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Structural Engineering Group

Climate resilient and seismic resistant buildings using cold-formed steel sections filled with concrete and materials for different climatic

Period:	2 years (April 2023 to March 2025)
Project Investigator:	M. M. Ansari (Task leader)
Type of Project:	CSIR Funded
Sponsored by:	CSIR, New Delhi
Cost:	Rs. Rs. 25 Lakh

Objectives: To design and develop safe/ thermally efficient CFS structure using Cold-Formed Steel Tubes filled with Concrete (CFSTC) and hot-rolled steel sections

Description of task:

This program deals with the design and development of Concrete-Filled Cold-Formed Steel Tubular (CFCFST) columns with connections and cross-sectional sizes of 200 mm x 200 mm and 150 mm x 150 mm. The full length of the CFCFST column has been optimized considering varied grades of infilled concrete, width-to-thickness ratio and fastener spacing in Cold Formed Sections (CFS). CFS hollow columns are built first using self-driven fasteners which are provided in a single row. Each corner has two rows of fasteners at each adjoining face. Fresh concrete of the required grade will be filled in the hollow CFS columns. The axial capacity of the CFS section is determined under compression. The failure of CFS section initiated with local buckling, i.e. wrinkle formation, which resulted in initial stiffness degradation.

The performance of a CFCFST column was analysed under compression, focusing on sequential failure modes. The column, with dimensions 150 mm x 150 mm x 3000 mm and M20 concrete, had an axial capacity of 950 kN. Before reaching peak load, local buckling and wrinkle formations were observed in the cold-formed steel (CFS) section. However, there were no signs of concrete crushing in the infilled concrete at this stage. The CFS section showed deformation, indicating its instability under compression. The ultimate failure of the column occurred when the infilled concrete crushed due to excessive compressive stress. This suggests that the concrete played a key role in the final failure, despite the earlier signs of instability in the steel tube. The study highlights the interaction between the steel tube and concrete in CFCFST columns under compression.