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Using steel fiber reinforced cementitious composites (SFRCC) in shallow embedded column base

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1. Introduction

Exposed column bases in Japan are commonly covered with lightly reinforced concrete (RC) slab, whose effect is neglected in seismic design so far. However, the experimental investigation by authors showed that the strength, stiffness and energy dissipation are all increased by the contribution of the RC slab, especially when the RC slab around the base plate is strengthened by steel rebar. But the improvement is small when thinner concrete slab is adopted.

SFRCC is a cement based material, which shows ultra high compressive strength and relative large tensile strength and high ductility behavior. As shown in Fig. 1, SFRCC shows extremely larger fracture energy than normal concrete. The difference between SFRCC and steel fiber reinforced concrete is the size of aggregate (fine aggregate for SFRCC, while coarse aggregate for steel fiber reinforced concrete) and the volume fraction of steel fibers (>6% for SFRCC, while <2% for steel fiber reinforce concrete).

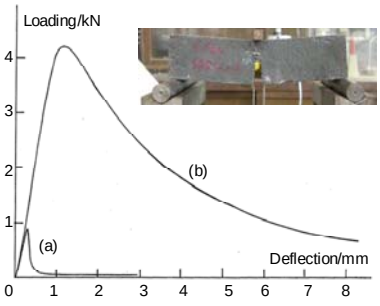


Fig. 1 Determination of fracture energy of the matrix material: (a) concrete; (b) SFRCC

In this study, SFRCC is employed for the slab around the base plate to further improve the behavior of exposed column base. The aim of this study is investigating the effect of high tensile strength and good compatibility with steel reinforcement of SFRCC on the response of shallow embedded column base to lateral load reversals.

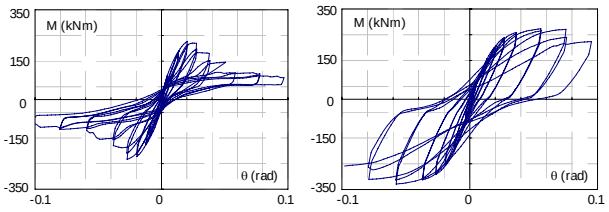
2. Specimens

In this study, 0.4 mm x 12.0 mm and 6% volume fraction straight steel fibers were adopted for SFRCC. The column base covered by a 110 mm flat slab was chosen as the fundamental specimen. Five specimens, one concrete and four SFRCC specimens, are tested to evaluate the improvement of SFRCC. The test parameters are properties of slab, size and strength of steel bars.

Fig. 2 Specimen configurations

3. Test Results

The hysteretic loops of unreinforced SFRCC and SFRCC reinforced by larger rebar specimens under constant axial force are shown in Fig. 3. The improvement by reinforcement on both strength and strength deterioration are shown obviously.



(a) (b)

Fig. 2 Moment-drift angle relationship of : (a) SFRCC specimen; (b) R/SFRCC specimen.