Appendix 7. Streetlighting and Illuminance Instructions

Resources

MCDOT Streetlight Design Requirements: Policy and design guidance on the planning, evaluation, design, and construction of streetlighting. • MCDOT Streetlight Map: Partial database of existing streetlights.

Concepts

- Illuminance
  The measure of the density of light on a surface divided by the area of the surface, which provides an average illuminance over that area. Illuminance is expressed in lux (lx) where 1 lx = 1 lumen per square meter, or footcandles (fc) where 1 fc = 1 lumen per square foot.
- Light Level Criteria
  MCDOT's Streetlight Design Requirements contains target minimum light level criteria by street type for Active Zones and Street Zones (Intersections and Segments).
    - Maintained Average Horizontal Illuminance
      The average amount of light falling on a horizontal plane within a defined area (Active Zone, Intersection, Segment) measured in footcandles. Values greater than or equal to the target value or range are adequate.
    - Maintained Average Surface Illuminance
      The average amount of light falling on a roadway surface within a defined area (Active Zone, Segment) measured in candela per square meter. Values greater than or equal to the target value or range are adequate.
    - Maintained Average Vertical Illuminance
      The average amount of light falling on a vertical plane within a defined area (Active Zone, Intersection, Segment) measured in footcandles. Values greater than or equal to the target value or range are adequate.
    - Minimum Horizontal Illuminance
      The lowest acceptable amount of light falling on a horizontal plane at a specific point measured within a defined area (Active Zone, Intersection, Segment). Values greater than or equal to the target value are adequate.
    - Uniformity Ratio
      The ratio of average horizontal illuminance to minimum horizontal illuminance within a given calculation area (Active Zone, Intersection, Segment). Values less than or equal to the target value are adequate. o Veiling Luminance The ratio of the maximum luminance divided by the average

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luminance for a Segment. Values less than or equal to the target value are adequate.

- Zones
    - Active Zone
      The portion of the right-of-way that contains the Maintenance Buffer, Frontage Zone, Clear Zone (including sidewalks, sidepaths, and separated bike lanes, but excluding buffered bike lanes, conventional bike lanes, and advisory bike lanes), and several types of buffers (Pedestrian-Bike Buffer and Street Buffer).
    - Street Zone
      The area bound by the curbs or pavement that provides access and mobility for motor vehicles, transit, freight, and emergency vehicles. It contains all uses that are typically between the curbs or edges of pavement, including travel lanes, transitway lanes, a median, a Curbside Zone which can include parking, and on-street bike lanes, but excludes separated bike lanes which are part of the Active Zone. The target lighting values for Street Zones are separated into Intersections and Segments. o Intersection: The portion of the Street Zone between the back of all legal crossings where streets intersect. o Segment: The portion of the Street Zone excluding the Intersection.

Approach

- Lighting value metrics must be calculated for each Active Zone, Intersection, and Segment individually. Zones are continuous until interrupted by another zone or roadway centerline.
    - When calculating metrics for a portion of a public street right-of-way, the Applicant may consider lighting output from other portions of a public street right-of-way. The applicant may not consider lighting output from a private street right-of-way.
    - When calculating metrics for a portion of a private street right-of-way, the Applicant may consider lighting output from other portions of a public street or private street right-of-way.
- Photometric evaluations must follow the calculation methodologies detailed in IES RP-821, Recommended Practice: Lighting Roadways and Parking Facilities. Select site specific lighting equipment and mounting heights from MCDOT's specifications.
- When proposing lighting for a private street right-of-way or frontage along a public street right-of-way, provide photometric plan sheets, a photometric legend with labels identifying each Active Zone, Intersection, and Segment (Figure 1), and a table with rows corresponding to locations in the legend and columns containing the information shown in Table 2.

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Local Area Transportation Review (LATR) Study: Illuminance Adequacy

- When determining existing conditions as part of an LATR Study, the Applicant may either collect lighting values in the field or perform a photometric evaluation using computer software based on the existing fixtures being in “like new” working condition.
- In the LATR Study Appendices, provide existing conditions photometric plan sheets, a photometric legend with labels identifying each Active Zone, Intersection, and Segment (Figure 1), and a table with rows corresponding to locations in the legend and columns containing the information shown in Table 2. Underline and highlight inadequate conditions in red, as shown in the example.
- If conditions are inadequate, the Applicant must propose mitigation improvements to bring conditions to adequate levels. The mitigations must be identified even if they are ultimately not included in the final list of mitigations under the proportionality guide. Analyze proposed conditions and provide a proposed conditions table with rows corresponding to locations in the plan sheet(s), and columns containing the information shown in Table 2. Underline and highlight any changed conditions in green, as shown in the example.

