

10 INŽENJERSKOGEOLOŠKI OPIS STIJENA

Inženjerskogeološki opis stijena provodi se na uzorcima iz bušotina ili sa izdanaka.

Pri tome je potrebno opisati značajke stijene važne za određivanje inženjerskih svojstava: čvrstoću, trošnost i diskontinuitete.

Pri tome se koristi geološka klasifikacija stijena jer ona uzima u obzir geološko porijeklo i strukturu područja. Na temelju nje je moguće korelirati bušotine, te razlučiti gromade stijena od osnovne stijene (u bušotinama njihovi uzorci mogu izgledati isto).

POSTUPAK OPISIVANJA

Radi jasnoće, prilikom opisivanja stijene, glavne značajke trebaju biti razvrstane na sljedeći način:

- 1) **značajke materijala stijene** odnose se na intaktni uzorak (koji je moguće držati u ruci) i obuhvaćaju: čvrstoću, strukturu, boju, teksturu, veličinu zrna, i naziv stijene (npr. "GRANIT")
- 2) **opće informacije** obuhvaćaju dodatne podatke kao što je detaljniji petrografski opis i geološka formacija
- 3) **značajke mase stijene** odnose se na strukturu stijenske mase (u idealnom slučaju veličine izdanka) a obuhvaćaju opise: stanja trošnosti, diskontinuiteta i raspucanosti.

Čvrstoća stijenskog materijala

Na terenu se određuje jednostavnim priručnim identifikacijskim pokusima; PLT aparatom i Schmidtovim čekićem.

Schmidtova čvrstoća	20	30	40	50	60
UCS (MPa)	12	25	50	100	200

Identifikacija i opis čvrstoće

opis stijene/tla	UCS (MPa)	in situ svojstva
vrlo čvrsta stijena	>100	slama se pod jakim udarcima čekića
čvrsta stijena	50-100	može se slomiti srednje jakim udarcem čekića
srednje čvrsta	12.5-50	može se zarezati šiljkom čekića
srednje slaba	5-12.5	ne može se slomiti rukom
slaba stijena	1.5-5	mrvi se pod udarcima čekića
vrlo slaba stijena	0.6-1.5	slama se rukom
vrlo kruto tlo	0.3-0.6	urezuje se noktom
kruto tlo	0.15-0.3	ne može se mijesiti prstima
čvrsto tlo	0.08-0.15	mijesi se prstima
meko tlo	0.04-0.08	lagano se mijesi prstima
vrlo meko tlo	<0.04	curi između prstiju

Trošnost stijenske mase

Od osobite je važnosti prilikom istraživanja za potrebe građenja u ili na stijenskoj masi, budući da se ovdje radi na malim dubinama, unutar zone utjecaja površinskog trošenja. Određuje se na osnovi distribucije i relativnog udjela svježeg i trošnog stijenskog materijala (pogl. 2).

Opis diskontinuiteta stijenske mase

Provodi se prema terminologiji prikazanoj u tablici. Upute za detaljan opis diskontinuiteta stijenske mase izdalo je Međunarodno društvo za mehaniku stijena (ISRM, 1979).

Identifikacija sedimentnih stijena za inženjersku namjenu prema BSI 5930: 1999

Grain size mm	Bedded rocks (mostly sedimentary)					SEDIMENTARY ROCKS
Grain size boundaries approximate	Grain size description		At least 50 % of grains are of carbonate	At least 50 % of grains are of grained volcanic rock	LIMESTONE and DOLOMITE (undifferentiated)	
	20	RUDACEOUS	CONGLOMERATE Rounded boulders, cobbles and gravel cemented in a finer matrix Breccia Irregular rock fragments in a finer matrix	Calciurudite		Fragments of volcanic ejecta in a finer matrix. Rounded grains AGGLOMERATE Angular grains VOLCANIC BRECCIA
6						
2	ARENACEOUS	SANDSTONE Angular or rounded grains commonly cemented by clay, calcitic or iron minerals Quartzite Quartz grains and siliceous cement Arkose Many feldspar grains Greywacke Many rock chips	Calcareous mudstone	Cemented volcanic ash	TUFF	GYPSUM
0.6						
0.2						
0.06	ARGILLACEOUS	MUDSTONE	SILTSTONE Mostly silt	Calcisiltite	Fine-grained TUFF	
0.002						
Amorphous or crypto-crystalline		Flint: occurs as bands of nodules in the Chalk Chert: occurs as nodules and beds in limestone and calcareous sandstone				COAL LIGNITE
Granular cemented - except amorphous rocks						
	SILICEOUS	CALCAREOUS	SILICEOUS	CARBONACEOUS		

Naziv stijene

Opisuje se na uzorku stijene. Geneza stijena vrlo je korisna za inženjersku geologiju, budući da su njome uvjetovana svojstva stijena. Upotreba geološkog naziva stijena kao osnovnog naziva stijene preporučuje se i stoga što ne postoji prikladniji sustav imenovanja stijena za inženjerske potrebe.

