

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION
Honolulu, Hawaii

BOARD OF LAND AND NATURAL RESOURCES

Suzanne D. Case
Chairperson

CONTRACT SPECIFICATIONS AND PLANS

JOB NO. J45CM41A
IAO VALLEY STATE MONUMENT FLOOD REPAIRS
WAILUKU, MAUI, HAWAII

| | |
|------------------------|------------------------------|
| CIVIL ENGINEER: | WILSON OKAMOTO CORPORATION |
| GEOTECHNICAL ENGINEER: | GEOLABS, INC. |
| STRUCTURAL ENGINEER: | KSF, INC. |
| HYDRAULICS ENGINEER: | RIVER FOCUS |
| TOPOGRAPHIC SURVEYING: | CONTROLPOINT SURVEYING, INC. |

December 2016

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State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION
Honolulu, Hawaii

CONTRACT SPECIFICATIONS AND PLANS

JOB NO. J45CM41A
Iao Valley State Monument Flood Repairs
WAILUKU, MAUI, HAWAII

Approved: *CURT A. COEFRELL*
CURT A. COEFRELL
Administrator
Division of State Parks

Approved: *CSC*
CARTY S. CHANG, P.E.
Chief Engineer
Engineering Division

December 2016

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NOTICE TO BIDDERS
(Chapter 103D, HRS)

COMPETITIVE BIDS for Job No. J45CM41A, Iao Valley State Monument Flood Repairs, Wailuku, Maui, Hawaii shall be submitted to the Department of Land and Natural Resources, Engineering Division on the specified date and time through the Hawaii State e-Procurement (HiePRO). HiePRO is accessible through the State Procurement Office website at www.spo.hawaii.gov.

The Department of Land and Natural Resources Interim General Condition, dated October 1994, as amended, and the General Conditions –AG008, latest revision shall be made part of the specifications.

The project is located at Iao Valley State Monument, Maui, Hawaii.

The bid deadline will be December 30, 2016 at 2:00 PM.

The work shall generally consist of the emergency repair to the damage done to the Iao Valley State Monument as a result of the September 2016 flood. Repairs shall include slope stabilization improvements, stream bank improvements, rockfall mitigation and bridge improvements to allow the park to reopen.

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

A voluntary pre-bid conference/site visit will be held at the parking lot of Iao Valley State Monument on December 15, 2016, at 10:00 AM.

The estimated cost of construction is \$860,600.

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

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

Since the estimated cost of construction is \$250,000 or more, the apprenticeship agreement preference pursuant to Hawaii Revised Statutes §103-55.6 (ACT 17, SLH 2009) shall apply.

Should there be any questions, please refer to the HiePRO solicitation.

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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. PROPOSALS: Bidders shall submit their bid, including the completed proposal form, bid bond, and any other documents required by the solicitation as part of their bid through the State of Hawaii e-Procurement System (HIePRO). See Item 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 questionnaire. When requested by the State, 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.
- 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.

- 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.
- 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.
- 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 Wailuku Water Company, Inc. 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 HAWAII RESIDENTS: The Contractor shall comply with Act 68, SLH 2010, in the performance and for the duration of this contract. The Contractor shall ensure that Hawaii residents compose not less than eighty percent of the workforce employed to perform

the contract work on the project. The eighty percent requirement shall be determined by dividing the total number of hours worked on the contract by Hawaii residents, by the total number of hours worked on the contract by all employees of the Contractor in the performance of the contract. The hours worked by any Subcontractor of the Contractor shall count towards the calculation for this section. The hours worked by employees with shortage trades, as determined by the Department of Labor and Industrial Relations (DLIR), shall not be included in the calculation for this section.

The requirements shall apply to any subcontract of \$50,000 or more in connection with the Contractor, that is, such Subcontractors must also ensure that Hawaii residents compose not less than eighty percent of the Subcontractor's workforce used to perform the subcontract.

- 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 for review and approval. After the Engineer approves the as-built drawings, the contractor shall submit an 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.

When indicated in the Proposal, the Contractor shall provide a project sign, size 4'-0" x 7'-0" to be placed as directed by the Engineer. The sign shall be constructed in accordance with Section 01581 - Project Sign of these specifications and approved by the Engineer. All wording, type and size of lettering and color selection shall be as specified in these specifications or as approved by the Engineer.

All signs shall be kept neat and clean, and properly erected at all times.

- CC. FIELD OFFICE AREA FOR DEPARTMENT: When indicated in the Proposal, the Contractor shall provide a housed working area of at least 100 square feet adjacent to the Contractor's office for the Department's use. This area will be used by the Engineer to perform tests and to store equipment. As a minimum, the field office shall include the following: standard sized office desk and chair, lighting, ventilation, window-type air conditioning rated at 5,000 BTU, door and window with locking hardware, electrical outlets, and working communications facilities (a cellular telephone is acceptable). The Department will pay for all long distance toll charges made by the Engineer.
- 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 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 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.

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.ehawaii.gov> to acquire a “Certificate of Vendor Compliance” indicating the bidder’s status is compliant with the requirements of §103D-310(c), HRS, and 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 \$12.00 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.

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PROPOSAL

FOR

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION
State of Hawaii

JOB NO. J45CM41A
IAO VALLEY STATE MONUMENT REPAIRS
WAILUKU, MAUI, HAWAII

_____, 20__

Chief Engineer
Engineering Division
Department of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

Dear Sir:

The undersigned, having carefully examined the local conditions and all available records and information covering conditions which may affect the cost of the work to be performed, and having carefully examined the Plans and Specifications, and other contract documents, hereby proposes to furnish and pay for all materials, tools, equipment, labor and other incidental work necessary to _____, as required or called for in this Proposal, all according to the true intent and meaning of the Notice to Bidders, Information and Instructions to Bidders, Proposal, Detailed Specifications, Interim General Conditions, Plans, and any and all addenda for:

JOB NO. J45CM41A
IAO VALLEY STATE MONUMENT FLOOD REPAIRS
WAILUKU, MAUI, HAWAII

on file in the office of the Engineering Division for the TOTAL BASE BID (Items 1 to 14) of:

_____ Dollars (\$_____)

and will fully complete all work under this contract within 30 consecutive calendar days from the date of written notice to proceed, including date of said order, said total sum being itemized on the following pages.

PROPOSAL

| Item No. | Quantity | Unit | Description | Unit Price | Total |
|--|-----------|------|---|---------------|---------------|
| <u>BASE BID</u> | | | | | |
| 1. | 1 | LS | Demolition Work; to include demolition, hauling & disposal as required to construct new improvements. | LS | \$ _____ |
| 2. | 2 | LS | Erosion Control Measures | LS | \$ _____ |
| 3. | 1 | LS | Bridge Repair, in place complete. | LS | \$ _____ |
| 4. | 10,000 | SF | Slope Scaling West of Pedestrian Bridge, in place complete. | | |
| 5. | 18,000 | SF | Slope Scaling Parking Lot Failure Area, in place complete. | | \$ _____ |
| 6. | 18,000 | SF | Shotcrete Slope (Phase 1), in place complete. | | \$ _____ |
| 7. | 200 | LF | Slope Toe Protection (Phase 1), in place complete. | | \$ _____ |
| 8. | 1 | LS | Boulder Stabilization, in place complete. | LS | \$ _____ |
| 9. | 13,700 | SF | Slope Scaling (Phase 2), in place complete. | | \$ _____ |
| 10. | 13,700 | SF | Shotcrete Slope (Phase 2), in place complete | | \$ _____ |
| 11. | Allowance | | Field Office and Sign | \$ 10,000.00 | \$ 10,000.00 |
| 12. | Allowance | | Archaeological Monitoring | \$ 200,000.00 | \$ 200,000.00 |
| Subtotal Base Bid (Items 1-12) | | | | | \$ _____ |
| 13. | 1 | LS | Mobilization and Demobilization (Slope Scaling and Boulder Stabilization) | LS | \$ _____ |
| 14. | 1 | LS | Mobilization and Demobilization (Work other than Slope Scaling and Boulder Stabilization) | LS | \$ _____ |
| Sum of Items 13 and 14 for Mobilization and Demobilization (not to exceed 10% of the Subtotal Base Bid) | | | | | |
| Total Base Bid (Items 1-14) | | | | | \$ _____ |

HAWAII PRODUCTS PREFERENCE AND/OR USE OF HAWAII PRODUCTS

In accordance with Act 175, SLH 2009, the Hawaii products preference is applicable to this solicitation. Bidders offering a Hawaii product (“HP”) shall identify the HP in the table below.

Persons desiring to qualify their product(s) not currently on the Hawaii Product List, shall complete Form SPO-38, *Certification for Hawaii Product Preference*, and submit the completed form no later than the deadline specified in the procurement notice and solicitation. The responsibility for certification and qualification shall rest upon the person requesting the preference. One form shall be completed and submitted for each product. Form SPO-38 is available at <http://hawaii.gov/spo/>

For the purpose of selecting the low bid when a solicitation contains both HP and non-HP, the price offered for a HP item shall be decreased by subtracting 10% for the class I or 15% for the class II HP item(s) offered. The lowest total offer, taking the preference into consideration, shall be awarded the contract, unless the offer provides for additional award criteria. The contract amount of any contract awarded, however, shall be the amount of the price offered, exclusive of the preferences.

In the event of any change that materially alters the bidder’s ability to supply the Hawaii product(s), the bidder shall immediately notify the procurement officer in writing and the parties shall enter into discussions for the purpose of revising the contract or terminating the contract for convenience.

| Item No. | Pre-Approved Hawaii Product Description & Manufacturer | Class (I or II) | Quantity | Unit Measure | Unit Price | Total Price |
|----------|--|-----------------|----------|--------------|------------|-------------|
| | | | | | | |
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| | | | | | | |

RECYCLED PRODUCTS PREFERENCE

This project allows a 10% price preference for recycled products in accordance with HRS 103D-1005. Please indicate your selection of recycled or non-recycled product by indicating its cost FOB jobsite unloaded in the schedule below, including applicable General Excise & Use Taxes.

| <u>DESCRIPTION</u> | <u>RECYCLED PRODUCT COST</u> | <u>NONRECYCLED PRODUCT COST</u> |
|--------------------|----------------------------------|-------------------------------------|
| _____ | \$ _____ | \$ _____ |
| _____ | \$ _____ | \$ _____ |
| _____ | \$ _____ | \$ _____ |
| _____ | \$ _____ | \$ _____ |

The bidder requesting a recycled product preference shall also complete and submit the form “CERTIFICATION OF RECYCLED CONTENT” as shown in the Interim General Conditions and provide all supporting information with this proposal. Additional information may be requested to qualify a product.

The following definitions are applicable to the CERTIFICATION OF RECYCLED CONTENT form:

"Post-consumer recovered material" means any product used by a consumer, including a business that purchases the material, that has served its intended end use, and that has been separated or diverted from the solid waste stream for the purpose of use, reuse, or recycling.

"Product" includes materials, manufactures, supplies, merchandise, goods, wares, and foodstuffs.

"Recovered material" means waste material and by-products that have been separated, diverted, or removed from the solid waste stream after a manufacturing process for the purpose of use, reuse, or recycling. Recovered material does not include those materials and by-products that are generated and normally reused on-site or within original manufacturing processes (such as mill broke, in the case of paper products).

"Recycled content" means the percentage of a product composed of recovered material, or post-consumer recovered material, or both.

"Recycled product" means a product containing recovered material, or post-consumer recovered material, or both.

The bidder agrees that preference for recycled products shall be taken into consideration to determine the low bidder in accordance with said Section and the rules promulgated, however, the award of contract will be in the amount of the bid offered exclusive any preference.

APPRENTICESHIP AGREEMENT PREFERENCE

1. If applicable to this project, any bidder seeking the preference must be a party to an apprenticeship agreement registered with the State Department of Labor and Industrial Relations (DLIR) at the time the bid is submitted for each apprenticeable trade the bidder will employ to construct the project. “Employ” means the employment of a person in an employer-employee relationship.
 - a. The apprenticeship agreement shall be registered with the DLIR and conform to the requirements of Hawaii Revised Statutes Chapter 372.
 - b. Subcontractors do not have to be a party to an apprenticeship agreement for the bidder to obtain preference.
 - c. The bidder is not required to have apprentices in its employ at the time the bid is submitted to qualify for the preference.
2. A bidder seeking the preference must state the apprenticeable trade the bidder will employ for each trade to be employed to perform the work by submitting a completed signed original Certification Form 1 verifying participation in an apprenticeship program registered with DLIR. “Apprenticeable trade” shall have the same meaning as “apprenticeable occupation” pursuant to Hawaii Administrative Rules (HAR) §12-30-5.
 - a. The *Certification Form 1* shall be authorized by an apprenticeship sponsor listed on the DLIR list of registered apprenticeship programs. “Sponsor” means an operator of an apprenticeship program and in whose name the program is approved and registered with the DLIR pursuant to HAR §12-30-1.
 - b. The authorization shall be an original signature by an authorized official of the apprenticeship sponsor.
 - c. The completed signed original Certification Form 1 for each trade must be submitted with the bid. Previous certifications shall not apply.
 - d. When filling out the *Certification Form 1*, the name of Apprenticeable Trade and Apprenticeship Sponsor must be the same as recorded in the List of Construction Trades in Registered Apprenticeship Programs that is posted on the DLIR website. “Registered apprenticeship program” means a construction trade program approved by the DLIR pursuant to HAR §12-301 and §12-30-4.
 - e. The *Certificate Form 1* and the List of Construction Trades in Registered Apprenticeship Programs is available on the DLIR website at: <http://hawaii.gov/labor/wdd>.
3. Upon receiving the *Certification Form 1*, the Procurement Officer will verify that the apprenticeship program is on the List of Construction Trades in Registered Apprenticeship Programs and that the form is signed by an authorized official of the Apprenticeship Program Sponsor. If the programs and signature are not confirmed by the DLIR, the bidder will not qualify for the preference.
4. If the bidder is certified to participate in an apprenticeship program for each trade which will be

employed by the bidder for the project, a preference will be applied to decrease the bidder's bid amount by five percent (5%) for evaluation purposes.

5. Should the bidder qualify for other preferences (e.g. Hawaii Products), all applicable preferences shall be applied to the bid price.

CONTRIBUTIONS BY STATE AND COUNTY CONTRACTORS PROHIBITED

Contractors are hereby notified of the applicability of Section 11-355, HRS, which states that campaign contributions are prohibited from specified State or county government contractors during the term of the contract if the contractors are paid with funds appropriated by a legislative body.

CONDITION OF AWARD

It is understood that the award of the contract will be made on the basis of the lowest responsible Total Base Bid (Items 1 to 14) selected by the Board of Land and Natural Resources. Write the total of bid items 1 to 14 on page P-1.

It is understood and agreed that the Board of Land and Natural Resources reserves the right to reject any and/or all bids and waive any defects when, in the Board's opinion, such rejection or waiver will be for the best interest of the State of Hawaii.

In the event all bids exceed available funds certified by the appropriate fiscal officer, the head of the purchasing agency responsible for the procurement in question is authorized in situations where time or economic considerations preclude resolicitation of work of a reduced scope to negotiate an adjustment of the bid price, including changes in the bid requirements, with the low responsible and responsive bidder, in order to bring the bid within the amount of available funds. It is understood and agreed upon that the head of the purchasing agency may delete a portion or all of any item(s) in the proposal at the stated unit or lump sum price as necessary to stay within the available funding. The bidder is responsible to make an earnest effort to represent the actual cost of each item, including all materials, labor, equipment, overhead and profit in their bid proposal to preclude claims of anticipated profit or loss of profit because of an unbalanced bid proposal.

It is also understood that if a mutually agreeable cost for the reduced scope of work necessitated by a lack of available funds cannot be agreed upon between the bidder and the head of the purchasing agency within 14 calendar days after the bid opening, then the bid may be rejected in the best interest of the purchasing agency, and the head of the purchasing agency may negotiate in progressive order (lowest to highest) with the next lowest responsible and responsive bidder.

It is also understood and agreed that the award of the contract shall be conditioned upon funds being made available for this project and further upon the right of the Board of Land and Natural Resources to hold all bids received for a period of sixty (60) days from the date of the opening thereof, unless otherwise required by law, during which time no bid may be withdrawn.

It is also understood that Notice to Proceed may be delayed up to one (1) year after the bid opening date, and that no additional compensation will be provided for any claim for escalation or delay for issuance of Notice to Proceed on or before that date.

It is also understood and agreed that the quantities given herewith are approximate only and are subject to increase or decrease, and that the undersigned will perform all quantities of work as either increased or decreased, in accordance with the provisions of the Contract Specifications.

It is also understood and agreed that the estimated quantities shown for the items for which a UNIT PRICE is asked in this Proposal are only for the purpose of comparing on a uniform basis, bids offered for the work under this contract, and the undersigned agrees that he is satisfied with and will at no time, dispute said estimated quantities as a means of claims for anticipated profit or loss of profit, because of a difference between the quantities of the various classes of work done or the materials and equipment installed, and the said estimated quantities. On UNIT PRICE bids, payment will be made only for the actual number of units incorporated into the finished project at the contract UNIT PRICE.

After the proposals are opened and read, the figures will be extended and/or totaled in accordance with the bid prices of the acceptable proposals and the totals will be compared. In the comparison of bids, words written in the proposal shall govern over figures and unit prices will govern over totals. Until the award of the contract, however, the right will be reserved to reject any and all proposals and to waive any defects or technicalities as may be deemed best for the interest of the State.

It is also understood and agreed that liquidated damages in the amount of TWO HUNDRED AND NO/100 DOLLARS (\$ 200.00) for each and every calendar day in excess thereof prior to completion of the contract shall be withheld from payments due to the Contractor.

It is also understood and agreed that if this bid is accepted, the successful bidder must enter into and execute a contract with the Board of Land and Natural Resources and furnish a Performance and Payment Bond, as required by law. These bonds shall conform to provisions of Section 103D-324 and 325, Hawaii Revised Statutes and any law applicable hereto.

It is also understood and agreed that the successful bidder will provide all necessary labor, materials, tools, equipment, and other incidentals necessary to do all the work and furnish all the materials specified in the contract in the manner and time herein prescribed, and according to the requirements of the Engineer as therein set forth.

It is understood that by submitting this proposal, the undersigned is declaring that his firm has not been assisted or represented on this matter by an individual who has, in a State capacity, been involved in the subject matter of this contract in the past two years.

It is understood that by submitting this proposal in accordance with HAR 3-122-192, the undersigned is declaring that the price submitted is independently arrived without collusion.

It is also understood that by submitting this proposal, a Certification for Safety and Health Programs for bids in excess of \$100,000 (in accordance with HRS 396-18), the undersigned certifies that his organization will have a written safety and health plan for this project that will be available and implemented by the Notice to Proceed date of this project. Details of the requirements of this plan may be obtained from the Department of Labor and Industrial Relations, Occupational, Safety and Health Division (HIOSH).

It is further understood and agreed that the successful bidder shall comply with paragraph 3.1.a "SUBCONTRACTING" of the General Provisions which requires that the contractor shall perform with his own organization and with the assistance of workmen under his immediate superintendence, work of a value not less than twenty percent (20%) of the value of all work embraced in the Contract, except that certain contract items of work, if specifically referred to in the special provisions, will be exempted from said twenty percent requirement.

Compliance with §103-310 HRS. As a condition of award all bidders shall comply with all laws governing entities doing business in the State, including Chapter 237 HRS (general excise tax); Chapter 383 HRS (employment security – unemployment insurance); Chapter 386 HRS (workers compensation); Chapter 392 HRS (temporary disability insurance); and Chapter 393 HRS (pre-paid health care), and shall produce all documents to the State (DLNR, Engineering Division) required to demonstrate compliance with these subsections. Any bidder making a false affirmation or certification under this subsection shall be suspended and may be debarred from further offerings or awards pursuant to §103D-702 HRS.

RECEIPT OF ADDENDA

The bidder also acknowledges receipt of any and all addenda issued by the Engineering Division, by recording the date of receipt of the respective addenda in the space provided below:

| <u>Addendum</u> | <u>Date Received</u> | <u>Addendum</u> | <u>Date Received</u> |
|-----------------|----------------------|-----------------|----------------------|
| No. 1 | _____ | No. 5 | _____ |
| No. 2 | _____ | No. 6 | _____ |
| No. 3 | _____ | No. 7 | _____ |
| No. 4 | _____ | No. 8 | _____ |

It is understood that failure to receive any such addendum shall not relieve the Contractor from any obligation under this Proposal as submitted.

It is also understood and agreed that if this Proposal is accepted and the undersigned should fail or neglect to contract as aforesaid, the Board may determine that the bidder has abandoned the Contract, and thereupon, forfeiture of the security accompanying his proposal shall operate and the same shall become the property of the Board.

**JOINT CONTRACTORS OR SUBCONTRACTORS
TO BE ENGAGED ON THIS PROJECT**

The Bidder agrees that the following is a complete listing of all joint contractors or subcontractors covered under Chapter 444, Hawaii Revised Statutes (HRS), who will be engaged by the Bidder on this project to perform the required work indicated pursuant to Section 103D-302, HRS. It is the sole responsibility of the contractor to review the requirements of this Project and determine the appropriate licenses that are required to complete the Project. The Bidder certifies that the completed listing of joint contractors or subcontractors fulfills the requirements for the project and the Bidder, together with the listed subcontractors or joint contractors have all the specialty contractor’s licenses to complete the work, except as provided for in HRS §103D-302(b). Failure of the Bidder to comply with this requirement may be just cause for rejection of the bid.

“A” General Engineering Contractors and “B” General Building Contractors are reminded that due to the Hawaii Supreme Court’s January 28, 2002 decision in Okada Trucking Co., Ltd. v. Board of Water Supply, et al., 97 Haw. 450 (2002), they are prohibited from undertaking any work, solely or as part of a larger project, which would require the general contractor to act as a specialty contractor in any area in which the general contractor has no license. Although the “A” and “B” contractor may still bid on and act as the “prime” contractor on an “A” or “B” project (See, HRS §444-7 for the definitions of an “A” and “B” project.), respectively, the “A” and “B” contractor may only perform work in the areas in which they have the appropriate contractor’s license (*An “A” or “B” contractor*

obtains “C” specialty contractor’s licenses either on its own, or automatically under HAR § 16-77-32). The remaining work must be performed by appropriately licensed entities.

General Engineering “A” Contractors automatically have these “C” specialty contractor’s licenses: C-3, C-9, C-10, C-17, C-24, C-31a, C-32, C-35, C-37a, C-37b, C-38, C-43, C-49, C-56, C-57a, C-57b and C-61.

General Building “B” Contractors automatically have these “C” specialty contractor’s licenses: C-5, C-6, C-10, C-12, C-24, C-25, C-31a, C-32a, C-42a and C-42b.

In completing the Joint Contractors or Subcontractors List, describe the specialty contractor’s nature and scope of work to be performed for this project and provide the complete firm name of the joint contractor or subcontractor in the respective columns. If the Bidder is a general contractor and providing the work of the required specialty contractor, fill in the Bidder’s (general contractor’s) name and nature and scope of work to be performed on this project.

List only one joint contractor or subcontractor per required specialty contractor’s classification, unless within the same specialty, the work of each joint contractor or subcontractor can be described so that there is no overlap in work descriptions.

If a contractor’s license is required by law for the performance of the work which is called for in this bid, the bidder and all subcontractors must have the required license before the submission of the bidder’s proposal in the case of a non-federal aid project, and for federal-aid projects, the bidder must have the required license prior to the award of the project and all subcontractors prior to the start of the subcontracted work.

| COMPLETE FIRM NAME OF JOINT CONTRACTOR OR SUBCONTRACTOR | NATURE AND SCOPE OF WORK TO BE PERFORMED |
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APPENDIX A, 44 C.F.R. PART 18 – CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

(To be submitted with each bid or offer exceeding \$100,000)

The undersigned [Contractor] certifies, to the best of his or her knowledge, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, U.S.C. § 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

The Contractor, _____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. § 3801 *et seq.*, apply to this certification and disclosure, if any.

Signature of Contractor’s Authorized Official

Name and Title of Contractor’s Authorized Official

Date



STATE OF HAWAII
CONTRACTOR'S
STANDARDS OF CONDUCT DECLARATION

For the purposes of this declaration:

"Agency" means and includes the State, the legislature and its committees, all executive departments, boards, commissions, committees, bureaus, offices; and all independent commissions and other establishments of the state government but excluding the courts.

"Controlling interest" means an interest in a business or other undertaking which is sufficient in fact to control, whether the interest is greater or less than fifty per cent (50%).

"Employee" means any nominated, appointed, or elected officer or employee of the State, including members of boards, commissions, and committees, and employees under contract to the State or of the constitutional convention, but excluding legislators, delegates to the constitutional convention, justices, and judges. (Section 84-3, HRS).

On behalf of _____, CONTRACTOR, the undersigned does declare as follows:

1. CONTRACTOR is* is not a legislator or an employee or a business in which a legislator or an employee has a controlling interest. (Section 84-15(a), HRS).
2. CONTRACTOR has not been represented or assisted personally in the matter by an individual who has been an employee of the agency awarding this Contract within the preceding two years and who participated while so employed in the matter with which the Contract is directly concerned. (Section 84-15(b), HRS).
3. CONTRACTOR has not been assisted or represented by a legislator or employee for a fee or other compensation to obtain this Contract and will not be assisted or represented by a legislator or employee for a fee or other compensation in the performance of this Contract, if the legislator or employee had been involved in the development or award of the Contract. (Section 84-14 (d), HRS).
4. CONTRACTOR has not been represented on matters related to this Contract, for a fee or other consideration by an individual who, within the past twelve (12) months, has been an agency employee, or in the case of the Legislature, a legislator, and participated while an employee or legislator on matters related to this Contract. (Sections 84-18(b) and (c), HRS).

CONTRACTOR understands that the Contract to which this document is attached is voidable on behalf of the STATE if this Contract was entered into in violation of any provision of chapter 84, Hawaii Revised Statutes, commonly referred to as the Code of Ethics, including the provisions which are the source of the declarations above. Additionally, any fee, compensation, gift, or profit received by any person as a result of a violation of the Code of Ethics may be recovered by the STATE.

*Reminder to Agency: If the "is" block is checked and if the Contract involves goods or services of a value in excess of \$10,000, the Contract must be awarded by competitive sealed bidding under section 103D-302, HRS, or a competitive sealed proposal under section 103D-303, HRS. Otherwise, the Agency may not award the Contract unless it posts a notice of its intent to award it and files a copy of the notice with the State Ethics Commission. (Section 84-15(a), HRS).

CONTRACTOR

By _____
(Signature)

Print Name _____

Print Title _____

Name of Contractor _____

Date _____

Enclosed herewith is a:

- 1. Surety Bond (*1))
- 2. Legal Tender (*2))
- 3. Cashier's Check (*3))
- 4. Certificate of Deposit (*3)) in the
- 5. Certified Check (*3)) amount
- 6. Official Check (*3)) of
- 7. Share Certificate (*3))
- 8. Teller's Check (*3))
- 9. Treasurer's Check (*3))

(Cross Out Those Not Applicable)

_____ Dollars (\$_____)

as required by law.

Respectfully submitted,

 Name of Company, Joint Venture
 or Partnership

 Contractor's License No.

By _____
 Signature (*4)

Title _____

Print Name _____

Date _____

Address _____

 Telephone No. _____

E-Mail Address _____

NOTES:

1. Surety bond underwritten by a company licensed to issue bonds in this State;
2. Legal tender; or
3. A certificate of deposit; share certificate; or cashier's, treasurer's, teller's, or official check drawn by, or a certified check accepted by, and payable on demand to the State by a bank, a savings institution, or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration.
 - A. These instruments may be utilized only to a maximum of \$100,000.
 - B. If the required security or bond amount totals over \$100,000, more than one instrument not exceeding \$100,000 each and issued by different financial institutions shall be accepted.
4. Please attach to this page evidence of the authority of this officer to submit bids on behalf of the Company and also the names and residence addresses of all officers of the Company.
5. Please complete and sign "CERTIFICATION REGARDING LOBBYING" on Page P-11 and "HAWAII CONTRACTOR'S STANDARDS OF CONDUCT DECLARATION" form on Page P-12.
6. Fill in all blank spaces with information asked for or bid may be invalidated. PROPOSAL MUST BE INTACT, MISSING PAGES MAY INVALIDATE YOUR BID.

End of Proposal

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.ehawaii.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 deleting “180 days” and replacing with “one (1) year” in the last paragraph.

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 Procurement System on the SPO website: <http://hawaii.gov/spo2/>.

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

The Contractor shall not commence any work until it obtains, at its own expense, all required 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 law to issue such insurance in the State of Hawaii.

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.

