

Bridge deck replacement using precast RC panels and cast-in-place UHPFRC top layer and joint filling

Philipp Hadl, Ph.D.* (corresponding author) – WALO USA, 433 Broadway – Suite 604, New York, 10013 NY, USA, (212) 691-4537/41794761294, Email: philipp.hadl@walo.com

Marco Maurer – WALO International AG, Heimstrasse 1, 8953 Dietikon, Switzerland, +41 +41 31 941 21 21 228, Email: marco.maurer@walo.ch

Gilbert Brindley –UHPC Solutions, 433 Broadway – Suite 604, New York, 10013 NY, USA (844) 857 8472, Email: gil.brindley@UHPCsolutions.com

Richard Thürler – Emch+Berger AG Bern, Schösslistrasse 23, 3001 Bern, Switzerland, +41 58 451 62 77, Email: Richard.Thuerler@emchberger.ch

Philippe Schiltz – École polytechnique fédérale de Lausanne, EPFL Station 18, 1015 Lausanne, +41 21 69 32882, Email: philippe.schiltz@epfl.ch

Eugen Brühwiler–Professor, École polytechnique fédérale de Lausanne, EPFL Station 18, 1015 Lausanne, +41 21 69 32882, Email : eugen.bruehwiler@epfl.ch

Primary Topic Area: Application/Projects

Secondary Topic Area: Bridges

Date Submitted: (10/12/2018)

Abstract

This case study describes a new approach for bridge deck replacement combining the benefits of partial-depth precast reinforced concrete (RC) panels and cast-in-place cast Ultra-High Performance Fiber Reinforced Cement-based Composite (UHPFRC) to form the top layer and to fill the joints. The partial-depth precast deck panels (about 14 cm (5½ ") thick) include the lower rebars and are connected to the steel or concrete girder by shear studs and cast-in-place UHPFRC joint filling. The layer of UHPFRC with a thickness of about 40 mm (1½ ") includes high amount of slender steel fibers (> 3.25% in volume) and the top rebars. Rigid bond between UHPFRC and precast RC panels is obtained by appropriate surface preparation of the concrete substrate. Due to the excellent durability of UHPFRC, the cover of the top rebars in the UHPFRC layer is reduced to 15 – 25 mm (5/8" to 1") which contributes in minimizing the dead load. In the US, the UHPFRC surface usually serves as riding surface (correction grinding and longitudinal grooving may be required), while in Europe and Asia asphalt pavement with a thickness of at least 40 mm (1½ ") is placed on top of the UHPFRC.

