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DEPARTMENT OF TRANSPORTATION
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TRAFFIC OPERATIONS MEMORANDUM NO. 2202

TDOT Traffic Design Manual Chapter 15 Roadway Lighting Design Supplement

Effective February 17, 2022, the attached TDOT Traffic Design Manual Chapter 15 Roadway Lighting Design Supplement includes LED and other roadway lighting design applications. This design supplement shall supersede the TDOT Design Manual Chapter 15 and the TDOT Roadway Lighting Standard Drawings when conflicts exist. However, the TDOT Traffic Design Manual Chapter 15 and the TDOT Roadway Lighting Standard Drawings will continue to be the background for other areas of the roadway lighting design not included in this Design Supplement. Any roadway lighting design deviations from the TDOT Traffic Design Manual Chapter 15, the TDOT Roadway Lighting Standard Drawings, or this Design Supplement shall be approved in writing from the TDOT Signal & Lighting Manager.


Lee Smith (Feb 17, 2022 08:43 CST)

Lee Smith, PE
Interim Director
Traffic Operations Division

LS:SB
2/16/2022
Attachment

General

All LED applications shall follow NCHRP 05-22 (Guidelines for New AASHTO LED Design Manuals) and NCHRP 05-23 (A Study of the Effect of LED on Drivers' Alertness). This design supplement will include LED applications and shall supersede the TDOT Design Manual Chapter 15 and the TDOT Roadway Lighting Standard Drawings when conflicts exist. However, the TDOT Traffic Design Manual Chapter 15 and the TDOT Roadway Lighting Standard Drawings will continue to be the background for other areas of the roadway lighting design not included in this design supplement.

Photometrics

The approved software for roadway lighting photometric analyses is AGI32 unless otherwise approved in writing from the TDOT Signal & Lighting Manager. Other photometric analyses requirements include:

1. Background, sheets, and sketches for the project shall include stations and offsets, names of interstate roads, state routes, and intersections.
 - a. No yellow colors shall be used in the sketch of the site. Two templates shall be prepared: one for the minimum footcandle (fc) and one for the maximum (fc) with the recommended colors are black and red respectively.
 - b. Statistics shall include the values in Table 15.3 for the minimum, average, and uniformity (the average divided by the minimum).
 - c. AASHTO determined the minimum of 0.2, Average shall be taken from Table 15.3 for the different road classification. Under no circumstances can these three values be taken individually (i.e., Table 15.3 lists the Average Maintain Horizontal Illuminance for pavement classification as a minimum but lists the Uniformity Ratio (Avg/Min.) as a maximum).
 - d. Backlight, Uplight, and Glare (BUG) are the new measures that replaced veiling. Using a BUG scale, the best values are 0,0,0 and the worst are 5,5,5. TDOT recommends a maximum BUG value of 3,3,3.
2. Color Correlation Temperature (CCT) shall be as follows:
 - a. Interstate Systems including Interchanges and associated Ramps: 4000-degree K.
 - b. State Routes (especially those near residential areas) and Local Roadways: 3000-degree K.
3. Light Loss Factor (LLF) for LED shall be the manufacturer's recommendations, however the LLF shall not be less than 0.8 in the AGI32 software.
4. Since LED consumes less than 50% of energy compared to HID, luminaires wattage values shall reflect this.
5. High mast mounting height shall not be less than 80 feet and not more than 180 feet. TDOT recommends a range of 100 feet to 150 feet for most locations. Luminaires per ring for the high mast structure shall be even numbers such as 4, 6, 8, and 12. Shields shall be used if residential areas and businesses are near the high mast pole locations. Unhindered access shall be provided for maintenance purposes when determining a high mast location. High mast poles can be moved 15' in longitudinal direction follow the roadway, but not closer to or further from the roadway.
6. Statistical calculations shall include both inside and outside shoulders.
7. The maximum spacing for light poles are set using the AGI32 software. The recommendation for maximum offset and mast arm poles spacing is 250 feet.
8. Type C pull boxes shall be used for all roadway lighting with a maximum spacing is 250 feet unless there is a sharp bend or jack & bore location involving existing roads and business entrances. Regular trenching having a depth of 24 inches shall be used for all locations outside of existing roads

and business entrances. However, a trenching depth of 36 inches shall be used if a jack & bore location is under an interstate or interstate ramps.

9. TDOT only uses the Illuminance Method. Any other method shall be approved by the TDOT Signal & Light Section Manager.

Offset Lighting

The following guidance shall be used for offset lighting:

1. Offset lighting shall be used for interstate systems and for locations where enough ROW is available. The minimum setback is 20 feet from the travel lane, but under no circumstances can the setback exceed 25 feet unless approved by the TDOT Signal & Light Section Manager. If the offset lighting pole is within the clear zone, breakaway supports shall be used.
2. Offset lighting pole mounting heights shall be 40 feet to 55 feet unless placed on median barrier or retaining wall. For mounting height definition, the chapter on definitions must be consulted.
3. Offset lighting cannot be used to light multi-use path or greenway. For these situations, a typical street light pole of less than 40 feet with mast arms shall be used unless decorative street light poles are requested by the local agency.

Voltage Drop

The voltage drop shall follow National Electric Code (NEC) recommendations and is not to exceed 5%. For the lighting control center cabinet, a 6+1 rule shall apply (6 circuit breakers and one spare). Safety factor for the main and branch breakers shall both be applied according to Equations 15.6 and 15.7. For typical interstate interchanges, provide two control centers (one for each side of the interstate). Section 110.12 of the NEC states “Electrical equipment must be installed in a neat and workmanlike manner”. The sizing of conduit(s) should be such as to not fill over 40% of the internal area of the conduit. The LED luminaire shall not use more than one amp.

Bridge Structures

Use the following table to determine whether a bridge structure should have roadway lighting included in the design process:

Proposed Bridge Length	Structural Lighting (714-01)	
	Urban Area	Rural Area
>500 Feet	Required	Local Agency Request
250 Feet to 500 Feet	Engineering Study Needed	Local Agency Request
<250 Feet	Local Agency Request	Local Agency Request

Other bridge structure guidance to follow include:

1. New bridges with the inclusion of pedestrian walkways or greenways shall have structural lighting item 714-01.
2. Underpass lighting shall be used for bridge structures 60 feet minimum width and 80 feet minimum length. Underpass lighting under existing bridge structures shall have 1-inch RGS conduit unless otherwise approved in writing from the TDOT Signal & Lighting Manager.

Other Roadway Lighting Design Criteria

Other roadway lighting design criteria to follow shall include:

1. All roundabouts and mid-block pedestrian crossing shall include lighting design.
2. TDOT only uses steel and aluminum poles. The use of concrete poles shall be approved in writing from the TDOT Signal & Lighting Manager.
3. TDOT standards/specifications shall be used if there is a conflict, perceived or not, between TDOT standards/specifications and local utility standards/specifications.

Typical Interchange Lighting Design Process Guidance

1. Assuming a diamond interchange layout, begin by assigning eight (8) high mast poles for the interchange (2 per quadrant). Make sure that the high mast poles are located outside the clear zone and not located in wetlands, ditches, and other drainage areas.
2. Use offset lights with a spacing of 250 feet when the light levels from the high mast poles is lower than 0.2 fc.
3. Use the AGI32 software to adjust final position and number of high mast poles including the number of luminaires per ring.
4. If a bridge includes structural lighting, then use the lighting poles on the bridge instead of using high mast poles for the lighting design.
5. Follow additional guidance specified in the TDOT Design Manual Chapter 15, TOM 2202, and the TDOT Roadway Lighting Standard Drawings.