SITE CLEARANCE

1.0 SITE CLEARANCE
Before the work is started, the area coming under the building and upto an extent of 6m as required beyond the periphery of the building shall be cleared of shrubs, rank vegetation, grass, brushwood, trees and saplings of girth upto 30 cm measured at height of 1 M above the existing ground level including removal of roots of trees and saplings to a depth of 60cm below the ground level and all rubbish removed to a dumping ground within the project site as directed by the Engineer In-charge. Nothing extra shall be paid for the site clearance.

2.0 SETTING OUT OF REFERENCE MARKS:
A masonry pillar to serve as a bench mark shall be erected at a suitable point in the area, which shall be visible from the large area. These bench mark pillar shall be constructed as per the drawing to be issued by the Engineer In-charge and connected with the standard bench mark. Number of reference pillars shall be made with reference to the bench mark and levels recorded with the levels marked on them to indicate the correct formation level before the work is started. The contractor shall supply the labour and materials for constructing bench mark, setting out and making profiles and connecting bench mark with the standard bench mark at his own cost. The reference pillars, pegs, bamboos and the bench mark shall be maintained by the contractor at his own cost for checking profiles during execution.

2.1 Site levels: After site clearance and before commencement of excavation or filling the contractor shall take levels at 3 metre intervals in either direction or at lesser intervals as considered necessary at site for the entire plot. A record of these levels shall be signed jointly by the Contractor and the Engineer-in-charge. The records shall be kept by the Engineer-in-charge. The required labour and equipments for taking levels shall be supplied by the contractor at his own cost.
Piling work

3.0 BORED CAST-in-SITU PILES :

All piling works until and unless specified shall be of uniform diameter bored cast in-situ piles. The work shall be executed as per IS code 2911 (Part-I Sec.-2) – 1979 and its further amendments up to date. The work shall be carried out as per the foundation layout plan and relevant structural drawings.

3.1 Boring & boring equipments

The boring operation shall be done by percussion type drilling rigs using direct mud circulation or reverse mud circulation methods. Bailer or chiesel method if used should be used with caution to avoid the effect of suction. The size of cutting tool shall not be less than the diameter of pile by more than 75mm in order to install the pile of diameter as per the drawing. Equipments to be used for piling work shall be got approved from the engineer-in-charge before erecting for piling works. Use of drilling mud for stabilising boreholes shall be restored as per directions of the engineer-in-charge.

3.2 Stabilization of boreholes

A minimum length of temporary casing unless otherwise specifically desired shall be inserted in each borehole in order to seal the borehole against ingress of ground water and against contamination of concrete. Additional length of casing may be used depending on the condition of the strata, ground water level etc. when concreting is carried out under water, a temporary casing shall be installed to the full depth of the borehole or 2m into non-collapsible stratum, so that fragments of ground cannot drop from the sides of the hole into the concrete as it is placed. The temporary casing may not be required except near the top when concreting is done under drilling mud. Drilling mud of suitable consistency may also be used instead of additional casing for stabilisation of boreholes. The slurry should be maintained at 1.5m above the ground water level if casing is not used.
3.3 Basic properties of drilling mud.
The bentonite suspension used for piling work shall satisfy the following requirements:-

a. The suspension of bentonite used in piling work shall have thixotropic property which permits the material to have the consistency of fluid when introduced into the borehole. It forms a jelly at undisturbed state and becomes fluid again when agitated.

b. The liquid limit or bentonite when tested in accordance with IS-2720 (Part-V) – 1965ll be more than 300% and less than 450%

c. The sand content of the bentonite powder shall not be more than 7%.

d. The density of the freshly prepared bentonite suspension shall be between 1.034 and 1.10gm/ml, depending upon the pile dimension and type of soil in which the piles shall be installed. However, the density of bentonite suspension after mixing with deleterious materials/ excavated materials in the borehole may be up to 1.25 gm/ml.

e. The marsh viscosity when tested by a marsh cone shall be between 30 to 60 seconds in special case it may be allowed up to 90. It be noted that in the later case, special methods of pumping shall be used.

