# Long Span Buoyancy Bridge

## with Submerged Cable Anchoring

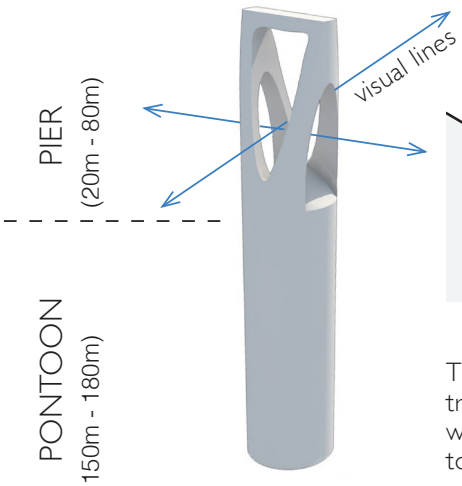
# Introduction

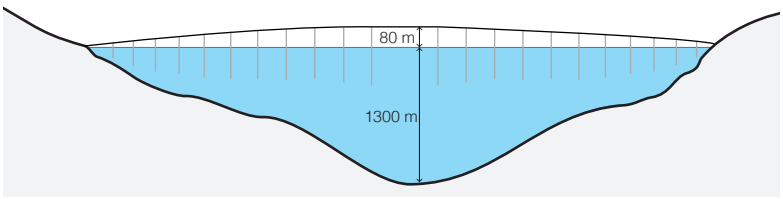
The new buoyancy bridge concept is a unique example of extreme bridge design and engineering. It has been developed for the 4 kilometer wide and 1 kilometer deep Sognefjord in Norway, considered to be one of the most challenging and difficult to cross of all fjords. It forms a constituent of Norway's 1100 km long E39 coastal highway comprising of eight ferry crossings that is the highest for the European trunk road system. Replacing the ferry connection at Sognefjord with a new buoyancy bridge concept would cut short travel time by a great extent and guarantees a seamless driving experience. Special attention has been paid to closely weave structural and architectural design concepts into one coherent gesture.



## Architectural Design

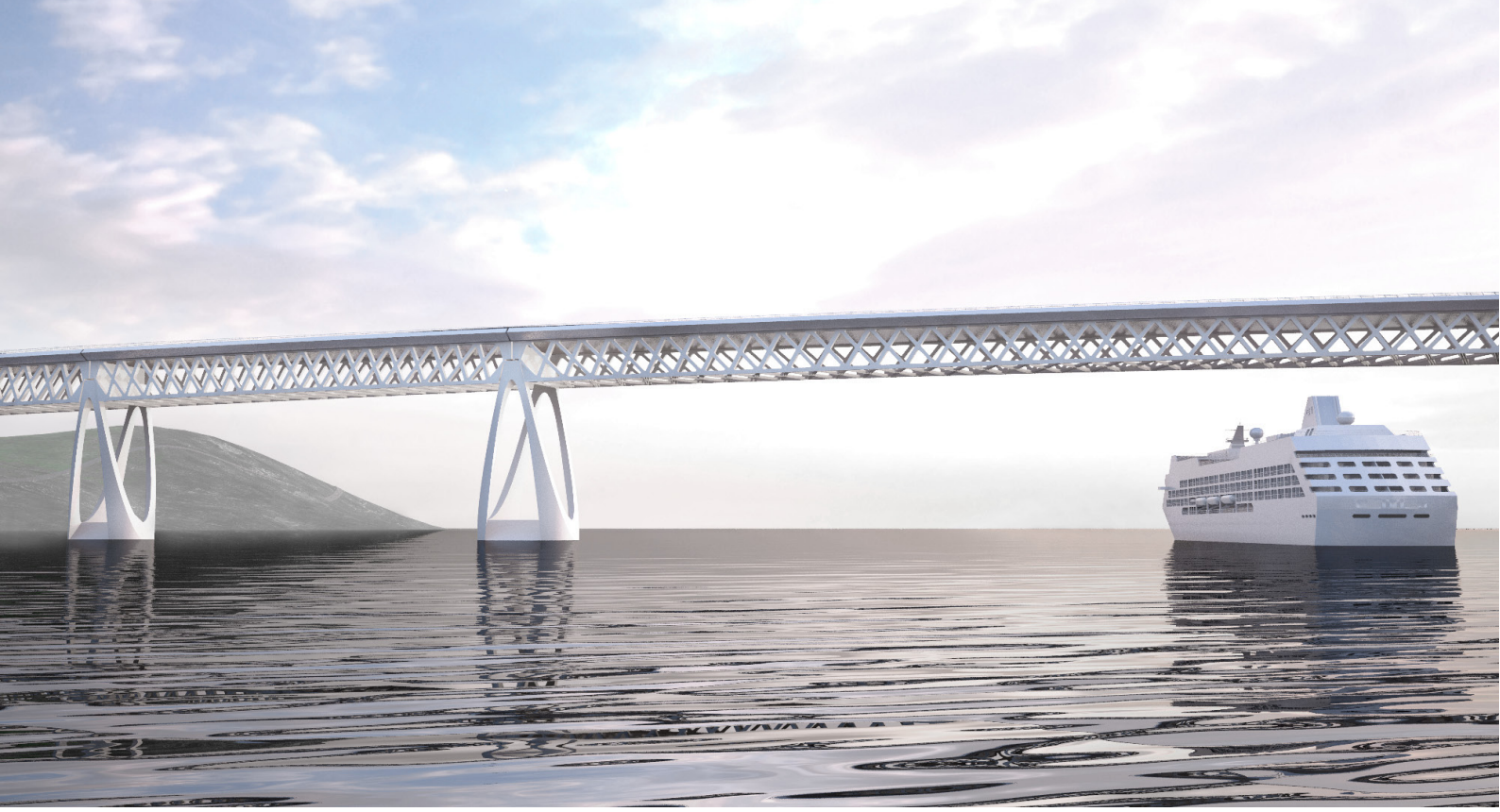
The architectural intention is to set an example of how a bridge and natural landscape can interact seamlessly with one another. The S-shape of the bridge originated in response to the existing landscape topologies, thus extending and accentuating the lines of movement alongwith dynamic views of the surrounding landscape. Furthermore, the bridge deck climbs up to 80 m above water level to create a large fairway clearance for ships. Thus creating 4500m. long slender, light, clean gesture connecting the two ends of the shore offering spectacular dramatic views of the Sognefjord owing to its derived shape.