Figure 6: Photometric Legend Example

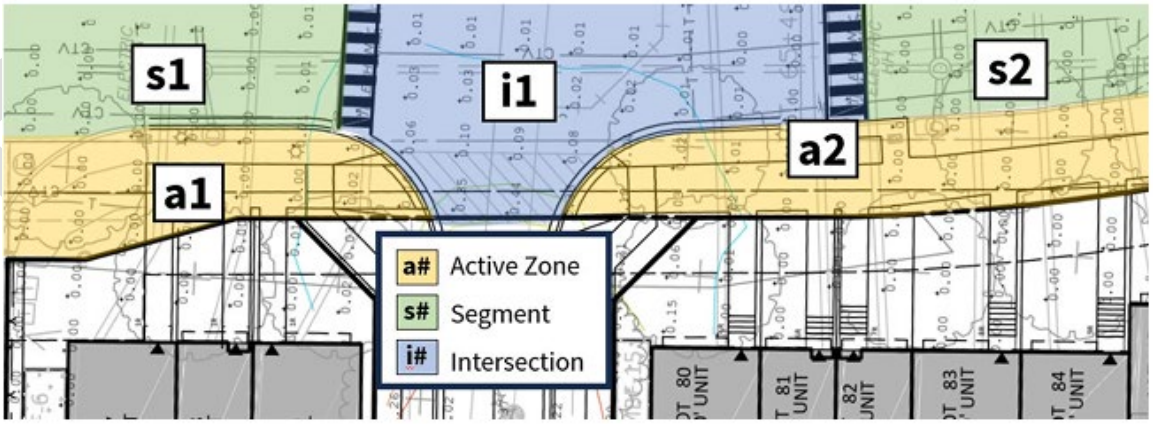

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Table 9: Existing Conditions Example

Key	Zone Type	CSDG Street Type	Min. Horizontal Illuminance (fc), $E_{H,min}$		Maintd. Avg. Horizontal Illuminance (fc), $E_{H,avg}$		Uniformity Ratio ($E_{H,avg}$ / $E_{H,min}$)		Maintd. Avg. Vertical Illuminance (fc), $E_{V,avg}$		Maintd. Avg. Surface Luminance (cd/m^2), L_{avg}		Veiling Luminance (L_{max}/L_{avg})	
			Target (Min.)	**Modeled Existing**	**Target (Min)**	**Modeled Existing**	**Target (Max.)**	**Modeled Existing**	**Target (Min.)**	**Modeled Existing**	**Target (Min.)**	**Modeled Existing**	**Target (Min.)**	**Modeled Existing**
a1	Active	Downtown Boulevard	0.2	0.2	0.9	1.1	3.0	**5.5**	1.0 – 1.2	1.1	2.0 – 2.5	2.2	------	------
a2	Active	Downtown Boulevard	0.2	0.3	0.9	1.1	3.0	3.0	1.0 – 1.2	1.1	2.0 – 2.5	2.2	------	------
s1	Street Zone: Segment	Downtown Boulevard	------	------	0.7 – 1.0	**0.4**	3.0	2.9	------	------	0.6 – 1.5	1.3	0.3	0.3
s2	Street Zone: Segment	Downtown Boulevard	------	------	0.7 – 1.0	0.9	3.0	2.9	------	------	0.6 – 1.5	1.3	0.3	0.3
i1	Street Zone: Intersection	Downtown Boulevard	0.2	0.3	0.9	1.1	3.0	**3.7**	------	------	------	------	------	------

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Table 10: Proposed Conditions Example

Key	Zone	CSDG Street Type	Min. Horizontal Illuminance (fc), $E_{H,min}$		Maintd. Avg. Horizontal Illuminance (fc), $E_{H,avg}$		Uniformity Ratio ($E_{H,avg}$ / $E_{H,min}$)		Maintd. Avg. Vertical Illuminance (fc), $E_{V,avg}$		Maintd. Avg. Surface Luminance (cd/m^2), L_{avg}		Veiling Luminance (L_{max}/L_{avg})	
			Target (Min)	**Modeled Proposed**	**Target (Min)**	**Modeled Proposed**	**Target (Max.)**	**Modeled Proposed**	**Target (Min)**	**Modeled Proposed**	**Target (Min.)**	**Modeled Proposed**	**Target (Min)**	**Modeled Proposed**
a1	Active	Downtown Boulevard	0.2	**0.3**	0.9	1.1	3.0	**3.0**	1.0 – 1.2	1.1	2.0 – 2.5	2.2	------	------
a2	Active	Downtown Boulevard	0.2	0.3	0.9	1.1	3.0	3.0	1.0 – 1.2	1.1	2.0 – 2.5	2.2	------	------
s1	Street Zone: Segment	Downtown Boulevard	------	------	0.7 – 1.0	**0.9**	3.0	2.9	------	------	0.6 – 1.5	1.3	0.3	0.3
s2	Street Zone: Segment	Downtown Boulevard	------	------	0.7 – 1.0	0.9	3.0	2.9	------	------	0.6 – 1.5	1.3	0.3	0.3
i1	Street Zone: Intersection	Downtown Boulevard	0.2	**0.5**	0.9	1.1	3.0	**2.2**	------	------	------	------	------	------