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GSA SECURITY CRITERIA

Building Technologies Division
Office of Property Development
Public Buildings Service
General Services Administration

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CHAPTER 1 GENERAL REQUIREMENTS

CHAPTER I GENERAL REQUIREMENTS

1.A Purpose

GSA developed these PDS security planning and project development criteria to ensure that security becomes an integral part of the planning, design, and construction of new Federal facilities and major alteration projects. The criteria consider security in all building systems and elements, and are intended to complement PBS-PQ100.1, The Facilities Standards for the Public Buildings Service.

Based on the work of GSA and other agencies' staff, as well as architects, planners, and specialty consultants, this document represents the best thinking of a multi-disciplinary group of professionals with recognized security expertise.

1.B Security Design Philosophy

The primary goal of these criteria is to save lives and prevent injury, and secondarily to protect Federal buildings, functions, and assets. The criteria focus on detecting, deterring, and delaying terrorist and criminal attacks through planning, programming, design, access control, and engineering measures. In the event of a major terrorist or criminal act, structural, mechanical, electrical, and life-safety criteria are aimed at facilitating safe evacuation and rescue and early recovery of the facility.

The criteria take a balanced approach to security, considering cost effectiveness, acknowledging acceptance of some risk, and recognizing that Federal buildings should be not bunker- or fortress-like, but open, accessible, attractive, and representative of the democratic spirit of the country. Prudent, rather than excessive, security measures are appropriate in facilities owned by and serving the public.

Security design requires a multi-disciplinary approach and coordination among professionals. Yet most design professionals are not trained to incorporate security into design, and most security professionals are not trained in architecture and engineering. The need to include security features in most building systems requires effective communication between all professionals beginning at the pre-conceptual stage of each project.

1.C Applicability

The GSA-PDS security planning and project development criteria, which are above and in addition to existing GSA criteria, apply to all new GSA projects and major building alteration projects. The criteria may also apply to long-term (10-years or more) leased constructed buildings. Unique facilities, such as those

classified by the Department of Justice's Vulnerability Assessment as Level V, are not included.

1.D Security Risk Assessment System

The following is a methodology for determining security and risk levels. As soon as possible, this method should replaced with a long term, more valid, and more cost effective risk management system. See 1.E for a discussion of the long term system. Also, see Limited Official Use Design Criteria, Chapter 1, for the specific threats and risks being considered.

1.D.1 Protection Levels

The Protection Levels described in this chapter and in Chapter 4 do not use size or population as the only factors. The Protection Levels are performance levels and more closely resemble those already in use by GSA. The GSA criteria describe expected building damage states in such scenarios as earthquakes and bomb blast and give a reliable and meaningful way to evaluate the performance of existing buildings which do not conform to building code provisions intended to limit damage. There is no direct correlation to protection levels defined in this criteria and the building classes in the Department of Justice Vulnerability Assessment (I, II, III, IV, V).

For planning purposes, a building's elements (architectural, structural, mechanical, etc.) may be separately assigned to one of five protection levels, depending on the need for security. When appropriate, the entire building may be assigned to a protection level. These levels in the context of costs are as follows:

E = Very High Level: this level not within the scope of these criteria.
D = High Level: protection requires significant, costly security measures. This category is rarely assigned.
C = Medium High Level: protection requires costly security measures.
B = Low Level: protection requires security measures of moderate additional cost.
A = Low Level: protection requires security measures of little additional cost.

1.D.2 Risk Analysis

For each facility element (or entire facility), a protection level is assigned on the basis of a risk analysis that considers the following definitions:

- Symbolic Importance: Some facilities are highly visible symbols of this country, either nationally, regionally, or locally. The Alfred P. Murrah Federal Building, for instance, was the primary symbol of the U.S. Government in Oklahoma City. Among symbolic structures, some represent critically important government missions. From a terrorist's point of view,

the more symbolic the targeted structure, the more impact an attack will have and the more publicity the attack will receive.

- Criticality: This measures the degree to which a building houses operations and functions critical to national interests of the United States. Examples of very critical activities may include foreign affairs, defense activities, the national airspace system, critical materials, etc. Less critical activities may include judicial activities, law enforcement agencies, government records, national records, and personnel information. The lowest level of criticality may involve functions similar to those performed in commercially owned buildings.

- Consequence: This measures the impact of an attack on a facility, including injuries and the loss of life; damage to the property or assets; interruption of the work done at the facility; and the time needed to repair, replace, or bypass the building in order to continue the work.

- Threat: These are classified as either terrorist threats, including bombs, chemical attacks, and biological attacks, or crime threats, based on local crime indexes. Terrorist threats are identified through intelligence on the capabilities and aims of terrorists and the probability of an attack. This information can come either through existing inter-agency working groups or through the creation of a new group.

- Verified Threat: A threat can be regarded as verified if there is threat information authenticated by an official intelligence or law enforcement agency based on highly trusted sources or methods, and included information that a specific location or agency will be attacked within a contemporary time frame. A threat may also be verified if reasonably reliable information of a threat has been received from two, or more, independent sources through intelligence or law enforcement channels. Great care needs to be taken to guard against false confirmation, by which the same source's information is reported by two different agencies and the source is not identified by one or both agencies.

- High Consequences: High consequences can be defined as the manifested effects of a criminal or criminal-like event that would involve the loss of life or the causation of injuries at to-be-defined levels. High consequences may also be the loss of, or damages to, tangible or intangible assets or the loss of irreplaceable assets and resources, all of which have significant worth on a national scale. Worth is not limited to monetary considerations. As one example, the loss of an old Spanish Mission in California may have little monetary impact, but may have great historical significance.

- Symbol: In the context of this study only, a symbol involves any thing or place for which there is a popular recognition of an object, name, or

governmental activity by virtue of its historic significance, its size, its uniqueness, or its context with specific ideas or sets of values or attitudes. A clear example would be the Statue of Liberty or the Liberty Bell. As another example, a street named Martin Luther King would have symbolic significance to a racist. Some symbols may have local or regional significance, but little recognition of a nation level.

1.D.3 Assessment Framework

Protection categories combined with threat and risk analyses provide a framework for assessing the extent and cost of security. The following is such a framework for protecting against a terrorist threat:

- Use Protection Level D when a building element or building needs a high level of protection. This would tend to be used when a building is a national symbol or of critical importance; and when its damage or loss will have high consequences; and when there is a verified high threat.

- Use Protection Level C when a building element or building needs a medium-to-high level of protection. This would tend to be used when a building is a regional symbol or has a significant impact on the government's mission; and when its damage or loss will have high consequences; and when there is a verified threat.

- Use Protection Level B when a building element or building needs a medium-to-low level of protection. This level would tend to be used when the building is a regional symbol or has an impact on the government's mission; and when its damage or loss will have moderate consequences; and when there is a suspected threat.

- Use Protection Level A when the building element or building does not need higher protection. This level would tend to be used when the building is of low consequence and when there is an unknown threat.

The following can provide a similar framework when protecting against a crime threat:

- Use Protection Level D when there is a high crime index; when the building houses critical operations; or when it has high asset value.

- Use Protection Level C when there is a medium crime index; when the building houses sensitive operations; or when it has moderate asset value.

- Use Protection Level B when there is a low crime index; when the building houses routine operations; or when it has low asset value.

- Use Protection Level A when the facility is small and has a very low crime index; when the building houses routine operations; and when it has very low asset value.

1.D.4 Project-Specific Assessment

A security risk assessment must be done for each new or major alteration project at the earliest stages of project programming and schematics. First, the facility must be categorized for crime and terrorist threats, as above. Then a panel of security, blast, intelligence, and technical experts must conduct a review of the rating. This will ensure the application of appropriate and cost-effective security measures, and give the design team building-specific security criteria to work with..

A facility may have different performance categories applied to each of its building systems. Table 1-1 shows the determination for a hypothetical facility with a low crime threat, limited bomb threat, verified biological threat (moderate consequence) and a verified chemical threat (high consequence). The highest level of threat along a horizontal plane dictates the level of protection for that building security element. Once each building element is assigned a performance level, designers can find corresponding protective measures in the engineering criteria that meet the specified performance.

Table 1-1 Determination of Elemental Protection Level

Element	**Threats**				
	Crime	**Bomb**	**Biological**	**Chemical**	**System Protection Level**
Stand-off	A	**B**	N/A	N/A	B
Building Facade	A	**B**	N/A	N/A	B
Structure	N/A	**B**	N/A	N/A	B
Interior Walls	N/A	**B**	N/A	N/A	B
Mechanical Systems	N/A	B	C	**D**	D
Windows	A	B	C	**D**	D
Electrical Systems	A	**B**	N/A	N/A	B
Security Systems	A	B	C	**D**	D
Security Operations	A	B	C	**D**	D

1.E Intelligence Sharing

Since good intelligence is essential for accurate threat analysis, information that affects GSA building security should be shared through an inter-departmental committee.

The Interagency Security Council's working group on intelligence could serve this function, or a new group could be formed. Sharing information about threats would improve decision-making, be a more cost effective use of resources, improve security in Federal buildings, and reduce Federal employees' fears. Action is required to better harness information currently in the government's possession.

1.F Planning

1.F.1 Crime Prevention Through Environmental Design (CPTED)

CPTED techniques shall be used as much as possible to help prevent and mitigate attacks. Good strategic thinking on CPTED issues such as site planning, perimeter definition, sight lines, lighting, etc. can eliminate some of the need for engineering solutions.

1.F.2 Capability to Increase Security

Designs shall include the ability to increase security in response to a heightened threat. More costly or inconvenient measures, such as prohibiting parking, shall be implemented as needed.

1.F.3 Concept of Tiered Defensive System

When possible, given the site to build on, try to follow a tiered defensive system with zones of intensifying security beginning at the perimeter and moving to the building's core. The possible tiers include (a) the perimeter fence or wall, (b) the stand-off distance, (c) the building's exterior walls, and (d) screening/access control area, and safe interior areas.

1.F.4 Interdisciplinary Approach

Each building system and element shall support risk mitigation and be designed to reduce casualties, property damage, and the loss of critical functions. Security shall be considered in all decisions, from selecting architectural materials to placing trash receptacles to designing redundant electrical systems.

1.F.5 Adjacent Sites

In order to control open space adjacent to Federal facilities, consideration shall be given to acquiring adjacent sites or negotiating for restrictions in or control of rights-of-way. This becomes particularly important when adjacent sites affect the application of these security criteria.

1.F.6 Site Security Requirements

Site security requirements, including stand-off, should be developed before a site is acquired and the PDS is finalized. These requirements may be used to prevent the purchase of a site that lacks necessary features, especially sufficient size, and to help reduce the need for more costly mitigation such as blast design.

Stand-off distance is defined as the distance from the center-of-gravity of a bomb to the face of the closest protected structure. The stand-off distance must be defended through barriers or other means (see 1.M.1).

1.F.7 Stand-Off Distances

For Protection Level D buildings, a stand-off distance of 100 feet should be a planning goal. The preferred design criteria for Level D specifies a 100 foot stand-off, and for Level C, a 20 foot stand-off from all parking, or compensating design measures.

1.G Life-Cycle Costing

In accordance with PQ100.1, these security criteria use life-cycle cost analysis. This allows the selection of materials and systems based on long term value rather than first cost. The impact of initial expenditures upon security-related operating costs can be significant. Security expenditures can also increase or decrease facility productivity. By way of providing a relative measure of this cash flow to the government, one year's salaries and operating expenses can about equal the entire cost of constructing a new facility.

1.H Co-location

Agencies that are functionally similar or that require similar levels of protection should be housed in the same location. High risk tenants, such as law enforcement agencies, should not be co-located with lower risk tenants. If co-location can not be avoided, high risk tenants should be segregated from publicly accessible areas.

1.I Child Care Centers

Child care centers may be located anywhere in low risk buildings. In medium to high risk buildings and courthouses, they should not be within 100 feet from the

main public entrance or a loading dock. They should also be placed 100 feet away from public parking unless there are compensating blast design measures.

1.J Parking

Parking facilities represent considerable risks, with potential for both terrorist attacks on buildings and criminal attacks on individuals. Public parking shall not be allowed under any GSA facility covered by these criteria. Depending on the protection level, parking by various employees shall either be disallowed or controlled. Curbside parking shall similarly be prohibited or controlled.

1.K Waivers

Waivers of these criteria shall be considered through a process to be developed by GSA. Requests for waivers must include persuasive evidence that the security of Federal employees and facilities will not be compromised by a less-than-standard facility. Every effort must be made to meet the security design criteria.

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1.L Design Criteria

Aggressors have historically employed a wide range of offensive strategies reflecting their capabilities and objectives. The criteria below categorize these strategies into various tactics. The following is a list of tactics addressed by the criteria in Chapters 2-8.[1]

1.L.1 To address a moving vehicle bomb (an aggressor drives an explosives-laden car or truck into a facility and detonates the explosives in a suicide attack) (see 2.A.1):

- For A and B Levels, no special construction;
- For C Levels, use stand-off elements designed to stop a W7 vehicle at the maximum practical approach speed up to Y1;
- For D Levels, use stand-off elements designed to stop a W8 vehicle at the maximum practical approach speed up to Y2.

In all cases, terrain and planning of the approaches should be used to limit the speed of approaching vehicles.

