Sample ID: NAN_DU12_3-6

Lab Sample ID: 580-137730-29

Date Collected: 03/10/24 13:10

Matrix: Solid

Date Received: 03/14/24 09:30

Method: SW846 6010D - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**5.0**		0.030	0.0027	mg/L		05/06/24 15:58	05/01/24 23:03	1

Method: SW846 6010D - TCLP Metals (ICP) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.029	U	0.060	0.0072	mg/L		04/25/24 11:48	04/25/24 20:21	1
Barium	**0.86**		0.020	0.0010	mg/L		04/25/24 11:48	04/25/24 20:21	1
Cadmium	**0.0026**	**J**	0.020	0.00090	mg/L		04/25/24 11:48	04/25/24 20:21	1
Chromium	0.0052	U	0.025	0.0027	mg/L		04/25/24 11:48	04/25/24 20:21	1
Lead	**23**		0.030	0.0027	mg/L		04/25/24 11:48	04/25/24 20:21	1
Selenium	0.035	U	0.10	0.0087	mg/L		04/25/24 11:48	04/25/24 20:21	1
Silver	0.034	U	0.050	0.0085	mg/L		04/25/24 11:48	04/25/24 20:21	1

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**11**		0.46	0.092	mg/Kg		04/01/24 12:29	04/05/24 05:35	20
Barium	**50**		0.92	0.21	mg/Kg		04/01/24 12:29	04/05/24 05:35	20
Cadmium	**0.29**	**J**	0.74	0.071	mg/Kg		04/01/24 12:29	04/05/24 05:35	20
Chromium	**87**		0.92	0.058	mg/Kg		04/01/24 12:29	04/05/24 05:35	20
Lead	**7900**		46	4.4	mg/Kg		04/01/24 12:29	04/05/24 05:38	2000
Selenium	**3.4**		1.4	0.26	mg/Kg		04/01/24 12:29	04/05/24 05:35	20
Silver	**0.086**	**J**	0.18	0.018	mg/Kg		04/01/24 12:29	04/05/24 05:35	20

Method: SW846 7470A - TCLP Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0020	U H	0.0030	0.0015	mg/L		04/25/24 12:11	04/30/24 16:02	1

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**75.6**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**24.4**		0.1	0.1	%			03/26/24 11:00	1

Client Sample ID: NAN_DU12_3-6
Date Collected: 03/10/24 13:10
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-29
Matrix: Solid
Percent Solids: 75.6

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.12**		0.022	0.0065	mg/Kg	☼	04/02/24 13:03	04/02/24 16:05	1

Client Sample Results

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU12_6-9

Date Collected: 03/10/24 13:10
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-30

Matrix: Solid

Method: SW846 6020B - Metals (ICP/MS)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	**10**		0.47	0.094	mg/Kg		04/01/24 12:29	04/05/24 05:52	20
Barium	**69**		0.94	0.21	mg/Kg		04/01/24 12:29	04/05/24 05:52	20
Cadmium	**0.30**	**J**	0.75	0.073	mg/Kg		04/01/24 12:29	04/05/24 05:52	20
Chromium	**90**		0.94	0.059	mg/Kg		04/01/24 12:29	04/05/24 05:52	20
Lead	**6500**		47	4.5	mg/Kg		04/01/24 12:29	04/05/24 05:55	2000
Selenium	**3.6**		1.4	0.27	mg/Kg		04/01/24 12:29	04/05/24 05:52	20
Silver	**0.068**	**J**	0.19	0.019	mg/Kg		04/01/24 12:29	04/05/24 05:52	20

General Chemistry

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids (SM22 2540G)	**72.9**		0.1	0.1	%			03/26/24 11:00	1
Percent Moisture (SM22 2540G)	**27.1**		0.1	0.1	%			03/26/24 11:00	1

Client Sample Results

Client Sample ID: NAN_DU12_6-9

Lab Sample ID: 580-137730-30

Date Collected: 03/10/24 13:10

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 72.9

Method: SW846 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.12**		0.023	0.0069	mg/Kg	☼	04/02/24 13:03	04/02/24 16:08	1

QC Sample Results

Method: 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Lab Sample ID: MB 580-454340/1-A
Matrix: Solid
Analysis Batch: 455366

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 454340

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	0.018	U	0.020	0.0074	mg/Kg		03/20/24 15:22	04/01/24 14:01	1
PCB-1221	0.018	U	0.020	0.012	mg/Kg		03/20/24 15:22	04/01/24 14:01	1
PCB-1232	0.018	U	0.020	0.0049	mg/Kg		03/20/24 15:22	04/01/24 14:01	1
PCB-1242	0.018	U	0.020	0.0080	mg/Kg		03/20/24 15:22	04/01/24 14:01	1
PCB-1248	0.018	U	0.020	0.0070	mg/Kg		03/20/24 15:22	04/01/24 14:01	1
PCB-1254	0.018	U	0.020	0.0090	mg/Kg		03/20/24 15:22	04/01/24 14:01	1
PCB-1260	0.018	U	0.020	0.0074	mg/Kg		03/20/24 15:22	04/01/24 14:01	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Tetrachloro-m-xylene	*95*		*44 - 130*	*03/20/24 15:22*	*04/01/24 14:01*	*1*
DCB Decachlorobiphenyl	*85*	*M*	*40 - 135*	*03/20/24 15:22*	*04/01/24 14:01*	*1*

Lab Sample ID: LCS 580-454340/2-A
Matrix: Solid
Analysis Batch: 455366

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 454340

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
PCB-1016			0.100	0.102	M	mg/Kg		102	47 - 134		
PCB-1260			0.100	0.0955	M	mg/Kg		96	53 - 140		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Tetrachloro-m-xylene	*91*	*M*	*44 - 130*
DCB Decachlorobiphenyl	*102*	*M*	*40 - 135*

Lab Sample ID: LCSD 580-454340/3-A
Matrix: Solid
Analysis Batch: 455366

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 454340

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
PCB-1016			0.100	0.101	M	mg/Kg		101	47 - 134	7	30
PCB-1260			0.100	0.105	M	mg/Kg		105	53 - 140	10	30

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
Tetrachloro-m-xylene	*99*		*44 - 130*
DCB Decachlorobiphenyl	*112*		*40 - 135*

Lab Sample ID: 580-137730-22 MS
Matrix: Solid
Analysis Batch: 455366

Client Sample ID: NAN_DU10_0-3
Prep Type: Total/NA
Prep Batch: 454340

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
PCB-1016	0.017	U M	0.0934	0.0948	M	mg/Kg		102	47 - 134		
PCB-1260	0.017	U J1 M	0.0934	0.171	J1 M	mg/Kg		183	53 - 140		

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Tetrachloro-m-xylene	*94*		*44 - 130*
DCB Decachlorobiphenyl	*101*	*M*	*40 - 135*

Method: 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography (Continued)

Lab Sample ID: 580-137730-22 MSD
Matrix: Solid
Analysis Batch: 455366
Client Sample ID: NAN_DU10_0-3
Prep Type: Total/NA
Prep Batch: 454340

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
PCB-1016	0.017	U M	0.0943	0.0908	M	mg/Kg		96	47 - 134	4	30
PCB-1260	0.017	U J1 M	0.0943	0.162	J1 M	mg/Kg		172	53 - 140	5	30

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
Tetrachloro-m-xylene	*88*		*44 - 130*
DCB Decachlorobiphenyl	*94*	*M*	*40 - 135*

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 580-458590/7-B
Matrix: Solid
Analysis Batch: 458233
Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 458592

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	0.011	U	0.030	0.0027	mg/L		05/06/24 15:58	05/01/24 22:12	1

Lab Sample ID: LCS 580-458590/8-B
Matrix: Solid
Analysis Batch: 458233
Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 458592

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Lead	1.00	1.00		mg/L		100	86 - 113

Lab Sample ID: LCSD 580-458590/9-B
Matrix: Solid
Analysis Batch: 458233
Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 458592

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Lead	1.00	0.998		mg/L		100	86 - 113	1	20

Lab Sample ID: 580-137730-1 MS
Matrix: Solid
Analysis Batch: 458233
Client Sample ID: NAN_DU8_0-3
Prep Type: SPLP West
Prep Batch: 458592

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Lead	0.59		1.00	1.65		mg/L		106	86 - 113

Lab Sample ID: 580-137730-1 MSD
Matrix: Solid
Analysis Batch: 458233
Client Sample ID: NAN_DU8_0-3
Prep Type: SPLP West
Prep Batch: 458592

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Lead	0.59		1.00	1.63		mg/L		104	86 - 113	1	20

Lab Sample ID: 580-137730-1 DU
Matrix: Solid
Analysis Batch: 458233
Client Sample ID: NAN_DU8_0-3
Prep Type: SPLP West
Prep Batch: 458592

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Lead	0.59		0.613		mg/L		4	20

QC Sample Results

Method: 6010D - TCLP Metals (ICP)

Lab Sample ID: MB 580-457398/15-B
Matrix: Solid
Analysis Batch: 457695

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 457588

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.029	U	0.060	0.0072	mg/L		04/25/24 11:48	04/25/24 18:49	1
Barium	0.00690	J	0.020	0.0010	mg/L		04/25/24 11:48	04/25/24 18:49	1
Cadmium	0.0016	U	0.020	0.00090	mg/L		04/25/24 11:48	04/25/24 18:49	1
Chromium	0.0052	U	0.025	0.0027	mg/L		04/25/24 11:48	04/25/24 18:49	1
Lead	0.011	U	0.030	0.0027	mg/L		04/25/24 11:48	04/25/24 18:49	1
Selenium	0.035	U	0.10	0.0087	mg/L		04/25/24 11:48	04/25/24 18:49	1
Silver	0.034	U	0.050	0.0085	mg/L		04/25/24 11:48	04/25/24 18:49	1

Lab Sample ID: MB 580-457398/16-B
Matrix: Solid
Analysis Batch: 457695

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 457588

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.029	U	0.060	0.0072	mg/L		04/25/24 11:48	04/25/24 18:52	1
Barium	0.00850	J	0.020	0.0010	mg/L		04/25/24 11:48	04/25/24 18:52	1
Cadmium	0.0016	U	0.020	0.00090	mg/L		04/25/24 11:48	04/25/24 18:52	1
Chromium	0.0052	U	0.025	0.0027	mg/L		04/25/24 11:48	04/25/24 18:52	1
Lead	0.011	U	0.030	0.0027	mg/L		04/25/24 11:48	04/25/24 18:52	1
Selenium	0.035	U	0.10	0.0087	mg/L		04/25/24 11:48	04/25/24 18:52	1
Silver	0.034	U	0.050	0.0085	mg/L		04/25/24 11:48	04/25/24 18:52	1

Lab Sample ID: LCS 580-457398/17-B
Matrix: Solid
Analysis Batch: 457695

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 457588

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	1.00	1.06		mg/L		106	87 - 113
Barium	1.00	1.01		mg/L		101	88 - 113
Cadmium	1.00	1.07		mg/L		107	88 - 113
Chromium	1.00	1.05		mg/L		105	90 - 113
Lead	1.00	1.03		mg/L		103	86 - 113
Selenium	1.00	1.11		mg/L		111	83 - 114
Silver	1.00	1.00		mg/L		100	84 - 115

Lab Sample ID: LCSD 580-457398/18-B
Matrix: Solid
Analysis Batch: 457695

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 457588

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	1.00	1.04		mg/L		104	87 - 113	2	20
Barium	1.00	0.999		mg/L		100	88 - 113	1	20
Cadmium	1.00	1.05		mg/L		105	88 - 113	1	20
Chromium	1.00	1.03		mg/L		103	90 - 113	2	20
Lead	1.00	1.02		mg/L		102	86 - 113	2	20
Selenium	1.00	1.09		mg/L		109	83 - 114	2	20
Silver	1.00	1.00		mg/L		100	84 - 115	0	20

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 580-455023/23-A
Matrix: Solid
Analysis Batch: 455179

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 455023

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.40	U	0.50	0.10	mg/Kg		03/28/24 09:38	03/29/24 05:58	20
Barium	0.40	U	1.0	0.23	mg/Kg		03/28/24 09:38	03/29/24 05:58	20
Cadmium	0.20	U	0.80	0.077	mg/Kg		03/28/24 09:38	03/29/24 05:58	20
Chromium	0.25	U	1.0	0.063	mg/Kg		03/28/24 09:38	03/29/24 05:58	20
Lead	0.19	U	0.50	0.048	mg/Kg		03/28/24 09:38	03/29/24 05:58	20
Selenium	1.0	U	1.5	0.29	mg/Kg		03/28/24 09:38	03/29/24 05:58	20
Silver	0.050	U	0.20	0.020	mg/Kg		03/28/24 09:38	03/29/24 05:58	20

Lab Sample ID: LCS 580-455023/24-A
Matrix: Solid
Analysis Batch: 455179

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 455023

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	25.0	24.3		mg/Kg		97	82 - 118
Barium	25.0	26.5		mg/Kg		106	86 - 116
Cadmium	25.0	24.7		mg/Kg		99	84 - 116
Chromium	25.0	22.1		mg/Kg		89	83 - 119
Lead	25.0	22.1		mg/Kg		88	84 - 118
Selenium	25.0	24.3		mg/Kg		97	80 - 119
Silver	25.0	24.6		mg/Kg		98	83 - 118

Lab Sample ID: LCSD 580-455023/25-A
Matrix: Solid
Analysis Batch: 455179

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 455023

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	25.0	24.4		mg/Kg		97	82 - 118	0	20
Barium	25.0	26.9		mg/Kg		108	86 - 116	1	20
Cadmium	25.0	25.2		mg/Kg		101	84 - 116	2	20
Chromium	25.0	22.3		mg/Kg		89	83 - 119	1	20
Lead	25.0	22.3		mg/Kg		89	84 - 118	1	20
Selenium	25.0	25.2		mg/Kg		101	80 - 119	3	20
Silver	25.0	25.1		mg/Kg		101	83 - 118	2	20

Lab Sample ID: MB 580-455073/23-A
Matrix: Solid
Analysis Batch: 455285

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 455073

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.40	U	0.50	0.10	mg/Kg		03/28/24 13:37	03/30/24 00:43	20
Barium	0.40	U	1.0	0.23	mg/Kg		03/28/24 13:37	03/30/24 00:43	20
Cadmium	0.20	U	0.80	0.077	mg/Kg		03/28/24 13:37	03/30/24 00:43	20
Chromium	0.25	U	1.0	0.063	mg/Kg		03/28/24 13:37	03/30/24 00:43	20
Lead	0.19	U	0.50	0.048	mg/Kg		03/28/24 13:37	03/30/24 00:43	20
Selenium	1.0	U	1.5	0.29	mg/Kg		03/28/24 13:37	03/30/24 00:43	20
Silver	0.050	U	0.20	0.020	mg/Kg		03/28/24 13:37	03/30/24 00:43	20

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 580-455073/24-A
Matrix: Solid
Analysis Batch: 455285

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 455073

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	25.0	24.2		mg/Kg		97	82 - 118
Barium	25.0	24.2		mg/Kg		97	86 - 116
Cadmium	25.0	24.4		mg/Kg		98	84 - 116
Chromium	25.0	24.9		mg/Kg		100	83 - 119
Lead	25.0	22.8		mg/Kg		91	84 - 118
Selenium	25.0	26.6		mg/Kg		106	80 - 119
Silver	25.0	25.0		mg/Kg		100	83 - 118

Lab Sample ID: LCSD 580-455073/25-A
Matrix: Solid
Analysis Batch: 455285

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 455073

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	25.0	23.9		mg/Kg		96	82 - 118	1	20
Barium	25.0	23.9		mg/Kg		96	86 - 116	1	20
Cadmium	25.0	24.0		mg/Kg		96	84 - 116	2	20
Chromium	25.0	24.1		mg/Kg		96	83 - 119	3	20
Lead	25.0	22.6		mg/Kg		91	84 - 118	1	20
Selenium	25.0	26.0		mg/Kg		104	80 - 119	2	20
Silver	25.0	24.7		mg/Kg		99	83 - 118	2	20

Lab Sample ID: MB 580-455329/13-A
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 455329

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.40	U	0.50	0.10	mg/Kg		04/01/24 12:29	04/04/24 17:08	20
Barium	0.40	U	1.0	0.23	mg/Kg		04/01/24 12:29	04/04/24 17:08	20
Cadmium	0.20	U	0.80	0.077	mg/Kg		04/01/24 12:29	04/04/24 17:08	20
Chromium	0.25	U	1.0	0.063	mg/Kg		04/01/24 12:29	04/04/24 17:08	20
Lead	0.19	U	0.50	0.048	mg/Kg		04/01/24 12:29	04/04/24 17:08	20
Selenium	1.0	U	1.5	0.29	mg/Kg		04/01/24 12:29	04/04/24 17:08	20
Silver	0.050	U	0.20	0.020	mg/Kg		04/01/24 12:29	04/04/24 17:08	20

Lab Sample ID: MB 580-455329/18-A
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 455329

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.40	U	0.50	0.10	mg/Kg		04/01/24 12:51	04/04/24 17:11	20
Barium	0.40	U	1.0	0.23	mg/Kg		04/01/24 12:51	04/04/24 17:11	20
Cadmium	0.20	U	0.80	0.077	mg/Kg		04/01/24 12:51	04/04/24 17:11	20
Chromium	0.25	U	1.0	0.063	mg/Kg		04/01/24 12:51	04/04/24 17:11	20
Lead	0.19	U	0.50	0.048	mg/Kg		04/01/24 12:51	04/04/24 17:11	20
Selenium	1.0	U	1.5	0.29	mg/Kg		04/01/24 12:51	04/04/24 17:11	20
Silver	0.050	U	0.20	0.020	mg/Kg		04/01/24 12:51	04/04/24 17:11	20

QC Sample Results

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: MB 580-455329/19-A
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 455329

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.40	U	0.50	0.10	mg/Kg		04/01/24 12:51	04/04/24 17:14	20
Barium	0.40	U	1.0	0.23	mg/Kg		04/01/24 12:51	04/04/24 17:14	20
Cadmium	0.20	U	0.80	0.077	mg/Kg		04/01/24 12:51	04/04/24 17:14	20
Chromium	0.25	U	1.0	0.063	mg/Kg		04/01/24 12:51	04/04/24 17:14	20
Lead	0.19	U	0.50	0.048	mg/Kg		04/01/24 12:51	04/04/24 17:14	20
Selenium	1.0	U	1.5	0.29	mg/Kg		04/01/24 12:51	04/04/24 17:14	20
Silver	0.050	U	0.20	0.020	mg/Kg		04/01/24 12:51	04/04/24 17:14	20

Lab Sample ID: LCS 580-455329/16-A
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 455329

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	25.0	24.9		mg/Kg		100	82 - 118
Barium	25.0	23.9		mg/Kg		96	86 - 116
Cadmium	25.0	23.9		mg/Kg		95	84 - 116
Chromium	25.0	24.4		mg/Kg		98	83 - 119
Lead	25.0	24.2		mg/Kg		97	84 - 118
Selenium	25.0	25.6		mg/Kg		102	80 - 119
Silver	25.0	24.4		mg/Kg		98	83 - 118

Lab Sample ID: LCSD 580-455329/17-A
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 455329

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	25.0	24.8		mg/Kg		99	82 - 118	0	20
Barium	25.0	24.7		mg/Kg		99	86 - 116	3	20
Cadmium	25.0	24.8		mg/Kg		99	84 - 116	4	20
Chromium	25.0	24.7		mg/Kg		99	83 - 119	1	20
Lead	25.0	24.2		mg/Kg		97	84 - 118	0	20
Selenium	25.0	25.3		mg/Kg		101	80 - 119	1	20
Silver	25.0	24.9		mg/Kg		100	83 - 118	2	20

Lab Sample ID: 580-137730-22 MS
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: NAN_DU10_0-3
Prep Type: Total/NA
Prep Batch: 455329

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits
Arsenic	9.6		23.5	30.0		mg/Kg		87	82 - 118
Barium	120	J1	23.5	145	4	mg/Kg		117	86 - 116
Cadmium	0.35	J	23.5	23.1		mg/Kg		97	84 - 116
Chromium	150	J1	23.5	178	4	mg/Kg		121	83 - 119
Selenium	5.8		23.5	24.6		mg/Kg		80	80 - 119
Silver	0.088	J	23.5	22.5		mg/Kg		95	83 - 118

QC Sample Results

Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: 580-137730-22 MS
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: NAN_DU10_0-3
Prep Type: Total/NA
Prep Batch: 455329

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Lead	8500	J1	23.5	8620	4	mg/Kg		701	84 - 118		

Lab Sample ID: 580-137730-22 MSD
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: NAN_DU10_0-3
Prep Type: Total/NA
Prep Batch: 455329

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Arsenic	9.6		23.5	30.7		mg/Kg		90	82 - 118	2	20
Barium	120	J1	23.5	150	4	mg/Kg		140	86 - 116	4	20
Cadmium	0.35	J	23.5	22.6		mg/Kg		94	84 - 116	2	20
Chromium	150	J1	23.5	180	4	mg/Kg		127	83 - 119	1	20
Selenium	5.8		23.5	26.3		mg/Kg		87	80 - 119	7	20
Silver	0.088	J	23.5	22.6		mg/Kg		96	83 - 118	1	20

Lab Sample ID: 580-137730-22 MSD
Matrix: Solid
Analysis Batch: 455760

Client Sample ID: NAN_DU10_0-3
Prep Type: Total/NA
Prep Batch: 455329

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Lead	8500	J1	23.5	8090	4	mg/Kg		-1541	84 - 118	6	20

Method: 7470A - TCLP Mercury (CVAA)

Lab Sample ID: MB 580-457398/15-C
Matrix: Solid
Analysis Batch: 458032

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 457590

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0020	U	0.0030	0.0015	mg/L		04/25/24 12:11	04/30/24 15:04	1

Lab Sample ID: MB 580-457398/16-C
Matrix: Solid
Analysis Batch: 458032

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 457590

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0020	U	0.0030	0.0015	mg/L		04/25/24 12:11	04/30/24 15:07	1

Lab Sample ID: LCS 580-457398/17-C
Matrix: Solid
Analysis Batch: 458032

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 457590

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Mercury			0.0200	0.0214		mg/L		107	82 - 119		

Lab Sample ID: LCSD 580-457398/18-C
Matrix: Solid
Analysis Batch: 458032

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 457590

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury			0.0200	0.0223		mg/L		111	82 - 119	4	20

QC Sample Results

Method: 7471A - Mercury (CVAA)

Lab Sample ID: MB 580-454663/23-A
Matrix: Solid
Analysis Batch: 454854

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 454663

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.010	U	0.018	0.0054	mg/Kg		03/25/24 10:09	03/26/24 14:14	1

Lab Sample ID: LCS 580-454663/24-A
Matrix: Solid
Analysis Batch: 454854

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 454663

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Mercury			0.100	0.119		mg/Kg		119	80 - 124		

Lab Sample ID: LCSD 580-454663/25-A
Matrix: Solid
Analysis Batch: 454854

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 454663

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury			0.100	0.112		mg/Kg		112	80 - 124	6	20

Lab Sample ID: 580-137730-1 MS
Matrix: Solid
Analysis Batch: 454854

Client Sample ID: NAN_DU8_0-3
Prep Type: Total/NA
Prep Batch: 454663

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Mercury	0.31		0.127	0.431		mg/Kg	☼	97	80 - 124		

Lab Sample ID: 580-137730-1 MSD
Matrix: Solid
Analysis Batch: 454854

Client Sample ID: NAN_DU8_0-3
Prep Type: Total/NA
Prep Batch: 454663

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury	0.31		0.128	0.418		mg/Kg	☼	85	80 - 124	3	20

Lab Sample ID: MB 580-455462/13-A
Matrix: Solid
Analysis Batch: 455504

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 455462

Analyte	MB Result	MB Qualifier	LOQ	DL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.010	U	0.018	0.0054	mg/Kg		04/02/24 13:03	04/02/24 15:27	1

