



Comparison of Rock Mass Properties Calculator with Rocscience Roclab

Rock Mass Properties Calculator is a specialized software designed to calculate rock mass strength parameters using the latest generalized Hoek–Brown failure criterion. It offers a straightforward and user-friendly approach, enabling users to accurately estimate rock mass properties and visualize how variations in these parameters influence failure envelopes.

We will compare the results generated by our calculator with those from RocLab to assess its accuracy and functionality.

See in the below the example in **Figure 1** from Roclab which we will use for comparison.

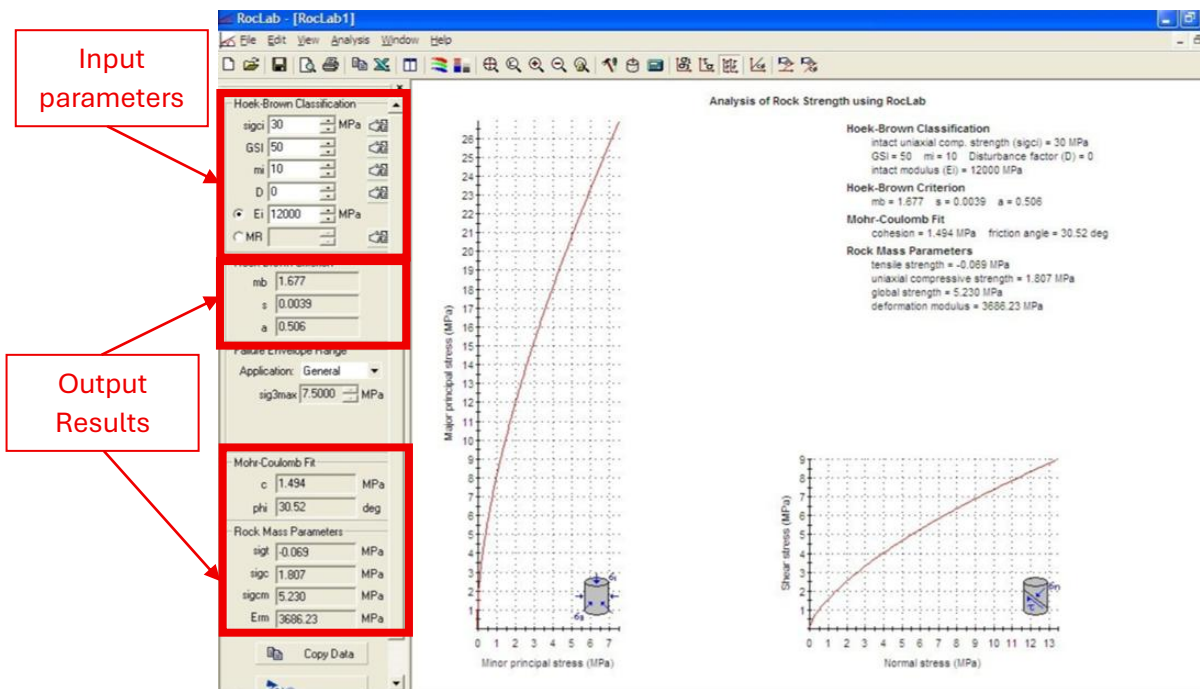


Figure 1 – Roclab Input and Output Results

Data Input/Output: Hoek-Brown Input and Output Parameters

Input Parameters

Using the following Hoek–Brown failure criteria parameters as input:

- the unconfined compressive strength of intact rock
- the geological strength index GSI
- the intact rock parameter m_i and
- the disturbance factor D

Table 1 - Input Parameters of Tunnel (Depth=342.4m)

Uniaxial compressive strength of intact rock	σ_{ci}	30	MPa
Young's Modulus	E_i	12000	MPa
Unit Weight	γ	25	kN/m ³
Depth of Tunnel	H	342.4	m
Intact Hoek–Brown constant:	m_i	10	



Geological Strength Index:	GSI	50
Disturbance factor:	D	0

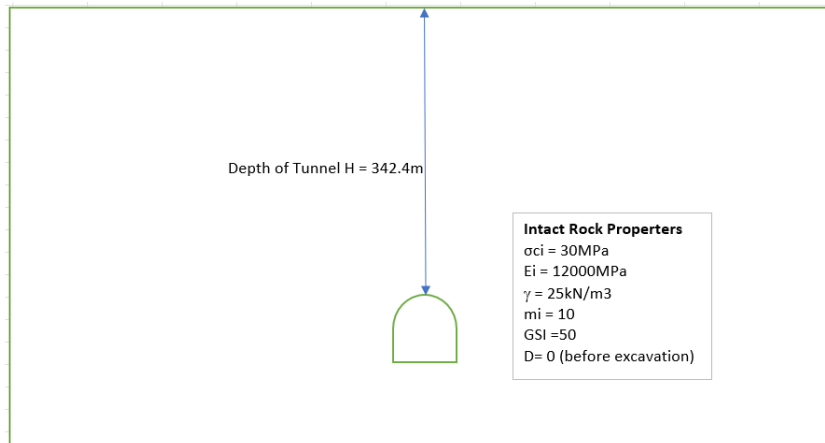


Figure 2 -Schematic Diagram of Tunnel Below Ground Surface

Now we will use the same input values in RMP calculator, used in Roclab to see the results.