1.L.2 To address a stationary exterior vehicle bomb (an aggressor covertly parks an explosives-laden car or truck near a facility, at least 20 feet from the exterior wall, and detonates the explosives by time delay or remote control):

- For A and B Levels, no special construction;
- For C Levels, consider W5 (minimum) in a vehicle parked beyond the curb lane;
- For D Levels, consider W6 (minimum) in a vehicle parked beyond the curb lane.

1.L.3 To address attacks on the exterior of a facility at close range (an aggressor uses weapons such as rocks, clubs, improvised incendiary or explosive devices, and hand grenades in exterior attacks):

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[1] Material in this section was adapted from a manual produced by Joint Departments of the Army and Air Force, TM 5--583-1/AFMAN 32-1071, Volume 1 Security Engineering-- Project Development 12 May 1994. Definitions of terms used herein are contained in that training manual. For additional information on mitigation measures and ways of accomplishing the required level of protection, see the training manual.

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- For A and B Levels, no special construction;
- For C Levels, design to rocks, clubs, and Molotov cocktails;
- For D Levels, design to rocks, clubs, and improvised incendiary devices.

1.L.4 To address small arms (an aggressor fires various small arms such as 9 mm pistols, submachine guns, shotguns, and rifles from a distance) - glazing only:

- For A and B Levels, no special construction;
- For C and D Levels, use concealment and hardening.

Concealment may include blinds, drapes, reflective film, and other visual barriers.

1.L.5 To address forced entry at the building envelope (an aggressor forcibly enters a facility using forced entry tools, which may include weapons and explosives):

- For A and B Levels, protect against limited hand tools[2] - no special construction;
- For C and D Levels, protect against limited hand tools (requires special construction), use CCTV and electronic sensors; consider necessary response time.

1.L.6 To address unauthorized entry (the aggressor attempts to enter a facility by using false credentials or stealth. The aggressor may carry weapons or explosives into the facility):

- For A and B Levels, use locks and alarms;
- For C Levels, use locks and alarms plus electronic access control, intrusion detection, and CCTV;
- For D Levels, use locks and alarms plus electronic access control, screening and intrusion detection, and CCTV.

1.L.7 Address visual surveillance (the aggressor employs ocular and photographic devices such as binoculars and cameras with telephoto lenses to monitor facility operations or to see assets):

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[2] Limited hand tools include sledge hammers and crowbars, but not power tools like jackhammers.

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- Courthouse only and D Levels. (Requirements to be developed on a project-specific basis by tenants.)

1.L.8 Address acoustic eavesdropping (the aggressor employs listening devices to monitor voice communication or other audibly transmitted information):

- Courthouse only and D Levels. (Requirements to be developed on a project-specific basis by tenants.)

1.L.9 Address electronic eavesdropping:

- Courthouses only and D Levels. (Requirements to be developed on a project specific basis by tenants.)

1.L.10 To address mail bombs (the aggressor delivers bombs or incendiary devices to the target in letters or packages. The bomb sizes involved are relatively small. The aggressor's goal is to kill or injure people):

- For A and B Levels, no special construction;
- For C and D Levels, design for W2.

1.L.11 To address medium and large size package or supply bombs (the aggressor conceals bombs in various containers and delivers them to supply and material handling points such as loading docks. The bomb sizes can be significantly larger than those in the mail bombs. The aggressor's goals are to damage the facility, kill or injure its occupants, and/or damage or destroy assets) (see issue 1.L.13 which deals with building lobbies):

- For A and B Levels, no special construction;
- For C and D Levels design for W4.

1.L.12 To address airborne contamination (an aggressor contaminates the air supply of a facility by introducing chemical or biological agents into it):

- For A, B, and C Levels, no special construction;
- For D Levels, consider low level protection in addition to location of air intake.

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1.L.13 To address small package bombs in uncontrolled public areas, prior to screening (the aggressor conceals bombs and delivers them to the lobby. Bomb sizes can be larger than those in the mail bomb tactic):

- For A and B Levels, no special construction;
- For C and D Levels, design for W3.

1.L.14 To address the introduction of explosives beyond controlled areas by individuals with authorized access:

- For A and B Levels, no special construction:
- For C and D Levels, consider W1.

1.L.15 To address a stationary vehicle bomb (an aggressor covertly places a bomb in a government employee's car, which is then parked in a facility. The aggressor detonates the explosive either by time delay or remote control):

- For A and B Levels, no special construction;
- For C and D Levels, design for W4.

1.M Classification

1.M.1 Except for those pages labeled LIMITED OFFICIAL USE (LOU), the document should be treated as a public document, disseminated via NIBS CD ROM only.

1.M.2 The risks, threats, and critical design criteria described in this chapter shall be for Limited Official Use or limited NIBS distribution. This NIBS distribution would only allow authorized users access to the criteria.

CHAPTER 2 SITE PLANNING AND LANDSCAPE DESIGN

CHAPTER 2 SITE PLANNING AND LANDSCAPE DESIGN

2.A Vehicular Control

Blast pressures from an exploding vehicle bomb decrease exponentially with distance from the explosion. One design strategy to mitigate blast effects is to maintain as much standoff distance as possible between the vehicle bomb and the facility. This will then minimize the amount of strengthening needed against the resulting blast pressures discussed in Chapters 3 and 4. The designer must balance the costs of providing standoff and providing hardening. (See 3.A.1 on designing for blast loads.)

2.A.1. Site Perimeter Barriers

Site perimeter barriers capable of stopping vehicles of the designated sizes for Protection Levels C and D shall be installed. A vehicle velocity shall be used considering the angle of incidence in conjunction with the distance between the perimeter and the point at which a vehicle would likely be able to start a run at the perimeter. A barrier shall be selected that will stop the threat vehicle. Except for the weight and speed of the vehicle, Army TM 5-853-1 and TM 5-853-2/AFMAN 32-1071, Volume 2 contain design procedures to make this selection. In designing this barrier system, the following should be considered:

- Various types and designs of barriers such as walls, fences, plantings, trees, static barriers, sculpture, and street furniture;
- Designing site circulation to prevent high speed approaches by vehicles;
- Offsetting vehicle entrances as necessary from the direction of a vehicle's approach to force a reduction in speed.

2.A.2 Perimeter Vehicle Inspection

For Level D, a vehicle inspection sally port shall be provided at the site perimeter with interlocked gates, including vehicle arrest devices on the site side of the sally port gate. A guard house, anti-ram gate barrier, and interlocked gates to prevent tailgating shall be included, as well as a pull-off area inside the sally port.

For Level C, there shall be mandatory inspection at the curb line for gross amounts of explosives. If screening cannot be provided, additional hardening may be required.

2.B Site Lighting

The following site lighting levels shall be provided: at vehicular and pedestrian entrances, 15 horizontal maintained foot candles; for perimeter and vehicular and pedestrian circulation areas, 5 horizontal maintained foot candles. Perimeter

lighting shall be continuous and on both sides of the perimeter barriers, with minimal hot and cold spots and sufficient to support CCTV and other surveillance.

2.C Site Signage

Confusion over site circulation, parking, and entrance locations can contribute to a loss of site security. Signs shall be provided off site and at entrances; there shall be on site directional, parking, and cautionary signs for visitors, employees, service vehicles, and pedestrians.

2.D Landscaping

Landscaping that permits concealment of criminals or obstruction of views by security personnel and CCTV shall be avoided.

Plants can be used as deterrents to unwanted entry. Site grading can limit access, and berms can be located to deflect explosions. Ponds, lakes, and streams can also be used to prevent vehicle access.

2.E Parking

2.E.1 Parking in Adjacent Streets

Parking is often permitted in curb lanes, with a sidewalk between the curb lane and the building. In dense, urban areas, this may place uncontrolled parked vehicles unacceptably close to a facility in public rights-of-way. Where distance from the building to the nearest curb provides insufficient standoff, parking in the curb lane shall be restricted as follows:

Level A - Allow unrestricted parking;
Levels B and C - Allow government-owned and key employee parking only;
Level D - Use the lane for stand-off. Use structural features to prevent parking.

For typical city streets this will require negotiating to close the curb lane for Level D.

2.E.2 Parking on Adjacent Properties

The following are recommended minimum stand-off distances between the building and parked vehicles:

Levels A and B - 5 feet;
Level C - 20 feet;
Level D - 100 feet.

SUMMARY OF CHAPTER 2 - SITE PLANNING AND LANDSCAPE DESIGN				
Section	A	B	C	D
2.A.1 Vehicular Control	Not required	Not required	Install barriers to stop a vehicle of the specified size and speed.	Install barriers to stop a vehicle of the specified size and speed.
2.A.2 Perimeter Vehicle Inspection	Not required	Not required	Controlled entrances for ratchet up ability.	Install sally port with vehicle arrest devices.
2.B Improve Site Lighting	Yes	Yes	Yes	Yes
2.C Improve Signage to Control Site Circulation	Yes	Yes	Yes	Yes
2.D Avoid Dense Landscaping	Yes	Yes	Yes	Yes
2.E.1 Parking in Adjacent Streets	No restrictions	Government and key employees only.	Same as B	Prevent parking by using structural features.
2.E.2 Parking on Adjacent Properties	5’ stand-off	Same as A	20’ stand-off	100’ stand-off

CHAPTER 3 ARCHITECTURAL AND INTERIOR DESIGN

CHAPTER 3 ARCHITECTURE AND INTERIOR SPACE PLANNING

3.A Parking

3.A.1 Perimeter Parking

Chapter 2 describes measures to keep parked vehicles away from buildings, and Chapter 4 gives blast design criteria. In the event that cars are not kept at a sufficient distance, increased hardening measures shall be required. The extent to which the site design is successful in keeping threats away from the building determines the amount and cost of blast design required.

This criterion may be in conflict with on site parking requirements. In addition, there may be costs or regulatory obstacles to removing street parking. These factors need to be considered in the decision to use blast criteria in lieu of parking restrictions.

3.A.2 Internal Parking

Internal parking shall be restricted as follows:

Levels A and B - Government vehicles and employees of the building only;
Level C - Selected government employees only;
Level D - Selected government employees with a need for security.

3.A.3 On Site Adjacent Surface or Structured Parking

Adjacent surface parking shall be restricted as follows:

Levels A and B - No restriction;
Level C - Within 50’ of the building, government vehicles and employees only; public parking preferably not closer than 100’;
Level D - 100’ minimum stand-off to parking.

3.A.4 Parking Facility Security Systems

Parking security systems have two features: passive and active. Passive security features are a physical part of the design of the facility (i.e., lighting). Active security measures invoke a response by the management and/or employees of the facility (i.e. , security patrols and monitored Closed Circuit Television [CCTV] systems) Active systems are often needed to solve problems created by constraints on the passive security features. Although active systems are generally not necessary in low risk facilities, the design should provide for later installation of additional security systems as needed.

3.A.5 Natural Surveillance in Parking Facilities

For stand-alone, above ground parking facilities, maximizing visibility across as well as into and out of the parking facility shall be a key design principle for Levels B, C, and D.

The preferred parking facility design employs express or non-parking ramps, speeding the user to parking on flat surfaces.

Pedestrian paths should be planned to concentrate activity to the extent possible. For example, bringing all pedestrians through one portal rather than allowing them to disperse to numerous access points improves the ability to see and be seen by other users. Likewise, concentrating vehicular entry/exits in a minimum number of locations is beneficial. Attended booths or parking offices should be located so that activity at pedestrian and vehicular entry points to the facility can be monitored. Likewise, a security station, if provided, should be located where it is visible to the public and where the attendant can directly monitor entry/exit activity.

During the design process, the structural system of the facility shall be evaluated from the security aspect as well as the engineering aspect. Long span construction and high ceilings create an effect of openness and aid in lighting the facility. Shear walls should be avoided, especially near turning bays and pedestrian travel paths. Where shear walls are required, large holes in shear walls can help to improve visibility. Openness to the exterior should be maximized.

It is also important to eliminate dead end parking areas as well as nooks and crannies.

Landscaping should be done judiciously so as not to provide hiding places. It is desirable to hold planting away from the facility to permit observation of intruders. (Protection Levels: A, B, C, and D)

3.A.6 Stair Towers and Elevators in Parking Facilities

Stair tower and elevator lobby design shall be as open as code permits. The ideal solution is a stair and/or elevator waiting area totally open to the exterior and/or the parking areas. If a stair must be enclosed for code or weather protection purposes, glass walls will deter the incidents of both personal injury attacks and various types of vandalism. Potential hiding places below stairs should be closed off; nooks and crannies should be avoided.

