CONTIGUOUS BORED PILES INSTALLATION

1.0 INTRODUCTION

Contiguous bored pile wall is a wall forms by bored piles in a series with close spacing to act as a wall. The installation method is similar to the bored pile installation. Therefore, the work procedure describe in the method statement of bored pile installation shall be followed. Nevertheless, base cleaning is not necessary if the contiguous bored is not a load bearing wall. In additional to that, the following sequence of work must put in attention.

2.0 INSTALLATION OF CONTIGUOUS BORED PILE

2.1 Guide Wall

Prior to the installation of contiguous bored piles, the guide wall shall be installed. The wall position must be level and flat for installing the guide wall. The alignment and position of the guide wall shall be set out according to the surveyer setting out point. The construction of the guide wall shall always be ahead of the installation of bored piles installation. Nevertheless, when drilling in dry hole area without casing, guide wall is not necessary.

2.2 Sequence of Bored Pile Installation

The general sequence of pile installation for the proposed contiguous bored pile (CBP) wall shall be as per detailed in the attached sketch.

2.3 Inspection

For a boring without casing, the diameter of the boring hole for a representative number of piles shall be measured by measuring tape prior to the placing of concrete into it. The joint measurement shall be carried out by the S.O. or his representative and the Contractor's representative.

Light will be provided for S.O. or Engineer to check the shape and verticality of pile shaft and cleanliness of pile base (in the case of dry hole). Nevertheless, cleanliness of pile is not important for contiguous bore pile as it doesn't act as foundation pile.

Should ground water seepage likely to occur during excavation, for the safety of all parties' purposes, inspection below ground by sending person into borehole is strictly not allowed. Alternatively, temporary spotlight or mirror with sufficient safety at the ground level will be provided to enable the Engineer to check the borehole. Generally, the following items are to be checked prior to concreting:-

a) Actual bore size

b) Actual bore depth

c) Actual bore shape

d) Pile base condition

e) Verticality

f) Eccentricity of Wall - after casting and excavation down to expose the wall (checked by as-built, on wall surface not protrude out from skin wall, the spacing shall be sufficient for construction of the inner permanent wall.)

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3.0 INSTALLATION OF BORED PILE

5.1 Boring

a) Boring in Soil

Boring commended after the position of the boring plant is checked. Usually, a soil auger of the required size is used to bore the hole. Excavation of the hole shall be continued until the required depth.

b) Boring in Hard Layer and Rock

If the soil boring tool ceased to penetrate further, hard material or rock is encountered and other boring tools may be utilized. Tungsten bit augering, coring or chiseling may be required to break up the hard stratum. A pre-study of the soil investigation reports will facilitate on the work.

The definition for the coring or chiseling of hard layer is based on SPT-N value more or equal to 200. If less than 200 shall be considered as normal soil.

If water or other drilling fluids are used to stabilize the excavation, when auger can not remove the soil from the hole, boring bucket shall be used to remove the soil inside the borehole.

After reaching the required depth, a cleaning bucket will be used to clean up the bottom the borehole. A jointly measurement of the depth of the bored hole among the S.O and the contractor's representative prior to lowering of reinforcement and concreting is necessary.

5.2 Boring Near Recently Cast Piles

As an extra precaution measure, piles shall not be bored so close to other piles which have recently been cast and which contain workable or unset concrete that a flow of concrete could be induced to avoid damage to any of the piles. In general, recently cast piles will be marked on the Construction Drawing for identification purposes. For this site, a minimum spacing of 3 piles diameters will be sufficient. Boring is only allowed after 12 hour of concreting where the concrete already harden.

5.3 Temporary Casings

When augering of borehole almost reaches the expected collapsible soil layer, temporary casing with inside diameter not smaller than that of the bored pile will be installed using the vibro-hammer mounted on a service crane to maintain stability of the pile excavation. However, temporary casing will only be used when necessary.

Temporary casings shall be free from significant distortion. They shall be of uniform cross-section throughout each continuous length. During concreting they shall be free from internal projections and encrusted concrete that might prevent the proper formation of piles.

5.4 Stability of Pile Excavation Using Water

Due to the physical constraint and difficulties of installing temporary casing into deeper and hard but collapsible soil layer, clean water will be used to maintain the stability of bored hole.

