Advanced Finite Element Modelling on Welded Stud Shear Connections in Composite Slabs with Profiled Steel Decking Having Various Geometrical Configurations

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Abstract
This paper presents an experimental and numerical investigation into structural behaviour of stud shear connections in composite slabs with various geometrical configurations of profiled steel decking, and a finite element model was established using the explicit method in the finite element package ABAQUS, after careful calibration against test data. Detailed numerical analysis was conducted to provide understanding of load transfer mechanisms of the stud shear connections in composite slabs. It is found that some essential details of the shear connections, e.g. a welding collar of the shear stud and a stiffening fold at middle of the decking trough, will significantly influence the shear resistances of the shear connections. Welding collars have a major contribution while the stiffening fold with dimensions of 30 mm width and 10 mm height leads to reductions on the shear resistances of the connections. Parametric studies based on the calibrated models were conducted to investigate the structural behaviour of these connections with various trough widths of profiled steel decking. Moreover, the structural behaviour of these connections with headed shear studs installed at both favourable and unfavourable positions in the decking troughs were also examined. Modified design rules by introducing a set of reduction factors ranging from 0.55 to 1.0 were proposed to determine the shear resistances of stud shear connections in composite slabs.

Keywords: Stud Shear Connections, Finite Element Modelling, Composite Slabs, Structural Behavior, Shear Resistances