

Course Introduction

Course Information

Purpose	Provide background knowledge on the installation and evaluation of security lighting requirements to protect DoD assets
Audience	Military, civilian, and contractor personnel responsible for physical security
Pass/Fail %	75% on final examination
Estimated completion time	90 minutes

Course Overview

This course is designed to provide background knowledge on the installation and evaluation of security lighting requirements to protect DoD assets. This course contains five modules as well as an optional practical exercise. You will be learning about the following concepts:

- The definition of security lighting and its purpose
- The different types of exterior security lighting
- The uses for each type of security lighting
- Different types of lighting units and bulbs
- The specific planning considerations for security lighting

The modules of instruction are followed by an optional interactive practical exercise that provides an opportunity to identify lighting requirements at a virtual entrance way.

Course Objectives

- Define security lighting
- Identify the purpose of security lighting
- Identify different types of security lighting
- Explain uses of each type of security lighting
- Describe specific planning considerations for security lighting
- List types of lighting units (luminaires)
- Describe types of lighting units (luminaires)
- Explain security lighting criteria for outdoor scenarios
- Provide proper installation details through demonstration

Course Structure

- Course Introduction

Exterior Security Lighting
Course Introduction

- Purpose of Security Lighting
- Types and Uses of Security Lighting
- Planning for Security Lighting
- Types of Lighting Units (Luminaires)
- Outdoor Security Lighting Criteria

Module 1: Purpose of Security Lighting

Module Introduction

In this first module, you will be learning about the purpose of Security Lighting. At the conclusion of this module, you will be able to:

- Explain how security lighting is appropriate for certain sensitive areas or structure under observation
- Explain how security lighting is used as a method of detection
- Explain the two basic systems to be used to provide practical and effective security lighting

Opening Activity

Read the following scenario and place a check next to the phrases you believe to be true.

My name is John Smith and I have been assigned to assist you in evaluating the Security Lighting at a secured facility. In order to evaluate whether or not security lighting is properly installed, you will need to learn a variety of concepts such as the different types of lighting units, bulbs, and their use. Let's begin with a basic background on security lighting.

Why do you think security lighting is necessary? Place a check next to the phrases you believe to be true.

- It is for those sensitive areas or structures such as pier and dock areas, vital buildings, and storage areas that are under observation.
- Its purpose is to discourage or deter attempts at entry by intruders.
- It facilitates the detection of unauthorized persons approaching or attempting malicious acts within the area.

Answer

- It is for those sensitive areas or structures such as pier and dock areas, vital buildings, and storage areas that are under observation.
- Its purpose is to discourage or deter attempts at entry by intruders.
- It facilitates the detection of unauthorized persons approaching or attempting malicious acts within the area.

All of these responses are correct.

Security Lighting is used for those sensitive areas or structures such as pier and dock areas, vital buildings, and storage areas that are under observation. Its purpose is to discourage or deter attempts at entry by intruders, and it facilitates the detection of unauthorized persons approaching or attempting malicious acts within the area.

Security Lighting Uses

1. Psychological Deterrent

Proper illumination may lead a potential intruder to believe detection is inevitable.

Take note:

Security lighting should not be used as a psychological deterrent alone. Lighting may deter unsophisticated criminals or vandals, yet additional security measures are required for sophisticated criminals or for terrorists.

2. Method of Detection

Security forces need to see for long distances at different low-level light contrasts, identify indistinct outlines of silhouettes, and be able to spot an intruder whose silhouette may only be exposed to view for a matter of seconds.

Additional Security Measures

Other security measures are needed to deter more sophisticated criminals or terrorists. It's important that you are aware of what those measures can be.

- Perimeter fence
- Windows breakage sensors
- Patrols (Guards/Security Personnel)
- Intrusion Detection Systems such as PIR Motion Sensors
- Automated personnel Access Control Systems such as badges, PIN and keypads, or biometrical personal identity verification.

Lighting as a Method of Detection

How can lighting be used as a method of detection? We learned that it is about detecting indistinct outlines of silhouettes. So, how does lighting do that?

High Brightness Contrast

High-brightness contrast between intruder and background should be the first consideration. Using light fixtures on the lower parts of buildings and structures may expose an intruder who is depending on dark clothing and darkened face and hands.

Broad Lighting

Broad-lighted areas against which intruders can be seen in and around the installation can also create good observation conditions.

Stripes

Stripes on walls have also been used effectively, as they provide recognizable breaks in outlines or silhouettes.

Volume and Intensity

The volume and intensity of lighting can assist the observer with improved visibility of intruder or intruder actions. It is important to point out that the volume and intensity of lighting will vary with the surfaces to be illuminated.

Two Basic Systems

To be effective, two basic systems or a combination of both may be used to provide practical and effective security lighting. The two methods are:

- Lighting the boundaries and approaches.
- Lighting the area and structures within the property's general boundaries.

Lighting Requirements

Jack is one of our guard force personnel. Let's listen to him explain how security lighting is useful.

Security Lighting must provide adequate lighting to improve our ability to visually assess and intervene on attempts at unauthorized entry. Our presence needs to be minimized while we are able to observe activities around or inside an installation. Lighting cannot cause any glare that may temporarily blind us. Also, the lighting cannot impede the use of closed-circuit television (CCTV) systems or other automated monitoring systems.

Example

To conclude this module, let's take a look at an example regarding an AA&E (Arms, Ammunition and Explosives) Facility.

Security lighting in an AA&E facility is used in conjunction with other security measures to maintain surveillance of potential illegal acts such as forced entry or the unauthorized removal of arms. Additional security measures include continuous guard surveillance, perimeter fencing, access control, and intrusion detection systems.

Exterior building and door lighting shall be provided for all structures storing SRC (Security Risk Category) I and II material as outlined in **DoDM 5100.76**. In order for security forces to maintain proper surveillance, lighting requirements are necessary.

Illumination

Lighting shall provide a minimum of 0.2 foot-candles (2 lux) illumination measured on the horizontal plane at ground level and be sufficient to allow detection of unauthorized activity.

Exterior Light Switches

Exterior light switches shall be installed so that they are only accessible to individuals with authorized access.

Review Activity

Try answering the following questions. When you are finished, see the Answer Key to check your answers.

Question 1

Adequate lighting improves the ability of security forces to detect intruders before they attack. Which of the following statements is false concerning lighting?

- It must be installed such that there is no glare that may temporarily blind the guards.
- Rough, uneven terrain with dense underbrush requires more illumination to achieve a constant level of brightness than do manicured lawns.
- Broad-lighted areas against which intruders can be seen in and around the installation can also create good observation conditions.
- Dark, dirty surfaces or surfaces painted with camouflage paint requires less illumination than installations and buildings with clean, concrete, light brick, or glass surfaces.

Question 2

Please indicate whether the statement below is True or False.

