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### Leirfjorden suspension bridge

**Kristian Berntsen**  
[kristian.berntsen@norconsult.com](mailto:kristian.berntsen@norconsult.com)  
Norconsult AS  
Sandvika, Norway

**Asma Manai**  
[asma.manai@norconsult.com](mailto:asma.manai@norconsult.com)  
Norconsult AS  
Sandvika, Norway

**Alexander Kyte**  
[alexander.kyte@norconsult.com](mailto:alexander.kyte@norconsult.com)  
Norconsult AS  
Bergen, Norway

#### ABSTRACT

Leirfjorden suspension bridge is currently under design. It spans over the 800 m wide Leirfjord and is to carry the national highway E6 in Norway. The initial tender design was completed in 2018. However, the project was stopped due to a lack of funding. In 2021 an aluminum concept was investigated. It was found feasible. However, the aluminum concept was not continued, mainly due to a lack of experience in using that material in a suspension bridge. During the following planning and geological testing, the rock conditions in the steep hillsides were poor. This resulted in moving the towers backwards to the top of the steep hillsides. Therefore, the bridge has relatively short towers located 62 m behind the abutments. This unusual design leads to compression in the first pairs of hangers, an increase in weak axis bending moment, and an increase in the girder end rotation. This paper presents solutions to tackle the above-mentioned challenges.

**Keywords:** Suspension bridge, cable system, aluminum, hanger to the land.

#### 1 INTRODUCTION

In the last few decades, the number of suspension bridges has increased worldwide. Only in Norway, 10 suspension bridges have been built since 1990, one more is under construction, and several more are planned, see table 1. The typical Norwegian suspension bridge crosses a deep fjord with steep hillsides. The tower height in these suspension bridges is typically 1/10 of the span length, in addition to the clearance for ship traffic. The bearings for the girder are located on a cross beam in the lower part of the towers.

During the design of the Leirfjord bridge, it was found that the towers should be placed away from the steep hillsides, which leads to a longer cable span, however, at the same time a shortening of the towers. In this paper, different solutions to take the concepts of short towers far from the girder ends (due to geological challenges) are presented and compared, taking advantage of the steep hillsides.