



# CPTED

## Crime Prevention Through Environmental Design

---

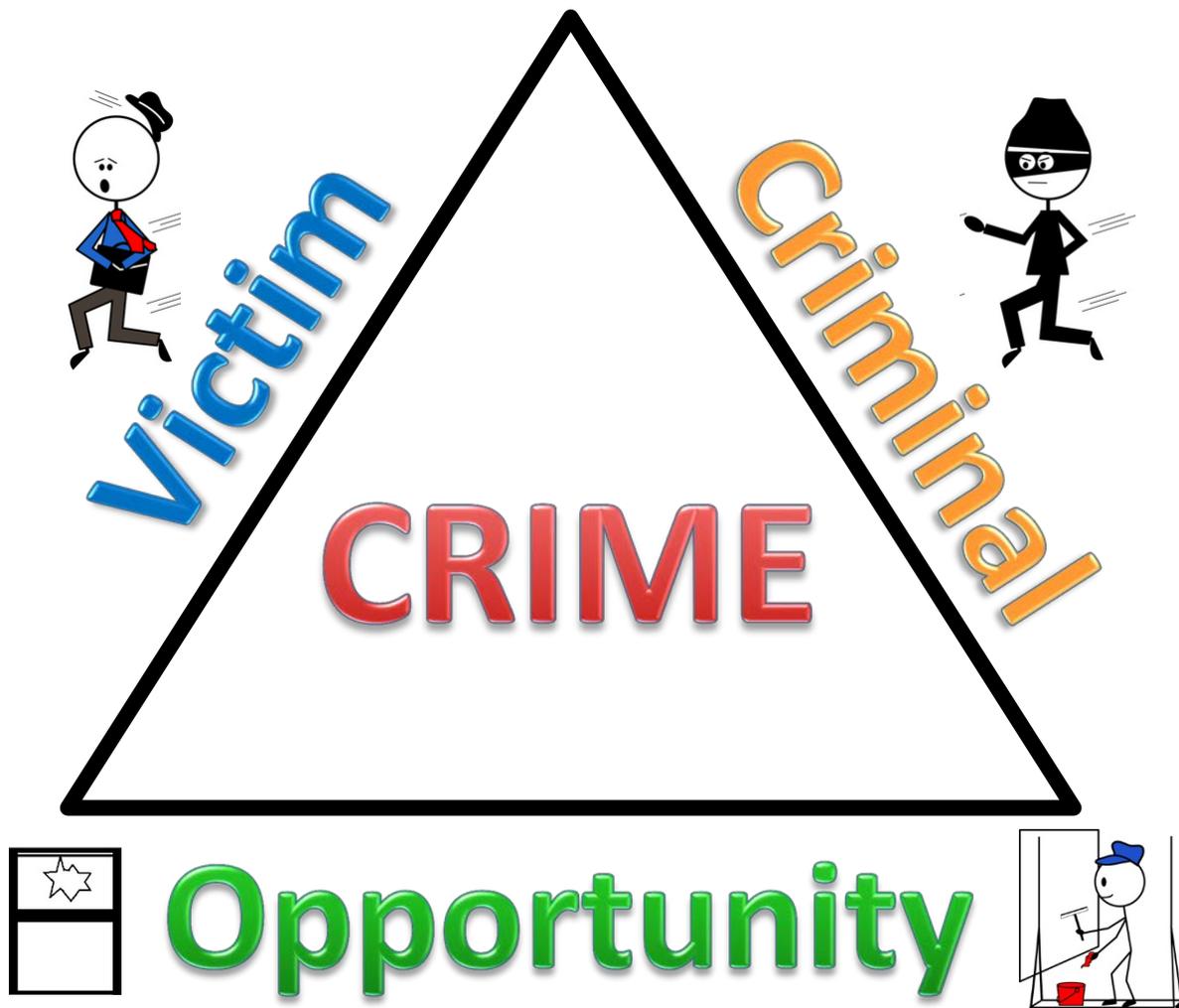
- OFFERS THE OPPORTUNITY TO REDUCE CRIME
- REDUCES CITIZENS' FEAR OF CRIME
- ENCOURAGES SOCIAL INTERACTION
- IMPROVES QUALITY OF LIFE

## Contents

Introduction to CPTED.....	4
1. Natural Surveillance.....	6
2. Natural Access Control.....	11
3. Territorial Reinforcement.....	12
4. Activity Support.....	15
5. Maintenance.....	19
The Broken Window Theory.....	20
Chandler C <sup>3</sup> Program Requirements.....	28
Appendix 1: Landscaping.....	29
Table 1: Suggested Vegetation.....	33
Appendix 2: Security Mechanisms.....	38
Appendix 3: Lighting for Safety.....	43
Table 2: Expected FC for the C <sup>3</sup> Program.....	57
Table 3: Types of Lighting and Cost Analysis.....	58
Table 4: Types of Fixtures.....	59
Table 5: Types of Directional Lighting.....	61

# Purpose

The goal of the CPTED requirements in the Chandler C<sup>3</sup> Program is to reduce **opportunities** for crimes that are inherent in the design of structures, landscape, and/or in the design of the community/neighborhood.



Disclaimer: CPTED principles and strategies are suggested for the purpose of reducing criminal activity on your property. It does not in any way predict or prevent all crime risks.

# Introduction

The theory and guidelines of Crime Prevention Through Environmental Design (CPTED), pronounced 'sep-ted', were first created in the 1960s; and like everything else, it evolved into what it is today. CPTED is a well-established and well-researched field of crime prevention utilized internationally. It has proven methods that increase the responsible, positive use of property while decreasing the likelihood of criminal behavior.

CPTED includes *physical and social* management and law enforcement recommendations that seek to affect positive human behavior as people interact with their environment. The *environment* is inclusive of the people, their physical, and social surroundings, and how people behave and act.



# The Five Principles of CPTED

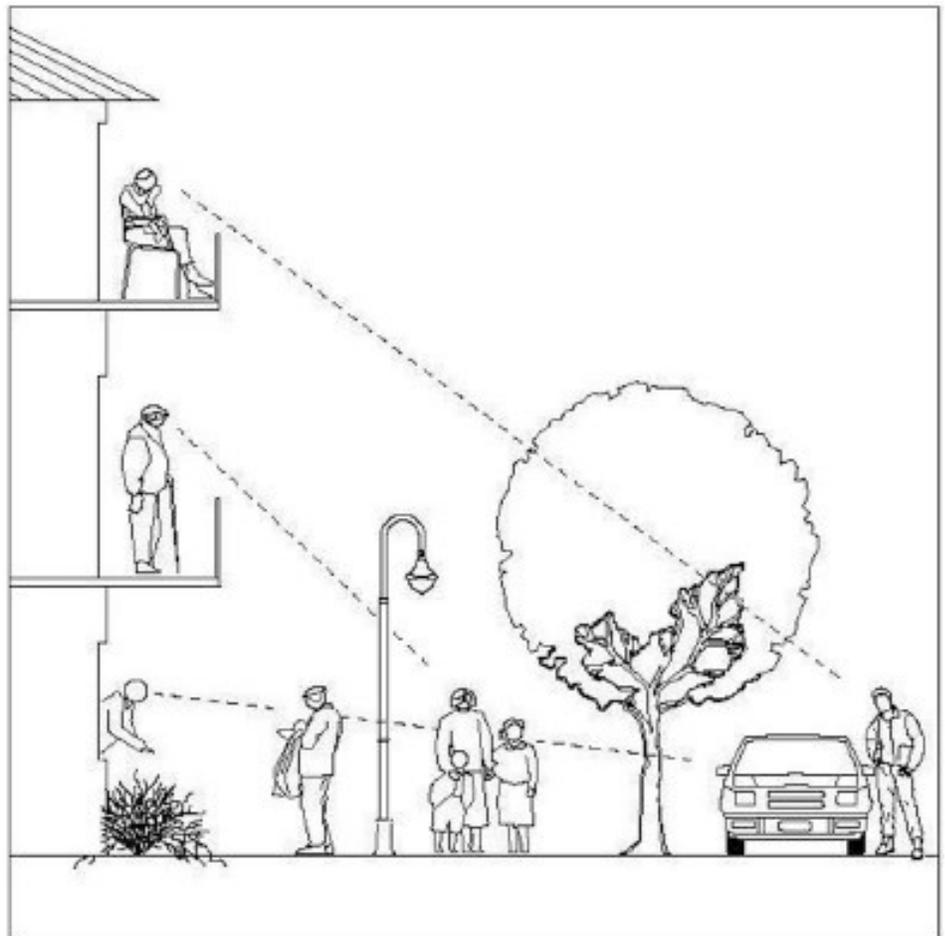


It cannot be overemphasized that ALL of these principles applied equally will lead to the objectives of enhanced livability and greater natural safety of the community.

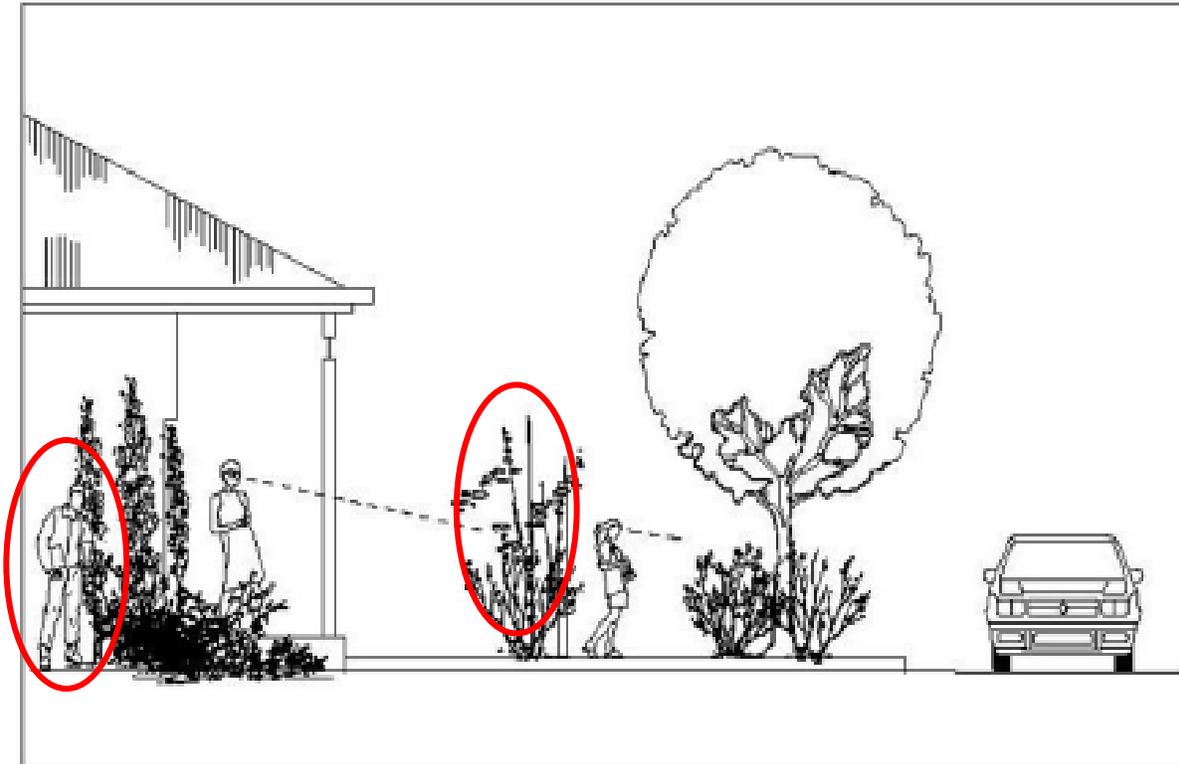
# Natural Surveillance:

Natural Surveillance is the placement of physical features, activities and people in such a way as to maximize visibility of the community. *"To see and be seen."*

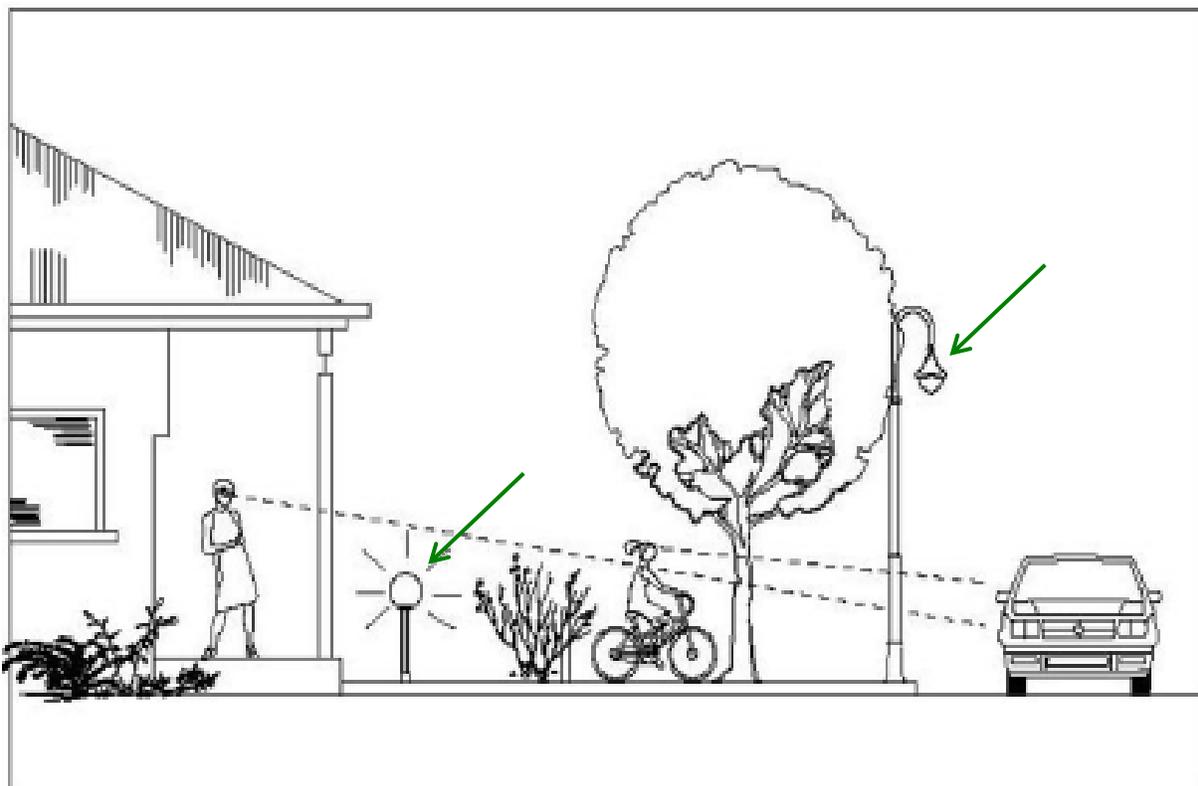
- Involves design and maintenance elements that ensure full opportunity for residents to engage in their normal behavior and activities to observe the space around them.
- Creates an opportunity for the owner/management team to minimize the opportunity for concealment or secrecy by a person intending to commit a criminal act.
- Increases visibility with landscaping in conjunction with proper lighting.
- Increases the chance of apprehension; therefore, reducing an opportunity for the criminal element
- This is achieved by:
  - appropriate and uniformed lighting
  - low or see-through fencing / shrubs
  - removal / redesign of areas that offer concealment
    - blind corners
    - shrubs / trees
    - walls



