BUILDING DESIGN FOR HOMELAND SECURITY
RESIDENT COURSE

STUDENT MANUAL

Emmitsburg MD
Month Year

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NATIONAL EMERGENCY TRAINING CENTER
EMERGENCY MANAGEMENT INSTITUTE

CLASS SCHEDULE

COURSE CODE: E155
BUILDING DESIGN FOR HOMELAND SECURITY
July 18–21, 2006

Course Manager	Place
Dawn Warehime	Building M, Room 202

Tuesday, July 18, 2006

8:30 a.m.	Welcome and Administrative Announcements	Dawn Warehime Training Specialist Mitigation Section Emergency Management Institute Emmitsburg, MD
	Unit 1-B: Introduction and Course Overview	Eric Letvin, P.E., Esq., CFM Principal Engineer URS Corporation Linthicum, MD
10:15	Break	
10:30	**Unit 2-B:** Asset Value Assessment	Wesley Lyon, PMP Senior Engineer Raytheon UTD Springfield, VA
11:45	Lunch	
12:45 p.m.	**Unit 3-B:** Threat and Hazard Assessment	Wesley Lyon
2:00	Break	
2:15	**Unit 4-B:** Vulnerability Assessment	Michael Kaminskas, P.E., BSCP Senior Engineer Raytheon UTD Springfield, VA

Tuesday, July 18, 2006 (Continued)

3:30 p.m.	Break	
3:45	Unit 4-B (Continued)	Michael Kaminskas
4:15	**Unit 5-B:** Risk Assessment and Risk Management	Eric Letvin
5:00	Adjourn	

Wednesday, July 19, 2006

8:30 a.m.	**Unit 6:** FEMA 452 Risk Assessment Database	Michael Kaminskas
9:45	Break	
10:00	**Unit 7:** Explosive Blast	Michael Kaminskas
11:15	**Unit 8-B:** Chemical, Biological, and Radiological (CBR) Measures	Wesley Lyon
12:30 p.m.	Lunch	
1:30	Written Exam	Eric Letvin Michael Kaminskas
2:00	Written Exam Review	Eric Letvin Michael Kaminskas
2:30	**Unit 9-B:** Site and Layout Design Guidance	Eric Letvin
3:45	Break	
4:00	Unit 9-B (Continued)	Eric Letvin
5:00	Adjourn	

Thursday, July 20, 2006

8:30 a.m.	**Unit 10-B:** Building Design Guidance	Michael Kaminskas
9:45	Break	
10:00	Unit 10-B (Continued)	Michael Kaminskas
11:30	Lunch	
12:30 p.m.	**Unit 11-B:** Electronic Security Systems	Wesley Lyon
1:15	Break	
1:30	**Unit 12-B:** Finalization of Case Study Results (Goal: Brief building owner on prioritized recommendations and justifications for security work.)	Michael Kaminskas
2:15	Break	
2:30	**Unit 12-B:** Presentation of Group Case Study Results and Discussion (10-minute presentation and 5-minute discussion per team)	Michael Kaminskas
4:00	**Unit 13:** Course Summary, Evaluation, and Graduation	Dawn Warehime
5:00	Course Adjourns	
5:30	Class Picnic	Log Cabin

Friday, July 21, 2006

9:30 a.m.	Buses Depart	Building C

Unit I-B

COURSE TITLE	Building Design for Homeland Security
UNIT TITLE	Introduction and Course Overview
OBJECTIVES	1. Describe the goal, objectives, and agenda for the course 2. Describe and find material in the course reference manual and student activity handout
SCOPE	The following topics will be covered in this unit: 1. Welcome and Opening Remarks 2. Instructor Introductions 3. Administrative Information 4. Student Introductions 5. Course Overview 6. Course Materials 7. Activity: Continue familiarization with Appendix B Urban Case Study materials
REFERENCES	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. Case Study – Appendix B: Urban, HazardCorp Building

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UNIT I-B CASE STUDY ACTIVITY:
CASE STUDY OVERVIEW
HAZARDCORP BUILDING
(Urban Version)

Requirements

Turn to Appendix B Case Study, and briefly peruse the document. Read the "familiarization" questions on the following worksheet and, as a group, complete the worksheet. Use only the Case Study data to answer worksheet questions. Information has been limited in an effort to focus the activity.

Students should read the case study before attending a course offering, but if not, we recommend reading it as soon as possible on the first day of class. During the first day of class students realize that the general reading is a good start, but assessment requires a more in depth analysis of content and functional and spatial inter-relationships to complete the student activities.

The answer to the first question is filled-in as an example.

Question	Answer	Page Number in Case Study
1. What are the major transportation modes in the surrounding area?	There is significant water access within 5-miles of the building and because of the water, ground access is constrained by bridges, tunnels, and ferries. While two major airports are over 5 miles from the building, what is not shown are 8 heliports and two skyports inside 5-miles of the building. A metropolitan subway also serves the business district and the nearest station is two blocks from the building. There is significant shipping serving the various ports carrying all types of materials for use in Hazard City and transshipment to other locations. In conjunction with the ports and the transshipment of goods, there is extensive railroad trackage, some as close as within 1-1/2 miles of the building. The area around Hazard City is the No. 4 intermodal port in the Western Hemisphere. Intermodal means the ability to move freight from ship to train to truck and back again.	B-2, B-3, B-14, B-26

Question	Answer	Page Number in Case Study
	While the HazardCorp Building is not located on a main thoroughfare, a random estimate of truck traffic within 1,000 feet of the building indicates 30 delivery trucks (18-foot-long enclosed bodies) transit the area per hour and a similar number of smaller delivery vans between 0600 and 1800. These numbers reduce to about 10 delivery trucks and 10 delivery vans on average per hour between 1800 and 0600. More than 2,000 trucks loads of hazardous materials are transported each day within city limits. HazardCorp receives mail, packages, and equipment at the Loading Dock where a recently renovated (per DoD criteria) mailroom/shipping office inspects the items using x-ray and other equipment before distributing to tenants within the building. By agreement, HazardCorp Building accepts deliveries for specific tenants in other buildings in the immediate vicinity (within 2 city blocks) due to this mailroom capability.	

Question	Answer	Page Number in Case Study
2. What life safety/ emergency response assets are available, and what are their response times?		B-9, B-18 - B-20, B-22 - B-24, B-26
3. What threats or hazards may affect HazardCorp Building?		B-8, B-26 - B-28

Question	Answer	Page Number in Case Study
4. What are the prevalent weather/wind conditions at HazardCorp Building?		B-8 – B-9, B-26
5. What are the components of HazardCorp Building's critical utility infrastructure?		B-10, B18 - B-25

Question	Answer	Page Number in Case Study
6. What are the components of HazardCorp's critical building infrastructure?		B-3, B-4, B-11, B-18
7. What personnel are key to the operation of HazardCorp Building?		No specific page – think globally of who in Building Management does what for tenants in general.

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Unit II-B

COURSE TITLE	Building Design for Homeland Security
UNIT TITLE	Asset Value Assessment
OBJECTIVES	1. Identify the assets of a building or site that can be affected by a threat or hazard 2. Explain the components used to determine the value of an asset 3. Determine the critical assets of a building or site 4. Provide a numerical rating for the asset and justify the basis for the rating
SCOPE	The following topics will be covered in this unit: 1. The core functions and critical infrastructure listed on the threat-vulnerability matrix 2. Various approaches to determine asset value – FEMA, Department of Defense, Department of Justice, and Veterans Affairs 3. A rating scale and how to use it to determine an asset value 4. Activity: Identify the assets to consider in the Appendix B Urban Case Study and determine the asset value for each asset of interest
REFERENCES	1. FEMA 426, *Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings*, pages 1-10 to 1-14 2. FEMA 452, *Risk Assessment - A How-To Guide to Mitigate Potential Terrorist Attacks Against Buildings*, pages 2-1 to 2-23 3. Case Study – Appendix B: Urban, HazardCorp Building

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UNIT II-B CASE STUDY ACTIVITY: ASSET VALUE RATING (Urban Version)

Asset value is the degree of debilitating impact that would be caused by the incapacity or destruction of a building's assets. **Page 1-13 of FEMA 426** provides an Asset Value Scale **(Table 1-1)** to quantify asset value, as well as definitions of the ratings. **Table 1-2 on page 1-14 of FEMA 426** provides a format to summarize the value of the major categories of a building's assets. **FEMA 452, pages 2-17 to 2-19** provide additional information.

Requirements

Refer to the Appendix B Case Study to determine answers to the following questions:

The first question is answered below as an **example.**

Identifying Building Core Functions

1. What are HazardCorp (HZC) Building's primary services or outputs associated with its providing office rental space? [Pages B-3, B-10]

   Building Management provides security (access control and physical), coordination of emergency actions, operation and maintenance of emergency response / life safety systems, underground parking, loading dock security and coordination for supply trucks, vendors, and trash supporting the tenants. Inspection of mail, packages, and equipment using x-ray and other equipment before distributing to tenants within the building and to other agencies within 2 blocks is also a primary service. Utilities, along with emergency backups; and vertical transportation (elevators and stairs) needed for general and specific tenant support.

2. What critical / functions activities take place at HZC to support the goals of the building management and goals of the building tenants? [Pages B-18 to B-26]

3. Who are the building's primary occupants and visitors? [Pages B-1, B-12]

4. What inputs from external organizations are required for HZC's success? [Pages B-18 to B-26]

Identifying Building Assets and Quantifying Asset Values

Use the following process to complete the following tables -- HZC Critical Functions Asset Value Rating and HZC Critical Infrastructure Asset Value Rating

1. Refer to **Table 1-1 in FEMA 426** and the associated value descriptions for the ratings listed below
   - Very High (10)
   - High (8-9)
   - Medium High (7)
   - Medium (5-6)
   - Medium Low (4)
   - Low (2-3)
   - Very Low (1)

2. Consider the questions on **page 1-11 in FEMA 426** and as you rate HZC's assets.

3. Refer to **Table 1-2 in FEMA 426, Nominal Building Asset Value Assessment** and use the descriptions of these asset categories as found in the Appendix B Case Study to focus the rating. Another approach is to use an asset value rating of 5 (mid-range) and do a pair-wise comparison to each asset category as the process continues, raising or lowering the rating from 5 as the team compares asset value inputs collected from the Appendix B Case Study.

NOTE 1: The first rows in both tables are completed as **examples**. Nominal ratings are provided in all other asset categories. Confirm the team's Value and Numeric Value rating for each category and provide Rationale for each rating. Enter information on the following worksheets and on the Risk Matrix poster.

NOTE 2: Consult **Table 1-22, pages 1-46 to 1-92, in FEMA 426.** Look at the content of the questions to understand the various infrastructure asset categories. For example, Utility Systems apply to all utilities outside the 3-foot drip line of the building (from the source to the building, but primarily on the site), while Mechanical, Plumbing, Gas, Electrical, Fire Alarm, Communications, and Information Technology Systems are inside the 3-foot drip line of the building.

HZC Critical Functions Asset Value Rating

Asset	Value	Numeric Value	Rationale
1. Administration	Medium High	7	While there may be some redundancy and staff skills that can be easily replaced, the Building Management administration keeps the building humming and loss of some or all administration staff would have serious consequences or impair core processes and functions for an extended period of time. Low to medium economic cost to replace, depending upon individual function.
2. Engineering / IT Technicians	High	8	Due to the complexity of building operations, including computer systems for Supervisory Control and Data Acquisition, Electronic Security Systems (CCTV and access control), Energy Management and Control Systems, etc., the loss of this function in whole or in part can result in severe loss of primary services or major loss of core processes and functions for an extended period of time. Interim workarounds include manufacturer's / technical service firms for each individual system. Moderately

Asset	Value	Numeric Value	Rationale
			high economic cost to replace based upon skill sets sought.
2. Loading Dock / Warehouse	Medium	5	
3. Data Center	High	8	
4. Communications	High	8	

Asset	Value	Numeric Value	Rationale
5. Security	Medium Low	4	
6. Housekeeping	Low	2	

HZC Critical Infrastructure Asset Rating

Asset	Value	Numeric Value	Rationale
1. Site	Medium	5	Building owner has a large investment in the building and site. Loss of access to site by Building Management, but more so tenants, would have rippling economic impact. Because only parking and some fuel storage is underground, and site is relatively small, the building and its functions will have moderate to serious consequences and impairment of core functions and processes supporting the tenants.
2. Architectural	Medium High	7	Locations of functions within the building and their proximity to high risk areas, like the lobby, loading dock, and streets place a high value on where functions are placed in the building and how they can be protected. Architectural placement has serious consequences and impact upon core processes and functions over an extended period of time.

Asset	Value	Numeric Value	Rationale
3. Structural Systems	High	8	
4. Envelope Systems	Medium High	7	
5. Utility Systems	High	8	

Asset	Value	Numeric Value	Rationale
6. Mechanical Systems	High	8	
7. Plumbing and Gas Systems	High	8	
8. Electrical Systems	High	8	

Asset	Value	Numeric Value	Rationale
9. Fire Alarm Systems	Medium Low	4	
10. IT / Communications Systems	High	8	

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Unit III-B

COURSE TITLE	Building Design for Homeland Security
UNIT TITLE	Threat/Hazard Assessment

OBJECTIVES

1. Identify the threats and hazards that may impact a building or site
2. Define each threat and hazard using the Department of Defense methodology
3. Provide a numerical rating for the threat or hazard and justify the basis for the rating
4. Define the Design Basis Threat and Levels of Protection

SCOPE

The following topics will be covered in this unit:

1. From what offices is threat and hazard information available?
2. The spectrum of event profiles for terrorism and technological hazards from FEMA 386-7.
3. The five components used by DoD to define a threat and how it can be applied to the Homeland Security Advisory System.
4. Various approaches to determine threat rating – FEMA, Department of Defense, Department of Justice, and Veterans Affairs.
5. A rating scale and how to use it to determine a threat rating.
6. Activity: As a team identify threat rating of the four threats selected for this course (Cyber Attack, Armed Attack, Vehicle Bomb, CBR Attack) using the Appendix B Case Study as applied against the identified assets of the HZC Building.

REFERENCES

1. FEMA 426, *Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings*, pages 1-14 to 1-24
2. FEMA 452, *Risk Assessment: A How-To Guide to Mitigate Potential Terrorist Attacks Against Buildings*, pages 1-1 to 1-30
3. Case Study – Appendix B: Urban, HazardCorp Building

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UNIT III-B CASE STUDY ACTIVITY: THREAT / HAZARD RATING (Urban Version)

After assets that need to be protected are determined, the next step is to identify the threats and hazards that could harm the building and its inhabitants. Hazards are categorized into two groups: natural and manmade. For the sake of this course, the four primary threats selected are Cyber Attack, Armed Attack, Vehicle Bomb, and CBR Attack.

Requirements

Refer to the Appendix B Case Study data and complete the following worksheets. Each student as part of their assessment team will interpret the HZC threat information and should select and justify a threat/hazard rating number with rationale.

- Any function with key IT systems connected to the Internet should get high cyber threat values.
- The threat of explosive blast should be looked upon as either as directly targeted or as collateral damage. Before giving a consistently low rating, consider your answer to Step 1 below as it would have been applied to the Murrah Building in Oklahoma City in 1995.
- A CBR attack or nearby HazMat spill could impact the entire facility, but to varying degrees by floors in a 50-story building if the agent is heavier or lighter than air.

Thus, to illustrate threat assessment, two separate steps were selected for their different methodology.

- Step 1 uses the FEMA 452 Criteria that has its basis in the rating process developed by the US Marshals Service after the Murrah Building bombing in Oklahoma City. The US Marshals Service process was then used by GSA to begin assessing Federal buildings. This method tends to look at the building as a whole.

- Step 2 uses the FEMA 426 methodology of applying a threat rating using specific or generic tactics in a given threat scenario against a specific asset, such as critical functions or critical infrastructure. Thus, this method tends to look at the various components of the building so as to focus limited resources to achieve maximum risk reduction by taking care of the most critical assets.

Final Action: Transfer answers from the Threat Rating tables below to the Risk Matrix poster after team agreement on team answer.

Step 1: Determine the threat score for a 500-lb. vehicle bomb as applied to HZC

Familiarize yourself with the process of determining the primary threats according to the FEMA 452 criteria (**Table 1-4, page 1-21, FEMA 452**) by determining the threat score for a 500-lb. (TNT equivalent) vehicle bomb using the information on the next page and in the Appendix B Case Study.

As shown in Table 1-5, page 1-22, FEMA 453, you can use this scoring methodology to determine your primary threats based upon the threats that achieve the highest scores. However note that the criteria actually intersperses Asset Value Rating, Threat Rating, and Vulnerability Rating as indicated below:

- Access to Agent (Threat – capability of potential threat elements)
- Knowledge/Expertise (Threat – capability of potential threat elements)
- History of Threats/Actual Usage (Threat – rhetoric and actual use by potential threat elements)
- Asset Visibility / Symbolic (Asset Value – but in eyes of potential threat elements as target)
- Asset Accessibility (Vulnerability)
- Site Population / Capacity (Asset Value or Threat (Targeting))
- Collateral Damage / Distance to Building (Vulnerability)

FEMA 452 Table 1-4 Criteria
Improvised Explosive Device (Bomb)

FEMA 452 Criteria

Step 2: Determine Threat Ratings for HazardCorp Building

The second step is the FEMA 426 method for determining the "Threat Rating." The rating scale is a scale of 1 to 10, with 1 being a very low probability of a terrorist attack and 10 a very high probability.

NOTE 1: In the previous student activity to determine Asset Value Rating, there was only one value of an asset – it did not change based upon threat or situation. The impact if the asset was damaged or lost is a view of its value.

NOTE 2: In like manner, the Threat Rating will tend to be the same across all assets. Variances can occur across large buildings where all functions may not exist in all portions of the building or the targeting of the asset may be negligible – no history, no capability – such as Cyber Attack against an asset that has no computer and no connection to the internet. This can be called a very low threat, but it also indicates that since cyber attack cannot occur, the asset has no vulnerabilities to that threat.

HZC Critical Functions Threat Rating

Function	Cyber Attack	Armed Attack	Vehicle Bomb	CBR Attack	Rationale
1. Administration					
2. Engineering / IT Technicians					
3. Loading Dock / Warehouse					
4. Data Center					

Function	**Cyber Attack**	**Armed Attack**	**Vehicle Bomb**	**CBR Attack**	**Rationale**
5. Communications					
6. Security					
7. Housekeeping					

HZC Critical Infrastructure Threat Rating

Infrastructure	**Cyber Attack**	**Armed Attack**	**Vehicle Bomb**	**CBR Attack**	**Rationale**
1. Site					
2. Architectural					
3. Structural Systems					
4. Envelope Systems					

Infrastructure	**Cyber Attack**	**Armed Attack**	**Vehicle Bomb**	**CBR Attack**	**Rationale**
5. Utility Systems					
6. Mechanical Systems					
7. Plumbing and Gas Systems					
8. Electrical Systems					
9. Fire Alarm Systems					
10. IT / Communications Systems					

Unit IV-B

COURSE TITLE — Building Design for Homeland Security

UNIT TITLE — Vulnerability Assessment

OBJECTIVES

1. Explain what constitutes a vulnerability
2. Identify vulnerabilities using the Building Vulnerability Assessment Checklist
3. Understand that an identified vulnerability may indicate that an asset is vulnerable to more than one threat or hazard and that mitigation measures may reduce the vulnerability to one or more threats or hazards
4. Provide a numerical rating for the vulnerability and justify the basis for the rating

SCOPE

The following topics will be covered in this unit:

1. A review of types of vulnerabilities, especially single-point vulnerabilities and tactics possible under threats/hazards for which there are no mitigation measures.
2. Various approaches and considerations to determine vulnerabilities – FEMA, Department of Defense, Department of Justice, and Veterans Affairs.
3. A rating scale and how to use it to determine a vulnerability rating.
4. Activity: Make an initial identification of vulnerabilities present in the Case Study answering selected Vulnerability Assessment Checklist questions. Then, determine the vulnerability rating for each asset-threat/hazard pair of interest, using the four threats selected for this course (Cyber Attack, Armed Attack, Vehicle Bomb, CBR Attack) as applied against the identified assets of the HZC Building. Achieve team concurrence on answers.