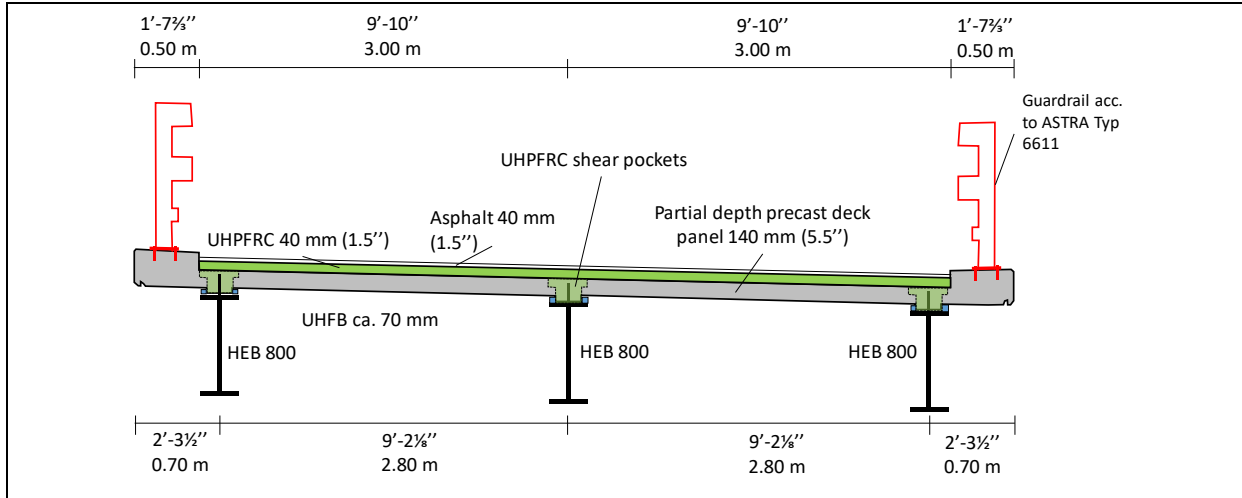


Figure 1. Schematic cross section

Installation of the partial depth precast RC panels is very quick. Cast-in-place casting of the UHPFRC joint filling and the top layer to achieve a fully composite deck usually takes only two casting days. No formwork is required. Due to the accelerated hardening of the UHPFRC, the bridge can be opened for traffic after 1-3 days of curing time (temperatures >60°F assumed).

The presented approach is intended to be used to rebuild a bridge in Switzerland in autumn 2019. The case study of the 26 m long (~85 ft) and 7 m wide (~23 ft) bridge demonstrates the benefits of the system.

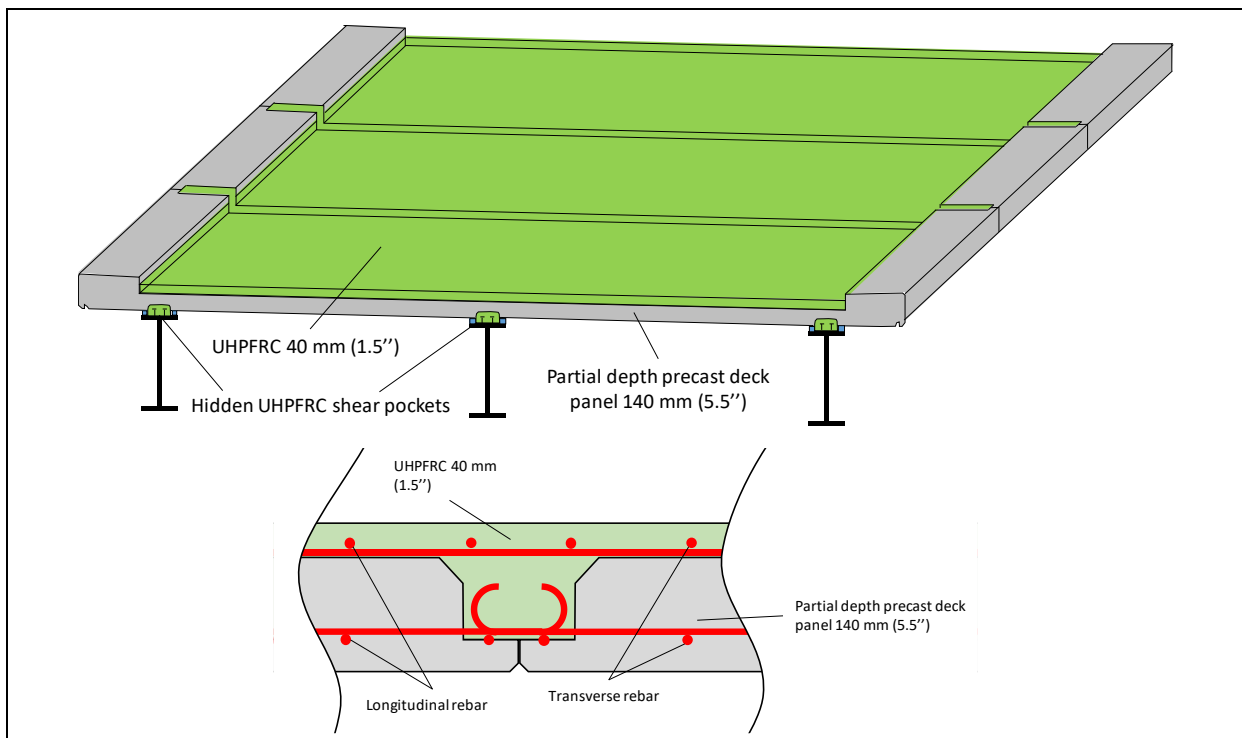


Figure 2. Schematic deck installation and transverse joint detail