



**METHOD STATEMENT FOR
CAST IN-SITU PILING
IN SOFT STRATA**

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THE BRIDGES

01) Purpose

The purpose is to define the procedure for piling construction works at a project in accordance with the requirements specified in the relevant specifications, procedures and drawings, considering safety and quality of the work activities.

This statement does not address all of the safety concerns, if any, associated with its work. Safety and health practices will be described separately.

02) Scope

The scope of work may include piling construction works at the existing ground level, dewatering and excavation for the pile cut off level. Before starting the piling work at the site ensure the availability of below list of equipment and tools.

- 🔧 Drilling Rig.
- 🔧 Crain, Vibro Hammer.
- 🔧 JCB, Dump Trucks used for disposal of muck.
- 🔧 Soil Auger, Cutting Bucket, Cleaning Bucket.
- 🔧 Tremmie Pipes, Hopper.
- 🔧 Concrete Pump.
- 🔧 Bentonite/Polymer mixing tank, pump, pipes
- 🔧 Bentonite/Polymer receiving tank.
- 🔧 Mud pumps & hose pipes.
- 🔧 Water tank.

03) REFERENCE DOCUMENTS

- 🔧 Concrete Mix Specification
- 🔧 Technical Specification/ Additional Tech Specifications as per Tender Document.
- 🔧 IS2911 Code of Practice for Design & Construction of Pile foundations
- 🔧 Approved drawings, QAP, Bar bending schedule
- 🔧 Cement conforming IS-1489
- 🔧 Aggregate conforming IS-383
- 🔧 Water conforming IS-456
- 🔧 Admixture conforming IS-9103
- 🔧 Reinforcement steel conforming IS-1786
- 🔧 Structural steel conforming IS-2062

04) 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

05) Sequential Construction Activities

Piling Works from the existing Ground Level

- Layout of Structure.
- Aligning the Piling Rig.
- Boring of Pile in soft Strata.
- Installation of Permanent / Temporary casing.
- Cutting and bending of reinforcement cage as per approved drawings.
- Transporting Rebar to site.
- Rebar cage fabrication.
- Termination of Bore.
- Cleaning of Bore.
- Placing & Lowering of Rebar Cage.
- Lowering of Tremmie Pipe.
- Producing and transporting the concrete to site as per the approved mix design.
- Concreting of Bore hole.

5.1) Layout of Structure

The Surveyor shall carry out the setting out of the pile center positions as per approved shop drawings. The setting out of pile locations should be approved by the Consultant. The setting out pegs will consist of steel reinforcing bar that will be driven slightly below the surface of the platform so they will not be disturbed by the piling activities. The pegs will be marked with a color ribbon so that they can be easily located.

The Surveyor checks and verifies the Ground level, cut-off level and marking concrete and steel cage levels.

Pile Numbering: All piles will be numbered for each location for easy reference and the as built drawings to be submitted.

5.2) Aligning the Piling Rig

Drilling shall be carried out with the use of piling rig keeping the positioned by keeping Kelly bar true to vertical at the piling location.

5.3) Boring of Pile in Soft Strata Bentonite / polymer



The bentonite required for piling will be mixed 24 hrs in advance / polymer can mix 30 minutes in advance can and stored in the bentonite tanks adjacent to the piling location Bentonite/Polymer tank should be 1.5times the pile quantity. As the boring progresses the bore will be topped with bentonite so as to maintain a head of at least 1m above the water table. The specific gravity of bentonite slurry will not to be more than 1.05 and it will be ensured that the specific gravity of bentonite is less than 1.20 at the bottom of the bore before commencing concreting operation. The bentonite sample at the bottom of the bore will be collected with

the help of a sampler from the bottom of the bore and checked for specific gravity with the help of Mud balance or Hydrometer before commencing pouring of concrete. The excess bentonite will be disposed of at suitable dumping yards as approved by local authorities. Some below mention parameters should be also tested at site before starting the concreting.

