



Developer's Tip:

Water Table Extents in Slide 5.0

Introduction

Many *Slide* models use a simple water table to model pore pressure. The pore pressure at any point in the slope depends on the vertical distance from the point to the water table. A common modeling mistake is to define a water table (or piezometric line) which does not span the extent of all materials for which it is intended to calculate the pore pressure. When this occurs, *Slide* will NOT calculate a safety factor for any slip surfaces where the pore pressure is undefined. This Developer's Tip describes how this problem may occur, and how to detect and avoid this modeling pitfall.

The Problem

Figure 1 illustrates a very simple homogeneous slope with no water table defined (i.e. dry material, pore pressure is not considered). The results from a circular failure surface analysis using Bishop's method are shown. Note that the factor of safety is approximately 1.14.

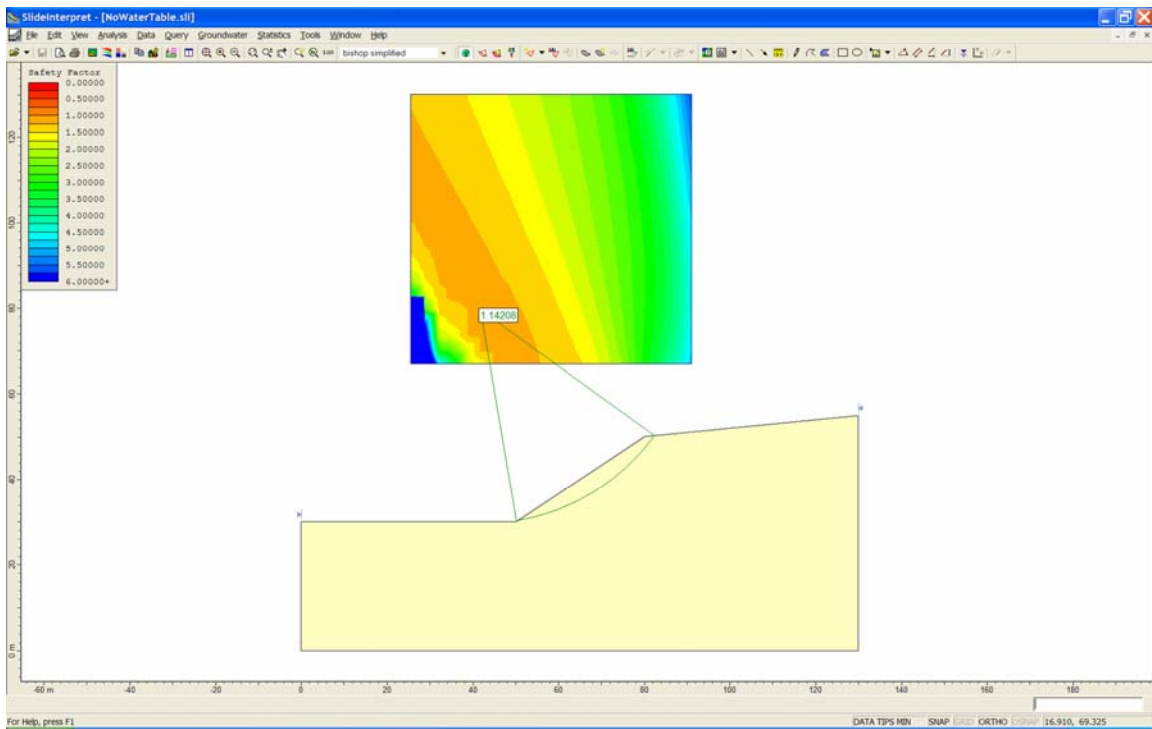


Figure 1: Dry slope (no water table defined)

Figure 2 illustrates the same model but with a water table defined only along the upper part of the slope surface.

