

## PART II

### SECTION 13 - STREET LIGHTING SYSTEMS

The City of Miami Beach (CMB) owns and operates the Street Lighting System on City right-of-way. Miami-Dade County operates all traffic signal system and street lights on State and/or County right-of-way. In some instances the CMB owns and operates street, pedestrian and/or up lighting within State and County right-of-way. Consult with Public Works Department prior to designing any system. The following are the minimum requirements to comply with the City's design standards:

#### 1.0 GENERAL

##### 1.1 GLOSSARY OF TERMS

Average Initial Illuminance – The average level of horizontal illuminance on the pavement area of a travelway at the time a lighting system is installed, when lamps are new and luminaires are clean; expressed in average footcandles (lux in metric).

Average Maintained Illuminance – The average level of horizontal illuminance on the pavement area of a travelway when the output of the lamp and luminaire are diminished by maintenance factors; expressed in average footcandles (lux in metric).

Ballast – A device used with a high-intensity discharge lamp to obtain the necessary circuit condition (voltage current and waveform) for starting and operating.

Bracket Arm – An attachment to a lamp post or pole from which a luminaire is suspended.

BUG Rating – A rating method for luminaires to define the amount of light trespass in each of three areas; backlight (B), Uplight (U) and Glare (G). Each area is classified separately on a scale from 0 to 5, where B0-U0-G0 indicated the lowest amount of light trespass and B5-U5-G5 represents the greatest amount of light trespass.

Candela (cd) – The unit of luminous Intensity.

Candlepower (cp) – Luminous intensity expressed in candelas (not an indication of total light output).

Coastal Construction Control Line – defines coastal areas where construction can adversely impact coastal dunes, beaches and wildlife. Construction within these areas require additional permitting from the Florida Department of Environmental Protection.

Cutoff – IESNA designation for a luminaire light distribution that limits up light.

Footcandle (fc) – The unit of illumination when the foot is taken as the unit of length. It is the illumination on a surface one square foot in area on which there is a uniformly distributed flux of one lumen. One footcandle = 10.76 lux.

Glare – The sensation cause by luminance (photometric brightness) within the visual field that is sufficiently greater that the luminance to which the eyes are adapted to cause annoyance, discomfort, of loss in visual performance and visibility.

Hazardous Area – places where fire or explosion hazards may exist due to flammable gases, flammable liquid–produced vapors, combustible liquid–produced vapors, combustible dusts, or ignitable fibers/flyings present in the air in quantities sufficient to produce explosive or ignitable mixtures.

High-intensity Discharge Lamps – A general group of lamps that include mercury vapor, metal halide and high pressure sodium lamps.

IESNA – Illuminating Engineering Society of North America. Publisher of lighting references and design guides.

Illuminance – The density of luminous flux incidental to a surface; it is the quotient derived by dividing the luminous flux by the area of the surface, when the latter is uniformly illuminated.

Lamp – a generic term for a man-made source of light, which is produced either by incandescence or luminescence.

Light Distribution Type – The pattern in which light is emitted from a light source. IESNA defines 5 basic light distribution types. Type 1 is thin and linear and intended for 1-2 lane roadways; Type 2 is linear but wider than Type 1; Type 3 is even wider and throws light forward from the light source; Type 4 maximized forward throw of the light and is the most asymmetrical distribution; Type 5 provides a symmetrical pattern of light on all sides.

Light Emitting Diode (LED) – A semiconductor device that emits visible light when an electric current passes through it. The color tint of a white light LED light source is measured by its color temperature in degrees Kelvin. Lower color temperature fixtures (i.e. 2,700K - 3,000K) will emit a more yellow colored light, while higher color temperature fixtures (i.e. 4,000K - 5,000K) will emit a more pure white colored light.

Light Loss Factor (LLF) – A depreciation factor applied to the initial average illuminance to determine average maintained illuminance. It is comprised of maintenance and equipment factors that affect light output over time.

Lumen (lm) – The unit of luminous flux, defined as the flux on a unit surface where all points are at a unit distance from a uniform point source of one candela.

Luminaire (Fixture) – A complete light assembly consisting of a lamp and the parts designed to distribute light, protect the lamp, and connect the lamp to a power supply.

Luminance (Photometric Brightness) – The luminous intensity of any surface in a given direction per unit of projected area of the surface as viewed for that direction.

Luminous Flux – The measure of the power of light as perceived by the human eye.

Lux (lx) – The International System (SI) unit of illumination.

Maintenance Factor (MF) – a component of light loss factor that denoted the deterioration of a luminaire's output over time due to lamp depreciation and dirt.

Mean Lamp Lumens – Output of a lamp calculated by determining the area beneath the lumen maintenance characteristic curve of a particular source over a given period of time and dividing that area by the time period in hours.

Mounting Height (MH) – The vertical distance between the roadway surface and the center of the apparent light source of the luminaire.

Non-cutoff – The IESNA luminaire light distribution category when there is no candlepower limitation in the zone above maximum candlepower.

Overhang – The distance between the vertical line passing through the luminaire and the curb or edge of roadway.

Spacing – The distance between successive lighting units measured along the centerline of the roadway.

Uniformity of Illuminance – The ratio of average footcandles (lux) of illuminance on the pavement

area to the footcandles (lux) at the point of minimum illuminance on the pavement, commonly called the uniformity ratio.

