

Development and Testing of an Underground Protective Shelter Constructed of Hyperbolic Paraboloid Shell Elements

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<p>This report documents the full-scale test of an underground shelter designed to resist near misses of conventional munitions. The structure was made of hyperbolic paraboloidal (HYPAR) panels and provided 750 square feet of usable floor space. The hyperbolic paraboloidal shape is an efficient means of carrying impulsive loads, characteristic of conventional munitions. The HYPARS derives its efficiency from its shape of two opposing curvatures. The HYPAR panels were approximately 6 inches thick composed of five layers. The layers were made up of two layers of reinforced concrete, two layers of unreinforced concrete and an asphalt reinforced with glass mat layer.</p> <p>Two blast tests were conducted. Each test used a MK-83 bomb. In the first test, the bomb was 14 feet from the shell. In the second test, the bomb was 10 feet from the shell. In both tests, the structure survived the blast. The structure underwent large deformations and localized failure but did not collapse and no spalling occurred.</p>			
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