EXPERIMENTAL THIN-WALLED U-PROFILE FOOTBRIDGE MADE OF UHPFRC

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Abstract

This paper presents design, production and installation of an experimental thin-walled U-profile footbridge made of ultra-high performance fiber reinforced concrete (UHPFRC) with dispersed steel fibers without any conventional reinforcement. Properties of UHPFRC leads to the design of very thin structures. In this case an experimental thin-walled U-profile footbridge with horizontal and vertical curvature was designed and manufactured. Single-span bridge has span of 10 m, clear width of 1.5 m with thickness of shell structure of 30 mm on the side guards and 45 mm on the deck. The paper presents a lots of calculation versions for optimization of the proposal bridge. Self-compacting character of UHPFRC with high flowability allowed casting the final structure in one piece without any vibration. Extensive research was done before production of footbridge. Large-scale specimens were casted and tested in laboratory. A technology of casting and production of formwork were tested and optimized many times because of complexity of whole experiment. Finally the paper presents detailed course on installation of the bridge in landscape and setting and results of static loading tests.

Keywords: footbridge, UHPFRC, shell structure, arch bridge.

1 Introduction

The bridge serve as a pedestrian bridge and have a span of 10 m. The bridge is designed with vertical and horizontal curvature. Vertical and transverse direction curvature is formed by a circular arc with a camber of 0.4 m in the middle of the bridge. The bridge has U-shaped cross section of the width of 1.5 m. The U-shape cross section consists of a bridge deck with 45 mm thickness and side guards with 30 mm thickness which serve as railings. Railing height is 1.1 m in the middle of the span and 1.5 m at the ends of the bridge.

The bridge is be made of ultra-high performance fibre reinforced concrete (UHPFRC). The main outstanding features of this material include the high compressive strength and the high tensile bending strength [1-4]. High levels of strength are provided by using steel fibers. They absorb energy and control cracks growth until failure [5, 6, 7]. High water impermeability is provided by a dense cement matrix and a very low level of porosity with unconnected pores. It is caused by a very low water-binder coefficient, close packing of fine grains of solid particles and by reaction of a very fine reactive material admixtures (microsilica, slag and fly ash) [1]. From high water impermeability are derived high resistance to frost and high durability [2].

The whole bridge has no reinforcement and it is only reinforced by steel dispersed fibers except anchor zones of the bridge where rebar network 60/60/6 mm are embedded into the formwork to transfer local pressures from the bearings.

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