

What is the bullet/ballistic resistance of concrete masonry?

Bullet Resistance of Concrete Masonry

Bullet resistance can have a high priority for many buildings, often more so than blast resistance. Unfortunately, much of the testing that has been conducted on the bullet resistance of concrete masonry assemblies is not available in the public domain. The most current published comprehensive study was conducted in Canada by the Canadian Masonry Research Institute and the Royal Canadian Mounted Police as reported in *Resistance of Exterior Walls to High Velocity Projectiles*. This document is available for free download [HERE](#). Although the firearms and bullets used in this study don't match Underwriters Laboratories UL 752 *Standard for Bullet-Resisting Equipment* bullet level classifications 1-8 (the standard often cited for bullet resistance), a comparison can be made according to the energy levels of the bullets with adjustments for the difference in the distance of the firearm to the target in the two documents as follows:

| Bullet Resistance of Concrete Masonry Wall Sections | | | | | | |
|--|--|-----------------------|-------------------------|---|-------------------------------|---------------------------------------|
| UL Specifications | | | CMRI Tests ¹ | | | |
| UL Level | Description | Energy J (ft-lb) | CMRI No. | Calibre/Make | Energy ² J (ft lb) | Successful Wall Sections ³ |
| Handguns | | | | | | |
| 1 | Medium power - 9 mm, Super 38 Automatic | 515-624 (380-460) | 14 | .40 Smith & Wesson (Glock 22) | 508 (688) | A, B, C |
| 2 | High Power - .357 magnum | 743-899 (548-663) | 4 | No direct match: however .223 Remington rifle well exceeds UL bullet energy 1672 (1234) | | A, B, C |
| 3 | Super Power - .44 magnum | 1317-1593 (971-1175) | 4 | No direct match: however .223 Remington rifle well exceeds UL bullet energy 1672 (1234) | | A, B, C |
| High Power Hunting and Sporting Rifles | | | | | | |
| 4 | 30-06 | 3498-4929 (2580-3048) | 8 | .30-06 Springfield | 3713 (2739) | C |
| 5 | Military ball full metal copper jacket ammunition fired from a hunting rifle | 3416-4133 (2519-3048) | 7 ^{4,5} | .308 Winchester | 3380 (2493) | C |
| Multiple Shots - Submachine Guns/Military Assault | | | | | | |
| 6 | Multiple shots from submachine gun - 9 mm Uzi | 732-885 (540-653) | 7 ^{4,6} | No direct match: however .308 Winchester rifle exceeds UL bullet energy 3380 (2493) | | C |
| 7 | Multiple shots from military assault rifle - M-16 | 1570-1901 (1158-1402) | 7 ^{4,6} | No direct match: however .308 Winchester rifle exceeds UL bullet energy 3380 (2493) | | C |
| 8 | Multiple shots from military assault rifle - M-14 | 3416-4133 (2519-3048) | 7 ^{4,5,6} | .308 Winchester | 3380 (2493) | C |
| .50 Caliber Machine Gun | | | | | | |
| | Well in excess of all UL level requirements | | 15 ⁴ | .50 Browning Machine Gun | 17083 (12600) | C ⁷ |

Notes:

¹ Source: *Resistance of Exterior Walls to High Velocity Projectiles*. Canadian Masonry Research Institute, 2001. The full report is available [HERE](#).

² Adjusted for difference in distance to target per UL of 15 ft (4.6 m) and ref.1 82.0 ft (25 m)

³ Wall section descriptions:

A - 150 mm (6-inch) nominal hollow concrete masonry units

B - 150 mm (6-inch) nominal split-face hollow architectural concrete masonry units

C - Multi-wythe wall with either 90 mm (4-inch nominal) clay or concrete brick with 150 mm (6-inch) nominal hollow concrete masonry unit backup

⁴ Indicates metal jacketed bullets used.

⁵ The muzzle energy exceeds UL minimum requirement; however, when adjustment is made for distance, the energy falls just below the UL minimum. The bullet stopped within the veneer however, and did not penetrate the backup.

⁶ Two shots fired at the same point in the wall.

⁷ When fired at a 45° angle to the wall the bullet penetrated the veneer but was trapped in the cavity. When fired at 90°, the bullet passed through the wall.

Previous to the Canadian study, most published ballistic testing on concrete masonry walls was carried out during World War II to make sure that adequate protection was provided for transformers, switching stations, and other installations subject to sabotage. Recommended constructions for bullet resistance are 8 in. (203 mm) solid or grouted concrete masonry walls or 12 in. (305 mm) hollow units with sand-filled cores. Both walls provided equal protection under test conditions. In no case did bullets penetrate the opposite face shell of the masonry when tested with high-powered rifles, revolvers, and machine guns.

Glass unit masonry products have been tested for bullet resistance. Solid glass unit masonry (8 x 8 x 3 in. thick) (203 x 203 x 76 mm) achieved UL Levels 1, 2, and 6. Hollow glass block (8 x 8 x 4 in. thick) (203 x 203 x 102 mm) with a thickened, 3/4 in. (19 mm), face shell achieved a Level 1 rating. These ratings apply to glass unit masonry panels at least three units high by three units wide framed on all four sides and laid with Type S mortar. For more information on bullet resistance, see NCMA TEK 14-21 also available through the NCMA web site www.ncma.org.