

Table 4. Some case studies evaluated for squeezing potential

sl	Rock type	Reference	Project	Q	γ (gm/cc)	Observed or computed strain, %	σ_{ci} (MPa)	E_i (GPa)	Critical Strain (ϵ_{cr} , %)		Squeezing Index (SI)		Classification		Observed ground condition
									Singh et al. (1997)	Barton (2002)	Singh et al. (1997)	Barton (2002)	Singh et al. (1997)	Barton (2002)	
1	Moderately fractured quartzites	Jethwa et al. (1982)	Maneri-Bhali hydro project, India	3.6	2.5	0.06	67 – 128 Av = 97.5	28.25 - 49.8 Av = 39.03	0.54	0.36	0.11	0.17	NS	NS	No squeezing
2	Foliated metabasics	Jethwa et al. (1982)	Maneri-Bhali hydro project, India	3.4 - 6.8 Av = 4.81	2.5	0.05	70.9 – 104 Av = 87.45	21 - 22.4 Av = 21.70	0.77	0.46	0.06	0.11	NS	NS	No squeezing
3	Sheared metabasics	Jethwa et al. (1982)	Maneri-Bhali hydro project, India	0.3 - 3.3 Av = 0.99	2.5	0.4	70.9 – 104 Av = 87.45	21 - 22.4 Av = 21.70	1.06	0.55	0.38	0.72	NS	NS	No squeezing
4	Grade-I phyllites, massive and distinctly jointed	Dube et al. (1982)	Khara hydel project, India	5	2.64	--	38 – 133 Av = 85.5	6.68 - 7.07 Av = 6.88	2.26	0.92	-	-	-	-	No squeezing
5	Crushed red shales, moderately squeezing	Jethwa et al. (1982)	Chibro-Khodri tunnel, India	0 – 0.1 Av = 0.05	2.73	2.8	16.8 – 37.0 Av = 26.9	10.80	0.56	0.44	3.36	4.29	HS	HS	Moderate squeezing
6	Crushed red shales, highly squeezing	Jethwa et al. (1982)	Chibro-Khodri tunnel, India	0 - 0.5 Av = 0.08	2.73	6.00	16.8 – 37.0 Av = 26.9	10.80	0.51	0.41	11.7 6	14.63	VHS	VHS	High squeezing
7	Soft plastic black clays, moderately squeezing	Jethwa et al. (1982)	Chibro-Khodri tunnel, India	0 - 0.03 Av = 0.02	2.64	4.5	1.86 – 8.27 Av = 5.065	0.26 - 2.83 Av = 1.55	0.32	0.38	14.0 6	11.84	VHS	VHS	Moderate squeezing
8	Clay shale	Jethwa et al. (1982)	Chibro-Khodri	Av =	2.64	2.0	7.7	1.55	0.61	0.53	3.3	3.75	HS	HS	Very heavy squeezing

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									Singh et al. (1997)	Barton (2002)	Singh et al. (1997)	Barton (2002)	Singh et al. (1997)	Barton (2002)	
			tunnel, India	0.026											
9	Very blocky and seamy slates	Jethwa et al. (1982)	Giri hydro tunnel, India	0.3 - 0.82 Av = 0.51	2.5	7.6	1 - 38.0 Av = 19.5	20.00	0.12	0.17	63.3 3	44.7	VHS	VHS	Moderate squeezing
10	Crushed phyllites	Jethwa et al. (1982)	Giri hydro tunnel, India	0.1- 0.32 Av = 0.2	2.3	12.4	38 - 133 Av = 85.5	6.68 - 7.07 Av = 6.88	4.67	1.36	2.66	9.12	FS	VHS	High squeezing
11	Crushed shales	Jethwa et al. (1982)	Loktak hydro tunnel, India	0 - 0.04 Av = 0.02	2.7	7	16.8 - 37 Av = 26.9	10.80	0.66	0.48	10.6 1	14.58	VHS	VHS	Moderate squeezing
12	Highly fractured quartzites	Sharma (1985)	Maneri- Bhali hydro project, India	0.5	2.5	7.9	67 - 128 Av = 97.5	28.25 - 49.8 Av = 39.03	0.80	0.46	9.86	17.17	VHS	VHS	Not reported
13	Highly jointed dolomites	Singh et. al (1992)	Salal hydel tunnel, India	1.2 - 1.7 Av = 1.43	2.8	---	46.94	29.0	0.25	0.26	-	-	-	-	--
14	Grade -II phyllites with banded structure of argillaceous material	Singh et. al (1992)	Tehri dam project, India	0.8	2.65	0.38	38 - 133 Av = 85.5	6.68 - 7.07 Av = 6.88	3.25	1.15	0.12	0.33	NS	NS	No squeezing
15	Competent massive quartzites of very high strength	Singh et. al (1992)	Kolar gold mines, India	100 - 200 Av = 141	2.8	--	67 - 128 Av = 97.5	28.25 - 49.8 Av = 39.03	0.24	0.23	-----	-----	-----	-----	No squeezing
16	Argillaceous conglomerate s	Singh et. al (1992)	Khara hydro project,	0.4	2.7	0.42	105.5	46.19	0.77	0.45	0.97	1.66	NS	LS	No squeezing