Elevator cabs should have glass backs whenever possible. Elevator lobbies should be well-lighted and visible to both patrons in the parking areas and the public out on the street. When enclosure is required, such as in underground

parking garages, an automatic fire door, or for a larger opening, a rolling fire shutter with an access door, can be employed so that the area is wide open during normal use. Either the door or shutter will be closed by a smoke detector when needed instead of a fire rated door that remains closed all the time. (Protection Levels: C and D)

3.A.7 Parking Facility Perimeter Access Control

While natural surveillance (visibility) may be adequate for lower risk situations, higher risk often requires access control. Security screening or fencing can be provided at points of low activity to discourage anyone from entering the facility on foot, while still maintaining openness and natural surveillance. In higher risk cases, a system of fencing, grilles, doors, etc. can be designed to completely close down access to the entire facility in unattended hours, or in some cases, all hours. Any ground level pedestrian exits that open into non-secure areas should be emergency exits only and fitted with panic bar hardware for exiting movement only. (Protection Levels: C and D)

3.A.8 Surface Finishes and Signage in Parking Facilities

Interior walls should be painted a light color (i.e., white or light blue) to improve illumination. Signage should be clear in order to avoid confusion and direct users to their destination efficiently. If an escort service is available, signs should inform users. (Protection Levels: A, B, C, and D)

Table 3-1

SUMMARY OF 3.A - PARKING				
Section	A	B	C	D
3.A.1 Perimeter Parking	See Chapters 2 and 4 for perimeter parking criteria and their impact on the building design.			
3.A.2 Internal Building Parking	Government vehicles and employees of the building	Same as A	Selected government employees only	Selected government employees with the need for security
3.A.3 On-site Controlled Parking	No restriction	Same as A	Within 50', government vehicles and employees only	100' stand off
3.A.4 Parking Facility Security Systems	Yes	Yes	Yes	Yes
3.A.5 Natural Surveillance in Parking Facilities	Yes	Yes	Yes	Yes
3.A.6 Open Stair Towers and Elevators in Parking Facilities	Not required	Not required	Yes	Yes
3.A.7 Perimeter Access Control	No control, but design for future change in level	Same as A	Yes	Yes
3.A.8 Finishes and Signage	Yes	Yes	Yes	Yes

3.B Planning

3.B.1 Office Locations

Offices of judges or other potentially vulnerable officials shall be placed or glazed so that the occupant cannot be seen from an uncontrolled public area such as a street. Whenever possible, such offices shall be placed facing courtyards, internal sites, or controlled areas. If this is not possible, suitable obscuring glazing or window treatment shall be provided. One such treatment is 9 mm ballistic resistant glass. (Protection Levels: C and D)

3.B.2 Mixed Occupancies

High risk target tenants shall not be housed with lower risk tenants. When this can not be avoided, publicly accessible areas (e.g., IRS, social security, procurement/contracting offices and agencies) should be clearly separated from potential verified risk targets not needing public access (e.g., ATF, FBI, and most law enforcement and intelligence agencies); the entire facility should be treated as one housing high risk tenants. (Protection Levels: C and D)

3.B.3 Public Toilets and Service Areas

Public toilets, service spaces, or access to vertical circulation systems shall not be located in any non-secure areas, including the queuing area and screening space at the public entrance. (Protection Levels: C and D)

3.B.4 Horizontal Refuge

In high-rise buildings, areas of horizontal refuge should be considered, with communications access to egress stairs, emergency medical supplies cabinet, water and a toilet facility. Spaces shall be separated with 2 hour fire rated smoke partitions. (Protection Level: D)

3.B.5 Loading Docks and Shipping and Receiving Areas

Loading docks and receiving and shipping areas shall be separated by at least 50 feet 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. As a planning goal, the location of the dock should not cause the vehicle to come under the building. In lieu of this, service shall be hardened for blast. (Protection Levels: B, C, and D)

3.B.6 Retail in the Lobby

Retail concessions shall be prohibited in the lobby prior to the security screening point. (Protection Levels: C and D)

3.B.7 Public Areas Not Subject to Screening

Where retail, service, or other public areas are in the facility but not subject to screening and access control, they shall be outside the main structure of the building. Alternatively, blast design separating these areas shall be provided. (Protection Levels: C and D)

3.B.8 Stairwells

Stairwells required for emergency egress shall be located as remotely as possible from areas where blast events might occur, such as lobbies, parking, and loading areas (see 3.E.3). Wherever possible, stairs shall not discharge into lobbies, parking, or loading areas. (Protection Levels: A, B, C, and D)

Table 3-2

SUMMARY OF 3.B - PLANNING				
Section	A	B	C	D
3.B.1 Locate Offices Away From Uncontrolled Public Areas	Not required	Not required	Locate offices in safe sites in the building or treat windows	Same as C
3.B.2 Separate High Risk Agencies	Yes	Yes	Yes	Yes
3.B.3 Do Not Locate Toilets and Service Spaces in Advance of Screening	Not required	Not required	Yes	Yes
3.B.4 Horizontal Areas of Refuge	Not required	Not required	Not required	Yes
3.B.5 Separate Building Utilities From Service Docks or Harden Utilities	Not required	Yes	Yes	Yes
3.B.6 Prohibit Retail Concessions in Lobby Prior to Security	Not required	Not required	Yes	Yes
3.B.7 Restrict Unscreened Retail	Not required	Not required	Yes, or provide blast design	Same as C
3.B.8 Locate Emergency Stairwells Away from High Risk Areas	Yes	Yes	Yes	Yes

3.C Access Control

3.C.1 Public Screening
3.C.2 Employee Screening

A combination of walk-through metal detectors and x-ray devices (shown in Table 3.3) shall be provided. For public entrances, the equipment shall be installed for C and D Levels with space to add it at Level B in times of heightened

alert; for employee entrances, the equipment shall be installed at Level D with space provided for future need at Level C.

3.C.3 Personnel Access Control

A combination of ID check, electronic access card, and turnstiles (as shown in Table 3.3) shall be provided for both public and employee entrances. Electronic access cards with turnstiles should reduce the amount of labor required to staff the entrances.

Sufficient access lanes shall be provided to avoid significant queuing, or queuing shall be provided at the screening area outside of the building footprint. If this is not possible, the queuing area shall be enclosed in blast-resistant construction.

Applicable ADA provisions shall be adhered to.

The capacity shall be provided to add vapor and other detection systems if they become part of Federal security criteria (see Chapter 8).

3.C.4 Combining Public and Employee Entrances

Combining public and employee entrances for buildings can have a significant life-cycle cost impact because there will be fewer guards required at entrances. If possible, minimize the number of entrances to realize this savings.

3.C.5 Bands of security should be provided in increasing levels, beginning at the perimeter and moving to the most protected areas at the core. Depending upon the need for security, this would include some or all of the following zones:

- Perimeter (curb lane, adjacent sites, or closest surface parking);
- Standoff (distance from perimeter to the building exterior wall);
- Exterior wall (structure and cladding);
- Screening/access control (public, employee, and service);
- Safe and restricted area (private and secure).

Table 3-3

SUMMARY OF 3.C - ACCESS CONTROL				
Section	A	B	C	D
3.C.1 Public Screening Systems	Not required	Future capability for walk-through and x-ray	Walk-through detectors, parcel x-ray	Same as C
3.C.2 Employee Screening	Not required	Not required	Provide future capability	Walk through and x-ray screening
3.C.3 Personnel Access Control	Not required	ID Check only or turnstile/electronic access card	Turnstile, electronic access cards, and ID check	Same as C plus capability for future vapor detector
3.C.4 Combining Public and Employee Entrances	Not applicable	Combine where possible	Combine where possible	Consider combining, depending upon security needs
3.C.5 Intensified Bands of Security	Yes	Yes	Yes	Yes

3.D Child Care Centers

3.D.1 Facilities Housing Child Care Centers

Child care centers located in high risk facilities and courthouses shall have compensating blast design measures unless the center meets all of the following conditions.

3.D.2 Locations Within Facilities

Acceptable locations for C and D Levels include:

- On or near the ground floor, but not within 100 feet of a public entrance or loading dock. Outdoor playgrounds should also be 100 feet from any vehicle location. Acceptable outdoor areas may include side or rear yards and enclosed courtyards, when these comply with other criteria;
- On the upper floors of a building that is more than 3 stories in height. When placing centers on elevated slabs, compensating blast design measures should be taken, and for high risk buildings, the center shall preferably be co-located with the area designated for horizontal refuge.

Locations in the basement, while possibly safe, are not judged acceptable because of the lack of natural daylight and windows providing exterior views.

3.D.3 Additional Security Measures, Policies and Procedures

A separate drop-off and pick-up site shall be provided that is not used for any other building entrance purpose.

Between the child care center and the mail room or other high hazard area, there shall be blast resistance for a medium package device of the specified threat size.

Play areas shall be separated from all parking and walkways with a fence that is at least 48 inches high.

Laminated glass or monolithic thermally tempered glass shall be used for all new construction. For additional criteria concerning windows see 4.B.5 and Table 4-1.

Access to the center shall be limited to staff, authorized users and approved visitors only.

There should be designated parking for staff, authorized users and approved visitors.

A 10-minute response time for medical, police and fire department support will be the standard.

Strict lock and key procedures will be maintained at all centers.

Table 3-4

SUMMARY OF 3.D - CHILD CARE CENTERS				
Section	A	B	C	D
3.D.1 Child Care Centers in Courthouses	Yes	Yes	Depending upon location	Depending upon location
3.D.2 Child Care Centers in Other Facilities	Not applicable	Yes	Depending upon location	Depending upon location
3.D.3 Separate Entrances	Not applicable	No	Yes	Yes

3.E Interior Construction

3.E.1 Mailroom

The basic design strategy is to detect delivered bombs before they explode. If a threat exists, x-ray all incoming packages and place any suspect letters or packages in a container for others to handle.

Space for disposal containers shall be located in the outside corner of the mailrooms. The mailroom shall be located at the perimeter away from facility entrances, high personnel density, and areas containing critical services, utilities, distribution systems, and other assets. Near the loading dock may be a preferred location. An off-site location may be cost effective in some areas. See Chapter 4 for hardening criteria related to mailrooms.

3.E.2 Lobby Doors and Partitions

Where screening and access control are performed to preclude introduction of weapons into a building, an adversary may bring a weapon into the pre-screening area. For Levels C and D, doors and walls along the line of screening security shall be 9 mm ballistic resistant.

3.E.3 Walls, Floors, and Ceilings Enclosing Critical Building Components

Assuming that the building has structurally survived a bomb blast, evacuation and rescue are the most important concerns. It is also important to restrict the movement of toxic gasses throughout the building.

When closer than 50 feet in any direction to any main entrance, vehicle circulation, parking, or maintenance area, the walls, floors, and ceilings for the following types of spaces shall be as specified in Table 3-5 for the specified threats:

- Emergency generator;
- Main switchgear;
- Telephone distribution and main switchgear;
- Fire pumps;
- Building Control Centers;
- UPS systems controlling critical functions;
- Main refrigeration systems if critical to building operation;
- Elevator machinery and controls;
- Shafts for stairs, elevators, and utilities;
- Critical distribution feeders for emergency power.

One obvious strategy to lower the costs of this requirement is to locate these systems outside of the blast influence areas.

Table 3-5

SUMMARY OF 3.E - INTERIOR CONSTRUCTION				
Section	A	B	C	D
3.E.1 Mailroom	Provide space for screening and disposal container	Same as A	Provide screening and disposal container	Same as C
3.E.2 Lobby doors and partitions	No special requirements	Same as A	9 mm ballistic resistance	Same as C
3.E.3 Walls, floors, and ceilings enclosing critical building components	Not applicable	Consider possible events when locating system components; hardening not required	Same as B, but place more emphasis upon locations, and consider providing selective blast hardening to systems within 25 feet of threat areas	Design for blast resistance within 50 feet of defined threat areas

3.F Exterior Doors and Walls

3.F.1 Forced Entry

The strategy is to detect aggressors early in the attempt and delay them long enough for a response force to intercept. Four levels of protection are proposed with applicability below. (See Chapter 8 for intrusion detection systems.)

Level A — Protect against limited hand tools only;

Level B — Protect against a wide variety of hand tools. No special construction; rely on visual detection of entry attempts through all but doors, windows, and other operable openings.

Levels C and D — Protect against a wide variety of hand tools and limited power or thermal tools. Requires special construction to delay or to equal the minimum necessary response time, and a complete detection system. Depending upon the response time, features may include, for example:
Walls: 4" concrete with #5 @ 6" or 8" CMU with #4 at 8";
Doors: 16 ga. hollow metal;
Windows: Plate glass with 4 mil. retention film.

3.F.2 Employee Entrances

Employee entrances, if separate from public entrances, shall be constructed in the same way as public lobbies with respect to the security features (see 3.C and 3.E.2). They shall be capable of instituting screening and access control on short notice.

3.F.3 Garage and Vehicle Service Entrances

All garage or service area entrances for government controlled or employee permitted vehicles that are not otherwise protected by site perimeter barriers shall be protected by vehicle arrest devices capable of arresting a vehicle of the designated threat size, at the designated speed. This criteria may be lowered if the access circumstances prohibit a vehicle from reaching this speed. See 2.A for a more detailed discussion of this issue.

Table 3-6

SUMMARY OF 3.F - EXTERIOR ENTRANCE				
Section	A	B	C	D
3.F.1 Forced Entry Protection	Not required	Low level of protection	Medium level of protection	Same as C
3.F.2 Employee Entrances	Same as lobby	Same as lobby	Same as lobby	Same as lobby
3.F.3 Garage or Service Entrance Vehicle Arrest Devices	Not required	Yes	Yes	Yes

3.G Additional Features

3.G.1 Areas of Potential Concealment

For B, C and D Levels, public areas before screening points shall be minimized to reduce the area in which devices can be concealed. Features such as trash receptacles and mail boxes that can be used to conceal devices shall not be installed. Mail or express box openings shall be restricted to prohibit insertion of packages.

3.G.2 Roof Access

Limit Roof Access to authorized personnel.

Table 3-7

SUMMARY OF 3.G - ADDITIONAL FEATURES				
Section	A	B	C	D
3.G.1 Reduce Potential for Concealing Devices in Pre-screening Areas	Not required	Yes	Yes	Yes
3.G.2 Limit Roof Access to Authorized Personnel	Yes	Yes	Yes	Yes

CHAPTER 4 STRUCTURAL ENGINEERING

General Approach

CHAPTER 4 STRUCTURAL ENGINEERING

General Approach

The structural engineering criteria focus on protecting people and assets against explosive attack and also on managing risk and cost. There are three basic approaches to blast design: loads can be reduced, primarily by increasing stand-off; a facility can be strengthened; or higher levels of risk can be accepted. The best answer is often a blend of the three.

