

SECTION 622 - ROADWAY LIGHTING SYSTEM

622.01 Description. This work includes furnishing labors, materials and equipment and installing complete in place and in operating condition a roadway lighting system and sign lighting system according to the contract. *

This work includes furnishing and installing of metal lamp posts with brackets, luminaires, breakaway support couplings, slip base inserts, series to multiple transformers, lamps, electrical conductors and conduits, fittings, pole line hardware insulators substation equipment, concrete bases, pullboxes, and other materials necessary for operating and controlling the roadway lighting and sign lighting systems and for salvaging and relocating existing roadway lights and furnishing and installing all materials necessary to connect the relocated lights to the existing light circuits according to the contract. *

The Contractor shall furnish and install the incidental parts necessary to complete the roadway lighting and sign lighting systems as though the contract showed such parts. *

Electrical equipment shall conform to the NEMA Standards. Material and workmanship shall conform to the latest requirements of the "National Electrical Code," herein referred as the Code; General Order Nos. 6 and 10, of the Hawaii Public Utilities Commission; the standards of the ASTM; the ANSI; Local Joint Pole Agreement; local power company rules; and local ordinances that may apply. *

622.02 Materials. Materials shall conform to the following:

Dark Green Enamel Paint	708.03
Welded Wire Fabric Reinforcement	709.01(C)
Pullboxes	712.06(B)
Conduits	712.27
Light Poles	712.28
Luminaires	712.29
Mast Arms	712.30
Expressway Sign Brackets	712.31
Light Sources	712.32
Isolating Transformers	712.33
Cables, Conductors and Wires	712.34

622.02

Disconnect and Protective Devices 712.35

Photo Control 712.36

Substation equipment shall be according to the contract. *

Concrete shall conform to Section 601 - Structural Concrete and shall be Class B. |

Anchor bolts and steel plate covers shall be structural steel conforming to ASTM A 325 and A 36 respectively. The Contractor shall zinc-coat anchor bolts if exposed. *|

Crossarms, hardware, and anchoring materials shall be of a type normally stocked and used for similar purpose by local public utility companies.

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. |

622.03 Construction Requirements.

(A) **Equipment List and Drawings.** Within ten (10) days following the award of the contract, the Contractor shall submit to the Engineer for acceptance six (6) copies of a list of materials and equipment that the Contractor will incorporate in the work. The list shall include the name of the manufacturer, size and catalog number of the unit, detailed scale drawings and wiring diagrams of special equipment, and proposed deviations from the contract. If required, the Contractor shall submit for acceptance samples of the material that the Contractor will use at no cost to the State. *|

Upon completion of the work, the Contractor shall submit an "As Built"-plan showing in detail construction changes. |

(B) **Excavation and Backfill.** Excavation and backfill shall conform to Section 206 - Excavation and Backfill for Conduits and Structures. |

The Contractor shall excavate carefully to prevent damage to pavements, sidewalks, and other improvements. *|

(C) Installation.

(1) **Foundations.** Concrete for foundations of metal lamp posts shall be Class B.

Locations of metal lamp posts shown in the contract are approximate only. The Engineer will decide the exact location in the field. |

Forms shall be true to the lines and grades as accepted. Forms shall be rigid and securely braced in place. The Contractor shall place the conduit ends and anchor bolts in proper position, placed in proper height, and held in place by a template until the concrete sets. The Contractor shall cure the concrete for not less than seventy-two (72) hours.

(2) **Metal Lamp Standards.** The Contractor shall install each metal lamp standard on a concrete foundation. The Contractor shall set the shaft precisely vertical by adjusting the two (2) nuts on each anchor bolt, while the bracket shall be perpendicular to the roadway centerline.

After the lamp standard is in its proper position, the Contractor shall place the grout under the base plate shown in the contract. The Contractor shall form the exposed portions to present a neat appearance.

Grout includes one (1) part by volume of portland cement and three (3) parts of beach sand.

The Contractor shall install metal lamp standards with breakaway design features at the locations shown in the contract. The Contractor shall install the standards with breakaway design features according to the manufacturer's recommendations and shown in the contract.

(3) **Mast Arms.** The Contractor shall install each mast arm on the wood pole shown in the contract. The mast arms shall be in a plane perpendicular to the roadway centerline.

(4) **Luminaires.** The Contractor shall install the roadway lighting luminaires on lamp posts and mast arms with the vertical axis perpendicular to the roadway and longitudinal axis parallel to the roadway centerline.

The Contractor shall install the luminaires at pedestrian stairways, underpasses and signs shown in the contract.

(5) **Circuits.** The Contractor shall encase the cables installed underground or in concrete rigid barrier type guard rail in conduits or other accepted encasement.

Before installation of wires and cables in conduits, the Contractor shall pull a wire brush, swab and mandrel through each conduit for the removal of extraneous matter and verification of the absence of obstructions and debris from the conduit system.

