Advancing the Future of Public Safety

Roadway Lighting Technician 1 Study Guide

Roadway Lighting Technician I

Advancing the Future of Public Safety

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Course Learning Objectives

- Introduction
- LESSON 1 - Tools and Equipment
- LESSON 2 - Personal Protective Equipment (PPE), Safety, and Underground Utilities
- LESSON 3 - Structures, Fixtures, and Associated Materials

2

Course Learning Objectives

- LESSON 4 - Basic Electrical Theory
- LESSON 5 - Work Zone set-up, Maintenance of Roadway Lighting, and Emergency Call-outs
- LESSON 6 - Complaint Validity, Site Assessment, and Component Power Source Verification
- LESSON 7 - Installation of Roadway Lighting

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Course Learning Objectives

- LESSON 8 - Site Clean-Up, Documenting Work Completion, and Fleet Equipment Maintenance
- LESSON 9 - Preventative Maintenance

4

Roadway Lighting

Introduction

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Roadway Lighting Course Introduction

- Roadway lighting plays a crucial role in enhancing safety, visibility, and overall efficiency on our streets and highways. As an integral part of urban infrastructure, roadway lighting provides illumination during nighttime and low-light conditions, ensuring clear visibility for drivers, pedestrians, and cyclists.
- Roadway lighting systems have evolved significantly over the years, with advancements in technology and energy efficiency. Traditional lighting solutions, such as high-pressure sodium (HPS) lamps, have been gradually replaced by more efficient options like light-emitting diodes (LEDs). LEDs offer numerous advantages, including longer lifespan, lower energy consumption, reduced maintenance costs, and the ability to adjust lighting levels and colors to meet specific requirements.

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Governing Agencies and Manuals

- FHWA (Federal Highway Administration)
- MUTCD (Manual of Uniform Traffic Control Devices)
  - Uniformity and Consistency, safety, legal compliance, and efficiency and traffic flow.
- OSHA (Occupational Safety and Health Administration
  - Worker Safety, Standard Setting, Compliance and Enforcement, whistleblower protection.
- NESC (National Electrical Safety Code)
  - The National Electrical Safety Code or ANSI Standard C2 is a United States standard of the safe installation, operation, and maintenance of electric power and communication utility systems including power substations, power and communication overhead lines, and power and communication underground lines
- NEC (National Electric Code)
  - Electrical Safety, National Standards, Electrical System Design, and Installation and Maintenance.
- NEMA (National Electrical Manufacturers Association
  - Standardization, Safety and Reliability, and Technical Expertise.
- IMSA (International Municipal Signal Association)

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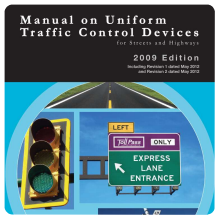
Manual of Uniform Traffic Control Devices - MUTCD



This Manual ensures uniformity across the United States and Canada (MUTCDC).

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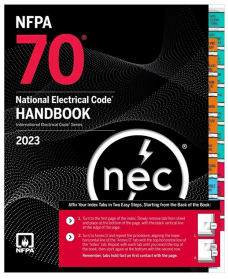
National Electrical Code Handbook

The National Electrical Code (NEC) Handbook is a comprehensive guidebook that provides detailed interpretations, explanations, and additional information to accompany the National Electrical Code. The NEC Handbook is published by the National Fire Protection Association (NFPA), which is responsible for developing and updating the NEC.

The NEC Handbook expands upon the NEC, which is a set of electrical standards and regulations that govern the safe installation, operation, and maintenance of electrical systems in the United States. It covers a wide range of topics, including electrical wiring, grounding, equipment installation, electrical calculations, and safety practices.



The NEC Handbook offers the following features:

1. Commentary
2. Case Studies
3. Historical Information
4. Cross-References and Index

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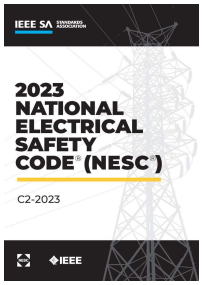
National Electrical Code Handbook



The 2023 NESC® covers practical safeguarding of persons during the installation, operation, or maintenance of:
Electric supply stations
Overhead supply and communications lines
Underground or buried supply and communication cables
It also includes work rules for the operation of electric supply and communications lines and equipment. This Code consists of the introduction, definitions, grounding rules, lists of referenced and bibliographic documents, and Parts 1, 2, 3, and 4 of the 2023 Edition of the National Electrical Safety Code.

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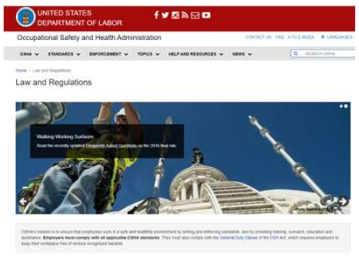
Occupational Safety and Health Administration

OSHA stands for the Occupational Safety and Health Administration. It is a federal agency within the United States Department of Labor. OSHA's primary mission is to ensure safe and healthy working conditions for employees across various industries in the United States.

Here are some key aspects of OSHA:

1. Workplace Safety Standards
2. Inspections and Compliance
3. Training and Education
4. Recordkeeping and Reporting
5. Whistleblower Protection
6. Partnerships and Collaboration

The role of OSHA is to enforce safety and health regulations, provide guidance and assistance, and promote a culture of workplace safety. By setting and enforcing standards, OSHA plays a vital role in safeguarding the well-being of workers and ensuring they have the necessary protections in their workplaces.



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International Municipal Signal Association - IMSA

IMSA offers educational and certification programs in Traffic Signals, Signs and Markings, Work Zone Traffic Control, Municipal and Interior Fire Alarm systems, Fiber Optics and Transportation Center Systems. To assist the governmental agencies in lowering the likelihood of unnecessary legal actions and to increase the quality of public safety personnel, it is the deep conviction of IMSA that a certification program is warranted in each area of public safety operations.

IMSA®
Advancing the Future of Public Safety

IMSA Mission

Dedicated to providing quality certification programs for the safe installation, operation and maintenance of public safety systems; delivering value for members by providing the latest information and education in the industry.

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FHWA – Federal Highway Administration

U.S. Department of Transportation
Federal Highway Administration

FHWA stands for the Federal Highway Administration. It is an agency within the United States Department of Transportation (USDOT) responsible for ensuring the safety, efficiency, and sustainability of the nation's highway system. The FHWA plays a crucial role in planning, designing, constructing, and maintaining highways and bridges across the country.

Here are some key aspects of FHWA:

1. Infrastructure Development
2. Safety Advocacy
3. Funding and Grants
4. Research and Innovation
5. Policy Development
6. Technical Assistance and Training

Through its diverse responsibilities and initiatives, the FHWA aims to improve the safety, efficiency, and effectiveness of the nation's highway system. It plays a vital role in facilitating the movement of people and goods, supporting economic growth, and enhancing the overall quality of transportation infrastructure in the United States.

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Roadway Lighting

Lesson 1: Tools and Equipment

Advancing the Future of Public Safety

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Bucket Truck

A bucket truck, also known as an aerial work platform or cherry picker, is a vehicle equipped with a hydraulic lift that allows workers to reach elevated areas safely. It is commonly used for installing or repairing overhead lighting fixtures on poles.

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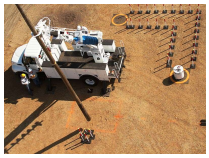
Digger Derrick



A digger derrick is a specialized type of truck-mounted equipment commonly used in construction, utility, and telecommunications industries. It combines the functionalities of a digger, a crane, and an auger to perform various tasks related to digging, lifting, and setting utility poles, as well as other similar applications.

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Light Meter & Multimeter

A light meter measures the intensity of light of a given area. It helps professionals assess the illumination levels and uniformity of roadway lighting, ensuring compliance with standards and regulations.

A digital multimeter is a versatile tool used for electrical troubleshooting and maintenance. It can measure voltage, current, and resistance, allowing technicians to test and diagnose electrical issues in roadway lighting systems.

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Insulation Resistance Testers

This tool is specifically used to measure the insulation resistance of electrical cables and connections. It helps identify any faults or weaknesses in the wiring of roadway lighting fixtures.

18

Wire Strippers & Cutters

Wire strippers and cutters are essential tools for electrical work. They are used to remove the insulation from wires, make clean cuts, and prepare the cables for proper connections during installation or repairs.

19

Cable Crimping Tool

A cable crimping tool is used to create secure and reliable connections between wires and connectors. It compresses the metal terminal onto the cable, ensuring a tight and durable connection..

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Roadway Lighting

Lesson 2: PPE, Safety, and Underground Utilities

Advancing the Future of Public Safety

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High Voltage Gloves

High voltage gloves, also known as electrical gloves or lineman gloves, are specialized gloves designed to protect workers from electrical hazards when working with high-voltage equipment. These gloves are primarily used by electricians, linemen, and other professionals who work with or near live electrical systems.

High voltage gloves are made from durable materials that provide insulation and prevent electric shock. They are typically constructed using layers of rubber or other dielectric materials. The gloves undergo rigorous testing and certification to ensure their effectiveness in protecting against electrical hazards.

It's important to note that working with high voltage is extremely dangerous, and proper training and safety protocols should always be followed. High voltage gloves are just one part of the personal protective equipment (PPE) required for working in these environments. They are typically used in combination with other safety equipment, such as insulated tools, protective clothing, and grounding systems, to provide comprehensive protection.

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Safety Harness

Safety harnesses have restraints that prevent the wearer from falling from a height. By wearing the belt or harness the risk of injury from a fall is greatly reduced. The harness allows the user to attach themselves to an object that is stationary, ensuring they will not hit the ground in the event of a possible fall.

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Safety Glasses

ANSI Z87. 1: OSHA-Approved Safety Glasses.

On every pair of safety glasses, you should see the marking "Z87+. This marking on safety glasses validate that the eye protection has been tested to the ANSI Z87. 1 standard.

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Hearing Protection

Choose The Hearing Protection That's Right For You

- *Expandable foam plugs*
- *Pre-molded, reusable plugs*
- *Canal caps*
- *Earmuffs*

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Hi-Vis Clothing

Who wears high-visibility clothing?

These occupations include railway and road workers, airport workers and emergency services. Cyclists and motorcyclists may also use high-visibility clothing to increase their visibility when operating amongst traffic.

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Safety Shoes

Safety toe protective footwear must be worn at all times regardless of the presence of a hazard; and the safety toe protective footwear must meet the following requirements - leather uppers, oil resistant and non-skid soles, and American Society for Testing and Materials (ASTM) F2413-05 with an impact resistance rating.

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Reflective Vest

Type 2 Class Vest

Type 3 Class Vest

All ANSI-approved safety vests must meet specific criteria regarding color, retroreflective material, and the placement of reflective stripes. They are typically available in fluorescent colors like orange, yellow, or lime green to enhance visibility during the day, and the reflective stripes ensure visibility in low-light or nighttime conditions.

All workers, including emergency responders, within the right-of-way who are exposed either to traffic (vehicles using the highway for purposes of travel) or to work vehicles and construction equipment within the TTC zone shall wear high-visibility safety apparel that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107–2004 publication entitled "American National Standard for High-Visibility Safety Apparel and Headwear" (see Section 1A.11), or equivalent revisions, and labeled as meeting the ANSI 107-2004 standard performance for Class 2 or 3 risk exposure.

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Safety
Underground Utilities

Underground Utilities

When digging or excavating is required there is the hazard of exposing or damaging underground utilities.

It is necessary to call or contact the utility locating service in your area, **811**

811 Know what's **below.** **Call** before you dig.

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Safety
Underground Utilities

No matter how shallow or how deep you are digging, you must contact 811 first. Most State laws defines excavation as "any operation in which earth is moved or removed by means of any tools, equipment, or explosives and includes auguring, backfilling, boring, ditching, drilling, grading, plowing-in, pulling-in, ripping, scraping, trenching, hydro excavating, post holing, and tunneling".

