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Flexural-Shear Behavior of Concrete-Filled Double-Layer Steel Tubular Column

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ABSTRACT

Concrete-filled steel tubular (CFT) column has been widely used in high-rise buildings because of a number of distinct advantages in earthquake zones, such as high lateral capacity and axial compressive strength, large energy absorption capacity, good ductility, and high stiffness. In order to meet the structural performance of the high-rise building as the height of the building increases, a special column with concrete-filled double-layer steel tubes was proposed in previous research. In this study, quasi-static cyclic test of a concrete-filled double-layer steel tubular column (CFDLT column) specimen was carried out under relatively high constant axial force ratio to investigate the effect of steel ratio on the flexural-shear behavior of the column by comparing with the hysteresis loop of the CFDLT column specimen in previous study. Regarding the progress of lateral strength reduction after the ultimate lateral capacity, the CFDLT column specimen with larger steel ratio showed a slight improvement over the other one with smaller steel ratio.

Keywords: CFDLT column, flexural-shear behavior, degree of lateral strength reduction, high-rise building, steel ratio.

1 INTRODUCTION

Concrete-filled steel tubular (CFT) column has been widely used in high-rise buildings because of a number of distinct advantages in earthquake zones, such as high lateral capacity and axial compressive strength, large energy absorption capacity, good ductility, and high stiffness. In order to meet the structural performance of the high-rise building as the height of the building increases, a special column with concrete-filled double-layer steel tubes shown in Figure 1 was proposed by Li (2017a). And, it was clarified that the progress of axial compressive strain of the proposed concrete-filled double-layer steel tubular (abbreviated as CFDLT hereinafter) column was remarkably slower than that of concrete-filled double-skin steel tubular column. Moreover, the experimental results suggested that the proposed CFDLT column has a potential of being used as a mega-column in super-tall buildings or mega-structures in the future in previous work of Li (2017a).

In this research, a CFDLT column specimen with thinner outer steel tube thickness than the CFDLT column specimen in reference of Li (2017a) was subjected to quasi-static cyclic test under a constant axial compressive force to collect basic data on the CFDLT column and to clarify the effect of the steel ratio on the flexural-shear behavior of the CFDLT column by comparing with the hysteresis loop of the CFDLT column specimen in the reference of Li (2017a). In this study, the parameter of steel ratio is regulated by thickness of outer steel tube. In addition, nonlinear numerical studies are carried out to evaluate the lateral force–drift ratio relationships of the CFDLT column

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