These criteria were developed as a response to defined threats that will be separately provided to the designer; the criteria should be continually re-evaluated as threat scenarios change.

NOTE: Section 4.E of this chapter, Further Discussion, contains additional explanations and information related to the structural criteria.

4.A General Requirements

4.A.1 Protection Levels

Entire buildings shall be assigned Protection Levels, according to a facility-specific threat and risk analysis (see Chapter 1 for a detailed discussion). Protection Levels are performance levels; the following are structural damage definitions for each protection level:

- LEVELS A/B: LOW LEVEL OF PROTECTION - Major damage, unrepairable. The facility or protected space will sustain a high level of damage without progressive collapse. Although progressive collapse is prevented, damage is sufficient to cause a question of safety, casualties will occur, and other assets may be damaged. Damaged building components, including structural members, will require replacement. Depending on the scale of the blast damage, its location, and facility characteristics, the facility may be completely unrepairable, requiring demolition and replacement.

- LEVEL C: MEDIUM LEVEL OF PROTECTION - Moderate damage, repairable. Repair is mandatory and possible. The facility or protected space will sustain a significant degree of damage, but the structure will be reusable. Some casualties may occur and assets may be damaged. Building elements other than major structural members may require replacement.

- LEVEL D: HIGH LEVEL OF PROTECTION - Minor damage. The building facility or protected space may globally sustain minor damage with local moderate damage possible. Occupants and assets may incur some injury or minor damage. Repair is advisable. Probability of limited casualties is low.

- LEVEL E: VERY HIGH LEVEL OF PROTECTION: This applies to facilities of the highest national significance and criticality: these are not within the scope of these criteria. However, this Protection Level is discussed in 4.E.1, as a possible alternative for Protection Level D in circumstances of increased threat.

- REPAIRABLE DAMAGE - Damage that is repairable within days to weeks (unless noted otherwise). It implies at least moderate damage and partial evacuation during repairs.

4.A.2 Designer Qualifications

Explosive effects, structural dynamics and blast resistant design are highly specialized requirements. The designer must take into account the various loading conditions based on the needs of each project. The designs and analyses must account for the spatial and temporal variations of blast loading on the structure, the potential combination of effects such as fragments and air blast overpressure, the time dependent loading including, and the non-linear response of the structure in ranges beyond elastic design. Training and experience are these areas is essential to ensure the desired level of protection and cost effective solutions. For buildings designed to meet Protection Level C or D, a blast consultant must be included as an integral member of the design team throughout all phases of planning and design.

Blast resistant designs and analyses for GSA facilities shall be performed and/or reviewed by qualified personnel. The blast consultant shall have formal training in structural dynamics and shall have demonstrated experience with accepted design practices for blast resistant design and with referenced technical manuals. A minimum of five years of blast resistant design is desired for the lead blast consultant.

4.A.3 Design Narratives

A design narrative and copies of design calculations shall be submitted at each phase, identifying the building-specific responses to the criteria. Blast requirements must be integrated into the overall building design starting with the planning phase.

4.A.4 Compliance

Full compliance with this document is expected; limited waivers may be given on a case by case basis (see Chapter 1, 1.L).

4.A.5 Good Judgment

Users of this document are cautioned to exercise good engineering judgment and care in the application of these criteria. There is no guarantee that specific structures designed in accordance with this document will achieve the desired performance.

4.A.6 New Techniques

Alternative analysis and mitigation methods shall be permitted, provided that the performance level is attained. New and untested methods shall be evaluated by a peer review panel designated by GSA.

4.A.7 Methods and References

All building components requiring blast resistance shall be designed using established methods and approaches for determining dynamic loads and dynamic structural response. Design and analysis approaches shall be consistent with those in the technical manuals (TMs) below. Where not addressed in this document, the TMs shall control.

The following are primary TMs (see 4.E.2 [Item 18] for additional references):

- Air Force Engineering and Services Center. Protective Construction Design Manual, ESL-TR-87-57. Prepared for Engineering and Services Laboratory, Tyndall Air Force Base, FL. (1989).

- U.S. Department of the Army, Fundamentals of Protective Design for Conventional Weapons, TM 5- 855-1. Washington, DC, Headquarters, U.S. Department of the Army. (1986).

- U.S. Department of the Army. Security Engineering, TM 5 853 and Air Force AFMAN 32-1071, Volumes 1, 2, 3, and 4. Washington, DC, Departments of the Army and Air Force. (1994).

- U.S. Department of the Army. Structures to Resist the Effects of Accidental Explosions, Army TM 5-1300, Navy NAVFAC P-397, AFR 88-2. Washington, DC, Departments of the Army, Navy and Air Force. (1990).

- U.S. Department of Energy, A Manual for the Prediction of Blast and Fragment Loadings on Structures, DOE/TIC 11268. Washington, DC, Headquarters, U.S. Department of Energy. (1992).

4.A.8 Structural and Non-Structural Elements

The priority for upgrades within a structure is based on the relative importance of a member. The following categories are defined for broad types of structural and non-structural elements:

- Primary Structural Elements - the essential parts of the building's resistance to catastrophic blast loads and progressive collapse, including columns, girders, roof beams, and main lateral resistance system;

- Secondary Structural Elements - all other load bearing members, such as floor beams, slabs, etc.;

- Primary Non-Structural Elements - elements (including their attachments) which 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 - all elements not covered in primary non-structural elements.

Priority shall be given to the critical elements which are essential to mitigating progressive collapse. Designs for secondary structural elements shall minimize the extent of injury and damage. Consideration shall also be given to reducing the extent of damage and injury from primary as well as secondary non-structural elements.

4.A.9 Loads

Where required, structures shall be designed to resist blast (B) loads. The demands on the structure will be equal to the combined effects of dead (D), Live (L*), and blast (B) loads shown in the following formulas. Blast loads and dynamic rebound may occur in directions opposed to typical gravity design requirements.

Demand = D+L*+B
Demand = D+B

L*= live load as defined in the appropriate Technical Manual, except as noted here.

For purposes of designing against progressive collapse, loads shall be defined as dead load plus a realistic estimate of actual live load. The value of the live load may be as low as 25% of the code prescribed live load.

B = the time-dependent air blast over-pressures which shall be determined using approved methods.

The design shall use ultimate strengths with dynamic enhancements based on strain rates. Allowable responses are generally post elastic.

In addition to the blast loads, structures shall be designed for all loads and load combinations as defined in model building codes.

4.B New Construction

4.B.1 Progressive Collapse[3]

Designs which facilitate or are vulnerable to progressive collapse must be avoided. At a minimum, all new GSA facilities shall be designed for the loss of one primary vertical load bearing member at the building perimeter for the first 2 floors above grade without progressive collapse. In addition, new facilities with a defined threat shall be designed with a reasonable probability that, if local damage occurs, the structure will not collapse or be damaged to an extent disproportionate to the original cause of the damage.

In the event of an internal explosion in an uncontrolled public ground floor area, the design shall prevent progressive collapse due to the loss of one primary vertical load bearing structural member, or the designer shall show that the proposed design precludes such a loss. That is, if columns are sized so that threat charge will not cause the column to be critically damaged then progressive collapse calculations are not required.

The following exception to this criterion is allowed:

> The requirement may be waived for buildings designed to Level A. If this is done, a written report clearly stating the potential vulnerability of the building to progressive collapse shall be written for use by GSA as a planning tool to reduce vulnerability (see 1.L).
>
> When a waiver is granted, good engineering practices as outlined in 4.E.2 must be followed to amplify the building's inherent resistance to progressive collapse.

Discussion: As an example, if an explosive event causes the local failure of one column and major collapse within one structural bay, design mitigating progressive collapse would preclude the additional loss of primary structural members beyond this localized damage zone (i.e., the loss of additional columns, main girders, etc.). This does not preclude the additional loss of secondary structural or non-structural elements outside the initial zone of localized damage, provided the loss of such members is acceptable for that performance level and that the loss does not precipitate the onset of progressive collapse.

[3] Design to mitigate progressive collapse is an independent analysis to determine a system's ability to resist structural collapse upon the loss of a major structural element. It is not a part of traditional blast analysis. It is possible, however, that a blast may be the cause of the removal of structural members. ASCE 7-95 describes progressive collapse and offers additional guidelines.

4.B.2 Explosive Threat

Where an explosive threat, as defined by this document, exists, structures shall be designed to resist blast (B) loads in combination with other loads (see 4.A.9).

4.B.3 Building Materials

All building materials and types are allowed which are also acceptable under model building codes. However, special consideration should be given to materials which have inherent ductility and which are better able to respond to load reversals (i.e., cast in place reinforced concrete and steel construction). Careful detailing is required for material such as pre-stressed concrete, precast concrete, and masonry to adequately respond to the design loads. The construction type selected must meet all performance criteria of the specified Level of Protection.

4.B.4 Exterior Cladding

For Level D only, exterior cladding shall be designed to resist the design loads. Exterior cladding is defined as all exterior veneer, backing, and non-load bearing wall construction, excluding glazing. Exterior shear walls which also function as cladding shall be considered structure and must meet the requirements of 4.B.2.

Where cladding is not designed for the design loads, special consideration shall be given to cladding types that reduce the potential for injury (see 4.B.3).

4.B.5 Exterior Glazing

Window systems (glazing, frames, anchorage to supporting walls, etc.) on the exterior facade shall be designed to mitigate the potentially lethal effects of flying glass following an explosive event. This design shall balance the features of the glazing, framing, and attachments with the capacity of the supporting structural walls. That is, the supporting walls, anchorage, and window framing shall be designed to fully develop the capacity of the glazing material selected.

Protection Level	Design Criteria
Levels A and B	No specific protection level in accordance with Table 4-1 is required. However, reasonable and prudent steps should be taken to minimize the potential hazards from flying glass fragments. The use of untreated monolithic annealed, heat strengthened, and wire glass is prohibited. Monolithic annealed and heat strengthened glass shall be used only if treated on the interior face with a minimum 4-mil-thick shatter resistant safety film. The use of thermally tempered glass (TTG) is preferred. The use of laminated glass (annealed or thermally tempered) or monolithic thermally tempered glass treated with a minimum 4-mil-thick shatter resistant safety film is preferred. Daylight installations of film are allowed, however, mechanically attached, edge-to-edge, and wet glazed installations provide additional protection and are preferred.
Levels C	For the areas of the building where the predicted pressures acting on the building face due to the design blast threat(s) are less than ½ psi, the glazing requirements for levels A and B apply. For areas of the buildings where the predicted pressures acting on the building face due to the design threat exceed ½ psi, the windows shall be designed to provide at least a medium level of protection as defined in Table 4-1 (i.e., condition 1,2,3 or 4 are acceptable). Windows intended for child care centers shall meet condition 1 or 2. All windows shall be designed to withstand the actual peak pressures and impulse acting on the building up to a maximum level of 4 psi and the corresponding impulse for the design threat. A triangular equivalent blast load pulse may be used in the design where the duration time of the linearly decaying pulse is determined as two times the peak impulse divided by the peak pressure. The frames and anchors for the windows shall be designed to with-stand the dynamic reaction loads imparted by the glazing. The total fenestration openings are not limited; however, a maximum of 40 percent per structural bay is a preferred design goal. Waiver requests must be accompanied by engineering documentation which verifies that the required level of protection is provided.
Level D	The windows shall be designed to withstand the actual peak pressures and impulse from the design blast threat(s) acting on the building up to a maximum level of 10 psi and the corresponding impulse from the design threat. A triangular equivalent blast load pulse may be used in the design where the duration time of the linearly decaying pulse is determined as 2 times the peak impulse divided by the peak pressure. The windows shall be designed to provide at least a high level of protection as defined in Table 4-1 (i.e., condition 1, 2 or 3 is acceptable). Windows intended for child care centers shall meet condition 1. The frames and anchors for the windows shall be designed to withstand the dynamic reaction loads imparted by the glazing. The total fenestration openings are not limited; however, a maximum of 40 percent per structural bay is strongly encouraged. Waiver requests must be accompanied by engineering documentation which verifies that the required level of protection is provided.

Glazing designs for protection levels C and D shall be performed by qualified personnel as required by paragraph 4.A.2. All glazing hazard reduction products offered by manufacturers and vendors for level C and higher shall be accepted by the GSA only if accompanied by product specific test results and rational analyses performed by qualified independent agents demonstrating the performance of said product under the specified blast loads stating that they meet or exceed the minimum required protection levels. Performance levels shall be based on the protection conditions presented in Table 4-1.

Glazing tests shall be in compliance with GSA Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings . Analyses shall be conducted using the Government produced computer programs WINLAC, SAFEVU or BLASTOP. GSA will review other analysis techniques on a case-by-case basis.

Window Frames: The frame system for new construction should be designed by a qualified blast consultant. This frame system should develop the full capacity of the chosen glazing type and provide the required level of protection without incipient failure. This can be shown through design calculations or approved testing methods. Past experience has shown that as a rule of thumb rotations of the frame system components should be limited to 0.5 degrees for monolithic glass and 1.0 degree for laminated glass systems.

