ITEM NO. 17551.9922 M - BORED-IN PILES - DESIGN LOAD LESS THAN 900 kN
ITEM NO. 17551.9923 M - BORED-IN PILES - DESIGN LOAD OF 900 kN OR MORE
ITEM NO. 17551.9924 M - BORED-IN PILES - WITH EXTENDED LENGTHS – DESIGN LOAD LESS THAN 900 kN
ITEM NO. 17551.9925 M - BORED-IN PILES - WITH EXTENDED LENGTHS – DESIGN LOAD OF 900 kN OR MORE

DESCRIPTION

General

Under this work, the Contractor shall design bored-in piles, furnish all labor and materials and perform all operations necessary to install bored-in piles at the locations and to the required capacities shown on the plans.

Engage a professional engineer, licensed and registered to practice in New York State, to design the piles. The Contractor's Engineer will design the piles to perform satisfactorily for both structural and geotechnical requirements. The structural design of the pile will be in accordance with AASHTO requirements for reinforcement of drilled shafts. The Contractor's Engineer will design the diameter, length, reinforcement, grout strengths, and grouting pressures, and select the equipment, procedures and methods so that each pile meets the pile acceptance criteria, and can support the ultimate tension and compression loads shown on the plans.

The Contractor's Engineer will design the piles to be compatible with the pile connections and permanent casing unless otherwise indicated on the plans. Progress all bored-in piles using a steel drill casing.

Submit the design and method of installation to the Engineer for approval by the Deputy Chief Engineer for Technical Services (D.C.E.T.S.). The D.C.E.T.S. will require thirty (30) working days to approve the submission. Do not begin work prior to receiving approval by the D.C.E.T.S. Approval of the installation method by the D.C.E.T.S. does not constitute a guarantee of acceptable pile installations. Acceptable installations are the responsibility of the Contractor.

The Contractor performing the work described in this specification shall submit proof of: 1.) two projects on which he has successfully installed bored-in piles or soil tiebacks, using non-displacement methods under similar site conditions as shown on the plans, and 2.) the proposed foreman for this work having supervised the successful installation of bored-in piles or soil tiebacks on at least two projects in the past two years.

Conduct all tasks associated with this item in accordance with all Federal, State, County and Local regulations.

Definition of Terms

This section defines terms for use with this specification.

Bond Breaker: A device or special treatment incorporated into a length of a bored-in pile that will allow no load to be transferred to the soil over that length. A bond

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breaker also provides full lateral support of the pile over the length of the bond breaker.

Grout placed in contact with the soil using gravity pressure only will not be considered to constitute a bond breaker.

Bond Zone: The pressure grouted or post grouted length of a bored-in pile that provides the pile's capacity.

Bored-in Pile: A friction pile formed by removing material using non-vibratory and non-displacement methods to create a cased open, cylindrical hole in the ground, which is subsequently filled with grout and steel reinforcement.

Design Load: The load permitted on a pile.

Duplex drilling: A method of progressing and cleaning out a hole for installing a bored-in pile in which the outer drill casing is progressed simultaneously with an inner drill rod string. The drill casing is cleaned using reverse circulation. Intimate contact between the soil and an outer drill casing is maintained during drilling.

Non-production pile: Non-production piles are piles that are not incorporated into the substructure, such as test piles, which are abandoned after testing has been completed.

Permanent Casing: A steel casing installed in the upper portion of a bored-in pile to increase the pile's lateral capacity against horizontal loads.

Positive circulation or flush: A method of progressing and cleaning out a hole for a bored-in pile wherein drilling fluid is injected into the hole and returns upward along the outside of the drill casing.

Post grouting: A method used to increase pile capacity after the grout column has reached initial set. Grout is pumped at very high pressure (up to 7000 kPa) through a sleeved port pipe (post grout tube), fracturing and expanding the grout column. A positive displacement piston pump with a liquid filled pressure gauge located near the pile head is used to pump the grout, and packers are used to isolate the grout ports.

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Pressure grouting: A method used to develop pile capacity wherein pressure is applied continuously to the top of the fluid grout column through the drill head using a grout pump and is applied continuously as the casing is removed from the bond zone.

Production pile: A pile which will be incorporated into the structure's foundation.

