Development of a Landscape Vulnerability Assessment Model in a Heightened Security Environment

Christine G. Sena

Virginia Polytechnic Institute and State University

Master of Landscape Architecture

Members of Committee

Patrick Miller
Ben Johnson
Barry Sullivan
Joseph Nestico

Date of Defense
May 1, 2003
Blacksburg, Virginia

Keywords

Landscape Architecture
Security Vulnerability
Anti-Terrorism

Development of a Landscape Vulnerability Assessment Model in a Heightened Security Environment

Christine G. Sena

ABSTRACT

Do current landscape security practices provide sufficient protection to support building sustainability in the event of a terrorist act? By exploring the relative effectiveness of current landscape security practices and methodologies, this thesis proposes to provide the landscape architect with sufficient background to define security objectives; participate in vulnerability assessments and design functional solutions while maintaining an open, aesthetically pleasing environment. This research thesis supports the study of site security as a discipline within the landscape architecture profession.

Recent events have resulted in a rush to install various types of permanent and temporary security measures such as, barriers, barricades, surveillance systems, etc. in the landscape. Typically, the placement of security components in the landscape has resulted in negative visible impacts on the environment, reinforcing an image of a siege, or fortress, mentality. This study will examine whether these security components, as currently employed, are effective deterrents against terrorist activities.

This thesis will provide landscape architects with a broad understanding of security objectives and design options. Security objectives can only be met if the client, engineers, architects and landscape architects work together as a team. This thesis will provide the landscape architect with sufficient knowledge concerning security vulnerability, facility blast survivability, and emergency response capabilities to coordinate site security requirements with the design team. A thorough knowledge of security component capabilities and facility site vulnerability will assist the landscape architect in making design decisions which are both functional and aesthetic, while meeting security objectives.

ACKNOWLEDGEMENTS

This paper is the result of many years of experience working within the law enforcement community, specifically the U.S. Marshals Service. Many individuals in the Department of Justice, the Administrative Office of the U.S. Courts, the military and intelligence agencies contributed to my knowledge of security and facility protection. I would like to thank Barry Sullivan, Chief, Architectural Services Branch, U.S. Marshals Service, for his in depth knowledge of federal courthouse security and for his long term friendship. I would also like to thank Joe Nestico, Senior Engineer, U.S. Department of State for his assistance in providing up-to-date information on protective security issues. Lastly, I would like to thank my daughter, Heather, and my son-in-law, Gregg Barrie, for encouraging me to pursue a Master's Degree in Landscape Architecture at Virginia Tech.

CONTENTS

References

Appendices

LIST OF FIGURES

Chapter I

1. Introduction

For the past 20 years, of a 30 year career with the federal government, I was involved with developing security standards for U.S. courthouses and other federal facilities requiring high levels of protection. In 1989, as a member of a task force evaluating U.S. Courthouses, I assisted the National Institute of Building Sciences (NIBS) in preparing the initial 1991 U.S. Courts Design Guide. Additional design and security work included the construction of the Justice Prisoner and Alien Transportation System Air Wing and planning, design and construction of facilities supporting protection operations for the U.S. Marshals Service.

As chief of facilities for the U.S. Marshals, I received many requests for security upgrades in U.S. courthouses. But, the requests were rarely based on site requirements. For, even among professionals who demanded high levels of facility security, there was always a difference of opinion as to what constituted the most effective security measures. More often than not, a request for a particular security design element, or system, would be based on whether it had been observed at another site, not if was appropriate for the site under consideration.

To be functional and effective, clear objectives need to be established prior to the selection and design of site security systems. The application and placement of security components within the landscape can only be effective if landscape architects understand system requirements and limitations. Much of the information concerning security system design, operation, application and effectiveness is based on personal experience.

1.1 Purpose

The intention of this thesis is to provide the landscape architect with a better understanding of site security options; the types and potential impacts of terrorist acts; the thought process behind site vulnerability/threat assessments, and the function and effectiveness of particular design remedies in reducing site vulnerability.

Current practices in site security include many design recommendations commonly provided by the landscape architecture profession. These design elements touch upon site planning; building setbacks; entry design; location of parking areas/garages, terraces, walls; location of delivery areas, drop-off zones, and the placement of street furniture to direct access.

However, many design professionals have limited knowledge of security options and the necessity of conducting site vulnerability assessments. The results are evident in the proliferation of Jersey barriers, and other temporary measures upon the landscape. which have proved to be a blight upon the landscape. These anti-terrorism security design applications have not generally been consistent, nor, in most cases effective

deterrents. The proliferation of temporary security measures has only reaffirmed the appearance of fortress-like pockets within the environment, while making the remaining, un-fortified facilities appear as vulnerable, "soft," targets for potential violence.

1.2 Scope

As with any type of analysis, I first assumed that I would need to review data concerning potential terrorist activities, or negative actions which could impact the landscape. To determine potential site damage from terrorist activities, I studied public source information on domestic and international terrorist acts spanning 1960 to 2002. The intention initially was to see if any particular trends were evident and to identify methods, and results. This information is contained in Appendix I and Appendix II.

1.3 Limitations

The information and recommendations included in this research thesis are limited to public source information and materials.

Many highly publicized terrorist acts have involved airline hijackings. For the purposes of his study, security site planning will limited to mitigating those activities involving land based activities.

1.4 Definition of Terms

This research thesis includes information and discussion of terrorism activities, including both domestic and international terrorism. An important area of discussion in this document includes the design community's response to security and anti-terrorism planning.

Terrorism: The U.S. Department of State (DOS) and the intelligence community are responsible for monitoring international terrorism acts and trends. Terrorism is "premeditated, politically motivated violence perpetrated against noncombatant targets by sub-national groups or clandestine agents, usually intended to influence an audience."[1] Domestic crime and/or terrorism tracking is the responsibility of the Federal Bureau of Investigation (FBI). The FBI defines terrorism as unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.

Domestic Terrorism: "Domestic terrorists are groups or individuals whose terrorist activities are directed at elements of the U.S. government or population without foreign direction."[2] The most recent act of domestic terrorism resulting in significant loss of life occurred on April 19, 1995, when a homemade bomb placed in the back of a rental truck caused the partial destruction of the Alfred P. Murrah Federal Building in Oklahoma

[1] 22 U.S.C., Section 2656f(d)
[2] "Terrorism Threat Handbook," Interagency OPSEC Support Staff (Greenbelt, MD), June 2001, p. 33.

City, killing 168, including 19 children, and injuring 782. Property losses totaled over $650 million.

Other examples of domestic terrorism include deliberate physical harm and property damage by animal rights activists, environmental activists, anti-abortion extremists and militia groups. Animal rights activists preferred tactics include vandalism and arson of university laboratories, graffiti spray painted on labs, breaking windows, burning vehicles, slashing tires and setting fur-bearing animals free. In England, animal rights activists have firebombed stores.

Members of the Earth Liberation Front (ELF) remain suspects in the 1998 destruction of two mountain lodges in Vail, Colorado. The act was committed at night when both buildings were soaked in gasoline and set on fire, resulting in $12 million in damages. Environmental groups had previously opposed the ski area's expansion proposals.

"Since 1997 several of these environmental and animal rights groups have been responsible for over $40 million in damage to public property by committing arson. Typical targets for environmental extremists have included energy and power companies, recreational facilities, and corporations involved in land development. Targets for animal rights extremists have included research and development facilities that use animals in medical research as well as establishments that process animals as a food source."[3]

Abortion clinic violence, by both pro and anti-abortion activists resulted in bombings, assaults, and murders. Assaults on persons entering and exiting clinics resulted in court ordered minimum distance restrictions (15 ft. average) between protestors and clinic employees and clients. During the 1996 Olympics in Atlanta, Georgia, anti-abortion activist, Rudolf, placed a bomb near the main stage, killing one and injuring 100. In 1997, bombs were placed in trash dumpsters adjacent to a clinic in Atlanta; the second bomb, filled with shrapnel, injured 4. In addition, doctors and staff in Pensacola, Florida, Boston, Massachusetts, and Buffalo, New York, were slain by abortion extremists.

International Terrorism: On September 11, 2001, the most grievous act of terrorism to occur on United States soil was perpetrated by an international extremist group, al-Qaida, funded by Sunni Muslim extremist, Osama bin Ladin. Over 3,000 people were killed during the multi-pronged attacks on the World Trade Center and the Pentagon.

Over the past 40 years, the number of terrorism acts decreased, while the number of victims increased. During the early 1960s and 70s, a number of high-profile political

---

[3] Hawley, Chris, Noll, Gregory G., and Hildebrand, Michael S., *Operations Security for Public Safety Agencies – Special Operations for Terrorism and HAZMAT Crimes*, Interagency OPSEC Support Staff (Greenbelt, MD, June 2001), 15, 16.

assassinations and hostage taking situations occurred. Hostages were generally released and the terrorists received world-wide media attention for their causes. In the 1980s terrorist activities escalated and heavy casualties were incurred in bombings in Lebanon, and Ireland; aircraft bombings occurred in Pakistan, Switzerland, Burma, India, Japan, and over Lockerbie, Scotland where 257 were killed on Pan Am flight 103. From the 1990s on, increased violence from bombings, biological and chemical (bio-chem) related incidents and direct attacks, resulted in significant civilian casualties. Table 1, Significant Acts of Terrorism, 1960 – 2002, contains data on specific terrorist acts including methods, victims and property damage.

Until the 1990's, the unwritten doctrine of terrorism was that they wanted a lot of people watching and not very many people dead. The emphasis was on bringing focus on the cause of the terrorist group. Killing too many people at one time could produce a negative effect in public opinion.

"In the past, the tools of the terrorist's trade included guns, letter bombs and the occasional package or car bomb. Historical acts of terrorism were simple events that did not need a great deal of resources and technical capability to carry out the operation. All that was required was the motive and commitment to follow through with the crime. Likewise, the plans needed to execute a terrorist operation were relatively simple; e.g., kidnap someone important; hijack an airliner to another country and let everyone go; call the police and warn them a car bomb will be detonating at a specific time and place, so the area can be cleared, etc.

A more violent breed of terrorist has evolved since the 1980's. Terrorist groups are playing by a new rulebook that doesn't have too many rules in it. Instead of taking an ambassador as hostage to achieve a specific demand, the terrorist takes the entire embassy and kills the hostages. Instead of sending a letter bomb to a government official and killing the target, an entire building is blown up killing hundreds of people, including innocent children. Instead of hijacking an airliner, an entire aircraft is blown up over a populated area….

Terrorist groups are also employing increasingly advanced Improvised Explosive Devices (IED's) and are using strategies such as simultaneous attacks on different targets. This is evidenced by the fact the number of people killed or injured in international terrorist attacks rose dramatically in the 1990s, despite a general decline in the number of incidents. Another factor effecting terrorist strategy is that as we have increased security around government and military facilities, terrorists have sought out "softer" targets that provide better opportunities for mass casualties with less risk."[4]

1.5 Organization of Thesis

The thesis reviews current planning and design applications for site security. A further breakdown includes a review of security components and their uses and relative effectiveness. Also included is a discussion of site vulnerability assessments and

[4] Hawley, 13, 14.

operations response planning. Three U.S. courthouses are examined in terms of current site security practices.

Recommendations for future site security planning options include site planning for new construction, campus-type environments and retrofitting existing sites. The three U.S. courthouses are discussed in terms of recommended security improvements.

The Appendix contains data collected from both public and Department of State sources concerning terrorist actions, methods and consequences.

Chapter II

2. Review of Current Practice and Related Research

"The federal government has been wrestling with how to balance security with public access since 1995, when the terrorist attack in Oklahoma City shook federal builders much as Sept. 11 did all the country. The task has fallen largely on the Interagency Security Committee, which meets monthly and draws together security directors from 17 major government agencies as well as representatives from law enforcement and national security agencies.

A panel regularly updates a seminal June 1995 federal study that set 52 security standards for federal facilities, such as perimeter lighting, physical barriers and television surveillance. The report divided facilities into five security levels assigning each one to escalating degrees of compliance with the standards."[5]

Since the events of September 11, dialog within the design community of engineers, architects and landscape architects has focused on what can be done to reduce casualties and increase survivability of potential incidents. Implementation of new planning and design considerations which include appropriate security and fire/safety measures, while still continuing to maintain a sense of openness within the landscape, require a level of analysis and implementation not previously employed by landscape architects. Similar to previous changes in the profession brought on by the enactment of the National Environmental Policy Act (NEPA) and the Americans with Disabilities Act (ADA), security and survivability issues will become basic considerations in all future design processes.

Figure 1, Jersey Barriers at the Washington Monument

While, most recognize that improved security is necessary, public reaction to the proliferation of temporary security barriers has been mixed, especially in Washington,

[5] Hsu, Spencer S., "U.S. Aims To Fortify Its Leased Buildings," *Washington Post*, 15 March, 2002, sec. A, p. 1, 14.

D.C. "That is no doubt why the concrete, metal and wood security barriers now enveloping almost every federal building and monument in downtown Washington have triggered revulsion among residents and tourists alike. Stark, haphazard and unsightly, the hodgepodge of fences, planters, gates and Jersey barriers is the antithesis of visual harmony for which Washington is famous….

Each set of barriers in the city's monumental core can trace its' origins back to a particular terrorist attack against the United States, starting with the concrete sewer pipes placed in front of the Capitol in 1983 after a bombing outside the Senate chamber doors.

The 1995 Oklahoma City bombing begat the closing of Pennsylvania Avenue in front of the White House and the massing of Jersey barriers at the 15th and 17th street entrances. The 1998 bombing of the U.S. embassies in Kenya and Tanzania produced a ring of Jersey barriers around the Washington Monument. The terrorist attacks of Sept. 11 set off the most ambitious round of barrier-building, with more sewer pipes dropped around the Capitol, chain-link fences erected along the Ellipse, a double row of 100 Jersey barriers stationed at the Lincoln Memorial and dozens more placed at the Jefferson Memorial."[6]

The increase in vehicle barriers, closed circuit televisions (cctvs) and building guards gives the impression that security has improved. But is that really the case? Have we approached facility security in a rational manner, or are these security elements merely a token reaction to recent events. For example, have we assessed what tools a potential terrorist has at his/her disposal and what are effective preventive measures? If barriers are intended to prevent a truck laden with explosives from destroying a building, will the current use of Jersey barriers protect a building and its' inhabitants?

The issue of effectiveness has also been a popular topic in the media. "Architectural historians may look back on the first decade of the 21st century as the security epoch, a time when protecting buildings and public spaces against possible acts of terrorism increasingly dominated urban design and architectural discourse.

They may also conclude that what was done, in addition to potentially compromising the aesthetic quality of cityscapes, served more as a placebo than preventative.

In buildings and public places, security measures may not eliminate risks or prevent a focused attack. That reality is eclipsed, however, by perceptions that such measures are effective and by the psychic comfort derived from believing that we are safer….

Throughout the United States – and especially in Washington and New York – architectural and urban design security concerns have become paramount. And security experts consider the primary threat, the source of greatest risk, to be a truck or car laden

[6] Wheeler, Linda, "Ugly Barricades On The Way Out," *Washington Post*, 13 January, 2002, sec. C, p. 1, 9.

with explosives hurtling into the side of a building. Although the tragedy of last September demonstrated that there are other forms of threat, the vehicular bomb continues to dominate defensive thinking….

If the NCPC (National Capital Planning Commission) plan becomes reality, the driver of an explosive-laden vehicle would have a hard time getting up to and directly hitting a building. But for security purposes, that's all the plan would do. It won't address other risks – chemical and biological – or other methods of assault. It won't prevent an aerial attack, an explosion on the street or a suicide bomber on foot. And it won't help if an enterprising terrorist concocts a vehicle with detachable components capable of getting over or through the barriers."[7]

2.1 Security Design Elements – Passive & Active Security

Site security can employ both passive and active design elements. Passive elements rely on the use of actual and perceived barriers to deter unwanted activity. Active design elements include electronic monitoring systems, security personnel and the use of various physical deterrents. The most effective systems are designed for redundant coverage – if one layer fails, a second, or third tier will provide coverage. The intent of security planning and the installation of monitoring systems are to provide advance warning of an event, or incident, and allow enough time for security personnel, or local law enforcement, to respond appropriately.

The main objective in designing an effective security plan is to delay the attack. "If an attack is initiated, through proper design, the architect and engineer can use devices to delay its execution by making it more difficult for the attacker to reach the intended target. This will give the security forces and authorities time to mobilize and, ideally, stop the attack before it is fully executed. This can be done by creating a buffer zone between the publicly accessible areas and the vital areas of the facility by means of an "obstacle course," a meandering path and/or a division of functions within the facility.

An effective way to implement these goals is to create layers of security within the facility. The outermost layer is the perimeter of the facility. Interior to this line is the approach zone to the facility, then the building exterior, and finally, the building interior. The interior of the building may be divided to successively more protected zones, starting with publicly accessible areas, such as the lobby and retail space, then to the more private areas of offices, and finally the vital functions such as control room and emergency functions. The advantage of this approach is that once a line of protection is breached, the facility has not been completely compromised. Also, by using this approach, not all the focus is on the outer layer of protection that may contribute to an unattractive, fortress-like appearance."[8]

---

[7] Lewis, Roger K., "Shaping the City, the Use and Limits of Security Placebos," *Washington Post*, 24 August, 2002, sec. H, p. 5.

[8] Task Committee: Edward L. Conrath, Ted Krauthammer, Kirk A. Marchand, and Paul F. Mlakar, *Structural Design for Physical Security: State of the Practice*, American Society of Civil Engineers, Reston, VA, 1999, 3-9.

2.2 Perimeter Security

Perimeter security routinely begins at the outermost edge of the property line and is intended to prevent, deter, and/or monitor unauthorized approach, or departure from a facility or site. Perimeter security elements can include any element which would make it difficult for a pedestrian, or vehicle to penetrate the site. Examples include fences, walls, earth berms, vehicle barriers, water features, etc.

"Access control refers to the controlled access to the facility through the perimeter line. Architects and engineers can accommodate security functions by providing adequate design for these activities which makes it difficult for a vehicle to crash onto the site. This may be done through the use of barrier walls and other devices. Also, the location of access points should be oblique to oncoming streets so that gaining enough velocity to break through these stations is difficult for a vehicle.

If space is available between the perimeter line and the building exterior, much can be done to delay an intruder. Examples include terraced landscaping, reflecting pools, staircases, circular driveways, planters, and any number of other obstacles that make it difficult to reach the building rapidly."[9]

In urban environments perimeter security is difficult to monitor and control. "At one landmark building in New York, for example, traffic around the building is monitored via cctv 24 hours a day. Since the area around the building is a "no-standing" zone for vehicles, stopped vehicles get the attention of guards in the control center. But in reality, says the site's former head of security, the barrage of tourist buses, taxis, and limousines constantly encircling this landmark make controlling the perimeter almost an impossible task."[10]

2.3 Surveillance Systems

Electronic surveillance systems include closed circuit television (cctv) coverage, combinations of sensors (infrared (IR), thermal, microwave, motion, etc.), electronic access controls, biometrics, etc. All of these systems require a professional response staff and direct connections to emergency power and uninterruptible (UPS) power systems. The use of electronic surveillance systems is sophisticated, costly, requires continual preventive and emergency maintenance and is susceptible to "false positive" alarms.

During a "false positive" alarm, the security system will function correctly, but the event may be non-threatening. For example, a perimeter fence motion sensor will detect a person trying to climb, or cut the fence; it will also, however, sound the same

---

[9] Krauthammer, 3-10.

[10] Gips, Michael A., *Building in Terrorism's Shadow*, Security Management online, May 2000. Database on-line. http://www.securitymanagement.com/ Accessed on 10 October, 2002.

alarm during high winds, or if a large animal rubs against the fence. If there is a high incidence of "false positive" alarms, security personnel may ignore, or disconnect, particular systems, thus compromising an electronic surveillance system.

Cctv surveillance systems can be very effective at recording an incident, or responding to an incident if the cameras are monitored by a professional staff and have security personnel located on site. Cctv recordings are often used as evidence during court proceedings. Many everyday transactions at banks, ATMs, stores, etc., are recorded via cctv. Well designed systems include a dual monitoring feature which transmits recorded activity to a remote monitoring site. This feature is especially valuable if the original recording or equipment is damaged. Also, many private and government security personnel provide remote site monitoring after hours. This allows the monitoring staff to alert local law enforcement and fire personnel to an incident. With remote monitoring, it is essential that critical infrastructure (electric and telephone) systems be protected.

External perimeter cctvs are normally installed within environmental housing units. These large housing units are quite visible and may provide an individual with the sense of being under constant observation. Covert units, which include pin point observation can be located most anywhere and are not evident to the casual observer. Many systems are designed to remain in a dormant mode until activated by a motion sensor. These systems also may contain pan-tilt-zoom features which may allow security personnel to distinguish facial features, or license plate information from 1/4 mile distances, or more.

IR and/or thermal detection cctvs systems are commonly used during low light, or no light situations. While external lighting may be a deterrent to criminal behavior in certain residential and commercial environments, some manufacturing and/or government facilities may not want to stand out, or illuminate their location and nocturnal activities. The use of both IR and thermal detection systems is an example of redundancy. Both systems provide night vision capabilities, but each system has its' advantages and disadvantages. Some fabrics can be treated to reduce detection and weather conditions, such as ground fog, can reduce thermal detection capabilities. It is important to layer detection systems, since no one system will provide complete coverage.

Sensors, including motion and ground sensors are common security elements of a redundant system. Motion sensors can be installed on perimeter fences, and act as a warning for the first indication of an undesired event. In evaluating the use of a perimeter fence, or barrier, system, sometimes a series of concentric fences are more effective in preventing, or inhibiting access. In these instances, the motion detectors would be placed on the innermost fences, thus eliminating the instances of "false positive" alarms from the most external fence.

Ground sensors can be hidden in landscape features, such as rock formations. Some ground sensors are battery, or solar, operated and can transmit alarms via radio

signals. Buried detection systems can contain parallel coaxial cable, which record pressure, or weight. These systems record in 100' intervals and require a buried environmental housing unit every 100'. High water tables, or groundwater could interfere with readings on buried coaxial cable systems and may result in "false positive" alarms. This is another example of why redundant systems are necessary in an effective system.

A buried sensitive film, which records weight, but also detects electronic sensors, is in use at some airports. For example, an airport may install sensors on all vehicles (food service trucks, tugs, emergency vehicles, etc.) authorized to operate within the air operating area. When a vehicle drives over pavement which contains a sheet of this sensitive film, the location is recorded and monitored by control tower staff.

Access controls can be mechanical, or electrical, or a combination of both. In the event of power, or systems failure it is prudent to have the capability of manual override. Access controls can be designed for people or vehicles.

Examples of mechanical access controls include keyed locks and manual key pads. The advantages of these systems are that they are relatively inexpensive to install and operate. The disadvantages include lost or duplicate keys and the issuance of manual keypad codes to unauthorized persons. For example, an employee may tell a friend, or spouse, the keypad code so the friend may park a vehicle in the employee garage. There is no record of this activity and the access code may be passed on further. Also, when a single code is entered on a manual system, there is the possibility that it may be observed by others.

Electrical access controls may consist of a scrambler-type electronic keypad, where the position of the numbers changes with each user. This makes it difficult for others to detect the sequence, but still allows employees to tell friends, or spouses the access code. More effective systems include the issuance of employee ID cards which are used on swipe, or proximity readers. These readers are generally located at building entrances, garage entrances, and internal doors. The advantage of this system is that security staff can tell which employee ID was used to access which area; the disadvantage is that the ID card may be used by anyone possessing the card. The use of passwords (individual numerical codes) can be added to employee IDs with an alternate universal "emergency response" code to be entered when an employee requires assistance.

The use of biometrics is becoming more common as an employee identifier. The use of hand scans and retina scans in access control systems is a common practice in some high security areas. Even with these narrow ID parameters, it is possible to "piggyback" an entry control system. That is, an employee may be coerced into allowing an unauthorized person access to a facility. In instances of high security facilities, additional screening/containment measures may be necessary.

2.4 Screening

U.S. courthouses were the first non-military government facilities to establish minimum security standards for all new construction. Entry screening posts were installed in all U.S. courthouses during the early 1990s. These posts consisted of walk-through magnetometers and x-ray machines. With increased threats against the judiciary, security screeners were primarily concerned with confiscating weapons. An average of 200,000 weapons and contraband are routinely seized each year in federal court facilities. Weapons include guns, knives, mace, etc. Contraband most commonly includes cameras, which are prohibited in federal courthouses.

With the advent of high threat terrorism trials, beginning with the 1993 bombing of the World Trade Center, the 1995 bombing of the Murrah Federal Building in Oklahoma City and the 2001 terrorism acts against the World Trade Center and the Pentagon, courthouses have added measures for bomb detection and biochem screening.

In addition to introducing screening devices and entry control systems for the most vulnerable building areas: entrances, delivery areas and parking garages, engineers and design professionals recommend pulling these functions away from the core facility which houses employees and other assets. The idea, to make these screening elements self contained, but connected to the main building(s), will have an impact on future site planning.

Bomb detection currently requires the use of bomb sniffing dogs, large screening equipment and bomb containment equipment. The bomb dogs work in shifts (approximately 2 hours each) and require a rest area. Each dog has a separate handler. Future site planning for facilities requiring bomb screening will require space interior/exterior for dogs and their handlers. The Pentagon is currently nearing completion of a building delivery area which includes consideration for bomb dogs. The design also separates the delivery area from the main structure with a blast wall.

