PART 1: GENERAL

1.01 INTENT AND BACKGROUND

A. The intent of this standard is to establish Cornell’s guidelines for the design, installation, and operation of exterior pole mounted lighting systems and to standardize the fixtures used across the Ithaca campus. This will create a more uniformed appearance while also decreasing maintenance costs.

B. Cornell requires lighting systems that produce a comfortable and efficiently illuminated environment and meet minimum Illuminating Engineering Society (IES) requirements. The pole mounted lighting systems shall be robust, reliable, maintainable, and easily operated. All life cycle cost implications are to be considered for the entire lighting system.

C. Cornell University has committed to a path toward climate neutrality by creating the Cornell Climate Action Plan (CAP). The CAP sets the goal of reducing carbon-based emissions from the Ithaca campus to net zero by the year 2035. This standard supports that goal through the use of energy efficient lighting products and design practices.

D. Any proposed deviations from this standard must be submitted to Cornell Facilities Engineering for approval.

1.02 DESIGN CONSIDERATIONS

A. Site lighting levels must be designed for safety and security as well as comfort for those individuals using the exterior areas.

B. The intent of the engineering design shall be to produce maximum useful light, minimize energy consumption, maximize reliability and minimize maintenance while adding to the aesthetic and historic character of the campus.

C. The intent is to standardize on a limited number of poles and fixtures on campus. The aesthetic appearance of campus will be improved by having a uniform look associated with similar poles, fixtures, illumination, color, and lighting levels for the various classification of areas.

D. This standard is intended to provide direction to mitigate the negative effects of mis-applying luminaire types, over lighting areas, under lighting areas, spill light, and sky glow.
E. Local lighting ordinances shall be adhered to and initiatives of the International Dark-Sky Association (IDA) shall be considered at all times. The Illuminating Engineering Society of North America (IESNA) is the primary resource for recommending lighting levels and defining the proper application of lighting and lighting systems.

F. Lighting designs should take into consideration all sources of illumination in the area. A lighting system should be developed that respects all aspects of the environment. Site lighting not only provides illumination for safety and security, but also designates an entrance or other feature as a destination through the way-finding process.

G. Light distribution types are to be selected to minimize all forms of light pollution and light trespass while providing illumination where needed.

H. Backlight/uplight/glare (BUG) ratings are to be minimized to mitigate the effects of spill light and light pollution.

I. Building mounted luminaires are discouraged to lessen the potential of compromising the building envelope or creating unintended glare. This is especially true on historically significant buildings.

J. Flood lighting and landscape lighting is strongly discouraged.

K. Site lighting and lighting control equipment shall be evaluated for contribution to LEED as governed by Cornell Design and Construction Standard 018110 - Green Building Guidelines.

L. Lighting system designs must consider solutions that offer the lowest total cost of ownership. Provide Lifecycle Cost Analysis (LCCA) of proposed designs using Cornell’s LIFE CYCLE COST ANALYSIS spreadsheet (see Cornell Standard 018130 “ENERGY MODELING GUIDELINES”). Discount rate and escalation rates shall be as specified in the spreadsheet.

M. HID products may be used for special applications upon approval by Cornell Facilities Engineering.

1.03 QUALITY ASSURANCE

A. All outdoor equipment and parts specified shall be UL wet listed/approved where directly exposed to the elements. Current with the date of submittal, the NFPA, NEC, and UL codes, standards and guidelines shall be applied.

B. Prior to design, the engineer shall provide a “Basis of Design” statement that describes lighting objectives and measures to prevent light trespass or pollution.
C. During design, the engineer shall provide a software generated light level report to include the following information: photometric site plan, defined calculation area, luminaire mounting heights, luminaire schedule and horizontal illuminance levels, including average footcandles, maximum/minimum, and average/minimum uniformity ratios. Vertical illuminance levels may be required in specific areas.

D. The design shall provide adequate lighting uniformity to avoid high levels of contrast between luminaires and existing areas of campus.