- 1- Ph. Value of Bentonite/Polymer (9.5 to 12 for bentonite and 8 to 12 for polymer)
- 2- Marsh cone Viscosity (30-40 sec for bentonite/ 35 to 120 sec for polymer)
- 3- Particle with size more than 75 micron (< 1% for bentonite/ up to 3 % for polymer)
- 4- Liquid limit of bentonite (min- 400%)

After aligning the piling rig in position, the drilling rig auger shall be set over the pile point location and soil will be drilled up to the non-collapsible depth. During boring the verticality of the drilled hole shall be constantly checked. And also the position of the bore shall be cross checked with the reference points.

Observe the stability of the bore hole and any Ground water table is available. Collect the soil samples to verify the strata.

If the bore hole is unstable insert a Permanent / Temporary Casing in to the bore hole. During this process stability of bore shaft shall be maintained by using bentonite or polymud slurry.

During drilling process as soon as the auger touches the rock level the pressure gauge in the cabin operator will show the starting of the hard layer.

5.4) Installation of Permanent / Temporary Casing

The Casing will be placed in the bore hole and pushed down using the Kelly of the Rotary rig and pushed till the top of Casing is about 300mm above the surrounding ground level. Boring with Soil Mech bucket will be resorted to if difficulty is faced in pushing of the Casing. The top level of Casing will be checked and recorded jointly. The temporary casing will be provided for the full length of the pile wherever possible or it will extend at least 2m into non-collapsible stratum. The Casing will be driven up to the depth of 2m more than where SPT value ($N = 10$) is available as per the geo-technical investigation report. After 4m driven if casing will required vibro hammer. The inner surface of the casing will be smooth and free of all internal projections. A Casing length of 5m to 6m will be used as at most places the SPT value $N=10$ is achieved at a depth of about 2.5 m. After driving of Casing the pile will be checked for verticality and boring will be continued.

During the boring Kelly bar can be checked for the verticality with the Plumb bob. The verticality of the pile should be within the limits of 1.5 % of the length and the pile should not deviate more than 75 mm in plan location.



5.5) Boring wet strata

After installation of permanent / temporary casing, continue drilling for designed depth is achieved. We will make sure to have the same toe level for all piles in one group of pile. After reaching the bore hole the designed depth the same shall be offered to customer for inspection and review.

5.6) Cleaning of Bore Hole

After attending the comments and suggestions given by ER/PMC after the inspection cleaning of the base of the bore hole shall be carried out with a cleaning bucket.

5.7) Placing of reinforcement cage

The reinforcement cage shall be fabricated in different lengths as required and transported to site. Cover blocks shall be fixed to the rebar cage as per the requirement.

Sufficient preventive care shall be taken for the handling disturbances.

After achieving the required founding level the pre-fabricated reinforcement cage shall be lowered and binding will be done stage wise.

The rebar cage shall be lowered into the bore by rig or by crane as suited at site. The first length of cage shall be lowered and held with top of the bars adequately strengthened above the bore on which upper cage is placed in position, lapped and joined in place and then cage is lowered. These laps should be welded (at location/in-situ) or joined with couplers before lowering. Verify lower the reinforcement cage into the bore hole to the base of bore hole or to the cut-off-level.



Ensure that the cage is maintained at the cut off level during concreting works.

5.8) Lowering of Tremmie pipe

After placing the reinforcement cage Tremmie of appropriate dia i.e. 200/250mm tremmie pipe with hopper shall be lowered in to the bore hole. Before lowering the pipe it will be ensured that the joints are air tight and intact. The gap between the base of pile and bottom of the tremmie shall be kept 150mm. A plug is also placed on the hopper for the first charge.

5.9) FLUSHING

Flushing of the bore will be done with bentonite pump / water pump attached with tremmie pipe and tremmie head. Flushing will be done with fresh bentonite and continued till the specific gravity of bentonite slurry is near equal to specific gravity of bentonite

being pumped and will always be less than 1.20 at the bottom of the bore checked by sampler. Flushing will be carried out for a period of 30min with a pump capable of pumping at the rate above 1,00,000 ltrs per hour. If required flushing will be done with the help of compressed air till commencement of the concreting.

5.10) Concreting in Wet Hole Conditions



The designed grade concrete shall be prepared at batching plant & transported to site in transit mixers. Pile concreting shall be done using tremmie pipes & funnel.

Only fresh batched concrete shall be used and the concreting has to be done continuously without interruption.