Certificate(s) of Insurance acceptable to the Department shall be filed with the Engineer prior to commencement of the work. These certificates shall contain a provision that coverages afforded under the policies will not be canceled or changed until at least thirty days written notice has been given to the Engineer by registered mail. The insurance policies shall name Wailuku Water Company, LLC, 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.

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.

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.

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.

2. 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 full worker's compensation insurance coverage 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 Insurance and Automobile Insurance. Contractor's commercial general liability insurance and automobile liability insurance shall both be obtained in a combined, single limit of not less than \$1,000,000 per occurrence that 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 insurance shall cover the entire premises, including all buildings, improvements, and grounds and all roadways or sidewalks on or adjacent to the premises in the use or control of the State and its consultants, contractors and/or persons acting for or on its behalf.

The Contractor's property damage liability insurance shall provide for a single combined limit of not less than \$1,000,000 and \$2,000,000 aggregate 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.

- (c) **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 Wailuku Water Company, LLC, 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.

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**Required Federal Contract Clauses in Accordance with 2 C.F.R. § 200.326
and 2 C.F.R. Part 200, Appendix II (Applies to all FEMA grant and cooperative
Agreement Programs, unless specified otherwise.)**

1. Remedies.

Applicable for contracts over \$150,000.

See Item No. 13 “Termination for Default,” Form AG-008 103D General Conditions.

2. Termination for Cause and Convenience.

Applicable for contracts over \$10,000.

See Item No. 14 “Termination for Convenience” and Item No. 42 (d) “Termination for Cause,” Form AG-008 103D General Conditions.

3. Equal Employment Opportunity.

During the performance of this contract, the contractor agrees as follows:

- (a) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
- (b) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.
- (c) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- (d) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- (e) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of

Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

- (f) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions as may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- (g) The contractor will include the portion of the sentence immediately preceding paragraph (a) and the provisions of paragraphs (a) through (f) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, That in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the contractor may request the United States to enter into such litigation to protect the interests of the United States.

4. Davis Bacon Act and Copeland Anti-Kickback Act. (Does not apply to State contracts for PA-funded projects.)
5. Contract Work Hours and Safety Standards Act.
Applicable to contracts over \$100,000.

Compliance with the Contract Work Hours and Safety Standards Act.

- (a) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- (b) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in

paragraph (a) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a) of this section.

- (c) Withholding for unpaid wages and liquidated damages. The State shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b) of this section.
- (d) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a) through (d) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a) through (d) of this section.

6. Rights to Inventions Made Under a Contract or Agreement. (Does not apply to the Public Assistance Program.)

7. Clean Air Act and the Federal Water Pollution Control Act.
Applicable for contracts over \$150,000.

(a) Clean Air Act

(1) The contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 *et seq.*

(2) The contractor agrees to report each violation to the State and understands and agrees that the State will, in turn, report each violation as required to assure notification to the Federal Emergency Management Agency and the appropriate Environmental Protection Agency Regional Office.

(3) The contractor agrees to include these requirements in each subcontract exceeding \$100,000 financed in whole or in part with Federal assistance provided by FEMA.

(b) Federal Water Pollution Control Act

(1) The contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 *et seq.*

(2) The contractor agrees to report each violation to the State and understands and agrees that the State will, in turn, report each violation as required to assure notification to the Federal Emergency Management Agency and the appropriate Environmental Protection Agency Regional Office.

(3) The contractor agrees to include these requirements in each subcontract exceeding \$100,000 financed in whole or in part with Federal assistance provided by FEMA.

8. Debarment and Suspension.

(a) This contract is a covered transaction for purposes of 2 C.F.R. pt. 180 and 2 C.F.R. pt. 3000. As such the contractor is required to verify that none of the contractor, its principals (defined at 2 C.F.R. § 180.995), or its affiliates (defined at 2 C.F.R. § 180.905) are excluded (defined at 2 C.F.R. § 180.940) or disqualified (defined at 2 C.F.R. § 180.935).

(b) The contractor must comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C and must include a requirement to comply with these regulations in any lower tier covered transaction it enters into.

(c) This certification is a material representation of fact relied upon by the State. If it is later determined that the contractor did not comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C, in addition to remedies available to the State, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment.

(d) The bidder or proposer agrees to comply with the requirements of 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

9. Byrd Anti-Lobbying Amendment, 31 U.S.C. § 1352 (as amended).

Contractors who apply or bid for an award of \$100,000 or more shall file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. § 1352. Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient.

APPENDIX A, 44 C.F.R. PART 18 – CERTIFICATION REGARDING LOBBYING
Certification for Contracts, Grants, Loans, and Cooperative Agreements

(To be submitted with each bid or offer exceeding \$100,000)

The undersigned [Contractor] certifies, to the best of his or her knowledge, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, U.S.C. § 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

The Contractor, _____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. § 3801 *et seq.*, apply to this certification and disclosure, if any.

Signature of Contractor’s Authorized Official

Name and Title of Contractor’s Authorized Official

Date

10. Procurement of Recovered Materials.

- (a) In the performance of this contract, the Contractor shall make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired
 - (1) Competitively within a timeframe providing for compliance with the contract performance schedule;
 - (2) Meeting contract performance requirements; or
 - (3) At a reasonable price.
- (b) Information about this requirement is available at EPA's Comprehensive Procurement Guidelines web site, <http://www.epa.gov/cpg/>. The list of EPA-designate items is available at <http://www.epa.gov/cpg/products.htm>."

11. Additional FEMA Requirements.

The Uniform Rules authorize FEMA to require additional provisions for non-Federal entity contracts. FEMA, pursuant to this authority, requires or recommends the following:

(a) Changes.

See Item No. 19 "Modifications of Contract" and Item No. 20 "Change Order," Form AG-008 103D General Conditions.

(b) Access to Records.

The following access to records requirements apply to this contract:

- (1) The contractor agrees to provide State, the FEMA Administrator, the Comptroller General of the United States, or any of their authorized representatives access to any books, documents, papers, and records of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts, and transcriptions.
- (2) The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.
- (3) The contractor agrees to provide the FEMA Administrator or his authorized representatives access to construction or other work sites pertaining to the work being completed under the contract.

12. U.S. Department of Homeland Security Seal, Logo, and Flags.

The contractor shall not use the U.S. Department of Homeland Security (DHS) seal(s), logos, crests, or reproductions of flags or likenesses of DHS agency officials without specific FEMA pre-approval.

13. Compliance with Federal Law, Regulations, and Executive Orders.

This is an acknowledgement that FEMA financial assistance will be used to fund the contract only. The contractor will comply with all applicable federal law, regulations, executive orders, FEMA policies, procedures, and directives.

14. No Obligation by Federal Government.

The Federal Government is not a party to this contract and is not subject to any obligations or liabilities to the non-Federal entity, contractor, or any other party pertaining to any matter resulting from the contract.

15. Program Fraud and False or Fraudulent Statements or Related Acts.

The contractor acknowledges that 31 U.S.C. Chap. 38 (Administrative Remedies for False Claims and Statements) applies to the contractor's actions pertaining to this contract.

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SECTION 01019

GENERAL SPECIFICATIONS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

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

1.2 GENERAL

- A. Examination of Premises: The Contractor shall contact the Engineer and obtain permission before visiting the site.
- B. All lines and grades shall be established by a licensed surveyor, or licensed Civil Engineer, registered in the State of Hawaii. The Contractor shall submit evidence of current and valid registration.
- 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 the 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 a safe passageway to and from the facility for the user agency personnel and the public at all times.
- F. Lead Paint
 - 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, and 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. The 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:

- 1) Immediately after these changes are constructed in place, the Contractor shall record them on the field office plans.
- 2) 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.
- 3) The Contractor shall submit the as-built drawings to the Engineer for review and approval. After the Engineer approves the as-built drawings, the Contractor shall submit an electronic copy in Adobe PDF format on CD ROM.
- 4) 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 – PRODUCTS (NOT USED)

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:

| <u>Abbreviation</u> | <u>Company</u> |
|---------------------|---|
| 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 |

| <u>Abbreviation</u> | <u>Company</u> |
|---------------------|--|
| 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 |

| <u>Abbreviation</u> | <u>Company</u> |
|---------------------|--|
| 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 - OEI) 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 |

| <u>Abbreviation</u> | <u>Company</u> |
|---------------------|---|
| 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 |
| FEDSPECS | 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 |

| <u>Abbreviation</u> | <u>Company</u> |
|---------------------|--|
| 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 |

| <u>Abbreviation</u> | <u>Company</u> |
|---------------------|--|
| | 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 |

| <u>Abbreviation</u> | <u>Company</u> |
|---------------------|---|
| 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 |

Abbreviation

Company

(Formerly called: West Coast Lumberman's Association - WCLA)
Yeon Building
Portland, CA 97204

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01100

ARCHAEOLOGICAL PROTECTION

PART 1 - GENERAL

- 1.1 This section covers the requirements for the protection and preservation of historical sites and values.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

- 3.1 **CONSTRUCTION METHOD:** Representatives of the State will from time to time examine the area as work proceeds. If historical values are noted, the State may order a halt to the work in the vicinity of the historical values until the State can examine further. The Contractor shall notify the State if he finds anything he suspects to be of historic significance and shall discontinue further work in the vicinity of the find until the State can examine the area. In either case, further work in the vicinity of such historical or suspected historical values may proceed only upon approval by the State. Such approval can be normally expected within one week and shall in no case require more than one month.

END OF SECTION

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SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Shop drawings shall be required for:

1. As called for in the plans, specifications or by the Engineer.

B. Other required submittals shall include:

1. Manufacturer's Data.
2. Certificates of Warranty.
3. Any others as called for in the plans, specifications, or by the Engineer.

1.2 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, AND WILL INTEGRATE THIS SUBMITTAL 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 eight copies 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 resubmit eight copies 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

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SECTION 01505

MOBILIZATION AND DEMOBILIZATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

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

1.2 MOBILIZATION: 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.

1.3 DEMOBILIZATION: 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

3.1 GUIDELINES: 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.

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.

All equipment, machinery, buildings, utilities and incidentals mobilized and demobilized under this section shall remain the property of the Contractor.

END OF SECTION

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SECTION 01567

POLLUTION CONTROL

PART 1 - GENERAL

1.1 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 for Oahu. 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. 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. Waste water 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 job-site.
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.

F. 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 to 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 to 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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01581

PROJECT SIGN

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

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

1.2 SUBMITTAL

The contractor shall provide the Engineer with six (6) shop drawings of the project sign for review and approval by the Engineer prior to ordering the sign.

1.3 LETTER STYLE

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.

1.4 ART WORK

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.

1.5 TITLES

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.

Design should follow the example on page 01581-3.

PART 2 - PRODUCTS

2.1 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 - EXECUTION

3.1 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.

3.2 MEASUREMENTS AND PAYMENT

The construction of the project sign, including all equipment, labor and material necessary to furnish and install the project sign will be paid for under the "Project Sign" proposal item.

END OF SECTION

SECTION 02020

REMOVAL OF STRUCTURES AND OBSTRUCTIONS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

This Section describes razing, removing, disposing of, or salvaging buildings, bridges, walls, fences, structures, old pavements, abandoned pipelines or utilities, and other structures and obstructions designated for removal.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Structures. Refer to Section 03290.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. Removal of Obstructions.

Remove obstructions that interfere with construction, such as the following:

1. Signs, posts, raised bars, guardrails, and structures placed for the information, safety, direction, or control of traffic.
2. Monuments, fences, walls, and headers, except items indicated to remain.
3. Curb and gutter, drainage and sewerage structures, except those constructed or Portland cement concrete.
4. Utility structures, such as pull boxes and handholes.

Remove existing roads that are not to remain in place. Removal includes rooting, plowing, pulverizing, or scarifying to a minimum depth of 6 inches or to bottom of new underlying base, whichever is less. Place earth cover of not less than 6 inches in thickness. Submit Earth Cover Plan.

Break up HMA into pieces not larger than 4 inches in their greatest dimension. Mix HMA with an equal quantity of underlying material. Shape ground to provide a presentable and well-drained area.

Remove abandoned utility lines, such as pipes and conduits, within the roadbed area contained inside project limits.

Seal pipes to be abandoned with one of the following:

- a. Tight-fitting plug.
- b. Wall of Class A or Class B concrete not less than 6 inches thick.
- c. Brick wall not less than 8 inches thick with cement mortar joints.

Demolish abandoned manholes, catch basins, and drop inlets to an elevation 3 feet below finished grade. Demolish and remove bottom of abandoned manholes, catch basins, and drop inlets before backfilling in accordance with the contract documents.

Remove material and debris, and dispose of at an authorized disposal site. Obtain written authorization from property owners and governmental authorities for disposal locations outside highway right-of-way limits.

When accepted by the Engineer, reduce degradable materials to mulch or chips of a maximum size of 1/4 inch and dispose of in areas enclosed by interchange loops and ramps or between slope lines and right-of-way lines. Spread mulch and chips uniformly on ground surface, and mix one to one with underlying earth.

Leave roadway and adjacent areas with neat and finished appearance. Dispose of slashings, flammable material, and other debris within or adjacent to highway right-of-way. Do not burn material and debris.

Backfill trenches, basements, cavities, depressions and pits left by the removal of obstruction to level of surrounding ground in accordance with Subsection 02020 (D)-Embankment Construction.

- B. Removal of Concrete Structures. Remove existing concrete slabs, foundations, and old pavements within roadbed areas contained inside project limits unless otherwise indicated in the contract documents.

Cut, with power-driven abrasive saw, a 1-1/2-inch-deep joint at interface of concrete curbs, gutters, sidewalks, aprons, driveways, or pavements that are to remain and that are to be removed. Cut neat and true with no shattering or spalling of concrete to remain in place.

Break demolished concrete structure into pieces not larger than 4 inches. Bury broken concrete pieces at a depth not less than 3 feet below finished grade of embankment. Do not bury broken concrete pieces in areas where deep foundations, such as driven piles and drilled shafts, are to be placed, or within 10 feet of trees, pipelines, poles, buildings, or other permanent objects or structures. Submit method that demolished concrete structure will be disposed of within project areas.

- C. Removal of bridges. At least 10 working days prior to beginning bridge removal over or adjacent to public traffic, submit details of bridge removal operations, showing methods and sequence of removal and equipment to be used. Do not begin bridge removal until the Engineer has accepted bridge removal plan and public traffic has been rerouted.

When accepted by the Engineer, partial bridge removal will be allowed. Conduct partial bridge removal in a manner that minimizes interference to public traffic.

During removal, protect from damage materials that are to be salvaged. Stockpile salvaged material at site accepted by the Engineer. Mark steel members so they may be matched later. During removal, protect from damage timber members that can be reused, and deliver them to a baseyard indicated by the Engineer.

Repair or replace damaged or destroyed salvaged materials planned for use in reconstruction work or ordered to be saved.

Remove pilings, piers, abutments, and pedestals to at least 3 feet below finished grade or at least 3 feet below scour line, whichever is lower.

Dispose of broken concrete in adjacent embankments in accordance with Subsection 02020 (B) - Removal of Concrete Structures.

Conduct partial bridge removal work without damaging remaining portion of bridge.

Protect from damage and thoroughly clean adhering material from existing reinforcement to be incorporated in new concrete work.

- D. Embankment Construction.

1. General. Strip live, dead, or decayed vegetation, rubbish, debris, and other foreign material from ground surface on which embankment is to be placed. When embankment is required on existing slopes steeper than five horizontal to one vertical, bench those areas as work is brought up in layers. Construct bench of sufficient width to permit operation of placing and compacting equipment. Use suitable excavated or borrow material, and cullet, or combination thereof in embankment construction. Use of embankment material containing cullet will not be allowed on surface of embankment. Placement of rocks, broken concrete, or other solid materials will not be allowed in embankment areas where deep foundations, such as driven piles or drilled shafts, are to be placed.

When soft or swampy ground condition is encountered that cannot support weight of trucks or other hauling equipment, lower part of fill may be constructed with a working platform. Construct working platform by either placing successive loads of gravel, cobbles, and boulders in a uniformly distributed layer of thickness not greater than necessary; or by using

permeable separator with granular material of adequate thickness to support construction equipment. Construct remainder of embankment in accordance with the contract documents.

For minimum depth of 2 feet from subgrade, place embankment material with maximum size of 6 inches and sand equivalent (SE) of 10 or greater, but not less than SE of soil material upon which it is placed. Except as otherwise indicated in the contract documents, embankment material below 2 feet from subgrade may consist of material with maximum size of 6 inches and SE of less than 10 but not less than SE of existing soil on which embankment is placed. Place embankment material in horizontal layers not exceeding 9 inches in loose thickness. Compact as specified before placing next layer. Manipulate material to ensure uniform density and surface smoothness, as compaction of each layer progresses. Add or remove water to obtain required density.

Embankment fill below top 2 feet from subgrade may contain material with rock fragments, hardpan, or cemented gravel larger than 6 inches but less than 3 feet in greatest dimension. Place in compacted lifts of thickness not exceeding approximate size of the rocks and not exceeding 3 feet. Process embankment material to reduce maximum size of particles so that material can be placed in specified lifts. Uniformly distribute larger rock throughout bottom of embankment and place sufficient selected material and other finer rock around large material to fill voids and to produce a dense, compact embankment. Provide earth or fine material to fill voids when not available in excavation.

Finish embankment slopes, as indicated in the contract documents, to within plus or minus 3 inches of lines and grades established and such that slopes contain no unsightly or undue irregularities. Replace portions that become displaced or damaged prior to acceptance at no increase in contract price or contract time.

2. Relative Compaction Test. Relative compaction test is a procedure for determining ratio of dry unit weight (density) of in-place soil to maximum dry unit weight of same soil, as determined by the following methods:
 - a. Maximum Dry Unit Weight. Test for maximum dry unit weight in accordance with AASHTO T 180, Method D. Use Hawaii Test Method HDOT TM 5 for sample preparation of sensitive soils when so designated by the Engineer. When oversized materials larger than 3/4 inch exceed 5 percent by weight of total sample, apply corrections to laboratory dry density in accordance with AASHTO T 224. When oversized materials larger than 3/4 inch exceed 30 percent, use compaction procedure specified in Subsection 02020 (D)(4) - Compaction of Embankments Without Moisture and Density Tests.

- b. Density of Soil In-Place. Test for soil in-place density in accordance with Hawaii Test Method HDOT TM 1, HDOT TM 2, and HDOT TM 3.
3. Compaction of Cut Areas and Embankments with Moisture and Density Tests. Prior to shaping and compacting, condition soil to moisture content within 2 percent above or below optimum moisture content determined in accordance with AASHTO T 180. Except as specified in Subsection 02020 (D)(4) – Compaction of Embankments Without Moisture and Density Tests, moisture condition embankment material and place in layers not to exceed 9 inches in loose thickness, and compact each layer of material as specified, before placement of next lift. Determine maximum density and relative compaction in accordance with Subsection 02020 (D)(2) – Relative Compaction Test.

In-situ soil or embankment material contained in prism within 2 feet below subgrade and within width of traveled way, auxiliary lane, and shoulder on each side shall have relative compaction of 95 percent or more. When in-situ material within 2 feet below subgrade does not conform to specified relative compaction, excavate and recompact material until specified relative compaction is achieved.

Top 6 inches of in-situ material and embankment material below top 2 feet of subgrade, and beyond traveled way, auxiliary lane, and shoulder prism, shall have relative compaction of at least 90 percent. When in-situ material cannot be compacted to 90 percent, provide working platform to allow 90 percent compaction of first lift.

4. Compaction of Embankments without Moisture and Density Tests. Use trial fill section to determine required degree of compaction and method to obtain that compaction, for materials with sufficient coarse material that compaction cannot be determined by Subsection 02020 (D)(2) – Relative Compaction Test. Use trial section to determine type and size of compaction equipment, lift thickness, and number of passes required to obtain compaction acceptable to the Engineer.

For rock fill placement in lifts not exceeding 2 feet in loose lift, the following compaction procedures may be used in lieu of trial section. For rock sizes not exceeding 9 inches in greatest dimension, place material in 12-inch loose lift and compact material full width using one of the following methods:

- a. Two passes of a 50-ton compression-type roller.
 - b. Two passes of a vibratory roller having minimum dynamic force of 40,000 pounds impact per vibration and minimum frequency of 1,000 vibrations per minute.

- c. Eight passes of a 10-ton compression-type roller.
- d. Eight passes of a vibratory roller having minimum dynamic force of 30,000 pounds impact per vibration and minimum frequency of 1,000 vibrations per minute.

Operate compression-type rollers at speeds less than 4 miles per hour and vibratory rollers at speeds less than 1.5 miles per hour. For rock sizes not exceeding 14 inches in greatest dimension, place material in 18-inch loose lift and compact material full width with increase in number of roller passes in Subsections (a) and (b) herein by two, and increase number of roller passes in Subsections (c) and (d) herein by four. For rock sizes not exceeding 18 inches in greatest dimension, place material in 24-inch loose lift and compact material full width with increase in number of roller passes in Subsections (a) and (b) herein by four, and increase number of roller passes in Subsections (c) and (d) herein by eight. Use trial fill section as specified in this subsection for embankment with rock sizes 19 to 36 inches in maximum dimension.

END OF SECTION

SECTION 02205

CUT SLOPE EXCAVATION

PART 1 - GENERAL

1.1 DESCRIPTION

This section describes excavation of cut slopes. Work described in this section is exclusive of other contract work, such as slope scaling, shotcrete placement, and installation of slope toe protection.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Excavated Material

PART 3 - EXECUTION

3.1 CONSTRUCTION

- A. Notify Engineer 10 working days before excavating cut slopes.
- B. Clear and grub area in accordance with Section 02110 – Clearing and Grubbing. Excavate cut slopes to the alignment, grades, and typical sections shown in contract documents. Excavate so as not to disturb material outside limits of slopes or limits of grading.
- C. Use suitable excavated material as needed, from cut slope excavation to construct slope toe protection or for other purposes. Unsuitable and surplus excavated material will become Contractor's property. Dispose of unsuitable and surplus excavated materials.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT

- A. The Engineer will not measure cut slope excavation for payment.

4.2 PAYMENT

- A. Cut slope excavation will not be paid for separately and Engineer will consider the cost of accepted cut slope excavation as included in the contract prices for the various contract pay items in Section 03361 – Shotcrete. The cost is for the work prescribed in this section

and contract documents.

END OF SECTION

Cut Slope Excavation
02205-2

SECTION 02206

SLOPE SCALING

PART 1 - GENERAL

1.1 DESCRIPTION

This section is for slope scaling and removing loose surface rock and other debris from the face of the slopes by the use of hand scaling and stabilization/relocation of a single boulder in accordance with the contract.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 CONTRACTOR'S QUALIFICATIONS

- A. The Contractor performing the slope scaling work must have performed satisfactory slope scaling for a minimum of five years or employ the services of a specialty subcontractor with a minimum of five years of satisfactory slope scaling experience. The Contractor shall submit a project reference list containing at least five projects in which similar work has been conducted and successfully completed within the past five years.

The minimum slope scaling crew shall consist of one scaling supervisor and three (3) slope scalers. The number of slope scaling crews to be employed on this project shall be determined by the Contractor or specialty subcontractor performing the slope scaling. The slope scaling activity for the project will be limited to five (5) days during a single week, as specified in the Contract drawings. The slope scaling operations shall be conducted within the times and duration specified on the Contract drawings. Rockfall protection measures are required to protect existing pavements, railings, rock walls, and other park features and infrastructure.

Prior to the start of the slope scaling work, the Contractor must submit a list identifying the scaling supervisor, scaler foremen, and slope scalers assigned to this project. In this list, the Contractor shall summarize the individual's experience for the Engineer to determine whether the qualifications of each individual meet the minimum requirements of the scaling supervisor, scaler foremen, and/or slope scalers as described in the following paragraphs. The Engineer will utilize the following definition of each category to determine the qualifications of each individual proposed by the Contractor.

1. Scaling Supervisor: The Contractor's designated representative responsible for the prosecution and coordination of slope scaling activities on this project. The

scaling supervisor shall be in charge of and responsible for the safety and work performed by the slope scaling crews. The scaling supervisor shall have a minimum of five (5) years of high slope scaling experience with a minimum of 2,000 hours of demonstrated experience supervising slope scaling. The scaling supervisor shall have completed the American Red Cross “basic first aid course” or equivalent, and shall have experience or training in the use of emergency remote rescue techniques.

2. **Scaling Foreman:** An individual who is directly in charge of and responsible for the safety and work performed by a crew of three (3) slope scalers. The scaler foreman shall be actively engaged at the site location and shall be engaged in actual slope scaling activities for at least 50% of the time charged for his/her slope scaling crew. The scaler foreman shall have a minimum of three (3) years of high slope scaling experience with a minimum of 2,000 hours of demonstrated experience performing slope scaling. Scaler foremen shall have completed the American Red Cross “basic first aid course” or equivalent, and shall have experience or training in the use of emergency remote rescue techniques.
3. **Slope Scaler:** An individual who is engaged in accessing the slope face and removing loose rock and materials from the slope face using a variety of hand tools at locations that require modified rock climbing techniques for the safe prosecution of the work. Slope scalers shall have a minimum of two (2) years experience with a minimum of 1,000 hours of demonstrated experience performing similar slope scaling work.

3.2 CONTRACTOR’S WORK PLAN

- A. Approval or denial of the Contractor’s qualifications and personnel will be made within 10 working days after receipt of the submittal. Slope scaling work shall not commence until approval of the Contractor’s qualifications and work plan has been obtained in writing from the Engineer. The Engineer will suspend the work if the Contractor substitutes unqualified personnel for approved personnel during construction.

The Contractor shall provide a detailed work plan of the slope scaling work, prior to any such activity, which includes the following items, as a minimum, for review by the Engineer. The Engineer shall have a minimum of 10 working days after receipt of the submittal to review and provide comments to the submittal. The work plan shall be approved by the Engineer prior to commencement of the slope scaling work.

1. The proposed construction sequence schedule from Monday through Friday.
2. The types of equipment and hand tools to be used for the slope scaling activities.
3. The number of slope scaling crews including the number of scaling supervisor(s),

scaler foremen, and slope scalers to be employed on the project.

4. Provisions to protect the existing park infrastructure including the path pavements, railings and any adjacent structures, and personnel below the scaling area, in or around the project site.
5. Removal and disposal plan for debris generated from the slope scaling work at the end of each shift.

The Contractor shall perform the slope scaling work according to the approved work plan and as directed by the Engineer. Maintain the minimum crew size specified and the number of slope scaling crews described in the work plan at all times. Any member of the slope scaling crew who must leave for any reason shall be replaced immediately by a qualified replacement. Do not perform slope scaling when the scaling supervisor is absent, unless an alternate supervisor meeting all the requirements of the scaling supervisor has been designated for the slope scaling work to continue.

3.3 SLOPE SCALING ACTIVITY

Perform the slope scaling work to the limits specified on the Contract drawings and/or as directed by the Engineer. The Engineer will determine the final locations and the limits of the area to be scaled in the field during construction after a review and/or inspection of the site conditions with the scaling supervisor.

Slope scalers are defined as persons performing the slope scaling activity directly on the slope face. Slope scaling activity may include slope scalers hanging from ropes attached to the top of the slope face (rappelling), using a man-lift bucket to allow the slope scalers to reach the slope face, or by any other means that can place slope scalers directly on the slope face. Slope scaling is performed by using hand tools, such as small power tools, crowbars, prybars, shovels, etc., and rolling or pushing scaled materials down toward the pathway below the slope. Excavation using mechanized equipment to scrape the slope face by the use of a backhoe or etc. is prohibited during slope scaling.

The Contractor shall provide all the necessary equipment and hand tools, which is to be of high quality and in good working condition, for each member of the slope scaling crew. The Contractor shall replace the equipment and hand tools when, in the opinion of the Engineer, the condition is below normal for efficient output and production. The Contractor shall also be responsible for providing a safe working environment on the project site.

The use of a ground person will be required to enable the Engineer to communicate with the scaling supervisor, scaler foremen and slope scalers and for safety considerations. The scaling supervisor may serve as the ground person. No additional payment will be made to the Contractor for the use of a ground person or for the communications equipment

required. Use of a ground person for communication and provision of communications equipment for the slope scaling crews will be considered incidental to the contract unit price for slope scaling.

The Contractor shall be responsible for protecting the pathway and all appurtenances from damage resulting from the Contractor's activities. The pathway shall be protected from damage by laying protection mats over the pavement surface, and/or placing a temporary protective barrier to prevent the majority of the slope materials from passing the pathway below the slope to be scaled, and/or other methods with prior approval of the Engineer. The Contractor shall be solely responsible for repairing any damage resulting from the scaling or other construction activities.