## 1.2 REFERENCE STANDARDS

- A. Electric equipment, materials and installation shall comply with the latest edition of National Electrical Code (NEC) and with the latest edition of the following codes and standards:
- (1) National Electrical Safety Code (NESC)
  - (2) Occupational Safety and Health Administration (OSHA)
  - (3) National Fire Protection Association (NFPA)
  - (4) National Electrical Manufacturers Association (NEMA)
  - (5) American National Standards Institute (ANSI)
  - (6) Insulated Cable Engineers Association (ICEA)
  - (7) Instrument Society of America (ISA)
  - (8) Underwriters Laboratories (UL)
  - (9) Factory Mutual (FM)
  - (10) International Electrical Testing Association (NETA)
  - (11) Institute of Electrical and Electronic Engineers (IEEE)
  - (12) Illuminating Engineering Society of North America (IESNA)
- B. All electrical equipment and materials shall be listed by Underwriter's Laboratories, Inc., and shall bear the appropriate UL listing mark or classification marking. Equipment, materials, etc. utilized not bearing a UL certification shall be field or factory UL certified prior to equipment acceptance and use.
- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.
- D. Additional applicable design guidelines include the following. Where these documents conflict with the City of Miami Beach's Public Works Manual, the City's Standards shall govern.
- (1) Roadway Lighting Design Guide, AASHTO
  - (2) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, AASHTO
  - (3) Plan Preparation Manual, FDOT
  - (4) Design Standards for Design, Construction, Maintenance and Utility Operations on the State Highway System, FDOT
  - (5) Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways "Florida Greenbook", FDOT
  - (6) Standard Specifications for Road and Bridge Construction, FDOT
  - (7) A Guide to Sea Turtle Lighting, US Fish & Wildlife Service

## 1.3 DESIGN REQUIREMENTS

- A. All plans shall be prepared using the standard FDOT state kit for AutoCAD.
- B. Quantity Take Offs (QTO) for all plans shall be prepared and provided on the plans.
- C. Voltage drops are essential design criterion to ensure proper operation of the finished system. The voltage provided by the electrical utility provider is typically 120/240 or 240/480 volt system. The voltage at the end of a circuit shall not be less than 7% of the voltage at the beginning of the circuit. A voltage drop in excess of 7% may cause the luminaries at the end of a circuit run to either not operate or provide reduced lumen output.
- D. All service points for powering roadway and parking lot lighting facilities, whether public or private, shall be located within the City right-of-way and shall be fully accessible by City maintenance and

emergency personnel.

- E. All luminaire light sources shall be LED with color temperature of 2,700K - 3,000K.
- F. In an effort to reduce impacts on sea life, and specifically sea turtle, all lighting within the Coastal Construction Control Line must adhere to strict design requirements, which include the following:
  - (1) Luminaire mounting heights must not exceed 12 feet.
  - (2) Light Shielding, either by berm or 270° internal shield, must be used to prevent direct exposure of light towards the beach.
  - (3) Use of turtle-friendly amber LED light source is required.
  - (4) Luminaires must be approved by both the Florida Fish and Wildlife Conservation Commission and the City of Miami Beach DPW prior to installation, and additional permitting requirements through the Florida Department of Conservation may be required. DESIGNER must discuss requirements with the City prior to design.
- G. Three classifications of lighting are defined for use within the City's public right-of-way. They include the following:
  - (1) Roadway Lighting – Light poles whose primary purpose is to light the roadway (or parking lot) for vehicular traffic. These lights also provide lighting for pedestrian and bicycle facilities adjacent to roadways. Roadway light poles are characterized by mounting heights of 25' - 45', and luminaires are typically mounted on bracket arms between 6' and 12' in length.
  - (2) Pedestrian-Scale Lighting – Light poles whose primary purpose is to light sidewalks, paths and other pedestrian facilities. These poles are typically shorter, 10' - 16' mounting heights and in most cases the luminaire is post-top mounted directly above the pole.
  - (3) Bollards – Short vertical posts (typically 42" high), which provide low level lighting. Typically used in pedestrian areas as accent lights, or in coastal areas to reduce the mounting height of the light.
  - (4) These classifications of lights are routinely combined to create the overall lighting system for a roadway or path. Bollards mixed with pedestrian-scale lights are most common in the coastal areas to limit light trespass onto the beach, and roadway and pedestrian-scale lights are often mixed on roadways with adjacent sidewalks to ensure adequately lighting of both elements.
  - (5) An additional classification of light that may be utilized is called up-lighting; smaller lights pointed at specific trees or structures to accent their presence. These lights are meant to be hidden and provide little to no impact on roadway or sidewalk light levels as they are pointed away from the pavement surface. As such, specific guidelines for the use of these type lights are not included in this manual. DESIGNER shall coordinate use and approval requirements for up-lighting with the City Engineering department prior to use.
- H. Illumination Standard - The DESIGNER must adequately provide illuminance calculations for each area to be lit using either the most current versions of Visual or AGI32 software packages. Illuminance values shall be in footcandles as measured horizontally from the pavement surface and shall appropriately consider the impacts of outside lighting sources, whether on public or private property, to the project computation area.
  - (1) Roadway and Sidewalks: Table 1 provides the minimum design standards for illuminance and uniformity ratio on all public and private streets within the City of Miami Beach. Illuminance criteria below represents the average initial values at time of installation, with no adjustment to light loss factor (LLF =1).

**Table 1: Roadway Illumination Criteria**

Road Classification	Area Classification	Average Initial Illuminance in Horizontal Footcandles (H.F.C.)	Uniformity Ratios	
			Avg/Min	Max/Min
Freeways, Major Arterials and State Highways	Commercial/Industrial	2.0	4:1	10:1
	Residential	1.5	4:1	10:1
Local Roadways	Commercial/Industrial	2.0	4:1	10:1
	Residential	1.0	4:1	10:1
Parking Lots	Commercial/Industrial	2.0	3:1	10:1
	Residential	1.0	3:1	10:1
Pedestrian Ways / Bike Ways	Separated Facilities	2.5	3:1	10:1
Construction Lighting (if applicable)		2.0	4:1	10:1

Notes:

1. Criteria shown above was adapted from recommendations in the *Florida Green Book* and *AASHTO's Roadway Lighting Design Guide*, with light levels adjusted to average initial fc consistent with the *FDOT Plan's Preparation Manual*.
2. The values above shall be considered standard, but should be increased as necessary to maintain an acceptable uniformity ratio. The maximum average illuminance value shall not exceed one and one half the value shown in the table.
3. The criteria above are for purposes of roadway safety and do not apply to lighting levels required for crime prevention.
4. Any deviation from these standards must be approved by the City Manager or Public Works Director.

