

The Submerged Floating Tube Bridge: Design Philosophy and Concept Development

Anders MYHR
Consultant
Dr. Techn.
Olav Olsen AS
Oslo, Norway
amy@olavolsen.no

Stein Atle HAUGERUD
Consultant
Dr. Techn.
Olav Olsen AS
Oslo, Norway
sah@olavolsen.no

Arianna MINORETTI
State department
Norwegian Public Road
Administration
Trondheim, Norway
arianna.minorette@vegvesen.no

**Andreas S.
BRANDTSEGG**
Consultant
Dr. Techn.
Olav Olsen AS
Oslo, Norway
asb@olavolsen.no

**Vegard B.
KRISTENSEN**
Consultant
Dr. Techn.
Olav Olsen AS
Oslo, Norway
vbk@olavolsen.no

**Tale EGEBERG
AASLAND**
Region west
Norwegian Public Road
Administration
Stavanger, Norway
tale.aasland@vegvesen.no

Summary

A feasibility study has been performed by Dr. Techn. Olav Olsen, Reinertsen, Norconsult and the Norwegian Public Road Administration (NPRA) for a Submerged Floating Tube Bridge (SFTB) crossing the Bjørnafjord strait. Design of flexible floating structures with lengths above 5 kilometers has previously not been developed to a detailed level. This article will discuss the approach the design team used to achieve a solution that was robust, reliable and economically viable for a SFTB for crossing the Bjørnafjord. The proposed approach was found to be an efficient and safe approach to reduce the total cost of the project. The experience is based mainly on work for the NPRA with the Bjørnafjord strait crossings on the west coast of Norway. This paper will address three main issues; 1) Design challenges, 2) Practical challenges and 3) SFTB sensitivities.

- 1) No complete standards was applicable and existing methods of predicting dynamic behavior proved to be too crude to be applicable in design. A significant work was therefore put into improving the above mentioned. This lead to a large amount of time domain simulations, which is an uncommon challenge in concept design. A solution to use this as an advantage is discussed along with the guidelines for concept screening and optimization with economic impact analyses.
- 2) A 100 year life time with minimal maintenance is requested by the NPRA. Technical solutions, with emphasis on landfalls and flexible parts of the structure is discussed.
- 3) A significant work with screening of response variations relative to changes in environmental loads has been performed. This was possible due to the methodical and analytical progress mentioned in 1)

The concluding remarks of the experience reported in the article show that the SFTB is both robust and flexible, with low sensitivity to change in environmental loads. Previous experience indicated that the SFTB was not suitable for harsh environments, whereas the new solutions indicate that even swell loading is more of a design issue rather than a feasibility issue.

Keywords: Strait-crossings, SFT, Submerged Floating Tunnel, Design philosophy, Green Box, Concept development, Pontoon, Tension leg, Archimedes Bridge.