An Introduction to Antiterrorism Assumptions for Building Design

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CONTENTS

1. ASSUMPTIONS. This discussion includes assumptions that form the foundation of standards and assumptions and philosophies behind some of the provisions of this topic. Given that terrorism threats are predominantly targeted at government venues, this discussion is focused on protection of government venues.

2. 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 Owner 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 personnel. The following are the terrorist tactics upon which these standards are based:

2.1 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 elsewhere. Their means of delivery are discussed below.

2.2 VEHICLE BOMBS. For the purposes of this discussion, 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.

2.2.1 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.

2.2.2 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.

2.2.3 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.

2.2.4 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.

2.2.5 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 is assumed to be the primary means of

protecting personnel from these weapons in these standards. Hardening to resist direct fire effects represents a higher level of protection than required by these standards.

2.2.6 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.

3. 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.

3.1 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.

3.3.1 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.

3.3.2 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.

3.4 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.

3.5 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.

4. 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. 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.

5. 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 analyzed at their actual standoff distances to determine which controls the window and door designs. 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.

Level of Protection	Potential Building Damage/Performance [2]	Potential Door and Glazing Hazards[3,4]	Potential Injury
Below AT standards[1]	Severe damage. Progressive collapse likely. Space in and around damaged area will be unusable.	Windows will fail catastrophically and result in lethal hazards. *(High hazard rating)* Doors will be thrown into rooms. *(Category V)*	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. *(Low hazard rating)* * Doors will become dislodged from the structure but will not create a flying debris hazard. *(Category IV)*	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. *(Very low hazard rating)* * Doors will experience non-catastrophic failure, but will have permanent deformation and may be inoperable. *(Category III)*	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[5]	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. *(Minimal hazard and No Hazard ratings)* * Doors will be openable but will have permanent deformation. *(Category II)*	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[5]	Minimal damage. No permanent deformations. The facility will be immediately operable.	* Innermost surface of glazing will not break.(No Break hazard rating) * Doors will be substantially unchanged and fully operable. *(Category I)*	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

Table 2-1

Levels of Protection – New and Existing Buildings

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 ratings are from \1\ ASTM F2912 /1/.
4. Door damage level categories are from ASTM F2247 and \1\ F2927 /1/.
5. Beyond minimum standards.

Table 2-1 (continued)

Levels of Protection – New and Existing Buildings

6. 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.

Level of Protection	Potential Structural Damage	Potential Injury
Below AT Standards[1]	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 structural capacity.	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 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.

Table 2-2

Levels of Protection – Expeditionary Structures

6.1 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 framing systems and they only address roofs to the extent that Table B-2 includes the least of the applicable wall conventional construction distances at which the roofs in Table 2-1 were found not to control any of the standoff distance /1/. 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 Tables B-1 and B-2 do not address windows. For some wall types in those tables the conventional construction standoff distances will require window and door construction that is significantly heavier and more expensive than windows and doors designed at the conventional construction standoff distances in previous versions of these standards. Tradeoffs between standoff distance and the associated wall, window, and door construction will have to be analyzed to determine what standoff distances are most economical. Those tradeoffs will generally need to be analyzed when standoff distances are less than 82 feet (25 meters) for Explosive Weight I and 33 feet (10 meters) for Explosive Weight II. 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. The least standoff distances at which the roofs in Table 2-3 can be considered to meet the performance requirements of these standards are tabulated at the bottom of Table B-2. Other roof construction or closer standoff distances will have to be analyzed. Exclusion from Table 2-3 should not be assumed to disqualify that construction from use in buildings. It only means that construction must be analyzed. Other types of construction other than that shown in this table may be permissible subject to validation by the designer of record.

Wall or Roof Type[1]	Analysis Assumptions[2, 8]						
	Sections	Span	Spacing	Support Condition	Supported Weight[5]	Reinforcement Ratio	Min. 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^2)	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^2)	N/A	875 psi (6 MPa)
Steel Studs – Brick Veneer[3]	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^2)	N/A	50,000 psi (345 MPa)
Steel Studs – EIFS[3]	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^2)	N/A	50,000 psi (345 MPa)
Metal Panels[6] (in wall or roof construction)	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^2)	N/A	33,000 psi (228 MPa)
Girts[b] (in wall or roof construction)	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^2)	N/A	50,000 psi (345 MPa)
Reinforced Concrete[7]	≥ 6 in (≥ 150 mm)	12 – 20 ft (3.7- 6 m)	N/A	S-S, One way flexure	10 psf (49 kg/m^2)	≥ 0.0015	3,000 psi (21 MPa)
Unreinforced Masonry[4, 8]	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^2)	0	1,500 psi (10 MPa)