Input Parameters

Enter Hoek-Brown failure criteria parameters for your rock mass analysis

Manual Input **Quick Presets**

Application Type

Tunnel Design

Uniaxial Compressive Strength (σ_{ci})

30 MPa

Typical range: 1-300 MPa

Rock Type & Modulus Ratio (MR)

Granite^{MR}: 425

Modulus Ratio (MR) **Calculated Ei (GPa)**

400 12.0

MR values from Hoek's Corner (RocScience). Ei = MR × UCS / 1000

Unit Weight (γ)

25 kN/m³

Typical range: 20-30 kN/m³ (for stress calculations)

Geological Strength Index (GSI)

50

Range: 0-100 (higher values indicate better rock mass quality)

Material Constant (mi)

10

Typical range: 4-35 (depends on rock type and grain size)

Disturbance Factor (D)

0

Range: 0-1 (0 = undisturbed, 1 = very disturbed)

Tunnel Shape

Circular (A: 3, B: 3)

Shape factors for tangential stress calculation

Tunnel Factor A **Tunnel Factor B**

3 3

Factors for tangential stress ($\sigma_\theta = A \cdot \sigma_v - B \cdot \sigma_h$)

Tunnel Depth/Cover

342.4 m

Earth Pressure Coefficient (K)

2

K = σ_h / σ_v . Typical range: 0.3-1.5 (σ_v and σ_h will be calculated)

Tunnel Diameter

4 m

Figure 2 - Rock Mass Properties Calculator Input parameters

After incorporating all the input parameters, we need to click to get the results.

[Calculate Hoek-Brown Parameters](#)

Output Parameters

Table 3- Output Results of Tunnel from RocLab

mb	Hoek's Constant	1.677
s	Hoek's Constant	0.0039



a	Hoek's Constant	0.506	
Ed	Modulus of Deformation	3686.23	Mpa
σ_c	UCS of Rockmass	1.807	MPa
σ_t	Tensile strength of the rock mass	-0.069	MPa
σ_{cm}	Global Rock Mass Strength	5.23	MPa
σ_{3max}	Maximum horizontal Stress	7.5	MPa
ϕ	Friction Angle of Rockmass	30.522	°
c'	Cohesion of Rockmass	1.493	Mpa

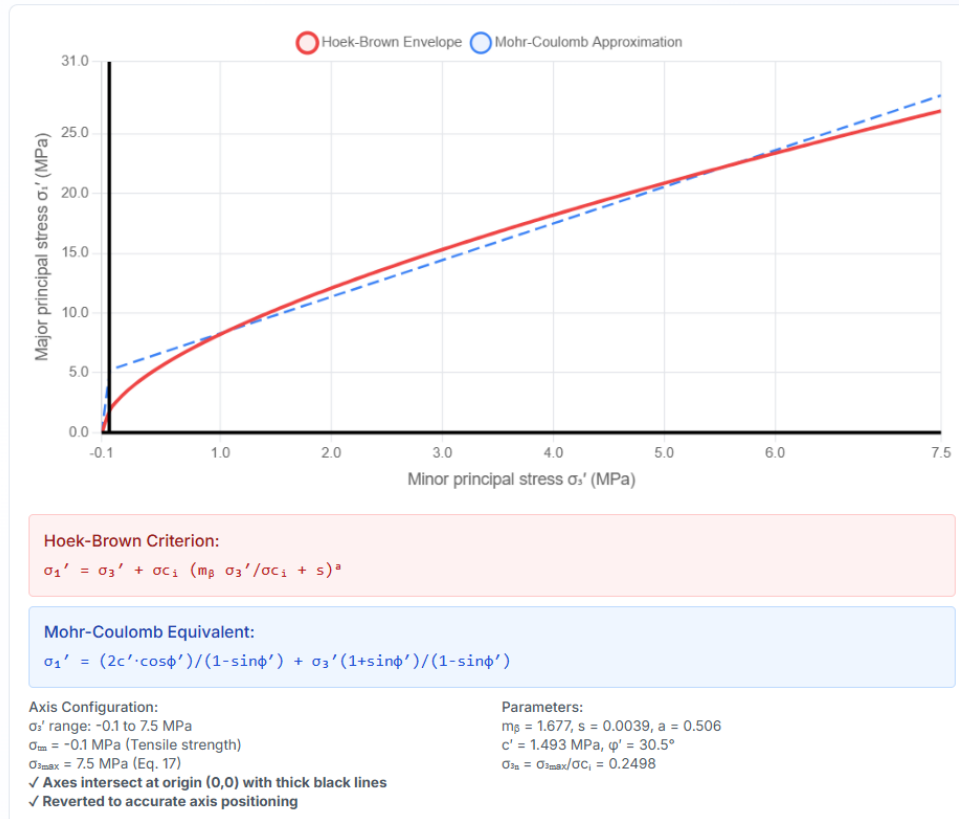
Calculation Results			Fair	PDF
Parameter	Value	Unit		
Hoek-Brown Parameters				
mb	1.677	-		
s	0.0039	-		
a	0.506	-		
In-Situ Stresses				
Vertical Stress (ov)	8.560	MPa		
Horizontal Stress (oh)	17.120	MPa		
Rock Mass Strengths				
UCS of Rock Mass (oc)	1.807	MPa		
Global Rock Mass Strength (ocm)	5.230	MPa		
Tensile Strength (otm)	0.069	MPa		
Deformation Modulus (Erm)	3.686	GPa		
Strain Analysis				
Strain (ε)	2.143	°		
Tunnel Stress Analysis				
Max Stress at Crown (omax)	42.800	MPa		
Max Stress at Walls (omax)	8.560	MPa		
Equivalent Mohr-Coulomb Parameters				
Cohesion (c')	1.493	MPa		
Friction Angle (φ')	30.522	°		

