TABLE OF CONTENTS

DIVISION 400 - PAVEMENTS		
Section	**Description**	**Pages**
401	Hot Mix Asphalt (HMA) Pavement	401-1a – 401-37a
407	Tack Coat	407-1a
411	Portland Cement Concrete Pavement	411-1a – 411-53a

DIVISION 500 - STRUCTURES		
Section	**Description**	**Pages**
503	Concrete Structures	503-1a – 503-9a
504	Prestressed Concrete Members	504-1a – 504-3a
507	Railings	507-1a
511	Drilled Shafts	511-1a – 511-27a
540	Very Early Strength Latex Modified Concrete (VESLMC)	540-1a – 540-13a

DIVISION 600 - INCIDENTAL CONSTRUCTION		
Section	**Description**	**Pages**
601	Structural Concrete	601-1a – 601-15a
602	Reinforcing Steel	602-1a
603	Culverts and Storm Drains	603-1a
607	Chain Link Fences and Gates	607-1a
614	Street Survey Monuments	614-1a
619	Planting	619-1a
621	Enhanced Vehicle Classification System	621-1a – 621-19a
622	Roadway and Sign Lighting System	622-1a – 622-2a
623	Traffic Signal System	623-1a – 623-6a
624	Water System	624-1a – 624-2a
625	Sewer System	625-1a
626	Manholes and Valve Boxes for Water and Sewer Systems	626-1a
627	Traffic Monitoring And Signal Control System	627-1a – 627-11a
629	Pavement Markings	629-1a – 629-4a
631	Traffic Control Regulatory, Warning, and Miscellaneous Signs	631-1a
634	Portland Cement Concrete Sidewalks	634-1a – 634-2a
636	E-Construction	636-1a – 636-3a
636	Traffic Monitoring and Signal Control System	636-1a – 636-12a
638	Portland Cement Concrete Curb and Gutter	638-1a – 638-2a
641	Hydro-Mulch Seeding	641-1a
645	Work Zone Traffic Control	645-1a
647	Fiber Optic Cable	647-1a – 647-8a

END OF TABLE OF CONTENTS

SECTION 107 - LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

Make the following amendments to said Section:

(l) Amend **Section 107.01 Insurance Requirements** from lines to 81 to read as follows:

> **"(A) Obligation of Contractor.** Contractor shall not commence any work until it obtains, at its own expense, all required insurance described herein. Such insurance shall be provided by an insurance company authorized by the laws of the State to issue such insurance in the State of Hawaii. Coverage by a "Non-Admitted" carrier is permissible provided the carrier has a Best's Rating of "A-VII" or better. The Contractor shall maintain and ensure all insurance policies are current for the full period of the contract until final acceptance of the work by the State. This requirement excludes builders' risk, which will end at substantial completion.
>
> The Certificate of Insurance shall contain: a clause that it is agreed that any insurance maintained by the State of Hawaii will apply in excess of, and not contribute with, insurance provided by this policy; and shall be accompanied by endorsement form CG2010 or equivalent naming the State as an additional insured to the policy which status shall be maintained for the full period of the contract until final acceptance of the work by State.
>
> The Contractor shall obtain all required insurance as part of the contract price. Where there is a requirement for the State of Hawaii and its officers and employees to be named as additional insureds under any Contractor's insurance policy, before the State of Hawaii issues the Notice to Proceed, the Contractor shall obtain and submit to the Engineer a Certificate of Insurance and a written policy endorsement that confirms the State of Hawaii and its officers and employees are additional insureds for the specific State project number and project title under such insurance policies. The written policy endorsement must be issued by the insurance company insuring the Contractor for the specified policy type or by an agent of such insurance company who is vested with the authority to issue a written policy endorsement. The insurer's agent shall also submit written confirmation of such authority to bind the insurer. Any delays in the issuance of the Notice to Proceed attributed to the failure to obtain the proof of the State of Hawaii and its officers and employees' additional insured status shall be charged to the Contractor.

A mere Certificate of Insurance issued by a broker who represents the Contractor (but not the Contractor's insurer), or by any other party who is not authorized to contractually name the State as an additional insured under the Contractor's insurance policy, is not sufficient to meet the Contractor's insurance obligations.

Certificates shall contain a provision that coverages being certified will not be cancelled or materially changed without giving the Engineer at least thirty (30) days prior written notice. Contractor will immediately provide written notice to the Director should any of the insurance policies evidenced on its Certificate of Insurance form be cancelled, reduced in scope or coverage, or not renewed upon expiration. Should any policy be canceled before final acceptance of the work by the State, and the Contractor fails to immediately procure replacement insurance as specified, the State, 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 or to become 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 State harmless pursuant to other provisions of this contract. In no instance will the State'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 be primary and cover the insured for all work to be performed under the contract, all work performed incidental thereto or directly or indirectly connected therewith, including but not limited to traffic detour work, barricades, warnings, diversions, lane closures, and 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 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.

(B) Types of Insurance. 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 any subcontractor or by anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable.

(1) Workers' Compensation. The Contractor shall obtain worker's compensation insurance for all persons whom they 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.

(2) Auto Liability. The Contractor shall obtain Auto Liability Insurance covering all owned, non-owned and hired autos with a Combined single Limit of not less than $1,000,000 per occurrence for bodily injury and property damage with the State of Hawaii named as additional insured. Refer to SPECIAL CONDITIONS for any additional requirements.

(3) General Liability. The Contractor shall obtain General Liability insurance with a limit of not less than $2,000,000 per occurrence and in the Aggregates for each of the following:

(a) Products - Completed/Operations Aggregate,

(b) Personal & Advertising Injury, and

(c) Bodily Injury & Property Damage

The General Liability insurance shall include the State as an Additional Insured. The required limit of insurance may be provided by a single policy or with a combination of primary and excess policies. Refer to SPECIAL CONDITIONS for any additional requirements.

(4) Builders Risk For All Work. The Contractor shall take out a policy of builder's risk insurance for the full replacement value of the project work; from a company licensed or otherwise authorized to do business in the State of Hawaii; naming the State as an additional insured under each policy; and covering all work, labor, and materials furnished by such Contractor and all its subcontractors against loss by fire, windstorm, tsunamis, earthquakes, lightning, explosion, other perils covered by the standard Extended Coverage Endorsement, vandalism, and malicious mischief. Refer to SPECIAL CONDITIONS for any additional requirements."

(II) Amend **Section 107.03 Working Hours; Night Work.** to add the following after line 142:

"Should the Contractor require extended work hours, the Contractor may submit a request to the Engineer. The request shall include dates, duration, location, and type of work. Refer to Section 107.04 Overtime and Nightwork amended herein for Noise Variance requirements."

(III) Amend **Section 107.04 Overtime and Night Work** to add the following after line 158:

"Contractor shall obtain applicable Noise Variance permits and submit to the Engineer copies of the Noise Variance Permits with noise variance hours, control conditions, and restrictions. The Engineer shall review and approve all Noise Variance permit applications prior to the Contractor submitting their application"

(IV) Amend Section 107.10 Furnishing Right-of-Way by adding the following paragraphs after line 279:

"The State DOT is processing Right-of Entry and Rental Agreements with the following property owners and the Contractor shall comply with terms of the Right-of-Entry and Rental Agreements, including but not limited to, the following:

(A) D.R. Horton TMK (1) 9-1-17:194, 195, 196, 201; 9-1-18:012, 019 (portion);
Gagko Hojin Tokai Daigaku TMK (1) 9-1-16:221 (portion);
Grace Pacific TMK (1) 9-1-16:004 (portion);
Hawaiian Electric TMK (1) 9-1-16:182 (portion);
HBP Partners TMK (1) 9-1-18:016 (portion); and
University of Hawaii TMK (1) 9-1-16:179, 183, 220 (portion)

(1) STATE's Responsibility. The State shall be responsible, to the extent permitted by law, for damage or injury caused by the State's officers and employees in the scope of their employment provided that the State's liability for such damage or injury has been determined by a court or agreed to by the State. The State shall pay for such damage and injury provided that funds are appropriate and allotted for that purpose.

(2) Insurance by CONTRACTOR. The State shall require the CONTRACTOR to include the GRANTOR and the STATE as additional insured on the insurance policies (Comprehensive Personal Injury and Property Damage Liability; Automobile Bodily Injury and Property Damage; and Worker's Compensation) that will be prescribed by the proposed Project construction contract. Said insurance policies shall also provide a waiver of subrogation in GRANTOR's favor. The STATE shall require the CONTRACTOR to provide written verification of compliance in

the form of an insurance certificate to the GRANTOR prior to the start of Project construction.

(3) Indemnification by CONTRACTOR. The STATE shall ensure that the CONTRACTOR shall execute an agreement whereby the CONTRACTOR would indemnify the GRANTOR against any liability, including all loss, damages, costs, expenses and attorney's fees, for any damage, if any, or injury to or death of persons when such damage, injury or death is caused by negligence, gross negligence, or willful action of the CONTRACTOR in the exercise of the rights granted under this Agreement; provided that the CONTRACTOR shall not be obligated to indemnify the GRANTOR if and to the extent that such damage, injury, or death is caused by the negligence of the GRANTOR or any of the GRANTOR's officers, employees, agents, licensees, invitees, contractors, representatives, or guests.

(4) Restoration. Upon the full or partial termination of this Agreement, the STATE and/or its contractors shall remove all equipment or tangible personal property from the Property or such portion thereof not required by the STATE and shall restore the ground condition of only of that portion of the Property no longer required by the STATE to the condition as mentioned in the STATE's offer letter to the property owners.

(V) Add **Section 107.18 Citizen and Residential Labor Force** after line 745 to read as follows:

"107.18 Citizen and Residential Labor Force.

(A) Citizen Labor. No person shall be employed as a laborer or mechanic unless such person is a citizen of the United States or eligible to become one; provided that persons without such qualifications may be employed with the approval of the Governor until persons who are citizens and are competent for such services are available for hire.

(B) Residential Labor Force. In accordance with Act 192; SLH 2011, no less than eighty (80) percent of the bidder's labor force working on the contract shall be provided by Hawaii residents. This act applies to all construction procurements under HRS Chapter 103D; however this act does not apply to procurements for professional services under Section 103D-304 and small purchases under Section 103D-305. This act is also applicable to any subcontract of $50,000.00 or more in connection with this contract.

Resident means a person who is physically present in the State of Hawaii at the time the person claims to have established the person's

domicile in the State of Hawaii and shows the person's intent is to make Hawaii the person's primary residence.

(C) Percentage of workforce shall be determined by dividing the labor hours (including subcontractors) provided by residents working on the project divided by the total number of hours worked by all employees of the contractor in the performance of the contract. Hours worked by employees within shortage trades as determined by the Department of Labor and Industrial Relations shall not be included in the calculation of this percentage.

(D) Certification of compliance with the forgoing provisions shall be made by the contractor in the form of a written oath submitted to the Procurement Officer on a monthly basis for the duration of the contract.

(E) Sanctions for non compliance with these provisions are as follows:

(1) With respect to the General Contractor, withholding of payment on the contract until the Contractor or its Subcontractor complies with HRS Chapter 103B as amended by Act 192, SLH 2011.

(2) Proceedings for debarment or suspension of the Contractor or Subcontractor under Hawaii Revised Statutes § 103D-702.

This Section shall not apply when its application will disqualify the State from receiving federal funds or aid."

END OF SECTION 107

Amend **Section 108 – PROSECUTION AND PROGRESS** to read as follows:

"SECTION 108 – PROSECUTION AND PROGRESS

108.01 Notice to Proceed (NTP).

A Notice To Proceed will be issued to the Contractor not more 30 calendar days after the contract certification date. The Engineer may suspend the contract before issuing the Notice To Proceed, in which case the Contractor's remedies are exclusively those set forth in Subsection 108.10 – Suspension of Work.

The Contractor shall be allowed up to 450 calendar days after the Notice to Proceed to begin physical work. The Start Work Date will be established when this period ends or on the actual day that physical work begins, whichever is first. Charging of Contract Time will begin on the Start Work Date. The Contractor shall notify the Engineer, in writing, at least five working days before beginning physical work

In the event that the Contractor fails to start physical work within the time specified, the Engineer may terminate the contract in accordance with Subsection 108.11 – Termination of Contract for Cause.

During the period between the Notice to Proceed and the Start Work Date the Contractor should adjust work forces, equipment, schedules, and procure materials and required permits, prior to beginning physical work.

Any physical work done prior to the Start Work Date will be considered unauthorized work. If the Engineer does not direct that the unauthorized work be removed, it shall be paid for after the Start Work Date and only if it is acceptable.

In the event that the Engineer establishes, in writing, a Start Work Date that is beyond 450 calendar days from the Notice to Proceed date, the Contractor may submit a claim in accordance with, Subsection 107.15 – Disputes and Claims for increased labor and material costs which are directly attributable to the delay beyond the first 450 calendar days after the Notice to Proceed date.

The Contractor shall notify the Engineer at least 24 hours before restarting physical work after a suspension of work pursuant to Subsection 108.10 – Suspension of Work.

Once physical work has begun, the Contractor shall work expeditiously and pursue the work diligently to completion with the contract time. If a portion of the work is to be done in stages, the Contractor shall leave the area safe and usable for the user agency and the public at the end of each stage.

108.02 Prosecution of Work. Unless otherwise permitted by the Engineer, in writing, the Contractor shall not commence with physical construction unless sufficient materials and equipment are available for either continuous construction or completion of a specified portion of the work.

108.03 Preconstruction Submittals. The awardee shall submit to the Engineer for information and review the pre-construction submittals within 21 calendar days from award. Until the items listed below are received and found acceptable by the Engineer, the Contractor shall not start physical work unless otherwise authorized to do so in writing and subject to such conditions set by the Engineer. Charging of Contract Time will not be delayed, and additional contract time will not be granted due to Contractor delay in submitting acceptable preconstruction submittals. No progress payment will be made to the Contractor until the Engineer acknowledges, in writing, receipt of the following preconstruction submittals acceptable to the Engineer:

(1) List of the Superintendent and other Supervisory Personnel, and their contact information.

(2) Name of person(s) authorized to sign for the Contractor.

(3) Work Schedule including hours of operation.

(4) Initial Progress Schedule (See Subsection 108.06 – Progress Schedule).

(5) Water Pollution and Siltation Control Submittals, including Site-Specific Best Management Practice Plan.

(6) Solid Waste Disposal form.

(7) Tax Rates.

(8) Insurance Rates.

(9) Certificate of Insurance, satisfactory to the Engineer, indicating that the Contractor has in place all insurance coverage required by the contract documents.

(10) Schedule of agreed prices.

(11) List of suppliers.

(12) Traffic Control Plan, if applicable.

108.04 Character and Proficiency of Workers. The Contractor shall at all times provide adequate supervision and sufficient labor and equipment for prosecuting the work to full completion in the manner and within the time required by the contract. The superintendent and all other representatives of the Contractor shall act in a civil and honest manner in all dealings with the Engineer, all other State officials and representatives, and the public, in connection with the work.

All workers shall possess the proper license, certification, job classification, skill, training, and experience necessary to properly perform the work assigned to them.

The Engineer may direct the removal of any worker(s) who does not carry out the assigned work in a proper and skillful manner or who is disrespectful, intemperate, violent, or disorderly. The worker shall be removed forthwith by the Contractor and will not work again without the written permission of the Engineer.

108.05 Contract Time.

(A) Calculation of Contract Time. When the contract time is on a working day basis, the total contract time allowed for the performance of the work will be the number of working days shown in the contract plus any additional working days authorized in writing as provided hereinafter. The count of elapsed working days to be charged against contract time, will begin from the Start Work Date and will continue consecutively to the date of Substantial Completion. When multiple shifts are used to perform the work, the State will not consider the hours worked over the normal eight working hours per day or night as an additional working day.

When the contract is on a calendar day basis, the total contract time allowed for the performance of the work will be the number of days shown in the contract plus any additional days authorized in writing as provided hereinafter. The count of elapsed days to be charged against contract time will begin from the Start Work Date and will continue consecutively to the date of Substantial Completion. The Engineer will exclude days elapsing between the orders of the Engineer to suspend work and resume work for suspensions not the fault of the Contractor.

(B) Modifications of Contract Time. Whenever the Contractor believes that an extension of contract time is justified, the Contractor shall serve written notice on the Engineer not more than five working days after the occurrence of the event that causes a delay or justifies a contract time extension. Contract time may be adjusted for the following reasons or events, but only if and to the extent the critical path has been affected:

(1) Changes in the Work, Additional Work, and Delays Caused by the State. If the Contractor believes that an extension of time is justified on account of any act or omission by the State, and is not adequately provided for in a field order or change order, it must request the additional time as provided above. At the request of the Engineer, the Contractor must show how the critical path will be affected and must also support the time extension request with schedules, as well as statements from its subcontractors, suppliers, or manufacturers, as necessary. Claims for compensation for any altered or additional work will be determined pursuant to Subsection 104.02 – Changes.

Additional time to perform the extra work will be added to the time allowed in the contract without regard to the date the change directive was issued, even if the contract completion date has passed. A change requiring time issued after contract time has expired will not constitute an excusal or waiver of pre-existing Contractor delay.

(2) Delay for Permits. For delays in the routine application and processing time required to obtain necessary permits, including permits to be obtained from State agencies, the Engineer may grant an extension provided that the permit takes longer than 30 days to acquire and the delay is not caused by the Contractor, and provided that as soon as the delay occurs, the Contractor notifies the Engineer in writing that the permits are not available. Permits required by the contract that take less than 30 days to acquire from the time which the appropriate documents are granted shall be acquired between Notice to Proceed and Start Work Date or accounted for in the contractor's progress schedule. Time extensions will be the exclusive relief granted on account of such delays.

(3) Delays Beyond Contractor's Control. For delays caused by acts of God, a public enemy, fire, inclement weather days or adverse conditions resulting therefrom, earthquakes, floods, epidemics, quarantine restrictions, labor disputes impacting the Contractor or the State, freight embargoes and other reasons beyond the Contractor's control, the Contractor may be granted an extension of time provided that:

(a) In the written notice of delay to the Engineer, the Contractor describes possible effects on the completion date of the contract. The description of delays shall:

1. State specifically the reason or reasons for the delay and fully explain in a detailed chronology how the delay affects the critical path.

2. Include copies of pertinent documentation to support the time extension request.

3. Cite the anticipated period of delay and the time extension requested.

4. State either that the above circumstances have been cleared and normal working conditions restored as of a certain day or that the above circumstances will continue to prevent completion of the project.

(b) The Contractor shall notify the Engineer in writing when the delay ends. Time extensions will be the exclusive relief granted and no additional compensation will be paid the Contractor for such delays.

(4) Delays in Delivery of Materials or Equipment. Due to COVID 19 and other supply chain issues, the Contractor shall anticipate delays into the project schedule at the time of bidding. Delay costs proven not anticipated at the time of bidding may be considered additional costs. For delays in delivery of materials or equipment, which occur as a result of unforeseeable causes beyond the control and without fault of the Contractor, its subcontractor(s) or supplier(s), time extensions shall be the exclusive relief granted and no additional compensation will be paid the Contractor on account of such delay. The delay shall not exceed the difference between the originally scheduled delivery date and the actual delivery date. The Contractor may be granted an extension of time provided that it complies with the following procedures:

(a) The Contractor's written notice to the Engineer must describe the delays and state the effect such delays may have on the critical path.

(b) The Contractor, if requested, must submit to the Engineer within five days after a firm delivery date for the material and equipment is established, a written statement regarding the delay. The Contractor must justify the delay as follows:

1. State specifically all reasons for the delay. Explain in a detailed chronology the effect of the delay on the critical path.

2. Submit copies of purchase order(s), factory invoice(s), bill(s) of lading, shipping manifest(s), delivery tag(s), and any other documents to support the time extension request.

3. Cite the start and end date of the delay and the time extension requested.

(5) Delays for Suspension of Work. When the performance of the work is totally suspended for one or more days (calendar or working days, as appropriate) by order of the Engineer in accordance with Subsections 108.10(A)(1), 108.10(A)(2), or 108.10(A)(5) the number of days from the effective date of the Engineer's order to suspend operations to the effective date of the Engineer's order to resume operations shall not be counted as contract time and the contract completion date will be adjusted. During periods of partial suspensions of the work, the Contractor will be granted a time extension only if the partial suspension affects the critical path. If the Contractor believes that an extension of time is justified for a partial suspension of work, it must request the extension in writing at least five working days before the partial suspension will affect the critical operation(s) in progress. The Contractor must show how the critical path was increased based on the status of the work and must also support its claim if requested, with statements from its subcontractors. A suspension of work will not constitute a waiver of pre-existing Contractor delay.

(6) Contractor Caused Delays. No time extension will be granted under the following circumstances:

(a) Delays within the Contractor's control in performing the work caused by the Contractor, subcontractor, supplier, or any combination thereof.

(b) Delays within the Contractor's control in arrival of materials and equipment caused by the Contractor, subcontractor, supplier, or any combination thereof, in ordering, fabricating, and delivery.

(c) Delays requested for changes which do not affect the critical path.

(d) Delays caused by the failure of the Contractor to make submittals in a timely manner for review and acceptance by the Engineer, such as but not limited to shop drawings, descriptive sheets, material samples, and color samples except as covered in Subsection 108.05(B)(3) – Delays Beyond Contractor's Control and 108.05(B)(4) – Delays in Delivery of Materials or Equipment.

(e) Delays caused by the failure to submit sufficient information and data in a timely manner in the proper form in order to obtain necessary permits related to the work.

(f) Failure to follow the procedure within the time allowed by contract to request a time extension.

(g) Failure of the Contractor to provide evidence sufficient to support the time extension request.

(7) Reduction in Time. If the State deletes or modifies any portion of the work, an appropriate reduction of contract time may be made in accordance with Subsection 104.02 - Changes.

108.06 Progress Schedules.

(A) Forms of Schedule. All schedules shall be submitted using the specific computer program designated in the bid documents. If no such scheduling software program is designated, then all schedules shall be submitted using the latest version of Microsoft Project by Microsoft or approved equivalent software program.

Schedule submittals shall be as follows:

(1) For Contracts $2,000,000 or less or For Contract Time 100 Working Days or 140 Calendar Days or Less. For contracts of $2,000,000 or less or for contract time of 100 working days or 140 calendar days or less, the progress schedule will be a Time Scaled Logic Diagram (TSLD). The Contractor shall submit a TSLD submittal package meeting the following requirements and having these essential and distinctive elements:

(a) The major features of work, such as but not limited to BMP installation, grubbing, roadway excavation, structure excavation, structure construction, shown in the chronological order in which the Contractor proposes to work that feature or work and its location on the project. The schedule shall account for normal inclement weather, unusual soil or other

conditions that may influence the progress of the work, schedules, and coordination required by any utility, off or on site fabrications, and other pertinent factors that relate to progress;

(b) All features listed or not listed in the contract documents that the Contractor considers a controlling factor for the timely completion of the contract work.

(c) The time span and sequence of the activities or events for each feature, and its interrelationship and interdependencies in time and logic to other features in order to complete the project.

(d) The total anticipated time necessary to complete work required by the contract.

(e) A chronological listing of critical intermediate dates or time periods for features or milestones or phases that can affect timely completion of the project.

(f) Major activities related to the location on the project.

(g) Non-construction activities, such as submittal and acceptance periods for shop drawings and material, procurement, testing, fabrication, mobilization, and demobilization or order dates of long lead material.

(h) Set schedule logic for out of sequence activities to retain logic. In addition, open ends shall be non-critical.

(i) Show target bars for all activities.

(j) Vertical and horizontal sight lines both major and minor shall be used as well as a separator line between groups. The Engineer will determine frequency and style.

(k) The file name, print date, revision number, data and project title and number shall be included in the title block.

(l) Have columns with the appropriate data in them for activity ID, description, original duration, remaining duration, early start, early finish, total float, percent complete, resources. The resource column shall list who is responsible for the work to be done in the activity. These columns shall be to the left of the bar chart.

(2) For Contracts Which Have A Contract Amount More Than $2,000,000 Or Having A Contract Time Of More Than 100 Working Days Or 140 Calendar Days. For contracts which have a contract amount more than $2,000,000 or contract time of more than 100 working days or 140 calendar days, the Contractor shall submit a Timed-Scaled Logic Diagram (TSLD) meeting the following requirements and having these essential and distinctive elements:

(a) The information and requirements listed in Subsection 108.06(A)(1) – For Contracts $2,000,000 or Less or For Contract Time 100 Working Days or 140 Calendar Days or Less.

(b) Additional reports and graphics available from the software as requested by the Engineer.

(c) Sufficient detail to allow at least weekly monitoring of the Contractor and subcontractor's operations.

(d) The time scaled schematic shall be on a calendar or working days basis. What will be used shall be determined by how the contract keeps track of time. It will be the same. Plot the critical calendar dates anticipated.

(e) Breakdown of activity, such as forming, placing reinforcing steel, concrete pouring and curing, and stripping in concrete construction. Indicate location of work to be done in such detail that it would be easily determined where work would be occurring within approximately 200 feet.

(f) Latest start and finish dates for critical path activities.

(g) Identify responsible subcontractor, supplier, and others for their respective activity.

(h) No individual activity shall have duration of more than 20 calendar days unless requested and approved by the Engineer.

(i) All activities shall have work breakdown structure codes and activity codes. The activity codes shall have coding that incorporates information for phase, location, who is responsible for doing work and type of operation and activity description.

(j) Incorporate all physical access and availability restraints.

(B) Inspection and Testing. All schedules shall provide reasonable time and opportunity for the Engineer to inspect and test each work activity.

(C) Engineer's Acceptance of Progress Schedule. The submittal of, and the Engineer's receipt of any progress schedule, shall not be deemed an agreement to modify any terms or conditions of the contract. Any modifications to the contract terms and conditions that appear in or may be inferred from an acceptable schedule will not be valid or enforceable unless and until the Engineer exercises discretion to issue an appropriate change order. Nor shall any submittal or receipt imply the Engineer's approval of the schedule's breakdown, its individual elements, any critical path that may be shown, nor shall it obligate the State to make its personnel available outside normal working hours or the working hours established by the Contract in order to accommodate such schedule. The Contractor has the risk of all elements (whether or not shown) of the schedule and its execution. No claim for additional compensation, time, or both, shall be made by the Contractor or recognized by the Engineer for delays during any period for which an acceptable progress schedule or an updated progress schedule as required by Subsection 108.06(E) – Contractor's Continuing Schedule Submittal Requirements had not been submitted. Any acceptance or approval of the schedule shall be for general format only and shall not be deemed an agreement by the State that the construction means, methods, and resources shown on the schedule will result in work that conforms to the contract requirements or that the sequences or durations indicated are feasible.

(D) Initial Progress Schedule. The Contractor shall submit an initial progress schedule. The initial progress schedule shall consist of the following:

(1) Four sets of the TSLD schedule.

(2) All the software files and data to re-create the TSLD in a computerized software format as specified by the Engineer.

(3) A listing of equipment that is anticipated to be used on the project. Including the type, size, make, year of manufacture, and all information necessary to identify the equipment in the Rental Rate Blue Book for Construction Equipment.

(4) An anticipated manpower requirement graph plotting contract time and total manpower requirement. This may be superimposed over the payment graph.

(5) A Method Statement that is a detailed narrative describing the work to be done and the method by which the work shall be accomplished for each major activity. A major activity is an activity that has one or more of the following:

(a) Has a duration longer than five days.

(b) Is a milestone activity.

(c) Is a contract item that exceeds $10,000 on the contract cost proposal.

(d) Is a critical path activity.

(e) Is an activity designated as such by the Engineer.

Each Method Statement shall include the following items needed to fulfill the schedule:

(a) Quantity, type, make, and model of equipment.

(b) The manpower to do the work, specifying worker classification.

(c) The production rate per eight hour day, or the working hours established by the contract documents needed to meet the time indicated on the schedule. If the production rate is not for eight hours, the number of working hours shall be indicated.

(6) Two sets of color time-scaled project evaluation and review technique charts ("PERT") using the activity box template of Logic – Early Start or such other template designated by the Engineer.

If the contract documents establish a sequence or order for the work, the initial progress schedule shall conform to such sequence or order.

(E) Contractor's Continuing Schedule Submittal Requirements. After the acceptance of the initial TSLD and when construction starts, the Contractor shall submit four plotted progress schedules, two PERT charts, and reports on all construction activities every two weeks (bi-weekly). This scheduled bi-weekly submittal shall also include an updated version of the project schedule in a computerized software format as specified by the Engineer. The submittal shall have all the information needed to re-create that time period's TSLD plot and reports. The bi-weekly submittal shall include, but not limited to, an update of activities based on actual durations,

all new activities and any changes in duration or start or finish dates of any activity.

The Contractor shall submit with every update, in report form acceptable to the Engineer, a list of changes to the progress schedule since the previous schedule submittal. The Engineer may change the frequency of the submittal requirements but may not require a submittal of the schedule to be more than once a week. The Engineer may decrease the frequency of the submittal of the bi-weekly schedule.

The Contractor shall submit updates of the anticipated work completion graph, equipment listing, manpower requirement graph or method statement when requested by the Engineer. The Contractor shall submit such updates within 4 calendar days from the date of the request by the Engineer.

The Engineer may withhold progress payment until the Contractor is in compliance with all schedule update requirements

(F) Float. All float appearing on a schedule is a shared commodity. Float does not belong to or exist for the exclusive use or benefit of either the State or the Contractor. The State or the Contractor has the opportunity to use available float until it is depleted. Float has no monetary value.

(G) Scheduled Meetings. The Contractor shall meet on a bi-weekly basis with the Engineer to review the progress schedule. The Contractor shall have someone attending the meeting that can answer all questions on the TSLD and other schedule related submittals.

(H) Accelerated Schedule; Early Completion. If the Contractor submits an accelerated schedule (shorter than the contract time), the Engineer's review and acceptance of an accelerated schedule does not constitute an agreement or obligation by the State to modify the contract time or completion date. The Contractor is solely responsible for and shall accept all risks and any delays, other than those that can be directly and solely attributable to the State, that may occur during the work, until the contract completion date. The contract time or completion date is established for the benefit of the State and cannot be changed without an appropriate change order or Substantial Completion granted by the State. The State may accept the work before the completion date is established, but is not obligated to do so.

If the TSLD indicates an early completion of the project, the Contractor shall, upon submittal of the schedule, cooperate with the Engineer in explaining how it will be achieved. In addition, the Contractor shall submit the above explanation in writing which shall include the State's part, if any, in achieving the early completion date. Early completion of the project shall not rely on changes to the Contract Documents unless approved by the Engineer.

(l) Contractor Responsibilities. The Contractor shall promptly respond to any inquiries from the Engineer regarding any schedule submission. The Contractor shall adjust the schedule to address directives from the Engineer and shall resubmit the TSLD package to the Engineer until the Engineer finds it acceptable.

The Contractor shall perform the work in accordance with the submitted TSLD. The Engineer may require the Contractor to provide additional work forces and equipment to bring the progress of the work into conformance with the TSLD at no increase in contract price or contract time whenever the Engineer determines that the progress of the work does not insure completion within the specified contract time.

108.07 Weekly Meeting. In addition to the bi-weekly schedule meetings, the Contractor shall be available to meet once a week with the Engineer at the time and place as determined by the Engineer to discuss the work and its progress including but not limited to, the progress of the project, potential problems, coordination of work, submittals, erosion control reports, etc. The Contractor's personnel attending shall have the authority to make decisions and answer questions.

The Contractor shall bring to weekly meetings a detailed work schedule showing the next three weeks' work. Directly submit an informational copy of the three-week schedule to the Material Testing Research Branch (MTRB) on the same day as the weekly meeting is held or was to be held. An informational copy is for informational use only and requires no response or further action from the MTRB. Number of copies of the detailed work schedule to be submitted will be determined by the Engineer. The three-week schedule is in addition to the TSLD and shall in no way be considered as a substitute for the TSLD or vice versa. The three-week schedule shall show:

(a) All construction events, traffic control and BMP related activities in such detail that the Engineer will be able to determine at what location and type of work will be done for any day for the next three weeks. This is for the State to use to plan its manpower requirements for that time period.

(b) The duration of all events and delays.

(c) The critical path clearly marked in red or marked in a manner that makes it clearly distinguishable from other paths and is acceptable to the Engineer.

(d) Critical submittals and requests for information (RFI's).

(e) The project title, project number, date created, period the schedule covers, Contractor's name and creator of the schedule on each page.

Two days prior to each weekly meeting, the Contractor shall submit a list of outstanding submittals, RFIs and issues that require discussion.

108.08 Liquidated Damages for Failure to Complete the Work or Portions of the Work on Time. The actual amount of damages resulting from the Contractor's failure to complete the contract in a timely manner is difficult to accurately determine. Therefore, the amount of such damages shall be liquidated damages as set forth herein and in the special provisions. The State may, at its discretion, deduct the amount from monies due or that may become due under the contract.

When the Contractor fails to reach substantial completion of the work for which liquidated damages are specified, within the time or times fixed in the contract or any extension thereof, in addition to all other remedies for breach that may be available to the State, the Contractor shall pay liquidated damages to the State, in the amount of $25,000 per working day.

(A) Liquidated Damages Upon Termination. If the State terminates on account of Contractor's default, liquidated damages may be charged against the defaulting Contractor and its surety until final completion of work.

(B) Liquidated Damages for Failure to Complete the Punchlist. The Contractor shall complete the work on any punchlist created after the pre-final inspection, within the contract time or any extension thereof.

When the Contractor fails to complete the work on such punchlist within the contract time or any extension thereof, the Contractor shall pay liquidated damages to the State of 20 percent of the amount of liquidated damages established for failure to substantially complete the work within contract time. Liquidated damages shall not be assessed for the period between:

(1) Notice from the Contractor that the project is substantially complete and the time the punchlist is delivered to the Contractor.

(2) The date of the completion of punchlist as determined by the Engineer and the date of the successful final inspection, and

(3) The date of the Final Inspection that results in Substantial Completion and the receipt by the Contractor of the written notice of Substantial Completion.

(C) Actual Damages Recoverable If Liquidated Damages Deemed Unenforceable. In the event a court of competent jurisdiction holds that any liquidated damages assessed pursuant to this contract are unenforceable, the State will be entitled to recover its actual damages for Contractor's failure to complete the work, or any designated portion of the work within the time set by the contract.

108.09 Rental Fees for Unauthorized Lane Closure or Occupancy. In addition to all other remedies available to the State for Contractor's breach of the terms of the contract, the Engineer will assess the rental fees in the amount of $500 for every one-to fifteen-minute increment or portion thereof, for each location, for each roadway lane closed to public use or encroached upon or occupied beyond the time periods authorized in the contract or by the Engineer. The State may, at its discretion, deduct the amount from monies due or that may become due under the contract. The rental fee may be waived in whole or part if the Engineer determines that the unauthorized period of lane closure or occupancy was due to factors beyond the control of the Contractor. Equipment breakdown is not a cause to waive liquidated damages.

108.10 Suspension of Work.

(A) Suspension of Work. The Engineer may, by written order, suspend the performance of the work, either in whole or in part, for such periods as the Engineer may deem necessary, for any cause, including but not limited to:

(1) Weather or soil conditions considered unsuitable for prosecution of the work.

(2) Whenever a redesign that may affect the work is deemed necessary by the Engineer.

(3) Unacceptable noise or dust arising from the construction even if it does not violate any law or regulation.

(4) Failure on the part of the Contractor to:

(a) Correct conditions unsafe for the general public or for the workers.

(b) Carry out orders given by the Engineer.

(c) Perform the work in strict compliance with the provisions of the contract.

(d) Provide adequate supervision on the jobsite.

(5) The convenience of the State.

(B) Partial and Total Suspension. Suspension of work on some but not all items of work shall be considered a "partial suspension". Suspension of work on all items shall be considered "total suspension". The period of suspension shall be computed from the date set out in the written order for work to cease until the date of the order for work to resume.

(C) Reimbursement to Contractor. In the event that the Contractor is ordered by the Engineer in writing as provided herein to suspend all work under the contract for the reasons specified in Subsections 108.10(A)(2), 108.10(A)(3), or 108.10(A)(5) of the "Suspension of Work" paragraph, the Contractor may be reimbursed for actual direct costs incurred on work at the jobsite, as authorized in writing by the Engineer, including costs expended for the protection of the work. An allowance of 5 percent for indirect categories of delay costs will be paid on any reimbursed direct costs, including extended branch and home-office overhead and delay impact costs. No allowance will be made for anticipated profits. Payment for equipment which is ordered to standby during such suspension of work shall be made as described in Subsection 109.06(H) - Idle and Standby Equipment.

(D) Cost Adjustment. If the performance of all or part of the work is suspended for reasons beyond the control of the Contractor except an adjustment shall be made for any increase in cost of performance of this contract (excluding profit) necessarily caused by such suspension, and the contract modified in writing accordingly.

However, no adjustment to the contract price shall be made for any suspension, delay, or interruption:

(1) For weather related conditions.

(2) To the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor.

(3) Or, for which an adjustment is provided for or excluded under any other provision of this Contract.

(E) Claims for Adjustment. Any adjustment in contra price made shall be determined in accordance with Subsections 104.02 – Changes and 104.06 – Methods of Price Adjustment.

Any claims for such compensation shall be filed in writing with the Engineer within 30 days after the date of the order to resume work or the claim will not be considered. The claim shall conform to the requirements of Subsection 107.15(D) – Making of a Claim. The Engineer will take the claim under consideration, may make such investigations as are deemed necessary and will be the sole judge as to the equitability of the claim. The Engineer's decision will be final.

(F) No Adjustment. No provision of this clause shall entitle the Contractor to any adjustments for delays due to failure of its surety, the cancellation or expiration of any insurance coverage required by the contract documents, for suspensions made at the request of the Contractor, for any delay required under the contract, for suspensions, either partial or whole, made by the Engineer under Subsection 108.10(A)(4) of the "Suspension of work" paragraph.

108.11 Termination of Contract for Cause.

(A) Default. If the Contractor refuses or fails to perform the work, or any separable part thereof, with such diligence as will assure its completion within the time specified in this contract, or any extension thereof, or commits any other material breach of this contract, and further fails within seven days after receipt of written notice from the Engineer to commence and continue correction of the refusal or failure with diligence and promptness, the Engineer may, by written notice to the Contractor, declare the Contractor in breach and terminate the Contractor's right to proceed with the work or the part of the work as to which there has been delay or other breach of contract. In such event, the State may take over the work, perform the same to completion, by contract or otherwise, and may take possession of, and utilize in completing the work, the materials, appliances, and plants as may be on the site of the work and necessary therefore. Whether or not the Contractor's right to proceed with the work is terminated, the Contractor and the Contractor's sureties shall be liable for any damage to the State resulting from the Contractor's refusal or failure to complete the work within the specified time.

(B) Additional Rights and Remedies. The rights and remedies of the State provided in this contract are in addition to any other rights and remedies provided by law.

(C) Costs and Charges. All costs and charges incurred by the State, together with the cost of completing the work under contract, will be deducted from any monies due or which would or might have become due to the Contractor had it been allowed to complete the work under the contract. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay the State the amount of the excess.

In case of termination, the Engineer will limit any payment to the Contractor to the part of the contract satisfactorily completed at the time of termination. Payment will not be made until the work has satisfactorily been completed and all required documents, including the tax clearance required by Subsection 109.11 – Final Payment are submitted by the Contractor. Termination shall not relieve the Contractor or Surety from liability for liquidated damages.

(D) Erroneous Termination for Cause. If, after notice of termination of the Contractor's right to proceed under this section, it is determined for any reason that good cause did not exist to allow the State to terminate as provided herein, the rights and obligations of the parties shall be the same as, and the relief afforded the Contractor shall be limited to, the provisions contained in Subsection 108.12 – Termination for Convenience.

108.12 Termination For Convenience.

(A) Terminations. The Director may, when the interests of the State so require, terminate this contract in whole or in part, for the convenience of the State. The Director will give written notice of the termination to the Contractor specifying the part of the contract terminated and when termination becomes effective.

(B) Contractor's Obligations. The Contractor shall incur no further obligations in connection with the terminated work and on the date set in the notice of termination the Contractor shall stop work to the extent specified. The Contractor shall also terminate outstanding orders and subcontracts as they relate to the terminated work. The Contractor shall settle the liabilities and claims arising out of the termination of subcontracts and orders connected with the terminated work subject to the State's approval. The Engineer may direct the Contractor to assign the Contractor's right, title, and interest under terminated orders or subcontracts to the State. The Contractor must still complete the work not terminated by the notice of termination and may incur obligations as necessary to do so.

(C) Right to Construction and Goods. The Engineer may require the Contractor to transfer title and to deliver to the State in the manner and to the extent directed by the Engineer, the following:

(1) Any completed work.

(2) Any partially completed construction, goods, materials, parts, tools, dies, jigs, fixtures, drawings, information, and contract rights (hereinafter called "construction material") that the Contractor has specifically produced or specially acquired for the performance of the terminated part of this contract.

(3) The Contractor shall protect and preserve all property in the possession of the Contractor in which the State has an interest. If the Engineer does not elect to retain any such property, the Contractor shall use its best efforts to sell such property and construction materials for the State's account in accordance with the standards of HRS Chapter 490:2-706.

(D) Compensation.

(1) The Contractor shall submit a termination claim specifying the amounts due because of the termination for convenience together with cost or pricing data, submitted to the extent required by HAR Subchapter 15, Chapter 3-122. If the Contractor fails to file a termination claim within one year from the effective date of termination, the Engineer may pay the Contractor, if at all, an amount set in accordance with Subsection 108.12(D)(3).

