

## **Particular Specification for Large Diameter Bored Piles Socketed into Bedrocks**

### **1.0 Definition**

Large Diameter Bored Piles Socketed into Bedrocks are those of a diameter exceeding 600 mm formed by boring, chiselling or grabbing, plus filling with concrete. The embedment depth into rocks shall be greater than 600 mm and formed by reverse circulation drill or other method approved by the Supervising Officer (SO).

### **2.0 Design Requirements**

#### **2.1 Design Assumptions**

The theoretical safe loading capacity of large diameter bored piles socketed into granitic and volcanic bedrocks may be taken as the sum of the frictional resistance of the rock socket and the end bearing resistance of the piles provided that the socket length used in the calculation of frictional resistance does not exceed 2 pile diameters or 6 m, whichever is the shorter. However, the contribution from the minimum socket depth of 600mm stipulated in Clause 5.19 (iii) of the General Specification for Building shall be ignored in the calculation of frictional resistance (i.e. the top level of effective rock socket shall be 600 mm below the bedrock level).

The presumed allowable friction between rock and concrete are shown in Table 1. (Large Diameter Bored Piles Socketed into Bedrocks shall not be founded on rocks inferior to Grade III).

Description of rock (granite and volcanic)	Presumed allowable bond or friction between rock and concrete (kPa)
Grade II or better rock with a total core recovery more than 95% and minimum unconfined compressive strength (UCS) not less than 50 MPa (equivalent point load index strength $PLI_{50}$ not less than 2 MPa)	700
Grade III or better rock with a total core recovery more than 85% and minimum unconfined compressive strength (UCS) not less than 25 MPa (equivalent point load index strength $PLI_{50}$ not less than 1 MPa)	500

Notes: (i) Concrete should have a minimum characteristic compressive strength of 30 MPa at 28 days.

(ii) The point load index strength of rock quoted is the equivalent value for 50 mm diameter cores.

Table 1: Presumed allowable bond or friction between rock and concrete

The unconfined compressive strength (UCS) of rocks in Table 1 shall be the values obtained from rock specimens taken at 1.5 m intervals along the length of rock socket.

The use of presumptive values in Table 1 does not preclude the requirement for consideration of settlement of the structure.

If both Grade II or better rock and Grade III rock are present in the socket, the lower grade of rock (i.e. Grade III) should be assumed in the calculation of shaft friction.

The presumed allowable maximum bearing pressure of piles on bedrock shall be in accordance with Clause 5.19 (iv) of the General Specification for Building.

\* Notwithstanding GS Clause 5.04(i), the average compressive stress of concrete pile shaft imposed by the working load shall not exceed 25% of the design grade strength of the concrete or 9.0 MPa whichever is smaller. The effect of reinforcement shall not be included in the calculation of the pile capacity.

### **OR**

\* The average compressive stress of concrete pile shaft imposed by the working load shall not exceed 25% of the design grade strength of the concrete or 7.5 MPa whichever is smaller. The effect of reinforcement shall not be included in the calculation of the pile capacity.

The Contractor shall satisfy himself that the above method of calculating the theoretical safe loading capacity provides sufficient factor of safety in his design. Should he consider that this method does not provide an adequate factor of safety in his design, he shall submit an alternative method of calculations for the approval of the SO.

## **2.2 Bell-out at Pile Base**

In the design of pile capacity, combining the rock socket side resistance and bell-out at the pile base to increase the load-carrying capacity shall not be allowed. For bell-out piles, the side resistance of rock socket shall be ignored.

## **2.3 Reinforcement Details**

Reinforcement should be provided as shown in Fig. 1.

\* delete as appropriate

## **2.4 Drilling before Construction**

Site borings to pre-determine the piles founding levels shall be carried out by an independent Ground Investigation Contractor from Group I and Group II of the List of Approved Suppliers of Materials and Specialist Contractors for Public Works – Ground Investigation Field Work Category.

Drill hole(s) (one for pile diameter less than or equal to 2.5 m and two for pile diameter greater than 2.5 m) shall be sunk at each bored pile position to determine the pile founding level and rock properties. For this purpose, continuous rock core samples of N size with length not less than 1.5 pile diameters plus the rock socket length plus 600 mm shall be taken below the bedrock level for inspection. However, this predicted founding level cannot be considered as final and the actual rock quality at base of pile should be inspected and verified during pile excavation before approval.

## **2.5 Other Requirements**

The requirements related to Large Diameter Bored Piles as stipulated in the General Specification for Building apply equally to Large Diameter Bored Piles Socketed into Bedrocks.

## **3.0 Controlling and Monitoring the Verticality and Alignment of Bored Piles**

The Contractor shall submit a detailed method statement and procedures for controlling and monitoring the verticality and alignment of piles for the SO's approval before commencement of pile installation.

