Developer's Tip

In this column I'll be dealing with the new added functionality of being able to apply pressures to either the slope or upper face in our Swedge 4 software program. These pressures can be used to model support as in the case of a pattern bolted slope face, or an externally applied uniformly distributed load at the top of the slope. To get this functionality you must download the latest Swedge update, 4.06, from our website, www.rocscience.com. There is no cost for people that have purchased version 4 of Swedge.

A common question that customers of our Swedge product have is: How do I model a pattern bolted slope face?

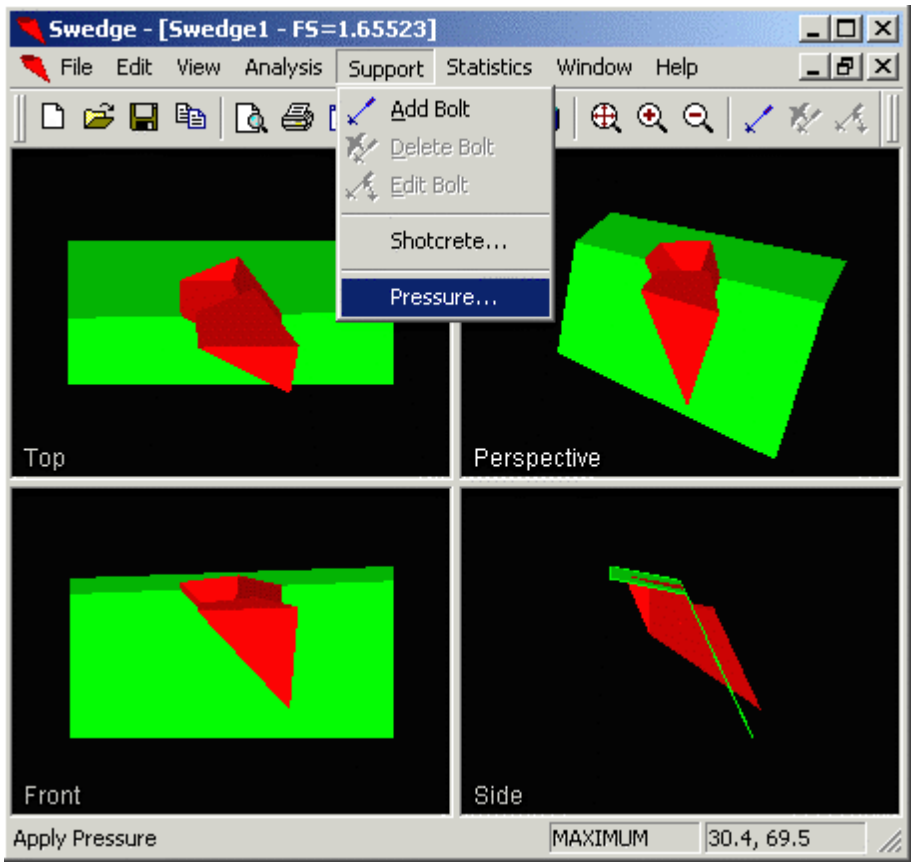
- In the deterministic mode of the program, the slope face area of the wedge is listed in the Infoviewer. Knowing the bolt pattern you can estimate the tributary area associated with each bolt. Using the individual bolt capacity you can then determine the stabilizing force of the pattern by multiplying it by the ratio of slope face area to tributary area.
- Likewise for pressure loading on the top of the slope it is easy to convert this to a single external load by multiplying by the upper face area. This value is also in the Infoviewer.
- The problem comes when you do a probabilistic analysis with joint orientations that are random variables. This results in slope and upper face areas that change with every simulation. Thus it is not possible to probabilistically model bolt patterns or pressure loads, in this case.

To solve this problem, Rocscience has added a new option in the Support menu that allows the user to add pressure loads to either the slope face, upper face or both. The pressure is defined as a stress vector with both magnitude and direction. By default, the direction is normal to the slope. The user can also define whether the force is active (reduces the driving forces) or passive (increases the resisting forces).

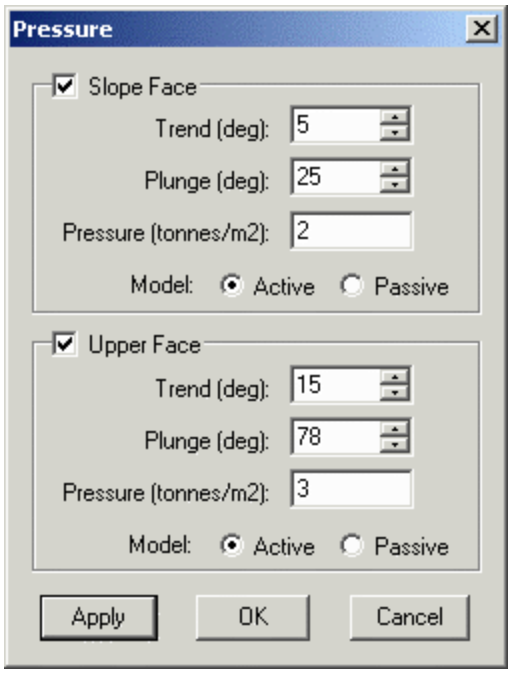
Rocscience often uses customer feedback as a way to improve and add to the functionality of its software products. In working closely with industry leaders we are able to provide the functionality that people ask for. All customer requests for functionality are taken seriously with the majority being implemented in future product upgrades. We strongly encourage customers to email us at software@rocscience.com with any suggestions or criticisms they have concerning our software.

