PILING PART-VI
CONSTRUCTION AND INSTALLATION OF RCC BORED CAST IN-SITU PILES

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PART-VI
CONSTRUCTION AND INSTALLATION OF
RCC BORED CAST IN-SITU PILES

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1. SCOPE

1.1 This standard specification covers the construction and installation of load bearing reinforced concrete bored cast-in-situ piles.

1.2 For specific work requirements concerning construction or otherwise modifying or supplementing the provision of this specification, reference may be made to “Specific Requirements” and the provisions of this specification, the “Specific Requirements” shall govern.

2.0 CODES

2.1 IS: 2911 (part I Sec.2) – Indian Standard Code of practice for Design and Construction of pile Foundations: Part I concrete piles, Section 2 – Bored Cast – in Situ piles, shall be referred in conjunction with these specifications during the entire design, construction and installation work.

2.2 Reference to any code shall always mean reference to the latest revised edition of the code including all its amendments up to date, unless otherwise specified. In the event of any conflict between the requirements of this specification and those of the referred codes, the former shall govern.

3.0 MATERIALS

3.1 All materials, vizcement, steel, aggregates, water, etc. which are to be used in the Construction work, shall conform to BHEL Standard Specification for Reinforced Concrete pile NO.PEDC/STD.SPEC/040-d.

3.2 Concrete

3.2.1 Methods of the manufacture of cement concrete shall in general, be in accordance with IS: 2911 (part I/Sec.2) and as per following clauses.

3.2.2 The grade of concrete shall be M30 a min. cement content of 400 kg/m³.

3.2.3 Slump of Concrete

Slump of concrete shall range between 100 to 180 mm depending on the manner of concreting. The table below gives the general guidance:
<table>
<thead>
<tr>
<th>PILING</th>
<th>SLUMP (in MM)</th>
<th>TYPICAL CONDITION OF USE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIN</td>
<td>MAX</td>
</tr>
<tr>
<td>A</td>
<td>100</td>
<td>180</td>
</tr>
<tr>
<td>B</td>
<td>150</td>
<td>180</td>
</tr>
</tbody>
</table>

4. DESIGN CONSIDERATIONS

4.1 Structural Design

The piles shall have necessary structural strength to transmit the loads imposed on it, to soil. Relevant parts of IS : 2911 (part 1/Sec.2) and specific requirements shall be considered to apply for assessing the structural capacity of piles.

4.2 Reinforcement

4.2.1 The minimum longitudinal reinforcement shall be 0.4% of the cross-sectional area of the pile.

4.2.2 Clear cover to the main reinforcement shall be 50 mm. This shall be increased to 75 mm. In case of aggressive soils and ground water conditions.

4.2.3 The vertical reinforcement shall project 50 times its diameter above the cut off level.

4.2.4 The minimum clear distance between the two adjacent main reinforcement bars should normally be 100 mm for the full depth of case. The bars shall be so placing as not to impede the placing of concrete.

4.2.5 The lateral ties in the reinforcing cage shall be preferably spaced not closer than 150 mm centre to centre and shall be tack welded to the main reinforcement.

4.2.6 The minimum diameter of the lateral ties shall be 6 mm.

5. EQUIPMENT AND ACCESSORIES
5.1 The equipment and accessories for installation of bored cast-in-situ piles shall be selected giving due consideration to the subsoil conditions and the manner of operations etc. these shall be of standard type and shall have approval of the Engineer-in-Charge.

5.2 The capacity of the rig shall be adequate so as to reach the desired depth.

5.3 Provision shall be kept for chiselling within the borehole in case of any underground obstruction/hard strata. However, chiselling shall be carried out only with the approval of Engineer-in-Charge.

5.4 In case pile list required to be socketted in medium or good quality rock strata, the equipment mobilized shall have adequate capability to do so up to the required socket length. For the purposes of classification of rock for the determination of the socketting and payment pilot drill holes shall be carried out in the areas to pile.

5.5 Pilot drill holes shall be Nx or Bx size as per specification requirements. Rock drilling shall be carried out using double tube core barrel. Drilling and storing of rock cores shall conform to relevant IS Codes. Rock quality shall be classified as under depending upon the RQD.

