SEEQUENT

GeoStudio Example File
Surcharge Loads

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Introduction

Surcharge loads can be used in a stability analysis to model a variety of loads at the ground surface, including equipment loads and material placement. This simple example illustrates the application of a surcharge load and discusses how it is incorporated in the stability calculations.

Numerical Simulation

The numerical analysis comprises a slope with a pile of sand placed near the crest (Figure 1). The pile of sand could have been modeled as a region, but sometimes it is more convenient to model certain features with a surcharge load. A key difference in this case is that the trial slip surfaces will not pass through the sand material. As such, any shear resistance from within the sand is excluded, while the driving force from the weight of the sand is included.

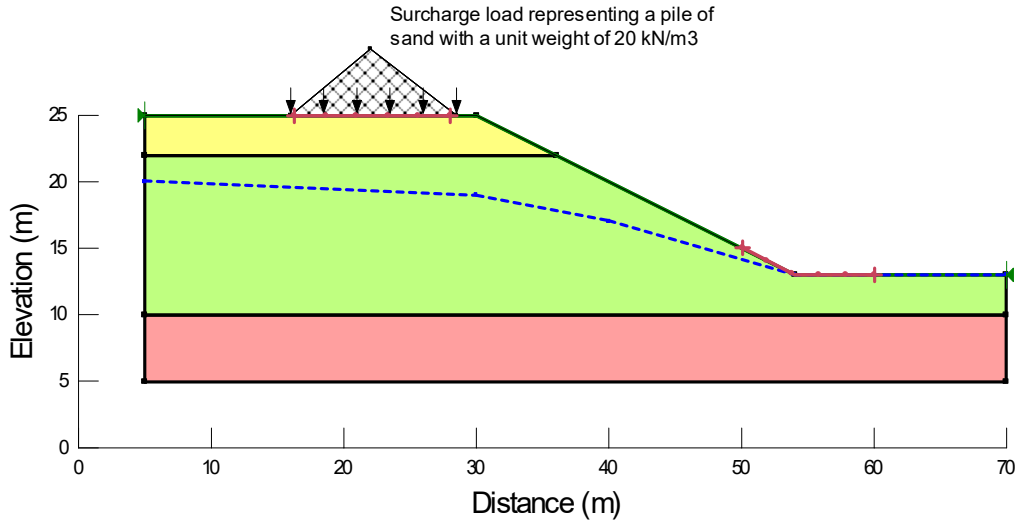

Figure 1. Example configuration.

Results and Discussion

Figure 2 and Figure 3 show the critical factor of safety results when the surcharge load is excluded and included, respectively. The factor of safety naturally decreases with the application of a driving load. The location of the critical slip surface also changes between the two analyses.

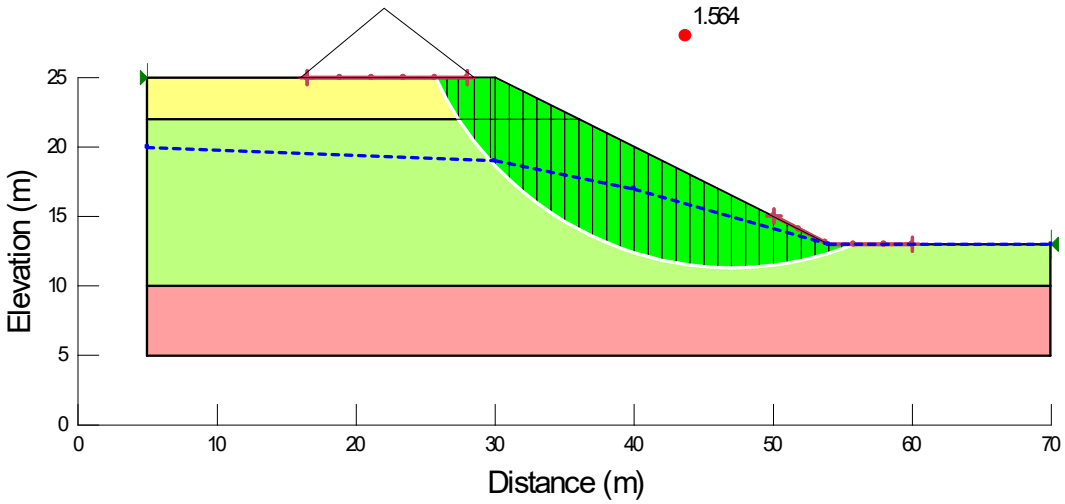

Figure 2. Factor of safety without the surcharge load.

