Abstract

The use of high-strength concrete has been steadily increasing due to its many advantages over normal-strength concrete. HSC is used primarily in high-rise buildings to significantly decrease the dimensions of the columns in lower stories, thereby reducing the volume of concrete. Studies have shown, however, that HSC is more brittle than NSC. Brittle behavior of high strength concrete in compression has to some extent, limited its application in seismically active regions. Commonly, to overcome the adverse effect of such brittleness on the column behavior, thoughtful confinement is adopted. The ductility of HSC can also be improved by adding steel fibers to the concrete mass. The maximum volumetric ratio of the fibers is bounded by the workability of the fresh concrete.

The behavior of high strength concrete columns with steel fibers under cyclic loading was investigated. Fourteen half-scale column specimens were tested under cyclic lateral load. The key variables covered in this investigation include the steel fibers ratio up to 1.50%. The concrete strength varied from 50 MPa to 100 MPa. The columns were subjected to constant axial loads corresponding to target values of 10%, 25% and 45% of the column axial-load capacity. The confinement index of the columns were 0.122, 0.230 and 0.392. The columns were designed according to seismic requirements of ACI 318 Code.

Provision of the steel fibers enhanced the cracking load, ultimate capacity, ductility and energy dissipation capacity of test columns. The utmost enhancement in the performance of columns was achieved with steel fibers content of 1.5%. The enhancement in the ultimate capacity and displacement ductility was 15% and 76%, respectively, for columns with concrete strength of 100 MPa. The corresponding improvement in the energy dissipation capacity was about five times that of columns without fibers. The ACI-318 Code requirements for transverse reinforcement in the plastic hinge region of a column appeared to be conservative for columns subjected to low axial load levels and with normal