Lab Sample ID: LCS 580-455462/14-A
Matrix: Solid
Analysis Batch: 455504

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 455462

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Mercury			0.100	0.116		mg/Kg		116	80 - 124		

Lab Sample ID: LCSD 580-455462/15-A
Matrix: Solid
Analysis Batch: 455504

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 455462

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury			0.100	0.111		mg/Kg		111	80 - 124	5	20

Method: 7471A - Mercury (CVAA)

Lab Sample ID: 580-137730-25 MS
Matrix: Solid
Analysis Batch: 455504

Client Sample ID: NAN_DU11_0-3
Prep Type: Total/NA
Prep Batch: 455462

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Mercury	0.10		0.140	0.257		mg/Kg	☼	109	80 - 124		

Lab Sample ID: 580-137730-25 MSD
Matrix: Solid
Analysis Batch: 455504

Client Sample ID: NAN_DU11_0-3
Prep Type: Total/NA
Prep Batch: 455462

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Mercury	0.10		0.143	0.249		mg/Kg	☼	101	80 - 124	3	20

Method: 2540G - SM 2540G

Lab Sample ID: 580-137730-1 DU
Matrix: Solid
Analysis Batch: 454764

Client Sample ID: NAN_DU8_0-3
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Percent Solids	71.8			76.4		%				6	20
Percent Moisture	28.2			23.6		%				18	20

Lab Chronicle

Client Sample ID: NAN_DU8_0-3

Lab Sample ID: 580-137730-1

Date Collected: 03/03/24 10:00
Date Received: 03/14/24 09:30
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
SPLP West	Analysis	6010D		1	458233	JLS	EET SEA	05/01/24 22:22
SPLP West	ISM Prep	Increment, prep			458588	JLS	EET SEA	05/06/24 15:49
SPLP West	Leach	1312			458590	JLS	EET SEA	05/06/24 15:52 - 05/06/24 15:53 [1]
SPLP West	Prep	3010A			458592	JLS	EET SEA	05/06/24 15:58
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	Prep	3010A			457588	JL	EET SEA	04/25/24 11:48
TCLP	Analysis	6010D		1	457695	JLS	EET SEA	04/25/24 19:56
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 06:51
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	Prep	7470A			457590	JL	EET SEA	04/25/24 12:11
TCLP	Analysis	7470A		1	458032	JL	EET SEA	04/30/24 15:37
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU8_0-3

Lab Sample ID: 580-137730-1

Date Collected: 03/03/24 10:00
Date Received: 03/14/24 09:30
Matrix: Solid
Percent Solids: 71.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:21

Client Sample ID: NAN_DU8_3-6

Lab Sample ID: 580-137730-2

Date Collected: 03/03/24 10:00
Date Received: 03/14/24 09:30
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 06:57
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU8_3-6

Lab Sample ID: 580-137730-2

Date Collected: 03/03/24 10:00
Date Received: 03/14/24 09:30
Matrix: Solid
Percent Solids: 70.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:28

Lab Chronicle

Client: EnviroQuest, Inc.
Job ID: 580-137730-1
Project/Site: Nanue Bridge

Client Sample ID: NAN_DU8_6-9
Lab Sample ID: 580-137730-3

Date Collected: 03/03/24 10:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 06:54
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU8_6-9
Lab Sample ID: 580-137730-3

Date Collected: 03/03/24 10:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 69.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:31

Client Sample ID: NAN_DU1_0-3_A
Lab Sample ID: 580-137730-4

Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 06:49
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_0-3_A
Lab Sample ID: 580-137730-4

Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 82.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:33

Client Sample ID: NAN_DU1_3-6_A
Lab Sample ID: 580-137730-5

Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 06:23
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_3-6_A

Lab Sample ID: 580-137730-5
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 78.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:36

Client Sample ID: NAN_DU1_6-9_A

Lab Sample ID: 580-137730-6
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 07:37
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_6-9_A

Lab Sample ID: 580-137730-6
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 75.2

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:43

Client Sample ID: NAN_DU1_0-3_B

Lab Sample ID: 580-137730-7
Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
SPLP West	Analysis	6010D		1	458233	JLS	EET SEA	05/01/24 22:49
SPLP West	ISM Prep	Increment, prep			458588	JLS	EET SEA	05/06/24 15:49
SPLP West	Leach	1312			458590	JLS	EET SEA	05/06/24 15:52 - 05/06/24 15:53 [1]
SPLP West	Prep	3010A			458592	JLS	EET SEA	05/06/24 15:58
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	ISM Prep	Increment, prep			457484	AUA	EET SEA	04/24/24 11:30
TCLP	Prep	3010A			457588	JL	EET SEA	04/25/24 11:48
TCLP	Analysis	6010D		1	457695	JLS	EET SEA	04/25/24 20:00
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 07:40
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	ISM Prep	Increment, prep			457484	AUA	EET SEA	04/24/24 11:30
TCLP	Prep	7470A			457590	JL	EET SEA	04/25/24 12:11
TCLP	Analysis	7470A		1	458032	JL	EET SEA	04/30/24 15:39
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_0-3_B
Lab Sample ID: 580-137730-7

Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 83.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:45

Client Sample ID: NAN_DU1_3-6_B
Lab Sample ID: 580-137730-8

Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 07:42
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_3-6_B
Lab Sample ID: 580-137730-8

Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 77.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:48

Client Sample ID: NAN_DU1_6-9_B
Lab Sample ID: 580-137730-9

Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 07:45
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_6-9_B
Lab Sample ID: 580-137730-9

Date Collected: 03/05/24 16:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 75.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:50

Lab Chronicle

Client Sample ID: NAN_DU1_0-3_C

Lab Sample ID: 580-137730-10

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 07:48
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_0-3_C

Lab Sample ID: 580-137730-10

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Matrix: Solid
Percent Solids: 80.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:52

Client Sample ID: NAN_DU1_3-6_C

Lab Sample ID: 580-137730-11

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455023	AUA	EET SEA	03/28/24 09:38
Total/NA	Analysis	6020B		20	455179	FCW	EET SEA	03/29/24 07:08
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU1_3-6_C

Lab Sample ID: 580-137730-11

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Matrix: Solid
Percent Solids: 77.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:55

Client Sample ID: NAN_DU1_6-9_C

Lab Sample ID: 580-137730-12

Date Collected: 03/05/24 16:00
Date Received: 03/14/24 09:30

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 01:09
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Lab Chronicle

Client Sample ID: NAN_DU1_6-9_C

Lab Sample ID: 580-137730-12

Date Collected: 03/05/24 16:00

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 73.7

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:57

Client Sample ID: NAN_DU3_0-3

Lab Sample ID: 580-137730-13

Date Collected: 03/06/24 12:30

Matrix: Solid

Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 00:46
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU3_0-3

Lab Sample ID: 580-137730-13

Date Collected: 03/06/24 12:30

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 69.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 14:59

Client Sample ID: NAN_DU3_3-6

Lab Sample ID: 580-137730-14

Date Collected: 03/06/24 12:30

Matrix: Solid

Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 02:33
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU3_3-6

Lab Sample ID: 580-137730-14

Date Collected: 03/06/24 12:30

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 70.7

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:02

Lab Chronicle

Client Sample ID: NAN_DU3_6-9

Lab Sample ID: 580-137730-15
Date Collected: 03/06/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
SPLP West	Analysis	6010D		1	458233	JLS	EET SEA	05/01/24 22:53
SPLP West	ISM Prep	Increment, prep			458588	JLS	EET SEA	05/06/24 15:49
SPLP West	Leach	1312			458590	JLS	EET SEA	05/06/24 15:52 - 05/06/24 15:53 [1]
SPLP West	Prep	3010A			458592	JLS	EET SEA	05/06/24 15:58
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	Prep	3010A			457588	JL	EET SEA	04/25/24 11:48
TCLP	Analysis	6010D		1	457695	JLS	EET SEA	04/25/24 20:03
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 02:30
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	Prep	7470A			457590	JL	EET SEA	04/25/24 12:11
TCLP	Analysis	7470A		1	458032	JL	EET SEA	04/30/24 15:42
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU3_6-9

Lab Sample ID: 580-137730-15
Date Collected: 03/06/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 72.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:04

Client Sample ID: NAN_DU2_0-3

Lab Sample ID: 580-137730-16
Date Collected: 03/06/24 15:00
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 01:34
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU2_0-3

Lab Sample ID: 580-137730-16
Date Collected: 03/06/24 15:00
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 75.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:11

Lab Chronicle

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Client Sample ID: NAN_DU2_3-6 — Lab Sample ID: 580-137730-17

Date Collected: 03/06/24 15:00 — **Matrix: Solid**
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 01:48
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU2_3-6 — Lab Sample ID: 580-137730-17

Date Collected: 03/06/24 15:00 — **Matrix: Solid**
Date Received: 03/14/24 09:30 — **Percent Solids: 77.2**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:14

Client Sample ID: NAN_DU2_6-9 — Lab Sample ID: 580-137730-18

Date Collected: 03/06/24 15:00 — **Matrix: Solid**
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	Prep	3010A			457588	JL	EET SEA	04/25/24 11:48
TCLP	Analysis	6010D		1	457695	JLS	EET SEA	04/25/24 20:07
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 02:22
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	Prep	7470A			457590	JL	EET SEA	04/25/24 12:11
TCLP	Analysis	7470A		1	458032	JL	EET SEA	04/30/24 15:45
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU2_6-9 — Lab Sample ID: 580-137730-18

Date Collected: 03/06/24 15:00 — **Matrix: Solid**
Date Received: 03/14/24 09:30 — **Percent Solids: 77.3**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:07
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:16

Lab Chronicle

Client: EnviroQuest, Inc. Job ID: 580-137730-1
Project/Site: Nanue Bridge

Client Sample ID: NAN_DU9_0-3 Lab Sample ID: 580-137730-19

Date Collected: 03/09/24 12:30 **Matrix: Solid**
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 ¹
TCLP	Prep	3010A			457588	JL	EET SEA	04/25/24 11:48
TCLP	Analysis	6010D		1	457695	JLS	EET SEA	04/25/24 20:10
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 02:28
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		2000	455425	FCW	EET SEA	04/01/24 18:07
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 ¹
TCLP	Prep	7470A			457590	JL	EET SEA	04/25/24 12:11
TCLP	Analysis	7470A		1	458032	JL	EET SEA	04/30/24 15:47
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU9_0-3 Lab Sample ID: 580-137730-19

Date Collected: 03/09/24 12:30 **Matrix: Solid**
Date Received: 03/14/24 09:30 **Percent Solids: 70.3**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:09
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:19

Client Sample ID: NAN_DU9_3-6 Lab Sample ID: 580-137730-20

Date Collected: 03/09/24 12:30 **Matrix: Solid**
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		20	455285	FCW	EET SEA	03/30/24 02:25
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455073	CSS	EET SEA	03/28/24 13:37
Total/NA	Analysis	6020B		2000	455425	FCW	EET SEA	04/01/24 18:04
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Lab Chronicle

Client Sample ID: NAN_DU9_3-6

Lab Sample ID: 580-137730-20
Date Collected: 03/09/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 61.5

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			454663	JL	EET SEA	03/25/24 10:09
Total/NA	Analysis	7471A		1	454854	JL	EET SEA	03/26/24 15:21

Client Sample ID: NAN_DU9_6-9

Lab Sample ID: 580-137730-21
Date Collected: 03/09/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 04:50
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 04:52
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU9_6-9

Lab Sample ID: 580-137730-21
Date Collected: 03/09/24 12:30
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 64.5

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 16:10

Client Sample ID: NAN_DU10_0-3

Lab Sample ID: 580-137730-22
Date Collected: 03/09/24 14:30
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3546			454340	E1W	EET SEA	03/20/24 15:22
Total/NA	Analysis	8082A		1	455366	TL1	EET SEA	04/01/24 14:54
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/04/24 17:39
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/04/24 18:01
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Lab Chronicle

Client Sample ID: NAN_DU10_0-3

Lab Sample ID: 580-137730-22

Date Collected: 03/09/24 14:30

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 71.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 16:13

Client Sample ID: NAN_DU10_3-6

Lab Sample ID: 580-137730-23

Date Collected: 03/09/24 14:30

Matrix: Solid

Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3546			454340	E1W	EET SEA	03/20/24 15:22
Total/NA	Analysis	8082A		1	455366	TL1	EET SEA	04/01/24 15:47
SPLP West	Analysis	6010D		1	458233	JLS	EET SEA	05/01/24 22:56
SPLP West	ISM Prep	Increment, prep			458588	JLS	EET SEA	05/06/24 15:49
SPLP West	Leach	1312			458590	JLS	EET SEA	05/06/24 15:52 - 05/06/24 15:53 [1]
SPLP West	Prep	3010A			458592	JLS	EET SEA	05/06/24 15:58
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	Prep	3010A			457588	JL	EET SEA	04/25/24 11:48
TCLP	Analysis	6010D		1	457695	JLS	EET SEA	04/25/24 20:14
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 05:01
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 05:04
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	Prep	7470A			457590	JL	EET SEA	04/25/24 12:11
TCLP	Analysis	7470A		1	458032	JL	EET SEA	04/30/24 15:50
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU10_3-6

Lab Sample ID: 580-137730-23

Date Collected: 03/09/24 14:30

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 70.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 15:45

Lab Chronicle

Client Sample ID: NAN_DU10_6-9

Lab Sample ID: 580-137730-24

Date Collected: 03/09/24 14:30

Matrix: Solid

Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/04/24 17:52
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/04/24 18:14
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU10_6-9

Lab Sample ID: 580-137730-24

Date Collected: 03/09/24 14:30

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 68.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 15:54

Client Sample ID: NAN_DU11_0-3

Lab Sample ID: 580-137730-25

Date Collected: 03/10/24 12:20

Matrix: Solid

Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 05:47
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 05:50
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU11_0-3

Lab Sample ID: 580-137730-25

Date Collected: 03/10/24 12:20

Matrix: Solid

Date Received: 03/14/24 09:30

Percent Solids: 62.7

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 15:36

Lab Chronicle

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Client Sample ID: NAN_DU11_3-6

Date Collected: 03/10/24 12:20
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-26
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3546			454340	E1W	EET SEA	03/20/24 15:22
Total/NA	Analysis	8082A		1	455366	TL1	EET SEA	04/01/24 16:04
SPLP West	Analysis	6010D		1	458233	JLS	EET SEA	05/01/24 22:59
SPLP West	ISM Prep	Increment, prep			458588	JLS	EET SEA	05/06/24 15:49
SPLP West	Leach	1312			458590	JLS	EET SEA	05/06/24 15:52 - 05/06/24 15:53 [1]
SPLP West	Prep	3010A			458592	JLS	EET SEA	05/06/24 15:58
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	Prep	3010A			457588	JL	EET SEA	04/25/24 11:48
TCLP	Analysis	6010D		1	457695	JLS	EET SEA	04/25/24 20:17
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 04:44
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 04:47
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	Prep	7470A			457590	JL	EET SEA	04/25/24 12:11
TCLP	Analysis	7470A		1	458032	JL	EET SEA	04/30/24 15:59
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU11_3-6

Date Collected: 03/10/24 12:20
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-26
Matrix: Solid
Percent Solids: 65.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 15:56

Client Sample ID: NAN_DU11_6-9

Date Collected: 03/10/24 12:20
Date Received: 03/14/24 09:30

Lab Sample ID: 580-137730-27
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 05:41
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 05:44
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU11_6-9 Lab Sample ID: 580-137730-27

Date Collected: 03/10/24 12:20 **Matrix: Solid**
Date Received: 03/14/24 09:30 **Percent Solids: 66.2**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 15:59

Client Sample ID: NAN_DU12_0-3 Lab Sample ID: 580-137730-28

Date Collected: 03/10/24 13:10 **Matrix: Solid**
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 04:55
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 04:58
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU12_0-3 Lab Sample ID: 580-137730-28

Date Collected: 03/10/24 13:10 **Matrix: Solid**
Date Received: 03/14/24 09:30 **Percent Solids: 68.0**

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 16:02

Client Sample ID: NAN_DU12_3-6 Lab Sample ID: 580-137730-29

Date Collected: 03/10/24 13:10 **Matrix: Solid**
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
SPLP West	Analysis	6010D		1	458233	JLS	EET SEA	05/01/24 23:03
SPLP West	ISM Prep	Increment, prep			458588	JLS	EET SEA	05/06/24 15:49
SPLP West	Leach	1312			458590	JLS	EET SEA	05/06/24 15:52 - 05/06/24 15:53 [1]
SPLP West	Prep	3010A			458592	JLS	EET SEA	05/06/24 15:58
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	Prep	3010A			457588	JL	EET SEA	04/25/24 11:48
TCLP	Analysis	6010D		1	457695	JLS	EET SEA	04/25/24 20:21
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 05:35
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 05:38

Client Sample ID: NAN_DU12_3-6
Lab Sample ID: 580-137730-29

Date Collected: 03/10/24 13:10
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
TCLP	ISM Prep	Increment, prep			457395	JL	EET SEA	04/23/24 17:04
TCLP	Leach	1311			457398	JL	EET SEA	04/23/24 17:24 - 04/25/24 11:45 [1]
TCLP	Prep	7470A			457590	JL	EET SEA	04/25/24 12:11
TCLP	Analysis	7470A		1	458032	JL	EET SEA	04/30/24 16:02
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU12_3-6
Lab Sample ID: 580-137730-29

Date Collected: 03/10/24 13:10
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 75.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 16:05

Client Sample ID: NAN_DU12_6-9
Lab Sample ID: 580-137730-30

Date Collected: 03/10/24 13:10
Matrix: Solid
Date Received: 03/14/24 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		20	455760	FCW	EET SEA	04/05/24 05:52
Total/NA	ISM Prep	Increment, prep			454054	MR	EET SEA	03/18/24 14:14
Total/NA	Prep	3050B			455329	CA	EET SEA	04/01/24 12:29
Total/NA	Analysis	6020B		2000	455760	FCW	EET SEA	04/05/24 05:55
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Analysis	2540G		1	454764	AUA	EET SEA	03/26/24 11:00

Client Sample ID: NAN_DU12_6-9
Lab Sample ID: 580-137730-30

Date Collected: 03/10/24 13:10
Matrix: Solid
Date Received: 03/14/24 09:30
Percent Solids: 72.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	ISM Prep	Increment, prep			454052	MR	EET SEA	03/18/24 13:58
Total/NA	Prep	7471A			455462	JL	EET SEA	04/02/24 13:03
Total/NA	Analysis	7471A		1	455504	JL	EET SEA	04/02/24 16:08

[1] This procedure uses a method stipulated length of time for the process. Both start and end times are displayed.

Laboratory References:

EET SEA = Eurofins Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Accreditation/Certification Summary

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Job ID: 580-137730-1

Laboratory: Eurofins Seattle

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
ANAB	Dept. of Defense ELAP	L2236	01-19-25

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
2540G		Solid	Percent Moisture
2540G		Solid	Percent Solids
7470A	7470A	Solid	Mercury

Sample Summary

Client: EnviroQuest, Inc.
Project/Site: Nanue Bridge

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-137730-1	NAN_DU8_0-3	Solid	03/03/24 10:00	03/14/24 09:30
580-137730-2	NAN_DU8_3-6	Solid	03/03/24 10:00	03/14/24 09:30
580-137730-3	NAN_DU8_6-9	Solid	03/03/24 10:00	03/14/24 09:30
580-137730-4	NAN_DU1_0-3_A	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-5	NAN_DU1_3-6_A	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-6	NAN_DU1_6-9_A	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-7	NAN_DU1_0-3_B	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-8	NAN_DU1_3-6_B	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-9	NAN_DU1_6-9_B	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-10	NAN_DU1_0-3_C	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-11	NAN_DU1_3-6_C	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-12	NAN_DU1_6-9_C	Solid	03/05/24 16:00	03/14/24 09:30
580-137730-13	NAN_DU3_0-3	Solid	03/06/24 12:30	03/14/24 09:30
580-137730-14	NAN_DU3_3-6	Solid	03/06/24 12:30	03/14/24 09:30
580-137730-15	NAN_DU3_6-9	Solid	03/06/24 12:30	03/14/24 09:30
580-137730-16	NAN_DU2_0-3	Solid	03/06/24 15:00	03/14/24 09:30
580-137730-17	NAN_DU2_3-6	Solid	03/06/24 15:00	03/14/24 09:30
580-137730-18	NAN_DU2_6-9	Solid	03/06/24 15:00	03/14/24 09:30
580-137730-19	NAN_DU9_0-3	Solid	03/09/24 12:30	03/14/24 09:30
580-137730-20	NAN_DU9_3-6	Solid	03/09/24 12:30	03/14/24 09:30
580-137730-21	NAN_DU9_6-9	Solid	03/09/24 12:30	03/14/24 09:30
580-137730-22	NAN_DU10_0-3	Solid	03/09/24 14:30	03/14/24 09:30
580-137730-23	NAN_DU10_3-6	Solid	03/09/24 14:30	03/14/24 09:30
580-137730-24	NAN_DU10_6-9	Solid	03/09/24 14:30	03/14/24 09:30
580-137730-25	NAN_DU11_0-3	Solid	03/10/24 12:20	03/14/24 09:30
580-137730-26	NAN_DU11_3-6	Solid	03/10/24 12:20	03/14/24 09:30
580-137730-27	NAN_DU11_6-9	Solid	03/10/24 12:20	03/14/24 09:30
580-137730-28	NAN_DU12_0-3	Solid	03/10/24 13:10	03/14/24 09:30
580-137730-29	NAN_DU12_3-6	Solid	03/10/24 13:10	03/14/24 09:30
580-137730-30	NAN_DU12_6-9	Solid	03/10/24 13:10	03/14/24 09:30

Eurofins Environmental Testing Northwest, LLC
5755 8th Street East
Tacoma, WA 98424

Chain of Custody Record

eurofins Environment Testing

Client Information	Sampler: KC, SM, RK	Lab PM: Tracy Dutton	Carrier Tracking No(s):	COC No:
Client Contact: Scott Moncrief	Phone: 808 2860222	E-Mail: scottmoncrief808@gmail.com	State of Origin: HI	Page: Page 1 of ~~1~~ 3 KC
Company: Kealamahi Pacific	PWSID:	**Analysis Requested**		Job #:

Address: 103 S Kalaheo Ave
City: Kailua
State, Zip: HI 96734
Phone: 808 2860222
Email: scottmoncrief808@gmail.com
Project Name: Nanue Bridge
Site:

Due Date Requested: std TAT
TAT Requested (days): std
Compliance Project: Δ Yes Δ No
PO #: Purchase Order not required
WO #:
Project #:
SSOW#:

Analysis Requested: Field Filtered Sample (Yes or No); Perform MS/MSD (Yes or No); 8 RCRA Metals; % moisture; Total Number of containers

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8 RCRA Metals	% moisture	Total Number of containers	Special Instructions/Note:
			Preservation Code:							
NAN-DU8-0-3	3/3/24	1000	MIS	S			X	X		50 increment DU
NAN-DU8-3-6	↓	1000	↓	↓			X	X		↓
NAN-DU8-6-9	↓	1000	↓	↓			X	X		↓
NAN-DU1-0-3-A	3/5/24	1600	↓	↓			X	X		↓
NAN-DU~~9~~1 KC-3-6-A	↓	1600	↓	↓			X	X		↓
NAN-DU~~9~~1 KC-6-9-A	↓	1600	↓	↓			X	X		↓
NAN-DU~~9~~1 KC-0-3-B	↓	1600	↓	↓			X	X		
NAN-DU~~9~~1 KC-3-6-B	↓	1600	↓	↓			X	X		
NAN-DU~~9~~1 KC-6-9-B	↓	1600	↓	↓			X	X		
NAN-DU~~9~~1 KC-0-3-C	↓	1600	↓	↓			X	X		
NAN-DU~~9~~1 KC-3-6-C	↓	1600	↓	↓			X	X		

580-137730 Chain of Custody

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☒ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify) std
Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment: FedEx

Relinquished by: Scott Moncrief	Date/Time: 3/11/24 1100 Am	Company KPC	Received by:	Date/Time: 3/14/24 0930	Company EETN
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