## Examples of Natural Surveillance: “Eyes on Ground”

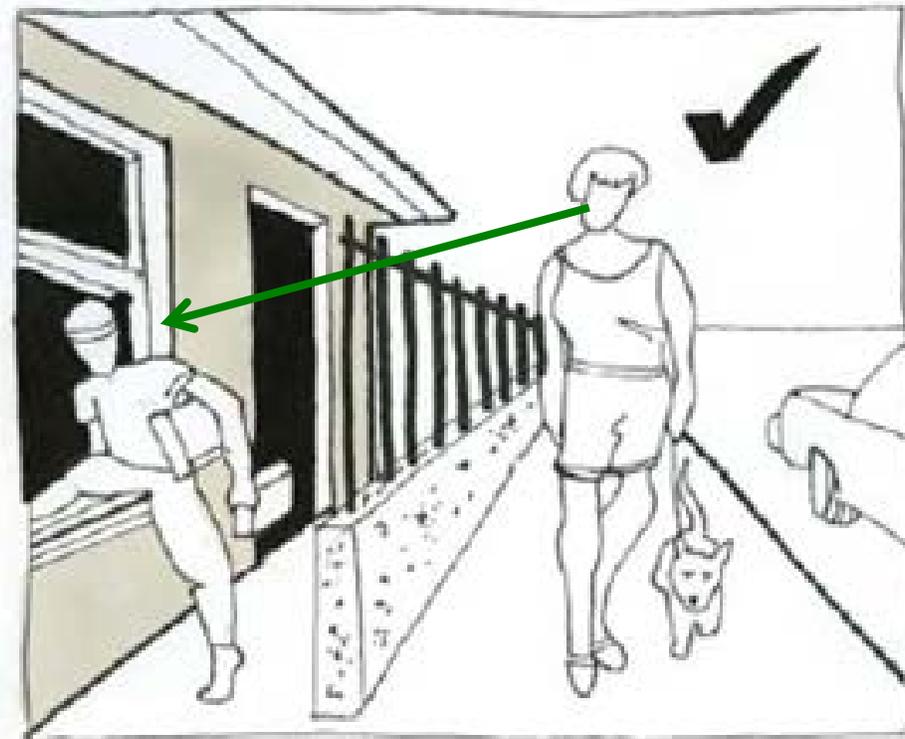


The criminal is hidden by tall foliage. Street view is obscured by tall foliage.



Clear line of sight from the porch and on to the street. Area is illuminated with proper heights and no obstructions.

Examples of Natural Surveillance: “Eyes on Ground”



Solid wall prevents visibility, but the see-through fence promotes Natural Surveillance.

*Examples of Natural Surveillance: “Eyes on Ground”*



Unable to see through the property: Blind spots behind the fence offering concealment to the criminal element.



Clear view through the property: Blind spots and concealment opportunities eliminated.

**Examples of Natural Surveillance: “Eyes on Ground”**



Overgrown vegetation prevents the ability to see in or out of the home and offers concealment for the criminal element.

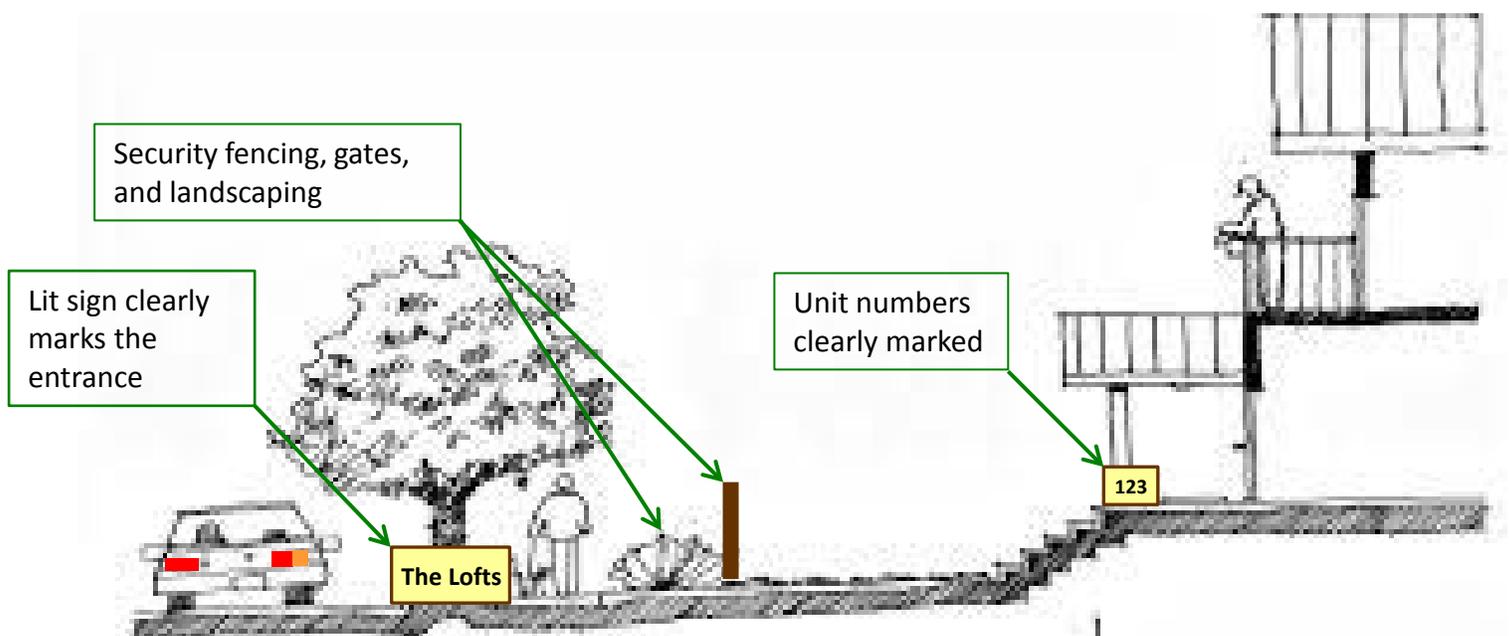


Trimmed and maintained vegetation offers curb appeal, clears visibility, and rids concealment opportunities for the criminal element.

# Natural Access Control

Natural Access Control is the physical guidance of people coming and going from a space by the placement of entrances, exits, fencing, landscaping, and lighting.

- Clearly define entrances and exits
  - Minimize uncontrolled movement
  - Well lit for greater natural surveillance
- Security fencing, gates, and hostile vegetation
  - Decreases the criminal element's accessibility
  - Keeps people on the designated path
- Wayfinding throughout the community
  - Community directory
  - Marked community activity spaces, buildings, and units
  - Clearly identifiable walkways with direction
- Layers of security mechanisms
  - Primary locks on doors / windows
  - Secondary locks on door/window locks
  - Security system
  - Surveillance system



# Territorial Reinforcement

Territorial Reinforcement creates a clear delineation of space and separates your space from non-legitimate users

- Accomplished with landscaping, hardscaping, fencing, signs, flags, artwork, and seating
- Expresses pride and ownership of your space

Owner/Management Teams are responsible for *Private*; *Semi-private*; and, occasionally, *Semi-public*.



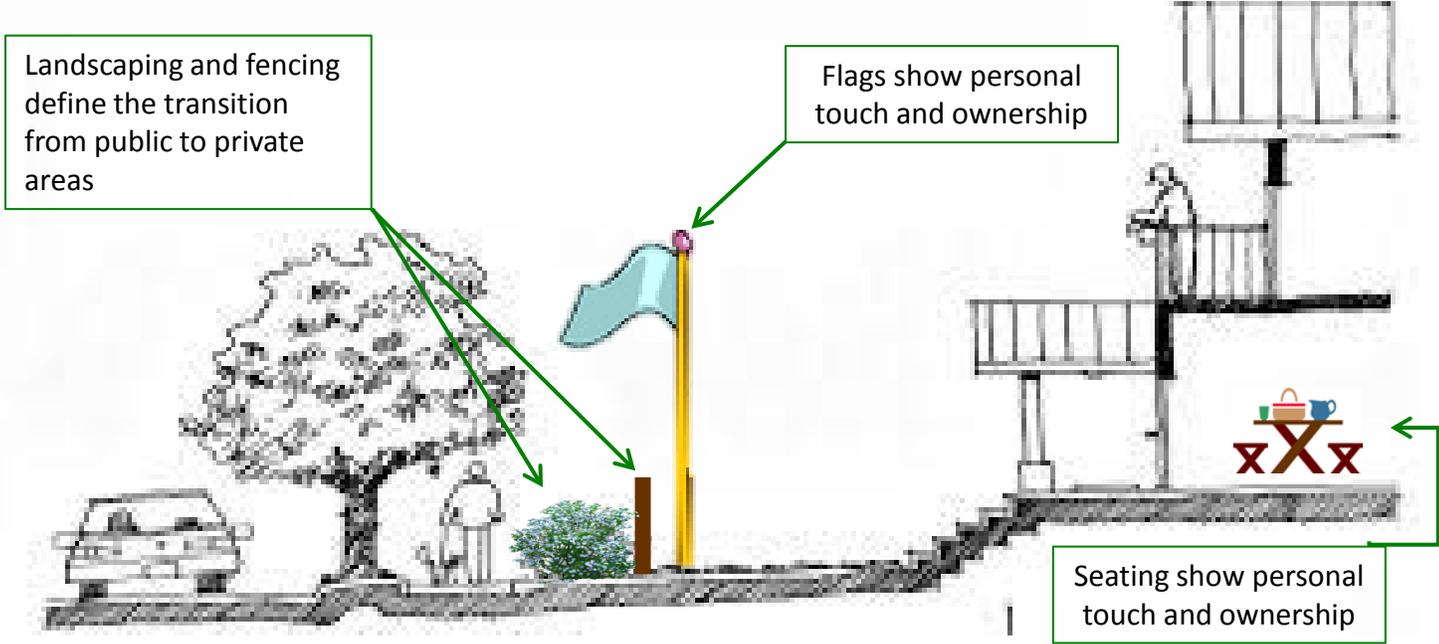
*Public* is the open thoroughfare for all to travel

*Semi-public* is the public pedestrian space

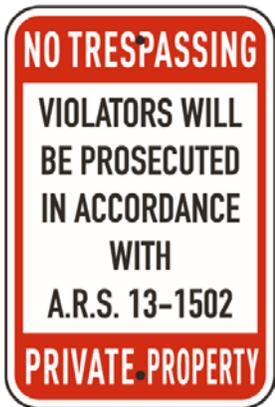
*Semi-private* is the front yard, sidewalk, and driveway leading to your home

*Private* is your porch/patio and home

# Examples of Territorial Reinforcement



# Examples of Territorial Reinforcement Signage



Copyright © 2008 SignNation



# Activity Support

Activity Support places any activity in a location so that individuals become a part of the natural surroundings, creating “natural surveillance.”

- An active place that is enjoyed safely, increasing the use of the activity space, adding value to the space, and discouraging actions of non-legitimate users.
- This is accomplished with active and passive efforts.
  - Passive – design elements that make area appealing and safe , such as parks, pools, playground, community rooms
  - Active – scheduled events or steps taken to attract users to the area, such as picnics, community and sporting events, concerts, play groups



## *Examples of Activity Support*

This image depicts an area that was unutilized or under-utilized, but was repurposed into an active gathering place in the community, creating “Natural Surveillance.”



## Examples of Activity Support

This image depicts an area that was unutilized or under-utilized, but was repurposed into an active gathering place in the community, creating “Natural Surveillance.”



## *Examples of Activity Support*

The creation of community space provided an active gathering place in the community, creating “Natural Surveillance.”



# Maintenance

Routine and preventative maintenance helps ensure CPTED elements serve their intended purpose.

- Allows for the continued use of a space for its intended purpose.
- Serves as an additional expression of territorial reinforcement.
- Demonstrates that someone cares and is watching over the property.
  - Neglected space often results in mistreatment by people
  - Willingness to call the police in the event of suspicious or criminal activity



## *Examples of Maintenance*

- Keep apartments to code standards
- Repair any damaged property
- Remove graffiti
- Replace / upgrade lighting
- Keep trash dumpster areas clean
- Maintain landscaping
- Remove abandoned / illegal vehicles
- Keep grounds free of trash, debris, and hazards

When done on a regular and consistent basis, maintenance can prevent The Broken Window Theory from becoming a reality in your community.

# The Broken Window Theory

James Wilson and George Kelling developed the Broken Window Theory in 1982. The broken windows theory is a criminological theory of the norm-setting of urban disorder and vandalism; increasing crime and anti-social behavior.



In short, when we see things broken or dilapidated, it is perceived that no one cares or is looking after it with any sense of ownership; thus, it is okay to further cause damage or violate the area/community without repercussions. This theory is also applied to people. When a person appears “broken” (e.g. an addict, prostitute, homeless, etc.) it is believed no one cares about them, so they, too, are violated without trouble or repercussion. The criminal’s thought is, “Who’s going to stop me or report it?” Crime is more likely to occur in communities with **less care**, **less cleanliness**, and **less orderliness**.