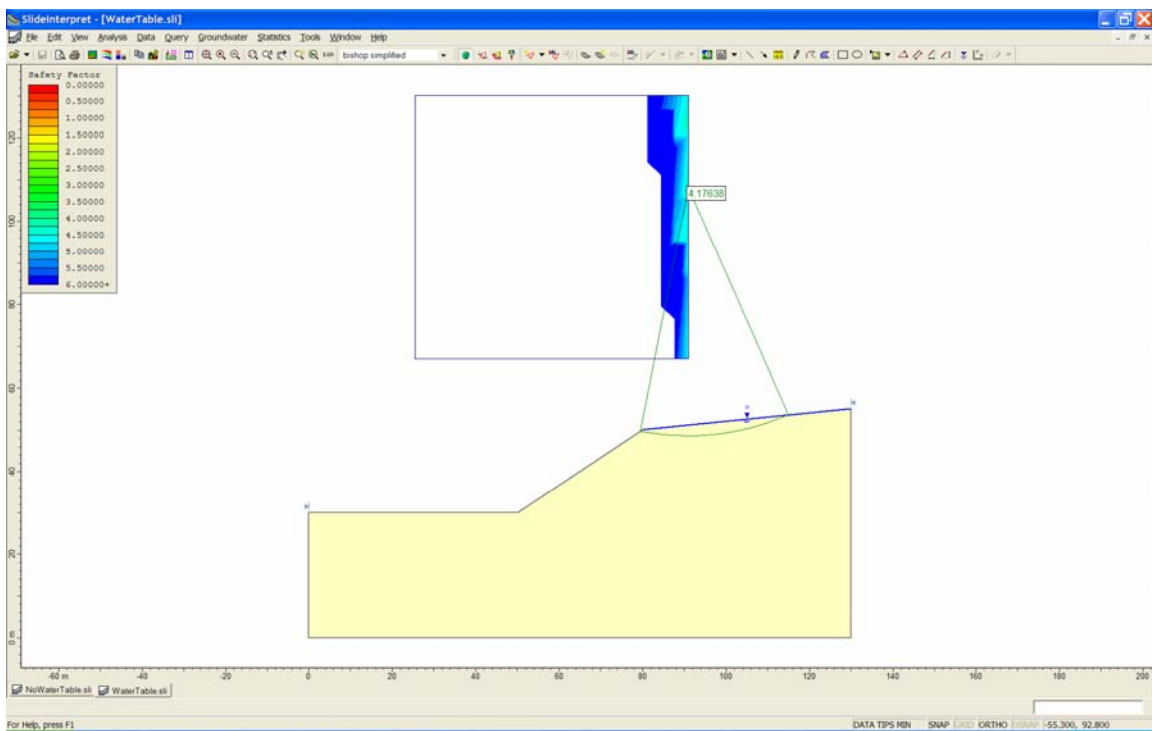


Figure 2: Water table defined

Note that the results are very different from Figure 1:

- Results are only available at the right side of the safety factor grid. A large portion of the grid is blank, signifying that no safety factor was calculated for circular slip surfaces with centers at these locations.
- The factor of safety has **increased** to 4.17. Exactly the opposite of what you would think should happen after adding a water table.

Why?

Often when importing water table geometry data from DXF files, the water table is either discontinuous or only defined in certain parts of the slope. *Slide* requires that the water table be a single continuous polyline that extends the full width of all materials whose pore pressure is defined using the water table. Notice in Figure 2 that the water table does not extend the full width of the slope. It only exists along the crest of the slope. However, the entire slope material has been defined as using this water table for pore pressure calculation.

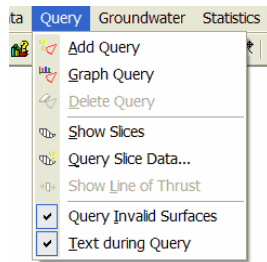
So what does *Slide* do when it has to calculate the pore pressure at a point inside a material, if the water table does not exist above the point in question? (for example, a point at the toe of the slope in Figure 2). The answer is simple: in order to avoid making assumptions about the value of pore pressure where the water table is undefined, the slip surface is flagged as invalid (error code -110). The program will not calculate slip surfaces for material regions where the water table is undefined.

In Figure 2, a large portion of the slip center grid is blank. This is primarily due to surfaces that lie partially or completely outside the span of the water table, and thus, no safety factor is calculated.

Identifying the Problem

If you do a lot of slope stability analyses with *Slide*, you will most certainly come across cases where the program does not calculate results and you want to know why. The easiest way to identify the problem is by using the **Query** facilities in the *Slide* Interpreter. This can be done as follows:

1. In the *Slide* Interpreter, go to the **Query** menu. Toggle on the **Query Invalid Surfaces** option. The option is on if a checkmark exists beside the option in the menu.



2. In the **Query** menu, choose the **Add Query** option. Move the mouse inside the slip center grid. As seen in Figure 3, the program will display error code information for why a particular center was not calculated. This information is usually enough to determine the reason for why the program is not calculating results at a particular location. A complete list of error codes is given in the *Slide* Help.