While a security lighting system may deter unsophisticated criminals or vandals, the system alone may not be sufficient to deter sophisticated criminals or terrorists.

- True
- False

Question 3

Select the two basic systems to be used to provide practical and effective security lighting.

- Lighting boundaries and approaches.
- Using high level lighting on security personnel.
- Using high contrast lighting in order for security personnel to detect silhouettes.
- Lighting the area and structures within the property's general boundaries.

Answer Key

Question 1

Adequate lighting improves the ability of security forces to detect intruders before they attack. Which of the following statements is false concerning lighting?

- It must be installed such that there is no glare that may temporarily blind the guards.
- Rough, uneven terrain with dense underbrush requires more illumination to achieve a constant level of brightness than do manicured lawns.
- Broad-lighted areas against which intruders can be seen in and around the installation can also create good observation conditions.
- Dark, dirty surfaces or surfaces painted with camouflage paint requires less illumination than installations and buildings with clean, concrete, light brick, or glass surfaces.

Dark, dirty surfaces or surfaces painted with camouflage paint require **more** illumination.

Question 2

Please indicate whether the statement below is True or False.

While a security lighting system may deter unsophisticated criminals or vandals, the system alone may not be sufficient to deter sophisticated criminals or terrorists.

- True
- False

Additional security measures must be installed to deter sophisticated criminals or terrorists.

Question 3

Select the two basic systems to be used to provide practical and effective security lighting.

- Lighting boundaries and approaches.
- Using high level lighting on security personnel.
- Using high contrast lighting in order for security personnel to detect silhouettes.
- Lighting the area and structures within the property's general boundaries.

Low level lighting is used on security personnel, and **low contrast** lighting helps security personnel to detect indistinct outlines of silhouettes.

Module 2: Types and Uses of Security Lighting

Module Introduction

In this module, you will be learning about different types of Security Lighting and the uses for each type. At the conclusion of this module, you will be able to:

- Identify and define the common types of security lighting and their usage
- Define glare projection, list what it consists of, and explain why it is a powerful deterrent
- Define controlled lighting, list what it consists of, and explain when it is most effective
- Define surface lighting, list what it consists of, and explain how it assists a security force

Opening Activity

Let's get back to learning more concepts about Security Lighting. We'll start with lighting types.

There are actually four types of lighting, each used for specific purposes. Complete the matching exercise below to see what you may already know or think about lighting types. Draw lines to match terms to their definitions.

Continuous Lighting	Consists of manually operated, movable searchlights that may be lit during hours of darkness or only as needed.
Standby Lighting	Luminaries are not continuously lit but are either automatically or manually turned on when suspicious activity is detected or suspected by the security force or alarm systems.
Emergency Lighting	Can be powered by installed, portable generator or battery and is used for power failure or other situations that render the normal system inoperative.
Portable Lighting	Most common type of lighting. It consists of a series of fixed lights arranged to flood a given area continuously during darkness with overlapping cones of light.

Answer

Let's review these topics.

- **Continuous lighting** is the most common type of lighting. It consists of a series of fixed lights arranged to flood a given area continuously during darkness with overlapping cones of light.
- **Standby lighting** consists of luminaires that are not continuously lit but are either automatically or manually turned on when suspicious activity is detected or suspected by the security force or alarm systems.

- **Emergency lighting** can be powered by installed or portable generator or battery and is used for power failure or other situations that render the normal system inoperative.
- **Portable lighting** consists of manually operated, movable searchlights that may be lit during hours of darkness or only as needed.

Let's talk about continuous lighting in more detail since this is the most common security lighting system. All known as stationary lighting, it consists of three primary methods.

Continuous Lighting

1. Glare Projection

Glare protection makes it difficult to see inside the area. Guards are protected by being kept in comparative darkness and able to observe the area. With continuous lighting, glare projection consists of lamps mounted on poles inside a protected area and directed outward. This method is used when the glare of lights directed across the surrounding area will not be considered a nuisance or interfere with adjacent operations.

2. Controlled Lighting

Controlled lighting consists of lamps mounted on 30-foot poles and shines down and out. This lighting is most effective when it limits the width of the lighted strip outside the perimeter, such as along highways.

3. Surface Lighting

Surface lighting consists of lamps mounted at ground surface and shines in and up onto the surface of a building or structure.

Surface lighting illuminates the face of a building from the ground up and assists the security force by elongating or exaggerating the shadow of an intruder who approaches a building.

Review Activity

Try answering the following questions. When you are finished, see the Answer Key to check your answers.

Question 1

Which type of lighting is considered the most common?

- Stand by lighting
- Continuous lighting
- Movable lighting

-
- Portable lighting

Question 2

Please indicate whether the statement below is True or False.

Surface lighting helps to exaggerate the shadow of a potential intruder approaching a building.

- True
- False

Question 3

Select the two statements below which are true about continuous lighting

- A. Three primary methods of using continuous lighting are: glare projection, controlled lighting, and surface lighting.
- B. Continuous lighting consists of a series of fixed lights arranged to flood a given area continuously during darkness with overlapping cones of light.
- C. Continuous lighting is used as a supplement to stand by lighting.
- D. Continuous lighting is a manual operation.

Answer Key

Question 1

Which type of lighting is considered the most common?

- Stand by lighting
- Continuous lighting
- Movable lighting
- Portable lighting

Continuous lighting is the most common lighting.

Question 2

Please indicate whether the statement below is True or False.

Surface lighting helps to exaggerate the shadow of a potential intruder approaching a building.

- True
- False

Surface lighting illuminates the face of a building from the ground up and assists the security force by elongating or exaggerating the shadow of an intruder who approaches a building.

Question 3

Select the two statements below which are true about continuous lighting

- A. Three primary methods of using continuous lighting are: glare projection, controlled lighting, and surface lighting.
- B. Continuous lighting consists of a series of fixed lights arranged to flood a given area continuously during darkness with overlapping cones of light.
- C. Continuous lighting is used as a supplement to stand by lighting.
- D. Continuous lighting is a manual operation.

C and D are false statements. Movable (or portable) lighting is used as a supplement to continuous (or stand by) lighting and is a manual operation.

Module 3: Planning for Security Lighting

Module Introduction

In this module, you will be learning about specific planning considerations for security lighting. At times during this module, you will be accessing tables and images. At the conclusion of this module, you will be able to:

- Identify specific planning considerations for security lighting

Opening Activity

Imagine that we are designing a Security Lighting Plan. What would be our considerations? Let's start with lighting function. Lighting function refers to the purpose of the lighting under consideration.

Often lighting designed for security will provide additional lighting functions. How well it performs these functions will depend on how well the lighting plan was designed.

Do you believe the statement below is true or false?

It is essential to be consistent in all areas of the facility when it comes to Security Lighting.