1 2 3 4 5 6 7 8 9 10 11

Eurofins Environmental Testing Northwest, LLC
5755 8th Street East
Tacoma, WA 98424

Chain of Custody Record

eurofins | Environment Testing

Client Information	Sampler:	Lab PM:	Carrier Tracking No(s):	COC No:
Client Contact:	Phone:	E-Mail:	State of Origin:	Page: ~~Page 1 of 1~~ KC 2 of 3
Company: Kealamahi Pacific	PWSID:	**Analysis Requested**		Job #:

Address:	**Due Date Requested:**
City:	**TAT Requested (days):**
State, Zip:	**Compliance Project:** Δ Yes Δ No
Phone:	PO #: Purchase Order not required
Email:	WO #:
Project Name: Nanue Bridge	Project #:
Site:	SSOW#:

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	**Sample Date**	**Sample Time**	**Sample Type** (C=comp, G=grab)	**Matrix** (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8 RCRA Metals	% moisture		Total Number of containers	**Special Instructions/Note:**
				Preservation Code:							
NAN-DU9-6-9-C KC	3/5/24	1600	MIS	S			X	X			50 increment DU
NAN-DU3-0-3	3/6/24	1230	↓	↓			X	X			↓
NAN-DU3-3-6	↓	1230					X	X			
NAN-DU3-6-9		1230					X	X			
NAN-DU2-0-3		1500					X	X			
NAN-DU2-3-6		1500					X	X			
NAN-DU2-6-9		1500					X	X			
NAN-DU9-0-3	3/9/24	1230					X	X			
NAN-DU9-3-6	↓	1230					X	X			
NAN-DU9-6-9		1230					X	X			
NAN-DU10-0-3		1430					X	X	X		

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☒ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify) std

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment: FedEx

Relinquished by: Scott Moncrieff	Date/Time: 3/11/24 11:00 AM	Company	Received by:	Date/Time: 3/14/24 0930	Company EETN
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Eurofins Environmental Testing Northwest, LLC
5755 8th Street East
Tacoma, WA 98424

Chain of Custody Record

eurofins | Environment Testing

1 2 3 4 5 6 7 8 9 10 11

Client Information	Sampler:	Lab PM:	Carrier Tracking No(s):	COC No:
Client Contact:	Phone:	E-Mail:	State of Origin:	Page: KC Page ~~1 of 1~~ 3 of 3
Company: Kealamahi Pacific	PWSID:	**Analysis Requested**		Job #:

Address:	**Due Date Requested:**
City:	**TAT Requested (days):**
State, Zip:	**Compliance Project:** ∆ Yes ∆ No
Phone:	PO #: Purchase Order not required
Email:	WO #:
Project Name: Nanue Bridge	Project #:
Site:	SSOW#:

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8 RCRA Metals	% moisture	PCBs	Total Number of containers	Special Instructions/Note:
			Preservation Code:		X	X				X	
NAN_DU10_3-6	3/9/24	1430	MIS	S			X	X	X		50 increment DU
NAN_DU10_6-9	↓	1430	↓	↓			X	X			↓
NAN_DU11_0-3	3/10/24	1220					X	X			
NAN_DU11_3-6	↓	1220					X	X	X		
NAN_DU11_6-9		1220					X	X			
NAN_DU12_0-3		1310					X	X			
NAN_DU12_3-6		1310					X	X			
NAN_DU12_6-9		1310					X	X			

LAST ENTRY

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☒ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For ______ Months*

Deliverable Requested: I, II, III, IV, Other (specify) std

Special Instructions/QC Requirements:

Empty Kit Relinquished by: | Date: | Time: | Method of Shipment: FedEx

Relinquished by: Scott Moncrief	Date/Time: 3/11/24 11:00 AM	Company	Received by:	Date/Time: 3/14/24 0930	Company RETN
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: ∆ Yes ∆ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks:

#1 IR11 13,3/13.2 LB/Ice/no/FPO

#2 IR11 13.2/13.1 LB/Ice/no/FPO

Login Sample Receipt Checklist

Client: EnviroQuest, Inc. Job Number: 580-137730-1

Login Number: 137730 **List Source: Eurofins Seattle**
List Number: 1
Creator: Groves, Elizabeth

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	Cooler temperature outside limits,acceptable per client data quality objectives
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

APPENDIX B1:

Synthetic Precipitation Leaching Procedure (SPLP)

Batch Test Leaching Method Results

Lab Report Available in Appendix A2

Table B-1: Analytical Soil Profiling Results - SPLP Pb - Nanue Bridge

			NAN_DU1_0-3_B 5-Mar-2024 0-3 inches bgs				NAN_DU3_6-9 6-Mar-2024 6-9 inches bgs				NAN_DU8_0-3 3-Mar-2024 0-3 inches bgs			
Analyte	Analytical Method	Units	**Results**	Q	RL	LOQ	**Results**	Q	RL	LOQ	**Results**	Q	RL	LOQ
Synthetic Precipitation Leaching Procedure (SPLP) Resource Conservation and Recovery Act (RCRA) Regulated Metals														
Total Lead	EPA 6020B	mg/kg	1133		0.47		1500		0.47		4300		0.47	
SPLP Lead	EPA 6010D	mg/L	0.080			0.030	0.41			0.030	0.59			0.030
SPLP Lead	EPA 6010D	ug/L	80				410			0.030	590			0.030
Kd Coefficient			**14,143**				**3,636**				**7,268**			

			NAN_DU10_3-6 9-Mar-2024 3-6 inches bgs				NAN_DU11_3-6 10-Mar-2024 3-6 inches bgs				NAN_DU12_3-6 10-Mar-2024 3-6 inches bgs			
Analyte	Analytical Method	Units	**Results**	Q	RL	LOQ	**Results**	Q	RL	LOQ	**Results**	Q	RL	LOQ
Synthetic Precipitation Leaching Procedure (SPLP) Resource Conservation and Recovery Act (RCRA) Regulated Metals														
Total Lead	EPA 6020B	mg/kg	9700		0.47		6400		0.48		7900		0.46	
SPLP Lead	EPA 6010D	mg/L	8.0			0.030	3.5			0.030	5.0			0.030
SPLP Lead	EPA 6010D	ug/L	8,000				3,500				5,000			
Kd Coefficient			**1193**				**1809**				**1560**			

Note: Kd Coefficient is greater than 20. Contaminant is not significantly mobile for concentration and soil type tested.

Notes:

bgs = below ground surface

mg/kg = miligram(s) per kilogram

mg/L = milligram(s) per liter

Kd = desorption coefficient

LOQ = Limit of quantification

Q = qualifier

Pb = lead

RL = reporting limit

SPLP = Synthetic Precipitation Leaching Procedure

ug/L = micrograms per liter

Batch Test Leaching Model NAN _DU1 0 to 3 inches B

Version: Fall 2011

Hawai'i Department of Health

Hazard Evaluation and Emergency Response Office

-Refer to accompanying technical memorandum for background and use of this spreadsheet (HDOH 2007).
-Physiochemical constants updated in Fall 2011 (refer to HDOH 2011).
-Spreadsheet calculates Kd desorption coefficient based on input contaminant concentration in soil and Batch Test data.
-Correlative concentration of contaminant in leachate calculated based on estimated Kd value (may differ from batch test data).
-Future impacts to groundwater estimated using simple groundwater/leachate dilution factor.
-Alternative model based on soil gas data provided in accompanying worksheet.
-Possibility of past impacts to groundwater not considered and must be evaluated separately.
-Check to ensure that this is an up-to-date version of the spreadsheet.
-Remove write protection if problems occur in selection of contaminant. Password to unprotect worksheet is "EAL" (under Tools menu).

STEPS:

1. Select chemical from pulldown list (unlisted chemicals - unprotect spreadsheet and input chemical name and chemical constants).
2. Input total contaminant concentration and SPLP (or other applicable batch test) concentration.
3. Input sample properties. Use default values if sample-specific data are not available.
4. Input Batch Test method information. Default SPLP method parameter values noted.
5. Input groundwater:leachate dilution factor (DF of 1.0 = no dilution; USEPA default = 20, USEPA 2002).
6. Input target groundwater action level for comparison to model calculation of groundwater impacts (optional).
7. Input chemical-specific Henry's Law Constant (Kh) and solubility if "Generic (Volatile)" or "Generic (Nonvolatile)" selected from pulldown list. Input "0" if values not available.
8. Spreadsheet calculates sample-specific Kd value and dissolved-phase concentration of contaminant in saturated sample.
9. Spreadsheet calculates concentration of contaminant in groundwater following impact by leachate.

Step 1: [10]Select Contaminant (use pulldown list)	**LEAD**

Step 2: Input Sample Data	**DEFAULT**	**INPUT**
[1]Concentration in soil sample (mg/kg)	N/A	1.2E+03
[1]Concentration in Batch Test solution (ug/L)	N/A	8.0E-02
Step 3: Input Sample Properties ([5]USEPA soil defaults noted)		
Sample density (g/cm^3)	1.50	1.50
Particle density (g/cm^3)	2.65	2.65
Fraction air-filled porosity (assume saturated soil)	0.00	0.00
Step 4: Batch Test Method Data (SPLP defaults noted)		
[2]Batch Test Solution Volume (ml):	2,000	2,000
[2]Batch Test Solution Density (g/cm^3):	1.0	1.0
[2]Batch Test Sample Weight (grams)	100	100

[3]Step 5: Input Groundwater/ Leachate Dilution Factor	**DEFAULT**	**INPUT**
	20	20
[4]Step 6 (optional): Input Target Groundwater Concentration (ug/L)		

Model Results	
[5]Kd partition Coefficient (cm^3/g):	1.5E+07
[6]Estimated Concentration in Source Area Leachate (ug/L):	-
[7]Estimated Concentration in Groundwater (ug/L):	-

Step 7: [10]Chemical Constants [Generic Chemical only]	

Kd >20. Contaminant not significantly mobile for concentration and soil type tested. Do not place below water table without further evaluation. Address other potential environmental concerns as needed (direct exposure, gross contamination, etc.).

Calculations:	
Sample porosity - total	0.43
Sample porosity - air-filled	0.00
Sample porosity - water-filled	0.43
Batch Test Solution Mass (grams)	2.0E+03
Batch Test Sample Mass (grams)	1.0E+02
Sample Mass:Solution Mass Ratio (gm/gm)	5.0E-02
Total Mass of Contaminant (ug)	1.2E+05
Mass Contaminant in Batch Test Solution (ug)	1.6E-01
Mass Contaminant Sorbed to Soil (ug)	1.2E+05
Concentration Sorbed (ug/kg)	1.2E+06
Batch Test Percent Solid Phase	100.0%
Batch Test Percent Dissolved Phase	0.0%
Batch Test Solid-Phase Contaminant Conc. (mg/kg)	1.2E+03
Batch Test Solution Contaminant Conc. (ug/L)	8.0E-02

Notes (refer also to accompanying memo).

1. Total contaminant concentration measured in soil sample and results of Batch Test analysis (e.g., SPLP).
2. Batch Test: Default SPLP method calls for 100 grams of sample and 2 liters of solution with a density of approximately 1.0
3. Site-specific or default groundwater/leachate dilution factor (default = 20, USEPA 2002).
4. Target groundwater action level. Refer to HDOH EAL document and appropriate groundwater category.
5. Partition Coefficient (Kd) = $\text{Concentration}_{\text{sorbed}}/\text{Concentration}_{\text{solution}}$ (after Roy et al 1992).
   Partition Coefficient units in L/Kg [(ug/Kg)/ug/L)] or cm^3/g [(ug/g)/ug/cm^3)]
   and assumed equilibrium partitioning (USEPA 2002). Refer to discussion and equations presented in accompanying HDOH
   contaminant concentration in leachate during transport through vadose zone not considered. Refer to Tier 2 concentration
8. Caution Message: A caution message will appear if the input batch test concentration is greater than 75% of the assumed contaminant solubility and a Kd value will not be generated (refer to "Leaching Evaluation of Heavily Contaminated Soils" in text). Model assumes that free product is present in the batch test solution and a Kd cannot be calculated (see text).
9. Error Message: The batch test data are not valid if the contaminant mass calculated for solute exceeds total mass calculated for sample (based on sample mass and input total contaminant concentration). This may not be uncommon given the potential for lab error at very low concentrations of contaminants.
10. "GENERIC CHEMICAL" can be selected from pulldown menu an used to model of any chemical, including chemicals not listed. Selection requires input of Kh (atm m3/mole) and Solubility constants in Step 7 if available. Note that a chemicals physiochemcial constants affect results for VOCs only if input Fraction Air-Filled Porosity is >0% (model considers partitioning into pore space air for VOCs as well as leachate).

References:

HDOH, 2007, Use of laboratory batch tests to evaluate potential leaching of contaminants from soil (updated April 2007): Hawai'i Dept. of Health, Hazard Evaluation and Emergency Response, http://hawaii.gov/health/environmental/hazard/index.html

HDOH, 2011, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater: Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response, Fall 2011, www.hawaii.gov/health/environmental/hazard/eal2005.html.

USEPA, 1994, Synthetic Precipitation Leaching Procedure: U.S. Environmental Protection Agency, Office of Solid Waste, SW-846 Method 1312, September 1994, www.epa.gov/epaoswer/hazwaste/test/main.htm.

USEPA, 1999, Understanding Variation in Partition Coefficient, Kd, Values: Office of Air and Radiation, August 1999, EPA/402/R/99/004A, http://www.epa.gov/radiation/docs/kdreport/

USEPA, 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites: U.S. Environmental Protection Agency, Solid Waste and Emergency Response, OSWER 9355.4-24, December 2002, http://www.epa.gov/superfund/resources/soil/ssg_main.pdf

Batch Test Leaching Model NAN_DU3 6 to 9 inches

Version: Fall 2011
Hawai'i Department of Health
Hazard Evaluation and Emergency Response Office

-Refer to accompanying technical memorandum for background and use of this spreadsheet (HDOH 2007).
-Physiochemical constants updated in Fall 2011 (refer to HDOH 2011).
-Spreadsheet calculates Kd desorption coefficient based on input contaminant concentration in soil and Batch Test data.
-Correlative concentration of contaminant in leachate calculated based on estimated Kd value (may differ from batch test data).
-Future impacts to groundwater estimated using simple groundwater/leachate dilution factor.
-Alternative model based on soil gas data provided in accompanying worksheet.
-Possibility of past impacts to groundwater not considered and must be evaluated separately.
-Check to ensure that this is an up-to-date version of the spreadsheet.
-Remove write protection if problems occur in selection of contaminant. Password to unprotect worksheet is "EAL" (under Tools menu).

STEPS:

1. Select chemical from pulldown list (unlisted chemicals - unprotect spreadsheet and input chemical name and chemical constants).
2. Input total contaminant concentration and SPLP (or other applicable batch test) concentration.
3. Input sample properties. Use default values if sample-specific data are not available.
4. Input Batch Test method information. Default SPLP method parameter values noted.
5. Input groundwater:leachate dilution factor (DF of 1.0 = no dilution; USEPA default = 20, USEPA 2002).
6. Input target groundwater action level for comparison to model calculation of groundwater impacts (optional).
7. Input chemical-specific Henry's Law Constant (Kh) and solubility if "Generic (Volatile)" or "Generic (Nonvolatile)" selected from pulldown list. Input "0" if values not available.
8. Spreadsheet calculates sample-specific Kd value and dissolved-phase concentration of contaminant in saturated sample.
9. Spreadsheet calculates concentration of contaminant in groundwater following impact by leachate.

Step 1: [10]Select Contaminant (use pulldown list)	**LEAD**

Step 2: Input Sample Data	**DEFAULT**	**INPUT**
[1]Concentration in soil sample (mg/kg)	N/A	1.5E+03
[1]Concentration in Batch Test solution (ug/L)	N/A	4.1E-01
Step 3: Input Sample Properties ([5]USEPA soil defaults noted)		
Sample density (g/cm^3)	1.50	1.50
Particle density (g/cm^3)	2.65	2.65
Fraction air-filled porosity (assume saturated soil)	0.00	0.00
Step 4: Batch Test Method Data (SPLP defaults noted)		
[2]Batch Test Solution Volume (ml):	2,000	2,000
[2]Batch Test Solution Density (g/cm^3):	1.0	1.0
[2]Batch Test Sample Weight (grams)	100	100

[3]Step 5: Input Groundwater/ Leachate Dilution Factor	**DEFAULT**	**INPUT**
	20	20
[4]Step 6 (optional): Input Target Groundwater Concentration (ug/L)		

Model Results	
[5]Kd partition Coefficient (cm^3/g):	3.7E+06
[6]Estimated Concentration in Source Area Leachate (ug/L):	-
[7]Estimated Concentration in Groundwater (ug/L):	-

Step 7: [10]Chemical Constants [Generic Chemical only]	

Kd >20. Contaminant not significantly mobile for concentration and soil type tested. Do not place below water table without further evaluation. Address other potential environmental concerns as needed (direct exposure, gross contamination, etc.).

Calculations:	
Sample porosity - total	0.43
Sample porosity - air-filled	0.00
Sample porosity - water-filled	0.43
Batch Test Solution Mass (grams)	2.0E+03
Batch Test Sample Mass (grams)	1.0E+02
Sample Mass:Solution Mass Ratio (gm/gm)	5.0E-02
Total Mass of Contaminant (ug)	1.5E+05
Mass Contaminant in Batch Test Solution (ug)	8.2E-01
Mass Contaminant Sorbed to Soil (ug)	1.5E+05
Concentration Sorbed (ug/kg)	1.5E+06
Batch Test Percent Solid Phase	100.0%
Batch Test Percent Dissolved Phase	0.0%
Batch Test Solid-Phase Contaminant Conc. (mg/kg)	1.5E+03
Batch Test Solution Contaminant Conc. (ug/L)	4.1E-01

Notes (refer also to accompanying memo).

1. Total contaminant concentration measured in soil sample and results of Batch Test analysis (e.g., SPLP).
2. Batch Test: Default SPLP method calls for 100 grams of sample and 2 liters of solution with a density of approximately 1.0
3. Site-specific or default groundwater/leachate dilution factor (default = 20, USEPA 2002).
4. Target groundwater action level. Refer to HDOH EAL document and appropriate groundwater category.
5. Partition Coefficient (Kd) = $\text{Concentration}_{\text{sorbed}}/\text{Concentration}_{\text{solution}}$ (after Roy et al 1992).
   Partition Coefficient units in L/Kg [(ug/Kg)/ug/L)] or cm^3/g [(ug/g)/ug/cm^3)]
   and assumed equilibrium partitioning (USEPA 2002). Refer to discussion and equations presented in accompanying HDOH
   contaminant concentration in leachate during transport through vadose zone not considered. Refer to Tier 2 concentration
8. Caution Message: A caution message will appear if the input batch test concentration is greater than 75% of the assumed contaminant solubility and a Kd value will not be generated (refer to "Leaching Evaluation of Heavily Contaminated Soils" in text). Model assumes that free product is present in the batch test solution and a Kd cannot be calculated (see text).
9. Error Message: The batch test data are not valid if the contaminant mass calculated for solute exceeds total mass calculated for sample (based on sample mass and input total contaminant concentration). This may not be uncommon given the potential for lab error at very low concentrations of contaminants.
10. "GENERIC CHEMICAL" can be selected from pulldown menu an used to model of any chemical, including chemicals not listed. Selection requires input of Kh (atm m3/mole) and Solubility constants in Step 7 if available. Note that a chemicals physiochemcial constants affect results for VOCs only if input Fraction Air-Filled Porosity is >0% (model considers partitioning into pore space air for VOCs as well as leachate).

References:

HDOH, 2007, Use of laboratory batch tests to evaluate potential leaching of contaminants from soil (updated April 2007): Hawai'i Dept. of Health, Hazard Evaluation and Emergency Response, http://hawaii.gov/health/environmental/hazard/index.html

HDOH, 2011, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater: Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response, Fall 2011, www.hawaii.gov/health/environmental/hazard/eal2005.html.

USEPA, 1994, Synthetic Precipitation Leaching Procedure: U.S. Environmental Protection Agency, Office of Solid Waste, SW-846 Method 1312, September 1994, www.epa.gov/epaoswer/hazwaste/test/main.htm.

USEPA, 1999, Understanding Variation in Partition Coefficient, Kd, Values: Office of Air and Radiation, August 1999, EPA/402/R/99/004A, http://www.epa.gov/radiation/docs/kdreport/

USEPA, 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites: U.S. Environmental Protection Agency, Solid Waste and Emergency Response, OSWER 9355.4-24, December 2002, http://www.epa.gov/superfund/resources/soil/ssg_main.pdf

Batch Test Leaching Model NAN_DU8 0 to 3 inches

Version: Fall 2011

Hawai'i Department of Health

Hazard Evaluation and Emergency Response Office

-Refer to accompanying technical memorandum for background and use of this spreadsheet (HDOH 2007).
-Physiochemical constants updated in Fall 2011 (refer to HDOH 2011).
-Spreadsheet calculates Kd desorption coefficient based on input contaminant concentration in soil and Batch Test data.
-Correlative concentration of contaminant in leachate calculated based on estimated Kd value (may differ from batch test data).
-Future impacts to groundwater estimated using simple groundwater/leachate dilution factor.
-Alternative model based on soil gas data provided in accompanying worksheet.
-Possibility of past impacts to groundwater not considered and must be evaluated separately.
-Check to ensure that this is an up-to-date version of the spreadsheet.
-Remove write protection if problems occur in selection of contaminant. Password to unprotect worksheet is "EAL" (under Tools menu).

STEPS:

1. Select chemical from pulldown list (unlisted chemicals - unprotect spreadsheet and input chemical name and chemical constants).
2. Input total contaminant concentration and SPLP (or other applicable batch test) concentration.
3. Input sample properties. Use default values if sample-specific data are not available.
4. Input Batch Test method information. Default SPLP method parameter values noted.
5. Input groundwater:leachate dilution factor (DF of 1.0 = no dilution; USEPA default = 20, USEPA 2002).
6. Input target groundwater action level for comparison to model calculation of groundwater impacts (optional).
7. Input chemical-specific Henry's Law Constant (Kh) and solubility if "Generic (Volatile)" or "Generic (Nonvolatile)" selected from pulldown list. Input "0" if values not available.
8. Spreadsheet calculates sample-specific Kd value and dissolved-phase concentration of contaminant in saturated sample.
9. Spreadsheet calculates concentration of contaminant in groundwater following impact by leachate.

Step 1: [10]Select Contaminant (use pulldown list)	**LEAD**

Step 2: Input Sample Data	**DEFAULT**	**INPUT**
[1]Concentration in soil sample (mg/kg)	N/A	4.3E+03
[1]Concentration in Batch Test solution (ug/L)	N/A	5.9E-01
Step 3: Input Sample Properties ([5]USEPA soil defaults noted)		
Sample density (g/cm^3)	1.50	1.50
Particle density (g/cm^3)	2.65	2.65
Fraction air-filled porosity (assume saturated soil)	0.00	0.00
Step 4: Batch Test Method Data (SPLP defaults noted)		
[2]Batch Test Solution Volume (ml):	2,000	2,000
[2]Batch Test Solution Density (g/cm^3):	1.0	1.0
[2]Batch Test Sample Weight (grams)	100	100

[3]Step 5: Input Groundwater/ Leachate Dilution Factor	**DEFAULT**	**INPUT**
	20	20
[4]Step 6 (optional): Input Target Groundwater Concentration (ug/L)		

Model Results	
[5]Kd partition Coefficient (cm^3/g):	7.3E+06
[6]Estimated Concentration in Source Area Leachate (ug/L):	-
[7]Estimated Concentration in Groundwater (ug/L):	-

Step 7: [10]Chemical Constants [Generic Chemical only]	

Kd >20. Contaminant not significantly mobile for concentration and soil type tested. Do not place below water table without further evaluation. Address other potential environmental concerns as needed (direct exposure, gross contamination, etc.).