Protection of the pathway and all appurtenances from damage resulting from the Contractor's activities (including controlled blasting) shall be the Contractor's responsibility and will be considered incidental to the contract unit price for slope scaling. All costs or other compensation for the mitigation of damage to the pathway and appurtenances (including re-paving of damaged areas) shall be the responsibility of the Contractor.

A pre-construction condition survey of the existing pathway, rock masonry wall barriers, and all appurtenances shall be conducted by the Contractor prior to commencement of the slope scaling activities. As a minimum, the pre-construction condition survey shall include photographs of the pathway and appurtenances to document the existing cracks and other damages already existing within the pathway and appurtenances prior to commencement of the slope scaling and related activities. A copy of the pre-construction condition survey shall be submitted to the Engineer for information only.

Slope scaling work shall begin only after the pathway protection measures as described in the work plan are put in place at the beginning of each slope scaling shift. The Contractor shall protect all persons from any rockfall hazards at all times during the Contractor's activities.

Start all slope scaling at the top of the slope and proceed down slope, removing loose surface rock and other debris as the work progresses. All material on the slope face that is loose, hanging or creates a safety hazard to the public must be removed or stabilized, to the Engineer's satisfaction, during or on completion of the section of slope. The Contractor shall exercise extra care in the slope scaling work and shall avoid excavation and over-steepening the slope face that may cause instability of the slope face. If during the slope scaling work, the Contractor encounters unstable slope conditions that may constitute a potential slide, immediately notify the Engineer.

Blocks of rock or debris that hang up on the slope during the slope scaling operations shall be removed upon completion of the first pass of slope scaling. The Contractor shall continue scaling of the slopes until the slope scaling has been completed to the satisfaction

of the Engineer. The Engineer will inspect the slope faces to determine whether or not scaling of the slope faces have been completed. The Contractor shall assist and provide a 'life line' for the Engineer or State's personnel during the inspection of the work. Assistance to the Engineer and provision of a "life line" for State personnel to inspect the slopes shall be considered incidental to the contract unit price for slope scaling.

3.4 DEBRIS REMOVAL

All debris generated from the slope scaling, including the debris generated from earth slump on the lower slope designated for removal on the Contract drawings, shall be the property of the Contractor and shall be removed from the project site for disposal. Alternatively, the debris may be screened and used for fill material as specified at other parts of the interim repair project. The Contractor shall sweep the pathway clean of all debris before the end of each day scaling shift. The Engineer will inspect the "cleaned up" pathway prior to opening of the pathway to the public on a daily basis.

3.5 BOULDER STABILIZATION/RELOCATION

The single large boulder shall be moved intact down slope to the flatter terrain adjacent to the existing railing and paved pathway as shown on the plan. The boulder shall be moved in a controlled manner using appropriate safety restraint apparatus to control the down slope boulder movement. Movement method and apparatus shall minimize scarring of the rock surface. The boulder shall be placed in the new location with the larger or flatter surface area oriented in a stable contact with the ground surface. Rock debris remaining or generated by the controlled movement shall be cleaned from the slope surface and deposited in a stable ground setting that is approved by the Engineer.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT

- A. Mobilization/demobilization will be paid on a lump sum basis. Measurement for payment will not apply.
- B. The Engineer will measure accepted slope scaling work by square foot complete in place
- C. Stabilization/relocation of the single large boulder will be paid on a lump sum basis. Measurement for payment will not apply.

4.2 PAYMENT

- A. The Engineer will pay for mobilization/demobilization on a contract lump sum basis. Payment will be full compensation for the work prescribed in this section and contract documents.

- B. The Engineer will pay for the accepted quantity of the slope scaling at the contract unit price per square foot of completed slope scaling. The contract unit price includes full compensation for providing all protective measures along the pathway and appurtenances and furnishing labor, materials, tools, equipment (including communications equipment) and incidentals necessary for scaling the slope face including removal of debris generated from the slope scaling and completing the work. Preparation for the slope scaling work including installation of the ropes, eyebolts, anchors and/or any other supporting equipment required for the slope scaling work will not be measured nor paid for and will be considered incidental to the unit price item.
- C. The Engineer will pay for accepted stabilization/relocation of the single large boulder on a contract lump sum basis. Payment will be full compensation for the work prescribed in this section and contract documents.

The Engineer will make payment under:

| Pay Item | Pay Unit |
|--|-----------------|
| Mobilization/Demobilization – Scaling Parking Lot Slope Failure Area | Lump Sum |
| Mobilization/Demobilization – Scaling West of Pedestrian Bridge Area | Lump Sum |
| Slope Scaling – Parking Lot Slope Failure Area | Square Foot |
| Slope Scaling – West of Pedestrian Bridge Area | Square Foot |
| Single Boulder Stabilization/Relocation | Lump Sum |

END OF SECTION

SECTION 02207

SLOPE TOE PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

This section describes constructing slope toe protection.

PART 2 - PRODUCTS

2.1 MATERIALS

| | |
|--|-------------|
| Grouted Rubble Paving | 02275 |
| Geotextiles for Permeable Separator Applications | 02243.3.1 |
| Geotextiles for Toe Protection Reinforcement | 02243.3.3 |
| Drain Rock Aggregates | 02231.2.1.C |

6-inch minus rock material shall consist of basalt rock and shall be free of vegetable matter and other deleterious substance. When tested in accordance with AASHTO T 27, grading shall conform to Table 02207-1 – 6-inch Minus Rock Grading Requirements.

| TABLE 02207-1 – 6-INCH MINUS ROCK MATERIAL GRADING REQUIREMENTS | |
|--|----------------------------------|
| Sieve Size | Percent Passing by Weight |
| 6 Inch | 100 |
| No. 200 | 0 - 15 |

PART 3 - EXECUTION

3.1 SITE PREPARATION

Clear and grub area in accordance with Section 02110 – Clearing and Grubbing.

3.2 EXCAVATION FOR TOE STONE

Excavate for toe stone to the alignment, grades, and typical sections shown in contract documents. Compact bottom of excavation until firm condition and finish to smooth surface.

3.3 INSTALLATION

- A. Excavate for toe stone to the alignment, grades, and typical sections shown in contract documents. Toe stones should consist of basalt rock weighing approximately 3 to 5 tons and nominal diameter of about 4 to 5 feet. Compact bottom of excavation until firm condition and finish to smooth surface.
- B. Place 6-inch minus rock fill material as shown on the typical section in the plans and contract documents. The 6 inch minus rock fill material may consist of excavated material from the cut slope excavation. The 6 inch minus material shall be placed in approximate 2-foot level lifts. Each lift shall be wrapped in geotextile fabric conforming to the requirements in Section 02243 – Geotextiles for Toe Protection Reinforcement.
- C. Construct grouted rubble paving, including weep holes and drain rock, to the alignment, grades, and typical sections shown in contract documents.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT

- A. Mobilization/demobilization will be paid on a lump sum basis. Measurement for payment will not apply.
- B. Grouted Rubble Paving: The Engineer will not measure grouted rubble paving. The Engineer will consider grouted rubble paving incidental to the Slope Toe Protection.
- C. 6-inch Minus Rock Fill Material: The Engineer will not measure 6 inch minus rock fill material. The Engineer will consider 6 inch minus rock fill material incidental to the Slope Toe Protection.
- D. Geotextiles for Permeable Separator Applications: The Engineer will not measure Geotextiles for Permeable Separator Applications. The Engineer will consider Geotextiles for Permeable Separator Applications incidental to the Slope Toe Protection.
- E. Geotextiles for Toe Protection Reinforcement: The Engineer will not measure Geotextiles for Toe Protection Reinforcement. The Engineer will consider Geotextiles for Toe Protection Reinforcement incidental to the Slope Toe Protection.

- F. Drain Rock Aggregates: The Engineer will not measure Drain Rock Aggregates. The Engineer will consider Drain Rock Aggregates incidental to the Slope Toe Protection.

4.2 PAYMENT

- A. The Engineer will pay for mobilization/demobilization on a contract lump sum basis. Payment will be full compensation for the work prescribed in this section and contract documents.
- B. Engineer will pay for accepted quantity of the Slope Toe Protection at the contract unit price per linear foot complete in place. The price includes full compensation for furnishing and installing grouted rubble paving, 6 inch minus rock fill material, geotextiles for permeable separator and toe protection reinforcement applications, weep holes, drain rock aggregates, materials, equipment, tools, labor and incidentals necessary for the construction of the slope toe protection.

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

| Pay Item | Pay Unit |
|--|-----------------|
| Mobilization/Demobilization – Slope Toe Protection | Lump Sum |
| Slope Toe Protection | Linear Foot |

END OF SECTION

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SECTION 02227

EXCAVATION AND BACKFILL FOR BRIDGE AND RETAINING STRUCTURES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

This Section describes the following:

- A. Excavating and backfilling to depths and lines established for bridge, retaining (reinforced concrete or cement rubble masonry) structures, foundations, and box culverts.
- B. Other excavating and backfilling specifically designated in the contract documents as structure excavations and backfills.
- C. Disposing of surplus material from structure excavations.
- D. Bailing, draining, sheathing, and constructing cofferdams, if necessary, and subsequently removing sheathing and cofferdams.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Filter Material. Refer to Section 03840, Subsection 1.4.
- B. Structure Backfill Material. Refer to Section 03840, Subsection 1.5.

Controlled Low Strength Material (CLSM) may be used in place of structure backfill material, subject to the Engineer's acceptance. Where CLSM is allowed, provide drainage system to accommodate underground water seepage.

PART 3 - EXECUTION

3.1 CONSTRUCTION

- A. Structure Excavation.
 - 1. General. Notify the Engineer 10 working days before excavating for structures.

The Contractor shall be responsible for the stability of temporary open cuts during construction of structures or trenches and shall take appropriate measures to meet OSHA requirements.

Except when excavations are made entirely in stable rock or excavations are less than 5 feet in depth and examination of the ground by a competent person

provides no indication of a potential cave-in, the Contractor shall be responsible for protecting the sides of the excavations from cave-ins. The Contractor shall submit shop drawings and calculations for any bracing or shoring to be installed. The shop drawings and calculations shall be stamped by a registered Hawaii Structural Engineer and a registered Civil Engineer specializing in Geotechnical Engineering in the State of Hawaii. If the Contractor decides not to brace the cut slope, the Contractor shall submit when requested by the Engineer, calculations, showing the stability of the slope, stamped by a registered Civil Engineer specializing in Geotechnical Engineering in the State of Hawaii. The shop drawings and calculations shall be reviewed and accepted by the Engineer before proceeding with the construction.

In structure excavation operations, do not disturb ground below elevations indicated in the contract documents. If ground below elevations indicated in the contract documents is disturbed, excavate disturbed ground until undisturbed ground is reached. Backfill this area with Class D concrete until required foundation elevation is reached.

Keep foundation excavation dry by draining, bailing, pumping, driving sheathings; or by constructing cofferdams and cribs.

When material from excavation does not meet quality requirements specified for backfill in accordance with Subsection 2.1 - MATERIALS, furnish conforming material, as required.

Deposit remaining structure excavation material that is not used as structural backfill, in roadway embankments as directed by the Engineer. Dispose of surplus selected material as directed by the Engineer.

2. Foundation Treatment. When footing concrete or masonry is to rest upon rock, fully uncover rock and remove rock surface to a depth sufficient to expose sound rock. Roughly level rock surface or cut to steps; and roughen rock surface.

Grout seams in rock under pressure. The Engineer will pay such cost by change order.

While excavating for non-pile foundations where footing concrete or masonry is to rest on an excavated surface other than rock, do not disturb excavation bottom. Remove foundation material to final grade immediately prior to placing concrete or masonry.

Complete driven pile foundation excavation to footing bottom before driving piles therein. Remove excess materials remaining in the excavation, after pile driving, to footing bottom elevation.

In pile foundations, excavating a sufficient distance below footing bottom will be allowed, as indicated in the contract documents, at no increase in contract price or contract time. When ground surface has risen above plan grade after pile driving, remove surplus material at no increase in contract price or contract time. When ground surface is below plan grade after pile driving, backfill and compact to plan grade with acceptable material, at no increase in contract price or contract time.

- B. Structure Backfill. Place structure backfill material A behind bridge abutments, wingwalls, and retaining structures. Do not deposit fill material against back of concrete abutments, piers, concrete box culverts, retaining structures, and foundations until the concrete has met the requirements in Section 03290, Subsection 3.1 E – Loading.

Cure test samples under conditions similar to those affecting the structure. Continue backfilling so that uneven or unsymmetrical lifts do not exceed 16 inches in height creating an unbalanced loading condition.

When spreading and compacting backfill, do not operate heavy equipment closer to abutment or retaining walls, than a distance equal to the height of backfill above top of footing. Compact area remaining, in layers not more than 4 inches in compacted thickness, with power-driven hand tampers suitable for material being compacted.

Place backfill material in uniform horizontal layers not exceeding 8 inches in loose thickness, before compaction. Moisten and compact each layer of backfill until relative compaction of not less than 95 percent is achieved in accordance with ASTM D1557. The Engineer may reduce 95 percent compaction requirement in situations where such compaction is not feasible.

When the Engineer cannot use field density test, compact each layer of backfill with vibratory or other accepted equipment on granular backfill material.

Compaction of backfill material by ponding or jetting will not be allowed.

When required, place sufficient fill at bridges ahead of other grading operations to permit public traffic to cross.

Compact structure backfill in the following areas to a relative compaction of not less than 90 percent:

1. Footings for slope protection, slope paving, and aprons.
2. Retaining walls, except portions under surfacing, and crib walls.
3. Footings not beneath surfacing.

4. Other locations where the contract documents indicate 90 percent relative compaction for structure backfill.
- C. Filter Material. Place backfill filter material at bridge and retaining structures in accordance with the contract documents.

Make subgrade as impervious as possible to direct drainage toward weep holes. Impervious material is defined as materials passing the No. 200 sieve and compacted to minimum 90 percent of maximum density, when tested in accordance with AASHTO T 180, Method D.

END OF SECTION

SECTION 02231

AGGREGATES

PART 1 - GENERAL

1.1 DESCRIPTION

This section describes aggregate materials. Products described in this section is exclusive of other contract work, such as slope scaling, shotcrete placement, and installation of slope toe protection.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fine Aggregate for Concrete: Fine aggregate for Portland cement concrete may be a combination of calcareous sand and basalt, or basalt alone, both being free of vegetable matter and other deleterious substances. Natural sand or manufactured sand from a brackish water source shall be processed by washing with fresh water.

Absolute volume of calcareous sand in fine aggregate shall be limited to 50 percent. Absolute volume of calcareous sand of up to 70 percent of absolute volume of fine aggregate will be acceptable, provided fine aggregate meets minimum insoluble residue of 60 percent; and processing or manufacturing of calcareous sand removes deleterious coatings and unsound materials. Insoluble residue content shall be determined in accordance with ASTM D 3042.

Fine aggregate shall be from an approved source and shall conform to Table 02231.2.1.A-1 - Physical Properties.

| TABLE 02231.2.1.A-1 - PHYSICAL PROPERTIES | | |
|--|---------------|---------------------|
| Test | Method | Requirements |
| Sand Equivalent | AASHTO T 176 | 70 Minimum (a) |
| Soundness Sodium Sulfate (5 cycles) | AASHTO T 104 | 10 Maximum (b) |
| Abrasion (500 Revolutions) | AASHTO T 96 | 40 Maximum (c) |

| TABLE 02231.2.1.A-1 - PHYSICAL PROPERTIES | | |
|--|--------------|--|
| Organic Impurities | AASHTO T 21 | Not darker than the reference standard color (d) |
| Coal and Lignite | AASHTO T 113 | 1 Maximum |
| <p>Notes:</p> <ol style="list-style-type: none"> 1. Sand equivalent (SE) requirement will be waived if material finer than No. 200 sieve does not exceed 5 percent when tested in accordance with AASHTO T 11. 2. When material has satisfactory service record of at least five years, soundness test will be waived 3. Parent material of fine aggregate manufactured by crushing shall have a loss by abrasion of less than 40 percent when tested in accordance with AASHTO T 96. 4. Materials that fail to meet organic impurity color test will be accepted, provided relative strength at 7 and 28 days is more than 95 percent when tested in accordance with AASHTO T 71. | | |

Fine aggregate grading shall conform to Table 02231.2.1.A-2 - Fine Aggregate Grading Requirements.

| TABLE 02231.2.1.A-2 - FINE AGGREGATE GRADING REQUIREMENTS | |
|--|----------------------------------|
| Sieve Sizes | Percent Passing by Weight |
| 3/8 Inch | 100 |
| No. 4 | 95 – 100 |
| No. 8 | 80 – 100 |
| No. 16 | 50 – 85 |
| No. 30 | 25 – 60 |
| No. 50 | 10 – 30 |
| No.100 | 2 - 12 |

Fine aggregate consisting of blend of fine natural sand with fineness modulus of less than

2.1 and basalt for concrete conforming to Table 02231.2.1.A-3 – Fine Aggregate Grading Requirements Fine Natural Sand Blend may be used, provided the Contractor furnishes test data, accepted by the Engineer, indicating that concrete produced will have properties equal to those of concrete made with designated grading.

| TABLE 02231.2.1.A-3 - FINE AGGREGATE GRADING REQUIREMENTS FINE NATURAL SAND BLEND | |
|--|----------------------------------|
| Sieve Size | Percent Passing by Weight |
| 3/8 Inch | 100 |
| No. 4 | 95 - 100 |
| No. 8 | 65 - 95 |
| No. 16 | x ± 10 |
| No. 30 | x ± 9 |
| No. 50 | x ± 6 |
| No. 100 | 2 - 14 |
| The symbol x is grading that the Contractor proposes to furnish for specific sieve size | |

Before beginning concrete work, typical grading of calcareous sand and crushed lava rock fines shall be submitted; and blend proportion proposed to be furnished shall be specified. Grading shall not have more than 45 percent retained between two consecutive sieves that are specified in control of fineness modulus.

Target fineness modulus shall be designated between 2.4 and 3.1. Fineness modulus using No. 4, 8, 16, 30, 50, and 100 sieves shall be computed. Fineness modulus shall be maintained at not more than 0.2 from target.

- B. Coarse Aggregate for Portland Cement Concrete: Coarse aggregate for portland cement concrete shall consist of crushed basalt free of adherent coatings.

Coarse aggregate shall conform to Table 02231.2.1.B-1 - Physical Properties.

| TABLE 02231.2.1.B-1 - PHYSICAL PROPERTIES | | |
|---|--------------------|------------------------------------|
| Deleterious Substances and Physical Properties | Test Method | Maximum Allowable (percent) |
| Clay Lumps and Friable Particles | AASHTO T 112 | 2.0 |
| Materials Finer than No. 200 (75- μ m) Sieve | AASHTO T 11 | 1.5 |
| Lightweight Pieces (Less than 2.0 specific gravity SSD) | AASHTO T 113 | 0.5 |
| Absorption | AASHTO T 85 | 6 |
| Abrasion (500) Revolutions | AASHTO T 96 | 40 |
| Soundness (Sodium Sulfate) | AASHTO T 104 | 12 |

When material has satisfactory service record of at least five years, soundness requirement will be waived. Coarse aggregate grading shall conform to appropriate size designation of AASHTO M 43 when tested in accordance with AASHTO T 21.

- C. Drain Rock: Drain rock material shall consist of crushed basalt that is free of vegetable matter and other deleterious substances. When tested in accordance with AASHTO T 96, wear shall not exceed 40 percent at 500 revolutions.

END OF SECTION

SECTION 02243

GEOTEXTILES

PART 1 - GENERAL

1.1 DESCRIPTION

This section describes geotextiles. Products described in this section is exclusive of other contract work, such as slope scaling, shotcrete placement, and installation of slope toe protection.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Unless otherwise indicated in the contract documents, geotextiles shall be manufactured from long-chain polymeric fibers or yarns, composed of at least 95 percent, by weight, of polyolefins or polyesters. Fibers or yarns, including selvages, shall be formed into a stable network such that their dimensional stability relative to each other is retained during handling, placement, and design service life. Geotextiles shall be free from defects or tears, and free of treatment or coating that would adversely alter hydraulic or physical properties of geotextiles after installation.

Factory and field seams shall be sewn with thread consisting of high strength polypropylene, polyester, or polyamide, having same or greater durability as geotextile material. Nylon threads will not be allowed. Thread shall be at least as ultraviolet resistant as geotextile material and of contrasting color to geotextile.

Unless otherwise indicated in the contract documents, geotextiles shall be free of rot-, mildew-, and chemical-resistant material conforming to requirements of this section.

2.2 ACCEPTANCE

- A. The manufacturer's certificate of compliance and certified test results on the product, tested within six months of the submittal, shall be submitted. The following shall be included
1. Manufacturer's name, current address, and telephone number.
 2. Full product name by trademark and product number.
 3. Geotextile polymer type(s).

4. Recommended geotextile use.
5. Recommended stapling pattern.
6. Six square yards of geotextile sample, with machine direction marked clearly on sample. Machine direction (long direction) is defined as direction perpendicular to axis of geotextile roll.

2.3 SAMPLING

- A. Sampling shall be in accordance with ASTM D 4354 and this subsection. Samples shall be cut from geotextile roll with scissors, sharp knife, or other suitable method that produces a smooth edge and does not rip or tear the material. Samples shall not be taken from outer wrap of geotextile roll, nor inner wrap of the core.

If geotextile seams are to be field sewn, the Contractor shall provide a section of sewn seam that can be sampled by the Engineer before geotextile is installed. Sewn seam for sampling shall be sewn using same equipment and procedures that will be used to sew production seams. If production seams will be sewn in both machine and cross-machine directions, sewn seams for sampling shall be provided that are oriented in both machine and cross-machine directions.

If geotextile seams are to be factory sewn, the Engineer will obtain samples of factory seam at random, from any of the rolls to be used. The Contractor shall submit seam assembly description, and the Engineer will include that description with seam sample obtained for testing. Seam assembly description shall include seam type, sewing thread type(s), and stitch density.

Each sample shall have minimum of 2 yards of seam length, with minimum of 18 inches of material on each side of seam, for each seam orientation (machine or cross-machine direction).

2.4 PHYSICAL ADDRESS

- A. Physical property values in these specifications, with the exception of apparent opening size (AOS), represent minimum average roll values (MARV). Average test results (weaker principal direction for mechanical tests) for a particular property, for any individual roll tested within a lot sampled, shall meet or exceed specified values. Values for AOS represent maximum average roll values.

2.5 PACKAGING

- A. Geotextiles shall be packaged in rolls of length and width to meet requirements.

Geotextiles shall be wound uniformly onto suitable cylindrical forms or cores to aid in handling and unrolling. Each roll of fabric and form or core shall be packaged individually in a sheath, wrapper, or container.

2.6 IDENTIFICATION

- A. Unless otherwise indicated in the contract documents, geotextiles shall be identified in accordance with ASTM D 4873 and this subsection. Include the following information:
1. Unique roll number, serially designated.
 2. Manufacturer's lot number or control numbers.
 3. Name of fabric manufacturer.
 4. Date of manufacture.
 5. Product brand name.
 6. Manufacturer's style or catalog designation of the fabric.
 7. Roll width, in feet.
 8. Roll length, in feet.
 9. Gross weight of entire package, including fabric, core, wrapping, and container.
 10. Net weight of fabric alone.

2.7 STORAGE AND HANDLING

- A. Geotextiles shall be stored and handled in accordance with ASTM D 4873 and this subsection. Geotextiles shall be kept dry and stored off the ground. During shipment and storage, material shall not be exposed to sunlight or other forms of light that contain ultraviolet rays, for more than five days.

PART 3 – APPLICATIONS

3.1 GEOTEXTILES FOR PERMEABLE SEPARATOR APPLICATIONS

- A. Materials shall conform to Table 02243.3.1-1 – Material Requirements.

| TABLE 02243.3.1-1 - MATERIAL REQUIREMENTS | | |
|--|-----------------------|-------------------|
| PHYSICAL PROPERTY | TEST PROCEDURE | REQ'T MARV |
| Grab Strength, (lbs.) (minimum) | ASTM D 4632 | 180 |
| Sewn Seam Strength (lbs.) (minimum) | ASTM D 4884 | 160 |
| Trapezoid Tear Strength (lbs.)(minimum) | ASTM D 4533 | 75 |
| Puncture Strength (lbs.) (minimum) | ASTM D 6241 | 500 |
| Permittivity (sec^{-1})(minimum) | ASTM D 4491 | 0.02 ¹ |
| Apparent Opening Size (U.S. Standard Sieve) ² | ASTM D 4751 | 70-120 |
| Ultraviolet Degradation, 500 hours. (Percent Strength Retained) (minimum) | ASTM D 4355 | 50 |
| ¹ Permittivity of geotextile shall be greater than that of soil. ² Apparent Opening Size (AOS) requirement may be adjusted when less than 50 percent of soil particles, by weight, passes U.S. No. 200 sieve, or when geotextile permeability (ASTM D 4491) is equal to or less than soil permeability. | | |

3.2 GEOTEXTILES FOR GEOCOMPOSITE DRAIN APPLICATIONS

- A. Material shall conform to Table 02243.3.2-1 - Material Requirements; and shall be one-side impermeable, able to pass water and to retain soil without clogging.

| TABLE 02243.3.2-1 - MATERIAL REQUIREMENTS | | |
|---|-----------------------|-------------------|
| PHYSICAL PROPERTY | TEST PROCEDURE | REQ'T MARV |
| Fabric Properties: | | |
| Grab Strength, either direction, (lbs) (minimum) | ASTM D 4632 | 110 |
| Elongation, either direction (percent) (maximum) | ASTM D 4632 | 70 |
| Puncture Resistance (lbs) (minimum) | ASTM D 4833 | 70 |
| Apparent Opening Size (U.S. Standard Sieve) ¹ | ASTM D 4751 | 70-120 |
| Core Properties: | | |
| Compressive Strength (psi) (minimum) | ASTM D 1621 | 40 |
| Flow Rate at 14.5 psi, gradient 1.0 (gal/min/ft) (minimum) | ASTM D 4716 | 15 |
| ¹ Apparent Opening Size (AOS) requirement may be adjusted when less than 50 percent of soil particles, by weight, passes U.S. No. 200 Sieve, or when geotextile permeability (ASTM D 4491) is equal to or less than soil permeability. | | |

3.3 GEOTEXTILES FOR TOE PROTECTION REINFORCEMENT

B. Material shall conform to Table 02243.3.3-1 - Material Requirements.

| TABLE 02243.3.3-1 - MATERIAL REQUIREMENTS | | |
|---|-----------------------|-------------------|
| PHYSICAL PROPERTY | TEST PROCEDURE | REQ'T MARV |
| Grab Strength, (lbs.) (minimum) | ASTM D 4632 | 370 |
| Sewn Seam Strength (lbs.) (minimum) | ASTM D 4884 | 250 |
| Trapezoid Tear Strength (lbs.)(minimum) | ASTM D 4533 | 100 |
| Puncture Strength (lbs.) (minimum) | ASTM D 6241 | 950 |
| Permittivity (sec ⁻¹) (minimum) | ASTM D 4491 | 0.28 ¹ |
| Apparent Opening Size (U.S. Standard Sieve) | ASTM D 4751 | 70 |
| Ultraviolet Degradation, 500 hrs (Percent Strength Retained) (minimum) | ASTM D 4355 | 90 |
| ¹ Permittivity of geotextile shall be greater than that of soil. | | |

3.4 GEOTEXTILES FOR TOE TEMPORARY SILT FENCE APPLICATIONS

- B. Material shall conform to Table 02243.3.4-1 - Material Requirements; and shall be installed in combination with support net of polymeric mesh or other material accepted by the Engineer and post supports, as indicated in the contract documents.

| TABLE 02243.3.4-1 - MATERIAL REQUIREMENTS | | |
|---|-----------------------|-------------------|
| PHYSICAL PROPERTY | TEST PROCEDURE | REQ'T MARV |
| Grab Strength, (lbs.) (minimum) | ASTM D 4632 | 100 |
| Puncture Resistance (lbs.) (minimum) | ASTM D 4833 | 55 |
| Trapezoid Tear Strength (lbs.)(minimum) | ASTM D 4533 | 40 |
| Permittivity (sec ⁻¹) (minimum) | ASTM D 4491 | 0.05 |
| Apparent Opening Size (U.S. Standard Sieve) | ASTM D 4751 | 30 |
| Silt film woven geotextiles | | 50 |
| All other geotextile types | | |
| Ultraviolet Degradation, 500 hrs (Percent Strength Retained) (minimum) | ASTM D 4355 | 70 |

END OF SECTION

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SECTION 02245

GEOCOMPOSITE DRAIN

PART 1 - GENERAL

1.1 DESCRIPTION

This section describes furnishing and placing geocomposite drains on slopes.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Geotextiles for Geocomposite Drain Applications 02243.3.2

PART 3 - EXECUTION

3.1 CONSTRUCTION

- A. Site Preparation: Before placing geocomposite material, clear ground site of sharp objects and vegetation. Excavate rock protruding above surfaces to neat lines.
- B. Installation:
1. When placing geocomposite drain on slopes, unroll and place geocomposite material on prepared surface with permeable fabric face against subgrade. Dragging geocomposite material on ground will not be allowed.
 2. At geocomposite drain joints, peel back fabric from core material and provide at least 3-inch fabric overlap. At ends of drainage panel, provide 3-inch lap over edge of core material.
 3. Limit geocomposite drain material exposure to elements between laydown and cover, to no more than five days or as recommended by the manufacturer.
- C. Damage Repair: Remove and replace torn, punctured, or damaged geocomposite material or combination thereof, with undamaged geocomposite material. Make repair maintaining minimum overlap requirements.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT

A. The Engineer will not measure Geocomposite drain for payment.

4.2 PAYMENT

A. Geocomposite drain will not be paid for separately and Engineer will consider the cost of accepted geocomposite drain as included in the contract prices for various contract pay items in Section 03361 – Shotcrete. The cost is for the work prescribed in this section and contract documents.