(2) The Engineer and the Contractor may agree to a settlement provided the Contractor has filed a termination claim supported by cost or pricing data submitted as required and that the settlement does not exceed the total contract price plus settlement costs reduced by payments previously made by the State, the proceeds of any sales of construction, supplies, and construction materials under Subsection 108.12(C)(3), and the proportionate contract price of the work not terminated.

(3) Absent complete agreement, the Engineer will pay the Contractor the following amounts less any payments previously made under the contract:

(a) The cost of all contract work performed prior to the effective date of the notice of termination work plus a 5 percent markup on the actual direct costs, including amounts paid to subcontractor, less amounts paid or to be paid for

completed portions of such work; provided, however, that if it appears that the Contractor would have sustained a loss if the entire contract would have been completed, no markup shall be allowed or included and the amount of compensation shall be reduced to reflect the anticipated rate of loss. No anticipated profit or consequential damage will be due or paid.

(b) Subcontractors shall be paid a markup of 10 percent on their direct job costs incurred to the date of termination. No anticipated profit or consequential damage will be due or paid to any subcontractor. These costs must not include payments made to the Contractor for subcontract work during the contract period.

(c) The total sum to be paid the Contractor shall not exceed the total contract price reduced by the amount of any sales of construction supplies, and construction materials.

(4) Cost claimed, agreed to, or established by the State shall be in accordance with HAR Chapter 3-123.

108.13 Pre-Final and Final Inspections.

(A) Inspection Requirements. Before the Engineer undertakes a final inspection of any work, a pre-final inspection must first be conducted. The Contractor shall notify the Engineer that the work has reached substantial completion and is ready for pre-final inspection.

(B) Pre-Final Inspection. Before notifying the Engineer that the work has reached substantial completion, the Contractor shall inspect the project and test all installed items with all of its subcontractors as appropriate. The Contractor shall also submit the following documents as applicable to the work:

(1) All written guarantees required by the contract.

(2) Two accepted final field-posted drawings as specified in Section 648 – Field-Posted Drawings;

(3) Complete weekly certified payroll records for the Contractor and Subcontractors.

(4) Certificate of Plumbing and Electrical Inspection.

(5) Certificate of building occupancy as required.

(6) Certificate of Soil and Wood Treatments.

(7) Certificate of Water System Chlorination.

(8) Certificate of Elevator Inspection, Boiler and Pressure Pipe Inspection.

(9) Maintenance Service Contract and two copies of a list of all equipment installed.

(10) Current Tax clearance. The contractor will be required to submit an additional tax clearance certificate when the final payment is made.

(11) And any other final items and submittals required by the contract documents.

(C) Procedure. When in compliance with the above requirements, the Contractor shall notify the Engineer in writing that the project has reached substantial completion and is ready for pre-final inspection.

The Engineer will then make a preliminary determination as to whether or not the project is substantially complete and ready for pre-final inspection. The Engineer may, in writing, postpone until after the pre-final inspection the Contractor's submittal of any of the items listed in Subsection 108.13(B) – Pre-Final Inspection, herein, if in the Engineer's discretion it is in the interest of the State to do so.

If, in the opinion of the Engineer, the project is not substantially complete, the Engineer will provide the Contractor a punchlist of specific deficiencies in writing which must be corrected or finished before the work will be ready for a pre-final inspection. The Engineer may add to or otherwise modify this punchlist from time to time. The Contractor shall take immediate action to correct the deficiencies and must repeat all steps described above including written notification that the work is ready for pre-final inspection.

After the Engineer is satisfied that the project appears substantially complete a final inspection shall be scheduled within ten working days after receipt of the Contractor's latest letter of notification that the project is ready for final inspection.

If, as a result of the pre-final inspection, the Engineer determines the work is not substantially complete, the Engineer will inform the Contractor in writing as to specific deficiencies which must be corrected before the work will be ready for another pre-final inspection. If the Engineer finds the work

is substantially complete but finds deficiencies that must be corrected before the work is ready for final inspection, the Engineer will prepare in writing and deliver to the Contractor a punchlist describing such deficiencies. At any time before final acceptance, the Engineer may revoke the determination of substantial completion if the Engineer finds that it was not warranted and will notify the Contractor in writing the reasons therefore together with a description of the deficiencies negating the declaration.

When the date of substantial completion has been determined by the State, liquidated damages for the failure to complete the punchlist, if due to the State will be assessed in pursuant to Subsection 108.08(B) - Liquidated Damages for Failure to Complete the Punchlist.

(D) Punchlist; Clean Up and Final Inspection. Upon receiving a punchlist after pre-final inspection, the Contractor shall promptly devote all required time, labor, equipment, materials and incidentals to correct and remedy all punchlist deficiencies. The Engineer may add to or otherwise modify this punchlist until substantial completion of the project.

Before final inspection of the work, the Contractor shall clean all ground occupied by the Contractor in connection with the work of all rubbish, excess materials temporary structures and equipment, shall remove all graffiti and defacement of the work and all parts of the work and the worksite must be left in a neat and presentable condition to the satisfaction of the Engineer.

Final inspection will occur within ten working days after the Contractor notifies the Engineer in writing that all punchlist deficiencies remaining after the pre-final inspection have been completed and the Engineer concurs. If the Engineer determines that deficiencies still remain at the final inspection, the work will not be accepted and the Engineer will notify the Contractor, in writing, of the deficiencies which shall be corrected and the steps above repeated.

If the Contractor fails to correct the deficiencies and complete the work by the established or agreed date, the State may correct the deficiencies by whatever method it deems appropriate and deduct the cost from any payments due the Contractor.

108.14 Substantial Completion and Final Acceptance.

(A) Substantial Completion. When the Engineer finds that the Contractor has satisfactorily completed all work for the project in compliance with the contract, with the exception of the planting period and the plant establishment period, the Engineer will notify the Contractor, in writing, of the project's substantial completion, effective as of the date of the

final inspection. The substantial completion date shall determine end of contract time and relieve contractor of any additional accumulation of liquidated damages for failure to complete the punchlist.

(B) Final Acceptance. When the Engineer finds that the Contractor has satisfactorily completed all contract work in compliance with the contract including all plant establishment requirements, and all the materials have been accepted by the State, the Engineer will issue a Final Acceptance Letter. The Final Acceptance date shall determine the commencement of all guaranty periods subject to Subsection 108.16 – Contractor's Responsibility for Work; Risk of Loss or Damage.

108.15 Use of Structure or Improvement. The State has the right to use the structure, equipment, improvement, or any part thereof, at any time after it is considered by the Engineer as available. In the event that the structure, equipment or any part thereof is used by the State before final acceptance, the Contractor is not relieved of its responsibility to protect and preserve all the work until final acceptance.

108.16 Contractor's Responsibility for Work; Risk of Loss or Damage. Contractor's Responsibility for Work; Risk of Loss or Damage. Until Substantial Completion or when the Work is put to its intended use, whichever occurs earlier, the Contractor shall take every precaution against loss or damage to any part of the work from any cause whatsoever, whether arising from the performance or from the non-performance of the work. The Contractor shall rebuild, repair, restore, and make good all loss or damage to any portion of the work resulting from any cause before Substantial Completion or when the Work is put to its intended use, whichever occurs earlier and shall bear the risk and expense thereof.

108.17 Guarantee of Work.

(1) Regardless of, and in addition to, any manufacturers' warranties, all work and equipment shall be guaranteed by the Contractor against defects in materials, equipment or workmanship for one year from the date of final acceptance or as otherwise specified in the contract documents.

(2) When the Engineer determines that repairs or replacements of any guaranteed work and equipment is necessary due to materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the contract, the Contractor shall, at no increase in contract price or contract time, and within five working days of receipt of written notice from the State, commence to all of the following:

(a) Correct all noted defects and make replacements, as directed by the Engineer, in the equipment and work.

(b) Repair or replace to new or pre-existing condition any damages resulting from such defective materials, equipment or installation thereof.

(3) The State will be entitled to the benefit of all manufacturers and installers warranties that extend beyond the terms of the Contractor's guaranty regardless of whether or not such extended warranty is required by the contract documents. The Contractor shall prepare and submit all documents required by the providers of such warranties to make them effective, and submit copies of such documents to the Engineer. If an available extended warranty cannot be transferred or assigned to the State as the ultimate user, the Contractor shall notify the Engineer who may direct that the warranted items be acquired in the name of the State as purchaser.

(4) If a defect is discovered during a guarantee period, all repairs and corrections to the defective items when corrected shall be guaranteed for a new duration equal to the original full guarantee period. The running of the guarantee period shall be suspended for all other work affected by any defect. The guarantee period for all other work affected by any such defect shall restart for its remaining duration upon confirmation by the Engineer that the deficiencies have been repaired or remedied.

(5) Nothing in this section is intended to limit or affect the State's rights and remedies arising from the discovery of latent defects in the work after the expiration of any guarantee period.

108.18 No Waiver of Legal Rights. The following will not operate or be considered as a waiver of any portion of the contract, or any power herein reserved, or any right to damages provided herein or by law:

(1) Any payment for, or acceptance of, the whole or any part of the work.

(2) Any extension of time.

(3) Any possession taken by the Engineer.

A waiver of any notice requirement or of any noncompliance with the contract will not be held to be a waiver of any other notice requirement or any other noncompliance with the contract.

108.19 Final Settlement of Contract.

(A) Closing Requirements. The contract will be considered settled after the project acceptance date and when the following items have been satisfactorily submitted, where applicable:

(1) All written guarantees required by the contract.

(2) Complete and certified weekly payrolls for the Contractor and its subcontractor's.

(3) Certificate of plumbing and electrical inspection.

(4) Certificate of building occupancy.

(5) Certificate for soil treatment and wood treatment.

(6) Certificate of water system chlorination.

(7) Certificate of elevator inspection, boiler and pressure pipe installation.

(8) Tax clearance.

(9) All other documents required by the Contract or by law.

(B) Failure to Meet Closing Requirements. The Contractor shall meet the applicable closing requirements within 60 days from the date of Project Acceptance or the agreed to Punchlist complete date. Should the Contractor fail to comply with these requirements, the Engineer may terminate the contract for cause."

END OF SECTION 108

SECTION 202 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Make the following amendments to said Section:

(I) Add the following paragraphs to Subsection **202.03(C) Removal of Bridges**, line 118, to read as follows:

"All concrete and/or reinforcing steel removed shall be recycled by an appropriately licensed or certified concrete recycling facility."

(II) Amend **202.04 – Measurement** by revising lines 119 to 120 to read as follows:

"**202.04 Measurement.** Removal of structures and obstructions will be paid on a lump sum basis if the pay unit is specified as lump sum in the proposal. Measurement for payment will not apply if the pay unit is specified as lump sum in the proposal.

If the proposal provides a contract item for the removal of structures and obstructions, the Engineer will measure the removal of structures and obstructions by the pay unit specified in the proposal."

(III) Amend **202.05 – Payment** by revising lines 122 to 131 to read as follows:

"**202.05 Payment.** If the proposal does not show a contract item for the removal of structures and obstructions, the Engineer will not pay for the removal of structures and obstructions separately. The Contractor shall consider them incidental to the various contract items.

The Engineer will pay for specific items stipulated for removal and disposal at the contract price bid per unit specified in the proposal. The price shall be full compensation for removal and disposal of that items, excavation, backfill, salvage of materials removed. Salvaging of materials removed includes their custody, preservation, storage on the right-of-way. Also, the price shall be full compensation for equipment, tools, labor materials and incidentals necessary to complete the work.

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

Pay Item	**Pay Unit**
Removal of Existing Bridges	Lump Sum
Removal of Guardrails	Linear Foot

Removal of Miscellaneous Walls and Fences	Linear Foot
Removal of AC Pavement	Square Yard
Removal of Concrete Curb and Gutter	Linear Foot
Removal of Concrete Sidewalk	Square Yard
Removal of Pavement Striping and Markers	Lump Sum
Removal of 5-inch, 24-Inch, 30-Inch and 36-Inch Water Lines	Linear Foot
Removal of gate valves, valve boxes, manholes, reaction blocks, thrust beams, fire hydrants, concrete jackets, and any other waterline appurtenances and incidentals	Lump sum
Removal of Drainage Culverts and Headwalls	Lump Sum
Removal of Excess Excavated Material, including Selected Material and Borrow Excavated Material	Cubic Yard”

END OF SECTION 202

SECTION 203 – EXCAVATION AND EMBANKMENT

Make the following amendments to said Section:

(I) Amend **203.03(C)(2)(a) – Maximum Dry Unit Weight** from line 245 to line 255 to read as follows:

> "**(a) Maximum Dry Unit Weight.** Test for maximum dry unit weight according to AASHTO T 180, and apply the correction for fraction larger than 3/4 inch. Use Hawaii Test Method HDOT TM 5 for sample preparation of sensitive soils when so designated by the Engineer."

(II) Amend **203.03(C)(3) – Compaction of Cut Areas and Embankments With Moisture and Density Tests** from line 261 to line 284 to read as follows:

> **(3) Compaction of Cut Areas and Embankments With Moisture and Density Tests.** Prior to shaping and compacting, condition the on-site clayey soil to a moisture content of at least 4 percent above optimum moisture content determined in accordance with AASHTO T 180. Moisture condition embankment material and place in layers not to exceed 8 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 203.03(C)(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 moisture condition or the relative compaction, excavate and recompact material until specified moisture condition and 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."

(III) Amend **203.04 – Measurement** by revising lines 345 to 366 to read as follows:

"**203.04 Measurement.**

(A) The Engineer will measure roadway excavation per cubic yard. The Engineer will compute quantities of roadway excavation by average end area method and centerline distances. Curvature correction will not be applied to quantities within roadway prism, as indicated in the contract documents. In computing excavation quantities from outside the roadway prism, where roadway centerline is used as a base, curvature correction will be applied when centerline radius is 1,000 feet or less.

When roadway excavation quantities by average end area method cannot be computed due to the nature of a particular operation or changed conditions, the Engineer will determine and use computation method that will produce an accurate quantity estimate.

(B) The Engineer will measure imported borrow per cubic yard in accordance with the contract documents. The Engineer will compute quantities of imported borrow incorporated into the work on a volume basis, using average end area method in place at work site.

(III) Amend **203.05 – Payment** by revising lines 368 to 457 to read as follows:

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

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

Pay Item	**Pay Unit**
Roadway Excavation	Cubic Yard

The Engineer will pay for:

(1) 15 percent of the contract bid price upon completion of obliterating old roadways and hauling.

(2) 30 percent of the contract bid price upon completion of preparing subgrade.

(3) 40 percent of the contract bid price upon completion of placing selected material in final position, rounding of slopes, and using water for compaction.

(4) 15 percent of the contract bid price upon completion of disposing of surplus excavation material.

Imported Borrow — Cubic Yard

The Engineer will pay for accepted quantities of subexcavation, as roadway excavation at the contract unit price per cubic yard, when ordered by the Engineer, for work prescribed in Subsection 203.03(A)(4) – Subexcavation. Payment will be full compensation for the work prescribed therein and in the contract documents.

The Engineer will pay for accepted quantities of unlined gutter excavation as roadway excavation at the contract unit price per cubic yard, when gutter is located as follows: within median area of a divided highway; and between roadbed shoulder and adjacent cut slope. Payment will be full compensation for removing and disposing of excavated material; backfilling and compacting; and for the work prescribed in the contract documents.

The Engineer will not pay for stockpiling selected material, placing selected material in final position, or placing selected material in windrows along tops of roadway slopes for erosion control work, separately and will consider the cost as included in the unit prices for the various excavation contract pay items. The cost is for work prescribed in this section and the contract documents.

The Engineer will not pay for overhaul separately and will consider the cost as included in the unit prices for the various excavation contract pay items. The cost is for work prescribed in this section and the contract documents.

The Engineer will not pay for embankment separately and will consider the cost as included in the unit price for roadway excavation. The cost is for work prescribed in this section and the contract documents.

The Engineer will not pay for Non-Woven Geotextile Fabric (Mirafi 180N or approved equal) separately and will consider the cost as included in the unit price for roadway excavation. The cost is for work prescribed in this section and the contract documents."

END OF SECTION 203

SECTION 204 – EXCAVATION AND BACKFILL FOR MISCELLANEOUS FACILITIES

Make the following amendments to said Section:

(I) Amend **204.04 – Measurement** by revising lines 180 to 186 to read as follows:

"**204.04 Measurement.**

(A) The Engineer will measure trench excavation for Water Lines, Sewer Lines, and Gas Pipelines per cubic yard in accordance with the contract documents.

(B) The Engineer will measure trench backfill for Water Lines, Sewer Lines, and Gas Pipelines per cubic yard in accordance with the contract documents.

(II) Amend **204.05 – Payment** by revising lines 196 to 200 to read as follows:

" **Pay Item**	**Pay Unit**
Trench Excavation for Water Lines	Cubic Yard
Trench Backfill for Water Lines	Cubic Yard
Trench Excavation for Sewer Lines	Cubic Yard
Trench Backfill for Sewer Lines	Cubic Yard
Trench Excavation for Gas Pipelines	Cubic Yard
Trench Backfill for Gas Pipelines	Cubic Yard"

END OF SECTION 204

Amend **Section 209 - TEMPORARY WATER POLLUTION, DUST, AND EROSION CONTROL** to read as follows:

"SECTION 209 - TEMPORARY WATER POLLUTION, DUST, AND EROSION CONTROL

209.01 Description. This section describes the following:

(A) Including detailed plans, diagrams, and written Site-Specific Best Management Practices (BMP); constructing, maintaining, and repairing temporary water pollution, dust, and erosion control measures at the project site, including local material sources, work areas and haul roads; removing and disposing hazardous wastes; control of fugitive dust (defined as uncontrolled emission of solid airborne particulate matter from any source other than combustion); and complying with applicable State and Federal permit conditions.

(B) Work associated with construction stormwater, dewatering, and hydrotesting activities and complying with conditions of the National Pollutant Discharge Elimination System (NPDES) permit(s) authorizing discharges associated with construction stormwater, dewatering, and hydrotesting activities.

(C) Potential pollutant identification and mitigation measures are listed in Appendix A for use in the development of the Contractor's Site-Specific BMP.

Requirements of this section also apply to construction support activities including concrete or asphalt batch plants, rock crushing plants, equipment staging yards/areas, material storage areas, excavated material disposal areas, and borrow areas located outside the State Right-of-Way. For areas serving multiple construction projects, or operating beyond the completion of the construction project in which it supports, the Contractor shall be responsible for securing the necessary permits, clearances, and documents, and following the conditions of the permits and clearances, at no cost to the State.

209.02 Materials. Comply with applicable materials described in Chapters 2 and 3 of the current HDOT "Construction Best Management Practices Field Manual". In addition, the materials shall comply with the following:

(A) Grass. Grass shall be a quick growing species such as rye grass, Italian rye grass, or cereal grasses. Grass shall be suitable to the area and provide a temporary cover that will not compete later with permanent cover. Alternative grasses are allowable if acceptable to the Engineer.

(B) Fertilizer and Soil Conditioners. Fertilizer and soil conditioners shall be a standard commercial grade acceptable to the Engineer. Fertilizer shall conform to Subsection 619.02(H)(1) - Commercial Fertilizer.

(C) Hydro-mulching. Hydro-mulching used as a temporary vegetative stabilization measure shall consist of materials in Subsections 209.02(A) - Grass, and 209.02(B) – Fertilizer and Soil Conditioners. Mulches shall be recycled materials including bagasse, hay, straw, wood cellulose bark, wood chips, or other material acceptable to the Engineer. Mulches shall be clean and free of noxious weeds and deleterious materials. Potable water shall meet the requirements of Subsection 712.01 - Water. Submit alternate sources of irrigation water for the Engineer's acceptance if deviating from 712.01 - Water. Installation and other requirements shall be in accordance with portions of Section 641- Hydro-Mulch Seeding including 641.02(D) - Soil and Mulch Tackifier, 641.03(A) – Seeding, and 641.03(B) - Planting Period. Install non-vegetative controls including mulch or rolled erosion control products while the vegetation is being established. Water and fertilize grass. Apply fertilizer as recommended by the manufacturer. Replace grass the Engineer considers unsuitable or sick. Remove and dispose of trash and debris. Remove invasive species. Mow as needed to prevent site or signage obstructions, fire hazard, or nuisance to the public. Do not remove down stream sediment control measures until the vegetation is uniformly established, including no large bare areas, and provides 70 percent of the density of pre-disturbance vegetation. Temporary vegetative stabilization shall not be used longer than one year.

(D) Silt Fences. Comply with ASTM D6462, Standard Practice for Silt Fence Installation.

Alternative materials or methods to control, prevent, remove and dispose pollution are allowable if acceptable to the Engineer.

209.03 Construction.

(A) Preconstruction Requirements.

(1) Water Pollution, Dust, and Erosion Control Meeting. Schedule a water pollution, dust, and erosion control meeting with the Engineer after Site-Specific BMP is accepted in writing by the Engineer. Meeting shall be scheduled a minimum of 7 calendar days prior to the Start Work Date. Discuss sequence of work, plans and proposals for water pollution, dust, and erosion control.

(2) Water Pollution, Dust, and Erosion Control Submittals. Submit a Site-Specific BMP Plan within 21 calendar days of date of NTP. Refer to Section 108 – Prosecution and Progress for details on NTP date. Submission of complete and acceptable Site-Specific BMP Plan is the sole responsibility of the Contractor and additional contract time will not be issued for delays due to incompleteness. Include the following:

(a) Written description of activities to minimize water pollution and soil erosion into State waters, drainage or sewer systems. BMP shall include the following:

1. An identification of potential pollutants and their sources.

2. A list of all materials and heavy equipment to be used during construction.

3. Descriptions of the methods and devices used to minimize the discharge of pollutants into State waters, drainage or sewer systems.

4. Details of the procedures used for the maintenance and subsequent removal of any erosion or siltation control devices.

5. Methods of removing and disposing hazardous wastes encountered or generated during construction.

6. Methods of removing and disposing concrete and asphalt pavement cutting slurry, concrete curing water, and hydrodemolition water.

7. Spill Control and Prevention and Emergency Spill Response Plan.

8. Fugitive dust control, including dust from grinding, sweeping, or brooming off operations or combination thereof.

9. Methods of storing and handling of oils, paints and other products used for the project.

10. Material storage and handling areas, and other staging areas.

11. Concrete truck washouts.

12. Concrete waste control.

13. Fueling and maintenance of vehicles and other equipment.

14. Tracking of sediment offsite from project entries and exits.

15. Litter management.

16. Toilet facilities.

17. Other factors that may cause water pollution, dust and erosion control.

(b) Provide plans indicating location of water pollution, dust and erosion control devices; provide plans and details of BMPs to be installed or utilized; show areas of soil disturbance in cut and fill, indicate areas used for construction staging and storage including items (1) through (17) above, storage of aggregate (indicate type of aggregate), asphalt cold mix, soil or solid waste, equipment and vehicle parking, and show areas where vegetative practices are to be implemented. Indicate intended drainage pattern on plans. Include flow arrows. Include separate drawing for each phase of construction that alters drainage patterns. Indicate approximate date when device will be installed and removed.

(c) Construction schedule.

(d) Name(s) of specific individual(s) designated responsible for water pollution, dust, and erosion controls on the project site. Include home, cellular, and business telephone numbers, fax numbers, and e-mail addresses.

(e) Description of fill material to be used.

(f) For projects with an NPDES Permit for Construction Activities, submit information to address all sections in the Storm Water Pollution Prevention Plan (SWPPP).

(g) For projects with an NPDES Permit, information required for compliance with the conditions of the Notice of General Permit Coverage (NGPC)/NPDES Permit.

(h) Site-Specific BMP Review Checklist. The checklist may be downloaded from HDOT's Stormwater Management website at http://stormwaterhawaii.com.

Date and sign Site-Specific BMP Plan. Keep accepted copy on site or at an accessible location so that it can be made available at the time of an on-site inspection or upon request by the Engineer, HDOT Third-Party Inspector, and/or DOH/EPA Representative. Amendments to the Site-Specific BMP Plan shall be included with original Site-Specific BMP Plan. Modify SWPPP if necessary to conform to revisions. Include date of installation and removal of Site-Specific BMP measures. Obtain written acceptance by the Engineer before implementing revised Site-Specific BMPs in the field.

Follow the guidelines in the current HDOT "Construction Best Management Practices Field Manual", in developing, installing, and maintaining Site-Specific BMPs for all projects. For any conflicting requirements between the Manual and applicable bid documents, the applicable bid documents will govern. Should a requirement not be clearly described within the applicable bid documents, notify the Engineer immediately for interpretation. For the purposes of clarification "applicable bid documents" include the construction plans, standard specifications, special provisions, Permits, and the SWPPP when applicable.

Follow Honolulu's City and County "Rules for Soil Erosion Standards and Guidelines" for all projects on Oahu. Use respective Soil Erosion Guidelines for Maui, Kauai and Hawaii projects.

(B) Construction Requirements. Do not begin work until submittals detailed in Subsection 209.03(A)(2) - Water Pollution, Dust, and Erosion Control Submittals are completed and accepted in writing by the Engineer.

Install, maintain, monitor, repair and replace site-specific BMP measures, such as for water pollution, dust and erosion control; installation, monitoring, and operation of hydrotesting activities; removal and disposal of hazardous waste indicated on plans, concrete cutting slurry, concrete curing water; or hydrodemolition water. Site-Specific BMP measures shall be in place, functional and accepted by HDOT personnel prior to initiating any ground disturbing activities.

If necessary, furnish and install rain gage in a secure location prior to field work including installation of site-specific BMP. Provide rain gage with a tolerance of at least 0.05 inches of rainfall. Install rain gage on project site in an area that will not deter rainfall from entering the gate opening. Do not install in a location where rain water may splash into rain gage. The rain gage installation shall be stable and plumbed. Maintain rain gage and replace rain gage that is stolen, does not function properly or accurately, is worn out, or needs to be relocated. Do not begin field work until rain gage is installed and Site-Specific BMPs are in place. Rain gage data logs shall be readily available. Submit rain gage data logs weekly to the Engineer.

Address all comments received from the Engineer.

Modify and resubmit plans and construction schedules to correct conditions that develop during construction which were unforeseen during the design and pre-construction stages.

Coordinate temporary control provisions with permanent control features throughout the construction and post-construction period.

Limit maximum surface area of earth material exposed at any time to 300,000 square feet. Do not expose or disturb surface area of earth material (including clearing and grubbing) until BMP measures are installed and accepted in writing by the Engineer. Protect temporarily or permanently disturbed soil surface from rainfall impact, runoff and wind before end of the work day.

Immediately initiate stabilizing exposed soil areas upon completion of earth disturbing activities for areas permanently or temporarily ceased on any portion of the site. Earth-disturbing activities have permanently ceased when clearing and excavation within any area of the construction site that will not include permanent structures has been completed. Earth-disturbing activities have temporarily ceased when clearing, grading, and excavation within any area of the site that will not include permanent structures will not resume for a period of 14 or more calendar days, but such activities will resume in the future. The term “immediately” is used in this section to define the deadline for initiating stabilization measures. “Immediately” means as soon as practicable, but no later than the end of the next work day, following the day when the earth-disturbing activities have temporarily or permanently ceased.

For projects with an NPDES Permit for Construction activities:

(1) For construction areas discharging into waters not impaired for nutrients or sediments, complete initial stabilization within 14 calendar days after the temporary or permanent cessation of earth-disturbing activities.

(2) For construction areas discharging into nutrient or sediment impaired waters, complete initial stabilization within 7 calendar days after the temporary or permanent cessation of earth-disturbing activities.

For projects without an NPDES Permit for Construction activities, complete initial stabilization within 14 calendar days after the temporary or permanent cessation of earth-disturbing activities.

Any of the following types of activities constitutes initiation of stabilization:

(1) Prepping the soil for vegetative or non-vegetative stabilization;

(2) Applying mulch or other non-vegetative product to the exposed area;

(3) Seeding or planting the exposed area;

(4) Starting any of the activities in items (1) – (3) above on a portion of the area to be stabilized, but not on the entire area; and

(5) Finalizing arrangements to have stabilization product fully installed in compliance with the deadline for completing initial stabilization activities.

Any of the following types of activities constitutes completion of initial stabilization activities:

(1) For vegetative stabilization, all activities necessary to initially seed or plant the area to be stabilized; and/or

(2) For non-vegetative stabilization, the installation or application of all such non-vegetative measures.

If the Contractor is unable to meet the deadlines above due to circumstances beyond the Contractor's control, and the Contractor is using vegetative cover for temporary or permanent stabilization, the Contractor may comply with the following stabilization deadlines instead as agreed to by the Engineer:

(1) Immediately initiate, and complete within the timeframe shown above, the installation of temporary non-vegetative stabilization measures to prevent erosion;

(2) Complete all soil conditioning, seeding, watering or irrigation installation, mulching, and other required activities related to the planting and initial establishment of vegetation as soon as conditions or circumstances allow it on the site; and

(3) Notify and provide documentation to the Engineer the circumstances that prevent the Contractor from meeting the deadlines above for stabilization and the schedule the Contractor will follow for initiating and completing initial stabilization and as agreed to by the Engineer.

Follow the applicable requirements of the specifications and special provisions including Section 619 Planting and Section 641 Hydro-Mulch Seeding.

Immediately after seeding or planting the area to be vegetatively stabilized, to the extent necessary to prevent erosion on the seeded or planted area, select, design, and install non-vegetative erosion controls that provide cover (e.g., mulch, rolled erosion control products) to the area while vegetation is becoming established.

Protect exposed or disturbed surface area with mulches, grass seeds or hydromulch. Spray mulches at a rate of 2,000 pounds per acre. Add tackifier to mix at a rate of 85 pounds per acre. Apply grass seeds at a rate of 125 pounds per acre. For hydromulch, use the ingredients and rates required for mulches and grass seeds. Submit recommendations from a licensed Landscape Architect when deviating from the application rates above.

Apply fertilizer to mulches, grass seed or hydromulch per manufacturer's recommendations. Submit recommendations from a licensed Landscape Architect when deviating from the manufacturer's recommendations.

Install velocity dissipation measures when exposing erodible surfaces greater than 15 feet in height.

BMP measures shall be in place and operational at the end of work day or as required by Section 209.03(B) Construction Requirements**.**

Install and maintain either or both stabilized construction entrances and wheel washes to minimize tracking of dirt and mud onto roadways. Restrict traffic to stabilized construction areas only. Clean dirt, mud, or other material tracked onto the road, sidewalk, or other paved area by the end of the same day in which the track-out occurs. Modify stabilized construction entrances to prevent mud from being tracked onto road. Stabilize entire access roads if necessary.

Chemicals may be used as soil stabilizers for either or both erosion and dust control if acceptable to the Engineer.

Provide temporary slope drains of rigid or flexible conduits to carry runoff from cuts and embankments. Provide portable flume at the entrance. Shorten or extend temporary slope drains to ensure proper function.

Protect ditches, channels, and other drainageways leading away from cuts and fills at all times by either:

(1) Hydro-mulching the lower region of embankments in the immediate area.

(2) Installing check dams and siltation control devices.

(3) Other methods acceptable to the Engineer.

Provide for controlled discharge of waters impounded, directed, or controlled by project activities or erosion control measures.

Cover exposed surface of materials completely with tarpaulin or similar device when transporting aggregate, soil, excavated material or material that may be source of fugitive dust.

Cleanup and remove any pollutant that can be attributed to the Contractor.

Install or modify Site-Specific BMP measures due to change in the Contractor's means and methods, or for omitted condition that should have been allowed for in the accepted Site-Specific BMP or a Site-Specific BMP that replaces an accepted Site-Specific BMP that is not satisfactorily performing. Modifications to Site-Specific BMP measures shall be accepted in writing by the Engineer prior to implementation.

Properly maintain all Site-Specific BMP measures.

For projects with an NPDES Permit for Construction Activities:

(1) For construction areas discharging into nutrient or sediment impaired waters, inspect, prepare a written report, and make repairs to BMP measures at the following intervals:

(a) Weekly.

(b) Within 24 hours of any rainfall of 0.25 inch or greater which occurs in a 24-hour period.

(c) When existing erosion control measures are damaged or not operating properly as required by Site-Specific BMP.

(2) For construction areas discharging to waters not impaired for nutrients or sediments, inspect, prepare a written report, and make repairs to BMP measures at the following intervals:

(a) Weekly.

(b) When existing erosion control measures are damaged or not operating properly as required by Site-Specific BMP.

For projects without an NPDES Permit for Construction activities, inspect, prepare a written report, and make repairs to BMP measures at the following intervals:

(a) Weekly.

(b) When existing erosion control measures are damaged or not operating properly as required by Site-Specific BMP.

Temporarily remove, replace or relocate any Site-Specific BMP that must be removed, replaced or relocated due to potential or actual flooding, or potential danger or damage to project or public.

Maintain records of inspections of Site-Specific BMP work. Keep continuous records for duration of the project. Submit copy of Inspection Report to the Engineer within 24 hours after each inspection.

The Contractor's designated representative specified in Subsection 209.03(A)(2)(d) shall address any Site-Specific BMP deficiencies brought up by the Engineer immediately, including weekends and holidays, and complete work to fix the deficiencies by the close of the next work day if the problem does not require significant repair or replacement, or if the problem can be corrected through routine maintenance. Address any Site-Specific BMP deficiencies brought up by the State's Third-Party Inspector in the timeframe above or as specified in the Consent Decree or MS4 NPDES

Permit, whichever is more stringent. The Consent Decree timeframe requirement applies statewide. The MS4 NPDES Permit only applies to Oahu. In this section, "immediately" means the Contractor shall take all reasonable measures to minimize or prevent discharge of pollutants until a permanent solution is installed and made operational. If a problem is identified at a time in the day in which it is too late to initiate repair, initiation of repair shall begin on the following work day. When installation of a new pollution prevention control or a significant repair is needed, complete installation or repair no later than 7 calendar days from the time of notification/Contractor discovery. Notify the Engineer and document why it is infeasible to complete the installation or repair within 7 calendar days and complete the work as soon as practicable and as agreed to by the Engineer. Address Site-Specific BMP deficiencies discovered by the Contractor within the timeframe above. The Contractor's failure to satisfactorily address these Site-Specific BMP deficiencies, the Engineer reserves the right to employ outside assistance or use the Engineer's own labor forces to provide necessary corrective measures. The Engineer will charge the Contractor such incurred costs plus any associated project engineering costs. The Engineer will make appropriate deductions from the Contractor's monthly progress estimate. Failure to apply Site-Specific BMP measures may result in one or more of the following: assessment of liquidated damages, suspension, or cancellation of Contract with the Contractor being fully responsible for all additional costs incurred by the State.

(C) Discharges of Storm Water Associated with Construction Activities. If work includes disturbance of one acre or more, an NPDES Permit authorizing Discharges of Storm Water Associated with Construction Activity (CWB-NOI Form C) or Individual Permit authorizing storm water discharges associated with construction activity is required from the Department of Health Clean Water Branch (DOH-CWB).

Do not begin construction activities until all required conditions of the permit are met and submittals detailed in Subsection 209.03(A)(2) – Water Pollution, Dust, and Erosion Control Submittals are completed and accepted in writing by the Engineer.

(D) Discharges Associated with Hydrotesting Activities. If hydrotesting activities require effluent discharge into State waters or drainage systems, an NPDES Hydrotesting Waters Permit (CWB-NOI Form F) or Individual Permit authorizing discharges associated with hydrotesting from DOH-CWB is required from the DOH-CWB.

Do not begin hydrotesting activities until the DOH-CWB has issued an Individual NPDES Permit or Notice of General Permit Coverage (NGPC). Conduct Hydrotesting operations in accordance with the conditions of the permit or NGPC.

(E) Discharges Associated with Dewatering Activities. If dewatering activities require effluent discharge into State waters or drainage systems, an NPDES Dewatering Permit (CWB-NOI Form G) or Individual Permit authorizing discharges associated with dewatering from DOH-CWB is required from the DOH-CWB.

Do not begin dewatering activities until the DOH-CWB has issued an Individual NPDES Permit or Notice of General Permit Coverage (NGPC). Conduct dewatering operations in accordance with the conditions of the permit or NGPC.

(F) Solid Waste. Submit the Solid Waste Disclosure Form for Construction Sites to the Engineer within 30 calendar days of contract certification date. Keep copies on-site or at an accessible location so that it can be made available at the time of an on-site inspection or upon request by the Engineer, HDOT Third-Party Inspector, and/or DOH/EPA Representative. Provide a copy of all the disposal receipts from the facility permitted by the Department of Health to receive solid waste to the Engineer by the last day of each month. Provide documentation from any intermediary facility where solid waste is handled or processed, haul tags, or any documentation as requested by the Engineer. Notify Engineer prior to removal of material from site. All material generated from the project and taken off site shall be considered to be solid waste. If the Contractor elects to reclassify material as inert fill to be reused, DOH HEER testing guidance shall be followed. No material generated from this project shall be classified as inert fill material for reuse without testing, obtaining required approvals/permits, providing disposal locations/quantities, and obtaining prior written approval from the Engineer. The Contractor shall indemnify the State of all violations of solid waste handling and disposal. Failure to comply with these requirements may result in fines or liquidated damages in accordance with Special Provisions Section 209 - Temporary Water Pollution, Dust, and Erosion Control and HDOT's Enforcement Response Plan.

(G) Construction BMP Training. The Contractor's representative responsible for development of the Site-Specific BMP Plan and implementation of Site-Specific BMPs in the field shall attend the State's Construction Best Management Practices Training. The Contractor shall keep training logs updated and readily available.

209.04 Measurement.

(A) Installation, maintenance, monitoring, and removal of BMP will be paid on a lump sum basis. Measurement for payment will not apply.

(B) The Engineer will only measure additional water pollution, dust and

erosion control required and requested by the Engineer on a force account basis in accordance with Subsection 109.06 – Force Account Provisions and Compensation.

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

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

Pay Item	**Pay Unit**
Installation, Maintenance, Monitoring, and Removal of BMP	Lump Sum

Payment for all work prescribed in this section including: submittals, sampling, testing, reporting, dust control measures, installation, maintenance, monitoring, implementation of the SWPPP, and removal of BMP's shall be paid for under the lump sum pay item shown in the proposal schedule. This includes payment for installation or modification of Site-Specific BMP measures due to change in the Contractor's means and methods, or for omitted condition that should have been allowed for in the contractor's accepted SWPPP or a Site-Specific BMP that requires repair or replacement of an accepted Site-Specific BMP that is not satisfactorily performing.

Additional Water Pollution, Dust, and Erosion Control	Force Account

An estimated amount for force account is allocated in proposal schedule under 'Additional Water Pollution, Dust, and Erosion Control', but actual amount to be paid will be the sum shown on accepted force account records, whether this sum be more or less than estimated amount allocated in proposal schedule. The Engineer will pay for BMP measures requested by the Engineer that are beyond the scope of the original contract work on a force account basis. No progress payment will be authorized until the Engineer accepts in writing Site-Specific BMP or when the Contractor fails to maintain project site in accordance with accepted BMP.

For all citations or fines received by the Department for non-compliance, including compliance with NPDES Permit conditions, the Contractor shall reimburse State within 30 calendar days for full amount of outstanding cost the State has incurred, or the Engineer will deduct cost from progress payment. The Engineer will not pay for work to repair or to compensate for damages caused by dust or water. The Engineer may assess liquidated damages up to $27,500 per day for non-compliance of each BMP requirement and all other requirements in this section in accordance with HDOT's Enforcement Response Plan.

Appendix A

The following list identifies potential pollutant sources and corresponding BMPs used to mitigate the pollutants. Each BMP is referenced to the corresponding section of the current HDOT Construction Best Management Practices Field Manual or appropriate Supplemental Sheets. The Manual may be obtained from the HDOT Statewide Stormwater Management Program Website at *http://www.stormwaterhawaii.com/resources/contractors-and-consultants/* under Construction Best Management Practices Field Manual. Supplemental BMP sheets are located at *http://www.stormwaterhawaii.com/resources/contractors-and-consultants/storm-water-pollution-prevention-plan-swppp/* under Concrete Curing and Irrigation Water.

