Streetlighting Best Practices
Training Module 3

Code Implementation

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Proper Code Selection and Implementation

Module Goals

Outdoor lights used to illuminate streets must be designed in compliance with the applicable safety codes. The initial task is determining which code is appropriate for the individual street lighting system.

The selection of the appropriate code should be determined based on the type of personnel who are operating the system.
Proper Code Selection and Implementation

Streetlighting must be designed and installed to comply with the following safety codes. Selection of the appropriate code should be determined based on the type of personnel who are operating the lighting system.

- **NEC** (National Electric Code)
- **NESC** (National Electric Safety Code)
- **Case Studies**
- **OSHA** (Occupational Safety and Health Administration)
- **DOT** (Department of Transportation)
Proper Code Selection and Implementation

- There are two primary codes used in the United States.

  - **NESC**
    The NESC is maintained by a committee of the Institute of Electrical and Electronics Engineers, Inc. (IEEE) and approval for this committee is given by the American National Standards Institute (ANSI).
    The NESC code is updated every four to five years with the most recent revision published in 2007. This code applies to electric and communication utilities.

  - **NEC**
    The NEC is developed and maintained by the National Fire Protection Association, with updates every two years. This code applies to private and public premises and associated common areas.
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The major differences between the codes is the style of the codes.

- NESC is a performance-based
- NEC is prescriptive.

The performance-based code provides rules on how a system should perform, but doesn’t provide details on how to achieve this performance.

Example: Electric utilities are required to maintain 18.5 feet above ground for 12-kV conductors. It is up to the designer to build a system to maintain the required height. Different size power poles for either short or long spans can be used to meet the height requirements above ground.
Proper Code Selection and Implementation

Prescriptive based code states exactly how a system is to be designed. Very specific rules in sizing of protective devices are required to make sure level of safety is achieved to prevent overloaded system components.

Prescriptive based code doesn’t require an advanced engineering degree to design a system.

**Example:** Electrical wiring in residential homes and commercial buildings are required to install to NEC standards and panel boxes are designed to sustain full load amps. The transition point from the NESC to NEC is referred to as the service point.
Proper Code Selection and Implementation

- Service Drop
  - NESC Code

- Service Entrance
  - NEC Code

- Connectors
Proper Code Selection and Implementation

Which Code Applies to Municipal Streetlights?

- The NEC and NESC have been developed by separate organizations which has led to conflicting codes. In the last few updates of both codes, an effort has been made to coordinate the requirements of the codes. Included in this coordination is the definition of the scope of the codes.

- NEC does not cover “installations under the exclusive control of an electric utility where such installations are located in legally established easements, or rights of way.”
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Rules found in the NESC handbook:

011. Scope

A. These rules cover supply and communication lines, equipment, and associated work practices employed by a public or private electric supply, communications, railway, or similar utility in the exercise of its function as a utility. They cover similar systems under the control of qualified persons, such as those associated with an industrial complex or utility interactive system.

B. The NESC covers utility facilities and functions up to the service point.
   
   NOTE: The National Electrical Code® (NEC®), NFPA 70-19991 covers utilization wiring requirements beyond the service point.

C. NESC rules cover street and area lights (supplied by underground or overhead conductors) under the exclusive control of utilities (including their authorized contractors) or other qualified persons (such as those associated with an industrial complex).
   
   NOTE: Luminaires not under such exclusive control are governed by the requirements of the NEC.
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These rules are used to determine which code would apply to municipal streetlights. NESC defines a qualified person as an individual “having been trained in and having demonstrated adequate knowledge of the installation, construction, or operation of lines and equipment and the hazards involved, including identification of and exposure to electric supply lines and equipment in or near the workplace.”

Typically, this individual is a high voltage lineworker or a first class lineworker but when applied exclusively to streetlighting systems, which operate below 600 volts, it is appropriate to use individuals trained only in these lower voltages.

This point is not necessarily determined by who installed the conduit or conductors, but rather by which party has responsibility for operation, maintenance and replacement.
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Another important definition to be considered is “utility” as used within the context of the NESC. The NESC defines utility to mean “an organization responsible for the installation, operation, or maintenance of electric supply or communications systems.”

Within this definition, a municipal water utility is not considered a utility by the NESC.
Case Studies

Municipal Electric Utility Provides Streetlighting

When a municipality operates an electric utility and installs streetlighting, the appropriate code is the NESC. The streetlighting systems must be controlled exclusively by the electric utility.

This means access to streetlight control boxes must be limited, in addition to convenience outlets, which are often times included on streetlight poles. If the public can access and use these outlets, the outlets are not in the exclusive control of the utility. The outlets must conform to the requirements of the NEC, which would require ground-fault circuit-interrupters on these outdoor outlets and a separate grounding conductor.

If, however, the convenience outlets are located high enough on the pole to limit public access, the NESC would be the appropriate code to use. The NESC provides no direction or rules regarding outlets, but the NEC is an excellent resource to determine appropriate measures to meet the general performance requirements of the NESC.
Electric Utility Provides Streetlighting

When an electric utility provides streetlighting as a service to the municipality, the lights are governed by the NESC, if the streetlights are in exclusive control of the utility.

