5.1 GOALS OF THE DESIGN APPROACH

It is impractical to design a civilian structure to remain undamaged from a large explosion. The protective objectives are therefore related to the type of building and its function. For an office, retail, residential, or light industrial building, where the primary asset is the occupants, the objective is to minimize loss of life. Because of the severity of large scale explosion incidents, the goals are by necessity modest. Moreover, it is recognized that the building will be unusable after the event. This approach is considered a damage-limiting or damage-mitigating approach to design.

To save lives, the primary goals of the design professional are to reduce building damage and to prevent progressive collapse of the building, at least until it can be fully evacuated. A secondary goal is to maintain emergency functions until evacuation is complete.

The design professional is able to reduce building damage by incorporating access controls that allow building security to keep large threats away from the building and to limit charge weights that can be brought into the building.

Preventing the building from collapsing is the most important objective. Historically, the majority of fatalities that occur in terrorist attacks directed against buildings are due to building collapse. Collapse prevention begins with awareness by architects and engineers that structural integrity against collapse is important enough to be routinely considered in design. Features to improve general structural resistance to collapse can be incorporated into common buildings at affordable cost. At a higher level, designing the building to prevent progressive collapse can be accomplished by the alternate-path method (i.e., design for the building to remain standing following the removal of specific elements) or by direct design of components for air-blast loading.

Furthermore, building design may be optimized by facilitating evacuation, rescue, and recovery efforts through effective placement, structural design, and redundancy of emergency exits and critical mechanical/electrical systems. Through effective structural design, the overall damage levels may be reduced to make it easier it is for occupants to get out and emergency responders to safely enter.

Beyond the issues of preventing collapse, and facilitating evacuation/ rescue the objective is to reduce flying debris generated by failed exterior walls, windows and other components to reduce the severity of injuries and the risk of fatalities. This may be accomplished through selection of appropriate materials and use of capacity-design methods to proportion elements and connections. A well designed system will provide predictable damage modes, selected to minimize injuries. Finally, good anti-terrorist design is a multidisciplinary effort requiring the concerted efforts of the architect, structural engineer, security professional, and the other design team members. It is also critical for security design to be incorporated as early as possible in the design process to ensure a cost-effective, attractive solution.

5.2 SECURITY PRINCIPLES

This section provides some fundamental security concepts that place physical security into the context of overall facility security. The components of security include deception, intelligence, operational protection, and structural hardening. These components are interrelated (see Figure 5-1).

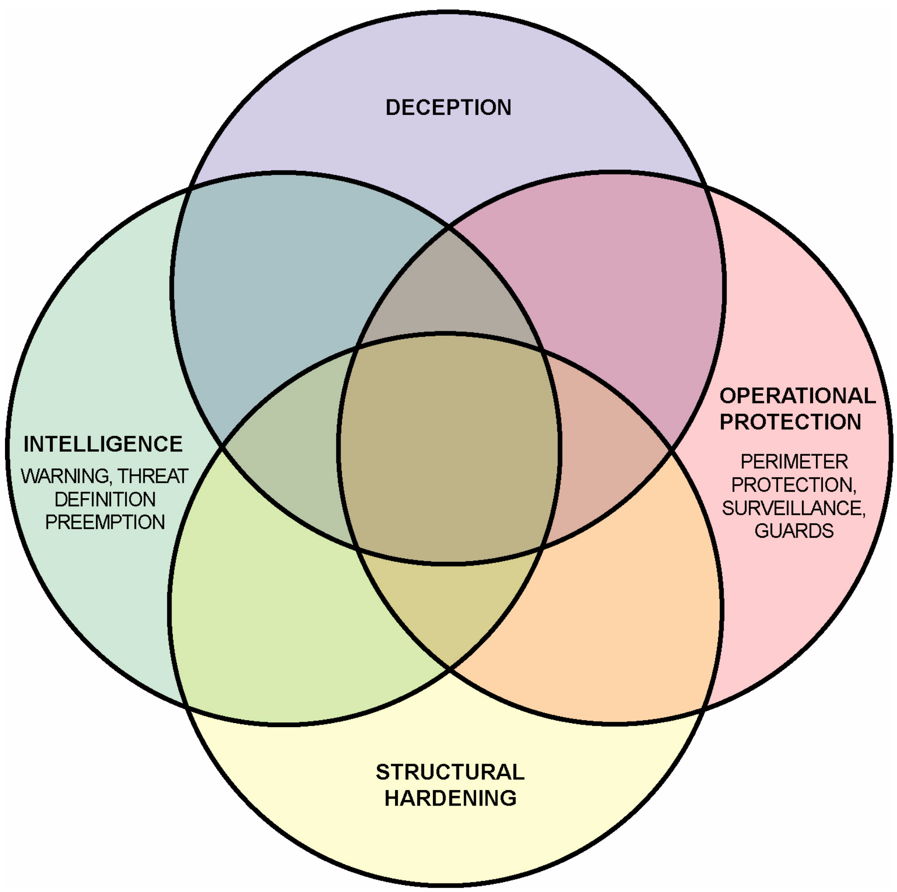

Figure 5-1 Components of security

Ideally, a potential terrorist attack is prevented or pre-empted through intelligence measures. If the attack does occur, physical security measures combine with operational forces (e.g., surveillance, guards, and sensors) to provide layers of defense that delay and/or thwart the attack. Deception may be used to make the facility appear to be a more protected or lower-risk facility than it actually is, thereby making it appear to be a less attractive target. Deception can also be used to misdirect the attacker to a portion of the facility that is non-critical. As a last resort, structural hardening is provided to save lives and facilitate evacuation and rescue by preventing building collapse and limiting flying debris.

