

# PHYSICAL SECURITY



Presented By:

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# DOMAIN 5 – PHYSICAL SECURITY (25%)

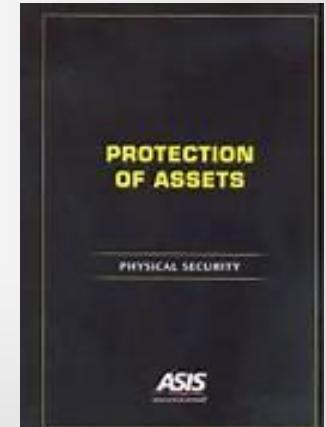
Part 1: Physical Protection System Goals and Objectives (Ch1)

Part 2: Physical Protection System Design (Ch2-8)

Part 3: Analysis (Ch11)

Part 4: Implementation (Ch 12)

**Protection of Assets Manual - (Protection of Assets)**



# WE WILL REVIEW...

- Facility Surveys
- Select, Implement and Manage Physical Security Strategies
- Assess the effectiveness of the security measures

# MORE DETAILS

- **Facility Surveys**
  - Security Protection Equipment and Personnel
  - Survey Techniques
  - Building Plans, drawings and schematics
  - Risk Assessment Techniques
  - Gap Analysis
- **Select, Implement and Manage Physical Security Strategies**
  - Fundamentals of security system design
  - Countermeasures
  - Budgetary projection development process
  - Bid package development and evaluation process
- Vendor qualification and selection process
- Final acceptance techniques
- Cost Benefit Analysis Techniques
- Labor-Technology Relationship
- **Assess the effectiveness of the security measures**
  - Protection of personnel, technology and processes
  - Audit and testing techniques
  - Preventive and corrective maintenance for systems

# NOTES

CPP Exam Guidelines



Notable / Tip



Big Picture



# FRAMEWORK

## Goals

Problem  
Definition

Design  
Principles

## Design

- Detection
- Deterrence
- Delay
- Response

## Analysis / Implementation

Audits

ROI

# FACILITY SURVEYS: 33% OF CONTENT

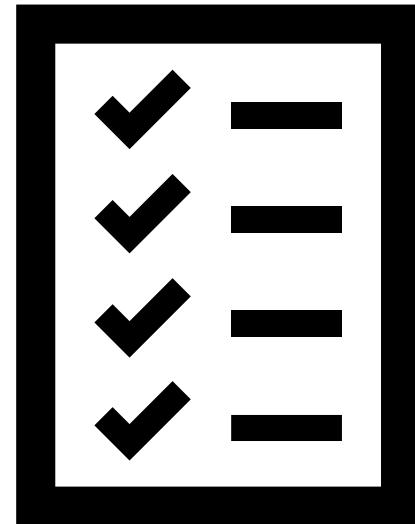
Security Protection Equipment and Personnel

Survey Techniques

Building Plans, drawings and schematics

Risk Assessment Techniques

Gap Analysis



# SECURITY EQUIPMENT AND PEOPLE

Sensors

Guards (response force)

Alarms

First Responders

Video Surveillance

Internal vs External  
Response forces

Doors

Locks

Windows



Integration in order to  
achieve a security system

Fences

Barriers

# Sensors

**Passive or Active**

**Covert or Visible**

**Line of Sight-  
Sensor or Terrain  
Following**

**Volumetric or  
Line detection**

**Application**

# Camera Systems: Types



# Camera Systems: Field of View



# Camera Systems: Resolution

**5 Px/ft**

**General:** clothing & colors  
not distinguishable

**7 Px/ft**

**Monitor:** general human  
or vehicles, traffic flows

**11 Px/ft**

**Detect:** but not identified

**18 Px/ft**

**Observe:** clothing & colors  
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**35Px/ft**

**Recognize**  
ID known individuals

**46 Px/ft**

**Subject ID** beyond a  
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**70 Px/ft**

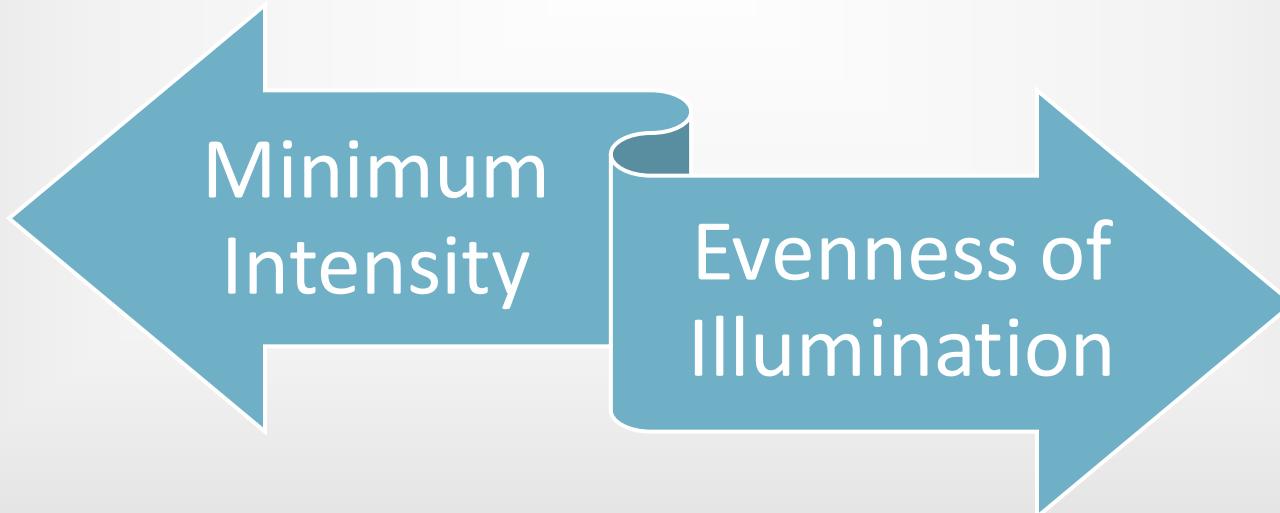
**License plate**

**88 Px/ft**

**Facial recognition**

# Lights: Basics

- The two most important parameters of a lighting system for CCTV: Intensity and Evenness
- The quantity of light emitted by a lamp is measured in lumens.



# Lights: Specific Applications

A general rule for lighting level is:

- 0.5 fc for **detection**
- 1.0 fc for **recognition**,
- 2.0 fc for **identification**
- **5 fc w/ uniformity Rate of 4:1 =Parking structures**

(Mcghee, 1988)

# Access Control

**Entry Control:** Physical equipment used to control movement of people or material into an area.

Performance

**Access Control:** the process of managing databases or other records and determining the parameters of authorized entry (who, what, where, when).

# ALARM COMMUNICATION AND DISPLAY

- AC&D – moves alarm information to a central point for an operator to act on
- Wireless, Cable
- Various subsystems (video, sensor)
- Loop, point to point and multiplex

# ENTRY CONTROL

- Personnel Entry Control
- Locks
- Access Control

# Barriers: Access Delay

Principle of Balanced Design: each aspect of barrier has an equal delay.

The more an adversary is delayed, the more time security staff have to assess the situation and send a response force.

