Transport Roads & Maritime Services

NSW GOVERNMENT

Test method T223

Determination of the point load strength of rock specimens

OCTOBER 2012

Revision Summary

Ed/Rev Number	Clause Number	Description of Revision	Authorisation	Date
		Reformatted and Revision Summary Added	D.Dash	May 1999
Ed 2/ Rev 0	All	Reformatted RMS template	J Friedrich	October 2012

Note that Roads and Maritime Services is hereafter referred to as 'RMS'.

The most recent revision to Test method T223 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T223

Determination of the point load strength of rock specimens

1. Scope

The Point Load strength test is based on the indirect tensile strength test or rock core by fracturing a specimen of rock using a machine equipped with conical platens and a load measuring system. the test provides a Point Load Strength (I_s) for different size samples which is then corrected to a standard 50 mm size equivalent, the Point Load Strength Index ($I_{s(50)}$), for comparison with other test results. The test is applicable to core samples, blocks and irregular specimens with a minimum dimension in the range 25 mm to 100 mm.

2. Apparatus

The Point Load testing machine shall incorporate a loading system (comprising for example, a loading frame pump, ram and platens), a system for measuring the load (P) required to break the specimen, and a system for measuring the distance (D) between the two platen contact points. The machine shall have the following characteristics:

(a) The loading system shall be adjustable to accept and test rock specimens in the size range 25 to 100 mm, with a load capacity of at least 50 kN.

(b) Spherically truncated conical platens shall be used to transmit load to the specimen. The 60° cone and 5 mm radius spherical truncation shall meet tangentially, and the platens shall be hardened so that they remain undamaged during testing. The platens shall be accurately aligned so that each is coaxial with the other, and the machine shall be sufficiently rigid to ensure that the platens remain aligned during testing. No spherical seat or other non-rigid component is permitted in the loading system.

(c) The load measuring system shall be readable and accurate to within 2% throughout the working range of the machine. It shall incorporate a maximum indicating device so that the reading is retained and can be recorded after specimen failure. It shall be resistant to hydraulic shock and vibration so that the accuracy of readings is maintained during testing.

(d) The distance-measuring system, to indicate the distance (D) between platen-contact points, shall be readable and accurate to within 0.5 mm. It shall be designed to allow zero check and adjustment and shall be robust so that its accuracy is maintained during testing.

3. Test Sample

The test may be carried out on rock core, cut specimens or irregular samples (eg taken from outcrop). There are two main types of test:

(a) The diametral test in which a cylinder of rock, usually core, is loaded normal to its axis (See Figure 1).

(b) The axial, block or irregular lump test where either loading is parallel to the core axis (axial test) or the sample is not cylindrical in shape. The results of these tests are corrected for shape to an equivalent diameter cylinder to give comparable strength values. Cire specimens with a length/diameter ratio of greater than 0.1 are suitable for diametral testing (see Figure 1); samples with a length/diameter ratio (for core) or intermediate/minimum dimension ratio (for blocks and irregular lumps) of between 0.3 and 1.0 are suitable for axial, block and irregular lump testing. Samples close to the index size of 50 mm are preferable.

Note: If possible samples should be tested at natural moisture content (as soon as possible after drilling in the case of core samples). Dried samples may have much greater strengths than moist samples. Moisture condition at the time of testing should always be recorded.

4. Procedure

The test procedure is as follows:

(a) Record the type of test being carried out.

(b) Measure and record the dimensions of the specimen, to the nearest 0.5 mm, as follows:

(i) for diametral tests, the core length (L).

(ii) for axial tests, the core diameter (W).

(iii) for block and irregular lump tests, the smallest width (W) perpendicular to the loading direction. If the sides of the specimen are not parallel then W is calculated as:

$$W = \frac{(W_1 + W_2)}{2}$$

Where W_1 and W_2 are the greatest and least values of the width in the plane of measurement (see Figure 1).

(c) Insert the specimen in the test machine and close the platens to make contact with the sample. For block and irregular lump tests the platens should make contact with the smallest dimension of the lump or block, away from edges or corners. Record the distance between platens (D) to the nearest 0.5 mm.

(d) Increase the load to failure and record the failure load (P) in kN.

(e) Sketch the mode of failure of the specimen.

(f) Record the moisture condition of the sample at the time of testing.

Note: Valid tests involve failure through the central section of the sample (see Figure 2). In the event of an invalid test the results are recorded as above but the invalid failure mode is noted.

5. Calculations

Calculate the Point Load Strength and Point Load Strength Index as follows:

(a) For diametral tests:

(i) Uncorrected Point Load Strength (I_s)

$$I_s = \frac{P \times 1000}{D^2} \text{ MPa}$$

Where P is the load at failure in kN

D is the platen separation in mm

(ii) Point Load Strength Index ($I_{s(50)}$)

$$I_{s(50)} = I_s \times \left(\frac{D}{50}\right)^{0.45} \text{ MPa}$$

(b) For axial, block and irregular lump tests:

(i) Uncorrected Point Load Strength (I_s)

$$I_s = \frac{P \times 1000}{{D_e}^2} \text{ MPa}$$

Where P is the load at failure in kN

D is the "equivalent core diameter" and is given by:

$${D_e}^2 = \frac{4 \times A}{\pi} \text{ mm}^2$$

Where A = W × D mm² - the minimum cross sectional area of the plane through the platen points.

