

## Major Engineering Rock Mass Classifications

<i>Name</i>	<i>Originator and Date</i>	<i>Country of Origin</i>	<i>Applications</i>
1. Rock Load	Terzaghi, 1946	USA	Tunnels with steel support
2. Stand-up Time	Lauffer, 1958	Austria	Tunneling
3. New Austrian Tunneling Method	Pacher, Rabcewicz, 1964	Austria	Tunneling
4. Rock Quality Designation	Deere et al., 1967	USA	Core logging, tunneling
5. Rock Structure concept RSR	Wickham et al., 1972	USA	Tunneling
6. <b>Rock Mass Rating system</b> <i><u>RMR system extensions</u></i>	Bieniawski, 1973, mod.1989	South Africa & USA	Tunnels, mines, slopes, foundations
	Weaver, 1975	South Africa	Rippability
	Laubscher, 1976	South Africa	Hard rock mining
	Olivier, 1979	South Africa	Weatherability
	Ghose and Raju, 1981	India	Coal mining
	Moreno Tallon, 1982	Spain	Tunneling
	Kendorski and Cummings, 1983	USA	Hard rock mining
	Nakao et al., 1983	Japan	Tunneling
	Serafim and Pereira, 1983	Brazil	Foundations
	Gonzalez de Vallego, 1983	Spain	Tunneling
	Ünal, 1983	USA	Coal mine roof bolting
	Romana, 1985	Spain	Slope stability
	Newman, 1985	USA	Coal mining
	Sandbak, 1985	USA	Boreability
	Smith, 1986	USA	Dredgeability
	Venkateswarlu, 1986	India (CMRS)	Coal mining
	Robertson, 1988	Canada	Slope stability
	Thiel, 1985	Poland	Carpathian flysch
	Ünal, 1996	Turkey	Weak rock, coal
	Pakalnis et al., 2007	Canada	Weak rock mining

7. Q-system	Barton et al., 1974	Norway	Tunnels, chambers
<b>7. Q-system</b> <i><u>Q- system extensions</u></i>	Barton et al., 1974	Norway, 1974	Tunnels, chambers
	Kirsten, 1982	South Africa	Excavatability
	Kirsten, 1983	South Africa	Tunneling
	Barton, 2000	Norway, Brazil	TBM tunneling
8. Strength-size	Franklin, 1975	Canada	Tunneling
9. Basic geotechnical description	ISRM, 1981	International	General, communication
10. Unified classification	Williamson, 1984	USA	General, communication
11. Coal Mine Roof Rating*	Molinda and Mark, 1994	USA	Coal mining
12. Geological Strength Index**	Hoek et al., 1995	Canada	Rock mass characterization
13. Rock mass index RMi	Palmström, 1995	Norway	Rock engineering, characterization
14. Deutsche Steinkohle	Witthaus, 2006	Germany	Coal mining
15. Rock Mass Excavability RME	Bieniawski et al., 2006	Spain	TBM tunneling

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\* Based on RMR format

\*\* Based on RMR data for correlation with modulus of deformation