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									Singh et al. (1997)	Barton (2002)	Singh et al. (1997)	Barton (2002)	Singh et al. (1997)	Barton (2002)	
			India												
17	Argillaceous conglomerate s	Singh et. al (1992)	Khara hydro project, India	0.4	2.7	0.75	105.5	46.19	0.77	0.45	0.97	1.66	NS	LS	No squeezing
18	Thinly bedded shales with calcite bands	Singh et. al (1992)	Upper Krishna project, India	15	2.67	0.18	16.8 – 37 Av = 26.9	10.80	0.18	0.22	1.00	0.82	NS	NS	No squeezing
19	Thinly bedded shales with calcite bands	Singh et. al (1992)	Upper Krishna project, India	15	2.67	0.08	16.8 – 37 26.9	10.80	0.18	0.22	0.44	0.36	NS	NS	No squeezing
20	Faulted sandstone	Dalgic (2002)	Istanbul metro tunnel	0.06	2.66	1.05	55	13.00	1.43	0.71	0.74	1.47	NS	LS	--
21	Mudstone	Dalgic (2002)	Istanbul metro tunnel	0.21 - 2.43 Av = 0.71	2.69	1.05	31	12.00	0.37	0.34	2.82	3.12	FS	HS	High squeezing +heaving
22	Graphite schist (Section-ISK- 8)	Kockar and Akgun (2003)	Ilikso tunnel, Turkey	0.9	2.71	2.70 0.92	50	26.60	0.34	0.30	7.94 2.71	9.00 3.07	VHS FS	VHS HS	*
23	Highly weathered tuff (BH-1)	Ozsan and Basarir (2003)	Urus dam site, Turkey	0.0018	1.8	0.26	12	8.70	0.46	0.36	0.57	0.72	NS	NS	*
24	Moderately weathered tuff (BH-2)	Ozsan and Basarir (2003)	Urus dam site, Turkey	0.11	1.99	0.26	19.9	11.60	0.33	0.29	0.79	0.89	NS	NS	*
25	Andesite (BH- 3 and BH-4)	Ozsan and Basarir (2003)	Urus dam site, Turkey	0.56	2.39	0.26	23.7	41.90	0.08	0.12	3.32	2.10	HS	FS	*
26	Limestone (Section-II)	Sari and Pasameh metoglu (2004)	Kaletepe tunnel, Turkey	1.52	2.68	1.37 1.36 0.08	72	87.20	0.17	0.18	8.06 8.00 0.47	7.61 7.56 0.44	VHS VHS NS	VHS VHS NS	*

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									Singh et al. (1997)	Barton (2002)	Singh et al. (1997)	Barton (2002)	Singh et al. (1997)	Barton (2002)	
27	Limestone (Section-III)	Sari and Pasameh metoglu (2004)	Kaletepe tunnel, Turkey	11	2.69	0.96 0.85 0.12	90	67.00	0.21	0.21	4.57 4.05 0.57	4.57 4.05 0.57	H S H S N S	H S H S N S	*
28	Limestone (Section-IV)	Sari and Pasameh metoglu (2004)	Kaletepe tunnel, Turkey	11.5	2.69	0.32 0.30 0.11	63	78.70	0.10	0.14	3.2 3.0 1.1	2.29 2.14 0.79	HS FS LS	FS FS LS	*
29	Limestone (Section-V)	Sari and Pasameh metoglu (2004)	Kaletepe tunnel, Turkey	10.8	2.65	0.24 0.23 0.095	81	76.80	0.16	0.18	1.5 1.44 0.59	1.33 1.28 0.53	LS LS NS	LS LS NS	*
30	Limestone (Section-VI)	Sari and Pasameh metoglu (2004)	Kaletepe tunnel, Turkey	12.3	2.63	0.32 0.31 0.14	75	77.00	0.14	0.16	2.23 2.21 1.00	2.00 1.94 0.88	FS FS NS	LS LS NS	*
31	Limestone (Section-VII)	Sari and Pasameh metoglu (2004)	Kaletepe tunnel, Turkey	9.99	2.63	0.24 0.24 0.11	85	77.00	0.17	0.18	1.41 1.41 0.65	1.33 1.33 0.61	LS LS NS	LS LS NS	*