Theoretical and Experimental research on Steel-Concrete Composite Truss

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Summary

The local effects of concentrated longitudinal shear forces should be appropriately examined in composite truss beams with the welded headed studs, located at the steel-concrete interface. Based on finite element modelling, new approaches are investigated theoretically. The experiment results from push-out testing and bending test of full-scale composite truss beams given in the paper showed rather good agreement between the test and the theory. Several effects on shear connection behaviour are also studied.

Keywords: composite truss; shear connection; numerical and experimental study; push-out testing.

1. Introduction

Composite steel-concrete trusses can be considered as one of the most economical systems for building, especially for greater spans allowing better use of internal space without restricting columns. The trusses are appropriate also to meet the requirements for building height limitation as well as the need to run complex electrical, heating, ventilating, and communication systems. Also composite steel bridges, whose carriageway deck is supported on a filigree steel truss structure and slim piers, are particularly preferable especially to ordinary concrete bridges.

To create an interaction between steel parts and concrete, it is necessary to prevent the relative slip at the steel-concrete interface using shear connectors. But the local effects of a concentrated longitudinal force and the distribution of the shear force between steel section and concrete slab, as special task, should be appropriately examined. There is no particular recommendation for the design of composite truss, except the formulas in EC 4 [1], clause 6.6.2.3 for the local effect of a concentrated longitudinal force and the distribution of the longitudinal shear force into local shear flow between steel section and concrete slab.

In the case of a composite truss, the longitudinal forces are introduced into the concrete slab similarly only locally in the nodes, where the web members are connected to the compressed chord. The finite element analyses can be used to investigate numerically this structural system behaviour, exploiting several computer procedures. Nowadays, different types of shear connectors are used. In our investigation, shear connection is developed using the welded headed studs. The outputs of this research are presented in the paper.

2. Numerical study of truss shear connection behaviour

2.1 Reference model

The finite element analyses can be used to investigate numerically shear connection of the truss structural system, exploiting several computer procedures. The software Cast3m [2] was used to evaluate the structural behaviour of a reference composite sample, taken from the experimental

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