

Division of Boating and Ocean Recreation

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF BOATING AND OCEAN RECREATION
ENGINEERING BRANCH
Honolulu, Hawaii

BOARD OF LAND AND NATURAL RESOURCES

Suzanne D. Case
Chairperson

CONTRACT SPECIFICATIONS AND PLANS

Job No. B46CM71B
Lahaina Small Boat Harbor Inner Marginal Wharf Repair
Lahaina, Maui, Hawaii

Consultant: Moffatt & Nichol

May 2020

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION
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Lahaina Small Boat Harbor Inner Marginal Wharf Repair
Lahaina, Maui, Hawaii

Approved: _____



EDWARD R. UNDERWOOD
Administrator
Division of Boating and Ocean Recreation

Approved: _____



FINN MCCALL, P.E.
Engineering Branch Head
Division of Boating and Ocean Recreation

May 2020

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NOTICE TO BIDDERS

(Chapter 103D, HRS)

COMPETITIVE SEALED BIDS for Job No. B46CM71B Lahaina Small Boat Harbor Inner Marginal Wharf Repair, Lahaina, Maui, Hawaii may be submitted to the Department of Land and Natural Resources, Division of Boating and Ocean Recreation, Engineering Branch on the specified date and time through the State of Hawaii e-Procurement System (HIePRO).

The Department of Land and Natural Resources Interim General Conditions dated October 1994 (DLNR General Conditions), as amended is attached to this solicitation. See also the Special Provisions attached to this solicitation for amendments to the DLNR. General Conditions – AG008, latest revision shall be made a part of the specifications and are attached to this solicitation.

The project is located at the Lahaina Small Boat Harbor, Lahaina, Maui, Hawaii.

The purpose of this Invitation for Bids (IFB) is to award to a Contractor work that shall generally consist of installation of a new aluminum framed inner marginal wharf with plastic lumber fenders and fiber reinforced plastic decking and new electrical and water systems with integral water/power pedestals including, but not limited to, demolition of the existing wooden wharf superstructure, pile cap repairs, Best Management Practices, and water quality monitoring at Lahaina Small Boat Harbor, Lahaina, Maui, Hawaii; and other related and appurtenant work.

Due to the nature of work contemplated, bidders must possess a valid State Contractor's license, Classification "A".

The estimated cost of construction is \$1,500,000,000.

Permitting Notes:

A permit from the U.S. Army Corps of Engineers (ACOE) has not yet been obtained for this project. For bidding purposes, the conditions in ACOE permit for Job No. OA19-02 Maunalua Bay Boat Ramp Repair, Honolulu, Oahu, Hawaii (Permit No. POH-2020-00037) attached to this solicitation. Water quality control shall be done in accordance Department of Health, Clean Water Branch Blanket Section 401 Water Quality Certification (File No. WQC0901) attached to this solicitation. The notice to proceed for this project may be delayed pending approvals by the required permitting and approving agencies and will be contingent on the State obtaining all required permits prior to start of construction.

As a condition for award of the contract and final payment, the vendor shall provide proof of compliance with the requirements of 103D-310(c) HRS. Proof of compliance/documentation is obtained through Hawaii Compliance Express (HCE). Vendors shall register in Hawaii Compliance Express (HCE), a program separate from HIePRO. The annual subscription fee to utilize the HCE service is currently \$12.00. Allow 2 weeks to obtain complete compliance status after initial registration. It is highly recommended that vendors subscribe to HCE prior to responding to a solicitation. The vendor is responsible for maintaining compliance. If the vendor does not maintain timely compliance in HCE, an offer otherwise deemed responsive and responsible may not be awarded.

The award of the contract, if it be awarded, will be subject to the availability of funds.

The Engineering Branch Head is responsible for administering and overseeing the Contract, including monitoring and assessing contractor performance.

The job is subject to preference for Hawaii Products established by Section 103D, Hawaii Revised Statutes. The Hawaii Product List may be examined at the State Procurement Office.

Should there be any questions, please use the question and answer section of the HIePRO solicitation.

INFORMATION AND INSTRUCTIONS TO BIDDERS

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INFORMATION AND INSTRUCTIONS TO BIDDERS

- A. PROJECT LOCATION AND SCOPE OF WORK: The project location and scope of work shall be as generally described in the Notice to Bidders.
- B. SEALED PROPOSALS: **Not applicable. See D. PROPOSAL FORM.**
- C. GENERAL CONDITIONS: The Department of Land and Natural Resources Interim General Conditions dated October 1994, as amended, shall be made a part of these contract specifications and are referred to hereafter as the General Conditions.
- D. PROPOSAL FORM: **The Bidders shall fill out and upload the electronic copy of the proposal form to the HiePRO website when submitting the bid. Bid Proposals shall not be mailed, faxed or delivered to the State, unless requested to do so after the designated closing date. The successful Bidder shall fill out and print a hard copy of the proposal form, sign and submit the form with the contract award package.**
- E. OMISSIONS OR ERASURES: Any proposal which contains any omission or erasure or alteration not properly initialed, or conditional bid, or other irregularity may be rejected by the Board of Land and Natural Resources (Board).
- F. NOTICE OF INTENT TO BID AND QUESTIONNAIRE:
A Notice of Intent to Bid is not required for this project. In compliance with HRS Section 103D-310, the lowest responsive and responsible bidder may be required to complete a standard questionnaire. When required, the completed questionnaire shall be submitted to the Chief Engineer for evaluation. Failure to furnish the requested information within the time allowed may be grounds for a determination of non-responsibility, in accordance with HRS Section 103D-310 and HAR Section 3-122-108.
- G. BID SECURITY: A bid security will be furnished by each bidder as provided in sub-section 2.7 of the General Conditions. The successful bidder's bid security will be retained until Contract execution and furnished a performance and payment bond in an amount equal to one hundred percent (100%) of the total Contract price, including an amount estimated to be required for extra work, is furnished. **No bid security is required for bids less than \$50,000.**
- The Board reserves the right to hold the bid securities of the four lowest bidders until the successful bidder has entered into a contract and has furnished the required performance bond. All bid securities will be returned in accordance with sub-section 3.5 of the General Conditions.
- Should the successful bidder fail to enter into a contract and furnish a satisfactory performance bond within the time stated in the proposal, the bid security shall be forfeited as required by law.
- H. CONTRACTOR'S LICENSE REQUIRED: The Board will reject all bids received from contractors who have not been licensed by the State Contractors License Board in accordance

with Chapter 444, HRS; Title 16, Chapter 77, Hawaii Administrative Rules; and statutes amendatory thereto. This project will require a Class "A" contractor's license.

- I. IRREGULAR BIDS: No irregular bids or propositions for doing the work will be considered by the Board.
- J. WITHDRAWAL OF BIDS: No bidder may withdraw his bid between the time of the opening thereof and the award of contract.
- K. SUCCESSFUL BIDDER TO FILE PERFORMANCE AND PAYMENT BONDS: The successful bidder will be required to file performance and payment bonds each; in the amount equal to the total contract price, including amounts estimated to be required for extra work, as provided in sub-section 3.6 of the General Conditions. **Performance and payment bonds are not required for bids less than \$50,000.**
- L. NUMBER OF EXECUTED ORIGINAL COUNTERPARTS OF CONTRACT DOCUMENTS: If requested by the Board, six copies of the Contract, performance and payment bonds shall be executed. **For contracts less than \$50,000, the State reserves the right to contract the work under a purchase order.**
- M. CHANGE ORDERS: No work of any kind in connection with the work covered by the plans and specifications shall be considered as change order work, or entitle the Contractor to extra compensation, except when the work has been ordered in writing by the Chief Engineer (Engineer) and in accordance with sub-section 4.2 of the General Conditions.

The Contractor shall clearly identify and inform the Engineer in writing of any deviations from the contract documents at the time of submission and shall obtain the Engineer's written approval to the specified deviation prior to proceeding with any work.

- N. WAGES AND HOURS: In accordance with sub-sections 7.3 to 7.9 of the General Conditions relative to hours of labor, minimum wages and overtime pay, the current minimum wage rates promulgated by the Department of Labor and Industrial Relations (DLIR) shall be paid to the various classes of laborers and mechanics engaged in the performance of this contract on the job site. The minimum wages shall be increased during the performance of the contract in an amount equal to the increase in the prevailing wages for those kinds of work as periodically determined by the DLIR.

The Department of Land and Natural Resources will not recognize any claim for additional compensation because of the payment by the Contractor of any wage rate in excess of the said minimum wage rates. The possibility of wage increase is one of the elements to be considered by the Contractor in determining his bid, and will not, under any circumstances, be considered as the basis of a claim against the Department under this Contract.

No work shall be done on Saturdays, Sundays, legal State holidays, and/or in excess of eight (8) hours each day without the written consent of the Engineer. Should permission be granted to work at such times, the Contractor shall pay for all inspection administrative costs thereof. No work shall be done at night unless authorized by the Engineer.

- O. PERMITS: The State will process permit applications whenever possible, and the Contractor

shall procure the pre-processed permits and pay the required fees. If permit applications are not processed by the State, the Contractor shall process the permit applications, permits and licenses, and pay all charges and fees. In all cases, the Contractor shall give all notices necessary and incident to the due and lawful prosecution of the work.

- P. PROPERTY DAMAGE: It shall be the responsibility of the contractor to respect State property and to prevent damage to existing improvements. The Contractor will be responsible for damages resulting from construction operations. Immediately upon discovery, the Contractor shall repair such damage to the satisfaction of the Engineer.

All trees and shrubbery outside the excavation, embankment or construction limits shall be fully protected from injury.

- Q. TIME: The time of completion is specified in the Proposal. It is the Board's intention to insist the Contractor diligently prosecute the work to completion within the specified time.

Prospective bidders are reminded that the State has the option to proceed with or abandon a project depending on whether the project can be completed for occupancy in the specified time.

It is the bidder's responsibility to check the availability of all materials before bidding. The bidder shall select sub-contractors and suppliers who can warrant availability and delivery of all specified or qualified materials to assure project completion within the specified time.

The successful bidder must assume all risks for completing the project by the specified date. There shall be no extension of time for any reason except for delays caused by acts of God, labor disputes involving unions, or actions of the State. If for any reason the project falls behind schedule, the Contractor shall at its own cost, take necessary remedial measures to get the project back on schedule, i.e., working overtime, air freighting all materials, etc. In addition, if the Contractor fails to fully complete the project by the completion date, Contractor will be required to make the facility usable at its own cost.

- R. BIDDER'S RESPONSIBILITY TO PROVIDE PROPER SUPERINTENDENCE: The successful low bidder shall designate in writing to the Engineer the name of its authorized superintendent (Superintendent), who will be present at the job site whenever any work is in progress. The Superintendent shall be responsible for all work, receiving and implementing instructions from the Engineer in a timely manner. The cost for superintendence shall be considered incidental to the project.

If the Superintendent is not present at the site of work, the Engineer shall have the right to suspend the work as described under sub-section 5.5 c. and 7.20 - Suspension of Work of the General Conditions.

- S. LIQUIDATED DAMAGES: Liquidated damages in the amount specified in the Proposal will be assessed for each and every calendar day from and after the expiration of the time period stated in the Contract for the completion of the project.

- T. HIRING OF LOCAL LABOR: The Contractor shall hire local labor whenever practicable.

- U. WATER AND ELECTRICITY: The Contractor shall make all necessary arrangements and pay all expenses for water and electricity used in the construction of this project.
- V. PUBLIC CONVENIENCE AND SAFETY: The Contractor shall conduct construction operations with due regard to the convenience and safety of the public at all times. No materials or equipment shall be stored where it will interfere with the safe passage of public traffic. The Contractor shall provide, install, and maintain in satisfactory condition, all necessary signs, flares and other protective facilities and shall take all necessary precautions for the protection of the work and the convenience and safety of the public. The Engineer shall have the right to suspend the performance of the work in accordance with sub-section 7.20 - Suspension of Work of the General Conditions.
- W. WORK TO BE DONE WITHOUT DIRECT PAYMENT: Whenever the contract that the Contractor is to perform work or furnish materials of any kind for which no price is fixed in the contract, it shall be understood that the Contractor shall perform such work or furnish said materials without extra charge or allowance or direct payment of any sort. The cost of performing such work or furnishing said material is to be included by the Contractor in a unit price for the appropriate item unless it is expressly specified that such work or material is to be paid for as extra work.
- X. AS-BUILT DRAWINGS: As-built drawings, the intent of which is to record the actual in-place construction so that any future renovations or tie-ins can be anticipated accurately, shall be required. All authorizations given by the Engineer to deviate from the plans shall be drawn on the job site plans. All deviations from alignments, elevations and dimensions which are stipulated on the plans shall be recorded on the as-built drawings. Final as-built drawings shall be submitted to the Engineer by the Contractor at the end of the project in both hard copy and electronic copy in Adobe PDF format on CD ROM.
- Y. ASBESTOS CONTAINING MATERIALS: The use of asbestos containing materials or equipment is prohibited. The Contractor shall insure that all materials and equipment incorporated in the project are asbestos-free
- Z. WORKER SAFETY: The Contractor shall provide, install and maintain in satisfactory condition all necessary protective facilities and shall take all necessary precautions for the protection and safety of its workers in accordance with the Occupational Safety and Health Standards for the State of Hawaii. The Engineer shall have the right to suspend the performance of the work in accordance with sub-section 7.20 - Suspension of Work of the General Conditions.
- AA. TOILET FACILITIES: All toilet facilities constructed at the project site shall be in accordance with the Public Health Regulations of the State Department of Health (DOH). All necessary precautions shall be observed at the project site. The use of sanitary facilities shall be strictly enforced and workers violating these provisions shall be promptly discharged.
- BB. SIGNS: Whenever the project involves closing or obstructing any public thoroughfare, the Contractor shall provide traffic signs conforming to the applicable provisions of the current edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways", published by the Federal Highway Administration as directed by the Engineer for the purpose

of diverting or warning traffic prior to the construction area. All traffic signs shall bear proper wording stating thereon the necessary information as to diverting or warning traffic. **A project sign is required for this project.**

- CC. FIELD OFFICE AREA FOR DEPARTMENT: **Not required for this project.**
- DD. QUANTITIES: All bids will be compared on the basis of quantities of work to be done as shown in the Proposal; the quantities shown in the Unit Price items are estimated, being given as a basis for comparison of bids. The Board reserves the right to increase or decrease the quantities given under the items or delete items entirely as may be required during the progress of the work.
- EE. OTHER HEALTH MEASURES: Forms of work site exposure or conditions which may be detrimental to the health or welfare of workers or of the general public shall be eliminated or reduced to safe levels as required by the DOH codes, standards, and regulations. Suitable first aid kits and a person qualified to render first aid, as specified in the DOH regulations, shall be provided at all times when work is scheduled.
- FF. HAWAII BUSINESS OR COMPLIANT NON-HAWAII BUSINESS REQUIREMENT: Bidders (Contractors) shall be incorporated or organized under the laws of the State or be registered to do business in the State as a separate branch or division that is capable of fully performing under the contract, as stipulated in §3-122-112 HAR.
- GG. COMPLIANCE WITH §3-122-112 HAR:
As a condition for award of the contract the contractor shall be in compliance with the following requirements:
- A. **TAX CLEARANCE REQUIREMENTS (HRS Chapter 237)**: Bidder shall obtain a tax clearance certificate from the Hawaii State Department of Taxation (DOTAX) and the Internal Revenue Service (IRS). The certificate is valid for six months from the most recently approved stamp date on the certificate; the certificate must be valid on the date received by the Department.
 - B. Department of Labor (DLIR) **“Certificate of Compliance”**. (HRS Chapter 383 - Unemployment Insurance, Chapter 386 - Workers’ Compensation, Chapter 392 - Temporary Disability Insurance, and 393 – Prepaid Health Care): Bidder shall obtain a certificate of compliance from the Hawaii State Department of Labor and Industrial relations (DLIR). The certificate is valid for six months from the date of issue; certificates must be valid on the date received by the Department.
 - C. Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG) **“Certificate of Good Standing”**. Bidder shall obtain a certificate of good standing issued by the Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG). The certificate of good standing is valid for six months from the date of issue; certificates must be valid on the date received by the Department.

COMPLIANCE, DOCUMENTATION AND HAWAII COMPLIANCE EXPRESS

As a condition for award of the contract and as proof of compliance with the following requirements of 103D-310(c) HRS:

Vendors are required to be compliant with all appropriate state and federal statutes. Proof of compliance (compliance documentation) is required. See the HIePRO Buyer FAQ on the State Procurement website for more information.

Proof of compliance/documentation is obtained through Hawaii Compliance Express (HCE). Vendors shall register in Hawaii Compliance Express (HCE), a program separate from HIePRO. The annual subscription fee to utilize the HCE service is currently \$12.00.

Allow 2 weeks to obtain complete compliance status after initial registration. It is highly recommended that vendors subscribe to HCE prior to responding to a solicitation.

The vendor is responsible for maintaining compliance. If the vendor does not maintain timely compliance in HCE, an offer otherwise deemed responsive and responsible may not be awarded.

SPECIAL PROVISIONS

Amend INTERIM GENERAL CONDITIONS, dated October 1994, as follows:

Section 2 – Proposal Requirements and Conditions

1. **AMEND** Section 2.1 Qualification of Bidder with the following:

Written Notice of Intent to Bid or Offer: A written Notice of Intent to Bid is not required for the Solicitation.

Standard Qualification Questionnaire: Bidders may be required to complete a standard qualifications questionnaire. When requested, the information shall be furnished within two working days or longer at the discretion of the Engineer. Failure to furnish the requested information within the time allowed may be grounds for a determination of non-responsibility, in accordance with HRS Section 103D-310 and HAR Section 3-122-108.

Hawaii Business or Compliant Non-Hawaii Business Requirement: Bidders shall be incorporated or organized under the laws of the State or be registered to do business in the State as a separate branch or division that is capable of fully performing under the contract, as stipulated in §3-122-112 HAR. A certified letter is not required prior to bid opening.

Compliance with §3-122-112 HAR: As a condition for award of the contract and as proof of compliance with the requirements of 103D-310(c) HRS, the apparent low bidder shall furnish the required documents to the Department. If the valid required certificates are not submitted on a timely basis for award of a contract, a bidder otherwise responsive and responsible may not receive the award. Bidder is responsible to apply for and submit the following documents to the Department.

- A. Tax Clearance (HRS Chapter 237): Bidder shall obtain a tax clearance certificate from the Hawaii State Department of Taxation (DOTAX) and the Internal Revenue Service (IRS). The certificate is valid for six months from the most recently approved stamp date on the certificate; the certificate must be valid on the date received by the Department.
- B. Department of Labor (DLIR) “Certificate of Compliance”. (HRS Chapter 383 - Unemployment Insurance, Chapter 386 - Workers’ Compensation, Chapter 392 - Temporary Disability Insurance, and 393 – Prepaid Health Care): Bidder shall obtain a certificate of compliance from the Hawaii State Department of Labor and Industrial relations (DLIR). The certificate is valid for six months from the date of issue; certificates must be valid on the date received by the Department.
- C. Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG) “Certificate of Good Standing”. Bidder shall obtain a certificate of good standing issued by the Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG). The certificate of good standing is valid for six months from the date of issue; certificates must be valid on the date received by the Department.

Hawaii Compliance Express. Alternately, instead of separately applying for these certificates at the various state agencies, bidder may choose to use the Hawaii Compliance Express (HCE), which allows businesses to register online through a simple wizard interface at <http://vendors.hawaii.gov> to acquire a “Certificate of Vendor compliance” indicating that bidder’s status is compliant with requirements of §103D-310(c), HRS, shall be accepted for contracting and final payment purposes.

Bidders that elect to use the new HCE services will be required to pay an annual fee of \$15.00 to the Hawaii Information Consortium, LLC (HIC). Bidders choosing not to participate in the HCE program will be required to provide the paper certificates as instructed in the previous paragraphs.

2. **ADD** Section 2.4a, Pre-Bid Conferences

Required Pre-bid Conferences: For construction and design-build projects with an estimated value of \$500,000 or more and solicited under the competitive sealed bid method (103D-302 HRS); and for construction and design-build projects with an estimated value of \$100,000 or more and solicited under the competitive sealed proposal method (103D-303 HRS); a pre-bid conference is required.

Other Pre-Bid Conferences: The Department may require a pre-bid conference for construction or design-build projects that are below the dollar threshold listed in above or when projects have special or unusual requirements.

Other Conditions: The Department may require the prospective Bidders to make a physical inspection of the project site and make attendance at the pre-bid conference a condition for submitting an offer.

Nothing stated at the pre-bid conference shall change the solicitation unless a change is made by written addendum.

3. **DELETE** Section 2.5, Addenda and Interpretations, in its entirety and replace with the following:

“Discrepancies, omissions, or doubts as to the meaning of drawings and specifications should be communicated using the question and answer section on the HIEPRO solicitation for interpretation and must be received in the time frame set in the HIEPRO solicitation. Any interpretation, if made and any supplemental instructions will be in the form of written addenda to the plans and specifications and made available prior to the offer due date. It shall be the prospective bidder’s sole responsibility to verify and obtain any said addenda. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the contract documents.”

Section 3 – Award and Execution of Contract

1. **AMEND** Section 3.3, Award of Contract, by deleting “sixty (60)” and replacing with “ninety (90)” in the first paragraph.

2. **AMEND** Section 3.3, Award of Contract, by adding the following after the first paragraph:

“If the contract is not awarded within the ninety (90) days, the Department may request the successful Bidder to extend the time for the acceptance of its bid. The Bidder may reject such a request without penalty; and in such case, the Department may at its sole discretion make a similar offer to the next lowest responsive and responsible bidder and so on until a bid is duly accepted or until the Department elects to stop making such requests.”

3. **AMEND** Section 3.9, Notice to Proceed, by replacing the last paragraph with the following:

In the event the Notice to Proceed is not issued within three hundred and sixty-five (365) days after the date of bid opening, the Contractor may submit a claim for increased labor and materials costs (but not overhead costs) that will be incurred after 365 days after the date of bid opening plus the contract time allowed for performance of the work. Such claims shall be accompanied with the necessary documentation to justify the claim. No payments will be made for escalation costs that are not fully justified as determined by the State.

4. **ADD** Section 3.10, Protests:

“3.10 PROTESTS—Pursuant to Section 103D-701, Hawaii Revised Statutes, an actual or prospective offeror who is aggrieved in connection with the solicitation or award may submit a protest. Any protest shall be submitting in writing to the Chairperson, Department of Land and Natural Resources, 1151 Punchbowl Street, Honolulu, Hawaii 96813, or designee as specified in the solicitation.

A protest shall be submitted in writing within five (5) working days after the aggrieved person knows or should have known the facts giving rise thereto; provided that a protest based upon the content of the solicitation shall be submitted in writing prior to the date set for receipt of offers. Further provided that a protest of an award or proposed award shall be submitted within five (5) working days after the posting of the award of the contract.

The notice of award, if any, resulting from this solicitation shall be posted on the HIePRO website.

Section 5 – Control of Work

AMEND Section 5.8 Value Engineering Incentive by deleting “\$100,000” and replacing with “\$250,000” in the first paragraph.

Section 6 – Substitution of Materials and Equipment

ADD the following to Section 6.3 Sub-paragraph b:

4. If the substitution meets all the requirements of the specifications and plans.

Section 7 – Prosecution and Progress

1. **DELETE** Section 7.2d in its entirety and replace with the following:

“d. INSURANCE REQUIREMENTS

1. **Obligation of Contractor** - Contractor shall not commence any work until it obtains, at its own expense, all required herein insurance. Such insurance must have the approval of the Department as to limit, form and amount and must be maintained with a company authorized by laws of the State to issue such insurance in the State of Hawaii. Coverage by a “Non-Admitted” carrier is permissible provided the carrier has a AM Best’s Rating of “A-VII” or better.
2. All insurance described herein will be maintained by the Contractor for the full period of the contract and in no event will be terminated or otherwise allowed to lapse prior to written certification of final acceptance of the work by the Department.
3. Certificate(s) of Insurance acceptable to the Department shall be filed with the Engineer prior to commencement of the work. Certificates shall identify if the insurance company is a “captive” insurance company or a “Non-Admitted” carrier to the State of Hawaii. The Best’s Rating must be stated for the “Non-Admitted” carrier. Certificates shall contain a provision that coverages afforded under the policies will not be canceled or changed until at least thirty (30) days written notice has been given to the Engineer by registered mail. The insurance policies shall name the State of Hawaii, its officers and employees as an additional insured and such coverage shall be noted on the certificate. Should any policy be canceled before final acceptance of the work by the Department, and the Contractor fails to immediately

procure replacement insurance as specified, the Department, in addition to all other remedies it may have for such breach, reserves the right to procure such insurance and deduct the cost thereof from any money due to the Contractor.

4. Nothing contained in these insurance requirements is to be construed as limiting the extent of Contractor's responsibility for payment of damages resulting from its operations under this contract, including the Contractor's obligation to pay liquidated damages, nor shall it affect the Contractor's separate and independent duty to defend, indemnify and hold the Department harmless pursuant to other provisions of this contract. In no instance will the Department's exercise of an option to occupy and use completed portions of the work relieve the Contractor of its obligation to maintain the required insurance until the date of final acceptance of the work.
5. All insurance described herein shall cover the insured for all work to be performed under the contract, all work performed incidental thereto or directly or indirectly connected therewith, including traffic detour work or other work performed outside the work area, and all change order work.
6. The Contractor shall, from time to time, furnish the Engineer, when requested, satisfactory proof of coverage of each type of insurance required or a copy of the actual policies covering the work. Failure to comply with the Engineer's request may result in suspension of the work and shall be sufficient grounds to withhold future payments due the Contractor and to terminate the contract for Contractor's default.
7. If the Contractor is self-insured, it shall furnish, upon the request and the satisfaction of the Engineer, any documentation to demonstrate the ability to self-insure itself. The Engineer, from time to time, can conduct an audit to determine the ability of the Contractor to be self-insured. Failure to comply with the Engineer's request will be considered a material breach of the contract, and at the discretion of the Engineer, may be sufficient grounds to terminate the contract, suspend any work or withhold future payments.
8. It is the responsibility of the Contractor to notify the Department of any changes to its insurance policies or if the Contractor receives a notice of cancellation of any of its insurance policies. The Contractor will immediately provide written notice to the Department should the insurance policies evidenced on its Certificate of Insurance form be cancelled, limited in scope, or not renewed upon expiration.
9. In addition, the Contractor's insurance policies shall contain the following clauses:
 - (a) The State of Hawaii is added as an additional insured with respect to operations performed for the State of Hawaii.
 - (b) It is agreed that any insurance maintained by the State of Hawaii will apply in excess of, and not contribute with, insurance provided by this policy.
- 10. Types of Insurance** - The Contractor shall purchase and maintain insurance described below which shall provide coverage against claims arising out of the Contractor's operations under the contract, whether such operations be by the Contractor itself or by the subcontractor or by anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable.
 - (a) **Worker's Compensation.** The Contractor and all subcontractors shall obtain worker's compensation insurance for all persons whom they employ or may employ in carrying out the work under this contract. This insurance shall be in strict conformity with the

requirements of the most current and applicable State of Hawaii Worker's Compensation Insurance laws in effect on the date of the execution of this contract and as modified during the duration of the contract.

- (b) Commercial General Liability. The Contractor shall obtain General Liability insurance with a limit of not less than \$1,000,000 per occurrence and \$2,000,000 aggregate. The commercial general liability insurance shall include the State as an additional insured. The required limit of insurance may be provided by a single policy or with a combination of primary and excess policies.
- (c) Comprehensive Automobile Liability. The Contractor shall obtain Auto Liability insurance covering all owned, non-owned and hired autos with a combined single Limit of not less than \$1,000,000 per accident for bodily injury and property damage. The State shall be named as additional insured. The required limit of insurance may be provided by a single policy or with a combination of primary and excess policies.

Furthermore, the Contractor's commercial general liability insurance and automobile liability insurance shall include coverage for bodily injury, sickness, disease or death of any person, arising directly or indirectly out of, or in connection with, the performance of work under this contract.

The Contractor's property damage liability insurance shall provide for all damages arising out of injury to or destruction of property of others including the Department's, arising directly or indirectly out of or in connection with the performance of the work under this contract including explosion or collapse.

