

**GEO Technical Guidance Note No. 53 (TGN 53)  
Supplementary Guidelines for Foundation Design and Construction**

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**1. SCOPE**

- 1.1 This Technical Guidance Note (TGN) updates the technical guidelines for foundation design given in the GEO Publication No. 1/2006 (GEO, 2006).
- 1.2 Any feedback on this TGN should be directed to the Chief Geotechnical Engineer/Standards & Testing of the GEO.

**2. TECHNICAL POLICY**

- 2.1 The guidelines promulgated in this TGN were agreed by the GEO's Geotechnical Control Conference (GCC).

**3. RELATED DOCUMENTS**

- 3.1 BD (2017). *Code of Practice for Foundations 2017*, Buildings Department, Hong Kong, 111 p.
- 3.2 GEO. (2006). *Foundation Design and Construction (GEO Publication No. 1/2006)*. Geotechnical Engineering Office, Hong Kong, 376 p.

**4. BACKGROUND**

- 4.1 GEO Publication No. 1/2006 gives the technical guidelines on the presumed values of allowable bearing capacity for igneous rocks of different weathering grades. The recommendations were based on the Code of Practice for Foundation (CoPF) published by the Buildings Department in 2004. In 2017, BD published the second edition of the CoPF (CoPF 2017) with the addition of new Category 2 Rocks, described as meta-sedimentary rock of material weathering grade III or better, and with not less than 85% TCR of the designated grade. The method for determining the TCR has also been updated in the CoPF 2017.
- 4.2 As a consequential change, the revision of GEO Publication No. 1/2006 is underway to align the technical standards. However, it is considered desirable to publish supplementary guidelines on foundation design, whenever they are ready, that could contribute to improved practice and result in substantial saving in terms of construction cost and programme.

**5. SUPPLEMENTARY TECHNICAL GUIDELINES**

**5.1 FOUNDATIONS FOUNDED ON IGNEOUS BEDROCK**

- 5.1.1 Over the years, instrumented pile loading tests have been carried out for piles founded on various rock formations, which included the comprehensive pile testing programme for the

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Airport Railway, West Rail, the West Kowloon District Development and private development at Sai Sha. GEO has collected and analysed these pile test data for improving knowledge and practice in foundation engineering. The instrumented pile loading test results indicate that there are substantial safety margin of the proven bearing capacity and shaft friction when compared with the recommendations given in the publication. Hence, updated guidelines on the presumed allowable bearing capacity and bond friction on igneous rocks are derived.

- 5.1.2 The presumed allowable bearing capacity as given in Table 1 should supersede the Table 6.6 of the GEO Publication No. 1/2006. The use of the presumed values should be subject to the conditions given in the notes to Table 1. In addition, the presumed allowable bond friction for piles socketed into igneous rocks of different weathering grade is also given in the same table.

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**Table 1 – Presumed Allowable Bearing Capacity and Shaft Friction for Foundations in Igneous Rocks**

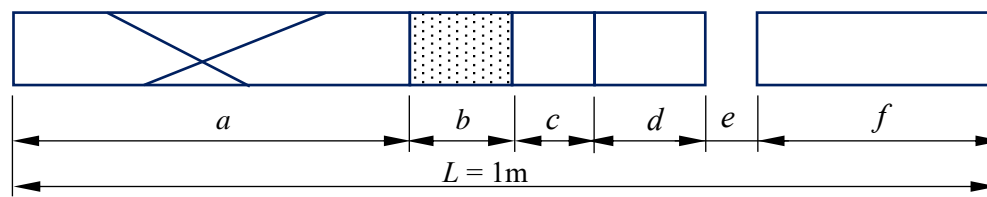
Category	Description of Igneous Rocks	Presumed Allowable Bearing Pressure (kPa)	Presumed Allowable Bond or Friction (kPa)
1(a)	Fresh to slightly decomposed strong to very strong granite or volcanic rock of material weathering grade II or better, with 100% TCR of the designated grade which has a minimum UCS of rock material not less than 75 MPa (or an equivalent point load index strength PLI50 not less than 3 MPa)	12,500	1,000 (under compression or transient tension) 500 (under permanent tension)
1(b)	Fresh to slightly decomposed strong granite or volcanic rock of material weathering grade II or better, and with not less than 95% TCR of the designated grade, which has a minimum UCS of rock material not less than 50 MPa (or an equivalent point load index strength PLI50 not less than 2 MPa)	10,000	
1(c)	Slightly to moderately decomposed moderately strong granite or volcanic rock of material weathering grade III or better, and with not less than 85% TCR of the designated grade, which has a minimum UCS of rock material not less than 25 MPa (or an equivalent point load index strength PLI50 not less than 1 MPa)	7,500	700 (under compression or transient tension) 350 (under permanent tension)
1(d)	Moderately decomposed, moderately strong to moderately weak granite or volcanic rock of material weathering grade III or better, and with not less than 50% TCR of the designated grade.	3,000	300 (under compression or transient tension) 150 (under permanent tension)

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**Notes to Table 1:**

- (1) The presumed values for allowable bearing pressure given are for foundations with negligible lateral loads at bearing level.
- (2) The self-weight of the length of pile embedded in soil or rock does not need to be included into the calculation of bearing stresses.
- (3) Minimum socket depth along the pile perimeter is 500 mm for categories 1(a) and 1(b), and 300 mm for categories 1(c) and 1(d).
- (4) TCR of the designated grade is defined in Figure 1.
- (5) The TCR of the designated grade should be proved to a depth at least 5 m into the specified category of rock. This requirement is deemed to be complied with if the rock underneath the minimum socket depth as mentioned in note (3) above has a length of at least 5 m which can be divided into a number of segments (in consecutive manner) such that (a) each segment is 1 m; and (b) the calculated TCR in accordance with Figure 1 of each segment should satisfy the required percentage of TCR of the designated grade.
- (6) The bearing surface of rock on which the foundation will be rested should be of the designated category and not in a non-intact condition for a depth not less than 600 mm.
- (7) Weathering grades and non-intact condition are defined in GEOGUIDE 3.
- (8) The point load index strength of rock quoted in the table is the equivalent value for 50 mm diameter cores.
- (9) The use of presumptive values does not preclude the requirement for consideration of settlement of the structure.
- (10) Concrete or grout should have a minimum characteristic compressive strength of 30 MPa.



$$\text{TCR of the designated grade} = \frac{a+c+d+f}{L}$$

1.  $a$ ,  $c$ ,  $d$  and  $f$  are materials of the designated grade or better.
2.  $b$  are materials inferior than the designated grade.
3.  $e$  are materials washed away during drilling.
4. The maximum continuous length of materials washed away/inferior to the designated grade,  $b+e$ , should not be greater than 300mm
5. TCR of the designated grade should not be confused with TCR of the core run shown in the site investigation report, which is equal to  $\frac{a+b+c+d+f}{L}$

Figure 1 – Determination of TCR for the Designated Grade of Rock