Development of Innovative Composite Beam- Column Connections to Resist Critical Loading in The Hybrid Construction System

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Abstract: The use of concrete-filled steel tubes (CFST) as structural members is getting very popular and widespread in the past few decades because of its various advantages such as high bearing capacity, ductility, easy construction, time, and cost-saving. Moreover, CFST provides reduced cross-sections and permanent formwork and improves structural aesthetics, high-temperature resistance, and blast resistance. It was also observed that the shrinkage strain for the concrete in CFST columns was minimal because of the sealed environment provided by the outer steel tube. The continuous lateral confinement provided by the steel tube resists the crushing and spalling of core concrete that enhances the strength and inelastic deformation of the concrete. At the same time, the core concrete resists the inward buckling of the steel tube, which delays the local buckling of the steel tube. All these advantages have made CFST members widely recognized as a structural element and have led to extensive use in structures. However, because of the very limited data available on the CFST beam-column connection, the use of CFST is limited in India. In the current study an innovative Beam-Column connection has been proposed and an empirical equation is to be developed to estimate the shear strength and plastic hinge length of CFST Beam-Column connection. A G+1 prototype frame will also be demonstrated using the same proposed Connection. This will help agencies aware about the composite beam-column joint system and attract more agencies to apply the same which intern will lead to the extensive use of the CFST structures.

Objectives:

- To develop a composite beam-column connection system using concrete-filled steel tube (CFST) and fiber-reinforced composites for modular hybrid construction to facilitate faster construction with seismic resistance.
- To investigate the structural performance of composite beam-column connections under combined reverse cyclic lateral loading and axial loading.
- To develop a design methodology for the proposed joint mechanism using empirical model to estimate the shear strength and the plastic hinge length.
- Demonstration and evaluation of G +1 prototype frame with the proposed mechanism.