SP- 156230
(New)

SPECIAL PROVISIONS FOR PEDESTRIAN SIGNALS

Dubuque County
TAP-U-2100(703)--8I-31

Effective Date
October 18, 2022

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

1. GENERAL

This specification includes the furnishing of all material and equipment necessary to complete installation of underground components as necessary for traffic signals and future fiber optic equipment to be installed.

2. MATERIALS

2.1. Fabrication or assembly process materials shall comply with the applicable parts of Section 2523 of the Standard Specifications.

2.2. Equipment and materials shall be of new stock unless the plans provide for the relocation of, or the use of fixtures furnished by others. New equipment and materials shall be the product of reputable manufacturers of electrical equipment and shall meet Engineer approval.

2.3. All electrical equipment shall conform to the standards of the NEMA, and all material and work shall conform to the requirements of the NEC, ASTM, ASA, and local ordinances. Miscellaneous electrical equipment and materials shall be UL approved.

Wherever reference is made in these specifications or in the standard provisions to the code, the safety orders, the general order, or the standards mentioned above, the reference shall be construed to mean the code, order, or standard that is in effect at the date of advertising of these specifications.

2.4 Certification from the manufacturers of all electrical equipment, bases, conduit and cable shall be supplied by the Contractor stating said material complies with these specifications.

3. CONDUIT SYSTEM

3.1. The number, type, and size of conduit shall be as shown on the plans. Conduit shall meet the requirements of Articles 2523.03, N, and 4185.10 of the Standard Specifications.

3.1.1. Conduit shown on the plans as PVC conduit shall meet the requirements of NEMA TC-2, Type 2, and applicable UL Standards. HDPE conduit with an SDR of 13.5 will be allowed to be used in place of PVC conduit.

3.1.2. Conduit for interconnect runs shall be inner duct as shown on the plans. Inner duct conduit shall be schedule SDR 13.5 high density polyethylene. Conduit shall provide nominal duct size as indicated on the plans, shall be orange in color unless otherwise specified, and be longitudinally ribbed on the inside wall.

3.1.3. Conduit attached to structures shall be nonmetallic, similar in color to the structure, and rigid enough not to sag under its own weight plus the weight of its contents between brackets.

3.2. Conduit shall be placed as shown on the plans. All locations subject to minor changes pending City of Dubuque Engineering. Change in direction of conduit shall be accomplished by bending such that the conduit will not be injured or its internal diameter changed. Bends shall be of uniform curvature and the inside radius of curvature of any bend shall not be less than six times the internal diameter of the conduit.

3.3. When it is necessary to cut and thread steel conduit, no exposed threads will be permitted. All couplings shall be tightened until the ends of conduits are brought together so that an electrical connection will be made throughout the entire length of the conduit run. All conduit and fittings shall be free from burrs and rough places and all conduit runs shall be cleaned, swabbed and

reamed before cables are installed. Nipples shall be used to eliminate cutting and threading where short lengths of conduit are required. Damaged galvanized finish on conduit shall be painted with zinc rich paint. All fittings used with rigid steel conduit shall be galvanized steel only.

3.4. Approved conduit bushings shall be installed on the exposed ends of rigid steel conduit. Bell end fittings shall be installed on the exposed ends of PVC conduit. In all bases, conduit shall extend minimum of 4 inches above the finished surface.

3.5. Whenever converting from PE to PVC or PE to PE or PVC to PVC conduits splicing shall be accomplished as follows:

3.5.1. If splicing from PE to PE a fusion splice is required. Fusion splicing shall not cause significant interior deformation or ridges. If deformation or ridges are present the conduit needs to be cut and refused.

3.5.2. If splicing from PE to PVC the approved coupling is a Shurlock II system as manufactured by AD Technologies or approved equal for the appropriate size conduit.

3.5.3. If splicing from PVC to PVC, an approved PVC primer must be applied along with an approved PVC glue to seal the connection.

3.5.4. If existing splices are in place and need to be repaired, or coupling is needed for conduits with existing infrastructure, the approved coupling is the MOR Clamp or approved equal. The MOR Clamp is manufactured by AD Technologies. The MOR Clamp shall only be used with the approval of the Engineer.

