Improvement of fatigue resistance through box-action for I-girder composite bridges

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Abstract

When strengthening existing I-girder composite bridges one idea is to make the cross section act like a box section, by adding a horizontal truss between the bottom flanges. This means that eccentric loads produce a torque that is transferred by shear forces around the section. The magnitude of the effects coming from introducing such a framework between girders is addressed in this article. The fatigue resistance will be improved by the reduced stress ranges and increased amount of tolerated load cycles and extend the lifetime of the details, and by so the lifetime for the bridge. The work described in the paper is part of the European R&D project Prolonging Life Time of Old Steel and Steel-Concrete Bridges (ProLife), RFCS 2015-00025

Keywords: Box action; composite; fatigue; framework; I-girder; steel; strengthening; torsion.

1 Introduction

Many old I-girder steel/composite bridges are too weak and in a need of replacement, repair or strengthening.

The rules for assessment/classification vary between the European countries. In addition, newer bridges designed according to the Eurocodes for example often give much tougher design in fatigue, which for example can give twice as large bottom flange in mid span than the old Swedish codes, which means that very few of the old bridges would survive a check with the Eurocodes for new bridges.

For symmetric I-girder bridges the loads from the weight of the steel and concrete are generally evenly distributed between the girders, just as for box girder bridges. For bridges consisting of two I-girders the concrete deck is often considered as simply supported in the transverse direction on top of the girders, meaning that a concentrated load on top of one girder will be distributed to only that girder, with no help from the second girder. In reality the torsional stiffness of the deck

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