Bio-chem screening appears to be an evolving science. There are many screening techniques available, but the large number of possible scenarios (involving available chemicals and/or biological agents) will make it difficult to narrow down screening options. Some firms are currently researching the feasibility of installing a form of ultraviolet bio-chem mitigation device within air handling systems. This will be a costly endeavor and may be a few years away from practical application. The current consensus among mechanical engineers is to prevent any possible harmful agents from entering the air handling system. The recommendation is to design the air handling systems for the building entry, the delivery area and the garage as separate systems that are sealed off from the main air handling system. Also, access to air intakes, air conditioning units, water systems and other critical building systems needs to be restricted and monitored by security personnel.

So to recap, future planning for high risk sites will include separating building entries, delivery areas and parking areas/structures from the main facility. It will also

include the installation of blast walls and separate air handling systems to mitigate any potential effects from a bomb or biochem incident.

2.5 Sallyport Functions

Sallyports have historically acted as hardened containment areas to screen a potential enemy, or to fend off a small attack. U.S. courthouses contain various types of sallyport structures which are mainly used for the movement of prisoners. The vehicle sallyport is designed to contain one, or more sedans, vans, or prisoner buses. Typically, the vehicle drives to an area within the courthouses' secure garage, to a separate garage structure. Once inside, an overhead door descends and locks the vehicle within the sallyport. Law enforcement personnel escort restrained prisoners from the vehicle to an internal sallyport corridor, or prisoner elevator. The prisoners are then brought to the main detention area where they will wait until escorted to court (via more sallyport corridors).

The sallyports take on many different forms, including vehicle and bus elevators. The objective is to observe and contain any violent activity without risking harm to court employees, or the general public.

The concept of sallyport design can be incorporated in designing entrances, delivery areas and garages for high risk facilities. There are many ways available to the professional to circumvent electronic security systems, however, this additional hardened security layer, if designed sensitively, will blend into the architectural design for the facility and will provide an additional measure of security for building occupants.

A sallyport for the building entry and delivery area may take on the form of a contained corridor with the ability to seal off both ends. In the garage, employees may key in their access code, drive into a sallyport containment area, where garage doors would close and contain the vehicle until the driver either enters a second code, or undergoes verbal screening Once cleared, the inner garage door would open allowing the driver to enter the main parking structure.

An example of sallyport-type design is currently being proposed for the Washington Monument. "The National Park Service yesterday reaffirmed its decision to replace the concrete barriers around the Washington Monument with an underground visitor center and tunnel, concluding in an environmental study that the plan is the best of three options for securing the landmark….

Under the Park Service plan, two stone-walled, 12-foot-wide sunken walkways would replace the Jersey barriers that have ringed the monument since 1998. Visitors would walk through a 400-foot-long tunnel to reach a 20,000 –square-foot underground center and screening facility. A temporary, aboveground screening facility and snack bar would be removed."[11]

[11] Hsu, Spencer S., "Underground Center At Monument Backed," *Washington Post*, 1 May, 2002, sec. B, p. 1, 7.

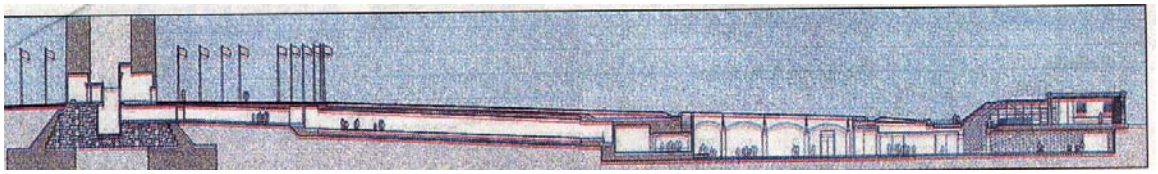


Figure 2. Proposed Tunnel Washington Monument

2.6 Redundancy

As noted above, no one method, or security system, will perform 100% of the time, nor will a determined professional be stopped by conventional systems. The purpose of installing redundant systems is to layer the coverage, so an intruder, or incident, can be slowed down, or contained sufficiently to allow security and emergency personnel to respond and to provide employees with the best opportunity for surviving an incident.

2.7 Deterrents

Additional elements employed to control, and/or inhibit access, or unauthorized activities include the use of non-lethal deterrents, less-than-lethal deterrents and lethal deterrents. Non-lethal deterrents, such as tear gas and pepper spray are a commonly used method for dispersing crowds. Aqueous foam, which inhibits movement within a defined space (such as a corridor), is another example of a non-lethal deterrent. The Pentagon's Non-Lethal Weapons Directorate is actively involved in developing non-lethal and less-than lethal deterrents that effect all five senses and individual mobility. For example the Army Corps of Engineers "hired scientists at San Antonio's Southwest Research Institute to develop a spray that makes asphalt, concrete, grass and wood as slippery as ice. The Marines expect to have the product ready for use in 2003.[12]

2.8 Communication

The ability of communications systems to remain functional during emergencies is critical to survivability. Telephone, data lines, radio transmission and repeater facilities are critical infrastructure elements which require special attention and protective measures to maintain functionality. The design and installation of buried electric lines, twisted pair, fiber-optic lines, T-1 connections, etc., in high threat environments require tamperproof and sensor monitored conduits, environmental junction boxes and manholes. Many security systems monitor access to utility systems, including in-ground, above ground and repeater towers.

Connections to emergency generators and UPS are essential design considerations for communications systems. UPS systems are battery operated and provide a continuous source of electric power to computers, security systems, emergency lighting and communications systems until the emergency generator power comes on. UPS operating

---

[12] "New weapons stink or hurt, but don't kill" *CNN*.com. 24 March, 2002. Database on-line. http://www.cnn.com/ Accessed on 25 March 2002.

time is very limited. The emergency generators require an external fuel supply and depending on the size of the generator, the fuel storage capacity and emergency support requirements, can operate anywhere from 2 - 48 hours before requiring refueling.

UPS systems can be located anywhere within a facility, but are generally close to the computer rooms, control rooms and communications centers they service. Emergency generators require ventilation, access to fuel storage tanks, and when they are in operation, generate a great deal of noise. In urban settings, emergency generators are frequently located in parking garages, delivery areas, or in first floor/basement levels of buildings, with access to outside ventilation. Where space is available, emergency generators are located outside the main structure in a contained (walled in) area, or in a separate structure. When planning the location of emergency power facilities, landscape architects should be aware of security issues, fuel delivery requirements and noise abatement considerations.

2.9 Response Personnel

The ability of fire, rescue and law enforcement personnel to access a facility and respond to emergencies is critical to the survivability of building occupants. Clear, unobstructed access to building facades and water sources is mandatory for fire equipment. When landscape architects plan for site security, which could include the installation of design elements such as barrier walls, water features, bollards, terrain/grade changes, access for emergency vehicles must be a primary consideration.

Often, the design intent of a security plan or protective system conflicts with the real needs of response personnel. "The first mode of protection is to create a "keep-out zone" that ensures a minimum guaranteed distance between the explosion and the target structure. This keep-out zone is achieved by placing at the site perimeter bollards, planters, fountains, and other barriers that cannot be compromised by ramming with a vehicle. While this is the most effective measure to lessen the effect of a terrorist attack, it can also work against rescue teams since the barriers could deter access to the rescue and firefighting vehicles. In most urban settings, the typical setback distance from the street to the building façade is 10 to 25 feet, which does not pose any access problems for emergency vehicles. However, when designing prestigious buildings, including landmark office towers, hospitals, and museums, the setback is often increased to create a grand public space. These setbacks could create keep-out distances of more than 100 feet with barriers to guarantee protection but which also could limit emergency vehicle access. Details that may provide operational bollards or fences should be included in the design to allow emergency access."[13]

[13] Rittenhouse, Tod, *Designing Terrorist Resistant Buildings* (Reprinted from Fire Engineering, Fairlawn, NJ, November 1995). Database on-line. http://www.wai.com/ Accessed on 11 November 2002.

2.10 Occupant/User Awareness/Training

Pre-planning awareness training and occupant emergency evacuation drills are important tools in ensuring survivability. The location of building exits should lead directly to "safe zones." These pre-planned "safe zones" should be located far enough away from potential hazards (flying glass, debris, etc.). There should be alternate "safe zones" in case the original meeting area is not usable. Emergency evacuation plans should include floor monitors (to ensure floors are evacuated), designated personnel to assist disabled occupants and a personnel tally at "safe zones." For site planning considerations, these "safe zones" can take the form of parks, playgrounds, plazas, or any open space directly accessible from building emergency exits.

Engineers and architects are currently re-evaluating fire-safety code requirements after completing intensive computer modeling studies of the collapse of the World Trade Center towers. The design, location and number of fire stairwells; elevator shaft design; elevator operability during emergencies; sprinkler coverage and water holding tank designs are all under evaluation. One area under consideration is the elimination of phased evacuations. Currently, if a fire alarm goes off in a high rise building, the occupants of the floor the alarm goes off on, and the occupants of the floor above and the floor below the alarm are notified via public address system to evacuate the building. The width of fire stairwells is designed to accommodate this 3 floor evacuation. In the case of the World Trade Center, phased evacuations led to fatal results.

For future site planning this will be an important consideration. If the fire safety codes are revised to accommodate total building evacuation, the exterior surfaces adjacent to fire exits must be unobstructed and sufficient in size to allow immediate egress and access to safe zones located well away from potential debris hazards.

2.11 Planning – Vulnerability/Threat Analysis

Security vulnerability and threat analysis assessments for existing, or planned developments are approached using the same analytical methods landscape architects currently employ when conducting a site analysis. The approach includes a review of existing site conditions, client requirements, identification of assets and liabilities, analysis of potential events, a determination of probability, and recommendations for remediation and/or mitigation.

Some assessment elements touched upon in Crime Prevention Through Environmental Design (CPTED) studies are similar to those employed by security planners. CPTED "researchers have made several assumptions about how physical features affect both potential offenders and residents or users in a setting. Offenders often operate in a rational fashion; they prefer to commit crimes that require the least effort, provide the highest benefits, and pose the lowest risks….

Offenders may decide whether or not to commit a crime in a location after they determine the following:

- How easy will it be to enter the area?
- How visible, attractive, or vulnerable do targets appear?
- What are the chances of being seen?
- If seen, will the people in the area do something about it?
- Is there a quick, direct route for leaving the location after the crime is committed?"[14]

These criteria were definitely employed in a recent domestic terrorism case involving the killing of a Buffalo, New York, abortion clinic doctor. Dr. Bernard Slepian, a doctor, who had not previously been a target of anti-abortion extremists, was killed by a high powered rifle while walking inside his residence. The killer, Quentin Kopp, "selected Slepian's name out of a telephone book and he had never read any news accounts about Slepian or ever participated in Buffalo protests before the shooting. No one in the Buffalo anti-abortion community recommended Slepian as a target, he told the Buffalo News.

Kopp said he targeted Slepian largely because his home was "vulnerable" because it had a rear window facing some woods.

Kopp said he scouted Slepian's neighborhood about six times over the course of a year before the attack. Twice, Kopp had his gun and was ready to shoot if he saw Slepian at the rear window, he said."[15]

In the case of international terrorists, many of the same evaluation criteria are used. However, with the increase in the number of suicide missions, the final requirement, to identify an escape route, does not appear to be important.

If an individual, business, or government agency has been the target of threats, or has identified potential threats, one of the first protective measures would be to maintain a low profile and protect information concerning business practices and employees. In the case of Doctor Slepian, obtaining an unlisted phone number and removing the family name from an outside mailbox could have prevented his killing. In businesses and government agencies, it is also advisable to develop procedures concerning the dissemination and handling of information about the business and/or its' employees.

Government agencies and law enforcement in particular are employing operations security (OPSEC) evaluation criteria as a tool in evaluating how effectively they conduct business. "OPSEC is a risk management tool used to deny an adversary information concerning our intentions and capabilities by identifying, controlling, and protecting

---

[14] Taylor, Ralph B., Harrell, Adele V., *Physical Environment and Crime*, U.S. Department of Justice, Office of Justice Programs, National Institute of Justice, Washington, D.C., January 1996, 2, 6.

[15] "Paper: Abortion opponent admits killing doctor," *CNN*.com, 20 November, 2002. Database on-line. http://www.cnn.com/ Accessed on 20 November, 2002.

indicators associated with the planning and execution of law enforcement and public safety missions.

The OPSEC process consists of five different steps: 1) Identify Critical Information; 2) Conducting a Threat Analysis; 3) Performing a Vulnerability Analysis; 4) Assessing Risks; and 5) Applying Countermeasures."[16] In the OPSEC evaluation process, activity indicators, which may appear on the surface to be inconsequential to an operation, can be important to an adversary. For example, during the Gulf War, the White House and the Pentagon were not giving out any definite information as to when an attack would take place. The media, however, had an early indicator when they noted that after normal working hours, the employee parking lots were full and pizza deliveries continued through the night. These two seemingly unrelated activities – parking and food deliveries, told the media what the official sources would not.

2.12 Characterize facility

When determining the character or/importance of a facility, the following should be considered:

- What type of facility? (i.e., water treatment plant, nuclear plant, fuel storage facility, school, laboratory, hospital, residential housing, recreation area, government building, etc.)
- What are the site boundaries? (i.e., city streets, perimeter walls/fences, river, natural barriers, etc.)
- How many employees/residents/visitors?
- What is processed on the site? (i.e., data, commercial products, energy, entertainment, etc.)
- What are the methods and numbers of ingress/egress points? (i.e., access roads, railroad, metro access, delivery roads, trails, pedestrian walkways, etc.)
- What are the scheduled hours of operation? (Is there shift work? Weekend work?)

2.13 Identify assets (potential targets)

Approach this analysis as if you were an adversary. What is the most important asset, or what would be the most detrimental event to occur to the facility owner?

- Equipment – is the equipment on site valuable? How difficult (time/money) would it be to replace?
- Personnel – is the workforce highly skilled, or irreplaceable?
- Materials – are raw, or processed materials valuable? Are information/data files a commodity?

[16] Hawley, Chris, Noll, Gregory G., and Hildebrand, Michael S., *Operations Security for Public Safety Agencies – Special Operations for Terrorism and HAZMAT Crimes*, Interagency OPSEC Support Staff (Greenbelt, MD, June 2001), 36.

- Is the reputation of the facility/commodity important?
- Is employee morale important?

2.14 Identify Credible Threats

Many events which are recorded daily in the news media provide a basis for determining threats, official sources, such as law enforcement and intelligence agencies can provide additional information. A good place to start is to look historically at what types of facilities have been targets for terrorist activities. As indicated previously, within the United States targets have included government buildings, power plants, electrical substations, research laboratories, reproductive health care providers, landmarks, etc. Based on historical activity, consider the following:

- What type of adversary or tactics are most likely to be employed?
- What is the objective – destruction, theft, disruption?
- What motivates the adversary? Is there an event (i.e., scheduled meeting of the International Monetary Fund (IMF)), or anniversary date (i.e., Supreme Court decision, *Roe v., Wade*) that might trigger a response?
- What are the adversary's capabilities? What tactics has the adversary used previously, what resources are available to him/her?
- What is the likelihood that this an inside/outside job?

The American Institute of Architects (AIA) recommends additional evaluation criteria.

"A threat analysis addresses the following questions:

- What factors about the building owner or occupant invite potential hostility?
- How conspicuous is the building?
- Does it have any symbolic value?
- How vulnerable does the building appear?
- What political event(s) may generate new hostilities?
- Have facilities like this been targets in the past?"[17]

The AIA analysis addresses the architectural significance, or symbolic significance of a particular building or facility. As seen on September 11, the perceived activities taking place inside the World Trade Center and the Pentagon made them attractive targets. Other targets, which included the Seattle Space Needle, the Los Angeles airport, the Statue of Liberty, were important from a symbolic or architectural standpoint.

2.15 Analyze Undesired Events

[17] "Building Security Through Design," American Institute of Architects, Washington, D.C., 2001, p 9.

In order to prepare an effective plan, it is necessary to evaluate the types of events which could occur. For example, if a facility has a history of pipe bomb attacks, it would be reasonable to remove containers which could conceal the bombs (i.e., waste baskets, mail boxes, etc.). It would also be reasonable to design a planting plan which would not allow for concealment of these types of devices in groundcovers and shrubs.

- What type of event could occur (theft, service disruption, shooting, bombing, etc.)?
- When would this event occur (after hours, during peak operating hours, on an anniversary date, during a planned special activity)?

British military engineers, with a history of dealing with conflicts arising from the radical, provisional arm of the Irish Republican Army (IRA), have designed an anti-terrorism planning program to evaluate the "robustness" of a facility during various undesired events. For example, using CAD/GIS, the results of a truck bomb, or other type of explosive attack, could be plotted out. Various mitigation proposals could be tested and evaluated in terms of effectiveness.

2.16 Determine Probability of Event

This would be the most difficult factor to evaluate, but it is most important in determining what design elements would be effective in mitigating the results of an undesired event.

- What is the probability of an undesired event occurring?
- If the undesired event occurred, how successful would it be?

2.17 Analyze and Rank List of Vulnerabilities

Based on the evaluation, a list of the site's most vulnerable elements (i.e., site access, data security, utility protection, etc.) can be identified and ranked in terms of importance. Funding priorities can be established and remediation plans proposed.

After the 1995 bombing of the Murrah Federal Building in Oklahoma City, a task force was formed to evaluate all U.S. courthouses and federal buildings in terms of security vulnerabilities. Evaluation criteria included the number of building entries and exits, access controls, security staff, etc. Each building was evaluated and ranked in terms of existing deficiencies. Cost estimates were prepared and a remediation plan was presented to Congress. The importance of presenting an analytical, systematic approach was evidenced in the ability to obtain the necessary funding.

2.18 Propose Site Remediation for Critical Infrastructure Protection

Design proposals should enhance overall security objectives which include detection, delay and response. Landscape architects provide critical expertise in planning access controls, setbacks, barrier design and placement, and grade change alternatives

while inherently improving the way security enhancements blend in with the environment and architectural theme of the facility.

The most important consideration in preparing a site remediation plan includes an understanding of the capabilities and limitations of all of the security elements to be employed in the plan. The design standards and product performance testing results should be available for both government and commercial endeavors. "Performance based recommended practices for vulnerability assessment and mitigation for new and existing buildings must be developed to provide cost-effective, standardized, and verified alternative approaches for facility owners, builders, and designers. These practices should offer flexibility to adapt protection from terrorist threats throughout the life of the buildings."[18]

2.19 U.S. Courts Design Guide

During the 1980s, the General Services Administration (GSA), the federal agency responsible for design, construction and maintenance of all federal buildings (with the exception of military, and certain exempted facilities), started receiving feedback from various components within the judicial system concerning the lack of standards, or guidelines, related to construction or renovation of U.S. Courthouses. Contract architectural and engineering firms, as well as GSA staff, did not fully understand court functions and consequently each new courthouse was built to a different standard, often omitting key components if an agency's representative had been left out of the planning process. During this same period of time, threats against judges and other members of the court family increased.

With the increase in federal civil and criminal court cases, and the subsequent increases in judicial appointments, the need for additional courtrooms and new courthouses became apparent. The Administrative Office of the U.S. Courts (AOUSC) and components within the U.S. Department of Justice, including the U.S. Marshals Service, U.S. Probation Office and the Office of the U.S. Attorneys, worked with the National Institute for Building Sciences (NIBS) to evaluate existing court facilities, and to develop standards including functions, space, circulation, and security.

During the evaluation process, task force representatives toured various types of court facilities, from U.S. Post Office and Courthouse buildings constructed during the 1930s to multi-storied skyscrapers constructed during the 1960s and 1970s. The earlier buildings were rich in architectural detail, but lacked security and the infrastructure necessary to accommodate computers and telecommunications systems. The modern office building/skyscraper type courthouses appeared to be functional, but judges were displeased with the sameness, or lack of importance the buildings conveyed.

---

[18] Dr. John Marburger, III, "Critical Infrastructure Protection Priorities: The Built Environment, Executive Summary" (Washington, D.C.: Executive Office of the President's Office of Science and Technology Policy, 23 September 2002. Photo-copied.

These feelings were expressed when the Guide was first published. "It is the intent of this *Guide* to encourage the creation of architecture for Federal courthouses which engenders in its users and the public a respect for the tradition and purpose of the American Judicial process.

To this end, a courthouse facility should be monumental in expressing solemnity, stability, integrity, rigor and fairness in the Federal Judicial system, and provide a civic presence through continuity with the American architectural heritage of public buildings and courthouses.

For the realization of these concepts, massing should be strong and direct with a sense of repose, and the scale of design components grand to reflect a national judicial enterprise, all in a proportional and hierarchical arrangement to signify orderliness. It is suggested that the materials employed should be consistently applied, natural and regional in origin, and durable for a sense of permanence. Colors should be subdued and compliment the natural materials utilized in the design."[19]

During the 1970s, the federal criminal courts were hearing numerous cases involving the Mafia. These cases involved violent criminals, but they tended to carryout acts of violence within their own families, or with other Mafia families. This changed in the 1980s and early 1990s with the increase in cases involving the Colombian drug cartels and the Mexican mafia. This new breed of criminals did not hold to the "code of honor" which protected innocents, including wives and children. Threats against judges, U.S. attorneys, probation officers, etc., increased. The need to increase security at U.S. courthouses was evident and the recommendation most visible to the general public included uniform entry screening requirements. "The public must enter the court building through a single controlled security screening point, staffed by deputy marshals or court security officers (CSO)s. Staff entry into the building from parking areas must also be controlled through a separate screening point in the public lobby. Judges and others who require additional security must be able to enter the building without intersecting public circulation by a restricted lobby and dedicated elevator from a secure parking area."[20]

2.20 Current Security Proposals for High Threat Terrorism Trials

The terrorism trials of *U.S. v., Timothy Mc Veigh* and *U.S. v. Terry Nichols* were the first in the United States to employ extra-ordinary security measures. Both trials were awarded a change of venue from Oklahoma City, which was devastated by the destruction and loss of life in the bombing of the Murrah Federal Building, to Denver. Security planners blocked off streets around the U.S. Courthouse in Denver with Jersey barriers and employed bomb dogs and x-ray machines to screen all deliveries. To allow

[19] U.S. Courts Design Guide, General Services Administration, National Institute of Building Sciences, Washington, D.C., 1993, 1-2.

[20] U.S. Courts Design Guide, 2-42.

families of the victim's access to court proceedings, an auditorium, with live audio-video feed was set up at the FAA training center in Oklahoma City. Federal courts do not allow television broadcasts of court proceedings, so this was an unusual allowance for the court. The security measures for the Oklahoma City bombing trials were dismantled at the trial conclusion.

The PAN AM 103 bombing case was tried by the World Court. A special courtroom, prisoner holding area and witness facilities were constructed at Camp Zeist, a military base, in the Netherlands. All visitors and vehicles were screened and due to the nature of being on a military base, the court building was removed from local streets. Court proceedings were broadcast live to special viewing rooms in New York City and Washington, D.C., to accommodate victim's families.

2.21 Retrofitting Case Studies:

The 1993 bombing of the World Trade Center resulted in a series of multi-defendant international terrorism trials heard at the U.S. Courthouse in Foley Square, New York. These trials, due to various motions, are still on going. Both temporary and permanent security measures were put in place for the 1993 trials.

The trials resulting from the September 11, 2001, destruction of the World Trade Center would normally have been heard by the Southern District of New York in the Foley Square Courthouse. However, a change of venue ruled that these trials resulting from the September 11 terrorist acts will take place in the Eastern District of Virginia which includes the U.S. Courthouse in Alexandria, Virginia.

The trial of Richard Reid, "the shoe bomber," was scheduled to be heard at the U.S. Courthouse in Boston, Massachusetts. Plans were ongoing to increase security at the Boston courthouse when Reid plead guilty to attempting to detonate a bomb constructed of plastique (C-4 type) explosive material while a passenger on an international flight.

All of the new courthouse buildings in Foley Square, New York, Alexandria, Virginia, and Boston, Massachusetts were designed and constructed according to standards set forth in the U.S. Courts Design Guide. Yet these buildings are still not secure enough to handle terrorism trials. The following will examine existing security, temporary security improvements for the terrorism trials and possible permanent security proposals based on findings in this thesis.

2.22 U.S. Courthouse Alexandria, Virginia

The U.S. Courts' Eastern District of Virginia, with headquarters in Alexandria, Virginia, traditionally hears the majority of federal cases involving national security. National security cases, involving classified information, require specially constructed facilities designed for voice, data and document security. Over the past few years the Alexandria court has heard numerous high profile espionage cases including Aldrich

Ames and Robert Hanson. Given the fact that this facility has benefited from the additional security measures necessary for espionage cases, it was nevertheless unprepared for high threat terrorism trials.

Figure 3, U.S. Courthouse, Alexandria, Virginia

The courthouse contains detention cells to house pre-sentenced prisoners during court activity. However, prisoners are not held over night. Federal pre-sentenced prisoners would normally be held in federal detention centers, or prisons managed by the Federal Bureau of Prisons. If there is no federal prison facility available, U.S. Marshals contract with local jails to house federal prisoners. In this instance, prisoners are housed in the local Alexandria Public Safety Center which is approximately ½ mile away from the courthouse. "Before Moussaoui's arrival, chain-link fences topped with barbed wire suddenly sprang up around the perimeter of the rust-orange brick Public Safety Center, which also houses the city's police department and magistrate's office. Jersey barriers line the entrance, parallel to the nearby Capital Beltway. All visitors to the Public Safety Center on Mill Road must stop at a checkpoint manned by deputies, show their identification and state their business."[21]

Prisoners are picked up each morning by U.S. Marshals and driven to the federal courthouse. From an operations standpoint, the drive from the jail, to the courthouse, through city streets, is high risk. Once at the courthouse, the prisoner vehicle enters a sallyport and the prisoner is then conveyed through sallyport corridors and elevators to the detention area.

