Technical Issues on Construction of Cable-stayed Bridge using UHPC

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Abstract

Ultra High Performance Concrete (UHPC) is one of the innovative technologies which facilitate building durable and effective structures. It also shows outstanding properties in terms of strengths (both of compressive and tensile) and ductility compare with ordinary concrete. For these reasons, many researchers in the world are interested in development of UHPC and already have their own techniques. As a result of the researches, many bridges for pedestrians and roadways have been already constructed in the world using UHPC.

Especially, in Korea, the construction of the world's first cable-stayed bridge (CSB) for roadway using UHPC was completed in 2018. Total length of the bridge is 966m including 766m of the approach bridges and 200m of the main span with cable stayed bridge. The main span is composed of 47 precast segments with 180MPa UHPC and circular shaped steel pylon.

While constructing the bridge, various technical issues were generated in the field due to the material properties of UHPC such as autogenous shrinkage, hydration heat, high fluidity, and etc. These issues are mainly caused by low water-cement(W/C) ratio which is inevitable retribution of UHPC for high strength. In this paper, the basic scheme of design and construction progress of the Legoland Access Bridge and key technical issues in the field to fabricate UHPC girder are presented.

Keywords: UHPC; SUPER Concrete; precast stiffening girder; steel pylon; circular pylon; cable-stayed bridge; Legoland access bridge; Chuncheon bridge.

1 Introduction

The world first cable-stayed bridge using UHPC, Legoland access bridge (Official name : Chuncheon Bridge) has been constructed in Chuncheon city, Korea. The bridge was required to be a local landmark as the main gate for Legoland theme park which is popular in children. For these reasons, cable-stayed bridge was designed with circular pylon inspired by stud of Lego block. To complement the structural characteristics of the circular pylon, the stiffening girder was required to be lightened [1], so that the girders were fabricated using UHPC [2].

Furthermore, it is required that short construction period to complete the bridge was required. To control the construction schedule, the girder fabrication was planned with precast method and each task was progressed simultaneously.

In this paper, the design schemes and construction procedures of Legoland access bridge are introduced. Particularly, it describes the technical issues in production, placement, and curing of girders using 180MPa UHPC. Additionally, the fabrication and erection method of precast stiffening girders are also shown.

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