INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study	:	Ph.D.

Thesis Title: Experimental and Analytical Investigations of Reinforced Concrete Beam-Column Joint Subjected to Shock and Impact Loading

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Thesis Submitted to the Department/ Center	:	CIVIL
Date of completion of Thesis Viva-Voce Exam	:	28-07-2020
Key words for description of Thesis Work	:	ALUMINUM HONEYCOMB SHIELDING; BEAM-COLUMN JOINT; SHOCK AND IMPACT LOADING

SHORT ABSTRACT

In recent years, numerous terrorist attacks occurred all over the world that has revealed the vulnerability of the building structure from blast explosions and missile impacts. The global behavior of the structure is governed by the strength and deformation capacity of individual structural elements such as beam, column, slab, and shear wall. Therefore, it is important to investigate the behavior of individual members considering its stiffness, strength, and boundary conditions. Beam-column joints are the vital structural element in the load path mechanism of the framed structural buildings due to their significant role in uniting the overall skeletal system of the building. Studies on beam-column joint subjected to seismic and cyclic loading have been researched extensively over the past four decades through the experimental, analytical, and numerical investigations. However, there is a lack of systematic research on beam-column joints subjected to shock and impact loading. Especially the available studies on the joints protected using composite shielding material to resist shock and impact is limited. Prior to this study, a detailed study on the Aluminum honeycomb composite shield was conducted. The current research effort advances the experimental and numerical investigation of reinforced concrete structures by enabling a sacrificial protective system using honeycomb composite to minimize impact damage in the beam-column joint assembly. Shock tube experimental setup was used to impact high-velocity impact on the proposed experimental test structure. Systematic high-velocity impact testing was conducted on an external beam-column joint to investigate the structural response. The external beam-column joint was further protected with honeycomb composite to resist impact loading. The enhancement of ballistic performance due to honeycomb composite was compared with the bare external beam-column joint. The ballistic performances were evaluated using displacement and acceleration response. Furthermore, the response of the structural member shielded with honeycomb composite was examined based on the ballistic limit velocity, perforation energy, impact morphology, evaluation of target damage, failure modes, and evolution of cracks. These energy absorbers offer a sustainable solution to shield and safeguard the parent structure against the blast and impact loading.