The Contractor shall either:

- i. Require each of its subcontractors to procure and to maintain during the life of its subcontract, subcontractors' comprehensive general liability, automobile liability and property damage liability insurance of the type and in the same amounts specified herein; or
- ii. Insure the activities of its subcontractors in its own policy.

The Contractor will be permitted, in cooperation with insurers, to maintain a self-insured retention for up to 25% of the per occurrence combined single limits of the commercial general liability and the automobile liability policies. The existence of the self-insured retention must be noted on the certificate of insurance coverage submitted to the Department or else it will be understood that the insurer is providing first dollar coverage for all claims. For all claims within the self-insured retention amount, the rights, duties and obligations between the Contractor and the Department shall be identical to that between a liability insurer and the Department, as an additional insured, as if there was no self-insured retention.

- (d) Builder's Risk Insurance. Unless included in the Specifications of this project, the Contractor shall not be required to provide builder's risk insurance. If required as noted in the Specifications, builder's risk insurance shall be provided during the progress of work and until final acceptance by the Department upon completion of the contract. It shall be "All Risk" (including but not limited to earthquake, windstorm and flood damage) completed value insurance coverage on all completed work and work in progress to the full replacement value thereof. Such insurance shall include the

Department as additional name insured. The Contractor shall submit to the Engineer for its approval all items deemed to be uninsurable. The policy may provide for a deductible in an amount of up to 25% of the amount insured by the policy. With respect to all losses up to any deductible amount, the relationship between the Contractor and the Department shall be that of insurer and additional insured as if no deductible existed”.

2. **DELETE** Section 7.16 in its entirety and replace with the following:

“RESPONSIBILITY FOR DAMAGE CLAIMS; INDEMNITY – The Contractor shall indemnify the State and the Department against all loss of or damage to the State’s or the Department’s existing property and facilities arising out of any act or omission committed in the performance of the work by the Contractor, any subcontractor or their employees and agents. Contractor shall defend, hold harmless and indemnify the Department and the State, their employees, officers and agents against all losses, claims, suits, liability and expense, including but not limited to attorneys’ fees, arising out of injury to or death of persons (including employees of the State and the Department, the Contractor or any subcontractor) or damage to property resulting from or in connection with performance of the work and not caused solely by the negligence of the State or the Department, their agents, officers and employees. The State or the Department may participate in the defense of any claim or suit without relieving the Contractor of any obligation hereunder. The purchase of liability insurance shall not relieve the Contractor of the obligations described herein.

The Contractor agrees that it will not attempt to hold the State and its Departments and Agencies and their officers, representatives, employees or agents, liable or responsible for any losses or damages to third parties from the action of the elements, the nature of the work to be done under these specifications or from any unforeseen obstructions, acts of God, vandalism, fires or encumbrances which may be encountered in the prosecution of the work.

The Contractor shall pay all just claims for materials, supplies, tools, labor and other just claims against the Contractor or any subcontractor in connection with this contract and the surety bond will not be released by final acceptance and payment by the Department unless all such claims are paid or released. The Department may, but is not obligated to, withhold or retain as much of the monies due or to become due the Contractor under this contract considered necessary by the Engineer to cover such just claims until satisfactory proof of payment or the establishment of a payment plan is presented.

The Contractor shall defend, indemnify and hold harmless the State and its Departments and Agencies and their officers, representatives, employees or agents from all suits, actions or claims of any character brought on account of any claims or amounts arising or recovered under the Worker’s Compensation Laws or any other law, by-law, ordinance, order or decree.

Section 8 – Measurement and Payment

1. **DELETE** Section 8.7a in its entirety and replace with the following:

- a. Tax Clearances from the State of Hawaii Department of Taxation and Internal Revenue Service, subject to section 103D-328, HRS, current within two months of issuance date indicating that all delinquent taxes levied or accrued under State Statutes against the contractor have been paid.

2. **ADD** Section 8.7d, Certificate of Compliance:

- d. A Certification from the Contractor affirming that the Contractor has, as applicable, remained in compliance with all laws as required by Section 103D-310, HRS, and Section 3-122-112, HAR. A

contractor making a false affirmation shall be suspended and may be debarred pursuant to section 103D-702, HRS.

1. Certification of Compliance for Final Payment, State Procurement Office Form-22. Must be Signed Original.

3. **ADD** Section 8.7e, Hawaii Compliance Express:

- e. In lieu of submitting the tax clearances from Taxation and IRS, and SPO Form -22, the Contractor may choose to use the Hawaii Compliance Express as described on page SP-1 of this Special Provisions.

DETAILED SPECIFICATIONS

DIVISION 1 – GENERAL REQUIREMENTS

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SECTION 01090 – STANDARD REFERENCES 7 pages
SECTION 01100 – ARCHAEOLOGICAL PROTECTION 1 page
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DIVISION 2 – SITEWORK

SECTION 02050 – DEMOLITION 2 pages
SECTION 02100 – SITE PREPARATION 2 pages
SECTION 02200 – EARTHWORK 5 pages
SECTION 02225 – TRENCHING, BACKFILLING, AND COMPACTING 7 pages
SECTION 02230 – AGGREGATE BASE COURSE 2 pages
SECTION 02512 – ASPHALTIC CONCRETE 5 pages
SECTION 02513 – PRIME COAT 2 pages
SECTION 02514 – TACK COAT 1 page
SECTION 02577 – PAVEMENT MARKING 2 pages
SECTION 02620 – HIGH DENSITY POLYETHYLENE (HDPE) PIPE 4 pages
SECTION 02700 – MARINA PIPING AND EQUIPMENT 3 pages

DIVISION 3 – CONCRETE

SECTION 03320 – MARINE CONCRETE 24 pages

DIVISION 10 – SPECIALTIES

SECTION 10110 – FIXED PIER 6 pages
SECTION 10300 – FIBER REINFORCED PLASTIC 2 pages

DIVISION 16 – ELECTRICAL WORK

SECTION 16011 – BASIC ELECTRICAL MATERIALS AND METHODS 6 pages
SECTION 16110 – MARINA ELECTRICAL WORK 3 pages

SECTION 01019
GENERAL SPECIFICATIONS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Work shall consist of furnishing all labor, tools, materials and equipment necessary and required to construct in place complete all work as indicated on the drawings and as specified herein.

1.02 GENERAL

- A. Construction Lines, Levels and Grades: The Contractor shall verify all lines, levels and elevations indicated on the drawings before any clearing, excavation or construction begins. Any discrepancy shall be immediately brought to the attention of the Engineer, and any change shall be made in accordance with the Engineer's instruction. The Contractor shall not be entitled to extra payment for failing to report the discrepancies before proceeding with any work whether within the area affected or not.
- B. Examination of Premises: The Contractor shall contact the Engineer and obtain permission before visiting the site.
- C. Notices: The Contractor shall notify the Engineer and give at least three (3) working days notice before starting any work.
- D. Disruption of Utility Services: All work related to the temporary disconnection of electrical system shall be pre-arranged with the Engineer so that any disruption of such services will be kept to a minimum. In the event temporary power hook-up is required, the Contractor shall provide the necessary services.
- E. Contractor's Operations
 - 1. The Contractor must employ, insofar as possible, such methods and means of carrying out the work so as not to cause any interruption or interference to the facility's operations. Where the Contractor's operations would result in interruptions which would hamper the operations of the facilities, the Contractor shall rearrange the schedule of work accordingly.
 - 2. The Contractor shall maintain safe passageway to and from the facility's occupied rooms and other occupied spaces for the user agency personnel and the public at all times.
- F. Contractor Use of Premises
 - 1. When the project includes paint to be disturbed that was applied prior to 1980, it shall be assumed to contain lead. The Contractor shall inform its employees, subcontractors, and all other persons engaged in the project that lead containing paints are present in the existing buildings at the job site and to follow the requirements of the Department of Labor and Industrial Relations, Division of Occupational Safety and Health, Title 12, Subtitle 8, Chapter 148, Lead Exposure in Construction, Hawaii Administrative Rules (Chapter 12-148, HAR).
- G. Parking Policy for Contractor

1. The Contractor and its employees will not be allowed to park in zones assigned to facility personnel.
 2. Areas to be used by the Contractor shall be as designated by the Engineer. Any lawn damaged by the Contractor shall be restored as instructed by the Engineer at no cost to the State.
- H. Toilet Accommodations: The Contractor may use the existing toilet facilities if so designated by the Engineer; however, it is the Contractor's responsibility to keep same clean and in a sanitary condition at all times.
- I. Protection of Property: The Contractor shall continually maintain adequate protection of all its work from damage and shall protect all property, including but not limited to buildings, equipment, furniture, grounds, vegetation, material, utility systems located at and adjoining the job site. The Contractor shall repair, replace or pay the expense of repair of damages resulting from its operations.
- J. Use of Power Driven Equipment: The Contractor is cautioned to take all necessary safety precautions to protect the facility personnel, and the public whenever power driven equipment is used.
- K. Safety: The Contractor shall carefully read and strictly comply with the requirements of the Hawaii Occupational Safety and Health Law, Chapter 396, Hawaii Revised Statutes, as amended, is applicable and made a part of the Contract.
- L. Clean Up Premises: The Contractor shall clean up and remove from premises all debris accumulated from operations as necessary or as directed. See also Section 7.25 of the General Conditions.
- M. Responsibility
1. The State will hold the Contractor liable for all the acts of Subcontractors and shall deal only with the prime Contractor in matters pertaining to other trades employed on the job. The Contractor shall be responsible for coordinating the work of all trades on the job.
 2. Should the Contractor discover any discrepancy in the plans or specifications, the Contractor shall immediately notify the Engineer before proceeding any further with the work, otherwise, the Contractor will be held responsible for any cost involved in correction of work placed due to such discrepancy.
- N. Cooperation with Other Contractors: The State reserves the right at any time to contract for or otherwise perform other or additional work within the contract zone limits of this Contract. The Contractor of this project shall, to the extent ordered by the State, conduct its work so as not to interfere with or hinder the progress or completion of the work performed by other contractors.
- O. Division of the Work: The Divisions and Sections into which these Specifications are divided shall not be considered an accurate or complete segregation of work by trades. This also applies to all work specified within each Section.
- P. Drawings and Specifications
1. Contractor shall not make alterations in the drawings and specifications. In the event the contractor discovers any errors or discrepancies, the Contractor shall immediately notify the Engineer in accordance with the General Conditions.

2. Where devices, or items, or parts thereof are referred to in the singular, it is intended that such reference shall apply to as many such devices, items or parts as are required to properly complete the work.
3. Specifications and drawings are prepared in abbreviated form and include incomplete sentences. Omission of words or phrases such as "the Contractor shall", "as shown on the drawings", "a", "an", and "the" are intentional. Omitted words and phrases shall be provided by inference to form complete sentences.

Q. Required Submittals

1. Required submittals as specified in the Technical Sections of these specifications include one or more of the following: Shop drawings; color samples; material samples; technical data; schedules of materials; schedules of operations; guarantees; operating and maintenance manuals; and as-built drawings.
2. The Contractor shall make a comprehensive list of the required submittals, by Specification Section, and submit this list to the Engineer within 15 days after notice to proceed.
3. **As-Built Drawings:** When as-built drawings are required for submittal, the following shall apply:
 - a. As-built drawings, the intent of which is to record the actual in-place construction so that any future renovations or tie-ins can be anticipated accurately, shall be required.
 - b. All deviations from alignments, elevations and dimensions which are stipulated on the plans shall be recorded in red on the as-built drawings.
 - c. The following procedure shall be followed:
 - i. Immediately after these changes are constructed in place, the Contractor shall record them on the field office plans.
 - ii. Within two weeks after final inspection of the project, the Contractor shall transfer the changes marked on the field office plans onto a clean copy of plans using a red pencil. Any deletions shall be so noted and redrawn as necessary. The Contractor shall stamp or mark the tracings "AS-BUILT", and also sign and date each drawing so marked.
 - iii. The Contractor shall submit the as-built drawings together with the marked-up field office plans to the Engineer.
 - iv. Any as-built drawing which the Engineer determines does not accurately record the deviation shall be corrected by the State, and the Contractor shall be charged for the services.

PART 2 - PART 2 – MATERIALS (not used)

PART 3 - PART 3 -EXECUTION (not used)

***** END OF SECTION *****

SECTION 01090
STANDARD REFERENCES

PART 1 - GENERAL

Wherever used in the project, the following abbreviations will have the meanings listed:

Abbreviation	Company
AA	Aluminum Association Incorporated 818 Connecticut Avenue, N.W. Washington, D.C. 20006
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W., Suite 225 Washington, D.C. 20001
ACI	American Concrete Institute P.O. Box 19150 Detroit, MI
AEIC	Association of Edison Illuminating Companies 51 East 42nd Street New York, NY 10017
AFBMA	Anti-Friction Bearing Manufacturer's Association 60 East 42nd Street New York, NY 10017
AGA	American Gas Association 8501 East Pleasant Valley Road Cleveland, OH 44131
AGMA	American Gear Manufacturer's Association 1330 Massachusetts Avenue, N.W. Washington, D.C.
AISC	American Institute of Steel Construction 101 Park Avenue New York, NY 10017
AISI	American Iron and Steel Institute 1000 16th Street, N.W. Washington, D.C. 20036
AITC	American Institute of Timber Construction 333 West Hampden Avenue Englewood, CO 80110
AMCA	Air Moving and Conditioning Association, Inc. 30 West University Drive Arlington Heights, IL 60004

ANSI	American National Standards Institute, Inc. 1430 Broadway New York, NY 10018
APA	American Plywood Association 1119 A Street Tacoma, WA 98401
API	American Petroleum Institute 1801 K Street N.W. Washington, DC 20006
ARI	Air-Conditioning and Refrigeration Institute 1814 North Fort Myer Drive Arlington, VA 22209
ASCE	American Society of Civil Engineers 345 East 47th Street New York, NY 10017
ASCII	American Standard Code for Information Interchange United States of America Standards Institute 1430 Broadway New York, NY 10018
ASE Code	American Standard Safety Code for Elevators, Dumbwaiter and Escalators American National Standards Institute 1430 Broadway New York, NY 10018
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers United Engineering Center 345 East 47th Street New York, NY 10017
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWPA	American Wood Preservers Association 1625 Eye Street Washington, DC 20006
AWS	American Welding Society 2501 N.W. 7th Street Miami, FL 33125
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235

CBM	Certified Ballast Manufacturers 2120 Keith Building Cleveland, OH 44115
CMAA	Crane Manufacturers Association of America, Inc. (Formerly called: Overhead Electrical Crane Institute - OECI) 1326 Freeport Road Pittsburgh, PA 15238
CRSI	Concrete Reinforcing Steel Institute 180 North La Salle Street Chicago, IL 60601
CSA	Canadian Standards Association 178 Rexdale Boulevard Rexdale, Ontario, M9W 1R3, Canada
DEMA	Diesel Engine Manufacturer's Association 122 East 42nd Street New York, NY 10017
DIS	Division of Industrial Safety California Department of Industrial Relations 2422 Arden Way Sacramento, CA 95825
EI	Edison Electric Institute 90 Park Avenue New York, NY 10016
EIA	Electronic Industries Association 2001 Eye Street N.W. Washington, DC 20006
EJMA	Expansion Joint Manufacturer's Association 331 Madison Avenue New York, NY 10017
ESO	Electrical Safety Orders, California Administrative Code, Title 8, Chap. 4, Subarticle 5 Office of Procurement, Publications Section P.O. Box 20191 8141 Elder Creek Road Sacramento, CA 95820
FEDSPEC	Federal Specifications General Services Administration Specification and Consumer Information Distribution Branch Washington Navy Yard, Bldg. 197 Washington, DC 20407
FEDSTDS	Federal Standards (see FEDSPECS)

FM	Factory Mutual Research 1151 Boston-Providence Turnpike Norwood, MA 02062
HEI	Heat Exchange Institute 122 East 42nd Street New York, NY 10017
HI	Hydraulic Institute 1230 Keith Building Cleveland, OH 44115
IAPMO	International Association of Plumbing and Mechanical Officials 5032 Alhambra Avenue Los Angeles, CA 90032
ICBO	International Conference of Building Officials 5360 South Workman Mill Road Whittier, CA 90601
ICEA	Insulated Cable Engineers Association P.O. Box P South Yarmouth, MA 02664
IEEE	Institute of Electrical and Electronics Engineers, Inc. 345 East 47th Street New York, NY 10017
IES	Illuminating Engineering Society C/O United Engineering Center 345 East 47th Street New York, NY 10017
ISA	Instrument Society of America 400 Stanwix Street Pittsburgh, PA 15222
JIC	Joint Industrial Council 7901 Westpark Drive McLean, VA 22101
MILSPEC	Military Specifications Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. 127 Park Street, N.E. Vienna, VA 22180
NAAMM	National Association of Architectural Metal Manufacturers 100 South Marion Street Oak Park, IL 60302

NACE	National Association of Corrosion Engineers P.O. Box 986 Katy, TX 77450
NEC	National Electric Code National Fire Protection Association 470 Atlantic Avenue Boston, MA 02210
NEMA	National Electrical Manufacturer's Association 155 East 44th Street New York, NY 10017
NESC	National Electric Safety Code American National Standards Institute 1430 Broadway New York, NY 10018
NFPA	National Forest Products Association (Formerly called: National Lumber Manufacturer's Association) 1619 Massachusetts Avenue, N.W. Washington, DC 20036
OSHA	Occupational Safety and Health Act U.S. Department of Labor San Francisco Regional Office 450 Golden Gate Avenue, Box 36017 San Francisco, CA 94102
PPIC	The Plumbing & Piping Industry Council, Inc. Suite 402 510 Shatto Place Los Angeles, CA 90020
SAE	Society of Automotive Engineers 2 Pennsylvania Street New York, NY 10001
SAMA	Scientific Apparatus Makers Association One Thomas Circle Washington, DC 20005
SBCC	Southern Building Code Congress 1116 Brown-Marx Building Birmingham, AL 35203
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc. 8224 Old Courthouse Road Tysons Corner Vienna, VA 22180
SSPWC	Standard Specifications for Public Works Construction Building News, Inc. 3055 Overland Avenue Los Angeles, CA 90034

TEMA	Tubular Exchanger Manufacturer's Association 331 Madison Avenue New York, NY 10017
UBC	Uniform Building Code Published by ICBO
UL	Underwriters Laboratories Inc. 207 East Ohio Street Chicago, IL 60611
UMC	Uniform Mechanical Code Published by ICBO
UPC	Uniform Plumbing Code Published by IAPMO
USBR	Bureau of Reclamation U.S. Department of Interior Engineering and Research Center Denver Federal Center, Building 67 Denver, CO 80225
WWPA	Western Wood Products Association (Formerly called: West Coast Lumberman's Association - WCLA) Yeon Building Portland, CA 97204

PART 2 - PART 2 - PRODUCTS (NOT USED)

PART 3 - PART 3 - EXECUTION (NOT USED)

***** END OF SECTION *****

SECTION 01100
ARCHAEOLOGICAL PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. This section covers the requirements for the protection and preservation of historical resources.
- B. The project site is located within the Lahaina National Historic Landmark District.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

- A. In the event that any previously unknown archaeological properties (such as artifacts; subsurface deposits of bone, shell or charcoal; or rock or coral alignments, paving or walls) or human remains are encountered, the Contractor shall suspend all work in the immediate area of the discovery and notify the Engineer and the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD) at 808-243-5169 as soon as possible. The potential significance of the discovery will be agreed upon and mitigation needs, as appropriate for non-burial sites, will be discussed and resolved with the SHPD archaeological staff. Notes, scaled maps, and photographic documentation will be recorded of cultural features that are encountered during excavations.
- B. If human remains are discovered, the County of Maui Police Department shall be notified in addition to the Engineer and SHPD. No work in the immediate area of the find shall proceed until SHPD has been able to assess the discovery as required under Chapter 6E-43.6, Hawaii Revised Statutes and Chapters 13-265 and 13-300, Hawaii Administrative Rules. Utmost care will be taken to ensure that any associated items or stratigraphic context are not further disturbed. No remains will be removed or further disturbed without SHPD determination. SHPD will assume the lead in consulting with the recognized descendants and the Maui Island Burial Council.
- C. Subsequently, if the State requires it, the Contractor shall engage the services of a professional archaeologist to assist the State in meeting historic preservation requirements and coordination with SHPD.
- D. A Kupuna, a person knowledgeable of the cultural area, and approved by the Engineer, should be invited to give a cultural perspective during the preconstruction orientation. Cost to consult with the Kapuna will be paid for by the Contractor.
- E. The Contractor shall hire an archaeologist to prepare an Archaeological Monitoring Plan to be submitted to SHPD; and to monitor ground disturbing activities if required by SHPD.

- F. A draft Archaeological Monitoring Report shall be submitted within 90 days of completion of monitoring fieldwork to the SHPD for review and approval. A final report will be submitted within 30 days of any review comments being received.

***** END OF SECTION *****

SECTION 01300
SUBMITTALS

PART 1 - GENERAL

1.01 SUBMITTALS

- A. Shop drawings shall be required for:
 - 1. Electrical and Mechanical Work.
 - 2. Fixed Pier
 - 3. FRP Grating
 - 4. Gangway
 - 5. Project Sign
 - 6. Mooring Assembly
 - 7. Ladder Assembly
 - 8. Fire Extinguisher and Life Ring Enclosures
 - 9. Harbor Use Navigation Plan and Safety Plan
 - 10. Any others as called for in the plans, specifications or by the Engineer.

- B. Other required submittals shall include:
 - 1. Fixed Pier Design Team Qualifications (due after Bid and prior to contract award)
 - 2. Fixed Pier Design Drawings sealed by Hawaii Licensed Structural Engineer
 - 3. Piping materials.
 - 4. Shoring and Sheeting Plan
 - 5. Fiber Reinforced Plastic Grating
 - 6. Site Specific Best Management Practices
 - 7. Electrical System
 - 8. Manufacturer's Data
 - 9. Certificates of Warranty
 - 10. Phasing Plan

11. Any others as called for in the plans, specifications, or by the Engineer.

1.02 BIDDER'S SPECIAL RESPONSIBILITY FOR COORDINATING CONTRACTUAL WORK AND SUBMITTALS:

- A. The Contractor is responsible for the coordination of all contractual work and submittals.
- B. The Contractor shall have a rubber stamp made up in the following format:

CONTRACTOR NAME

PROJECT: _____

JOB NO: _____

THIS SUBMITTAL HAS BEEN CHECKED BY THIS GENERAL CONTRACTOR. IT IS CERTIFIED CORRECT, COMPLETE, AND IN COMPLIANCE WITH CONTRACT DRAWINGS AND SPECIFICATIONS. ALL AFFECTED CONTRACTORS AND SUPPLIERS ARE AWARE OF THIS REQUIREMENT AND WILL INTEGRATE THIS INTO THEIR OWN WORK.

DATE RECEIVED _____

SPECIFICATION SECTION _____

SPECIFICATION PARAGRAPH _____

DRAWING NUMBER _____

SUBCONTRACTOR NAME _____

SUPPLIER NAME _____

MANUFACTURER NAME _____

CERTIFIED BY: _____

- C. This stamp, "filled in", should appear on the title sheet of each shop drawing, on a cover sheet of submittals in an 8-1/2" x 11" format, or on one face of a cardstock tag (min. 3" x 6") tied to each sample. The tag on the samples should state what the sample is so that, if the tag is accidentally separated from the sample, it can be matched up again. The back of this tag will be used by the Engineer for his receipt, review, and log stamp and for any comments that relate to the sample.
- D. All submittals for material, equipment, and shop drawings listed in the contract documents, including dimensioned plumbing shop drawings, shall be required and shall be reviewed by the Engineer, prior to any ordering of materials and equipment.

- E. Unless otherwise noted, the Contractor shall submit to the Engineer for his review TWO ELECTRONIC COPIES (ONE SIGNED, ONE UNSIGNED) of all shop drawings, piping layout, and/or catalog cuts for fabricated items and manufactured items (including mechanical and electrical equipment) required for the construction. Drawings shall be submitted in sufficient time to allow the Engineer not less than twenty regular working days for examining the drawings.
- F. The drawing shall be accurate, distinct, and complete and shall contain all required information, including satisfactory identification of items, units and assemblies in relation to the contract drawings and specifications.
- G. Unless otherwise approved by the Engineer, shop drawings shall be submitted only by the Contractor, who shall indicate by a signed stamp on the drawings or other approved means that the Contractor has checked the shop drawings and that the work or equipment shown is in accordance with contract requirements and has been checked for dimensions and relationship with work of all other trades involved. All deviations from the plans and specifications shall be listed. The practice of submitting incomplete or unchecked shop drawings for the Engineer to correct or finish will not be acceptable, and shop drawings which, in the opinion of the Engineer, clearly indicate that they have not been checked by the Contractor will be considered as not complying with the intent of the contract documents and will be returned to the Contractor for resubmission in the proper form.
- H. When the shop drawings have been reviewed by the Engineer, two sets of submittals will be returned to the Contractor appropriately stamped. If major changes or corrections are necessary, the drawing may be rejected and one set will be returned to the Contractor with such changes or corrections indicated, and the Contractor shall correct and TWO ELECTRONIC COPIES (ONE SIGNED, ONE UNSIGNED) of the drawings, unless otherwise directed by the Engineer. No changes shall be made by the Contractor to the resubmitted shop drawings other than those changes indicated by the Engineer. The resubmittal shall be so indicated on the shop drawing.
- I. The review of such drawings and catalog cuts by the Engineer shall not relieve the Contractor from responsibility for correctness of the dimensions, fabrication details, and space requirements or for deviations from the contract drawings and specifications, unless the Contractor has called attention to such deviations, in writing, by a letter accompanying the drawings and the Engineer approved the change or deviations, in writing, at the time of submission; nor shall review by the Engineer relieve the Contractor from the responsibility for errors in the shop drawings. When the Contractor does call such deviations to the attention of the Engineer, he shall state in his letter whether or not such deviations involve any deduction or extra cost adjustment.
- J. The approval of the above drawings, lists, prints, specifications, or other data shall in no way release the Contractor from his responsibility for the proper fulfillment of the requirements of this contract nor for fulfilling the purpose of the installation nor from his liability to replace the same should it prove defective or fail to meet the specified requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

***** END OF SECTION *****

SECTION 01505
MOBILIZATION AND DEMOBILIZATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Description: This section covers the requirements for mobilization and demobilization.

1.02 MOBILIZATION

- A. Mobilization shall consist of the transporting, assembling, constructing, installing, and making ready for use at the job site, all the equipment, machinery, structures, utilities, materials, labor, and incidentals necessary to do the work covered by this contract.

1.03 DEMOBILIZATION

- A. Demobilization shall consist of the dismantling and removal of the above-mentioned equipment, machinery, structures, utilities, materials, and incidentals, and the cleaning up of the site.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GUIDELINES

- A. If the Contractor utilizes private lands other than the sites provided by the Department for mobilization purposes, the provisions of this section shall apply, and the mobilization and demobilization work on said private lands shall be in accordance with the agreement between the Contractor and the land owner.
- B. Any and all additional mobilization or demobilization costs in excess of the maximum amounts specified in the Proposal shall be included in the appropriate unit prices bid in the Proposal. The Contractor shall not receive any compensation for mobilization and demobilization in addition to those specified in the Proposal.
- C. All equipment, machinery, buildings, utilities and incidentals mobilized and demobilized under this section shall remain the property of the Contractor.

***** END OF SECTION *****

SECTION 01530

BARRICADES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Description. This work shall consist of furnishing, installing and maintaining barricades in accordance with the requirements of the contract.

Barricade application shall be provided for in the latest edition of the FHWA publication, Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), and as amended.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Lumber: Lumber for rails, frames and braces shall be dry, sound, undamaged, well seasoned, and free from any defect which may impair their strength and durability.
- B. Hardware: Nails shall be galvanized wire nails. As many and as large a size as is practicable shall be used.
- C. Paints: Paints shall be exterior enamel paint of the best grade or first line as made by approved manufacturers.
- D. Sheet Reflecting Material: Sheet reflecting material shall conform to the applicable requirements of Subsection 712.20(C) of the "Standard Specifications for Road and Bridge Construction".
- E. Alternate Designs: Alternate barricade designs such as plastic molded barricades may be used subject to the Engineer's approval. The Contractor shall submit shop drawings or catalog cuts for approval.

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

- A. General: Barricades shall be constructed in a first class, workmanlike manner in accordance with details shown on the plans and as specified herein.