Generally, introduction of water into borehole will be commenced immediately after the installation of casing as well as the removal of soil inside the casing.

For the first introduction of water, PVC hose or equivalent with diameter varying from 1" to 4" may be used to lower into the borehole. Prior to continuing boring, the level of the water in the borehole shall be high enough so that the internal fluid pressure always exceeds the pressure exerted by the soils and external ground water.

Subsequent introduction of water into the borehole can be directly discharged from the top of the borehole.

An adequate temporary casing length shall be used in conjunction with the method to ensure stability of the strata near ground level until concrete has been placed.

5.5 Spillage and Disposal

Reasonable steps will be taken to prevent the spillage of drilling fluid suspension on the site in areas outside the immediate vicinity of bore. If necessary, temporary earth drain near the pile will be formed to divert the water into adjacent site drain.

5.6 Pumping from Bored Hole

If necessary, pumping from bored hole will only be allowed when temporary casing has been penetrated placed into a stratum that prevents the flow of water from other strata in significant quantities into the bore. In stable hole, no pumping exercise will be carried out.

5.7 Cleaning of Pile Bases

Upon completion of boring, loose and disturbed or remoulded soil shall be removed from the base of the pile using an appropriate size of cleaning bucket.

5.8 Inspection

For a boring without casing, the diameter of the boring hole for a representative number of piles shall be measured by measuring tape prior to the placing of concrete into it. The joint measurement shall be carried out by the S.O or his representative and the Contractor's representative.

Light will be provided for S.O. or Engineer to check the shape and verticality of pile shaft and the cleanliness of pile base (in the case of dry hole).

Should ground water seepage be likely to occur during pile excavation, for the safety of all parties' purposes, inspection below ground by sending person into borehole will be not exercised. Alternatively, temporary spotlight or mirror with sufficient safety at the ground level will be provided to enable the Engineer to check the borehole. Generally, the following items are to be checked prior to concreting:-

a) Actual bore size

b) Actual bore depth

c) Actual bore shape

d) Pile base condition

e) Verticality

f) Eccentricity – after casting (check by as- built)

5.9 Continuity of Construction

As a quality control measure, a pile constructed in a stable soil without the use of temporary casing or other support shall be bored and concreted without prolonged delay to ensure that soil characteristics are not significantly altered.

5.10 Surface Water

Generally, temporary casings are slightly higher than working platform to prevent surface water from entering into the borehole. For uncased hole, proper earth drain near the pile will be formed to prevent any water from entering into the borehole.

5.11 Excavation Materials

Surplus earth resulting from boring operations will be used to backfill the empty bored hole above the cut off level, and removed away from the site as directed by the Engineer.

4.0 Placement of Reinforcement

All reinforcement will be inspected and approved by S.O prior to placement. Reinforcement to the design requirement of bored piles will be pre-fabricated in the reinforcement yard and transported to the borehole for placing. After fabrication by the bar benders, depending on the rigidity of the steel cage, the helical links might be tack welded to the main reinforcement at about 2m interval to prevent collapse during lifting of the steel cage. Laps are also to be spot welded at approximately 100mm interval so that they are intact during transportation and lifting. Three (3) nos, of cement / sand mortar round spacers will be placed at 3m c/c to the reinforcement to provide the cover to the reinforcement against the soil during concreting.

The reinforcement will be lowered to the completed borehole, prior to concreting, by means of a service crane and to be adjusted to the correct level.

Required steel bar longer than 12m for bore pile will be lapped at 40 times of smaller bar size according to the Drawings.

7.0 Concreting

Immediately after the boring for the pile has been completed, approval for concreting will be sought from the S.O. Before placing concrete, measures shall be taken to ensure that there is no accumulation of silt or other loose materials at the base of the bore. Concreting shall be carried out continuously without interruption.

7.1 In Wet Hole Condition

For concreting of bored pile in wet hole (bored hole filled with water), grade 40T2 with tremie method shall be used. An 8” to 10” diameter tremie pipe is inserted at the center of the reinforcement cage and down into the bottom of the bored hole.