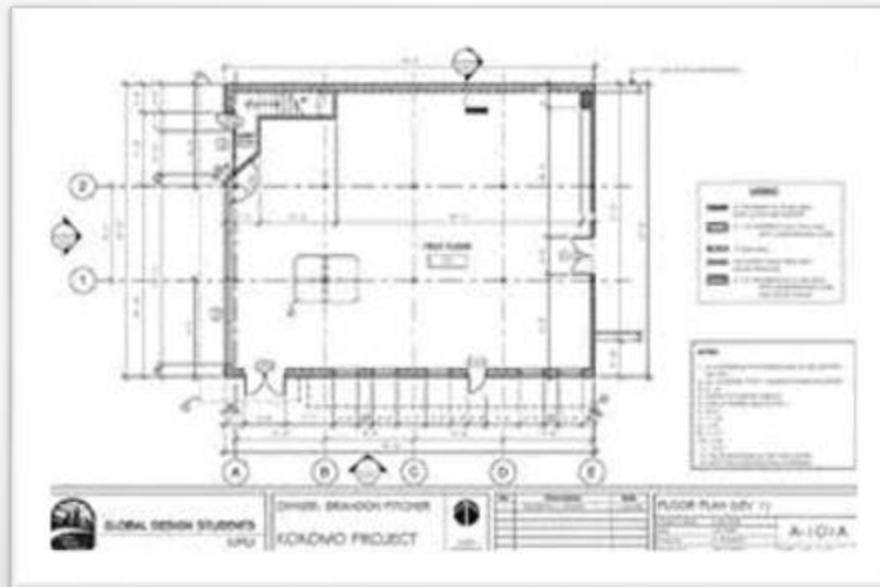
**Passive Barriers** – doors, walls, floors, locks, vents, ducts, and fences

**Personnel** – security officers, receptionist, concierge

**Disposable Barriers** – chemical fogs and smokes, foams, irritants

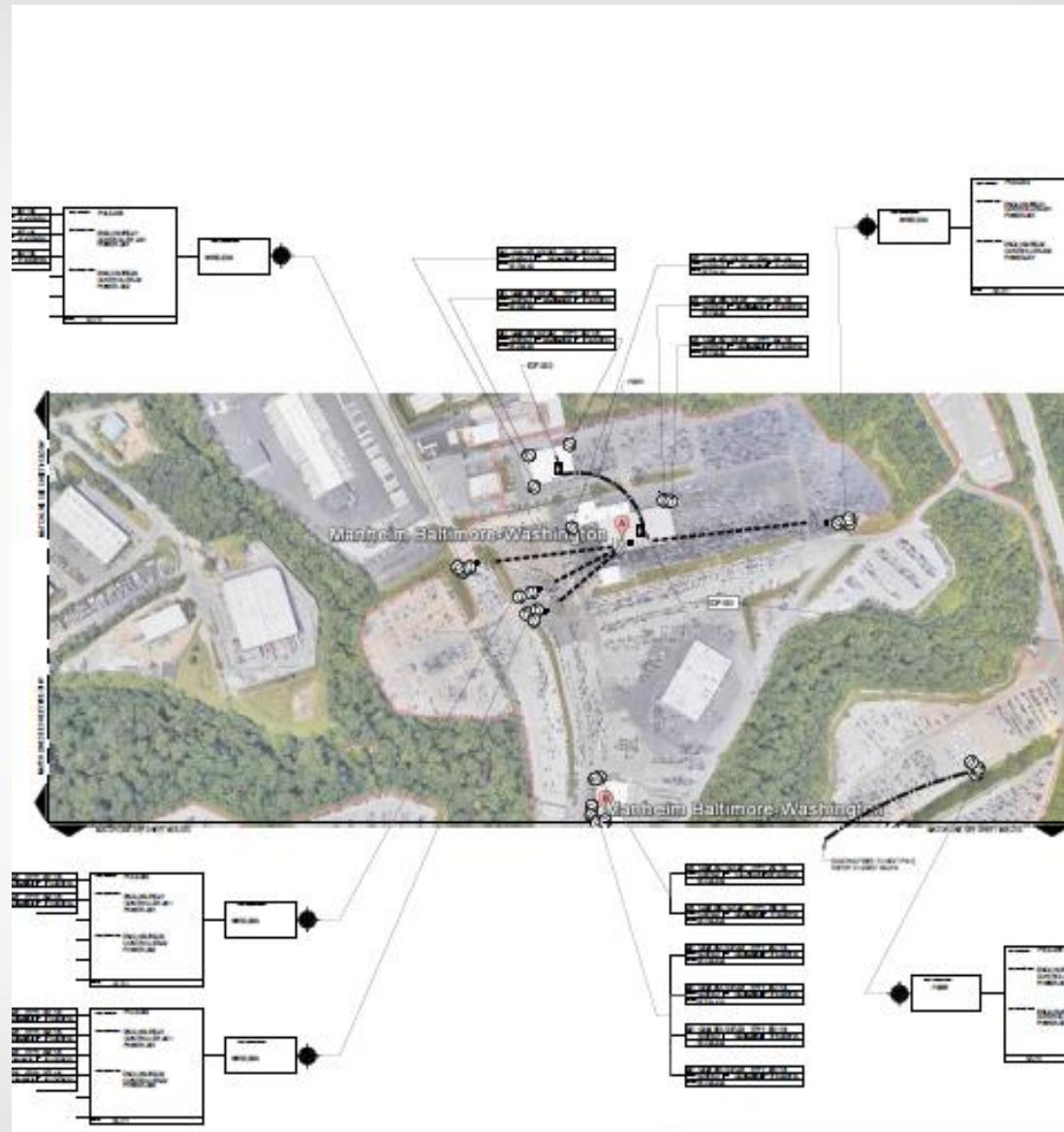
# BUILDING DRAWINGS

- Plans
  - Top-down, map-like view of an area
  - Symbols set for manual drafting is issued by the ASTM International in *Standard Practice for Security Engineering Symbols*



# SYSTEM DESIGNS

- Location and Type of Cameras
- Location of Servers
- WAPs
- Fiber Runs





# RISK ASSESSMENT

# WHAT IS RISK

**Threat + Consequence + Vulnerability = Risk**

- Threat = adversary capability, equipment, motivation, intent and the likelihood of the attack
  - Likelihood of the attack can be based on frequency or probability
- Consequence = undesirable outcome
- Vulnerability = PPS weakness that can be exploited

# UNDERSTANDING THE RISK



# RISK ANALYSIS BIG PICTURE

What can go wrong?

What is the likelihood that it will happen?

What is the consequence?



# RISK ANALYSIS: CONSEQUENCE CRITERIA

Undesired Consequence	Low	Medium	High
Loss of life	1-10	11-50	>50
Loss of asset	<\$5k	\$5-50k	>\$50K
Days out of operation	<1	2-3	>3
Loss of reputation	Stock price drops 1 day	Stock prices drops 5 days	Stock price drops 30 days
Redundancy	>3 locations	2 locations	1 locations

# RISK ANALYSIS: TYPES

Quantitative – measurable data

Qualitative – tend to be subjective

Inductive – start with event/consequence

Deductive – end with the event

CARVER (a qualitative analysis)

