THE RESPONSE OF STEEL WIDE FLANGE COLUMNS TO CLOSE-IN EXPLOSIONS

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Abstract: A series of blast tests involving steel wide flange columns and charges placed at standoff distances ranging from contact to 24 in (610 mm) were performed. Three column sizes were considered and charges were placed to align with either the strong or weak axis of the column. The blast tests resulted in large localized deformations, tearing failures, and in some cases, brittle cleavage-type fracture. For the columns that remained intact following the blast test, the axial compressive residual capacity was determined by displacing the top of the column downward until the peak force was obtained. These tests provided a suite of data that was subsequently used to validate a first principles high-fidelity physics-based (HFPB) modeling approach for steel wide flange columns exposed to explosions at contact and near-contact standoff distances. This paper summarizes the results of the tests as well as how the HFPB modeling results compared with the tests. The capabilities and limitations of the modeling approach are discussed. Recommendations for further testing and computational modeling work are provided.