Calculations:	
Sample porosity - total	0.43
Sample porosity - air-filled	0.00
Sample porosity - water-filled	0.43
Batch Test Solution Mass (grams)	2.0E+03
Batch Test Sample Mass (grams)	1.0E+02
Sample Mass:Solution Mass Ratio (gm/gm)	5.0E-02
Total Mass of Contaminant (ug)	4.3E+05
Mass Contaminant in Batch Test Solution (ug)	1.2E+00
Mass Contaminant Sorbed to Soil (ug)	4.3E+05
Concentration Sorbed (ug/kg)	4.3E+06
Batch Test Percent Solid Phase	100.0%
Batch Test Percent Dissolved Phase	0.0%
Batch Test Solid-Phase Contaminant Conc. (mg/kg)	4.3E+03
Batch Test Solution Contaminant Conc. (ug/L)	5.9E-01

Notes (refer also to accompanying memo).

1. Total contaminant concentration measured in soil sample and results of Batch Test analysis (e.g., SPLP).
2. Batch Test: Default SPLP method calls for 100 grams of sample and 2 liters of solution with a density of approximately 1.0
3. Site-specific or default groundwater/leachate dilution factor (default = 20, USEPA 2002).
4. Target groundwater action level. Refer to HDOH EAL document and appropriate groundwater category.
5. Partition Coefficient (Kd) = Concentration$_{sorbed}$/Concentration$_{solution}$ (after Roy et al 1992).
   Partition Coefficient units in L/Kg [(ug/Kg)/ug/L)] or cm^3/g [(ug/g)/ug/cm^3)]
   and assumed equilibrium partitioning (USEPA 2002). Refer to discussion and equations presented in accompanying HDOH
   contaminant concentration in leachate during transport through vadose zone not considered. Refer to Tier 2 concentration
8. Caution Message: A caution message will appear if the input batch test concentration is greater than 75% of the assumed contaminant solubility and a Kd value will not be generated (refer to "Leaching Evaluation of Heavily Contaminated Soils" in text). Model assumes that free product is present in the batch test solution and a Kd cannot be calculated (see text).
9. Error Message: The batch test data are not valid if the contaminant mass calculated for solute exceeds total mass calculated for sample (based on sample mass and input total contaminant concentration). This may not be uncommon given the potential for lab error at very low concentrations of contaminants.
10. "GENERIC CHEMICAL" can be selected from pulldown menu an used to model of any chemical, including chemicals not listed. Selection requires input of Kh (atm m3/mole) and Solubility constants in Step 7 if available. Note that a chemicals physiochemcial constants affect results for VOCs only if input Fraction Air-Filled Porosity is >0% (model considers partitioning into pore space air for VOCs as well as leachate).

References:

HDOH, 2007, Use of laboratory batch tests to evaluate potential leaching of contaminants from soil (updated April 2007): Hawai'i Dept. of Health, Hazard Evaluation and Emergency Response, http://hawaii.gov/health/environmental/hazard/index.html

HDOH, 2011, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater: Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response, Fall 2011, www.hawaii.gov/health/environmental/hazard/eal2005.html.

USEPA, 1994, Synthetic Precipitation Leaching Procedure: U.S. Environmental Protection Agency, Office of Solid Waste, SW-846 Method 1312, September 1994, www.epa.gov/epaoswer/hazwaste/test/main.htm.

USEPA, 1999, Understanding Variation in Partition Coefficient, Kd, Values: Office of Air and Radiation, August 1999, EPA/402/R/99/004A, http://www.epa.gov/radiation/docs/kdreport/

USEPA, 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites: U.S. Environmental Protection Agency, Solid Waste and Emergency Response, OSWER 9355.4-24, December 2002, http://www.epa.gov/superfund/resources/soil/ssg_main.pdf

Batch Test Leaching Model NAN DU10 3 to 6 inches

Version: Fall 2011

Hawai'i Department of Health

Hazard Evaluation and Emergency Response Office

-Refer to accompanying technical memorandum for background and use of this spreadsheet (HDOH 2007).
-Physiochemical constants updated in Fall 2011 (refer to HDOH 2011).
-Spreadsheet calculates Kd desorption coefficient based on input contaminant concentration in soil and Batch Test data.
-Correlative concentration of contaminant in leachate calculated based on estimated Kd value (may differ from batch test data).
-Future impacts to groundwater estimated using simple groundwater/leachate dilution factor.
-Alternative model based on soil gas data provided in accompanying worksheet.
-Possibility of past impacts to groundwater not considered and must be evaluated separately.
-Check to ensure that this is an up-to-date version of the spreadsheet.
-Remove write protection if problems occur in selection of contaminant. Password to unprotect worksheet is "EAL" (under Tools menu).

STEPS:

1. Select chemical from pulldown list (unlisted chemicals - unprotect spreadsheet and input chemical name and chemical constants).
2. Input total contaminant concentration and SPLP (or other applicable batch test) concentration.
3. Input sample properties. Use default values if sample-specific data are not available.
4. Input Batch Test method information. Default SPLP method parameter values noted.
5. Input groundwater:leachate dilution factor (DF of 1.0 = no dilution; USEPA default = 20, USEPA 2002).
6. Input target groundwater action level for comparison to model calculation of groundwater impacts (optional).
7. Input chemical-specific Henry's Law Constant (Kh) and solubility if "Generic (Volatile)" or "Generic (Nonvolatile)" selected from pulldown list. Input "0" if values not available.
8. Spreadsheet calculates sample-specific Kd value and dissolved-phase concentration of contaminant in saturated sample.
9. Spreadsheet calculates concentration of contaminant in groundwater following impact by leachate.

Step 1: [10]Select Contaminant (use pulldown list)	**LEAD**

Step 2: Input Sample Data	**DEFAULT**	**INPUT**
[1]Concentration in soil sample (mg/kg)	N/A	9.7E+03
[1]Concentration in Batch Test solution (ug/L)	N/A	8.0E+00
Step 3: Input Sample Properties ([5]USEPA soil defaults noted)		
Sample density (g/cm^3)	1.50	1.50
Particle density (g/cm^3)	2.65	2.65
Fraction air-filled porosity (assume saturated soil)	0.00	0.00
Step 4: Batch Test Method Data (SPLP defaults noted)		
[2]Batch Test Solution Volume (ml):	2,000	2,000
[2]Batch Test Solution Density (g/cm^3):	1.0	1.0
[2]Batch Test Sample Weight (grams)	100	100

[3]Step 5: Input Groundwater/ Leachate Dilution Factor	**DEFAULT**	**INPUT**
	20	20
[4]Step 6 (optional): Input Target Groundwater Concentration (ug/L)		

Model Results	
[5]Kd partition Coefficient (cm^3/g):	1.2E+06
[6]Estimated Concentration in Source Area Leachate (ug/L):	-
[7]Estimated Concentration in Groundwater (ug/L):	-

Step 7: [10]Chemical Constants [Generic Chemical only]	

Kd >20. Contaminant not significantly mobile for concentration and soil type tested. Do not place below water table without further evaluation. Address other potential environmental concerns as needed (direct exposure, gross contamination, etc.).

Calculations:	
Sample porosity - total	0.43
Sample porosity - air-filled	0.00
Sample porosity - water-filled	0.43
Batch Test Solution Mass (grams)	2.0E+03
Batch Test Sample Mass (grams)	1.0E+02
Sample Mass:Solution Mass Ratio (gm/gm)	5.0E-02
Total Mass of Contaminant (ug)	9.7E+05
Mass Contaminant in Batch Test Solution (ug)	1.6E+01
Mass Contaminant Sorbed to Soil (ug)	9.7E+05
Concentration Sorbed (ug/kg)	9.7E+06
Batch Test Percent Solid Phase	100.0%
Batch Test Percent Dissolved Phase	0.0%
Batch Test Solid-Phase Contaminant Conc. (mg/kg)	9.7E+03
Batch Test Solution Contaminant Conc. (ug/L)	8.0E+00

Notes (refer also to accompanying memo).

1. Total contaminant concentration measured in soil sample and results of Batch Test analysis (e.g., SPLP).
2. Batch Test: Default SPLP method calls for 100 grams of sample and 2 liters of solution with a density of approximately 1.0
3. Site-specific or default groundwater/leachate dilution factor (default = 20, USEPA 2002).
4. Target groundwater action level. Refer to HDOH EAL document and appropriate groundwater category.
5. Partition Coefficient (Kd) = Concentration$_{sorbed}$/Concentration$_{solution}$ (after Roy et al 1992).
   Partition Coefficient units in L/Kg [(ug/Kg)/ug/L)] or cm^3/g [(ug/g)/ug/cm^3)]
   and assumed equilibrium partitioning (USEPA 2002). Refer to discussion and equations presented in accompanying HDOH
   contaminant concentration in leachate during transport through vadose zone not considered. Refer to Tier 2 concentration
8. Caution Message: A caution message will appear if the input batch test concentration is greater than 75% of the assumed contaminant solubility and a Kd value will not be generated (refer to "Leaching Evaluation of Heavily Contaminated Soils" in text). Model assumes that free product is present in the batch test solution and a Kd cannot be calculated (see text).
9. Error Message: The batch test data are not valid if the contaminant mass calculated for solute exceeds total mass calculated for sample (based on sample mass and input total contaminant concentration). This may not be uncommon given the potential for lab error at very low concentrations of contaminants.
10. "GENERIC CHEMICAL" can be selected from pulldown menu an used to model of any chemical, including chemicals not listed. Selection requires input of Kh (atm m3/mole) and Solubility constants in Step 7 if available. Note that a chemicals physiochemcial constants affect results for VOCs only if input Fraction Air-Filled Porosity is >0% (model considers partitioning into pore space air for VOCs as well as leachate).

References:

HDOH, 2007, Use of laboratory batch tests to evaluate potential leaching of contaminants from soil (updated April 2007): Hawai'i Dept. of Health, Hazard Evaluation and Emergency Response, http://hawaii.gov/health/environmental/hazard/index.html

HDOH, 2011, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater: Hawai’i Department of Health, Office of Hazard Evaluation and Emergency Response, Fall 2011, www.hawaii.gov/health/environmental/hazard/eal2005.html.

USEPA, 1994, Synthetic Precipitation Leaching Procedure: U.S. Environmental Protection Agency, Office of Solid Waste, SW-846 Method 1312, September 1994, www.epa.gov/epaoswer/hazwaste/test/main.htm.

USEPA, 1999, Understanding Variation in Partition Coefficient, Kd, Values: Office of Air and Radiation, August 1999, EPA/402/R/99/004A, http://www.epa.gov/radiation/docs/kdreport/

USEPA, 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites: U.S. Environmental Protection Agency, Solid Waste and Emergency Response, OSWER 9355.4-24, December 2002, http://www.epa.gov/superfund/resources/soil/ssg_main.pdf

Batch Test Leaching Model NAN DU11 3 to 6 inches
Version: Fall 2011
Hawai'i Department of Health
Hazard Evaluation and Emergency Response Office

-Refer to accompanying technical memorandum for background and use of this spreadsheet (HDOH 2007).
-Physiochemical constants updated in Fall 2011 (refer to HDOH 2011).
-Spreadsheet calculates Kd desorption coefficient based on input contaminant concentration in soil and Batch Test data.
-Correlative concentration of contaminant in leachate calculated based on estimated Kd value (may differ from batch test data).
-Future impacts to groundwater estimated using simple groundwater/leachate dilution factor.
-Alternative model based on soil gas data provided in accompanying worksheet.
-Possibility of past impacts to groundwater not considered and must be evaluated separately.
-Check to ensure that this is an up-to-date version of the spreadsheet.
-Remove write protection if problems occur in selection of contaminant. Password to unprotect worksheet is "EAL" (under Tools menu).

STEPS:

1. Select chemical from pulldown list (unlisted chemicals - unprotect spreadsheet and input chemical name and chemical constants).
2. Input total contaminant concentration and SPLP (or other applicable batch test) concentration.
3. Input sample properties. Use default values if sample-specific data are not available.
4. Input Batch Test method information. Default SPLP method parameter values noted.
5. Input groundwater:leachate dilution factor (DF of 1.0 = no dilution; USEPA default = 20, USEPA 2002).
6. Input target groundwater action level for comparison to model calculation of groundwater impacts (optional).
7. Input chemical-specific Henry's Law Constant (Kh) and solubility if "Generic (Volatile)" or "Generic (Nonvolatile)" selected from pulldown list. Input "0" if values not available.
8. Spreadsheet calculates sample-specific Kd value and dissolved-phase concentration of contaminant in saturated sample.
9. Spreadsheet calculates concentration of contaminant in groundwater following impact by leachate.

Step 1: [10]Select Contaminant (use pulldown list)	**LEAD**

Step 2: Input Sample Data	**DEFAULT**	**INPUT**
[1]Concentration in soil sample (mg/kg)	N/A	6.4E+03
[1]Concentration in Batch Test solution (ug/L)	N/A	3.5E+00
Step 3: Input Sample Properties ([5]USEPA soil defaults noted)		
Sample density (g/cm^3)	1.50	1.50
Particle density (g/cm^3)	2.65	2.65
Fraction air-filled porosity (assume saturated soil)	0.00	0.00
Step 4: Batch Test Method Data (SPLP defaults noted)		
[2]Batch Test Solution Volume (ml):	2,000	2,000
[2]Batch Test Solution Density (g/cm^3):	1.0	1.0
[2]Batch Test Sample Weight (grams)	100	100

[3]Step 5: Input Groundwater/ Leachate Dilution Factor	**DEFAULT**	**INPUT**
	20	20
[4]Step 6 (optional): Input Target Groundwater Concentration (ug/L)		

Model Results	
[5]Kd partition Coefficient (cm^3/g):	1.8E+06
[6]Estimated Concentration in Source Area Leachate (ug/L):	-
[7]Estimated Concentration in Groundwater (ug/L):	-

Step 7: [10]Chemical Constants [Generic Chemical only]	

Kd >20. Contaminant not significantly mobile for concentration and soil type tested. Do not place below water table without further evaluation. Address other potential environmental concerns as needed (direct exposure, gross contamination, etc.).

Calculations:	
Sample porosity - total	0.43
Sample porosity - air-filled	0.00
Sample porosity - water-filled	0.43
Batch Test Solution Mass (grams)	2.0E+03
Batch Test Sample Mass (grams)	1.0E+02
Sample Mass:Solution Mass Ratio (gm/gm)	5.0E-02
Total Mass of Contaminant (ug)	6.4E+05
Mass Contaminant in Batch Test Solution (ug)	7.0E+00
Mass Contaminant Sorbed to Soil (ug)	6.4E+05
Concentration Sorbed (ug/kg)	6.4E+06
Batch Test Percent Solid Phase	100.0%
Batch Test Percent Dissolved Phase	0.0%
Batch Test Solid-Phase Contaminant Conc. (mg/kg)	6.4E+03
Batch Test Solution Contaminant Conc. (ug/L)	3.5E+00

Notes (refer also to accompanying memo).

1. Total contaminant concentration measured in soil sample and results of Batch Test analysis (e.g., SPLP).
2. Batch Test: Default SPLP method calls for 100 grams of sample and 2 liters of solution with a density of approximately 1.0
3. Site-specific or default groundwater/leachate dilution factor (default = 20, USEPA 2002).
4. Target groundwater action level. Refer to HDOH EAL document and appropriate groundwater category.
5. Partition Coefficient (Kd) = Concentration$_{sorbed}$/Concentration$_{solution}$ (after Roy et al 1992).
   Partition Coefficient units in L/Kg [(ug/Kg)/ug/L)] or cm^3/g [(ug/g)/ug/cm^3)]
   and assumed equilibrium partitioning (USEPA 2002). Refer to discussion and equations presented in accompanying HDOH
   contaminant concentration in leachate during transport through vadose zone not considered. Refer to Tier 2 concentration

8. Caution Message: A caution message will appear if the input batch test concentration is greater than 75% of the assumed contaminant solubility and a Kd value will not be generated (refer to "Leaching Evaluation of Heavily Contaminated Soils" in text). Model assumes that free product is present in the batch test solution and a Kd cannot be calculated (see text).
9. Error Message: The batch test data are not valid if the contaminant mass calculated for solute exceeds total mass calculated for sample (based on sample mass and input total contaminant concentration). This may not be uncommon given the potential for lab error at very low concentrations of contaminants.
10. "GENERIC CHEMICAL" can be selected from pulldown menu an used to model of any chemical, including chemicals not listed. Selection requires input of Kh (atm m3/mole) and Solubility constants in Step 7 if available. Note that a chemicals physiochemcial constants affect results for VOCs only if input Fraction Air-Filled Porosity is >0% (model considers partitioning into pore space air for VOCs as well as leachate).

References:

HDOH, 2007, Use of laboratory batch tests to evaluate potential leaching of contaminants from soil (updated April 2007): Hawai'i Dept. of Health, Hazard Evaluation and Emergency Response, http://hawaii.gov/health/environmental/hazard/index.html

HDOH, 2011, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater: Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response, Fall 2011, www.hawaii.gov/health/environmental/hazard/eal2005.html.

USEPA, 1994, Synthetic Precipitation Leaching Procedure: U.S. Environmental Protection Agency, Office of Solid Waste, SW-846 Method 1312, September 1994, www.epa.gov/epaoswer/hazwaste/test/main.htm.

USEPA, 1999, Understanding Variation in Partition Coefficient, Kd, Values: Office of Air and Radiation, August 1999, EPA/402/R/99/004A, http://www.epa.gov/radiation/docs/kdreport/

USEPA, 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites: U.S. Environmental Protection Agency, Solid Waste and Emergency Response, OSWER 9355.4-24, December 2002, http://www.epa.gov/superfund/resources/soil/ssg_main.pdf

Batch Test Leaching Model NAN DU12 3 to 6 inches

Version: Fall 2011

Hawai'i Department of Health

Hazard Evaluation and Emergency Response Office

-Refer to accompanying technical memorandum for background and use of this spreadsheet (HDOH 2007).
-Physiochemical constants updated in Fall 2011 (refer to HDOH 2011).
-Spreadsheet calculates Kd desorption coefficient based on input contaminant concentration in soil and Batch Test data.
-Correlative concentration of contaminant in leachate calculated based on estimated Kd value (may differ from batch test data).
-Future impacts to groundwater estimated using simple groundwater/leachate dilution factor.
-Alternative model based on soil gas data provided in accompanying worksheet.
-Possibility of past impacts to groundwater not considered and must be evaluated separately.
-Check to ensure that this is an up-to-date version of the spreadsheet.
-Remove write protection if problems occur in selection of contaminant. Password to unprotect worksheet is "EAL" (under Tools menu).

STEPS:

1. Select chemical from pulldown list (unlisted chemicals - unprotect spreadsheet and input chemical name and chemical constants).
2. Input total contaminant concentration and SPLP (or other applicable batch test) concentration.
3. Input sample properties. Use default values if sample-specific data are not available.
4. Input Batch Test method information. Default SPLP method parameter values noted.
5. Input groundwater:leachate dilution factor (DF of 1.0 = no dilution; USEPA default = 20, USEPA 2002).
6. Input target groundwater action level for comparison to model calculation of groundwater impacts (optional).
7. Input chemical-specific Henry's Law Constant (Kh) and solubility if "Generic (Volatile)" or "Generic (Nonvolatile)" selected from pulldown list. Input "0" if values not available.
8. Spreadsheet calculates sample-specific Kd value and dissolved-phase concentration of contaminant in saturated sample.
9. Spreadsheet calculates concentration of contaminant in groundwater following impact by leachate.

Step 1: [10]Select Contaminant (use pulldown list)	**LEAD**

Step 2: Input Sample Data	**DEFAULT**	**INPUT**
[1]Concentration in soil sample (mg/kg)	N/A	7.9E+03
[1]Concentration in Batch Test solution (ug/L)	N/A	5.0E+00
Step 3: Input Sample Properties ([5]USEPA soil defaults noted)		
Sample density (g/cm^3)	1.50	1.50
Particle density (g/cm^3)	2.65	2.65
Fraction air-filled porosity (assume saturated soil)	0.00	0.00
Step 4: Batch Test Method Data (SPLP defaults noted)		
[2]Batch Test Solution Volume (ml):	2,000	2,000
[2]Batch Test Solution Density (g/cm^3):	1.0	1.0
[2]Batch Test Sample Weight (grams)	100	100

[3]Step 5: Input Groundwater/ Leachate Dilution Factor	**DEFAULT**	**INPUT**
	20	20
[4]Step 6 (optional): Input Target Groundwater Concentration (ug/L)		

Model Results	
[5]Kd partition Coefficient (cm^3/g):	1.6E+06
[6]Estimated Concentration in Source Area Leachate (ug/L):	-
[7]Estimated Concentration in Groundwater (ug/L):	-

Step 7: [10]Chemical Constants [Generic Chemical only]	

Kd >20. Contaminant not significantly mobile for concentration and soil type tested. Do not place below water table without further evaluation. Address other potential environmental concerns as needed (direct exposure, gross contamination, etc.).

Calculations:	
Sample porosity - total	0.43
Sample porosity - air-filled	0.00
Sample porosity - water-filled	0.43
Batch Test Solution Mass (grams)	2.0E+03
Batch Test Sample Mass (grams)	1.0E+02
Sample Mass:Solution Mass Ratio (gm/gm)	5.0E-02
Total Mass of Contaminant (ug)	7.9E+05
Mass Contaminant in Batch Test Solution (ug)	1.0E+01
Mass Contaminant Sorbed to Soil (ug)	7.9E+05
Concentration Sorbed (ug/kg)	7.9E+06
Batch Test Percent Solid Phase	100.0%
Batch Test Percent Dissolved Phase	0.0%
Batch Test Solid-Phase Contaminant Conc. (mg/kg)	7.9E+03
Batch Test Solution Contaminant Conc. (ug/L)	5.0E+00

Notes (refer also to accompanying memo).

1. Total contaminant concentration measured in soil sample and results of Batch Test analysis (e.g., SPLP).
2. Batch Test: Default SPLP method calls for 100 grams of sample and 2 liters of solution with a density of approximately 1.0
3. Site-specific or default groundwater/leachate dilution factor (default = 20, USEPA 2002).
4. Target groundwater action level. Refer to HDOH EAL document and appropriate groundwater category.
5. Partition Coefficient (Kd) = $\text{Concentration}_{\text{sorbed}}/\text{Concentration}_{\text{solution}}$ (after Roy et al 1992).
   Partition Coefficient units in L/Kg [(ug/Kg)/ug/L)] or cm^3/g [(ug/g)/ug/cm^3)]
   and assumed equilibrium partitioning (USEPA 2002). Refer to discussion and equations presented in accompanying HDOH
   contaminant concentration in leachate during transport through vadose zone not considered. Refer to Tier 2 concentration
8. Caution Message: A caution message will appear if the input batch test concentration is greater than 75% of the assumed contaminant solubility and a Kd value will not be generated (refer to "Leaching Evaluation of Heavily Contaminated Soils" in text). Model assumes that free product is present in the batch test solution and a Kd cannot be calculated (see text).
9. Error Message: The batch test data are not valid if the contaminant mass calculated for solute exceeds total mass calculated for sample (based on sample mass and input total contaminant concentration). This may not be uncommon given the potential for lab error at very low concentrations of contaminants.
10. "GENERIC CHEMICAL" can be selected from pulldown menu an used to model of any chemical, including chemicals not listed. Selection requires input of Kh (atm m3/mole) and Solubility constants in Step 7 if available. Note that a chemicals physiochemcial constants affect results for VOCs only if input Fraction Air-Filled Porosity is >0% (model considers partitioning into pore space air for VOCs as well as leachate).

References:

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HDOH, 2011, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater: Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response, Fall 2011, www.hawaii.gov/health/environmental/hazard/eal2005.html.

USEPA, 1994, Synthetic Precipitation Leaching Procedure: U.S. Environmental Protection Agency, Office of Solid Waste, SW-846 Method 1312, September 1994, www.epa.gov/epaoswer/hazwaste/test/main.htm.

