TRAFFIC DESIGN MANUAL

APPENDIX E

TDOT LED Specifications/ Roadway and Intersection Lighting Forms

Traffic Operations Division
Traffic Engineering Office

SECTION 714-10 [Excerpt] – TDOT HIGHWAY LIGHTING LED SPECIFICATIONS

714-10-B Light Emitting Diode (LED) Luminaires:

A. Description:

LED (Light Emitting Diode) is an evolving technology and can change very rapidly in terms of luminous efficacy, color quality, optical design, thermal management and cost. Light Emitting Diode (LED) luminaire consists of two components: mechanical and the electrical. Additional materials (i.e. warranty) to support the operation of the luminaire will be discussed in these pages.

1. Mechanical parts:

a. Housing: LED luminaire shall be furnished as a complete unit manufactured according to ANSI C136.37-2011 (or recent version). All luminaires shall utilized LED's from well know and reputable LED manufacturers. As part of the submittal package, the designer shall supply all testing and data sheets for the proposed LED's and these should include-but not limited to- the following: Illuminating Engineering Society of North America (IESNA): LM-79-08, LM-80-08, RP-8-00, TM-3-95 and TM-15-07 (all should be up-to-date versions). LM-79-xx deals with Electrical and Photometric Measurements of Solid-State Lighting Products. LM-80-xx deals with Measuring Lumen Maintenance of LED Light Sources.

1) All internal components shall be assembled and pre-wired using modular electrical connections. Luminaires shall accept a designated voltage range as specified in the plans and operate normally with an input voltage that is within 10 percent of the specified voltage. The luminaires must have a Calculated L70 life at a minimum range of not less than 90,000 but can be more than 100,000 hours. All highway luminaires must be equipped with a "Bird Spike" option to deter nesting on the fixtures.

2) Finished surface: Furnish luminaires with the color mentioned in the plans. The surface of luminaire housing shall meet UL-1598 listed for wet locations, ASTM B117 for salt chamber exposure, and ASTM D1654 for rust creepage.

3) Thermal Management: the luminaire shall start and operate in the ambient temperature range of -40C to +40C.

4) Optical Assembly: The LED optical assembly-consisting of LED packages-shall have a minimum Ingress Protection rating of IP 66 according to ANSI/IEC 60529. The luminaire shall have a standardized refractor/reflector to meet the required optical distribution as required by the plans. The optical assembly shall utilize high brightness, long life, minimum 70 color rendering index (CRI), (3000 K-4000 K) color temperature LEDs binned according to ANSI C78.377. Lenses shall be UV-stabilized acrylic or glass. Provisions for house-side shielding shall be provided when specified.

5) Prevent the entrance of wildlife by limiting openings around the pipe tenon mounting area.

2. Electrical Parts and Safety Testing:

   a. Luminaires shall comply with an ANSI C136.41 with 7-pin receptacle that is fully pre-wire for LED driver's control. Furnish and install photo control unit with the specified driver on each LED luminaire. Decorative, wall mounted, and recessed luminaire may be exempted from these requirements.

   b. LED Driver Requirements: The driver shall meet the following requirements:

      1) Rated to operate in -40 degrees C to 40 degrees C ambient.

      2) Total Harmonic Distortion (THD) to be less than 20 percent.

      3) Have minimum power factor of 90 percent.

      4) Comply with the FCC regulations in 47 CRF Part 15.

      5) Rated for outdoor operations with a rating of IP66.

      6) If a dimmable driver is requested then it shall be compatible with IEC 60929.

   c. Surge Protection: If required per plans then it shall comply with FCC regulations in 47 CFR Part 15, Subpart B for the emission of electronic noise.

   Documents for the materials submitted need a certification from a National Voluntary Laboratory Accreditation Program (NVLAP) and that lab must be recognized by the U.S. Department of Energy.

3. Warranty:

   The entire luminaire and all of its component parts shall be covered by a 10 year written warranty. The warranty should cover materials, fixture finish, and workmanship. Failure is when one or more of the following occur:

   a. Negligible light output from more than 10 percent of the LED packages.

   b. Condensed moisture inside the optical assembly.

   c. Driver that continues to operate at a reduced output below 15% of the rated nominal output.

   The warranty period shall begin on the date of final acceptance of the lighting work. The signed warranty certificate shall be submitted prior to final payment.

