Unit IX-A

COURSE TITLE	Building Design for Homeland Security	**TIME**	150 minutes

UNIT TITLE Site and Layout Design Guidance

OBJECTIVES

1. Identify site planning concerns that can create, reduce, or eliminate vulnerabilities and understand the concept of "Layers of Defense".
2. Recognize protective issues for suburban site planning.
3. Compare the pros and cons of barrier mitigation measures that increase stand-off or promote the need for hardening of buildings at risks.
4. Understand the need for keeping up with the growing demand for security design.
5. Understand the benefits that can be derived from appropriate security design.
6. Understand the benefits of adopting a creative process to face current design challenges.
7. Understand the benefits of including aesthetic elements compatible with security and architecture characteristics of building and surrounding environment.
8. Apply these concepts to an existing site or building and identify mitigation measures needed to reduce vulnerabilities

SCOPE

The following topics will be covered in this unit:

1. Land use considerations both outside and inside the property line
2. Site planning issues to include site design, layout and form, vehicular and pedestrian circulation, and landscape and urban design
3. Creating stand-off distance using perimeter controls, non-exclusive zones, and exclusive zones along with the design concepts and technology to consider
4. Design considerations and mitigation measures for site security

REFERENCES

1. FEMA 426, *Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings*, Chapter 2; Checklist at end of Chapter 1
2. FEMA 430, *Primer for Incorporating Building Security Components in Architectural Design*
3. FEMA 452, *Risk Assessment: A How-To Guide to Mitigate Potential Terrorist Attacks Against Buildings*, pages 5-1 to 5-16
4. Case Study – Appendix A: Suburban, Hazardville Information
5. Student Manual, Unit IX-A
6. Unit IX-A visuals

REQUIREMENTS

1. FEMA 426, *Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings*
2. FEMA 452, *Risk Assessment: A How-To Guide to Mitigate Potential Terrorist Attacks Against Buildings*
3. Instructor Guide, Unit IX-A
4. Student Manual, Unit IX-A
5. Overhead projector or computer display unit
6. Unit IX-A visuals
7. Threat Matrices poster and dry-erase markers (one per team)
8. Chart paper, easel, and markers

UNIT IX-A OUTLINE

9. Second Layer, Yards and Plazas	7.5 minutes	IG-IX-A-26
10. Second Layer, Roadways	1.5 minutes	IG-IX-A-29
11. Second Layer, Parking	9 minutes	IG-IX-A-29
12. Second Layer, Signage	1.5 minutes	IG-IX-A-33
13. First/Second Layer, Security Lighting	1.5 minutes	IG-IX-A-34
14. First Layer, Sensors/CCTV	1.5 minutes	IG-IX-A-34
15. Second Layer, Site Utilities	4.5 minutes	IG-IX-A-35
16. Best Practices	4.5 minutes	IG-IX-A-38
17. Activity: Site and Layout Design Guidance [45 minutes for students, 15 minutes for instructor review]	60 minutes	IG IX-A-40

PREPARING TO TEACH THIS UNIT

- **Tailoring Content to the Local Area:** Review the Instructor Guides to identify topics that should focus on the local area. Plan how you will use the generic content, and prepare for a locally oriented discussion. The locally oriented discussion should be in conjunction with the version of the case study selected as the student activity used during the course offering.

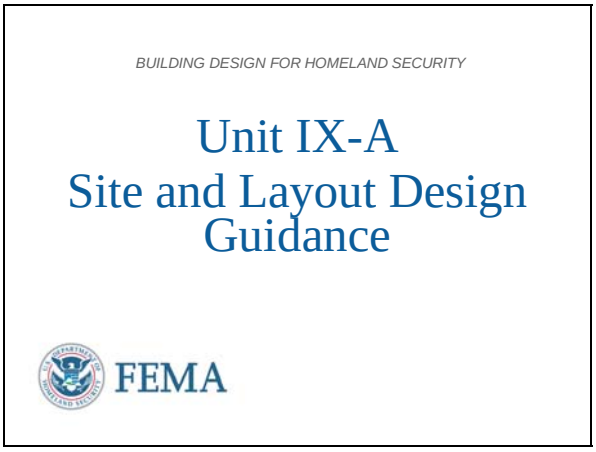
- **Optional Activity:** There are three versions of the student activity available for use during this course -- Suburban, Urban, or Continuity of Operations Planning (COOP).
  Group Roundtable / Plenary / Discussion session can occur after Unit IX with regular student activity for Unit IX being combined with Unit X at end of Unit X. In certain course offerings the experience of well-qualified students can enhance learning through cross pollination of lessons learned, impediments, successes, etc. Students may consider doing some parts of Unit IX student activity for homework. [Hidden slide at end of Visuals IX-A cover this and replaces existing last slide.]

- **Activity:** The students will continue the familiarization with the Case Study materials. The Case Study is a complete risk assessment and analysis of mitigation options and strategies for a typical commercial office building located in a mixed urban-suburban environment business park (suburban), a 50-story high-rise office building located in a downtown urban environment (urban), or an alternate facility to be assessed for potential COOP use (based upon the suburban building). The assessment will use the DoD Antiterrorism Standards and the GSA Interagency Security Criteria to determine Levels of Protection and identify specific

vulnerabilities. Mitigation options and strategies will use the concepts provided in **FEMA 426** and other FEMA publications related to emergency planning and disaster recovery.

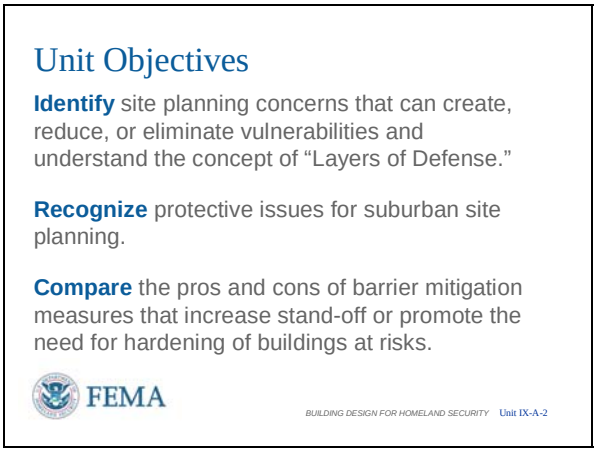
- Refer students to their Student Manuals for worksheets and activities.
- Direct students to the appropriate page in the Student Manual.
- Read the activity instructions found in the Student Manual.
- Describe how the selected case study appendix in the Student Manual is used to obtain the data needed for the building assessment.
- "Walk through" the pages of the activity with the students, describing the steps followed to obtain the answers in the completed examples, and what is expected of the groups for this activity.
- If applicable to this activity, explain what information is to be transferred to the Risk Matrix poster. For this activity, the assessment of the building in greater depth may result in the groups adjusting the Risk Matrix scores for vulnerability rating, with resultant changes to risk rating.
- Tell students how long they have to work on the requirements.
- While students are working, <u>all</u> instructors should closely observe the groups' process and progress. If any groups are struggling, immediately assist them by clarifying the assignment and providing as much help as is necessary for the groups to complete the requirement in the allotted time. Also, monitor each group for full participation of all members. For example, ask any student who is not fully engaged a question that requires his/her viewpoint to be presented to the group.
- At the end of the working period, reconvene the class.
- Ask a representative from one group to provide the answer to the first requirement. Then simply ask if anyone disagrees. If the answer is correct and no one disagrees, state that the answer is correct and move on to the next requirement. If there is disagreement, provide the "school solution" and move on.
- If time is short, simply provide the "school solution" and ask for questions. Do not end the activity without ensuring that students know if their answers are correct or at least on the right track. Note, there are no right or wrong answers, but all answers must be justified with rationale.
- Ask for and answer questions.

INSTRUCTOR NOTES	CONTENT/ACTIVITY
Unit IX-A-1	**Introduction and Unit Overview**



This is Unit IX, Site and Layout Design Guidance. This lecture will examine site level considerations and concepts for integrating land use planning, landscape, architecture, site planning, and other strategies to mitigate the design basis threats. The students will gain an understanding of the myriad options available to enhance site design taking into account many environmental challenges.

Unit IX-A-2



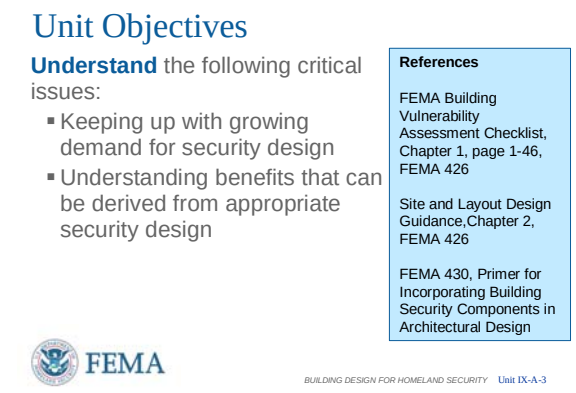
Unit Objectives

At the end of this unit, the students should be able to:

1. Explain the concerns of basic land use planning that affect vulnerabilities to threats and hazards due to terrorism and technological accidents.
2. Understand the concept of "Layers of Defense" which will be applied throughout this instruction unit and the next.
3. Recognize protective issues for suburban site planning so as to aid in selecting appropriate mitigation measures.
4. Compare the pros and cons of barrier mitigation measures that increase stand-off and the need for hardening buildings at risk.

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

Unit IX-A-3

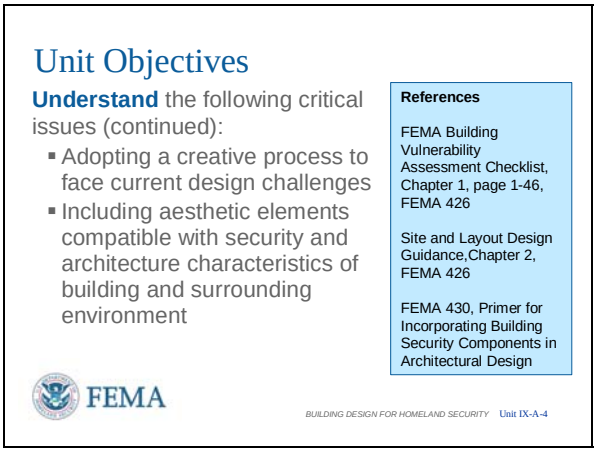


Unit Objectives (cont.)

5. Understand the benefits in keeping up with the growing demand for security design issues. The technology and manufacturing continues to improve.
6. Understand the benefits that can be derived from appropriate security design. Meeting security design can satisfy other requirements at the same time.

FEMA 426 and FEMA 430 contain architectural and site planning considerations for new design or renovation of existing.

Unit IX-A-4



Unit Objectives (cont.)

7. Understand that there are benefits to adopting a creative process to face current design challenges. While many criteria are prescriptive, there are many techniques to meet the spirit, intent, purpose, and performance sought.
8. Understand that design can include aesthetic elements that are compatible with security and architectural characteristics of the building and surrounding environment. Blending security so that it does not look like security so that buildings feel open and friendly should be a goal.

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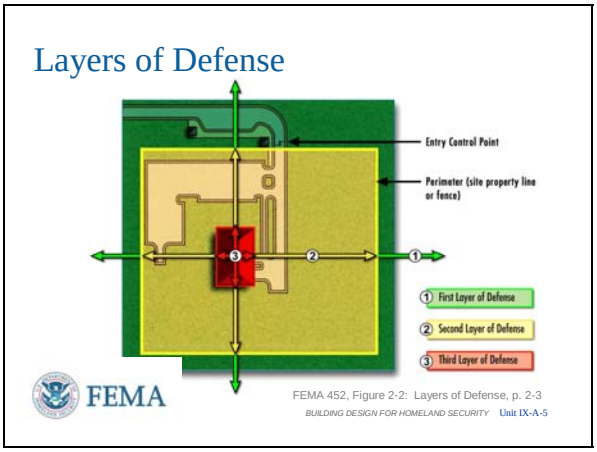
Unit IX-A-5



From FEMA 452

The layers of defense is a traditional approach in security engineering and use concentric circles extending out from an area or site to the building or asset that requires protection. They can be seen as demarcation points for different security strategies. Identifying the layers of defense early in the assessment process will help you to understand better the assets that require protection and determine your mitigation options. Figure 2-2 shows the layers of defense described below.

First Layer of Defense. This involves understanding the characteristics of the surrounding area, including construction type, occupancies, and the nature and intensity of adjacent activities. It is specifically concerned with buildings, installations, and infrastructure outside the site perimeter. For urban areas, it also includes the curb lane and surrounding streets. **The building owner has little or no control outside of working with the city or municipality. The first layer of defense should be designed to prevent large bombs or weapons into the site and control access**

Layers of Defense

There should always be multiple layers of defense in order to deter and detect potential threat elements that attempt to access critical assets to their benefit and everyone else's detriment. There may be an additional layer applied around a building when a site is large or one or more additional layers inside a building when a building has functions at various levels of security. The intent is to deter first, then detect sufficiently quickly to have a response force engage the potential threat elements prior to reaching the next layer.

The first layer is the demarcation between control and no control. Outside the first layer the local, regional, and national police and intelligence forces work to track, detain, and arrest the potential threat elements before they can initiate an incident. This should be a controlled perimeter whose intent is to keep large threats outside by deterrence or detect them at this point and prevent entry. If the weapon activates at this layer the effectiveness is reduced if sufficient stand-off exists.