Barricades shall be in good condition and approved by the Engineer for use within the project limits. Barricade application and installation shall be as shown on the plans and as directed by the Engineer in accordance with the guidelines provided in the latest edition of the FHWA publication, Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), and any amendments or revisions thereof as may be made from time to time.

Sand bags or other approved weights shall be provided where required or as directed by the Engineer. Sand bags or other approved weights shall not be placed on any striped barricade rail.

Steady burn and/or flashing lamps shall be required on selected barricades used during hours of darkness. Locations shall be as shown on the plans and as directed by the Engineer. Lamps shall be attached on the barricade ends closest to the traveled way and shall be visible to the motorist.

Barricades furnished and paid for as provided for as provided herein may be used for temporary detours, construction phasing, or other temporary traffic control work.

Barricades furnished and paid for use in temporary detours or construction phasing may be used for permanent location called for on the plans.

Upon completion of the construction work, barricades shall be left in place, relocated, or removed and disposed of as shown on the plans or as directed by the Engineer. Barricades left in place, or relocated to new permanent locations shall become the property of the State. Barricades directed to be removed and disposed of shall become the property of the Contractor.

- B. Painting: Wooden rails, frames and braces shall be given a prime coat and 2 finish coats of new white exterior enamel paint. Rail faces to be reflectorized may be left unpainted unless otherwise specified or directed.
- C. Reflectorization: Reflectorization of barricade rails shall be done in a first class, workmanlike manner and the attachment of reflective sheeting shall be as shown on the plans, specified herein, or as directed and approved by the Engineer.

Both vertical faces of each barricade rail shall be reflectorized as shown on the plans.

Wooden rails shall be reflectorized with one of the following:

- 1. Reflective sheeting specified in Subsection 712.20(C)(4) of the "Standard Specifications for Road and Bridge Construction" and backed with a 26 gage galvanized steel sheet, or
 - 2. a hardened aluminum backed reflective sheeting as specified in Subsection 712.20(C)(5) of the "Standard Specifications for Road and Bridge Construction."
- D. Color: Rails, frames and braces shall be white.

The front and back faces of barricade rails shall have 6-inch wide alternative colored and white striped sloping downward toward the traveled way at an angle of 45 degrees with the vertical. The colored stripes shall be either orange or red in accordance with the following requirements:

- 1. Orange and white stripes shall be used in the following conditions:
 - a. Construction work.
 - b. Detours.
 - c. Maintenance work.

2. Red and white stripes shall be used in the following conditions:
 - a. On roadways with no outlet (ie. dead-ends, cul-de-sacs).
 - b. Ramps or lanes closed for operational purposes.
 - c. Permanent or semipermanent closure or termination of a roadway.
- E. Maintenance: Barricades shall be kept in good condition throughout their usage during construction until the end of the contract.
- F. The Contractor shall repair, repaint, clean or replace the barricades as required and as directed by the Engineer to maintain their effectiveness and appearance.

The Constructor shall immediately replace all lost, stolen or damaged barricades, lamps, sand bags and other approved weights.

Barricades used during construction phasing, temporary detours or other temporary traffic control work shall be cleaned and repaired as necessary, prior to being relocated to a permanent location shown on the plans or as directed.

No extra payment will be made for any repair work, repainting, or cleaning of barricades. The Engineer shall determine the suitable condition of each barricade and shall determine when each barricade shall be repaired, repainted or cleaned.

***** END OF SECTION *****

SECTION 01567

ENVIRONMENTAL PROTECTION AND POLLUTION CONTROL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Rubbish Disposal

1. No burning of debris and/or waste materials shall be permitted on the project site.
2. No burying of debris and/or waste material except for materials which are specifically indicated elsewhere in these specifications as suitable for backfill shall be permitted on the project site.
3. All unusable debris and waste material shall be hauled away to an appropriate off-site dump area. During loading operations, debris and waste materials shall be watered down to allay dust.
4. No dry sweeping shall be permitted in cleaning rubbish and fines which can become airborne from floors or other paved areas. Vacuuming, wet mopping or wet or damp sweeping is permissible.
5. Enclosed chutes and/or containers shall be used for conveying debris from above to ground floor level.
6. Clean up shall include the collection of all waste paper and wrapping materials, cans, bottles, construction waste materials and other objectionable materials, and removal as required. Frequency of clean up shall coincide with rubbish producing events.

B. Dust

1. The Contractor shall prevent dust from becoming airborne at all times including non working hours, weekends and holidays in conformance with the State Department of Health, Administrative Rules, Title 11, Chapter 60 Air Pollution Control.
2. The method of dust control and costs shall be the responsibility of the Contractor. Methods of dust control shall include the use of water, chemicals or asphalt over surfaces which may create airborne dust.
3. The Contractor shall be responsible for all damage claims in accordance with Section 7.16 "Responsibility for Damage Claims" of the GENERAL CONDITIONS.

C. Noise

1. Noise shall be kept within acceptable levels at all times in conformance with the State Department of Health, Administrative Rules, Title 11, Chapter 46 Community Noise Control. The Contractor shall obtain and pay for the Community Noise Permit from the State Department of Health when the construction equipment or other devices emit noise at levels exceeding the allowable limits.

2. All internal combustion engine powered equipment shall have mufflers to minimize noise and shall be properly maintained to reduce noise to acceptable levels.
3. Pile driving operations shall be confined to the period between 9:00 a.m. and 5:30 p.m., Monday through Friday. Pile driving will not be permitted on weekends and legal State and Federal holidays.
4. Starting up of construction equipment meeting allowable noise limits shall not be done prior to 6:45 a.m. without prior approval of the Engineer. Equipment exceeding allowable noise levels shall not be started up prior to 7:00 a.m.

D. Erosion

1. During interim grading operations, the grade shall be maintained so as to preclude any damage to adjoining property from water and eroding soil.
2. Temporary berms, cut off ditches and other provisions which may be required because of the Contractor's method of operations shall be installed at no cost to the State.
3. Drainage outlets and silting basing shall be constructed and maintained as shown on the plans to minimize erosion and pollution of waterways during construction.

E. Silt and Debris Containment

1. Prior to any work over water, Contractor shall install floating silt curtains extending to full harbor depth to provide containment of silt and debris from the construction activities. The limits of the silt curtains shall be changed from time-to-time to provide full containment of construction activities with minimum area of containment required.
2. Remove piers in sections and provide floating platforms during all stages of work to prevent dust and debris from entering the water.
3. Should there be any observed change in water quality (turbidity), construction activities shall immediately cease and corrective actions taken to prevent and contain any further discharge or pollution. Clean up to remove any contaminants shall be the contractor's responsibility and shall commence immediately.

F. Others

1. Wherever trucks and/or vehicles leave the site and enter surrounding paved streets, the Contractor shall prevent any material from being carried onto the pavement. Wastewater shall not be discharged into existing streams, waterways, or drainage systems such as gutters and catch basins unless treated to comply with the State Department of Health water pollution regulations.
2. Trucks hauling debris shall be covered as required by PUC Regulation. Trucks hauling fine materials shall be covered.
3. No dumping of waste concrete will be permitted at the job site.
4. Except for rinsing of the hopper and delivery chute, and for wheel washing where required, concrete trucks shall not be cleaned on the jobsite.

5. Except in an emergency, such as a mechanical breakdown, all vehicle fueling and maintenance shall be done in a designated area. A temporary berm shall be constructed around the area when runoff can cause a problem.
6. When spray painting is allowed such spray painting shall be done by the "airless spray" process. Other types of spray painting will not be allowed.

G. Suspension of Work

1. Violations of any of the above requirements or any other pollution control requirements which may be specified in the Technical Specifications herein shall be cause for suspension of the work creating such violation. No additional compensation shall be due the Contractor for remedial measures to correct the offense. Also, no extension of time will be granted for delays caused by such suspensions.
2. If no corrective action is taken by the Contractor within 72 hours after a suspension is ordered by the Engineer, the State reserves the right to take whatever action is necessary to correct the situation and to deduct all costs incurred by the State in taking such action from monies due the Contractor.
3. The Engineer may also suspend any operations which he feels are creating pollution problems although they may not be in violation of the above mentioned requirements. In this instance, the work shall be done by force account as described in Subsection 4.2b "Additional Work" of the GENERAL CONDITIONS and paid for in accordance with Subsection 8.4b "Force Account Work" therein. The count of elapsed working days to be charged against the contract in this situation shall be computed in accordance with Subsection 7.18 "Contract Time" of the GENERAL CONDITIONS.

H. Environmental Permits

The contractor shall be required to comply will the conditions of all environmental permits and compliance documents associated with the project to include, but not be limited to, the following:

1. U.S. Army Corps of Engineers Permit
2. State Department of Health, Section 401 Water Quality Certification
3. County of Maui, Historic District Approval
4. Best Management Practices Plan
5. Applicable Monitoring and Assessment Plan (Water Quality Monitoring)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

*** END OF SECTION ***

SECTION 01581
PROJECT SIGN

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Furnish all labor, materials and equipment necessary to construct and install all project sign as specified hereinafter.

1.02 SUBMITTAL

- A. The contractor shall provide the Engineer with review TWO ELECTRONIC COPIES (ONE SIGNED, ONE UNSIGNED) shop drawings of the project sign for review and approval by the Engineer prior to ordering the sign.

1.03 LETTER STYLE

- A. Copy is centered and set in Adobe Type Futura Heavy. If this specific type is not available, Futura Demi Bold may be substituted. Copy should be set and spaced by a professional typesetter and enlarged photographically for photo stencil screen process.

1.04 ART WORK

- A. Constant elements of the sign layout - frame, outline, stripe, and official state information - may be duplicated following drawing measurements, or be reproduced and enlarged photographically using a layout template if provided. The "STATE OF HAWAII" masthead should be reproduced and enlarged as specified, using the artwork provided.

1.05 TITLES

- A. The specific major work of the project under construction is emphasized by using 3-3/4" type, all capitals. Secondary information such as location or buildings uses 2-1/4" type, all capitals. Other related information of lesser importance uses letter heights as indicated on 01581-3, upper / lower case letters.
- B. Design should follow the example on page 01581-3.

PART 2 - PART 2 - PRODUCTS

2.01 MATERIALS

- A. LUMBER
 - 1. Panel is 3/4" exterior grade high density overlaid plywood, with resin-bonded surfaces on both sides.
 - 2. 4"x4" sign posts shall be Douglas Fir No. 1 or better.
- B. PAINTS & INKS

Screen print inks are matte finish. Paints are satin finish, exterior grade. References to Ameritone Color Key Paint are for color match only.

COLOR:	1.	1BL10A	Bohemian Blue
	2.	2H16P Softly (White)	
	3.	2VR2A	Hot Tango (Red)
	4.	1M52E	Tokay (Gray)

C. CONCRETE

Concrete shall be class B with a 2,500 psi 28-day compressive strength.

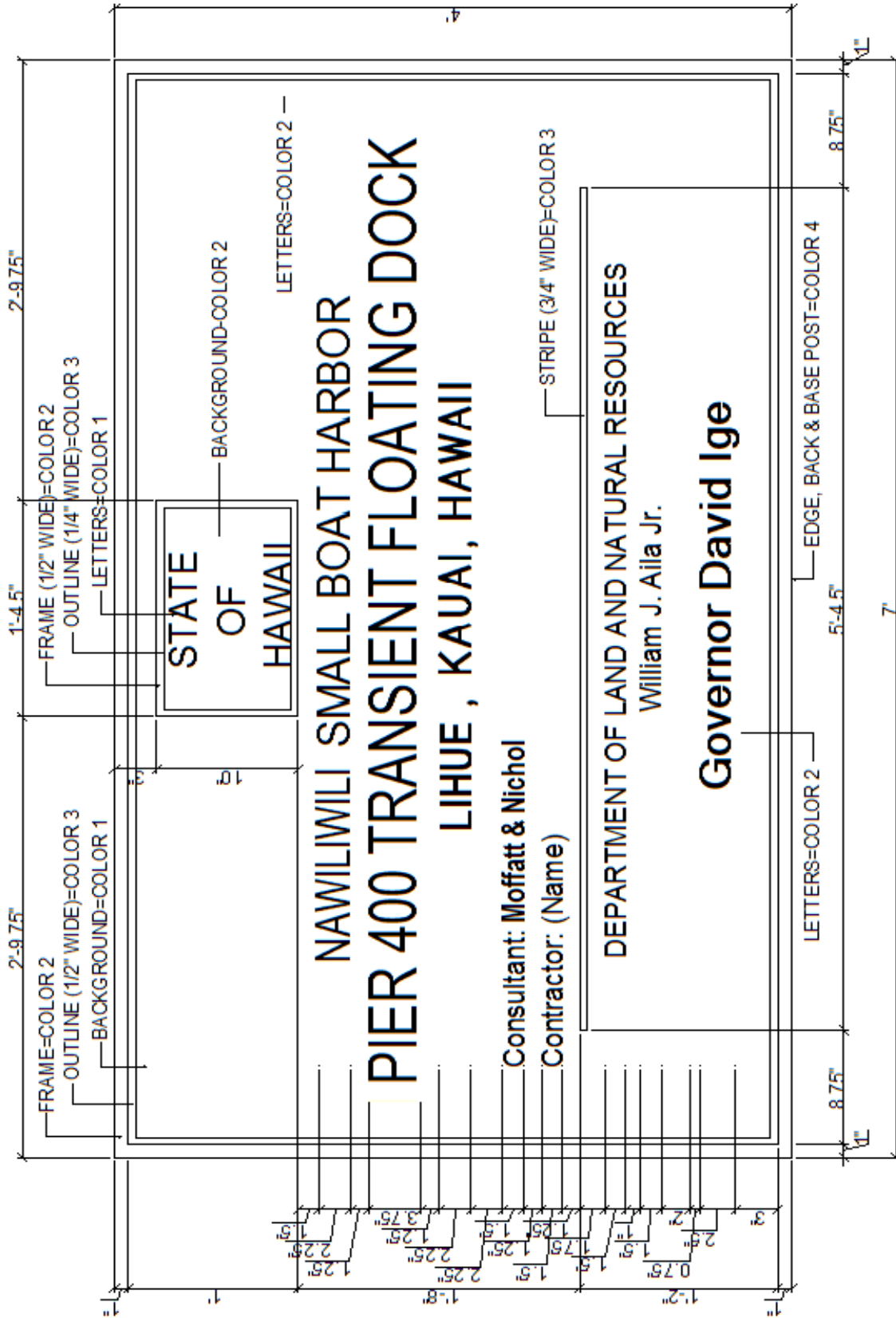
PART 3 - PART 3 - EXECUTION

3.01 GENERAL

- A. The Project Sign shall be constructed with new materials as specified above.
- B. The Project sign shall be installed at the location indicated on the drawings or as designated by the Engineer. The project sign shall be erected upon commencement of work.

3.02 MEASUREMENTS AND PAYMENT

- A. The construction of the project sign, including all equipment, labor and material necessary to furnish and install the project sign will be included within an appropriate lump sum item on the Bid Form



*** END OF SECTION ***

Project Sign
01581-3

NOTE: Number of signs required 1

SECTION 02050
DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

- A. The work covered by this Section includes the furnishing of all material and equipment and the performing of all labor to complete the demolition, removal and disposal of structures off the property as shown on the Contract Drawings and as herein specified or directed by the State's Representative. Unless otherwise noted within the Contract Documents, the Contractor shall be responsible for disposing of all demolition and removal items off-site. During the demolition work, adjacent tenant equipment and storage areas shall be protected from damage. Any damage resulting from demolition work shall be repaired or replaced by the Contractor to the satisfaction of the State's Representative at no additional cost to the State. Cleanup of all debris shall be done by the Contractor.

1.02 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. Unless otherwise indicated the most recent edition of the publication, including any revisions, shall be used.
- B. AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)
 - ASSE/SAFE A10.6 Safety Requirements for Demolition Operations
- C. U.S. ARMY CORPS OF ENGINEERS (USACE)
 - EM 385-1-1 Safety -- Safety and Health Requirements
- D. U.S. FEDERAL AVIATION ADMINISTRATION (FAA)
 - FAA AC 70/7460-1 (Rev K) Obstruction Marking and Lighting
- E. U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
 - 40 CFR 61 National Emission Standards for Hazardous Air Pollutants
 - 40 CFR 82 Protection of Stratospheric Ozone
 - 49 CFR 173.301 Shipment of Compressed Gases in Cylinders and Spherical Pressure Vessels

1.03 DEMOLITION REQUIREMENTS

- A. Do not begin demolition or deconstruction until authorization is received from the State. **The work of this section is to be performed in a manner that maximizes salvage and recycling of materials.** Remove rubbish and debris from the project site daily, unless otherwise directed; do not allow accumulations inside or outside the site(s). The work includes demolition, deconstruction, salvage of identified items and materials, and removal of resulting rubbish and debris. Store materials that cannot be removed daily in areas specified by the State's Representative. In the interest of occupational safety and health, perform the work in accordance with **EM 385-1-1**, Section 23, Demolition, and other applicable Sections.

1.04 SUBMITTALS

- A. The Contractor shall submit the following in accordance with Contract Documents. Note that approval of the submittals by the State's Representative shall not be construed as relieving the Contractor from responsibility for compliance with the specifications nor from responsibility of errors of any sort in the submittals.
- B. Preconstruction Submittals
 - 1. Existing Conditions
 - 2. Demolition Plan: Submit a demolition plan including sequence of work and methods for demolishing existing pier structures. Include plan for capture, control, and transport of demolished materials.
 - 3. Work Procedures: Proposed salvage, demolition, deconstruction, and removal procedures for approval before work is started.

1.05 REGULATORY AND SAFETY REQUIREMENTS

- A. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSE/SAFE A10.6.
- B. Notifications
 - 1. General Requirements: Furnish timely notification of demolition, deconstruction, and renovation projects to State and local authorities. Notify the State's Representative in writing 10 working days prior to the commencement of work.

1.06 DUST AND DEBRIS CONTROL

- A. Prevent the spread of dust and debris to adjacent building and structures, and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, flooding, sedimentation of harbor waters or storm sewers, or other pollution.

1.07 PROTECTION

- A. Traffic Control Signs
- B. Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the State's Representative prior to beginning such work.

- C. Contractor must provide a minimum of 2 aviation red or high intensity white obstruction lights on temporary structures (including cranes) over 100 feet above ground level. Light construction and installation must comply with FAA AC 70/7460-1. Lights must be operational during periods of reduced visibility, darkness, and as directed by the State's Representative. Maintain the temporary services during the period of construction and remove only after permanent services have been installed and tested and are in operation.
- D. Existing Conditions Documentation: Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the State's Representative showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document.
- E. Items to Remain in Place: Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the State. Repair or replace damaged items as approved by the State's Representative. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract. Do not overload structural elements or pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the State's Representative prior to performing such work. Any damage to the adjacent structures or pavements during demolition shall be made good to the satisfaction of the State's Representative at the Contractor's expense. Stop work immediately if adjacent structures appear to be in danger.
- F. Existing Construction Limits and Protection: Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove snow, dust, dirt, and debris from work areas daily.
- G. Weather Protection: Protect materials and equipment from the weather at all times. Have materials and workmen ready to provide adequate and temporary covering of exposed areas and materials where necessary.
- H. Utility Service: Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Locate and mark utilities to remain with highly visible tags or flags, with identification of utility type. Coordinate work with utility companies and notify before starting work. Comply with their requirements and obtain required permits. Do not disrupt public utilities without permit from the authority having jurisdiction. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to the State. Do not close, shut off, or disrupt existing utility branches or take-off that are in use without at least 3 days prior written notification to the State. The cost of either relocation or removal and plugging of utilities shall be incidental to the demolition and removal work. Provisions shall be made to install temporary services to supply the adjacent structures where necessary.

- I. Facilities: Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Piles, caps, sheet piles and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the State's Representative. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.
- J. Protection of Personnel: Before, during and after the demolition and deconstruction work the Contractor shall continuously evaluate the condition of the structures being demolished and deconstructed and take immediate action to protect all personnel working in and around the project site. No area, section, or component of piles, caps, decking, sheeting, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.08 BURNING

- A. The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.09 RELOCATIONS

- A. Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Items to be relocated which are damaged by the Contractor shall be repaired or replaced with new undamaged items as approved by the State's Representative at no additional cost to the State.

1.10 REQUIRED DATA

- A. Prepare a Demolition Plan. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Identify components and materials to be salvaged for reuse or recycling with reference to paragraph Existing Facilities to be Removed. Append tracking forms for all removed materials indicating type, quantities, condition, destination, and end use. Coordinate with Waste Management Plan. State provisions that will be used for securing the safety of the workers throughout the performance of the work. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by the State's Representative prior to the start of work.

1.11 ENVIRONMENTAL PROTECTION

- A. Comply with the requirements in Section 01568-Environmental Permits and Pollution Control.

1.12 USE OF EXPLOSIVES

- A. Use of explosives will not be permitted.

PART 2 - PRODUCTS

2.01 FILL MATERIAL

- A. Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill voids, depressions or excavations resulting from demolition or deconstruction of structures.

2.02 REMOVED MATERIALS

- A. All material and debris, either existing or resulting from demolition and removal work, which are not designated to be salvaged or relocated, shall become the property of the Contractor and shall be removed from the property and disposed of off-site at an approved facility. The Contractor shall exercise care in performing demolition and removal work in order not to damage adjacent structures or materials to be reused or stored for future use as directed by the State's Representative.

PART 3 - EXECUTION

3.01 EXISTING FACILITIES TO BE REMOVED

- A. Inspect and evaluate existing structures on site for reuse. Existing construction scheduled to be removed for reuse shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Unless stated otherwise, salvage materials or other reuse of materials shall be for temporary structures and utility services for temporary installations only, and in no case shall salvage materials be used in new construction for permanent facilities. Salvage materials are intended to be removed and disposed of by the Contractor and provided to recycling facilities to the greatest extent practical.
- B. Structures
 - 1. Remove existing structures indicated to be removed as shown in the Contract Drawings.
 - 2. Demolish structures in a systematic manner from the top of the structure to the bottom elevations. Complete demolition work above before the supporting members on the lower level are disturbed. Demolish concrete and masonry walls in small sections. Remove structural framing members and transport to grade by means of derricks, platforms hoists, or other suitable methods as approved by the Engineer.
 - 3. Locate demolition and deconstruction equipment throughout the structure and remove materials so as to not impose excessive loads to supporting piles, cap beams, framing or other structural elements.
- C. Utilities and Related Equipment
 - 1. General Requirements: Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the State's Representative. Do not interrupt existing utilities serving facilities occupied and used by the State except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

2. **Disconnecting Existing Utilities:** Remove existing utilities, as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the State's Representative. When utility lines are encountered that are not indicated on the drawings, the State's Representative shall be notified prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions of the State's Representative.
- D. **Paving and Slabs:** Sawcut concrete and asphaltic concrete paving and slabs as indicated to full depth below grade. Provide neat sawcuts at limits of pavement removal as indicated. Pavement and slabs designated to be recycled and utilized in this project shall be moved, ground and stored as directed by the Engineer. Pavement and slabs not to be used in this project shall be removed from the Site at Contractor's expense.
- E. **Concrete:** Saw cut concrete structures along straight lines. Make each cut in structure perpendicular to the face and in alignment with the demolition limits shown on the contract drawings. Break out the remainder of the concrete provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete.
- F. **Miscellaneous Metal:** Recycle scrap metal as part of demolition and deconstruction operations. Provide separate containers to collect scrap metal and transport to a scrap metal collection or recycling facility, in accordance with the Waste Management Plan.
- G. **Patching:** Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:
 1. **Concrete and Masonry:** Completely fill holes and depressions, caused by previous physical damage or left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.
- H. **Mechanical Equipment and Fixtures:** Disconnect mechanical hardware at the nearest connection to existing services to remain, unless otherwise noted. Mechanical equipment and fixtures must be disconnected at fittings. Remove service valves attached to the unit. Salvage each item of equipment and fixtures as a whole unit; listed, indexed, tagged, and stored. Salvage each unit with its normal operating auxiliary equipment. Transport salvaged equipment and fixtures, including motors and machines, to a designated storage area as directed by the State's Representative. Do not remove equipment until approved. Do not offer equipment for reuse; provide to recycling service for disassembly and recycling of parts.
 1. **Preparation for Storage:** Water, dirt, dust, and foreign matter from units; tanks, piping and fixtures shall be drained; interiors, if previously used to store flammable, explosive, or other dangerous liquids, must be steam cleaned. Seal openings with caps, plates, or plugs. Secure motors attached by flexible connections to the unit. Change lubricating systems with the proper oil or grease.

2. Piping: Disconnect piping at unions, flanges and valves, and fittings as required to reduce the pipe into straight lengths for practical storage. Store salvaged piping according to size and type. If the piping that remains can become pressurized due to upstream valve failure, end caps, blind flanges, or other types of plugs or fittings with a pressure gage and bleed valve shall be attached to the open end of the pipe to ensure positive leak control. Carefully dismantle piping that previously contained gas, gasoline, oil, or other dangerous fluids, with precautions taken to prevent injury to persons and property. Store piping outdoors until all fumes and residues are removed. Classify piping not designated for salvage, or not reusable, as scrap metal.
- I. Electrical Equipment and Fixtures: Demolish existing electrical equipment including shore power pedestals.
 1. Electrical Devices: Demolish electrical devices completely over limits per construction drawings.
 2. Wiring Ducts or Troughs: Demolish wiring completely over limits per construction drawings.
 3. Conduit and Miscellaneous Items: Demolish conduits completely over limits per construction drawings.
 - J. Items with Unique/Regulated Disposal Requirements: Remove and dispose of items with unique or regulated disposal requirements in the manner dictated by law or in the most environmentally responsible manner.

3.02 DISPOSITION OF MATERIAL

- A. Title to Materials: Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from the State's property. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the State's Representative of the Contractor's demolition, deconstruction, and removal procedures, and authorization by the State's Representative to begin demolition and deconstruction. The State will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.
- B. Reuse of Materials and Equipment: Remove and store materials and equipment listed in the Demolition Plan to be reused or relocated to prevent damage and reinstall as the work progresses.
- C. Salvaged Materials and Equipment: Remove materials and equipment that are listed in the Demolition Plan to remain the property of the Contractor or specified to remain the property of the State and deliver to a storage site as directed.
 1. Store all materials salvaged for the Contractor as approved by the State's Representative and remove from the State's property before completion of the contract. Material salvaged for the Contractor shall not be sold on the site.
 2. Remove salvaged items to remain the property of the State in a manner to prevent damage and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage must be repaired or replaced to match existing items. Properly identify the contents of containers.

- D. Fire Suppression Containers: Deactivate fire suppression system cylinders and canisters with electrical charges or initiators prior to shipment. Also, safety caps must be used to cover exposed actuation mechanisms and discharge ports on these special cylinders.

3.03 CLEANUP

- A. Remove debris and rubbish from excavations. Remove and transport in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.04 DISPOSAL OF REMOVED MATERIALS

- A. Regulation of Removed Materials: Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations. Storage of removed materials on the project site is prohibited.
- B. Removal from State Property: Transport waste materials removed from demolished and deconstructed structures, except waste soil, from State property for legal disposal. Dispose of waste soil as directed.

3.05 REUSE OF SALVAGED ITEMS

- A. Recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

3.06 MEASUREMENT AND REPAYMENT

- A. Demolition and removal will be paid under a Contract Lump Sum Bid Item for demolition. Payment will be full compensation for the work prescribed in this section and the contract documents.

***** END OF SECTION *****

SECTION 02100
SITE PREPARATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The work to be performed under this section shall include clearing the premises of all obstacles and obstructions, the removal of which will be necessary for the construction, execution and completion of the other work included in this contract.

1.02 COORDINATION WITH OTHER SECTIONS

- A. SECTION 01100 – ARCHAEOLOGICAL PROTECTION
- B. SECTION 01530 – BARRICADES
- C. SECTION 01568 – ENVIRONMENTAL PERMITS AND POLLUTION CONTROLS
- D. SECTION 02050 – DEMOLITION
- E. SECTION 02200 – EARTHWORK

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

- A. Maintenance of Traffic: The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, passageways, etc.

When necessary, the Contractor shall provide and erect barriers, etc., with special attention to protection of personnel.

