rocscience

Damage Regions (Generalized Hoek-Brown)

1.0 Introduction

This tutorial will cover how to define a damage region for a Generalized Hoek-Brown material.

In deep slope excavations, the rock near the surface of the excavation will be subject to reduced material properties from blast damage and stress relaxation. For Generalized Hoek-Brown materials, the parameter D is a "disturbance factor" which depends upon the degree of disturbance to which the rock mass has been damaged. It varies from 0 for undisturbed in situ rock masses to 1 for very disturbed rock masses.

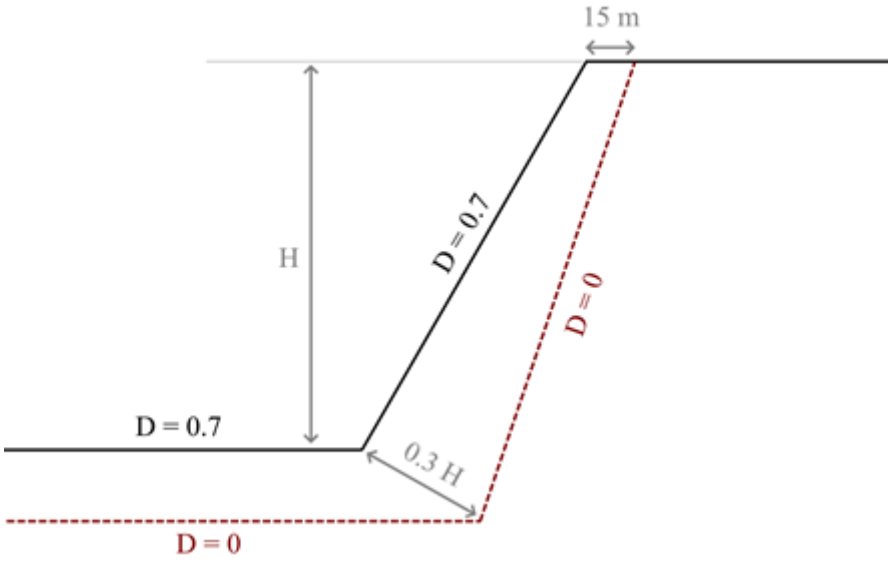
Finished Product:

The finished product of this tutorial can be found in the *Tutorial 40 Damage Regions (final).slmd* data file. All tutorial files installed with Slide2 can be accessed by selecting **File > Recent Folders > Tutorials Folder** from the Slide2 main menu.

2.0 Define Damage Region

There are various methods in the literature that can be used to determine the extent of the damage region.

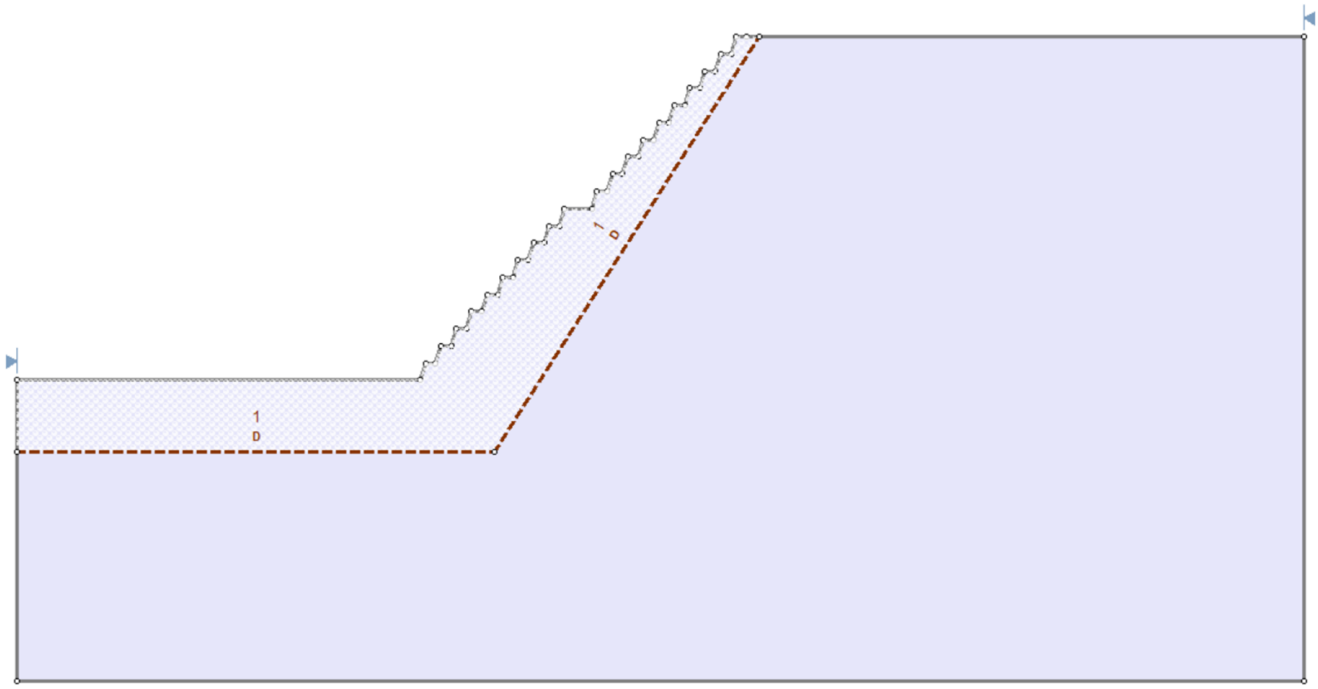
For this example, we will assume the damage region extends perpendicular to the slope to a distance up to 0.3 times the height of the slope at the base of the slope, as shown in the image below.



