SECTION 16500

LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work Included: This Section specifies lighting systems, complete and operable, as indicated in the Contract drawings including fixtures; fixture mounting hardware including brackets, canopies, hangers, and poles; lamps; auxiliary lighting equipment; and lighting control equipment for the MBTA South Acton Commuter Rail Station.

1. The equipment and materials required under this Section shall be in accordance with the general description as indicated in Section 16050 - BASIC MATERIALS AND METHODS FOR ELECTRICAL WORK.
2. Lighting levels shall exceed code minimums for safety and security purposes.
3. The Light control panels shall be located in the Electrical Room.

B. Related Work:

1. Section 16050 - BASIC MATERIALS AND METHODS FOR ELECTRICAL WORK

1.2 SUBMITTALS

A. Submit shop drawings, catalog cuts, descriptive information and photometric data for all lighting fixtures, lamps, auxiliary lighting equipment, lighting control equipment, and mounting hardware. Photometric data to include a computerized print-out detailing the entire finished area being lighted by the submitted luminaires detailing a statistical summary of maintained illuminance levels (MF-.65) on the platform by means of a grid spaced no further than 3 feet on center at a scale of 1" = 8'-0" accompanied with a copy of all input data used to create report. Approval of printout and lighting calculations will be made by the Engineer prior to manufacture of any material.

B. Submit manufacturer's installation instructions detailing the installation procedures and recommended maintenance procedures that will comply with the warranty specified in Section 16500-1, 1.02, D.

C. If specified, before production is commenced, submit a sample fixture of each style, mounting and lamp arrangement specified. Reports indicating that required tests specified have been successfully completed shall accompany each pre-production sample at the time it is submitted. The sample, if approved, will be retained until completion of the work to confirm quality conformance to the prescribed requirements herein. Provide the sample for operation at 120 volts with six-foot cord and plug.

D. Sample for finishes and colors:

1. Submit samples for acceptance showing nominal color(s) and gloss, and the high and low color and gloss range(s) within which the production materials will be processed.
2. Identify samples as to alloy, pretreatment and color.

3. Hold Point. Do not begin processing of production materials until Engineer's written approval of samples has been obtained.

4. Maintain variation in color of installed materials to the color range established by the acceptance samples.

1.3 QUALITY ASSURANCE

A. Fixtures and auxiliary equipment shall be listed, labeled or certified by UL.

B. Replace lamps, which fail within 90 days after final acceptance, at no cost to the Owner.

C. Installation Tolerances: Deviation from location, alignment and mounting height: 1/2 inch noncumulative in any unit or continuous run of fixtures.

1.4 PRODUCT DELIVERY, STORAGE & HANDLING

A. The Manufacturer is required to ship the lighting fixtures, poles, and accessories securely packaged and labeled for safe handling during shipment to avoid damage or distortion.

B. The Contractor is responsible for storing lighting fixtures, poles and accessories in a secure and dry facility and in original packaging to prevent soiling, physical damage, wetting or corrosion prior to installation.

C. Contractor must provide for storage inspection by the Engineer after fixtures have been delivered.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

A. General Requirements

1. Provide lighting fixtures, complete and ready for service, in compliance with UL 57, of the number, type, material, finish, electrical components and characteristics, and with all necessary hardware and auxiliary equipment indicated.

2. The fixtures shall be clearly marked with manufacturer's name and catalog number, voltage, acceptable lamp type, maximum wattage, ballast type, and self-protection, if any. The fixtures shall be identified with standard lamp type and wattage on the exterior of the fixture housing visible from ground level. Two-inch adhesive labels with a number indicating wattage and color signifying lamp type shall be provided.

3. Fixtures shall be rain-tight and dust-tight for use along trackways, for outdoor use, and as indicated. Fixtures must meet IP55 test for water and dust.

