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Seismic performance of Z-type cantilever beam splices of column–tree connection

Ai-lin Zhang[a, b, c], Zhi-peng Guo[a, b,] ,Xue-chun Liu[a, b, c]
[a] College of Architecture and Civil Engineering, Beijing University of Technology, Beijing, China
[b] Beijing Engineering Research Center of High-rise and Large-span Prestressed SteelStructures, Beijing University of Technology, Beijing, China
[c] Beijing Advanced Innovation Center for Future City Design, Beijing, China

Highlights

- Beam Splices of column-tree ductile connection.
- Static and quasi-static experimental researches to obtain seismic performances.
- Energy dissipation by utilizing slip of the splice or plastic deformation of RBS.
- Numerical simulation research to expand experimental results.
- Simplified calculation formula of slip load, yielding load and ultimate load.

Abstract

Three types of Z-type cantilever beam splices of the column–tree connection have been designed, which dissipate energy through plastic hinges: weakened beam splice, beam splice with a reduced beam and beam splice with a reduced cantilever beam. The weakened beam splice mainly dissipates energy through slipping, the beam splice with a reduced beam utilizes the slip of the splice and plastic deformation of the reduced beam section to dissipate energy, and beam splice with a reduced cantilever beam mainly utilizes plastic deformation of the reduced cantilever beam to dissipate energy. The behavior of three types of beam splices of the column–tree connection is investigated and discussed based on both tests and finite element analyses. The results show that the three types of specimens have good ductility performance and plastic rotation capacity. The energy dissipation capacity of the beam splice with a reduced cantilever beam is better than that of the weakened beam splice. The energy dissipation capacity of the beam splice with a reduced beam section is between the two splices. Simplified computation formulas and seismic design requirements for beam splices are proposed, and the computation results are in good agreement with those of the experiments.

Keywords : Prefabricated steel structure; Weakened beam splice; Beam splice with a reduced beam; Column–tree connection; Static behavior; Seismic behavior.

Graphical abstract