The second layer keeps any smaller weapons that may slip past the first layer from getting close enough to the critical asset to cause damage. This layer should mitigate the effectiveness of tactics, reduce the impact due to insider action, and controls the stand-off from the building for the smaller weapons that may get through.

The first and second layers are primarily the venue for site and layout design, the basis for this unit.

The third layer (usually 3 layers are the minimum found) is the building envelope which also deters and detects, but if an incident occurs this layer is the only one that provides

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

of personnel.

Second Layer of Defense. This refers to the space that exists between the site perimeter and the assets requiring protection. It involves the placement of buildings and forms in a particular site and understanding which natural or physical resources can provide protection. It entails the design of access points, parking, roadways, pedestrian walkways, natural barriers, security lighting, and signage. For urban areas, it refers specifically to the building yard. **The building owner has control of this layer. The second layer controls stand-off from the building which provides protection from weapons that may slip through the first layer of defense.**

Third Layer of Defense. This deals with the protection of the asset itself. It proposes to harden the structures and systems, incorporate effective HVAC systems and surveillance equipment, and wisely design and locate utilities and mechanical systems. Note that, of all blast mitigation measures, distance is the most effective measure because other measures vary in effectiveness and can be more costly. However, often it is not possible to provide adequate stand-off distance. For example, sidewalks in many urban areas may be less than 10 meters (33 feet), while appropriate stand-off may require a minimum of 25 meters (82 feet). **The building owner has control of this layer and its main mitigation measures are hardening against blast and security sensors/CCTV as final access control.**

any level of protection during the tactic and weapon release. The third layer is the venue for building design which will be found in the next instruction unit.

It is important to remember that the nature of any threat is always changing. Consideration should be given to accommodating enhanced protection measures in response to future threats that may emerge. Asset protection must be balanced with other design objectives, such as the efficient use of land and resources, and must also take into account existing physical, programmatic, and fiscal constraints.

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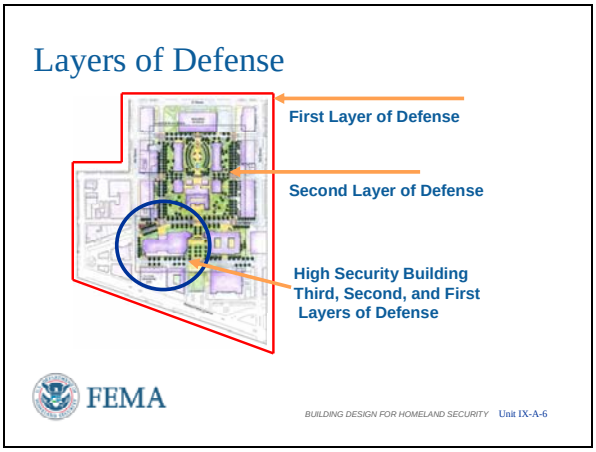
Unit IX-A-6



The layers of defense are not predetermined and they may vary from site to site and from building to building. If a particular building requiring protection is part of a campus or located in a rural, semi-rural, or urban area, a similar analysis may be applicable for all cases when determining the importance of the asset. However, the security elements necessary to protect the building can be entirely different, depending on its location. The approach suggests establishing different demarcation points in order to identify sound security strategies. The layers of defense concept proposes that each designer study a particular site and determine critical assets that need to be protected and how protection should take place.

Note: Layers of Defense will be during this and the next two instruction units to illustrate the elements:

- Deter
- Detect
- Deny
- Devalue

Layers of Defense

The layers of defense convey the idea of using concentric circles extending out from an area or site to the building that requires protection. They are used as demarcation points for different security strategies. The objective of layers of defense is to create succeeding more difficult layers to security to penetrate, provide additional warning and response time, and allow building occupants to more into defensive positions or designated Safe Haven protection.

The layers of defense defines sites and projects as follows *(While the previous slide is a generic explanation, this slide shows the campus or suburban situation where there are more options to the layers of defense)*:

- The first layer addresses the characteristics of the surrounding area and the public realm. It starts at the site perimeter and outward. The building owner has very limited or no control to implement mitigation measures.
- Although a controlled access zone is one of the best methods of ensuring stand-off, issues as the size of site, site limitations, building siting within the parcel, and property line restrictions do not always allow this zone to be created.
- The second layer is concerned with the space and physical barriers at the perimeter of the site to keep explosives at a distance to protect buildings. It comprises the space between the site perimeter and building. The building owner has the authority and control to implement mitigation measures.
- The third deals with the protection integral to the building itself. The building owner has certain level of control to implement mitigation measures. Incorporating the protection in initial design, whether blast hardening or security, is the least expensive approach. Retrofitting after the building

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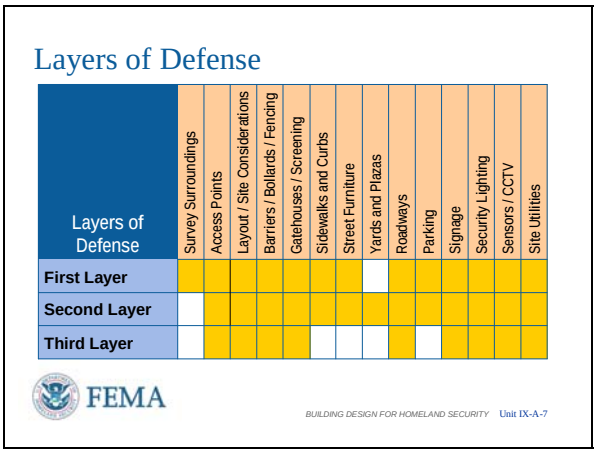
has been constructed can cost up to 30% of the original construction, if the retrofitting can be done.

Instructors may want to relate to a castle – First layer of defense is clearing all trees and vegetation out to the effective range of arrows and crossbows. Second layer of defense is moat and initial castle wall. Third layer of defense is the castle keep where the last defensive position exists with its additional walls.

Unit IX-A-7



Layers of Defense

There are many mitigation techniques available that can be used at one or more layers of defense. This instruction unit concentrates on site and layout design, thus it looks primarily at the first and second layers of defense and emphasizes the predominant layer of defense considered.

Here are general mitigation considerations for the suburban environment and this presentation will follow the flow of these measures from left to right – starting with Survey Surroundings on the left and ending with Site Utilities on the right.

The flow also follows the general assessment approach of looking from outside to inside and going from general information to specific information.

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Unit IX-A-8

Survey Surroundings – Data Collection

In a suburban environment, this action normally follows the points on a compass -- in the horizontal plane.

However, understanding the surroundings includes any structures above and under the building and site of interest as to their impact on design or assessment. GIS applications are excellent resources that enable designers and building owners to analyze various demographic, hazardous areas, transportation networks, access control points, etc., in order to identify potential threats, hazards, and vulnerabilities. These applications may depict a truer picture of the surrounding situation, allowing decision-makers to take proactive measures to mitigate potential vulnerabilities.

Geographic and topographic concerns include terrain that limits access of vehicles – natural barriers, like water, slope, vegetation, etc.

Unit IX-A-9

Access Points

Entry control and vehicular access should:

- Prevent unauthorized access
- Avoid traffic queuing (queues become potential targets)
- Have commercial vehicle gates if possible – keep larger vehicles further away and barriers increased in capability to handle. Have an Alternate Plan B if a suspected vehicle closes down one or the other vehicle gates
- Provide traffic calming
- Avoid high speed approaches
- Have equal security capacity for exit

Traffic calming strategies seek to use design measures to cue drivers as to the acceptable speed for an area. These include raised

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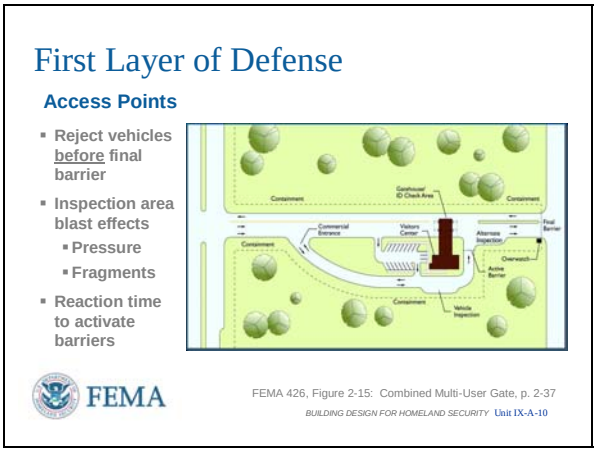
crosswalks, speed humps and speed tables, pavement treatments, build outs, and traffic circles. Additionally, by controlling the angle of approach, requiring turns or providing curves, vehicles must slow down.

The arrival sequence design to and through a site contribute to the project's identity, including the visitor's orientation to the site and route to reach their destination. The circulation routes, signage, checkpoints, control of site lines (screening or emphasizing views of certain areas), and topography all contribute to the arrival process and legibility of the site. The establishment of circulation and access points may differentiate between entries and routes for pedestrians, staff, visitors, deliveries and service, each with differing security requirements to be satisfied.

Unit IX-A-10



Location selection for vehicular access and entry control for a building starts with an evaluation of the anticipated demand for access to the controlled site. An analysis of traffic origin and destination, and an analysis of the capability of the surrounding connecting road network, including its capacity to handle additional traffic, should then be performed. Expansion capacity

Access Points

Gatehouses, lobbies, and guard posts should be provided with clear views of approaching traffic -- pedestrian and vehicular. Screening areas and entries may be located to offer more privacy and protection.

It is advisable to design circulation to separate different types of traffic and provide separate routes for staff, for visitors, and for deliveries. With the separation of vehicle types, security can more easily address differing needs for screening, observation, and potential threat mitigation.

Roadway network design that uses straight-line approaches to buildings may give approaching vehicles the opportunity to gather the necessary speed to ram protective barriers and crash into buildings. Possible solution: design approaches to be parallel to the façade, with berms, high curbs, trees, and other measures used to prevent vehicles from departing the

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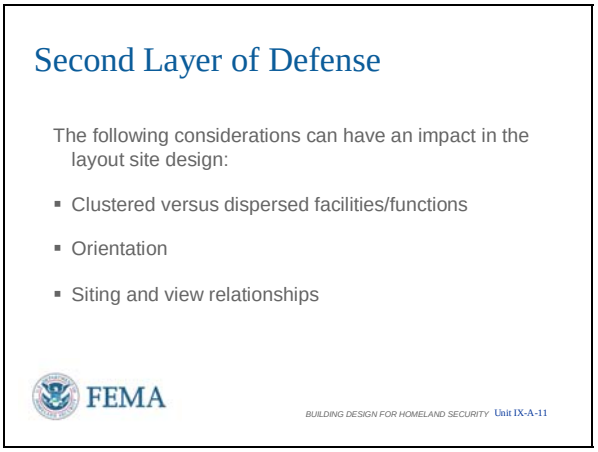
should also be considered. The analysis should be coordinated with the state and local departments of transportation.

Two security measures that are overlooked are: First, allowing the vehicle to enter the site so that it can turn around and leave. A proper entry control point would never allow the vehicle to enter the site if it were not authorized. Second, there are multiple reaction times that must be added – guard recognition that vehicle is avoiding security, guard reaction to activate final barriers, and activation time from closed to open for the final barriers. The time delay from recognition to deployment must be less than the speed of the vehicle between the recognition point and the final barrier.

Unit IX-A-11



roadway.

The existing terrain can have a significant impact on the suitability of a potential entry control point site. Flat terrain with no thick vegetation is generally preferred. A gentle rise in elevation up to the entry control guard building allows for a clear view of arriving vehicles. Consider how existing natural features such as bodies of water or dense tree stands may enhance perimeter security and vehicle containment, without restricting observation capability or allowing easier surveillance of the building by potential threat elements. Entry control spatial requirements vary, depending on the type, the traffic demand, and the necessary security measures.

Second Layer of Defense

The following aspects of the building program and layout impact the site design and assessment:

- Overall size and number of structures placed on site with high-risk buildings clustered together for increased security or stand-off or dispersed to devalue as a target.
- Orientation of buildings to reduce damage from bomb blast and prevent direct approaches by high speed vehicles.
- Increase views of approaches to the building, but screen views from outside surveillance.

