The 2021 World Congress on
Advances in Structural Engineering and Mechanics (ASEM21)
GECE, Seoul, Korea, August 23-26, 2021

Behaviour and design of stainless steel shear connectors in composite beam

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ABSTRACT

Stainless steel-concrete composite beam has become an attractive structural form for offshore bridges and iconic high-rise buildings, owing to the superior corrosion resistance and high ductility of stainless steel material. In a composite beam, stainless steel shear connectors play an important role by establishing the interconnection between stainless steel beam and concrete slab. To enable the best use of high strength stainless steel shear connectors, high strength concrete is recommended to be employed at the same time. To date, the application of stainless steel shear connectors in composite beams is still very limited due to the lack of experimental data and proper design recommendations. In this paper, a total of seven pushout specimens were tested to investigate the load-slip behaviour of stainless steel shear connectors. A thorough discussion has been made on the differences between stainless steel bolted connectors and welded studs, in terms of the failure modes, load-slip behaviour and ultimate shear resistance. In parallel with the experimental programme, a finite element model was developed with ABAQUS to simulate the shear behaviour of stainless steel shear connectors, with which the effects of shear connector strength, concrete strength and embedded connector height to diameter ratio (*h*/*d*) were evaluated. The obtained experimental and numerical results were analysed and compared with existing codes of practice, including AS/NZS 2327 and EN 1994-1-1. The comparison results indicated that the current design equations need to be reviewed for high strength stainless steel shear connectors. On this basis, modified design equations were proposed to predict the shear capacity of stainless steel bolted connectors and welded studs in stainless steel-concrete composite beams.

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