INVESTIGATION OF CONVENTIONALLY DESIGNED STEEL FRAME STRUCTURES' INHERENT RESISTANCE TO LATERAL BLAST LOADING, TEST 1 RESULTS

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ABSTRACT

The United States Department of State has developed wall and window retrofits primarily for use in reinforced concrete frame structures. As the Department builds new, and renovates existing, steel frame structures, it is vital to understand the performance and global response differences between a reinforced concrete and a steel frame structure subjected to blast loads. To ensure occupancy of safe and secure steel frame buildings, a two-phase research program has been developed.

First, an analytical study was performed to evaluate the global lateral response of different types of steel frames against blast loads. The buildings were designed to represent typical office buildings with conventional and blast-resistant facades. The global blast response was evaluated using non-linear dynamic structural analysis. The study showed that conventionally designed steel frame buildings when used in conjunction with blast-resistant facades, could be susceptible to failure due to the high blast reactions transferred to the Lateral-Force-Resisting-System (LFRS).

Second, a test program was initiated to validate the findings from the study. Two tests will be performed using a full-scale, conventionally designed three-story steel braced frame. The structure will be instrumented with strain, and deflection gauges to measure the forces and displacements of the LFRS. Test 1, in which a conventional curtain wall was installed on the steel braced frame structure has been conducted. The presentation will review the research program findings, discuss the testing goals, present the Test 1 setup, and present Test 1 results through high-speed video, pictures, pertinent gauge data, and comparison with pre-test analyses. The set up for test 2 using a hardened façade will also be discussed.