

# STEP 5: CONSIDER MITIGATION OPTIONS

## OVERVIEW

The fifth step in this How-To Guide is to identify and evaluate various mitigation options that are directly associated with, and responsive to, the major risks identified during Step 4 (see Figure 5-1). After the risk assessment process is completed, the stakeholders are frequently left with several areas where assets require mitigation measures and are limited by factors discussed in this step. Thus, decisions need to be made to focus the available resources on the most practical mitigation options.

The consider mitigation options process involves the following tasks:

- Identifying preliminary mitigation options
- Reviewing mitigation options
- Estimating cost
- Reviewing mitigation options, cost, and the layers of defense

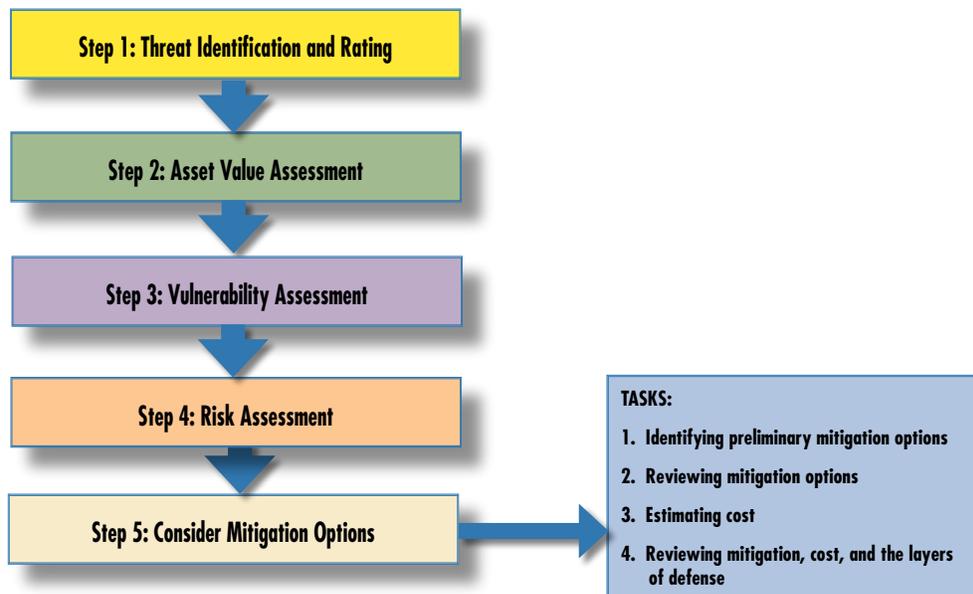


Figure 5-1 Steps and tasks

Step 5 emphasizes mitigation measures that can reduce the destructive effects against buildings in case of a terrorist attack. During this step, you will examine the mitigation options from the point of view of their effectiveness, acceptability, and feasibility with respect to prevailing implementation condi-

tions. The proposed procedure for examining the mitigation options is not meant to replace full and thorough analysis of the technical assessment; it is meant to help you narrow down your options and focus your attention on those measures that have the greatest chance of effective implementation.

Worksheets 4-3, 5-1, and 5-2 and the Building Vulnerability Assessment Checklist (Appendix A) should be used for the preparation of your mitigation options.

In order to identify, select, and implement the most appropriate mitigation measures, general mitigation goals and objectives, and the merits of each potential mitigation measure should be examined. The building owner may take the final decision regarding which mitigation measures should be implemented. However, engineers, architects, landscape architects, and other technical people should be involved in this process to ensure that the results of the risk assessment are met with sound mitigation measures that will increase the capability of the building to resist potential terrorist attacks.

To select, evaluate, and prioritize potential mitigation options, this How-To Guide has selected criteria that help to answer the following questions:

- Which mitigation measures are most appropriate for the types of risks faced by your assets?
- Are resources and capabilities sufficient to implement these measures and what additional resources might be needed?
- What impacts will the implementation of these measures have in areas surrounding your building(s) or in your community?