f. The differential free swell shall be more than 540%

g. The PH value shall be between 9 and 11.5

3.4 Control of drilling mud
In case a hole is bored by use of drilling mud, the specific gravity of the mud suspension near about the bottom of the hole shall, whenever practicable, be determined by suitable slurry sampler in a first few piles and at suitable interval of piles and recorded as directed by the Engineer-in-charge. Consistency of the drilling mud suspension shall be controlled throughout the boring as well as in
concreting operation in order to keep the hole stabilized as well as to avoid concrete getting mixed up with the thicker suspension of the mud.

3.5 Cleaning of borehole before concreting:
In case, a bored pile is stabilized by drilling mud or by maintaining water heads within the hole, the bottom of the hole shall be cleaned very carefully before concreting work is taken up. The cleaning of the hole shall be ensured by careful operation of boring toll and / or flushing of the drilling mud through the hole / holes provided at the bottom of the boring tool. Flushing of boreholes before concreting shall be done with fresh drilling fluid/ mud.

3.6 Concrete
The mix as stated in the item shall be used for concrete subject to slump of concrete shall range from 110 to 150mm depending as per relevant IS code. Concreting of the piles shall be done by tremie concreting without permitting the concrete to fall freely through the drilling mud and to avoid segregation. In addition to the normal precautions to be taken in tremie concreting, the following requirements are particularly applicable to the use of tremie concrete in piles.

a) The concrete shall be coherent, rich in cement as specified and of slump not less than 150mm.

b) The hopper and tremie should be a closed system embedded in the placed concrete, through which water cannot pass.

c) The tremie should be large enough with due regard to the size of the aggregate. For 20mm aggregate, the tremie pipe shall be of diameter not less than 200mm. Aggregates more than 20mm shall not be used.

d) The first charge of concrete should be placed with a sliding plug pushed down the tube ahead of it or with a steel plate of adequate charge to prevent mixing of concrete and water. However, the plug should not be left in the concrete as a lump. The tremie pipe should always penetrate well into the concrete with an adequate margin of safety against accidental withdrawal of the pipe is surged to
discharge the concrete.

e) The pile should be concreted wholly by tremie and the method of deposition should not be changed part way up the pile, to prevent the laitance from being entrapped with the pile.
f) All tremie tubes shall be cleaned before and after use.

g) Normally concreting of the piles should be uninterrupted. In the exceptional case of interruption of concreting, but which can be resumed within 1 or 2 hours, the tremie shall not be taken out of the concrete. Instead it shall be raised and lowered slowly, from time to time to prevent the concrete around the tremie from setting. Concreting should resumed by introducing a little richer concrete with a slump of about 200mm for easy displacement of the partly set concrete. If the concreting cannot be resumed before final set up concrete already placed, the pile so cast shall be rejected or accepted with modifications.

h) In case of withdrawal of tremie out of the concrete, either accidentally or to remove a choke in the tremie, the tremie may be reintroduced in the following manner to prevent impregnation of laitance or scum lying on the top of the concrete already deposited in the bore.

i) The tremie shall be gently lowered on the old concrete with very little penetration initially. A vermiculite plug should be introduced in the tremie. Fresh concrete of slump between 150mm and 175mm shall be filled in the tremie which will push the plug forward and will emerge out of the tremie displacing the laitance / scum. The tremie will be pushed further in steps making fresh concrete sweep away laitance / scum in its way. When tremie is buried by about 60 to 100cm, concreting may be resumed.

j) The top of concrete in a pile shall be brought at least 60cm above the cut-off level to permit removal of all laitance and weak concrete before capping and to ensure good concrete at the cut-off level for proper embedment into the pile cap. Prior to pile cap/ tie beam top 60cm must be dismantled at contractor’s cost. The
rates quoted should cover these scopes of works.