- True
- False

Answer

It is not essential to light all areas of the facility consistently. In fact, each area of a facility presents its own unique set of considerations based on physical layout, terrain, atmospheric and climatic conditions, and security requirements.

Planning

During the planning phase, there are several important concepts that must be considered for the lighting function.

1. Luminance

Luminance is the measurement of light existing in a given area or at a selected point in that area.

How is it measured?

It can be measured in either foot candles or lux.

2. Illuminance

Illuminance is a measure of the amount of light falling on a surface.

How is it measured?

It is measured in output of light (lumens) compared to power input (watts) to define lamp efficiency (efficacy). Lamp output (lumens per watt) is measured when the lamp is new.

3. Foot Candles

One foot-candle, which is an English measurement, is the illuminance at a point on a surface that is 1 foot from, and perpendicular to, a uniform point source of one candela. There are commercially made light meters available to measure illuminance. Older model light meters indicate in units of foot-candles.

4. Lux

One lux is the illuminance at the same point at a distance of 1 meter from the source. There are commercially made light meters available to measure illuminance. Newer models indicate in units of lux.

5. Conversion

One foot-candle equals 10.76 lux. For example, 50 foot-candles equals 538 lux.

Foot-candle = (lux) x 10.76

Light Direction Question

Another important consideration when planning is the direction that the light is coming from. This would mean either horizontal or vertical.

Which do you think is the most important direction when it comes to Security Lighting?

- Horizontal
- Vertical

Light Direction Answer

The amount of vertical illuminance is far more important than horizontal in many security lighting applications. The security lighting system must provide adequate and uniform vertical illuminance. Vertical illuminance should average 0.2 to 0.5 foot-candles at 5 feet above the ground. Furthermore, it should have a very uniform coverage of 4:1 average to minimum.

Lighting Examples

Let's take a minute to look at some examples. The following tables show Foot Candles and Lux values.

ACP		
Areas	Foot Candles	Lux
Approach zone and response zone	3	32
Parking and roadways	3	32
Access control zone	5	53
Search areas (vehicle and ID checking)	10	107
Vital locations or structures	5	53
Building surrounds	1	10

Buildings Floodlighted		
Bright Surroundings	Foot-Candles	Lux
Light surfaces	15	161
Medium-light surfaces	20	215
Medium-dark surfaces	30	322
Dark surfaces	50	538
Dark Surroundings		
Light surfaces	5	53
Medium-light surfaces	10	107
Medium-dark surfaces	15	161
Dark surfaces	20	215
Gates and doors	2	21
Office space	50	538

Self-parking (Other than ACP)	Foot-Candles	Lux
Self-parking	1	10
Attendant parking	2	21
Covered parking	5	53

Rail Yards, Marshaling, and Loading Areas	Foot-Candles	Lux
Loading and unloading platforms	20	215
Freight car interiors	10	107
Lumber yards	1	10

Service Station		
Light Surroundings	Foot-Candles	Lux
Approach	3	32
Driveway	5	53
Pump island	30	322
Building faces	30	322
Service areas	7	75
Landscape highlights	5	53
Dark Surroundings		
Approach	1.5	16
Driveway	1.5	16
Pump island	20	215
Building faces	10	107
Service areas	3	32

Landscape highlights	2	21
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Ship Yards	Foot-Candles	Lux
General	5	53
Ways	10	107
Fabrication areas	30	322

Storage Yards	Foot-Candles	Lux
Active	20	215
Inactive	1	10

Uniformity

Let's take a minute to talk about uniformity. Uniformity refers to the consistency of the lighting. It is very important to prevent "spotty" lighting especially in interior areas where people are working, and exterior areas where safety and security are concerns.

1. Light Uniformity

Light uniformity allows security personnel to see ahead and to the sides with an absence of dark areas caused by shadows. The lighting should be brightest in the secure area, with the light gradually less in the areas adjacent to the high-illumination areas.

2. Illuminance Uniformity

Lighting level or illuminance uniformity is important on work surfaces where sustained tasks are performed as well as on wall and ceiling surfaces that make up a significant portion of the field of view.

Glare Question

Let's move on now to talk about glare. Read the phrase below. Do you think it is true or false?

There are circumstances in which direct glare can enhance security.

- True
- False

Answer

In most exterior applications, security is best achieved by reducing glare. However, in some circumstances such as entries and checkpoints, glare can be used to increase vertical illuminance on approaching vehicles or individuals while increasing visibility for guards and patrols.

Glare Reduction Planning

Imagine you are designing the lighting at a secure facility. You are developing a plan to reduce glare. What will you do and what are some questions you will have?

Questions	Requirements
Where will the light be placed?	Ensure that individuals are not working directly under direct luminaires.
What are the typical angles?	Use luminaires that are classified as cutoff* or semi-cutoff**
What type of lamp and luminaire (lighting fixture) will be used?	Use indirect luminaires to light the ceiling surface and avoid totally direct luminaires.
What is the mounting height of the light?	

*Cutoff: A luminaire light distribution where the candela per 1000 lamp lumens does not numerically exceed 25 (2.5 percent) at an angle of 90 degrees above nadir, and 100 (10 percent) at a vertical angle of 80 degrees above nadir. This applies to all lateral angles around the luminaire.

**Semi-cutoff: A luminaire light distribution where the candela per 1000 lamp lumens does not numerically exceed 50 (five percent) at an angle of 80 degrees above nadir. This applies to all lateral angles around the luminaire.

Light Trespass Question

We have two more important factors to consider when designing Security Lighting. Let's start with Light Trespass. Which phrase below do you think describes light trespass?

- When light from one facility spills over into an adjoining facility
- When color shift causes problems with identifying persons and objects in the lighted area

Answer

Light trespass is when light from one facility spills over into an adjoining facility, where it could cause interference with the security of that area. The factors that affect glare are also a consideration for light trespass.

Designing Lighting

Imagine you are designing the lighting at a secure facility. You are developing a plan to minimize light trespass. See the list below for guidelines.

- Use only fully shielded luminaires for area lighting.
- When unshielded luminaires such as wall packs and decorative luminaires are used at low mounting heights, reduce the light source brightness to that of a 4200 lumen light source (similar to a 55 watt induction light source) or less.
- Do not over light areas because reflected light can also result in complaints and poor visibility by increasing visual adaptation.
- Dim or turn lighting off when not needed and activate with motion sensors or timers when activity occurs.

Think for a minute about security personnel at an ID badge check area. What might be another factor to consider when it comes to lighting? The ability to identify colors accurately and confidently.

This is determined by the light source spectral power distribution and the illuminance level. This capability is commonly referred to as **color rendition** and is measured by the color rendition index (CRI). To ensure appropriate color rendition, use a light source with CRI greater than or equal to 65 in the ID check areas, and use any nominally white light source (CRI greater than or equal to 50) at the illuminances typically encountered in the remaining areas.

