

Bond behaviour of deformed steel bars in steel fibre high-strength self-compacting concrete

ABSTRACT

Research on the bond behaviour between deformed steel bars and the Self-Compacting Concrete (SCC) has been conducted extensively. However, bond study using the high-strength SCC (HSSCC) added with steel fibres is still rare and has not been fully explored. Therefore, in this study, experimental works were carried out to investigate the effects of adding 1% hooked-end steel fibres on the bond behaviour between deformed steel bars and the Steel Fibre High-Strength Self-Compacting Concrete (SFHSSCC) using the direct pullout test method. A total of 39 cubes of HSSCC and SFHSSCC pullout specimens with a dimension of 200 mm were prepared and tested. Highyield deformed steel bars were used as reinforcement bars. The effects of bar sizes (12, 16 and 20 mm diameter), concrete cover (94, 92, 90 and 35 mm thickness), embedment length (3 and 5 times bar diameter) and concrete age (30 ± 2 days and 6 months) towards the mode of failures and bond stress-slip curves were investigated. Coring samples were also taken from the pullout specimen to examine the distribution of the steel fibres. The results showed that size effects in rebars and the concrete cover thickness did not affect the mode of failures for a well-confined SFHSSCC as all bar sizes exhibit the same bond failure, which is pullout failure. More importantly, the addition of steel fibres enhanced the bond ductility in SFHSSCC through the passive confinement effects. The addition of steel fibres to SFHSSCC specimens bonded with 20 mm diameter bars also changed the failure mode from premature splitting to pullout. Meanwhile, the self-flowable SFHSSCC mixture effectively flowed and distributed the steel fibres within the concrete matrix.