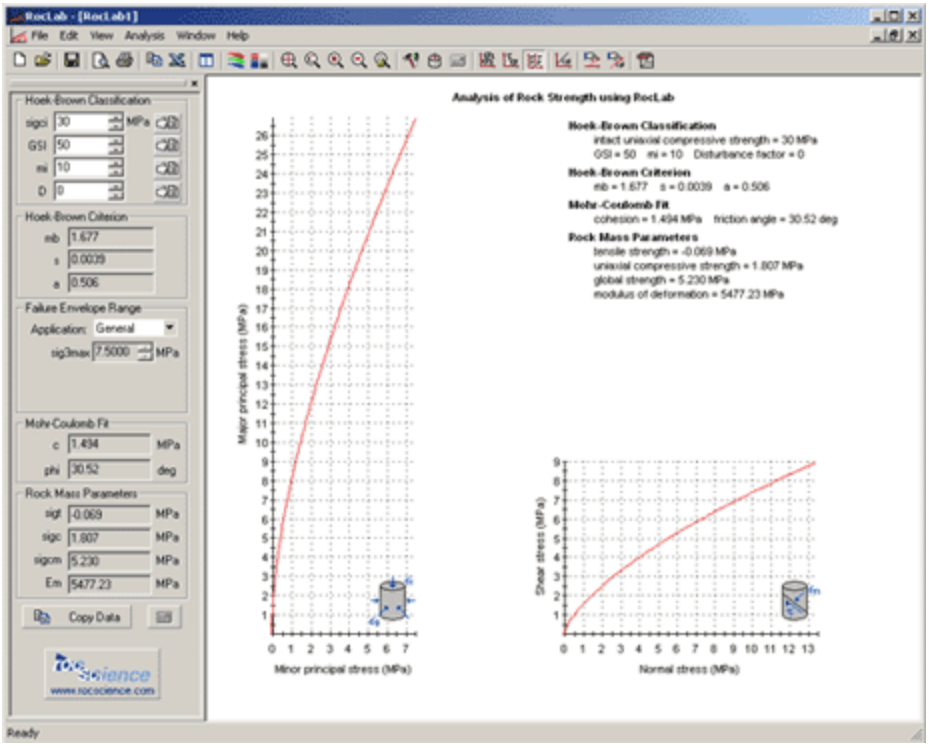
Software tools for rock and soil

RocLab is the newest addition to the Rocscience suite of geotechnical analysis software

RocLab is a software program for determining rock mass strength parameters, based on the generalized Hoek-Brown failure criterion. This new program is now available as a FREE download from the Rocscience website: **www.rocscience.com**



The calculations in the ***RocLab*** program, are based on the latest version of the Generalized Hoek-Brown failure criterion, as detailed in the following paper:

Hoek, E., Carranza-Torres, C.T., and Corkum, B. (2002), Hoek-Brown failure criterion – 2002 edition. *Proc. North American Rock Mechanics Society meeting in Toronto in July 2002*

RocLab incorporates all of the latest developments described in this paper.

RocLab and the corresponding paper will be introduced at the NARMS conference (North American Rock Mechanics Society) meeting in Toronto, July 8-10, 2002, and will be available to all attendees during the conference.

Why *RocLab*?

One of the major obstacles which is encountered in the field of numerical modeling for rock mechanics, is the problem of data input for rock mass properties.

The usefulness of elaborate constitutive models, and powerful numerical analysis programs, is greatly limited, if the analyst does not have reliable input data for rock mass properties.

The latest version of the Hoek-Brown failure criterion (Ref.), in conjunction with its implementation in the software program ***RocLab***, goes a long way toward remedying this situation.

Some formerly troublesome issues with the failure criterion have now been resolved, including:

The applicability of the criterion to very weak rock masses
The calculation of equivalent Mohr-Coulomb parameters, from the Hoek-Brown failure envelope

The program ***RocLab*** provides a simple and intuitive implementation of the Hoek-Brown failure criterion, allowing users to easily obtain reliable estimates of rock mass properties, and to visualize the effects of changing rock mass parameters, on the failure envelopes.

