

Soil and Rock Description in Engineering Practice

David Norbury

Consultant; Director, David Norbury Limited, Reading, UK
Honorary Professor in Engineering Geology, University of Sussex, UK



WHITTLES PUBLISHING



CRC Press
Taylor & Francis Group

Contents

Preface	xi
Definitions	xiii
1 Introduction	1
1.1 What are we describing and why?	5
1.2 Description compared with classification	9
1.3 Communication in description	10
1.4 Soil meets rock	12
1.5 Health and Safety in description	14
2 History of Description in Codification	17
2.1 Prior to 1970	17
2.2 The period 1970–1981	17
2.3 The period 1981–1999 and the first BS 5930	23
2.4 Rock weathering	26
2.5 1999 and the second BS 5930	29
2.6 The period since 1999	30
2.7 Multiple usage of defined terms	31
2.7.1 Clay and silt terminology	31
2.7.2 Secondary constituent terms	33
2.7.3 Loose and dense	33
2.7.4 Compactness of silt	33
2.7.5 Rock strength	34
2.7.6 Rock weathering	34
2.7.7 Comparison of descriptive terminology	34
3 Systematic Description	38
3.1 Standard word order	39
3.2 The multiple sentence approach	41
4 Description of Materials	43
4.1 Principal soil and rock types	43
4.2 Size fractions	45
4.3 Description procedure using flow chart	46
4.4 Very coarse soils	49
4.5 Coarse soils	56
4.6 Particle shape	58
4.7 The coarse soil/fine soil boundary	59
4.8 Fine soils	62
4.9 Classification of plasticity of fine soils	71
4.10 The soil/rock boundary	72

4.11	Rock naming	75
4.11.1	General naming of rocks	75
4.11.2	Description of coal	77
4.11.3	Naming of carbonate sediments	78
4.11.4	Naming of volcanoclastic sediments	78
4.12	Grain size in rocks	81
5	Relative Density and Strength	83
5.1	Relative density in coarse soils	83
5.2	Consistency of fine soils	87
5.3	Strength: shear or unconfined	89
6	Structure, Fabric and Texture	96
6.1	Structure	97
6.2	Fabric	97
6.3	Texture	101
7	Colour	103
8	Secondary and Tertiary Fractions	110
8.1	Secondary fractions	110
8.1.1	Secondary fractions in very coarse soils	110
8.1.2	Very coarse particles as a secondary fraction	112
8.1.3	Secondary fractions in coarse soils	114
8.1.4	Fine soil as a secondary constituent	119
8.1.5	Secondary fractions in fine soils	122
8.1.6	Multiple secondary fractions	123
8.2	Tertiary fractions	126
8.3	Description of widely graded soils	128
8.4	Description and classification of particle size grading	130
8.5	Other information	131
9	Geological Formation	134
10	Weathering	137
10.1	Weathering of soils	137
10.2	Rock weathering	140
10.3	Approach 1: description of weathering	143
10.4	Approaches 2 and 3: classifications for homogeneous stronger rocks	145
10.5	Approach 4: classification for heterogeneous weaker rocks	146
10.6	Material specific weathering schemes	147
10.7	Approach 5: special cases	147
10.7.1	Chalk	147
10.7.2	Karstic limestone	157
10.7.3	Tropical weathering	157
11	Discontinuity Logging	161
11.1	Types of discontinuity	161
11.2	Discontinuity description	162
11.3	Orientation	163
11.4	Spacing	166

11.5	Persistence and termination	168
11.6	Surface form	169
11.7	Wall strength	171
11.8	Aperture and infilling	171
11.9	Seepage	173
11.10	Discontinuity sets	174
12	Fracture State Recording	177
12.1	Total core recovery	180
12.2	Solid core recovery	184
12.3	Rock quality designation	186
12.4	Fracture spacing	187
13	Low Density Soils	190
13.1	Organic soils	190
13.1.1	Topsoil	190
13.1.2	Peat	192
13.1.3	Transported mixtures of organic soils	204
13.2	Volcanic soils or rocks	205
13.3	Loess and brickearth	206
14	Made Ground	208
14.1	Types of made ground	209
14.2	Identification of made ground	212
14.3	Odours	214
14.4	Definitions of some combustion products	215
14.5	Description of concrete or macadam	215
14.5.1	Aggregate content	218
14.5.2	Voids	219
14.5.3	Deleterious substances	219
14.5.4	Reinforcement	220
14.6	Pavement material types	220
14.7	Description of brickwork	222
14.8	Logging cores of manufactured materials	223
15	Classification Schemes	225
15.1	Classification according to EN ISO	228
15.2	International classification systems	228
15.3	Classification systems taking account of engineering properties	231
15.4	Rock classification and rating schemes	233
16	The Description Process – Boreholes	235
16.1	The approach to description	236
16.2	Logging equipment and the toolbox	237
16.3	Description of samples and cores	239
16.4	Check logging	244
16.5	Photography of samples and cores	245
16.6	Testing and sampling	250
16.7	Compilation of field log	251
16.8	Checking against test results	254
16.9	Editing the field log to completion	255

17	Description Process – Field Exposures	258
17.1	Geological and geomorphological mapping	259
17.2	Field logging	259
17.3	Information to be recorded in exposure logging	262
17.4	Surveying	264
17.5	Safety	266
	Appendix: Pro-Forma Field Record Sheets	269
	References	279
	Index	285