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## WHAT IS THE BULLET/BALLISTIC RESISTANCE OF CONCRETE MASONRY?

The actual resistance of concrete masonry assemblies to high velocity projectiles such as bullets varies considerably depending on the details of the assembly and the type and energy of the projectile. While many tests have been conducted through the years documenting the ballistic resistance of concrete masonry construction, much of this research 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* [1]. A key conclusion of this report noted that:

*“Walls finished with either a clay brick or concrete brick veneer prevented all but the 0.50 Browning from complete penetration of the wall assembly.”*

Although the firearms and bullets used in this study do not exactly match Underwriters Laboratories bullet resistance levels under UL 752, *Standard for Bullet-Resisting Equipment* [2], (the standard often cited for bullet resistance), a comparison can be made by adjusting for the impact energy level as shown in the table below.

Before 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 similar 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.

### REFERENCES

1. “Resistance of Exterior Walls to High Velocity Projectiles”, TR-03-2002, Canadian Police Research Centre, 2002. <https://pubs.drdc-rddc.gc.ca/BASIS/pcandid/www/engpub/DDW?W%3DSYSNUM=529986>
2. “Standard for Bullet-Resisting Equipment”, UL 752, Underwriters Laboratory, 2009. [www.ul.com](http://www.ul.com)

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Bullet Resistance of Concrete Masonry Wall Sections					
UL Specifications			CPRC Results <sup>1</sup>		
UL Level	Firearm Description	Energy J (ft-lb)	Firearm Description	Energy J (ft-lb) <sup>2</sup>	Successful Wall Sections
<b>Handguns</b>					
1	Medium power 9 mm; Super 38 Automatic	515-624 (380-460)	.40 Smith & Wesson (Glock 22)	508 (688)	A, B, C, D
2	High Power - .357 Magnum	743-899 (548-663)	Closest match: .223 Remington rifle	1672 (1234)	A, B, C, D
3	Super Power - .44 Magnum	1317-1593 (971-1175)	Closest match: .223 Remington rifle	1672 (1234)	A, B, C, D
<b>High Power Hunting and Sporting Rifles</b>					
4	.30-06	3498-4929 (2580-3048)	.30-06 Springfield	3713 (2739)	A, B, C, D
5	Military ball full metal copper jacket ammunition fired from a hunting rifle	3416-4133 (2519-3048)	.308 Winchester <sup>4</sup>	3380 (2493)	A, C, D
<b>.50 Caliber</b>					
Exceeds UL 752 requirements			.50 Browning Machine Gun	17083 (12600)	D

Notes:

<sup>1</sup> Source: Reference 1.

<sup>2</sup> Adjusted for difference in distance to target per UL 752 of 15 ft (4.6 m) and Ref.1 of 82.0 ft (25 m).

<sup>3</sup> Wall section descriptions:

A – Concrete masonry or clay masonry brick veneer with a nominal thickness of 90 mm (4 in.).

B – 150 mm (6 in.) nominal hollow concrete masonry units.

C – 150 mm (6 in.) nominal split-face hollow architectural concrete masonry units

D – Multi-wythe wall with either 90 mm (4 in.) nominal clay or concrete masonry brick with 150 mm (6 in.) nominal hollow concrete masonry unit backup.

<sup>4</sup> 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.

## ABOUT CMHA

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