REFERENCES

1. FEMA 426, *Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings*, pages 1-24 to 1-35 and pages 1-45 to 1-93
2. FEMA 452, *Risk Assessment: A How-To Guide to Mitigate Potential Terrorist Attacks Against Buildings*, pages 3-1 to 3-20
3. Case Study – Appendix B: Urban, HazardCorp Building

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UNIT IV-B CASE STUDY ACTIVITY: VULNERABILITY RATING (Urban Version)

Vulnerability is any weakness that can be exploited by an aggressor or, in a non-terrorist threat environment, make an asset susceptible to hazard damage. Vulnerabilities may include:

- Critical functions or systems that lack redundancy and, if damaged, would result in immediate organization disruption or loss of capability ("Single-Point Vulnerability")
- Redundant systems feeding into a single critical node
- Critical components of redundant systems collocated
- Inadequate capacity or endurance in a post-attack environment

Vulnerability rating requires identifying and rating the vulnerability of each asset-threat pair of interest. An in-depth vulnerability assessment of a building evaluates specific design and architectural features and identifies all vulnerabilities of the building functions and infrastructure systems.

Requirements

1. Answer the following Building Vulnerability Checklist Questions and record relevant observations in the table regarding the HZC site and building information from the Appendix B Case Study. Determine if the observation indicates that any vulnerabilities exist:

2. Complete the tables for HZC Critical Functions Vulnerability Rating and HZC Critical Infrastructure Vulnerability Rating by filling in the initial vulnerability rating for the asset-threat/hazard pairs.

3. Transfer the vulnerability ratings to the Risk Matrix poster after reaching team consensus on the team answer.

Section	Vulnerability Question	Guidance	Observations
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. Reference: *GSA PBS-P100*	On the east side of the plaza is a drop off zone where no parking is allowed and building stand-off is 80 feet. On the north and west sides of the building for the whole building block, parking is restricted to government vehicles only with designated parking spaces. Double parking next to the government

Section	Vulnerability Question	Guidance	Observations
			vehicles provides 15 feet of stand-off on the north side and 10 feet of stand-off on the west. Commercial parking is allowed on the south side in support of the Loading Dock and stand-off is 10 feet.
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*	
2.15	Are critical assets (people, activities, building systems and components) located close to any main entrance, vehicle circulation, parking, maintenance area, loading dock, or interior parking? Are the critical building systems and components hardened?	Critical building components include: Emergency generator including fuel systems, day tank, fire sprinkler, and water supply; Normal fuel storage; Main switchgear; Telephone distribution and main switchgear; Fire pumps; Building control centers; Uninterruptible Power Supply (UPS) systems controlling critical functions; Main refrigeration and ventilation systems if critical to building operation; Elevator machinery and controls; Shafts for stairs, elevators, and utilities; Critical distribution feeders for emergency power. Evacuation and rescue require emergency systems to remain operational during a disaster and they should be located away from attack locations. Primary and backup systems should be separated to reduce the risk of both being impacted by a	

Section	Vulnerability Question	Guidance	Observations
		single incident if collocated. Utility systems should be located at least 50 feet from loading docks, front entrances, and parking areas. One way to harden critical building systems and components is to enclose them within hardened walls, floors, and ceilings. Do not place them near high-risk areas where they can receive collateral damage. Reference: *GSA PBS-P100*	
2.16	Are high-value or critical assets located as far into the interior of the building as possible and separated from the public areas of the building?	Critical assets, such as people and activities, are more vulnerable to hazards when on an exterior building wall or adjacent to uncontrolled public areas inside the building. Reference: *GSA PBS-P100*	
4.2	Are there less than 40 percent fenestration openings per structural bay? Is the window system design on the exterior façade balanced to mitigate the hazardous effects of flying glazing following an explosive event? (glazing, frames, anchorage to supporting walls, etc.)	The performance of the glass will similarly depend on the materials. Glazing may be single pane or double pane, monolithic or laminated, annealed, heat strengthened or fully tempered. The percent fenestration is a balance between protection level, cost, the architectural look of the building within its surroundings, and building codes. One goal is to keep fenestration to below 40 percent of the building envelope vertical surface area, but the process must balance differing requirements. A blast engineer may prefer no windows; an architect may favor window curtain walls; building codes require so much fenestration per square footage of floor area; fire codes require a prescribed window opening area if the window is a designated escape route; and the building owner has cost concerns. Ideally, an owner would want 100 percent of the glazed area to	

Section	Vulnerability Question	Guidance	Observations
		provide the design protection level against the postulated explosive threat (design basis threat – weapon size at the expected stand-off distance). However, economics and geometry may allow 80 percent to 90 percent due to the statistical differences in the manufacturing process for glass or the angle of incidence of the blast wave upon upper story windows (4th floor and higher). Reference: *GSA PBS-P100*	

HZC Critical Functions Vulnerability Rating

Requirements

Refer to the Appendix B Case Study and rate the vulnerability of the following asset-threat/hazard pairs of interest. Transfer vulnerability ratings to the Threat Matrix and achieve team consensus on the answers.

Function	Cyber Attack	Armed Attack	Vehicle Bomb	CBR Attack
1. Administration				
2. Engineering / IT Technicians				
3. Loading Dock / Warehouse				
4. Data Center				
5. Communications				
6. Security				
7. Housekeeping				

HZC Critical Infrastructure Vulnerability Rating

Refer to the Appendix B Case Study and rate the vulnerability of the following asset-threat/hazard pairs of interest. Transfer vulnerability ratings to the Threat Matrix and achieve team consensus on the answers.

Infrastructure	Cyber Attack	Armed Attack	Vehicle Bomb	CBR Attack
1. Site				
2. Architectural				
3. Structural Systems				
4. Envelope Systems				
5. Utility Systems				
6. Mechanical Systems				
7. Plumbing and Gas Systems				
8. Electrical Systems				
9. Fire Alarm Systems				
10. IT / Communications Systems				

Unit V-B

COURSE TITLE	Building Design for Homeland Security
UNIT TITLE	Risk Assessment/Risk Management

OBJECTIVES

1. Explain what constitutes risk.
2. Provide a numerical rating for risk and justify the basis for the rating.
3. Evaluate risk using the Risk (Threat-Vulnerability) Matrix to capture assessment information.
4. Identify top risks for asset-threat/hazard pairs of interest that should receive measures to mitigate vulnerabilities and reduce risk.

SCOPE

The following topics will be covered in this unit:

1. Definition of risk and the various components to determine a risk rating.
2. The FEMA 426 approach to determining risk.
3. A rating scale and how to use it to determine a risk rating. One or more specific examples will be used to focus students on the following activity.
4. The relationships between high risk, the need for mitigation measures, and the need to identify a Design Basis Threat and Level of Protection.
5. Activity: Determine the risk rating for the asset-threat/hazard pairs of interest. Identify the top three risk ratings for the Case Study.

REFERENCES

1. FEMA 426, *Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings*, pages 1-35 to 1-44
2. FEMA 452, *Risk Assessment: A How-To Guide to Mitigate Potential Terrorist Attacks Against Buildings*, pages 4-1 to 4-9
3. Case Study – Appendix B: Urban, HazardCorp Building

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UNIT V-B CASE STUDY ACTIVITY: RISK RATING (Urban Version)

One approach to conducting a risk assessment is to assemble the results of the asset value assessment, the threat/hazard assessment, and the vulnerability assessment, and determine a numeric value of risk for each asset-threat/hazard pair of interest using the following formula:

Risk = Asset Value x Threat Rating x Vulnerability Rating

Requirements

1. Use the following tables to summarize the HZC asset, threat, and vulnerability assessments conducted in the previous three unit activities. Then use the formula above to determine the risk rating for each asset-threat/hazard pair of interest identified under Critical Functions and under Critical Infrastructure. Transfer to the Threat Matrix and reach team consensus on answers.

2. Identify the highest risk ratings and use **Figure 1-13 of FEMA 426 (page 1-44)** to begin a determination of the risk management options available to reduce these risk ratings by reducing applicable individual ratings for asset value, threat/hazard, or vulnerability. Then identify the top three risk ratings and keep in mind as mitigation measures are discussed in future instruction units.

HZC Critical Functions Risk Rating

Function	**Cyber Attack**	**Armed Attack**	**Vehicle Bomb**	**CBR Attack**
1. **Administration** **Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				
2. **Engineering/IT Technicians** **Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				

Function	Cyber Attack	Armed Attack	Vehicle Bomb	CBR Attack
3. **Loading Dock/ Warehouse** **Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				
4. **Data Center** **Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				
5. **Communications** **Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				
6. **Security** **Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				
7. **Housekeeping** **Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				

HZC Critical Infrastructure Risk Rating

Infrastructure	Cyber Attack	Armed Attack	Vehicle Bomb	CBR Attack
1. **Site** **Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				
2. **Architectural** **Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				
3. **Structural Systems** **Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				
4. **Envelope Systems** **Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				
5. **Utility Systems** **Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				

Infrastructure	Cyber Attack	Armed Attack	Vehicle Bomb	CBR Attack
6. **Mechanical Systems Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				
7. **Plumbing and Gas Systems Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				
8. **Electrical Systems Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				
9. **Fire Alarm Systems Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				
10. **IT/Communications Systems Risk Rating**				
Asset Value				
Threat Rating				
Vulnerability Rating				

Unit VI

COURSE TITLE	Building Design for Homeland Security
UNIT TITLE	FEMA 452 Risk Assessment Database

OBJECTIVES

1. Explain the database install process
2. Identify where to save photos, maps, drawings, plans, etc. to interface with the database
3. Explain the information required for the database to function within each screen, how to move between screens, and switch between the assessor's tool and the master database
4. Explain the benefit and approaches to setting priorities on identified vulnerabilities
5. Explain how to use the master database to produce standard reports and search the database for specific information

SCOPE

The following topics will be covered in this unit:

1. The installation of the assessor tool database and the master database as selected to do.
2. Inputting data into the database and linking associated information, such as GIS images, Miscellaneous files, and Photos.
3. Navigation in the database to operate all functions.
4. Risk management capability using the database.
5. Activity: Students will follow the instruction unit by installing the databases as selected to do and navigating the databases following the instructor's presentation.

REFERENCES

1. FEMA 426, *Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings*, Chapter 1
2. FEMA 452, *Risk Assessment - A How-To Guide to Mitigate Potential Terrorist Attacks Against Buildings,* pages 4-1 to 4-10
3. FEMA 452 Risk Assessment Database CD with Install Wizard (latest version)

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UNIT VI CASE STUDY ACTIVITY:
FEMA 452 RISK ASSESSMENT DATABASE

To this point the assessment procedures have been done manually to understand the thought process. Once the process is understood, the need to be able to manage assessment information, especially from multiple assessments, becomes evident. This unit shows the features of the FEMA 452 Risk Assessment Database v2.0, 5 April 2006, in a demonstration/performance instruction approach.

Requirements

Students ideally should have individual personal laptops that they have brought to the course. The instructor will provide a CD to each student at the beginning of this instruction block. The CD contains the install wizard programs to install the assessor tool database and master database on the laptop. It also contains other files to illustrate the user interface, input, and functions of the database.

As the instructor presents the instruction unit, the student will follow on their laptop so that at the end of the instruction block the student has an initial familiarization of the database features, how to use the database as a risk assessment/risk management tool, and has it loaded on the laptop for their personal use in the future.

It the student does not have a laptop, they may look over the shoulder of someone who does have a laptop or just follow along the slide presentation which uses screen captures of the software throughout the processes demonstrated.

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Unit VII

COURSE TITLE	Building Design for Homeland Security
UNIT TITLE	Explosive Blast

OBJECTIVES

1. Explain the basic physics involved during an explosive blast event, whether it was caused by terrorism or was a technological accident
2. Explain building damage and personnel injuries resulting from the blast effects upon a building
3. Perform an initial prediction of blast loading and effects based upon incident pressure

SCOPE

The following topics will be covered in this unit:

1. Time-pressure regions of a blast event and how these change with distance from the blast
2. Difference between incident pressure and reflected pressure
3. Differences between peak pressure and peak impulse and how these differences affect building components
4. Building damage and personnel injuries generated by blast wave effects
5. Levels of protection used by the Department of Defense and the General Services Administration
6. The nominal range-to-effect chart [minimum stand-off in feet versus weapon yield in pounds of TNT-equivalent] for an identified level of damage or injury
7. The benefits of stand-off distance
8. Approaches to predicting blast loads and effects, including one using incident pressure

REFERENCES

1. FEMA 426, *Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings*, pages 4-1 to 4-20
2. Case Study – Appendix A: Suburban, Hazardville Information Company or Appendix B: Urban, HazardCorp Building as selected

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UNIT VII CASE STUDY ACTIVITY: STAND-OFF DISTANCE AND THE EFFECTS OF EXPLOSIVE BLAST

The requirements in this unit's activity are intended to provide a check on learning about explosive blast.

Requirements

1. In the empty cells in the table below, identify whether the adjacent description defines incident pressure or reflected pressure.

Definition	Type of Pressure
Characterized by an almost instantaneous rise from atmospheric pressure to peak overpressure.	
When blast wave impinges on a structure that is not parallel to the direction of the blast wave's travel, the pressure wave is reflected and reinforced.	

2. Refer to **Figure 4-5 in FEMA 426 (page 4-11)** to answer the following questions regarding the explosives environment:

   - What is the minimum stand-off distance from explosion of a 100-pound (TNT equiv.) bomb to have a level of confidence that severe wounds from glass (without fragment retention film) will not occur?

   - What damage would be sustained at 400 foot stand-off from a 5,000-pound (TNT equiv.) explosion?

3. Refer to **Figure 4-10 and Table 4-3 in FEMA 426 (pages 4-17 and 4-19, respectively)** to answer the following questions regarding the explosives environment.

   - What is the minimum stand-off required to limit the incident pressure to under 0.5 psi for a 100-pound (TNT equiv.) bomb?

- What incident pressure would be expected at 500 feet from a 500-pound (TNT equiv.) bomb and what is the approximate damage that can be expected?

4. Refer to **Figure 4-5 (page 4-11) in FEMA 426** to answer the following questions.

   - For the Design Basis Threats of the selected Case Study being used in this course offering, determine the standoff distance for the damage or injury indicated:

     - ________ pounds TNT-equivalent
       - Glass – Severe Wounds – ______ feet
       - Potentially Lethal Injuries – ______ feet
       - Threshold, Concrete Columns Fail – ______ feet

     - ________ pounds TNT-equivalent
       - Glass – Severe Wounds – ______ feet
       - Potentially Lethal Injuries – ______ feet
       - Threshold, Concrete Columns Fail – ______ feet

Unit VIII

COURSE TITLE	Building Design for Homeland Security
UNIT TITLE	Chemical, Biological, and Radiological (CBR) Measures
OBJECTIVES	1. Explain the five possible protective actions for a building and its occupants 2. Compare filtration system efficacy relative to the particles present in CBR agents 3. Explain the key issues with CBR detection 4. Identify the indications of CBR contamination
SCOPE	The following topics will be covered in this unit: 1. The five possible protective actions for a building and its occupants: evacuation; sheltering in place; personal protective equipment; air filtration and pressurization; and exhausting and purging 2. Air filtration and cleaning principles and its application 3. CBR detection technology currently available 4. Indications of CBR contamination that do not use technology
REFERENCES	1. FEMA 426, *Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings*, pages 5-1 to 5-36 2. FEMA 426, *Appendix C*, Chemical, Biological, and Radiological Glossary 3. Case Study – Appendix A: Suburban, Hazardville Information Company or Appendix B: Urban, HazardCorp Building as selected

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UNIT VIII CASE STUDY ACTIVITY:
CHEMICAL, BIOLOGICAL, AND RADIOLOGICAL (CBR) MEASURES

The requirements in this unit's activity are intended to provide a check on learning about the nature of chemical, biological, and radiological agents and associated mitigation measures.

Requirements

1. Identify the prevalent CBR threat(s) that exist and/or are identified as the Design Basis Threat in the selected Case Study.

Refer to **Table 5-1 on page 5-12 of FEMA 426** and answer the following questions:

2. What size filtration unit (MERV) is required to filter out 80 percent of Legionella and dust particles (1 to 3 microns)?

3. What range of MERV is required to remove 85 percent of smoke particles greater than 0.3 micron in size?

4. What mitigation measures can be used in HVAC systems to destroy bacteria and viruses?

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Unit IX-B

COURSE TITLE	Building Design for Homeland Security
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, including 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 building 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* (when available)
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 B: Urban, HazardCorp Building

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UNIT IX-B CASE STUDY ACTIVITY: SITE AND LAYOUT DESIGN GUIDANCE (Urban 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. It can also be used for assessment of an existing building and its site. The checklist includes questions that determine if critical and emergency systems will continue to function to enhance deterrence, detection, denial, and damage limitation during and after a threat or hazard situation.

Requirements

Assign sections of the checklist to the group member who is most knowledgeable and qualified to perform an assessment of the assigned area. Refer to the Appendix B 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: There are 42 questions below (**18** in Section 1, **4** in Section 2, and **20** in Section 5), so it is recommended that the team split up the questions among themselves taking 5-7 questions each and review the Appendix B Case Study for answers. Apportion the available time for gathering the answers and then provide each other the answers while performing the two actions below.

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 Risk Matrix poster accordingly for vulnerability rating and risk rating.

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/hazard pairs of interest 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 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)?	**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 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	The HazardCorp Building is located in the downtown business district of a major urban city. There are several commercial iconic properties, several government offices, and various high-density attractions within a 5-mile radius of the building. In the immediate vicinity of HazardCorp Building are two residential condominiums, four office buildings, and a hotel. There are additional office buildings, hotels, and parking structures within easy walking distance. As with many major cities, there is significant water access to various locations within 5-mile radius of the building and the river is within 0.05 miles of the building. Because of the water, ground access is constrained by bridges, tunnels, and ferries. While two major airports are over 5 miles from the building, what is not shown are 8 heliports and two skyports inside the 5-mile radius. A metropolitan subway also serves the business district and the nearest station is two blocks from the building. There is significant shipping serving the various ports carrying all types of materials for use in Hazard City and transshipment to other locations. In conjunction with the ports and the transshipment of goods,

Section	Vulnerability Question	Guidance	Observations
		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 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/in-dustrial 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	there is extensive railroad trackage, some as close as within 1-1/2 miles of the building. The area around Hazard City is the No. 4 intermodal port in the Western Hemisphere. Intermodal means the ability to move freight from train to truck and back again. An intermodal port ties together ship, rail, and truck freight transfers. There are extensive tank farms east and west of HazardCorp Building on the other side of the river in the respective directions. There is also a high concentration of police in the area due to multiple jurisdictions having authority. A fire station is within 1/4 mile of the building and seven hospitals are within 3 miles.

Section	Vulnerability Question	Guidance	Observations
		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 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*	

Section	Vulnerability Question	Guidance	Observations
1.3	In dense, urban areas, does curb lane parking allow uncontrolled vehicles to park 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*	
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*	
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	

Section	Vulnerability Question	Guidance	Observations
		access point. Reference: *USAF Installation Force Protection Guide*	
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*	
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*	
1.10	What are the existing types of vehicle anti-ram devices for the site or building? Are these devices at the property boundary or at the building?	Passive barriers include bollards, walls, hardened fences (steel cable interlaced), trenches, ponds/basins, concrete planters, street furniture, plantings, trees, sculptures, and fountains. Active barriers include pop-up bollards, swing arm gates, and rotating plates and drums, etc. Reference: *GSA PBS-P100*	

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*	
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*	
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*	
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.	Refer to answer given in Unit IV-B, Vulnerability Assessment

Section	Vulnerability Question	Guidance	Observations
		Reference: *GSA PBS-P100*	
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*	
1.18	Are garage or service area entrances for employee-permitted vehicles protected by suitable anti-ram devices? Coordinate this protection with other anti-ram devices, such as on the perimeter or property boundary to avoid duplication of arresting capability.	Control internal building parking, underground parking garages, and access to service areas and loading docks in this manner with proper access control, or eliminate the parking altogether. The anti-ram device must be capable of arresting a vehicle of the designated threat size at the speed attainable at the location. Reference: *GSA PBS-P100*	

Section	Vulnerability Question	Guidance	Observations
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*	Refer to answer given in Unit IV-B, Vulnerability Assessment
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*	
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 or vehicles outside normal circulation routes or attempting to approach the building unobserved. Reference: *USAF Installation Force Protection Guide*	

Section	Vulnerability Question	Guidance	Observations
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 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	

Section	Vulnerability Question	Guidance	Observations
		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:** - 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*	
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.	

