

Illumination**SPP# 1926.56****Quick Reference**

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1.0 Purpose

The purpose of this safety policy and procedure is to establish guidelines for illumination for North Carolina Department of Transportation (NCDOT) facilities and activities.

2.0 Scope and Applicability

Lighting or lack of lighting can contribute to accidents and to visual strain. Employees and the general public need to see what they are doing and where they are going.

This safety policy and procedure provides guidelines to assist NCDOT management in ensuring that proper and adequate lighting exists in NCDOT facilities and on jobsites. It includes provisions for training, discussion on lighting hazards, recommended illumination levels, night-time construction illumination requirements, and illumination measurement equipment.

This safety policy and procedure also details the areas of responsibility for managers/unit heads, supervisors, employees, and Safety and Loss Control within NCDOT. This safety policy and procedure affects all NCDOT facilities and jobsites.

3.0 Reference

This safety policy and procedure is established in accordance with the Occupational Safety and Health Standards for the Construction Industry (29 CFR 1926.56).

4.0 Policy

It is the policy of NCDOT to provide a place of employment that is free from recognized hazards that cause or are likely to cause death or serious physical harm to employees or the public. Therefore, all NCDOT facilities and construction sites will be properly and adequately lighted to minimize accidents. Where poor lighting exists or there is inadequate lighting for the job tasks, NCDOT will provide sufficient lighting for the task. These measures will be implemented to minimize those hazards to ensure the safety of employees and the public.

5.0 General Responsibilities

It is the responsibility of each manager/unit head, supervisor, and employee to ensure implementation of NCDOT's safety policy and procedure on Illumination. It is also the responsibility of each NCDOT employee to report immediately any unsafe conditions to his or her supervisor. Specific responsibilities are found in Section 6.3.

6.0 Procedure

This section provides applicable definitions, establishes general provisions, and identifies specific responsibilities required by NCDOT's safety policy and procedure on Illumination.

6.1 Definitions

Illumination

Light falling on a surface measured in foot candles.

Luminance

Light emitted or reflected from a surface unit area measured in foot/lambert.

Reflectance

Portion of arriving light on a surface that is reflected, measured in percent.

6.2 General Provisions

This section details the provisions of this safety policy and procedure with each provision discussed in a separate subsection. These provisions are:

- Training
- Hazards
- Recommended Illumination Levels for NCDOT Facilities
- Illumination for Night-Time Construction
- Illumination Measurement

6.2.1 Training

Employees will be trained to recognize improper and inadequate lighting in their workplaces. Employees will be trained at the time of their initial employment or assignment.

6.2.2 Light Sources

Light sources are daylight and artificial light. The types of artificial light in NCDOT include:

- Incandescent
- Fluorescent
- High intensity discharge (mercury and sodium vapor)

Each type of artificial light provides a different spectrum of wavelengths and are used in NCDOT based on lighting needs.

Lighting is also classified as general or supplemental. General lighting provides lighting to a large area. A form of supplementary lighting is task lighting. Task lighting provides additional targeted lighting for a particular task or activity.

6.2.3 Hazards

The major hazards associated with lighting include:

- Illumination levels
- Changes in illumination levels
- Glare
- Luminous contrast

Illumination levels can either be too little or too much light. If there is too little light, employees or the public cannot see well. This could result in an error occurring because a dangerous situation may not be recognized with a corresponding decrease in an individual's reaction time.

Extremely bright light can injure receptor cells in the eye. Also, extremely bright light can cause afterimages that can obscure an individual's visual field until their receptor cells can recover. (The afterimage from a camera flashbulb or similar bright light is a common example.) Until an individual can recover from a bright light, the bright light may interfere with one's ability to detect an object.

Changes in illumination levels interfere with the ability of the eye to adjust quickly enough to permit seeing without error. Examples of changing light levels are the transition from bright outdoor light to dark interiors or from a bright area of a building to a dark one. Another example is looking at a brightly lighted task, then moving the eye to a location that is darker.

Glare is the presence of a bright light in the visual field. Direct glare occurs when the light in the visual field is a source light. An example of direct glare is the headlights of an oncoming car at night. Reflected glare occurs when a bright light reflects from a surface. Glare can lead to errors in perception and detection that result in accidents and may produce afterimages or delay visibility due to adaptation.

