THE BRIDGES

METHOD STATEMENT FOR

PILING

DIRECT MUD CIRCULATION

CONTENTS

01) PREAMBLE

The object of this method statement is to lay down a procedure for the installation of bored cast in-situ piles by **D**irect **M**ud **C**irculation method.

This work method statement covers the technical requirements for the manufacture and installation of bored cast in-situ piles land and rock strata. This WMS also covers the furnishing of all materials, plant, labor etc. for complete and proper installation of vertical concrete piles including surveying and setting out correct location of piles, cut-off level of piles etc.

02) EQUIPMENT & MATERIALS

- Tripod
- Pre tube (1000 mm OD X 1.5 mm Long)
- DMC Pipe (In pieces 3.0 m avg. Length)
- DMC Chisel (1000 mm OD)
- 3 Ton Capacity Piling Winch
- Batching Plant
- Water tank
- Mud pumps, hose pipes & channels
- Transit mixers 4 to 6 cum capacity
- Tremiee pipes of 250mmØ and steel hopper/funnel for concreting.
- Crane
- Rebar cutting & bending m/c
- Trailer/truck
- Power generator of suitable capacity

03) ROLES & RESPONSIBILITIES

Project Manager

1. He shall be responsible to control all the activities for the construction all works.
2. Ensures that the project works in his zone are carried out in accordance with company policies and in accordance with the requirements of the project quality plan.
3. Ensuring the full compliance of subcontractor operations with corporate quality policies and with the requirements of quality plan.
4. Make sure that all the suitable equipment requirement to execute the works according to the construction program are available, in good condition, and provide any additional equipment.
5. Coordinate with the Construction Manager, Project Engineer, Safety Engineer, for a safe and proper execution of the works.
6. To guide specific attention to all safety measures in co-ordination with the safety officer/engineer.
7. Selection of equipment's according to work condition in coordination with plant and machinery team.
8. He shall be responsible to control all the activities for the construction all works.
9. Ensures that the project works in his zone are carried out in accordance with company policies and in accordance with the requirements of the project quality plan.
10. Ensuring the full compliance of subcontractor operations with corporate quality policies and with the requirements of quality plan.
11. Make sure that all the suitable equipment requirement to execute the works according to the construction program are available, in good condition, and provide any additional equipment.
12. Coordinate with the Construction Manager, Project Engineer, Safety Engineer, for a safe and proper execution of the works.
13. To guide specific attention to all safety measures in co-ordination with the safety officer/engineer.
14. Selection of equipment's according to work condition in coordination with plant and machinery team.

Construction Manager

1. Report to the Project Manager
2. Ensure area is ready and safe to start the works.
3. Concrete Mix design shall be submitted to Employer's representative and take approval before use
4. Ensure reinforcement / structural steel is ready before start of work.
5. Set up necessary equipment and plant through discussion with the Project Manager and Project Engineer/Works Supervisor.
6. Ensure the works are carried out according to the specification, quality and approved shop drawings.
7. Liaise and coordinate with the project manager for the agreed sequence of works with respect to the construction methodology and program.
8. Allocation of required manpower through co-ordination with the PM.
9. Ensure the availability of the risk assessments for the works activities in hand.
10. Provide sufficient and safe access for operatives, Crain, trucks and pumps.
11. Take precautionary measures with regards to protecting works from hot weather, cold, sun and rain etc.

HSE Engineer/Officer

1. Report to the Project Manager
2. To ensure implementation of all safety measures related to the nature of works being carried out, and in accordance with the Project Safety Plan.
3. Ensure that all the persons involved in the works are aware of their

responsibilities, and that they have enough understanding of the safety procedures.
4. The safety officer in co-ordination with the Project Manager will ensure that all the implemented safety measures are effective enough to maintain safe working conditions on the site.
5. To maintain continuous inspections of the site activities, advise and train persons on a daily basis to prevent accidents and personnel injury.
6. Give special concern to housekeeping, and ensure that the site is well maintained clean and tidy.
7. To ensure all the relevant safety sign boards for different works are in place.

