BLAST RESPONSE OF BUILDING WALL AND FRAME STRUCTURES

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A specialized building structural response model was developed combining plate theory and equivalent Slab systems to model. the wall response coupled with an available finite element program capable of describing the structural frame. The wall is modeled as a one degree of freedom system attached to the frame. Stiffness and mass characteristics of the system are based on the geometric and material properties of the wall . Loadings are applied to the wall using an algorithm which predicts pressure-time histories from prescribed charge weights, standoff distances, and angle of blast wave impingement. Stress levels are monitored for the wall using the plate theory and for the frame using the finite element code directly. Developed stresses are compared with allowable to determine failure of either the wall or frame. Responses predicted by the model have compared favorably with data from the open literature, although failure prediction depends heavily of on accurate estimates of ultimate stress properties of the materials involved.
One shock tunnel test by the Defense Civil Preparedness Agency against a brick wall was analyzed using the model and results compared extremely well. The response model has been used to predict damage susceptibilities for nine typical structures representing five construction categories:
brick, concrete block, metal prefab, reinforced concrete, and wood frame. Comparison of predicted and observed damages demonstrate the reliability of the analytical model.