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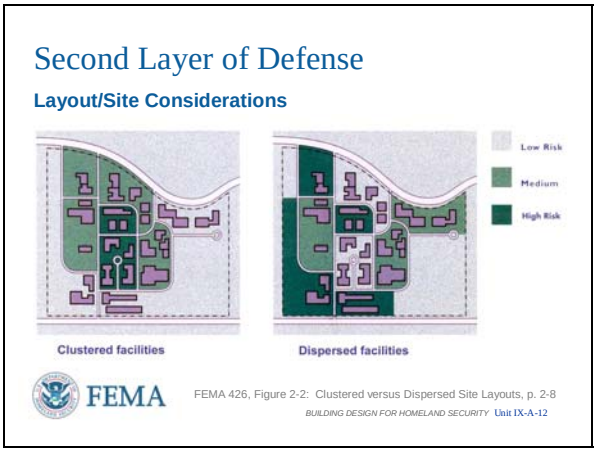
Unit IX-A-12

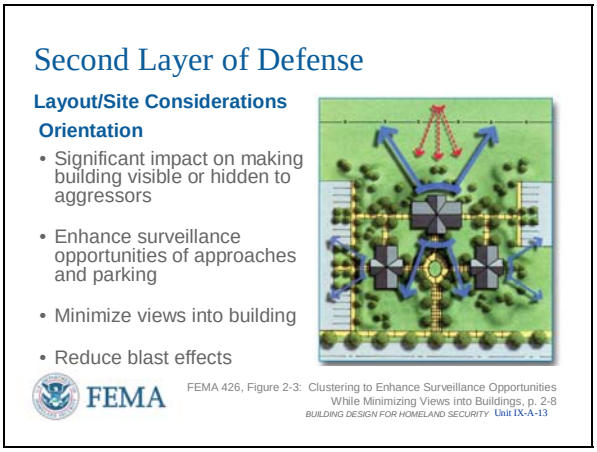


Layout / Site Considerations – Clustered versus Dispersed Facilities

Depending on the site characteristics, the occupancy requirements, and other factors, buildings may be clustered tightly in one area, or dispersed across the site. Both patterns have compelling strengths and weaknesses.

Concentrating people, property, and operations in one place creates a target-rich environment, and the mere proximity of any one building to any other may increase the risk of collateral impacts. Additionally, the potential exists for the establishment of more single-point vulnerabilities in a clustered design than would exist in a more dispersed pattern. However, grouping high risk activities, concentrations of personnel, and critical functions into a cluster can help maximize stand-off from the perimeter and create a "defensible space."

Unit IX-A-13



Layout / Site Considerations -- Orientation

Orientation is the building's spatial relationship to the site, its orientation relative to the sun, and its vertical or horizontal aspect relative to the ground.

- How many times have you seen aluminum foil on windows because the afternoon summer sun overcomes the air-conditioning capacity along that side of a building?

The physical positioning of a building relative to its surroundings may seem subtle, but can be a greater determinant of security.

Good site design, orientation, and building placement should allow building occupants to look out of the facility while minimizing views into the building.

The proximity of a vulnerable façade to a parking area, street, adjacent site, or other area

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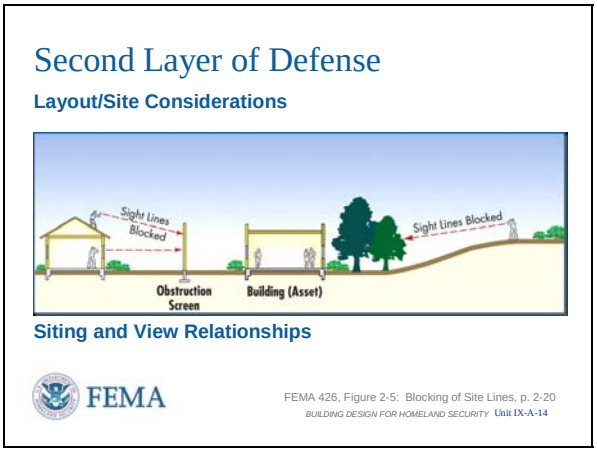
that is accessible to vehicles and/or difficult to observe can greatly contribute to its vulnerability.

Unit IX-A-14



Layout / Site Considerations – Siting and View Relationships

Landscape and urban design inherently define the "line of sight" in a space. Operational security is not a traditional element of master planning, but managing the threat of hostile surveillance is a significant consideration in protecting people, property, and operations. With careful selection, placement, and maintenance, landscape elements can provide visual screening that protects sensitive operations, gathering areas, and other activities from surveillance without creating concealment for covert activity.

These techniques seek to deny aggressors a "line of sight" to a potential target, either from on or off site. This increases the protection of sensitive information and inhibits operation of stand-off weapons. In addition to the use of various screening options, anti-surveillance measures (e.g., building orientation, landscaping, screening, and landforms) can also be used to block sight lines.

The design should maximize opportunities for internal surveillance of site perimeters and screening of internal areas from external observation. Topography, relative elevation, walls, and fences are design elements that can open and close views. Vegetation can open, close, or block views, not only for security purposes but also to provide beauty and to support wayfinding. As a rule of thumb, vegetation should be very high or very low, to keep views open. Vegetation at the base of buildings and structures should be designed and maintained to prevent explosives from being hidden from view – easily see a briefcase

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or a backpack.

Landforms can have a direct bearing on the security of a facility. They can be either beneficial (e.g., an elevated site that may enhance the surveillance of the surrounding area), or detrimental to anti-surveillance.

Generally speaking:

- For security purposes, buildings should not be sited immediately adjacent to higher surrounding terrain or buildings if at all possible.

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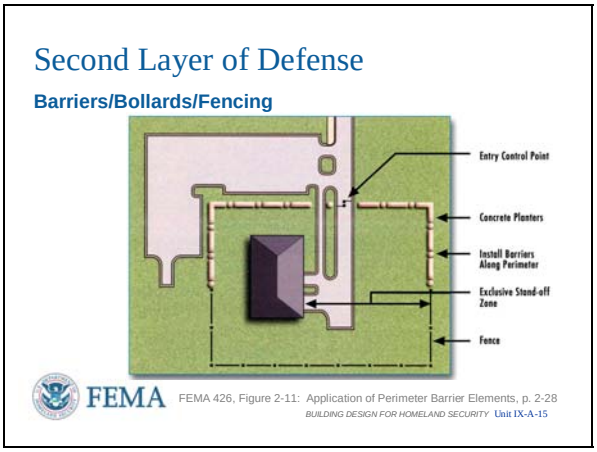

Barriers / Bollards /Fencing

A number of elements may be used to create a physical barrier, some natural and some manmade. Natural barrier elements include rivers, lakes, waterways, steep terrain, mountains, barren areas, plants, soft sand, and other terrain features that are difficult to traverse. Manmade elements include fencing, walls, buildings, bollards, planters, concrete barriers, and fountains. Selection of elements must consider the level of security desired and the type of threat most likely to occur.

When placing bollards, make sure you adhere to ADA (Americans with Disabilities Act) compliance.

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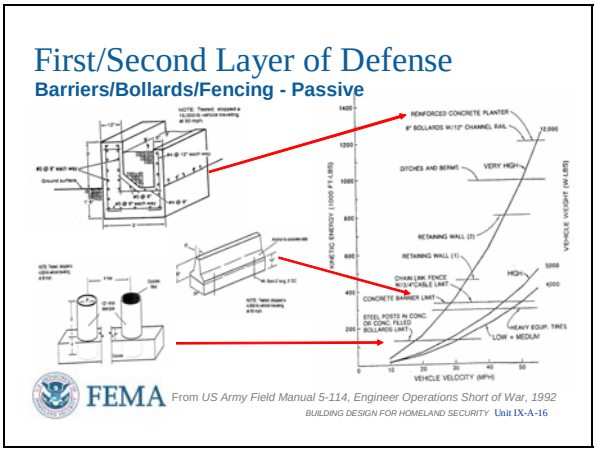

Discuss the mass (vehicle size) and vehicle speed in the chart. Note that since speed is squared (K.E. = ½ * mass * speed * speed), controlling speed is a primary concern.

Unit IX-A-17

Barriers / Bollards /Fencing – Passive Barriers

It is one thing to provide a passive barrier, it is another to ensure the barrier will provide the protection level sought. We have talked about controlling vehicle speed approaching access points and buildings. Essentially, any barrier will stop a given level of kinetic energy which is ½ mass * velocity squared. Thus, the bigger the vehicle and the higher its speed the stronger the barrier must be as shown by this chart.

The greater the barrier mass and reinforcement and the deeper it is connected to the earth, the higher its rating.

Notice the jersey barrier has the rating listed only if there are four rebar pinning the barrier at least 18 inches into pavement. Alternately, a 1-inch steel cable linking the jersey barriers would be an alternate technique, but with some penetration.

Barriers / Bollards /Fencing – Water Barriers

Water-filled barriers are another approach as they are lightweight and easy to deploy. The left photo shows the stopping power and the right photo shows water barriers that support a fence. Filling the barriers with sand make them less portable.

As with jersey barriers, linking the barriers with 1-inch steel cable improves their performance, but with additional penetration (less mass). Also, these barriers must be checked periodically for leaks, especially if allowed to freeze when filled with water. Without water or sand these would lack critical needed mass.

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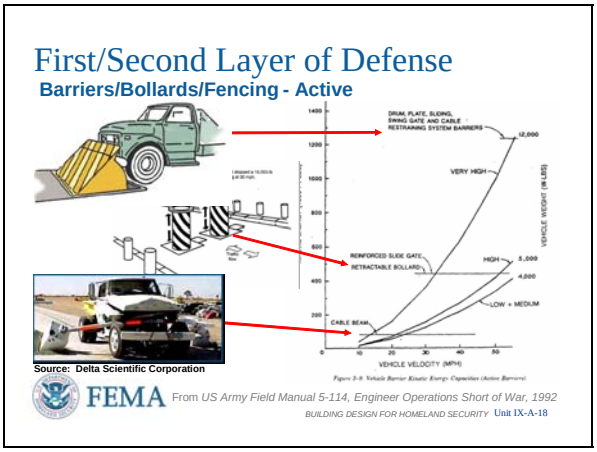
Unit IX-A-18



Barriers / Bollards /Fencing – Active Barriers

As with passive barriers, active barriers also have different levels of kinetic energy stopping power, based upon mass and connection to the earth.

The advantage of active barriers is that access points and building access to loading docks or for maintenance can allow vehicles to pass or not based upon authorization.

One company is marketing a turntable that allows the fixed bollards to be turned 90 degrees to the vehicle path, then rotated back to block vehicle traffic.

Unit IX-A-19

Barriers / Bollards /Fencing – Active Barriers

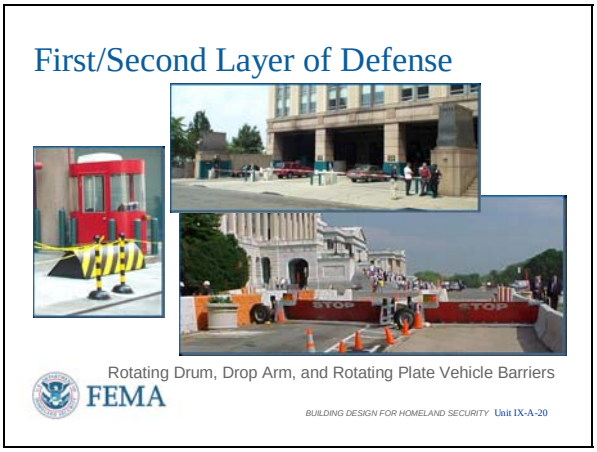
These photos show retractable bollards stopping a substantial truck with very little penetration.

An active barrier can be activated in seconds (1 to 3) and should be either always up (sally port concept) or deployed upon identification that the gate is being crashed (taking into consideration response time, maximum vehicle speed and activation speed.

Pop-up barriers can create serious damage to vehicles, especially if deployed when a vehicle is above the barrier. Consider manual activation to avoid unnecessary damage (avoid magnetic vehicle loops to redeploy a barrier that will catch a tailgating vehicle).

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

Unit IX-A-20



Barriers and Street Closure

In alleys and typical urban streets adequate stand-off distance is an impossibility without street closure. This is generally undesirable because of the disruption caused to traffic patterns.

The top and left photos show permanently installed barriers, while the bottom right photo shows temporary barriers that can be rapidly deployed and moved into position to control site and parking access, control traffic flow, and provide stand-off distance for buildings.

Improvised closures tend to destroy the attractiveness of the street with a combination of security personnel and ugly temporary barriers. Configuration for access, queuing, and inspection shout be planned in any case to reduce potential problems by reducing circulation and aggregated space in a city.

Full closure is often impossible because of the need for service entry. Temporary closure can be achieved by active or manual barriers, combined with public works and security personnel.

Consider the “Ring of Steel” being installed in a core area of London, England. It acts as a first layer of defense, inspecting, restricting, and documenting all vehicles that enter the core area to keep larger weapons out.

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

Unit IX-A-21

First/Second Layer of Defense

Barriers, Bollards, and Fencing

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	<= 3.3
K8	15,000	40	<= 3.3
K12	15,000	50	<= 3.3

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

FEMA

BUILDING DESIGN FOR HOMELAND SECURITY Unit IX-A-21

Department of State Barrier Ratings

Department of State barrier ratings are probably more suitable to an urban environment where stand-off is limited -- the 3.3 feet distance allowed past the barrier is for the leading edge of the cargo area of the truck (where the bomb is most likely being carried).

Also, Department of State has found that diesel trucks have greater penetration capability, so their tests now require the use of diesel trucks vice gasoline powered trucks.

Unit IX-A-22

First/Second Layer of Defense

Barriers, Bollards, and Fencing

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	<=3(L3)/20(L2)/50(L1)
15,000	40	<=3(L3)/20(L2)/50(L1)
15,000	50	<=3(L3)/20(L2)/50(L1)
10,000	50	0 to 50
10,000	15	50 to 100

FEMA

BUILDING DESIGN FOR HOMELAND SECURITY Unit IX-A-22

Department of Defense Barrier Ratings

Department of Defense barrier ratings use the old Department of State criterion that allows the front of the vehicle to penetrate a given distance past the barrier. This would be more suitable in a suburban environment where there is greater distance between the barrier and the nearest building than in the urban environment.

