Street Lighting Design Guideline

1. PURPOSE

The purpose of this guideline document is to assist the internal and external stakeholders dealing with street lighting design, review and approval of electrical drawings. This document briefly summarizes some of the street lighting design criteria outlined with ANSI/IES RP-8-18 Report. Once the IES publishes a new and updated version of the RP-8-18 Report, this document will become void, as only the current IES design standards for pedestrian and roadway lighting should be followed.

2. STREET LIGHTING DESIGN CRITERIA

2.1. Lighting Design Input Parameters

Two sets of main input parameters are to be used for lighting design criteria:

1. Pedestrian activity;
2. Road classification.

Pedestrian activity can be low, medium, or high, based on the total number of pedestrians walking in both directions, within examined area, during the busiest hour of the night:

<table>
<thead>
<tr>
<th>Pedestrian Activity</th>
<th>Number of Pedestrians/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>10 or less</td>
</tr>
<tr>
<td>Medium</td>
<td>11 to 100</td>
</tr>
<tr>
<td>High</td>
<td>Over 100</td>
</tr>
</tbody>
</table>

Table 1: Pedestrian Activity Levels

Road classification can be local, collector, arterial (or major).

2.2. Roadway Lighting

The following lighting parameters to be used for roadway lighting design criteria:

- Average luminance $L_{avg}$ (cd/m$^2$)
- Average uniformity ratio ($L_{avg}/L_{min}$)
- Maximum-to-minimum uniformity ratio ($L_{max}/L_{min}$)
- Maximum-to-average veiling luminance ratio ($L_{Vmax}/L_{avg}$)
The following table summarizes the roadway lighting design standards:

<table>
<thead>
<tr>
<th>Road Classification and Pedestrian Activity</th>
<th>Average luminance $L_{avg}$ (cd/m²)</th>
<th>Average uniformity ratio $(L_{avg}/L_{min})$</th>
<th>Maximum-to-minimum uniformity ratio $(L_{max}/L_{min})$</th>
<th>Maximum-to-average veiling luminance ratio $(L_{Vmax}/L_{avg})$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterial High</td>
<td>≥1.2</td>
<td>≤3.0</td>
<td>≤5.0</td>
<td>≤0.3</td>
</tr>
<tr>
<td>Arterial Medium</td>
<td>≥0.9</td>
<td>≤3.0</td>
<td>≤5.0</td>
<td>≤0.3</td>
</tr>
<tr>
<td>Arterial Low</td>
<td>≥0.6</td>
<td>≤3.5</td>
<td>≤6.0</td>
<td>≤0.3</td>
</tr>
<tr>
<td>Collector High</td>
<td>≥0.8</td>
<td>≤3.0</td>
<td>≤5.0</td>
<td>≤0.4</td>
</tr>
<tr>
<td>Collector Medium</td>
<td>≥0.6</td>
<td>≤3.5</td>
<td>≤6.0</td>
<td>≤0.4</td>
</tr>
<tr>
<td>Collector Low</td>
<td>≥0.4</td>
<td>≤4.0</td>
<td>≤8.0</td>
<td>≤0.4</td>
</tr>
<tr>
<td>Local High</td>
<td>≥0.6</td>
<td>≤6.0</td>
<td>≤10.0</td>
<td>≤0.4</td>
</tr>
<tr>
<td>Local Medium</td>
<td>≥0.5</td>
<td>≤6.0</td>
<td>≤10.0</td>
<td>≤0.4</td>
</tr>
<tr>
<td>Local Low</td>
<td>≥0.3</td>
<td>≤6.0</td>
<td>≤10.0</td>
<td>≤0.4</td>
</tr>
</tbody>
</table>

Table 2: Roadway Lighting Design Standards

2.3. Intersection Lighting

Intersection lighting levels based on various road types and pedestrian activity levels are defined in following table:

<table>
<thead>
<tr>
<th>Road Classification</th>
<th>Average Maintained Horizontal Illuminance (Lux) at Pedestrian Activity Levels</th>
<th>Average-to-Minimum Uniformity Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Arterial/Arterial</td>
<td>≥34.0</td>
<td>≥26.0</td>
</tr>
<tr>
<td>Arterial/Collector</td>
<td>≥29.0</td>
<td>≥22.0</td>
</tr>
<tr>
<td>Arterial/Local</td>
<td>≥26.0</td>
<td>≥20.0</td>
</tr>
<tr>
<td>Collector/Collector</td>
<td>≥24.0</td>
<td>≥18.0</td>
</tr>
<tr>
<td>Collector/Local</td>
<td>≥21.0</td>
<td>≥16.0</td>
</tr>
<tr>
<td>Local/Local</td>
<td>≥18.0</td>
<td>≥14.0</td>
</tr>
</tbody>
</table>

Table 3: Intersection Lighting Design Standards

2.4. Walkways and Pathways Lighting

Along existing sidewalks, the following lighting design criteria should be met:

<table>
<thead>
<tr>
<th>Pedestrian Activity</th>
<th>Maintained Average Horizontal Illuminance (Lux)</th>
<th>Average-to-Minimum Horizontal Uniformity Ratio</th>
<th>Minimum Maintained Vertical Illuminance (Lux) – Desired but not Mandatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>≥20.0</td>
<td>≤4.0</td>
<td>≥10.0</td>
</tr>
<tr>
<td>Medium</td>
<td>≥5.0</td>
<td>≤4.0</td>
<td>≥2.0</td>
</tr>
<tr>
<td>Low</td>
<td>≥3.0</td>
<td>≤6.0</td>
<td>≥0.8</td>
</tr>
</tbody>
</table>
Typically, lighting will be considered for MUPs with expected medium or high pedestrian activity levels.