Table 2-3

Conventional Construction Parameters

Wall or Roof Type[1]	Analysis Assumptions[2, 9]						
	Sections	Span	Spacing	Support Condition	Supported Weight[5]	Reinforcement Ratio	Min. Static Material Strength
Reinforced Masonry[7, 8]	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^2)	0.0005 - 0.0030	1,500 psi (10 MPa)
European Block[3, 4]	6 – 8 in (150 – 200 mm)	10 – 12 ft (3 – 3.7 m)	N/A	S-S, Brittle Flexure	10 psf (49 kg/m^2)	0	1,800 psi (12 MPa)
Concrete Roofs[7]	4 – 12 in (100 - 300 mm)	6 ft (1.8 m)	N/A	F-S	15 psf (73 kg/m^2)	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) Concrete Topping	30 ft (9.1m)	4 – 8 ft (1.2 – 2.4 m)	S-S	15 – 90 psf (73 – 439 kg/m^2)	N/A	50,000 psi (345 MPa)

1. Other types of construction other than that shown in this table may be permissible subject to validation by the designer of record.
2. See PDC Technical Report 10-01 for details on the analysis assumptions and material properties.
3. Steel studs are assumed to be connected top and bottom for load bearing walls. For non-load bearing walls steel studs are assumed to have a slip-track connection at the top.
4. Unreinforced masonry must have adequate lateral support at the top and bottom.
5. Weight supported by the wall that moves through the same deflection as the wall, not including self-weight of the component.
6. For walls or roofs built using metal panels and girts; use the greater of the standoffs for the metal panel and the girt /1/.
7. Reinforcing steel is 60,000 psi (414 MPa) tensile strength.
8. Concrete Masonry Units (excluding European block) are medium weight (120 pcf / 1922 kg/m^3)
9. Shear will need to be checked when using higher than minimum material strengths.

S-S = Simple - Simple Supports F-S = Fixed - Simple Supports

Table 2-3 (continued)

Conventional Construction Parameters

6.2 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. 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.

6.3 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 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.

6.4 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.

6.5 EXPEDITIONARY CONSTRUCTION. The standoff distances 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 being thrown into building interiors that injure 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.

7. 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.

7.1 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 to be closer to inhabited buildings than the minimum standoff distance, except for existing buildings in accordance with the paragraph above entitled “Minimum Standoff Distance”. 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.

7.2 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 the guidance in Standard 2.

8. 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.

8.1 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 these standards.

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

8.3 ENHANCED USE LEASES. Enhanced use leases are leases of land to other entities. It is assumed that as long as there is no access to installations to get to the enhanced lease facilities that there is no increased threat to 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 use in the long term. For that reason, the tenant building requirements are not enforced on enhanced use lease tenants. Buildings in enhanced lease areas must still comply with these standards, however.

9. LAMINATED GLASS AND POLYCARBONATE. Laminated glass is preferred as the protective layer (the inner lite 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. Monolithic glass and acrylic is not allowed by these standards because those glazing's break into hazardous fragments. Polycarbonate or other glazing systems that can be shown to provide the response required by these standards are allowed because they limit fragment hazards

9.1 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. 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. Film and curtain solutions are good interim solutions where compliance with these standards is not required.

9.2 GLAZED DOORS. Glazed exterior doors are required to be tested in accordance with ASTM F2927 or otherwise have their hazards mitigated in accordance with the Alternative Design provisions within Standard 12. When complying with the Alternative Design requirements the glazing in glazed doors is exempted from the framing and connection provisions of Standard 10 because that alternative allows doors to fail and enter buildings as long as their hazards are mitigated. Because that is allowed for exterior doors in general, to make the glazing meet all Standard 10 provisions would result in glazed doors effectively being held to a higher performance 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 panel and that its hazard can be mitigated as an assembly as for non-glazed doors.

9.3 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 tested in accordance with ASTM F2247 or ASTM F2927or otherwise have their hazards mitigated in accordance with Standard 12.