QA/QC In-charge

1. Report to the Project Manager
2. Ensuring that Consultant/Client inspection requests are implemented.
3. Compilation of all necessary quality control checklists.
4. Assisting consultants during the Inspections.
5. Coordinating with the third party lab regarding tests and results.
6. The control of work performance by means of checking the work before consultants inspection and issuing RFIs, punch lists as necessary.
7. Completion of documentation to verify the work performed.
8. Controlling all inspection activities on site in line with ITP's.
9. Ensuring that all test equipment including surveying equipment is calibrated and is suitable for use on the project site.

Plant In-charge

1. Report to the Project Manager.
2. Analyze suitability of Plants & Machinery required to execute work, check technical specifications.
3. Ensure good working condition of all P&M.
4. Regular inspection of P&M along with safety officer to maintain good mechanical condition of P&M.
5. Ensure all Third Party Inspections of P&M as per statutory requirements.
6. Ensuring suitable and skilled technicians to keep P&M in good working condition and training to workmen using P&M.
7. Controlling minimum spares inventory at site to ensure smooth operation of P&M and to tackle breakdowns.
8. Controlling storage, allocation of diesel, monitoring consumptions to avoid misuse.
9. Monitoring performance, availability, utilization of P&M.

Project Engineer

1. Report to the Construction Manager
2. The engineer will carry out his duties in a manner that will be coordinated by the Construction manager on a daily basis, and will ensure proper distribution of the workforce and equipment at different site locations.
3. To be aware of test frequencies related to the work.
4. Control disposal of waste excavation material according to the instructions from the project manager/customer.
5. Coordinate with the Safety Officer to maintain safe working and proper housekeeping of the site. To comply with the safety measures and ensure that all the HSE team is aware of the same to prevent accident and loss.
6. Ensure reinforcement ready to working as per requirement.
7. To monitor and check all activities and ensure that works will be carried out according to specifications, quality and approved drawings.
8. To inform the QC Inspector of the areas ready for inspection.

QC Engineer

1. Report Site QA/QC In-Charge.
2. Shall be responsible for overall control and inspection of QC activities as per checklist and QAP at site during concrete work.
3. Shall be responsible for performing all checks and taking slump / temperature tests and accepting / rejecting concrete

Surveyor

1. Co-ordinate with the Foreman /Project Engineer and Construction Manager
2. To establish benchmarks from agreed reference points, provide required setting out and level markings and follow up with regular checks.
3. Co-ordinate with the Project Engineer / Foreman and ensure the approved shop drawings/construction drawings will be implemented properly.
4. Maintain survey details and reports, periodically check the progressing works and advise the project manager of any deviation from the drawings.

HSE Engineer/Officer

1. Report to the Project Manager
2. To ensure implementation of all safety measures related to the nature of works being carried out, and in accordance with the Project Safety Plan.
3. Ensure that all the persons involved in the works are aware of their responsibilities, and that they have enough understanding of the safety procedures.
4. The safety officer in co-ordination with the Project Manager will ensure that all the implemented safety measures are effective enough to maintain safe working conditions on the site.
5. To maintain continuous inspections of the site activities, advise and train persons on a daily basis to prevent accidents and personnel injury.
6. Give special concern to housekeeping, and ensure that the site is well maintained clean and tidy.
7. To ensure all the relevant safety sign boards for different works are in place.

Foremen/ Works Supervisor

1. Report to the Project Engineer
2. Ensure the work progress inline with the targets and sequence as per the PM directions and orders.
3. Liaise with the Project / Construction Manager for the allocation of the work force, ensuring adequate manpower is available.
4. Liaise with the site manager to ensure all the plant/materials are available to perform the construction works.
5. Full time supervision to ensure the works are in accordance to specifications, quality and GFC drawings.

04) Scope

A. Layout of Structure.
B. Aligning the tripod .
C. Setting of bentonite tank
D. Installation of Temporary casing.
E. Cutting and bending of reinforcement cage as per approved drawings.
F. Transporting Rebar to site.
G. Rebar cage fabrication.
H. Boreing.
I. Cleaning of Bore.
J. Placing & Lowering of Rebar Cage.
K. Lowering of Tremmie Pipe.
L. Producing and transporting the concrete to site as per the approved mix design.
M. Concreting of Bore hole.