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Safety
Underground Utilities

Types of underground utilities

- Electrical
- Communications
- Natural Gas
- Water
- Sewer and drainage

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Safety
Underground Utilities

As a Roadway Lighting Technician, you may be required to locate underground wiring before others dig.

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Safety
Trenching / Shoring

OSHA requires employers to provide ladders, steps, ramps, or other safe means of egress for workers working in trench excavations 4 feet (1.22 meters) or deeper.

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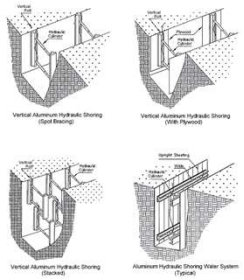
Safety
Trenching / Shoring

Trenches 5 feet (1.5 meters) deep or greater require a protective system (shoring) unless the excavation is made entirely in stable rock. If less than 5 feet deep, a competent person may determine that a protective system is not required.



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Safety
SDS

OSHA requires that the chemical manufacturer, distributor, or importer provide Safety Data Sheets (SDSs) (formerly MSDSs or Material Safety Data Sheets) for each hazardous chemical to downstream users to communicate information on these hazards.

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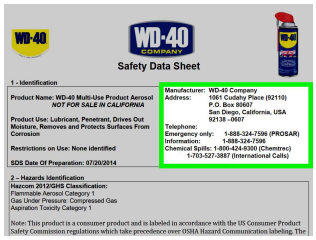
Safety
SDS

Technicians are required to maintain a file of SDS sheets for chemicals and hazardous substances that they use.


WD-40 COMPANY

Safety Data Sheet

1 - Identification

Product Name: WD-40 Multi-Use Product Aerosol
NOT FOR SALE IN CALIFORNIA

Product Use: Lubricant, Penetrant, Drives Out Moisture, Removes and Protects Surfaces From Corrosion

Restrictions on Use: None identified

SDS Date Of Preparation: 07/20/2014

Manufacturer: WD-40 Company
Address: 1061 Cudahy Place (92110)
P.O. Box 80607
San Diego, California, USA
92138 -0607

Telephone:
Emergency only: 1-888-324-7596 (PROSAR)
Information: 1-888-324-7596
Chemical Spills: 1-800-424-9300 (Chemtrec)
1-703-527-3887 (International Calls)

2 – Hazards Identification

Hazcom 2012/GHS Classification:
Flammable Aerosol Category 1
Gas Under Pressure: Compressed Gas
Aspiration Toxicity Category 1

Note: This product is a consumer product and is labeled in accordance with the US Consumer Product Safety Commission regulations which take precedence over OSHA Hazard Communication labeling. The

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IMSA
Knowledge Check
True or False:
If a utility marking is absent, it means the site is safe for excavation.

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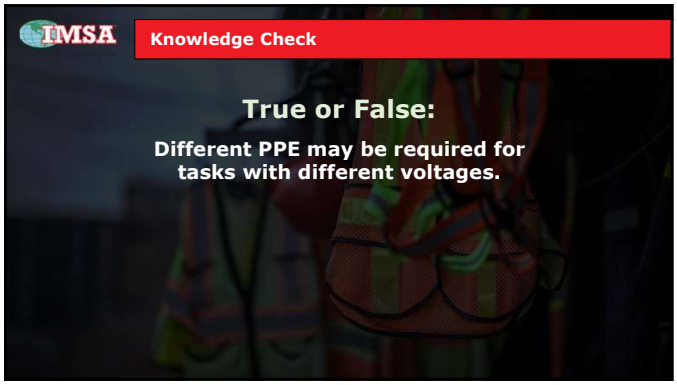
IMSA
Knowledge Check
True or False:
Different PPE may be required for tasks with different voltages.

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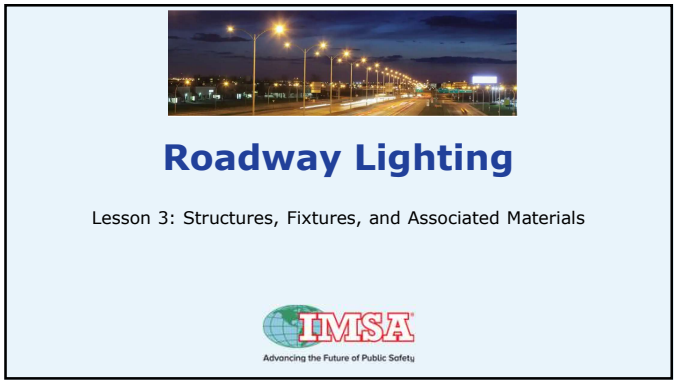
Roadway Lighting
Lesson 3: Structures, Fixtures, and Associated Materials
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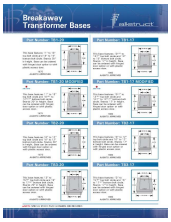
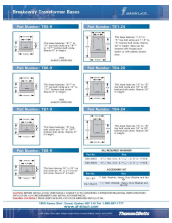
Breakaway Transformer Bases



The purpose of breakaway transformer bases is to ensure that if a vehicle collides with a transformer or its base, the force of the impact causes the base to release. This prevents the transformer from acting as a rigid object that could cause severe damage to the vehicle or pose a hazard to individuals nearby. By detaching upon impact, breakaway bases reduce the risk of secondary accidents, electrical shock, and injuries.



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Breakaway Couplings

The purpose of breakaway couplings is to ensure that if a vehicle collides with a lighting pole or fixture, the force of the impact causes the coupling to release. This prevents the pole from acting as a rigid object that could cause severe damage to the vehicle or pose a hazard to individuals nearby. By detaching upon impact, breakaway couplings reduce the risk of secondary accidents and injuries.

When a breakaway coupling is triggered, it is important for the lighting fixture or pole to detach safely without causing additional hazards. This means that the pole should not fall onto the roadway or obstruct traffic flow. Ideally, the lighting fixture should remain operational or be designed to automatically shut off when the coupling is broken.

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Fused Breakaways

Breakaway fuse holders are designed to ensure safe and reliable operation. They typically have features such as:

Pull-apart design: The fuse carrier can be easily separated from the base by pulling it out, disconnecting the circuit from the power source.

Fuse protection: The fuse holder base provides protection for the fuse against external elements, such as dust or moisture, while still allowing easy access for fuse replacement.

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DOT•PLUG Breakaway Wiring System for Roadway Lighting Systems

Components of the DOTPLUG Breakaway Wiring System

The DOTPLUG breakaway system is composed of a modular color-coded cable system consisting of rubber cords with integrally molded watertight submersible connectors, inline fuses, submersible surge arrester and breakaway connectors. The system provides power from the junction box to the luminaire. The cables extend from a junction box near the base of the pole to the luminarie(s) at the top of the pole. Pursuant to AASHTO Guidelines and other Passive Safety Standards, upon knockdown, the pole cable system electrically disconnects at the foundation, leaving no more that four inches (0.10 m) of wires, cables, or connectors protruding from the electrical conduit. All fusing for electrical fixtures is located and protected below grade.

A pole cable system must be considered on all breakaway lighting systems and even may provide additional safety, maintenance, and economical benefits to non-breakaway lighting systems.

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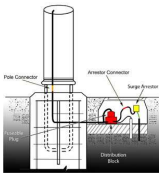
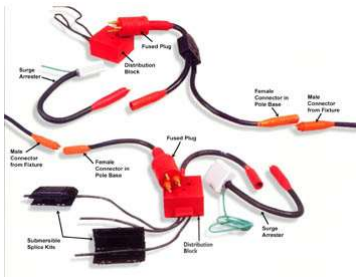
DOT•PLUG Breakaway Wiring System for Roadway Lighting Systems





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Conductors

Roadway lighting conductors, also known as street lighting conductors or streetlighting cables, are electrical cables used to supply power to roadway lighting fixtures. These conductors are designed to safely transmit electricity from the power source to the lighting fixtures, ensuring proper illumination of the road for enhanced visibility and safety.

The conductors used for roadway lighting are typically insulated to protect against electrical hazards and environmental conditions such as moisture, temperature variations, and physical damage. They are usually made of copper or aluminum, which are both good conductors of electricity. Copper is known for its excellent conductivity and resistance to corrosion, while aluminum is lighter and less expensive.

The size and capacity of the roadway lighting conductors depend on various factors, including the power requirements of the lighting fixtures, the distance between the power source and the fixtures, and the voltage drop limitations. Electrical engineers and lighting designers consider these factors to determine the appropriate conductor size and type to ensure efficient and reliable power distribution.

It's worth noting that specific regulations and standards may vary depending on the country or region. Local electrical codes and industry standards provide guidelines for the installation and maintenance of roadway lighting conductors to ensure safety and compliance with electrical standards.

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Types of Roadway Lighting Poles

Height of Poles:
The height of the pole is a critical factor in roadway lighting. It must be high enough to provide adequate illumination to the roadway and pedestrian pathways. The height of the pole can vary depending on the type of roadway, the type of light fixture used, the level of illumination required, and local regulations. However, typical heights for street lighting poles are between 4m to 12m (about 13 to 39 feet).

Spacing of the Poles:
The spacing between poles is another important consideration. The spacing depends on the intensity of the lights, the height of the poles, the type of roadway, and the specific illumination requirements. On average, the spacing could be anywhere between 100 to 150 feet for residential areas, but this can be much greater for highways or rural roads. The spacing is usually designed to prevent dark spots between the light poles while also avoiding excessive overlapping of the light.

Standards:
The design and installation of roadway lighting systems must comply with various local, national, and international standards. In the U.S., the Illuminating Engineering Society (IES) and the American National Standards Institute (ANSI) provide guidelines for roadway lighting. These standards address issues like minimum illumination levels, uniformity ratios, glare control, and energy efficiency.

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Types of Roadway Lighting Poles

TYPES OF ROADWAY LIGHTING POLES

- Steel Poles
- Concrete Poles
- Aluminum Poles
- Wooden Poles
- Fiberglass Poles
- Composite Poles

It's important to note that the type of pole used can depend on several factors, including the location, local weather conditions, aesthetic preferences, budget, and the specific requirements of the lighting fixtures to be used.

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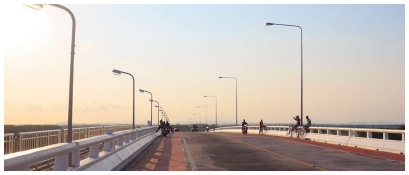
Lighting Poles

Steel Poles: These are the most common type of pole structures in roadway lighting. They are durable, relatively inexpensive, and can handle a wide range of fixture types and light loads.



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Lighting Poles

Concrete Poles: Concrete poles are durable and resistant to the elements, making them a good choice for areas with severe weather conditions. They're often used in highway or large roadway settings.

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Lighting Poles

Aluminum Poles: Lighter than steel or concrete, aluminum poles are easier to transport and install. They are also resistant to rust, which can be an advantage in certain climates.

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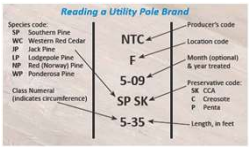
Lighting Poles

Wooden Poles: Wooden poles, often made from treated timber, are used in some roadway lighting scenarios. While they don't have the same level of durability as steel or concrete, they can be more economical and fit better in natural or rural settings.