mid-fjord ships passage

The piers were designed to reflect a sense of robustness, transparency and lightness. This gave rise to an ingenious solution whereby the piers were combined with the pontoon floating devices to create seamless unibody geometry.

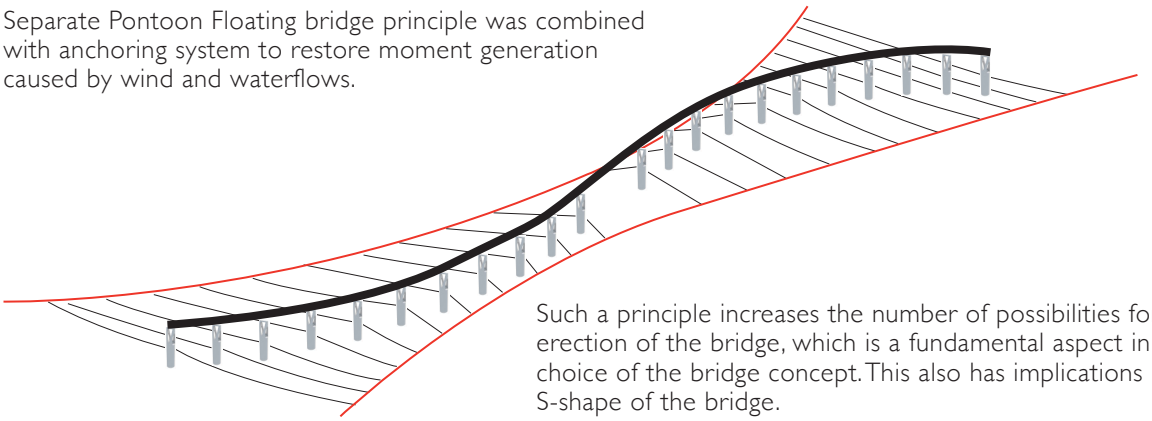


## Structural Design

The limits of civil engineering have been challenged in this concept by exploring new possibilities for a buoyancy bridge, which consisted of 20 differential spans ranging between 200m and 465m. A buoyancy bridge with these properties is unprecedented.

Separate lattice bridge girders with a width and height of approximately 25 m are designed and equipped with a special set of supports, capable of dealing with the spatial motions caused by the floating principle. The bridge girder varies in torsional rigidity along its span to follow the system induced flexural deformations.

Separate Pontoon Floating bridge principle was combined with anchoring system to restore moment generation caused by wind and waterflows.



Such a principle increases the number of possibilities for the erection of the bridge, which is a fundamental aspect in the choice of the bridge concept. This also has implications in S-shape of the bridge.

Although the design is a concept, the study shows that a structurally and aesthetically competitive buoyancy bridge for the Sognefjord appears to be a feasible idea and that it is worthwhile to conduct further investigations towards this buoyancy bridge concept, also for other occasions.

The bridge has been developed in close cooperation with ZJA Zwarts & Jansma Architects, IV Consult and TU Delft.

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