



***Interim Department of Defense
Antiterrorism/Force Protection
Construction Standards***

December 16, 1999

***Deputy Under Secretary of Defense for
Installations***

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FOREWORD

This document is issued under the authority of DoD Instruction Number 0-2000.16, "DoD Combating Terrorism Program Standards," May 10, 1999. DoD Instruction 0-2000.16 established DoD Standard 20, which requires the development of antiterrorism/force protection guidelines for new construction. This interim standard implements the requirement to provide guidance for the minimum construction requirements that should be incorporated into all inhabited new construction and major renovations funded under the Military Construction (MILCON) appropriation.

This document applies to the Office of the Secretary of Defense (OSD); the Military Departments (including their National guard and Reserve components); the Chairman, Joint Chiefs of Staff and Joint Staff; the Combatant Commands; and the Defense Agencies (hereafter referred to collectively as "DoD Components").

This document is effective immediately and is mandatory for use by all the DoD Components.

Send recommended changes to this document to:

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Washington, DC 20301-3340

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REFERENCES

- (a) DoD Directive 5200.8R, "Physical Security Program," May, 1991.
- (b) DoD Instruction 2000.16, "DoD Combating Terrorism Program Standards," with Change 1, May 10, 1999.
- (c) FMR, Part 7000.14R, "DoD Financial Management Regulation," April 1998.
- (d) Technical Manual 5-853-1/Air Force Manual 32-1071, Volume 1, Security Engineering - Project Development (For Official Use Only), May 1994.
- (e) Technical Manual 5-853-2/Air Force Manual 32-1071, Volume 2, Security Engineering - Concept Design (For Official Use Only), May 1994.
- (f) Technical Manual 5-853-3/Air Force Manual 32-1071, Volume 3, Security Engineering - Final Design (For Official Use Only), May 1994.
- (g) Technical Instruction 809-4, Seismic Design for Buildings, December 1998.
- (h) Military Handbook 1013/1A, "Design Guidelines for Physical Security of Facilities," June 28, 1993.
- (i) User's Guide UG-2031-SHR, "User's Guide on Protection Against Terrorist Vehicle Bombs," June 1998.
- (j) User's Guide UG-2030-SHR, "User's Guide on Security Glazing Applications," June 1998.
- (k) U.S. Army Corps of Engineers Engineer Technical Letter 1110-3-498, "Design of Collective Protection Shelters to Resist Chemical, Biological, and Radiological (CBR) Agents," February 24, 1999.
- (l) U.S. Central Command Operations Order (OPORD) 97-01A, Appendix 2 to Annex C, Construction Standards (Secret), April 15, 1999.
- (m) U.S. European Command Antiterrorism/Force Protection Operations Order 99-01, Appendix 1 to Annex D, Force Protection Design Standards (For Official Use Only), May 18, 1999.
- (n) U.S. Pacific Command Antiterrorism Operations Order 5050-99, Tab B to Appendix 1 to Annex M, Construction Standards, February 10, 1999.
- (o) U.S. Southern Command Regulation 380-16, Appendix G, Military Construction Considerations, September 9, 1998.

DL1. DEFINITIONS

DL1.1. Terms used in this Manual are defined below:

DL1.1.1. Active Vehicle Barrier. A vehicle barrier which must be manually or automatically deployed in response to detection of a threat.

DL1.1.2. Aggressor. Any person seeking to compromise an asset. Aggressor categories include protesters, criminals, terrorists, and subversives.

DL1.1.3. Annealed Glass. The most common form of glass available. Depending on manufacturing techniques, it is also known as plate, float, or sheet glass.

DL1.1.4. Asset. A resource requiring protection. For this interim standard, the asset is limited to people.

DL1.1.5. Conventional Construction. Building construction including doors, windows, or manufacturers' components which is not designed to resist tools, weapons, or explosives but is designed to resist common environmental conditions.

DL1.1.6. DoD Personnel. Any U.S. military, DoD civilian, or family member.

DL1.1.7. Exclusive Standoff Zone. A controlled area surrounding a structure into which only service and delivery vehicles are allowed. The perimeter of this area is defined by perimeter barriers and is set at a standoff distance sufficient to reduce the blast effects of vehicle bomb detonations on the protected structure.

DL1.1.8. Facility. Any single building, project, or site.

DL1.1.9. Fragment Retention Film. A thin optically clear film applied to glass to minimize the spread of glass fragments when the glass is shattered. The film may also be treated with reflective coatings to provide obscuration.

DL1.1.10. Glazing. Glass, plastic, or composite sheets used in windows.

DL1.1.11. Inhabited Structure. Structures intended to be occupied by DoD personnel with a personnel density of greater than one person per 400 square feet. This density generally excludes industrial and storage facilities. This does not include guard type facilities, single and duplex detached family housing. It may include portions of structures in which not all areas have such population densities.

DL1.1.12. Laminated Glass. Two or more individual sheets of glass bonded together by a polyvinyl butyral (PVB) plastic interlayer.

DL1.1.13. Level of Protection. The degree to which an asset is protected against a tactic based on the asset's value. Levels of protection refer to the amount of damage a structure is allowed to sustain or the probability that an aggressor will be defeated by the protective system. Specific levels of protection are associated with each tactic.

DL1.1.14. Major Renovation. Modifications to buildings that cost in excess of 50 percent of the replacement cost of the building.

DL1.1.15. Minimum Standards. Protective measures to be applied to all inhabited structures or billeting or primary gathering structures regardless of the identified threat. These measures provide a degree of protection that will not preclude direct effects of blast, but will minimize collateral damage of buildings and people and will limit progressive collapse of structures. They add relatively little additional cost, and they may also facilitate future upgrades and deter acts of aggression.

DL1.1.16. Nonexclusive Standoff Zone. A controlled area used in conjunction with an exclusive standoff zone which provides less restrictive land use than an exclusive standoff zone. Cars (but not trucks) may be granted uncontrolled access to a nonexclusive standoff zone. The nonexclusive standoff zone perimeter is defined by barriers and set at a standoff distance sufficient to reduce the blast effects of a truck bomb detonation on the protected structure.

DL1.1.17. Passive Vehicle Barrier. Any perimeter barrier that serves the function of arresting or impeding vehicular movement and that is non-movable.

DL1.1.18. Perimeter Barrier. A fence, wall, passive vehicle barrier, landform, or line of vegetation applied along an exterior perimeter used to obscure vision, hinder personnel access, or hinder or prevent vehicle access.

DL1.1.19. Permanent Structure. All structures intended for use by DoD personnel for more than three years. They are normally, but not exclusively, structures designed with masonry exteriors.

DL1.1.20. Planning Team. The team responsible for criteria development on a project and for generating all of the necessary programming documents. The installation project planning team typically consists of a facilities planner, and representatives from security forces, force protection, intelligence, logistics, operations, and the facility user.

DL1.1.21. Primary Gathering Structures. A subset of inhabited structures in which 50 or more DoD personnel routinely gather (e.g., office buildings, and indoor recreation facilities).

DL1.1.22. Protective Measures. Elements of a protective system which protect an asset against a threat. Protective measures are divided into defensive and detection measures.

DL1.1.23. Protective System. An integration of all of the protective measures required to protect an asset against the range of threats applicable to the asset.

DL1.1.24. Standoff Distance. A distance maintained between a structure or inhabited portion of a structure and the potential location for an explosives detonation to reduce the explosives' blast effects on the structure. Standoff distances required vary with building component construction.

DL1.1.25. Tactics. The specific methods of achieving the aggressor's goals to injure personnel, destroy military assets, or steal military materiel or information.

DL1.1.26. Temporary Structures. Structures intended for use for a period of 3 years or less, and are not expeditionary. These structures are often capable of being relocated such as some pre-engineered buildings, trailers, and stress tension shelters.

DL1.1.27. Troop Billeting Structure. A subset of inhabited structures in which DoD personnel are billeted, not to include military family housing.

DL1.1.28. Threat Severity Levels. Levels within each tactic which correspond to different sets of tools, weapons, and explosives. The

severity of effects of the tools, weapons, and explosives increases with increasing threat severity levels.

C1. CHAPTER 1

CONSTRUCTION STANDARDS

C1.1. GENERAL.

C1.1.1. Recent terrorist attacks have demonstrated the vulnerability of U.S. military and civilian personnel and the facilities where they work and live. A heightened awareness of the terrorist threat has prompted the Department of Defense (DoD) to find methods to reduce injuries and death in the event of future attacks. To address that issue, DoD Instruction 2000.16 (reference a) established DoD Standard 20, which requires the development of antiterrorism/force protection guidelines for new construction. This interim standard partially implements that requirement.

C1.1.2. The purpose of this standard is to ensure that force protection standards are incorporated into the planning, programming, and budgeting for the design, and construction of Military Construction (MILCON) funded facilities. This interim standard will be updated with the completion of the first volume of the DoD Security Engineering Manual. This standard includes minimum construction requirements that will be incorporated into all inhabited new MILCON construction and major renovations regardless of the threat level. It also addresses measures that can be applied where higher threat levels apply. Inhabited structures are defined for the purposes of this standard as structures occupied by DoD personnel with a personnel density of greater than one person per 400 square feet. This density generally excludes industrial and storage facilities and also does not cover guard facilities or family housing. The standard also provides additional guidance for troop billeting and primary gathering structures, a special case of inhabited structures.

C1.1.3. This interim construction standard addresses what could effectively be addressed in the short term and what the Chairman of the Joint Chiefs of Staff wanted to be covered as soon as possible. It applies to all DoD agencies and services with MILCON programming, design, or construction responsibilities. It applies to new MILCON construction and major renovations for inhabited structures both within and outside the continental United States funded under the MILCON appropriation for fiscal year 2002 and beyond. This interim standard is the minimum set for DoD. Each Commander-in-Chief (CINC) may set more stringent AT/FP construction standards to meet the specific threats in that CINC's area of responsibility.

C1.2. SCOPE.

C1.2.1. This standard provides guidance to:

C1.2.1.1. Specify the planning, engineering, design, and construction criteria for incorporating force protection requirements into MILCON projects.

C1.2.1.2. Provide a process and a tool for incorporating force protection costs into DD Form 1391 for MILCON projects.

C1.2.2. This standard establishes minimum construction standards for all DoD inhabited structures with additional requirements for troop billeting and primary gathering structures.

C1.3. CONSTRUCTION STANDARDS.

C1.3.1. Minimum Standards. Minimum standards apply regardless of the identified threat. Where there is no specific threat identified and you meet minimum standoff distances in Appendix 2, add approximately 0.5 percent of facility cost for one- and two-story buildings, except for administrative buildings and 1 percent for administrative buildings and buildings of three or more stories). The minimum standards include application of effective layout or prudent use of elements not specifically required to mitigate threats. They also may facilitate future upgrades and increased threat conditions (THREATCON) and may deter acts of aggression. Minimum standards are addressed in detail in Appendix 2. Those measures are to be considered minimum construction standards that will be incorporated into all new construction and major renovations for inhabited structures. Appendix 2 includes additional protective measures for troop billeting and primary gathering structures, a critical subset of inhabited structures.

C1.3.2. Threat Specific Standards. In addition to the minimum standards described above this interim standard provides guidance for incorporating additional measures to mitigate specific threats. That guidance includes design strategies for mitigating the effects of specific aggressor tactics to defined levels of protection and the effect on building cost of applying those measures. Refer to Appendix 1 for design strategies and Appendices 3 and 4 for guidance on determining cost.

C1.4. RECORDING FORCE PROTECTION COSTS ON DD FORM 1391.

C1.4.1. The following provides interim guidance for recording costs for force protection on DD Form 1391 in accordance with DoD FMR 7000.14R (reference b). It should not supercede any service or agency guidance on filling out DD Form 1391. Instructions for determining the costs to which this paragraph refers are included in Appendix 4.

C1.4.1.1. Where there is no specific threat identified and one meets minimum standoff criteria in Appendix 2, add 0.5 percent to the primary facility costs for buildings of one or two stories and add 1 percent for buildings of three or more stories. There are instances where threat criteria costs may or may not be additive with the minimum standards costs. Table AP4.T3 summarizes the application of minimum criteria and multiple threat costs integration. Enter the percentage as described below.

C1.4.1.2. Where there is a specific threat identified, enter the enhanced construction cost for the building as a cost per square foot as a separate line item under “Primary Facility” on the DD Form 1391. The line item should be titled “Antiterrorism Force Protection/Physical Security Measures.” Those costs should include measures such as special structural improvements and bullet resistant glass, etc. They should not include costs for security measures that are mandated elsewhere.

C1.4.1.3. Where there is a specific threat identified that includes blast, the 0.5 to 1 % minimum criteria cost is included in the tables addressed in AP4.T4.

C1.4.1.4. Where there is a specific ballistics threat but not a blast threat, than the 0.5 to 1% minimum criteria cost must be added to the costs for ballistics protection. Where combination threats exist for both ballistics and blast, the cost tables values are additive.

C1.4.1.5. Where land acquisition serves a specific purpose such as providing standoff distance for force protection, the acquisition shall be listed as a separate antiterrorism/force protection line item under the primary facility.

C1.4.1.6. Where applicable, enter costs for site improvements for antiterrorism/force protection that are specifically applied to mitigate the effects of a threat (such as the vehicle barriers, fencing, berms, and landscaping, etc.) on a separate line item under “Supporting Facilities” on the DD Form 1391. Use the same title used for the primary facility.

C1.4.1.7. List the specific antiterrorism/force protection measures and considerations that the project provides in the applicable paragraph of the DD Form 1391 in accordance with component guidance. Include reference to the design criteria used to determine the enhanced costs.

C1.5. ADDITIONAL ASSISTANCE. Additional assistance in applying this standard is available from the sources listed in Table C1.T1.

Table C1.T1. List of Sources

Component	Organization	Point of Contact	Phone Number	E-Mail Address
DoD Agencies	Joint Staff (J-34)	LTC Vincent Kam	(703) 693-7551 ext 119	kamvw@js.pentagon.mil
Air Force	Air Force Civil Engineer Support Agency	Mr. James Lafrenz	(850) 283-6332	jim.lafrenz@afcesa.af.mil
Army	HQ Corps of Engineers	Mr. Ray Navidi	(202) 761-0223	ray.g.navidi@usace.army.mil
	Corps of Engineers Protective Design Center	Mr. Curt Betts	(402) 221-4918	curt.p.betts@usace.army.mil
Marine Corps	HQ U.S. Marine Corps (POS)	Capt Thomas Mockbee	(703) 614-4177 ext 114	Mockbeetb@hqmc.usmc.mil
	HQ U.S. Marine Corps Land Use and Military Construction Branch	Ms. Jane Brattain	(703) 695-8321	Brattainhj@hqmc.usmc.mil
Navy	NCIS/N-34	Mr. Bruce Bittenbender	(202) 433-9087	Bbitten@ncis.navy.mil
	Naval Facilities Engineering Service Center	Mr. Mitch Hardin	(805) 982-1571	hardinmd@nfesc.navy.mil

AP1. APPENDIX 1

PLANNING AND DESIGN STRATEGIES

AP1.1. INTRODUCTION. The design strategies presented in this appendix apply to the development of protective measures beyond the minimum standards. Summaries of design strategies are provided to help one understand the basis for determining the costs of mitigating the effects of the tactics included in this standard. They include both the basic design strategies and the more specific design strategies associated with different levels of protection. By understanding the levels of protection one will know what risks are associated with each level. These strategies are discussed in more detail in references d, e, and f.

AP1.2. VEHICLE BOMB TACTICS.

AP1.2.1. Vehicle bomb tactics include moving and stationary vehicle bombs. In both of these tactics, aggressors attack facilities to destroy, damage, injure, or kill people or assets within them using a vehicle laden with explosives. In the moving vehicle bomb tactic, the aggressor drives the vehicle into the target structure and detonates the explosives. In the stationary vehicle bomb tactic, the aggressor parks the vehicle near the structure and detonates the explosives remotely or by a time delay. When one threat severity level is selected, the threat also includes all lower threat severity levels. The basic design strategy and levels of protection are described below.

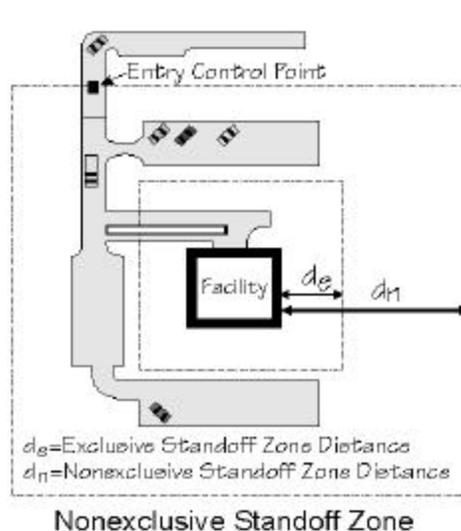
AP1.2.1.1. Standoff Distance. Blast pressures near an exploding vehicle bomb are very high, but they decrease rapidly with distance from the explosion. The design strategy for these tactics is to maintain as much standoff distance as possible between the vehicle bomb and the structure and then, if necessary, to harden the structure for the resulting blast pressures. The standoff distance will be considered to be the distance from the face of the target structure (at any point) to the point on the site at which you can effectively establish a perimeter within which you can control vehicle access. Alternatively, where there is an area of a structure that does not meet the requirements of an inhabited structure, that area can be considered to be part of the standoff distance. In that case, the standoff distance would be from the site perimeter to the face of that portion of the structure constituting the inhabited structure. The standoff distance is maintained by barriers on the perimeter of the resulting standoff zone. See the passive vehicle barrier cost graph in Appendix 4 (Table AP4.T.22.) to establish perimeter cost for a facility.

AP1.2.1.1.1. Exclusive Standoff Zone. Exclusive standoff zones may be used at all threat severity levels. Only emergency response, delivery, and service vehicles are allowed into the exclusive standoff zone. Give special consideration to allowing unimpeded access to the exclusive standoff zone for emergency response vehicles.

AP1.2.1.1.2. Nonexclusive Standoff Zone. Nonexclusive standoff zones may be used for the high, very high, and special case threat severity levels to minimize limitations on land use. Where the nonexclusive standoff zone is employed, it encloses an exclusive standoff zone. The inner perimeter is set at the distance associated with the 220 pound TNT threat and the outer perimeter is set at the distance associated with the truck bombs. Cars can enter the outer perimeter with only cursory visual searches, but are not allowed within the inner perimeter. Trucks cannot enter the outer perimeter without being searched. Note that these searches require manpower, which is not accounted for in this standard.

AP1.2.1.2. Vehicle Barriers. The difference between the moving and stationary vehicle bomb tactics is that the aggressor using the moving vehicle bomb tactic will attempt to crash through the vehicle barriers, and the aggressor using the stationary vehicle bomb tactic will not. Therefore, vehicle barriers for the moving vehicle bomb tactic must be capable of stopping the moving threat vehicle at the perimeter of the standoff zone. For the stationary vehicle bomb tactic, vehicle barriers must mark the perimeter of the standoff zone but are not required to stop the moving threat vehicle. Perimeter barriers extend around the entire perimeter ending only at entry points. They are applied for both non-exclusive and exclusive standoff zones. Active barriers are installed at all entry points and can be raised or lowered to allow vehicles to pass. See Figure AP1.F1. For barriers to resist the moving vehicle tactic, including means to slow vehicle approach will decrease the requirements for both perimeter and active vehicle barriers.

Figure AP1.F1. Nonexclusive Standoff Zone



AP1.2.1.3. Levels of Protection.

AP1.2.1.3.1. Low Level of Protection: Damaged, Unrepairable.

The structure or protected space will sustain a high degree of damage without collapse. Although collapse is prevented, occupants may be injured and other assets may be damaged but will survive. Damaged building components, including structural members, will require replacement. Depending on the scale of the blast damage, its location, and structure characteristics, the structure may be completely unrepairable, requiring demolition and replacement. The damage allowed may make surviving assets vulnerable to subsequent attack. Majority of personnel will suffer lacerations and blunt trauma from window glazing fragments and other non-structural debris.

AP1.2.1.3.1.1. Windows will break and be propelled into the room up to a few feet.

AP1.2.1.3.1.2. Doors will only be hollow metal.

AP1.2.1.3.2. Medium Level of Protection: Damaged, Repairable.

The structure or protected space will sustain a significant degree of damage, but the structure will be reusable. Occupants and other assets may sustain minor injuries or damage. Damaged building components other than structural members may require replacement, but damaged structural members can be repaired. Personnel will suffer mostly minor and some serious lacerations and blunt trauma from window glazing fragments and non-structural debris.

AP1.2.1.3.2.1. Windows will break, but will not fall out of the frame.

AP1.2.1.3.2.2. Doors will be blast resistant.

AP1.2.1.3.3. High Level of Protection: Superficial Damage.

The structure or protected space will sustain only superficial damage. Occupants and other assets will also incur only superficial injury or damage. Personnel will suffer only minor lacerations and blunt trauma from window glazing fragments and non-structural debris.

AP1.2.1.3.3.1. Windows will not break.

AP1.2.1.3.3.2. Doors will be blast resistant.

AP1.3. PLACED BOMB TACTIC.

In this tactic the aggressor carries an explosive device up to a structure, places it, and detonates it either remotely or on a time delay. The basic design strategy is to establish a standoff zone as for the vehicle bomb tactics and maintain it with a fence. Levels of protection are the same as the vehicle bomb tactics.

AP1.4. BALLISTICS TACTIC. In this tactic aggressors fire small arms at assets within the structure. The basic design strategy is dependent on the level of protection. The strategy for the low level of protection is predicated on the assumption that aggressors will not shoot at what they cannot see; therefore, protection is limited to obscuring the assets from views from outside the building. Obscuration might be achieved by installing reflective fragment retention film on the windows and glazed doors of the building or blocking sightlines from uncontrolled vantage points with vegetation, walls, or other structures. At the high level of protection the design strategy involves ensuring that all building components, including windows and doors are bullet resistant.

AP2. APPENDIX 2

DOD ANTITERRORISM/FORCE PROTECTION MINIMUM STANDARDS

AP2.1. SECURITY ENGINEERING STANDARD 1: SITEWORK.

AP2.1.1. Facility Access.

AP2.1.1.1. Eliminate, minimize, or mitigate lines of approach perpendicular to inhabited structures.

AP2.1.1.2. Minimize vehicle access points.

AP2.1.1.3. Coordinate with the installation master plan to site facilities with large non-DoD visitor populations away from inhabited structures where possible.

AP2.1.2. Facility Characteristics.

AP2.1.2.1. Avoid conditions within 30 feet of inhabited structures that permit concealment of aggressors or that would obscure the view of objects or packages 6 inches in height from the view of security personnel.

AP2.1.2.2. Minimize exposure to surveillance and observation of assets within inhabited structures from uncontrolled natural or man-made vantage points.

AP2.1.3. Facility Standoff / Separation. Facility standoff distances are intended to prevent the progressive collapse of structures. For all cases below, standoff distances will be to the face of that portion of a structure that meets the criteria of an inhabited structure or a troop billeting or primary gathering structure. Portions of structures with lesser occupancies may be located within the stated standoff distances. When the standoff distance is not available, select a cost for the low level of protection against a 50 pound TNT explosive at the available standoff. Costs to achieve the low level of protection are included in Appendix 4. For design purposes, design the structure to sustain an equivalent degree of damage to what it would experience from a 50 pound TNT explosive placed at 80 feet.

AP2.1.3.1. Maintain a minimum standoff distance of 80 feet from inhabited structures to installation perimeters.

AP2.1.3.2. For troop billeting and primary gathering structures, maintain a minimum standoff distance of 150 feet from the structures to installation perimeters.

AP2.1.3.3 Locate trash containers at least 30 feet from inhabited structures.

AP2.1.3.4. Locate trash containers at least 80 feet from troop billeting and primary gathering structures.

AP2.1.3.5. Maintain a minimum building separation of 50 feet for troop billeting and primary gathering structures.

AP2.2. SECURITY ENGINEERING STANDARD 2: PARKING AND ROADWAYS.

AP2.2.1. Parking beneath inhabited structures is strongly discouraged. If unavoidable, mitigate by designing columns assuming loss of lateral support at any one floor level (i.e., a laterally unsupported length equal to two stories) to avoid progressive collapse and control access to the parking structure.

AP2.2.2. To limit the possibility of progressive collapse, locate parking lots and roadways at least 30 feet from inhabited structures and 80 feet from troop billeting and primary gathering structures. The standoff distance from roadways is measured from the nearest edge of pavement. Portions of structures with lesser occupancies may be located within the stated standoff distance. When the standoff distance is not available, select a cost for the low level of protection against a 50 pound TNT explosive at the available standoff. Costs to achieve the low level of protection are included in Appendix 4. For design purposes, design the structure to sustain an equivalent degree of damage to what it would experience from a 50 pound TNT explosive placed at 80 feet.

AP2.3. SECURITY ENGINEERING STANDARD 3: BUILDING LAYOUT.

AP2.3.1. Minimize or mitigate exposure of personnel in inhabited structures to potential glass fragment hazards.

AP2.3.2. Design circulation within inhabited structures to provide detection of people approaching controlled areas or occupied spaces.

AP2.3.3. Locate activities with large non-DoD visitor populations within or around inhabited structures away from protected assets where possible.

AP2.3.4. When possible, position exterior doors on inhabited structures so they cannot be easily targeted from the installation perimeter or uncontrolled vantage points.

AP2.4. SECURITY ENGINEERING STANDARD 4: SUPERSTRUCTURE.

AP2.4.1. Structural. The intent of these requirements is to minimize the possibility of progressive collapse. Where these requirements cannot be met for major MILCON funded renovations or existing structures, design the renovation to provide as much mitigation as is practical.

AP2.4.1.1. For inhabited structures of three stories or more, use a moment resisting frame support system and design in structural redundancy that allows the loss of one primary vertical or one primary lateral load-carrying element without progressive collapse.

AP2.4.1.2. For all multistory inhabited structures, design all multistory vertical load carrying elements assuming loss of lateral support at any one floor level (i.e., a laterally unsupported length equal to two stories).

AP2.4.1.3. Exterior masonry walls will be reinforced in all inhabited structures.

AP2.4.1.4. On multistory inhabited structures, run concrete floor slab reinforcement continuously through both faces of the slab and into the beams and columns to improve capability to withstand load reversals.

AP2.4.1.5. Exterior walls in inhabited structures will employ one-way wall elements spanning vertically to minimize blast loads on columns.

AP2.4.1.6. Structurally separate portions of inhabited structures with lesser occupancies from the inhabited portions of the structure when portions with lesser occupancies are located within prescribed standoff distances.

AP2.4.2. Non-structural. Attach interior ceiling mounted fixtures to the supporting structural system (i.e., use seismic detailing from Technical Instruction 809-4) in inhabited structures. This includes suspended ceilings, light fixtures, and mechanical and electrical ducting and pipes.

AP2.4.3. Exterior Windows. For single glazed windows in inhabited structures, use a minimum of ¼-inch (6-mm) annealed laminated glass. For insulated glass units, the inner pane should be a minimum of ¼-inch (6-mm) annealed laminated glass.

AP2.4.4. Exterior Doors. Use a minimum of ¼-inch (6-mm) annealed laminated glass for exterior door glazing in inhabited structures.

AP2.5. SECURITY ENGINEERING STANDARD 5: MAILROOMS.

AP2.5.1. Avoid routing key utilities (including communications, fire detection and alarm, water mains, etc.) through or on common walls to mailrooms in inhabited structures.

AP2.5.2. Locate mailrooms on perimeters of inhabited structures.

AP2.6. SECURITY ENGINEERING STANDARD 6: MECHANICAL AND UTILITY SYSTEMS.

AP2.6.1. Locate air intakes above the first story ceiling (for two-story or higher inhabited structures) or on the roof of single-story inhabited structures , and restrict access to the intakes.

AP2.6.2. Control access to roofs of inhabited structures. Avoid external ladder access by providing entry from internal stairways or ladders such as in mechanical rooms. Alternatively, secure external ladders.

AP2.6.3. Include an emergency shutoff switch in the control system that immediately shuts down the heating, ventilation, and air conditioning (HVAC) system of inhabited structures.

AP2.6.4. Ensure that redundant utilities in inhabited structures do not run in the same locations or chases.

AP2.6.5. Secure exterior access to power/heat plants, gas mains, water supplies, communications, electrical service, or other support facilities or infrastructure.

AP2.6.6. Construct fire protection systems in inhabited structures using seismic detailing.

AP3. APPENDIX 3

THREAT SPECIFIC CONSTRUCTION GUIDANCE

AP3.1. THREAT SPECIFIC CONSTRUCTION GUIDANCE. The security engineering documents listed as references d through f and h (Army TM 5-853/Air Force AFMAN 32-1071 series and the Navy MIL HNDBK 1013/1A) provide detailed guidance for developing protective measures to mitigate the effects of the threats described by this standard. Those documents will be considered to be the acceptable means of implementing this standard and for developing protective measures for DoD assets associated with new construction and major renovations for inhabited structures. References i and j can also be used. In addition to the guidance presented in this standard and in its references, the costs for protection can be further optimized by having a qualified team perform vulnerability assessments of sites.

AP3.2. ANTITERRORISM/FORCE PROTECTION DESIGN CRITERIA

AP3.2.1. Planning and design criteria are developed and recommended for projects by local planning teams. These criteria must include the elements described below. Detailed discussion of these issues may be found in TM 5-853-1/AFMAN 32-1071, Volume 1 and MIL HNDBK 1013/1A. For areas within specific CINC's areas of operations, refer to the applicable CINC Operations Orders or regulations (references l through o) for guidance.

AP3.2.1.1. Assets. The user must identify the assets to be protected and the design criteria must be focused on those assets. This interim standard focuses on people as assets, as opposed to buildings, equipment, or other objects. It does not preclude providing antiterrorism/force protection for mission critical or otherwise important assets.

AP3.2.1.2. The Design Basis Threat. Threat that generates requirements for design must be described by the installation commander in terms of the tactics aggressors are likely to use in attempting to compromise assets and the weapons, tools, and explosives that they will use in carrying out those tactics. For this interim standard, those threats will be limited to explosives and ballistics threats. Additional threats will be addressed in the DoD Security Engineering Manual. The explosive threats in this standard may include both vehicle and placed bombs. The tactics and threat parameters addressed in this interim standard are described below. The specific

threat parameters associated with those tactics are described by threat severity levels of low, medium, high, very high, and special case as detailed in Table AP3.T1. Design basis threats are not the same as the National Threat Level Systems. While national level threats apply to a geographic area, design basis threats apply to specific assets within facilities.

AP3.2.1.2.1. Vehicle Bomb Tactic. This can take the form of either a moving or stationary vehicle bomb. In a moving vehicle bomb scenario an aggressor drives an explosive laden vehicle into a target structure or along a target perimeter road and detonates it. In the stationary vehicle bomb scenario the aggressor parks an explosive laden vehicle near a target structure, leaves, and detonates the explosive either remotely or on a time delay.

AP3.2.1.2.2. Placed Bomb Tactic. In this tactic the aggressor carries a man portable explosive to a structure and places it in a position near the structure. The bomb is either detonated remotely or via a time delay. This tactic is referred to as the exterior tactic in TM 5-853-1 / AFMAN 32-1071, Volume 1. It is included under the stationary tactic in MIL HNDBK 1013/1A.

Table AP3.T1. Threat Parameters (Interim Standard)

Tactic	Threat Severity Level	Weapon	Tool
Vehicle bomb	Special Case	20,000 pounds TNT	60,000-pound truck
(Moving and Stationary)			
	High	1000 pounds TNT	5000-pound truck
	Medium	500 pounds TNT	4000-pound car
	Low	220 pounds TNT	4000-pound car
	Minimum	50 pounds TNT	4000-pound car
Placed bomb		50 pounds TNT	
Mail bomb		2 pounds TNT	
Ballistics	Very high	7.62 mm Armor Piercing	
	High	7.62 mm	
	Medium	.44 Magnum	
	Low	.38 Special	

AP3.2.1.2.3. Mail Bomb. In this tactic aggressors deliver bombs or incendiary devices to the target in letters or packages.

AP3.2.1.2.4. Ballistics Tactic. In this tactic aggressors fire small arms at target facilities with the intent of hitting people inside the facilities.

AP3.2.1.2.5. Chemical, Biological, and Radiological Threats. These threats can come from a wartime attack, a terrorist attack, or from an industrial accident.

AP3.2.1.3. Levels of Protection. Levels of protection addressed by this interim standard reflect the degree to which the assets will be protected against the threat. These levels of protection reflect different levels of damage to inhabited structures and injury to occupants from the effects of specific tactics. These levels of protection provide protection beyond that provided by applying the minimum standards in appendix 2. They should be applied where a design basis threat is specified by an installation planning team. The levels of protection specific to each of the above tactics and the level of protection provided by applying the minimum standards are described in Table AP3.T2.

AP3.3. FORCE PROTECTION COST TOOLS.

AP3.3.1. Appendix 4 provides estimates of the costs of force protection enhancements for new construction projects subjected to threats described above. The costs in the blast tables include the costs of applying the minimum standards. The cost tables are for costs to achieve protection to levels of protection over and above those associated with applying the minimum measures in Appendix 2. The tables provide increases in the costs per square foot of floor space for a variety of construction baselines. There are separate tables for each of the threat parameters detailed above, and a separate chart for perimeter barrier costs. The costs in the cost tables reflect construction that will be adequate to mitigate the effects of the applicable threats to the applicable level of protection. Including these costs will identify funding required for force protection requirements.

Table AP3.T2. Levels of Protection

Tactic	Level of Protection	Potential Structure Damage	Potential Injury
Bombing tactics	Minimum	Significant damage, but no progressive collapse	Majority of personnel suffer serious injuries. There are likely to be a limited number of fatalities
	Low	Damaged – unreparable No collapse, but structural members will require replacement	Majority of personnel suffer lacerations and blunt trauma injuries from window glazing and non-structural elements
	Medium	Damaged - repairable Damaged structural elements can be repaired	Mostly minor and some serious lacerations and blunt trauma from window glazing and non-structural elements
	High	Superficial damage	Only superficial lacerations and blunt trauma from non-structural elements
Ballistics tactic	Low	Limited - screening	Unlikely
	High	Superficial – hardened	None

AP3.3.2. Costs for protection against mail bombs and chemical, biological, and radiological threats are not specifically addressed in this interim standard except as measures incorporated into the minimum standards.

AP3.3.3. Appendix 1 provides descriptions of the basic design strategies used in developing the protective measures that were used as the basis for the cost calculations. The protective measures include perimeter barriers and building components designed to resist weapons and explosives effects, including walls, doors, windows, and roofs. Understanding the design strategies allows the user to understand the basis for the costs.

AP4. APPENDIX 4

COST TOOLS

AP4.1. INTRODUCTION. These tools can be used in formulating costs for antiterrorism/ force protection for MILCON projects. They are only to be used in programming for new construction. This interim standard does not include cost increases for major renovations, which are likely to be higher than those for new construction.

AP4.2. FORMULATION OF TOOLS. The tools described in this appendix were developed by determining the ballistics and blast resistance of various “hardened” building components to applicable levels of protection and estimating the costs of buildings built using those components. The relative costs of the hardened buildings were tabulated as increases over baseline costs for six common building categories in terms of percentage cost increase per square foot of floor space. The relative costs reflect all construction, labor, and material costs for the buildings. They also include the costs of applying the minimum standards in appendix 2. The costs in the tables in this appendix must be corrected with area cost factors, building area factors, escalation, and any other special construction considerations commonly programmed into DD Forms 1391 at your installation or for the applicable type of facility. The baseline construction for walls, doors, windows, and roofs for each of the six building categories is summarized below. The six structure types selected represent a majority of recent military construction. They can be used to represent other structure types that are similar from the standpoint of function and basic construction.

Table AP4.T1. Baseline Construction

Structure Category	Building Component Construction			
	Walls	Doors	Windows	Roofs
288 Person Barracks (interior corridor) (3 stories) (115,000 gross sf)	Concrete masonry unit	3' X 7' Hollow metal and 6' X 7' glazed pairs	Aluminum frame / sliding	Standing seam metal
288 Person Barracks (exterior entrances) (3 stories) (102,000 gross sf)	Concrete masonry unit	3' X 7' Hollow metal and 6' X 7' glazed pairs	Aluminum frame / sliding	Standing seam metal
Dining Facility (1 story) (14,000 gross sf)	Brick veneer / metal stud	Hollow metal and glazed, 3' X 7' & 6' X 7' pairs	Aluminum frame / fixed	Standing seam metal
Administrative Facility (2 stories) (26,000 gross sf)	Brick veneer / metal stud	Hollow metal and glazed, 3' X 7' & 6' X 7' pairs	Aluminum frame / fixed, projected, & storefront	Standing seam metal
Medical Clinic (1 story) (40,000 gross sf)	Brick veneer / metal stud	Hollow metal and glazed, 3' X 7' & 6' X 7' pairs	Aluminum frame / fixed	Built-up roofing

Special Structures	Concrete masonry unit	Hollow metal and glazed, 6' X 7' pairs	Aluminum frame / fixed	Standing seam metal
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Table AP4.T2. Examples of Facility Construction Types Represented by Baseline

Baseline Structure	Occupancy Classification	Examples of Facility Construction Types Represented
Barracks, External Entrances	Housing	<ul style="list-style-type: none"> • Enlisted Barracks • Trainee Barracks • Transient Unaccompanied Personnel Housing • Unaccompanied Enlisted/NCO/Officers Quarters
Barracks, Internal Corridor	Housing	<ul style="list-style-type: none"> • Enlisted Barracks • Trainee Barracks • Transient Unaccompanied Personnel Housing • Unaccompanied Enlisted/NCO/Officers Quarters
Administration Facility	Office	<ul style="list-style-type: none"> • Airfield Operations Building • Aviation Unit Operations Building • • Brigade/Battalion/Company Headquarters • Cargo Handling Office Building • Community Services Center • Courtroom • Dispatch Building • Emergency Operations Center • Field Operations Building • National Guard/Reserve Center • School • Child Development Center • Ship Operations Building
Medical Clinic	Medical	<ul style="list-style-type: none"> • Ambulance Garage/Fire Station/Police Station • Dental Clinic • Laboratory • Medical Center/Hospital • Pharmacy • Red Cross Building • Troop Dispensary/Health Clinic • Veterinary Facility
DINING FACILITY	Services Facility	<ul style="list-style-type: none"> • Dining Facility • Drug/Alcohol Abuse Center • Laundry
Special Structures		<ul style="list-style-type: none"> • Auditoriums • Chapels • Gymnasiums • Theaters

AP4.3. USING THE TOOLS.

AP4.3.1. Using the construction cost increase tables.

AP4.3.1.1. Select a baseline structure category using Table AP4.T1 or AP4.T2. The baseline facility types can be extrapolated with Table AP4.T2. Then

select the table that applies to the bomb size or ballistics threat and level of protection that is being programmed using Table AP4.T3 and AP4.T4 as a guide for explosives or Table AP4-T20. for ballistics.

AP4.3.2. Using the tables for bomb threats.

AP4.3.2.1. Enter the table with the standoff distance (in feet) from the site perimeter to the standoff distance will be considered to be the distance from the face of the target structure (at any point) to the point on the site at which you can effectively establish a perimeter within which you can control vehicle access. Alternatively, where there is an area of a structure that does not meet the requirements of an inhabited structure, that area can be considered to be part of the standoff distance. In that case, the standoff distance would be from the site perimeter to the face of that portion of the structure constituting the inhabited structure.

AP4.3.2.2. Follow the line to the structure category that corresponds to your facility type. That cost increase (as a percentage of the square foot cost) will correspond to the cost above “conventional construction” to provide the construction required to mitigate the postulated design basis threat to the applicable level of protection.

AP4.3.2.3. Multiply the percentage cost increase per square foot by the square foot cost for the baseline construction for the planned facility. That cost may be the baseline cost for the type of facility being programmed as found in the Military Construction Pricing Guide or other baseline cost guidance. Because these costs are presented as percentages, they are not specific to any particular year and do not have to be escalated separately from the total project cost.

AP4.3.3. Using the tables for ballistic threats.

AP4.3.3.1. Select Table AP4-T20 for the appropriate level of protection (high or low).

AP4.3.3.2. For the low level of protection, select the percentage cost increase that corresponds to your structure type.

AP4.3.3.3. For the high level of protection, select the percentage cost increase for your structure under the desired threat severity level.

AP4.3.4. Using the vehicle barrier cost chart (Figure AP4.F1.). This chart is only necessary when the moving vehicle bomb tactics apply. Note that the costs in this chart are current for Calendar Year 1999. Application for future years will require cost escalation factors.

AP4.3.4.1. Perimeter Barriers. Use the standoff distance used above to estimate the total perimeter vehicle barrier cost. Read the total cost associated with that standoff distance from figure AP4.F1 for the vehicle applicable barrier rating (refer to Table AP4.T21). Alternatively, determine perimeter length and apply the unit cost in Table AP4.T21.

AP4.3.4.2. Active Barriers.

AP4.3.4.2.1. Assume the number of egress and ingress locations through the perimeter based on traffic volume. The barrier costs as tabulated are for a 12-foot traffic lane. Commonly an entry point will have two lanes, each of which needs a barrier.

AP4.3.4.2.2. Enter the active vehicle barrier Table AP4.T22. and multiply the cost by the number of lanes assumed.

AP4.3.5. Multiple Tactic Costs. Costs associated with protecting a structure from more than one threat (i.e., ballistics and explosives) will be considered to be multiple tactic costs. In this interim standard, the costs for multiple tactics are conservatively considered to be additive. Table AP4.T3 provides a guide on the integration of multiple threats and designates costs that should be combined for the total estimate.

AP4.3.6. Vehicle Bomb Example. Consider a 288-person barracks with interior corridors for which the planning team has postulated a low threat severity level (220 pounds TNT) for the moving vehicle bomb threat. The required level of protection is low. The baseline cost is \$142 per square foot from the Military Construction Pricing Guide. The available standoff distance is limited to approximately 80 feet. Based on expected traffic to the facility, assume you will need 4 entry/exit lanes through the perimeter.

AP4.3.6.1. Determine the additional construction cost for the primary facility.

AP4.3.6.1.1. Select Table AP4.T8 that corresponds to the 220-pound explosive/low level of protection for the 288-person barracks with interior corridors.

AP4.3.6.1.2. Enter the table at the available standoff distance of 80 feet.

AP4.3.6.1.3. Read across the table to the column that corresponds with baseline facility type (barracks interior corridor) to find the percentage cost “increase.” In this example it is 3.1 percent.

AP4.3.6.1.4. Determine the additional cost. 3.1 percent X \$142 per square foot is \$4.40 per square foot additional cost. That additional cost would be entered into the DD Form 1391 on the force protection line item under “primary facility.”

AP4.3.6.2. Determine the vehicle barrier costs.

AP4.3.6.2.1. Determine the perimeter barrier costs by entering the perimeter barrier Figure AP4.F1. with 80 feet of standoff distance.

AP4.3.6.2.2. Read Figure AP4.F1 for an estimate for the low level of protection at 80 ft standoff: \$70,000.

AP4.3.6.3. Refer to the active barrier Table AP4.T22 at the low to medium rating and read \$25,000 per lane. Multiply \$25,000 by four lanes for a total of \$100K.

AP4.3.6.4. Total Vehicle Barrier Cost. Add the passive vehicle barrier system \$70,000 to the active vehicle barrier system \$100,000 for a total of \$170,000.

AP4.3.7. Multiple Threat Example. There is a requirement to build a dining facility that will provide a high level of protection against a medium severity level ballistic threat and a medium level of protection against a 1000-pound explosive device. Available unencumbered land will make it possible to place a perimeter around the building at a 300-foot standoff distance. The perimeter must stop a 15,000-pound truck traveling at speeds of up to 30 miles per hour. The building perimeter must have two entrances and two exits.

AP4.3.7.1. Vehicle Barrier Costs.

AP4.3.7.1.1. Active vehicle barrier cost. From Table AP4.T22, each entrance and exit lane will require an active vehicle barrier that costs approximately \$25,000. Therefore, since two entrance barriers and two exit barriers are required, \$100,000 should be planned for procurement and installation of four active vehicle barriers located around the perimeter.

AP4.3.7.1.2. Passive Vehicle Barrier Cost. From Figure AP4.F1., the passive barrier system cost for a building requiring 300 feet of standoff is \$140,000

AP4.3.7.1.3. Total vehicle barrier cost for active and passive barrier systems.

System	\$ 140,000 – Passive Vehicle Perimeter Barrier
	<u>\$ 100,000 – Active Vehicle Barrier Systems</u>
	\$ 240,000 – Total Vehicle Barrier Cost

AP4.3.7.2. Structure Hardening Cost to Protect against Explosive Attack. From Table AP4.T15, (1000 lbs TNT medium level of protection) the cost increase per square foot of floor space for a DINING FACILITY with 300 feet of standoff is 10 percent. Assuming that the average cost per square foot for a DINING FACILITY is \$209.65 per square foot, the increase is $(0.10 \times \$209.65/\text{SF} = \$20.96/\text{SF})$.

AP4.3.7.3. Structure Hardening Cost to Protect against Ballistic Attack. From Table AP4.T20, the cost per square foot increase is 3.9 percent for a DINING FACILITY that requires a high level of protection against a medium threat severity level ballistic attack. Assuming that the average cost per square foot for a DINING FACILITY is \$209.65 per square foot, the increase is $0.039 \times \$209.65/\text{SF} = \$8.18/\text{SF}$.

AP4.3.7.4. Total Facility Hardening Cost.

Ballistics Threat Cost Increase ----	\$ 8.18/SF
Explosives Threat Cost Increase --	\$20.96/SF
Total Cost Increase -----	\$29.14/SF

AP4.3.7.5. Estimated Costs for Antiterrorism/Force Protection.

\$ 240,000 – Total vehicle barrier cost

\$ 29.14/SF – Estimated additional cost of the DINING FACILITY with ballistic and blast protection.

Table AP4.T3. Minimum Criteria and Multiple Threat Costs Integration

Costs to be Included				
Criteria	Standard Cost 0.5 - 1.0 %	Blast Tables Cost AP4.T4	Ballistics Table Cost AP4.T20	Vehicle Barrier AP4.T21&22 and/or AP4.F1
Minimum Standards	X			
Minimum, Standoff not met		X		
Blast Threat		X		
Ballistics Threat	X		X	
Blast and Ballistics		X	X	
Blast with vehicle		X		X
Blast with vehicle and ballistics		X	X	X

Table AP4.T4. Index of Tables for Various Bomb Sizes and Levels of Protection

	Levels of Protection		
<u>TNT</u>	<u>Low</u>	<u>Medium</u>	<u>High</u>
50 LBS	AP4.T5	AP4.T6	AP4.T7
220 LBS	AP4.T8	AP4.T9	AP4.T10
500 LBS	AP4.T11	AP4.T12	AP4.T13
1,000 LBS	AP4.T14	AP4.T15	AP4.T16
20,000 LBS	AP4.T17	AP4.T18	AP4.T19

Table AP4.T5. 50 lbs TNT Low Level of Protection

STANDOFF DISTANCE IN FEET	Percentage Building Cost Increase					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTURE
30-34	4.7	4.6	10.3	20.5	8.0	6.7
35-39	3.4	3.3	9.0	12.7	6.8	4.8
40-49	3.3	3.2	8.9	12.1	6.7	4.6
50-69	2.8	2.7	8.5	10.3	6.3	4.2
70-89	2.8	2.7	8.4	10.0	6.2	4.1
90-149	2.7	2.5	8.3	9.5	6.1	4.0
150-	2.1	2.0	7.3	7.4	4.7	4.0

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Table AP4.T6. 50 lbs TNT Medium Level of Protection

STANDOFF DISTANCE IN FEET	Percentage Building Cost Increase					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTURE
30-34	26.7	6.7	11.9	24.7	15.4	14.1
35-37	26.2	6.2	11.4	21.6	14.8	13.3
38-39	25.8	5.7	11.1	21.0	14.6	12.1
40-45	25.0	5.0	10.3	16.4	13.8	11.0
46-49	17.5	4.3	9.0	14.5	12.0	8.7
50-62	17.3	4.1	8.8	13.0	11.7	8.3
63-74	17.0	3.9	8.6	12.7	11.6	8.2
75-89	17.0	3.8	8.5	12.4	11.5	8.1
90-99	2.7	2.6	6.1	9.5	8.3	4.0
100-149	2.6	2.5	6.1	9.2	8.3	3.9
150-	2.1	2.0	4.7	7.0	7.3	3.9

Table AP4.T7. 50 lbs TNT High Level of Protection

STANDOFF DISTANCE IN FEET	<i>Percentage Building Cost Increase</i>					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTURE
30-31	28.7	8.7	14.1	27.7	17.3	20.4
32-34	28.4	8.3	13.8	27.2	17.0	19.2
35-37	27.3	7.3	12.8	23.2	16.1	16.7
38-39	26.7	6.7	12.1	22.3	15.7	14.7
40-42	26.5	6.4	11.9	22.0	15.5	13.8
43-45	26.2	6.2	11.4	21.6	14.8	13.3
46-50	18.8	5.6	10.2	20.3	13.2	11.2
51-74	17.4	4.2	8.9	13.7	11.9	8.5
75-79	17.3	4.1	8.8	13	11.7	8.3
80-89	17.2	4.0	8.7	12.7	11.7	8.2
90-109	2.8	2.7	6.2	10.0	8.4	4.1
110-149	2.6	2.5	6.1	9.2	8.3	3.9
150-	2.1	2.0	4.7	7.0	7.3	3.9

Table AP4.T8. 220 lbs TNT Low Level of Protection

STANDOFF DISTANCE IN FEET	Percentage Building Cost Increase					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTURE
40-43	7.6	7.5	11.1	27.1	13.1	15.1
44-45	7.3	7.1	10.8	26.5	12.8	13.8
46-47	6.8	6.6	10.3	25.7	12.4	12.1
48-49	6.5	6.3	9.8	25.3	11.8	11.6
50-51	4.6	4.5	8.1	14.5	9.9	8.9
52-53	4.0	3.9	7.5	13.6	9.5	6.9
54-64	3.6	3.5	7.1	12.4	9.2	5.8
65-70	3.6	3.5	7.0	12.0	9.1	5.7
71-74	3.2	3.1	6.7	11.5	8.8	4.5
75-89	3.2	3.1	6.6	11.3	8.8	4.5
90-109	3.1	3.0	6.5	11.0	8.7	4.4
110-124	3.1	3.0	6.5	10.6	8.6	4.4
125-129	2.8	2.7	6.3	10.3	8.5	4.2
130-339	2.8	2.7	6.2	10.0	8.4	4.1
180-339	2.6	2.5	6.1	9.2	8.3	3.9
340-	2.1	2.0	4.7	7.0	7.3	3.9

Table AP4.T9. 220 lbs TNT Medium Level of Protection

STANDOFF DISTANCE IN FEET	Percentage Building Cost Increase					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTURE
40-42	60.6	13.3	21.1	38.4	25.6	35.3
43-45	58.8	11.5	19.4	35.8	24.3	29.6
46-49	44.0	10.4	17.0	33.2	21.0	25.4
50-54	42.2	8.5	15.3	22.4	19.2	22.7
55-57	42.0	8.4	15.2	21.6	19.0	22.7
58-59	41.7	8.0	14.8	21.0	18.7	21.2
60-64	41.2	7.5	14.3	20.3	18.4	19.5
65-68	41.1	7.4	14.2	19.9	18.3	19.4
69-81	40.2	6.6	13.4	18.6	17.7	16.6
82-87	39.9	6.3	12.8	18.0	17.0	15.9
88-89	25.1	5.1	10.5	15.5	13.8	11.8
90-109	24.7	4.7	10.1	14.6	13.5	10.5
110-147	24.7	4.7	10.0	14.3	13.4	10.4
148-149	17.3	4.1	8.8	13.0	11.7	8.3
150-165	17.2	4.0	8.7	12.7	11.7	8.2
166-179	17.0	3.8	8.5	12.4	11.5	8.1
180-189	2.8	2.7	6.2	10.0	8.4	4.1
190-339	2.6	2.5	6.1	9.2	8.3	3.9
340	2.1	2.0	4.7	7.0	7.3	3.9

Table AP4.T10. 220 lbs TNT High Level of Protection

STANDOFF DISTANCE IN FEET	Percentage Building Cost Increase					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTURE
39	61.7	14.4	22.6	40.1	27.1	38.6
40-41	61.3	14.0	21.9	39.4	26.1	37.8
42-45	60.6	13.3	21.1	38.4	25.6	35.3
46-49	45.8	12.1	18.8	35.9	22.3	31.2
50-52	44.0	10.4	17.2	25.6	20.6	28.6
53-71	42.3	8.7	15.4	23.0	19.3	22.9
72-74	41.7	8.0	14.8	22.1	18.8	20.8
75-83	41.2	7.5	14.3	20.3	18.4	19.5
84-87	40.3	6.7	13.4	19.0	17.8	16.7
88-99	25.5	5.5	11.0	16.5	14.5	12.5
100-114	25.4	5.4	10.9	15.9	14.4	12.3
115-147	24.8	4.8	10.1	14.9	13.5	10.6
148-159	17.4	4.2	8.9	13.7	11.9	8.5
160-179	17.2	4.0	8.8	12.7	11.8	8.3
180-199	3.0	2.9	6.5	10.3	8.6	4.2
200-214	2.9	2.8	6.3	9.5	8.4	4.0
214-339	2.6	2.5	6.1	9.2	8.3	3.9
340-	2.1	2.0	4.7	7.0	7.3	3.9

Table AP4.T11. 500 lbs TNT Low Level of Protection

STANDOFF DISTANCE IN FEET	<i>Percentage Building Cost Increase</i>					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTURE
50-53	7.6	7.4	11.2	18.9	12.5	18.2
54-68	5.9	5.7	9.5	16.3	11.3	12.5
69-72	5.2	5.1	8.8	15.4	10.8	10.4
73-74	4.9	4.8	8.6	14.9	10.6	9.4
75-83	4.8	4.6	8.4	14.1	10.4	9.2
84-87	4.2	4.1	7.8	13.2	10.0	7.2
88-89	3.6	3.5	7.1	12.4	9.2	5.8
90-115	3.6	3.5	7.0	12.0	9.1	5.7
116-119	3.2	3.1	6.6	11.3	8.8	4.5
120-149	3.1	3.0	6.6	11.0	8.8	4.4
150-189	3.1	3.0	6.5	10.6	8.6	4.3
190-207	3.0	2.9	6.4	10.3	8.6	4.2
208-278	2.8	2.7	6.2	10.0	8.4	4.1
279-519	2.6	2.5	6.1	9.2	8.3	3.9
520-	2.1	2.0	4.7	7.0	7.3	3.9

Table AP4.T12. 500 lbs TNT Medium Level of Protection

STANDOFF DISTANCE IN FEET	Percentage Building Cost Increase					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTURE
50-51	81.6	13.9	23.7	32.4	29.1	41.3
52-59	80.9	13.2	23.0	31.3	28.6	38.9
60-68	66.1	12.0	20.6	28.8	25.3	34.7
69-74	64.4	10.3	18.9	26.3	24.1	29.0
75-89	56.9	9.6	17.6	24.1	22.3	26.7
90-91	56.2	8.9	16.9	22.8	21.8	24.5
92-99	55.9	8.6	16.6	22.4	21.5	23.6
100-104	55.8	8.6	16.5	22.1	21.5	23.5
105-107	41.0	7.4	14.2	19.6	18.3	19.3
108-119	40.2	6.6	13.3	18.4	17.7	16.5
120-129	40.2	6.5	13.3	18.1	17.6	16.4
130-144	39.9	6.2	12.8	17.7	17.0	15.9
145-149	39.5	5.9	12.4	17.1	16.7	14.7
150-209	39.5	5.8	12.4	16.8	16.7	14.6
210-266	24.6	4.6	10.0	14.0	13.4	10.4
267-269	24.7	4.4	9.7	13.6	13.1	10.2
270-354	24.2	4.2	9.6	12.8	13.0	10.0
355-449	16.8	3.7	8.4	11.6	11.4	7.9
450-518	2.6	2.5	6.1	9.2	8.3	3.9
520-	2.1	2.0	4.7	7.8	7.3	3.9

Table AP4.T13. 500 lbs TNT High Level of Protection

STANDOFF DISTANCE IN FEET	Percentage Building Cost Increase					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTURE
50-51	84.2	16.4	26.7	42.0	32.6	46.2
52-59	83.5	15.7	25.8	41.0	31.5	44.5
60-65	67.6	13.4	22.4	32.3	27.2	38.4
66-69	66.9	12.8	21.7	31.3	26.7	36.1
70-71	66.7	12.5	21.5	30.0	26.5	35.8
72-74	66.2	12.1	20.7	29.3	25.4	34.9
75-79	58.8	11.5	19.5	28.1	23.8	32.8
80-104	57.1	9.8	17.8	25.5	22.6	27.0
105-106	42.1	8.4	15.2	21.6	19.1	22.5
107-109	41.5	7.8	14.6	20.7	18.7	20.5
110-129	41.2	7.5	14.3	20.3	18.4	19.5
130-139	40.3	6.7	13.4	19.0	17.8	16.7
140-174	40.2	6.6	13.3	18.4	17.7	16.5
175-189	39.9	6.2	13.0	17.8	17.4	15.3
190-209	39.6	5.9	12.5	17.4	16.8	14.8
210-224	24.8	4.8	10.1	14.9	13.5	10.6
225-229	24.7	4.7	10.0	14.3	13.4	10.4
230-289	24.6	4.6	10.0	14.0	13.4	10.4
290-341	24.5	4.5	9.8	13.2	13.2	10.1
342-354	24.2	4.2	9.6	12.8	13.0	10.0
355-449	16.8	3.7	8.4	11.6	11.4	7.9
450-519	2.6	2.5	6.1	9.2	8.3	3.9
520-	2.1	2.0	4.7	7.0	7.3	3.9

Table AP4.T14. 1000 lbs TNT Low Level of Protection

STANDOFF DISTANCE IN FEET	Percentage Building Cost Increase					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTURE
50-54	8.4	8.2	12.1	20.1	13.1	20.9
55-59	8.3	8.1	11.9	19.9	13.0	20.6
60-80	7.6	7.4	11.2	18.9	12.5	18.2
81-99	5.8	5.7	9.4	16.3	11.2	12.4
100-103	5.7	5.5	9.3	15.4	11.1	12.2
104-109	5.1	4.9	8.7	14.5	10.6	10.2
110-119	4.8	4.6	8.4	14.1	10.4	9.2
120-122	4.7	4.6	8.4	13.7	10.4	9.1
123-124	4.1	4.0	7.8	12.8	9.9	7.1
125-134	3.8	3.7	7.5	12.2	9.7	6.2
135-149	3.5	3.4	7.0	11.8	9.1	5.7
150-169	3.5	3.4	7.0	11.5	9.0	5.6
170-184	3.1	3.3	6.6	11.0	8.8	4.4
185-249	3.1	3.0	6.5	10.7	8.7	4.3
250-309	3.0	2.9	6.4	10.3	8.6	4.2
310-339	2.8	2.7	6.2	10.0	8.4	4.1
340-739	2.6	2.5	6.1	9.2	8.3	3.9
740-	2.1	2.0	4.7	7.0	7.3	3.9

Table AP4.T15. 1000 lbs TNT Medium Level of Protection

STANDOFF DISTANCE IN FEET	Percentage Building Cost Increase					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTUR E
50-54	82.9	15.1	25.5	34.2	31.3	44.3
55-62	82.6	14.8	25.2	33.7	31.0	43.2
63-69	82.2	14.4	24.6	33.2	30.2	42.5
70-74	81.7	14.0	23.8	32.5	29.1	41.7
75-94	66.1	12.0	20.6	28.8	25.3	34.7
95-97	58.7	11.4	19.5	27.6	23.7	32.7
98-99	57.0	9.7	17.7	25.0	22.5	26.9
100-119	56.9	9.6	17.6	24.1	22.3	26.7
120-127	56.8	9.5	17.5	23.7	22.2	26.5
128-129	56.1	8.9	16.8	22.6	21.7	24.5
130-131	41.3	7.7	14.5	20.1	18.5	20.3
132-149	41.1	7.4	14.2	19.6	18.3	19.3
150-169	40.4	6.8	13.5	18.1	17.8	17.3
170-184	40.2	6.5	13.3	18.1	17.6	16.4
185-199	40.1	6.5	13.2	17.8	17.6	16.3
200-209	39.8	6.2	12.7	17.4	16.9	15.8
210-219	39.5	5.8	12.4	16.8	16.7	14.6
220-269	24.7	4.7	10.0	14.3	13.4	10.4
270-349	24.6	4.6	10.0	14.0	13.4	10.4
350-399	24.5	4.5	9.8	13.1	13.2	10.1
400-437	24.2	4.2	9.6	12.8	13.0	10.0
438-562	16.8	3.7	8.4	11.6	11.4	7.9
563-739	2.6	2.5	6.1	9.2	8.3	3.9
740-	2.1	2.0	4.7	7.0	7.3	3.9

Table AP4.T16. 1000 lbs TNT High Level of Protection

STANDOFF DISTANCE IN FEET	Percentage Building Cost Increase					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTUR E
60-62	84.9	17.1	27.5	45.3	33.5	47.4
63-64	84.7	16.9	27.2	45.0	33.1	47.0
65-69	84.5	16.7	27.0	43.6	32.9	46.6
70-74	83.9	16.1	26.4	41.5	32.4	45.2
75-89	68.1	13.9	23.1	33.0	28.1	39.5
90-94	67.4	13.2	22.2	31.0	27.0	38.1
95-110	59.3	12.0	20.3	28.7	24.8	33.7
111-119	57.6	10.3	18.6	26.2	23.6	27.9
120-124	57.1	9.8	17.8	25.5	22.6	27.0
125-129	56.9	9.6	17.6	24.1	22.3	26.7
130-148	42.1	8.4	15.2	21.6	19.1	22.5
149-174	42.1	7.9	15.2	20.7	19.1	20.5
175-178	41.1	7.4	14.2	19.6	18.3	19.3
179-219	40.2	6.6	13.3	18.4	17.7	16.5
220-244	25.4	5.4	10.9	15.9	14.4	12.3
245-289	25.1	5.1	10.6	15.3	14.2	11.1
290-299	24.9	4.9	10.4	14.4	14.0	10.9
300-379	24.6	4.6	10.0	14.0	13.4	10.4
380-437	24.5	4.5	9.8	13.2	13.2	10.1
438-489	17.1	3.9	8.6	11.9	11.6	8.1
490-739	16.9	3.7	8.4	11.6	11.5	8.0
740-	2.1	2.0	4.7	7.0	7.3	3.9

Table AP4.T17. 20,000 lbs TNT Low Level of Protection

STANDOFF DISTANCE IN FEET	Percentage Building Cost Increase					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTURE
176-186	9.8	9.6	14.0	23.6	15.5	27.5
187-199	9.5	9.3	13.7	23.1	15.3	26.2
200-204	9.4	9.2	13.6	22.9	15.2	25.7
205-233	9.2	9.0	13.4	21.6	15.0	25.4
234-239	8.4	8.2	12.0	20.5	13.1	23.8
240-242	8.3	8.1	11.9	19.9	13.0	23.7
243-258	7.6	7.4	11.2	18.9	12.5	20.8
259-279	7.2	7.1	10.7	18.4	11.8	20.2
280-282	7.1	6.9	10.6	17.6	11.6	20.0
283-310	5.4	5.3	8.9	15.0	10.4	13.1
311-319	4.8	4.7	8.2	14.1	10.0	10.7
320-373	4.7	4.6	8.2	13.7	9.9	10.6
374-379	4.4	4.3	7.9	13.3	9.7	9.4
380-410	4.4	4.2	7.8	13.0	9.6	9.3
411-465	3.8	3.6	7.2	12.1	9.2	6.9
466-569	3.5	3.4	6.9	11.8	9.0	5.7
570-625	3.4	3.3	6.9	11.2	8.9	5.7
626-799	3.1	3.0	6.5	10.6	8.6	4.3
800-997	3.0	2.9	6.4	10.3	8.6	4.2
998-1059	2.8	2.7	6.2	10.0	8.4	4.1
1060-2659	2.6	2.5	6.1	9.2	8.3	3.9
2660-	2.1	2.0	4.7	7.0	7.3	3.9

Table AP4.T18. 20,000 lbs TNT Medium Level of Protection

STANDOFF DISTANCE IN FEET	Percentage Building Cost Increase					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTURE
178-185	85.7	17.9	29.1	39.8	35.3	55.9
186-199	84.4	16.5	27.8	37.7	34.3	50.5
200-204	69.6	15.4	25.4	35.2	31.1	46.3
205-215	69.4	15.1	25.2	33.9	30.9	46.0
216-239	67.9	14.8	22.9	31.7	27.9	42.4
240-259	67.7	13.5	22.7	31.1	27.7	41.8
260-273	60.3	12.9	21.5	29.8	26.1	39.7
274-279	59.4	12.9	20.2	28.6	24.2	38.1
280-281	59.3	12.8	20.0	27.8	24.1	37.9
282-291	58.6	11.3	19.3	26.7	23.6	35.1
292-319	58.3	11.3	18.8	26.2	22.8	34.5
320-335	58.2	11.2	18.7	25.9	22.7	34.4
344-349	56.5	9.2	17.0	23.3	21.5	27.4
350-372	41.7	8.1	14.6	20.8	18.3	23.3
373-379	41.1	7.5	14.0	19.9	17.9	20.8
380-444	41.1	7.4	14.0	19.7	17.8	20.8
445-494	40.7	7.1	13.6	19.2	17.5	19.6
495-569	40.1	6.5	13.0	18.3	17.1	17.1
570-574	40.0	6.4	12.9	17.7	17.0	17.0
575-674	39.8	6.2	12.7	17.3	16.8	16.0
675-766	25.0	5.0	10.3	14.8	13.6	11.8
767-799	24.7	4.7	10.0	14.8	13.4	10.4
800-1059	24.6	4.6	9.9	14.0	13.3	10.3
1060-1099	24.5	4.5	9.8	13.1	13.2	10.1
1100-1237	17.1	3.9	8.6	11.9	11.5	8.0
1238-2659	16.8	3.7	8.4	11.6	11.4	7.9
2660-	2.1	2.0	4.7	7.0	7.3	3.9

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Table AP4.T19. 20,000 lbs TNT High Level of Protection

STANDOFF DISTANCE IN FEET	Percentage Building Cost Increase					
	BARRACKS EXTERNAL ENTRANCES	BARRACKS INTERIOR CORRIDOR	DINING FACILITY	ADMIN FACILITY	MEDICAL CLINIC	SPECIAL STRUCTURE
227-251	69.6	15.4	25.4	35.2	31.1	46.3
252-254	69.3	15.0	25.1	34.8	30.9	45.0
255-261	69.1	14.8	24.9	33.4	30.6	44.7
262-317	60.4	14.1	21.6	30.3	26.2	39.9
318-322	59.5	14.1	20.2	29.1	24.3	38.3
323-329	58.8	13.4	19.5	28.1	23.8	35.4
330-349	58.5	13.4	19.0	27.6	23.0	34.8
350-364	43.7	11.1	16.6	25.1	19.8	30.6
365-407	43.5	10.9	16.4	23.7	19.6	30.3
408-470	41.8	8.4	14.7	21.2	18.3	23.4
471-509	41.1	7.5	14.0	20.2	17.9	20.9
510-524	41.1	7.5	14.0	19.8	17.8	20.8
525-604	40.7	7.1	13.6	19.2	17.5	19.6
605-674	40.1	6.5	13.0	18.3	17.1	17.1
675-773	25.4	5.4	10.7	15.8	13.9	13.0
774-859	25.1	5.1	10.4	15.4	13.7	12.0
860-964	25.0	4.9	10.3	14.5	13.6	11.7
965-1099	24.6	4.6	9.9	14.0	13.3	10.3
1100-1159	17.2	4.0	8.7	12.7	11.7	8.2
1160-1516	17.1	3.9	8.6	11.9	11.5	8.0
1517-2659	16.8	3.7	8.4	11.6	11.4	7.9
2660-	2.1	2.0	4.7	7.0	7.3	3.9

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Table AP4.T20. Ballistic Threat Low and High Levels of Protection

Structure Type	Percentage Building Cost Increases				
	Low Level of Protection	High Level of Protection			
		Low Threat Severity	Medium Threat Severity	High Threat Severity	Very High Threat Severity
DINING FACILITY	0.18	2.6	3.9	5.4	6.1
Administration Bldg.	0.81	17.5	25.3	27.8	30.4
Medical Clinic	0.12	3.1	4.4	5.8	6.5
Barracks, Exterior Entrance	0.13	6.4	8.1	15.0	17.0
Barracks, Corridor Entrance	0.13	3.1	4.5	5.2	5.7
Special Structures	0.18	4.2	5.0	9.7	11.9

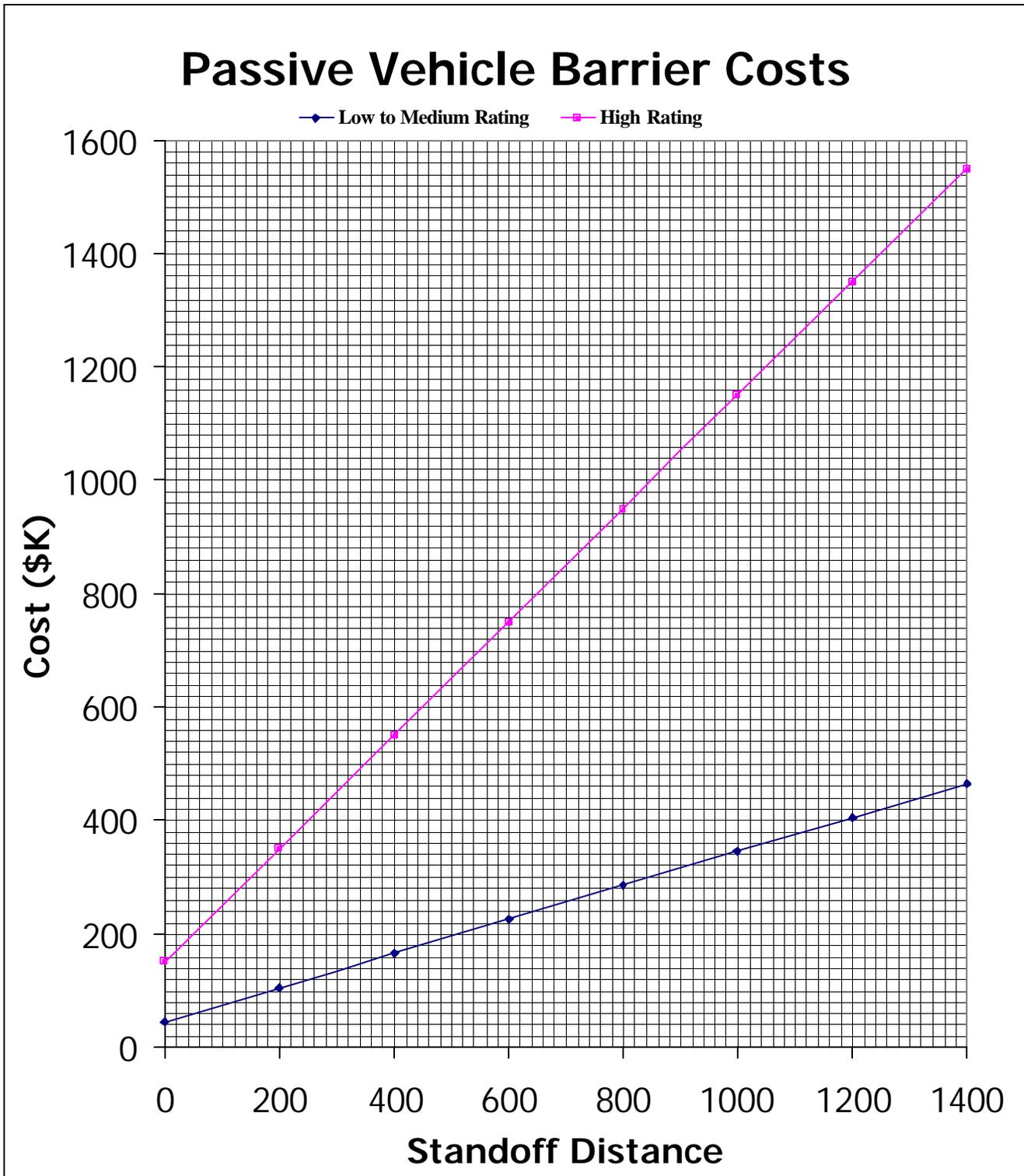
Table AP4.T21. Passive Vehicle Barrier Costs and Ratings

Rating	Cost Per Foot	Vehicle Weight (in lbs)	Vehicle Speed MPH
High	\$100	60,000	Up to 25
High	\$100	15,000	30-50
Low to Medium	\$30	15,000	Up to 30
Low to Medium	\$30	4,000	Up to 55
Non-rated fence	\$23	Not Applicable	Not Applicable

Table AP4.T22. Active Vehicle Barrier Costs per Vehicle Entrance/Exit

Rating	Cost Per Vehicle Lane	Vehicle Weight (in lbs)	Vehicle Speed MPH
High	\$42,000	60,000	Up to 25
High	\$42,000	15,000	30-50
Low to Medium	\$25,000	15,000	Up to 30
Low to Medium	\$25,000	4,000	Up to 55
Non-rated access control gate	\$2,000	Not Applicable	Not Applicable

Figure AP4.F1. Total Cost for Passive Vehicle Barrier Systems Versus Standoff Distance



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