Chapter 6 Roadway Lighting and Electrical

6.1 Introduction

The primary purpose of this chapter is to provide a comprehensive source of information pertaining to the development of roadway lighting plans for the North Carolina Department of Transportation (NCDOT or Department). The material presented in this chapter provides the user with a synopsis of the highway lighting design process, establishes uniform procedures and standards for designing new roadway lighting systems located within the Department's right of way and presents the Department's criteria, policies, and procedures on these issues.

The illumination requirements are based on recommendations found in the AASHTO *Roadway Lighting Design Guide*, as modified in this chapter, and follow the industry consensus of providing maximum illumination benefits at reasonable costs.

6.1.1 Lighting Overview

The primary purpose of roadway lighting is to provide improved safety, security, and aesthetics for the various users of the roadway and associated facilities. Roadway lighting assists drivers in recognizing the geometry and conflict points of the roadway at extended distances, thereby simplifying the driving task at night. This increases driver visual comfort and reduces driver fatigue, which helps contribute to highway safety.

6.1.2 References

Refer to Section 6.10 below for a list of reference manuals applicable to NCDOT lighting designs.

6.2 Lighting Policy

The *NCDOT Roadway Lighting Policy* is maintained by the Lighting and Electrical Team in the Roadway Design Unit. The NCDOT Roadway Lighting Policy describes the responsibilities and procedures for evaluating projects for lighting warrants and justifications and describes an exception and appeals process.

6.2.1 Roadway Lighting Committee

The NCDOT Roadway Lighting Committee is composed of a diverse group of technical experts from the Roadway Lighting and Electrical Team, Roadway Design Unit, Technical Services, Field Support, Asset Management, Traffic Safety, and Planning and Programming. Federal oversight is performed by a Federal Highway Administration (FHWA) liaison assigned to attend NCDOT Roadway Lighting Committee meetings. The Committee meets quarterly to discuss lighting evaluations performed by the Lighting and Electrical Team and makes a formal determination on including roadway lighting in projects.

6.3 Lighting Evaluations

Because it is not economically feasible to light all conflict points along the roadway, the Department has adopted the Total Design Process (TDP) described in *NCHRP Report 152 Warrants for Highway Lighting* to determine warrants (minimum conditions) for installation of fixed roadway lighting systems on parts of roadways including, but not limited to, continuous sections, interchanges and intersections.

The guidelines for establishing warrants consist of average daily traffic (ADT), geometric, operational, environmental and accident factors. The evaluation method favors roadway facilities that are high in warranting conditions which can be lighted most economically.

Due to confidential cost information required to determine justification, all lighting evaluations are performed in-house by the NCDOT Lighting and Electrical Team.

6.3.1 Full Control of Access Freeways and Interchanges

Lighting evaluations for interchanges and continuous freeway sections are performed in accordance with the TDP as described in *NCHRP Report 152 Warrants for Highway Lighting*. The TDP is a method of determining the cost-effectiveness of installing roadway lighting by generating a Priority Index (PI) to determine if investing state funds is justified.

The PI is based on need (warrant), benefit (traffic volume), and annualized cost factors. The PI is a unitless number established by multiplying need and benefit factors and then dividing by the cost. The result is compared to an accepted threshold value, below which investing state funds for roadway lighting is not justified. If the PI is above the threshold, roadway lighting is justified, and funds may be allocated on a priority basis.

Where a short continuous section of freeway between two justified interchanges does not justify lighting based on the results of the lighting evaluation, lighting may be considered for that section to reduce lighting transitions for motorists. The NCDOT Roadway Lighting Committee makes the final determination on lighting of these sections.

Division Engineers may request lighting for interchanges or continuous freeway sections which are not justified by the lighting evaluation.

Refer to the Exceptions and Appeals sections of the *NCDOT Roadway Lighting Policy* for more information.

6.3.2 Partial, Limited and No Control of Access Roadways and Intersections

The NCDOT Lighting and Electrical Team does not currently evaluate limited, partial, or no control of access roadways and intersections. It is recommended that lighting these facility types be installed via the encroachment process.

