A short introduction to the Rock Mass index (RMi) and its applications

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An important issue has been to use parameters in the RMi, which have the greatest significance in engineering. The main principles in the RMi value and the input data used are shown in Figures 1 and 2.

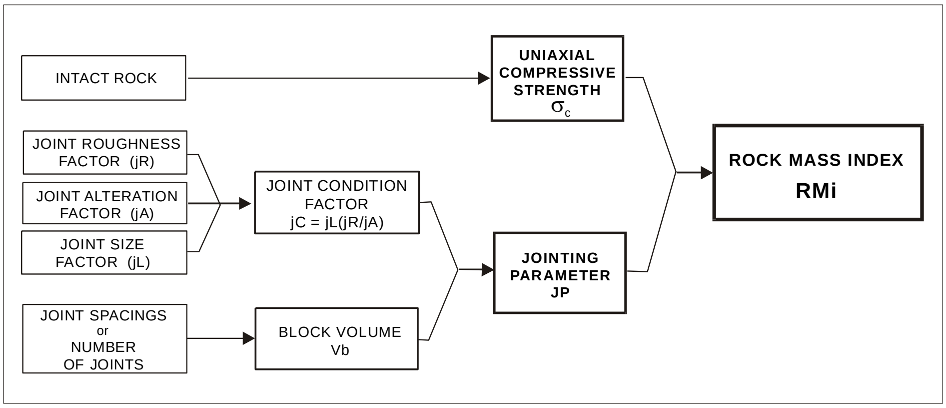

Figure 1 The layout of the Rock Mass index, RMi

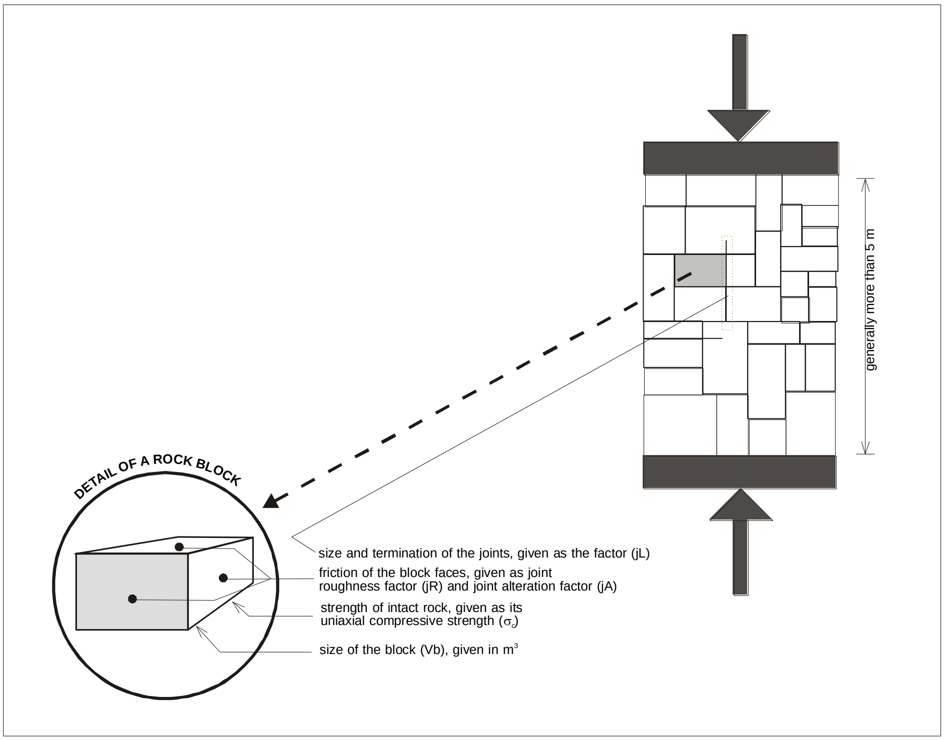

Figure 2 The main parameters in the rock mass are included in the RockMass index, which approximately characterizes the uniaxial compressive strength of a rock mass.

RMi is based on the principle that the joints intersecting a rockmass tend to reduce its strength. Consequently, it is expressed as: RMi = $\sigma_c \times$ JP

Here σ_c = the uniaxial compressive strength of intact rock (in MPa), measured on 50 mm samples.
JP = the jointing parameter, expressing the reduction in strength of the intact rock caused by the joints. As shown in Figure 1 it incorporates the main joint features in the rock mass. The expression for JP was found using the diagram in Figure 3.