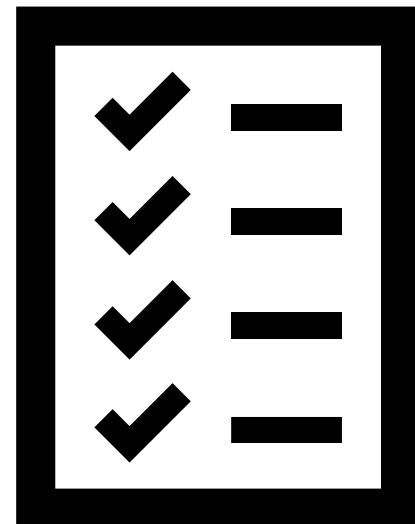
ASD – Adversary Sequence Diagrams

## CHECK IN

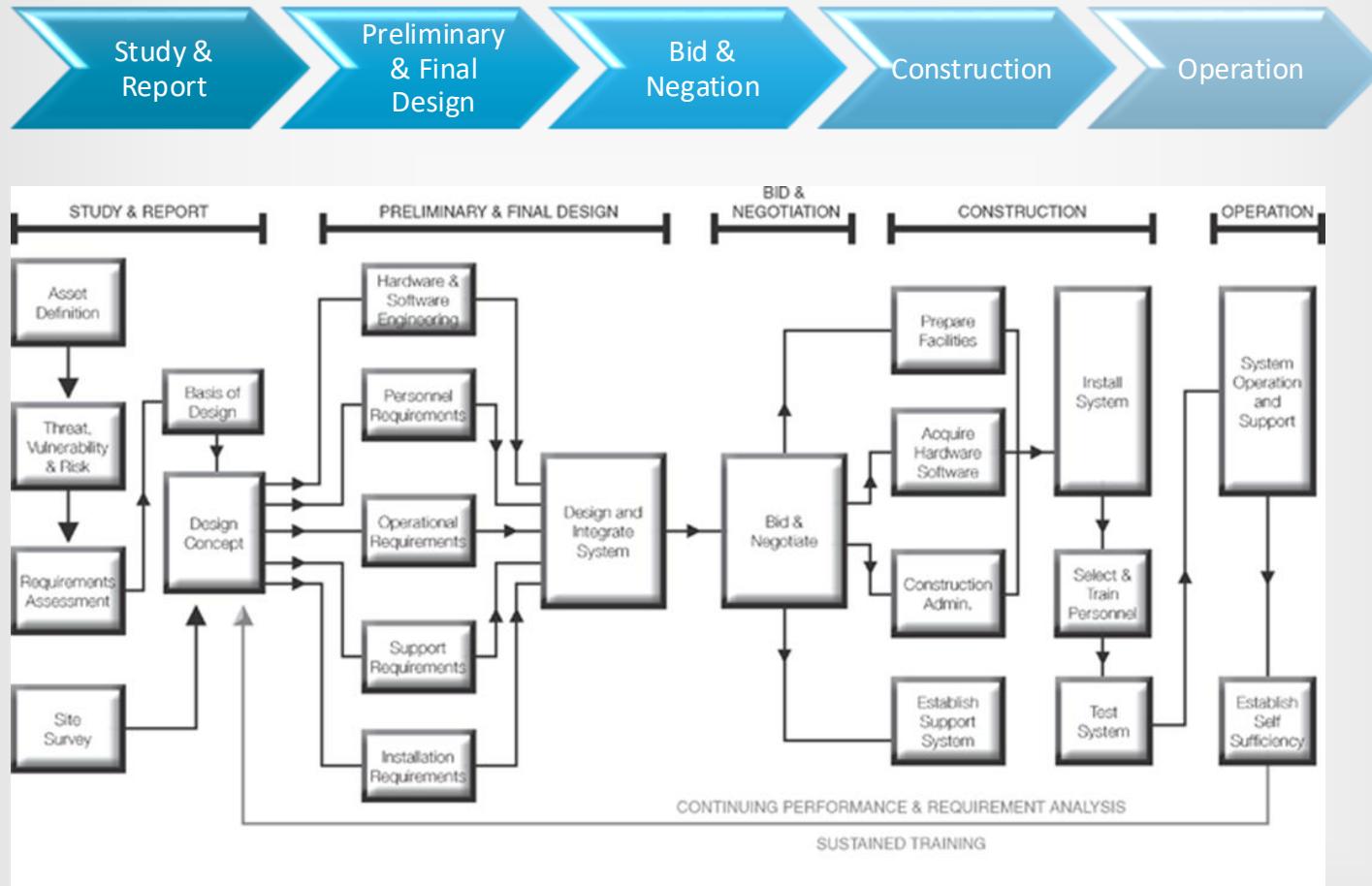
- What is the measure that defines the intensity of light per square foot?
- What are the TWO measures used to gauge the effectiveness of SENSORS
- What are the components of a Risk Assessment?

# SELECT, IMPLEMENT AND MANAGE PHYSICAL SECURITY STRATEGIES: 33%

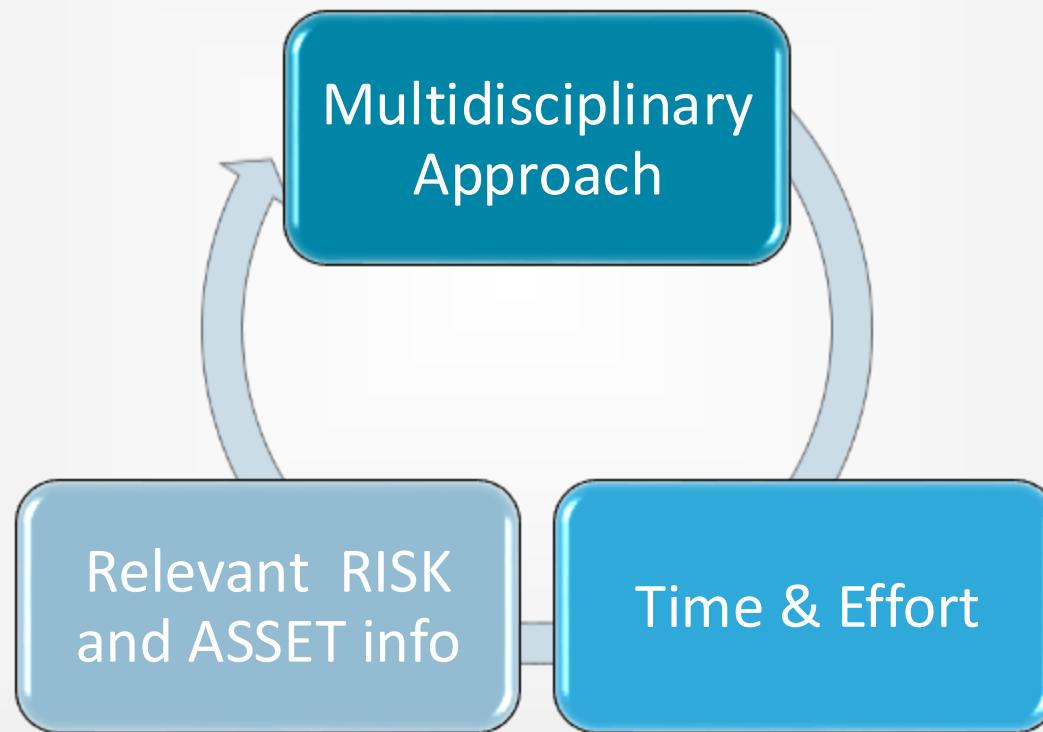
- Fundamentals of security system design
- Countermeasures
- Budgetary projection development process
- Bid package development and evaluation process
- Vendor qualification and selection process
- Final acceptance techniques
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- Labor-Technology Relationship



# FUNDAMENTALS OF SYSTEM DESIGN



# KEY INGREDIENTS IN PLANNING



# HISTORY LESSON



## Marquis de Laplace

- French mathematician and astronomer :
- Developed the 10 principles of probability
- The importance of having a redundant security system

## **Designers: Four Principal Security Strategies**

Prevention

Detection

Control

Intervention

## **Homeland Security: Five Principal Security Strategies**

Prevention

Detection

Preparation

Response

Recovery

# DESIGN CRITERIA

- Codes & Standards – Fire & Life Safety
- Quality
- Capacity – 10% - 15% Spare capacity
- Performance
- Features
- Cost - Budget is part of Design
- Operations
- Culture & Image
- Monitoring & Response – Small & Medium sites can go to a Central Station / Large or complex sites have a Security Operations Center

# DESIGN TEAM

CEO

CFO

HR Manager

IT Manager

Facilities  
Manager

Project  
Architect

Construction  
Manager

Security  
System  
Designer

Security  
Manager

# **BID PACKAGE DEVELOPMENT AND EVALUATION PROCESS**

## Procurement Types

Sole Source Procurement

RFP – Request for Proposal

IFB – Invitation For Bid

# BUDGETARY PROJECTION DEVELOPMENT PROCESS

## Preliminary Cost Estimate:

- The budget should be within 15%- 20% of final bid prices
- ✓ Include:
  - Capitol Project
  - Service Projects
  - Recurring Costs

# VENDOR SELECTION

- Compare life cycle costs
- Check for large discrepancies
- Company reps (good chemistry, competence, trouble shooting)
- Reasonable profit will make for a better relationship
- References, licenses and credentials

# INSTALLATION AND OPERATION

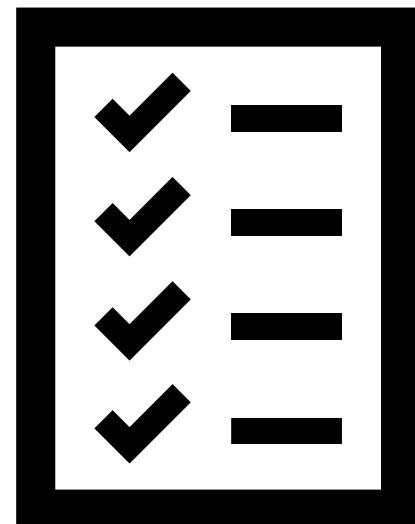
- Do a walk to confirm the locations
- Inspect and test all current equipment
- Downtime
- Follow installation standards
- Periodically review
- Ensure staff is trained