There are frequently used lamps (bulbs) each with its own impact on color of light and color rendition. It is important to consider which bulb type to utilize depending on the area of the facility and the appropriate tasks that need to be accomplished by security personnel in that area.

Important note:

Because different light sources radiate more in one area of the color spectrum than others, certain colors will be emphasized more than others when they illuminate a neutral surface. This color shift can cause problems with identifying persons and objects in the lighted area.

Cost-Related Question

Another consideration for lighting design is cost-related and it has to do with the lamp efficiency. Which definition do you think is correct?

- Lamp efficiency refers to the amount of light (lumens) that is produced by a light source for every watt of energy.
- Lamp efficiency refers to how the amount of light (lumens) degrades over time with the amount of energy consumed remaining constant while the light output slowly reduces.

Answer

Lamp efficiency refers to the amount of light (lumens) that is produced by a light source for every watt of energy. The other definition is for lamp lumens depreciation, which we will learn about shortly.

Lamp Efficiency

Let's take a minute to go over the calculation. Lamp efficiency is the quotient of the total luminous flux emitted to the total light source power input. It is measured in terms of lumens (light output) per watt (power required to operate the lamp).

Different light sources produce light at different efficiencies. Remember what you learned earlier about different bulb types? Incandescent lamps have the lowest efficiency, whereas fluorescent, induction, and metal halide sources have the highest efficiencies.

Lamp Lumen Depreciation

So what happens as a light source is used over time? This is known as Lamp Lumen Depreciation. Lamp Lumen Depreciation refers to the fact that Lamp efficiency degrades over time with the amount of energy consumed remaining constant while the light output slowly reduces. The bulb types we learned about earlier each have an average rated life. For planning purposes, you should review this information.

Type of Lamp	Wattage Range	Initial Lumens Per Watt Including Ballast Losses	Average Rated Life (Hours)
Low-pressure sodium	18–180	62–150	12,000–18,000
High-pressure sodium	35–1,000	51–130	7,500–24,000+
Metal halide	70–2,000	69–115	5,000–20,000
Mercury Vapor			
Standard	40–1,000	24–60	12,000–24,000+
Self-ballasted	160–1,250	14–25	12,000–20,000
Fluorescent	4–215	14–95	6,000–20,000+
Incandescent	15–1,500	8–	750–3,500
Tungsten-halogen	20–1,875	10–30	950–6,000

Jen from the Finance department is going to talk to you about how lamp efficiency relates to costs.

The careful selection of light sources to use the most efficient and lowest-wattage light source for the application reduces energy use and cost. This results in a significant benefit with a low-cost increase. For example, fluorescent lamps, typically rated in milliamperes (MA), may have an initial higher cost; however, they are more efficient, have a longer life, and typically pay back in energy savings and replacement costs in a few years.

In the planning of security lighting for a site, the cost of operation of older lamps must be weighed versus the cost of lamp replacement.

Joe is a Physical Security Officer (PSO). He wants you to learn about additional factors to consider when planning a security lighting system.

Joe's List

- Cost of replacing lamps and cleaning fixtures, as well as the cost of providing the required equipment (such as ladders and mechanical buckets) to perform this maintenance.
- Provision of manual-override capability during a blackout, including photoelectric controls.
- These controls may be desirable in a peacetime situation but undesirable when a mandatory blackout is a possibility.
- Effects of local weather conditions on lighting systems.
- Fluctuating or erratic voltages in the primary power source.
- Grounding requirements.
- Provisions for rapid lamp replacement.
- Lamp compatibility with the luminaire.
- Use of lighting to support a CCTV system.
- Lighting requirements for adjoining properties and activities.
- Strike or warm-up time of the lamp (the time required before the light will function properly when first turned on).
- Restrike time of the lamp (the time required before the light will function properly

after a brief power interruption).

- Color accuracy.
- Other facilities requiring lighting, such as parking areas.

Review Activity

Try answering the following questions. When you are finished, see the Answer Key to check your answers.

Question 1

What is the term used when light from one facility spills over into an adjoining facility?

- Lamp Lumen Depreciation
- Light Uniformity
- Light Trespass
- Direct Glare

Question 2

Please indicate whether the statement below is True or False.

Luminance is a measure of the amount of light falling on a surface

- True
- False

Question 3

Which lamp types have the highest efficacy? Select all that apply.

- A. Fluorescent
- B. Incandescent
- C. Induction
- D. Metal halide

Answer Key

Question 1

What is the term used when light from one facility spills over into an adjoining facility?

- Lamp Lumen Depreciation
- Light Uniformity
- Light Trespass
- Direct Glare

Question 2

Please indicate whether the statement below is True or False.

Luminance is a measure of the amount of light falling on a surface.

- True
- False

Illuminance is a measure of the amount of light falling on a surface. Luminance is the measurement of light existing in a given area or at a selected point in that area.

Question 3

Which lamp types have the highest efficiency? Select all that apply.

- A. Fluorescent
- B. Incandescent
- C. Induction
- D. Metal halide

Fluorescent, Induction, and Metal halide sources have the highest efficiency, while Incandescent has the lowest.

Module 4: Types of Lighting Units (Luminaires)

Module Introduction

In this module, you will be learning about the different types of lighting units (luminaires). At the conclusion of this module, you will be able to:

- Define luminaire, including lamp, ballast, and lens.
- Explain how to utilize a pole as for outdoor lighting fixtures and list considerations in terms of pole height and number of lights.
- Provide examples of various luminaire types, explain the light pattern for the luminaire type, describe the use of the luminaire type and provide associated pole height.

Lighting Types

We are now at the point where we are selecting the appropriate type of lighting units for the various areas of the facility. In order to do that, we need to learn about the different types of lighting units and at what height they should be placed in specific areas.

Let's start with some basic definitions.

1. Luminaire

A luminaire is a complete lighting unit, including lamps, ballast(s), and lens; the units come in all sizes and shapes, and their use depends on the installation's overall security requirements.

2. Ballast

A ballast is a device used with an electric-discharge light source to obtain the necessary circuit conditions (voltage, current, and waveform) for starting and operating.

3. Lamp

A lamp is surface lighting mounted at ground surface and shines in and up onto the surface of a building or structure.

4. Lens

A lens is a glass or plastic element used in luminaires to change the direction and control the distribution of light rays.