The Contractor shall pull the cables directly from their cores *
 or reels into the conduits. The Contractor shall not pull off and *
 lay the cable on the ground before installation. The Contractor *
 shall make the pulls in one (1) direction only. Lubricants used *
 shall be as recommended by the cable manufacturer or accepted by the *
 Engineer. *

The Contractor shall not leave wires or cables under tension *
 nor tight against bushings or fittings. The Contractor shall remove *
 damaged ends resulting from the use of pulling grips soon after the *
 Contractor pulls the cable. The Contractor shall maintain the cable *
 end seals. The Contractor shall not pull open ended cables through *
 the conduits. Cables shall be continuous from pulling point to *
 pulling point. The Engineer will not permit splices. The Contractor *
 shall make splices, taps and terminations with pressure-indented *
 connectors or lugs as appropriate or specified in the contract. |

If the Contractor requires splicing, the Contractor shall join *
 the conductors by a "western union" type splice or by using an *
 accepted connector. The Contractor shall use the connectors for *
 splicing conductors, No. 8 AWG or larger. The Contractor shall *
 solder the "western union" type splice by the pouring or dipping *
 method. Cable splices and termination shall be according to the *
 cable manufacturer's recommendation. The Contractor shall submit *
 the cable manufacturer's splicing instruction sheets for acceptance. |

The Contractor shall trim the conductor insulation to a conical *
 shape. The Contractor shall roughen the conductor insulation before *
 applying splice insulation. Splice insulation includes layers of *
 thermoplastic electrical insulating tape not over 0.007 inches thick *
 conforming to Federal Specification MIL-I-7798. The Contractor shall *
 apply the splice insulation a thickness equal to and well lapped *
 over the original insulation. For high voltage and multiple lighting *
 conductor splices, the Contractor shall apply two (2) layers of *
 synthetic oil resistant rubber tape conforming to ASTM D 119 over *
 each conductor before placing the thermoplastic tape. The Contractor *
 shall then cover the splice well with at least two (2) layers of *
 asphaltic impregnated open mesh fabric tape and a coating of high *
 grade insulating paint or similar material. The Contractor shall *
 leave at least two (2) feet of slack for each conductor at each *
 splice. *

The Contractor shall coil at least five (5) feet of slack *
 neatly near each lamp post foundation at both ends of each cable *
 run. *

The Contractor shall string the overhead line wires according *
 to Chart No. 1, General Order 6, as amended, by the Hawaii Public *
 Utilities Commission. *

Wiring on the surface of wood poles shall be in rigid steel conduits from ground level to eight (8) feet above ground and in PVC Schedule 80 conduits from above eight (8) feet.

(6) Secondary Connections. The Contractor shall make the connections from the secondary power supply line to fuse boxes with aluminum or copper cable to match the existing secondary cable material. Sizes shall be as specified in the contract.

(7) Bonding and Grounding. The Contractor shall secure the metallic cable sheaths, conduits and lamp posts mechanically and electrically to form a continuous system. The Contractor shall ground them effectively specified in the Code and in the contract.

(8) Pullboxes. The Contractor shall install pullboxes at the locations shown in the contract.

The Contractor shall install pullboxes so that the covers are level with the curb or sidewalk grade or one (1) inch above the existing ground.

The Contractor shall give frames and covers two (2) coats of asphaltic base paint after installation.

(9) Conduits. The Contractor shall lay the zinc-coated rigid steel and polyvinyl chloride (PVC) conduits carefully in trenches prepared to receive the conduits. Conduits under roadway areas and driveways shall be PVC, Schedule 80 or shown in the contract.

The Contractor shall lay the conduit that the Contractor will place in concrete structure or encased in concrete to the required lines and grades. The Contractor shall support the conduit rigidly in place by masonry material, manufactured conduit spacers, or other accepted means. The Contractor shall wire the conduit so that the Contractor will not dislodge the conduit during the placing and tamping of the concrete. The thickness of the concrete around the conduits shall be shown in the contract. The Contractor shall use only hand shovels in compacting the concrete. The Contractor shall cure the concrete jackets for at least seventy-two (72) hours before permitting vehicular traffic.

The Contractor shall install the rigid steel conduit according to Article 346 of the Code. The Contractor shall use white and tinted ready-mixed paint on the threads of joints. The Contractor shall repair zinc-coated surfaces according to Subsection 501.03(G)(2) - Repairing of Damaged Zinc-Coated Surfaces.

The Contractor shall install rigid PVC conduit according to Article 347 of the Code. PVC conduit connections shall be of the solvent-weld type. The Contractor shall make solvent-weld joints

according to the conduit manufacturer's recommendations and as *|
 accepted by the Engineer. The Engineer will permit pre-assembling *|
 sections of conduit. *|

The Contractor shall make directional changes in non-metallic *|
 conduit runs such as bends and changes to clear obstructions with *|
 curved segments using accepted deflection couplings or with short |
 lengths of straight ducts and couplings. The deflection angle
 between two (2) adjacent lengths of duct shall not exceed six (6)
 degrees and the bends shall not have a radius of less than twelve |
 (12) times the nominal size of the conduit unless the Contractor *|
 uses factory-made ells. *|

The Contractor shall thread the fittings for connecting non- *|
 metallic conduits to rigid metal conduits on the side that the *|
 Contractor will connect to the metal conduit. Metal conduits *|
 entering pullboxes shall end in insulating grounding bushings. Non- *|
 metallic conduits shall end in end bells. *|

