

## The main rockmass parameters and how these best can be measured

Table 1 shows that the input parameters applied in the Q, RMR and RMi classification systems are almost all of the main rockmass parameters shown in Table 2.

Table 1: The main ground parameters applied in three classification systems

PARAMETER		APPLICATION					
		in the Q system		in the RMi support method		in the RMR system	
Rock	Rock strength	-	-	$\sigma_c$	uniaxial compressive strength	A1	uniaxial compressive strength or point load strength
Jointing	Degree of jointing	RQD	rock quality designation	-	-	A2	RQD
	Block size	-	-	Vb	block volume	-	-
	Joint spacing	-	-	-	-	A3	joint spacing
	Joint sets (pattern)	Jn	joint set number	Nj	joint set factor	-	-
Joint	Joint smoothness	Jr	joint roughness number	js	joint smoothness	A4c	joint roughness
	Joint planarity			jw	waviness	-	-
	Joint coating / infilling	Ja	joint alteration number	jA	joint condition	A4d	joint infilling, gouge
	Joint alteration / weathering					A4e	joint weathering
	Joint size	-	-	jL	joint length and continuity	A4a	joint length, persistence
	Joint separation	-	(partly in Ja)	-	(partly in jA)	A4b	joint separation
	Joint orientation	-	-	Co	joint orientation factor	B	orientation of joints
Weakness zone	Size (thickness)	-	-	Tz	zone thickness	-	-
	Type of zone	SRF	stress reduction factor	-	-	-	-
Stress condition	SL			stress level factor	-	-	
Water	Ground water	Jw	joint water reduction factor	GW	ground water influence	A5	water inflow

Table 2 shows the most useful investigation method for collecting properties of the various rockmass parameters. The usefulness of the parameter in the evaluations and calculations to be made, should be compared with the cost for the investigation.

Field observations in terrain surface, cuttings or in the underground excavation generally form the main basis in assessing the characteristics of parameter values (when other measurements and tests are performed).

Table 2: The main possibilities for collecting information on characteristic rock mass parameters (partly from Palmström and Nilsen, 2000).

ROCKMASS PARAMETER	WHAT CAN BE OBSERVED/MEASURED?		
	On rock outcrops and on cuttings	In drill hole or core logging	In underground excavations
<b>Rocks</b>			
- outlook/texture (schistosity, bedding, layering)	x / (x)	x	x
- distribution of rocks	x / (x)	x	x
- strength <sup>4)</sup> and other properties	x <sup>1)</sup>	x	x
<b>Joints and jointing</b>			
- spacing within joint set	x	(x)/ -	x
- length	x / (x)	-	(x)/ x
- orientation of joints	x	(x) <sup>2)</sup>	x
- waviness	x	-	x
- smoothness	x / (x)	x	x
- separation	(x)/ -	(x)	x
- filling or coating material	(x)	x	x
<b>Faults and weakness zones</b>			
- orientation	x / (x)	-	x / (x)
- thickness	(x)/ -	(x)	x
- gouge material	(x) <sup>3)</sup> / -	x	x
- structure and composition	-	(x)	x
<b>Groundwater</b>			
- inflow	-	(x)	x
- water pressure	-	x	x
<b>Stresses</b>			
- stress level	-	x	x
- bursting features	-	-	x
- squeezing features	-	-	x
x parameter/task can easily be observed/handled	<sup>1)</sup> possible weathering may influence on result		
(x) parameter/task may partly or sometimes be observed/accomplished	<sup>2)</sup> not possible unless special core orientation drilling is implemented		
- not possible to measure/accomplish the parameter/task	<sup>3)</sup> can sometimes be seen in cuttings and eroded slopes		
	<sup>4)</sup> approx. strength can be found from the hammer test		