USEPA, 1999, Understanding Variation in Partition Coefficient, Kd, Values: Office of Air and Radiation, August 1999, EPA/402/R/99/004A, http://www.epa.gov/radiation/docs/kdreport/

USEPA, 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites: U.S. Environmental Protection Agency, Solid Waste and Emergency Response, OSWER 9355.4-24, December 2002, http://www.epa.gov/superfund/resources/soil/ssg_main.pdf

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In reply, please refer to:
File: EHA/HEER Office

TO: Interested Parties 2007-223-RB

FROM: Roger Brewer, Ph.D
Environmental Risk Assessment
Hazard Evaluation and Emergency Response

THROUGH: Barbara Brooks, Ph.D
Toxicologist
Hazard Evaluation and Emergency Response

DATE: April 12, 2007

SUBJECT: Use of laboratory batch tests to evaluate potential leaching of contaminants from soil (update to November 2006 technical memorandum)

Executive Summary

This technical memorandum presents the Batch Test Leaching Model (BTLM), a simple, Tier 3 approach for assessing the potential impact to groundwater posed by leaching of contaminants from vadose-zone soils. The BTLM uses site-specific soil data to evaluate contaminant mobility and estimate contaminant concentrations in soil leachate. If the contaminant is deemed sufficiently mobile, the model predicts future impacts to groundwater based on simple leachate dilution assumption. This can then be compared to target groundwater action levels appropriate for the site. An Excel spreadsheet is included to facilitate use of the model. Use of the spreadsheet model only requires input of the concentration of the contaminant in soil (in mg/kg) and the result of the batch test analysis (in µg/L). The BTLM can also be used to develop more realistic, site-specific soil action levels in lieu of the conservative, Tier 1 action levels for this concern published by HDOH. This guidance will be updated periodically as additional information and improved approaches are identified.

The guidance is most pertinent to vadose zone soils. Direct monitoring of groundwater should be carried out to evaluate leaching of contaminants in soils situated below the water table. Guidance presented in this memo does not apply to the evaluation of waste being placed in regulated landfills or to hazardous waste determinations. Evaluation of waste to be placed in landfills must be carried out under direction of the HDOH Solid and Hazardous Waste Branch.

Introduction

At a screening level, leaching of contaminants from soil is the primary environmental concern for the majority of the organic contaminants presented in the Hawai‘i Department of Health (HDOH) document *Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater* (i.e., Tier 1 soil action levels for leaching concerns are lower than action levels for direct exposure, vapor intrusion, ecotoxicity and gross contamination concerns, HDOH 2005). Site-specific evaluation is recommended when soil action levels for leaching concerns are exceeded. In addition, action levels for metals are not provided in the document and leaching concerns must again be evaluated on a site-by-site basis. However, easy-to-use and technically sound soil leaching models that can be applied to both organic and inorganic contaminants have been lacking. The guidance presented below is intended to help address this issue.

The guidance focuses on the use of laboratory batch tests to quantify the mobility of the contaminant in soil and estimate the initial concentration of the contaminant in soil leachate. Batch tests involve placing a small amount of the soil in buffered, de-ionized water, agitating the mixture for a set period of time and measuring the fraction of the contaminant that desorbs from the soil and goes into solution. The ratio of the mass of a contaminant that remains sorbed to the mass that goes into solution, adjusted to the test method, is referred to the contaminant’s “desorption coefficient” or “Kd” value.

A contaminant’s Kd value is a key parameter in soil leaching models. The lower the Kd value, the greater the mobility of the contaminant in soil and the greater the leaching threat. Contaminants with Kd values less than 1.0 are considered to be highly mobile and pose a significant threat to groundwater resources. Contaminants with Kd values greater than 20 are considered to be so tightly bound to the soil that they are essentially immobile and do not pose a significant leaching concern. The strength of binding can vary among different soil types, as well as contaminant concentration and the age of the release.

Batch test data can be input into an Excel spreadsheet model (“Batch Test Leaching Model (April 2007)) that accompanies this technical memorandum to calculate Kd values for target contaminants. Use of the model only requires input of the concentration of the contaminant in soil (in mg/kg) and the results of batch test analysis (in µg/L). Additional, default parameter values in the model can be adjusted if needed but this is generally not recommended. The concentration of the contaminant in leachate hypothetically derived from the soil tested is calculated based on the Kd value determined for the contaminant. The spreadsheet then estimates the ultimate concentration of the contaminant in groundwater based on a simple groundwater/leachate mixing model. The inclusion of a more refined approach for estimating contaminant concentrations in groundwater is anticipated for future updates to this guidance.

The remainder of this guidance provides a detailed discussion of contaminant partitioning in soil, key questions to be asked in site-specific leaching models, batch test methodologies for estimation of site-specific Kd values and calculation of contaminant concentrations in soil leachate and groundwater. Equations used in the Batch Test Leaching Model are presented in Appendix 1. The use of soil gas data to estimate concentrations of volatile contaminants in leachate is also briefly introduced. A detailed understanding of these topics is not necessarily needed to use the accompanying spreadsheets and carry out a simple, site-specific evaluation of potential soil leaching concerns using batch test data. A basic understanding of contaminant fate and transport in the subsurface is very useful, however, in determining how confident one can be in applying the results of the models to actual field conditions.

This memo updates a previous November 2006 version of the guidance and replaces text regarding use of the SPLP test presented in the May 2005 edition of the HDOH document *Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater"* (Volume 1, Section 3.3.3; HDOH 2005). The approach described should be considered guidance only. Alternative approaches can be proposed for specific sites. This guidance will be updated as needed in the future. Comments and suggestions are welcome at any time and should be directed to Roger Brewer of HDOH at roger.brewer@doh.hawaii.gov.

Partitioning of Contaminants in Soil

Contaminants released into soil will partition into up to four different phases in the soil matrix (Figure 1). Some of the contaminant will dissolve into the soil moisture to form leachate. Another portion will chemically bind ("sorb") to soil particles, primarily organic carbon and clay particles. If the contaminant is volatile, a portion will also partition into air-filled pore space as a vapor phase. If the total mass of the contaminant is great enough, the soil particles, soil moisture and soil vapor will become saturated and free-phase product will also be present.

In theory, the various phases of a contaminant will eventually come into equilibrium with each other. The nature of this equilibrium is controlled by the chemical properties of the contaminant, the chemistry and physical properties of the soil and the presence of other contaminants. Contaminants that readily bind to soil particles will be present primarily in the sorbed phase (e.g., PAHs, PCBs, etc.). Contaminants that are not very sorptive will accumulate in the soil moisture or soil vapor (e.g., perchlorate, chlorinated herbicides, BTEX, MTBE, solvents, etc.). Contaminants that are by nature gases will persist mainly as vapors in the air-filled pore space, especially if the soil is very dry (e.g., vinyl chloride).

In the absence of free product, the relationship between sorbed, dissolved and vapor phases of a contaminant in soil is relatively straightforward and can be described by simple partition coefficients (USEPA 2001). A contaminant's "Henry's Law Constant" is the ratio of the vapor-phase concentration of a contaminant to the dissolved-phase concentration, at equilibrium. The Henry's Law Constant is relatively constant between sites, although it may vary slightly due to differences in soil temperature and the presence of other contaminants.

A contaminants sorption coefficient, or "Kd" value, is the ratio of the sorbed-phase concentration to the dissolved-phase concentration, at equilibrium (see Figure 1). For initial screening purposes and calculation of Tier 1 soil Action Levels, Kd values for organic chemicals are estimated using published *sorption* coefficients ("koc" values) and assumptions about the organic carbon content of the soil (Kd = published koc value x assumed fraction organic carbon in soil, typically 0.1%). Generic Kd values have also been published for a limited number of metals and other inorganic contaminants, although they are considered to much less reliable than for organic compounds. In the field, however, contaminant sorption (or more specifically "desorption") coefficients can vary significantly between sites, due to differences in soil properties, the mixture of contaminants present and even the age of the release. The variability of contaminant Kd values in the field implies that this parameter should be included in site-specific evaluations of potential leaching concerns. In practice, this is rarely done.

A contaminants Henry's Law Constant and assumed (or site-specific) Kd value can be used in conjunction with assumed or know soil properties to determine how the contaminant is actually distributed in the soil. Table 1 summarizes the distribution of several common contaminants in soil as assumed in the leaching models used to generate Tier 1 action levels published but HDOH (HDOH 2005). The percent mass in each phase is calculated based rearrangement of a simple equilibrium partitioning equation presented in USEPA's *Soil Screening Guidance* (USEPA 2001, refer also to Appendix 1). Similar assumptions about contaminant partitioning in soil are made in the models used to generate the USEPA Preliminary Remediation Goals or Preliminary Remediation Goals, although this cannot be readily discerned from the equations presented in the accompanying guidance document (USEPA 2004).

As expected, contaminants such as benzo(a)pyrene and PCBs are almost entirely absorbed to soil particles (refer to Table 1). Perhaps surprising, however, is the tendency for the main mass of moderately volatile contaminants such as benzene, PCE and MTBE to be sorbed to soil particles or dissolved in soil moisture, versus being present as vapors in the soil air space. Confusion about this issue has led to over estimation (and probably over concern) of contaminant loss during sampling of soil for this group of chemicals. Compare this to contaminants that are gases and truly volatile by nature, such as vinyl chloride (see Table 1). Testing soil samples for the presence of vinyl chloride and estimating leaching concerns is probably not a worthwhile effort. The use of soil gas samples to estimate concentrations of highly volatile contaminants in soil leachate and even monitor the downward migrating vapor plumes is much more preferable. A brief introduction to this approach is provided later in this guidance and also included in the BTLM spreadsheet.

Site-Specific Evaluation of Soil Leaching Concerns

Four basic questions need to be posed when evaluating the potential for contaminants to leach from soil and impact groundwater (Figure 2):

1. "Is the contaminant potentially mobile?"
2. "What is the concentration of the contaminant in leachate in the primary source area?"
3. "What is the concentration of the contaminant in leachate at the point that the leachate reaches the top of the water table?" and
4. "What is the concentration of the contaminant in groundwater after the leachate has impacted the groundwater?"

Each of these relatively common sense and straight forward questions should be answered in a site-specific evaluation of potential soil leaching concerns. In practice, they rarely are, due in part to the "black box" nature of most soil leaching models. The guidance presented in this technical memorandum focuses on the first two of these questions, contaminant mobility and the initial concentration of the contaminant in leachate.

<u>Mobility in Soil</u>

Contaminant mobility in soil is evaluated in terms of how tightly bound the contaminant is to soil particles. From a modeling perspective, this is again described in terms of the contaminant's desorption coefficient or Kd value. Increasing Kd values reflect decreasing mobility in soil.

Figure 3 presents default, Tier 1 Kd values for several common contaminants and subdivides them in terms of relative mobility or leachability in soil (after Fetter 1993). Contaminants with a generic Kd value of less than 1.0 are considered to be highly mobile in soil, a fact that correlates well with field data and a list of common groundwater contaminants. Contaminants with a Kd value of greater than 20 in soil are considered to be essentially immobile. Not surprisingly, contaminants such as MTBE, PCE, BTEX, perchlorate and chlorinated pesticides like atrazine are predicted to be highly mobile in soil, at least at a screening level, whereas PAHs, PCBs and similar contaminants are considered to be essentially immobile. (Note that trace levels of strongly sorptive contaminants like chlordane in groundwater indicate that these contaminants can be mobile under some circumstances, especially if the leachate is migrating through unweathered bed rock.)

The ability of a contaminant to bind to soil is very much tied to the nature and concentration of the contaminant, the presence of other contaminants that may compete for prime sorption spots, the soil mineralogy and chemistry (including organic carbon and clay content) and the time elapsed since the release of the contaminant. Use of generic Kd values could in theory *under* predict how strongly bound a contaminant is to soil, especially in the presence of other contaminants or in soils with extreme pH, redox or other soil conditions. Based on (admittedly limited) data collected to date, however, generic Kd values typically used for organic contaminants tend to significantly *over* predict the potential mobility of contaminants in soils. This is especially true for organic contaminants. This makes the use of laboratory batch tests very important when Tier 1 action levels or screening levels for potential leaching concerns (based on generic Kd values) suggest that leaching concerns need to be further evaluated.

Initial Concentration in Leachate

A contaminant's Kd value is used in conjunction with it's Henry's Law Constant and assumptions about soil properties to estimate the initial concentration of a contaminant in leachate. The relatively simple equation used to perform this calculation is presented in Appendix 1 and incorporated into the accompanying spreadsheet. The proportion of the contaminant that will move into soil leachate is again mainly controlled or reflected by the contaminant's Kd value. A Kd value less than 1.0 indicates that most of the contaminant will move into soil leachate in comparison to the fraction of the contaminant that will remain sorbed to soil particles.

Concentration in Leachate at Groundwater Interface

As the leachate migrates downward, contaminant concentrations can be progressively reduced due to resorption of the contaminant to soil particles, chemical or biological degradation or volatilization into the soil air space. Estimates of contaminant concentrations in leachate at the point that the leachate reaches the groundwater interface can be made using a vadose-zone fate and transport model. This important step is not included into the BTLM at this time. The BTLM model instead very conservatively assumes that the concentration of the contaminant in leachate at the groundwater interface is equal to that in the initial source area. A more detailed evaluation of contaminant fate and transport in soil leachate (e.g., using SESOIL, VLEACH or other vadose-zone leaching models) may be particularly useful at sites where the depth to groundwater from the base of the contaminated soil is greater than approximately ten meters and target contaminants that have default koc values greater than 1,000 cm^3/g (e.g., naphthalene), are highly degradable (e.g., TPH and BTEX), and/or are moderately or highly volatile (e.g., PCE and vinyl chloride).

Concentration in Groundwater

The concentration of a contaminant in groundwater after mixing of the leachate with the groundwater can be estimated by either dividing the concentration of the contaminant in leachate by simple dilution factor or again by use of a more rigorous fate and transport model (refer to equations in Appendix 1). The BTLM model presented relies on the former, although a more refined approach may be added in the future.

The HDOH Environmental Action Levels document (or EAL Surfer) should be referred to for target groundwater goals (HDOH 2005). Target groundwater goals will in general be the lowest of the drinking water goal (i.e., lowest of Primary and Secondary MCLs or equivalents), surface water goal (assuming potential discharge to a body of surface water, acute or chronic aquatic toxicity goal based on site location) and any other applicable goals (vapor intrusion, gross contamination, etc.).

Use of Batch Test Data To Estimate Contaminant Kd Values

Relatively simple batch test methods have been in use for decades to evaluate leaching of metals from mine tailings and estimate the mobility of pesticides sprayed on agricultural lands (USEPA 1992, 1999). The tests collectively account for a host of factors that may control binding to (sorption) and leaching of (desorption) contaminants from soil. The tests do not identify exactly how the contaminant is bound to the soil, although a review of soil properties and chemistry can shed light on this issue if needed. The most commonly used batch test method to evaluate potential leaching of contaminants from soil is the *Synthetic Precipitation Leaching Procedure* or "SPLP" test (USEPA 1994, similar to the California "WET" test). The SPLP test is carried out as follows:

Step 1. Analyze soil sample for concentrations of target contaminants (e.g., in mg/kg)

Step 2. Run SPLP test on split sample:

- Place 100 grams soil in two liters of a de-ionized water solution (pH 5.5, 25° C),
- Remove airspace (especially for VOCs),
- Agitate 18 hours.

Step 3. Analyze extract for contaminants of concern.

Step 4. Estimate Kd by comparison of the mass of contaminant that remained sorbed to the soil to the mass of the contaminant that went into solution.

The equations used to calculate a contaminant's Kd value in soil based on batch test data are provided in Appendix 1 and incorporated into the accompanying BTLM spreadsheet. The calculated Kd value is then used to evaluate the potential mobility of the contaminant in the soil and estimate the initial concentration of the contaminant in soil leachate and groundwater, as described in the previous section.

For batch test results that are below standard, commercial lab Method reporting Limits (MRL), Kd can be estimated using 1/2 the MRL. If the estimated Kd is less than 20, a worst-case concentration of the contaminant in groundwater can calculated as described above.

Contaminant Kd values estimated through use of batch tests apply only to the soil tested and only for the reported concentration of the contaminant in the soil. Kd values could vary with respect to contaminant concentration in the same soil type. This may need to be evaluated on a site-specific basis in cases where soil contamination is widespread and very heterogeneous.

For large areas where contaminant concentrations vary significantly and individual spill areas cannot be easily identified, it may be useful to conduct a series of batch tests and evaluate the variation in Kd with respect to contaminant concentrations in soil (keeping in mind the need to separate different soil types). Soil cleanup levels can then be developed by plotting contaminant concentration in soil versus estimated concentration in leachate, generating a regression line through the data (USEPA 1992, 1999). Soil cleanup levels can be calculated or read directly off of the graph by setting a target concentration of the contaminant in the leachate (e.g., target groundwater concentration times assumed groundwater/leachate dilution factor). An example of this approach based on perchlorate soil and SPLP data collected at a site in California is given in Figure 4. (Note that final cleanup standards varied slightly from that noted in the figure due to assumptions about representative contaminant distribution and Kd values in soil across the site.) In Hawai‘i, this approach may be especially useful in the evaluation of large, pesticide mixing areas associated with former agricultural lands.

It is important to understand that batch tests were not designed to directly estimate the concentration of a contaminant in soil leachate. Batch tests were instead designed to calculate Kd sorption or desorption coefficients, which can then be used to estimate contaminant concentrations in leachate if desired. The volume of solution used in batch test can be used to illustrate this point. A solution volume of two liters was selected primarily to help ensure that laboratory detection limits could be met, not to mimic the supposed concentration of the contaminant in actual soil leachate – as is commonly misinterpreted (USEPA 1992). If the same mass of soil (generally 100 grams) were placed in a swimming pool-size volume of solution then the resulting concentrations of target contaminants in the batch test would of course be very different. Assuming that the contaminant is not completely stripped from the soil, however, the ratio of the mass that remains sorbed to the mass that moves into solution (i.e., the Kd value) should be constant. For highly sorptive contaminants (e.g., PCBs and PAHs) and for many metals, the difference between batch test results and calculated concentration of the contaminant in leachate may indeed be very small. For less sorptive contaminants like BTEX, MTBE, perchlorate and moderately mobile pesticides, however, estimated concentrations in leachate may be an order of magnitude or more greater than the concentration reported in the batch test data. This is especially true for contaminants with Kd values less than 20 in the soil tested, where a significant fraction of the contaminant partitions into the batch test solute (e.g., >25%).

Soil Sampling Strategies

A minimum of three soil samples is generally needed to validate batch test data for each area investigated. Recording the soil type and testing for the total organic carbon content and percent clay content of the soil is also recommended. Although not directly incorporated into the BTLM, this information may prove useful in understanding the nature of contaminant binding in the soil and help direct soil cleanup actions, if needed.

For large sites with varying soil types, contaminant mixtures or release histories, it may be necessary to define multiple "decision units" and evaluate each area separately. For example, the binding capacity of sandy soils is likely to be much lower than clayey or organic-rich soils. If both soil types are present at a contaminated site, it would be prudent to treat each soil type area as a separate decision unit.

The collection and analysis of multi-increment samples (essentially very good "composite" samples) is preferred for easily identifiable spill areas or "hot spots," especially where the primary contaminants are non-volatile. Collection and field-based extraction of multi-increment samples for volatile contaminants may also feasible, although this subject is beyond the current scope of this memo. Guidance on the collection and evaluation of multi-increment samples is currently being prepared by HDOH. In the interim, and especially for cases under the formal oversight of HDOH, it is recommended that potential users of the BTLM guidance review sampling plans with the HDOH project manager prior to collection and submittal of the samples for analysis.

Use of Soil Gas Data to Evaluate Groundwater Protection Concerns

Batch tests can be used to evaluate both nonvolatile and volatile contaminants, although special care must be taken during sampling and testing of the latter (refer to USEPA 1994 SPLP method guidance). The concurrent use of soil gas data to estimate the concentration of volatile contaminants in soil leachate may also be prudent. Reasonably accurate estimations of the contaminant concentrations in soil moisture or leachate can be made by dividing the concentration of the contaminant in soil gas (converted to ug/L) by the chemical's dimensionless Henry's Law Constant (see equation in Appendix 1). A simple model based on this approach and incorporating a groundwater:leachate dilution factor is presented in Appendix 1 and included in the BTLM spreadsheet.

Cases where soil gas data may prove beneficial for evaluation of potential impacts to groundwater include: 1) sites with releases of relatively persistent, volatile chemicals that remain very dry throughout much of the year (i.e., non-irrigated areas with very low precipitation, or paved areas that overlie shallow groundwater), 2) sites known to be impacted by volatile contaminants but where specific source areas have not been identified, 3) sites where the threat to groundwater is primarily posed by downward releases of vapors from underground tanks, pipelines, etc., and 4) sites where the vulnerability and sensitivity of the first-encountered groundwater resource is very high (e.g., unconfined aquifer that is currently used as a source of drinking water). In very wet or heavily irrigated areas (e.g., groundwater recharge greater than ten inches or 25cm per year), mass loading of the contaminant to groundwater via vapor-phase plumes is likely to be insignificant in comparison to contaminant migration via leachate. In very dry areas, however, the amount of moisture in the soils may not be sufficient to initiate the downward migration of leachate by the force of gravity. If this is the case then the model discussed above will overstate the potential threat to groundwater posed by dissolved-phase contaminants in the soil moisture.

A focus on the potential for vapor plumes to impact groundwater will be more appropriate for dry areas. Easy-to-use models that specifically evaluate the downward migration of vapor plumes to groundwater are not currently available. An evaluation of potential groundwater impact concerns may instead have to rely on long-term monitoring of soil gas in the vadose zone. Soil gas “action levels” for protection of groundwater can be developed by rearranging the Herny’s Law Constant equation to solve for the concentration of the contaminant in soil vapor and setting the dissolved-phase concentration of the contaminant equal to a target groundwater or leachate goal (refer to equations in Appendix 1).

Soil gas data will be less useful for estimation of semi-volatile contaminant concentrations in leachate. This is due to the very low Henry’s Law Constants for these contaminants and associated limitations on soil gas method reporting limits. As noted in Table 1 for PAHs, the overwhelming majority of the contaminant mass will also be sorbed to the soil, rather than in the soil vapor. Batch tests on representative soil samples therefore offer a better approach for the evaluation of leaching concerns related to these contaminants.

Leaching of Heavily Contaminated Soils

Soils that contain significant amounts of pure-phase or “free” product” may not be amenable to use of the Batch Test Leaching Model as described above (i.e., contaminant that is not sorbed to the soil, dissolved into the soil moisture or present as vapors in air-filled pore space). This is particularly true for soils that are heavily contaminated with petroleum. Contaminant Kd values can only be calculated if any free product present completely dissolves into the batch test solution. If free product forms in the batch test solution then analysis of solution for dissolved-phase constituents will not accurately reflect the total mass of contaminants that were stripped from the soil during the test. This will cause the model to over predict the mass of the contaminant that remained sorbed to the soil and in turn over predict the contaminants Kd value.

If the reported concentration of a contaminant in a batch test analysis exceeds 75% of the assumed solubility then it should be assumed that pure-phase contaminant product may be present in the batch test solution. In such cases, the spreadsheet model will generate a caution message and a Kd value will not be calculated. The potential mobility of the contaminant with respect to it’s Kd value therefore cannot be accurately evaluated. In the spreadsheet model, the estimated concentration of contaminant in soil leachate is set to the highest of the contaminant’s solubility and the reported concentration of the contaminant in the batch test analysis. Potential impacts to groundwater are estimated by dividing the assumed concentration of the contaminant in leachate by the input groundwater:leachate dilution factor. The potential downward mobility of liquid-phase free product in the soil should also be further evaluated.

Special Considerations For Petroleum-Contaminated Soils

Soils impacted by petroleum should be tested for both Total Petroleum Hydrocarbons (TPH) and target indicator compounds, including BTEX, MTBE and related fuel oxygenates and the PAHs naphthalene and methylnaphthalene (refer to Volume 1, Section 2.2.2 in HDOH EAL document, HDOH 2005). Testing for other PAHs is not necessary, due to their relative immobility in soil and low concentration in most petroleum products.