E. Provide suitable documents and renderings to present to the Authority Having Jurisdiction (AHJ) for approval, if required by the project.

F. Design specifications shall include the requirement for contractors to provide actual foot-candle data with as-built documentation.

G. Reviews and Approvals: Depending upon the scope and location of the project, it may require review and approval from multiple stakeholders as listed below:

1. Cornell University Architect
2. Campus Planning Office
3. Facilities Engineering
4. Energy & Sustainability
5. Cornell University Crime Prevention
6. Grounds Department
7. Local municipality

H. References and Codes:


PART 2: PRODUCTS

2.01 TRADITIONAL/HISTORIC AREAS (Gothic style fixtures and fluted poles)

A. Acceptable Manufacturers

1. Stresscrete/King Luminaire:
   a. Light source – LED
b. Luminaire - K56-S Tudor series. Flat array LED optics and acrylic rippled globe. Total lamp wattage and IES lighting distribution as required per design. Color temperature to be 4500K. Aluminum housing with finial and spurs. Standard 3-1/2” slipfitter for mounting to pole. Factory applied prime coat, one sub coat and one finish coat of black paint.

c. Pole – Cleveland fluted cast aluminum, tapered shaft, overall height 13 feet. Tenon top and base access door and stainless steel hardware. Factory applied prime coat, one sub coat and one finish coat of black paint. Mount on concrete base.

2. Spring City:

a. Light source - LED

b. Luminaire - Edgewater LED series, ALMEDM style. LED’s shall be mounted directly to the roof. Total lamp wattage and IES lighting distribution as required per design. Color temperature to be 4500K. Aluminum housing with finial and spurs. Standard 3-1/2” slipfitter for mounting to pole. Cast aluminum housing with seeded acrylic side panels. Factory applied prime coat, one sub coat and one finish coat of black paint.

c. Pole – North Hampton fluted cast aluminum, one piece unit, overall height 13 feet. Catalog number APSNRT-20-13. Tenon top and base access door and stainless steel hardware. Factory applied prime coat, one sub coat and one finish coat of black paint. Mount on concrete base.

2.02 PARKING LOTS AND ROADWAY AREAS (Shoebox style fixture with round pole)

A. Approved Manufacturers

1. Leotek:

a. Light source - LED

b. Luminaire – Arieta 13 series for poles up to 20 feet, Arieta 18 series for poles above 20 feet. Square, low profile modular design with die-cast aluminum housing assembly, UL wet listed, optional back light cut off shielding, international dark sky association compliant, distribution type (1-5) to be determined during design, direct arm mount with round pole adapter, number of LED’s determined during design, and factory applied prime coat, one sub-coat and one finish coat of black paint. No individual photocell required.

c. Pole – Round straight aluminum. Base access door. Factory applied prime coat, one sub-coat and one finish coat of black paint. Height as required per design, however proposed pole heights should match adjacent conditions where appropriate. Mount on concrete base.
2.03 MODERN/CONTEMPORARY AREAS (Small area non-gothic fixtures and poles)

A. Acceptable Manufacturers

1. Selux:
   a. Light source – LED
   b. Luminaire – Quadro H2 LED, die-cast and formed, low-copper aluminum construction, high transmittance custom molded lenses, IP67 LED module and driver, stainless steel fasteners, tenon top mounting, black.
   c. Pole – Round straight aluminum (A35) with standard base cover (BC5). Height as required per design, however proposed pole heights should match adjacent conditions where appropriate. Mount on concrete base.

2. Bega:
   a. Light source – LED.
   b. Luminaire – 8970LED for symmetrical installations or 8976LED for asymmetrical installations. Die-cast aluminum with clear safety glass and black finish.
   c. Pole – Round straight aluminum. Height as required per design, however proposed pole heights should match adjacent conditions where appropriate. Mount on concrete base.