The theory states that **maintaining** and **monitoring** environments to prevent small crimes such as graffiti, trespassing, disorderly behavior, criminal damage, theft, and public drinking helps to create an atmosphere of order and lawfulness, thereby preventing more serious crimes from happening.

## *Examples of Maintenance*

Set and maintain living standards for the community



**BEFORE**



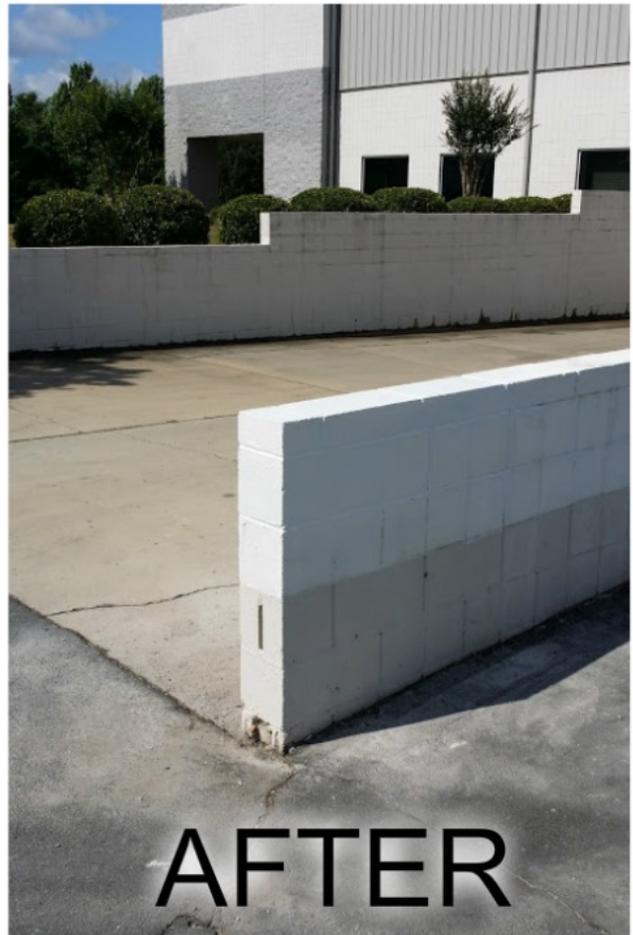
**AFTER**

## Examples of Maintenance

Properly repair/replace damaged property



Damage this severe requires replacement of the door, *framing*, and locks



## *Examples of Maintenance*

Remove graffiti – Treat problem area(s) and surfaces with anti-graffiti paint or supplies; it ultimately reduces future costs and labor.



## *Examples of Maintenance*

Keep trash dumpster areas clean



## Examples of Maintenance

### Maintain Landscaping



The above picture depicts overgrown shrubs, creating a visual barrier and hiding places for the criminal element.



Following the 2'/6' Rule, the shrubs are trimmed low, the tree canopies are high, and the properties are clean throughout.



## *Examples of Maintenance*

Remove abandoned, unregistered, and/or illegal vehicles



## Examples of Maintenance

Enforce parking standards



Confirm signage standards with the traffic and/or police departments.

Consider a parking standard that vehicles cannot be backed in, so all license plates are visible.



# CPTED Program Requirements

## BASIC

- Landscaping (2'/6' Rule)

## INTERMEDIATE

- Deadbolts with 1" inch throw
- 3" strike plate screws
- Window and sliding door locks

## ADVANCED

- Uniform lighting (table)
- Solid core doors
- 180° eye viewer
- Legible apartment/building numbers
- Illuminated directory at entrance(s)

# Appendix 1: Landscaping

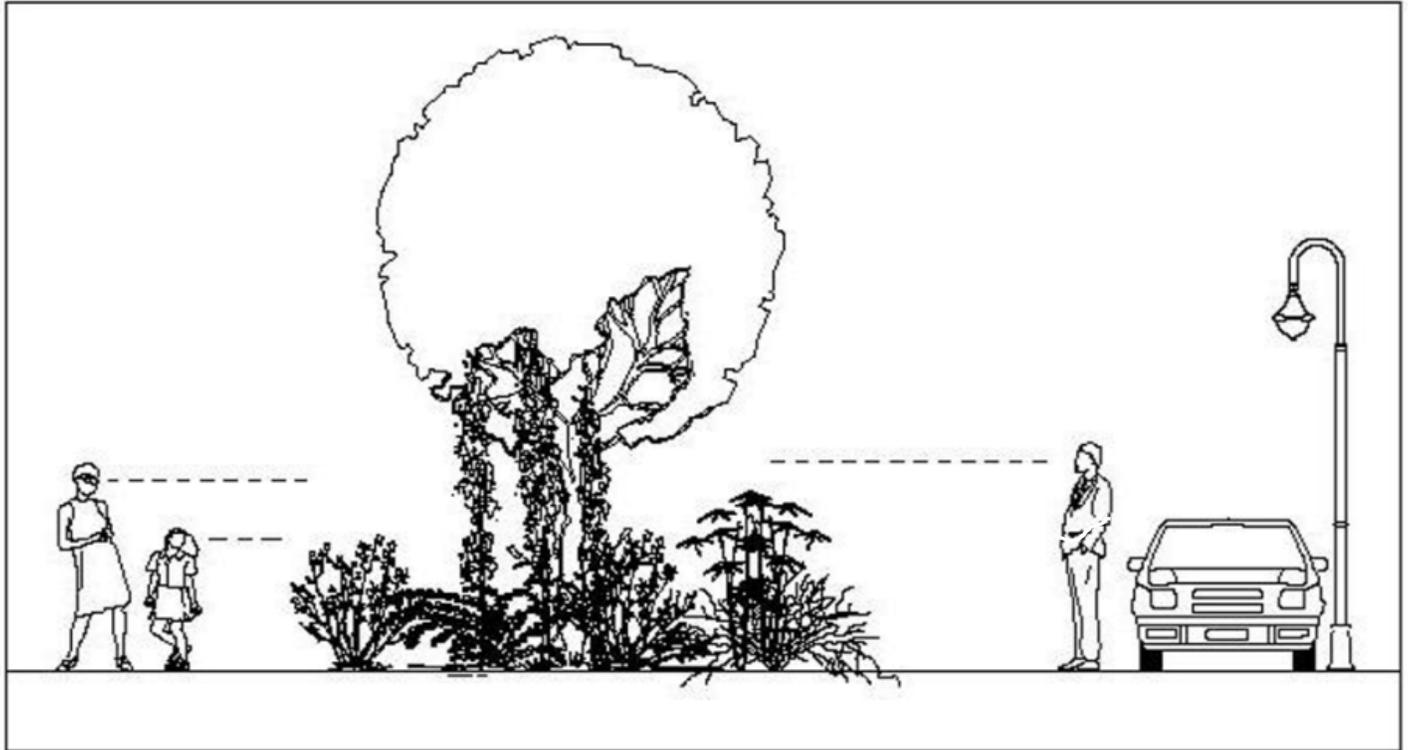
## Considerations when landscaping:

- What is the vegetation maturity and growth rate?
- How and what is its shape at full growth?
- Is it poisonous or dangerous to human or animal life?
- Will it interfere with established or future lighting?
- Will it interfere with lines of sight (natural surveillance)?
- Is it friendly to activity space?
- What kind of maintenance will it require?
- Does it litter?



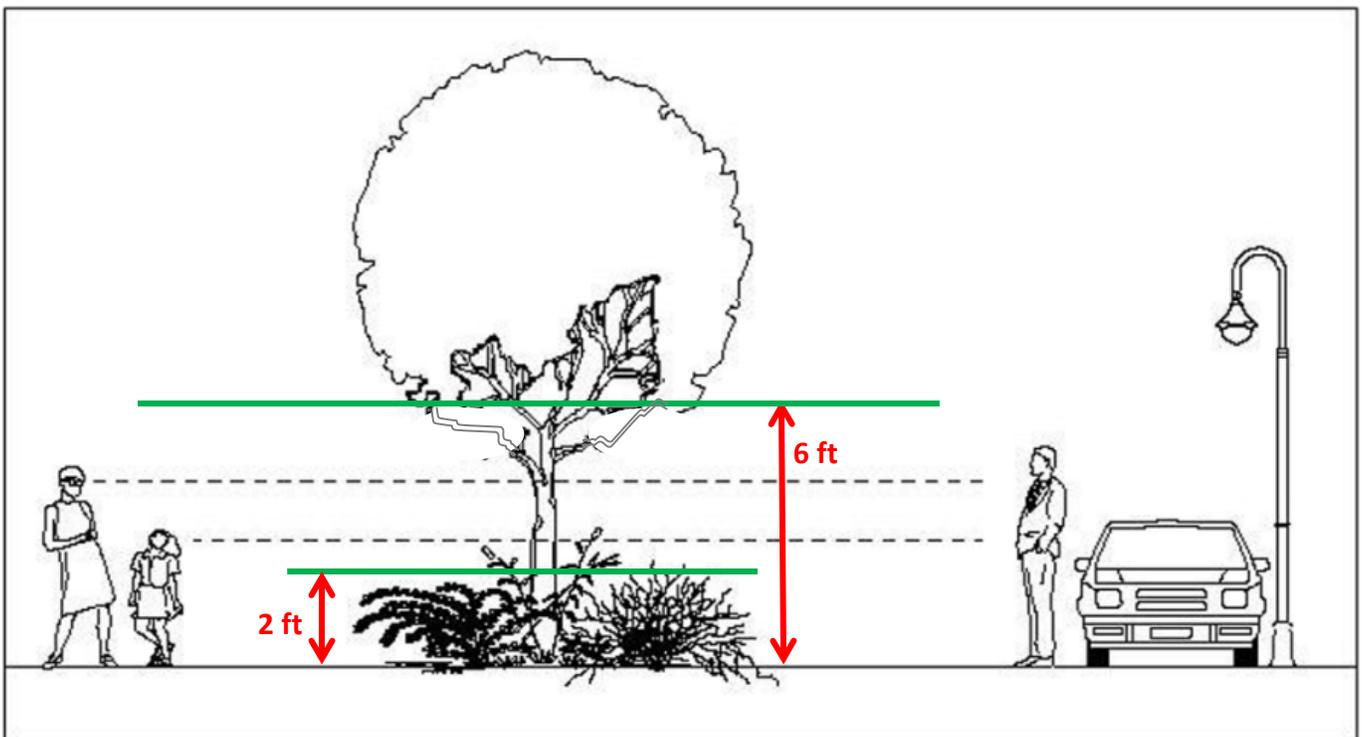
# Landscaping

Requirement for ALL levels is the 2ft/6ft Rule:



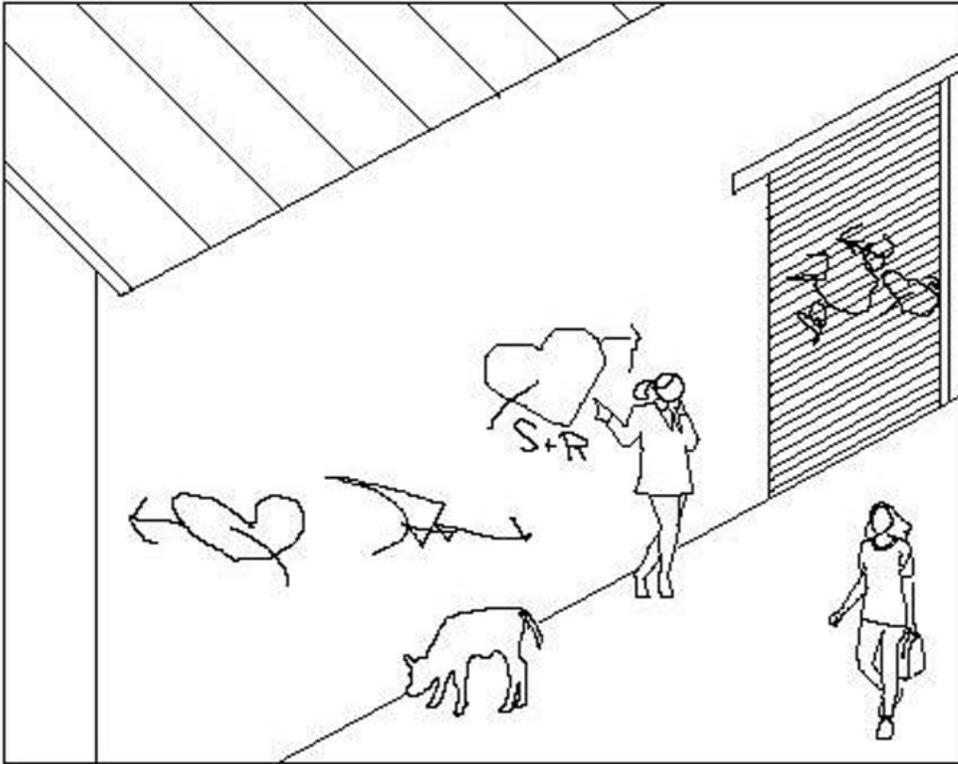
- Trim dense shrubs at 2ft or less.
- Trim tree canopies at 6ft or higher.

Both reduce hiding places and increases lighting and overall visibility.

