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Slope stability for road construction project: using FEM and LEM [PLAXIS and GeoStudio]

Revised by Stefanos Papavasileiou • 2m ago • 4935 Views • ★★★★★

Application	PLAXIS 2D GeoStudio SLOPE/W
Version	PLAXIS 2D CONNECT Edition V22.01 GeoStudio V2021
Status	Technology Preview
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Introduction

On the North Island of New Zealand a new road section has to be constructed along the shore line of a tidal bay, see figure 1.

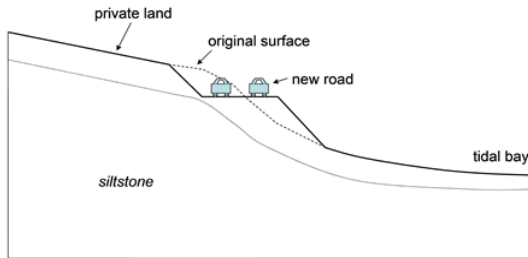


Figure 1: Situation overview for the newly constructed road

Though the easiest solution would have been to construct the road at a larger distance from the bay as the slope gradients are easier there, this is not possible as the upper land is privately owned which for historic reasons cannot be changed. The new road therefore had to be constructed along the steeper gradient just next to the shoreline of the tidal bay.

The hillside is mainly siltstone, weathered at the surface but intact at certain depth. Construction will take place in summer when the ground water level is low. However, in winter the hillside side almost fully saturates due to heavy rainfall, which has a significant influence on the stability. For the construction of the new road part of the slope was excavated. The excavated material is crushed and mixed with sand and gravel to make fill material to support the road.

During the first winter after the road construction the road started to tilt towards the tidal bay and after assessing the winter situation the factor of safety was considered too low. The decision was taken to stabilize the fill and hillside below the road using so-called launched soil nails: long steel reinforcement bars that are shot with high speed into the ground.

Additionally, concerns have raised about rock fall and landslides above the road and thus an additional analysis of the slope stability above the road must be performed. The strength reduction method in Finite Elements gives the most critical slip surface, but it's not so easy to determine a factor of safety for a specific area and therefore for the slope stability above the road a Limit Equilibrium analysis is used.

Main goals

Main goal of the analysis:

- Determine the factor of safety of the original hillside

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- Construct the new road under dry (summer) conditions and calculate its factor of safety
- Simulate wet (winter) conditions and calculate its factor of safety
- Apply stabilising soil nails and calculate the factor of safety in wet conditions
- Calculate the slope stability above the road using GeoStudio SLOPE/W.

Requirements

To run this tutorial case, you will need the following:

- PLAXIS 2D CONNECT Edition V21 Update 1 or later
- PLAXIS 2D LE CONNECT Edition V21 or later
- The PLAXIS 2D to Limit Equilibrium converter Python script, available here: [How to run a Limit Equilibrium Method analysis from PLAXIS 2D](#)

Downloads

- Case description: [Stability_of_a_road_along_a_hill_side_using_FEM_and_LEM_PLAXIS_2D_2022.pdf](#)
- Command log file: [Stability_of_a_road_along_a_hill_side_using_FEM_and_LEM_PLAXIS_2D_2022.log](#) [command log file, use save as]

See also

[How to run a Limit Equilibrium Method analysis from PLAXIS 2D](#) *[Tutorials]*

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