The U.S. Courthouse in Alexandria, Virginia is a federal building located within a private mixed development of office buildings, condominium high rises and commercial establishments. The Carlyle Development Corporation owns and maintains the streets and pedestrian areas which abut the courthouse. This private ownership has allowed security planners to install guard houses and delta-type vehicle barriers in these privately owned streets around the courthouse. "Closer to the courthouse, authorities are planning

[21] Davis, Patricia, "Jail's High Profile Gets Even Higher," Washington Post, 17, January, 2002, sec. A, p. 1, & B4.

highly visible security measures, such as concrete barriers. Courthouse guards have begun requiring visitors to show identification and pass through two sets of metal detectors to enter hearings in the trials. Bomb-sniffing dogs check the courthouse, and police close the adjacent road every time a high-security prisoner is brought to or from the nearby jail. When the trials begin, access to the streets leading to the courthouse, including Jamison Avenue and Mill Road, will be restricted."[22]

Figure 4, Guard House and delta barriers installed in private street

International media coverage is expected at all court proceedings and measures are underway to contain the press in one location. "Alexandria officials have added round-the-clock security, built a new gravel parking lot, are restricting parking and are preparing to close roads near the federal courthouse as they anticipate an onslaught of media this week for a hearing in the case against Zacarias Moussaoui."[23]

The U.S. Courts Design Guide includes provisions for press briefing areas within the courthouses. However, the September 11th terrorism trials are of such high interest that the press cannot be accommodated within the building. Limited courtroom seats will be available for the press and cameras are not allowed within the courthouse. The planning for a temporary media center to house domestic and international press has also disrupted employees and residents in the area surrounding the courthouse. "The Alexandria City Council voted yesterday to install as many as 17 trailers near the U.S. District Courthouse as a media center for the hundreds of journalists who will cover two high-profile terrorism trials late this summer

The decision was not welcome by dozens of residents of the nearby Carlyle Towers condominium building who turned out for a public hearing on media accommodations for the trials of John Walker Lindh, the American accused of fighting

[22] Jenkins, Chris L., "Media Center During Trials Irks Residents," *Washington Post*, 16 June, 2002, sec. C, p. 1.

[23] "Security Stepped Up Around Courthouse," *Washington Post*, 22 July, 2002, sec. C, p. 2.

with the Taliban in Afghanistan, and Zacarias Moussaoui, suspected of conspiring with the hijackers of the four airliner that were crashed on Sept. 11.

Several said the onslaught of journalists would make it difficult to take a simple walk to the store – and could make their neighborhood a target for terrorism."[24]

2.23 U.S. Courthouse New York, New York

The Foley Square Courthouse complex in lower Manhattan consists of two courthouses, the Metropolitan Detention Center (MDC) (a Federal Bureau of Prisons high rise prison) and a building housing the Office of the U.S. Attorney. The complex abuts city streets and pedestrian plazas and walkways. The older of the two courthouses is a landmark building with the façade designed to resemble a Greek temple. This original courthouse was the scene of many famous trials including the espionage trial of Julius and Ethel Rosenberg and numerous high profile mafia trials of the 1960s, 1970s and 1980s.

This older courthouse was not designed to accommodate security concerns. For example, there are no separate interior circulation systems, a pubic elevator could, at one time, hold a judge, the prisoner he had just sentenced, the family of the victim and a reporter…an interesting mix, but not necessarily a healthy one.

The new Foley Square Courthouse was designed and constructed according to the U.S. Courts Design Guide. The building is monumental in scale and rich in the selection of architectural finishes. The main entrance is via a pedestrian walkway. The walkway was created when small streets were closed off to vehicular traffic. Large granite bollards were installed to limit access.

[24] Jenkins, Chris L., "Media Center During Trials Irks Residents," *Washington Post*, 16 June, 2002, sec. C, p. 1.

Figure 5, l-r, NY State Court, new and old U.S. Courthouses,
Foley Square, New York

The site includes underground parking for judicial staff and a large delivery area under the courthouse. The delivery area is accessed by large elevators which can accommodate delivery trucks and buses. Once in the delivery area, trucks are positioned into loading docks via a large turntable. The terrorist trials and associated threat updates have made it necessary to incorporate multiple screening areas for deliveries. Prior to accessing the building delivery area, trucks are lined up in an area defined by Jersey barriers. This double row of barriers is on a public street, closed off to vehicular traffic. The trucks are visually inspected and bomb dogs and bomb detection equipment are also employed. Once clear, the delivery trucks are allowed into the restricted exterior passage area and then onto the delivery elevators. The loading dock contains addition x-ray and package screening equipment where all packages and envelopes are screened prior to delivery.

The Metropolitan Detention Center (MDC) is located between the old and new courthouses. The multi-story structure was designed to hold pre-sentenced prisoners awaiting trial. The original plans included a rooftop recreation area with basketball

courts. However, this design was modified shortly after the MDC opened, after a successful helicopter escape made it necessary to cover the basketball courts with a large expanse of security grille work. The MDC currently holds most of the defendants in the 1993 World Trade Center bombing. Prisoners are moved into the new courthouse via an underground tunnel sallyport.

Figure 6, l-r, MDC, Old Courthouse Tower New Courthouse Tower

The U.S. Attorney's building faces a large pedestrian plaza and access to the court buildings is via pedestrian walkways.

2.24 U.S. Courthouse Boston, Massachusetts

The U.S. Courthouse in Boston, Massachusetts is located on the harbor in a section called the "Fan Pier." The section facing the harbor and the Boston skyline is a very dramatic wall of concave glass. The front of the building is designed to blend in with the predominately brick warehouse-type district in which it is located. A public waterfront park is located adjacent to the courthouse and public walkways run between the courthouse and the waterfront. Although this building was designed to comply with U.S. Courts Design Guide standards, the local judicial review committee wanted the building accessible to the public for art shows, concerts and other non-judicial events.

Fig 7, Boston Courthouse Front Entrance

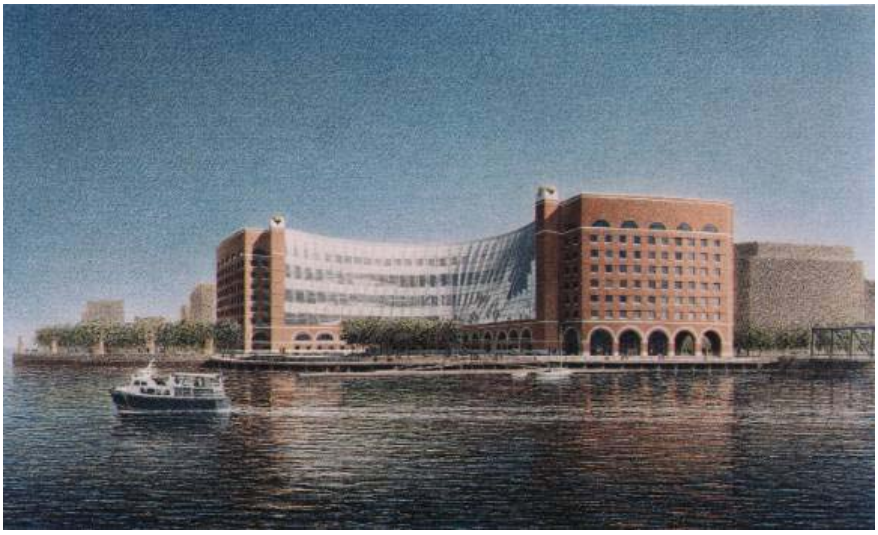


Figure 8, Boston Courthouse Rear, Harbor Side View

The decision to try terrorist Richard Reid in the Boston courthouse brought security concerns to the forefront. The question of whether the courts could maintain an "open" public facility, while still ensuring the safety and security of the courts was in question. Although security measures, including a large blast plate on the waterfront side, were incorporated into the building design, additional measures were proposed for the Reid trial. "Specifically, a team of architects recommended a series of "bollards" –

steel beams sunk 10 feet into the ground and anchored to a steel crossbeam. They will be encased in granite, creating waist-high domed columns….

More than a year after the Sept. 11 attacks and five weeks before a major terrorism trial opens in Boston, the federal courthouse on Fan Pier is getting its first physical security upgrade, a measure that many court employees and some experts dismiss as little more than cosmetic.

Jackhammers have been rattling the sidewalk in front of what is arguably the most exposed public building in the city to put in place a series of granite-encased steel barriers, strong enough to stop a truck driving 40 miles per hour toward the front door of the building.

What irks some courthouse employees, however, is that the $500,000 beefed-up barrier – at least for the time being- protects only a tiny fraction of the ornate, expensive, and, to appearances, vulnerable building."[25]

Reid recently pled guilty to charges. As a result, there are no ongoing plans to hear terrorism cases in the Boston courthouse.

2.25 Protection Systems

"Building owners and developers, led by the U.S. government, are taking a closer look at incorporating measures to alleviate the effects of a terrorist attack on their buildings. Military installations for years have been designed to resist conventional weapons or blast attacks, with the single focus toward sustaining the structure for the purpose of maintaining the mission. For commercial buildings, the single most important design consideration is to construct buildings to save lives in the event of a terrorist attack. There is absolutely no concern for saving the structure other than to save the people."[26] This "survivability" line of thinking, which evolved after the events of September 11, 2001, represents a radical departure from previous security and protection strategies which were directed more towards protecting a structure.

The need for comprehensive survivability standards is currently being studied by the Army Corps of Engineers Protective Design Center in Omaha, Nebraska. When completed, the engineering guidelines to protect new and existing buildings against terrorist attacks will also apply to non-military facilities which are considered vulnerable. The Corps guidelines will include recommendations on increased surveillance, electronic measures, restricted access, barriers, etc. Operations improvements, such as coordination

---

[25] Cambanis, Thanasis, "Some Say Posts Wouldn't Bar Courthouse Attack." *Boston Globe*, 9 September 2002, 1. Database on-line. http://www.boston.com/dailyglobe2/273/ Accessed on 1 October, 2002.

[26] Rittenhouse, Tod, *Designing Terrorist Resistant Buildings* (Reprinted by permission from Fire Engineering, Fairlawn, NJ, November 1995). Database on-line. http://www.wai.com/ Accessed on 11 November 2002.

with local law enforcement agencies and employee awareness training will also be discussed in the guide.

For landscape architects the challenge will come in balancing the functional requirements of security components and the desire to create harmonic landscapes. Even design applications using natural landform elements can meet with public criticism when viewed as security enhancements. "For decades, federal buildings like the Federal Reserve have been bulwarked with berms and removed from the street as if the Goths would dash across the moat. The nation's anti-terrorist overkill of barricades and mechanical frisking make the local passport or other federal, state and local offices feel like airports fending off Hollywood's Men in Black."[27]

The American Society of Landscape Architects (ASLA) recognized the importance of this issue when, on October 11, 2001, they convened a meeting with other design professions to propose the development of a Security Design Coalition, using the Nation's Capital as a model. The ASLA took an active role by testifying "on the proposed design for an underground approach for the recently renovated Washington Monument. Designed by the landscape architecture firm Olin Partnership of Philadelphia, the plan calls for walled, sunken walkway and an underground tunnel entrance to replace the jersey barriers that currently circle the monument in a haphazard fashion."[28]

2.26 Siting – Building Setbacks

The Murrah Federal Building in Oklahoma City was a 9 story, reinforced concrete frame structure designed in 1974. On one side of the building, the structural columns were partially exposed and provided a canopy for curbside vehicle access. This side of the building also was glazed with a full height glass curtain wall. The truck carrying 4,800 lbs of ammonium nitrate and fuel oil (ANFO) was parked in the passenger loading zone, 10 feet away from the building. The shock waves from the blast caused the failure of the closest column and floor slabs on the lower levels, which in turn resulted in progressive collapse of the structure and the deaths of 168 people.

---

[27] Holtz Kay, Jane, "The Courthouse as a Bastion Against Terror." (Reprinted from the *New York Times*, 3 January 1999). Database on-line. http://www.janeholtzkay.com/ Accessed on 18 October 2002.

[28] *Argust Testifies on Proposed Security Enhancements for Washington Monument*, American Society of Landscape Architects. Database on-line. http://www.asla.org/ Accessed on 27 February, 2002.

Figure 9, Alfred P. Murrah Federal Building, Oklahoma City North Elevation – prior to bombing

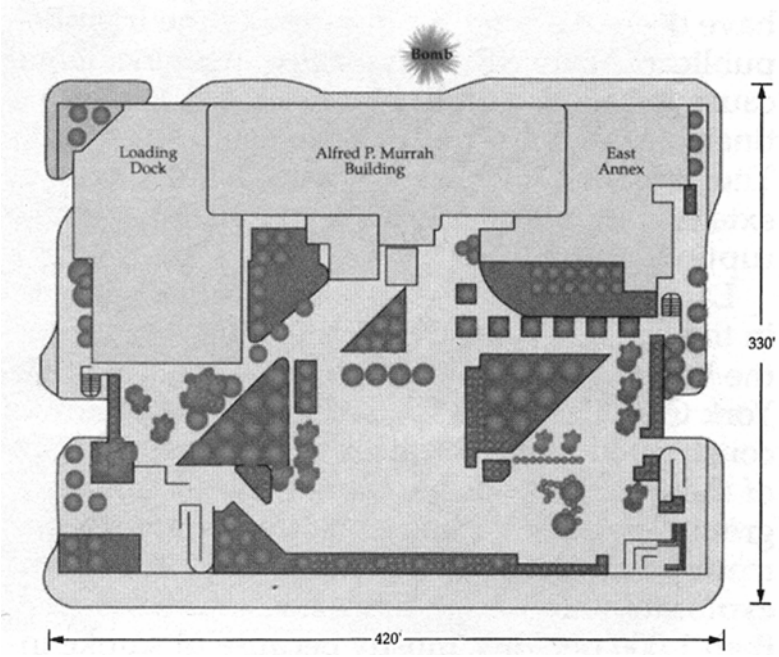


Figure 10, Site Plan - Showing truck bomb location

In August 1998, two terrorists attempted to drive a truck laden with explosives into the basement parking garage of the U.S. Embassy in Nairobi, Kenya. The perimeter security fencing and barrier system stopped the truck and Embassy guards refused to let them enter the compound. The suicide bombers then detonated the explosives in the Embassy parking lot causing 291 deaths and 4,671 injuries. Most of the deaths were Kenyans employed in the adjacent bank buildings.

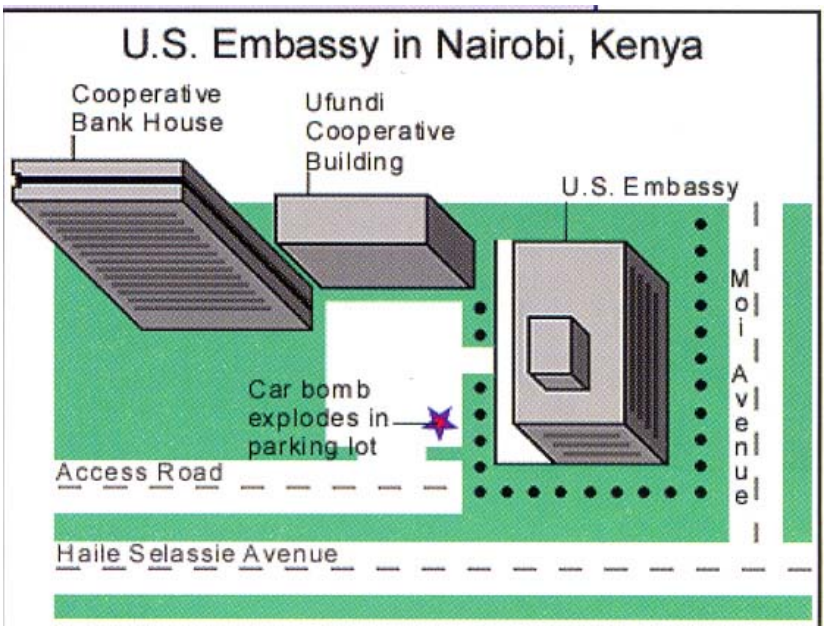


Figure 11, Nairobi Embassy bombing damage

Moments after the bombing of the U.S. Embassy in Kenya, a truck laden with explosives attempted to enter the U.S. Embassy compound in Dar Es Salaam, Tanzania. A water truck blocked its' path and the suicide driver detonated the explosives approximately 35' outside the outer wall. Twelve members of the security staff were killed.

In considering the very real threats posed from vehicle and truck bombs, the General Services Administration is reviewing building setback requirements. "Recommendations under consideration for new or renewed leases include setting sensitive buildings up to 100 feet from streets, securing parking lots or garages and using stronger construction materials and techniques to prevent a catastrophic collapse."[29]

Is 100' a reasonable distance? The Alcohol Tobacco and Firearms (ATF) Vehicle Bomb Explosion Hazard and Evacuation Distance Tables lethal air blast range for a compact sedan bomb are 100' and go up to 600' for a semi tractor trailer. According to

[29] Hsu, Spencer S., "U.S. Aims To Fortify Its Leased Buildings," *Washington Post*, 15 March, 2002, sec. A, p.1, 14.

the Table, the small box van used in the Oklahoma City bombing has a lethal blast range of 300' with falling glass hazard distance of 3,750'.

ATF	VEHICLE DESCRIPTION	MAXIMUM EXPLOSIVES CAPACITY	LETHAL AIR BLAST RANGE	MINIMUM EVACUATION DISTANCE	FALLING GLASS HAZARD
	COMPACT SEDAN	500 Pounds 227 Kilos *(In Trunk)*	100 Feet 30 Meters	1,500 Feet 457 Meters	1,250 Feet 381 Meters
	FULL SIZE SEDAN	1,000 Pounds 455 Kilos *(In Trunk)*	125 Feet 38 Meters	1,750 Feet 534 Meters	1,750 Feet 534 Meters
	PASSENGER VAN OR CARGO VAN	4,000 Pounds 1,818 Kilos	200 Feet 61 Meters	2,750 Feet 838 Meters	2,750 Feet 838 Meters
	SMALL BOX VAN *(14 FT BOX)*	10,000 Pounds 4,545 Kilos	300 Feet 91 Meters	3,750 Feet 1,143 Meters	3,750 Feet 1,143 Meters
	BOX VAN OR WATER/FUEL TRUCK	30,000 Pounds 13,636 Kilos	450 Feet 137 Meters	6,500 Feet 1,982 Meters	6,500 Feet 1,982 Meters
	SEMI-TRAILER	60,000 Pounds 27,273 Kilos	600 Feet 183 Meters	7,000 Feet 2,134 Meters	7,000 Feet 2,134 Meters

Figure 12, ATF Vehicle Bomb Explosion Hazard and Evacuation Tables

With the ATF's test data in mind, most of the temporary security measures, Jersey barriers, planters, bollards, etc., put in place after September 11, would, on their own merits, have little, if any beneficial effects in mitigating the impacts from a vehicle bomb.

However, when used in combination with technologies employed to prevent progressive structural collapse of buildings and to prevent injuries from falling glass, well designed barriers can assist in meeting security plan objectives.

2.27 Bollards

Bollards can be an effective security design tool. The lack of visual mass and the option to retract, make this security component more versatile than permanent wall-type barriers. The retractable bollards are used in many cities to close off entertainment areas to vehicles in the evenings. In the mornings, the bollards are retracted and trash and delivery vehicles are allowed through. This feature is also an important consideration when designing access for emergency response vehicles.

The area in front of the White House on Pennsylvania Avenue in Washington, D.C., is currently undergoing a major security upgrade. "Redesigned barricades would be added at both ends of the two-block stretch, which was sealed without warning by the White House after the 1995 Oklahoma City bombing. A row of retractable, four-foot-high steel posts would be embedded into the pavement and guardhouses would replace hastily deployed chain-link fencing, concrete barriers and police cars….

The National Capital Planning Commission voted unanimously to accept a design from Michael Van Valkenburgh Associates of New York City to convert the six-lane roadway into a pink, granite-paved promenade, lined by trees and an access lane for emergency vehicles and a proposed tourist trolley."[30]

Permanent, or non-retractable bollards are planned for the U.S. Capitol where "a project to replace all the plaza's concrete pipes with eagle-decorated, cast iron posts – known as bollards – is fully funded and slowly proceeding. The bollards are to be in place on three sides of the Capitol by year's end, with the east side not completed until 2005, when a visitor center now under construction is to be finished….Bollards have also emerged as the leading choice at the Lincoln and Jefferson memorials. The Park Service wants to encircle both with Victorian-style bollards similar to the ones placed at Lafayette Square several years ago. Planners say a ring of the three-foot-high posts would be as effective as Jersey barriers in stopping a truck attack. The proposal needs approval from two federal review commissions.

Although there is near-universal impatience to get rid of all the Jersey barriers across the Mall, not everyone agrees that bollards are the answer. Even when they are spaced several feet apart, a row of bollards looks like a solid wall to a person walking by it becoming another blot on the city's open vistas…. A better solution to deter trucks at the Lincoln Memorial might be to raise the curb stone about six inches and angle it sharply, and possibly build a small dry moat behind that."[31]

It seems that many members of the media have opinions on security barriers. But why is it acceptable to design 4' bollards for the area near the White House and 3' bollards for the monuments, is the higher bollard more effective at stopping vehicles, or is this an aesthetic choice given the natural landform of these sites? The media's suggestion to raise curb heights and construct moats is interesting, but on its' own, does it serve any functional purpose?

---

[30] Hsu, Spencer S, "Federal Panel Adopts Design For Pennsylvania Avenue," *Washington Post*, 7 June, 2002, sec. B, p. 1.

[31] Wheeler, Linda, "Ugly Barricades On The Way Out," *Washington Post*, 13 January, 2002, sec. C, p. 1, 9.

2.28 Barriers

The proliferation of Jersey barriers after September 11, 2001, in Washington, D.C., has produced perhaps the most negative feedback of any of the temporary security design solutions. "Some security measures are so out of keeping with their surroundings that members of the American Society of Landscape Architects held a news conference and walking tour in Washington last week to point out the problems they see.

Last fall, the organization assembled a group called the Security Design Coalition to promote the need for better security designs. Its members say the temporary measures taken after Sept. 11 were fully understandable. But they fear that if such barriers become permanent fixtures, Americans could lose their sense of heritage and connection to the environment. They say it is important to balance security measures with the need to maintain a free and open society."[32]

The use of Jersey barriers as a security measure has been unevenly applied throughout the country. Perhaps the fact that these barriers are readily available and easy to rent makes them more a more attractive deterrent. On October 29, 2001, Chicago Tribune architecture critic Blair Kamin's column focused on a new threat emerging in the wake of the September 11 terrorist attacks a danger that "Americans will overreact to the destruction of the twin towers by barricading public spaces that form centers of community and symbolize American openness and optimism….

Walking through downtown Chicago, Kamin observed numerous changes intended to increase security – or the perception of it – but whose main effect was to impede pedestrian access and create "a new architecture of fear." Concrete "Jersey barriers" were protecting three icons of that city's skyline: the Sears Tower, the Aon Center (formerly Amoco Building), and the John Hancock Center; as well as the Chicago Federal Center and its outdoor plaza. Public passageways through private buildings had been closed, and the management of the historic Rookery Building had even closed its lobby to tour groups in the name of security.

Meanwhile, in stark contrast to the scene at the Federal Plaza, people were making merry at the city's Richard J. Daley Center Plaza, enjoying pre-Halloween events and hot cider. "Are Americans being prepared or paranoid?" Kamin asked. In interviewing several city officials and building managers, he found that in many cases, owners of buildings were requesting even more barriers and security measures – in part to soothe the fears of their tenants. What are the costs of such measures – in terms of both finance and freedom?"[33]

---

[32] Gunts, Edward, "When Safety Proves a Barrier to Beauty, Public buildings must be protected, but barricades don't have to be ugly or off-putting," *Baltimore Sun*, 23 June, 2002. Database on-line. http://www.asla.org/ Accessed on 2 July 2002.

[33] *Land of the Sort of Free*, Project for Public Spaces, Inc. Database on-line. http://www.pps.org/ Accessed on 2 April 2002.