Just a Note:

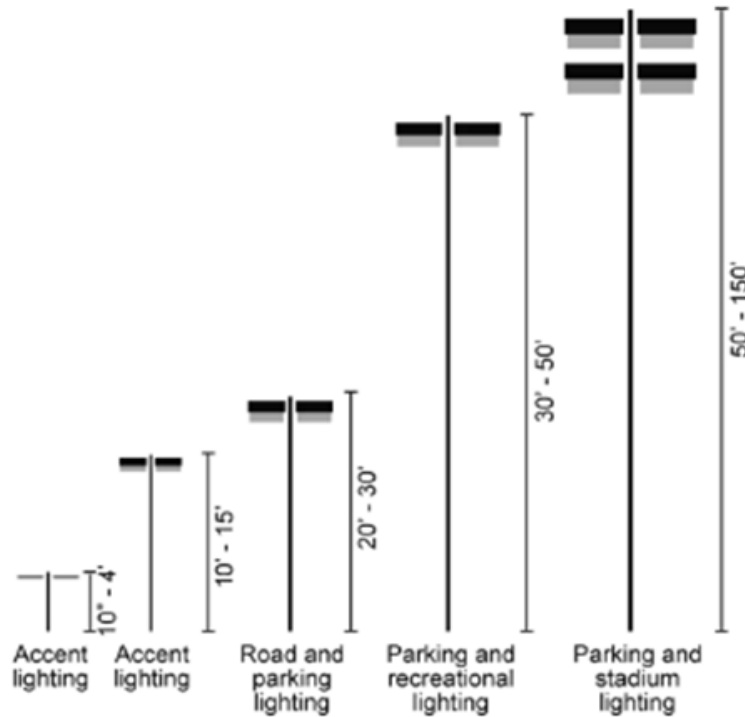
Existing luminaires can be converted to accept a new kind of lamp; this will entail the installation of new ballasts. It may be more cost-effective to replace the luminaires rather than use the old ones.

Lighting Placement

I had mentioned earlier that the placement of the luminaire (lighting unit) is also an important consideration. Height is essential and will have an impact on the lighting design,

specifications, and the system used. In a decision on the types of poles or mounts to be used, the overall design configuration of the site must be considered.

Where the lighting is mounted depends on the specified area. Increased height permits use of higher-wattage, more efficient lamps and luminaires, resulting in reduced glare. Additionally, more than one luminaire can be mounted on the taller poles. With more lights per pole, fewer poles will be needed.



In many instances, poles will not be needed, because the luminaires can be mounted on the sides or roofs of buildings or other facilities in the complex.

Cut-off

This luminaire is used to reduce direct glare in lighting medium-to-large areas where control of spill light and direct glare is important.

Where?

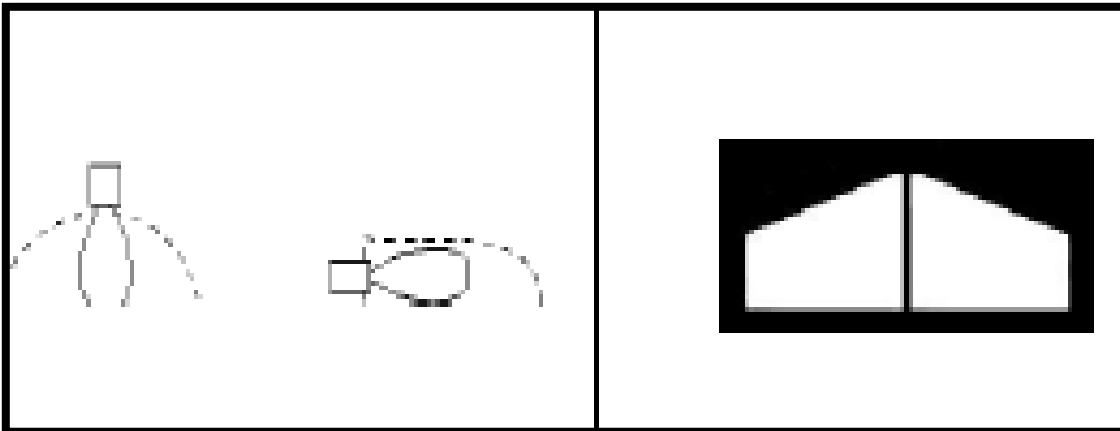
Parking lots next to residential areas

Pole Height?

Pole heights can vary from 30 to 50 feet.

Example

Light Pattern



Refractor

This luminaire is used where spill lighting and glare control are less important.

Where?

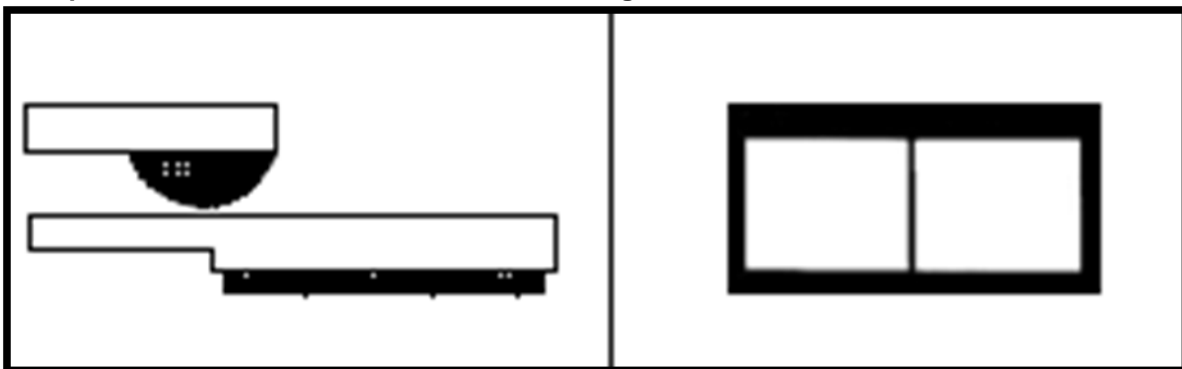
Highway, street, and general-area lighting

Pole Height?

Pole heights are 50 feet and up.

Example

Light Pattern



Low-mounted sight lighting

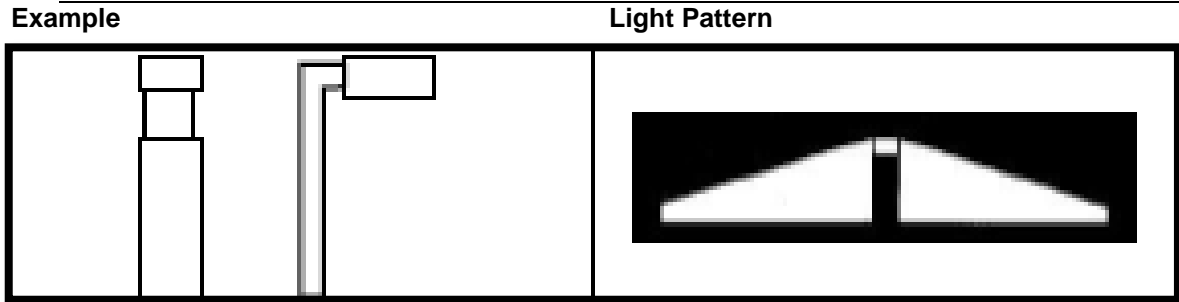
This low-wattage luminaire produces low-level, glare-free lighting of small areas.

