

Refurbishment of orthotropic steel decks with steel plates

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Abstract

A common problem in steel bridges is fatigue of orthotropic decks due to heavy traffic demands. Whilst replacing the asphalt with a high strength concrete overlay can solve this problem, it imposes significant additional self-weight. This additional self-weight often requires strengthening of the superstructure which in turn can result in long execution times with associated hindrance and costs. As no existing method addressed these issues Arup engineers developed an innovative solution for Rijkswaterstaat (RWS), the Dutch Highways Authority. The new solution consists of bolting steel plates to the orthotropic steel deck, stiffening it for fatigue. Arup and RHDHV work in a joint venture, the Managing Contractor, on the renovation of steel bridges for and with RWS.

Keywords: Refurbishment, life extension, steel bridges, orthotropic decks, fatigue

1 Introduction

A solution for the fatigue cracks in orthotropic decks that was developed by RWS and de Jong [1] was the replacement of the asphalt with a significantly stiffer and temperature independent 75mm thick high strength concrete (HSC) overlay. The HSC overlay is effective in reducing the stress fluctuations in the deck at the weld between the trough and the deck plate, see Figure 1. The HSC overlay adds weight increasing the renovation scope and it yields long execution times, associated hindrance and it is not suitable for movable bridges. These downsides became apparent during the preparation of the HSC renovation of the Van Brienoordbrug, on which Arup developed an alternative strengthening solution addressing the fatigue issues in the orthotropic deck. It was developed for a similar life extension to the HSC overlay, 30 years. On the existing deck plate an

additional steel plate is connected using HSFG bolts in combination with fill plates and epoxy. This steel plate is then covered with asphalt. The steel plates increase the stiffness of the overlay, reducing the stresses in the sensitive details.

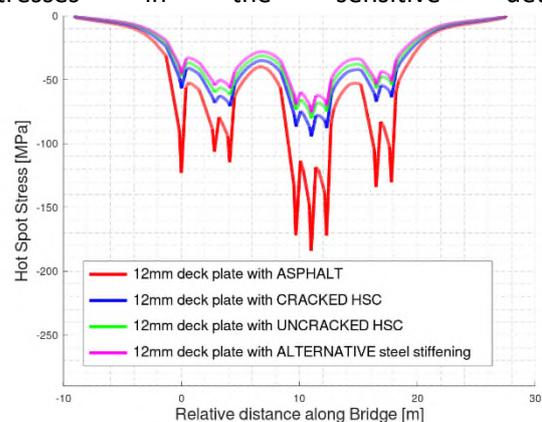


Figure 1. Truck (T1203A2) stress histories deck at intersection trough, deck and cross girder.