



CPTED

Crime Prevention Through Environmental Design

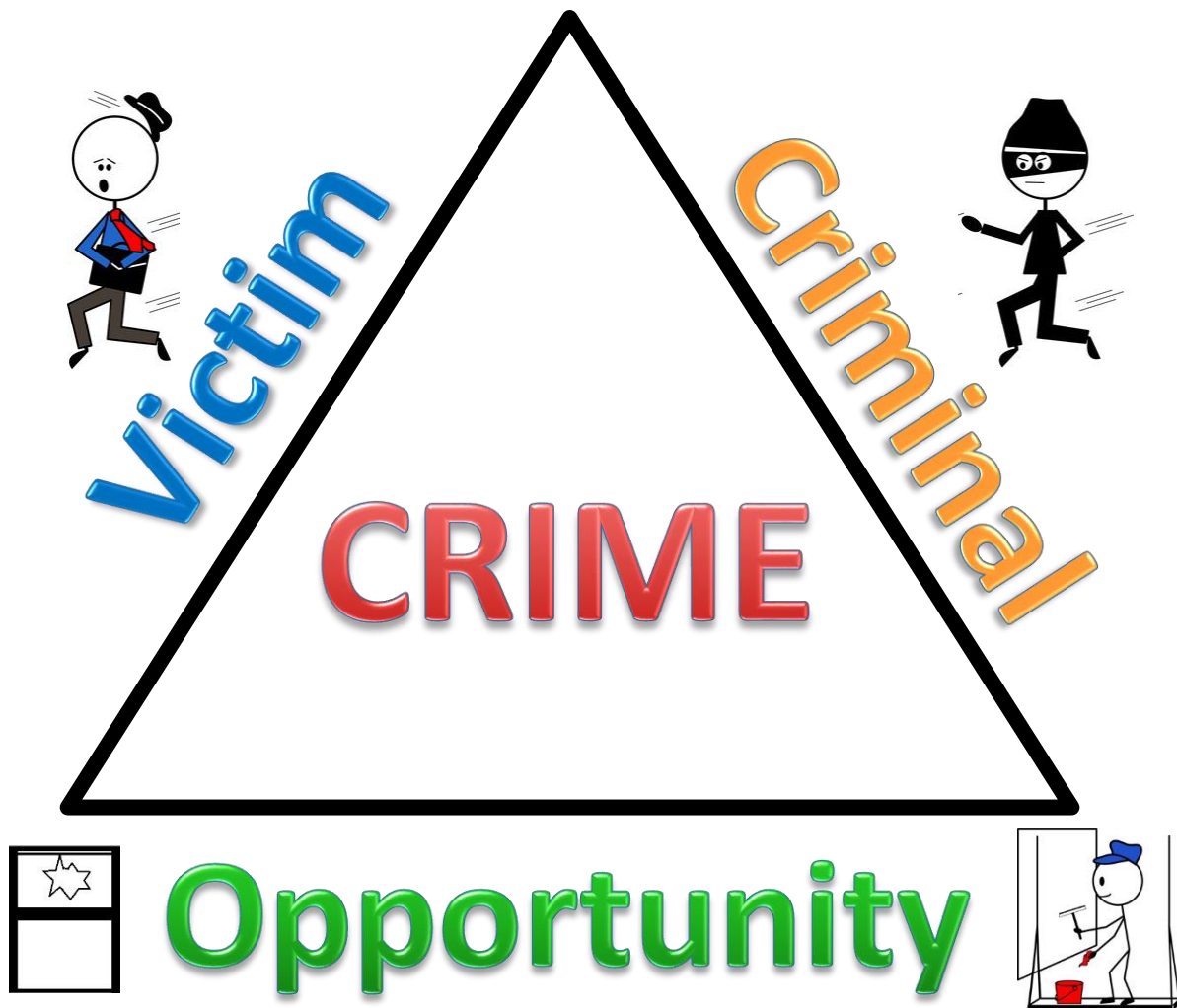
- OFFERS THE OPPORTUNITY TO REDUCE CRIME
- REDUCES RESIDENTS FEAR OF CRIME
- ENCOURAGES SOCIAL INTERACTION
- IMPROVES QUALITY OF LIFE

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Purpose

The goal of the CPTED requirements in the Chandler C³ 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

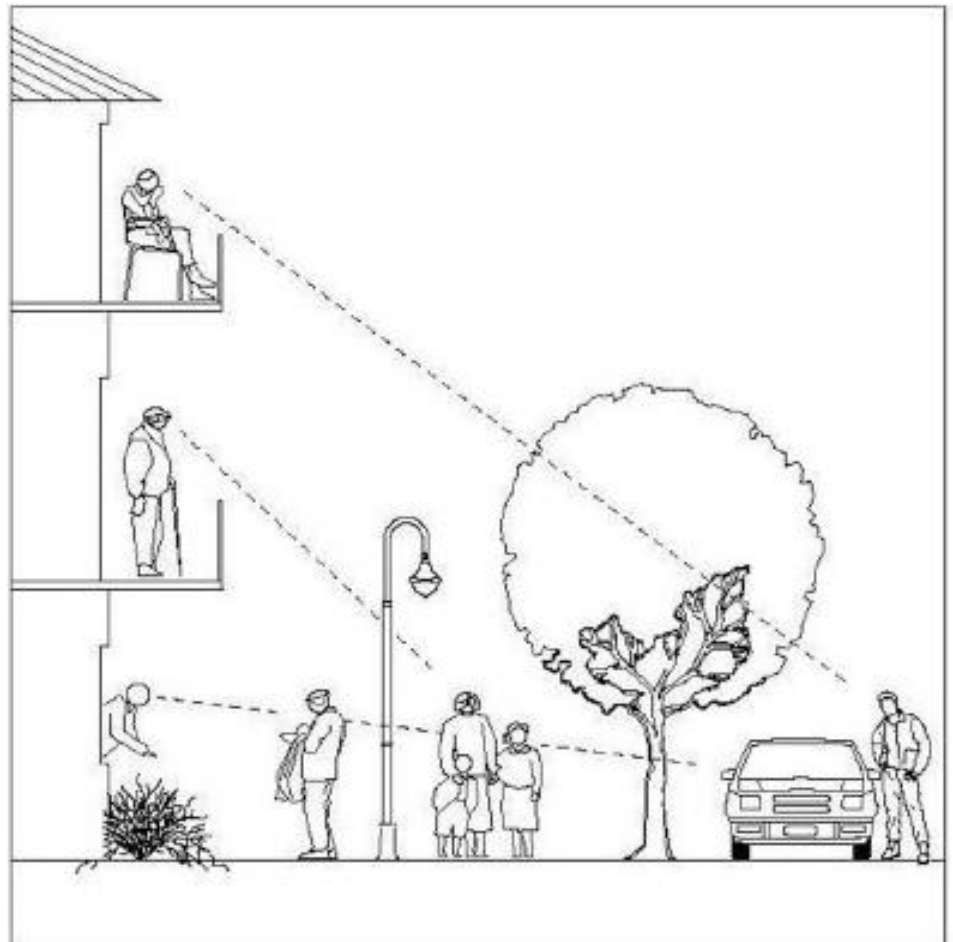


It cannot be overemphasized that ALL of these principles applied equally will lead to the objectives of enhanced livability and greater natural safety of the community.

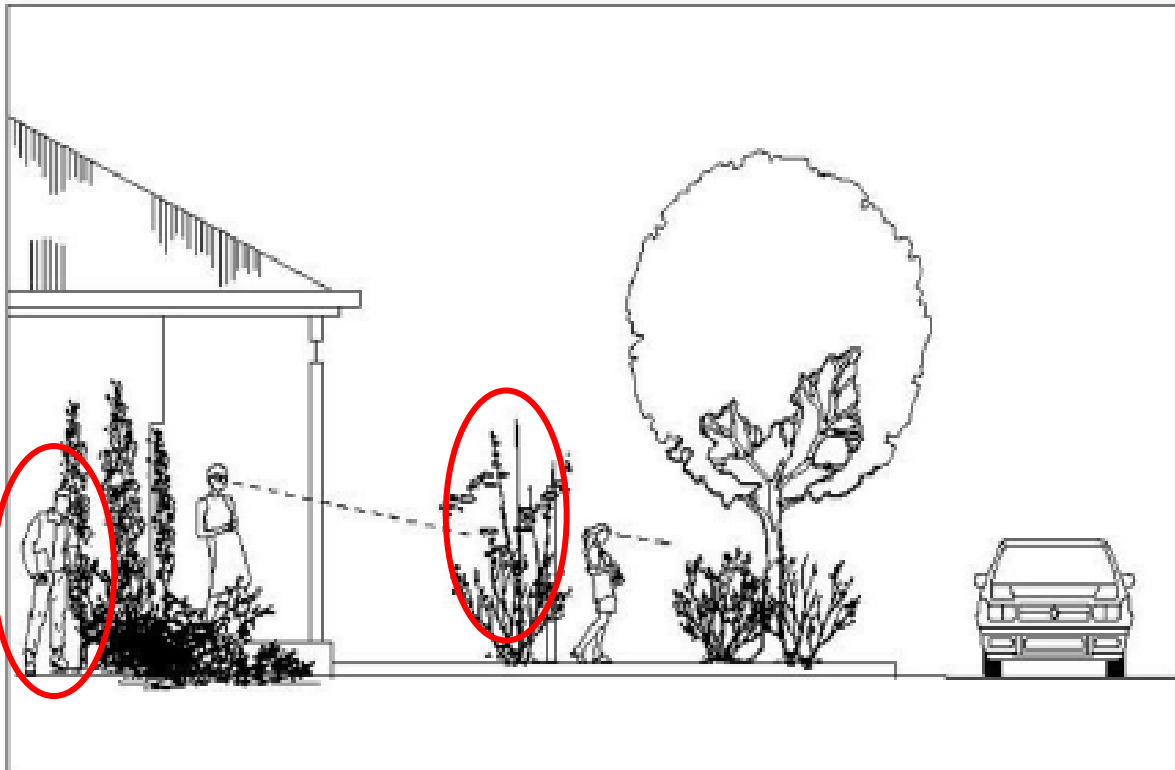
Natural Surveillance:

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."*

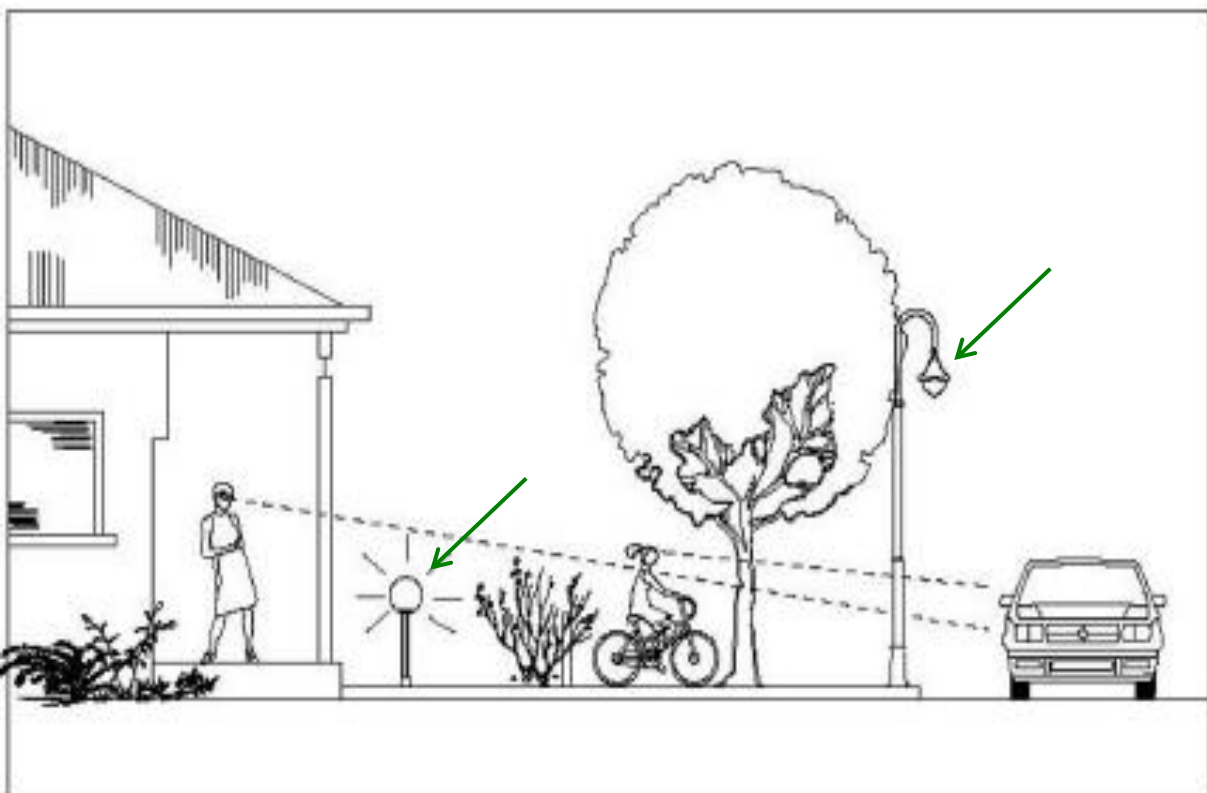
- Involves design and maintenance elements that ensure full opportunity for residents to engage in their normal behavior and activities to observe the space around them.
- Creates an opportunity for the owner/management team to minimize the opportunity for concealment or secrecy by a person intending 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”

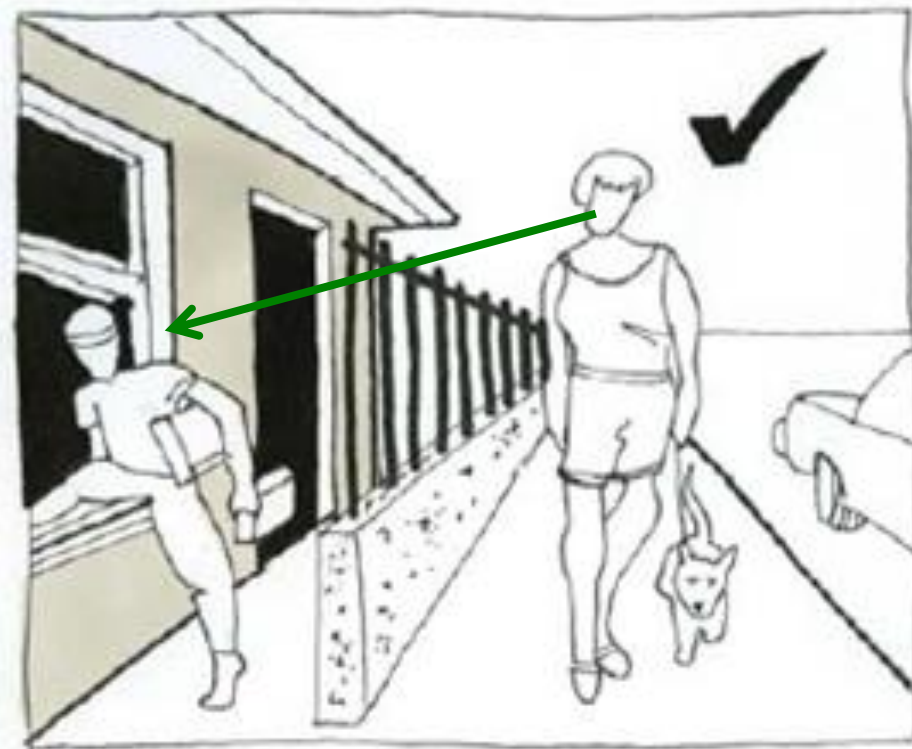


The criminal is hidden by tall foliage. Street view is obscured by tall foliage.



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.

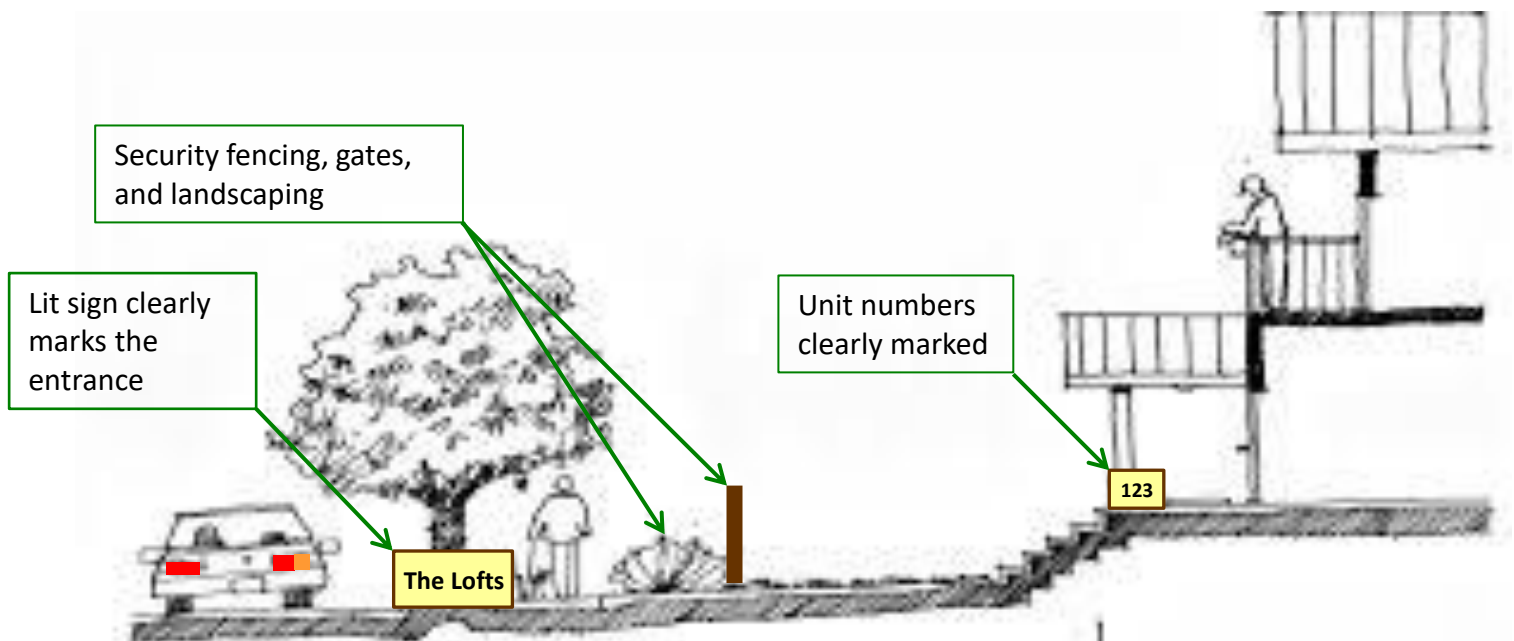


Trimmed and maintained vegetation offers curb appeal, clears visibility, and rids concealment opportunities for the criminal element.

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*.



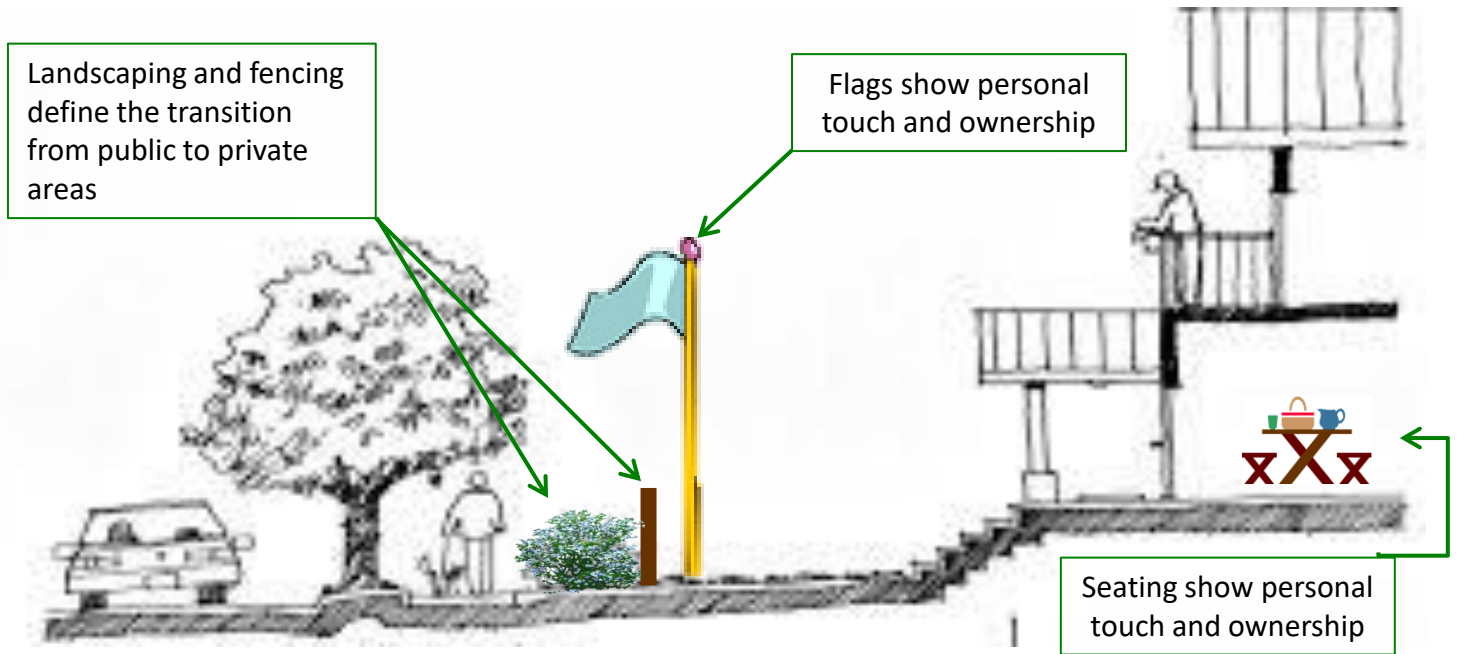
Public is the open thoroughfare for all to travel

