

APPLICATION OF MILITARY BLAST EFFECTS EXPERT SYSTEM TO MODERN FORCE PROTECTION STRUCTURES

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Defence R&D Canada has developed and evaluated military structures for field fortification and camps. Typical structures include: trenches, personnel collective protection, observation posts, tents and storage facilities for water, fuel and ammunition. In support of this work, a Military Blast Effects Expert System (MBEES) has been developed to facilitate the design and deployment of these structures, and to assess their vulnerability to conventional and enhanced blast weapons. MBEES consists of four modules:

1. Explosives and Weapons Module: calculates blast properties for a variety of HE, FAE, thermobaric weapons and terrorist improvised explosives.
2. Structures and Scenes Module: provides easy visual set-up of structures and camp layouts, and graphical presentation of the blast loading and structural response.
3. Loading, Response and Design Module: calculates the blast loading and structural/human response, and evaluates the overall damage to the structure. Blast loading is based on a collection of sub-models for external loading and ingress. These models combine semi-empirical models with an extensive library of computational fluid dynamics results. The structural response algorithms assess blast-induced deformations, including bending, shear and torque deformations. This response is computed using a semi-empirical three-degrees-of-freedom model and a structural mechanics based continuous system model. Blast and response models are combined for an overall vulnerability assessment of structures and their occupants.
4. Field Advisor Module: guides the user in the construction and deployment of the structures.

The modules, including blast and structural response models, are reviewed. Applications to typical force protection structures are presented. Due to construction methods and location, requirements for military structures can be quite different from urban structures. Some important factors for military structures include: the possibility of attack from a wide variety of threats, the highly ductile materials used in the construction of gabion-based structures, and the blast protection measures used in the overall structural design.