Jersey barriers are most commonly used by highway departments to prevent vehicles from crossing highway medians into oncoming traffic. They are also used as temporary barriers to direct traffic around construction zones. "Although it is not clear exactly when or where the first concrete median barriers were used, concrete median barriers were used in the mid-1940s on US-99 on the descent from the Tehachapi Mountains in the central valley south of Bakersfield, California. This first generation of concrete barriers was developed to (a) minimize the number of out-of-control trucks penetrating the barrier, and (b) eliminate the need for costly and dangerous median barrier maintenance in high-accident locations with arrow medians – concerns that are as valid today as they were 50 years ago."[34]

There are various types of Jersey barriers. Each barrier has a slightly different base angle which is designed to deflect vehicles. The most common barrier in use today is the "S" barrier which is most effective in deflecting compacts, sedans and small trucks. The "F" style barrier is most effective in deflecting large trucks. "When a single unit truck, such as a Ryder or U-Haul rental truck, hits a concrete barrier in a crash test, it rolls toward the barrier until the underside of the truck bed comes to rest on top of the barrier. This stops the roll motion. Then, the vehicle slides along the top of the barrier until it is redirected upright. For this to occur, the concrete barrier must have a minimum height of 815 mm (32 in). To contain and redirect an "18-wheeler" or tractor-trailer in a crash test, a concrete barrier must have a minimum height of 1070 mm (42 in)….To contain and redirect a 36,000-kg gasoline tanker after impacts at high angles and speeds, a 2290-mm (90 in) concrete barrier is required."[35]

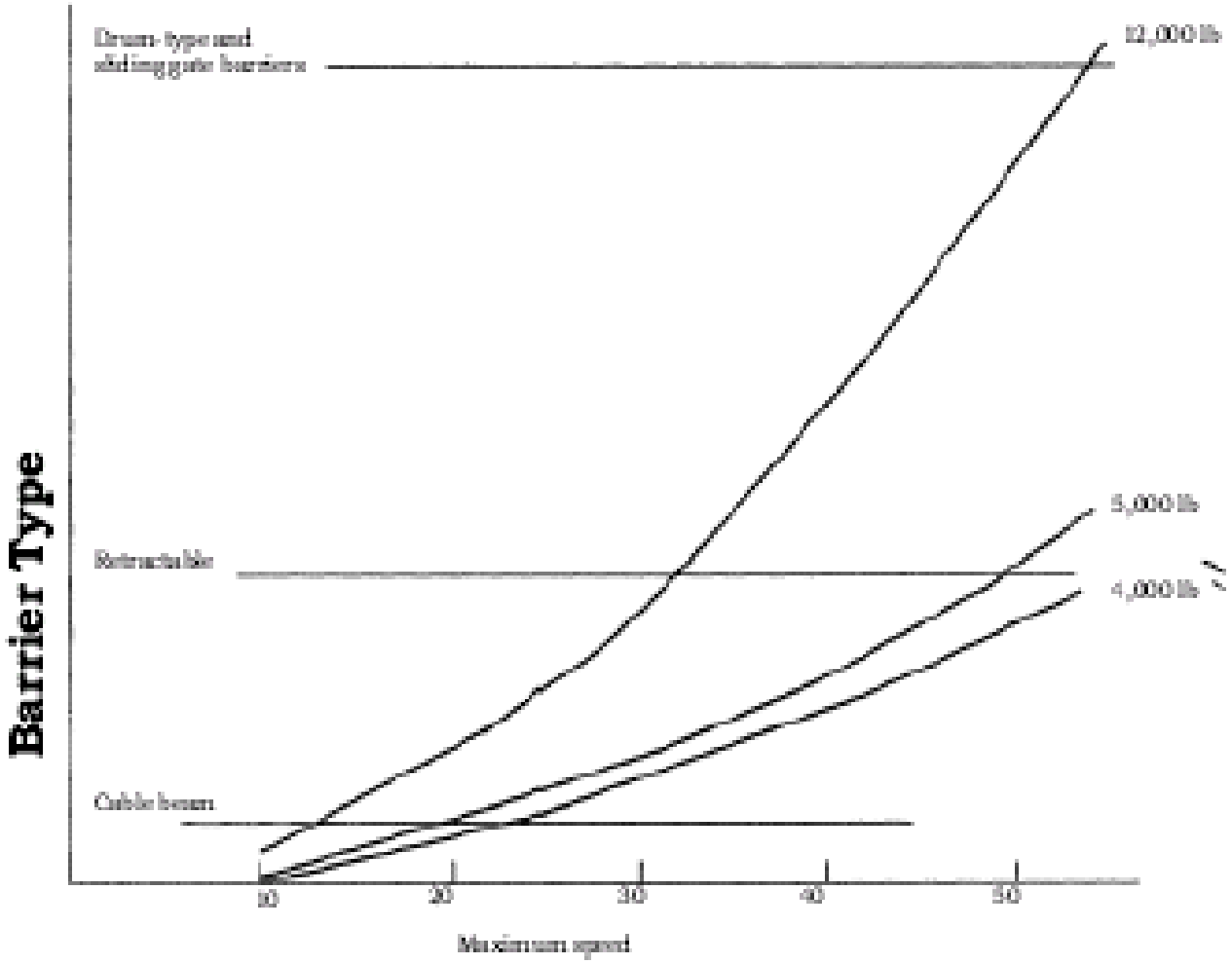
Landscape Architects are attempting to design public space perimeters to have the same performance results as these barriers, but with different aesthetics. As in the case of the new proposal for the Washington Monument, "the concrete barriers, installed to prevent vehicles with explosives from getting close to the monument, will be replaced in Olin's design by a ring of pathways and low stone walls located an average of 400 feet from the memorial. At crucial points these walls will be hidden from a distant view by gentle rises in the earth, a time-honored device used to hide fences in English romantic landscapes….Olin's walls do the same thing as the Jersey barriers – stop vehicles – but do it attractively. Overall, the graceful system of pathways, low walls and more than 300 carefully located new trees will improve the setting without significantly altering its open, field like character."[36]

---

[34] *NCHRP Synthesis 244, Guardrail and Median Barrier Crashworthiness*, Transportation Research Board, National Research Council, Chapter 5, 1997, in Kozel, Scott M., *Roads to the Future*, Pennways, 2000. Database on-line. http://www.roadstothefuture.com/ Accessed on 4 February 2002.

[35] McDevitt, Charles F., *Basics of Concrete Barriers*, Turner-Fairbank Highway Research Center, McLean, VA. Database on-line. http://www.tfhrc.gov/ Accessed on 4 February 2002.

[36] Forgey, Benjamin, "Washington's Tunnel Vision for Tourists," *Washington Post*, 18 May, 2002, sec. C. p. 1, 5.



Active vehicle barriers capabilities.

Figure 13, Military FM5-114 Test Data

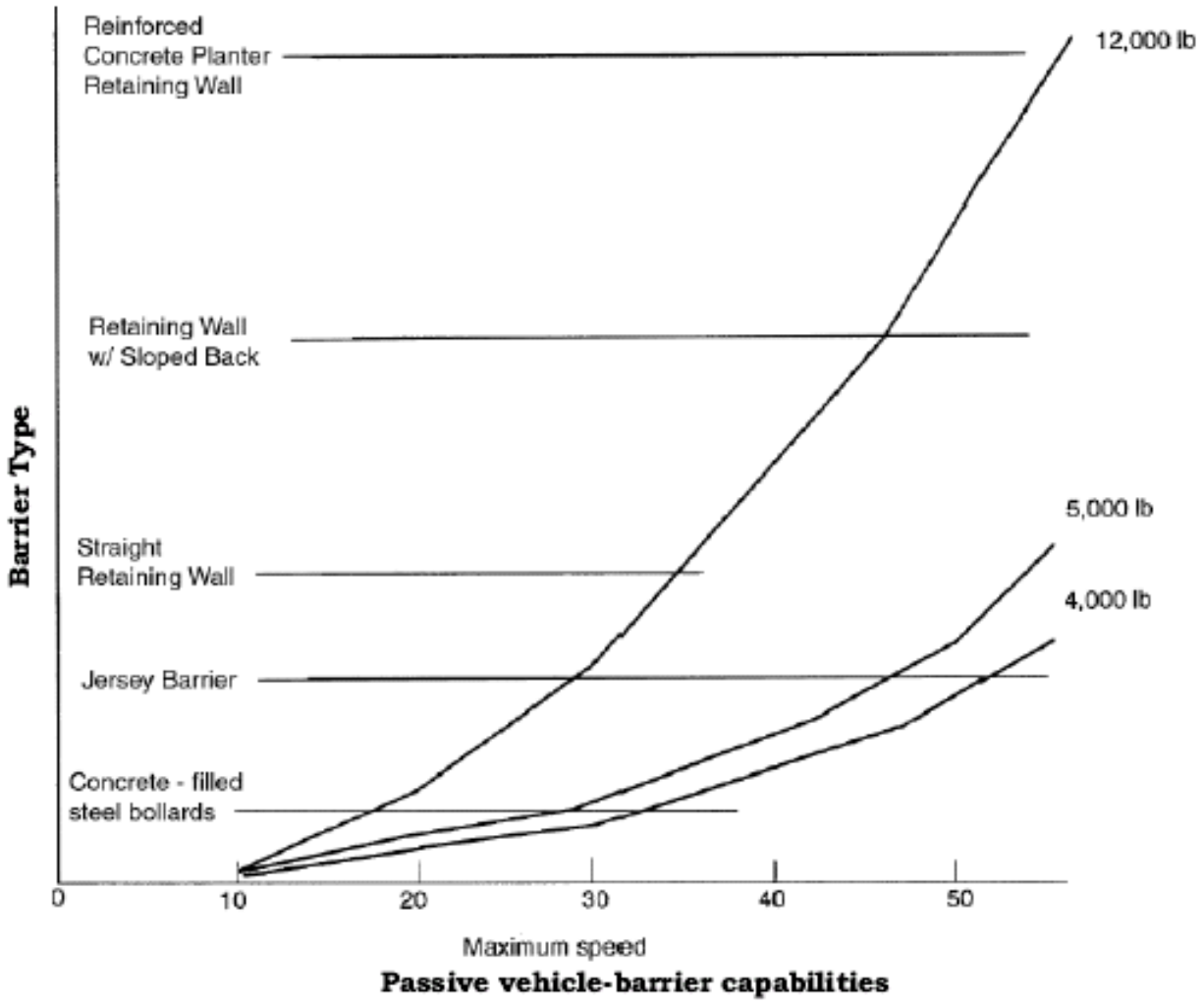


Figure 14, Military FM5-114 Test Data

2.29 Planters

Planters can provide maximum force protection at minimum expense. The lighter weight, glass fiber reinforced planters (cement mortar with strands of embedded glass fiber), or polymer planters filled with earth have been successfully tested to stop 15,000 lb vehicles at speeds up to 50 mph. Planters used as vehicle barriers are effective at 41" in height x 48" in depth. They can be custom designed, designed to encase existing Jersey barriers, or form double retaining walls filled with earth and plantings.

Earth (used in planters, or behind retaining walls) and water (used as pools or fountains contained by concrete walls) are very effective deterrents in stopping vehicles. There are many temporary traffic barricade systems available which use water ballast to control vehicles. These systems are light weight, portable and stackable. Additional design solutions such as "hardened" street furniture-landscaped planting walls, security bollards, or barriers, embedded within rows of hedges could improve rather than detract from the streetscape.

Figure 15, Planter Box

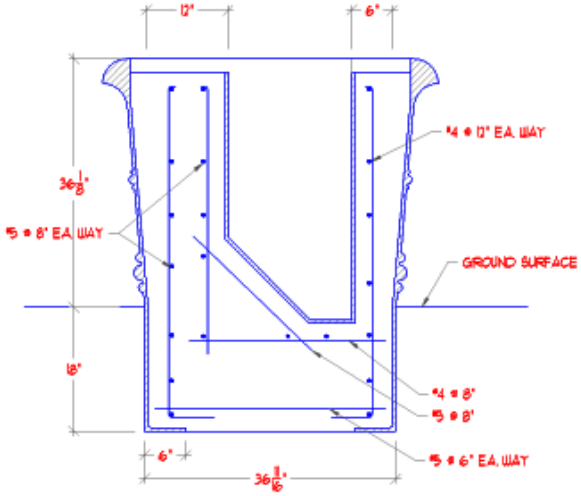
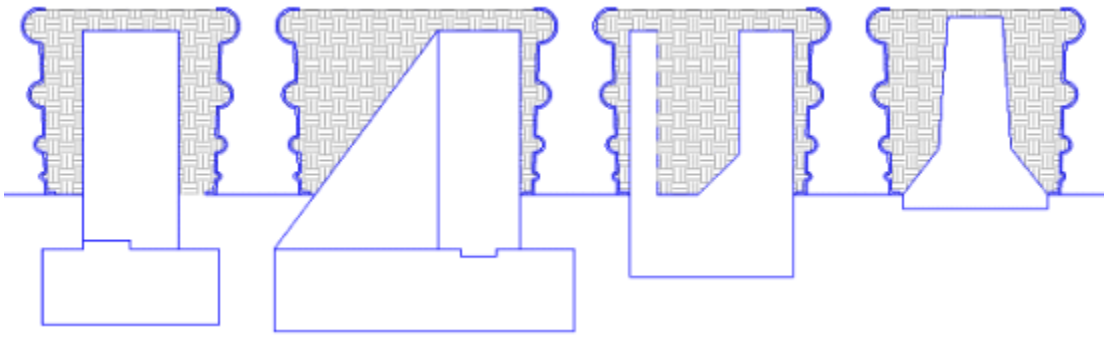


Figure 16, Planter Box Cross Section
Designed to State Department Standards

The most effective planters are designed with a 6" vertical wall facing traffic, a rear base which is slanted up to meet a 12" vertical wall. The walls are separated by a minimum of 18" of soil. This type of planter/barrier" will stop a 15,000 lb vehicle traveling at a maximum speed of 50 mph.



Stopped 15,000 lb Vehicle @ 30 mph	Stopped 15,000 lb vehicle @ 40 mph	Stopped 15,000 lb vehicle @ 50 mph	Stopped 4,000 lb vehicle @ 50 mph

Figure 17, Comparison of Barrier Types Tested By the Army Corps of Engineers

Employing combinations of traditional street furniture, planters, light fixtures, etc., or repositioning existing streetscape elements can improve security and also improve the use of the space. In Chicago, reporter, "Karin complimented the city for its approach at Daley Plaza, which included subtle changes like moving granite benches to the perimeter of the plaza, and employing metal planters as attractive fortification. He also recalled a tried-and-true phenomenon of public space: people tend to draw more people, and that, in turn, makes everyone feel safer. Pointing to Daley Plaza, Kamin noted, Here is one way to balance security and openness and to keep those competing interests -- and our fears – in proper perspective."[37]

Figure 18, Glass Fiber Reinforced Planter Wall

Concrete security planters can be designed to be attractive as well as have the ability to stop a 15,000 vehicle.

The Army Corps of Engineers also tested planters and retaining walls in terms of stopping strength.

	Retaining Wall Type		
	Straight	Sloped Back	Planter Design
Tested Stopping Strength	15,000 lb @ 30 mph	15,000 lb @ 40 mph	15,000 lb @ 50 mph
Depth Below Ground	49.5"	30"	18"
Wall Thickness	21"	18"-54"	12"-18", Dirt – 6"
Rebar Size at Impact Area	#7 @ 5"	#7 @ 6"	#5 @ 8"

Figure 19, Retaining Wall Stopping Strengths

[37] *Land of the Sort of Free*, Project for Public Spaces, Inc. Database on-line. http://www.pps.org/ Accessed on 2 April 2002.

2.30 Berms/Grade Changes

As indicated above, earth provides an excellent means for controlling traffic and, depending on the circumstances can also mitigate the effects of bomb blasts. Berms can be used to control pedestrian and vehicular traffic flow while also providing a base for plantings. This natural landscape element can be both functional in terms of enhancing security and aesthetic, and its' importance has been noted by the Washington press. "Perhaps 2002 will be the year when closed streets reopen, when digging up pavement to lay cable will be a thing of the past and when civic edifices and landscapes will look less besieged.

This could be the year when more attractive elements – trees, trellises, pergolas, bollards, low walls or berms, depressed walkways, water features, decorative fencing, benches, or kiosks – might begin appearing around buildings and monuments, not only to provide needed security, but also to provided visual and functional amenity."[38]

Figure 20, Concrete Berms at Phillip Burton Federal Building and U.S. Courthouse, San Francisco, California

[38] Lewis, Roger K., "Shaping the City, A Resolution To Banish Jersey Barriers," Washington Post, 29 January, 2002, sec. H, p. 1, 3.

Figure 21, Berms as Vehicle Barriers, Phillip Burton Federal Building and U.S. Courthouse, San Francisco, California

2.31 Blast Walls

When I initially undertook this topic, I had assumed that vehicle barriers could be designed to absorb the impact from vehicle bomb blasts, or that barriers could be placed far enough away from a structure to minimize damage. Both of these assumptions are correct, however, the practical and visual results of this would be that all new planning for vulnerable facilities would be in campus-like, controlled settings. Existing buildings, in urban environments would be surrounded by 18' high, 4' wide blast walls, located as close to the edge of the pavement as possible. The Israelis have in fact constructed 18' high combination vehicle barrier blast walls around vulnerable buildings and 30' high blast walls around fuel storage tanks. It would be as if every office building were surrounded by a highway noise wall.

The visual impact of high walls in the natural landscape have evoked negative reaction all over the country, but Californians have been quite vocal on this issue. "CalTrans can essentially erect sound walls how and where they please. And have they ever. The result of this missionary zeal is that, here in the most beautiful state in the nation, vast stretches of once-panoramic roadway are pointlessly hemmed in on both sides by monstrous barriers, whose complete visual boredom is only feebly relieved by the occasional use of colored or patterned block.

For hapless commuters, humane vistas of trees, countryside and -- God forbid! – even messy backyards, are all a thing of the past. Instead, we're treated to mile after mile

of 12-foot-high block walls that serve mainly to give delighted graffiti artists a near-infinite canvas."[39]

When viewing this issue from a survivability standpoint, that is ensuring that building occupants can be safely evacuated if an undesirable event occurs, then we would be considering measures which would prevent the structure from collapsing during an emergency. "Often, buildings thought to be vulnerable to terrorist attack are in urban areas where only the exterior wall of the building stands between the outside world and the facility. Here the options are limited. Often the perimeter line can be pushed out to the edge of the sidewalk by means of bollards, planters and other obstacles. To push this line even further outward, restricting parking along the curb may be arranged with the local authorities. Sometimes street closings could be an option. In other cases, one could consider the use of structurally composite blast-resistant and energy absorbing panels to enhance and protect the exterior walls….

Off-site parking is recommended for facilities vulnerable to terrorist attack. Though on-site parking is not recommended, imposing such a restriction is often impractical. If on-site or underground parking is used, then one should take precautions to limit access to these areas to only the building occupants and/or have all vehicles inspected. Place parking as far as practical from the building. If an underground area is used, one should consider a space next to the building rather than directly underneath the building itself. Another measure is to limit the size of vehicles that can enter. This can be done by imposing a height or weight limitation.

Barrier walls designed to resist the effects of an explosion can, sometimes, act to reduce the pressure levels acting on the exterior walls. However, they may not enhance security because they prohibit observation of activities that are occurring on the other side of the wall. Here, an anti-ram knee wall with a fence may be an effective solution."[40]

---

[39] Gellner, Arrol, "An unsound idea Freeway sound walls make for a bleak commute, unfriendly landscape." *San Francisco Chronicle*, 24 April, 2002. Database on-line. http://sfgate.com/cgi-bin/article.cgi?f=/c/a/2002/04/24/HO239831.DTL. Accessed on 3 June, 2002.

[40] Task Committee: Edward L. Conrath, Ted Krauthammer, Kirk A. Marchand, and Paul F. Mlakar, *Structural Design for Physical Security: State of the Practice*, American Society of Civil Engineers, Reston, VA, 1999, 3-9,10.

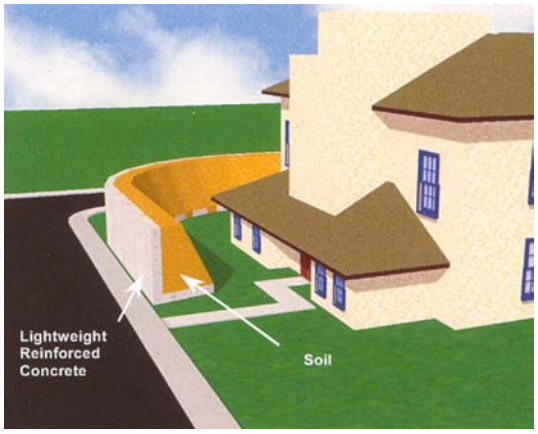


Figure 22, Single Sided Soil Barrier

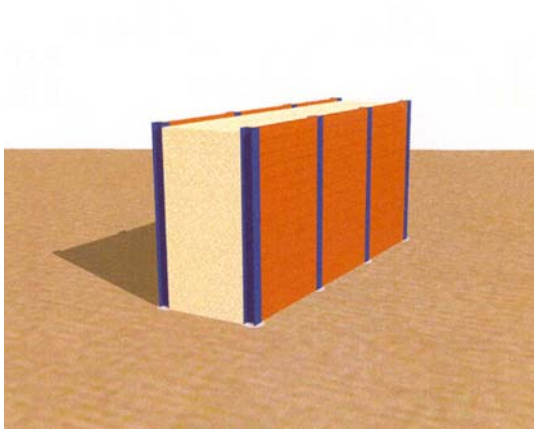


Figure 23, Two Sided Soil Barrier

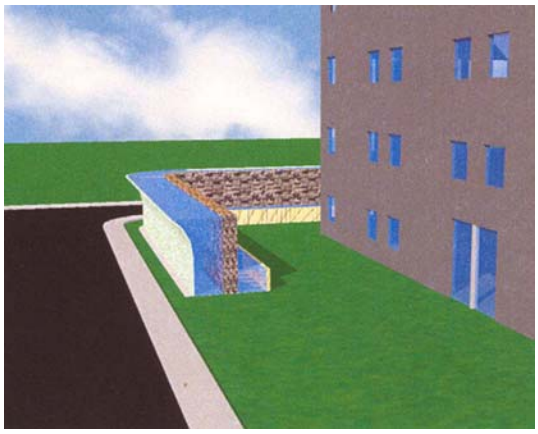


Figure 24, Combination Barrier, Composed of a Wall of Water and a Reinforced Concrete Wall


Figure 25, Fabric Blast Shield

The figures above were developed and tested as air blast barrier designs. Using soil or water as integral components of the barrier design can allow the landscape architect to use the barrier feature as a green wall, with plantings and water can be incorporated into an interesting fountain, or series of pools. Both of these elements supplement the stopping capacity of barriers, retaining walls and bollards.

2.32 Blast Mitigation Elements

To design an effective system to mitigate blast effects, it is important to understand the various types of attacks which could occur against a facility. The ATF Vehicle Explosion Hazard and Evacuation Distance Tables is an excellent tool, but there are other methods besides vehicle bombs available to adversaries.

- "An exterior mode of attack involves the throwing or placing of explosive charges near a facility. The objective of such an attack is generally the destruction of the facility or death of nearby target persons. Explosive weights are limited to what can be carried by the aggressor(s).

- The vehicle mode of attack can use either a moving or stationary car or truck filled with explosives. With the moving attack, the aggressor drives a vehicle into a facility and detonates the explosive. The goal is to destroy the facility and to kill personnel within the blast area; the death of the driver is generally assumed.

- With a stationary attack, an aggressor parks a vehicle carrying high explosives near the facility. Since the explosives are then detonated remotely or by a timing device, the vehicle driver can escape. Explosive weights are sometimes limited to what can be concealed on the vehicle since the time between parking and detonation may be substantial; weights of up to a few hundred pounds may be possible. Three methods can be used to place a stationary bomb.

    - The first method is to abandon the vehicle at the pre-selected location.
    - The second method is to place the explosives in an innocent individual's vehicle who unknowingly delivers the bomb to the target.
    - The third method is to coerce an innocent individual to deliver the vehicle bomb.

The blast from a vehicle bomb will produce high, relatively uniform pressures and impulses over a large area of adjacent structures. This loading can result in collapse of nearby structures and in the progressive collapse of some types of building construction. Such a detonation will produce extensive glass breakage. A confined explosion, such as one in a parking garage, or basement, can result in catastrophic collapse of the structure through the effects of the direct blast loading and of the quasi-static pressure developed in closed space.

- Rocket propelled attack: The most likely-to-be-encountered rocket-propelled anti-tank weapon is the RPG-7 (rocket-propelled grenade) weapon system. This system consists of a shoulder-fired grenade launcher with optical sight, an anti-tank grenade, and a propelling charge....The accuracy of the system is fairly good to distances of 200 m. The warhead is capable of perforating up to 10 in of steel armor plate ….or 6 in reinforced concrete slab….

- Forced entry attack: The intent of a protective facility for forced-entry resistance is typically to delay the attacker's entry until protection personnel can respond. …….The objective of a forced-entry attack is assumed to be the production of a man-passable opening in the protective covering of the facility. A man-passable opening is defined as a minimum area required for an intruder to physically pass through a barrier and enter a secure area. (NAFAC 1982). This opening is generally quantified as 96 sq in."[41]

[41] Task Committee: Edward L. Conrath, Ted Krauthammer, Kirk A. Marchand, and Paul F. Mlakar, *Structural Design for Physical Security: State of the Practice*, American Society of Civil Engineers, Reston, VA, 1999, 2-25.

All of these blast/attack scenarios were taken into account when plans were developed to improve security at the Pentagon. The Pentagon was originally designed as a series of concentric walls which were beneficial in reducing the loss of life during the September 11 attack. Prior to the attack, the Army Corps of Engineers developed, researched, and recommended design improvements, including reinforced walls, columns, and blast resistant windows, which are credited with reducing the loss of life. "The plane struck the building at the intersection of two segments, or "wedges." Steel reinforcement of the outer wall, which was necessary to install the heavy safety windows, helped keep the structure from collapsing quickly and is credited with giving numerous people the opportunity to escape. The windows were only one aspect of the force protection measures installed in the first wedge of the Pentagon. Material similar to Kevlar lined the inner part of the outside wall, protecting occupants from flying masonry fragments. Structural reinforcement was also added. Even the second wedge performed well. Engineers marveled that areas that had lost several support pillars were still standing."[42]

Figure 26, Pentagon Plan View
Impact Area Top Right, 9/12/01

Rescue helicopter responded to attack near Washington, DC on September 11, 2001, after hijacked American Airlines Flight 77 crashed into the Pentagon, killing 189 persons, including all aboard the aircraft.