Section	Vulnerability Question	Guidance	Observations
		Reference: *GSA PBS-P100*	
2.4	Are there trash receptacles and mailboxes in close proximity to the building that can be used to hide explosive devices?	The size of the trash receptacles and mailbox openings should be restricted to prohibit insertion of packages. Street furniture, such as newspaper vending machines, 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*	
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*	
5.2	Are there multiple entry points for the water supply?	If the building or site has only one source of water entering at one location, the entry point should be secure. Reference: *GSA PBS-P100*	

Section	Vulnerability Question	Guidance	Observations
5.3	Is the incoming water supply in a secure location?	Ensure that only authorized personnel have access to the water supply and its components. Reference: *FEMA 386-7*	
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 the Department of Veterans Affairs Facilities*	
5.5	What is the source of water for the fire suppression system? (local utility company lines, storage tanks with utility company backup, lake, or river) Are there alternate water supplies for fire suppression?	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. 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*	

Section	Vulnerability Question	Guidance	Observations
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*	
5.7	Do the sprinkler/standpipe interior controls (risers) have fire- and blast-resistant separation? Are the sprinkler and standpipe connections adequate and redundant? Are there fire hydrant and water supply connections near the sprinkler/standpipe connections?	The incoming fire protection water line should be encased, buried, or located 50 feet from high-risk areas. The interior mains should be looped and sectionalized. Reference: *GSA PBS-P100*	
5.8	Are there redundant fire water pumps (e.g., one electric, one diesel)? Are the pumps located apart from each other?	Collocating fire water pumps puts them at risk for a single incident to disable the fire suppression system. References: *GSA PBS-P100 and FEMA 386-7*	
5.9	Are sewer systems accessible? Are they protected or secured?	Sanitary and stormwater sewers should be protected from unauthorized access. The main concerns are backup or flooding into the building, causing a health risk, shorting out electrical equipment, and loss of building use.	

Section	Vulnerability Question	Guidance	Observations
		Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
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*	
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*	
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*	

Section	Vulnerability Question	Guidance	Observations
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*	
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 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*	
5.18	What provisions for emergency power exist? What systems receive emergency power and have capacity requirements been tested?	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.	

Section	Vulnerability Question	Guidance	Observations
	Is the emergency power collocated with the commercial electric service? Is there an exterior connection for emergency power?	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*	
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*	
5.20	Are there multiple or redundant locations for the telephone and communications service?	Secure locations of communications wiring entry to the site or building are required. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
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.?	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	

Section	Vulnerability Question	Guidance	Observations
	Is there an intermediary alarm monitoring center?	necessary response and inform the responding agency. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
5.22	Are utility lifelines aboveground, underground, or direct buried?	Utility lifelines (water, power, communications, etc.) can be protected by concealing, burying, or encasing. References: *GSA PBS-P100 and FEMA 386-7*	

Unit X-B

COURSE TITLE	Building Design for Homeland Security
UNIT TITLE	Building Design Guidance
OBJECTIVES	1. Explain architectural considerations to mitigate impacts from blast effects and transmission of chemical, biological, and radiological agents from exterior and interior incidents 2. Identify key elements of building structural and non-structural systems for mitigation of blast effects 3. Compare and contrast the benefit of building envelope, mechanical system, electrical system, fire protection system, and communication system mitigation measures, including synergies and conflicts 4. Apply these concepts to an existing building or building conceptual design and identify mitigation measures needed to reduce vulnerabilities
SCOPE	The following topics will be covered in this unit: 1. Architectural considerations, including building configuration, space design, and special situations 2. Building structural and nonstructural considerations with emphasis on progressive collapse, loads and stresses, and good engineering practices 3. Design issues for the building envelope, including wall design, window design, door design, and roof system design with approaches to define levels of protection 4. Mechanical system design issues, including interfacing with operational procedures, emergency plans, and training 5. Other building systems design considerations for electrical, fire protection, communications, electronic security, entry control, and physical security that mitigate the effects of a threat or hazard. 6. Activity: Select mitigation measures that reduce vulnerability and associated risk from the building perspective for the highest risk pairs (asset - threat/hazard) identified in Unit V-B.

References

1. FEMA 426, *Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings*, pages 3-1 to 3-46 and 3-48 to 3-52; Checklist at end of Chapter 1
2. FEMA 427, *Primer for Design of Commercial Buildings to Mitigate Terrorist Attacks*
3. FEMA 430, *Primer for Incorporating Building Security Components in Architectural Design* (when available)
4. FEMA 452, *Risk Assessment: A How-To Guide to Mitigate Potential Terrorist Attacks Against Buildings*, pages 5-1 to 5-16
5. Case Study – Appendix B: Urban, HazardCorp Building

UNIT X-B CASE STUDY ACTIVITY:
BUILDING DESIGN GUIDANCE
(Urban Version)

In this unit, the emphasis will be upon providing a balanced building envelope that is a defensive layer against the terrorist tactics of interest and avoiding situations where one incident affects more than one building system. 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 building design vulnerability assessment or for assessment of an existing building. The checklist includes questions that determine if critical and emergency systems will continue to function to enhance deterrence, detection, denial, and damage limitation during and after a threat or hazard situation.

Requirements

Assign sections of the checklist to the group member who is most knowledgeable and qualified to perform an assessment of the assigned area. Refer to the Appendix B 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 questions of the **Building Vulnerability Assessment Checklist (FEMA 426, Table 1-22, pages 1-46 to 1-93)** which address building design.

   Note: There are 49 questions below (**15** in Section 2, **7** in Section 3, **2** in Section 4, **7** in Section 6, **3** in Section 7, **3** in Section 8, **4** in Section 9, **5** in Section 10, **2** in Section 11, and **1** in Section 13), so it is recommended that the team split up the questions among themselves taking 7-9 questions each and review the Appendix B Case Study for answers. Apportion the available time for gathering the answers and then provide each other the answers while performing the two actions below.

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 for vulnerability rating and risk rating.

3. Select mitigation measures to reduce vulnerability and associated risk based upon the building design.

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
2 Architectural			
2.5	Do entrances avoid significant queuing?	If queuing will occur within the building footprint, the area should be enclosed in blast-resistant construction. If queuing is expected outside the building, a rain cover should be provided. For manpower and equipment requirements collocate or combine staff and visitor entrances. Reference: *GSA PBS-P100*	
2.6	Does security screening cover all public and private areas? Are public and private activities separated? Are public toilets, service spaces, or access to stairs or elevators located in any non-secure areas, including the queuing area before screening at the public entrance?	Retail activities should be prohibited in non-secured areas. However, the Public Building Cooperative Use Act of 1976 encourages retail and mixed uses to create open and inviting buildings. Consider separating entryways, controlling access, hardening shared partitions, and special security operational countermeasures. References: *GSA PBS-P100 and FEMA 386-7*	
2.7	Is access control provided through main entrance points for employees and visitors? (lobby receptionist, sign-in, staff escorts, issue of visitor badges, checking forms of personal identification, electronic access control systems)	Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	

Section	Vulnerability Question	Guidance	Observations
2.8	Is access to private and public space or restricted area space clearly defined through the design of the space, signage, use of electronic security devices, etc.?	Finishes and signage should be designed for visual simplicity. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
2.9	Is access to elevators distinguished as to those that are designated only for employees and visitors?	Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
2.10	Do public and employee entrances include space for possible future installation of access control and screening equipment?	These include walk-through metal detectors and x-ray devices, identification check, electronic access card, search stations, and turnstiles. Reference: *GSA PBS-P100*	
2.11	Do foyers have reinforced concrete walls and offset interior and exterior doors from each other?	Consider for exterior entrances to the building or to access critical areas within the building if explosive blast hazard must be mitigated. Reference: *U.S. Army TM 5-853*	

Section	Vulnerability Question	Guidance	Observations
2.13	Do circulation routes have unobstructed views of people approaching controlled access points?	This applies to building entrances and to critical areas within the building. References: *USAF Installation Force Protection Guide and DoD UFC 4-010-01*	
2.15	Are critical assets (people, activities, building systems and components) located close to any main entrance, vehicle circulation, parking, maintenance area, loading dock, or interior parking? Are the critical building systems and components hardened?	Critical building components include: Emergency generator including fuel systems, day tank, fire sprinkler, and water supply; Normal fuel storage; Main switchgear; Telephone distribution and main switchgear; Fire pumps; Building control centers; Uninterruptible Power Supply (UPS) systems controlling critical functions; Main refrigeration and ventilation systems if critical to building operation; Elevator machinery and controls; Shafts for stairs, elevators, and utilities; Critical distribution feeders for emergency power. Evacuation and rescue require emergency systems to remain operational during a disaster and they should be located away from potential attack locations. Primary and back-up systems should be separated to reduce the risk of both being impacted by a single incident if collocated. Utility systems should be located at least 50 feet from loading docks, front entrances, and parking areas. One way to harden critical building systems and components is to enclose them within hardened walls, floors, and ceilings. Do not place them near high-risk areas where they can receive collateral damage. Reference: *GSA PBS-P100*	Refer to answer given in Unit IV-B, Vulnerability Assessment

Section	Vulnerability Question	Guidance	Observations
2.16	Are high-value or critical assets located as far into the interior of the building as possible and separated from the public areas of the building?	Critical assets, such as people and activities, are more vulnerable to hazards when on an exterior building wall or adjacent to uncontrolled public areas inside the building. Reference: *GSA PBS-P100*	Refer to answer given in Unit IV-B, Vulnerability Assessment
2.17	Is high visitor activity away from critical assets?	High-risk activities should also be separated from low-risk activities. Also, visitor activities should be separated from daily activities. Reference: *USAF Installation Force Protection Guide*	
2.19	Are loading docks and receiving and shipping areas separated 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.?	Loading docks should be designed to keep vehicles from driving into or parking under the building. If loading docks are in close proximity to critical equipment, consider hardening the equipment and service against explosive blast. Consider a 50-foot separation distance in all directions. Reference: *GSA PBS-P100*	
2.20	Are mailrooms located away from building main entrances, areas containing critical services, utilities, distribution systems, and	The mailroom should be located at the perimeter of the building with an outside wall or window designed for pressure relief. By separating the mailroom and the loading dock, the collateral damage of an	

Section	Vulnerability Question	Guidance	Observations
	important assets? Is the mailroom located near the loading dock?	incident at one has less impact upon the other. However, this may be the preferred mailroom location. Off-site screening stations or a separate delivery processing building on site may be cost- effective, particularly if several buildings may share one mailroom. A separate delivery processing building reduces risk and simplifies protection measures. Reference: *GSA PBS-P100*	
2.22	Are areas of refuge identified, with special consideration given to egress?	Areas of refuge can be safe havens, shelters, or protected spaces for use during specified hazards. Reference: *FEMA 386-7*	
2.23	Are stairwells required for emergency egress located as remotely as possible from high-risk areas where blast events might occur? Are stairways maintained with positive pressure or are there other smoke control systems?	Consider designing stairs so that they discharge into other than lobbies, parking, or loading docks. Maintaining positive pressure from a clean source of air (may require special filtering) aids in egress by keeping smoke, heat, toxic fumes, etc., out of the stairway. Pressurize exit stairways in accordance with the National Model Building Code. References: *GSA PBS-P100 and CDC/NIOSH Pub 2002-139*	
2.25	Do interior barriers differentiate level of security within a building?	Reference: *USAF Installation Force Protection Guide*	
2.26	Are emergency systems located away from high-risk areas?	The intent is to keep the emergency systems out of harm’s way, such that one incident takes out all capability – both the regular systems and their backups. Reference: *FEMA 386-7*	

Section	Vulnerability Question	Guidance	Observations
3 Structural Systems			
3.1	What type of construction? What type of concrete and reinforcing steel? What type of steel? What type of foundation?	The type of construction provides an indication of the robustness to abnormal loading and load reversals. A reinforced concrete moment-resisting frame provides greater ductility and redundancy than a flat-slab or flat-plate construction. The ductility of steel frame with metal deck depends on the connection details and pre-tensioned or post-tensioned construction provides little capacity for abnormal loading patterns and load reversals. The resistance of load-bearing wall structures varies to a great extent, depending on whether the walls are reinforced or unreinforced. A rapid screening process developed by FEMA for assessing structural hazard identifies the following types of construction with a structural score ranging from 1.0 to 8.5. The higher the score indicates a greater capacity to sustain load reversals. Wood buildings of all types - 4.5 to 8.5 Steel moment-resisting frames - 3.5 to 4.5 Braced steel frames - 2.5 to 3.0 Light metal buildings - 5.5 to 6.5 Steel frames with cast-in-place concrete shear walls - 3.5 to 4.5 Steel frames with unreinforced masonry infill walls - 1.5 to 3.0 Concrete moment-resisting frames - 2.0 to 4.0 Concrete shear wall buildings - 3.0 to 4.0 Concrete frame with unreinforced masonry infill walls - 1.5 to 3.0 Tilt-up buildings - 2.0 to 3.5 Precast concrete frame buildings - 1.5 to 2.5 Reinforced masonry -3.0 to 4.0 Unreinforced masonry - 1.0 to 2.5 References: *FEMA 154 and Physical Security Assessment for the Department of Veterans Affairs Facilities*	
3.3	Are the steel frame connections moment connections? Is the column spacing	A practical upper level for column spacing is generally 30 feet. Unless there is an overriding architectural requirement, a practical limit for floor-to-floor heights is generally less than or equal to 16 feet.	

Section	Vulnerability Question	Guidance	Observations
	minimized so that reasonably sized members will resist the design loads and increase the redundancy of the system? What are the floor-to-floor heights?	Reference: *GSA PBS-P100*	
3.4	Are critical elements vulnerable to failure?	The priority for upgrades should be based on the relative importance of structural or non-structural elements that are essential to mitigating the extent of collapse and minimizing injury and damage. Primary Structural Elements provide the essential parts of the building's resistance to catastrophic blast loads and progressive collapse. These include columns, girders, roof beams, and the main lateral resistance system. Secondary Structural Elements consist of all other load bearing members, such as floor beams, slabs, that are essential for life safety systems or elements which can cause substantial injury if failure occurs, including ceilings or heavy suspended mechanical units. Secondary Non-Structural Elements consist of all elements not covered in primary non-structural elements, such as partitions, furniture, and light fixtures. Reference: *GSA PBS-P100*	
3.5	Will the structure suffer an unacceptable level of damage resulting from the postulated threat (blast loading or weapon impact)?	The extent of damage to the structure and exterior wall systems from the bomb threat may be related to a protection level. The following is for new buildings: **Level of Protection Below Antiterrorism Standards** - Severe damage. Frame collapse/massive destruction. Little left standing. Doors and windows fail and result in lethal hazards. Majority of personnel suffer fatalities. **Very Low Level Protection** - Heavy	

Section	Vulnerability Question	Guidance	Observations
		damage. Onset of structural collapse. Major deformation of primary and secondary structural members, but progressive collapse is unlikely. Collapse of non-structural elements. Glazing will break and is likely to be propelled into the building, resulting in serious glazing fragment injuries, but fragments will be reduced. Doors may be propelled into rooms, presenting serious hazards. Majority of personnel suffer serious injuries. There are likely to be a limited number (10 percent to 25 percent) of fatalities. **Low Level of Protection** - Moderate damage, unrepairable. Major deformation of non-structural elements and secondary structural members and minor deformation of primary structural members, but progressive collapse is unlikely. Glazing will break, but fall within 1 meter of the wall or otherwise not present a significant fragment hazard. Doors may fail, but they will rebound out of their frames, presenting minimal hazards. Majority of personnel suffer significant injuries. There may be a few (<10 percent) fatalities. **Medium Level Protection** - Minor damage, repairable. Minor deformations of non-structural elements and secondary structural members and no permanent deformation in primary structural members. Glazing will break, but will remain in the window frame. Doors will stay in frames, but will not be reusable. Some minor injuries, but fatalities are unlikely. **High Level Protection** - Minimal damage, repairable. No permanent deformation of primary and secondary structural members or non-structural elements. Glazing will not break. Doors will be reusable. Only superficial injuries are likely. Reference: *DoD UFC 4-0101-01*	

Section	Vulnerability Question	Guidance	Observations
3.8	Are there transfer girders supported by columns within unscreened public spaces or at the exterior of the building?	Transfer girders allow discontinuities in columns between the roof and foundation. This design has inherent difficulty in transferring load to redundant paths upon loss of a column or the girder. Transfer beams and girders that, if lost, may cause progressive collapse are highly discouraged. Reference: *GSA PBS-P100*	
3.10	Will the loading dock design limit damage to adjacent areas and vent explosive force to the exterior of the building?	Design the floor of the loading dock for blast resistance if the area below is occupied or contains critical utilities. Reference: *GSA PBS-P100*	
3.11	Are mailrooms, where packages are received and opened for inspection, and unscreened retail spaces designed to mitigate the effects of a blast on primary vertical or lateral bracing members?	Where mailrooms and unscreened retail spaces are located in occupied areas or adjacent to critical utilities, walls, ceilings, and floors, they should be blast- and fragment-resistant. Methods to facilitate the venting of explosive forces and gases from the interior spaces to the outside of the structure may include blow-out panels and window system designs that provide protection from blast pressure applied to the outside, but that readily fail and vent if exposed to blast pressure on the inside. Reference: *GSA PBS-P100*	

Section	Vulnerability Question	Guidance	Observations
4 Building Envelope			
4.1	What is the designed or estimated protection level of the exterior walls against the postulated explosive threat?	The performance of the façade varies to a great extent on the materials. Different construction includes brick or stone with block backup, steel stud walls, precast panels, curtain wall with glass, stone or metal panel elements. Shear walls that are essential to the lateral and vertical load bearing system and that also function as exterior walls should be considered primary structures and should resist the actual blast loads predicted from the threats specified. Where exterior walls are not designed for the full design loads, special consideration should be given to construction types that reduce the potential for injury. Reference: *GSA PBS-P100*	
4.2	Are there less than 40 percent fenestration openings per structural bay? Is the window system design on the exterior façade balanced to mitigate the hazardous effects of flying glazing following an explosive event? (glazing, frames, anchorage to supporting walls, etc.) Do the glazing systems with a ½-inch (¾-inch is better) bite contain an application of structural silicone? Is the glazing laminated or is it protected with an anti-shatter (fragment retention) film?	The performance of the glass will similarly depend on the materials. Glazing may be single pane or double pane, monolithic or laminated, annealed, heat strengthened or fully tempered. The percent fenestration is a balance between protection level, cost, the architectural look of the building within its surroundings, and building codes. One goal is to keep fenestration to below 40 percent of the building envelope vertical surface area, but the process must balance differing requirements. A blast engineer may prefer no windows; an architect may favor window curtain walls; building codes require so much fenestration per square footage of floor area; fire codes require a prescribed window opening area if the window is a designated escape route; and the building owner has cost concerns. Ideally, an owner would want 100 percent of the glazed area to provide the design protection level against the postulated explosive threat (design basis threat – weapon size at the expected stand-off distance). However, economics and geometry may allow 80 percent to 90 percent due to the statistical differences in	Refer to answer given in Unit IV-B, Vulnerability Assessment

Section	Vulnerability Question	Guidance	Observations
	If an anti-shatter film is used, is it a minimum of a 7-mil thick film, or specially manufactured 4-mil thick film?	the manufacturing process for glass or the angle of incidence of the blast wave upon upper story windows (4th floor and higher). Reference: *GSA PBS-P100*	
6 Mechanical Systems (HVAC and CBR)			
6.1	Where are the air intakes and exhaust louvers for the building? (low, high, or midpoint of the building structure) Are the intakes and exhausts accessible to the public?	Air intakes should be located on the roof or as high as possible. Otherwise secure within CPTED-compliant fencing or enclosure. The fencing or enclosure should have a sloped roof to prevent throwing anything into the enclosure near the intakes. Reference: *GSA PBS-P100* states that air intakes should be on the fourth floor or higher and, on buildings with three floors or less, they should be on the roof or as high as practical. Locating intakes high on a wall is preferred over a roof location. Reference: *DoD UFC 4-010-01* states that, for all new inhabited buildings covered by *FEMA 426*, all air intakes should be located at least 3 meters (10 feet) above the ground. Reference: *CDC/NIOSH Pub 2002-139* states: “An extension height of 12 feet (3.7 m) will place the intake out of reach of individuals without some assistance. Also, the entrance to the intake should be covered with a sloped metal mesh to reduce the threat of objects being tossed into the intake. A minimum slope of 45° is generally adequate. Extension height should be increased where existing platforms or building features (i.e., loading docks, retaining walls) might provide access to the outdoor air intakes.” Reference: *LBNL Pub 51959*: Exhausts are also a concern during an outdoor release, especially if exhaust fans are not in continuous operation, due to wind effects and chimney effects (air movement due to differential temperature).	