- (2) Sidewalks and Bike Lanes Adjacent to Roadways: Use the same design criteria for illuminance and uniformity as the roadway.
- (3) Intersections and Mid-Block Pedestrian Crosswalks: Intersections and Mid-Block Crosswalks should be provided with additional illumination. The average illumination level in the crosswalk area should be at least equal to 1.5 times the average illumination of the overall roadway.
- (4) Bus Stop Facilities: Illumination levels over or in close proximity to a Bus Stop facility should have an average illumination level of 2.5 fc with a uniformity ratio of 3:1. Lighting levels should be regardless of the level required for the regular street lighting system.
- (5) Temporary Lighting: During construction or repair along roadways with existing lighting systems, 95% of the existing luminaires shall remain operational at all times. In cases where more than 5% of the lights become inoperable, a temporary lighting system must be designed and put in place to maintain light levels as shown in Table 1 above for construction lighting. In these cases, the temporary lighting design must be approved by the City Engineer prior to implementation.

1.4 PRIORITY OF THE CONTRACT DOCUMENTS

- A. If, during the performance of the WORK, the CONTRACTOR finds a conflict, error or discrepancy between or among one or more of the Sections or between or among one or more Sections and the Drawings, the WORK shall be governed by the higher performance requirements. The higher performance requirement shall be considered the equipment, material, device or installation method which represents the most stringent option, the highest quality or the largest quantity.
- B. In all cases, figured dimensions shall govern over scaled dimensions, but WORK not dimensioned shall be as directed by the Engineer and WORK not particularly shown, identified, sized, or located shall be the same as similar WORK that is shown or specified.
- C. Detailed Drawings shall govern over general drawings, larger scale Drawings take precedence

over smaller scale Drawings, Change Order Drawings shall govern over Contract Drawings and Contract Drawings shall govern over Shop Drawings.

- D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the CONTRACTOR, unless otherwise directed by the Engineer.

In accordance with the intent of the Contract Documents, the CONTRACTOR accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the CONTRACTOR'S responsibility to comply with all Laws and Regulations at all times.

#### 1.5 SCOPE OF WORK

- A. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals required and install complete and make operational, the electrical system, as shown on the Drawings and as specified herein.
- B. The WORK performed by the CONTRACTOR shall include furnishing and installing the following, as called for on the drawings:
- (1) Electrical Services from the Power Company.
  - (2) Conduit, wire and field connections for all lighting control panels, light fixtures and electrical equipment under these specifications.
  - (3) Furnish and install precast hand holes and light pole bases.
  - (4) Furnish and install hand hole frames and covers.
  - (5) It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all WORK which may be reasonably implied as being incidental to the WORK of this Section shall be furnished at no extra cost.
- C. Each bidder or their authorized representatives shall, before preparing their proposal, visit all areas of the existing site, buildings and structures in which WORK under this section is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that their representative has visited the site, buildings and structures and noted the locations and conditions under which the WORK will be performed and that he/she takes full responsibility for a complete knowledge of all factors governing his/her WORK.
- D. The CONTRACTOR shall field verify all existing underground electrical and mechanical piping prior to digging/trenching.
- E. The CONTRACTOR shall prepare and furnish electrical conduit layout shop drawings for yard electrical, within and under all roads, buildings and structures to the Engineer for approval prior to commencing WORK. Layouts shall include but not be limited to equipment, hand holes, pull boxes, conduit routing, dimensioning, methods and locations of supports, reinforcing, encasement, materials, conduit sizing, equipment access, potential conflicts, building and yard lighting, and all other pertinent technical specifications for all electrical conduits and equipment to be furnished. All layouts shall be drawn to scale on 11" x 17" sheets.

- F. The WORK shall include complete testing of all equipment and wiring at the completion of WORK and making any minor correction changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; substandard WORK will be rejected.
- G. A single manufacturer shall provide main breaker, panel-boards, mini power zone, lighting control panels, disconnect switches, etc.
- H. CONTRACTOR shall provide their own temporary power for miscellaneous power (drills, pumps, etc.). No facility circuits shall be used unless approved in writing by the Engineer. Any temporary added shall be removed at job completion.
- I. The CONTRACTOR shall coordinate with all SUBCONTRACTORS to obtain and submit all relevant equipment submittals.
- J. The CONTRACTOR is responsible for maintaining the existing street lighting system at all times throughout the project. This may include the installation of supplemental light fixtures, as needed, to ensure the system remains active at all times per the requirements of section 1.3.H.

#### 1.6 SUBMITTALS

- A. Shop drawings shall be submitted for the following equipment:
  - (1) Raceways, Boxes, Fittings and Hangers
  - (2) Wires and Cables
  - (3) Miscellaneous Equipment
  - (4) Lighting Fixtures and Lamps
  - (5) Precast Hand holes, Frames and Covers
  - (6) Grounding Hardware and Connections
- B. The manufacturers name and product designation or catalog numbers shall be submitted for the following material utilized:
  - (1) Testing Equipment
  - (2) Ground System Resistance Test Equipment
- C. Check shop drawings for accuracy and contract requirements prior to submittal. Shop drawings shall be stamped with the date checked and a statement indicating that the shop drawings conform to the Specifications and the Drawings. This statement shall also list all exceptions to the Specifications and the Drawings. Shop drawings not so checked and noted shall be returned.
- D. The Engineer's check shall be for conformance with the design concept of the project and compliance with the Specifications and the Drawings. Errors and omissions on approved shop drawings shall not relieve the CONTRACTOR from the responsibility of providing materials and workmanship required by the Specifications and the Drawings.
- E. All dimensions shall be field verified at the job site and coordinated with the WORK of all other trades.
- F. Material shall not be ordered or shipped until the shop drawings have been approved. No material shall be ordered or shop WORK started if shop drawings are marked "APPROVED AS NOTED - CONFIRM", "APPROVED AS NOTED - RESUBMIT" or "NOT APPROVED".
- G. In addition to manufacturer's equipment shop drawings, submit electrical installation working drawings containing the following:

- (1) Concealed and buried conduit layouts, shown on plans drawn at not less than 1-in = 40-ft scale. The layouts shall include locations of transformers, control panels, equipment, motors, switches, motor starters, large junction or pull boxes, hand holes, and any other electrical devices connected to concealed or buried conduits.
- (2) Plans shall be drawn on paper, minimum size 11-in by 17-in, and shall be presented in a neat, professional manner.
- (3) Concrete floors and/or walls containing concealed conduits shall not be poured until conduit layouts are approved.