600

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
Construction debris, green waste, general litter	• *Separate contaminated clean up materials from construction and demolition (C&D) wastes.* • *Provide waste containers (e.g., dumpster or trash receptacle) of sufficient size and number to contain construction and domestic wastes.* • *Inspect construction waste and recycling areas regularly.* • *Schedule solid waste collection regularly.* • *Schedule recycling activities based on construction/demolition phases.* • *Empty waste containers weekly or when they are two-thirds full, whichever is sooner.* • *Do not allow containers to overflow. Clean up immediately if they do.* • *On work days, clean up and dispose of waste in designated waste containers.* • *See Solid Waste Management Section SM-6 for additional requirements.* • *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.* • *Collect and dispose of all waste materials in trash dumpsters. Place dumpsters, with secure watertight lids, away from storm water conveyances and drains, in a covered materials storage area.* • *Dispose of construction and non- construction solid waste in accordance with State DOH regs.* • *Load removed non- recyclable vegetation directly onto trucks; cover and transport to a licensed facility*	*See Solid Waste Management Section SM-6. Storm Drain Inlet Protection SC-1, and Perimeter Sediment Controls where applicable.*

601

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
Materials associated with the operation and maintenance of equipment, such as oil, fuel, and hydraulic fluid leakage	• *Use off-site wash racks, repair and maintenance facilities, and fueling sites when practical.* • *Designate bermed wash area if cleaning on site is necessary.* • *Place drip pans or drop cloths under vehicles and equipment to absorb spills or leaks.* • *Provide an ample supply of readily available spill cleanup materials.* • *Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly.* • *Do not clean surfaces or spills by hosing the area down.* • *Eliminate the source of the spill to prevent a discharge or a continuation of an ongoing discharge.* • *Inspect on-site vehicles and equipment regularly and immediately repair leaks.* • *Regularly inspect fueling areas and storage tanks.* • *Train employees on proper maintenance and spill practices and procedures and fueling and cleanup procedures.* • *Store diesel fuel, oil, hydraulic fluid, or other petroleum products or other chemicals in water-tight containers and provide cover or secondary containment.* • *Do not remove original product labels and comply with manufacturer's labels for proper disposal.* • *Dispose of containers only after all the product has been used.* • *Dispose of or recycle oil or oily wastes according to Federal, State, and Local requirements.* • *Store soaps, detergents, or solvents under cover or other means to prevent contact with rainwater.* • *See Vehicle and Equipment Cleaning, Maintenance, and Refueling, Sections SM-11, SM-12, and SM-13 and Material Storage and Handling Section SM-2 for additional requirements.*	*See Vehicle and Equipment Cleaning, Maintenance, and Refueling, Sections SM-11, SM-12, and SM-13, and Material Storage and Handling, Section SM-2, and Spill Prevention and Control SM-10.*

602

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
Soil erosion from the disturbed areas	• *Provide Soil Stabilization, Slope Protection, Storm Drain Inlet Protection SC-1, Perimeter Controls and Sediment Barriers, Sediment Basins and Detention Ponds, Check Dams SC-3 ,Level Spreader EC-6, Paving Operations SM-20, Construction Roads and Parking Area Stabilization SC-10, Controlling Storm Water Flowing Onto and Through the Project, Post-Construction BMPs, and Non-Structural BMPs (Construction BMP Training SM-1, Scheduling SM-14, Location of Potential Sources of Sediment SM-15, Preservation of Existing Vegetation SM-17).* • *Delineate, and clearly mark off, with flags, tape, or other similar marking device all natural buffer areas defined in the SWPPP.* • *Preserve native topsoil where practicable.* • *In areas where vegetative stabilization will occur, restrict vehicle/equipment use in areas to avoid soil compaction or condition soil to promote vegetative growth.* • *For Storm Drain Inlet Protection, clean, or remove and replace, the protection measures as sediment accumulates, the filter becomes clogged, and/or performance is compromised.* • *Where there is evidence of sediment accumulation adjacent to the inlet protection measure, remove the deposited sediment by the end of the same day in which it is found or by the end of the following work day if removal by the same day is not feasible.* • *Sediment basins shall be designed and maintained in accordance with HAR Chapter 11-55.* • *Minimize disturbance on steep slopes (Greater than 15% in grade).* • *If disturbance of steep slopes are unavoidable, phase disturbances and use stabilization techniques designed for steep grades.* • *For temporary drains and swales use velocity dissipation devices within and at the outlet to minimize erosive flow velocities.*	*Soil Stabilization* *1. SM-22 Topsoil Management* *2. EC-12 Seeding and Planting* *3. EC-14 Mulching* *4. EC-11 Geotextiles and Mats* *Slope Protection* *1. EC-12 Seeding and Planting* *2. EC-14 Mulching* *3. EC-11 Geotextiles and Mats* *4. EC-4 Slope Roughening, Terracing, and Rounding* *5. EC-7 Slope Drains and Subsurface Drains* *6. EC-9 Slope Interceptor or Diversion Ditches/Berms* *SC-1 Storm Drain Inlet Protection*

603

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	*BMP Requirements*
		Perimeter Controls and Sediment Barriers *1. SC-7 Silt Fence or Filter Fabric Fence* *2. SC-2 Vegetated Filter Strips and Buffers* *3. SC-6 Compost Filter Berm/Sock* *4. SC-8 Sandbag Barrier* *5. SC-9 Brush or Rock Filter* *Sediment Basins and Detention Ponds* *1. SC-4 Sediment Trap* *2. SC-5 Sediment Basin* *SC-3 Check Dams* *EC-6 Level Spreader* *SM-20 Paving Operations* *SC-10 Construction Roads and Parking Area Stabilization*

604

Pollutant Source	*Appropriate Site-Specific BMP to be Implemented*	*BMP Requirements*
		Controlling Storm Water Flowing onto and Through the Project *1. EC-3 Run-On Diversion* *2. EC-5 Earth Dike, Swales and Ditches* *Post Construction BMPs* *1. EC-2 Flared Culvert End Sections* *2. EC-10 Rip-Rap and Gabion Inflow Protection* *3. EC-8 Outlet Protection and Velocity Dissipation Devices* *4. SM-22 Topsoil Management* *Non-Structural BMPs* *1. SM-1 Construction BMP Training* *2. SM-14 Scheduling* *3. SM-15 Location of Potential Sources of Sediment* *4. SM-17 Preservation of Existing Vegetation*

605

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
Sediment from soil stockpiles	• *Locate stockpiles a minimum of 50 feet or as far as practicable from concentrated runoff or outside of any natural buffers identified on the SWPPP.* • *Place bagged materials on pallets and under cover.* • *Provide physical diversion to protect stockpiles from concentrated runoff.* • *Cover stockpiles with plastic or comparable material when practicable.* • *Place silt fence, fiber filtration tubes, or straw wattles around stockpiles.* • *Do not hose down or sweep soil or sediment accumulated on pavement or other impervious surfaces into any storm water conveyance (unless connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or state water.* • *Unless infeasible, contain and securely protect stockpiles from the wind.* • *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.* *See Stockpile Management Section SM-3 for additional requirements.*	*See Stockpile Management Section SM-3. Storm Drain Inlet Protection SC-1, and Perimeter Sediment Controls where applicable.*
Emulsified asphalt or prime/tack coat	• *Provide training for employees and contractors on proper material delivery and storage practices and procedures.* • *Restrict paving operations during wet weather to prevent paving materials from being discharged.* • *Use asphalt emulsions such as prime coat when possible.* • *Protect drain inlet structures and manholes during application of tack coat, seal coat, slurry seal, and fog seal.* • *Keep ample supplies of drip pans and absorbent materials on site.* • *Inspect inlet protection devices.* • *See Material Storage and Handling Section SM-2 and Paving Operations Section SM-20 for additional requirements.* • *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.*	*See Material Storage and Handling Section SM-2,* and Stockpile Management Section SM-3, *Paving Operations Section SM-20, Storm Drain Inlet Protection SC-1, and Perimeter Sediment Controls where applicable.*

606

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
Materials associated with painting, such as paint and paint wash solvent	• *Hazardous chemicals shall be well-labeled and stored in original containers.* • *Keep ample supply of cleanup materials on site.* • *Dispose container only after all of the product has been used.* • *Remove as much paint from brushes on painted surface.* • *Rinse from water-based paints shall be discharged into the sanitary sewer system where possible. If not, direct all washwater into a leak-proof container or leak-proof pit. The container or pit must be designed so that no overflows can occur due to inadequate sizing or precipitation.* • *Locate on-site wash area a minimum of 50 feet away or as far as practicable from storm drain inlets, open drainage facilities, or water bodies.* • *Do not dump liquid wastes into the storm drainage system.* • *Filter and re-use solvents and thinners.* • *Dispose of oil-based paints and residue as a hazardous waste.* • *Ensure collection, removal, and disposal of hazardous waste complies with regulations.* • *Immediately clean up spills and leaks.* • *Properly store paints, solvents, and epoxy compounds.* • *Properly store and dispose waste materials generated from painting and structure repair and construction activities.* • *Mix paints in a covered and contained area, when possible, to minimize adverse impacts from spills.* • *Do not apply traffic paint or thermoplastic if rain is forecasted.* • *See Material Storage and Handling Use SM-2, Hazardous Materials and Waste Management Section SM-9, Spill Prevention and Control Section SM-10, and Structure Construction and Painting Section SM-21 for additional requirements.* *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.*	*See Material Storage and Handling Use Section SM-2, Stockpile Management Section SM-3, Hazardous Materials and Waste Management Section SM-9, Waste Management, Spill Prevention and Control Section SM-10, and Structure Construction and Painting Section SM-21, Storm Drain Inlet Protection SC-1, and Perimeter Sediment Controls where applicable.*

607

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
Industrial chemicals, fertilizers, and/or pesticides	• *Hazardous chemicals shall be well-labeled and stored in original containers.* • *Keep ample supply of cleanup materials on site.* • *Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly.* • *Do not clean surfaces or spills by hosing the area down.* • *Eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge.* • *Dispose container only after all of the product has been used.* • *Retain a complete set of safety data sheets (formerly MSDS) on site.* • *Store industrial chemicals in water-tight containers and provide either cover or secondary containment.* • *Provide cover when storing fertilizers or pesticides to prevent these chemicals from coming into contact with rainwater.* • *Restrict amount of pesticide prepared to quantity necessary for the current application.* • *Do not apply fertilizers or pesticides during or just before a rain event.* • *Do not apply to stormwater conveyance channels with flowing water.* • *Comply with fertilizer and pesticide manufacturer's recommended usage and disposal instructions. Document departures from manufacturer's specifications in Attachment J.* • *Apply fertilizers at the appropriate time of year for the location, and preferably timed to coincide as closely as possible to the period of maximum vegetation uptake and growth.* • *Follow federal, state, and local laws regarding fertilizer application.* • *Do not dispose of toxic liquid wastes (solvents, used oils, and paints) or chemicals (additives, acids, and curing compounds) in dumpsters allocated for construction debris.*	*See Material Storage and Handling Use Section SM-2, Stockpile Management Section SM-3, and Hazardous Materials and Waste Management Section SM-9, and Spill Prevention and Control SM-10*

608

609

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
	• *Ensure collection, removal, and disposal of hazardous waste complies with regulations. Hazardous waste that cannot be reused or recycled shall be disposed of by a licensed hazardous waste hauler.* *See Material Storage and Handling Use SM-2, and Hazardous Materials and Waste Management Section SM-9 for additional requirements.*	
Hazardous waste (Batteries, Solvents, Treated Lumber, etc.)	• *Do not dispose of toxic materials in dumpsters allocated for construction debris.* • *Ensure collection, removal, and disposal of hazardous waste complies with regulations.* • *Hazardous waste that cannot be reused or recycled shall be disposed of by a licensed hazardous waste hauler.* • *Segregate and recycle wastes from vehicle/equipment maintenance activities such as used oil or oil filters, greases, cleaning solutions, antifreeze, automotive batteries, and hydraulic and transmission fluids.* • *Store waste in sealed containers, which are constructed of suitable materials to prevent leakage and corrosion, and which are labeled in accordance with applicable Resource Conservation and Recovery Act (RCRA) requirements and all other applicable federal, state, and local requirements.* • *All containers stored outside shall be kept away from surface waters and within appropriately sized secondary containment (e.g., spill berms, decks, spill containment pallets). Provide cover if possible.* • *Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly.* • *Do not clean surfaces or spills by hosing the area down.* • *Eliminate the source of the spill to prevent a discharge or a continuation of an ongoing discharge.*	*See Hazardous Materials and Waste Management Section SM-9 and Vehicle and Equipment Maintenance SM-12*

610

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
	• *Ensure collection, removal, and disposal of hazardous waste complies with manufacturer's recommendations and is in compliance with federal, state, and local requirements.* • *See Hazardous Materials and Waste Management Section SM-9 and Vehicle and Equipment Management, Vehicle and Equipment Maintenance SM-12 for additional requirements.*	
Metals and Building Materials	• *Inspect construction waste and recycling areas regularly.* • *Schedule solid waste collection regularly.* • *If building materials or metals are stored on site (such as rebar or galvanized poles) store under cover under tarps or in containers.* • *Minimize the amount of material stored on site.* • *Do not stockpile uncovered metals or other building materials in close proximity to discharge points.* • *See Solid Waste Management Section SM-6 for additional requirements.*	*See Solid Waste Management Section SM-6*
Contaminated Soil	• *See Waste Management, Contaminated Soil Management Section SM-8 and/or Hazardous Materials and Waste Management Section SM-9 for additional requirements.* • *At minimum contain contaminated material soil by surrounding with impermeable lined berms or cover exposed contaminated material with plastic sheets.*	*See Waste Management, Contaminated Soil Management Section SM-8 and/or Hazardous Materials and Waste Management Section SM-9*

611

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
Fugitive Dust Control and Dust Control Water	• *Do not over spray water for dust control purposes which will result in runoff from the area.* • *Apply water as conditions require.* • *Washing down of debris or dirt into drainage, sewage systems, or State waters is not allowed.* • *Minimize exposed areas through the schedule of construction activities.* • *Utilize vegetation, mulching, sprinkling, and stone/gravel layering to quickly stabilize exposed soil.* • *Direct construction vehicle traffic to stabilized roadways.* • *Cover dump trucks hauling material from the site with a tarpaulin.* *See Dust Control Section SM-19 for additional requirements.*	*See Dust Control Section SM-19*
Concrete Truck Wash Water	• *Disposal of concrete truck wash water via percolation is prohibited.* • *Wash concrete-coated vehicles or equipment off-site or in the designated wash area.* • *Locate on-site wash area a minimum of 50 feet away or as far as practicable from storm drain inlets, open drainage facilities, or water bodies.* • *Runoff from the on-site concrete wash area shall be contained in a temporary pit or level bermed area where the concrete can set.* • *Design the area so that no overflow can occur due to inadequate wash area sizing or precipitation.* • *The temporary pit shall be lined with plastic to prevent seepage of wash water into the ground.* • *Allow wash water to evaporate or collect wash water and all concrete debris in a concrete washout system bin.* • *Do not dump liquid wastes into storm drainage system.* • *Dispose of liquid and solid concrete wastes in compliance with federal, state, and local standards.* • *See Waste Management, Concrete Wash and Waste Management Section SM-4 for additional requirements.*	*See Waste Management, Concrete Wash and Waste Management Section SM-4*

612

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
Sediment Track-Out	• *Include Stabilized Construction Entrance at all points that exit onto paved roads.* • *A sediment trapping device is required if a wash rack is used in conjunction with the stabilized construction entrance/exit.* • *The pavement shall not be cleaned by washing down the street.* • *If sweeping is ineffective or it is necessary to wash the streets, wash water must be contained either by construction of a sump, diverting the water to an acceptable disposal area, or vacuuming the wash water.* • *Use BMPs for adjacent drainage structures.* • *Remove sediment tracked onto the street by the end of the day in which the track-out occurs.* • *Restrict vehicle use to properly designated exit points.* • *Include additional BMPs that remove sediment prior to exit when minimum dimensions cannot be met.* *See Stabilized Construction Entrance/Exit Section SC-11 for additional requirements.*	*See Stabilized Construction Entrance/Exit Section SC-11*
Irrigation Water	• *Consider irrigation requirements.* • *Where possible, avoid species which require irrigation.* • *Design, timing and application methods of irrigation water to eliminate the runoff of excess irrigation water into the storm water drainage system.* *See Seeding and Planting Section EC-12 and California Stormwater BMP Handbook SD-12 Efficient Irrigation included in SWPPP Attachment A for additional requirements.*	*See Seeding and Planting Section EC-12 and California Stormwater BMP Handbook SD-12 Efficient Irrigation*
Hydrotesting Effluent	• *If work includes removing, relocation or installing waterlines, and Contractor elects to flush waterline or discharge hydrotesting effluent into State waters or drainage systems, the Contractor shall prepare and obtain HDOT acceptance of a NOI/NPDES Permit Form F application for HDOT submittal to DOH CWB at least 30 calendar days prior to the start of Hydrotesting Activities if necessary. Site specific BMPs will be included in the NOI/NPDES Permit Form F submittal.*	*Site specific BMPs will be included in the NOI/NPDES Permit Form F submittal.*

613

Pollutant Source	***Appropriate Site-Specific BMP to be Implemented***	***BMP Requirements***
Dewatering Effluent	*If excavation or backfilling operations require dewatering, and Contractor elects to discharge dewatering effluent into State waters or existing drainage systems, Contractor shall prepare and obtain HDOT acceptance of a NOI/NPDES Permit Form G application for HDOT submittal to DOH CWB at least 30 calendar days prior to the start of Dewatering Activities if necessary. See Site Planning and General Practices, Dewatering Operations Section SM-18 for additional requirements.*	*See Dewatering Operations SM-18. Site specific BMPs will be included in the NOI/NPDES Permit Form G submittal.*
Saw-cutting Slurry	• *Saw cut slurry shall be removed from the site by vacuuming.* • *Provide storm drain protection during saw cutting. See Paving Operations Section SM-20 for additional requirements.* *Provide Storm Drain Inlet Protection and/or Perimeter Sediment Controls as applicable.*	*See Paving Operations Section SM-20, Storm Drain Inlet Protection SC-1, Perimeter sediment controls where applicable*
Concrete Curing Water	• *Avoid overspraying of curing compounds.* • *Apply an amount of compound that covers the surface, but does not allow any runoff of the compound.* *See California Stormwater BMP Handbook NS-12 Concrete Curing included in SWPPP Attachment A for additional requirements.*	*See California Stormwater BMP Handbook NS-12 Concrete Curing*

614

Pollutant Source	Appropriate Site-Specific BMP to be Implemented	BMP Requirements
Plaster Waste Water	• *Direct all washwater into a leak-proof container or leak-proof pit. The container or pit must be designed so that no overflows can occur due to inadequate sizing or precipitation.* • *Locate on-site wash area a minimum of 50 feet away or as far as practicable from storm drain inlets, open drainage facilities, or water bodies.* • *Any significant residual materials remaining on the ground after the completion of construction shall be removed and properly disposed. If the residual materials contaminate the soil, then the contaminated soil shall also be removed and properly disposed of.* • *Plaster waste water shall not be allowed to flow into drainage structures or State waters. See Material, Storage and Handling Use SM-2, Stockpile Management Use Section SM-3, and Hazardous Materials and Waste Management Section SM-9 for additional requirements.*	*See Material, Storage and Handling Use Section SM-2, Stockpile Management Use Section SM-3, and Hazardous Materials and Waste Management Section SM-9*
Water-Jet Wash Water	• *For Water-Jet Wash Water used to clean vehicles, use off site wash racks or commercial washing facilities when practical.* • *See Vehicle and Equipment Cleaning Section SM-11 for additional information.* • *For Water-Jet Wash Water used to clean impervious surfaces, the runoff shall not be allowed to flow into drainage structures or State Waters.*	*See Vehicle and Equipment Cleaning Section SM-11*
Sanitary/Septic Waste	• *Locate Sanitary facilities in a convenient place away from drainage facilities.* • *Position sanitary facilities so they are secure and will not be tipped over or knocked down.* • *Wastewater shall not be discharged to the ground or buried.* • *A licensed service provider shall maintain sanitary/septic facilities in good working order.* • *Schedule regular waste collection by a licensed transporter.* • *See Sanitary Waste Section SM-7 for additional requirements.*	*See Sanitary Waste Section SM-7.*

"

END OF SECTION 209

Amend Section 401 – HOT MIX ASPHALT (HMA) PAVEMENT to read as follows:

"SECTION 401 – HOT MIX ASPHALT (HMA) PAVEMENT

401.01 Description. This section describes furnishing and placing dense graded HMA pavement (herein referred to as HMA) on a prepared surface.

401.02 Materials.

Asphalt Cement (PG 64-16)	702.01(A)

Use for non-surface mixes, unless otherwise specified in the project documents.

Asphalt Cement (PG 64E-22)	702.01(B)

Use for all surface mixes, except for on Lanai and Molokai, and unless otherwise specified in the project documents. Polymer modified asphalt (PMA) pavement refers to asphalt mix using PG 64E-22, unless otherwise indicated.

Emulsified Asphalt	702.04
Warm Mix Asphalt Additive	702.06
Aggregate for Hot Mix Asphalt Pavement	703.09
Filler	703.15
Hydrated Lime or a liquid anti-strip approved by the engineer	712.03

(A) General. HMA pavement shall be plant mixed and shall include mixture of aggregate and asphalt binder and may include reclaimed asphalt pavement (RAP) or filler, or both.

The manufacture of HMA may include warm mix asphalt (WMA) processes in accordance with these specifications. WMA processes include combinations of organic additives, chemical additives, and foaming.

HMA pavement shall include surface course and may include one or more binder courses, depending on HMA pavement thickness indicated in the contract documents.

RAP is defined as removed or reprocessed pavement materials containing asphalt and aggregates. Process RAP by crushing until 100 percent of RAP passes 3/4-inch sieve. Size, grade uniformly, and combine materials such that blend of RAP and aggregate material conforms to grading

requirements of Subsection 703.09 - Aggregate for Hot Mix Asphalt Pavement.

In surface and binder courses, aggregate for HMA may include RAP quantities up to 20 percent of total mix weight.

Quantity of filler material to correct deficiencies in aggregate gradation passing the No. 200 sieve shall not exceed 3 percent by weight of fine aggregates.

(B) Job-Mix Formula and Tests. Design job-mix formula in accordance with procedures contained in current edition of Asphalt Institute's *Mix Design Methods for Asphalt Concrete and Other Hot Mix Types,* Manual Series No. 2 (MS-2) for either Marshall Method or Hveem Method of Mix Design.

Limit compacted lift thickness and asphalt content of job-mix formula as specified in Table 401.02-1 - Limits of Compacted Lift Thickness and Asphalt Content.

TABLE 401.02-1 - LIMITS OF COMPACTED LIFT THICKNESS AND ASPHALT CONTENT

MIX NO.	II	III	IV	V
Minimum to Maximum Compacted Thickness for Individual Lifts (Inches)	2-1/4 to 3	2 to 3	1-1/2 to 3	1-1/4 to 3
Asphalt Content Limits (Percent of Total Weight of Mix)	3.8 to 6.1	4.3 to 6.1	4.3 to 6.5	4.8 to 7.0

Asphalt content limits for porous aggregate may be exceeded only if it is requested ahead of placement and is reviewed then accepted in writing by the Engineer.

Meet job-mix formula design criteria specified in Table 401.02-2 - Job-Mix Formula Design Criteria.

TABLE 401.02-2 - JOB-MIX FORMULA DESIGN CRITERIA	
Hveem Method Mix Criteria (AASHTO T 246 and AASHTO T 247)	
Stability, minimum	37
Air Voids (percent)[1]	3 - 5
Marshall Method Mix Criteria (AASHTO T 245)	
Compaction (number of blows each end of specimen)	75
Stability, minimum (pounds)	1,800
Flow (x 0.01 inch)	8 - 16
Air Voids (percent)[1]	3 - 5
Notes: 1. Air Voids: AASHTO T 166 or AASHTO T 275; AASHTO T 209, AASHTO T 269.	

Minimum percent voids in mineral aggregates (VMA) of job-mix formula shall be as specified in Table 401.02-3 - Minimum Percent Voids in Mineral Aggregates (VMA).

TABLE 401.02-3 - MINIMUM PERCENT VOIDS IN MINERAL AGGREGATES (VMA)					
Nominal Maximum Particle Size, (Inches)	1-1/2	1	3/4	1/2	3/8
VMA, (percent)[1]	11.0	12.0	13.0	14.0	15.0
Notes: 1. VMA: See Asphalt Institute Manual MS-2					

(C) Submittals. Establish and submit job-mix formula for each type of HMA pavement mix indicated in the contract documents a minimum of 30 days before paving production. Job mix shall include the following applicable information:

(1) Design percent of aggregate passing each required sieve size.

(2) Design percent of asphalt binder material (type determined by type of mix) added to the aggregate (expressed as % by weight of total mix),

(3) Design proportion of processed RAP.

(4) Design temperature of mixture at point of discharge at paver.

(5) Source of aggregate.

(6) Grade of asphalt binder.

(7) Test data used to develop job-mix formula.

Except for item (4) in this subsection, if design requirements are modified after the Engineer accepts job-mix formula, submit new job-mix formula before using HMA produced from modified mix design. Submit any changes to the design temperature of mixture at point of discharge for acceptance by the Engineer.

Submit a certificate of compliance for the asphalt binder, accompanied by substantiating test data from a certified testing laboratory.

(D) Range of Tolerances for HMA. Provide HMA within allowable tolerances of accepted job-mix formula as specified in Table 401.02-4 - Range of Tolerances HMA. These tolerances are not to be used for the design of the job mix, they are solely to be used during the testing of the production field sample of the HMA mix.

TABLE 401.02-4 - RANGE OF TOLERANCES HMA	
Passing No. 4 and larger sieves (percent)	± 7.0
Passing No. 8 to No. 100 sieves (inclusive) (percent)	± 4.0
Passing No. 200 sieve (percent)	± 3.0
Asphalt Content (percent)	± 0.4
Mixture Temperature (degrees F)	± 20

The tolerances shown are the allowable variance between the physical characteristics of laboratory job mix submitted mix design and the production or operational mix, i.e., field samples.

401.03 Construction.

(A) Weather Limitations. Placement of HMA shall not be allowed under the following conditions:

(1) On wet surfaces, e.g., surface with ponding or running water, surface that has aggregate or surface that appears beyond surface saturated dry, as determined by the Engineer.

(2) When air temperature is below 50 degrees F and falling. HMA may be applied when air temperature is above 40 degrees F and rising. Air temperature will be measured in shade and away from artificial heat.

(3) When weather conditions prevent proper method of construction.

(B) Equipment.

(1) Mixing Plant. Use mixing plants that conform to AASHTO M 156, supplemented as follows:

(a) All Plants.

1. Automated Controls. Control proportioning, mixing, and mix discharging automatically. When RAP is incorporated into mixture, provide positive controls for proportioning processed RAP.

2. Dust Collector. AASHTO M 156, Requirements for All Plants, Emission Controls is amended as follows:

Equip plant with dust collector. Dispose of collected material. In the case of baghouse dust collectors, dispose of collected material or return collected material uniformly.

3. Modifications for Processing RAP. When RAP is incorporated into mixture, modify mixing plant in accordance with plant manufacturer's recommendations to process RAP.

(b) Drum Dryer-Mixer Plants.

1. Bins. Provide separate bin in cold aggregate feeder for each individual aggregate stockpile in mix. Use bins of sufficient size to keep plant in continuous operation and of proper design to prevent overflow of material from one bin to another.

2. Stockpiling Procedures. Separate aggregate for Mix II, Mix III and Mix IV into at least three stockpiles with different gradations as follows: coarse, intermediate, and fine. Separate aggregates for Mix V into at least two stockpiles. Stockpile RAP separately from virgin aggregates.

3. Checking Aggregate Stockpile. Check condition of the aggregate stockpile often enough to ensure that the aggregate is in optimal condition.

(c) Batch and Continuous Mix Plants.

1. Hot Aggregate Bin. Provide bin with three or more separate compartments for storage of screened aggregate fractions to be combined for mix. Make partitions between compartments tight and of sufficient height to prevent spillage of aggregate from one compartment into another.

2. Load Cells. Calibrated load cells may be used in batch plants instead of scales.

(2) Hauling Equipment. Use trucks that have tight, clean, smooth metal beds for hauling HMA.

Thinly coat truck beds with a minimum quantity of non-stripping release agent to prevent mixture from adhering to beds. Diesel or petroleum-based liquid release agents, except for paraffin oil, shall not be used. Drain excess release agent from truck bed before loading with HMA.

Provide a designated clean up area for the haul trucks.

Equip each truck with a tarpaulin conforming to the following:

(a) In good condition, without tears and holes.

(b) Large enough to be stretched tightly over truck bed, completely covering mix. The tarpaulin shall be secured in such a manner that it remains stretched tightly over truck bed and HMA mix until the bed is about to be raised up in preparation for discharge.

(3) Asphalt Pavers. Use asphalt pavers that are:

(a) Self-contained, power-propelled units.

(b) Equipped with activated screed or strike-off assembly, heated if necessary.

(c) Capable of spreading and finishing courses of HMA mixtures in lane widths applicable to typical section and thicknesses indicated in the contract documents.

(d) Equipped with receiving hopper having sufficient capacity for uniform spreading operation.

(e) Equipped with automatic feed controls to maintain uniform depth of material ahead of screed.

(f) Equipped with automatic screed controls with sensors capable of sensing grade from outside reference line, sensing transverse slope of screed, and providing automatic signals to control screed grade and transverse slope.

(g) Capable of operating at constant forward speeds consistent with satisfactory laying of mixture.

(h) Equipped with a means of preventing the segregation of the coarse aggregate particles from the remainder of the bituminous plant mix when that mix is carried from the paver hopper back to the paver augers. The means and methods used shall be approved by the paver manufacturer and may consist of chain curtains, deflector plates, or other such devices and any combination of these.

The following specific requirements shall apply to the identified bituminous pavers:

1. **Blaw-Knox Bituminous Pavers.** Blaw-Knox bituminous pavers shall be equipped with the Blaw-Knox Materials Management Kit (MMK).

2. **Cedarapids Bituminous Pavers.** Cedarapids bituminous pavers shall be those that were manufactured in 1989 or later.

3. Barber-Green/Caterpillar Bituminous Pavers. Barber-Green/Caterpillar bituminous pavers shall be equipped with deflector plates as identified in the December 2000 Service Magazine entitled “New Asphalt Deflector Kit {6630, 6631, 6640}”.

Bituminous pavers not listed above shall have similar attachments or designs that shall make them equivalent to the bituminous pavers listed above. The Engineer will solely decide if it is equal to or better that the setups described for the equipment listed above.

Submit for review and acceptance, prior to the start of using the paver for the placing of plant mix, a full description in writing of the means and methods that will be used to prevent the bituminous paver from having both aggregate and temperature segregation. Use of any paver that has not been accepted is prohibited until acceptance of the paver is received from the Engineer. Any pavement placed with an unaccepted paver will be regarded as not compliant work and may not be paid for and may require removal.

Supply a Certificate of Compliance that verifies that the manufacturer’s approved means and methods used to prevent bituminous paver from having both aggregate and temperature segregation have been implemented on all pavers used on the project and are working in accordance with the manufacturer’s requirements and Contract Documents.

(4) Rollers. Rollers shall be self-propelled, steel-tired tandem, pneumatic-tired, or vibratory-type rollers capable of reversing without shoving or tearing the just placed HMA mixture. Provide sufficient number, sequencing, type, and rollers of sufficient weight to compact the mixture to required density while mixture is still in workable condition unless otherwise indicated. Equipment shall not excessively crush aggregate. Operate rollers in accordance with manufacturer's recommendations and Contract Documents. The use of intelligent compaction is encouraged and may be required elsewhere in the Contract Documents.

(a) Steel-Tired Tandem Rollers. Steel-tired tandem rollers used for initial breakdown or intermediate roller passes shall have minimum gross weight of 12 tons and shall provide minimum 250-pound weight per linear inch of width on drive wheel.

Steel-tired tandem rollers used for finish roller passes shall have minimum total gross weight of 3 tons.

Do not use roller with grooved or pitted rolling drum or worn scrapers or wetting pads. Replace excessively worn scrapers and wetting pads before use.

(b) Pneumatic-Tired Rollers. Pneumatic-tired rollers shall be oscillating-type, equipped with smooth-tread pneumatic tires of equal size and diameter. Maintain tire pressure within 5 pounds per square inch of designated operational pressure when hot. Space tires so that gaps between adjacent tires are covered by following set of tires.

Pneumatic-tired rollers used for breakdown or intermediate roller passes shall have a ballast capable of establishing an operating weight per tire of not less than 3,000 pounds. Equip rollers with tires having minimum 20-inch wheel diameter with tires inflated to 70 to 75 pounds per square inch pressure when cold and 90 pounds per square inch when hot. Equip rollers with skirt-type devices to maintain temperature of tires during rolling operations.

Pneumatic-tired rollers used for kneading finished asphalt surfaces shall have a ballast capable of establishing an operating weight per tire of not less than 1,500 pounds. Equip rollers with tires having minimum 15-inch wheel diameter with tires inflated to 50 to 60 pounds per square inch pressure. If required, equip rollers with skirt-type devices to maintain temperature of tires during rolling operations.

(c) Vibratory Rollers. Vibratory rollers shall be steel-tired tandem rollers having minimum total weight of 3 tons. Equip vibratory rollers with amplitude and frequency controls and speedometer. Operate vibratory roller in accordance with manufacturer's recommendations. For very thin lifts, 1 inch or less in thickness, vibratory rollers shall not be used in the vibratory mode. Instead, operate the unit in the static mode.

(5) Hand Tools. Keep hand tools used in production, hauling, and placement of HMA clean and free of contaminants. Diesel or mineral spirits or other cleaning material that is potentially deleterious to HMA may be used to clean hand tools providing:

(a) It does not contaminate HMA with cleaning material.

(b) Clean hand tools over catch pan with capacity to hold all the cleaning material.

(c) Remove all diesel or mineral spirits or other cleaning material that is potentially deleterious to HMA from hand tools before using with HMA.

(d) Hand tools used shall be in a condition such that it meets the requirements that it was manufactured for, e.g., a straightedge shall meet the straightness requirement of the manufacturer.

(6) Material Transfer Vehicle (MTV).

(a) Usage. MTV usage applies to surface courses of paving projects on all Islands except Lanai, unless otherwise indicated. When placing HMA surface course use MTV to independently deliver mixtures from hauling equipment to paving equipment. MTV usage will not be required for the following:

1. Projects with less than 1,000 tons of HMA.

2. Temporary pavements.

3. Bridge deck approaches.

4. Shoulders.

5. Tapers.

6. Turning lanes.

7. Driveways.

8. Areas with low overhead clearances.

(b) Equipment. When using MTV, install minimum 10-ton-capacity hopper insert in conventional paver hopper. Provide the following equipment:

1. High-capacity truck unloading system in MTV capable of receiving HMA from hauling equipment.

2. MTV storage bin with minimum 15-ton capacity.

3. An auger mixing system in one of the following:

the MTV storage bin, or paver hopper insert, or paver hopper to continuously mix HMA prior to discharging to the paver's conveyor system.

Avoid stop-and-go operations by coordinating plant production rate, number of haul units, and MTV and paver speeds to provide a continuous, uniform, segregation-free material flow and smooth HMA pavement. Maintain uniform paver speed to produce smooth pavements.

(c) Performance Evaluation. Evaluate the performance of MTV and mixing equipment by measuring mat temperature profile immediately behind paver screed on first day of paving and when it feels the need to do so due to perceived changes in performance or as directed by the Engineer.

Use a hand-held temperature device that has been calibrated within the past 12 months. It shall be an infrared temperature gun is capable of measuring in one degree or finer increments between the temperatures of 80 degrees to 400 degrees F with a laser to indicate where the temperature reading is being taken. Six temperature profile measurements shall be taken of mat surface using infrared temperature gun at 50-foot intervals behind paver. Each temperature profile shall consist of three surface temperature measurements taken transversely across the mat in approximately a straight line from screed while paver is operating. For each profile, temperatures shall be measured approximately 1 foot from each edge and in middle of mat. The difference between maximum and minimum temperature measurements for each temperature profile shall not exceed 10 degrees F. If any two or more temperature profiles exceeds the allowable 10-degree F temperature differential, halt paving operation and adjust MTV or mixing equipment to ensure that material placed by paver meets specified temperature requirements. Redo the measuring of mat temperature profile until adjustment of the MTV or mixing equipment is adequate. Submit all temperature profiles to the Engineer by next business day. Information on the report shall show location and temperature readings and time test was performed. Enough information shall be given, so the Engineer will be able to easily locate the test site of the individual measurement.

When requested temperature profile measurements shall be done in the presence of the Engineer.

Once adjustments are made, repeat measurement procedure for the next two placements to verify that material placed by paver meets specified temperature requirements. Terminate paving if temperature profile requirements are not met during repeated measurement procedure. If equipment fails to meet requirements after measurement procedure is repeated once, replace equipment before conducting any further temperature profile measurements

The Engineer may perform surface temperature profile measurements at any time during project. The Engineer may in lieu of a hand-held infrared temperature device use an infrared camera or device that is capable of measuring temperatures to locate cold spots. If such cold spots exist, the Engineer may require adjustments to the MTV.

If bleeding or fat spots occur in the pavement adjust means and methods to eliminate such pavement defects and perform remedial repair to pavement acceptable to the Engineer. Bleeding is defined as excess binder occurring on the surface of the pavement. It may create a shiny, glass-like, reflective appearance and may be tacky to the touch. Fat spots are localized bleeding.

(d) Transport.

1. Trailered MTV. Transport MTV by means of truck-tractor/trailer combination in accordance with Chapter 104 of Title 19, Department of Transportation, entitled “The Movement by Permit of Oversize and Overweight Vehicles on State Highways”.

2. Crossing Bridges for Self-Powered MTV. When self-powered MTV exceeds legal axle or total weight limits for vehicles under the HRS, Chapter 291, conform to the following when crossing bridges within project limits unless otherwise indicated:

a. Completely remove mix from MTV.

b. Move MTV at relatively constant speed not exceeding 5 miles per hour. MTV will not be allowed to stop on bridge.

c. No other vehicle or equipment will be allowed on bridge.

d. The MTV shall not attempt to cross a bridge where the posted load limit is less than or equal to the weight of the MTV empty. Permission to cross the bridge shall be obtained from the Engineer and HWY-DB in writing.

(C) Preparation of Surface. Clean existing pavement in accordance with Section 310 - Brooming Off. Apply tack coat in accordance with Section 407 - Tack Coat. Tack coat shall not be applied to surfaces to receive an application of joint adhesive.

Where indicated, bring irregular surfaces to uniform grade and cross section by furnishing and placing one or more leveling courses of HMA Mix V. Spread leveling course in variable thicknesses to eliminate irregularities in existing surface. Place leveling course such that maximum depth of each course, when thoroughly compacted to the Contract Documents' requirements, does not exceed 3 inches.

In multiple-lift leveling course construction, spread subsequent lifts beyond edges of previously spread lifts in accordance with procedures contained in current edition of the Asphalt Institute's *Construction of Hot Mix Asphalt Pavements,* Manual Series No. 22 (MS-22) for leveling wedges.

Notify the Engineer of existing surfaces that may not be in a condition that will have enough strength to be a good bonding surface or foundation and should be removed or have remedial repairs done before new pavement placement.

(D) Plant Operation.

(1) Preparation of Asphalt Binder. Uniformly heat asphalt binder and provide continuous supply of heated asphalt cement from storage to mixer. Do not heat asphalt binder above the recommendation of the supplier for modified binders or above 350 degrees F for neat binders.

(2) Preparation of Aggregate. Dry and heat aggregate material at temperature sufficient to produce design temperature of job-mix formula. Do not exceed 350 degrees F. Adjust heat source used for drying and heating to avoid damage to and contamination of aggregate. When dry, aggregate shall not contain more than 1 percent moisture by weight.

For batch plants, screen aggregates immediately after heating and drying into three or more fractions. Convey aggregates into separate compartments ready for batching and mixing with asphalt binder.

(3) Mixing. Measure aggregate and asphalt; or aggregate, RAP, and asphalt into mixer in accordance with an accepted job-mix formula. Mix until components are completely mixed and adequately coated with asphalt binder in accordance with AASHTO M 156. Percent of coated particles shall be 95 percent when tested in accordance with AASHTO T 195.

(4) Plant Inspection. For control and acceptance testing during periods of production, provide a testing laboratory that meets the requirements of AASHTO M 156. Provide space, utilities, and equipment required for performing specified tests.

(E) Spreading and Finishing. Prior to each day's paving operation, check screed or strike-off assembly surface with straight edge to ensure straight alignment and there is no damage or wear to the machine that will affect performance. Provide screed or strike-off assembly that produces finished surface without tearing, shoving, and gouging HMA. Discontinue using spreading equipment that leaves ridges, indentations, or other marks, or combination thereof in surface that cannot be eliminated by rolling or affects the final smoothness of the pavement or be prevented by adjustment in operation.

Maintain HMA at minimum 250 degrees F temperature at discharge to paver. The Engineer shall observe the contractor measuring the temperature of mix in hauling vehicle just before depositing into spreader or paver or MTV.

Deposit HMA in a manner that minimizes segregation. Raise truck beds with tailgates closed before discharging HMA.

Lay, spread, and strike off HMA upon prepared surface. Where practical, use asphalt pavers to distribute mixture.

Where practical, control horizontal alignment using automatic grade and slope controls from reference line, slope control device. Existing pavements or features shall not be used for grade control alone.

Obtain sensor grade reference, horizontal alignment by using established grade and slope controls. For subsequent passes, substitution of one ski with joint-matching shoe riding on finished adjacent pavement is acceptable. Use of a comparable non-contact mobile reference system and joint matching shoe is acceptable.

Avoid stop-and-go operation. Maintain a constant forward speed of paver during paving operation and minimize other methods that impact smoothness.

Offset longitudinal joint in successive lifts by approximately 6 inches. Incorporate into paving method an overlap of material of 1-inch +/- 0.5 inches at the longitudinal joint. The HMA overlap material shall be left alone when initially placed and shall not be bumped back or pushed back with a lute or any other hand-held device. If the overlap exceeds the maximum amount, remove the excess with a flat shovel, allowing recommended amount of overlap HMA material to remain in place to be compacted. Do not throw the removed excess HMA material on to the paving mat. The longitudinal joint in a surface course when total roadway width is comprised of two lanes shall be near the centerline of pavement or near lane lines when roadway is more than two lanes in width. The longitudinal joint shall not be constructed in the wheel path or under the longitudinal lane lines. Make a paving plan drawing showing how the longitudinal joint will not be located in these areas.

Control the horizontal alignment of the longitudinal edge of the HMA mat being installed so that the edge is parallel to the centerline or has a uniform alignment, e.g., the edge of the mat is straight line or uniform curve, no wavy edge, etc. to have a consistent amount of HMA material at the joint.

Check the compaction of the longitudinal joint during paving often enough to ensure that it will meet the compaction requirements.