Section	Vulnerability Question	Guidance	Observations
6.3	Are there multiple air intake locations?	Single air intakes may feed several air handling units. Indicate if the air intakes are localized or separated. Installing low-leakage dampers is one way to provide the system separation when necessary. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
6.4	What are the types of air filtration? Include the efficiency and number of filter modules for each of the main air handling systems. Is there any collective protection for chemical, biological, and radiological contamination designed into the building?	MERV – Minimum Efficiency Reporting Value HEPA – High Efficiency Particulate Air Activated charcoal for gases Ultraviolet C for biologicals Consider mix of approaches for optimum protection and cost effectiveness. Reference: *CDC/NIOSH Pub 2002-139*	
6.5	Is there space for larger filter assemblies on critical air handling systems?	Air handling units serving critical functions during continued operation may be retrofitted to provide enhanced protection during emergencies. However, upgraded filtration may have negative effects upon the overall air handling system operation, such as increased pressure drop. Reference: *CDC/NIOSH Pub 2002-139*	
6.8	How are air handling systems zoned? What areas and functions do each of the primary air handling systems serve?	Understanding the critical areas of the building that must continue functioning focuses security and hazard mitigation measures. Applying HVAC zones that isolate lobbies, mailrooms, loading docks, and other entry and storage areas from the rest of the building HVAC zones and maintaining negative pressure within these areas will contain CBR releases. Identify common return systems that service more than one zone, effectively making a large single zone.	

Section	Vulnerability Question	Guidance	Observations
		Conversely, emergency egress routes should receive positive pressurization to ensure contamination does not hinder egress. Consider filtering of the pressurization air. References: *CDC/NIOSH Pub 2002-139 and LBNL Pub 51959*	
6.14	Where are the building automation control centers and cabinets located? Are they in secure areas? How is the control wiring routed?	Access to any component of the building automation and control system could compromise the functioning of the system, increasing vulnerability to a hazard or precluding their proper operation during a hazard incident. The HVAC and exhaust system controls should be in a secure area that allows rapid shutdown or other activation based upon location and type of attack. References: *FEMA 386-7, DOC CIAO Vulnerability Assessment Framework 1.1, and LBNL Pub 51959*	
7 Plumbing and Gas Systems			
7.1	What is the method of water distribution?	Central shaft locations for piping are more vulnerable than multiple riser locations. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
7.3	Is there redundancy to the main piping distribution?	Looping of piping and use of section valves provide redundancies in the event sections of the system are damaged. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	

Section	Vulnerability Question	Guidance	Observations
7.4	What is the method of heating domestic water? What fuel(s) is used?	Single source of hot water with one fuel source is more vulnerable than multiple sources and multiple fuel types. Domestic hot water availability is an operational concern for many building occupancies. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
8 Electrical Systems			
8.1	Are there any transformers or switchgears located outside the building or accessible from the building exterior? Are they vulnerable to public access? Are they secured?	Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
8.3	How are the electrical rooms secured and where are they located relative to other higher-risk areas, starting with the main electrical distribution room at the service entrance?	Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
8.4	Are critical electrical systems collocated with other building systems? Are critical electrical systems located in areas	Collocation concerns include rooms, ceilings, raceways, conduits, panels, and risers. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	

Section	Vulnerability Question	Guidance	Observations
	outside of secured electrical areas? Is security system wiring located separately from electrical and other service systems?		
8.6	Does emergency backup power exist for all areas within the building or for critical areas only? How is the emergency power distributed? Is the emergency power system independent from the normal electrical service, particularly in critical areas?	There should be no single critical node that allows both the normal electrical service and the emergency backup power to be affected by a single incident. Automatic transfer switches and interconnecting switchgear are the initial concerns. Emergency and normal electrical equipment should be installed separately, at different locations, and as far apart as possible. Reference: *GSA PBS-P100*	
9 Fire Alarm Systems			
9.1	Is the building fire alarm system centralized or localized? How are alarms made known, both locally and centrally? Are critical documents and control systems located in a secure yet accessible location?	Fire alarm systems must first warn building occupants to evacuate for life safety. Then they must inform the responding agency to dispatch fire equipment and personnel. Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
9.2	Where are the fire alarm panels located? Do they allow access to	Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	

Section	Vulnerability Question	Guidance	Observations
	unauthorized personnel?		
9.3	Is the fire alarm system standalone or integrated with other functions such as security and environmental or building management systems? What is the interface?	Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
9.5	Is there redundant off-premises fire alarm reporting?	Fire alarms can ring at a fire station, at an intermediary alarm monitoring center, or autodial someone else. See Items 5.21 and 10.5 of the checklist.	
10 Communications and IT Systems			
10.1	Where is the main telephone distribution room and where is it in relation to higher-risk areas? Is the main telephone distribution room secure?	One can expect to find voice, data, signal, and alarm systems to be routed through the main telephone distribution room. Reference: *FEMA 386-7*	
10.2	Does the telephone system have an uninterruptible power supply (UPS)?	Many telephone systems are now computerized and need a UPS to ensure reliability during power fluctuations. The UPS is also needed to await any emergency power coming on line or allow orderly shutdown.	

Section	Vulnerability Question	Guidance	Observations
	What is its type, power rating, operational duration under load, and location? (battery, on-line, filtered)	Reference: *DOC CIAO Vulnerability Assessment Framework 1.1*	
10.5	Are there redundant communications systems available?	Critical areas should be supplied with multiple or redundant means of communications. Power outage phones can provide redundancy as they connect directly to the local commercial telephone switch off site and not through the building telephone switch in the main telephone distribution room. A base radio communication system with antenna can be installed in stairwells, and portable sets distributed to floors. References: *GSA PBS-P100 and FEMA 386-7*	
10.15	Is there a mass notification system that reaches all building occupants? (public address, pager, cell phone, computer override, etc.) Will one or more of these systems be operational under hazard conditions? (UPS, emergency power)	Depending upon building size, a mass notification system will provide warning and alert information, along with actions to take before and after an incident if there is redundancy and power. Reference: *DoD UFC 4-010-01*	
10.16	Do control centers and their designated alternate locations have equivalent or reduced capability for voice,	Reference: *GSA PBS-P100*	

Section	Vulnerability Question	Guidance	Observations
	data, mass notification, etc.? (emergency operations, security, fire alarms, building automation) Do the alternate locations also have access to backup systems, including emergency power?		
11 Equipment Operations and Maintenance			
11.7	Are backup power systems periodically tested under load?	Loading should be at or above maximum connected load to ensure available capacity and automatic sensors should be tested at least once per year. Periodically (once a year as a minimum) check the duration of capacity of backup systems by running them for the expected emergency duration or estimating operational duration through fuel consumption, water consumption, or voltage loss. Reference: *FEMA 386-7*	
11.8	Is stairway and exit sign lighting operational?	The maintenance program for stairway and exit sign lighting (all egress lighting) should ensure functioning under normal and emergency power conditions. Expect building codes to be updated as emergency egress lighting is moved from upper walls and over doorways to floor level as heat and smoke drive occupants to crawl along the floor to get out of the building. Signs and lights mounted high have limited or no benefit when obscured. Reference: *FEMA 386-7*	
13 Security Master Plan			
13.1	Does a written security plan exist for this site or building? When was the initial	The development and implementation of a security master plan provides a roadmap that outlines the strategic direction and vision, operational, managerial, and technological mission, goals, and objectives of the organization's security	

Section	Vulnerability Question	Guidance	Observations
	security plan written and last revised? Who is responsible for preparing and reviewing the security plan?	program. Reference: *DOC CIAO Vulnerability Assessment Framework 1.1*	

Building Design Mitigation Measures
(Urban Version)

Asset-Threat/Hazard Pair	Current Risk Rating	Suggested Mitigation Measure	Revised Risk Rating

Unit XI-B

COURSE TITLE	Building Design for Homeland Security
UNIT TITLE	Electronic Security Systems
OBJECTIVES	1. Use the assessment process to identify electronic security system requirements that are needed to mitigate vulnerabilities 2. Describe the electronic security system concepts and practices that warrant special attention to enhance public safety 3. Explain the basis concepts of electronic security system components, their capabilities, and their interaction with other systems 4. Justify selection of electronic security systems to mitigate vulnerabilities
SCOPE	The following topics will be covered in this unit: 1. Control centers and building management systems 2. Perimeter layout and zoning of sensors 3. Intrusion detection systems and sensor technologies 4. Entry-control systems and electronic entry control technologies 5. Closed circuit television and data-transmission media 6. Definitions of the degree of security and control
REFERENCES	1. FEMA 426, *Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings*, o Pages 3-47 to 3-50 o Appendix D o Security Systems and Security Master Plan sections of Checklist at the end of Chapter 1, pages 1-81 and 1-92 2. Case Study – Appendix B: Urban, HazardCorp Building

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UNIT XI-B CASE STUDY ACTIVITY:
ELECTRONIC SECURITY SYSTEMS
(Urban Version)

In this unit, the emphasis will be upon the various components and technology available for use in electronic security systems. The **Building Vulnerability Assessment Checklist in FEMA 426** can be used as a screening tool for preliminary building design vulnerability assessment or for assessment of an existing building and site.

Requirements

Refer to the Appendix B Case Study to determine answers to the following questions. Then review results to identify vulnerabilities and possible mitigation measures.

1. Complete the following components of the **Building Vulnerability Assessment Checklist (Table 1-22, pages 1-81 to 1-89 of FEMA 426)** which address security systems.

2. Upon completion of these portions of the checklist, refer back to the risk ratings determined in Unit V-B Student Activity and, based on this detailed analysis, decide if any ratings need adjustment.

3. Select mitigation measures among security system design and operation features to reduce vulnerability and associated risk.

4. Estimate the new risk ratings for high risk asset-threat/hazard pairs of interest based on the recommended mitigation measures and complete the table.

Section	Vulnerability Question	Guidance	Observations
12 Security Systems			
Perimeter Systems			
12.1	Are black/white or color CCTV (closed circuit television) cameras used? Are they monitored and recorded 24 hours/7 days a week? By whom? Are they analog or digital by design? What is the number of fixed, wireless, and pan-tilt-zoom cameras used?	Security technology is frequently considered to complement or supplement security personnel forces and to provide a wider area of coverage. Typically, these physical security elements provide the first line of defense in deterring, detecting, and responding to threats and reducing vulnerabilities. They must be viewed as an integral component of the overall security program. Their design, engineering, installation, operation, and management must be able to meet daily security challenges from a cost-effective and efficiency perspective. During and after an	There is a mixture of black/white and color CCTV used. All entries to the building, especially the Loading Dock, are covered by color CCTV systems. The cameras are color, pan, tilt, and zoom. Elevator lobbies on underground parking levels both under the building and under the plaza are also on color cameras with pan, tilt, and zoom. Underground parking has fixed black and white CCTV cameras

Section	Vulnerability Question	Guidance	Observations
	Who are the manufacturers of the CCTV cameras? What is the age of the CCTV cameras in use?	incident, the system, or its backups, should be functional per the planned design. Consider color CCTV cameras to view and record activity at the perimeter of the building, particularly at primary entrances and exits. A mix of monochrome cameras should be considered for areas that lack adequate illumination for color cameras. Reference: *GSA PBS P-100*	except at the vehicle entrances and exits where the cameras are color, pan, tilt, and zoom to aid in identifying people who do not pay or cause damage to the drop arms or automated equipment. There are black and white cameras covering stairwell doors on underground parking levels. One person in Building Security Office monitors cameras and alarms on a 24/7 basis. DVR (Digital Video Recording) is used to record all perimeter color cameras. Requires further investigation to determine analog or digital design of cameras, only know that DVR for recording is digital. There are 14 fixed B/W cameras, no wireless cameras were identified during assessment, and 24 color cameras with pan-tilt-zoom. The manufacturers and age of the CCTV cameras require further investigation.
12.2	Are the cameras programmed to respond automatically to perimeter building alarm events? Do they have built-in video motion capabilities?	The efficiency of monitoring multiple screens decreases as the number of screens increases. Tying the alarm system or motion sensors to a CCTV camera and a monitoring screen improves the man-machine interface by drawing attention to a specific screen and its associated camera. Adjustment may be required after installation due to initial false alarms, usually caused by wind or small animals.	

Section	Vulnerability Question	Guidance	Observations
		Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
12.4	Are panic/duress alarm buttons or sensors used, where are they located, and are they hardwired or portable?	Call buttons should be provided at key public contact areas and as needed in offices of managers and directors, in garages and parking lots, and other high-risk locations by assessment. Reference: *GSA PBS P-100*	
12.5	Are intercom call boxes used in parking areas or along the building perimeter?	See Item 12.4.	
12.7	Who monitors the CCTV system?	Reference: *DOC CIAO Vulnerability Assessment Framework 1.1*	
12.8	What is the quality of video images both during the day and hours of darkness? Are infrared camera illuminators used?	Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	

Section	Vulnerability Question	Guidance	Observations
12.9	Are the perimeter cameras supported by an uninterruptible power supply, battery, or building emergency power?	Reference: *Physical Security Assessment for the Department of Veterans Affairs Facilities*	
Interior Systems			
12.12	Are black/white or color CCTV (closed circuit television) cameras used? Are they monitored and recorded 24 hours/7 days a week? By whom? Are they analog or digital by design? What is the number of fixed, wireless and pan-tilt-zoom cameras used? Who are the manufacturers of the CCTV cameras? What is the age of the CCTV cameras in use?	Security technology is frequently considered to compliment or supplement security personnel forces and to provide a wider area of coverage. Typically, these physical security elements provide the first line of defense in deterring, detecting, and responding to threats and reducing vulnerabilities. They must be viewed are an integral component of the overall security program. Their design, engineering, installation, operation, and management must be able to meet daily security challenges from a cost effective and efficiency perspective. During and after an incident, the system, or its backups, should be functional per the planned design. Consider color CCTV cameras to view and record activity at the perimeter of the building, particularly at primary entrances and exits. A mix of monochrome cameras should be considered for areas that lack adequate illumination for color cameras. Reference: *GSA PBS P-100* See Item 12.1. --Reference: *Physical Security Assessment for Department of Veterans Affairs Facilities*	

Section	Vulnerability Question	Guidance	Observations
12.13	Are the cameras programmed to respond automatically to perimeter building alarm events? Do they have built-in video motion capabilities?	The efficiency of monitoring multiple screens decreases as the number of screens increases. Tying the alarm system or motion sensors to a CCTV camera and a monitoring screen improves the man-machine interface by drawing attention to a specific screen and its associated camera. Reference: *Physical Security Assessment for Department of Veterans Affairs Facilities*	
12.24	Are panic/duress alarm buttons or sensors used? Where are they located? Are they hardwired or portable?	Call buttons should be provided at key public contact areas and as needed in offices of managers and directors, in garages and parking lots, and other areas high risk locations by assessment. Reference: *GSA PBS P-100*	

Electronic Security System Mitigation Measures (Urban Version)

Asset-Threat/Hazard Pair	Current Risk Rating	Suggested Mitigation Measure	Revised Risk Rating

Unit XII-B

COURSE TITLE	Building Design for Homeland Security
UNIT TITLE	Case Study
OBJECTIVES	1. Explain building security design issues to a building owner for consideration prior to a renovation or new construction 2. Explain the identification process to arrive at the high-risk asset-threat/hazard pairs of interest 3. Justify the recommended mitigation measures, explaining the benefits in reducing the risk for the high-risk situations of interest
SCOPE	The following topics will be covered in this unit: 1. Activity: Preparation and presentation of the highest risks identified by the groups, the vulnerabilities identified for these risks, and recommended mitigation measures to reduce vulnerability and risk. The top three risks will be prioritized as well as the top three recommended mitigation measures with rationale and justification. This includes any consideration for changes to electronic security systems per Unit XI.
REFERENCES	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*, pages 5-1 to 5-18 3. Case Study – Appendix B: Urban, HazardCorp Building

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UNIT XII-B CASE STUDY ACTIVITY: PREPARATION AND PRESENTATION OF GROUP RESULTS (Urban Version)

In this activity, students work with their groups to finalize their assessments, decide on high priority risk concerns, determine appropriate mitigation measures, and present findings to the class. The student presenter(s) will decide on the number of asset-threat/hazard pairs to present and the mitigation measures to apply. Of great importance is the groups rationale for the selection of these high risk asset-threat/hazard pairs and the rationale for the recommended mitigation measures. In light of limited resources that building owners/decision makers have to work with, the presenter(s) will identify the top three asset-threat/hazard pairs that their assessment identified and the top three mitigation measures that they would recommend to have funded using those limited resources. No Cost / Low Cost recommended mitigation measures are always welcome as procedural changes can derive significant benefit.

Requirements

1. Based on findings from the previous activities completed in the previous 11 units, complete the following table. Ensure the top three risks and the top three mitigation measures are identified.

2. Select one or two presenters from the assessment team to present the team's conclusions and their recommendations with rationale and justifications to the class in a 5-7 minute presentation.

One entry is provided as an example.

Prioritized Asset-Threat/Hazard Pair	Requirements to Mitigate	Rationale
Envelope Systems / Vehicle Bomb	Maintain available stand-off • Retain reserved government vehicle parking • Add energy-rated bollards on north, west, and south curbs nearest building • Add energy-rated planters / street furniture to plaza along sidewalk property line Harden glazing • Replace glazing on first	Design basis threats include car bomb and truck bomb, with truck bomb more difficult to mitigate • Apply known standards, such as GSA Level IV or DoD Standards / Recommendations • Note that known standards are based upon a design basis threat that may or may not equate to design basis threat selected for

	seven floors with 1-inch thick laminated glass, including strengthened window curtain wall connections • Replace any ¼-inch heat strengthened glazing on Federal floors with 3/8-inch thermally tempered glass removed from floors 1-3 • Retain 3/8-inch heat strengthened glazing on Federal Floors and add 15-mil fragment retention film with 4-sided attachment • Federal floors will meet minimum GSA pressure/impulse with these changes	the assessment Realize that these recommendations do not harden the envelope to a high level of protection, although Federal floors do very well against the car bomb.

Prioritized Asset-Threat/Hazard Pair	Requirements to Mitigate	Rationale

Prioritized Asset-Threat/Hazard Pair	Requirements to Mitigate	Rationale

Unit XIII

COURSE TITLE	Building Design For Homeland Security
UNIT TITLE	Course Wrap-Up
OBJECTIVES	1. Reflect upon the reasons for attending the course provided during Unit 1 Introductions (any Case Study version) and the conduct of course. a. Expectations met? b. Likes and dislikes? c. Value? 2. Provide written feedback to the Course Director and Instructors through course evaluation forms and verbal comments related to the course specifically or building design for Homeland Security in general. This feedback is critical to improving the course.
SCOPE	The following topics will be covered in this unit: 1. Discussion of general issues and concerns. 2. Course evaluations – forms and verbal comments. 3. Distribution of course certificates.
REFERENCES	No references are required for this unit.

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APPENDIX B: URBAN CASE STUDY

HAZARDCORP BUILDING

INTRODUCTION

The 50-story privately owned and developed office building was completed in 1987. It is located in the central business district of a major city. It has 2,023,680 gross square feet of enclosed space. The building foot print is 248 feet by 170 feet; the area of each floor is 42,160 square feet. Figure 1 shows the east elevation of the building. There is a public plaza at the main entrance to the building providing an 80 foot setback to the curb.

With so many different tenants in the building the occupancy at any given moment is difficult to judge. However, each tenant estimated on average that two-thirds of personnel assigned to the building were present on a given day. Extrapolated over the whole building, the actual occupancy is estimated to be 8,000 people. In addition, the first floor lobby and retail spaces can have an additional 1,000 people depending upon time of day.

Figure 1. East Elevation of HazardCorp Building

GENERAL SITE DATA

The HazardCorp Building is located in the downtown business district of a major urban city. There are several commercial iconic properties, several government offices, and various high-density attractions within a 5-mile radius of the building. As with many major cities, there is significant water access to various locations within the 5-mile radius and because of the water, ground access is constrained by bridges, tunnels, and ferries. While two major airports are over 5 miles from the building, what is not shown are 8 heliports and 2 skyports inside the 5-mile radius. A metropolitan subway also serves the business district and the nearest station is two blocks from the building. There is significant shipping serving the various ports carrying all types of materials for use in Hazard City and transshipment to other locations. In conjunction with the ports and the transshipment of goods, there is extensive railroad trackage, some as close as within 1-1/2 miles of the building. The area around Hazard City is the No. 4 intermodal port in the Western Hemisphere. Intermodal means the ability to move freight from ship to train to truck and back again. An intermodal port ties together ship, rail, and truck freight transfers.

