Design of an Experimental Arch Pedestrian Bridge Made of UHPC

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Abstract

This paper presents the design of an experimental arch pedestrian bridge made of ultra-high performance concrete (UHPC). The structure is designed as a permanent single-span bridge. The span of the bridge structure is 10.00 m, the total width of shell structure is 0.03 m, and the clearance width of the bridge is 1.50 m. The main structure of the bridge is one prefabricated arch shell structure made of UHPC with dispersed steel fibers without conventional reinforcement. Simultaneously with the designing of the bridge, computer analyses were created in which optimization of the material and geometric parameters of the structure were carried out. The presentation on the conference will contain also production and assembly of the pedestrian bridge. The presentation will include also long-term monitoring of the specimen of the shell structure in 1:1 scale and finally experimentally obtained load bearing capacity of the specimen. Production and testing of the bridge is scheduled for July 2016.

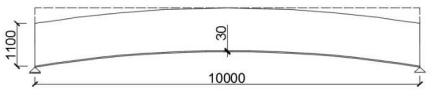
Keywords: ultra-high performance concrete, arch bridge

1 Introduction

The bridge should serve as a pedestrian bridge and will have a span of 10 m. The bridge is designed with double curvature. In the vertical and transverse direction it is a circular arc with a camber of 0.4 m. The cross section of the bridge has a width of 1.5 m and it is U-shaped. The bridge deck consists of a bottom plate with only 30 mm thickness and 30 mm thick side desks which serve as railings. Railing height is 1.1 m in the middle bridge span. In place of the anchor zones is the bridge reinforced with rebar networks B500B. The rest of the bridge has no reinforcement and it is only reinforced by steel fiber reinforcement.

The bridge will be made from ultra-high performance concrete (UHPC). 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].

Figure 1. Scheme of the bridge



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