H. Operation and Maintenance Data:

- (1) Submit operations and maintenance data for equipment furnished under this Section. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists, etc, to instruct operating and maintenance personnel unfamiliar with such equipment.
- (2) Manuals shall include the following as a minimum:
  - a) A comprehensive index.
  - b) A complete "As-Built" set of approved shop drawings.
  - c) A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.
  - d) A table listing of the "as left" settings for all timing relays and alarm and trip set points.
  - e) System schematic drawings "As-Built", illustrating all components, piping and electric connections of the systems supplied under this Section.
  - f) Detailed service, maintenance and operation instructions for each item supplied.
  - g) Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.
  - h) The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.
  - i) Complete parts list with stock numbers, including spare parts.

1.7 CONTROL OF MATERIALS

- A. Materials and equipment shall be new, except where specifically identified on the Drawings to be re-used.
- B. Lighting equipment shall be installed in accordance with the City's Standard Street Lighting Details.
- C. Material and equipment of the same type shall be the product of one manufacturer and shall be UL listed.
- D. All equipment furnished shall be warrantied for a minimum of five years. The CONTRACTOR is responsible for all warranty repairs, replacements, troubleshooting, or other costs for 90 days after final acceptance.
- E. All lighting systems shall be protected by an overcurrent device. This is in the form of a fuse or circuit breaker. The fuse or circuit breakers shall be sized in accordance with NEC Section 204-3. The minimum size fuse and circuit breaker used for a service point shall be 20 amps. In addition, all lighting systems shall include a 50KA surge protective device at the service point.



F. Equipment Interconnections:

- (1) Review shop drawings of equipment furnished under other Divisions and prepare coordinated wiring interconnection diagrams or wiring tables. Submit copies of wiring diagrams or tables with the Record Drawings.
- (2) Furnish and install all equipment interconnections.

G. Hazardous Areas:

- (1) Equipment, materials and installation in areas designated as hazardous on the Drawings shall comply with NEC Articles 500, 501, 502 and 503.
- (2) Equipment and materials installed in hazardous areas shall be UL listed for the appropriate hazardous area classification.

H. Codes, Inspections and Fees:

- (1) Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction.
- (2) Obtain all necessary permits and pay all fees required for permits and inspections.

I. Enclosure Types - Unless otherwise specified herein or shown on the Drawings, electrical enclosures shall have the following ratings:

- (1) NEMA 1 for dry, non-process indoor locations.
- (2) NEMA 12 for "DUST" locations.
- (3) NEMA 4X for outdoor locations, rooms below grade (including basements and buried vaults), "DAMP" and "WET" locations.
- (4) NEMA 4X for "CORROSIVE" locations.
- (5) NEMA 7 (and listed for use in the area classifications shown) for "Class I Division 1 Group D", "Class I Division 2 Group D" and "Class II Division 1" hazardous locations shown on the Drawings.
- (6) NEMA 3R shall be used for indoor installations.

J. EQUIPMENT IDENTIFICATION

- (1) Identify equipment (lighting control panels, etc.) furnished as part of the lighting system with an ID TAG with the identification number of the equipment it serves. ID TAG requirements are as follows:
  - a) ID TAGS on lighting enclosures shall be engraved laminated plastic with one-inch minimum height white lettering on a black background.
  - b) Light pole ID TAGS shall have one-inch high black lettering on a yellow background. Tags on poles can be either aluminum pole tags, or self-sticking vinyl lettering.
- (2) ID TAGS shall be screw mounted to NEMA 1 enclosures, or bonded to all other enclosure types using an epoxy or similar permanent waterproof adhesive. Two sided foam adhesive tape is not acceptable. Where the equipment size does not have space for mounting a nameplate, the nameplate shall be permanently fastened to the adjacent mounting surface. Cemented nameplates shall not be drilled.
- (3) All conductors within pull boxes, junction boxes etc. shall be identified with cable tags

stating circuit number and voltage when multiple circuits run through the same pullbox.

K. Tests and Settings:

- (1) Field testing and commissioning shall be performed in accordance with the latest revisions of NETA Standard ATS "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems" unless otherwise modified by these Sections.
- (2) A typed test report for each component tested shall be submitted to the Engineer for the project record files. Test report forms shall be in compliance with NETA standards. A minimum of three complete copies shall be provided. Reports shall be signed by the person in responsible charge of the field testing, and an officer of the Electrical
- (3) Make adjustments to the systems and instruct the Owners personnel in the proper operation of the systems.
- (4) In addition to the specific testing requirements listed in the individual sections, the following minimum tests and settings shall be performed.
  - a) Mechanical inspection, testing and settings of circuit breakers, control circuits and equipment for proper operation.
  - b) Check power and control power fuse ratings. Replace fuses if they are found to be of the incorrect size.
  - c) Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by control schematic and wiring diagrams.
  - d) Inspect each piece of equipment in areas designated as hazardous to ensure that equipment of proper rating is installed.
  - e) Check all wire and cable terminations. Verify to the Engineer connections meet the equipment's torque requirements.
- (5) Make the following minimum tests and checks prior to energizing electrical equipment. Submit test reports upon completion.
  - a) Test and calibrate protective relays and circuit breakers.
  - b) Mechanical inspection of air interrupter switches and circuit breakers to assure proper operation.
- (6) Testing shall be scheduled and coordinated in writing with the Engineer at least 2 weeks in advance. The testing firm shall provide all material, labor, equipment and technical supervision to perform the tests and inspection. Provide certified calibration sheets including dates for all equipment to be used for testing with notice of scheduled testing. Calibration sheets shall also indicate that the units have been calibrated within six months of the testing date. The CONTRACTOR shall have qualified personnel present during the testing.