- B. Protection: Throughout the progress of the work protection shall be provided for all property and equipment, and temporary barricades shall be provided as necessary. Work shall be done in accordance with the safety provisions of the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America, and the State of Hawaii's Occupational Safety and Health Standards, Rules and Regulations.
- C. Fires: No burning of fires of any kind will be allowed.
- D. Reference Points: Bench marks, etc., shall be carefully maintained, but if disturbed or destroyed, shall be replaced as directed, at the Contractor's expense.
- E. Disposal: All materials resultant from operations under this Section shall become the property of the Contractor and shall be removed from the site. Loads of materials shall be trimmed to prevent droppings.

3.02 EXISTING UTILITY LINES

- A. The existence of active underground utility lines within the construction area is not definitely known other than those indicated in their approximate locations on the Drawings. Should any unknown line be encountered during excavation, the Contractor shall immediately notify the Engineer of such discovery. The Engineer shall then investigate and issue instructions for the preservation or disposition of the unknown line. Authorization for extra work shall be issued by the Engineer only as he deems necessary.

3.03 CLEARING AND GRUBBING

- A. The Contractor shall clear the premises of all obstacles and obstructions, the removal of which will be necessary for the proper reception, construction, execution and completion of other work included in this contract.
- B. Where specified by owner, remove trees and roots to a minimum of 3 feet below existing ground level. Remove all large roots in excess of 2 inches in diameter, and backfill and compact the resulting depression. All debris accumulated from this operation shall be completely removed from the premises by the Contractor.
- C. The Contractor shall protect from injury and damage all surrounding trees, plants, etc., and shall leave all in as good as condition as at present. Any damage to existing improvement shall be repaired or replaced by the Contractor to the satisfaction of the Engineer.

3.04 CLEAN UP OF PREMISES

- A. Clean up and remove all debris accumulated from clearing operations from time-to-time as directed by the Engineer. Upon completion of the construction work and before final acceptance of the contract work, remove all surplus materials, equipment, scaffoldings, etc., and leave entire job site raked clean and neat to the satisfaction of the Engineer.

***** END OF SECTION *****

SECTION 02200
EARTHWORK

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. This section covers the requirements for earthwork.
- B. It shall be the responsibility of the Contractor to examine the project site and determine for themselves the existing conditions.
- C. Obvious conditions of the site existing on the date of the bid opening shall be accepted as part of the work, even though they may not be clearly indicated on the drawings and/or described herein or may vary therefrom.
- D. All debris of any kind accumulated from clearing shall be disposed of from the site, and the whole area left clean. The Contractor shall be required to make all necessary arrangements relative to the proposed place of disposal.

1.02 REMOVAL AND REPAIR WORK

- A. General

The Contractor shall exercise every precaution to preserve and protect all structures, walkways or utility improvements which are to remain or be relocated. Portions of walkway and pavement which are to remain shall be saw cut neat and true to line. Restore all pavement and curbs upon completion of the work.

1.03 SEQUENCE OF WORK

- A. All sequence of work shall be subject to the approval of the Engineer.

1.04 PROTECTION

- A. Barricade: Erect temporary barricade to prevent people from entering into project area, to the extent as approved by the Engineer. The extent of barricades may be adjusted as necessary with the approval of the Engineer. This work shall be accomplished at no extra cost to the State of Hawaii.
- B. Take all precautions and safety measures as required to protect the State of Hawaii free and harmless from liability of any kind. Conduct operations with minimum interference to streets, driveways, sidewalks passages, etc.
- C. Adequate precautions shall be taken before commencing and during the course of the work to ensure the protection of life, limb, and property.
- D. The Contractor shall protect from damage all surrounding structures, trees, plants, grass, walks, pavements, etc. Any damage will be repaired or replaced by the Contractor, at his expense, to the satisfaction of the Engineer.

1.05 PERMITS

- A. The Contractor shall obtain and pay for necessary permits prior to the commencement of work.

1.06 MAINTAINING TRAFFIC

- A. The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, traffic activities, etc.
- B. When necessary, the Contractor shall provide, erect and maintain lights, barriers, etc., as required by traffic and safety regulations with special attention to protection of life.

1.07 CONSTRUCTION LINES, LEVELS AND GRADES

- A. The Contractor shall verify all lines, levels and elevations indicated on the drawings before any clearing, excavation or construction begins. Any discrepancy shall be immediately brought to the attention of the Engineer and any changes shall be made in accordance with his instructions. The Contractor shall not be entitled to extra payment if he fails to report the discrepancies before proceeding with any work whether within the area affected or not.
- B. The laying out of base lines, establishment of grades and staking out the entire work shall be done by a licensed Surveyor or a licensed Civil Engineer, registered in the State of Hawaii. He shall be solely responsible for their accuracy. Erect and maintain substantial batter boards showing construction lines and levels.

1.08 CLEANUP

- A. Clean up and remove all debris accumulated from construction operations from time to time, and when directed by the Engineer. Upon completion of the construction work and before final acceptance of work, remove all surplus materials, equipment, etc. and leave entire jobsite clean and neat.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Yard Fill: Fill materials shall be soil with expansion value not greater than 3%, free from debris, perishable or combustible materials, sod and stones larger than 6 inches in maximum dimension. Rock or broken masonry shall be well distributed in earth or other fine material with voids filled and shall be placed within three feet of finished grades.
- B. Structural Fill: New structural fill below interior and exterior concrete slabs or paving, with allowance for depth of cushion fill, shall be select borrow material. This material shall be granular with an expansion value not greater than 3% non-adobe and with a plasticity index less than ten. Decayed rubbish, debris, or rocks greater than 3" in diameter shall not be allowed as structural fill material. Certificate of compliance shall be submitted to the Engineer for approval prior to filling.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Protective Measures
 - 1. All excavation shall be protected and guarded against danger to life, limb and property.

2. Shoring, cribbing and logging, as required to safely preserve the excavations and earth banks, free from damages resulting from the work shall be provided and installed by the Contractor.
3. All excavations shall be kept free from standing water. The Contractor shall do all pumping and draining that may be necessary to remove water to the extent required in carrying on the work. Grading shall be controlled so that the ground surface is properly sloped to prevent water run-off into structural foundations and open trenching excavations.
4. The underground utilities lines traversing the construction area known to exist by the designer are indicated on the plans. Should any be encountered during excavation, the Contractor shall not disconnect same without authorization from the Engineer but shall inform the latter immediately of each discovery. The Engineer shall investigate and issue proper authorization for procedure.

B. General

1. Excavation shall be done to the lines and grades indicated. Concrete slabs, concrete curbs, asphaltic concrete pavement, etc., not indicated to remain shall be removed and disposed of at a landfill.
2. Excavation for footings, foundation, etc., shall have level beds on unfilled, undisturbed, firm bearing, with stepped level where necessary. Small soft spots shall be compacted to unyielding firmness.

If soil conditions are suitable and approved, footing cuts may be made to exact size of footing.

3. Structural excavations carried below specified level shall be filled with concrete to the proper level at the expense of the Contractor.
4. Excavated materials declared unusable by Engineer shall be removed from the site at the Contractor's expense.

3.02 BACKFILL

A. Yard Area

1. Yard fill where no concrete slab occurs shall be in 6" layers (compacted thickness) compacted to 90% of maximum density as determined by ASTM Test, Method D-1557.
2. The areas not covered by asphalt paving or concrete slab shall be graded to conform to finish contours. Rough grading shall prevent the drainage of water into construction areas.

B. Structural Fill

1. In advance of preparing the subgrade or depositing a specified layer of material, existing material within the area where such materials is to be placed, which in the opinion of the Engineer is unsuitable as a subgrade foundation, shall be removed and the resulting space refilled with approved material and compacted.
2. Backfilling shall progress so that excessive unbalanced load is not introduced against any structure.

3. New structural fill material shall be placed in layers not to exceed 6" per compacted layer and compacted to a compaction of 95% as determined by ASTM Test, Method D-1557.
4. Materials and compaction of all yard and structural fill shall be tested by an independent testing agency approved by the Engineer and all after-compaction test results submitted to the Engineer for approval. All cost of testing shall be borne by the Contractor. Testing shall be made throughout the area for each 6" compacted layer as directed by the Engineer. All test results must be approved before proceeding with placing of topsoil, cushion fill or base course.
5. In the event insufficient amount of structural fill or yard fill is derived from earthwork operations, import the necessary materials without any additional cost to the State. Such imported material shall meet the requirements as specified for each category of materials.
6. The ground shall be scarified 6" below existing grade and recompacted to 90% compaction. Fill shall conform to structural fill.
7. Under interior and exterior slabs, the cushion fill as specified shall be compacted to a level surface to 95% compaction as determined by modified ASTM Test Method, D1557.

C. Grading

1. Rough Grading: The areas not covered by asphalt paving or concrete slab up to the contract zone limit shall be graded to the finish contours. Contractor shall take the necessary precautions to prevent the drainage of water into construction area.
2. Finish Grading: Outdoor areas not covered by pavement shall be graded to finish grade and contours. Grading shall conform with the ordinances of the applicable County issuing the Grading Permit and as amended.

***** END OF SECTION *****

SECTION 02225
TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. This section covers the requirements for trenching, backfilling, and compacting.
- B. Work included: Trench, backfill, and compact as specified herein and as needed for installation of underground utilities associated with the Work.
- C. Related Work:
 - 1. SECTION 01100 – ARCHAEOLOGICAL PROTECTION
 - 2. SECTION 01530 – BARRICADES
 - 3. SECTION 02050 – DEMOLITION

1.02 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.
- C. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the Engineer.
- D. Compaction requirements are defined by American Society for Testing and Materials (ASTM) publication D-1557 "Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10-lb Rammer and 18-inch Drop."

1.03 SUBMITTALS

- A. Shoring and sheeting plan: Describe materials of shoring system to be used. Indicate whether or not components will remain after filling or backfilling. Provide plans, sketches, or details along with calculations by a professional engineer registered in Hawaii. Indicate sequence and method of installation and removal.
- B. Dewatering plan: Describe methods for removing collected water from open trenches and diverting surface water or piped flow away from work area. Describe equipment and procedures for installing and operating the dewatering system indicate.

1.04 PERMITS

- A. Obtain necessary permits required from applicable agencies. All permit fees will be considered incidental to the work and a separate payment shall not be made.

PART 2 - PRODUCTS

2.01 BACKFILL MATERIALS

- A. Select Material: Backfill from the bottom of the trench to one foot above the top of the pipe shall be select material. Sand, graded crushed rock (commonly known as "rock sand") or excavated granular or sandy material shall be used for select material provided that all rocks or lumps of material over one inch in its longest dimension have been removed. Select material shall be free from salt, ashes, refuse, organic material or other material which, in the opinion of the Engineer, is unsuitable.

All material to be used as select material backfill shall be approved by the Engineer. If in the opinion of the Engineer the excavated material does not meet the grading requirements of select material, the Contractor shall be required to screen the material prior to its use as select material backfill.

- B. Ordinary Material: Material used in the upper portion of the backfill from one foot above the top of the pipe to the surface of the ground or subgrade of the road shall not contain stone, rock or other material larger than six inches in its longest dimensions. No wood, vegetable matter or other material which, in the opinion of the Engineer, is unsuitable, shall be included in the backfill. No "adobe" or other materials determined to be deleterious by the Engineer shall be included in the backfill.
- C. The Contractor shall obtain the approval of the Engineer of all backfill material.

2.02 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 FINISH ELEVATIONS AND LINES

- A. All material excavated from trenches shall be considered unclassified, whether consisting of earth, lava, soft rock, decomposed rock, solid rock, boulders, or coral. The trench shall be so dug that the pipe can be properly installed to the alignment and grade specified. Excavation shall commence at the point directed by the Engineer and shall be carried on in an orderly manner. No trench shall be opened more than 500 feet in advance of the installed pipe without the approval of the Engineer. No jumps or spaces will be permitted unless approved by the Engineer. Before proceeding with any excavation under asphaltic concrete and concrete pavements, the Contractor shall cut the edges of the excavation with a power saw to insure a neat cut along the pavement.
- B. Trench Widths:
 - 1. The widths of trenches for all pipes and appurtenances shall be as shown on the Drawings.

2. Increases in widths over those shown due to sheeting, bracing, or other necessities of construction, may be made by the Contractor with the approval of the Engineer but no additional compensation will be allowed for such extra width.
 3. Bell holes shall be provided at each joint to permit the jointing of pipes to be made properly.
- C. Trench Depths:
1. In general, trench depths for all pipes and appurtenances shall be as shown on the Drawings.
 2. Where necessary, the Engineer reserves the right to raise or lower the grades or to change alignments from those shown on the Drawings.
- D. Excavation Below Grades:
1. Any part of the trench excavated below grade by the Contractor shall be corrected with select material, thoroughly compacted in place at no cost to the State.

3.03 PROCEDURES

- A. Utilities:
1. All excavated areas shall be toned prior to excavation.
 2. Unless shown to be removed, protect lines shown on the drawings or otherwise made known to the Contractor prior to trenching. If damaged, repair or replace at no additional cost to the State.
 3. If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
 4. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the State.
 5. Expose existing utilities to confirm clearances as initial trenching work. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.
 6. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.
- B. Protection of persons and property:
1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.
 2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

- C. Blasting:
 - 1. Blasting for excavation is prohibited.
- D. Dewatering:
 - 1. Remove water by pumping or other methods to prevent the softening of surfaces exposed by excavation, prevent hydrostatic uplift, and provide a stable trench condition for installation of the utility. Use screens and gravel packs or other filtering systems on the dewatering devices to prevent the removal of fines from soil.
 - 2. Dispose water at an approved location by pumps, drains, and other approved methods.
- E. During the period of construction, the Contractor shall protect the public against mud, dust and similar nuisances and shall take steps to abate such nuisances.
- F. Convenient access to buildings along the line of work shall be maintained and temporary approaches shall be provided and kept in order. Temporary bridges for pedestrian traffic shall have handrails securely fastened to them. Handrails shall be free from any projecting nails, splinters, and rough edges.
- G. Storing of excavated material alongside the trench shall be done in such a manner as not to obstruct traffic. Whenever, in the opinion of the Engineer, proper storage of excavated material cannot be made alongside the pipe trench, the material shall be hauled away from the work site. If the excavated material meets the requirements for backfill material and proper storage cannot be made alongside the pipe trench, the material shall be stockpiled at convenient locations for later use in backfill.
- H. Surplus Material:
 - 1. Unless otherwise specified in the Plans or Specifications, or ordered by the Engineer, surplus excavated material shall become the Contractor's property and shall be removed from the work site and disposed of at no cost to the State.

3.04 TRENCHING

- A. Comply with pertinent provisions of applicable "Soils Report" as provided for the project and the provisions of this Section.
- B. Provide sheeting and shoring necessary for protection of the Work, undermining of existing facilities and for the safety of personnel.
 - 1. Prior to backfilling, remove all sheeting.
 - 2. Do not permit sheeting to remain in the trenches except when, in the opinion of the Engineer, field conditions or the type of sheeting or methods of construction such as use of concrete bedding are such as to make removal of sheeting impracticable. In such cases, the Engineer may permit portions of sheeting to be cut off and remain in the trench.
- C. Excavation:
 - 1. Short sections of a trench may be tunneled if, in the opinion of the Engineer, the conduit can be installed safely and backfill can be compacted properly into such tunnel.

2. Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining after removal of the objects at no additional cost to the State, as directed by the Engineer.
3. When the void is below the subgrade for the utility bedding, use select materials and compact to the relative density directed by the Engineer, but in no case to a relative density less than 90%.
4. When the void is in the side of the utility trench or open cut, use suitable earth or sand compacted or consolidated as approved by the Engineer, but in no case to a relative density less than 80%.
5. Excavating for appurtenances:
 - a. Excavate for manholes and similar structures to a distance sufficient to leave at least 12" clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.
 - b. Overdepth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the Engineer, and at no additional cost to the State.

D. Depressions:

1. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.
2. Except where rock is encountered, do not excavate below the depth indicated or specified.
3. Where rock is encountered, excavate rock to a minimum overdepth of 4" below the trench depth indicated or specified.

E. Where trenching occurs in existing lawns, remove turf in sections and keep damp. Replace turf upon completion of the backfilling.

F. Cover:

1. Provide a minimum cover over the top of the pipe as indicated on the drawings.
2. Where the minimum cover is not provided, jacket the pipes in concrete as indicated. Provide concrete with a minimum 28 day compressive strength of 2500 psi.

3.05 BEDDING

- A. Provide bedding as indicated on the Drawings.

3.06 BACKFILLING

- A. General

1. All backfill material shall be placed in the trench by hand or by approved mechanical methods. The compaction of backfill material shall be done by tamping with hand tools or approved pneumatic tampers, by using vibratory compactors, by puddling if the backfill material can be suitably drained, or by any combination of the three. The method of compaction shall be approved by the Engineer and all compaction shall be done to the satisfaction of the Engineer.
2. When removal of unsuitable excavated material creates a shortage of backfill material, the Contractor shall, at no cost to the State, furnish material as specified in this section in the amount required to complete the backfill.
3. When backfill material is delivered by trucks, the material shall not be dumped directly into the trench but the fall of the material shall be broken at the edge of the trench. The backfill material shall then be deposited by hand or by approved mechanical methods.
4. Ensure that no damage is done to structures or their protective coatings.

B. Backfilling Around Pipe:

1. Select material shall be used to backfill the trench from its bottom to one foot above the pipe. Prior to the laying of the pipe, the select material cushion shall be deposited in the trench and shall be leveled off, compacted, and shaped to obtain a smooth compacted bed providing firm uniform bearing along the laying length of the pipe.
2. After the pipe is installed, but prior to testing the line, select material shall be deposited in the trench evenly on both sides and along the full length of the pipe in 6-inch maximum loose lifts. If necessary, additional select material can be deposited over the center of each length of pipe to prevent undue movement during testing of the line. Ensure that initially placed material is tamped firmly under pipe haunches. The bell holes at the pipe joints shall not be backfilled at this time.
3. The pipeline shall then be tested. After the pipeline has passed the test, the Contractor shall backfill the bell holes with select material. The select material, which had been previously deposited over the pipe in the trench, shall be leveled and compacted.

C. Backfilling to Grade:

1. From an elevation one foot above the top of the pipe to grade, the backfill material shall be placed in layers not to exceed 12 inches in loose lifts each lift shall be compacted to a relative density not less than 90%.
2. If the trench section is flooded, no further backfill shall be placed for two (2) days. After this period, the backfill shall again be thoroughly compacted to a relative density of not less than 90% by a method and with equipment approved by the Engineer.
3. The Contractor shall reconstruct the base course and pavement of roadway damaged by the construction of the pipeline as covered elsewhere in these Detailed Specifications.
4. Other improvements such as driveways, sidewalks, curbs, gutters, stonewalls, fences and other structures damaged during construction shall be replaced or repaired to their original condition or better as approved by the Engineer.

3.07 FIELD QUALITY CONTROL

- A. The Engineer will inspect and approve open cuts and trenches before installation of pipeline or structures, and will make the following tests:
1. Assure that trenches are not backfilled until all tests have been completed;
 2. Check bedding for proper layer thickness and compaction;
 3. Verify that test results conform to the specified requirements, and that sufficient tests are performed;
 4. Assure that defective work is removed and properly replaced.

***** END OF SECTION *****

SECTION 02230
AGGREGATE BASE COURSE

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Description. This work shall consist of furnishing and placing one or more courses of aggregate base on a prepared surface in accordance with the requirements of the contract.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials shall meet the requirements specified in the following Subsections of Division 700 Materials of the "Hawaii Standard Specifications of Road and Bridge Construction, State of Hawaii, Department of Transportation Highways Division, Honolulu, Hawaii, 2005," and all subsequent amendments.

Aggregate	703.06
Water	712.01

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

- A. Placing
1. The base material shall be placed on the prepared surface without segregation. Segregated materials shall be remixed until a uniform distribution is obtained. The material shall not be dumped in piles on the prepared surface.
 2. Depositing and spreading shall commence at that part of the work farthest from the point of loading the material and shall progress continuously without breaks, unless otherwise directed by the Engineer.
 3. If the required compacted depth of the base course exceeds 6 inches, the base shall be constructed on 2 or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches.
 4. If the contractor uses a vibratory roller weighing 9 tons or more, the lift thickness may be increased to 7 inches.
 5. Spreading of binder material over the surface of the compacted base will not be permitted. Additional material if required shall be incorporated uniformly throughout the thickness of the compacted material by scarifying and blading. The combined material shall meet all quality requirements as specified.
- B. Shaping and compacting

1. The Contractor shall perform such shaping work as necessary and such that the finished base shall conform to the required grade and cross-section. The finished base where not controlled by adjacent structures or features shall not vary more than 0.04 foot above or below the theoretical grade.
 2. Compaction of each layer shall continue until a density of not less than 95 percent of the maximum density, determined in accordance with the requirements of Subsection 106.09 - Special Test Methods, of the "Standard Specifications for Road and Bridge Construction, has been achieved. Field density determination will be made in accordance with Hawaii Test Method HWY-TC 1. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture is produced and the aggregates firmly keyed. Water shall be uniformly applied over the base materials during compaction in the quantity necessary for proper consolidation.
 3. Should high or low spots develop during rolling operations, such spots shall be smoothed out by blading with a self-propelled and pneumatic-tired motor grader having a wheel base not less than 15 feet long and a blade not less than 10 feet long.
 4. Each layer shall be compacted initially by rolling with three-wheel rollers followed by intermediate rolling with pneumatic-tired rollers. Final rolling shall be done with three-wheel rollers.
- C. Equipment. Three-wheel rollers and pneumatic-tired rollers shall conform to the requirements specified in Subsection 401.03(B)(4) - Rollers.

***** END OF SECTION *****

SECTION 02512
ASPHALT PAVING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Asphaltic concrete shall consist of a mixture of mineral aggregate and bituminous material, mixed at a central plant in the proportions hereinafter specified and spread and compacted on a prepared base or existing road surface.

The pavement may consist of a surface course mixture and leveling or base course mixture, as hereinafter specified.

PART 2 - PART 2 - PRODUCTS

2.01 MATERIALS

- A. All materials shall meet the requirements specified in the "Hawaii Standard Specifications of Road and Bridge Construction, State of Hawaii, Department of Transportation Highways Division, Honolulu, Hawaii, 2005," and all subsequent amendments with the following subsections of Division 700 - Materials.

Bituminous Material (Asphalt Cement, Grades AR 40 or 80)	702.01
Asphalt Paint (Emulsified Asphalt)	702.04
Aggregate	703.09
Filler	703.15
Blending Sand	703.22
Hydrated Lime	712.03

Leveling or base course mixture shall be Mix No. 2, surface wearing course mixture shall be as shown on the plans or called for in the special provision or proposal.

- B. Grading and Composition Requirements: Materials composing the asphalt concrete shall be combined to meet the requirements set forth in Table 1. The grading composition limits specified are based on materials of uniform specific gravity. Correction of grading limits shall be made to compensate for any variations in specific gravity of the individual sizes.

Compacted Thickness Individual Layers	Base and Leveling Course	Roadway Mixes		Resurfacing Mix
		Std.	Dense Grade	
Minimum	1-1/2"	1-1/4"	1-1/4"	3/4"
Maximum	2-1/2"	2-1/2"	2-1/2"	1-1/2"

GRADING AND COMPOSITION REQUIREMENTS

	Mix Number			
	2	3	4	5
Sieve Size	COMBINED AGGREGATE Total Percent Passing by Weight			
1-1/4"	100	-	-	-
1"	85-100	100	-	-
3/4"	-	90-100	100	-
1/2"	60-85	70-90	85-100	100
3/8"	-	-	72-88	80-100
No.4	36-55	40-57	48-66	55-75
No.8	26-41	30-47	32-48	35-52
No.16	17-32	20-36	21-37	22-38
No.30	12-25	16-28	15-27	14-26
No.50	8-18	10-22	9-21	8-20
No.100	5-14	8-17	6-16	6-15
No.200	1-8	4-10	4-10	4-10
Percentage by weight of Asphaltic Cement to be Added	4.5-6.5	5.0-7.0	6.0-8.0	5.0-7.0

- C. The grading within the above tolerances shall be to the percentage of aggregate passing the sieves during any day's run will conform to the following limitations:
- | | | |
|----|------------------------------------|---------------------|
| 1. | Passing No. 4 and larger sieves | 7% above or below |
| 2. | Passing No. 8 and No. 100 sieves | 4% above or below |
| 3. | Passing No. 200 sieves | 2% above or below |
| 4. | Bituminous Binder | 0.4% above or below |
| 5. | Temperature of Mixture on Delivery | 20°F above or below |

PART 3 - PART 3 - EXECUTION

3.01 DETAILS

- A. Mixing: The asphaltic cement shall be heated in a kettle of approved type, and maintained at a temperature between 275NF and 300NF. The heat must be so applied that there can be no burning of any portion of the asphaltic cement. No live steam shall be injected into the cement. The mineral aggregate shall be heated in an approved appliance to a temperature of not less than 275NF nor more than 320NF.

After heating to the required temperature, the required amount of asphalt cement shall be added to the heated aggregate. This mass shall be introduced into the mixer within 25NF of each other's temperature.

- B. Prime Coat: All surfaces on or against which asphalt concrete is to be placed shall first be given an asphaltic cement prime or tack coat as specified in Section 02513, "Prime Coat," of these specifications.

Before applying the prime and tack coat, the Contractor shall prepare the existing surfaces by power brooming to remove all loose particles, dust, sand, and other foreign materials.

- C. Asphaltic Concrete Interlayer Fabric Membrane: Immediately after installation of the prime coat and prior to installation of the asphaltic concrete wearing surface the interlayer fabric membrane is to be installed in accordance with Section 02517 (Not applicable for this project).

- D. Laying Wearing Surface: In advance of placing asphalt concrete over an existing base, surfacing, or pavement, and after the base, surfacing, or pavement has been prepared as herein specified, and if ordered by the Engineer or shown on the plans, a leveling course mixture shall be spread to level irregularities, dips, depressions, sags, and excessive crown, and to provide a smooth base of uniform grade and cross-section in order that the surface course will be of uniform thickness. The above specified material shall not be placed more than one day in advance of placing the surface course. No additional compensation will be allowed for placing leveling course mixture as specified above and full compensation for all work incidental to such operations shall be considered as included in the contract prices or price paid for the asphalt concrete mixture used.

The mixture as prepared above shall be brought to the work in suitable vehicles at a temperature of not less than 250 degrees F. Tarpaulins shall be provided and used upon all loads.

The wearing surface shall be spread with self-propelled mechanical spreading and finishing equipment, provided with a screed or strike-off assembly capable of distributing not less than the full width of a traffic lane. The screed shall be adjustable to the required crown and elevation. Screeding includes any cutting, crowding or other action which is effective on the mixture without tearing, shoving, or gouging, and which produces a finished surface of an even texture. The equipment shall be provided with rolling, tamping, or other suitable compacting devices, and shall be operated with a forward speed of not more than 20 feet per minute.

If the spreading and finishing equipment leaves ridges, indentations, or other marks in the surface that cannot be eliminated by rolling or prevented by adjustment in operation, its use shall be discontinued and other acceptable equipment shall be furnished by the Contractor.

If more than one course is to be laid in any area, not more than 24 hours shall elapse between the spreading and finishing of any two successive courses in that area.

The self-propelled mechanical spreading and finishing machine shall be capable of propelling the vehicle being unloaded in uniform manner and, if necessary, the load of the haul vehicle shall be so limited that satisfactory spreading will be obtained. While being unloaded, the vehicle shall be firmly attached to the machine and the brakes on the vehicle shall not be depended upon to obtain contact between the vehicle and the machine.

Before placing asphalt concrete wearing surface adjacent to cold transverse construction joints, such joints shall be trimmed to a vertical face in a neat line. The location of the proposed joint shall be tested with a 10-foot straight-edge and cut back such that when the straight-edge is laid on the finished surface parallel with the center line of the street, the surface shall in no place vary from the lower edge of the straight-edge more than 1/8 inch.

Before placing asphalt concrete adjacent to any existing asphalt concrete, the face of the existing asphalt concrete shall be trimmed to a vertical face in a neat line.

Where asphalt concrete wearing surface is placed adjacent to a Portland cement concrete gutter, the asphalt concrete wearing surface shall be so laid that its surface, after compaction, will approximately be 1/4-inch above the surface of the adjacent concrete. The edge of the asphalt concrete wearing surface shall then be smoothed and sealed over a width of approximately 3 inches with hot hand-irons having a self-contained heating unit.