Figure 27 Pentagon, 9/11/01

2.32 Elimination of Progressive Failure

Various design considerations can contribute to successful mitigation of progressive failure from bomb blasts. "The shape of a building can affect the overall damage to the structure. Air blast may be thought of as a wave that washes over and around a building, like a wave at the seashore washing over a box. As an example of the effect shape can have on response, "U-" or "L-shaped" buildings may trap the wave, which may exacerbate the effect of the air blast. Therefore, it is recommended that

[42] ASLA Attends Briefing on WTC and Pentagon Recovery Efforts, American Society of Landscape Architects, 12 October, 2001. Database on-line. http://www.asla.org/ Accessed on 3 December 2001.

reentrant corners be avoided."[43] This is an important consideration when designing a site plan for a vulnerable facility.

Carbon/Kevlar/glass reinforced polymer fabrics can be used to wrap and reinforce columns against bomb blasts. This type of application allows support columns to flex – not shear during a blast. Also the application of these types of fabrics on exterior building walls and on interior walls in parking structures can prevent progressive collapse. These fabric applications, thus the elimination of progressive collapse, would allow landscape architects to focus perimeter security design considerations for exterior spaces spanning 35 – 100'.

Figure 28, Column Blast Tests

In addition to polymer fabrics, coatings can be effective in stopping progressive failure. The military tested Line-X Blast Mitigation PAXCON coating at the Force Protection equipment Demonstration on May 9-11, 2001, at the Quantico Marine Base in Virginia. "A 1/8th" coating of PAXCON was applied to one of two 9' x 9' panels. The panels were representative of typical walls in mobile military buildings. They were constructed of 2'x4' studs, 16" on center, corrugated aluminum siding, and particle board paneling.

A 50 lb TNT charge was detonated 35' from the panels. The uncoated wall was destroyed, while the coated wall remained unharmed. A 50 lb bomb could typically

[43] Task Committee: Edward L. Conrath, Ted Krauthammer, Kirk A. Marchand, and Paul F. Mlakar, *Structural Design for Physical Security: State of the Practice*, American Society of Civil Engineers, Reston, VA, 1999, 3-10.

represent a briefcase bomb. During earlier tests, the manufacturer found it took at least 1,000 lbs of TNT to cause the coating to tear, fragmentation was still averted. A 1,000 lb charge is representative of a full size sedan car bomb. The Air Force Research Lab determined that an 1/8th" coating, applied front and back, reduces the stand off distance by over 50%."[44] The use of polymer fabrics and coatings in structural columns, exterior walls and parking structures would allow more flexibility in determining setback areas.

When retrofitting a structure for blast mitigation, the following applications should be considered:

- High Risk Area: apply sheet metal bonded to rigid polyurethane (apply on surface away from the event)
- Medium Risk Areas: apply Kevlar laminate to back of masonry wall (apply on surface away from the event)
- Low Risk Area: apply polyurethane spray (apply on surface away from the event)

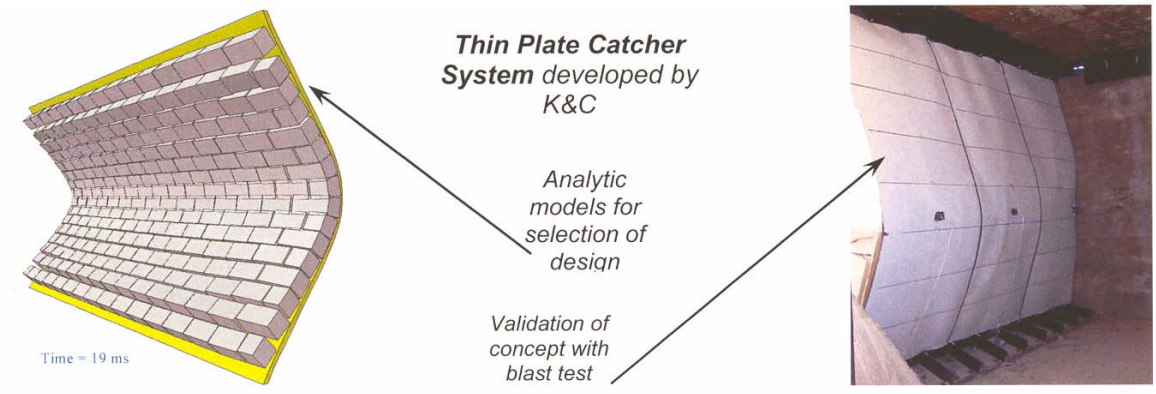


Figure 29, Interior Wall Retrofit

2.33 Glazing Hazards

Glass is highly vulnerable to bomb blasts because it breaks at low pressures and creates shards hazardous to people inside and outside the target building. "To limit this danger, several approaches can be taken. One way is to limit the number and size of windows. This will limit the number of lethal shards created. Also, smaller windows will generally break at higher pressures than larger windows, making them less prone to breakage. ….the number of windows on lower floors, where the pressures are expected to be higher due to an external explosive threat, can be limited.

[44] LINE-X, *Air Force Approves LINE-X for Bomb Blast Mitigation*. Database on-line. Available from http://www.line-xicd.com/ Accessed on 11 November 2002.

Two measures that may be considered for the retrofit of existing windows include polyester film coating on the inside face of a window and blast curtains to hold the shards together if the window breaks….

Materials not acceptable for windows used for blast protection include annealed, thermally strengthened, and wire-reinforced glass and acrylic, unless these materials are used on the threat side of a composite system. These materials all have highly variable, relatively low strengths and fracture into sharp, irregular shards. They may be used for environmental protection of polycarbonate and as a "spall shield" on the protected side of composite FE/BR windows. …(protection from forced entry/ballistic resistant)"[45]

The U.S. Courts Design guide recommends the use of bullet resistant glazing on the lower floors of courthouses. This type of glazing is effective for a limited ballistic attack, however, if ballistic glazing is intended for blast mitigation, the window frames must be designed to prevent the glazing from flying out of the frame. This can be accomplished by designing vertical, or horizontal bars which will prevent glazing from injuring building occupants. "Bullet-resistant windows work on the principle of using multiple layers of glass and plastic bonded together to blunt, slow down, and catch a projectile. Forced entry is accomplished by presenting a tough but flexible barrier that requires time, energy, and special tools to defeat. A layer of sacrificial glass used on the attack side will fracture into large pieces that remain bonded to the durable polycarbonate plane. Multiple layers of this sandwich system create a secure barrier that is capable of resisting multiple ballistic rounds or prolonged physical attack."[46]

Ballistic glazing is rated in terms of a specific weapon, projectile caliber, impact velocity, and the number of times the projectile strikes the target. For example, if a specific weapon hits once, or twice, the glazing may remain intact. However if the glazing is struck multiple times it will fail. The objective is to give the target sufficient time to escape.

2.35 Fire/Rescue

For landscape architects, the ability design a secure access to a building, or site complex, is challenged by the conflicting requirement to provide emergency access for fire/rescue vehicles. Access to fire hydrants and sufficient space to conduct emergency evacuations is a key element is designing sustainable structures. As discussed previously, new fire codes, which would eliminate phased evacuations, would require clear, safe evacuation routes to protected exterior space.

---

[45] Task Committee: Edward L. Conrath, Ted Krauthammer, Kirk A. Marchand, and Paul F. Mlakar, *Structural Design for Physical Security: State of the Practice*, American Society of Civil Engineers, Reston, VA, 1999, 5-4.

[46] Conrath, , 5-2.

2.36 Protected Space

The building codes in Israel include provisions to harden egress and rescue areas. For example, in apartment buildings, every third bedroom is a "safe room", or "protected space," where, in the event of a bomb attack, victims can wait for rescuers. In this study, protected space is an exterior space (park, playground, etc.) where evacuees can be safe from bodily harm caused by debris, flying glass shards, etc.

2.37 Utilities Protection/Redundancy

"Emergency functions and elevator shafts are to be placed away from internal parking areas and loading docks. Elevator shafts can become chimneys in the event of an explosion, transmitting smoke and heat from the explosion to all levels of the building. Emergency functions, such as sprinkler systems, and generators are critical for mitigating the effects of an explosion and need to be placed away from vulnerable areas of the building such a underground parking areas. Furthermore, system redundancy, and the separation between different types of utilities and systems could be wiped out if they are placed in one location (e.g., a utility room). It is recommended to distribute, separate, and protect such systems so that, in case of incident, emergency services would be functional. The attention to such systems must not be limited only to inside the building. Often it is possible to disrupt utilities (water, power, communications, ventilation, etc.) by damaging sites that are located outside the building (e.g., hookup vaults, exhaust or intake shafts)."[47]

2.38 HVAC Protection/Redundancy

The potential for CBR (chemical, biological and radiation) attacks are important in today's environment. The anthrax attacks on U.S. Postal facilities and Capitol Hill made it quite apparent how vulnerable the United States is to these types of attacks. An important design consideration is to monitor activity and deny access to all HVAC systems. In addition, designing separate HVAC systems for vulnerable areas, such as the building entry and screening area, the loading dock-delivery area and the parking structure, should prevent any bio-chem agents from entering the primary HVAC system.

Hospitals currently use HEPA/HEGA filtration systems in operating rooms to prevent infectious diseases from spreading throughout the building. These filtration systems reduce air flows by 15%-20%. Military research and development labs are studying the possibility of using post ultra violet light in HVAC systems to destroy bio-chem agents.

---

[47] Task Committee: Edward L. Conrath, Ted Krauthammer, Kirk A. Marchand, and Paul F. Mlakar, *Structural Design for Physical Security: State of the Practice*, American Society of Civil Engineers, Reston, VA, 1999, 3-13.

Chapter III

3. Results

3.1 Future Site Planning Considerations – New Construction

New planning and construction should undergo site vulnerability and threat assessments to determine the level and type of security needed to ensure sustainability if an undesired event occurs. In high to moderate threat environments the use of "U" and "L" shaped building envelopes should be discouraged. Planning site access is a critical design element.

Elements which pose the highest risk to the main structure should be designed as separate structures. For example, to prevent the risk of damage from car, truck, mail, or package bombs, garages and delivery areas should pulled away from the main structure, with blast plates providing additional protection. Employees, visitors and deliveries, in a high to moderate risk facility, should be screened prior to entering the main structure.

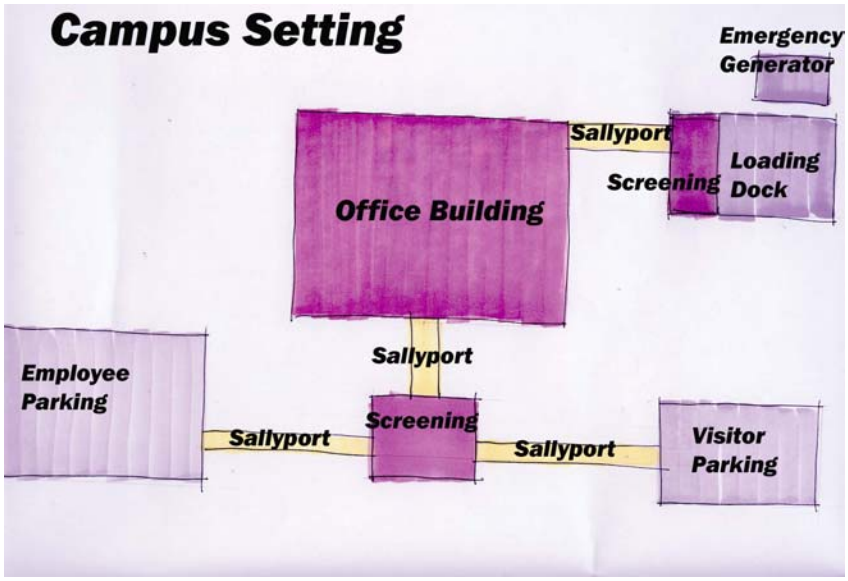


Figure 30, Campus Setting

3.2 Entry/Egress

- The entrance should be pulled away from the main building. This would allow passage through an additional sallyport prior to entering the main structure.
- Employee and visitor screening should be contained in the entrance
- Package and mail screening should be contained in the delivery area.
- The entrance, delivery area, and parking garages should have separate HVAC systems, separate from the main structure. This would minimize the risk from introducing a bio-chem agent into the facility.
- A blast wall/plate should protect the main structure from the entrance, the garages and the delivery area.

- A sallyport/corridor should be constructed between the screening area and the main building to act as a containment area in the event of an unwanted activity.
- Careful consideration should be given to the design and size of areas adjacent to emergency exits.
- Prepare "safe zones" away from potential hazardous situations. "Safe zones" should be located in parks, or open space, away from the possibility injury from hazardous debris. Secondary "safe zones" should be also identified. Employees should be routinely reminded of the zone locations.

Figure 31, "Safe Evacuation Zones"

- Prepare site plan that will accommodate emergency vehicles. Emergency vehicles should have unobstructed access to the site and main building. Advance planning with fire and rescue officials should identify barrier and bollard limitations. Where possible, use retractable bollards and surface road barriers which can be operated manually in the event of power failure.

3.3 Parking

- Locate parking garages away from the main building. After the 1993 truck bombing of the World Trade Center, engineers and security planners advocated the elimination of parking garages and delivery areas from underneath the primary structure.
- Separate employee and visitor parking. In high and moderate level secure facilities, visitor vehicles will require thorough screening.

- If employee parking is located under the main building, install access via a vehicle sallyport. The sallyport entrance will be cardkey controlled. Once an employee has swiped their card, the garage door will open and allow the vehicle into the sallyport. A second card reader and visual identification may be required to open the interior garage door.

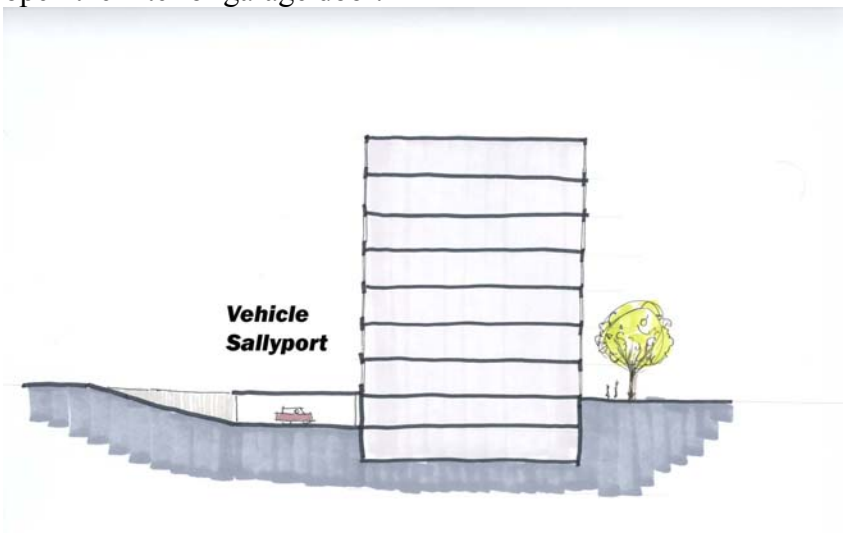


Figure 32, Vehicle Sallyport

- In high threat environments, install polymer fabric on interior garage walls – this will prevent the progressive collapse if a car bomb is detonated.
- Parking garages requiring HVAC should have a separate system away from the main building.
- Install blast wall/plate between parking garage and main building.

3.4 Loading, Delivery Areas

- Locate delivery and trash pickup areas away from the main building
- Provide separate HVAC systems
- Install blast wall/plate between delivery area and main building
- In high threat environments provide areas for bomb dogs and their handlers. Sufficient park- like space should be designed to allow bomb dogs to rest every two hours.
- Provide sufficient space for screening equipment. Screening equipment may include x-ray machines, bomb detection equipment, etc.
- Establish ID checks for delivery drivers/trash pickup.
- High security facilities may require sufficient space for large document shredders.

Figure 33, Bomb Sniffing Dog, Pentagon Loading Docks

3.5 Utility Systems

- Design access controls and monitoring systems for critical utilities such as electric, gas, fuel storage, communications and data systems, water systems and ventilation systems.

Although campus-type sites with large setbacks are a better security risk, in the urban environment that type of setting is not always possible. "Officials point to the recently completed U.S. mission to the United Nations in New York, planned before September, as one of the most secure federal facilities ever built in a city. The mission has hardened exterior walls, large windows restricted to high above street level and other measures that render it safe even though it is less than 50 feet from the street. Similarly secure buildings are being constructed from Brooklyn to Los Angeles to Seattle, where a federal building uses a water pool as a moat."[48]

3.6 Set Backs

ATF is planning to start construction of a new headquarters building in Washington, D.C., in the spring of 2003. The building is designed with a large curving three-story garden wall that also serves as a defensive ring. The two streets behind the building will be partially closed off to traffic, allowing the headquarters to meet a 100' setback buffer.

[48] Hsu, Spencer S.,"U.S. Aims To Fortify Its Leased Buildings," *Washington Post*, 15 March, 2002, sec. A, p. 14.

Figure 34, Proposal for ATF Headquarters, Washington, D.C.

The ATF has found a creative solution to a difficult security set back problem, however, other federal agencies in Washington are not so innovative. "In December, the Federal Emergency Management Agency surprised GSA and Washington officials by canceling plans to move its national headquarters and 1,000 workers to the million-square-foot Potomac Center redevelopment near Washington's waterfront, backing out of a 10-year, $100 million lease after citing unspecified security concerns.

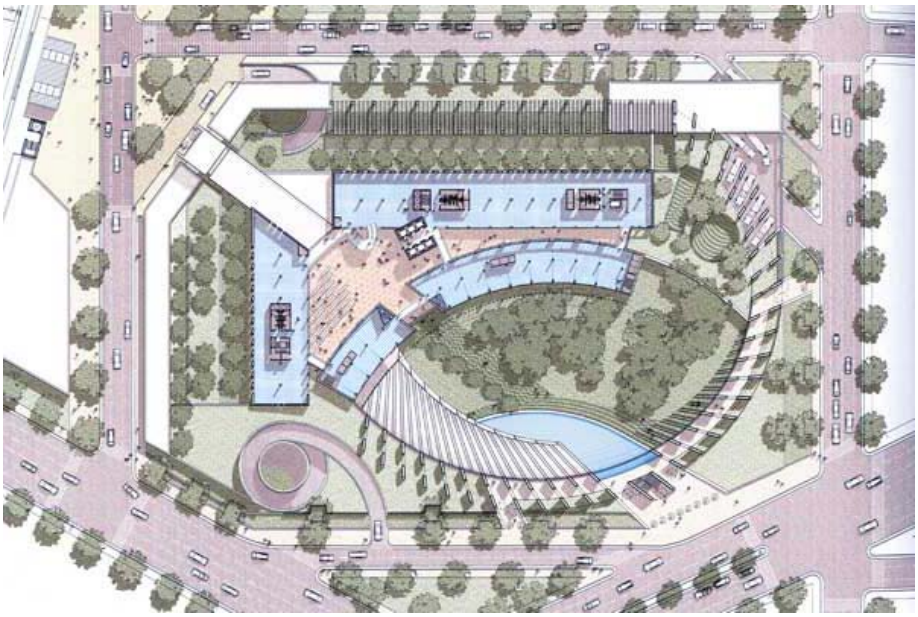


Figure 35,Proposed Site Plan for New ATF Headquarters, Washington, D.C.

Members of Congress quietly grumbled at the FEMA decision, which, they say is an overreaction. People close to the project say the agency demanded that the building be set back 100 feet from the street, strictly interpreting a safeguard that could make major federal offices unsuitable in downtowns…. Law enforcement agencies concluded that the building was exposed because it was close to the street, an off-ramp of Interstate 395 and the Potomac River, a flight corridor for Reagan National Airport."[49]

Figure 36, U.S. Courthouse Proposal, Springfield, MA

Figure 37, U.S. Courthouse Proposal, Springfield, MA

[49] Hsu, sec. A, p. 14.

The proposal for the new U.S. Courthouse in Springfield, Massachusetts, was designed by Moshe Safdie Associates, the same architectural firm that designed the ATF Headquarters.
Similar security features are incorporated into the courthouse design. A large multi-storied sculptural wall separates the main courthouse building from the street. The combination of grade elevation changes and the sculptural wall provide effective security setbacks from vehicular attacks.

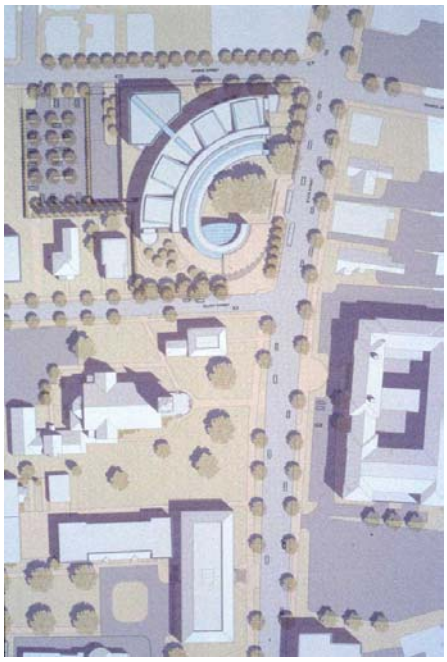


Figure 38, Proposed Site Plan U.S. Courthouse, Springfield, Massachusetts

3.7 Campus Type Siting

A campus-type location is ideal for planning adequate building setbacks, constructing perimeter security systems, and controlling vehicular and pedestrian access. The U.S. Department of State is concerned about security abroad. "Security and infrastructure matters are central to our business. No more embassies are being built on main streets. They will be out and away from built-up areas, on 10- and 12-acre compounds with five layers of security."[50]

Standards for designing an embassy plan have been developed for design professionals when contracted to perform State Department work. "The prototype consists of three basic plans in varying sizes, each to be built on a 10-acre site. The size of the land alone would likely push the embassies to the outskirts of a foreign capital

[50] Williams, Charles E., "Government Executives Share Engineering-Related Snapshots of Their Agencies" in *CE Conference Daily, Federal Forum, 1st Annual Congress on Infrastructure Security for the Built Environment*. Congress held in Washington, D.C.
5-7 November 2002, (Washington, D.C.: American Society of Civil Engineers, 2002, 2, 7.

instead of downtown. On the site there will be entrances for maintenance vehicles and visiting dignitaries, as well as a third entrance, protected from the rest of the complex, where the public can enter to apply for visas and the like. Offices are designed so that, for example, maintenance workers, who are often foreign nationals, will rarely need to access secure office areas. The exteriors of the embassies will be blast-resistant and positioned well away from fences."[51]

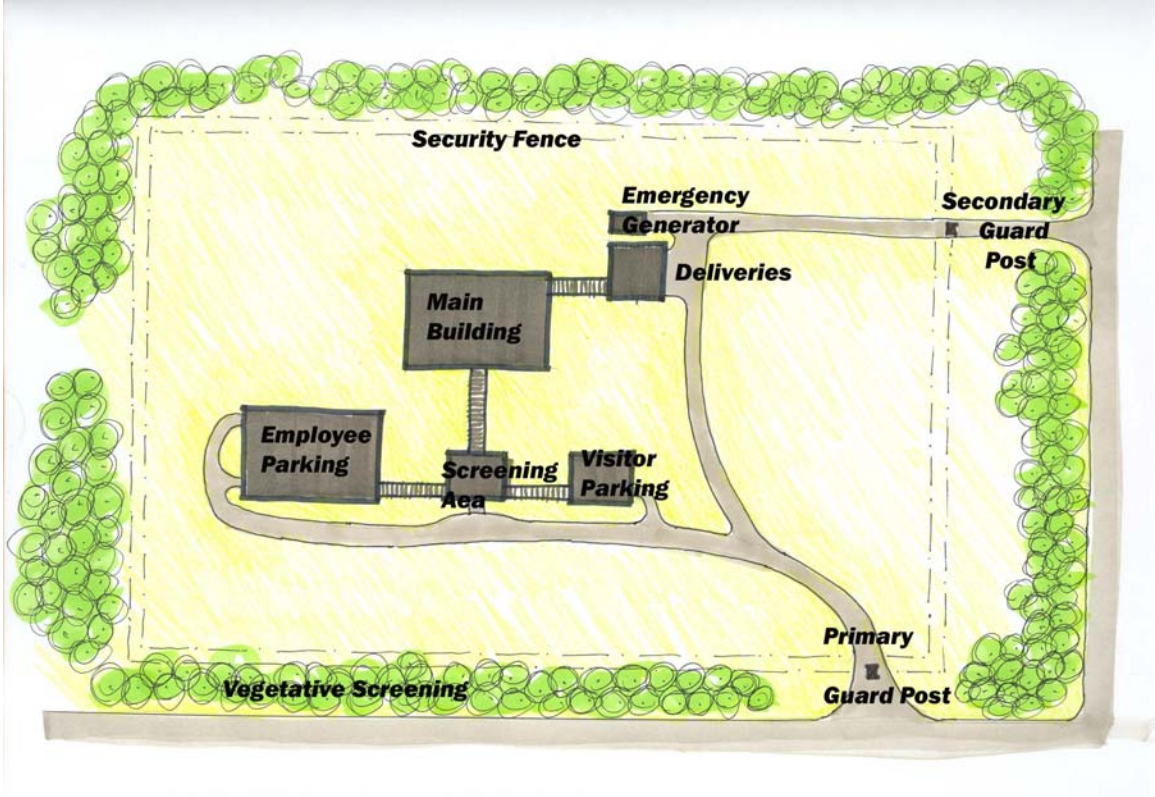


Figure 39, Access and Perimeter Screening, Campus Type Setting

Figure 40, Vegetative Screening

[51] Irwin, Neil, "Embassy Architects Juggle Security, Aesthetics," Washington Post, 2 September, 2002.

