

BULKING FACTORS FOR EXPANSION OF COMMON ROCK MATERIALS

Material	Density (g/cm ³)		% Expansion
	In place	After excavation	
Unconsolidated sediments			
Wet sand	1.95	1.56	20-30
Dry sand	1.60	1.28	20-30
Wet gravel	2.0	1.60	20-30
Dry gravel	1.8	1.4	20-30
Wet clayey gravel	1.92	1.28	50
Clay	1.86	1.49	20-30
Clayey soil	1.76	1.41	20-30
Rocks			
Basalt	3.0	1.72	75
Dolomite	2.56	1.73	50
Gneiss	2.69	1.54	75
Granite	2.72	1.55	75
Limestone	2.69	1.54	75
Quartz	2.64	1.51	75
Sandstone	2.42	1.38	75
Slate	2.80	1.52	85
Ores			
Bauxite (Weipa)	1.4		
Iron ore (Hamesley hematite) Range	4.21-4.45		
Iron ore (Hammersley hematite) Average	4.3		
Iron ore (Mt Whaleback - Brockman type)	3.85		
Iron ore (Mt Whaleback - Marra Mamba)	2.8		
Iron ore (Pilbara-limonite deposits)	2.5		
Copper (Bougainville porphyry ore)	2.6		
Lead-zinc (Broken Hill)	3.5		
Nickel (Kambalda massive sulphides)	3.6		
Uranium (Mary Kathleen)	4.1		