Semi-public is the public pedestrian space

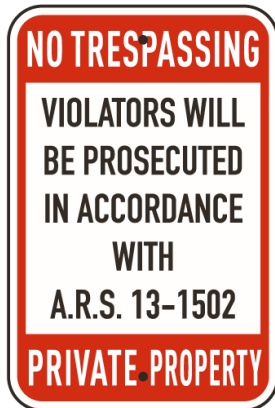
Semi-private is the front yard, sidewalk, and driveway leading to your home

Private is your porch/patio and home

Examples of Territorial Reinforcement



Examples of Territorial Reinforcement Signage



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

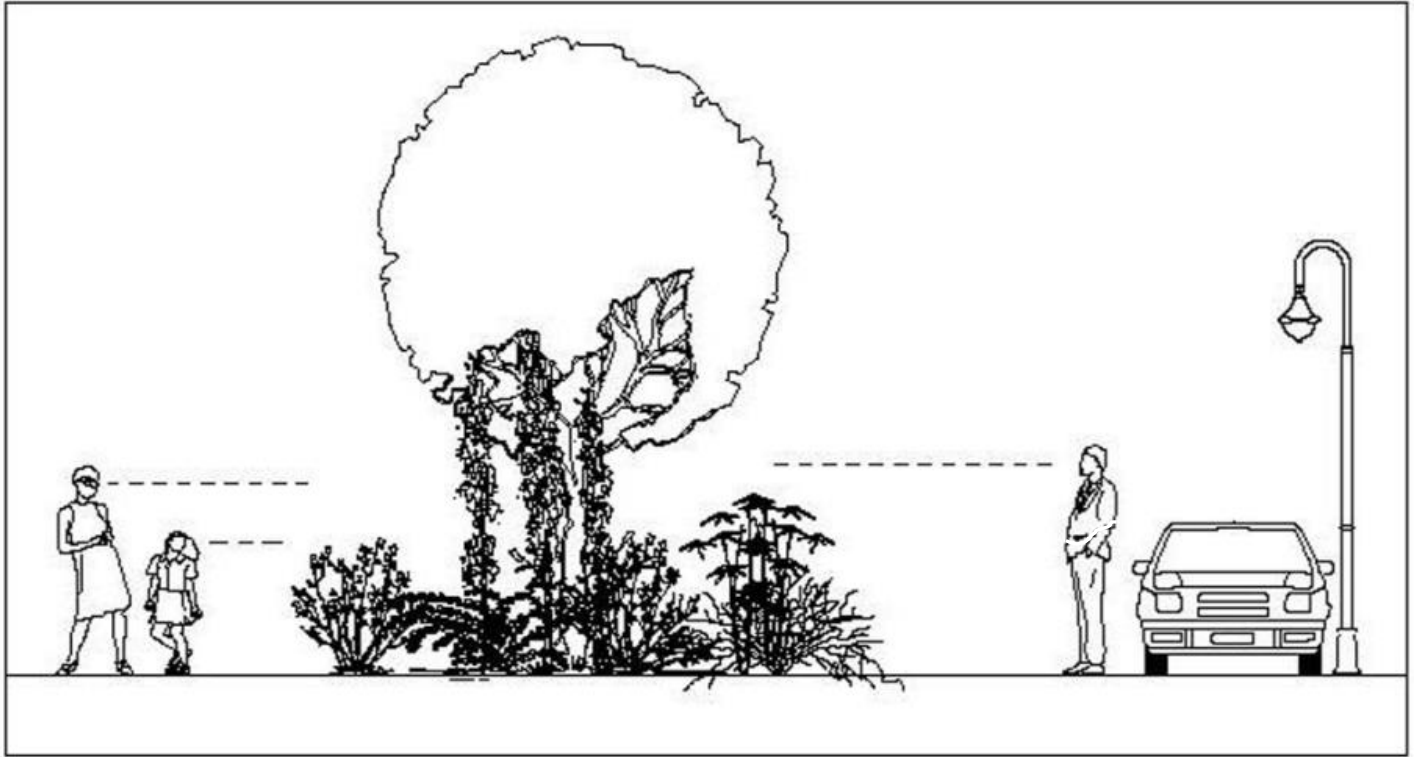
Considerations when landscaping:

- 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?



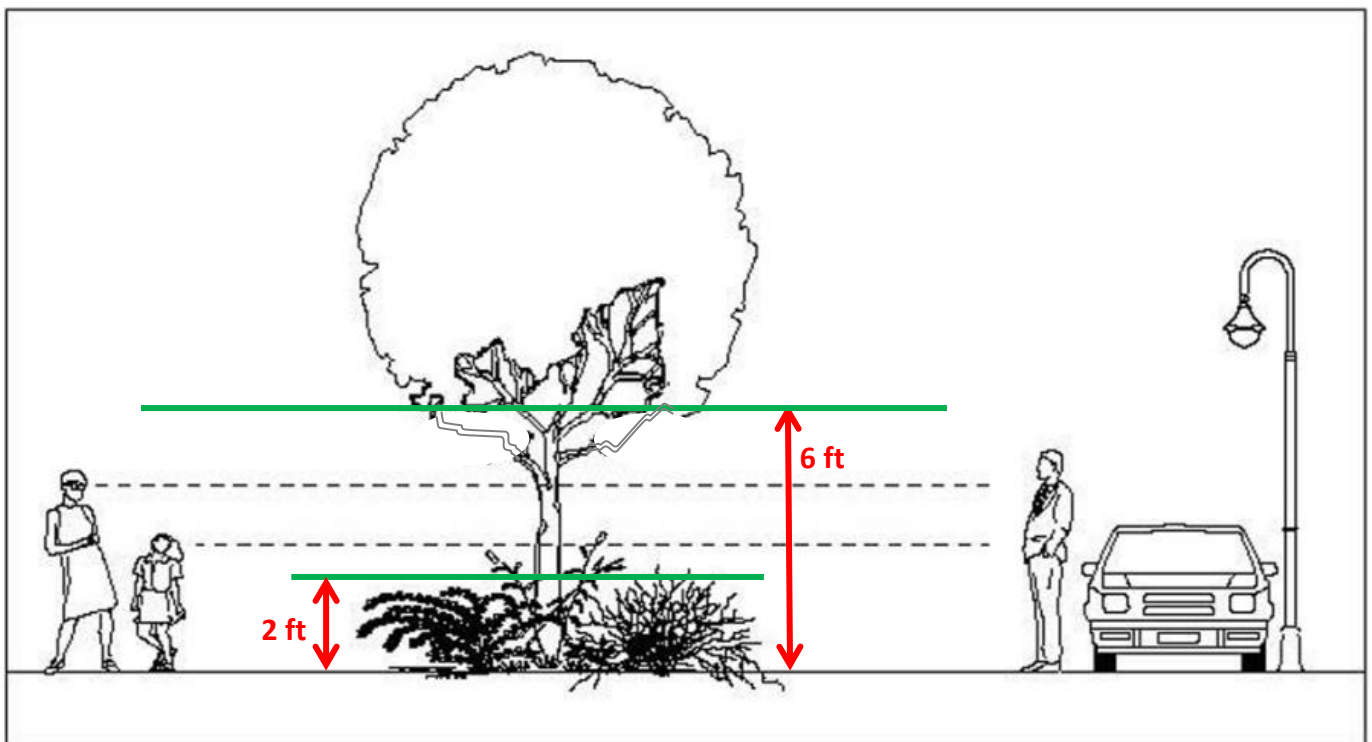
Landscaping

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



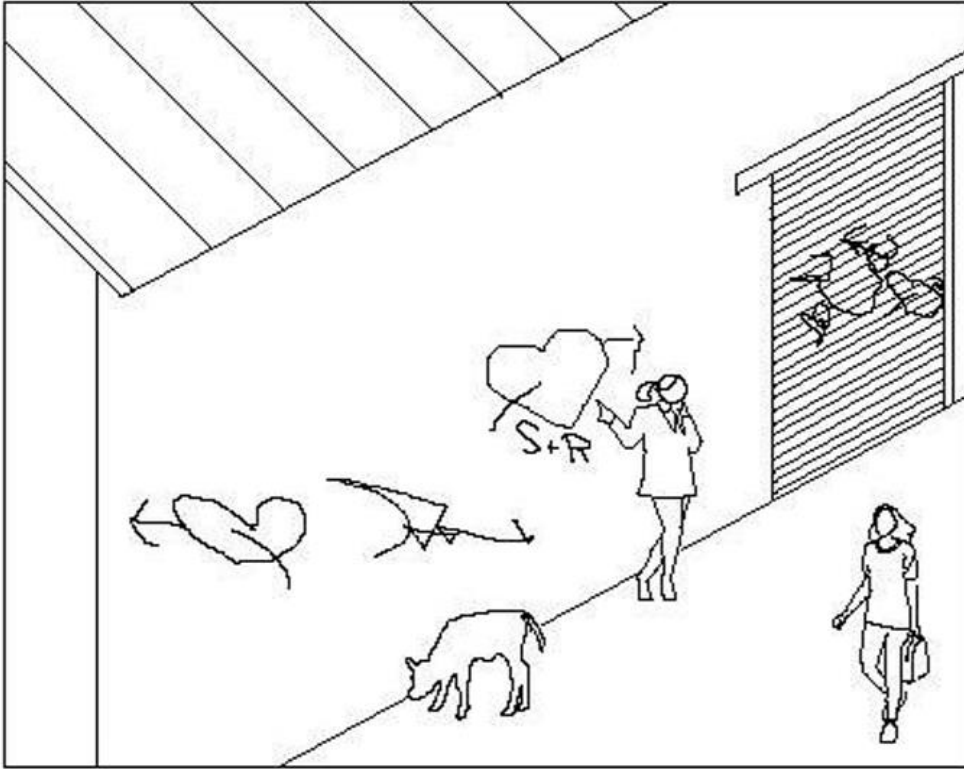
- Trim dense shrubs at 2ft or less.
- Trim tree canopies at 6ft or higher.

Both reduce hiding places and increase lighting and overall visibility.