If nuclear gauges and ground penetrating radar are used as the contractor's quality control method, they shall be properly calibrated and periodically checked by comparison to cores taken from the pavement. The use of sand as an aid in properly seating the gauge may also be considered for improving the accuracy of the gauge.

In areas where irregularities or unavoidable obstacles make use of mechanical spreading and finishing equipment impracticable, spread, rake, and lute mixture by hand tools. For such areas, deposit, spread evenly, and screed mixture to required compacted thickness.

Demonstrate competence of personnel operating grade and crown control device before placing surface courses. If automatic control system becomes inoperative during the day's work, the Engineer will permit the Contractor to finish day's work using manual controls. The Engineer may also allow additional HMA to be ordered and placed using manual controls if it will provide a safer work site for the public to travel through. Do not resume work until automatic control system is made operative. The Engineer may waive requirement for electronic screed control device when paving gores, shoulders, transitions, and miscellaneous reconstruction areas where the use of the devices is not practical.

When production of HMA can be maintained and when practicable, use pavers in echelon shall be used to place surface course in adjacent lanes.

At the end of each workday, HMA pavement that is open to traffic shall not extend beyond the panel of the adjacent new lane pavement by more than the distance normally placed in one workday. At end of each day's production, construct tapered transitions along all longitudinal and transverse pavement drop-offs; this shall apply to areas where existing pavement is to meet newly placed pavement. Use slopes of 6:1 for longitudinal taper transitions and 48:1 for transverse tapered transitions. Maximum drop-off height along the joints shall be 2 inches. Also, using a 48:1 slope provides a taper around any protruding object, e.g., manholes, drain boxes, survey monuments, inlets, etc., that may be above pavement surface when opened to the public. If the object is below the surface of the pavement then fill the depression until it is level with the surrounding pavement or raise depressed objects to the finish grade of the placed pavement. Remove and dispose of all transition tapers before placing adjoining panel or next layer of HMA. Notify traveling public of pavement drop-offs or raised objects with signs placed in every direction of traffic that may use and encounter pavement drop-offs or protruding objects or holes.

Use the same taper rates for areas where there is a difference in elevation due to construction work.

At end of each workweek, complete full width of the roadway’s pavement, including shoulders, to same elevation with no drop-offs.

(F) Compaction. Immediately after spreading and striking off HMA and adjusting surface irregularities, uniformly compact mixture by rolling.

Initiate compaction at highest mix temperature allowing compaction without excessive horizontal movement. Temperature shall not be less than 220 degrees F.

Finish rolling using tandem roller while HMA temperature is at or above 175 degrees F.

On superelevated curves, begin rolling at lower edge and progress to higher edge by overlapping of longitudinal trips parallel to centerline.

If necessary, repair damage immediately using rakes and fresh mix. Do not displace line and grade of HMA edges during rolling.

Keep roller wheels properly moistened with water or water mixed with small quantities of detergent. Use of excess liquid, diesel, and petroleum-based liquids will not be allowed on rollers.

Along forms, curbs, headers, walls and other places not accessible to rollers, compact mixture with hot hand tampers, smoothing irons, or mechanical tampers. On depressed areas, trench roller or cleated compression strips under roller may be used to transmit compression.

Before the start of compaction or during compaction or both remove pavement that is loose, broken, or contaminated, or combination thereof; pavement that shows an excess or deficiency in asphalt binder content; and pavement that is defective in any way. Replace with fresh HMA pavement of same type, and compact. Remove and replace defective pavement and compact at no increase in contract price or contract time.

Operate rollers at slow and uniform speed with no sudden stops. The drive wheels shall be nearest to the paver. Continue rolling to attain specified density and until roller marks are eliminated.

Rollers shall not be parked on the pavement placed that day or shift.

(1) HMA Pavement Courses One and a Half Inches Thick or Greater. Where HMA pavement compacted thickness indicated in the Contract Documents is 1-1/2 inches or greater, compact to not less than 93.0 percent nor greater than 97.0 percent of the maximum specific gravity determined in accordance with AASHTO T 209, modified by deletion of Supplemental Procedure for Mixtures Containing Porous Aggregate.

Place HMA pavement in individual lifts that are within minimum and maximum allowable compacted thickness for various types of mixture as specified in Table 401.02-1 - Limits of Compacted Lift Thickness and Asphalt Content.

(2) HMA Pavement Courses Less Than One and a Half Inches Thick. Where HMA pavement compacted thickness indicated in the contract documents is less than 1-1/2 inches, compaction to a specified density will not be required.

Use only non-vibratory, steel-tired, tandem roller. Roll entire surface with minimum of two roller passes. A roller pass is defined as one trip of the roller in one direction over any one spot.

For intermediate rolling, roll entire surface with minimum of four passes of roller.

Finish rolling using steel-tired, tandem roller. Continue rolling until entire surface has been compacted with minimum of three passes of roller, and roller marks have been eliminated.

Do not use rollers that will excessively crush aggregate.

(3) HMA Pavement Courses One and a Half Inches Thick or Greater In Special Areas Not Designated For Vehicular Traffic. For areas such as bikeways that are not part of roadway and other areas not subjected to vehicular traffic, compact to not less than 90.0 percent of maximum specific gravity determined in accordance with AASHTO T 209, modified by deletion of Supplemental Procedure for Mixtures Containing Porous Aggregate. Increase asphalt content by at least 0.5 percent above that used for HMA pavements designed for vehicular traffic. Paved shoulders shall be compacted in the same manner as pavements designed for vehicular traffic.

(G) Joints, Trimming Edges and Utility Marking. At HMA pavement connections to existing pavements, make joints vertical to depth of new pavement. Saw cut existing pavement and cold plane in accordance with Section 415 - Cold Planing of Existing Pavement to depth equal to thickness of surface course or as indicated in the Contract Documents.

At HMA connections to previously placed lifts, form transverse joints by cutting back on previous run to expose full depth of course. Dispose of material trimmed from edges. Protect end of freshly laid mixture from rollers.

Before and after paving, identify and mark location of existing utility manholes, valves, and handholes on finished surface. Adjust existing frames and covers and valve boxes to final pavement finish grade in accordance with Section 604 - Manholes, Inlets and Catch Basins and Section 626 - Manholes and Valve Boxes for Water and Sewer Systems.

(1) Longitudinal joints. Submit for review the means and methods that will be used to install longitudinal joints at the required compaction and density. Compact longitudinal joints to be not less than 91.0 percent of the maximum specific gravity determined in accordance with AASHTO T 209, modified by deletion of Supplemental Procedure for Mixtures Containing Porous Aggregate. Verify the compaction of the longitudinal joints meets requirements by using non-destructive testing methods during paving and submit the results on the daily quality control test reports.

Test for compaction and density regardless of layer thickness. Compaction and density of the longitudinal joint shall be determined by using six-inch diameter cores. For longitudinal joints made using butt joints cores shall be taken over the joint with half of the core being on each side of the joint. For longitudinal joints using butt wedge joints, center core over the center of the wedge so that 50 percent of the material is from the most recently paved material and the remaining 50 percent of the core is from the material used to pave the previous layer. One core shall be taken at a maximum of every 250 tons of longitudinal joint and any fraction of that length for each day of paving with a minimum of one core taken for each longitudinal joint per day. Cores taken for the testing of the longitudinal joint may be used to determine pavement thickness.

When the longitudinal joints are found to have less than 91.0 percent of the maximum specific gravity, overband all longitudinal joints within the entire lot represented by the non-compliant core, PG binder seal coat, or other type of joint enrichment accepted by the Engineer. The overband shall not decrease the skid resistance of the pavement under any ambient weather condition. Submit overband material's catalog cuts, test results and application procedure for review and acceptance by the Engineer before use. Center the overband over the longitudinal joint. The overband shall be placed in a uniform width and horizontal alignment. The overband shall have no holidays or streaking in its placement. The width of the overband shall be based on how the longitudinal joint was constructed or as directed by the Engineer. If a butt joint is used, the overband width shall be a minimum of 12-inches. For butt wedge or wedge joints the overband width shall be the width of the wedge plus an additional six-inches minimum. Replace any pavement markings damaged or soiled by the overband remedial repair process.

For longitudinal joints that have a compaction of less than 89 percent of the maximum specific gravity; removal may be required by the Engineer instead of overbanding the non-compliant joint.

Persistent low compaction results may be cause to suspend work and remove non-conforming work. During the suspension of paving, revise

means and methods used in constructing longitudinal joints and submit to the Engineer for review and acceptance. Suspension may occur when:

(1) Two or more longitudinal joints tests fail to meet the minimum compaction

(2) One sample reveals that the joint compaction is 89 percent or less.

Compaction results for longitudinal joints until January 1, 2023 will not be included in any Sliding Scale Pay Factor for Compaction payment calculation. After, January 1, 2023 it will be included.

(H) HMA Pavement Samples. Obtain test samples from compacted HMA pavement within 72 hours of lay down. Provide minimum 4-inch diameter cores consisting of undisturbed, full-depth portion of compacted mixture taken at locations designated by the Engineer in accordance with the "Sampling and Testing Guide for Acceptance and Verification" in Hawaii DOT Highways Division, *Quality Assurance Manual for Materials*, Appendix 3. Cores shall be taken in the presence of the Engineer. Turn cores over to Engineer immediately after cores have been taken.

For pavement samples for longitudinal joints provide 6-inch diameter cores minimum. For pavement samples for other than longitudinal joints 4-inch diameter cores minimum shall be taken. All cores shall consist of undisturbed, full-depth of the lift of the compacted mixture taken at locations designated by the Engineer in accordance with the "Sampling and Testing Guide for Acceptance and Verification" in Hawaii DOT Highways Division, *Quality Assurance Manual for Materials*, appendix 3. Coring of longitudinal joints shall use a modified HDOT Sampling and Testing Guide as required by the Contract Documents.

Cores that separate shall indicate to the Engineer that there is insufficient bonding of layers. Modify the previously used paving means and methods to prevent future debonding of layers. Debonding of a core sample after adjustment of the Contractor's methods will be an indication of continued non-conforming work and the Engineer may direct removal of the layer at no additional cost or contract time.

Restore HMA pavement immediately after obtaining samples. Clean core hole and walls of all deleterious material that will prevent the complete filling of the core hole and the bonding of the new HMA to the existing. Apply tack coat to vertical faces of sample holes. Fill sampled area with new HMA pavement of same type as that removed. If hand compaction is used; fill in layers not exceeding the minimum thickness stated in Table 401.02-1 - Limits of Compacted Lift Thickness And Asphalt Content. Compact each layer to compaction requirements. If Mechanical Compaction methods are used, then

layers may be the maximum layer thickness stated in Table 401.02-1 - Limits of Compacted Lift Thickness And Asphalt Content. Using tires or hand tamping to compact the HMA material to restore the pavement shall not be considered as mechanical compaction.

Only sample and test leveling course if 1-1/2 inches or greater. No compaction requirements for less than 1-1/2 inches.

(I) HMA Pavement Thickness Tolerances.

The Engineer will measure thickness of pavement by cores obtained by the Contractor in accordance with HDOT TM 09-19 Field Sampling Bituminous Material after Compaction (Obtaining Cores). The Engineer will measure cores in accordance with HDOT TM 09-19, except that measurement will be taken to nearest one thousandth of an inch; and average of such measurements will be taken to nearest one hundredth of an inch.

Thickness of finished HMA pavement shall be within 0.25 inch of thickness indicated in the Contract Documents. Pavement not meeting the thickness requirements of the Contract Documents may be required by the Engineer to be removed and replaced.

Corrective methods taken on pavement exceeding specified tolerances, e.g., insufficient thickness by methods accepted by the Engineer, including removal and replacement, shall be at no increase in contract price or contract time.

The checking of pavement thickness shall be done after all remedial repairs, e.g., smoothness compliance repairs, compaction, have been completed, reviewed, and accepted by the Engineer.

(J) Quality Control Using New Technology. The Engineer and MTRB reserves the right to utilize new technology and methods to improve the detection of noncompliant work on the project. The technology or method may be used to locate defects in the work, e.g., ground penetrating radar to locate delaminations, moisture damage, thin sections, voids, non-compliant compaction, other non-destructive testing to locate flaws. The defect will be verified by the methods stated in the Contract Documents or by other established conventional means. If the technology or method has already been accepted elsewhere or has standardized testing procedures the results may be judged acceptable by the Engineer and no further testing will be required. These new technologies and methods may be used for the selection of sampling locations.

(K) Protection of HMA Pavement. Except for construction equipment directly connected with paving operations, keep traffic off HMA pavement.

Protect HMA pavement from damage until it has cooled and set.

Do not refuel equipment or clean equipment or hand tools over paved surfaces unless catch pan or device that will contain spilled fuel and other products is provided. After completion of refueling or cleaning, remove catch pan or device without spilling any of the collected content.

Do not park roller or other paving equipment on HMA pavement paved within 24 hours of laydown.

(L) Pavement Joint Adhesive

(1) Pavement Joint Adhesive on Joints. Use on all asphalt pavement construction where joints are formed at such locations but not limited to the following:

(a) Adjacent asphalt pavements, e.g., trafficked lanes, shoulders, etc.

(b) Asphalt pavement and adjacent concrete pavement or curb and gutter or any other surface where the bonding of the asphalt pavement and concrete surface is desired,

(c) Transverse joints between asphalt pavements not placed at the same time or if the pavement's temperature on one side of the joint is below the minimum temperature the mix can be at, during asphalt pavement compaction or installation.

(d) Cut face of an existing pavement where it will have new HMA pavement placed against it, e.g., utility trenches, partial or full depth repairs, etc.

Pavement joint adhesive is not required on a longitudinal construction joint between adjacent hot mix asphalt pavements formed by echelon paving. Echelon paving is defined as paving multiple lanes side-by-side with adjacent pavers slightly offset at the same time.

A longitudinal construction joint between one shift's work and another shall have pavement joint adhesive applied at the joint. Any longitudinal construction joint formed, with the temperature on one side of the joint that is below the minimum temperature the mix can be when compacted to contract requirements during asphalt pavement installation, shall have pavement joint adhesive applied at the joint.

(2) Material requirements. Asphalt joint adhesive shall meet requirements as specified in Table 401.03-1 - Asphalt Joint Adhesive Specifications.

TABLE 401.03-1 – ASPHALT JOINT ADHESIVE SPECIFICATIONS		
TEST		**SPECIFICATION**
Brookfield Viscosity, 204 °C [400 °F]	ASTM D 3236	4,000-10,000 cp
Cone Penetration, 25 °C [77 °F]	ASTM D 5329	60-100 dmm
Resilience, 25 °C [77 °F]	ASTM D 5329	30% minimum
Ductility, 25 °C [77 °F]	ASTM D 113	30 cm minimum
Ductility, 4 °C [39.2 °F]	ASTM D 113	30 cm minimum
Tensile Adhesion, 25 °C [77 °F]	ASTM D 5329	500% minimum
Softening Point	ASTM D 36	77 °C [170 °F] min.
Asphalt Compatibility	ASTM D 5329	Pass

(3) Construction Requirements for Asphalt Joint Adhesive

(a) Equipment Requirements. Use a jacketed double boiler type melting unit, with both agitation and recirculation systems. Provide a pressure feed wand application system.

(b) Material Handling. Submit a copy of the manufacturer's recommendations for heating, re-heating, and applying the joint adhesive material. Follow manufacturer's recommendations. Do not remove the joint adhesive from the package until immediately before it is placed in the melter. Joint adhesive boxes must be clearly marked with the name of the manufacturer, the trade name of the adhesive, the manufacturer's batch and lot number, the application/pour temperature, and the safe heating temperature. Feed additional material into the melter at a rate equal to the rate of material used.

Verify the pouring temperature of the joint adhesive at least once per hour at the point of discharge. Stop production if the adhesive falls below the recommended application/pour temperature. When the temperature of the adhesive exceeds the maximum safe heating temperature, stop production, empty the melter, and dispose of that adhesive in an environmentally safe method. No payment will be made for this material or its disposal.

Do not blend or mix different manufacturer’s brands or different

types of adhesives.

(c) Joint Adhesive Application: The face of the joint that the new asphalt pavement will bind to shall be clean and dry before the joint adhesive is applied. Apply the pavement joint adhesive material to the entire face of the surface where HMA pavement shall be installed. The thickness of the asphalt adhesive application shall be approximately 1/8 inch. Use an application shoe attached to the end of application wand. Do not overlap the joint by greater than 1/2-inch at the top of the joint or two-inches at the bottom of the joint. Apply the joint adhesive immediately in front of the paving operation. If the adhesive is tracked by construction vehicles, repair the damaged area, and restrict traffic from driving on the adhesive.

(d) Field Sampling. Take a sample from the application wand during the first 20 minutes of placing sealant. One sample should be taken per manufacturer's batch or minimum of every 6 months on the Project in the presence of the Engineer.

Each sample shall consist of one quart in an aluminum or steel sample container. The sampling container shall be labeled with Contractor's name; project name and number; date and time sample taken; location of where material was used at, e.g., from where to where it was used at in stations; manufacturer and lot number of the sealant. Turn over samples to Engineer without Engineer losing sight of the sample. The Engineer reserves the right to conduct supplementary sampling and testing of the sealant material.

(M) Pavement Smoothness Rideability Test. Perform surface profile tests frequently to ensure that the means and methods being used produces pavement that is compliant with the surface profile smoothness requirement. Test the pavement surface for smoothness with High-Speed Inertial Profiler to determine the International Roughness Index (IRI) of the pavement. For the locations determined by the Engineer, a 10-foot straightedge shall be used to measure smoothness.

All smoothness testing must be performed with the presence of the Engineer. The High-Speed Inertial Profiler operator shall be a certified operator by MTRB or the manufacturer.

The High-Speed Inertial Profiler operator's certification shall be no older than five years old at the date of the Notice to Proceed and at the day of the pavement profile measurement.

The finished pavement shall comply to all the following requirements:

(a) Smoothness Test using 10-Foot Straightedge (Manual or rolling) The 10-foot straightedge is used to identify the locations that vary more than 3/16 inch from the lower edge when the 10-foot straightedge is laid on finished pavement on the direction parallel with the centerline or perpendicular to centerline. Remove the high points that cause the surface to exceed that 3/16 inch tolerance by grinding.

The Contractor shall use a 10-foot straightedge for the following locations:

1. Longitudinal profiling parallel to centerline, when within 15 feet of a bridge approach or existing pavement which is being joined.

2. Transverse profiling of cross slopes, approaches, and as otherwise directed. Lay the straightedge in a direction perpendicular to the centerline.

3. When pavement abuts bridge approaches or pavement not under this Contract, ensure that the longitudinal slope deviations of the finished pavement comply with Contract Document's requirements.

4. Short pavement sections up to 600 feet long, including both mainline and non-mainline sections on tangent sections and on horizontal curves with a centerline radius of curve less than 1,000 feet.

5. Within a superelevation transition on horizontal curves having centerline curve radius less than 1,000 feet, e.g., curves, turn lanes, ramps, tapers, and other non-mainline pavements.

6. Within 15 feet of transverse joint that separates pavement from existing pavement not constructed under the contract, or from bridge deck or approach slab for longitudinal profiling.

7. At miscellaneous areas of improvement where width is less than 11 feet, such as medians, gore areas, and shoulders.

8. As otherwise directed by the Engineer. The Engineer may confine the checking of through traffic lanes with the

straightedge to joints and obvious irregularities or choose to use it at locations not specifically stated in this Section.

(b) High-Speed Inertial Profiler

There shall be a minimum 3 profile runs per lane, for each wheel path (left and right) which is approximately three feet from edge lane line. The segment length shall be 0.1 mi. The final segments in a lane that are less than 0.1 mi shall be evaluated as an independent segment and pay adjustments will be prorated for length. The profiles shall be taken in the direction of traffic only.

The latest version of FHWA ProVAL software shall be used to conduct profile analysis to determine IRI and areas of localized roughness. The IRI values shall be reported in units of in/mi.

Areas of localized roughness will be identified by using ProVAL's "Smoothness Assurance" analysis, calculating IRI with a continuous short interval of 25 feet and the 250-mm filter applied.

Additional runs may be required by the Engineer if the data indicate a lack of repeatability of results. A 92% agreement is required for repeatability and IRI values shall have at minimum a 95% confidence level.

(N) Required Pavement Smoothness

The IRI for the left and right wheel paths in an individual lane will be computed and then averaged to determine the Mean Roughness Index (MRI) values. The MRI will be used to determine acceptance and pay adjustment. Each lane shall be tested and evaluated separately.

There are three (3) categories of target MRI values:

TABLE 401.03-2 – PAVEMENT SMOOTHNESS CATEGORIES

Category	Description	MRI
Type A	Three or more HMA Lifts	Shall not exceed 60 in/mi
Type B	Two HMA Lifts	Shall not exceed 70 in/mi
Type C	One HMA Lift	Shall not exceed 75 in/mi

For the location where a 10-foot manual straightedge is required, the surface shall not vary more than 3/16 inch from the lower edge of a straightedge.

No pre-final inspection, final inspection, and substantial completion granted will be made until the pavement meets smoothness requirement and all required profile reports are submitted to the Engineer and MTRB and are accepted.

(O) Request for Profile Testing by the Department.

For Type C, prior to pavement activities, the Engineer will measure the smoothness of the existing pavement.

The Contractor shall submit a written request to the Engineer to perform all required profile tests.

The request shall be made at least 30 days before desired testing date and shall include an approximate acceptance profile testing date, a plan view drawing of the area to be tested with the limits of the test area highlighted.

The Contractor shall reimburse HDOT for any incurred cost related to any Contractor-caused cancellation or a deduction to the monthly payment will be made.

(P) Department Requirements for Profile Testing. When a request for testing is made, the requested area to be tested shall be 100% of the total area indicated to be paved in the Contract Documents unless the requirement is waived by the Engineer and MTRB.

Department acceptance surface tests will not be performed earlier than 14 days after HMA placement.

Clean debris and clear obstructions from area to be tested, as well as a minimum of 100 feet before and beyond the area to be tested before testing starts for use as staging areas. Provide traffic control for all profile testing.

The Engineer or MTRB or both may cancel the profile testing if the test area is not sufficiently clean, traffic control is unsatisfactory, or the area is not a safe work environment or test area does not meet Contract Document requirements. This canceled profile test will count as one profile test.

(Q) Cost of Acceptance Profile Testing by The Department. The Engineer, MTRB, or State's Third-Party Consultant will perform one initial profile test, at no cost to the Contractor for each area to be tested.

The Department's High-Speed Inertial Profiler pavement profile will be used to determine if the pavement's profile, i.e., smoothness is acceptable.

If the profile of the pavement does not meet the requirements of the Contract Documents, the Contractor shall perform remedial work, i.e. corrective work then retest the area to ensure that the area has the required MRI, i.e., smoothness, before requesting another profile test by the Engineer.

(1) Additional testing. Additional testing, by the Department beyond the initial test will be performed at cost to the Contractor as follows:

(a) $2,500 per test will be required when Department personnel or State's Third-Party Consultant is used.

(R) Remedial Work for Pavements.

(1) Corrective work shall be required for any 25 ft interval with a localized roughness in excess of 160 in/ mi. The Engineer may waive localized roughness requirements for deficiencies resulting from manholes or other similar appurtenances. Adjust manholes or other similar appurtenances so that using a 10-ft. straightedge the area around that manhole or other similar appurtenance shall not have more than 3/16-in. variation between any 2 contacts on the straightedge.

If corrective action is not successful, the Engineer may require continued corrective action, or apply a payment adjustment of $250 per occurrence.

(2) Corrective work shall also be required for any 0.1 mile interval with an average MRI above 95.0 in/mi for Types A and B. For Type A, correct the deficient section to an MRI of 60 in/mi or less. For Type B, correct the deficient section to an MRI of 70 in/mi or less. For Type C, corrective work may be required by the Engineer for 0.1 mile intervals that have an average MRI above the threshold shown in Tables 401.03-4 and 5, Smoothness Pay Disincentives With MRI and Smoothness Pay Disincentives For Percent Improvement, respectively, as applicable.

If corrective action does not produce the required improvement, the Engineer may require continued corrective action, or apply payment adjustment as shown in Tables 401.03-4 and 5, Smoothness Pay Disincentives With MRI and Smoothness Pay Disincentives For Percent Improvement, respectively.

(3) The Contractor shall notify the Engineer at least 24 hours prior to commencement of the corrective work. The Contractor shall not

commence corrective work until the methods and procedure have been approved in writing by the Engineer.

(4) All smoothness corrective work for areas of localized roughness shall be for the entire lane width. Pavement cross slope shall be maintained through corrective areas.

(5) The remedial repair areas shall be neat, rectangular areas having a uniform surface appearance.

(6) If grinding is used on HMA pavement, the surface shall have nearly invisible grinding marks to passing motorist.

(7) Other methods may include milling and overlaying HMA pavement. The length, depth of the milling and the replacement material will be solely decided by the Engineer.

(8) The finished repaired pavement surface shall leave no ridges or valleys or fins of pavement other than those allowed below.

(9) Remedial repairs shall not leave any drainage structures' inlets higher than the surrounding pavement or alter the Contract Document's drainage pattern.

(10) For items in the pavement other than drainage structures, e.g., manhole frame and covers, survey monuments, expansion joints etc., the finish pavement, ground or not, shall not be more than 1/4 inch in elevation difference. Submit to the Engineer remedial repair method to correct these conditions for acceptance.

(11) Pick up immediately grinding operation residue by using a vacuum attached to grinding machine or other method acceptable to the Engineer.

(a) Any remaining residue shall be picked up before the end of shift or before the area is open to traffic, whichever is earlier.

(b) Prevent residue from flowing across pavement or from being left on pavement surface or both.

(c) Residue shall not be allowed to enter the drainage system.

(d) The residue shall not be allowed to dry or remain on the pavement.

(e) Dispose of all material that is the result of the remedial repair operation, e.g., HMA residue, wastewater, and dust at a legal facility.

(12) Complete corrective work before determining pavement thickness for HMA pavements in accordance with Subsection 401.03(I) – HMA Pavement Thickness Tolerances.

(13) All HMA wearing surface areas that have been ground shall receive a coating, e.g., a coating material that will restore any lost impermeability of the HMA due to the grinding of the surface. The coating used shall not be picked up or tracked by passing vehicles or be degraded after a short period of time has passed, i.e., it shall have a service life equal to or greater than the HMA pavement. The coating shall not decrease the pavement's friction value. The coating's limits shall be the full width of the lane regardless how small. If the remedial repair area extends into the next lane, then the repair area will be full lane width also. Extend the length of coating areas in order for the coating area to look like the rest of the road and does not have patches on it, i.e., make the road look uniform in color. The coating shall be of a color that matches the surrounding pavement. The areas receiving the coating shall not be open to traffic until it has cured enough so that it cannot be picked up or tracked by passing vehicles or degrade. Submit means and methods of the coating and type of coating to the Engineer or MTRB for review and acceptance. Do not proceed with the coating without acceptance from the Engineer.

(14) Recompacting cold HMA, i.e., HMA that has reached ambient temperature is not an acceptable remedial repair method.

(15) Replace all pavement markings damaged or discolored by remedial repairs.

(16) Reprofile the corrected area and provide the Engineer the results that show the corrective action, i.e., remedial repairs were successful.

(S) Pavement Smoothness and Acceptance.

(1) Price and payment in various paving sections, e.g., 401 (Hot Mix Asphalt Pavement), shall be full compensation for all work and materials specified in the various paving sections and this section, including but not limited to furnishing all labor, materials, tools, equipment, testing, incidentals and for doing all work involved in micro milling, milling (cold planing), grinding existing or new pavement, removing residue, cleaning the pavement, necessary disposal of

residue, furnishing of any water or air used in cleaning the pavement and any other related ancillary work or material or services. Also, it includes any remedial work, e.g., re-paving, surface grinding, application of a coating, curing compound, and replacement of damaged pavement markings.

(2) The contract price in those sections may be adjusted for pavement smoothness by the Engineer. The pavement smoothness contract unit price adjustments and work acceptance will be made in accordance with the following schedules.

TABLE 401.03-3 –SMOOTHNESS PAY INCENTIVES

Category	MRI (in/mi)	Pay Adjustment $ per 0.1 mi
Type A (Three or more HMA Lifts)	<30.0	$580
	30.0- less than 35.0	$480
	35.0- less than 40.0	$380
	40.0- less than 45.0	$280
	45.0- less than 50.0	$180
	50.0- less than 55.0	$80
	55.0- less than 60.0	$0
Type B (Two HMA Lifts)	<35.0	$420
	35.0- less than 40.0	$360
	40.0- less than 45.0	$300
	45.0- less than 50.0	$240
	50.0- less than 55.0	$180
	55.0- less than 60.0	$120
	60.0- less than 65.0	$60
	65.0- less than 70.0	$0
Type C (One HMA Lift)	<40.0	$280
	40.0- less than 45.0	$240
	45.0- less than 50.0	$200
	50.0- less than 55.0	$160
	55.0- less than 60.0	$120
	60.0- less than 65.0	$80
	65.0- less than 70.0	$40
	70.0- less than 75.0	$0

(3) Pay Pavement Smoothness Adjustment will be based on the initial measured MRI for both left and right wheel path, prior to any corrective work for the 0.10-mile section, except for sections that the Contractor has chosen to remove and replace. For sections that are replaced, assessments will be based on the MRI determined after replacement.

(a) The Pavement Smoothness Adjustment will be computed using the plan surface area of pavement shown in the Contract Documents. This Pavement Smoothness Adjustment will apply to the total area of the 0.10-mile section for the lane width represented by MRI for the same lane. It does not include any other price adjustments specified in the Contract Documents. Those price adjustments will be, for each adjustment, calculated separately using the original contract price to determine the amount of adjustment to be made to the contract price. Sections shorter than 0.1 mile and longer than 50 feet shall be prorated.

(b) For 0.1 mile intervals with an average MRI above the threshold shown in Table 401.03-3 Smoothness Pay Incentives, the Engineer shall apply a disincentive payment adjustment up to the limit shown.

i. For Types A and B, payment adjustments shall be applied up to an MRI of 95.0 per Table 401.03-4 Smoothness Pay Disincentives With MRI.

ii. For Type C, the payment adjustment shall be dependent on the average MRI of the pavement prior to paving activities
    1. If the MRI of the pavement prior to paving activities is 125.0 in/mi or less, the payment adjustment shall be per Table 401.03-4 Smoothness Pay Disincentives With MRI.
    2. If the MRI of the pavement prior to paving activities is more than 125.0 in/mi, the disincentive payment adjustment shall be per Table 401.03-5 Smoothness Pay Disincentives For Percent Improvement, and based on the percent improvement using the following formula:

% Improvement = (Initial segment MRI – Final segment MRI) x 100 / (Initial Segment MRI)

TABLE 401.03-4 –SMOOTHNESS PAY DISINCENTIVES WITH MRI		
Category	**MRI (in/mi)**	**Pay Adjustment $ per 0.1 mi**
Type A (Three or more HMA Lifts)	60.0- less than 65.0	-$100
	65.0- less than 70.0	-$250
	75.0- less than 80.0	-$350
	80.0- less than 85.0	-$450
	85.0- less than 95.0	-$550
	> 95.0	Corrective Work
Type B (Two HMA Lifts)	70.0- less than 75.0	-$100
	75.0- less than 80.0	-$200
	80.0- less than 85.0	-$300
	85.0- less than 95.0	-$400
	> 95.0	Corrective Work
Type C (One HMA Lift) (pre-paving MRI < 125)	75.0- less than 80.0	-$50
	80.0- less than 85.0	-$100
	85.0- less than 90.0	-$150
	90.0- less than 100.0	-$200
	>100.0	-$250

TABLE 401.03-5 –SMOOTHNESS PAY DISINCENTIVES FOR PERCENT IMPROVEMENT		
Category	**Percent Improvement %**	**Pay Adjustment $ per 0.1 mi**
Type C (One HMA Lift) (pre-paving MRI > 125)	≥ 40	$0
	20.0- less than 40.0	-$100
	< 20	-$200

(c) Incentives will not apply to areas where payment deductions or remedial repairs has been made for non-compliant work, e.g., low compaction, thin pavement, thermal segregation, low compressive or flexural strength, non-compliant alignment. Incentives will also not apply to

areas where corrective work was required to meet contract smoothness requirements, unless the pavement section was replaced. All areas where corrective work was performed shall be tested again to ensure the smoothness requirements are met.

(d) There will be no incentive price adjustments to the contract prices regardless of the pavement meeting the Contract Documents' requirements for incentive contract price adjustment, when 25% of the total area paved of that particular type of pavement on the project has failed to meet any of the Contract document requirements, e.g., smoothness, thickness, unit weight, asphalt content, pavement defects, compaction, flexural or compressive strength. Areas exempt from the smoothness requirements may not be included in the total area calculation unless it is non-compliant.

(e) For contracts using lump sum the method described in Subsection 104.06 Methods of Price Adjustment paragraph (3), will be used to calculated proportionate unit price, i.e., the Engineer's calculated theoretical unit price. This calculated proportionate unit price will be used to calculate the unit price adjustment.

401.04 Measurement.

(A) The Engineer will measure HMA and PMA pavement per ton in accordance with the Contract Documents.

(B) Engineer will measure additional State pavement profiling work when applicable on a cost-plus basis as specified in this section and as ordered by Engineer. The Engineer will issue a billing for the pavement profile work done for the time period with the invoices and receipts that the billing was based on attached to the Contractor for each contract item. The Contractor's pavement profile work required in this section will not be measured and will be considered incidental to the various paving items unless stated otherwise.

401.05 Payment. The Engineer will pay for the accepted HMA or PMA pavement at the contract price per pay unit, as shown in the proposal schedule. Payment will be full compensation for the work prescribed in this section and the contract documents.

(A) Price and payment in Section 401 – HMA Pavement will be full compensation for all work and materials specified in this Section including furnishing all labor, materials, tools, equipment, testing, pavement profiles and incidentals and for doing all work involved in grinding existing or new

pavement, removing residue, and cleaning the pavement, including necessary disposal of residue and furnishing any water or air used in cleaning the pavement and remedial work needed to conform to the requirements of the Contract Documents.

(B) No payment for the Contractor's pavement profile work required in this section will be made. The Contractor's pavement profile work shall be considered incidental to the various paving items unless stated otherwise.

(C) Engineer will pay or deduct for the following pay items when included in proposal schedule:

Pay Item	**Pay Unit**
_____ HMA Pavement Speed Table, Mix No. _____	Ton
_____ PMA Pavement, Mix No. _____	Ton

(1) 70% of the contract unit price or the theoretical calculated unit price upon completion of submitting a job-mix formula acceptable to the Engineer; preparing the surface, spreading, and finishing the mixture; and compacting the mixture.

(2) 20% of the contract unit price or the theoretical calculated unit price upon completion of cutting samples from the compacted pavement for testing; placing and compacting the sampled area with new material conforming to the surrounding area; protecting the pavement; and compaction acceptance. Maintain temporary pavement markings and other temporary work zone items, maintain a clean work site.

(3) 10% of the contract unit price or calculate the unit price when the final configuration of the pavement markings is in place.

The Engineer will pay for adjusting existing frames and covers and valve boxes in accordance with and under Section 604 – Manholes, Inlets and Catch Basins. Adjustments for existing street survey monument frames and covers will be paid for as if each were a valve box frame and cover.

The Engineer may, at his sole discretion, in lieu of requiring removal and replacement, use the sliding scale factor to accept HMA pavements compacted below 93.0 percent and above 97.0 percent. The Engineer will make payment for the material in that production day, if the Engineer decides to use a sliding scale factor, at a reduced price arrived at by multiplying the contract unit price by the pay factor. The Engineer is not obligated to allow non-compliant work to remain in place and may at any time chose not to use a sliding scale factor method of payment and

instead require removal of the noncompliant pavement that is greater than 97.0 or less than 93.0.

In compliance with Subsection 105.12 Removal of Non-Conforming and Unauthorized Work remove and replace HMA compacted below 90.0 percent.

The Engineer will solely decide if the noncompliant work would be acceptable if a reduced payment for the noncompliant work is made. The Engineer is not obligated to allow noncompliant work to remain in place and may at any time choose not to use a sliding scale factor method of payment as a method of resolution. Instead, utilize the remedy allowed in Subsection 105.12 Removal of Non-Conforming and Unauthorized Work, requiring removal of the noncompliant pavement, shall be used.

Such a reduced payment, if made and accepted by the Contractor, shall be a mutually agreeable resolution to the noncompliant work being addressed. If it is not mutually acceptable, the noncompliant work shall be removed. If the reduced payment is acceptable; the Engineer will make the reduced payments for the noncompliant work in accordance with Table 401.05-2 - Sliding Scale Pay Factor for Compaction. The amount of tonnage to be reduced will be determined by the Engineer by using the initial cores taken on the mat. No additional cores shall be taken to determine the limits of the non-compliant area unless requested by the Engineer.

The Engineer, for determining the reduced tonnage for noncompliant work, will assume the level of compaction is linear and will proportion the compaction level from the last core that indicated an acceptable compaction level to the nearest core indicating a noncompliant compaction level to determine the calculated limit of acceptable compaction. The length will be the linear distance between the cores measured along the baseline. If there is no core that was taken for the shift's or day's work that were compliant then the limit will be the end or start of the day's or shift's work. The width will be the nominal paving width. Use the day's specific gravity of the mix to determine tonnage. The thickness will be the nominal paving thickness.

The total reduced noncompliant tonnage to be paid will be determined by multiplying the applicable percent of reduction by the computed tonnage of the noncompliant work. Percent of Quantity Paid shall be the percentage shown in Table 401.05-2 - Sliding Scale Pay Factor for Compaction. The reduced tonnage shall be used as the payment quantity for the noncompliant work. The reduced quantity paid that is used for the monthly payment will be arrived at by multiplying the contract unit price by the reduced tonnage.

Table 401.05-2 – Sliding Scale Pay Factor for Compaction	
Percent Compaction	**Percent of Quantity Paid**
> 98.0	Removal
>97.0 - 98.0	95
93.0- 97.0	100
90.0 - <93.0	80
<90.0	Removal

END OF SECTION 401”

”

SECTION 503 - CONCRETE STRUCTURES

Make the following amendments to said Section:

(I) Amend **503.01 Description** by revising the word culverts in line 4 to read "box culverts".

(II) Amend **503.02 Materials** by deleting Abrasive Coating 712.11 at line 31 and by adding the following after line 32:

"Grout 712.04"

(III) Amend **503.03(B) Falsework, Formwork, or Centering** as follows:

Delete the word formwork from line 59.

Replace the words "AASHTO LRFD Bridge Specifications" with "AASHTO Guide Design Specifications for Bridge Temporary Works" at line 78.

Add the following two sentences at the end of the first paragraph at line 63: "Formwork is a temporary structure or mold used to retain the plastic on fluid concrete in its designated shape until it hardens. Formwork must have enough strength to resist the fluid pressure exerted by plastic concrete and any additional fluid pressure effects generated by vibrations."

(IV) Amend **503.03(B) Falsework, Formwork, or Centering** by adding the following sentence to the seventh paragraph at line 106:

"Temporary bracing shall be provided, as necessary to withstand all imposed loads during erection, construction and removal of falsework."

(V) Amend **503.03(B) Falsework, Formwork, or Centering** by revising the ninth paragraph from lines 112 to 122 as follows:

"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 form 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 ± 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."

(VI) Amend **503.03(C)(1) Construction** by revising the first paragraph between lines 169 and 172 as follows:

(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."

(VII) Amend **503.03(C)(1) Construction** by revising the second paragraph between lines 174 and 176 to read as follows:

"Unless otherwise indicated in the contract documents, place minimum ¾ inch by ¾ inch chamfer at sharp edges of exposed concrete surfaces. Give girder and coping forms bevels or drafts to ensure easy removal."

(VIII) Amend **503.03(C)(1) Construction** by adding the following sentence to the ninth paragraph at line 209:

"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."

(IX) Amend **503.03(C)(2) Form Lumber** by adding the following sentence to the first paragraph after line 223:

"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."

(X) Amend **503.03(D) Removal of Falsework and Forms** by revising Table 503.03-1 – Removal of Falsework and Forms at line 297 to read as follows:

"TABLE 503.03-1 – 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."						

(XI) Amend **503.03(D) Removal of Falsework and Forms** by deleting the last paragraph between lines 329 and 334.

(XII) Amend **503.03(E) Loading** by deleting the words, "except abutment walls and wing walls" in line 337.

(XIII) Amend **503.03(F)(1) General** by adding the following paragraphs after line 419:

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

The rate of evaporation shall be measured by using the nomograph: ACI 308R Figure 4.1 Nomograph for Estimating the Maximum Potential Rate of Evaporation of the Environment Assuming a Water-Covered Surface in Which the Water Temperature Is Equal to the Concrete Temperature or by using an evaporation rate calculator e.g., Kestrel 5200 hat has been reviewed and accepted by the Engineer. Use procedures as stated in ACI 308R Chapter 4 – Monitoring Curing and Curing Effectiveness. Approximately 30 minutes prior to the scheduled start of concrete placement measure the ambient air temperature, relative humidity and wind velocity with industrial grade weather monitoring instruments or with an evaporation rate calculator to determine the on-site evaporation rate. When the rate of evaporation is equal to or exceeds 0.05 lb/sq ft/h fogging shall begin. During the placement of the concrete recalculate evaporation rate every 15 minutes using new real-time data including actual temperature of concrete being placed. The concrete shall be fogged before, during and after finishing. Fogging shall start at the point the bleed water starts to evaporate. Fogging may stop when the curing compound application is complete. Fogging shall be accomplished by self-powered atomized mister, e.g. BossTek DustBoss, that creates a mist of water droplets above the concrete surface that

will float in the air. The droplets should float in the air, not fall on the concrete. The goal is to humidify the air, not wet the concrete. Let the water evaporate before finishing. If the concrete is fogger before floating, brooming or trowelling, do not finish the accumulated surface water into the concrete surface or it will weaken it. Do not allow water to run off the concrete surface. Adjust foggers or pause its operation. Foggers shall not drip water on the poured concrete surface. Point foggers into the air above the concrete pour not at it and not in the direction of the incoming wind. It shall not be acceptable to use a water hose to spray water into the air as a substitute. This will be considered adding additional water to the deck surface. If plastic shrinkage cracks appear during the finishing, the cracks shall be closed by striking each side of the crack with a float and refinishing the concrete."