1.8 INTERPRETATION OF DRAWINGS

- A. The Drawings are not intended to show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.

- B. Unless otherwise approved by the Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.
- C. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.
- D. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation. Any adjustments required in the field shall be provided at no additional cost to the Owner and coordinated and approved by the Engineer.
- E. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the CONTRACTOR and approved by the Engineer during construction. Obtain information relevant to the placing of electrical WORK and in case of any interference with other WORK, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the WORK in an approved manner.
- F. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of the approved equipment at no additional cost to the Owner.
- G. Redesign of electrical or mechanical WORK, which is required due to the CONTRACTOR'S use of an alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the CONTRACTOR at his/her own expense. Redesign and detailed plans shall be submitted to the Engineer for approval. No additional compensation will be provided for changes in the WORK, either his/her own or others, caused by such redesign.
- H. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by 1.72 inch spacers to provide a clearance between wall and equipment.
- I. All ground mounted electrical equipment shall be placed on 4-inch thick (3/4-inch, 45 degree chamfer at all exposed edges) concrete pads, provide reinforcement, anchors, etc.
- J. The CONTRACTOR shall coordinate the WORK of the different trades so that interferences between conduits, piping, equipment, architectural and structural WORK will be avoided. All necessary offsets shall be furnished so as to take up a minimum space and all such offsets, fittings, etc, required to accomplish this shall be furnished and installed by the CONTRACTOR without additional expense to the Owner. In case interference develops, the Engineer is to decide which equipment, piping, etc., must be relocated, regardless of which was installed first.

## 1.9 FINAL ACCEPTANCE

### A. Design Approval:

- (1) The DESIGNER shall design all lighting systems in accordance to the specifications herein. To ensure completeness and consistency of the preliminary plan submittal, DESIGNER shall submit the City's standard lighting design checklist along with preliminary plans, a detailed photometric analysis, voltage drop calculations, and a variance list describing all deviations from the specification and design standards described herein. See Appendix 13-1 for a copy of the City's design checklist.
- (2) Any pole or luminaire not on the City's Approved Product List (APL) are considered non-standard and will require special approval by the City Engineer prior to design. DESIGNER shall send equipment specification sheets/shop drawings along with a

statement detailing why non-standard equipment is required to the Department of Public Works for review. Approval will be granted on a case-by-case basis and must be reasonably justified to be considered. The City shall be given a minimum of 60 days to complete their evaluation of non-standard equipment.

- (3) DESIGNER will address all preliminary plan comments made by the city and submit final plans along with a comment resolution letter to the City for final approval prior to installation.

B. Record Drawings:

- (1) As the WORK progresses, legibly record all field changes on a set of Project Contract Drawings, hereinafter called the Record Drawings.
- (2) Record Drawings shall accurately show the installed condition of the following items:
  - a) Power Riser Diagram(s).
  - b) Equipment elevations (front views).
  - c) Raceways and pull boxes.
  - d) Conductor sizes and conduit fills.
  - e) Control Wiring Diagram(s).
  - f) Lighting fixture, receptacle and switch outlet locations.
  - g) Underground raceway, hand hole and duct bank routing.
  - h) Plan view, sizes and locations of distribution transformers and outdoor electrical equipment enclosure.
- (3) Submit the record drawings to the Engineer.

C. System Acceptance

- (1) Inspection, testing and submittal requirements listed in these specifications must be performed prior to application for final acceptance.
- (2) Once construction is complete, the Contractor must submit the following documents to the City's Department of Public Works to apply for final acceptance of the lighting system by the City.
  - a) System Inspection Certification from a Florida Licensed Electrical Engineer who personally inspected the field equipment and has verified that the installed lighting system is in conformance with all application building and electrical codes.
  - b) Design Certification Letter from the ENGINEER OF RECORD stating that the constructed lighting system meets the design intent and was installed in accordance with all applicable codes and is suitable to be energized.
  - c) Elevation Certification (FEMA Form 086-0-33) completed and signed by a Florida licensed engineer or land surveyors verifying equipment elevations compared to the Base Flood Elevation.
  - d) As-Built plans identifying any change made to the design during construction.
- (3) Contractor is responsible for the maintenance and repair of the lighting system until Final Acceptance of the equipment by the City.
- (4) Where non-standard poles or light fixtures are allowed, the CONTRACTOR or DEVELOPER shall submit a written agreement to maintain the lighting system until such time as the City deems necessary.

## 2.0 MATERIALS

### 2.1 SERVICE POINTS

- A. 100 AMP typical (60 AMP Minimum); 240 volts typical (480 volt maximum), 3 wire single phase.
- B. Contractor to coordinate with Florida Power & Light (FPL) for service location and schedules
- C. To have disconnect, lighting contactor and photo cell at a minimum.
- D. Must have separate circuits for Pedestrian Lights, Street Lights and up-lights. Also separate circuit(s) for receptacles. Circuits will be as shown on the drawings and shall be clearly marked within the service point enclosure.
- E. All below – grade conduit 2” PVC.
- F. All above – grade conduit 2” RIGID.
- G. Service points on FPL poles not allowed.