# COST BENEFIT

- Does the risk avoided outweigh the cost of the program
- Did you reduce cost with system efficiencies
- Insurance claims

## ASSESS THE EFFECTIVENESS OF PHYSICAL SECURITY MEASURES : 33%

- Protection of personnel, technology and processes
- Audit and testing techniques
- Preventive and corrective maintenance for systems



# TYPES OF SYSTEMS TESTS

1. Pre-delivery or factory acceptance tests
2. Site acceptance test
3. Reliability or availability tests
4. After-acceptance tests

## PERSONNEL, EQUIPMENT AND PROCESSES

- Video Systems – object classification, lag time, 24/7 operation, field of view, sensor integration
- Lights – are to standard
- Entry Control – are there redundancies

# AUDIT AND TESTING TECHNIQUES

- **Analysis:** The evaluation of the PPS compared to threats and asset value (not the overall risk analysis that is also done).
- Analysis of the PPS
  - It establishes the assumption under which a design was formed
  - It relates system performance to threats and assets, making possible a **cost-benefit decision**.

$$PE = PI \times PN$$

PE: Physical protection system effectiveness

PI: Probability of interruption

PN: Probability of neutralization

# QUALITATIVE ANALYSIS

- Detect an adversary
- Timely and accurate alarms
- Timely distribution of alarm to responders
- Does it address 3 D's
- Detection before delay?
- Is the delay sufficient?
- Protection in depth
- Balanced protection
- Engage adversaries
- Path/Scenario Analysis

# AFTER-IMPLEMENTATION TESTING

1. Operational tests
2. Performance tests
3. Post maintenance tests
4. Subsystem tests
5. Limited scope tests
6. Evaluation tests

# PREVENTIVE AND CORRECTIVE MAINTENANCE FOR SYSTEMS

- 2 Main Types of Maintenance
- BOTH are normally included in a service agreement

Remedial

Preventative



# PHYSICAL SECURITY EQUIPMENT

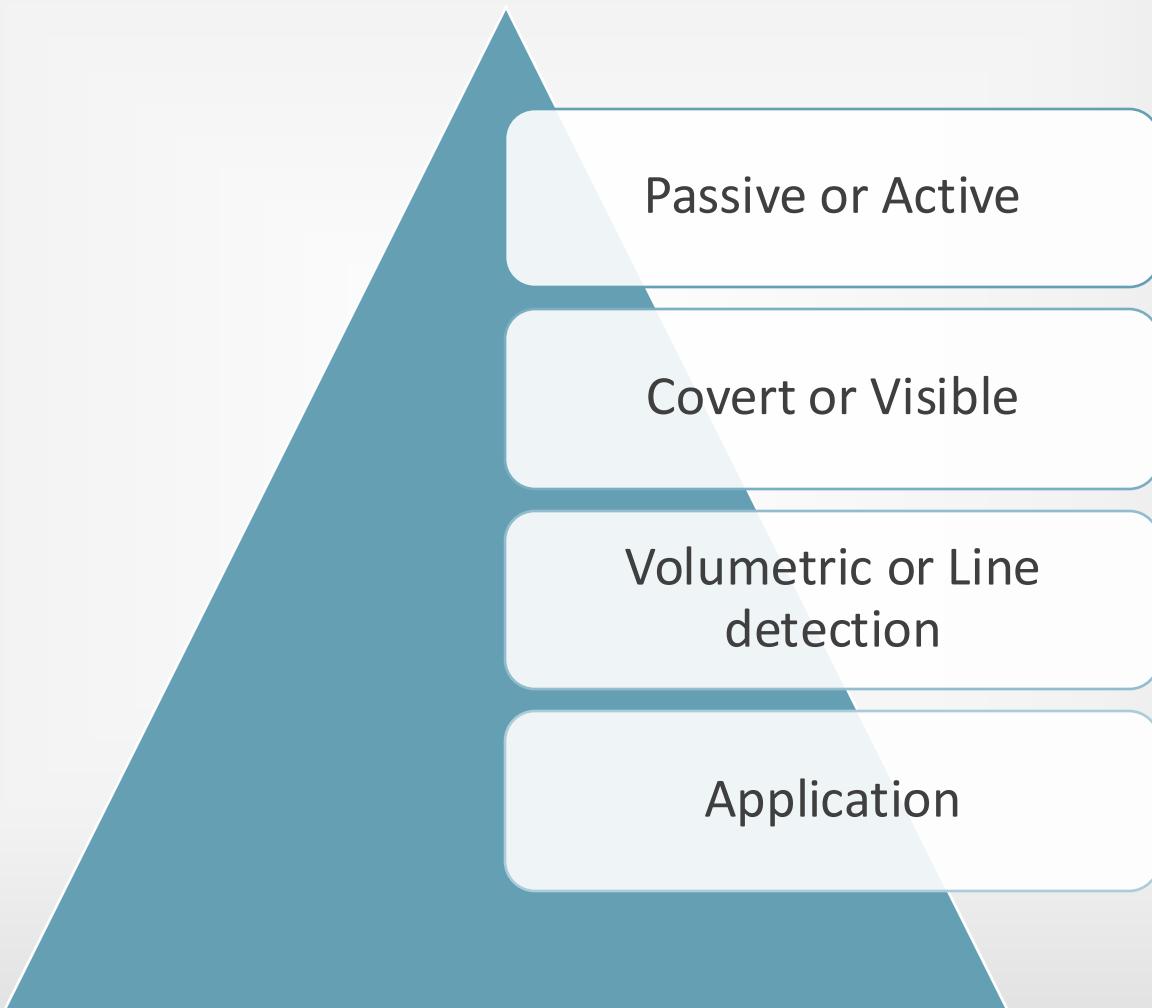
- Sensors
- Video Systems
- Alarms
- Entry Control
- Barriers
- Lighting



# SENSORS



# INTERIOR SENSORS



Passive or Active

Covert or Visible

Volumetric or Line  
detection

Application

# PASSIVE OR ACTIVE

## Passive

- No signal from a transmitter
- Energized near sensor



## Active

- Transmitter & Receiver
- Detect change or deflection of signal



# Interior Sensors

Sensor	Passive / Active	Covert / Visible	Volumetric / Line Detection	Application
<b>Boundary Penetration</b>				
Vibration	Passive	Either	Line	
Electromechanical	Passive	Visible	Line	
<b>Interior Motion</b>				
Microwave (Doppler)	Active	Visible	Volumetric	
Passive IR (50 watt Bulb)	Active	Visible	Volumetric	
Dual Technology	Both	Visible	Volumetric	
Video Motion Detection (VMD)	Passive	Visible	Volumetric	
<b>Proximity</b>				
Pressure Mat				
Capacitance				
Wireless				

# INTERIOR SENSORS



Water Sensor



Volumetric  
Sensor



Panic Sensor



Pressure Mat  
Sensor



Shock Sensor



Vibration Sensor

# SENSORS: DEFINITIONS

- Volumetric
  - Entire room covered by MOTION
- Line Detection
  - Narrow area covered
- Electromechanical
  - Switch installed on doors and windows typically using a magnetic design
  - Ultrasonic – Transmit in the Ultrasonic range
  - When the received signal changes from its expected level (due to sound deflection or absorption), an alarm is transmitted.
- Not recommended in areas with draft or change in humidity
- Microwave System – pattern of radio waves that are transmitted and partially reflected back to the antenna

# Interior Sensors: PIR

## Passive Infrared Sensors (PIR)

- Are visible and volumetric
- Respond to changes in the energy emitted by human
  - Equal to heat of **50-watt bulb**
- Also detect changes in the background



# Interior Sensors: PIR

## PIR - Advantage

**Totally passive technology**

## PIR - Disadvantage

Moderate vibration sensitively

**Well define detection zones**

Sensitivity variation due to room temperature

**No interaction between multiple devices**

Line-of-sight operation with easily blocked field of view

**Low to moderate cost**

Potential nuisance alarms from rapid temperature changes

**Relatively few nuisance alarms**

-----

# Interior Sensors: Dual Tech

- Active and passive, visible and volumetric.
- Achieve alarm confirmation while maintaining a high probability of detection.
- Combine two technologies, such as microwave and infrared sensors.