3.6. Conduit buried in open trenches shall be placed a minimum of 24 inches deep unless otherwise directed by the Engineer. Open trench methods of placing conduit will be permitted except where the conduit is to be placed under existing pavement. If conduit is installed in an open trench, the conduit must be placed on backfill for support. Conduit in pavement areas shall be placed to a minimum depth of 24 inches below the finished pavement surface or as directed by the Engineer.

3.7. Tracer wire will be tied together at all locations. The tracer wire shall be pulled alongside of the bored or trenched conduit. Tracer wire for open-trench installation shall be a No. 10 AWG solid, PRO-TRACE® HF-CCS PE30 with orange insulation color. Conductor shall be soft-drawn, 21% IACS, copper clad steel, utilizing a AISI 1006 low carbon steel core (required to meet break load and flexibility), with break load of 448 pounds (55,000 psi). Conductor shall be extruded with a 30 mil, high density polyethylene, and meet the APWA color code of the buried utility line. Tracer wire shall be rated for direct burial use at 30 volts and RoHS compliant. Tracer wire shall be PRO-TRACE ® HF-CCS PE30 as manufactured by Pro-Line Safety Products

3.8. Inner duct and conduit containing fiber optic cable shall be buried a minimum of 42 inches.

3.8.1. Generally, 7 Way Microduct with innerduct being 13 mm ID and 16 mm OD 13.5 HDPE 7 color (Blue, Red, Green, Yellow, Brown, Grey, Orange) conduits will be installed between vaults. One exception to this rule is when there is not a receiving vault at the end of this conduit, in which case the conduit shall be capped with a tracer wire installed.

3.8.2. Two inch HDPE SDR 13.5 fiber conduit from the fiber vault to the traffic control cabinet shall make a direct path between the two structures and should be kept separate from any intersection wiring conductors and handholes. This fiber conduit shall terminate in the back-left side of the traffic control cabinet.

3.8.3. In areas where fiber inner duct it is open trenched, it shall also contain 3 inch non-detectable underground tape: "CAUTION BURIED FIBER OPTIC LINE BELOW" (Orange) at approximately 18 inches to 24 inches in depth.

3.9. The backfill material in open trenches shall be deposited in layers not to exceed 6 inches in depth and each layer shall be thoroughly compacted before the next layer is placed. Backfill material shall be free of cinders, broken concrete, or other hard or abrasive materials. All surplus material shall be removed from the public right-of-way.

3.10. Whenever excavation is made across parkways, driveways or sodded areas, the sod, topsoil, crushed stone or gravel shall be replaced or restored as nearly as possible to its original condition and the whole area involved shall be left in a neat and presentable condition. Concrete sidewalks, pavements, base courses and bituminous surfaces shall be replaced with new materials. Surface restoration in grass areas shall be considered incidental to the bid items of the project and will not be paid for separately unless a bid item has been provided for the surface replacement.

3.11. "Pushed" conduit shall be placed by jacking, pushing, boring or any other means necessary to place the conduit without cutting, removing, or disturbing existing pavement. The size of a bored hole shall not exceed the outside diameter of the conduit that is to be placed. Tunneling under the pavement or water jetting will not be permitted. Pits for boring shall not be closer than 2 feet to the back of curb unless otherwise directed by the Engineer.

3.12. All conduit openings in the controller cabinet, handholes, and bases shall be sealed with an approved polyurethane expansion joint sealing compound such as BASF Sonolastic NP1, Bostik Chem-Calk 915, Tremco Vulkem 116 or approved equal. This compound shall be readily workable soft plastic. It shall be workable at temperatures as low as 30° F, and shall not melt or run at temperatures as high as 300° F.

3.13. All empty conduits to have flat polyester pull-tape (1250 pounds tensile) with footing markings, when connecting to existing conduit. This pull-tape is to be attached to the expandable plug and sealed within conduit with a minimum of 48 inches of slack in the pull-tape on each end (96 inches total).