END OF SECTION

SECTION 02275

GROUTED RUBBLE PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

This section describes constructing grouted rubble paving.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement
- B. Fine Aggregate for Concrete 02231.2.1.A
- C. Water
- D. Paving stones shall be clean, sound, durable, free from organic material and shall be at least the minimum size in the Plans and have minimum unit weight of 155 pounds per cubic foot.
- E. Grout shall consist of 1 part portland cement to 3 parts fine aggregate by volume.

PART 3 - EXECUTION

3.1 CONSTRUCTION

- A. Excavate in accordance with Section 02207 – Slope Toe Protection.
- B. Free foundation bed of brush, trees, stumps, roots, debris, and other objectionable materials, and dress to smooth surface.
- C. Compact bed until firm condition and finish to smooth surface. Prior to laying stones, provide 3 days notice to Engineer for inspection of foundation bed. Begin laying stones only after foundation is acceptable to Engineer.
- D. Moisten bedding material with water. Wet stones before laying. Lay stones in a full bed of grout having stiff consistency. Use selected stones and shape roughly to make joints between 1/4 inch to 1/2 inch in width.

- E. Bed stones in grout and form uniform planar surface with broken joints.
- F. Within 24 hours after placing stones, point joints with grout to create 1/4-inch recesses. Keep paving surface wet throughout pointing process. Texture of recessed pointing shall not be smooth, but shall match texture of stone used. Visible grout on exposed rock surface will not be allowed.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT

- A. The Engineer will not measure grouted rubble paving for payment.

4.2 PAYMENT

- A. Grouted rubble paving will not be paid for separately and Engineer will consider the cost of accepted grouted rubble paving as included in the contract prices for the various contract pay items in Section 02207 – Slope Toe Protection. The cost is for the work prescribed in this section and contract documents.

END OF SECTION

SECTION 03210
REINFORCING STEEL

PART 1 - GENERAL

1.1 DESCRIPTION

This section describes furnishing, storing, and placing reinforcing steel (also referred to as rebar, bar, or reinforcement).

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Bar Reinforcement. Bar reinforcement shall conform to AASHTO M 31 for billet-steel bars or ASTM A 706 for low-alloy steel bars, and the following requirements:
 - 1. Bars shall be deformed type.
 - 2. Bars shall be Grade 60.
 - 3. Cold twisted bars will not be allowed.
- B. Steel Wire Reinforcement. Steel wire reinforcement shall conform to AASHTO M 32.

Submit certificate of compliance for reinforcing steel. When steel bars, other than bars conforming to ASTM A 706, are to be spliced by welding, or when requested by the Engineer, submit six copies of certified mill test reports showing physical and chemical analyses for each heat and size of reinforcing steel.

PART 3 - CONSTRUCTION

3.1 CONSTRUCTION

- A. Order Lists and Bending Diagrams. Submit six copies of reinforcing steel order lists and bending diagrams to the Engineer prior to fabrication. Assume absolute responsibility for accuracy of lists and diagrams.
- B. Storage, Surface Condition, and Protection of Reinforcement. Store reinforcing steel above ground surface on platforms, skids, or other supports. Protect reinforcing steel from mechanical damage and surface deterioration caused by exposure to corrosion-producing conditions. When placed in the work, reinforcing steel shall be free from dirt, loose rust or scale, mortar, paint, grease, oil, or other coatings that would destroy or reduce bond. Reinforcing steel shall be free from injurious defects such as cracks and laminations. Bonded rust, surface seams, surface irregularities, or mill scale shall not be cause for rejection, provided minimum dimensions, cross-sectional area, and

tensile properties of a hand-wire-brushed specimen meet physical requirements for size and grade of steel specified.

C. Fabrication.

1. Bending. Bend reinforcing steel cold. Do not field bend bars that are partially embedded in concrete, except as indicated in the contract documents or permitted by the Engineer.

Bend or straighten bars in a manner that shall not damage the material. Bars having cracks or splits at bends will be rejected. Unless otherwise indicated in the contract documents, bend steel only once at the same location.

2. Hooks and Bend Dimensions. Dimensions of hooks and diameters of bends shall be in accordance with the contract documents. When dimensions of hooks or diameter of bends are not indicated in the contract documents, they shall conform to AASHTO *LRFD Bridge Design Specifications*, Second Edition, Article 5.10.2 – Hooks and Bends.

3. Identification. Ship reinforcing steel in standard bundles. Tag bundles of reinforcing bars showing quantity, grade, size, and identification that allows for checking, sorting, and placing. Tag bundles of welded wire fabric reinforcement showing quantity, style designation, width, and length.

- D. Placing and Fastening. Unless otherwise indicated in the contract documents, place and fasten reinforcing steel in accordance with the CRSI Placing Reinforcing Bars and the CRSI Manual of Standard Practice. Accurately place reinforcing steel and hold firmly in position indicated in the contract documents by wiring at intersections and splices; and by using bar supports accepted by the Engineer that have sufficient strength to resist crushing under applied loads. Unless otherwise indicated in the contract documents, place reinforcing steel within tolerances conforming to Table 03210-1 – Placement Tolerances. Begin concrete placement only after the Engineer inspects and accepts reinforcing steel position.

| TABLE 03210-1 - PLACEMENT TOLERANCES | |
|---|--|
| Clear distance to side forms and resulting concrete surfaces and clear distance to formed and resulting concrete soffits in direction of tolerance: Member size 4 inches or less Member size over 4 inches but not over 12 inches..... Member size over 12 inches but not over 2 feet..... Member size over 2 feet | + 1/4 inch - 3/8 inch ± 3/8 inch ± 1/2 inch ± 1 inch |
| Concrete cover measured perpendicular to concrete surface in direction of tolerance: ^{1,2} Member size 12 inches or less Member size over 12 inches | - 3/8 inch - 1/2 inch |

| | |
|--|---|
| Distance between unbundled bars (providing that distance between reinforcement shall not be less than the greater of d_b or 1 inch) ³ | One-quarter specified distance not to exceed 1 inch |
| Distance between bundled bars: 2 bar bundles..... | Not less than the greater of 1 inch or $1.4d_b$ |
| 3 bar bundles..... | $1.7d_b$ |
| 4 bar bundles..... | $2d_b$ |
| Spacing of non-prestressed reinforcement, deviation from specified location: ⁴ Slabs and walls other than stirrups and ties | ± 3 inches |
| Stirrups..... | Beam depth in inches/12 X 1 inch |
| Ties | Least width of column in inches/12 X 1 inch |
| Longitudinal location of bends and ends of bars: At discontinuous ends of brackets and corbels..... | $\pm 1/2$ inch |
| At discontinuous ends of other members..... | ± 1 inch |
| At other locations..... | ± 2 inches |
| Embedded length of bars and length of bar laps: No. 3 through No. 11 | - 1 inch |
| No. 14 and No. 18 bar sizes (embedment only)..... | - 2 inches |
| Notes: | |
| ¹ Reduction in cover shall not exceed one-third specified concrete cover except for bridge decks. | |
| ² Reduction in cover to formed soffits shall not exceed 1/4 inch. | |
| ³ d_b = Diameter of individual bar | |
| ⁴ Total number of bars shall not be less than that specified. | |

Maintain proper clearance between reinforcing steel and boundaries of concrete by precast concrete bar supports of equal compressive strength as concrete to be placed around them, and of shape and dimensions accepted by the Engineer.

Unless otherwise indicated in the contract documents, bar supports and their spacing shall conform to recommendations in Chapter 3 – Bar Supports of *CRSI Manual of Standard Practice (MOSP)*. Steel wire bar supports shall be Class 1 (plastic-protected) bar supports, as described in *CRSI MOSP*. All plastic bar supports will be allowed only in prestressed concrete members and for vertical positions in drilled shafts.

Separate bar layers using precast concrete blocks or other bar supports accepted by the Engineer. Use of pebbles, pieces of broken stone or brick, metal pipes, or wooden blocks will not be allowed.

Maintain minimum 2-1/2 bar diameters for center-to-center spacing of parallel bars. Minimum clear distance between bundles of bars and adjacent bundles or single bars shall be not less than the following: bundles of two bars, 2 times diameter of larger bar; bundles of three bars, 2 1/2 times diameter of largest bar; bundles of four bars, 3 times diameter of largest bar.

In no case shall clear distance between bars or bundles of bars be less than 1-1/2 times maximum coarse aggregate size or less than 1-1/2 inches, whichever is greater.

Except in decks where parallel reinforcing steel is placed in two or more layers, with clear distance between layers not exceeding 6 inches, place bars in upper layers directly above those in bottom layer, and maintain clear distance between layers of not less than 1 inch or the nominal bar diameter, whichever is greater.

Tie bundled bars together at a distance of not more than 6 feet on centers along length of bar. Limit maximum number of bars in bundle to two bars for No. 14 and No. 18 bars and four bars for other sizes. Bundling bars by tack welding will not be allowed.

Individual bars in bundle that are cut off within span of member shall be terminated at different points, with at least a 40-bar diameter stagger.

Unless otherwise indicated in the contract documents, concrete cover for unprotected main reinforcing steel shall conform to Table 03210-2 - Concrete Cover (Main Bars). Cover for rebar mechanical connections shall be same as for reinforcing steel.

Cover to ties and stirrups may be 1/2 inch less than values specified in Table 03210-2 – Concrete Cover (Main Bars) but shall not be less than 1 inch.

| TABLE 03210-2 - CONCRETE COVER (MAIN BARS) | |
|--|-----------------------|
| Exposure Condition | Cover (Inches) |
| Direct exposure to salt or brackish water | 4 |
| Cast against and permanently exposed to earth | 3 |
| Exterior (exposed to earth or weather): | 2 |
| Interior (not exposed to weather or in contact with ground): | |
| Up to No. 11 bar | 1-1/2 |
| No. 14 and No. 18 bars | 2 |
| Precast soffit form panels | 3/4 |
| Precast reinforced piles | |
| Noncorrosive environments | 2 |
| Corrosive environments ¹ | 3 |
| Precast prestressed piles | 2 |
| Cast-in-place piles: | |
| Noncorrosive environments | 2 |

| | |
|--|---|
| Corrosive environments ² | 3 |
| Shells | 2 |
| Auger-cast, tremie concrete, or slurry construction | 3 |
| Notes: | |
| ¹ Environments where concrete will be exposed to external sources of chlorides in service, such as brackish water, seawater, or spray from these sources. | |

E. Splicing of Bars.

1. General. Furnish reinforcing steel in full lengths in accordance with the contract, except in the following cases:
 - a. Unless otherwise indicated in the contract documents, when required lengths of bars No. 4 through No. 11 are longer than 40 feet, bars may be spliced by lapping, butt welding, mechanical butt splicing, or mechanical lap splicing.
 - b. Lap splicing for bars No. 14 and No. 18 will not be allowed. When required lengths of these bars are longer than commercially available lengths, use butt welding or mechanical butt splicing.

Welded lap splicing and mechanical lap splicing may only be used for bars No. 4, 5, and 6.

Welded splices will not be allowed in decks.

Reinforcing steel may be made continuous at locations where splices are indicated in the contract documents, at the Contractor's option.

Submit splice locations. Locate splices in areas of low stresses. Splicing bottom reinforcing steel at or near centerline of span and splicing top reinforcing steel at or near continuous support will not be allowed.

Unless otherwise indicated in the contract documents, splices in adjacent reinforcing bars at any particular section shall be staggered. Minimum distance between staggered lap splices or mechanical lap splices shall be equal to the length required for a lapped splice in the largest bar being spliced. Minimum distance between staggered butt splices shall be 2 feet, measured between splice midpoints, along a line that is centered between axes of the adjacent bars.

Number of bars spliced at sections normal to axis of member shall not exceed 33 percent of total main reinforcing steel in member. If bars cross construction joint, embed each end of reinforcing steel a distance equal to required length of lap, on each side of joint.

Deviation in alignment of reinforcing bars at welded or mechanical splice shall not exceed 1/4 inch over a 3-1/2-foot length of bar.

Unless otherwise indicated in the contract documents, splice spiral reinforcing bars either by V-groove welded splice, welded lap splice, or mechanical lap splice. Anchor each unit of spiral reinforcing bars by lapping free end of bar to continuous spiral and using either welded lap splice detail or mechanical lap splice detail.

V-groove welded splice and welded lap splicing shall conform to details indicated in the contract documents and the following requirements:

On V-groove welded splices, reinforcing bars at joint shall not be offset at weld by more than 1/8 inch.

Trim back or shape ends of reinforcing bars to be spliced by V-groove welding by carbon arc, oxyacetylene cutting, or sawing. Trim back sheared surfaces not less than 1/8 inch.

Unless otherwise specified, weld by manual shielded metal-arc process. Use low hydrogen electrodes conforming to requirements of AWS A5.1 for E7016 or E7018 electrodes.

Purchase electrodes in hermetically sealed containers, or dry for two hours at 450 degrees F. to 500 degrees F. before use. Immediately after removal from hermetically sealed containers or from drying ovens, store electrodes in ovens held at temperature of at least 250 degrees F. Redry electrodes not used within four hours after removal from hermetically sealed containers or from drying or storage ovens.

Do not weld in inclement or wet weather unless protection accepted by the Engineer is provided.

Flare welds may be made in one pass. Make butt welds with multiple passes.

Pre-heating or post-heating of ASTM A 706 bars in weld area will not be required.

Tack welding for alignment purposes will be allowed when tack weld will be consumed by subsequent weld.

Visual inspection of completed welds shall show no evidence of cracks, lack of fusion, undercutting, excessive piping, porosity, or inadequate size.

Prequalify welders by requiring them to make procedure and qualification weld that conforms to provisions in Section 03210, Subsection 3.1 E.4. - Qualification of Welding and Mechanical Splicing. Perform procedure and qualification welding in presence of the Engineer, using materials similar to those to be welded on the Project, in same position as will be encountered in the work.

Individual hoops, made continuous with welded butt splices, may be substituted for bar spiral reinforcement. Welded butt splices for individual hoops shall conform to provisions in Section 03210, Subsection 3.1 E.3.a. - Welded Butt Splices.

Except when otherwise indicated in the contract documents, mechanical lap splicing shall conform to details shown on plans, provisions for mechanical butt splices as specified in this subsection; and Section 03210, Subsection 3.1 E.3.b. - Mechanical Butt Splices, Section 03210, Subsection 3.1 E.4. - Qualification of Welding and Mechanical Splicing, and Section 03210, Subsection 3.1 E.5. - Job Control Tests. Mechanical lap splice shall be unit consisting of a sleeve, in which reinforcing bars are positioned, and a wedge is driven through holes in sleeve, between reinforcing bars.

2. Lapped Splices. Lapped splices shall consist of reinforcing steel placed in contact and wired together in such a manner as to maintain alignment and provide minimum clearances. Non-contact lapped splices will not be allowed.

The lengths of lapped splices shall conform to Table 03210-4.

| TABLE 03210-4 - LENGTHS OF LAPPED SPLICES | | | | | |
|--|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| BAR SIZE | f'c = 3000 PSI | f'c = 4000 PSI | f'c = 4500 PSI | f'c = 6000 PSI | f'c = 9000 PSI |
| #3 | 16 | 16 | 16 | 16 | 16 |
| #4 | 21 | 21 | 21 | 21 | 21 |
| #5 | 26 | 26 | 26 | 26 | 26 |
| #6 | 33 | 31 | 31 | 31 | 31 |
| #7 | 45 | 39 | 36 | 36 | 36 |
| #8 | 59 | 51 | 49 | 42 | 41 |
| #9 | 74 | 64 | 62 | 52 | 46 |
| #10 | 94 | 81 | 79 | 67 | 54 |
| #11 | 115 | 100 | 97 | 82 | 67 |

NOTES:

1. Lengths shown in inches.
2. Top bars are horizontal or nearly horizontal reinforcement, so placed that more than 12.0 in. of fresh concrete is cast below the reinforcement. The lengths of lapped splices above shall be multiplied by 1.4 for top bars.”

Lapped splices will not be allowed at locations where concrete section is insufficient to provide minimum clear distance between splice and nearest adjacent bar, as specified in Section 03210, Subsection 3.1 D - Placing and Fastening for minimum clear distance between parallel bars or bundles of bars.

Lapped splices in bundled bars shall conform to the following: in bundles of two bars, make lapped splice length same as single bar lapped splice length; in bundles of three bars, make lapped splice length 1.2 times single bar lapped splice length; in bundles of four bars, make splices by butt welding or by mechanical butt splicing.

At lapped splices in wire spiral reinforcement, anchor each end of spiral by a 135-degree hook with 6-inch tail hooked around an intersecting longitudinal bar; and lap wire spiral reinforcement to be spliced at least 80 bar diameters between anchors.

3. **Butt Jointed Splices.** Butt-jointed splices shall be either welded or mechanical splices. Do not locate splices on bent portions of bars. Butt jointed splices shall be capable of resisting flexural and other load effects due to construction activities, including handling and placing of reinforcing steel. Completed butt splices shall develop not less than the specified tensile strength of the unspliced bars.

Prior to use in the work, qualify welded and mechanical butt splices by tests made on sample splices, as specified in Section 03210, Subsection 3.1 E.4. - Qualification of Welding and Mechanical Splicing. Perform job control tests on sample splices representing each lot of mechanical butt splices as specified in Section 03210, Subsection 3.1 E.5. - Job Control Tests. Test sample splices for qualification and job control tests for compliance with splice requirements in accordance with the contract. The Contractor shall fabricate and test sample splices and shall submit copy of test results to the Engineer.

- a. **Welded Butt Splices.** Welded butt splices in reinforcing steel shall be complete joint penetration butt welds conforming to requirements of AWS D1.4 and the contract documents.

Shop-produced resistance butt welds conforming to requirements of the contract documents and produced by fabricator accepted by the Engineer may be used.

Use only joint details and dimensions as shown in Figure 3.2 - Direct Butt Joints of AWS D1.4 98, for making complete joint penetration butt welds of reinforcing steel. Split pipe backing will not be allowed.

Use flat plate in accordance with ASTM A 709, Grade 36, as backing for complete joint penetration butt welds of reinforcing steel. Flat plate shall be 1/4-inch thick, with width as measured perpendicular to bar axis, equal to nominal bar diameter; and length not exceeding twice nominal bar diameter. Fit flat plate backing tightly to bar, with weld root centered on plate. Grind smooth and flush with adjacent surface, bar deformations or obstructions preventing a tight fit. Locate tack welds used to fit backing plates, within weld root area, so that tack welds are completely consumed by finished weld. Do not remove backing plates.

Make butt welds with multiple weld passes using stringer bead, without appreciable weaving motion. Maximum stringer bead width shall be 2.5 times electrode diameter. Perform slagging between each weld pass. Weld reinforcement shall not exceed 1/8 inch in convexity.

Terminate or initiate welds made on unbent portion of cold bent reinforcing steel, at minimum distance of two bar diameters from points of tangency for radius created by cold bending.

Before any electrodes or flux electrode combinations are used, submit at no increase in contract price or contract time, certified copies of test reports for pertinent tests specified in AWS A5.1, AWS A5.5, AWS A5.18 or AWS A5.20, whichever is applicable, made on electrodes or flux electrode combinations of the same class, brand, and nearest specified size as the electrodes to be used. Tests may have been made for process qualification or quality control, and shall have been made within one year prior to manufacture of electrodes and fluxes to be used. Include in report manufacturer's certification that process and material requirements were same for manufacturing tested electrodes and electrodes to be used.

Electrodes for manual shielded metal arc welding of ASTM A 615, Grade 60 bars shall conform to AWS A5.5 for E9018 M or E10018 M electrodes.

Electrodes for manual shielded metal arc welding of ASTM A 706 bars shall conform to AWS A5.5 for E8016 C3 or E8018 C3 electrodes.

Solid and composite electrodes for semiautomatic gas metal arc and flux cored arc welding of Grade 40 reinforcing bars shall conform to

AWS A5.18 for ER70S 2, ER70S 3, ER70S 6 or ER70S 7 electrodes; or AWS A5.20 for E70T 1, E70T 5, E70T 6 or E70T 8 electrodes.

Electrodes for semiautomatic welding of ASTM A 615, Grade 60 and ASTM A 706 bars shall produce weld metal deposit with properties conforming to Section 5.3.4 in AWS D1.1 for ER80S Ni1, ER80S Ni2, ER80S Ni3, ER80S D2, E90T1 K2 and E91T1 K2 electrodes.

Prior to welding ASTM A 615 bars, preheat bars for a distance of not less than 6 inches on each side of joint.

For all welding of ASTM A 615, Grade 40 or Grade 60 bars, requirements of Table 5.2 - Minimum Preheat and Interpass Temperatures of AWS D1.4-98 are superseded by the following:

Minimum preheat and interpass temperatures shall be 400 degrees F. for Grade 40 bars and 600 degrees F. for Grade 60 bars. Immediately after completing welding, cover at least 6 inches of bar on each side of splice with insulated wrapping to control rate of cooling. Keep insulated wrapping in place until bar has cooled below 200 degrees F.

When welding different grades of reinforcing steel, electrode shall conform to Grade 40 bar requirements and preheat shall conform to Grade 60 bar requirements.

If specified preheat, interpass, or post weld cooling temperatures are not met, remove all weld and heat-affected zone metal and reweld splice.

Protect welding from air currents, drafts, and precipitation in a manner accepted by the Engineer.

Direct butt splicing of reinforcing steel by thermite welding will not be allowed.

b. Mechanical Butt Splices.

1. General. The following mechanical butt splices may be used: sleeve filler metal type, sleeve threaded type, sleeve swaged type, sleeve filler grout type, sleeve lockshear bolt type, two part sleeve forged bar type, or two part sleeve friction bar type.

Use mechanical butt splices of design accepted by the Engineer. The Engineer's acceptance of a new design will be based upon the following: technical data, including test results, and other proof of satisfactory performance submitted by manufacturer; and test results by the Engineer or the

Engineer's authorized representative on manufacturer-furnished sample splices and splice material. Resubmit design if change is made in details or materials previously submitted and accepted.

Total slip of reinforcing steel within splice sleeve, after loading in tension to 30,000 pounds per square inch and relaxing to 3,000 pounds per square inch, shall not exceed values listed in Table 03210-3 – Allowable Total Slip. Slip shall be measured between gage points that are clear of splice sleeve.

| TABLE 03210-3 - ALLOWABLE TOTAL SLIP | |
|---|--------------------------|
| Bar Size Number | Total Slip (inch) |
| 4 | 0.010 |
| 5 | 0.010 |
| 6 | 0.010 |
| 7 | 0.014 |
| 8 | 0.014 |
| 9 | 0.014 |
| 10 | 0.018 |
| 11 | 0.018 |
| 14 | 0.024 |
| 18 | 0.030 |

Slip requirements shall not apply to mechanical lap splices.

Splicing procedures shall conform to manufacturer's recommendations, except as modified in this subsection. Make splices using manufacturer's standard equipment, jigs, clamps, and other required accessories.

Cut ends of reinforcing bars to be butt-spliced, nominally square.

Splice sleeves shall have concrete cover of not less than 1 3/4 inches, measured from concrete surface to outside of sleeve. Adjust or relocate stirrups, ties, and other bars, and place additional reinforcing steel, if necessary, to provide planned concrete cover to reinforcing steel.

Submit the following information for each shipment of splice material, as specified:

- a. Type or series identification of splice material and for sleeve threaded type sleeves, heat treatment lot number.
 - b. Bar grade and size number to be spliced, by material.
 - c. Copy of manufacturer's technical documentation giving complete data on splice material and procedures.
 - d. Statement that splicing systems and materials used in accordance with manufacturer's procedures shall develop not less than minimum tensile strengths, based on nominal bar area of the unspliced bars and shall comply with total slip requirements and other requirements indicated in the contract documents.
 - e. Statement that splice material conforms, in all respects, to details and materials of a specific design accepted by the Engineer.
2. Sleeve Filler Metal Mechanical Butt Splices. Sleeve filler metal type of mechanical butt splices shall consist of a steel splice sleeve that fits closely over the reinforcing bar, with ferrous filler metal in annular space between reinforcing steel and sleeve, and between ends of reinforcing steel. Melt filler metal by exothermic reaction. Splicing process shall not fuse filler metal with reinforcing steel or heat reinforcing steel to its melting point, except for nominal melting of ends of reinforcing steel at mid length of splice sleeve.

Remove oversize projections and distortions of reinforcing steel within sleeve by grinding.

Clean surfaces of reinforcing steel within sleeve and for 2 inches beyond end of sleeve, of slag, mill scale, rust, and other foreign materials. Clean either by oxyacetylene torch

followed by power wire brushing or by abrasive blast cleaning.

Immediately prior to adding filler material to splice sleeve, preheat cleaned bar ends and entire splice sleeve to 300 degrees F. \pm 50 degrees F. When gas torches are used for preheating, do not direct flame into the inside of splice sleeve.

In completed splice, sound, non-porous filler metal shall be visible completely around reinforcing steel, at both ends of splice sleeve and at tap hole in center of sleeve.

Fill annular space between reinforcing steel and sleeve with filler material, to the extent that the average depth of any recess, over entire perimeter, caused by use of packing ring, and voids due to other causes, at each end of sleeve, does not exceed 1/2 inch. Depth of recesses and voids will be measured by wire probe inserted to deepest points of recesses and voids.

3. Sleeve Threaded Mechanical Butt Splices. Sleeve threaded type of mechanical butt splices shall consist of a steel splice sleeve, with tapered interior threads, that joins reinforcing bars with matching tapered threads. Taper threads to such a degree that cross threading will not occur during assembly.

Mark each splice sleeve with heat treatment lot number.

After completion of assembly, tighten splice to torque value recommended by manufacturer.

4. Sleeve Swaged Mechanical Butt Splices. Sleeve swaged type of mechanical butt splices shall consist of a seamless steel sleeve applied over ends of reinforcing bar and swaged to bars by means of a hydraulic press.
5. Sleeve Filler Grout Mechanical Butt Splices. Sleeve-filler grout type of mechanical butt splices shall consist of a steel splice sleeve that fits closely over reinforcing bars with non-shrink grout filler in annular space between reinforcing steel and sleeve, and between ends of reinforcing steel.

Allow no vibration or movement of reinforcing bar or sleeve at splice while splice is developing sufficient strength to support reinforcing bar. Submit complete details of bracing and clamping system to eliminate vibration or movement at splice during setup of filler for approval by the Engineer.

6. Sleeve-Lockshear Bolt Mechanical Butt Splices. Sleeve-lockshear bolt type of mechanical butt splices shall consist of a seamless steel sleeve, center hole with centering pin, and bolts that are tightened until bolt heads shear off, leaving bolt ends embedded in reinforcing bar. Seamless steel sleeve shall be either formed into a V configuration or shall have two serrated steel strips welded to inside of sleeve.
 7. Two Part Sleeve Forged Bar Mechanical Butt Splices. Two part sleeve forged bar type of mechanical butt splices shall consist of a shop-machined, two part threaded steel sleeve that interlocks two hot forged reinforcing bar ends. Forged bar ends may be either shop-produced or field-produced.
 8. Two Part Sleeve Friction Bar Mechanical Butt Splices. Two part sleeve friction bar type of mechanical butt splices shall consist of a shop machined, two part threaded steel sleeve whose ends are friction welded, in the shop, to reinforcing bar ends.
4. Qualification of Welding and Mechanical Splicing. Procedures to be used in splicing reinforcing bars and welders and operators who will apply these procedures shall be qualified by tests performed by the Contractor on sample splices of the type to be used, before making splices in the work.