05) REFERENCE DOCUMENTS

A. Concrete Mix Specification
B. Technical Specification/ Additional Tech Specifications as per Tender Document.
C. IS2911 Code of Practice for Design & Construction of Pile foundations
D. IRC:78 Standard specifications and code of practice for roads and bridges, Foundation & Substructure
E. MORTH Vth Revision
F. Approved drawings, QAP, Bar bending schedule

06) CONSTRUCTION MATERIAL DETAILS

A. Cement conforming IS-1489
B. Aggregate conforming IS-383
C. Water conforming IS-456
D. Admixture conforming IS-9103
E. Reinforcement steel conforming IS-1786
F. Structural steel conforming IS-2062

07) INSTALLATION OF CASSION

The exact location of pile center will be established by ground survey. At the point, where the pile is required, initial digging of earth is performed by manual labour. A circular c/s pit excavated having a depth a little larger than the depth of the cassion which is to be installed. The Diameter of the pit is kept so that the cassion can be driven easily. The Role of this cassion is to guide the boring tool into the Bore hole and also to support the walls of the bore hole while it contains water.

08) SETTING UP OF EQUIPMENT

The Boring tool is hanged with a wire on the top pulley of the tripod stand. The Boring tool is provided with a series of pipe joined with each other. The Job of these pipes is to transfer the drilling fluid (water + bentonite) into the bore hole.

The tripod will be erected and centered to match with the centerline of the pile. The winch will be positioned and fixed at the assigned location in such a manner that the tripod and winch are properly held in position. Drive the pre tube such that the top of the same is flushed with the ground surface. Cut an open drain on the ground between the top of plate of the pre tube and Bentonite slurry tank to allow return flow of Bentonite mixed with excavated sandy material in to tank for its sedimentation

Setting up the bentonite tank and arrangement for circulation of drilling fluid:-

The Bentonite tank that is constructed near by the site for boring of pile is filled with water and bentonite material. The density of bentonite is kept 1.2 g/cc

The Arrangements are made for the circulating of drilling mudin the bore hole. A submersible pump is fitted on one side of the bentonite tank .This pump the drilling mud to the boring tool with help of a water hose and a series of pipes to which the boring tool is attached .

The water overflows out of the top of the bore hole and open drain is dug from the top of boring hole to the bentonite tank so that the extra water is overflown back to the bentonite tank.