3.14. Conduits entering handholes or vaults shall enter with no more than 4 inches or less than 1 inch of exposed conduit inside of the handhole. All conduits shall contain an orange No. 10-AWG tracer wire and be plugged with an expandable rubber plug.

3.15. Trenches need to be excavated straight and true with bottom uniformly sloped to low points. Excavate trenches to a depth of 3 inches below invert of pipe, unless otherwise indicated. Backfill with porous backfill 2 feet over water lines and conduit followed by native material (no organic material or rocks larger than 1 inch or debris) in all areas where no pavement would be placed. Course sand backfill material with hydraulic compaction can be used in trenches that are too narrow to be compacted by mechanical compactors. Trenches under all paved surfaces will be backfilled with compacted limestone to sub-grade elevation. In lawn areas, any settling that occurs shall be repaired and re-graded before seeding is done.

3.16. The length measured for payment shall be the plan distance along a straight line measured between changes in direction and the center of terminal structures.

3.17. General Guidelines (unless otherwise specified)

3.17.1. Generally, a 4 inch PVC or HDPE (if bored) will be used between the traffic controller and signal base. A 2 inch PVC or HDPE will be used to connect to the upright pedestal signals. Conduit placed under the street will be assumed to be bored unless otherwise noted.

3.17.2. Street lighting conduit will be installed from the service pedestal into the hand-hole located next to the traffic controller. The metered service feed for the traffic controller will be fed directly into the front right side of the controller base. The metered service for the Fiber Hub cabinet will be fed directly from the meter pedestal to the right side of the fiber hub base.

3.17.3. All empty and used conduits at foundation locations shall be plugged. Empty conduits shall be plugged with appropriately sized duct plugs. Conduits with conductors shall be plugged with duct seal.

4. WIRING

4.1. Where practical, color codes shall be followed so that the red insulated conductor connects to the red indication terminal, yellow to yellow, and green to green. Circuits shall be properly labeled at the controller by durable labels, or other appropriate methods, attached to the cables.

4.2. All cable runs shall be continuous from connections made in the handhole compartment of street light bases to the terminal compartment in the controller cabinet. Splicing will not be allowed in underground handholes unless specifically called for on the plans.

4.3. Power lead-in cable runs shall be continuous from the Power Company service point to the service pedestal and from the service pedestal to the controller cabinet.

4.4. Slack for each cable shall be provided by a 4 foot length in each handhole and a 2 foot length in each street light pole, pedestal and controller base (measured from the handhole compartment in the pole to the end of the cable). No coils for grounding and bonding wire will be permitted in the handholes.

4.5. Cables shall be pulled through conduit by means of a cable grip designed to provide a firm hold upon the exterior covering of the cable or cables, with a minimum of dragging on the ground or pavement. This shall be accomplished by means of reels mounted on jacks, frame mounted pulleys, or other suitable devices. Only vegetable lubricants may be used to facilitate the pulling of cable.

4.6. Conductor dimensions on construction plans are plan length between bases, contractor must adjust for any vertical runs.

5. ELECTRICAL CABLE

5.1. General

5.1.1. Electrical cable for intersection signalization shall be rated 600 volts minimum.

5.1.2. The number of conductors and size of all electrical cable shall be as shown on the plans.

5.1.3. All wire shall be plainly marked on the outside of the sheath with the manufacturer's name and identification of the type of the cable.

5.2. Street Light Cable

5.2.1. Street light cable for underground lighting circuits shall be single conductor, Class B stranded, annealed copper, 600 volt, 90°C Type XHHW. Street light cable shall be of the size shown on the plans. All underground cable shall be in conduit of the type and size shown on the plans and shall conform to the National Electric Code currently in effect.

Unless otherwise specified, use a three conductor No. 8 AWG XHHW (Black, White, Green) to feed between the luminaires and the meter pedestal.

5.3. Cable Installation

5.3.1. All classes of cable shall be shipped on substantially constructed reels plainly marked as to size, type, and insulation identification. Only one length of cable will be shipped on each reel. All cable must be new. Damaged cable, or repairs to damaged cable, will not be permitted.