2.04 REMOTE TRAIL AREAS

A. Approved Manufacturers

1. Cree:
   a. Light source – LED.
   b. Luminaire – XSP1, horizontal tenon mount, type 2 optics, 400k temp rating, universal voltage, black color. Provide mounting bracket PT-1H.
   c. Pole – Fiberglass, as manufactured by PLP Composite Technologies, Inc. 700 series, model number D715, 18 feet total height, 4 feet direct buried, 14 feet above ground. Provide 2-3/8” tenon top and standard sized handhole near base.

2.05 SPORTS FIELD AREAS (High Mast Style Poles and Fixtures)

A. Luminaire: Recent installations of luminaire assemblies for sports lighting on campus have utilized the MUSCO system. Engineer shall consider MUSCO as the preferred system for future installations. System performance and maintenance shall be major considerations for any installation.
B. Mounting:

1. Install each luminaire/pole assembly on a concrete base. Structural analysis shall be provided by engineer for base.
2. Where poles are installed on concrete bases, provide and install the number and size of anchor bolts as recommended by the luminaire manufacturer. Templates will be provided to installer for setting anchor bolts. Anchor bolts shall have right angle legs. Threaded end of anchor bolt should be hot dipped galvanized for a minimum of 10 inches. Two galvanized nuts will be supplied with each anchor bolt. Minimum 4 x 6 inch hand-hole will be provided for conductor splicing. Hand-hole cover shall be attached to pole with vandal resistant fasteners. Pole and luminaire are to meet all EPA requirements.

C. Ballast: High power factor electronic metal halide lamp ballast which maintains lamp wattage within +/-10 percent upon +/-10 percent variation in line voltage and starting current is lower than the operating current, minimum starting temperature and operation at –29C. Ballast voltage rating shall suit available branch circuit voltage and as specified on Contract Drawings.

D. Lamp: Lamp shall be metal halide. Wattage to be specified based on design calculations.

E. Recommended Light Levels: Refer to recommended light levels identified by the IESNA (Illuminating Engineering Society of North America). Coordinate lighting levels based on the use and class/level of competition.

2.06 EMERGENCY BLUE LIGHT

A. Location

1. Emergency lights are for persons in distress to notify the Cornell University Police Department (CUPD) of their situation. They are commonly referred to as “Blue Lights” as they contain a lamp housed in a blue lensed assembly. The assembly includes luminaire, pole, and campus connected telephone.
2. The intent is to locate “Blue Lights” emergency notification assemblies for areas where high levels of security are needed and low levels of refuge exist.

B. Approved Lamp and housing: Manufactured by RAB, model number “VXLED13DG-UP BLU.” This includes die cast aluminum housing, guard, blue frosted globe, 13W LED lamp and driver.
C. Mounting

1. Luminaire shall be mounted to end of 3” heavy wall steel threaded ell. Refer to Cornell Standard Detail 6.6.1 – Blue Light Emergency Telephone.
2. Final design location to be reviewed and approved by Cornell stakeholders (refer to 1.03.G above).

2.07 OTHER AREAS

A. Contact Cornell Facilities Engineering for requirements pertaining to non-pole mounted fixtures such as bollards, wall packs, and parking garage areas. Vandal resistant, temporary and landscape lighting fixtures and applications shall also be coordinated with Cornell Facilities Engineering.

PART 3: EXECUTION

3.01 DESIGN CONSIDERATIONS

A. It is generally more economical to use lamps with higher lumen output at longer interval spacings and higher mounting heights, provided the spacing-to-mounting height ratio is within the range of lighting distribution for which the luminaire system is designed. Refer to section 3.02 for minimum average foot candles and uniformity.

3.02 ILLUMINANCE LEVELS

A. Roadway Classification: Per the Illuminating Engineering Society of North America handbook, most roadways within the central Ithaca campus will be given the “Local” classification. This is defined as roadways used primarily for direct access to commercial property. They do not include roadways carrying through traffic.

