

*BUILDING DESIGN FOR HOMELAND SECURITY*

# Unit IX-B

## Site and Layout Design Guidance



**FEMA**

# Unit Objectives

**Identify** site planning concerns that can create, reduce, or eliminate vulnerabilities and understand the concept of “Layers of Defense.”

**Recognize** protective issues for urban site planning.

**Compare** the pros and cons of barrier mitigation measures that increase stand-off or promote the need for hardening of buildings at risks.



**FEMA**

# Unit Objectives

**Understand** the following critical issues:

- Need for keeping up with the growing demand for security design
- Benefits that can be derived from appropriate security design

## References

FEMA Building Vulnerability Assessment Checklist, Chapter 1, page 1-46, FEMA 426

Site and Layout Design Guidance, Chapter 2, FEMA 426

FEMA 430, Primer for Incorporating Building Security Components in Architectural Design



**FEMA**

# Unit Objectives

**Understand** the following critical issues (continued):

- Benefits of adopting a creative process to face current design challenges
- Benefits of including aesthetic elements compatible with security and architectural characteristics of building and surrounding environment

## References

FEMA Building Vulnerability Assessment Checklist, Chapter 1, page 1-46, FEMA 426

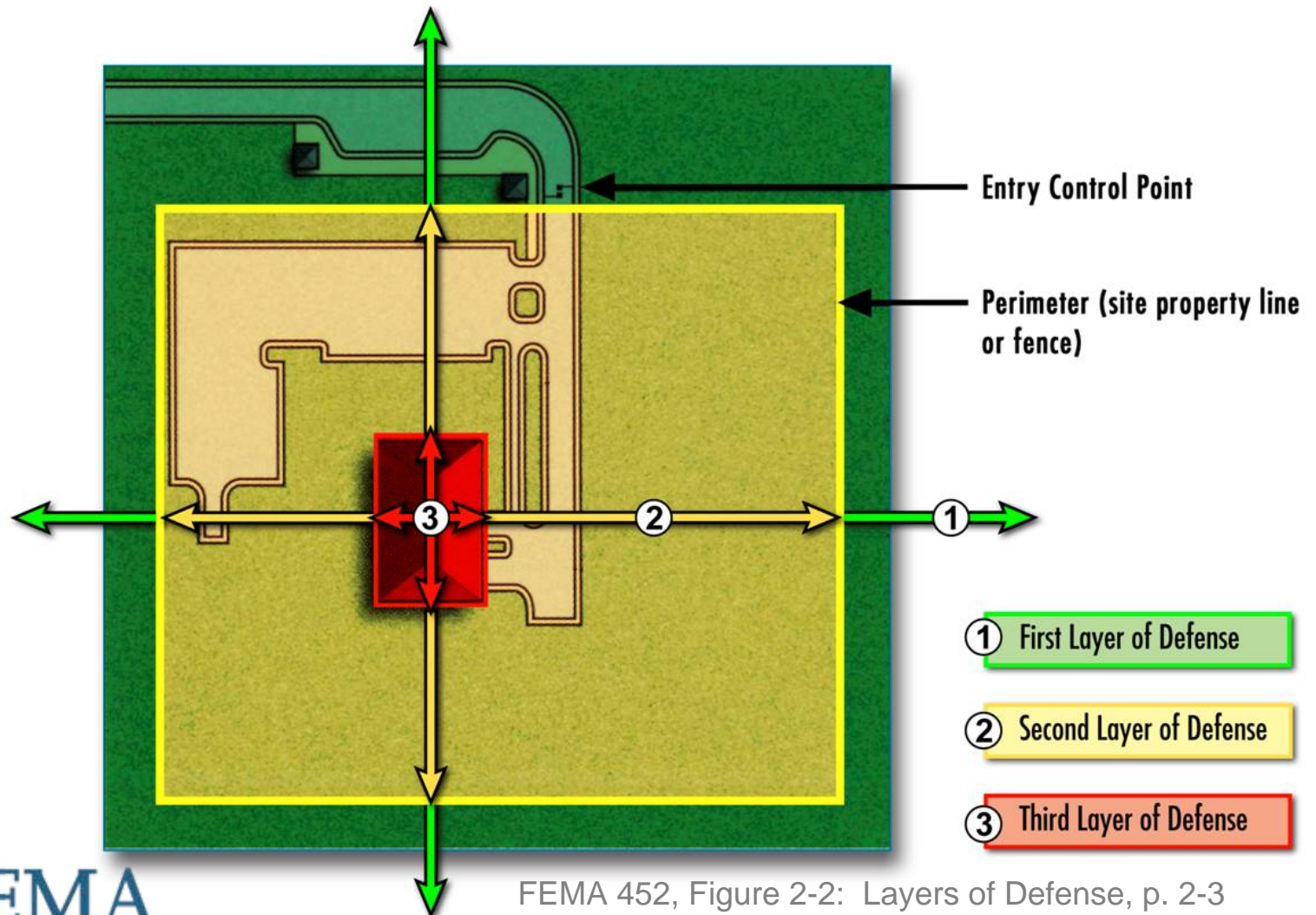
Site and Layout Design Guidance, Chapter 2, FEMA 426

FEMA 430, Primer for Incorporating Building Security Components in Architectural Design



**FEMA**

# Layers of Defense



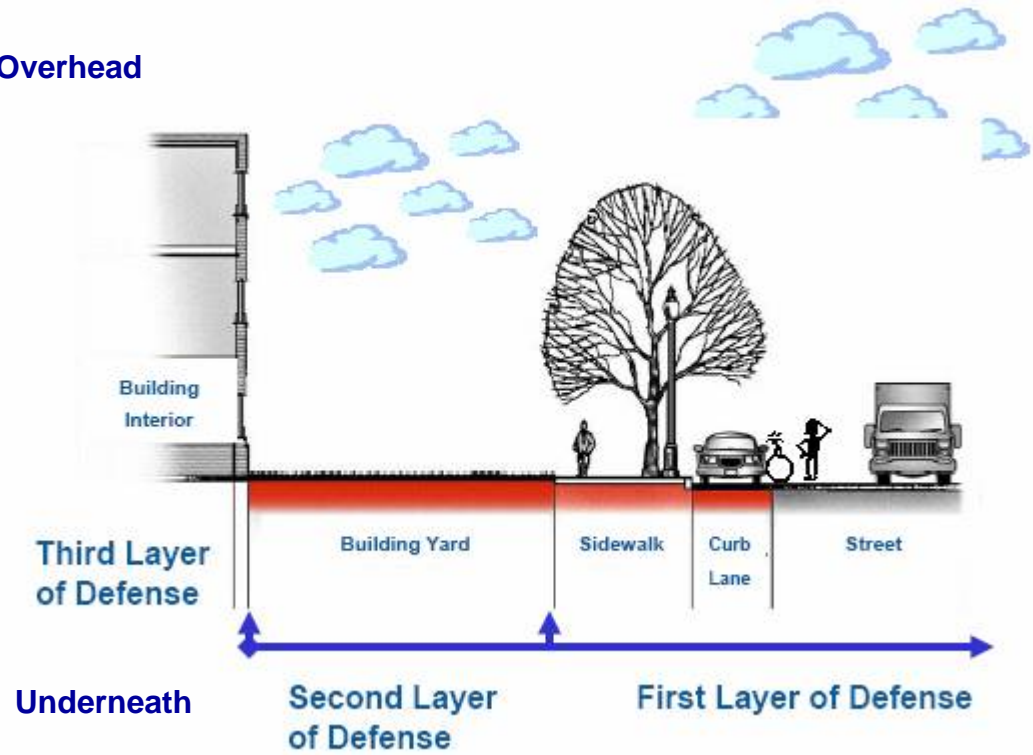
FEMA 452, Figure 2-2: Layers of Defense, p. 2-3



# Layers of Defense



Overhead



Building yards many not exist in urban areas



FEMA

# Layers of Defense

Layers of Defense	Survey Surroundings	Access Points	Sidewalks and Curbs	Street Furniture	Barriers and Bollards	Yards and Plazas	Gatehouses / Screening	Parking	Signage	Security Lighting	Sensors / CCTV	Site Utilities
First Layer												
Second Layer												
Third Layer												