At locations where the width of asphalt concrete mixture to be spread is too narrow to permit the use of self-propelled mechanical spreading and finishing equipment, or where the surfacing is to extend to a featheredge and the use of such a machine is not practicable, the mixture may be spread by hand-raking. Where hand-raking is permitted, the mixture shall be finally shaped and smoothed by means of a wooden float 8 feet long, one-inch thick and 4 inches wide. The float shall be rigidly ribbed, and to insure a true and flat surface on the underside, adjusting screws shall be placed between the rib and float at not more than 24-inch centers. The float shall be operated by means of a long handle, from the side of the area being paved or surfaced, and parallel with the center line of the pavement or surfacing. High spots and irregularities that are transverse to the path of traffic shall be cut down and the material redistributed over the area. The maximum depth of wearing surface which may be spread and rolled in one course shall not exceed a compacted thickness of 2 inches. Where such thickness exceeds 2 inches, it shall be spread and rolled in courses each not to exceed a compacted thickness of 1-1/2 inches unless otherwise specified in these specifications.

Wearing surface mixture shall not be spread from hauling vehicles.

No wearing surface shall be spread when the atmospheric temperature is below 50°F or during other unsuitable weather, or when the base is wet.

- E. Rolling: Immediately after the wearing surface has been laid as specified above, it shall be compressed with power rollers, smooth running, and in first-class mechanical condition. Initial rolling or tamping shall be performed when the temperature of the mixture is between 220NF and 245NF.

After the first pass of the roller, any low or grainy spots shall be broken up with a hot rake and more material worked in to insure a surface of uniform texture and maximum density. Rolling equipment shall be self-propelled. Initial rolling of asphalt concrete mixtures shall be performed by means of a three-wheeled roller weighing not less than 12 tons and with a compression on the rear wheels of not less than 325 pounds per linear inch of tire width, or in lieu thereof, by means of a three-axle tandem roller weighing not less than 12 tons. For production not exceeding 150 tons per hour, not less than one of the above specified rollers shall be used for initial rolling. For productions in excess of 150 tons per hour, one additional roller of a type designated by the Engineer will be required for each additional 100 tons or fraction thereof of asphalt concrete mixture placed.

Three-axle-tandem type rollers shall be so constructed that the rolls, when locked in position for all treads to be in one plane, are held with a rigidity which will permit the following test under full load. With the weight of the roller supported on the central roll, the tread of the central roll shall not be more than 1/8-inch above the plane tangent to the treads of the end rolls. With the weight of the roller supported on the end rolls, the tread of the central roll shall not be more than 1/4-inch below the plane tangent to the treads of the end rolls.

In general, three-axle tandem roller shall not be used in rolling over a crown or on warped surfaces when the axle is in a locked position.

Finishing rolling of asphalt concrete mixtures shall be performed by means of a tandem roller weighing not less than 10 tons.

Rolling shall continue until the compressed pavement or surfacing has a relative specific gravity of not less than 95 percent of the specific gravity of the combined mixture without voids.

- F. Smoothness: The finished surface of the pavement shall be true to grade and cross-section, free from depressions, or grainy spots, and shall show a uniform distribution of aggregate.

When a straight-edge, 10 feet long, is laid on the finished surface parallel to the center line of the pavement, the surface shall in no place vary from the lower edge of the straight-edge more than $3/16$ of an inch.

No traffic shall be permitted on any course of asphalt concrete until it has cooled and set, except such traffic as may be necessary for construction purposes.

***** END OF SECTION *****

SECTION 02513

PRIME COAT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. This section covers the requirements for furnishing and installing of prime coat.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Bituminous Material: Bituminous material for prime coat shall be a medium curing liquid asphalt, Grade MC-30, conforming to the applicable requirements of Section 702 - Bituminous Materials, "Hawaii Standard Specifications of Road and Bridge Construction, State of Hawaii, Department of Transportation Highways Division, Honolulu, Hawaii, 2005," and all subsequent amendments.

The Contractor shall submit a Certificate of Compliance accompanied by test data, conforming to the requirements of ASTM M82-75 Cut-Back Asphalt (Medium Curing Type), for each lot or batch of MC-30. Medium curing liquid asphalt, grade MC-30 will not be accepted without adequate documentation.

The Engineer reserves the right to waive any of the requirements for the MC-30 provided that its performance is not affected.

PART 3 - EXECUTION

3.01 DETAILS

- A. Immediately before applying the prime coat, the surface to be treated shall be swept clean of all loose material, dirt, excess dust or other objectionable material.

Prime coat shall not be applied when the surface to be treated is appreciably damp or when weather conditions are unsuitable.

- B. The material shall be uniformly applied by a vehicle, mounted, pressure operated, sprayer type distributor at an approximate rate of 0.35 of a gallon per square yard. The exact rate of application shall be determined by the Engineer. After the prime coat has penetrated the surface, deficient areas shall receive additional applications and areas of excess bituminous material shall be blotted with clean sand. Traffic shall be kept off the prime coat until the material has been completely absorbed.
- C. Curbs, sidewalks and gutters shall be protected from prime coat. Any material sprayed on adjoining improvements shall be immediately cleaned off. The edges of existing asphalt paving, manholes and catch basin frames, concrete gutters, etc., against which asphaltic concrete pavement is to be placed shall be given a prime coat.

***** END OF SECTION *****

SECTION 02514

TACK COAT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. This section covers the requirements for furnishing and installing bituminous tack coat.

PART 2 - PRODUCTS

- A. All sections or subsections called for in the specifications shall be referred to the "Hawaii Standard Specifications of Road and Bridge Construction, State of Hawaii, Department of Transportation Highways Division, Honolulu, Hawaii, 2005," and all subsequent amendments.

2.02 MATERIALS

- A. Bituminous material for tack coat shall be slow-setting emulsified asphalt, Type SS-1 or Type SS-1H, conforming to the applicable requirements of Section 407 - Bituminous Tack Coat.
- B. Water shall conform to the requirements of Subsection 712.01 - Water.

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

- A. Weather Limitations: Tack coat shall not be applied on a wet surface or when weather conditions otherwise shall prevent proper construction.
- B. Equipment: The Contractor shall provide equipment for heating and applying the bituminous material. This equipment shall meet the requirements of Subsection 405.03(B) - Equipment.
- C. Preparation of Surface: Immediately before applying the tack coat, the surface to be treated shall be swept clean of all loose material, dirt, excess dust or other objectionable matter. A power broom or power blower, supplemented by hand methods if necessary, shall be used.
- D. Application of Bituminous Material: The emulsified asphalt shall be diluted with water at a rate of one part emulsion to one part of water by volume. The quantity, rate of application, temperature, and areas to be treated will be approved prior to application.

Tack coat shall be placed only so far in advance of the surface course placement as is necessary for it to cure to the proper condition for placement of such surface course.

Unless otherwise specified, tack coat shall be applied at the rate of 0.05 - 0.15 gallon per square yard on surface of base course.

Tack coat will not be measured for payment. Tack coat will be considered as incidental to the various contract items.

***** END OF SECTION *****

SECTION 02577

PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Furnish materials, labor and equipment required to accomplish pavement markings as indicated on the drawings.

1.02 SUBMITTALS

- A. Submit manufacturer's product data and application instructions.

1.03 DELIVERY AND STORAGE

- A. Deliver paints and paint materials in original sealed containers that plainly show the designated name, specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. No asbestos containing materials shall be under this section. The Contractor shall insure that all materials incorporated in the project are asbestos-free.
- B. Paint: Non-reflective conforming to Fed. Spec. TT-P-102, color as indicated on the drawings or as selected by DLNR.
- C. Retroreflective Thermoplastic Compound Pavement Markings
 - 1. Retroreflective thermoplastic compound pavement markings shall conform to AASHTO M 247 and AASHTO M 249.
 - 2. Pigment, beads, and filler shall be uniformly dispersed in the resin. Material shall be free from skins, dirt, foreign objects, and ingredients that cause bleeding, staining, or discoloration, or combination thereof, and shall conform to Table 1 Composition Requirements.

COMPOSTION REQUIREMENTS		
Component	White	Yellow
Binder (percent minimum)	18	18
Titanium Dioxide (TiO ₂) Pigment (percent minimum)	10	N/A
Glass Beads (percent by weight)	30-40	30-40
Yellow Pigment	N/A	See Note*
Calcium Carbonate Filler (percent maximum)	42	48
* Note: Amount of yellow pigment, calcium carbonate, and inert fillers shall be at manufacturer's option, provided that all other requirements of these specifications are met. Yellow pigment used shall not contain materials listed under the Resource Recovery and Conservation Act (RRCA), including lead, cadmium, mercury, and hexavalent chromium. Total content of these materials in striping compound shall not exceed 100 parts per million.		

3. Glass beads shall conform to the following requirements:
 - a. Have minimum refractive index of 1.50 when tested by liquid immersion method at 77 ± 9 degrees F, an minimum 70 percent true spheres, and be free from air inclusions.
 - b. Have standardized Type I gradation as specified in Table 2 - Glass Bead Gradation.

GLASS BEAD GRADATION	
U.S. Sieve Number	Percent Passing
20	100
30	75-95
50	15-35
100	0-5

- c. At least 70 percent of spheres shall conform to the following requirements:
 - i. Surfaces of spheres shall be smooth, lustrous, and free from film scratches and pits
 - ii. Spheres shall be clear, transparent, and not ovate in shape or fused.
 - iii. Spheres shall show high auto collimating efficiency, with less than 1 percent of spheres black, amber, or milky.
4. Thermoplastic material shall conform to the following requirements:
 - a. Material shall be a maleic-modified glycerol ester resin (Alkyd-based) compound designed for traffic markings.
 - b. Material shall not be slippery, once installed.
 - c. Material shall not deteriorate by contact with sodium chloride, calcium chloride, oil content of pavement materials, or oil droppings from traffic, before warranty period has expired.

- d. Material shall not be volatile, shall not give off fumes in application state, and shall not be toxic, noxious, or injurious to persons or property.
 - e. Material shall not break down or deteriorate if held at application temperature for 4 hours, or if reheated to application temperature three times.
 - f. Material shall not discolor as result of up to three reheatings, or vary in color from batch to batch.
 - g. Material shall not change color and brightness characteristics after prolonged exposure to sunlight.
5. Application properties of thermoplastic compound shall conform with the following:
- a. Compound shall be machine-applied to pavement and concrete surface in molten state at temperature range of 412.5 ± 12.5 degrees F. Material shall not scorch or discolor if kept at molten state temperatures for up to 4 hours.
 - b. After cooling to ambient temperature and without polymerization or other chemical change, compound shall form traffic marking stripe of quality and appearance as specified herein.
 - c. Material shall show no appreciable deformation or discoloration under local traffic conditions and in ambient or pavement temperatures ranging from 0 degrees F to 120 degrees F.
 - d. Drying time is defined as minimum elapsed time from marking application to time after which normal local traffic leaves no impression or imprint on applied marking, and after which stripe attains and retains required characteristics, including thickness.
 - e. When applied at temperature range of 412.5 ± 12.5 degrees F and thickness of 1/8 inch to 3/16 inch, material drying time shall not exceed two minutes when the air temperature is 50 ± 3 degrees F. When air temperature is 90 ± 3 degrees F, drying time shall not exceed 10 minutes
 - f. Material shall allow stripe to maintain original dimensions and placement. Exposed surface shall be free from tack. Applied marking shall not chip or debond under normal movement of pavement surface.
 - g. Pigment shall be dispersed evenly throughout material. Material shall be of uniform density and character, throughout its thickness.
 - h. Material shall not smear or spread at pavement temperatures of 140 degrees F or less.
6. Specifications and Testing
- a. Material color after heating for 240 ± 5 minutes at 425 ± 3 degrees F and cooled to 77 ± 3 degrees F shall meet the following requirements:
 - i. White: Daylight reflectance at 45 degrees to 0 degrees shall be minimum of 75 percent. Chemical analysis of white titanium pigment shall be performed in accordance with ASTM D 1394. Material shall have maximum yellowness index of 15

- ii. Yellow: Daylight reflectance at 45 degrees to 0 degrees shall be minimum of 45 percent. Yellow color shall match Federal Standard Number 595B, Color 13538.
- b. Material shall have less than 0.5 percent by weight of retained water when tested in accordance with ASTM D 570, Procedure (a).
- c. After heating for 240 ± 5 minutes at 425 ± 3 degrees F, material shall have softening point of 215 ± 15 degrees F when tested in accordance with ASTM D 36.
- d. Material shall have specific gravity of 1.9 to 2.5 when determined in accordance with ASTM D 153, Method A. Kerosene shall be used as immersion liquid. Test sample shall be ground to pass No. 30 sieve.
- e. Material shall have impact resistance of not less than 10 inch-pounds at 77 degrees F when tested as follows:
 - i. Heat material for 240 ± 5 minutes at 425 ± 3 degrees F.
 - ii. Cast material into bars of 1 square inch cross-sectional area, 3 inches long.
 - iii. Place material with 1 inch extending above vise in cantilever beam (Izod Type) tester, using 25 inch-pound scale 974 in accordance with ASTM D 256.
- f. Material shall have bond strength of not less than 150 pounds per square inch. Two concrete blocks, 2 inches by 3 inches by 7 inches, shall be cemented together on 3-inch by 7-inch 979 faces with 1/16- to 1/8-inch layer of thermoplastic traffic line material and tested in accordance with ASTM D 4796.
- g. After heating material for 240 ± 5 minutes at 425 ± 3 degrees F, testing in accordance with ASTM D 2240, and taking Shore Durometer readings after 15 seconds, material shall exhibit minimum hardness values, at designated testing temperature, as specified in Table 3 - Indentation Resistance.

INDENTATION RESISTANCE	
TEMPERATURE	READING
115 degrees F	65
77 degrees F	95
40 degrees F	95

- h. Each unit container shall be marked clearly to show color of material, process batch number or similar manufacturer's identification, manufacturer's name, plant address, and manufacture date. Each batch manufactured shall have its own, unique number. Label shall warn user that material shall be heated to 412.5 ± 12.5 degrees F during application.

Material shall be delivered to designated area in unit containers, such as sacks or bags, as processed by manufacturer; and shall weigh more than 24 pounds but less than 52 pounds, or as ordered by the Engineer.

2.02 EQUIPMENT

- A. Painting Equipment: The mechanical marker shall be an atomizing spray-type marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at the required coverage and shall be designed so as to apply markings of uniform cross-sections and clear-cut edges without running or spattering and within the limits for straightness set forth herein.
- B. Use wheeled, motor-propelled applicator machine to apply traffic paint at nominal thickness of 0.015 inch or at rate of 300 linear feet of single 4-inch stripe for 1 gallon 150 paint. Use applicator having appropriate shields around nozzles to permit sharp stripe definition, and separate nozzle to direct air stream immediately ahead of paint application for clearing debris, dust, and other foreign matter. Immediately remove misted, dripped, and spattered paint from pavements.
- C. Thermoplastic Extrusion Pavement Marking Equipment: Apply material to pavement by extrusion method. One side of shaping die shall be pavement surface and other three sides shall be contained by, or shall be part of equipment for heating and controlling flow of material.
 - 1. Equipment shall provide continuous mixing and agitation of material. Conveying parts of equipment shall be constructed to prevent accumulation and clogging.
 - 2. Mixing and conveying parts, including shaping die, shall maintain material at plastic temperature.
 - 3. Applicator shall cleanly and squarely cut off stripe ends. Pans, aprons, or similar appliances that the die overruns will not be allowed.
 - 4. Apply beads to entire surface of completed stripe by automatic bead dispenser attached to liner.
 - 5. Equip bead dispenser with automatic cutoff control synchronized with cutoff of thermoplastic material.
 - 6. Use equipment that provides for varying die widths to produce varying widths of traffic markings.
 - 7. Provide kettle for melting and heating composition. Equip kettle with automatic thermoplastic control device so that heating can be done by controlled heat transfer liquid rather than direct flame.
 - 8. Equip and arrange applicator and kettle in accordance with National Fire Underwriters requirements.
 - 9. Use mobile and maneuverable applicator that is capable of following straight lines and making curves in true arcs.
 - 10. Use applicator capable of containing minimum of 125 pounds of molten material.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions under which pavement markings are to be installed. Should any condition be found unsuitable, no work shall be done until the unsatisfactory conditions have been corrected and are acceptable to the Contractor. Proceeding with the work will imply acceptance of the conditions by the Contractor.

3.02 SURFACE PREPARATION

- A. Allow new pavement surfaces to cure for a period of not less than 30 days before application of marking materials. Thoroughly clean surfaces to be marked before application of the paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required. Remove rubber deposits, existing paint markings, and other coatings adhering to the pavement by water-blasting. Scrub affected areas, where oil or grease is present on old pavements to be marked, with several applications of tri-sodium phosphate solution or other approved detergent or degreaser and rinse thoroughly after each application. After cleaning oil-soaked areas, seal with shellac or primer recommended by the manufacturer to prevent bleeding through the new paint.

3.03 PAINTING INSTALLATION

- A. Do not apply paint until the layouts, indicated alignment, and the condition of the existing surface has been approved by the Engineer.
- B. Provide guidelines and templates as necessary to control paint application. Take special precautions in marking symbols. Sharply outline all edges of markings. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. Striping widths for lines shall be 4 inches, unless otherwise indicated.
- C. The finished product shall have an opaque, well-painted appearance, with no black or other discoloration showing through.

3.04 THERMOPLASTIC INSTALLATION

- A. Clean off dirt, blaze, paint, tape, and grease. Apply thermoplastic extrusion pavement marking only when pavement surface is dry.
- B. Use equipment that can apply material in variable widths from 2 inches to 12 inches. Apply material for full width of stripe in one application or pass.
- C. On concrete pavements, on HMA pavements more than seven days old, and on HMA pavements paved within seven days containing less than 6 percent bituminous asphalt, pre-stripe application area with binder material, primer, or prime seal coat recommended by pavement marker manufacturer.
- D. Line thickness, as viewed from lateral cross section, shall measure not less than 3/32 inch at edges, and not less than 1/8 inch in center.
- E. Provide finished lines with well-defined edges, free of waviness.

3.05 TRAFFIC CONTROL AND PROTECTION

- A. Place warning signs near the beginning of the work site and well ahead of the work site for alerting traffic. Place small markers along newly painted lines to control traffic and prevent damage to newly painted surfaces.

***** END OF SECTION *****

SECTION 02620
HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing high density polyethylene (HDPE) pipe and fittings.

1.02 REFERENCES

- A. ASTM D3035: Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
- B. ASTM F714: Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR), Based on Outside Diameter
- C. ASTM F1962: Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings
- D. AWWA C901: Polyethylene (PE) Pressure Pipe and Tubing, $\frac{3}{4}$ In. (19mm) Through 3 In. (76mm), for Water Service
- E. AWWA M55: PE Pipe – Design and Installation

PART 2 - PRODUCTS

2.01 MATERIALS

- A. The pipe and fittings shall be made from PE4710 high-density polyethylene resin meeting cell classification 445574C according to ASTM F714. The manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.
- B. The material shall be listed and approved for potable water in accordance with NSF Standard 14 and 61.
- C. The pipe shall be manufactured and tested in accordance with AWWA C901 and shall be so marked.
- D. Compliance with the requirements of this paragraph shall be certified in writing by the pipe supplier, upon request.
- E. Inspection and Certification: All material furnished under these specifications shall be inspected and tested prior to shipment for conformance to the State of Hawaii "Water System Standards," 2002, as amended.

- F. The manufacturer of the pipe and fittings shall submit to the Engineer a sworn statement that the inspection and all tests for the pipe have been made and met as specified. The manufacturer shall also submit a warranty guaranteeing his product against production or material defects. This warranty shall be of one year, from date of final acceptance of this project, replacing free of charge all defective materials only. Failure to obtain this material warranty shall be just cause for the rejection of all pipe installed by the Contractor.
- G. High-density polyethylene pipe shall be DR-11 rating capable of withstanding working pressures up to 200 pounds per square inch.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install pipe and fittings in accordance with the applicable referenced standard, the manufacturer's instructions and as specified herein. PE pipes shall be in accordance with AWWA M55.
- B. Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe and fittings, and maintain in a clean condition.
- C. Joints between the plain end of pipes and fittings shall be joined by the method of thermal butt-fusion. Pipe shall be fused by qualified fusion technicians, as required by manufacturer of the fusion equipment. Record and log each fusion joint by an electronic monitoring device (data logger) connected to the fusion machine. Log fusion data and create Post-Construction Fusion Report with software specifically developed for the pipe material being fused. Software must record the parameters required by the fusion equipment manufacturer and these specifications. Manual log data not logged by the data logger and be included in the Post-Construction Fusion Report. Assemble fusible pipe lengths in the field with butt-fused joints. Follow the manufacturer's fusion equipment procedures.
- D. Install butt fused PE Pipe in accordance with ASTM F1962.
- E. Post-Construction Fusion Report shall include the following data for each fusible connection in the report
 - 1. Pipe Size and Thickness
 - 2. Machine Size
 - 3. Fusion Technician Identification
 - 4. Job Identification
 - 5. Fusion Joint Number
 - 6. Fusion, Heating, and Drag Pressure Settings
 - 7. Heat Plate Temperature
 - 8. Time Stamp
 - 9. Heating and Cooling Down Time of Fusion

10. Ambient Temperature

- F. A stiffener shall be installed in the bore of the polyethylene pipe when an outside-diameter (O.D.) compression mechanical coupling is used and when connecting plane end pipe to a mechanical joint pipe, fitting, or appurtenance.
- G. Branch connections to the main shall be made with saddle fittings or tees and fused. Joints between the main and saddle branch fittings or corporation stops shall be made using saddle fusion. Follow the manufacturer's fusion equipment procedures.
- H. The pipe supplier shall be consulted to obtain machinery and expertise for the joining by butt-fusion of polyethylene pipe and fittings. No pipe or fittings shall be joined by fusion by any contractor unless he is adequately trained and qualified in the techniques involved.

3.02 LEAK TESTING

- A. Hydrostatic testing shall be conducted in accordance with ASTM F2164, "Field Leak Testing of PE Pressure Piping Systems using Hydrostatic Pressure". Pneumatic pressure testing is prohibited. The test pressure shall be as indicated by the Engineer. Use a hydrostatic pressure not less than the maximum working pressure of the system. Leak test may be performed at the same time and at the same test pressure as the pressure test.
- B. Wherever possible, the leak test shall be done in sections isolated from valve to valve or pipe cap. Ensure each end is properly restrained to withstand the test pressure.
- C. An isolation valve shall be provided between the pressurizing equipment and test section.
- D. Leak testing shall be performed according to the following procedure:
 - 1. Filling: Fill the restrained section of pipe, ensuring all trapped air has been released.
 - 2. Initial Expansion Phase: Gradually pressurize the test section to the test pressure and maintain the test pressure for three (3) hours. Periodically add water to maintain test pressure in the test section as the pipe initially expands.
 - 3. Test Phase: Immediately following the Initial Expansion Phase, shut the isolation valve between the pressurizing equipment and test section. Reduce pressure in test section by 10 PSI and observe pressure for one (1) hour.
 - 4. Acceptance Criteria: If the test section pressure does not decrease by more than 5% of the target pressure over the one (1) hour period, the test section will have passed the leak test.

3.03 CHLORINATION

Chlorination of water mains shall be per specification 02700 Marina Piping and Equipment.

***** END OF SECTION *****

SECTION 02700

MARINA PIPING AND EQUIPMENT SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. MARINA PIPING AND EQUIPMENT SYSTEMS consists of furnishing transportation, labor, materials, and equipment to furnish, install, and test the dock potable water and fire system, including piping, valves, hose bibs, and fire extinguisher cabinets, as specified and as indicated on the mechanical Drawings for the docks.

1.02 RELATED WORK

- A. Section 16100 – Marina Electrical
- B. Section 10110 – Fixed Pier

1.03 REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society of Mechanical Engineers (ASME):
 - ASME B16.5 Pipe Flanges & Flanged Fittings
 - ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings
 - ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
- C. American Society for Testing and Materials (ASTM International)
 - ASTM B32 Standard Specification for Solder Metal
 - ASTM B88 Standard Specification for Seamless Copper Water Tube.
 - ASTM D3035 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside
 - ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
- A. American Water Works Association (AWWA):
 - AWWA C606 Standard for Grooved and Shoulder Joints
 - AWWA C651 Disinfecting Water Mains
- B. Factory Mutual (FM)
- C. Manufacturers Standardization Society of The Valve And Fittings Industry, Inc. (MSS):

MSS SP-110

Ball Valves Threaded, Socket-Welding, Solder Joint,
Grooved and Flared Ends

D. National Fire Protection Association (NFPA):

NFPA 10

Portable fire Extinguishers

E. Reference Specifications (RS) are the 2009 Edition of the "Greenbook", Standard Specifications for Public Works Construction

F. Underwriters Laboratories Incorporated (UL)

G. Uniform Plumbing Code (UPC)

1.04 SUBMITTALS

A. Provide manufacturer's data including but not limited to drawings, connection details, manuals, UL listings, FM approvals, disinfection reports, bacteriological reports, installation instructions and/or catalog cut sheets for the following:

1. Pipe, fittings and valves
2. Backflow preventer
3. Joints and couplings
4. Fire extinguisher cabinets
5. Fire extinguishers
6. Pipe hangers and supports

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspect materials delivered to site for damage. Unload and store with minimum handling and in accordance with manufacturer's instruction. Store materials on site in enclosures or under protective covering. Store plastic piping under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and equipment free of dirt and debris.

B. Pipes:

1. Store pipe in stockpiles built on a flat base.
2. Keep rubber gaskets from excessive heat and free from oil and grease.

C. Store fittings, cabinets, and valves on wooden platforms above ground.

D. Handle pipe, fitting, valves, and other accessories in such manner as to ensure delivery to the docks and installation location in a sound undamaged condition.

PART 2 - PRODUCTS

2.01 WATER SYSTEMS MATERIALS

- A. The materials and equipment to be furnished under this Section shall be standard products of the manufacturer. Where two or more units of the same equipment are required, units shall be the product of a single manufacturer. Materials shall be delivered to the jobsite new and unused. All materials shall be weatherproof and suitable for a corrosive marine environment, including UV resistance. No ferrous materials shall be used unless specified or indicated on the plans.
- B. Hangers, straps, brackets, fasteners, and appurtenances above the water line shall be type 316 stainless steel as detailed on the Drawings. Other hangers and supports shall be as indicated on Drawings or required to maintain indicated support spacing.
- C. Potable Water Piping: The pipe material for installation is noted on Drawings. Fittings, flanges, and appurtenances shall be compatible with the pipe.
 - 1. High Density Polyethylene (HDPE) Piping:
 - a. HDPE piping shall be SDR-11, per ASTM D3035 and ASTM F714.
 - b. Joints shall be butt fused welded.
 - c. Plastic pipe and fittings shall bear the seal of the National Sanitation Foundation for potable water service.
 - 2. Flexible Hose:
 - a. Flexible Hose and fittings materials shall be compatible with potable water and suitable for 24-hour contact with chlorine sterilization solution in the hose interior and with seawater and sunlight on the hose exterior.
 - b. Factory assembled lengths with 200 psi working pressure and marine stainless-steel couplings at each end. Contractor shall provide an isolating flange and ensure that copper flanges are the same design pressure as the stainless-steel coupling.
 - 3. Copper Tubing:
 - a. ASTM B88, Type K with ASME B16.18 or ASME B16.22 solder joint fittings. Provide ASTM B42 copper pipe nipples with threaded end connections. Provide approved lead-free solder.
 - b. Ball valves shall be copper alloy with threaded ends. Ball valves shall be full port have a quarter turn lever handles and be rated for 600 psi. Ball valves shall comply with MSS SP-110.
 - 4. Hose Bibbs
 - a. Dock hose bibb stations shall be ¾" Arrowhead "Arrow-Breaker" with integral vacuum breaker or approved equal.
 - 5. Backflow Preventer
 - a. Backflow preventer shall be lead free double check assembly backflow preventer. Body shall cast copper silicon alloy body with silicone elastomers and stainless-steel springs.
- D. Fire Extinguishers and Cabinets:

1. Fire extinguishers cabinets shall have one 10-pound fire extinguisher having a minimum rating of 4A-80B: C and shall be as noted on the Drawings. Fire extinguishers shall conform to NFPA 10.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install all materials in accordance with the Uniform Plumbing Code as well as any applicable reference standards or manufacturer's instructions as indicated herein. Material and equipment shall be worked into a complete, convenient, and economical system or systems; all apparatus, parts, materials, and accessories which are necessary to accomplish this result shall be furnished and worked into place.
- B. Piping shall follow the general arrangement shown on Drawings. Provision for expansion and contraction of pipelines shall be made where necessary. Piping shall be run essentially as indicated on Drawings, care being taken to avoid interference with other piping, conduit, or equipment. The location of piping to be run along the ramp and docks shall be carefully coordinated with electrical conduits specified, other utility piping and equipment location. Before jointing and erection of piping, thoroughly clean interiors of pipe, and components. Maintain cleanliness by closure of pipe openings with caps or plugs. Before making final equipment connections, blow out each system with compressed air at 100 psig or more.
- C. Pipe, fittings, valves, and accessories will be carefully inspected by the Contractor before and after installation and those found defective shall be replaced. Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories and maintain in a clean condition. Cut pipe accurately to measurements established at the site and work into place without springing or forcing. Replace by one of the proper dimensions any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Provide proper facilities for positioning piping into installation location. Provide anchors and supports where necessary for fastening work into place. Make proper provision for expansion and contraction of piping. At the end of each day's work, close open ends of pipe temporarily until pipe is to be worked on.
- D. Solder End Valves:
 1. Remove stems and washers and other item subject to damage by heat during installation. Reassemble valve after soldering is completed. Valves without heat sensitive parts do not require disassembly but shall be opened at least two turns during soldering.