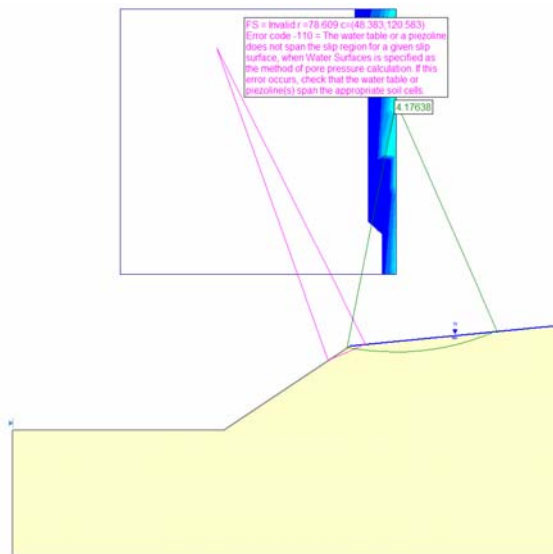


Figure 3: Viewing slip surface error codes

3. You may also view the complete list of error codes generated by an analysis in the *Slide* Info Viewer (at the bottom of the Info Viewer listing). It is important to realize that most analyses result in a few surfaces that generate error codes. It is generally not a matter for concern and in no way invalidates the overall results of the analysis.

Fixing the Problem

For the model in Figure 2, the solution is simple. Using the editing tools in *Slide*, simply extend the water table along the entire length of the slope. Figure 4 illustrates the same model with the water table along the entire length of the slope. Note that the factor of safety has been reduced from 1.14 (dry case) to 0.46 for the case where the water table exists along the entire ground surface.

Conclusion

Always make sure that a water table (or piezometric line) **completely spans the horizontal extent of all materials for which it is intended to define the pore pressure** !!!!!

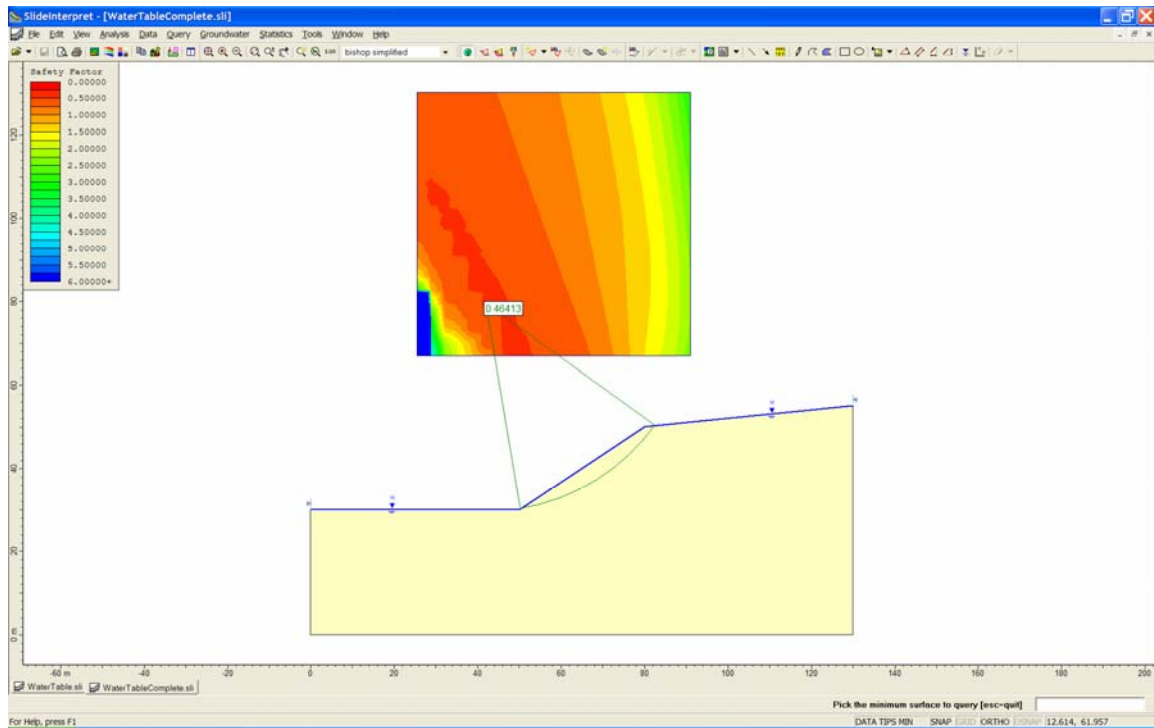


Figure 4: Water table defined along entire slope