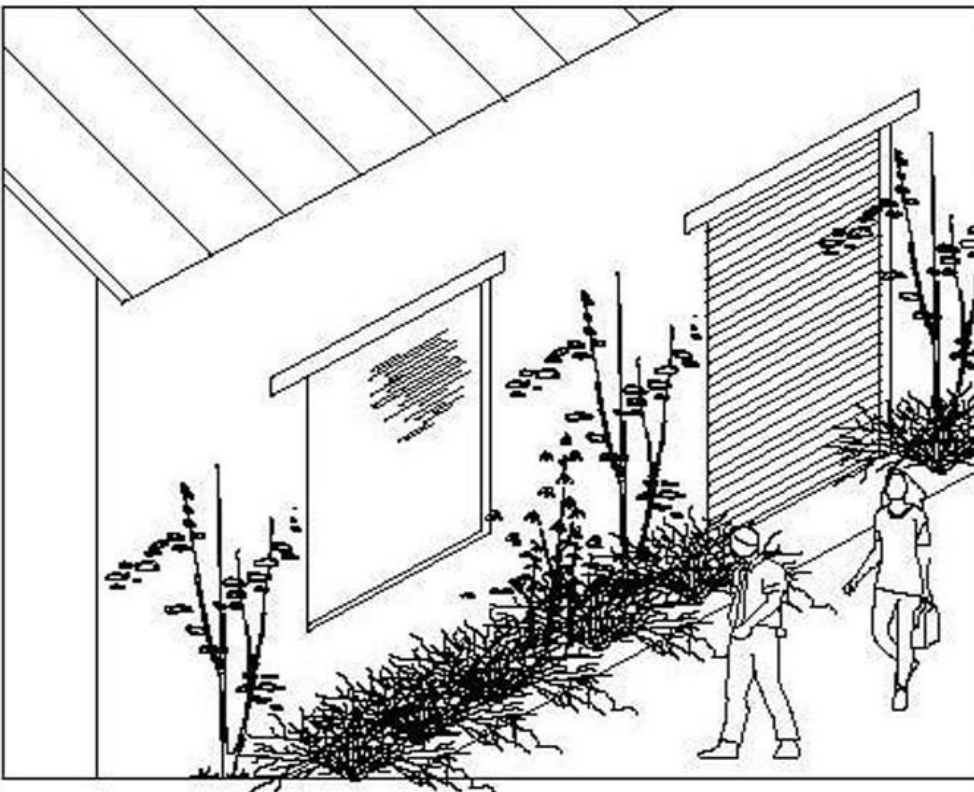


Landscaping

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

| | | |
|---------------------|--------------------------|----------------------|
| AllioniaIncarnata | 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 |

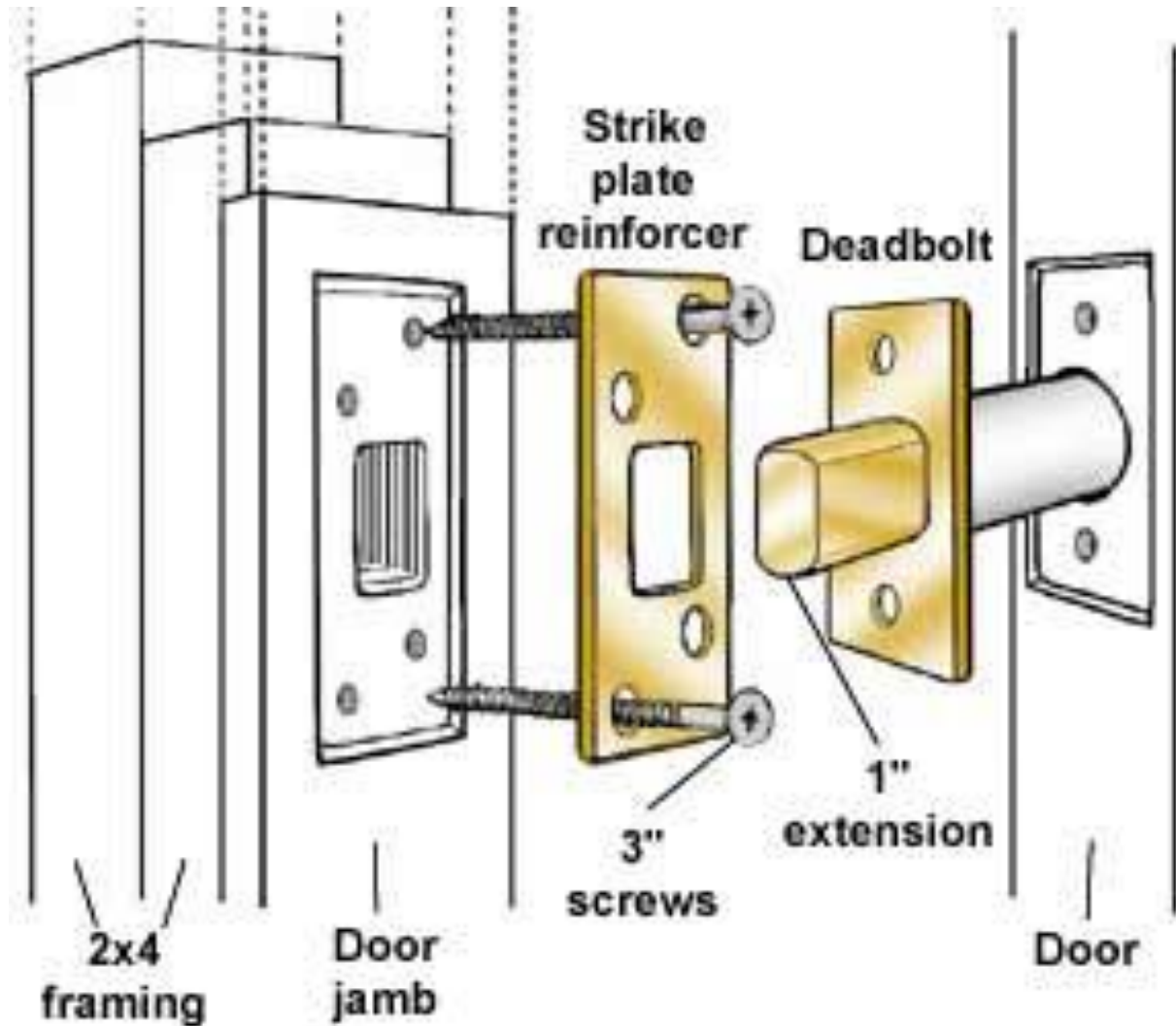
Suggested Vegetation

| 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

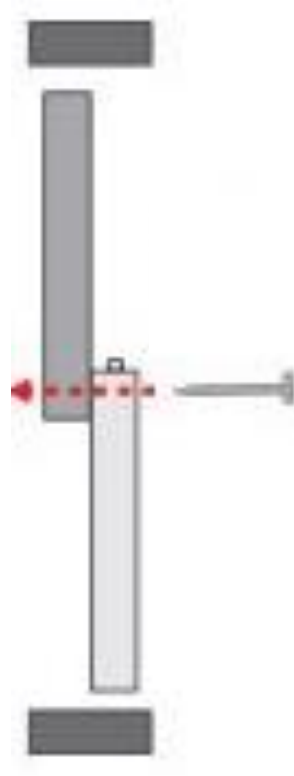
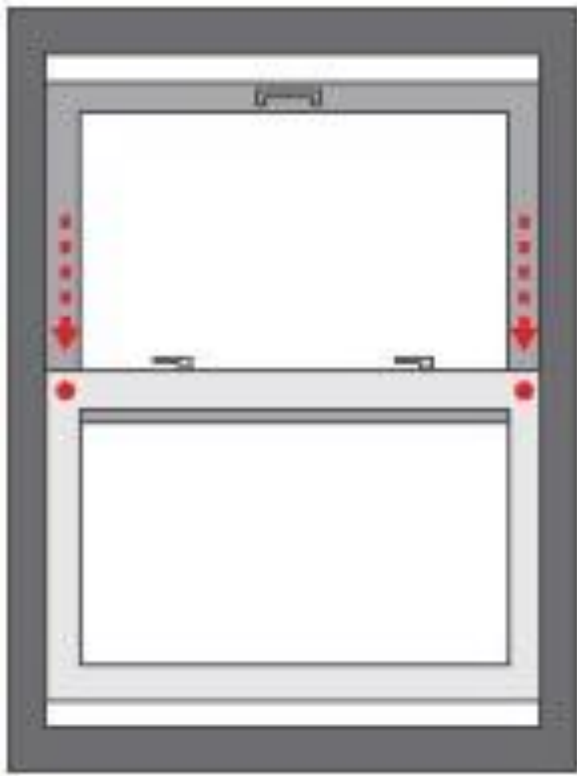


Bolt must have a minimum 1" throw and strike plates installed with 3" screws into the framing.

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.

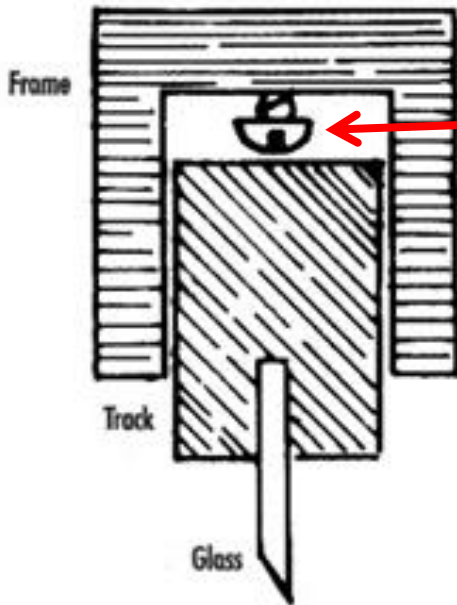


Thumb locks reduce the opportunity of the door or window opening; but if a hole is drilled into the track and the screw is twisted through, then it will prevent the door or window from opening.

Security Mechanisms

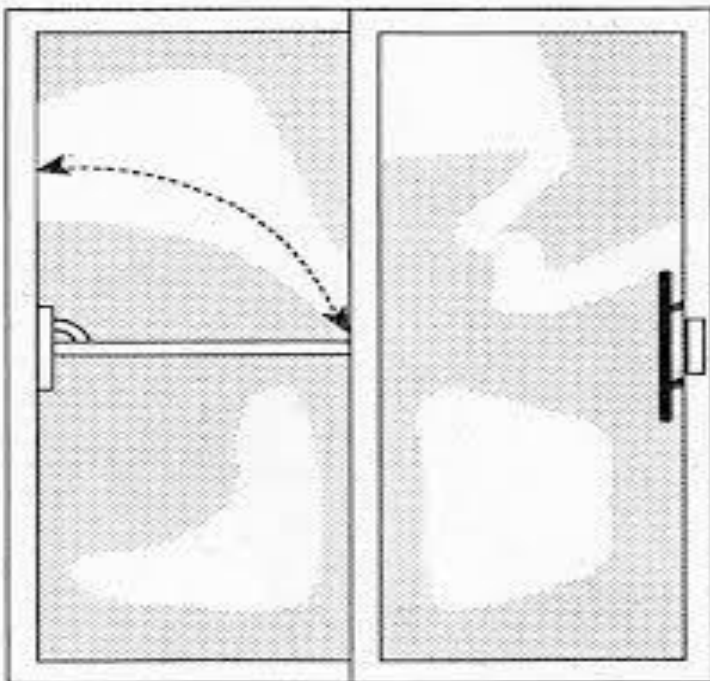
Intermediate requirements:

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

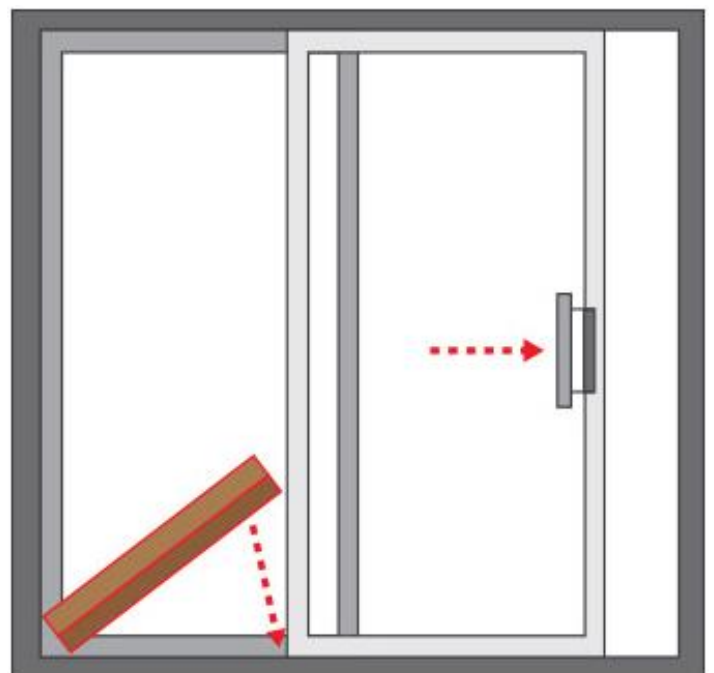


Installing screws above the door's pane prevents lifting.