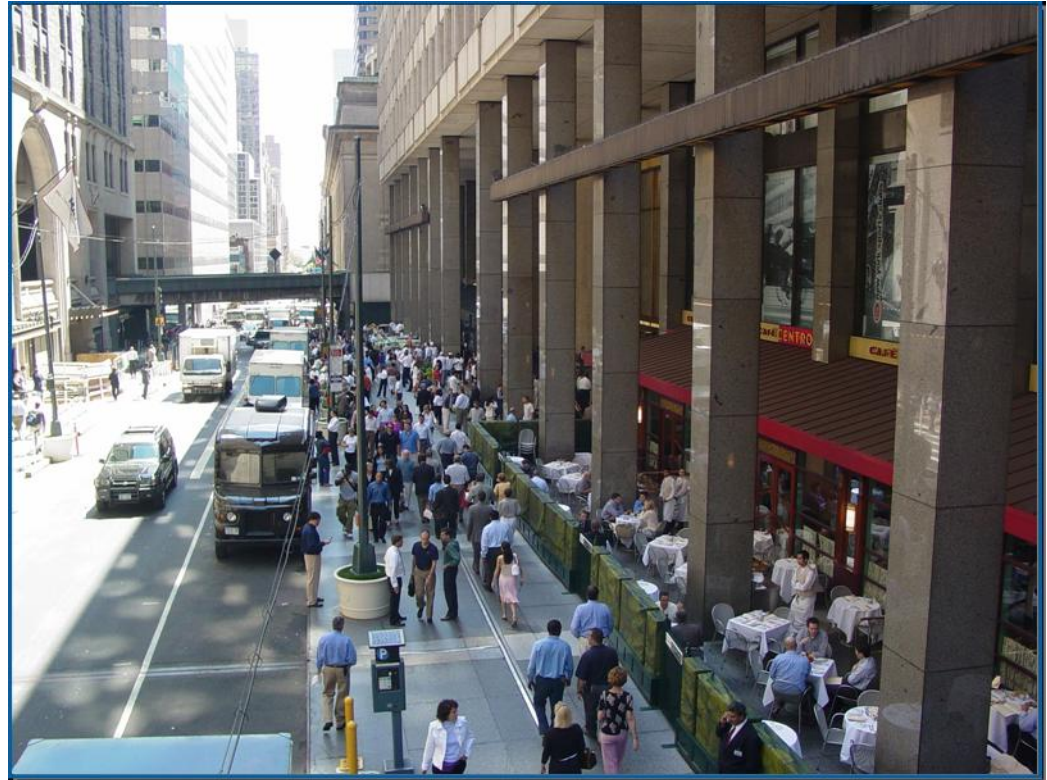


**FEMA**

# First Layer of Defense

## Survey Surroundings / Data Collection:

- 360 degrees - all directions
- Overhead – structures that can collapse and strike building of interest
- Underneath – subways, roadway tunnels, and utilities



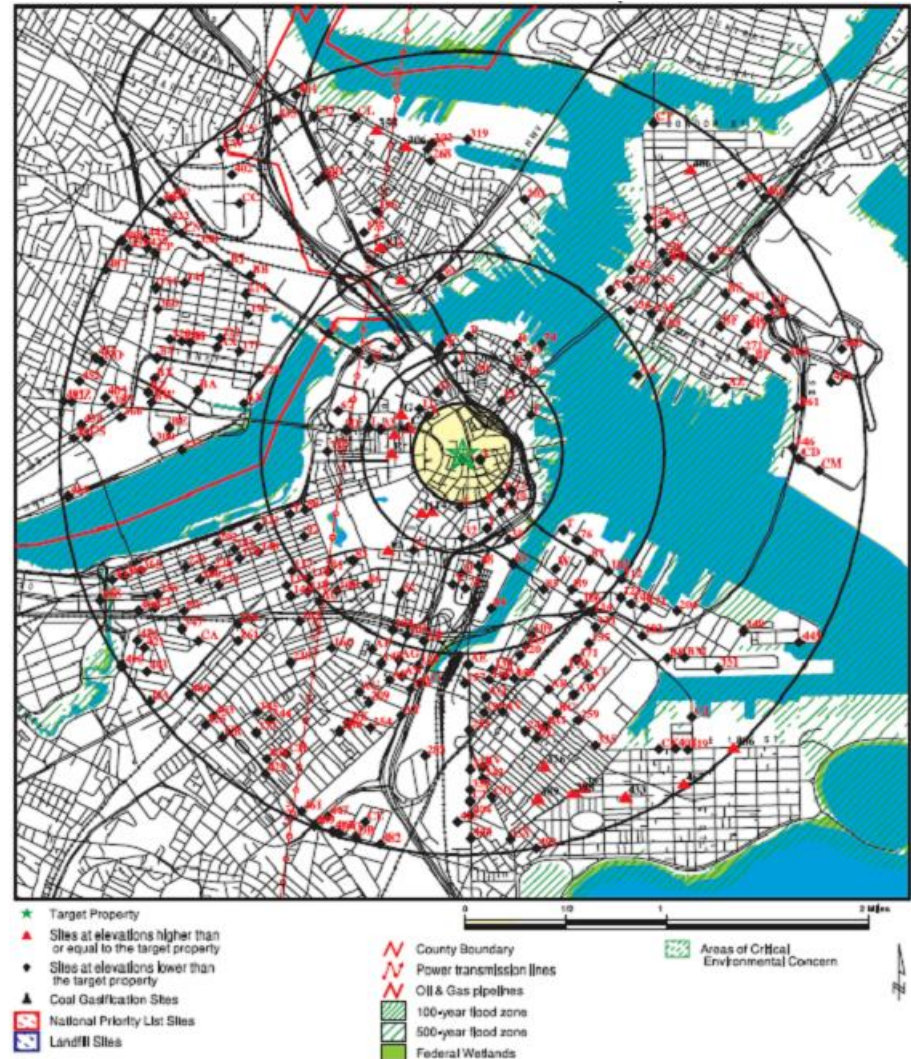
FEMA



# First Layer of Defense

## Data Collection -- use GIS to help determine:

- Approaches to site/building
  - Personnel
  - Vehicles
- Potential collateral damage near facility
- Buildings and infrastructure of concern nearby
- Important geographic and topographic elements



FEMA

# First Layer of Defense

## Access Points

- Ring of steel
- Temporary stand-off
  - Road closure
  - Temporary barriers / parked vehicles
- Work with local authorities



FEMA

# First Layer of Defense

## Access Points

- Interruption of traffic pattern or street closure can impact a wide area
- Interruption or closure only justified when stand-off absolutely required



FEMA

# First Layer of Defense

## Access Points

- Control angle of approach
  - Turns
  - Curves
- Slow down approaching vehicles

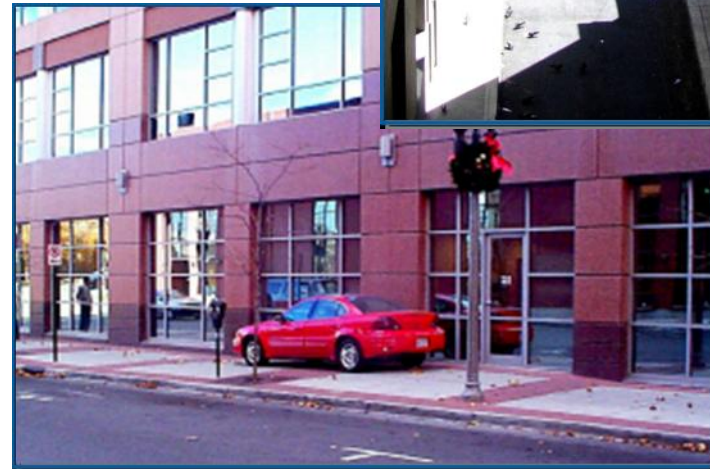


**FEMA**

# First Layer of Defense

## Sidewalks and Curbs

- Most central business district buildings have exterior wall on the property line
- Stand-off distance is generally impossible to achieve; sidewalks provide less than 10 feet
- Low curbs do not keep vehicles away from buildings
- Hardening in lieu of stand-off can be very expensive, especially for existing buildings