Unit IX-A-23

First/Second Layer of Defense

Barriers, Bollards, and Fencing

- Fixed bollards
- Retractable bollards
- Planters

Fixed bollards

FEMA

BUILDING DESIGN FOR HOMELAND SECURITY Unit IX-A-23

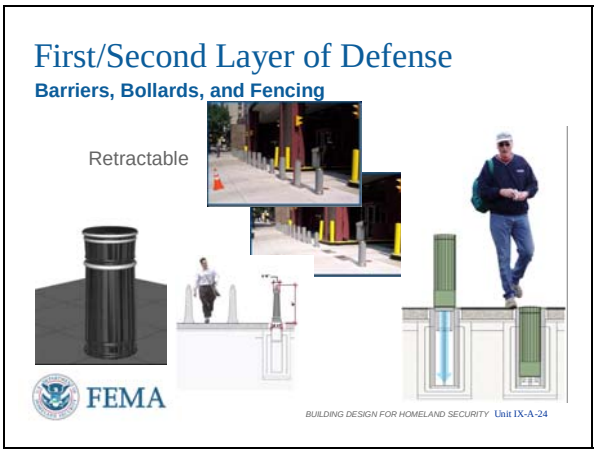
Barriers / Bollards /Fencing – Bollards and Planters

Sidewalks serve as the common space for pedestrian interaction, movements, and activity.

Extending barriers into sidewalks, streets or parking lanes may provide additional stand off distance. While this is technically possible, this approach often creates negative impacts within the public realm, which may make this an unfeasible solution. Be sure that introduced security measures are effective.

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

Unit IX-A-24



CONFIRM REFERENCES??

Unit IX-A-25

Bollards and other barriers are ideally the first layer of defense in the urban environment so as to obtain the most stand-off possible.

Barriers / Bollards /Fencing -- Retractable Bollards

Retractable bollards are an excellent (though expensive) solution when the use of security elements is critical and the width of the street does nor allow their permanent placement.

Effective bollards must be carefully engineered with deep foundations and the additional depth required for retractability may cause problems with underground utilities and services, building basements extending under sidewalks in urban areas, and other structures that may exists under sidewalks that affect retractable bollard performance.

Barriers / Bollards /Fencing -- Planters

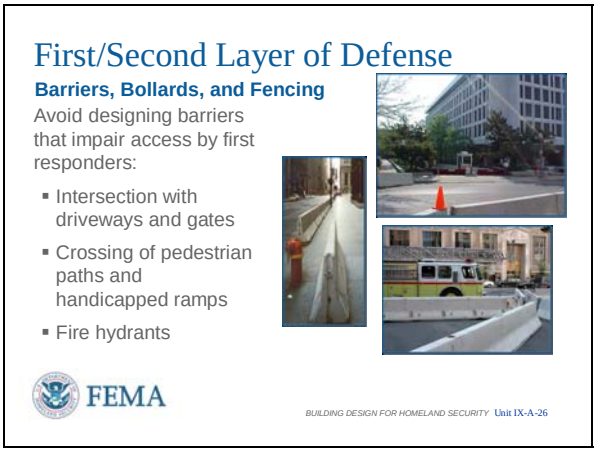
Bollards and planters can help create an appealing streetscape depending upon their design and the current environment in which they are installed.

When placed, make sure that they accomplish their function and distance between them is appropriate. The distance must allow free flow of pedestrians, but restrict flow of vehicles.

Fragmentation is always a concern with any barrier system, whether caused by bomb blast or vehicle impact.

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

Unit IX-A-26



Barriers / Bollards /Fencing -- Jersey Barriers

Least desirable of barrier types

- Difficult to place and move
- No vehicle stopping capability unless tied to pavement with at least 4 pieces of #4 (1/2-inch diameter) rebar into pavement about 18 inches deep and/or tied together with steel cable (3/4 to 1-inch)
- Can cause sidewalk failure due to concentrated load and fact that sidewalk may be hollow underneath for storage or utilities
- Adds to fragmentation (barrier shatters) if vehicle bomb explodes next to barrier
- They impede access – pedestrians and first responders
  - Utilities (if placed on top of manholes)
  - Emergency access (fire trucks, ambulance, police)
  - ADA (Americans with Disabilities Act) access – crosswalks and ramps

Unit IX-A-27

Barriers / Bollards /Fencing -- Bollards

When placed, make sure that they accomplish their barrier function with an appropriate distance of not less than 4 feet-between them.

Bollards placed in long unbroken rows present a monotonous appearance and may appear as a wall from some angles.

<u>Pay attention</u> to how bollards or fences:

- Turn the corner
- Intersect with driveways and gates
- Cross pedestrian paths and handicapped ramps

In an urban environment, bollards and barriers are ideally the first layer of defense to obtain the most stand-off possible.

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

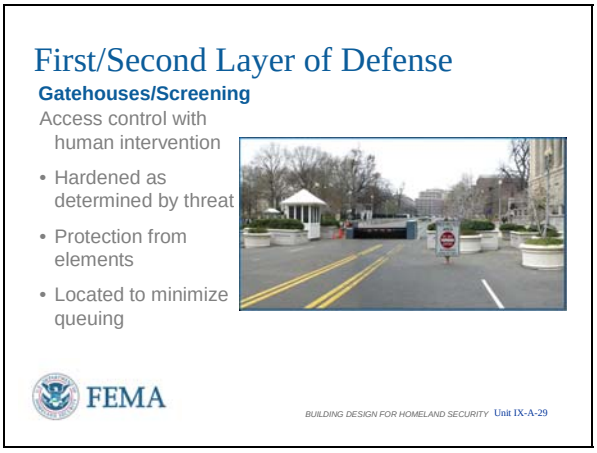
Unit IX-A-28

Barriers / Bollards /Fencing -- Fencing

Fencing can be limited to channeling law-abiding people (pedestrians and vehicles) to massive with the intent of controlling malicious people and vehicles.

As a basic it provides access control for pedestrians and vehicles (with the help of other barriers). Fencing in each layer of defense is enhanced with electronic security – sensors and CCTV, be it the first layer or a restricted area around a building.

Unit IX-A-29



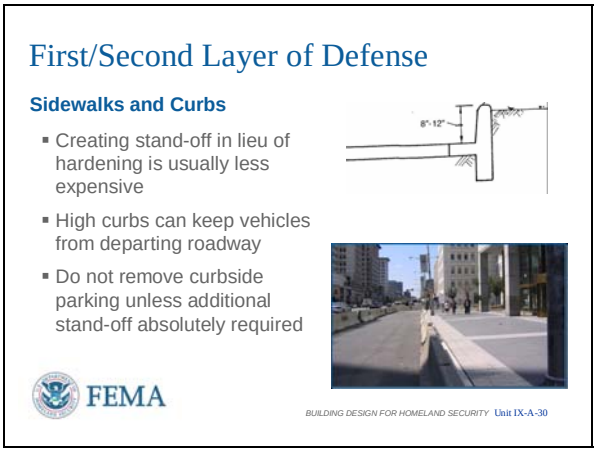
Gatehouses / Screening

Gatehouses are to assist the screening of vehicles and pedestrians to ensure they have proper authorization for access. This can be at the first layer of defense (normally) or at any restricted perimeter

- Depending on the threat the gatehouse should be hardened, but at the very least PPE (personal protective equipment, like bullet-resistant vests) should be worn
- The elements – wind, rain, heat, cold make this job difficult enough that the gatehouse should provide a refuge with water, heat, and air conditioning, including a rest room
- Proper placement so that the guard can interact with drivers without having to cross the traffic lane and adequate throughput so that queues will not form waiting for access.

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

Unit IX-A-30



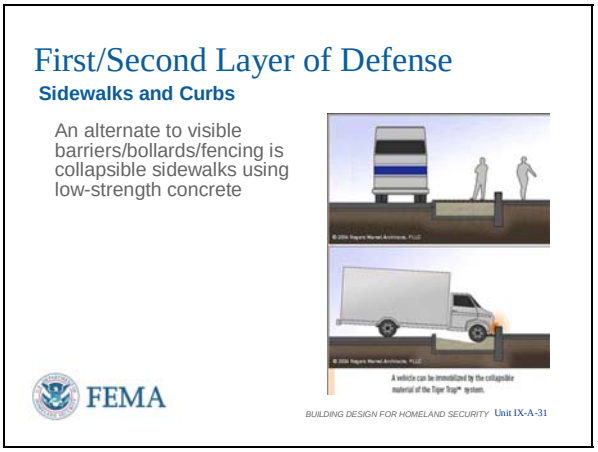
Sidewalks and Curbs

Sidewalks serve as the common space for pedestrian interaction, movements, and activity. Sidewalks should be open and accessible to pedestrians to the greatest extent possible and security elements should not interfere with circulation particularly in crowded locations

Curbside parking should not be removed unless additional stand-off distance is absolutely necessary for high-risk buildings. Prohibiting on street parking or closing lanes should only be used as a temporary measure during times of increased alert.

High curbs and other measures may be installed to keep vehicles from departing the roadway (especially if curb height is at the axle height) in an effort to avoid other security counter measures. In one instance, an armored car firm was asked to park their vehicles around a building that had received credible threats to act as barriers and increase stand-off.

Unit IX-A-31



Sidewalks and Curbs

Another unobtrusive approach for providing a vehicle barrier is combining collapsible sidewalk with a small wall that will catch a vehicle bumper. The sidewalk is made of low-strength concrete that takes pedestrian weight but not vehicle weight.

These graphics are of the Rock Twelve Security Architecture Tiger Trap ™ and their product literature information:

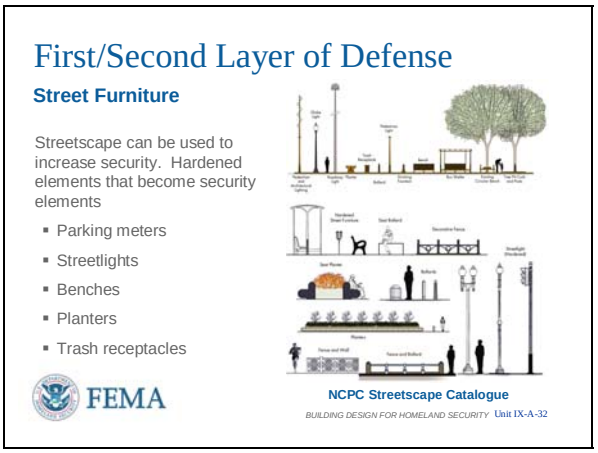
- Designed to reduce the impact of security on public space, this innovative vehicle arrest system utilizes a subgrade compressible material that lowers the elevation of an attacking vehicle and a

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

low wall that then halts the lowered vehicle.

- The subgrade compressible material allows the rear wall to be as low as a bench or even completely below grade.
- The compressible material combined with a decorative covering surface supports pedestrian loads, but fails under the weight of a vehicle.

Unit IX-A-32



Street Furniture

At the site perimeter, walls and fences may be hardened (strengthened) to resist the impact of a weapon-laden vehicle. However, planters, bollards or decorative boulders can accomplish the same objective in a much more aesthetically pleasing manner.

The streetscape can included hardened versions of parking meters, street lights, benches, planters and trash receptacles that act as barriers to moving vehicles.

The National Capital Planning Commission (NCPC) provides a catalog that shows several examples of hardened streetscape furniture.

Unit IX-A-33

Street Furniture

The scale of the streetscape should be appropriate to its primary users and it can be manipulated to increase the comfort level of desired users while creating a less inviting atmosphere for users with malicious intent.

It is critical to maintain important functions such as adequate space for pedestrian circulation and appropriate distances between vehicles and security barriers. The recommended distance to place streetscape security components is at least 24 inches from

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

the edge of the curb to allow for the opening of car doors and pedestrian movement from car to sidewalk.

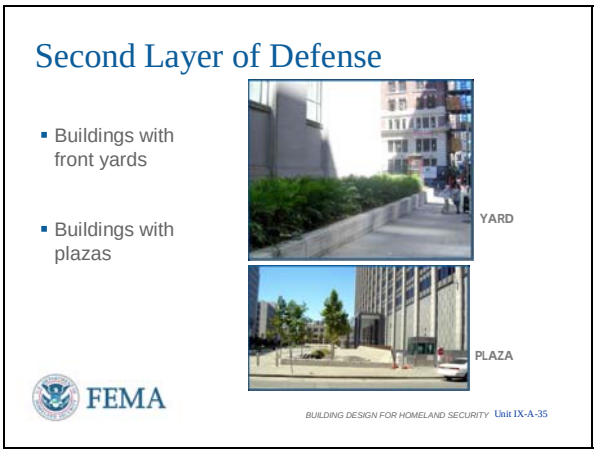
Well planned barriers can also assist in clearly defining areas of public and private space and in protecting pedestrians from traffic.

Unit IX-A-34

Street Furniture

Numerous urban design elements present opportunities to provide security. Even at the pedestrian scale, certain operational requirements must be accommodated. For example, although efficient pedestrian and vehicle circulation systems are important for day-to-day living, they are also critical for emergency response, evacuation, and egress. Furthermore, despite an emphasis on downsizing the scale of the streetscape, it is critical to maintain the maximum stand-off distance possible between vehicles and structures.