Prior to the installation of underground cable, the Contractor shall make sure that the conduit is open, continuous, free of water, and clear of debris. The cable shall be installed in such a manner and by such methods as to ensure against harmful stretching of the conductor, injury to the insulation, or damage to the outer protective covering of the cable. No splices or joints will be permitted to be drawn inside the conduit. Where more than one cable is to be installed in the conduit, all shall be pulled at the same time. No splices or joints shall be made in any cable outside of pole bases or traffic signal heads. All splices or joints of cable in pole bases shall be made waterproof using high grade rubber splicing tape; and the finished splice or joints shall be waterproofed and covered with vinyl plastic tape to provide mechanical protection in accordance with these special provisions. An approved cable lubricant may be used to aid in pulling cables through conduit when necessary to avoid stretching the conductor or damaging the insulation.

The Contractor shall provide drip loops at all signal hangers, wire inlet and service entrance heads. All wire inlets on the poles and signal heads shall be sealed with duct seal.

5.3.2. All splices and connectors shall be covered with rubber type electrical insulation tape, applied 1 1/2 times the thickness of the cable insulation. All bolt type connectors shall be wrapped with one layer of paper tissue prior to the application of the electrical insulation tape. The insulation tape shall be covered with a 1/2 lapped layer of thermoplastic electrical insulating tape extended past the rubber insulation tape at each end of the splice. Splices shall be finished with an application of asphaltic impregnated open mesh fabric tape or coated with a waterproof compound. A layer of conductive shielding tape shall be applied to any splice of two shielded cables to continue the shield through the splice. All splices shall be made in accordance with the cable manufacturer’s recommendations.

Connectors shall be either a bronze, bolted type, soldered, or a compression sleeve type. Connectors of the proper size to fit the largest conductor in the connection shall be used to join wires in pullboxes and pole bases. All connectors shall be Underwriters Laboratory (UL) approved.

Wire ends must be thoroughly cleaned after the insulation is stripped off to insure complete contact with another wire, or the connector. If strands are damaged when the insulation is removed, the section of cable must be discarded. Nicked or damaged conductor strands will not be permitted inside of connectors. Loose wire ends shall not be used as “shims” to make a connection.

Covered connections must be arranged so that they will not be in contact with pullbox lids or metal pole bases.

All splices and connections shall be capable of satisfactory operation under continuous immersion of water.

Cable connections in signal heads and controller cabinets shall be made at the terminal

boards provided for this purpose. All stranded wires inserted under a binder head screw shall be equipped with a solderless pressure type space connector with a pre-insulated shank. All solid wire shall have an eye bend and shall not have a terminal connector.

6. CONCRETE BASES

6.1. Concrete bases/foundation for light poles, pedestal poles, electrical services and battery backups should be precast from a pre-approved vendor. The ends of the conduit stubs shall be capped.

6.2. Prior to setting poles, the anchor bolts shall be covered in such a manner as to protect them against damage and to protect the public from possible injury. The foundations must be given a minimum of 7 days to cure before poles are erected.

6.3. Backfilling of structures shall use floodable backfill material meeting the requirements of Section 4134 of the Standard Specifications. Backfill may be placed in lifts up to 2 feet thick. To ensure uniform surface flooding and adequate compaction, fan-spray water in successive 1 to 2 foot increments using a 2 inch diameter hose for 3 minutes within each increment. Run hose fully, but with the water pressure low enough to avoid eroding material. After flooding, evaluate the effectiveness of the compaction with a vibratory pan or other approved compactor. If the compactor produces visible compaction, repeat the flooding process until the compactor produces no visible compaction.

6.4. During removal, all existing signal foundations shall be removed and disposed of. If there are circumstances that prevent their removal, the exposed concrete must be removed to 6 inches below the ground surface level.

7. BONDING AND GROUNDING

7.1. Ground rods must be UL listed, made of copper-clad steel with a nominal diameter of 5/8 inches. Ground rod sections must be a minimum of 8 feet in length and manufactured for the sole purpose of providing electrical grounding.

