Wind induced response of the Sandsfjord Bridge - a balanced cantilever bridge at the western coast of Norway

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Abstract

The Sandfjord bridge is a concrete box girder bridge with a 290 meter main span. The erection is done by the free cantilever method, i.e. after erection of the piers the bridge girder is cast in 5 meter segments from the piers keeping the cantilevers in balance, after which the cantilever beams are connected at centre span and the landings. During the construction stage the bridge is very sensitive to the dynamic action of the wind. This paper deals with the analytical calculations, wind tunnel tests and field measurements carried out.

Keywords: box girder bridge; balanced cantilever bridge; construction stage; dynamic behaviour; wind engineering; buffeting; vortex shedding; wind tunnel tests; field measurements.

Figure 1. Sandsfjord Bridge from the south side, just before the bridge is continuous (axis 1 to the right)

1 Introduction

The Sandsfjord Bridge is located in southwestern Norway in Rogaland County, crossing the Sandsfjord, which is ending in the industrial city Sauda. Construction started in the summer of 2013. The bridge was opened for traffic in November 2015 after a construction period of 2.5 years, replacing an existing ferry crossing. Dr. Ing. A. Aas-Jakobsen AS (Aas-Jakobsen) carried out the design in cooperation with the Norwegian Public Roads Administration Western Region (NPRAW) in Stavanger, starting with concept study and preliminary design in 2010.

Since the bridge is crossing an important shipping route in a deep fjord with difficult navigation conditions near the bridge, the main foundations had to be located on dry land. This led to the design of a concrete cantilevered bridge with a main span of 290 meter and shipping clearance of 65 meter, which is an extraordinary combination worldwide. Total length of the bridge is 580 meter. The width of the bridge deck is 10 meter, carrying two traffic lanes only. The depth of the main girder varies from 3.5 to 14.0 meter. The three longest cantilevers are built with high strength lightweight concrete in order to reduce

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