Enhancing Protective Building Design using Explicit Dynamic

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ABSTRACT

Careful design of public buildings is needed to provide an optimized response that accounts for various loading cases, such as seismic, wind, and blast loads. Effective building design needs to be well-balanced for various scenarios. Fundamental understanding of structural behavior and dynamic response is crucial for the protective building design under blast load, in which peak pressure is orders of the highest magnitude, but their durations are very short. This study incorporated the explicit dynamics method into the investigation, mainly focusing on simulating fundamental components' structure and material properties. In general, explicit dynamics elucidates how structural elements react to explosive forces, providing a comprehensive view of global and localized effects. When applied rigorously, this method makes a substantial contribution toward advancing our comprehension of the fundamental principles that govern the behavior of structures in the face of explosive forces. This study used ANSYS and LS-DYNA to model the reinforced concrete panel under the blast load to study and investigate the behaviors. The TNT explosive was placed at a stand-off distance over the RC panel. For a blast scenario, a 3D air box was created around the panel to act as a domain for the analysis. The ANSYS explicit dynamics module created a 3D wedge filled with air and TNT materials and continued untill the panel failure. In another technique, the LS-DYNA prepost uses the LBE method to simulate the blast behavior. Currently, investigations and findings on the structural behavior under blast loads are very limited which provide some recommendations to ensure greater strength in building structures that must withstand localized failure. However, a performance-based approach to design building members and structures under blast loads is still lacking.

Keywords: Blast analysis, TNT, Explicit dynamics, LS-DYNA

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