3.02 FIELD TESTS AND INSPECTIONS

- A. The potable water system shall be subjected to hydrostatic test. The system may be tested as a unit, subject to approval by the Engineer. Prior to application of the test pressure, install a calibrated test pressure gage in the system to indicate any loss in pressure occurring during the test. Apply and maintain the test pressure as noted on the Drawings and in conformance with the agencies having jurisdiction, during which time there shall be no evidence of leakage as detected by a reduction in test pressure. Should a reduction occur, leaks shall be located, repaired, and the test repeated. Test pressure shall be as stated on Drawings. All equipment and apparatus required for the tests shall be furnished by the Contractor. Coordinate the proposed method for disposal of wastewater from hydrostatic testing.

- B. The Engineer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in the utility applicable section. Contractor shall be able to produce evidence, when required, that each item of work has been constructed in accordance with the Drawings and Specifications.

3.03 STERILIZATION OF POTABLE WATER SYSTEMS

- A. Upon completion of the potable water installation and pressure testing, the Contractor shall flush and disinfect the water system. Unless otherwise specified, the Contractor shall perform all work necessary for the disinfection of pipelines under the supervision and coordination of the Owner or Owner's authorized representative. Chlorination of water mains shall be in accordance with AWWA C651. Disinfection of mains shall be repeated until samples show absence of coliforms. The Department of Water reserves the right to request and test additional water samples in the interest of safeguarding public health and safety at no additional cost to the Department of Water. A certified bacteriological test result shall be provided within one week prior to placing the system in service.
- B. The Contractor shall be responsible for the proper disposal of chlorinated water to safeguard public health and environment in accordance with applicable Department of Health and NPDES requirements.

3.04 SYSTEM STARTUP

- A. Water mains and appurtenances must be completely installed, disinfected, flushed, and satisfactory sterilization prior to permanent connections being made to the active distribution system. Obtain approval by the agency having jurisdiction prior to the new potable water system being placed into service.

3.05 CLEANUP

- A. Upon completion of the installation of the potable water system and appurtenances, remove all debris and surplus materials resulting from the work.

***** END OF SECTION *****

SECTION 03320
MARINE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. The work covered by this Section includes the furnishing of all materials and equipment and the performing of all labor to complete marine concrete work associated with the Landside and Waterside elements as shown on the Contract Drawings and as herein specified or directed by the Engineer. This work shall include but is not limited to Landside concrete ramp and gangway concrete pads; and/or Waterside concrete pile caps.

1.02 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Unless otherwise indicated, the most recent edition of the publication, including any revisions, shall be used.

B. ACI INTERNATIONAL (ACI)

ACI 117	Standard Specifications for Tolerances for Concrete Construction and Materials
ACI 121R	Quality Management System for Concrete Construction
ACI 201.2R	Guide to Durable Concrete
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 214R	Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	Specifications for Structural Concrete
ACI 304.2R	Placing Concrete by Pumping Methods
ACI 304R	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	Hot Weather Concreting
ACI 306.1	Standard Specification for Cold Weather Concreting
ACI 308R	Guide to Curing Concrete
ACI 309R	Guide for Consolidation of Concrete
ACI 311.4R	Guide for Concrete Inspection
ACI 318M	Metric Building Code Requirements for Structural Concrete and Commentary

ACI 347	Guide to Formwork for Concrete
ACI SP-15	Field Reference Manual: Standard Specifications for Structural Concrete with Selected ACI and ASTM References
ACI SP-2	ACI Manual of Concrete Inspection
ACI SP-66	ACI Detailing Manual
C.	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
AASHTO M 182	Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats
AASHTO T 259	Resistance of Concrete to Chloride Ion Penetration
D.	AMERICAN WELDING SOCIETY (AWS)
AWS D1.4/D1.4M	Structural Welding Code - Reinforcing Steel
E.	ASTM INTERNATIONAL (ASTM)
ASTM A 185/A 185M	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 496/A 496M	Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497/A 497M	Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
ASTM A 615/A 615M	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A 706/A 706M	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 82/A 82M	Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A 934/A 934M	Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A 966/A 966M	Standard Test Method for Magnetic Particle Examination of Steel Forgings Using Alternating Current
ASTM C 1017/C 1017M	Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1064/C 1064M	Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

ASTM C 1077	Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1107/C 1107M	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1116/C 1116M	Standard Specification for Fiber-Reinforced Concrete
ASTM C 1157	Standard Specification for Hydraulic Cement
ASTM C 1202	Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
ASTM C 1218/C 1218M	Standard Specification for Water-Soluble Chloride in Mortar and Concrete
ASTM C 1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C 138/C 138M	Standard Test Method for Density ("Unit Weight"), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 143/C 143M	Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C 150	Standard Specification for Portland Cement
ASTM C 171	Standard Specification for Sheet Materials for Curing Concrete
ASTM C 172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 173/C 173M	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 227	Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
ASTM C 231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 295	Petrographic Examination of Aggregates for Concrete
ASTM C 309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31/C 31M	Standard Practice for Making and Curing Concrete Test Specimens in the Field

ASTM C 33	Standard Specification for Concrete Aggregates
ASTM C 39/C 39M	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42/C 42M	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 441	Effectiveness of Pozzolans or Ground Blast-Furnace Slag in Preventing Excessive Expansion of Concrete Due to the Alkali-Silica Reaction
ASTM C 469	Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression
ASTM C 494/C 494M	Standard Specification for Chemical Admixtures for Concrete
ASTM C 496/C 496M	Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM C 595	Standard Specification for Blended Hydraulic Cements
ASTM C 597	Pulse Velocity Through Concrete
ASTM C 618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C 642	Density, Absorption, and Voids in Hardened Concrete
ASTM C 805	Rebound Number of Hardened Concrete
ASTM C 881/C 881M	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 920	Standard Specification for Elastomeric Joint Sealants
ASTM C 94/C 94M	Standard Specification for Ready-Mixed Concrete
ASTM C 989	Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM D 1179	Fluoride Ion in Water
ASTM D 1190	Standard Specification for Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 1339	Sulfite Ion in Water
ASTM D 1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D 1752	Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D 3867	Nitrite-Nitrate in Water
ASTM D 512	Chloride Ion in Water
ASTM D 516	Sulfate Ion in Water
ASTM E 329	Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
F. U.S. ARMY CORPS OF ENGINEERS (USACE)	
COE CRD-C 572	Specifications for Polyvinylchloride Waterstops
COE CRD-C 61	Test Method for Determining the Resistance of Freshly Mixed Concrete to Washing Out in Water
G. U.S. GENERAL SERVICES ADMINISTRATION (GSA)	
FS SS-S-1614	(Rev A; Am 1) Sealants, Joint, Jet-Fuel-Resistant, Hot-Applied, for Portland Cement and Tar Concrete Pavements
FS SS-S-200	(Rev E; Am 2) Sealant, Joint, Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland Cement Concrete Pavement

1.03 DEFINITIONS

- A. "Blending size" is an aggregate that complies with the quality requirements in ASTM C 33 and paragraph entitled "Aggregates" and as modified herein and can be blended with coarse and fine aggregate to produce a well graded combined grading.
- B. "Cementitious material" as used herein shall include portland cement, pozzolan, fly ash, and ground granulated blast-furnace slag.
- C. "Design strength" (f'c) is the specified compressive strength of concrete to meet structural design criteria.
- D. "Marine concrete" is that concrete that will be in contact with or subject to submersion, tidal variations, splash, or spray from water in navigable waterways.
- E. "Mixture proportioning" is a description of the proportions of a concrete mixture that were selected to enable it to meet the performance durability requirements, constructability requirements, and the initial and life-cycle cost goals.
- F. "Mixture proportions" is the concrete supplier's by-mass proportions to replicate the mixture design.
- G. "Pozzolan" is a silicious or silicious and aluminous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.

- H. "Field test strength" (fcr) is the required compressive strength of concrete to meet structural and durability criteria. Determine (fcr) during mixture proportioning process.

1.04 SUBMITTALS

- A. The Contractor shall submit the following in accordance with Contract Documents. Note that approval of the submittals by the Owner's Representative shall not be construed as relieving the Contractor from responsibility for compliance with the specifications nor from responsibility of errors of any sort in the submittals.
- B. Shop Drawings
 - 1. Reinforcing steel
 - 2. Formwork
 - 3. Construction joints
 - 4. Reproductions of contract drawings are unacceptable.
- C. Product Data
 - 1. Waterstops
 - 2. Materials for curing concrete
 - 3. Joint sealants
 - 4. Joint filler
 - 5. bonding compound
 - 6. Synthetic reinforcing fibers
 - 7. Epoxy coatings
 - 8. Non-shrink grout
 - 9. Sealer-hardener
 - 10. Preformed joint filler
 - 11. Reinforcement supports
- D. Samples
 - 1. Topping slab finish sample
- E. Design Data
 - 1. Mixture design
- F. Test Reports
 - 1. Concrete mixture proportions

2. Fly ash
3. Natural pozzolan
4. Ground iron blast-furnace slag
5. Aggregates
6. Admixtures
7. Cement
8. Water
9. Reinforcement and protective coating

G. Certificates

1. Curing concrete elements
2. Concrete placement and compaction
3. Quality assurance
4. Field testing technician and testing agency
5. Mixture designs

1.05 MODIFICATION OF REFERENCES

- A. Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to " the "Structural Engineer," and the "Architect/Engineer" to mean the Owner's Representative.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver concrete until vapor barrier, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. ACI 301 and ASTM A 934/A 934M for job site storage of materials. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground. Protect materials from contaminants such as grease, oil, and dirt. Ensure materials can be accurately identified after bundles are broken and tags removed.

1.07 QUALITY ASSURANCE

- A. Concrete Mixture Design

1. At least 30 days prior to concrete placement, submit proportions for a concrete mixture for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, aggregate, fly ash, (or slag pozzolans), ground slag, polypropylene fibers, anti-washout and other admixtures for underwater concreting, corrosion inhibitors; and applicable reference specifications. Submit additional data regarding concrete aggregates if the source of aggregate changes. Submittal shall clearly indicate where each mixture will be used when more than one mix design is submitted. The mixture shall be prepared by an accredited laboratory experienced in this field and under the direction of a licensed/registered civil engineer, who shall sign all reports and designs.

B. Drawings

1. Reinforcing Steel: ACI SP-66. Provide bending and cutting diagrams, assembly diagrams, splicing placement and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars. Only complete drawings will be accepted.
2. Formwork: ACI 347. Include design calculations indicating arrangement of forms, sizes and grades of supports (lumber), panels, and related components. Indicate placement schedule, construction, and location and method of forming control joints. Include locations of inserts, pipework, conduit, sleeves, and other embedded items. Furnish drawings and descriptions of shoring and reshoring methods proposed for slabs, beams, and other horizontal concrete members.

C. Certificates

1. Curing Concrete Elements: Submit proposed materials and methods for curing concrete elements.
2. Concrete Placement and Compaction
 - a. Submit technical literature for equipment and methods proposed for use in placing concrete. Include pumping or conveying equipment including type, size and material for pipe, valve characteristics, and the maximum length and height concrete will be pumped. No adjustments shall be made to the mixture design to facilitate pumping.
 - b. Submit technical literature for equipment and methods proposed for vibrating and compacting concrete. Submittal shall include technical literature describing the equipment including vibrator diameter, length, frequency, amplitude, centrifugal force, and Manufacturer's description of the radius of influence under load. Where flat work is to be cast, provide similar information relative to the proposed compacting screed or other method to ensure dense placement.
3. Quality Assurance: Develop and submit for approval a quality control plan in accordance with the guidelines of ACI 121R and as specified herein. The plan shall include plans for the concrete supplier, the reinforcing steel supplier, and installer. Maintain a copy of ACI SP-15 and CRSI Manual of Practice at the project site.
4. Field Testing Technician and Testing Agency
 - a. Submit data on qualifications of proposed testing agency and technicians for approval by the Owner's Representative prior to performing any work.

- i. Work on concrete under this contract shall be performed by an ACI Concrete Field Testing Technician Grade 1 or Grade 2 qualified in accordance with ACI SP-2 or equivalent. Equivalent certification programs shall include requirements for written and performance examinations as stipulated in ACI SP-2.
 - ii. Testing agencies that perform testing services on reinforcing steel shall meet the requirements of ASTM E 329.
 - iii. Testing agencies that perform testing services on concrete materials shall meet the requirements of ASTM C 1077.
5. Mixture Designs: Provide a detailed report of materials and methods used, test results, and the field test strength (fcr) for marine concrete required to meet durability requirements.

D. Test Reports

1. Concrete Mixture Proportions
 - a. Submit copies of test reports by independent test labs conforming to ASTM C 1077 showing that the mixture has been successfully tested to produce concrete with the properties specified and that mixture will be suitable for the job conditions. Test reports shall be submitted along with the concrete mixture proportions. Obtain approval before concrete placement.
 - b. Fully describe the processes and methodology whereby mixture proportions were developed and tested and how proportions will be adjusted during progress of the work to achieve, as closely as possible, the designated levels of relevant properties.
2. Fly Ash and Natural Pozzolan: Submit test results in accordance with ASTM C 618. Submit test results performed within 6 months of submittal date.
3. Ground Iron Blast-Furnace Slag: Submit test results in accordance with ASTM C 989 for ground iron blast-furnace slag. Submit test results performed within 6 months of submittal date.
4. Aggregates: Submit test results for aggregate quality in accordance with ASTM C 33, and the combined gradation curve for grading proposed for use in the work and used in the mixture qualification, and ASTM C 295 for results of petrographic examination. Where there is potential for alkali-silica reaction, provide results of tests conducted in accordance with ASTM C 227 or ASTM C 1260. Submit results of all tests during progress of the work in tabular and graphical form as noted above, describing the cumulative combined aggregate grading and the percent of the combined aggregate retained on each sieve.
5. Admixtures: Submit test results in accordance with ASTM C 494/C 494M and ASTM C 1017/C 1017M for concrete admixtures, ASTM C 260 for air-entraining agent, and Manufacturer's literature and test reports for corrosion inhibitor and anti-washout admixture. Submitted data shall be based upon tests performed within 6 months of submittal.
6. Cement: Submit test results in accordance with ASTM C 150 portland cement and/or ASTM C 595 and ASTM C 1157 for blended cement. Submit current mil data.

7. Water: Submit test results in accordance with ASTM D 512 and ASTM D 516.
8. Reinforcement and Protective Coating: Provide coating Manufacturer's and coating applicator's test data sheets certifying that applied coating meets the requirements of ASTM A 934/A 934M.

E. Field Samples

1. Topping Slab Finish Sample: Install minimum of 4 -foot by 4-foot slab. Finish as required by specification.

PART 2 - PRODUCTS

2.01 CONCRETE

- A. Durability and Strength: ACI 201.2R and ACI 211.1. For structural elements to be exposed in a marine environment, adjust the concrete 28-day design strength to produce concrete of minimum design strength (f'c) of 5000 psi for cast-in-place concrete elements, 6000 psi for precast (non-prestressed) concrete elements.
- B. Contractor-Furnished Mixture Proportions
 1. Strength and Water-Cementitious Materials Ratio. Strength requirements shall be based on 28-day compressive strength determined on 6 by 12-inch cylindrical specimens in accordance with ASTM C 39/C 39M. The specified compressive strength of the concrete (f'c) for each portion of the structure shall meet the requirements in the contract documents.
 2. The mixture proportions for marine concrete shall be developed by the Contractor to produce the design strength (f'c) and to provide durability, workability, and mixture consistency to facilitate placement, compaction into the forms and around reinforcement without segregation or bleeding. The requirements for durability consideration specified in Table 1 and subparagraph "Chloride Ion Penetration" below shall be incorporated in the mixture proportions.

Concrete Quality Requirements

Zone	Exposure Condition	Maximum water to cement ratio	Minimum quantity of cementitious material (lb/cy)	Minimum quantity of portland cement (lb/cy)
Submerged (1) and Tidal (2)	(a) Directly exposed to salt water	0.40	675	505
	(b) Subject to severe abrasion	0.40	675	505
Splash (3)	(a) Directly exposed to salt water	0.40	675	505
Atmospheric (4)	(a) Directly exposed to salt water	0.40	675	505
	(b) Protected from direct exposure to marine atmosphere	0.45	607	505

3. The maximum mass of fly ash, natural pozzolans, or ground granulated blast-furnace slag that is included in the calculation of water-to-cementitious materials ratio shall not exceed the following limits:
 - a. Fly ash shall not be used for more than 25 percent by mass of the cementitious material. The fly ash and other pozzolans present in a Type IP or IPM blended cement, ASTM C 595, shall be included in the calculated percentage. If fly ash or other pozzolan is used in concrete with slag, the portland cement shall not be less than 50 percent of the total mass of cementitious materials. A higher percentage of fly ash may be used if tests are made using actual job materials to ascertain the early and later age strengths and durability performance specified, and the use is approved by the Owner's Representative.
 - b. ~~No Slag in this project. The weight of ground granulated blast-furnace slag conforming to ASTM C 989 shall not exceed 50 percent of the weight of cement. The slag used in manufacture of a Type IS or ISM blended hydraulic cement conforming to ASTM C 595 shall be included in the calculated percentage. Higher percentage of ground granulated blast-furnace slag may be used if tests are made using actual job materials to ascertain the early and later age strengths and durability performance specified, and the use is approved by the owner.~~
 - c. The minimum amount of portland cement is 50 percent of the total mass of cementitious material.
 4. Air Content. Concrete that will be subject to destructive exposure (other than loading and wear in a passive environment) such as freezing and thawing, severe weathering, or deicing chemicals shall be air entrained and shall conform to the air limits specified in ACI 301.
 5. Slump. The concrete mixture shall be proportioned to have, at the point of deposit, a maximum slump of 4 inches as determined by ASTM C 143/C 143M. Where an ASTM C 494/C 494M, Type F or G admixture is used, the slump after the addition of the admixture shall be no less than 6 inches nor greater than 8 inches. Slump tolerances shall comply with the requirements of ACI 117.
 6. Chloride Ion Penetration (topping slabs only). To ensure the durability of concrete in marine environment, concrete shall be proportioned to have the chloride ion penetration test in accordance with ASTM C 1202, and be below 1500 coulombs for concrete specimens tested at 28 days. Alternatively, a ponding test in accordance with AASHTO T 259 may be performed to validate chloride ion penetration in accordance with ASTM C 1202. Alternative chloride ion penetration resistance testing program may be submitted to Owner's Representative for review and approval.
- C. Required Average Strength of Concrete: The minimum compressive strength (fcr) of the selected mixture shall equal or exceed the strength required under ACI 301 for laboratory mixture designs and which passes the test indicated in the subparagraph entitled "Chloride Ion Penetration." The average compressive strength produced under field tests shall be the minimum compressive strength (fcr) required during construction.

2.02 MATERIALS

- A. Cement: ASTM C 150, Type II and/or ASTM C 595, Type IP(MS) or IS(MS) and ASTM C 1157, Type MS blended cement except as modified herein. The tricalcium aluminate (C3A) content shall not be less than 4 percent to provide protection for the reinforcement and shall not be more than 10 percent to obtain concrete that is resistant to sulfate attack. Blended cements shall consist of a mixture of ASTM C 150 cement and one of the following materials: ASTM C 618 pozzolan or fly ash, ~~or ASTM C 989 ground granulated blast furnace slag~~. Use one Manufacturer for each type of cement, ~~ground slag~~, fly ash, and pozzolan.
1. Fly Ash and Pozzolan: ASTM C 618, Type N, F, or C, except that the maximum allowable loss on ignition shall be 6 percent for Types N and F. Add with cement.
- B. Water: Water shall comply with the requirements of ASTM C 94/C 94M and the chloride and sulfate limits in accordance with ASTM D 512 and ASTM D 516. Mixing water shall not contain more than 500 parts per million of chlorides as Cl and not more than 100 parts per million of sulfates as SO₄. Water shall be free from injurious amounts of oils, acids, alkalis, salts, and organic materials. Where water from reprocessed concrete is proposed for use in the work, submit results of tests to verify that the treatment has negated adverse effects of deleterious materials.
- C. Aggregates: ASTM C 33, except as modified herein.
1. The combined aggregates in the mixture (coarse, fine, and blending sizes) shall be well graded from the coarsest to the finest with not more than 18 percent nor less than 8 percent, unless otherwise permitted, of the combined aggregate retained on any individual sieve with the exceptions that the No. 50 may have less than 8 percent retained, sieves finer than No. 50 shall have less than 8 percent retained, and the coarsest sieve may have less than 8 percent retained. Use blending sizes where necessary, to provide a well graded combined aggregate. Reports of individual aggregates shall include standard concrete aggregate sieve sizes including 1 1/2 inches, one inch, 3/4 inch, 1/2 inch, 3/8 inch, No. 4, No. 8, No. 16, No. 30, No. 50, and No. 100.
 2. Provide aggregates for exposed concrete from one source, ASTM C 227. Do not provide aggregates that react deleteriously with alkalis in cement. Refer to appendix, paragraph entitled "Test Method C227" of ASTM C 33 for expansion limits. Provide aggregate containing no deleterious material properties as identified by ASTM C 295.
 3. Where a size designation is indicated, that designation indicates the nominal maximum size of the coarse aggregate.
 4. Aggregate may contain materials deleteriously reactive with alkalis in the cement, if cement contains less than 0.60 percent alkalis (percent Na₂O plus .658 percent K₂O). Provide a material such as fly ash ~~or slag~~ as specified to be effective in preventing harmful expansion due to alkali-aggregate reaction by ASTM C 441.
 5. Where historical data is used, provide aggregates from the same sources having the same size ranges as those used in the concrete represented by historical data.
 6. Marine aggregate may be used when conforming to ASTM C 33 and if it originates from the up-current side of the land mass and it has been washed by the fresh water so that the total chloride and sulfate content of the concrete mixture does not exceed the limits defined herein.
- D. Nonshrink Grout: ASTM C 1107/C 1107M.
- E. Admixtures

1. Provide chemical admixtures that comply with the requirements shown below and in accordance with Manufacturer's recommendations, and appropriate for the climatic conditions and the construction needs. Do not use calcium chloride or admixtures containing chlorides from other than impurities from admixture ingredients.
2. Provide minimum concentrations of corrosion-inducing chemicals as shown in Table 2 below. For concrete that may be in contact with prestressing steel tendons, the concentration shall not exceed 60 percent of the limits given in Table 2. For the concentration in grout for prestressing ducts, do not exceed 25 percent of the limits in Table 2.

Limits on Corrosion-Inducing Chemicals

Chemical*	Limits, Percent**	Test Method
Chlorides	0.10	ASTM D 512
Fluorides	0.10	ASTM D 1179
Sulphites	0.13	ASTM D 1339
Nitrates	0.17	ASTM D 3867

* Limits refer to water-soluble chemicals

** Limits are expressed as a percentage of the mass of the total cementitious materials.

3. The total alkali content shall not increase the total sodium-oxide equivalent alkali content of the concrete by more than 0.5 lb/cy.
4. Air Entraining Admixture: Provide air entraining admixtures conforming to ASTM C 260. Provide the admixture of such a type and dosage that the total air content in the hardened concrete can be readily maintained within the limits specified in Table 3.

Air Content

Nominal maximum size of coarse aggregate, inch(es)	Size Number	Total air content, percent by volume
3/8	8	6-10
1/2	7	5-9
3/4	67	4-8
1	57	3.5-6.5
1 1/2	467	3-6
2	357	2.5-5.5
3	-	1.5-4.5

5. Accelerating: ASTM C 494/C 494M, Type C.
6. Retarding: ASTM C 494/C 494M, Type B, D, or G.
7. Water Reducing: ASTM C 494/C 494M, Type A, E, or F.
8. High Range Water Reducer (HRWR): ASTM C 494/C 494M, Type F and ASTM C 1017/C 1017M.

- F. Calcium Nitrite Corrosion Inhibitor: Include in concrete mix for all concrete. Add to the concrete mix at an application rate of 3 gallons per cubic yard of concrete, to inhibit corrosion to 9.9 lbs of chloride at the rebar level per cubic yard of concrete. The Contractor shall furnish one concrete cylinder for every 50 cubic yards of concrete produced, or 2 cylinders per day minimum, in order to verify the concentrations of calcium nitrite in hardened concrete. Concrete failing to contain calcium nitrite at the required concentration as tested shall be subject to rejection. Any air-entraining, water-reducing, and/or set-controlling admixtures used in the production of concrete mixtures for concrete shall be compatible with calcium nitrite solutions. The Contractor shall strictly adhere to the manufacturer's written recommendations regarding the use of the admixture including storage, transportation, and method of mixing. The calcium nitrite, which acts as an accelerator, may be used in conjunction with the retarder to control the set of concrete, as per Manufacturer's recommendation.
- G. Materials for Forms: Provide wood, plywood, or steel. Use plywood or steel forms where a smooth form finish is required. Lumber shall be square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Plywood: PS-1, B-B concrete form panels or better. Steel form surfaces shall not contain irregularities, dents, or sags.
1. Form Ties and Form-Facing Material
 - a. Provide a form tie system that does not leave mild steel after break-off or removal any closer than 2 inches from the exposed surface. Do not use wire alone. Form ties and accessories shall not reduce the effective cover of the reinforcement.
 - b. Form-facing material shall be structural plywood or other material that can absorb air trapped in pockets between the form and the concrete and some of the high water-cementitious materials ratio surface paste. Maximum use is three times. Provide forms with a form treatment to prevent bond of the concrete to the form.
 - c. As an alternate to using an absorptive wood form contact face as a form liner, use "Zendrain" or an approved equal in strict accordance with the Manufacturer's recommendations.
- H. Reinforcement
1. Reinforcing Bars: ACI 301 unless otherwise specified. ASTM A 615/A 615M Grade 60
 2. Mechanical Reinforcing Bar Connectors: ACI 301. Provide 125 percent minimum yield strength of the reinforcement bar. Coat connectors in accordance with the same requirements as reinforcing bars.
 3. Welded Wire Fabric: ASTM A 185/A 185M or ASTM A 497/A 497M. Provide flat sheets of welded wire fabric for slabs and toppings.
 4. Wire: ASTM A 82/A 82M or ASTM A 496/A 496M.
 5. Weldable Reinforcing Bars: All reinforcing steel to be welded shall conform to ASTM A706.
- I. Polyvinylchloride Waterstops: COE CRD-C 572.
- J. Materials for Curing Concrete
1. Impervious Sheeting: ASTM C 171; waterproof paper, clear or white polyethylene sheeting, or polyethylene-coated burlap.