5-Mile Radius

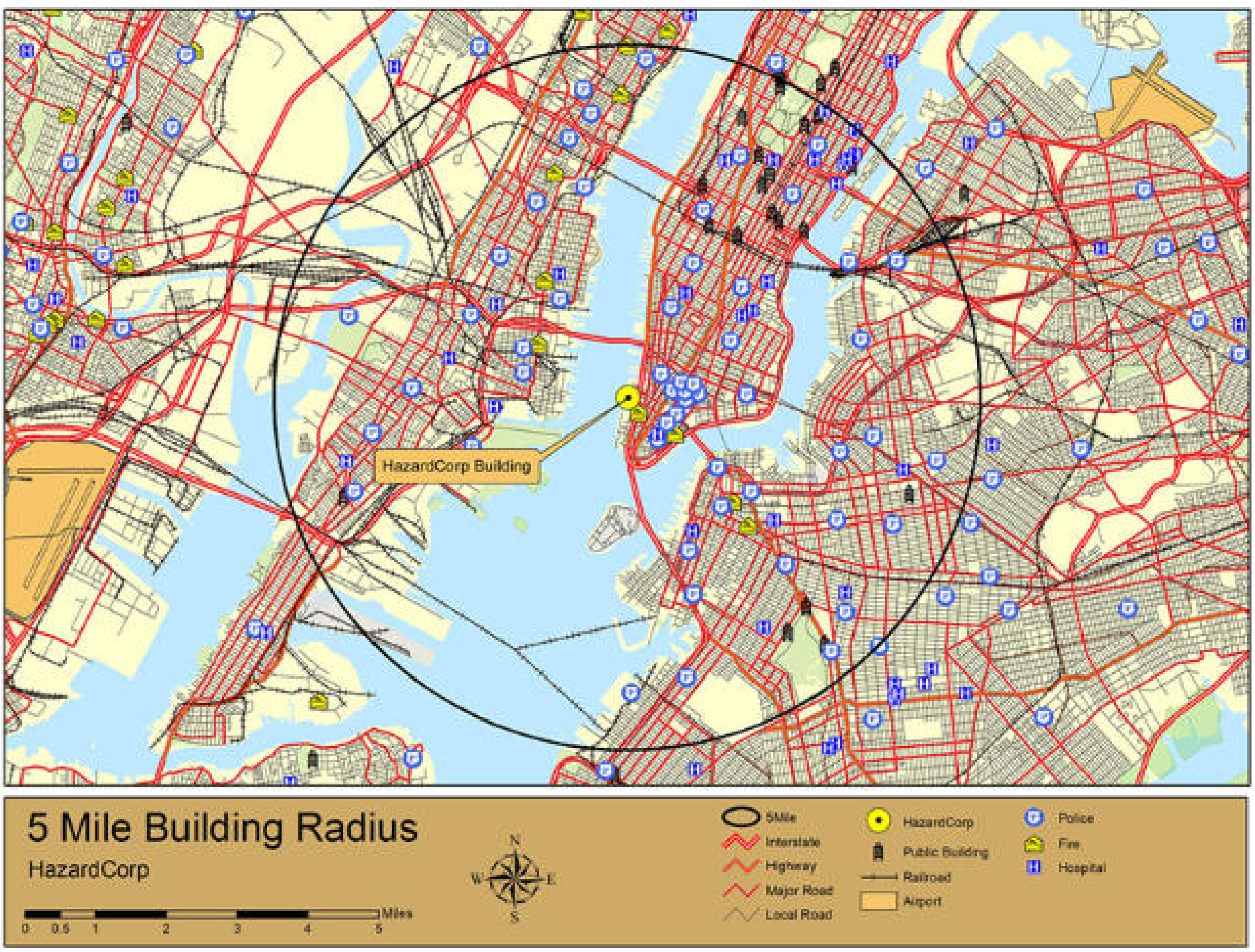


Figure 2. HazardCorp Building 5-Mile Radius

Local Imagery

The HazardCorp Building is bounded by city streets with high traffic volumes and is within 0.05 miles of a nearby river. The building has underground parking within the property lines and a large loading dock area for supply trucks, vendors, and trash supporting the tenants of this building. Trash is handled by a large dumpster located in the loading dock area with no special provisions in building structure. Outside the building the trash containers, USPS mailboxes, newspaper vending machines, Fed-Ex/UPS/DHL boxes and the like are kept to the edge of the sidewalk on the far east side of the plaza. The plaza is otherwise bare, except for 8 area lights on poles with a circular bench around the base of each light pole. HazardCorp receives mail, packages, and equipment at the Loading Dock where a recently renovated (per DoD criteria) mailroom/shipping office inspects the items using x-ray and other equipment before distributing to tenants within the building. By agreement, HazardCorp Building accepts deliveries for specific tenants in other buildings in the immediate vicinity (within 2 city blocks) due to this mailroom capability.

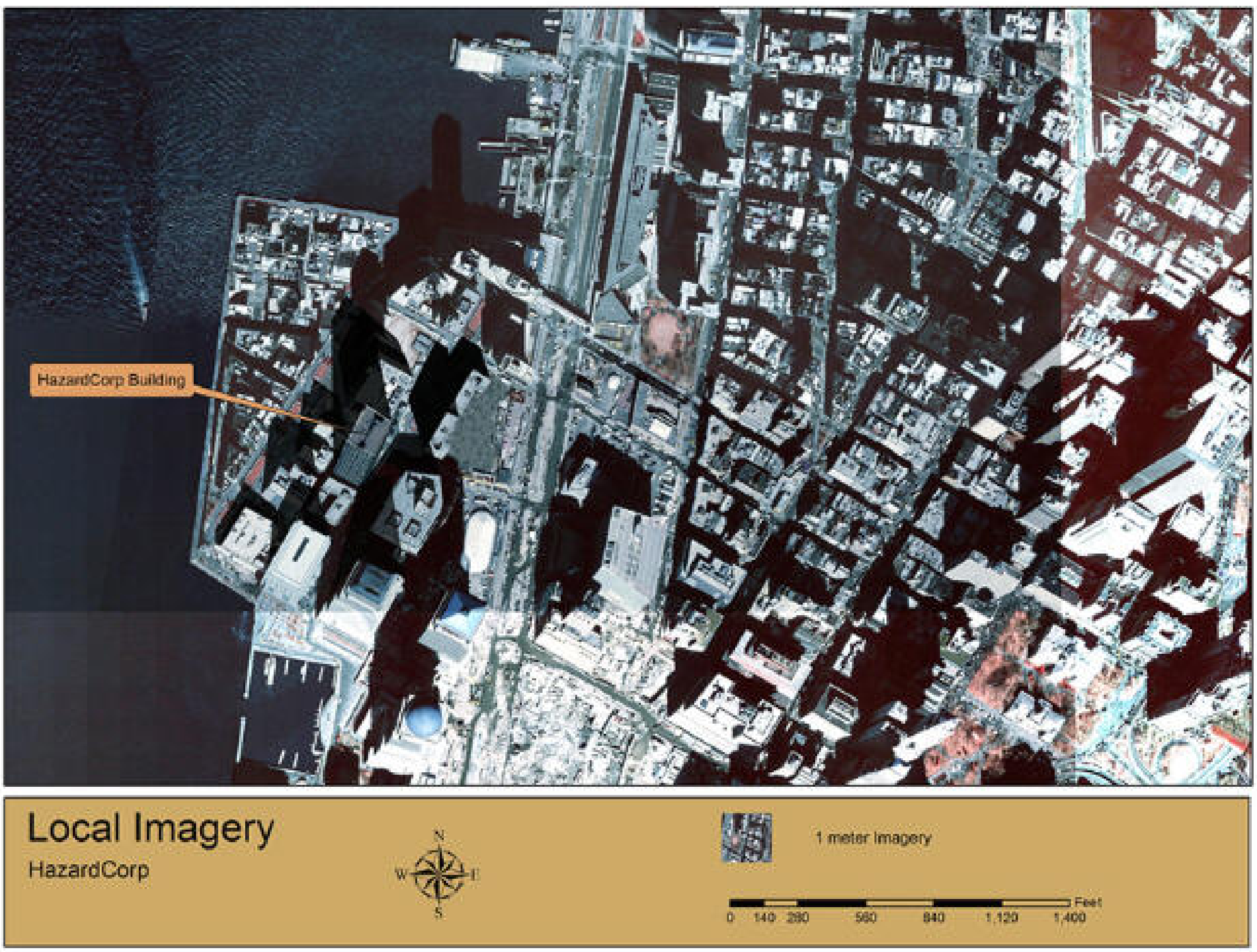


Figure 3. HazardCorp Building Locale and Surrounding Buildings

Site Imagery/Drawings/Photos

The plaza provides significant stand-off distance from the major thoroughfare on that side of the building. However, the other sides of the building have smaller well traveled streets, and there is significant truck traffic to the HazardCorp Building Loading Dock. On the east side of the plaza is a drop off zone where no parking is allowed and building stand-off is 80 feet. On the north and west sides of the building for the whole building block, parking is restricted to government vehicles only with designated parking spaces. Double parking next to the government vehicles provides 15 feet of stand-off on the north side and 10 feet of stand-off on the west. Commercial parking is allowed on the south side in support of the Loading Dock and stand-off is 10 feet. There are two entrances and exits to underground parking on the site – on the northwest under the building and on the southwest under the plaza. There are three levels of parking underground.

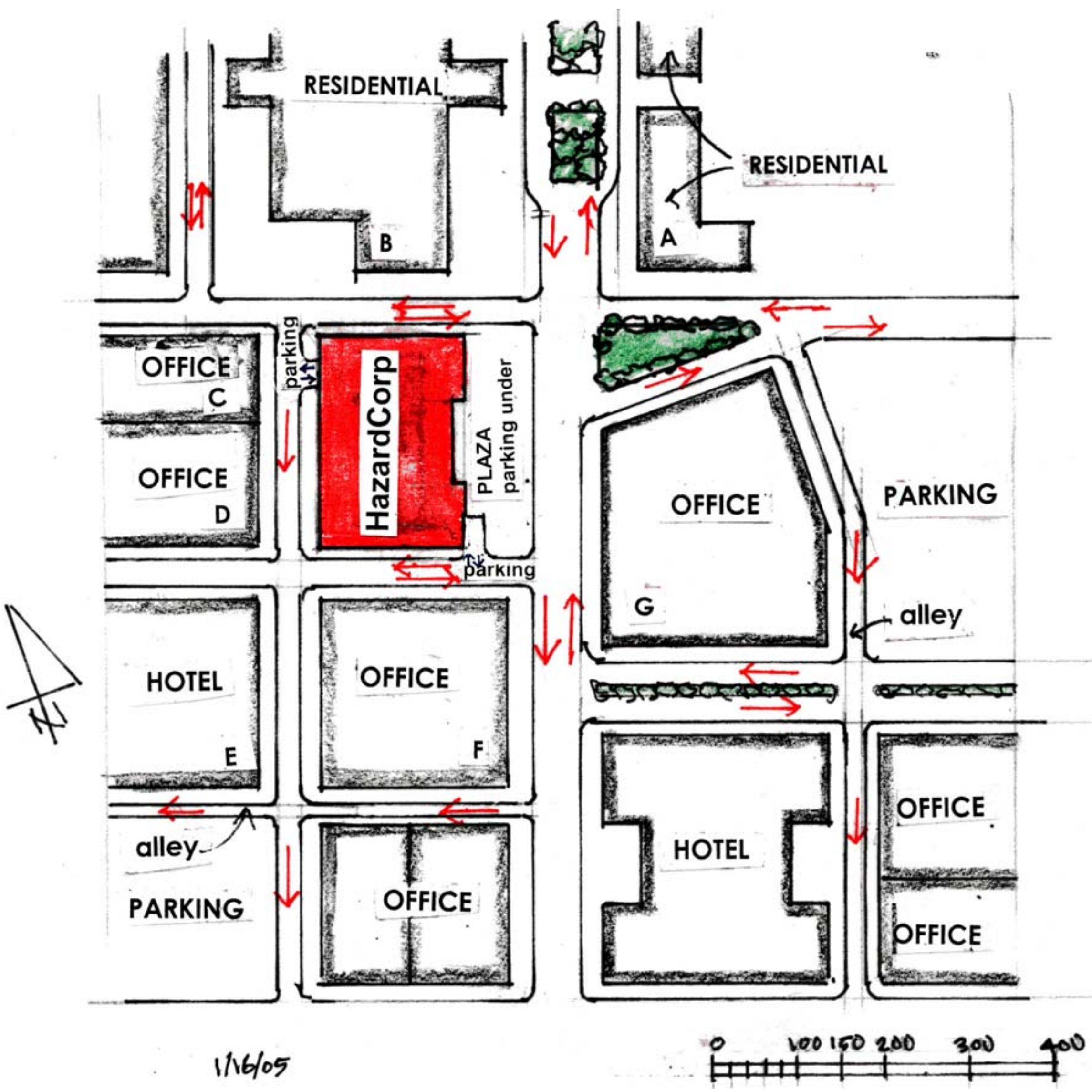


Figure 4. HazardCorp Building Location

Figure 5 below shows the character of the adjacent buildings, identified by alphabetical reference number on the site plan.

A and B: 14 – 26-story residential condominiums, constructed 2001-2005 (Figure 5-1 and Figure 5-2).
C: 10-story office, constructed 1925 (Figure 5-3)
D: 10- story office, constructed 1934 (Figure 5-4)
E: 14- story hotel, constructed 1935 (Figure 5-5)
F: 20-story office, constructed 1970 (Figure 5-6)
G: 20-story office, constructed 1994 (Figure 5-7)

Figure 5-1. Building A

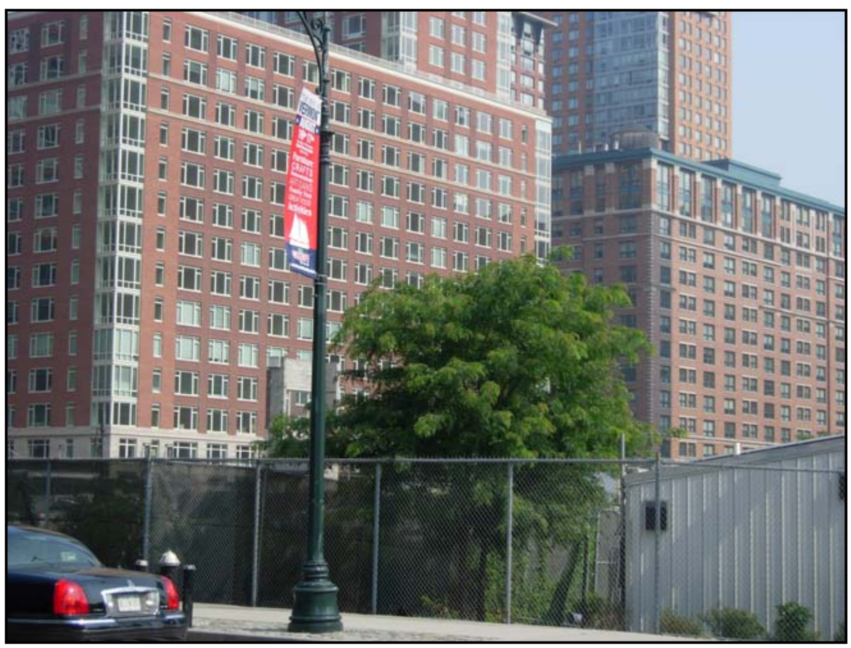


Figure 5-2. Building B

Figure 5-3. Building C

Figure 5-4. Building D

Figure 5-5. Building E

Figure 5-6. Building F

Figure 5-7. Building G

Figure 5: Buildings Adjacent to HazardCorp Building, as Identified on the Figure 4. Site Plan

Hazardous Material (HazMat) Sites

There are a significant number of hazardous materials use and waste sites in near proximity to the HazardCorp Building. The vast majority are small generators such as gas stations, dry cleaning, and other commercial businesses. Large generators are identified by labels. Note the prevailing winds impact upon toxic releases. In addition rail and maritime transportation move significant hazardous materials through the area. Maritime shipping lanes to the west of the building see large shipments of fertilizer, petroleum products, and compressed natural gas. This port area is the No. 4 intermodal port in the Western Hemisphere. Intermodal means the ability to move freight from train to truck and back again. In fact, shipment between maritime, truck, and rail makes this a truly intermodal port in the broader sense.

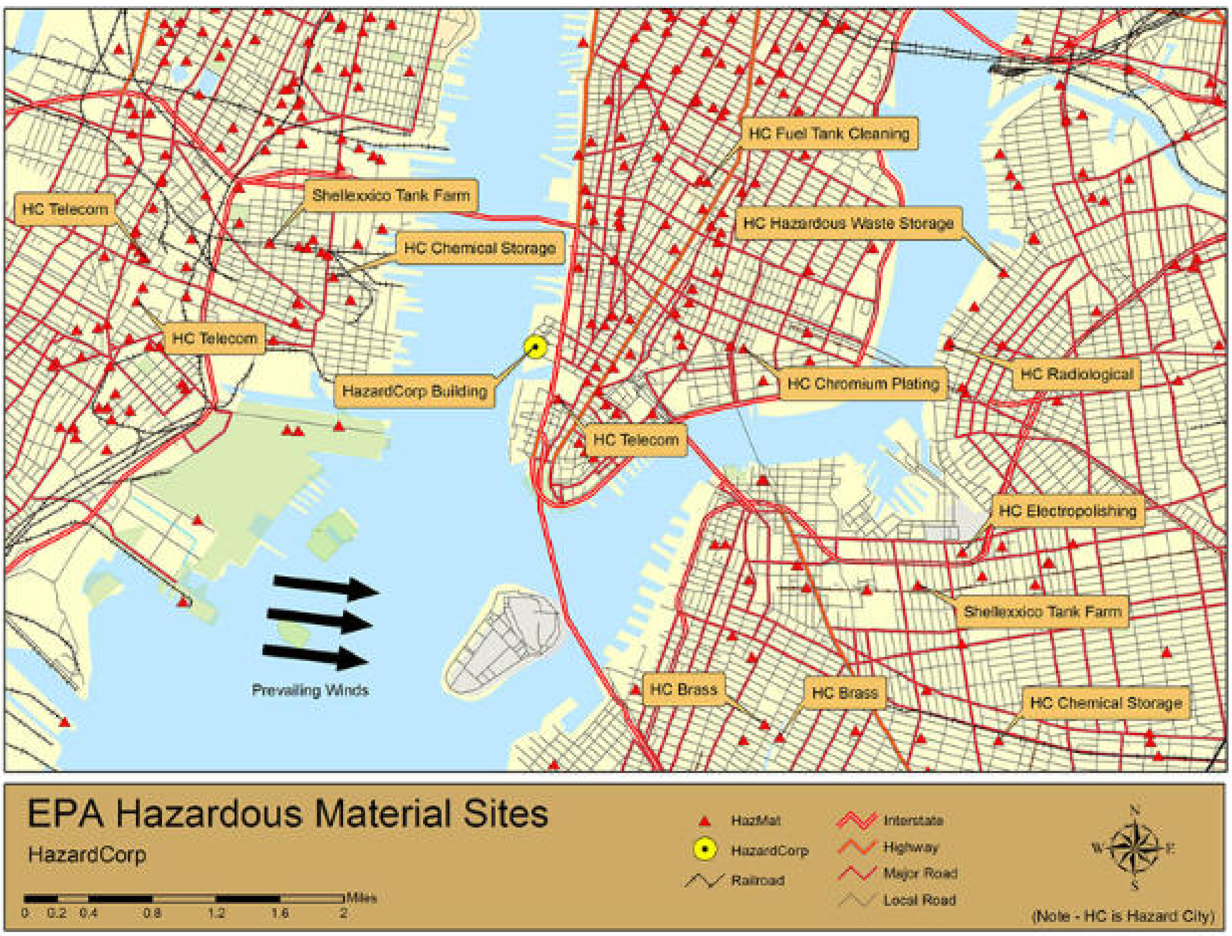


Figure 6. HazMat Sites Near the HazardCorp Building

The prevailing weather pattern comes out of the west on the average. Seasonally, the weather patterns and winds shift, coming out of the northwest during the winter and out of the southwest during the summer. The area is known for periodic flooding due to storm surges during hurricane season with up to 100 tornadoes of various F-scale ratings per year. There are recorded deaths due to tornadoes of 25 or more people per year on about a 20-year cycle (1967 and 1990, the last occurrences).

Emergency Response Capabilities

The local emergency response capabilities show primary police and medical facilities within 2 miles of the HazardCorp Building. There are multiple police jurisdictions in the area meaning all police locations would probably not respond to an incident at HazardCorp Building. Fire facilities are more limited, with 2 fire stations nearby. However, the other fire stations, while 2-3 miles from the building, must travel along transportation chokepoints to get over water, resulting in longer response times. There are multiple means of ingress and egress to the HazardCorp building site, mostly on secondary roads for the last 0.2 miles. The building is ringed by 20- to 24-inch water mains with a single hydrant on each side of the building just off the sidewalk curb.

Figure 7. Emergency Response Capabilities Near the HazardCorp Building

Building Layout by Function

A loading dock and service entry is located at the south-west corner of the first floor with retail space on the exterior walls as shown in Figure 8. The core as shown in Figure 9 is the basic layout of the upper floors. The ramp down and ramp up for access to parking is typical for the arrangement serving the plaza parking. Table 1 lists the larger tenants and the floors they are on in the HazardCorp Building. Utility service entrances are indicated on Figure 8 by arrows and utility name outside the building footprint. These services enter the building at one of the underground parking levels.