Refer to the *NCDOT Utility Accommodations Manual* for information concerning lighting encroachment requirements.

6.4 Illumination Requirements

Recommended roadway lighting illuminance and luminance values are found in the AASHTO *Roadway Lighting Design Guide*. NCDOT uses this guide as the basis for lighting design requirements for freeways, interchanges, rest areas, weigh stations, bridges, and vehicular tunnels. Average illumination requirements have been modified from the AASHTO *Roadway Lighting Design Guide* as discussed in the following subsections.

Luminance is the light value emitted from a source point plus light that is reflected from a surface. Illuminance is the light value on a surface. Using the luminance method for lighting design requires an in-depth knowledge of the many reflective characteristics of the pavement. NCDOT uses the illuminance method for lighting designs.

6.4.1 Continuous Freeway Lighting

Average maintained illumination on travel lanes, including travel lanes on bridges, shall be 0.8 foot-candles with 4:1 average to minimum uniformity ratio. At no point shall the minimum value go below 0.2 foot-candles.

When an overpass bridge is 200 feet or wider, provide underpass lighting when continuous freeway lighting is provided. Provide a light level and uniformity ratio for the underpass equal to the adjacent roadway lighting.

6.4.2 Complete Interchange Lighting

The average maintained illumination on all travel lanes, including travel lanes on bridges, within an interchange, from ramp merging points with the mainline on both sides of the interchange to the ramp terminals with the crossroad, shall be 0.8 foot-candles with 4:1 average to minimum uniformity ratio. At no point shall the minimum value go below 0.2 foot-candles.

When an underpass is 200 feet or wider, provide underpass lighting where freeway or interchange lighting is provided. Lighting shall always be provided when movements for Single Point Urban Interchanges or Diverging Diamond Interchanges are under the structure. Provide a light level and uniformity ratio for the underpass equal to the adjacent roadway lighting.

6.4.3 Rest Areas

The average maintained illumination for the entry gore, interior roadways, and exit gore shall be 0.6 foot-candle, with a maximum 4:1 average to minimum uniformity ratio and a maximum 0.3:1 veiling luminance ratio.

The average maintained illumination for all parking areas shall be 1 foot-candle with a maximum 4:1 average to minimum uniformity ratio, and a maximum 0.3:1 veiling luminance ratio.

The average maintained illumination for picnic areas, sidewalks and other pedestrian areas inside the perimeter roadway and parking areas, shall be 1 foot-candle, with a maximum 4:1 average to minimum uniformity ratio, and a maximum 0.3:1 veiling luminance ratio. Give special attention to areas of sidewalk with steps. Place light standards near steps to provide maximum benefit to pedestrians traversing these areas at night.

The average maintained illumination for walking trails which lead pedestrians away from the outside perimeter of the parking area shall be 2 foot-candles with a maximum 3:1 average to minimum uniformity ratio.

6.4.4 Weigh Stations

The average maintained illumination for all ramps, bypass lanes, parking areas and weigh bridges shall be 1 foot-candle with a maximum 4:1 average to minimum uniformity ratio.

6.4.5 Vehicular Tunnels

Refer to AASHTO *Roadway Lighting Design Guide* Chapter 4.0 for vehicular tunnel lighting requirements.

6.4.6 Limited, Partial and No Control of Access Facilities

Design lighting for limited, partial, and no control of access facilities to meet illumination values shown in the R3 pavement type column of the Illuminance and Luminance Design Value table in the AASHTO *Roadway Lighting Design Guide*.

6.4.7 Roundabouts

Lighting may be included at roundabouts on a case-by-case basis as determined by the Department. Where roundabout lighting is to be included, provide transition lighting along each approach leg, and extend lighting for a minimum of 400 feet from the center of the roundabout.

Design lighting for roundabouts with no lighting on any approach leg beyond the transition lighting at a value 1.3 times the value of the highest light level on any approach leg based on the classification.

