Blast Test

This memorandum briefly summarizes the set?up and results of two open?air blast tests performed by Stone?OBL on a single Blast? Resistant wood laminated panel on July 14, 2016. The tests were performed at the Stone?OBL blast testing site located in Deschutes County, Oregon approximately 30 miles (48 km) east of Bend, Oregon. An existing reinforced concrete reaction structure was supplemented with a rigid steel frame and plate system to accommodate the test panel, as shown in Figure 1.

Test Set?Up

The panel consists of a proprietary patent?pending composite wood system. The panel had 3/4?in (19?mm) diameter bolt holes drilled at 6 inches (152 mm) on center along their vertical edges to allow for connection to the surrounding steel framing elements, resulting in one?way horizontal span. An 8?inch (203?mm) strip of panel was removed at the bottom to further accommodate the steel framing. Exposed gaps between the test panel and steel plates were filled in with the removed panel strips and foam pieces.

Test Results

The test loads were developed by detonating two batches of Ammonium nitrate/fuel oil (ANFO), a widely used bulk industrial explosive mixture. Each shot used a different explosive weight and standoff from the test specimen. Five pressure gauges were mounted to the steel plates on the front of the reaction structure surrounding the test specimen. Two laser?based displacement readers were also positioned along the vertical center line of the panel for each test. The ranges of gauge readings recorded for positive phase pressure and impulse are presented in Table 1.

Figure 2 and Figure 3 (below) show photographs of the panel following Test 1 and Test 2, respectively.

Video 1 and Video 2 (below) show the actual blasts (of Test 1) from both outside and inside the test structure.

Table 1 – Reflected Blast Pressure Gauge Readings

Test Number	Pressure in psi (kPa)	Impulse in psi?ms (kPa?ms)
1	33?35 (230?240)	90?103 (620?710)
2	25?28 (170?190)	96?123 (660?850)

The maximum displacement of the panel did not exceed 0.4 inches (10 mm) for either test within the first 150 ms of recorded response. Surrounding wood strips and foam pieces around the panel that sealed the gaps were dislodged, as seen in Figure 2 and Figure 3. Moreover, no permanent panel deformation was observed in either case during post?test inspection (i.e., the panel returned to its original pre?test position resulting in an elastic response). As such, wood laminated panels with a similar through?thickness lay?up and span can likely sustain significantly higher blast loads than those tested prior to achieving permanent deformation. The panels can potentially take even higher loads for applications where permanent panel deformation is acceptable (e.g., where panels are subjected to a one?time blast event and only need to sustain capacity to allow for personnel egress).

Video 1 - Exterior of Test 1

Video 2 - Interior of Test 1