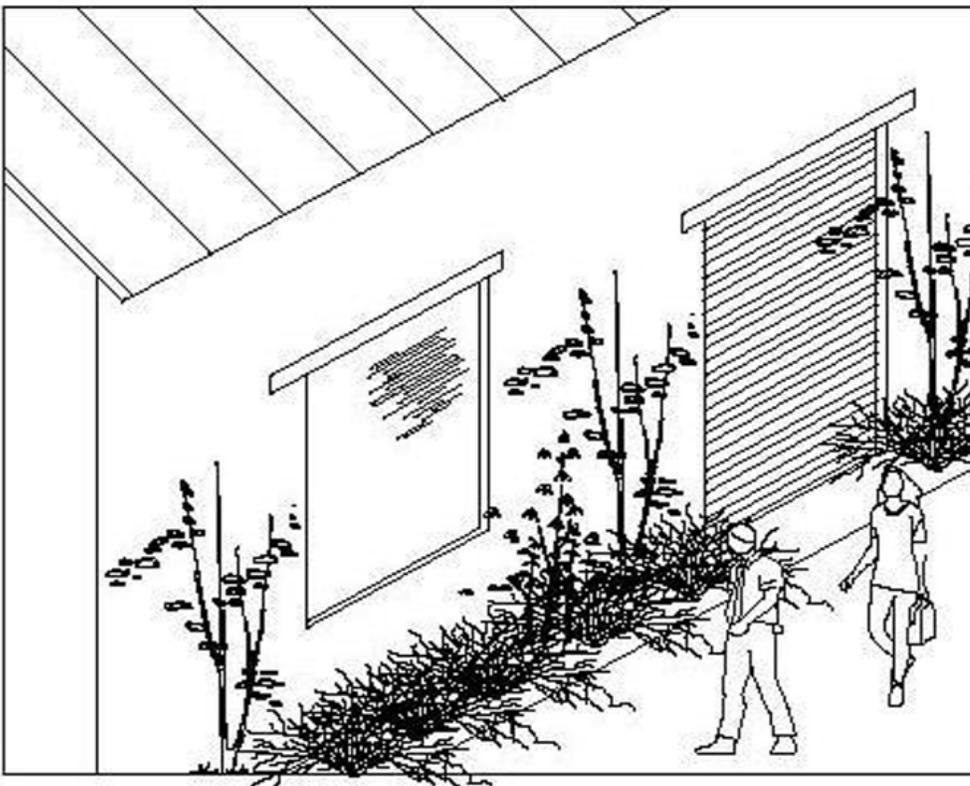


# Landscaping

## Other recommendations:



Plant hostile vegetation under and along walls and accessible windows.



This deters access to windows, trespassing, and degradation of walls.

# Landscaping

## Other recommendations:

Avoid the use of rip-rap or river rocks; these become tools of opportunity.



Use small granite rocks in landscaping; it can be heard when walked on.



# Table 1: Suggested Vegetation

## Recommended Plant Material:

The following lists are not meant to be all-inclusive, but to represent plants that require minimal maintenance to meet visual surveillance objectives.

SHRUBS		
Ambrosia Deltoidea	Ambrosia Dumosa	White Bursage
Triangle leaf Bur-sage	Artemisia Caucasica	Silver Spreader
Artemisia Schmidtiana	Silver Mound	Artiplex Semiba Obata
Saltbush	Dalea Greggii	Indigo Bush
Dalea	Oaxacana	Eriogonum Umbellatum
Buckwheat	Euphorbia Rigida	Euphorbia
Gutierrezia Microcephala	Juniper (except Procumbens)	Juniperus Chinensis var.
Krameria Parvifolia	Snakeweed	Krameria Parvifolia
Lantana Montevicensis	Spreading Sunshine	Maytenus Phyllanthoides
	Mangle Dulce	

# Suggested Vegetation

BARRIER PLANTS (Hostile)		
Acacia Constricta	Acacia Greggii	Agave
White Thorn Acacia	Catclaw Acacia	Pithecellobium
Atriplex Lentiformis	Quailbush, Big Saltbush	Bougainvillea
Carissa	Natal Plum	Condalia Warnockii
Mexican Crucillo	Ferocactus	Barrel Cactus
Fouquieria Splendens	Ocotillo	Texas Ebony
Pyracantha	Firethorn	Rosa
Celtis Pallida	Desert Hackberry	Rose
Cercidium Floridum	Blue Palo Verde	Cercidium Microphyllum
Foothill Palo Verde	Chaenomeles	Flowering Quince
Chamaerops Humilis	Mediterranean Fan Palm	Ilex
Holly	Ilex Vomitoria	Stoke's Yaupon Holly
Lycium Species	Wolfberry, Lycium	Mayt enus Phyllanthoides
Baja Dulce	Opuntia	Prickly Pear
Yucca Aloifolia	Spanish Bayonet	Yucca Baccata
Datil Yucca	Zizyphus Obtusifolia	Gray Thorn

# Suggested Vegetation

## GROUND COVER PLANTS

Carpobrotus Edulis	Malephora Crocea	Santolina Virens
Ice Plant	Myoporum Parvifolium	Green Santolina
Clianthus Formosus	Myoporum	Verbena Bipinnatifida
Sturt' s Desert Pea	Oenothera Berlandieri	Verbena
Convolvulus Mauritanicus	Mexican Evening Prim rose	Verbena Peruviana
Ground Morning Glory	Oenothera Stubbei	Peruvian Verbena
Gazania Spp.	Saltillo Prim rose	Verbena Rigida
Gazania	Rosmarinus Officinallis	Sandpaper Verbena
Lantana Montevicensis	Prostrate Rosemary	Verbena Tenera
Trailing Lantana	Santolina Chamaecyparissus	Moss Verbena
Lavender Cotton	Wedelia	Wedelia Trilobata

## PERENNIAL WILFLOWERS

Allionia Incarnata	Dichelostemma Pulchellum	Evolvulus Arizonicus
Trailing Windmills	Bluedicks	Arizona Blue Eyes
Bahia Absinthifolia	Dyssodia Acerosa	Ipomopsis Longiflora
Bahia	Dyssodia	Pale Blue Trumpets
Bailey Multiradiata	Dyssodia Pentachaeta	Justicia Sonorae
Desert Marigold	Erigeron Divergens	Sonoran Justicia
Castilleja Chromosa	Spreading Fleabane	Linum Lewisii
Indian Paintbrush		Blue Flax

# Suggested Vegetation

## ANNUAL WILDFLOWERS

Abronia Villosa	Ipomoea Leptotoma	Monarda Austromontana
Sand-Verbena	Morning Glory	Bee Balm
Camissonia Brevipes	Kallstroemia Grandiflora	Monoptilon Bellioides
Yellow Cups	Arizona Poppy	Belly Flower
Catharanthus Roseus	Lasthenia Chrysostoma	Nama Demissum
Madagascar Periwinkle	Layia Platyglossa	Purple Mat
Clarkia Amoena	Tidy Tips	Nam a Hispidum
Farewell-to-Spring	Lesquerella Gordonii	Nemphila Maculata
Collinsia Heterophylla	Yellow Blanket	Five Spot
Chinese-houses	Linaria Spp.	Nemophila Menziesii
Coreopsis Bigelovii	Toadflax	Baby Blue Eyes
Desert Coreopsis	Dimorphotheca Spp	African Daisy
Eriophyllum Lanosum	Lupinus Arizonicus	Arizona Lupine
Lupinus Densiflorus	Oenothera Deltoides	Birdcage Evening Primrose
Oenothera Primiveris	Woolly Daisy	Eriophyllum Wallacei
Lupine	Lupinus Sparsiflorus	Desert Lupine
Evening Prim rose	Orthocarpus Purpurascens	Owl' s Clover
Eschscholzia Calif	Machaeranthera Canescens	Pectis Papposa
California Poppy	(Aster Bigelovii) Big Aster	Chinch Weed
Eschscholzia	Machaeranthera Tanacetifolia	Perityle Emoryi
Mexicana	Painted Spurge	Rock Daisy
Mexican Gold Poppy	(Aster) Tahoka Daisy	Matriciaria Grandiflora
Euphorbia Heterphylla	Pineapple Weed	Cream Cups

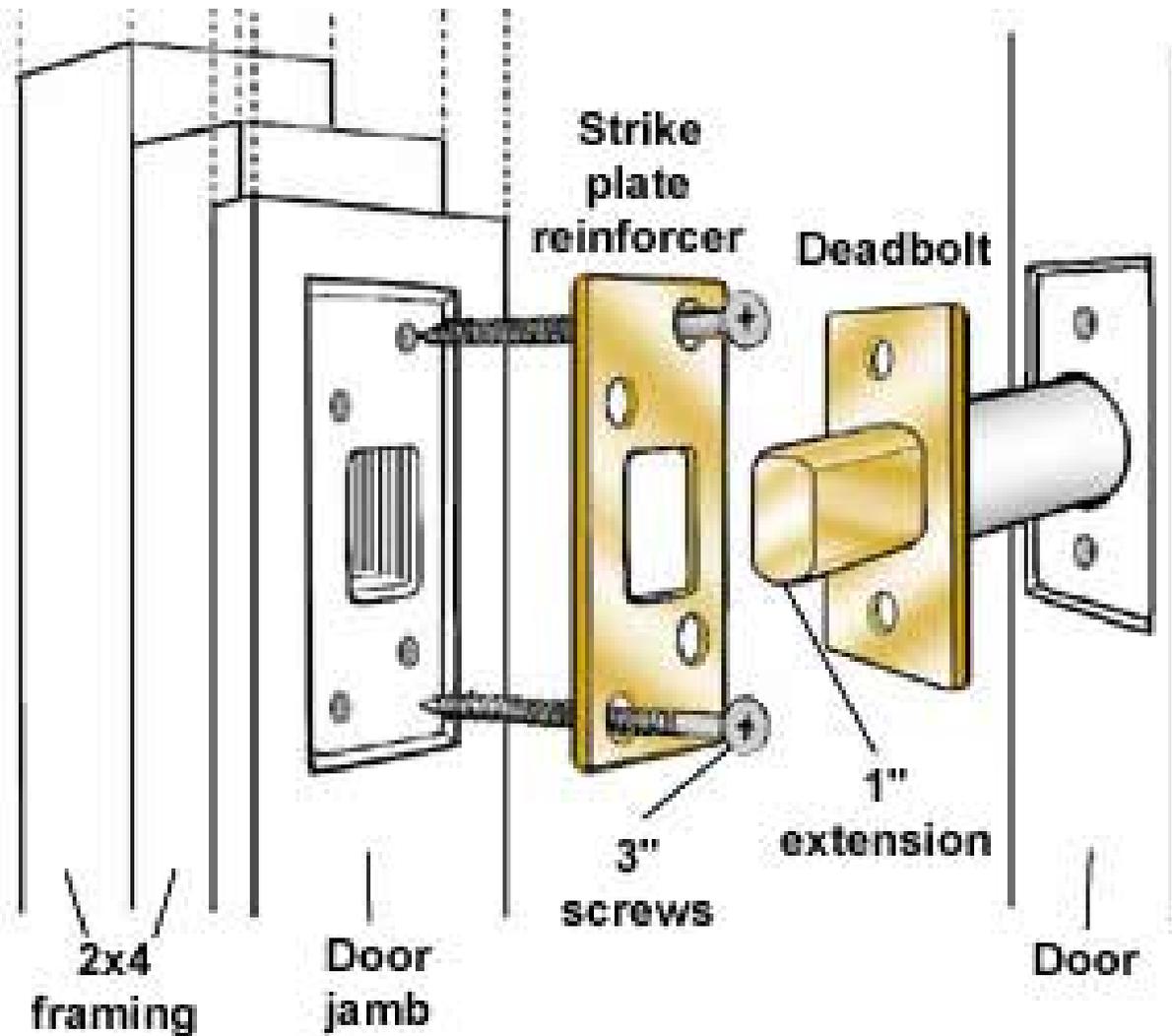
# Suggested Vegetation

ANNUAL WILDFLOWERS (Continued)		
Platystemon Californicus	Gaillardia Pulchella	Fire Wheel Blanket Fl
Gilia Leptantha	Mattiola Longibpetala cv. 'Bicornis'	Evening Scented Stock
Mimulus Begelovii	Proboscidea Parviflora	Devil's Claw
Rafinesquia Neomexicana	Showy Blue Gilia	Gomphrene Globosa
Globe Amaranth	Helipterum Sp.	Helipterum
Begelow's Monkeyflower	Mohavea Confertiflora	Ghost Flower
Desert-chicory	Salvia Columbariae	Chia

# Security Mechanisms

## Intermediate level requirements:

Deadbolt locks on all exterior doors

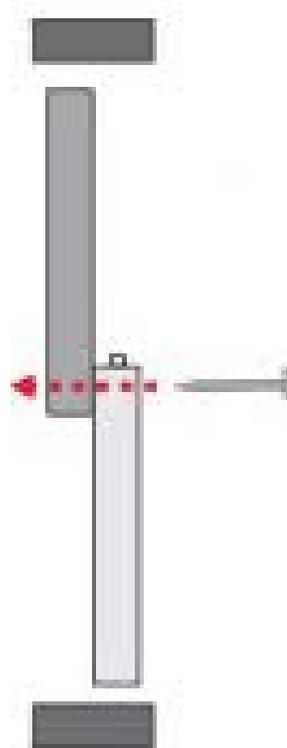
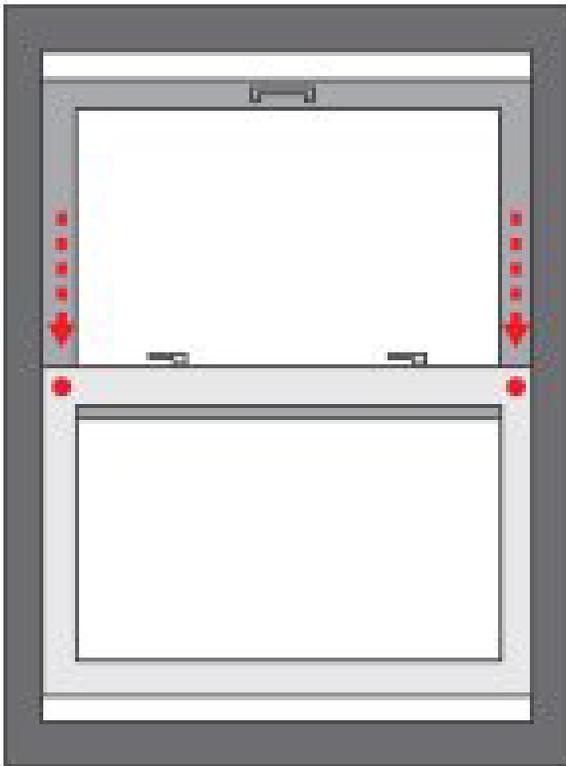


Bolt must have a minimum 1" throw and strike plates installed with 3" screws into the framing.

# Security Mechanisms

## Intermediate requirements:

Secondary locks (thumb, pinned, rods, etc.) on all accessible windows and sliding doors



Pins prevent the door or window from opening.

