COMPOSITE PLATES WITH STUD SHEAR CONNECTORS

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Abstract

The first part of this dissertation is concerned with the theoretical analysis of simply supported steel-concrete composite plates and plated beams under the action of moving wheel loads with full or partial interaction. These show that the stud shear connectors will be subjected to either uniaxial or biaxial forces; the latter have been termed “rotating shear forces”. The magnitude and type of force depend on the position of the stud in relation to the line of passage of the load. The magnitude also depends on the flexibility of the connector and the degree of cracking in the concrete.

The second part describes fatigue tests on plated beams in which the studs were subjected to uniaxial loads at different shear ratios and shear ranges. The results are compared wit the Code of Practice for the fatigue of studs in composite beams. The lives of the studs appear to depend only on the range of load applied and are well in excess of the Code of Practice recommendations. The measured strains and interface slip agree well with those predicted by the partial interaction analysis.

The third part describes fatigue tests on single studs in rotating shear. The lives obtained are compared with the recommendations of the Code of Practice for studs in uniaxial shear in composite beams. For a given maximum range of load, the fatigue life drops rapidly as the polar of shear tends towards a circle, giving lives as low as 10% of that under uniaxial loading. Some cumulative damage specimens were tested, at two different shapes of polar plot of shear – they suggest that Miner’s Law holds for studs under this type of loading.

On the basis of the theoretical analysis and the fatigue tests, a method of designing the studs in composite plates is proposed.