# Interior Sensors: Video Motion

## Video Motion Detection (VMD)

- A passive sensor that processes the video signal from a CCTV camera
- Factors should be considered when selecting VDM:
  - Consistent controlled lighting with no flickering
  - Camera Vibration
  - Objects that could cause blind areas
  - Moving objects, such fans, curtains, and small animals
  - Changing sunlight or shadows

# Interior Sensors: Best Practices

- Audible or visible alarm indicator that can be recognized from a distance of 10-35 ft.
- All sensors should be performance tested after maintenance
- Installation and maintenance of sensor should be performed at least to the manufacturer's specifications



# Exterior Sensors

**Passive or Active**

**Covert or Visible**

**Line of Sight-  
Sensor or Terrain  
Following**

**Volumetric or  
Line detection**

**Application**

# Exterior Sensors

- Covert: hidden underground or in something contain explosives vapors or materials.
- Visible: attached to a fence or structure being detectable
- Passive sensors
  - Detect energy by an object.
  - Detect a change in a field of energy
  - Safer in environments that
- Active sensors typically contain both transmitter and a receiver.
- Line of Sight-Sensor or Terrain Following
  - Require a clear LOS

# Exterior Sensors

- Terrain following Sensors- Where terrain is flat
  - Requires extensive site preparation
- Volumetric Sensor = Alarm when an intruder enters the detection volume
- Line Detection = motion along a line
- Buried line
- Fence associated
- Free standing



# Exterior Sensors

Sensor	Active / Passive	Covert / Visible	LOS / Terrain Following	Volumetric / Line Detection	Application
Ported Coaxial Cables <i>(Motion)</i>	Active	Covert	TF	Line	Buried
Fence Disturbance Sensors <i>(Motion or Shock)</i>	Passive	Visible	TF	Line	Fence
Sensor Fences <i>(Deflections of wire)</i>	Passive	Visible	TF		
Electric Field or Capacitance <i>(Change in Capacitance)</i>	Active	Visible	TF		
Freestanding IR <i>(Break in Beam)</i>	Active	Visible	LOS		Freestanding
Bistatic Microwave Sensors <i>(Movement-chg in Vector Sum)</i>	Active	Visible	LOS		Freestanding
Exterior Video Motion Detectors (VMDs) <i>(Motion)</i>	Passive	Covert	LOS		

# Exterior Sensors: Best Practices

## Protection-in-Depth

At least two continuous lines of detection should be used in high security systems.

- Complimentary Sensors
- Priority Schemes
- Combination of Sensors
- Sensor Configuration



## Clear Zone (Also called “Isolated Zone”)

- 2 Parallel fences around perimeter
- Detection zone is in between fences
- Increases detection probability; reduces nuisance alarms, and prevents defeat.
- Used at High Security facilities (i.e. prison, nuclear)