(ii) Point Load Strength Index ($I_{s(50)}$)

$$I_{s(50)} = I_s \times \left(\frac{D_e}{50}\right)^{0.45} \text{ MPa}$$

Where the rock substance is banded (e.g. by bedding or metamorphic foliation) the degree to which the banding affects the rock sample strength can be presented as the Anisotropy Index ($I_{a(50)}$) where:

$$I_{a(50)} = \frac{I_{s(50)}}{I_{s(50)}} \quad \begin{matrix}\text{Normal to banding} \\ \text{Parallel to banding}\end{matrix}$$

6. Reporting

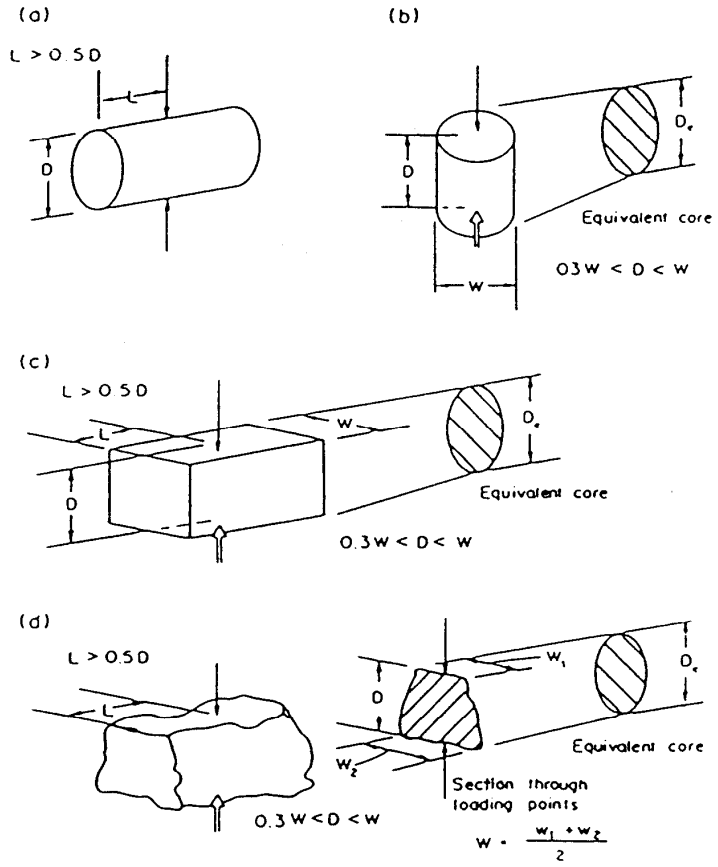
(a) Report the Point Load Strength Index ($I_{s(50)}$) to the nearest 0.1 MPa, or to one significant figure if less than 0.1 MPa.

Note: The occurrence of any invalid failure mode and the presence of any moisture condition which may affect the interpretation of the result.

The strength of the rock may also be expressed as being within a range, as follows:

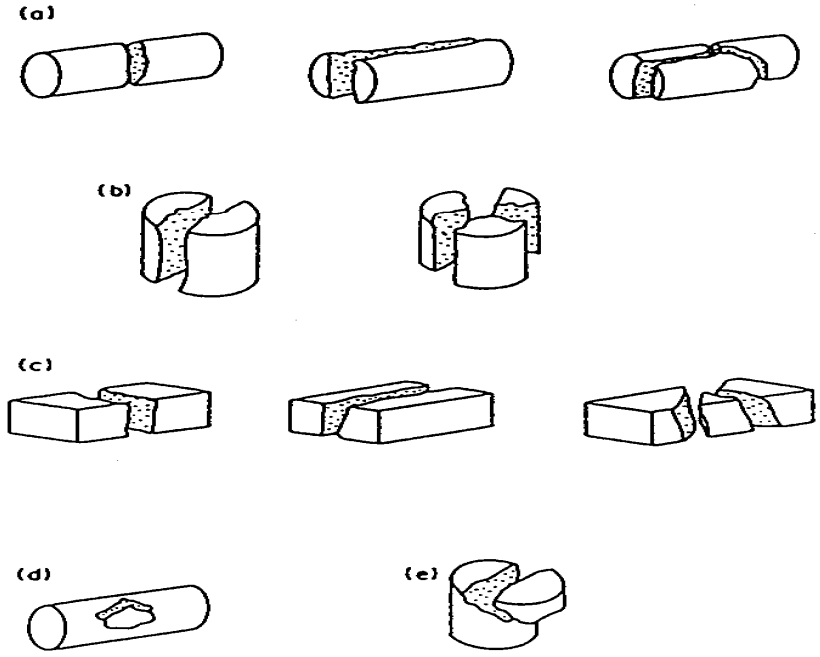
$I_{s(50)}$ MPa	Term	Abbreviation
>10	Extremely High Strength	EH
3-10	Very High Strength	VH
1-3	High Strength	H
0.3-1	Medium Strength	M
0.1-0.3	Low Strength	L
0.03-0.1	Very Low Strength	VL
<0.03	Extremely Low Strength	EL

(b) If required, report the Anisotropy Index $I_{a(50)}$ to 1 decimal place.



Specimen shape requirements for (a) the diametral test, (b) the axial test, (c) the block test and (d) the irregular lump test.

Figure 1



Typical modes of failure for valid and invalid tests. (a) Valid diametral tests; (b) valid axial tests; (c) valid block tests; (d) invalid core test; (e) invalid axial test.

Figure 2