(XIV) Amend **503.03(F)(2) Box Culverts** by revising the paragraphs from lines 421 to 429 as follows:

> **(2) Box Culverts.** "Place and allow base slab or footings of box culverts to set at least 12 hours before constructing remainder of culvert.
>
> When constructing box culverts, place and allow concrete in walls to set at least 12 hours before placing top slab. Provide appropriate keys in sidewalls for anchoring top slab."

(XV) Amend **503.03(F)(3) Box Girder Spans** by revising the title Box Girder Spans at line 431 to read Sequence.

(XVI) Amend **503.03(F)(7) Hot Weather Concreting** by adding the word "ambient" in front of the word "temperature" at line 560.

(XVII) Amend **503.03(F) Placing Concrete** by adding the following Subsection after line 565:

> **"(8) 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."

(XVIII) Amend **503.03(G) Joints** by adding the following sentence after line 566:

"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 Standard Plans."

(XIX) Amend **503.03(G)(1) Construction Joints** by revising the second paragraph between lines 572 and 579 to read as follows:

"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 ¼ inch."

(XX) Amend **503.03(G)(3) Contraction Joints** by revising the first paragraph from lines 661 to 665 to read as follows:

"(3) 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."

(XXI) Amend **503.03(I)(3) Flashing Compound for Joints** between lines 755 and 757 by deleting this subsection.

(XXII) Amend **503.03(L) Curing Methods** by adding the following paragraph after line 794:

"The Contractor shall have the option to use curing compound SINAK WCE or SINAK LITHIUM for bridge structures 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."

(XXIII) Amend **503.03(L)(2) Impervious Membrane Curing** by revising the third sentence of the first paragraph from lines 818 to 819, to read as follows:

"Use ratio of at least one gallon for each 100 square feet of concrete surface."

(XXIV) Amend **503.03(L)(2) Impervious Membrane Curing** by adding the following sentences to the first paragraph after line 819:

"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 503.03(L)(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."

(XXV) Amend **503.03(L)(2) Impervious Membrane Curing** by revising the last sentence of the second paragraph between lines 822 and 825 as follows:

"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."

(XXVI) Amend **503.03(M) Finishing Concrete Surfaces** by adding the following sentences at line 841:

"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. Only finishing aids shall be used to finish the concrete surface and only evaporation retarders used to minimize the evaporation rate of the plastic concrete. These solutions shall not be used interchangeably."

(XXVII) Amend **503.03(M)(3)(a)1. Machine Finishing** by adding the following sentences at the end of the second paragraph at line 1021:

"The screed rails shall be adjustable for elevations. The screed shall be set to elevations, with allowances for anticipated settlement, camber and deflection, as required to form the surface of the bridge deck to the line and grade shown in the contract. The Contractor shall install screed rail type such that the rails shall not deflect appreciably under the applied loads. The supports for the screed rails shall not be placed within the full width of the bridge.

The Contractor shall not apply any additional water to the deck surface in an effort to aid his finishing operation. The unauthorized application of water will result in the rejection of that day's concrete placement."

(XXVIII) Amend **503.03(M)(3)(a)1. Machine Finishing** by deleting the last three paragraphs between lines 1098 to 1111 and adding the following five paragraphs:

"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 plus or minus 0.02 inch and the groove depth shall be 1/8 inch plus 1/16 inch or minus zero inches.

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

Before grooves are cut into the accepted hardened concrete, the upper 1/8 inch of the concrete surface for the bridge deck, approach slabs, and sleeper slabs shall be removed by grinding. Grooving shall be done after the concrete

has attained sufficient strength to prevent spalling and raveling, 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 411.03(N) Surface Test shall apply to concrete bridge decks and concrete approach slabs. If additional 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."

(XXIX) Amend **503.03(M)(3)(b) Sidewalk and Median Strip** by revising the first and second paragraphs from lines 1182 to 1191 to read as follows:

(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 ¼-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."

(XXX) Amend **503.03 Construction** by adding subsection 503.03(0) beginning at line 1200 as follows:

"**(0) 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, PCI Tolerance for Precast and Prestressed Concrete, and PCI MNL-116 Manual for Quality Control of Plants and Production of Structural Precast Concrete Products."

(XXXI) Amend **503.04 Measurement** by revising lines 1201 to 1205 to read as follows:

"503.04 Measurement. The Engineer will not measure concrete when contracted on a lump sum basis.

The Engineer will not make deductions for the volume occupied by reinforcing steel, piles, floor drains, weepholes, timber bumpers, pipes less than eight (8) inches, conduits, or expansion joint materials."

(XXXII) Amend **503.05 Payment** by revising lines 1206 to 1223 to read as follows:

"**503.05 Payment.** The Engineer will pay for the accepted quantities of concrete complete in place and the accepted mechanical grooving and grinding at the contract lump sum price for the pay items listed below and contained in the proposal.

The contract lump sum amount paid shall be full compensation for mechanical grooving; for grinding upper concrete deck surface; for the concrete; for placing, curing and finishing; for furnishing materials including admixtures and cement (including extra cement added to concrete deposited under water); for furnishing and installing drains, scuppers, premolded joint fillers, joint seals, waterproofing at construction joints, waterstops, pipes and conduits; for furnishing and installing metal rockers, anchor bolts, structural shapes for expansion joints and other similar items; for timber bumpers, forms, form lining and falsework or centering, bearing pads, structural steel bearing plates; and for equipment, tools, labor, materials and incidentals necessary to complete the work.

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

Pay Item	Pay Unit
Concrete for _____	Lump Sum
Blanket Grinding and Mechanical Grooving for _____	Lump Sum

The Engineer will pay for excavation and backfill for foundations in accordance with and under Section 205 – Excavation and Backfill for Bridge and Retaining Structures and Section 206 – Excavation and Backfill for Drainage Facilities."

END OF SECTION 503

SECTION 507 - RAILINGS

Make the following amendments to said Section:

(I) Amend **507.04 – Measurement** by revising lines 171 to 172 to read as follows:

"**507.04 Measurement.** The Engineer will measure bridge concrete railings of the various types by the linear foot. The Engineer will make the measurement along the centerline and from end to end of the railing. The Engineer will measure end posts per each in accordance with the contract documents."

(II) Amend **507.05 Payment** by revising lines 174 to 186 to read as follows:

"**507.05 Payment.** The Engineer will pay for the accepted bridge concrete railings by the linear foot and the accepted concrete end post railings per each. Payment will be full compensation for the work prescribed in this section and the contract documents.

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

Pay Item	**Pay Unit**
Bridge Concrete Railing for _____	Linear Foot
Concrete End Post Railing for _____	Each

The Engineer will pay for portions of railing bars that extends into slabs or beams under Section 602 – Reinforcing Steel."

END OF SECTION 507

Amend **Section 511 - Drilled Shafts** to read as follows:

"SECTION 511 - DRILLED SHAFTS

511.01 Description. This section is for installing, drilling, reinforcing, concreting and crosshole sonic logging of drilled shafts in the locations shown on the plans.

511.02 Materials. Materials shall conform to the following:

(A) Portland Cement Concrete. Concrete shall conform to Section 601 - Structural Concrete and Section 511 – Drilled Shafts.

The in-place concrete shall have minimum 28-day compressive strength f'_c = 5000 pounds per square inch and maximum water to cement ratio of 0.45.

Proportion the concrete mix designs to get properties of high workability, compaction under self-weight, resistance to segregation, and resistance to excessive bleeding. The maximum nominal aggregate size shall be 3/4 inch. The slump range shall be 7.0 inches $\pm$ 1.0 inch for concrete poured into a water free borehole and 8.0 inches $\pm$ 1.0 inch for concrete placed under water or under drilling slurry. Slump for the concrete shall be a minimum of four inches after four hours from initial mixing or after the completion of the concrete placement, whichever occurs later.

A migrating corrosion inhibiting amine carboxylate water-based admixture shall be added to the concrete. The minimum dosage shall be 1.5 pints per cubic yards of concrete.

The Engineer will permit superplasticizers.

At the time of placement, the concrete temperature shall not exceed 85°F.

The final concrete mix design shall be based on field trial batches to determine the most suitable materials and proportions that will provide a concrete mixture having the least amount of segregation and bleeding, and at the same time provide the necessary workability to meet placing requirements.

(B) Reinforcing Steel. Reinforcing steel shall conform to Section 602 - Reinforcing Steel.

(C) Casings. Casings shall have inside diameters not less than the required diameter of the shafts and wall thicknesses specified or adequate to withstand construction loads and stresses.

(D) Cement Grout. Cement grout used for setting the expandable load cells and for filling the access tubes after completion of crosshole sonic logging tests and cored holes, shall be prepackaged, non-shrink, and non-metallic grout

with the same strength as the drilled shaft concrete. The grout shall contain 10 grams of water-based migrating amine carboxylate corrosion inhibitor per 0.5 cubic feet. Cement grout used to fill cored holes shall be extended with 3/8 inch pea gravel per manufacturer's recommendations.

(E) Crosshole Sonic Logging (CSL) Test Access Tube. Access tube shall be at least 2-inch inside diameter, Standard steel pipe conforming to ASTM A53, Grade B, Type E.

Access tube shall have round, regular inside diameter, free of defects and obstructions, including all pipe joints, in order to permit free unobstructed passage of 1.375-inch maximum diameter source and receiver probes used for crosshole sonic logging testing. Access tube shall be watertight, free from corrosion, with clean internal and external faces to ensure good bonding between the drilled shaft concrete and access tubes. Fit access tubes with watertight caps on bottom and top. Both ends of the access tube shall be capped at all times except when being connected to another access tube. The end of the tubes shall be undamaged and suitably prepared for the end caps and coupling system adopted. Access tube coupling shall be used when extension of the access tubes is necessary. The access tube coupling shall be watertight.

When crosshole sonic logging testing is indicated in the contract documents, submit manufacturer's certificate of compliance for the acceptance of the access tube.

511.03 Construction.

(A) Qualifications of Drilled Shaft Contractor. Be capable of installing drilled shafts, conducting load tests and other related work as specified in the contract and shall have the following minimum experience requirements below.

Because of the expertise required to successfully complete the drilled shafts according to the contract, a qualified drilled shaft Contractor shall install the drilled shaft. The drilled shaft Contractor shall have installed at least three projects completed in the last three years on which the Contractor has installed a minimum of five drilled shafts per project of a diameter and length similar to those shown in the contract.

(B) Experience Information. Submit the following information to the Engineer within 30 days after award of contract for acceptance by the Engineer:

(1) List of drilled shaft projects completed in the past 10 years. The list of projects shall contain the names and phone numbers of owner's representatives who can verify participation on that project. The drilled shaft Contractor shall have installed at least three projects completed in the last three years on which the Contractor has installed a minimum of five drilled shafts per project of a diameter and length similar to those shown in the contract.

(2) Name and experience record of the drilled shaft superintendent who will be in charge of drilled shaft operations for this project. Drilled shaft superintendent shall have minimum three years' experience within the last 10 years in drilled shaft construction similar to type proposed. Drilled shaft superintendent shall remain on the project for the duration of the drilled shaft work. Drilled shaft superintendent who leaves the project shall be replaced with personnel with equal or better experience. Submit proposed superintendent's name and experience record for acceptance.

(C) Protection of Existing Structures. Prevent damage to existing structures and utilities. Preventive measures shall include:

(1) Selecting construction methods and procedures that will prevent caving of the shaft excavation and

(2) Monitoring and controlling the vibrations from construction activities such as the driving of casing or sheeting or drilling of the shaft

(D) Installation Plan. At least 30 days before constructing the drilled shafts, submit an installation plan for acceptance by the Engineer. This plan shall at a minimum provide information on the following:

(1) List of proposed equipment such as cranes, drills, augers, bailing buckets, final cleaning equipment, concrete pumps, and casing,

(2) Details of construction operation sequence and the sequence of shaft construction in bents or groups,

(3) Details of shaft excavation methods including how the excavated material from the drilled shaft will be controlled on site and removed; and method of setting and extracting temporary casing,

(4) If the Contractor plans to use slurry, details of the methods to mix, circulate and desand slurry,

(5) Details of methods to clean the shaft excavation,

(6) Details of reinforcement placement including lifting, support, and centralization methods,

(7) Details of concrete placement including proposed operational procedures for pumping method,

(8) Details of attaching the crosshole sonic logging test access tubes to the reinforcing cage, details of testing access tubes for leakage after cage installation and prior to shaft concrete placement, and details for grout placement in the crosshole sonic logging test access tubes after testing is completed,

(9) Details of required load tests, including equipment, procedures, and recent calibrations for jacks or load cells supplied by the Contractor,

(10) Proposed concrete mix design, including expected strengths at 3, 7, 14 and 28 days. Concrete mix design shall minimize segregation and bleed. Submit test results of both a trial mix and a slump loss test, conducted by State-accepted testing laboratory using methods specified in Section 601 - Structural Concrete. Tests shall demonstrate that concrete meets 4-hour plasticity requirement at expected ground ambient temperature and at highest expected ambient air temperature (two separate slump loss tests required), and

(11) Test results from laboratory measurements of the ultrasonic pulse velocity, performed in accordance with ASTM C 597, on 3-day, 7-day, and 28-day concrete trial mix samples described in Subsection 511.03(D)(10).

The Engineer will evaluate the drilled shaft installation plan for conformance with the contract documents. Within 30 days after receipt of the plan, the Engineer will notify the Contractor of additional information required including if applicable, changes necessary to meet the contract requirements. The Engineer will reject parts of the installation plan that are unacceptable. The Contractor shall resubmit changes for re-evaluation within 15 days. The Engineer will have another 30 days to review all resubmittals. Procedural acceptance given by the Engineer shall be subject to trial in the field. The acceptance shall not relieve the Contractor of the responsibility to complete the work according to the contract.

(E) Trial Shaft Installation. Demonstrate adequacy of proposed methods and equipment by successfully constructing a trial shaft of the shaft diameter to be installed, in accordance with contract documents. The details of trial shaft shall be the same as for the production drilled shafts. Position trial shaft away from production shafts, at location shown in the contract documents, or as ordered by the Engineer. Drill trial shaft to the depth shown on the contract documents.

CSL test access tubes shall be installed in the trial shaft as shown on the contract to allow performance of CSL tests. Installation of the CSL tubes shall be in accordance with Subsection 511.03(N) - Crosshole Sonic Logging (CSL) Test Access Tubes and shall be incidental to the trial shaft work.

The trial shaft shall be subject to integrity testing using concrete coring to evaluate the effectiveness of the concrete placement method proposed by the Contractor. Coring shall be conducted by the Contractor in the presence of the Engineer. The Contractor shall core a vertical hole beginning four feet above the top of drilled shaft (cutoff elevation) and ending at bottom of drilled shaft at two locations of the trial shaft determined by the Engineer. Core specimens shall be a minimum diameter of 3.75 inches. The Contractor shall submit the coring samples to the Engineer in core boxes properly labeled with the core number and depths. Coring of the trial shaft shall be incidental to the trial shaft work.

If the Engineer rejects trial shaft due to deviation from requirements of the contract documents, alterations to proposed methods and equipment may be required. Drill additional trial shaft holes to demonstrate adequacy of altered construction methods or equipment at no increase in contract price or contract time. Once the Engineer has accepted trial shaft and has authorized construction of production shafts, do not deviate from accepted methods or equipment without the Engineer's written approval.

Fill trial shaft hole with concrete similar to the construction of production shafts, using method proposed for production shaft construction. Cut the concreted trial shafts off 24 inches below finished grade and leave in place. Restore disturbed areas at trial shaft sites to original condition, unless otherwise specified.

(F) Drilled Shaft Load Tests. Load test shall be performed at the location shown on the plans and be completed after the trial shaft but before construction of any production drilled shafts. This work includes all labor, materials, equipment and services necessary for conducting the bi-directional axial load tests and reporting the results, including the following: (a) the number of bi-directional expandable load cells as indicated on the plans, (b) materials to construct a stable reference beam system(s) for monitoring vertical and horizontal deflection of the drilled shaft during testing, supported a minimum distance of the reference system, (c) materials sufficient to construct and protect the work area, load test equipment, and personnel from inclement weather and sunlight, and illuminate area as needed, (d) electric power as required and suitable for lights, welding, instruments, etc., and (e) suitable optical survey equipment to measure the horizontal and vertical displacement of shafts during tests independent of the reference beam(s) and electronic equipment.

(1) Experience Requirements. The Contractor shall obtain the services of an experienced specialty Subcontractor with a minimum of three years of bi-directional load testing experience accepted by the Engineer to direct the assembly and instrumentation of the load cells, and to record all data and furnish results of the test to the Engineer.

(2) Materials. Materials for the drilled shaft load test shall conform to the requirements of Section 511.02 - Materials.

(3) Load Test Instrumentation. Provide instrumentation consisting of vibrating wire embedment strain gauges connected to a central data collection terminal; expandable load cell with readout device, and/or other equipment specified or indicated to measure movement of the top and bottom plates of the load cell, top of shafts, and strain at indicated locations within the shaft.

The embedment strain gauges shall be positioned along the test shaft at intervals shown on the Plans. The embedment strain gauges shall be attached securely to prevent movement from the installed location. The Engineer may require relocation of the embedment strain

gauges and load cell based on the submittals provided by the Contractor. Each embedment strain gauge shall be capable of measuring strain to the nearest 0.0001 inch/inch and shall be capable of measuring or compensating for temperature. All embedment strain gauges shall have been calibrated or certified as accurate prior to installation. Take precautions not to damage the embedment strain gauges.

Load cell shall be a flat, hydraulically expandable load cell of a minimum of 26 inches in diameter and capable of applying a load test of at least 3,600 kips in each direction. The load cell shall be accurate to within 1%, shall expand uniformly, and shall be capable of being installed as described herein. The load cell shall have provisions for monitoring displacements of the upper and lower plates to an accuracy of 0.001 inch. The load cell shall have been calibrated or certified as accurate to within 1% of the true loads not more than six months prior to installation.

(4) Construction Requirement. The drilled shaft load test shall be a bi-directional load test utilizing a hydraulically expanded load cell. The bi-directional load test separately tests the shear resistance and end-bearing of the drilled shaft by loading the shaft in two directions (upward-shear resistance, downward-end bearing and shear resistance), using hydraulically expanded load cell, or by loading the shaft using other accepted methods capable of full separation of the shear bearing components. The drilled shaft used for the load test program shall be instrumented, as specified in Section 511 – Drilled Shafts, by an experienced specialty Subcontractor accepted by the Engineer. Load test shaft with excessive lateral extension (more than 12 inches) of the shaft diameter will be rejected, unless accepted by the Engineer. Rejected load test shaft shall be replaced at no additional cost to the State.

The Contractor shall supply equipment required to install the load cell, conduct the load test, and remove the load test apparatus as required. For the drilled shaft load test, the following set up procedure shall be used:

(a) The load cell, piping and other attachments will be assembled and made ready for installation under the direction of the specialty Subcontractor, in a suitable area, adjacent to the load test shaft, to be provided by the Contractor. The load cell assembly shall be placed at the location shown on the plans in conjunction with the construction of the reinforcing cage. The Engineer reserves the right to adjust the location of the load cell prior to installation.

(b) Advance the load test excavation to the maximum depth shown on the plans. A successfully completed trial shaft that is acceptable to the Engineer may not be used as the load test shaft.

(c) Clean the bottom of the shaft excavation after drilling is complete.

(d) Caliper testing shall be performed on the load test shaft to obtain profile shape data to be used to verify the shaft verticality and diameter. A minimum of eight data points around the circumference of the load test shaft shall be obtained at every one foot increment throughout the depth of the load test shaft. Caliper testing may be performed using a sonar-type caliper.

(e) Install the rebar cage assembly and load cell under the direction of the specialty Subcontractor and in the presence of the Engineer. The Contractor shall use the utmost care in handling the rebar cage/test equipment assembly so as not to damage the instrumentation during installation.

(f) After the installation of the rebar cage/test equipment assembly, the drilled shaft shall be concreted in the same manner as accepted by the Engineer based on the trial shaft installation and as specified for production shafts.

(5) Load Test Schedule. The Contractor shall notify the Engineer of the load testing schedule a minimum of fifteen calendar days prior to the commencement of load testing.

(6) Load Test Procedures. The load test shall be completed and the load test data evaluated by the Engineer for revision to the production shaft length before construction of any production shafts. The Engineer shall have at least 21 calendar days after submission of the load test report to review the load test result prior to providing the production shaft lengths. Load testing on the shaft shall not begin until the concrete has attained a compressive strength of 4,000 psi and aged for seven days.

Load the load test shaft using the quick load test method of ASTM D1143 except as modified herein. Apply the test load in increments of 50 to 100 kips, as directed by the Engineer. A load-deflection curve shall be plotted as the test progresses to avoid missing information near the failure load or to correct the precise load increments.

The load test shall be conducted to the maximum test load of 3,000 kips or plastic failure, whichever occurs first. Plastic failure is defined as the load corresponding to mobilization of side shear or end bearing and no further increase in load can be obtained.

The load test shall be held for a minimum of 4 hours each at the 2,000, 2,500, and 3,000-kip load interval to evaluate the creep effects, or at specific loads as directed by the Engineer.

(7) Cleanup. After completion of the load test, and at the direction of the Engineer, the Contractor shall remove all equipment, waste and other material that is not a part of the finished structure. The load cell remaining in the shafts shall then be grouted through the piping provided as a part of the load cell assembly. Use non-shrink, non-metallic, non-gaseous grout of the same strength as the drilled shaft concrete.

After completing the test, cut off the load test shafts at an elevation 24 inches below the finished ground surface. The portion of the shafts cut off and removed shall remain the property of the Contractor.

(8) Replacement. Load test shaft found inadequate because of improper or failure of instrumentation, testing or construction procedures shall be replaced and retested, at no additional cost to the State.

(9) Reporting. Report the test results as specified in ASTM D1143-81 including, but not limited to, the following:

(a) Introduction;

(b) Drilled shaft installation procedure;

(c) Load test procedure and instrumentation; and

(d) Appendix which shall include report of calibration of instruments, plan view location of the load test and test boring related to the Project, records of subsurface exploration, records of load test shaft installation, tabular and graphical presentation of the load-deflection data of end-bearing and side shear from the load test.

(G) Construction Sequence. Complete the excavation to footing elevations before shaft construction begins. Repair the disturbances caused by shaft installation to the footing area before pouring the footing.

When installing drilled shafts with embankment placement, construct drilled shafts after the placement of fills.

Do not cap the drilled shafts before placing the fills as near to final grade as possible. Only leave room for construction of the caps.

(H) Construction Methods. Excavate for shafts to the dimensions and elevations shown in the contract. Its methods and equipment shall be suitable for the intended purpose and materials met. Use the permanent casing method only when required by the contract or authorized by the Engineer. Blasting shall not be permitted.

(1) Dry Construction Method. The dry method includes drilling the shaft excavation, removing accumulated water and loose material from the

excavation, and placing the reinforcing cage and shaft concrete in a dry excavation. Use this method only at sites where the groundwater table and soil conditions are suitable to permit construction of the shaft in a dry excavation. The Engineer will inspect the sides and bottom of the shaft visually before placing the concrete. Dry excavation is defined as an excavation where maximum depth of water does not exceed 3 inches.

(2) Wet Construction Method. This method includes using water, mineral, or polymer slurry to maintain stability of the hole perimeter while advancing the excavation to final depth, placing the reinforcing cage, and concreting the shaft. Use this method at sites where a dry excavation for placement of the shaft concrete cannot be maintained

Reuse drilling water only if permitted by the Engineer and contingent upon control of unit weight to no more than 62.5 pounds per cubic foot and Marsh funnel viscosity to not more than 27 seconds per quart, at the time drilling water is introduced into the borehole.

When locating drilled shafts in open water areas, extend the exterior casings from above the water elevation into the ground. Install the exterior casing to produce a positive seal at the bottom of the casing so that no intrusion or extrusion of water or other materials occurs into or from the shaft excavation.

(3) Casing Construction Method. The casing method may be used when shown in the contract or at sites where the dry or wet construction methods are inadequate. The casing may be placed either in a predrilled hole or advanced through the ground by twisting, driving, before cleaning the casing.

(l) Excavation.

(1) General. Make the shaft excavations at locations, and to shaft geometry and dimensions shown in the contract. After acceptance by the Engineer, adjust drilled shaft tip elevations when the material met during excavation is unsuitable and/or differs from that anticipated in the design of the drilled shaft.

Maintain a construction method log during shaft excavation. Submit method log within 24 hours of shaft drilling completion. The log shall contain information such as:

(a) Excavation diameters;

(b) Equipment used;

(c) Type of material excavated with the elevations of the material;

(d) Rate of excavation including time drilling started, when different material is encountered, tool changes, finish of shaft excavation, and difficulties encountered;

(e) The description of and approximate top and bottom elevation of each soil or rock material encountered.

(f) Elevation and approximate rate of any seepage or groundwater; and

(g) Remarks, including temporary stoppages

Drilling of shafts within a horizontal distance of 3.0 times the shaft diameter to the hole being drilled shall not commence until a minimum of 24 hours after the drilled shaft has been completed by placement of concrete to the top of shaft elevation in order to avoid interaction effects between adjacent shafts.

On projects with cofferdams, provide a qualified diver to inspect the cofferdam conditions when the contract requires a seal for construction. Before placing the concrete seal, the diver shall inspect the cofferdam interior periphery. The cofferdam interior periphery inspection includes each sheeting indentation and around each drilled shaft.

Any drilled shaft concrete over the theoretical amount required to fill any excavations for the shafts dimensioned on the plans shall be furnished at no additional cost.

Dispose the excavated material according to Section 203 - Excavation and Embankment.

Furnish drilled shaft concrete required to fill excavations for shafts dimensioned in the contract documents.

Do not permit workers to enter the shaft excavation unless:

(a) A suitable casing is in place.

(b) The water level is lowered and stabilized below the level the workers will occupy, and

(c) Adequate safety equipment and procedures are provided, performed and in place.

(2) Excavation and Drilling Equipment. The excavation and drilling equipment shall have adequate capacity including power, torque, and down thrust to excavate a hole to the maximum diameter and to a depth of ten feet or 20% beyond the depths shown in the contract, whichever is greater.

The use of special drilling equipment and/or procedures will be necessary to drill through the cobbles and boulders. The Contractor shall anticipate an abundance of boulders or various sizes in deposits classified as ”fill” and “older alluvium” on the boring logs and shall make allowance for difficult drilling in his bid. In addition, the Contractor shall make allowance for difficult drilling in his bid within the basalt rock formation.

The excavation and overreaming tools shall be of adequate design, size, and strength to do the work shown in the contract.

(a) Special Drilling Equipment. When conventional earth augers and/or underreaming tools cannot be used for drilling, provide special drilling equipment including rock core barrels, rock tools, air tools and other equipment as necessary to construct the shaft excavation to the size and depth required. The use of special drilling equipment and/or procedures will be necessary to drill through the cobbles and boulders, and cost shall be incidental to unclassified shaft excavation.

(b) Sidewall Overreaming. When the sidewall of the hole has softened, swelled, or degraded, sidewall overreaming will be required by the Engineer. Overreaming thickness shall be a minimum of 0.5 inch and a maximum of 3.0 inches. The Contractor may overream with a grooving tool or overreaming bucket. The thickness and elevation of sidewall overreaming shall be according to the contract or as directed by the Engineer. Overream sidewall and place additional shaft concrete at no cost to the State.

(3) Unclassified Excavation. All excavation for the production drilled shafts shall be designated as unclassified. The Contractor shall anticipate the presence of cobbles and boulders within the depths of the drilled shafts. The Contractor shall provide the necessary equipment to remove and dispose of materials met in forming the drilled shaft excavation, including installation of temporary casing and/or use of slurry, as necessary. The Engineer will not make separate payment for excavation of materials of different densities and character (hardness) or employment of special tools and procedures necessary to excavate. The Engineer will pay for obstruction removal separately.

(4) Obstructions Removal. Remove obstructions at drilled shafts locations when authorized by the Engineer. Obstructions shall include man-made materials such as but not limited to old concrete foundations not shown on the Plans.

The Contractor shall employ special procedures and/or tools after the Contractor cannot advance the hole using conventional augers fitted with soil or rock teeth, drilling buckets, core barrels and/or underreaming tools. Such special procedures/tools may include: chisels, boulder

breakers, air tools, hand excavation, temporary casing, and increasing the hole diameter.

Drilling tools and any other equipment, lost in excavation, are not considered obstructions. Remove the drilling tools and any other equipment promptly. The cost due to tools lost in the excavation shall be at no additional cost to the State including costs associated with hole degradation (requiring overreaming or other methods) due to removal operations or the time the hole remains open or any other remedial actions needed to be performed to correct the situation caused by the tool lost.

Natural materials used as fill materials such as cobbles and boulders shall be anticipated at the site during excavation and shall not be considered an obstruction regardless of the size and hardness of the boulder. These natural materials used as fill materials shall not be considered an obstruction under this section.

(J) Casings.

(1) General. Casings shall be steel conforming to ASTM A252, Grade 3, smooth, watertight, and of ample strength to withstand both handling and driving stresses and the pressure of concrete and the surrounding earth materials. The inside diameter of the casing shall not be less than the specified size of the shaft. The Engineer will not allow extra compensation for concrete required to fill the oversized casing or oversized excavation. Remove casings from shaft excavations except when the casing is permanent. If the Contractor elects to pre-drill for the permanent casing, the pre-drilled hole diameter shall be no larger than the outside diameter of the permanent casing. The Contractor shall take proper measures and shall be responsible for maintaining the tip elevation of the permanent casing at the specified elevations.

When the shaft extends above ground or through a body of water, the shaft may be formed with removable casing except when the casing is permanent. Remove the casing carefully, where specified, so that the casing will not damage the cured concrete. When the casing needs to be removed after the concrete hardens in open water, design and submit the special system for acceptance by the Engineer. The Contractor may remove the casings only when the concrete attains sufficient strength provided:

(a) The curing of the concrete continues for the full 72 hour period,

(b) The shaft concrete is not exposed to salt water or moving water for a minimum of 7 days after placement, and

(c) The concrete reaches a compressive strength of at least 2,500 pounds per square inch.

(2) Temporary Casing. The Engineer will consider subsurface casing temporary unless shown in the contract as permanent casing. Remove the temporary casing before completing the placing of concrete in the drilled shaft. The Contractor may require telescoping, predrilling with slurry, and/or overreaming to beyond the outside diameter of the casing to install casing.

When choosing to remove a casing and substituting a longer or larger diameter casing through caving soils, stabilize the excavation with slurry or backfill before installing the new casing.

Before withdrawing the casing, the level of fresh concrete in the casing shall be the higher of the following:

(a) Minimum of five feet above the hydrostatic water level, or

(b) Level of drilling fluid, outside the casing.

While withdrawing the casing, maintain an adequate level of concrete within the casing to:

(a) Displace the fluid trapped behind the casing upward and

(b) Discharge the fluid at the ground surface without contaminating or displacing the shaft concrete.

When temporary casings become bound or fouled during shaft construction and cannot be removed, the Engineer will consider the drill shaft defective. Improve such defective shafts according to the contract or submit remedial repair for acceptance by the Engineer. Such improvement may consist of removing the shaft concrete and extending the shaft deeper, providing straddle shafts to compensate for capacity loss, or providing a replacement shaft. Do corrective measures including redesign of footings caused by defective shafts according to the contract at no cost to the State or extension of the contract time. Any redesign of the footing shall be submitted to the Engineer for acceptance. The redesign shall be performed by a structural engineer and a civil engineer specializing in the geotechnical practice both licensed in the State of Hawaii. All remedial repairs shall have drawings and calculations signed and stamped by both of the above licensed engineers. The Engineer will not pay for the casing remaining in place as well as any redesign or remedial repair.

(K) Slurry. If required, use only polymer slurry in the drilling process. The polymer slurry shall have sufficient viscosity and gel characteristics to transport excavated material to suitable screening system. The percentage and specific

gravity shall be sufficient to maintain the stability of the excavation and to allow proper concrete placement.

During construction, maintain the level of the slurry at a height sufficient to prevent caving of the hole. When a sudden significant loss of slurry occurs, delay the construction of that foundation until an alternate construction procedure is submitted for acceptance by the Engineer.

Premix the polymer slurry thoroughly with clean fresh water in slurry tanks and adequate time (as prescribed by the manufacturer) allotted for dehydration before introducing the slurry by pumping into the shaft excavation. The slurry tanks shall have capacity for adequate slurry circulation, storage, and treatment. Excavated slurry pits in lieu of slurry tanks will not be allowed without the written permission of the Engineer.

Use desanding equipment to control slurry sand content to less than 0.5% by volume in the borehole for polymer slurry. The Engineer will not require desanding equipment for setting temporary casing, sign post, or lighting mast foundations.

Prevent the slurry from "setting up" in the shaft, such as: agitation, circulation and/or adjusting the properties of the slurry. Dispose of slurry in suitable areas off from the project site.

The Contractor shall have the representative from the manufacturer of the slurry product on site providing the technical support for the slurry preparation, placement, testing and other quality control. Carry out the control tests using suitable apparatus on the polymer or mineral slurry to resolve the density, viscosity, pH, and sand content. Acceptable range of values for those physical properties for two types of polymer slurries is in Tables 511-1 - Shore Pac GCV (CETCO Drilling Products Group) IN FRESH WATER and 511-2 - SLURRYPRO CDP (KB Technologies Ltd.) IN FRESH WATER.

Test the density, viscosity, and pH value during the shafts excavation to establish a consistent working pattern. Make a minimum of four sets of tests during the first 8 hours of slurry use. When the results show consistent behavior, decrease the testing frequency to one set every four hours of slurry use.

TABLE 511-1 - Shore Pac GCV (CETCO Drilling Products Group) IN FRESH WATER			
Property	**Range of Values ***		**Test Method**
	Time of Slurry Introduction	**In Hole At Time Of Concreting**	
Density (pcf)	Less than or equal to 64.0**	Less than or equal to 64.0**	Density Balance
Viscosity (sec/qt)	33 - 74	Less than or equal to 57	Marsh Cone
PH	8.0 – 11.0	8.0 – 11.0	pH paper pH meter

* At 20^{0} C

** Increase by two pounds per cubic foot in salt water

Notes: a. When the Contractor does not need to control the bottom hole conditions or when tests show that other criteria are appropriate, the Engineer may modify the values.

b. When the contract requires desanding, the sand content shall not exceed 0.5% percent (by volume) in the bore hole as resolved by the American Petroleum Institute sand content test.

c. Submit changes for acceptance in writing by the Engineer.

d. Increases in the viscosity of polymer slurry beyond the above acceptable ranges during drilling may be allowed by the Engineer. However, increases in the viscosity of the polymer slurry beyond the above acceptable ranges during concrete placement will not be allowed. Use of other polymer materials that increase the cohesion of the soil material, or other construction methods to reduce the slurry viscosity just prior to concrete placement may be considered in-lieu of increasing the viscosity of the slurry.

TABLE 511-2 - SLURRYPRO CDP (KB Technologies Ltd.) IN FRESH WATER

Property	Range of Values *		Test Method
	Time of Slurry Introduction	In Hole At Time Of Concreting	
Density (pcf)	Less than or equal to 67.0**	Less than or equal to 64.0**	Density Balance
Viscosity (sec/qt)	50 - 120	Less than or equal to 70	Marsh Cone
PH	6.0 – 11.5	6.0 – 11.5	pH paper pH meter

* At 20^{0} C

** Increase by two pounds per cubic foot in salt water

Notes: a. When the Contractor does not need to control the bottom hole conditions or when tests show that other criteria are appropriate, the Engineer may modify the values.

b. When the contract requires desanding, the sand content shall not exceed 0.5% percent (by volume) in the bore hole as resolved by the American Petroleum Institute sand content test.

c. Submit changes for acceptance in writing by the Engineer.

d. Increases in the viscosity of polymer slurry beyond the above acceptable ranges during drilling may be allowed by the Engineer. However, increases in the viscosity of the polymer slurry beyond the above acceptable ranges during concrete placement will not be allowed. Use of other polymer materials that increase the cohesion of the soil material, or other construction methods to reduce the slurry viscosity just prior to concrete placement may be considered in-lieu of increasing the viscosity of the slurry.

Before placing concrete in the shaft excavation, take slurry samples from the base of the shaft using a sampling tool. Extract slurry samples from the base of the shaft and at intervals not exceeding 10 feet up the shaft. Extract samples until two consecutive samples produce acceptable values for density, viscosity, pH, and sand content (within the values shown on Table 511-1 - Shore Pac GCV

(CETCO Drilling Products Group) IN FRESH WATER or 511-2 - SLURRYPRO CDP (KB Technologies Ltd.) IN FRESH WATER).

Ensure that the bottom of the shaft does not accumulate heavily contaminated slurry suspension. The heavily contaminated slurry suspension could impair the free flow of concrete. When finding unacceptable slurry samples, take actions necessary to bring the slurry as specified in the contract. Do not pour the concrete until re-sampling and testing results produce acceptable values.

Furnish the reports of tests required above to the Engineer on completion of each drilled shaft. An authorized person of the Contractor shall sign the reports.

During construction, maintain at the level of slurry not less than five feet above the highest piezometric water pressure along the depth of a shaft. When the slurry construction method fails, stop this method and propose an alternate method for acceptance by the Engineer

The Contractor shall use and dispose of slurry in accordance with applicable Federal, State, and County requirements.

(L) Excavation Inspection. Provide equipment for checking the dimensions and alignment of each permanent shaft excavation. Determine the dimensions and alignment according to the contract. Measure the final shaft depths with a suitable weighted tape after final cleaning.

A minimum of 50% of the base of each shaft shall have less than 0.5 inch of sediment at the time the concrete is placed. The maximum depth of sediment or debris on the base of the shaft shall not exceed 1.5 inches. The Contractor will measure the shaft cleanliness in the presence of the Engineer by methods deemed appropriate to the Engineer.

Also, for dry excavations the maximum depth of water shall not exceed 3 inches before pouring the concrete.

(M) Reinforcing Steel Cage Construction and Placement. Assemble and place the reinforcing steel cage immediately after the Engineer inspects and accepts the shaft excavation before pouring the concrete. To prevent deformation of the cage while lifting, brace the reinforcing steel cage until the cage is set in it's final position. The reinforcing steel cage includes longitudinal bars, ties, cage stiffener bars, spacers, centralizers, and other necessary appurtenances to acceptably complete and place the cage.

Tie and support the reinforcing steel in the shaft so that the reinforcing steel will remain within allowable tolerances given in Subsection 511.03(P) – Construction Tolerances. Use the concrete spacers or other approved non-corrosive spacing devices at sufficient intervals (near the bottom and at intervals not exceeding 10 feet up the shaft) to ensure concentric spacing for the entire

cage length. Use minimum of four spacers, equally spaced around circumference, at each vertical interval. The spacers shall be constructed of accepted material equal in quality and durability to concrete specified for the shaft, and shall be of adequate dimension to insure a minimum of four inches annular space between the outer portion of the reinforcing steel cage and the side of the excavated hole. Provide accepted cylindrical concrete bottom supports to maintain the proper distance between bottom of the cage and base of the shaft excavation.

Check the elevation of the top of the steel reinforcing cage and center of cage location before, during and after pouring the concrete. When not maintaining the rebar within the specified tolerances, make the corrections needed to bring to within tolerances of the contract. Do not construct additional shafts until after modifying the reinforcing steel cage support according to the contract.

When the excavation at the bottom of the constructed shaft elevation is lower than shown in the contract, extend at least half of the longitudinal bars required in the upper portion of the shaft the additional length. Continue the tie bars for the extra depth, spaced two-foot on center measured along the circumference of the reinforcing steel cage. Extend the stiffener bars to the final depth. These bars may be lap spliced or unspliced bars of the proper length. The Engineer will not permit welding to the reinforcing steel. Unless the extra depth of the drilled shaft is required due to modifications by the Engineer, the additional reinforcing bars shall be at no additional cost to the State.

(N) Crosshole Sonic Logging (CSL) Test Access Tubes. Installation of access tubes shall be in accordance with ASTM Standard Test Method for Integrity Testing of Concrete Deep Foundations by Ultrasonic Crosshole Testing Designation D 6760, except as modified herein. Install access tubes in all drilled shafts to allow performance of CSL tests. Attach CSL access tubes securely to the interior of the reinforcement cage as near to parallel as possible to the vertical center axis of the drilled shaft in each drilled shaft and in the pattern shown on the plans. Extend the access tubes from the bottom of the reinforcement cage to at least 3.5 feet above the top of the shaft. The bottom of the access tube shall be capped permanently. Joints required to achieve full length of access tubes shall be watertight. Contractor shall take extra care to prevent damaging the access tubes during reinforcement cage installation. Fill the tubes with potable water to the top of the tubes as soon as the reinforcing steel cage is installed. Check for leakage, misalignment, and damage before placing concrete in the drilled shaft. Stop all leaks if present and repair any damages or misalignment before placement of concrete starts. Check water level as soon as possible after concrete placement (within 4 hours after concrete placement) and fill with potable water if needed. Check water level in tubes every day until CSL testing is completed. Top off tubes with potable water if needed to prevent the debonding of the CSL tubes from the drilled shaft concrete and thereby make any testing invalid. Keep the water level of the CSL tubes at the top and under no circumstances shall the water level in the CSL tube go below the concrete level. If leakage is detected after the pouring of the drilled

shaft concrete, monitor and top off the CSL tubes as often as needed to keep the water level in the tubes at the required level 24/7. Always reinstall the top watertight caps. Installation of CSL access tubes shall be incidental to the construction of the drilled shaft and shall be at no additional cost to the State.