Anchorage: This anchorage must develop the full capacity of the glass/frame system and remain attached to the walls of the facility during an explosive event without incipient failure. A minimum factor of safety of 1.5 should be used on any calculations for window system anchorage for new construction. Capacity of the anchorage system can be shown through design calculations or approved tests which demonstrate that incipient failure of the proposed anchorage will not occur and that the full capacity of the frames and glazing is developed.

Glazing types and glazing hazard reduction technologies which are deemed viable by the GSA for each protection level are as follows:

Levels A and B:

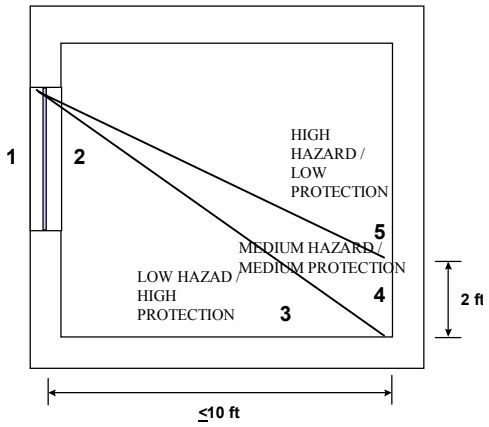
1. Preferred systems include: thermally tempered glass with an attached 4 mil minimum safety film; laminated thermally tempered or laminated annealed glass.
2. Acceptable systems include: thermally tempered glass; thermally tempered, heat strengthened or annealed glass with a minimum 4 mil thick safety film applied (edge to edge, wet glazed, or daylight installations).
3. Prohibited systems include: untreated monolithic annealed glass or heat strengthened glass; wire glass.

Levels C and D:

1. Preferred systems include: thermally tempered glass with a minimum 7 mil thick security film mechanically attached to the frame; laminated thermally tempered or annealed glass.
2. Acceptable systems include: monolithic thermally tempered glass without film if the lite is designed to fully withstand the full design threat (see condition 1 on Table 4-1).
3. Unacceptable systems include: monolithic annealed or heat strengthened glass; wire glass.

In special areas of certain buildings, there may be requirements for protection from forced entry and/or ballistic protection. In these cases, these specially designed glazings are acceptable provided that they also meet or exceed the minimum protection levels specified in Table 4-1.

Table 4-1. Glazing protection levels based on fragment impact locations.



Side Elevation View of Test Structure

Condition	Description	Glass Fragments		Hazard Level	Protection Level
		Exterior to Structure	Interior to Structure		
1	Glass not cracked, fully survived and/or fully retained by frame and no glass fragments either inside or outside structure.	None	None	NA	Very high
2	Glass may be cracked but is retained by the frame.	Yes	No significant fragments. Dusting or very small fragments near sill or on floor acceptable.	Very Low	Very High
3	Glass failed and not fully retained in frame.	Yes	Yes - land on floor no more than 10 ft from window	Low	High
4	Glass failed and not fully retained in frame.	Yes	Yes - land on floor more than 10 ft from window and impact a vertical surface located not more than 10 ft behind the window no higher than 2 ft above floor level.	Medium	Medium
5	Glass fails catastrophically.	Yes	Yes - land on floor more than 10 ft from window and impact a vertical surface not more than 10 ft behind window above a height of 2 ft.	High	Low

4.B.6 Non-Window Openings

Non-window openings such as mechanical vents and exposed plenums shall be designed to the Level of Protection required for the exterior cladding. Designs shall account for potential infilling of blast over-pressures through such openings. The design of structural members and all mechanical system mountings and attachments shall resist these interior fill pressures.

4.B.7 Interior Glazing

Interior glazing should be minimized where a threat exists. The designer should avoid locating critical functions next to high risk areas with glazing, such as lobbies, loading docks, etc.

4.B.8 Parking

The following criteria apply to parking inside a facility where the building superstructure is supported by the parking structure:

Protection Level	Design Requirement
Levels A and B	The designer shall protect primary vertical load carrying members by implementing architectural or structural features which provide a minimum 6 inch stand-off.
Levels C and D	All columns in the garage area shall be designed for an unbraced length equal to two floors. Primary vertical members shall resist the close-in detonation of the specified explosive charge.

4.B.9 Localized Design Areas

The following criteria apply to lobbies and other localized areas with specified explosive threats:

Protection Level	Design Requirement
Levels A and B	The designer shall implement architectural or structural features which deny contact with exposed primary vertical load members in these areas. A stand-off of at least 6 inches from these members is required.
Levels C and D	Primary vertical load carrying members shall be designed to resist the effects of the specified threat. The designer shall provide analyses or other data which demonstrate that these members can resist the threat, or perform a detailed progressive collapse calculation for the loss of one interior column in the affected area.

4.B.10 Loading Docks

The loading dock design for C and D Levels of Protection shall limit damage to adjacent areas and vent explosive force to the exterior of the building. Provisions shall be made to prevent significant structural failure and collapse beyond the loading dock. The floor of the loading dock does not need to be designed for blast resistance if the area below is not occupied and contains no critical utilities. (Protection Levels: C and D)

4.B.11 Mail Rooms and Unscreened Retail Spaces

Mailrooms where packages are received and opened for inspection, and unscreened retail spaces (see 3.B.6 and 3.B.7) shall be designed to mitigate the effects of a blast on primary vertical or lateral bracing members. Where these rooms are located in occupied areas or adjacent to critical utilities, walls, ceilings, and floors shall be blast and fragment resistant. (Protection Levels: C and D)

4.B.12 Exitways

Exitways shall be designed to the overall requirements of the designated Protection Level. However, consideration shall be given to alternate exit paths. Good design practice requires that special consideration be given to stairwell construction and location.

4.C Existing Construction

4.C.1 Protection Levels

Existing structures shall be upgraded to new construction requirements consistent with the assigned Protection Level as noted in section 4.B except where noted in 4.C.2. Feasibility studies shall be performed of existing structures based on the new construction criteria; the results, including at a minimum recommendations and cost, shall be presented to GSA and documented in a written report. Where implementation procedures, such as planning options (relocation, etc.), cannot downgrade the risk level of a building to match existing conditions, the existing building shall be upgraded to new construction criteria.

No PDS is to be submitted without the feasibility study and report having been performed (Protection Levels A, B, C and D)

4.C.2 Progressive Collapse

Existing buildings will not be retrofitted to prevent progressive collapse unless required by the PDS.

Prior to the submission of the PDS, all structures shall be analyzed according to requirements for new construction and a written report shall clearly state the potential vulnerability of the building to progressive collapse. This report shall be used by GSA as a planning tool to reduce vulnerability. Findings of the design-analysis shall be summarized in a written report which includes a discussion of approach and methodology used, a detailed progressive collapse analysis, retrofit recommendations for the structure, a preliminary estimate for the upgrade, and supporting calculations.

No PDS is to be submitted without the progressive collapse analysis having been performed. (Protection Levels: A, B, C, and D)

4.C.3 Exterior Cladding

Existing exterior cladding shall be governed by the same requirements as for new construction. Some options for upgrading existing exteriors include adding a blast wall behind existing cladding, replacing existing cladding, strengthening existing framing, hardening an interior hard line, and maintaining a frangible exterior wall.

4.C.4 Exterior Glazing

Exterior glazing shall be governed by the same general requirements as those governing new construction. Renovation and retrofit priority shall be given to high risk facilities (C, D) based upon facility risk and threat evaluations.

4.C.5 Interior Glazing

Interior glazing should be minimized where a threat exists. The designer should carefully consider locating critical functions away from high risk areas with extensive glazing, such as lobbies. (Protection Levels: C and D)

4.C.6 Additions and Modifications

All additions and major modifications to the structure shall be according to the requirements of new construction.

This criterion may be waived for minor areas of new design in existing configurations.

4.D Historic Buildings

4.D.1 Protection Levels

Historic buildings shall be designed to Protection Levels determined by the risk. Historic buildings are to be fully covered by these criteria. If historic buildings can not be downgraded to an A, B, or C Level because their symbolic importance makes them targets, they shall be treated on a case by case basis. The emphasis shall still be on meeting these criteria and the overall goals of protecting life and minimizing injury.

4.E Further Discussion

4.E.1 Protection Level E

The highest Level of Protection applies to facilities/facility elements of the highest national significance and criticality. These are not within the scope of these criteria, but information on Level E is provided here as a possible alternative to Level D in times of increased threat.

Structural Performance Expected and Maximum Allowable Damage: At Level E, the structure will sustain only superficial damage and be readily and fully repairable, with only short term disruptions of functions. Occupants may sustain minor injuries and assets may receive minor damage (see 4.A.1).

Exterior Glazing: At Level E, the glazing system shall be designed for the design threat, up to a maximum of 30 psi, which linearly decays to zero pressure in 10 msec. (see 4.B.5).

Loading Docks: At Level E, the loading dock shall be designed to contain structural damage to the immediate vicinity of the loading dock area and to vent the explosive forces to the exterior of the building. The design shall explicitly consider all primary and secondary structural members as well as primary non-structural members which comprise the envelope of the loading dock area. It is not necessary to design the floor of the loading dock for this blast resistance if the area below is not occupied and contains no critical utilities (see 4.B.10).

Other Criteria: For other structural criteria, including those addressing exterior cladding, non-window openings, parking facilities, lobbies, mail rooms, and exitways, Level E shall be treated in the same way as Level D.

4.E.2 Good Engineering Practice Guidelines

The following are rules of thumb commonly used to mitigate the effects of blast on structures. Details and more complete guidance is available in the Technical Manuals listed in 4.A.7 and in the references listed below. The following guidelines are not meant to be complete, but are provided to assist the designer in the initial evaluation and selection of design approaches.

For higher levels of protection from blast, cast-in-place reinforced concrete is normally the construction type of choice. Other types of construction such as properly designed and detailed steel structures are also allowed. Several material and construction types, while not disallowed by these criteria, are generally undesirable and uneconomical for protection from blast. These include: precast or pre-stressed concrete, unreinforced masonry, tilt up construction, glass curtain walls, and other non-ductile constructions.

1. In order to economically provide protection from blast, inelastic or post elastic design is standard. This allows the structure to absorb the energy of the explosion through plastic deformation while achieving the objective of saving lives. To design and analyze structures for blast loads, which are highly nonlinear both spatially and temporally, it is essential that proper dynamic analysis methods be used. Static analysis methods will generally result in unachievable or uneconomical designs.

2. The designer must recognize that components may act in directions for which they are not designed. This is due to the engulfment of structural members by blast, the negative phase, the upward loading of elements, and dynamic rebound of members. Making steel reinforcement (positive and negative faces) symmetric in all floor slabs, roof slabs, walls, beams and girders will

address this issue. Symmetric reinforcement also increases the ultimate load capacity of the members.

3. Lap splices should fully develop the capacity of the reinforcement.

4. Lap splices and other discontinuities should be staggered.

5. Ductile detailing should be used for connections, especially primary structural member connections.

6. There should be control of deflections around certain members, such as windows, to prevent premature failure. Additional reinforcement is generally required.

7. Balanced design of all building structural components is desired. For example, for window systems the frame and anchorage shall be designed to resist the full capacity of the weakest element of the system.

8. Special shear reinforcement including ties and stirrups is generally required to allow large post elastic behavior. The designer should carefully balance the selection of small but heavily reinforced (i.e., congested) sections with larger sections with lower levels of reinforcement.

9. Connections for steel construction should be ductile and develop as much moment connection as practical. Connections for cladding and exterior walls to steel frames shall develop the capacity of the wall system under blast loads.

10. In general, single point failures which can cascade, producing wide spread catastrophic collapse, are to be avoided. A prime example is the use of transfer beams and girders which, if lost, may cause progressive collapse and are therefore highly discouraged.

11. Redundancy and alternative load paths are generally good in mitigating blast loads. One method of accomplishing this is to use two-way reinforcement schemes where possible.

12. In general, column spacing shall be minimized so that reasonably sized members can be designed to resist the design loads and increase the redundancy of the system. A practical upper level for column spacing is generally 30 ft. for the levels of blast loads described herein.

13. In general, floor to floor heights should be minimized. Unless there is an overriding architectural requirement, a practical limit is generally less than or equal to 16 ft.

14. It is recommended that the designer use fully grouted, reinforced CMU construction in cases where CMU is selected.

15. There are basically three areas in which the blast design of a facility can be affected. The loads can be reduced by increasing standoff, the resistance of the structure can be increased to accept the loads, or higher levels of risk can be accepted. It is essential that the designer actively coordinate structural requirements for blast with other disciplines including architectural and mechanical.

16. The use of one-way wall elements spanning from floor-to-floor is generally a preferred method to minimize blast loads imparted to columns.

17. In many cases, the ductile detailing requirements for seismic design and the alternate load paths provided by progressive collapse design assist in the protection from blast. The designer must bear in mind, however, that the design approaches are at times in conflict. These conflicts must be worked out on a case by case basis.

18. The following additional references are recommended:

- Biggs, John M. Introduction to Structural Dynamics. McGraw-Hill. (1964).
- The Institute of Structural Engineers. The Structural Engineer's Response to Explosive Damage. SETO, Ltd., 11 Upper Belgrave Street, London SW1X8BH. (1995).
- Mays, G.S. and Smith, P.D. Blast Effects on Buildings: Design of Buildings to Optimize Resistance to Blast Loading. Thomas Telford Publications, 1 Heron Quay, London E14 4JD. (1995).
- National Research Council. Protecting Buildings From Bomb Damage. National Academy Press. (1995).