4. Fixtures shall be of the same design shape and supplied by the same manufacturer. Luminaires for the project are broken down as follows:

Parking areas, stairwells, sidewalks and platforms will use a 150 watt metal halide luminaire with a fixture (housing) dimension measuring 12" x 17" x 6", or as shown on the contract drawings.

Canopies will use a 100 watt Metal halide luminaire indirect with an (inverted) fixture (housing) dimension measuring 12" x 17 x 6", or as shown on the contract drawings. All canopy fixtures shall be UL approved for raintight use.

B. Materials

1. Thicknesses, gauges and tempers of products: indicated, and as recommended by the manufacturer for the specific finish, proper forming operations and structural requirements.
2. Lighting sheet for reflector material: Prefinished aluminum, minimum thickness 0.032 inch, architectural Type 1 with Class M1, anodic coating providing 83% reflectively.
3. Concrete for base foundations: Section 03300 - CAST-IN-PLACE CONCRETE
4. Acrylic lenses: 100% virgin acrylic plastic.
5. Polycarbonate lenses and diffusers: Injection molded, crystal clear material, polycarbonate.
6. Lenses shall be clipped and hinged.

C. Finishes

1. Finishes shall be in accordance with the manufacturer's recommendations for the specific application.
2. Commence no finishing operations until fabrication and forming operations have been completed.
3. Aluminum work shall be anodized shall be given a preanodic treatment followed by an architectural Class 1, anodic coating as described by the Aluminum Association.

   Anodize aluminum in accordance with procedures established by alloy manufacturer to achieve color within specified range.

   Apply a clear organic protective coating to exposed aluminum surfaces that may experience prolonged contact with caustic material, i.e., concrete, plaster.
4. Baked enamel: Factory applied to clean surfaces prepared with a chromate conversion coating, and prime coating, as indicated.
5. Porcelain enamel coating: In accordance with the requirements of Porcelain Enamel Institute, PEI-S-100.
6. Galvanized coating: Hot-dip galvanized or hot-zinc conforming to ASTM A 386. Where painting of the galvanized surface is indicated, prepare the surface with vinyl acid wash primer with polyvinyl butyral resin 56 pounds, 80 gallons zinc chromate pigment and phosphoric acid.

D. Electrical Components

1. Lampholders and sockets: Class and style recommended by the lamp manufacturer for the specified lamp required by each fixture design and rated for 660 watts, 600 volts or as indicated. Rigidly and securely fastened to the mounting surfaced with the necessary provisions to prevent lampholder from turning and front removable without dismantling any part of the fixture. Located in the lighting fixtures to place each lamp, of size specified, in proper position with relation to the fixture design specified, clearly marked to indicate manufacturer lamp type and

voltage and appropriate listings. High intensity discharge (HID) lampholders: Glazed porcelain body with nonferrous metal components of heavy duty design, vibration resistant, Edison-based lampholders in accordance with the applicable requirements of UL 496.

1) Metal halide lamps that are to be operated in the horizontal position: Position oriented mogul base socket.

2. Ballasts: Ensure ballast operating characteristics comply with the recommendations of the lamp manufacturer with regard to lamp electrical characteristics. Provide ballasts suitable for the line voltage with 0.9 power factor, and maximum current crest factor of 1.8. The ballast shall provide reliable lamp starting at the minimum temperature indicated, and operate in ambient temperatures up to 105˚C with maximum ballast case temperature of 90˚C. Each ballast shall be securely mounted inside the fixture, in such a manner as to obtain the necessary heat dissipation. High intensity discharge ballasts shall conform to the applicable requirements of UL 1029. Fluorescent ballasts shall conform to the applicable requirements of UL 935.
Metal halide lamps: Operated by a lead peaked auto, LPA, type ballast. The ballast shall provide reliable single lamp starting at minus 20˚F, and allow plus or minus 10 percent lamp watts variation for a plus or minus 10 percent input voltage variation.
One light fixture per ballast.
Use of remote ballasts shall be restricted to canopy arm light fixtures only.