Where?

Buildings where aesthetic appeal is needed.

Pole Height?

Pole heights 4 feet and under.



Post-top (uncontrolled)

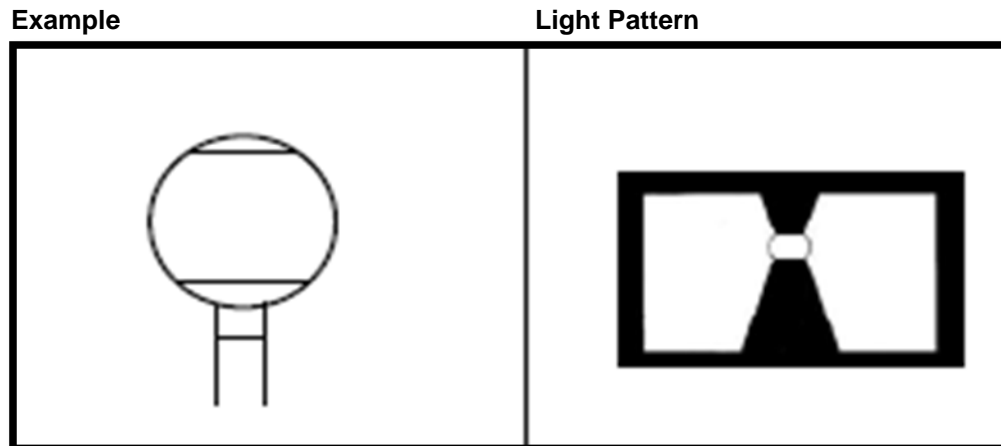
This low-wattage luminaire is used for decorative purposes and provides 360 degrees of light distribution. A considerable amount of light is lost above the horizontal.

Where?

Decorative purposes.

Pole Height?

Pole heights are from 4 to 10 feet, depending on the area design.



Post-top (controlled)

This low-to-medium wattage luminaire is used when it is necessary to direct most of the light into the desired area.

Where?

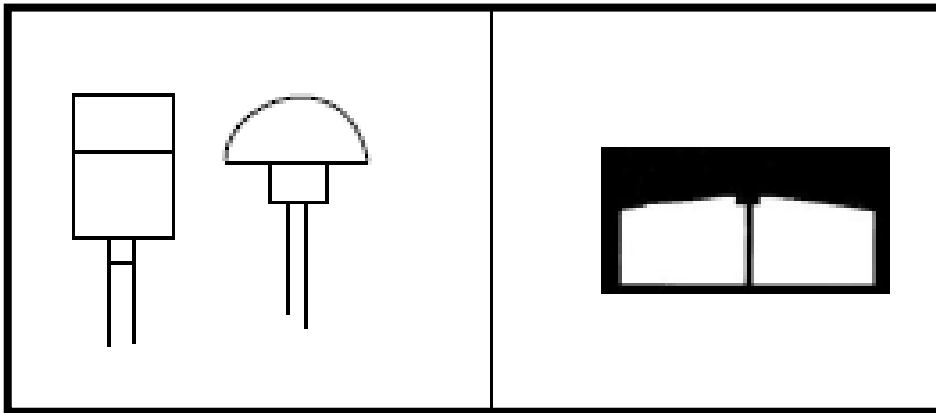
It is used for medium-to-small areas and pedestrian walkways.

Pole Height?

Pole heights are from 4 to 10 feet, depending on the area design.

Example

Light Pattern



High mast

This is a high-wattage luminaire used for large area coverage with good glare control.

Where?

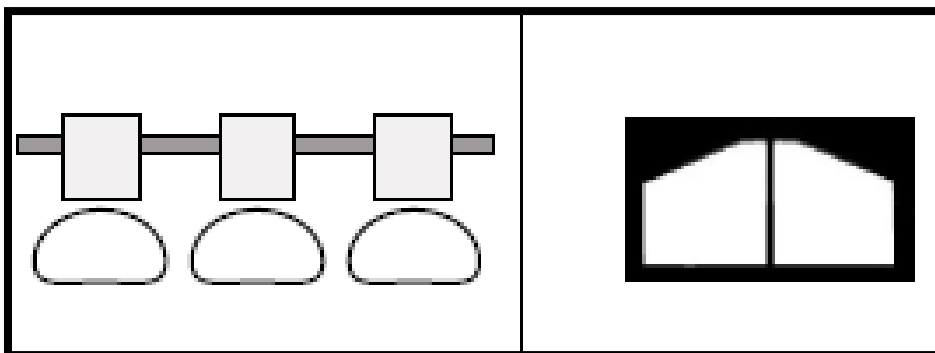
Railroad yards, large parking lots, industrial yards, and highway interchanges.

Pole Height?

It is pole-mounted and ranges from 60 to 150 feet high.

Example

Light Pattern



Floodlight or projector (full cut off)

This medium-to-high wattage luminaire is used to control glare and light trespass. The shape of the luminaire allows a sharp cutoff of the upper light beam.

Where?

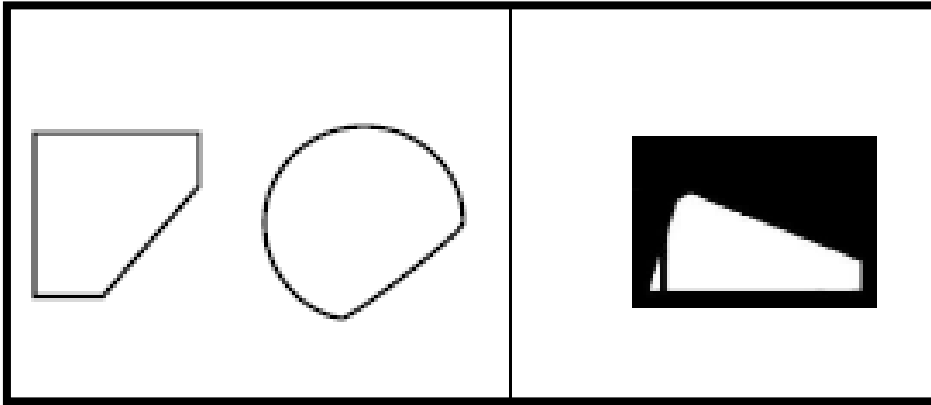
Airport aprons and areas adjacent to residential neighborhoods.

Pole Height?

Pole heights are up to 50 feet.

Example

Light Pattern



Floodlight or projector (semi-cut off)

This medium-to-high wattage luminaire is used to control spill light and glare with louvers and hoods.

Where?

