PART 1  GENERAL

1.01  SUMMARY

A. Section Includes:
   1. Site lighting luminaires and poles
   2. Site lighting illumination levels

B. Related Sections
   1. Section 16501 - Lamps
   2. Section 16502 - Ballasts and Accessories
   3. Section 03300 - Concrete

1.02  REFERENCES

A. Specify Underwriters Laboratories (UL) listed equipment, assemblies and materials.

B. Where appropriate, refer to current ANSI and NEMA Standards for material ratings.


1.03  SUBMITTALS

A. Require submittals under the provisions of Section 16010 - Basic Electrical requirements and 01300 - Submittals.

B. The successful bidder may be required, as a condition of final award, to submit a complete certified photometric test report, produced by an independent testing laboratory, showing candlepower values in 10° horizontal planes (0°, 5°, 15°, . . . 75°, 85°, 90°) and vertical planes (0°, 10°, 20°, 30°,...,170°, 180°) along with complete catalog cut sheets and foot candle level plots.

1.04  Design Requirements

A. Meet light levels and uniformity ratios as recommended by the IESNA’s Recommended Practice Manual: Lighting for Exterior Environments (RP-33-99) and described within this document.

B. All exterior luminaires with more than 1000 initial lamp lumens must be shielded and all luminaries with more than 3500 initial lamp lumens must meet the Full Cutoff IESNA Classification.

C. The maximum candela value of all exterior lighting shall fall within the property.
D. Any luminaire within a distance of 2.5 times its mounting height from the property boundary shall have shielding such that no light from that luminaire crosses the property boundary. Exterior lighting must have a maximum initial luminance of 0.20 horizontal and vertical footcandles at the site boundary and a maximum 0.01 initial horizontal footcandles 15 feet beyond the intended lighting area.

E. Step lights are not permitted to be installed outdoors on campus.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Standard Exterior Luminaires:

1. Luminaires shall be in full compliance with the UCB site lighting master plan and the following:
   a. Luminaries shall be rectilinear style, cut-off type, for LED lamps; shall be of totally enclosed style with extruded aluminum mastarm; shall be rain-tight, dust-tight, and corrosion resistant; shall have housing sides and lens frame made of anodized extruded aluminum with mitered corners, or one-piece cast aluminum housing.
   b. Walkway Luminaries shall be dome top luminaires with the same construction as above.
2. Luminaires must meet the following design criteria:
   a. Luminaires shall be full cut-off.
   b. No candlepower shall be present at or above 90° from nadir.
3. Lamps shall be 70 to 100 watt metal halide for pedestrian lighting, 70 to 150 watt for building, landscape, plazas, and 100-250 watt for roadway and parking lot lighting.
4. Fixture arm shall be a one-piece rectangular aluminum extrusion 0.125” minimum thickness, with centering guides. Luminaire-to-pole assembly shall not have exposed fasteners or welds. Arm assembly, luminaire and pole shall be reinforced as required in order that complete assembly shall withstand 150 MPH wind loading. All steel or cast iron parts shall be hot-processed galvanized and red prime painted.
5. All electrical components shall be UL listed and be an integral part of the luminaire. Ballast components are to be integrated on a single mounting plate, as a self-contained sub-assembly with plug disconnecting means, for easy removal and replacement. Provisions for fast field wiring shall be provided by pre-wiring all electrical components with quick disconnect plugs, temperature stabilized. Ballasts shall not be located inside poles.
6. Ballasts shall be high power factor, constant wattage auto-transformer type and shall provide plus or minus 5% lamp power regulation with plus or minus 10% variation from rated input voltage.

B. Pole:

1. 20-35 foot poles shall be used for roadway and parking lot lighting, 16-20 foot poles for large plaza areas, and 12-15 foot poles for pedestrian lighting. Pole shall be tapered steel shaft of a single piece construction. Shaft shall be continuously welded top and bottom. A reinforced handhole with cover and ground lug shall be provided 18” up from base. Complete standard pole base and base cover shall be provided
including four (4) galvanized anchor bolts with eight (8) nuts and washers and a pressed wood base and bolt circuit template. All poles shall have weathertight caps.

2. Pole shall be supplied with a round base plate cover that shall completely cover the anchor bolts and base plate. The cover shall be drilled and tapped to allow attachment of the cover to the pole.

3. Pole strength shall be guaranteed to withstand winds up to 150 MPH when specified luminaires are attached.

C. Luminaire and Pole Finish:

1. Luminaire, arm and pole top fitting shall receive integral color, Aluminum Association Architectural Class I anodizing (Duranodic R or kalcolorR) after fabrication, Black. Pole should be provided with paint to match luminaire anodized color. A three-stage finishing process consisting of: (a) acid etching, (b) priming, and (c) baked enamel finish, 5 mil thick, shall be considered an acceptable alternate to anodizing.