The rock mass properties determined by ***RocLab*** can be used as input for numerical analysis programs such as ***Phase2*** (finite element stress analysis and support design for excavations) or ***Slide*** (limit equilibrium slope stability analysis). ***Phase2*** and ***Slide*** are also available from Rocscience.

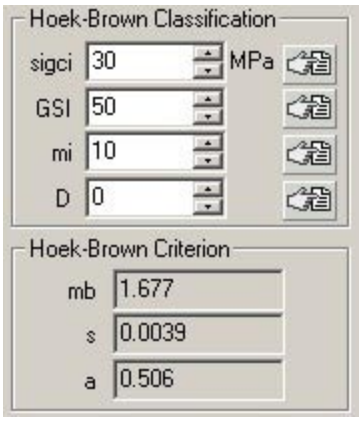
How can I use *RocLab*?

The following tasks can be accomplished with RocLab. For more information and screen captures, see the RocLab webpage: http://www.rocscience.com/products/RocLab.asp.

Determine Strength Parameters

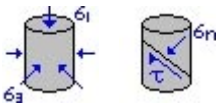
Determine the Generalized Hoek-Brown strength parameters of a rock mass (mb, s and a), based on the following input data:

Unconfined compressive strength of intact rock **sigci**
The intact rock parameter **mi**
The geological strength index **GSI**
The disturbance factor **D**

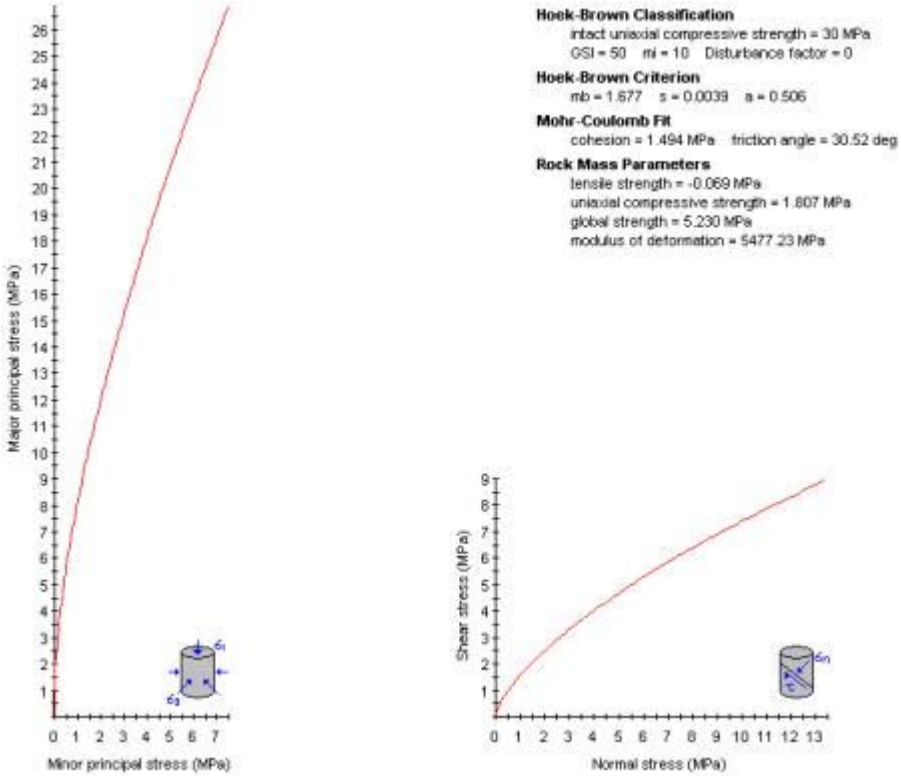


Plot failure envelopes

RocLab can plot the Hoek-Brown failure envelope in principal and / or shear-normal stress space.



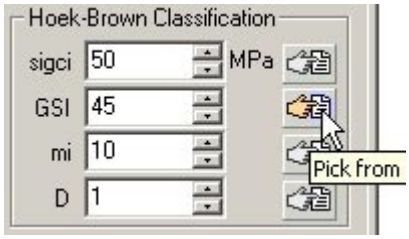
The user can interactively change sigci, GSI, mi, D, to see how the failure envelope changes with each parameter.



