Experimental study and finite element analysis on seismic behavior of flat vertical-diaphragm stiffened concrete-filled SHS column joints

Jianan Chen, Xin Zhao
Tongji Architectural Design (Group) Co., Ltd., Shanghai, China

Danlin Feng, Wei Wang
Tongji University, Shanghai, China

Yang Wang, Yi Huang
China Overseas Property Group Co., Ltd., Shenzhen, China

Contact: 22zx@tjad.cn

Abstract
There are great advantages in adopting steel structure for tall residential buildings. In order to study the mechanical properties of the flat vertical-diaphragm stiffened concrete-filled SHS column joints, such as stiffness, bearing capacity, failure mode, and deformation capacity, full-scale tests and finite element analysis are conducted based on the actual case in China. Results of cyclic tests are listed in this paper. Proper design suggestions and a scientific foundation are provided to the application of this kind of joints accordingly. The test results show that the failure mode of specimen FCFST-S-H is ductile failure due to connection loss and the failure mode of specimen FCFST-C-H is observed as connection failure. In both sets of cyclic loading tests, the joint has good energy dissipation capacity. The finite element analysis results are consistent with the test results.

Keywords: vertical-diaphragm stiffened joints; full-scale test; finite element analysis; seismic performance; cyclic testing results.

1 Introduction
CFST columns, also known as concrete-filled steel tube or concrete-filled square hollow sections, are being increasingly popular as structural elements. Filling the steel section with concrete results in increased strength and ductility without increasing the section size. (1) The objective technological innovation has many potential benefits in construction. Consequently, various domestic and foreign scholars have conducted numerous experimental and theoretical studies. This has led to a growing emphasis on the application of CFST column-steel beam connection in research.

Dehghani and Aslani (2) provided a comprehensive review and statistical analysis on the available experimental fatigue data of CFTS joints and while also exploring research gaps in this field. Tort and Hajjar (3) carried out a computational study to investigate the nonlinear response of composite