At the top of the slope, a horizontal distance of 15 m is defined for the extent of the damage region.

1. Select **File > Recent > Tutorials** folder from the Slide2 main menu. Open the file titled "*Tutorial 40 Damage Regions (initial).slmd*".
2. Go to **Boundaries > Add Damage Region (D = 0)**.
3. Draw the polyline using the points: (0,267), (557,267), and (865,750). Press **Enter** to finish.

The **D** symbol should be shown above the polyline, and the materials above the polyline should have a hatch overlay:

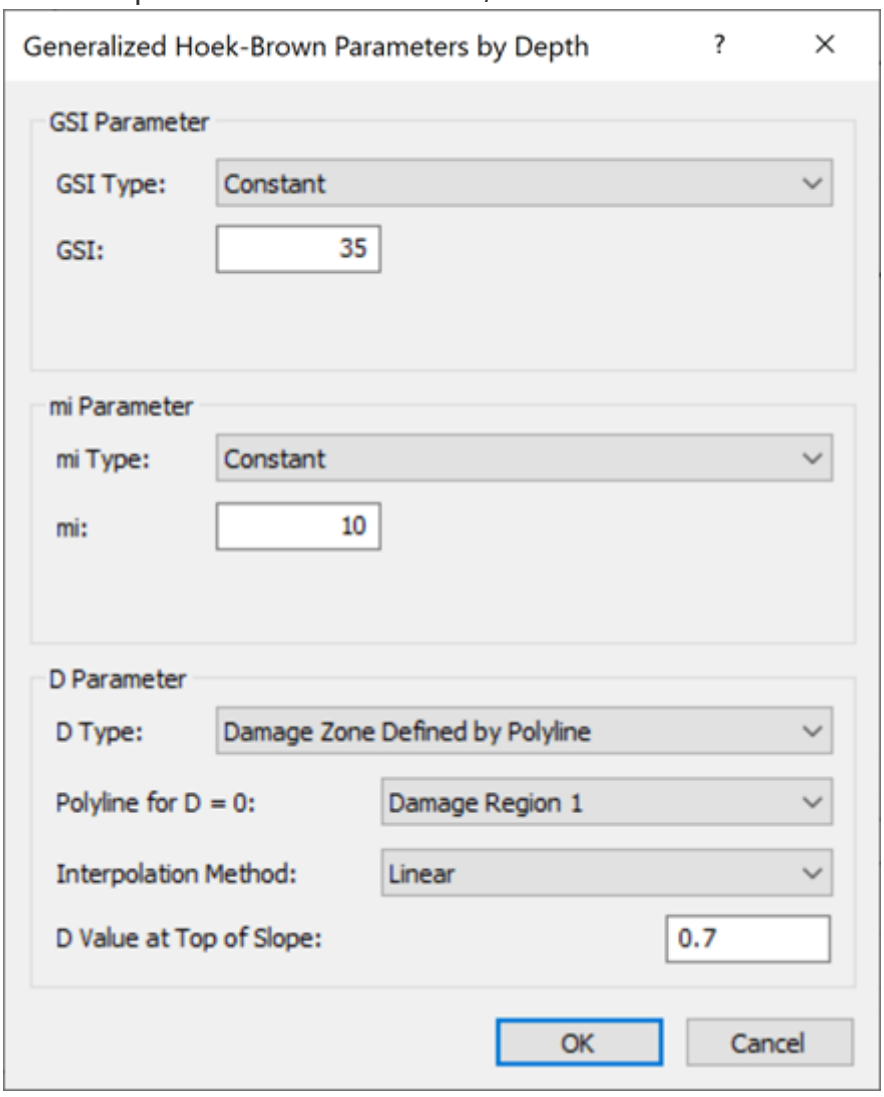


3.0 Define Material Properties