Unit IX-A-35



Yards and Plazas

Three generic site types will be found in the central business district of any large city.

- Buildings with zero setback and alleys. The building face is on the property line. An alley is a narrow street that divides a city block and provides service access to the side or rear of the building.
- Buildings with front yards. The building is set back from its property line and the space is usually landscaped. The building yard includes pedestrian entries and loading docks.
- Building with plazas. The building is placed within an open space that is publicly accessible.

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Unit IX-A-36

Building Yard

Some buildings have a "yard" between the building face and the sidewalk. The yard is within the property line and typically consists of a grassy or planted area adjacent to the building.

Yards are typical, narrow, of the order of 10 to 20 feet, providing some stand-off distance.

The yard may be flush or raised above the level of the sidewalk. A raised yard can provide a barrier to vehicles.

Major public buildings may have wide yards that are more of a landscaped forecourt that can offer reasonable stand-off distance. Yards are usually provided for governmental or institutional buildings in which coverage of the entire property may not be economically critical as is the case for private development.

Sometimes small yards (within the property line) are matched with a wide sidewalk provided by the city.

Unit IX-A-37

Building Yard

A typical raised, low planter that can act as a bench (or plinth wall that holds back soil or rock), as shown in the left photo, presents a significant barrier to small and medium-sized vehicles. The high stepped yard in the right photo, which is along the side of the building, is a significant barrier and could also act as a deflector of blast from a curbside vehicle.

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

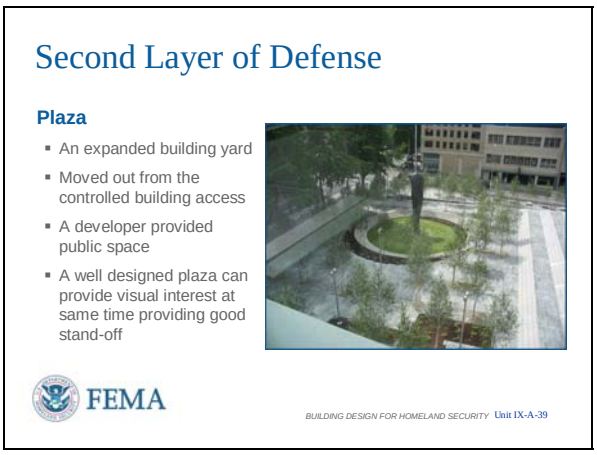
Unit IX-A-38

Building Yard

Security elements within the building yard should complement the building architecture and landscaping and should be designed so as to appear as well designed landscape objects rather than expressing security. The security elements should be located near the outer edge of the yard to maximize stand-off.

Good examples of this are shown in these photos.

Unit IX-A-39



Plaza

Extensive business district development with very large buildings began after World War II. The straight tower with no setbacks became fashionable, but new ordinances permitted building developers to construct taller buildings, with greater floor area, if a public plaza was incorporated. In fact, in Tokyo, new high-rises must ensure they do not completely block the sun from surrounding buildings.

In effect, the plaza became an expanded building yard. It was moved outside the controlled access space of the building and became public space provided by the developer.

The additional space provided by plazas enables a more effective second layer of defense to be achieved. Often an acceptable stand-off distance can be created on one or more faces of the building depending on the plaza /building layout.

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

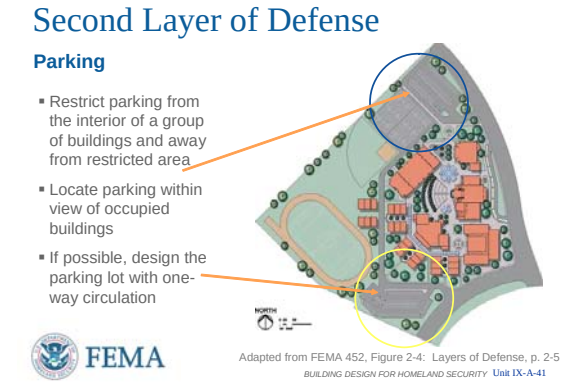
Unit IX-A-40

Roadways

Given that the energy transferred when one object strikes another is a function of its mass and its velocity, a bollard that can stop a 15,000-pound truck moving at 35 miles per hour may not be able to stop the same truck moving at 55 miles per hour. In developing a system of street alignments with protection in mind, the designer cannot determine the size or weight of a vehicle that will travel along the road, because that is a management decision. However, the designer can propose a roadway system to minimize vehicle velocity, thus using the roadway itself as a protective measure.

Minimizing street closure and disrupting vehicle and pedestrian patterns should always be a goal. But at higher threats, it may be one of the few available mitigation options.

Unit IX-A-41



Parking

Building placement on the site must balance stand-off distances; relationship to adjacent streets and buildings; siting of utilities, parking areas, and driveways; as well as access to parking and loading areas.

There are three primary types of parking facilities, all of which present security trade-offs.

- Surface lots can be designed to keep vehicles away from buildings, but they consume large amounts of land and, if constructed of impervious materials, can contribute greatly to stormwater runoff volume. They can also be hazardous for pedestrians if dedicated pedestrian pathways are not provided.
- In contrast, non-street parking is often convenient for users and a source of revenue for local governments, but this type of parking may provide little or no setback.

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

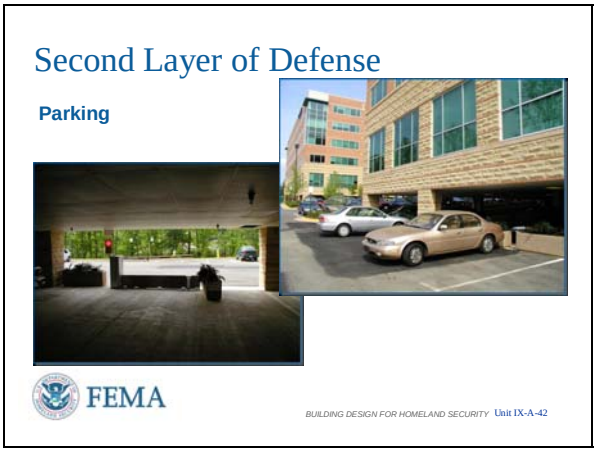
- Finally, garage structures provide revenue and can be convenient for users, but they may require structural measures to ensure blast resistance as well as crime prevention measures to prevent street crime.

Although the cost of land suggests that the construction of a garage below a building (either underground or aboveground) may be the most economically viable approach for many developments, they can be highly vulnerable to vehicle-borne weapons, endangering the building above. If garages must be used, human security procedures (e.g., vehicle searches) and electronic systems (e.g., closed circuit television) may be necessary.

Parking structures open to the public should be sited and evaluated with concern for stand-off from other buildings, screening from critical operations and sensitive areas that might be observed from within the parking structure, and as a point of access or staging for use of weapons or explosives. Progressive collapse can become a concern in parking structures.

If stand-off distance is needed between a building and a First Layer controlled perimeter, placing parking in this area is an excellent use of the available space, as shown in this graphic.

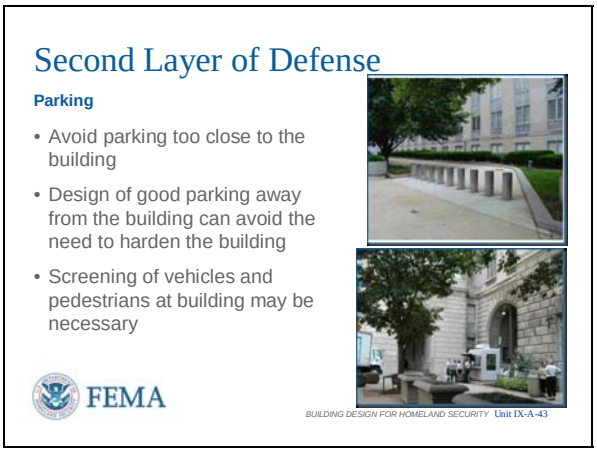
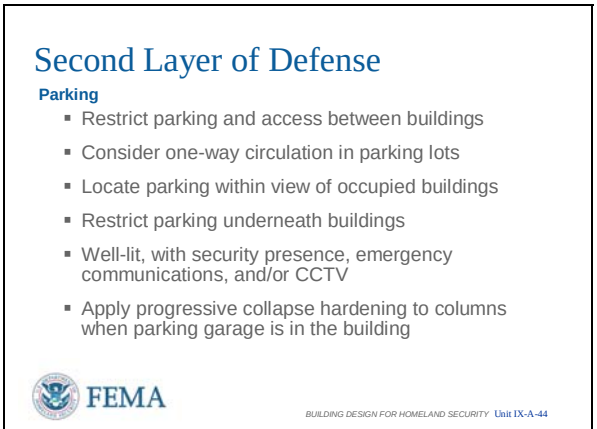
Unit IX-A-42



Parking

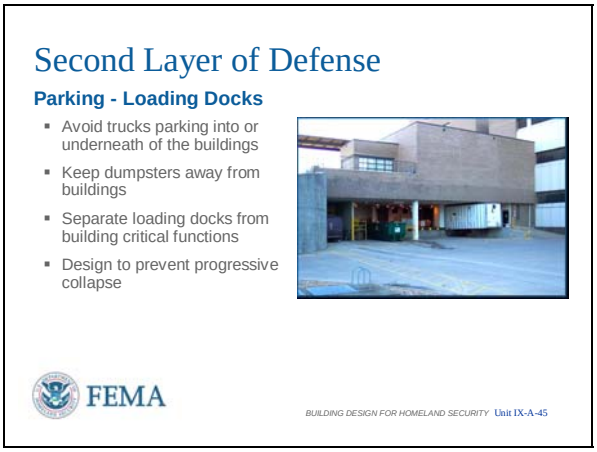
Parking layout and circulation is often one of the largest program elements in site design. Public street parking, parking lots, free standing structured parking buildings, and underground parking have different characteristics to be considered.

Note the limited physical barriers that are in place to prevent unauthorized vehicles from parking underneath this building as shown in the slide. Also note the limited stand-off and the parking proximity to columns supporting

INSTRUCTOR NOTES	CONTENT/ACTIVITY
	the exterior wall of the building.
Unit IX-A-43	**Parking**
	Avoid parking too close to the building, especially large vehicles. Good parking design can prevent the need to harden the building.
Unit IX-A-44	**Parking**
	When designing parking, the following should be taken into consideration: • Maintain stand-off distance from building • Restrict parking from the interior of a group of buildings and away from any restricted area • Avoid having parking near, within or underneath buildings – Consider hardening against progressive collapse if parking garage is in the building. • Locate parking within view of occupied buildings • If possible, design the parking lot with one-way circulation that restricts straight-on high-speed approaches to buildings • Provide signage to clearly mark separate entrances for different parking lots • Keep parking areas well lit; use emergency communications, and/or CCTV

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

Unit IX-A-45



Significant structural damage to the walls and ceiling of the loading dock may be acceptable; however, the areas adjacent to the loading dock should not experience severe structural damage or collapse.

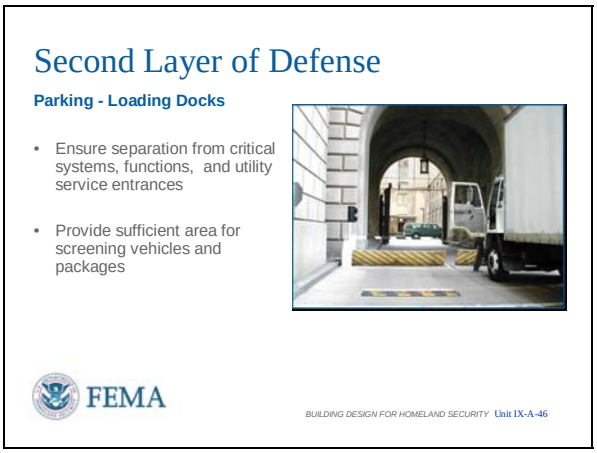
This photo is a good example of a loading dock that is not underneath the building. This will be covered in more detail in the next instruction unit.

Parking – Loading Docks

Loading docks and service access areas are commonly required for a building and are typically desired to be kept as invisible as possible.

- Locate loading docks so that vehicles will not be allowed underneath the building or too close to the building at the curb lane. If this is not possible, the dock area should be hardened for blast.
- Design to prevent progressive collapse, especially if loading dock is under the building.
- Separate (by at least 50 feet) loading docks and shipping and receiving areas in any direction from utility rooms, utility mains, and service entrances, including electrical, telephone/data, fire detection/alarm systems, fire suppression water mains, cooling and heating mains, etc.
- Siting and layout of loading areas should be secured and accommodate sufficient area for screening vehicle and packages.
- Trash dumpsters should be relocated away from the building. (Explosive devices can be tossed in the dumpster creating a blast effect.)

