

Numerical Study of Steel Structures Responses to External Explosions

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Abstract : Due to the constant increase in terrorist attacks, the research and engineering communities have given significant attention to building performance under explosions. This paper presents a methodology for studying and simulating the dynamic responses of steel structures during external detonations, particularly for accurately investigating the impact of incrementing charge weight on the members total behavior, resistance and failure. Prediction damage method was introduced to evaluate the damage level of the steel members based on five scenarios of explosions. Johnson–Cook strength and failure model have been used as well as ABAQUS finite element code to simulate the explicit dynamic analysis, and antecedent field tests were used to verify the acceptance and accuracy of the proposed material strength and failure model. Based on the structural response, evaluation criteria such as deflection, vertical displacement, drift index, and damage level; the obtained results show the vulnerability of steel columns and un-braced steel frames which are designed and optimized to carry dead and live load to resist and endure blast loading.

Keywords : steel structure, blast load, terrorist attacks, charge weight, damage level

Conference Title : ICCEA 2017 : International Conference on Civil Engineering and Architecture

Conference Location : Berlin, Germany

Conference Dates : May 21-22, 2017