2. Pervious Sheeting: AASHTO M 182.
- K. Liquid Chemical Sealer-Hardener Compound: Provide magnesium fluosilicate compound which when mixed with water seals and hardens the surface of the concrete. Do not use on exterior slabs exposed to freezing conditions. Compound shall not reduce the adhesion of resilient flooring, tile, paint, roofing, waterproofing, or other material applied to concrete.
- L. Expansion/Contraction Joint Filler: ASTM D 1751 or ASTM D 1752, 1/2 inch thick, unless otherwise indicated.
- M. Joint Sealants
 1. Horizontal Surfaces, 3 Percent Slope, Maximum
 - a. ASTM D 1190 or ASTM C 920, Type M, Class 25, Use T.
 2. Vertical Surfaces Greater Than 3 Percent Slope
 - a. ASTM C 920, Type M, Grade NS, Class 25, Use T.
- N. Bonding Compound: ASTM C 881/C 881M. Provide Type I for bonding hardened concrete to hardened concrete; Type II for bonding freshly mixed concrete to hardened concrete; and Type III as a binder in epoxy mortar or concrete, or for use in bonding skid-resistant materials to hardened concrete. Provide Grade 1 or 2 for horizontal surfaces and Grade 3 for vertical surfaces. Provide Class A if placement temperature is below 40 degrees F; Class B if placement temperature is between 40 and 60 degrees F; or Class C if placement temperature is above 60 degrees F.
- O. Dovetail Anchor Slot: Provide preformed metal slot approximately one by one inch minimum 22 gage galvanized steel. Coordinate size and throat opening with dovetail anchors. Provide with removable filler material.

PART 3 - EXECUTION

3.01 FORMS

- A. ACI 301. Set forms mortar-tight and true to line and grade. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch unless otherwise indicated. Forms submerged in water shall be watertight.
- B. Provide formwork with clean-out openings to permit inspection and removal of debris. Formwork shall be gasketed or otherwise rendered sufficiently tight to prevent leakage of paste or grout under heavy, high-frequency vibration. Use a release agent that does not cause surface dusting. Limit reuse of plywood to no more than three times. Reuse may be further limited by the Owner's Representative if it is found that the pores of the plywood are clogged with paste to the degree that the wood does not absorb the air or the high water-cementitious materials ratio concrete surface.
- C. Patch form tie holes with a nonshrink patching material in accordance with the Manufacturer's recommendations and subject to approval.
- D. Coating: Before concrete placement, coat the contact surfaces of forms with a nonstaining mineral oil, nonstaining form coating compound, or two coats of nitrocellulose lacquer. Do not use mineral oil on forms for surfaces to which adhesive, paint, or other finish material is to be applied.

- E. Removal of Forms and Supports: After placing concrete, forms shall remain in place for the time periods specified in ACI 347, except for concrete placed underwater, forms shall remain in place 48 hours. Prevent concrete damage during form removal.
 - 1. Special Requirements for Reduced Time Period
 - a. Forms may be removed earlier than specified if ASTM C 39/C 39M test results of field-cured samples from a representative portion of the structure or other approved and calibrated non-destructive testing techniques show that the concrete has reached a minimum of 85 percent of the design strength.
- F. Reshoring: Do not allow construction loads to exceed the superimposed load which the structural member, with necessary supplemental support, is capable of carrying safely and without damage. Reshore concrete elements where forms are removed prior to the specified time period. Do not permit elements to deflect or accept loads during form stripping or reshoring. Forms on columns, walls, or other load-bearing members may be stripped after 2 days if loads are not applied to the members. After forms are removed, slabs and beams over 10 feet in span and cantilevers over 4 feet shall be reshored for the remainder of the specified time period in accordance with paragraph entitled "Removal of Forms." Perform reshoring operations to prevent subjecting concrete members to overloads, eccentric loading, or reverse bending. Reshoring elements shall have the same load-carry capabilities as original shoring and shall be spaced similar to original shoring. Firmly secure and brace reshoring elements to provide solid bearing and support.

3.02 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

- A. ACI 301. Remove rust, scale, oil, grease, clay, or foreign substances from reinforcing.
- B. Reinforcement Supports. Place reinforcement and secure with noncorrodible chairs, spacers, or metal hangers. Support reinforcement on the ground with concrete or other noncorrodible material, having a compressive strength equal to or greater than the concrete being placed.
- C. Splicing: As indicated. For splices not indicated, ACI 301. Do not splice at points of maximum stress. Overlap welded wire fabric the spacing of the cross wires, plus 2 inches. AWS D1.4/D1.4M.
- D. Future Bonding: Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Bolt threads shall match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt is installed.
- E. Cover: Concrete cover for reinforcement is shown in Table 4. Placement tolerance is plus 1/4 inch. The cover to the principle reinforcing bars shall be not less than 2 times the nominal maximum aggregate size nor less than 1.5 times the effective diameter of the reinforcing bars.

Minimum Concrete Cover Over Reinforcement

<u>Zone</u>	<u>Cover over reinforcing steel</u>
Atmospheric zone not subject to salt spray	2.5 in
Tidal, splash, and atmospheric zone subject to salt spray	3.0 in
Submerged zone	2.5 in
Cover of stirrups	1/2 in less than those listed above

- F. Setting Miscellaneous Material and Prestress Anchorages: Place and secure anchors, bolts, pipe sleeves, conduits, and other such items in position before concrete placement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete. Electrically isolate exposed steel work and its anchor systems from the primary steel reinforcement with at least 2 inches of concrete. Coat exposed steel work to reduce corrosion. Take particular care to ensure against corrosion on edges and horizontal surfaces. Use epoxy coatings for protection of carbon steel plates and fittings.
- G. Construction Joints: Locate joints to least impair strength. Continue reinforcement across joints unless otherwise indicated.
- H. Expansion Joints and Contraction Joints: Provide expansion joints where indicated. Make expansion joints 1/2 inch wide unless indicated otherwise. Fill expansion joints not exposed to weather with preformed joint filler material. Completely fill joints exposed to weather with joint filler material and joint sealant. Do not extend reinforcement or other embedded metal items bonded to the concrete through any expansion joint unless an expansion sleeve is used. Place contraction joints, either formed or saw cut or cut with a jointing tool, to the indicated depth after the surface has been finished. Sawed joints shall be completed within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.
- I. Waterstop Splices: Fusion weld in the field.
- J. Pits and Trenches: Place bottoms and walls monolithically or provide waterstops and keys.

3.03 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

- A. ASTM C 94/C 94M, ACI 301, and ACI 304R, except as modified herein. Batching equipment shall be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch tickets imprinted with mix identification, batch size, batch design and measured weights, moisture in the aggregates, and time batched for each load of ready mix concrete. When a pozzolan is batched cumulatively with the cement, it shall be batched after the cement has entered the weight hopper.
- B. Measuring
 - 1. Make measurements at intervals as specified in paragraphs entitled "Sampling" and "Testing."
 - 2. Adjust batch proportions to replicate the mixture design using methods provided in the approved quality assurance plan. Base the adjustments on results of tests of materials at the batch plant for use in the work. Maintain a full record of adjustments and the basis for each.

- C. **Mixing:** ASTM C 94/C 94M and ACI 301. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 85 degrees F. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 85 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, if both the specified maximum slump and water-cementitious material ratio are not exceeded. When water is added, an additional 30 revolutions of the mixer at mixing speed is required. If time of discharge exceeds time required by ASTM C 94/C 94M, submit a request along with description of precautions to be taken. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch.
- D. **Transporting:** Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

3.04 PLACING CONCRETE

- A. Place concrete as soon as practicable after the forms and the reinforcement have been inspected and approved. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water. Prior to placing concrete, remove dirt, construction debris, water, snow, and ice from within the forms. Deposit concrete as close as practicable to the final position in the forms. Do not exceed a free vertical drop of 3 feet from the point of discharge. Place concrete in one continuous operation from one end of the structure towards the other or lifts for vertical construction. Position grade stakes on 10 foot centers maximum in each direction when pouring interior slabs and on 20 foot centers maximum for exterior slabs. At no time shall the concrete temperature exceed 150°F.
- B. **Vibration**
 - 1. Comply with the requirements of ACI 309R and ASTM A 934/A 934M using vibrators with a minimum frequency of 9000 vibrations per minute (VPM). Use only high cycle or high frequency vibrators. Motor-in-head 60 cycle vibrators may not be used. For walls and deep beams, use a minimum of two vibrators with the first to melt down the mixture and the second to thoroughly consolidate the mass. Provide a spare vibrator at the casting site whenever concrete is placed. Place concrete in 18 inch maximum vertical lifts. Insert and withdraw vibrators approximately 18 inches apart. Penetrate at least 8 inches into the previously placed lift with the vibrator when more than one lift is required. Extract the vibrator using a series of up and down motions to drive the trapped air out of the concrete and from between the concrete and the forms.
 - 2. For slab construction use vibrating screeds designed to consolidate the full depth of the concrete. Where beams and slabs intersect, use an internal vibrator to consolidate the beam. Do not vibrate concrete placed with anti-washout admixtures. Vibrators shall be equipped with rubber vibrator heads.
- C. **Application of Bonding Compound:** Apply a thin coat of compound to dry, clean surfaces. Scrub compound into the surface with a stiff-bristle brush. Place concrete while compound is tacky. Do not permit compound to harden prior to concrete placement. Follow Manufacturer's instructions regarding safety and health precautions when working with epoxy resins.

- D. Pumping: ACI 304R and ACI 304.2R. Pumping shall not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment shall not exceed 2 inches. Do not use pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of coarse aggregate to 33 percent of the diameter of the pipe. Maximum size of well rounded aggregate shall be limited to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.
- E. Hot Weather: ACI 305R. Maintain required concrete temperature using Figure 2.1.5, "Effect of Concrete Temperatures, Relative Humidity, and Wind Velocity on the Rate of Evaporation of Surface Moisture From Concrete" in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

3.05 SURFACE FINISHES

- A. Defects: Repair formed surfaces by removing minor honeycombs, pits greater than one square inch surface area or 0.25 inch maximum depth, or otherwise defective areas. Provide edges perpendicular to the surface and patch with nonshrink grout. Patch tie holes and defects when the forms are removed. Concrete with extensive honeycomb including exposed steel reinforcement, cold joints, entrapped debris, separated aggregate, or other defects which affect the serviceability or structural strength will be rejected, unless correction of defects is approved. Obtain approval of corrective action prior to repair. The surface of the concrete shall not vary more than the allowable tolerances of ACI 347. Exposed surfaces shall be uniform in appearance and finished to a smooth form finish unless otherwise indicated.
- B. Formed Surfaces
 1. Tolerances: ACI 117 and as indicated.
 2. As-Cast Rough Form: Provide for surfaces not exposed to public view. Patch holes and defects and level abrupt irregularities. Remove or rub off fins and other projections exceeding 0.25 inch in height.
 3. As-Cast Form: Provide form facing material producing a smooth, hard, uniform texture on the concrete. Arrange facing material in an orderly and symmetrical manner and keep seams to a practical minimum. Support forms as necessary to meet required tolerances. Material with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair the texture of the concrete surface shall not be used. Patch tie holes and defects and completely remove fins.
- C. Finish: ACI 301. Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater. Finish exterior surfaces not otherwise specified with wood floats to even surfaces, and match adjacent finishes.

1. Scratched: Use for surfaces intended to receive bonded applied cementitious applications. After the concrete has been placed, consolidated, struck off, and leveled, the surface shall be roughened with stiff brushes or rakes before final set.
2. Floated: After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further, until ready for floating. Whether floating with a wood, magnesium, or composite hand float, with a bladed power trowel equipped with float shoes, or with a powered disc, float shall begin when the surface has stiffened sufficiently to permit the operation.
3. Broomed: Perform a floated finish, then draw a broom or burlap belt across the surface to produce a coarse scored texture. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab.
4. Scored: Where indicated, provide a scored finish on the unformed (top) surface of the cast-in-place concrete element. Scoring patterns shall be as indicated in the Contract Documents. Provide sample of pattern to Owner's Representative as requested.
5. Concrete Toppings Placement: ACI 301. The following requirements apply to the placement of toppings of concrete on concrete surfaces that are either freshly placed and still plastic, or on hardened base slabs.
 - a. Placing on a Fresh Concrete: Screed and bull float the base slab. As soon as water sheen has disappeared, lightly rake surface of the base slab with a stiff bristle broom to produce a bonding surface for the topping. Immediately spread topping mixture evenly over the roughened base before final set takes place. Give topping the finish indicated on the drawings.
 - b. Bonding to a Hardened Concrete: When the topping is to be bonded to a floated or troweled hardened base, roughen the base by scarifying, grit-blasting, scabbling, planing, flame cleaning, or acid-etching to lightly expose aggregate and provide a bonding surface. Remove dirt, laitance, and loose aggregate by means of a stiff wire broom. Keep the clean base wet for a period of 12 hours preceding the application of the topping. Remove excess water and apply a 1:1:1/2 cement-sand-water grout, and brush into the surface of the base slab. Do not allow the cement grout to dry, and spread it only short distances ahead of the topping placement. Do not allow the temperature differential between the completed base and the topping mixture to exceed 10 degrees F at the time of placing. Place the topping and finish as indicated.

3.06 CURING AND PROTECTION

- A. ACI 301 and ACI 308R unless otherwise specified. Prevent concrete from drying by misting surface of concrete. Begin curing immediately following final set. Avoid damage to concrete from vibration created by blasting, pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, by rain or running water, adverse weather conditions, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer-hardener or epoxy coating.
- B. Wet cure marine concrete using potable water for a minimum of 7 days. Do not allow construction loads to exceed the superimposed load which the structural member, with necessary supplemental support, is capable of carrying safely and without damage.

- C. Moist Curing: Remove water without erosion or damage to the structure.
1. Ponding or Immersion: Continually immerse the concrete throughout the curing period. Water shall not be 20 degrees F less than the temperature of the concrete.
 2. Fog Spraying or Sprinkling: Apply water uniformly and continuously throughout the curing period.
 3. Pervious Sheeting: Completely cover surface and edges of the concrete with two thicknesses of wet sheeting. Overlap sheeting 6 inches over adjacent sheeting. Sheeting shall be at least as long as the width of the surface to be cured. During application, do not drag the sheeting over the finished concrete nor over sheeting already placed. Wet sheeting thoroughly and keep continuously wet throughout the curing period.
 4. Impervious Sheeting: Wet the entire exposed surface of the concrete thoroughly with a fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 12 inches minimum. Provide sheeting not less than 18 inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting. Cover or wrap columns, walls, and other vertical structural elements from the top down with impervious sheeting; overlap and continuously tape sheeting joints; and introduce sufficient water to soak the entire surface prior to completely enclosing.
- D. Liquid Chemical Sealer-Hardener: Apply the sealer-hardener in accordance with Manufacturer's recommendations. Seal or cover joints and openings in which joint sealant is to be applied as required by the joint sealant Manufacturer. The sealer-hardener shall not be applied until the concrete has been moist cured and has aged for a minimum of 30 days. Apply a minimum of two coats of sealer-hardener.
- E. Curing Periods: Moist cure concrete using potable water for a minimum of 7 days. Continue additional curing for a total period of 21 days. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing shall be subject to approval by the Owner's Representative.

3.07 FIELD QUALITY CONTROL

- A. Evaluation of Mixture Designs
1. The adequacy of the mixture design to produce the minimum specified strength and durability shall be confirmed by testing field batches. Slump shall not exceed the slump proposed for the work. Cure the castings using the same methods as the associated concrete element.
 2. Test the fresh concrete as follows:
 - a. Slump in accordance with ASTM C 143/C 143M.
 - b. Air content in accordance with ASTM C 231 or ASTM C 173/C 173M.
 - c. Unit weight in accordance with ASTM C 138/C 138M.

- d. For strength, cast nine 6 by 12 inch cylinders in accordance with ASTM C 31/C 31M.
3. Test 6 by 12 inch cylinders as follows:
- a. Measure and weigh each specimen to determine unit weight as they are stripped from the molds.
 - b. Test specimens to be tested at each age for pulse velocity through concrete in accordance with ASTM C 597.
 - c. Three at each age of 3, 7 and 28 days in accordance with ASTM C 39/C 39M.
4. Sampling and determination of water soluble chloride ion content in accordance with ASTM C 1218/C 1218M. Maximum water soluble chloride ion concentrations in hardened concrete at ages from 28 to 42 days contributed from the ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed the limits of Table 5 below. Sampling and determination of chloride ion penetration (ponding test) in accordance with AASHTO T 259.

Maximum Chloride Ion Content for Corrosion Protection

<u>Type of Member</u>	<u>Maximum water soluble chloride ion (Cl) in concrete, percent by weight of cement</u>
Prestressed concrete	0.06
Reinforced concrete exposed to chloride in service	0.08
Reinforced concrete that will be dry or protected from moisture in service	0.15
Other reinforced concrete construction	0.30

- 5. Submit test results for evaluation and acceptance.

B. Sampling

- 1. ASTM C 172. Collect samples of fresh concrete to perform tests specified. ASTM C 31/C 31M for making test specimens.
- 2. Sample concrete on a random basis except where a batch appears to be deficient and the test can be used to verify the observed deviation. Identify samples so taken in a manner that they can be segmented from other tests. Obtain at least one sample for each 100 cubic yards, or fraction thereof, of each design mixture of concrete placed in any one day. When the total quantity of concrete with a given design mixture is less than 50 cubic yards, the strength tests may be waived by the Owner's Representative, if in his judgment, adequate evidence of satisfactory strength is provided.

C. Testing

- 1. Slump Tests: ASTM C 143/C 143M. Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved high range water reducing (HRWR) admixture provided that the water-cement ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 10 cubic yards (maximum) of concrete.
- 2. Temperature Tests

- a. Test the concrete delivered and the concrete in the forms. Perform tests in hot weather conditions above 80 degrees F for each batch (minimum) or every 10 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.
 - b. Determine temperature of each composite sample in accordance with ASTM C 1064/C 1064M.
 - c. The temperature of Concrete at time of placement shall not exceed 90 degrees F.
3. Compressive Strength Tests: ACI 214R tests for strength - conduct strength tests of concrete during construction in accordance with the following procedures:
- a. Mold and cure six 6 by 12 inch cylinders from each sample taken in accordance with ASTM C 31/C 31M. Prevent evaporation and loss of water from the specimen.
 - b. Test cylinders in accordance with ASTM C 39/C 39M. Test one cylinder at 3 days, two cylinders at 7 days, two cylinders at 28 days, and hold one cylinder in reserve. The compressive strength test results for acceptance shall be the average of the compressive strengths from the two specimens tested at 28 days. If one specimen in a test shows evidence of improper sampling, molding or testing, discard the specimen and consider the strength of the remaining cylinder to be the test result. If both specimens in a test show any defects, the Owner's Representative may allow the entire test to be discarded.
 - c. If the average of any three consecutive strength test results is less than the specified strength (f'_c) or the minimum test strength (f_{cr}) for durability, whichever is higher, by more the 500 psi, take a minimum of three core samples in accordance with ASTM C 42/C 42M, from the in-place work represented by the low test results. Locations represented by erratic core strengths shall be retested. Remove concrete not meeting strength criteria and provide new acceptable concrete. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.
 - d. Strength test reports shall include location in the work where the batch represented by a test was deposited, batch ticket number, time batched and sampled, slump, air content (where specified), mixture and ambient temperature, unit weight, and water added on the job. Reports of strength tests shall include detailed information of storage and curing of specimens prior to testing.
 - e. Final reports shall be provided within 7 days of test completion.
4. Air Content: ASTM C 173/C 173M or ASTM C 231 for normal weight concrete. Where concrete will be exposed to deicing salts as indicated. Make air content tests on samples from the first three batches in the placement and until three consecutive batches have air contents within the range of the specified air content, at which time test every fifth batch. Maintain this test frequency until a batch is not within the specified range at which time resume testing of each batch until three consecutive batches have air contents within the specified range. Perform additional tests as necessary for control. Take air content tests from planned composite samples or from samples taken in accordance with ASTM C 172 at the point of concrete placement.
5. Chloride Ion Concentration: ACI 318M. Determine water soluble chloride ion concentration. Perform test once for each mix design.

D. Non-Destructive Tests

1. Non-destructive tests - use of the rebound hammer in accordance with ASTM C 805, ASTM C 597, or other non-destructive processes may be permitted by the Owner's Representative in evaluating the uniformity and relative concrete strength in place, or for selecting areas to be cored.
2. Evaluate and validate test results conducted on properly calibrated equipment in accordance with standard ASTM procedures indicated
3. Core Tests
 - a. Obtain and test cores in accordance with ASTM C 42/C 42M. If concrete in the structure is dry under service conditions, air dry cores (temperature 60 to 80 degrees F, relative humidity less than 60 percent) for 7 days before testing and test dry. If concrete in the structure will be more than superficially wet under service conditions, test the cores, after moisture conditioning, in accordance with ASTM C 42/C 42M.
 - b. Take at least three representative cores from each member or area of concrete in place that is considered potentially deficient. Impair the strength of the structure as little as possible. If, before testing, cores show evidence of having been damaged subsequent to or during removal from the structure, take replacement cores.
 - c. Fill core holes with low slump concrete or mortar of a strength equal to or greater than the original concrete.
 - d. The Contracting Office will evaluate and validate core tests in accordance with the specified procedures. Before testing in compression, test each core to determine pulse velocity through concrete in accordance with ASTM C 597. Correlate pulse velocity of concrete cores with pulse velocity of in-place concrete.

E. Acceptance of Concrete Strength

1. Standard Molded and Cured Strength Specimens: When the averages of all sets of three consecutive compressive strength test results equal or exceed the design compressive strength (f'_c) or the required field test strength (f_{cr}) whichever is higher, and no individual strength test falls below the specified compressive strength (f'_c) or the required field durability strength (f_{cr}) by more than 500 psi, whichever is higher. These criteria also apply when accelerated strength testing is specified unless another basis for acceptance is specified.
2. Non-Destructive Tests: Non-destructive tests may be used when permitted to evaluate concrete where standard molded and cured cylinders have yielded results not meeting the criteria.
3. Core Tests: When the average compressive strengths of the representative cores are equal to at least 85 percent of the design strength (f'_c) or the required average test strength (f_{cr}), whichever is higher, and if no single core is less than 75 percent of the specified strength (f'_c) or the required average field test strength (f_{cr}), whichever is higher, strength of concrete is satisfactory.

F. Inspection: ACI 311.4R. Inspect concrete placed under water with qualified engineer/divers.

3.08 MEASUREMENTS AND PAYMENT

- A. Cast-in-place concrete and reinforcement shall be included within the appropriate lump sum item on the Bid Form. Payment will be full compensation for the work prescribed in this section and the contract documents.

***** END OF SECTION *****

**SECTION 10100
FIXED PIER SYSTEM ALUMINUM FABRICATIONS**

PART 1 - GENERAL

1.01 SCOPE

- A. FIXED PIER SYSTEM ALUMINUM FABRICATIONS consists of furnishing transportation, labor, materials, and equipment to design, fabricate and install the aluminum fixed piers, landing platforms, ramps, and associated appurtenances. All components shall be part of the "fixed pier system".

1.02 RELATED WORK

- A. Marina Piping and Equipment – Section 02700
- B. Basic Electrical Materials and Methods – Section 16011
- C. Fiber Reinforced Plastic – Section 10300

1.03 REFERENCES

- A. References shall be the latest edition available as of the date of the invitation to bid unless otherwise specified. The following standards are hereby incorporated in this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. Design Standards
 - 1. IBC-2012 (International Building Code)
 - 2. BRITISH STANDARD (BS 6349) Shall be used as the marine code, as applicable to the facility use, when the IBC does not provide marine guidance. whenever BS 6349 does not provide sufficient information or is not applicable, reference can be made to other international codes/standards or guidelines.
 - 3. ASCE-50,2012 Planning and Design Guidelines For Small Craft Harbors (American Society Of Civil Engineers)
 - 4. Marinas and Small Craft Harbors, 2nd Edition, 2000, Tobiasson.
 - 5. UFC-4-152-07 Design: Small Craft Berthing Facilities (Unified Facilities Criteria)
 - 6. ASCE 07-10 American Society Of Civil Engineers (ASCE), "Minimum Design Loads For Buildings And Other Structures," (2010)
 - 7. ADA Department Of Justice (DOJ), 2010 ADA Standards For Accessible Design, (2010)
 - 8. ADM-1 2010 (Aluminum Design Manual, Specifications For Aluminum Structures)
 - 9. AISC 360-10 (American Institute Of Steel Construction, Specification For Structural Steel Buildings)
 - 10. AISC 303-10 (American Institute Of Steel Construction, Code Of Standard Practice For Steel Buildings And Bridges)

11. RCSC Specifications For Structural Joints Using ASTM A 325 OR ASTM A 490 - 2009 (Research Council On Structural Connections)
12. ACI 318-11 (American Concrete Institute, Building Code Requirements For Structural Concrete And Commentary)
13. PCI Precast Prestressed Concrete Institute (PCI), "PCI Design Handbook - Precast And Prestressed Concrete, 7th Edition", (2010)
14. NDS National Design Specifications (NDS) For Wood Construction, (2012)

C. American Society for Testing and Materials (ASTM)

ASTM A 36	Specification for Structural Steel
ASTM A 123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 276	Specification for Stainless Steel Bars and Shapes
ASTM A 325	Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 666	Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM B 221	Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM B 308	Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM D 4976	Specification for Polyethylene Plastics Molding and Extrusion Materials
ASTM F 436	Specification for Hardened Steel Washers
ASTM F 593	Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F 594	Specification for Stainless Steel Nuts

D. American Welding Society

AWS D1.1	Welding for Steel Structures
AWS D1.2	Welding for Aluminum Structures

E. The Society for Protective Coatings (SSPC)

SSPC SP 6	Commercial Blast Cleaning
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1.04 CONTRACTOR'S QUALIFICATIONS

- A. The fixed pier system shall be designed, furnished and installed by a firm having a minimum of five (5) years' experience in the design, fabrication and installation of aluminum waterfront structures.

1.05 WARRANTY

- A. The fixed pier system shall carry a manufacturer's written warranty against defects in materials and workmanship with a minimum term of 2 year from date of project acceptance. The warranty shall clearly state its conditions and any exclusions from coverage.

1.06 DESIGN REQUIREMENTS

- A. Contractor shall provide a design team with a Structural Engineer licensed in the State of Hawaii and experienced, 5 years minimum, with waterfront marine design and aluminum design.
- B. Minimum design criteria and loading are identified in structural drawings.
- C. Contractor's design team shall provide a complete design of the aluminum superstructure including the main walkway, access ramps, railings, supports structure for all appurtenances including but not limited to pedestals, cleats, life rings, ladders, fire extinguisher stands, and all other components for this to be a complete and fully functional superstructure. This will include all connections within the aluminum structure, to all appurtenances, to all foundation components including the ramp landings, the pile caps and the piles.
- D. The design team will design the work in accordance with IBC 2012 provisions. Where the IBC does not provide marine guidance, marine design shall be in accordance with British Standard (BS 6349), as applicable to the facility use. Whenever BS 6349 does not provide sufficient information or is not applicable, reference can be made to other international codes, standards or guidelines.
- E. The design is expected to meet the criteria for a less than substantial structural repair under IBC 2012 section 3405.4 and is also expected not to increase the gravity load on existing structural elements carry gravity load more than 5% as described identified in IBC 2012 Section 3403.3. Contractor's design team to verify that the new design will meet these criteria prior to proceeding along this design path. Contractor may proceed along other design paths that are in general accordance with IBC 2012 and the other applicable standards noted above.
- F. Information presented in this Specification is based upon the best estimate of those environmental and physical factors which reasonably can be expected to affect the design, performance, and durability of the proposed fixed pier system. These criteria shall be considered as minimum requirements. Final calculations for the fixed pier system, shall be designed for a minimum forty (40) year life expectancy. After 40-years, the structure shall be able to safely resist the original design loads. Proper maintenance shall include cleaning and protective coating repair. Contractor to identify coating repair requirements over the 40-year life.
- G. Final calculations shall demonstrate that the fixed piers are designed to withstand the required loading without damage throughout the specified design life using the criteria specified in this section as a minimum standard.
- H. The Drawings show general layout and configuration of the fixed pier system as well as required dimensions. Complete dimensions, which conform to these requirements, specific site conditions, and OSHA and ADA Regulations will be required from the fabricator.

