SMG14: POINT LOAD TEST

INTRODUCTION

The point load test (PLT) is a comparative test that does not yield strength property of rock material directly unlike the Unconfine Compressive Strength (UCS) test or tensile strength test. Instead, PLT yield an index called the 'point load strength index / value' (Is). The index may then be used to predict other strength properties such us compressive or tensile strength by means of applying certain correlation factor(s) established.

The main advantages of the test include little sample preparation is required and sample may be in a form of core, block or lump, equipment is portable and demand no electricity supply, simple test procedure and the load strength index has more practical value than other direct strength test.

OBJECTIVE

To determine point load strength index (Is) of rock samples
To classify strength of rock samples using Is
To predict the corresponding uniaxial compressive strength of rock samples

APPARATUS

(a) ELE Point Load Tester
(b) Electronic Balance
(c) Digital Caliper
(d) Rebound Hammer
(e) Rock samples

PROCEDURES

1) The test procedure is described in extracts from ELE Point Load Tester Manual part 4 (refer to Appendix 1)
2) Use Table PLT-1 to record your results.
3) The calculation method is described in extracts from ELE Point Load Tester Manual part 5 (refer to Appendix 2)

DISCUSSION

1) Classify the strength of rock material given based on Wilson, Broch and Franklin (taken from Geotechnology, Roberts 1977) and Bieniawski (1974). Comment on your results (refer Appendix 3).
2) Predict compressive strength of the rock samples tested using known correlation between UCS and PLT index that has been published. Justify your prediction based on the type of rock samples given.
3) Relate the use of the Point Load Strength Index with any Rock Mass Classification system(s).
4) Relate and PLT result to the value found via Rebound Hammer. Give your comment on the different strength measurement technique.

DATASHEET

Sample no								
Borehole ref.								
Depth	From		to		From		to	
Description								
Physical Properties								
Mass (kg)								
Width, W (mm)	W1	W2	W	Average	W1	W2	W	Average
Depth, D (mm)				Average				Average
Density (kg/m^3)								
Point Load Test Results								
Data Type	☐ diametrical	☐ axial	☐ block	☐ irregular lump				
Failure load P (kN)								
Failure remarks								
Width, W (m)								
Depth, D (m)								
Equivalent core diameter, De^2 (m^2) $De^2 = D^2$ or $De^2 = 4A/\pi$, for axial, block lump and irregular lump tests A = WD								
$I_s = P/De^2$ (MPa)								
Size correction factor, F $F = (De/50)^{0.45}$								
$I_{s(50)} = F \times I_s$ (MPa)								

4 Operation

4.1 Basic diametral test procedure (figure 8 and 9a)

4.1.1 Select a core to be tested.

4.1.2 Close the pressure release valve (9).

4.1.3 Place the core diameter between the platen points.

4.1.4 Using the pump (17) raise the lower platen point into firm contact with the specimen.

4.1.5 Measure the diameter 'D' of the specimen from the scale pointer (14).

4.1.6 Record 'D' to an accuracy of ± 2%

4.1.7 Check the maximum load pointers (14) are set to the load indicators.

4.1.8 Steadily apply the load to cause failure of the specimen within the period 10 to 60 seconds.

4.1.9 Record the maximum load achieved.

4.1.10 Open the pressure release valve (9) and manually force the lower platen down to allow the next specimen to be tested.

Important: goggles for eye protection should be worn.

4.2 The axial test (figure 9b)

4.2.1 Where the specimen length/diameter ratio is between 0.3 and 1.0 the axial test can be used.

4.2.2 Locate the specimen with the ends contacting the platen points.

4.2.3 Proceed as in 4.1.

4.3 The block irregular lump test (figures 9c and 9d)

4.3.1 Where the specimen size is 50 ± 35 mm and of suitable shape the block test can be used.

4.3.2 The ratio of depth/width should be between 0.3 and 1.0 and preferably nearer to 1.0.

4.3.3 Place the specimen with the smallest dimension between the platen points.

4.3.4 Proceed as for the basic test 4.1.

Note: for irregular lumps calculate W from the formula:

$$W = \frac{W1 + W2}{2}$$

where W1 is opposite to W2

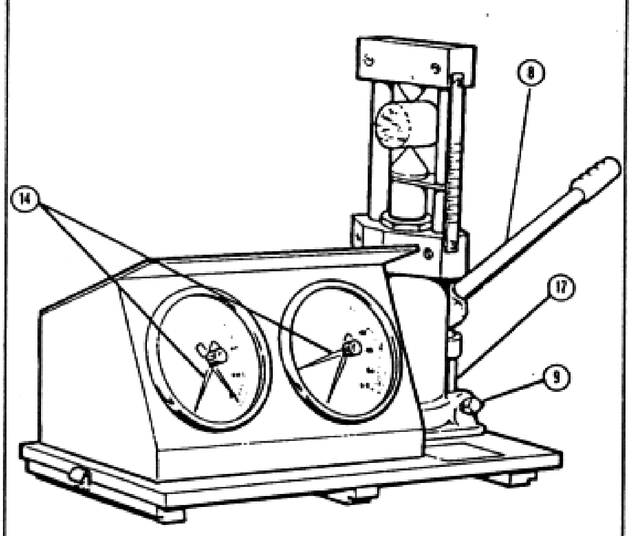


Figure 7 Testing

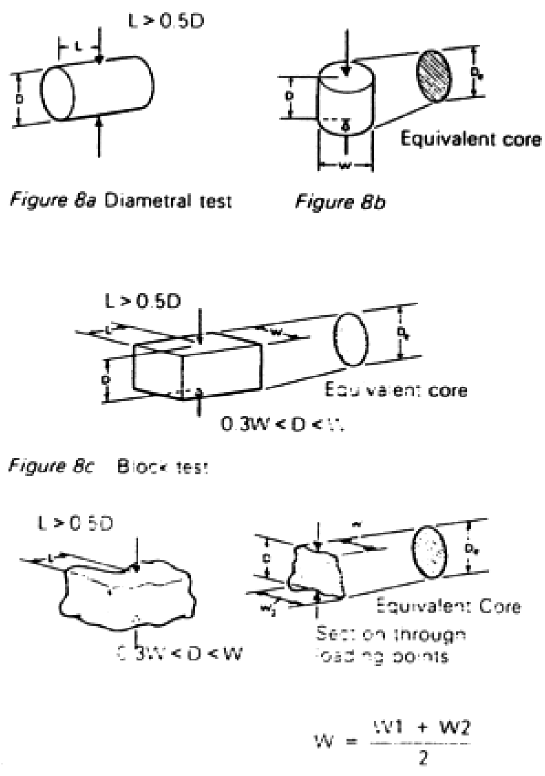


Figure 8a Diametral test *Figure 8b*

Figure 8c Block test

Figure 8d Irregular lump test

Figures 8a to 8d

Appendix 2

5 Calculations

5.1 Uncorrected point load strength (table 1)

5.1.1 The uncorrected point load strength value Is is calculated as:

P/De^2

where De^2 the equivalent core diameter is given by:

$De^2 = D^2$ for diametral tests
$De^2 = {}^{4A}/_{\pi}$ for axial, block and lump tests

and

A = WD = minimum cross sectional area of a plane through the platen contact points.

5.1.2 The Nomogram Table I offers a quick method to determine the uncorrected point load strength value I_s.

5.2 Point load strength correction (figure 10)

5.2.1 The point load strength index will vary slightly with specimen diameter 'D'. To overcome this, it is common practice to relate the test to that for specimens of 50 mm diameter.

5.2.2 To obtain the maximum accuracy and repeatability therefore, it is recommended that tests are conducted on specimens as near as possible to 50 mm diameter.

5.2.3 The most reliable method of size correction is to test the sample over a range of D or De2 and to plot graphically the relationship between P and De. If a log-log plot is used the relationship will follow closely to a straight line.

5.3 Result tabulation (figure 11)

5.3.1 It is recommended that results are collated in a similar manner to that shown.

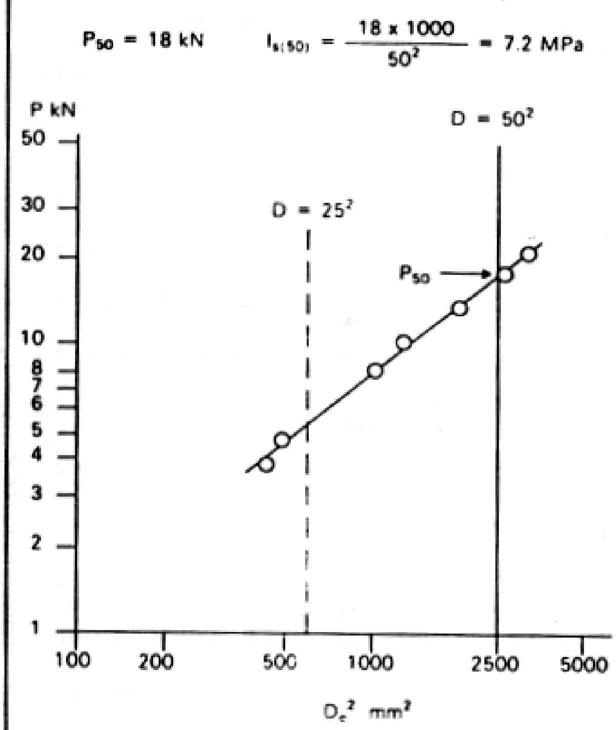


Figure 10 Load v. (equivalent diameter)² log-log graph

Appendix 3

Table 1: Classification of rock material for strength (after Bieniawski, 1974)

