SECTION 26 5600 EXTERIOR AREA LIGHTING

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following lighting equipment:
 - 1. Exterior LED light fixtures with LED modules and drivers.
 - 2. Poles and accessories.

1.02 SUBMITTALS

- A. General:
 - 1. Submit all light fixtures, specified for use on this Project, in a single submittal package of portfolios, so that all light fixtures can be reviewed at one time.
- B. Prepare portfolios from manufacturer's standard specification sheets, and include the number indicated on the Light Fixture Schedule to identify each light fixture. Do not combine more than one light fixture type on a single sheet.
 - 1. Fixture or other materials shall not be shipped, stored, or installed into the work without approval of shop drawings.
 - 2. Modifications to fixtures shall be in accordance with Architect's comments.
- C. Product Data: For each light fixture, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Summary page with the following for each light fixture type.
 - a. The number, type and wattage of the light fixture lamps or LEDs (including, but not limited to, assemblies, arrays, bars or modules).
 - b. Light fixture ballast, driver or auxiliary device manufacturer, number and type.
 - 2. Fixture cut sheets with name of manufacturer and options to be provided marked, including, but not limited to, voltage, lensing, and finish/color.
 - a. Descriptive information providing physical characteristics of light fixture, including, but not limited to, materials, dimensions, effective projected area, fixture efficacy and/or efficiency, and verification of indicated parameters.
 - b. For LED fixtures, include also L70 lifetime and wattage of luminaire including driver/power supply losses.
 - 3. Light fixture mounting details, including, but not limited to, non-standard outlet boxes.
 - 4. Construction of light fixture housing and door (if applicable).
 - 5. Power supply, transformer, and/or driver cut sheet with options marked, providing physical description of auxiliary device including, but not limited to, voltage, power factor, amperage, wattage, and maximum remote distance charts between device and light fixture.

a. For dimming LED, also include dimming type technology and dimming range/limits.

- 6. Lamp cut sheet with options marked, providing physical description of lamps, including, but not limited to, voltage, wattage, efficacy, CCT, CRI, lumens, and life expectancy.
 - a. For LED lamps, include also number of MacAdam ellipse steps and L70 lifetime.
- 7. Details of attaching light fixtures and accessories.
- 8. Details of installation and construction.
- 9. Photometric data, in IESNA format, including LM-79 for LED luminaires, based on laboratory tests of each light fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the light fixture as applied in this Project.
- 10. For pole-mounted LED area lighting fixtures, IES-TM-21 LED luminaire lifetime and lumen maintenance projections.
- 11. Emergency ballast cut sheet: Descriptive cut sheets providing physical description of emergency ballasts for use in normal light fixtures, including, but not limited to, complete battery information, lumens, and method for testing per NFPA 101.
- 12. Photoelectric relays.
- 13. Materials, dimensions, and finishes of poles.

- 14. Means of attaching light fixtures to supports, and indication that attachment is suitable for components involved.
- 15. Anchor bolts for poles.
- 16. Manufactured pole foundations.
- D. Delegated-Design Submittals for Pole-Mounted Area Lighting: Submit the following documents, signed and sealed by a qualified professional engineer:
 - 1. Structural analysis data and calculations used for pole selection and foundations.
 - a. Manufacturer Seismic Qualification Certification: Submit certification that lighting components and their mounting and anchorage provisions are designed to remain in place with out separation of any parts when subject to seismic forces defined in Division 26 Section "Vibration and Seismic and Seismic Controls for Electrical Systems" Include the following:
 - 1) Basis for Certification: Indicate whether withstand certifications are based on actual test of assembled components or calculation.
 - 2) Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - b. Manufacturer Wind-Load Strength Certification: Submit certification that selected total support system, including poles and equipment anchorage devices, complies with AASHTO LTS-4 or as required by the local authority having jurisdication, whichever is more stringent, for location of project.
 - 2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
 - 3. Design calculations for the following:
 - a. Design calculations indicating strength of screw foundations and soil conditions on which they are based.
 - b. Design calculations for determination of poured-in-place concrete foundation size and reinforcement
 - 4. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
- E. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 or as noted elsewhere in this specification and that loads imposed by light fixtures and attachments have been included in design. This certification shall be based on design calculations by a professional engineer.
- F. Qualification Data: For Installer and field testing agency.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For light fixtures and poles to include in operation and maintenance manuals.
- I. Warranty: Special warranties specified in this Section.