- I. The fixed pier shall be designed as simply supported span between each pile to pile span. Contractor shall verify length of pier spans in the field prior to fabrication. Pile to pile distances may change after demolition. The design will accommodate these potential changes or provide adequate means in the design to accommodate post demolition movement
- J. See contract drawings for locations of ramps, cleats, utilities, and other appurtenances.
- K. Coordinate utility routing through structure and provide supports as required, see contract documents.
- L. Cleat and pedestal locations shall be in accordance with the contract documents. Cleat and pedestal layout to match slip spacing, if cleats and pedestals do not match the slip layout contractor shall notify the owner immediately.
- M. Fenders to have a composite timber wearing surface per construction drawings.
- N. Mooring cleats are located along the pier per contract drawings.
- O. Seismic load check may not be required if the new design meets the criteria for a less than substantial structural repair per IBC 2012 SECTION 3405.4, does not increase the deadload by more than 5% and other IBC 2012 requirements.
- P. The design of the aluminum frame to the pile cap and to the pile connection is the responsibility of the contractor. If the existing pile cap is used it must be structurally checked that it will withstand required loading.
- Q. Pier caps/piles may shift after removing the existing superstructure. Field measurements must be performed post demolition and either before aluminum fabrication or with an aluminum design to accommodate post demolition movement.
- R. Design shall also consider stresses resulting from handling and installation and provide notations on how to lift to unload and set in place.
- S. The completed fixed pier system shall have a manufacturer's label plate attached in a conspicuous location. This label plate shall be aluminum, brass or stainless steel. The following information shall be stamped or etched into this plate in letters not less than 1/4-inch high filled with black enamel:
 - 1. Manufacturer's name
 - 2. Date of Manufacture
 - 3. Overall length (not including transition plate)
 - 4. Capacity (maximum live load)
- T. The fixed pier shall have a guardrail system as shown in the contract drawings with a handrail extending a minimum of 1 foot beyond the ends of the structure, designed in accordance with OSHA and ADA requirements. The rails shall be fabricated of aluminum pipe or tubing.
- U. The fixed pier including the ramp slope, railing details, etc. will conform in all respects to design requirements of OSHA, ADA rules for marinas and local codes. Design shall meet the slope, cross slope, gaps between deck and differential height requirements between decking sections in accordance with ADA requirements.

1.07 SUBMITTALS

Submit the following:

- A. Prior to ordering materials or starting fabrication of the fixed pier system, submit final design calculations signed and sealed by a SER (Structural Engineer of Record) holding a valid Structural Engineer License from the State of Hawaii. The calculations shall demonstrate that the fixed pier system, using the criteria specified herein as minimum requirements, is designed to withstand the specified loads without damage throughout the design life of the fixed pier system. All documents submitted shall bear the professional seal and signature of the SER with the Statement: "This work was prepared by me or under my supervision and construction of this project will be under my observation." The SER shall be the Contractor's State of Hawaii Licensed Structural Engineer who will be the Structural Engineer of Records (SER) for the fixed pier structure.
- B. Prior to ordering materials or starting fabrication of the fixed pier system, submit shop drawings signed and sealed by a SER (Structural Engineer of Record) holding a valid Structural Engineer License from the State of Hawaii. The shop drawings shall indicate the proposed fixed pier system construction and connection details, and methods for attaching to the pier or ground substrate. Submit shop drawings for all fabricated items and catalog sheets for all standard manufactured items that are to be incorporated into the fixed pier system. All documents submitted shall bear the professional seal and signature of the SER with the Statement: "This work was prepared by me or under my supervision and construction of this project will be under my observation." The SER shall be the Contractor's State of Hawaii Licensed Structural Engineer who will be the Structural Engineer of Records (SER) for the fixed pier system.
- C. Submit experience data verifying the fixed pier supplier's required years of experience in the manufacture of aluminum waterfront structures after bid and prior to contract award.
- D. Submit quality control plan to be used during:
 - 1. The fabrication of the fixed pier system.
 - 2. Installation of the fixed pier: The fixed pier SER shall provide details and notes on how the Contractor is to lift the fixed pier to set in-place (location and number of picking points).
- E. Prior to fabrication of the fixed pier, submit certified test reports for the following:
 - 1. Aluminum
 - 2. Steel hardware items

PART 2 - PRODUCTS

2.01 MISCELLANEOUS METAL

- A. Miscellaneous steel components shall conform to ASTM A 36 and shall be hot-dip galvanized after fabrication in accordance with ASTM A 123. Welding of steel shall comply with AWS D 1.1.
- B. Stainless steel hardware shall be Type 316. Bolts shall be ASTM F593, Group 2. Nuts shall be ASTM F 594, Group 2. Flat washers shall be cut from Type 316 stainless steel plate that conforms to the provisions in ASTM A 666.

C. Materials for drill and bond fasteners for the fixed pier landings and pile caps shall be:

1. Adhesive bonding material shall be Hilti HVA or approved equivalent.
2. The anchor rod assembly shall be Hilti HAS or approved equivalent.

2.02 FIXED PIER SYSTEM

A. Aluminum shall be alloy 6061-T6 conforming to ASTM B 308, or 6063-T6 conforming to the provisions in ASTM B 221. Welding of aluminum shall comply with AWS D1.2.

2.03 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be isolated with UHMW PE bushings and washers.

PART 3 - EXECUTION

3.01 WORKMANSHIP

All work shall conform to the approved Shop Drawings, project drawings and this specification. Construction details, finishing details and colors shall be consistent throughout. Work shall be accurately set to establish lines and elevations, and securely fastened in place. Cutting, drilling and punching shall produce clean true lines and surfaces. Exposed surfaces of work shall have a smooth finish.

3.02 FINISHING

All exposed surfaces of the fixed pier system except handrails and grating, shall be sandblasted in accordance with Commercial Sand Blast SSPC-SP-6, which produces a coarse matte finish. The handrails shall have a rubbed or light brush finish and provide a smooth gripping surface.

3.03 FIXED PIER SYSTEM INSTALLATION

- A. Install in accordance with the manufacturer's instructions. Posts and vertical rails shall be plumb, and line rails level.
- B. Do not begin installation until site has been properly prepared. Contractor shall not disturb concrete repairs before manufacturers recommendation or 21 days.
- C. Contractor shall furnish all materials and equipment required for fixed pier system installation. The fixed pier shall not be dragged or skidded into place.
- D. Contractor shall provide, install and remove when no longer required, all temporary supports used to secure the fixed pier in place during installation.
- E. Protect installed products until completion of project.

3.04 MEASUREMENTS AND PAYMENTS

Aluminum Fixed piers shall be included within the appropriate lump sum item on the Bid Form. Payment will be full compensation for the work prescribed in this section and the contract documents.

***** END OF SECTION *****

SECTION 10300
FIBER REINFORCED PLASTIC

PART 1 - GENERAL

1.01 GENERAL

- A. This section covers the furnishing and installation of fiber reinforced polymer (FRP) grating as shown on the plans and ANSI/ACMA/FGMC FRP Composites Grating Manual for Pultruded and Molded Grating and Stair Treads.

1.02 SHOP DRAWINGS

The Contractor shall submit:

- A. Shop drawings of all fabricated pultruded gratings shall be submitted to the Engineer for approval in accordance with the requirements of Section 01300-Submittals. Fabrication shall not start until receipt of Engineer's approval marked "Approved As Submitted" or "Approved As Noted".
- B. Manufacturer's catalog data showing:
 - 1. Materials of construction
 - 2. Dimensions, spacings, and construction of grating, handrails and building panels.
- C. Detail shop drawings showing:
 - 1. Dimensions
 - 2. Sectional assembly
 - 3. Location and identification mark
 - 4. Size and type of supporting frames required
- D. Samples of each type of product shall be submitted for approval by the Engineer.

1.03 QUALITY ASSURANCE

- A. The material covered by these specifications shall be furnished by an ISO-9001 certified manufacturer of proven ability who is regularly engaged in the manufacture, fabrication and installation of FRP systems.
- B. Substitution of any component or modification of system shall be made only when approved by the Engineer.
- C. Fabricator Qualifications: Firm experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.
- D. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.04 DESIGN CRITERIA

- A. The design criteria of the FRP pultruded grating, including connections, shall be in accordance with governing building codes and accepted standards in the FRP composites industry.
- B. Gratings: Design live loads of FRP gratings for walkway applications shall be 50 psf (2.39 kN/m²) uniformly distributed load per ASCE 50-12 or as required by the governing building code with a maximum deflection of 0.25" (6.4mm) at the center of a simple span.
- C. Structural support members shall not deflect more than L/180 of span for structural members unless specifically stated otherwise in drawings and/or supplementary conditions. Connections shall be designed to transfer the design loads.

PART 2 - MATERIALS

2.01 MATERIALS

- A. General
 - 1. Grating shall be shipped from the manufacturer, palletized and banded with exposed edges protected to prevent damage in shipment.
 - 2. Each piece shall be clearly marked showing manufacturer's applicable drawing number.
 - 3. The grating type and color shall match the FRP grating installed on the Outer Marginal Wharf. The bid price will be based upon a custom color that matches the Outer Marginal Wharf. The final color shall be selected by DOBOR.
 - 4. Grating shall be DURAGRID, t-2500 SERIES as manufactured by Strongwell or approved equal.
- B. Design
 - 1. Grating panels shall be selected by the Contractors Structural Engineer from Strongwell's Fiberglass Grating brochure.
 - 2. The bearing bars shall be joined into panels by passing continuous length fiberglass pultruded cross rods through the web of each bearing bar. A continuous fiberglass pultruded bar shaped section shall be wedged between the two cross rod spacers mechanically locking the notches in the cross rod spacers to the web of the bearing bars. Continuous adhesive bonding shall be achieved between the cross rod spacers and the bearing web and between the bar shaped wedge and the two cross rod spacers locking the entire panel together to give a panel that resists twist and prevents internal movement of the bearing bars. Each stair tread shall utilize a box-shaped nosing on its lead edge to enclose cross rods and ensure a smooth vertical edge.
 - 3. The top surface of all panels shall have a non-skid grit affixed to the surface by an epoxy resin followed by a baked-on top coat of epoxy resin.
 - 4. Surface should have a Wear Index of less than 1.0 when tested to ASTM D4060 (Before and after 750 hours of UV exposure per ASTM D4329 cycle A).
 - 5. Panels shall be fabricated to the sizes shown on the drawings.

6. Hold down clamps shall be type 316L stainless steel clips provided by the grating manufacturer. Use 2 at each support with a minimum of 4 per panel.
7. Color shall be brown (custom color to match the Outer Marginal Wharf).
8. All bearing bars that are to be exposed to UV shall be coated with polyurethane coating to provide additional UV protection.

C. Products

1. The Pultruded FRP grating shall be fabricated from bearing bars and cross rods manufactured by the pultrusion process. The glass fiber reinforcement for the bearing bars shall be a core of continuous glass strand rovings wrapped with continuous strand glass mat. With the exception of grating and stair treads manufactured using phenolic resin, a synthetic surface veil fabric shall encase the glass reinforcement.
2. Fiberglass Grating
 - a. Fiberglass grating shall be made from a chemical resistant, fire retardant resin system to meet the flame spread rating of 25 or less in accordance with ASTM E-84 testing, the flammability characteristics of UL 94 V0 and satisfies the self-extinguishing requirements of ASTM D-635. UV inhibitors are added to the resin to reduce UV attack.
3. All cut and machined edges, holes and abrasions shall be sealed with a resin or compatible coating with the resin matrix used in the bearing bars and cross rods.
4. All panels shall be fabricated to the sizes shown on the approved shop drawings.

PART 3 - EXECUTION

3.01 SHIPPING AND STORAGE INSTRUCTIONS

- A. All gratings and components shall be shop fabricated and assembled into the largest practical size suitable for transporting.
- B. All materials and equipment necessary for the fabrication and installation of pultruded gratings and treads and appurtenances shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials or equipment, including damage due to over exposure to the sun. Any material which, in the opinion of the Design Engineer, has become damaged as to be unfit for use, shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.
- C. Identify and match-mark all materials, items and fabrications for installation and field assembly.

3.02 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction.
- B. Coordinate delivery of such items to project site.

3.03 INSPECTION AND TESTING

- A. The Engineer shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.
- B. All labor, power, materials, equipment and appurtenances required for testing shall be furnished by the Contractor at no cost to the State.

3.04 INSTALLATION

- A. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as determined by the Engineer.
- B. Cutting, fitting and placement: Perform cutting, drilling and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; measured from established lines and levels.
- C. Penetrations through grating may require additional supports in order to meet design criteria. The Engineer shall follow manufacturer recommendations for each occurrence.
- D. If required, all field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer.
- E. Install items specified as indicated and in accordance with manufacturer instructions.
- F. The grating shall be layed out and installed in good workmanlike manner, as shown on the plans. Adjustments shall be made by the Contractor at his expense and to the satisfaction of the Engineer.
- G. A sufficient amount of fasteners/clips shall be used to ensure that the grating is securely fastened to the aluminum structure and/or concrete pile cap.

***** END OF SECTION *****

SECTION 16011

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. ASTM INTERNATIONAL (ASTM)
- | | |
|-----------|---|
| ASTM D709 | (2017) STANDARD SPECIFICATION FOR LAMINATED THERMOSETTING MATERIALS |
|-----------|---|
- C. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
- | | |
|----------------|--|
| IEEE 100 | (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms |
| IEEE C2 | (2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code |
| IEEE C57.12.28 | (2014) Standard for Pad-Mounted Equipment - Enclosure Integrity |
| IEEE C57.12.29 | (2014) Standard for Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments |
- D. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
- | | |
|----------|---|
| NEMA 250 | (2018) Enclosures for Electrical Equipment (1000 Volts Maximum) |
|----------|---|
- E. NATIONAL FIRE PROTECTION ASSOCIATION
- | | |
|---------|---|
| NFPA 70 | (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code |
|---------|---|

1.02 RELATED REQUIREMENTS

- A. This section applies to all sections of Division 26, ELECTRICAL, of this project specification unless specified otherwise in the individual sections.

1.03 DEFINITIONS

- A. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.

- B. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.
- C. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.04 ELECTRICAL CHARACTERISTICS

- A. Electrical characteristics for this project shall be 120/240V, single phase, three wire, 60 Hz electrical service. Contractor shall coordinate with electrical utility provider, Maui Electric, for connection to the new utility transformer.

1.05 ADDITIONAL SUBMITTALS INFORMATION

- A. Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.
- B. Shop Drawings: Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.
- C. Product Data: Submittal shall include performance and characteristic curves.

1.06 QUALITY ASSURANCE

- A. Regulatory Requirements: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the owner. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.
- B. Standard Products: Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.
- C. Alternative Qualifications: Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.
- D. Material and Equipment Manufacturing Date: Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.07 WARRANTY

- A. The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.08 POSTED OPERATING INSTRUCTIONS

- A. Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:
- B. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
- C. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
- D. Safety precautions.
- E. The procedure in the event of equipment failure.
- F. Other items of instruction as recommended by the manufacturer of each system or item of equipment.
- G. Engrave operating instructions in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.09 MANUFACTURER'S NAMEPLATE

- A. Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.10 FIELD FABRICATED NAMEPLATES

- A. ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

1.11 WARNING SIGNS

- A. Provide warning signs for the enclosures of electrical equipment including substations, pad-mounted transformers, pad-mounted switches, generators, and switchgear having a nominal rating exceeding 600 volts.
- B. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28 or IEEE C57.12.29, such as for pad-mounted transformers, provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall be a decal and shall have nominal dimensions of 7 by 10 inches with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal 2 inch high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background.

1.12 ELECTRICAL CHARACTERISTICS

- A. Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

1.13 INSTRUCTIONS TO OWNER

- A. Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated owner personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation.

PART 2 - PRODUCTS

2.01 FACTORY APPLIED FINISH

- A. Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 - EXECUTION

3.01 FIELD APPLIED PAINTING

- A. Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in the section specifying the associated electrical equipment.

3.02 FIELD FABRICATED NAMEPLATE MOUNTING

- A. Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.03 WARNING SIGN MOUNTING

- A. Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

***** END OF SECTION *****

SECTION 16110
MARINA ELECTRICAL WORK

PART 1 - GENERAL

1.01 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

INTERNATIONAL (ASTM)

ASTM B1 (2013) Standard Specification for Hard-Drawn Copper Wire

ASTM B8 (2011; R 2017) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

National Electrical Manufacturers ASSOCIATION (NEMA)

NEMA RN 1 (2005; R 2013) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

NEMA TC 2 (2013) Standard for Electrical Polyvinyl Chloride (PVC) Conduit

NEMA TC 14 (2002) Standard for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

NEMA WD 1 (1999; R 2015) Standard for General Color Requirements for Wiring Devices

NATIONAL FIRE PROTECTION ASSOCIATION

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code

NFPA 303 (2016) Fire Protection Standards for Marinas and Boatyards

1.02 RELATED REQUIREMENTS

Section [26.00.00](#) BASIC ELECTRICAL MATERIALS AND METHODS, applies to this section with additions and modifications specified herein.

1.03 SUBMITTALS

Shop Drawings

Panelboards

Ground Fault Protection

Shore Power Pedestals

Product Data

Receptacles

Conduit and fittings (each type)

Grounding and bonding equipment

Device plates

Wires and cables

Outlet boxes

Splice and termination components

Wireways

Cabinets, junction boxes, and pull boxes

Mounting straps

Conduit support

Test reports

600 – volt wiring test

Grounding system test

Ground fault system coordination test

Submit test results for approval in report format

1.04 QUALITY ASSURANCE

Grounding System Tests: Submittal shall include written results of each test and indicate location of rods as well as resistance and soil conditions at the time measurements were made.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as a minimum, meet requirements of UL where UL standards are established for those items, and requirements of NFPA 70 and NFPA 303.

2.02 CONDUITS AND FITTINGS

Rigid non - metallic conduit conforming to the following:

Rigid non - metallic conduit: PVC Type EPC-80 and EPC-40 in accordance with NEMA TC 2, or fiberglass conduit in accordance with NEMA TC 14.

Plastic-Coated Rigid Steel and IMC Conduit: NEMA RN 1, Type 40 one mils thick.

Fittings for Metal Conduit and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium or zinc coated in accordance with UL 514B.

Fittings for Rigid Metal Conduit

Threaded type. Split coupling unacceptable

Fittings for Rigid Nonmetallic Conduit

UL 514B and UL 651.

Expansion Joints

Provide conduit expansion joints having 6 inch expansion at each expansion joint in the pier and in each conduit run exceeding 250 feet. Provide expansion joints having 2 inch expansion in each conduit run of less than 250 feet.

2.03 OUTLET BOXES AND COVERS

UL 514C.

2.04 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 200 cubic inches, UL 50, NEMA 4X nonmetallic or 316 stainless steel.

2.05 WIRES AND CABLES

Shall meet applicable requirements of **NFPA 70** and UL for type of insulation, jacket, and conductor specified or indicated. Do not provide wires and cables manufactured more than 12 months prior to date of delivery to site.

Conductors

No. 8 AWG and larger diameter shall be stranded; No. 10 AWG and smaller shall be solid. Conductors shall be copper. Conductor sizes and ampacities shown are based on copper.

Minimum Conductor Sizes: Minimum size for branch circuits shall be No. 12 AWG.

Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutral shall be white with colored, except green, stripe. Color of ungrounded conductors in different voltage systems shall be as follows:

120/240 volt, single phase: red and black

Insulation

Unless otherwise required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN, XHHW, or RHW, except that grounding wire may be Type TW; remote-control and signal circuits shall be Type TW, THW, or TF. Conductors shall conform to UL 83. Where lighting fixtures require 90-degree C conductors, provide only conductors with 90-degree C insulation or better

Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

Splice And Termination Components

UL 486A-486B, for wire connectors, and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure type in accordance with UL 486A-486B, twist-on splicing connector. Provide solderless terminal lugs on stranded conductors.

Watertight splice box connectors: Malleable iron with protective grounding sleeve for jacketed metal-clad cable and designed for mounting on fiberglass splice boxes.

Watertight pin connectors: Connectors shall be rated 600 volts, and individual pins shall have ampere rating equal to or greater than the cable to which they are joined. Connectors shall be molded-to-cable, quick-disconnect, polarized type having full male shroud so that when male and female assemblies are joined the shroud shall provide a completely sealed connection. Connector material shall be neoprene resistant to oil, dust, acids, and sunlight and shall be watertight.

2.06 DEVICE PLATES

Provide UL listed, one-piece device plates for outlets to suit the devices installed. Plates shall be nylon or lexan, minimum 0.10 inch wall thickness. Plates shall be same color as receptacle with which they are mounted. Screws shall be stainless steel machine type with countersunk heads in color to match finish of plate. Use of sectional-type device plates will not be permitted. Plates shall be gasketed and UL listed for wet locations.

2.07 RECEPTACLES

UL 498 and NEMA WD 1, heavy-duty, grounding type. Bodies shall be of brown thermosetting plastic supported on a metal mounting strap. Provide screw type, side wired wiring terminals. Connect grounding pole to mounting strap.

Duplex Receptacles

Receptacles shall be 20 amperes, 125 volts.

Weatherproof Receptacles

Provide in nonmetallic box with gasketed, weatherproof, nonmetallic cover plate and gasketed cap over each receptacle opening. Provide caps with a spring-hinged flap. Provide UL listed receptacle for use in wet locations.

Ground-Fault Circuit Interrupter (GFCI) Receptacles

UL 943. Duplex type for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping in accordance with UL 943 for Class A GFCI devices.

Special-Purpose Receptacles

Receptacles serving shore power are special purpose. Provide in ratings indicated.

2.08 PANELBOARDS

UL 67 and UL 50 having a short-circuit current rating of 22,000 amperes symmetrical minimum. Panelboards for use as service disconnecting means shall additionally conform to UL 869A. Panelboards shall be circuit breaker equipped. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. Where "space only" is indicated, make provisions for future installation of breakers. Key panelboard locks the same. Directories shall indicate load served by each circuit in panelboard and main source of service to panelboard, such as Panel PA served from Panel MDP. Type directories and mount in holder behind transparent protective covering.

Panelboard Buses

Copper. Support bus bars on bases independent of circuit breakers. Design main buses and back pans so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus in accordance with UL 67 for connecting grounding conductors, bond to steel cabinet.

Circuit Breakers

UL 489 thermal magnetic type having a minimum short-circuit current rating equal to the short-circuit rating of the panelboard in which the circuit breaker will be mounted. Breaker terminals shall be UL listed as suitable for type of conductor provided. Plug-in circuit breakers and series rated circuit breakers are unacceptable.

Multipole breakers

Provide common trip type with single operating handle. Breaker design shall be such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C respectively.

Circuit Breaker With GFCI

UL 943 and NFPA 70. Provide with push-to-test button, visible indication of tripped condition, and ability to detect and trip on current imbalance of 6 milliamperes or greater in accordance with UL 943 for Class A GFCI devices.

Panelboard Enclosure

NEMA 6P, 316 stainless steel. Hardware shall be 316 stainless steel.

2.09 MOUNTING STRAPS

316 stainless steel, two-hole type designed for rigid steel conduit support.

2.10 GROUNDING AND BONDING EQUIPMENT

UL 467. Ground rods shall be copper-clad steel, with minimum diameter of 3/4 inch and minimum length of 10 feet.

2.11 NAMEPLATES

Provide nameplates in accordance with Section 26 00 00. BASIC ELECTRICAL MATERIALS AND METHODS.

2.12 PIER LIGHTING

Provide lighting in marina pedestals as indicated on drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

Electrical installations shall conform to requirements of **NFPA 70** and to requirements specified herein.

Underground Service

Underground service conductors and associated conduit shall be continuous from service equipment to the power system connection.

Service Entrance Identification

Label or identify service entrance disconnect devices, switches, and enclosures.

Labels: Where work results in service disconnect devices in more than one enclosure, as permitted by NFPA 70, label each enclosure, new and existing, as one of several enclosures containing service entrance disconnect devices. Label, at minimum, shall indicate number of service disconnect devices housed by enclosure and shall indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels with letters no less than 0.25 inch in height; and engrave on black-on-white matte finish.

Wiring Methods

Provide insulated conductors installed in rigid conduit, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated, green equipment grounding conductors for circuits installed in conduit and raceways. Minimum conduit size shall be 3/4 inch in diameter for low-voltage lighting and power circuits

Galvanized Rigid Steel: Use for stub-ups to panelboard as indicated on drawings.

PVC Schedule 40 and PVC Schedule 80: Do not install PVC Schedule 40 in areas subject to physical damage. Do not install PVC Schedule 80 in areas subject to severe physical damage. Do not install in hazardous areas.

Service Entrance Conduit, Underground: PVC, Type EPC-40. Install a minimum of 24 inches below slab or grade

Underground Conduit Other Than Service Entrance: PVC, Type EPC-40. Convert nonmetallic conduit to galvanized rigid steel conduit before rising above finished grade

Conduit Installation

Run conduit supported by straps on dock structure. Install conduit parallel with or at right angles to structural members.

Conduit Support: Support conduit by 316 stainless steel pipe straps, wall brackets, hangers, or trapeze. Fasten by 316 stainless steel bolts to dock structure. Provide isolation pads between pipe straps and dock structure. Where conduit crosses expansion joints, provide suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means.

Directional Changes in Conduit Runs: Make changes in direction of runs with symmetrical bends or molded fittings. Make field-made bends and offsets with conduit-bending machine suitable for type of conduit used. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent dirt or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

Expansion Joints: Install as recommended by the manufacturer for the temperature conditions at time of installation.

Pull Wire: Install in empty conduits in which wire is to be installed by others. Pull wire shall be plastic having minimum 200 pound tensile strength. Leave minimum 12 inches of slack at each end of pull wire.

Locknuts And Bushings: Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are provided, and where bushings cannot be brought into firm contact with the box; otherwise, provide minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

Stub-Ups: Provide conduits stubbed up for connection to freestanding equipment with adjustable top or coupling threaded inside for plugs. Extend conductors to equipment in rigid conduit. Where no equipment connections are made, install screwdriver-operated threaded flush noncorroding plugs in conduit end.

Conduit And Cable Connections: Provide watertight connectors for conduit and cable connections to boxes and cabinets.

Boxes, Outlets, And Supports

Provide boxes in wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub type, and when specifically indicated. Boxes in other locations shall be nonmetallic boxes provided with nonmetallic conduit system. Each box shall have volume required by NFPA 70 for number of conductors enclosed in a box. Provide gaskets for boxes. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature. Fasten boxes and supports with 316 stainless steel bolts with isolation pads on dock structure. Support boxes directly from structure or by 316 stainless steel hangers. Where stainless steel bar hangers are provided, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box.

Pull Boxes: Construct of at least minimum size required by NFPA 70 compatible with nonmetallic raceway systems, except where cast-metal boxes are required in locations specified herein. Furnish boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

Mounting Heights

Mount panelboards, circuit breakers, and disconnecting switches so maximum height of operating handle is 78 inches above finished structure. Mount receptacles a minimum of 18 inches above finished structure. In no case shall entire or part of panelboards, boxes, cabinets, receptacles, and other electrical devices be mounted below the electrical datum plane as defined in NFPA 303. Measure mounting heights of wiring devices and outlets to center of device or outlet.

Conductor Identification

Provide within each enclosure where tap, splice, or termination is made. For conductor sizes No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductor sizes No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations.

Splices

Make splices in accessible locations. Make splices in conductor sizes No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductor sizes No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation. All splices shall be listed as waterproof.

Covers And Device Plates

Install gasketed plates with alignment tolerance of 1/16 inch.

Grounding And Bonding

NFPA 70. Ground-exposed, noncurrent-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. When flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Make ground connection to driven ground rods. Where ground-fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

Resistance: Maximum resistance-to-ground of grounding system shall not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section. Except as otherwise noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section, but shall be provided under the section specifying associated equipment.

3.02 REPAIR AND SERVICE OF EXISTING STRUCTURES AND EQUIPMENT

Perform repair of existing structures and equipment, demolition, and modification of existing electrical distribution systems as follows:

Workmanship

Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of existing surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to structure, piping, and equipment using skilled craftsmen of trades involved.

Existing Electrical Distribution System Removal

Include removal of equipment's associated wiring, including conductors, cables, exposed conduit, boxes, fittings, anchors, supports, and other such items, as indicated. Fill holes in structure where electrical equipment is removed with material to match adjacent surface. Provide unused openings in remaining boxes, fittings, and equipment with watertight nonmetallic knockout seals.

3.03 FIELD QUALITY CONTROL

Furnish test equipment and personnel. Notify Engineer 5 working days prior to each test.

Devices Subject To Manual Operation

Operate each device subject to manual operation at least five times, demonstrating satisfactory operation each time.

600 – Volt Wiring Test

Test wiring rated 600 volts and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

Grounding System Test

Test grounding system to ensure continuity and resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall.

***** END OF SECTION *****