7.2. Ground rod assemblies: consisting of one or more ground rods coupled together, such that the total length of the assembly is a minimum of 20 feet, driven into the earth at a single point, without disrupting the electrical continuity of the assembly. Ground rod assemblies shall be full length as shown on the plans and each rod length shall be the tapered end style, not threaded.

7.3. Ground Rod Array: is the inter-connection of the ground rods at each pole or structure at the site, consisting of two or more ground rod assemblies, bonded together in accordance with NEC Article 250 bonding.

7.4. Ground wires shall be connected to the ground rods with one piece non-ferrous clamps which employ set screws as tightening devices ILSCO clear tap cat no. PCT(4/10), often referred to as Acorn Nuts. Connections to ground rods need not be taped. Ground rods and assemblies shall be of the length specified on the plans.

7.5. Cabinet location shall use a 20 foot ground rod assembly as specified in Article 7.2 with a No. 4 AWG, bare, tinned, solid annealed copper ground wire bonded back to the cabinet earth and electrical neutral bus at the cabinet and main service disconnect.

7.6. Ground rod assembly electrodes shall be provided in and accessible at the adjacent hand holes at each structure including but not limited to signal poles, pedestal poles and controllers as detailed on the plans. The entire intersection grounding array shall be a single ground array and bonded back to the cabinet ground along with the cabinet and main disconnect.

7.7. All metal structures and their associated grounds shall be bonded together to the cabinet main disconnect, (NEC Article 250 Bonding). Ground rods should extend to just below the top of the manhole or vault and be located between 3 inches and 6 inches of the side to allow measuring of ground array using a clamp- on tester and inspection of the connections as part of a preventative maintenance program.

7.8. All ground wires between metal structure and nearest ground rod shall be No. 4 AWG, bare, solid, annealed copper wire unless otherwise specified on the plans. Each steel pole or pedestal shall be firmly connected to the ground rod provided, by means of an internal grounding terminal or earth lug. Placing the ground wire under an anchor bolt nut, anchor bolt cover, or similar device will not be permitted.

7.9. All conduit, steel poles, pedestals, and hand holes in the immediate intersection shall be bonded between structures and cabinet to form a continuous effective ground array. Bonding ground wires shall be No. 6 AWG, XHHW insulated green, multi-strand copper wire or equal connected by appropriate sized split bolt or crimp connectors to the No. 4 AWG ground wires specified in Article 7.5.

7.10. The No. 6 AWG, XHHW insulated green multi-strand copper wire shall be installed in all PVC conduit that carries electrical conductors (including low voltage).

8. REPLACING DAMAGED IMPROVEMENTS

8.1. Improvements such as sidewalks, curbs, driveways, roadway pavement and any other improvements removed, broken, or damaged by the Contractor shall be replaced or reconstructed with the same kind of materials found on the work or with materials of equal quality. The new work shall be left in serviceable condition satisfactory to the Engineer. Whenever a part of a square or slab of existing concrete sidewalk, driveway, or pavement is broken or damaged, the entire square or slab shall be removed and the concrete reconstructed.

8.2. Surface restoration shall be considered incidental to the bid items of the project and will not be paid for separately unless specified to be replaced and a bid item is provided.

9. PEDESTRIAN PUSH BUTTONS

9.1 Pedestrian push button detectors shall be Model Bulldog III manufactured by Polara and shall be Yellow in color with a black push button cup and shall be ADA compliant.

9.2 The push button shall be weatherproof and of sturdy design. The entire assembly shall be weather tight, secure against electrical shock, and able to withstand continuous hard usage. The contacts shall be normally open with no current flowing except at the moment of actuation.

9.3 The housing shall be made of aluminum alloy and furnished with suitable mounting hardware.

9.4 Push button signs shall be furnished and shall conform to the requirements of the current MUTCD. Signs shall be R10-3E as specified in the plans.

9.5 The Engineer shall be furnished with a certification from the equipment manufacturer stating that the equipment furnished under this specification complies with all provisions of this specification. If there are any items, which do not comply with this specification, then a list of those exceptions must be detailed on the certification.