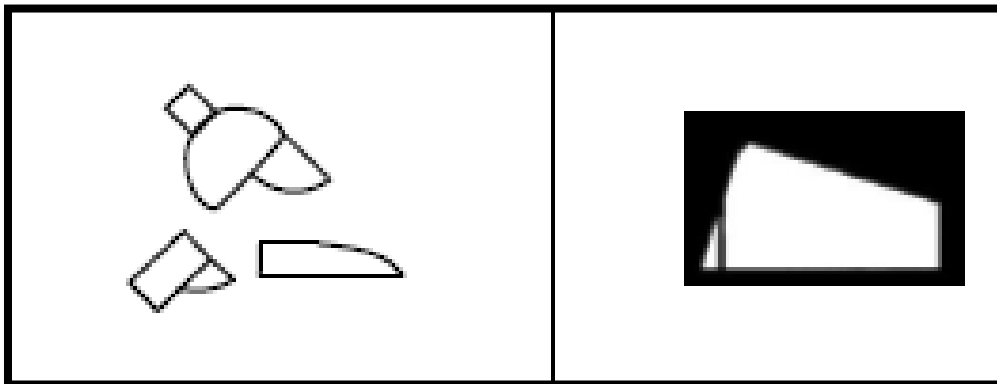
Typically used near residential areas

Pole Height?

Pole heights are up to 50 feet.

Example

Light Pattern



Floodlight or projector (non cut-off)

This medium-to-high wattage luminaire is used to provide a tight symmetrical beam.

Where?

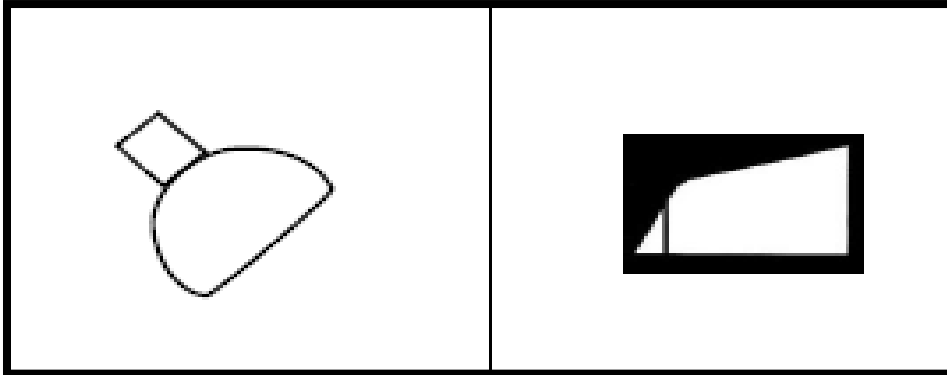
It is used for buildings, sports, and area lighting where light spillage is not a concern.

Pole Height?

The height of the building will dictate how high the luminaire can be mounted or, for sports, the pole can be from 60 to 150 feet.

Example

Light Pattern



Building mounted (cut off type)

This is a low-wattage luminaire used for tighter beam control and low brightness. It is used to control light spillage/trespass and glare

Where?

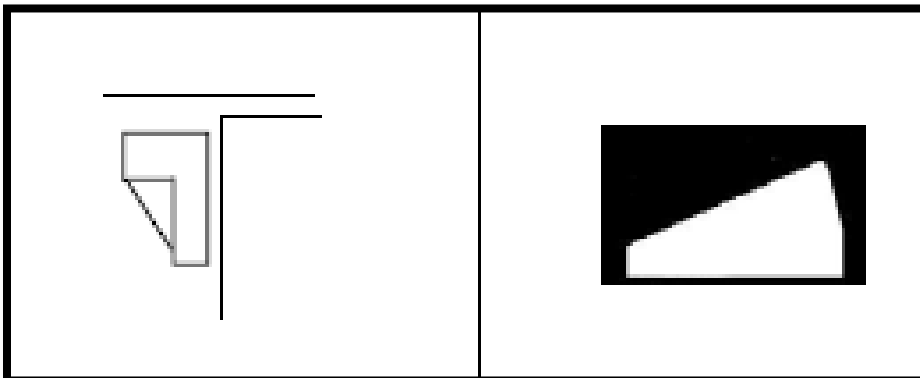
It is used on all types of buildings.

Pole Height?

Mounting height depends on the building height and the desired coverage area.

Example

Light Pattern



Building mounted (refractor type)

This is a low-wattage luminaire used to produce a wide-beam distribution

Where?

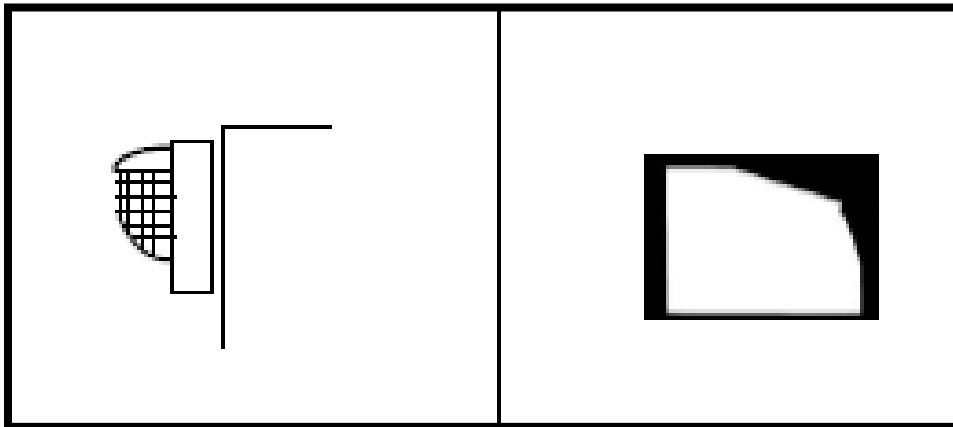
It is used for general lighting of buildings, and the glare may be objectionable.

Pole Height?

Mounting height depends on the building height.

Example

Light Pattern



Review Activity

Try answering the following questions. When you are finished, see the Answer Key to check your answers.

Question 1

Of the four luminaire types listed below, which one is used for railroad yards, large parking lots, industrial yards, and highway interchanges?

- Post-Top Controlled
- Floodlight (semi-cut off)
- Post-Top Uncontrolled
- High Mast

Question 2

Please indicate whether the statement below is True or False.

A ballast is a complete lighting unit.

- True
- False

Question 3

Which statements below are true about poles?

- A. With more lights per pole, fewer poles will be needed.
- B. Poles are always required to mount luminaires.
- C. Increased height permits use of higher-wattage.
- D. Stadium lighting requires 10 foot pole height.

Question 4

Lighting is to be installed in a large parking lot. You must measure the luminance. What is an appropriate height for the lighting unit to be installed on the pole?