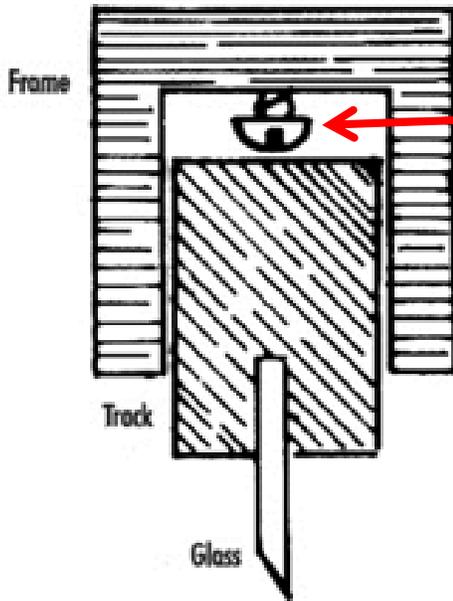


Thumb locks reduce the opportunity of the door or window opening; but if a hole is drilled into the track and the screw is twisted through, then it will prevent the door or window from opening.

# Security Mechanisms

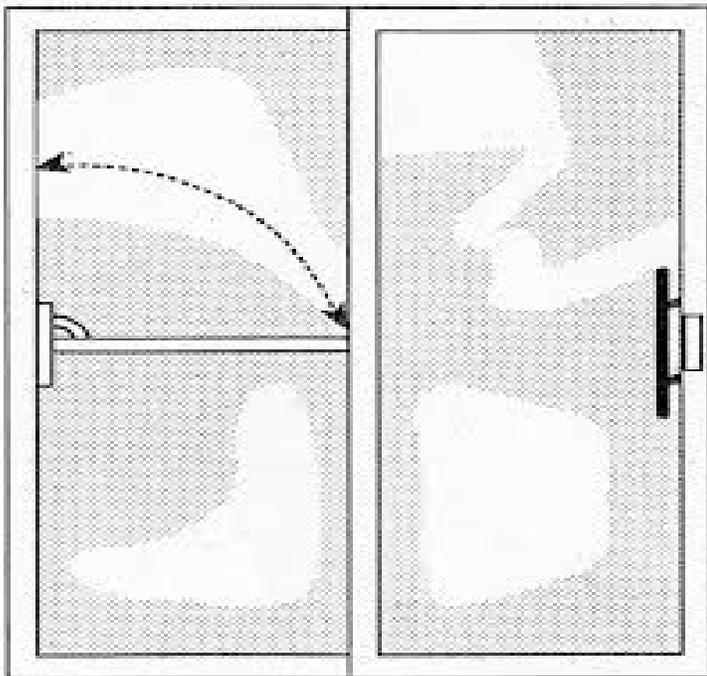
## Intermediate requirements:

Secondary locks (thumb, pinned, rods, etc.) on all accessible windows and sliding doors

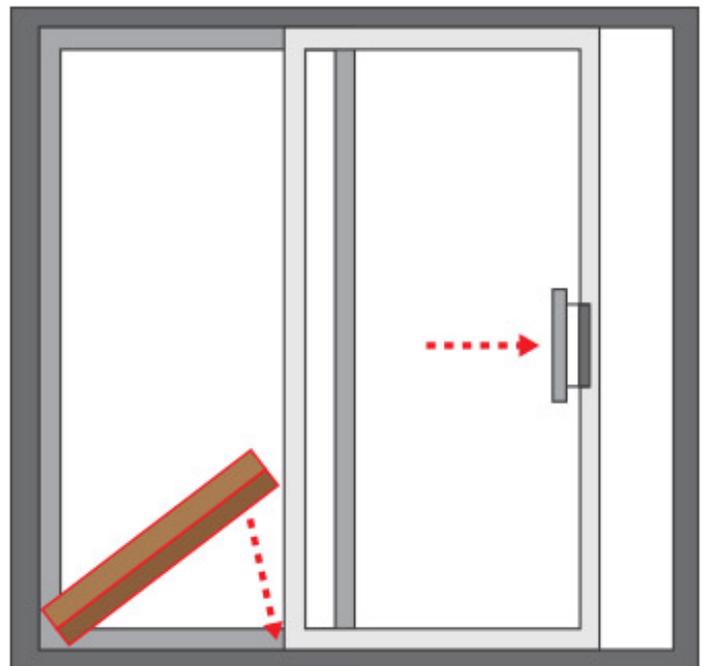


Installing screws above the door's pane prevents lifting.

Installing a drop bar prevents the door from sliding.



Placing a wooden or metal rod, that fits "snugly," prevents the door from sliding.

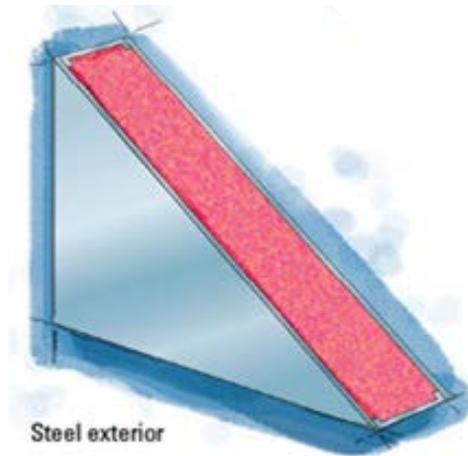
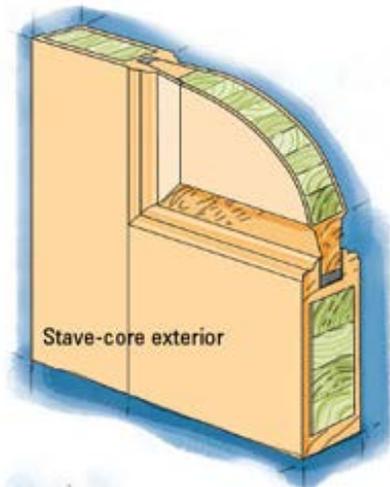


# Security Mechanisms

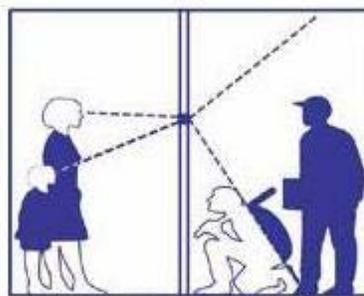
## Advanced requirements:

Solid core doors with a minimum thickness of 1 ¾ "

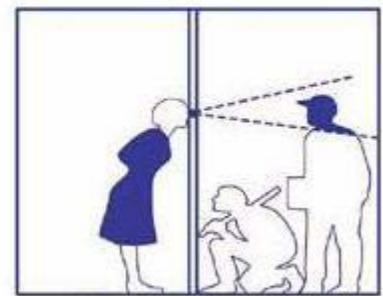
- Wood and metal are BEST



180° eye viewer



Security Door Viewer



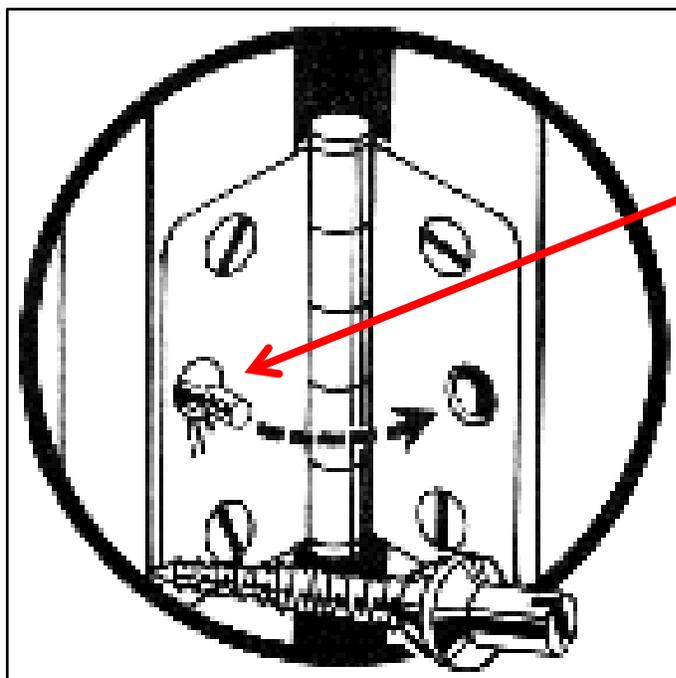
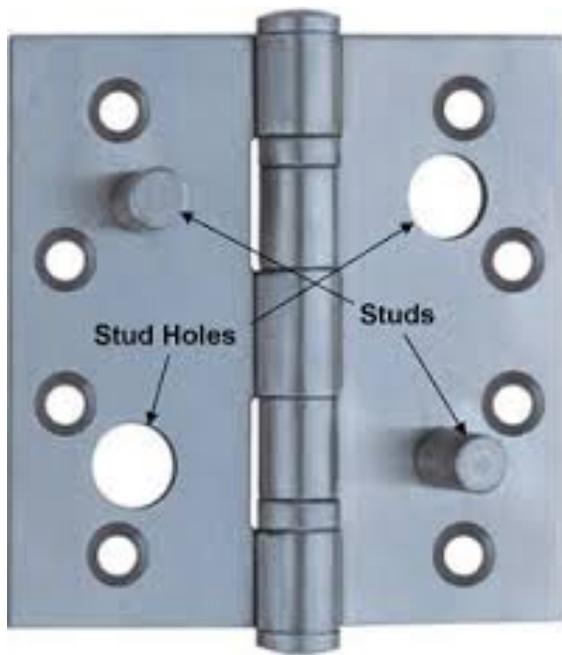
Traditional Peephole



# Security Mechanisms

## Other recommendations:

Security hinges or replacement screws keep the door locked in place even if the hinge pins are removed.



Replace the hinge screws with the security screws.

# Lighting for Safety

## Lighting is so much more than screwing in a light bulb!

Lighting is used for the illumination of human activity and security. Lighting by itself does not prevent crime, but it does provide a sense of safety, the ability to SEE a potential threat, which provides the opportunity of choice. Proper lighting allows a person to clearly see and identify a person's ethnicity, facial features, and various colors of clothing or objects at 100 feet.

When applied within the CPTED principles, lighting is a great tool for owners, management teams, and residents to control and reduce FEAR, and the opportunity for criminal activity. Proper lighting, in conjunction with "natural surveillance," is the best application.

*Crimes against persons and property are self explanatory, but crimes against society (gambling, prostitution, and drug violations, etc.) represent society's prohibition against engaging in certain types of activity; they are typically victimless crimes in which persons or property are not the object.*

## Statistics:

- Most **U.S.** crimes occur at night (6p-6a):
  - Crimes against persons: 52%
  - Property crimes: 40%
  - Crimes against society: 55%

## Purpose:

- Reduce:

- Crimes
- Trespassers
- Concealment
- Lawsuits

- Increase:

- Security
- Confidence
- Territoriality
- Use/Surveillance

# Lighting for Safety

## Lighting “Language”:

- Foot-candle (FC) – a unit of illumination that is equivalent to the illumination of one candle at a distance of one foot
- Luminance – light reflected from a surface, otherwise known as brightness
- Lumen – measure of the luminous flux emitted by one candle’s intensity (brightness)
- Watt – a unit of power
- Uniform lighting – relative or equal luminance over an area
- Adaptation – time for the human eye to adjust to lighting change
- Light trespass (pollution) – unwanted light that crosses property lines

## Considerations when planning or retro-fitting lighting:

Lighting should:

- be energy efficient and illuminated during ALL hours of darkness; both are accomplished by using timers or dawn to dusk sensors.
- be vandal and tamper resistant.
- provide uniform and consistent levels of illumination that prevents pockets of shadows or glare where an adult-size person could gain concealment.
- illuminate the following:
  - Building and door numbers (visible from the street, numbers at least 6” in height)
  - Dark walls and corners
  - All exterior doors
  - Pathways
  - Parking structures
  - Specified and common areas
  - Persons or objects at 100 feet

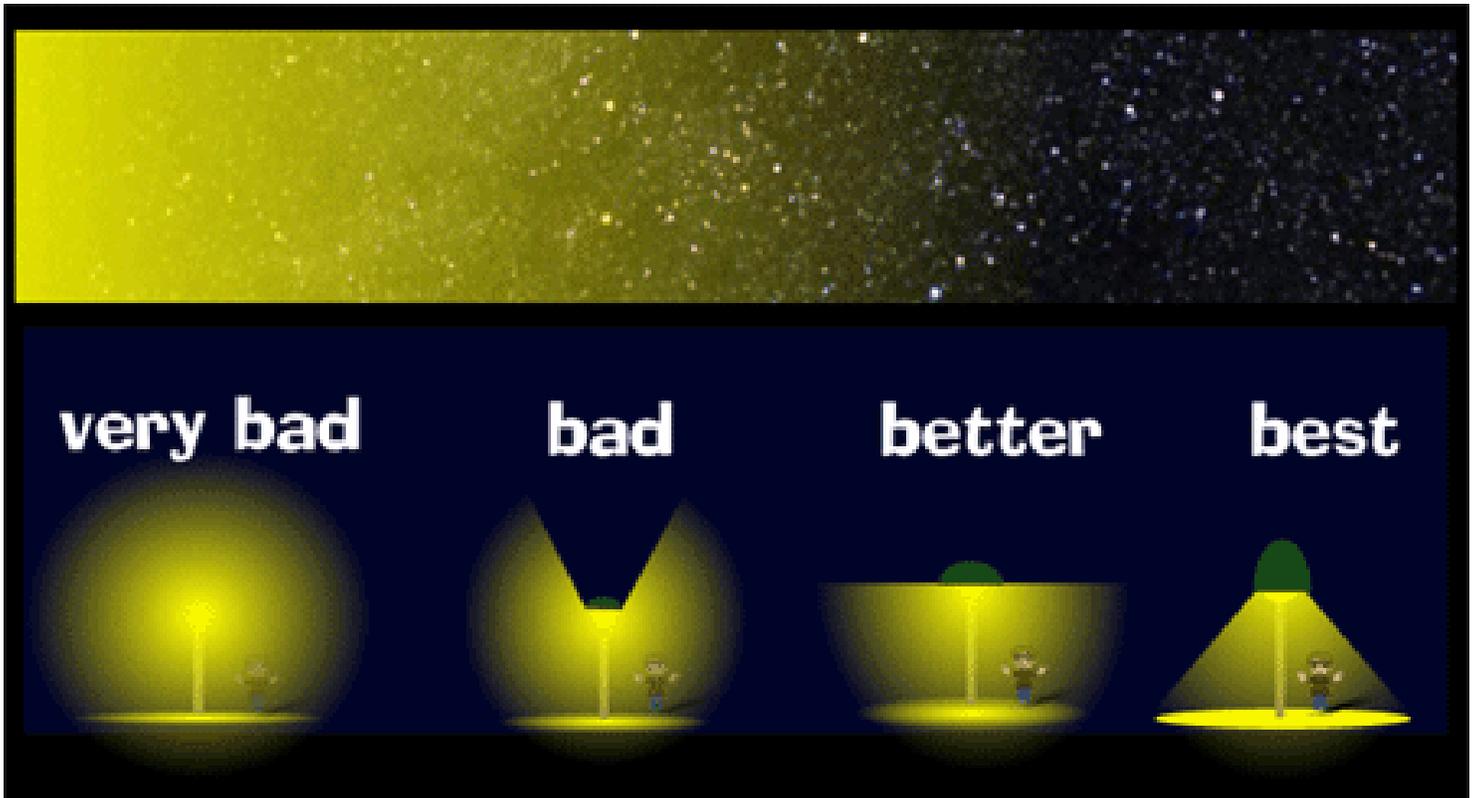
Be certain to replace damaged lighting; and when doing so, consider upgrading to LED and changing the fixtures. (See Tables 2-5)