9.6 General Specifications

9.6.1 Body Material: Die Cast Aluminum, Powder Coated.

9.6.2 Button Material: 316 Stainless Steel.

9.6.3 Piezo Driven Solid State Switch

9.6.4 Operating Temperature: -30°F to 165°F
9.6.5 Operating Life: Greater than 100 million operations
9.6.6 BDPM3 (Momentary LED Model)
9.6.6.1 Operating Force: 3 pounds Maximum
9.6.6.2 Operating Voltage: 15-36V DC or 12-28V AC
9.6.6.3 On Resistance: 10 Ω Typical.
9.6.6.4 Operating Standby Current: 10µA typical (equivalent to 2MΩ at 20V)
9.6.6.5 Operating Mode: Approx. 0.025 sec flash each time button is pressed.
9.6.6.6 Luminous Intensity: Greater than 1200 mcd (ultra bright red)
9.6.6.7 Viewing Angle: 160 degrees
9.6.7 Audible Tone
9.6.7.1 Sounds simultaneously with button push.
9.6.7.2 Different tones for press and release: 2.6kHz and 2.3kHz
9.6.7.3 Beeper uses power from existing switch wires.

10. POLES

10.1 Poles shall be manufactured in accordance with the requirements of the latest Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals as approved by AASHTO.

10.2 Poles shall have minimum yield strength of 48,000 PSI. The base and flange plates shall be of structural steel conforming to AASHTO M183 (ASTM A36) and cast steel conforming to ASTM A27, Grade 65-35 or better.

10.3 The pole shall be designed to support the traffic signals, lighting and/or signs as shown on the plans.

10.4 The pole shall be galvanized inside and out in accordance with the requirements of ASTM A123, latest revision.

10.5 Where mast arms are used, the hole located on the upright pole shall be large enough for all the wires used for equipment located on the mast arm.

10.6 Where a combination street lighting/signal pole is specified on the plans, the pole shall be equipped with a minimum 4 inch by 6 inch hand hole and cover located opposite the signal mast arm.

10.7 Where a combination street lighting/signal pole is specified on the plans, the luminaire arm is to be mounted in the same vertical plane as the signal arm unless otherwise indicated on the plans.

10.8 The luminaire arm type shall be a single member type arm unless specified otherwise on the plans.

10.9 The luminaire arm shall provide the spread and nominal mounting height as shown on the plans.

10.10 The luminaire arm shall be arched.

10.11 The pole shall be equipped with a minimum 8 inch by 12 inch hand hole and aluminum cover located in the transformer base of the pole. Securing of the cover to the base shall be done with the use of simple tools. Hardware shall be corrosion resistant.

10.12 The mast arms and poles shall be equipped with all necessary hardware, shims and anchor bolts to provide for a complete installation without additional parts.

10.13 All hardware shall be steel, hot dipped galvanized meeting the requirements of ASTM A123, Class D.

10.14 Commercial style lighting shall use a galvanized Valmont four anchor bolt style transformer base with 12 inch bolt circle, 15 foot arm length.

10.15 Subdivision Style lighting shall use a Valmont three anchor bolt style base (DS-200 style 20 foot galvanized pole) with a Urban Townguide Classic “T” Clear.

10.16 The anchor bolts shall meet the requirements of ASTM A36 or better.

10.16.1 The anchor bolts shall be hot dip galvanized for a minimum of 12 inches on the threaded end.

10.16.2 The anchor bolts shall be threaded and exposed a minimum of 6 inches at one end and have a 4 inch long, 90 degree bend at the other end.

11. PEDESTRIAN TRAFFIC SIGNAL HEADS

11.1 The pedestrian signal head shall comply with the latest version of the ITE Standards on Pedestrian Traffic Signal Heads.

11.2 **Signal Head Assembly**

11.2.1 The LED signal section shall be a self-enclosed, sealed unit, with electrical connections to be terminated on the standard terminal block, spade termination, mounted in the traffic signal section. The signals shall be 120 VAC rated and shall be compatible with either public utility or backup power sources of a 60-hertz, +/- 5-hertz with a voltage variance between 80 and 135.