For welded splices, submit written welding procedure specifications (WPS) and welder qualification tests to be used that conform to requirements in AWS D1.4.

Fabricator accepted by the Engineer shall produce resistance butt welds.

Each operator qualification test for mechanical splices shall consist of two sample splices. Each mechanical splice procedure test shall consist of two sample splices.

For sleeve filler, sleeve threaded, sleeve lockshear bolt, and two part sleeve friction bar mechanical butt splices, make sample splices on largest reinforcing bar size to be spliced by procedure or operator being tested, except that No. 14 bars may be substituted for No. 18 bars.

For sleeve swaged and two part sleeve forged mechanical butt splices, and mechanical lap splices, make sample splices on largest reinforcing bar size, of each deformation pattern to be spliced by procedure or operator being tested. When joining new reinforcing bar to existing reinforcing bar, make qualification test sample bars using only deformation patterns of new reinforcing bar to be joined.

If operator is qualified for mechanical splicing of reinforcing bar of a given size, that operator will also be considered qualified for reinforcing bar sizes smaller than those used in making tests.

Perform separate operator qualification test or procedure test for each mechanical splicing position and procedure that operator is expected to use in the work.

Operator and procedure qualification tests may be performed simultaneously.

The Engineer will accept mechanical splice procedures and operators based upon acceptance of previous tests performed on appropriate sample splices.

Submit completed sample splices at least 60 inches long, with splice at mid length.

Make and test sample splices in the presence of the Engineer or the Engineer's authorized representative, including tests performed by a commercial agency.

5. Job Control Tests. When mechanical butt splices, shop-produced complete joint penetration butt-welded splices, or shop-produced resistance butt-welded splices are used, submit job control tests from a qualified testing laboratory. Job control test shall consist of fabrication, under conditions used to produce splice, and physical testing of three sample splices for each lot of 150 splices.

A mechanical butt splice lot is defined as 150, or fraction thereof, of the same type of mechanical butt splices used for each combination of bar size and bar deformation pattern that is used in the work.

A shop-produced, complete joint penetration butt-welded splice lot, or shop-produced, resistance butt-welded splice lot, is defined as 150, or fraction thereof, of the same type of welds used for each combination of bar size and bar deformation pattern that is used in the work.

When joining new reinforcing bar to existing bars, make job control test using only deformation patterns of new reinforcing steel to be joined.

Sample splice shall consist of splice made at job site to connect two 30 inch long minimum length bars, using same splice materials, position, location, and equipment, and following same procedures as are being used to make splices in the work. Shorter sample splice bars may be used if accepted by the Engineer.

Make and test sample splices in the presence of the Engineer or the Engineer's authorized representative.

Identify sample splices with weatherproof markings prior to shipment to testing laboratory.

For sleeve threaded mechanical butt splices, fabricate reinforcing bars to be used for job control tests on a random basis, during thread cutting on reinforcing steel of each lot. Ship job control test samples to jobsite with material they represent.

For shop-produced, complete joint penetration butt welds, shop-produced, resistance butt-welded splices, and all types of mechanical butt splices, except sleeve threaded type, the Engineer will designate when job control test samples are to be fabricated, and will determine limits of lot represented by each job control test.

Should average of test results made on three sample splices, or should more than one sample splice in any job control test fail to meet requirements for splices, all splices represented by that test will be rejected. Rejection shall prevail unless the Contractor, at no increase in contract price or contract time, obtains and submits evidence acceptable to the Engineer, that strength and quality of splices in the work are acceptable.

6. Nondestructive Splice Tests. The Contractor shall perform required radiographic examinations of complete joint penetration butt-welded splices in accordance with requirements of AWS D 1.4 and as otherwise indicated in the contract documents.

Prior to radiographic examination, welds shall conform to requirements of Subsection 4.4 - Quality of Welds, of AWS D1.4 98.

Perform radiographic examinations on 25 percent of all complete joint penetration butt-welded splices from production lot. Size of production lot will be maximum of 100 splices. The Engineer will select splices that will compose production lot and also splices within each production lot to be radiographically examined.

Should more than 12 percent of splices that have been radiographically examined in any production lot be defective, radiographically examine an additional 25 percent of splices, selected by the Engineer, from same production lot. Should more than 12 percent of cumulative total of splices tested from same production lot be defective, radiographically examine all remaining splices in lot.

Perform additional radiographic examinations due to identification of defective splices, at no increase in contract price or contract time.

Welds found to be defective shall be repaired in accordance with requirements of ANSI/AWS D1.4 at no increase in contract price or contract time.

In addition to radiographic examinations performed by the Contractor, any mechanical or welded splice may be subject to inspection or nondestructive testing by the Engineer. Provide sufficient access facilities in shop and at jobsite to permit the Engineer or the Engineer's authorized representative to perform inspection or testing.

Notify the Engineer in writing 48 hours prior to performing any radiographic examinations.

Radiographic procedure used shall conform to ASME Boiler and Pressure Vessel Code, Section V, Article 2 and the following:

Make two exposures for each complete joint penetration butt-welded splice. For each of the two exposures, center radiation source on each bar to be radiographed. Make first exposure with radiation source placed at zero degrees from top of weld and perpendicular to weld root, and identified with station mark of "0." When obstructions prevent zero degree placement of radiation source for first exposure, and when approved in writing by the Engineer, source may be rotated around centerline of reinforcing bar, a maximum of 25 degrees. Make second exposure at 90 degrees to "0" station mark and identify with station mark of "90."

For field-produced, complete joint penetration butt welds, radiograph no more than one weld during one exposure. For shop-produced, complete joint penetration butt welds, if more than one weld is to be radiographed during one exposure, angle between root line of each weld and direction to radiation source shall be not less than 65 degrees.

Make radiographs by either X ray or gamma ray. Radiographs made by X ray or gamma rays shall have densities of not less than 2.3 or more than 3.5, in area of interest. Tolerance of 0.05 in density will be allowed for densitometer variations. Gamma rays shall be from iridium 192 isotope and emitting specimen shall not exceed 0.175 inch in greatest diagonal dimension.

Place radiographic film perpendicular to radiation source at all times; parallel to root line of weld, unless source placement determines that film must be turned; and as close to weld root as possible.

Maintain minimum source-to-film distance such that radiographs maintain maximum geometric unsharpness of 0.020, regardless of reinforcing bar size.

Place penetrameters on source side of bar and perpendicular to radiation source at all times. Place one penetrameter in center of each bar to be radiographed, perpendicular to weld root, and adjacent to weld. Penetrameter images shall not appear in weld area.

When radiography of more than one weld is being performed per exposure, include minimum of one penetrometer per bar for each exposure, or three penetrameters per exposure. When three penetrameters per exposure are used, place one penetrometer on each of the two outermost bars of the exposure, and place remaining penetrometer on centrally located bar.

Allowable weld buildup of 0.16 inch may be added to total material thickness when determining proper penetrometer selection. No image quality indicator equivalency will be accepted. Wire penetrameters or penetrometer blocks will not be allowed.

Shim penetrameters using radiographically identical material. Penetrometer image densities shall be minimum of 2.0 and maximum of 3.6.

Use Class 1 radiographic film, regardless of reinforcing bar size.

Keep radiographs free of film artifacts and processing defects, including streaks, scratches, pressure marks, or marks made for identifying film or for welding indications.

Clearly identify each splice on each radiograph. Before radiographic inspection begins, radiograph identification and marking system shall be established between the Contractor and the Engineer. Identify film by lead numbers only. Etching, flashing, or writing in identifications of any type will not be permitted. Make each piece of film identification information legible and include, as a minimum, the following information: Contractor's name, date, name of nondestructive testing firm, initials of radiographer, contract number, part number, and weld number. Place the letter "R" and repair number directly after weld number to designate radiograph of a repaired weld.

Develop radiographic film within time range of one minute less to one minute more than film manufacturer's recommended maximum development time. Sight development will not be allowed.

Use processing chemistry with consistent mixture and quality. Keep processing rinses and tanks clean. Maintain records of all developing processes and any chemical changes to developing processes. Submit those records to the Engineer upon request. The Engineer may request, at any time, that a sheet of unexposed film be processed in the presence of the Engineer, to verify processing chemical and rinse quality.

Record results of radiographic interpretations on signed certification and keep copy with film packet.

Include developer temperature, developing time, fixing duration, and rinse times in technique sheets prepared in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 2, Section T 291.

- F. Splicing of Welded Wire Fabric. Overlap flat sheets of welded wire fabric (WWF) to maintain uniform strength. Fasten sheets of WWF at ends and edges. Use edge lap not less than the following: one spacing of cross wires plus 2 inches; or 6 inches; or the numerical value of the longitudinal wire size (W-Size Number) times 4.3 divided by the longitudinal wire spacing in inches.

END OF SECTION

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SECTION 03290

CONCRETE STRUCTURES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

This section describes construction of concrete bridges, grade separations, box culverts, head walls, retaining walls, and other concrete structures.

PART 2 - PRODUCTS

2.1 MATERIALS

Structural Concrete. Refer to Section 03310.

Reinforcing Steel. Refer to Section 03210.

Curing Materials. Refer to Section 03390, Subsection 1.1.

Admixtures. Refer to Section 03390, Subsection 1.2.

PART 3 - EXECUTION

3.1 CONSTRUCTION

- A. Foundation. Excavate and backfill foundations in accordance with Section 02227 - Excavation and Backfill for Bridge and Retaining Structures and as indicated in the contract documents.

Elevation of bottom of footings shown is approximate only. Upon completion of excavation work, request that the Engineer inspect foundation. The Engineer may order changes in dimensions or elevations of footings as may be necessary to secure a satisfactory foundation.

Backfill unauthorized excavation made below required footing elevation or beyond lines shown, with Class D concrete. When foundation requires redesign because of unauthorized excavation, the Contractor shall engage the services of a Hawaii Licensed Structural Engineer to prepare detailed drawings of a redesigned footing. Submit redesign proposal and after the Engineer reviews and accepts proposal, construct redesigned foundation at no additional increase in contract price or contract time. Claim for delay or additional cost resulting from foundation redesign will not be allowed. The State will deduct costs to review the redesign from the Contractor.

- B. Falsework, Formwork, or Centering. Falsework, formwork, or centering is temporary construction work on which other work is wholly or partially supported until permanent construction is strong enough to support itself. This includes form lining and sheathing, as well as necessary supporting members, hardware, and bracing.

Submit falsework and centering erection plans including soil bearing value, stress sheets, superstructure placing diagram and sequence, falsework and centering removal procedures, and design calculations for falsework and centering, as a complete package, stamped and signed by a Hawaii Licensed Structural Engineer. Submit manufacturer's certificates or perform tests, as necessary, to demonstrate adequacy of devices proposed for use or to verify design assumptions.

Do not start falsework, formwork, or centering construction until the Engineer has accepted drawings and calculations. Acceptance of drawings or inspections of system by the Engineer does not relieve the Contractor from responsibility of results obtained by using such drawings and calculations.

Use the Alternate Design Method and service limit state in ACI 318 – Building Code Requirements for Structural Concrete for the design of falsework, formwork, or centering but the maximum extreme flexural fiber stress of the concrete in compression shall not exceed $0.40 f'_c$. AASHTO, UBC/ICBO and other industry specifications or codes may be used upon acceptance where allowable stresses are not specified in ACI. Limit maximum deflection due to weight of dead and live loads to 0.4 percent of span. Provide camber strips to compensate for deflections or other movements greater than $\frac{1}{4}$ inch.

Take length of spans to be the smaller of center-to-center distance between supports or clear span plus member depth. Design formwork for bottom slab of box girders to carry dead and live loads of both top and bottom slabs, as well as loads of webs, unless calculations indicate bottom slab is to carry loads of top slabs temporarily imposed upon it. Arrange falsework system so that loads imposed produce symmetrical and approximately equal reactions. Submit falsework soil pressure, pile capacity, and ground preparation, with supporting data and documentation. Show these items on working drawings. When structures cross over waterways and other flood prone areas, use special consideration in design of supporting falsework to prevent reduction in support capacity due to effects of water.

Design load for falsework or centering includes dead and live vertical loads, slope load of structure, and lateral loads. Minimum vertical live load to be used in design is 50 pounds per square foot of surface area plus 150 pounds per linear foot, applied at outside edge of cantilevered members. Add minimum vertical live load to actual weight of required construction equipment. Use minimum lateral load in design to be the greater of either 3 percent of total dead load or 150 pounds per linear foot. Apply minimum lateral load at top surface of falsework support. Temporary bracing shall be provided, as necessary to withstand all imposed loads during erection, construction and removal of falsework.

When falsework is over or adjacent to existing roadways, install falsework system to withstand vehicle impact and maintain until falsework removal.

Show stresses and deflection of load supporting members in design calculations. Show anticipated total settlements of falsework and forms on falsework drawings,

including falsework footing pressure and settlement, and joint take-up. Construct deck slab form between girders with no allowance for settlement relative to girders. Do not exceed 1 inch for anticipated settlements of falsework. Provide tell-tales attached to soffit forms, readable from the ground, at sufficient locations to determine total settlements and deflections resulting from concrete placement. Check for any movement or deformation of forms and falsework that may exceed the calculated or anticipated deflection or settlement. If the movement or deformation is exceeded, take appropriate action. This action may include halting concrete placement to install additional bracing or changing the rate or sequence of concrete placement to achieve the required lines and grade. Discontinue concrete placement when settlements deviate more than $\pm 3/8$ inch from those indicated on falsework drawings. In such affected areas, provide corrective measures prior to initial set of concrete. Remove unacceptable concrete.

In designing falsework and centering, assume weight of 160 pounds per cubic foot for concrete. Design and construct falsework to provide necessary rigidity and to support loads without appreciable settlement or deformation. Use screw jacks or hardwood wedges to take up settlement in formwork either before or during placement of concrete. Design falsework for support of superstructure to support loads that would be superimposed as if entire superstructure were placed at once. Design vertical falsework members supporting spans with single hinge, or double hinges within span, for twice tributary falsework requirements at distance of 10 feet on each side of hinges, measured parallel to centerline of girder. Apply requirement to conventionally reinforced and prestressed concrete structures. Design falsework for prestressed concrete structures for additional loads caused by prestressing.

Place falsework or centering upon footing safe against undermining and softening when footing type foundations are to be used. Show bearing value of soil in shop drawings of falsework or centering.

When used, space, drive, and remove falsework piling as accepted by the Engineer. Set falsework to give finished structure camber specified. Construct arch centering in accordance with centering plans accepted by the Engineer. Make provisions for gradual lowering of centers and for rendering arch self-supporting. Use jacks to correct slight settlement that may occur during placement of concrete.

In design of bottom slab plywood forms and timber joists for concrete box girders, top slab loads may be omitted when placing top slab separately from webs and bottom slab.

If lost post method of concrete box girder deck forming is used, 2 by 6 continuous mudsills beneath posts will not be required when 2 by 4 or smaller timber posts, with soft wood wedges, are used for supports.

Use manufactured items conforming to AASHTO standards. When items are not covered by AASHTO, use standards of nationally known organizations such as AISC for steel, ACI for concrete, and NFPA for lumber. In all cases, furnish data listing

manufacturer's design criteria conforming to design specifications and recommendations, or perform tests, as necessary, to show adequacy of proposed device.

C. Forms.

1. Construction. Use wood or metal forms that are impervious to moisture, non-staining to concrete, mortar tight and sufficiently rigid to prevent distortion due to pressure of concrete and other loads, including vibration, incidental to construction. Construct and maintain forms to prevent joints from opening. Formwork joints shall be filled with approved material that is impervious to moisture, will not stain concrete, and produces tight joints.

Unless otherwise indicated in the contract documents, place minimum $\frac{3}{4}$ inch by $\frac{3}{4}$ inch chamfer at sharp edges of exposed concrete surfaces. Give girder and coping forms bevels or drafts to ensure easy removal.

Set and maintain forms true to lines designated. When forms appear to be unsatisfactory, either before or during concrete placement, the Engineer may stop work until defects are corrected.

When forms are submerged in water and concrete is placed in the dry, make forms watertight below high water level.

Cover knotholes and damaged areas in wood forms with metal patches.

Control rate of depositing concrete in forms to prevent form deflection or form panels that exceed permitted deflections. When structure height is greater than 6 feet, submit rate of depositing concrete.

Use forms for concrete surfaces not completely enclosed or hidden below permanent ground surface that conform to requirements, in this subsection, for exposed-surface forms. Interior surfaces of underground drainage structures will be considered completely enclosed surfaces.

Before using forming systems for exposed surfaces, submit form design and materials data for each system.

Design and construct forms for exposed concrete surfaces so that formed surface of concrete does not undulate excessively between studs, joists, form stiffeners, form fasteners, or walls. Undulations exceeding either $\frac{3}{32}$ inch or $\frac{1}{270}$ of center-to-center distance between studs, joists, form stiffeners, form fasteners, or walls will be considered to be excessive. The Engineer will reject portions of concrete structure with surface undulations over limits specified herein. The Engineer will stop the use of the forms or forming systems which produce a concrete surface with excessive undulations until the Contractor makes modification acceptable to the Engineer.

Form exposed surfaces of each concrete structure element with same forming material or with materials that produce similar concrete surface textures, color, and appearance.

For exposed surfaces, provide form panel facing consisting of continuous sections of form facing material, unbroken by joint marks, against which concrete is placed.

2. Form Lumber. Use form lumber, except for curved and special surfaces, of five ply panel boards or dressed shiplap, used with or without form liners. Rough lumber may be used for unexposed surfaces in finished structure. Three-ply panel boards may be used for forming soffit of unexposed portions of box girder top slabs. When requested by the Engineer, submit certificates verifying grade and species of any piece of lumber which does not have a grade or species stamp.

Use plywood conforming to latest edition of "United States Product Standard PS 1 for Construction and Industrial Plywood" for forms. Place form panels in uniform widths of not less than 36 inches and in uniform lengths of not less than 6 feet, except where dimensions of members formed are less than specified panel dimensions. Place plywood panels with grain of outer plies in direction of span.

Place form panels in neat, symmetrical pattern, subject to acceptance of the Engineer. Place panels with long dimension horizontal and with horizontal joints level and continuous. Stagger and position perpendicular to vertical joints, as shown in the contract documents.

3. Form Ties. Use form ties of sufficient strength and number to hold form securely in place and prevent spreading of forms during concrete placement. The following will not be allowed:
 - a. Ties consisting of twisted wire loops to hold forms in position.
 - b. Non-metallic forming ties, anchorages, forming supports or other accessories that may be embedded permanently in concrete.
 - c. Driven type anchorages for fastening forms or form supports to concrete.

Construct form ties or anchorages within forms to permit removal to depth of at least 1 inch from face, without injury to concrete. Design fittings for form ties or anchorages so that, upon removal, cavities left are of the smallest possible size. Fill cavities completely with cement mortar and leave surface sound, smooth, even, and uniform in color.

4. Walls. For narrow walls and columns where bottom of form is inaccessible, leave lower form boards loose.
 5. Surface Treatment. Immediately before each use, clean and treat forms with non- staining form oil that will permit ready release of forms and will not discolor concrete.
 6. Metal Forms. Specifications for forms regarding design, mortar tightness, filleted corners, beveled projections, bracing, alignment, removal, reuse, and oiling apply to metal forms. Metal thickness used for forms shall be such that forms will remain true to shape. Countersink bolts and rivet heads. Design clamps, pins, or other connecting devices to hold forms rigidly together and to allow removal without injury to concrete. Metal forms that are rough or crooked will not be allowed.
 7. Reuse of Forms. Maintain shape, strength, rigidity, watertightness, and surface smoothness of reused forms. Resize warped or bulged lumber before using.
- D. Removal of Falsework and Forms. Before removing shoring beneath beams or girders, remove forms from columns to allow the Engineer to inspect condition of column concrete.

Remove supports using method that permits concrete to uniformly and gradually take stresses caused by its own weight.

In continuous or rigid frame structures, release falsework only after last concrete (excluding concrete above bridge deck) in that span and first adjoining spans on each side have been in place for 14 days. For falsework removal, consider spans with a single hinge within span to be continuous. Consider hinges of suspended spans within a bridge, as ends of bridge, for determining shoring requirements. In structures of these types, remove falsework gradually and uniformly over whole length.

After placing concrete, remove or release falsework and forms no earlier than removal times specified in Table 03290-1 – Removal of Falsework and Forms. The Engineer will determine exact removal time. Removal time of formwork does not relieve the Contractor’s compliance with curing period requirements.

| TABLE 03290-1 - REMOVAL OF FALSEWORK AND FORMS | | | |
|---|---|----|--------------|
| Railing and Barriers – 12 Hours Removal Time | | | |
| Beams, Arches, and Other Members – 14 days Removal Time | | | |
| Slabs With Maximum Thickness of (Inches) | 9 | 12 | more than 12 |
| | | | |

| Removal Time (Days) | 7 | | 10 | | 14 | |
|--|-----|---|----|----|----|------------|
| Walls, Columns, and Vertical Sides of Beams With Maximum Height of (Feet) | 2 | 5 | 10 | 20 | 30 | 40 or More |
| Removal Time (Days) | 0.5 | 1 | 2 | 3 | 5 | 7 |
| Note: Where forms also support vertical or horizontal loads imposed on slab or beam soffits, use 14 days for removal time. | | | | | | |

Do not release falsework for cast-in-place prestressed portions of structures until after prestressing steel has been tensioned.

Do not release falsework supporting overhangs and girder stems that slope 45 degrees or more off vertical until 7 days after placing deck concrete. If reshoring system is installed, falsework supporting sides of girder stems that slope less than 45 degrees off vertical may be removed prior to placing deck slab concrete. Design reshoring system, consisting of lateral supports, to resist rotational forces acting on stem, including those caused by placement of deck slab concrete. Install reshoring system immediately after each form panel is removed and prior to release of supports for adjacent form panel.

Do not remove falsework and forms supporting bottom slab of box girders until 14 days after final top slab is placed. Remove forms for webs of box girders before placing deck slab. Forms supporting concrete top slab of box girder may be left in place. Completely remove interior forms in box girders except those permitted to remain in place. Where minimum crawl space dimensions and unobstructed access to enclosed utilities are provided, interior forms of box girders may be left in place. Clear and sweep loose material from inside of box girder.

Removal time of falsework may be reduced to 10 days when concrete test specimens develop compressive strengths equal to or greater than required 28-day compressive strength. Cure concrete test specimen in accordance with paragraph 9.4 of AASHTO T 23.

After removing forms of railing or barriers, protect exposed concrete surfaces from damage after form removal.

- E. Loading. Inducing loading, outside its own weight, onto any part of a structure, will not be allowed until the following conditions have been met: at least 15 days have elapsed since placing concrete; and test specimens show that concrete has developed compressive strength of either 3,000 psi or required 28-day compressive strength, whichever is greater.

Material storage of any kind on structure, within 15 days of concrete placement, will not be allowed. After a minimum of 15 days have elapsed since concrete placement,

materials weighing no more than 50 percent of design live load may be stored on structure. Submit shop drawings showing locations and weights of stored materials.

Release falsework before placing loads on structure.

Live loads will not be allowed on completed portions of structure when such live loads will produce more than allowable stresses permitted by AASHTO LRFD *Bridge Design Specifications*.

Backfill abutment and wing walls in accordance with Section 02227 - Excavation and Backfill for Bridge and Retaining Structures.

F. Placing Concrete.

1. General. Place and consolidate concrete by methods that shall not cause aggregate segregation or unsound concrete and shall result in dense, homogeneous concrete, free of voids, rock pockets and other defects. Use concrete while it is plastic and has sufficient workability for placement. Retempering or remixing concrete that has partially hardened will not be allowed. Allow no more than 30 minute interval between placement of two consecutive batches or partially hardened will not be allowed. Allow no more than 30 minute interval between placement of two consecutive batches or loads of concrete.

Do not deviate from schedule for placing concrete without permission from the Engineer.

Water blast laitance and foreign material and moisten interface surfaces with water immediately before placing concrete over subgrade or construction joint.

Submit method and sequence of concrete placement. Place concrete on structure only after forms have been cleared of debris and the Engineer has checked and accepted forms and reinforcing steel.

Place concrete for foundations, bottom slabs of box culverts, and aprons on ground that is free from water. Dewater, sheath, place filter material, and do other work, as required by field conditions, to ensure saturated surface dry foundation bed. Costs for obtaining saturated surface dry foundation bed will be included in price for structure excavation.

Excavate and place sides of concrete or masonry footings not supported on piles or rock to neat lines.

Begin placing concrete at low point and proceed upgrade. Remove struts, stays, braces, or blockings when concrete placed has reached elevation rendering them unnecessary.

Deposit concrete in approximate horizontal layers to avoid flowing along forms. When less than a complete layer is placed in one operation, terminate layer in vertical bulkhead. Layer depth shall not exceed 20 inches and shall be such that succeeding layer shall be placed before previous layer has attained its initial set. Place concrete in layers than can be satisfactorily consolidated with vibrators.

Thoroughly work external surface of concrete with vibrator. Work to force coarse aggregate from surface and to bring mortar against forms, producing a smooth finish, nearly free from water and air pockets, and honeycomb.

Fill each part of form by depositing concrete as close to final position as possible. Work coarse aggregate back from forms and around reinforcement without displacing bars. After initial set of concrete, do not jar forms and do not place stress on ends of projecting reinforcing.

After concrete placement stops, remove accumulations of mortar on reinforcing steel and surfaces of forms, before next concrete placement. If concrete is wet, prevent dried mortar chips, other foreign material, and dust from falling onto wet concrete surface. If concrete has set, clean reinforcing steel in a manner that will not be detrimental to concrete steel bond.

At the time of placement, the concrete temperature shall not exceed 90 degrees Fahrenheit.

During flatwork concrete operations, the rate of evaporation shall be measured by using the nomograph: ACI 308R-23 Figure 4.1. When the rate of evaporation exceeds 0.15 lb/sq ft/hr, the concrete shall be fogged before and after finishing. Fog nozzles, in lieu of garden hose nozzles, shall be used to atomize water to create a fog blanket. If plastic shrinkage cracks appear during finishing, the cracks shall be closed by striking each side of the crack with a float and refinishing the concrete.

Do not place concrete sidewalks and curbs not monolithic with bridge deck until falsework for spans has been released.

2. Chutes and Troughs. The use of aluminum for chutes, tremies, troughs or pipes will not be allowed. Place concrete so as to avoid segregation of materials and displacement of reinforcement.

When plans require steep slopes, equip chutes with baffle boards, or furnish chutes in short lengths that reverse direction of movement.

Use of long troughs, chutes, and pipes of minimum 6-inch diameter will be allowed only with written authorization by the Engineer. Incline chutes or pipes to allow concrete to flow at required consistency. Addition of water to concrete mix to promote free flow in chutes of low inclination will not be allowed.

Do not drop concrete into forms from vertical distance of more than 5 feet unless confined by closed chutes or pipes.

Keep chutes, troughs, and pipes clean and free from coatings of hardened concrete by thoroughly flushing them with water after each run. Discharge flushing water away from in-place concrete.

3. **Vibrating.** Consolidate concrete, except for concrete placed under water, using high frequency internal vibrators. Minimum transmitted vibration frequency shall be 4,500 impulses per minute, and shall be such as to visibly affect mass of concrete of 1-inch slump over radius of at least 18 inches. Use sufficient number of vibrators to properly consolidate incoming concrete within 15 minutes after depositing concrete in forms. Make at least two vibrators available at structure site when placing more than 25 cubic yards of concrete. Apply vibrators at uniformly spaced points and not farther apart than is visibly effective. Attaching vibrators to or holding them against forms or reinforcing steel will not be allowed. Insert vibrators in vertical position at a uniform spacing over the entire concrete placement area. Dragging vibrators through concrete will not be allowed.

External vibrators accepted by the Engineer may be used to consolidate concrete when concrete is inaccessible for adequate consolidation, provided forms are constructed sufficiently rigid to resist displacement or damage from external vibration.

When required, supplement vibration by hand spading with suitable tools to ensure proper and adequate compaction. Manipulate vibrators to work concrete thoroughly around reinforcement and imbedded fixtures; and into corners and angles of forms. Using vibrators to cause concrete to flow or run into position, instead of placing, will not be allowed. Vibrate sufficiently to compact, but avoid prolonging vibration to the point where segregation occurs.

4. **Depositing Concrete Underwater.** Do not deposit concrete underwater except cofferdam seals, tremie concrete, and drilled shaft concrete. Use seal concrete conforming to Section 03310 – Structural Concrete for cofferdam seal concrete deposited underwater.

Place concrete underwater in a compact mass in its final position by tremie or closed-bottom dump bucket. Do not disturb deposited concrete after placement. Maintain still water at point of deposit.