Now, the properties of the surrounding rock mass need to be defined.

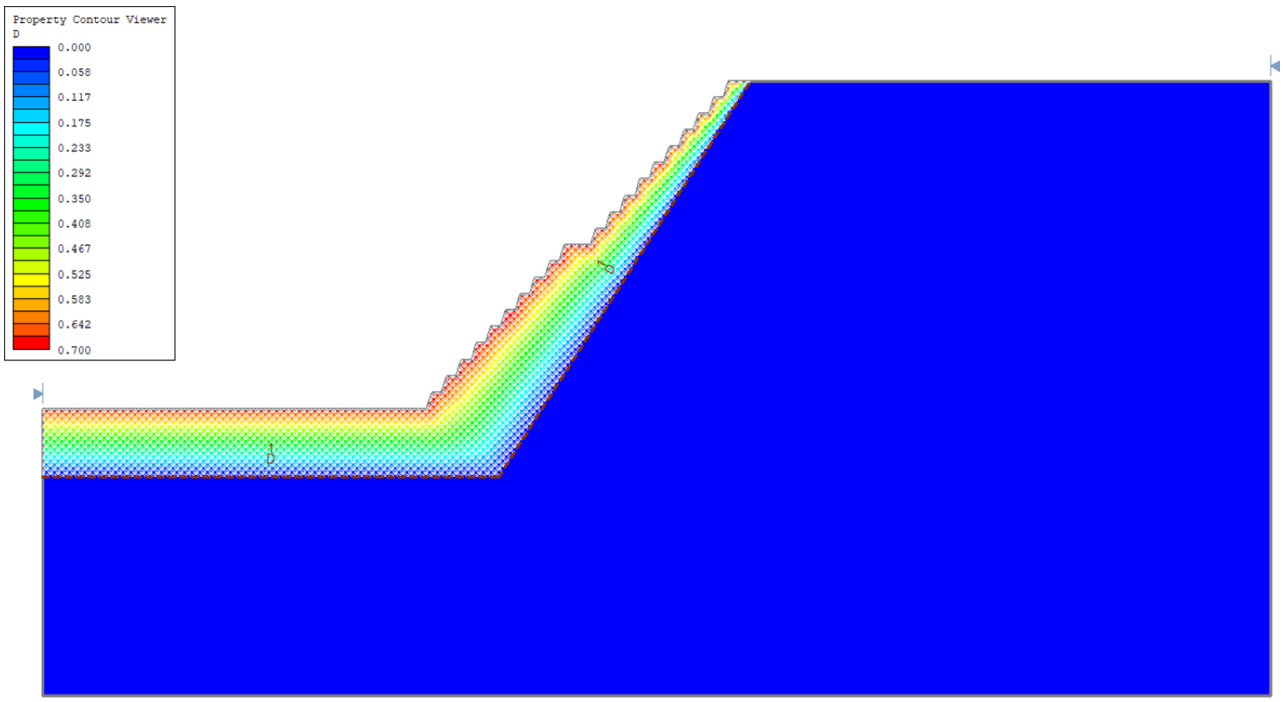
1. Go to **Properties > Define Materials**.
2. Ensure **UCS = 58,000 kPa** is entered for the rock mass.
3. Ensure **Define strength using: GSI, mi, D** is selected.
4. Toggle **ON** the **Parameters vary with depth** checkbox, and click **Define...**
5. Change the settings as follows:
    - GSI Parameter: **Constant, 35**
    - mi Parameter: **Constant, 10**
    - D Type: **Damage Zone Defined by Polyline**
    - Polyline for D=0: **Damage Region 1** (this assigns the polyline that we just created to the material)