Luminous contrast refers to the changing light levels of an environment. For example, one may look at work on a desk that has a certain illumination. Shifting the eyes to a wall presents a much darker or lighter level of illumination. When there is too much difference between the two surfaces, the eyes have difficulty adapting, which may lead to visual errors.

6.2.4 Recommended Illumination Levels

Appendix A presents minimum illumination intensities for construction areas, ramps, runways, corridors, offices, shops, and storage areas.

The values in Appendix A should be used as minimum guidelines. Actual environmental conditions and lighting needs may dictate higher illumination levels. However, higher illumination levels have to be balanced against the hazards of that lighting level (See section 6.2.2).

6.2.5 Illumination for Night-Time Construction

Specifications for night-time construction lighting are found in Section 1412 of NCDOT *Standard Specifications for Roads and Structures*. Night-time construction lights consist of tower lights and machine lights.

Tower lights consist of mercury vapor, metal halide, high pressure sodium or low pressure sodium fixtures mounted on a tower approximately 30 feet in height. The lights should be aimed and positioned to illuminate the area for construction work with no disabling glare to the motorist.

Machine lights are mercury vapor, metal halide, high pressure sodium, or low pressure sodium. They are typically conventional roadway enclosed fixtures mounted on supports attached to the construction machine at a height of approximately 13 feet above ground. Machine lights are installed in addition to conventional automotive type head lights.

SAFETY POLICY & PROCEDURE

Night-time construction lighting must meet all the specifications, provide adequate lighting for the construction work being performed, and sufficiently identify the work zone to motorists. Night-time illumination must be approved by the Resident Engineer.

6.2.6 Illumination Measurement

Illumination is measured in foot-candles. The illumination meter is a convenient piece of equipment that measures illumination of any specified location. This instrument is useful in quantifying your facility's lighting area deficiencies.

6.3 Specific Responsibilities

6.3.1 Managers/Unit Heads

Managers/Unit Heads are responsible for ensuring that adequate funds are available and budgeted to ensure that adequate illumination levels are maintained in their facilities and jobsites. Managers/Unit Heads will obtain and coordinate the required training for employees.

Managers/Unit Heads will also ensure compliance with this safety policy and procedure through their auditing process.

6.3.2 Supervisors

Supervisors will identify areas with inadequate or improper illumination through their facility and jobsite audits. They will also communicate these illumination deficiencies to managers/unit heads.

6.3.3 Employees

Employees shall comply with all applicable guidelines contained in this safety policy and procedure. Additionally, they shall report any unsafe illumination conditions to their supervisor.

6.3.4 Safety and Loss Control

Safety and Loss Control will provide prompt assistance to managers/unit heads, supervisors, or others as applicable on any matter concerning this safety policy and procedure. Safety and Loss Control will assist in developing or securing the required training.

Safety and Loss Control will provide technical guidance on illumination problems in the workplace. (NCDOT Design Services will provide technical guidance on night-time illumination problems.)

SAFETY POLICY & PROCEDURE

Safety Engineers and the Industrial Hygienist will provide consultative and audit assistance to ensure effective implementation of this safety policy and procedure.

SAFETY POLICY & PROCEDURE

APPENDIX A: Minimum Illumination Intensities

| Area of Operation or Task | Foot-Candles |
|---|--------------|
| General construction area lighting | 10 |
| General construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas | 3 |
| Indoors: warehouses, corridors, hallways, and exit ways | 20 |
| Tunnels, shafts, and general underground work areas: (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau Mines approved cap lights shall be acceptable for use in the tunnel heading) | 5 |
| General construction plant and shops (e.g., batch plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active store rooms, barracks or living quarters, locker or dressing rooms, mess halls, and indoor toilets and workrooms) First Aid stations, infirmaries, and offices | 30 |
| Working with very small sized objects | 100 |
| | 200 |
| Working with very small sized objects over a prolonged period | 200 - 500 |
| Performance of very prolonged and exacting tasks | 500 - 1000 |