Installing a drop bar prevents the door from sliding.



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

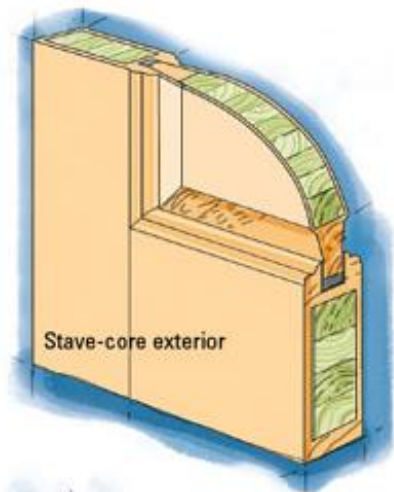


Security Mechanisms

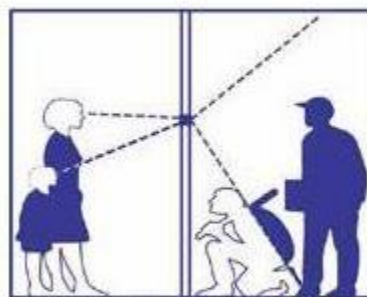
Advanced requirements:

Solid core doors with a minimum thickness of 1 ¾ "

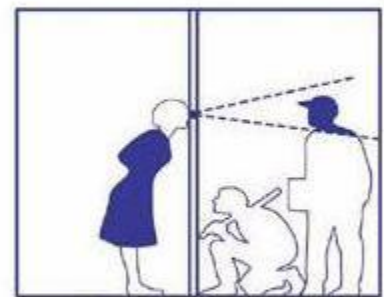
- Wood and metal are BEST



180° eye viewer



Security Door Viewer



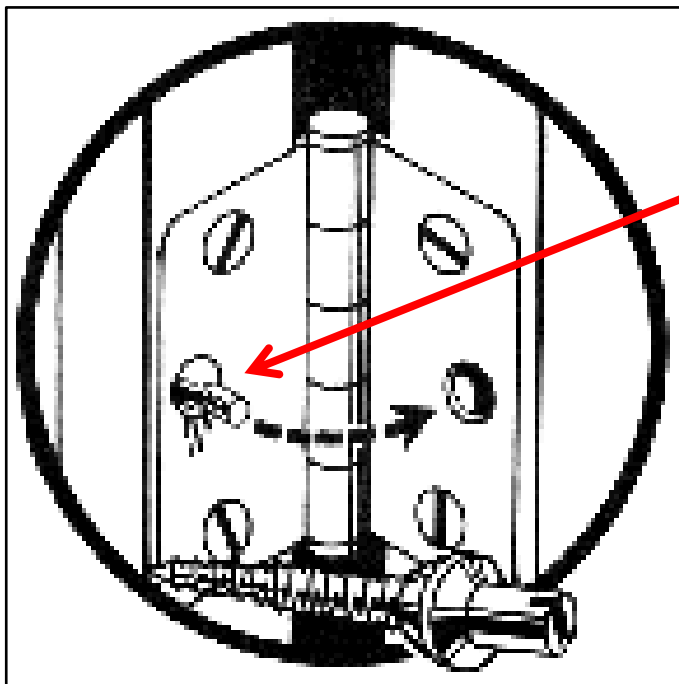
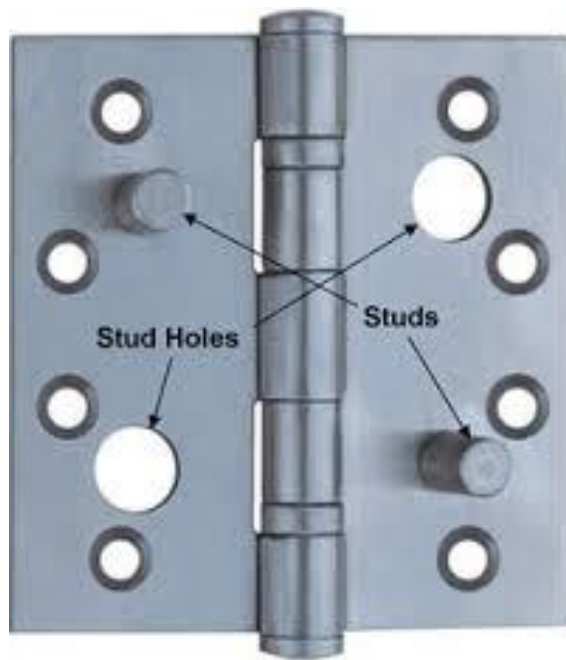
Traditional Peephole



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

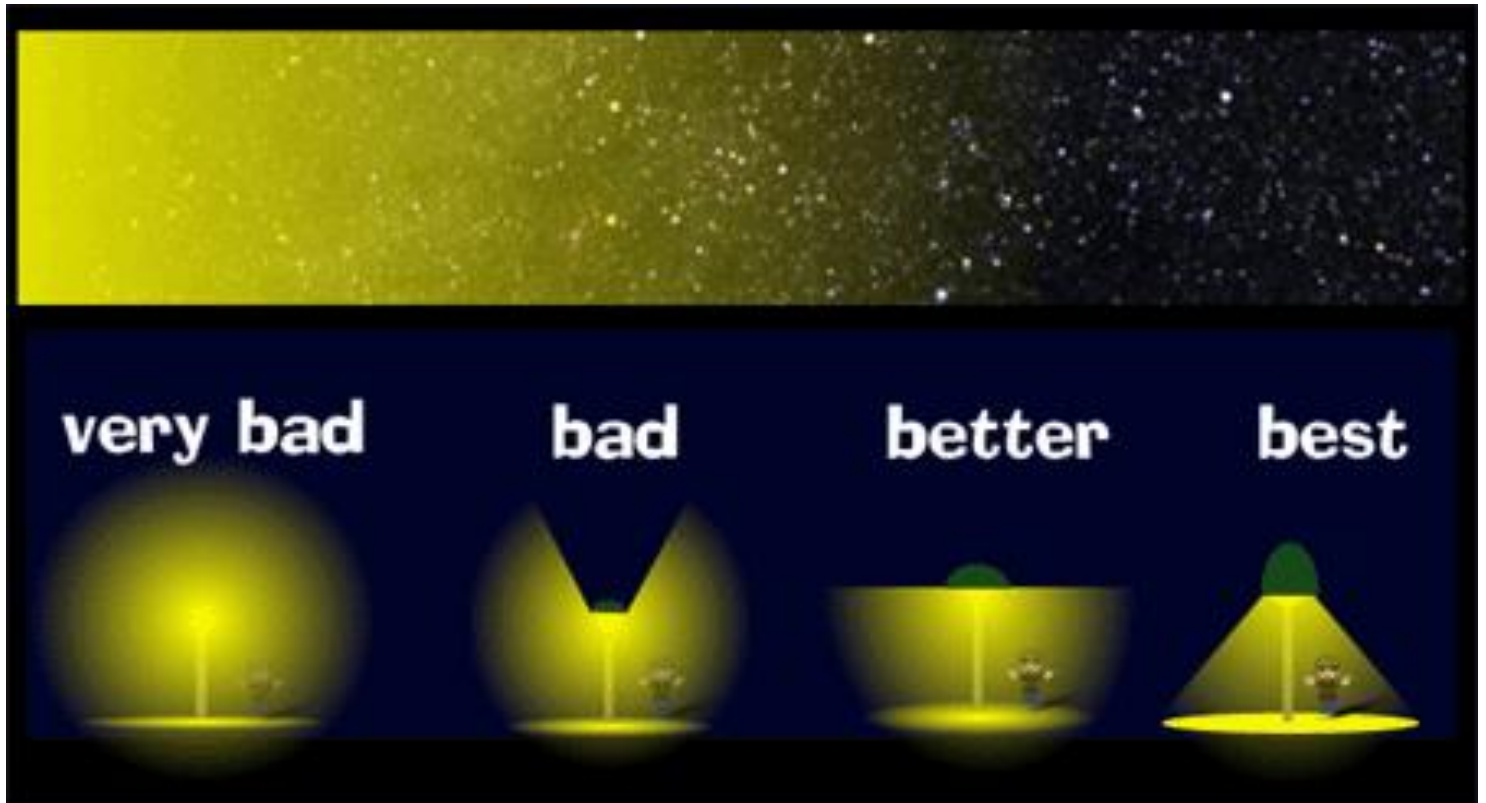
Be certain to replace damaged lighting; and when doing so, consider upgrading to LED and changing the fixtures. (See Tables 2-5)

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

Lighting Comparisons

Light trespass (pollution)