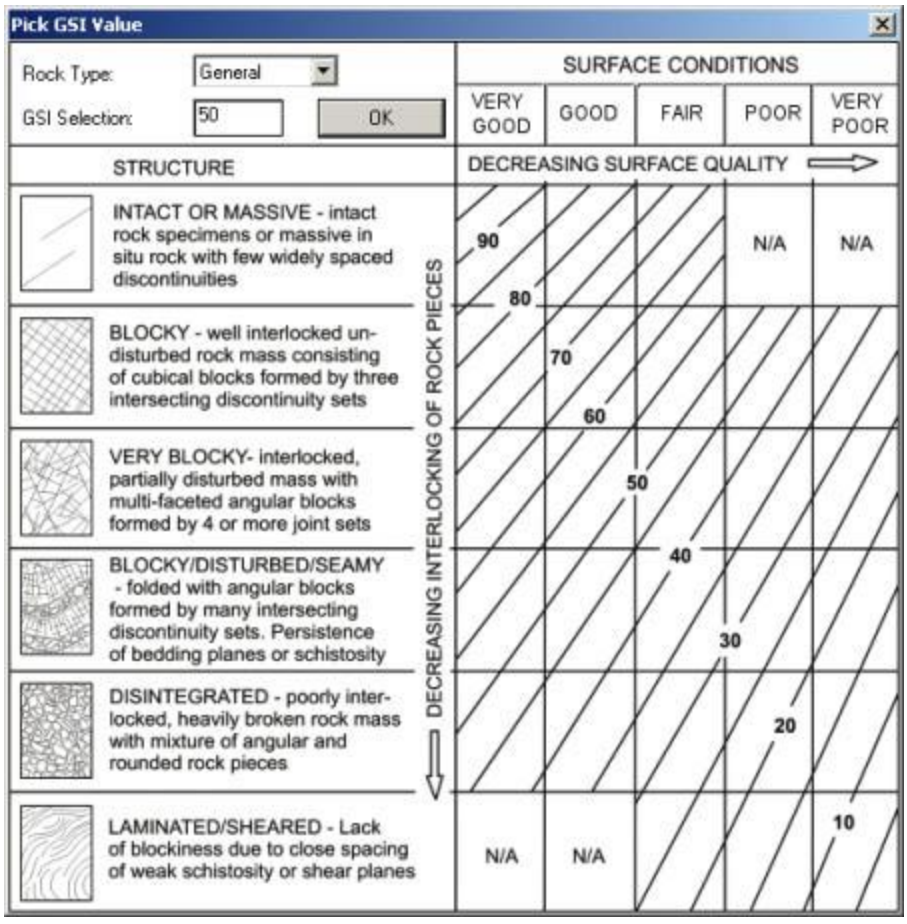
Estimation of input parameters

Each of the parameters used as input for the Hoek-Brown criterion – sigci, mi, GSI and D – can be estimated using convenient charts and tables built into ***RocLab***.

These charts and tables are accessed by selecting the “Pick” button located beside each of the input parameter edit boxes in the sidebar.



When you select a Pick button, a table or chart will appear, allowing you to determine a suitable value for the desired parameter, based on rock type, geological conditions, etc. For example, the dialog for estimation of GSI (Rock Type = General) is shown below.