3.8 “Hiding in Plain Sight,” Camouflage

After the attacks of September11, 2001, there were many discussions concerning skyscrapers, landmark buildings and monuments and how they presented an attractive target for potential terrorists. “As a practical matter, only a few major skyscrapers rise to “icon” status and thus qualify as potential targets of terror. But the fiery deaths of so many occupants and rescuers – 2,803 victims in the New York towers – set off alarms about safety against any disaster in buildings with floors beyond the reach of conventional fire ladders. That means anything taller than about 75 feet, a common definition of “high rise.” Skycrapers.com, which compiles building statistics worldwide, uses a higher definition: At least 115 feet or 12 stories tall. By either yardstick, thousands of buildings (more than 16,500 nationally and at least 4,448 in New York City alone, by Skyscrapers.com’s count) face potential review.”[52]

One option is to maintain a low profile, that is, to conduct business in a non-descript building, such as a warehouse, where fences and security cameras are a normal occurrence. “Many agencies and companies, particularly those involved with national security, are pushing for walled-off, nondescript offices in the outer suburbs, rather than a big building with easy foot access and a big sign in front announcing the occupant.”[53] Some facilities, opting to maintain low profiles, eliminate signs and logos, or use a subdued form of signage.

3.9 Validation, or pre-testing options

Once a site security plan is developed, it can be tested by various computer programs. The British Royal Engineers developed a program, linked to GPS, which tests various military base designs against potential terrorist activities. The test results lead to design changes, including the placement and height of vehicle barriers and other security components.

In the U.S., Sandia Labs in Albuquerque, NM, has developed a similar pre-test program, RAMPART (Risk Assessment Method-Property Analysis and Ranking Tool) which is in use with the military, the Department of Energy and the General Services Administration. RAMPART includes data on the structure which is tested against various hazards including, earthquakes, crime, etc.

FEMA (the Federal Emergency Management Agency) sponsors practical exercise drills with multi-state and federal agencies participating. During February 2003, FEMA staged a mock bio/chem. terrorist attack against the U.S. Courthouse in Alexandria, Virginia. This exercise was designed to coordinate various response groups, evaluate response activities and make recommendations for improvement.

---

[52] O’Driscoll, Patrick, “High-rises remain vulnerable after 9/11,” *USA Today*, 25 October, 2002.

[53] Irwin, Neil, “Embassy Architects Juggle Security, Aesthetics,” Washington Post, 2 September, 2002.

3.10 Case Study – U.S. Courthouse Boston, Massachusetts

Occupants of the courthouse have expressed concern over the General Services' Administration's proposal to install vehicle barriers only at the public entrance. The entire front of the courthouse, which parallels a public street, is unprotected. The street traffic includes many delivery vehicles servicing the piers and cruise ship docks.

To eliminate the potential for progressive failure, the installation of fiber reinforced polymer fabrics around columns and exterior walls is recommended. To prevent a direct impact, a planter, designed to deflect a large delivery vehicle could be installed along the curb at the front of the courthouse. The planter/barrier could be faced with the same brick that was used to construct the courthouse.

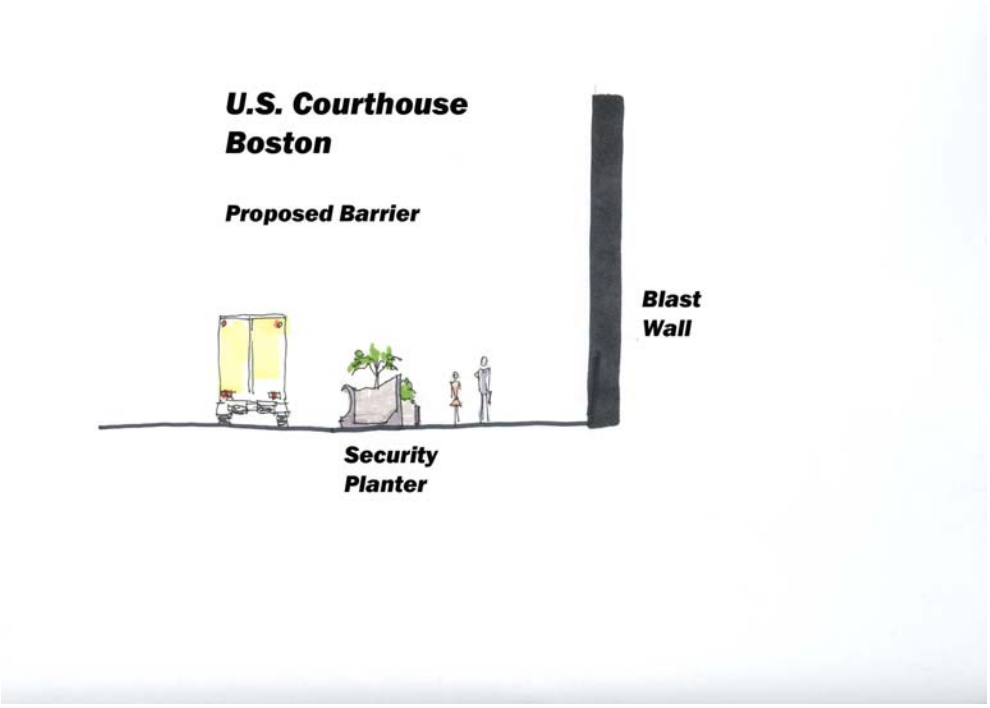


Figure 41 Recommended Security Barrier, U.S. Courthouse, Boston, Massachusetts

3.11 Case Study – U.S. Courthouse Foley Square, New York

The original design for the Foley Square courthouse included a shared delivery area in the basement of the building. Delivery trucks, mail trucks and U.S. Marshals delivering prisoners all shared the same entrance to the building. Trucks drove down a small street and entered a truck elevator which brought them to the lower level delivery docks. After completing deliveries, the truck drove onto a turntable which faced it the correct position to drive back onto a truck elevator.

Security was enhanced during the trials resulting from the 1993 bombing of the World Trade Center and the access roads separating the courthouses and the Metropolitan Detention Center were closed to vehicular traffic. Delivery security became a priority. A

portion of the public street was closed off with Jersey barriers so delivery trucks could cue up. While in this enclosed lane, trucks are visually inspected, and bomb dogs are employed.

Figure 42 Current Delivery Screening, U.S. Courthouse, Foley Square, New York

The security would be enhanced if commercial deliveries and mail deliveries could occur outside the building envelope for the new Foley Square courthouse. A separate delivery could be constructed adjacent to the courthouse. A blast plate could separate the loading docks from the main structure and a separate HVAC system could be installed.

The roof of the loading dock area could be designed as a roof garden providing a quiet area for bomb dogs and aesthetic improvement for employees. Moving packages and mail into the courthouse could be provided via a series of freight elevators connecting to lower level service corridors.

This type of facility would reduce the risk of blast damage from truck bombs and also reduce the adverse potential from any bio-chem incidents.

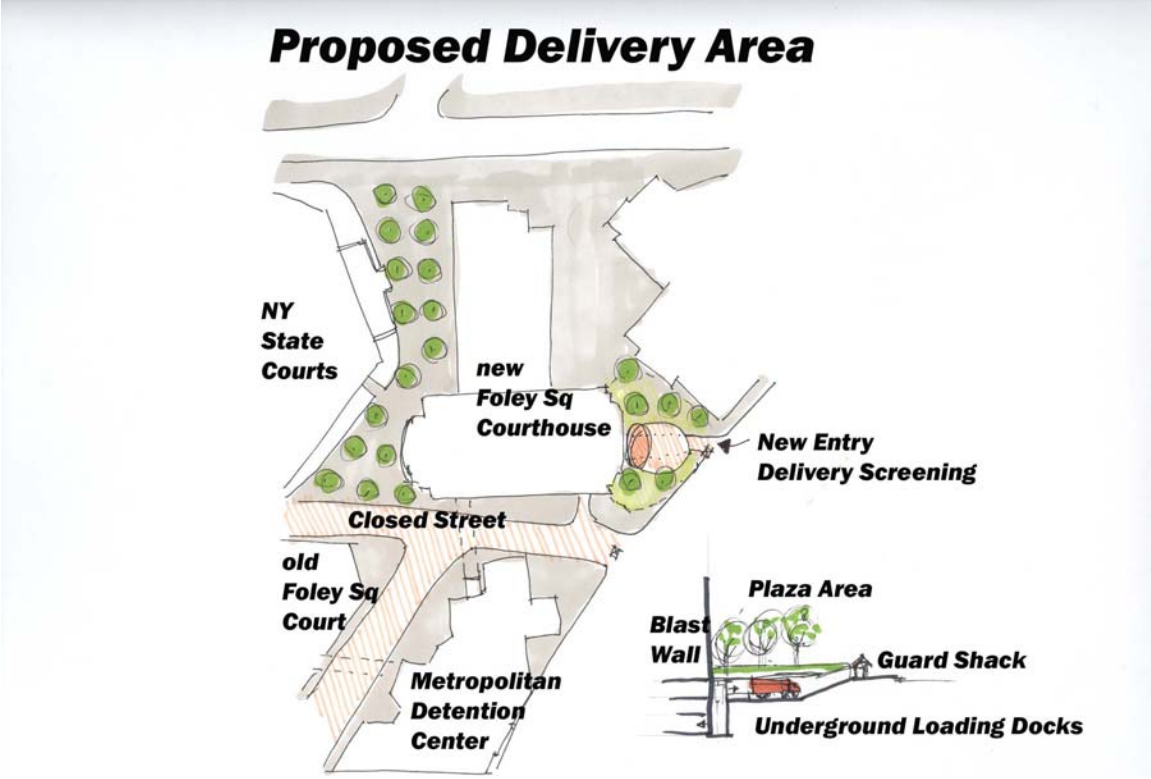


Figure 43 Proposed Delivery Screening, U.S. Courthouse, Foley Square, New York

3.12 Case Study – U.S. Courthouse, Alexandria, Virginia

The temporary security measures installed for the 9/11 terrorist trials at the U.S. Courthouse in Alexandria, Virginia, appear to be functional from a security standpoint. However, the overall appearance of the guard shacks and vehicle barriers could be improved. The design could be amended to complement the architecture of the court facility. This could be achieved by using some of the same materials.

The vehicle barrier control mechanisms could be hidden behind security planters. A gateway type entry arch could limit the size of vehicles dropping off visitors to the courthouse.

Figure 44, Proposal for Barriers and Guard Station, U.S. Courthouse, Alexandria, Virginia

Chapter IV

4. Conclusions

Security concerns will remain a priority well into the future. Landscape architects have the ability to make valuable contributions in this area. A broad knowledge of security concepts, objectives and limitations is required in order to make informed decisions in planning and designing secure landscapes.

4.1 Findings as a Result of the Study

Design professionals are currently re-evaluating building codes with the intention of designing structures which will withstand a terrorist action long enough for building occupants to safely evacuate. In planning for site security, landscape architects must obtain information concerning proposed client activity, site vulnerability, the probability of whether an adverse event could occur and building survivability prior to developing a site plan which will adequately address security concerns.

Many tools currently in use by landscape architects can prove valuable in determining site vulnerability. For example, a topographic analysis of "seen areas," or scenery visible from certain vantage points can also be used to determine "line-of-sight" vulnerability from certain types of weapons. The use of landforms and vegetation to blend structures and roads into the natural landscape can also shield these activities from casual, or unwanted, observers.

An in depth knowledge of plant materials, soils and geologic formations are also invaluable in the design and placement of cameras, sensors and other site detection devices. Current attempts to camouflage security systems may be invisible to the casual observer, but are quite obvious to those with a rudimentary knowledge of natural systems.

4.2 Outcomes Strategies

Landscape architects can provide valuable service in the planning and design of site security. However, a working knowledge of security concepts, equipment, threat assessments, physical vulnerability assessments and limitations is essential in formulating functional plans. The formal education process, in both undergraduate and graduate studies should include a segment on site security issues.

Construction classes could include information on bollards, barriers, fences, etc., with test data on the strengths and weaknesses of specific designs and materials. Studies could also address the conflicts and possible resolutions in attempting to meet security requirements while also meeting health, safety and ADA access requirements. Site analysis and assessment studies could include a section on preparing vulnerability assessments. These assessments would build on current studies which include analyses of topography, geology, vegetation, hydrology and socio-economic data.

The landscape architecture profession can be kept informed through professional publications and by online updates from the American Society of Landscape Architects (ASLA) "LAND" news. The annual ASLA convention could include a session on site security issues.

The General Services Administration conducts an annual award program for federal public buildings. In 2000, GSA established an award category of Landscape Architecture/Security. The entry plaza design for the Phillip Burton Federal Building and U.S. Courthouse in San Francisco, California, was cited for security enhancements in this award program (figures 21 and 22). This type of recognition could be extended to the ASLA annual design award programs. Positive examples of functional design solutions would encourage landscape architects to take a more active role in designing secure landscapes.

Also, a portion of the state licensing examinations could address site security issues, problem solving and/or design details which would enhance security.

4.3 Summary of Other Findings – things not anticipated, or planned, as part of the study

When I initially undertook this study, I assumed that a barrier could be designed to prevent a building from collapsing from a car bomb explosion. Well, I found that assumption to be true, but the results (18' high, 4' wide wall) would not blend in well with most American landscapes. The concept that buildings could be retrofitted to withstand blasts and film could be applied to windows to prevent injuries from glass shards meant that the location and design of barriers could be both effective and attractive.

Security issues will continue to receive priority consideration in all new planning and design projects. Landscape architects will need to play an integral role in site planning in this heightened security environment. To design effective and functional landscapes, landscape architects must be cognizant of the vulnerability/threat assessment process. They must also be aware of the potential results of undesirable events so that material selection, site design, site access and building setbacks are planned with maximum sustainability.

Many design professionals are involved in security issues with the intention of creating "a continual focus on safety and security through codes, new materials, and new design standards, to include security as a key design consideration for the long term."[54] Landscape architects provide a key role in integrating security elements within the landscape while focusing on the landscape's ability to visually absorb these changes and maintain an open, aesthetically enhanced environment.

[54] The Infrastructure Security Partnership Building Systems Security Summit, Washington, D.C., 8 March, 2002

4.4 So What?

Security is big business. If landscape architects sit on the sidelines, they will be tasked, after the fact, to improve site aesthetics when the majority of the site security plan has already been determined. The recent establishment of the Homeland Security Agency and the allocation of funding to improve domestic security will have a profound impact on the design professions. With this influx of funding comes an opportunity to influence outcomes. That is, landscape architects can play a major role in how effectively security considerations are applied to the landscape. Landscape architects have always had the ability to coordinate and absorb new programs (i.e., National Environmental Policy Act and Americans for Disabilities Act). With this influx of funding and design focus, site security considerations should be an integral component of landscape assessment and design.

4.5 What are the Implications?

The landscape architecture profession can make valuable contributions in the area of security planning. The importance of understanding security concepts and objectives, the ability to participate in vulnerability assessments and the knowledge of security systems will insure that landscape architects have a role in this growing discipline.

4.6 Suggestions for Additional Research

The unavailability of reliable test data made portions of this thesis difficult to research. The establishment of a national laboratory to test and evaluate security systems, barriers and other materials used in security designs would be a benefit to engineers, architects and landscape architects. Current testing is spread around various government laboratories and universities. It would be beneficial to have a centralized database in which to search and review the appropriateness of various materials.

Additionally, a nationally recognized security rating system for construction materials would be an asset for engineers, architects and landscape architects. For example, the Department of State sets classification levels for ballistic glazing and armoring materials used in the manufacture of armored vehicles. These rating levels determine which type of material should be used in a vehicle which operates in a high, moderate, or low threat environment. A similar rating system could be applied to site security components, including bollards, barriers, wall types, etc. Once a site vulnerability assessment has been completed, a determination could be made on which level of security is most appropriate. At that juncture, a selection of materials, based on the security rating, could be incorporated into the design.

4.7 Indicate What Group, Theory, Organization, or Discipline may be able to Profit from your Research.

Both landscape architects and security professionals would benefit from cross training. Most security professionals are very knowledgeable about security components, but are unaware of the benefits to be derived from a professionally designed site plan. The ability to transform a landscape and blend man made materials into natural forms has distinct advantages when planning security enhancements.

The American Society for Industrial Security (ASIS) is currently the lead professional organization for individuals and companies dedicated to security assessments and security systems design and application. The annual ASIS conference would be an appropriate forum to introduce members to the benefit of early coordination with the landscape architecture profession.

The importance of establishing working relationships with engineers, architects and security professionals is essential in providing secure landscapes which are aesthetically pleasing and open in appearance.

LIST OF FIGURES

Figure

9 Alfred P. Murrah Federal Building, Oklahoma City, north elevation – prior to bombing.
Hinman, Eve E. and Hammond, David J., "Lessons From the Oklahoma City Bombing," ASCE Press, New York, NY, 1997, Fig. 1.1, p.2. . Reproduction permission granted by photographer James Loftis, Architect, Oklahoma City.

10 Site plan showing truck bomb location.
Hinman, Eve E. and Hammond, David J., "Lessons From the Oklahoma City Bombing," ASCE Press, New York, NY, 1997, Fig. 1.3, p.4. Permission granted for use by the Copyrights and Permissions Department, American Society of Civil Engineers, Reston, VA

11 Nairobi Embassy bomb location. Permission to use graphics granted by IOSS (Interagency OPSEC Support Group). IOSS does not have any copyright restrictions on their publications. Hawley, Chris, Noll, Gregory G., Hildebrand, Michael S., "Operations Security for Public Safety Agencies," IOSS, Greenbelt, MD, June 2001, Figure 3-2, p. 4.

12 ATF Vehicle Bomb Explosion Hazard Evacuation Tables.
Bureau of Alcohol, Tobacco and Firearms. Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

13 Active vehicle barriers capabilities.
Army Corps of Engineers. Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

14 Passive vehicle barriers capabilities.
Army Corps of Engineers. Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

15 Planter box, www.stonewear.com, with permission

16 Planter box designed to State Department standards, www.stonewear.com, with permission

17 Comparison of barrier types tested by the Army Corps of Engineers, www.stonewear.com, with permission

18 Glass fiber reinforced planter wall, www.stonewear.com, with permission

19 Retaining wall stopping strengths, www.stonewear.com, with permission

20 Concrete Berms at Phillip Burton Federal Building and Courthouse, San Francisco, California. General Services Administration, Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

21 Berms as Vehicle Barriers, Phillip Burton Federal Building and Courthouse, San Francisco, California. General Services Administration, Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

22 Single sided soil barrier, Karagozian and Case, Burbank, California, with permission

23 Two sided soil barrier, Karagozian and Case, Burbank, California, with permission

24 Combination barrier, composed of a wall of water and a reinforced concrete wall, Karagozian and Case, Burbank, California, with permission

25 Fabric blast shield, Karagozian and Case, Burbank, California, with permission

26 Pentagon plan view impact area top right.
Aerial photo provided courtesy of Space Imaging's IKONOS Satellite.

27 Helicopter operations.
www.state.gov/ Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

28 Retrofitting reinforced concrete columns to improve their blast resistance, Karagozian and Case, Burbank, California, with permission

29 Interior wall retrofit, Karagozian and Case, Burbank, California, with permission

30 Campus Setting

31 "Safe Evacuation Zones"

32 Vehicle Sallyport

33 Bomb Sniffing Dog, http://renovation.pentagon.mil/ Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

34 Proposal for ATF Headquarters Washington, D.C.
Moshe Safdie Associates for GSA Public Buildings Service, Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

35 Proposed Site Plan for ATF Headquarters Washington, D.C.
Moshe Safdie Associates for GSA Public Buildings Service, Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

36 U.S. Courthouse proposal Springfield, MA. Moshe Safdie Associates for GSA Public Buildings Service, Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

37 U.S. Courthouse proposal Springfield, Massachusetts. Moshe Safdie Associates for GSA Public Buildings Service, Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

38 Proposed Site Plan U.S. Courthouse, Springfield, Massachusetts. Moshe Safdie Associates for GSA Public Buildings Service, Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

39 Access and Perimeter Screening – Campus-Type Setting

40 Vegetative Screening

41 Recommended Security Barrier U.S. Courthouse, Boston, Massachusetts

42 Current Delivery Screening, U.S. Courthouse, Foley Square, New York

43 Proposed Delivery Screening, U.S. Courthouse, Foley Square, New York

44 Proposed Barrier/Guard Station, U.S. Courthouse, Alexandria, Virginia

45 Appendix II, Total Anti-US Attacks, 2001, http://www.state.gov/ Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

46 Appendix II, Total US Citizen Casualties Caused by International Attacks, 1996-2001, http://www.state.gov/ Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

47 APPENDIX II, Total International Terrorist Attacks, 1981-2001, http://www.state.gov/ Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

48 APPENDIX II, Total International Attacks by Region, 1996-2001, http://www.state.gov/ Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

49 APPENDIX II, Total International Casualties by Region, 1996-2001, http://www.state.gov/ Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

50 APPENDIX II, Total Facilities Struck by International Attacks, 1996-2001, http://www.state.gov/ Per 17 U.S.C. sec 101 (1994), all work of the United States Government is in the public domain. No copyright notices were posted per 17 U.S.C. sec 403 (1994)

BIBLIOGRAPHY

American Society of Landscape Architects
12 February, 2002, Press Release: Argust Testifies on Proposed Security Enhancements for Washington Monument

Press Release, 30 November, 2001, Security Design Coalition Convened

Today's Political Landscape, Good Design = Good Security, 30 November 2001

Barriers and Bollards, *23, October, 2002, http://www.barriersandbollards.com*

Basics of Concrete Barriers, McDevitt, Charles F., Federal Highway Administration, 1998

Building in Terrorism's Shadow, *Gipe, Michael A., May 2000, Security Management Online, http://www.securitymanagement.com*

CIA Instructional Guide on Assassination, 1954

Conference: Freedom Without Fortresses, National Building Museum, 27 November 2001

Counter Terrorism, Patterns of Global Terrorism 2002, U.S. Department of State
Counterintelligence Awareness Programs, National Counter Intelligence Center, February 1966

Domestic Violence Awareness, U.S. Department of Justice, USGPO

Emergency Public Information Guide, Emergency Management Laboratory, Oak Ridge Institute for Science and Education, Oak Ridge, TN, 1/95

The Layman's Guide to Security, Department of Defense Security Institute, Richmond, VA, May 1995

Laminated Glass Brings Day lighting and Security to Boston Courthouse, *May 2001, Dupont Laminated Glass News*

Nataska Maximum Security Barrier, *23, October, 2002, http://www.nataska.com*

National Capital Planning Commission
Designing for Security in the Nation's Capital, October 2001

The National Capital Urban Design and Security Plan, October 2002

National Crime Prevention Institute
CPTED Strategies

New Jersey Barrier History, Kozel, Scott M., Roads To the Future, Pennways, 2001

Operations Security for Public Safety Agencies, Special Operations for Terrorism and Hazmat Crimes, Hawley, Chris, Noll, Gregory, Hildebrand, Michael S., Interagency OPSEC Support Staff, June 2001

Profiling and Behavioral Assessment Unit, Department of Justice, FBI Academy Critical Incident Response Unit, Quantico, VA

Personal Security Handbook, Department of Justice, U.S. Marshals Service, USGPO 1993

Personal Security Checklist for Home, Business, and Vehicle, unpublished document by U.S. Marshals Service Protective Operations

Recent Espionage Cases, Summaries and Sources, Department of Defense Security Institute, May 1996

Requirements and Specifications for Special Purpose and Support Space Manual, US. Department of Justice, U.S. Marshals Service, 1 May 1997

RoadTech Manufacturing, *23, October, 2002, http://www.roadteh.com*

Sallyports, Barriers and Bridges, *McDuffie, P.E., Civil War Field Fortifications, 15 September, 2002, http://www.civilwarfortifications.com*

Security in the Workplace, U.S. Department of Justice, U.S. Marshals Service

Stonewear, Force Protection, *23, October, 2002, http//www.stonewear.com*

The Supreme Court of the United States, publication, undated

Traffic Calming, Pedestrian Facilities User Guide, FHWA, 2000

Terrorism and Threat Handbook, Interagency OPSEC Support Staff, June 2001

U.S. Courts Design Guide, National Institute of Building Sciences, 1993

U.S. Department of Justice, Office of Justice programs, National Institute of Justice.
Security Concepts and Operational Issues- New School Design, undated

Disorder in Urban Neighborhoods – Does it Lead to Crime? February 2001

Physical Environment and Crime, Taylor, Ralph B., and Harrell, Adele V., January 1996

U.S. Department of State
DOS Certified Anti-Ram Vehicle Barriers, 30, November, 2001

Patterns of Global Terrorism, 2001

U.S. Department of the Treasury, Bureau of Alcohol Tobacco and Firearms.
ATF Vehicle Explosion Hazard and Evacuation Distance Tables

Vulnerability Assessment of Federal Facilities, U.S. Department of Justice, 28 June, 1995

Your Passport to a Safe Trip Abroad, USGPO, U.S. Department of State

News Media

Baltimore Sun
Gunts, Edward, 23 June 2002, When Safety Proves a Barrier to Beauty

Boston Globe
Cambanis, Thanassis, 1 October, 2002, Some Say Posts Won't Bar Courthouse Attack

Chicago Tribune
Kamin, Blair, Land of the Sort of Free, 29 October, 2001

CNN.com/ Associated Press
New Weapons Stink or Hurt, but Don't Kill, 24 March, 2002

East Bay Business Times
Valke, N., 4, March, 2002, Highways Next Target for Anti-terrorism

The Jackson Sun, *2002, Terrorism Timeline in the U.S.*

New York Times, Holtz Kay, Jane, 3 January 1999, *The Courthouse as a Bastion Against Terror*

San Francisco Chronicle
Gellner, Arrol, An Unsound Idea, Freeway sound Walls Make for a Bleak Commute, Unfriendly Landscape, 24 April, 2002

The Sydney Morning Herald
Moore, Mathew; Riley, Mark, 14, October, 2002, Terrorism Strikes Home

16, October, 2002, Twisted Ties of Terrorist Network

USA Today

Hale, Ellen, 17, October, 2002, Israelis Are Able to Create a New Normal.