Figure 3 - Rock Mass Properties Calculator Output Parameters



Display Capabilities: Instantaneous MC Sampler

The Instantaneous Mohr–Coulomb Sampler feature enables users to visually extract cohesion and friction angle values at any point along the Hoek–Brown failure envelope.



Batch Calculator

Batch Calculator works on the same principle as in the Single Calculator. Batch Calculator with includes many sections along the tunnel alignment. Right now, you can add up to 50 rows. If you need more rows, please let us know.

**Batch Calculator**
Calculate multiple problems simultaneously

← Back to Home

**Batch Calculation Table**
Enter parameters for up to 50 problems. All rows will be calculated at once.

 Import CSV  Export CSV  Add Row  Calculate All

#	Actions	Depth (m)	GSI	UCS (MPa)	m _i	D	γ (kN/m³)	K	MR	Tunnel Shape	Factor A	Factor B	Diameter (m)	σ _v (MPa)	σ _h (MPa)	E _i (GPa)	m _B	s	a	σ _c (MPa)	σ _c (MPa)	E _m (GPa)	c	(M
1		30	60	100	25	0.5	25	0.5	425	Circular 	3	3	5	-	-	42.50	-	-	-	-	-	-		
2		30	60	100	25	0.5	25	0.5	425	Circular 	3	3	5	-	-	42.50	-	-	-	-	-	-		
3		30	60	100	25	0.5	25	0.5	425	Circular 	3	3	5	-	-	42.50	-	-	-	-	-	-		
4		30	60	100	25	0.5	25	0.5	425	Circular 	3	3	5	-	-	42.50	-	-	-	-	-	-		

Total Rows: 4 / 50

Legend:

- Blue columns = Input parameters (editable)
- Green columns = Output results (calculated)
- E_i is calculated as: MR × UCS / 1000



All Reference Charts You will get below Educational Resources.

Educational Resources

Learn about the Hoek-Brown failure criteria, parameter meanings, and practical applications

Reference Charts for Parameter Selection

The following reference charts from Hoek and collaborators provide guidance for selecting appropriate parameter values.

GSI Chart



Blasting Factor D



modulus ration (MR)



mi Chart



Relationship between Strain and Squeezing Ground Condition



Reference

1. Hoek-Brown failure criterion – 2002 Edition E. Hoek, C. Carranza-Torres and B. Corkum *Proc. NARMS-TAC Conference*, Toronto, 2002, 1, 267-273.
2. Hoek E. (2002). *Practical Rock Engineering*. London: Institution of Mining and Metallurgy. pp. 325.
3. Hoek E. and Brown E.T. (1980). "Empirical strength criterion for rock masses". *J. Geotechnical Engineering Division ASCE*: 1013–1025.
4. Hoek, E. and Brown (1988). "The Hoek-Brown failure criterion - a 1988 update". *Proc. 15th Canadian Rock Mech. Symp.*: 31-38. Hoek E, Carranza-Torres CT, Corkum B (2002). "Hoek-Brown failure criterion-2002 edition". *Proceedings of the fifth North American rock mechanics symposium* vol. 1: 267–273.