The completed drilled shaft foundations will be tested by crosshole sonic logging (CSL) after at least five days of curing time, but no later than 20 days after concreting. The CSL test will be performed by the Engineer. The Contractor shall assist in the testing by making all the shafts in the project accessible to the Engineer; provide electricity, lights and other needs whenever requested by the Engineer. Assistance by the Contractor shall be incidental to the construction of the drilled shaft and shall be at no additional cost to the State. The Contractor shall provide accurate data on the dates and time of concrete placement for each drilled shaft and the surveyed location of each tube. Also, provide the elevation of the concrete at the top of the drilled shaft. The Engineer will require a minimum of 20-working days after testing of any drilled shaft to accept or reject that shaft.

The results of the CSL tests will be based on the percentage decrease in velocity as correlated to the following Concrete Condition Rating Criteria (CCRC), as shown in Table 511-3 – Concrete Condition Rating Criteria. Deviations from the following values shall be used for determining the Concrete Condition Rating.

Table 511-3 Concrete Condition Rating Criteria

Concrete Condition Rating	Rating Symbol	Velocity Reduction	Indicative Results
Good	G	0 – 10%	Acceptable concrete
Questionable	Q	10% - 25%	Minor concrete contamination or intrusion. Questionable quality concrete.
Poor	P/D	> 25%	Defects exist, possible water slurry contamination, soil intrusion, and or poor quality concrete.
Water	W	V=4760 – 5005 feet/sec	Water intrusion or water filled gravel intrusion with few or no fines present.
No Signal	NS	No signal received	Soil intrusion or other severe defect absorbed the signal, tube debonding if near top.

Shafts with test results other than “Good” will be tested in accordance with Subsection 511.03(R), Integrity Testing.

After completion of the crosshole sonic logging tests and final acceptance of the drilled shaft, all the access tubes shall be completely filled using a tremie method of placement. Access tubes shall be free of debris and water before filling with grout. Use non-shrink, non-metallic, grout of the same strength as the drilled shaft concrete. Filling the access tubes shall be at no additional cost to the State.

(O) Concrete Placement.

(1) General. Place the concrete through a concrete pump or other means as accepted by the Engineer using accepted methods as described below.

Concrete shall be placed in the shaft immediately after placing the reinforcing steel.

Concrete placement for the load test drilled shaft shall be continuous from the bottom to at least the top of shaft cutoff elevation and until good quality concrete emerges above the top of the shaft cutoff elevation. To ensure that the drilled shaft concrete is sound below the top of shaft cutoff elevation, the trial and production drilled shafts shall be poured four feet above the cutoff elevation and until good quality concrete is evident four feet above top of shaft cutoff elevation. For the production drilled shafts, the drilled shaft concrete four feet above the cutoff elevation shall be removed no sooner than final set and 48 hours after the completion of the production drilled shafts concrete pour. Final set shall be when the concrete has reached a compressive strength of 1000 psi. For the trial drilled shafts, the concrete four feet above the cutoff elevation shall be removed after the coring is completed. Prior to removing the concrete above the cutoff elevation, a circumferential diamond blade sawcut 2½ inches deep shall be made at the cutoff elevation. Then the portion of the drilled shaft more than one foot above the cutoff elevation shall be removed with equipment no larger than a 90 pound pavement breaker. Thereafter the remaining one foot of the drilled shaft above the cutoff elevation shall be removed using jack hammers no heavier than 30 pounds for the upper nine inches and 15 pound maximum for the lowest three inches.

A minimum of four and two, 6-inch by 12-inch concrete cylinders shall be made for the compressive strength testing and unit weight testing, respectively. Production shaft and trial shaft cylinders with compressive strengths less than the minimum 28-day compression strength will be considered defective. Production shafts and trial shaft with air-dry core sample unit weight less than two pounds per cubic foot of the air-dry unit weight test cylinders will be considered defective. Contractor shall submit

a corrective method plan for the defective shaft to the Engineer for review and approval prior to their use.

The elapsed time from the beginning of concrete placement in the shaft to the completion of the placement shall not exceed four hours. Adjust admixtures accepted by the Engineer so that concrete remains in a workable plastic state throughout 4-hour placement limit. A longer placement time may be requested, and requests shall be submitted to the Engineer for review and acceptance 30 days prior to the time the concrete pour (with a longer placement time) is needed. Should the Contractor exceed the 4-hour limit without obtaining prior acceptance by the Engineer, the Contractor may be required to core the drilled shaft. These drilled shaft corings shall be at no additional cost to the State and no additional time will be granted.

Before placing the concrete, provide results of 3-day, 7-day, 14-day and 28-day compressive strength tests of a trial mix and a slump loss test at least 30 days prior to placement of concrete. Supply a concrete mix that will maintain a slump of four inches or greater after four hours from initial mixing. Conduct the trial mix and slump loss tests using concrete and under ambient temperatures appropriate for the site conditions. The ambient temperature used shall be the temperature at the elevation of existing ground before any excavation started.

Drilled shaft mix design shall minimize segregation and bleeding. The top surface of the drilled shafts shall be leveled, cleaned, and roughened prior to concrete placement for the footing.

(2) Monitoring Concrete Volume. For each drilled shaft, prepare and submit a monitoring record the next working day after concrete placement has been completed. All monitoring shall be performed in the presence of the Engineer or his representative. As a minimum, the monitoring record shall consist of the following:

(a) A chart that is made up after drilled shaft excavation has been completed and accepted by the Engineer and before concrete placement has commenced. Indicated on the chart, depth of hole plotted with theoretical volume of concrete to fill drilled shaft hole. Plot concrete elevation (surface) along the vertical axis and concrete volume along the horizontal axis.

(b) As concrete is being place, measure concrete surface at an interval of approximately each cubic yard of concrete discharged. Plot concrete volume actually placed at each elevation point. Use this chart to determine if any necking down or enlargement of shaft has occurred during concrete placement.

(c) Keep records of steel and concrete movement to document the following conditions:

(1) When removing temporary or permanent casing, elevation of the top of reinforcing cage shall not rise more than 2 inches from its original elevation;

(2) As temporary casing is extracted, static level of fluid concrete shall not rise.

(3) Concreting by Pump. Concrete pumps and discharge lines for concrete placement in wet or dry excavations shall be used. Pumps and pump lines used to place concrete shall be of sufficient length, weight, and diameter to discharge concrete at the shaft base elevation. The pump and pump lines that will come in contact with concrete shall not contain aluminum parts. Discharge line shall have a minimum diameter of 4 inches and watertight joints. Concrete placement shall not begin until the pump line discharge orifice is at the shaft base elevation.

For wet excavations, use a plug to separate the concrete from the fluid in the hole until pumping begins. Remove the plug from the excavation or use plugs, made from a material accepted by the Engineer that will not cause a defect, if not removed.

The discharge orifice shall remain at least five feet below the surface of the fluid concrete. When lifting the pump line during concreting, reduce the line pressure temporarily until the orifice at a higher level in the excavation has been repositioned.

Upon removal of the pumpline orifice from the fluid concrete column and/or discharging concrete above the rising concrete level during the concrete pour, the Engineer will consider the shaft defective. In such a case, remove the reinforcing cage and concrete, the necessary sidewall removal specified by the Engineer, and repour the shaft. Costs of replacement of defective shafts shall be at no costs to the State and no additional time will be granted.

(P) Construction Tolerances. The following construction tolerances apply to drilled shafts:

(1) The center of the drilled shaft concrete and reinforcing bars shall be within 1/12 of the shaft diameter or 3 inches, whichever is less, in the horizontal plane at the plan elevation for the top of the shaft.

(2) The vertical alignment of the shaft excavation shall not vary from the plan alignment by more than 0.25 inch per foot of depth. The alignment of a battered shaft excavation shall not vary by more than 0.5 inch per foot of depth from the prescribed batter.

(3) After placing the concrete, the top of the reinforcing steel cage shall be no more than 6.0 inches above and no more than 3.0 inches below plan position.

(4) The cutoff (top) elevation of the shaft shall have a tolerance of ± 0.5 inch from the plan top of shaft elevation.

(5) The dimensions of casing are subject to American Pipe Institute tolerances applicable to regular steel pipe.

(6) Design the excavation equipment and methods so that the completed shaft excavation will have a flat bottom. The cutting edges of excavation equipment shall be normal to the vertical axis of the equipment within a tolerance of ± 3/8 inch per foot of diameter.

(7) Casing diameters shown in the contract documents to outside diameter (OD) dimensions. When accepted by the Engineer, a casing larger in diameter than shown in the contract documents may be provided to facilitate meeting this requirement. When using a series of telescoping casings, size casing to maintain shaft diameters.

Drilled shaft excavations that cannot be completed within the required tolerances are unacceptable. When accepted by the Engineer, corrections may be made to an unacceptable drilled shaft excavation by accepted combination of the following methods:

(1) Overdrill the shaft excavation to a larger diameter to permit accurate placement of the reinforcing steel cage with the required minimum concrete cover.

(2) Increase the number, size, or length of the reinforcing steel.

(3) Redesign the foundation.

(4) Other methods accepted by the Engineer.

The acceptance of correction procedures is dependent on analysis of the effect of the degree of misalignment and improper positioning. The Contractor is solely responsible to submit remedial repair procedures that shall make the structure equal to or better than the original design. The Engineer will solely determine if the remedial repair meets the requirements and is acceptable. A Hawaii Licensed Professional Structural Engineer and a Hawaii Licensed Professional Civil Engineer who specializes in Geotechnical Engineering shall stamp and sign the redesign drawings and computations. Correct out of tolerance drilled shaft excavations including engineering analysis and redesign at no cost to the State. No time extension will be granted for any impact to the critical path due to the Contractor's incorrect installation of the drilled shaft.

(Q) As-Built Drilled Shaft Location. The Contractor shall provide survey ties to all as-built location of all drilled shafts.

The Contractor shall notify the Engineer prior to performing the survey work and the Contractor shall survey the drilled shafts under the supervision of the Engineer or the Engineer's representative. A copy of the survey notes and the scaled plan locating all the completed drilled shafts in a given footing shall be submitted to the Engineer for review and approval. Submit accepted copy of the survey notes and the scaled plan as an electronic file, the Engineer will determine the acceptable format and media.

No form work for any footing shall proceed until the drilled shafts are found acceptable by the Engineer.

(R) Integrity Testing. Drilled shafts shall be visually inspected and tested for density, strength and soundness. Integrity testing will be performed on drilled shafts as determined by the Engineer. Integrity testing shall consist of partial or full depth concrete coring at drilled shafts determined by the Engineer. Coring shall be performed by the Contractor at the locations designated by the Engineer in the presence of the Engineer. The Engineer will solely determine if the cored shaft is acceptable or defective. Defective shafts shall be replaced and drawings and computations stamped and signed by a Hawaii Licensed Professional Engineer in the Structural Branch and Civil Branch (specializing in the Geotechnical field) shall be submitted for acceptance by the Engineer. The Contractor shall core vertical holes at locations and depths determined by the Engineer. The number of core holes to be done shall be determined by the Engineer. The core hole shall be accepted by the Engineer. The recovered core samples shall have a minimum diameter of 3.3 inches or 3 times the nominal maximum aggregate size of the concrete mix, use whichever is larger.

The measured unit weight of the air dry core samples shall not be less than two pounds per cubic foot of the air dry unit weight test cylinders.

Provide concrete cores properly marked in a core box with labels of the drilled depth at each interval of core recovery to the Engineer for evaluation and testing. The Engineer will be allowed a minimum of 7 working days for evaluation and testing of the core samples. The cored holes shall be filled with prepackaged, non-shrink, non-metallic, grout of the same minimum strength as the drilled shaft.

Cost of coring performed on acceptable production drilled shafts with no defects will be borne by the State. Cost of full depth coring of trial shaft shall be borne by the Contractor. Cost of coring performed on any drilled shaft that has defects shall be borne by the Contractor. If the drilled shaft in question is on the critical path, a time extension and the linear foot payment for coring will be the sole remedy given if the drilled shaft has no defects. The delay will be calculated from the end of the 20 working days review period of the cores to when the last core was taken. Contractor shall submit a corrective methods plan for the defective shafts to the Engineer for review and approval prior to their use. The corrective methods plan shall restore the defective drilled shaft to a condition

equal or better that of a drilled shaft that had no defects. Do not begin repair operations until receiving the Engineer's acceptance of the corrective methods plan for that defective drilled shaft.

511.04 Measurement.

(A) Furnishing drilled shaft drilling equipment and furnishing instrumentation and collecting data will be paid on a lump sum basis. Measurement for payment will not apply.

(B) The Engineer will measure obstruction per hour in accordance with the contract documents. Once the Engineer authorizes compensation for obstruction removal, duration of obstruction removal, including time required for obstruction disposal, will be measured for payment. Depth of obstruction removed will be subtracted from total depth measured for payment under other applicable drilled shaft excavation pay items.

(C) The Engineer will measure load test per each in accordance with the contract documents.

(D) The Engineer will measure trial shaft holes per linear foot. The Engineer will compute length between existing ground surface elevation at trial shaft hole center, before drilling, and authorized bottom elevation of hole.

(E) The Engineer will measure unclassified shaft excavation per linear foot, along shaft centerline, including bells. The Engineer will compute length between plan top of shaft elevation to plan estimated tip elevation.

(F) The Engineer will measure drilled shaft per linear foot. The Engineer will compute length between plan top of shaft elevation and to plan estimated tip elevation.

(G) The Engineer will measure coring for integrity testing per linear foot. The Engineer will compute length between the bottom of coring elevation and the top of the shaft concrete elevation.

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

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

Pay Item	**Pay Unit**
Furnishing Drilled Shaft Drilling Equipment	Lump Sum

The Engineer will pay for:

(A) 60 percent of the contract bid price when drilling equipment is on job site, assembled, and ready to drill foundation shafts.

(B) 40 percent of the contract bid price upon completion of drilling shafts, and placing shaft concrete up to top of shafts.

Obstructions Hours

The Engineer will pay for:

(A) 80 percent of the contract bid price upon completion of removing the obstruction.

(B) 20 percent of the contract bid price upon removing and disposing of the obstruction.

The maximum payment per designated obstruction shall not exceed 20 times the unit cost for unclassified excavation.

Load Test at _____ Each

The Engineer will pay for:

(A) 100 percent of the contract bid price upon completion of bi-directional load test shaft installation/construction, caliper and load testing with reports, and other related costs to the performance of the load test.

Trial Shaft at _____ Linear Foot

The Engineer will pay for:

(A) 60 percent of the contract bid price upon completion of excavation trial shaft holes through to bottom of shaft elevation or as authorized by the Engineer and providing inspection facilities.

(B) 20 percent of the contract bid price upon completion of coring and backfilling holes..

(C) 20 percent of the contract bid price upon completion of CSL testing and restoring the site.

The Engineer will not pay for trial shaft holes that the Contractor failed to demonstrate to the Engineer the adequacy of its proposed methods and equipment.

Unclassified Shaft Excavation at _____ Linear Foot

The Engineer will pay for:

(A) 60 percent of the contract bid price upon completion of using drilling equipment, using special tools and drilling equipment to excavated shaft.

(B) 20 percent of the contract bid price upon completion of furnishing and installing temporary casing.

(C) 20 percent of the contract bid price upon completion of removing and disposing of excavated material.

Drilled Shaft at _____ Linear Foot

The Engineer will pay for:

(A) 60 percent of the contract bid price upon completion of drilling.

(B) 15 percent of the contract bid price upon completion of furnishing, assembling, and placing steel cage.

(C) 15 percent of the contract bid price upon completion of furnishing and placing concrete.

(D) 10 percent of the contract bid price upon completion of removing and disposing of excavated material.

Coring for Integrity Testing for Acceptable Drilled Shafts Linear Foot

The Engineer will pay for:

(A) 70 percent of the contract bid price upon completion of concrete coring.

(B) 20 percent of the contract bid price upon completion of filling cored holes with non-shrink grout of the same minimum strength as drilled shaft.

(C) 10 percent of the contract bid price upon completion of packaging the core samples and delivering them to the Engineer."

END OF SECTION 511

SECTION 603 – CULVERTS AND STORM DRAINS

Make the following amendments to said Section:

(I) Amend **603.03(C)(1) - Culverts** by revising lines 106 to 108 to read as follows:

"Spacing between multi-barrel culverts shall be a minimum of 18 inches or 0.5 the culvert width, whichever is greater. The minimum spacing shall be 1 foot when placing controlled low strength material (CLSM) as backfill. Anchor the culverts in such a manner that the horizontal and vertical alignment of the culverts does not change."

(II) Amend **603.04 – Measurement** by revising lines 284 to 288 to read as follows:

"**(A)** The Engineer will measure bed course material for culverts per cubic yard in accordance with contract documents.

(B) The Engineer will measure reinforced concrete pipe per linear foot in accordance with contract documents."

(III) Amend **603.05 – Payment** by revising lines 303 to 305 to read as follows:

"Bed Course Material for Culvert Cubic Yard

_____ - Inch Reinforced Concrete Pipe, Class III Linear Foot"

(IV) Amend **603.05 – Payment** by deleting lines 356 to 357.

END OF SECTION 603

Make the following section a part of the Standard Specifications:

"SECTION 621 – ENHANCED VEHICLE CLASSIFICATION SYSTEM

621.01 Description. This work includes furnishing labor, materials, tools, machinery, and equipment necessary to install new Enhanced Vehicle Classification (EVC) System(s) or restore existing EVC System(s), complete in place according to the Contract. The Contractor shall make improvements as shown in the Contract, including the following:

(A) Provide for traffic counting and classification operations by installing (new stations) or replacing (existing stations) classification sensors (piezoelectric sensors), vehicle detector inductance loops (loop sensors), conduits, cable wiring, EVC controller cabinet(s), and electrical and communications service.

(B) Install (new stations) or restore (existing stations) the electrical and communications service and metering facilities and pay for the electric company's and the communications company's services when Contract Documents call for these utility services. When Contract Documents call for utility service connections, the Contractor shall coordinate service agreements with the respective electric company, communications company, and the respective State of Hawaii Department of Transportation (HDOT) District Engineer.

(C) For new stations, provide underground conduit systems including trenching and structural excavation. Furnish and install pull boxes. Provide backfilling and restoration work required to install the new EVC System(s) and restore other improvements at the site(s). For station restorations, provide new conduits, pull boxes, and necessary trenching, excavation, backfilling, and restoration of other improvements as called for in Contract Plans.

(D) Coordinate work with and arrange for inspection of work by the Engineer. Arrange for a representative from the piezoelectric sensor's manufacturer to supervise installation of piezoelectric sensors.

(E) Conduct required testing of the loop sensors and piezoelectric sensors. Submit acceptance test procedures and criteria for acceptance test results to the Engineer. Notify the Engineer a minimum of 1 week before the date scheduled for testing.

(F) Turn over to the Engineer complete and operating EVC System(s) according to the Contract.

Furnish and install incidental parts necessary to complete the EVC System(s) as though such parts were in the Contract.

621.02 Materials. Electrical equipment shall conform to the National Electrical Manufacturers Association (NEMA) Standards and this Contract. Materials and workmanship shall conform to the National Electric Code (NEC), General Order Nos. 6 and 10 of the Hawaii Public Utilities Commission, ASTM standards, the ANSI, and applicable revisions for all the above codes, standards, and local ordinances that may apply.

(A) Piezoelectric Sensors (Piezo Sensors).

(1) Piezo sensors shall meet the following conditions:

(a) Be Class 1 BL Weigh-in-Motion unencapsulated piezoelectric sensors.

(b) Have a minimum operating life of 1 year from the date of acceptance.

(c) Meet the requirements as outlined in the FHWA document *A Summary of Vehicle Detection and Surveillance Technologies Used in Intelligent Transportation Systems*.

(d) Be of the length shown in the Contract Plans (or as determined by the Engineer).

(e) Be manufactured complete with the piezo sensor lead cable and the sensor itself as one integral unit.

(f) Have a 16 gauge, flat, braided, silver plated copper wire center core that is spiral-wrapped by PVDF piezoelectric film.

(g) Have an outer sheath of 0.16-inch thick brass meeting CDA 260, as required by ASTM B587-19, *Standard Specification for Welded Brass Tube*.

(h) Be approximately 0.26 inches wide, with a maximum thickness of 0.063 inch (plus/minus 0.005 inch).

(i) Have insulation resistance between core and shield greater than 500 megaohms.

(j) Have a nominal piezoelectric coefficient greater than or equal to 20 pC/N.

(k) Have designs and installation techniques proven reliable in soil and environmental conditions similar to those in Hawaii.

(l) Be able to withstand at least 1 million cycles.

(m) Have a compatible interface with the electronics housed in the EVC cabinet(s) to perform the applications required for the EVC System(s).

(n) Include all mounting hardware and PU200 piezo installation resin (or equivalent) used for installation.

(2) The piezo sensor lead cable to the EVC cabinet(s) shall meet the following conditions:

(a) Be manufactured complete with the piezo sensor lead cable and the sensor itself as one integral unit.

(b) Be RG58 type, rated for underground direct burial.

(c) Have an outer jacket of 0.187-inch outside diameter.

(d) Have a nominal capacitance of at least 27 pF/ft.

(e) Be field measured so that the length of piezo sensor lead cable ordered suits the installation conditions.

(f) Be sufficiently long to reach the EVC cabinet(s) with at least an additional 12 inches extra slack within the cabinet(s). Excess piezo lead cable, beyond the 12 inches of slack, shall be trimmed in the field during installation.

(g) The maximum length of piezo lead cable shall be 300 feet.

(h) Splicing of the piezo sensor lead cable will not be allowed under any condition.

(3) The supplied PU200 piezo installation resin (or equivalent) shall meet the following conditions:

(a) Be suitable for installation in both Asphalt Concrete (AC) and Portland Cement Concrete (PCC) pavements.

(b) Have a short curing time (less than 75 minutes) to minimize lane closure time.

(c) Be of sufficiently thick consistency to prevent ‘running’ when being applied in saw cuts.

(d) Be uniform in consistency such that particulate matter within the sealant does not separate or settle.

(e) Be approved by the piezo sensor manufacturer and the Engineer.

(4) An appropriate in-road temperature sensor shall be supplied to provide temperature correction data for the piezo sensors. The temperature sensor shall be an in-road sensor, as approved by the Engineer.

(B) Loop sensors.

(1) Loop sensor wire shall meet the following conditions:

(a) Be polyethylene insulated.

(b) Be 14 AWG stranded THHN.

(c) Be 600 Volts rated.

(d) Be IMSA Spec. 51-3 certified.

(e) Be tested at the factory prior to shipment.

(f) Include installation materials and loop sealant for installation.

(2) Loop sensor home-run cables shall meet the following conditions:

(a) Be polyethylene insulated.

(b) Be stranded-tinned-copper 14 AWG.

(c) Be a 2-conductor cable.

(d) Have a stranded-tinned-copper drain wire.

(e) Be aluminum–polyester shielded.

(f) Be polyethylene jacketed.

(g) Be 600 Volts rated.

(h) Be IMSA Spec. 50-2 certified.

(i) Be tested at the factory prior to shipment.

(j) Be sufficiently long that the loop sensor home-run cable is one piece that reaches all the way from the pull box (where it is spliced to the twisted pair of loop wires) to the EVC cabinet(s). The cable length shall allow for a service loop of 5 feet of extra slack in pull boxes for each loop sensor home-run cable, and an extra 12 inches slack inside the cabinet(s).

(k) Splicing of the home-run cable to the twisted pair of loop wires shall only be allowed at the closest pull box to the loop. Splicing shall only be done using an accepted splice kit.

(3) The supplied loop sealant shall meet the following conditions:

(a) Be compatible with IMSA Spec. 51-3 loop detector wire.

(b) Be suitable for installation in both AC and PCC pavements.

(c) Shall have a short curing time (less than 75 minutes) to minimize lane closure time.

(d) Shall be uniform in consistency such that particulate matter within the sealant does not separate or settle.

(e) Shall be approved by the Engineer.

(C) Backer Rod. The Contractor shall use 3/8-inch to 1/2-inch diameter backer rod to secure loop sensor wires at the bottom of saw cuts, as shown on Contract Plans.

(D) Conduits. The Contractor shall use PVC-coated galvanized steel electrical conduits for all new above-ground exposed construction, or as directed by the Engineer. PVC conduits shall be used for all new underground construction. All new direct-burial PVC conduits shall be Schedule 80. New PVC conduits under pavement and at utility crossings shall be concrete encased. New concrete-encased PVC conduits can be Schedule 40. New trenched conduits shall conform to Standard Plan TE-35 or TE-36 as indicated on Contract Plans, or as directed by the Engineer. Installation of new conduits must comply with Chapter 6-73, Hawaii Administrative Rules, 'Installation, Operation, and Maintenance of Overhead and Underground Electrical Supply and Communication Lines,' and be installed in areas under pavement before the new pavement is placed.

(1) Steel Conduits. New steel conduits shall meet the conditions of Section 712.27 (D), 'Rigid Steel Conduit PVC Coated' of the Standard Specifications.

(2) Plastic Conduits. New plastic (PVC) conduits shall meet the conditions of Section 712.27 (B), 'Plastic Conduits' of the Standard Specifications.

(3) Duct Sealing Compound. New duct (conduit) sealing compound shall meet the conditions of Section 712.27 (E621.0), 'Duct Sealing Compound' of the Standard Specifications.

(E) EVC Cabinet(s). New EVC cabinet(s) shall consist of ground-mounted cabinet(s) on reinforced concrete foundations. EVC cabinet(s) shall be a Caltrans Traffic Signal 332A cabinet or equivalent, with EIA 19" rack, shelf, 30-amp main circuit breaker, surge-protected 6-outlet power strip, LED overhead lights, front and rear door vents with reusable/washable metal filters, and thermostat-controlled fan, as specified on Contract Plans. Cabinet(s) and shall be capable of housing all required communications and control equipment necessary for the EVC System. Cabinet(s) shall be powder coated in anti-graffiti forest green color on the exterior. Contractor shall furnish and install power cables from the Hawaiian Electric Company service point.

(F) Pre-cast Foundation(s). Pre-cast foundation(s) for cabinets and poles shall only be used if accepted by the Engineer. Manufacturer's brochures, catalog cuts, and shop drawings of any pre-cast foundations to be used shall be submitted to the Engineer for acceptance as specified in Section 621.03 (A) Equipment List and Drawings below.

(G) Wired Telecommunications. When required by the Contract Documents, if the site has available wired telecommunications service, the service connection facilities shall be supplied (new stations) or restored (existing stations) in accordance with the respective telecommunications service company's requirements. The Contractor shall make any necessary arrangements with the telecommunications company for new or restoration of services.

(H) Power. Power connections and service to new cabinet(s) shall be provided according to the Contract Documents.

(1) Power from Utility Company. When required by the Contract Documents, if the site has available electrical utility service, the electric power connection facilities shall be supplied in accordance with the respective power company's requirements for electrical service.

(2) Power from Solar Assembly. When required by the Contract Documents, solar power equipment and connection facilities shall

be provided to the cabinet(s) at locations specified in the Contract Plans.

(a) Power to cabinet(s) shall be provided via sealed 12-Volt batteries connected to a solar panel and pole assembly.

(b) The Contractor shall provide a complete solar panel assembly for each cabinet or as required by the Contract Documents. A complete solar panel assembly consists of a minimum of one solar panel, associated supports, pole, concrete foundation, and wiring to the EVC cabinet(s).

(c) Each solar power system shall include surge protection, grounding according to NEC requirements, and a battery charge controller.

(d) The solar power system shall have enough reserve capacity to operate the station uninterrupted for up to three days without charging by the solar panels.

(e) The Contractor shall submit shop drawings of a complete solar power system to the Engineer prior to ordering materials as specified in section 621.03 (A) Equipment List and Drawings below. Manufacturer's brochures, catalog cuts, and shop drawings submitted to the Engineer for acceptance shall include information on pole, foundation, wiring, grounding, solar panels, and associated supports. Solar assembly pole(s) shall be located no more than 20 feet away from cabinet(s).

(l) Excavation Warning Signs. The Contractor shall furnish and install new warning signs and appropriate mounting adjacent to the sensor lead cable runs or as close as possible to the cables as indicated in the Contract Plans. Signs and mountings shall conform to the requirements of Section 750.02, 'Sign Posts' of the Standard Specifications and Standard Plan TE-01, and Contract Documents. For station restorations, existing sign posts are to remain and shall be reused if possible. If new sign posts are required, they shall be no more than 20 feet from cabinet(s). New signs shall be 12 inches wide by 18 inches high. Bottom of signs shall be at 8 feet above finished grade. New sign text shall read as follows, where 'XXXXXX' shall be replaced with the existing station short name used by Highway Planning Branch. For new stations, new signs shall leave a blank space of length 'XXXXXX' so that once the station short name has been determined, it can be added to the sign later:

WARNING
BURIED TRAFFIC MONITORING LINES

NOTIFY HWY-PLANNING BRANCH AT
(808) 587-6352 BEFORE DIGGING OR EXCAVATION
STATION XXXXXX

The first line shall be a minimum of 2 inches in height. Subsequent lines of text shall be 1 inch in height. No border is necessary, but a minimum margin of 1/4 inch shall be maintained. For the letters and background, use black and yellow (non-retro-reflective) paints, respectively. The first line of text shall be centered. Subsequent lines shall also be centered; however, the Contractor shall have the option to move the wording within these lines to allow for best fit. Details of the furnished warning signs, mounting, and sign post shall be submitted to the Engineer for acceptance prior to purchase. Furnishing warning signs, mounting, and installation shall be incidental to the Contract.

(J) Pull Boxes and Covers. For station restorations, existing pull boxes are to remain and shall be reused if possible. New pull boxes, if required, shall be furnished and installed as indicated in the Contract Documents. New pull box covers shall be labeled TRAFFIC MONITORING. This label shall be cast or molded into the cover material and not just marked on the cover surface. Pull boxes and covers shall be rated for the largest potential vertical vehicle loads they might encounter, according to their position in shoulders, medians, and traffic lanes, or by direction of the Engineer and as shown in the Contract Documents.

(K) Other Materials. Other materials shall meet the requirements specified in the following sections of the Standard Specifications:

Structural Concrete	Section 601
Reinforcing Steel	Section 602
Trench Backfill Material	Subsection 703.21
Concrete Pull Box	Subsection 712.06 (B)

621.03 Construction Requirements.

(A) Equipment List and Drawings. Within 7 days following Contract award, two copies of materials and equipment purchase requisition, including copies of the equipment list, manufacturer's brochures, catalog cuts, and shop drawings shall be submitted to the Engineer for acceptance.

Materials and equipment shall be ordered immediately upon acceptance by the Engineer. If the Contract award is rescinded by the Department after ordering of materials and equipment, the Department will purchase

ordered materials and equipment at cost based on invoices. Purchase price will include transportation cost and applicable State excise taxes. Purchase price will not include profit.

Upon completion and acceptance of work, an 'As Built' or corrected plan shall be submitted, showing in detail any construction changes per Section 648, 'Field Posted Drawings' of the Standard Specifications.

(B) Excavation and Backfill. Excavation and backfill shall be made in accordance with Section 204, 'Excavation and Backfill for Miscellaneous Facilities' of the Standard Specifications. Material from excavation shall be placed to prevent damage and obstruction to vehicular and pedestrian traffic and interference with surface drainage.

(C) Installation. The Contractor shall notify the State and schedule a meeting at least 14 days prior to any construction activity. The State shall install new traffic monitoring equipment and electronics in the cabinet(s) after the installation of the cabinet(s) and sensors. Installation of sensors shall occur after any and all grinding and or milling of the finished pavement surface and after application of pavement markings or striping.

(1) Piezo Sensors.

(a) Installation shall be supervised by the piezo sensor manufacturer's representative.

(b) Construction shall reflect the number and configuration for the piezo sensors as shown in the Contract Plans.

(c) Piezo sensors and leads shall be installed at least 18 inches away from cracks, potholes or joints within the pavement. If the finished pavement at the installation site has cracks, potholes or joints, the number and configuration of piezo sensors shall be modified.

(d) Piezo sensors shall be installed within the roadway, two each per lane, in both traffic directions. Refer to the configuration shown in the Contract Plans.

(e) If the sensor configuration needs to be modified, the Contractor shall inform the State 14 days before the start of construction and submit Shop Drawings of the revised configuration for approval.

(f) A 3/4-inch thick saw blade shall be used to make 3/4-inch wide by 2-inch deep slots for piezo sensors in a single pass of the

saw. The slots shall be made as shown in the Contract Plans, or as approved by the Engineer.

(g) A 3/8-inch thick saw blade shall be used to make 3/8-inch wide by 4-inch deep slots (unless shown otherwise on the Contract Plans or by direction of the Engineer) for the piezo sensor lead cables. The transition from the 2-inch deep sensor slot to the 4-inch deep lead cable slot shall be smooth and gradual to prevent a sharp edge under where the lead cable and sensor connect.

(h) Saw cuts shall be made by wet cutting. Dry cutting shall not be allowed.

(i) Dust, dirt, and refuse shall be collected and cleaned away promptly after saw cutting is done. The slots shall be cleared by water applied by pressure washer. Residual water within the slots shall be vacuumed by use of a wet/dry vacuum. The slots shall then be dried by air compressor. Flame torches shall not be used to dry slots. After the slots are dried, any remaining debris stuck within the slot must be removed. The slots must be completely clean and dry before inserting the piezo sensors and lead-in cables.

(j) The slots shall be inspected before inserting piezo sensors. If any additional debris or moisture is observed, compressed air shall be used to dry the slots and remove any additional debris before proceeding with installation.

(k) Piezo sensors shall be tested and cleaned prior to installation according to manufacturer’s installation instructions.

(l) Piezo sensors shall be laid in slots at 1-1/4 inch below the surface of the roadway or as recommended by the manufacturer. Piezo sensors shall be installed straight and flat in slots. Piezo sensors shall be secured in place along the entire length of sensors in slots by seating them in slots with the clips provided in the sensor kit from the manufacturer. The clips shall be spaced 6 inches apart.

(m) Voids of the piezo sensor slots shall be filled with PU200 piezo installation resin (or equivalent) so that the piezo sensors are fully encapsulated. The PU200 piezo installation resin (or equivalent) shall be prepared in accordance with the manufacturer's instructions and shall result in a finish approximately 1/16 inch above the surface of pavement. Once the resin has sufficiently hardened, the sealant shall be ground flush with the road surface along the saw cut.

(n) Hot tar shall not be used.

(o) A service loop of 5 feet of extra slack shall be provided in pull boxes for each piezo lead cable.

(p) Piezo lead cables shall be trimmed after allowing for an extra 12 inches of slack inside the EVC cabinet(s). Splicing to lengthen the piezo lead cable shall not be allowed under any condition. Spliced piezo lead cables will be rejected.

(q) The in-road temperature sensor shall be installed according to the manufacturer's instructions, as approved by the Engineer. The temperature sensor shall be placed in a 3/8-inch wide by 2-inch deep slot at 1-1/4 inch below the road surface. The slot for the temperature sensor and its lead shall be cut by wet cutting, then cleaned and prepared in the same way as the slots for the piezo sensors.

(r) Adequate power shall be provided for all test equipment to meet the detailed and specific requirements of the manufacturer for all tests required for certification and acceptance. All necessary equipment to perform the required tests shall be provided.

(s) Traffic shall not be allowed on the completed system until the manufacturer's representative approves all conditions of the installation with the acceptance by the Engineer. Thereafter, testing in accordance with the manufacturer's requirements shall be completed before public traffic is allowed.

(t) HDOT or its representative will make the final connection inside the EVC cabinet(s); however, the Contractor shall label the wires clearly to identify traffic direction, lane number, and sequence of piezo sensors in each lane per direction. All labeling at pull boxes and cabinet(s) must be consistent.

(2) Loop Sensors.

(a) Construction shall reflect the number and configuration of loop sensors as shown in the Contract Plans.

(b) Loop sensors and their leads shall be installed at least 18 inches away from cracks, potholes or joints within the pavement. If the finished pavement at the installation site has cracks, potholes or joints, the number and configuration of the loop sensors shall be modified.

(c) If the configuration of the loop sensors needs to be modified, the Contractor shall inform the State 14 days before construction and submit Shop Drawings of the revised configuration for approval.

(d) Loops shall be installed two per lane to measure speed and length of the vehicles and to classify vehicles in conjunction with the axle detectors (piezo sensors). Loops shall be installed such that they are centered in lanes relative to the final lane striping. Loop sensors not installed centered in each lane relative to the final lane striping shall be replaced correctly at no additional cost to the State. If lanes are less than 12 feet in width, the loop configuration may be specified as a non-centered configuration or otherwise modified. Refer to the configuration specified in the Contract Plans.

(e) A 3/8-inch thick blade shall be used to make 4-inch deep (or as shown on Contract Plans) slots for the loop sensors and their leads.

(f) Saw cuts shall be made by wet cutting. Dry cutting shall not be allowed.

(g) Dust, dirt, and refuse shall be cleaned away promptly after saw cutting is done. The slots shall be cleared by water applied by pressure washer. Residual water within the slots shall then be vacuumed using a wet/dry vacuum. The slots shall then be dried by air compressor. After the slots are dried, any debris stuck within the slot must be removed.

(h) The loop sensor and lead wire shall be one continuous piece of wire, from the pull box, to the loop, around it four turns, and back to the pull box. The size of loops is specified in the Contract Plans.

(i) After laying the four turns of loop sensor wire in the bottom of the 4-inch deep slot, 1-inch long pieces of backer rod shall be pressed down on top of the wires in each foot around the loop, to anchor the wires in the bottom of the slot before applying the loop sealant. Backer rod pieces shall also be placed on top of the loop leads as was done around the loops, to anchor the leads in the bottom of the collector slots that run from the loops to the conduit entry point at the edge of the pavement. Backer rod shall be embedded at least 2 inches below the top of pavement. The backer rod shall be placed into the slot with a blunt object, such as a wooden stir stick. No sharp object, such as a screwdriver, shall be used to press backer rod into slots.

(j) Loop sealant shall be applied to slots so that there are no voids, completely filling the slot, and such that the sealant will cure flush with the road surface.

(k) Twisted-pair loop leads shall be twisted five twists per foot from the conduit entry point at the roadside to the pull box, where they will be spliced to the home-run cable. The twisting shall be completed prior to inserting the resulting twisted-pair loop lead into the conduit leading to the pull box.

(l) A twisted pair of loop leads from one loop sensor shall not be twisted with the twisted pair from another loop sensor.

(m) The twisted-pair lead-in wires from the loop sensors shall be spliced (as directed by the Engineer) to new home-run cables at the closest pull box to the loop, using a splice kit. The splice kits shall be used in accordance with the manufacturer's specifications. The splices shall be inspected by the Engineer before acceptance. Splice points of cables must be suspended near the top of the pull box with a j-hook or equivalent.

(n) A service loop of 5 feet of extra slack shall be provided in pull boxes for each loop sensor home-run cable.

(o) Loop sensor home-run cables shall be trimmed after allowing for an extra 12 inches of slack inside the EVC cabinet(s).

(p) HDOT or its representative will make the final connection inside the EVC cabinet(s); however, the Contractor shall label the wires clearly to identify traffic direction, lane number, and sequence of loops sensors in each lane per direction. All labeling at pull boxes and cabinet(s) must be consistent.

(3) Pull Boxes.

(a) New pull boxes shall be furnished and installed as indicated in the Contract Plans. Locations for new pull boxes shall be excavated carefully. For station restorations, existing pull boxes are to remain and shall be reused when possible.

(b) New pull boxes shall be installed so that covers are level with curb or sidewalk grade or 1 inch above surrounding ground.

(4) Foundations.

(a) New foundations shall be constructed as indicated in the Contract documents. Foundations within the Clear Zone, as defined by the AASHTO *Roadside Design Guide*, including anchor bolts, shall not extend more than 4 inches above the surrounding ground. Pre-cast foundations, if used, shall also not extend more than 4 inches above the surrounding ground if located within the Clear Zone.

(b) For cast-in-place foundations, forms shall be set true to correct line and grade. Rigid forms shall be securely braced in place. Conduit ends shall be placed in proper position and height and held in place by rigid top template during concrete placement and until concrete sets. Concrete shall be cured not less than 72 hours.

(c) Mixing, placement and curing of concrete for cast-in-place foundations shall be in accordance with Section 601, 'Structural Concrete' and Section 503, 'Concrete Structures' of the Standard Specifications.

(5) EVC Cabinet(s).

New EVC cabinet(s) shall be mounted on foundation(s) and set at required locations as shown in the Contract Plans or as ordered by the Engineer. Cabinet(s) shall be secured to the foundation(s) with 1/2-inch by 4-1/2-inch stainless steel wedge anchors.

(6) New Conduits.

(a) New conduits shall drain towards pull boxes. Conduits shall not drain towards the EVC cabinet(s).