Design lighting for roundabouts with approach lighting beyond the transition lighting at a value 2 times the value of the highest light level on any approach leg based on the classification.

Ensure the average to minimum uniformity ratio for all roundabouts is 3:1 or better.

For roundabouts with pedestrian crossings, place lighting so pedestrians are illuminated with positive contrast. Place light poles at a distance of approximately one-half pole height in front of the crosswalk from the driver's perspective.

6.4.8 Pedestrian Underpasses, Culverts and Tunnels

Provide adequate lighting for all pedestrian underpasses, culverts, and tunnels. A well-designed lighting system in these facilities aids users in facial recognition and eliminates dark areas, thereby increasing comfort level, safety, and security of pedestrians using the tunnel.

Design daytime lighting of pedestrian overpasses, culverts, and tunnels at a minimum average of 10 foot-candles with a maximum 3:1 average to minimum uniformity ratio.

Design nighttime lighting of pedestrian overpasses, culverts, and tunnels at a minimum average of 4 foot-candles with a maximum 3:1 average to minimum uniformity ratio.

6.5 Design Criteria

Design lighting to meet the illumination requirements of the AASHTO *Roadway Lighting Design Guide* (as discussed in Section 6.4 above), and the electrical requirements of the *NFPA 70 National Electrical Code* (NEC), and local codes. Use the illumination design values shown in the AASHTO *Roadway Lighting Design Guide* for the lighting design in areas not specifically addressed in Section 6.4. Refer to Section 6.10 below for luminaire specifications.

Provide full interchange lighting for interchanges approved for lighting. Approval from the lighting committee is required for partial lighting, which only provides lighting at decision points and is typically not used.

Lighting designs for interchanges and continuous freeway sections require either light standards (single and/or twin arm) with LED luminaires (traditionally referred to as cobrahead luminaires) or high mast standards with high mast LED luminaires, or a combination of light standards and high mast standards.

Typical mounting height for light standards is 45 feet, unless special circumstances exist which require alternative mounting heights. Include an FHWA approved impact attenuation (breakaway) device for light standards installed in the grassy shoulder or grassy median. Light standards mounted on median barrier or bridge barrier rail do not require impact attenuation devices.

Typical mounting heights for high mast standards are 60 feet, 80 feet, 100 feet, and 120 feet.

6.5.1 Lighting Layout Guidelines

Design the lighting system so lighting can be contained on five circuits or less, leaving one circuit as a spare for future expansion, when possible. Consider the load current for each circuit so that circuits meet the limits presented in Section 6.5.2 below.

Place high mast standards near the intersections of the mainline ramps and the crossroad, with a single high mast standard placed diagonally on each side of the crossroad at the ramp terminal intersections. Place high mast standards between the ramps and the mainline or in the median where setback distance can be met. Maximize the use of high mast poles in the design to reduce use of single and twin arm poles.

Use single arm and twin arm light standards to illuminate areas where lighting from high mast poles cannot adequately reach. Place single arm light standards along the outside shoulder where the ramps merge with the mainline. Place twin arm light standards in a grassy median or on median barrier.

Select combinations of light standards and high mast standards which provide the best lighting design while maintaining the average illumination requirements of Section 6.4 above. Maximize the use of high mast standards to the greatest extent possible to reduce the number of roadside obstacles. Minimize light trespasses outside of the right of way to lessen the impact on residential areas close to interchanges.

Refer to Section 6.5.3 below, for additional pole placement guidelines.

Underpass lighting may be required where interchange or freeway lighting is included. Refer to Section 6.4.8 above for underpass lighting requirements. Where underpass lighting is required, wall mount (Type WM) luminaires mounted on the mechanically stabilized earth wall coping or end bent caps are preferred. When the road intersecting the mainline runs under the mainline, pendant mount (Type PM) luminaires hung from the bridge deck can be used when underpass lighting is required. Because Type PM luminaires require the closure of travel lanes to perform maintenance activities, only use Type PM when Type WM luminaires cannot adequately light under the bridge or when movements for Single Point Urban Interchanges and Diverging Diamond Interchanges occur under the bridge.