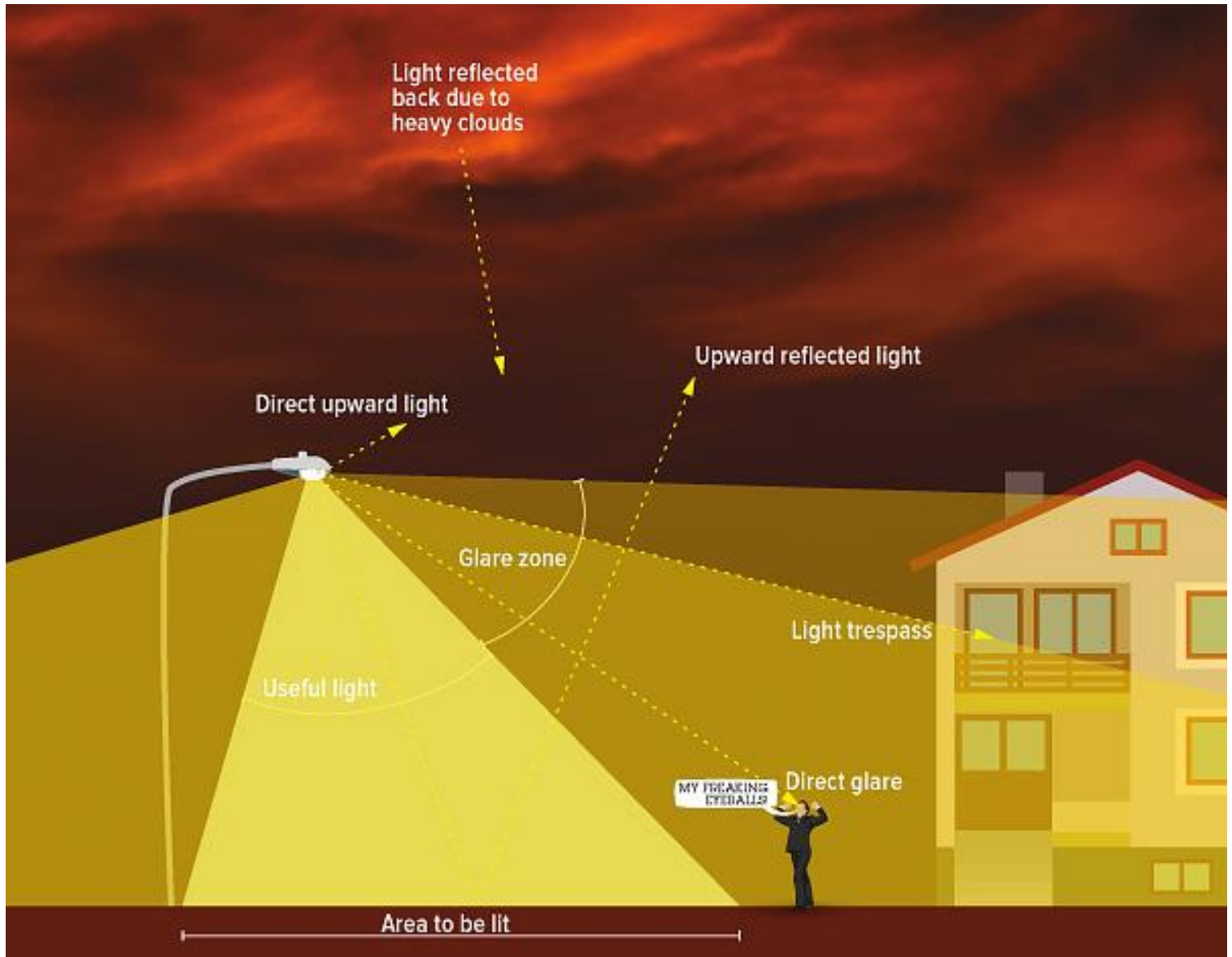
The **BEST** is not always the BRIGHTEST



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.

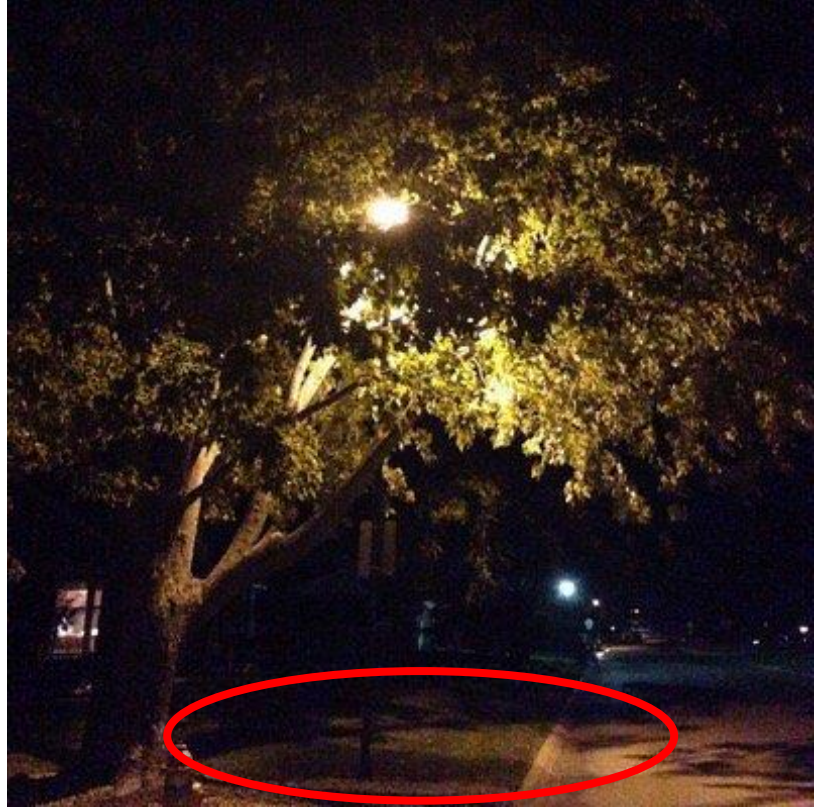
Keep all lights free of any obstruction for the best uniform lighting.



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.

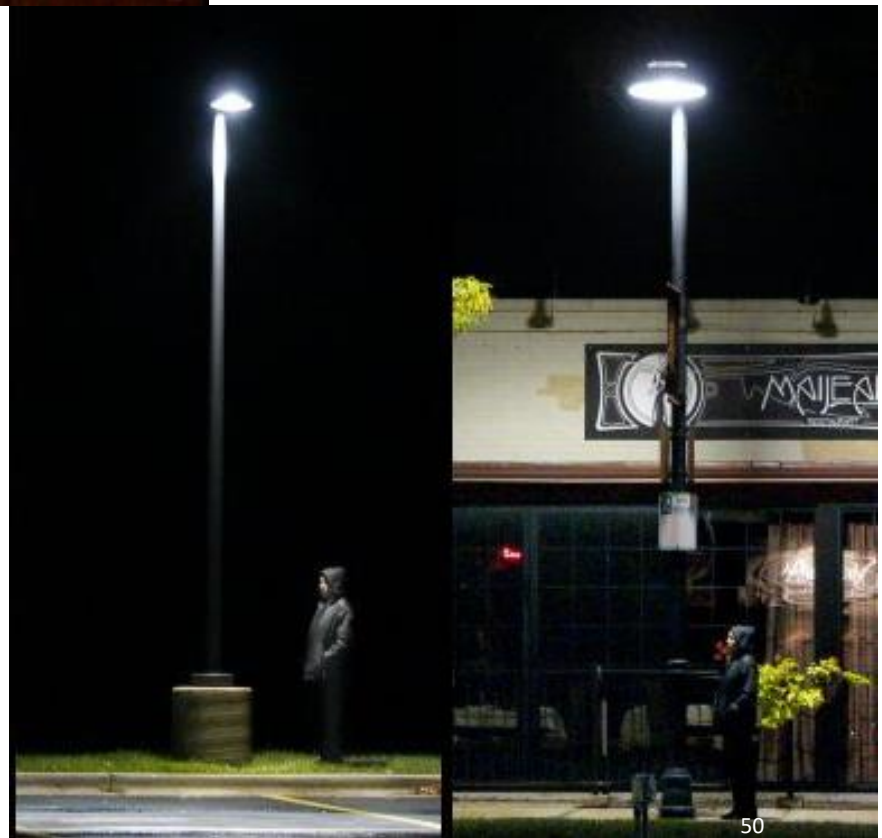
Lighting Comparisons

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



Before



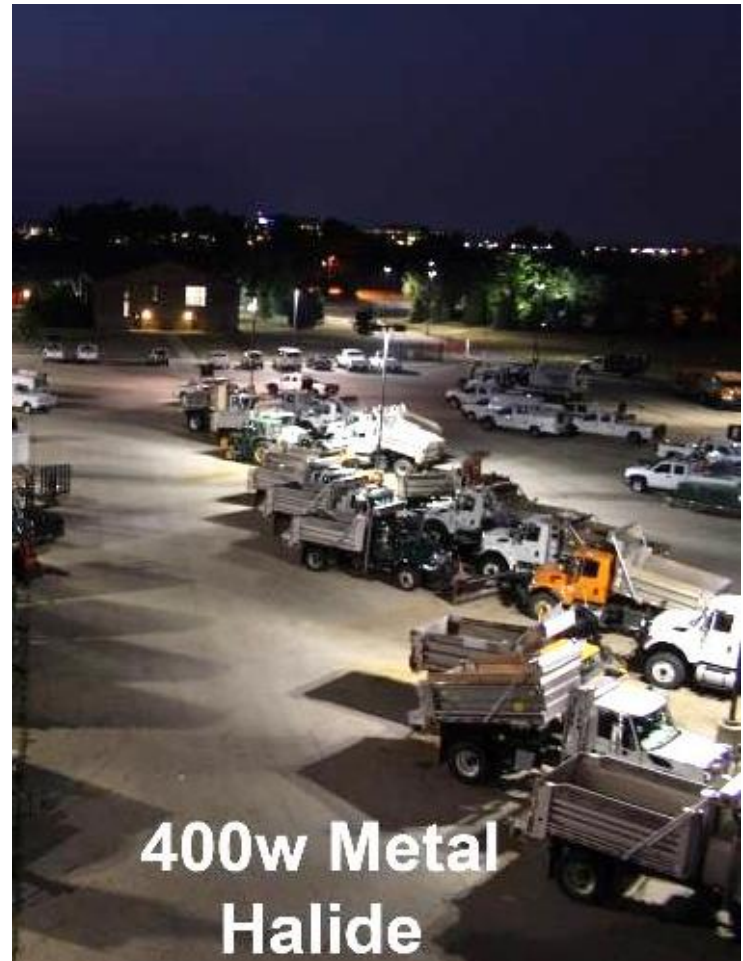
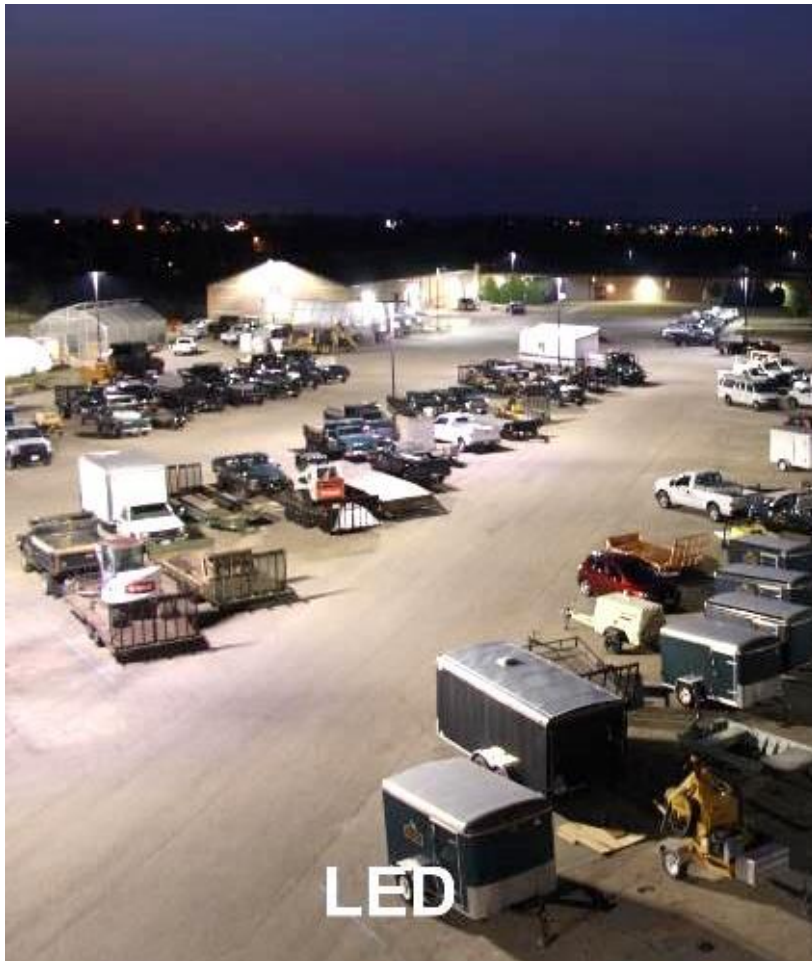
After