(b) Directional changes in conduits, such as bends and changes to clear obstructions, shall be made with curved segments using accepted deflection couplings or with short lengths of straight conduits and couplings. The deflection angle between two adjacent lengths of conduits shall not exceed 6 degrees. The bends shall not have a radius of less than 12 times the nominal size of the conduit. The Contractor may use factory-made ells.

(c) Rigid PVC conduits shall be cut with a hacksaw. The ends shall be squared and trimmed after cutting to remove rough edges. The connections shall be of the solvent-weld type and be made according to the conduit manufacturer's recommendations and as accepted.

(d) Conduit ends shall be sealed with plugs at the end of each day of work, whenever problems interrupt the conduit installation work, and whenever conduits are subject to submergence in water.

(e) New conduits shall be kept clean during construction.

(f) Conduits under pavement and at utility crossings shall be trenched and concrete encased, per Standard Plan TE-36. Metallic Excavation Warning Tape shall be placed above the conduit per Standard Plan TE-36. Conduits in some unpaved parts of the Right of Way may be installed per Standard Plan TE-35, as indicated on Contract Plans.

(g) Only hand shovels shall be used in compacting concrete encasements. Concrete shall be cured for at least 72 hours before permitting vehicular traffic to run over the concrete.

(h) The entire length of a conduit run between pull boxes or between pull boxes and cabinets shall be of one type of material.

(i) The completed conduits shall be subject to a field test. A bullet-shaped test mandrel about 14 inches long with a diameter 0.5 inch less than the inside diameter of the conduits shall be passed through the entire length of each conduit run. The Engineer will consider scouring found on the mandrel deeper than 1/32 inch an indication of burrs and/or obstructions in the conduit run. Normal abrasion between the conduit line and bottom of mandrel is not an indication of burrs and/or obstructions in the conduit run. Any burrs and/or obstructions shall be removed, then the test mandrel shall be passed through again. The process shall be repeated until the Contractor gets a satisfactory result.

(j) Each conduit run shall be provided with a No.10 gauge flexible, zinc-coated pull wire (or 1/8-inch polyester or polyolefin pull wire) extending through its entire length. An additional 5 feet of pull wire shall be doubled back into the conduit at each end of the run. Conduits and sleeves entering pull boxes shall be fitted with belled ends and shall end flush in the wall with ends ground smooth and plugged temporarily.

(7) Existing Conduits.

(a) For station restorations, existing conduits are to remain and shall be reused if possible, after removal of existing wiring and any accumulated dirt or debris.

(b) Each conduit run shall be provided with a No.10 gauge flexible, zinc-coated pull wire (or 1/8-inch polyester or polyolefin pull wire) extending through its entire length. An additional 5 feet of pull wire shall be doubled back into the conduit at each end of the run.

(8) New Wiring.

(a) Wiring shall conform to the appropriate articles of the NEC and shall be arranged within assemblies and pull boxes neatly. Wiring installed underground must be in conduits—no direct burial. Before the final installation of cables in conduits, a wire brush, swab, and mandrel shall be pulled through each conduit, to ensure that extraneous matter has been removed, and to verify that the conduit system is clean and free from obstructions.

(b) Cables shall be handled with great care to avoid damage to the conductors or the jacket. Cables shall not be pulled off and laid on the ground before installation. Pulls shall be made in one direction only. Lubricants used shall be as recommended by the cable manufacturer or accepted by the Engineer. Wires or cables shall not be left under tension nor tight against bushings or fittings.

(c) Damaged ends resulting from the use of pulling grips shall be removed soon after pulling conductor and cable. Cable ends shall be temporarily taped or capped to exclude moisture and shall remain protected until HDOT or its representative makes the final connections inside the EVC cabinet(s). The Contractor shall label the wires clearly to identify traffic direction, lane number, and sequence of loops and piezo sensors in each lane per direction. All labeling at pull boxes and cabinet(s) must be consistent.

(9) Equipment Installed in EVC Cabinet

(a) EVC equipment to be installed inside of EVC cabinet shall be furnished by HDOT. Contractor shall coordinate with HDOT for procurement of equipment and shall be responsible for installing equipment and all testing required by HDOT ensuring equipment is functioning, installed and connected correctly. Damaged equipment which fails testing shall be replaced at Contractor's expense.

(D) Bonding and Grounding. For station restorations, existing bonding and grounding equipment shall remain and be reused when possible. New stations shall have bonding and grounding constructed as follows:

(1) Metallic conductor and cable sheaths and conduits shall be secured mechanically and electrically to form a continuous system.

(2) The system shall be grounded in accordance with the NEC and as specified herein. No. 8 AWG copper wire or equivalent copper strap of same cross-sectional area shall be provided for bonding and grounding jumpers.

(3) Conduits and neutral wires shall be grounded at service points as required in accordance with the NEC, using No. 6 AWG or equal for grounding conductors.

(4) Copper-clad steel or pure copper ground rod, 5/8-inch diameter by 8 feet long, shall be installed inside cabinet foundation(s).

(5) Grounding rods shall use No. 6 AWG wire to connect to No. 8 AWG ground wire loop and power system neutral.

(6) On wood poles, equipment mounted less than 8 feet above grade shall be grounded.

(E) Power Service. New stations shall have necessary new power service facilities coordinated and constructed in accordance with the respective power company's requirements. For station restorations, existing power service equipment shall remain and be reused when possible.

(F) Wired Telecommunication Service. If new EVC(s) will be using utility wired telecommunication service, the necessary new facilities shall be coordinated and constructed in accordance with the respective communications company's requirements. For station restorations, existing wired communication equipment shall remain and be reused when possible.

(G) Inspection and Testing.

(1) Before Installation. The equipment shall be given requisite factory tests and inspected by the contractor upon receipt to determine that the workmanship and materials are free from defects.

(2) After Installation.

(a) Piezo sensors shall be tested after installation. Hard copy and digital format test results shall be furnished for each piezo sensor, showing:

1) Resistance: at least 1 megaohm.

2) Capacitance: between 5 and 20 nanofarads.

3) Dissipation Factor: less than 0.04.

(b) Loop sensors shall be tested after installation. Hard copy and digital format test results shall be furnished for each loop sensor, showing:

1) Induced voltage (V).

2) f = Frequency of Loop (kHz).

3) L = Inductance of Loop (μH).

4) R = Resistance of Loop (ohm).

5) Meg Test = Loop insulation resistance should be greater than 100 megaohms.

(c) The Contractor shall provide all testing equipment such as BK 875A or equivalent LCR meter, Fluke 75 or higher/equivalent multimeter, megohmmeter, and scope meter or oscilloscope for the above tests.

(d) Any defects discovered as a result of the sensor tests shall be corrected at no additional cost to the State.

(3) Acceptance of EVC System(s). The EVC System(s) shall not be accepted and payment shall not be made until testing results requirements have been successfully met and the test results have been submitted to the State within 30 calendar days from the completion of sensor installation.

(H) Restoring Pavements and Other Improvements. Existing pavements and other improvements, such as driveways, sidewalks, curbs, and gutters disturbed by excavation shall be restored to their original condition. Replacement material equal to or better in quality than existing materials shall be used. Existing grades, thickness, texture, and color shall be matched whenever applicable.

(I) Warranty. New material and equipment for permanent construction shall be provided. Copies of manufacturer's warranty or warranties guaranteeing equipment free from defects in materials, design, and manufacturing, for not less than 12 months from the date of acceptance shall be furnished. Adjustment or repair of material and equipment under

warranty shall be made within 24 hours from time of notification. Temporarily replacement of under-warranty material and equipment requiring factory corrections shall be made within 24 hours from time of notification. Factory-corrected or new material and equipment shall be installed no later than 30 days from time of notification.

621.04 Method of Measurement. The EVC System will be paid for on a lump sum basis. Measurement for payment will not apply.

621.05 Basis of Payment. The Engineer will pay for the accepted EVC System on a lump sum basis. Payment will be full compensation for the work prescribed in this section and the Contract Documents.

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

Pay Item	**Pay Unit**
EVC System	Lump Sum

END OF SECTION 621”

SECTION 622 – ROADWAY AND SIGN LIGHTING SYSTEM

Make the following amendments to said Section:

(I) Amend Subsection 622.05 Measurement from lines 402 to 403 to read as follows:

" (A) The Engineer will measure the luminaire assembly, luminaire bracket arms, luminaire poles, luminaire bases, luminaire appurtenances, metering cabinet assembly and appurtenances, pullboxes per each in accordance with the contract documents.

(B) The Engineer will measure streetlight conductors, casing, trench excavation, removal of ductbank and cables per linear foot in accordance with the contract documents.

(C) Hawaiian Electric Company service connection fees for street light service and removal of existing streetlights will be paid on a lump sum basis. Measurement for payment will not apply.

(II) Amend **Subsection 622.05 Payment** from lines 412 to 414 to read as follows:

"**Pay Item**	**Pay Unit**
State Street Light Standard, 98W LED, Luminaire, 8' Bracket Arm, Standard Pole, Base and Appurtenances	Each
State Street Light Standard, 98W LED Luminaire, 8' bracket arm, 18' Pole, Base and Appurtenances	Each
State Street Light Standard, 98W LED Luminaire, 8' bracket arm, 17' Pole, Base and Appurtenances	Each
State Street Light Standard, 120W LED, Luminaire, 8' Bracket Arm, Standard Pole, Base and Appurtenances	Each
State Street Light Standard, 120W LED Luminaire, 8' bracket arm, 18' Pole, Base and Appurtenances	Each
State Street Light, 98W LED Luminaire, 8' bracket arm, 25' Pole, Base and Appurtenances	Each
State Street Light Standard, 120W LED Luminaire, 8' bracket arm, Mounted on HECO Wood Pole	Each
Street Light Metering Cabinet, pad, panelboard, meter socket and,	

appurtenances	Each
GE Light Grid Node	Each
Type “B” Highway Lighting Pullboxes	Each
Streetlight Conductors #2 RHW	L.F.
Streetlight 2”C Pvc Sch 40	L.F.
Street Light Trench Excavation	L.F.
Street Light Concrete	C.Y.
Remove Type “B” Streetlight Pull box	Each
Remove Pole Mounted Streetlight, Bracket Arm, Luminaire, and Appurtenances	Lump Sum
Remove Standalone Streetlight Base, 30’ Pole, Bracket Arm, Luminaire, and Appurtenances	Lump Sum
Remove Streetlight Ductbank	L.F.
Remove Streetlight Cables	L.F.
HECo. Service Charge for Street Light Service	Lump Sum

END OF SECTION 622

SECTION 623 – TRAFFIC SIGNAL SYSTEM

Make the following amendment to said Section:

(I) Amend **Section 623.04 - Measurement** by replacing lines 578 to 579 to read:

"**623.04 Measurement.** The Engineer will not measure software for controller, interconnect, or electrical risers for payment.

(A) The Engineer will measure the controller assembly, foundation for traffic signal controller, traffic signal standard, foundation for traffic signal standard, pedestrian or traffic signal assembly, pedestrian pushbutton, pullbox, loop detector sensing unit, emergency vehicle preemption optical receiver, service and metering equipment assembly, and advance warning beacon assembly per each in accordance with the contract documents.

(B) The Engineer will measure camera cable, traffic signal interconnect subduct, traffic signal ductline, secondary electrical ductline and conductors per linear foot in accordance with the contract documents.

(C) Hawaiian Electric Company service connection fees for traffic signal service will be paid on a lump sum basis. Measurement for payment will not apply.

(II) Amend **Section 623.05 – Payment** by replacing lines 581 to 594 to read:

"**623.05 Payment.** The Engineer will pay for the controller assembly at the contract unit price per each complete in place. The price includes full compensation for submitting the equipment list and drawing; furnishing and mounting the controller cabinet; furnishing, assembling, wiring, software, and housing the controller and auxiliary equipment; painting the controller cabinet; testing; providing turn-on service; submitting warranty; and furnishing equipment, tools, labor, materials and other incidentals necessary to complete the work. Conduits and cables up to 10' away from the controller assembly are considered incidental to the installation of the controller assembly.

The Engineer will pay for the traffic signal standard at the contract unit price per each complete in place. The price includes full compensation for submitting the equipment list and drawing; furnishing and installing the traffic signal standard; wiring; bonding and grounding; testing; providing turn-on service; submitting warranty; and furnishing equipment, tools, labor, materials; and other incidentals necessary to complete the work. Conduits and cables up to 10' away from the traffic signal standards are considered incidental to the installation of the traffic signal standard.

The Engineer will pay for the traffic signal assembly installed on street light standards at the contract unit price per each complete in place. The price includes full compensation for submitting the equipment list and drawing; furnishing and installing the traffic signal standard; wiring; bonding and grounding; testing; providing turn-on service; submitting warranty; and furnishing equipment, tools, labor, materials; and other incidentals necessary to complete the work. Conduits and cables up to 10' away from the street light standards are considered incidental to the installation of the traffic signal assembly.

The Engineer will pay for the foundation for controller cabinet and traffic signal standard at the contract unit price per each complete in place. The price includes full compensation for excavating and backfilling; forming; furnishing and placing the reinforcing steel; mixing, placing, and curing the concrete; furnishing and setting the anchor bolts; restoring the pavement; construction of a raised concrete pedestal; and furnishing equipment, tools, materials and other incidentals necessary to complete the work. Conduits and cables up to 10' away from the traffic signal standards are considered incidental to the installation of the traffic signal standard.

The Engineer will pay for the pedestrian and traffic signal assembly at the contract unit price per each complete in place. The price includes full compensation for submitting the equipment list and drawing; assembling the signal heads; wiring; bonding and grounding; painting the signal head mounting; testing; providing turn-on service; submitting warranty; and furnishing equipment, tools, labor, materials and other incidentals necessary to complete the work.

The Engineer will pay for the pedestrian pushbutton with instruction sign at the contract unit price per each complete in place. The price includes full compensation for submitting the equipment list and drawing; furnishing and installing the pedestrian pushbutton with the instruction sign; wiring; bonding and grounding; testing; providing turn-on service; submitting warranty; and furnishing equipment, tools, labor, materials; and other incidentals necessary to complete the work.

The Engineer will pay for the pullbox at the contract unit price per each complete in place. The price includes full compensation for submitting the equipment list and drawing; furnishing and installing the pullbox at the designated locations; saw cutting; excavating and backfilling; restoration of concrete sidewalks, asphalt concrete pavement and landscaping; coating the frames and covers; and furnishing equipment, tools, labor, materials and other incidentals necessary to complete the work.

The Engineer will pay for the loop detector sensing unit at the contract unit price per each complete in place. The price includes full compensation for saw cutting; cleaning and blowing the saw cut areas; furnishing and inserting the loop cable; splicing in the pullbox; filling the saw cut groove with epoxy sealer or hot

applied rubberized sealant; and furnishing equipment, tools, labor, materials and other incidentals necessary to complete the work.

The Engineer will not pay for the interconnect or electrical risers. The work includes furnishing and installing the riser; and furnishing equipment, tools, labor, materials, and other incidentals necessary to complete the work. The Engineer will consider the cost for risers as included in the contract price for the various contract items.

The Engineer will pay for the emergency vehicle preemption (EVP) optical receiver at the contract unit price per each complete in place. The price includes full compensation for submitting the equipment list and drawing; furnishing and installing the EVP; wiring; bonding and grounding; testing; providing turn-on service; submitting warranty; and furnishing equipment, tools, labor, materials; and other incidentals necessary to complete the work.

The Engineer will pay for the camera cable at the contract unit price per linear foot complete in place. The price includes full compensation for furnishing and installing the preemption detector cable from the detector to the cabinet; and furnishing equipment, tools, labor, materials and other incidentals necessary to complete the work.

The Engineer will pay for the traffic signal ductlines at the contract unit price per linear foot complete in place. The price includes full compensation for saw cutting; trenching; excavating and backfilling, including asphalt concrete pavement, aggregate base course and aggregate subbase course for trench repair; concrete curb and/or gutter, concrete sidewalk repair and striping restoration; furnishing, installing, bonding, and grounding the conduits and interconnect subducts; and furnishing equipment, tools, labor, materials and other incidentals necessary to complete the work.

The Engineer will pay for the traffic signal interconnect subduct at the contract unit price per linear foot complete in place. The price includes full compensation for furnishing and installing; and furnishing equipment, tools, labor, materials and other incidentals necessary to complete the work.

The Engineer will pay for the traffic signal cables at the contract unit price per linear foot complete in place. The price includes full compensation for furnishing, installing, splicing, and taping the cable; furnishing and installing interconnect fabric subducts; making the connections; providing turn-on service; and furnishing equipment, tools, labor, materials and other incidentals necessary to complete the work.

The Engineer will pay for the service and metering equipment assembly at the contract unit price per each complete in place. The price includes full compensation for furnishing and installing the meter/main safety socket box, pullbox, support structure, ground rod, conduit, conductors; and furnishing

equipment, tools, labor, materials and other incidentals necessary to complete the work.

The Engineer will pay for Hawaiian Electric Company service connection fees and transformer installation on a force account basis according to Subsection 109.06 – Force Account Provisions and Compensation. An estimate amount for the force account is allocated in the proposal schedule under Hawaiian Electric Company Service Connection Fees and Transformer Installation Fees. The actual amount to be paid will be the sum shown on the accepted force account records whether this sum be more or less than the estimated amount allocated in the proposal schedule.

The Engineer will pay for traffic signal pullboxes at the contract unit price per each complete in place. The price includes full compensation for furnishing and installing the pullbox, and furnishing equipment, tools, labor, materials and other incidentals necessary to complete the work.

The Engineer will pay for traffic signal pullbox tie-in at the contract unit price per each complete in place. The price includes full compensation for furnishing and installing the pullbox tie-in, and furnishing equipment, tools, labor, materials and other incidentals necessary to complete the work.

The Engineer will pay for the secondary electrical ductline at the contract price per linear foot complete in place. The price includes full compensation for saw cutting, excavating and backfilling; furnishing, installing, grounding, terminating conductors; and furnishing equipment, tools, labor, materials and other incidentals necessary to complete the work.

The Engineer will consider full compensation for additional materials and labor not shown in the contract that are necessary to complete the installation of the various systems incidental to the various contract items. The Engineer will not allow additional compensation.

The Engineer will pay for the traffic signal assembly at the contract unit price per each complete in place. The price includes full compensation for submitting the equipment list and drawing; furnishing and installing the signal assembly; wiring; bonding and grounding; testing; providing turn-on service; submitting warranty; and furnishing equipment, tools, labor, materials; and other incidentals necessary to complete the work. Wiring from the traffic signal mast arm or pole to the handhole are considered incidental to the traffic signal assembly.

The Engineer will pay for the Closed-Circuit Television Camera (CCTV) at the contract unit price per each complete in place. The price includes full compensation for submitting the equipment list and drawing; furnishing and installing the CCTV camera; wiring; bonding and grounding; testing; providing

turn-on service; submitting warranty; and furnishing equipment, tools, labor, materials; and other incidentals necessary to complete the work.

The Engineer will pay for the penetration of existing pullbox at the contract unit price per each complete in place. The price includes full compensation for furnishing and installing conduits and ends incidental to the penetration; wiring; bonding and grounding; testing; finishing; submitting warranty; and furnishing equipment, tools, labor, materials; and other incidentals necessary to complete the work.

The Engineer will pay for saw cutting, excavation, backfill and restoration of the traffic signal ductlines at the contract unit price complete in place. The prince includes full compensation for saw cutting; trenching; excavating and backfilling, including asphalt concrete pavement, aggregate base course and aggregate subbase course for trench repair; concrete rub and/or gutter and concrete sidewalk repair; and furnishing equipment, tools, labor, materials and other incidentals necessary to complete the work.

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

Pay Item	**Pay Unit**
Traffic Signal Cabinet and Foundation	Each
Type I (10') Traffic Signal Standard _____ with conduit & Cabling	Each
Type II Traffic Signal Standard _____ with conduit & Cabling	Each
Street Light Traffic Signal Standard	Each"
Traffic Signal Assembly _____ with Cabling	Each
Traffic Signal Assembly _____ Programmed Visibility	Each
Pedestrian Pushbutton with Instruction Sign with Cabling	Each
Pedestrian Signal Assembly with Cabling	Each
Type "A" Pullbox	Each
Type "B" Pullbox	Each
Type "C" Pullbox	Each
Pullbox Tie-in	Each
Loop Detector Sensing Unit (6 Ft. x 6 Ft.) with Cabling	Each

EVP Optical Receiver	Each
EVP Optical Receiver Cabling	Linear Foot
Traffic Signal Ductline _____	Linear Foot
Type 1 Cable – 26C#14	Linear Foot
Type 2 Cable – 2C#14	Linear Foot
Type 6 Cable – Electrical Service Cable	Linear Foot
Demolish Traffic Signal Conduits, Cables, and Equipment	Lump Sum
Service and Metering Equipment Assembly	Each
HECo. Service Charge for Traffic Signal Service	Lump Sum”

END OF SECTION 623

SECTION 624 – WATER SYSTEM

Make the following amendments to said Section:

(I) Amend **624.04 – Measurement** by revising lines 587 to 588 to read as follows:

"**624.04 Measurement.**

(A) The Engineer will measure ductile iron pipe per linear foot, inclusive of all fittings, special castings, and all appurtenances in accordance with Contract Documents.

(B) The Engineer will measure bevel geared gate valves, gate valves, air relief valves (ARV) and fire hydrants, inclusive of all fittings, special castings, and all appurtenances per each in accordance with Contract Documents.

(C) Relocation of Water Service Lateral at Station 144+92.6, inclusive of all fittings, and all appurtenances in accordance with Contract Documents will be paid on a lump sum basis. Measurement for payment will not apply.

(D) Cathodic protection will be paid on a lump sum basis. Measurement for payment will not apply.

(E) The Engineer will not measure connection to existing waterlines, inclusive of all fittings, special castings, and all appurtenances per each in accordance with the Contract Documents. The cost of connection to existing waterlines shall be considered incidental to the various items of work in Section 624.

(F) Temporary Waterline By-pass will be paid on a lump sum basis. Measurement for payment will not apply."

(II) Amend **624.05 – Payment** by revising lines 589 to 596 to read as follows:

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

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

Pay Item	**Pay Unit**

_____ - Inch Ductile Iron Pipe, Class 53	Linear Foot
_____ - Inch Bevel Geared Gate Valve	Each
_____ - Inch Gate Valve	Each
_____ - Inch ARV	Each
_____ - Inch Offset ARV	Each
Relocate Water Service Lateral at Station 144+92.6	Lump Sum
Fire Hydrant	Each
Cathodic Protection	Lump Sum
Temporary Waterline By-Pass _____	Lump Sum”

END OF SECTION 624

SECTION 626 – MANHOLES AND VALVE BOXES FOR WATER AND SEWER SYSTEMS

Make the following amendment to said Section:

(I) Amend **626.04 - Measurement** by replacing lines 172 to 173 to read:

"**626.04 Measurement.**

(A) The Engineer will measure manholes and valve boxes, inclusive of frames and covers per each for water and sewer systems.

(B) Adjusting manhole frame and covers, and adjusting water valve boxes will be paid on a lump sum basis. Measurement for payment will not apply."

(II) Amend **626.05 – Payment** by revising lines 174 to 192 to read as follows:

"**626.05 Payment.** The Engineer will pay for the accepted pay items listed below at the contract price bid per unit specified in the proposal. Payment will be full compensation for work prescribed in this section and in contract documents.

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

Pay Item	**Pay Unit**
____ Manhole, ____ feet to ____ feet	Each
Adjusting _____ Manhole Frame and Cover	Lump Sum
(_____) Standard Valve Box	Each
Adjusting Water Valve Box	Lump Sum

The Engineer will pay for excavation and backfill in accordance with and under Section 204 -- Excavation and Backfill for Miscellaneous Facilities."

END OF SECTION 626

Make the following section part of the Standard Specifications:

"SECTION 627 – TRAFFIC MONITORING AND SIGNAL CONTROL SYSTEM

627.01 Description. This section shall consist of all work and materials necessary to complete a fully operational CCTV and signal control system for traffic control and surveillance of various sites shown on the plans. The work shall involve coordinating all equipment and labor necessary to incorporate and integrate the new upgraded digital CCTV sites into Honolulu's existing Pelco CCTV master system, using Internet Protocol (IP) based communications, located at the Joint Traffic Management Center (JTMC) at 710 South King Street. The expanded CCTV and signal control system will assist operators at the JTMC to monitor traffic conditions, mitigate traffic congestion, and set the appropriate traffic plans which best suits and improves the traffic progression along Honolulu's busiest arterials.

The CCTV and signal control system shall consist of remotely controlled color cameras, remote video switching, IP communications system, and a fiber optic link. From camera sites to a central gigabit switch, video signals and control data will be transmitted over two single-mode fibers through a 100/1000/10000base T/FX IP switch. At several of the central gigabit switch's 1000base FX bi-directional channels, data and video from all of the cameras and traffic signals on site Ethernet switch will be connected. The central gigabit switch shall be connected to the JTMC's gigabit switch through a 10000Base FX channel using two single mode fiber optic cables. From the JTMC's gigabit switch, IP video decoders, one for each camera site, shall be used to connect to the existing Pelco switcher.

All camera equipment shall be identical and/or compatible with the existing Honolulu system in terms of hardware and software.

There shall be a locally based supplier of the CCTV system and fiberoptic hardware who shall have at least 3 (three) years experience from the project advertisement in installing and setting up of CCTV and fiberoptic systems specifically for traffic-highway applications. The CCTV firm shall be responsible for testing all fiberoptic hardware and cables to provide a documented optical budget loss analysis for each link to and from a hub station. The CCTV supplier will be responsible for all hookup, assignments, dedication, testing, matching, and splicing of the fiberoptic cables. All fiberoptic splice points shall have pigtails on all fiberoptic members which attach to fiberoptic hardware and components with SC-connectors. All unused fiber optic strands shall be jumpered color for color using a fiberoptic patch panel. The CCTV supplier shall be fully responsible for all splices, budget loss, attenuators, appropriate fiber hardware, accessories, and pigtail connections for a fully operational system. All other hardware, equipment, and labor necessary shall be considered incidental.

The Fiberoptic Cable Contractor shall be a locally based installer who shall have at least 3 (three) years experience from the project advertisement in installing fiberoptic cables specifically for outdoor overhead joint-pole and underground applications. The firm

shall also track and document the installation data and tension measurements when installing the fiberoptic cables. Any tension measurements which exceeds the manufacturer's recommendations will be considered means for the cable rejection. The Fiberoptic Contractor shall be fully responsible for the quality and integrity of the installed cable and the operability of the final fiberoptic cable product.

627.02 Video, Signal Control and Fiberoptic Hardware. For bidding purposes, the qualified, as stated in Section 627.01 Description, CCTV Supplier shall furnish and install the following items and quantity. All other equipment necessary to complete a fully operational system will be considered incidental.

Interconnected Signals Site Equipment. In order to communicate with the JTMC over an Ethernet network, a 170E controller will need an Ethernet module. The Ethernet module shall enable any 170E controller to communicate over an Ethernet network. The Ethernet module shall be designed to plug into the modem slot of the 170E controller. Communication to the controller is through the EIA-232 serial port lines while the RJ-45 connector supports the Ethernet interface. The module shall be auto sensing for 100/1000Base-T. The Ethernet module shall process the Ethernet protocol packet such that the 170E Signal controller only sees the intended message.

The Contractor shall at each of the sites shall furnish and install, but not limited to, the following items:

332A Fiberoptic cabinet with outdoor Category 6 cable between the 170E Ethernet Module and Ethernet Switch

Ethernet Module meeting the following requirements:

a. The module shall have the Model 400 modem footprint
b. EIA-232 Interface to the 170 Controller
c. RJ45 Ethernet Interface
d. Direct IP addressing
e. Auto-Sensing 100Base-T or 1000Base-T
f. Operating temperature shall be 37°C to +74°C
g. Data Rates 1200 to 38.4 kbps
h. Characters 7 or 8 data bits
i. Parity: odd, even, or none. Stop: bits 1 or 2
j. Operate between +12 volts @ 125 mA Max and –12 volts @ 25 mA Max
k. On-board LED Indicators, Red Tx and Rx LEDs
l. Supports Protocols TCPIP, ARP, UDP, ICMP, Telnet, TFTP, DHCP, HTTP, SNMP protocols
m. Connector RJ-45
n. A minimum of 2 Year warranty

(A) Hardened Ethernet Switch.

The network managed Layer 2, with light Layer 3 managed switch is a hardened DIN-rail mounted managed PoE++ Ethernet switch equipped with

12 gigabit PoE++ ports along with 360W power and IEEE 802.3.bt protocol support and 4 dual rate 1G/10G SFP ports. The managed switch shall be optically and electrically compatible with any IEEE 802.3 compliant Ethernet devices. The managed Ethernet switch will provide transmission of eight 100/1000 BASE-TX and four 1/10G FX ports. The managed Ethernet switches shall be environmentally hardened units, designed for roadside operating environments, and are available for use with either conventional CAT 6 copper or optical transmission media. The twelve electrical ports support the 10/100/1000 Mbps Ethernet IEEE 802.3 protocol, auto-negotiating and auto-MDI/MDIX, four 1/10G FX ports are configurable for copper or fiber media for use with multimode or single mode optical fiber, selected by optional SFP modules, plug-and-play design, and no electrical or optical adjustments required. LED indicators for monitoring the operating status of the managed switch and network and is either DIN-rail or wall mountable.

The hardened managed Ethernet switch shall meet the following minimum requirements:

a. Layer 2 with light Layer 3 managed switch
b. Layer 3 Features at a minimum includes IP Packet Routing (64 hardware routes, Static routing, RIP v1/v2, OSPF v2) and Routing Redundancy
c. Transmission of 4 channels of 1/10G over one or two single-mode fibers respectively.
d. Transmission of 12 channels of 10/100/1000 Mbps over Cat-6 cable.
e. 2 – Hardened Single (LC), 1 Gigabit, 40 Km SFP modules.
f. 1 – Hardened Duplex (LC), 1 Gigabit, 40 Km SFP modules.
g. 1 – Hardened Duplex (LC), 10 Gigabit, 40 Km SFP modules (1310 nm).
h. Up to 90W per PoE port, with a power budget of 360 Watts. Compliance to IEEE 802.3bt type 4.
i. Shall support the Ethernet data IEEE 802.3 protocol using Auto-negotiating for port speed and duplex.
j. Provide power, link speed, and fiber port status indicating LED's for monitoring system operation.
k. Provide 2 - alarm contact closure.
l. Power Supply: 480W / 10A DIN Rail, 48VDC Industrial Power Supply, similar to NDR-480-48 or equal
m. Serial connection with cable for local management of the device.
n. Shall operate in an environment with relative humidity of 5% to 95% (non-condensing).
o. Shall operate in an environment with ambient temperature range of –40° C to +75° C without the assistance of fan-forced cooling.
p. Shall be DIN rail mountable.
q. Lifetime manufactures warranty.

(B) Dual Camera Site Equipment. The Contractor shall at each of the sites where shown on the plans, furnish and install, but not limited to, the following items:

2 Each, Color Camera Package, as described in section 627.03 CCTV Traffic Camera Assembly.

2 Each, Side or top mounted pole bracket for camera.

2 Each, Video/Data IP Decoder meeting the following requirements:

a. H264 encoding
b. Adjustable IP Packet size streams.
c. Flash memory.
d. Remote user reset via all modes of interface.
e. NTSC video format at 30 frames per second capability
f. Max pixel resolution of 720x480
g. Less than 200 msec video latency
h. 75-ohm, unbal BNC (f) connectors
i. RJ-45 Ethernet connectors, 10/100BaseT-TX
j. Auto sensing, half/full duplex
k. One static IP address for the Encoder, Classes A, B, or C configurable by the user.
l. Gateway needs to be user configurable or can be left blank.
m. RS232/RS422/RS485 asynchronous port
    - Standard data rates from 300 bps to 115,200 bps, 8N1
    - One front panel Craft port set permanently for 9600 bps, 8N1
    - Stop bits 1 and 2
    - Databits 5, 6, 7, 8, 9, 10, 11 or 12
    - None, even or odd, space or mark parity
    - IP socket to Encoder serial port
    - Encoder serial port to Decoder serial port data stream
    - Local and remote Loopback Test Capability
n. -40 degrees C to +75 degrees C operating temperature

1 Ea., Hardened Managed Ethernet Switch as described in section 627.02(A).

1 Each, Rack Mounted 72 Splice Capacity SC Compatible Patch Panel, ADC FDM-SB36000 with all necessary splice fittings and pigtails.

Incidentals: Furnish and install all necessary cables and hardware for power, control data, and video. Local CCTV Power requires POE++CAT6, shielded outdoor cable Where No. 4, 6, or 8 HE feeder cables and service meters are necessary, the said items will not be paid for as a separate unit and will be considered incidental. All other equipment and labor necessary to complete a fully operational system will be the Contractor's responsibility and considered incidental to the cost of the camera site bid.

(C) Quad Camera Site Equipment. The Contractor shall at each of the sites where shown on the plans, furnish and install, but not limited to, the following items:

4 Each, Color Camera Package, as described in section 627.03.

4 Each, Side or top mounted pole bracket for camera.

4 Each, Video/Data IP Decoder meeting the following requirements:

a. H264 encoding
b. Adjustable IP Packet size streams.
c. Flash memory.
d. Remote user reset via all modes of interface.
e. NTSC video format at 30 frames per second capability
f. Max pixel resolution of 720x480
g. Less than 200 msec video latency
h. 75-ohm, unbal BNC (f) connectors
i. RJ-45 Ethernet connectors, 10/100BaseT-TX
j. Auto sensing, half/full duplex
k. One static IP address for the Encoder, Classes A, B, or C configurable by the user.
l. Gateway needs to be user configurable or can be left blank.
m. RS232/RS422/RS485 asynchronous port
    - Standard data rates from 300 bps to 115,200 bps, 8N1
    - One front panel Craft port set permanently for 9600 bps, 8N1
    - Stop bits 1 and 2
    - Databits 5, 6, 7, 8, 9, 10, 11 or 12
    - None, even or odd, space or mark parity
    - IP socket to Encoder serial port
    - Encoder serial port to Decoder serial port data stream
    - Local and remote Loopback Test Capability
n. -40 degrees C to +75 degrees C operating temperature

1 Ea., Hardened Managed Ethernet Switch as described in section 627.02(A) Hardened Ethernet Switch.

1 Each, Rack Mounted 72 Splice Capacity SC Compatible Patch Panel, ADC FDM-SB36000 with all necessary splice fittings and pigtails.

Incidentals: Furnish and install all necessary cables and hardware for power, control data, and video. Local CCTV Power requires POE++CAT6, shielded outdoor cable Where No. 4, 6, or 8 HE feeder cables and service meters are necessary, the said items will not be paid for as a separate unit and will be considered incidental. All other equipment and labor necessary to complete a fully operational system will be the Contractor's responsibility and considered incidental to the cost of the camera site bid.

(D) 1/10 Gigabit Layer 3 Switch Site Equipment. The Central Gigabit Layer 3 Switch Site Equipment includes the gigabit switch in the field and the Joint Traffic Management Center (JTMC). The Central Gigabit Switch Site Equipment will provide a high bandwidth connection between the Central Gigabit Switch Site and the JTMC. The gigabit switch in the field will forward any number of IP packets consisting of MPEG-4 compressed video, camera data and signal control data between the JTMC's gigabit switch and the camera and signal on-site switches. At the JTMC's gigabit switch, IP video and data decoders shall be integrated to the existing switcher inputs and outputs. All necessary combiners, splitters, power supplies, racks, cables, expansion cards, and other associated hardware needed to complete a fully operational system shall be furnished and installed by the Contractor and considered included in the cost of the other items in the bid.

The Contractor shall remove existing items, furnish, install, and integrate, but not limited to, the following items at the hub locations where shown on the plans and at the JTMC as designated:

1 Each, Hardened Gigabit Managed Ethernet Layer 3 Switch meeting the following requirements:

a. Shall support the transmission of a minimum of 4 channels of 1/10 GB over two single-mode fibers.
b. Shall support the transmission of 24 channels of 10/100/1000 Mbps over Cat-6 cable.
c. Shall support the Ethernet data IEEE 802.3 protocol using Auto-negotiating and Auto-MDI/MDI-X features.
d. Features 24 fixed 10/100 Base-T electrical ports and 8 100 Base-FX optical ports.
e. Features 4 1/10 GB Base-FX optical ports.
f. Shall require no in-field electrical or optical adjustments or in-line attenuators to ease installation.
g. Shall provide power, link speed, and fiber port status indicating LED's for monitoring proper system operation.
h. Provides a contact closure for an over temperature alarm.
i. Shall provide automatic re-settable solid-state current limiters and independent voltage regulators on each module to reduce the chance of a single point failure of the system.
j. Shall have redundant power supply connections to minimize single point failure.
k. Shall provide a serial connection for local management of the device.
l. Shall operate in an environment with relative humidity of 0% to 95% (non-condensing).
m. Shall operate in an environment with an ambient temperature range of –0° C to +50° C without the assistance of fan-forced cooling.
n. Shall be rack mountable.

o. Shall have a minimum 2 year warranty.

Incidentals: All other equipment and labor necessary to complete a fully operational system will be the Contractor's responsibility and considered incidental to the cost of the bid.

627.03 CCTV TRAFFIC CAMERA ASSEMBLY. The camera assemblies are for the replacement and maintenance of the existing traffic cameras used for traffic monitoring and traffic signal operations at the Traffic Management Center. It shall be an integrated camera unit consisting of a receiver, pan & tilt, housing, and cables built as a single assembly having 360 degree of continuous pan rotation. The camera shall have full HD 1080p 30 image resolution with integral 30x optical zoom lens. The positioning device shall include true day-night with variable speed pan and tilt technology with a minimum sensitivity of 0.0 lux @30 IRE. The camera shall provide up to 5 independent output video streams configurable for H.264 and MJPEG and analog video output, electronic image stabilization, and wide dynamic range. Camera assembly shall be furnished with components assembled, complete, and a ready-to-install system. Camera system shall meet FHWA's Buy America requirement.

(A) CAMERA IMAGING

a. Image Sensor: Progressive Scan CMOS
b. Image Size: Diagonal 6mm
c. Image Resolution: 1920 horizontal x 1080 vertical pixels
d. Picture Elements (total) 1920 (H) x 1440 (V)
e. Sensitivity: Scene Illumination; F1.4 @ 50% Video
    i. 0.4 Lux (0.04 fc) @ 1/30 shutter, color mode
    ii. 0.0025 Lux (0.00025 fc) @ 1/2 shutter, mono mode
f. Day/Night Operation: Adjustable (Auto, Color and Mono Modes)
g. Optical Zoom Range: 30x, minimum
h. Digital Zoom: 1x to 12x in 1x increments. The camera system shall support digital zoom limit setting
i. Auto Focus: Selectable Auto/Manual; Minimum Scene Illumination for Reliable Auto Focus shall be no more than 50% video output.
j. Auto Iris; Selectable auto/manual; Iris shall automatically adjust to compensate for changes in scene illumination to maintain constant video level output.
k. Electronic Image Stabilization: Shall support On/Off mode
l. Backlight Compensation: Shall support On/Off mode
m. White Balance: Shall support Auto/Manual mode
n. IR Correction: Shall support On/Off mode
o. Sharpness: Shall provide user control of increases or decreases in image sharpness through 4 user selectable settings of soft, normal, sharp and sharpest

(B) H.264/MJPEG ENCODING ENGINE

i. The video encoding shall allow the following possible video stream configurations:
   i. H.264 Streams: (1) 1920x1080 @ 30fps, (1) 1280x720 @ 30 fps,
      720x480 @ 15 fps.
   i. MJPEG Streams: 1920x1080 @ 10 fps, 1280x720 @ 20 fps
   ii. Analog Video Output: (1).

ii. Each video encoder channel shall provide the following configurable properties;
   i. Codec.
   i. Video frame shall be adjustable from 30 fps to 1 fps in increments
      of 1 fps.
   ii. Bite Rate control

c. Video Stream Protocols; the camera system shall support the following protocols:
   i. RTSP/RTP; The RTSP communication shall occur over a TCP socket. RTP video packets shall be sent over UDP.
   ii. RTSP Interleaved; RTSP commands and the RTP video packets shall be transmitted over a single TCP connection.
   iii. HTTP tunneling; this mode shall use two separate TCP connections for sending and the other for received data from the client over port 80.
   iv. RTP multicast; this mode shall send RTP video packets to the user assigned multicast destination. This mode shall be required to be enabled or disabled.

d. Network Protocol Layers: TCP, UDP, IPv4, IGMP, ICMP, DNS, DHCP, RTP, RTSP, NTP, HTTP, HTTPS, ARP, and ONVIF Profile S as a minimum.

(C) PAN AND TILT DRIVE UNIT SPECIFICATIONS

1. Pan Movement; 360 degrees continuous rotation.
2. Pan Speed; Variable from 0.05 to 45 degrees/second .
3. Pan Repeatability; +/- 0.05 degree precision.
4. Pan Preset Speed; 180 degree movement 2.5 < Seconds.
5. Tilt Movement; Minimum of +90 to –90 degrees.
6. Tilt Speed; Variable from 0.05 to 45 degrees/second.
7. Tilt Repeatability; +/- 0.05 degree precision.
8. Tilt Preset Speed; 180 degree movement < 2.5 Seconds.
9. Proportional Zoom Control; Positioning control shall allow variable pan/tilt. speeds based on zoom position.
10. Home Position: Shall be a user defined point.

11. The Inter Process Communication System (IPCS) shall not have any exposed wiring from the positioning drive to the camera head enclosure.

