Design and construction methods for UHPFRC bridge deck

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Abstract

This paper presents researches related to UHPFRC (Ultra High Performance Fibre-Reinforced Concrete) deck design for cable stayed and ILM bridges. Structural analysis of a cable stayed deck with 1100 meters main span and an ILM deck with 100 meters main spans are performed and discussed, taking into account main tools related not only to resistance and durability, but also construction methods and economical effectiveness. Steel and concrete quantities are compared with those of actual classical solutions for analogous spans.

Keywords: cable stayed bridge; ILM viaduct; UHPFRC; construction methods.

1 Introduction

Concrete, composite steel-concrete and steel decks are today widely used to build cable-stayed bridges, designed worldwide for main span going up to 1100m. Table 1 shows main features of some major existing cable stayed bridges with reference to each type of deck. Stay cables ratio is the quantity of steel necessary to bear 1 m^2 of the main span, including back spans stay cables.

For shorter span, another type of bridge construction called Incremental Launching Method (ILM) can be utilized. This method is economically efficient for span up to 70m in the case of conventional concrete deck. Table 2 shows some properties of few existing ILM bridges.

Actually, not a lot of UHPFRC deck of such a great size exists in the world, the story of the material being quite recent. Nevertheless, after more than 25 years of experiences, UHPFRC has proved its efficiency and durability, and engineers begin to be familiar with its special properties and characteristics.

		Material	Main span	Width	Stay cables	Self-weight	Self-weight ratio	Stay cables ratio
			[m]	[m]	[t]	[t/ml]	[t/m²]	[t/m²]
1977	Brotonne	Concrete	320	19.2	1040	23.1	1.2	0.17
2018	Panama bridge	Concrete	530	23.6	1700	34.2	1.45	0.14
2018	Queensferry	Composite	650	40	6700	46	1.15	0.17
1994	Normandie	Steel	856	19.2	2300	11.9	0.62	0.13
2013	Russki	Steel	1104	26	3650	18	0.69	0.13
2017	Bosphorus third	Steel	1408	58.5	8500	42	0.72	0.1

Table 1: Main cable stayed bridges features (Bosphorus third is partially suspended)

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