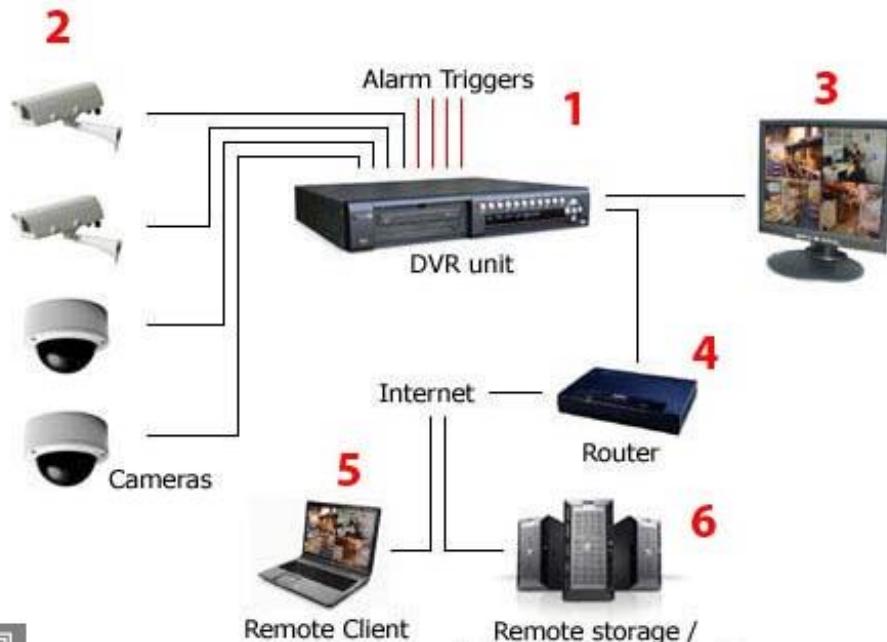
# VIDEO SYSTEMS



# Camera Systems

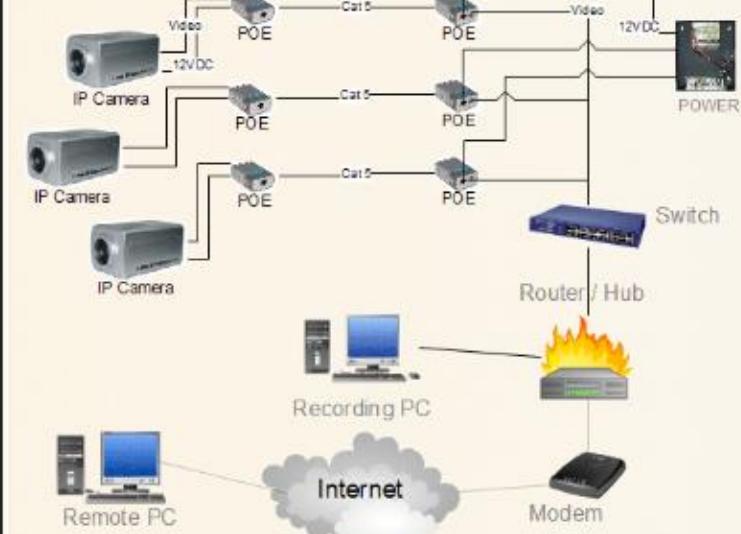
## Analog System

CCTV System

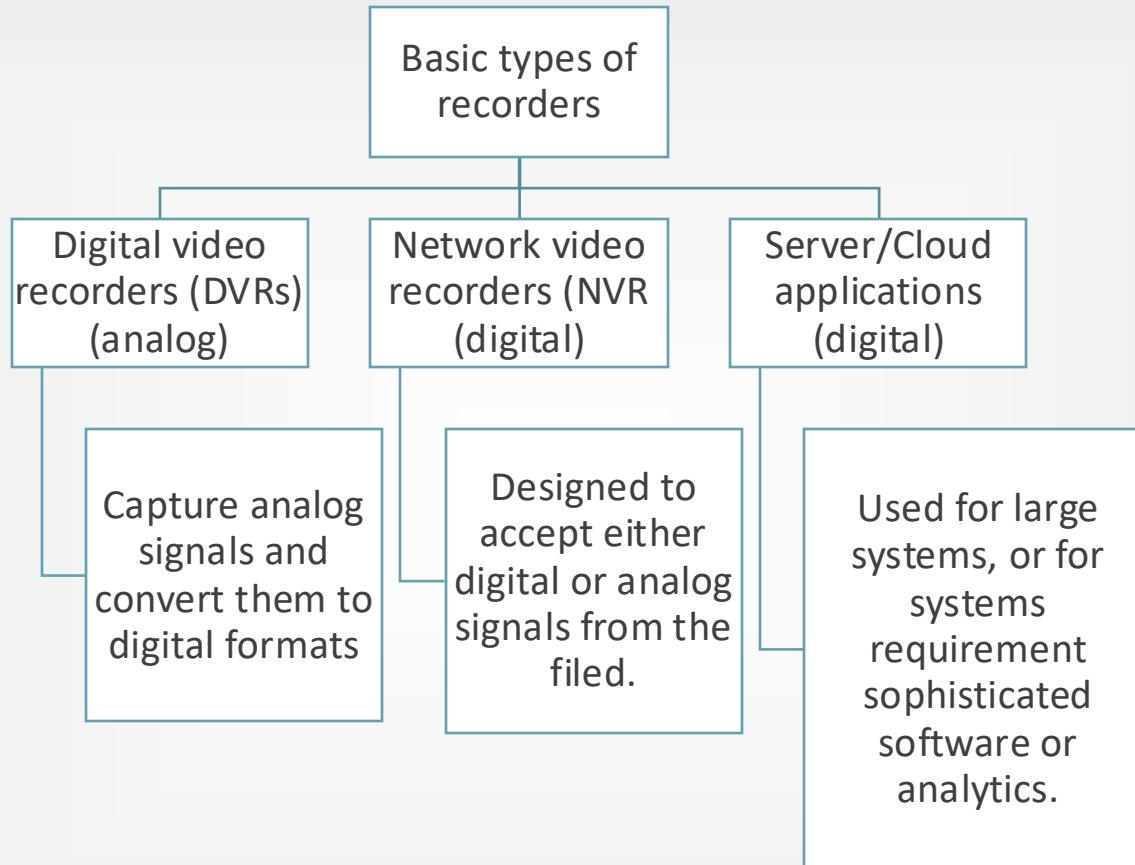


## Digital System

IP System



# Camera Systems: Recorders



# Camera Systems: Resolution

**5 Px/ft**

**General:** clothing & colors  
not distinguishable

**7 Px/ft**

**Monitor:** general human or  
vehicles, traffic flows

**11 Px/ft**

**Detect:** but not identified

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**Observe:** clothing & colors  
start to become distinctive

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**Recognize**  
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**Subject ID** beyond a shadow  
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**70 Px/ft**