CHAPTER 5 MECHANICAL ENGINEERING

CHAPTER 5 MECHANICAL ENGINEERING

General Approach

The purpose of the mechanical system is to continue the operation of key life safety components during evacuation following a terrorist or criminal attack. The criteria focus on locating components away from likely targets, limiting access to mechanical systems, and providing a reasonable amount of redundancy.

The design objective can be achieved through current state-of-the-art methods if the impact of an assault has been fully considered. Similarly, new reliable and approved technical devices or methods can be used if they will provide effective service in the event of an attack.

5.A Air Filtration

5.A.1 Air Intakes

Outside air intakes should be located at the highest practical level to reduce the risk of airborne contaminants being introduced into the ventilation system. On buildings of more than 4 stories, the intakes should be on the 4th floor or higher. (Protection Levels: A, B, C, and D)

5.A.2 Electronic Filtering System

A filtering system should be installed at the air handling units to allow limited duration 100% recycling of building air. The filtering system should consist of both electrostatic filters, which would remove dust and particulates, and carbon absorptive filters for odor removal. In the event of an airborne agent (contaminated outside air) outside air intakes should close, and air in the facility should be filtered and recirculated. However, this is only a temporary measure since the carbon dioxide level would slowly increase, eventually making the building air unhealthy to breathe. (Protection Level: D only)

5.A.3 Gas Detection

A tested and approved biological/chemical detector system should be installed at air intake ports to sense hazardous airborne contaminants. Air handlers should shut down upon detection, and the system should have manual override to restart.

New technology is constantly being developed. New detection systems must be tested and evaluated in the field before being used. (Protection Level: D only)

5.B Utility Protection

5.B.1 Utilities and Feeders

Loading docks, front entrances, and parking areas in or adjacent to buildings are likely targets for terrorist attacks. Utility systems should be located as far from such high threat areas as possible. Access to utilities should be restricted to reduce the risk of tampering or attack. (Protection Levels: C and D)

5.B.2 Incoming Utilities

Within building and property lines, incoming utility systems should be concealed and given blast protection, including burial whenever possible, or proper encasement (i.e., rigid conduit for electrical wires). (See 6.A.2) (Protection Levels: C and D)

5.C Smoke Evacuation

5.C.1 Ventilation Systems

In the event of a blast attack, the ventilation system is essential to sustaining the outside air supply during evacuation. Ventilation equipment should be located away from high risk areas such as loading docks, garages, etc. The system controls and power wiring to the equipment should be protected. The ventilation system should be connected to emergency power to provide smoke evacuation.

Ventilation and smoke evacuation equipment should be provided with stand-alone local control panels that can continue to individually function in the event the control wiring is severed from the main control system. (Protection Levels: C and D)

5.C.2 Pressurized Stairways

A stairway pressurization system should maintain positive pressure in stairways for occupant refuge, safe evacuation, and access by fire fighters. The entry of smoke and hazardous gases into stairways must be minimized. The maximum pressure differential across any stairway doors should be 0.3 inch W.G. This criterion is not needed in buildings lower than 75’ or six stories above or below grade. (Protection Levels: C and D)

SUMMARY OF CHAPTER 5 - MECHANICAL ENGINEERING				
Section	A	B	C	D
5.A.1 Air Intakes	Yes	Yes	Yes	Yes
5.A.2 Electronic Filtering	Not required	Not required	Not required	Yes
5.A.3 Gas Detection	Not required	Not required	Not required	Yes
5.B.1 Utilities and Feeders	Not required	Not required	Yes	Yes
5.B.2 Incoming Utilities	Not required	Not required	Yes	Yes
5.C.1 Ventilation Systems	Not required	Not required	Yes	Yes
5.C.2 Pressurized Stairways	Not required	Not required	Yes	Yes

CHAPTER 6 ELECTRICAL ENGINEERING

General Approach

CHAPTER 6 ELECTRICAL ENGINEERING

General Approach

The electrical system's major security functions are to maintain power to essential building services, especially those required for life safety and evacuation, to provide lighting and surveillance to deter criminal activities, and to provide emergency communication.

6.A Service and Distribution

6.A.1 Distributed Emergency Power

Emergency and normal electric panels, conduit, and switchgear should be installed separately, at different locations, and as far apart as possible. Electric distribution should also run at separate locations. (Code presently does not allow normal and emergency power in the same conduit.) Emergency power may not be available in small buildings except for power conditioner or UPS system. (Protection Levels: B, C, and D).

6.A.2 Normal Fuel Storage

The main fuel storage should be located away from areas that are likely targets, such as loading docks, entrances, and parking. Access should be restricted and protected (i.e., locks on caps and seals). Security is particularly important if this fuel is the only source of emergency back-up power. (Protection Levels: B, C, and D).

6.A.3 Emergency Fuel Storage

The day tank should be mounted near the generator, given the same protection as the generator (see 6.A.5), and sized to store approximately 8 hours of fuel. A smaller building or leased facility could be served by battery and UPS. (Protection Levels: B, C, and D).

6.A.4 Exterior Connection for Emergency Power

Conduit and line should be installed outside to allow a trailer-mounted generator to connect to the building's electrical system. This is a tertiary source of power for buildings where operational continuity is critical. An operations plan should be in place to provide a trailer-mounted generator quickly when needed. (Protection Level: D only).

6.A.5 Emergency Generator

The emergency generator should be located away from high threat areas such as loading docks, entrances, and parking. More secure locations include the roof, protected grade level, and protected interior areas. (Protection Levels: B, C, and D).

6.A.6 Utilities and Feeders

Utility systems should be located away from high threat areas such as loading docks, entrances, and parking. Underground service is preferred. (Protection Levels: B, C, and D)

6.B Power and Lighting

6.B.1 Site Lighting

For Levels A and B, site lighting should be designed as per current standards. For Levels C and D with CCTV surveillance systems, there should be increased lighting levels to enhance visual clearness; the lighting should be coordinated with CCTV equipment. Although cameras are available for low-light applications, operations are enhanced with higher uniform lighting levels. (Protection Levels: C and D)

6.B.2 Restrooms

Emergency power should be provided for exit lighting in restrooms. (Protection Levels: C and D)

6.B.3 Stairways and Exit Signs

Self-contained battery lighting should be provided in stairwells and for exit signs as back up in case of emergency generator lag time or failure. As an alternative to battery powered lighting, handrails, stair treads, signs, and doors can be painted with phosphorescent paint. (Protection Levels: C and D)

6.C Special Electrical Systems

6.C.1 Redundant Telephone Service

For Protection Level D, facilities should have a second telephone service to maintain communications in case of a terrorist or criminal event. This criterion does not apply if criterion 6.C.7 is adopted. (Protection Level: D only)

6.C.2 Radio Telemetry

Distributed antennas should be located throughout the facility for emergency communication through wireless transmission of data. (Protection Level: D)

6.C.3 Alarm and Information Systems

Alarm and information systems should not be collected and mounted in a single conduit, or even co-located. Circuits to various parts of the building shall be installed in at least two directions and/or risers. Having circuits follow different paths reduces the risk of total system failure in case of a bomb attempt. (Protection Levels: C and D)

6.C.4 Empty Conduits

Empty conduits and power outlets should be provided for access control equipment. This avoids major retrofits and facilitates installing security equipment, including metal detectors, explosives detectors, and X-ray machines, as the need arises and technology advances. (Protection Levels: C and D)

6.C.5 Exterior Surveillance

A CCTV surveillance system shall be provided to view and record activity at the perimeter of the building, particularly at primary entrances and exits. Cameras should be used to deter crime. (Protection Levels: C and D)

6.C.6 Elevator Emergency Message

Criterion 8.C.1 specifies an emergency recall button at the fire command center to recall elevators to a floor other than the lobby. In conjunction with that criterion, a pre-recorded message should be installed in elevator cab speakers, notifying passengers of an emergency and explaining how to proceed. (Protection Levels: C and D)

6.C.7 Radio Communication

A base radio communication system with antenna should be installed in the stairwell, and portable sets distributed on each floor. This is a preferred alternative to criterion 6.C.1, and will ensure communication if telephone and electrical systems fail. (Protection Levels: C and D)

6.D Parking

Traditionally, parking enclosures are vulnerable to criminal and terrorist attacks. The following section presents criteria to prevent, deter, and detect such acts.

6.D.1 Lighting for Parking

Lighting levels should comply with the following table:

Maintained Illumination Levels
Factors to Multiply to Recommended IESNA Foot Candle Levels by standard

	A	B	C	D
Horizontal illumination at pavement, minimum				
Covered parking areas	1.25	1.50	1.75	2.00
Roof and surface parking areas	0.25	0.50	0.75	1.00
Stairwells, elevator lobbies	2.5	3.5	4.5	5.5
Uniformity ratio (average: minimum)	4:1	4:1	4:1	4:1
Uniformity ratio (maximum: minimum)	20:1	20:1	20:1	20:1
Vertical illumination 5 above pavement, minimum 1				
Covered parking areas	0.625	0.75	0.875	1
Roof and surface parking areas	0.125	0.25	0.375	0.5
Stairwells, elevator lobbies	1.25	1.75	2.25	2.75

The lighting level standards recommended by the Illuminations Engineering Society of North America (IESNA) Subcommittee on Off-Roadway Facilities are the lowest acceptable lighting levels for any parking facility. The factors adjust the levels according to the level of risk at a facility. A point by point analysis should be done in accordance with the IESNA standards. (Protection Levels: A, B, C, and D)

6.D.2 Vehicle Access Control for Parking

For Level A, control includes the use of decals, and for Level B, electronic card IDs.

The following should be installed for Levels C and D:

- A card reader-keypad-biometrics station at vehicle and pedestrian entrances (with optional installation at exit-only openings);
- Control over the use of pedestrian emergency exit-only routes for unauthorized entry or escape;
- Devices to allow for an audit trail of cards or keypad codes that have been used to release electromechanical locks, activate roll-up service door motors, or otherwise permit entrance to a controlled parking area;
- Features to prevent entrance piggy-backing.

Adjacent public parking should be directed to more distant or better protected areas, segregated from employee parking and away from the facility. (Protection Levels: A, B, C and D)

6.D.3 Emergency Communications for Parking

Emergency intercom/duress button stations should be placed on structure columns, fences, other posts, and/or freestanding pedestals and brightly marked with stripping or paint visible in low light. In high risk areas, a station should be within 50 feet of reach. This is not an alternative to on-site monitoring, but is to be used in conjunction with monitoring. (Protection Levels: C and D)

6.D.4 CCTV for Parking

Color CCTV cameras with fixed lenses and scanner mounts should be placed at entrance and exit vehicle ramps. The cameras should be wired to record license plates of entering and departing vehicles, and to record pedestrians exiting or entering via vehicle ramps. Fixed-mount, fixed-lens color or monochrome cameras should be placed on at least one side of regular use and emergency exit doors connecting to the building or leading outside (see 8.D).

The intent of this criterion is to assist or deny access, to assess alarms, to look for potential danger, and to gather information for investigations. (Protection Levels: C and D)

SUMMARY OF CHAPTER 6 - ELECTRICAL ENGINEERING				
Section	A	B	C	D
6.A.1 Distributed Emergency Power	Not required	Yes	Yes	Yes
6.A.2 Normal Fuel Storage	Not required	Yes	Yes	Yes
6.A.3 Emergency Fuel Storage	Not required	Yes	Yes	Yes
6.A.4 Exterior Connection for Emergency Power	Not required	Not required	Not required	Yes
6.A.5 Emergency Generator	Not required	Yes	Yes	Yes
6.A.6 Utilities and Feeders	Not required	Yes	Yes	Yes
6.B.1 Site Lighting	Not applicable	Not applicable	Yes	Yes
6.B.2 Restrooms	Not required	Not required	Yes	Yes
6.B.3 Stairways and Exit Signs	Not required	Not required	Yes	Yes
6.C.1 Redundant Telephone Service	Not required	Not required	Not required	Yes
6.C.2 Radio Telemetry	Not required	Not required	Not required	Yes
6.C.3 Alarm and Information Systems	Not required	Not required	Yes	Yes
6.C.4 Empty Conduits	Not required	Not required	Yes	Yes
6.C.5 Exterior Surveillance	Not required	Not required	Yes	Yes
6.C.6 Elevator Emergency Message	Not required	Not required	Yes	Yes
6.C.7 Radio Communication	Not required	Not required	Yes	Yes
6.D.1 Lighting	Yes	Yes	Yes	Yes
6.D.2 Vehicle Access Control	Yes	Yes	Yes	Yes
6.D.3 Emergency Communications	Not required	Not required	Yes	Yes
6.D.4 CCTV	Not required	Not required	Yes	Yes

CHAPTER 7 FIRE PROTECTION ENGINEERING

General Approach

CHAPTER 7 FIRE PROTECTION ENGINEERING

General Approach

The purpose of the fire protection system inside the building is to maintain life safety protection after a terrorist or criminal attack and to allow safe evacuation of the building.

There are three components of the fire protection system: active features, including sprinklers, fire alarms, smoke control, etc.; passive features, including fire resistant barriers; and operational features, including system maintenance and employee training. Some passive features are included in Chapter 3. This chapter focuses on the other two components and includes redundancy criteria to ensure system operation during emergencies.