9.4 EXTERIOR STAIRWELLS AND COVERED OR ENCLOSED WALKWAYS.

Exterior stairwells and covered or enclosed walkways exterior to buildings 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.

10. 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.

10.1 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.

10.2 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.

10.3 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.

10.4 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.

10.5 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 are not exempted because they do not meet the visibility, accessibility, and routine population assumptions as the other recruiting stations.

10.6 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.

10.7 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 1and 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. These windows are not constructed for blast resistance. They are constructed to minimize hazardous fragments.

10.8 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.

11. 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 installations and buildings, developing common operational policies and procedures is unrealistic. It is assumed for the purposes of this discussion that policies and procedures will be developed by physical security personnel at individual installations or buildings based on their local capabilities and situations.

11.1 OTHER DESIGN CRITERIA. It is assumed that the provisions of these standards will be coordinated with all other applicable 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.

11.2 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 personnel have been trained in basic antiterrorism awareness in accordance with 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.

Distance to:	Building Category	Standoff Distances				
		Applicable Level of Protection	Conventional Construction Standoff Distance		Minimum Standoff Distance [2]	Applicable Explosive Weight [3]
			Load Bearing Walls [1]	Non-Load Bearing Walls [1]		
Controlled Perimeter or Parking and Roadways without a Controlled Perimeter	Billeting and High Occupancy Family Housing	Low	A	C	20 ft (6 m)	I
	Primary Gathering Building	Low	A	C	20 ft (6 m)	I
	Inhabited Building	Very Low	B	D	20 ft (6 m)	I
Parking and Roadways within a Controlled Perimeter	Billeting and High Occupancy Family Housing	Low	E	G	13 ft (4 m)	II
	Primary Gathering Building	Low	E	G	13 ft (4 m)	II
	Inhabited Building	Very Low	F	H	13 ft \1\ (4 m) /1/	II
Trash Containers	Billeting and High Occupancy Family Housing	Low	E	G	13 ft (4 m)	II
	Primary Gathering Building	Low	E	G	13 ft (4 m)	II
	Inhabited Building	Very Low	F	H	13 ft \1\ (4 m) /1/	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 explosive weights I and II. UFC 4-010-02 is For Official Use Only (FOUO).

Table B-1

Standoff Distances for New and Existing Buildings

Wall Type \1\ (1, 6) /1/	Column Letter							
	Without Controlled Perimeter Applicable Explosive Weight I (6)				Within Controlled Perimeter Applicable Explosive Weight II \1\ (5) /1/			
	Load Bearing Walls		Non-Load Bearing Walls		Load Bearing Walls		Non-Load Bearing Walls	
	A PG & BIL LLOP	B INHAB VLLOP	C PG & BIL LLOP	D INHAB VLLOP	E PG & BIL LLOP	F INHAB VLLOP	G PG & BIL LLOP	H INHAB VLLOP
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)	86 ft (26 m)	86 ft (26 m)	66 ft (20 m)	56 ft (17 m)
Metal Studs – Brick Veneer	187 ft (57 m)	187 ft (57 m)	207 ft (4) (63 m)	187 ft (3) (57 m)	75 ft (23 m)	75 ft (23 m)	82 ft (4) (25 m)	75 ft (3) (23 m)
Metal Studs – EIFS	361 ft (110 m)	361 ft (110 m)	420 ft (4) (128 m)	361 ft (3) (110 m)	151 ft (46 m)	151 ft (46 m)	167 ft (4) (51 m)	151 ft (3) (46 m)
Metal Panels	n/a (4)	n/a (2)	151 ft (46 m)	108 ft (33 m)	n/a (4)	n/a (2)	56 ft (17 m)	39 ft (12 m)
Girts	n/a (4)	n/a (2)	115 ft (35 m)	59 ft (18 m)	n/a (4)	n/a (2)	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 (4)	262 ft (80 m)	262 ft (80 m)	125 ft (38 m)	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\ Roof Construction in Table 2-3 /1/	20 ft (6 m)				13 ft (4 m)			

Table B-2

Conventional Construction Standoff Distances

1. Refer to Table 2-3 for details on the analysis assumptions and material properties for these wall types.\1\ Note that window and door construction will need to be heavier and more expensive when standoff distances are less than 82 feet (25 meters) for Explosive Weight I and 33 feet (10 meters) for Explosive Weight II.