B. Area Classification: Per IESNA, most road area classifications will be defined as “Intermediate.” This is defined as those areas of a municipality characterized by frequent, moderately heavy nighttime pedestrian activity, as in blocks having libraries, community recreation centers, large apartment buildings (dorms), or neighborhood retail stores.

C. Uniformity: In roadway lighting, the average-to-minimum and maximum-to-minimum ratios will be used.

D. Minimum Roadway Lighting Levels:
### Recommended Maintained Illuminance Values in footcandles

<table>
<thead>
<tr>
<th>Road Classification</th>
<th>Area Classification</th>
<th>Average Illuminance</th>
<th>Uniformity Avg-to-Min</th>
<th>Uniformity Max-to-Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Intermediate</td>
<td>0.5</td>
<td>6 to 1</td>
<td>10 to 1</td>
</tr>
</tbody>
</table>

### Minimum Pedestrian Walkways and Bikeways Lighting Levels:

Note: Crosswalks traversing roadways in the middle of long blocks and at street intersections should be provided with additional illumination.

<table>
<thead>
<tr>
<th>Sidewalk Classification</th>
<th>Area Classification</th>
<th>Average Horiz. Illuminance</th>
<th>Uniformity Avg-to-Min</th>
<th>Uniformity Max-to-Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadside</td>
<td>Intermediate</td>
<td>0.6</td>
<td>6 to 1</td>
<td>N/A</td>
</tr>
<tr>
<td>Distant</td>
<td>Intermediate</td>
<td>0.5</td>
<td>6 to 1</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Minimum Parking Area Lighting Levels:

<table>
<thead>
<tr>
<th>Parking Classification</th>
<th>Minimum Horizontal Illuminance</th>
<th>Enhanced Minimum Horz. Illuminance</th>
<th>Uniformity Max-to-Min</th>
<th>Enhanced Security Max-to-Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Lot</td>
<td>0.2</td>
<td>0.5</td>
<td>20:1</td>
<td>15:1</td>
</tr>
<tr>
<td>Garage</td>
<td>1.0</td>
<td>N/A</td>
<td>10:1</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### 3.03 INSTALLATION AND CONTROLS

A. Luminaire circuits shall be controlled using a main contactor and single photocell arrangement for the entire group or circuit of luminaires. Individual luminaire photocell control is discouraged unless fixtures are remotely located on a building or other structure. Provide a Hand-Off-Auto (HOA) manual switch in a separately labeled box.
B. The circuit breaker or other overcurrent device protecting an outdoor lighting circuit shall withstand the starting inrush current without nuisance tripping.

C. Fixtures shall be grounded using a safety ground wire. Pole-mounted lights shall be grounded using an 8’ (eight foot) ground rod in pole base in addition to safety ground. Refer to the Cornell University Standard Detail 2.2.6 – Pole Base-Gothic Style.

D. Underground conduit shall be Schedule 40 type PVC encased in concrete, or direct buried Schedule 80 PVC conduit. Install CDR Systems Corporation fiberglass/concrete composite splice box with bolted cover (13”x24” minimum) model A12-1324-24. Install such that distance between boxes does not exceed 300 feet. Coordinate splice box spacing and locations with Cornell Facilities Engineering. Where conduit runs have more than two bends, or severe elevation changes, additional splice locations will be considered. Pull box covers should be labeled “LIGHTING.”

E. Pole-mounted luminaires shall be identified with a field painted white-stenciled number at 8’ (eight foot) above finished grade facing the walk or roadway. Cornell Facilities Engineering will provide all luminaire identification numbers.

F. Poles, luminaries, and pole bases shall be installed and shimmed to be square and plumb. Touch up any marks on luminaire finish made during installation.

G. Coordinate connection of a new luminaire circuit to an existing circuit with Cornell’s Facilities Engineering Electrical Section to verify circuit ampacity and voltage.

H. Poles may be direct burial (without concrete encasement) upon approval of Cornell Facilities Engineering.

I. All luminaires are to be mounted plumb and level.