Recirculation: A method of handling drilling fluid where the fluid coming back out of the hole is captured in a pan and reused.

Reverse circulation: A method of cleaning the inside of the drill casing. Drilling fluid is circulated down through the drill rods and returns upwards through the inside of the drill casing to flush the drill casing clean.

Static Pile Load
Test Acceptance Criteria: On a Load versus Gross Vertical Top Movement curve of data from a Static Pile Load Test in which the pile was loaded to twice the design load - the slope of the curve shall be 0.15 mm per kN or less at twice the design load.

Tremie grouting: A method used to place grout in a wet hole. A grout tube is placed to the bottom of the drill hole. While keeping the tube opening submerged in the grout, grout is pumped into the hole and causing the drilling fluid to be displaced.

MATERIALS

A. Drill Casing
Provide steel drill casing conforming to ASTM A252. Drill casing shall be of the flush joint type, and shall be of appropriate thickness to withstand the stresses associated with advancing it into the ground, in addition to the stresses due to hydrostatic and earth pressures.

B. Grout
Provide a pumpable grout consisting of, as a minimum, Portland Cement - Type 2, Fly Ash and Water meeting the following Specification requirements:

Material	Subsection
Portland Cement, Type 2	701-01
Grout Sand	703-04
Fly Ash	711-10
Water	712-01

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The use of grout sand in the mix is optional. Field sampling and testing shall be done in accordance with procedural directives of the Materials Bureau of the Technical Services Division.

C. Reinforcement

Provide Bar reinforcement meeting the requirements of Subsection 709-01, Bar Reinforcement Grade 420, or continuously threaded "Uncoated High-Strength Steel Bar for Prestressing Concrete" - ASTM A722.

If a casing is used, provide a new and unused pipe section conforming to the requirements of Subsection 715-01. If threaded connections are used on the steel casing, details of the connections shall be submitted for approval by the Deputy Chief Engineer for Structures Design and Construction (D.C.E.S.).

If weld splices are used on the steel casing, they shall be welded in conformance with the provisions of the Steel Construction Manual. These requirements include, but are not limited to, a NYS Certified welder and a welding procedure approved by the D.C.E.S.

CONSTRUCTION DETAILS

General

Removing or relocating existing utilities, structures or structural members will not be allowed for installation convenience only.

A. Submittals

Submit computations and shop drawings to the Engineer for approval by the D.C.E.T.S. at least thirty (30) days prior to starting the work. Include in the submittal:

1. Pile details for each design capacity including, but not limited to, nominal diameter, length, reinforcement, post grout tube and grouting pressures.

2. Details of equipment and procedures for pile installation including, but not limited to, consecutive steps and the approximate time required for each step.

3. Procedures for advancing through boulders and other obstructions.

4. Procedures for containment of drilling fluid and spoil, and disposal of spoil.

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5. Where applicable, drawings that show the specific work can be performed under limited headroom conditions and as close to obstructions as site conditions warrant to install the piles at the locations shown on the plans.

6. Procedures and equipment for placing grout.

7. Details of post-grouting equipment and procedures, including the method, procedure and equipment required.

8. Layout drawings showing the proposed sequence of pile installation. Coordinate this sequence with the proposed phasing and scheduling.

Prepare the mix design for the grout and obtain documentation from an independent laboratory (approved by the D.C.E.T.S.) showing that the mix design conforms to the submitted mix and meets the strength requirements set by the Contractor. Submit this information to the Engineer for approval by the D.C.E.T.S. at least thirty (30) calendar days prior to use.

B. Drilling and Excavation

Place the drill casing inside the permanent casing, previously installed under a separate item. Refer to part "G" for tolerances. Perform drilling for pile installation by rotating or oscillating the drill casing while applying a static vertical load. Advance the hole using a duplex drilling method. Do not drill or flush ahead of the drill casing by more than 0.3 m. Perform drilling and excavation in such a manner to prevent collapse of the hole. Use of bentonite slurry is not permitted. Use of polymer slurry to remove cuttings from the cased hole must be approved by the Engineer.

If obstructions are encountered during excavation for a pile, progress through them by means of coring or a tricone roller bit. Use of drop type impact hammers and blasting are not permitted. Use of a down-the-hole hammer must be approved by the D.C.E.T.S. The vibration level induced by any approved down-the-hole hammer must not exceed the ambient vibration level.