The Contractor shall cap or plug and mark the ends of conduits *|
 shown or specified. The Contractor shall provide each conduit run *|
 with a No. 10 gage flexible zinc-coated pull wire or one-eighth (1/8)
 inch polyolefin line extending uninterrupted through handholes for |
 the entire length of run. The Contractor shall double an additional *|
 two (2) feet of wire or polyolefin line back into the conduit at *|
 both ends of the run. *|

Ends of conduit runs shall extend at least twenty-four (24)
 inches past the face of curb or edge of pavement, unless the ends
 end in pullboxes. The Contractor shall locate the ends accurately by *|
 special markers, markings on curbs or as ordered. *|

The Contractor shall keep the interior of conduits clean during *|
 the construction. The Contractor shall plug the ends of conduits *|
 temporarily to keep the ends clear during construction. The *|
 Contractor shall install the conduits to drain toward a pullbox. The *|
 Contractor may consider a single run to drain toward both ends. *|

(D) Painting. The Contractor shall furnish the metal poles and mast *|
 arms in natural finish. The Contractor requires no painting. *|

The Contractor shall paint expressway sign brackets specified in *|
 Subsection 712.31 - Expressway Sign Brackets. *|

(E) Electric Service. The Contractor shall apply for electric service
 at each location shown in the contract and shall comply with the power |
 company's requirements. The Engineer will un-meter the service according *|
 to Schedule F for multiple service. *|

The Contractor shall install, on multiple circuits, a laminated *| black and white plastic identification tag to meet the local power company's requirements at each source, where the State takes multiple *| service and on each wood pole or metal lamp post supporting a luminaire.

The Contractor shall provide the secondary circuit extensions to *| the power company's service. The Engineer will pay for permanent service *| connections made by the power company. *|

During relocation, reconstruction or other improvements of existing roadway lighting facilities, the Contractor shall keep the existing roadway lighting system operational in its entirety during hours of darkness. The Contractor shall schedule the work accordingly and provide a temporary lighting system if necessary, to keep the project area illuminated during the hours of darkness.

(F) Field Test. Before acceptance of the work, the Contractor shall *| make the following tests on lighting circuits, in the presence of the *| Engineer.

- (1) Test for continuity of each circuit.
- (2) Test for grounds in each circuit.
- (3) A megger test on each circuit between the circuit and ground. The insulation resistance shall not be less than the values specified in Table 622-I when measured with an instrument having a voltage rating of five hundred (500) volts.

TABLE 622-I - 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) A functional test to show that each part of the system functions according to the contract. |

The Contractor shall correct the faults in the material or the installation revealed by these tests at no cost to the State. The Contractor shall repeat the tests until no fault appears. *|
*|
*|

(G) Salvaging Electrical Equipment. The contract directs the Contractor to Section 202 - Removal of Structures and Obstructions, regarding existing highway facilities. If shown in the contract or ordered, the Contractor shall remove and salvage the existing electrical equipment including luminaires, standards, mast arms, ballasts, transformers, service equipment and pullboxes carefully. *|
*|
*|

Underground conduits, conductors and foundations not reused in the work shall become the property of the Contractor. The Contractor shall remove them from the highway right-of-way at no cost to the State. *|
*|

If the Contractor abandons a foundation in-place on outside the roadbed area, the Contractor shall remove the the top of the foundation, anchor bolts and conduits to a depth of six (6) inches below the surface of the ground. The Contractor shall backfill the resulting hole with material equivalent to the surrounding material. *|
*|
*|

If the Contractor reinstalls salvaged electrical equipment, the Contractor shall furnish and install the materials, equipment and incidentals necessary to complete the work. *|

The Contractor shall clean and relamp the lighting fixtures that the Contractor will reinstall. *|
*|

If the existing materials and equipment that the Contractor plans to relocate is not according to the contract, the Contractor shall replace them with new material and equipment. The Engineer will pay for them as extra work according to Subsection 104.03 - Extra Work. *|
*|

The Contractor shall salvage and stockpile the existing equipment removed and not reused in the work at the work site. *|
*|

622.04 Method of Measurement. The Engineer will not measure roadway lighting systems, sign illumination systems, lighting systems on structures, modifying systems, temporary systems, or removing systems when contracted on a lump sum basis. *|
*|

The Engineer will measure the various components of said systems per each, if contracted on a unit price basis. *|
*|

622.05 Basis of Payment. The Engineer will pay for the roadway lighting systems, sign illumination systems, lighting systems on structures, modifying systems, temporary systems, or removing systems 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, equipments, 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 hauling and stockpiling of salvaged materials *|
and equipment off the right-of-way as ordered as extra work according to *|
Subsection 104.03 - Extra Work. *|

The Engineer will make payment under: *|

Pay Item	Pay Unit
Roadway Lighting System (<u>Component of the System</u> Each)	Lump Sum
Expressway Sign Lighting System (<u>Component of the System</u> Each)	Lump Sum
(<u>Component of the System</u>)	Each