   Where wall types include multiple cladding systems such as brick half way up the wall and EIFS above that, use the greater of the two applicable standoff distances /1/
2. Metal panels and girts are not considered primary structural members. \1\ Where they are used in the same wall, use the applicable standoff that is the greatest of the two components /1/.
3. Non-load bearing steel studs are assumed to have slip-track connections. Closer distances may be obtained through non-standard detailing and analysis.
4. Only used for analysis of existing structures. Not allowed for new construction.
5. \1\ Note that standoff distances less than 43 feet (13 meters) for Explosive Weight I and 23 feet (7 meters) for Explosive Weight II will require dynamic analysis for windows because lesser distances are outside the range of ASTM F2248 /1/.
6. \1\ Note that all of the construction included in this table must also be checked for loading conditions specified by other applicable structural criteria/1/.

Table B-2 (continued)

Conventional Construction Standoff Distances

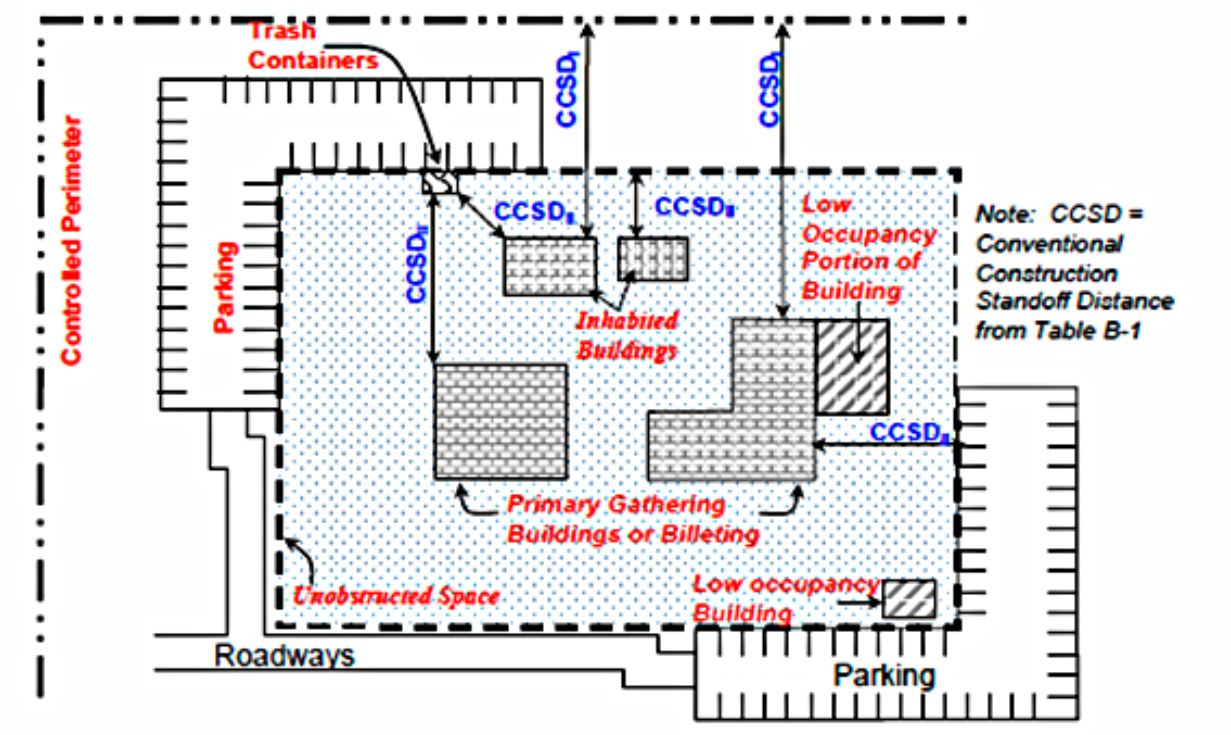

Figure B-1

Standoff Distances – With Controlled Perimeter

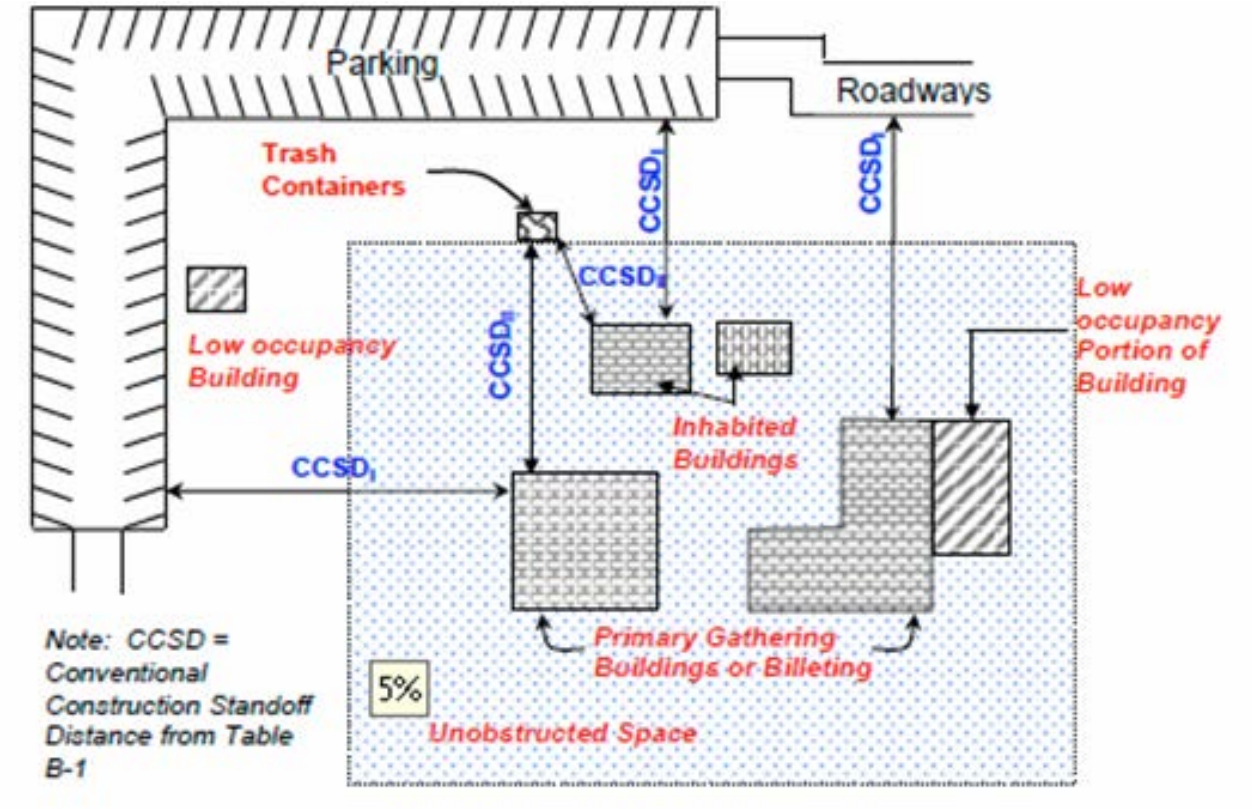

Figure B-2

Standoff Distances – No Controlled Perimeter

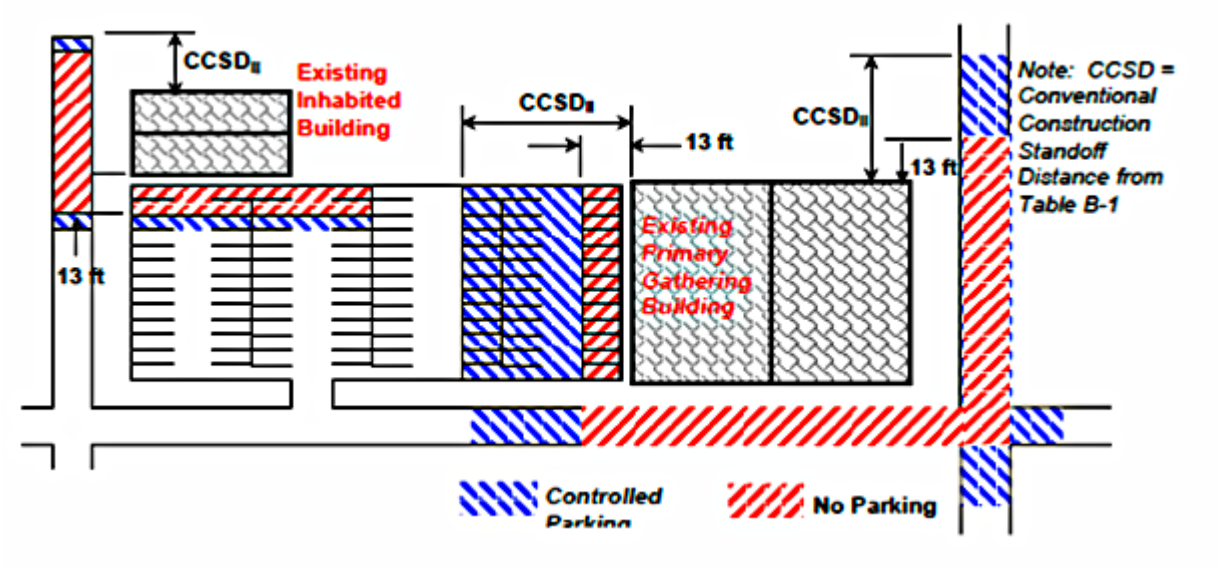

Figure B-3

Parking and Roadway Control for Existing Buildings – Controlled Perimeter

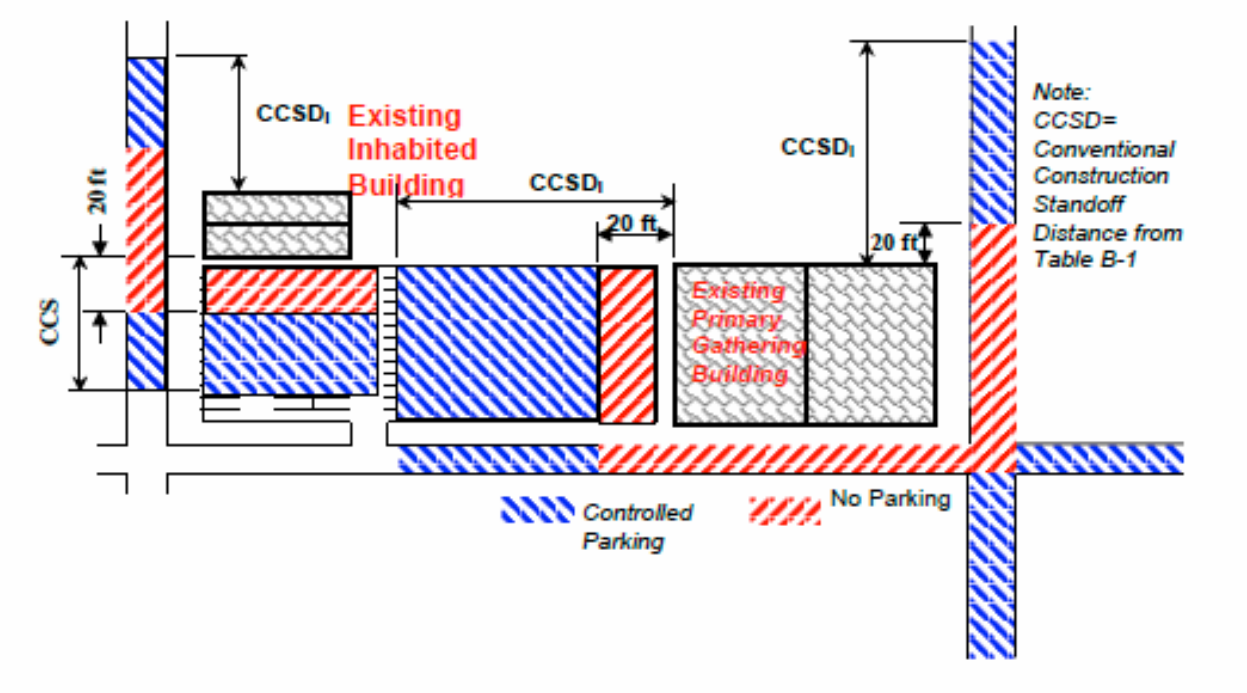

Figure B-4

Parking and Roadway Control for Existing Buildings – No Controlled Perimeter

Location	Structure Category	Standoff or Separation Distance			
		Applicable Level of Protection	Fabric Covered Structures[1]	Trailers, and Other Expeditionary Structures[1][2]	Applicable Explosive Weight (TNT)[3]
Controlled Perimeter	Billeting	Low	102 ft (31 m)	233 ft (71 m)	I
or Parking and Roadways without a Controlled Perimeter	Primary Gathering Structure	Low	102 ft **APPENDIX E** (3 1 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[4]	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[1]	Trailers, and Other Expeditionary Structures[1][2]	Applicable Explosive Weight (TNT)[3]
	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.