7.A Active System

7.A.1 Water Supply

The fire protection water system should be protected from single point failure in case of a blast. The incoming line should be encased or buried, or located 50' away from high threat areas such as loading docks, front entrances, and parking, and the interior mains should be looped and sectionalized. (Protection Levels: A, B, C, and D)

7.A.2 Dual Fire Pumps: Electric and Diesel

To increase the reliability of the fire protection system, a dual pump arrangement should be used, with one electric pump and one diesel pump. The pumps should be located apart from each other to increase reliability in case of a blast. (Protection Level: D only)

7.A.3 Standpipe Connection

Locked covers should be provided on standpipe and Siamese connections to ensure reliability and prevent damage to threads. (Protection Levels: A, B, C, and D)

7.A.4 Fire Alarm System

A microprocessor-based addressable fire alarm system with voice capability should be provided. The system should be configured so that any single impairment shall not disable the system on more than one-half of a floor. The configuration should include individual data gathering panels arranged on a network with stand-alone capability, in case the main control panel is incapacitated. The system main control panel should be located in the fire control room near the building's main entrance to facilitate fire department access.

7.A.5 Egress Door Locks

All security locking arrangements on doors in the means of egress must comply with requirements of NFPA 101.

7.B Operational System

7.B.1 Guard and Employee Training

The following elements of emergency training should be implemented:

- An occupant emergency plan (OEP) manual should be created for every facility location (Protection Levels: A, B, C, and D);
- Security guards and employees should receive emergency training in the proper reporting and response to fires and other emergencies, and in the use of portable and built-in protection systems, including training in system maintenance (Protection Levels: A, B, C, and D)

7.B.2 Building Documents

An area should be designated, preferably in the Operation Control Center, where the following building documents will be readily available:
- Emergency instructions (Protection Levels: A, B, C, and D);
- OEP manuals (Protection Levels: A, B, C, and D);
- Building Plans (Protection Levels: C and D).

SUMMARY OF CHAPTER 7 - FIRE PROTECTION ENGINEERING				
Section	A	B	C	D
7.A.1 Water Supply	Yes	Yes	Yes	Yes
7.A.2 Dual Fire Pumps: Electric and Diesel	Not required	Not required	Not required	Yes
7.A.3 Standpipe Connection	Yes	Yes	Yes	Yes
7.B.1 Guard and Employee Training	Yes	Yes	Yes	Yes
7.B.2 Building Documents	Emergency instructions and OEP manual	Same as A	Same as A plus building plans	Same as C

CHAPTER 8 ELECTRONIC SECURITY

General Approach

CHAPTER 8 ELECTRONIC SECURITY

General Approach

The purpose of electronic security is to improve the reliability and effectiveness of life safety systems, security systems, and building functions. When possible, accommodations should be made for future developments in security systems.

8.A Control Centers and Building Management Systems

8.A.1 The Operational Control Center (OCC), Fire Command Center (FCC), and Security Control Center (SCC)

8.A.2 The Backup Control Center (BCC)

Centralization of control centers improves the reliability and effectiveness of life safety systems, security systems, and building functions. Therefore, the OCC, FCC, and SCC should be co-located. (NOTE: This does not require the addition of an OCC, FCC or SCC if one does not currently exist.)

For Level C, a BCC should be provided in a different location such as a manager's or engineer's office. For Level D, a redundant back-up center should be installed.

8.B Security for Utility Closets

8.B.1 Electrical Utility Closets, Mechanical Rooms, and Telephone Closets

For Levels A and B, the present system of key entry should be maintained, with some method of noting times of entry and departure, such as a watchman's clock system. (Protection Levels: A and B)

For Levels C and D, access to mechanical, electrical, and telecommunication rooms shall be authorized, programmed, and monitored by the SCC through pre-identification of maintenance personnel. (Protection Levels: C and D)

8.C Devices and Alarms

8.C.1 Elevator Recall

A recall button should be provided on the FCC to recall elevators to an alternate floor. This will keep people from congregating on the first floor (lobby) in case of a fire or bomb threat (see 6.C.6 for elevator cab emergency message). (Protection Levels: A, B, C, and D)

8.D Intrusion Protection System

8.D.1 Door Locks

All facilities should be key-locked during evenings, weekends, and at other times the facility is unoccupied.

In addition, for Level B, a security keying system should be used and for Levels C and D, a very high security keying system should be used. Duplicating the keys on a conventional machine should be made difficult. A formal key control program or system should be maintained at Levels C and D.

Also at Level D, critical entrances should have electronic locking such as electromagnetic locks for fire egress exits.

8.D.2 Intrusion Detection

For Levels A and B, basic intrusion detection should be provided for entrances into the facility, generally by means of magnetic reed switches. For Level B, glass break sensors are optional if local crime conditions justify additional intrusion detection measures.

For Level C, basic intrusion detection should be provided for entrances into the facility. Interior door protection should be by means of magnetic reed switches. Exterior door protection, especially at loading docks, should be provided by balanced magnetic contact switch sets, to include all overhead/roll-up doors. Glass-break sensors should be provided.

For Level D, basic intrusion detection should be provided for entrances into the facility. Interior door protection should be by means of magnetic reed switches or by means of balanced magnetic contact switch sets for locations at which "magnet substitution" is a vulnerability. Exterior door protection, especially at loading docks, should only be provided by balanced magnetic contact switch sets, to include all overhead/roll-up doors. Glass-break sensors should be provided. Requirements for roof intrusion detection should be reviewed.

8.D.3 Monitoring

For Levels A and B, monitoring should be provided by a commercial central station. For Level B, in special circumstances an on-site security central control center may be provided during normal business hours.

For Level C, security systems should be monitored by an on-site, proprietary security control center. In order to mitigate staffing requirements and annual

operating costs, commercial central stations may be used for after-hours or to supplement on-site monitoring.

For Level D, security systems should be monitored by an on-site, proprietary security control center.

8.D.4 Closed Circuit TV (CCTV)

For Levels A and B, CCTV monitoring is generally unwarranted. In special circumstances, CCTV may be used if the purpose is to record security events on video tape for subsequent review, investigation, and prosecution.

For Level C, minimal use of CCTV monitoring should be provided; for Level D, CCTV should be provided. The monitoring for both these Levels should be mainly at entrances, monitored exits, vehicular entrances into parking garages, and loading docks. The CCTV systems should be primarily for alarm assessment and access control automation purposes. The use of the CCTV system for general surveillance should be discouraged, with the occasional exception of automated guard tours.

All CCTV cameras should be on real-time and time-lapsed video recorders. For deterrence as well as to aid post-incident investigations, key exterior areas (for Level C) or most exterior areas (for Level D), especially vehicle routes close to the facility, should be video recorded.

8.D.5 Duress Alarms

For all Levels, local duress alarms should be provided at key public contact areas, and as needed in the offices of managers and directors and in garages. Alarms for Levels A and B should report to the central station during normal business hours, and Levels C and D duress alarms should report to the security command center. (See 3.C for access control criteria, including the use of electronic card systems.)

SUMMARY OF CHAPTER 8 - ELECTRONIC SECURITY				
Section	A	B	C	D
8.A.1 Co-locate the Operational Control Center (OCC), Fire Command Center (FCC), and Security Control Center (SCC)	Not required	Not required	Yes	Yes
8.A.2 The Backup Control Center (BCC)	Not required	Not required	Manager's or Engineer's office	Redundant BCC
8.B.1 Electrical Utility Closets, Mechanical Rooms, and Telephone Closets	Present system of key entry should be maintained, with some method of noting times of entry and departure, such as a watchman's clock system	Same as A	Access to mechanical, electrical, and telecommunicatio n rooms shall be authorized, programmed, and monitored by the SCC through pre-identification of maintenance personnel	Same as C
8.C.1 Elevator Recall	Yes	Yes	Yes	Yes
8.D.1 Door Lock	Key-locked	Security keying system	High security keying system	Electronic locks
8.D.2 Intrusion Detection	Magnetic reed switches	Same as A w/ optional glass break sensor	Same as A w/balanced magnetic contact switch set and glass break sensor	Same as C
8.D.3 Monitoring	Commercial Central Station	Same as A	On-site, proprietary security control center	Same as C, plus review roof intrusion detection
8.D.4 CCTV	Not required	Optional for recording purpose	Yes	Yes
8.D.5 Duress Alarms	Key public contact areas and executive offices as needed	Same as A with garages as needed	Same as B	Same as B

PART 11. SUMMARY OF COSTS

Introduction

The workshop has estimated the cost impact of each of the various security criteria recommended. This impact is shown as dollars per square foot of the total GSA construction program. The cost takes into account the full range of construction projects based on the FY 1997 appropriation request.

To prepare the cost estimates, a composite cost model was developed based on GSA historical cost data and estimates of future GSA construction spending.

Cost Model Development

GSA is currently conducting a construction cost study, based on cost estimates and completed construction costs, to determine the range of costs the government can expect for various projects. This study has developed cost information for 15 space types typically found in the GSA inventory.

The preliminary results of the GSA cost study to develop the cost model for estimating criteria costs. Costs for space types were weighted according to the projected distribution of projects based on FY 1997 construction program information. The FY 1997 request breakdown is shown in Figure 1. It can be seen that repair and alteration (R & A) projects represent a significant portion of the total program. The cost model was weighted to include this type of work by reducing the structural system costs (UNIFORMAT levels 01, 02 and 03) in accordance with the projected amount of this type of work.

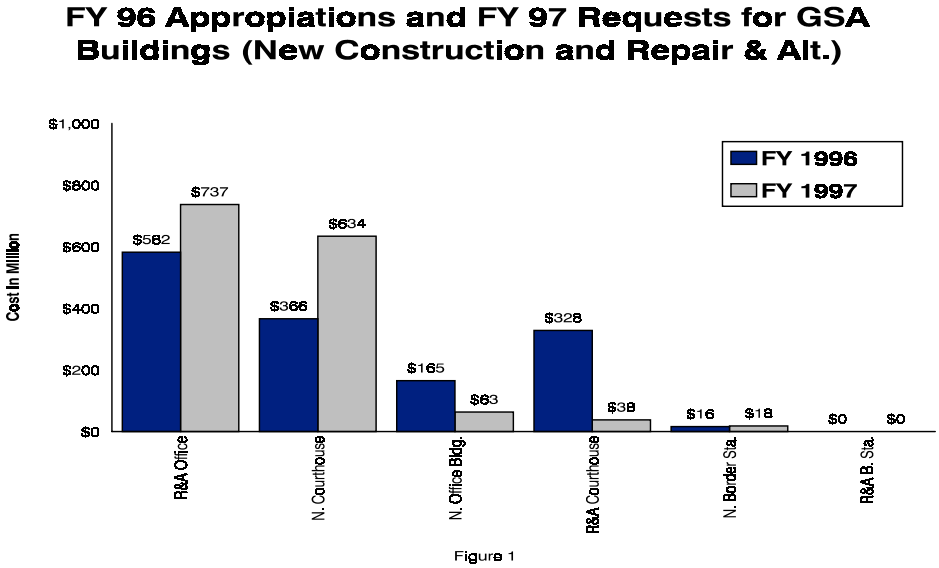


Figure 1

The composite cost model, using GSA's UNIFORMAT work breakdown structure, is shown in Figure 2. The total cost for this model is $102.24 per gross square foot of

building. As noted above, this model is a composite for projected future construction, assuming a breakdown similar to that indicated for FY 1997.

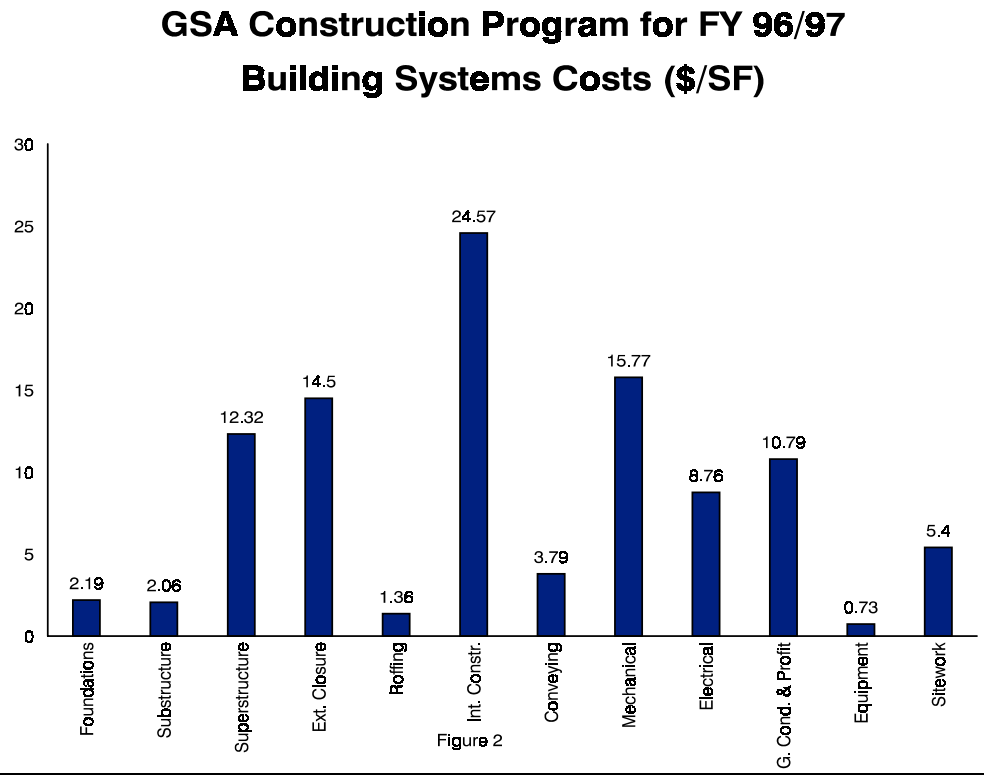


Figure 2

Physical Model Development

In order to assess the cost impact of criteria, a physical model of an average, composite GSA building was also developed. Using FY 1997 funding request information, it was determined that an average, composite building would contain 518,000 gross square feet and have a construction cost of $52,889,000. It would have a site acquisition cost of $10.17/SF. For estimating purposes, it was assumed that the average building would cover a ground area measuring 180 feet x 360 feet and have 7 stories above ground and 1 story below ground. The building would occupy a site with an area twice as large as the building footprint.