### **Identifying Preliminary Mitigation Options (Task 5.1)**

After the Assessment Team and building stakeholders know which assets are at greatest risk (see Step 4), they can then identify mitigation measures to reduce this risk. Because it is not possible to completely eliminate risk and every project has resource limitations, you must carefully analyze your mitigation options. Worksheet 5-1 and the remaining sections of Task 5.1 will help you to identify your preliminary mitigation options.

## Prioritized Observations from the Building Vulnerability Assessment Checklist

The Building Vulnerability Assessment Checklist (Appendix A) is the main source for identifying mitigation options. To identify your mitigation options you should start with the observations made in the Checklist when conducting the on-site assessment (see Task 3.2), but use your expertise and experience during the assessment to determine any vulnerabilities or mitigation options that may not be covered in the standard process. Then prioritize these observations as vulnerabilities (see Task 4.3). The remaining part of this task will help you to create a feasible framework for the identified observations.

## Regulatory Measures, Rehabilitation of Existing Structures, and Protective and Control Structures Parameters

Mitigation measures can be viewed from many different perspectives. In this How-To Guide, the emphasis is on addressing building infrastructure and core building functions. The purpose is to identify sound mitigation measures directed at reducing the effects of potential terrorist attacks on the built environment. For this task, three broad categories have been identified:

- Regulatory measures
- Repair and strengthening of existing structures
- Protective and control measures

**Regulatory Measures.** Regulatory measures include legal and other regulatory instruments that governments use to prevent, reduce, or prepare for the losses associated with manmade hazard events that affect commercial buildings, which are the central topic of this How-To Guide. Examples include:

- Legislation that organizes and distributes responsibilities to protect a community from manmade threats
- Regulations that reduce the financial and social impact of manmade hazards through measures, such as insurance
- New or updated design and construction codes
- New or modified land use and zoning regulations

- Incentives that provide inducements for implementing mitigation measures

In most cases, regulatory measures should be considered before implementing other measures because regulatory measures provide the framework for decision-making, organizing, and financing of mitigation actions.

**Repair and Strengthening of Existing Structures.** As its name implies, repair and strengthening deals with structural and non-structural modifications of existing buildings and infrastructure facilities. Although new construction can include protective measures to reduce the potential impact against terrorist attacks, existing buildings may be at risk because they were constructed without the appropriate safety measures to withstand potential terrorist attacks. Thus, improving the safety and structural integrity of existing buildings and infrastructure facilities is often the best way to reduce the impact of manmade events on such structures.

When a manmade hazard occurs, it can directly damage a target building or indirectly cause secondary effects in adjacent buildings. The level of damage is impacted by each structure's quality of design and construction. Poorly engineered and constructed buildings are usually not able to resist the forces generated by a blast event or serve as safe havens in case of CBR attacks.

**Protective and Control Measures.** Unlike other mitigation measures that improve the resistance of buildings and infrastructure to disasters, protective and control measures focus on protecting structures by deflecting the destructive forces from vulnerable structures and people.

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 (for more information, see Task 2.1). 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 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, because this may 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 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, 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, structural protection efforts will serve to control the extent and consequences of damage. In the context of the overall security provided to the building, structural 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.

The goal of the assessment process is to achieve the level of protection sought through implementation of mitigation measures in the building design. These measures may reduce risk by deterring, detecting, denying, or devaluing the potential threat element prior to or during execution of an enemy attack. The Department of Homeland Security uses the following methodology to achieve this purpose.

**Deter:** The process of making the target inaccessible or difficult to defeat with the weapon or tactic selected. It is usually accomplished at the site perimeter using highly visible electronic security systems, fencing, barriers, lighting, and security personnel and in the building by securing access with locks and electronic monitoring devices.

**Detect:** The process of using intelligence sharing and security services response to monitor and identify the threat before it penetrates the site perimeter or building access points.

**Deny:** The process of minimizing or delaying the degree of site or building infrastructure damage or loss of life or protecting assets by designing or using infrastructure and equipment designed to withstand blast and chemical, biological, or radiological effects.

**Devalue:** The process of making the site or building of little to no value or consequence, from the terrorists' perspective, such that an attack on the facility would not yield their desired result.

## **Reviewing Mitigation Options (Task 5.2)**

At this point, you should have identified a preliminary list of mitigation options. These options should have been grouped under the regulatory, rehabilitation, and protective and control framework for blast and CBR. The remaining sections of Task 5.2 provide a set of criteria to help you to narrow down the mitigation options identified during Task 5.1. Worksheet 5-2 will help you to analyze further your mitigation options in order to select those that are more feasible to be implemented. The selected criteria include the following:

### **Available Political Support**

Political support involves examining the proposed mitigation options by seeking the opinions of local and State elected officials, as well as the community as a whole. Most communities have learned that success of mitigation efforts hinges on political- and community-wide support. Building an effective political constituency for implementation of mitigation measures in most cases requires time and patience. However, some mitigation options will garner such support more easily than others.

### **Community Acceptance**

Community acceptance cannot be viewed separately from the need for political support for the proposed mitigation options. Both are necessary preconditions for their successful implementation. In many cases, community-wide campaigns are necessary to explain the risks, the reasons for, and the expected benefits from the proposed measures.

### **Cost**

Although the implementation of mitigation measures hinges on political commitment and technical capacity, it also depends heavily on the costs involved. After identifying your mitigation measures in Task 5.1, you will have some idea of the cost involved and opportunities for implementation.

### **Benefit**

When implementing a mitigation measure, it is important to consider that the benefit of implementing the option outweighs the cost. After identifying your mitigation measures in Task 5.1, you will have some idea of the benefits that may result from implementing your mitigation measures.

## **Available Financial Resources**

As you begin Task 5.2, it is important to have some knowledge of the available resources for implementing mitigation options. The Team should discuss this issue with the site and building owners because the amount of financial resources may define the type of mitigation options to be adopted. The Team should also discuss any Federal and State programs available for financing large-scale mitigation measures.

## **Legal Authority**

Without the appropriate legal authority, a mitigation action cannot lawfully be undertaken. You will need to determine whether the building owner has the legal authority to implement the selected mitigation options or whether it is necessary to wait for new laws or regulations. For example, creating stand-off distances in urban areas can be against zoning ordinances and building set-back requirements.

## **Adversely Affected Population**

While implementing your mitigation measures to solve problems related to blast and CBR resistance, you may want to consider that some segments of the population may be adversely affected. For example, the construction of barriers and bollards can inhibit the number of tourists visiting a particular city and might affect the community and the hospitality sector.

## **Adverse Effects on the Already Built Environment**

Some mitigation measures may have a negative effect on the already built environment. When selecting mitigation measures, the following should be strictly scrutinized:

- Effects on traffic/vehicular mobility
- Effects on pedestrian mobility
- Effects on ingress and egress to the building
- Effects on other building operations
- Effects on aesthetics
- Potential interference with first responders

## **Impact on the Environment**

When considering mitigation options, it is important to consider whether the recommended mitigation options will have a negative effect on environmental assets such as threatened and endangered species, wetlands, and other protected natural resources.

## **Technical Capacity**

Some mitigation measures require highly skilled and specialized engineering expertise for implementation. Although experts can be hired on a short-term basis, the technical complexity of some mitigation solutions may require the expertise for long-term maintenance. It is therefore necessary to examine the technical capacities of all stakeholders and identify key technical expertise needed for each proposed mitigation option. If adequate technical capabilities are available for proposed mitigation measures, you should rank them higher on your priority list.

## **Funding for Maintenance and Operations**

When considering the implementation of your mitigation options, you should be sure that funding is available for maintenance and operations.

## **Ease and Speed of Implementation**

Different mitigation measures require different kinds of authority for their implementation. The Team must identify public authorities and responsible agencies for implementing mitigation measures and must examine their rules and regulations. The Team must identify all legislative problem areas and institutional obstacles as well as the incentives that can facilitate mitigation and implementation. The Team will have to balance the desirability of the mitigation measure against the community's rules and regulations in order to decide which takes precedence.

## **Timeframe and Urgency**

Some mitigation measures require immediate implementation due to their nature (i.e., repetitive security breaches), political desire (i.e., platform project), or social perception (i.e., recent damage and disaster) of the risk. These perceptions can be the drivers to determining the timeframe for implementation of your mitigation options.

## **Short-term Solutions/Benefits**

When considering your mitigation options, you may want to evaluate your

short-term solutions (i.e., mitigation options that will solve a particular problem temporarily, but may require additional funding in the future for follow-on projects). A short-term solution can be quickly accomplished and can demonstrate immediate progress in satisfying your community needs.

## **Long-term Solutions/Benefits**

When considering your mitigation options, you may want to evaluate your long-term solutions (i.e., mitigation options that cannot be funded immediately, but will solve the problem permanently in the future when funds are available). A long-term solution can be more cost-effective in the long run than a short-term one.

## **Estimating Cost (Task 5.3)**

The initial construction cost of protection has two components: fixed and variable. Fixed costs include such items as security hardware and space requirements. These costs do not depend on the level of an attack (i.e., it costs the same to keep a truck away from a building regardless of whether the truck contains 500 or 5,000 pounds of TNT). Blast protection, on the other hand, is a variable cost. It depends on the threat level, which is a function of the explosive charge weight and the stand-off distance. Building designers have no control over the amount of explosives used, but are able to change the level of protection by defining an appropriate stand-off distance, adopting hardening measures for their buildings, and providing sacrificial spaces that can be affected by terrorist attacks, but, at the same time, can protect people and critical building functions and infrastructure.

The optimal stand-off distance is determined by defining the total cost of protection as the sum of the cost of protection (construction cost) and the cost of stand-off (land cost). These two costs are considered as a function of the stand-off for a given explosive charge weight. The cost of protection is assumed to be proportional to the peak reflected pressure at the building envelope while the cost of land is proportional to the square of the stand-off distance. The optimal level of protection is the one that minimizes the sum of these costs.

If additional land is not available to move the secured perimeter farther from the building, the required floor area of the building can be distributed among additional floors. As the number of floors is increased, the footprint decreases, providing an increased stand-off distance. By balancing the increasing cost of the structure (due to the added floors) and the corresponding decrease in protection cost (due to added stand-off), it is possible to

find the optimal number of floors to minimize the cost of protection.

These methods for establishing the best stand-off distance are generally used for the maximum credible explosive charge. If the cost of protection for this charge weight is not within the budgetary constraints, the design charge weight must be modified. A study can be conducted to determine the largest explosive yield and corresponding level of protection that can be incorporated into the building, given the available budget.

Although it is difficult to assign costs to different upgrade measures because they vary, based on the site-specific design, some generalizations can be made (see Figure 5-2). Below is a list of enhancements arranged in order from least expensive to most expensive:

- Hardening of unsecured areas
- Measures to prevent progressive collapse
- Exterior window and wall enhancements

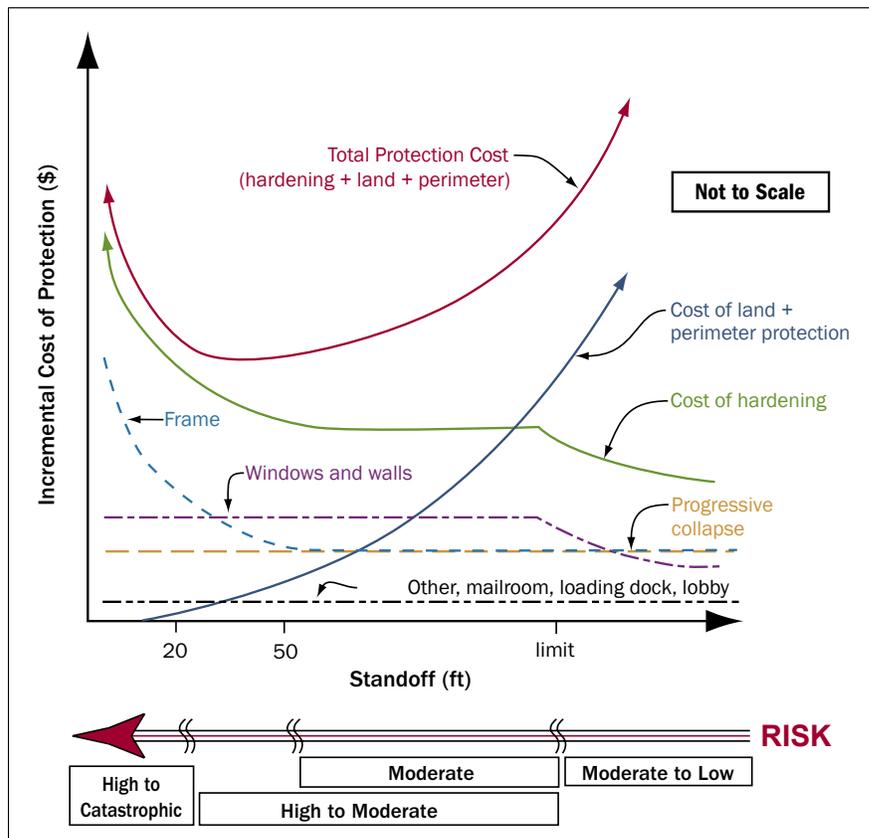


Figure 5-2 Cost considerations

## Life-Cycle Costs

Life-cycle costs need to be considered as well. For example, if it is decided that two guarded entrances will be provided, one for visitors and one for employees, they may cost more during the life of the building than a single well designed entrance serving everyone. Also, maintenance costs may need to be considered. For instance, the initial costs for a CBR detection system may be modest, but the maintenance costs are high. Finally, if the rentable square footage is reduced as a result of incorporating robustness into the building, this may have a large impact on the life-cycle costs.

## Setting Priorities

If the costs associated with mitigating manmade hazards are too high there are three approaches available that can be used to combination: (1) reduce the design threat, (2) reduce the level of protection, or (3) accept the risk. In some cases, the owner may decide to prioritize enhancements, based on their effectiveness in saving lives and reducing injuries. For instance, measures against progressive collapse are perhaps the most effective actions that can be implemented to save lives and should be considered above any other upgrades.

Laminated glass is perhaps the single most effective measure to reduce extensive non-fatal injuries. If the cost is still considered too great, and the risk is high because of the location or the high-profile nature of the building, then the best option may be to consider building an unobtrusive facility in a lower-risk area instead. In some cases (e.g., financial institutions with trading floors), business interruption costs are so high they outweigh all other concerns. In such a case, the most cost-effective solution may be to provide a redundant facility.

Early consideration of manmade hazards will significantly reduce the overall cost of protection and increase the inherent protection level provided to the building. If protection measures are considered as an afterthought or not considered until the design is nearly complete, the cost is likely to be greater, because more areas will need to be structurally hardened. An awareness of the threat of manmade hazards from the beginning of a project also helps the Team to determine early in the process what the priorities are for the facility. For instance, if extensive teak paneling of interior areas visible from the exterior is desired by the architect for the architectural expression of the building,

### NIST PUBLICATIONS

For more information on life-cycle cost, see: NISTIR 7025, *Applications of Life-Cycle Cost Analysis to Homeland Security Issues in Constructed Facilities: A Case Study*, and NISTIR 7073, *Cost-Effective Responses to Terrorist Risks in Constructed Facilities*.

For more information on setting priorities, see: NIST GCR 04-865, *Best Practices for Project Security*, and NIST GCR 04-871, *Risk Analysis for Extreme Events: Economic Incentives for Reducing Future Losses*.

Electronic copies of these reports are available at [www.bfrl.nist.gov/oe/oe.html](http://www.bfrl.nist.gov/oe/oe.html).

but the cost exceeds that of protective measures, then a decision needs to be made regarding the priorities of the project. Including protective measures as part of the discussion regarding trade-offs early in the design process often helps to clarify such issues.

## **Applicability of Benefit/Cost to Terrorist Threats**

When prioritizing hazard mitigation alternatives, a benefit/cost analysis is generally conducted for each proposed action. A benefit/cost analysis involves calculating the costs of the mitigation measure and weighing them against the intended benefits, frequently expressed as losses avoided. However, applying benefit/cost analysis to terrorist threats can be challenging due to the following three main factors (for more information on this subject, see FEMA 386-7, *Integrating Human-Caused Hazards Into Mitigation Planning*):

**The probability of an attack or frequency is not known.** The frequency factor is much more complex in the case of manmade hazards than for natural hazards. Although it is possible to estimate how often many natural disasters will occur (i.e., a structure located in the 100-year floodplain is considered to have a 1 percent chance of being flooded in any given year), it is very difficult to quantify the likelihood of a terrorist attack or technological disaster. Quantitative methods to estimate these probabilities are being developed, but have not yet been refined to the point where they can be used to determine incident probability on a facility-by-facility basis. The Assessment Team may use a qualitative approach based on threat and vulnerability considerations to estimate the relative likelihood of an attack or accident rather than the precise frequency. Such an approach is necessarily subjective, but can be combined with quantitative estimates of cost-effectiveness (the cost of an action compared to the value of the lives and property it saves in a worst-case scenario) to help illustrate the overall risk reduction achieved by a particular mitigation action.

**The deterrence rate may not be known.** The deterrence or preventive value of a measure cannot be calculated if the number of incidents it averts is not known. Deterrence in the case of terrorism may also have a secondary impact in that, after a potential target is hardened, a terrorist may turn to a less protected facility, changing the likelihood of an attack for both targets.

**The lifespan of the action may be difficult to quantify.** The lifespan of a mitigation action presents another problem when carrying out a benefit/cost analysis for terrorism and technological hazards. Future benefits are generally calculated for a natural hazard mitigation action in part by estimating the number of times the action will perform successfully over the course of its

useful life. However, some protective actions may be damaged or destroyed in a single manmade attack or accident. For example, blast-resistant window film may have performed to 100 percent effectiveness by preventing injuries from flying glass, but it may still need replacement after one “use.” Other actions, such as a building setback, cannot be “destroyed” or “used up” per se. This is in contrast to many natural hazard mitigation actions, where the effectiveness and life span of a structural retrofit or land use policy are easily understood and their value over time is quantifiable.

## **Improving the Accuracy of your Cost Estimates**

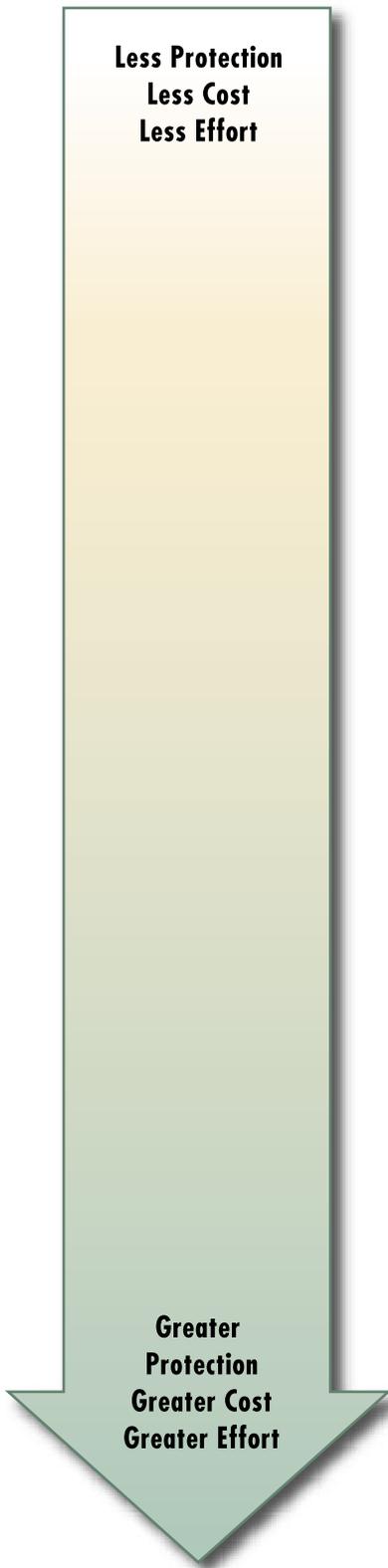
To improve the accuracy of your cost estimates, consult the Building Vulnerability Assessment Checklist in Appendix A. The Checklist follows the Construction Specifications Institute (CSI) format and cost estimates for infrastructure and equipment can be developed using industry standard applications and processes. Costing of mitigation options of physical security systems, blast-resistant materials and fixtures, and CBR protective sensors and devices is an emerging practice. A companion text to Appendix A is the RS Means Building Security; Strategies and Costs, which provides both a manual and an electronic costing approach.

## **Risk Assessment Database**

The Risk Assessment Database provides a simple cost field for each mitigation option and cost summary reporting capability. Appendix B provides an extensive explanation on the subject.

## **Mitigation, Cost, and the Layers of Defense (Task 5.4)**

A general spectrum of site mitigation measures ranging from the least protection, cost, and effort to the greatest protection, cost, and effort are provided in Figures 5-3 and 5-4. These mitigation measures have been arranged by layers of defense (second and third layers), following the principle that the layers of defense create a succeeding number of security layers more difficult to penetrate. The underlying purpose of this task is to provide you with examples of mitigation measures for each layer and give you a broad idea on the potential correlation between protection and cost.

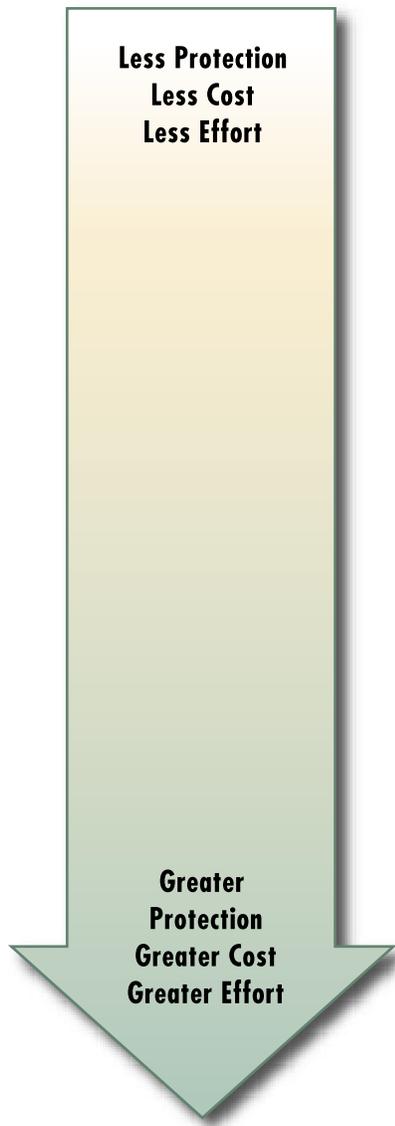


- Place trash receptacles as far away from the building as possible.
- Remove any dense vegetation that may screen covert activity.
- Use thorn-bearing plant materials to create natural barriers.
- Identify all critical resources in the area (fire and police stations, hospitals, etc.).
- Identify all potentially hazardous facilities in the area (nuclear plants, chemical labs, etc.).
- Use temporary passive barriers to eliminate straight-line vehicular access to high-risk buildings.
- Use vehicles as temporary physical barriers during elevated threat conditions.
- Make proper use of signs for traffic control, building entry control, etc. Minimize signs identifying high-risk areas.
- Introduce traffic calming techniques, including raised crosswalks, speed humps and speed tables, pavement treatments, bulbouts, and traffic circles.
- Identify, secure, and control access to all utility services to the building.
- Limit and control access to all crawl spaces, utility tunnels, and other means of under building access to prevent the planting of explosives.
- Utilize Geographic Information Systems (GIS) to assess adjacent land use.
- Provide open space inside the fence along the perimeter.
- Locate fuel storage tanks at least 100 feet from all buildings.
- Block sight lines through building orientation, landscaping, screening, and landforms.
- Use temporary and procedural measures to restrict parking and increase stand-off.
- Locate and consolidate high-risk land uses in the interior of the site.
- Select and design barriers based on threat levels.
- Maintain as much stand-off distance as possible from potential vehicle bombs.
- Separate redundant utility systems.
- Conduct periodic water testing to detect waterborne contaminants.
- Enclose the perimeter of the site. Create a single controlled entrance for vehicles (entry control point).
- Establish law enforcement or security force presence.
- Install quick connects for portable utility backup systems.
- Install security lighting.
- Install closed circuit television cameras.
- Mount all equipment to resist forces in any direction.
- Include security and protection measures in the calculation of land area requirements.
- Design and construct parking to provide adequate stand-off for vehicle bombs.
- Position buildings to permit occupants and security personnel to monitor the site.
- Do not site the building adjacent to potential threats or hazards.
- Locate critical building components away from the main entrance, vehicle circulation, parking, or maintenance area. Harden as appropriate.
- Provide a site-wide public address system and emergency call boxes at readily identified locations.
- Prohibit parking beneath or within a building.
- Design and construct access points at an angle to oncoming streets.
- Designate entry points for commercial and delivery vehicles away from high-risk areas.
- In urban areas with minimum stand-off, push the perimeter out to the edge of the sidewalk by means of bollards, planters, and other obstacles. In extreme cases, push the line farther outward by restricting or eliminating parking along the curb, eliminating loading zones, or through street closings. For this measure, you need to work with your local officials.
- Provide intrusion detection sensors for all utility services to the building.
- Provide redundant utility systems to support security, life safety, and rescue functions.
- Conceal and/or harden incoming utility systems.

Figure 5-3 Mitigation options for the second layer of defense



Figure 5-4 Mitigation options for the third layer of defense



- Treat exterior shear walls as primary structures.
- Orient glazing perpendicular to the primary façade facing uncontrolled vehicle approaches.
- Use reinforced concrete wall systems in lieu of masonry or curtain walls.
- Ensure active fire system is protected from single-point failure in case of a blast event.
- Install a Backup Control Center (BCC).
- Avoid eaves and overhangs or harden to withstand blast effects.
- Establish ground floor elevation 4 feet above grade.
- Avoid re-entrant corners on the building exterior.

Figure 5-4 Mitigation options for the third layer of defense (continued)

## WORKSHEET 5-1: PRELIMINARY MITIGATION OPTIONS

Prioritized Observations	Blast Regulatory Measures	CBR Regulatory Measures	Blast Repair and Strengthening of Existing Structures	CBR Repair and Strengthening of Existing Structures	Blast Protection and Control Measures	CBR Protection and Control Measures
	Observation 1					
Observation 2						
Observation 3						
Observation 4						
Observation 5						
Observation 6						
Observation 7						
Observation 8						
<b>Preliminary Mitigation Options for Blast</b>						
Mitigation 1						
Mitigation 2						
Mitigation 3						
Mitigation 4						
<b>Preliminary Mitigation Options for CBR</b>						
Mitigation 5						
Mitigation 6						
Mitigation 7						
Mitigation 8						

*Worksheet 5-1 will help to identify your preliminary mitigation options.*

*After you have prioritized your observations/vulnerabilities (Task 4.3), proceed to rank them for impact during blast and CBR events. Using the first part of the Worksheet (Prioritized Observations) indicate if these observations merit a regulatory, rehabilitation, and/or protective measure and if they directed at blast or CBR.*

*Using the second (Preliminary Mitigation Options for Blast) and third (Preliminary Mitigation Options for CBR) parts of the Worksheet, determine mitigation options that address the main concerns included in your observations and provided parameters.*

## WORKSHEET 5-2: PRELIMINARY MITIGATION OPTIONS

*Worksheet 5-2 will help you to identify a short list of mitigation options. Bring forward preliminary mitigation options from Worksheet 5-1 and review them against the list of criteria provided in the upper part of the worksheet. The selected criteria are described in Task 5.2. Mark with a plus “+” or a minus “-” as to whether your preliminary mitigation options have positive or negative impact. The lower portion of the worksheet is reserved for writing a short list of options as a result of the former exercise.*

	Available Political Support	Community Acceptance	Cost	Benefit	Available Financial Resources	Legal Authority	Adverse Effects on the Already Built Environment	Adversely Affected Population	Environmental Impact	Technical Capacity	Funding for Maintenance and Operations	Ease and Speed of Implementation	Timeframe and Urgency	Short-Term Solutions/Benefits	Long-Term Solutions/Benefits	Others
Mitigation 1																
Mitigation 2																
Mitigation 3																
Mitigation 4																
Mitigation 5																
Mitigation 6																
Mitigation 7																
<b>Short List of Mitigation Options for Blast</b>																
Option 1																
Option 2																
Option 3																
<b>Short List of Mitigation Options for CBR</b>																
Option 1																