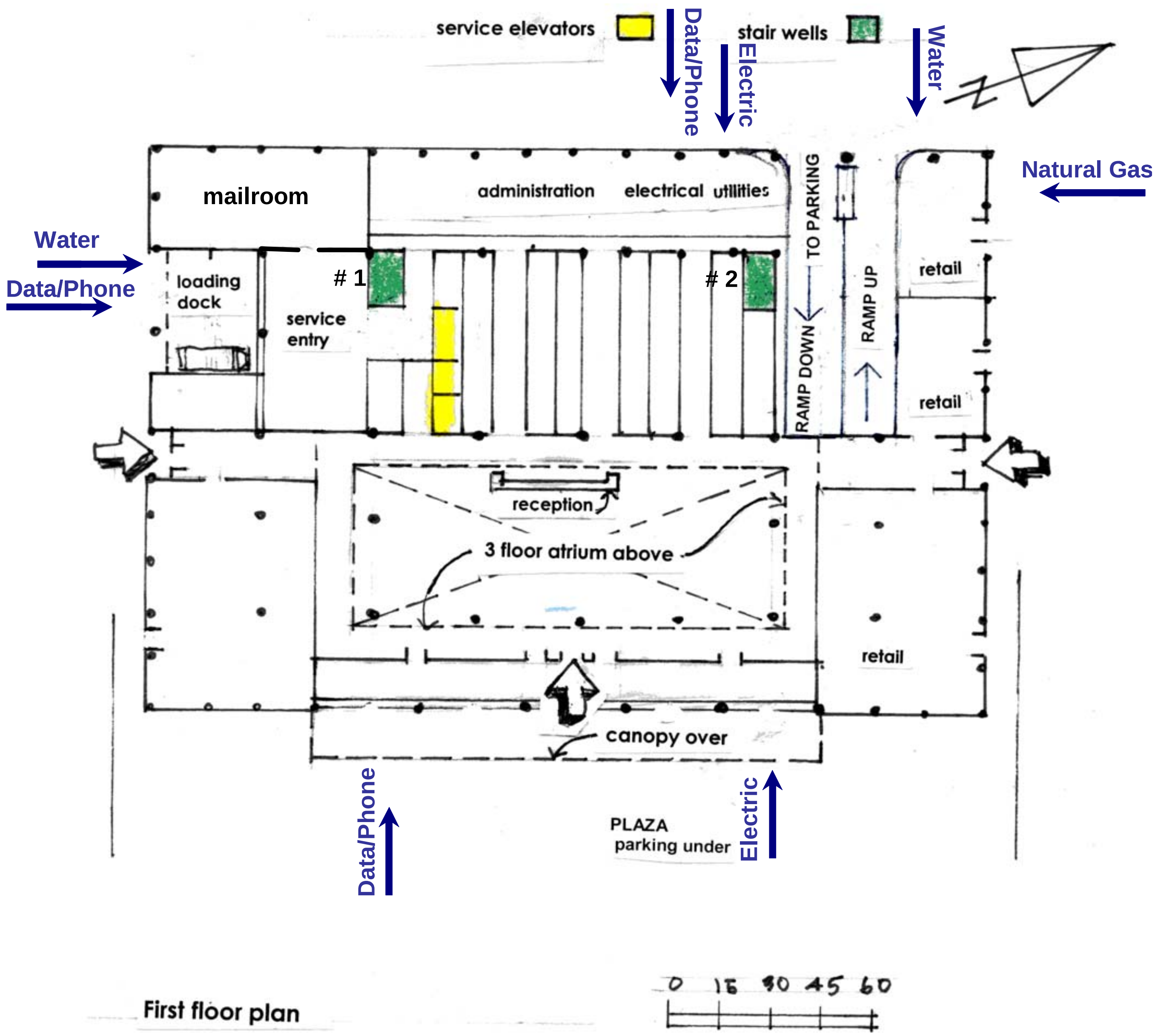


Figure 8. HazardCorp Building, First Floor Plan

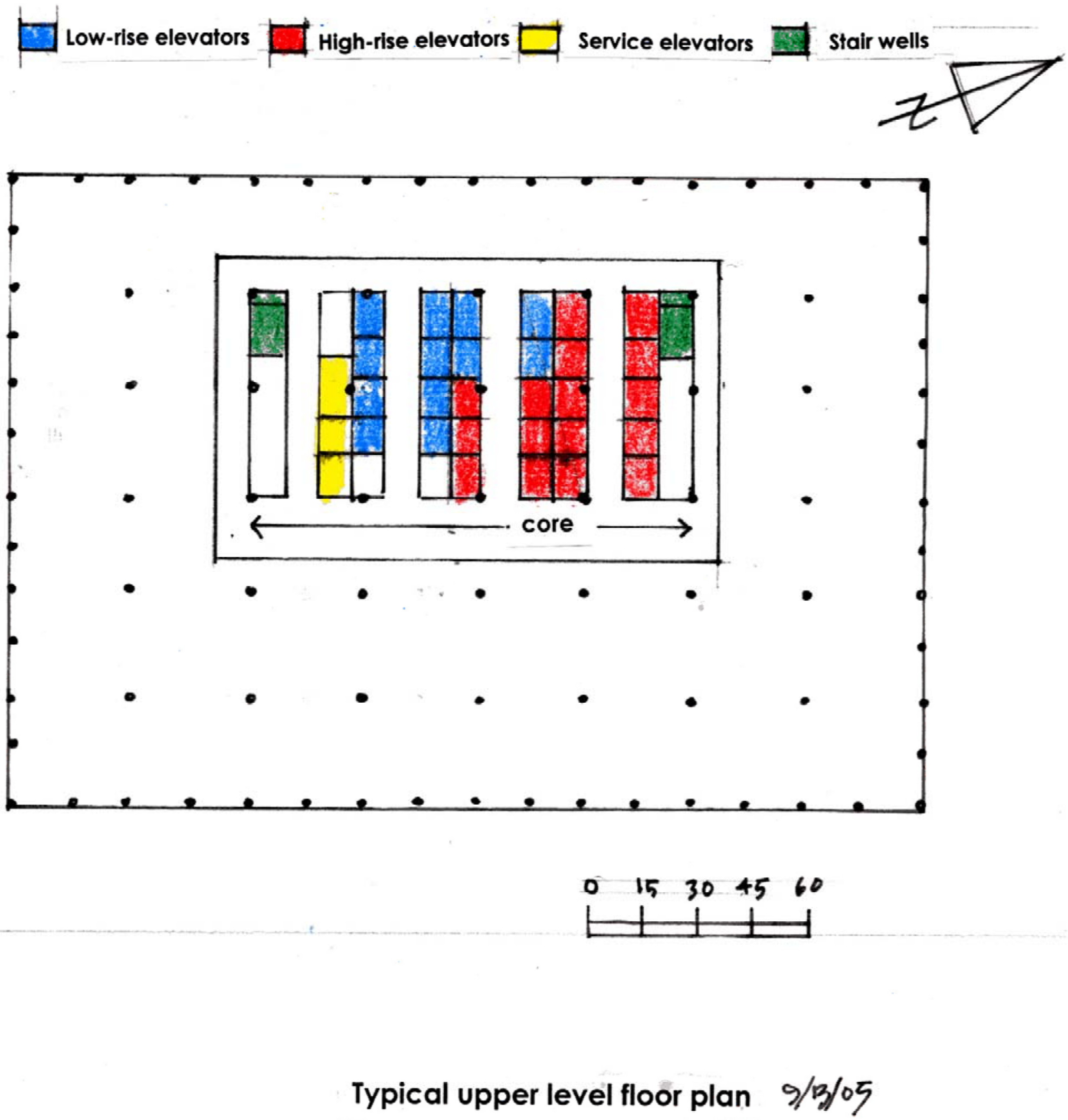


Figure 9. HazardCorp Building: Typical Upper Floor Plan and Core Space

The legend in Figure 9 shows the location of low-rise elevators, high-rise elevators, service elevators, and stairs. The white blocks in the core of Figure 9 contain the toilets, air conditioning ducts, and risers for electrical, telecom, computer, fire protection, and plumbing unless indicated elsewhere.

Table 1. HazardCorp Building: Tenant Occupancies

FLOOR	TENANT OCCUPANCY
49-50	Mechanical Floors
31-48	National financial services company
29-30	Bank offices
27-28	Federal government offices (IRS, DOD, CIA)
26	Mechanical room
25	Office of Emergency Management
23-24	Financial service company
20-22	Insurance company
19	State Employment Commission
15-18	Vacant
14	Financial management company
8-13	Federal government offices (SEC, Secret Service)
6-7	Bank offices
4-5	Storage, switch gear, generators, transformers
3	Open to first floor lobby, rentable meeting space, building management
2	Open to first floor lobby, rentable meeting space
1	Lobby, retail, fuel storage, switchgear, building administration, loading dock
UG1	Parking
UG2	Parking
UG3	Parking

There is a standard menu board found in the Lobby that indicates the tenants on each floor and the associated primary room number.

Potential Blast Effects – Nominal Car Bomb

The nominal range to effects chart radius of influence of a car bomb detonation at the front entrance (plaza side) indicates that the building would experience some damage, but likely not suffer progressive collapse. The car bomb could be in a limousine which frequent the area and are seen parking and standing for long periods of time. The limousine could have a larger weapon yield than a standard sedan. The front façade of the building is approximately 80 feet from the car bomb and only a portion of the red and orange rings are inside the building. The building has a window curtain wall on the exterior. The Lobby, albeit having stronger glass has fewer structural members to which to transfer blast loading, and will be affected the most by this blast location. Due to the stand-off distance, it is not expected that any load-bearing structural members will fail in this situation.

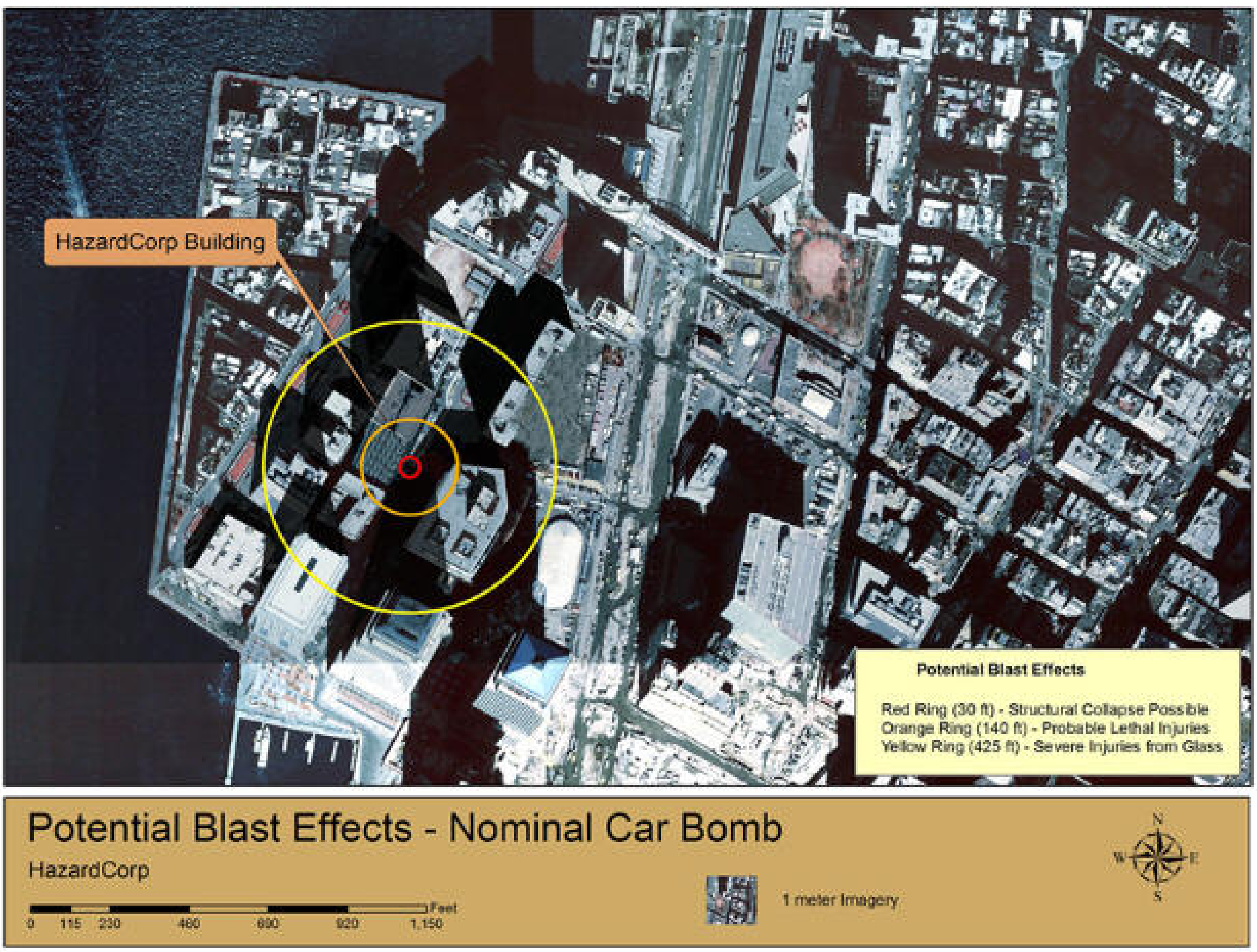


Figure 10. Car Bomb Blast Effects (Plaza Drop Off)

Potential Blast Effects – Nominal Truck Bomb Detonated Nearby

A truck bomb detonation on a nearby street (another building is the target) would cause significant damage to the HazardCorp Building, primarily glass breakage and potentially some structural damage based upon the ultimate size of the bomb. Depending on the height of adjacent buildings, effects from reflected blast could increase the collateral damage and potential for casualties. While the HazardCorp Building is not located on a main thoroughfare, a random estimate of truck traffic within 1,000 feet of the building indicates 30 delivery trucks (18-foot-long enclosed bodies) transit the area per hour and a similar number of smaller delivery vans between 0600 and 1800. These numbers reduce to about 10 delivery trucks and 10 delivery vans on average per hour between 1800 and 0600.

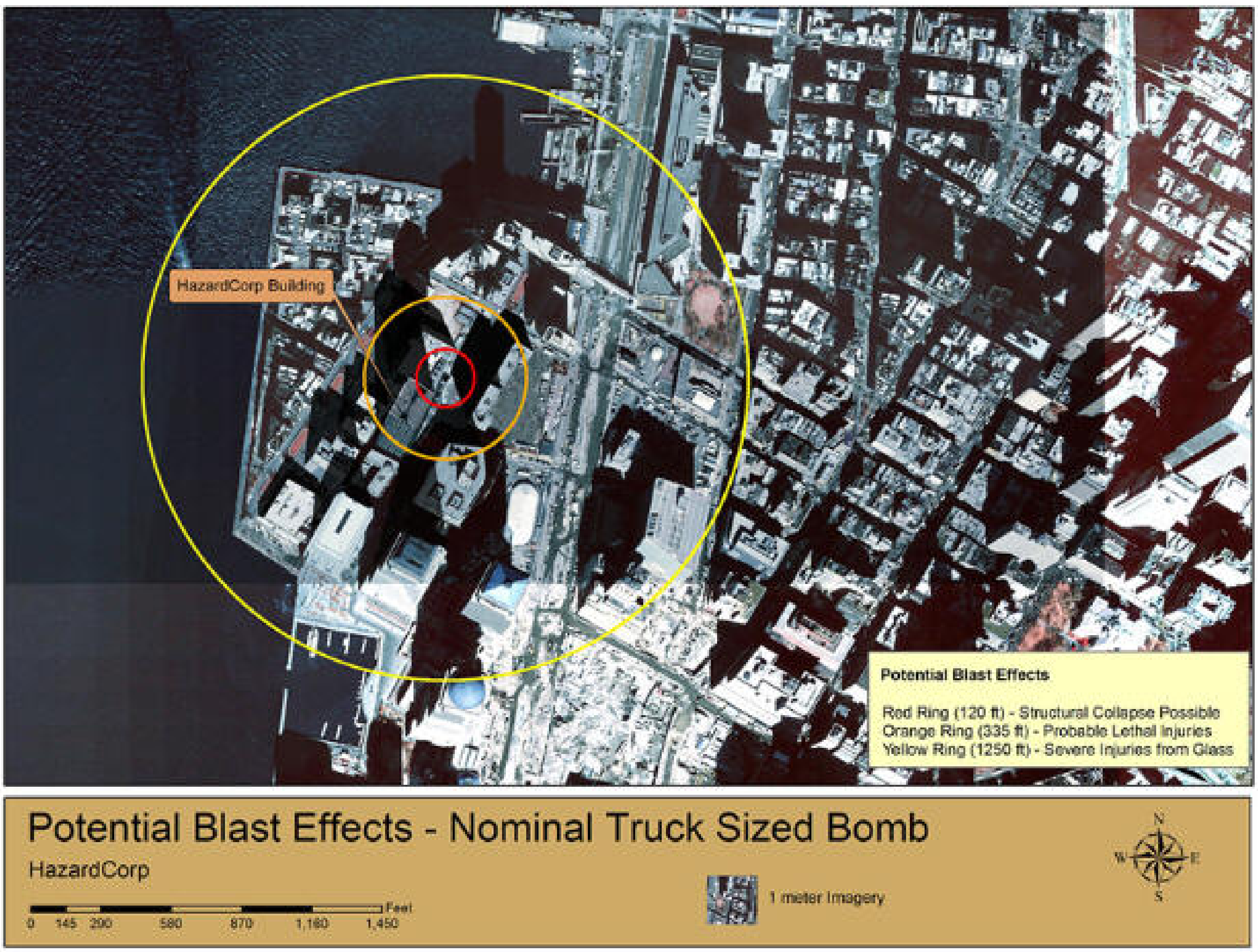


Figure 11. Truck Bomb Blast Effects (Another Building Targeted)

Potential Blast Effects – Nominal Truck Bomb Detonated On Site

A truck bomb detonation at the HazardCorp Building Loading Dock would result in significant structural damage along with the strong potential for progressive collapse, especially in and above the atrium area. The constraint of the Loading Dock will direct more blast into the service entry affecting critical infrastructure, especially in the core area.

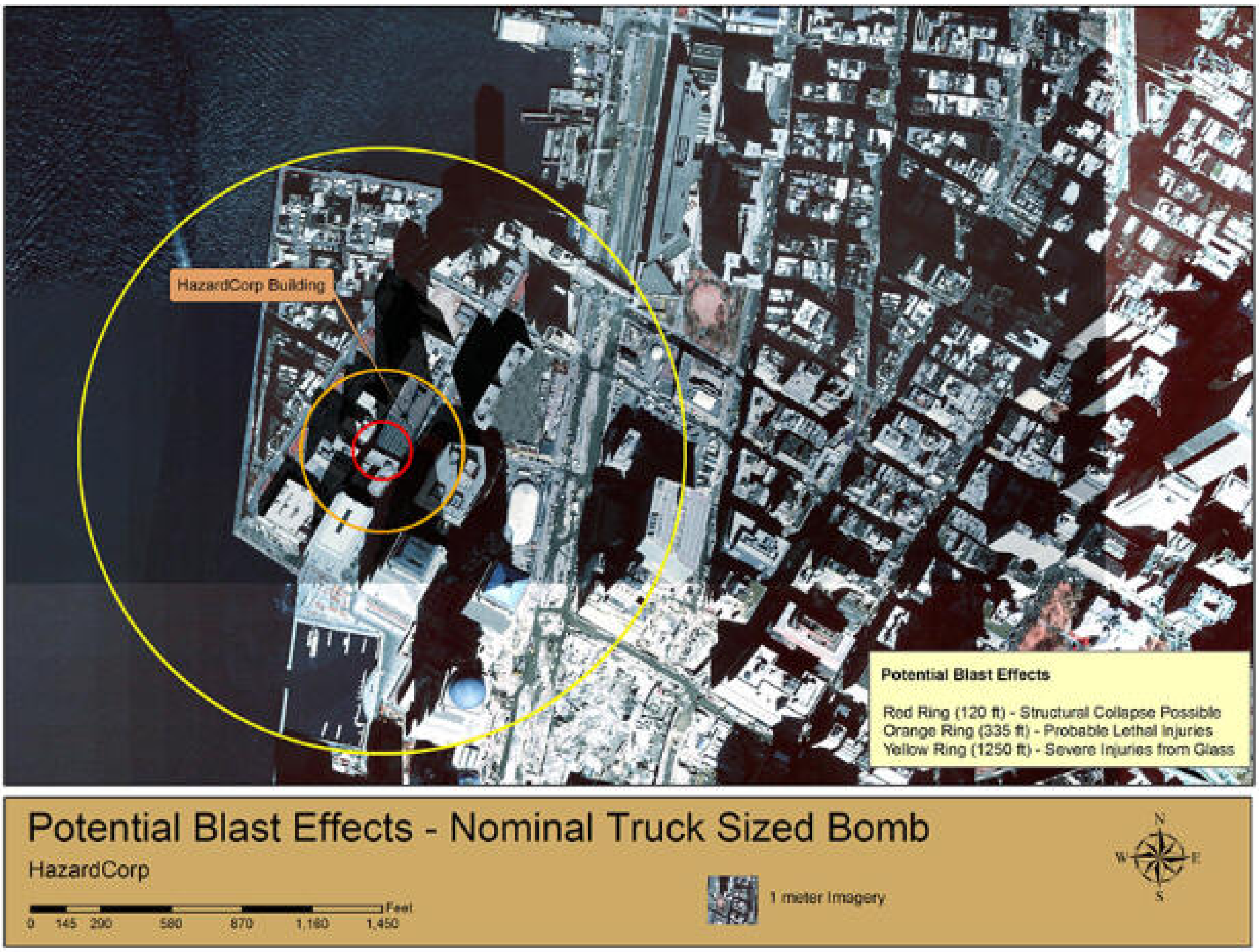


Figure 12. Truck Bomb Blast Effects (Loading Dock)

BUILDING DATA

The building was designed in 1985 using the various applicable building codes in force in 1984. Construction began in 1986 and was completed in 1987. The region has low level seismic activity and the building was designed to a Seismic Zone 2A where the expected peak ground acceleration with 10% probability of exceedance in 50 years is Z = 0.15 or 4%g per 2002 revisions.