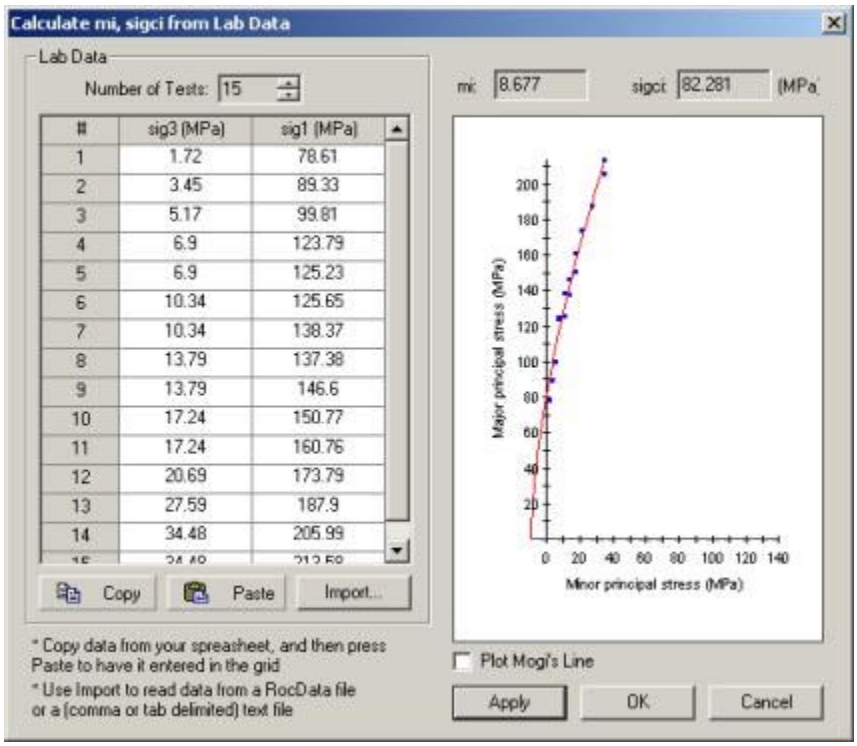


GSI chart (Rock Type = General)

Triaxial lab test data

Triaxial lab tests on intact rock, can be used to determine sigci and mi using the Marquardt-Levenberg fitting technique.

The triaxial data can be imported from Microsoft Excel through the clipboard, tab-delimited or comma separated value text files, RocData or other RocLab files.
The data can also be entered in the program using a built-in spreadsheet.



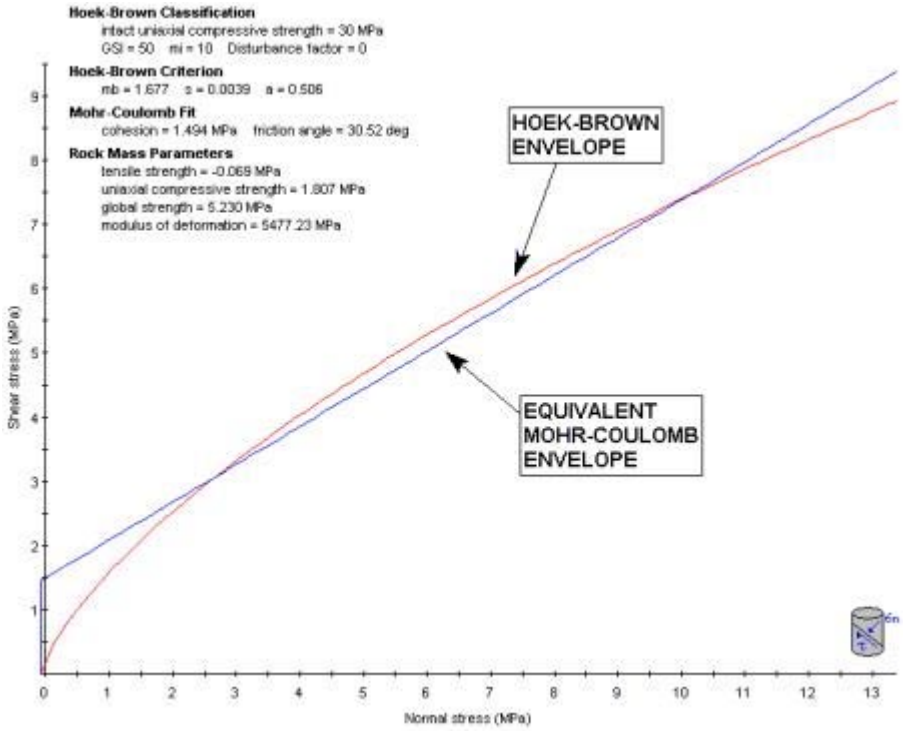
Equivalent Mohr-Coulomb Parameters

RocLab also calculates equivalent Mohr-Coulomb parameters (cohesion and friction angle) for the rock mass.