The arrangement is as shown below

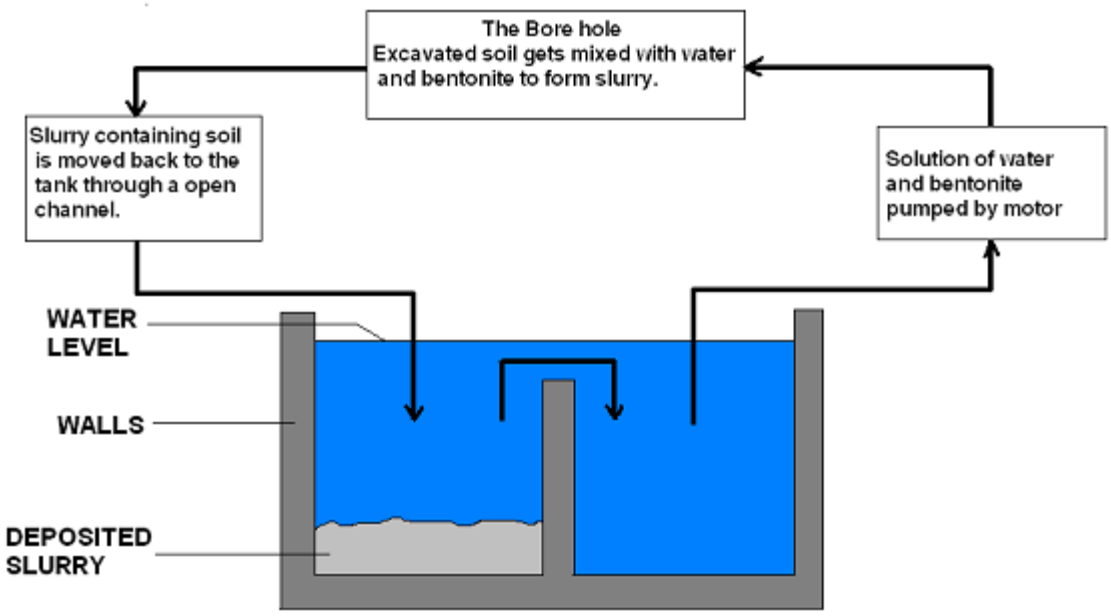
09) INITIALIZATION OF BORING PROCESS

The boring tool is lifted up by the wire connected to the electric motor. Then it is let to fall freely under gravity. The chiseling action of boring tool excavates out the soil. This soil is mixed with water bentonite coming out of the boring tool. This creates a slurry which is overflown from the top of the bore hole to the bentonite tank by a open drain.

The Bentonite material is responsible for providing strength to the soil which is present on the walls of the bore hole. The ions of Bentonite material are responsible for creating a bond between the soil particle which helps to prevent the soil from falling into the bore hole.

In the process direct mud circulation, the density of the bentonite in water has to be maintained constantly. The density of the bentonite decreases continuously because of the continuous deposition of bentonite on the walls of the bore hole. The density is maintained by adding extra bentonite into the bentonite tank.

This process is continued until the required depth is achieved. The picture below shows the boring of pile under progress.



SCHEMETIC WORKING OF THE BENTONITE TANK

10) FABRICATION AND INSTALLATION OF REINFORCEMENT FOR THE PILES

Reinforcement plays a crucial role in the load carrying capacity of the piles. The reinforcement is made in form of the desired shape by bending the initially straight reinforcement members and then joining them together by suitable means like tieing them with use of wires or by welding them together.

The reinforcement shall be prepared and installed very carefully because it is a major load carrying component of the structure.

Steps Involved

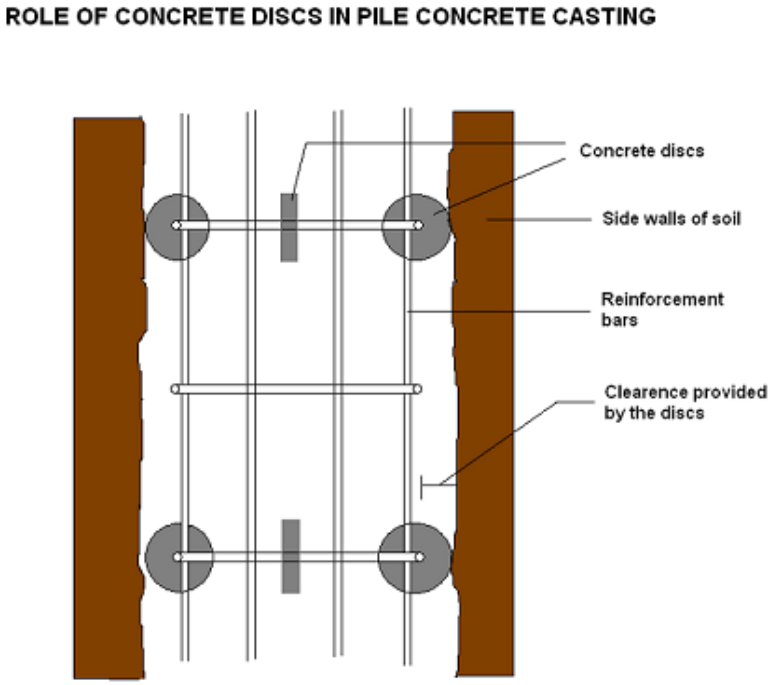
1. Before fabrication of reinforcement form the reinforcement, members are cleaned off and dusted for any corroded surface, dust or any lose material. This is done to achieve better bond strength in the concrete and reinforcement material.
2. The reinforcement for the piles mainly consists of longitudinal main reinforcement bars, Internal links spaced horizontally at specified distance, outer spiral reinforcement. All the reinforcement member are initially straight. The tie rings and the spiral reinforcement has to be bent in shape as per the design.

