Amend Section 622 – ROADWAY AND SIGN LIGHTING SYSTEM to read as follows:

"SECTION 622 – ROADWAY AND SIGN LIGHTING SYSTEM and INTELLIGENT TRANSPORTATION SYSTEM (ITS)"

622.01 Description:

"This work includes furnishing and installing a new roadway and sign lighting system and intelligent transportation system (ITS), including power and communication raceway systems in accordance with the contract documents.

This work includes furnishing and installing metal lamp posts with brackets, luminaires, transformer bases, electrical conductors and conduits, fittings, concrete bases, pull-boxes, and other materials necessary for operating and controlling the roadway lighting system and furnishing and installing all materials necessary to reconnect the existing roadway lights to new or existing light circuits according to contract documents.

This work also includes furnishing and installation of conduits and pullboxes and other materials necessary for ITS.

Furnish and install the incidental parts necessary to complete the roadway lighting system and ITS as though the contract showed such parts."

622.02 Materials.

Welded Wire Fabric Reinforcement	709.01(C)
Concrete Pull Box	712.06(B)
Conduits	712.27
Cables and Wires for Roadway Lighting System	760.04

Concrete shall conform to Section 601 – Structural Concrete and shall be Class B. See structural drawings for concrete requirement pertaining to footings, traffic railings, and drilled shafts.

Stainless steel anchor bolts and steel plate covers shall be structural steel conforming to ASTM A 325 and A 36 respectively.

Materials will be subject to inspection. Failure of the Engineer to note faulty material or workmanship during construction will not relieve the responsibility of the Contractor for removing or replacing such materials and redoing the work at no cost to the State."

Electrical equipment shall conform to standards of the following, wherever applicable:

(A) NEMA.

(B) UL, Inc.

(C) Electrical Testing Laboratories (ETL).

(D) National Electrical Testing Association, Inc. (NETA).

Materials shall conform to requirements of the contract documents and the following:

(A) NEC.

(B) Chapter 6-73, Hawaii Administrative Rules, "Installation, Operation, and Maintenance of Overhead and Underground Electrical Supply and Communication Lines,

(C) ASTM.

(D) ANSI.

(E) Local utility company rules.

(F) Local ordinances that may apply.

622.03 Construction. Perform work in accordance with requirements of the contract documents and the following: NEC; General Order Nos. 6 and 10 of the Hawaii Public Commission; ASTM; ANSI; local utility company rules; and local ordinances that may apply.

(A) Equipment List and Drawings. Submit within seven days following contract award, 10 copies of materials and equipment list. Include name of manufacturer, size and identifying number of each item, detailed scale drawings, wiring diagrams of special equipment, and proposed deviations from the contract. If required, submit samples of materials.

When existing lights are damaged or non-functional, install and operate temporary lighting system during hours of darkness. Provide same amount of illumination as existing lighting system.

Upon completion and acceptance of work, submit construction as-built drawings showing detailed construction changes.

(B) Excavation and Backfill. Excavate and backfill in accordance with Section 204 – Excavation and Backfill for Miscellaneous Facilities.

(C) Installation.

(1) Conduits. Lay polyvinyl chloride (PVC) conduits carefully in trenches prepared to receive conduits. Concrete encase PVC Schedule 40 conduits for installation in planting areas, on grade and under roadway areas. Exposed conduits shall be PVC coated galvanized rigid steel.

Set conduits to be placed in concrete structure or encased in concrete to required lines and grades. Support conduit rigidly in place by masonry material, manufactured conduit spacers, or other acceptable means, so that conduit will not dislodge during concrete placing and tamping. Place concrete encasement using hand shovels only. Cure concrete for at least 12 hours before backfilling and compacting.

Whether shop or field cut, ream end of conduits to remove burrs and rough edges. Make cuts square and true. Slip joints or running threads will not be allowed for coupling conduit. When standard coupling cannot be used for coupling metal-type conduit, use of UL or ETL listed threaded union will be allowed.

Install and repair surfaces of PVC-coated rigid steel conduit in accordance with manufacturer's recommendations.

Install PVC conduit in accordance with NEC requirements. Use solvent weld connections. Make solvent weld joints in accordance with conduit manufacturer's recommendations.

Make directional changes in non-metallic conduit with curved segments using accepted deflection couplings, or with short lengths of straight conduits and couplings. Deflection angle between two adjacent lengths of conduit shall not exceed 6 degrees. Do not use radius of less than 12 times nominal size of conduit, unless using factory-made ells.

Thread connection for PVC conduits to rigid metal conduits on metal conduit side.

Provide each conduit run with No. 10 gage flexible, zinc-coated pull wire or 1/8-inch polyolefin line extending through entire length. Double additional 2 feet of wire or polyolefin line back into conduit at both ends of run. End metal conduits entering pull boxes

with insulating grounding bushings. End non-metallic conduits with end bells. Cap or plug ends temporarily.

Cap or plug and mark ends of conduit stub-outs. Ends of conduit runs shall extend at least 24 inches past face of curb or edge of pavement, unless entering pull boxes. Install markers or markings on curbs for conduit runs. Show locations on as-built plans, as specified under Subsection 622.03(A) – Equipment List and Drawings.

Keep interior of conduits clean during construction by temporarily plugging ends of conduits. Plug conduit ends at end of each workday, whenever work is stopped, and whenever conduits are subject to submergence in water. Install conduits to drain toward pull boxes or hand-holes.