11.2.2 All electronics in the signal shall meet NEMA temperature rating of –40 to +74 ºC. The enclosure shall conform to NEMA Moisture Resistance Standard 250-1991 for Type 4 enclosures <ITE 6.4.6.2 Moisture Resistance>. The signal electronics shall meet FCC Title 47, Subpart B, Section 15 Regulations for Electrical Noise dissemination. The electronics shall be provided with an operating power factor correction of a minimum of 0.9 and shall be provided with fuse and transient suppression incorporated for line and load protection.

11.2.3 The LED modules shall be rated for low power consumption and for use in a backup power installation. LED modules shall be compatible with NEMA TS-2 requirements for traffic controller installations and be fully compliant and compatible with industry standard conflict monitors and malfunction monitor units. LED modules shall be at the rated power consumption, without exception, as backup power sources have been rated based on these design parameters. Charging circuit design shall preclude battery damage caused by continuous battery charge power availability.

11.2.4 LED modules shall be warranted for a minimum field life of 15 years, repair or replacement; and, be designed for a minimum life of 15 years non-degrading for illumination output caused by lens deterioration or LED degrading

11.2.5 The housing for the individual signal sections shall be made of a durable polycarbonate. It shall be clean, smooth and free from flaws, cracks, blowholes, and other imperfections. It shall be designed as a self-contained unit capable of separate mounting or inclusion in a signal face containing two or more signal sections rigidly and securely fastened together. It shall be equipped with openings and positive locking devices in the top and bottom so that it may be rotated between waterproof supporting brackets capable of being directed and secured at any angle in the horizontal plane. Doors and lenses shall be provided with suitable water-tight gaskets and doors shall be suitably hinged and held securely to the body of the housing by simple locking devices of non-corrosive material.

11.2.6

11.2.6.1 Count down style LED Signal shall be a 16 inch by 18 inch module, which incorporates a Portland orange hand and a lunar white walking person. Lenses shall be polycarbonate; glass lenses are not acceptable. LED lenses shall be used for the hand symbol and walking person.

11.2.6.2 LED lenses shall meet the following ITE specification: *Vehicle Traffic Control Signal Heads – Part 2: Light Emitting Diode (LED) Vehicle Traffic Control Signal Modules, An Interim Purchase Specification of the Institute of Transportation Engineers*

11.2.6.3 Lenses shall have an effective area for the "HAND" or "WALKING PERSON" legends. The size shall comply with the ITE Standards on Pedestrian Traffic Signal Heads

11.2.6.4 The "HAND" symbol shall be red LED

11.2.6.5 "WALKING PERSON" symbol lunar white LED.

11.2.6.6 The color of all polycarbonate signal heads shall be black in their entirety. The color shall be an integral part of the materials composition

11.2.6.7 Signal mounting hardware shall consist of aluminum 1 1/2 inch pipe and appropriate fittings or PELCO ASTRO-BRAC ® for pedestrian head side of pole mounting. Signals shall be secured to pole by using a stainless-steel cable mounting material.

12. METHOD OF MEASUREMENT & BASIS OF PAYMENT

12.1 Contract unit prices shall include all costs for each item of work. The Engineer shall measure the units of each item installed. Installed lengths incorporated into an operation system shall be included for measurement and payment, lengths not incorporated into the final system shall not be included for payment. The length measured for payment for conduit shall be the distance along a straight line measured between changes in direction and the center of terminal structures.

12.2 Conduit will be paid for at the contract price per linear foot, which price shall be full compensation for furnishing all equipment, materials, labor, and all other work necessary for installation of the conduit.

12.3 Foundations shall be paid for by the contract unit price each, which includes furnishing all equipment, material, labor, and all other work necessary for the installation of foundations as specified.

12.4 Pedestrian button poles shall be paid for by the contract unit price each, which includes furnishing all equipment, material, labor, and all other work necessary for the installation of street light poles as specified.