

ABSTRACT

Column is a very important load bearing structural element. When column fails, it does not only cause the collapse of the story where the column exists but may catastrophically disintegrate the overall structure. In this manner, first story column should possess sufficient ductility by which the structure should be able to deform with large lateral drift, hence, the life safety extendsway beam mechanism develops. One way to enhance concrete ductility is by using confinement as it enhance the stress and strain of concrete. This study proposes new alternative of confining concrete column by means of external steel ring. Steel ring is employed solely as an external confinement. Despite the fact that the steel ring does not act as external reinforcement, however, it improves the ductility, enhances the column capacity, maintains the cross-sectional area of concrete from premature spalling, and strengthens the columns.

The preliminary study employed concrete cylinder confined with steel rings. The cylinder was 300 mm in height and 155 mm in diameter subjected to uniaxial load according to SNI 03-1974-1990. The study was conducted to investigate the effect of confinement on the mechanical properties of concrete. The thickness of steel ring was constant at 2.4 mm. Variation of steel ring volumetric ratio is based on variations in width (28, 45, and 73 mm) and the clearances between the steel ring (90, 47, and 25 mm). The results were used as the basis to predict the the capacity and ductility of the reinforced concrete (RC) columns confined with steel rings under cyclic loading. Eventually, half scale laboratory test was performed to determine the effects of the external confinement. The test specimen was a RC circular column with height of 1710 mm and diameter of 260 mm. The thickness of steel ring was 6.3 mm, the width of 50 mm and clearances between the steel ring was 80 mm (volumetric ratio of steel rings was 1.86%). The specimen was subjected to a constant axial load and lateral cyclic in accordance to ACI 374.2R-13. Three RC circular columns specimens were employed in the investigation. The first specimen was unconfined column (K0-0,4) and the second specimen was column confined by steel rings (KT-0.4). Both were under constant axial load with axial load ratio of $0,4P_0$. The third specimen was a column confined by steel ring (KT-0.6) subjected to a constant axial load with axial load ratio of $0,6P_0$.

The preliminary study clearly demonstrates that the steel ring is effectively confine the concrete, as its stress and strain increases compared to the unconfined concrete. With steel rings volumetric ratio range was 1.25 to 2.28%, it is found that the confinement of concrete may be attributed as high confinement level as the effective confinement index reaches 21.99 while the concrete strength reaches 2.29. The half scale RC circular columns confined with steel ring exhibit higher ductility, load carrying capacity and resistance than the unconfined column. The displacement ductility index of the test specimen K0-0,4; KT-0,4; and KT-0,6 column are 6.33; 8.38; and 6.82, respectively, while the curvature ductility index of specimen KT0-0,4; KT-0,4; and KT-0,6 column are 7.72; 9.72; and 8.23 respectively.

Keywords: column, ductility, external confinement, steel rings