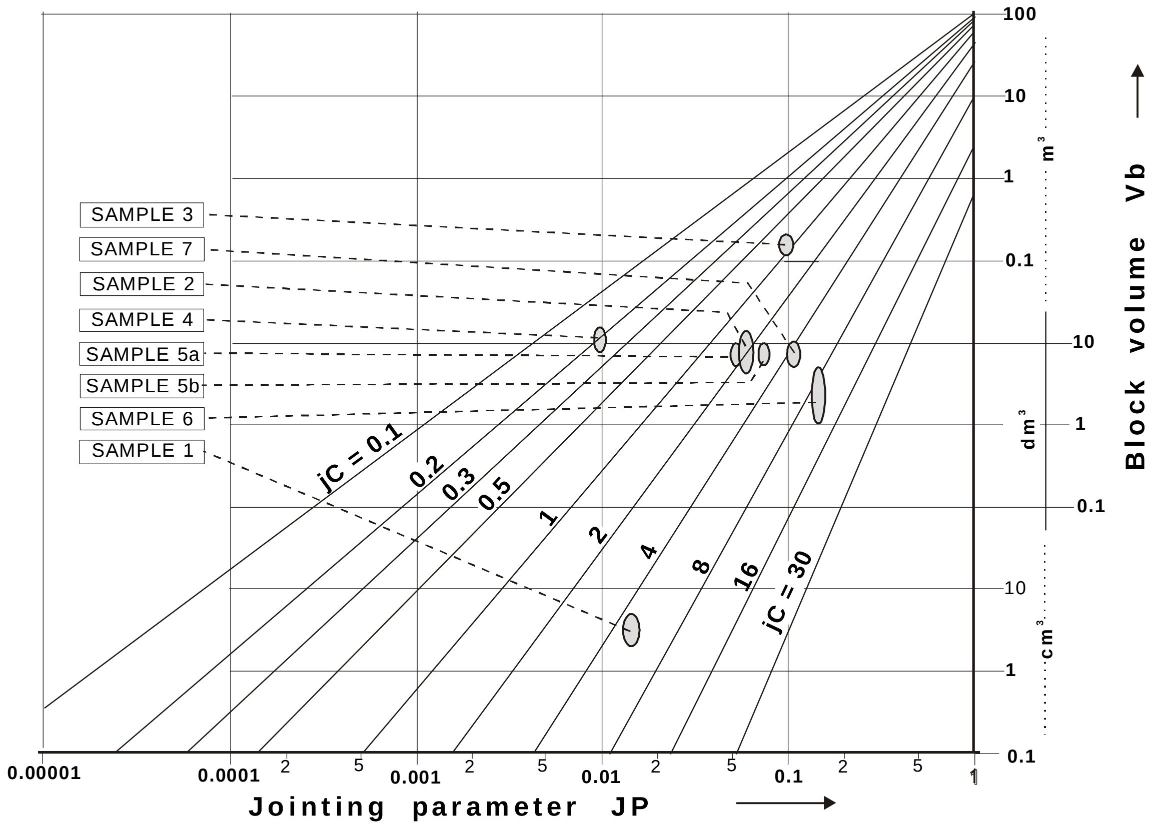

Figure 3 Test results from 8 large scale compressive strength tests or back calculations were used to find the expression for the jointing parameter, JP. The known data for the samples were plotted in the diagram and the lines for the joint characteristics, jC, were draw as shown. These lines represent the expression for JP. Unfortunately, it was not possible to detect more than the 8 large scale test results, though many organisations and companies were contacted.

From Figure 3 the Jointing Parameter was found as JP = $0.2\sqrt{jC} \times Vb^{D}$

where D = $0.37jC^{-0.2}$

The diagram in Figure 3 can be used to find JP when Vb and jC are known from field observations or estimated from site descriptions. The values or ratings of the input joint features incorporated in JP are shown in Table 1.

As RMi is a measure for the strength of a rock mass it can be applied in several applications. The main are shown in Figure 4.

Table 1 The input parameters to RMi

Uniaxial compressive strength of intact rock (σ_c)	**value** in MPa (from lab. tests or assumed from handbook tables)
Block volume (Vb)	**value** in m³ (from observations at site or on drill cores, etc.)
Joint condition factor (jC)	**jC = jR x jL / jA** (ratings of jR, jA and jL from the tables below)

jR (joint roughness factor, which is composed of large scale and small scale undulations, similar to Jr in the Q-system)

(The ratings in ***bold italic*** are similar to Jr)		Large scale waviness of joint plane				
		Planar	Slightly undulating	Undulating	Strongly undulating	Stepped or interlocking
Small scale smoothness of joint surface	Very rough	2	3	4	6	6
	Rough	***1.5***	2	***3***	4.5	6
	Smooth	***1***	1.5	***2***	3	4
	Polished or slickensided *)	***0.5***	1	***1.5***	2	3
	For filled joints jR = 1 For irregular joints a rating of jR = 6 is suggested					