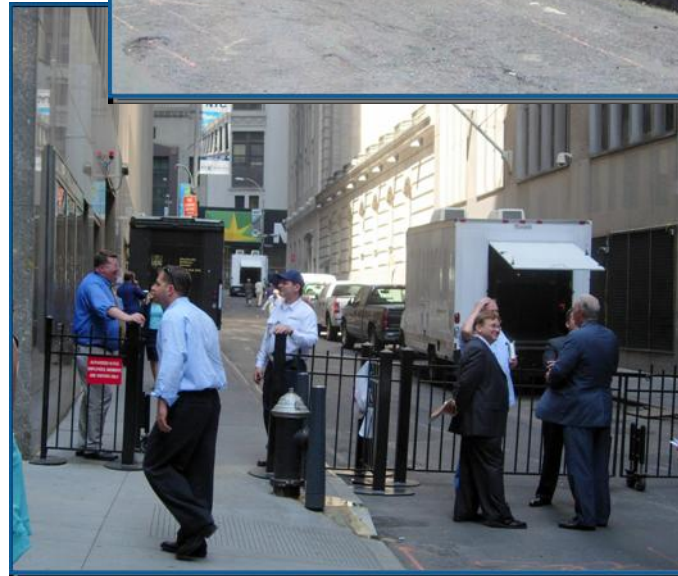


**FEMA**

# First Layer of Defense

## Sidewalks and Curbs

- Interruption of a sidewalk is only justified when stand-off is absolutely required
- Closure can be temporary or permanent

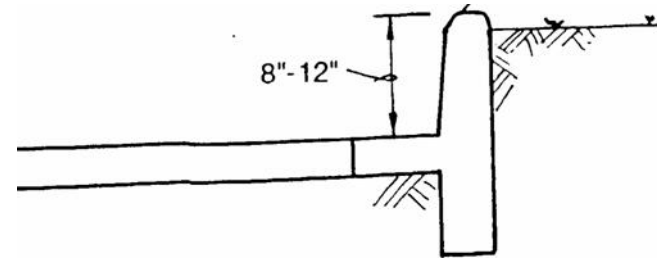


FEMA

# First Layer of Defense

## Sidewalks and Curbs

- High curbs can keep vehicles from departing roadway
- Do not remove curbside parking unless additional stand-off absolutely required

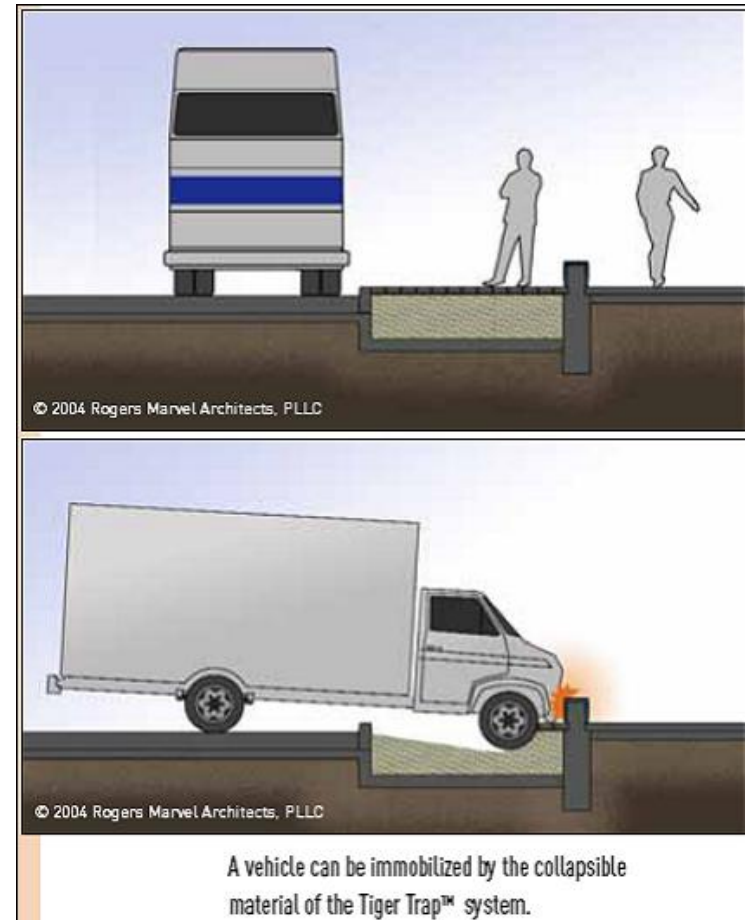


FEMA

# First Layer of Defense

## Sidewalks and Curbs

An alternate to visible barriers or bollards is collapsible sidewalks using low-strength concrete



FEMA

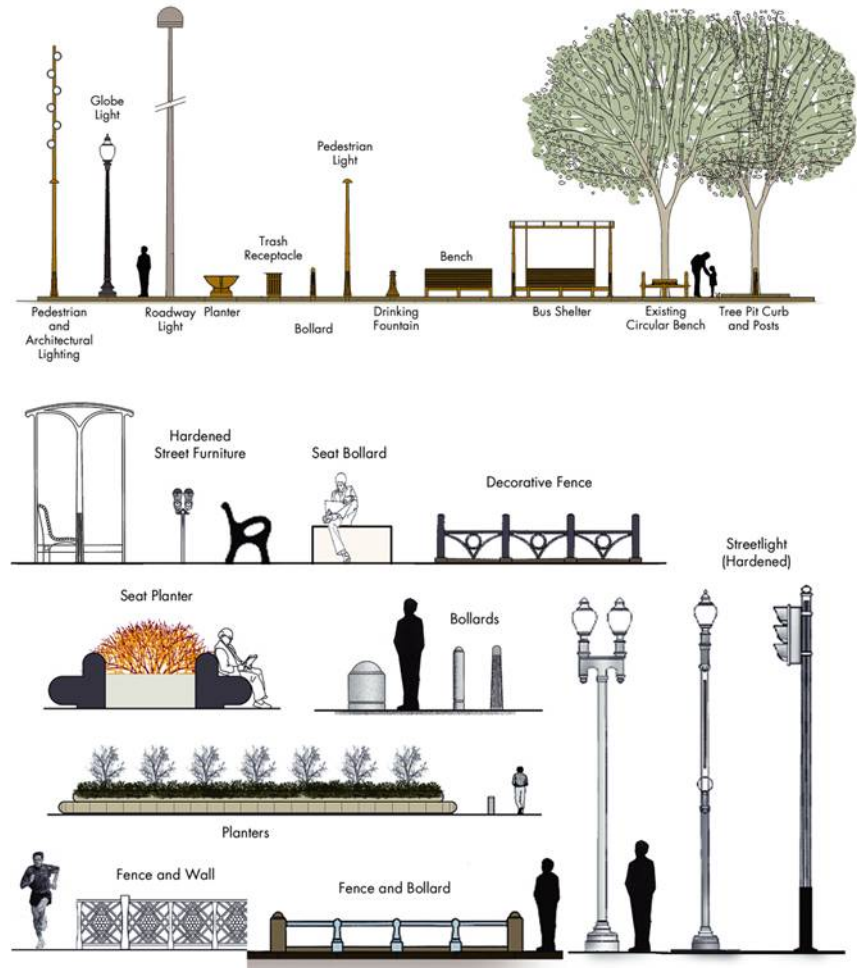


# First Layer of Defense

## Street Furniture

Streetscape can be used to increase security. Hardened elements that become security elements

- Parking meters
- Streetlights
- Benches
- Planters
- Trash receptacles



## NCPC Streetscape Catalogue

BUILDING DESIGN FOR HOMELAND SECURITY Unit IX-B-17



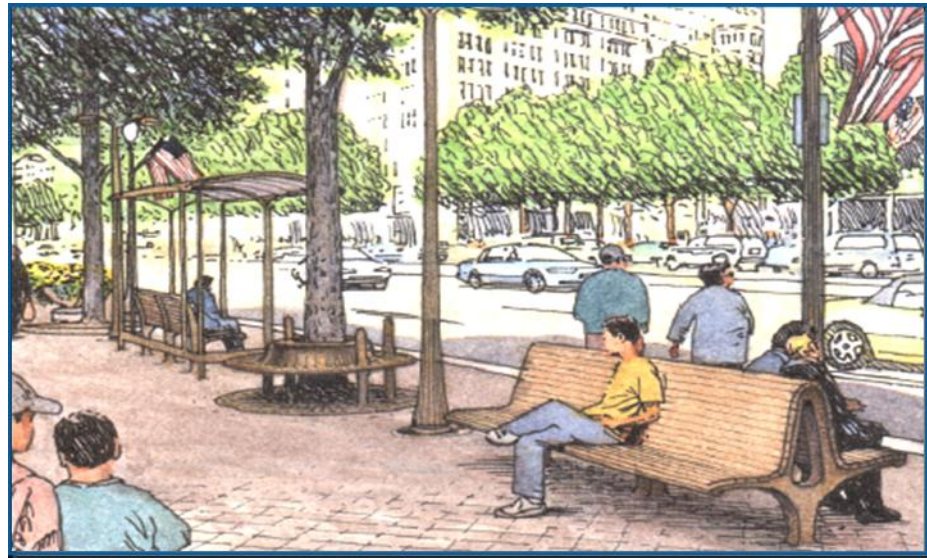
# FEMA

# First Layer of Defense

## Street Furniture

Place streetscape security components at least 24 inches from edge of curb

- Allow for opening car doors
- Allow for pedestrian movement from car to sidewalk