Wood Pole Class	Horizontal Load (lbs)	Length Range (ft)	Minimum Tip Circumference (inch)
H6	11,400	45-125	37
H5	10,000	45-125	37
H4	8,700	40-125	35
H3	7,500	40-125	33
H2	6,400	35-125	31
H1	5,400	35-125	29
1	4,500	35-125	27
2	3,700	20-125	25
3	3,000	20-90	23
4	2,400	20-70	21
5	1,900	20-50	19
6	1,500	20-45	17
7	1,200	20-35	15
9	740	20-30	15
10	570	20-25	12



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Lighting Poles

Fiberglass Poles: Fiberglass poles are a less common option, but they're durable, light, and resistant to corrosion. They can also be designed to match a wide variety of aesthetic styles.

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Lighting Poles

Composite Poles: These are made from a blend of materials, often fiberglass and resin, to combine the benefits of different pole types. They can be both lightweight and highly durable.

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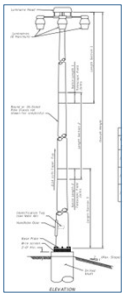
High Mast Lighting



FDOT Standard Plans High Mast Lighting Diagram

High mast lighting refers to a tall lighting structure typically used to illuminate large outdoor areas such as highways, sports stadiums, airports, and industrial facilities. It consists of a tall pole or tower with multiple lighting fixtures mounted at the top. High mast lighting offers a high level of uniform illumination over a wide area, making it suitable for large spaces that require bright and evenly distributed lighting.

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High Mast Lighting

Here are some key features and benefits of high mast lighting:

Height: High mast lighting structures are typically much taller than standard lighting poles. The height can vary but is generally in the range of 30 to 150 feet (9 to 46 meters). The increased height allows for a wider coverage area and better visibility, especially over large expanses of land.

Multiple lighting fixtures: High mast lighting installations usually include several lighting fixtures mounted at the top of the pole. The number of fixtures can vary depending on the specific requirements and lighting design. These fixtures are often equipped with powerful lamps, such as high-intensity discharge (HID) lamps or light-emitting diodes (LEDs), to provide bright and efficient illumination.

Wide coverage area: High mast lighting is designed to provide broad and uniform lighting coverage over a large area. This makes it suitable for applications such as highways, interchanges, parking lots, airports, and sports stadiums, where consistent illumination is crucial for safety, visibility, and security.

Maintenance and accessibility: High mast lighting systems are designed with ease of maintenance in mind. The fixtures are typically installed at a height that allows easy access for maintenance and repair, often utilizing a lowering device or winch system to bring down the fixtures to ground level for servicing.

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High Mast Lighting

Energy efficiency: With the advancement of LED lighting technology, high mast lighting has become more energy-efficient. LED fixtures offer significant energy savings compared to traditional lighting technologies, reducing operating costs and environmental impact.

Lighting control and automation: High mast lighting systems can incorporate advanced lighting control and automation features. This includes the ability to adjust brightness levels, schedule lighting patterns, and integrate with sensors or intelligent systems for energy optimization and adaptive lighting based on ambient conditions.

High mast lighting plays a vital role in providing safe and effective illumination for various outdoor applications, ensuring visibility, security, and comfort in large areas that require high-quality lighting.

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Types of Roadway Lighting Fixtures

Roadway lighting fixtures are devices specifically designed to provide illumination along roads, highways, streets, and other transportation routes. These fixtures are crucial for ensuring visibility and safety for drivers, pedestrians, and cyclists during nighttime or low-light conditions. Roadway lighting fixtures come in various types, each with its own characteristics and purpose. Here are some commonly used roadway lighting fixtures:

- High-Pressure Sodium (HPS) Fixtures
- Light-Emitting Diode (LED) Fixtures
- Metal Halide (MH) Fixtures

When selecting roadway lighting fixtures, factors such as road type, traffic volume, desired light distribution, energy efficiency, maintenance requirements, and local regulations should be considered. Proper installation, aiming, and spacing of fixtures are also crucial to ensure uniform lighting and maximize visibility on the roadways

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Types of Roadway Lighting Fixtures

High-Pressure Sodium (HPS) Fixtures: HPS fixtures produce a yellowish-white light and have been widely used in roadway lighting for many years. They are known for their energy efficiency and long lifespan, making them a popular choice for street lighting.

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Types of Roadway Lighting Fixtures

A high-pressure sodium (HPS) roadway lighting fixture typically consists of the following main parts:

Housing: The housing is the outer structure of the fixture that protects the internal components. It is typically made of a durable material such as aluminum or steel.

Reflector: The reflector is a curved or parabolic component located inside the housing. It is designed to direct and distribute light emitted by the lamp, ensuring maximum light output onto the roadway.

High-Pressure Sodium Lamp: The HPS lamp is the light source in the fixture. It consists of a translucent ceramic arc tube containing a mixture of gases and a small amount of sodium. When the lamp is energized, the sodium vaporizes and produces a yellowish-orange light.

Ballast: The ballast is an electrical device that regulates the voltage and current supplied to the lamp. In the case of HPS lighting fixtures, the ballast is typically an electromagnetic or electronic ballast specifically designed for HPS lamps.

Ignitor: The ignitor is a small component that initiates the electrical discharge in the lamp. It generates a high-voltage pulse to start the lamp and stabilize its operation.

59

Types of Roadway Lighting Fixtures

Capacitor: In some HPS fixtures, a capacitor is used to help improve the power factor and provide additional power to the lamp. The capacitor corrects the lagging power factor caused by the inductive nature of the HPS lamp.

Photocell *(optional):* Some roadway lighting fixtures may include a photocell, also known as a dusk-to-dawn sensor. This sensor detects ambient light levels and automatically turns the fixture on at dusk and off at dawn, providing energy savings and convenience.

Mounting Bracket: The mounting bracket is used to attach the fixture to a pole or other mounting structure. It provides stability and allows for easy installation and adjustment.

It's important to note that the specific design and configuration of HPS roadway lighting fixtures may vary among manufacturers and models. The aforementioned parts are the key components commonly found in such fixtures, but additional features or accessories may also be present depending on the specific requirements and options chosen.

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Types of Roadway Lighting Fixtures

Light-Emitting Diode (LED) Fixtures: LED fixtures have gained significant popularity in recent years due to their energy efficiency, long lifespan, and ability to provide high-quality, directional lighting. LEDs offer various color temperatures and can be programmed for dimming or adaptive lighting systems.

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Types of Roadway Lighting Fixtures

LED roadway lighting fixtures consist of several key components that work together to provide efficient and effective lighting. Here are the main components typically found in LED roadway lighting fixtures:

LED Chips: The heart of the LED roadway lighting fixture is the light-emitting diode (LED) chips. These semiconductor devices produce light when an electric current passes through them. LED chips are known for their energy efficiency, durability, and long lifespan.

Optics: LED roadway lighting fixtures are equipped with optics, such as lenses or reflectors, to control the direction and spread of light. Optics help direct the light emitted by the LED chips onto the roadway, minimizing light pollution and maximizing illumination efficiency.

Heat Sink: LEDs generate heat while producing light, so roadway lighting fixtures include heat sinks to dissipate this heat and prevent the LED chips from overheating. Heat sinks are typically made of aluminum or other materials with excellent thermal conductivity to enhance heat dissipation.

Housing: The housing or fixture body encloses and protects the internal components of the LED roadway lighting fixture. It is usually made of durable materials like aluminum or stainless steel to withstand harsh environmental conditions.

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Types of Roadway Lighting Fixtures

Driver: LED roadway lighting fixtures require a driver to regulate the electrical current supplied to the LED chips. The driver converts the incoming AC voltage into the appropriate DC voltage and current required by the LEDs. It also provides dimming and control capabilities for energy management and adaptive lighting systems.

Mounting Bracket: The mounting bracket attaches the lighting fixture to the roadway pole or arm. It ensures stability and proper positioning of the fixture for optimal lighting distribution.

Photocell or Motion Sensor (Optional): Some LED roadway lighting fixtures may include additional components like photocells or motion sensors. Photocells detect ambient light levels and can automatically adjust the lighting output based on the natural light conditions. Motion sensors detect movement and can trigger the lights to turn on or off, providing energy savings when the area is not in use.

These components work together to provide efficient and reliable lighting for roadways while minimizing energy consumption and maintenance needs. LED roadway lighting fixtures offer advantages over traditional lighting technologies in terms of energy efficiency, longevity, and environmental friendliness.

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Types of Roadway Lighting Fixtures

Metal Halide (MH) Fixtures: Metal halide fixtures produce a bright white light and are commonly used in large parking lots, sports fields, and highways. They provide good color rendering but are less energy-efficient compared to LED fixtures.

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Types of Roadway Lighting Fixtures

A metal halide roadway lighting fixture typically consists of several components. Here are the main parts you would find in such a fixture:

Housing: This is the outer casing that encloses and protects the internal components of the fixture. It is usually made of durable materials such as aluminum or steel.

Reflector: The reflector is a reflective surface located inside the housing. Its purpose is to direct and distribute the light emitted by the metal halide lamp. It helps enhance the fixture's light output and efficiency.

Lamp Socket: The lamp socket is the component that holds the metal halide lamp in place. It provides electrical contact with the lamp and ensures a secure connection.

Ballast: Metal halide lamps require a ballast to regulate the electrical current flowing through them. The ballast provides the necessary voltage and current to start and maintain the lamp's operation.

Ignitor: The ignitor is responsible for providing a high voltage pulse to initiate the metal halide lamp's ignition process. It helps establish the electric arc within the lamp, enabling it to produce light.

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Types of Roadway Lighting Fixtures

Capacitor: Metal halide lamps often require a capacitor to help stabilize and improve the power factor of the electrical circuit. The capacitor assists in compensating for the lamp's inductive load and optimizing the overall efficiency of the lighting system.

Lens or Glass Cover: This component is located at the front of the fixture, protecting the lamp and other internal parts from external elements such as dust, moisture, and debris. It also helps shape the light distribution pattern and reduce glare.

Mounting Bracket: The mounting bracket is used to secure the fixture to a pole or other supporting structure. It provides stability and ensures proper alignment of the lighting fixture.

Wiring and Connectors: Various wires and connectors are used to connect the internal components, including the lamp socket, ballast, ignitor, and capacitor. These enable the electrical circuitry to function properly and supply power to the lamp.

Access Panel or Cover: Some fixtures may feature an access panel or cover that allows for convenient maintenance and replacement of internal components. It provides easy access to the lamp, ballast, and other parts when needed.

It's worth noting that the specific design and configuration of a metal halide roadway lighting fixture can vary depending on the manufacturer and model.

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Types of Roadway Lighting Fixtures

Unless you are new to the industry, you've grown accustomed to the yellow, red, and blue labels that tell us the HID Source and wattage on fixtures. We could tell from the ground what lamp wattage and source was needed without having to go up the pole.

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Types of Roadway Lighting Fixtures

LED labels started as a white label with black text providing the actual wattage of the LED fixture. Later the label was rounded to the nearest 10 (i.e., a 73-watt LED has a label for 70 watts and a 95-watt LED has a label for 100 watts).

The labels are changing again, and you may start seeing these in your shipments. ANSI (American National Standards Institute) and NEMA (National Electric Manufacturers Association) allow manufacturers to phase these in as they use up label stock.

What does the new label look like?

Per the ANSI C136.15 Luminaire Field Identification, it will add the color temperature and the lumen output. This helps us to recognize the changes in color temperature and lumen output that have been prevalent with LED upgrades. The wattage will continue to be rounded to the nearest 10 and lumens to the nearest 1000.

340
38000 L
4000 K

68

Roadway Lighting Control Cabinet

A roadway lighting control cabinet is a piece of infrastructure used to control and manage the lighting system along a road or highway. It is typically installed at specific intervals along the road and houses various electrical components that control the operation of the roadway lights.

69

Roadway Lighting Control Cabinet

Here are some key features and components you might find in a roadway lighting control cabinet:

Control System: The control system is the brain of the cabinet, responsible for managing the lighting operations. It may include programmable logic controllers (PLCs), relays, or other electronic devices to control the switching and dimming of lights.