If it is decided that lighting should be provided for MUPs which are remote from the roadways, the following design criteria to apply:

- Maintained Average Horizontal Illuminance of 5 Lux or greater;
- Maximum-to-Minimum Uniformity Ratio of 10:1 or less.

MUP will be categorized as a remote type (from roadway) including but not limited to the following cases:

- the walking and cycling area of the MUP is not adjacent to the curb of the roadway;
- the walking and cycling area of the MUP is not adjacent to the boulevard that separates the roadway from the MUP’s walking area, and if the area separating the roadway from the MUP contains features (including but not limited to trees, structures, fences etc.) that significantly reduce illumination of the MUP generated by the roadway lighting;
- the walking and cycling area of the MUP is further away from the roadway, at a distance that prevents from proper illumination of the MUP by the roadway lighting.

2.5. Dimming Options

Where dimming of the lighting is considered at certain time of day for justified reasons, the lighting designer to complete two sets of calculations for the same roadways and/or intersections, and to provide two sets of street lighting tables – one corresponding to the lighting levels before dimming is applied, and one corresponding to the lighting levels after dimming is applied. Use of controllers that could be used for creating a smart city multi-application network should be also considered.

2.6. Use of Shields

The City Engineer may consider use of shields for lighting fixtures that are expected to cause, or have been found to cause, lighting trespass.

3. OTHER CONSIDERATIONS

3.1. Pole Color

Unless specified otherwise, the pole color to be Galvanized and Powder Coated Semiglass Textured Black (nut covers to match pole color). RAL 9005.

3.2. Color Temperature

Unless specified otherwise, lighting color temperature to be 3000K CCT.
3.3. Streetlighting Fixture

Unless specified otherwise, all new street lighting fixtures to be designed as LED type, and for Davit type poles use of the following fixture is recommended, but not mandatory:

- LED Roadway lighting, NXT series Fixture: LED Roadway Lighting NXT series fixture, NXT-XX-X-7-2ES-X-XX-3-ULS-2H with adjustable selectable driver. All X's are attributes to be determined by the lighting Consultant to meet City standards for that area. Use of Lumen IQ A640 controllers also to be considered:
  - Where a new service is provided – Lumen IQ640 controllers to be included in design and construction;
  - Where new lights are connected to existing service – Lumen IQ640 controllers to be installed on the new fixtures, but to be set to operate as individual photoelectric cell.
- American Electric, AutoBahn fixture American Electric AutoBahn fixture Model No. ATB2-80BLEDEXX-XXX-R2-XX-P7, could be considered for arterial roads with high capacity.

All new fixtures are required to have 7 pin receptacle (not a 3 pin receptacle), and adjustable selectable driver.

3.4. Additional Design Considerations

Street lighting layout will be determined on a case by case basis by City's Traffic Engineering staff. In general:

- All arterial and collector roads shall have street lighting design with staggered double-sided layout;
- All local roads on 100, 200 and 300 blocks shall have staggered design layout;
- Pedestrian lighting design by including pedestrian luminaires on a stand-alone 4.3m or 4.5m poles, and/or installed on the back of the roadway lighting poles to be provided for:
  - All arterial and collector roads;
  - All local roads on 100, 200 and 300 blocks;
  - St Andrews Avenue;
  - In vicinity of schools, playgrounds, parks, and other pedestrian generators;
  - As determined by City staff on a case by case bases.

Designer engaged to prepare electrical design for a project located on one side of the road, or at one, two or three intersection corners, is required to prepare a complete design including but not limited to:

- Intersection lighting design, including the proposed lights that will be delivered through the current project and future lights at corners that will be constructed by others through future projects;
- When double-sided design is needed, the roadway design shall include the proposed lights that will be delivered through the current project and future lights at opposite site of the road that will be constructed by others through future projects;
- For intersection and roadway lighting calculations, both the proposed and the future lights shall be considered;
- Existing BC owned lease lights shall not be included in lighting calculations. When applicable, removal of existing BC Hydro lease lights shall be considered after City owned lights are commissioned.

Designers working on a street lighting or intersection design on corridors that are on the City plan for future fibre network expansion, shall include empty fibre conduits along the new street lighting
conduits and junction boxes for future fibre. Specifications for the empty conduits and junction boxes for future fibre expansion:

- Concrete Junction Box 5686 METER BOX 15 inch GROOVE TOP WITH K/O;
- New conduit installations shall use 76mm (3") Rigid Type DB/2 PVC conduit for direct bury/concrete applications. If possible the ducts shall be orange in color;
- Only prefabricated factory 90-degree bends (long sweep) are to be used to change conduit direction;
- Prefabricated factory conduit “bell” type end fitting are to be used when ducts enter pull box, manhole, vault, hand hole or other equivalent transitional space;
- Minimum of 2x76mm conduits will be installed during a new installation unless site conditions prevent it.

The following corridors are on City plan for future fibre network expansion:

- Chesterfield Avenue;
- St Georges Avenue;
- East 3rd Street;
- West 3rd Street;
- Lonsdale Avenue;
- 23rd Street;
- Fell Avenue.

3.5. Areas with unique specifications

The following areas have unique specifications. Please contact City’s representative from Traffic Operations/Engineering for additional details:

- Marine Drive
- Esplanade
- Lonsdale
- Harbourside / Automall
- Spirit Trail
- Green Necklace Trail
- Victoria Park
- Waterfront Park
- Jack Loucks Court
- Shipyards
- Rogers
- Carrie Cates

Local roads shall be designed 7.6m galvanized powder coated black Davit poles. Collector and Arterial roads shall be designed with one piece 9.1m or 10.7m galvanized powder coated black poles and 2.4m arms. Typical pedestrian lighting shall be designed with 4.3m to 4.5m poles per City of North Vancouver design detail E1P.