3. Fixture Wiring
Fixture Wires: Stranded tinned-copper construction, not smaller than No. 16 AWG. Insulation: silicone rubber type SF-2 and 200˚C rated. Conductor size, temperature rating, voltage rating and manufacturer clearly marked on the insulation of each conductor.
Use wires between lampholders and associated operating and starting equipment of the same ampacity rating as leads from the ballast. Wiring within the fixtures shall conform to the requirements of the NEC.
Tape wires at all points of abrasion. No splices shall be permitted within fixtures other than as required to connect lampholders and ballasts.
Fixture Grounding. Unless otherwise specified, the housing of each ballasted lighting fixture shall be provided with a separate, factory-installed grounding device. The grounding device is to be used for connecting a separate, green, grounding conductor to the fixture housing.
Wireways and wiring channels shall have rounded edges or bushed holes wherever conductors pass through. Insulated bushings shall be installed at points of entrance and exit of wiring.

E. Fixture Hardware

1. Latch and release mechanism, hinges, pins and other retaining parts of fixtures; screws, bolts or other assembly and mounting parts: manufactured of Type 316 stainless steel. All springs: heavy duty stainless steel. All retaining hardware: self-retaining.

2. Frame light transmitting elements of the fixture to permit replacement of panels in the frames without the use of tools other than screwdriver or pliers. Secure panels in the frames in a neat, rattle-free manner that will provide proper tolerance for normal expansion and contraction.

3. Form gaskets, sealants and adhesives subjected to high temperature from silicone rubber. Provide other gaskets of neoprene, or as indicated.

4. Fasteners: Provide bolts, nuts, washers, screws, nails, rivets and other fastenings necessary for proper erection or assembly of work. When exposed to the atmosphere, provide fasteners made of 18-8 stainless steel. Fasteners within the housing shall be made of zinc plated, bright iridite, steel or electrogalvanized, gray. Nuts shall have captive externally footed lockwashers.

F. Welding

1. Locate welds in assemblies to be anodized to conceal visible discoloration in the heat-affected zone.

2. Where weld metal will be exposed after anodizing, select filler alloys to closely match composition of base metal. Comply with parent metal manufacturer's recommendations for such filler alloys.

2.2 FIXTURE MOUNTING HARDWARE

A. General Requirements. Provide the fixtures with brackets, straps, canopies, poles and miscellaneous hardware suitable for the mounting method specified.

B. Secure mounting brackets to housing, quantity and spacing as indicated. When exposed to public view, fabricate and finish hardware in matching material to fixture body. Fabricate internal brackets from sheet steel, zinc coated after fabrication.

C. Canopies, holders and similar parts shall be drawn or spun in one piece with a minimum 0.026 inch finished thickness.

D. Tubing used for supporting member shall be seamless drawn with a minimum of 1/16 inch wall thickness of size and length as indicted.

E. Light poles: quantity shall be as per contract drawings. Shall be square, straight (non-tapered) one piece construction with one flush-welded vertical seam, designed to support the light fixture. Pole manufacturer shall provide a wireway access through the base of the pole to accommodate (3) 1" conduits. The wireway access shall cover the entire inside opening of the pole shaft. Pole heights shall be as indicated on the Contract Drawings. Unless otherwise indicated, all poles shall measure nominally 4" x 4" square and shall be manufactured of the same gauge cold rolled steel. Lighting poles along the Platform shall have a mounting height of 12 feet to the top fixture, as shown on Contract Drawings. Poles shall be capable of supporting sign housings measuring 1'-0¾ in size including brackets as required. Sign housings (Track Number Signs & Train Approach Signs) shall be mounted by means of stainless steel hardware in accordance with Section 5500 (Miscellaneous Metals). Poles where speakers will be located shall have the assembly mounted at the top of the pole centered on the mounting for the luminaires (unless otherwise noted). The installing contractor shall coordinate all drilling patterns with the pole manufacturer to accept luminaire(s), sign housings and speaker assemblies as required for mountings as well as wireway access and conduit connections. Poles with sign housings require a 3"x 5" handhole shall be located in line with the top of the sign (9'-0" above finished platform as shown on drawings). The installing contractor shall field verify base conditions and coordinate with base details shown in contract drawings to assure that no field modification of bases will be required. Pole base and anchor bolts shall be covered by a one piece galvanized shroud and secured to the pole base by stainless steel screws.