License plate

**88 Px/ft**

Facial recognition

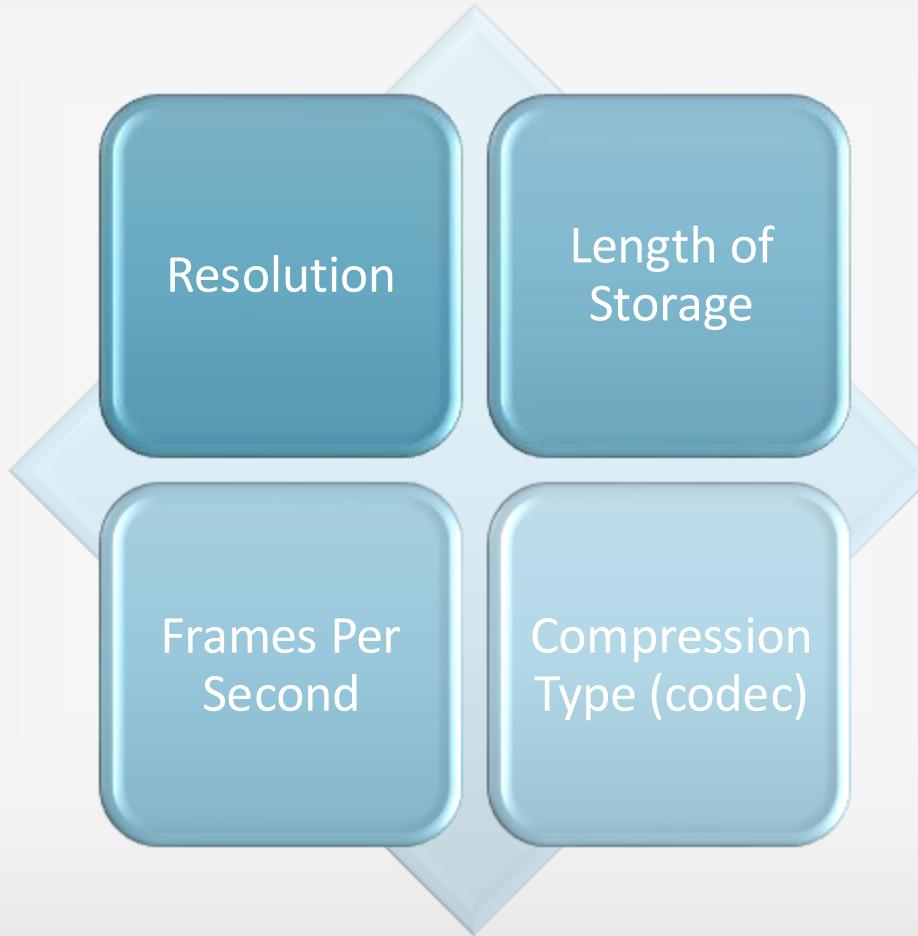
# Camera Systems: Types



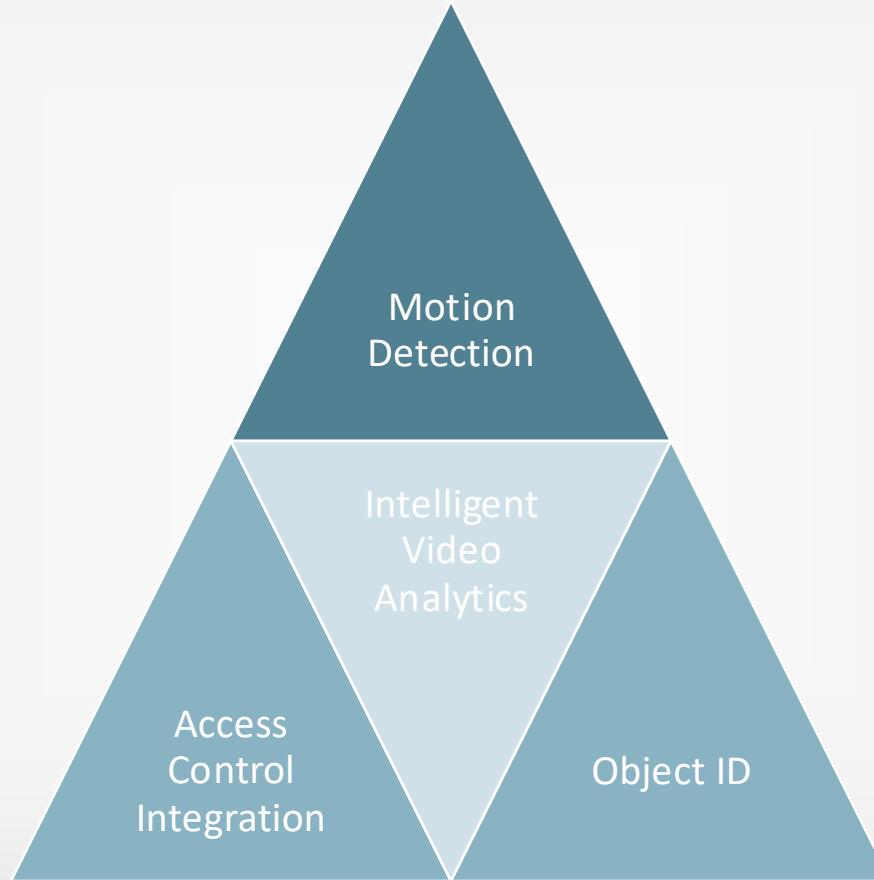
# Camera Systems: Field of View



# Camera Systems: Recording



# Camera Systems: Technology



# Camera Systems: Legal

## Placement

- Bathrooms, places where there is an expectation of privacy

## Application

- microphones



# ALARMS



# Alarm Systems

## AC&D: Alarm Communication and Display

Transportation (or communication) of data

Presentation or display of that data to a human operator in a meaningful manner

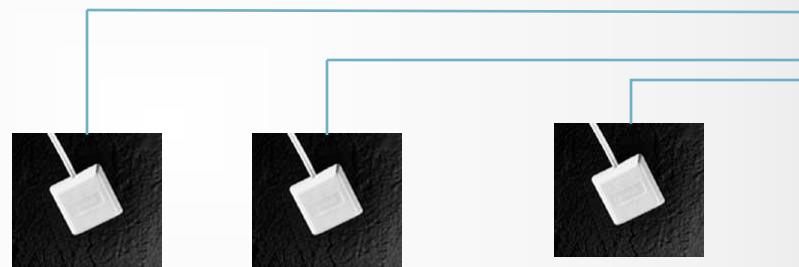
# Alarm Systems

**Loop**



Panel

**Point-to-Point**



Panel

**Multiplexing**



Panel

# Alarm Systems: Best Practices

## Line Protection:

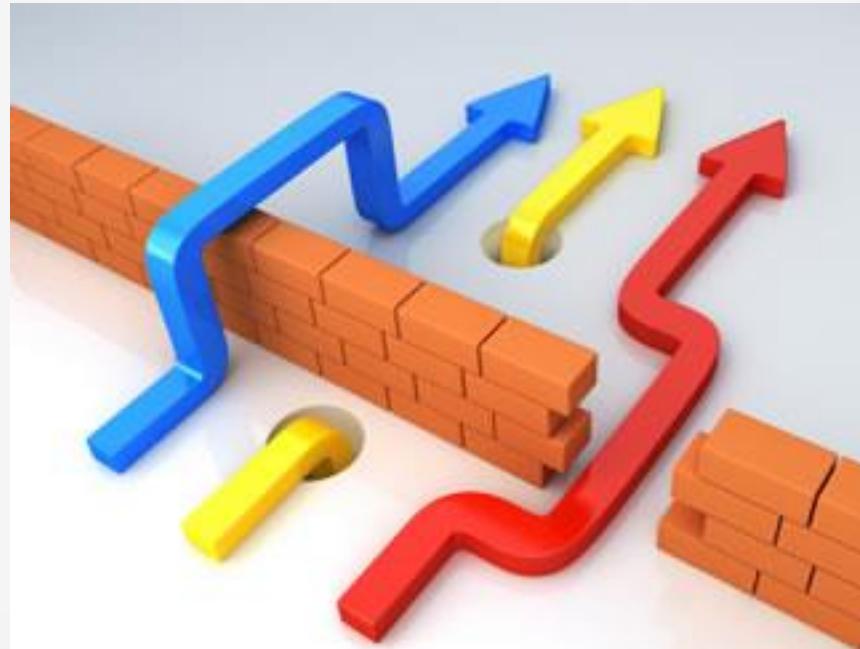
Physical protection of wires: buried or in conduit

## Line Supervision:

Means of continuous checking on line integrity electronically.

- Simplest is by using an End of Line resistor and checking for that value.
- Higher security methods include quasi-random pulses, minimizing variance, frequency shifting

# ENTRY CONTROL



# Access Control

**Entry Control:** Physical equipment used to control movement of people or material into an area. Performance

**Access Control:** the process of managing databases or other records and determining the parameters of authorized entry (who, what, where, when).

# Access Control: Threats

False pretenses to gain entry

Deceit

Use of tools to force entry

Direct Physical Attack

Forge a credential, guess a PIN or obtain another person's credential

Technical Attack

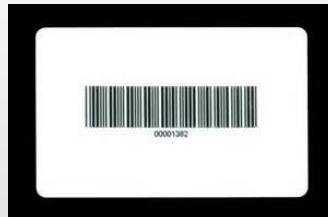
# Access Control: Types

## Entry Types

1. PIN
2. Tokens (Credentials)
3. Photo ID
4. Coded Credential
5. Biometrics
6. Personnel Entry Control Bypass

# Access Control: Cards

- Mag Stripe - easy to decode
- Wiegand – wires in card
  - not used any more
  - Protocol is industry standard
- Bar Code – printed on credential / easy to decode unless in 2-D
- Proximity –low or high frequency ( 125kHz or 2.5MHz-1GHz)
- Smart Card
  - Imbedded circuit / 8-64 kilobytes / encrypted communications
  - HSPD12 – Homeland Defense Presidential Directive 12
  - FIPS 201 – Federal Information Processing Standard
  - contact & contactless



# Access Control: Biometrics

Type I Error (false reject) / Type II Error (false accept)

- **Hand / Finger Geometry** –measures finger WxL and hand thickness
- **Handwriting** –
  - low security / easy to forge
- **Fingerprints** – compare minutia points (ridge endings) / ultrasound – below surface
- **Eye Pattern** –
  - Uses a camera 10-12" away
  - slow – 5-15 seconds
- **Voice** – low security
- **Face** – complicated metrics
  - camera or thermal image
  - difficult: varied expressions & lighting



# BARRIER



# Barriers: Access Delay

**Principle of Balanced Design:** each aspect of barrier has an equal delay.

The more an adversary is delayed, the more time security staff have to assess the situation and send a response force.

**Passive Barriers** – doors, walls, floors, locks, vents, ducts, and fences

**Personnel** – security officers, receptionist, concierge

**Disposable Barriers** – chemical fogs and smokes, foams, irritants

# Barriers

- Active dispensable barriers contain:
  - A process for deciding when to activate
  - Command and control hardware
  - Material that is deployed to incapacitate the adversary
  - A dispensing mechanism
  - Security officers on-site
- Passive dispensable barriers do not have the command and control hardware.
  - Examples – Rigid foam, stabilized aqueous foam, irritants (pepper mace), smoke and fogs, sticky foam, entanglement devices

# Barriers: Examples

## **Perimeter:**

Fences: Rolls of barded  
tape

Gates:

Vehicle:

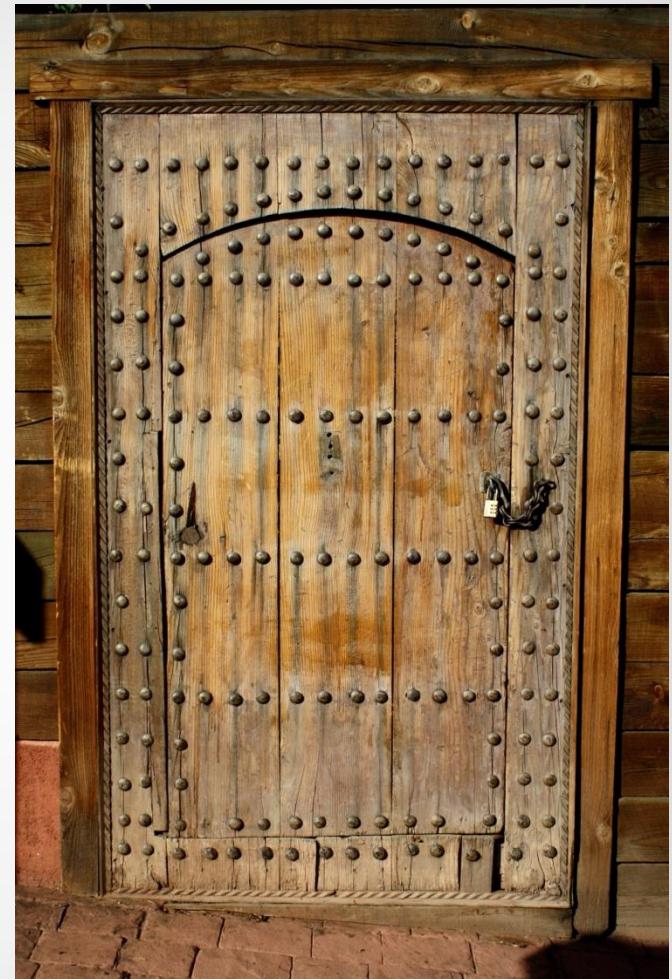
## **Structural:**

Walls  
Doors  
Windows & Utility Ports  
Roofs and Floors  
Disposable Barriers

The US Department of State formerly set performance standards for both perimeter and portal vehicles barriers. A new standard is **ASTM F 2656-07.**

# Barriers: Doors

- Standard industrial doors
- Personnel doors
- Attack and bullet-resistant doors
- Vehicle access doors
- Vault doors
- Blast-resistant doors
- Turnstile gates



# Barriers: Doors Best Practices

The principle of balanced design requires that doors and their associate frames, hinges, bolts, and locks be strengthened to provide the same delay as that provided by floors, walls, and ceilings of the parent structure.



# Barriers: Glass

- Tempered glass – safety glass
- Annealed glass – breaks in to large pieces (Float Glass, rolled, sheet)
- Wired
- Laminated
- Bullet Resistance
  - Glass/polycarbonate composite glazing contains a core of *poly carbonate between the two layers of glass* and was developed for prisons.