1.03 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature
- C. CFL: Compact Fluroescent
- D. CRI: Color-rendering index.
- E. CU: Coefficient of utilization.
- F. Delegated-Design Submittals: Documents, including, but not limited to, drawings, calculations, and material and product specifications prepared as a responsibility of Contractor to obtain acceptance by Owner and authorities having jurisdiction.
- G. EISA: Energy Independence and Security Act of 2007.
- H. HID: High-intensity discharge.
- I. L70: minimum 70% maintained initial-rated lumens at average rated life for LEDs
- J. LED: Light Emitting Diode

- K. LED Lamp: Replaceable LED light source with an integral driver within envelope of lamp. Lamp/Base types may include MR16/bi-pin, PAR/medium base, etc.
- L. LED Module: Light source that contains LEDs, and may include additional components such as lenses, reflectors, or refractors, however do not include drivers.
- M. LER: Light fixture efficacy rating.
- N. Light fixture: Complete light fixture, including ballast housing if provided.
- O. LLD: Lamp Lumen Depreciation.
- P. LLF: Light Loss Factor.
- Q. Luminaire: Complete lighting fixture, including ballast housing if provided.
- R. Pole: Light fixture support structure, including tower used for large area illumination.
- S. Standard: Same definition as "Pole" above.

1.04 QUALITY ASSURANCE

- A. Buc-ee's has secured a special terms program with the lighting fixture manufacturers. For details and pricing contact the following manufacturers:
 - 1. LSI
 - a. Tim Brundrett at Rice Christ Inc., 7002 Briton Centre Court, Houston, Tx 77069, phone: 832 418 9255, timb@rice-christ.com.
 - b. Thomas S. Wright, Regional Sales Manager, LSI Lighting Solutions; phone 214-553-9526(Office),832-866-1155(Mobile);tom.wright@lsi-industries.com.

2. Current Lighting

- a. Jon Thornton (Factory Representative) at Whiteway, Phone 281 744 6223 (Office), Email: Jthornton@vsareps.com.com
- B. Light Fixture Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- C. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this project.
- D. 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.
- E. Comply with IEEE C2, "National Electrical Safety Code."
- F. Comply with NFPA 70.

1.05 COORDINATION

A. Unless otherwise noted, perform all electrical Work required for the proper installation and operation of equipment, furnishings, devices and systems specified in other Divisions of these Specifications, furnished under other contracts, and/or furnished by the Owner for installation under this Contract.

1.06 WARRANTY

A. General Guarantee: For a period of one year after Owner's initial acceptance and establishment of the beginning date of the guarantee period, and at no cost to the Owner, Contractor shall promptly furnish and install replacements for any fixtures or components deemed by the Owner as defective in workmanship under normal operating conditions, excluding lamp replacement as noted in Section 1.12.A.1. Contractor shall repair installed equipment on the job site to Owner's satisfaction. For any time during said guarantee period that fixtures are not fully functional due to defects in material or workmanship, Contractor shall provide or pay for suitable temporary light fixtures, and shall remove said temporary fixtures upon installation of replacement elements. Contractor shall furthermore guarantee replacement fixtures for a period of one year following replacement.

- B. LED Warranties: Shall be free from defects in materials and workmanship for the period indicated from date of factory shipment.
 - 1. LED Luminaires, including LED modules, arrays and drivers: Ten years.
 - 2. LED Lamps: Ten years.
- C. 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. Warranty Period for Light fixtures: Free from defects in materials and workmanship (excluding fuses and lamps) for a period of ten years from date of Substantial Completion.
 - 2. Warranty Period for Metal Corrosion: Free from defects in materials and workmanship for a period of ten years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Free of fading for a period of ten years from date of Substantial Completion.
 - 4. Warranty Period for Poles: Repair or replace light poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than ten years from date of Substantial Completion.
 - 5. Warranty for Pole-Mounted LED Area Lights: Light fixture (including LEDs and drivers) and pole will be free of defects in material and workmanship for a period of ten years from date of product purchase.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. 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.
- C. Retain factory-applied pole wrappings on metal poles until right before pole installation.
- D. Handle all poles with web fabric straps.

