INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: PROGRESSIVE COLLAPSE ANALYSIS AND PROBABILISTIC MODELS FOR ANALYSIS AND DESIGN OF MULTI-STOREY BUILDINGS SUBJECTED TO BLAST LOADING.

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SHORT ABSTRACT

Concrete and steel rigid frame structures are the most utilised civil engineering structures in building constructions. The rigid frame buildings can experience to blast loads (lateral loads) during their lifetime. This research presents a finite element simulations of charge shapes and their spherical equivalents, the validation of the Multi-Material Arbitrary Lagrangian Eulerian (MM-ALE) approach and the analysis of an RC frame subject to internal blast loading. This research develops a novel quadratic blast profiles and response spectra for both quadratic and exponential profiles, and presents the numerical validation of blast profile. This research also develops the multi-storey rigid frame structures' critical load factors analysis, probabilistic models of critical load factors, and the peak loads of multi-storey buildings, and presents their validation. This research also presents the dynamic analysis of multi-storey buildings subject to blast loading, eigen modal analysis, generalised equation of motion, development of modified shape function, and validation of the modified shape function. This research illustrates the framework for designing multi-storey buildings subject to blast loading and the member design approach, equivalent SDOF design method, and multi-storey building design procedure. This research also presents the methodology and framework to quantify the required resistance of multi-storey buildings to mitigate progressive collapse. This research also develops the probabilistic models for collapse resistance factors for the series of top and bottom column removal in the multi-storey buildings. Finally, this research presents a simple, accurate and probabilistic framework for the analysis and design of multi-storey building subject to blast loading. The MATLAB code is used to develop the quadratic blast profiles. The SAP2000 and LS-DYNA softwares are used to carry out the simulations of RC frame subject to blast loading. The OriginPro is used to develop probabilistic models of progressive collapse resistance and peak load factors. The limitations of building shape function, peak loads of multi-storey buildings, the charge shape and progressive collapse methods are addressed to enhance the blast resistant design techniques. This study is limited to the rigid frame multi-storey buildings subject to blast loading only.