- A. 60–150 feet
- B. Exactly 50 feet
- C. 4–10 feet
- D. Under 4 feet

Question 5

Lighting is to be installed in a pedestrian walkway. A low-to-medium wattage luminaire is used when it is necessary to direct most of the light into the desired area. To provide the necessary level of brightness for human recognition, which lighting unit should be installed at which height?

- A. Refractor between 50–60 feet
- B. Floodlight (semi cut off) no higher than 50 feet
- C. Low mounted site lighting under 4 feet
- D. Post-top controlled between 4–10 feet

Answer Key

Question 1

Of the four luminaire types listed below, which one is used for railroad yards, large parking lots, industrial yards, and highway interchanges?

- Post-Top Controlled
- Floodlight (semi-cut off)
- Post-Top Uncontrolled
- High Mast

High Mast lighting is a high-wattage luminaire used for large area coverage with good glare control.

Question 2

Please indicate whether the statement below is True or False.

A ballast is a complete lighting unit.

- True
- False

A luminaire is a complete lighting unit, which consists of a ballast, lamp, and lens.

Question 3

Which statements below are true about poles?

- A. With more lights per pole, fewer poles will be needed.
- B. Poles are always required to mount luminaires.
- C. Increased height permits use of higher-wattage.
- D. Stadium lighting requires 10 foot pole height.

Poles are not always necessary since luminaires can be mounted on the sides or roofs of a building, and stadium lighting requires a much higher pole height, up to 150 feet.

Question 4

Lighting is to be installed in a large parking lot. You must measure the luminance. What is an appropriate height for the lighting unit to be installed on the pole?

- A. 60–150 feet
- B. Exactly 50 feet
- C. 4–10 feet
- D. Under 4 feet

In order to provide the appropriate level of brightness to cover a large area, the lighting unit should be installed between 60–150 feet on the pole.

Question 5

Lighting is to be installed in a pedestrian walkway. A low-to-medium wattage luminaire is used when it is necessary to direct most of the light into the desired area. To provide the necessary level of brightness for human recognition, which lighting unit should be installed at which height?

- A. Refractor between 50–60 feet
- B. Floodlight (semi cut off) no higher than 50 feet
- C. Low mounted site lighting under 4 feet
- D. Post-top controlled between 4–10 feet

In order to direct most of the light in the desired area, a post-top controlled lighting unit should be installed between 4–10 feet on the pole.

Module 5: Outdoor Security Lighting Criteria

Module Introduction

In Module 5, you will be presented with several outdoor lighting scenarios. You will learn about the correct installation details for each scenario such as:

- Perimeter Fencing (Isolated, semi-isolated, and non-isolated)
- Entrance ways (pedestrian walkway, vehicle access, and gatehouses)
- Open yards
- Open storage spaces
- Piers and docks

After Module 5, you may choose to participate in an optional interactive practical exercise.

Perimeter Fencing

Let's keep in mind the concepts you have learned as we walk around the facility. I will be talking to you about Security Lighting on the perimeter fencing, entrance way, open yard, open storage spaces, and piers and decks.

We are going to start first with the perimeter fencing. Isolated fenced perimeters are fence lines around areas where the fence is 100 feet or more from buildings or operating areas.

1. Semi-isolated

Semi-isolated fenced perimeters are fence lines where approach areas are clear of obstruction for 60 to 100 feet outside of the fence.

2. Non-isolated

Non-isolated fenced perimeters are fence lines immediately adjacent to operating areas.

Guidelines for Dock Lighting

Area 1

Gatehouses at entrances should have a low level of interior illumination, enabling guards to see approaching pedestrians and vehicles.

Area 2

Vehicle access points should have two lighting units located to facilitate the complete inspection of passenger cars, trucks, and freight cars, as well as their contents and passengers.

Area 3

Entrances for pedestrians should have two or more lighting units that provide adequate illumination for recognition of persons and examination of credentials. Pedestrian zones must provide light for both pedestrians and security personnel. Pedestrians must have a clear view of gates and card access readers and security personnel must be able to see pedestrians approaching the ACP.

Semi-active and inactive entrances should have the same degree of continuous lighting as the remainder of the perimeter, with standby lighting to be used when the entrance becomes active.

Post-top controlled luminaires will direct the light into the desired area. With regard to the bulb type, good color rendition is also important when human appearance is essential.

Area 4

For isolated fenced perimeters, the approach area is clear of obstruction for 100 or more feet outside of the fence. Other personnel do not use the area. Use glare projection for these perimeters, and keep patrol routes unlit.

For semi-isolated fenced perimeters, the general public or installation personnel seldom have reason to be in the area. Use controlled lighting for these perimeters and keep patrol routes in relative darkness.

For non-isolated fenced perimeters, these areas may be in an installation or public thoroughfares. Outsiders or installation personnel may move about freely in this approach area. The width of the lighted strip depends on the clear zones inside and outside the fence. Use controlled lighting for these perimeters. It may not be practical to keep the patrol area dark.

Area 5

Outdoor storage spaces include: material storage areas, railroad sidings, motor pools, and parking areas

Lighting units should be placed in outdoor storage spaces to provide an adequate distribution of light in aisles, passageways, and recesses to eliminate shadowed areas where unauthorized persons may hide.

- Color Appearance (and Color Contrast): In storage rooms, individuals may need to locate and sort items. Light source sources should have a high color-rendering index to accurately portray colors and labels.
- Source / Task eye Geometry: Locate luminaires to minimize direct glare and light shelves uniformly with minimal shadowing.
- Target Vertical Illuminance ($\pm 10\%$): 100 lux (10 fc) average

Area 6

An open yard adjacent to a perimeter (between guards and fences) will be illuminated according to the perimeter's illumination requirements. Where lighting is necessary in other open yards, illumination will not be less than 0.2 foot-candles at any point. Lighting of the building frequently includes some area lighting as well. By using fully shielded, wall mounted luminaires; both the building and the adjacent area can be illuminated. Mounting luminaires at the top of the facade and aiming the light down will increase the facade brightness and also reduce light trespass and light pollution.

Area 7

Illuminating both water approaches and the pier area safeguards piers and docks located on an installation.

Decks on open piers will be illuminated to at least 1 foot-candle, and the water approaches (extending to a distance of 100 feet from the pier) to at least 0.5 foot-candles.

In general, high mast lighting provided for waterfront operations supply adequate illuminance for security requirements. Coordinate number, height, and location of poles and the associated concrete pedestals to minimize obstructions to pier and wharf operations.

The area beneath the pier floor will be lit with small-wattage floodlights arranged on the piling. Movable lighting is recommended as a part of the protective lighting system for piers and docks.

You now have the background knowledge you need to evaluate exterior security lighting. Although it is not likely that you will be physically tasked to install security lighting, you will need to be able to evaluate the installation.