Implementation

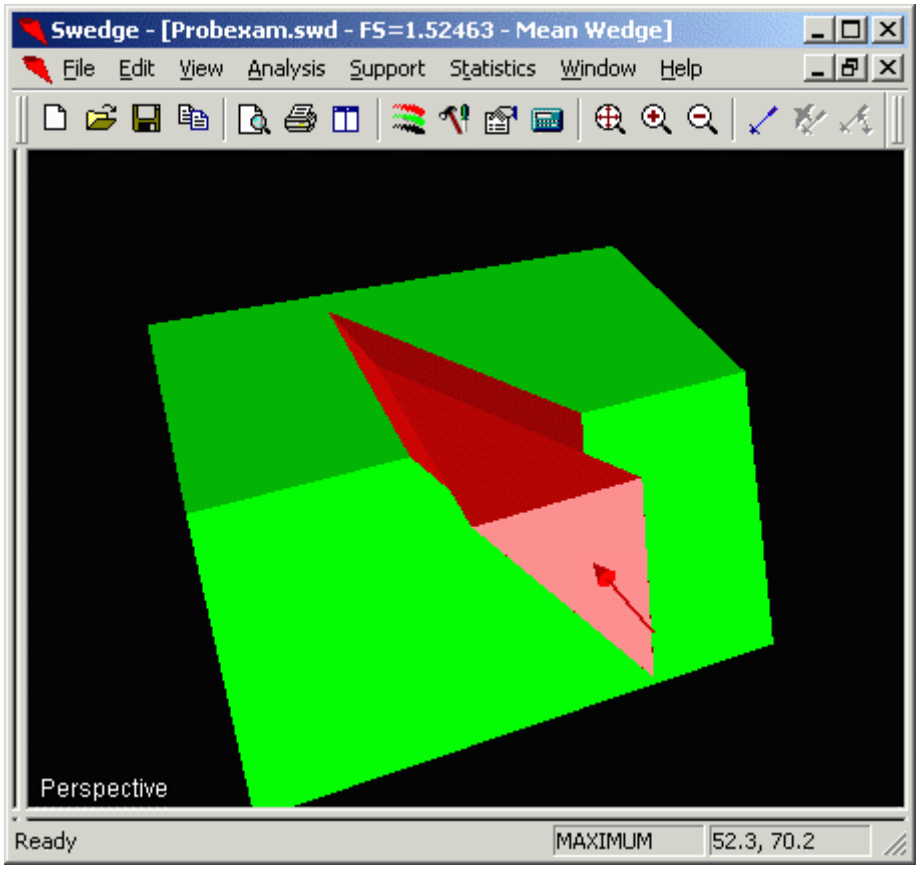
To add pressures on either the slope or upper face choose the Pressure option in the Support menu as shown in the following figure.



Then choose whether you want to add a pressure to the slope or upper face by selecting the appropriate check box. Then fill out the values for the orientation and magnitude of the pressure. The pressure magnitude is multiplied by the face area to give a force vector that is entered into the equilibrium equations for factor of safety. The following figure shows the dialog for entering the pressure.