Maintaining the same style of fixture throughout the community will show Territorial Reinforcement

# Lighting Comparisons

Light trespass (pollution)

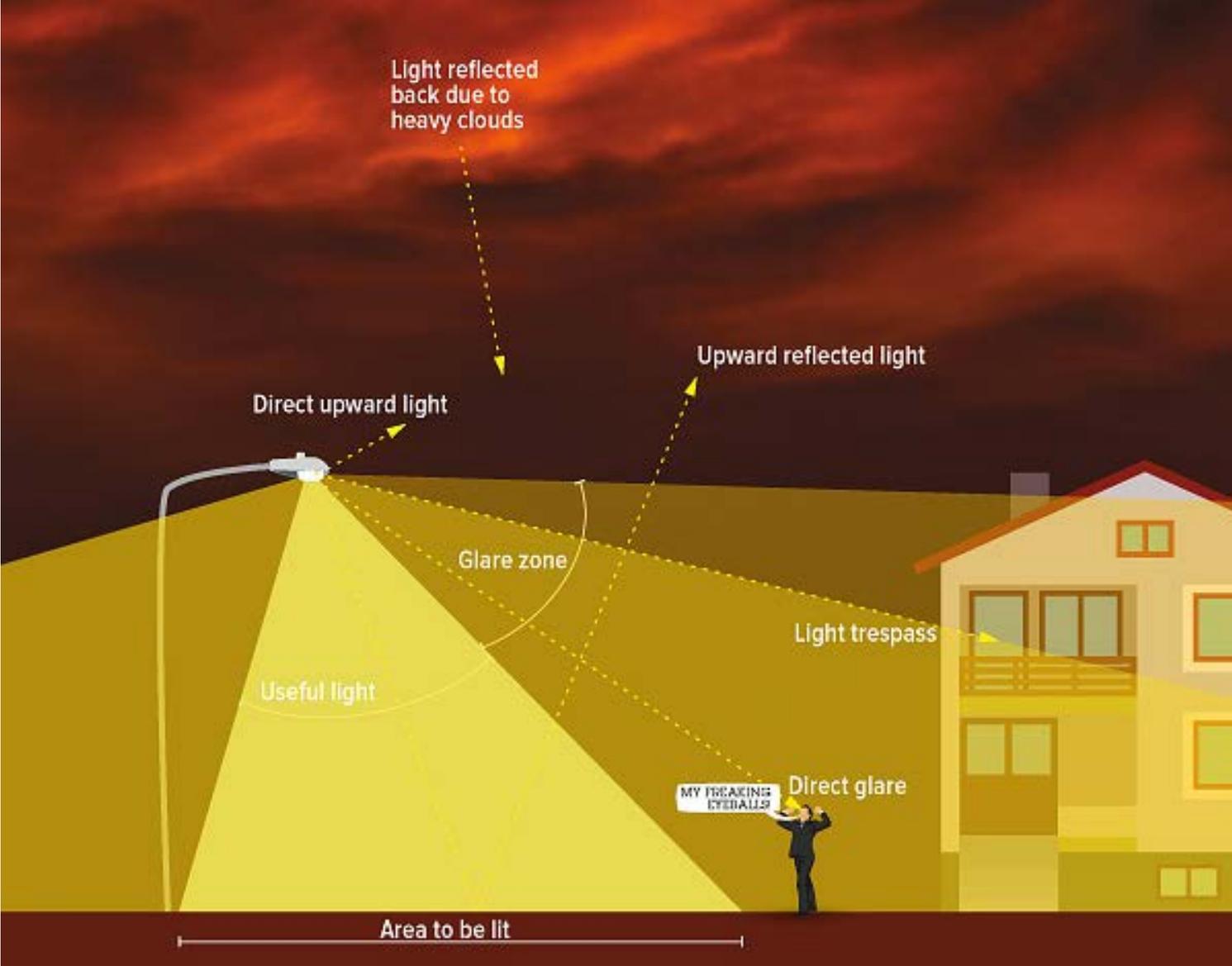
The **BEST** is not always the BRIGHTEST



# Lighting Comparisons

## Light trespass (pollution)

**GOOD** lighting is intentional and not random.



# Lighting Comparisons

## Examples of obstructed and unobstructed lighting



The light is obstructed by the tree illustrating the importance of planning and maintaining the landscaping and lighting.

Keep all lights free of any obstruction for the best uniform lighting.



# Lighting Comparisons

## Examples of obstructed and unobstructed lighting

The light is obstructed by the tree, casting a variety of shadows



Keep all lights free of any obstruction for the best uniform lighting.

# Lighting Comparisons

## Examples of overly bright and glare



Overly bright lights shock the human eyes and cause a temporary blindness.

### Direct vs. Reflected Glare

Direct glare occurs when a source of brightness is in the line of vision.

Reflected glare occurs when brightness from the source is reflected on a shiny surface that is in the line of vision

Glare makes it hard to see, causing an unsafe situation



By simply blocking an overly bright light, we allow you to see beyond it, demonstrating the importance of directed and shielded lighting.

# Lighting Comparisons

## Examples of glare



HP sodium vapor or metal halide lights without direction: Unable to see subject directly under the light.

Directed LED lights provide uniform lighting: Clearly able to see subject and his surroundings.



# Lighting Comparisons

## HPS/Metal Halide vs LED

LED lighting:

- directed and reduces light trespass
- reduces glare and offers true color rendition
- reduces energy costs up to 70%
- provides more uniform lighting and reduces shadows

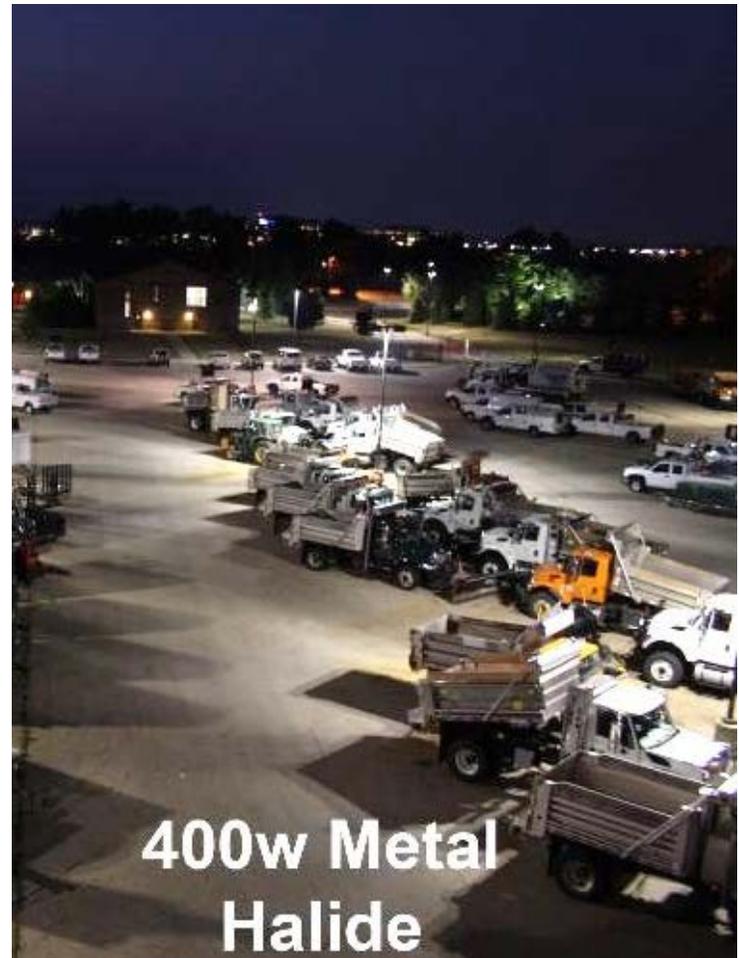
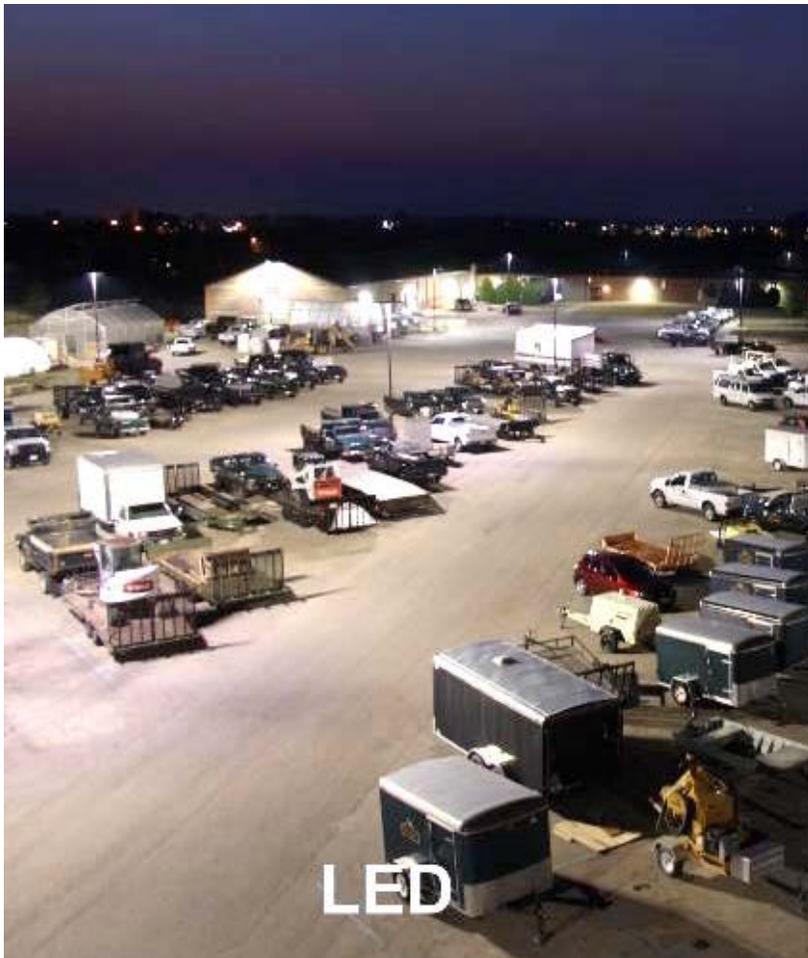


# Lighting Comparisons

## HPS/Metal Halide vs LED

LED lighting:

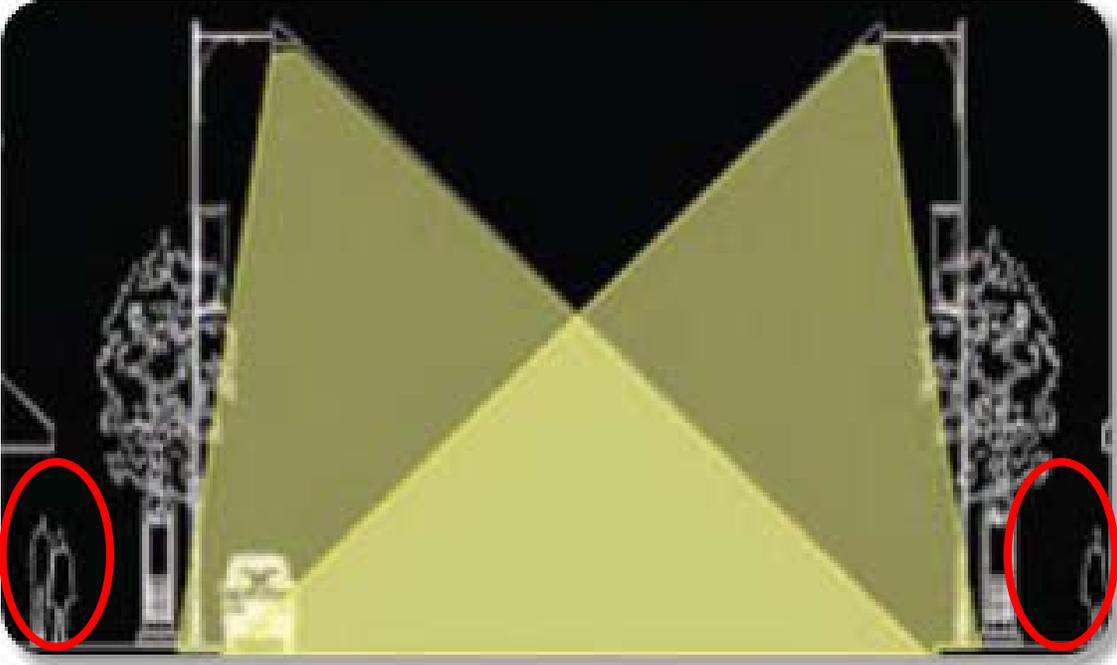
- reduces energy costs up to 70%
- reduces shadows
- offers true color rendition
- provides uniform lighting
- reduces glare