### 2.2 CONDUIT

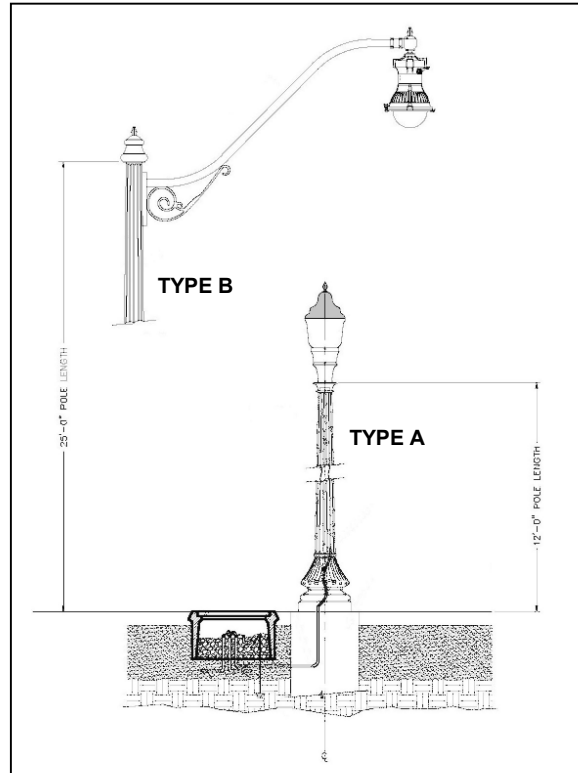
- A. Shall be scheduled 40 2” PVC electrical grade, unless noted otherwise on the drawings.
- B. Shall be solvent welded at all joints.
- C. Shall be at a minimum 24” depth.
- D. When trenching for new system without new road construction, conduit trench shall be backfilled to 2” above pipe with clean sand. Flowable fill shall be used to fill the rest of the trench when under roadways.
- E. In new road construction, the CONTRACTOR shall trench and backfill with compacted limerock in concert with roadway base construction.
- F. Shall be located, where practical: along Lip-of-gutter, 6” – 12” out; along median curb, 12” – 24” out; back of curb, 6” – 12” out.
- G. Caution / locating strip to be placed above all conduit runs.

### 2.3 PULL BOXES

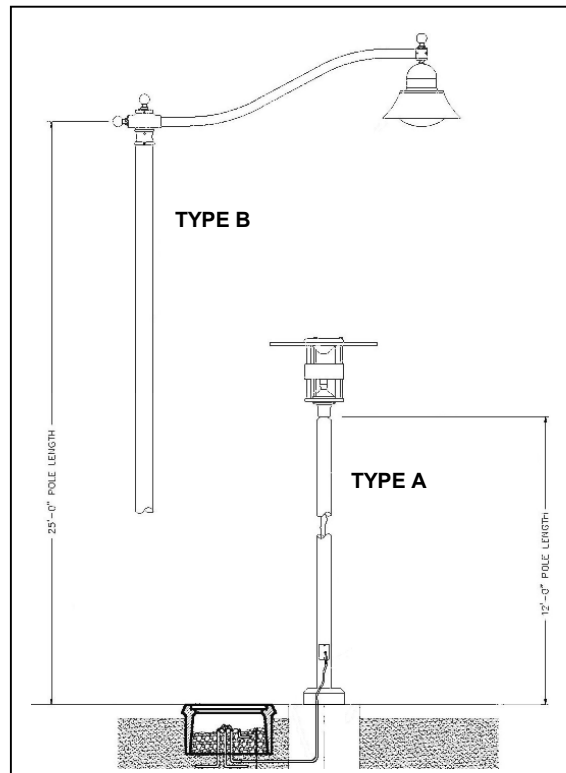
- A. To be Quazite 13”X24” or 17”X30” as applicable – see standard details.
- B. Shall be installed within 3 feet of each light pole location.
- C. Shall have 4” deep concrete collar, with 12” minimum width on all sides, in areas that are subject to possible vehicular traffic.
- D. Shall be installed on both sides of any road crossing.
- E. Shall have a ground rod inside box wherever splices are made within the box.
- F. Shall have 12” pea rock base plus interior filled to 2” depth with pea rock – see standard details.

## 2.4 STREET LIGHTS

- A. Only approved light poles and luminaires, as shown on the City's Approved Product List (APL), shall be used within the right-of-way along City streets. The APL can be found in Appendix 13-2 of these specifications. Other poles and fixtures will only be considered for use if there is a compelling justification to do so. Non-standard equipment will require approval by both the Department of Public Works (DPW) and the Planning Department prior to design.
- B. The City allows three distinct styles of lighting; Traditional Ornamental, Modern and Coastal, each of which are described below. However, not all styles are allowed within all areas of the City. DESIGNER shall contact the City's Planning Department and Confirm which styles are allowed within a specific project area prior to design.
- (1) **Traditional Ornamental Style** – These are decorative fixtures that provide a vintage or “throwback” feel. They typically consist of fluted poles with antique-looking base. Roadway lighting poles of this style typically provide a 25' to 30' mounting height and pedestrian scale poles are typically 10' to 16' in height. In both cases, the use of an LED light source is required to reduce electrical and maintenance cost and a IES Type III light distribution is typical to limit the amount of light thrown to the back side of the poles (away from the street). This style light is used throughout the City in a variety of residential and commercial areas and are typically black in color. All post top mounted pedestrian lights shall include an opaque cap to reduce up-light.
  - (2) **Modern Style** – These decorative fixtures portray a more modern and vibrant feel than traditional ornamental fixtures. The mounting heights are similar to the traditional fixtures, with poles in the 25' to 30' range for roadway lighting and 10' to 16' for pedestrian-scale lighting, and the required light source is LED for cost savings. Light distribution for modern fixtures, is typically IES Type



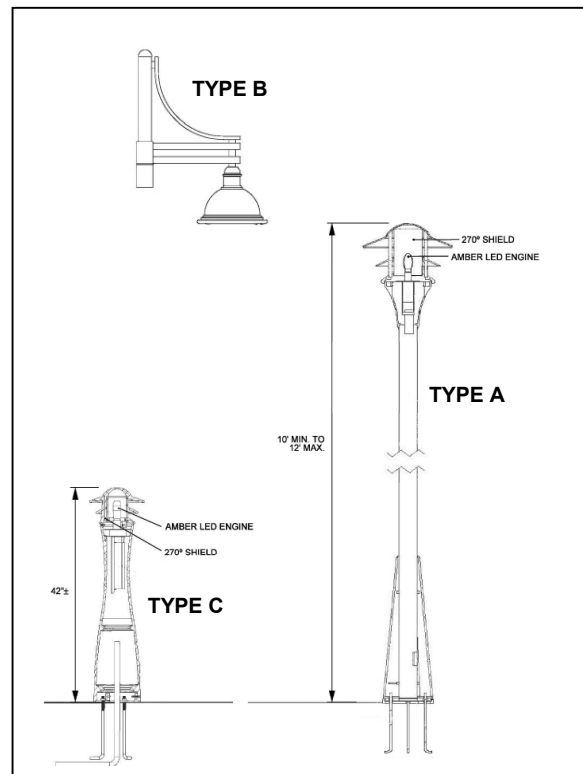
*Example of Traditional Ornamental Style Lighting  
(Type A – Pedestrian Scale; Type B – Roadway)*



*Example of Modern Style Lighting  
(Type A – Pedestrian Scale; Type B – Roadway)*

III along roadways, but IES Type V is allowed for pedestrian scale lighting in commercial areas to brighten the activity areas in front of businesses. This style light is mostly used in commercial areas where businesses desire a more modern feel. They are not recommended for residential zones. Depending on the areas of the City, modern lights may be colored black, white, gray or silver. The color selected must be consistent with existing lighting within the project area.

