A PRELIMINARY INVESTIGATION INTO THE PROPAGATION OF SHOCK WAVES BEHIND A SIMPLE RECTANGULAR STRUCTURE

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Typically, the pressure acting on the rear face of a rigid rectangular structure subjected to blast loading is described terms such as "somewhat less than the stagnation pressure"[1], or as approaching "the instantaneous value for P_{stag} - P_{drag}"[2], i.e. the stagnation pressure minus the drag pressure. These descriptions can be difficult to interpret and the terms P_{stag} and P_{drag} are not as intuitive as side on pressure or reflected pressure. In this paper a different approach is taken, it is assumed that the interaction of the shock wave with the structure results in the formation of three independent shockwaves, travelling three separate paths, one around one side of the structure, one around the other side and one over the top of the structure. A theoretical wave form, both positive and negative phase, is calculated for each of these shocks, a diffraction coefficient is applied, and then the waves are mapped onto a common time line. The final load on the rear face of the structure is determined by the addition of the three waves.

Testing, for the purpose of model verification was performed using an instrumented test table, a 38 x 38 x 53 cm rigid aluminium structure and spherical charges of sensitised nitromethane of nominally 5.5 g, 25 g and 58 g. The test results verify the hypothesis that two of the waves travel around the sides of the structure while the third travels over the top. The diffraction coefficient data resulting from the testing was used to write a simple excel spread sheet that can be used to determine the expected waveform behind a simple rectangular structure. The results of this model are compared with the test results.

REFERENCES

1. Kinney, G., and Graham, K., "Explosive Shocks in Air", Second edition Springer-Verlag New York, 1985.
2. Baker, W., "Explosions in Air", Wilfred Engineering, San Antonio, 1983.