- Interpolation Method: **Linear**, with a value of **0.7** at the top of the slope.



If a non-linear variation of the *D* parameter is preferred between the top of the slope and the polyline, you may also select the **Piecewise** option, and enter a table of values to define the change of D as a function of relative distance from the top of the slope (distance = 0%) and the polyline (distance = 100%). For detailed information on how the **Piecewise** or other **D Type** options work, please see the documentation on Generalized Hoek Brown.

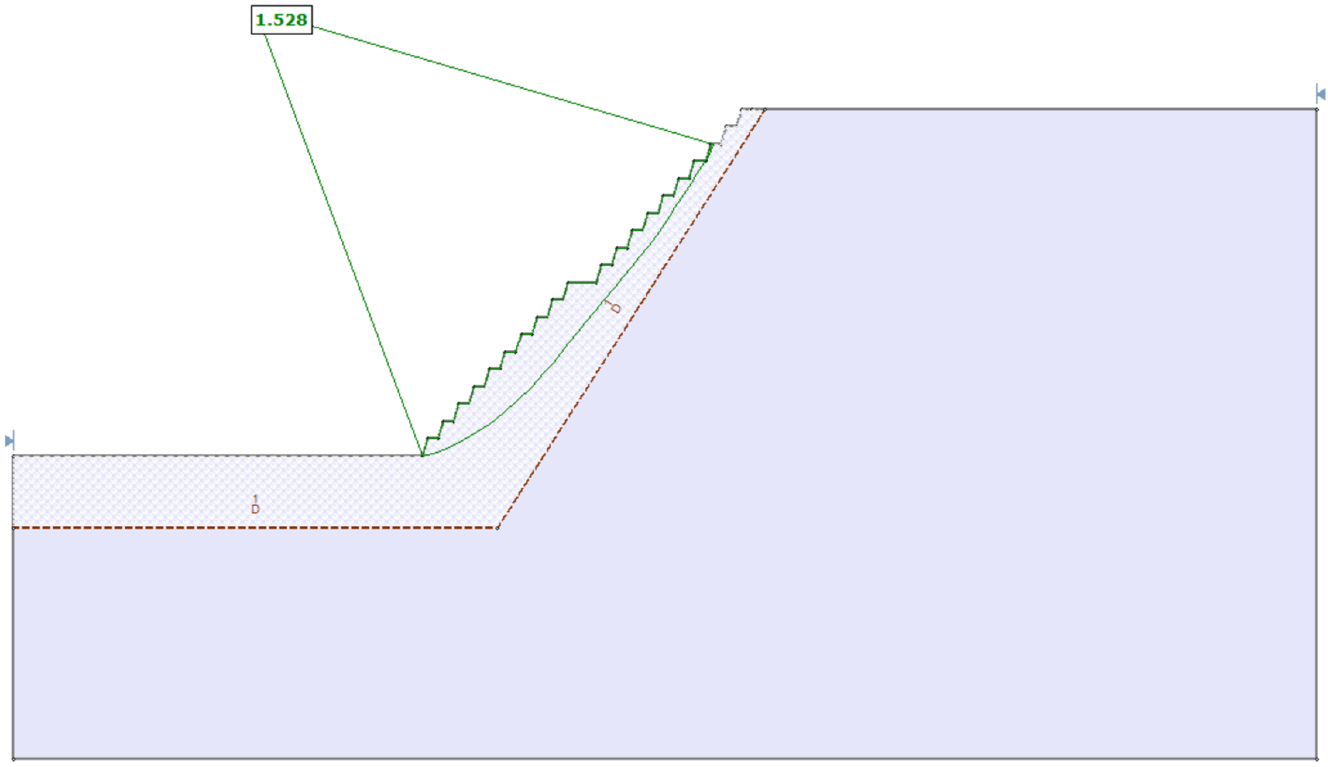
Click **OK** twice to return to the model.



