

Strengthening Paudèze bridges decks using UHPFRC struts

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1 Abstract

Paudèze bridges are two 400-m long parallel highway bridges located in Switzerland and opened to traffic in 1974. After over 40 years of service life, both bridges must be completely rehabilitated and strengthened while constantly maintaining 2 traffic lanes in both directions.

The bridge deck slab was strengthened using UHPFRC (Ultra-High Performance Fiber Reinforced Concrete) struts. These inclined struts connect the end of the deck slab cantilever and the box girder web, forming a Warren truss. They thus reduce the bending moments in the deck slab and the existing steel reinforcement could be kept.

The joint between the prefabricated UHPFRC struts and the existing concrete web is done through a cast in-place UHPFRC beam, without any mechanical connection. Forces go through the joint and into the web by a combination of friction and compression forces.

Various experimental tests and numerical simulations confirmed the feasibility of this solution. In particular, the UHPFRC-concrete web connection, the UHPFRC-UHPFRC connection and the global behavior of the strut were tested and modelled.

The strengthening of the bridges decks took place between 2017 and 2019. The developed solution, using UHPFRC struts, was shown to be very effective to strengthen the deck and creates a rhythm in the structure.

Keywords: bridge; rehabilitation; strengthening; UHPFRC; struts.

2 Introduction

Paudèze bridges, shown on Figure 1, are twin reinforced and prestressed concrete bridges located on highway N09, near Lausanne, in Switzerland. Both bridges are 400-m long and cross the valley formed by Paudèze river. They were built and opened to traffic at the beginning of the 70s.

The deck of both Paudèze bridges is a box-girder with a variable height built by balanced cantilever. The box-girder has a width of 6.80 m for a height

varying between 2.2 m at mid-span and 6.0 m over the pier. As shown on Figure 3, both bridges have 5 spans with a maximal length of 104 m.

Inspections and investigations on the bridges have revealed their bad state (Figure 1). Problems with the waterproofing of the deck have led to concrete spalling and corrosion of the rebars in various location. Moreover, heavy cracking was observed on the webs and the lower slab of the box-girder, as described in [1]. Therefore, a complete rehabilitation and strengthening of the bridges were planned.

<https://doi.org/10.2749/newyork.2019.1469>

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