After receiving the docket the concrete shall be sampled for the slump, temperature and cube casting by certified QC Engineer. The slump of concrete shall be minimum 150-200 mm at the time of pouring. The temperature of concrete at placing point should not be more than 38°C.

Tremmie pipe concreting shall be done joining a series of pipes. The hopper at the top shall have a volume greater than the tremmie pipe volume. A suitable steel stopper at the neck of the hopper which can be withdrawn with least resistance or a sliding plug can be used. The hopper and pipe shall be clean of encrusted concrete, dust, debris etc., and shall be watertight.

Concrete placing into the hopper shall be facilitated using suitable ramps for direct pour from the transit mixers. In case of inaccessible locations, concrete can alternatively be placed into the hopper by concrete pump.

The hopper shall be filled with concrete completely and then the stopper plate is removed to allow the concrete to flow into the pipe. Subsequent charges of concrete shall be maintained continuous as required till the pile bore is cast to the specified height. The bottom of tremmie pipe shall always be inside concrete forming watertight system. The tip shall be minimum 3.0 metres inside concrete depending upon rate of pouring concrete.

The tremmie pipe shall be withdrawn in stages as and when concrete builds up in the bore. Particular care shall be taken when vertical movement is imparted on tremmie pipe to force concrete down into the pipe and also when tremmie pipe is raised so that the rebar cage is not disturbed from its position.

All the piles shall be concreted to a level at least that of the cut-off level. The top of concrete in a pile shall be brought above cut-off level up to a minimum height of 300mm to permit removal of all laitance and weak concrete, so that the concrete at the cut-off level shall be dense and sound. After completion of the concreting the empty bore will be protected and carefully back filled.

5.11) CASING REMOVAL

The casing will be removed as soon as the concreting is completed with the help of crane ensuring a sufficient quantity of concrete is maintained within the bore. The concrete will not be placed in the bore once the bottom of the casing has been lifted above the top of the concrete . Concrete for pile will cater for initial set of minimum 4 hrs. The tremmie will be extracted before the concrete reaches initial set, concrete is not disturbed after initial setting.

