Experimental Study on the Ultimate Behavior of Concrete Filled Tubular Columns Using Spiral Welded Pipes under High Fluctuating Axial Force

K. Miyanishi [(1)], T. Ebisawa [(2)], A. Nakano [(3)], Y. Xu [(4)]

[(1)] *Graduate Student, Nagoya Institute of Technology, k.miyanishi.878@stn.nitech.ac.jp*
[(2)] *Assistant Professor, Nagoya Institute of Technology, ebisawa@nitech.ac.jp*
[(3)] *Engineer, Hanshin Expressway Company Limited, akari-nakano@hanshin-exp.co.jp*
[(4)] *Professor, Tongji University, yanxu@tongji.edu.cn*

Abstract

An integrated column by multiple steel pipes is a structure consisting of four spiral welded pipes connected by shear panels. This design suppresses damage to the main pipes by concentrating seismic damage into the shear panels. While shaking table tests on the continuous elevated girder bridge supported by these columns confirmed that this structure possesses seismic performance exceeding design earthquake motions, the local buckling occurred at the bottom of main pipes. These tests utilized small-diameter electric resistance welded (ERW) steel pipes instead of the spiral welded pipes due to the limitation of the load capacity of the shake table. To evaluate the influence of the difference between spiral welded pipes and ERW pipes on the ultimate state of the columns, static cyclic loading tests were conducted on the single-pier CFT specimens modeling the bottom part of the column. Considering that the large axial force as a couple caused by horizontal loads act on the pipes of the integrated column, fluctuating axial forces were applied on the top of the single-pier specimens. The experimental results indicated that the difference of pipe types had less effect, with both types showing similar load-displacement hysteresis. Furthermore, strain measurement using the three-dimensional digital image correlation confirmed that the local buckling occurred across the spiral weld lines, suggesting that the influence of spiral weld lines on the deformation shapes of the pipes at the ultimate state was also limited.

Keywords*: Integrated column; Local buckling; Digital image correlation; Cyclic loading;*