

Introduction

In a sparsely populated country like Iceland there is great need for good transportation connections. Due to largely spread peat zones some roads must be constructed on peat. Road construction on peat can however be problematic due to specific characteristics of the material. Peat is very compressible, with high moisture content and relatively low shear strength.

The objective of this project was to document the methodology that is used in settlement predictions due to roads on peat and then apply that knowledge on real conditions.

Suðurlandsvegur road

Between the towns Hveragerði and Selfoss in South Iceland currently lies two-lane single carriageway road, see Figure 1.

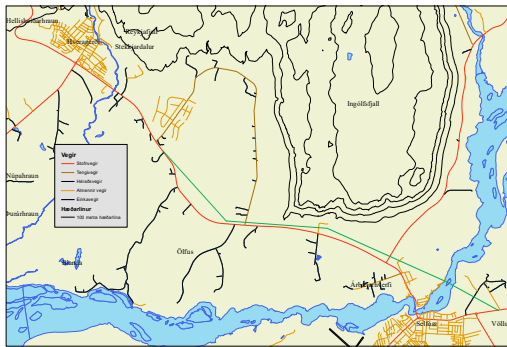


Figure 1: Overview of the existing Suðurlandsvegur road (red) and proposed road (green).

Current length of the road is about 13 km. However a new two-lane dual carriageway road is proposed, see Figure 1. Large part of the road will be constructed on peat. In this project, nearly 11 km chapter from Hveragerði to the west bank of the river Ölfusá was taken into consideration.

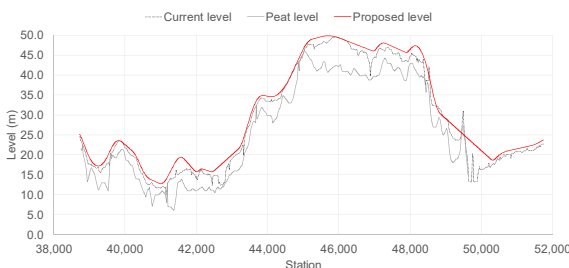


Figure 2: Current level of land, peat level and level of proposed road.

Along the proposed road alignment average peat depth was determined 3.9 m with a maximum value of 8.2 m. For the settlement prediction the considered area was split up to segments whether it was needed to construct full or half cross section of the road. Both short and long term settlement predictions were determined. Results gave an indication of total settlements around 225,000 m³ in the corresponding area. That could lead to 400-600 million ISK increase in budget cost due to extra fill materials.

Settlement prediction for standard cross section

Settlement predictions were made for one carriageway for different height of embankment. The prediction was determined so that loading under the middle of the subgrade in the middle of the peat will not exceed 20 kPa in first step and not exceeding 30 kPa in later steps. Combined settlement for 20 and 50 kPa loading can be seen in Figure 3.

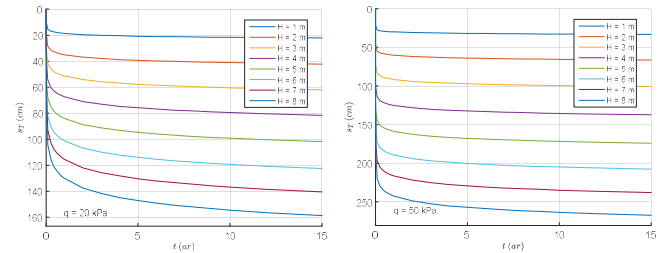


Figure 3: Combined settlement for 20 and 50 kPa stress respectively.

Stability of embankment

The stability of embankment was analysed with PLAXIS. A 2 m high embankment and a peat depth of 4 m gave insufficient factor of safety while the use of stabilising berm to the side of the embankment gave an acceptable factor of safety. The results can be seen in Figure 5.

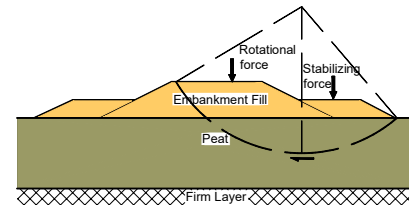


Figure 4: Slope stability analysis.

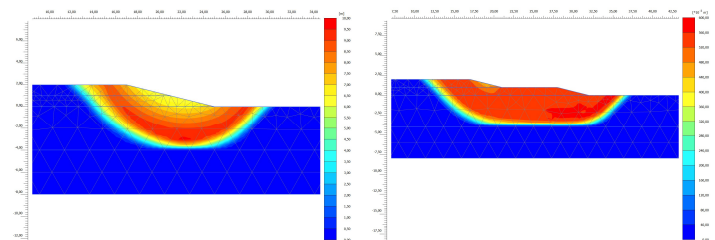


Figure 5: To the left, failure surface of embankment, $F_s = 1.16$. To the right, failure surface of embankment with stabilising berm, $F_s = 1.53$.

Conclusion

- Large settlements can be expected along the new road. They have been estimated to be up to 2.5 m.
- With preloading the expected consolidation time is less than a month. Secondary consolidation time is however up to 10 years.
- Road embankment can lead to unstable slopes. To increase their stability a stabilizing berm should be considered.