<table>
<thead>
<tr>
<th>RQD (%)</th>
<th>ROCK QUALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Poor</td>
</tr>
<tr>
<td>25 to 75</td>
<td>Medium</td>
</tr>
<tr>
<td>75</td>
<td>Good</td>
</tr>
</tbody>
</table>

6. PILING INSTALLATION

6.1 Control of Alignment

6.1.1 The piles shall be installed as accurately as possible as per the designs and drawings. The permissible positional deviations shall be governed by IS : 2911 (part I/Sec.2). in case of piles deviating beyond such permissible limits, the piles shall be replaced or supplemented by additional piles, as directed by Engineer-in-Charge.

6.2 Boring

6.2.1 The boring shall be done by one of the following methods:
   (a) direct mud circulation
   (b) Reverse mud circulation.
   The actual method of construction to be followed shall be as per specific Requirements as furnished in customer’s specification.

6.2.2 In case the strata being bored through is reasonably stiff or dense and the length of the pile is less than 10 m use of bail bentonite method may be permitted.
6.2.3 In very soft soil a permanent liner shall be installed to ensure stability of borehole. A liner shall be used to protect the green concrete where a high hydrostatic pressure exists in the subsoil or where an underground flow of hydrostatic pressure exists in the subsoil or where an underground flow of water exists and which is likely to damage the concrete on withdrawal of casing.

6.2.4 Use of temporary liner in lieu of bentonite to stabilise sides of boreholes shall not be permitted.

6.2.5 Properties of bentonite used and quality control shall be as per IS : 2911 (part I/Sec.2).

6.3 Concreting of piles

6.3.1 Reinforcement

6.3.1.1 The reinforcement shall be made into cages sufficiently rigid to withstand handling without damage. In case the reinforcement cage is made up of more than one segment, the same shall be assembled by providing necessary laps or, preferably, by welding.

6.3.1.2 Stirrups to the main bars shall be tack welded.

6.3.1.3 Care shall be taken to ensure that the reinforcement bars do not move together before the cage is lowered down the hole.

6.3.1.4 Proper cover and central placement of the reinforcement shall be ensured by use of suitable concrete spacers or rollers, case specifically for the purpose.

6.3.2 Concreting

6.3.2.1 Concreting shall not be commenced until the Engineer-in-charge satisfies himself that at final borehole depth the soil is not weaker than that taken as the basis for pile design. If necessary, SPT or similar test shall be conducted to ensure the above.

6.3.2.2 Borehole bottom shall be thoroughly cleaned to make it free from sludge or any foreign matter before lowering the reinforcement cage. The full length of reinforcement cage shall be in position before start of concreting.

6.3.2.3 Concreting shall be done by tremie method. The operation of tremie concreting shall be governed by IS : 2911 (part I/Sec.2).

6.3.2.4 The concrete placing shall not proceed if density of fluid near about the bottom of borehole exceeds 1250 Kg/m³. Determination of the density of the drilling mud from the base of the borehole shall be carried out by taking samples of fluid...
by suitable slurry sample approved by the Engineer-in-charge, in first few piles and at a suitable interval of piles there after and the results recorded. Control of Concreting operations.

6.3.2.5 Care shall be exercised to preserve correct cover and alignment of reinforcements and avoid any damage to it throughout the complete operation of placing the concrete.

6.3.2.6 The top of pile shall be brought up above the cut of level by min 1.0 m or upto the ground whichever is more as to permit removal of all laitance and weak concrete before capping and to ensure good and sound concrete at the cut-off level for proper embedment into the pile cap. Any defective concrete in the head of the completed pile shall be cut-away and made good with new concrete.

7.0 DEFECTIVE PILES

7.1 Defective piles shall be removed or left in place, as judged convenient by the Engineer-in-charge, without affecting the performance of adjacent piles or capping above and additional piles shall be provided to replace them.

8.0 RECORDING OF DATA

8.1 A competent supervisor shall be present to record the necessary information during the installation of piles. The data to be recorded shall include:

a) The dimensions of the piles, including the reinforcement detail and the mark of the pile.

b) The type of boring employed.

c) The type of soil in which pile is constructed.

d) The depth bored.

e) The depth of water table.

f) When drilling mud is used, the specific gravity of the fresh supply and contaminated mud in the borehole before concreting is taken up, in case of first few piles and subsequently at suitable interval of piles.

g) The time taken for concreting.

h) The cut off level/working level, and

i) The consumption of cement

j) Any other important observations.
8.2 Typical data sheets of recording piling data shall be as given in Appendix D of IS:2911 (part I/Sec.2).

8.3 Any deviation from the designed location, alignment of load carrying capacity of any pile shall be noted and promptly reported to the Engineer-in-charge.