Because of the interrelationship between physical and operational security measures, it is imperative for the owner and security professional to define early in the design process what extent of operational security is planned for various threat levels.

If properly implemented, physical security measures will contribute toward the goals listed below in prioritized order.

- *Preventing an attack.* By making it more difficult to implement some of the more obvious attack scenarios (such as a parked car in the street) or making the target appear to be of low value in terms of the amount of sensation that would be generated if it were attacked, the would-be attacker may become discouraged from targeting the building. On the other hand, it may not be advantageous to make the facility too obviously protected or not protected, for this may have the opposite of the intended affect and provide an incentive to attack the building.
- *Delaying the attack.* If an attack is initiated, properly designed landscape or architectural features can 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 possibly to stop the attack before it is executed. This is 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 serpentine path and/or a division of functions within the facility. Alternatively, through effective design, the attacker could be enticed to a non-critical part of the facility, thereby delaying the attack.
- *Mitigating the effects of the attack.* If these precautions are implemented and the attack still takes place, then structural protection efforts will serve to control the extent and consequences of damage. In the context of the overall security provided to the building, struc-

tural protection is a last resort that only becomes effective after all other efforts to stop the attack have failed. In the event of an attack, the benefits of enhancements to life-safety systems may be realized in lives saved.

An effective way to implement these goals is to create layers of security within the facility (see Figure 5-2). The outermost layer is the perimeter

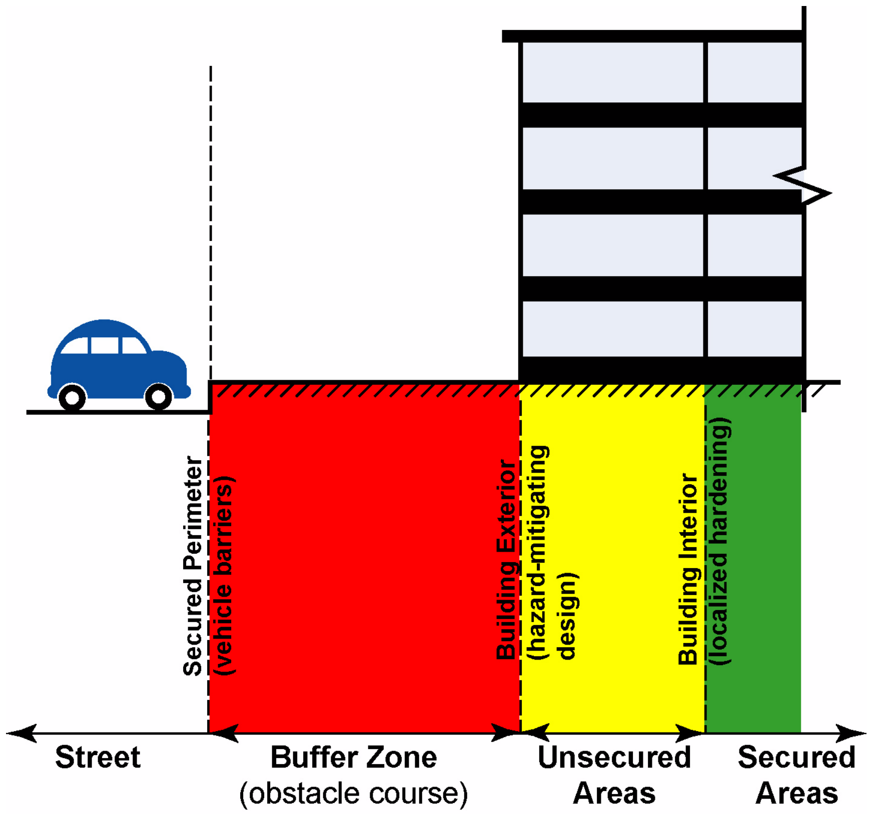

Figure 5-2 Schematic showing lines of defense against blast

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 into successively more protected zones, starting with publicly accessible areas such as the lobby and retail space, to the more private areas of offices, and finally the vital functions such as the 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. Having multiple lines of defense provides redundancy to the security system, adding robustness to the design. Also, by using this approach, not all of the focus is on the outer layer of protection, which may lead to an unattractive, fortress-like appearance.

To provide a reliable design, each ring must have a uniform level of security provided along its entire length; security is only as strong as the weakest link.

To have a balanced design, both physical and operational security measures need to be implemented in the facility. Architects and engineers can contribute to an effective physical security system, which augments and facilitates the operational security functions. If security measures are left as an afterthought, expensive, unattractive, and make-shift security posts are the inevitable result. For more information on security, refer to FEMA 426 (*Reference Manual to Mitigate Potential Terrorist Attacks in High-Occupancy Buildings*).

5.3 FURTHER READING

Listed below are sources for some of the existing protective design criteria prepared by the federal government using the damage-limiting approach.

Federal Aviation Administration, 2001, *Recommended Security Guidelines for Airport Planning, Design and Construction* (DOT/FAA/AR-00/52), Associate Administrator for Civil Aviation Security Office of Civil Aviation Security, Policy and Planning, Federal Aviation Administration, Washington, D.C.

Interagency Security Committee. 2001, *Security Design Criteria for New Federal Office Buildings and Major Modernization Projects*, Washington D.C. [For Official Use Only] http://www.oca.gsa.gov/restricted/protectedfiles/ISCCriteriaMay282001.PDF

U.S. Department of Defense, 2002, *DoD Minimum Antiterrorism Standards for Buildings.* Unified Facilities Criteria (UFC), UFC 4-010-01, Department of Defense, Washington, D.C. http://www.tisp.org/pugli-cation/pubdetails.cfm?&pubID=105

U.S. Department of State, Bureau of Diplomatic Security, *Architectural Engineering Design Guidelines* (5 Volumes) [For Official Use Only]