SEEQUENT

GeoStudio Example File
Search Techniques: Fully Specified

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Introduction

In certain situations, the location of the failure or potential failure surface is known *a priori*. This would be the case, for example, when back-analyzing a failing slope or analyzing failure along a joint-set in a rock mass. In these cases, it is useful to take advantage of the Fully-Specified slip surface feature in SLOPE/W.

Numerical Simulation

Consider the illustrative case shown in Figure 1. There are signs of a tension crack near the crest of the slope. Slope inclinometer measurements have shown there is movement in the weak layer at depth. Two points on the slip surface are therefore known, but the remainder is undefined. A Fully-Specified slip surface was drawn with a series of data points to analyze this scenario (Figure 1). Note that the first and last points are above the green ground surface line. SLOPE/W then computes the intersection points between the specified slip lines and the ground surface line.

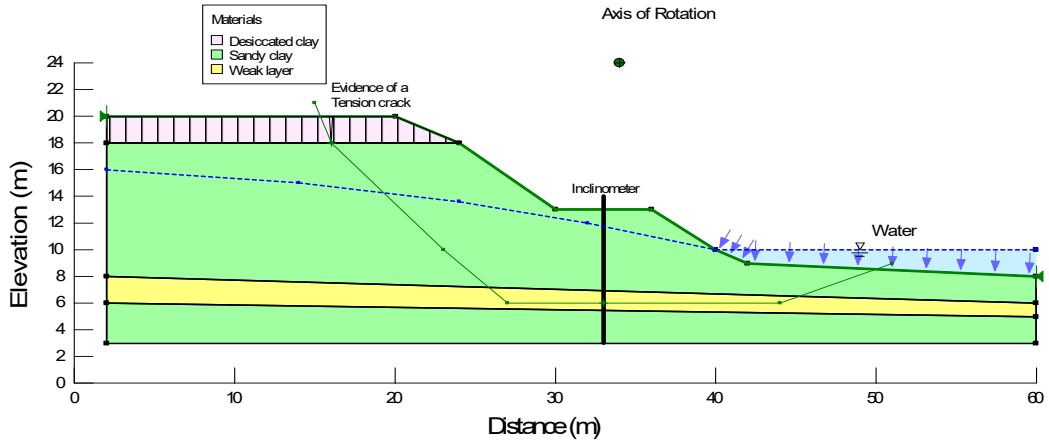

Figure 1. Example configuration.

In order to not over-constrain the slip search, the 'optimization' option was selected. SLOPE/W will first analyze the stability of the full-specified slip surface and then it will adjust the geometry until it finds a lower factor of safety. In this case, however, the location of the slip surface at the base of the tension crack and in the inclinometer should be fixed during optimization. This can be accomplished using the Define | Slip Surface | Fully Specified dialog box (Figure 2).

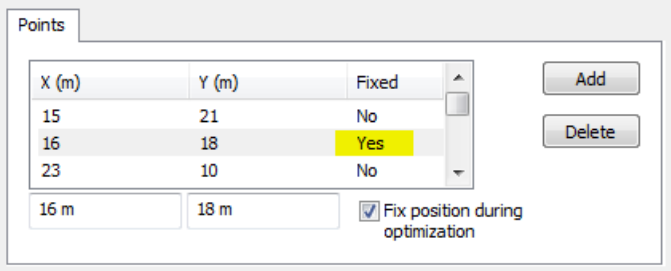

Figure 2. Fixing points on a Fully Specified slip surface.

SLOPE/W has some user-specified controls on the optimization process. For this analysis, the intent was to prevent a concave curvature in the slips surface and, therefore, angles were set to 0.1 degrees (Figure 3).

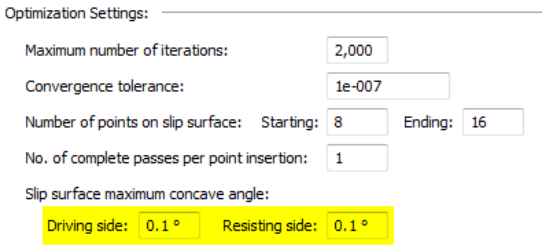

Figure 3. Optimization settings in SLOPE/W.

Sometimes it is desirable to specify the location about which to take moments. For illustrative reasons, an axis location has been specified in this example. The exact location of the axis point does not have an effect on the factor of safety calculations if the method satisfies both moment and force equilibrium. The axis position does have an effect for methods that do not satisfy both force and moment, such as the Bishop and Janbu Simplified methods.

Results and Discussion

Figure 4 and Figure 5 show the results for the non-optimized and optimized full-specified slip surface. Note that the optimized solution gives a slightly better shape and results in a lower factor of safety. It is not difficult to imagine that the actual slip surface is close to the optimized shape.

