



Strengthening the Chillon viaducts deck slabs with reinforced UHPFRC

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Abstract

Located in Switzerland, Chillon viaducts are two parallel highway posttensioned concrete bridges built in the late 1960s. The concrete of the deck slabs of these bridges shows signs of early stages of the alkali-aggregate reaction (AAR), which will induce, in time, a decrease of the concrete strength. To insure structural safety for future traffic demands, it was decided to strengthen the slab by adding a layer of 40 mm of an Ultra High Performance Fiber Reinforced cement-based Composite (UHPFRC) material, reinforced with steel rebars. Strain-hardening UHPFRC, with its low permeability, is used as a waterproofing layer protecting the slabs from the water to reduce the rate of AAR. UHPFRC has excellent mechanical properties and also acts as an external tensile reinforcement for the slab, increasing its bending and shear resistance and extending the fatigue life. To investigate this increase in structural resistance, an analytical calculation is done using models previously developed based on extensive experimental campaigns. Finally, the choice of UHPFRC for strengthening was also the most efficient in terms of intervention duration and cost.

Keywords: UHPFRC; reinforced concrete; composite section; resistance; analytical model; rehabilitation; strengthening; bridge deck slab; casting method.