FEMA

# First Layer of Defense

## Street Furniture

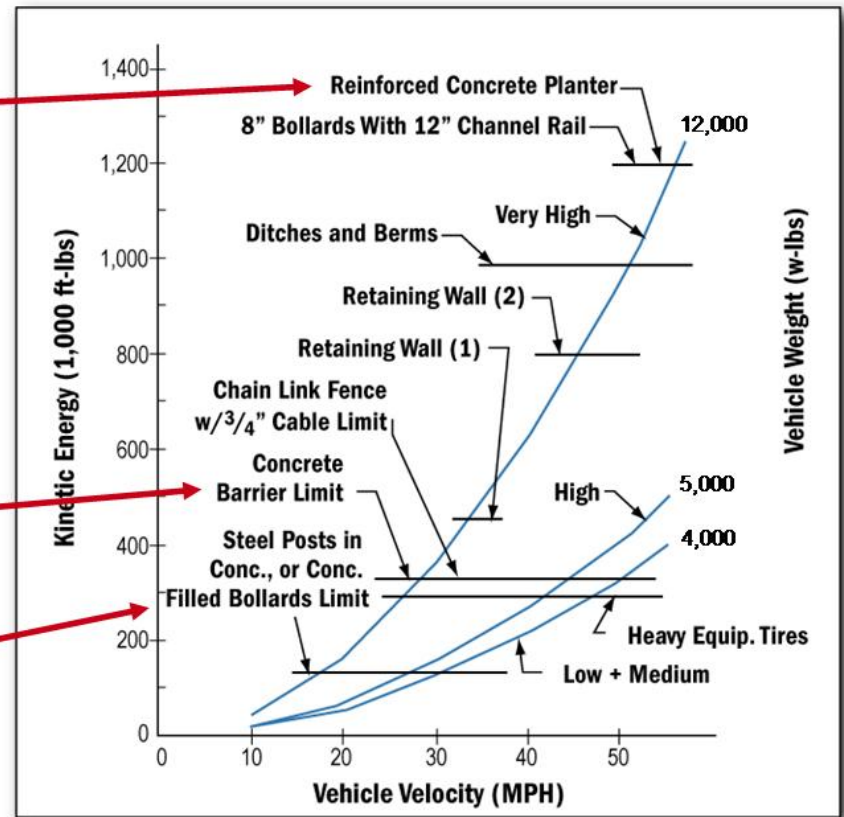
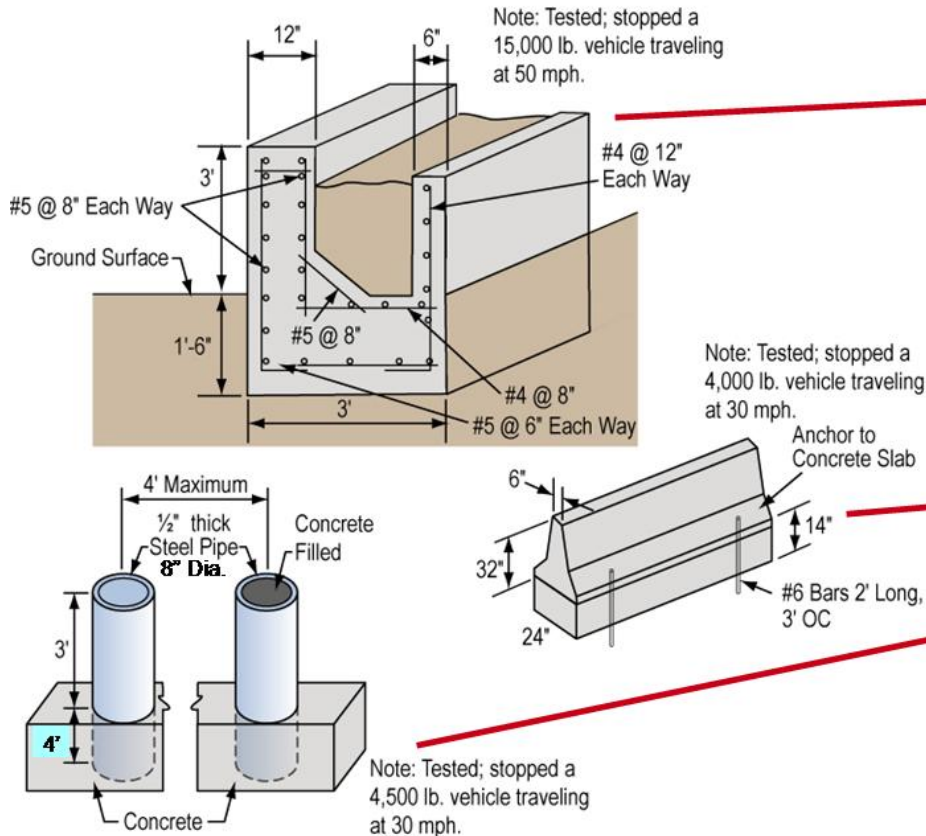
- Treatment of security elements should be compatible with existing elements
- Perimeter barriers can go hand-in-hand with streetscape improvements and plantings
- Appropriate design can blend security into existing streetscape; serving as amenities for tenants and neighbors