LIGHTING DESIGN CHECKLIST COVER PAGE
(FOR ALL LIGHTING PLANS SUBMITTALS)

COUNTY: _____

FEDERAL PROJECT NO.: _____

STATE PROJECT NO.: _____

STATE PROJECT IDENTIFICATION NO.: _____

ROUTE: _____

PROJECT DESCRIPTION: _____

DESIGNER: _____

TDOT DESIGN MANAGER: _____

PROJECTED TURN-IN DATE: _____

PROJECTED LETTING DATE: _____

PHOTOMETRIC/PRELIMINARY LIGHTING PLANS CHECKLIST

PIN: _____ **SHEET 1 OF 1**

DESIGNER: _____

A. LIGHTING CALCULATION SUBMITTALS

___Photometric input File
___Photometric output file (results)
___Survey work file
___Preliminary lighting design work file
___GPK file
___Tin File

B. PHOTOMETRIC DESIGN CALCULATIONS SHEET

Luminaire schedule table:
___Legend, ___Quantity
___Description, ___Catalogue
___Number, ___Lamp wattage
___IES file, ___Light loss factor
___Pole location table, ___Pole
___Numbers, ___Legend, ___Location
___Mounting height, ___Tilt angle

Photometric criteria/design table:
___Avg, ___Max, ___Min
___Max:Min, ___Avg.:Min
___R value, ___L_{avg}, ___L_{min}, ___L_{max}
___L_{Vmax}, ___L_{max}:L_{min}, ___L_{avg}:L_{min}
___L_{Vmax}:L_{avg}, ___Zone symbol
___Utility project number

C. LIGHTING LAYOUT SHEETS (FOR LARGE PROJECTS ONLY)

___Plans layout sheet with sheet number identified
___North arrow and scale
___Legend
___Utility project number

D. PHOTOMETRIC LAYOUT SHEET

___North arrow and scale
___Existing topography and existing
___ROW dimensions
___Location diagram or coordinates for reference points
___Reference points table
___Property owner(s)
___Cross-drains
___All side roads properly labeled
___Proposed horizontal alignment with curve data
___Point by point photometric values
___Legend
___Utilities (Existing)
___Existing light poles to remain
___Existing light poles to be removed
___Proposed light poles and numbers
___Utility project number
___Visual/AGi32 pole locations match proposed pole location in plans
___Photometric calculation zone and zone symbol
___Utility project number

UTILITY/RIGHT-OF-WAY LIGHTING PLANS CHECKLIST

PIN: _____ **SHEET 1 OF 2**

DESIGNER: _____

A. TITLE SHEET

___Location map showing route to be improved, local roads, streams, railroads and towns
___County, state route and description (include log mile)
___P.E. project number
___North arrow
___Project location identified
___Roadway, bridge, box bridge and project length
___Scale
___Design traffic and design speed
___Designer's name
___Index of sheets (Utility)
___Manager 1 name
___Equations and exclusions
___Type of work (Utility)
___Project county identified on state map
___Signatures in signature block

B. CONTROL CENTER DETAILS SHEET

___Preliminary wiring schematic for each control center
___Preliminary breaker sizes
___Preliminary main breaker size
___Service voltage
___Utility/R.O.W. project number
___Preliminary pole mounted controller construction detail
___Preliminary pad mounted controller construction detail
___Proposed control center location and layout referenced

C. LIGHTING DETAILS SHEET

Pole schedule table:
___Pole number, ___Lamp type
___Wattage, ___Voltage,
___Number of heads,
___Control center number
___Circuit number, ___Mounting height station, ___Offset/side

Wire/conduit schedule table:
___Wire number
___Cable number and size
___Conduit number and size
___Spare conduit
___Utility/R.O.W. project number

D. LIGHTING LAYOUT SHEETS (FOR LARGE PROJECTS ONLY)

___North arrow and scale
___Plans layout sheet with sheet number identified
___Utility list/owner
___Legend
___Utility/R.O.W. project number

UTILITY/RIGHT-OF-WAY LIGHTING PLANS CHECKLIST

PIN: _____ **SHEET 2 OF 2**

DESIGNER: _____

E. PRESENT AND PROPOSED LAYOUT SHEET

___North arrow and scale
___Existing topography and existing
___ROW dimensions
___Location diagram or coordinates for reference points
___Reference points table
___Property owner(s)
___Cross-drains
___All side roads properly labeled
___Proposed horizontal alignment with curve data
___Breaks in proposed ROW flagged
___Legend
___Utilities (Existing)
___Utility list/owner
___Existing light poles to remain
___Existing light poles to be removed
___Proposed light poles and numbers
___Proposed lighting conduits and numbers
___Control center
___Proposed jack and bore
___Proposed power source
___Notes
___Utility/R.O.W. project number

CONSTRUCTION LIGHTING PLANS CHECKLIST

PIN: _____ **SHEET 1 OF 4**

DESIGNER: _____

A. TITLE SHEET

___New title sheet for Construction plans showing location map with route to be improved, local roads, streams, railroads, and towns
___County, state route and description (include log mile)
___P.E. project number
___North arrow
___Project location identified
___Roadway, bridge, box bridge and project length
___Scale
___Design traffic and Design speed
___Designer's name
___"See sheet no. 1A for index" added to index area
___Manager 1 name
___Equations and exclusions
___Type of work (construction)
___Project county identified on state map
___Signatures in signature block
___Adjacent construction projects labeled