Cost Development

Using the above information, costs have been estimated for each building protection category affected by each criterion. Costs shown are estimated additional costs which will be incurred if the particular criterion is implemented. Costs may be additional capital costs, or additional (or reduced) operating costs. All costs are expressed in dollars per gross square foot of project construction. In the case of operating costs, annual recurring costs are shown as present value costs, using a 30 year period and a net discount rate of 5%.

Cost development is based on a mix of new and renovation construction as indicated in the FY 1997 appropriation request. Whether the building is new or a renovation primarily affects the cost impact of the structural engineering criteria; therefore, the itemized cost tabulation for the structural engineering items has been broken down into a component for new buildings and a component for renovations.

The cost estimates do not consider the impact of implementing the security criteria for the renovation of historic buildings. For these buildings the structural renovation costs may be substantially larger than the costs shown. Most historic building projects will require funding in addition to that required for other projects.

There is obviously a relationship between the site planning criteria and the other criteria for a facility. For example if a building were located in the center of a very large site, where access to the site could be controlled at the outer perimeter, there would be a significant impact on the cost to implement other criteria, particularly structural engineering items. The cost estimates assume that the site planning criteria will be implemented to the greatest extent practical and consistent with an overall economic analysis.

Cost Summary

A detailed cost summary is shown in the attached spread sheet. Costs for all criteria have been totaled to show a total cost for each building protection level assuming all criteria are implemented. For summary purposes, the sum of the initial costs (ETPC) and operating costs (PV ANNUAL COST) are shown as the TOTAL PV COST.

In order to obtain an estimate of the cost impact for all protection categories, it is necessary to make an assumption regarding the future distribution of buildings by category.

RISK CLASSIFICATION	INITIAL COST (per GSF) A	B	C	D	PV OF ANNUAL COST (per GSF) A	B	C	D
2 SITE	$0.07	$0.84	$1.36	$3.25	$0.39	$0.39	$0.39	$0.39
3 ARCHITECTURAL	$0.31	$0.76	$1.83	$2.09	$0.00	$0.00	$0.63	$0.63
4 STRUCTURAL	$2.10	$2.10	$16.37	$29.09	$0.00	$0.00	$0.00	$0.00
5 MECHANICAL	$0.00	$0.00	$0.10	$0.69	$0.00	$0.00	$0.06	$0.51
6 ELECTRICAL	$0.24	$0.27	$0.70	$2.16	$0.35	$0.35	$0.87	$2.31
7 FIRE PROTECTION	$0.02	$0.02	$0.02	$0.16	$0.00	$0.00	$0.00	$0.09
8 ELECTRONIC	$0.05	$0.20	$2.21	$2.21	$0.07	$0.15	$5.56	$8.54
					$0.81	$0.88	$7.51	$12.47
TOTAL ECCA	$2.79	$4.19	$22.59	$39.65				
OWNER'S COST (18.5%)	$0.52	$0.77	$4.18	$7.34				
TOTAL ETPC	$3.30	$4.96	$26.77	$46.98				
TOTAL PV ANNUAL COST	$0.81	$0.88	$7.51	$12.47				
TOTAL PV COST	$4.11	$5.84	$34.28	$59.45				

1. ECCA is the estimated construction cost at award
2. Owner's cost includes reservations, construction contingency, design & review cost, and management & inspection costs
3. ETPC is the estimated total project cost
4. PV cost is the present value of the sum of ETPC and the annual costs.

	RISK CLASSIFICATION	INITIAL COST (per GSF) A	B	C	D	ANNUAL COST IN PV (per GSF) A	B	C	D	TOTAL COST (per GSF) A	B	C	D
2.A.1	Site perimeter barriers	$0.00	$0.00	$0.52	$0.87	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.52	$0.87
2.A.2	Perimeter vehicle inspection	$0.00	$0.00	$0.00	$0.28	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.28
2.B	Site lighting	$0.06	$0.06	$0.06	$0.06	$0.37	$0.37	$0.37	$0.37	$0.43	$0.43	$0.43	$0.43
2.C	Site signage	$0.01	$0.01	$0.01	$0.01	$0.02	$0.02	$0.02	$0.02	$0.03	$0.03	$0.03	$0.03
2.E.1	Parking in adjacent streets	$0.00	$0.77	$0.77	$1.50	$0.00	$0.00	$0.00	$0.00	$0.00	$0.77	$0.77	$1.50
2.E.2	Parking on adjacent properties	$0.00	$0.00	$0.00	$0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.53
3.B.2	Separate mixed occupancies	$0.31	$0.31	$0.31	$0.31	$0.00	$0.00	$0.00	$0.00	$0.31	$0.31	$0.31	$0.31
3.B.4	Horizontal refuge	$0.00	$0.00	$0.00	$0.06	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.06
3.B.5	Separate loading dock areas	$0.00	$0.04	$0.04	$0.04	$0.00	$0.00	$0.00	$0.00	$0.00	$0.04	$0.04	$0.04
3.B.7	Retail, service, or other public areas	$0.00	$0.00	$0.15	$0.15	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.15	$0.15
3.C.1	Screening system	$0.00	$0.30	$0.33	$0.33	$0.00	$0.00	$1.23	$1.23	$0.00	$0.30	$1.56	$1.56
3.C.3	Personnel access control	$0.00	$0.00	$0.36	$0.54	$0.00	$0.00	($0.60)	($0.60)	$0.00	$0.00	($0.24)	($0.06)
3.E.2	Lobby doors & partitions	$0.00	$0.00	$0.37	$0.37	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.37	$0.37
3.E.3	Walls enclosing critical components	$0.00	$0.00	$0.07	$0.09	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.07	$0.09
3.F.1	Non-supervised entries	$0.00	$0.00	$0.09	$0.09	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.09	$0.09
3.F.3	Garages and service entrances	$0.00	$0.11	$0.11	$0.11	$0.00	$0.00	$0.00	$0.00	$0.00	$0.11	$0.11	$0.11
4.B.1	Progressive collapse												
	New Building	$0.85	$0.85	$0.85	$0.85	$0.00	$0.00	$0.00	$0.00	$0.85	$0.85	$0.85	$0.85
	Renovation	$0.85	$0.85	$0.85	$0.85	$0.00	$0.00	$0.00	$0.00	$0.85	$0.85	$0.85	$0.85
4.B.2	Explosive threat												
	New Building	$0.00	$0.00	$3.00	$6.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$3.00	$6.00
	Renovation	$0.00	$0.00	$6.00	$12.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$6.00	$12.00
4.B.4	Exterior cladding New & Renovation	$0.00	$0.00	$0.50	$1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.50	$1.00
4.B.5	Exterior glazing New & Renovation	$0.25	$0.25	$3.00	$6.22	$0.00	$0.00	$0.00	$0.00	$0.25	$0.25	$3.00	$6.22
4.B.8	Parking												

	RISK CLASSIFICATION	INITIAL COST (per GSF) A	B	C	D	ANNUAL COST IN PV (per GSF) A	B	C	D	TOTAL COST (per GSF) A	B	C	D
	New Building	$0.02	$0.02	$0.02	$0.02	$0.00	$0.00	$0.00	$0.00	$0.02	$0.02	$0.02	$0.02
	Renovation	$0.03	$0.03	$0.03	$0.03	$0.00	$0.00	$0.00	$0.00	$0.03	$0.03	$0.03	$0.03
4.B.9	Localized design areas												
	New Building	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Renovation	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
4.B.10	Loading dock												
	New Building	$0.00	$0.00	$0.59	$0.59	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.59	$0.59
	Renovation	$0.00	$0.00	$1.17	$1.17	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.17	$1.17
4.B.11	Mail room												
	New Building	$0.05	$0.05	$0.13	$0.13	$0.00	$0.00	$0.00	$0.00	$0.05	$0.05	$0.13	$0.13
	Renovation	$0.05	$0.05	$0.24	$0.24	$0.00	$0.00	$0.00	$0.00	$0.05	$0.05	$0.24	$0.24
5.A.1	Electrostatic filters	$0.00	$0.00	$0.00	$0.40	$0.00	$0.00	$0.00	$0.30	$0.00	$0.00	$0.00	$0.70
5.A.3	Gas detector	$0.00	$0.00	$0.00	$0.19	$0.00	$0.00	$0.00	$0.15	$0.00	$0.00	$0.00	$0.34
5.C.1	Ventilation	$0.00	$0.00	$0.06	$0.06	$0.00	$0.00	$0.04	$0.04	$0.00	$0.00	$0.10	$0.10
5.C.2	Pressurize stairway	$0.00	$0.00	$0.04	$0.04	$0.00	$0.00	$0.03	$0.03	$0.00	$0.00	$0.07	$0.07
6.A.1	Separate emergency power	$0.00	$0.02	$0.02	$0.02	$0.00	$0.00	$0.00	$0.00	$0.00	$0.02	$0.02	$0.02
6.A.3	Emergency fuel storage	$0.00	$0.01	$0.01	$0.01	$0.00	$0.00	$0.00	$0.00	$0.00	$0.01	$0.01	$0.01
6.A.4	Exterior generator	$0.00	$0.00	$0.00	$0.02	$0.00	$0.00	$0.00	$0.01	$0.00	$0.00	$0.00	$0.03
6.B.2	Restroom emergency lighting	$0.00	$0.00	$0.01	$0.01	$0.00	$0.00	$0.01	$0.01	$0.00	$0.00	$0.02	$0.02
6.B.3	Stairways and exit signs	$0.00	$0.00	$0.02	$0.02	$0.00	$0.00	$0.07	$0.07	$0.00	$0.00	$0.09	$0.09
6.C.1	Redundant telephone service	$0.00	$0.00	$0.00	$0.96	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.96
6.C.2	Radio telemetry	$0.00	$0.00	$0.00	$0.48	$0.00	$0.00	$0.00	$1.43	$0.00	$0.00	$0.00	$1.91
6.C.3	Alarm and information system	$0.00	$0.00	$0.01	$0.01	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.01	$0.01
6.C.4	Empty conduits	$0.00	$0.00	$0.01	$0.01	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.01	$0.01
6.C.5	Exterior surveillance	$0.00	$0.00	$0.12	$0.12	$0.00	$0.00	$0.12	$0.12	$0.00	$0.00	$0.24	$0.24
6.C.6	Elevator recall message	$0.00	$0.00	$0.06	$0.06	$0.00	$0.00	$0.03	$0.03	$0.00	$0.00	$0.09	$0.09

	RISK CLASSIFICATION	INITIAL COST (per GSF) A	B	C	D	ANNUAL COST IN PV (per GSF) A	B	C	D	TOTAL COST (per GSF) A	B	C	D
6.C.7	Radio communication	$0.00	$0.00	$0.11	$0.11	$0.00	$0.00	$0.17	$0.17	$0.00	$0.00	$0.28	$0.28
6.D.1	Parking lighting	$0.20	$0.20	$0.20	$0.20	$0.30	$0.30	$0.30	$0.30	$0.50	$0.50	$0.50	$0.50
6.D.2	Vehicle access control	$0.04	$0.04	$0.04	$0.04	$0.05	$0.05	$0.05	$0.05	$0.09	$0.09	$0.09	$0.09
6.D.3	Parking emergency communication	$0.00	$0.00	$0.01	$0.01	$0.00	$0.00	$0.02	$0.02	$0.00	$0.00	$0.03	$0.03
6.D.4	Parking CCTV	$0.00	$0.00	$0.08	$0.08	$0.00	$0.00	$0.10	$0.10	$0.00	$0.00	$0.18	$0.18
7.A.1	Water supply	$0.02	$0.02	$0.02	$0.02	$0.00	$0.00	$0.00	$0.00	$0.02	$0.02	$0.02	$0.02
7.A.2	Dual fire pumps: electric & diesel	$0.00	$0.00	$0.00	$0.14	$0.00	$0.00	$0.00	$0.09	$0.00	$0.00	$0.00	$0.23
7.A.3	Standpipe connection	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
8.A.2	Backup control center	$0.00	$0.00	$0.46	$0.46	$0.00	$0.00	$0.34	$0.34	$0.00	$0.00	$0.80	$0.80
8.B.1	Utility closets	$0.00	$0.00	$0.29	$0.29	$0.00	$0.00	$0.43	$0.43	$0.00	$0.00	$0.72	$0.72
8.C.1	Elevator recall	$0.02	$0.02	$0.02	$0.02	$0.03	$0.03	$0.03	$0.03	$0.05	$0.05	$0.05	$0.05
8.D	Intrusion protection system	$0.03	$0.18	$1.44	$1.44	$0.04	$0.12	$4.76	$7.74	$0.07	$0.30	$6.20	$9.18
	TOTAL	$2.79	$4.19	$22.59	$39.65	$0.81	$0.88	$7.51	$12.47	$3.60	$5.07	$30.10	$52.12