6.5.2 Voltage Drop Requirements

NEC Articles 210-19(A) (Informational Note No. 3) and 215-2(A)(1)(b) (Informational Note No. 2), recommend no more than 5 percent combined voltage drop for feeder and branch circuits. Size conductors for lighting circuits to limit the voltage drop from the lighting control panel to the end of any branch circuit to no greater than 3 percent.

6.5.3 Equipment Locations

Locate light standards and high mast standards in areas which provide adequate clearances from utility lines, railroads, and airport glide slope paths. Coordinate lighting design with other utility features. Lighting installations near airfields may require written approval from the Federal Aviation Authority (FAA). Refer to Section 6.9.1 below, for additional information.

The minimum pole setback distances are:

- 15 feet from the edge-of-travel for shoulder mounted light standards
- 50 feet from the edge-of-travel for high mast standards
- 6 feet behind the face of guardrail for both light standards and high masts

- 12 feet from cable guiderail for both light standards and high masts

Install twin arm light standards in a grassy median where the median width is greater than 30 feet or the twin arm standards are protected by guardrail on both sides. Install twin arm light standards on median barrier when barrier is present. Twin arm light standards installed on a barrier are preferred over single arm light standards installed on the shoulder.

Do not locate high mast standards or light standards in the following areas:

- any ditch lines
- retention ponds or other areas of low-lying ground
- inside overhead power utility easements
- in railroad right of way

Placement of high mast standards is typically limited to interchange gore areas. Do not locate high mast standards to the outside of interchange loops, particularly at the location where the loop separates from the high-speed mainline, to the outside shoulder of interchange ramps, or to the outside shoulder of continuous sections of freeway between interchanges. Due to the need for guardrail protection and potential conflict with future widening, installation of high mast standards in the median is discouraged. Exhaust all other methods of providing adequate, cost-effective lighting prior to installing high mast standards in the median.

Locate the lighting control system panel near access to electrical service, inside the control access fence, with easy access and in a central location for all circuit runs. When a meter is mounted on a service pole, mount the pole in an area easily accessible from the road. Mount the service pole no more than 10 feet from the control of access fence as shown in *NCDOT Roadway Standard Drawings* Std. No. 1407.01. If a meter is not mounted on a service pole, as shown in *NCDOT Roadway Standard Drawings* Std. No. 1408.01, Sheet 2, ensure the meter enclosure is easily accessible and not located within 3 feet of an obstruction.

For lighting designs prepared by private engineering firms, submit preliminary lighting plans showing pole and equipment locations to the NCDOT Lighting and Electrical Team Lead prior to proceeding with design.

6.5.4 Photometric Designs

A photometric analysis of the project is required to determine the correct pole type and layout. Use photometric analysis software to calculate the light level and uniformity ratio on all roadway surfaces. The photometric analysis should delineate the coverage area to separate segments of the roadway travel lanes such as the mainline, intersecting road, roundabouts, and bridge underpasses. Refer to Section 6.4 above for illumination requirements.

For lighting designs prepared by private engineering firms, submit photometric layouts with the preliminary lighting plans.

6.5.5 Limited, Partial and No Control of Access Facilities

Generally, the Department does not install, own, or maintain lighting on limited, partial, and no control of access NCDOT maintained roadways per the *NCDOT Roadway Lighting Policy*. Exceptions may be made on a case-by-case request.

Municipalities desiring street lighting for existing NCDOT maintained roadways must submit an Encroachment Agreement request to the District Engineer's office through the *NCDOT Encroachment Agreements* website.

Refer to the *NCDOT Utility Accommodations Manual* for lighting encroachment requirements.

Municipalities desiring installation of street lighting as part of an NCDOT TIP project are required to enter into a municipal agreement documenting the ownership and maintenance of the lighting system after project completion. In most cases the Municipality will be required to reimburse the Department for lighting installed as part of the TIP project and must agree to own, maintain, and pay all utility bills associated with the installed lighting. Municipal Agreements may be coordinated with the Project Manager.