Unit IX-A-46



Parking – Loading Docks

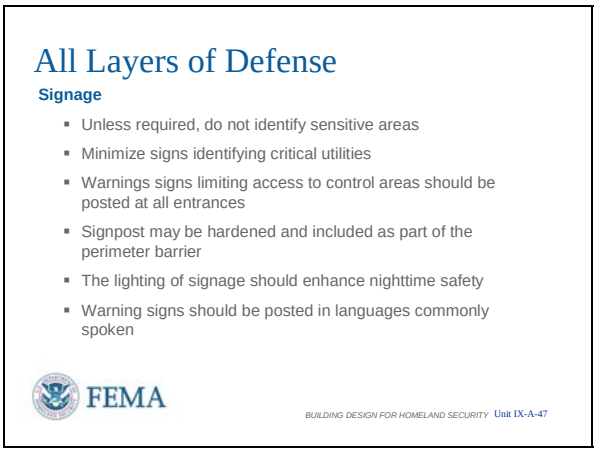
Loading dock on-site accommodation is essential. Security issues relating to loading docks must be examined on a site by site basis, possibly involving the cooperation of civic authorities, especially in an urban environment.

For increased threat levels, you may coordinate local policy to screen vehicles before approaching the loading dock. In any case, the vehicles need an inspection area established for normal operations at lower threat levels in

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

order to protect the building.

Unit IX-A-47



Whatever the strategy for signage, it is important that signage be developed in concert with other site design elements, be included in the site design palette, and designed and placed in coordination with all other materials. To reduce the potential of clutter, signage should be integrated with other streetscape elements and architectural elements. Access, maintenance, and adaptability should be considered in selection of signage systems. Periodically changes are required to signage content. A comprehensive signage plan should be tailored to the mission of the facility accompanying the FEMA 426 guidelines.

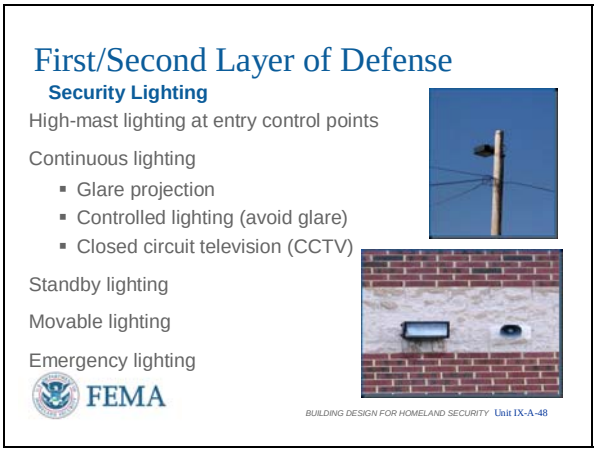
Signage

Building owners should determine how visible the project should be and corresponding implications for site signage. For some projects, a degree of anonymity may be part of the security strategy.

- Unless required, signs should not identify sensitive areas.
- Minimize signs identifying critical utility complexes, such as power plants and water treatment plants.
- Warning signs should be posted at all entrances to limited, controlled, and exclusion areas.
- The wording on the signs should denote warning of a restricted area.
- Signs should be posted at intervals of no more than 100 feet and should not be mounted on fences equipped with intrusion-detection equipment.
- Signage may be mounted on other elements, such as fences and walls to reduce the number of posts along the street or perimeter.
- Signposts may be hardened and included as part of the perimeter barrier.
- The lighting of signage may also enhance nighttime safety to those who come to the site during evening or early morning hours.
- Locate variable message signs, which give information on site/organization special events and visitors, so that they are not observable from site perimeters (first layer)
- Warning signs must use languages commonly spoken.

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

Unit IX-A-48

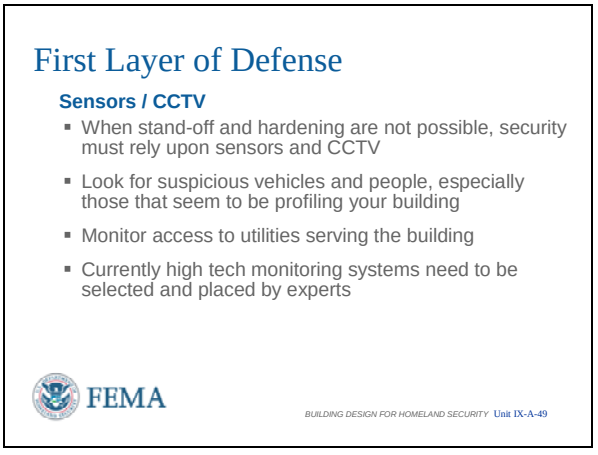


Security Lighting

Security lighting should be provided for overall site and building illumination and along the perimeter to allow security personnel to maintain visual assessment during darkness. Lighting is desirable around areas such as piers, fence lines, loading docks, storage areas, and parking lots. At entry points, a recommended minimum surface lighting average of 4 horizontal foot candles will help ensure adequate lighting.

Security lighting has different purposes – to blind, to allow vehicle inspection, to identify credentials, to support CCTV capabilities, etc. Thus, security lighting must be coordinated for all purposes.

Unit IX-A-49



Sensors / CCTV

Manned and electronic security increases deterrence and detection with attendant reduction in risk. It is the fastest technology to add and upgrade when selected, installed, and used properly.

It should cover vehicle, pedestrian, and utility entrances as all of these are potential approaches for terrorist tactics.

This will be covered in more detail under Electronic Security Systems later.

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Unit IX-A-50

A thorough walk-through of the site property should be conducted and proper protection devices should be applied to exposed utilities. The electrical substation shown can be easily damaged from outside the fenceline by projectiles or short circuiting actions. The structure on the right only has fencing on three sides.

Site Utilities

Utility systems can suffer significant damage when subjected to the shock of an explosion. Some of these utilities may be critical for safely evacuating people from the building. Their destruction could cause damage that is disproportionate to other building damage resulting from an explosion.

Loss of a utility because access was readily available to a potential threat element is one reason for assessing site utilities to ensure physical security measures are in place to limit access to authorized personnel only.

Unit IX-A-51

Site Utilities

- Top Right – Open Gate allowing access to Critical Cooling Unit for Computer Center
- Lower Right – Exposed air conditioning systems
- Middle – antenna system for Emergency Operations Center accessible from the ground
- Lower Left – Exposed generator and natural gas regulators

Concealed or underground utilities are easier to protect than exposed or aboveground constructions.

Access to utilities should be protected or secure, allowing only authorized personnel access to perform maintenance and repair.

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

If physical security measures cannot limit access, then add sensors/CCTV to provide added protection.

The location and accessibility of site utilities directly impacts the vulnerability of systems to disruption and failure.

Incoming utility systems should have two entry points to the site for redundancy as required by criticality.

Looped versus radial distribution of utilities on site allows for higher system reliability and faster repair by avoiding utility loss by a single incident.

When selecting locations for utilities, be aware of possible conflicts and spacing requirements both horizontally and vertically. In addition there can be demand for underground zones for planting beds and foundations for hardened street furniture.

Unit IX-A-52

Site Utilities

The U.S. utility infrastructure is highly concentrated, utilizing the same rights-of-way, tunnels, underground conduits, and other service points. Examine where the utilities intersect (manholes, poles, city blocks, etc.) to find critical nodes.

Even if the utility is underground, manholes that provide access to the system should be physically secured.

Install fencing and if possible, remote monitoring capability at key electrical substations, pumping plants, and communications vaults.

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

Unit IX-A-53

Best Practices

Best practices include but are not restricted to the following:

- Appropriate design can blend security into the existing streetscape and serve as amenities for tenants and neighbors --
- Treatment of the security elements should be compatible existing elements – so that they do not look like security elements
- Perimeter barriers can be hand-in-hand with streetscape improvements and street planting
- Careful design should be paid to how bollards or fences turn the corner, intersect with driveways and gates, cross pedestrian paths and handicapped ramps

- Avoid street closure and removal of parking as the only solution of establishing stand-off distance
- Landscaping can provide visual interest and at the same time provide good stand-off

Unit IX-A-54

Best Practices

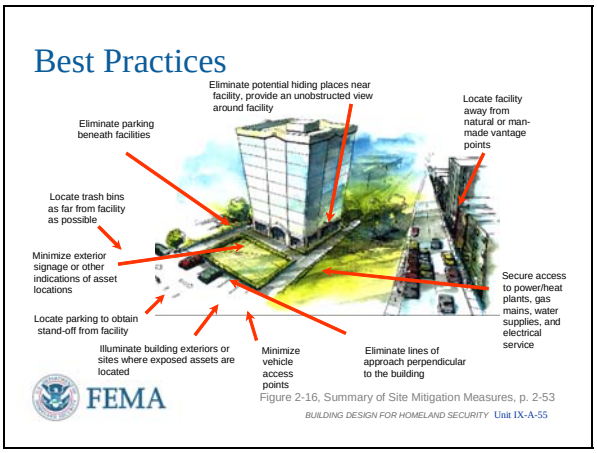
Good examples to follow and bad examples to avoid:

- Avoid introducing inappropriate security elements that will make tenants and neighbors feel more vulnerable and can detract from surrounding architecture and streetscape – jersey barrier at entrance steps – also ineffective as placed directly on pavement
- Signage and way-finding should be carefully designed to increase security
- Long expanses of bollards should be carefully designed and sited to avoid monotony – as can be seen in the lower photo
- Use perimeter barriers to define pedestrian

INSTRUCTOR NOTES | **CONTENT/ACTIVITY**

zones and increase the safety of pedestrian by separating them from vehicular traffic
- Avoid designing perimeter barriers that impair access by first responders

Unit IX-A-55



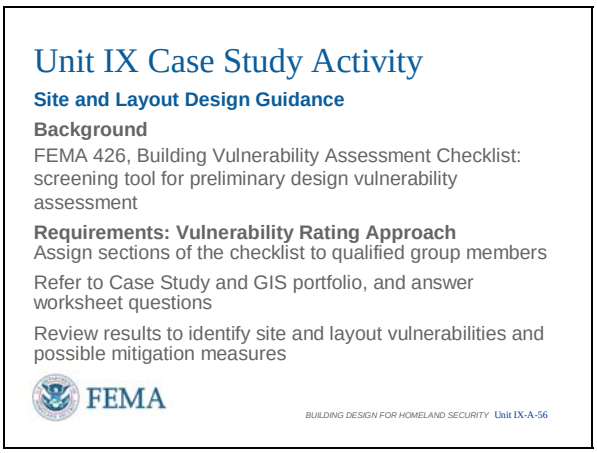
Page 2-52 of FEMA 426 provides a comprehensive list of security/protection measures that can be taken – increasing in *protection, cost, and level of effort* – that complements this graphic on Site Mitigation Measures.

Best Practices

To summarize:

- A broad spectrum of mitigation actions can be taken – with a wide range of cost, protection provided, and level of effort required by the asset owner.
- The nominal ranking of mitigation measures on Page 2-52 provides a framework for the identification of short-term and long-term measures that can be taken.
- This is a great summary slide and can be found in FEMA 426 and the Air Force Installation Force Protection Guide on your Student Reference CD.

Unit IX-A-56



Refer participants to **FEMA 426**, the Unit IX Case Study activity in the Student Manual.

Student Activity

The **Building Vulnerability Assessment Checklist in FEMA 426** can be used as a screening tool for preliminary design vulnerability assessment or for assessing an existing site. The checklist includes questions that determine if critical systems will continue to function to enhance deterrence, detection, denial, and damage limitation, and if emergency systems will function during a threat or hazard situation.

Activity Requirements

- Continue working in small groups.
- Assign sections of the checklist to the

INSTRUCTOR NOTES	CONTENT/ACTIVITY
Members of the instructor staff should be available to answer questions and assist groups as needed. There are 38 questions to answer by the team and then confer. With an average of 7 team members this means each member answers about 6 questions or about 5 minutes per question during their 30 minutes of research.	group member who is most knowledgeable and qualified to perform an assessment of the assigned area. • Refer to the Case Study to determine answers to the worksheet questions. • Then review results to identify vulnerabilities and possible mitigation measures. Take 45 minutes to complete this activity broken down as 30 minutes of research and 15 minutes of group interaction to compare information and discuss mitigation measures. Solutions will be reviewed in plenary group, taking about 15 minutes to ensure no group is drastically off track. **Transition** Unit X will cover Building Design Guidance.

UNIT IX-A -- CASE STUDY ACTIVITY: SITE AND LAYOUT DESIGN GUIDANCE (Suburban Version)

The **Building Vulnerability Assessment Checklist in FEMA 426 (Table 1-22, pages 1-46 to 1-93)** can be used as a screening tool for preliminary design vulnerability assessment of the site where the building is located and the layout of the building on that site. The checklist includes questions that determine if critical systems will continue to function to enhance deterrence, detection, denial, and damage limitation, and emergency systems function during a threat or hazard situation.

Requirements

Assign sections of the checklist to the group members who are most knowledgeable and qualified to perform an assessment of the assigned area. Refer to the Case Study to determine answers to the questions. Then review results as a team to identify vulnerabilities and possible mitigation measures.

1. Complete the following components of the **Building Vulnerability Assessment Checklist (FEMA 426, Table 1-22, pages 1-46 to 1-93)**, which address site and layout. Note: Vulnerability Questions that cannot be answered with the case study information provided have not been included in this student exercise.

2. Upon completion of these portions of the checklist, refer back to the vulnerability ratings determined in the Unit IV Case Study Activity and, based on this more detailed analysis, decide if any vulnerability rating needs adjustment. Adjust the Threat Matrix chart accordingly.

3. Select mitigation measures to reduce vulnerability and associated risk from the site and layout perspective.

4. Estimate the new risk ratings for high-risk asset-threat pairs (as adjusted in step 2 above) based on the recommended mitigation measures.