3. Firstly, inner tie rings are joined by fixing them with 2-3 longitudinal bars keeping a fixed center to center distance between the rings. Then this arrangement is put on a series of small stand and rest of the reinforcement is assembled together as per design.

4. The reinforcement cage so formed is provided with small discs made of concrete .These discs have a hole in their center and these are put in the circular tie rings .These rings serve the purpose of providing clearance between the walls of the bore hole and the reinforcement cage.

The Picture below shows the fabrication of reinforcement cage under progress

Preparation of reinforcement cage for pile.



5. After the fabrication is complete the whole reinforcement form has to be lifted and installed into the bore hole. This lifting creates movement in the joints of reinforcement cage. To prevent excessive movement of joints the reinforcement cage joints are welded at some points to attain rigidity.

6. Then the reinforcement cage is lifted by hydraulic crane and lowered into the bore hole. The figure below shows the process of installation of reinforcement cage.

Installation of reinforcement cage into the pile hole

11) CONCRETING OF PILES

The method used of concreting of piles is treimme method of concreting. The concreting of bored cast in situ piles is done when the bore hole is still filled with water. So special consideration of is top be given so that the water does not adversely affect the properties of concrete.

After the reinforcement of the pile has been lowered down into the bore hole. The arrangements are made for the concreting of piles. Following are steps involved in the concreting of piles

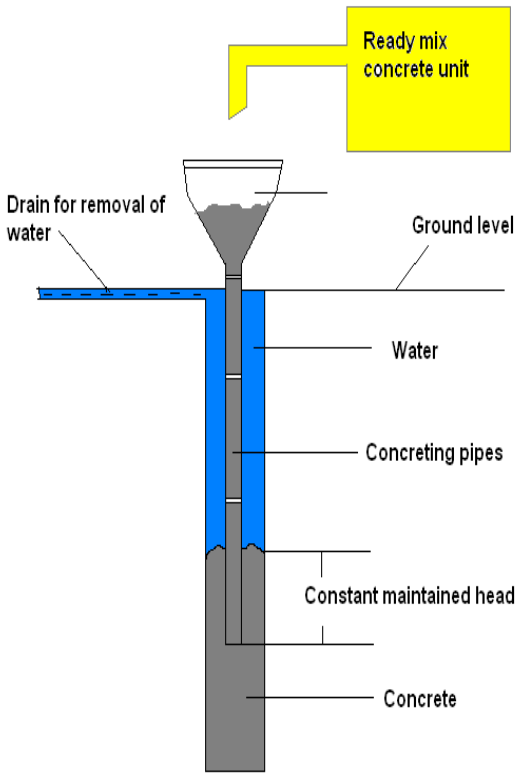
i. Steel pipes having a dia of 250 mm, thickness of of 6 mm and a length of 1.65 m are joined with each other by head to tail joint. These pipes formed a single pipe. This pipe is lowered down into the bore hole with the help of a crane until it touches the bottom of bore hole. Then the concrete hopper unit is placed on top of the pipes.

ii. The ready-mix concrete is put into the hopper which transfers it into the bottom of the bore hole via the pipes that are installed for the purpose.

i. The concrete when reaches the bottom of the pit replaces the water that was there previously. This extra water overflows from the drain provided at the top of the bore hole.

iv. A constant head (0.5 m) is maintained between the top of concrete and the bottom of the concrete installation pipe. So that the concrete does not mix with water.

v. After the concreting with one set of pipes, the setup of hopper and the pipes is lifted up by a crane. This is done to shorten the pipe length one or two pipes are removed and then the hopper is attached to the pipe again. While doing the process is taken so that a constant head between the top of the concrete surface and the bottom of the concreting pipes.



vi. The process mentioned in points iii, iv. v, vi are repeated until the concreting is done up to the top of the bore hole.

vii. A portion of the reinforcement bar is kept outside the concreted portion of the pile. This reinforcement is used to make the connections between the pile and the pile cap.