Photocells or Light Sensors: These sensors detect the ambient light levels and enable the lighting system to automatically adjust its intensity based on the surrounding conditions. They ensure that the roadway lights are properly dimmed or brightened depending on the time of day or specific lighting requirements.

Time Clocks: Time clocks or timers allow for the scheduling of lighting operations. They can be programmed to turn the lights on or off at specific times, helping to conserve energy during daylight hours or activate lighting during specific periods, such as evening rush hour.

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Roadway Lighting Control Cabinet

Communication Equipment: Some advanced lighting control cabinets may be equipped with communication devices such as Ethernet, Wi-Fi, or cellular modules. This allows for remote monitoring and control of the lighting system, enabling real-time adjustments, monitoring of energy consumption, and the ability to receive alerts or notifications about system issues.

Surge Protection and Electrical Distribution: The cabinet may include surge protection devices to safeguard the electrical components from power surges or voltage spikes. It also houses the electrical distribution components to provide power to the lighting fixtures.

Status Indicators: LED indicators or display screens are often present on the cabinet to provide visual feedback on the operational status of the lighting system. They can indicate whether the lights are on or off, if there are any faults or malfunctions, or display system information.

Roadway lighting control cabinets play a crucial role in managing the energy consumption, maintenance, and overall performance of the lighting system along roads and highways. They help improve safety, optimize energy usage, and provide a more efficient and reliable lighting infrastructure for drivers and pedestrians.

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Roadway Lighting

Lesson 4: Basic Electrical Theory

Advancing the Future of Public Safety

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Basic Electrical theory

- **Electrical Safety**
- **Conductors and Insulators**
- **Ohms Law**
- **AC / DC**
- **Series / Parallel**
- **Grounding and Bonding**
- **Voltage Drop**

73

Basic Electrical Theory

The Electrical Safety Foundation International (ESFI) uses the U.S. Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI) and Survey of Occupational Injuries (SOII) to distill information specifically pertaining to fatal and nonfatal occupational electrical injuries. Each year the ESFI publishes electrical injury information in tabular and graphical form on our website. The most recent data covers electrical injuries from 1992 – 2020 and fatalities from 2003 – 2020 but mainly focuses on 2011 – 2020 data.

Fatal Electrical Injuries

There were 126 electrical fatalities in 2020. A 24% decrease over 2019 and the lowest number of electrical fatalities recorded (recording started in 2003). In 2020, 5.3% of all electrical incidents were fatal.

The number of electrical fatalities varies between ages

- 7% of electrical fatalities occurred in workers aged 20 – 24
- 33% of electrical fatalities occurred in workers aged 25 – 34
- 21% of electrical fatalities occurred in workers aged 34 – 44
- 18% of electrical fatalities occurred in workers aged 45 – 54
- 17% of electrical fatalities occurred in workers aged 55 – 64

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Basic Electrical Theory

Non-fatal Electrical Injuries

There were 2,220 non-fatal electrical injuries involving days away from work. This was a 17% increase over 2019 and a return to the same levels as 2017.

Age of worker involved in non-fatal electrical injury:

- 16 – 19 years old: 2%
- 20 – 24 years old: 22%
- 25 – 34 years old: 24%
- 35 – 44 years old: 22%
- 45 – 54 years old: 16%
- 55 – 64 years old: 7%
- 65 years and over: 1%

Length of service with employer when injury occurred:

- Less than 3 Months: 26%
- 3 Months to 11 Months: 10%
- 1 year to 5 Years: 32%
- More Than 5 Years: 31%

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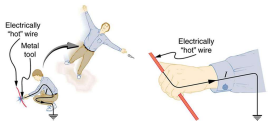
Basic Electrical Theory
Electrical Safety

Roadway Lighting Technicians may be required to work on components or wiring while energized(hot).

Using insulated tools, non-conductive tools and wearing gloves can reduce the chances of getting shocked. Also your freehand should not be touching the cabinet, pole or any other grounded device.



Don't Complete the Circuit!

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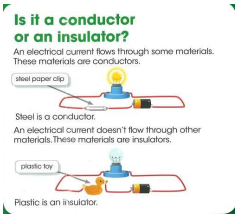
Basic Electrical Theory
Conductors and Insulators

Difference between Conductors and Insulators



Conductors anticipate free flow of electric current because electrons roam freely from one atom to another with ease. Insulators, on the other hand, oppose electric current because they won't permit free flow of electrons from one particle to another.

Conductors can easily transfer energy in the form of electricity or heat, for that matter. However, insulators cannot transfer electrical energy so easily so they resist electricity.

Conductors conduct electricity while insulators insulate electricity. For example, the metallic wire in an electric cord is a conductor, while the sheath or the protective cover is the insulator.

Touching a live conductor might kill you. On the other hand, if you touch a live insulator, it won't even hurt a bit because it resists electric current.

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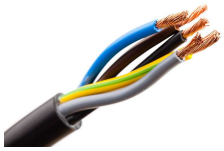
Basic Electrical Theory
Conductors and Insulators

Conductors are materials that conduct electricity. Most metals are conductors.

Copper is the most commonly used material for electrical wiring.

Gold and silver are better conductors than copper but are much too expensive to use for wire.



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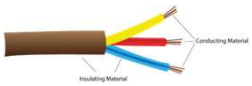
Basic Electrical Theory
Conductors and Insulators

Insulators are materials that do not conduct electricity.
Some materials commonly used as insulators are various types of plastics or rubber, glass and ceramic.



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Basic Electrical Theory
Ohms Law

Understanding electricity

Electricity flowing through wires (conductors) is similar to water flowing through pipes.

- **Voltage** is like Water Pressure
- **Current** is like amount of water
- **Resistance** is like size of the pipe

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Basic Electrical Theory
Ohms Law

Ohm's Law is a fundamental principle in electrical engineering that describes the relationship between voltage, current, and resistance in an electrical circuit. It is named after the German physicist Georg Simon Ohm, who formulated the law in the early 19th century.

According to Ohm's Law, the current flowing through a conductor between two points is directly proportional to the voltage across the two points and inversely proportional to the resistance of the conductor. Mathematically, it can be expressed as:

$$V = I * R$$

Where:

V represents the voltage measured in volts (V).
I represents the current measured in amperes (A).
R represents the resistance measured in ohms (Ω).

In words, this equation states that the voltage across a conductor is equal to the product of the current flowing through it and the resistance of the conductor. This relationship holds true for most conductors at a constant temperature, assuming the conductor obeys Ohm's Law.

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Basic Electrical Theory
Ohms Law

Voltage, Current & Resistance:

- The basis for Ohms Law
- A ratio comparison that we use as a formula
- **V** = **I** x **R**
  - **V** = Voltage (Electromotive Force) (Volts)
  - **I** = Current (Intensity) (Amps)
  - **R** = Resistance (Ohms)

Voltages can vary depending on the roadway lighting systems. Some common voltages are 120/240VAC, 208/277VAC, and 480VAC.

The amount of current flowing in a circuit is determined by the resistance and the voltage.

If you increase the voltage and the resistance remains the same the current will increase.

If you decrease the resistance and the voltage remains the same the current will increase.

For example, if you add another fixture to a circuit, that reduces the resistance of that circuit, and the current will increase.(The voltage remains the same)

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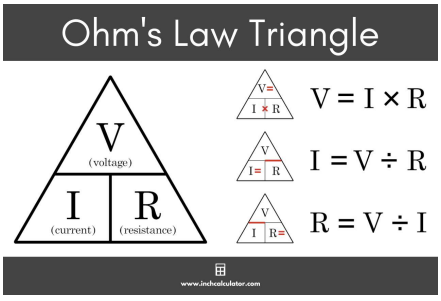
Basic Electrical Theory
Ohms Law



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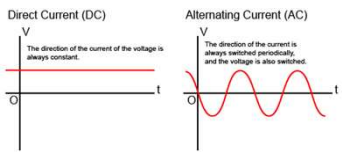
Basic Electrical Theory
AC / DC

AC – Alternating Current

DC – Direct Current

Electric current flows in two ways, as an Alternating Current (AC) or Direct Current (DC). The main difference between AC and DC lies in the direction in which the electrons flow.

In DC, the electrons flow steadily in a single direction, while electrons keep switching directions, going forward and then backwards in AC.



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Basic Electrical Theory
AC / DC

AC – Alternating Current

Alternating current AC is the type of electricity that powers our homes businesses and factories and our Roadway Lighting. It is generated by various types of generators and distributed through the power grid. It is typically 120 volts and alternates at 60 cycles per second (60 Hertz)

DC – Direct Current

Direct Current DC is produced by batteries or power supplies. Electronic circuits and devices run on DC. Typical voltages used in electronics are 5 Volts, 12 Volts, and 24 Volts.

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Basic Electrical Theory
Series / Parallel

Schematic Symbols

- Diode
- Capacitor
- Inductor
- Resistor
- DC voltage source
- AC voltage source

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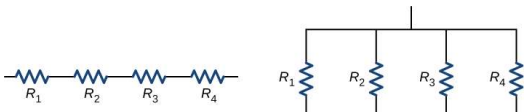
Basic Electrical Theory
Series / Parallel



(a) Resistors connected in series

(b) Resistors connected in parallel

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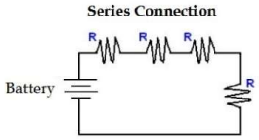
Basic Electrical Theory
Series / Parallel

In a series circuit the current remains constant.



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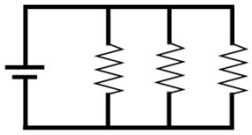
Basic Electrical Theory
Series / Parallel



In a Parallel circuit voltage remains constant.

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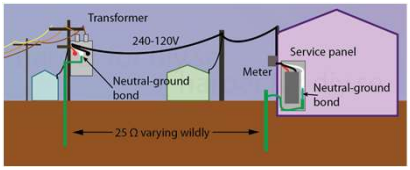
Basic Electrical Theory
Grounding and Bonding

Bonding

Article 100 of the NEC defines bonded (bonding) as "connected to establish electrical continuity and conductivity." Bonding metal parts, such as enclosures and raceways, ensures that they are all continuous on an effective ground-fault current path (EGFCP) that references back to ground (earth). The EGFCP helps operate devices such as circuit breakers and fuses or ground-fault detectors in ungrounded systems.



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Basic Electrical Theory
Grounding and Bonding

Bonding

In grounded systems, it is important to bond the equipment grounding conductors to the system grounded conductor to complete the EGFCP back to the source of electricity. The conductivity of the EGFCP is critical for protective devices to work properly. This speaks to why we scrape the paint from contact surfaces of metallic enclosures to make our electrical system bonding connections. Removing the paint, as required in Section 250.12, provides for a better connection and conductivity path.

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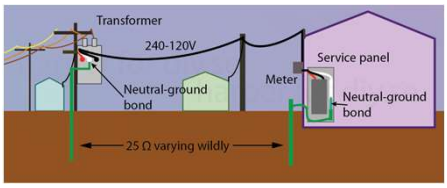
Basic Electrical Theory
Grounding and Bonding

Grounding

The NEC defines ground as "the earth." Grounding is a conductive connection, intentional or accidental, between a circuit or electrical equipment and the ground or some conductive object acting as the ground. In an airplane, for example, the fuselage acts as the ground



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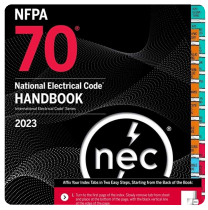
Basic Electrical Theory
Grounding and Bonding



Grounding and Bonding

Section 250.4 of the NEC states the general requirements for grounding and bonding of electrical systems for both grounded and ungrounded systems. For grounded systems, the NEC requires you to perform all of the following: electrical system grounding, electrical equipment grounding, electrical equipment bonding, and bonding of electrically conductive materials. In ungrounded systems, the same actions are required except for electrical system grounding. When these NEC requirements are implemented, an effective ground-fault current path is created, which is your desired end goal.