PART 2 PRODUCTS AND MATERIALS

2.01 MANUFACTURERS

- A. Buc-ee's has secured a special terms program with the lighting fixture manufacturers. For details and pricing contact the following manufacturers:
 - 1. LSI
 - a. Tim Brundrett at Rice Christ Inc., 7002 Briton Centre Court, Houston, Tx 77069, phone: 832 418 9255, timb@rice-christ.com.
 - b. Thomas S. Wright, Regional Sales Manager, LSI Lighting Solutions; phone 214-553-9526(Office),832-866-1155(Mobile);tom.wright@lsi-industries.com.
 - 2. Current Lighting
 - a. Craig Allen at Current Lighting, 663 Embro Road, Littleton, NC 27850. Phone 252 257 2141 (Office), 252 955 1445 (Mobile). Email: <u>Craig.Allen@currentlighting.com</u>
 - b. Jon Thornton (Factory Representative) at Whiteway, Phone 281 744 6223 (Office), Email: Jthornton@vsareps.com.com
- B. Manufacturers acceptable contingent upon Product's compliance with the specifications: refer to Lighting Fixture Schedules on the drawings for acceptable manufacturers of light fixtures. Acceptable Pole Manufacturers: LSI.

2.02 LIGHT FIXTURES, GENERAL REQUIREMENTS

A. Provide luminaires of the sizes, type and ratings indicated, complete with housings, lenses, refractors, electronics, mounting brackets or hardware with adjusting means and wiring.

- B. Provide luminaires with rigidly formed, weather and light tight enclosures that will not warp, sag, or deform in use. Provide housings free from burrs, sharp edges or corners.
- C. Provide captive hardware hinged doors. Equip door mechanism to preclude accidental falling of the door when opening or closing or when secured in the closed position.
- D. Provide stainless steel hinges, latches, fasteners, and hardware to prevent corrosion of hardware or the staining of adjacent surfaces.
- E. Provide finishes of the color and type indicated and having the following properties:
 - 1. Protection of metal from corrosion minimum 10-year warranty against perforation or erosion of the finish from weathering.
 - 2. Color retention minimum 10-year warranty against fading, staining, or chalking from weathering, including solar radiation.
 - 3. Provide finish of uniform thickness and color, free from streaks, stains or orange-peel texture.
- F. LED sources shall meet the following requirements:
 - 1. Operating temperature rating shall be between -40 degrees F and 120 degrees F.
 - 2. Color Rendering Index (CRI): \geq 65.
 - 3. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR.
- G. LED drivers shall meet the following requirements.
 - 1. Drivers shall have a minimum efficiency of 85%.
 - 2. Starting Temperature: -40° F [-40° C].
 - 3. Input Voltage: 120 to 480 (±10%) V.
 - 4. Power Supplies: Class I or II output.
 - Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
 - 6. Power Factor (PF): ≥ 0.90 .
 - 7. Total Harmonic Distortion (THD): \leq 20%.
 - 8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
 - 9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

2.03 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

- A. Provide poles of the types and heights indicated. Provide internal raceway for underground power supply, with luminaire support pole base indicated. Provide poles that will carry the indicated supports, luminaires and appurtenances, at the required heights above grade, without excessive defection or whipping of the luminaire when subjected to the local IBC basic wind speed with 1.3 gust factor. Pole structural integrity shall rely solely on the anchor bolts, nuts and washers. Pole shall not be in direct contact with concrete base or mortar.
- B. Provide metal lighting poles with steel shaft; equipped for bolt on arm luminaire mounting. Provide wiring access hand hole with welded ½" NC ground lug, readily accessible from hand hole opening. Provide features as follows:
 - 1. Provide a one-piece pole shaft fabricated from weldable grade carbon structural steel tubing with a uniform thickness as required. Material shall conform to ASTM A-500, Grade C.
 - 2. Provide anchor base of the same material and finish as the pole, welded to the pole. Provide adequately sized (at least 15 square inches) hand hole with screwed cover. Provide galvanized steel hold-down or anchor bolts and leveling nuts. Provide full base cover.
 - 3. Factory prime coat with polyester powder-coat paint. Steel poles shall be prime coat, with polyester powder-coat paint. Color to match light fixture. 5-year finish warranty.

- C. Anchor bolts:
 - 1. Provide zinc coated anchor bolts and nuts. Length shall be per pole manufacturer's shop drawings, complete with 3 inch right angle bend on one end and 6 inches of thread on the other end. Provide zinc coated flat washers, lock washers, and hexagonal nuts for each pole.
 - 2. Provide template for positioning of anchor bolts.
- D. Accessories:
 - 1. Full base covers, finish to match pole.
 - 2. Hand hole with cover plate and vandal resistant hardware.

2.04 LUMINAIRE MOUNTINGPOLE ACCESSORIES

- A. Provide corrosion resistant metal luminaire mounting compatible with the poles and fixtures that will not cause galvanic action at contact points. Provide mounting that will correctly position the luminaire to provide the required light distribution. Provide drill mounting to pole shaft unless specified otherwise.
- B. Provide brackets, cantilevered and without under brace, of the sizes, styles, and finishes indicated with straight tubular end section to accommodate the luminaire.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Install in accordance with manufacturer's instructions.