3.7 Control of piling installation:
Piles shall be installed as accurately as possible as per design, drawing either vertically or to the specified batter.

a) Control of alignment: The maximum allowable tolerance for the piling installation shall be as follows:
   - Horizontal displacement : 50mm
   - Vertical displacement of pile toe with respect to the Top of pile at working level : 1.5% of the length of pile

b) Control of cover: The minimum clear cover to all main reinforcement in pile shaft and to the bottom of the pile shall be not be less than as specified in the drawing. Provision shall be made to maintain clear cover in sides as well as at the bottom as specified during insertion of reinforcement cage, during concreting as well as during withdrawal of tremie pipes to the satisfaction of the engineer-in-charge.

3.8 Effective length of piles for measurement: The effective length of piles shall be measured from the bottom of the borehole to the bottom of the pile cap (cut-off level) as specified in the drawing. When concrete is placed by tremie method, concrete shall be cast to the piling platform level (working level) to permit overflow of concrete for visual inspection or to a minimum of one meter above cut-off level whichever is higher. In circumstance where cut-off level is below ground water level the need to maintain a pressure on the unset concrete equal to or greater than water measure should be observed and accordingly length of extra concrete above cut-off level shall be determined. However measurement shall be given for effective length only.

3.9 Defective piles:
In case, defective piles are formed, they shall be removed or left in place
whichever is convenient without affecting the performance of the adjacent piles or the cap as a whole. Additional piles shall be provided to replace them as directed at the contractor's cost. Any deviation from the designed location, alignment or load capacity of any pile shall be noted and adequate measures taken well before the concreting of the pile cap and plinth beam if the deviations are beyond the permissible limit. For all the defects attributable to the contractor in this connection shall be rectified at the contractor's cost.

3.10 Trimming of pile heads
Completed piles shall be trimmed to the cut-off levels shown on the drawings or until sound concrete is found. In the event of trimming being carried below the cut-off level, the pile shall be made up to the concrete cut-off level, with concrete of the same quality as used in the piles as the contractor's expense. A non-conformance will be raised in such circumstances. Reinforcement shall be exposed for the full bond length appropriate to the diameter of the bar and projected in the pile cap as per drawing. All concrete and cement shall be removed from the bars, which shall also be wire-brushed to remove any loose rust, dirt and scale. Rate shall include cost of all these operations.

3.11 Lengthening of piles
Where it is necessary to increase the length of any pile after it has been installed, the head of the pile shall be cut-off to expose the reinforcement for a full bond length of the bars to lap with the new bars. The exposed surface of the concrete shall be chiseled to form a key brushed to remove loose material and covered with 25 mm thick cement mortar (1:2 mix) immediately before the new concrete is placed.

3.12 Pile load Tests: The pile load test shall have to be carried out as per the latest edition of IS-2911-Part—IV.

Information to be submitted: The tenderer should submit the following information along with the tender.

a) Full details of method of installing the pile
b) Details of pile installing rings

c) Proposed construction program matching with the capacity of equipment and taking into consideration the various idle and non-productive period on account of shifting of equipment and testing and possible delays keeping in view the completion date as stipulated in the tender.

d) Execution plan: within 15 (fifteen) days of receiving the letter of intent the contractor will submit 6 (six) copies of drawings showing the sequence of pile boring. The drawings will be prepared on the basis of a master plan giving identification nos. of piles, which will be furnished by the Engineer -in-charge

e) Test results : The test data and result for the various ingredient of reinforcement cement concrete cubes and cylinders, driving of the shell, staticload test on single pile and group and on working piles will be submitted regularly and as and when directed by the Engineer-in-charge. For resulting the ingredients of RCC the relevant clauses of the —technical specification for cement concrete (plain and reinforced) will apply.

