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Concept overview of a multi-span suspension bridge on floating foundations

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Abstract

A ground-breaking solution is envisaged for the crossing of Bjørnafjorden on the West coast of Norway. The proposed solution consists of a three span suspension bridge whose two central pylons rest on floaters. The floaters are inspired by the Tension-leg platform technology commonly used in the offshore industry in areas of extreme depths. Similarly to Tension-leg platforms, the floaters are anchored to the seabed by means of vertical tethers. Different floater geometries, both in concrete and steel, have been considered. A top cable has been introduced between the top pylons in order to provide the system with sufficient longitudinal stiffness to accommodate the asymmetric traffic load situations that would, otherwise, lead to large deflections in the loaded spans. The rest of the superstructure consists of the main suspension cables, pylons, hangers and an aero-dynamical bridge girder. Multi-span suspension bridges, tension-leg platforms and top cables are known and proven technologies however they are brought to an unprecedented scale and combined into a construction that could become one of the world's most innovative bridges.

Keywords: Strait crossing, floating bridge, suspension bridge, offshore structure

1 Introduction

The Norwegian Public Roads Administration (NPRA) has initiated one of the most ambitious and ground-breaking large scaled infrastructure programs whose objective is to connect Kristiansand to Trondheim without ferry crossing. The present paper deals exclusively with the feasibility study that have been conducted regarding a multi-span suspension bridge on floating supports solution for the crossing of Bjørnafjorden whose combined constraints in terms of depth of the seabed and total length would be unprecedented. The length of the different alternatives exceeds 4,000 m while the maximum depth of the fjord is about 550 m.

The concepts and conclusions presented in this report reflect the work performed over the course of the second phase of the feasibility studies. A consortium consisting of Aas Jakobsen, COWI and Johs. Holt assisted by Aker Solutions, Moss Maritime, NGI, Plan Arkitekt og Wind onDemand have investigated the feasibility of building such a bridge.

2 Concept description

2.1 General layout

The proposed solution comprises four pylons and three main spans of 1385 m + 1325 m + 1385 m. The southern pylon is founded on solid ground while the northern pylon is founded on a caisson at a depth of 58 m. The two central pylons rest on floaters that are Tension-Legged Platforms positioned at locations where the fjord is 450 and 530 m (see Figure 1)

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