Lighting Comparisons

HPS/Metal Halide vs LED

LED lighting:

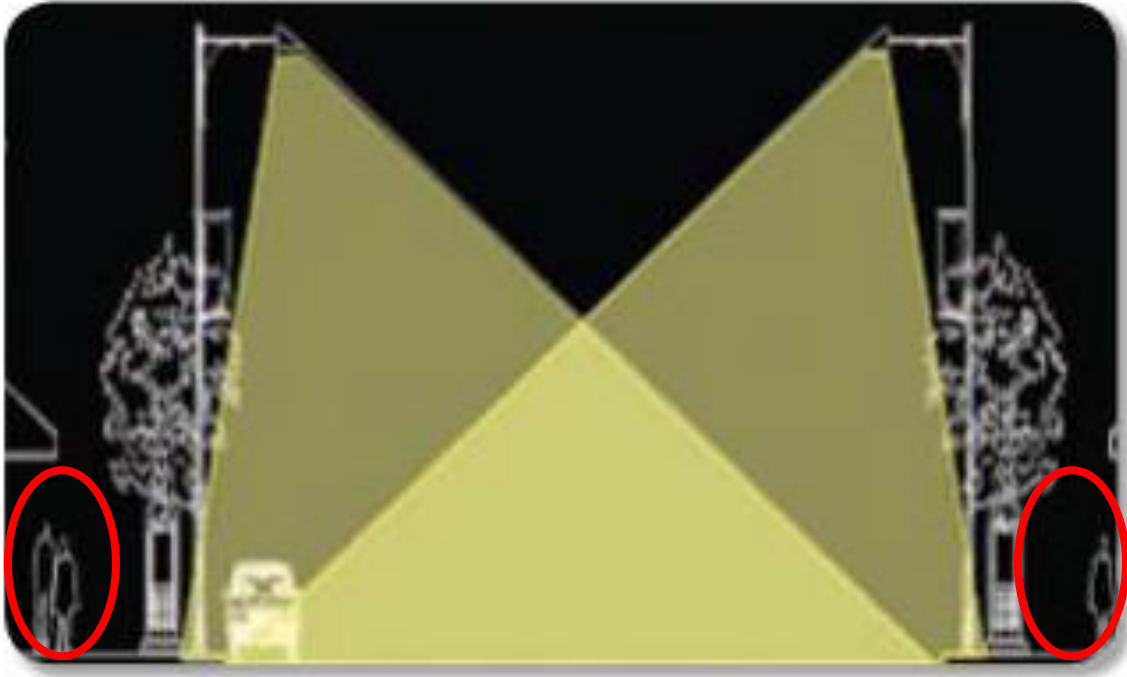
- reduces energy costs up to 70%
- reduces shadows
- offers true color rendition
- provides uniform lighting
- reduces glare



Lighting Comparisons

Range of uniformity and overlap

Pedestrian area is not illuminated.



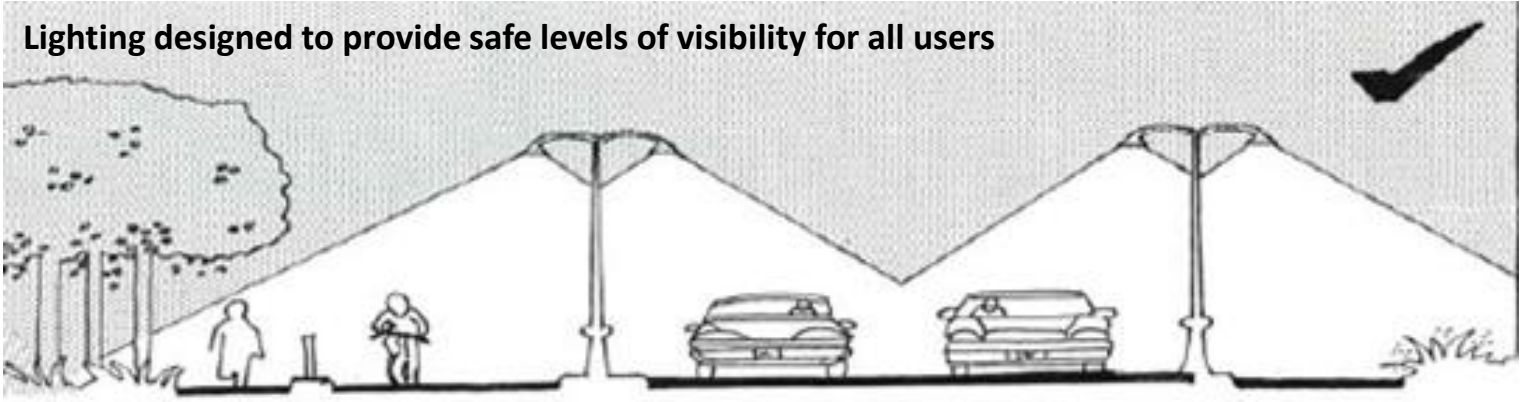
Pedestrian area, parking area, and roadway are clearly illuminated.



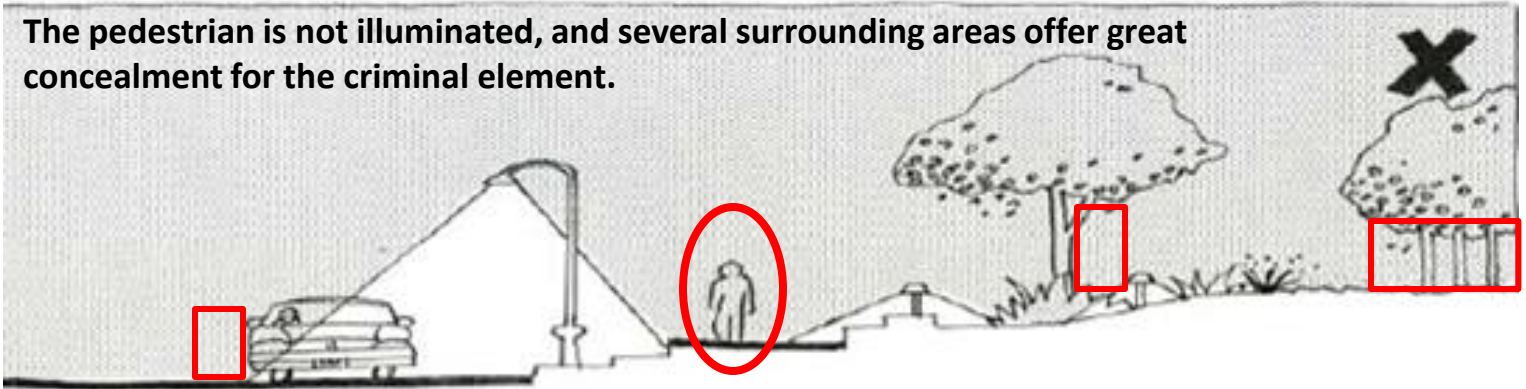
Lighting Comparisons

Range of uniformity and overlap

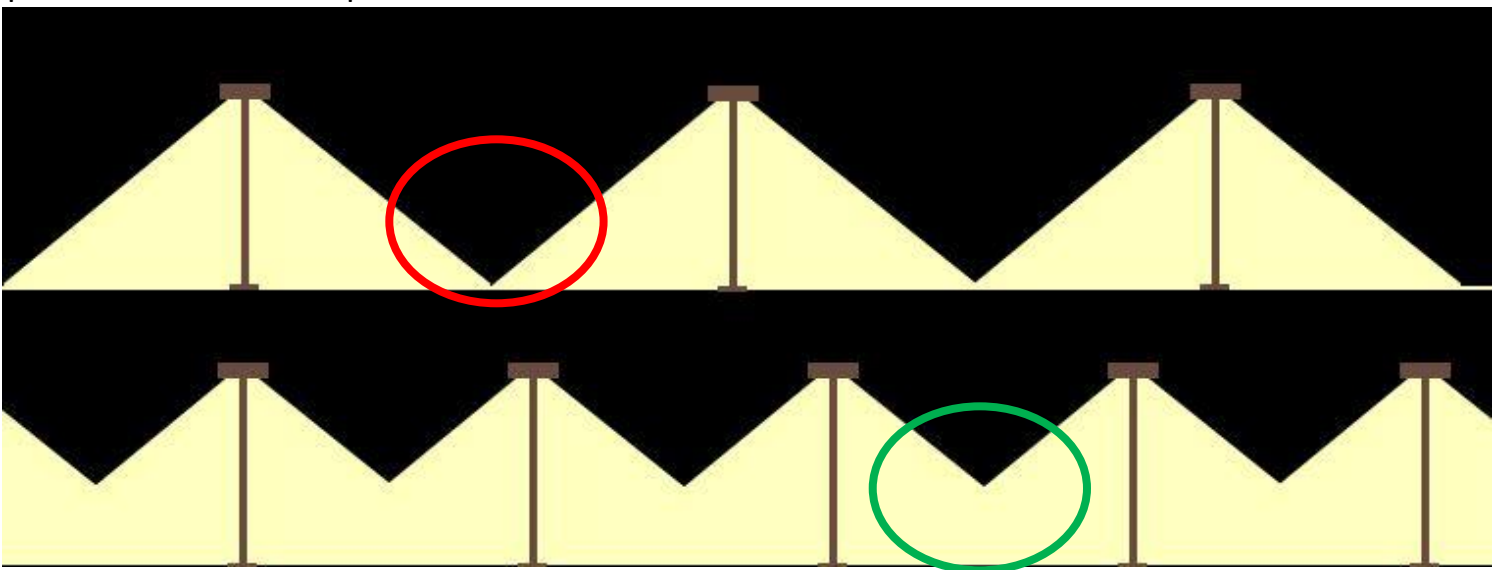
Lighting designed to provide safe levels of visibility for all users



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.