Section	Vulnerability Question	Guidance	Observations
1	**Site**		
1.1	What major structures surround the facility (site or building(s))? What critical infrastructure, government, military, or recreation facilities are	**Critical infrastructure to consider includes:** **Telecommunications infrastructure** Facilities for broadcast TV, cable TV; cellular networks; newspaper offices, production, and distribution; radio stations; satellite base stations; telephone	*There are two Critical Hazard Facilities within 2 miles of the HIC Headquarters, one to the north and the other to the southwest. In addition, there are more than a dozen Tier II HAZMAT Facilities within 3 miles of the building (in all*

Section	Vulnerability Question	Guidance	Observations
	in the local area that impact transportation, utilities, and collateral damage (attack at this facility impacting the other major structures or attack on the major structures impacting this facility)?	trunking and switching stations, including critical cable routes and major rights-of-way **Electric power systems** Power plants, especially nuclear facilities; transmission and distribution system components; fuel distribution, delivery, and storage **Gas and oil facilities** Hazardous material facilities, oil/gas pipelines, and storage facilities **Banking and finance institutions** Financial institutions (banks, credit unions) and the business district; note schedule business/financial district may follow; armored car services **Transportation networks** Airports: carriers, flight paths, and airport layout; location of air traffic control towers, runways, passenger terminals, and parking areas Bus Stations Pipelines: oil; gas Trains/Subways: rails and lines, railheads/rail yards, interchanges, tunnels, and cargo/passenger terminals; note hazardous material transported Traffic: interstate highways/roads/tunnels/ bridges carrying large volumes; points of congestion; note time of day and day of week Trucking: hazardous materials cargo loading/unloading facilities; truck terminals, weigh stations, and rest areas Waterways: dams; levees; berths and ports for cruise ships, ferries, roll-on/roll-off cargo vessels, and container ships; international (foreign) flagged vessels (and cargo) **Water supply systems** Pipelines and process/treatment facilities, dams for water collection; wastewater treatment **Government services** Federal/state/local government	*directions).* *A major interstate highway is located within ¼ mile of the HIC Headquarters.* *CSX Transportation and Norfolk-Southern Railway maintain a transportation corridor about ½ mile from HIC. There appear to be no restrictions on the material carried along these rail lines.* *A leg of the Piedmont Petroleum Pipeline (PPP) runs underneath the office park in the vicinity of HIC Headquarters. Part of Piedmont's regional network, this portion of the pipeline normally carries a variety of refined products, including commercial and military jet fuels, diesel and three grades of gasoline, home heating fuels, etc. Four buried pipes carry approximately 20 million gallons per day.* *Connected to the pipeline, less than 1 mile from HIC, is a 20-million gallon capacity fuel farm. Operated by the Shellexxico Company, this tank farm stores a variety of petroleum products, primarily gasoline.* *Two airports are in the vicinity of HIC. One is a major international airport approximately 8 miles away. The other is a small, but busy general aviation airport approximately 2 miles away.*

Section	Vulnerability Question	Guidance	Observations
		offices – post offices, law enforcement stations, fire/rescue, town/city hall, local mayor's/governor's residences, judicial offices and courts, military installations (include type-active, Reserves, National Guard) **Emergency services** Backup facilities, communications centers, Emergency Operations Centers (EOCs), fire/Emergency Medical Service (EMS) facilities, Emergency Medical Centers (EMCs), law enforcement facilities **The following are not critical infrastructure, but have collateral damage potential to consider:** **Agricultural facilities**: chemical distribution, storage, and application sites; crop spraying services; farms and ranches; food processing, storage, and distribution facilities **Commercial/manufacturing/industrial facilities:** apartment buildings; business/corporate centers; chemical plants (especially those with Section 302 Extremely Hazardous Substances); factories; fuel production, distribution, and storage facilities; hotels and convention centers; industrial plants; raw material production, distribution, and storage facilities; research facilities and laboratories; shipping, warehousing, transfer, and logistical centers **Events and attractions**: festivals and celebrations; open-air markets; parades; rallies, demonstrations, and marches; religious services; scenic tours; theme parks **Health care system components**: family planning clinics; health department offices; hospitals; radiological material and medical	

Section	Vulnerability Question	Guidance	Observations
		waste transportation, storage, and disposal; research facilities and laboratories, walk-in clinics **Political or symbolically significant sites**: embassies, consulates, landmarks, monuments, political party and special interest groups offices, religious sites **Public/private institutions**: academic institutions, cultural centers, libraries, museums, research facilities and laboratories, schools **Recreation facilities**: auditoriums, casinos, concert halls and pavilions, parks, restaurants and clubs (frequented by potential target populations), sports arenas, stadiums, theaters, malls, and special interest group facilities; note congestion dates and times for shopping centers References: *FEMA 386-7*, *FEMA SLG 101*, *DOJ NCJ181200*	
1.2	Does the terrain place the building in a depression or low area?	Depressions or low areas can trap heavy vapors, inhibit natural decontamination by prevailing winds, and reduce the effectiveness of in-place sheltering. Reference: *USAF Installation Force Protection Guide*	Based on terrain elevation data, the ground level of the tank farm is 49 feet higher than the ground level at HIC. Only some of the fuel tanks are bermed, but leaking fuel is not likely to reach HIC's office park. The interstate highway between the two is 16 feet lower than the tank farm and slightly lower than the office park. The rear parking area behind HIC slopes steeply away from the building to a stream which allows winds to pass over the structure unhindered. Thus, HIC is not in a depression or low area.

Section	Vulnerability Question	Guidance	Observations
1.3	In dense, urban areas, does curb lane parking place uncontrolled parked vehicles unacceptably close to a building in public rights-of-way?	Where distance from the building to the nearest curb provides insufficient setback, restrict parking in the curb lane. For typical city streets, this may require negotiating to close the curb lane. Setback is common terminology for the distance between a building and its associated roadway or parking. It is analogous to stand-off between a vehicle bomb and the building. The benefit per foot of increased stand-off between a potential vehicle bomb and a building is very high when close to a building and decreases rapidly as the distance increases. Note that the July 1, 1994, Americans with Disabilities Act Standards for Accessible Design states that required handicapped parking shall be located on the shortest accessible route of travel from adjacent parking to an accessible entrance. Reference: *GSA PBS-P100*	With a loading dock on the west side, it is possible for vehicles to park right next to the building. Normal parking for employees is in front; the closest parking slot is 44 feet from the front door.
1.4	Is a perimeter fence or other types of barrier controls in place?	The intent is to channel pedestrian traffic onto a site with multiple buildings through known access control points. For a single building, the intent is to have a single visitor entrance. Reference: *GSA PBS-P100*	There is no fence or other type of barrier on the site's perimeter. The only fence is a short 4-foot high fence for life safety to keep anyone from falling down the steep embankment in the rear of the building.
1.5	What are the site access points to the site or building?	The goal is to have at least two access points – one for passenger vehicles and one for delivery trucks due to the different procedures needed for each. Having two access points also helps if one of the access points becomes unusable, then traffic can be routed through the other access point. Reference: *USAF Installation Force Protection Guide*	There are three vehicle access points into the parking lot spread along the main road. Access to the HIC building includes the loading dock on the west side (rear) of the building and front entrance with an 8-foot overhang. There are three exits from the mezzanine and four additional exits from the building.

Section	Vulnerability Question	Guidance	Observations
1.6	Is vehicle traffic separated from pedestrian traffic on the site?	Pedestrian access should not be endangered by car traffic. Pedestrian access, especially from public transportation, should not cross vehicle traffic if possible. References: *GSA PBS-P100 and FEMA 386-7*	Sidewalks at the front of the building allow access to the site without pedestrian/ vehicle interface. However, pedestrians must negotiate the parking lot to access the sidewalk.
1.7	Is there vehicle and pedestrian access control at the perimeter of the site?	Vehicle and pedestrian access control and inspection should occur as far from facilities as possible (preferably at the site perimeter) with the ability to regulate the flow of people and vehicles one at a time. Control on-site parking with identification checks, security personnel, and access control systems. Reference: *FEMA 386-7*	There is no access control to the site; however, security personnel monitor parking areas, and rear parking areas are well lit and monitored by CCTV cameras. Front parking areas are lit only. Area proximity card prevent access to HIC building by unauthorized personnel.
1.8	Is there space for inspection at the curb line or outside the protected perimeter? What is the minimum distance from the inspection location to the building?	Design features for the vehicular inspection point include: vehicle arrest devices that prevent vehicles from leaving the vehicular inspection area and prevent tailgating. If screening space cannot be provided, consider other design features such as: hardening and alternative location for vehicle search/ inspection. Reference: *GSA PBS-P100*	The building has no protected perimeter; however, there is adequate space for an inspection area at the southern-most parking lot access. This area is 125 feet away from the nearest building and 500 feet away from HIC. The added advantage of this location is that the vehicle inspections are adjacent to an embankment and the building is on top of the embankment. The embankment catches fragmentation and blast is directed upward. If this area is used to search visitor vehicles, then once access is given, the visitor must drive all the way around the office park to get access to the front parking lot.

Section	Vulnerability Question	Guidance	Observations
1.13	Does site circulation prevent high-speed approaches by vehicles?	The intent is to use site circulation to minimize vehicle speeds and eliminate direct approaches to structures. Reference: *GSA PBS-P100*	No, entering at the center access point from the main road, turning left, and then turning right to proceed in front of the southern-most building, a car could easily reach 75 mph when striking the HIC building.
1.14	Are there offsetting vehicle entrances from the direction of a vehicle's approach to force a reduction of speed?	Single or double 90-degree turns effectively reduce vehicle approach speed. Reference: *GSA PBS-P100*	There are three long straightaways approaching the building, with only one straight enough to achieve a high speed approach to the HIC building. Using speed bumps, especially angled speed bumps would be one way to reduce speed. Using barriers to direct traffic so there is no long straightaway is another approach, but an "S" route entrance may be frustrating for visitors, but would significantly reduce the maximum speed capability of any vehicle approach to the buildings. As a minimum, closing off the last openings near each building should be considered as a minimum.
1.15	Is there a minimum setback distance between the building and parked vehicles?	Adjacent public parking should be directed to more distant or better-protected areas, segregated from employee parking and away from the building. Some publications use the term setback in lieu of the term stand-off. Reference: *GSA PBS-P100*	It is possible for vehicles to park right next to the building near the loading dock. Normal parking for employees is in front; the closest parking slot is 44 feet from the building.
1.16	Does adjacent surface parking on site maintain a minimum stand-off distance?	The specific stand-off distance needed is based upon the design basis threat bomb size and the building construction. For initial screening, consider using 25 meters (82 feet) as a minimum with more distance needed for unreinforced masonry or wooden walls.	Adjacent parking is that parking associated with the next building or site that is not under the control of the owners of the building being assessed. There is no adjacent parking per se as it is one office park,

Section	Vulnerability Question	Guidance	Observations
		Reference: *GSA PBS-P100*	but there is one parking lot or area that any tenant or visitor to the office park can use. Stand-off distance to the front parking lot is less than 82 feet. Cars or trucks can drive up to the loading dock in the rear.
1.17	Do standalone, aboveground parking garages provide adequate visibility across as well as into and out of the parking garage?	Pedestrian paths should be planned to concentrate activity to the extent possible. Limiting vehicular entry/exits to a minimum number of locations is beneficial. Stair tower and elevator lobby design shall be as open as code permits. Stair and/or elevator waiting areas should be as open to the exterior and/or the parking areas as possible and well lighted. Impact-resistant, laminated glass for stair towers and elevators is a way to provide visual openness. Potential hiding places below stairs should be closed off; nooks and crannies should be avoided, and dead-end parking areas should be eliminated. Reference: *GSA PBS-P100*	No aboveground parking garages exist on site. However the open, ground-level parking provides adequate visibility across the lot.
1.19	Do site landscaping and street furniture provide hiding places?	Minimize concealment opportunities by keeping landscape plantings (hedges, shrubbery, and large plants with heavy ground cover) and street furniture (bus shelters, benches, trash receptacles, mailboxes, newspaper vending machines) away from the building to permit observation of intruders and prevent hiding of packages. If mail or express boxes are used, the size of the openings should be restricted to prohibit the insertion of packages. Reference: *GSA PBS-P100*	There is no street furniture shown for this building. The landscaping shown is grass and trees are mature/tall enough so that a package cannot be hidden at the base. The hedge along the building drip line may conceal a package, if allowed to get taller or denser. There is no mail or express box and there is no slot in the glass main entrance door. Due to the size of the building columns, a package

Section	Vulnerability Question	Guidance	Observations
			could be overlooked.
1.20	Is the site lighting adequate from a security perspective in roadway access and parking areas?	Security protection can be successfully addressed through adequate lighting. The type and design of lighting, including illumination levels, is critical. Illuminating Engineering Society of North America (IESNA) guidelines can be used. The site lighting should be coordinated with the CCTV system. Reference: *GSA PBS-P100*	Both rear and front parking areas are well lit. Rear areas are also monitored by CCTV cameras.
1.21	Are line-of-sight perspectives from outside the secured boundary to the building and on the property along pedestrian and vehicle routes integrated with landscaping and green space?	The goal is to prevent the observation of critical assets by persons outside the secure boundary of the site. For individual buildings in an urban environment, this could mean appropriate window treatments or no windows for portions of the building. Once on the site, the concern is to ensure observation by a general workforce aware of any pedestrians and vehicles outside normal circulation routes or attempting to approach the building unobserved. Reference: *USAF Installation Force Protection Guide*	No, lines of sight are not integrated with landscaping and green space. There are clear, approximately 300-foot, lines of sight in all directions from off the office park to buildings in this office park.
1.22	Do signs provide control of vehicles and people?	The signage should be simple and have the necessary level of clarity. However, signs that identify sensitive areas should generally not be provided. Reference: *GSA PBS-P100*	There are no parking lot signs.
1.23	Are all existing fire hydrants on the site accessible?	Just as vehicle access points to the site must be able to transit emergency vehicles, so too must the emergency vehicles have access to the buildings and, in the case of fire trucks, the fire hydrants. Thus, security considerations must accommodate emergency	Yes, fire hydrants in the office park are accessible and the hydrant nearest to HIC is 200 feet away.