(2) Cables and Wires. Provide cables and wires conforming to the NEC. Arrange cables and wires within enclosures, cabinets, luminaires, standards, and pull boxes neatly; and cable together using self-clinching nylon cable ties or other method accepted by the Engineer.

Immediately before installing cables and wires in conduits, pull wire brush through each conduit to remove extraneous matter, obstructions, and debris.

Furnish cables and wires on reels.

Pull cables and wires directly from their cores or reels into conduits with cable grip designed to provide firm hold on exterior covering of conductor and cable. Do not pull off and lay cables and wires on the ground before installation. Make pulls in one direction only. Use UL or ETL listed inert lubricant. Do not leave cables and wires under tension or tight against bushings or fittings.

Remove damaged ends resulting from use of pulling grips immediately after pulling cable and wire. Maintain cable and wire end seals. Do not pull open-ended cables and wires through conduits. Install cables and wires continuous from pulling point to pulling point. Splices between pulling points will not be allowed. Splices shall only occur inside pull boxes, hand-holes, or transformer bases.

After cables and wires are installed, seal conduits ends with duct sealing compound conforming to Subsection 712.2(E) – Duct Sealing Compound. Seal vacant conduits with duct sealing

compound or plug designed for that purpose and accepted by the Engineer.

When splicing is required, join cables and wires with no-solder pressure connectors. Use no-solder pressure connectors for splicing cables and wires, No. 8 AWG or larger. Leave no sharp points that can pierce taping. Splicing and terminate cable and wire in accordance with cable and wire manufacturer's recommendations. Submit cable and wire manufacturer's splicing instruction sheets.

Trim cable and wire insulation to conical shape. Roughen cable and wire insulation before applying splice insulation. Splice insulation includes layers of thermoplastic electrical insulating tape not over 0.007 inch thick conforming to Military Specification MIL-I-24391C. Apply splice insulation well lapped over and with same thickness as original insulation. For high voltage and multiple lighting cable and wire splices, apply two layers of synthetic oil-resistant rubber tape conforming to ASTM D 4388 over each cable and wire before placing thermoplastic tape. Then cover splice with at least two layers of asphaltic-impregnated, open-mesh, fabric tape and coating of high-grade insulating paint of similar material.

Coil neatly, at least 5 feet of slack cable or wire near each lamp-post foundation, pull box, or transformer base.

(3) Continuity of Service. Keep existing system operational until reconstructed or new system is in service. Arrange work accordingly and provide temporary lighting system as necessary.

(D) Field Test. Perform the following tests in presence of the Engineer and submit test results as follows:

(1) Test for continuity of each circuit.

(2) Test for grounding of each circuit.

(3) Megger test each circuit between circuit and ground. Insulation resistance shall not be less than values specified in Table 622.03-1 – Insulation Resistance when measured with instrument having voltage rating of 500 volts.

TABLE 622.03-1 – INSULATION RESISTANCE

Cable or Circuit	Minimum Resistance (ohms)
No. 14 – No.12 wire	1,000,000
25 to 50 amperes	250,000
51 to 100 amperes	100,000
101 to 200 amperes	50,000
201 to 400 amperes	25,000
401 to 800 amperes	12,000
Over 800 amperes	5,000

(4) Functional test to show that system functions as specified.

Replace or repair faults in material or installation revealed by these tests. Repeat same test until no fault appears.

(E) Restoring Pavements and Other Improvements. Restore to their original condition, existing pavements and other improvements, such as driveways, sidewalks, curbs, and gutters, disturbed by excavation. Use replacement material equal to or better in quality than existing materials. Match existing grades, thickness, texture, and color whenever applicable.

(F) Warranty. Provide new material and equipment for permanent construction.

Furnish copies of manufacturer's warranty or warranties guaranteeing equipment free from defects in materials, design, and manufacturing, for not less than 12 months from date of acceptance.

Adjust or repair material and equipment under warranty within 24 hours from time of notification.

Temporarily replace under-warranty material and equipment requiring factory corrections, within 24 hours from time of notification. Install factory-corrected or new material and equipment no later than 90 days from time of notification.

622.04 Measurement. The Engineer will not measure roadway and sign lighting system and ITS work when contracted on a lump sum basis.

The Engineer will measure the various components of said system per each or linear feet, if contracted on a unit price basis." Measurement for payment will apply.

The Engineer will measure Roadway Lighting System – HECO charge on a force account basis according to Subsection 109.06 – Force Account Provisions and Compensation and as ordered by the Engineer.

622.05 Payment. The Engineer will pay for the roadway lighting and ITS work on a lump sum basis if specified in the proposal.

The Engineer will pay for the accepted quantities of the various units of said systems at the contract unit price per each if specified in the proposal.

The price shall be full compensation for and for furnishing and installing, modifying or removing the systems, excavating and backfilling, restoring sidewalks, pavements and appurtenances damaged or destroyed during construction, salvaging existing materials; making required tests, furnishing labors, materials, equipment, tools, and 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 accepted Roadway Lighting System – HECO charge on a force account basis according to Subsection 109.06 – Force Account Provisions and Compensation. Payment will be full compensation for the work prescribed in this Section, by the Engineers and Subsection 109.04 – Full Compensation, Changes.

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

Pay Item	**Pay Unit**
Roadway Lighting System - _____	Lump Sum
Roadway Lighting System - _____	Each
Roadway Lighting System - _____	Linear Feet
ITS System - _____	Each
ITS System - _____	Linear Feet
Roadway Lighting/ITS System- _____	Linear Feet

END OF SECTION 622