Terminologija za opis diskontinuiteta stijenske mase prema BSI 5930: 1999

Spacing	Orientation	Persistence	Type of termination	Roughness	Wall strength	Aperture	Filling	Seepage	No. of sets	
Extremely wide > 6 m	Dip amount only in cores	Discontinuous	Cannot normally be described	Small scale (cm) and intermediate scale (m)	Schmidt hammer	Cannot normally be described in cores	Clean	Cannot be described in cores	Cannot be described in cores	
Very wide 2 to 6 m				Stepped			Surface staining (colour)			
Wide 600 mm to 2 m				Rough			Soil infilling (describe in accordance with 41)			
Medium 200 to 600 mm				Smooth						
Close 60 to 200 mm	Take No. of readings, of dip direction/dip e.g. 015/08° Report as ranges and on stereo net if appropriate	Very high > 20 m	Termination x (outside exposure) r (within rock) d (against discontinuity)	Striated	Point load test	Very open > 10 mm	Mineral coatings (e.g. calcite, chlorite, gypsum etc.)	Moisture on rock surface	Record spacing and orientation of sets to each other and all details for each set	
Very close 20 to 60 mm				Planar		Open 2.5 mm to 10 mm				
Extremely close < 20 mm				High 10 to 20 m		Rough				Moderately open 0.5 mm to 2.5 mm
				Medium 3 to 10 m		Smooth				Tight 0.1 mm to 0.5 mm
Take number of readings state min. average and max.				Low 1 to 3 m		Striated				Very tight < 0.1 mm
				Very low < 1 m		Record also size of exposure				Take number of readings state min. average and max.
				Large scale (dm)	Other index tests		Other - specify			
				Waviness	Visual assessment		Record width and continuity of infill	Small flow 0.05 - 0.5 l/s		
				Curvature				Medium flow 0.5 - 5.0 l/s		
				Straightness				Strong flow > 5 l/s		
				Measure amplitude and wavelength of feature						

Identifikacija magmatskih i metamornih stijena za inženjersku namjenu prema BSI 5930: 1999

Igneous rocks: generally massive structure and crystalline texture				Metamorphic rocks	
Grain size description				Foliated	Massive
COARSE	GRANITE ¹	DIORITE ^{1,2}	GABBRO ^{1,2}	GNEISS Well developed but often widely spaced foliation sometimes with schistose bands Migmatite Irregularly foliated; mixed schists and gneisses	MARBLE QUARTZITE GRANULITE HORNFELS AMPHIBOLITE SERPENTINE
MEDIUM	MICROGRANITE ¹	MICROIORITE ^{1,2}	DOLERITE ^{3,4}	SCHIST Well developed undulose foliation; generally much mica	
FINE	RHYOLITE ^{4,5}	ANDESITE ^{4,5}	BASALT ⁵	PHYLLITE Slightly undulose foliation; sometimes spotted SLATE Well developed plane cleavage (foliation) MYLONITE Found in fault zones, mainly in igneous and metamorphic areas	
Amorphous Crypto-crystalline	OBSIDIAN ⁵	VOLCANIC GLASS			
↑ increasing grain size					
← Pale → Dark					
ACID Much quartz				CRYSTALLINE SILICEOUS	
INTER-MEDIATE Some quartz				Mainly SILICEOUS	
BASIC Little or no quartz					
ULTRA BASIC					
				IGNEOUS ROCKS Composed of closely interlocking mineral grains. Strong when fresh; not porous. METAMORPHIC ROCKS Generally classified according to fabric and mineralogy rather than grain size Most metamorphic rocks are distinguished by foliation which may impart fissility. Foliation in gneisses is best observed in outcrop. Non-foliated metamorphics are difficult to recognise except by association. Most fresh metamorphic rocks are strong although perhaps fissile.	