**FEMA**

# First Layer of Defense

## Barriers and Bollards - Passive



**FEMA**

From US Army Field Manual 5-114, Engineer Operations Short of War, 1992

BUILDING DESIGN FOR HOMELAND SECURITY Unit IX-B-20

# First Layer of Defense

## Barriers and Bollards - Passive



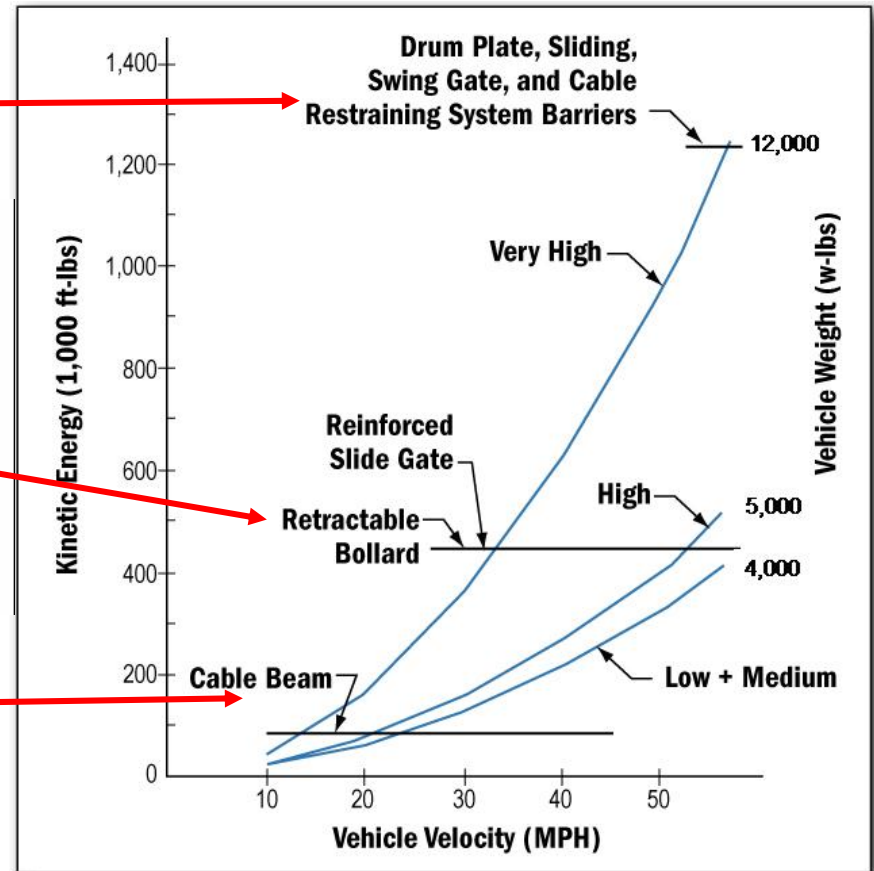
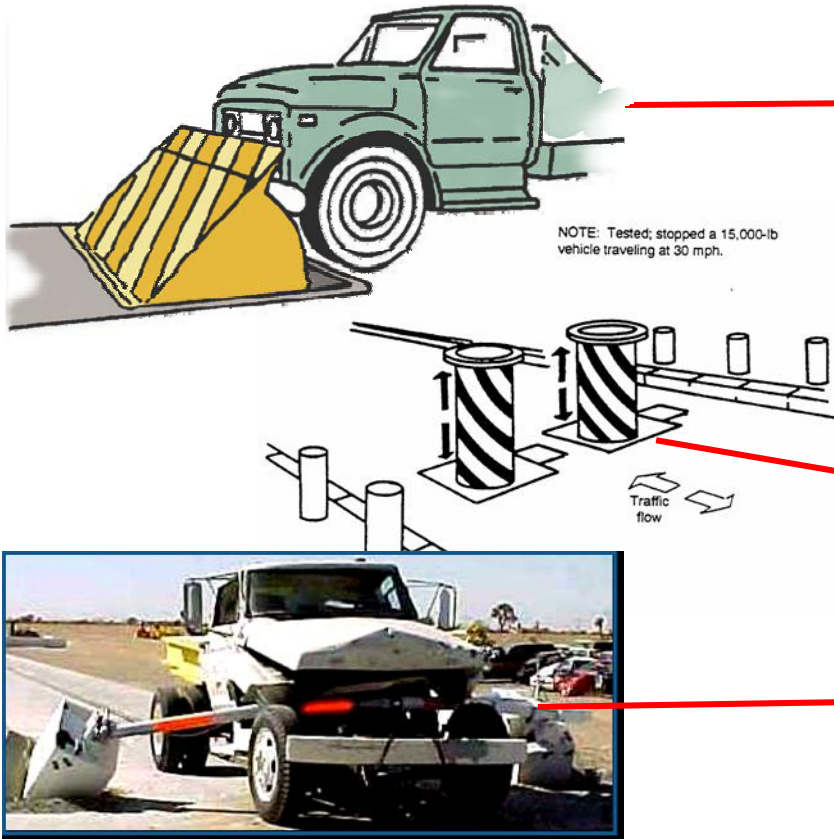
Source: Yodock Wall Company



**FEMA**

# First Layer of Defense

## Barriers and Bollards - Active



Source: Delta Scientific Corporation



**FEMA**

From *US Army Field Manual 5-114, Engineer Operations Short of War, 1992*

BUILDING DESIGN FOR HOMELAND SECURITY Unit IX-B-22

# First Layer of Defense

## Barriers and Bollards - Active



FEMA

# First Layer of Defense



Rotating Drum, Drop Arm, and Rotating Plate Vehicle Barriers  
**FEMA**



# First Layer of Defense

## Barriers and Bollards

**Department of State periodically issues list of manufacturers and model numbers certified in meeting prescribed testing criteria (March 2003)**

Rating	Vehicle Weight (lbs.)	Vehicle Speed (mph)	Distance Past Barrier (ft)
K4	15,000	30	$\leq 3.3$
K8	15,000	40	$\leq 3.3$
K12	15,000	50	$\leq 3.3$

**Check site utilities, water runoff, and other subterranean Conditions when installing bollards and barriers**



**FEMA**

# First Layer of Defense

## Barriers and Bollards

Department of Defense periodically issues list of manufacturers and model numbers certified in meeting prescribed testing criteria (August 2003)

Vehicle Weight (lbs.)	Vehicle Speed (mph)	Distance Past Barrier (ft)
15,000	30	$\leq 3(L3)/20(L2)/50(L1)$
15,000	40	$\leq 3(L3)/20(L2)/50(L1)$
15,000	50	$\leq 3(L3)/20(L2)/50(L1)$
10,000	50	0 to 50
10,000	15	50 to 100



FEMA

# First Layer of Defense

## Barriers and Bollards

- Fixed bollards
- Retractable bollards
- Planters



Fixed bollards

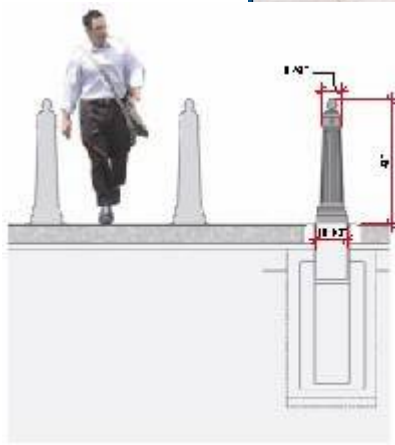
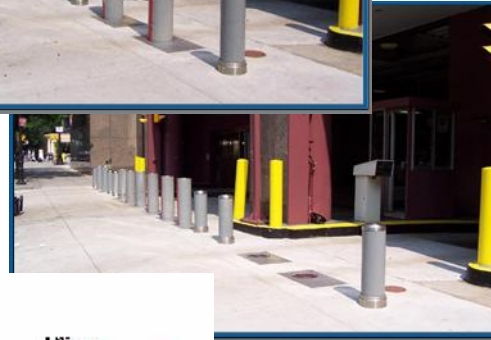


**FEMA**

# First Layer of Defense

## Barriers and Bollards

Retractable



FEMA

# First/Second Layer of Defense

## Barriers and Bollards



### Planters

- If well designed, planters can be an element of beautification
- Ensure barriers are properly anchored to stop vehicles and configured to reduce fragmentation



**FEMA**

# First Layer of Defense

## Barriers and Bollards

Avoid designing barriers that impair access by first responders:

- Intersection with driveways and gates
- Crossing of pedestrian paths and handicapped ramps
- Fire hydrants



**FEMA**

# First Layer of Defense

## Barriers and Bollards



Ensure barriers are properly anchored to stop vehicles



**FEMA**

# First Layer of Defense

## Barriers and Bollards



Properly anchored barriers stop vehicles and reduce fragmentation during blast



**FEMA**



# First Layer of Defense

## Barriers and Bollards

Long expanses of bollards should be carefully designed and sited to avoid monotony



Bollard spacing should ensure no vehicles can get through



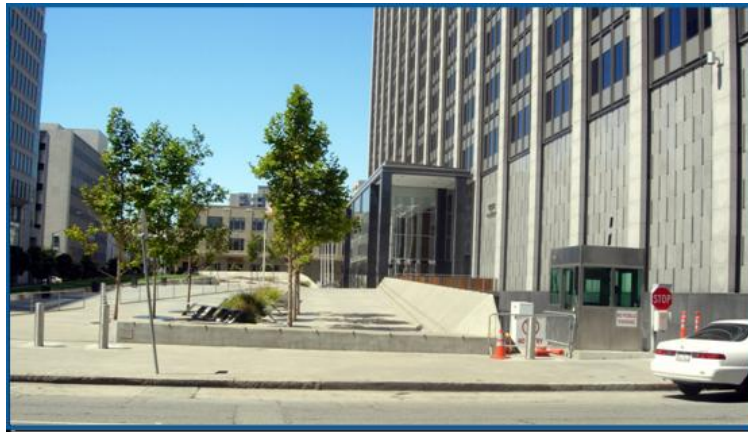
**FEMA**

# Second Layer of Defense

- Buildings with front yards
- Buildings with plazas



YARD



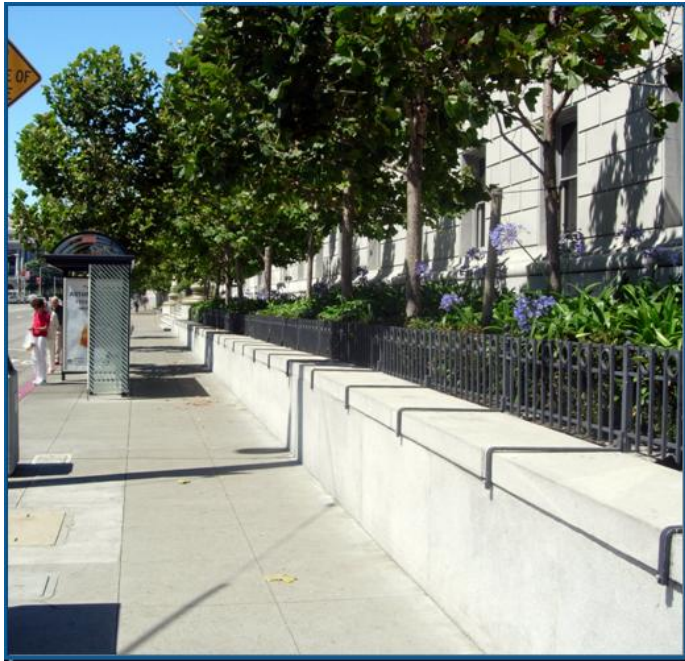
PLAZA



**FEMA**

# Second Layer of Defense

## Building Yard



Narrow yard incorporating low stone wall and metal fence

- **Generally small**
- **Usually provided for governmental & institutional buildings**



