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# Updated Military Criteria for Antiterrorism Design

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UFC 4-010-01, *DoD Minimum Antiterrorism Standards for Buildings*, dated February 2012, outlines 21 standards that govern site planning and the design of structural, architectural, electrical and mechanical systems for Low and Very Low Levels of Protection. The current document was developed as an update to a previous version originally issued in October 2003 and modified by Change 1, in January 2007. Though some of the revisions were incremental and provided additional clarification to existing standards, others were significant and represent a major change in approach. Implementation of the updated criteria is likely to result in levels of hardening or analysis that vary from those required by earlier editions.

The most obvious changes pertain to the standoff distances at which conventional construction may be used, the unobstructed space requirements, and the design of window and door systems. Each of the adjustments comes with opportunities, but also potential pitfalls that could lead to unintended cost increases or criteria violations.

## Standoff Distances

Standard 1 outlines the conventional construction standoff distances (CCSDs) that permit the structure and façade, other than glazing systems and supporting elements, to be designed without specific analysis for blast effects. In the 2007 version, CCSDs and minimum standoffs were based solely on the building category and level of protection for a corresponding explosive threat. The 2012 version has overhauled this approach by specifying varying CCSDs for defined wall and roof construction types based on multiple construction parameters and limitations that were developed by a variety of dynamic calculations. As a result, this new version typically requires a larger CCSD for walls that are load-bearing versus non-load-bearing by allowing more damage to the latter.

This approach allows the designer to tailor a conventional construction type to the available standoff. The CCSD for heavier materials, such as reinforced concrete and masonry, are smaller when compared to the generic values in the 2007 criteria, thereby permitting the use of such construction without blast analysis when less standoff is available. However, implementation of the reduced CCSDs is limited because they are only applicable for the specified range of element parameters, including spacing, span, supported weight, boundary conditions, and material strength. For example, two-way flat slab roofs do not qualify because such boundary conditions are not included in the recognized set of parameters. Other common roof types, such as steel-framed with wide flange shapes, are also not included. Per the criteria, "Any construction type that does not fall within the specified parameters needs to be analyzed for blast loads due to the explosive threats at the appropriate standoff." It is reasonable to expect that structural systems that are similar to or stronger than those specified in the criteria can meet the intent of the CCSD criteria. However, the use of these systems without submitting dynamic analysis calculations may leave the design team in a position of having not met the criteria as written.

The new version also states that all façade elements are assumed to conform to a pin-pin condition, which is not always the case. A cantilever condition, such as a wall below ribbon windows, is not considered. Therefore, if such elements are utilized, dynamic calculations must be performed to verify that they can resist the direct blast loads and the reaction from the window system, which can be represented as a point load at the end. This will generate the need for more analysis during design compared to the 2007 criteria, which had no restrictions based on the type of construction as long as the prescribed standoff distances were provided.

In addition, the unobstructed space now extends out to the closest applicable standoff distance for Explosive Weight II, which applies to parking and roadways within a controlled perimeter and to trash containers, but not less than the minimum standoff distance for a qualifying construction type. The 2007 criteria required 33 feet of unobstructed space regardless of construction type. This change greatly increases the required interaction with the site and landscape design in coordination with the blast protection and construction type required in Standard 1.

## Windows and Doors

Standard 10 outlines the design provisions for glazing systems, which are applicable even if the CCSD of the wall supporting or surrounding the window is met or exceeded, and also impose a tradeoff when the site design takes advantage of the reduced CCSDs for heavier construction types. Several significant changes were made to Standard 10 in the 2012 criteria (see *Table*).

The structural elements supporting windows and skylights can now be designed statically by simply accounting for their increased tributary area relative to the rest of the wall. This factor is multiplied to the moment and shear capacity of the conventional wall or roof element to determine the required capacity of the supporting element and its connections to the structure, including any load-transferring elements such as kickers.

Finally, the new version provides additional guidance for exterior doors, which must now

be tested to achieve the applicable level of protection in accordance with ASTM F2247. Previously, the doors merely had to swing outward. This requirement will present challenges for door manufacturers; they may be required to test their products for the smaller CCSDs that are now allowed for heavier construction types. Glazed doors must also meet the glazing and bite provisions of Standard 10.

## Conclusion

In summary, the CCSDs have changed to allow threats closer to the building based on the exterior wall and roof types. The design team must carefully consider whether the chosen construction meets the parameters outlined in the new criteria, or if dynamic analysis will be required. Additionally, some of the parameters may have an adverse impact on project budgets. For windows and doors in particular, smaller standoffs allowed under the new criteria will typically increase the cost relative to previous versions. There will be a period of time before vendors adjust to these changes during which the products they offer may be severely limited and expensive. If these constraints are known in advance, then the design team can make informed decisions early in the process and avoid unanticipated expenses to the building.▪

*Comparison of Standard 10, v2007 and v2012.*

| ***Element*** | ***2007 UFC*** | ***2012 UFC*** |
|---|---|---|
| Glazing | Prescriptive Design w/ Table B-3 | Design w/ ASTM E1300 and ASTM F2248 (based on explosive weight, standoff distance, and glazing size) |
| Framing | Design Loading per ASTM F 2248<br>Deflection < L /160 | Design Loading per ASTM F2248<br>Deflection < L /160<br>**AND**<br>2X Glazing Resistance per ASTM E 1300<br>Deflection ≤ L /60 |
| Connections | 2X Design Loading per ASTM F 2248 | Design Loading per ASTM F 2248<br>Deflection < L /160<br>**AND**<br>2X Glazing Resistance per ASTM E 1300<br>Deflection ≤ L /60 |
| Supporting Structure | 8X Glazing Resistance per ASTM E1300 | Increase capacity of elements relative to typical wall by ratio of tributary areas |
| Skylights | Same as Above | Glazing requires dynamic analysis |