Tremie consists of a tube having inside diameter at least 6 times the maximum size of aggregate used in concrete mix and not less than 10 inches, constructed in sections having flanged couplings, fitted with gaskets. Tremie shall not contain aluminum parts that will come in contact with concrete,

including pump and discharge lines. Equip tube with receiving hopper at the top and device that closes discharge end to prevent water from entering tube, while tube is being charged with concrete. Support tremie to permit free movement of discharge end over entire top surface of work and rapid lowering, when necessary, to retard or stop flow of concrete.

Close and seal discharge end entirely at start of work to prevent water from entering tube. Keep tremie tube full to bottom of hopper. When a batch is dumped into hopper, induce concrete flow by slightly raising discharge end, always keeping discharge end in deposited concrete. Maintain continuous flow until work is completed.

Use underwater bucket with open top and bottom doors that open freely outward, when tripped. Completely fill and slowly lower bucket, to avoid backwash. Discharge bucket only when bucket rests on surface upon which concrete is to be deposited. After discharge, raise bucket slowly until well above concrete. The use of bottom dump buckets for bottom seal around foundation piling will not be allowed.

Submit concrete seal design calculations and working drawings, prepared, stamped, and signed by Hawaii Licensed Structural Engineer. Exact thickness of concrete seal shall depend upon hydrostatic head, bond, pile spacing, and cofferdam size. Construct concrete seal after the Engineer accepts design. Allow seal to remain in place for not less than 7 days before dewatering. After sufficient time has elapsed, dewater cofferdam and remove scum, laitance, and sediment from concrete. Before depositing fresh footing concrete, remove local high spots, as necessary, to ensure proper clearance for footing reinforcing steel.

5. Hot Weather Concreting. Do not place concrete where ambient temperature is above 90 degrees F unless design mix and placement method conform to ACI 305 R-91 Hot Weather Concreting. When ambient temperature is above 90 degrees F, cool reinforcing steel, forms, and other surfaces to below 90 degrees F with water spray or other acceptable methods before placing of concrete.
6. Certified Concrete Flatwork Finisher Requirement. Perform the placement, and finishing operations of concrete flatwork with a minimum ratio of one certified ACI Concrete Flatwork Finisher and Technician with 4,500 hours of acceptable work experience (certified craftsman) per three concrete finishers (concrete finishers without ACI Concrete Flatwork Finisher and Technician certification and 4,500 hours of acceptable work experience) at each location having flatwork done. The concrete flatwork shall be under the direct supervision of a certified craftsman. Designate the certified craftsman who will be supervising and responsible for determining the quality of the finish of the concrete flatwork being performed. No flatwork shall be performed without the required amount of certified craftsman present.

- a. Flatwork concrete is defined as any concrete work that requires tools or machines to be used during the placement and finishing operations of concrete. Concrete flatwork includes concrete work that requires a specified finishing, smoothness or rigid surface tolerances such as sidewalks, walkways, Portland cement concrete pavement, concrete white-topping, girder seats, pier caps, bridge decks, on-grade concrete slabs, approach slabs, concrete overlays, and concrete repairs which exceed one square foot per day.
 - b. Areas that are not considered flatwork concrete are the top of foundations or structures that will have backfill material placed directly on the concrete surface.
 - c. Submit copies of the craftsman's current ACI certification 30 days before concrete flatwork begins for the Engineer's review and acceptance. The Engineer has the right to require the removal, replacement, retraining and re-certification of a certified craftsman if that person does not, in the opinion of the Engineer, demonstrate the ability to place and finish concrete in accordance with the practices recommended in the ACI Concrete Flatwork Finisher Certification Program and to meet the finishing standards required by the contract documents.
 - d. Any cost or impact to the Contractor in providing, training, certification, retraining, replacement or re-certification is incidental to the contract items that require concrete flatwork.
- G. Joints. Prior to backfilling with earth or other materials against the joints, all construction, expansion, contraction, and control joints shall be waterproofed with flashing compound waterproofing as detailed in the Contract Plans.
1. Construction Joints. Place construction joints only at locations indicated in the contract documents, perpendicular to principal lines of stress and at points of minimum shear.

Before placing concrete on substrate concrete at construction joint, the following work shall be performed:
 - a. Remove laitance, loose particles, dust, dirt, impervious membrane curing compound, and any other material foreign to the construction joint and projecting reinforcement.
 - b. Roughen horizontal construction joint by abrasive blast cleaning or other approved methods to full amplitude of approximately 1/4 inch.
 - c. Dampen substrate to saturated, surface-dry condition. Remove any

excess water.

- d. Apply bonding agent as required according to manufacturer's recommendations.

Before placing new concrete, draw forms tightly against concrete already in place. Thoroughly clean, water blast laitance and foreign material, and saturate old surface with water to a saturated surface-dry condition immediately before placing new concrete. Place concrete in substructures so that horizontal construction joints are truly horizontal. Where possible, place joints such that they will be hidden from view in finished structure. Where vertical construction joints are necessary, extend reinforcing bars across joint to make structure monolithic. Do not place construction joints through paneled wing walls or other large surfaces that are to be treated architecturally.

When construction joint is necessary because of emergency, furnish and place reinforcing steel across construction joint as ordered by the Engineer, at no increase in contract price or contract time.

2. Contraction Joints. Contraction joints in walls and in other structures shall be spaced at not more than 20 feet on centers and shall be spaced, at abrupt changes in height or thickness and at obtuse corners unless otherwise directed by the Engineer.

H. Concrete Exposed to Sea Water. In concrete structures exposed to sea water, construction joints will not be allowed between levels of extreme low water and extreme high water, as indicated in the contract documents. Between these levels, leave forms in place for at least 30 days.

I. Protection and Curing. Protect concrete from mechanical damage and damage caused by exposure to sun, rain, and flowing water. Do not allow concrete to dry out from time of concrete placement until end of minimum curing period. Minimum curing period shall be as follows:

1. Cure structures for at least 7 days. Maintain temperature of structural concrete at not less than 45 degrees F for 72 hours after placing. Maintain temperature at not less than 40 degrees F for an additional 4 days. Submit written outline of proposed method for protecting concrete.
2. Cast-in-place parts of a structure to be submerged permanently in freshwater, may be cured for a period sufficient to prevent washing out of cement, and then submerged immediately.
3. Cure with freshwater for at least 5 days, cast in place parts of a structure to be submerged permanently in brackish or seawater. Then submerge in accordance with Section 03290, Subsection 3.01 H. - Concrete Exposed to

Sea Water.

- J. Curing Methods. Cure concrete for cast-in place structures, other than bridge decks, by water curing, impervious membrane curing, or forms-in-place curing. Cure full width of concrete bridge decks using a combination of impervious membrane curing and water curing. Cure concrete surfaces that are to receive Class 2 Rubbed Finish, by water curing or forms-in-place curing. Cure surfaces of construction joints by application of water curing or non-membrane curing compound that seals concrete without reducing interface bonding capacity. Before applying curing compound, submit proposed curing methods, including copies of test results and manufacturer's catalogue. Precast concrete members may be steam cured in accordance with Section 03420, Subsection 3.01 G. - Curing.

The Contractor shall have the option to use curing compound SINAK LITHIUM for structures except for bridge decks when approved by the Engineer. Six copies of the manufacturer's brochure and certificates of test results shall be submitted. All work shall conform with the manufacturer's recommendations.

1. Water Curing. Water cure by keeping concrete continuously wet with fresh water, using water sprays, acceptable water saturated coverings, or ponding. Keep wood forms that remain in place sufficiently damp to prevent opening at joints and drying of concrete.

After surface water has evaporated, apply moisture to concrete surface using fog spray nozzle. Continue applying moisture to surface until regular curing begins. Use adequate water supply and sufficient moisture to fog and water cure concrete without damaging surface or texture of concrete.

Begin water curing for bridge decks after curing compound is applied and immediately after concrete surface is hard enough to receive water without damaging surface or texture of concrete. Continue water curing until end of specified curing period.

Prevent curing water from falling on traveled roadways under structure. Channel curing water away from falsework and structure foundations.

2. Impervious Membrane Curing. Seal concrete surface thoroughly with liquid membrane-forming compound. Apply compound uniformly in two or more applications. Use ratio of at least one gallon for each 100 square feet of concrete surface. The curing compound shall be applied to the concrete following the surface finishing operation, immediately before the moisture sheen disappears from the surface, but before any drying shrinkage or craze cracks begin to appear. In the event of any drying or cracking of the surface, application of water with an atomizing nozzle (fog spray) as specified in Section 03290, Subsection 3.01 J.1 - "Water Curing", shall be started immediately and shall be continued until application of the compound is resumed or started; however, the compound shall not be applied over any

resulting freestanding water. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures and 72 hours in the case of pavement, the damaged portion shall be repaired immediately with additional compound.

Use curing compounds that will not permanently darken concrete on exposed surfaces of completed structure. Do not apply membrane curing compound on surfaces to which concrete is to be bonded or to which waterproofing or epoxy is to be applied.

Keep concrete surfaces moist before applying impervious membrane. If membrane film is broken or damaged during specified curing period, apply new treatment to affected area, duplicating first application.

3. Forms-In-Place Curing. Cure formed surfaces of concrete by retaining forms in place. Maintain forms in place for minimum period of 7 days after concrete placement. Keep all form joints and joints between end of forms and concrete, moisture-tight during curing period. Reseal cracks in forms and cracks between forms and concrete by methods accepted by the Engineer.

K. Finishing Concrete Surfaces. Apply the following requirements to several classes of surface finishes that ordinarily apply to various parts of concrete structures. No additional water shall be added to the concrete surfaces in an effort to aid the finishing operation as the application of water to aid the finishing operation will result in the rejection of the concrete pour. Finishing aids or evaporation retarders may be used only with written authorization by the Engineer.

1. Class 1 Ordinary Surface Finish. Apply ordinary surface finish to concrete surfaces, either as final finish or preparatory to applying higher-class finish. On surfaces to be buried underground or that are enclosed, such as cells of box girders, removal of fins and form marks and rubbing of mortared surfaces to obtain a uniform color will not be required.

After removing forms, remove form bolts and ties to depth of at least 1 inch below concrete surface. Clean, wet, and fill resulting holes or depressions with mortar. Mortar shall consist of one part cement to two parts sand by volume. Add white cement to mortar in sufficient quantity to tint mortar a shade lighter than surrounding concrete. Use mortar that is not more than 1 hour old and that bonds indistinguishably with concrete. After mortar has thoroughly hardened, rub surface with carborundum stone to obtain same color in mortar as in surrounding concrete. Remove fins caused by form joints and other projections. Remove stains and discolorations visible from traveled way.

Clean and fill pockets with mortar, except for those scattered pockets or pinholes less than 1/2-inch long or wide and less than 3/8 inch deep. Pockets shall not affect strength of structure or shorten life of steel reinforcement. Fill

pockets on surfaces visible to pedestrian traffic and surfaces exposed to stream flow, salt air, and salt water. Use mortar for filling pockets, as specified for bolt and tie holes. When rock pockets affect strength of structure materially or shorten life of steel reinforcement, the Engineer will declare concrete unacceptable and require removal and replacement of affected structure.

Clean, wet, and fill with mortar, all holes or depressions in surfaces that are to receive Class 2 Rubbed Finish. Clean, wet, and fill at least 7 days before starting Class 2 Rubbed Finish.

2. Class 2 Rubbed Finish. Apply Class 2 Rubbed Finish to the following surfaces:
 - a. Surfaces of bridge superstructures, including pedestrian overpasses, except for the following: inside vertical surfaces of "T" girders; slab soffits of interior bays of "T" girders; enclosed surfaces of box girders; top surfaces of bridge decks; walkway surfaces; and median strips.
 - b. Surfaces of bridge and pedestrian overpass piers, piles, columns, pier caps, abutments, wing walls, and retaining walls above finished ground, to at least 1 foot below finished ground.
 - c. Surfaces of open spandrel arch rings, spandrel columns, and abutment towers.
 - d. Surfaces above finished ground of culvert headwalls, and endwalls, where visible from a traveled way.
 - e. Surfaces of inside box culvert barrels having a height of 4 feet or more, for a distance inside the barrel equal to the height of culvert or as far as is visible from a Traveled Way, whichever is greater.
 - f. Surfaces of concrete railings, end posts, and curbs.

After completing Class I Ordinary Surface Finish, sand with power sanders areas that do not exhibit a smooth, even surface of uniform texture and appearance.

Use power carborundum stones or disks to remove unsightly bulges or irregularities.

The intent is to secure a smooth, even surface of uniform appearance and to remove unsightly bulges or depressions due to form marks and other imperfections. Scattered pockets or pinholes permitted under ordinary finish will not be considered to affect uniformity or texture. Extent of sanding and

grinding shall be as specified.

Final operation for this finish consists of removing powder on surface resulting from sanding and grinding. When additional repairs are made after sanding and grinding, repeat sanding and grinding after repair has cured. Leave finished surface free from powder and other foreign matter by washing or wiping with clean cloth. Collect and dispose wash water.

3. Class 6 Float Finish. Attain Class 6 Float Finish as follows:

- a. Finishing Bridge Decks and Bridge Approach Slabs. For bridge decks and bridge approach slabs, obtain smooth riding surface of uniform texture, true to required grade and cross section.

Place concrete in bridge decks and bridge approach slabs at a minimum finished deck placement rate of 20 linear feet per hour. Measure rate along centerline of roadway. Employ experienced operators and concrete finishers to finish deck. Keep necessary finishing tools and equipment on hand at work site and in satisfactory condition for use.

Unless acceptable lighting facilities are provided, complete finishing operations during daylight hours.

Immediately before placing bridge deck concrete, check falsework and wedges. Minimize settlement and deflection due to added weight of bridge deck concrete. Furnish suitable instruments, such as settlement gages, to permit ready measurement of settlement and deflection by the Engineer.

When settlement or other unanticipated events occur, stop deck concrete placement until corrective measures have been submitted and accepted. If accepted corrective measures have not been provided prior to initial concrete set, stop concrete placement and install bulkhead at location designated by the Engineer. Remove concrete placed beyond bulkhead.

Place bridge deck and bridge approach slab concrete in uniform heading, approximately perpendicular to roadway centerline. Limit rate of concrete placement to that which can be finished before beginning of initial set. Do not place deck surface concrete more than 10 feet ahead of strike off. Spread concrete to uniform height, such that required strike off does not exceed 3 inches of concrete.

Finish bridge decks and bridge approach slabs with concrete wearing surfaces in accordance with Section 03290, Subsection 3.01 K.3.a.1. - Machine Finishing.

During finishing operation while concrete is still plastic, test surface with 10-foot straight edge. Test surface from side or from transverse finishing bridges, in presence of the Engineer. Make necessary corrections to attain required tolerance, with minimum amount of remedial work after concrete has hardened.

After concrete has hardened sufficiently, test finished surface in presence of the Engineer with 10-foot straight edge. Surface for concrete deck finish shall not vary more than 1/8 inch from lower edge of straight edge.

Grind high areas in hardened surface, leaving finished texture that is not smooth or polished. Produce final surface with uniform texture of longitudinal grooves, with tine dimensions in accordance with Section 03290, Subsection 3.01 K.3.a.1. - Machine Finishing.

Submit method of correcting low areas. Begin remediation of low spots only after the Engineer accepts submittal.

Strike off bridge deck surfaces under curbs, railings, and sidewalks to same plane as roadway. Leave bridge deck surfaces under curbs, railings, and sidewalks undisturbed when future widening is shown on Plans.

When deck width is 4 feet or less, finishing methods other than those specified herein may be used, provided completed deck surface conforms to specified requirements.

Perform remedial measures on completed bridge decks and bridge approach slabs not meeting specified requirements, at no increase in contract price or contract time.

1. Machine Finishing. Strike off and finishing machines shall be of the self-propelled types, operating on rails and conforming to specified requirements.

Use elevation-adjustable screed rails. Set screed to elevations, with allowances for anticipated settlement, camber and deflection, as required to form surface of bridge deck and bridge approach slab to specified line and grade. Screed-rails shall not deflect appreciably under applied loads. The supports for the screed rails shall not be placed within the full width of the bridge.

Before beginning concrete operations, operate strike off and finishing machines over full length of bridge segment to be

paved. Test run with screed and float adjusted to their finishing positions. While testing machines, perform the following: check screed rails for deflection; make required adjustments; measure cover on slab reinforcement; check controlling dimensions of slab reinforcement and forms.

During test run, use same number of machines and finishing bridges that will be used during production concrete placement, carrying production loads. Make necessary corrections at this time.

After placing and consolidating concrete, strike off surface of concrete carefully, using strike off machine. Make uniform deck surface, true to required grade and cross section.

When strike-off machine has wheelbase greater than 6 feet, float concrete by the following means: hand-operated longitudinal float board; or finishing machine equipped with longitudinal float; or rotating element followed by drag float pan.

Use longitudinal float on finishing machine not less than 8 feet or more than 12 feet long. When both strike off and floating are to be performed by machines, provide two separate machines with separate operators, one for strike off and one for floating. Perform final float pass as far back of strike off as concrete workability will permit.

When strike off machine has wheelbase of 6 feet or less, provide two separate hand-operated float boards or finishing machine accepted by the Engineer. Place first hand-operated float in operation as soon as concrete surface condition permits. Operate second hand-operated float as far back from first float as concrete workability permits. Apply provisions in this subsection pertaining to hand-operated float boards, to the two separate float boards specified for longitudinal floating.

Use longitudinal floats, either hand-operated or machine-operated, with long axis of float parallel to bridge roadway centerline. Operate longitudinal floats with combined longitudinal and transverse motion. Operate rotating float with rotational and transverse movements. Use floats to plane off high areas and float material removed into low areas. Lap each pass with previous pass by half-length of float. Continue floating until smooth riding surface is obtained. Meet surface tolerances as specified herein.

In lieu of separate machines for strike off and finishing, a single machine equipped with rotating auger for strike off and rotating element followed by drag float pan for consolidating and finishing may be used. Submit previous project experience demonstrating that proposed machine is capable of meeting specified requirements for satisfactory bridge deck and bridge approach slab finishing. When requested by the Engineer, submit three copies of manufacturer's operators and parts manual for dual-purpose alternative machine. Operate machine in accordance with manufacturer's manual.

After the concrete has been struck off by machine and consolidated by vibration, it shall be further smoothed and consolidated with a longitudinal float of a suitable design approved by the Engineer.

Use not less than two transverse finishing bridges.

The riding surfaces including shoulders of concrete bridge decks, concrete sleeper slabs, and concrete approach slabs shall be textured longitudinally by mechanical grooving. Grooves shall be cut into the hardened concrete using a mechanical water-cooled diamond edge blade saw device which shall produce straight uniformly spaced grooves spaced at 3/4 inch. The groove width shall be 1/8 inch and the groove depth shall be 1/8 inch.

If grooves cannot be cut into a continuous longitudinal operation, the continuation of grooves shall be aligned such that joints are not visible.

Prior to mechanical grooving high areas shall be reduced by grinding the upper 1/8 inch of hardened concrete with an approved diamond grinding machine. Grinding shall be accomplished by sawing with an industrial diamond abrasive which is impregnated in the saw blades. The saw blades shall be assembled in a cutting head mounted on a machine designed specifically for diamond grinding that will texture the concrete without damaging the concrete. Grinding equipment that causes ravels, aggregate fractures, spalls or disturbance to the joints will not be permitted. Grooving shall be done after the concrete has attained sufficient strength to prevent spalling and ravelling, and before the structure is opened to traffic.

A working drawing to control, collect and dispose of run-off

water at an accepted off-site facility shall be submitted to the Engineer.

The requirements of Section 03290, Subsection 3.01 L - Surface Test shall apply to concrete bridge decks and concrete approach slabs. If grinding is required to achieve the specified profile index, the grinding shall be performed prior to the mechanical grooving and shall be done only in the longitudinal direction.

- b. Sidewalks and Median Strips. Provide final finish for concrete sidewalks and median strips using wooden float and broom finish. Do not plaster surface. Use edging tool with 1-inch radius to finish outside edges of sidewalk. Finish sidewalk as plane surface with 2-percent (allowable construction tolerance of plus or minus 0.4 percent maximum) cross slope towards roadway. Test surface of concrete sidewalk with 10-foot straightedge. Correct any deviation in excess of ¼ inch.
- L. Surface Test. Request testing to take place not more than 14 days following concrete placement. If the Engineer does not test the surface until after the 14-day period, the results shall be accepted as if it took place within the 14-day time period. Finished pavement shall conform to the following requirements when tested by the Engineer:
- 1. Conduct surface test using 12-foot straightedge at locations determined by the Engineer. When straightedge is laid on finished pavement in direction parallel or normal to centerline, surface shall not vary more than 1/4 inch from lower edge.
 - 2. The Engineer will determine profile of pavement surface using profilograph in accordance with HDOT TM 6 and these specifications. The Engineer will take profiles 3 feet from and parallel to each pavement edge and at approximate location of each longitudinal joint.

Make profile test request to the Engineer at least seven calendar days before desired testing date. When request for testing is made, submit total area to be tested. Clean and clear obstructions from area to be tested. The Contractor shall provide traffic control for profilograph testing. The Engineer will perform initial and one follow-up profilograph test, at no cost to the Contractor. Based on initial profilogram, the Contractor shall perform remedial work before requesting follow-up profilograph testing. The Contractor shall perform additional remedial work and the Engineer will perform follow-up testing until acceptable surface is obtained. Additional testing, beyond initial test and one follow-up, will be performed at cost to the Contractor of \$1,000 per test per day.

During initial paving operations or after a long shutdown, when concrete has cured sufficiently to allow testing, furnish, operate, and test pavement surface using California-type profilograph, to calculate profile index.

Repair curing membrane damaged during surface remediation and testing operations.

The Contractor and the Engineer will use initial profile testing results to aid in evaluating paving methods and equipment. When average profile index exceeds 15 inches per mile, suspend paving operations. Resumption of paving operations will not be allowed until corrective action is taken and accepted by the Engineer. Subsequent paving operations will be tested in accordance with initial testing procedures.

Use paving equipment and methods that produce riding surface having profile index of 10 or less, except as provided herein.

Profile testing will not be required for the following pavement areas:

- a. Within superelevation transition on horizontal curves having centerline curve radius less than 1,000 feet.
- b. Within 15 feet of transverse joint that separates pavement from existing pavement not constructed under the contract or from structural deck or approach slab.

Reduce individual high points over 0.3 inch, as determined by profilogram measurements in accordance with HDOT TM 6, by grinding until such high points shown by profilograph reruns do not exceed 0.3 inch.

After completing grinding of high points, perform additional grinding as necessary to produce riding surface with a profile index of 10 or less.

Perform additional grinding as necessary so that lateral limits of grinding are at constant offset from and parallel to nearest lane line or pavement edge. Perform additional grinding, as necessary, to extend area ground within any one surface area, in each longitudinal direction so that grinding begins and ends at lines normal to pavement centerline. Ground areas shall be neat, rectangular areas having uniform surface appearance.

Do not grind pavement to smooth or polished finish. Unless otherwise indicated in the contract documents, grinding shall provide a line-type texture that contains parallel, longitudinal corrugations with ridge peaks approximately 1/16 inch higher than groove

bottoms; and with 55 to 60 evenly spaced grooves per foot. Pick up grinding-operation residue using vacuum attached to grinding machine. Prevent residue from flowing across pavement and from being left on pavement surface. Dispose of grinding residue.

Use of bush hammers and other impact devices will not be allowed for pavement surface remediation.

Complete corrective work before determining pavement thickness.

- M. Cleaning Up. Upon completion of finishing operation and before final acceptance of structure, remove falsework, excavated or useless material, rubbish, and temporary buildings. Replace or restore public or private fences or property damaged during prosecution of work. Leave bridge site and adjacent highway in neat and presentable condition. Remove excavated material or falsework placed in stream channel during construction before final acceptance.
- N. Tolerance for Concrete Construction and Materials. Conform to the stricter of tolerances specified in the specifications, ACI 117 Standard Specifications for Tolerance for Concrete Construction and Materials.

END OF SECTION

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SECTION 03310

STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

This section describes structural concrete consisting of portland cement, fine aggregate, coarse aggregate, and water. This will include adding admixtures for the purpose of entraining air, retarding or accelerating set, tinting, and other purposes as required or permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

Portland Cement. Refer to Section 03541, Subsection 1.1.

Fine Aggregate for Concrete. Refer to Section 03840, Subsection 1.1.

Coarse Aggregate for Portland Cement Concrete. Refer to Section 03840, Subsection 1.2.

Admixtures. Refer to Section 03390, Subsection 1.2.

Water. Refer to Section 03870, Subsection 1.1.

PART 3 - EXECUTION

3.1 CONSTRUCTION

- A. Quality Control. Portland cement concrete production requires Contractor responsibility for quality control of materials during handling, blending, mixing, curing, and placement operations.

Sample, test, and inspect concrete to ensure quality control of component materials and concrete. Sampling and testing for quality control in accordance with standard methods shall be performed by certified ACI Concrete Field Technician Grade I. Perform quality control tests for slump, air content, temperature, and unit weight during production of structural concrete other than concrete for incidental construction. Submit quality control test results.

- B. Design and Designation of Concrete. Design concrete mixture for concrete work specified. Submit mix designs using State Highways Division form DOT 4151. Do not start work until the Engineer accepts mix design. The Engineer will accept concrete mix design using information given in Table 03310-1 - Design of Concrete, and other pertinent requirements.

Whenever 28-day compressive strength, f'_c , is 4,000 psi or greater, designate concrete by required minimum 28-day compressive strength.

The 28-day compressive strength, f'_c , less than 4,000 psi listed in Table 03310-1 – Design of Concrete, is for design information and designation of class only. It is not a requirement for acceptance of concrete.

Proportion concrete designated by compressive strength such that concrete conforms to required strength.

When type of concrete is not indicated in the contract documents, use Class A concrete.

Design concrete as specified in Table 03310-1 – Design of Concrete.

| TABLE 03310-1 - DESIGN OF CONCRETE | | | |
|---|---|---|--|
| Class of Concrete | 28-Day Strength f'_c, psi | Minimum Cement Content lbs./c.y. (800 Maximum) | Maximum Water-Cement Ratio, lb./lb. |
| A | 3000 | 560 | 0.55 |
| B | 2500 | 500 | 0.62 |
| C | 2000 | 440 | 0.71 |
| D | 1500 | 400 | 0.80 |
| BD | 3750 | 610 | 0.49 |
| SEAL | 3000 | 610 | 0.55 |
| Designated by Strength f'_c or $*f'_r$ | As Specified | 610 | 0.40 |
| $*f'_r$ = Specified Modulus of Rupture | | | |

Proportion concrete materials in accordance with requirements of concrete designated by class, cement content in pounds per cubic yards, or specified 28-day compressive strength, using absolute volume method. Use volumetric proportioning methods as outlined in the

American Concrete Institute (ACI) Standard 211.1, “Recommended Practices for Selecting Proportions for Normal and Heavyweight Concrete.”

Use coarse aggregate size No. 57 (one inch to No. 4) or No. 67 (3/4 inch to No. 4) for concrete. For concrete placed in bottom slabs and stems of box girders, use No. 67 size aggregate. If accepted by the Engineer in writing, smaller size aggregates are permitted when encountering limited space between forms and reinforcement.

Use the following standard methods in Table 03310-2 – Standard Methods for determining compliance with requirements indicated in this subsection:

| TABLE 03310-2 – STANDARD METHODS | |
|---|---|
| Sampling Fresh Mixed Concrete | AASHTO T 141 |
| Mass Per Cubic Meter (Cubic Foot) Yield and Air Content (Gravimetric) of Concrete | AASHTO T 121 |
| Slump of Hydraulic Cement Concrete | AASHTO T 119 |
| Air Content of Freshly Mixed Concrete by the Pressure Method | AASHTO T 152 |
| Specific Gravity and Absorption of Fine Aggregate | AASHTO T 84 |
| Specific Gravity and Absorption of Coarse Aggregate | AASHTO T 85 |
| Temperature of Freshly Mixed Portland Cement Concrete | ASTM C 1064 |
| Making and Curing Concrete Test Specimens in the Field | AASHTO T 23 |
| Compressive Strength of Molded Concrete Cylindrical Specimens | AASHTO T 22(6 inch by 12 inch cylinders only) |
| Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading) | AASHTO T 97 |

When concrete is designated by compressive strength, f'_c , or flexural strength, f'_r , the Engineer will require prequalification of materials and mix proportions proposed for use before placing such concrete. The Engineer will prequalify concrete based on past performance records using statistical computations of population sizes and (n-1) weighting, or trial batch test reports in compliance with computed minimum average strength for

material and mix proportions. The Engineer will determine minimum average strength on probability of not more than one in 20 tests falling below specified strength for the following conditions:

1. When past performance records are available, furnish the following documented performance records:
 - a. Minimum of 15 consecutive 28-day strength tests from projects having same materials and mix proportions.
 - b. Two groups totaling 30 or more test results representing similar materials in which mix proportion strengths are within 20 percent of specified strength, from data obtained within one year of proposed use.