Problems related to the presence of free product in the batch test solution as discussed above could be especially pronounced for soils heavily impacted with middle distillates (diesel, jet fuel, etc.) and heavier residual fuels (waste oil, hydraulic fluid, etc.). The low solubility of these fuels in comparison to gasoline can lead to the presence of droplets of free product in soil at concentrations above only a few hundred parts-per-million (mg/kg) TPH. At high enough concentrations, this could lead to the presence of free product in the batch test solution. This will negate use of the BTLM model to calculate a Kd value for the sample tested and evaluate the potential mobility of the contaminant, as discussed in the previous section.

If the batch test results for Total Petroleum Hydrocarbons (TPH) suggest the potential presence of free product in the solution then the concentration of TPH in soil leachate should be assumed to be equal to the higher of the reported result and the assumed solubility of the targeted petroleum product. In the absence of a more site-specific review, the potential concentration of the contaminant in groundwater should be estimated by dividing the concentration in leachate but the groundwater:leachate dilution factor selected for the site. This is automatically carried out in the accompanying BTLM spreadsheet.

The presence of potentially mobile free product in the soil should also be evaluated. This can be done by comparison of TPH data for vadose-zone soil to HDOH action levels for gross contamination concerns in subsurface soils (HDOH 2005, Appendix 1). An action level of 2,000 mg/kg for gasoline contaminated soils. A somewhat higher action level 5,000 mg/kg is used for soils contaminated with either middle range petroleum distillates (e.g., diesel fuel and jet fuel) or residual fuels (motor oil, waste oil, etc.). These action levels are intended to minimize the presence of mobile free product in soil and are based on field observations and published studies (e.g, API 2000). Minimum conditions for use of the action levels in other areas include: 1) the source of the release has been eliminated, 2) grossly contaminated soil has been removed to the extent practicable (e.g., within 15 feet of the ground surface and/or to the top of bedrock) and 3) remaining contamination does not threaten nearby water supply wells or aquatic habitat (refer also to Volume 1, Section 2.2 of the HDOH 2005 EAL document).

Residual petroleum contamination in soil can be expected to naturally degrade over time. Note that impacted soil that is disturbed during future subsurface activities must also be properly managed. Continued groundwater monitoring may also be required for highly sensitive sites. Additional guidance for the long-term management of petroleum-contaminated soil (and groundwater) is currently being prepared by HDOH.

Other Limitations

Evaluation of Past Impacts to Groundwater

The approach described in this technical memorandum can only be used to predict *future* leaching of contaminants from soil and subsequent impacts to groundwater. Batch tests on residual contaminants in soil cannot necessarily be used to predict if *past* impacts to groundwater may have occurred. In part this is because the contaminants may be much more strongly bound to soil particles under current conditions than during the initial release. The possibility of past impacts to groundwater must be evaluated on a site-by-site basis, based on the nature of the contaminant released, the subsurface geology and the depth to groundwater among other factors.

Placement of Soil Below Water Table

The batch test method may not accurately mimic the placement of contaminated soil or other media below the water table for long periods of time and should not be used to predict these conditions. Long-term immersion could significantly enhance desorption of contaminants, especially if rate-limited processes such as desorption, organic carbon decay or mineral dissolution affect contaminant partitioning. Long-term immersion of the soil could increase impacts to groundwater that significantly exceed levels predicted by short-term batch tests. In the absence of a more detailed groundwater impact study, placement of contaminated soil below the water table or at a depth that is subject to future inundation by a rise in groundwater should be avoided (e.g., areas where the water table has dropped significantly due a prolonged dry period but is expected to rise again in the future). If this cannot be avoided and nearby water supply wells or aquatic habitats could be threatened, then long-term monitoring of the groundwater to verify that the contaminants are not significantly mobile is probably warranted.

Long-Term Groundwater Monitoring

Although the batch test method is believed to be very accurate, long-term groundwater monitoring may be prudent in some cases to verify the results of the evaluation. Monitoring may be especially warranted at sites where batch test data suggest that relatively high concentrations of chlorinated solvents, pesticides or other persistent contaminants can be left in place (e.g., in comparison to Tier 1 action levels for leaching concerns) but important drinking water resources are potentially threatened. Monitoring may also be needed at site where subsurface conditions could change over time and allow for increased leaching of contaminants (e.g., rising water table).

Use of Kd Values in Fate & Transport Models

Contaminant Kd values derived from batch tests cannot necessarily be incorporated into vadose-zone fate and transport models for deeper soils, even if the soil types are very similar. This is because the Kd value most likely reflects an increased difficulty in desorbing or leaching of *aged* contaminants from the tested soil. Use of the Kd value to evaluate migration of the contaminant in leachate through deeper soils not yet impacted by the initial release could over predict *resorption* to soil particles thus *under* predict potential impacts to groundwater. The use of batch tests to estimate site-specific *sorption* coefficients for contaminants in deeper soils may be practical but is beyond the current scope of this technical memorandum.

Evaluation of Solid or Hazardous Waste

Guidance presented in this memo does not apply to the evaluation of waste being placed in regulated landfills or to hazardous waste determinations. Evaluation of waste to be placed in landfills must be carried out under direction of the HDOH Solid and Hazardous Waste Branch.

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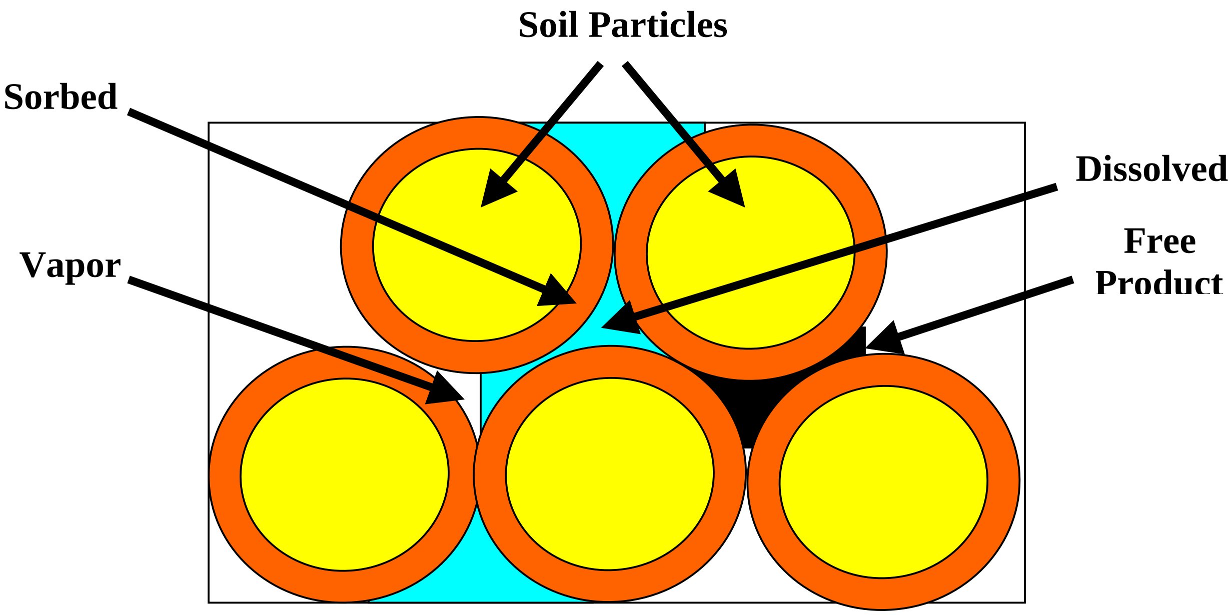
Table 1. Distribution of contaminants in soil based on contaminant properties and soil characteristics assumed in Tier 1 leaching models. Note how the fraction of the contaminant in the dissolved-phase is strongly tied to the assumed sorption coefficient or "Kd" value.

Chemical	**Default Sorption Coefficient (Kd)**	***Contaminant Phase Versus Percent Total Mass in Soil**		
		Sorbed	**Dissolved**	**Vapor**
Arsenic	29	99.9+%	0.0004%	0%
Benzo(a)pyrene	5,500	99.9+%	0.002%	0%
PCBs	33	99.7%	0.3%	0.01%
TPH	5.0	98%	1.9%	0.1%
Atrazine	0.23	70%	30%	0%
PCE	0.16	39%	25%	35%
Benzene	0.059	29%	50%	21%
MTBE	0.006	5%	91%	4%
Vinyl Chloride	0.0	5%	31%	64%

*Based on soil equilibrium partitioning equation presented in USEPA *Soil Screening Guidance* (USEPA 2001). Leachate is represented by the dissolved-phase mass of the contaminant. For organic contaminants, Tier 1 Kd value = published sorption coefficient (koc) x assumed total organic carbon content in soil of 0.1% (refer to HDOH 2005, Appendix 1, Table H). Assumes and soil moisture content of 0.10. Arsenic default Kd from USEPA *Soil Screening Guidance*.



Partition Coefficients

Kd = Sorbed Concentration/Dissolved Concentration

Henry's Law constant = Vapor Concentration/Dissolved Concentration

Figure 1. Partitioning of contaminants in soil between sorbed, dissolved and vapor phases.

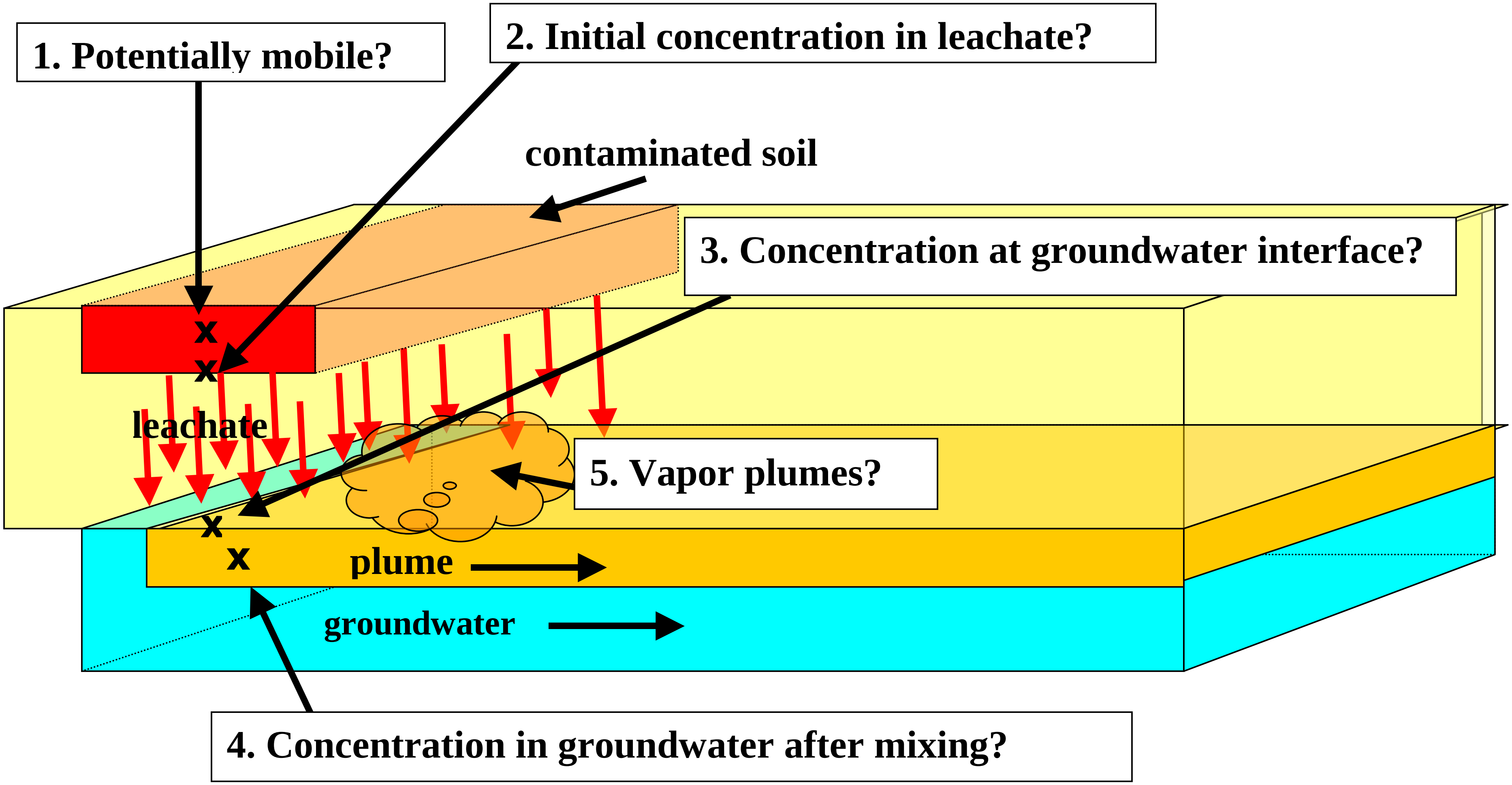


Figure 2. Basic questions that should be answered in all site-specific evaluations of soil leaching concerns. The guidance focuses on site-specific approaches to answering Questions 1 and 2, although approaches for answering the remaining questions are also provided.

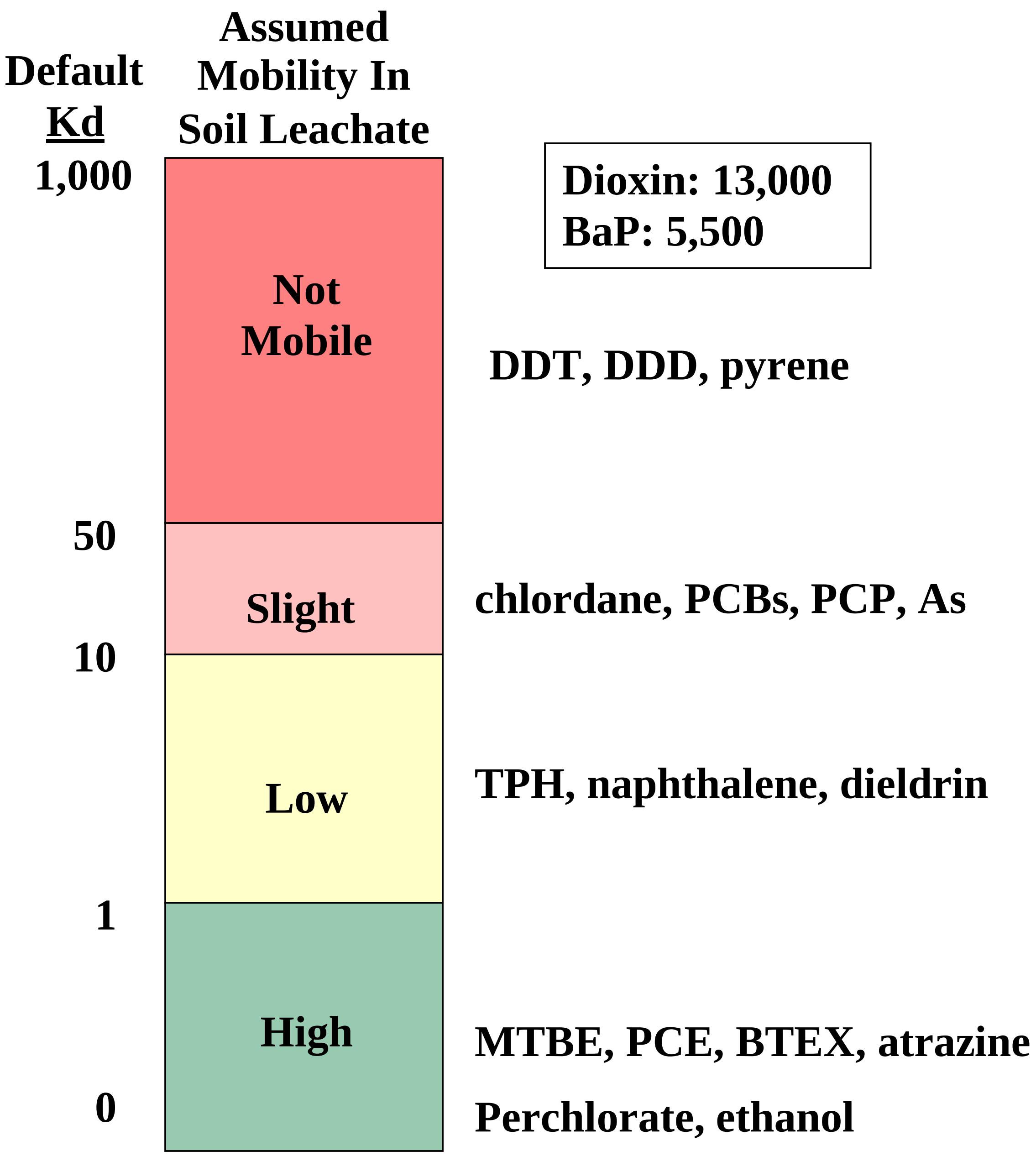


Figure 3. Assumed mobility of contaminants in soil leachate with respect to default Kd values used to develop HDOH Tier 1 soil action levels for leaching concerns. For organic contaminants, Kd values based on published koc sorption coefficients and total organic carbon content in soil of 0.1% (refer to Appendix 1 in HDOH EAL document, HDOH 2005). For arsenic, default Kd value of 29 from USEPA *Soil Screening Guidance* (USEPA 2001).

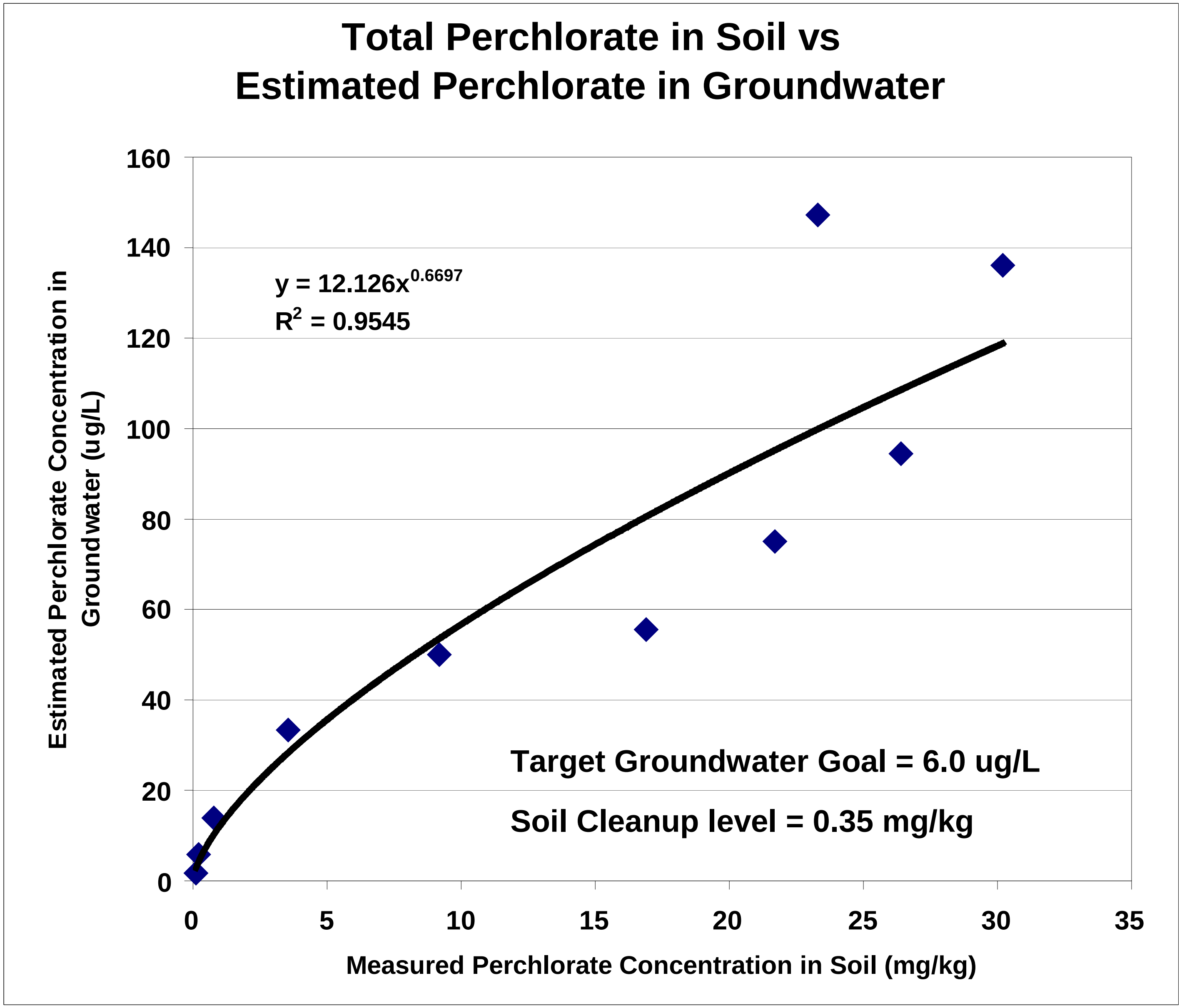
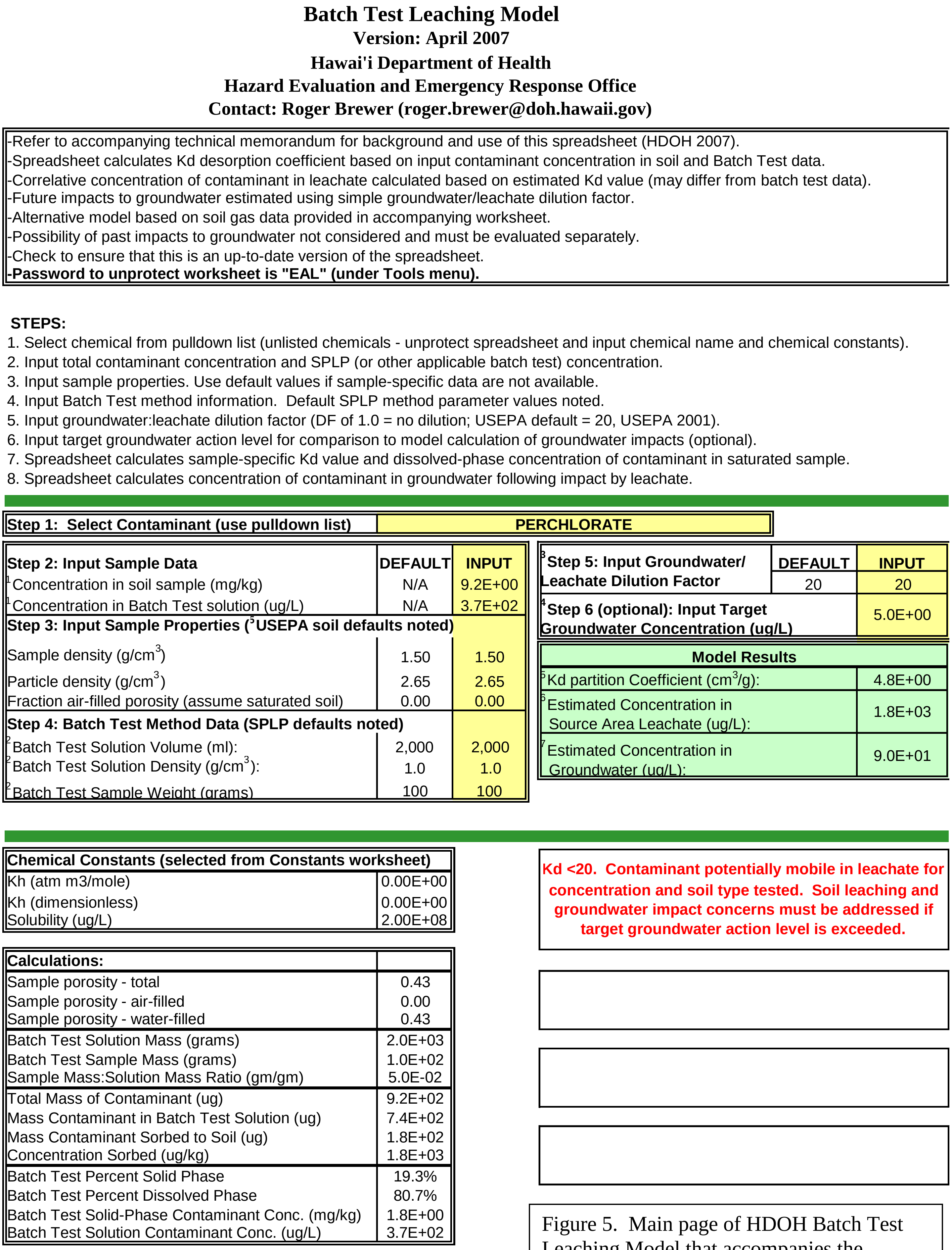


Figure 4. Example graphical calculation of soil cleanup levels based on use of multiple batch tests to estimated perchlorate desorption coefficients and correlative concentrations of perchlorate in soil leachate and groundwater at varying soil concentrations of perchlorate in soil. (For example only.)