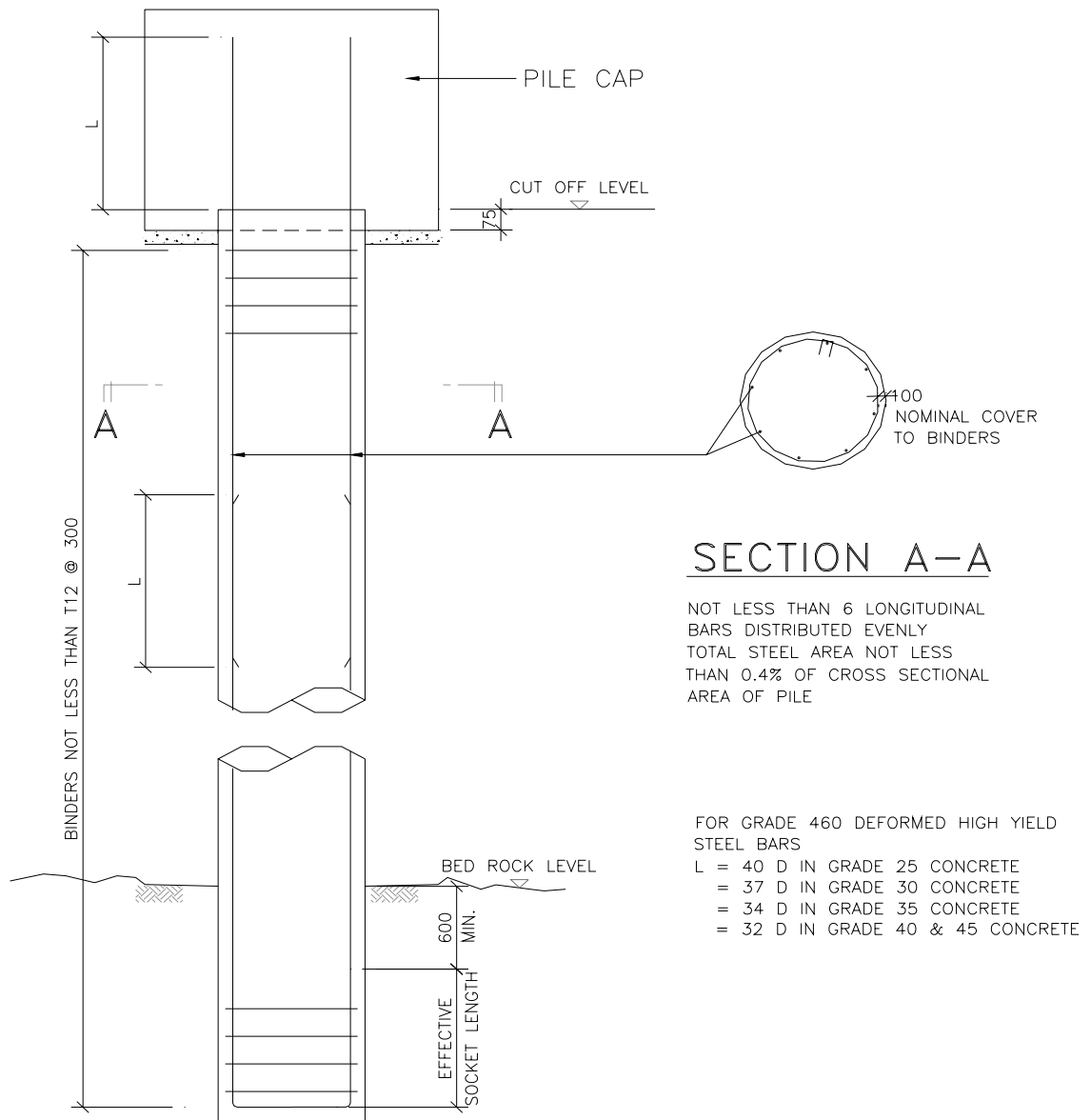
During the pile installation, tolerance for verticality of each pile shall be frequently checked as directed by the SO. In case the deviation exceeding the allowable tolerance, the Contractor shall propose method of rectification for the SO's approval prior to further pile installation.

## **4.0 Design Submissions**

In addition to those stated in Clause 5.02 of the General Specification for Building and 3.0 above, submit 2 copies of each of the following with the design submissions:-

- a. Details of boring method and equipment.
- b. Details of concrete mix.
- c. Sequence and details of concreting operation.

No piling works shall commence on site unless the design submissions are approved by the SO.



**Fig. 1** TYPICAL DETAIL OF LARGE DIAMETER BORED PILE  
SOCKETED INTO BED ROCK