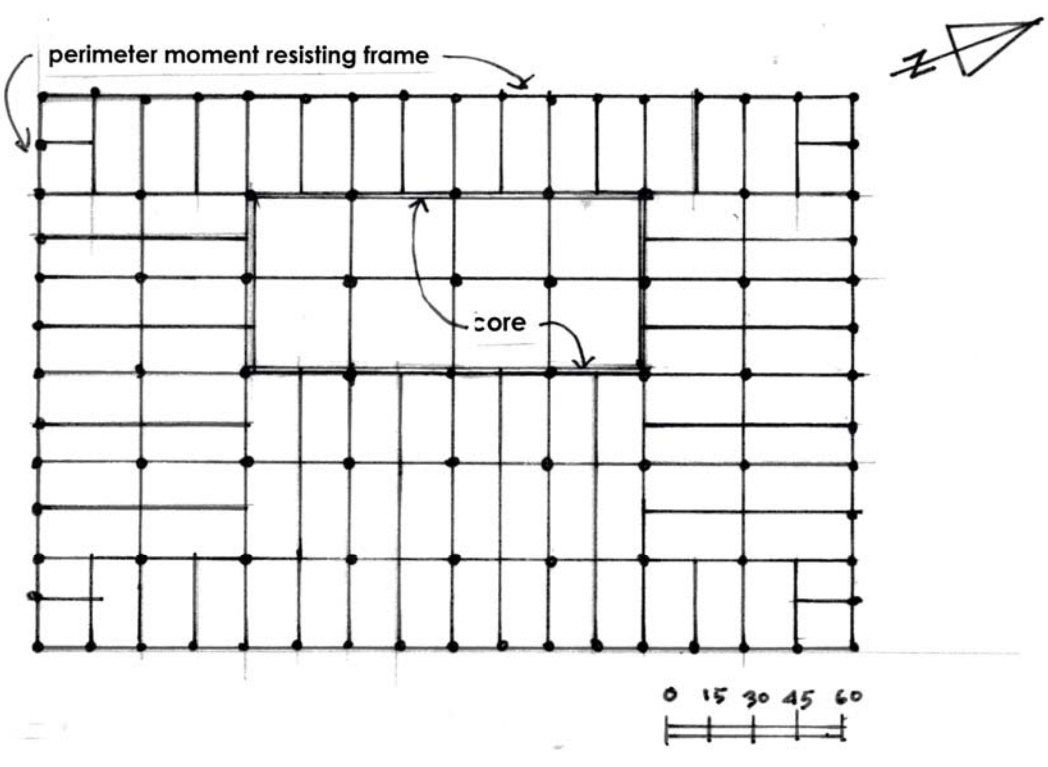
BUILDING STRUCTURE

Structural Systems

The building foundations are reinforced concrete caissons.

The typical floor framing shown in Figure 13 is used for the 4th through the 48th floors.

In the first to third floors there is an open atrium and 60 foot transfer trusses (also called transfer girders or transfer beams) at the fourth floor span between the core and girders towards the front of the atrium to provide clear space.



Typical floor framing plan, 4th through 49th floor.

Figure 13. Typical Floor Framing Plan, 4th through 49th Floors

The gravity framing consists of composite steel beams that span from the core to the perimeter frame. The office floor slab is an electrified composite 3-inch metal deck with 2-1/2- inch normal-weight concrete fill spanning between the steel beams. The underground parking floor slabs are substantial cast-in-place reinforced concrete with reinforced concrete columns that align with steel columns on the first floor and have additional columns to handle the vehicle loading.

The lateral load resisting system (for wind loads only) consists of four perimeter moment frames, with a column spacing of approximately 15 feet , one at each exterior wall, augmented by two-story belt trusses between the 4th and 6th floors and the 22nd and 24th floors. There are additional trusses at the north and south elevations below the 4th floor. An interior cross braced core extends from the foundations to the 6th floor. The horizontal shear is transferred into the core at the 4th and 6th floors. The 4th floor diaphragm consists of a 14-inch thick reinforced concrete slab with embedded T-sections. The 6th floor is an 8-inch thick reinforced concrete slab.

The floor-to-floor story height for office and parking garage floors is 12 feet. The first three floors are 14 feet and the mechanical floors are 16 feet in height.

Connections

A variety of framing connections are used. Seated beam connections are used between the exterior columns and the floor beams. Single-plate shear connections are generally used at beam-to-beam connections. Double- angle connections are provided between some beam and end-plate connections at beam- to- interior columns

Along the four exterior elevations, center-to-center column spacing is approximately 15 feet. Column trees are used at these locations. A column tree is a shop-fabricated column assembly with beam stubs shop-welded to the column flanges.

Along the exterior elevations, and within the core up to the 6th floor, the spans are approximately 30 feet. Interior column spacing is approximately 30 feet. At these locations, traditional moment frame construction is used. Top and bottom flange plates, as well as one-sided web shear plates, were shop welded to column flanges. The beams were then field-bolted into the connection.

The majority of column splices were bolted according to American Institute of Steel Construction details. They are located 3 feet 6 inches above the floor and are not designed to accommodate tensile forces. Some columns below the 6th floor are special large sections or built-up box shapes with plates up to 10 inches thick welded from flange to flange, parallel to the web, to provide the necessary section properties.

The majority of the bracing members are two channels or two T-sections connected to the structure by a welded gusset plate. A single wide flange section is also used. These members are connected with web and flange plates, similar to those used in the moment frames.

Exterior Wall Cladding

The building exterior is clad with an aluminum/glass curtain wall attached to the face of the building structure. Typical glazing is ¼ inch or 3/8 inch annealed single pane double-strength glass for wind loading. The first three floors are 3/8 inch thermally tempered single pane glass, including doorways on the first floor. The ¼-inch double strength single-pane glass can be found on Floors 4 to 8 based upon wind velocities predicted. The 3/8-inch double strength single-pane glass is installed on Floor 9 and higher. The glazing pane size is 5 feet by 5 feet for vision glass and the same size or smaller for spandrel glass over structural elements due to the different floor heights. The framing for the exterior glass is heavy weight aluminum with great ductility and strength resulting in each pane of glass reacting independently.

FIRE PROTECTION SYSTEMS

Egress Systems

There are two main exit stairwells in the building. Stairwell #1 is located on the southwest side and Stairwell #2 is located on the northwest side within the central core. Both exit stairwells discharge to the building interior at ground level or to the parking levels underneath the building and are approximately 4 feet 10 inches wide. The staircases were built of fire-rated construction using gypsum wall board and are pressurized to keep smoke out of the stairwells during a fire per local building code. Battery operated emergency lighting is provided in the stairwells and photo-luminescent paint is placed on the edge of the stair treads to facilitate emergency exits. In addition to the battery-powered lighting, the stairs also have emergency system lighting powered by the generators. These stairwells extend to all underground parking levels. There are also two stairwells serving the underground parking under the plaza, on the northwest and southeast corners of the plaza.

Twenty-eight passenger elevators and three service elevators serve the various levels of the building. Occupants using the elevators would typically discharge at the first level and exit through the Lobby to the outside. Two building elevators provide service to the underground parking levels. The plaza underground parking has two elevators that are located just east of the plaza parking entrance and exit.

There is a Building Security Committee made up of security representatives from each tenant. The Building Security Committee maintains the fire evacuation and response plan for the building, coordinated with the fire evacuation and response plan for each tenant.

There are also trained Fire Watch personnel on each floor that know the occupants of that floor, any special egress requirements, where equipment is stored to assist personnel during evacuation, and communication procedures. These personnel have training exercises in conjunction with the responding fire station every other month.

Detection and Alarm

Smoke detectors are located in the telecommunications, electrical, and communications closets as well as inside the HVAC system ducts, in the mechanical rooms and in all elevator lobbies. Manual pull stations are provided at the entrances to stairwells and at each of the exits. Public Address speakers for voice evacuation announcements are located throughout the building and are activated manually at the Fire Control Center (FCC). Strobes are provided and are activated automatically upon detection of smoke, water flow or initiation of a manual pull station. Monitoring of the fire-alarm control panel for the building is provided independently at a central station. In addition to the emergency generators, the existing uninterruptible power supply (UPS) provides 4 hours of full operation for the fire alarm system and 212 hours of standby operation. The floors contain a combination of area smoke and heat detectors.

The FCC is located in the Building Security Office on the first floor in the administration area.

Compartmentation

Concrete floor slabs provide vertical compartmentation to limit fire and smoke spread between floors. The space between the edge of the concrete floor slab and curtain wall, which ranges from 2 to 10 inches is filled with fire-stopping material.

A zoned, smoke control system is provided in the building. This system is designed to pressurize the floors above and below the floor of alarm and exhaust the floor of alarm to limit smoke and heat spread.

The building code in force at the time of construction, Classification 1B (2-hour rating for beams, girders, trusses, and 3-hour rating for columns), was specified for the building. The building construction notes specified the following:

- Interior columns and exterior wall columns are fireproofed with spray-on fireproofing.
- Beams and girders are fireproofed with spray-on fireproofing.
- Spray- on fireproofing was required to be subject to controlled inspection.

Suppression Systems

The primary water supply is provided by a dedicated fire yard main looped around the complex. This main is supplied directly from the municipal water supply. Fire department connections are provided at the west and north sides.

The building is sprinkled, with the exception of the electrical equipment rooms. The sprinkler protection is of a “light hazard” design. The sprinkler system on most floors is a looped system fed by a riser located in Stairwell #2. The Loading Dock is protected with a dry-type sprinkler. The area of the fuel tank for the Office of Emergency Management (OEM) system has a special fire detection and suppression system.

Each stairwell has standpipes in it. At each floor in each stairwell, there is a 2-1/2-inch outlet with a 1-1/2 –inch hose (with a ¾-inch nozzle). In addition, the south side of each floor also has a supplemental fire hose cabinet. Primary water supply to the standpipe system comes from yard main, which is fed from the municipal water supply.

There are a limited number of hand-held fire extinguishers located in the building, usually in mechanical spaces, where cooking is done, and in a designated Fire Watch area on each floor. Filled with monoammonium phosphate under approximately 200-250 pounds pressure, these extinguishers are designed to combat Class A, B, and C fires. The fire extinguishers are visually inspected to make sure pressure is in the allowable band on a monthly basis by a Building Management.

ELECTRIC POWER – COMMERCIAL AND BACKUP GENERATORS

Power to the building enters at 13,800 volts (V) in a Hazard City Electric Company substation, located in the electrical utilities area of the first floor, and fed by a looped system. The incoming voltage is stepped down to 480/277 V by silicone oil-filled transformers in individual masonry vaults on the 4th floor, and is distributed throughout the building. In addition there are a number of transformers on the first floor. On each floor a dry-type three phase transformer taps into the 480/277 V distribution and steps down to supply single-phase 120 V branch circuits. The main switch has ground fault protection. Emergency power generators are located on various levels and provide a secondary power supply to tenants. This Building Management equipment provides back-up power for communications equipment, elevators, emergency lighting in corridors and stairwells, access control systems, CCTV, physical security alarms, fire detection and alarms, and fire pumps. Emergency lighting units in the exit stairwells, elevator lobbies and elevator cabs are equipped with individual backup batteries. Some tenants have their own emergency power generators to sustain their critical operations – see Table 2.

The tanks that provide fuel for the emergency generators are located in the building. The tanks that provide fuel for the 30-48th floors are underground below the Loading Dock. The fuel oil pipes and distribution piping for these floors were dedicated to the tenant's generator plant. The OEM tank on the ground floor is on a fire-rated platform within a 4-hour fire-rated enclosure. The base building life safety generators and OEM generators have their own dedicated fuel oil pipes and piping. Table 2 shows the location of fuel tanks and generators throughout the building.

The switchgear for commercial power and backup generator power are co-located on the same floor, normally within the same electrical room. The OEM generators are the one exception where these feed an automatic transfer switch / emergency panel on the 26th floor and then fed to the OEM on the 25th floor. The commercial power is run to the automatic transfer switch through an electrical riser on the opposite side of the core area from the electrical riser used to run the backup power.

Testing of generators is done by each respective tenant for their systems. The Building Management generators are run once every three months for 2 hours, exercising all components of the system under near maximum load conditions. If the 2 hour test fails, then repairs are made and another test is coordinated within 2 weeks and so on until the system runs successfully for 2 hours. A rule of thumb for generator fuel consumption is 0.07 gallon/KW load/hour. Assume 100 per cent loading unless otherwise known.

TABLE 2. Building Fuel Distribution Systems

Occupant	Storage tanks	Risers	Day Tanks	Generators
OEM	Uses Building Management to fill day tanks	Located in shaft in west elevator bank	275-gallon tank on 5th floor and 6,000- gal. tank located between 2nd and 3rd. floors.	Three 500-kW on 5th floor on east side
National Financial Company	Two 6,000-gallon tanks under Loading Dock at ground level	Located in shaft on south west corner of building	None Uses Pressurized Re-circulating Loop	Nine 1,725 kW on 4th floor, six on west side, three on south-east side.
U.S. Secret Service	Uses Building Management tanks	Located in shaft in west elevator bank	Approximately 50-100 gallon tank under generator on 8th floor	8th floor
Building Management	Two 12,000-gallon tanks under Loading Dock on ground level	Located in shaft in west elevator bank	275-gallon tank on 4th floor	Two 900-kW on 5th floor on south east corner

HVAC (Heating, Ventilation, and Air Conditioning) SYSTEM

The building is serviced by an all air HVAC system delivering treated air at the ceiling through VAV (variable-air-volume) outlets. Return air is through a ceiling plenum. The main mechanical rooms are located on the 26th, 49th, and 50th floors. The building HVAC system uses heat pumps with supplemental electric heat for cooling and heating. The lighting system for the building is an integrated heat source in the operation of the building, meaning all lights need to stay on all the time during the winter, but can be turned off or turned down during the summer. Also see Compartmentation under Fire Protection Systems.

The major tenants have significant computer systems on their respective floors with associated air conditioning to support. Digital Environmental Managers (DEMs) are generally used to direct cool or warm air where it is needed, and add or remove humidity from the air as needed by the equipment. These computer systems are normally located near the core of the building as water cooling is used for condenser heat rejection and this reduces the piping length.

The air used to heat and cool the HazardCorp Building is filtered in the various mechanical rooms using standard industrial grade MERV 8 filters. Outside make-up air is brought in through vents in the wall located at the associated mechanical room floor, with the lowest vent being on the 4th floor. Screened exhaust ducts are located at the mechanical floor level or are extended to the roof.

The ductwork for return air from conditioned spaces has sufficient room inside the ductwork and mechanical room area for equipment under control of Building Management to incorporate additional filters and equipment. HVAC systems within tenant spaces usually have much less space for making changes.

NATURAL GAS

There is a 4-inch diameter gas line going into the building on the first floor northwest corner of the first floor plan. This natural gas is for cooking purposes and limited to the first floor only along the north side of the building.

WATER and SEWER

There are water tanks on each mechanical floor (4^{th}, 26^{th}, and 50^{th}). The tanks are 2,000 gallons for potable water and 3,000 gallons for sprinkler systems. There are two water service lines, one coming into the building from the west side and one coming from the south (under the Loading Dock). Electric pumps at various levels pump water from the street level to the tanks for distribution throughout the building. There is a number of diesel powered fire pumps as required by code located with the electric pumps.

Since natural gas is piped only to retail space on the first floor, electric water heaters are throughout the building near the point of use for hot water (bathrooms, kitchenettes, etc.).

Sewer mains serving the building follow the water main routes, with the sewer mains normally 3 feet or more underneath the water mains. Sewer piping inside the building also uses the same risers as the water piping and also follow the same routes. Since the terrain is flat, the water and sewage utility uses sewage lift pumps and forced mains on their system to keep the sewage flowing to the nearest sewage treatment plant. The sewage lift stations have their own emergency electrical generators to avoid sewage backups.

COMPUTER OPERATIONS

Each tenant has operating procedures for access to computer systems and spaces, cyber attack, (firewalls, passwords, and virus/data mining/registry file protection), backup, and shutdown.

Building Management has the same approach as the tenants for their administrative computer system. Building Management also has SCADA (Supervisory Control and Data Acquisition), EMCS (Energy Management and Control System), and Building Security systems coordinated with the needs of the tenants and the building overall. Note that the Building Management Systems are connected to the internet for alarms/monitoring/adjustment by engineering/security personnel from home. The Building Management data center is co-located with the Building Security Center / Fire Control Center.

COMMUNICATIONS

Data

The HazardCorp Building has three T3 lines connected at the demark to the high performance backbone network of three different telecommunication providers. The fiber connectivity provides more than enough bandwidth for the building and tenant current needs and planned future expansion. One line enters underneath the Loading Dock, one comes in underground from the north to the first floor utilities area, and the third comes into a telecommunications room in the core area from a manhole on the east side of the building. Future expansion was envisioned so that each of the telecom services use 4-inch conduit with three 4-inch conduits as spares.

Uninterruptible Power Supplies for tenant data computer systems are varied based upon the needs of the tenants and the available space in their rented area. Capacity varies from 10 minutes to 2 hours.

Communications to support classified systems used by government tenants cannot be discussed in detail. Nevertheless, they use leased lines for point-to-point connectivity, and they are robust, with diversity and redundancy built in. They are separate from the T3 lines discussed earlier and use the spare conduits mentioned above.

Figure 14. Telecom and Network Connections

Voice

Each tenant and Building Management have different voice telecommunication providers. Some tenants use VOIP (Voice Over Internet Protocol) voice providers and others use separate copper or fiber service to analog or digital telephone service providers. One tenant has a satellite communications dish that has two voice circuits built in for trouble shooting satellite connectivity.

Building Management uses VOIP as their main voice telecom service and ensures there are Uninterruptible Power Supplies (UPS) on all powered connection points and that these points are also on backup generator power. The Building Security Office/Fire Control Center on the first floor has a “red” phone copper landline connection to a telephone central office as backup communications to the VOIP. Certain tenants also use this system as backup.

There is also a Fire Watch phone in each stairwell on each floor that provides communications with the Building Security Office/Fire Control Center. It is a copper wire system powered from the Fire Control Center that provides a backup to other communications for the trained Fire Watch personnel on each floor.

PHYSICAL SECURITY

The HazardCorp Building has a Building Security Committee that coordinates the specific and general security needs of the tenants with each other and for the building as a whole. Building Management heads this committee with the Building Security Chief as the chairman. There is a staff of 12 personnel to provide 24/7 security for the building with one person in the Building Security Office monitoring cameras and alarms and two roving personnel with handheld radios. There are repeaters for these radios positioned throughout the building to ensure coverage in any location for use by security and maintenance personnel. The Building Security Office has spare radios to issue as necessary. The repeaters are on UPS and connected to backup generator power. The repeaters also support the fire department and police department hand held frequencies for both transmission and reception. These frequencies are tested by respective department personnel once a quarter.

The reception desk on the first floor also comes under the Building Security Office. This desk is manned with two personnel from 0600 to 1800 during business days and with one person at other times and days.