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Basic Electrical Theory
Voltage Drop

Voltage drop is a common phenomenon that occurs in electrical systems, including roadway lighting. When electrical current flows through a conductor, there is a natural resistance to the flow of electricity, causing a drop in voltage along the length of the conductor.

This calculation assumes an unbalanced load, with phase and neutral conductors of the same size.

VOLTAGE DROP CALCULATOR FORMULA

VD = (2 · A · L · R) / 1000

Where:

VD = Voltage Drop (Volts) per unit circuit length

A = Full Load Current (Amps)

L = One-Way Circuit Length (ft)

R = Resistance (Ohms/Kft)

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Basic Electrical Theory
Voltage Drop

In roadway lighting systems, voltage drop can occur due to various factors:

Cable Length: The longer the cable length between the power source and the roadway lights, the greater the voltage drop. This is because the resistance of the cable increases with length.

Cable Size: The gauge or size of the cable used in the system also affects voltage drop. Smaller gauge cables have higher resistance and, therefore, result in greater voltage drop compared to larger gauge cables.

Load: The electrical load connected to the roadway lighting system affects voltage drop. If the load is heavy or there are multiple lights connected, it can lead to a higher voltage drop.

Cable Material: The material of the cable can impact voltage drop. Different materials have different resistivities, and cables with higher resistivities will result in more significant voltage drops.

Connections: Poorly made or loose connections in the roadway lighting system can contribute to voltage drop. Loose connections have higher resistance, leading to higher voltage drop.

Voltage drop can have various consequences for roadway lighting systems, including reduced light output and increased power consumption. Insufficient voltage reaching the lights can result in dimmer illumination and decreased visibility. It can also lead to premature failure of the lighting fixtures and increased maintenance costs.

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Basic Electrical Theory
Voltage Drop

To mitigate voltage drop in roadway lighting, several measures can be taken:

Proper Cable Sizing: Using cables with larger gauges can help reduce resistance and minimize voltage drop.

Voltage Regulation: Implementing voltage regulation devices, such as voltage regulators or stabilizers, can help maintain a stable voltage level, compensating for voltage drop.

Efficient Design: Ensuring that the design of the lighting system takes into account the cable length, load requirements, and expected voltage drop can help optimize performance.

Regular Maintenance: Regular inspections and maintenance of the roadway lighting system, including checking connections and cable integrity, can help identify and address any issues that contribute to voltage drop.

By considering these factors and implementing appropriate measures, voltage drop in roadway lighting systems can be minimized, ensuring optimal performance and visibility on the roads.

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Roadway Lighting

Lesson 5: Work Zone set-up, Maintenance of Roadway Lighting, and Emergency Call-outs

IMSA
Advancing the Future of Public Safety

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TEMPORARY TRAFFIC CONTROL DEVICES

An attenuator truck, also known as a crash truck, impact protection vehicle, or safety truck, is a vehicle used in construction zones, especially in highway and freeway maintenance operations, to improve safety for workers and motorists. The purpose of these trucks is to absorb and minimize the impact of a vehicle collision in a roadwork zone to protect the workers and equipment on-site.

The key feature of an attenuator truck is the crash cushion, also known as an impact attenuator, installed on the rear of the vehicle. The attenuator is a specially designed device, often accordion-like in design, that crumples and absorbs the energy of a colliding vehicle. It can reduce the severity of an accident by slowing down the colliding vehicle in a controlled manner, which can potentially save lives and reduce property damage.

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TEMPORARY TRAFFIC CONTROL DEVICES

These trucks are often deployed in various traffic work zones where workers are present on the road, for example:

1. Road maintenance or road construction zones: These could be long-term construction projects or short-term maintenance work. Attenuator trucks are used to create a safety buffer between the flow of traffic and the workers and equipment in the work zone.

2. Incidents or emergencies: In case of a car accident or a vehicle breakdown, an attenuator truck can be deployed to provide a safe environment for first responders and the individuals involved in the incident.

3. Highway operations: During operations such as line painting or asphalt repair, attenuator trucks can protect workers from the flow of traffic.

Attenuator trucks are usually brightly colored or have high-visibility striping and flashing lights to be easily seen by approaching motorists. They may also display signs or arrows to guide drivers safely around the work zone

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TEMPORARY TRAFFIC CONTROL DEVICES

Here are a few points about Attenuators to consider

1. Effectiveness: Attenuator trucks have been found to be effective in reducing the severity of crashes in work zones. The cushion or barrier absorbs the kinetic energy generated during a collision, which helps minimize damage to vehicles and injuries to occupants.

2. Work Zone Safety: Attenuator trucks are primarily used in work zones to protect workers and provide a buffer between traffic and construction activities. By absorbing or redirecting the force of impact, they can significantly reduce the likelihood of serious injuries or fatalities.

3. Variations in Crash Statistics: Crash statistics can vary depending on several factors, such as the specific design and type of attenuator truck used, the traffic conditions, the behavior of motorists, and adherence to safety protocols. It's important to note that crash statistics can change over time as new safety measures and technologies are implemented.

To obtain the most accurate and recent crash statistics involving attenuator trucks in traffic work zones, I recommend reaching out to local traffic safety authorities, transportation departments, or relevant research organizations. They will have access to the latest data and studies specific to your region.

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TEMPORARY TRAFFIC CONTROL DEVICES

An arrow board is a type of visual signaling device used in traffic management, particularly within construction zones or areas where traffic needs to be directed due to a disruption or special event. It typically consists of a series of lights arranged in an arrow shape, which can be programmed to indicate a specific direction for vehicles to follow or to display cautionary messages.

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TEMPORARY TRAFFIC CONTROL DEVICES

Arrow boards are primarily used for:

1. Guiding Traffic: They direct vehicles away from road works or obstacles and towards a new temporary traffic path. They're a highly visible way of informing drivers of a change in normal road layout, ensuring that the traffic continues to flow smoothly.

2. Enhancing Safety: By providing clear, visible signs, they reduce the likelihood of accidents, as drivers have advanced warning about changes to the road layout or possible hazards.

3. Displaying Messages: In some cases, arrow boards may be designed to display specific messages related to road conditions, hazards, or other important information.

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TEMPORARY TRAFFIC CONTROL DEVICES

Within a traffic work zone, an arrow board is typically located ahead of the actual work area, to provide drivers with enough warning and time to respond to the changed conditions. It's often mounted on a vehicle or trailer so it can be easily moved and positioned as needed. The placement of the arrow board is very important, and it needs to be visible from a reasonable distance to ensure drivers have ample time to react. If the work zone is particularly large or complex, multiple arrow boards might be used at various points to guide traffic effectively.

Some arrow boards are also solar-powered to allow for extended use without the need for frequent battery changes or a continuous power source, making them a practical and efficient tool for traffic management.

Remember, arrow boards are just one part of a comprehensive traffic control plan in a work zone, which can also include road cones, barricades, signage, flaggers, and more, depending on the size and complexity of the project.

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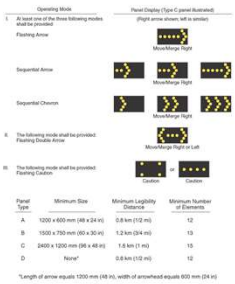
TEMPORARY TRAFFIC CONTROL DEVICES

Figure 6F-6. Advance Warning Arrow Display Specifications



Panel Type	Minimum Size	Minimum Legibility Distance	Minimum Number of Elements
A	1200 x 600 mm (48 x 24 in)	0.8 km (1/2 mi)	12
B	1500 x 750 mm (60 x 30 in)	1.2 km (3/4 mi)	13
C	2400 x 1200 mm (96 x 48 in)	1.6 km (1 mi)	15
D	None*	0.8 km (1/2 mi)	12

*Length of arrow equals 1200 mm (48 in), width of arrowhead equals 600 mm (24 in)

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TEMPORARY TRAFFIC CONTROL DEVICES

Traffic control devices shall be defined as all signs, signals, markings, and other devices used to regulate, warn, or guide road users, placed on, over, or adjacent to a street, highway, private roads open to public travel, pedestrian facility, or bikeway by authority of a public body or official having jurisdiction.

All traffic control devices used for construction, maintenance, utility, or incident management operations on a street, highway, or private road open to public travel shall comply with the applicable provisions of the MUTCD.

FHWA policy requires that all roadside appurtenances such as traffic barriers, barrier terminals and crash cushions, bridge railings, sign and light pole supports, and work zone hardware used on the National Highway System meet the crashworthy performance criteria contained in the National Cooperative Highway Research Program (NCHRP) Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

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TEMPORARY TRAFFIC CONTROL DEVICES

Setting up a temporary traffic work zone can be a complex task and typically requires the use of various devices to ensure safety and efficient traffic flow. Here are some of the key devices and equipment you might need:

A channelizing device is a piece of equipment used in roadwork and construction zones to control the flow of traffic, providing both visual and physical guidance for motorists. They can be used to direct drivers around a work zone, restrict access to certain areas, or serve as barriers between traffic and workers.

Examples of channelizing devices include:

1. Cones: Typically orange and reflective, used to redirect traffic or indicate hazards.
2. Drums: Large, highly-visible devices that provide a more substantial physical presence.
3. Vertical Panels: Tall, slim devices that serve as visual guides.
4. Barricades: Robust structures that physically block access to certain areas.
5. Delineators: Smaller devices often used to outline the edge of a road or path.

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TEMPORARY TRAFFIC CONTROL DEVICES

When it comes to specifications for these devices in temporary traffic control within work zones, the U.S. Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD) provides detailed standards. The MUTCD specifies the following general requirements:

1. Color: Channelizing devices should be orange, white, or yellow for visibility.
2. Reflectivity: They should be made of retroreflective material so they're visible at night.
3. Stability: Devices need to resist displacement by wind or passing traffic.
4. Height and size: Cones and tubes should be at least 28 inches tall in high-speed areas. Drums should have a minimum diameter of 18 inches and a minimum height of 36 inches.

The specifications can vary depending on the specific application, and local or state regulations might have additional or different requirements. Always check the most recent guidelines and local laws when planning a roadwork project.

Please note that the above specifications are subject to change, and you should refer to the most recent version of the MUTCD or your local equivalent for the most current guidance.

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TEMPORARY TRAFFIC CONTROL

TYPES OF WORK ZONES

Work zones are areas where roadwork takes place and usually involve lane closures, detours, or reduced speeds for safety purposes. They are marked by signs, traffic cones, barrier walls, and other safety devices. The type of work zone typically determines its duration. The Minimum standard that shall be used when developing or implementing a temporary traffic control plan can be found in the MUTCD.

Below are a few types of work zones and their average durations:

1. **Long-term Stationary:** These are established work that occupies a location more than 3 days.. In these zones, traffic patterns can be significantly affected for an extended period. These zones can last several months to several years. Examples include major highway construction or expansion, significant bridge reconstruction, or large-scale infrastructure improvements.

2. **Intermediate Stationary:** These zones are set up for work that occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than 1 hour.

3. **Short-term Stationary:** These are established for daytime work that occupies a location for more than 1 hour within a single daylight period. Examples include minor road repairs, utility work, or tree trimming near the roadway.

4. **Short Duration:** This is work that occupies a location for up to 1 hour.

5. **Mobile:** These zones move along the road as work is completed. They are typically used for operations like pothole repair, road striping, or road sweeping. The duration of these zones can range from a few minutes to a few hours, depending on the extent of the work being done.