Small yard with wide pavement that provide some useful stand-off



**FEMA**

# Second Layer of Defense

## Building Yard



Low planting makes a moderate barrier



High stepped yard on sloping site make a strong barrier



**FEMA**

# Second Layer of Defense

## Building Yard



Monumental yards make excellent barriers and elements of beautification



**FEMA**

# Second Layer of Defense

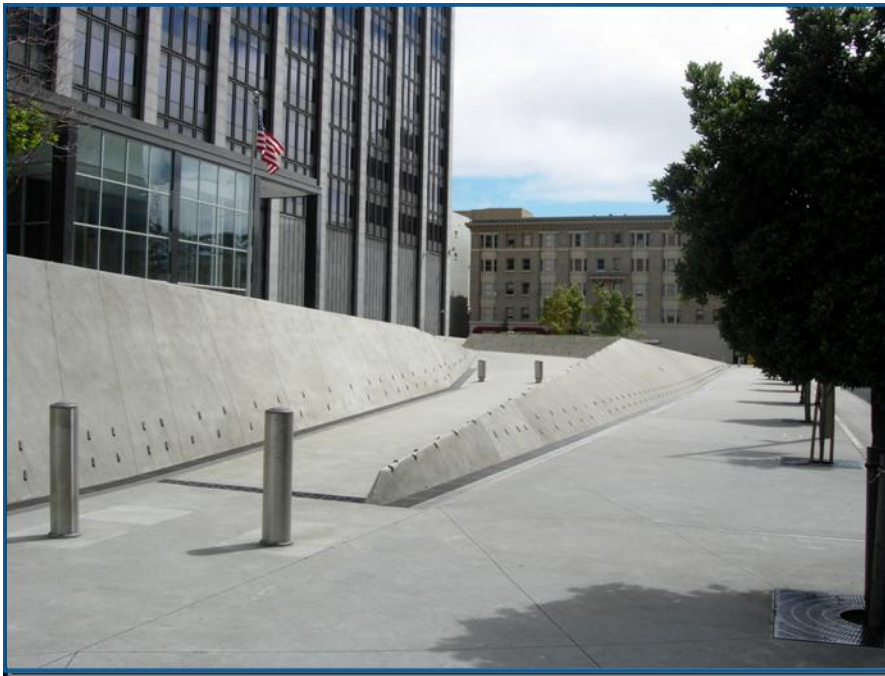
## Plaza

- An expanded building yard
- Moved out from the controlled building access
- A developer provided public space
- A well designed plaza can provide visual interest at same time providing good stand-off



**FEMA**

# Second Layer of Defense Plaza



Plaza with sculptured barrier forms



**FEMA**

# Second Layer of Defense

## Gatehouses

- Access control with human intervention
  - Hardened as determined by threat
  - Protection from elements



FEMA

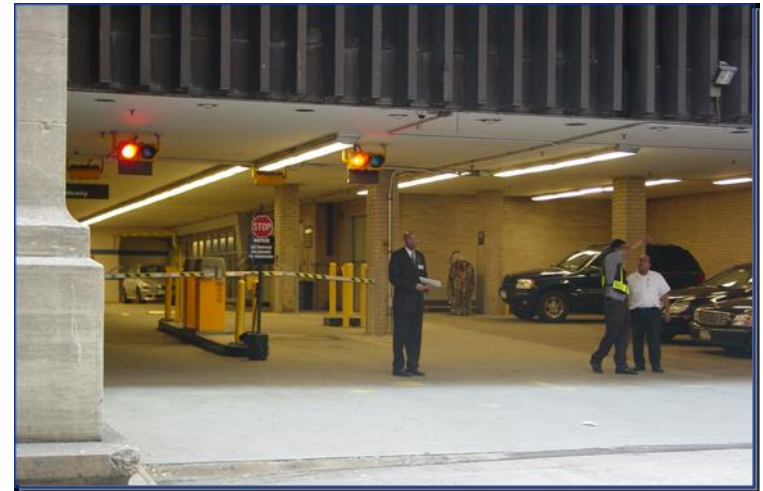


# All Layers of Defense

## Parking



- Parking can be applicable to all layers of defense



FEMA

# All Layers of Defense

## Parking – Delivery / Loading Dock

- Develop plan for delivery and queuing
  - Coordinate with civic authorities as necessary
- Place barriers, guardhouse, if possible
- Avoid parking too close to building even after screening



FEMA

# All Layers of Defense

## Parking

- Restrict parking and access between buildings
- Consider one-way circulation in parking lots
- Well-lit, with security presence, emergency communications, and/or CCTV
- Open, observable, no hiding places
- Restrict parking underneath buildings
- Apply progressive collapse hardening to columns when parking garage is in building



**FEMA**

# All Layers of Defense

## Signage

- Unless required, do not identify sensitive areas
- Minimize signs identifying critical utilities
- Warnings signs limiting access to control areas should be posted at all entrances
- Signpost may be hardened and included as part of the perimeter barrier
- The lighting of signage should enhance nighttime safety
- Warning signs should be posted in languages commonly spoken



**FEMA**

# Second Layer of Defense

## Security Lighting

### Continuous lighting

- Glare projection
- Controlled lighting (avoid glare)
- Compatible with closed circuit television (CCTV)

### Emergency lighting



**FEMA**

# First Layer of Defense

## Sensors / CCTV

- When stand-off and hardening are not possible, security must rely upon sensors and CCTV
- Look for suspicious vehicles and people, especially those that seem to be profiling your building
- Monitor access to utilities serving the building
- Currently high tech monitoring systems need to be selected and placed by experts



**FEMA**

# Second Layer of Defense

## Site Utilities

- Concealed versus exposed
- Underground versus overhead
- Protect/secure versus accessible
- Surveillance if possible



FEMA

# Campus/University

The following considerations can impact the site and layout design:

- Overall size and number of structures placed on site
- Massing and placement of structures
- Access/egress points, such as visitor entries, staff entries, and loading docks



**FEMA**



# Campus/University



## First Layer of Defense (Uncontrolled)

- Personnel Access Control
- Vehicle Access Control & Inspection
- Vehicle Stand-off