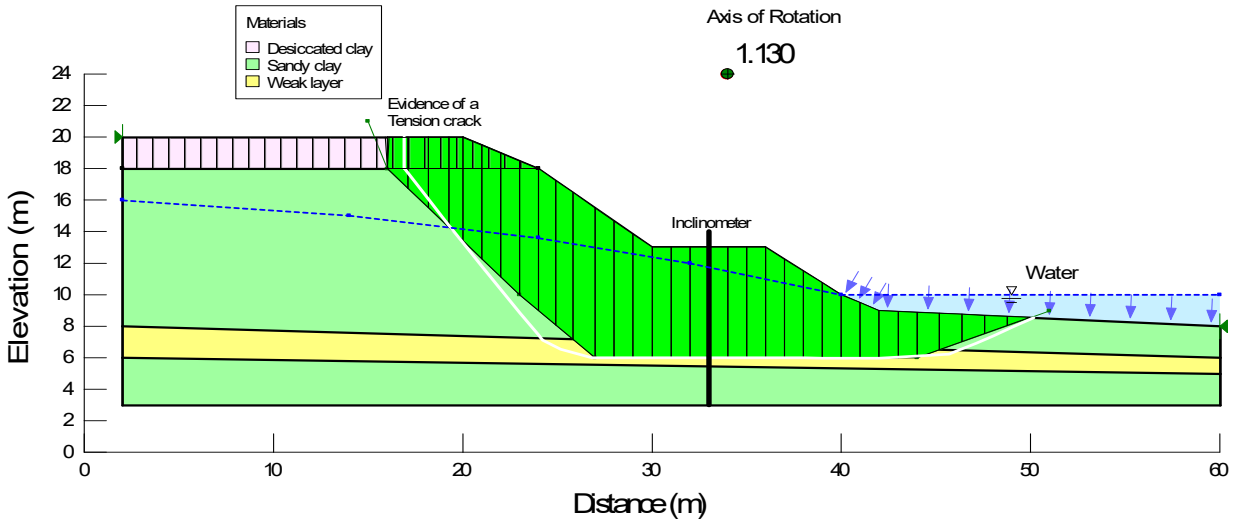

Figure 4. Result with a Fully Specified slip surface.

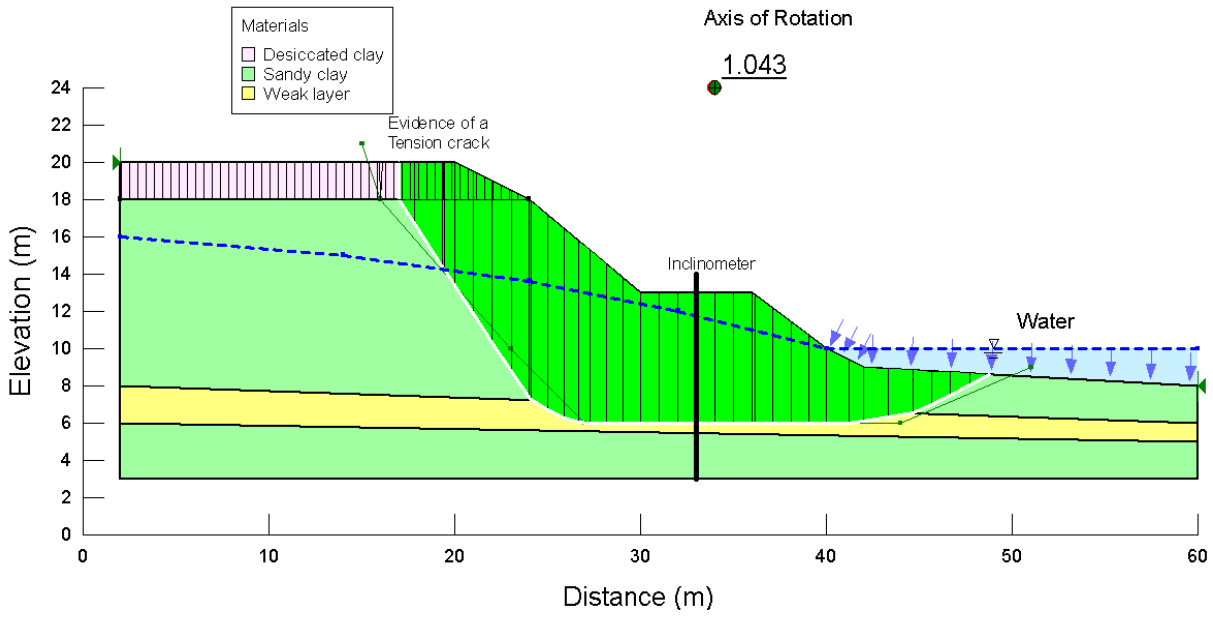

Figure 5. Result with optimized slip surface.

Summary and Conclusions

The fully-specified search technique in SLOPE/W can be a valuable approach for analyzing a specific slip surface shape and location. It can also be used in conjunction with optimization to find a more critical shape or to refine the shape along sections where the location is unknown.