Please note that the durations provided above are general estimates and can vary significantly depending on the complexity of the project, unforeseen challenges, and other factors. In many cases, work is done during off-peak hours or overnight to minimize disruption to traffic, so even for longer-term work zones, motorists may not encounter them at all times.

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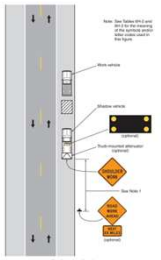
TEMPORARY TRAFFIC CONTROL

Figure 6H-4. Short-Duration or Mobile Operation on a Shoulder (TA-4)

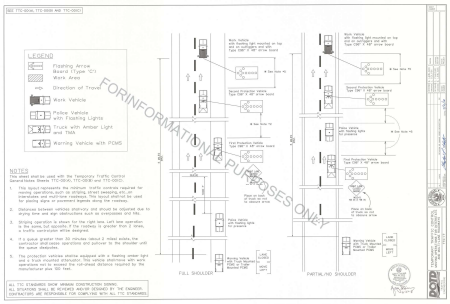


Typical Application 4

Mobile: These zones move along the road as work is completed. They are typically used for operations like pothole repair, road striping, or road sweeping. The duration of these zones can range from a few minutes to a few hours, depending on the extent of the work being done.

109

TEMPORARY TRAFFIC CONTROL



110

TEMPORARY TRAFFIC CONTROL DEVICES

Maintenance of roadway lighting is an important aspect of ensuring safe and functional roadways. Here are some key considerations for the maintenance of roadway lighting:

Regular Inspections: Conduct routine inspections of the roadway lighting system to identify any issues such as burnt-out bulbs, damaged fixtures, or electrical problems. Inspections can be scheduled at regular intervals or in response to specific complaints or concerns.

Cleaning and Clearing: Keep the light fixtures clean and free from dirt, debris, and vegetation. Regularly clear any obstructions, such as tree branches, that may block the light output. This helps to maximize the effectiveness of the lighting and ensures proper illumination.

Bulb Replacement: Replace burnt-out or faulty bulbs promptly to maintain adequate lighting levels. Keep a stock of spare bulbs to minimize downtime and ensure quick replacements. LED bulbs are commonly used in roadway lighting due to their energy efficiency and longer lifespan.

Electrical System Maintenance: Check the electrical connections, wiring, and control systems regularly. Ensure that all connections are secure, and there are no loose or damaged wires. Periodically inspect and maintain the electrical panels, transformers, and other components of the lighting system.

Timers and Controls: If the roadway lighting system includes timers or controls, verify their proper functioning. Adjust the timers as necessary to align with daylight hours or specific time requirements. Calibrate and test any lighting control systems to ensure they are working correctly.

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TEMPORARY TRAFFIC CONTROL DEVICES

Pole and Fixture Maintenance: Inspect the poles and fixtures for any signs of damage, corrosion, or deterioration. Repair or replace any damaged or unstable poles. Check the integrity of the fixtures, including lenses and reflectors, and make repairs or replacements as needed.

Power Supply and Backup: Ensure a reliable power supply for the lighting system. Regularly check connections to the power source and monitor voltage levels. If the lighting system has a backup power source, such as a generator or battery system, test and maintain it to ensure functionality during power outages.

Documentation and Record-Keeping: Maintain a comprehensive record of maintenance activities, including inspections, repairs, and replacements. This documentation helps track the maintenance history and allows for better planning and budgeting.

Community Feedback and Reporting: Encourage the public to report any issues with the roadway lighting, such as malfunctioning lights or areas with inadequate illumination. Establish a reporting mechanism, such as a hotline or online form, to facilitate communication and address concerns promptly.

Collaboration with Local Authorities: Coordinate with local authorities responsible for roadway maintenance and safety. Share information on lighting issues, collaborate on repairs or upgrades, and ensure compliance with relevant regulations and standards.

By following these maintenance practices, roadway lighting can be kept in optimal condition, ensuring safer driving conditions for motorists and pedestrians alike.

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Basic Repair Safety and PPE

Before completing repairs, first make sure you have the appropriate PPE.

Different PPE may be required for tasks with different voltages.

*PPE Examples:

- Vest
- Gloves
- Hard hat
- Face shield
- Non-dielectric safety shoes

This is a sample list. Check your local jurisdiction and NEC standards.

113

Wiring

Damage

- Ensure no visible damage to wire (nicks, kinks, etc.).
- Check continuity.
- Use fault locator to identify damage if necessary.

Connections

- Ensure connections are tight.
- Tighten connections if necessary.
- Replace connectors if necessary.

Proper Wiring

- Ensure proper wiring is used.
- Replace wiring if it does not align with local/NEC standards.

114

Conduit



Damage
- Ensure there are no breaks in conduit.
- Repair breaks with PVC glue if necessary.
- Use duct seal if necessary.

Proper Bends
- Ensure bends do not exceed 360 degrees.
- Add a pull box and begin a new run if necessary.

Proper Conduit Type/Size
- Ensure proper sized conduit is used.
- Ensure pull boxes are used when more than one type of conduit is needed.

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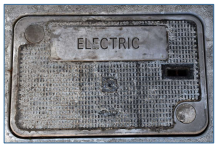
Pull Boxes




Damage
- Ensure box cover and other components are intact.
- Replace components or box if necessary.

Proper Installation
- Ensure dirt surrounding box is compacted.
- Re-install box if necessary.

Proper Box Size/Type
- Ensure proper sized pull box is used.
- Ensure box is traffic bearing.
- Ensure APL is displayed.
- Replace box if necessary.

116

Repairing Fuses and Breakers

Blown Fuses/Tripped Breaker
- Confirm blown fuse via visual inspection or multimeter and fault locator.
- **Disconnect power.**
- Clear short and replace failed fuses or breakers.

Corrosion/Damage
- If corrosion is present, clean or replace panel.
- If gaps, cracks, holes, etc. are present, replace panel.

Proper Fuse Type/Class
- Ensure proper fuse type and class is used.
- Replace if necessary.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Why is it Important to Disconnect Power?

Always disconnect the power before working on fuses or breakers!

Play the video to see what happens when power is not turned off.

https://www.youtube.com/watch?v=6hpE5LYj-CY&t

118

Photocells and Motion Sensors

Photocell/Motion Sensor Function
- Cover photo eye to see if light turns on when nighttime is simulated.
- Replace photocell or sensor if light remains powered on.

Photocell/Motion Sensor Position
- Ensure sensor position is facing to the north.
- Reposition if necessary.

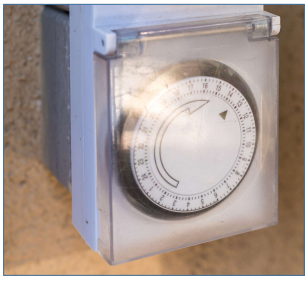
Proper Components
- Ensure proper photocell/motion sensor control components are used.
- Replace if necessary.

119

Time Clock Controls

Battery Replacement
- Check battery voltage and replace battery if necessary.
- Reset the time clock and replace if necessary.

Time Adjustments
- Ensure time and date tabs/pins are set correctly.
- Reset tabs if necessary.



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HID Luminaires

Most older street lighting assemblies use High Intensity Discharge (HID) bulbs, which provide a large amount of light per unit of energy.

If HID luminaire is not functioning:

1. Inspect pole and lighting assembly and remove potential hazards.
2. Inspect the door of the assembly.
3. Follow manufacturer's guidelines to inspect lamps, starters, ballasts, and capacitors.

121

LEDs

LEDs have a long lifespan, are energy efficient, do not have a "cool down" and "restrike" period, and can be dimmed via automatic lighting systems.

If LED is not functioning:

1. Inspect pole and lighting assembly and remove potential hazards.
2. Inspect voltage and replace the string of LEDs.
3. Inspect LED driver.
4. Inspect driver surge protection module.

122

Pole and Foundation Assessment

First, make sure the power is disconnected from the pole.
Then, inspect the following components:

1. Pole alignment
2. Anchor bolts
3. Concrete/Foundation

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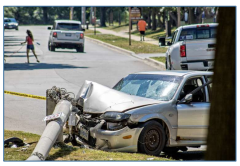
Pole and Foundation Repair



1. If pole or foundation needs to be replaced, follow protocol for utility marking.
2. Remove bolts and existing lighting fixture.
3. Remove existing foundation.
4. Set up rebar and anchor bolts.
5. Pour concrete.
6. Install pole.
7. Ensure pole is properly aligned.

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Pole and Lamp Repair Video

https://www.youtube.com/watch?v=Al9TdTFHJjk

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Emergency Call-Outs

In the event of an emergency related to roadway lighting, it is important to follow a proper callout procedure to ensure a swift response and resolution. Here's a general outline of an emergency callout procedure for roadway lighting:

Assess the Situation: Determine the nature and severity of the emergency related to the roadway lighting. This could include complete or partial outage, damaged fixtures, electrical issues, or any other concerns.

Contact the Authorities: If the emergency poses an immediate danger, such as a hazardous condition or an accident-prone area, contact the local authorities, such as the police or highway patrol, and inform them about the situation.

Notify the Responsible Agency: Identify the appropriate agency or organization responsible for roadway lighting maintenance and repairs. This could be a municipal department, transportation authority, or a specific maintenance contractor. Contact them to report the emergency and provide detailed information about the location and nature of the problem.

Provide Essential Information: When reporting the emergency, be prepared to provide the following details:

- Exact location of the affected roadway section (street name, mile markers, nearby landmarks, etc.)
- Description of the issue (outage, damaged fixtures, electrical issues, etc.)
- Any additional relevant information that may assist in assessing and addressing the problem.

Follow Agency Procedures: Follow the instructions provided by the responsible agency or organization. They may have specific procedures and protocols in place for emergency callouts. Cooperate with their instructions and provide any additional information they may request.

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Emergency Call-Outs

Ensure Safety: If the emergency poses a safety hazard, take necessary precautions to warn motorists and pedestrians of the danger. For example, setting up temporary warning signs, cones, or barriers to divert traffic away from the affected area.

Document and Report: Take photos or videos of the emergency situation, if possible, to document the problem. This evidence can be useful for the responsible agency's investigation and resolution process. Additionally, follow up with the agency to confirm that the issue has been resolved and report any ongoing concerns if necessary.

It's important to note that specific procedures may vary depending on the jurisdiction and organization responsible for roadway lighting. Therefore, it is advisable to consult the local guidelines, protocols, or contacts provided by the relevant authorities to ensure accurate and up-to-date information.

127

Emergency Call-Outs

128

Knowledge Check

True or False:

Lighting strikes and power surges are the most common cause of LED damage.

129

Knowledge Check

True or False:

It is not necessary to turn the power off before working with fuses and breakers.

130

Roadway Lighting

Lesson 6: Complaint Validity, Site Assessment, and Component Power Source Verification

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Receiving Complaints

First, a complaint regarding a roadway lighting issue is received. Complaints are commonly received from:

- Citizens
- Police departments
- Automated systems
- Visual inspection
- Power companies

> *"For months, long stretches of street lights have been out of order along Republic Road. Two stretches in particular are on dangerous curves. When I drive around Northcliff and Cresta I am always in the dark at night which is unsafe," said Wendy Louw of Northcliff.*

> *"Almost the entire Windsor West has no street lights – yet, it is said to be one of the most dangerous places in our area with drugs and other petty crimes. Whenever I log a complaint, no one does anything about it. I just keep on receiving different reference numbers," said Louw.*

132

Complaint Ownership & Validity

When a complaint is received, verify two things:

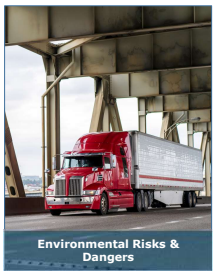
Asset Ownership
The asset in question must be owned by the jurisdiction. If not, the work order is forwarded to the owner.