*) *For slickensided surfaces the ratings apply to possible movement along the lineations*

jA (joint alteration factor, which ratings are based on Ja in the Q-system)

Contact between joint walls	CLEAN JOINTS:	Healed or welded joints	filling of quartz, epidote, etc.		jA = 0.75
		Fresh joint walls	no coating or filling, except from staining (rust)		1
		Altered joint walls	- one grade higher alteration than the rock		2
			- two grades higher alteration than the rock		4
	COATING or THIN FILLING OF:	Frictional materials	sand, silt calcite, etc. without content of clay		3
		Cohesive materials	clay, chlorite, talc, etc.		4
Partly or no wall contact	THICK FILLING OF:	Frictional materials	sand, silt calcite, etc. (non-softening	jA = 4	8
		Hard, cohesive materials	clay, chlorite, talc, etc.	6	5 - 10
		Soft, cohesive materials	clay, chlorite, talc, etc.	8	12
		Swelling clay materials	material exhibits swelling properties	8 - 12	13 - 20
				Thin filling (< 5 mm)	Thick filling

jL (joint size factor, which is composed of the length and continuity of the joint)

		Continuous joints	***Discont. joints****
Bedding or foliation partings	length < 0.5 m	jL = 3	jL = 6
Joints	with length 0.1 - 1 m	2	4
	with length 1 - 10 m	1	2
	with length 10 - 30 m	0.75	1.5
(Filled) joint, seam or shear **)	length > 30 m	0.5	1

*) Discontinuous joints end in massive rock **) Often a singularity and should in these cases be treated separately

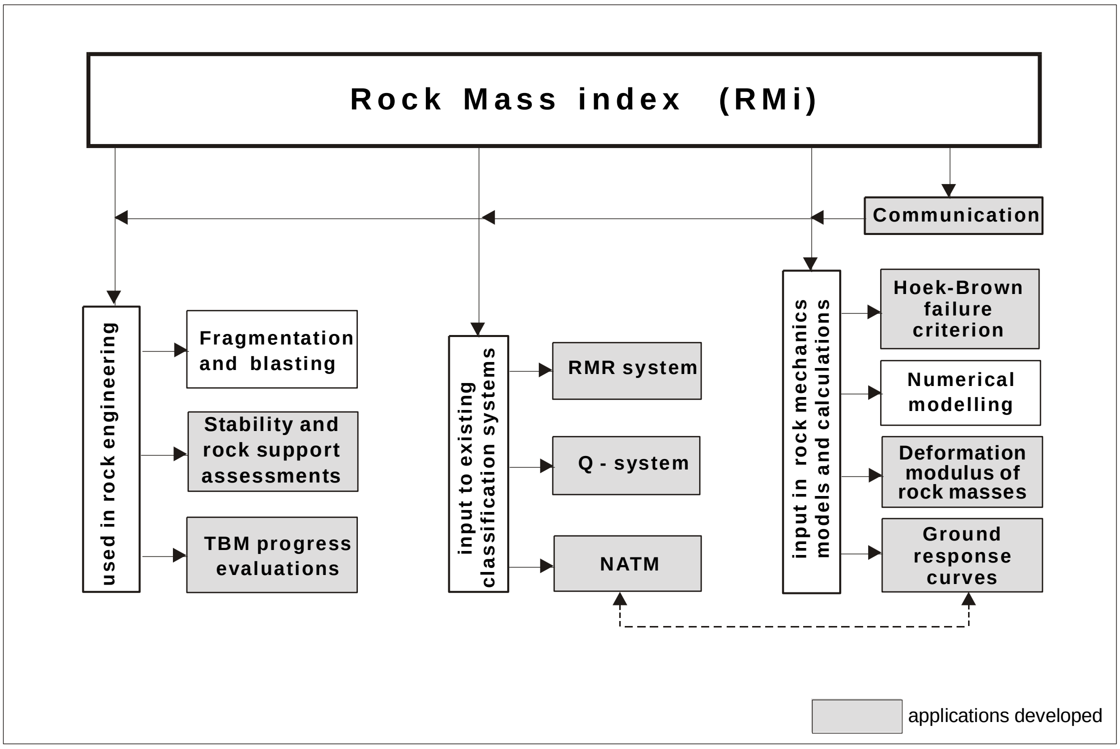

Figure 4 The main applications of the Rock Mass index