6.6 Design-Build Guidelines

Design-Build projects present unique challenges not experienced on conventional design-bid-build projects. To keep costs down and maintain design consistency, the Lighting and Electrical Team generally provides preliminary and final lighting plans for Design-Build projects.

6.6.1 Scope of Work and Preliminary Lighting Plans

A Lighting Scope of Work is required for all Design-Build projects. The Lighting Scope of Work is included in the request for proposal and describes the Department's requirements for the Design-Build Team as part of the project, including whether the Department or the Design-Build Team is responsible for the lighting design.

For Design-Build projects where NCDOT personnel are responsible for the lighting design, a preliminary lighting design is prepared based on the preliminary roadway plans available at the time of the advertisement. The preliminary lighting design is prepared to a roughly 90 percent state where all equipment is known and the locations are identified; however, stationing is not required at the preliminary stage. The preliminary lighting plans are included with the Design-Build request for proposals. The preliminary lighting design is updated after the final release for construction roadway plans are accepted by the Department. Refer to Section 6.6.2 below for information regarding final lighting plans.

For Design-Build projects where the Design-Build Team is responsible for the lighting design, the team must submit plans showing proposed lighting equipment locations along with a photometric design to the NCDOT Lighting and Electrical Team prior to proceeding with the final lighting design. Maximize the use of high mast poles for interchange lighting designs. It is understood that high mast poles have a higher up-front cost, but this is offset by the ease of maintenance and reduction in roadside obstacles. The NCDOT Lighting and Electrical Team will review the equipment locations for construction or maintenance conflicts. Upon NCDOT approval of the equipment locations, the Design-Build Team may proceed with the final lighting design.

6.6.2 Final Lighting Plans

For Design-Build projects where NCDOT personnel are responsible for the lighting design, upon acceptance of the Design-Build Team's release for construction roadway design plans, the Lighting and Electrical Team prepares the final lighting design plans. Due to the compressed schedules prominent in most Design-Build projects, there is minimal time available to complete the final lighting plans; generally, 10 to 20 business days. Final sealed lighting plans are provided to the Design-Build Engineer who is responsible for distributing the sealed lighting plans to the Design-Build Team.

For Design-Build projects where the Design-Build Team is responsible for the lighting design, the team must prepare and submit final lighting plans based on the equipment locations shown

in Section 6.6.1 above. At a minimum, submit 100 percent plans prior to release for construction plan submittal to allow the Department to comment on the design. Include equipment layout with location, circuitry and duct layout, voltage drop calculations, and photometric calculations with the 100 percent plans. Additional pre-release for construction lighting plan submittals is encouraged during the development of the lighting plans.

6.7 Power Supply

Consider the available power supply when designing lighting plans. The voltage supplied to lighting control systems for roadway lighting is typically 240/480V, 3 Wire, Single Phase. Alternate service voltages and phases can be utilized on a case-by-case basis.

The voltage supplied for rest area, visitor center, or weigh station lighting is typically 120/208V, 4 Wire, 3 Phase.

In the lighting design file, place a control panel with a service pole, when required, near overhead power lines (if available), ideally near the top of a ramp of an interchange.

Refer to *NCDOT Standard Specifications for Roads and Structures* Section 1400-9 for instruction on how to establish electrical service during construction.

A control panel is used to provide power to the luminaires from a central location. Label control panels as “Suitable for Use as Service Equipment” per Standard Specification 1408-02. Include a load schedule table in the lighting plans on the same sheet as the control panel(s). Include location, voltage required, circuit identification, quantity of luminaires, current, KW load, and breaker size in amps on the load schedule. Refer to Section 6.5.3 above for recommended control panel locations.

6.8 Bid Items and Estimates

Lighting bid items are located in Section 1400 of the most recent version of the *NCDOT Master Pay Item List*. Not all items in the Master Pay Item List are required on each project. Pay items with SP in the section column require a Special Provision. Special Provisions are supplied with the project plans and estimate. Refer to Section 6.10 below for additional information on Special Provisions.