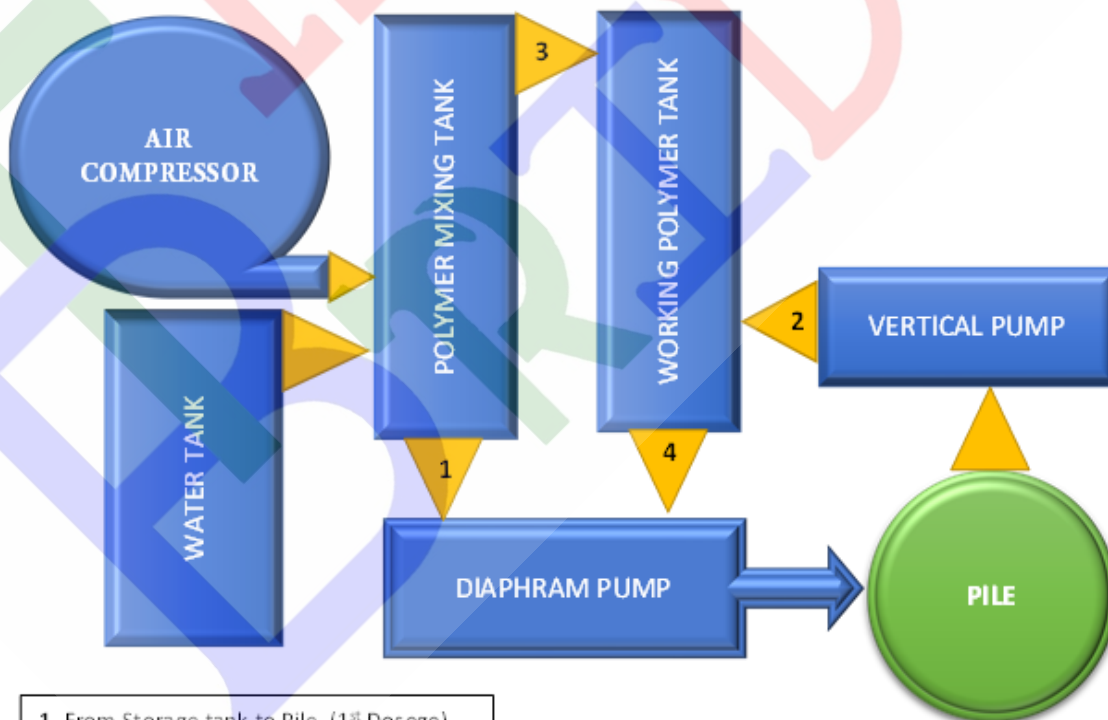
5.12) Installation Records

Detailed pile installation records in duplicate for each pile installed shall be maintained. The details of the record shall include among others, pile number, coordinates, pile size, pile elevation, pile cut-off, ground level, pile bore data (such as length of liner, boring duration, bored length, pile length etc.), concreting record (grade of concrete, as mixed slump, volume of concrete, timing, pile cage details, etc.)

5.13) Clean-up

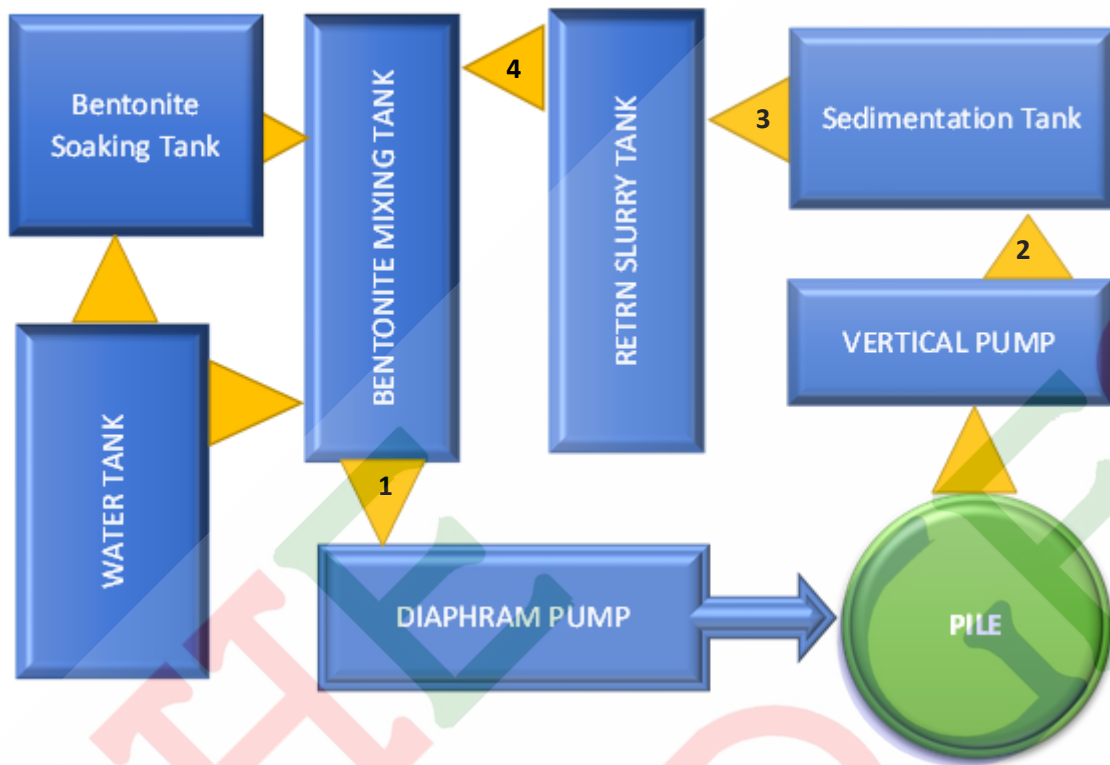
Upon completion of piling, casings, equipment, construction tools, debris, scrap, muck etc. shall be removed from the place of work. Exposed and finished concrete and dowel surface shall be left in a clean condition.

The Polymer Circulation Arrangement



1. From Storage tank to Pile. (1st Dosege),
2. From Pile bore to working polymer tank.
3. From storage to working polymer tank.
4. From working polymer tank to pile.

The Bentonite Circulation Arrangement



1. From storage tank to pile
2. From pile to sedimentation tank
3. From sedimentation tank to return tank
4. From return tank to Bentonite tank