Since there is potential for multiple police jurisdictions within the building, the Building Security Office knows the procedures required for each tenant that comes under a special jurisdiction.

Each tenant is responsible for their specific security requirements and coordination through the Building Security Committee for general security requirements.

- The Lobby has open access to retail, atrium, mailroom, and meeting room spaces.
- Administration, electrical, and utilities, along with the utility risers have controlled access, either key lock, electronic lock using proximity card, and/or balanced magnetic switch with fixed Black and White CCTV (Closed Circuit Television) coverage. When a door is opened, the CCTV monitor that includes coverage of that door alerts Building Security in conjunction with the door alarms to assist in identifying the activity. This is also used proactively in that anyone opening a controlled space contacts the Building Security Office prior to opening the controlled space and the person monitoring the CCTVs verifies the person before the space is opened.
- Security desk as required by tenants are at one or more elevator lobbies at the floors rented by those tenants. Some tenants have a security desk at only one floor, with access to other floors controlled.
- Designated elevators, including one service elevator, have card readers and PIN (Personal Identification Number) keypads for movement to and from access controlled floors. To get the elevator to move to a specific floor you have to press the floor key, read your card, and enter your PIN. In addition, there is a Duress PIN that alerts building and floor security that an authorized

person is moving to a controlled floor with a security problem. Two of the designated building elevators with access controls serve the underground parking levels. The elevators will not move upward with someone in the car unless proper access is accepted. The elevators reset to the lobby automatically when there is no additional weight sensed in the elevator car.

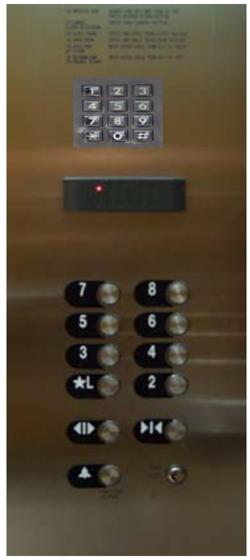


Figure 15. Elevator Control with Card Reader and PIN Pad

- The building stairwells extending into the underground parking have card readers and PIN keypads at each level of underground parking to gain entrance to the stairwells. A Duress PIN also works at the stairwells.
- Visitors to controlled floors are instructed to go to the Lobby Reception Desk and call the office to be visited to get an escort. That escort will come to the desk and take the visitor to the office.
- The Administration Office on the first floor is pre-notified of all deliveries to the Loading Dock. During allowed delivery hours a Building Management representative monitors the Loading Dock and commercial parking area.
- The underground parking entrances and exits have automated controls with lightweight drop arms to issue tickets upon entrance and to take payment upon exit. The elevators serving the underground parking that is not under the building have no access control equipment installed.

Security Lighting and CCTV coverage

All entries, especially the Loading Dock, are covered by color CCTV systems with DVR (Digital Video Recording). The Lobby on the first floor and the elevator lobbies on all floors (including the elevator lobbies on underground parking levels both under the building and under the plaza.) are similarly covered. Lighting is coordinated with CCTV requirements to ensure good quality pictures, both on the monitors and on recordings. The cameras are color, pan, tilt, and zoom throughout for these situations. Cameras on access to utility spaces are less complicated as explained previously under Physical Security above.

Underground parking has fixed black and white CCTV cameras except at the vehicle entrances and exits where the cameras are color, pan, tilt, and zoom to aid in identifying people who do not pay or cause damage to the drop arms or automated equipment or as describe above for elevator lobbies. There are black and white cameras covering stairwell doors on underground parking levels.

EMERGENCY RESPONSE

Emergency Operations Center

Hazard City has an emergency operations center located within the Office of Emergency Management on the 25th floor. The Building Security Office on the first floor in the administration area serves as the emergency operations center for HazardCorp Building as it is the hub for all emergency communications within the building. Additionally, cell phone coverage is adequate in this office, but is spotty throughout the building.

Fire and Medical

There are two fire stations within 1 mile of HazardCorp Building. Seven other fire stations are within 5 miles of the site. Firefighters are trained as Emergency Medical Technicians (EMTs) and Hazardous Material Technicians. Many are also skilled in technical rescue (high places, confined spaces, etc.). Ambulances are also dispatched from these stations. Emergency response time for emergencies is estimated to be 5 minutes.

There are two hospitals with emergency rooms within 1 mile and seven other hospitals within 2.75 miles. There are 50 emergency beds among these hospitals and about 3,000 other beds with varying occupancy levels.

NATURAL AND TECHNOLOGICAL HAZARDS

Natural Hazards

The Hazard City Local Emergency Planning Committee provided the following information regarding natural disasters:

- The area experiences about 100 tornadoes/hurricanes/severe weather conditions per year. HazardCorp Building is in the evacuation zone for storm surges caused by severe weather, winds, and tides.
- The building was in a major flood in 1995.
- The area's earthquake risk is 2A (Scale 0-4).
- The city experiences 25 lightning strikes per year on average.

Technological Hazards

- The city experiences 600 water main breaks per year, some causing extensive flooding.
- More than 2,000 trucks loads of hazardous materials are transported each day within city limits.
- Two large Hazardous Material (HazMat) Storage facilities are to the west of the building. One a large petroleum tank farm and the other a chemical storage tank farm with chlorine, compressed natural gas, and hydrofluoric acid. These tank farms receive and distribute product by truck, rail, and ship.
- Shipping along the river to the west of the building carries petroleum products, fertilizer, and compressed natural gas among other items.
- Prevailing winds are out of the west with shifts out of the northwest during the winter and shifts out of the southwest during the summer.
- There are on average 100 hazardous materials spills and releases each year in the city.
- Two major airports are in the area and approximately 8 miles from the HazardCorp Building. These airports have combined 1.06 aircraft movements, 81 million passengers, and move 2.7 million tons of cargo.

THREAT ANALYSIS

The following information was obtained from the regional office of the FBI, the State Police, and the City police intelligence division.

Terrorist Threat

Since September 11, 2001, the terrorist threat in the area has been Orange. Specific intelligence information has resulted in heightened security for those potential targets identified, primarily transportation and banking.

Orange Definition: Credible intelligence indicates that there is a high risk of a local terrorist attack, but a specific target has not been identified.

The high threat condition is due to information or threat to the area in which the HazardCorp Building is located, but not with the building or its tenants specifically.

Although HazardCorp Building is not currently a primary target, there are tenants that could be assessed by domestic or international terrorists as valuable targets. Thus, HazardCorp Building could be a recipient of potential collateral damage due to higher value targets in the area, or it may be targeted as an alternate to these other targets due to perceived conditions during surveillance of the targets on the terrorist list.

Intelligence Threat

The Building Security Committee maintains close coordination with government security officers and law enforcement agents as part of the normal duties of the tenant security representatives. Tenants with security clearances are potential targets for foreign intelligence services. The Building Security personnel follow counterintelligence guidance and procedures from the Defense Security Service and the Defense Intelligence Agency (DIA) regarding:

- Risk management of classified programs in industry
- Threat awareness
- Deterrence of illegal technology transfers
- Facilitating the prevention of economic espionage in defense contractor facilities

Part of the intelligence threat includes commercial processes, financial information, and technology development that are the focus of the commercial tenants of HazardCorp Building. Many of the procedures used in a classic government intelligence threat situation apply to the gathering of commercial intelligence. These same procedures also provide benefit to identify terrorists performing surveillance of the building.

Criminal Threat

Violent Crime

The 2004 Crime Index, which is composed of murder, forcible rape, robbery, aggravated assault, burglary, larceny-theft, motor vehicle theft, and arson for the downtown business district of Hazard City USA is provided below with comparison to the US National statistics all normalized for comparison based upon incidents per 100,000 population.

Year 2004 Crime Comparison (Rates per 100,000 population)

Crime	HC Business District	United States
Murder	12.2	5.5
Rape	67.1	32.2
Robbery	8,665.0	136.7
Aggravated Assault	2,868.0	291.1
Burglary	1,006.8	729.9
Larceny	29,265.3	2,365.9

Vehicle Theft	1,094.8	421.3
Arson	12.2	28.2

DESIGN BASIS THREAT

The owner of HazardCorp Building in conjunction with the Building Management, and Building Security Committee reviewed the site, building, and threat information collected, and determined the Design Basis Threat to be:

Explosive Blast: Car Bomb - approximately 500 lb. TNT equivalent. Truck Bomb - approximately 5,000 lb. TNT equivalent (Murrah Federal Building class weapon).

Chemical: Large quantity gasoline spill and toxic plume from the upwind petroleum tank farm or large quantity chlorine release from the upwind chemical storage tank farm. Small quantity (tanker truck and rail car size) spills of HazMat materials (chlorine).

Biological: Anthrax delivered by mail or in packages, smallpox distributed by spray mechanism mounted on truck or aircraft around metropolitan area.

Radiological: Small “dirty” bomb detonation within the 10-mile radius of the HazardCorp Building.

Criminal Activity/Armed Attack: High powered rifle (sniper attack) or handgun shooting (direct assault on individuals).

Cyber Attack: Focus on IT and building systems infrastructure (SCADA, alarms, etc.) accessible via internet access. For computer systems look at location, redundancy, backup storage, and power supply meeting National Institute of Standards and Technology (NIST) and industry standards for physical access and protection to the extent information is provided. The analysis is not to include information assurance assessment activities (e.g., password, network monitoring, host and intrusion detection, etc.).

LEVEL OF PROTECTION

Based on the Design Basis Threat and after reviewing the Interagency Security Committee (ISC) and Department of Defense (DoD) standards, the owner of HazardCorp Building in conjunction with the Building Security Committee selected the preliminary Levels of Protection most applicable to this building, with the guidance that adoption of any recommendations would be to the most stringent standard and would be in compliance with life safety codes. After the vulnerability and risk assessments were complete and mitigation options developed, final selection of mitigation options would be made by senior management and determined on a benefit/cost and risk reduction basis. The Levels of Protection to be used as the basis for the vulnerability and risk assessments are:

Level IV

A Level IV facility has 450 employees and more than 150,000 square feet.

1. Perimeter Security

   a. Security control is required over public areas and building entry points. Private tenancies are expected to comply. Security control means (generally) the right to inspect at point of entry and at any time present in the public space and the right to deny access.

   b. Adequate lighting, with emergency power backup, for the exterior of the building is required. Parking areas shall also be adequately lighted.

   c. 24-hour CCTV surveillance cameras with time-lapse video recording is required as deemed necessary by a Security Specialist.

   d. Application of shatter-resistant material shall be applied on exterior windows in areas occupied by Federal Employees.

2. Entry Security

   a. Security Guards for public lobbies and public entrances entries shall be required for such purposes as ID/pass control and manning of x-ray and magnetometer equipment. Guards manning x-ray and magnetometer equipment shall be armed.

   b. Magnetometers, manned by armed Security Guards, are required at public entrances. Guards will direct the building population and visitors through the magnetometers.

   c. All mail and packages entering the building shall be subject to x-ray screening and visual inspection by armed Security Guards. This includes packages and personal belongings of the building occupants and visitors, as well as shipments brought into a loading dock.

   d. Intrusion Detection System (IDS) with central monitoring capability is required for the building perimeter. An internal IDS **may** be required as deemed necessary by a Security Specialist.

   e. Exterior entrances shall have high security locks.

3. Interior Security

   a. Acceptable government-issued photo ID (e.g., driver's license) is required for all building occupants upon entry to the building.

   b. A visitor control/screening system acceptable to the Security Specialist, is required. At a minimum, the system shall require Security Guards to screen visitors but could result in a level of control that may require escorting them.

c. Utility areas shall be secured and only authorized personnel shall have access.

d. Emergency power sources to critical systems (i.e., alarm systems, radio communications, computer facilities, CCTV monitoring, fire detection, entry control devices, etc.) are required.

e. The following requirements pertain to the added protection of the building environment from airborne chemical, biological, or radiological attacks.

(1) Accessible fresh air intakes shall either be relocated, extended or secured to prevent easy ground or roof access.

(2) Access to mechanical areas and building roofs shall be strictly controlled.

(3) Dedicated HVAC shall be required for lobbies, centrally-operated mailrooms, and loading docks to prevent widespread dispersion of a contaminant released in those areas.

(4) Procedures (should airborne hazards be suspected or found) are required for the notification of the lessor's building manager, building security guard desk, local emergency personnel, or other Government emergency personnel, for the possible shutdown of air handling units serving any possibly affected areas.

(5) Securing accessible return-air grilles is required. Protection measures shall not adversely affect the performance of the building HVAC system.

(6) Access to building information, including mechanical, electrical, vertical transport, fire and life safety, security system plans and schematics, computer automation systems, and emergency operations procedures shall be required. Such information shall be released to authorized personnel only. Names and locations of Government tenants shall not be disclosed within any publicly accessed document or record.

(7) A fire alarm system with voice communication is required for emergency notification and instructions to building tenants, in the event of possible contamination of the HVAC system or other emergency.

4. Administrative Procedures

a. Building managers and owners are required to cooperate with and participate in the development and implementation of Occupant Emergency Plans (OEPs).

b. Conduct background security checks and/or establish security control procedures for contract service personnel as deemed necessary.

c. The Government reserves the right, at its own expense and manpower, to temporarily upgrade security during heightened security conditions due to emergency situations such as terrorist attacks, natural disaster and civil unrest. The measures shall be in accordance with the latest version of the Homeland Security Advisory System.

5. Blast/Setback Standards are not required for existing buildings but achieving the same level of protection per minimum new construction standards is desirable:

For Level IV, a 50 foot setback[1] guideline with appropriate window glazing, as prescribed by WINGARD 3.15 or later or WINLAC 4.3 software, to achieve a glazing performance condition of 3b[2] and a façade protection level of "medium"[3] given a minimum GSA blast load standard.

[1] Setback refers to the distance from the face of the building's exterior to the protected/defended perimeter (i.e., any potential point of explosion). This would mean the distance from the building to the curb or other boundary protected by bollards, planters, or other street furniture. Such potential points of explosion may be, but not limited to, such areas that could be accessible by any motorized vehicle (i.e., street, alley, sidewalk, driveway, parking lot).

[2] Glazing Performance Condition 3b provides for a high protection level and a low hazard level. The glazing cracks and fragments enter the space and land on the floor not further than 10 feet from the window.

[3] A "Medium Level Protection" to the facade will result in moderate, but repairable damage. The facility or protected space will sustain a significant degree of damage, but the structure should be reusable. Some casualties may occur and assets may be damaged. Building elements other than major structural members may require replacement.

DoD Standards

HazardCorp senior management evaluated the DoD standards for leased facilities and determined that they would attempt to meet the intent and objective of as many of the recommendations as possible. Of particular concern are blast, CBR, and associated operations/locations of functions and equipment such as mailrooms, dumpsters, loading docks, and emergency shut down.

These standards only apply where DoD personnel occupy leased or assigned space constituting at least 25% of the net interior useable area or the area as defined in the lease, and they only apply to that portion of the building that is occupied by DoD personnel. For this standard to apply to HazardCorp Building, the DoD personnel would have to occupy between 10 and 12 floors of the building.

The DoD level of protection selected is “low,” and the building category is “Primary Gathering Facility.”

Table 3. DoD Minimum AT Standards

UFC 4-010-01 APPENDIX B DoD MINIMUM ANTITERRORISM STANDARDS FOR NEW AND EXISTING BUILDINGS	
Standard 1	Minimum Stand-off Distances
Standard 2	Unobstructed Space
Standard 3	Drive-Up/Drop-Off Areas
Standard 4	Access Roads
Standard 5	Parking Beneath Buildings or on Rooftops
Standard 6	Progressive Collapse Avoidance
Standard 7	Structural Isolation
Standard 8	Building Overhangs
Standard 9	Exterior Masonry Walls
Standard 10	Windows, Skylights, and Glazed Doors
Standard 11	Building Entrance Layout
Standard 12	Exterior Doors
Standard 13	Mailrooms
Standard 14	Roof Access
Standard 15	Overhead Mounted Architectural Features
Standard 16	Air Intakes
Standard 17	Mailroom Ventilation
Standard 18	Emergency Air Distribution Shutoff
Standard 19	Utility Distribution and Installation

Standard 20	Equipment Bracing
Standard 21	Under Building Access
Standard 22	Mass Notification
Recommendation 1	Vehicle Access Points
Recommendation 2	High-Speed Vehicle Approaches
Recommendation 3	Vantage Points
Recommendation 4	Drive-Up/Drop-Off
Recommendation 5	Building Location
Recommendation 6	Railroad Location
Recommendation 7	Access Control for Family Housing
Recommendation 8	Stand-off for Family Housing
Recommendation 9	Minimize Secondary Debris
Recommendation 10	Building Separation
Recommendation 11	Structural Redundancy
Recommendation 12	Internal Circulation
Recommendation 13	Visitor Control
Recommendation 14	Asset Location
Recommendation 15	Room Layout
Recommendation 16	External Hallways
Recommendation 17	Windows

DOD Low Level of Protection:

Level of Protection	**Potential Structural Damage**	**Potential Door and Glazing Hazards**	**Potential Injury**
Low	Damaged – unrepairable. Major deformation of nonstructural elements and secondary structural members and minor deformation of primary structural members, but progressive collapse is unlikely.	Glazing will break, but fall within 1 meter of the wall or otherwise not present a significant fragment hazard. Doors may fail, but they will rebound out of their frames, presenting minimal hazards.	Majority of personnel suffer significant injuries. There may be a few (<10%) fatalities

DOD Primary Gathering Building:

Location	**Building Category**	**Stand-off Distance or Separation Requirements**			
		Applicable Level of Protection	Conventional Construction Stand-off Distance	Effective Stand-off Distance	Applicable Explosives Weight
Controlled Perimeter or Parking and Roadways without a Controlled Perimeter	Primary Gathering Building	Low	45 m 148 ft	25 m 82 ft	Car Bomb

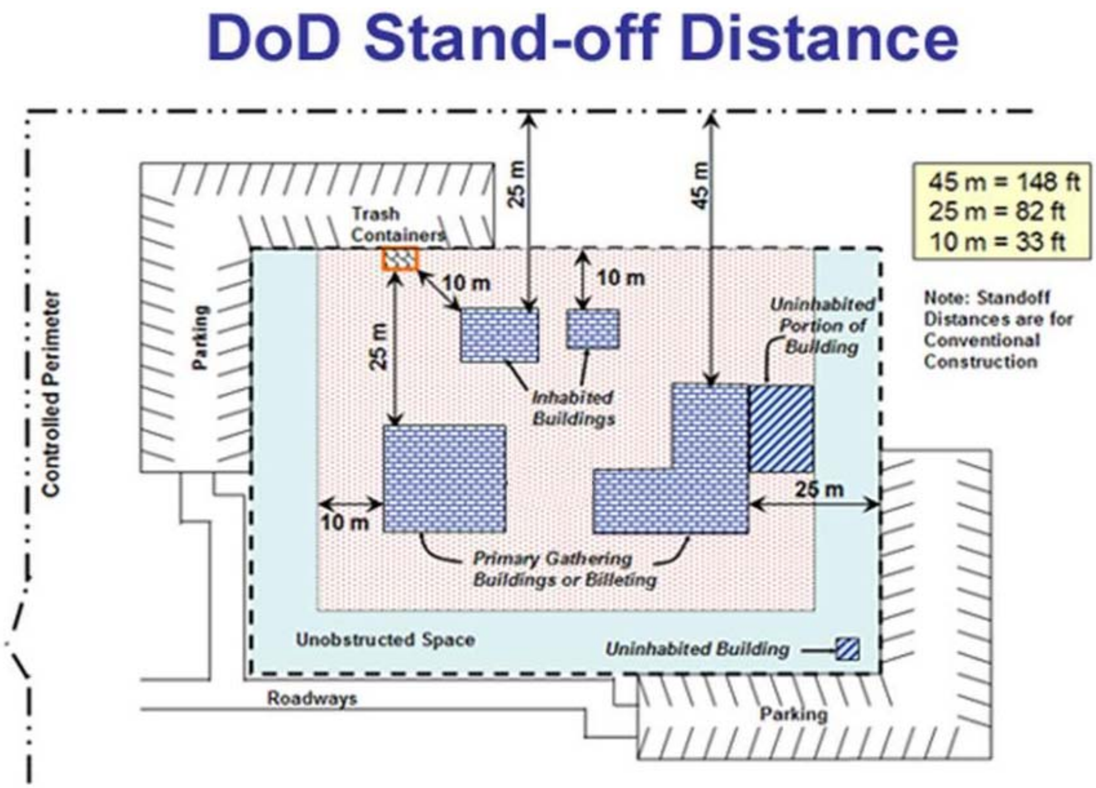


Figure 16. DoD Stand-off Distance