BLAST ANALYSIS AND DESIGN OF ROOF TRUSS SYSTEMS

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ABSTRACT

Building envelope is the most critical line of defense to protect structural components and occupants against external explosion threats. Much research has been done, and design methods have been developed and verified, for exterior building wall systems under blast loads. Limited research exists for roof truss systems under blast loading, and the resistance of roof trusses to failure is not well-defined. In addition, the blast load on a roof system varies with space and time, which makes it more complex compared to that experienced by building walls. Current design methods calculate the response based on an equivalent blast roof loading. In this paper, the dynamic response of roof system under blast loading will be predicted numerically using the actual blast load on the roof and compared to the dynamic response calculated based on the equivalent blast roof loading. The dynamic predictions will be verified using full-scale field experiments using live explosives. In addition, the static resistance function of open-web steel joist roof trusses will be developed using full-scale experiments and numerical simulations. Past research showed that the static resistance of cold-formed steel roof trusses could be limited by their end-connection capacities. In this paper, the behavior of different cold-formed steel trusses end-connections will be investigated experimentally under horizontal and vertical loading up to failure. Connections failure FE models will be developed and verified experimentally. The toughness and the ultimate capacities of end-connections are important parameters for improving the performance of cold-formed steel roof trusses against blast loading.