

Section 16521

Exterior Lighting

PART 1: General

- 1.1 *Summary* – This Section includes the following:
- 1.1.1 Exterior luminaires with lamps and drivers.
 - 1.1.2 Poles and accessories.
- 1.2 *Definitions* –
- 1.2.1 CRI – Color-rendering index.
 - 1.2.2 Luminaire – Complete lighting fixture, including driver housing if provided.
 - 1.2.3 LED – Light Emitting Diode.
 - 1.2.4 Pole – Luminaire support structure, including tower used for large area illumination.
- 1.3 *Structural Analysis Criteria For Pole Selection* –
- 1.3.1 *Dead Load* – Weight of luminaire and its horizontal and vertical supports, and supporting structure, applied as stated in AASHTO LTS-4.
 - 1.3.2 *Live Load* – Single load of 500 lbf, distributed as stated in AASHTO LTS-4.
 - 1.3.3 *Wind Load* – Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4. Wind speed for calculating wind load is 160 mph.
- 1.4 *Submittals* –
- 1.4.1 *Product Data* – For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1.4.1.1 Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - 1.4.1.2 Details of attaching luminaires and accessories.
 - 1.4.1.3 Details of installation and construction.
 - 1.4.1.4 Luminaire materials.
 - 1.4.1.5 Photoelectric relays.
 - 1.4.1.6 Drivers, including energy-efficiency data.

- 1.4.1.7 LEDs/LED bars, including life, output, and energy-efficiency data.
- 1.4.1.8 Materials, dimensions, and finishes of poles.
- 1.4.1.9 Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
- 1.4.1.10 Anchor bolts for poles.
- 1.4.1.11 Manufactured pole foundations.
- 1.4.2 *Shop Drawings* –
 - 1.4.2.1 Anchor-bolt templates keyed to specific poles and certified by manufacturer.
 - 1.4.2.2 Design calculations, certified by a registered Florida Professional Engineer, indicating strength of screw foundations and soil conditions on which they are based.
 - 1.4.2.3 Power wiring diagrams.
- 1.4.3 *Pole and Support Component Certificates* – Signed by Manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.
- 1.4.4 *Operation and Maintenance Data* – For luminaires and poles to include in emergency, operation, and maintenance manuals.
- 1.4.5 *Warranty* – Special warranty specified in this Section.
- 1.5 *Quality Assurance* –
 - 1.5.1 *Electrical Components, Devices, and Accessories* – Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 1.5.2 *Standards* – Comply with IEEE C2, "National Electrical Safety Code" and NFPA 70.
- 1.6 *Delivery, Storage, And Handling* –
 - 1.6.1 Package poles for shipping according to ASTM B 660.
 - 1.6.2 Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
 - 1.6.3 Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.
- 1.7 *Warranty* –
 - 1.7.1 *Special Warranty* – Manufacturer's standard form in which Manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified

warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

- 1.7.1.1 *Warranty Period for Luminaires:* Five years from date of Substantial Completion.
- 1.7.1.2 *Warranty Period for Metal Corrosion:* Ten years from date of Substantial Completion.
- 1.7.1.3 *Warranty Period for Color Retention:* Five years from date of Substantial Completion.
- 1.7.1.4 *Warranty Period for LEDs:* Replace LEDs and fuses that fail within 5 years from date of Substantial Completion.
- 1.7.1.5 *Warranty Period for Poles:* Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within Manufacturer's standard warranty period, but not less than five years from date of Substantial Completion.

1.8 *Extra Materials –*

1.8.1 Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1.8.1.1 *Drivers:* Furnish at least one of each type.

PART 2: Products

2.1 *Manufacturers –* In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

2.1.1 *Luminaire –* Refer to Drawings for fixture manufacture and model number.

2.1.2 *Pole –* Provide pole by one of the available manufacturers, unless noted otherwise on the Drawings:

- 2.1.2.1 Lyte Poles, Inc.

2.2 *Luminaires,*

2.2.1 *General Requirements –*

2.2.1.1 Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

2.2.1.2 Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

2.2.2 *Metal Parts –* Free of burrs and sharp corners and edges.

- 2.2.3 *Housings* – Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use.
- 2.2.4 *Doors, Frames, and Other Internal Access* – Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- 2.2.5 *Exposed Hardware Material* – Stainless steel (316L).
- 2.2.6 *Light Shields* – Factory installed in LEDs, arranged to block light distribution to indicated portion of normally illuminated area or field.
- 2.2.7 *Factory-Applied Finish for Luminaire* – Durable polyester power-coated finish, utilizing a 5-stage pre-treatment and painting process, able to withstand corrosive environment exposure. Color shall match luminaire color.

2.3 *Luminaire-Mounted Photoelectric Relays* –

- 2.3.1 *Standards* – Comply with UL 773 or UL 773A.
- 2.3.2 *Contact Relays* – Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
 - 2.3.2.1 Relay with locking-type receptacle shall comply with NEMA C136.10.
 - 2.3.2.2 Adjustable window slide for adjusting on-off set points.