F. Pole Mounted Fixture Support Arm: Shall be one-piece extruded aluminum measuring 4¼ x 1¾ in section and 5" in length with internal bolt guides and fully radiussed top and bottom. Luminaire-to-pole attachment shall be by internal stainless steel hardware with a gasket to protect from galvanic action and a pole reinforcing plate with a strain relief-wiring device. The arm shall be cut for the specified pole to insure a clean fit.

G. Pole Mounted Fixture Housing: Shall be one-piece die-cast aluminum with integral cooling fins over the optical chamber and electrical compartments. A solid barrier wall shall separate the optical and

electrical compartments. There shall be a double-thick wall with gussets on the support-arm mounting end. Fixture finishes to match that used for the canopy luminaire.

H. Pole Mounted Fixture Lens, Frame, and Latch: Furnish a one-piece die-cast aluminum lens frame with 1" minimum depth around the gasket flange. Integral hinges with stainless steel pins shall provide no-tool mounting and removal from housing. Single die-cast aluminum cam-latch shall provide positive locking and sealing of the optical chamber by a one piece extruded and vulcanized EDPM gasket. A one piece vacuum formed clear UV stabilized polycarbonate enclosure shall be furnished to maintain the seal in lieu of standard tempered glass lens.

I. Pole Mounted Fixture Reflector Module: Modules shall consist of specular Alzak optical segments rigidly mounted in an aluminum frame that attaches to the housing as a one piece module. Modules shall be field rotatable in 90E lateral increments by loosening 4 stainless steel screws and shall meet or exceed the IES distribution referred to as Type III with a Medium classification. The lamp shall be held in place by a 5KV pulse rated socket which is pre-wired by the manufacturer with a quick disconnect plug. All wireways to the optical compartment shall be sealed to prevent unnecessary dirt accumulation.

J. Pole Mounted Fixture Luminaire Electrical Assembly: Provide a removable plate which supports the electrical components. The assembly shall be removable by means of stainless steel spring latches or a quick turn fastening device. Quick disconnect plugs shall be incorporated to aid in the removal of the assembly. All electrical components within this assembly must conform to Section 16500, 2.01.D. Electrical Components.

K. Canopy & Covered Ramp Mounted indirect Fixture Housing: Shall be of sealed, captive, extruded aluminum construction with window cut out for regressed lens and silicon gasket. The 100W metal halide fixture housings shall have integral electronic cold weather ballast suitable for 240V operation.

L. Canopy & Covered Ramp Mounted Fixture Lens, Frame, and Latch: Furnish a one-piece die-cast aluminum lens frame with 1" minimum depth around the gasket flange. Single die-cast aluminum cam-latch shall provide positive locking and sealing of the optical chamber by a one piece extruded and vulcanized EDPM gasket. Lens shall be tempered glass type with micro-prismatic aperture.

M. Canopy & Covered Ramp Mounted Fixture Reflector Module: The module shall consist of specular Alzak optical segments rigidly mounted in an aluminum frame that attaches to the housing as a one piece module. All wireways to the optical compartment shall be sealed to prevent unnecessary dirt accumulation.

N. Canopy & Covered Ramp Mounted Fixture Luminaire Electrical Assembly: Provide a removable plate that supports the electrical components. The assembly shall be removable by means of stainless steel spring latches or a quick turn fastening device. Quick disconnect plugs shall be incorporated to aid in the removal of the assembly. All electrical components within this assembly must conform to Section 16500, 2.01.D. Electrical Components.