Section	Vulnerability Question	Guidance	Observations
		response requirements. Reference: *GSA PBS-P100*	
2	**Architectural**		
2.1	Does the site and architectural design incorporate strategies from a Crime Prevention Through Environmental Design (CPTED) perspective?	**The focus of CPTED is on creating defensible space by employing:** **1. Natural access controls:** - Design streets, sidewalks, and building entrances to clearly indicate public routes and direct people away from private/restricted areas - Discourage access to private areas with structural elements and limit access (no cut-through streets) - Loading zones should be separate from public parking **2. Natural surveillance:** - Design that maximizes visibility of people, parking areas, and building entrances: doors and windows that look out on to streets and parking areas - Shrubbery under 2 feet in height for visibility - Lower branches of existing trees kept at least 10 feet off the ground - Pedestrian-friendly sidewalks and streets to control pedestrian and vehicle circulation - Adequate nighttime lighting, especially at exterior doorways **3. Territorial reinforcement:** - Design that defines property lines - Design that distinguishes private/restricted spaces from public spaces using separation, landscape plantings; pavement designs (pathway and roadway placement); gateway treatments at lobbies, corridors, and door placement; walls, barriers, signage, lighting, and “CPTED" fences - “Traffic-calming” devices for vehicle speed control **4. Target hardening:**	Site design has some features of Crime Prevention Through Environmental Design strategies. The site clearly directs visitors to the front of the building and to clearly marked entrances. Loading areas are separate from public parking. Natural surveillance is maximized towards the building front with many occupied windows having a clear view of the central parking lot. There is adequate lighting at night in front and back parking areas. There is electronic access control to gain entrance to buildings in the office park. Where people cannot observe from windows, CCTV cameras provide coverage.

Section	Vulnerability Question	Guidance	Observations
		- Prohibit entry or access: window locks, dead bolts for doors, interior door hinges - Access control (building and employee/visitor parking) and intrusion detection systems **5. Closed circuit television cameras:** - Prevent crime and influence positive behavior, while enhancing the intended uses of space. In other words, design that eliminates or reduces criminal behavior and at the same time encourages people to "keep an eye out" for each other. References: *GSA PBS-P100 and FEMA 386-7*	
2.2	Is it a mixed-tenant building?	Separate high-risk tenants from low-risk tenants and from publicly accessible areas. Mixed uses may be accommodated through such means as separating entryways, controlling access, and hardening shared partitions, as well as through special security operational countermeasures. Reference: *GSA PBS-P100*	The building is a multiple-tenant facility and there are multiple buildings in the office park with multiple tenants. HIC has neighbors on one side in its building and a different neighbor in the adjacent building.
2.3	Are pedestrian paths planned to concentrate activity to aid in detection?	Site planning and landscape design can provide natural surveillance by concentrating pedestrian activity, limiting entrances/exits, and eliminating concealment opportunities. Also, prevent pedestrian access to parking areas other than via established entrances. Reference: *GSA PBS-P100*	Each tenant facility has its own entrance, spreading pedestrian activity across the front of the buildings within easy observation of each entrance to aid in detection. Loading docks are likewise spread out across the rear of the buildings. HIC uses a CCTV camera on the building rear to aid in detection of personnel approaching the rear entrance.
2.4	Are there trash receptacles and mailboxes in close proximity to the building	The size of the trash receptacles and mailbox openings should be restricted to prohibit insertion of packages. Street furniture, such as newspaper vending machines,	There is no indication that there are trash receptacles and mailboxes in close proximity to the building.

Section	Vulnerability Question	Guidance	Observations
	that can be used to hide explosive devices?	should be kept sufficient distance (10 meters or 33 feet) from the building, or brought inside to a secure area. References: *USAF Installation Force Protection Guide and DoD UCF 4-010-01*	The dumpster is approximately 50 feet from the rear of the building.
5	**Utility Systems**		
5.1	What is the source of domestic water? (utility, municipal, wells, lake, river, storage tank) Is there a secure alternate drinking water supply?	Domestic water is critical for continued building operation. Although bottled water can satisfy requirements for drinking water and minimal sanitation, domestic water meets many other needs – flushing toilets, building heating and cooling system operation, cooling of emergency generators, humidification, etc. Reference: *FEMA 386-7*	The water to the fire protection system within the building and the fire hydrants in the office park comes from the local municipal distribution mains which is also the source for all water uses in the building – rest rooms, kitchen/break room, HVAC equipment, etc. There is only one water supply line to the HIC building. Per request from employees, four bottled water dispensers are throughout the building, with an average of 2 water bottles (5 gallons each) in reserve at any given time for each dispenser.
5.4	Does the building or site have storage capacity for domestic water? How many gallons of storage capacity are available and how long will it allow operations to continue?	Operational facilities will require reliance on adequate domestic water supply. Storage capacity can meet short-term needs and use water trucks to replenish for extended outages. Reference: *Physical Security Assessment for Department of Veterans Affairs Facilities.*	The building currently stores drinking water as delivered in 5-gallon bottles. The site has the capacity to have 80 gallons on hand at the time of delivery. The bottled water supply would last for a few days to one week for drinking purposes only. There are no storage tanks for servicing other water uses in the HIC building.
5.5	What is the source of water for the fire suppression system? (local utility company lines, storage tanks with	The fire suppression system water may be supplied from the domestic water or it may have a separate source, separate storage, or nonpotable alternate sources.	The only water source for fire suppression is the municipal water mains serving the office park.

Section	Vulnerability Question	Guidance	Observations
	utility company backup, lake, or river) Are there alternate water supplies for fire suppression?	For a site with multiple buildings, the concern is that the supply should be adequate to fight the worst case situation according to the fire codes. Recent major construction may change that requirement. Reference: *FEMA 386-7*	
5.6	Is the fire suppression system adequate, code-compliant, and protected (secure location)?	Standpipes, water supply control valves, and other system components should be secure or supervised. Reference: *FEMA 386-7*	Yes, the fire suppression system is adequate and meets all fire codes.
5.10	What fuel supplies do the building rely upon for critical operation?	Typically, natural gas, propane, or fuel oil is required for continued operation. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	Heating for the HIC building is provided by a combination of natural gas and electricity. Backup electric generators use diesel fuel.
5.11	How much fuel is stored on the site or at the building and how long can this quantity support critical operations? How is it stored? How is it secured?	Fuel storage protection is essential for continued operation. Main fuel storage should be located away from loading docks, entrances, and parking. Access should be restricted and protected (e.g., locks on caps and seals). References: *GSA PBS-P100 and Physical Security Assessment for the Department of Veterans Affairs Facilities*	Emergency power is provided by a single diesel generator, located in a shed in the rear parking lot. The generator has a 50-gallon day tank, maintained at 80 percent capacity. A 2,000-gallon main tank is buried under the parking lot, near the generator. There are no security measures for the fuel.
5.12	Where is the fuel supply obtained? How is it delivered?	The supply of fuel is dependent on the reliability of the supplier. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	Natural gas enters the building through two meters under the loading dock staircase and is supplied from the local gas distribution company. Electric power for the HIC office is provided by Hazardville Electric Power Company through two transformers outside the building. Two sets of buried transmission lines deliver

Section	Vulnerability Question	Guidance	Observations
			12,470 volt (12.47KV) power to two separate transformers outside the building from a nearby substation. Diesel fuel is delivered by truck from a local supplier, who normally responds the day after being called.
5.13	Are there alternate sources of fuel? Can alternate fuels be used?	Critical functions may be served by alternate methods if normal fuel supply is interrupted. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	The single electric generator powered by diesel fuel is the only alternate long-term fuel supply to electricity. However, batteries to support the UPS (Uninterruptible Power Supply) are in a small room next to the UPS room. The UPS provides enough electric power for an orderly shutdown of the computer.
5.14	What is the normal source of electrical service for the site or building?	Utilities are the general source unless co-generation or a private energy provider is available. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	Main power for the HIC office is provided by Hazardville Electric Power Company through two transformers outside the building. Two sets of buried transmission lines deliver 12,470 volt (12.47KV) power to the transformers (one set to each) from a nearby substation.
5.15	Is there a redundant electrical service source? Can the site or buildings be fed from more than one utility substation?	The utility may have only one source of power from a single substation. There may be only single feeders from the main substation. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	Each transformer with its respective feeder can handle the complete electrical load of HIC. However, both feeders come from the same substation.
5.16	How many service entry points does the site or building have for electricity?	Electrical supply at one location creates a vulnerable situation unless an alternate source is available. Ensure disconnecting requirements according to NFPA 70 (National Fire Protection	There are two service entrance points for electricity, one feeding the Computer Center Bus and the other feeding the Support Bus as shown in Figure 19 of Appendix A.

Section	Vulnerability Question	Guidance	Observations
		Association, National Electric Code) are met for multiple service entrances. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
5.17	Is the incoming electric service to the building secure?	Typically, the service entrance is a locked room, inaccessible to the public. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	The electric service entrance comes into the Mechanical and Electrical Room from underground. The room is inside a secured facility and the room has a keyed lock to limit access to authorized personnel.
5.18	What provisions for emergency power exist? What systems receive emergency power and have capacity requirements been tested? Is the emergency power collocated with the commercial electric service? Is there an exterior connection for emergency power?	Besides installed generators to supply emergency power, portable generators or rental generators available under emergency contract can be quickly connected to a building with an exterior quick disconnect already installed. Testing under actual loading and operational conditions ensures the critical systems requiring emergency power receive it with a high assurance of reliability. Reference: *GSA PBS-P100*	Emergency power is provided by a single diesel generator with a maximum capacity of 1250 KW/1563 KVA. This generator is large enough to take the complete load of the building. The backup diesel generator has never had to support HIC's power demands for longer than about 2 hours, and never with more than one chiller operating. It has never been tested for an extended period under a heavy load. The diesel generator is configured to automatically start upon loss of commercial power to the Computer Center Bus (CCB). This happens about twice a year due to electrical storms or utility maintenance in the neighborhood. Batteries to support the UPS were tested 2 years ago and calculated to provide 60 minutes of power for orderly shutdown of the Computer Center. At 319 GPH at 1250 KW loading, the backup generator consumes 0.255 gallons per

Section	Vulnerability Question	Guidance	Observations
			hour per KW. This is NOT a very efficient generator as 0.07 gallons per hour per KW is a DoD design minimum. This generator with a 2,000 gallon tank will carry the maximum load for a little over 6 hours, which would require frequent refilling for an extended outage. The generator is outside the HIC building, but the Automatic Transfer Switch and commercial power service entrances are collocated in the Mechanical and Electrical Room. There is no exterior connection for electric power (like a fire pumper Siamese connection). A backup generator to the backup would either have to be wired to the Automatic Transfer Switch or spliced into the cables leaving the installed generator.
5.19	By what means do the main telephone and data communications interface the site or building?	Typically communication ducts or other conduits are available. Overhead service is more identifiable and vulnerable. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	HIC has two T1 lines and one T3 line connected at the demark to ATT's high performance backbone network. The ATT fiber connectivity provides more than enough bandwidth for HIC's current needs and planned future expansion. The demark is in the Comm Center on the opposite side of the building from the Mechanical and Electrical Room. As with all other utilities, the telephone and data service is underground.

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5.21	Does the fire alarm system require communication with external sources? By what method is the alarm signal sent to the responding agency: telephone, radio, etc.? Is there an intermediary alarm monitoring center?	Typically, the local fire department responds to an alarm that sounds at the station or is transmitted over phone lines by an auto dialer. An intermediary control center for fire, security, and/or building system alarms may receive the initial notification at an on-site or off-site location. This center may then determine the necessary response and inform the responding agency. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	The Security Officer has a key to the building that has the main fire panel. The main fire panel is located in the lobby area, which is open to unrestricted access during normal business hours. In the event of a fire, the panel alerts the local fire department and the security company using dedicated telephone lines. There is no intermediary alarm monitoring center, but the security company acts as a backup to ensure the fire department is alerted.
5.22	Are utility lifelines aboveground, underground, or direct buried?	Utility lifelines (water, power, communications, etc.) can be protected by concealing, burying, or encasing. Reference: *GSA PBS-P100 and FEMA 386-7*	Utility lines are buried at this location.

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