Washington Post (Washington, D.C.).
9 February 2003
Davis, Patricia, Terrorism Drill Moves Closer to Home

2 September 2002
Irwin, Neil, Embassy Architects Juggle Security, Aesthetics

24 August 2002.
Lewis, Roger K., The Use and Limits of Security Placebos.

22 July 2002
Security Stepped up Around Courthouse

16 June 2002
Jenkins, Chris L., Media Center During Trials Irks Residents

7 June 2002
Hsu, Spencer S., Federal Panel Adopts Design for Pennsylvania Avenue Plaza

1 June 2002
Faiola, Anthony, Brazil's Elites Fly Above Their Fears

18 May 2002
Forgey, Benjamin, Washington's Tunnel Vision for Tourists

17 May 2002
Hsu, Spenser S., Arts Panel Drops Backing of Underground Center

1 May 2002
Hsu, Spencer S., Underground Center at Monument Backed

29 April 2002
Miller, Bill, Study Urges Focus on Terrorism with High Fatalities, Costs

16 March, 2002
Hsu, Spencer S., U.S. Aims to Fortify its Leased Buildings, Rules Would Effect Cities, Private Buildings

13 March 2002
Masters, Brooke A., Alexandria, Courthouse Brace for Trying Times

17 January 2002
Davis, Patricia; Masters, Brooke A.,Jails High Profile Gets Even Higher

13 January 2002
Wheeler, Linda, Ugly Barricades on Way Out

29 January 2001
Lewis, Roger K., A Resolution to Banish Jersey Barriers

31 July, 1988
Foote, Cornelius F., Jr., Vault-Like Rooms Become Standard Office Equipment

APPENDIX 1

Significant Acts of Terrorism
1960 - 2002

1960s	Act	Location	Method	Victim (s)	Damage	Comments
1968	Aircraft hijacking	Algiers	Armed passenger(s)	Hostages released; 10 crew/ 38 passengers		High media attention
1968	Aircraft hijacking	Algeria, Israel, Italy	Hijack El Al flight on route to Tel Aviv	Passengers and crew detained for 6 weeks		Popular Front for the Liberation of Palestine
1970s	**Act**	**Location**	**Method**	**Victim (s)**	**Damage**	**Comments**
1970	Swiss Air bombing	Zurich to Tel Aviv	bomb	47 killed	aircraft destroyed	PFLP (Palestinian)
1972	Massacre	Lod Airport, Israel		26 killed		Japanese Red Army
1972	"Bloody Sunday" car bombs	Belfast, Ireland	26 Car bombs detonated	11 killed, 130 injured		Provisional IRA
1972	Olympic massacre	Munich, Germany	Palestinian Black September terrorists massacre Israeli athletes during Olympic games			Black September terrorists
1972	Seizure of Israeli Embassy	Bangkok, Thailand	Black September terrorists take hostages	Hostages released after negotiation for safe conduct		Black September terrorists
1973	Assassination	Khartoum, Sudan	Seizure of Saudi Embassy	US Ambassador and Deputy Chief of Station killed		
1973	Hostage situation	Paris, France	Palestinian terrorists seize the Saudi embassy	5 hostages; 1 released in France, 4 released in Kuwait		
1974	Assassination	Nicosia, Cyprus	sniper	US Ambassador killed		
1975	American and Swedish consular Hostage situation	Malaysia		52 hostages released		Japanese Red Army negotiated for release of 5 JRA members
1975	OPEC conference attack	Vienna, Austria - Algeria	Pro-Palestinian guerrillas attack conference taking 81 hostages; 41 hostages released in Vienna; 40 released in Algeria	3 killed; 7 wounded; 81 held hostage		Pro-Palestine
1975	Assassination	Athens, Greece	Shooting outside residence	1 US embassy official		11/17 terrorist group
1976	Assassination	Beirut, Lebanon	Kidnapping/assassination	US Ambassador, Economic officer and driver killed		
1976	Airline hijacking	Entebbe, Uganda		103 hostages freed after Israeli raid		
1976	Hotel hostage situation	Damascus, Syria	Abu Nidal terrorists seize hotel w/ 90 hostages; resulting gun fight	All terrorists and 4 hostages killed, 34 injured		Abu Nidal
1977	Kidnapping	Cologne, Germany		President West German Employer's Assn kidnapped/killed		Red Army Faction
1978	Assassination	Rome, Italy	kidnapping	Aldo Moro, Italian Premier killed		Red Brigade

1970s cont.	Act	Location	Method	Victim(s)	Damage	Comments
1978	Airport take over	Narita, Japan	Violent struggle		Postponement of airport opening	Japanese radical leftists
1978	Attempted assassinations during Tokyo Economic Summit	Tokyo, Japan	Terrorists fired home made rockets at heads of state arriving for the summit	No casualties		Chukaku-Ha terrorists
1978	Seizure of Iraqi embassy	Paris, France	Armed terrorist	2 killed, terrorist injured		Al Fatah terrorist
1978	Terrorist attacks	Puerto Rico	Murders; armed bank robberies; weapons thefts, bombings of US government buildings			Los Macheteros
1979	Assassination	Irish Coast	Bomb planted on yacht	Earl Mountbatten killed		IRA
1979	US Embassy attacked	Islamabad, Pakistan	Embassy attacked and burned following rumors of US takeover of Grand Mosque in Mecca		Embassy burned	Islamic militants
1980s	**Act**	**Location**	**Method**	**Victim (s)**	**Damage**	**Comments**
1980	Hostage situation	Bogota, Colombia	Dominican Embassy seized by armed gunmen	Hostages released; Diplomatic corps, including US Ambassador		Guerillas of the April 19 Movement
1980	Hostage situation	London, England	Armed Iranian Arabs seize the Iranian Embassy	26 hostages; 2 hostages killed; 5 terrorists killed	Embassy destroyed by fire	British SAS stormed Embassy
1980	Assassination	El Salvador		Archbishop Oscar Arnulfo Romero killed		Right Wing death squad
1981	Assassination attempt	Rome, Italy	shooting	Pope is shot and wounded		Turkish fugitive shootist
1981	Kidnapping	Milan, Italy	US General kidnapped by Red Brigade terrorists; rescued in Padua by Italian counter-terrorist squad			5 Red Brigade terrorists captured
1982	Assassination	Los Angeles, CA	Shot/point blank range while stopped at a traffic light	Turkish Consul		Home-to-work commute pattern routine exploited by assassin
1982	Assassination	Paris, France		Israeli diplomat		Lebanese Armed Revolutionary Faction
1982	Pan Am aircraft bomb	Honolulu, Hi	Bomb exploded as plane landed	1 killed, several injured	aircraft exploded	Palestinian terrorist
1982	TWA 847 hijacking	Cairo, Egypt	Armed passenger	1 killed		Ali Hamadei
1982	Assassination attempt	London, England	shooting	Israeli Ambassador critically injured		Abu Nidal
1982	Park bombings	London, England	Regency Park and Hyde Park bombings	11 killed		Provisional IRA
1982	Airport attack	Ankara, Turkey	shooting	9 killed, 70 wounded		Armenian Secret Army
1982	Restaurant attack	Paris, France	Hand grenade	6 killed, 27 wounded		
1982	Assassination	Canada		Turkish Military attaché killed		Armenian extremists
1983	US Marine Barracks bombing	Lebanon	Truck bomb/suicide driver, 12,000 lbs of explosive. Truck drove through inadequate perimeter defenses	241 killed; 80 wounded	Truck drove through door, driver detonated explosives	Hizbollah
1983	Bombing	Beirut, Lebanon	Car bomb explodes outside US Embassy	63 killed, over 100 injured		Islamic Jihad

1980s cont.	Act	Location	Method	Victim(s)	Damage	Comments
1983	Assassination attempt	Serbia	Motorcade attack	1 Yugoslav student killed, Armenian Ambassador and driver injured		Armenian terrorists
1983	Bomb	Sydney, Australia	Bomb explodes outside Union Carbide factory			
1983	Airport bombing	Orly Airport, Paris, France	bomb			Armenian terrorists
1983	Ambush/riots	Sri Lanka	Ambush/killing 13 Sri Lanka soldiers results in anti-Tamil riots	13 soldiers and 400 Tamils killed		
1983	Assassination attempt	Rangoon, Burma	Bomb detonation during state visit of South Korean president	21 killed		North Korean terrorists
1983	Omani Gulf aircraft bombing	Karachi to Abu Dhabi flight	bomb	111 killed	Aircraft destroyed	
1983	US facilities bombings	Spain	8 separate bombings in Basque territories			Basque terrorists
1983	US & French Embassy bombings	Kuwait	Bomb attacks also at US housing complex, Kuwaiti oil facility, airline terminal and Kuwaiti govt office			Islamic Jihad
1983	Harrod's Department Store bombing	London, England	Bomb detonated inside store	5 killed, 91 injured		Provisional IRA
1984	Assassination	Rome, Italy		1 US diplomat killed		Red Brigades
1984	Assassination	Namibia	Booby trap bomb	1 US diplomat killed		
1984	Assassination	Philippines	Shooting/5 gunmen	Philippine Constabulary Chief killed		Gunmen escape via smoke grenades
1884	Massacre	India		300 Sikhs killed		Indian troops stormed Sikh temple
1984	US Embassy annex bombing	Awkar, Lebanon	Truck bomb	14 killed, 70 injured		Islamic Jihad
1984	Assassination attempt	Brighton, England	Hotel bombing	4 killed, Prime Minister Thatcher escapes		Provisional IRA
1984	Assassination	India	Prime Minister Indira Ghandi assassinated by Sikh bodyguards	1,000s of Sikh deaths following rioting		
1984	US Embassy attack	Lisbon, Portugal	Mortar attack – 4 rounds fired at embassy			4/25 terrorist group
1984	Kuwaiti Airline hijacking	Kuwait-Pakistan flight diverted to Teheran, Iran	4 armed Islamic Jihad terrorists; Iranian troops storm aircraft	2 US AID personnel killed; 3 others tortured		Islamic Jihad
1985	Police Station attack	Northern Ireland	Mortar attack	9 members of Royal Ulster Constabulary killed		Provisional IRA
1985	Attack on US businesses	Spain	Molotov cocktails thrown at Citibank and Xerox offices			
1985	Mass killing	Anuradhpaura, Sri Lanka		150 killed at Buddhist shrine		Tamil separatists
1985	TWA 847 hijacking	Athens to Lebanon	Armed hijackers	1 US military killed, 39 US hostages released in Syria		

1980s cont.	Act	Location	Method	Victim(s)	Damage	Comments
1985	Airline ticket office bombings, British Airways/TWA	Madrid, Spain	bomb	1 killed, 27 injured		Abu Nidal
1985	Airline ticket office bombing Northwest Orient	Copenhagen, Denmark	bomb	27 injured		
1985	Seizure of Achille Lauro cruise ship	Alexandria, Egypt	4 Palestinian gunmen hijack ship	1 wheelchair bound American killed		US fighters intercept jet carrying hijackers, force landing on NATO base in Italy
1985	Egyptian jet hijacking	Malta	Egyptian troops stormed jet in Malta	59 passengers killed during rescue attempt		
1985	Airport attack	Vienna, Austria				Abu Nidal
1985	Airport attack	Rome, Italy				Abu Nidal
1986	Assassination	Stockholm, Sweden	shooting	Prime Minister, Olaf Palme killed		
1986	US Embassy Bombing	Lisbon, Portugal	bomb			Popular forces of 4/25
1986	German-Arab Friendship Association bombing	West Berlin	Bomb	7 injured		Syria sponsored
1986	TWA 840 bombing	Rome to Athens	bomb	4 killed; 9 injured	Aircraft lands safely in Athens, Greece	
1986	Nightclub bombing	West Berlin	bomb	2 US soldiers, 1 Turkish woman killed; 200 injured		Libya sponsored
1986	Assassination attempt	Khartoum, Sudan	shooting	1 US Embassy communicator shot and wounded while riding home		Libya sponsored
1986	Massacre	Lima, Peru	Security forces open fire during a prison riot by jailed guerilla group	200 killed		Sendero Luminoso (Shining Path)
1986	Assassination	Germany		Dr. Beckurts/Siemans corp killed		Red Army Faction
1986	Pan Am 73 hijacking	Pakistan	4 armed Arab hijackers	21 killed		
1986	Attack on synagogue	Istanbul, Turkey	Attack by Abu Nidal terrorist team	21 killed		Abu Nidal
1986	Airport bombing	Kimpo Airport, Seoul, Korea	bomb	5 killed, 29 injured		North Korea
1986	Police station bombing	Main Police HQ, Paris, France	Bomb detonated inside building	1 killed, 51 injured		
1986	Assassination	France	President of Renault killed	1 killed		Action Directe
1987	Assassination	Lebanon		Prime Minister of Lebanon killed		
1987	Bombing	US Embassy, Rome, Italy	Car bomb explodes outside back gate of US Embassy, rockets fired from across the street	1 injured		Two pronged attack
1987	Air France hijacking	Switzerland	Lebanese terrorist is overpowered by flight crew	1 killed, stewardess attacked		
1987	Bombing	Greece	Bomb explodes near bus	10 US air force crew injured		November 17th group

1980s cont.	Act	Location	Method	Victim(s)	Damage	Comments
1987	Sri Lanka parliament attack	Sri Lanka	grenade	1 killed		
1987	Bombing	Enniskillen, Ireland	Bomb detonated during ceremony	13 killed		Provisional IRA
1987	Korean Airlines 858 bombing	Andaman Sea, near Burma	Bomb detonated during flight	115 killed	Aircraft destroyed	2 North Korean agents planted bomb
1987	Timber logging tampering	Western US	Spikes embedded in tree	Mill worker injured		Earth First
1978-87	Assassinations Scientists/businessmen	US	Mail bombs	3 killed, 3 injured		Uni-bomber/ Ted Kaczyinski
1988	British Army ceremony bomb attempt	Gibraltar	Bomb attempt	3 IRA terrorists killed by British SAS		Provisional IRA
1988	Attack on mourners for failed Gibraltar bomb	Ireland, UK	Hand grenades, pistol	3 mourners killed		Protestant extremists
1988	British soldiers shot during funeral procession	Ireland, UK	handguns	2 British soldiers killed		Belfast mourners
1988	Pan Am 103 bombing	Lockerbie, Scotland	Bomb exploded in flight	All 257 on aircraft killed; 11 killed on the ground	Aircraft destroyed and ground damage	Libya
1988	Chemical weapons attack	Halabja, Iraq	Chemical weapons attack	Kurdish village		Iraqi military
1988	Bombing attempt	New York	Pipe bombs			Japanese Red Army terrorist arrested on NJ Turnpike
1988	Assassination	Tunis, Tunisia		Commander of western sector of Fatah assassinated in his home		
1988	Assassination	Athens, Greece	shooting	Head of Armenian Secret Army is shot in his home		2 gunmen
1988	Hostage situation	Ouvea caves, New Caledonia	23 French Gendarmes were held hostage	20 killed by French forces		Kanak Socialist National Liberation Front
1988	Assassination	Athens, Greece	Car bomb	US Defense Attache killed		
1988	Cruise ship attack	Poros, Greece	shooting	9 killed, 98 injured		
1989	Massacre	Tiananmen Square, Peking, China	Chinese People's Liberation Army opens fire on student dissidents	100s, maybe 1,000s killed		
1989	Air India bombing	Canada/North Atlantic	Bomb explodes as aircraft departs Canada	329 killed	Aircraft destroyed	Sikh extremists
1989	Airport bombing	Narita, Japan	Bomb explodes in airport	2 killed		Sikh extremists
1989	UTA 772 bombing	Chad, Niger	bomb	All crew and passengers killed		
1989	Assassination	Frankfurt, Germany	Bomb detonated outside car as head of Deutche Bank AG is driven to work	1 killed		Red Army Faction
1989	Bio-terrorism attempt	Minneapolis, MN	Manufacture of ricin	Potential to kill 100		
1990s	**Act**	**Location**	**Method**	**Victim (s)**	**Damage**	**Comments**
1990	Attack on police stations	Sri Lanka	Rebels stormed 24 police stations	Several hundred hostages, several killed		Liberation Tigers of Tamil Eelam
1991	Attack on #10 Downing St	London, England	Mortar attack from parked van			IRA

1990s	Act	Location	Method	Victim(s)	Damage	Comments
1991	Massacre	Timor, Indonesia	Troops open fire during funeral procession	101 killed		
1991	Hutu-Tutsi massacre	Bujumbura, Burundi	Machete massacre	100 killed		Tutsi rebels
1992	Assassination	South Lebanon	Helicopter ambush	Hizbollah general secretary killed		Israel helicopter attack
1992	16th Century Moslem Mosque destroyed	Ayodhya, India	Hindu extremists destroy mosque, resulting in Hindu/Moslem clashes	Over 1,000 killed		Hindu extremists
1992	Mink Research Facility arson	Michigan State Univ	Arson/ release of research animals		University research lab destroyed	ALF/ Animal Liberation Front
1993	FBI storms Branch Davidian complex	Waco, TX	52 day siege, complex goes up in flames	82 killed	Complex destroyed	
1993	UN bomb attempt	New York, NY				15 arrests National Islamic Front, Sudan sponsored
1993	World Trade Center bombing	New York, NY	Truck bomb in garage	6 killed, 1,000 injured	Structural damage to complex	Egyptian Islamic group/ Gama-at; Rachman, Yousef
1993	Assassination during public celebration	Colombo, Sri Lanka	Suicide bomber	President Premadasa		
1993	Attacks on US helicopters	Somalia				Bin Laden
1993	Assassination, abortion doctor	Pensacola, FL	Shooting, outside of clinic	1 killed		Anti-abortion extremist
1994	Philippine Airline bombing	Philippine – Tokyo route	Bomb exploded under seat	1 passenger killed		Yousef
1994	Assassination, abortion doctor	Florida	Shooting into vehicle	2 killed, 1 injured		Anti-abortion extremist
1994	Assassination, abortion doctor	Vancouver, BC, Canada	Sniper shooting/AK-47; at residence	1 killed		Anti-abortion extremist
1994	Assassinations, abortion clinics	Brookline, MA	Shooter opened fire at 2 clinics	2 receptionists killed, 5 injured		Anti-abortion extremist
1995	Sarin Gas attack on subway	Tokyo, Japan	Deploy 2 containers of sarin poison gas in the Tokyo subway system	12 killed, 5,000 hospitalized		Aum Shinri Kyo cult
1995	FBI NCIC bombing attempt	Clarksburg, WV	Group obtained facility plans w/ intent to bomb. NCIC contains all criminal history records in US			
1995	Bombing of Alfred P. Murrah Federal Building	Oklahoma City, OK	Truck bomb (parked in loading zone)	168 killed, more than 500 injured.	Building destroyed; $650 million in damages	McVeigh, Nichols
1995	Assassination attempt	Addis Abada, Ethiopia	Attempt on Egyptian President Mubarek foiled			Islamic group Gama-at
1995	Abortion clinic violence attempts	Oklahoma	5 arrested	Attacks planned on Federal buildings, civil rights offices, abortion clinics		Anti-abortion activists
1995	AMTRAK derailment	Arizona	Tracks tampered with	1 killed, 213 injured		
1995	Radioactive materials placed in public park	Moscow, Soviet Union	Chechen placed radioactive materials in park			
1996	Bombing of Khobar Towers	Saudi Arabia	Fuel truck explodes in towers complex near US air base	9 killed, 260 injured		
1996	Olympic bombing	Atlanta, GA	Bomb placed near main stage	1 killed, 100 injured		Abortion extremist/Rudolph
1997	Nightclub bombing	Atlanta, GA	2 bombs; timed explosions	2nd bomb aimed at police		Rudolph

1990s cont.	Act	Location	Method	Victim(s)	Damage	Comments
1997	Abortion clinic bombing	Atlanta, GA	2 bombs near trash dumpsters	2nd bomb (w/shrapnel) injured 4		Abortion extremist/Rudolph
1997	Tourist massacre	Luxor, Egypt	Gunfire	58 Japanese tourists killed		Islamic group Gama-at
1997	Gas storage facility bombing attempt	Southern US	KKK members arrested in foiled bombing attempt			
1998	Bombing of US Embassy	Nairobi, Kenya	Suicide truck bombers	291 killed, 4,671 injured	Embassy and nearby offices destroyed	Bin Laden, al-Qaida
1998	Bombing of US Embassy	Dar Es Salaam, Tanzania	Suicide truck bomb; driver blocked by water tanker truck – 35' from outer wall of the Chancery	12 security force killed; 85 injured		Bin Laden, al-Qaida
1998	Research lab damage	Cornell Univ., NY	Released lab animals; destroyed equipment	Research and equipment destroyed		ALF?
1998	2 Mountain ski lodges destroyed	Vail, CO	arson	Both buildings destroyed	$12 M damages	ELF/ Earth Liberation Front
1999	Boise Cascade office destruction	Monmouth, OR				ELF
1999	Research lab damage	UCSF, CA	Vandalized 3 labs/ scientist's residence			Threatened scientist's family
2000	**Act**	**Location**	**Method**	**Victim(s)**	**Damage**	**Comments**
2000	USS Cole bombing	Aden, Yemen	small boat bomb, suicide mission	17 killed; 39 injured		Bin Laden – al-Qaida
2001	2 Aircraft hijackings AA#11 and UA#175	World Trade Center, New York, NY	Armed suicide hijackers; 2 commercial aircraft used as bombs	2,797 killed	16 acres destroyed, 2 110 story buildings $93 B damages	Bin Laden – al-Qaida
2001	Aircraft hijacking AA#77	Arlington, VA	Armed suicide hijackers; Commercial aircraft used as bomb	189 killed	Portion of Pentagon damaged; rebuilt w/in one year	Bin Laden – al-Qaida
2001	Aircraft hijacking UA#93	Somerset, PA	Armed suicide hijackers; Commercial aircraft	40 killed		Bin Laden – al-Qaida
2001-02	Anthrax attacks	FL,NJ,MD, CT, DC	Anthrax spores distributed through US Postal Service	5 deaths	US Capitol office buildings US Post Offices and many government buildings closed for inspection and decontamination	
2002	French Freighter bombing	Aden, Yemen	small boat bomb, suicide mission	1 killed		Al-Qaida (susp)
2002	Nightclub bombings	Bali, Indonesia	1 small bomb in nightclub; 1car bomb outside of nightclub, 1 car bomb at US consulate	200 killed (est.)	Multiple buildings destroyed	Al- Qaida (susp) Timed bombings