Convenience outlets on these poles are commonly used for decorative displays for Christmas and other holidays. The use of these outlets should be limited to the electric utility or to individuals deemed qualified by the electric utility.

The NESC allows qualified contractors to work on the electric utility’s system. Thus, the electric utility should be aware that providing permission to the municipality’s personnel to access these convenience outlets implies that the utility believes the municipality is utilizing “qualified” persons. Alternately, the convenience outlets must be designed to meet the requirements of the NEC if the utility does not recognize the municipal worker as a qualified person.
Municipality Without an Electric Utility Installs Streetlights

In this scenario, a municipality receives power from an electric utility at utilization voltage, then installs and maintains lights along its streets. For the NESC to be the applicable code, the municipality must fit the definition of a utility. It may be difficult to define that portion of the municipality that operates and maintains the street lights as a utility.

Often streetlighting personnel work for other municipal departments, such as water or parks and recreation. In most cases, if the municipality is not providing retail electric service, the municipality should comply with the NEC. Under this scenario, convenience outlets on the poles would also need to comply with the NEC. Individuals must be trained, as required by OSHA Subpart S of the General Industry Standards, to work on the electrical components of a street-light system. Many municipal utilities are not required to comply with OSHA requirements.
Proper Code Selection and Implementation

OSHA Requirements

In addition to the safety codes for the design of the streetlighting system, Occupational Safety and Health Administration (OSHA) requirements are applicable. OSHA requirements are geared toward personnel operating and maintaining the streetlighting system. OSHA defines who can work on these systems and what requirements are necessary for their protection.

OSHA’s protection of workers from electrical hazards is broken into two parts. OSHA standards Subpart S of the General Industry Standards address electrical utilization systems, i.e., installations of electric conductors and equipment that use electric energy for mechanical, chemical, heating, lighting or similar purposes. Subpart S protects most employees from the hazards associated with electric utilization equipment and with premises wiring. Subpart S would apply to electricians working on premises wiring, including area lightning.
Further, subpart S relates more to the electrical systems covered by the NEC since the hazards are associated with utilization equipment. Not all municipalities fall under OSHA control.

OSHA requires that persons be trained in and familiar with the safety-related work practices, safety procedures, and other safety requirements that pertain to their respective job assignments.

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OSHA requires workers to treat non-current-carrying metal parts as energized at the highest voltage to which they are exposed, unless the employer determines that these parts are grounded before work begins. This rule can be important in the grounding methods used for metal poles and fixtures.

Some utilities provide a separate grounding conductor at the base of a streetlight mast arm. This visible ground would provide confirmation of grounding. Other utilities rely simply on the bonding of the neutral conductor inside the fixture for grounding of the mast arm. This method would require the arm to be treated as if it were energized with the voltage inside the light fixture. Grounding the base of a metal pole or standard can be accomplished in many different ways, i.e., ground rod or system-neutral.
Proper Code Selection and Implementation

Department of Transportation

Each state adopts its own safety requirements for rights-of-way of state and county roads. These requirements are typically based on the recommendations from the American Association of State Highway and Transportation Officials (AASHTO), American National Standards Institute (ANSI) and National Cooperative Highway Research Program (NCHRP).

The AASHTO standards on streetlighting focus mostly on the need to clear space adjacent to the traveled edge of the roadway. There is a greater probability of a vehicle contacting a pole when the pole is close to the traveled edge of a roadway.
Department of Transportation

The AASHTO standards recognize that the speed of traffic is a component in determining this distance. The problem faced by transportation engineers is that the poles must be close to economically light the roadway. Without the lights, the roadway is not as safe, but, with a pole near the edge of the roadway, the roadway is not as safe. Thus, a balance must be found between these conflicting requirements.

In general, all ground-mounted luminary supports exposed to traffic and located within the clear zone should be provided with breakaway or yielding bases, unless they are located with the protection of a barrier. The clear zone is based on vehicle speed, average daily traffic, and shoulder slopes. AASHTO recommends that efforts should be made in all breakaway poles that house electrical components to effectively reduce fire and electrical hazards posed after structure impact (break away connector).
The AASHTO publication “Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals, 2001” provides standards for breakaway poles. This document states that breakaway supports shall be designed to yield, fracture or separate when struck by an errant vehicle. Other sources of information on breakaway poles are Recommended Procedures for Safety Performance Evaluation of Highway Features and AASHTO’s Roadside Design Guide.

AASHTO recommends that all breakaway poles that house electrical components reduce fire and electrical hazards posed after structure impact. Upon knockdown, the support should electrically disconnect as close to the pole base as possible. Industry groups, such as the Illuminating Engineers Society of North America (IESNA) and AASHTO, provide recommendations for lighting levels on roadways, provide sample lighting design calculations, and set standards for fixtures and lens. However, they do not address the electrical service or grounding requirements of the poles or light fixtures.
Proper Code Selection and Implementation

Example of AASHTO approved break-away fiberglass pole specifications.
Proper Code Selection and Implementation

Questions and Discussions