Batch Test Leaching Model

Version: April 2007

Hawai'i Department of Health

Hazard Evaluation and Emergency Response Office

Contact: Roger Brewer (roger.brewer@doh.hawaii.gov)

-Refer to accompanying technical memorandum for background and use of this spreadsheet (HDOH 2007).
-Spreadsheet calculates Kd desorption coefficient based on input contaminant concentration in soil and Batch Test data.
-Correlative concentration of contaminant in leachate calculated based on estimated Kd value (may differ from batch test data).
-Future impacts to groundwater estimated using simple groundwater/leachate dilution factor.
-Alternative model based on soil gas data provided in accompanying worksheet.
-Possibility of past impacts to groundwater not considered and must be evaluated separately.
-Check to ensure that this is an up-to-date version of the spreadsheet.
-Password to unprotect worksheet is "EAL" (under Tools menu).

STEPS:

1. Select chemical from pulldown list (unlisted chemicals - unprotect spreadsheet and input chemical name and chemical constants).
2. Input total contaminant concentration and SPLP (or other applicable batch test) concentration.
3. Input sample properties. Use default values if sample-specific data are not available.
4. Input Batch Test method information. Default SPLP method parameter values noted.
5. Input groundwater:leachate dilution factor (DF of 1.0 = no dilution; USEPA default = 20, USEPA 2001).
6. Input target groundwater action level for comparison to model calculation of groundwater impacts (optional).
7. Spreadsheet calculates sample-specific Kd value and dissolved-phase concentration of contaminant in saturated sample.
8. Spreadsheet calculates concentration of contaminant in groundwater following impact by leachate.

Step 1: Select Contaminant (use pulldown list)	**PERCHLORATE**

Step 2: Input Sample Data	**DEFAULT**	**INPUT**
[1] Concentration in soil sample (mg/kg)	N/A	9.2E+00
[1] Concentration in Batch Test solution (ug/L)	N/A	3.7E+02
Step 3: Input Sample Properties ([5] USEPA soil defaults noted)		
Sample density (g/cm^3)	1.50	1.50
Particle density (g/cm^3)	2.65	2.65
Fraction air-filled porosity (assume saturated soil)	0.00	0.00
Step 4: Batch Test Method Data (SPLP defaults noted)		
[2] Batch Test Solution Volume (ml):	2,000	2,000
[2] Batch Test Solution Density (g/cm^3):	1.0	1.0
[2] Batch Test Sample Weight (grams)	100	100

[3] **Step 5: Input Groundwater/ Leachate Dilution Factor**	**DEFAULT**	**INPUT**
	20	20
[4] **Step 6 (optional): Input Target Groundwater Concentration (ug/L)**		5.0E+00

Model Results	
[5] Kd partition Coefficient (cm^3/g):	4.8E+00
[6] Estimated Concentration in Source Area Leachate (ug/L):	1.8E+03
[7] Estimated Concentration in Groundwater (ug/L):	9.0E+01

Chemical Constants (selected from Constants worksheet)	
Kh (atm m3/mole)	0.00E+00
Kh (dimensionless)	0.00E+00
Solubility (ug/L)	2.00E+08

Kd <20. Contaminant potentially mobile in leachate for concentration and soil type tested. Soil leaching and groundwater impact concerns must be addressed if target groundwater action level is exceeded.

Calculations:	
Sample porosity - total	0.43
Sample porosity - air-filled	0.00
Sample porosity - water-filled	0.43
Batch Test Solution Mass (grams)	2.0E+03
Batch Test Sample Mass (grams)	1.0E+02
Sample Mass:Solution Mass Ratio (gm/gm)	5.0E-02
Total Mass of Contaminant (ug)	9.2E+02
Mass Contaminant in Batch Test Solution (ug)	7.4E+02
Mass Contaminant Sorbed to Soil (ug)	1.8E+02
Concentration Sorbed (ug/kg)	1.8E+03
Batch Test Percent Solid Phase	19.3%
Batch Test Percent Dissolved Phase	80.7%
Batch Test Solid-Phase Contaminant Conc. (mg/kg)	1.8E+00
Batch Test Solution Contaminant Conc. (ug/L)	3.7E+02

Figure 5. Main page of HDOH Batch Test Leaching Model that accompanies the technical memorandum (as of April 2007).

Appendix 1

Batch Test and Soil Gas Leaching Model Equations

Batch Test Leaching Model Equations

The equations discussed below are incorporated into the Excel-based Batch Test Leaching Model that accompanies this technical memorandum. Figure 5 in the main text depicts the first page of the model (April 2007 version). The model will be updated as needed in the future.

Step 1. Calculate a partition coefficient for each chemical of potential concern.

The results of the SPLP test can be used to develop a sample-specific partition coefficient (Kd) for each chemical of potential of concern. The partition coefficient is calculated as follows (after Roy et. al, 1992; see also McClean and Bledsoe, 1992, and USEPA 1999):

$$Kd\ (L/kg) = \frac{Concentration_{sorbed}\,(\mu g/Kg)}{Concentration_{solution}\,(\mu g/L)} \qquad (1)$$

where $Concentration_{sorbed}$ is the concentration of the contaminant that remained sorbed to the soil following the batch test and $Concentration_{solution}$ is the resulting concentration of the contaminant in the batch test solution. The term Kd is commonly reported in equivalent units of $(ug/g)/(ug/cm^3)$ or cm^3/g, based on an assumed batch test solution density of 1.0 g/cm^3.

The sorbed concentration of the contaminant is calculated as follows:

$$Concentration_{sorbed}(ug/kg) = \frac{Mass_{sorbed}\,(\mu g)}{Sample\ Mass\,(kg)}. \qquad (2)$$

where $Mass_{sorbed}$ is the mass of the contaminant still sorbed to the soil following the batch test. The mass of the sample called for in the SPLP batch test is 100 grams or 0.1 Kg (USEPA 1994).

The mass of the contaminant sorbed to the soil is calculated by subtracting the mass of the contaminant that went into the batch test solution from the initial, total mass of the contaminant in the soil sample:

$$Mass_{sorbed}\,(\mu g) = Mass_{total}\,(\mu g) - Mass_{solution}\,(\mu g) \qquad (3)$$

where $Mass_{total}$ is original, total mass of the contaminant in the soil sample and $Mass_{solution}$ is the mass of the contaminant in the batch test solution. The total mass of the contaminant in the soil sample is calculated as:

$$Mass_{total}(\mu g) = Concentration_{total}\ (mg/kg) \times \left(\frac{1{,}000\,\mu g}{1mg}\right) \times Sample\ Mass(kg) \qquad (4)$$

where $Concentration_{total}$ is the reported total concentration of the contaminant in the soil sample that used in the batch test (tested on a split sample). The mass of the contaminant in the batch test solution is calculated as:

$$Mass_{solution}\,(\mu g) = Concentration_{solution}\,(\mu g/L) \times Solution\,Volume(L)\,. \qquad (5)$$

The default volume of solution used in SPLP batch tests is two liters (USEPA 1994).

Note that use of the batch test method to estimate Kd values is not longer valid if the solubility limit of the contaminant is exceeded in the batch test solution (refer to section on Leaching of Heavily Contaminated Soils in the main text). Exceeding the contaminants solubility suggests that free product is present in the soil (either liquid or dry). As a precautionary measure, a cutoff of 75% the assumed contaminant solubility is used in the Batch Test Leaching Model spreadsheet to identify if free product may be present in the batch test solution. The free product acts as a second reservoir of contaminant mass that will bias the true equilibrium concentration of the contaminant in the dissolved and sorbed phases. To accurately calculate desorption coefficients, batch test analyses must be run samples with lower concentrations of the contaminant in soil.

Step 2. Estimate the concentration of the contaminant in source-area leachate.
Once the soil-specific Kd value for a target contaminant has been determined, it is relatively simple to estimate the concentration of the contaminant in the soil moisture or "leachate" within the main body of contaminated soil or the leachate "source area"). This is done by incorporating the calculated Kd into a simple equilibrium partitioning equation and assuming default (or site-specific) soil properties (after USEPA 2001):

$$C_{total} = C_{leachate} \times \left(Kd + \left(\frac{\theta_w + (\theta_a \times H')}{\rho b} \right) \right) \times \left(\frac{1mg}{1000\mu g} \right) \qquad (6)$$

where: C_{total} = Total concentration of chemical in sample (mg/kg);

$C_{leachate}$ = Dissolved-phase concentration of chemical (µg/L);

Kd = Estimated or measured partition coefficient L/kg;

$Theta_w$ = water-filled porosity (L_{water}/L_{soil});

$Theta_a$ = air-filled porosity (L_{air}/L_{soil});

H' = Henry's Law Constant at 25°C ((µg/L-vapor)/(µg/L-water)); and

p_b = Soil bulk density (Kg/L).

Table H in Appendix 1 of the HDOH EAL document provides a summary of "dimensionless" Henry's Law Constants (H') for common volatile contaminants (HDOH 2005). For the purpose of calculating Tier 1 action levels, Kd is calculated as the chemical's published organic carbon partition coefficient (koc) times the fraction organic carbon in the soil (foc). This is discussed in Appendix 1 of the HDOH Environmental Action Levels document (HDOH 2005). Note that in this equation Kd and p_b are expressed in units of L/Kg and Kg/L, respectively, rather than in equivalent units of cm^3/g and g/cm^3. A default soil density of 1.5 Kg/L and soil porosity of 43% (0.43) are typically used in Tier 1 risk assessment models (e.g., USEPA 2001, 2004).

Equation 6 can be rearranged to solve for $C_{leachate}$ as follows:

$$C_{leachate} = C_{total} \div \left(\left(Kd + \left(\frac{\theta_w + (\theta_a \times H')}{\rho b} \right) \right) \times \left(\frac{1mg}{1000\mu g} \right) \right). \qquad (7)$$

This equation is incorporated into the "Batch Test Leaching Model" worksheet of the Excel file that accompanies this technical memo. The sorption coefficient should be used to estimate the dissolved-phase concentration of the contaminant in a hypothetical, saturated sample of soil at equilibrium and at the same contaminant concentration as the SPLP test. Since the soil is assumed to be fully saturated with water, the vapor-phase term of the equation "θ_a x H'" goes to zero.

Step 3. Tier 3 calculation of ultimate contaminant concentration in groundwater.

A conservative estimate of the contaminant concentration in groundwater that cuold be impacted by the leachate is made by dividing the calculated concentration of the contaminant in leachate by an assumed groundwater:leachate dilution factor (DF):

$$C_{groundwaater} = \frac{C_{leachate}}{DF} \qquad (8)$$

$$DF = \frac{\text{Volume Impacted Groundwater}}{\text{Volume Leachate}}. \qquad (9)$$

where: $C_{groundwater}$ = Concentration of chemical in groundwater (µg/L);
$C_{leachate}$ = Concentration of chemical in leachate (µg/L); and
DF = Groundwater/Leachate dilution factor (m^3/m^3).

This equation is incorporated into the Batch Test Leaching Model spreadsheet that accompanies this technical memo. A default DF of 20 is considered appropriate for sites less than or equal to 0.5 acres in size (USEPA 2001). A more site-specific DF factor can be calculated if needed, based on the following equation (USEPA 2001):

$$\text{Dilution Factor} = 1 + \left(\frac{K \times i \times d}{I \times L} \right) \qquad (10)$$

where "K" is the aquifer hydraulic conductivity (m/year), "i" is the regional hydraulic gradient, "d" is the assuming mixing zone depth (default is two meters), "I" is the surface water infiltration rate (m/year" and "L" is the length of the contamianted soil area that is parallel to groundwater flow (m).

Note that this equation does not consider an expected reduction in contaminant concentrations as the leachat migrates downward. This component of the evalaution can be included in more site-specific evaluations as needed.

Soil Gas Leaching Model

For volatile contaminants, soil gas data offer an alternative approach for estimation of contaminant concentrations in leachate as well as a method to evaluate the threat posed to groundwater by downward migrating vapor plumes. The relationship between vapor-phase and dissolved-phase volatile chemicals under equilibrium conditions is relatively straightforward:

$$H' = \frac{Cvapor\ (ug/L)}{Cleachate\ (ug/L)}. \qquad (11)$$

where: H'=Henry's Law Constant at 25°C;

C_{vapor}= Vapor-phase concentration in soil gas;

$C_{leachate}$= Dissolved-phase concentration in soil pore waters.

Table H in Appendix 1 of the HDOH EAL document provides a summary of "dimensionless" Henry's Law Constants (H') for common volatile contaminants (HDOH 2005). To calculate the concentration of the contaminant in the soil moisture the equation is rearranged to solve for "$C_{leachate}$." The C_{vapor} term is also adjusted to units of ug/m3 to correspond with the units typically reported in site data:

$$Cleachate\ (ug/L) = \frac{Cvapor\ (ug/m3) \times \frac{1\,m3}{1{,}000\,L}}{H'}. \qquad (12)$$

Equation 8 above can be used to estimate potential impacts to groundwater with respect to soil gas-based estimates of contaminant concentrations of the in leachate.

Soil gas "action levels" for protection of groundwater can be developed by rearranging the equation to solve for C_{vapor} and setting $C_{leachate}$ equal to a target leachate goal (e.g., groundwater action level times appropriate groundwater:leachate dilution factor):

$$\mathrm{Cvapor\ (ug/m3) = Cleachate\ (ug/L) \times H' \times \frac{1{,}000\ L}{1\ m3} \times AF} \qquad (13)$$

The term "AF" is an attenuation factor that describes the anticipated decrease in contaminant concentrations over time as the vapor migrates to and eventually impacts groundwater (e.g., via natural degradation, resorption to soil particles or migration into soil moisture). Approaches for calculation of site-specific, vapor attenuation factors are not well established and beyond the scope of this technical memorandum.

APPENDIX B2:

Toxicity Characteristic Leaching Procedure (TCLP) Results

Lab Report Available in Appendix A2

Table B2: Analytical Soil Profiling Results - TCLP RCRA Regulated Metals - Nanue Bridge (Page 1 of 3)

			Sample Identifier	NAN_DU1_0-3_B			NAN_DU2_6-9			NAN_DU3_6-9		
			Sample Date	5-Mar-2024			6-Mar-2024			6-Mar-2024		
			Sample Depth (inches bgs)	0-3			6-9			6-9		
Analyte	Analytical Method	Units	Regulatory Limits for TCLP Metals	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL
Toxic Characteristic Leaching Procedure (TCLP) Resource Conservation and Recovery Act (RCRA) Regulated Metals												
Arsenic	EPA 6010D	mg/L	5.0	ND		0.060	ND		0.060	ND		0.060
Barium	EPA 6010D	mg/L	100	**0.89**		0.020	**0.98**		0.020	**1.0**		0.020
Cadmium	EPA 6010D	mg/L	1.0	ND		0.020	ND		0.020	ND		0.020
Chromium	EPA 6010D	mg/L	5.0	ND		0.025	ND		0.025	ND		0.025
Lead	EPA 6010D	mg/L	5.0	**0.60**		0.030	**0.69**		0.030	**1.1**		0.030
Mercury	EPA 7470A	mg/L	0.2	ND	H	0.0030	ND	H	0.0030	ND	H	0.0030
Selenium	EPA 6010D	mg/L	1.0	ND		0.10	ND		0.10	ND		0.10
Silver	EPA 6010D	mg/L	5.0	ND		0.050	ND		0.050	ND		0.050

Notes:

BGS = below ground surface

mg/L = milligram(s) per liter

ND = not detected in concentrations above the laboratories method reporting limit

RL = reporting limit

Q = qualifier

H = Sample was prepped or analyzed beyond the specified holding time. This does not meet regulatory requirements.

Table B2: Analytical Soil Profiling Results - TCLP RCRA Regulated Metals - Nanue Bridge (Page 2 of 3)

Sample Identifier				NAN_DU8_0-3			NAN_DU9_0-3			NAN_DU10_3-6		
Sample Date				3-Mar-2024			9-Mar-2024			9-Mar-2024		
Sample Depth (inches bgs)				0-3			0-3			3-6		
Analyte	Analytical Method	Units	Regulatory Limits for TCLP Metals	**Results**	Q	RL	**Results**	Q	RL	**Results**	Q	RL
Toxic Characteristic Leaching Procedure (TCLP) Resource Conservation and Recovery Act (RCRA) Regulated Metals												
Arsenic	EPA 6010D	mg/L	5.0	ND		0.060	ND		0.060	ND		0.060
Barium	EPA 6010D	mg/L	100	**1.1**		0.020	**0.64**		0.020	**1.1**		0.020
Cadmium	EPA 6010D	mg/L	1.0	ND		0.020	ND		0.020	ND		0.020
Chromium	EPA 6010D	mg/L	5.0	ND		0.025	ND		0.025	ND		0.025
Lead	EPA 6010D	mg/L	5.0	**3.7**		0.030	**2.8**		0.030	**17 ****		0.030
Mercury	EPA 7470A	mg/L	0.2	ND	H	0.0030	ND	H	0.0030	ND	H	0.0030
Selenium	EPA 6010D	mg/L	1.0	ND		0.10	ND		0.10	ND		0.10
Silver	EPA 6010D	mg/L	5.0	ND		0.050	ND		0.050	ND		0.050

Notes:

BGS = below ground surface

mg/L = milligram(s) per liter

ND = not detected in concentrations above the laboratories method reporting limit

RL = reporting limit

Q = qualifier

H = Sample was prepped or analyzed beyond the specified holding time. This does not meet regulatory requirements.

** = above regulatory limits

Table B2: Analytical Soil Profiling Results - TCLP RCRA Regulated Metals - Nanue Bridge (Page 3 of 3)

			Sample Identifier	NAN_DU11_3-6			NAN_DU12_3-6		
			Sample Date	10-Mar-2024			10-Mar-2024		
			Sample Depth (inches bgs)	6-Mar			3-6		
Analyte	Analytical Method	Units	Regulatory Limits for TCLP Metals	**Results**	Q	RL	**Results**	Q	RL
Toxic Characteristic Leaching Procedure (TCLP) Resource Conservation and Recovery Act (RCRA) Regulated Metals									
Arsenic	EPA 6010D	mg/L	5.0	ND		0.060	ND		0.060
Barium	EPA 6010D	mg/L	100	**0.92**		0.020	**0.86**		0.020
Cadmium	EPA 6010D	mg/L	1.0	ND		0.020	ND		0.020
Chromium	EPA 6010D	mg/L	5.0	ND		0.025	ND		0.025
Lead	EPA 6010D	mg/L	5.0	**12 ****		0.030	**23 ****		0.030
Mercury	EPA 7470A	mg/L	0.2	ND	H	0.0030	ND	H	0.0030
Selenium	EPA 6010D	mg/L	1.0	ND		0.10	ND		0.10
Silver	EPA 6010D	mg/L	5.0	ND		0.050	ND		0.050

Notes:

BGS = below ground surface

mg/L = milligram(s) per liter

ND = not detected in concentrations above the laboratories method reporting limit

RL = reporting limit

Q = qualifier

H = Sample was prepped or analyzed beyond the specified holding time. This does not meet regulatory requirements.

** = above regulatory limits

APPENDIX C:

Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered (TBC) Criteria

Appendix C: Preliminary Applicable or Relevant and Appropriate Requirements (ARAR) and Guidance to be Considered.

Requirement	Citation	Description	Governmental Authority	ARAR/TBC Information Type	Applicability to Site	Determination
Removal or Remedial Action						
EPA RSLs	EPA RSL Tables (November 2019)	Predetermined risk-based criteria used as a screening tool to determine the presence of pollutants, trigger investigation, and identify initial cleanup goals.	Federal	Chemical-Specific	Lead is present in site soil at concentrations exceeding **EPA** RSLs for residential land use.	TBC Information. EPA RSLs are not promulgated.
HDOH EALs	HDOH EAL Tables (November 2017)	Predetermined risk-based criteria used as a screening tool to determine the presence of pollutants, trigger investigation, and identify initial cleanup goals.	State	Chemical-Specific	Lead is present in site soil at concentrations exceeding HDOH **EALs.**	TBC Information. HDOH EALs are not promulgated. Relevant to lead as the state recommended clean-up levels for parks is more stringent than the RSLs for residential land use.
Excavation and/or Earth Moving Activities						
Discharge of Dredged or Fill Material to Waters of the U.S.	33 use§ 1344; CWA § 404; 33 USC§ 1311(a)	Requires permits for the discharge of dredged or fill materials to into waters of the United States, including wetlands.	Federal	Action-Specific	The site is adjacent to Nanue Stream.	Potentially applicable. The site is adjacent to Nanue Stream. The National Wetland Inventory classifies the stream channel and banks as riverine upper perennial, unconsolidated bottom, permanently flooded. If a survey determines that the wetland is jurisdictional, then compliance with the substantive requirements of the CWA and § 404 Permit process may be required for any response action that includes excavation of soil and installation of clean fill material in the wetland area.
Coastal Zones	HRS Title 13, Chapter 205A: Coastal Zone Management. S	Provides for the protection of coastal resources.	State	Location-Specific	The majority of the site is located within a Special Management Area as designated by the State of Hawaii.	Potentially applicable. Excavation activities that alter coastal vegetation and landforms will comply with substantive requirements to minimize effects on coastal resources.
Coastal Zones	16 USC §-1455 (c); 15 CFR § 930.30-33, 36(a}, and 39(b-d)	Requires federal actions or activities conducted within or affecting a coastal zone be consistent with the State's coastal program. Also requires protection of valuable coastal ecosystems and minimization of adverse impacts on coastal ecosystems.	Federal	Location-Specific	The majority of the site falls within a Special Management Area as designated by the State of Hawaii.	Potentially applicable. The selected response action will comply with this regulation because the site location is within the coastal zone.
NPDES	CWA§ 402; 33 USC§ 1311(a): 40 CFR Parts 122 and 125	Regulates the discharge of treated effluent and storm water runoff to waters of the United States.	Federal	Action-Specific	The site is adjacent to Nanue Stream.	Applicable if the selected response action disturbs more than 1 acre (Current potential remedial action area is more than 1 acre). Response activities will comply with the **ARARs** to prevent discharge to the adjacent stream. BMPs will be implemented. Although administrative requirements do not qualify as **ARARs,** a stormwater pollution prevention plan will be prepared to demonstrate compliance with the substantive requirements of this regulation.
Soil Erosion and Sediment Control, Grading Excavation, Clearing and Grubbing.	HRS Title 12, Chapter 180C, Soil Erosion and Sediment Control. Hawaii County Code (1983, 2016 Amended) Chapter 10, Section 10-26	Regulates grading, excavation, clearing and grubbing activities for management of soil erosion and sediment control.	State County	Action-Specific	Response actions that include grading or excavation.	Applicable. Any grading, grubbing, stockpiling activities will require a permit and BMPs to manage soil erosion and sediment control. Any removed vegetation should not be stored along the banks of Nanue Stream. Grading activities will result in positive drainage to prevent the accumulation or retention of surface water in depressions. Hazardous conditions will not be created by fill.