6. Click **Analysis > Property Viewer** to view the variation of *D* within the material.
7. Save the model in a different location.
8. Compute the model. This may take a few minutes.

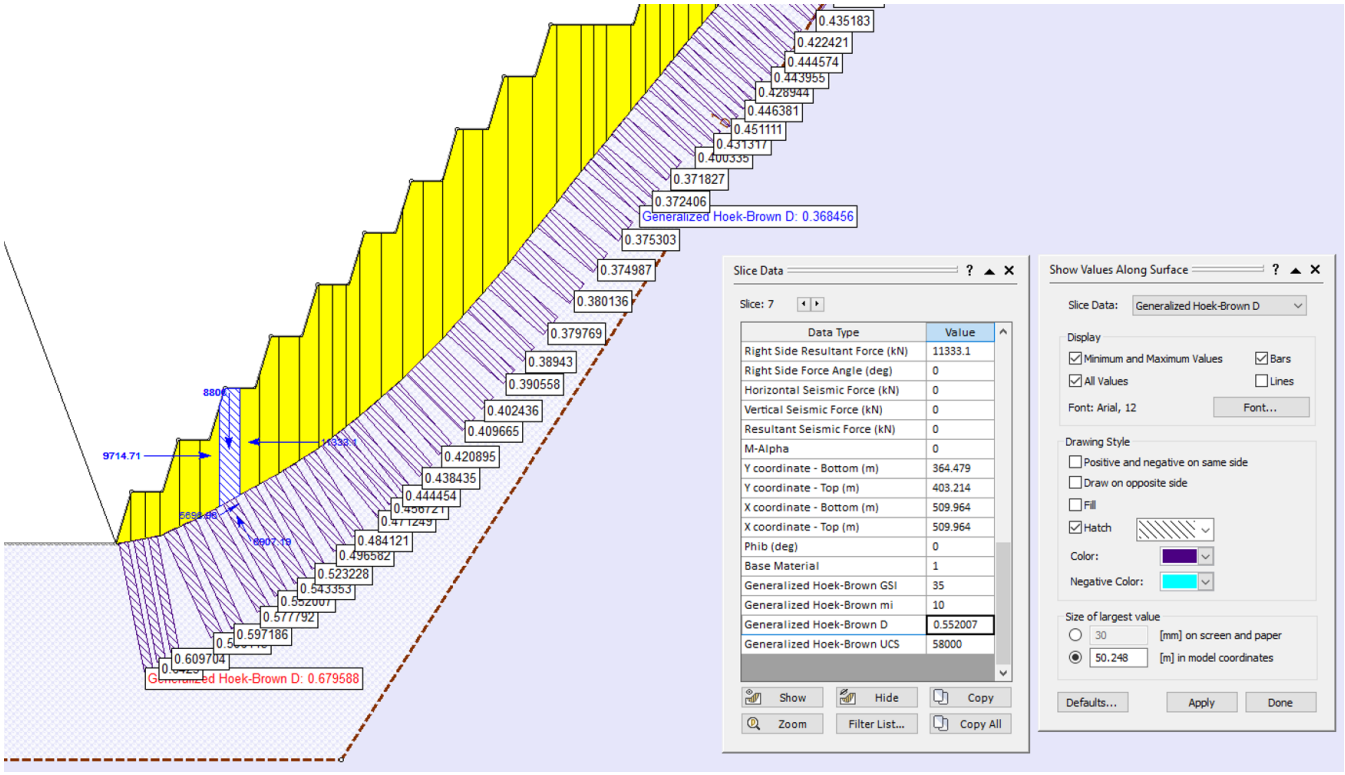
4.0 Results

Click on **Interpret** to view the computed results.



You can also view the actual values of *D* assigned to each slice during the computation via either of the following two options:

1. **Query Slice Data** and click on a slice.
2. **Show Values Along Surface** and select **Slice Data: Generalized Hoek-Brown D**. Toggle **All Values**.



This concludes the tutorial for damage region.