3.13 Rates

a) The rate for the item of installation of pile shall include the cost of all materials consumed in the work or incidental to it as well as testing of materials, the cost of plants and equipment, labour, supervision, transport, taxes, insurance, royalties and revenue expenses, securities and safety measures, approaches, power, fuel, lubricants, services, preliminary and enabling works, camps, stores etc. Andover heads and profits complete. The rates shall include the entire cost of driving, supplying and installing concrete including the cost of providing extra concrete above cut off level and subsequent dismantling and removing the same before construction of pile caps. Rate for providing reinforcement including cutting, bending, binding and placing in position shall be quoted separately. The work to be provided for by the contractor for installing cast-in-situ piles is given under clause 2.1 and elsewhere in this specification. In case no specific items is provided in the schedule to cover any particular item of work, it is implied that the contractor will include the cost of executing all such works in the rates quoted for
connected items in the schedule.

**b) Load Test** Measurement will be taken for static/ dynamic, lateral load or pull out tests on single piles or groups as per specification and schedule of items on each occasion of test.

c) **Other Items**
The mode measurement of the other connected item of work like excavation, casting pile caps and beams etc. will be governed by the relevant clauses of the Technical Specification.

**CONCRETE (PLAIN AND REINFORCED)**

4.1 This specification establishes the materials, mixing, placing, curing, etc. of all types of cast-in-situ and pre-cast concrete used in foundation under-ground and over-ground structures, floors, etc., Any special requirement as shown or noted in the drawings shall supersede over the provisions of this specification.

4.2 **Materials:**

a) **Cement:** Cement shall be OPC/Slag Cement/Portland Pozzolana cement from reputed manufacturers of cement, having an annual production of at least one million tons and conforming to relevant IS codes. The cement shall be stored in a dry waterproof go down. As and when desired by the Engineer-in-charge the contractor shall be required to produce the test certificate from the approved test house at his own cost. The mandatory tests of cement shall be carried out by the contractor at his own cost in IITG Laboratory.

b) **Fine Aggregate:** For all concrete work, it shall be coarse sand conforming to the grading as given below: (zone I or II only applicable to concrete). Quality of sand shall be got approved by the Engineer-in-charge before bulk purchase. Silt content shall not exceed 4% by weight. The grading of fine aggregate shall be as follows:
<table>
<thead>
<tr>
<th>IS Sieve Designation</th>
<th>Percentage Passing by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grading Zone I</td>
</tr>
<tr>
<td>10 mm</td>
<td>100</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>90-100</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>60-95</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>30-70</td>
</tr>
<tr>
<td>600 micron</td>
<td>15-34</td>
</tr>
<tr>
<td>300 micron</td>
<td>5-20</td>
</tr>
<tr>
<td>150 micron</td>
<td>0-10</td>
</tr>
</tbody>
</table>

c) Coarse aggregate: For concrete it shall be broken/crushed stone graded coarse aggregate. Coarse aggregate up to 20 mm size. Grading shall be within the limit as given below:
<table>
<thead>
<tr>
<th>IS Sieve Designation</th>
<th>Percentage passing for graded aggregate of nominal size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40 mm</td>
</tr>
<tr>
<td>80 mm</td>
<td>100</td>
</tr>
<tr>
<td>63 mm</td>
<td>-</td>
</tr>
<tr>
<td>40 mm</td>
<td>95-100</td>
</tr>
<tr>
<td>20 mm</td>
<td>30-70</td>
</tr>
<tr>
<td>10 mm</td>
<td>10-35</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>0-5</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>-</td>
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</tbody>
</table>

Note: If directed by Engineer-in-charge, the aggregate (fine as well as coarse) shall be washed to remove all dust, dirt, clay particles etc., at contractor's expenses.

d) Water: Water to be used in concrete, masonry work, plasters shall be clean, fresh and non-saline. Sample of water shall be got tested before use according to relevant IS code if required by Engineer-in-charge.

4.3 Grade of Concrete:
Whenever grade of concrete is mentioned as M20, M25, M30 etc., as per items only design mix concrete shall be used. The mix shall be designed to produce the required grade of concrete having required workability and characteristic strength as per IS: 456. As long as a quality of materials do not change a mix design done earlier shall be considered adequate for later work. However, in case the quality of materials changes, the Engineer-in-charge may ask for a new design mix. The concrete mix design will be
carried out by the contractor at his own cost in IITG Laboratory. While designing the mix durability requirements as given in IS:456 shall be taken into account.