APPENDIX II

U.S. Department of State Statistics on Terrorism Activities

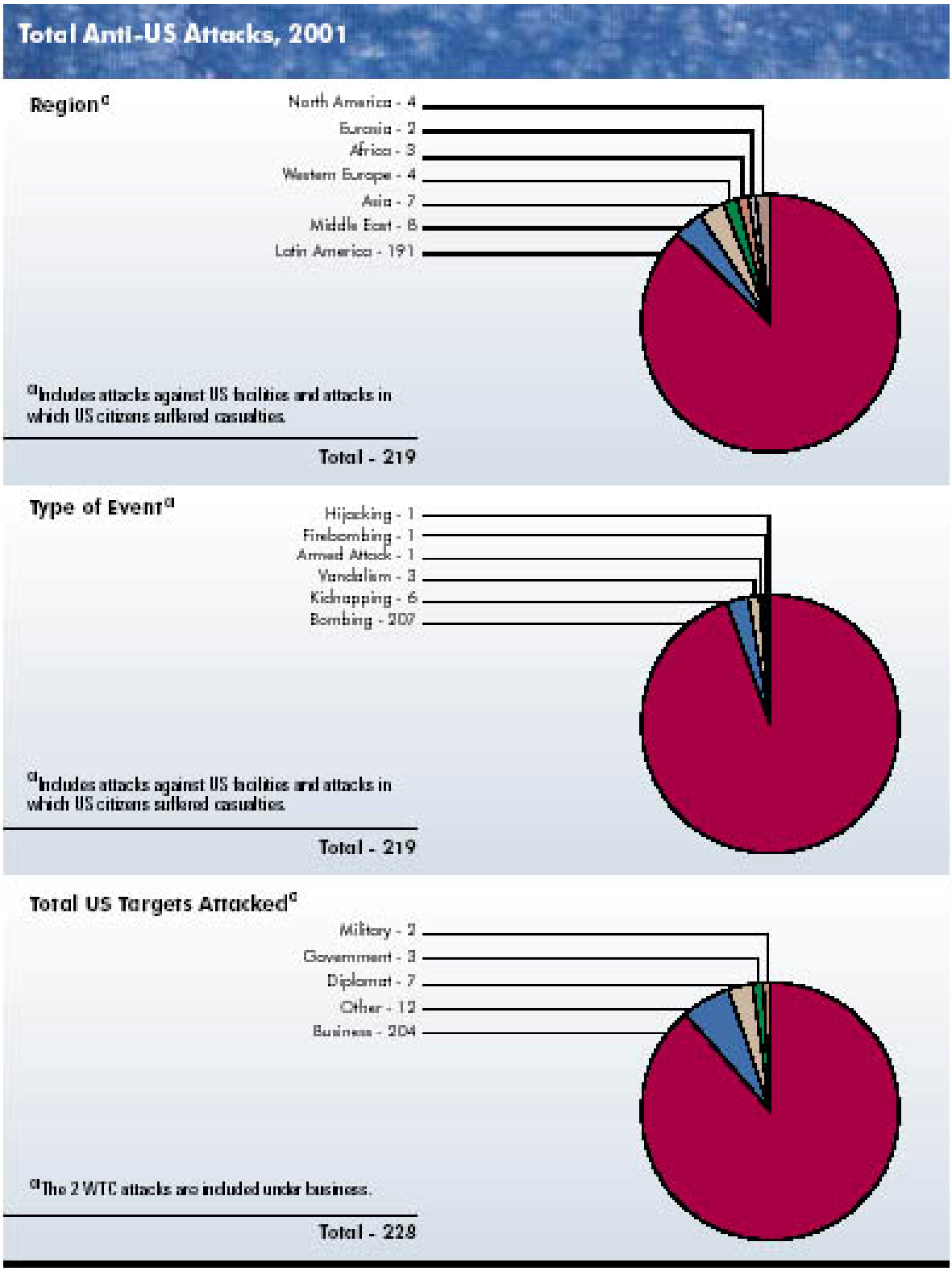


Figure 46

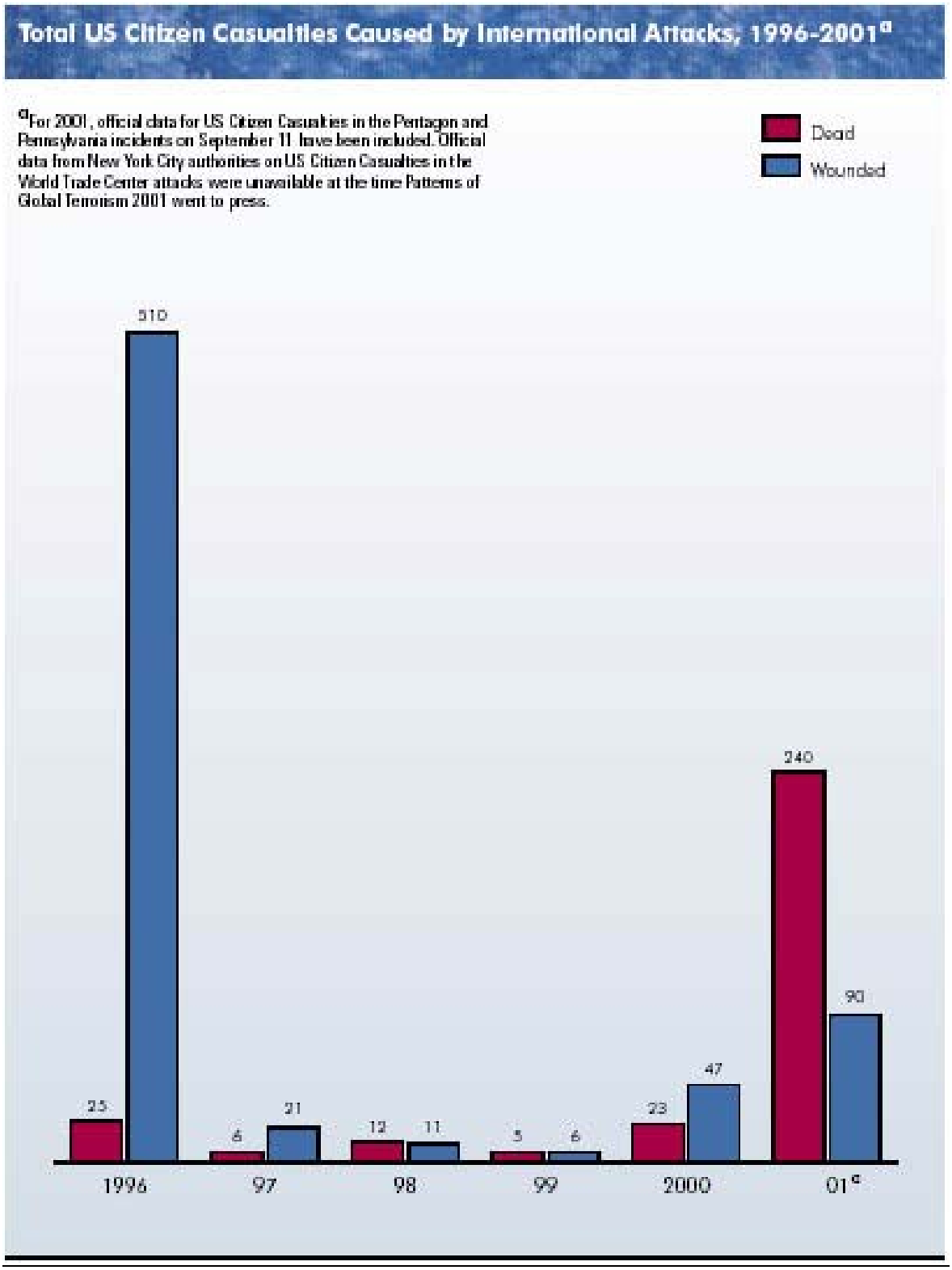

Total US Citizen Casualties Caused by International Attacks, 1996-2001[a]
[a]For 2001, official data for US Citizen Casualties in the Pentagon and Pennsylvania incidents on September 11 have been included. Official data from New York City authorities on US Citizen Casualties in the World Trade Center attacks were unavailable at the time Patterns of Global Terrorism 2001 went to press.
Dead
Wounded
510
25
6
21
12
11
5
6
23
47
240
90
1996
97
98
99
2000
01[c]

Figure 47

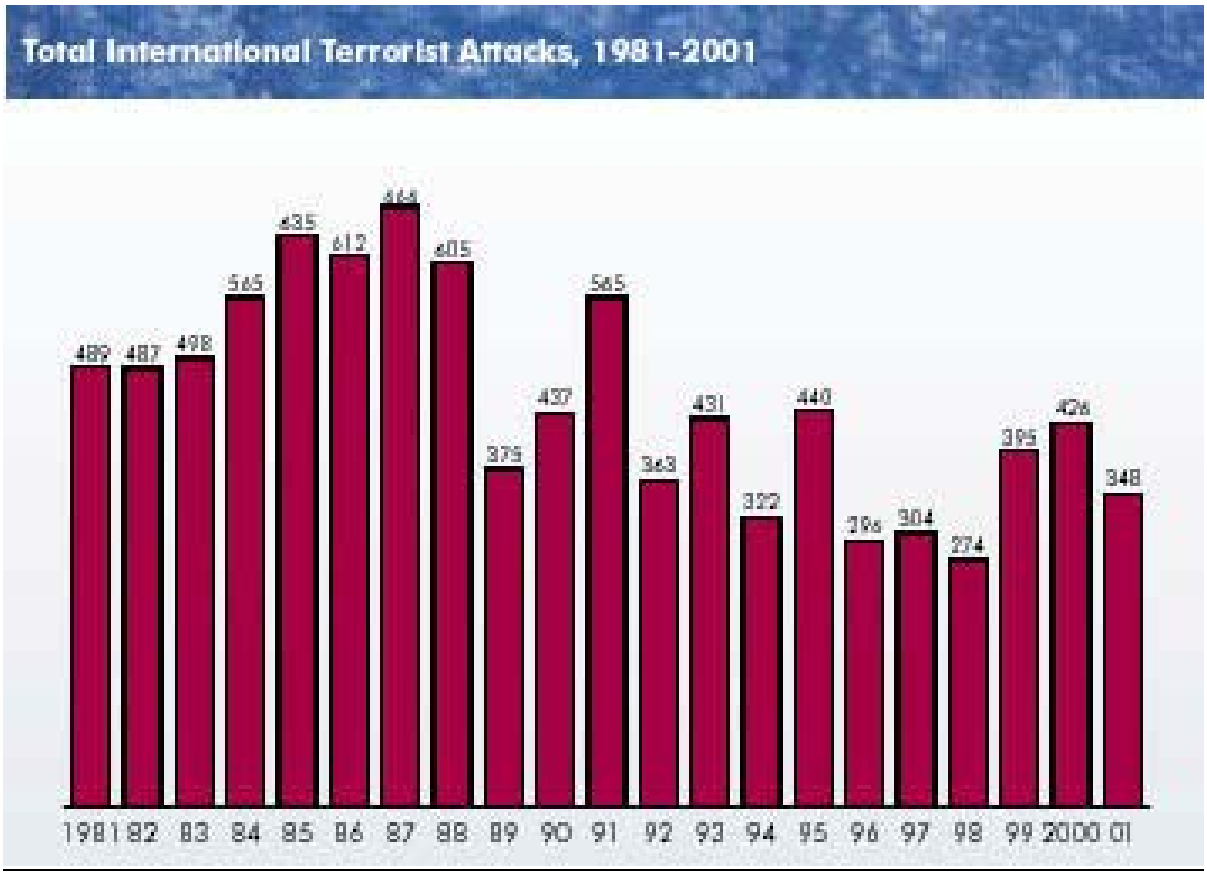

Total International Terrorist Attacks, 1981-2001
489
487
498
565
635
612
644
605
375
437
585
363
431
322
440
296
304
274
395
426
348
1981 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 2000 01

Figure 48

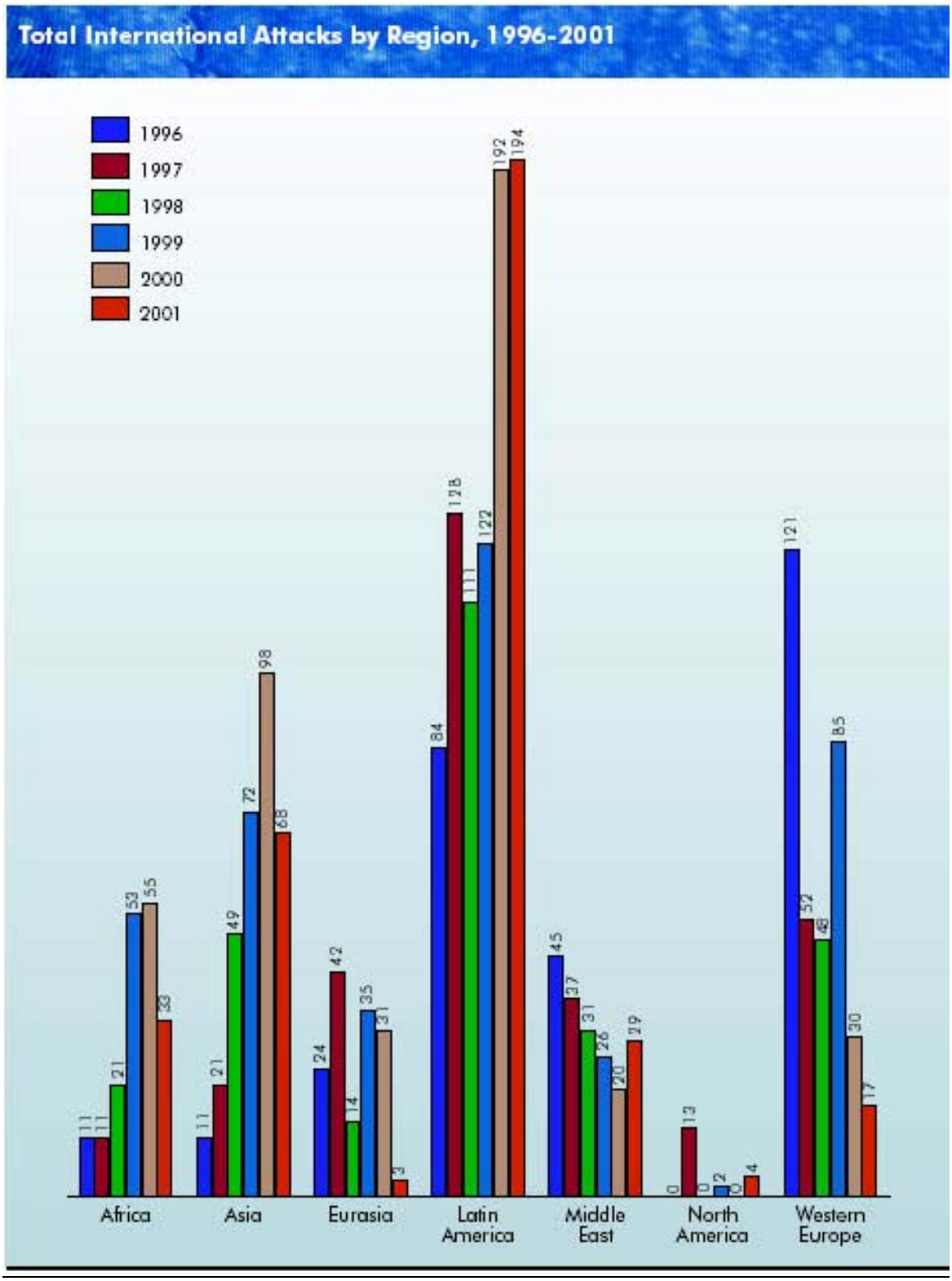

Total International Attacks by Region, 1996-2001
1996
1997
1998
1999
2000
2001
11
11
21
53
55
33
11
21
49
72
98
68
24
42
14
35
31
3
84
118
111
122
192
194
45
37
31
26
20
29
0
13
0
2
0
4
121
52
46
85
30
17
Africa
Asia
Eurasia
Latin America
Middle East
North America
Western Europe

Figure 49

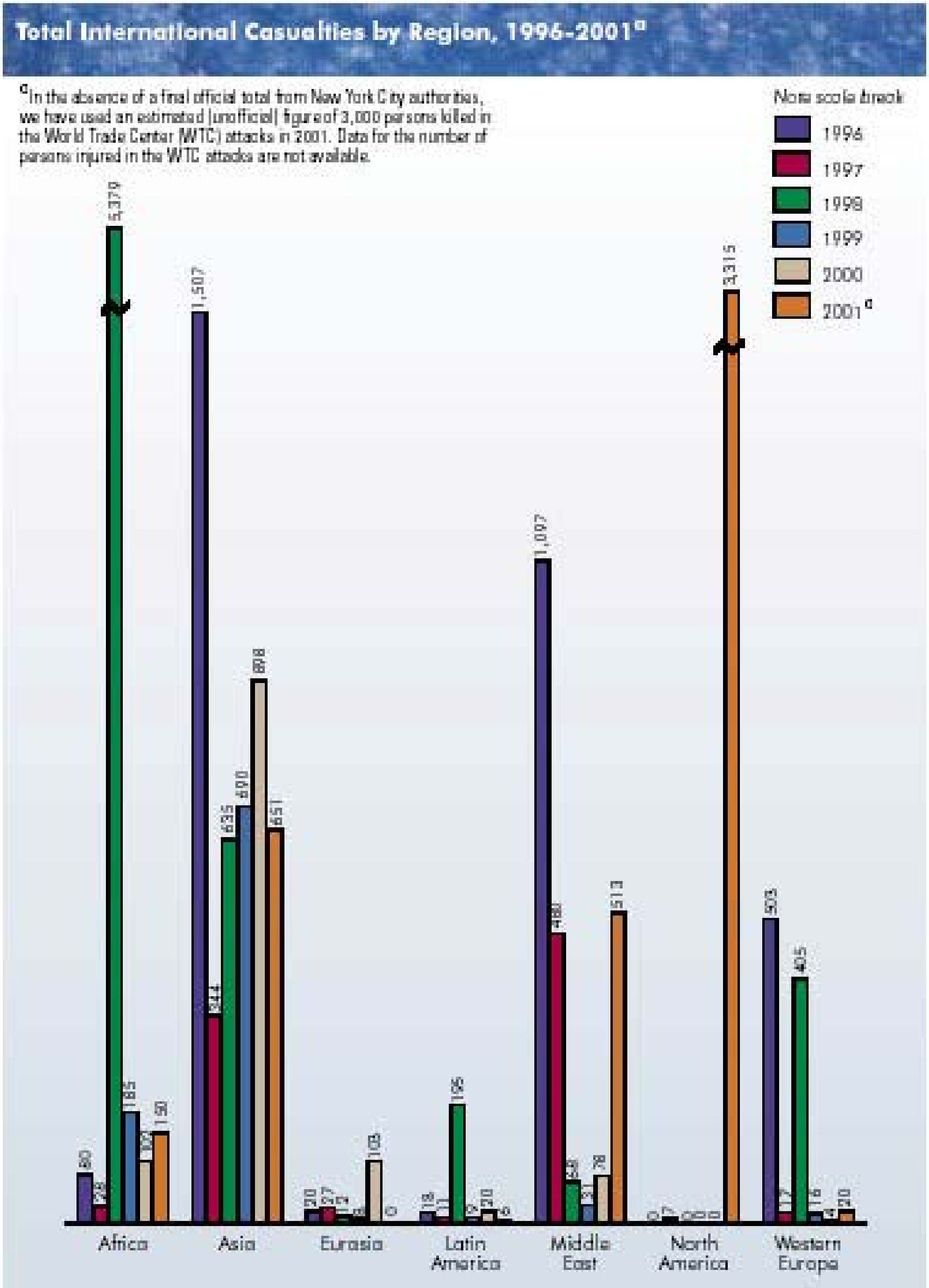

Total International Casualties by Region, 1996-2001[a]
[a]In the absence of a final official total from New York City authorities, we have used an estimated (unofficial) figure of 3,000 persons killed in the World Trade Center (WTC) attacks in 2001. Data for the number of persons injured in the WTC attacks are not available.
Note scale break
1996
1997
1998
1999
2000
2001[a]
5,379
1,507
344
635
690
898
651
185
150
80
103
195
1,097
480
513
3315
503
405
Africa
Asia
Eurasia
Latin America
Middle East
North America
Western Europe

Figure 50

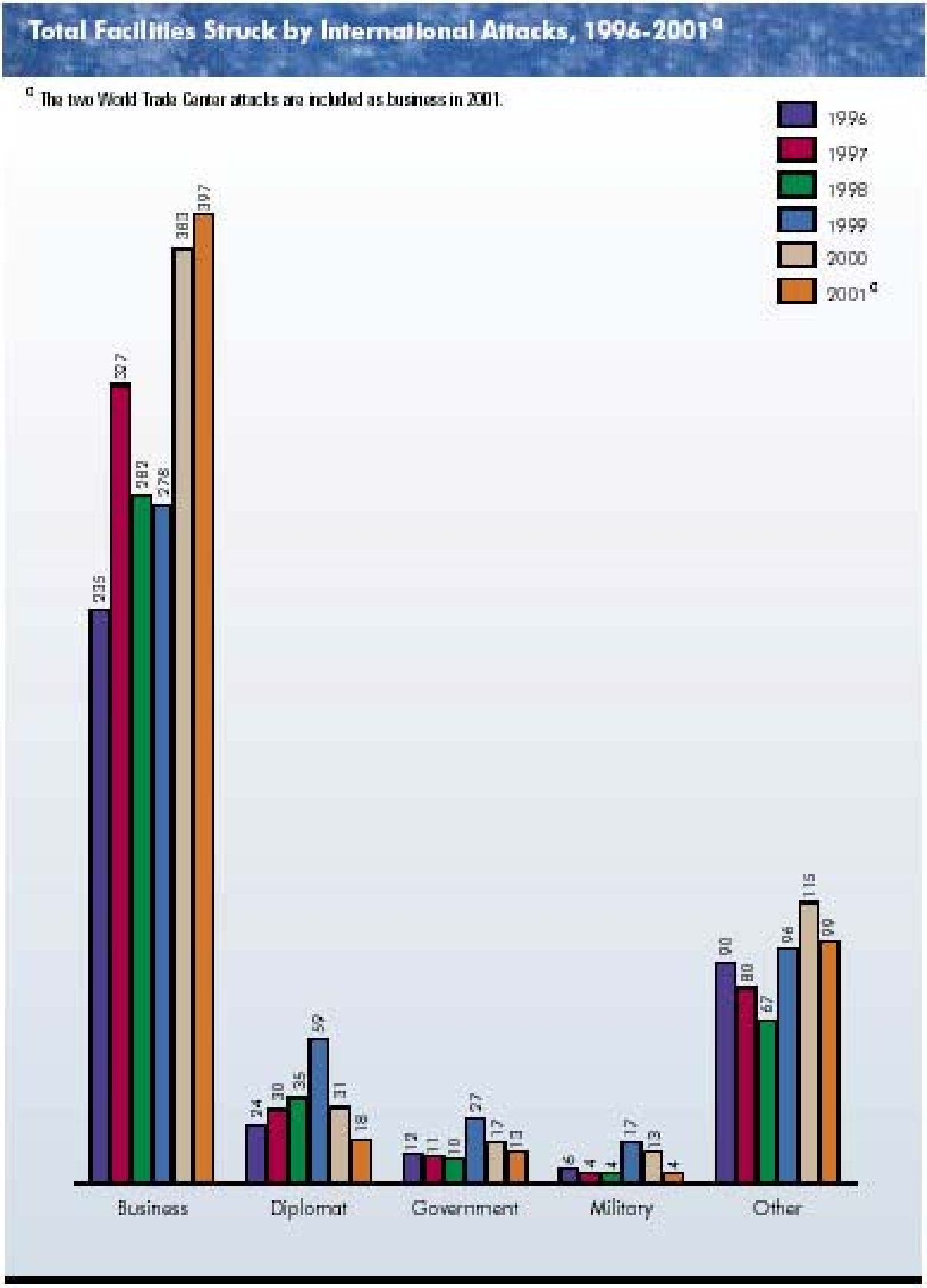

Total Facilities Struck by International Attacks, 1996-2001[a]
[a] The two World Trade Center attacks are included as business in 2001.
1996
1997
1998
1999
2000
2001[a]
235
327
282
278
383
387
24
30
35
59
31
18
12
11
10
27
17
13
6
4
4
17
13
4
90
80
67
96
115
99
Business
Diplomat
Government
Military
Other

Figure 51

VITA

Christine G. Sena

Christine G. Sena, a native of Medford, Massachusetts, received a Bachelor of Science degree cum laude in Landscape Architecture and City Planning from the University of Massachusetts, Amherst, in 1968. After working for a city planning firm in Cambridge, Massachusetts, she accepted a position as a landscape architect with the U.S. Forest Service in San Francisco, California. Various Forest Service projects included a visual resource management study of Mineral King, California, and a site plan for the Sawtooth National Recreation Area Visitor Center in Sun Valley, Idaho.

Other employment included work in environmental protection for the Federal Highway Administration in Boston, Massachusetts, and for the U.S. Coast Guard in Washington, D.C. She also worked as an engineering designer for Pacific Gas and Electric in San Francisco.

In 1978, Ms. Sena joined the U.S. Marshals Service in Washington, D.C., serving as the Chief of Facilities and advancing to program manager positions in Judicial Security and Protective Operations. In 1993, Ms. Sena was selected as the Chairperson for the Department of Justice National Performance Review Laboratory on Debt Collection. Ms. Sena served as liaison with the U.S. Department of State for foreign training; the U.S. Air Force Space Command, for the Missile Escort Program; the U.S. Navy, for security related facility support services; the U.S. Army, for security support services and the Department of Transportation National Transportation Systems Center, for transport security related studies. Ms. Sena was also project manager for the Justice Prisoner and Alien Transportation Center in Oklahoma City and a Special Ops Training Center in Louisiana. In 1991, she participated in a National Institute of Building Sciences task force which developed long range planning requirements for U.S. Courthouses and published the results in "The U.S. Courts Design Guide." She served as a member of the Science and Technology Working Group at the Office of National Drug Control Policy and acted as liaison with the Department of Interior committee supporting anti-crime initiatives in the Pacific Trust Territories.

Specialized training included NSA sponsored National Operations Security, FinCEN/Interpol Working Group on Financial Analysis, Fraud Investigation, Money Laundering and Criminal Intelligence Analysis. Prior to retiring from the Marshals Service in July 2002, Ms. Sena traveled to many Eastern and Central European countries to coordinate specialized training programs in protective operations.

Ms. Sena is a licensed Landscape Architect and is a member of the American Society of Landscape Architects. She maintains a residence in Edwards, Colorado, and has one daughter, Heather, who is an architect in Vail, Colorado.