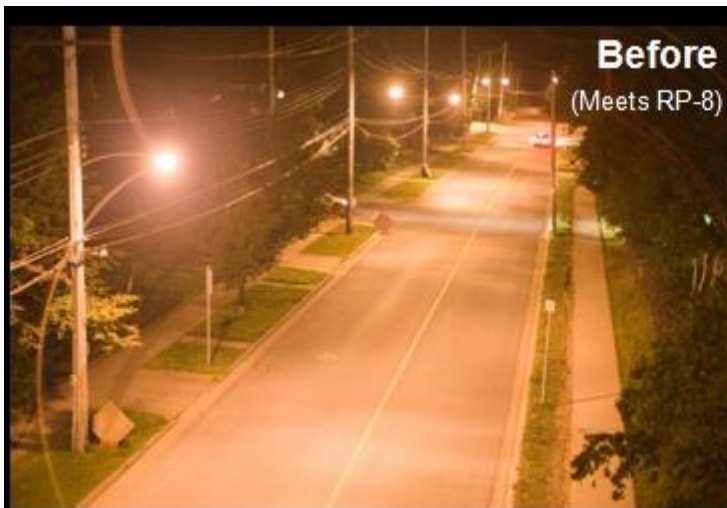


Lighting Comparisons

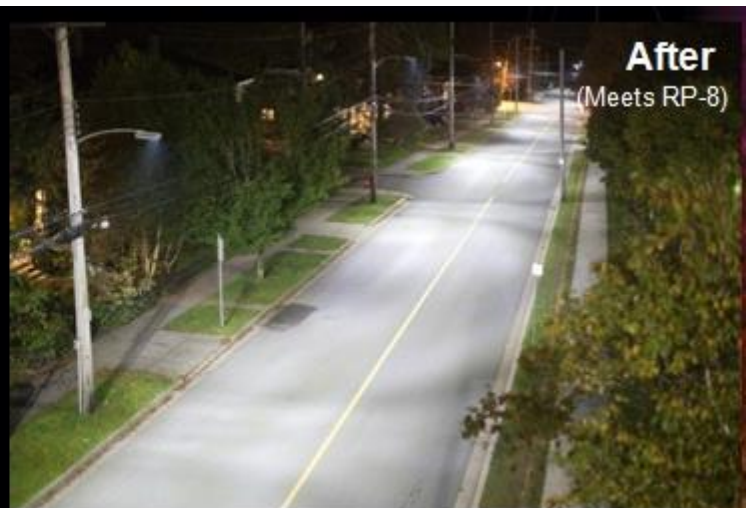
HPS/Metal Halide vs LED



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) | | |
| All 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 - MEDIUM HIGH Risk Activity Areas | |
|--|-----------------|
| Greenbelt | Retention areas |

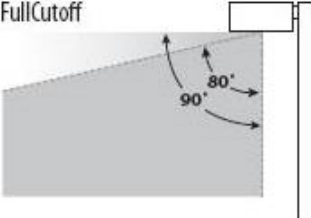
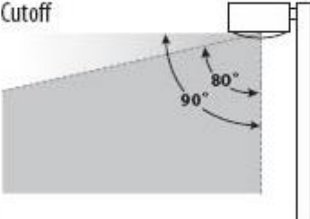
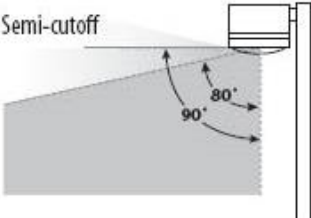
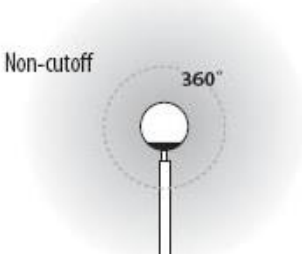


| .5 to 1 FC - Decorative Areas | |
|-------------------------------|--|
|-------------------------------|--|

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.

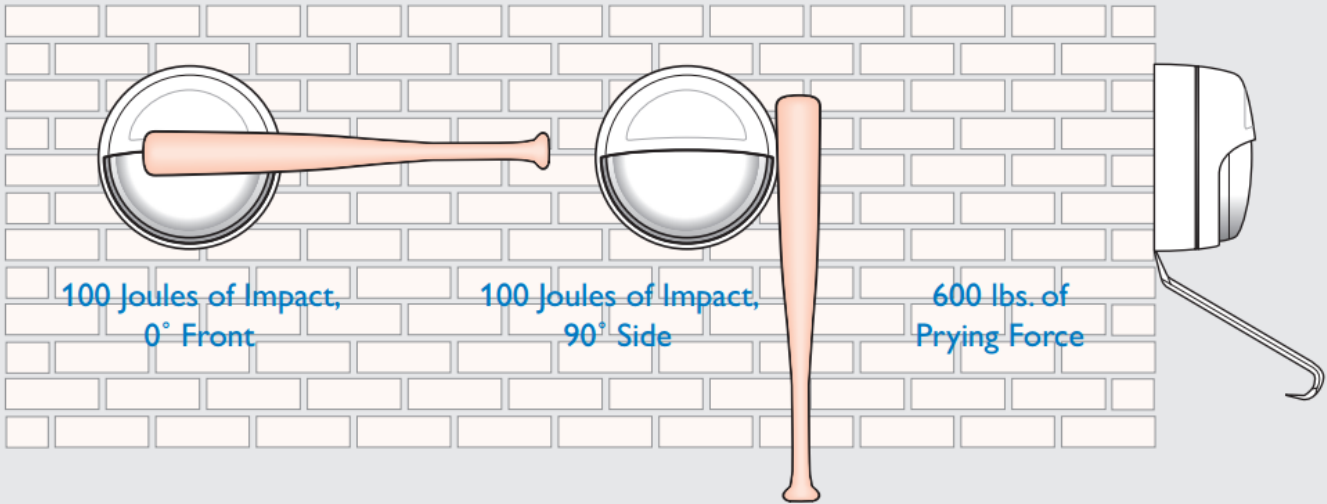
Table 4: Lighting Fixtures

| Fixture | Definition | Benefits | Limitations |
|---|--|---|--|
| FullCutoff  | <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"> - Limits spill light onto adjacent property. - Reduces glare. - No light is emitted directly from the luminaire into the sky. | <p>May reduce pole spacing to maintain uniformity; increasing pole and luminaire quantities for proper lighting.</p> |
| Cutoff  | <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"> - May allow some up-light from fixture causing trespass. - Typically a small overall impact on sky glow. |
| Semi-cutoff  | <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"> - Little control of light at property line. - Potential for increased glare when using high wattage luminaires. - Typically directs more light into the sky than cutoff. |
| Non-cutoff  | <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"> - Location and aiming are critical. - Most likely of all categories to produce offensive brightness and sky glow. - Easily shaken and broken |
| Vandal Resistant  | <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"> - Increased safety - Durable - Reduced maintenance - Reduced costs - Aesthetically pleasing | <ul style="list-style-type: none"> - Initial cost - Application options regarding lamp posts |
| Bollard  | <p>Provides elements of safety for larger outdoor spaces.</p> | <ul style="list-style-type: none"> - Defines space and boundaries - Physical barrier - Illuminate pedestrian areas - Greater light than standard decorative lighting for pedestrians | <ul style="list-style-type: none"> - Initial costs - Reduced amount of illumination |

Lighting Fixtures

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

Vandal / Tamper resistant fixtures



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.

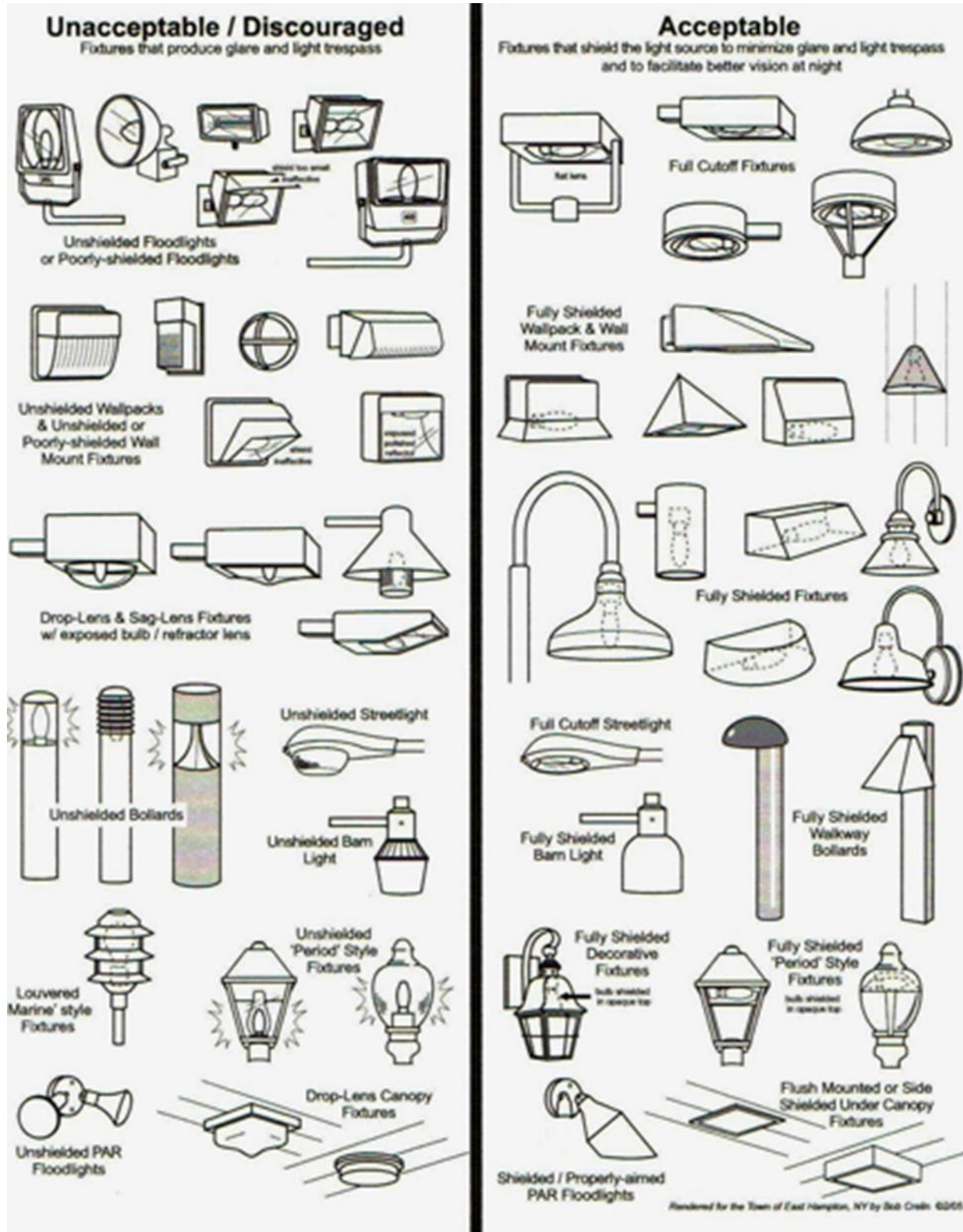


Install lighting fixtures with tamper resistant screws.

Table 5: Directional Lighting Fixtures

Directional style lighting

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



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