DESIGN GUIDANCE FOR BLAST LOADED STRUCTURAL CONNECTIONS: A SUMMARY

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Abstract: Current design guidance for blast loaded connections is typically general in nature, does not distinguish between ductile or brittle limit states, and relies on limit state capacity equations from building codes developed to address serviceability considerations. On the demand side, idealized single degree of freedom analytical models with simplified boundary conditions, which are commonly used to design blast-resistant members, can grossly over or underestimate the design reaction forces for connection elements when the blast loading is large or nonuniformly applied. Given the general design guidance offered by blast protection standards and the relative uncertainty surrounding the design reaction forces for blast loaded connections, it is important for engineers to understand the actual capacity and deformation characteristics of potential limit states under dynamic loading conditions. This paper summarizes the findings of a recent effort to (a) document the response phenomenology of known limit states for connections exposed to blast loading and (b) identify current gaps in the body of knowledge. Blast loaded connections including concrete anchorage; steel bolt, stud, and threaded rod; and welded connections are discussed. For each limit state, past testing efforts that undergird the current building code limit state capacity equations are documented, as well as rate effects testing efforts in which failure according to the limit state was observed. Based on this information, limit state capacity equations for use in blast loaded conditions are proposed with applicable static and dynamic increase factors.