## Second Layer of Defense (Controlled)

- Personnel Access Control
- Vehicle Access Control
- Vehicle Stand-off

## High Security Building Third, Second, and First Layers of Defense (Controlled)

- Personnel Access Control
- Vehicle Access Control
- Hardening

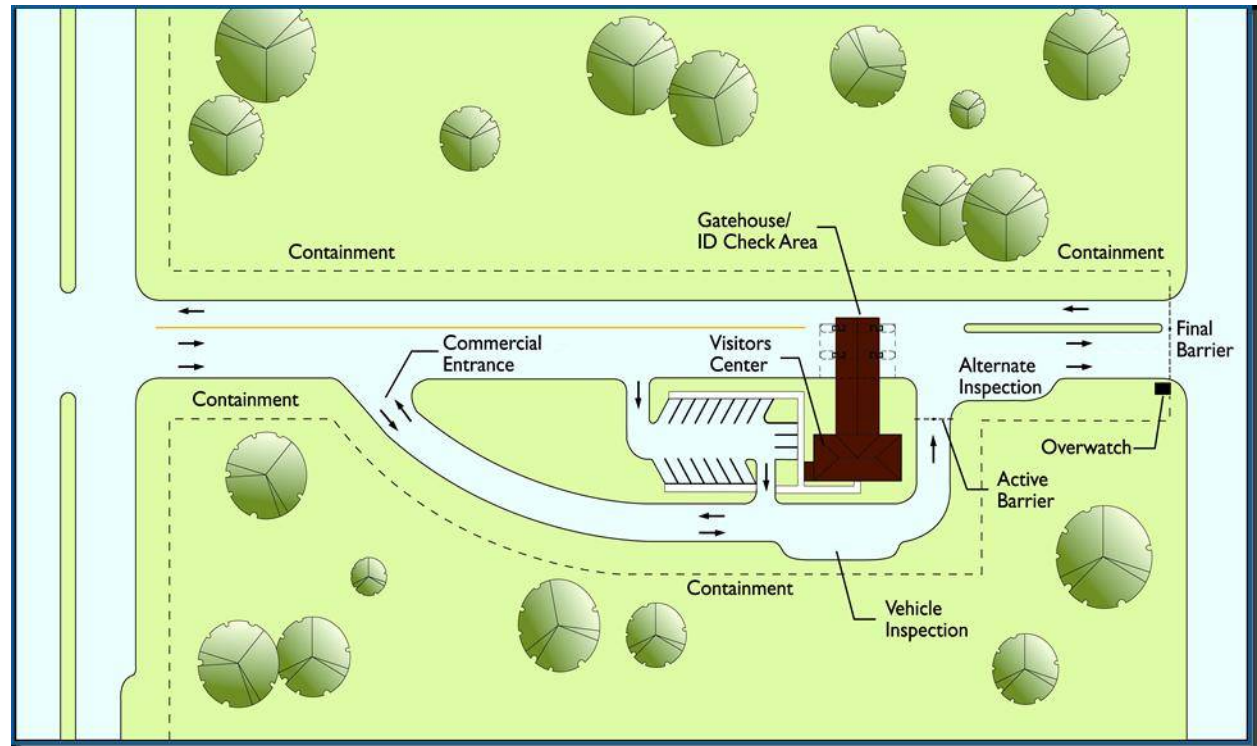


FEMA

# Campus/University

## Access Points

- Reject vehicles before final barrier
- Inspection area blast effects
  - Pressure
  - Fragments
- Reaction time to activate barriers

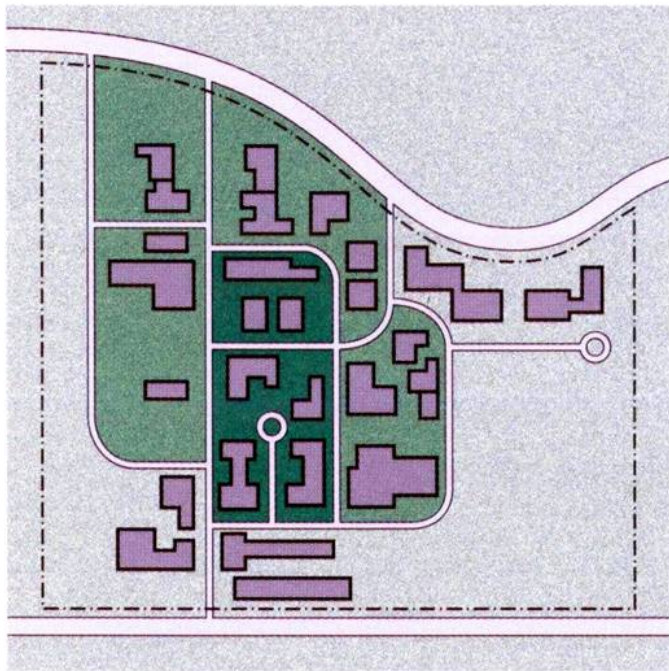


FEMA

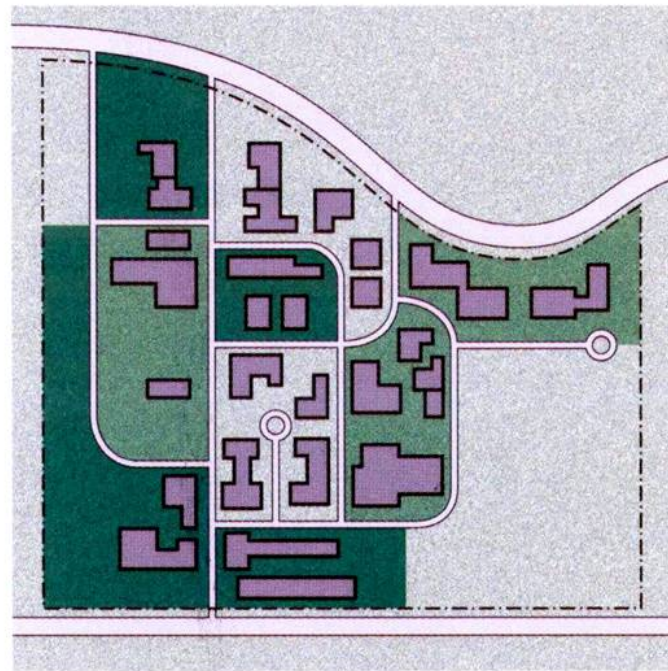
FEMA 426, Figure 2-15: Combined Multi-User Gate, p. 2-37