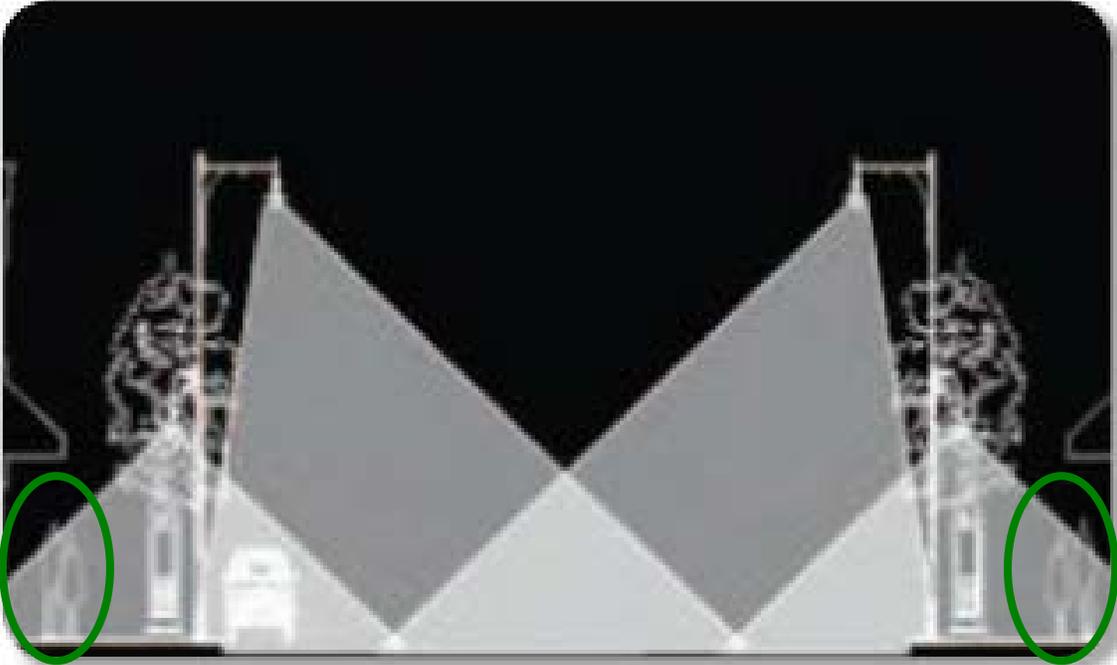
# Lighting Comparisons

## Range of uniformity and overlap

Pedestrian area is not illuminated.



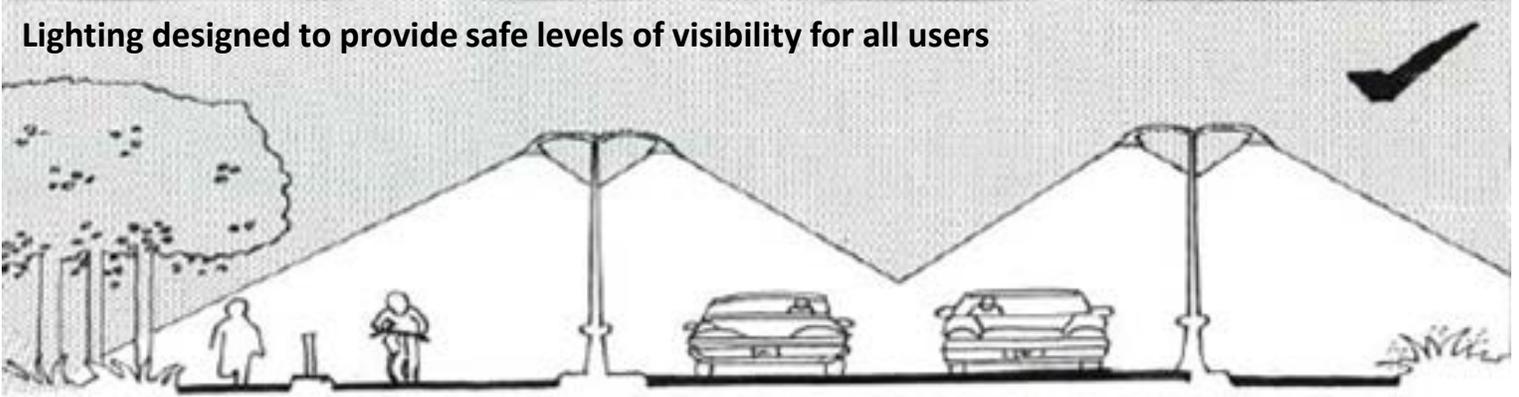
Pedestrian area, parking area, and roadway are clearly illuminated.



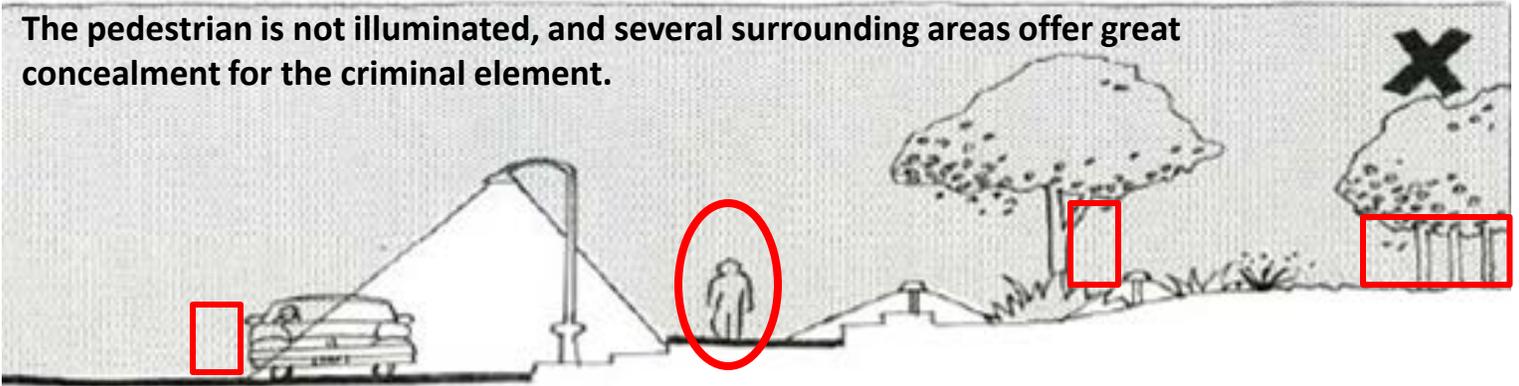
# Lighting Comparisons

## Range of uniformity and overlap

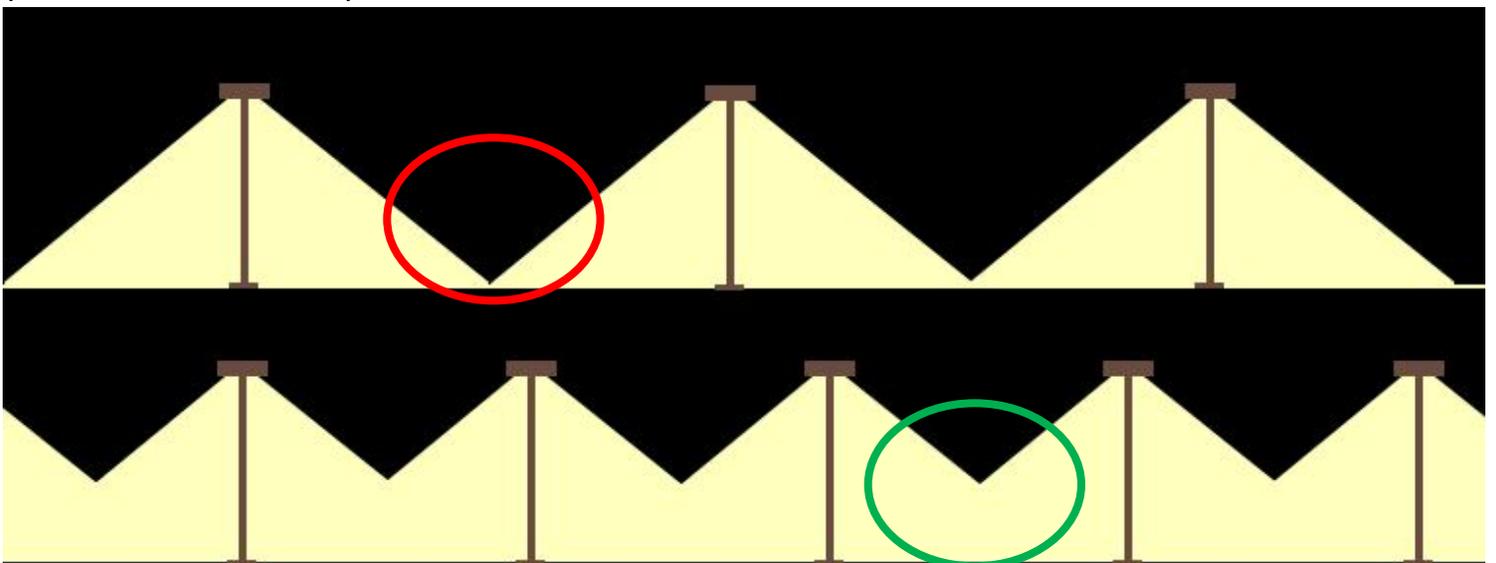
Lighting designed to provide safe levels of visibility for all users



The pedestrian is not illuminated, and several surrounding areas offer great concealment for the criminal element.



Although the lighting is directional, the failure to overlap allowed shadows and void areas that provides an adult-size person with concealment.



The additional posts provide overlapped and uniform light, effectively eliminating the vulnerable areas.

# Lighting Comparisons

## HPS/Metal Halide vs LED



It is apparent the LED lighting provides a more uniform, brighter, and pure illumination of the space.

It creates a safer environment.

It enables a person to clearly see a person, object, and true colors (color rendition) at 100 feet or better.

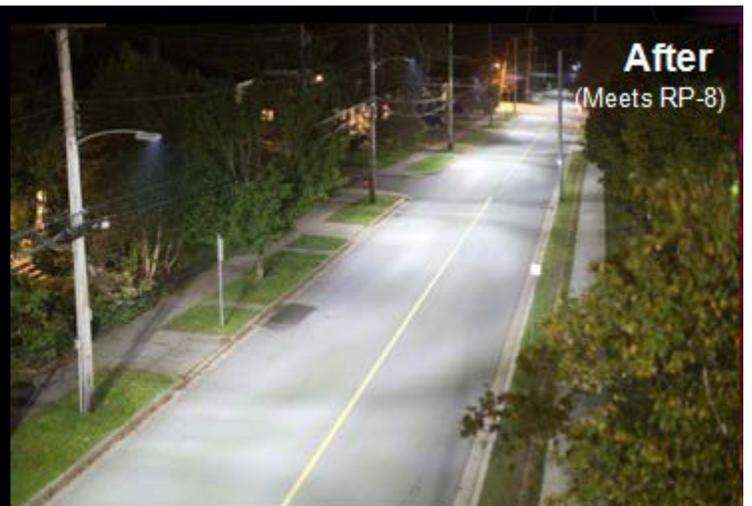
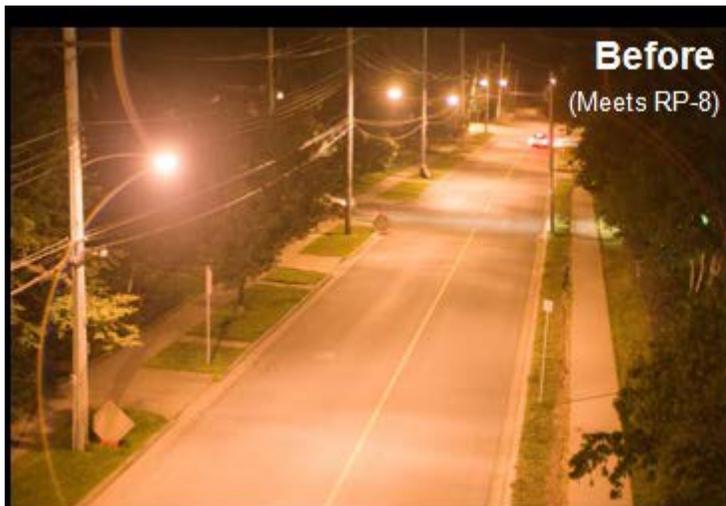


# Lighting Comparisons

HPS/Metal Halide vs LED



Which street would you rather walk along?



100 Watt Lamp

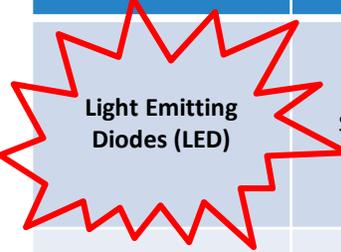
44 Watts

# Table 2: Expected Foot-candles (FC)

Consult with your Crime Prevention Officer to see which apply to your community.