B. INDEX AND STANDARD DRAWINGS SHEET

___Title sheet
___Roadway index sheets
___Estimated roadway quantities sheet
___General notes sheet
___Special notes sheet (high mast only)
___Control center details sheet
___Lighting details sheet
___Lighting layout sheet (for large projects only)
___Present and proposed layout sheets
___Bore locations and geotechnical notes sheet (high mast only)
___Bore log details (high mast only)
___Foundation details sheet (high mast only)
___Utility index, utility owner, and utility sheets
___Standard roadway drawings drawing number, current revision date and title from roadway design standards index for: traffic control appurtenances; erosion control and landscaping
___Construction project number

C. ESTIMATED ROADWAY QUANTITIES SHEET

___Roadway quantity block with all items of construction to bid, including, ___Item numbers, ___ Description, ___Units, ___Quantity
___Footnotes and miscellaneous removal items
___Sign quantities tabulation block
___Lighting quantities
___Quantities on this sheet checked against other tabulation blocks
___Quantities checked and item numbers agree with cost estimate form
___Construction project number

CONSTRUCTION LIGHTING PLANS CHECKLIST

PIN: _____ **SHEET 2 OF 4**

DESIGNER: _____

D. GENERAL NOTES SHEET

___Grading
___Utilities
___Construction work zone & traffic control
___Lighting
___Special Notes
___Construction project number

E. SPECIAL NOTES SHEET (FOR HIGH MAST PROJECTS ONLY)

___Special notes (for high mast)
___High mast service voltage
___Step down transformer size (lowering device)
___Construction project number

F. CONTROL CENTER DETAILS SHEET

___Final wiring schematic for each control center
___Final breaker sizes
___Final main breaker size
___Service voltage
___Construction project number
___Final pole mounted controller construction detail
___Final pad mounted controller construction detail
___Proposed control center location and layout referenced

G. LIGHTING DETAILS SHEET

Pole schedule table:
___Pole number, ___Lamp type
___Wattage, ___Number of heads
___Control center number
___Circuit number, ___Mounting height station, ___Offset/side

Wire/conduit schedule table:
___Wire number
___Cable number and size
___Conduit number and size
___Spare conduit
___Construction project number

H. SPECIAL LIGHTING DETAILS SHEET

___Details of non-standard TDOT lighting items
___Notes
___Dimensions
___Construction project number

I. LIGHTING LAYOUT SHEETS (FOR LARGE PROJECTS ONLY)

___North arrow and scale
___Plans layout sheet with sheet number identified
___Utility list/owner
___Legend
___Construction project number

CONSTRUCTION LIGHTING PLANS CHECKLIST

PIN: _____ **SHEET 3 OF 4**

DESIGNER: _____

J. PRESENT AND PROPOSED LAYOUT SHEET

___North arrow and scale
___Existing topography and existing
___ROW dimensions
___Location diagram or coordinates for reference points
___Reference points table
___Property owner(s)
___Cross-drains
___All side roads properly labeled
___Proposed horizontal alignment with curve data
___Breaks in proposed ROW flagged
___Legend
___Utilities
___Utility list/owner
___Existing light poles to remain
___Existing light poles to be removed
___Proposed light poles and numbers
___Proposed lighting conduits and numbers
___Proposed jack and bore
___Proposed power source
___Notes
___Construction project number

K. UNDERPASS LIGHTING DETAILS SHEET

___North arrow and scale
___Underpass/bridge labeled
___Existing light poles to remain
___Existing light poles to be removed
___Proposed light poles and numbers
___Proposed lighting conduits and numbers
___Underpass lighting fixture and number
___Conduit size
___Junction box size
___Road side pull box
___Pull box at top of bank
___Electrical connection
___Utilities
___Legend
___Control center and number
___Proposed jack and bore
___Proposed power source
___Notes
___Construction project number

L. BORE LOCATIONS AND GEOTECHNICAL NOTES (FOR HIGH MAST ONLY)

___North arrow and scale
___Existing topography and existing
___ROW dimensions
___Location diagram or coordinates for reference points
___Proposed horizontal alignment with curve data
___Legend
___Bore location and number
___Geotechnical notes
___Geotechnical parameters
___Construction project number

CONSTRUCTION LIGHTING PLANS CHECKLIST

PIN: _____ **SHEET 4 OF 4**

DESIGNER: _____

M. BORE LOG DETAILS SHEET (FOR HIGH MAST ONLY)

___Bore log number
___Bore depth
___Sample number
___N-value (blow counts)
___Graphic Log
___Soil description
___SPT N- value (standard penetration test)
___Water levels
___Construction project number

N. FOUNDATION DETAILS SHEET (FOR HIGH MAST ONLY)

___Foundation details
___Foundation dimensions
___Design wind speed
___Foundation notes
___Materials description
___Construction project number