Description	Uniaxial compressive strength (MPa)	Point Load strength Index (MPa)
Very high strength	> 200	> 8
High strength	100 – 200	4 – 8
Medium strength	50 – 100	2 – 4
Low strength	25 – 50	1 – 2
Very Low strength	< 25	< 1

A.

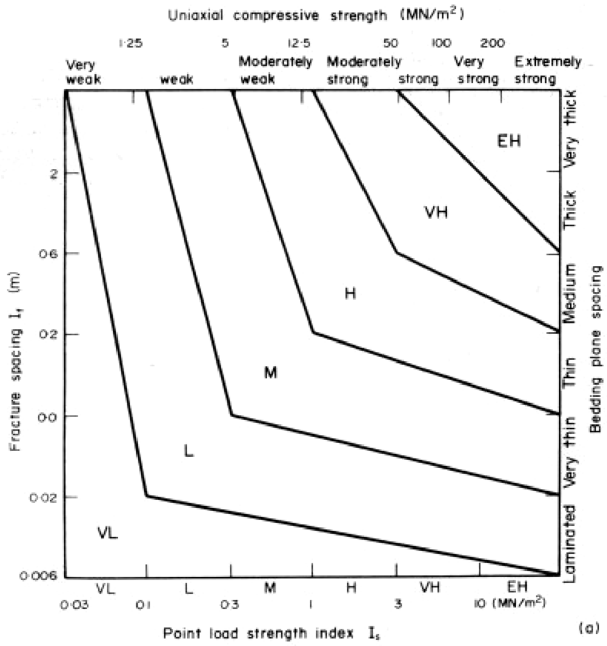
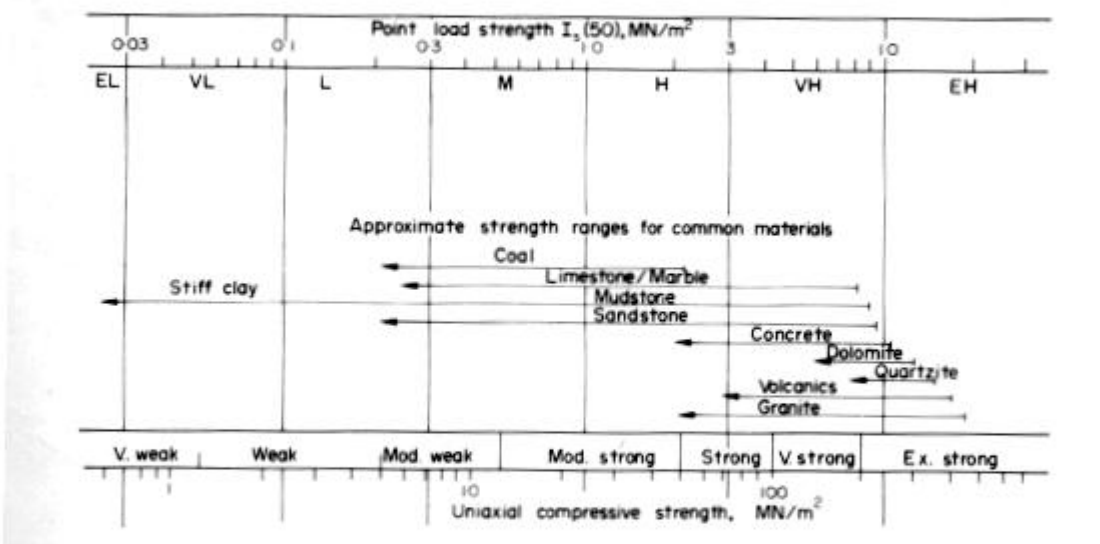


Fig. 1.2(a). Rock quality designation diagrams. General classification.



(b)

Fig. 1.2(b). Strength classification. Two alternative systems of subdivision and nomenclature are shown, together with the correlation between uniaxial and point load strengths and typical ranges of values for common rocks (Wilson, Brocht, and Franklin).