The Engineer will analyze performance records to establish standard deviation.

2. When sufficient past performance records are not provided, the Engineer will assume current standard deviation to be 500 psi for compressive strength, f'_c , and 50 psi for flexural strength, f'_r .

Unless sufficient performance records are available from other projects at DOT Materials Testing and Research Branch, submit test performance records or trial test reports for prequalifications, based on data of most recent tests made on concrete of proposed mix design, and data obtained within one year of proposed use.

Include the following information in test data and trial batch test reports: date of mixing; mixing equipment and procedures used; size of batch in cubic yards and weight, type, and source of ingredients used; slump of concrete; air content of concrete when using air entraining agent; age at time of testing; and strength of concrete cylinders tested.

Show that concrete strength tests equal or exceed minimum average strength in trial test reports. Test is average 28-day test results of five consecutive concrete cylinders or concrete beams taken from single batch. No cylinder or beam shall have strength less than 85 percent of minimum average strength.

Submit test data and trial test reports signed by official of firm that performed tests.

The Engineer reserves the right to stop work when a series of low strength tests occur. Do not continue concrete work until cause is established and the Engineer is informed of and accepts, necessary corrective action to be taken.

- C. Batching. Measure and batch materials in accordance with the following provisions:

1. Portland Cement. Either sacked or bulk cement may be used. Do not use fraction of sack of cement in concrete batch unless cement is weighed.

Weigh bulk cement on weighing device accepted by the Engineer. Seal and vent bulk cement-weighing hopper properly to preclude dusting during operation. Do not suspend discharge chute from weighing hopper. Arrange discharge chute so that cement will not lodge in hopper or leak from hopper.

Batching accuracy shall be within 1 percent, plus or minus, of required weight.

2. Water. Measure water by volume or by weight. Use readily adjustable device for measurement of water, with accuracy within 1 percent, plus or minus, of quantity of water required for batch. Arrange device so that variable pressure in water supply line does not affect measurements. Equip measuring tanks with outside taps and valves or other accepted means to allow for checking calibration.
3. Aggregates. When storing and stockpiling aggregates, avoid separation of coarse and fine particles within each size, and do not intermix various sizes before proportioning. Protect stored or stockpiled aggregates from dust or other foreign matter. Do not stockpile together, aggregates from different sources and of different gradations.

When transporting aggregates from stockpiles or other sources to batching plant, ensure uniform grading of material is maintained. Do not use aggregates that have become segregated or mixed with earth or foreign matter. Stockpile or bin aggregates at least 12 hours before batching. Produce or handle aggregates by hydraulic methods and wash and drain aggregates. If aggregates exhibit high or non uniform moisture content, the Engineer will order storage or stockpiling for more than 12 hours.

Proportion aggregates by weight, with the exception that aggregates in concrete for minor structures, curbs, and sidewalks may be proportioned by either volume or weight. For volumetric proportioning, use measuring boxes of known capacity to measure quantity of each aggregate size.

Use batch weight based on dry materials plus total weight of moisture (both absorbed and surface) contained in aggregate. Measure individual aggregates to within 2 percent, plus or minus, of required weight, and total weight of aggregates to within 1 percent, plus or minus, of required weight.

4. Admixtures. All admixtures shall be compatible with each other. Admixtures which significantly increase the drying shrinkage or creep in the concrete may be rejected by the Engineer. Store, proportion, and dispense admixtures in accordance with the following provisions:

- a. **Liquid Admixtures.** Dispense chemical admixtures, air entraining admixtures, and corrosion inhibiting admixtures in liquid form. Use mechanical dispensers for liquid admixtures with sufficient capacity to measure prescribed quantity for each batch of concrete. Include graduated measuring unit in each dispenser to measure liquid admixtures to within 5 percent, plus or minus, of prescribed quantity for each batch. Read graduations accurately from point of measuring unit, and control proportioning operations to permit visual check of batch accuracy before discharging. Mark each measuring unit clearly for type and quantity of admixture.

Arrange with supplier to provide sampling device consisting of valve located in safe and accessible location for sampling admixtures.

When using more than one liquid admixture for concrete mix, use separate measuring unit for each liquid admixture and dispense separately to avoid interaction that may interfere with admixture efficiency and adversely affect concrete. Dispense liquid admixture by injecting so as not to mix admixture at high concentrations.

When using liquid admixtures in concrete that is completely mixed in paving or continuous mixers, operate dispensers automatically with batching control equipment. Equip such dispensers with automatic warning system that will provide visible or audible signals at point where proportioning operations are controlled, when the following occurs: quantity of admixture measured for each batch of concrete varies from pre-selected dosage by more than 5 percent; or entire contents of measuring unit from dispenser is not emptied into each batch of concrete.

Unless liquid admixtures are added to batch with pre-measured water, discharge liquid admixtures into stream of water that disperses admixtures uniformly throughout batch. An exception is that air-entraining admixtures may be dispensed directly into moist sand in batching bins, provided adequate control of concrete air content can be maintained.

Measure and disperse special admixtures, as recommended by admixture manufacturer, and as accepted by the Engineer. Special admixtures include high-range water reducers requiring dosages greater than capacity of conventional dispensing equipment. For site-added, high-range water reducers, use calibrated, portable dispenser supplied by manufacturer.

- b. **Mineral Admixtures.** Protect mineral admixtures from exposure to moisture until used. Pile sacked material of each shipment to permit access for tally, inspection, and identification.

Provide adequate facilities to ensure that mineral admixtures meeting specified requirements are kept separate from other mineral admixtures and that only specified mineral admixtures are allowed to enter into the work. Provide safe and suitable facilities for sampling mineral admixtures at weigh hopper or in feed line immediately in advance of hopper.

Incorporate mineral admixtures into concrete using equipment conforming requirements for portland cement weigh hoppers, and charging and discharging mechanisms specified in ASTM C 94 and Section 03310, Subsection 3.01 C - Batching.

When concrete is completely mixed in stationary paving or continuous mixers, weigh mineral admixture in separate weigh hopper. Introduce mineral admixture and cement simultaneously into mixer, proportionately with aggregate.

When interlocks are required for cement-charging mechanisms, and cement and mineral admixtures are weighed cumulatively, interlock their charging mechanisms to prevent introduction of mineral admixture until mass of cement in weigh hopper is within tolerances specified in Section 03310, Subsection 3.01 C.1. - Portland Cement.

In determining maximum quantity of free water that may be used in concrete, consider mineral admixture to be cement.

5. Bins and Scales. At batching plant, use individual bins, hoppers, and scale for each aggregate size. Include separate bin, hopper, and scale for bulk cement and fly ash.

Except when proportioning bulk cement for pavement or structures, cement weigh hopper may be attached to separate scale for individual weighing or to aggregate scale for cumulative weighing. If cement is weighed cumulatively, weigh cement before other ingredients.

When proportioning for pavement or structures, keep bulk cement scale and weigh hopper separate and distinct from aggregate weighing equipment.

Use springless-dial or beam-type batching scales. When using beam-type scales, make provisions to show operator that required load in weighing hopper is approaching. Use devices that show condition within last 200 pounds of load and within 50 pounds of overload.

Maintain scale accuracy to 0.5 percent throughout range of use. Design poises to lock to prevent unauthorized change of position. Use scales inspected by the State Measurement Standards Branch of the Department of

Agriculture to ensure their continued accuracy. Provide not less than ten 50-pound weights for testing scales.

Batching plants may be equipped to proportion aggregates and bulk cement by automatic weighing devices.

6. Batching and Hauling. When mixing is to be performed at work site, transport aggregates from batching plant to mixer in batch boxes, vehicle bodies, or other containers of adequate capacity and construction. Use partitions to separate batches and prevent spilling from one compartment to another while in transit or during dumping.

Transport bulk cement to mixer in tight compartments carrying full quantity of cement required for batch. Once cement is placed in contact with aggregates, batches shall be mixed and placed within 1-1/2 hours of contact. Cement in original shipping packages may be transported on top of aggregates. Ensure that each batch contains number of sacks required by job mix.

Deliver batches to mixer intact. Charge each batch into mixer without loss of cement. When carrying more than one batch on truck, charge batch into mixer without spilling material from one batch compartment into another.

- D. Mixing. Mix concrete in mechanically operated mixers. When accepted by the Engineer, batches not exceeding 1/3 cubic yard may be hand mixed in accordance with methods described at end of this subsection.

Use stationary or truck mixers that distribute materials thoroughly and produce concrete uniform in color and appearance. When there is variation in mixed concrete attributable to worn pickup or throw-over blades, the Engineer will inspect mixer. If inspection reveals that blades are worn more than one inch below original height of manufacturer's design, repair or replace blades. Upon request, make copy of manufacturer's design, showing dimensions and arrangement of blades.

Charge batches into central or truck mixers so that portion of mixing water enters ahead of cement and aggregates. Deliver uniform flow of water. Place entire amount of batch water in mixer by end of first quarter of mixing period. When mixers with multiple compartment drums are used, time required to transfer material between compartments will be included as mixing time. Use drum rotation speed as designated by manufacturer. If mixing does not produce concrete of uniform and smooth texture, provide additional revolutions at same speed until thorough mixing of each concrete batch is attained. Begin measuring mixing time from time cement, aggregates, and 60 percent of water are in drum. Do not exceed manufacturer's rated capacity for volume of concrete mixed in each batch.

Equip central or truck mixers with attachment for automatically timing mixing of each concrete batch. Timing device shall include automatic feature for locking

discharge chute and device for warning operator when required mixing duration has been met. If timing or locking device fails to operate, immediately furnish clock or watch that indicates seconds, to mixer operator. If timing device is not repaired within three days after becoming inoperative, shut down batching operation until timing device is repaired.

For stationary mixers, use mixing time between 50 seconds and 5 minutes. Select mixing time, as necessary, to produce concrete that meets uniformity criteria when tested in accordance with Section 11.3.3 of ASTM C 94. The Contractor may designate mixing time for which uniformity tests are to be performed, provided mixing time is not less than 50 seconds or more than 5 minutes. Before using concrete for pavements or structures, mix concrete to meet specified uniformity requirements. The Contractor shall furnish labor, sampling equipment, and materials required for conducting uniformity tests of concrete mixture. The Engineer will furnish required testing equipment, including scales, cubic measure, and air meter; and will perform tests. The Engineer will not pay separately for labor, equipment, materials, or testing, but will consider the costs incidental to concrete. After batching and mixing operational procedures are established, the Engineer will not allow changes in procedures without the Contractor re-establishing procedures by conducting uniformity tests. Repeat mixer performance tests whenever appearance of concrete or coarse aggregate content of samples is not conforming to requirements of ASTM C 94. For truck mixers, add four seconds to specified mixing time if timing starts as soon as skip reaches its maximum raised position.

Unless otherwise indicated in the contract documents or accepted by the Engineer, concrete shall be mixed at proportioning plant. Operate mixer at agitating speed while in transit. Concrete may be truck-mixed only when cement or cement and mixing water are added at point of delivery. Begin mixing truck-mixed concrete immediately after introduction of mixing water to cement and aggregates, or introduction of cement to aggregates.

Inclined-axis, revolving drum truck mixers shall conform to Truck Mixer, Agitator and Front Discharge Concrete Carrier Standards TMMB 100-01, 15th Revision, published by Truck Mixer Manufacturers Bureau.

Truck mixers shall produce thoroughly mixed and uniform mass of concrete, and shall discharge concrete without segregation.

Manufacturer's standard metal rating plate shall be attached to each truck mixer, stating maximum rating capacity in terms of volume of mixed concrete for various uses; and maximum and minimum mixing speeds. When using truck mixers for mixing, adhere to maximum capacity shown on metal rating plate for volume of concrete in each batch.

Operate truck mixers at mixing speed designated by manufacturer, but at not less than 6 or more than 18 revolutions per minute. Mix truck-mixed concrete initially between 70 and 100 revolutions at manufacturer-designated mixing speed, after ingredients, including water, are in mixer. Water may be added to mixture not more

than two times after initial mixing is completed. Each time that water is added, turn drum an additional 30 revolutions or more at mixing speed until concrete is mixed uniformly.

When furnishing shrink-mixed concrete, transfer partially mixed concrete at central plant to truck mixer. Apply requirements for truck-mixed concrete. The Engineer will not credit number of revolutions at mixing speed for partial mixing in central plant.

When accepted by the Engineer, concrete batches not exceeding 1/3 cubic yard may be hand mixed on a watertight, level platform. Measure proper amount of coarse aggregate in measuring boxes and spread on platform. Spread fine aggregate on that coarse aggregate layer. Limit coarse and fine aggregate layers to total depth of one foot. Spread dry cement on this mixture. Turn whole mass not less than two times dry. Add sufficient clean water, distributed evenly. Turn whole mass again, not less than three times, not including placing in carriers or forms.

- E. Transporting Mixed Concrete. Transport central-mixed concrete to delivery point in truck agitators or truck mixers operating at speed designated by equipment manufacturer as agitating speed; or in non-agitating hauling equipment, provided consistency and workability of mixed concrete upon discharge at delivery point is suitable for placement and consolidation in place; and provided mixed concrete after hauling to delivery point conforms to uniformity criteria when tested as specified in Section 12.5 of ASTM C 94.

For revolving drum truck mixers transporting central-mixed concrete, limit concrete volume to manufacturer's rated capacity for agitator operation. Maintain agitating speed for both revolving drum mixers and revolving blade type agitators as designated on manufacturer's data plate. Equip truck mixers or truck agitators with electrically or mechanically actuated counters. Actuate counters after introducing cement to aggregates.

Bodies of non-agitating hauling equipment shall be smooth, watertight, metal containers equipped with gates to permit control of concrete discharge. Protect open-topped haul vehicle against weather with cover accepted by the Engineer. When hauling concrete in non agitating trucks, complete discharge within 30 minutes after introducing mixing water to cement and aggregates.

When truck mixer or agitator is used for transporting central-mixed concrete to delivery point, complete discharge within 1-1/2 hours, or before 250 revolutions of drum or blades, whichever comes first after introduction of mixing water to cement and aggregates, or cement to aggregates. For truck-mixed concrete, complete concrete discharge within 1-1/2 hours, or before 300 revolutions of drum or blades, whichever comes first. These limitations are permitted to waived if concrete is of such slump after the 1-1/2 hour time or 300-revolution limit has been reached, that it can be placed, without addition of water to the batch.

Submit delivery tickets from manufacturers of truck-mixed concrete and central-mixed concrete with each truckload of concrete before unloading at jobsite. Printed, stamped, or written delivery ticket shall include the following information:

1. Name of concrete plants.
2. Serial number of ticket.
3. Date and truck number.
4. Name of Contractor.
5. Specific project, route, or designation of job (name and location).
6. Specific class or designation of concrete in accordance with contract documents.
7. Quantity of concrete in cubic yards.
8. Time of loading batch or mixing of cement and aggregates.
9. Water added by receiver of concrete and receiver's initials.
10. Information necessary to calculate total mixing water added by producer. Total mixing water includes free water on aggregates, water, and water added by truck operator from mixer tank.
11. Readings of non-resettable revolution counters of truck mixers after introduction of cement to aggregates, or introduction of mixing water to cement aggregates.
12. Supplier's mix number or code.

Furnish additional information designated by the Engineer and required by job specifications upon request.

- F. Consistency. Regulate quantity of water used in concrete mixes so that concrete consistency, as determined by AASHTO T 119 test method, is within nominal slump range specified in Table 03310-3 - Slump for Concrete. If concrete slump exceeds nominal slump, adjust mixture of subsequent batches. If slump exceeds maximum slump, the Engineer will reject concrete unless deemed satisfactory for its use.

The Engineer will also reject harsh or unworkable concrete that cannot be properly placed. Remove rejected concrete at no increase in contract price or contract time.

Slump for concrete shall be as specified in Table 03310-3 – Slump for Concrete.

| TABLE 03310-3 - SLUMP FOR CONCRETE | | |
|---|-----------------------------|-----------------------------|
| Type of Work | Nominal Slump Inches | Maximum Slump Inches |
| Concrete Pavements | 0 – 3 | 3-1/2 |
| Reinforced Concrete Structures: | | |
| Sections Over 12 Inches | 0 – 4 | 5 |
| Sections 12 Inches Thick or Less | 2 – 5 | 6 |
| Non-Reinforced Concrete Facilities | 1 – 3 | 4 |
| Concrete Placed Underwater | 6 – 8 | 9 |
| Bridge Decks | 6 – 8 | 9 |

If the slump of the ready mix concrete upon delivery is below the design slump, water may be added provided:

1. Water shall not be added to the concrete if more than ¼ cubic of concrete has been discharged from the mixer.
2. Water may be added only up to 30 minutes after the average travel time to the jobsite.
3. The maximum slump, the maximum water/cement ratio, and the maximum water per cubic yard shall not be exceeded.
4. Not more than 1 ½ gallons of water per cubic yard shall be added to the concrete, but not more than the amount of “held-back” water.
5. The amount of “held-back” water from the approved mix design shall be shown on the delivery ticket.

In adverse or difficult conditions that may affect placement of concrete, the above slump limitations may be exceeded for placement workability, with the addition of admixture conforming to Section 03390, Subsection 1.2 - Admixtures, if accepted by the Engineer in writing and provided water-cement ratio is maintained. Provide additional cement and water, or admixture at no increase in contract price or contract time.

- G. Forms. Construct forms in accordance with applicable sections.

- H. Placing Concrete. Place concrete in accordance with applicable sections.
- I. Finishing Concrete Surfaces. Finish concrete surfaces in accordance with applicable sections.
- J. Curing Concrete. Cure concrete in accordance with applicable sections.

END OF SECTION

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SECTION 03361

SHOTCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

This work includes furnishing all materials and labor required for placing and securing geocomposite drainage materials, weep holes, and shotcrete for the slope protection as shown on the Plans. The work also includes any preparatory trimming and cleaning of soil/rock surfaces.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials for shotcrete shall conform to the following requirements:

| MATERIALS | REQUIREMENTS |
|-------------------------------------|---|
| Cement | AASHTO M85/ASTM C150, Type I, II, III, or V |
| Fine Aggregate | AASHTO M6/ASTM C33 clean, natural |
| Coarse Aggregate | AASHTO M80, Class B for quality |
| Water | Clean and Potable. AASHTO M157/ASTM C1141 |
| Chemical Admixtures Accelerator | Fluid type, applied at nozzle, meeting requirements of AASHTO M194/ASTM C494/ASTM C1141 |
| Air-Entraining Agent | AASHTO M154/ASTM C260 |
| Water-reducer and Superplasticizer | AASHTO M194/ASTM C494 Type A, C, D, E, F or G |
| Retarders and Mineral Admixtures | AASHTO M194/ASTM C494 Type B or D |
| Fly Ash | AASHTO M295/ASTM C618 Type F or C, cement replacement up to 35 percent by weight of cement |
| Silica Fume | ASTM C1240, 90 percent minimum silicon dioxide solids content, not to exceed 12 percent by weight of cement |
| Curing Compounds | AASHTO M148, Type 1D or Type 2 |
| Prepackaged Shotcrete | ASTM C928 |
| Migrating Corrosion Inhibitor | Amine carboxylate based, MCI 2005NS or approved equal |
| Synthetic Macro Fiber Reinforcement | ASTM C1116-03, Strux 85/50 or accepted equal |
| Geocomposite Drain Strip | Miradrain 6000, Amerdrain 500 or approved equal |
| Film Protection | Polyethylene films per AASHTO M-171 |

| MATERIALS | REQUIREMENTS |
|----------------|---|
| PVC Drain Pipe | ASTM 1785 Schedule 40 PVC, solid and perforated wall, cell classification 12454-B or 12354-C, wall thickness SDR 35, with solvent weld or elastomeric gasket joints |

Materials shall be delivered, stored and handled to prevent contamination, segregation, corrosion or damage. Store liquid admixtures to prevent evaporation and freezing.

- B. Geocomposite drain strips shall be provided in rolls wrapped in a protective covering and stored in a manner that protects the fabric from mud, dirt, dust, debris, and shotcrete rebound. Protective wrapping shall not be removed until immediately before the geotextile or drain strip is installed. Extended exposure to ultra-violet light shall be avoided. Each roll of geotextile or drain strip in the shipment shall be labeled to identify the production run.
- C. Shotcrete shall have a minimum compressive strength at 28 days of 4,000 psi and have a maximum 0.45 water to cement ratio. A shrinkage reducing admixture, such as Eclipse or Master Life AS20 or approved equal, shall be added at a dosage of 128 oz. per cubic yard as recommended by the manufacturer. Shotcrete shall contain 7.5 lbs. of Strux 90/40 synthetic structural fiber or equivalent.

2.2 CONSTRUCTION SUBMITTALS

- A. No shotcreting shall be performed until the following submittal are accepted by the Engineer. At least 15 days before the planned start of shotcrete placement, submit 8 copies of the following information, in writing, to the Engineer for review and acceptance:
 - B. Written documentation of the finisher's and nozzlemen's qualifications including proof of ACI certification (if applicable).
 - C. Proposed methods of shotcrete placement and of controlling and maintaining facing alignment and location and shotcrete thickness.
 - D. Shotcrete mix design including:
 - 1. Type of Portland cement.
 - 2. Aggregate source and gradation.
 - 3. Proportion of mix by weight and water-cement ratio.
 - 4. Proposed admixtures, manufacturer, dosage, and technical literature.
 - E. Previous strength test results for the proposed shotcrete mix completed within one year of

the start of shotcreting may be submitted for initial verification of the required compressive strengths at start of production work.

- F. Certificates of Compliance, manufacturers' engineering data and installation instructions for the drainage geotextile, geocomposite drain strip, drain grate and accessories.

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

Use either the dry mix or the wet mix process of shotcreting as follows:

A. Dry Mix Process

1. Mix the cement and damp fine aggregates thoroughly.
2. Feed the cement-fine aggregate mixture into a special mechanical feeder (gun) or other accepted delivery equipment.
3. Meter the mixture into a delivery hose by a feed well or distributor.
4. Convey this mixture by compressed air through the delivery hose to a special nozzle. Fit the nozzle with a perforated manifold that the Contractor can introduce the water under pressure and intimately mix with the other ingredients.
5. Jet the mortar from the nozzle at high velocity onto the surface that the Contractor will shotcrete.

B. Wet Mix Process

1. Mix the ingredients specified in Part 3.1.A.1 - Dry Mix Process including water thoroughly.
2. Introduce the mortar into the chamber of the delivery equipment.
3. Meter the mortar into the delivery hose and convey the mortar by compressed air or other means to a nozzle.
4. Inject additional air at the nozzle to increase the velocity and improve the gunning pattern.
5. Jet the mortar from the nozzle at high velocity onto the surface that the Contractor will shotcrete.

3.2 EQUIPMENT

- A. General: At least 15 calendar days before the planned start of shotcrete placement, submit the equipment that will be used on the project, manufacturer's specifications and operating instructions for acceptance by the Engineer. Operate the equipment according to the manufacturer's recommendations.

The Contractor may do proportioning of the mortar ingredients, except water, either volumetrically or by weight. Apply the water as specified above. The Engineer will not permit batches requiring fractional sacks unless the Contractor weighs the cement.

- B. Qualification: The shotcrete contractor shall be capable of performing the work specified herein and shall have the following minimum experience requirements below.

The workers handling the nozzle employed for the work shall be competent operators with at least two years of experience in this type of work. The person handling the nozzle may be an apprentice with at least 6 months of experience if supervised by foreman in charge. The foreman in charge shall have at least two years of experience handling the nozzle.

3.3 ALIGNMENT CONTROL

Surfaces that the Contractor will shotcrete shall conform to the dimensions shown in the Plans or ordered by the Engineer. The surfaces shall not contain free moisture but shall be sufficiently damp to prevent absorption. Install adequate ground wires as guides to establish the thickness and surfaces of the shotcrete build-up. The wires shall be taut and true to line at all times during the operation.

3.4 SURFACE PREPARATION

Clean the face of the slope and other surfaces to be shotcreted of loose materials, mud, rebound, overspray or other foreign matter that could prevent or reduce shotcrete bond. Protect adjacent surfaces for overspray during shooting. Avoid loosening, cracking, or shattering the ground during cleaning. Remove any surface material which is so loosened or damaged to a sufficient depth to provide a base that is suitable to receive the shotcrete. Remove material that loosens as the shotcrete is applied. Cost of additional shotcrete is incidental to the work. Divert water flow and remove standing water so that the shotcrete placement will not be detrimentally affected by standing water.

3.5 SHOTCRETING

- A. Mixing

The Contractor may do proportioning of the mortar ingredients, except water, either volumetrically or by weight. Apply the water as specified above. The

Engineer will not permit batches requiring fractional sacks unless the Contractor weighs the cement.

1. Dry-Mix Process: Mix the ingredients thoroughly with mixing equipment so the Contractor can coat the fine aggregate particles with cement. Provide mixing equipment for the continuous application of the mortar.

The moisture content of the fine aggregate shall be such that the fine aggregate-cement mixture shall flow at a uniform rate (without slugs) through the delivery hose. The optimum moisture content shall depend on the delivery equipment used, but shall be between 3% and 6%.

Discharge the fine aggregate-cement mixture into the delivery hose under close control. Deliver a continuous, smooth stream of uniformly mixed material at the proper velocity to the discharge nozzle.

Equip the discharge nozzle with a manually operated water injection system (water ring) for directing and even distribution of water through the fine aggregate-cement mixture. The water valve shall be readily adjustable in varying the quantity of water, and shall be convenient to the person handling the nozzle.

Deliver a conical discharge stream of uniform appearance. Distortion of this stream or nonuniform appearance shall be cause to stop the work until the Contractor has corrected the situation.

Maintain a supply of clean air adequate for providing sufficient nozzle velocity for parts of the work and for the simultaneous operation of a blowpipe for clearing away rebound.

The water pressure at the discharge nozzle shall be greater than the operating air pressure to assure that the water shall intimately mix with the other materials. If the water line pressure is inadequate, use a water pump to increase and get the required pressure. The water pressure shall be non-pulsating.

2. Wet Mix Process: The wet mix delivery equipment shall be of a design and size that has produced good results in similar work. The wet mix process shall have the capacity to deliver the pre-mixed materials accurately, uniformly and continuously through the delivery hose. Follow the manufacturer's recommendations as to: the type and size of nozzle, cleaning the equipment, inspecting the equipment and maintaining the equipment.

The air compressor shall conform to Part 3.7.B.1 – Dry Mix Process.

C. Gunning:

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1. Apply the shotcrete from the lower part of the area upwards to prevent accumulation of rebound. Orient nozzle at a distance and approximately perpendicular to the working face so that rebound will be minimal and compaction will be maximized.
2. Allow each layer ample time to set. Each layer shall be free of rebound material before applying the next layer. If final set has taken place, wet down the area before the next application.
3. If high winds prevent the person handling the nozzle from making proper application of the mortar or if rain occurs causing washing out of the cement or sloughing of the mortar, the Engineer will suspend gunning.

D. Rebound:

1. Remove rebound. The Engineer will not allow rebound to become a part of the work.

E. Construction Joints:

1. Form construction joints by tamping to a thin edge over a distance of about 12 inches. Clean the construction joint thoroughly and wet the construction joint before the subsequent application of shotcrete.

F. Finishing:

1. The surface finish of the shotcrete construction facing shall be the natural finish as applied. Finish the surface with proper floats and steel trowels. Round the exposed edges with an edging tool.

G. Film Curing:

1. Film curing with polyethylene sheeting may be used to supplement water curing on shotcrete that will be covered later with additional shotcrete or concrete. Spray the shotcrete surface with water immediately prior to installation of the polyethylene sheeting. Polyethylene sheeting shall completely cover the surfaces. Overlap the sheeting edges for proper sealing and anchorage. Joints between sheets shall be sealed. Promptly repair any tears, holes, and other damage. Anchor sheeting as necessary to prevent billowing.

H. Control Testing:

1. When required by the Engineer, the Contractor shall furnish unreinforced test

panels, at least 12 inches square and 3 inches thick. The Contractor shall make test panels to represent actual job conditions.

I. Geocomposite Drain Strips:

1. Install geocomposite drain strips as shown on the Plans and the requirements specified in Section 02245 - Geocomposite Drain. The drain strips shall be at least 24 inches wide and placed with the geotextile side against the ground. Secure the strips to the excavation face and prevent shotcrete from contaminating the ground side of the geotextile. Drain strips shall be continuous vertically. Splices shall be made with a 24-inch minimum overlap such that the flow of water is not impeded. Repair damage to the geocomposite drain strip, which may interrupt the flow of water.