O. Finishes

1. Pole Mounted and Canopy Mounted Fixture Housing: A Gray/Galvanized TGIC Thermoset Polyester Powder-Coat 2.5Mil nominal thickness paint shall be applied over a chromate conversion coating to housing, lens frame, latch and support arm.

2. Lighting Poles & Base Cover: Finish shall be hot-dip galvanized conforming to Section 16500-2.1, C, 6.

2.3 LAMPS

A. General Requirements. Provide each lighting fixture with the number, type, and wattage of lamps required by the Contract Drawings. Provide lamps of standard manufacture, readily available, and of the highest efficiency and life consistent with other requirements of the illumination system.

B. Metal Halide Lamps: Clear and provided with position oriented mogul bases. Photometric characteristics shall provide lamp maximum luminous output while lamp operates in the vertical position.

C. Provide an additional 10% spare of each type of lamp installed.

2.4 LIGHTING CONTROL EQUIPMENT

A. General Requirements. Provide lighting control components suitable for the lighting system specified and compatible for interface with other associated control devices. Lighting control components shall be rated for continuous service and operate satisfactorily in every respect while the branch circuit power supply voltage to each system is within a 110 to 480 volt range at 60 hertz. Electrical contacts shall have precious metal surfaces.

B. Lighting Contactors

1. Conform to the applicable requirements of UL 508.
2. Electrically operated and mechanically held.
3. Rated at 600 volts, 60 hertz with ampere rating, number of poles and enclosure as indicated.

C. Time Switches

1. Conform to the applicable requirements of UL 887.
2. Pre-wired with astronomic dial, 36-hour synchronous reserve power motor.
3. Manual on-auto-off bypass switches for up to three individual circuits.
4. Rated at 277 volts, 60 hertz, 40 amperes continuous duty with number of poles, throws and enclosure as rated.

D. Photoelectric Sensor

1. Conform to the applicable requirements of UL 773.
2. Operation in temperature range of minus 50˚C to plus 60˚C.
3. Dusk to dawn operation with adjustments from two to 50 foot candles with a five-second time delay to preclude false switching.
4. Weatherproof and tamperproof.
5. Acceptable for operation from a supply voltage range of 105 to 285 volts AC.
6. Model/manufacturer type as indicated in the drawings
7. Minimum life at rated load: 8000 on-off operations.
8. Photoelectric sensors shall be mounted facing a northerly direction.

9. 1Photoelectric sensors, upon failure, shall default to the “on lighting” position.

E. Wall Switches

1. Installed where indicated in drawing package.
2. Switches: Single unit, toggle, butt contact, quiet type with an integral mounting strap.
3. Switch Ratings - for 120 volt circuits: 20 amperes at 120 volts AC.
4. Switches shall be connected to the wiring with screw clamp type terminals.
5. Wall Plates

F. Wall Plates

1. Type 304 stainless steel. Standard designs so the products of different manufacturers will be interchangeable.

PART 3 - EXECUTION

3.1 LIGHTING FIXTURES

A. Install lighting fixtures in accordance with the manufacturer's instructions, complete with lamps, hangers, brackets, poles, fittings, and accessories, ready for operation as indicated. Align, mount and level the lighting fixtures uniformly.

B. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Engineer.

C. Lighting fixture supports shall provide support for all the fixtures. Anchor supports to the structural slab or to structural members as indicated. Supports shall maintain the fixture positions after cleaning and relamping.

D. Surface mounted lighting fixtures shall be bracketed rigidly from the mounting surfaces. Provide a 1/4-inch clearance between surfaces when the fixture is flat mounted against concrete surfaces. Nipples carrying wire between fixtures shall be watertight.

E. Exterior fixtures mounted on block or brick walls shall be supported by anchor devices of the expansive lead type. No power driven anchors will be acceptable.

