BLAST TESTING OF STEEL FRAME MOMENT CONNECTION ASSEMBLIES

J. Karns[1], D. Houghton[1], B. Hall [2], J. Kim[1], K Lee[1]

[1] *Myers, Houghton & Partners, Inc.*
4500 E. Pacific Coast Hwy., Ste. 100, Long Beach, CA, 90804 United States of America
[2] *General Services Administration, Office of Chief Architect*
Washington, D.C., United States of America

This paper will present the results to date of a first-ever, three-year-long steel frame blast research program sponsored by the U.S. General Services Administration Office of the Chief Architect (GSA/OCA), as part of an historic integrated test program with the U.S. Defense Threat Reduction Agency (DTRA), to a) evaluate the behavior of selected steel frame moment connections subjected to explosive tests, b) determine their post-blast integrity for the purpose of mitigating progressive collapse, c) validate the analytical tools used to predict frame performance, and d) identify effective solutions. The GSA Test Program combines 1) predictive analysis using state-of-the-art analytical tools, including air fluid/structure modeling techniques which replicate the actual explosive material, the shock wave pressures generated, and a detailed model of the test article and its critical components with and without concrete cladding to parametrically simulate possible curtain wall systems; with 2) actual blast testing of full-scale test articles to corroborate the predicted behavior and assess the post-blast capacity of steel frame structures to mitigate progressive collapse.

The paper will focus on two-sided moment connection frame assemblies configured in a double-span condition and subjected to direct air blast attack, to assess frame performance. The effects of high strain rates in critical components, girder twist, weak-axis bending and shear, and post-blast integrity of beam-to-beam structural continuity across a compromised column, will be explored, initially absent gravity loads; followed by subjecting the blast-damaged steel frame assemblies to monotonic application of vertical load to simulate gravity applied load and to assess post-blast integrity of beam-to-beam structural continuity, which is fundamentally required to arrest structural mechanisms that are known to trigger progressive collapse.