3.6 QUALITY CONTROL/QUALITY ASSURANCE

- A. Preconstruction Testing: Prepare and test preconstruction test panels in accordance with ASTM C1140. Produce test panels for each proposed mix proportion, each anticipated shooting orientation, and each proposed nozzle operator. Make test panels at least 30 inches square with the same thickness as in the structure, but not less than 3 inches.

Test specimens for conformance to specified physical properties in accordance with ASTM C42.

- B. Construction Testing: Produce material test panel for each mix and each workday or every 50 cubic yards placed, whichever is less. Keep test panels moist and at 70 degrees F \pm 10 degrees F until moved to test laboratory. Obtain test specimens either from job site material test panel or from in-place shotcrete. Test specimens from test panels in accordance with ASTM C1140.

Test specimens from in-place shotcrete in accordance with ASTM C42.

The mean compressive strength of a set of three cores shall equal or exceed 0.85f'c with no individual core less than 0.75 f'c. The mean of a set of three cubes shall equal or exceed f'c with no individual cube less than 0.88f'c.

C. Shotcrete Core Grades

1. Grade 1: Shotcrete specimens are solid; there are no laminations, sandy areas or voids. Small air voids with maximum diameter of 1/8 inch and maximum length of 1/4 inch are normal and acceptable. Sand pockets or voids behind continuous reinforcing steel are unacceptable. The surface against the form or bond plane shall be sound, without sandy texture or voids.

2. Grade 2: Shotcrete specimens shall have no more than two laminations or sandy areas with dimensions not to exceed 1/8 inch thick by 1 inch long. The height, width, and depth of voids shall not exceed 3/8 inch. The surface against the form or bond plane shall be sound, without sandy texture or voids.
 3. Grade 3: Shotcrete specimens shall have no more than two laminations or sandy areas with dimensions exceeding 3/16 inch thick by 1-1/4 inches long, or one major void, sand pocket, or lamination containing loosely bonded sand not to exceed 5/8 inch thick and 1-1/4 inches in width. The surface against the form or bond plane may be sandy, with voids containing overspray to a depth of 1/16 inch.
 4. Grade 4: Core shall meet, in general, requirements of Grade 3 cores, but may have two major flaws such as described for Grade 3, or may have one flaw with maximum dimension of 1 inch perpendicular to the face of the core, with maximum width of 1-1/2 inches. The end of the core that was shot against the form may be sandy, with voids containing overspray to a depth of 1/8 inch.
 5. Grade 5: Core that does not meet criteria of core grades 1 through 4, by being of poorer quality, shall be classified as Grade 5.
 6. Determine grade by computing the mean of a minimum of three test specimens. Accept mean grade of 2.5 or less. Reject individual shotcrete cores with grade greater than 3.
 7. The above core grades are based on cores with surface area of 50 square inches. For cores with greater or lesser area than 50 square inches, adjust allowable flaws relative to 50 square inches.
- D. Evaluation of In-Place Shotcrete: Remove and replace shotcrete that is delaminated, exhibits laminations, voids, or sand pockets exceeding limits for specified grade of shotcrete. Remove and replace shotcrete that does not comply with specified material properties.

Repair core holes in accordance with ACI 301 Chapter 9. Do not fill holes by shooting.

- E. Acceptance: The Engineer will accept shotcrete work that meets requirements of the contract documents. The Engineer will accept shotcrete work that has previously failed to meet one or more requirements, but which has been repaired to meet requirements of the contract documents.

Shotcrete work that fails to meet one or more requirements and that cannot be brought into compliance will be evaluated for acceptance by the Engineer. Modifications may be required to ensure remaining work complies with requirements of the contract documents.

PART 4 – MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT

- A. Mobilization/demobilization will be paid on a lump sum basis. Measurement for payment will not apply.
- B. Clearing and Grubbing: The Engineer will not measure clearing and grubbing. The Engineer will consider clearing and grubbing incidental to Section 03361 – Shotcrete.
- C. Cut Slope Excavation: The Engineer will not measure cut slope excavation. The Engineer will consider cut slope excavation incidental to Section 03361 – Shotcrete.
- D. Geocomposite Drain: The Engineer will not measure geocomposite drain. The Engineer will consider the geocomposite drain incidental to Section 03661 – Shotcrete.
- E. Shotcrete: The Engineer will measure accepted shotcrete by square foot complete in place.

4.2 PAYMENT

- A. The Engineer will pay for mobilization/demobilization on a contract lump sum basis. Payment will be full compensation for the work prescribed in this section and contract documents.
- B. Engineer will pay for accepted quantity of the shotcrete at the contract unit price per square foot complete in place. Payment will be full compensation for clearing and grubbing, cut slope excavation, geocomposite drain, providing proper shotcrete facing alignment and thickness control, furnishing and installing admixtures, test panels, including all sampling, testing, and reporting required; and furnishing labor, material tools, equipment, and incidentals as necessary to complete the work.

The Engineer will make payment under:

| Pay Item | Pay Unit |
|--|-----------------|
| Mobilization/Demobilization – Shotcrete Parking Lot Slope Failure Area | Lump Sum |
| Shotcrete | Square Foot |

The Engineer will not pay for additional shotcrete or cast-in-place concrete needed to fill voids created by irregularities in the slope face, excavation overbreak or inadvertent excavation beyond the Plan face line or failure to construct the shotcrete construction facing to the specified line and grade tolerances. The Contractor shall anticipate

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substantial excavation overbreak and subsequent backfill with shotcrete at the face of the slope due to the cobbly and rocky nature of the subsurface materials at the site.

Any citations or fines that the Department receives as a result of Clean Water Act violations resulting from Contractor operations shall be reimbursed by the Contractor within 30 days for the full amount of outstanding cost that State has incurred, or Engineer will deduct cost from progress payment.”

END OF SECTION

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SECTION 03390

CONCRETE CURING MATERIALS AND ADMIXTURES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Curing materials shall conform to requirements of Table 03390-1 - Curing Material Requirements.

| TABLE 03390-1 - CURING MATERIAL REQUIREMENTS | |
|--|----------------------|
| MATERIAL | SPECIFICATION |
| Liquid Membrane-Forming Compounds for Curing Concrete (Excluding Bridge Decks) | AASHTO M 148 |
| Waterproof Paper for Curing Concrete | AASHTO M 171 |
| White Polyethylene Sheeting (Film) for Curing Concrete | AASHTO M 171 |
| Burlap Cloth Made from Jute or Kenaf | AASHTO M 182 |

1.01 ADMIXTURES

Admixtures in portland cement concrete shall be used when indicated in the contract documents or authorized in writing by the Engineer.

Admixture containing calcium chloride shall not be used in concrete with steel reinforcement or other embedded metal.

Admixture that is non uniform during application shall not be used.

If two or more admixtures are used, all shall be compatible.

In determining total quantity of free water per cubic yard of concrete, liquid admixture that requires dosage greater than 1/2 gallon per cubic yard shall be considered to be free water.

- A. Admixture Material. Admixtures shall conform to requirements of Table 03390-2 - Admixture Requirements.

| TABLE 03390-2 - ADMIXTURE REQUIREMENTS | |
|---|----------------------|
| TYPE | SPECIFICATION |

| | |
|--|---|
| Chemical Admixtures for Concrete | AASHTO M 194 |
| Air-Entraining Admixtures for Concrete | AASHTO M 154 |
| Calcium Chloride | AASHTO M 144 |
| Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete | AASHTO M 295, except that loss on ignition shall not exceed 3 percent |

- B. Admixture Acceptance. The Engineer's written acceptance is required prior to use of admixture in concrete. Acceptance is contingent upon furnishing of certified test results by the Contractor and additional tests the Engineer may choose to perform. If the Engineer requests samples of admixture for testing, samples shall be submitted at least 30 days prior to intended use.

If previously accepted admixture is proposed for use, the Contractor shall provide a certificate of compliance from manufacturer affirming that both admixtures are identical. The Engineer reserves the right to sample admixture even with the certification.

If mineral admixture is delivered directly to work site or is to be used in ready-mix concrete or precast concrete product, the Contractor shall submit a certificate of compliance signed by manufacturer or concrete supplier.

- C. Admixture Usage. If chemical admixture or calcium chloride is indicated for use in the contract documents or ordered in writing by the Engineer, quantity shall be as indicated or ordered. If quantity is not indicated or ordered, manufacturer's recommendation shall be followed.

Admixtures allowed are shown on the plans and are also Type A or Type F water reducing, Type B retarding, and Type D or Type G water reducing and retarding, in accordance with AASHTO M 194, to economize on cement or facilitate construction.

If air-entraining admixture is specified in the contract documents or ordered in writing by the Engineer, quantity of admixture shall be as required to produce concrete with specified air content, when tested in accordance with AASHTO T 152.

Air-entraining admixture will be allowed even when not specified or ordered. In such event, air content of concrete shall be 4 percent plus or minus 1 percent.

Replacement of up to 15 percent by weight of portland cement, other than Type IP, with mineral admixture will be allowed, except when high early strength concrete is specified or mineral admixture is prohibited. Weight of mineral admixture shall be

equal to or greater than weight of portland cement replaced. In determining free water for concrete, mineral admixture shall be considered to be cement.

Same brand and percentage of mineral admixture shall be used for concrete in exposed surface of structures.

PART 2 - PRODUCTS

(Not used)

PART 3 - EXECUTION

(Not used)

END OF SECTION

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SECTION 03541

HYDRAULIC CEMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Portland cement shall consist of Type I or Type II portland cement, or Type IP portland-pozzolan cement.

Type I and Type II portland cement shall conform to AASHTO M 85 and the 28-day compressive strength requirement cited in AASHTO M 85, Table 4.

Type IP portland-pozzolan cement shall conform to AASHTO M 240.

Mineral admixtures may be used to replace a portion of the required portland cement in accordance with Section 033900, Subsection 1.02 - Admixtures.

Safe and suitable facilities for sampling cement shall be provided at the weigh hopper or in the feedline immediately in advance of the hopper. Cement shall be stored in a weathertight building that will protect cement from dampness and minimize warehouse set, and stored in such a manner to permit easy access for proper inspection and identification of each shipment.

Cement which for any reason has become partially set or which contains caked lumps shall not be used.

Different types of cement shall not be mixed or used in the same unit of construction. Cement used in the manufacture of cast-in-place concrete for exposed surfaces of like elements of a structure shall be from the same mill.

Certificate of compliance shall be submitted to the Engineer before using any cement. Certificate of compliance shall include pertinent information as to the type of cement; and applicable chemical and physical test results from samples taken at local distribution sites or concrete batch plants.

Once certificate of compliance has been accepted, the Engineer may permit use of cement before release by the laboratory. Cement furnished without an accepted certificate of compliance shall not be used until the Engineer has had sufficient time to make appropriate tests and has accepted cement for use.

If cement does not conform to requirements of the contract documents, as determined by laboratory test samples, use of cement from the same source shall be delayed until the Engineer can make tests on each cement lot delivered.

PART 2 - PRODUCTS

(Not used)

PART 3 - EXECUTION

(Not used)

END OF SECTION

SECTION 03602

DRILLING HOLES AND INSTALLING DOWEL REINFORCING BARS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

This section describes drilling holes and installing dowel reinforcing bars where new concrete is to be joined to existing concrete by means of dowel reinforcing bars epoxied into holes drilled into existing concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

Reinforcing Bars. Refer to Section 03210.

Epoxy Adhesive. Refer to Section 03603.

Submit test certificates indicating conformance of materials to standards referenced in this subsection.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. Drilling and Installation. Drill holes by methods that will not shatter or damage concrete adjacent to hole. Unless otherwise specified or shown on plans, diameter of drilled holes shall be 1/8-inch larger than nominal dowel diameter. Holes encountering longitudinal or transverse reinforcement during drilling will be rejected. Adjacent to rejected hole, drill new hole to required depth, avoiding existing reinforcement. Place dowel reinforcing bars after drilling to depth shown on plans and cleaning holes of dust and residue. Fill holes with epoxy after removing fine particles.

All drilled holes shall be cleaned, filled with epoxy, and reinforcing dowels and anchor bolts installed prior to end of the work day.

B. Inspection. Before filling holes with epoxy, notify the Engineer that holes are ready for inspection.

END OF SECTION

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SECTION 03603

EPOXY ADHESIVE

PART 1 - GENERAL

1.1 EPOXY-RESIN ADHESIVE

Submit six copies of product brochures. The use of the epoxy resin adhesive shall conform to the manufacturer's recommendations. The contractor shall also submit a certificate of compliance from the manufacturer or supplier affirming that the proposed material conforms to ASTM C 881 and is able to support and carry sustained tensile (creep) loads, and is appropriate for the intended use. The color for exposed surfaces shall closely match the surrounding material.

PART 2 - PRODUCTS

(Not used)

PART 3 - EXECUTION

(Not used)

END OF SECTION

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SECTION 03840

AGGREGATES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Fine aggregate for portland cement concrete may be a combination of calcareous sand and basalt, or basalt alone, both being free of vegetable matter and other deleterious substances. Natural sand or manufactured sand from a brackish water source shall be processed by washing with fresh water.

Submit Quality Control Plan (QCP) with detailed process control procedures and type and frequency of sampling and testing. For aggregate used in structural concrete, exclusive of concrete for incidental construction, minimum frequency of sieve analysis and sand equivalent testing shall be once a day. Provide the Engineer access to project-related plant production records and when requested, informational copies of sampling and testing reports.

Absolute volume of calcareous sand in fine aggregate shall be limited to 50 percent. Absolute volume of calcareous sand of up to 70 percent of absolute volume of fine aggregate will be acceptable, provided fine aggregate meets minimum insoluble residue of 60 percent; and processing or manufacturing of calcareous sand removes deleterious coatings and unsound materials. Insoluble residue content shall be determined in accordance with ASTM D 3042.

Fine aggregate shall be from an approved source and shall conform to Table 03840-1 - Physical Properties.

| TABLE 03840-1 - PHYSICAL PROPERTIES | | |
|--|---------------|--|
| Test | Method | Requirements |
| Sand Equivalent | AASHTO T 176 | 70 Minimum (a) |
| Soundness Sodium Sulfate (5 cycles) | AASHTO T 104 | 10 Maximum (b) |
| Abrasion (500 Revolutions) | AASHTO T 96 | 40 Maximum (c) |
| Organic Impurities | AASHTO T 21 | Not darker than the reference standard color (d) |
| Coal and Lignite | AASHTO T 113 | 1 Maximum |

Notes:

- (a) Sand equivalent (SE) requirement will be waived if material finer than No. 200 sieve does not exceed 5 percent when tested in accordance with AASHTO T 11.
- (b) When material has satisfactory service record of at least five years, soundness test will be waived.
- (c) Parent material of fine aggregate manufactured by crushing shall have a loss by abrasion of less than 40 percent when tested in accordance with AASHTO T 96.
- (d) Materials that fail to meet organic impurity color test will be accepted, provided relative strength at 7 and 28 days is more than 95 percent when tested in accordance with AASHTO T 71.

Fine aggregate grading shall conform to Table 03840-2 - Fine Aggregate Grading Requirements. On the islands of Hawaii and Kauai, fine aggregate grading shall conform to Table 03840-2 - Fine Aggregate Grading Requirements or Table 03840-3 - Fine Aggregate Grading Requirements, Hawaii and Kauai.

| TABLE 03840-2 - FINE AGGREGATE GRADING REQUIREMENTS | |
|--|----------------------------------|
| Sieve Sizes | Percent Passing by Weight |
| 3/8 Inch | 100 |
| No. 4 | 95 – 100 |
| No. 8 | 80 – 100 |
| No. 16 | 50 – 85 |
| No. 30 | 25 – 60 |
| No. 50 | 10 – 30 |
| No.100 | 2 - 12 |

| TABLE 03840-3 - FINE AGGREGATE GRADING REQUIREMENTS, HAWAII AND KAUAI | | |
|--|----------------------------------|---------------------------|
| Sieve Sizes | Percent Passing by Weight | |
| | Calcareous Sand | Crusher Screenings |
| 3/8 Inch | 100 | 100 |
| No. 4 | 95 – 100 | 95 - 100 |
| No. 8 | - | 50 - 85 |
| No. 16 | - | - |
| No. 30 | - | 32 - 60 |
| No. 50 | - | 15 - 30 |
| No. 100 | 0 – 5 | 5 - 20 |

Fine aggregate consisting of blend of fine natural sand with fineness modulus of less than 2.1 and basalt for concrete conforming to Table 03840-4 - Fine Aggregate Grading Requirements Fine Natural Sand Blend may be used, provided the Contractor furnishes test data, accepted by the Engineer, indicating that concrete produced will have properties equal to those of concrete made with designated grading.

| TABLE 03840-4 - FINE AGGREGATE GRADING REQUIREMENTS FINE NATURAL SAND BLEND | |
|--|----------------------------------|
| Sieve Size | Percent Passing by Weight |
| 3/8 Inch | 100 |
| No. 4 | 95 – 100 |
| No. 8 | 65 – 95 |
| No. 16 | x ± 10 |
| No. 30 | x ± 9 |

| | |
|---|-----------|
| No. 50 | $x \pm 6$ |
| No. 100 | 2 – 14 |
| The symbol x is grading that the Contractor proposes to furnish for specific sieve size | |

Before beginning concrete work, typical grading of calcareous sand and crushed lava rock fines shall be submitted; and blend proportion proposed to be furnished shall be specified. Grading shall not have more than 45 percent retained between two consecutive sieves that are specified in control of fineness modulus.

Target fineness modulus shall be designated between 2.4 and 3.1. Fineness modulus using No. 4, 8, 16, 30, 50, and 100 sieves shall be computed. Fineness modulus shall be maintained at not more than 0.2 from target.

1.2 COARSE AGGREGATE FOR PORTLAND CEMENT CONCRETE

Coarse aggregate for portland cement concrete shall consist of crushed basalt free of adherent coatings.

Coarse aggregate shall conform to Table 03840-5 - Physical Properties.

| TABLE 03840-5 - PHYSICAL PROPERTIES | | |
|---|--------------------|------------------------------------|
| Deleterious Substances and Physical Properties | Test Method | Maximum Allowable (percent) |
| Clay Lumps and Friable Particles | AASHTO T 112 | 2.0 |
| Materials Finer than No. 200 (75- μ m) Sieve | AASHTO T 11 | 1.5 |
| Lightweight Pieces (Less than 2.0 specific gravity SSD) | AASHTO T 113 | 0.5 |
| Absorption | AASHTO T 85 | 6 |
| Abrasion (500) Revolutions | AASHTO T 96 | 40 |
| Soundness (Sodium Sulfate) | AASHTO T 104 | 12 |

When material has satisfactory service record of at least five years, soundness requirement will be waived.

Coarse aggregate grading shall conform to appropriate size designation of AASHTO M 43 when tested in accordance with AASHTO T 27. Grading and material finer than No. 200 (75 µm) sieve testing shall be part of the Quality Control Plan required in Section 03840, Subsection 1.1 - Fine Aggregate for Concrete.

1.03 AGGREGATE FOR SUBBASE

Aggregate for subbase shall consist of gravel, stone, basalt, or coral, or combination thereof, and shall be free of overburden, vegetable matter, and other deleterious substances. When tested in accordance with AASHTO T 27, subbase shall conform to Table 03840-6 - Subbase Grading Requirements.

| TABLE 03840-6 - SUBBASE GRADING REQUIREMENTS | | |
|---|--|---|
| Sieve Size | Percent Passing by Weight | |
| | Subbase Material Placed in Top 6 Inches | Subbase Material Placed Below Top 6 Inches |
| 6 Inch | - | 100 |
| 2-1/2 Inch | 100 | - |
| No. 4 | 20 - 60 | 20 - 60 |
| No. 200 | 0 - 15 | 0 - 15 |

When tested in accordance with AASHTO T 176, SE value shall not be less than 25. A minimum SE of 20 shall be provided when material passing No. 4 sieve is entirely crushed coral limestone.

When tested in accordance with AASHTO T 89 and AASHTO T 90, subbase shall conform to Table 03840-7 - Subbase Plasticity Index.

| TABLE 03840-7 - SUBBASE PLASTICITY INDEX | |
|---|-------------------------|
| Percent Passing No. 200 Sieve | Plasticity Index |
| 0 - 9 | 15 Maximum |
| 10 - 15 | 10 Maximum |

1.04 FILTER MATERIAL

Filter material shall consist of hard, tough, durable, lava rock conforming to Table 03840-8 - Filter Material Test Requirements and Table 03840-9 - Filter Material Grading Requirements.

| TABLE 03840-8 - FILTER MATERIAL TEST REQUIREMENTS | | |
|--|----------------------------|--|
| Test | Test Method | Requirement |
| Los Angeles Abrasion | AASHTO T 96 (Grading A) | 10% Maximum @ 100 Rev. 40% Maximum @ 500 Rev. |
| Sand Equivalent | AASHTO T 176 | 35% Minimum |
| Plasticity Index | AASHTO T 90 | 6% Maximum |
| Grading | AASHTO T 27 | Refer to Table 703.04-2 |

| TABLE 03840-9 - FILTER MATERIAL GRADING REQUIREMENTS | |
|---|----------------------------------|
| Sieve Size | Percent Passing by Weight |
| 2 Inch | 100 |
| 1-1/2 Inch | 90 - 100 |
| 3/4 Inch | 50 - 90 |
| No. 4 | 15 - 50 |
| No. 200 | 0 - 5 |

1.05 STRUCTURE BACKFILL MATERIAL

Structure backfill material shall be free of vegetable matter and other deleterious substance and shall conform to Table 03840-10 - Structure Backfill Grading Requirements and other requirements of this subsection. RAP shall not be used for structural backfill material A.

| TABLE 03840-10 - STRUCTURE BACKFILL GRADING REQUIREMENTS | | |
|---|--------------------------------------|--------------------------------------|
| Sieve Size | Percent Passing by Weight | |
| | Structure Backfill Material A | Structure Backfill Material B |
| 3 Inch | 100 | 100 |
| No. 4 | 20 - 75 | 20 - 100 |
| No. 200 | 0 - 15 | - |

SE shall be tested in accordance with AASHTO T 176. Structural backfill material A shall have minimum SE of 20. Structural backfill material B shall have SE equal to or greater than SE of surrounding soil in area to be backfilled.

PART 2 - PRODUCTS

(Not used)

PART 3 - EXECUTION

(Not used)

END OF SECTION

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SECTION 03870

MISCELLANEOUS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Water shall conform to AASHTO M 157, Section 4.1.4 for mixing and curing concrete, mortar and grout. Potable water requires no testing.

Recycled water from mixer wash may be used for mixing concrete if recycling is achieved by dilution. Under this process, extensive dilution and continuous agitation keep solids in a state of suspension. Water reclaimed in this manner shall not contain coloring agents or more than 300 parts per million of alkalis (Na_2O plus $0.658\text{K}_2\text{O}$) as determined by filtration. Specific gravity of recycled wash water shall not exceed 1.03 plus or minus 0.01. Use of recycled water shall be discontinued if there is undesirable reaction with admixtures or aggregates.

Water that has been reclaimed by concentration will not be allowed for use.

Potable water from a local government water supply will be accepted without testing. Contractor shall test water from non-governmental water supply sources to meet criteria of AASHTO M 157 unless Engineer waives test requirements. If requested, Contractor shall submit evidence based on tests made by an independent certified laboratory that water meets the requirements of this subsection.

PART 2 - PRODUCTS

2.1 NONSHRINK GROUT

Nonshrink grout shall be portland cement base, prepackaged, non-metallic, non-gaseous ready to use grout mix and shall be applied as recommended by the manufacturer. Provide a minimum compressive strength of 4,300 pounds per square inch at 3 days and 10,000 pounds per square inch at 28 days. A manufacturer's certificate of compliance shall be submitted. The nonshrink grout shall contain at least 10 grams of migrating amine carboxylate corrosion inhibitor per 0.5 cubic feet of nonshrink grout.

2.2 BONDING AGENT

Bonding agent shall be a three-component, pre-proportioned, anti-corrosion, water-based, epoxy Portland cement and shall have a bond strength exceeding 2,400 pounds per square inch in accordance with ASTM C882.

2.3 ELASTOMERIC BEARING PAD

Elastomeric bearing pad $\frac{1}{2}$ inch and less in thickness shall not be laminated. Pad thicker than $\frac{1}{2}$ inch shall be laminated. Total thickness of pad shall not be less than that specified in contract documents and not greater than $\frac{1}{4}$ inch above specified thickness. Thickness of individual layer shall not exceed specified thickness by more than $\frac{1}{8}$ inch. Length and

width of pad shall not vary more than 1/8 inch from dimensions specified in the contract documents.

Rounding of corners and edges of molded pads is allowed. Radius of corners shall be 3/8 inch maximum. Radius of edges shall be 1/8 inch maximum.

Rubber components of elastomeric laminations shall be at least 60 percent neoprene by volume.

Elastomer of samples and test specimens shall be tested for conformance to Table 03870-1 - Elastomer Requirements Original Physical Properties.

| Table 03870-1 - Elastomer Requirements Original Physical Properties | | |
|--|-------------------------|--------------------|
| TEST | ASTM Designation | Requirement |
| Tensile strength, psi | D 412 | 2,500 min. |
| Elongation at break, percent | D 412 | 350 min. |
| Compression set, 22 hours at 158 degrees F, percent (Method B) | D 395 | 25 max. |
| Tear strength, Pounds per inch (Die C) | D 624 | 250 min. |
| Hardness (Type A) | D 2240 | 60 \pm 5 |
| Ozone resistance, 20 percent strain, 100 hours at 100 degrees F \pm 2 degrees F | D 1149* | No cracks |
| Low temperature stiffness, Young's Modulus at 40 degrees F, psi | D 797 | 10,000 max. |
| After accelerated aging in oven for 70 hours at 212 degrees F the elastomer shall not show deterioration changes in excess of the following: | D 573 | |
| Tensile strength, percent | | \pm 15 |
| Elongation at break, percent change | | - 40 max. |
| Hardness, point | | 0 to \pm 15 |
| *Samples shall be solvent wiped before test to remove surface impurities. | | |

Contractor shall submit to Engineer for acceptance Certificates of Compliance from a independent certified laboratory affirming conformance of elastomeric pads with requirements of this subsection. Certificates shall be submitted before installing elastomeric pads.

Adhesive used to secure pad to concrete shall be as recommended by manufacturer.

PART 3 - EXECUTION

(Not used)

END OF SECTION

Miscellaneous
03870-3

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SECTION 05800

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

The General Provisions of the contract, including General and Special Provisions, General Requirements of the Specifications, and the Drawings apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

A. This section includes, but not limited to, all the design, shop drawings, materials, labor, construction, placement and finishing of structural steel beams, columns, and plates necessary to complete the project.

1.3 SUBMITTALS

The following shall be submitted in accordance with section 01300-SUBMITTALS.

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Show fabrication of structural-steel components.
2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
3. Include erection plans.
4. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.

C. Welding certificates.

D. Qualification Date: For Installer

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.

2. Bolts, nuts, and washers including mechanical properties and chemical analysis.

F. Source quality control test reports.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, “Structural Welding Code - Steel.”
- B. Comply with applicable provisions of the following specifications and documents:
 1. AISC “Manual of Steel Construction”.
 2. AISC Certification Program for Structural Steel Fabricators.

1.5 DELIVERY, STORAGE, AND HANDLING

Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 COORDINATION

Furnish anchorage items to be embedded in or attached to other construction without delaying the work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. W-Shapes: ASTM A 992.
- B. All Plates: ASTM A 36.
- C. All Other Structural Steel: ASTM A 36.
- D. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. Bolts, Nuts, and washers connecting steel to steel: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

2.3 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings-- Allowable Stress Design and LRFD Design.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

2.4 SHOP CONNECTIONS

- A. High Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

Joint Type: Snug tightened unless indicated on drawings.

- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

2.5 SOURCE QUALITY CONTROL

- A. Correct deficiencies in Work that test reports and inspections indicate does

not comply with the Contract Documents.

- B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 3 - EXECUTION

3.1 CONSTRUCTION

Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.2 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard practice for Steel Buildings and Bridges" and Specification for Structural Steel Buildings--Allowable Stress Design and LRFD Design".
- B. Plates: Clean concrete surfaces of bond-reducing materials, and roughen surfaces prior to setting base plates. Clean bottom surface of plates.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure.
- E. Do not use thermal cutting during erection.
- F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.3 FIELD CONNECTIONS

- A. High-Strength Bolts: Field install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

Joint Type: Snug tightened unless indicated on drawings.

- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings - Allowable Stress Design and LRFD Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: The State will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Field-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION

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