# RocData / RocLab Update

## Implementation of the Hoek-Diederichs Modulus Estimation Method

*RocData* version 4 and *RocLab* version 1 have both been updated to provide the user with a more accurate technique for the determination of rock mass modulus $E_{rm}$ through the Hoek-Diederichs modulus estimation method[1].

The Hoek-Diederichs method uses the equation:

$$E_{rm} = E_i \left( 0.02 + \frac{1 - D/2}{1 + e^{((60+15D-GSI)/11)}} \right)$$

*where*,

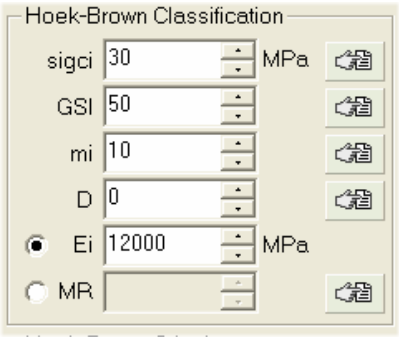
$E_{rm}$ = Rock Mass Modulus

$E_i$ = Intact Rock Modulus

$D$ = Disturbance Factor

$GSI$ = Geological Strength Index

to determine the rock mass modulus. It has shown to provide more reliable results than both the Simplified Hoek-Diederichs method[1] and the Hoek, Carranza-Torres and Corkum method[2]. As a result, Rocscience has updated both the *RocData* and *RocLab* software packages to reflect this. *RocLab* no longer supports the above two methods and only uses the Hoek-Diederichs method to compute rock mass modulus. *RocData* still maintains support for the above two methods but by default uses the Hoek-Diederichs method to compute rock mass modulus.




In both *RocData* and *RocLab*, the sidebar has been updated to reflect the required definition of the intact rock modulus $E_i$. If the value of $E_i$ is unknown, or completely undisturbed sampling for measurement of $E_i$ is difficult, a modulus ratio $MR$[3] can be used to estimate $E_i$. Using the modulus ratio $MR$ and the unconfined compressive strength of intact rock $\sigma_{ci}$, it is possible to estimate the intact modulus $E_i$ through the equation:

$$E_i = (MR)\sigma_{ci}$$

To help define a modulus ratio, a popup table has been added to help the user pick from a list of estimated *MR* values for different rock types, as shown in Figure 1.

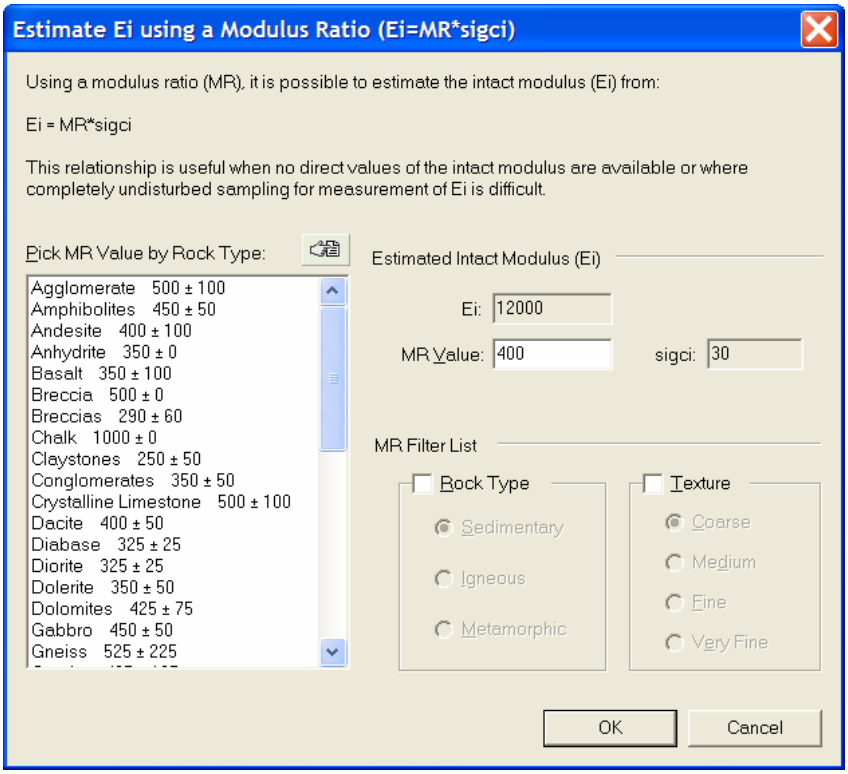



*Figure 1 – Table for estimation of $E_i$ from MR*

Another option for estimating intact modulus $E_i$ in *RocData*, is to use the *RocProp* program to search the database of rock properties for modulus values of a particular rock type, as shown in Figure 2.