Complaint Validity
Inspect the issue and surrounding area to ensure the issue does not require additional support.

133

Site Assessment

Consider the following items when completing a site assessment:



Environmental Risks & Dangers

Site Access Requirements

Traffic Control Needs

134

Environmental Risks and Dangers

Visually inspect the site to identify environmental risks and dangers.

Common hazards:

1. Water
2. Soft ground
3. Heavy traffic
4. Power lines
5. Weather conditions

135

Site Access Requirements

Once you've assessed the hazards and documented the worksite condition, determine whether the site is accessible.

The site could be inaccessible due to:

1. Location
2. Permission

IN AN EMERGENCY, THE TOP PRIORITY IS TO ENSURE THE SITE IS SAFE.

136

Traffic Control

Determine the appropriate type of traffic control based on the site conditions.

- Law enforcement to direct traffic
- Arrow boards
- Cones
- Flaggers
- Detours

137

Basic Testing Safety and PPE

Before testing components, first make sure you have the appropriate PPE.

Different PPE may be required for tasks with different voltages.

*PPE Examples:

- Vest
- Gloves
- Hard hat
- Face shield
- Non-dielectric safety shoes

This is a sample list. Check your local jurisdiction and NEC standards.

138

Confirming Component Operation


Test the following components:
- Pole & Lighting Assembly
- Circuits & Voltage

139

Confirming Power Source Operation

1. Locate power source for the site
2. Acquire permission, if necessary
3. Check voltage with multimeter

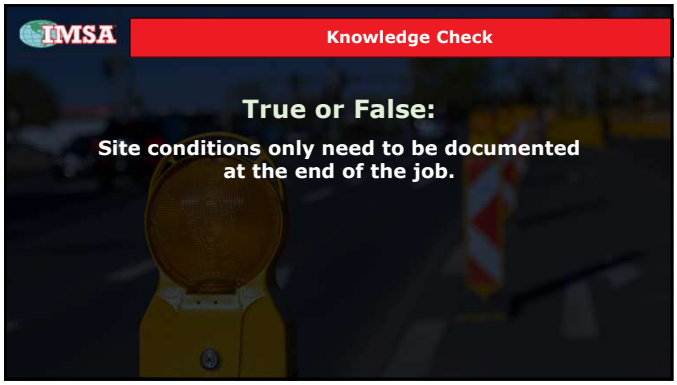
Note: Always use a lockout tagout system during power maintenance.

140

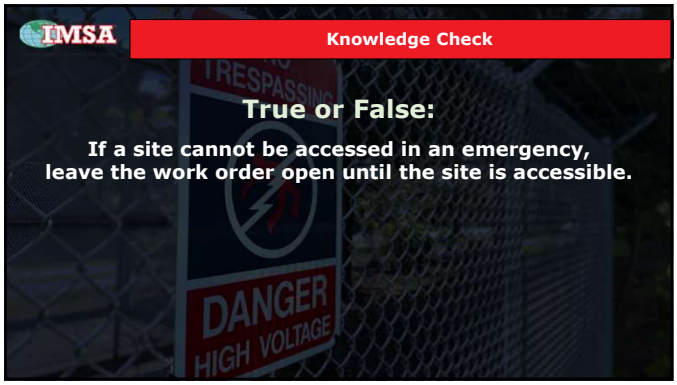
Confirmation Component Operation

Test the following components:
- Pole & Lighting Assembly
- Circuits & Voltage
- Grounding
- Photocell
- Timeclock
- Fuses, breakers, surge protection
- Wiring
- Lamps
- Ballasts/Drivers

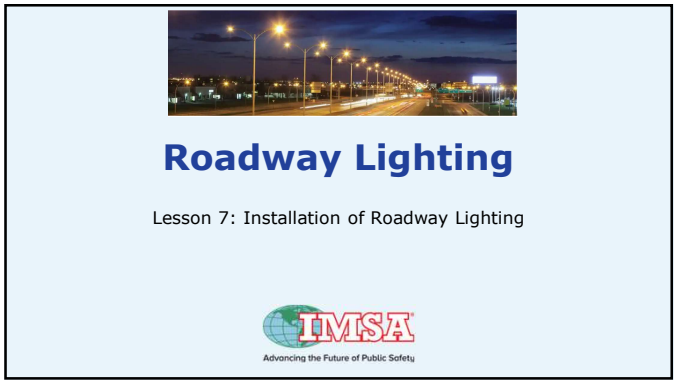
141


IMSA
Knowledge Check
True or False:
Site conditions only need to be documented at the end of the job.

142


IMSA
Knowledge Check
TRESPASSING
True or False:
If a site cannot be accessed in an emergency, leave the work order open until the site is accessible.
DANGER
HIGH VOLTAGE

143


Roadway Lighting
Lesson 7: Installation of Roadway Lighting
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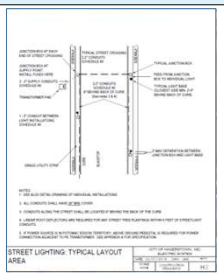
Metal Pole Installation Materials

Review the load list and determine which materials to obtain.

Materials:

- Installation plans
- Measuring wheel
- Trencher, auger, shovel
- Conduit (proper size and length)
- Fittings (90-degree and elbow)
- Glue
- Pull boxes
- Pea gravel for drainage
- Prefabricated foundation OR
  - Concrete
  - Anchor bolts
  - Rebar cage
  - PVC pipe
- Pole
- Luminaires
- Lamps
- Wire and cable
- Fuses and fuse holders
- Ground rods and clamps
- Service and contactor
- Photocell/Time clock



Hagerstown MD Light Department

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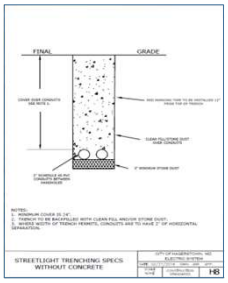
Underground Conduit Installation



1. Identify the appropriate area to install conduit.
2. Excavate the conduit area.
3. Install underground conduit and 90-degree bends.
4. Tape open ends.
5. Bury and tamp dirt surrounding conduit.

Hagerstown MD Light Department

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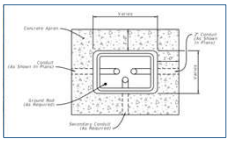
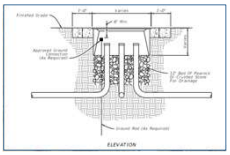
Pull Box Installation





1. Open taped ends.
2. Pour pea gravel.
3. Level pull box.
4. Bury and compact dirt surrounding box or install concrete apron.

FDOT Standard Plans Pull Box Diagram

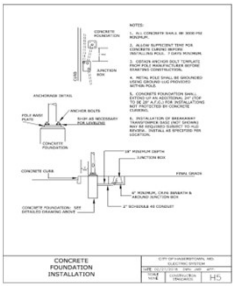
147

Pull Box Installation Video

https://www.youtube.com/watch?v=dWopbJQX6C4

148

Concrete Foundation Installation



1. Install PVC.
2. Install rebar cage and anchor bolts.
3. Pour concrete foundation (or add pre-fabricated).

Hagerstown MD Light Department

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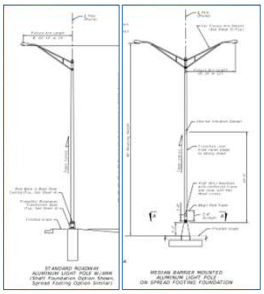
Pole Installation



1. Install pole on foundation.
2. Assemble pole and mount luminaires.
3. Align pole.

FDOT Standard Plans Aluminum Pole Diagram

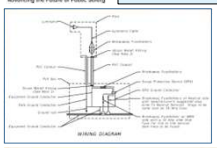
150

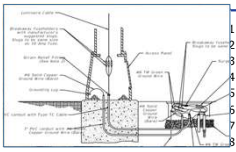
Pole Installation Video

https://www.youtube.com/watch?v=1pFxugh_0Po

151

Connecting the Circuit





1. Determine type of wiring to use.
2. Install grounding rods.
3. Pull cables through conduit, pull boxes, PVC, and pole base.
4. Install service contactor and photocell or time clock.
5. Install meter.
6. Make connections in pull box, handhold, luminaire, and control.
7. Connect fuses and run them up to the luminaire.
8. Test components.

FDOT Standard Plans Conventional Wiring Diagram

152

Knowledge Check

True or False:

Failure to tamp down or compact dirt around conduit and pull boxes can result in holes in the dirt over time, causing a tripping hazard.

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Roadway Lighting

Lesson 8: Site Clean-Up, Documenting Work Completion, and Fleet Equipment Maintenance

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Fleet Vehicle Inspection

Bucket truck maintenance is essential to ensure the safe and reliable operation of the vehicle. Regular maintenance helps prevent breakdowns, extends the lifespan of the equipment, and ensures compliance with safety regulations. Here are some key aspects of bucket truck maintenance:

Pre-Trip Inspection: Before using a bucket truck, conduct a thorough pre-trip inspection. Check the tires, brakes, fluid levels, lights, hydraulic systems, and controls. Look for any signs of damage, leaks, or wear.

Fluids and Lubrication: Regularly check and change the engine oil, hydraulic fluid, coolant, and other fluids as recommended by the manufacturer. Lubricate moving parts, such as the boom and outriggers, according to the manufacturer's guidelines.

Electrical System: Inspect the battery regularly and clean the terminals. Check the wiring, switches, and controls for any signs of damage or loose connections. Ensure all lights, including headlights, taillights, and signal lights, are in proper working order.

Hydraulic System: Inspect hydraulic hoses, fittings, and cylinders for leaks, cracks, or wear. Replace damaged or worn components promptly. Check hydraulic fluid levels and replace or top up as necessary.

Structural Inspection: Regularly inspect the boom, bucket, and other structural components for signs of damage, such as cracks, weld failures, or excessive wear. Ensure all safety features, such as safety harnesses and lanyards, are in good condition.

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Fleet Vehicle Inspection

Tires and Wheels: Check tire pressure, tread depth, and overall condition regularly. Rotate tires as recommended by the manufacturer. Inspect wheels for damage or loose lug nuts.

Brakes and Suspension: Inspect the brake system for proper functioning, including brake pads, rotors, and brake lines. Check suspension components, such as shocks and springs, for wear or damage.

Safety Devices: Ensure all safety devices, such as emergency stop buttons, warning lights, backup alarms, and outrigger interlocks, are working correctly. Test the emergency lowering system of the boom periodically.

Operator Training and Manuals: Ensure operators are properly trained and follow the manufacturer's guidelines for safe operation and maintenance. Keep the vehicle's manuals and documentation readily available for reference.

Regular Servicing: Adhere to the recommended maintenance schedule provided by the manufacturer. This may include periodic inspections, fluid changes, filter replacements, and other maintenance tasks. Consider partnering with a qualified service provider for specialized maintenance and repairs.

Remember, safety is paramount when operating and maintaining a bucket truck. If you are unsure about any maintenance tasks, consult the manufacturer's guidelines or seek assistance from a qualified professional.

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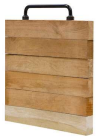
Aerial Lift Components to Inspect

Inspect the following aerial equipment components:

1. Hydraulics
2. Stabilizers
3. Stabilizer pads
4. Boom and bucket
5. Cleanliness of boom
6. Wear pad thickness
7. Bucket insert
8. Bucket door
9. Fiberglass insert
10. Bucket cover
11. Boom welds
12. Load chart and safety labels
13. Fasteners
14. Manufacturer's serial placard








157

Inspecting and Repairing Air Compressors

Proper maintenance of a portable air compressor is essential to ensure its longevity and optimal performance. Here are some maintenance tips to keep your portable air compressor in good working condition:

Read the manual: Start by reading the manufacturer's manual thoroughly. It will provide specific instructions and guidelines for maintenance that are specific to your model of air compressor.