- (3) **Coastal Style** – This style light is used within the Coastal Construction Control Line to limit light trespass onto beach areas. Fixtures included in this style are much more restricted in their light distribution options, mounting heights and lamp types. Coastal style pole must not exceed a 12 foot mounting height and the light source must be shielded from the coastline by a 270° shield or through the use of a berm. The light source for all Coastal style lights must be Amber LED for Sea Turtle protection. Poles can be white or black in color.



*Example of Coastal Style Lighting  
(Type A – Pedestrian Scale; Type B – Ped. Scale Pendant; Type C – Bollard)*

- C. All poles must meet the requirements of AASHTO's Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, and the FDOT Structures Manual. Poles shall be designed to withstand a 150 mph wind load.
- D. LED Lamps are the required light source for all new lighting systems installed within the City. The light color emitted by the LED lamps shall be in the 2,700K to 3,000K temperature range, unless the City Engineer directs use of a whiter light (4,000K or 5,000K) for crime prevention purposes. Coastal areas will utilize sea-turtle safe amber colored LED's.
- E. Mounting height shall be as shown on the City's lighting standards for the luminaire specified.
- F. To be set on pre-cast concrete base (cast-in-place not allowed) – see standard details.
- G. Base to have tamper-proof access panel.
- H. Luminaires shall be wired for 3-wire single phase power, unless otherwise approved by the Engineer. Voltage shall 120V to 480V based on the service point output.
- I. Light bases shall have in-line fuses on both hot & neutral legs. Fuse shall be 5A for hot legs and a copper plug shall be used on neutral legs.
- J. Each roadway luminaire shall have its own photocell, even if photocontrol exists at the service point, to allow the ability of full time power at each pole for future receptacles, CCTV cameras or other equipment attachments. Pedestrian poles and bollards do not require separate photocells unless receptacles are planned for in the design.
- K. All poles shall include a hand hole located on the side opposite approaching traffic.

### **3.0 EXECUTION**

#### **3.1 INSTALLATION**

- A. Any WORK not installed according to the Drawings and this Division or without approval by the Engineer shall be subject to change as directed by the Engineer. No extra compensation will be allowed for making these changes.
- B. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If an apparatus has been damaged, such damage shall be repaired at no additional cost. If any apparatus has been subject to possible injury by water, it shall be replaced at no additional cost to the Owner, the damaged unit(s) or systems shall remain on site and returned to the manufacturer after the replacement unit(s) or systems have been delivered to the site. Under no circumstances will electrical equipment damaged by water be rehabilitated or repaired; new equipment shall be supplied and all cost associated with replacement shall be borne by the CONTRACTOR.
- C. Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the Engineer's discretion.
- D. Repaint any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted per the field painting requirements, at no additional cost to the Owner.
- E. Phase Balancing: The Drawings do not attempt to balance the electrical loads across the phases. Circuits on panel boards shall be field connected to result in evenly balanced loads across all phases.
- F. All existing equipment removed shall be surrendered to the City at a location that is determined by the City's Department of Public Works. The CONTRACTOR shall contact the City's Department of Public Works to coordinate the equipment transfer prior to commencement of equipment installation.

#### **3.2 SAFETY REQUIREMENTS**

- A. The CONTRACTOR shall make every effort to keep all employees and/or subcontractors aware of the danger inherent in working in dangerous proximity to the existing power lines. The minimum recommended precautionary measures are as follows:
  - (1) Make sure that all persons responsible for operating cranes, draglines and other mobile equipment have a copy of, and are familiar with the State Department of Commerce Regulations for Use of Cranes, Draglines and Similar Equipment Near Power Lines, as well as the U.S. Department of Labor OSHA Regulations, before commencing operation of said equipment.
  - (2) Make sure that all cranes, draglines and other mobile equipment have attached to them the black and yellow Department of Commerce warning signs required by the said Regulations of State Department of Commerce.
  - (3) Warn all employees on the ground, new and old employees alike, of the danger of holding on to or touching a cable or other piece of equipment or machinery that is located or working close to any overhead power line.
  - (4) If, during the course of construction, it becomes necessary for the CONTRACTOR, or subcontractor, and their employees, to operate cranes, draglines, or their mobile



equipment, in dangerous proximity of any overhead power lines, or in such a manner that such equipment might come close to any overhead power lines, the CONTRACTOR shall give the Power Company or overhead power line owner prior notice of such proposed operation.