Preliminary and final estimates are required for each lighting design. Preliminary estimates are calculated and provided to the Estimating Management Section as part of the lighting evaluation process. Refer to Section 6.3 above for information on lighting evaluations. Final estimates are prepared and provided to the Estimating Management Section after the lighting design is complete.

6.8.1 Design-Bid-Build Projects

Upon completion of the final lighting plans for Centrally let and Division let Design-Bid-Build projects, a complete list of lighting bid items is assembled and uploaded.

For in-house lighting designs, the bid items are uploaded by the Lighting and Electrical Team into AASHTOWare Project (AWP).

For lighting designs prepared by private engineering firms, the firm is required to upload the lighting bid items using the Pay Items and Quantities (PIQ) Tool.

Refer to RDM Part II Chapter 5 Section 5.6 for additional information concerning the PIQ Tool. Notify the Lighting and Electrical Team Lead after all lighting items are uploaded by the private engineering firm using the PIQ Tool.

After bid items have been uploaded to AASHTOWare Project or PIQ, the NCDOT Lighting and Electrical Team generates a Quantity Estimate Report for lighting items. Bid item estimated prices are manually written on the Quantity Estimate Report and the report with pricing is provided to the Engineer's Estimate Squad Leader in the Estimating Management Section.

In addition, a final lump sum lighting estimate based on the sealed contract plans is emailed to the Preliminary Estimating Squad Leader.

6.8.2 Design-Build Projects

The NCDOT Lighting and Electrical Team is responsible for lighting estimates on Design-Build projects. Design-Build lighting estimates are lump sum and pay item lists are not provided. Design-Build estimates are sent to the State Estimating Engineer in a sealed envelope marked Confidential.

For Design-Build projects where the lighting plans are prepared in-house by the NCDOT Lighting and Electrical Team, the lump sum lighting estimate is based on the preliminary plans included in the Design-Build request for proposals and includes construction cost only.

For Design-Build projects where the lighting plans are prepared by the Design-Build Team, the lump sum lighting estimate includes the preliminary costs shown in the Lighting Evaluation (refer to Section 6.3 above) and a man-hour estimate for creation and completion of the lighting plans.

6.9 Special Considerations

6.9.1 Coordination with the Federal Aviation Authority

Where a lighting design is located within 5 miles of an airport runway, perform calculations to determine if any lighting system component penetrates any runway approach or other imaginary surface.

Refer to *FAA Form 7460-1, Notice of Proposed Construction or Alteration* Section 77.9 for calculation requirements.

Submit any pole determined to penetrate an imaginary surface as outlined in Form 7460-1 to the FAA for review and determination. The FAA will review and respond to the submission via email. A determination will be made within 45 days. The FAA may require modification of the pole heights to reduce hazards to navigable airspace.

Refer to NCDOT document *FAA Coordination* for additional information.

6.9.2 Wildlife Sensitive Areas

When roadway lighting is included in areas with light sensitive flora and fauna, the lighting design may have to be reviewed and approved by staff in the Environmental Analysis Unit (EAU) and the United States Fish and Wildlife Service. Make every effort to address comments and concerns from the EAU or United States Fish and Wildlife Service staff.

Listed bat species have been found to have a habitat in the counties shown in Table 6-1. When performing lighting evaluations in these counties, copy an Environmental Program Consultant within the EAU on the evaluation. Bring any biological concerns from the EAU to the attention of the State Roadway Design Engineer and the NCDOT Roadway Lighting Committee.

