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3D finite-element analysis of innovative coconut palm stem shaped headed shear connectors

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Abstract

Headed studs are shear connectors in composite structures used at the adjoining face of a steel beam and a concrete slab. In this research, the conventional shape of a headed stud was restructured to resemble the shape of a coconut palm stem (royal palm) without a change in the overall material volume, with the aim of improving the shear strength of the composite connection. Six innovative shear connectors for composite structures, named coconut palm stem royal shaped headed stud shear connectors (CPSR studs), were examined. Abaqus/Explicit was used to model a push-out specimen and the finite-element model was successfully validated using published experimental results. The six different CPSR studs encased in three grades of concrete (C40, C50 and C60) were tested for shear strength, stiffness and load–slip performance. The results for the innovative CPSR studs were compared with those for uniform cross-section headed studs; when embedded in C40, C50 and C60 grade concrete, the results showed, respectively, 35–41%, 37–44% and 41–52% improvements in the ultimate strength of the shear connection. The improved shear strength capacity of the CPSR studs without a change in the overall volume of stud material means that fewer studs are required, leading to economic benefits.

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shaped headed shear connectors

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