Regular cleaning: Keep your air compressor clean to prevent dust and debris from entering the internal components. Wipe the exterior with a damp cloth and remove any accumulated dirt or grime.

Check the oil level: Some portable air compressors require oil to lubricate the internal components. Check the oil level regularly and change it according to the manufacturer's recommendations. Make sure to use the recommended type and grade of oil.

Drain moisture from the tank: Moisture can accumulate in the tank, leading to corrosion and reduced efficiency. Drain the tank regularly by opening the drain valve and letting the moisture escape. Do this after each use or at least once a month, depending on the compressor's usage.

Inspect and clean the air filters: Air filters prevent debris and dust from entering the compressor. Check the filters regularly and clean or replace them as needed. Clogged filters can restrict airflow and reduce the compressor's performance.

Check for leaks: Inspect all connections, hoses, and fittings for any signs of leaks. Leaks can affect the compressor's efficiency and lead to pressure loss. Tighten loose connections and replace damaged components.

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Inspecting and Repairing Air Compressors

Inspect the belts: If your air compressor has belts, visually inspect them for wear and tension. Replace any worn or damaged belts promptly to avoid unexpected failures.

Lubricate moving parts: Some portable air compressors have moving parts that require lubrication. Refer to the manual to identify the components that need lubrication and use the recommended lubricant.

Store properly: When not in use, store your portable air compressor in a clean and dry location. Protect it from extreme temperatures, moisture, and dust. Consider covering it with a breathable cover to prevent debris from settling on it.

Regular maintenance checks: Periodically perform a comprehensive inspection of the air compressor, including checking for any loose or damaged parts, unusual noises, or signs of wear. If you notice any issues, refer to the manual or consult a professional for assistance.

Remember that the specific maintenance requirements may vary depending on the make and model of your portable air compressor. Always refer to the manufacturer's instructions for the most accurate and up-to-date information.



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Inspecting Arrow Panels and Boards

Daily inspection of arrow panels and boards is important to ensure their proper functioning and to maintain safety on the road. Here are some guidelines for conducting a daily inspection:

Visual Inspection: Start by visually inspecting the arrow panel or board for any visible damage or defects. Look for cracks, dents, loose parts, or signs of wear and tear. Ensure that the arrow panel or board is clean and free from dirt or debris that may obstruct the visibility of the arrows.

Power Source: Check the power source of the arrow panel or board. If it is battery-powered, make sure the battery is charged and in good condition. If it is solar-powered, ensure that the solar panels are clean and not obstructed by any objects.

Controls and Display: Test the control panel and display functions. Check if all the buttons and switches are working properly. Verify that the display is functioning correctly, showing the appropriate arrow patterns or messages as intended.

Arrow Patterns and Messages: Cycle through all the arrow patterns and messages to ensure that they are displayed correctly. Pay attention to the clarity and brightness of the arrows. Verify that the arrows are pointing in the right direction and are easily visible from a distance. o repair or replace the arrow panel or board to maintain road safety.

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Inspecting Arrow Panels and Boards

Mounting and Stability: Check the mounting of the arrow panel or board. Ensure that it is securely attached to its mounting surface, such as a vehicle or a stand. Verify that there are no loose bolts or fasteners. Shake the panel or board gently to ensure that it is stable and doesn't wobble excessively.

Wiring and Connections: Inspect the wiring and connections of the arrow panel or board. Look for any loose or frayed wires, damaged connectors, or signs of electrical malfunction. Ensure that all connections are properly secured and protected from moisture or water intrusion.

Remote Control (if applicable): If the arrow panel or board has a remote control, test its functionality. Ensure that it can effectively operate the arrow patterns and messages from a reasonable distance.

Documentation: Keep a record of the daily inspections, noting any issues or maintenance requirements. This documentation can be helpful for tracking the history of inspections and addressing any recurring problems.

Remember, if you notice any significant defects, damage, or malfunction during the inspection, it is important to report it immediately and take appropriate actions to repair or replace the arrow panel or board to maintain road safety.

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Site Cleanup

Remove trash and debris from performed work

Inspect site for necessary landscape cleanup

Conduct final sweep of site with photo verification

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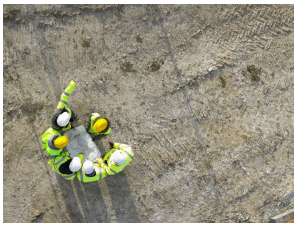
Documenting Worksite Completion

Ensure that all tasks including inspections, repairs, replacements, and materials used are documented. All assets for every work site should be current and accurate.

Include the following items in your worksite documentation:

- Category of work completed
- Equipment, labor, and materials
- Manufacturer materials
- Supplemental materials (receipts, etc.)
- Other relevant information



163

Knowledge Check

True or False:

Fiberglass should be kept clean because dirt and dust can carry electricity.

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Knowledge Check

True or False:

Fleet vehicle inspections should take place every morning.

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Roadway Lighting

Lesson 9: Preventative Maintenance

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Preventative Maintenance

Preventive maintenance in roadway lighting involves a systematic approach to ensure the proper functioning and longevity of lighting infrastructure on roads. Here are some key aspects and practices related to preventive maintenance in roadway lighting:

1.Regular Inspection: Conduct regular inspections of roadway lighting systems to identify any signs of damage, malfunctioning fixtures, or other issues. Inspections can be performed visually or through advanced monitoring systems.

2.Cleanliness: Keep the fixtures and lenses clean from dirt, dust, and other contaminants. This helps maintain optimal light output and visibility.

3.Lamp Replacement: Replace burned-out or failing lamps promptly to ensure consistent lighting levels along the roadways. Consider using energy-efficient lighting technologies, such as LED, to improve longevity and reduce energy consumption.

4.Electrical Connections: Check and tighten electrical connections regularly to prevent loose connections, which can cause flickering or complete failure of the lighting system.

5.Control Systems: Inspect and maintain lighting control systems, including timers, sensors, and photocells. Ensure they are properly calibrated and functioning correctly to optimize energy usage and provide appropriate lighting levels.

6.Pole and Mounting Structure Maintenance: Inspect and maintain poles, brackets, and other mounting structures to ensure their stability and integrity. Look for signs of corrosion, rust, or physical damage that may affect the lighting system's stability.

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Preventative Maintenance

7.Vegetation Management: Trim and manage vegetation around the lighting fixtures to prevent obstruction of the light distribution and maintain visibility.

8.Systematic Maintenance Schedule: Develop a preventive maintenance schedule based on manufacturer recommendations, industry best practices, and local conditions. This schedule should include routine tasks like cleaning, inspection, and maintenance activities.

9.Documentation: Maintain records of maintenance activities, including dates, tasks performed, and any issues encountered. This documentation helps track maintenance history and facilitates future planning and decision-making.

10.Collaboration with Local Authorities: Coordinate with relevant local authorities responsible for roadway lighting to ensure compliance with regulations, standards, and safety requirements.

By implementing a proactive preventive maintenance program, roadway lighting systems can operate efficiently, reduce energy consumption, improve road safety, and minimize unexpected failures. Regular inspections, cleaning, lamp replacement, and adherence to maintenance schedules are essential for maintaining optimal roadway lighting conditions.

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Lighting Maintenance Surveys

Survey Scheduling
Review the survey schedule to determine the appropriate lights for inspection.

Conducting the Survey
Drive around the scheduled area during the day and at night.

Preventative Maintenance Tools
Compare the survey results to your truck's inventory to determine the materials necessary for preventative maintenance.

Examples:
- MSDS Sheets
- Bug/Wildlife Protection

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Preventative Inspections

Refer to checklists and jurisdiction for detailed preventative maintenance procedures.

Inspect the lighting assembly and pole:
1. Pole damage
2. Paint (steel poles)
3. Guy wires (wooden poles)
4. Foundation
5. Wiring
6. Grounding connection
7. Hardware
8. Clearance
9. Lamps/Luminaires

For any tasks that go beyond preventative maintenance, create an additional work order.

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Lighting Assembly Cleaning & Painting

Cleaning Preventative Maintenance:
- Use water, cleaning supplies, scraping tools, etc. to remove advertisements, stickers, and graffiti.
- If items cannot be removed, you may need to paint over them.

Painting Preventative Maintenance:
- Paint over rust and chipped or faded paint.
- Ensure new paint matches the original.
- Protect the work area.
- Remove damaged paint and repaint.

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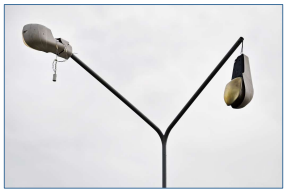
Replacing Lamps/Luminaires

Identify the lights that need replacement or repair based on the maintenance survey.

Preventative Maintenance Tasks:

1. Identify site conditions and gain access.
2. Remove and replace existing lamps/luminaires.
3. Return to troubleshooting steps for electrical issues and submit work order if necessary.



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Streetlight Maintenance Video

https://www.youtube.5com/watch?v=79uqQj_ji4k

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High Mast Lighting Maintenance

High mast maintenance refers to the regular upkeep and repair of high mast lighting systems. High mast lighting is commonly used in outdoor areas such as highways, airports, sports stadiums, and large parking lots. These tall structures are equipped with multiple light fixtures mounted on a high mast, providing effective illumination over a wide area. Proper maintenance of high mast lighting is essential to ensure the system's optimal performance, longevity, and safety.

Here are some key aspects of high mast maintenance:

Cleaning: Regularly clean the fixtures, lenses, and reflectors to remove dirt, dust, and debris that can diminish the lighting output. This can be done using appropriate cleaning solutions and tools, following the manufacturer's guidelines.

Inspection: Conduct routine inspections to identify any signs of damage, such as cracks, loose connections, or corrosion. Inspect the mast structure, cables, electrical components, and anchor bolts. Check for any signs of wear and tear that may compromise the integrity of the system.

Electrical Systems: Inspect the electrical components, including the power supply, cables, connectors, and control panels. Ensure that all connections are secure and free from damage. Test the functionality of switches, timers, and sensors.

Lamp Replacement: High mast lighting systems use lamps or bulbs that require periodic replacement. Monitor the performance of the lamps and replace any faulty or burned-out ones promptly. Follow the manufacturer's specifications for lamp replacement to ensure compatibility and optimal performance.

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High Mast Lighting Maintenance

Alignment and Adjustment: Verify that the lights are correctly aligned and aimed at the desired area. Adjust the fixtures as necessary to maintain uniform lighting coverage and avoid light pollution.

Lubrication: Lubricate moving parts, such as the hinges, pulleys, and mechanical components, to prevent friction and ensure smooth operation. Use appropriate lubricants recommended by the manufacturer.

Structural Integrity: Regularly inspect the mast structure for signs of damage or deterioration. Check for cracks, rust, or any structural weaknesses. Ensure that the anchor bolts are secure and properly tightened.

Safety Measures: During maintenance activities, follow proper safety procedures, such as using appropriate personal protective equipment (PPE), working at heights with proper safety harnesses, and adhering to electrical safety guidelines.

Documentation: Maintain detailed records of maintenance activities, including inspection reports, repair work, lamp replacements, and any other relevant information. This documentation can help track the maintenance history and identify patterns or recurring issues.

It's important to consult the manufacturer's guidelines and recommendations for specific maintenance procedures for your high mast lighting system. Additionally, consider engaging qualified professionals or specialized maintenance services to ensure the proper upkeep of your high mast lighting infrastructure.

175

Knowledge Check

True or False:

If unscheduled maintenance is required, create an additional work order and complete the task (if possible).

176

Knowledge Check

True or False:

Roadways are selected/scheduled for survey based on a schedule.

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