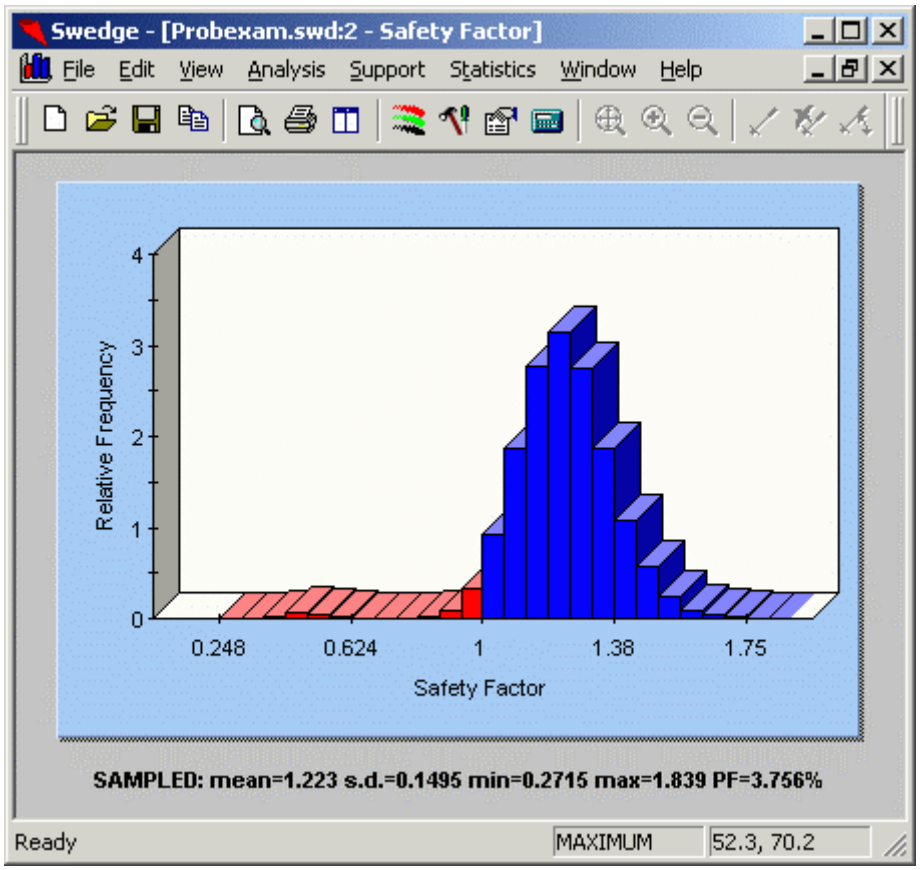


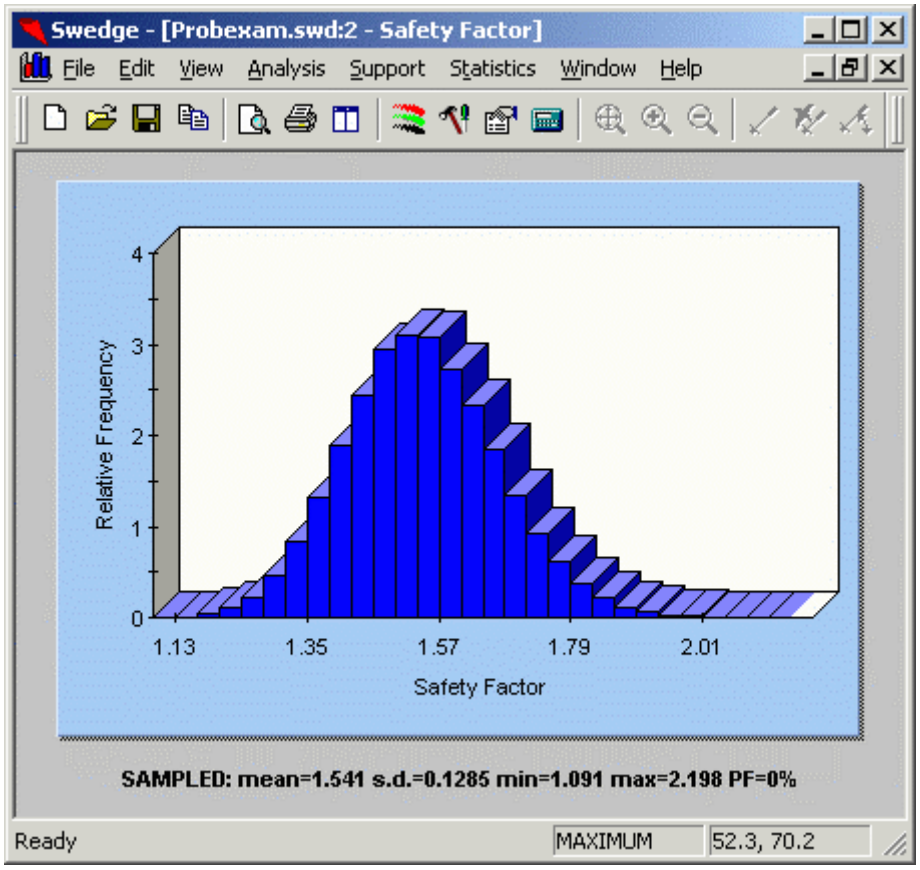
When a pressure is applied to a face, the face is drawn with a lighter color and an arrow is added to represent the force due to the pressure, as seen in the following figure:



To see the influence of a support pressure on the face of the slope, you can look at a plot of factor of safety with and without the pressure. The following two figures represent the results from a probabilistic analysis, with the previous wedge model, using 50000 samples and the latin-hypercube simulation technique.

- The first histogram illustrates a simulation with NO support pressure on the slope face. It shows a probability of failure of 3.76% and a mean factor of safety of 1.22.
- The addition of a 2.5MPa support pressure normal to the slope yields a probability of failure of 0% and a mean factor of safety of 1.54. This is depicted in the factor of safety histogram in the second figure.





As can be seen, the addition of support pressure makes the modeling of pattern bolted slopes very simple. Likewise, the modeling of pressure loads on the top of the slope is also very easy. For more information on Swedge and its features, visit the Rocscience website.