# LIGHTING



# Lights: Basics

A lighting System:

1. The lamp –(light bulb)
2. The luminaire –(fixture) is the complete lighting unit
3. Mounting hardware –wall bracket or light pole,
4. Electric power



# Lights



- **Continuous** – Most Common
- **Glare Protection** – Illuminates the intruder
- **Standby** – Used only when suspicious activity is detected
- **Controlled** – Lights limited space only
- **Portable Light Systems**
- **Emergency Lighting** - Limited to Time of Power Failure

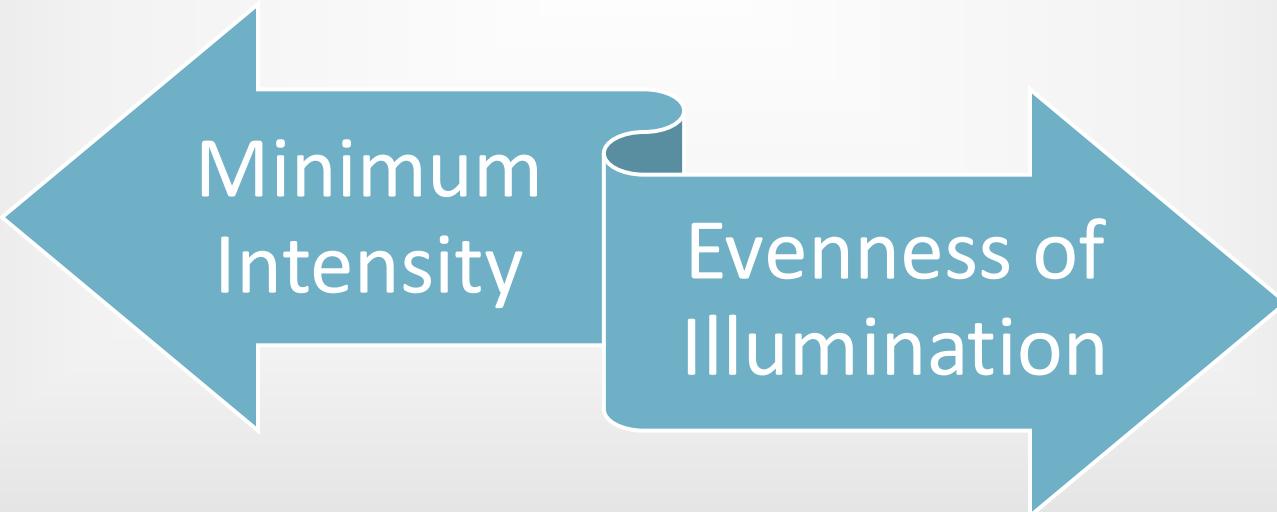
# Lights

- Street Light
- Search Light
- Flood Light
- Fresnel – Narrow horizontal beam  
(perimeter)
- High Mast Lighting (70ft - 150Ft)



# Lights: Basics

- The two most important parameters of a lighting system for CCTV: Intensity and Evenness
- The quantity of light emitted by a lamp is measured in lumens.



Minimum  
Intensity

Evenness of  
Illumination

# Lights: Reflectance

**Reflectance:** The % of light reflected from a scene

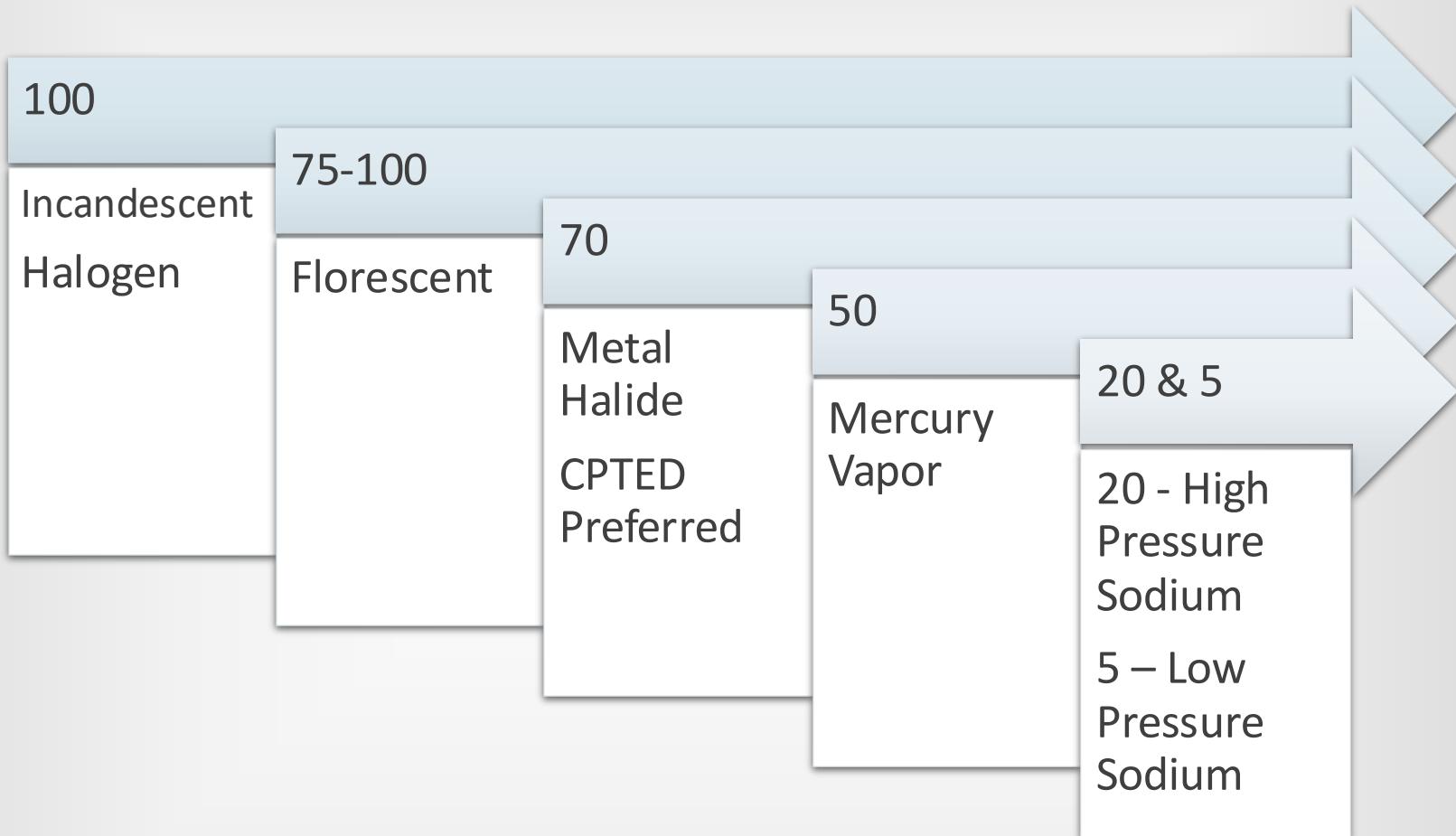
## Reflectance Measurements

- 5% = Asphalt
- 25% = New Concrete
- 25% = Brick
- 40% = Old Concrete
- 40% = Grass
- 95% = Snow

## Color Rendition Index

- 70-80 = Good
- 80 + = Excellent
- 100 = Daylight

# Lights



# Lights

Ratio of average light to minimum light

- 1:0.7 = Working Environment
- 4:1 = Pedestrian Walkway
- 10:1 = Roadway

Type	Start (Min)	Restrike (Min)
Incandescent	Instant	Instant
Halogen	Instant	Instant
Florescent	Instant	Instant
Metal Halide	5-8	10-20
Mercury Vapor	5-8	10-20
High Pressure Sodium	2-5	1-20
Low Pressure Sodium	5-8	0-8

# Lights: Specific Applications

A general rule for lighting level is:

- 0.5 fc for **detection**
- 1.0 fc for **recognition**,
- 2.0 fc for **identification**
- **5 fc w/ uniformity Rate of 4:1 =Parking structures**

(Mcghee, 1988)

# TRAINING TOPICS

- System Administration
- System Monitoring
- Alarm Assessment & Dispatch
- Incident Response
- System Troubleshooting & Maintenance
- IT Functions
- System Overview