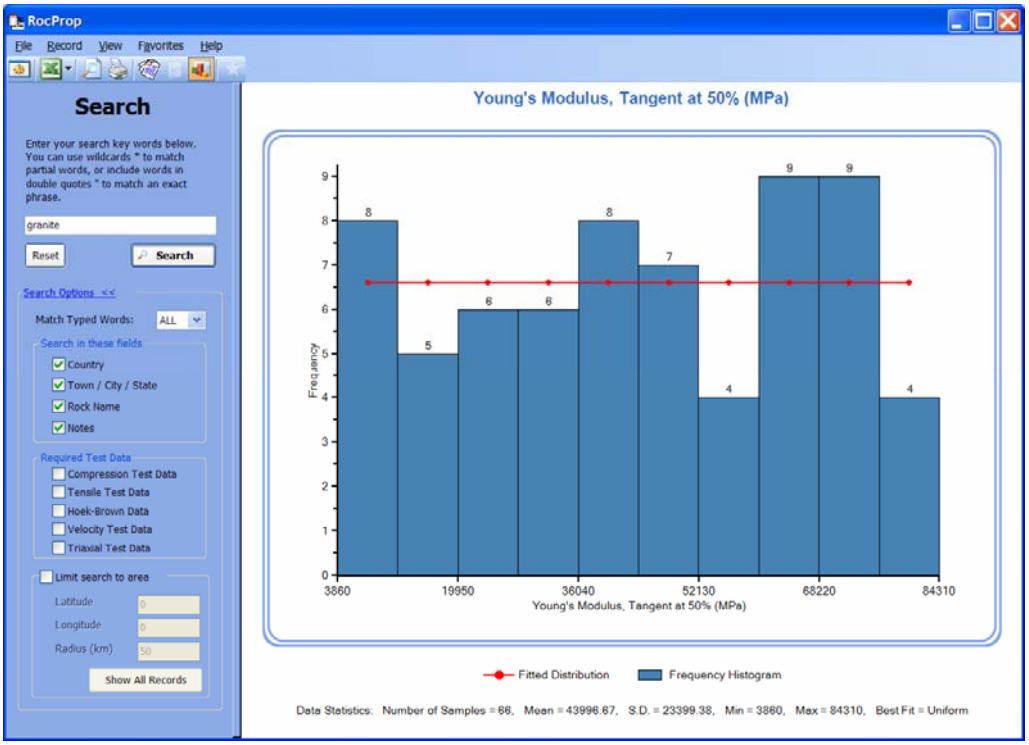



*Figure 2 – RocProp results for intact modulus of granite*

*RocProp* provides a database of over 900 lab tests on rock samples. It provides numerous values of both intact strength and modulus for many different rock types. It also contains entire triaxial datasets for hundreds of tests. If you are unsure of your intact strength or modulus values, we highly recommend using *RocProp* to gain insight into these values.

To download the latest *RocLab* and *RocData* updates, we recommend using the Automatic update feature in the Help menu of both programs. You can also download the full install of *RocLab*, for free, from our website.

## References


1. Hoek, E. and Diederichs, M.S. (2006), Empirical estimation of rock mass modulus. *International Journal of Rock Mechanics and Mining Sciences*, **43**, p. 203–215.

2. Hoek, E., Carranza-Torres, C.T., and Corkum, B. (2002), Hoek-Brown failure criterion – 2002 edition. *5th North American Rock Mechanics Symposium and 17th Tunneling Association of Canada Conference: NARMS-TAC, 2002,* p. 267-271.

3. Deere, D.U. (1968), Chapter 1: Geological considerations. In: Stagg K.G., Zienkiewicz O.C., editors. *Rock mechanics in engineering practice*. London: Wiley; 1968. p. 1–20.