Proportioning of the mix shall mean the process of determining the proportions of various ingredients to be used to produce concrete of required strength, workability, durability and other properties.

The Engineer-in-charge shall verify the strength of the concrete mix, before giving his sanction of its use. However, this does not absolve the contractor of his responsibility as regards achieving the prescribed strength of the mix. If during the execution of the work, cube tests show lower strength than required, the Engineer-in-charge shall order fresh trial mixes to be made by the contractor. No claim to alter the rates of concrete work shall be entertained due to such changes in mix variations. Any variation in cement consumption shall be taken into consideration for material reconciliation only.

Preliminary mix designs shall be established well ahead of start of work. The design mix shall conform to the guidelines of IS: 10262.

a) Mixing: All concrete for reinforced cement concrete shall be mixed in an Automatic Concrete Batching plant as described in special conditions of contract. Wherever designation of concrete is given as M-20 or M-25, etc, only design mix shall be used.

b) Placing: Placing of concrete in all structural members shall be done with the help of Concrete Pump(s) of required capacities or any other method approved by Engineer in Charge.

c) Consolidation: Concrete for all reinforced concrete works in footings, columns, beams, slabs and the like shall be deposited and well consolidated by vibrating, using portable mechanical vibrators. Concrete in other items such as in chajjas, lintels, shelves etc., shall be laid and well consolidated by beating and tamping. Care shall be taken to ensure that concrete is not over vibrated so as to cause segregation and bleeding.
5.0 STEEL REINFORCEMENT:

5.1 Only steel conforming to Fe500D grade of IS 1786:2008 as per item shall only be used. As and when desired by the Engineer-in-charge the contractor shall be required to produce the test certificate from the approved test house at his own cost. The mandatory tests of reinforcement shall be carried out by the contractor at his own cost in IITG Laboratory.

5.2 Cleaning of reinforcement: Before steel reinforcement is placed in position, the surface of the reinforcement shall be cleaned out of rust, dust, grease and any other objectionable deleterious substances.

5.3 Bar bending schedule of reinforcement: On receipt of structural drawing, Contractor shall prepare bar bending schedule of reinforcement and shall obtain approval of the Engineer in-charge.

5.4 Placing and security: Reinforcement bars shall be accurately placed and secured in position by 20 gauge soft black annealed steel wire and firmly supported or wedged by pre-cast concrete blocks of suitable thickness at sufficiently close intervals so that they will not sag between the supports or get displaced during the placing of concrete or any other operation of the work. At intersection point binding of reinforcement point shall be in both the direction. Contractor shall maintain reinforcement in its correct position without displacement and correct specified cover.

5.5 Welding: Welding of bars shall not be carried out unless specifically authorized in writing by Engineer in-charge as per I.S. Code of Practice in place of splicing. However, no extra payment shall be allowed for the same.

5.6 Inspection of reinforcement: No concreting shall be commenced until Engineer in-charge has inspected the reinforcement in position and until his approval has been obtained. A notice of at least 72 hours shall be given to the Engineer in-charge by the contractor for inspection of reinforcement. If in the opinion of the Engineer in-charge,
any materials are not in accordance with the specification or the reinforcement is incorrectly spaced, bent or otherwise defective, the contractor shall immediately remove such materials from the site and replace with new material and rectify any other defects in accordance with the instruction of the Engineer in-charge and to his satisfaction.

5.7 Cover for reinforcement: To be followed as per IS Code of practice if not specified.

5.8 Net measurement: Reinforcements shall be placed as shown on the structural drawings and payment will be made on the net measurements in accordance with the drawing and taken at the site. Only such laps, dowels, chairs and pins in reinforcement as approved by the Engineer in-charge or shown in drawings shall be paid for. The contractor shall allow in the quoted rates for all wastage, which will not be paid separately.