Prefabricated UHPFRC Slabs as a Strengthening Alternative for Ewijk Bridge

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Summary

In order to address orthotropic steel deck fatigue problems typically encountered in the Netherlands, such as longitudinal deck plate to trough cracks, in-situ poured High Strength Concrete (HSC) deck strengthening has recently been used. This method has been further developed by using an innovative Prefabricated Ultra High Performance Fibre Reinforced Concrete/Béton Spécial Industriel® (UHPFRC/BSI®) Slab solution.

The prefabricated slabs can be installed faster than pouring and curing concrete in-situ. Also, if a deck plate repair is required, it can be made post deck strengthening using traditional welding methods as the presented solution is less sensitive to heat than the in-situ HSC solution, which utilises a heat sensitive Epoxy-Bauxite bonding layer between the concrete and steel deck. The presented solution has been used by Eiffage on one bridge in France (Pont de Illzach, Alsace) and it has been developed for the Ewijk Bridge. This development, documented in this paper, constitutes a significant change in terms of bridge typology and loading.

Keywords: orthotropic steel deck; fatigue; Ultra High Performance Fibre Reinforced Concrete (UHPFRC); prefabricated slab; steel deck strengthening.

1. Introduction

This strengthening method, developed by French contractors Eiffage and introduced by Dutch contractor KWS-Infra, works by means of covering the surface of the deck with prefabricated slabs of UHPFRC/BSI® connected via in-situ poured UHPFRC/BSI®. The slabs are prefabricated in a factory before the start of works on the bridge, placed on top of the deck plate and then grout is injected to fill the void under the slabs. The high tensile strength of the concrete means it is resistant to cracking, therefore it retains its un-cracked stiffness, even under heavy truck loading. The high stiffness of the un-cracked concrete reduces the deck stresses and hence increases the life span of the steel deck.

The deck fatigue performance under the prefabricated UHPFRC/BSI® solution has been compared against the in-situ HSC system using finite element based methods to justify its suitability.

This strengthening technique represents an innovative and sustainable solution to orthotropic steel deck fatigue problems by extending the life of existing road bridges for a further 30 years.

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