Project proposals to Post doc research position for

‘Validation and verification of dynamic analysis for submerged floating tube bridge design under environmental loads’.

In the past few years Statens vegvesen has carried out concept design for a few most challenging fjord crossings. For them the submerged floating tube bridge (SFTB, or called submerged floating tunnel) is one of the three types of marine bridges that were considered as technological feasible for all of the the crossings studied.

The environmental conditions are different for each fjord. These environmental loads include wind, surface waves, current and possibly internal waves and (slides induced) tsunami. The design and analysis of an SFTB requires tremendous multidisciplinary knowledge. In SVV’s design campaign, the dynamics of an extremely long SFTBs (for example, 5 km long for Bjørnafjord) under these loads have been considered based on engineering design methods or recommended practice from e.g., DNV.GL for subsea pipelines. Though we consider that the predicted design loads and responses were on the conservative side, thus reliable structure design guaranteed, there are a lot of unanswered questions regarding the verification and validation aspects of all the different types of analysis methods and assumptions. At present, these questions were answered with relatively high load factors compared with common offshore steel structure design. Without prepared research, these factors may even go up in the future when the project is going to be realized, unnecessarily increasing the cost and reducing the competitiveness of the structure.

The current research proposes to carry out a series of verification and validation work for the following issues:

1. General dynamics and response properties of an SFTB under waves, current, wind and other applicable loads like internal waves, etc.;
2. Special dynamics and response properties of an SFTB in a typical Norwegian fjord featured by mild wave and current conditions (e.g., Bjørnafjord)
3. Special dynamics and response properties of an SFTB in a typical Norwegian fjord featured by higher wave and current conditions (e.g., Sulafjord)
4. Design tool validation for SFTB design (SIMA, OrcaFlex, etc.)
5. Model tests validation of the analysis and design tools. Properly designed scaled model tests for the purpose of validating SFTB will be carried out based on the output from 1-4.

The research activity of this concept has much increased in the recent years; among others there are Korean and Chinese research centres that have just started working on this type of extreme crossing...
technologies. Statens vegvesen has initiated a few research projects on explosion, direct numerical simulation CFD, etc, but no engineering and design oriented verification and validation research project up to now. The additional necessary knowledge in relation to this structure will not only help the designers to optimize the future projects and to validate them, but it will also increase the confidence of the politicians with respect to this novel type of structure which has never been built before. This will give guidance in the choice of this structure for some of the future fjord crossings, where the first SFTB can be built.