3.02 EXAMINATION

- A. Verify conditions of equipment and installation prior to beginning work.
- B. Verify that equipment is ready for connecting, wiring, and energizing.

3.03 LIGHT FIXTURE INSTALLATION

- A. Install exterior luminaires at locations and heights as indicated, in accordance with the manufacturer's written instructions, applicable requirements of NFPA 70, ANSI C2 and with recognized industry practices to ensure that lighting installation fulfills requirements.
- B. Fasten luminaires securely to indicated structural supports and check to ensure that the required degree of freedom is provided to allow alignment or aiming of the fixtures for indicated light distribution.
- C. Clean exterior luminaires of dirt and debris upon completion of installation. Do not damage finishes or lens.
- D. Provide equipment grounding connections using branch circuit equipment and connected sufficiently tight to assure a permanent and effective ground.

3.04 LIGHT POLE INSTALLATION

- A. Contractor shall not rough-in conduit, drill or pour concrete foundations for site lighting until review of the site lighting submittals is complete. This is to ensure coordination with the current site plan paving and utilities and photometric performance of the submitted product.
- B. Install lighting poles as follows:
 - 1. Install lighting poles and standards as indicated, in accordance with manufacturer's written instructions, and in compliance with ANSI C2.
 - 2. Provide excavation and poured concrete bases using 3,000 pound 28-day concrete, and provide anchor hook-bolts, nuts and washers in conformance with the details and manufacturer's requirements. Refer to Division 3 for concrete work. Project anchor bolts 2-inches minimum above base. Use double nuts for adjustment.
 - 3. To protect finish, use fabric web slings (not chain or cable) to raise and set finished poles and standards.
 - 4. Install pole clear of contact of concrete base or mortar.

- C. Grounding: Provide equipment bonding and grounding connections, sufficiently tight to assure permanent and effective grounds. Bond all metal, non-current carrying parts to ground. Provide 25-feet #4 solid ground electrode from pole base hand holes encased in pier, to bottom of concrete pier with excess ground electrode coiled at bottom of concrete pier. Secure the ground electrode to the reinforcement steel to prevent movement during concrete pour. Bond all metal parts of the pole shaft ground lug. Provide #6 electrode grounding conductor from pole base ground lug to the ground conductor, using thermal fusion (exothermic) methods.
- D. Wiring:
 - 1. Provide cable abrasion wrap at pole top from fixture arm down 2 feet inside pole shaft.
 - 2. Install inline fuse holders, fuses, at base of pole lights on each lighting circuit. Provide Bussman weatherproof insulating boot installed over conductor terminations. Fuse size shall be as follows:

WATTAGE	# OF Fixtures	208V	240V	277V	480V
0-400	1	5	5	5	5
0-400	2	8	8	5	5
0-400	3	10	10	8	5
0-400	4	15	10	10	8

3.05 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Division 26 Section "Raceways and Boxes for Electrical Systems", including use of coated conduits in concrete foundations.

3.06 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole, unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting light fixture to grounding system.
- B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole.
 - 2. Install grounding conductor and conductor protector.
 - 3. Ground metallic components of pole accessories and foundations.

3.07 FIELD QUALITY CONTROL

- A. General: Upon installation of lighting fixtures, and after building circuits are energized, apply electrical energy to demonstrate proper operations of lighting fixtures, emergency lighting, and controls. When possible, correct malfunctioning units at the site, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting.
- B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including plastics and glassware, adjust trim to fit adjacent surfaces, replace broken or damaged parts, and lamp and test fixtures for electrical and mechanical operation. Any fixtures, or parts of fixtures that show signs of rust or corrosion at the time of completion, shall be removed, and replaced with protected metal parts. At the time of Substantial Completion, aim all adjustable fixtures, such as flood and spot lights, per the Architect's direction. Provide all necessary equipment to support this effort, such as scaffolds and lifts, as required.
- C. At the time of Final Acceptance of this Project by the Owner, all lamps shall be in working order and all light fixtures shall be fully lamped.
- D. Final aiming and Adjustment: Aim and adjust aimable and adjustable lighting fixtures for their intended purpose. Re-aim and re-adjust as required to the satisfaction of the Architect/ Owner, including nighttime adjustment of exterior lighting in the presence of the Architect/ Owner.

3.08 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain light fixtures. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION