

# UNIFIED FACILITIES CRITERIA (UFC)

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## DoD MINIMUM ANTITERRORISM STANDARDS FOR BUILDINGS



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**UNIFIED FACILITIES CRITERIA (UFC)**

**DoD MINIMUM ANTITERRORISM STANDARDS FOR BUILDINGS**

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DEPUTY UNDER SECRETARY OF DEFENSE (INSTALLATIONS AND ENVIRONMENT)

U.S. ARMY CORPS OF ENGINEERS (Preparing Activity)

NAVAL FACILITIES ENGINEERING COMMAND

AIR FORCE CIVIL ENGINEER SUPPORT AGENCY

Record of Changes (changes are indicated by \1\ ... /1/)

<b>Change No.</b>	<b>Date</b>	<b>Location</b>

## FOREWORD

The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with [USD \(AT&L\) Memorandum](#) dated 29 May 2002. UFC will be used for all DoD projects and work for other customers where appropriate. All construction outside of the United States is also governed by Status of Forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the most stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

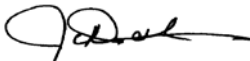
UFC are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and Air Force Center for Engineering and the Environment (AFCEE) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DoD working group. Recommended changes with supporting rationale should be sent to the respective service proponent office by the following electronic form: [Criteria Change Request](#). The form is also accessible from the Internet sites listed below.

UFC are effective upon issuance and are distributed only in electronic media from the following source:

- Whole Building Design Guide web site <http://dod.wbdg.org/>.

Hard copies of UFC printed from electronic media should be checked against the current electronic version prior to use to ensure that they are current.

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**FOREWORD (continued)**

This specific document is also issued under the authority of DoD Instruction Number 2000.16, DoD Antiterrorism Standards which requires DoD Components to adopt and adhere to common criteria and minimum construction standards to mitigate antiterrorism vulnerabilities and terrorist threats. In addition, this document was further implemented by a USD(AT&L) Memorandum dated 20 September 2002.

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; the Office of the Inspector General of the Department of Defense; the Defense Agencies; the Department of Defense Field Activities; and all other organizational entities within the Department of Defense hereafter referred to collectively as “the DoD Components.”

The standards established by this document are minimums set for DoD. Each DoD Component may set more stringent antiterrorism building standards to meet the specific threats in its area of responsibility.

Any changes, updates, or amendments to this particular UFC must have the approval of the DoD Engineering Senior Executive Panel (ESEP).

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

**UNIFIED FACILITIES CRITERIA (UFC)  
REVISION SUMMARY SHEET**

**Subject:** UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings

**Cancel:** UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings, dated 08 October 2003 with Change 1 dated 22 January 2007

**Reasons for Changes:** UFC 4-010-01 was updated for the following reasons:

- To reduce misunderstandings of some of its provisions.
- To address situations not previously addressed by the standards.
- To improve consistency of interpretation.
- To reduce redundancy or inconsistency with other UFCs that were not available at the time of the previous revision.
- To eliminate standards or recommendations that were unnecessary or that had been superseded by other UFCs.
- To incorporate information based on new studies and research or new or revised national standards.

Description of Changes:

- Clarifications have been made throughout the document to address frequently asked questions and issues that were frequently misapplied.
- Added applicability paragraphs for:
  - DoD purchases of existing buildings.
  - Visitor centers and museums.
  - Visitor control centers.
- Added exemption paragraphs for:
  - Low occupancy buildings.
  - Town Centers.
  - Enhanced use leases.
  - Temporary and relocatable buildings intended for use for less than 5 years.
  - Construction administration structures.
- Included all transitional structures in exemption from all standards for life of contract, but not to exceed 5 years.

- Added size limitation for stand-alone shoppettes, minimarts and similarly sized commissaries that are partially exempt from the standards.
- Added requirements for design submittals.
- Added definitions for clarity.
- Based building replacement cost on plant replacement value.
- Replaced definition for net usable space with a definition that is based on an ANSI/BOMA standard for measuring floor area in office buildings.
- Changed approach to conventional construction standoff distance to be based on specific materials to resolve conservatism in previous numbers and because people were not taking advantage of existing allowances.
- Reduced minimum standoff distance to the distances at which buildings would be within the realm of hardened structures based on the two applicable explosive weights in this UFC associated with vehicle borne and placed explosives.
- Added guidance for standoff distances for following cases:
  - Underground parking adjacent to buildings.
  - Parking of mobile ground tactical platforms.
  - Parking in driving lanes of parking areas.
  - Standoff to entry control facilities / access control points.
- Added guidance on what to do when buildings are exempt from the parking and roadways standoff distances in Standard 1.
- Added clarifying guidance for unobstructed spaces and established that they should extend to parking and roadway standoff distance for explosive weight II.
- Removed requirements for progressive collapse resistance that were in addition to the requirements in UFC 4-023-03.
- Added guidance on controlled public access that establishes when interior load bearing structural elements must be evaluated for progressive collapse.
- Made major changes to Standard 10 on windows and skylights. Most changes were in applying the static design method of ASTM F 2248, although the standard was also completely rewritten for clarity.
- Eliminated windows and doors from any consideration of conventional construction standoff distance.
- Eliminated minimum window and skylight construction requirements except for buildings that are exempt from parking and roadway standoff distances provisions of Standard 1 and for windows and skylights in

existing buildings that are being replaced as part of window and skylight replacement projects.

- Added guidance on exterior stairwells and covered or enclosed walkways.
- Adopted ASTM F 2247 for design of doors.
- Added statement that heating, ventilating, and air conditioning system emergency shutoffs should not be installed where they would violate building or fire codes or where they would create an unsafe condition.
- Eliminated Standard 19 on utility distribution and installation because it did not address any issues that were likely to result in mass casualties.
- Eliminated Recommendations 9, 11, and 17 because they were impractical or unnecessary.
- Removed temporary structures from Appendix D, limiting it to expeditionary structures.

**Impact.** Most of the changes should result in cost savings or no change in costs. Further impacts should include the following:

- More consistent application of the provisions of the document due to more detailed guidance.
- Non-compliance with the standards should be reduced because some perceived “loop holes” were eliminated through clarifying language and because the commonly misunderstood provisions that were leading to non-compliance have been clarified.
- Reduced conflict between security and antiterrorism personnel and design teams due to clarifications.
- By establishing design submittal requirements there should be better and more consistent compliance with the standards.
- Due to the changes in conventional construction standoff distances there should be a general reduction in building setbacks from parking and roadways that should reduce DoD land use.
- Reduced costs of window systems and of supporting structural elements due to changes in Standard 10 on windows and skylights.
- Reduced costs for transitional structures because of expanding exemption to all standards as long as expected occupancy will be less than 5 years.

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## CHAPTER 1 INTRODUCTION

### 1-1 **GENERAL.**

This document represents a significant commitment by DoD to seek effective ways to minimize the likelihood of mass casualties from terrorist attacks against DoD personnel in the buildings in which they work and live.

#### 1-1.1 **Authorities.**

DoD Directive 2000.12 stipulates that each military service will ensure that antiterrorism (AT) protective features be incorporated into planning, design and execution of all facility construction to mitigate AT vulnerabilities and terrorist threats. In addition, 10 US Code §2859 required the Secretary of Defense to develop common guidance and criteria to be used to develop construction standards designed to reduce the vulnerability to terrorist attack and to improve the security of the occupants of those structures. This UFC is intended to meet those requirements. In accordance with DoD Instruction 2000.16, all DoD Components will fully comply with this UFC.

#### 1-1.2 **Background.**

One of the findings in the 1996 Downing Commission report on the Khobar Towers bombing in Dhahran, Saudi Arabia was that there were no standards for force protection in fixed DoD facilities. In partial response to that finding, the initial version of this document was published as an interim standard in December 1999. It applied to Military Construction (MILCON) funded new construction and major renovations of DoD buildings beginning with the Fiscal Year 2002 program. It was transmitted by a memorandum dated 20 September 2002 from the Undersecretary of Defense for Acquisition and Technology. The standards were republished in July 2002 as a UFC that applied the standards to all DoD construction meeting the occupancy levels specified by the standard, regardless of funding source. It was also transmitted by a memorandum from the Undersecretary of Defense and was referenced as a requirement by DoD Instruction 2000.16. Subsequently the UFC was republished in October 2003 and with Change 1 in January 2007. This revision predominantly clarifies issues that have been sources of misunderstanding and makes changes that reflect technology transfer of research and development.

#### 1-1.3 **Responsibilities.**

Protecting people in DoD occupied space must start with an understanding of the risk of a terrorist attack. Application of the standards herein should be consistent with the perceived or identified risk. Everyone in DoD is responsible for protecting DoD personnel and other resources.

##### 1-1.3.1 **Individuals.**

Each DoD employee, contractor, or family member is responsible for minimizing opportunities for terrorists to threaten or target themselves, their co-workers, and their families in DoD occupied space.

### **1-1.3.2 Installation Commanders.**

Installation commanders and senior commanders in buildings that are occupied, managed, or controlled by or for DoD must protect the people on his or her installation or in his or her building by managing and mitigating the risk to those people in the event of a terrorist attack. The commander is responsible for applying the standards herein, consistent with the identified or perceived risk of people being injured or killed and with the implementing guidance established by the applicable Service, Agency, or Command.

In addition, they are responsible for implementing additional guidance established by geographic combatant commanders for the areas of responsibility within which the installation or building is located.

The commanders will obtain prior approval consistent with Service or Agency guidance if any new construction project, renovation project, leased building, or existing building purchased by DoD to which these standards apply will not meet any one or more of these standards. Lack of funding alone will not be cause to neglect complying with any standard. Commanders cannot deviate from these standards or accept risk based on their own authorities.

### **1-1.3.3 Heads of DoD Components.**

Service Secretaries and Agency Heads will ensure compliance with these standards and will issue guidance for their implementation. That guidance will include a process for evaluating and approving any deviations from these standards where an installation commander believes that it will not be feasible to meet one or more of them on any new construction project, renovation project, leased building, or existing building purchased by DoD to which these standards apply. Any such request for deviation will include plans, procedures, and compensatory measures to mitigate the risks associated with those situations. Implementing guidance will also include processes for notifying (as a minimum) geographic combatant commanders of any deviations from these standards. Any proposed deviations from these standards or additional requirements imposed by geographic combatant commanders must also satisfy geographic combatant commander deviation requirements.

### **1-1.3.4 Geographic Combatant Commanders.**

Geographic combatant commanders may establish additional guidance to ensure uniform and consistent application of these standards within their areas of operations or to account for any special circumstances. Combatant commanders may establish policies to deal with deviations from any additional standards they develop.

### **1-1.4 Planning and Integration.**

When the best procedures, proper training, and appropriate equipment fail to deter terrorist attacks, adherence to these standards goes far toward mitigating the possibility of mass casualties from terrorist attacks against DoD personnel in the buildings in which they work and live. Although predicting the specific threat is not possible, proper



planning and integration of those plans provide a solid foundation for preventing, and if necessary reacting, when terrorist incidents or other emergencies unfold.

An effective planning process facilitates the necessary decision making, clarifies roles and responsibilities, and ensures support actions generally go as planned. A team consisting of the chain of command and key personnel from all appropriate functional areas who have an interest in the building and its operation executes this planning process.

The team should include, as a minimum, antiterrorism/force protection, intelligence, security, and facility engineering personnel. This team is responsible for identifying requirements for the project, facilitating the development of supporting operational procedures, obtaining adequate resources, and properly supporting all other efforts needed to prudently enhance protection of the occupants of every inhabited DoD building. For further information on planning and integration, refer to UFC 4-020-01.

#### 1-1.5 **Master Plans.**

Installation master plans must include roadmaps for UFC 4-010-01 compliance for all new and existing facilities. For site planning this is predominantly standoff from parking, base perimeters, and entry control points / access control facilities, but it can also include utilities, vantage points, and the location of high value assets.

Buildings sited at the minimum standoff distances in Appendix B that are designed to provide the structural performance required to meet these standards will require construction that is significantly heavier and more expensive than conventional construction; therefore, the minimum standoff distances should not be used as a common master planning strategy unless the resulting cost increases are taken into account.

Clustering facilities into compounds or pods provides a higher density core with pedestrian friendly green space that provides antiterrorism and environmental benefits. Parking and vehicle circulation are then kept on the perimeter of the compound.

#### 1-2 **REFERENCES.**

- 36 CFR Part 800, *Protection of Historic Properties*
- American National Standards Institute (ANSI)/ Building Owners and Managers Association (BOMA) Z65.1-1996, *Standard Method for Measuring Floor Area in Office Buildings*
- American Society of Civil Engineers Standard (ASCE/SEI) 7-10, *Minimum Design Loads for Buildings and Other Structures*, 2010
- ASTM Standard E1300-09, *Standard Practice for Determining Load Resistance of Glass in Buildings*
- ASTM Standard F1642-04, *Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings*

- ASTM Standard F2247-03, *Metal Doors Used in Blast Resistant Applications (Equivalent Static Method)*
- ASTM Standard F2248-09, *Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass*
- DoD 6055.09-M, *DoD Ammunition and Explosive Safety Standards*, 4 August 2010
- DoD Directive 5160.58E, *Recruiting Facilities*, 31 August 2005
- DoD Directive 5400.07, *DoD Freedom of Information Act (FOIA) Program*, 2 January 2008
- DoD Handbook 2000.12-H, *DoD Antiterrorism Handbook*, 9 February 2004 (For Official Use Only [FOUO])
- DoD Instruction 2000.16, *DoD Antiterrorism Standards*, 2 October 2006, incorporating Change 2, 8 December 2006
- Federal Highway Administration Manual on Uniform Traffic Control Devices, 2009
- GTA 90-01-011, *Joint Forward Operations Base (JFOB) Survivability and Protective Construction Handbook*, October 2009 (For Official Use Only [FOUO])
- National Fire Protection Association (NFPA) 30-08, *Flammable and Combustible Liquids Code*
- NFPA 72, *National Fire Alarm and Signaling Code*
- PDC Technical Report 06-08, *Single Degree of Freedom Structural Response Limits for Antiterrorism Design*
- PDC Technical Report 10-01, *Conventional Construction Standoff Distances for the Low and Very Low Levels of Protection*
- PDC Technical Report 10-02, *Blast Resistant Design Methodologies for Window Systems Designed Statically and Dynamically*
- SHAPE Document 6160/SHLOFA-059/82, *NATO Approved Criteria and Standards for Tactical and Transport Airfields (6<sup>th</sup> Addition)*, 30 March 1982 (NATO Restricted)
- UFC 4-010-02, *DoD Minimum Antiterrorism Standoff Distances for Buildings* (For Official Use Only [FOUO])
- UFC 4-020-01, *DoD Security Engineering Facilities Planning Manual*, 11 September 2008
- UFC 4-020-02, *DoD Security Engineering Facilities Design Manual*
- UFC 4-021-01, *Design and O&M: Mass Notification Systems*, 9 April 2008
- UFC 4-022-01, *Security Engineering: Entry Control Facilities/Access Control Points*, 25 May 2005

- UFC 4-023-03, *Design of Buildings to Resist Progressive Collapse*, 25 January 2005
- UFC 3-701-01, *DoD Facilities Pricing Guide for FY2011*, March 2011, with Change 1
- UFC 3-301-01, *Structural Engineering*, 27 January 2010
- UFC 3-340-01, *Design and Analysis of Hardened Structures to Conventional Weapons Effects*, 1 June 2002
- The Deputy Secretary of Defense, 12 July 2011, *Memorandum, Subject: Antiterrorism (AT) Standards for Leased Space*
- The Under Secretary of Defense for Acquisition, Technology, and Logistics, 18 September 2009, *Memorandum, Subject: Expiration of Leases Impacted By Base Realignment and Closure (BRAC) 2005*
- US Army Protective Design Center web site (<https://pdc.usace.army.mil>)

### 1-3 **GENERAL BUILDING REQUIREMENTS.**

UFC 1-200-01, "General Building Requirements", provides applicability of model building codes and government-unique criteria for typical design disciplines and building systems, as well as for accessibility, antiterrorism, security, sustainability, and safety. Use this UFC in addition to UFC 1-200-01 and the UFCs and government criteria referenced therein.

### 1-4 **SECURITY ENGINEERING UFC SERIES.**

This UFC is one of a series of security engineering unified facilities criteria documents that cover minimum standards, planning, preliminary design, and detailed design for security and antiterrorism. The manuals in this series are designed to be used sequentially by a diverse audience to facilitate development of projects throughout the design cycle. The manuals in this series include the following:

#### 1-4.1 **DoD Minimum Antiterrorism Standards for Buildings.**

This UFC and 4-010-02 establish standards that provide minimum levels of protection against terrorist attacks for the occupants of all DoD inhabited buildings. These UFCs are intended to be used by security and antiterrorism personnel and design teams to identify the minimum requirements that must be incorporated into the design of all new construction and major renovations of inhabited DoD buildings. They also include recommendations that should be, but are not required to be incorporated into all such buildings.

#### 1-4.2 **Security Engineering Facilities Planning Manual.**

UFC 4-020-01 presents processes for developing the design criteria necessary to incorporate security and antiterrorism into DoD facilities and for identifying the cost implications of applying those design criteria. Those design criteria may be limited to the requirements of the minimum standards, or they may include protection of assets other than those addressed in the minimum standards (people), aggressor tactics that

are not addressed in the minimum standards, or levels of protection beyond those required by the minimum standards. The cost implications for security and antiterrorism are addressed as cost increases over conventional construction for common construction types. The changes in construction represented by those cost increases are tabulated for reference, but they represent only representative construction that will meet the requirements of the design criteria. The manual also addresses the tradeoffs between cost and risk. The Security Engineering Facilities Planning Manual is intended to be used by planners as well as security and antiterrorism personnel with support from planning team members.

#### **1-4.3 Security Engineering Facilities Design Manual.**

UFC 4-020-02 provides interdisciplinary design guidance for developing preliminary systems of protective measures to implement the design criteria established using UFC 4-020-01. Those protective measures include building and site elements, equipment, and the supporting manpower and procedures necessary to make them all work as a system. The information in UFC 4-020-02 is in sufficient detail to support concept level project development, and as such can provide a good basis for a more detailed design. The manual also provides a process for assessing the impact of protective measures on risk. The primary audience for the Security Engineering Design Manual is the design team, but it can also be used by security and antiterrorism personnel.

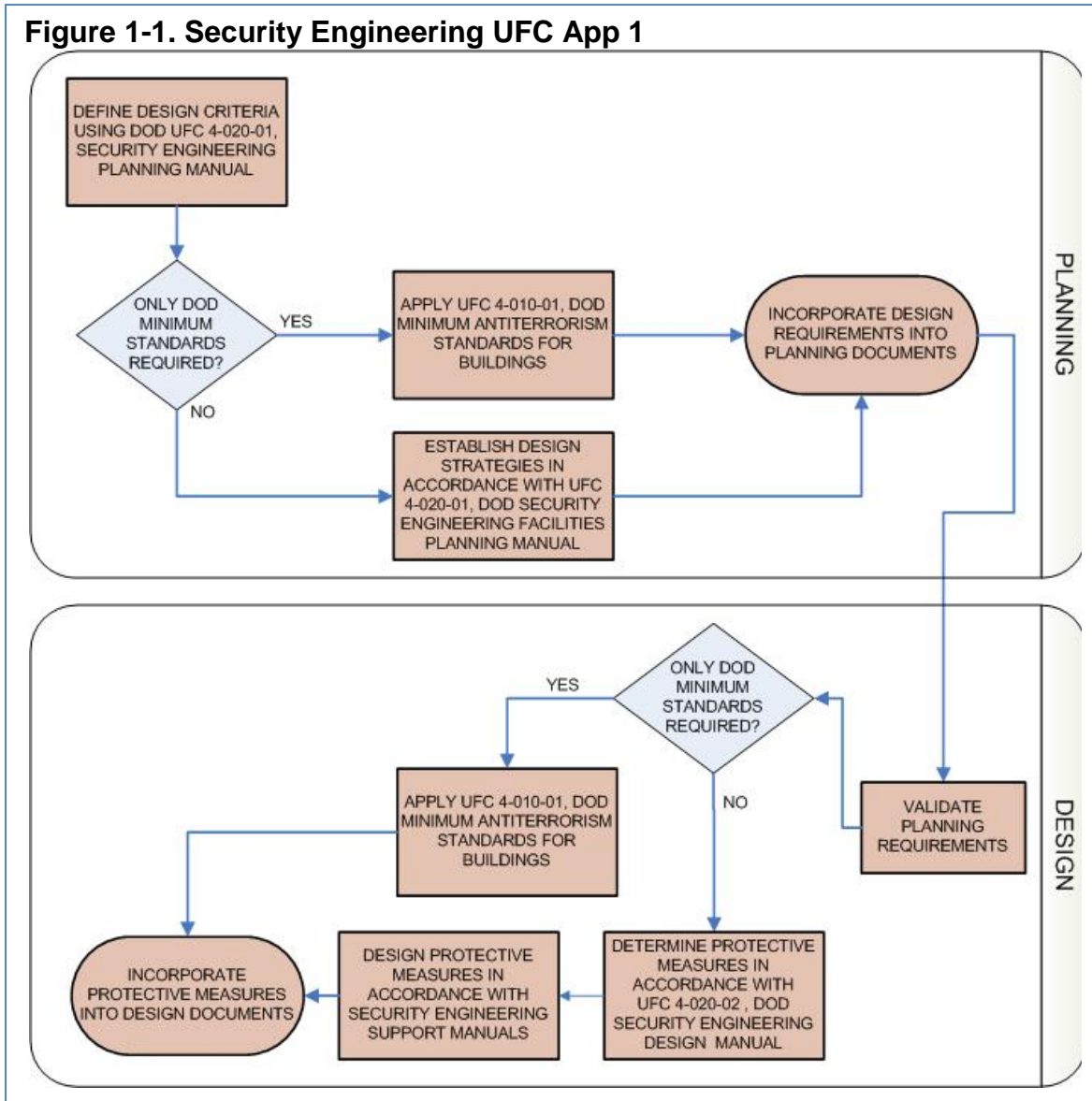
#### **1-4.4 Security Engineering Support Manuals.**

In addition to the standards, planning, and design UFCs mentioned above, there is a series of additional UFCs that provide detailed design guidance for developing final designs based on the preliminary designs developed using UFC 4-020-02. These support manuals provide specialized, discipline specific design guidance. Some address specific tactics such as direct fire weapons, forced entry, or airborne contamination. Others address limited aspects of design such as resistance to progressive collapse or design of portions of buildings such as mail rooms. Still others address details of designs for specific protective measures such as vehicle barriers or fences. The Security Engineering Support Manuals are intended to be used by the design team during the development of final design packages.

#### **1-4.5 Security Engineering UFC Application.**

The application of the security engineering series of UFCs is illustrated in Figure 1-1. UFC 4-020-01 is intended to be the starting point for any project that is likely to have security or antiterrorism requirements. By beginning with UFC 4-020-01, the design criteria will be developed that establishes which of the other UFCs in the series will need to be applied. The design criteria may indicate that only the minimum standards need to be incorporated, or it may include additional requirements, resulting in the need for application of additional UFCs. Even if only the minimum standards are required other UFCs may need to be applied if sufficient standoff distances are unavailable. Applying this series of UFCs in the manner illustrated in Figure 1-1 will result in the most efficient use of resources for protecting assets against security and antiterrorism related threats.

Figure 1-1. Security Engineering UFC App 1



1-5 **STANDARDS AND RECOMMENDATIONS.**

Mandatory DoD minimum antiterrorism standards for new and existing inhabited buildings are contained in Appendix B. Additional recommended measures for new and existing inhabited buildings are included in Appendix C. Mandatory DoD minimum antiterrorism standards for expeditionary structures are contained in Appendix D. The standards and recommendations in this document include a combination of performance and prescriptive requirements. In many cases where there are minimum prescriptive requirements, those requirements are based on performance standards and there are generally provisions to allow those performances to be provided through alternate means where those means will provide the required levels of protection.

1-6 **INTENT.**

The intent of these standards is to minimize mass casualties in buildings or portions of buildings owned, leased, privatized, or otherwise occupied, managed, or controlled by

or for DoD in the event of a terrorist attack. These standards provide appropriate, implementable, and enforceable measures to establish levels of protection against terrorist attacks for all inhabited DoD buildings where no known threat of terrorist activity currently exists. While complete protection against all potential threats for every inhabited building is cost prohibitive, the intent of these standards can be achieved through prudent master planning, real estate acquisition, and design and construction practices.

Where the conventional construction standoff distances detailed in these standards are met, most conventional construction techniques can be used with only marginal impact on the total construction or renovation cost. The financial impact of these standards will be significantly less than the economic and intangible costs of a mass casualty event.

While it is feasible to apply these standards to new construction as of the effective dates established herein, applying them to all existing construction and to all leased facilities as of those dates would not be feasible. The intent, therefore, is to bring existing buildings into compliance with these standards over time as major investments are made in them, as leases are initiated or renewed, or as existing buildings are purchased such that eventually all inhabited DoD buildings will comply with these standards.

## **1-7 LEVELS OF PROTECTION.**

The levels of protection provided by these standards meet the intent described above and establish a foundation for the rapid application of additional protective measures in higher threat environments. These standards may be supplemented where specific terrorist threats are identified, where more stringent local standards apply, or where local commanders or senior leaders dictate additional measures. Detailed descriptions of the levels of protection are provided in Chapter 2 and UFC 4-020-01.

### **1-7.1 DoD Component Standards.**

Where DoD Component standards such as geographic Combatant Commander standards address unique requirements, those standards will be incorporated in accordance with their implementing directives, but not to the exclusion of these standards.

### **1-7.2 Threat-Specific Requirements.**

Determining the Design Basis Threat (DBT) is an installation function requiring programmers, antiterrorism officers, and members of the threat working group. Determining the facility DBT is the first step in planning antiterrorism requirements. The DBT is unique for each individual facility and is based on the threat likelihoods and the values of the assets in the building. The DBT development process will determine if the minimum AT standards from UFC 4-010-01 are adequate or if additional protective measures are required per UFC 4-020-01.

Where a DBT is identified whose mitigation requires protective measures beyond those required by these standards or DoD Component standards, those measures will be developed in accordance with the provisions of UFC 4-020-01. Those provisions

include the design criteria that will be the basis for the development of the protective measures, estimates of the costs of those measures, and detailed guidance for developing the measures required to mitigate the identified threat.

The design criteria include the assets to be protected, the threats to those assets, and the desired levels of protection. Use of UFC 4-020-01 will ensure uniform application, development, and cost estimation of protective measures throughout DoD.

### **1-7.3 Critical Facilities.**

Buildings that must remain mission operational during periods of national crisis and may be subjected to terrorist attack may warrant design to higher levels of protection than those provided by these standards. Ensure detailed risk and threat assessments are executed using UFC 4-020-01 for buildings containing critical assets.

### **1-7.4 Explosives Safety Standards.**

These antiterrorism standards establish criteria to minimize mass casualties and progressive collapse of buildings from terrorist attacks. DoD 6055.09-M, *DoD Ammunition and Explosives Safety Standards* as implemented by Service component explosive safety standards, establish acceptable levels of protection for accidental explosions of DoD-titled munitions. The explosive safety and antiterrorism standards address hazards associated with unique events; therefore, they specify different levels of protection. Compliance with both standards is required where applicable. Where conflicts arise, the more stringent criteria will govern.

## **1-8 APPLICABILITY.**

These standards apply to all DoD Components, to all DoD inhabited buildings, billeting, and high occupancy family housing, and to all DoD expeditionary structures in accordance with the following:

### **1-8.1 New Construction.**

Implementation of these standards is mandatory for all new construction regardless of funding source in accordance with the following. Projects programmed or designed under previous editions of these standards do not have to be reprogrammed or redesigned to meet the requirements of these standards if design has proceeded beyond 35% completion or, for design-build projects, at the Request for Proposal phase. The provisions of the previous editions will apply to those projects. Due to minor changes between these standards and previous editions, projects currently under design and beyond 35% completion should comply with these standards where possible, however. These standards apply to new construction projects funded under host-nation agreements after the implementation date of these standards or as soon as negotiations with the foreign governments can be completed.

### **1-8.2 Existing Buildings.**

These standards apply to existing buildings when triggered as specified below, regardless of funding source as of the implementation date of these standards except

that host nation and other foreign government funded projects may be implemented following negotiations with foreign governments. Projects programmed or designed under previous editions of these standards do not have to be reprogrammed or redesigned to meet the requirements of these standards if design has proceeded beyond 35% completion or, for design-build projects, at the Request for Proposal phase. The provisions of the previous editions will apply to those projects. Due to minor changes between these standards and previous editions, projects currently under design and beyond 35% completion should comply with these standards where possible, however. None of the triggers under this paragraph apply to leased buildings. For existing leased buildings see paragraph 1-8.4.

#### **1-8.2.1 Major Investments.**

Implementation of these standards to bring entire inhabited buildings into compliance is mandatory for all DoD building renovations, modifications, repairs, revitalizations, and restorations where those costs exceed 50% of the plant replacement value of the existing building in accordance with UFC 3-701-01 based on a building of the same size except as otherwise stated in these standards. The 50% cost is exclusive of the costs identified to meet these standards.

In window replacement projects the window replacement and glazing costs should not be used to cause any building to exceed 50% of the plant replacement value where only the window replacement project trigger in paragraph 1-8.2.3 applies to the buildings. This is to ensure that window replacement projects alone do not trigger whole building compliance with these standards.

In addition, costs of building additions will not be included in calculating the 50% trigger. Requirements for building additions are in paragraph 1-8.3. Where costs do not exceed the 50% threshold, compliance with these standards is recommended, but not required.

#### **1-8.2.2 Change of Occupancy Level.**

Implementation of these standards is mandatory when any building or portion of a building is converted from its current occupancy to a higher occupancy. Examples would include a warehouse (low occupancy) being converted to administrative (inhabited) use, an inhabited administrative building being converted to a primary gathering building, billeting being converted to a primary gathering building, and any building being converted to billeting.

#### **1-8.2.3 Window Replacement.**

Because of the significance of glazing hazards in a blast environment, implementation of all provisions of paragraphs B-3.1 and B-3.3.2 of these standards is mandatory for existing inhabited buildings any time a window or glazed door is being replaced. Such replacements may require window frame modification or replacement and building reinforcement around the windows in addition to glazing replacement. Note that the window replacement and glazing costs should not be used to cause any building to exceed 50% of the plant replacement value where only this trigger applies to the building as described in Paragraph 1-8.2.1 above.



#### 1-8.2.4 **Roadway Improvement Projects.**

When roadway improvement projects not associated with a building renovation, modification, repair, revitalization, or restoration requiring compliance with these standards encroach on the conventional construction standoff distances in Tables B-1 and B-2, that encroachment will not require bringing those existing buildings into compliance with these standards. Those buildings would not be required to meet these standards until they meet one of the triggers above. Paragraph B-1.1.12 establishes the requirements for roadway projects.

#### 1-8.3 **Building Additions.**

Inhabited additions to existing inhabited buildings shall comply with the minimum standards for new buildings except that operational procedures allowed for control of parking around existing buildings in Appendix B may be applied to the building addition where conventional construction standoff distances are unavailable. If the addition is 50% or more of the gross area of the existing building, the existing building will comply with the minimum standards for existing buildings in Appendix B. If the building addition causes the occupancy of the building to change from inhabited to primary gathering occupancy, the entire inhabited portion of the building will be considered to be primary gathering and will trigger upgrades to the inhabited portion of the building due to change of occupancy. These triggers do not apply to leased buildings.

#### 1-8.4 **Leased Buildings.**

DoD personnel occupying leased buildings deserve the same level of protection as those in DoD-owned buildings. Implementation of these standards is therefore mandatory for all buildings with DoD populations that meet the population densities to be considered inhabited buildings that are leased for DoD use or in which DoD receives a space assignment from another government agency except as established below. This requirement is intended to cover all situations, including General Services Administration space, privatized buildings, and host-nation and other foreign government buildings. This requirement is applicable for all new leases and to all renewals or extensions of existing leases.

In accordance with an Under Secretary of Defense for Acquisition, Technology, and Logistics memorandum dated 18 September 2009, for leases within the National Capital Region (NCR) impacted by Base Realignment and Closure (BRAC) 2005, execution of lease renewals until September 30, 2011 to accommodate continued occupancy by DoD organizations in the NCR affected by BRAC is authorized even where existing leased buildings occupied by DoD personnel are not in compliance with these standards. Those lease renewals may be for a term sufficient to allow occupancy by those organizations until their movement to the installations directed by the BRAC recommendations, including any time necessary to complete the disposal process, but in no event beyond September 30, 2014.

In accordance with a Deputy Secretary of Defense memorandum dated 12 July 2011, the requirements of these standards are temporarily suspended for lease renewals or extensions. Existing leases may be renewed or extended for a maximum lease term of

5 years without changes to the security conditions of the buildings. New leases, which typically cover a term of 10 or more years, are not covered by the suspension. This is an interim situation until comparisons between DoD completes its assessment of DoD and interagency standards for leased space and determines which standards are appropriate.

**1-8.4.1 Partial Occupancy.**

These standards only apply where DoD personnel occupy leased or assigned usable office area constituting at least 25% of the usable building area, and they only apply to that portion of the building that is occupied by DoD personnel. If additional DoD tenants enter into leases in buildings with existing DoD tenants and those additional tenants increase the DoD occupied usable office area to 25% or more of the usable building area, the entire portion of the building occupied by DoD personnel must comply with these standards as the applicable leases are renewed.

**1-8.4.2 New Buildings.**

Buildings that are built to lease to DoD will comply with the standards for new construction.

**1-8.4.3 Existing Buildings.**

New leases, renewals of leases, or modifications of leases in existing buildings that result in DoD occupied usable office area exceeding 25% of the usable building area will trigger the minimum standards for existing buildings . Major renovations of leased buildings do not trigger these standards unless they involve new leases or lease renewals or modifications. Lease status is the only applicable trigger for existing leased buildings other than the partial occupancy criteria in paragraph 1-8.4.1.

**1-8.5 DoD Purchases of Existing Buildings.**

Existing inhabited buildings purchased for use by DoD will comply with the minimum standards for existing buildings. Those buildings will meet the requirements before they can be occupied by DoD personnel. Building purchases in progress or programmed as of the date of publication of this UFC are exempt from these standards until they meet one of the other triggers in paragraph 1-8.2.

**1-8.6 Non-DoD Tenant Buildings on DoD Installations.**

Because buildings built by non-DoD tenants on DoD property may be taken over by DoD during their life cycles, non-DoD tenant-built buildings other than those that meet one of the exemptions below shall comply with these standards, regardless of funding source. For the purposes of these standards, non-DoD tenant-built building occupancies will be calculated assuming that building occupants are DoD personnel.

**1-8.7 National Guard Buildings.**

Any National Guard building that uses Federal funding for new construction, renovations, modifications, repairs, restorations, or leasing and that meets the applicability provisions above, will comply with these standards.

**1-8.8 Visitor Centers and Museums.**

Where DoD or non-DoD visitors to visitor centers, museums, and similar buildings on DoD property routinely increase the occupancy of those buildings to levels meeting the definitions of inhabited or primary gathering buildings, those buildings will comply with these standards.

**1-8.9 Visitor Control Centers at Entry Control Facilities / Access Control Points.**

For the purposes of this standard, visitor control centers located at controlled perimeters will be considered to be outside the controlled perimeter, and their population will include all permanently assigned DoD personnel plus the average daily peak population of visitors in the building.

**1-8.10 Expeditionary Structures.**

Implementation of these minimum standards is mandatory for all expeditionary structures that meet the occupancy criteria for inhabited or primary gathering buildings or billeting. See Appendix D for structure types that meet the expeditionary structures criteria. Many expeditionary structures are in forward operating locations where there is a conventional and/or terrorist threat more severe than those addressed in these standards. In those situations more detailed planning and additional measures are needed for providing protection. Refer to the GTA 90-01-011, Joint Forward Operations Base (JFOB) Survivability and Protective Construction Handbook. Where there is no known terrorist threat the following apply:

**1-8.10.1 New Structures.**

These standards apply to all new expeditionary structures effective as of the implementation date of these standards.

**1-8.10.2 Existing Structures.**

These standards will apply to all existing expeditionary structures as they undergo major modifications or renovations as of the implementation date of these standards.

**1-9 EXEMPTIONS.**

Unless DoD Components dictate otherwise, the following buildings are exempt from requirements of these standards as specified below. Compliance with these standards for those buildings is recommended where possible. In addition, there are some exemptions to elements of individual standards that are included in the text of those standards in Appendix B. The rationale for all exemptions is detailed in Chapter 2.

1-9.1 **Low Occupancy Buildings.**

Buildings whose occupancies do not meet the occupancy levels of inhabited or primary gathering buildings or of billeting are exempt from all provisions of these standards.

1-9.2 **Low Occupancy Family Housing.**

Family housing with 12 units or fewer per building is exempt from all provisions of these standards.

1-9.3 **Fisher Houses.**

Fisher houses with 24 units or fewer are exempt from all provisions of these standards.

1-9.4 **Town Centers.**

Town Center buildings that include retail, health, or community services space on the first floor and not more than 12 units of family housing above that space are exempt from all provisions of these standards. This exemption will not apply where the buildings contain any occupancy other than retail, health, community services, and family housing or where the retail space is more than half of the total area of the family housing.

1-9.5 **Enhanced Use Leases.**

Where facilities associated with enhanced use leases on DoD installations are completely outside installation controlled perimeters and where access to those facilities does not require access from within the controlled perimeter, those facilities are exempt from all provisions of these standards. This does not apply to buildings owned or leased by DoD within enhanced lease areas.

1-9.6 **Transitional Structures and Spaces.**

These buildings and structures, including buildings and structures leased to provide transitional spaces, are exempt from all provisions of these standards during the life of the construction or renovation contract for which the transitional buildings and structures are being provided, but no longer than 5 years.

1-9.7 **Temporary and Relocatable Buildings.**

Temporary and relocatable buildings that are intended for use for less than 5 years except those constructed in expeditionary environments are exempt from all provisions of these standards.

1-9.8 **Construction Administration Structures.**

Temporary structures, including construction trailers, used during the durations of individual construction contracts and whose purpose it is to support administration of such contracts are exempt from all provisions of these standards.

1-9.9 **Recruiting Stations in Leased Spaces.**

Recruiting stations located in leased spaces are exempt from all provisions of these standards. This exemption does not apply to intermediate command stations or main stations as defined in DoD Directive 5160.58E.

1-9.10 **Stand Alone Gas Stations and Car Care Centers.**

These facilities are exempt from all provisions of these standards.

1-9.11 **Military Protective Construction.**

Facilities designed to the North Atlantic Treaty Organization (NATO) (or equivalent) standards for collaterally protected, semi-hardened, protected, and hardened facilities are exempt from all provisions of these standards; however, the threats included in this standard should be incorporated into the design criteria for the military protective construction. (Refer to SHAPE document 6160/SHLOFA-059-82.)

1-9.12 **Stand-Alone Franchised Fast Food Operations.**

These buildings are exempt from standoff distances to parking and roadways portions of Standard 1 and to the provisions of Standard 2. All other standards apply. This exemption applies to fast food style restaurants and does not apply to sit-down dining restaurants.

1-9.13 **Stand Alone Shoppettes, Mini Marts, and Similarly Sized Commissaries.**

Buildings such as these with areas of less than 15,000 square feet (1394 square meters) are exempt from standoff distances to parking and roadways portions of Standard 1 and to the provisions of Standard 2. All other standards apply.

1-9.14 **Small Stand-Alone Commercial, Bank, and Pharmacy Facilities.**

Stand-alone commercial, bank, and pharmacy facilities are exempt from standoff distances to parking and roadways portions of Standard 1 and to the provisions of Standard 2. All other standards apply.

1-10 **HISTORIC PRESERVATION COMPLIANCE FOR IMPLEMENTATION OF ANTI-TERRORISM STANDARDS.**

Implementation of these standards will not supersede DoD's obligation to comply with the National Historic Preservation Act and its implementing regulations. Conversely, historic preservation compliance does not negate the requirement to implement DoD policy on these antiterrorism standards for buildings.

The planning for and implementation of these standards in historic buildings may constitute an undertaking as defined by the National Historic Preservation Act. Personnel responsible for such buildings should seek the assistance of preservation professionals in the consideration of the processes established by section 106 and its

implementing regulations contained in 36 CFR Part 800. Once a building has been determined to be an historic property, the section 106 process requires determination of the effects of the anti-terrorism measures upon the building and, if adverse, how the effects can be avoided, minimized and/or mitigated. Planning should be designed to allow State Historic Preservation Offices, the Advisory Council on Historic Preservation, and other parties and stakeholders to consider, review and consult as appropriate on proposed DoD actions and their impacts to buildings that are historic properties.

Personnel at DoD installations outside of the United States are encouraged to coordinate with their DoD legal counselors and host nation counterparts to determine appropriate measures and considerations for the effects of anti-terrorism measures to buildings that are culturally or historically significant in foreign lands.

#### **1-11 DESIGN SUBMITTALS.**

Design submittals for DoD projects requiring compliance with these standards will include the following elements as a minimum. Additional submittals may be required to show compliance with specific standards. Note that any references to explosive weights other than referring to them as Explosive Weights I, II, and III in narratives or calculations will result in information sensitivity issues as described in Paragraph 1-11.

- Narratives of how each applicable standard is met.
- Applicable explosive weights and levels of protection.
- Standoff distances provided.
- Blast resistant window system and supporting structure calculations or test results.
- Building element structural analysis or design calculations where standoff distances of less than the applicable conventional construction standoff distance are provided.
- Progressive collapse calculations (where applicable).

#### **1-12 INFORMATION SENSITIVITY.**

Some information associated with these standards is exempt from mandatory disclosure under the Freedom of Information Act. The sensitive information that is exempt is the explosive weights upon which the standoff distances are based, which are included in UFC 4-010-02. Allowing potential aggressors to know the minimum explosive weights that DoD inhabited buildings are designed to resist could constitute a vulnerability to DoD personnel. To minimize the possibility of that information being used against DoD personnel, the following provisions apply. Note that in cases where the information indicates specific vulnerabilities to facilities that the information may rise to the level of being classified in accordance with the Defense Threat Reduction Agency Security Classification Guide For Vulnerability Assessments.

**1-12.1 Distribution.**

Follow governing DoD and Component guidance for specific requirements for handling and distribution of For Official Use Only information. In general, distribution of this document is unlimited. Distribution of the tables (Tables 1 and 2) in UFC 4-010-02 is authorized only to U.S. Government agencies and their contractors. In addition, where it is within Status of Forces Agreements (SOFA) or other similar information exchange agreements, the information in these standards may be distributed to host-nation elements for the purposes of their administration and design of host-nation funded or designed construction in accordance with those agreements. Distribution to foreign elements will be coordinated with Foreign Disclosure Officers.

**1-12.2 Posting to the Internet.**

This document may be posted freely to the Internet; however, because the tables (Tables 1 and 2) in UFC 4-010-02 are For Official Use Only, they cannot be posted to any web site that is accessible to the general public. In addition, other documents that include information from these standards that are identified as For Official Use Only cannot be posted to web sites accessible to the general public. For Official Use Only information may be posted to protected, non-publicly accessible web sites that comply with standards established by DoD and Components for administration of web sites.

**1-12.3 Plans and Specifications.**

The explosive weights from UFC 4-010-02 upon which these standards are based will not be entered into plans and specifications unless the plans and specifications are properly safeguarded. Plans and specifications may be posted to the Internet in accordance with existing DoD and Component guidance, but such documents will not include For Official Use Only information. All plans and specifications for inhabited buildings will include an annotation that cites the version of these standards that was used for design.

**1-12.4 Design – Build Contracts.**

Where design – build contracts are employed, prospective contractors will be responsible for developing design proposals for those projects that may be impacted by provisions of these standards. Where that is the case, consider alternate means to provide sufficient information to support their proposals. Consider, for example, either specifying specific design loads or specifying standoff distances and providing candidate structural systems that would allow for mitigation of the applicable explosives at those standoff distances. Refer to Tables B-1 and B-2 in this standard and to UFC 4-020-01 for candidate structural systems. Once the design – build contracts are awarded the contractors will be eligible to receive the applicable explosive weight information in UFC 4-010-02 for use in the development of the final design packages, but they will be responsible for protecting the integrity of the information throughout the contract and through any subcontracts into which they might enter.

**1-12.5 Design Submittals.**

Design submittals such as calculations, test reports, narratives, any other related documents that reference or include the explosive weights upon which designs are based other than referring to them as Explosive Weights I, II and III shall be marked as For Official Use Only as a minimum and will be handled in accordance with DoD Directive 5400.07.



## CHAPTER 2 PHILOSOPHY, DESIGN STRATEGIES, AND ASSUMPTIONS

### 2-1 GENERAL.

The purpose of this chapter is to clarify the philosophies on which these standards are based, the design strategies that are their foundation, and the assumptions inherent in their provisions. The further purpose of this chapter is to provide background and rationale for the requirements in Chapter 1 and in the appendices; therefore, nothing in this chapter should be construed to establish a requirement. Effective implementation of these standards depends on a reasonable understanding of the rationale for them. With this understanding, engineers and security and antiterrorism personnel can maximize the efficiency of their solutions for complying with these standards while considering site-specific issues and constraints that might dictate measures beyond these minimums.

### 2-2 PHILOSOPHY.

The overarching philosophy upon which this document is based is that comprehensive protection against the range of possible threats may be cost prohibitive, but that an appropriate level of protection can be provided for all DoD personnel at a reasonable cost. That level of protection is intended to lessen the risk of mass casualties resulting from terrorist attacks.

Full implementation of these standards will provide some protection against a wide range of threats and will significantly reduce injuries and fatalities for the threats upon which these standards are based. The costs associated with those levels of protection are assumed to be less than the physical and intangible costs associated with incurring mass casualties.

Furthermore, given what is known about terrorism, all DoD decision makers must commit to making smarter investments with the scarce resources available and stop investing money in inadequate buildings that DoD personnel will have to occupy for decades, regardless of the threat environment. There are three key elements of this philosophy that influence the implementation of these standards.

#### 2-2.1 Time.

Protective measures needed to provide the appropriate level of protection must be in place prior to the initiation of a terrorist attack. Incorporating those measures into DoD buildings is least expensive at the time those buildings are being constructed, are undergoing major renovation, repair, restoration, or modification, when new leases are being established or leases are being renewed, or when existing buildings are being purchased. Because of that investment strategy, it is recognized that it may take significant time before all DoD buildings comply with these standards.

#### 2-2.2 Master Planning.

Many of these standards significantly impact master planning. The most significant such impact will be in standoff distances. If standoff distances are not "reserved" they

will be encroached upon and will not be available when compliance for existing facilities is required due to meeting one of the triggers in paragraph 1-8.2.

The master planning implications of these standards are not intended to be resolved overnight. They should be considered to be a blueprint for facilities and installations that will be implemented over decades as those facilities and installations evolve.

Note that costs increase significantly as standoff distance is reduced. Even providing the conventional construction standoff distances in accordance with Appendix B may result in significantly increased window and supporting structure costs. There are also allowances in Appendix B for minimum standoff distances. Buildings sited at the minimum standoff distance that are designed to provide the structural performance required to meet these standards will require construction that is significantly heavier and more expensive than conventional construction; therefore, the minimum standoff distances should not be used as a common master planning strategy unless the resulting cost increases are taken into account.

### **2-2.3 Design Practices.**

The philosophy of these standards is to build a baseline level of resistance to terrorist attack into all DoD inhabited buildings. That philosophy affects the general practice of designing inhabited buildings. While these standards are not based on a direct threat, they are intended to provide the easiest and most economical methods to minimize injuries and fatalities in the event of a terrorist attack. The primary methods to achieve this outcome are to maximize standoff distance, to construct superstructures to avoid progressive collapse, and to reduce flying debris hazards. These and related design issues are intended to be incorporated into standard design practice.

## **2-3 DESIGN STRATEGIES.**

There are several major design strategies that are applied throughout these standards. They do not account for all of the measures considered in these standards, but they are the most effective and economical in protecting DoD personnel from terrorist attacks. These strategies are summarized below.

### **2-3.1 Maximize Standoff Distance.**

The primary design strategy is to keep terrorists as far away from inhabited DoD buildings as possible. The easiest and least costly opportunity for achieving the appropriate levels of protection against terrorist threats is to incorporate sufficient standoff distance into project designs. While sufficient standoff distance is not always available to provide the standoff distances required for conventional construction, maximizing the available standoff distance always results in the most cost-effective solution except where land is at a premium. Maximizing standoff distance also ensures that there are opportunities in the future to upgrade buildings to meet increased threats or to accommodate higher levels of protection.

### 2-3.2 **Prevent Building Collapse.**

Provisions for preventing building collapse are essential to minimizing mass casualties of building occupants. Those provisions apply regardless of standoff distance or the ability of buildings to resist blast effects since structural systems that provide greater continuity and redundancy among structural components will help limit collapse for any extreme loading events.

### 2-3.3 **Minimize Hazardous Flying Debris.**

In past explosive events where there was no building collapse, a high number of injuries resulted from flying glass fragments and debris from walls, ceilings, and fixtures (non-structural features). Flying debris can be minimized through building design and avoidance of certain building materials and construction techniques. The glass used in most windows breaks at very low blast pressures, resulting in hazardous, dagger-like fragments. Minimizing those hazards through reduction in window numbers and sizes and through enhanced window construction has a major effect on limiting mass casualties. Window and door designs must treat glazing, frames, connections, and the structural components to which they are attached as integrated systems. Hazardous fragments may also include secondary debris such as those from barriers and site furnishings.

### 2-3.4 **Provide Effective Building Layout.**

Effective design of building layout and orientation can significantly reduce opportunities for terrorists to target building occupants or injure large numbers of people.

### 2-3.5 **Limit Airborne Contamination.**

Effective design of heating, ventilation, and air conditioning (HVAC) systems can significantly reduce the potential for chemical, biological, and radiological agents being distributed throughout buildings.

### 2-3.6 **Provide Mass Notification.**

Providing a timely means to notify building occupants of threats and what should be done in response to those threats reduces the risk of mass casualties. Effective designs will include means for both local and remote origination of information.

## 2-4 **ASSUMPTIONS.**

This section includes assumptions that form the foundation of these standards and assumptions and philosophies behind some of the provisions of these standards.

### 2-4.1 **Baseline Threat.**

The location, size, and nature of terrorist threats are unpredictable. These standards are based on a specific range of assumed threats that provides a reasonable baseline for the design of all inhabited DoD buildings. Designing to resist baseline threats will provide general protection today and will establish a foundation upon which to build

additional measures where justified by higher threats or where the threat environment increases in the future.

While those baseline threats are less than some of the terrorist attacks that have been directed against U.S. personnel in the past, they represent more severe threats than a majority of historical attacks. It would be cost prohibitive to provide protection against the worst-case scenario in every building.

The terrorist threats addressed in these standards are further assumed to be directed against DoD personnel. Threats to other assets and critical infrastructure are beyond the scope of these standards, but they are addressed in UFC 4-020-01. The following are the terrorist tactics upon which these standards are based:

#### **2-4.1.1 Explosives.**

The baseline explosive weights are identified in Tables B-1 and D-1 as explosive weights I, II, and III. The actual explosive weights associated with those are tabulated in UFC 4-010-02. Their means of delivery are discussed below.

##### **2-4.1.1.1 Vehicle Bombs.**

For the purposes of these standards, the vehicle bomb is assumed to be a stationary vehicle bomb. The assumption inherent in the stationary vehicle bomb is that the aggressors want to park the vehicles covertly without being noticed as doing anything unusual; therefore, it is assumed that they will park in legal parking spaces or areas.

The sizes of the explosives in the vehicle bombs associated with explosive weight I (in equivalent weight of TNT) are likely to be detected in a vehicle during a search. Therefore, explosive weight I is the basis for the standoff distances associated with a controlled perimeter or situations in which there is no controlled perimeter.

The quantity of explosives associated with explosive weight II is assumed to be able to enter a controlled perimeter undetected; therefore, explosive weight II is the basis for the standoff distances for parking and roadways within controlled perimeters. Explosive weight II was selected because it represents a tradeoff between likelihood of detection and the risk of injury or damage.

##### **2-4.1.1.2 Waterborne Vessel Bombs.**

For the purposes of these standards, waterborne vessels will also be assumed to contain quantities of explosives associated with either explosive weight I or II, depending on whether or not a controlled perimeter has been established.

##### **2-4.1.1.3 Placed Bombs.**

Hand-carried explosives placed near buildings can cause significant localized damage, potentially resulting in injuries or fatalities. It is assumed that aggressors will not attempt to place explosive devices in areas near buildings where those devices could be visually detected by building occupants casually observing the area around the building within the unobstructed space. Explosive weight II is assumed to be placed by hand either in trash containers or in the immediate vicinities of buildings. That quantity

of explosives is further assumed to be built into a bomb 6 inches (150 millimeters) or greater in height.

#### 2-4.1.1.4 **Mail Bombs.**

Explosives in packages delivered through the mail can cause significant localized damage, injuries, and fatalities if they detonate inside a building. No assumption as to the size of such explosives is made in these standards. Provisions for mail bombs are limited to specifying locations of mail rooms so that they can be more efficiently hardened if a specific threat of a mail bomb is identified in the future.

#### 2-4.1.2 **Indirect Fire Weapons.**

For the purpose of these standards, indirect fire weapons are assumed to be military mortars with fragmentation rounds containing explosives equivalent to explosive weight III in Table D-1. They only apply to expeditionary environments for the purposes of these standards. Protection against the effects of direct hits from such rounds on an individual building is not considered practical as a minimum standard; therefore, these standards are intended to limit collateral damage to adjacent buildings from these weapons.

#### 2-4.1.3 **Direct Fire Weapons.**

For the purpose of these standards, direct fire weapons include small arms weapons and shoulder fired rockets that require direct lines of sight. Some standards in this document are predicated on a direct fire weapon threat. Provisions of those standards are based on the assumption that those weapons will be fired from vantage points outside the control of an installation or facility. Obscuration or screening that minimizes targeting opportunities and mass notification are assumed to be the primary means of protecting DoD personnel from these weapons in these standards. Hardening to resist direct fire effects represents a higher level of protection than required by these standards.

#### 2-4.1.4 **Chemical, Biological, and Radiological Weapons.**

For the purposes of these standards, these weapons are assumed to be improvised weapons containing airborne agents employed by terrorists. These standards do not assume comprehensive protection against this threat. They provide means to reduce the potential for widespread dissemination of such agents throughout buildings in the event of an attack either outside buildings or in mail rooms.

#### 2-4.2 **Controlled Perimeters and Access Control.**

These standards assume that procedures are implemented to search for and detect explosives to limit the likelihood that a vehicle carrying quantities of explosives equivalent to explosive weight I in Tables B-1 and D-1 could penetrate a controlled perimeter undetected. It is further assumed that access control will include provisions to reject vehicles without penetrating the controlled perimeter. Access control measures and procedures are beyond the scope of these standards.

### 2-4.3 **Vehicle Barriers.**

Because the assumptions in these standards are predicated on the stationary vehicle bomb threat, vehicle barriers provided to meet these standards are not required to stop moving vehicles.

#### 2-4.3.1 **Controlled Perimeter.**

Perimeter barriers are not required for controlled perimeters. Controlled perimeters require physical boundaries that channel vehicles to access control points as described in the definition of controlled perimeter in the glossary. They are intended to clearly delineate the perimeter and to force potential aggressors to perpetrate an overt act to breach the perimeter rather than being able to cross the perimeter at other than the entry control point without any obstacles.

#### 2-4.3.2 **Parking and Roadways.**

Parking areas and roadways do not require physical barriers. They only require means to ensure the boundaries are clearly identified such that driving past that boundary would draw attention.

### 2-4.4 **Government Vehicle Parking.**

Limitations on parking near buildings apply to all vehicles, including official and tactical vehicles, except for mobile ground tactical platforms, emergency vehicles, and operations support vehicles that are never driven out of restricted access areas, as established in these standards. Government vehicles other than those vehicles are included in the parking limitations in these standards because it is assumed that when they are out of restricted access areas they may be out of the immediate control of their operators, which could make them susceptible to having explosives placed on or inside of them.

### 2-4.5 **Emergency, Command, and Operational Support Vehicles and Mobile Ground Tactical Platforms.**

Emergency vehicles and command vehicles are exempted from parking restrictions because they are assumed to be under strict control while they are both in and away from their usual parking spaces. Operational support vehicles are exempted because they are assumed to always operate within restricted access areas. Mobile ground tactical platforms are exempted because they are provided strict security and access control due the sensitive nature of their missions and because they must be parked adjacent to buildings to support their connectivity for electronic system updates.

### 2-4.6 **Levels of Protection.**

The potential levels of protection are described qualitatively in Tables 2-1 and 2-2. Those descriptions should be used for general understanding of the goals of the levels of protection. Detailed, quantitative descriptions of the levels of protection are included in PDC Technical Report 06-08.

These standards provide a Low Level of Protection for billeting, high occupancy family housing, and primary gathering buildings and a Very Low Level of Protection for other inhabited buildings. Greater protection is provided for primary gathering buildings, billeting, and high occupancy family housing because of the higher concentration of personnel and the more attractive nature of the targets.

If the conventional construction standoff distances are provided, or if mitigating measures are provided to achieve an equivalent level of protection, and if the threats are no greater than those indicated in Tables B-1, B-2, and D-1, the risk of injuries and fatalities will be reduced. Threats higher than those envisioned in Tables B-1, B-2, and D-1 will increase the likelihood of injuries and fatalities regardless of the level of protection. Refer to UFC 4-020-01 for guidance on levels of protection and how to achieve them for a wide range of threats.

#### **2-4.7 Applicable Explosive Weight.**

The applicable explosive weights to be used in designing buildings required to comply with these standards are commonly established based on potential bomb locations with the larger explosive weight (explosive weight I) required to be applied at controlled perimeters or in parking areas and on roadways where there are no controlled perimeters. The smaller explosive weight (explosive weight II) applies in parking areas and on roadways within controlled perimeters, in trash containers, and around buildings outside unobstructed spaces.

Where buildings within controlled perimeters are distant from the perimeters (beyond 200 feet [60 meters]) the effects of an explosive of the size of explosive weight I placed at the controlled perimeter will be less than those of an explosive of the size of explosive weight II located near the buildings. In those cases, only explosive weight II is used in the design of the windows and doors. Where buildings are closer than 200 feet (60 meters) to the controlled perimeter, both explosive weights I and II need to be investigated at their actual standoff distances to determine which controls the window and door designs.

**Table 2-1 Levels of Protection – New and Existing Buildings**

Level of Protection	Potential Building Damage/Performance <sup>2</sup>	Potential Door and Glazing Hazards <sup>3,4</sup>	Potential Injury
Below AT standards <sup>1</sup>	Severe damage. Progressive collapse likely. Space in and around damaged area will be unusable.	Doors and windows will fail catastrophically and result in lethal hazards. ( <i>High hazard rating</i> )	Majority of personnel in collapse region suffer fatalities. Potential fatalities in areas outside of collapsed area likely.
Very Low	Heavy damage - Onset of structural collapse, but progressive collapse is unlikely. Space in and around damaged area will be unusable.	* Glazing will fracture, come out of the frame, and is likely to be propelled into the building, with potential to cause serious injuries. ( <i>Low hazard rating</i> )  * Doors will be severely deformed but will not become a flying debris hazard. ( <i>Category IV</i> )	Majority of personnel in damaged area suffer serious injuries with a potential for fatalities. Personnel in areas outside damaged area will experience minor to moderate injuries.
Low	Moderate damage – Building damage will not be economically repairable.  Progressive collapse will not occur. Space in and around damaged area will be unusable.	* Glazing will fracture, potentially come out of the frame, but at reduced velocity, does not present a significant injury hazard. ( <i>Very low hazard rating</i> )  * Doors will experience non-catastrophic failure, but will have permanent deformation and will be inoperable. ( <i>Category III</i> )	Majority of personnel in damaged area suffer minor to moderate injuries with the potential for a few serious injuries, but fatalities are unlikely. Personnel in areas outside damaged areas will potentially experience minor to moderate injuries.
Medium <sup>5</sup>	Minor damage – Building damage will be economically repairable.  Space in and around damaged area can be used and will be fully functional after cleanup and repairs.	* Glazing will fracture, remain in the frame and results in a minimal hazard consisting of glass dust and slivers. ( <i>Minimal hazard rating</i> )  * Doors will be operable but will have permanent deformation. ( <i>Category II</i> )	Personnel in damaged area potentially suffer minor to moderate injuries, but fatalities are unlikely. Personnel in areas outside damaged areas will potentially experience superficial injuries.



High <sup>5</sup>	Minimal damage.  No permanent deformations. The facility will be immediately operable.	* Glazing will not break.(No hazard rating)  * Doors will remain intact and show no permanent deformation. ( <i>Category I</i> )	Only superficial injuries are likely.
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1. This is not a level of protection and should never be a design goal. It only defines a realm of more severe structural response, and may provide useful information in some cases.
2. For damage / performance descriptions for primary, secondary, and non-structural members, refer to PDC Technical Report 06-08.
3. Glazing hazard levels are from ASTM F 1642.
4. Door hazard levels are from ASTM F 2247.
5. Beyond minimum standards.

<b>Table 2-2 Levels of Protection – Expeditionary Structures</b>		
Level of Protection	Potential Structural Damage	Potential Injury
Below AT Standards <sup>1</sup>	Severe damage. Frame collapse/massive destruction. Little left standing.	Majority of personnel in collapse region suffer fatalities. Potential fatalities in areas outside of collapsed area likely.
Very Low	Heavy damage. Major portions of the structure will collapse. A significant percentage of secondary structural members will collapse.	Majority of personnel in damaged area suffer serious injuries with a potential for fatalities. Personnel in areas outside damaged area will experience minor to moderate injuries.
Low	Moderate damage. Damage will be unrepairable. Some sections of the structure may collapse or lose	Majority of personnel in damaged area suffer minor to moderate injuries with the potential for a few serious injuries, but fatalities are unlikely. Personnel in areas outside damaged areas will

	structural capacity.	potentially experience a minor to moderate injuries.
Medium	Minor damage. Damage will be repairable.  Minor to major deformations of both structural members and non-structural elements. Some secondary debris will be likely, but the structure remains intact with collapse unlikely.	Personnel in damaged area potentially suffer minor to moderate injuries, but fatalities are unlikely. Personnel in areas outside damaged areas will potentially experience superficial injuries.
High	Minimal damage.  No permanent deformation of primary and secondary structural members or non-structural elements.	Only superficial injuries are likely.

1. This is not a level of protection, and should never be a design goal. It only defines a realm of more severe structural response, and may provide useful information in some cases.

Where buildings within controlled perimeters are located closer than the conventional construction standoff distances for both explosive weights I and II, building walls, windows, and doors will have to be evaluated for both explosive weights because the blast effects of the two explosive weights will have differing effects on the various wall types tabulated in Table B-2.

#### 2-4.8 **Standoff Distances.**

The conventional construction standoff distances identified in Tables B-1, B-2 and D-1 were developed to provide survivable structures for a wide range of conventionally constructed buildings and expeditionary structures. These buildings range from tents and wood framed buildings to reinforced concrete buildings. For detailed information on how the standoff distances for buildings other than expeditionary buildings were developed and the building construction to which they apply, refer to PDC Technical Report 10-01.

##### 2-4.8.1 **Conventional Construction Standoff Distance.**

The standoff distances in the “Conventional Construction Standoff Distance” column in Tables B-1 and B-2 are based on analysis of common conventionally constructed building walls that are in PDC Technical Report 10-01. They do not address roofs or framing systems because those were found not to control any of the standoff distance analyses at the conventional construction standoff distances. The building components

upon which the conventional construction standoff distances in Tables B-1 and B-2 are based are tabulated in Table 2-3.

Note that windows at some of the conventional construction standoff distances in Table B-2 may need to be significantly heavier than conventional windows to meet the requirements of these standards, so designers will have to weigh the economics of providing heavier windows or more standoff distance in some cases.

The wall and roof types in Table 2-3 are those that were analyzed to establish the conventional construction standoff distances in Tables B-1 and B-2. Those distances may be used as long as the construction for the applicable walls fits within the ranges of properties in Table 2-3. Any construction outside those ranges will have to be analyzed. Roofs may be assumed not to control the designs of buildings for which any of the conventional construction standoff distances are provided as long as they fall within the ranges of properties for the concrete and metal roofs in Table 2-3. Other roof construction will have to be analyzed.

Table 2-3 Conventional Construction Parameters

Wall or Roof Type	Analysis Assumptions <sup>1</sup>						
	Sections	Span	Spacing	Support Condition	Supported Weight <sup>4</sup>	Reinforcement Ratio	Static Material Strength
Wood Studs – Brick Veneer	2x4 & 2x6 in (50x100 & 50x150 mm)	8 – 10 ft (2.4 - 3 m)	16 - 24 in (400 – 600 mm)	S-S	44 psf (215 kg/m <sup>2</sup> )	N/A	875 psi (6 MPa)
Wood Studs – EIFS	2x4 & 2x6 in (50x100 & 50x150 mm)	8 – 10 ft (2.4 – 3 m)	16 -24 in (400 -600 mm)	S-S	10 psf (49 kg/m <sup>2</sup> )	N/A	875 psi (6 MPa)
Steel Studs – Brick Veneer <sup>2</sup>	600S162-43 600S162-54 600S162-68	8 – 12 ft (2.4 – 3.7 m)	16 - 24 in (400 – 600 mm)	S-S	44 psf (215 kg/m <sup>2</sup> )	N/A	50,000 psi (345 MPa)
Steel Studs – EIFS <sup>2</sup>	600S162-43 600S162-54 600S162-68	8 – 12 ft (2.4 – 3.7 m)	16 - 24 in (400 – 600 mm)	S-S	10 psf (49 kg/m <sup>2</sup> )	N/A	50,000 psi (345 MPa)
Metal Panels	1.5 – 3 in (38 - 76 mm) 22, 20, & 18 ga	4 – 8 ft (1.2 - 2.4 m)	N/A	S-S	10 psf (49 kg/m <sup>2</sup> )	N/A	33,000 psi (228 MPa)
Girts	8Z3 & 10Z3 16, 14, & 12 ga	20 – 25 ft (6 – 7.6 m)	6 – 8 ft (1.8 – 2.4 m)	S-S	5 psf (24 kg/m <sup>2</sup> )	N/A	50,000 psi (345 MPa)
Reinforced Concrete	≥ 6 in (≥ 150 mm)	12 – 20 ft (3.7- 6 m)	N/A	S-S, One way flexure	10 psf (49 kg/m <sup>2</sup> )	≥ 0.0015	3,000 psi (21 MPa)
Unreinforced Masonry <sup>3</sup>	6 – 12 in (150 – 300 mm)	8 – 12 ft (2.4 – 3.7 m)	N/A	S-S, One way flexure	10 psf (49 kg/m <sup>2</sup> )	0	1,500 psi (10 MPa)
Reinforced Masonry	8 – 12 in (200 - 300 mm)	10 – 14 ft (3 – 4.3 m) 12 ft (3.7m) 14 ft (4.3m)	N/A	S-S, One way flexure	10 psf (49 kg/m <sup>2</sup> )	0.0005 - 0.0030	1,500 psi (10 MPa)
European Block <sup>3</sup>	6 – 8 in (150 – 200 mm)	10 – 12 ft (3 – 3.7 m)	N/A	S-S, Brittle Flexure	10 psf (49 kg/m <sup>2</sup> )	0	1,800 psi (12 MPa)

**Table 2-3 Conventional Construction Parameters**

Wall or Roof Type	Analysis Assumptions <sup>1</sup>						
	Sections	Span	Spacing	Support Condition	Supported Weight <sup>4</sup>	Reinforcement Ratio	Static Material Strength
Concrete Roofs	4 – 12 in (100 - 300 mm)	6 ft (1.8 m)	N/A	F-S	15 psf (73 kg/m <sup>2</sup> )	0.0015 - 0.005	3,000 psi (21 Mpa)
Metal Roofs	K and LH joists with Metal Deck and/or 3.5 - 5.5 in (90 - 140 mm) Topping	30 ft (9.1m)	4 – 8 ft (1.2 – 2.4 m)	S-S	15 – 90 psf (73 – 439 kg/m <sup>2</sup> )	N/A	50,000 psi (345 MPa)

1. See PDC Technical Report 10-01 for details on the analysis.
2. Steel studs are connected top and bottom with slip tracks.
3. Unreinforced masonry must have adequate lateral support at the top and bottom.
4. Weight supported by the wall that moves through the same deflection as the wall, not including self-weight of the component.

S-S = Simple - Simple Supports

F-S = Fixed - Simple Supports

#### 2-4.8.2 Minimum Standoff Distance.

These standards allow for the adjustment of standoff distances based on the results of a structural analysis considering the applicable explosive weights in Table B-1. The minimum standoff distances represent the distances at which the flexural behavior assumptions of conventional structural design are no longer applicable. At those distances buildings have to be designed as hardened structures considering breaching behavior in accordance with UFC 3-340-01, Design and Analysis of Hardened Structures to Conventional Weapons Effects.

For new buildings, even if such an analysis suggests a standoff distance of less than those in the “Minimum Standoff Distance” column of Table B-1, standoff distances less than the minimum standoff distances are not allowed because those distances can be readily accommodated in building and site design.

For existing buildings, the standoff distances less than the “Minimum Standoff Distance” column of Table B-1 will not be allowed except where providing the minimum standoff distance is not possible. In those cases, lesser standoff distances may be allowed where the required level of protection can be shown to be achieved through analysis or can be achieved through building hardening or other mitigating construction or retrofit. This is allowed for existing buildings because of the recognition that there are instances where providing even the minimum standoff distances is impractical.

### 2-4.8.3 **Operational Option for Existing Buildings.**

Because moving parking and roadways associated with existing buildings or applying structural retrofits to harden those buildings may be impractical, operational options are provided for complying with the standoff distance requirements for existing parking and roadways associated with existing buildings (including leased buildings). Those operational options allow for establishing access control for authorized parking at the applicable standoff distances in Tables B-1 and B-2, in which case parking can be allowed to be as close as the minimum standoff distance to buildings without hardening or analysis.

The access control in those situations must be established at distances in accordance with Tables B-1 and B-2. The assumption is that by establishing access control into parking areas, there will be lesser opportunities to enter the parking areas with explosive in vehicles. For roadways, the operational option is to prohibit parking along roadways within the standoff applicable distances in Tables B-1, B-2, and D-1. As with procedures at controlled perimeters, the wide variations in the situations for various buildings and installations necessitate leaving the development of specific access control measures and procedures to local physical security and antiterrorism personnel.

These operational options will result in increased risk for existing buildings, but acceptance of that risk is necessary to make application of these standards to existing buildings practical. The additional option for allowing parking even closer than the minimum standoff distance as long as the applicable level of protection is met, is based on the recognition that there may be some buildings, especially in urban areas, where achieving even the minimum standoff distance is not possible.

### 2-4.8.4 **Standoff to Entry Control Facilities/Access Control Points.**

Standoff distances from buildings to entry control facilities/access control points are based on the distances to identification check areas instead of final denial barriers (if present) because these standards are predicated on the stationary vehicle bomb tactic as described above. With that assumption, measuring to the identification check area is sufficient because that is the furthest point at which unauthorized vehicles can approach.

### 2-4.8.5 **Expeditionary Construction.**

The standoff distances in Table D-1 are based on blast testing conducted against TEMPER Tents, SEA Huts, General Purpose Shelters, and Small Shelter Systems. The human body is capable of surviving blast pressures higher than what conventionally constructed buildings will commonly survive. It is commonly failed building components or building debris such as walls and columns or being thrown into building interiors that injures people. Many kinds of expeditionary construction have lesser standoff distances than permanent construction, therefore, because of the lesser weight of their structural and non-structural components.

#### 2-4.9 **Unobstructed Space.**

The assumptions inherent in establishing the requirements for unobstructed spaces include the basis for the distance at which they are established and the issue of concealment of explosives within unobstructed spaces and within equipment and enclosures located within them.

##### 2-4.9.1 **Distance.**

The threat upon which the unobstructed space is predicated involves the same explosive weight (Explosive Weight II) as that upon which parking and roadway standoff distances within a controlled perimeter and standoff to trash containers are based. Because of that, where buildings are located within controlled perimeters, the unobstructed space is required to extend to the same distance as is provided to parking, roadways, and trash containers. The distance to the outer edge of the unobstructed space is not allowed be closer to inhabited buildings than the minimum standoff distance, except for existing buildings in accordance with paragraph 2-4.8.2.

In previous editions of these standards the unobstructed space was set at 33 feet (10 meters) without consideration of the effects of bombs of Explosive Weight II on buildings when placed at that distance. That resulted in inconsistent protection between that provided for the unobstructed space and that provided for parking, roadways, and trash containers. With revisions to the conventional construction standoff distances based on building construction, the previous inconsistency has been eliminated and the bases for establishing the dimensions of the unobstructed space and the standoff distance to parking, roadways, and trash containers are now the same.

The extension of the unobstructed space to the parking and roadway standoff distance does not apply where there is no controlled perimeter, however. The reason for that is that the assumed explosive weight where there is no controlled perimeter (Explosive Weight I) is much larger than the hand carried explosive that is assumed for the unobstructed space. Explosive weight II is, therefore, the basis for establishing the unobstructed space regardless of the existence of a controlled perimeter.

##### 2-4.9.2 **Concealment.**

The issue of concealment is predicated on the assumption of hand carried explosive devices equivalent to Explosive Weight II. It is further assumed that the devices will have a least dimension of 6 inches (150 mm) in height, which is consistent with a brief case or satchel sized object.

The requirements for the unobstructed space are based on eliminating any opportunities to conceal objects of that size. It is further assumed that aggressors will not attempt to place explosives where they believe they might be noticed. The key, therefore, to determining what may be located in unobstructed spaces is whether or not a person could see the objects. With that, even if objects are hidden behind obstructions such as large trees, those trees would be permissible because the devices could be seen from at least one direction. Concealment establishes the basis for the requirement for above ground objects or obstructions. Indentations in landscapes such as ditches should also be evaluated with respect to concealment.

The requirements related to equipment and enclosures should be evaluated based on similar criteria. Equipment should be evaluated based on the capacity to conceal objects, primarily underneath and inside it. If there are voids within the equipment into which explosives could be inserted or space underneath it large enough to conceal explosives, that equipment will need to be secured if it is to be within the unobstructed space. For equipment or trash enclosures the test should be whether or not something could be concealed behind the equipment or trash container. If the enclosures are two sided it may be assumed that people could see something out of place as they walk by, so it could be assumed aggressors would not try to conceal explosives there. If the enclosures have three or more sides, they provide opportunities for concealment and will need to be secured in accordance with guidance in Standard 2.

#### **2-4.10 Building Occupancy Levels.**

Buildings other than billeting and family housing can be categorized as low occupancy, inhabited, or primary gathering as defined in Appendix A. Low occupancy portions of buildings can be treated for the purposes of these standards as separate from the inhabited portions subject to specific provisions in Appendix B. Buildings that meet the population to be considered a primary gathering building cannot be further separated into primary gathering portions and inhabited portions. The reason for that is that it is assumed that during the life of the building space utilization changes would result in moving additional people into those areas that are inhabited, but do not meet the primary gathering threshold. Only low occupancy portions can be treated separately.

#### **2-4.11 Expeditionary Structures.**

Expeditionary structures are commonly built of either combinations of metal frames and fabric or wood frames and rigid walls. It is assumed that most expeditionary structures cannot be retrofitted or hardened sufficiently for higher threats; therefore, unless adequate planning is done to obtain the needed space to achieve appropriate standoff, it is unlikely that such structures will be able to be built in compliance with Appendix B.

#### **2-4.12 Leased Buildings.**

DoD personnel occupying leased buildings require the same level of protection as those in DoD-owned buildings; therefore, leased buildings are required to meet the requirements of these standards. The thresholds in those criteria reflect the significance of higher populations of DoD personnel as targets versus the inherent risk reduction associated with dispersing DoD personnel.

#### **2-4.13 Tenant Buildings on DoD Installations.**

Tenant buildings on DoD installations are required to comply with these standards because it is assumed that the tenant buildings are likely to be turned over to DoD sometime during their design life and that they will then be occupied by DoD personnel.

#### **2-4.14 Enhanced Use Leases.**

Enhanced use leases are leases of DoD land to non-DoD entities. It is assumed that as long as there is no access to DoD installations to get to the enhanced lease facilities



that there is no increased threat to DoD personnel. It is further assumed that the type of construction that is likely to be emplaced in enhanced use lease areas is relatively short life cycle construction that would not be suitable for DoD use in the long term. For that reason, the tenant building requirements are not enforced on enhanced use lease tenants. DoD buildings in enhanced lease areas must still comply with these standards, however.

#### 2-4.15 **Laminated Glass and Polycarbonate.**

Laminated glass is required as the protective layer (the inner pane in an insulating glass window) in glass windows required to meet these standards because when laminated glass fails the laminate interlayer tends to retain the glass fragments, significantly reducing the hazardous fragments entering inhabited areas. Laminated glass is the only glass allowed by these standards. Polycarbonate is allowed because it does not break into hazardous fragments when it fails.

#### 2-4.16 **Alternate Window Treatments.**

Standard 10 does not allow for the use of window treatments such as fragment retention films and blast curtains where buildings are required to meet these standards, except for leased buildings. The primary reason for that is the fact that such solutions commonly have much shorter design lives than laminated glass windows, which requires their replacement multiple times as compared to laminated glass windows. Laminated glass, while more expensive initially, is less expensive over its life cycle. Additionally, in the case of blast curtains there need to be operational procedures to ensure that they remain closed at all times for them to be effective. Such solutions are allowed in leased buildings because landlords are often reluctant to replace windows for one tenant. Film and curtain solutions are also good interim solutions where compliance with these standards is not required.

#### 2-4.17 **Glazed Doors.**

The glazing in glazed doors is exempted from the framing and connection provisions of Standard 10 because the alternate design provision of Standard 12 allows doors to fail and enter buildings as long as their hazards are mitigated. Because that is allowed for doors in general, to make the glazing meet all Standard 10 provisions would result in glazed doors effectively being held to a higher standard than non-glazed doors. In forcing the glazing to meet the glazing and frame bite provisions of Standard 10, it is likely that the glazing will respond with the remainder of the door and that its hazard can be mitigated as an assembly as for non-glazed doors.

#### 2-4.18 **Exterior Conventional Doors.**

In previous versions of these standards conventional doors were only required to open outwards at the conventional construction standoff distances. At those standoff distances conventional doors tended to rebound off the door frames and fail outwards, resulting in minimal hazards. With the reductions in conventional construction standoff distances that assumption is no longer valid, so exterior doors are now required to be designed in accordance with ASTM 2247 or otherwise have their hazards mitigated in accordance with Standard 12.

2-4.19 **Exterior Stairwells and Covered or Enclosed Walkways.**

Exterior stairwells and covered or enclosed walkways may be excluded from consideration of inhabited buildings because they generally are not considered to be routinely occupied. An additional consideration with respect to exterior stairwells, even emergency exit stairwells, is that there are commonly multiple such stairwells and with the explosive weights considered in these standards it is unlikely that multiple stairwells would be significantly impacted unless they were very close together. Also, stair structures are commonly of robust construction, and even though they do not require Standard 10 compliant glazing, it is likely that they will still be usable even though they are covered with broken glass. Standoff distance, therefore, may be to the walls of the buildings instead of the walls of the exterior stairwells or covered walkways.

2-4.20 **Exempted Building Types.**

For the reasons below, some building types are exempted from some or all of these standards. The minimum standards should be applied to the exempted building types where possible, however.

2-4.20.1 **Low Occupancy Family Housing.**

The exemption of family housing with 12 units or fewer in a single building acknowledges that the density of such units is generally low, reducing the likelihood of mass casualties. It also acknowledges the fact that low-density housing has rarely been directly targeted by terrorists.

2-4.20.2 **Town Centers.**

These facilities have mixed use of low occupancy family housing and small scale retail, health, or community services operations. Those small scale operations are exempted from the standards as described above, and it is assumed that their combination does not significantly increase their attractiveness to aggressors.

2-4.20.3 **Gas Stations and Car Care Centers.**

These facilities are exempted from these standards because, by the nature of their operation, cars must be allowed to be in close proximity to them. Other measures included in these standards would be ineffective in the absence of any control on vehicles. In addition, they commonly do not have routine occupancies that meet the standards of inhabited buildings.

2-4.20.4 **Transitional and Temporary Buildings, Structures, and Spaces, Construction Administration Structures, and Relocatable Buildings.**

These buildings, structures, and spaces may be required for limited durations to maintain operations during construction, for other temporary mission requirements, or for administering construction contracts. Lightweight buildings or trailers are frequently provided for these structures, and those kinds of structures are commonly not commercially available with construction such as laminated glass windows that will meet these standards. Enforcing the standards on those structures, therefore, would be of

questionable economic feasibility for the short duration for which they are anticipated to be used.

#### 2-4.20.5 **Recruiting Stations in Leased Spaces.**

These facilities are exempted because their visibility and accessibility necessitate their being located in public spaces, which makes requiring them to comply with these standards impractical. In addition, the majority of these facilities do not have a sufficient routine population and population density to meet the inhabited building standard. Intermediate command stations and main stations as defined in DoD Directive 5160.58E are not exempted because they do not meet the visibility, accessibility, and routine population assumptions as the other recruiting stations.

#### 2-4.20.6 **Military Protective Construction.**

These facilities are exempted because the military conventional and nuclear weapons threats to which they are designed are much more stringent than those included in these standards due to their purpose of protecting critical military functions. Facilities designed to protective construction standards will provide higher levels of protection for facility occupants than those required by these standards.

#### 2-4.20.7 **Stand-Alone Franchised Food Operations, Shoppettes, Mini Marts, Similarly Sized Commissaries, and Other Small Stand Alone Commercial Facilities.**

These facilities are exempted from the standoff distances for parking and roadways provisions of Standards 1 and 2 because by the nature of their smaller size and their operations they require parking in close proximity. Applying other upgrades required by these standards is feasible, however, and will lessen the risk of mass casualties. Allowing the buildings to be designed with the prescriptive windows required for these buildings while allowing parking to be closer than the distance at which those windows will provide the required performance accounts for the risk that needs to be accepted due to the nature of the buildings' operations, but still reduces the collateral damage to the buildings due to nearby explosions.

#### 2-4.20.8 **Parking at High Occupancy Family Housing.**

The assumption in allowing the designation of parking spaces for specific residents or residences for existing family housing with 13 or more units per building is that the risk of parking vehicle bombs in those parking areas is reduced due to increased awareness by the building occupants of the vehicles that are authorized to park there.

#### 2-4.21 **Policies and Procedures.**

Policies and procedures are a critical adjunct to building standards. It is assumed that there are means to control access to controlled perimeters, underground parking, and other locations where vehicle access needs to be limited. It is further assumed that there will be sufficient access controls to preclude explosives and chemical, biological, and radiological agents from being introduced into inhabited building interiors. It is also assumed that unusual packages or containers or improperly parked vehicles will be

recognized as potential terrorist threats and appropriate reactive measures will be implemented to reduce the potential for casualties. Finally, it is assumed that policies and procedures will be developed to support these and other related issues and that those policies and procedures will be incorporated into antiterrorism plans, training, and exercises. Because of the wide variance in situations at different DoD installations and buildings, developing common operational policies and procedures is unrealistic. It is assumed for the purposes of this UFC that policies and procedures will be developed by physical security personnel at individual installations or buildings based on their local capabilities and situations.

**2-4.22 Other Design Criteria.**

It is assumed that the provisions of these standards will be coordinated with all other applicable DoD building and design criteria and policies. Nothing in these standards should be interpreted to supersede the provisions of any other applicable building or design criteria. Where other criteria mandate more stringent requirements, it is assumed that the provisions of those criteria will be followed.

**2-4.23 Training.**

It is assumed that key security and facility personnel will receive training in security engineering, antiterrorism, physical security, and related areas. It is further assumed that all DoD personnel have been trained in basic antiterrorism awareness in accordance with DoDI 2000.16, that they are able to recognize potential threats, and that they know the proper courses of action should they detect a potential threat.

## APPENDIX A GLOSSARY

### ABBREVIATIONS and ACRONYMS

**AFCEE** Air Force Center for Engineering and the Environment

**ANSI** American National Standards Institute

**ASCE** American Society of Civil Engineers

**ASTM** Not an Abbreviation (Formerly American Society of Testing and Materials, now ASTM International)

**AT** Antiterrorism

**BIA** Bilateral Infrastructure Agreements

**BOMA** Building Owners and Managers Association

**BRAC** Base Realignment and Closure

**C** Tributary width increase factor

**CCR** Criteria Change Request

**CCSD<sub>I</sub>** Conventional Construction Standoff Distance for Explosive Weight I

**CCSD<sub>II</sub>** Conventional Construction Standoff Distance for Explosive Weight II

**CFM** Cubic Feet per Minute

**CONEX** Container Express

**DBT** Design Basis Threat

**DoD** Department of Defense

**EIFS** Exterior Insulation and Finish System

**ESC** Expandable Shelter Containers

**ESEP** Engineer Senior Executive Panel

**FOUO** For Official Use Only

**FSTFS** Frame-Supported Tensioned Fabric Structures

**Ft** Feet

**GP** General Purpose

**HNFA** Host Nation Funded Construction Agreement

**HQUSACE** Headquarters, US Army Corps of Engineers

**HVAC** Heating, Ventilating, and Air Conditioning

**IGU** Insulating Glass Units

**In** Inches

**ISO** International Organization for Standardization

**JFOB** Joint Forward Operations Base

**Kg/m<sup>2</sup>** Kilograms per square meter

**M** Meters

**MILCON** Military Construction

**Mm** Millimeters

**MPa** MegaPascals

**MSS** Medium Shelter Systems

**M<sub>CW</sub>** Moment, conventional wall

**M<sub>SSE</sub>** Moment, Supporting Structural Element

**NATO** North Atlantic Treaty Organization

**NAVFAC** Naval Facilities Engineering Command

**NCR** National Capital Region

**NFPA** National Fire Protection Association

**OSD** Office of the Secretary of Defense

**Pa** Pascals

**PDC** Protective Design Center

**PSF** Pounds per square foot

**PSI** Pounds per square inch

**PVB** Polyvinyl-butyril

**SEA** Southeast Asia

**SHAPE** Supreme Headquarters Allied Powers Europe

**SOFA** Status of Forces Agreement

**SSS** Small Shelter Systems

**TEMPER** Tent, Extendable, Modular, Personnel

**TNT** Trinitrotoluene

**UFC** Unified Facilities Criteria

**USD (AT&L)** Undersecretary of Defense for Acquisition, Technology, and Logistics

**V<sub>CW</sub>** Shear, conventional wall

**V<sub>SSE</sub>** Shear, Supporting Structural Element

## DEFINITIONS

**Access control.** For the purposes of these standards, any combination of barriers, gates, electronic security equipment, and/or guards that can limit entry or parking of unauthorized personnel or vehicles.

**Access road.** Any roadway such as a maintenance, delivery, service, emergency, or other special limited use road that is necessary for the operation of a building or structure.

**Analysis.** For the purposes of evaluating compliance with standoff distance and supporting structure requirements of these standards, evaluation of structural components using commonly accepted analysis methodologies such as single degree of freedom or finite element analysis.

**Billeting.** Any building or portion of a building, regardless of population density, in which 11 or more unaccompanied DoD personnel are routinely housed, including Temporary Lodging Facilities and military family housing permanently converted to unaccompanied housing. Fisher Houses are similar to hotels, but they are categorized as billeting regardless of accompanied or unaccompanied occupancy. Billeting also applies to expeditionary structures with similar populations and functions.

**Breezeway.** A covered passage that passes between two buildings or portions of buildings or covered areas underneath or attached to buildings.

**Building.** A structure, usually enclosed by walls and a roof, constructed to provide support or shelter for an intended occupancy. Note that other structures, such as canopies, are not considered buildings for the purposes of these standards.

**Building hardening.** Enhanced conventional construction that mitigates threat hazards where standoff distance is limited. Building hardening may also be considered to include the prohibition of certain building materials and construction techniques.

**Building occupancy.** For the purposes of these standards, the planned occupancy of a building or the allowable occupancy calculated in accordance with life safety codes where the occupancy is not known.

**Building overhangs.** Any structural configuration in which the outer walls or columns of the ground floor are set back from the outer walls or column lines of floors above.

**Building separation.** The distance between closest points on the exterior walls of adjacent buildings or structures.

**Collateral damage.** Injury to personnel or damage to buildings that are not the primary targets of attacks.

**Command vehicles.** Government owned or leased vehicles operated by installation or senior mission commanders, exclusive of privately owned vehicles



**Commercial facilities.** Facilities that are not DoD owned or operated and that support commercial activities other than food service and retail activities such as banks.

**Container structures.** Structures built using shipping containers that are designed to withstand structural loadings associated with shipping, including Container Express (CONEX) and International Organization for Standardization (ISO) containers. Testing has shown that these structures behave similarly to buildings for the purposes of these standards.

**Controlled parking.** For the purposes of these standards, parking that is limited to authorized vehicles that is enforced through physical security measures such as card operated gates, identification or vehicle checks by personnel or similar measures that are acceptable to physical security personnel.

**Controlled perimeter.** For the purposes of these standards, a physical boundary at which vehicle access is controlled with sufficient means to channel vehicles to the access control points. At a minimum, access control at a controlled perimeter requires the demonstrated capability to search for and detect explosives. Where the controlled perimeter includes a shoreline and there is no defined perimeter beyond the shoreline, the boundary for measuring standoff distances will be at the mean high water mark or the elevation associated with top of bank (associated with a flood recurrence interval of 1.2 years).

**Conventional construction.** Building construction that is not specifically designed to resist weapons or explosives effects. Conventional construction is designed only to resist common loadings and environmental effects such as wind, seismic, and snow loads. Note that for the purposes of these standards, conventional construction may still require special windows, structural reinforcement around windows, and progressive collapse resistant construction.

**Conventional construction standoff distance.** The standoff distances at which conventional construction may be used for building components other than doors and windows without a specific analysis of blast effects, except as otherwise required in these standards.

**Change of occupancy.** Change of occupancy level as defined in these standards. It does not relate to conversions of facility category code. Examples include occupancy changing from low occupancy to inhabited or inhabited to primary gathering.

**Deviation.** Temporary or permanent conditions in which a provision of these standards is not met, excluding alternate means of meeting the standard that provide an equivalent level of protection,

**Design basis threat.** The threat (aggressors, tactics, and associated weapons, tools, or explosives) against which assets within a building must be protected and upon which the security engineering design of the building is based.

**DoD building.** Any building or portion of a building (permanent, temporary, or expeditionary) owned, leased, privatized, or otherwise occupied, managed, or controlled

by or for DoD. DoD buildings are categorized within these standards as low occupancy, inhabited, primary gathering, high occupancy family housing, and billeting.

**DoD components.** 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; the Office of the Inspector General of the Department of Defense; the Defense Agencies; the DoD Field Activities; and all other organizational entities within DoD.

**DoD Installation.** A base, camp, post, yard, center, homeport facility for any ship, or other activity under the jurisdiction of the Department of Defense, including any leased facility.

**DoD personnel.** Any U.S. military, DoD civilian, or family member thereof, host-nation employees working for DoD, or contractors occupying DoD buildings. For the purposes of these standards, non-DoD visitors to DoD owned or controlled visitor centers, visitor control centers, museums, and similar facilities will be included in DoD personnel populations of those facilities. Visitor counts will be based on routine visitor levels.

**Emergency vehicles.** Vehicles such as fire trucks and ambulances and other vehicles that are critical to emergency response and for which close proximity to inhabited buildings or containment therein is essential.

**Enhanced use lease.** Out leases of non-excess DoD land or facilities to a public or private entities for development under the authority of 10 US Code Section 2667.

**Equivalent level of protection.** Performance of building components that results in building damage or door and glazing hazards similar to that required for the required level of protection as described in Table 2-1 or as specified in PDC Technical Report 06-08.

**Expeditionary structures.** Structures that are erected in forward operating locations and that are intended to be occupied only during the period of operations. This group of structures typically includes but is not limited to tents, Small and Medium Shelter Systems, Expandable Shelter Containers (ESC), ISO and CONEX containers, General Purpose (GP) Medium tents and GP Large tents, trailers, and modular and light wood framed structures.

**Fabric covered structures.** A construction type that can be identified by wood or metal (usually aluminum) posts or load-bearing frames with some type of fabric (such as canvas) stretched or pulled over the posts or frames. Examples of the types of structures that should be considered under this classification of structures include Frame-Supported Tensioned Fabric Structures (FSTFS); Tent, Extendable, Modular, Personnel (TEMPER Tents); and Small and Medium Shelter Systems (SSS and MSS); General Purpose (GP) Medium tents and GP Large tents; and air supported fabric structures. Testing has shown that for these fabric structures, the posts and frames are what cause hazards.

**Family housing.** DoD buildings used as quarters for DoD personnel and their dependents. For the purposes of these standards, family housing will be considered to include Morale, Welfare, and Recreation housing (cottages) and temporary family lodging of similar occupancies.

**Fisher Houses.** Houses constructed by the Fisher House Foundation at military medical centers for lodging families of military personnel while the military personnel are hospitalized.

**Force Protection Condition (FPCON).** A DoD-approved system that standardizes the Departments' identification and recommended preventive actions and responses to terrorist threats against U.S. personnel and facilities. This system is the principle means for a commander to apply an operational decision on how to protect against terrorism and facilitates inter-Service coordination and support for antiterrorism activities.

**Glazing.** The part of a window, skylight, or door assembly that is transparent or translucent and transmits light, but not air.

**High occupancy family housing.** Family housing with 13 or more units per building.

**Inhabited building.** Buildings or portions of buildings routinely occupied by 11 or more DoD personnel and with a population density of greater than one person per 430 gross square feet (40 gross square meters). This density generally excludes industrial, maintenance, and storage facilities, except for more densely populated portions of those buildings such as administrative areas. The inhabited building designation also applies to expeditionary structures with similar population densities. In a building that meets the criterion of having 11 or more personnel with portions that do not have sufficient population densities to qualify as inhabited buildings, those portions that have sufficient population densities will be considered inhabited buildings while the remainder of the building may be considered low occupancy, subject to provisions of these standards. An example would be a hangar, warehouse, or maintenance facility with an administrative area within it. The administrative area would be treated as an inhabited building while the remainder of the facility could be treated as low occupancy. External stairwells and covered or enclosed walkways are not part of the inhabited space of a building. (Note: This definition differs significantly from the definition for inhabited building used by DoD 6055.09-M and is not to be construed as authorization to deviate from criteria of DoD 6055.09-M.)

**Laminated glass.** Multiple sheets of glass bonded together by a bonding interlayer.

**Level of protection.** The degree to which an asset (person, equipment, object, etc.) is protected against injury or damage from an attack.

**Low occupancy building.** Any building or portion of a building occupied by fewer than 11 DoD personnel or with a population density of less than one person per 430 gross square feet (40 gross square meters).

**Low occupancy family housing.** Family housing with 12 or fewer units per building.

**Mail room.** A facility operated by or for the Department of Defense for the receipt and delivery of mail for military units or other authorized organizations and agencies by entities outside the DoD. This does not include mail rooms that receive mail distribution that was initially received at a central DoD mail handling facility.

**Mass notification.** Capability to provide real-time information to all building occupants or personnel in the immediate vicinity of a building during emergency situations.

**Military protective construction.** Military facilities designed to resist military conventional and nuclear weapons to the NATO (or equivalent) standards of hardened, protected, semi-hardened, collaterally protected, or splinter protected.

**Minimum standoff distance.** The smallest permissible standoff distance for new construction regardless of any analysis results or hardening of the building. For existing buildings, standoff should never be less than this distance, but may with appropriate hardening or analysis where this distance is unachievable.

**Operations support vehicles.** Vehicles such as airfield support equipment or material handling equipment whose purpose is direct support to operations and which are operated only within a restricted access area.

**Parking areas.** Designated areas where vehicles may be left unattended, including parking lots, designated parking areas along roadways, and roadways within or accessing parking areas.

**Plant replacement value.** The cost to design and construct a notional facility to current standards and building codes to replace an existing facility at the same location calculated in accordance with UFC 3-701-01.

**Primary gathering building.** Inhabited buildings or portions of buildings routinely occupied by 50 or more DoD personnel and with a population density of greater than one person per 430 gross square feet (40 gross square meters). This designation will be applied to the entire portion of a building that meets the population density requirements for an inhabited building. Buildings will not be divided into inhabited and primary gathering areas. Only low occupancy portions of buildings may be treated separately from the remainder of the building. For example, if a portion of an inhabited building has 50 or more people in it, the entire inhabited portion of the building will be considered a primary gathering building. Inhabited buildings whose populations are increased through inhabited building additions such that the combined building meets the definition of a primary gathering building will be considered to be primary gathering buildings for their entire inhabited portions. The primary gathering building designation also applies to expeditionary structures with similar populations.

**Progressive collapse.** The spread of an initial local failure from building element to building element, eventually resulting in the collapse of an entire structure or a disproportionately large part of it.

**Punched window.** A window installed as a punched opening surrounded by cladding, as opposed to being arranged in vertical or horizontal strips.

**Relocatable building.** Personal property used as a structure designed to be readily moved, erected, disassembled, stored, and reused and whose sum of building disassembly, repackaging, and non-recoverable building components, including typical foundation costs does not exceed 20% of the purchase cost of the relocatable building. Personal property is managed as equipment as opposed to real property.

**Ribbon window.** Windows installed in vertical or horizontal strips with no building wall elements between them but surrounded by cladding around the overall opening perimeter.

**Roadways.** Any surface intended for routine motorized vehicle traffic, including driving lanes of parking areas.

**Routinely occupied.** For the purposes of these standards, an established or predictable pattern of activity within a building that terrorists could recognize and exploit.

**Security engineering.** The process of identifying practical, risk managed short and long-term solutions to reduce and/or mitigate dynamic manmade hazards by integrating multiple factors, including construction, equipment, manpower, and procedures.

**Spandrel Glass.** Glass used in non-vision areas of building exteriors

**Specific threat.** Known or postulated aggressor activity focused on targeting a particular asset.

**Standoff distance.** A distance maintained between a building or portion thereof and the potential location for an explosive detonation.

**Structure group.** A cluster of expeditionary structures occupied by 200 or fewer DoD personnel .

**Structural glazed window systems.** Window systems in which glazing is bonded to both sides of the window frame using an adhesive such as a high-strength, high-performance structural silicone.

**Superstructure.** The supporting elements of a building above the foundation.

**Supporting structural elements.** Structural elements that support windows and that are not in direct contact with the glass, such as walls.

**Temporary buildings.** For the purposes of these standards, those buildings, other than expeditionary structures, that are real property facilities and are designed and constructed on an expedient basis, with finishes, materials, and systems selected with energy efficiency, maintenance, and life cycle cost factors being secondary considerations and with a life expectancy of five years or less.

**Testing.** For the purposes of these standards, experiments performed in accordance with standardized procedures that prove that building components meet the performance required to meet a specific level of protection.

**Town Centers.** Mixed use retail, health, or community services and family housing facilities in the same buildings.

**TNT equivalent weight.** The weight of TNT (trinitrotoluene) that has an equivalent energetic output to that of a different weight of another explosive compound.

**Transitional structures and spaces.** Structures or spaces within buildings that are used to temporarily relocate DoD occupants of buildings while those buildings or other buildings to which they will relocate undergo renovations, modifications, repairs, or restorations or are being constructed. (Also known as swing space.)

**Uncontrolled Public Access.** Spaces within and beneath buildings where there is insufficient positive access control to preclude unauthorized access. For the purposes of these standards, positive access control will be considered to include (but not be limited to) electronic access control on all exterior doors or providing personnel to control visitors.

**Unobstructed space.** Space around inhabited buildings in which there are no opportunities for concealment from observation of explosive devices 6 inches (150 mm) or greater in height or width.

**Useable Building Area.** The useable area of a building that includes office areas, store areas, and building common areas as defined by ANSI/BOMA Z65.1. Note that building common area specifically excludes floor common areas, parking spaces, portions of loading docks outside the building line, and major vertical penetrations (such as stairwells and elevator cores).

**Usable Office Area.** That portion of building area where tenants normally house personnel and/or furniture. Note that this usable office area excludes floor common areas as defined by ANSI/BOMA Z65.1, which include areas such as washrooms, janitorial closets, utility rooms, elevator lobbies, and public corridors.

## APPENDIX B DOD MINIMUM ANTITERRORISM STANDARDS FOR NEW AND EXISTING BUILDINGS

### B-1 SITE PLANNING.

Operational, logistic, and security requirements must be integrated into the overall design of buildings, equipment, landscaping, parking, roads, and other associated features. Standards associated with site planning are established to address vehicle borne and hand placed explosive threats. The most cost-effective solution for mitigating explosive effects on buildings is to keep explosives as far as possible from them. Standoff distance must be coupled with appropriate building hardening to provide the necessary level of protection to DoD personnel as described in Table 2-1.

The following standards detail standoff distances, referred to as “conventional construction standoff distances,” that when achieved will allow for buildings to be built with minimal additional construction costs for blast protection. Note, however, that standoff distances for building walls may require more heavily constructed windows and doors, which may result in significant building cost increases.

Where conventional construction standoff distances detailed in these standards cannot be achieved because land is unavailable, these standards allow for building hardening to mitigate the blast effects. Planning level costs and requirements for building hardening are addressed in UFC 4-020-01. None of these standards require physical barriers that are capable of stopping moving vehicles to prevent vehicles from accessing areas within the standoff distances required below. Measures using landscaping features, curbing, or pavement marking will meet the requirements of these standards for establishing standoff.

#### B-1.1 Standard 1. Standoff Distances.

The standoff distances apply to all new and existing (when triggered) DoD buildings required to comply with these standards. They address standoff distances to controlled perimeters, parking areas, roadways, and trash containers. The standoff distances are presented in Tables B-1 and B-2 and illustrated in Figures B-1 and B-2 for new buildings and Figures B-3 and B-4 for existing buildings.

Where the standoff distances in the “Conventional Construction Standoff Distance” columns of Tables B-1 and B-2 can be met, conventional construction for the

**Table B-1 Standoff Distances for New and Existing Buildings**

Distance to:	Building Category	Standoff Distances				
		Applicable Level of Protection	Conventional Construction Standoff Distance		Minimum Standoff Distance <sup>(2)</sup>	Applicable Explosive Weight <sup>(3)</sup>
			Load Bearing Walls <sup>(1)</sup>	Non-Load Bearing Walls <sup>(1)</sup>		
Controlled Perimeter or Parking and Roadways without a Controlled Perimeter	Billeting and High Occupancy Family Housing	Low	A	C	18 ft (5.5 m)	I
	Primary Gathering Building	Low	A	C	18 ft (5.5 m)	I
	Inhabited Building	Very Low	B	D	18 ft (5.5 m)	I
Parking and Roadways within a Controlled Perimeter	Billeting and High Occupancy Family Housing	Low	E	G	12 ft (3.6 m)	II
	Primary Gathering Building	Low	E	G	12 ft (3.6 m)	II
	Inhabited Building	Very Low	F	H	12 ft (3.6 m)	II
Trash Containers	Billeting and High Occupancy Family Housing	Low	E	G	12 ft (3.6 m)	II
	Primary Gathering Building	Low	E	G	12 ft (3.6 m)	II
	Inhabited Building	Very Low	F	H	12 ft (3.6 m)	II

1. See Table B-2 for standoff distances.
2. For new construction, standoff distances less than those in this column are not allowed for new buildings regardless of analysis or hardening. For existing buildings that are constructed / retrofitted to provide the required level of protection, standoffs less than those in this column are allowed, but discouraged.
3. See UFC 4-010-02, for the specific explosive weights (pounds / kg of TNT) associated with designations I and II. UFC 4-010-02 is For Official Use Only (FOUO).



**Table B-2 Conventional Construction Standoff Distances**

Wall Type	Column Letter							
	A	B	C	D	E	F	G	H
Wood Studs – Brick Veneer	105 ft (32 m)	105 ft (32 m)	79 ft (24 m)	66 ft (20 m)	36 ft (11 m)	36 ft (11 m)	23 ft (7 m)	16 ft (5 m)
Wood Studs – EIFS	207 ft (63 m)	207 ft (63 m)	164 ft (50 m)	141 ft (43 m)	85 ft (26 m)	85 ft (26 m)	66 ft (20 m)	56 ft (17 m)
Metal Studs – Brick Veneer	187 ft (57 m)	108 ft (33 m)	207 ft <sup>(2)</sup> (63 m)	186 ft <sup>(2)</sup> (57 m)	75 ft (23 m)	43 ft (13 m)	82 ft <sup>(2)</sup> (25 m)	75 ft <sup>(2)</sup> (23 m)
Metal Studs – EIFS	361 ft (110 m)	207 ft (63 m)	420 ft <sup>(2)</sup> (128 m)	361 ft <sup>(2)</sup> (110 m)	151 ft (46 m)	85 ft (26 m)	167 ft <sup>(2)</sup> (51 m)	151 ft <sup>(2)</sup> (46 m)
Metal Panels	n/a <sup>(1)</sup>	n/a <sup>(1)</sup>	151 ft (46 m)	108 ft (33 m)	n/a <sup>(1)</sup>	n/a <sup>(1)</sup>	56 ft (17 m)	39 ft (12 m)
Girts	n/a <sup>(1)</sup>	n/a <sup>(1)</sup>	115 ft (35 m)	59 ft (18 m)	n/a <sup>(1)</sup>	n/a <sup>(1)</sup>	23 ft (7 m)	16 ft (5 m)
Reinforced Concrete	66 ft (20 m)	66 ft (20 m)	26 ft (8 m)	20 ft (6 m)	16 ft (5 m)	16 ft (5 m)	13 ft (4 m)	13 ft (4 m)
Unreinforced Masonry <sup>(3)</sup>	262 ft (80 m)	262 ft (80 m)	125 ft (38)	33 ft (10 m)	80 ft (24 m)	80 ft (24 m)	26 ft (8 m)	16 ft (5 m)
Reinforced Masonry	86 ft (26 m)	86 ft (26 m)	30 ft (9 m)	20 ft (6 m)	30 ft (9 m)	30 ft (9 m)	13 ft (4 m)	13 ft (4 m)
European Block	164 ft (50 m)	164 ft (50 m)	59 ft (18 m)	30 ft (9 m)	39 ft (12 m)	39 ft (12 m)	23 ft (7 m)	16 ft (5 m)

1. Metal panels and girts are not considered primary structural members.
2. Non-load bearing steel studs are assumed to have slip-track connections. Closer distances may be obtained through non-standard detailing and analysis.
3. Only used for analysis of existing structures. Not allowed for new construction.

Figure B-1 Standoff Distances – With Controlled Perimeter

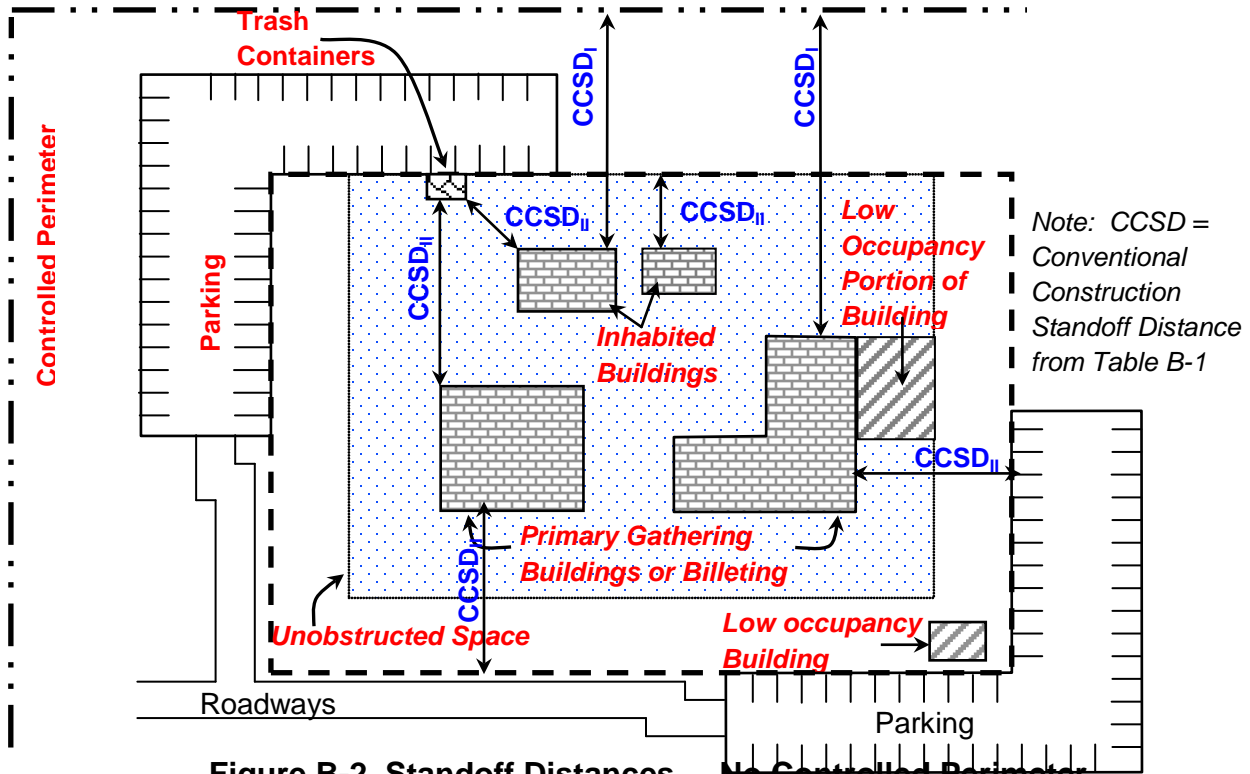


Figure B-2 Standoff Distances – No Controlled Perimeter

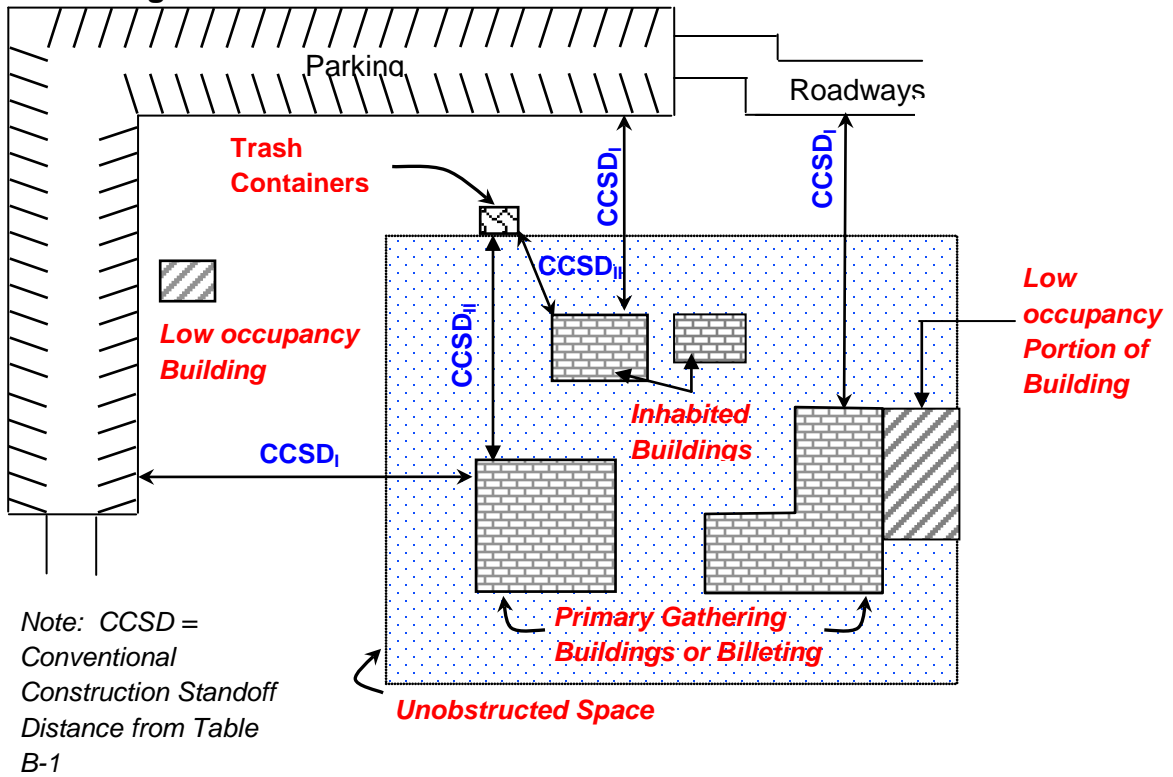


Figure B-3 Parking and Roadway Control for Existing Buildings – Controlled Perimeter

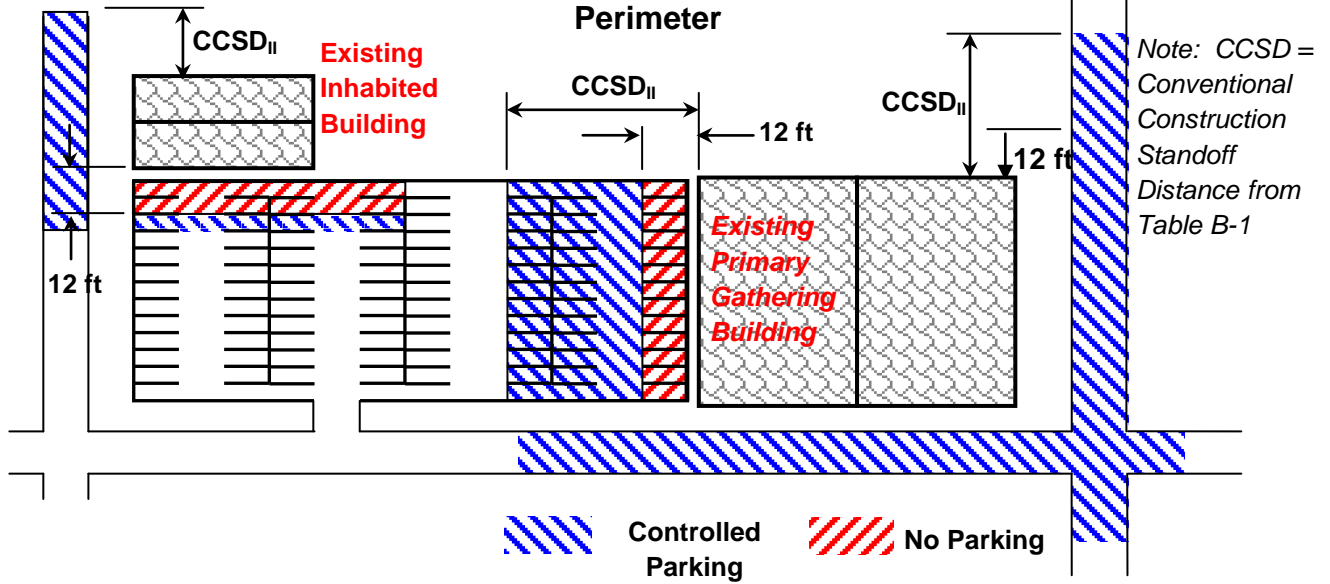
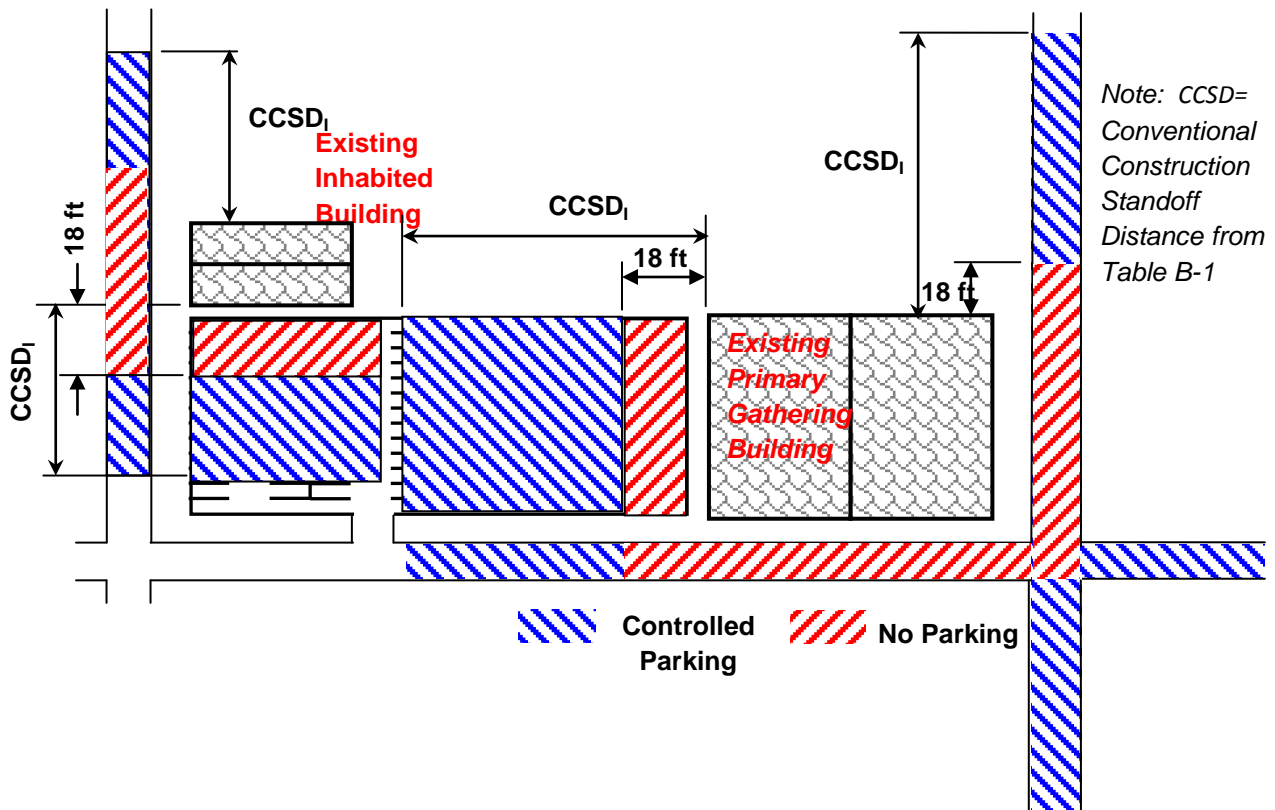


Figure B-4 Parking and Roadway Control for Existing Buildings – No Controlled Perimeter



applicable building walls may be used for the buildings without a specific analysis of blast effects, except as otherwise required in these standards. Windows and doors must be designed for the applicable standoff distances except where otherwise established in these standards. Roofs do not need to be analyzed where the conventional construction standoff distances are met and where they are within the ranges of one of the roof construction types in Table 2-3.

Where conventional construction standoff distances are not available, lesser standoff distances may be validated through analysis that verifies the applicable level of protection is met, but none may be closer than the minimum standoff distances except as allowed in these standards for existing buildings. Allowable building damage and door and window hazards for the various levels of protection are described in Table 2-1. Note that regardless of standoff distance, where buildings are three stories or more, the progressive collapse provisions of Standard 6 must be applied.

### **B-1.1.1 Conventional Construction Standoff Distance.**

In previous versions of these standards conventional construction standoff distances applied to all conventional construction types and only varied based on the applicable level of protection and explosive weight. In this revision of the standards standoff distances vary based on the specific construction of the walls, on whether they are load bearing or non-load bearing, by level of protection, and by explosive weight.

The specific construction types upon which the standoff distances are based are indicated in Table B-2 and detailed descriptions of their design parameters are tabulated in Table 2-3. The separate conventional construction standoff distances columns in Table B-1 for load bearing and non-load bearing wall construction reflect the fact that the damage allowed to load bearing construction is less than that allowed to non-load bearing construction for the same level of protection as explained in PDC Technical Report 06-08. The standoff distances in those columns lead to entries in Table B-2 where specific standoff distances are tabulated for different construction types. Note that the conventional construction standoff distance columns in Table B-2 are limited to walls because the walls in that table always controlled the conventional construction standoff distance over any of the roofs indicated in Table 2-3. Walls and roofs of construction other than those included in Table 2-3 must be designed to provide the applicable response described in Table 2-1 and detailed in PDC Technical Report 06-08.

Conventional construction standoff distances do not apply to windows and doors. Windows and doors must be designed in accordance with Standards 10 and 12 to provide the applicable levels of protection. For some wall types the conventional construction standoff distances will require window and door construction that is heavier and more expensive than common conventional windows and doors. Planners and designers will have to investigate tradeoffs between wall standoff and window and door construction. There are tools in UFC 4-020-01 that can assist in evaluating those tradeoffs.

### **B-1.1.2 Minimum Standoff Distance.**

Minimum standoff distance is the smallest permissible standoff distance allowed for a building required to comply with these standards regardless of any analysis results or hardening of the building that would allow for a closer standoff distance, except as established below for existing buildings. Note that achieving the minimum standoff distance generally requires a significant degree of building component hardening; therefore, where only the minimum standoff distance is provided there must be analysis results that show it can be achieved while still providing the required level of protection.

For new buildings, standoff distances of less than those shown in the “Minimum Standoff Distance” column in Table B-1 are not allowed.

For existing buildings, the standoff distances in the “Minimum Standoff Distance” column of Table B-1 will be provided except where doing so is not possible. In those cases, lesser standoff distances may be allowed where the required level of protection can be shown to be achieved through analysis or can be achieved through building hardening or other mitigating construction or retrofit as described in these standards.

### **B-1.1.3 Distances Between Conventional and Minimum Standoff Distances.**

Where the conventional construction standoff distances are not available, an engineer experienced in blast-resistant design must analyze the building and apply building hardening as necessary to mitigate the effects of the applicable explosives indicated in Table B-1 at the achievable standoff distance to the appropriate level of protection. The appropriate levels of protection for each building category are shown in Table B-1 and are described in Table 2-1 and in UFC 4-020-01. Detailed design parameters for meeting the levels of protection are in PDC Technical Report 06-08. Where buildings within controlled perimeters are located closer than the conventional construction standoff distances for both Explosive Weights I and II, building components must be evaluated for both explosive weights at their applicable standoff distances to determine which controls the designs. Buildings will be designed for fully reflected blast pressures except where it can be proven that a wall could never be exposed to reflected pressures. Windows and doors are covered separately in Standards 10 and 12.

### **B-1.1.4 Inhabited Buildings Partially Exempt from Standard 1.**

Where buildings are exempt from parking and roadway standoff distance provisions of this standard in accordance with Chapter 1, any of the walls in Table 2-3 may be used without analysis regardless of the actual standoff distances to parking and roadways. Exterior masonry walls, if used, must still comply with Standard 9.

### **B-1.1.5 Controlled Perimeter Standoff Distance.**

Measure the standoff distance from the controlled perimeter to the closest point on the building exterior or inhabited portion of the building or to specific building components.

### **B-1.1.6 Parking and Roadways Standoff Distances.**

Standoff distances between parking and roadways and buildings required to comply with these standards will be less where they are within a controlled perimeter than

where there is no controlled perimeter. That is based on the assumption that where there is a controlled perimeter larger vehicle bombs will be detected and kept from entering it. Where there is a controlled perimeter, the standoff distances and explosive weight associated with parking and roadways within a controlled perimeter in Table B-1 apply.

If there is no controlled perimeter, assume that the larger explosive weights upon which the controlled perimeter standoff distances are based (Explosive Weight I from Table B-1) can access parking and roadways near buildings. Therefore, where there is no controlled perimeter, use standoff distances to parking and roadways and the explosive weight associated with Parking and Roadways without a Controlled Perimeter in Table B-1.

Measure the standoff distance from the closest edge of parking areas, driving lanes within parking areas, and roadways to the closest point on the building exterior or inhabited portion of the building or to specific building components. In addition, the following apply:

**B-1.1.6.1 New Buildings.**

None of the operational options that are allowed for existing buildings within this standard will be allowed to be applied for new construction. The minimum standoff distance for all new buildings required to comply with these standards regardless of hardening or analysis is that indicated in Table B-1 for both parking areas and roadways, whether parking is allowed on the roadways or not.

**B-1.1.6.2 Existing Buildings.**

Where possible, move parking and roadways away from existing buildings required to comply with these standards (including leased buildings) in accordance with the standoff distances and explosive weights in Table B-1. It is recognized, however, that moving existing parking areas and roadways or applying structural retrofits may be impractical in some cases; therefore, the following operational options are provided for existing buildings required to comply with these standards:

a. **Controlled Parking Areas.**

Controlled parking associated with existing buildings may be allowed to be as close as the minimum standoff distance in Table B-1 without hardening or analysis if access control (see definition in glossary) to the parking area is established at the applicable conventional construction standoff distance for parking in Table B-1.

In cases where the applicable level of protection can be provided (based on hardening or analysis) with a standoff distance between the conventional construction standoff distance and the minimum standoff distance, uncontrolled parking may be allowed at the standoff distance at which the level of protection can be achieved subject to the requirements below, but not closer than the minimum standoff distance in Table B-1.

To mitigate the introduction of hand delivered explosives into the controlled parking areas in violation of the unobstructed space standard (Standard 2), controlled parking

areas will have some means to control pedestrian access as well as vehicular access, such as fencing or walls

b. Parking Within a Controlled Perimeter.

The applicable conventional construction or minimum standoff distance at which access will be controlled will be based on the standoff distances for parking and roadways within a controlled perimeter in Table B-1 and illustrated in Figure B-3 for the applicable building category.

c. Parking Without a Controlled Perimeter.

The applicable conventional construction or minimum standoff distance at which access will be controlled will be based on the standoff distances for parking and roadways without a controlled perimeter in Table B-1 and illustrated in Figure B-4 for the applicable building category.

d. Driving Lanes within Parking Areas.

Where limited space necessitates, driving lanes within parking areas may be closer to existing buildings than parking spaces located at the required standoff distances, but vehicles may not be left unattended in those driving lanes. This is not allowed for new buildings required to comply with these standards.

e. Alternate Situations.

Parking may be closer to existing buildings than the minimum standoff distance where it is impractical to achieve that distance and where it can be shown through analysis that the required level of protection can be provided at the lesser standoff distance or if it can be provided through building hardening or other mitigating measures or retrofits designed for those standoff distances. Allowing any parking closer than the distances established in the paragraphs above should be avoided wherever possible, however.

f. Parking on Existing Roadways.

Parking along roadways is subject to similar standoff considerations as to other parking. Where there are existing roads adjacent to existing buildings required to comply with these standards, ensure there is no parking on those roadways closer than the conventional construction standoff distance unless the applicable level of protection can be provided (based on hardening or analysis) with a standoff distance between the conventional construction standoff distance and the minimum standoff distance. Parking along those roadways will not be closer than the minimum standoff distance under any circumstance. (Refer to Figures B-3 and B-4). Where parking along existing roadways adjacent to existing buildings can be controlled, parking may be allowed to be as close as the minimum standoff distance in Table B-1 without hardening or analysis.

g. Parking for Existing High Occupancy Family Housing.

For existing high occupancy family housing within a controlled perimeter or where there is access control to the parking area, parking within the required standoff distances may be allowed where designated parking spaces are assigned for specific residents or residences. Do not label assigned parking spaces with names or ranks of the residents, however. Where the existing standoff distances are less than the required standoff

distances (conventional construction or minimum in accordance with Tables B-1 and B-2) do not encroach upon those existing standoff distances with any additional parking. Parking closer than the minimum standoff distance in Table B-1 should be avoided, however.

**B-1.1.7 Adjacent Underground Parking.**

Where underground parking is provided adjacent to (not underneath) buildings required to comply with these standards, parking may be allowed as close to the buildings as the construction of the building superstructure will allow based on the required level of protection and the applicable explosive weight. Analysis must show that the soil-structure interaction and any venting into the building will not cause progressive collapse of the building or damage to inhabited areas of the building beyond the applicable level of protection. Also, ensure there is no venting into inhabited areas of buildings that could result in occupant injuries.

**B-1.1.8 Parking of Emergency, Command, and Operations Support Vehicles.**

Emergency and command vehicles, as well as operations support vehicles may be parked closer to buildings required to comply with these standards than allowed in Tables B-1 and B-2 without hardening or analysis if access to the vehicles is continuously controlled or as long as they are never removed from a restricted access area. Command and operations support vehicles may not be parked closer than the applicable minimum standoff distance in Table B-1. In addition, where standard operation of buildings includes parking emergency vehicles inside them, such as in fire stations, those emergency vehicles may be parked inside the buildings.

**B-1.1.9 Parking of Vehicles Undergoing Maintenance.**

Vehicles undergoing maintenance may be parked inside maintenance buildings closer to inhabited areas of those buildings than allowed in Tables B-1 and B-2 while they are undergoing repair without providing any hardening or analysis of the buildings.

**B-1.1.10 Parking of Mobile Ground Tactical Platforms.**

Where operational requirements require parking mobile ground tactical platforms containing non-removable sensitive compartmented information systems adjacent to buildings required to comply with these standards, ensure those parking areas are surrounded by a 6 foot (2 meter) chain link security topped by a single outrigger with three-strands of barbed wire and that access to those parking areas is controlled so that the vehicles cannot be accessed without the access being detected.

**B-1.1.11 Parking for Handicapped Personnel.**

Parking for handicapped personnel will not be located closer than the standoff distances necessary to meet these standards.

**B-1.1.12 Parking and Roadway Projects.**

Where practical, all roadway and parking area projects not associated with a building renovation, modification, repair, or restoration requiring compliance with these



standards should comply with the applicable conventional construction standoff distances from existing inhabited buildings in Tables B-1 and B-2. Where parking areas that are within the standoff distances in Tables B-1 and B-2 from such existing buildings are being constructed, expanded, or relocated, those parking areas will not encroach on the existing standoff distances of any existing inhabited building unless it can be shown that the building can provide the appropriate level of protection that would apply if the building were required to comply with these standards.

If roadway projects include road widening or encroachment on existing standoff distances is otherwise unavoidable, ensure there are operational procedures in place to prohibit parking on the roadways within those standoff distances as described in paragraph B-1.1.6.2.f.

Driving lanes within parking areas may be allowed to be closer to existing buildings than the closest parking spaces where limited space necessitates, but vehicles may not be left unattended in those driving lanes. Parking and driving lanes closer than the minimum standoff distance in Table B-1 must comply with paragraph B-1.1.2.

#### **B-1.1.13 Standoff to Entry Control Facilities/Access Control Points.**

For the purposes of this standard, standoff distances from buildings to Entry Control Facilities/Access Control Points will be measured from the identification check area to the closest point on the building exterior or inhabited portion of the building or to specific building components.

#### **B-1.1.14 Location of Trash Containers.**

For buildings that are required to comply with these standards, provide standoff distances from the nearest points of trash containers or trash container enclosures to the closest points on the building exteriors or inhabited portions of the buildings or to specific building components in accordance with the conventional construction standoff distance from trash containers in Tables B-1 and B-2. Where the applicable conventional construction standoff distance is not available, analyze the building and apply building hardening as necessary to mitigate the effects of the explosives indicated for trash containers in Table B-1 at the achievable standoff distance to the appropriate level of protection.

Alternatively, harden trash enclosures to mitigate the direct blast effects and secondary fragment effects of the explosive on the building if the applicable level of protection can be proven by analysis or testing.

As an additional alternative, if trash containers or enclosures are secured to preclude introduction of objects 6-inches (150 mm) or greater in height or width into them by unauthorized personnel, they may be located closer to the building as long as they do not violate the unobstructed space provisions of Standard 2. Openings in screening materials and gaps between the ground and screens or walls making up an enclosure must not be greater than 6 inches (150 mm).

### **B-1.1.15 Adjacent Existing Buildings.**

Where projects for new and existing buildings designed in accordance with these standards include locating parking, roadways, or trash containers near existing inhabited buildings that are not required to meet these standards, the standoff distances from parking, roadways, and trash containers to the buildings that are not required to comply with these standards should comply with the applicable standoff distances in Tables B-1 and B-2.

Where those standoff distances are not available, do not allow parking and roadways to encroach on existing standoff distances to parking and roadways associated with those existing buildings.

The encroachment provision above applies only to parking and roadways. Do not allow trash containers associated with new or existing buildings being designed to comply with these standards to be located closer to existing inhabited buildings that are not required to meet these standards than the applicable standoff distances in Tables B-1 and B-2.

### **B-1.2 Standard 2. Unobstructed Space.**

It is assumed that aggressors will not attempt to place explosive devices in areas near buildings where those explosive devices could be visually detected by building occupants observing the area around the building. Ensure there are unobstructed spaces in which there are no obstructions or building features that might allow for concealment from observation of explosive devices 6 inches (150 mm ) or greater in height or width around buildings and underneath building overhangs or breezeways. This does not preclude the placement of site furnishings or plantings around buildings. It only requires conditions such that any explosive devices placed in the unobstructed spaces would be observable by building occupants either from within the buildings or as they walk into or around it.

Where buildings required to meet these standards are located within controlled perimeters, the unobstructed space will extend out to the applicable conventional construction standoff distance for parking and roadways within a controlled perimeter in accordance with Tables B-1 and B-2, but not less than the minimum standoff distance. Alternatively, for distances between the conventional construction standoff distance and the minimum standoff distance, standoff distances may be validated through analysis that verifies the applicable level of protection is met based on mitigating the effects of Explosive Weight II at the distance between the location of the explosive and the area of the building being protected. For existing buildings where the standoff distances for parking and roadways have been established at less than the minimum standoff distance in accordance with paragraph B-1.1.2, the unobstructed space may be reduced to be equivalent to those distances.

Where buildings are not located within a controlled perimeter, the unobstructed space will be established based on the applicable standoff distances for Explosive Weight II, regardless of the parking and roadway standoff distances required in the absence of a controlled perimeter. The applicable standoff distances may either be the conventional

construction standoff distances or standoff distances established through analysis, but not less than the minimum standoff distance,

#### **B-1.2.1 Controlled Parking.**

Where controlled parking associated with existing buildings has been allowed in accordance with paragraphs B-1.1.6.2.1 and B-1.1.6.2.4, the unobstructed space will be considered to extend to those parking areas. To mitigate the introduction of hand delivered explosives into the controlled parking areas those areas will have some means to control pedestrian access as well as vehicular access, such as fencing or walls.

#### **B-1.2.2 Electrical and Mechanical Equipment.**

The preferred location for electrical and mechanical equipment such as transformers, air-cooled condensers, and packaged chillers is outside the unobstructed space or on the roof. This standard, however, does not preclude placement within the unobstructed space as long the equipment provides no opportunity for concealment of explosive devices with heights of 6 inches (150 mm) or greater or the equipment is secured to prevent concealment of the devices.

#### **B-1.2.3 Equipment and Trash Container Enclosures.**

If walls or other screening devices with more than two sides are placed around trash containers that have been secured, hardened, or located in accordance with paragraph B-1.1.14 or around electrical, mechanical, or other equipment within the unobstructed space, enclose the trash containers or equipment on all four sides and the top. Openings in screening materials and gaps between the ground and screens or walls making up an enclosure will not be greater than 6 inches (150 mm). Secure any surfaces of the enclosures that can be opened so that unauthorized personnel cannot gain access through them. Opaque top enclosures will have a pitch of at least 1 vertical to 2 horizontal to increase visibility of objects thrown onto them and to increase the likelihood that the objects will slide off. Alternatively, if the vertical surfaces of the enclosures are transparent and at least 7 feet (2.1 meters) high, a top enclosure is not required.

#### **B-1.2.4 Fuel Tanks.**

Fuel tanks may be located within unobstructed spaces if they do not provide opportunities for concealment of explosives as described above. Standoff distances from buildings for fuel tanks are based on flammability (not explosive equivalence); therefore, they should be determined using NFPA 30.

#### **B-1.2.5 Parking Within Unobstructed Spaces.**

Parking will not be allowed within unobstructed spaces except for parking of emergency, command, and operations support vehicles and mobile ground tactical platforms.

### **B-1.2.6 Adjacent Existing Buildings.**

Where projects for new and existing buildings designed in accordance with these standards are located near existing inhabited buildings that are not required to meet these standards, ensure that the unobstructed spaces for buildings that must comply with the standards are maintained between those buildings and other existing buildings. If there are opportunities for concealment in the spaces around the other existing buildings those spaces should be modified to ensure fully compliant unobstructed spaces around the buildings that must comply.

### **B-1.2.7 Adjacent Uncontrolled Public Space.**

Where there are uncontrolled public spaces below, above, or beside building areas that are occupied by DoD, it shall be considered that explosives equivalent to explosive weight II may be located in those spaces and the spaces occupied by DoD should be designed to ensure that they meet the applicable level of protection.

## **B-1.3 Standard 3. Drive-Up/Drop-Off Areas.**

Some facilities require access to areas within the required standoff distances for dropping off or picking up people or loading or unloading packages and other objects. Examples that may require drive-ups or drop-offs include, but are not limited to, medical facilities, exchanges and commissaries, and schools. In these cases, standoff distances will be measured to the nearest legal parking spaces, not the drive-ups or drop-offs. No building hardening will be required to compensate for the closer standoff distances associated with the drive-ups or drop-offs. This standard also applies to drive-through lanes such as those at stand alone franchised food operations.

### **B-1.3.1 Marking.**

Where operational or safety considerations require drive-up or drop-off areas or drive-through lanes near buildings required to comply with these standards, ensure those areas or lanes are clearly defined and marked in accordance with the Manual on Uniform Traffic Control Devices and that their intended use is clear to prevent parking of vehicles in those areas.

### **B-1.3.2 Unattended Vehicles.**

Do not allow unattended vehicles in drive-up or drop-off areas or drive-through lanes. Prohibit unattended vehicles within conventional construction standoff distances in accordance with Tables B-1 and B-2 or ensure through analysis that buildings can provide the appropriate level of protection at lesser standoff distances. Unattended vehicles may never be allowed closer than the minimum standoff distance.

### **B-1.3.3 Location.**

Do not allow drive-through lanes or drive-up/drop-off areas to be located under any inhabited portion of a building.

**B-1.4 Standard 4. Access Roads.**

Where access roads are necessary for the operation of buildings required to comply with these standards (including those required for emergency access), ensure that access control measures are implemented to prohibit unauthorized vehicles from using access roads within the applicable standoff distances in Tables B-1 and B-2. Because situations at various buildings and installations are different, the development of specific access control measures and procedures is beyond the scope of these standards. That is left to local physical security personnel.

**B-1.5 Standard 5. Parking Beneath Buildings or on Rooftops.**

Avoid parking beneath buildings or on rooftops of buildings required to comply with these standards. Where very limited real estate makes such parking unavoidable, the following measures must be incorporated into the design for new buildings or mitigating measures must be incorporated into existing buildings to achieve the required level of protection.

**B-1.5.1 Access Control.**

Ensure that access control measures are implemented to prohibit unauthorized personnel and vehicles from entering underground or rooftop parking areas. Because situations at various buildings and installations are different, the development of specific access control measures and procedures is beyond the scope of these standards. That is left to local physical security personnel. See Appendix A for the definition of access control.

**B-1.5.2 Structural Elements.**

Ensure that there is not general collapse of more than one single bay of floor beneath or floors/roof above inhabited areas and that all other adjacent supporting structural elements will not fail from the detonation in the parking area of an explosive equivalent to explosive weight II in Table B-1. Unless it can be shown that a greater standoff distance can be justified, evaluate structural elements in parking areas at a standoff distance of 4 feet (1.2 m). Failure will be evaluated based on the applicable level of protection in accordance with PDC Technical Report 06-08. Also, ensure there is no venting into inhabited areas of buildings that could result in occupant injuries.

**B-2 STRUCTURAL DESIGN.**

If the conventional construction standoff distances are achieved, conventional construction should minimize the risk of mass casualties from a terrorist attack. Even if those standoff distances can be achieved, however, incorporate the following additional structural measures into building designs to ensure that buildings do not experience progressive collapse or otherwise experience disproportionate damage.

**B-2.1 Standard 6. Progressive Collapse Resistance.**

Progressive collapse is considered to be a significant risk for buildings of three or more stories. Basements and penthouses will be considered stories if there is any space that is designed for human occupancy and that is equipped with means of egress as well as

light and ventilation facilities that meet the local building code requirements as detailed in UFC 4-023-03. For all new and existing DoD buildings of three stories or more required to comply with these standards, regardless of the standoff distance provided, follow the requirements in UFC 4-023-03 *Design of Buildings to Resist Progressive Collapse*. Design the superstructures to sustain local damage with the structural systems remaining stable without being damaged to extents disproportionate to the original local damage.

### **B-2.1.1 Progressive Collapse Avoidance Design Requirements.**

Follow the design guidance in UFC 4-023-03 for new and existing DoD Buildings to reduce the potential for progressive collapse due to localized structural damage due to unforeseeable events. For inhabited buildings, primary gathering buildings, billeting, and high occupancy family housing, apply the requirements for occupancy category II or higher. UFC 3-301-01 defines occupancy categories for numbers of occupants and different types of occupancies. The design requirements in UFC 4-023-03 are related to those occupancy categories. When DoD personnel meet the partial occupancy criteria in paragraph 1-8.4.1, the progressive collapse requirements of UFC 4-023-03 are applicable to the entire structure, not just the portion of the building occupied by DoD personnel.

### **B-2.1.2 Uncontrolled Public Access.**

UFC 4-023-03 requires interior columns and/or walls to be evaluated for progressive collapse where there is underground parking or other uncontrolled public access. For the purposes of this standard and for applying the provisions of UFC 4-023-03, access control at controlled perimeters will not normally be considered to establish sufficient positive access controls for buildings within those perimeters to be considered to have controlled public access. For the purposes of this standard, positive access control will be considered to include (but not be limited to) electronic access control on all exterior doors. Where visitor processing makes locking visitor entrances during building operating hours impractical, providing personnel to control visitor access can be considered positive control at those entrances. Controlled public access to individual buildings or groups of buildings should be coordinated with local physical security policies and procedures.

## **B-2.2 Standard 7. Structural Isolation.**

### **B-2.2.1 Building Additions.**

Design all building additions that are required to comply with these standards to be structurally independent from the adjacent existing buildings. This will minimize the possibility that collapse of one part of a building will affect the stability of the remainder of the building. Alternatively, verify through analysis that collapse of either the addition or the existing building will not result in collapse of the remainder of the building. Structural isolation is not necessary if the existing buildings have been designed in accordance with these standards (including previous versions).

### **B-2.2.2 Portions of Buildings.**

Low occupancy portions of inhabited buildings required to comply with these standards will be designed to ensure their superstructures are structurally independent from the inhabited portions of the buildings. This will minimize the possibility that collapse of low occupancy areas of buildings will affect the stability of the superstructure of the inhabited portions of buildings.

Alternatively, verify through analysis that collapse of low occupancy portions of buildings will not result in collapse of any portion of buildings covered by these standards or show that the low occupancy portions of buildings meet the standoff distance and unobstructed space requirements for inhabited buildings in accordance with Standards 1 and 2 and that they are not built using unreinforced masonry in accordance with Standard 9. This standard is not mandatory for existing structures, but it should be implemented where possible.

This standard will only apply to separations between inhabited portions of buildings (including primary gathering) and low occupancy portions of buildings. It will not be applied to separate inhabited areas of buildings that do not meet the definition of primary gathering from those that do meet the primary gathering definition. Where buildings have both inhabited occupancies and primary gathering occupancies, the entire inhabited portion of the building will be considered to be primary gathering.

### **B-2.3 Standard 8. Building Overhangs and Breezeways.**

For all buildings required to comply with these standards, avoid building overhangs and breezeways with inhabited spaces above them where people could gain access to the areas underneath the overhangs. Where such overhangs or breezeways must be used, incorporate the following measures.

#### **B-2.3.1 Parking and Roadway Restrictions.**

Ensure that there are no roadways or parking areas under overhangs or breezeways. In the case of existing buildings, roadways that cannot be abandoned or relocated may be controlled to ensure vehicles do not park underneath the overhang or breezeway.

#### **B-2.3.2 Building Elements.**

Ensure the areas underneath the overhangs or breezeways are clear of any obstructions that could allow for concealment from observation of explosive devices 6 inches (150 mm) or greater in height or width in accordance with the provisions of the unobstructed space requirements of Standard 2. The areas underneath the overhangs or breezeways can be considered to be extensions of the surrounding unobstructed spaces. Ensure that any external building elements, including walls, doors, windows, and floors of overhangs or ceilings of breezeways, provide the applicable level of protection against an explosive equivalent to Explosive Weight II in Table B-1 placed at the edge of the unobstructed space established by Standard 2.

## **B-2.4 Standard 9. Exterior Masonry Walls.**

The following requirements apply to exterior walls of new and existing buildings required to comply with these standards:

### **B-2.4.1 New Buildings.**

Unreinforced masonry walls are prohibited for the exterior walls of new buildings required to comply with these standards. All exterior masonry walls must have vertical and horizontal reinforcement distributed throughout the wall section. The vertical reinforcement ratio will be at least 0.05%, spaced no more than 4 feet (1200 mm) on center with reinforcement within 1.3 feet (410 mm) of the ends of walls. The horizontal reinforcement ratio must be at least 0.025%, consisting of either joint reinforcement spaced no more than 1.3 feet (410 mm) on center, or bond beam reinforcement spaced no more than 4 feet (1200 mm) on center, with reinforcement within 1.3 feet (410 mm) of the top and bottom of the wall. For new buildings, wood or metal studs that meet the analysis assumptions of Table 2-3 may be considered to meet the provisions of this standard when used in conjunction with an otherwise unreinforced masonry wall.

### **B-2.4.2 Existing Buildings.**

For existing buildings where the conventional construction standoff distance for unreinforced masonry determined using Tables B-1 and B-2 is not provided, implement mitigating measures to provide the applicable level of protection as identified in Table 2-1. For non-load bearing walls, ensure they have adequate load transfer capacity at the top and bottom regardless of standoff distance

## **B-3 ARCHITECTURAL DESIGN.**

Even where the conventional construction standoff distances are achieved, many aspects of building layout and other architectural design issues must be incorporated into designs to improve overall protection of personnel inside buildings.

### **B-3.1 Standard 10. Windows and Skylights.**

To minimize hazards from flying debris from windows and skylights, apply the following provisions for glazing, framing, connections, and supporting structural elements for all new and existing buildings required to comply with these standards. These provisions apply to window systems at all standoff distances, even those that meet or exceed the wall conventional construction standoff distances. These provisions only address minimum standards (very low and low levels of protection.) For higher levels of protection, refer to PDC Technical Report 10-02. The specific requirements below will result in window and skylight systems that provide for effective hazard mitigation. These provisions allow for design by dynamic analysis, testing, or the ASTM F 2248 design approach as described in the paragraphs below. Use strength design with load factors of 1.0 and strength reduction factors of 1.0 for all methods of analysis referenced herein.

In addition to guidance in Table B-1 for applicable explosive weights, where a building is within a controlled perimeter, the applicable explosive weights for design of windows will



be determined based on the standoff from the controlled perimeter. If the facility is more than 200 feet (60 meters) away from the controlled perimeter, only Explosive Weight II needs to be considered in the design of the windows. If the facility is within 200 feet (60 meters) of the controlled perimeter both Explosive Weights I and II shall be considered in the design of the windows at their respective standoff distances to parking and roadways, to controlled perimeters, and to the outer edges of unobstructed spaces..

Monolithic glass or monolithic acrylic used as a single pane or as the inner pane of a multi-pane system is not allowed for the purposes of complying with this standard. This standard does not apply to translucent fiberglass panels, other lightweight translucent plastics, spandrel glass when backed by a structural wall or spandrel beam, and glass unit masonry. Those components shall comply with Standard 1. Engineered glass block window systems and spandrel glass that is open to occupied space shall be designed in accordance with this standard. For glazing in doors, refer to Standard 12.

### **B-3.1.1 Dynamic Analysis.**

Any of the glazing, framing members, connections, and supporting structural elements may be designed using dynamic analysis to prove the window or skylight systems will provide performance equivalent to or better than the hazard rating associated with the applicable level of protection as indicated in Table 2-1. Dynamic analysis guidance is presented in PDC TR 10-02. The design loading for dynamic analyses will be the appropriate pressures and impulses from the applicable explosive weights at the actual standoff distances at which the windows are sited. The design loading will be applied over the areas tributary to the element being analyzed. The allowable response limits of structural elements for all of the levels of protection are provided in PDC-TR 06-08. Response limits for steel and aluminum window frame members are provided in PDC-TR-10-02. Window frames constructed from materials other than aluminum or steel must be tested in accordance with paragraph B-3.1.2 or proven by analysis to demonstrate performance equivalent to or better than the hazard rating associated with the applicable level of protection as indicated in Table 2-1.

### **B-3.1.2 Testing.**

Window and skylight systems may be dynamically tested to demonstrate performance equivalent to or better than the hazard rating associated with the applicable level of protection as indicated in Table 2-1. Testing will include the entire window or skylight system, including connections, and will be in accordance with ASTM F 1642.

The structural supporting material used in the test for fastener attachment will be representative of the fielded application. Any deviations in field application of the connections or the connected elements from the test must be demonstrated by calculation to provide the required level of protection for the specific application.

The design loading for a dynamic test will be the appropriate pressure and impulse from the applicable explosive weight at the actual standoff distance at which the window is sited.

### **B-3.1.3      ASTM F 2248 Design Approach for Laminated Glass Glazing Systems.**

Windows and skylights fabricated using laminated glass may be designed using ASTM F 2248 and ASTM E 1300 in accordance with the requirements below. The application of ASTM F 2248 and ASTM E 1300 results in higher levels of protection than those required in these standards as reflected in Table 2-1. In order to reduce the conservatism associated with using the ASTM methodology the window systems may be designed using dynamic analysis or they may be tested in accordance with the previous paragraphs.

#### **B-3.1.3.1      Glazing.**

Provide laminated glass with a minimum interlayer thickness of 0.030-inch (0.75-mm) and a load resistance determined from ASTM E 1300 greater or equal to the 3-second duration equivalent design load determined from ASTM F 2248.

Note that ASTM F 2248 can be used for a limited range of charge weights and standoffs, including those covered by this standard. For charge weights and standoffs outside of the range of ASTM F 2248 and for glazing alternatives to laminated glass that provide equivalent levels of protection, refer to PDC Technical Report 10-02.

#### **B-3.1.3.2      Frames.**

Provide window and skylight frames, mullions and sashes of aluminum or steel designed in accordance with ASTM F 2248. Window frames constructed from materials other than aluminum or steel must be tested in accordance with paragraph B-3.1.2 or proven by analysis to demonstrate performance equivalent to or better than the hazard rating associated with the applicable level of protection as indicated in Table 2-1.

In the case of a punched or ribbon window, the supported edge length will be taken as equal to the longest span of a single pane of glass, regardless of any intermediate support connections.

For storefront and curtain wall systems, primary mullions that span between points of structural support shall be considered supporting frame members and may be designed dynamically in accordance with paragraph B-3.1.1 or statically. If designed by the static method the moment and shear capacities of framing members shall be designed to resist two (2) times the glazing resistance applied to the framing members only from the tributary area of the window, and deflection shall be limited to 1/60 of the members' span lengths between points of structural support. Intermediate mullions shall be checked for deflection with the supported edge length taken as equal to the longest span of a single glass panel and the deflection will be calculated based on simple support conditions for that length.

#### **B-3.1.3.3      Glazing Frame Bite.**

Glazing frame bite requirements for structurally or non-structurally glazed windows or skylights shall be in accordance with ASTM F 2248. Apply structural silicone bead or

glazing tape to both sides of the glass panel for single pane glazing but only to the inboard side for insulating glass units.

#### **B-3.1.3.4 Connection Design.**

Connections of window and skylight frames to surrounding walls or roofs, of hardware and associated connections, of glazing stop connections, and of other elements in shear shall be designed for the connection design load determined in accordance with ASTM F 2248 and will account for the geometry of the particular frame and the connection configuration being used when calculating bending, shear, bearing, and pull out loads for the connections.

#### **B-3.1.4 Static Design of Supporting Structural Elements.**

Supporting structural elements (i.e. those structural elements that frame the rough opening) for window and skylight systems of any glazing material can be designed statically to account for the increase in tributary areas to the adjacent supporting elements due to windows or skylights. Building elements that have only glazing framed into them, such as curtain walls and storefronts, shall be designed as frame members in accordance with paragraph B-3.1.3.2.

##### **B-3.1.4.1 Wall and Roof Elements.**

For window and skylight systems in buildings situated at or beyond the wall conventional construction standoff distance for the wall material to which it is attached, the surrounding wall and roof elements and their connections to the rest of the structure shall be designed as described below. For window and skylight systems in buildings situated at less than the wall conventional construction standoff distance the surrounding wall and roof elements will be designed dynamically in accordance with paragraph B-3.1.1.

The supporting structural elements adjacent to windows shall be designed to account for their increased tributary areas that represent the tributary areas of windows or skylights and the appropriate tributary areas of the walls or roof above and below them whose loads must be laterally supported by those elements. Those increases in tributary areas will be accounted for by applying a tributary area increase factor (C) to the moment and shear capacities of the walls. The tributary area increase factor is the ratio of the tributary area that accounts for the windows or skylights and the walls or roofs above and below them to the tributary area upon which typical conventional wall sections or elements are designed. See PDC Technical Report 10-02 for an illustration. The tributary area increase factor is shown in Equation 1 and shall not be taken as less than 1.

$$C = \frac{a_{trib}}{a_{wall}} \geq 1$$

Equation 1

$a_{wall}$  = tributary area for typical conventional wall section or element

$a_{trib}$  = combined tributary area for supported window or skylight and wall or roof section or element

Design the supporting structural elements to have moment and shear capacities equal to or greater than the calculated conventional wall capacities multiplied by the applicable tributary area increase factor as shown in Equation 2 and Equation 3. Connection loads for the supporting structural element shall be determined based on the increase in member shear capacity.

$$M_{SSE} \geq C \cdot M_{CW} \quad \text{Equation 2}$$

$$V_{SSE} \geq C \cdot V_{CW} \quad \text{Equation 3}$$

$M_{SSE}$  and  $V_{SSE}$  are moment and shear capacities of supporting structural element

$M_{CW}$  and  $V_{CW}$  are moment and shear capacities of conventional wall section.

#### **B-3.1.4.2 Reactions.**

The reactions from the supporting structural element analysis normally do not have to be carried through the horizontal and lateral bracing systems of buildings to the foundations. The main concern is that these loads are transferred into horizontal floor and roof systems without failing those connections or the attached elements, as the building mass dissipates those loads before they are transferred to the foundation. It is left to the structural engineer to assess the adequacy of these connections, the attaching elements, and the need for further analysis.

#### **B-3.1.5 Skylights.**

Because glazing fragment hazards are increased when glazing falls from the elevations of skylights, skylight glazing will be designed as a minimum to break, but remain in the frame, which is equivalent to the minimal hazard rating in ASTM F 1642 (medium level of protection in Table 2-1). Use the appropriate blast load for the applicable angle of incidence to design or test the skylight.

#### **B-3.1.6 Window and Skylight Replacement Projects.**

Whenever window and skylight glazing is being replaced as part of a planned window or glazing replacement project in existing buildings that meet the occupancy provisions of these standards, whether or not the building meets the triggers in paragraph 1-8.2, design glazing, frames, connections, and supporting structural elements to meet all of the requirements of this standard. Base the window designs on either the standoff distances to existing parking and roadways or to the planned locations for future parking and roadways in accordance with the installation or facility master plan.

Provide no less than 1/4-inch (6-mm) nominal polycarbonate or laminated glass for exterior windows or skylights. The 1/4-inch (6-mm) laminated glass consists of two nominal 1/8-inch (3-mm) glass panes bonded together with a minimum of a 0.030-inch (0.75-mm) interlayer of a material designed and tested for bomb blast resistance. For insulating glass units (IGU), use the polycarbonate or laminated glass for the innermost pane as a minimum.

For laminated glass provide a glazing frame bite in accordance with ASTM F 2248. For polycarbonate provide a glazing frame bite of no less than 1.5 times the polycarbonate thickness.

### **B-3.1.7 Buildings Partially Exempt from Standard 1.**

Where buildings are exempt from parking and roadway standoff distance provisions of Standard 1 in accordance with Chapter 1, provide windows and skylights constructed as described below.

Provide no less than 1/4-inch (6-mm) nominal polycarbonate or laminated glass for exterior windows or skylights. The 1/4-inch (6-mm) laminated glass consists of two nominal 1/8-inch (3-mm) glass panes bonded together with a minimum of a 0.030-inch (0.75-mm) interlayer of a material designed and tested for bomb blast resistance. For IGU, use the polycarbonate or laminated glass for the innermost pane as a minimum.

For laminated glass provide a glazing frame bite in accordance with ASTM F 2248. For polycarbonate provide a glazing frame bite of no less than 1.5 times the polycarbonate thickness.

### **B-3.1.8 Alternative Window Treatments.**

Window retrofit products that rely on fragment retention film, fragment retention film as part of a retrofit system, or blast curtain or blind systems generally have higher life cycle costs than laminated glass windows due to their shorter design lives and due to operation and maintenance issues. Application of those products, therefore, will be governed by the following paragraphs:

#### **B-3.1.8.1 New Buildings and Existing Buildings Undergoing Major Renovations or Window Replacement Projects.**

Window retrofits incorporating alternative window treatments will not be considered an acceptable alternative for new buildings or existing buildings that are required to comply with these standards, except for leased buildings as stated below.

#### **B-3.1.8.2 Leased Buildings.**

For leased buildings that are required to comply with these standards, windows using laminated glass are preferred, but window retrofits incorporating alternative window treatments may be allowed if they provide the appropriate level of protection as indicated in Table 2-1 as long as the lease agreement stipulates that they will be maintained and replaced in accordance with manufacturers' recommendations. This will include meeting the requirements for supporting structural elements. Compliance with the required level of protection may be demonstrated through analysis or through testing. Testing will be performed in accordance with ASTM F 1642.

#### **B-3.1.8.3 Other Existing Buildings.**

For existing buildings that are not required to comply with these standards, window retrofits incorporating alternative window treatments are viable and economical

solutions to mitigating the effects of explosive attacks, but will be evaluated prior to installation so that reduction in glass hazards may be validated.

#### **B-3.1.9 Exterior Stairwells and Covered or Enclosed Walkways.**

Glazing in stairwells and covered or enclosed walkways that are exterior to buildings required to comply with these standards is not required to comply with the provisions of this standard because exterior stairwells and walkways generally are not considered to be routinely occupied. Building components behind the exterior stairwell glazing must be capable of mitigating any hazards resulting from the stairwell or enclosed walkway glazing failure in response to a blast event in accordance with the applicable levels of protection described in Table 2-1.

#### **B-3.2 Standard 11. Building Entrance Layout.**

The areas outside of controlled perimeters are commonly not under the direct control of installations. Where the main entrances to buildings face controlled perimeters, people entering and exiting the buildings are vulnerable to being fired upon from vantage points outside those perimeters. To mitigate those vulnerabilities apply the following measures for buildings required to comply with these standards:

##### **B-3.2.1 New Buildings.**

For new buildings, ensure that the main entrance to the building does not face a controlled perimeter or other uncontrolled vantage points with direct lines of sight to the entrance or provide means to block the lines of sight.

##### **B-3.2.2 Existing Buildings.**

For existing buildings where the main entrance faces a controlled perimeter, either use a different entrance as the main entrance or screen that entrance to limit the ability of potential aggressors to target people entering and leaving the building.

##### **B-3.2.3 Entries with Multiple Sightlines.**

Where main building entrances have sightlines from multiple vantage points at or outside of controlled perimeters, where there are no controlled perimeters, or where it is otherwise infeasible to avoid building entrances facing those vantage points, provide screening or otherwise block lines of sight.

#### **B-3.3 Standard 12. Exterior Doors.**

For all new and existing buildings required to comply with these standards provide exterior doors into inhabited areas in accordance with the provisions below. In addition to guidance in Table B-1 for applicable explosive weights, for buildings within controlled perimeters the applicable explosive weights for design of doors will be determined based on the standoff from the controlled perimeters. If buildings are more than 200 feet (60 meters) away from controlled perimeters, only explosive weight II needs to be considered in the design of exterior doors. If buildings are within 200 feet (60 meters) of controlled perimeters both Explosive Weights I and II shall be considered in the design

of exterior doors at their respective standoff distances to parking and roadways and to the controlled perimeters.

#### **B-3.3.1 Unglazed Doors**

Provide doors that are tested to achieve the applicable performance in Table 2-1 in accordance with ASTM F 2247 or that meet the provisions of the alternative designs paragraph below.

#### **B-3.3.2 Glazed Doors.**

In addition to the provisions above, glazing in glazed doors must meet the glazing and frame bite provisions of Standard 10. Framing, connection, and supporting structure provisions of Standard 10 do not have to be applied.

#### **B-3.3.3 Alternative Designs.**

As an alternative to the above provisions for all doors, position doors such that they will not be propelled into inhabited areas if they fail in response to a blast or provide other means to ensure they are intercepted by a surface with sufficient strength to keep the doors from translating into inhabited areas if they fail or otherwise ensure they do not become hazards to building occupants. The glazing in glazed doors must still meet the provisions of paragraph B-3.3.2 if this alternative is exercised to reduce the glazing hazard. Where it is not possible to design surfaces to safely intercept doors, the doors will be designed to remain in the door frames.

#### **B-3.3.4 Vestibules or Foyers.**

In vestibules, foyers, or similar entry configurations into inhabited areas where there are inner and outer doors the vestibules, foyers, or similar entries are considered not to be routinely occupied spaces. The inner doors must meet the provisions of these standards and any other glazing associated with inner door entries such as sidelights and transoms must meet the requirements of Standard 10. The inner doors and glazing must be capable of mitigating any hazards resulting from the enclosed vestibule or foyer outer doors and glazing failure in response to the design blast event. This is to account for the fact that at the levels of protection required in these standards the outer doors and glazing may fail, which would subject the inner doors and glazing to significant blast loads.

#### **B-3.3.5 Inhabited Buildings Partially Exempt from Standard 1.**

Where buildings are exempt from parking and roadway standoff distance provisions of Standard 1 in accordance with Chapter 1, provide doors that open outwards. Where glazed doors are provided follow the glazing and frame bite provisions in paragraph B-3.1.7.

#### **B-3.3.6 Overhead Doors.**

Because it is impractical to design conventional overhead doors to meet the required performance in Table 2-1, ensure overhead doors do not open into inhabited spaces or

ensure that if they fail that they are intercepted by walls that are designed with sufficient strength to keep the overhead doors from translating into inhabited areas.

#### **B-3.4 Standard 13. Mail Rooms.**

The following measures address the location of rooms to which mail is delivered or in which mail is handled in new and existing buildings required to comply with these standards. These standards need not be applied to mail rooms to which mail is delivered that was initially delivered to a central mail handling facility. These standards should be applied to such mail rooms where possible, however, to account for potential changes in mail handling procedures over the life of the building. The measures in this standard involve limiting collateral damage and injuries and facilitating future upgrades to enhance protection should it become necessary. This standard does not require the hardening of mail rooms because the mail bomb threat is beyond the scope of these standards. Refer to UFC 4-020-01 where there is an identified mail bomb threat.

##### **B-3.4.1 Location.**

Where a new or existing building required to comply with these standards must have a mail room, locate that mail room on the perimeter of the building. By locating the mail room on the building perimeter there is an opportunity to modify it in the future if a mail bomb threat is identified. Where mail rooms are located in the interiors of buildings, few retrofit options are available for mitigating the mail bomb threat. In addition, having mailrooms on the building perimeter avoids situations where contaminated packages would be transported through the rest of the building.

##### **B-3.4.2 Proximity.**

Locate mail rooms as far from heavily populated areas of buildings and from critical infrastructure as possible. This measure will minimize injuries and damage if a mail bombs detonate in mail rooms. Further, it will reduce the potential for wider dissemination of hazardous agents. This applies where mail rooms are not specifically designed to resist those threats.

#### **B-3.5 Standard 14. Roof Access.**

For all new and existing inhabited buildings required to comply with these standards, control access to roofs to minimize the possibility of aggressors placing explosives or chemical, biological, or radiological agents there or otherwise threatening building occupants or critical infrastructure.

##### **B-3.5.1 New Buildings.**

For new buildings eliminate all external roof access by providing access from internal stairways or ladders, such as in mechanical rooms.

##### **B-3.5.2 Existing Buildings.**

For existing buildings, eliminate external access where possible or secure external ladders or stairways with locked cages or similar mechanisms.



**B-3.6 Standard 15. Overhead Mounted Architectural Features.**

For all new and existing buildings required to comply with these standards, ensure that overhead mounted features weighing 31 pounds (14 kilograms ) or more (excluding distributed systems such as suspended ceilings that collectively exceed that weight) are mounted using either rigid or flexible systems to minimize the likelihood that they will fall and injure building occupants. Mount all such systems so that they resist forces of 0.5 times the component weight in any horizontal direction and 1.5 times the component weight in the downward direction. This standard does not preclude the need to design architectural feature mountings for forces required by other criteria such as seismic standards.

**B-4 ELECTRICAL AND MECHANICAL DESIGN.**

Electrical and mechanical design standards address protecting building occupants against falling equipment and chemical, biological, and radiological threats and notifying building occupants of threats or hazards.

**B-4.1 Standard 16. Air Intakes.**

Air intakes to heating, ventilating, and air conditioning (HVAC) systems that are designed to move air throughout a building that are at ground level provide an opportunity for aggressors to easily place contaminants where they could be drawn into buildings. The following measures will be applied to minimize those opportunities.

**B-4.1.1 New Buildings.**

For all new buildings required to comply with these standards locate all air intakes at least 10 feet (3 meters) above the ground.

**B-4.1.2 Existing Buildings.**

Add means such as exterior chimneys to extend the elevations of air intakes to at least 10 feet (3 meters) above the ground.

**B-4.1.3 Interior Walls in Equipment Rooms.**

Where air intakes that are designed to cool equipment may allow blast pressures to infiltrate equipment rooms, design equipment room interior walls to the same standards for blast resistance as the exterior walls of buildings based on the standoff distance provided and allowing for blast pressure reductions where they can be validated.

**B-4.2 Standard 17. Mail Room Ventilation.**

To ensure airborne chemical, biological, and radiological agents introduced into mail rooms do not migrate into other areas of buildings in which the mail rooms are located, provide separate, dedicated air ventilation systems for mail rooms in buildings required to comply with these standards.

#### **B-4.2.1 Other Heating and Cooling Systems.**

Building heating and cooling systems such as steam, hot water, chilled water, and refrigerant may serve mail rooms as long as the airflow systems for the mail rooms and other areas of the buildings in which they are located remain separate.

#### **B-4.2.2 Dedicated Exhaust Systems.**

Provide dedicated exhaust systems within mail rooms to maintain slight negative air pressures (minimum of 0.05 inches of water [12.5 Pa]) with respect to the remainder of the buildings in which the mail rooms are located so that the flow of air is into and contained in the mail rooms. Though the airflow into the mail rooms will not eliminate the potential spread of contamination by personnel leaving the mail room, it will limit the migration of airborne contaminants through openings and open doorways.

#### **B-4.2.3 Outside Intakes, Relief, and Exhausts.**

Provide mail room ventilation system outside air intakes, relief air, and exhausts with low leakage isolation dampers that can be automatically closed to isolate the mail rooms. The low leakage dampers will have maximum leakage rates of 3 cfm/square foot (15 liters/second/square meter) with a differential pressure of one inch of water gage (250 Pa) across the damper.

#### **B-4.2.4 Isolation Controls.**

Provide separate switches or methods of control to isolate mail rooms in the event of a suspected or actual chemical, biological, or radiological release in the mail room.

#### **B-4.3 Standard 18. Emergency Air Distribution Shutoff.**

For all new and existing buildings required to comply with these standards, provide an emergency shutoff switch in the HVAC control system that can immediately shut down the air distribution system throughout the building except where interior pressure and airflow control would more efficiently prevent the spread of airborne contaminants and/or ensure the safety of egress pathways. Locate the shutoff switch (or switches) to be easily accessible by building occupants by locating them similarly to manual fire alarm boxes in accordance with NFPA 72 and with at least one shutoff switch per floor and so that the travel distance to the nearest shutoff switch will not be in excess of 200 feet (61 meters). Ensure that the shutoff switches are well labeled and of a different color than fire alarm pull stations. Providing such a capability will allow for limiting the distribution of airborne contaminants that may be introduced into the building.

#### **B-4.3.1 Outside Air Intakes, Relief Air, and Exhausts.**

Provide all outside air intakes, relief air, and exhaust openings with low leakage dampers that are automatically closed when the emergency air distribution shutoff switch is activated. The low leakage dampers will have maximum leakage rates of 3 cfm/square foot (15 liters/second/square meter) with a differential pressure of one inch of water gage (250 Pa) across the damper. If shutting down an exhaust system will violate building or fire codes or create an unsafe condition, then the exhaust system

may continue to operate. For example, the installation of dampers in kitchen exhaust ductwork, where the dampers can become laden with grease, may be a violation of fire codes. Also, kitchen hood exhaust fans may have to continue to operate to avoid potential fire hazards.

#### **B-4.3.2 Critical Areas.**

Local air handling units serving critical areas where cooling and/or heating must be maintained to prevent mission failure, loss of data or unsafe conditions can continue to recirculate air, but outside air, relief air and exhaust must be closed with low leakage isolation dampers.

#### **B-4.3.3 Fan Coil Unit Heaters and Air Conditioners.**

Fan coil unit heaters and air conditioners do not require low leakage dampers, but for all new buildings required to comply with these standards, they must have a system that allows all of them to be shut off in an emergency. Emergency shutoffs for fan coil unit heaters and air conditioners are recommended, but not mandatory, for existing inhabited buildings required to comply with these standards.

#### **B-4.4 Standard 19. Equipment Bracing.**

For all buildings required to comply with these standards mount all overhead utilities and other fixtures weighing 31 pounds (14 kilograms ) or more (excluding distributed systems such as piping networks that collectively exceed that weight) using either rigid or flexible systems to minimize the likelihood that they will fall and injure building occupants. Design all equipment mountings to resist forces of 0.5 times the equipment weight in any horizontal direction and 1.5 times the equipment weight in the downward direction. This standard does not preclude the need to design equipment mountings for forces required by other criteria such as seismic standards.

#### **B-4.5 Standard 20. Under Building Access.**

To limit opportunities for aggressors placing explosives underneath buildings, ensure that access to crawl spaces, utility tunnels, and other means of under building access is controlled in all buildings required to comply with these standards.

#### **B-4.6 Standard 21. Mass Notification.**

All buildings required to comply with these standards must have a timely means to notify occupants of threats and instruct them what to do in response to those threats. To achieve that goal, provide the following:

##### **B-4.6.1 New Buildings.**

New buildings must have a capability to provide real-time information to building occupants or personnel in the immediate vicinity of the building during emergency situations. The information relayed must be specific enough to determine the appropriate response actions. The information must be capable of being originated both locally at the building and from a remote location. Design these systems in accordance with UFC 4-021-01.

**B-4.6.2 Existing Buildings.**

For existing buildings, the above requirement is mandatory for primary gathering buildings, billeting, and high occupancy family housing, but recommended for other inhabited buildings.

## APPENDIX C RECOMMENDED ADDITIONAL ANTITERRORISM MEASURES FOR NEW AND EXISTING BUILDINGS

### C-1 SITE PLANNING.

The following additional measures, if implemented, will significantly enhance site security with little increase in cost and should be considered for all new and existing buildings required to comply with these standards.

#### C-1.1 Recommendation 1. Vehicle Access Points.

The first line of defense in limiting opportunities for aggressors to get vehicles close to DoD buildings is at vehicle access points at controlled perimeters, in parking areas, and at drive-up/drop-off points. The number of access points should be kept to the minimum necessary for operational or life safety purposes. This will limit the number of points at which access may have to be controlled with barriers and/or personnel at increased Force Protection Conditions or if the threat increases in the future.

#### C-1.2 Recommendation 2. High-Speed Vehicle Approaches.

The energy of a moving vehicle increases with the square of its velocity; therefore, minimizing a vehicle's speed allows vehicle barriers to be lighter and less expensive should vehicle barriers required to stop the energy of a moving vehicle ever become necessary. To facilitate reductions in vehicle speeds in the future, avoid unobstructed vehicle approaches perpendicular to buildings.

#### C-1.3 Recommendation 3. Vantage Points.

Vantage points are natural or man-made positions from which potential aggressors can observe and target people or other assets in and around buildings. Vantage points outside the control of personnel in targeted buildings should be identified and either eliminated or means should be provided to avoid exposure to them. Means to avoid exposure may include actions such as reorienting buildings or shielding people or assets in and around them using such measures as reflective glazing, walls, privacy fencing, or vegetation.

#### C-1.4 Recommendation 4. Drive-Up/Drop-Off Areas.

Drive-up and drop-off areas should be located away from large glazed areas of buildings to minimize the potential for hazardous flying glass fragments in the event of an explosion. Consider locating the lanes at outside corners of buildings or otherwise away from main entrances or minimizing glazing in the proximity of drive-up and drop-off areas. Building geometries in the vicinity of drive-up and drop-off areas should be laid out to minimize the possibility that explosive blast forces could be increased due to being trapped or otherwise concentrated.

#### C-1.5 Recommendation 5. Building Location.

Activities with large visitor populations provide opportunities for potential aggressors to get near buildings with minimal controls and limit opportunities for early detection of

aggressor activity. To limit opportunities for aggressors, separation distances should be maximized between buildings required to comply with these standards and areas with large visitor populations.

**C-1.6 Recommendation 6. Railroad Location.**

Avoid sites for buildings required to comply with these standards that are close to railroads. Where railroads are in the vicinity of existing buildings, standoff distances between the railroad and any inhabited buildings should be based on the standoff distances and explosive weight associated with controlled perimeters in Table B-1. Where those standoff distances are not available, and since moving existing railroads may be difficult and prohibitively expensive, procedures should be in place to prohibit trains from stopping in the vicinity of buildings required to comply with these standards.

**C-1.7 Recommendation 7. Access Control for Family Housing.**

For new family housing areas, space should be provided at the perimeter of the housing area so that a controlled perimeter with an entry control facility/access control point can be established there if the need arises in the future in accordance with UFC 4-022-01.

**C-1.8 Recommendation 8. Standoff for Family Housing.**

For new low occupancy family housing construction, standoff distances should be maintained in accordance with the controlled perimeter standoff distance in Table B-1 from installation perimeters and roads, streets, or highways external to housing areas.

**C-1.9 Recommendation 9. Building Separation.**

This recommendation applies to new buildings and is established to minimize the possibility that an attack on one building causes injuries or fatalities in adjacent buildings. The separation distance is predicated on the potential use of indirect fire weapons such as those containing explosives equivalent to explosive weight III in Table D-1.

**C-1.9.1 Primary Gathering Buildings, Billeting, and High Occupancy Family Housing.**

For all new billeting, high occupancy family housing, and primary gathering buildings, all adjacent inhabited buildings should be separated from those buildings by at least 33 feet (10 meters). Where it is necessary to encroach on those building separations, buildings should be analyzed and provided with hardened building components as necessary to mitigate the effects of the indirect fire weapons equivalent to those identified as explosive weight III in Table D-1 to the low level of protection. Levels of protection are described in Table 2-1 and in UFC 4-020-01. The indirect fire weapon should be assumed to detonate at a distance from the target building of one-half of the separation distance.

**C-1.9.2 Inhabited Buildings.**

There are no minimum separation distances recommended for antiterrorism purposes for inhabited buildings other than billeting, high occupancy family housing, and primary gathering buildings.

**C-2 STRUCTURAL AND ARCHITECTURAL DESIGN.**

The following additional measures, if implemented, will significantly enhance building occupants' safety and security with little increase in cost. Consider these measures for all new and existing buildings required to comply with these standards.

**C-2.1 Recommendation 10. Internal Circulation.**

Circulation within buildings should be designed to facilitate visual detection and monitoring of unauthorized personnel approaching controlled areas or occupied spaces.

**C-2.2 Recommendation 11. Visitor Control.**

Controlling visitor access maximizes the possibility of detecting potential threatening activities. Locations in buildings where visitor access is controlled should be kept away from sensitive or critical areas, areas where high-risk or mission-critical personnel are located, or other areas with large population densities of DoD personnel.

**C-2.3 Recommendation 12. Asset Location.**

To minimize exposure to direct blast effects and potential impacts from hazardous glass fragments and other potential debris, critical assets and mission-critical or high-risk personnel should be located away from the building exterior.

**C-2.4 Recommendation 13. Room Layout.**

In rooms adjacent to the exterior of the building, personnel and critical equipment should be positioned to minimize exposure to direct blast effects and potential impacts from hazardous glass fragments and other potential debris.

**C-2.5 Recommendation 14. External Hallways.**

Because doors can become hazardous debris during explosive blast events and designing them to resist blast effects is expensive, avoid building configurations that have large numbers of exterior doors leading into inhabited areas in buildings required to comply with these standards. A common example is a barracks/dormitory with exterior doors into each room or suite. Internal hallways with interior entrances to rooms or suites are preferable.

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## APPENDIX D DOD MINIMUM ANTITERRORISM STANDARDS FOR EXPEDITIONARY STRUCTURES

### D-1 GENERAL.

Implementation of these minimum standards is mandatory for all expeditionary structures that meet the occupancy criteria for inhabited or primary gathering buildings or billeting. Many expeditionary structures are in forward operating locations where there is a conventional and/or terrorist threat more severe than those addressed in these standards. In those situations more detailed planning and additional measures are needed for providing protection. Refer to the GTA 90-01-011, Joint Forward Operations Base (JFOB) Survivability and Protective Construction Handbook. However, where there is no known terrorist threat the following apply:

New buildings built in expeditionary environments or existing buildings used by DoD in those environments will comply with all of the standards in Appendix B.

New expeditionary structures built in expeditionary environments will comply with the provisions of this appendix.

### D-2 SITE PLANNING STANDARDS.

All the standards that are unique to expeditionary structures pertain to site planning. Integrate operational, logistic, and security requirements into the overall configuration of structures, equipment, landscaping, parking, roads, and other features during planning for expeditionary construction. The most cost-effective solution for mitigating explosive effects on expeditionary structures is to keep explosives as far away from them as possible. This is especially critical for these types of structures because hardening may not be possible or may be prohibitively expensive. Dispersed layouts reduce risks from a variety of threats by taking full advantage of terrain and site conditions; therefore, nothing in these standards is intended to discourage dispersal. Costs and requirements for expeditionary structure hardening are addressed in UFC 4-020-01.

#### D-2.1 Standard 1. Standoff Distances.

The standoff distances apply to all new and existing DoD expeditionary structures that are required to comply with these standards except as otherwise stated below. The applicable standoff distances are presented in Table D-1 and illustrated in Figure D-1. Except as otherwise required in these standards, where the standoff distances in Table D-1 can be provided, use conventional expeditionary structures without a specific analysis of blast effects.

Where those distances are not available, analysis of the structures by an engineer experienced in blast-resistant design is required and hardening will be applied as necessary (in those cases which permit structure hardening) to mitigate the effects of the explosives indicated in Table D-1 at the achievable standoff distances to the appropriate levels of protection.

The appropriate levels of protection for each structure category are shown in Table D-1, and are described in Table 2-2 and in UFC 4-020-01. Note that container structures

and pre-engineered buildings respond similarly to permanent buildings, so they are separated from the other expeditionary structures below. Of the remaining expeditionary structure types, the two structure types in Table D-1 respond in fundamentally different ways to explosive effects. Standoff distances in Table D-1 reflect those differences. Note that geographic combatant command antiterrorism operations orders may have more stringent requirements. See UFC 4-020-01 for a list of applicable operations orders.

#### **D-2.1.1 Controlled Perimeter.**

Measure the standoff distance from the closest point on the structure exterior to the controlled perimeter.

##### **D-2.1.1.1 Container Structures and Pre-engineered Buildings.**

For these structures, apply the guidance for new and existing buildings in Appendix B.

##### **D-2.1.1.2 Fabric Covered and other Expeditionary Structures.**

Provide the standoff distance from Table D-1 for the applicable structure category.

#### **D-2.1.2 Parking and Roadways.**

Standoff distances for parking and roadways are based on the assumption that there is a controlled perimeter at which larger vehicle bombs will be detected and kept from entering the controlled perimeter. Where there is a controlled perimeter, the standoff distances and explosive weight associated with parking and roadways within a controlled perimeter in Table D-1 apply unless otherwise stated below. If there is no controlled perimeter, assume that the larger explosive weight upon which the controlled perimeter standoff distances are based (explosive weight I from Table D-1) can access parking and roadways near structures. Where there is no controlled perimeter, therefore, use standoff distances from parking and roadways according to the distances and the explosive weight associated with controlled perimeters in Table D-1.

##### **D-2.1.2.1 Container Structures and Pre-engineered Buildings.**

For these structures, apply the guidance for new and existing buildings in Appendix B.

##### **D-2.1.2.2 Fabric Covered and other Expeditionary Structures.**

Measure the standoff distance from the closest point on the structure exterior to the closest edge of parking areas and roadways. The minimum standoff for all expeditionary structures regardless of hardening or analysis is 33 feet (10 meters).

##### **D-2.1.2.3 Existing Fabric Covered and other Expeditionary or Structures.**

Moving existing parking areas and roadways may be difficult to achieve and structural retrofits to existing structures may be prohibitively expensive or technically impossible; therefore, the following operational options are provided for existing inhabited structures where the standoff distances in Table D-1 are impractical to achieve.

a. Parking Areas.

Establish access control to portions of parking areas to ensure unauthorized vehicles are not allowed closer than the required standoff distances. For primary gathering structures and billeting, if access control is provided to prevent unauthorized parking within the required standoff distances, controlled parking may be permitted as close as 33 feet (10 meter ) without hardening or analysis.

b. Roadways.

Eliminate parking within the required standoff distances along roads adjacent to existing structures covered by these standards.

**D-2.1.3 Trash Containers.**

Measure the standoff distance from the nearest point of the trash container or trash container enclosure to the closest point on the structure exterior. Where the applicable standoff distances in Table D-1 are not available, hardening of trash enclosures to mitigate the direct blast effects and secondary fragment effects of the explosives on the structure is acceptable, if the applicable level of protection can be proven by analysis or testing. If trash enclosures are secured to preclude introduction of objects into the enclosures by unauthorized personnel, they may be located closer to the structures as long as they do not violate the unobstructed space provisions of Standard 3 below. Openings in screening materials and gaps between the ground and screens or walls making up an enclosure will not be greater than 6 inches (150 mm).

**D-2.1.3.1 Container Structures and Pre-engineered Buildings.**

For these structures, apply the guidance for new and existing buildings in Appendix B.

**D-2.1.3.2 Fabric Covered and other Expeditionary Structures.**

Provide the standoff distance from Table D-1 for the applicable structure category.

**D-2.2 Standard 2. Structure Separation.**

Structure separation requirements are established to minimize the possibility that an attack on one structure causes injuries or fatalities in adjacent structures. The separation distance is predicated on the potential use of indirect fire weapons.

**D-2.2.1 Billeting and Primary Gathering Structures.**

**D-2.2.1.1 Modular and Container Structures and Pre-engineered Buildings.**

For these structures, ensure that adjacent inhabited structures are separated by at least 33 feet (10 meters). Where it is necessary to encroach on that separation distance, analyze the structure and harden structure components or shield the structures as necessary to mitigate the effects of the explosive indicated in Table D-1 to the appropriate level of protection shown in Table B-1. Levels of protection are described in Table 2-1 and in UFC 4-020-01.

**D-2.2.2 Fabric Covered and other Expeditionary Structures and Trailers.**

For all new billeting and primary gathering structures, ensure that adjacent structures are separated by at least the distances in Figure D-1. Where it is necessary to encroach on those structure separations, analyze the structure and provide hardened structure components or shield the structures as necessary to mitigate the effects of the explosive indicated in Table D-1 to the appropriate level of protection as shown in Table D-1. Levels of protection are described in Table 2-2 and in UFC 4-020-01. Note, that there are additional requirements in some geographic combatant command antiterrorism operations orders. See UFC 4-020-01 for a list of applicable operations orders.

**D-2.2.3 Other Inhabited Structures.**

There are no minimum separation distances required for antiterrorism for inhabited structures other than billeting and primary gathering structures.

**D-2.3 Standard 3. Unobstructed Space.**

Keep areas within 33 feet (10 meters) of all expeditionary structures free of items other than those that are part of the utilities and other supporting infrastructure.

**D-3 ADDITIONAL STANDARDS.**

In addition to the specific standards detailed in this appendix, apply the standards from Appendix B to expeditionary structures as follows:

**D-3.1 Pre-engineered Buildings.**

For these structures, all standards in Appendix B apply.

**D-3.2 Fabric Covered, Container Structures, Trailers, Modular Structures, and other Expeditionary Structures.**

Apply the following standards from Appendix B to these structures:

- Standard 3. Drive-Up/Drop-Off Areas.
- Standard 4. Access Roads.
- Standard 10. Windows and Glazed Doors.
- Standard 11. Building Entrance Layout.
- Standard 12. Exterior Doors
- Standard 19. Equipment Bracing.
- Standard 21. Mass Notification.

**D-4 ANTITERRORISM RECOMMENDATIONS.**

Apply all recommendations except for Recommendation 7 (Access control for family housing) and Recommendation 8 (Standoff for family housing) from Appendix C to all expeditionary structures.

**Table D-1 Standoff and Separation Distances for Expeditionary Structures**

Location	Structure Category	Standoff or Separation Distance			
		Applicable Level of Protection	Fabric Covered Structures <sup>(1)</sup>	Trailers, and Other Expeditionary Structures <sup>(1)(2)</sup>	Applicable Explosive Weight (TNT) <sup>(3)</sup>
Controlled Perimeter or Parking and Roadways without a Controlled Perimeter	Billeting	Low	102 ft (31 m)	233 ft (71 m)	I
	Primary Gathering Structure	Low	102 ft (31 m)	233 ft (71 m)	I
	Inhabited Structure	Very Low	79 ft (24 m)	154 ft (47 m)	I
Parking and Roadways within a Controlled Perimeter	Billeting	Low	46 ft (14 m)	105 ft (32 m)	II
	Primary Gathering Structure	Low	46 ft (14 m)	105 ft (32 m)	II
	Inhabited Structure	Very Low	33 ft (10 m)	75 ft (23 m)	II
Trash Containers	Billeting	Low	46 ft (14 m)	105 ft (32 m)	II
	Primary Gathering Structure	Low	46 ft (14 m)	105 ft (32 m)	II
	Inhabited Structure	Very Low	33 ft. (10 m)	75 ft. (23 m)	II
Structure Separation <sup>(4)</sup>	Separation between Structure Groups	Low	59 ft (18 m)	59 ft (18 m)	III(5)
	Separation between Structure Rows	Low	30 ft (9 m)	30 ft (9 m)	III (5)

**Table D-1 Standoff and Separation Distances for Expeditionary Structures**

Location	Structure Category	Standoff or Separation Distance			
		Applicable Level of Protection	Fabric Covered Structures <sup>(1)</sup>	Trailers, and Other Expeditionary Structures <sup>(1)(2)</sup>	Applicable Explosive Weight (TNT) <sup>(3)</sup>
	Separation between Structures in a Row	Very Low	12 ft (3.5 m)	12 ft (3.5 m)	III(5)

1. See Definitions for a complete description of these structure types.
2. For container structures, Appendix B applies.
3. See UFC 4-010-02, for the specific explosive weights (pounds / kg of TNT) associated with designations – I, II, III. UFC 4-010-02 is For Official Use Only (FOUO).
4. Applies to Billeting and Primary Gathering Structures only. No minimum separation distances for other inhabited structures.
5. Explosive for building separation is an indirect fire (mortar) round at a standoff distance of half the separation distance.

Figure D-1 Standoff and Separation Distances for Expeditionary Structures