Since most rock engineering software is still written in terms of the Mohr-Coulomb failure criterion, the calculation of equivalent Mohr-Coulomb parameters from the Hoek-Brown failure criterion, is an important feature of the ***RocLab*** program.

The best-fit Mohr-Coulomb strength envelope is determined over a stress range that you can define based on your application (i.e. tunneling or slope stability).

The corresponding Mohr-Coulomb envelope can be plotted in both principal and shear-normal stress space.



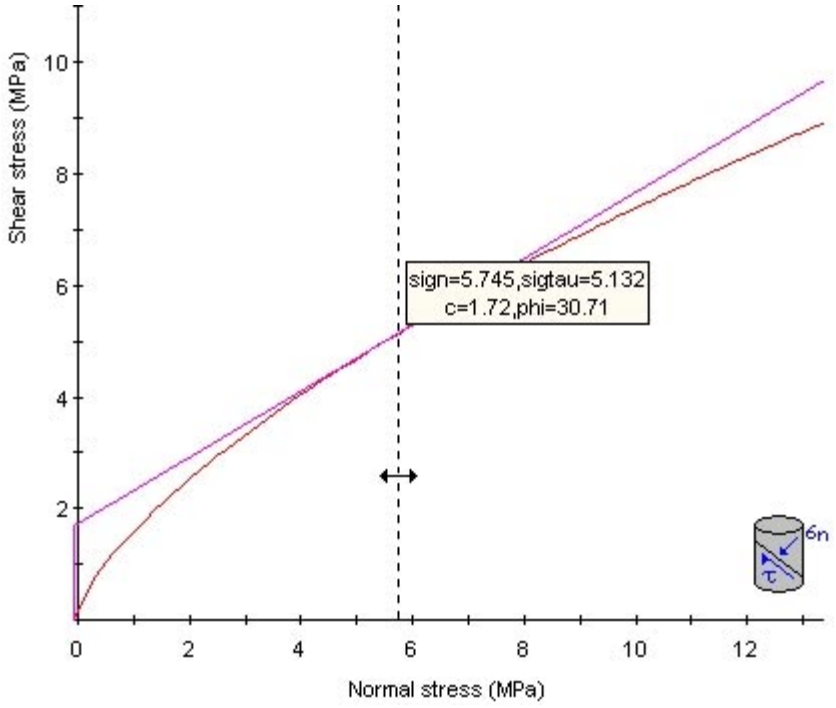
Mohr-Coulomb envelope displayed as an overlay on shear-normal plot.

Stress Sampler

Graphically sample the Hoek-Brown or Mohr-Coulomb failure envelope to determine strength for any discrete value of stress (principal, shear or normal stress).

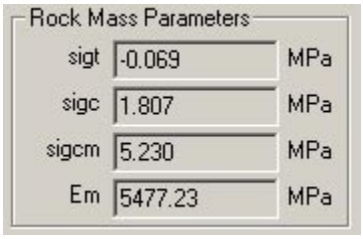
Instantaneous MC Sampler

The *Instantaneous Mohr-Coulomb Sampler* option allows the user to graphically obtain the instantaneous Mohr-Coulomb parameters (cohesion and friction angle), at any point along the Hoek-Brown failure envelopes.



Other Rock Mass Parameters

The program also calculates rock mass parameters such as tensile strength, uniaxial compressive strength and deformation modulus.



Export Data / Images

Export data for further analysis or report writing:

Copy the data and / or plots to the clipboard for easy import into Microsoft Word or your favorite word processor or image editing program.
Direct export to Excel - export data and plots directly into Microsoft Excel with a single mouse click
Save the plots directly to a JPEG or BMP image file.
Print and Print Preview capabilities.

Display Options

Numerous Display Options to customize the appearance of your plots:

Change colors, fonts, line thickness
Grid overlay
Add plot title and show input data directly on plots
Zooming
Plot Mogi's line (transition from brittle to ductile failure)
Grayscale for output to black and white printers

References

Hoek, E., Carranza-Torres, C.T., and Corkum, B. (2002), Hoek-Brown failure criterion – 2002 edition. *Proc. North American Rock Mechanics Society meeting in Toronto in July 2002.*