Requirement	Citation	Description	Governmental Authority	ARAR/TBC Information Type	Applicability to Site	Determination
Excavation and/or Earth Moving Activities *(continued)*						
Control of Fugitive Dust	HRS 19 342B-11; 34 HAR Title 11, Chapter 60.1-33: Air Pollution Control	Requires mitigation of fugitive dust visible beyond the property line through implementation of best practical operation or treatment.	State	Action-Specific	Response actions that include excavation.	Potentially applicable. Response actions will not cause or permit the discharge of visible fugitive dust beyond the site perimeter. Dust may be controlled by screen or limited application of water spraying over disturbed area to prevent the discharge of fugitive dust. Runoff from dust control is not permitted.
Control of Noise	HRS Title 19, Chapter 342F-30; HAR Title 11, Chapter 46: Noise Pollution Control	Defines maximum permissible sound levels to prevent, control, and abate noise pollution from stationary noise sources and equipment related to agricultural, construction, and industrial activities.	State	Action-Specific	Response actions that include the use of heavy machinery and trucks.	Potentially applicable. Response actions will not cause excessive noise beyond the exclusion zone outside of the hours of 0700 and 2200. Permissible sound outside of the exclusion zone for multifamily residential, commercial, and resort areas shall not exceed 60 decibels. Outside of the hours of 0700 and 2200, permissible sound levels shall not exceed 50 decibels. Site is located within an isolated gulch. Residential housing is above the site.
Waste Disposal						
Identification of Hazardous Waste	40 CFR Part 261	Identifies solid wastes subject to regulation as hazardous wastes under **RCRA.** Identifies chemical characteristics of hazardous waste for comparison with site-specific waste data.	Federal	Chemical-Specific	Lead is present in site soil.	Relevant and appropriate for excavation activities because the regulation establishes procedures and numeric limits for the identification and management of listed and characteristic hazardous waste. Sample results in the bridge area are below the US EPA TCLP standard for Hazardous Waste.
Storage, Handling, and Pre-Transportation Requirements for Hazardous Waste	40 CFR Part 262	Specifies hazardous waste storage, handling, labeling, record keeping, manifesting, and all pre-transport requirements.	Federal	Action-Specific	Lead is are present in site soil.	Potentially Applicable for excavation activities because the regulation establishes procedures for the storing and handling listed and characteristic hazardous waste. Sample results from the DUs in the bridge area are above the standards for TCLP identified hazardous waste.
Conservation and Protection of Ecological and Cultural Resources						
Migratory Bird Treaty Act	16 USC §703(a)	Prohibits the taking, possessing, buying, selling, or bartering of any migratory bird, including feathers or other parts, nest eggs, or products, except as allowed by regulations.	Federal	Location-Specific	Potential for migratory birds to loaf/nest on site.	Potentially applicable. Survey site and follow guidelines for disturbance of migratory bird species. Potential for habitat for the indigenous, Black-crowned Night-Heron (*Nycticorax nycticorax*) based on 2018 Kapue Bridge Survey.
Native American Graves Protection and Repatriation Regulations	43 CFR 10, § 3c and 3d	Requires coordination with Native Hawaiian organization to determine disposition of human remains and cultural artifacts. Requires protection of said items when	Federal	Location-Specific	No identified archaeological sites. Additional review will be conducted. Site has been highly disturbed due to bridge construction, tsunami impacts, and flooding.	Potentially relevant and appropriate. Comply with substantive requirements excavation, removal. and preservation of human remains and artifacts if selected response action includes excavation and human remains, burial sites, or cultural artifacts are encountered.

Appendix C: Preliminary Applicable or Relevant and Appropriate Requirements (ARAR) and Guidance to be Considered.

Conservation and Protection of Ecological and Cultural Resources *(continued)*

Requirement	Citation	Description	Governmental Authority	ARAR/TBC Information Type	Applicability to Site	Determination
Burial Sites and Human Remains	HAR Title 13, Chapter 300: Rules of Practice and Procedures Relating to Burial Sites and Human Remains	Governs practices and procedures relating to the proper care and protection of burial sites and human skeletal remains 50 years or older.	State	Location-Specific		Potentially applicable. Comply with the substantive requirements for the excavation, removal, and preservation of humans remains if selected response action includes excavation and human remains or burial sites are encountered.
Protection of Archaeological Resources	43 CFR § 7.4(a) and 7.5(b)(1)	Requires protection of archaeological resources if discovered.	Federal	Location-Specific		Potentially applicable. Comply with substantive requirements to prevent irreparable damage to or destruction of human remains and artifacts and to preserve archaeological and scientific data if selected response action includes excavation and human remains, burial sites, or cultural artifacts are encountered.
National Archaeological and Historical Preservation Act; National Historic Preservation Act	16 USC 469; 16 USC§ 470; 36 CFR Part 800	Alteration of terrain that threatens significant scientific, prehistoric, historic, or archeological data may require actions to recover and preserve artifacts. Includes coordination with federal and state officials to determine proposed site activities have the potential to cause adverse effects on historic properties.	Federal	Action-Specific and Location-Specific		Potentially applicable. Comply with the substantive requirements to provide for data recovery and preservation activities if selected response action includes terrain alterations that result in irreparable loss or destruction of significant scientific, prehistoric, historical, or archaeological data.
Historic Preservation	HRS Chapter 6E.	Requires action to be taken to locate, identify, evaluate, and protect cultural resources.	State	Location-Specific		Potentially applicable. Comply with substantive requirements to prevent the irreparable damage and destruction of human remains or artifacts and to preserve the archaeological and scientific data if selected response action includes excavation and human remains. burial sites, or cultural artifacts are encountered.
Endangered Species Act	16 USC§ 1538(a)(1)(B); 50 CFR § 17.21	Requires action to conserve endangered or threatened species, including coordination with the Department of the Interior and the U.S. Fish and Wildlife Service.	Federal	Location-Specific	The site has potential habitat for the Hawaiian stilt (*Himantopus mexicanus knudseni*). Potential for Hawaiian Hoary bat (*Aeorestes semotus*), or Hawaiian Hawk (*Buteo solitarius*), however no trees will be removed or disturbed during site work, minimizing potential impacts. Construction will take place during daylight hours and will not use nocturnal lights. Vegetation is non-native or common species and consists of maintained landscaping (grass).	Potentially relevant and appropriate. No designated critical habitat is at the site. Comply with requirements to protect rare/threatened and endagered species and their habitat if documented or if they appear at the site.

APPENDIX D:

REMEDIAL ALTERNATIVE COST COMPARISON: TBD

APPENDIX D:

REMEDIAL ALTERNATIVE COST COMPARISON

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Appendix D: Rough Order of Magnitude Cost Comparison

Nanue Lead Impacted Soil Remedial Alternative Analysis

Client: HDOT
Project: Hakalau Beach Park Remedial Alterntives
Location: Hakalau, Hawaii

Option	All Options	7a	6a	6b	6c	7b
Task:	Planning	Alternative 7a	Alternative 6a	Alternative 6b	Alternative 6c	Alternative 7b
Billing Type:	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum
Task Title: Scope of Work:	Project Management, Permitting, Public Meeting Support Assume all alternatives have a similar amount of planning effort. This cost would be in addition to each of the alternatives evaluated.	No Action - Institutional Controls. Signage warning of Lead Risk. EHMP Needed. Land Use Controls and perform 5-year inspections. Assume two updates every 30 years to accommodate maintenance changes (Pre-construction EHMPs).	EHMP needed. 5-year inspections. Clear and Grub and install BMPs. Cover contaminated areas over entire HDOT Right of Way with Tecco system. Coconut matting, soil anchors, and Tecco mesh (aluminum and HDPE mesh fabric). Archeological Consultation and Monitoring (5 weeks)	Soil cover. Use wire mesh, soil nails and apply shotcrete slope armor. EHMP needed. Land Use controls and 5-year inspections. Clear and Grub and install BMPs. Install soil nails, welded fabric and wire reinforcing tie downs. Cover with Shotcrete. Archeological Consultation and Monitoring (5 weeks)	Soil Excavation and Off-Site Disposal for lead impacted soil greater than 800 mg/kg for total lead. If lead-impacted soil passes TCLP send to WHSL. If Lead impacted soil > 800 mg/kg fails TCLP, dispose of CONUS. EHMP needed based on confirmation sampling. Assume miriafi/geotextile/jute matting placed over post excavation surface. No replacement fill. Matting will be nailed down with wood stakes. Archeological Consultation and Monitoring (5 weeks)	Institutional and Engineering Controls - Prepare EHMP and update every 5 years. Install a fence around all areas under HDOT Right of Way. Fence to include gates. Signage warning of Lead Risk. EHMP needed. Assume two updates over 30 years to accommodate bridge maintenance changes (Pre-construction EHMPs). Assume LUC inspections every 5 years with brush removal along fence and periodic maintenance. Two weeks of clearing using a four man crew.
Duration:		Days	105 Days	115 Days	94 Days	36 Days

				All Options		7a		6a		6b		6c		7b	
#NAME?	**1a. Labor**	Loaded Rate ($)	Unit	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)
101	Principal	$199.29	Hour	36	$7,174.54	20	$3,985.85	50	$9,964.64	60	$11,957.56	40	$7,971.71	20	$3,985.85
103	Project Manager	$140.12	Hour	80	$11,209.94	40	$5,604.97	40	$5,604.97	60	$8,407.46	60	$8,407.46	40	$5,604.97
105	Senior Environmental Scientist/Engineer	$127.23	Hour	120	$15,267.93										
106	Senior Project Scientist	$127.97	Hour	160	$20,474.48	600	$76,779.28	800	$102,372.38	850	$108,770.65	680	$87,016.52	600	$76,779.28
111	Assistant Project Scientist	$76.89	Hour	320	$24,605.27	600	$46,134.89	840	$64,588.85	920	$70,740.17	752	$57,822.40	600	$46,134.89
125	Construction Manager	$152.89	Hour					840	$128,427.55	920	$140,658.75	752	$114,973.24	288	$44,032.30
140	Technical Editor	$114.81	Hour	24	$2,755.45	40	$4,592.42	8	$918.48	8	$918.48	8	$918.48	40	$4,592.42
122	Word Processor	$61.47	Hour	24	$1,475.27	40	$2,458.79	8	$491.76	8	$491.76	8	$491.76	40	$2,458.79
136	Senior CADD Operator	$93.11	Hour	48	$4,469.51	60	$5,586.88	12	$1,117.38	12	$1,117.38	24	$2,234.75	60	$5,586.88
120	Project Administrator	$70.81	Hour	80	$5,664.97	40	$2,832.48	40	$2,832.48	40	$2,832.48	40	$2,832.48	40	$2,832.48
135	Senior Project Accountant	$92.30	Hour			80	$7,384.15	80	$7,384.15	80	$7,384.15	80	$7,384.15	80	$7,384.15
			Subtotals	**892**	**$93,097.36**	**1520**	**$155,359.71**	**2718**	**$323,702.64**	**2958**	**$353,278.84**	**2444**	**$290,052.95**	**1808**	**$199,392.01**

Category Code	**1b. Subcontractor Labor**	Loaded Rate ($)	Unit	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)
	Landscape Laborer -Davis Bacon	$47.00	hour					80	$3,760.00	80	$3,760.00	320	$15,040.00	480	$22,560.00
	Landscape Laborer -Davis Bacon	$47.00	hour					80	$3,760.00	80	$3,760.00	320	$15,040.00	480	$22,560.00
	Landscape Laborer -Davis Bacon	$47.00	hour					80	$3,760.00	80	$3,760.00	320	$15,040.00	480	$22,560.00
	Landscape Laborer -Davis Bacon	$47.00	hour					80	$3,760.00	80	$3,760.00	320	$15,040.00		
			Subtotals	**0**	**$0.00**	**0**	**$0.00**	**320**	**$15,040.00**	**320**	**$15,040.00**	**1280**	**$60,160.00**	**1920**	**$90,240.00**

Category Code	**2. Equipment**	Loaded Rate ($)	Unit	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)
	Excavator with Shear attachment	$132.55	hr					40	$5,301.80	40	$5,301.80	40	$5,301.80	0	
	Backhoe (operated)	$66.28	hr					40	$2,651.13	40	$2,651.13	40	$2,651.13	0	
	Dump Truck operated	$72.91	hr					40	$2,916.29	40	$2,916.29	40	$2,916.29	20	$1,458.14
	SUV 1	$1,590.60	mt					2.5	$3,976.50	3.5	$5,567.09	2.25	$3,578.85	3	$4,771.79
	SUV 2	$1,590.60	mt					2.5	$3,976.50	3.5	$5,567.09	2.5	$3,976.50	3	$4,771.79
	Porta Potty	$328.72	month					2.5	$821.81	3.5	$1,150.53	2.5	$821.81	5	$1,643.62
	misc brush clearing equipemnt	$99.41	dy					40	$3,976.47	40	$3,976.47	80	$7,952.93	120	$11,929.40
		$0.00													
			Subtotals		**$0.00**		**$0.00**		**$23,620.50**		**$27,130.40**		**$27,199.31**		**$24,574.74**

Appendix D: Rough Order of Magnitude Cost Comparison

Nanue Lead Impacted Soil Remedial Alternative Analysis

Client: HDOT
Project: Hakalau Beach Park Remedial Alterntives
Location: Hakalau, Hawaii

Option:	All Options	7a	6a	6b	6c	7b
Task:	Planning	Alternative 7a	Alternative 6a	Alternative 6b	Alternative 6c	Alternative 7b
Billing Type:	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum
Task Title:	Project Management, Permitting, Public Meeting Support Assume all alternatives have a similar amount of planning effort. This cost would be in addition to each of the alternatives evaluated.	No Action - Institutional Controls. Signage warning of Lead Risk. EHMP Needed. Land Use Controls and perform 5-year inspections. Assume two updates every 30 years to accommodate maintenance changes (Pre-construction EHMPs).	EHMP needed. 5-year inspections. Clear and Grub and install BMPs. Cover contaminated areas over entire HDOT Right of Way with Tecco system. Coconut matting, soil anchors, and Tecco mesh (aluminum and HDPE mesh fabric). Archeological Consultation and Monitoring (5 weeks)	Soil cover. Use wire mesh, soil nails and apply shotcrete slope armor. EHMP needed. Land Use controls and 5-year inspections. Clear and Grub and install BMPs. Install soil nails, welded fabric and wire reinforcing tie downs. Cover with Shotcrete. Archeological Consultation and Monitoring (5 weeks)	Soil Excavation and Off-Site Disposal for lead impacted soil greater than 800 mg/kg for total lead. If lead-impacted soil passes TCLP send to WHSL. If Lead impacted soil > 800 mg/kg fails TCLP, dispose of CONUS. EHMP needed based on confirmation sampling. Assume mirafi/geotextile/jute matting placed over post excavation surface. No replacement fill. Matting will be nailed down with wood stakes. Archeological Consultation and Monitoring (5 weeks)	Institutional and Engineering Controls - Prepare EHMP and update every 5 years. Install a fence around all areas under HDOT Right of Way. Fence to include gates. Signage warning of Lead Risk. EHMP needed. Assume two updates over 30 years to accommodate bridge maintenance changes (Pre-construction EHMPs). Assume LUC inspections every 5 years with brush removal along fence and periodic maintenance. Two weeks of clearing using a four man crew.
Scope of Work:						
Duration:		Days	105 Days	115 Days	94 Days	36 Days

Code	3. Materials and Other Dire	Loaded Rate ($)	Unit	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)
	consumables (water etc.) Health and safety	$33.13	day					46	$1,524.14	66	$2,186.80	54	$1,789.20	240	$7,952.02
	PPE	$33.13	day					46	$1,524.14	66	$2,186.80	54	$1,789.20	240	$7,952.02
	Eyewash	$99.41	ls					2	$198.82	4	$397.65	4	$397.65	1	$99.41
	Misc Health and Safety items	$662.75	ls					2	$1,325.50	4	$2,650.99	4	$2,650.99	4	$2,650.99
	Plastic sheeting	$144.47	roll					5	$722.37	15	$2,167.12	10	$1,444.75	0	
	Restoration (not backfill)	$1,325.50	ls												
	Disposal of Vegetation HD	$662.75	day					20	$13,254.97	20	$13,254.97	20	$13,254.97	80	$53,019.86
	Fuel of vehicles	$6.10	gal					500	$3,051.16	600	$3,661.39	500	$3,051.16	720	$4,393.67
	Report reproduction	$165.69						3	$497.07	3	$497.07	3	$497.07	6	$994.14
			Subtotals		**$0.00**		**$0.00**		**$22,098.17**		**$27,002.79**		**$24,874.99**		**$77,062.11**

Category Code	**4. Subcontractors**	Loaded Rate ($)	Unit	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)
	Construction Screening	$22,898.00	ls					1	$22,898.00	1	$22,898.00	1	$22,898.00		
	Transport and Tipping Fee (Mainland)	$2,400.00	yrd 3					0		0		1798	$4,316,160.00		
	Transport and Tipping Fee (WHSL - On Island)	$300.00	yrd3					0		0		450	$134,880.00		
	Excavate, Lift, Load Impacted Soil	$2,006,933.33	ls					0		0		1	$2,006,933.33		
	Hydroseed	$1.14	sqft					0		0		46551	$53,296.24		
	Mirafi/Geotextile spread across site	$1.50	sqft					0		0		60,682	$91,023.00		
	Dust Controls, Water meter, water truck	$2,003.58	day					0		0		0			
	Cargo Air Samples Hilo to Hono	$165.69	ea					4	$662.76	4	$662.76	4	$662.76		
	Fed EX Hono to AAL	$129.90	ea					4	$519.60	4	$519.60	4	$519.60		
	Wood Chipper	$1,325.50	week					4	$5,301.99	4	$5,301.99	4	$5,301.99		
	Archeological Support	$20,035.75	ls					1	$20,035.75	1	$20,035.75	1	$20,035.75		
	Archeological Monitoring	$6,296.95	wk					5	$31,484.75	5	$31,484.75	5	$31,484.75		
	Fencing Installation	$95.00	ft.											1,487	$141,265.00
	Air Monitoring	$1,200.00	day					20	$24,000.00	20	$24,000.00	20	$24,000.00	40	$48,000.00
	Anchor with Tecco Mesh System	$100.00	sq. ft.					60682	$6,068,200.00						
	Soil Nail Shotcrete Slope Armor	$150.00	sq. ft.							60,682	$9,102,300.00				
ISM	ISM Prep	$114.49	ea					10	$1,144.90	10	$1,144.90	30	$3,434.70		
ISM	RCRA 8 METAL	$92.78	ea					10	$927.83	10	$927.83	30	$2,783.48		
ISM	PERCENT MOISTURE	$13.26	ea					10	$132.58	10	$132.58	30	$397.74		
ISM	DRYSLIEVE	$100.00	ea					10	$1,000.00	10	$1,000.00	30	$3,000.00		
	RCRA 8 METAL -TCLP	$183.18	ea					10	$1,831.84	10	$1,831.84	30	$5,495.52		

Appendix D: Rough Order of Magnitude Cost Comparison
Nanue Lead Impacted Soil Remedial Alternative Analysis

Client: HDOT
Project: Hakalau Beach Park Remedial Alterntives
Location: Hakalau, Hawaii

	All Options	7a	6a	6b	6c	7b
Option	All Options	7a	6a	6b	6c	7b
Task:	Planning	Alternative 7a	Alternative 6a	Alternative 6b	Alternative 6c	Alternative 7b
Billing Type:	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum	Lump Sum
Task Title:	Project Management, Permitting, Public Meeting Support Assume all alternatives have a similar amount of planning effort. This cost would be in addition to each of the alternatives evaluated.	No Action - Institutional Controls. Signage warning of Lead Risk. EHMP Needed. Land Use Controls and perform 5-year inspections. Assume two updates every 30 years to accommodate maintenance changes (Pre-construction EHMPs).	EHMP needed. 5-year inspections. Clear and Grub and install BMPs. Cover contaminated areas over entire HDOT Right of Way with Tecco system. Coconut matting, soil anchors, and Tecco mesh (aluminum and HDPE mesh fabric). Archeological Consultation and Monitoring (5 weeks)	Soil cover. Use wire mesh, soil nails and apply shotcrete slope armor. EHMP needed. Land Use controls and 5-year inspections. Clear and Grub and install BMPs. Install soil nails, welded fabric and wire reinforcing tie downs. Cover with Shotcrete. Archeological Consultation and Monitoring (5 weeks)	Soil Excavation and Off-Site Disposal for lead impacted soil greater than 800 mg/kg for total lead. If lead-impacted soil passes TCLP send to WHSL. If Lead impacted soil > 800 mg/kg fails TCLP, dispose of CONUS. EHMP needed based on confirmation sampling. Assume miriafi/geotextile/jute matting placed over post excavation surface. No replacement fill. Matting will be nailed down with wood stakes. Archeological Consultation and Monitoring (5 weeks)	Institutional and Engineering Controls - Prepare EHMP and update every 5 years. Install a fence around all areas under HDOT Right of Way. Fence to include gates. Signage warning of Lead Risk. EHMP needed. Assume two updates over 30 years to accommodate bridge maintenance changes (Pre-construction EHMPs). Assume LUC inspections every 5 years with brush removal along fence and periodic maintenance. Two weeks of clearing using a four man crew.

Scope of Work:

Category Code	5. Travel	Loaded Rate ($)	Unit	All Options Units	All Options Task ($)	7a Units	7a Task ($)	6a Units	6a Task ($)	6b Units	6b Task ($)	6c Units	6c Task ($)	7b Units	7b Task ($)
			Duration:				Days	105	Days	115	Days	94	Days	36	Days
	Shipping to lab	$457.96	ea					3	$1,373.88	6	$2,747.76	4	$1,831.84		
			Subtotals		**$0.00**		**$0.00**		**$6,179,513.88**		**$9,214,987.76**		**$6,724,138.70**		**$189,265.00**
Category Code	5. Travel	Loaded Rate ($)	Unit	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)	Units	Task ($)
	Flights to Hilo RT Honolulu - Hawaii Construction Manager	$314.85	RT					8	$2,518.78	14	$4,407.87	4	$1,259.39	10	$3,148.48
	Flights to Hilo RT Honolulu - Hawaii Mid Engineer	$314.85	RT					8	$2,518.78	14	$4,407.87	4	$1,259.39	10	$3,148.48
	Per Diem Construction Manager	$99.41	day					64	$6,362.35	92	$9,145.87	75	$7,455.88	30	$2,982.35
	Per Diem Mid Engineer	$99.41	day					64	$6,362.35	92	$9,145.87	75	$7,455.88	30	$2,982.35
	Lodging Construction Manager	$160.88	day					64	$10,296.41	92	$14,801.08	75	$12,066.10	30	$4,826.44
	Lodging Mid Engineer	$160.88	day					64	$10,296.41	92	$14,801.08	75	$12,066.10	30	$4,826.44
			Subtotals		**$0.00**		**$0.00**		**$38,355.08**		**$56,709.64**		**$41,562.74**		**$21,914.54**
			SUBTOTALS		**$93,097.36**		**$155,359.71**		**$6,602,330.27**		**$9,694,149.43**		**$7,167,988.69**		**$602,448.40**
	PROFIT	0.06	**Percent**		**$5,585.84**		**$9,321.58**		**$396,139.82**		**$581,648.97**		**$430,079.32**		**$36,146.90**
	SUBTOTOTAL				**$98,683.20**		**$164,681.29**		**$6,998,470.09**		**$10,275,798.40**		**$7,598,068.01**		**$638,595.30**
	Bonding, Insurance, and Tax	Rate ($)	Unit												
	Markup	0.066	Percent												
	HI GET	0.04712	Percent		$4,649.95		$7,759.78		$329,767.91		$484,195.62		$358,020.96		**$28,387.37**
	Unit Rate Adjustment	$1.00	LS												
			TASK TOTALS		**$103,333.15**		**$172,441.08**		**$7,328,238.00**		**$10,759,994.02**		**$7,956,088.98**		**$666,982.67**