D. Pole Bases:

1. Concrete pole bases with rebar reinforcement and with embedded anchor bolts. Coordinate design with Structural Engineer for wind loading. Provide one additional empty conduit stub extending five feet from the base of the pole. Each pole base shall have its own ground rod (as per NEC) bonded to rebar.

PART 3 EXECUTION

3.01 INSTALLATION

A. Require ground conductor attached to ground stud on pole and connected to rebar in pole base for all pole mounted assemblies. In addition, a green insulated ground wire shall be required back to panelboard.

B. Require shimming and grouting of pole base to maintain luminaire in true vertical position.

C. Pole bases shall be 2” above finished grade, except where vehicular contact is possible pole bases shall be 3’ above finished grade. Depth of pole base shall be coordinated with Structural Engineer for wind loading of pole assembly.

D. Require aiming at night of directional floodlighting luminaires.

E. The University discourages the use of ballards, direct burial, and ground mounted flood luminaires. Use of these shall be with written University approval only.

F. In ground J-boxes are not permitted. Design shall include pole to pole installation of conduit and wire.

3.02 LUMINAIRE CONTROLS
A. Exterior lighting shall be photocell controlled. Where possible, connect all exterior lighting to a single panel and control with a single photocell contactor system.

3.03 EXTERIOR ILLUMINATION LEVELS

A. Having the campus lighted more effectively with an integrated appearance will improve safety, security, campus image and nighttime space definition. Better continuity in luminaire spacings, fixture types suited to the pedestrian, and improved lighting of buildings and night destinations, is needed.

B. The quality of the light is more important than the quantity of light.

1. Provide proper brightness and glare control. Excessive light levels, or light that is poorly directed, can cause a loss of visibility. If a light is too bright, or if it creates glare, it will prevent a person from seeing through the glare.

2. Provide uniform light. Existing light levels are often more than sufficient for providing a safe environment. Improvements in the quality of the lighting will result in more secure environments, and will improve campus image. For example, reducing lamp wattages for existing area lighting and adding pedestrian-scale luminaires will reduce overall system energy use and will improve the uniformity of light, resulting in less glare and better visibility. Lighting levels shall not exceed 8:1.

3. Light vertical surfaces. The best approach to exterior lighting is to light vertical surfaces like building facades. If only the sidewalk or street pavement is lighted, it is often difficult to detect an approaching person. When an individual’s face is lighted, then detection and recognition can happen much more readily, even at great distances.

The illuminance levels around campus should vary in response to people-use and potential hazards. The following levels of illumination should be maintained for each of the specified locations:

<table>
<thead>
<tr>
<th>Recommended Maintained Horizontal Illuminances For Parking Lots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Activity</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>Low</td>
</tr>
</tbody>
</table>
### Recommended Maintained Horizontal Illuminances for Pedestrian Areas

<table>
<thead>
<tr>
<th>Location of Pathway</th>
<th>Avg. Illuminance Levels in footcandles (at Ground Level)</th>
<th>Average to Minimum Ratio (Not to Exceed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sidewalks along major streets</td>
<td>0.6</td>
<td>5:1</td>
</tr>
<tr>
<td>Nodes</td>
<td>0.4 to 1.8</td>
<td>4:1</td>
</tr>
<tr>
<td>Primary Pathways</td>
<td>0.5</td>
<td>5:1</td>
</tr>
<tr>
<td>Secondary Pathways</td>
<td>0.2</td>
<td>5:1</td>
</tr>
<tr>
<td>Tertiary Pathways</td>
<td>0.2</td>
<td>10:1</td>
</tr>
<tr>
<td>Residential/Dormitories</td>
<td>0.2</td>
<td>5:1</td>
</tr>
</tbody>
</table>

### Recommended Luminance Ratios for Exterior Lighting Effects

<table>
<thead>
<tr>
<th>Lighting Effect</th>
<th>Maximum Luminance Ratio (Max./Min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blending in with surrounds</td>
<td>1:2</td>
</tr>
<tr>
<td>Softly accented</td>
<td>1:3</td>
</tr>
<tr>
<td>Accented</td>
<td>1:5</td>
</tr>
<tr>
<td>Strongly accented</td>
<td>1:10</td>
</tr>
</tbody>
</table>

4. Posts and standards along walks, streets, and bikeways should be placed so that they do not present hazards to pedestrians or vehicles.

5. Glare shields should be installed in new and old fixtures to minimize the amount of light directed by the luminaire into the sky. Light pollution is a serious detriment to campus astronomers.

### 3.04 LUMINAIRE SCHEDULE

A. List outdoor luminaires in luminaire schedule as set forth in Section 16510 - Lighting Fixtures.

END OF SECTION 16530