The hooper and tremie pipe shall be clean and watertight throughout. The pipe shall extend to the base of the pile. Vermiculite or polystyrene beads may be poured into tremie pipe to form as a sliding plug in order to prevent direct contact between the first charge of concrete in the tremie pipe and the water in the drilling fluid. The pipe shall at all times penetrate to concrete that has previously been placed. At all times, sufficient quantity of

concrete shall be maintained within the pipe to ensure that the pressure from it exceeds that from the water. As the concreting proceeds, the pipe is gradually withdrawn until the concrete is at its finishing level. The finishing level should be 1m higher than the cut off level.

Measurement of the level of the concrete surface shall be taken after completion of concrete pouring of every truck.

7.2 In Dry Hole Condition

For no water in the hole, Concrete Grade 35P or G35T1 with tremie method shall be used. Concreting will be performed through a short pipe of diameter not less than 150mm. The pipe shall extend to 3m above the base of the pile. As the concreting proceeds, the pipe is gradually withdrawn until the concrete is at its finishing level.

In general slump at the time of discharge into the pile boring hole shall be in following condition.

Piling Mix Workability	*Slump Range*		*Typical Condition of Use*
	Minimum	*Maximum*	
G35P	75mm	125mm	Water-free bored hole. Reinforcement spacing > 100mm
G35T1	100mm	175mm	Water-free bored hole. Reinforcement spacing < 100mm
G35T2	150mm	225mm	Water or stabilising fluid bored hole

8.0 EXTRACTION OF TEMPORARY CASING

All temporary casings are to be extracted immediately after completion of concreting where the concrete within them remains sufficiently workable to ensure that the concrete is not lifted. A service crane with or without the vibro-hammer will be used to extract the casing.

Reasonable care should be taken to ensure the concrete level is above the cut-off level after extraction of casing.

9.0 RECORDS

Bored piling records shall be properly recorded in the Bore Log provided, which shall contain complete information as below:-

- Project Title,
- Pile details including pile dimension, location, reference number and working load,
- Plant and equipment details including type, model and capacity of boring rig,
- Operators,
- Existing working platform and ground level,

- Specified cut off level and toe level of bored pile,
- Length of pile,
- Ground water table,
- Boring date including date, time, soil description, actual diameter and depth of bored hole,
- Size and length temporary casing used,
- Number, length and size of main reinforcement bar, size and pitch of links,
- Concreting data including date, grade, slump, theoretical volume, volume delivered, length, wastage, concreting method and time required.

10.0 Pile Hacking

1) This work method statement is a work procedure for pile hacking to cast in-situ bored pile.
2) Concrete will place higher than the cut off level to provide better integrity and sound concrete to the pile.
3) After excavation and expose the pile head, cut off level will mark to the pile. Any cast concrete higher than the cut off level will be removed by hacking method.
4) Excavator type hydraulic hammer or pneumatic type hammer 60 to 70 pound shall be used to carry out the hacking works.

10.1 Starter bar shorter than the length

1) Drill a hole of minimum 32mm diameter with 800mm depth into the bored pile adjacent to the short starter bar.
2) Clean the drill hole with air or water; fill the hole with SIKA 214 or 215 cementitious non-shrink grout in accordance to the SIKA brochure recommendation. Then, insert the steel bar into the hole and allow some grout spillage out from the hole.

10.2 Unsound concrete of the pile lower than the cut off level

1) Excavate down (soil or back fill material) until the sound concrete and remove the unsound concrete.
2) Built up the pile until cut off level with steel casing as guide. After concrete placing, remove the steel casing.

10.3 Pile As- Built Survey

1) After pile hacking, the pile as-built will be survey. The ECC of the piles will be calculated and recorded.
2) If the pile group ECC is more than 75mm in either one direction, a technical design will be carried out to the pile and pilecap.
3) If single pile group ECC is more than 75mm in either direction, a short column method design according to the BS8110 will be carried out to the pile.

10.4 PDA Test and PIT Test

1) After pile hacking, PIT test can be carried out according to the method statement of PIT submitted. If the piles have any defect, proposal of remedial work will be submitted for the Engineer approval.

2) If the pile is choose for PDA test, after the hacking of the pile, a pile head will be cast with casing and cover the starter bar. The PDA test then can be carried out when a minimum concrete strength achieved (normally 7 days). Detail of method statement refer to the respective work procedure submitted separately**.**