Table 6-1 Counties with Listed Bat Species

Alexander	Carteret	Gaston	Martin	Surry
Alleghany	Catawba	Gates	McDowell	Swain
Ashe	Cherokee	Graham	Mecklenburg	Transylvania
Avery	Clay	Haywood	Mitchell	Tyrrell
Beaufort	Cleveland	Henderson	New Hanover	Washington
Bertie	Columbus	Hyde	Pasquotank	Watauga
Bladen	Craven	Iredell	Pender	Wilkes
Buncombe	Currituck	Jackson	Polk	Yadkin
Burke	Dare	Jones	Rowan	Yancey
Cabarrus	Davidson	Lincoln	Rutherford	
Caldwell	Davie	Macon	Stanly	
Camden	Forsyth	Madison	Stokes	

6.10 Specifications

NCDOT has standard specifications and provisions for lighting system components installed as part of lighting projects.

Refer to *NCDOT Standard Specifications for Roads and Structures Division 14* and *NCDOT Roadway Standard Drawings* Std. Nos. 1401.01 through 1412.01 for lighting standard drawings.

Typically, each lighting project has unique features or items not covered in the standard specifications and drawings. Include lighting design items not covered in the standard specifications as a Special Provision.

6.10.1 Standard Specifications

Refer to *NCDOT Standard Specifications for Roads and Structures Division 14* for information required to furnish, install, and bring into service roadway lighting at designated locations. Division 14 consists of several sections. Each section covers information and details pertaining to a specific roadway lighting topic.

Refer to *NCDOT Roadway Standard Drawings* for detailed drawings of components required for lighting installations such as high mast standards, light standards, control system panels, and underpass lighting. Use the NCDOT Roadway Standard Drawings in conjunction with the NCDOT Standard Specifications for Roads and Structures.

6.10.2 Standard Provisions

The Department maintains a list of *NCDOT Standard Provisions* for pay items that require frequent updates. Project specific Standard Provisions are inserted by the Contracts Standards and Development Unit when specific pay items are included in a contract. Two examples related to lighting pay items are the Standard Provisions titled Foundations and Anchor Rod Assemblies for Metal Poles and Roadway Lighting Foundations. Both Standard Provisions are maintained by the Geotechnical Engineering Unit.

6.10.3 Project Special Provisions

Lighting Project Special Provisions cover items and tasks that are part of the lighting project but not addressed in Section 1400 of the *NCDOT Standard Specifications for Roads and Structures* and *NCDOT Roadway Standard Drawings* or included as a Standard Provision.

Each Special Provision typically consists of four categories: Description, Material, Construction Methods and Payment.

Refer to the *NCDOT Provision Writers' Guide* for format, style, and specific information to include in Special Provisions.

6.10.4 Additional Resources

Refer to the following resources along with the RDM when designing roadway lighting and electrical systems. Editions and years mentioned below are current as of the date of publication of this manual.

Table 6-2 Additional Resources

Resource Title	Edition	Year	Organization
NCDOT 2018 Specifications and Special Provisions		2018	NCDOT
NCDOT ITS and Signals Unit Manual Part 3 - ITS		2004	NCDOT
NCDOT LED Luminaire Specifications		2021	NCDOT
NCDOT LED Luminaire Special Provisions		2021	NCDOT
NCDOT Provision Writers' Guide		2012	NCDOT
NCDOT Roadway Lighting Policy		2020	NCDOT
NCDOT Standard Roadway Drawings		2018	NCDOT
NCDOT Standard Specifications for Roads and Structures		2018	NCDOT
NCDOT Utilities Accommodation Manual		2021	NCDOT
AASHTO Roadside Design Guide	4th	2011	AASHTO
AASHTO Roadway Lighting Design Guide	7th, GL-7	2018	AASHTO
AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals	6th	2013	AASHTO
ANSI/IES Luminaire Classification System for Outdoor Luminaires	TM-15-20	2020	ANSI/IES
ANSI/IES Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting	RP-8-18	2018	ANSI/IES
FHWA Lighting Handbook		2012	FHWA
Code of Federal Regulations Title 14 Part 77.9		2010	FAA
National Electric Safety Code (NESC)		2017	IEEE
NFPA 70 NEC		2020	NFPA
NCHRP Warrants for Highway Lighting	Report 152	1974	NCHRP/TRB

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