BUILDING DESIGN FOR HOMELAND SECURITY Unit IX-B-50

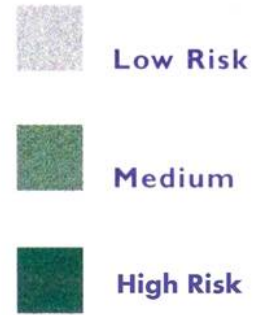
# Campus/University



**Clustered facilities**



**Dispersed facilities**



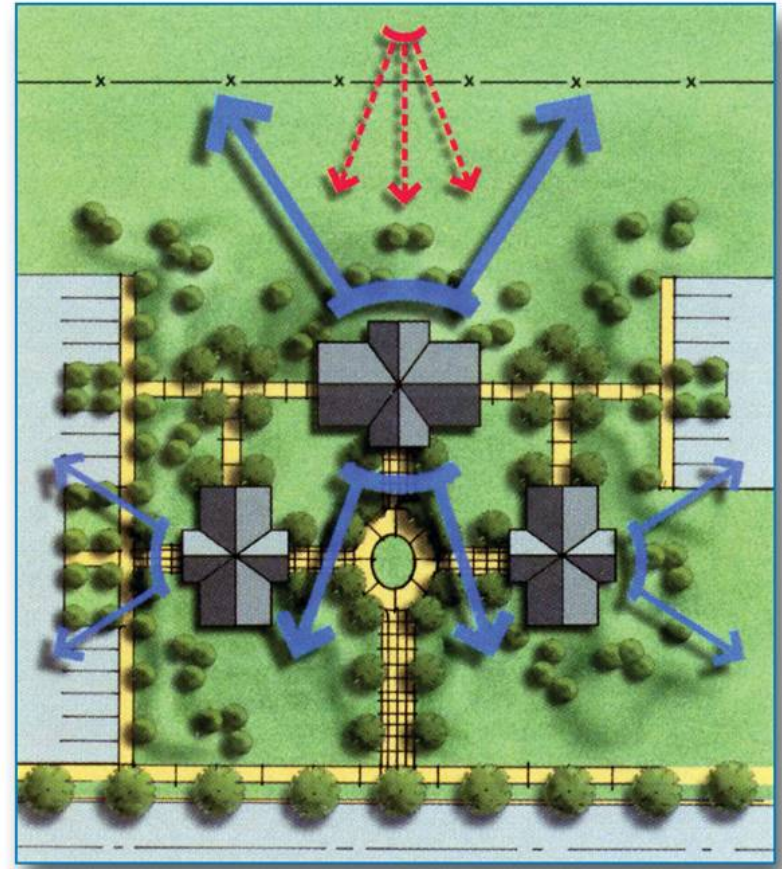
**FEMA**

FEMA 426, Figure 2-2: Clustered versus Dispersed Site Layouts, p. 2-8

*BUILDING DESIGN FOR HOMELAND SECURITY* Unit IX-B-51

# Campus/University Orientation

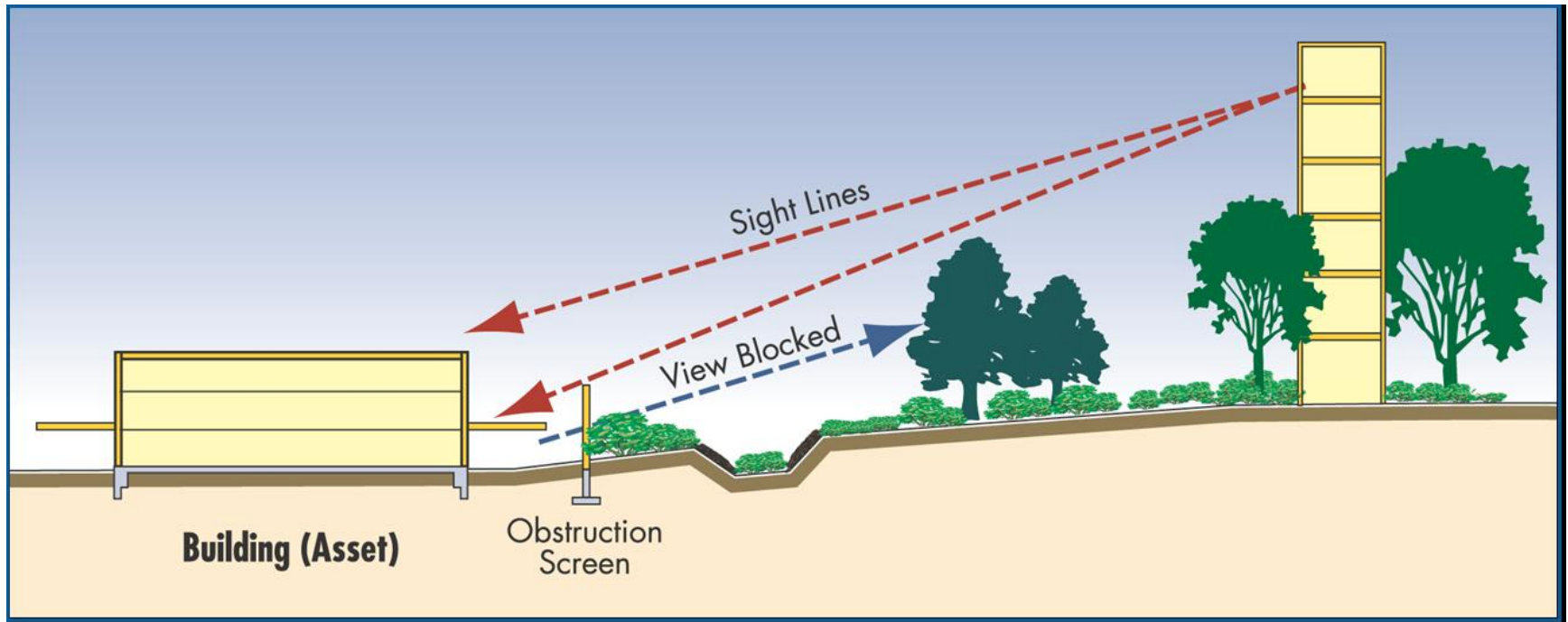
- Significant impact on making building visible or hidden to aggressors
- Enhance surveillance opportunities of approaches and parking
- Minimize views into building
- Reduce blast effects



**FEMA**

FEMA 426, Figure 2-3: Clustering to Enhance Surveillance Opportunities While Minimizing Views into Buildings, p. 2-8  
*BUILDING DESIGN FOR HOMELAND SECURITY* Unit IX-B-52

# Campus/University Siting and View Relationships



Blocking Sight Lines



FEMA

FEMA 426, Figure 2-5: Blocking of Site Lines, p. 2-20

*BUILDING DESIGN FOR HOMELAND SECURITY* Unit IX-B-53

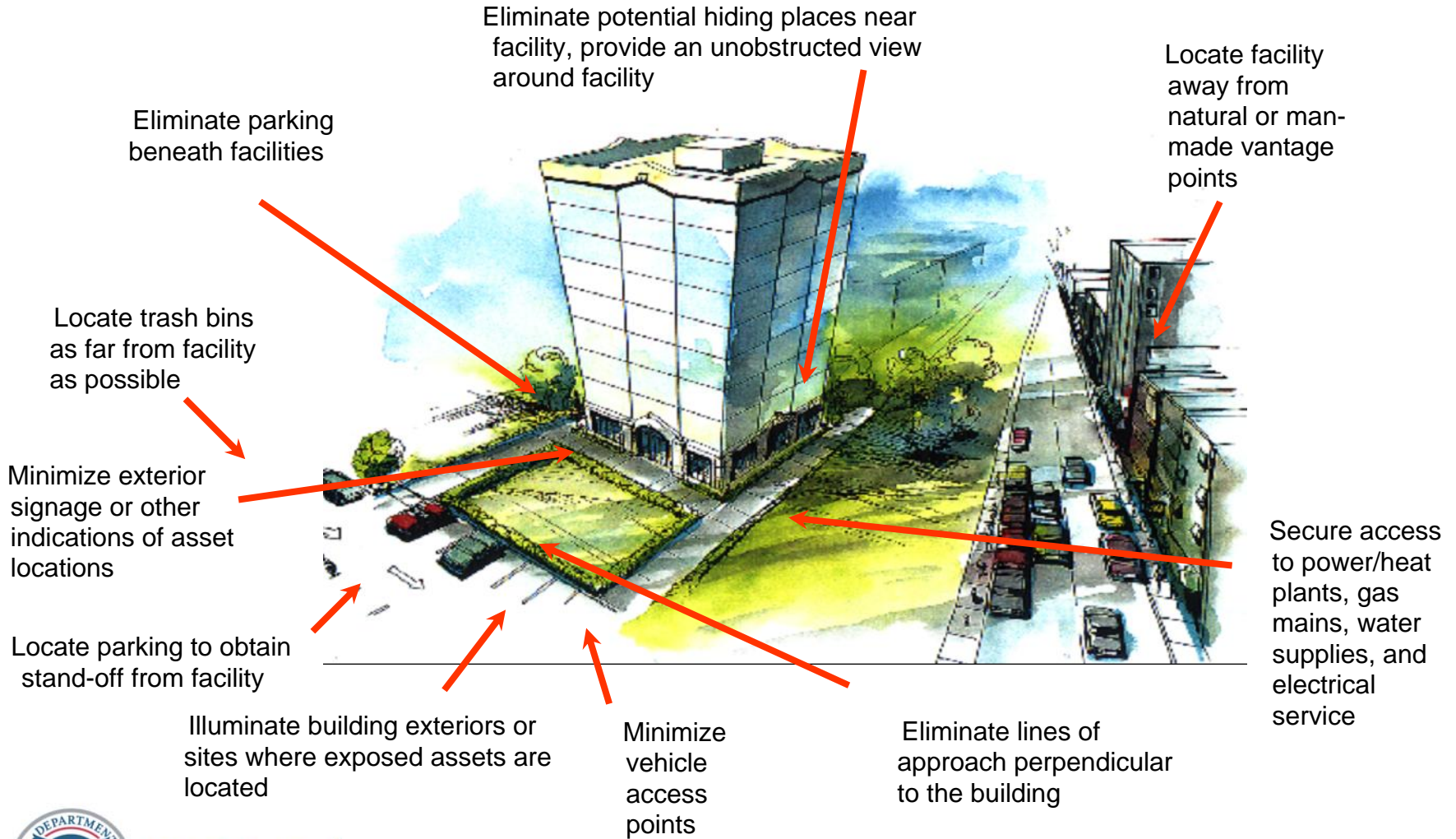
# Campus/University Parking

- Restrict parking from the interior of a group of buildings and away from restricted area
- Locate parking within view of occupied buildings
- If possible, design the parking lot with one-way circulation



**FEMA**

# Best Practices



FEMA

Figure 2-16, Summary of Site Mitigation Measures, p. 2-53

# Unit IX Case Study Activity

## Site and Layout Design Guidance

### Background

FEMA 426, Building Vulnerability Assessment Checklist: screening tool for preliminary design vulnerability assessment

### Requirements: Vulnerability Rating Approach

Assign sections of the checklist to qualified group members

Refer to Case Study and answer worksheet questions

Review results to identify site and layout vulnerabilities and possible mitigation measures



**FEMA**