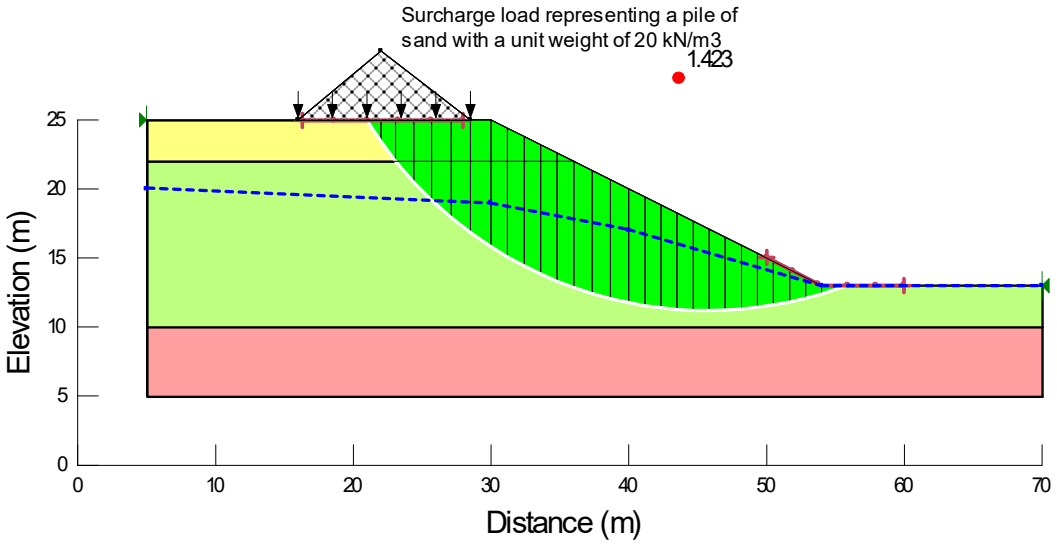

Figure 3. Factor of safety with the surcharge load.

The effect of the surcharge can be viewed by looking at free-body diagrams for individual slices. Figure 4 shows the free-body diagram for Slice 4. The slice width is 1.3083 m. The vertical distance from the green ground surface line to the surcharge line at the mid-point of the slice is 2.6602 m. The magnitude of the force representing the surcharge is calculated as:

2.6602 m * 20 kN/m3 * 1.3083 m = 69.607 kN

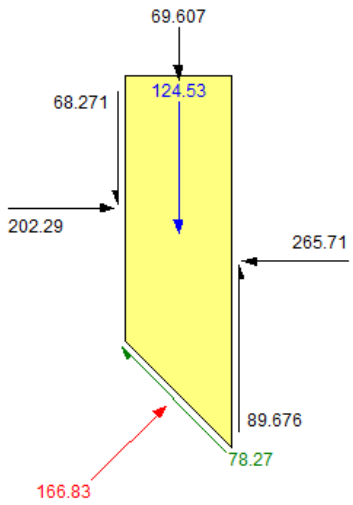

Figure 4. Free body diagram for Slice 4.

It is important to recognize that the surcharge load is essentially adding to the slice weight. This affects the slice base normal and, in-turn, the base shear resistance. The base normal for slice 4 without the surcharge load is approximately 95 kN.

Summary and Conclusions

This simple example demonstrates the application of a surcharge load at the top of a slope. The results can be interpreted by looking at the slice forces and free-body diagram to make sure that the surcharge loads have been applied as intended.