Table D-1 (continued)

Standoff and Separation Distances for Expeditionary Structures

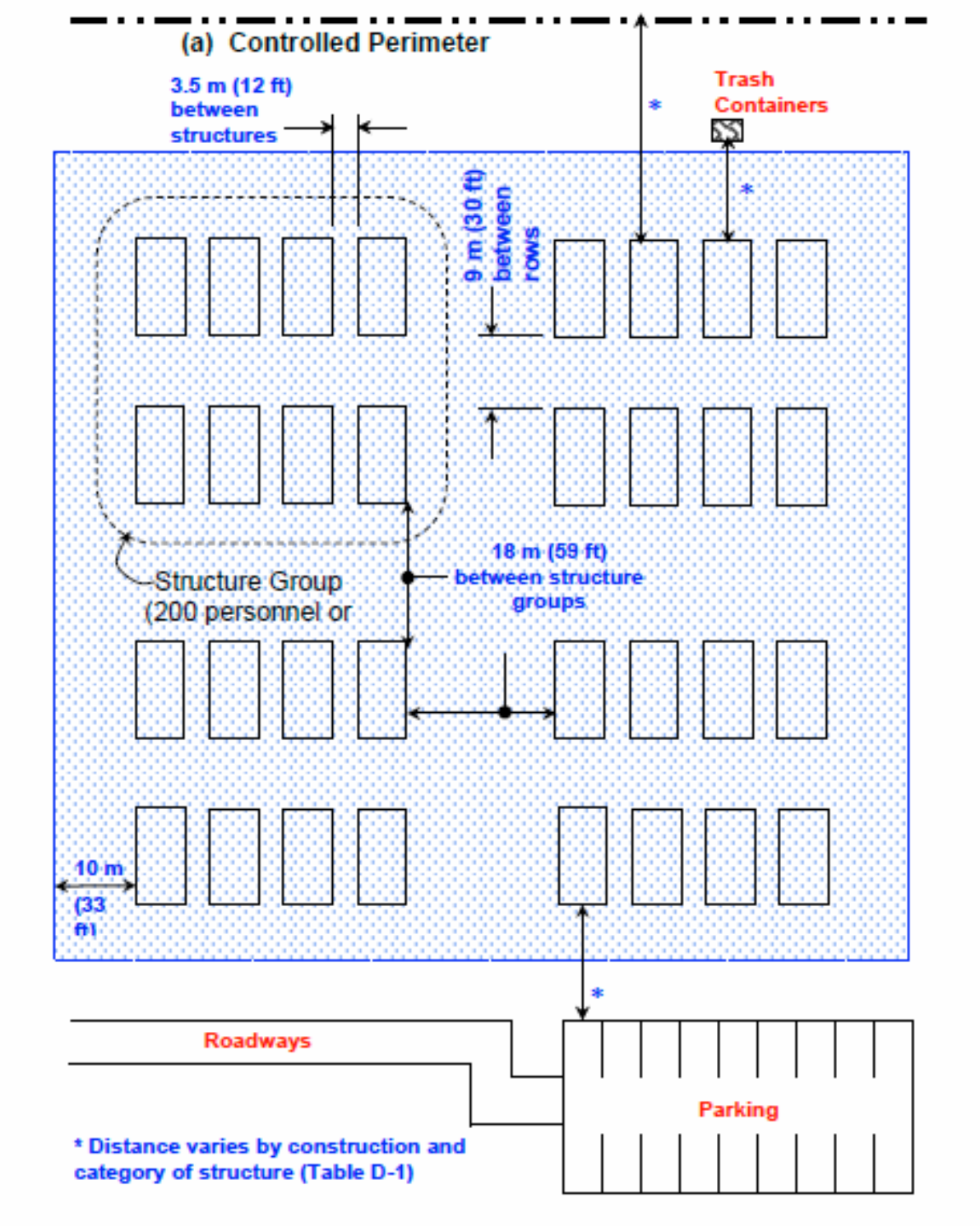

Figure D-1

Standoff and Separation Distance