(D) Electrical

Operating Voltage; The camera system shall provide flexible power input as required by the installation to include:

i. Power over Ethernet, LTPoE++.
ii. Power injector

(E) Certifications/Ratings

a. FCC Class A.
b. International Electrotechnical Commission (IEC) / European Conformity (CE) cover product emission and immunity requirements (CISPR) 22 24.
c. Restriction of Certain Hazardous Substances (RoHs)

(F) Enclosure

a. Aluminum
b. Dust-tight
c. Waterproof & Pressurized

(G) Controls

Shall be controllable or interoperable by a Pelco analog switcher and control System using Pelco P protocol
IP protocol shall be controllable by either Pelco P or Onvif protocol

(H) Adapter Plate

A Stainless Steel, ¼" minimum, adapter plate shall be provided to integrate the supplied camera mounting to the existing mounting.

(I) Warranty

Manufacturer's warranty period shall be three (3) years minimum.

(J) Mount

a. Outdoor type
b. Aluminum or stainless steel components
c. Mount cantilever style on pole shafts using straps, or on horizontal mast arm shaft
d. Constructed of marine grade stainless steel

e. Has cable feed-through
f. Supports up to 100 lbs
g. Painted White
h. Wall to pole mount adapter, as required
i. Provide ability to level and adjust camera to plumb

(K) CCTV Cabinet. 1 Each, per single camera and dual camera site. All cabinet shall be furnished assembled and configured with the components stated below:

Cabinet shall be a Traffic Signal 332A anodized aluminum cabinet with a 19" rack, 50 amp circuit breaker, surge-protected, and thermo-control fan.

Each Model 332A Cabinet shall meet the following additional requirements:

a. Provide Best Lock (C&C of Honolulu keyed) Security Tumbler Door locks of solid brass rim and include 4 keys.
b. A rack mounted 6 outlet surge protector power strip
c. A 19 inch pull out shelf
d. Remote data port with monitor and control, Stand Alone, all connectors and cables included
e. Rack Mounted 48 fiber optic Splice Capacity Tray
f. Rack Mounted 72 fiber optic SC jumper connector

Surge Protection: Contractor shall install a 120V AC, 3-wire, 20 Amp inline surge protection device. The surge protection device will have an operating temperature of -40 to 85 degree C, maximum surge current of 30,000 amps and surge voltage of 10,000 volts, 138 Volts for clamping voltage, power indicator, open circuit for fail safe operation, and protection shall be between line to neutral, line to ground, ground to neutral.

Furnish and install power cables from existing traffic signal meter or new Hawaiian Electric service point.

(L) Cabinet Foundation. 1 Each, per CCTV cabinet. Construction per details on drawings.

627.04 Measurement. The Engineer will measure the various components of the system per unit when contracted on a unit price basis.

The Engineer will measure camera site equipment, Gigabit switch site equipment, splice cabinets, Type “D” cabinet base, and guy and anchor; per each, complete in place. The conduits for the Type 'D' traffic signal cabinet base will not be measured but considered part of the concrete base each-unit.

627.05 Payment. The Engineer will pay for the accepted quantities of the various components of the system at the contract unit price, complete in place.

The Engineer will pay for accepted quantities of camera site equipment, hub site equipment, splice cabinets, Type “D” concrete base, poles, cables, conduits, and risers at the contract unit price per each completed in place. The price shall include furnishing and installing the items, and all tools, labor, equipment, and incidentals necessary to complete the work. The conduits for the Type "D' will not be paid for but considered included in the base unit price.

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

Pay Item	**Pay Unit**
CCTV Controller, CCTV	Each
CCTV Type “C” Pullbox	Each
CCTV Ductline _____ , Concrete Encased	Linear Foot
Dual Camera Site Equipment	Each
Quad Camera Site Equipment	Each
CCTV Camera Cable	Linear Foot
Removal _____	Lump Sum
Broadband Type “B” Pullbox	Each
Broadband Ductline _____, Concrete Encased	Linear Foot”

END OF SECTION 627

SECTION 631 – TRAFFIC CONTROL, REGULATORY, WARNING, AND MISCELLANEOUS SIGNS

Make the following amendment to said Section:

(I) Amend Section 631.03(C) Labeling of Signs, from lines 42 to 51 to read:

"**(C) Labeling of Signs**. Label back of each sign with sign stickers as directed by the State. Sign stickers will be provided by the State."

(II) Amend **Section 631.04 – Measurement** by replacing lines 67 to 69 to read:

"**631.04 Measurement.** The Engineer will measure regulatory, warning, and miscellaneous signs as complete units of the type and design specified in the proposal.

The Engineer will not measure removal and disposal and storing of existing and temporary signs that the Contractor will not incorporate in the completed highway for payment."

(III) Amend **Section 631.05 – Payment** by replacing lines 71 to 99 to read as follows:

"**631.05 Payment.** The Engineer will pay for new regulatory, warning, and miscellaneous signs at the contract price per each for the type and design specified complete in place. Payment will be full compensation for excavating and backfilling, furnishing and installing materials, furnishing equipment, tools, labors and incidentals necessary to complete the work.

The Engineer will not pay for removing and disposing or storing of existing and temporary signs that the Contractor will not incorporate in the completed highway separately. The Engineer will consider them incidental to the various contract items.

The Engineer will not pay for relocation of existing signs. The Engineer will consider them incidental to the various contract items.

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

Pay Item	**Pay Unit**
Regulatory, Warning and Miscellaneous Sign (10 Square Feet or Less)	Each

"

END OF SECTION 631

Make the following Section a part of the Standard Specifications:

SECTION 636 – E-CONSTRUCTION

636.01 Description. This section specifies requirements for performing the Project in a "paperless" manner, using electronic tools for all submittals, communications, quantity tracking, testing, and sampling, scheduling, quality control, and performance monitoring.

636.02 General Requirements. The Contractor shall implement the use of the E-Construction platform, as provided by the HDOT and directed by the Engineer, for use throughout the project. Paper-based or hard copy submittals will not be accepted.

This Special Provision shall take precedence over all other Specification sections with respect to providing and receiving paper copy communications, submittals, and any project records. Where conflicts exist, and a decision between a hard-copy item and a corresponding electronic version is needed, the electronic version shall be selected, unless otherwise directed by the Engineer.

636.03 Construction

(A) Plans and Specifications. Project drawings will not be provided to the Contractor in hard copy format. An electronic version will be provided in the E-Construction platform for use during the project.

The Contractor shall note all changes to the work, including all subcontractor's work, in electronic format using the E-Construction platform Red annotations shall be used to note changes. Blue annotations shall be used for any additional notes that will be helpful for the State in interpreting the field posted drawings. Other drafting standards may be implemented by the Engineer and shall be adhered to by the Contractor. Changes shall be input by the Contractor and reviewed by the Engineer monthly. The Contractor shall make any changes that the Engineer requires.

(B) Submittals. The Contractor shall provide all required submittals, as listed within the contract documents, via the E-Construction platform. All review, approval, and resubmittal regarding submittals shall also be documented within the E-Construction platform

(C) Correspondence. Electronic mail (email) shall be the preferred method of electronic communication. All communications that affect project scope, schedule, cost, or quality, including changes and requests for information, shall be submitted as directed by the Engineer.

(D) Prosecution and Progress. The Contractor shall provide all administrative, management, and project support documents required by various specification sections, using the E-Construction platform. These elements include, but are not limited to:

(1) Preconstruction Submittals (Section 108.03)
(2) Correspondence regarding Contract Time and Delays (Section 108.05)
(3) Progress Schedules (Section 108.06)
(4) Weekly Meeting preparatory materials (Section 108.07)
(5) Samples, certifications, material data, installation instructions, and shop drawings (Sections 105 and 106)
(6) Field-posted Drawings (Section 648)
(7) Pre-Final Inspection submittals (Section 108.13)
(8) Warranty documentation (Section 108.17)
(9) Project Closing Documents (Section 108.19)

In addition to the foregoing, the Contractor shall provide any other materials, correspondence, and submittals using the E-Construction platform as directed by the Engineer.

(E) Resources. The Contractor shall provide a comprehensive list of Contractor labor and equipment, including all subcontractor labor and equipment, that will be deployed on the project, using spreadsheet-based templates provided in the E-Construction platform. All template fields shall be completed. The submitted information shall comply with the requirements of Specification Section 108 – Prosecution and Progress (identification of labor and equipment resources) and Specification Section 109 - Measurement and Payment (cost data) and represent all individual personnel with labor categories and rates, and all equipment owned or rented, with associated rates, on this project. Updates for additional personnel or equipment shall be accomplished by the Contractor at will and shall be completed when directed by the Engineer.

636.04 Measurement. The Engineer will measure additional E-Construction programs, additional licenses, or additional equipment, if ordered by the Engineer, on a force account basis in accordance with Subsection 109.06 – Force Account Provisions and Compensation.

636.05 Payment. The Engineer will pay for the additional E-Construction programs, additional licenses, or additional equipment, on a force account basis in accordance with Subsection 109.06 – Force Account Provisions and Compensation.

The Engineer may withhold progress payment until the Contractor is in compliance with all E-Construction requirements.

Pay Item	Pay Unit
Additional E-Construction Programs, additional licenses or additional equipment	Force Account

An estimated amount for force account may be allocated in the proposal schedule under "Additional E-Construction Programs, additional licenses or additional equipment." The actual amount to be paid will be the sum shown on accepted force account records.

END SECTION 636

Delete Section 647 in its entirety and replace with the following:

"SECTION 647 – FIBER OPTIC CABLE

647.01 Description. This work includes furnishing labor, materials, tools, machinery, and equipment necessary to install fiber optic cable according to the contract.

There shall be a fiber optic cable Subcontractor, who shall have at least 3 (three) years experience in installing fiber optic systems specifically for outdoor overhead joint-pole and underground in traffic-highway applications. The fiber optic cable Subcontractor shall be responsible for testing all fiber optic cables to provide a documented optical budget loss analysis The fiber optic cable Subcontractor shall be responsible for all hookups, assignments, dedication, testing, matching, termination, and splicing of the fiber optic cables, unless otherwise indicated. All fiberoptic splice points shall have pigtails on all fiberoptic members which attach to fiberoptic hardware and components with SC-connectors. All unused fiber optic strands shall be jumpered color for color using a fiberoptic patch panel. The fiber optic cable Subcontractor shall be fully responsible for all splices, budget loss, attenuators, appropriate fiber hardware, accessories, and pigtail connections for a fully operational system. All other hardware, equipment, and labor necessary shall be considered incidental.

647.02 Materials. The fiber optic cables, which will be used to transmit video and data signals, will consist of 72 single-mode fibers. Cables will be installed in existing and new conduits. The Contractor shall furnish and install fiber optic cable suitable, and meeting standards, for underground and aerial lashing installations. The fiber optic cables shall meet the following specifications:

Armored loose-tube, 72 single-mode OS2 fiber optic cable suitable for overhead or underground installation. Cable shall be 8.3/125 micron loose buffer, single-mode, step index optical fiber cable containing glass of type, SMF-28e, AFL SR-15e, or approved equal, and that meets the following specifications:

1. ITU-T G.652 (Categories A, B, C and D)
2. IEC Specification 60793-2-50 Type B1.3
3. TIA/EIA 492-CAAB
4. Telecordia GR-20

All cables shall be free of material or manufacturing defects and dimensional non-uniformitythat would:

Interfere with the cable installation using accepted cable installation practices. Degrade the transmission performance and environmental resistance after installation.Inhibit proper connection to interfacing elements.

Otherwise yield an inferior product.

(A) Mechanical and Performance Requirements. The cable shall be a rugged all dielectric armored outdoor cable containing color coded buffer tubes with 12 single mode color-coded fibers per- buffer tube, dual window (1310 nm and 1550 nm) fibers with UV acrylate coating in color coded, gel-free, loose buffer tubes.

Strand the loose buffer tubes around an all-dielectric center strength element using a reverseoscillation lay, wrapped by water blocking core separator or functional equivalent. The maximum allowable attenuation of the fiber is .35 dB/km for 1310 nm and .25 dB/km for1550 nm.

Each buffer tube shall contain a water blocking element for water-blocking protection. The water blocking elements shall be non-nutritive to fungus, electrically non-conductive. Thebuffer-tube shall be gel-free. Apply water swellable tape longitudinally around the outside of the stranded tubes/fillers. The water swellable tape shall be non-nutritive to fungus, electrically non-conductive, andhomogenous. It shall also be free from dirt and foreign matter. The cable manufacturer shall be TL 9000 registered.

(B) Outer Jacket. Cables shall be all dielectric cable (with armoring) and shall be jacketed (sheathed) with **yellow** medium density polyethylene as defined by ASTM D1248, Type II, Class C, Category 4 and Grades J4, E7 and E8.

Armored cable shall have two jackets, one molded to the outside of the armor and one that floats freely within the armor and contains the buffer tubes and other fiber optic cable construction components as required.

Apply jacketing material directly over the tensile strength members to provide mechanical protection, and to serve as the primary moisture barrier.

Design cable sheath to meet or exceed the tensile criteria defined in EIA-455-89a. Ensure the jacket or sheath is free of any holes, splits, or blisters. The cable jacket shall contain no metal elements and shall be of a consistent thickness.The cable shall contain at least one ripcord under the sheath for easy sheath removal.

(C) Temperature. The shipping, storage, installation, and operating temperature range of the cableshall meet or exceed -20 °F to +155 °F (-29 °C to +60°C).

(D) Loose Buffer. Contain single-mode fibers in a loose buffer tube.

The configuration shall be dimensionally sized to minimize local stresses and microbend losses.

The optical fiber cable shall be an approved product of the U.S. Department of Agriculture, Rural Electrification Administration in accordance with the requirements of REA-PE-90, or as otherwise indicated, and shall conform to EIA/TIA-598.

Each optical fiber shall consist of a doped silica core surrounded by a concentric silica cladding.

Buffer tubes shall be polypropylene. Include fillers in the cable core to lend symmetry to the cable cross section where needed.

(E) Colors. All optical fibers shall be identifiable by standard color codes as

defined in EIA/TIA-598. Each fiber shall be distinguishable, from others bymeans of color coding and shall conform to the following EIA/TIA sequence of colors:

1. Blue	7. Red
2. Orange	8. Black
3. Green	9. Yellow
4. Brown	10. Violet
5. Slate	11. Rose
6. White	12. Aqua

Buffer tubes containing fibers shall also be color-coded with distinct and recognizable colors according to the following sequence of colors:

1. Blue
2. Orange
3. Green
4. Brown
5. Slate
6. White
7. Red
8. Black
9. Yellow
10. Violet
11. Rose
12. Aqua

The color formulation shall be compatible with the fiber coating and be heat stable. Color formulation shall not fade or smear or be susceptible to migration and it shall not affectthe transmission characteristics of the optical fibers and shall not cause fibers to stick together.

(F) Cable Marking. The fiber optic cable outer jacket shall be marked with manufacturer's name, the year of manufacture, the words "optical fiber cable", fiber count, type of fiber, and sequential linear foot markings. Repeat the markings every 3 feet.
The actual length of the cable shall be within -0/+1% of the length marking.The marking shall be in a contrasting color to the cable jacket.
The marking shall be 2.5 mm in height and must be permanent weatherproof and shall not wearoff during the installation in the underground conduit system.

(G) Quality Assurance Provision. The fiber optic cable shall meet or exceed the requirements of this specification when measured in accordance with the methods of the individual requirements or the following methods as defined in EIA-455-A:

1. Fiber dimensions
2. Attenuation
3. Numerical aperture
4. Fiber proof test
5. Crush resistance
6. Cable bending
7. Tensile load
8. Impact resistance
9. Attenuation vs. Temperature

(H) Packaging. Top and bottom ends of the cable shall be available for testing.

Both ends of the cable shall be sealed to prevent the ingress of moisture. Each reel shall have a weather resistant reel tag attached identifying the reel and cable.

The reel tag shall include the following information:

Cable number	Gross Weight
Shipped length in meters	Job order number
Product Number	Date cable tested

Each cable shall be accompanied by a cable data sheet. Cable data shall include manufacturer number, billable length, bandwidth specs and measured attenuation of each fiber.

(I) Raceway Innerduct. Raceway Innerduct shall be installed in all new and existing raceways containing new 72 strand fiber optic cables. Innerduct will consist of flexible, textile material, commonly referred to as “fabric duct”. Fabric duct will have, the following minimum specifications:

(1) Three cell configuration, shall be attached the entire length of the product, to help minimize twisting of cable. Maximum co-efficient of friction shall be 0.08.

(2) Innerduct shall contain color coded stitching for cell identification, with a solid copper, polyvinyl color coated conductor (19 AWG minimum) for tracing, rated for a minimum of 6 amps and 600 volts. Conductor shall be located in the sidewall edge fold of the sleeve.

(3) All cells will contain a minimum 1250lb pull tape, color coded.

MaxCell or approved BICSI compliant product.

647.03 Construction Requirements.

(A) Material Sample and Certificate of Compliance. The Contractor shall submit material samples according to Subsection 106.04 – Material Sample, and any certificates of compliance according to Subsection 106.07 – Certificate of Compliance.

The Contractor shall submit a fiber optic cable pulling plan for review and approval by the Engineer prior to beginning fiber optic cable installation. The fiber optic cable pulling plan shall include:

(1) Location of start and end of pulls,

(2) Location of cable reel trailers during installation,

(3) Location of any "figure-eight" of fiber optic cable, and

(4) Location of staged equipment.

Upon completion of the work, submit an "As Built" or corrected plan showing in detail the following:

(1) Construction changes,

(2) Location and attenuation of every event along the installed fiber optic cable,

(3) Index of refraction of installed fiber,

(4) Fiber optic cable index of refraction, and

(5) Sequential fiber optic cable markings at each pullbox, cabinet, and splice closure.

(B) Excavation and Backfill. Excavation and backfill shall conform to Section 204 – Excavation and Backfill for Miscellaneous Facilities.

The Contractor shall be responsible for the repair of any damage to pavements, sidewalks and other improvements. Place the material from the excavation to prevent damage and obstruction to vehicular and pedestrian traffic and interference with surface drainage.

(C) Fiber Optic Cable. The fiber optic cable Subcontractor shall install the new fiber optic cable underground in conduits as shown on the plans. The Contractor will be responsible for furnishing and pulling the new fiber

in PVC ductlines using a breakaway swivel to prevent exceeding the tensile load during installation.

All fiber optic splices shall be fusion splices. Mechanical splices shall not be used. Fiber optic splice locations are permitted only at splice points where splice cabinets are shown on the plans, or in existing State Department of Transportation signal pullboxes as is necessary, and only with the prior approval of the Department of Transportation Services (DTS), and the State Department of Transportation (DOT), Highways Division. Fiber optic fibers shall be spliced in every splice cabinet location, and it is the responsibility of the Contractor to maintain a continuous run throughout the system. The Contractor shall leave a minimum of 20-feet of cable service loops at every cabinet and 10 feet at every pullbox.

Provide documented historical cable pulling data indicating tensile forces exerted on the cable during the installation. Any tension measurements, which exceed the manufacturer's recommendation, will be considered means for the cable rejection. The fiber optic cable Subcontractor shall be fully responsible for the quality and integrity of the installed cable and the operability of the final fiber optic cable product. All fibers shall be spliced at camera cabinets, hubs, and splice cabinets and shall have no more than 0.07 dB loss per splice based on the appropriate system operating wavelength.

The Contractor shall complete all required fiber optic splices prior to final testing and acceptance. As part of the final testing and acceptance, submit optical time domain reflectometer (OTDR) readings in both hardcopy and electronic formats (such that it can be examined using the manufacturer's OTDR software) to the Engineer for review. Testing shall be conducted on all singlemode fibers at 1310 nm and 1550 nm. Powermeter attenuation testing should be performed at dual wavelength, bi-directionally.

All necessary equipment and plug-in, fiber optic pigtails, fittings, splice tags, enclosures, and work to complete an operational system shall be furnished and installed by the Contractor, unless otherwise indicated, at no added cost, and will be considered included in the cost of the contract items in this Section.

(D) Services Provided By The City.

The City and County of Honolulu, Department of Transportation Services (DTS) will not be responsible for any splices or connections in pullboxes and cabinet locations.

The Contractor shall be responsible for the following:

(1) The Contractor will be responsible for all required splices and connections in pullboxes and CCTV cabinet locations.

(2) Arrange for phases of work with DTS or as specified by the Engineer.

(3) Give at least seven calendar days of advance notice to DTS when phases of the work require its services.

(E) Restoring Pavements and Other Improvements. Restore the existing pavements and other improvements such as driveways, sidewalks, curbs and gutters disturbed by excavation to their original condition according to the contract. Materials used for restoration work shall be equal to or better in quality than the materials the Contractor will replace, and matching in thickness, texture, and color whenever applicable. The grades of the restored surfaces shall conform to the existing grades.

(F) Warranty. Materials and equipment installed for permanent construction shall be new. The contract contemplates the use of first-class material and equipment throughout the performance of the contract.

Secure from the manufacturer(s), a warranty or warranties guaranteeing equipment from defects in materials, design and workmanship for not less than 12 months from the date of acceptance.

When requiring adjustments or repairs during the warranty period, adjust or repair the existing unit within 24 hours from the time of notification.

When requiring repairs that need factory corrections during the warranty period, replace the existing unit with an accepted temporary operational replacement unit within 24 hours from the time of notification until the Contractor can install the new unit. Install the new, identical non-defective unit within 30 days from the time of notification.

647.04 Method of Measurement.

(A) Installation of pullboxes, ITS fiber optic cable, innerduct, and ductline will be measured in accordance to contract documents.

(B) ITS demolishment will be paid on a lump sum basis. Measurement for payment will not apply.

647.05 Payment. The Engineer will pay for the accepted fiber optic cable underground at the contract unit price per linear foot complete in place. The

price includes full compensation for messenger cable both, existing and new, splicing, patch panels, and all other materials required to complete a fully functioning fiber optic infrastructure. submitting the equipment list and drawing; furnishing, installing, splicing and taping the cable, as required; making the connections; providing turn-on service, restoring pavements and other improvements; testing and furnishing equipments, tools, labor, materials and other incidentals necessary to complete the work.

The Engineer will make payment under:

Pay Item	**Pay Unit**
Type “B” Pullbox	Each
ITS _____ Fiber Optic Cable	Lin. Ft.
ITS _____ Innerduct	Lin. Ft.
ITS Ductline _____, Concrete Encased	Lin. Ft.
ITS Demolish _____	Lump Sum”

END OF SECTION 647

SECTION 770 – TRAFFIC SIGNAL MATERIALS

Make the following amendments to said Section:

(I) Amend **Subsection 770.02(A) – Standard Traffic Signal Heads** by revising the first paragraph from line 211 to 216 to read:

"(b) To ensure quality and performance, LED head shall have prior history of testing and use by CALTRANS and shall exceed ITE standards. Failure on one LED shall not affect other LED's. LED head shall have fully-encapsulated electronic circuitry and configuration for 12-inch ball."

(II) **Amend Subsection 770.02(A)(4) – Back Plates** from line 285 to 290 to read:

"(4) Back Plates. Louvered back plates shall be furnished and installed on mast arm mounted signal heads. Back plates shall be constructed of aluminum alloy 3003-H14 sheet having minimum thickness of 0.058 inch and minimum dimensions equal to signal head size plus five-inch border, with a two-inch retro-reflective border around the outside edge of the front surface. Back plates shall be dull black in color."

(III) Amend **Subsection 770.04 – Pedestrian Signal** from line 447 to 600 to read:

"(A) Purpose.

The purpose of this specification is to provide the minimum requirements for the LED "walking person" and "hand" icon pedestrian signal modules with countdown. This specification is only for the nominal overall message-bearing surface of 16 x 18 in. This specification is not intended to impose restrictions upon specific designs and materials that conform to the purpose and the intent of this specification. This specification refers to definitions and practices described in "Pedestrian Traffic Control Signal Indications" published in the *Equipment and Materials Standards of the Institute of Transportation Engineers*, (referred to in this document as "PTCSI") and in the Applicable Sections of Manual on Uniform Traffic Control Devices (MUTCD) 2009 Section 4E.

(B) Physical and Mechanical Requirements.

The modules shall fit into existing pedestrian signal housings built for the PTCSI sizes stated in Section 1 of the "walking person" and "hand" icon pedestrian signal indication Standard without modification to the housing and shall not require special tools for installation.

Installation of a retrofit replacement module into existing pedestrian signal housing shall only require the removal of the existing optical unit components, shall be weather tight and fit securely in the housing; and shall connect directly to existing electrical wiring. The LED module shall have a visual appearance similar to that of an incandescent lamp (ie: Smooth and non-pixilated). Screwed on lenses are not allowed. Only modules with internal mask shall be utilized. No external silk-screen shall be permitted.

When not illuminated, the WALKING PERSON, UPRAISED HAND, and COUNTDOWN DIGITS shall not be readily visible. The countdown digits of the pedestrian signal module shall be located to the right of the associated UPRAISED HAND. The display of the number of remaining seconds shall begin only at the beginning of the pedestrian change interval. After the countdown displays zero, the display shall remain dark until the beginning of the next countdown. The walking person, hand icons and countdown digits shall be incandescent looking.

The units shall not have any external attachments, dip switches, toggle switches or options that will allow the mode to be changed from counting the clearance cycle, to the full walk/don't walk cycle or any other modification to the icons or digits.

For each nominal module, use the corresponding minimum H (height) and W (width) measurements:

Module Size	Icon Height	Icon Width	Countdown Height	Countdown Width	Countdown Segment Width
(16 x 18 in)	11 in	7 in	9 in	7 in	0.7 in

All exposed components of a module shall be suitable for prolonged exposure to the environment. As a minimum, the module shall be rated for use in the ambient operating temperature range, measured at the exposed rear of the module, of -40°C to +74°C (-40°F to +165°F).

The module shall be a single, self-contained device, not requiring on-site assembly for installation into an existing pedestrian signal housing. The power supply shall be located inside the pedestrian signal module. The assembly and manufacturing process for the module shall be designed to assure all internal LED and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.

The front window shall be a transparent polycarbonate material with internal masking to prevent the icons and digits from being visible when not in operation. External masking or silk-screen technology shall not be permitted.

Each module shall be identified on the backside with the manufacturer's name, model, serial number and operating characteristics. The operating characteristics shall include the nominal operating voltage and stabilized power consumption, in watts and/or Volt-Amperes.

(C) Photometric Requirements

For a minimum period of 60 months, the maintained minimum luminance values for the modules under operating conditions, when measured normal to the plane of the icon surface, shall not be less than:

- Walking person: 2,200 cd/m^2;
- Hand: 1,400 cd/m^2.
- Countdown digits: 1,400 cd/m^2;

The luminance of the emitting surface, measured at angles from the normal of the surface, may decrease linearly to a value of 50% of the values listed above at an angle of 15 degrees. The LED module shall have a visual appearance similar to that of an incandescent lamp (ie: Smooth and non-pixilated).
Maximum permissible luminance: When operated within the temperature range, the actual luminance for a module shall not exceed three times the required peak value of the minimum maintained luminance. Luminance uniformity: The uniformity of the signal output across the emitting section of the module lens (i.e. the hand, person or countdown icon) shall not exceed a ratio of 5 to 1 between the maximum and minimum luminance values (cd/m^2).

The standard colors for the LED Pedestrian Signal Module shall be White for the walking person and Portland Orange for the hand icon and the countdown digits.

(D) Electrical Requirements

All wiring and terminal blocks shall meet the requirements of Section 13.02 of the VTCSH Standard. Maximum of three secured, color coded, 1 meter (39 in) long 600 V, 16 AWG minimum, jacketed wires, conforming to the National Electrical Code, rated for service at +105°C, are to be provided for electrical connection. The

conductors shall be color coded with orange for the hand, blue for the walking person and white as the common lead.

LED modules shall operate from a 60 ± 3 Hertz ac line power over a voltage range from 80 to 135 VAC RMS. Nominal operating voltage for all measurements shall be 120 ± 3 VAC RMS. Fluctuations in line voltage over the range of 80 to 135 VAC RMS shall not affect luminous intensity by more than ± 10 %. To prevent the appearance of flicker, the module circuitry shall drive the LEDs at frequencies greater than 100 Hz when modulated, or at DC, over the voltage range specified.

Low Voltage Turn Off: There should be no illumination of the module when the applied voltage is less than 35 VAC RMS. To test for this condition, each icon must first be fully illuminated at the nominal operating voltage. The applied voltage shall then be reduced to the point where there is no illumination. This point must be greater than 35 VAC RMS.

Turn-ON and Turn-OFF Time: A module shall reach 90% of full illumination (turn-ON) within 75 msec of the application of the nominal operating voltage. The signal shall cease emitting visible illumination (turn-OFF) within 75 msec of the removal of the nominal operating voltage.

Default Condition: For abnormal conditions when nominal voltage is applied to the unit across the two-phase wires (rather than being applied to the phase wire and the neutral wire) the pedestrian signal unit shall default to the hand symbol. The on-board circuitry of a module shall include voltage surge protection:

- To withstand high-repetition noise transients and low-repetition high-energy transients as specified in NEMA Standard TS-2 2003; Section 2.1.8
- Section 8.2 IEC 1000-4-5 & Section 6.1.2 ANSI/IEEE C62.41.2-2002, 3kV, 2 ohm
- Section 8.0 IEC 1000-4-12 & Section 6.1.1 ANSI/IEEE C62.41.2-2002, 6kV, 30 ohm

The LED signal and associated on-board circuitry shall meet the requirements of the Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise by Class A digital devices. The modules shall provide a power factor of 0.90 or greater when operated at nominal operating voltage, and 25ºC (77ºF). Total harmonic distortion

induced into an AC power line by the module, operated at nominal operating voltage, and at 25ºC (77ºF) shall not exceed 20%.

The current draw shall be sufficient to ensure compatibility and proper triggering and operation of load current switches and conflict monitors in signal controller units. Off State Voltage Decay: When the module is switched from the On state to the Off state the terminal voltage shall decay to a value less than 10 VAC RMS in less than 100 milliseconds when driven by a maximum allowed load switch leakage current of 10 milliamps peak (7.1 milliamps AC).

(E) Module Functions

The module shall operate in one mode: *Clearance Cycle Countdown Mode Only.* The module shall start counting when the flashing don't walk turns on and will countdown to "0" and turn off when the steady "Don't Walk" signal turns on. The m*odule shall not have user accessible switches or controls for the purpose of modifying the cycle, icons or digits.* At power on, the module enters a single automatic learning cycle. During the automatic learning cycle, the countdown display shall remain dark. The unit shall re-program itself if it detects any increase or decrease of Pedestrian Timing. The digits shall go blank once a change is detected and then take one complete pedestrian cycle (with no counter during this cycle) to adjust its buffer timer.

The module shall allow for consecutive cycles without displaying the steady Hand icon ("Don't Walk"). The module shall recognize preemption events and temporarily modify the crossing cycle accordingly. If the controller preempts during the walking man, the countdown shall follow the controller's directions and shall adjust from walking man to flashing hand. It shall start to count down during the flashing hand. If the controller preempts during the flashing hand, the countdown shall continue to count down without interruption. The next cycle, following the preemption event, shall use the correct, initially programmed values. This specification is worded such that the flashing don't walk time is not modified.

If the controller output displays Don't Walk steady condition or if both the hand /person go dark and the unit has not arrived to zero, the unit suspends any timing and the digits shall go dark.

(F) Warranty

Manufacturers will provide the following warranty provisions. Replacement or repair of an LED signal module that fails to function

as intended due to workmanship or material defects within the first 5 years (60 months) from the date of project acceptance."

(IV) Amend **Subsection 770.05(A)- Controller Assembly** from line 617 to 625 to read:

"(1) Model 332A controller cabinet refers to latest Model 332A controller cabinet listed on CALTRANS QPL. Model 170E controller will be provided by DTS.

(2) The 170E software shall be the latest version of BI Trans Systems, Inc's 233 Traffic Signal Program and shall be Contractor furnished. The Contractor shall furnish and install the EPROM chips in the controller.

(3) Each controller assembly listed in Table 770.05-1 – Controller Assembly Requirements contains sufficient equipment for full 8-vehicle, 4-pedestrian, and 4-preemption phase intersection, even though the contract documents may not require it.

TABLE 770.05-1 – CONTROLLER ASSEMBLY REQUIREMENTS

Item	Quantity
Model 2070ATC Controller	Gov. Furn. Equip.
Model 412C Prom Module	1
Model IP Modem	1
332A Aluminum Cabinet	1
Model 200 Load Switches	12
Model 204 Flasher	All
Model 242 Isolators	2
Model FS/ST Isolator	All
Flash Transfer Relays	All
Software	1
Model 210ECL Conflict Monitor (Crimp and Poke Type, such as Molex Dualcon TM Straight/on Edge Dual Position Connectors, or approved equal)	1
Model 262C Detector Amplifiers (Rotary Sw Type)	8
Model M762 Preempt. Car (Non-QPL) with M768 Auxiliary Input Panel	2

(V) Amend **Subsection 770.05(B)- Model 170E Controller** by deleting line 643.

(VI) Amend **Subsection 770.05(C)- Cabinet** by deleting lines 660 to 665.

(VII) Amend **Subsection 770.05(D)- Auxiliary Equipment** from line 697 to 741 to read:

(1) Model M762 Optical Preemption Module with M768 Auxiliary Input Panel. M762 shall be card-type and shall interface with Model 170 cabinet preemption slots of input file. Each M762 Module shall have two channels of preemption. M762 shall include firmware to discriminate between two valid priority signals, to prioritize valid same priority signals on a first come, first served basis, and to override low priority signal if high priority is received. M762 Module shall receive input signals (9.639 and 14.035 Hz) to permit priority preemption operation within 170 local intersection program. M762 shall optically isolate output signals and shall trigger active low signal to controller for high priority and pulsed active low signal for low priority. M768 Auxiliary Input Panel shall be used to interconnect M762 with the terminals inside the traffic cabinet. The State's preemption systems employ the 3M/Global Traffic Technologies Opticom System. New preemption equipment shall be 3M/Global Traffic Technologies Opticom or accepted equal that is fully compatible with 3M/Global Traffic Technologies Opticom.

(2) Security Tumbler for Signal Cabinet. The signal control cabinet door locks (2 locks for each cabinet) are keyed to take Best Lock Series tumblers. The contractor shall furnish and install 2 lock cylinders that will fit in the current locks on the signal cabinet. The lock cylinders keys shall be one of a kind, licensed to DTS, and each cylinder shall have 2 sets of keys with "do not duplicate" stamped on each key.

(VIII) Amend **Subsection 770.06(G) – Type 7 Preemption Detector (Opticom) Cables** from line 788 to 798 to read:

"(G) Type 7 - Preemption Detector (Opticom) Cables. Preemption detector (Opticom) cables are specific cables that run continuously from optical detectors mounted on traffic signal standards to terminal blocks for M762 phase module located in controller cabinet. Each detector shall be furnished with its own cable running back to controller cabinet. 3M/Global Traffic Technologies' M138 Optical Detector Cable shall be furnished for detector cable because it is compatible and consistent with requirements for Opticom Preemption System. M138 cable shall be furnished that is BerkTek Type B, shield jacket, three - insulated conductor cable, 20 AWG, one - 20 AWG bare stranded ground, 600 Volts, orange-blue-yellow color coded and 5/16 inch diameter."

(IX) Amend **Subsection 770.11 – Preemption Detectors** from line 997 to 1009 to read:

"(A) Description. Preemption Detectors shall be located on traffic signal standards to convert optical signals emitted from an emergency vehicle to electrical pulses for emergency preemption of traffic signals. Electrical signals from optical detector shall be transmitted by 4-conductor cable to preemption module M762 located in input slot of controller cabinet. M762 preemption module shall direct and hold controller in preemption mode until signal disappears. Preprogrammed selection of phases and signal displays shall be controlled by Local Intersection Program. The State's preemption system employ 3M/Global Traffic Technologies Opticom System. New preemption equipment shall be by 3M/Global Traffic Technologies Opticom or equal accepted by the Engineer, that is fully compatible with 3M/Global Traffic Technologies Opticom. Astro-mini brackets or similar device for attaching preemption detector to poles shall be included."

(X) Amend **Subsection 770.11 – Preemption Detectors** from line 1012 to 1021 to read:

"(1) Type 7 Cable. Type 7 preemption detector (Opticom) cables shall be specific cables that run continuously from optical detectors mounted on traffic signal standards to terminal blocks for M762 phase module in controller cabinet. Type 7 preemption detector cable shall be compatible with 3M/Global Traffic Technologies' M138 Optical Detector cable and shall be consistent with requirements for Opticom Preemption System. M138 cable shall be BerkTek Type B, shield jacket, 3-insulated conductor, 20AWG stranded copper, 1-20AWG bare stranded ground, 600 volts, orange-blue-yellow color coded, and 5/16-inch diameter."

(XI) Add **Subsection 770.12 – Pedestrian Signal Push Button With Integral Sign** to read:

"770.12 Pedestrian Signal Push Button With Integral Sign.

(A) Description. The pedestrian push button unit shall consist of an assembly that can be secured to traffic poles with standard screws, be tamper proof, weatherproof, and constructed so that electrical shocks are impossible to receive.

(B) Materials.

(1) The housing for the push button assembly shall be of cast and/or machined aluminum. The push button assembly shall be weatherproof with a water diverting groove set in the outside diameter of the actuator button receptor. The housing shall be

designed to reduce vandalism and shall mount on the side or top of a pole with a minimum 2-inch diameter button. The push button housing shall be capable of mounting in an 'up button' or 'down button' configuration. All wire connections shall be accessible from the back of the assembly.

(2) An ADA acceptable raised directional sign shall be installed with stainless steel fasteners to the housing. The sign shall consist of a raised walking person and a raised arrow indication. Paint the unit black and paint the raised walking person and arrow white. The sign shall be capable of mounting in an 'up button' or 'down button' configuration. The raised walking person and arrows shall be directional and match the indication as shown in the plans.

(3) The pushbutton shall extend from the sign faceplate approximately three inches. The pushbutton actuator shall be convex in design having a flat area on the face for uses of a stylus, ADA acceptable, two inches in diameter, and have a tension of less than five pounds when pressed. The button shall be manufactured in a way that it cannot be stuck in a closed (constant call) position.

(4) The pedestrian push button shall be a piezo electric type and be UL listed. The button shall have a stainless steel actuator and shall be mounted within the housing with stainless steel, non-corrosive, tamper proof fasteners. The unit shall operate between 12-24V DC or AC, 3 inch round mounts with 4 mounting bolts. The pedestrian button shall give an audio and visual signal each time the pedestrian button is activated."

(XII) Add **Subsection 770.13 – Interconnect Fabric Subduct** to read:

"770.13 Interconnect Fabric Subduct.

(A) Description A non-metallic flexible textile raceway known as interconnect fabric subduct, which is placed within PVC conduits. The interconnect fabric subduct allows for the future communication upgrades, including transitioning from multipair copper cables to fiber optic media. To further that effort and achieve maximum conduit utilization, all new and empty existing conduits containing the interconnect/fiber optic cables shall contain an interconnect fabric subduct. The interconnect fabric subduct shall consist of flexible, textile material, sometimes referred to as "fabric duct".

(B) Fabric The interconnect fabric subduct shall consist of the following:

(1) Standard Outdoor Textile subduct: Micro (33mm), 2-inch, 3-inch and 4-inch multi-cell polyester/nylon textile subduct containing 1,250 lb polyester flat woven pull tape.

Number of cells shall be the maximum number allowed for the conduit size.

(2) Conduit Plugs: Compression-type conduit plugs with locking nuts for sealing and securing one or more textile subducts within a conduit.

(3) Pull Tape: The subduct pull tape shall be constructed of synthetic fiber, printed with accurate sequential footage marks and color-coded.

(4) Duct Water Seal: products suitable for closing underground and entrance conduit openings where subduct is installed, to prevent entry of gases, liquids, or rodents into the structure.

(C) Installation The contractor shall protect the interconnect fabric subduct from the effects of moisture, UV exposure, corrosion and physical damage during installation. The contractor shall install the interconnect fabric subduct prior to installing the new interconnect and fiber optic cables.

The contractor shall provide interconnect fabric subduct in conduits using continuous unspliced lengths of interconnect fabric subduct between pull boxes, and/or termination points as indicated on the drawings.

The contractor shall make a 2" incision, approximately 18" from the end of interconnect fabric subduct. Pull out and cut off approximately 2 feet of pull-tape. Thus allowing the pull tape ends to retract back into the cells.

Using approximately 6 feet of pull tape, tie a non-slip knot to the incision. Then tie 3 to 6 half-hitch knots down to the end of interconnect fabric subduct. Apply black vinyl tape over all knots and the end of interconnect fabric subduct. Using a Bow Line knot tie a swivel to the end of 3 feet pull tape. For multi-pack installations one swivel is sufficient, but stagger each interconnect fabric subduct.

Using a Bow Line knot, attach the pull rope located in the rigid conduit to the other end of the swivel. Install interconnect fabric subduct - ensuring that no twist is introduced to the interconnect fabric subduct.

Provide suitable interconnect fabric subduct slack in the pull boxes, and at turns to ensure there is no kinking or binding of the product.

At locations where interconnect fabric subduct will be continuous through a pullbox, allow sufficient slack so that the interconnect fabric subduct may be secured to the side of the pullbox maintaining the minimum bending radius.

At pullboxes serving as the junction location, pull the exposed end of the interconnect fabric subduct to the far end of the pullbox, install termination bag, and secure to the pullbox.

Seal all conduit and interconnect fabric subduct entering the pullboxes to prevent entrance into the pullboxes of gases, liquids or rodents."

END OF SECTION 770