2.4 *Drivers* –

- 2.4.1 *Low-Temperature Driver Capability* – Rated by its Manufacturer for reliable starting and operation of indicated LED(s) at temperatures 0°F and higher.
- 2.4.2 *Driver Characteristics* –
 - 2.4.2.1 Power Factor: 90 percent, minimum.
 - 2.4.2.2 Sound Rating: A.
 - 2.4.2.3 Total Harmonic Distortion Rating: Less than 10 percent.
 - 2.4.2.4 Driver: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
 - 2.4.2.5 Case Temperature for Compact Lamp Ballasts: 65°C, maximum.
 - 2.4.2.6 Transient-Voltage Protection: Comply with IEEE C62.41 Category A or better.
- 2.4.3 *Low-Temperature LED Capability* – Rated for reliable starting and operation with ballast provided at temperatures 0°F and higher.

- 2.4.3.1 Average rated life of 100,000 hours (at a base point of 25°C), minimum
- 2.5 LEDs – ANSI C78.42, CRI 21 (minimum), color temperature 4000 K, and average rated life of 100,000 hours, minimum.
- 2.6 *Poles and Support Components, General Requirements –*
- 2.6.1 *Structural Characteristics – Comply with AASHTO LTS-4.*
- 2.6.1.1 *Wind-Load Strength of Poles – Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.*
- 2.6.1.2 *Strength Analysis – For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.*
- 2.6.2 *Luminaire Attachment Provisions – Comply with luminaire Manufacturers' mounting requirements. Use stainless-steel (316L) fasteners and mounting bolts, unless otherwise indicated.*
- 2.6.3 *Mountings, Fasteners, and Appurtenances – Corrosion-resistant items compatible with support components.*
- 2.6.3.1 *Materials: Shall not cause galvanic action at contact points.*
- 2.6.3.2 *Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.*
- 2.6.3.3 *Anchor-Bolt Template: Plywood or steel.*
- 2.6.4 *Concrete Pole Foundations – Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 3300-"Paving for Driveways and Parking Areas."*
- 2.7 *Aluminum Poles –*
- 2.7.1 *Poles – Seamless, extruded structural tube complying with ASTM B 429, Alloy 6063-T6 with access hand hole in pole wall.*
- 2.7.2 *Poles – ATM B 209, 5052-H34 marine sheet alloy with access hand hole in pole wall.*
- 2.7.2.1 *Shape: Round, tapered or Square, tapered.*
- 2.7.2.2 *Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.*
- 2.7.3 *Grounding and Bonding Lugs – Welded 1/2-inch threaded lug, complying with requirements in Section 16060-"Grounding and Bonding," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through hand hole.*

- 2.7.4 *Brackets for Luminaires* – Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel (316L) bolts.
 - 2.7.4.1 Tapered oval cross section, with straight tubular end section to accommodate luminaire.
- 2.7.5 *Finish* – Durable polyester power-coated finish, utilizing a 5-stage pre-treatment and painting process, able to withstand corrosive environment exposure. Color shall match luminaire color.

PART 3: Execution

- 3.1 *Luminaire Installation* –
 - 3.1.1 Install LEDs in each luminaire.
 - 3.1.2 Fasten luminaire to indicate structural supports. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by Manufacturer.
 - 3.1.3 Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.
- 3.2 *Pole Installation* –
 - 3.2.1 *Alignment* – Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
 - 3.2.2 *Clearances* – Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:
 - 3.2.2.1 Fire Hydrants and Storm Drainage Piping: 60 inches.
 - 3.2.2.2 Water, Gas, Electric, Communication, and Sewer Lines: 60 inches.
 - 3.2.2.3 Trees: 10 feet
 - 3.2.3 *Concrete Pole Foundations* – Set anchor bolts according to anchor-bolt templates furnished by pole Manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 3300-"Paving for Driveways and Parking Areas."
 - 3.2.4 *Foundation-Mounted Poles* – Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole Manufacturer.
 - 3.2.4.1 Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by Manufacturer.
 - 3.2.4.2 Grout void between pole base and foundation. Use no shrink or expanding concrete grout firmly packed to fill space.

- 3.2.4.3 Install base covers, unless otherwise indicated.
- 3.2.4.4 Use a short piece of 1/2-inch- diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- 3.2.5 *Raising and Setting* – Raise and set poles using web fabric slings (not chain or cable).
- 3.3 *Corrosion Prevention* – When in direct contact with earth or concrete, protect aluminum by wrapping the conduit with 0.010-inch- thick, anti-corrosion plastic tape applied twice, with a 50 percent overlap for each wrap application.
- 3.4 *Grounding* –
 - 3.4.1 *Metal Poles* – Ground metal poles and support structures according to Section 16060-"Grounding and Bonding."
 - 3.4.1.1 Install grounding electrode for each pole, unless otherwise indicated.
 - 3.4.1.2 Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
 - 3.4.2 *Nonmetallic Poles* – Ground nonmetallic poles and support structures according to Section 16060-"Grounding and Bonding."
 - 3.4.2.1 Install grounding electrode for each pole.
 - 3.4.2.2 Install grounding conductor and conductor protector.
 - 3.4.2.3 Ground metallic components of pole accessories and foundations.
- 3.5 *Field Quality Control* –
 - 3.5.1 *Damage Inspection* – Inspect each installed fixture for damage. Replace damaged fixtures and components.
 - 3.5.2 *Illumination Observations* – Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source. Verify operation of photoelectric controls.
 - 3.5.3 *Illumination Tests* – Measure light intensities at night. Use photometers with calibration referenced to NIST standards.