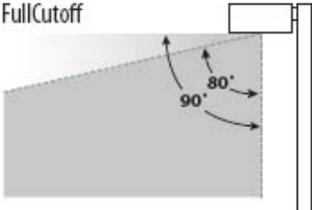
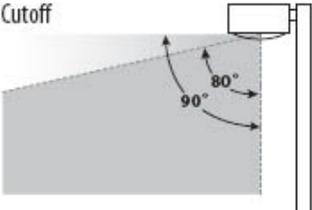
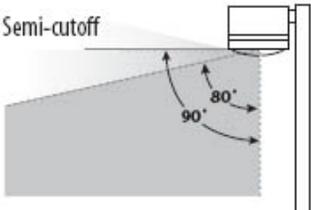
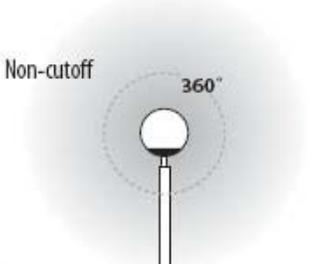
4 to 5 FC - HIGH Risk Activity Areas		
Gated community entries	Breezeways	Covered walkways
Pay phones	Tunnels	ATMs
Cluster mailboxes (minimum of 20' radius from edge of mail box)		
<b>All</b> commercial exterior entrances - Typically 5 FC of light will be the recommended as the minimum standard with a radius of 15' from the center of each door; however, each entrance will be assessed based upon use and risk.		
3 to 4 FC - MEDIUM HIGH Risk Activity Areas		
Parking areas		
Parking Structures (10 FC daytime)(parking garages, multilevel)		
Community activity space (playground, ramada, pools, courts)		
2.5 to 3 FC - MEDIUM Risk Activity Areas		
Laundry areas (Interior)	Storage areas	
1 to 2.5 FC - MEDIUM LOW Risk Activity Areas		
Multi-family housing entrances	Community walkways	
General office (night use for the interior)		
1 FC - LOW Risk Activity Areas		
Greenbelt	Retention areas	
.5 to 1 FC - Decorative Areas		

# Table 3: Lighting Type and Cost Analysis

Type	Initial Costs	Energy Costs	Life Hours	Pros	Cons
 Light Emitting Diodes (LED)	\$25.99	\$82.17	60,000	Longest life Highly rugged Instant light Silent operation Low energy costs Best color rendition	Continuous development High initial cost
High Pressure Sodium	\$19.99	\$92.50	24,000	Low energy costs Good life Good optical control	Moderate initial cost Fair color rendition Contains mercury Restart time Cycle at end of life
Low Pressure Sodium	\$29.99	\$19.54	14,000	Low energy costs High efficiency	High initial cost Worst color rendition Safety concerns
Metal Halide	\$18.19	\$38.20	12,000	Low energy costs High efficiency Good optical control Great color rendition	Moderate initial cost Restart time Short life Contains mercury
Compact Fluorescent (CFL)	\$4.98	\$191.73	10,000	Minimal initial cost Good efficiency Moderate life 90% less heat Good color rendition Instant ON response	Full intensity at start-up Contains mercury
Fluorescent	\$15.99	\$92.80	6,000	Moderate initial cost Good efficiency Good color rendition Instant ON response	Moderate energy costs Moderate life Contains mercury
Quartz/Quartz Halogen	\$9.98	\$789.60	2,000	Good color rendition	High heat Short Life Low efficiency Fragile
Incandescent	\$1.38	\$821.72	750 -2000	Minimal initial cost	High energy costs Short life High heat Low efficiency Fair color rendition Fragile

Assessment is based on 60,000 hours of operation of 800 lumens.

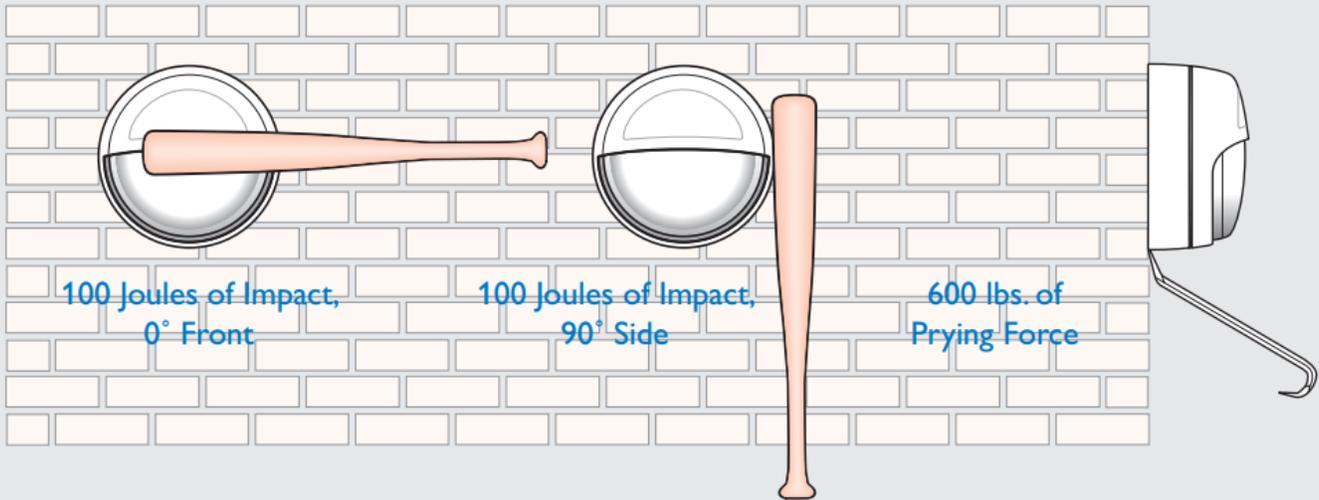
# Table 4: Lighting Fixtures

Fixture	Definition	Benefits	Limitations
 <p>Full Cutoff</p>	<p>BEST - Commonly used for wide coverage in large spaces (parking lots, streets, playing fields, etc.)</p> <p>Zero intensity at or above horizontal .</p>	<ul style="list-style-type: none"> <li>- Limits spill light onto adjacent property.</li> <li>- Reduces glare.</li> <li>- No light is emitted directly from the luminaire into the sky.</li> </ul>	<p>May reduce pole spacing to maintain uniformity; increasing pole and luminaire quantities for proper lighting.</p>
 <p>Cutoff</p>	<p>BETTER - Commonly used for wide coverage in large spaces (parking lots, streets, playing fields, etc.)</p> <p>Intensity at or above 90° horizontal no more than 2.5%.</p>	<p>Small increase in high-angle light allows increased pole spacing.</p>	<ul style="list-style-type: none"> <li>- May allow some up-light from fixture causing trespass.</li> <li>- Typically a small overall impact on sky glow.</li> </ul>
 <p>Semi-cutoff</p>	<p>GOOD - Commonly used for wide coverage in large spaces (parking lots, streets, playing fields, etc.)</p> <p>Intensity at or above 90° horizontal, no more than 5%.</p>	<p>High-angle light accents taller vertical surfaces such as buildings. Most light is still directed downward.</p>	<ul style="list-style-type: none"> <li>- Little control of light at property line.</li> <li>- Potential for increased glare when using high wattage luminaires.</li> <li>- Typically directs more light into the sky than cutoff.</li> </ul>
 <p>Non-cutoff</p>	<p>No limitations on light distribution at any angle.</p>	<p>Uniform luminous surfaces such as internally illuminated signs or globes. Wattage should be limited. Suitable for sports lighting, facade, landscape, or other applications where luminaires are tilted due to limitations in pole or fixture locations.</p>	<ul style="list-style-type: none"> <li>- Location and aiming are critical.</li> <li>- Most likely of all categories to produce offensive brightness and sky glow.</li> <li>- Easily shaken and broken</li> </ul>
 <p>Vandal Resistant</p>	<p>Lighting fixtures designed for use in abusive environments; most common forms of abuse are impact and prying.</p>	<ul style="list-style-type: none"> <li>- Increased safety</li> <li>- Durable</li> <li>- Reduced maintenance</li> <li>- Reduced costs</li> <li>- Aesthetically pleasing</li> </ul>	<ul style="list-style-type: none"> <li>- Initial cost</li> <li>- Application options regarding lamp posts</li> </ul>
 <p>Bollard</p>	<p>Provides elements of safety for larger outdoor spaces.</p>	<ul style="list-style-type: none"> <li>- Defines space and boundaries</li> <li>- Physical barrier</li> <li>- Illuminate pedestrian areas</li> <li>- Greater light than standard decorative lighting for pedestrians</li> </ul>	<ul style="list-style-type: none"> <li>- Initial costs</li> <li>- Reduced amount of illumination</li> </ul>

# Lighting Fixtures

Fixture	Definition	Benefits	Limitations
<p>Up-lighting</p> 	<p>Known as spotlights, flood lights, and well lights. Often used to illuminate building numbers, flags, landscaping</p>	<ul style="list-style-type: none"> <li>- Illuminates building numbers</li> <li>- Aesthetically pleasing with a dramatic effect</li> </ul>	<ul style="list-style-type: none"> <li>- Greater opportunity of light trespass</li> </ul>
<p>Decorative</p> 	<p>Small, limited illuminating lighting fixtures to add ambient lighting to a space</p>	<ul style="list-style-type: none"> <li>- Defines space and boundaries</li> <li>- Aesthetically pleasing</li> </ul>	<ul style="list-style-type: none"> <li>- Initial costs</li> <li>- Reduced amount of illumination</li> <li>- Not likely to be vandal resistant</li> </ul>

## Vandal / Tamper resistant fixtures



**100 Joules of Impact, 0° Front**

**100 Joules of Impact, 90° Side**

**600 lbs. of Prying Force**

**Example:** A luminaire rating of VR5+P6 would be able to withstand an impact of 50 joules and have a pry-off resistance strength of 600 lbs. More information on individual luminaires is available by visiting [www.survivrseries.com](http://www.survivrseries.com).

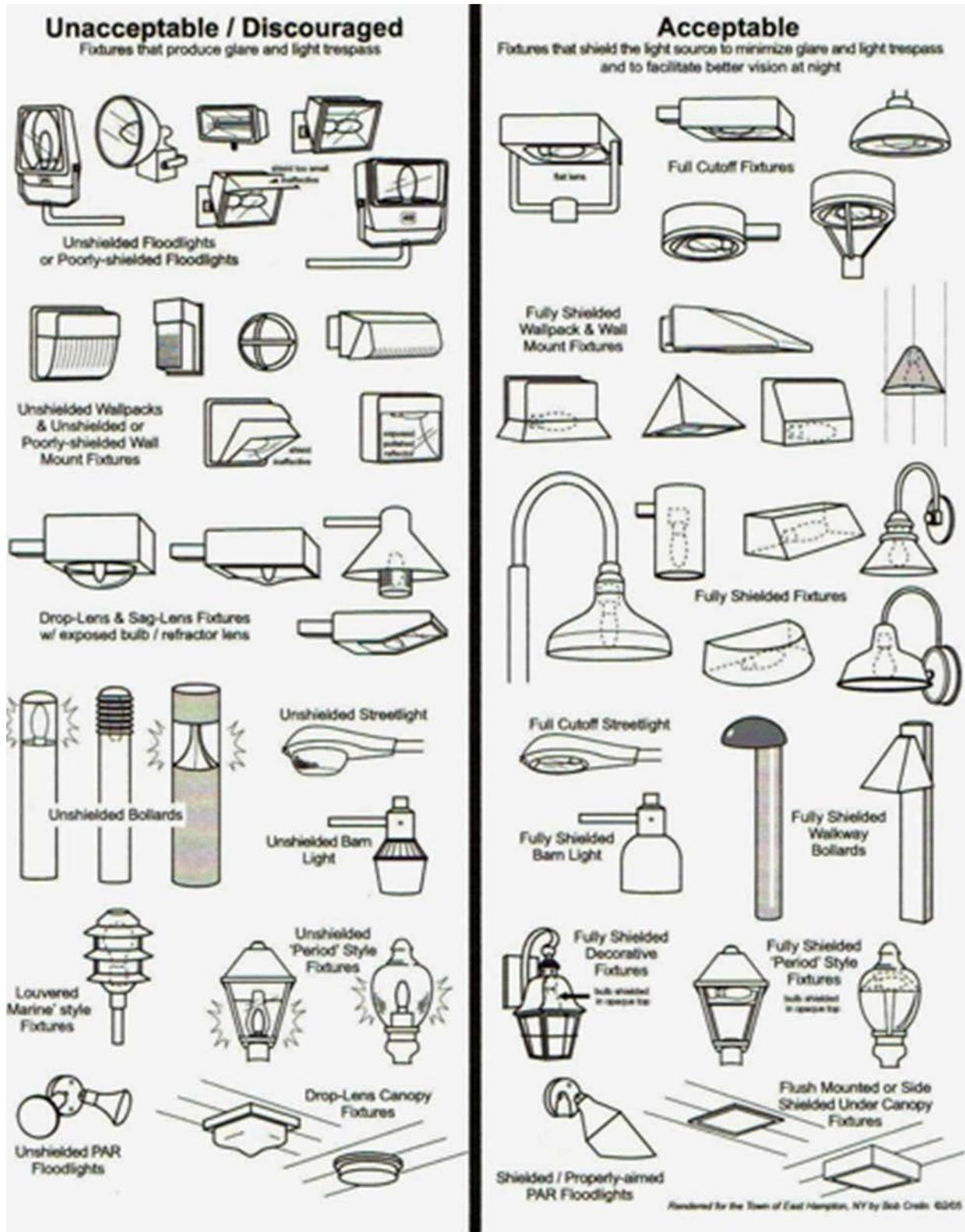


Install lighting fixtures with tamper resistant screws.

# Table 5: Directional Lighting Fixtures

## Directional lighting

Most of the lighting on the LEFT does NOT provide direction and permits lighting trespass or pollution



# Works Cited:

City of Portland. *City of Portland CPTED Definition and Policy Strategies*. Portland: City of Portland, n.d. Web. 9 Oct. 2015.

City of Portland. *Crime Prevention Through Environmental Design*. Portland: City of Portland, n.d. Web. 9 Oct. 2015.

City of Tempe. *City of Tempe - CPTED Guidelines*. Tempe: City of Tempe, 1997.

*Florida Design Out Crime Association (FLDOCA)*. City of Tempe. Web. 9 Oct. 2015.

Hushen, Art. "Crime Prevention Through Environmental Design." *Crime Prevention Through Environmental Design - Basic*. Paradise Valley Police Department, Paradise Valley. Jan. 2015. Lecture.

Mesa Police Department. *Crime Prevention Through Environmental Design*. Mesa: Mesa Police Department, n.d. Web. 9 Oct. 2015.

Mesa Police Department. *Tri Star Mgr Handbook*. Mesa: Mesa Police Department, n.d. *Tri Star Mgr Handbook*. Web. 9 Oct. 2015.

Oakland Police Department. *CPTED Security Handbook*. Oakland: Oakland Police Department, n.d. *Greater Rockridge Neighborhood Crime Prevention Council*. Web. 9 Oct. 2015.

"Federal Crime Data, 2014." *FBI*. FBI, 11 June 2013. Web. 30 Nov. 2015.

"Why Does Outdoor Lighting Matter?" *Illinois Coalition for Responsible Outdoor Lighting*. N.p., n.d. Web. 30 Nov. 2015.

---