F. Where aluminum is placed in contact with dissimilar materials, except galvanized steel, zinc or stainless steel, treat contact surfaces as follows:

1. When in contact with dissimilar metals, apply a prime coat of zinc chromate primer followed by two coats of aluminum and masonry paint.
2. When in contact with concrete, masonry and plaster, apply to aluminum contact surfaces zinc chromate primer, bituminous paint, aluminum metal and masonry paint or pressure tape.
3. When in contact with wood or other absorptive materials, apply two coats of aluminum house paint to such materials and protect aluminum contact surfaces with bituminous paint.

G. Fixtures shall be pole mounted in accordance with the manufacturers recommended installation practices as indicated.

H. Provide required lamps in each lighting fixture as soon as fixtures are properly installed.

3.2 BALLASTS

A. Install ballasts, other than those mounted integrally within luminaires, as indicated, and in such a manner that the ballast is protected from weather, moisture, and other atmospheric conditions, and in such a manner that ambient temperature surrounding the ballast will not cause the temperature of the ballast housing hot spot to exceed UL requirements. Voltage drop to lamp, due to remote mounting shall not exceed one percent of the nominal lamp voltage. Secondary ballast conductors for metal halide lamps shall have 1000-volt, high temperature insulation. When more than one ballast is mounted at one location, the minimum spacing between ballasts shall be 6 inches in a horizontal direction and 12 inches in a vertical direction. Ballasts shall be cold weather rated type suitable for outdoor operation.

3.3 LIGHT POLES

A. Install light poles in accordance with the manufacturers recommended installation practices as indicated.

3.4 CONCRETE BASES

A. Obtain necessary templates and anchor kits before starting work.

3.5 AUXILIARY LIGHTING EQUIPMENT

A. Install as indicated and in accordance with manufacturer's instructions.

B. Anchor firmly in place.

C. Test and adjust for proper operation in accordance with the manufacturer's instructions.

3.6 LIGHTING CONTROL DEVICES

A. Install lighting control devices in accordance with the manufacturer’s recommended installation practices, and as indicated.

3.7 NEW ELECTRICAL SERVICE – NSTAR

A. NSTAR shall provide pad mounted transformer, new poles and connection to existing aerial medium voltage network. Electrical contactor shall provide concrete transformer pad per NSTAR standards. Electrical contractor shall provide secondary duct bank and cabling to new electrical service closet as indicated in the contract drawings. Electrical contractor shall also provide primary duct bank, concrete encasement and trench backfill up to NSTAR riser pole as indicated in the contract drawings. NSTAR shall provide primary underground cabling, primary and secondary terminations at transformer.

3.8 FIELD QUALITY CONTROL AND INSPECTION

A. Inspect luminaires, lamps and associated hardware prior to and after installation to confirm that they are of the quality and type as specified herein and as indicated, and are free of defects and damage.

B. Provide luminaires and lighting equipment to the project site complete, with suspension accessories, canopies, hickey, castings, sockets, holders, reflectors, ballasts, diffusing materials, louvers, frames, recessing boxes, and related items, completely wired and assembled as indicated.

C. Whenever practicable, verify lighting system operation at the same time that the distribution panelboard or switchboard is tested.

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

A. Separate measurement and payment will not be made for work under this section, but all costs in connection therewith shall be included in the total Contract Lump Sum price for Item 0130.130 - CONSTRUCT PASSENGER STATION FACILITIES

B. An allowance item No. 0130.436 ELECTRIC COMPANY is included in the schedule of bid prices to reimburse the Contractor for costs associated with materials supplied and work performed by NSTAR in relation to NSTAR bringing an electrical service to the South Acton Commuter Rail Station. The allowance does not cover the Contractors costs associated with the installation of this service. Those cost shall be included in the total Contract Lump Sum price for Item 0130.130 - CONSTRUCT PASSENGER STATION FACILITIES

4.2 PAYMENT ITEMS

ITEM NO.	DESCRIPTION	UNIT
0130.130	CONSTRUCT PASSENGER STATION FACILITIES	LS
0130.436	ELECTRIC COMPANY	AN

END OF SECTION