New steel-concrete connections by adhesion, interlocking and friction for composite bridges

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Summary

A new type of connection resisting by adhesion, interlocking and friction constitutes a structural concept that aims to create a durable connection between steel girder and prefabricated concrete slab used in composite bridges. The resistance is based on the development of longitudinal shear stresses in the interfaces which form the connection. This paper presents experimental and analytical researches that were conducted on this new connection. A large study of its resistance to cyclic loadings was undertaken by mean of tests on interfaces, push-out tests and test on a composite beam. The paper presents the analysis of the test results and a design method to predict the fatigue resistance of this connection. It is shown that the damage due to cyclic loading on the interfaces and on the connection is expressed by the accumulation of a residual slip. Provided that the shear stresses remain lower than the elastic stress limit and that the accumulated slip does not exceed the failure slip for static loading, the fatigue resistance of the new connection is ensured

Keywords: slip, uplift, interfaces, confinement effect, shear connection, cyclic loading, residual slip, fatigue limit.

1. Introduction

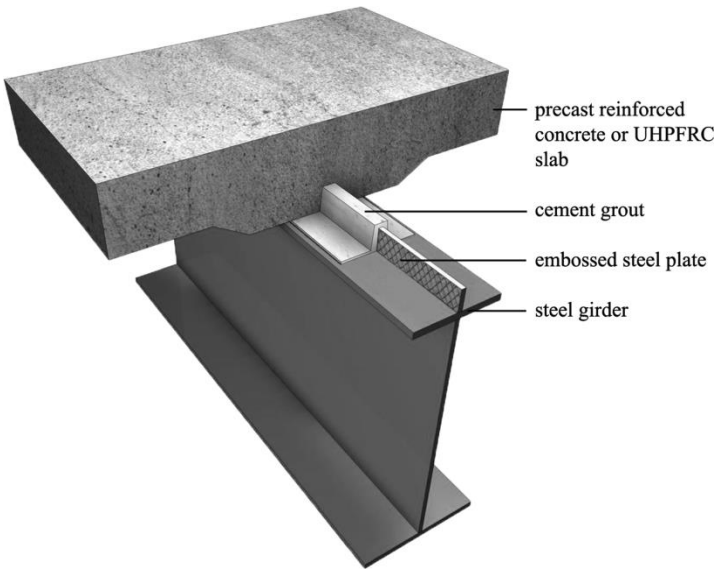

Fig. 1: Connection by adhesion, interlocking and friction

In steel-concrete composite bridge construction with prefabricated slab elements, the traditional solution to apply the composite action between the slab elements and the steel girders is concreting the openings (shear pockets) of the slab elements in which shear studs are enclosed. Studs are typically welded on the upper part of the flanges of the girders. However this method presents several disadvantages. The supplementary work in situ for concreting the pockets increases the overall construction time. Due to the development of shrinkage in the concrete of the shear pockets and due to stress concentration, cracks appear at the perimeter and at the corner of the shear pockets. Corrosion agents such as de-icing salt which enter the cracks might decrease the durability of the structure and damage

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