**APPENDIX 13-1**  
**LIGHTING DESIGN CHECKLIST**

**PROJECT LOCATION:** \_\_\_\_\_ **DATE:** \_\_\_\_\_

**DESIGNER:** \_\_\_\_\_ **PREPARED BY:** \_\_\_\_\_

**1. Style of Lighting Uses (circle one):**      Traditional Ornamental      Modern      Coastal

A. Verification from City Planning that Style is appropriate for project area. \_\_\_\_\_  
Verified by (print name):

**2. Design Criteria**

A. Roadway Type: \_\_\_\_\_

B. Design Standard Criteria:    \_\_\_\_\_ Avg. fc    \_\_\_\_\_ Avg:Min Ratio    \_\_\_\_\_ Max:Min Ratio

**3. Coastal Construction Line (if Applicable)**

A. Is Project within Coastal Construction Line (Check with City Planning Department):    Y / N

B. If Yes, has the following been considered:

i.      Maximum Mounting Height of 12 feet:    Y / N

ii.     Beach Side Shielding:    Y / N

iii.    Type of Shielding:    270° internal shield    or    berm obstructing line of sight

iv.     Turtle Friendly Amber LED Light Source:    Y / N

v.      Is a Florida Department of Conservation permit required:    Y / N      Obtained:    Y / N

**4. Service Point Design**

A. Service Voltage: \_\_\_\_\_ ; Circuit Voltage: \_\_\_\_\_

B. Main Breaker Size: \_\_\_\_\_

C. Photocell at Service Point:    Y / N

D. 50KA Surge Protection included at Service Point:    Y / N

E. Separate Circuits for Roadway Lights, Pedestrian Lights, Up-lights and Receptacles:    Y / N

If No, Provide Justification: \_\_\_\_\_

**APPENDIX 13-1**  
**LIGHTING DESIGN CHECKLIST**

**5. Street Light Design**

A. Are Poles and Luminaires on Approved Product List (APL): Y / N

If No, has non-standard equipment been authorized by City Engineer: Y / N \_\_\_\_\_  
Authorized By (print name)

B. LED Color Temperature: \_\_\_\_\_

C. Mounting Height of Luminaires: \_\_\_\_\_

D. Are House Side Shields to be used: Y / N Why? \_\_\_\_\_

E. Is a pullbox include at each pole: Y / N

F. Are pullboxes located on either side of each road crossing: Y / N

**6. Photometric Analysis**

A. Was photometric analysis performed using approved software: Y / N \_\_\_\_\_  
Software used

B. Does analysis consider potential obstructions (Trees, Buildings, etc.): Y / N

C. Does analysis consider outside light sources that affect analysis area: Y / N

D. Design Values: \_\_\_\_\_ Avg. fc \_\_\_\_\_ Min. fc \_\_\_\_\_ Max. fc  
\_\_\_\_\_ Avg:Min Ratio \_\_\_\_\_ Max:Min Ratio

**7. Voltage Drop Calculations**

A. Number of Circuits being used: \_\_\_\_\_

B. Breaker Size for Lighting Circuits: \_\_\_\_\_

C. Were voltage drop calculations performed for each circuit: Y / N

D. Were all circuit voltage drops less than 7%: Y / N

**8. Plan Submittal and Approval**

A. The following items are to be submitted as part of the initial plan submittal to the City Engineer:

- i. Completed Lighting Design Checklist
- ii. Preliminary Plan Set (3 hardcopies)
- iii. Photometric Analysis with Lighting Contours (1 hardcopy, 1 electronic analysis file)
- iv. Voltage Drop Calculations

B. Once comments from the initial plan submittal are addressed by the design, final plans can be submitted for approval.

**APPENDIX 13-2  
APPROVED PRODUCT LIST (APL)**

<b>LIGHT POLES</b>					
<b>Style</b>	<b>Lighting Type</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Comments</b>	
Traditional Ornamental	Roadway	Hapco	Arlen A0CxxD7-TF0	Tapered Fluted Aluminum	
		Sternberg Lighting	Barrington 8500-RTF	Tapered Fluted Aluminum	
		Traditional Concrete	900 Series	Octagonal Spun Concrete	
	Pedestrian- Scale	Hapco	Arlen A7SxxB5-TF0	Tapered Fluted Aluminum	
		Sternberg Lighting	Barrington 5200-ETFP6	Tapered Fluted Aluminum	
		Traditional Concrete	900 Series	Octagonal Spun Concrete	
	Bollards	Sternberg	Barrington 5201	50" Fluted Aluminum	
	Modern	Roadway	Hapco	RSAXxD6-4	Round Straight Aluminum
			Sternberg Lighting	Urbanline-RSA	Round Straight Aluminum
Pedestrian- Scale		Louis Poulsen	RSA-4.5	Round Straight Aluminum	
		Sternberg Lighting	Urbanline-RSA	Round Straight Aluminum	
Bollards		Louis Poulsen	Waterfront WAT-B	35" Straight Round Alum.	
Coastal	Roadway	Not Applicable. Poles Must be 12' Mounting Height or Less			
	Pedestrian- Scale	Sternberg Lighting	Urbanline-RSA	Round Straight Aluminum	
		Forms+Surfaces	Triada Pedestrian	Round Straight Aluminum	
	Bollards	Forms+Surfaces	Triada Bollard	41.9" Aluminum/Amber LED	

Effective Date: December 20, 2016

**APPENDIX 13-2**  
**APPROVED PRODUCT LIST (APL)**

<b>LUMINAIRES</b>				
<b>Style</b>	<b>Lighting Type</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Comments</b>
Traditional Ornamental	Roadway	Holophane Lighting	Esplanade ESL2 LED	Arm Mounted Pendant Light
		Sternberg Lighting	XRLED-1912	Arm Mounted Pendant Light
		Spring City Electric	ALMEDX-LE-CP	Arm Mounted Pendant Light
	Pedestrian- Scale	Holophane Lighting	Granville II LED*	Post Top Mount
		Sternberg Lighting	Ripon Series 1130ALED*	Post Top Mount
		Spring City Electric	ALMEDM-LE*	Post Top Mount
Modern	Roadway	Sternberg Lighting	Gallery 1970LED	Arm Mounted Pendant Light
		Lithonia Lighting	MR1 LED	Arm Mounted
	Pedestrian- Scale	Louis Poulsen	Albertslund Maxi Post	Post Top Mount
		Lithonia Lighting	MRP LED	Post Top Mount
Coastal	Roadway	Not Applicable. Poles Must be 12' Mounting Height or Less		
	Pedestrian- Scale	Beacon Products	Capitol (Turtle Friendly)	Pendant Mount/Amber LED
		Forms+Surfaces	Triada Pedestrian	Special Request Amber LED

Effective Date: December 20, 2016

\*Note: All Traditional Ornamental Pedestrian Scale Luminaries to be equipped with shorting cap and finial.