Control the procedures and operations so as to prevent mining, damage or settlement to adjacent structures, tunnels, utilities or adjacent ground. If any mining, damage or settlement occurs, halt operations. Provide a written plan to the Engineer for review with procedures to avoid reoccurrence. Resume work only after the Engineer has approved the plan in writing. Repair all damage and settlement to the satisfaction of the Engineer, at no additional cost to the State.

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Control the procedures and operations so as to prevent the soil at the bottom of the hole from flowing into the hole. Maintain the fluid level inside the hole above the ground water level at all times during installation and cleaning out. Monitor and record the rate of fluid flow used to progress the holes.

Control drilling fluid and dispose of spoil in accordance with the approved procedure.

Do not progress a hole, pressure grout, or post-grout, within a radius of five (5) pile diameters or 1.5 m, whichever is greater, of a bored-in pile until the grout for that bored-in pile has set for 24-hours.

C. Piles with Extended Lengths

Design and install piles with extended lengths at the locations shown on the plans. The specified ultimate tension and compression resistance derived from the soil and/or bedrock will be achieved below the elevations shown on the plans.

D. Reinforcement and Post Grout Tube Placement

Centralizers, spaced not to exceed 3 m, must be used to center the reinforcement for its entire length. Do not drop, but lower the steel reinforcement to its specified location in the hole. If a post grout tube is used, attach it to the steel reinforcement prior to lowering it.

Install the footing connections according to the details shown on the plans.

E. Grout Placement and Casing Removal

Place grout by means of a tremie pipe from the bottom of the pile upward. Remove the drill casing slowly while pressure grouting. Closely control the rate of drill casing removal so that the grout level is at least 3 m higher than the drill casing tip, or at the exiting ground elevation, whichever is lower. Upon completion, maintain the grout level at or above the pile cut off elevation until the grout has set for 24-hours.

Calculate and record the initial volume of grout required to fill the hole. Record grouting pressure and volume of grout being pumped into the pile during pressure grouting. Conveniently locate the grout pressure and volume measuring gages at the pile installation site.

F. Post Grouting

Provide the equipment and materials to perform post grouting. Perform post grouting after the grout for the bored-in pile has set for 24 to 72 hours. The work consists of pumping grout under pressure into a post grout tube cast into the pile.

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The grout will exit the post grout tube one port at a time, with the port being isolated, using a packer system. Record the pressure at which the grout was pumped and the volume pumped through each port.

G. Construction Tolerance

Install the piles so that the center of each bored-in pile does not vary from the plan location by more than 75 mm. Do not allow the bored-in pile to vary from the vertical or established batter by more than 20 mm per meter, as measured above ground.

Cut off the top of the pile within 50 mm of the elevation shown on the plans, or where ordered by the Engineer.

If the soil at the pile tip is post grouted, monitor the elevation of the pile top during post grouting. If movement occurs, the Engineer shall immediately notify the D.C.E.T.S.

H. Pile Acceptance Criteria

1. If the pile is load tested, it shall meet the load test acceptance criteria defined in Definition of Terms.

2. If the pile is load tested, the gross vertical top movement of the pile at the design load, shall not exceed the amount specified on the plans.

3. Pile meets Construction Tolerance criteria.

4. Pile is installed according to the criteria shown in the submittals approved by the D.C.E.T.S.

5. Pile is not damaged.

I. Unacceptable Piles

Submit to the Engineer a written plan of remedial action for approval by the D.C.E.T.S., showing how to correct the problem and prevent its reoccurrence. Repair or augment the unacceptable pile in accordance with the approved remedial plan to the satisfaction of the Engineer.

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METHOD OF MEASUREMENT

The quantity for bored-in piles will be measured by the number of acceptable bored-in piles installed in accordance with the Specifications.

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BASIS OF PAYMENT

Include the cost of furnishing all labor and materials necessary to install bored-in piles in the unit price bid per pile as shown on the plans and as accepted by the Engineer.

Payment for Static Pile Load Tests and Furnishing Equipment For Installing Permanent Casing and Bored-In Piles will be made under separate items.

Payment for installing Permanent Casing will be made under a separate item. No payment will be made for rejected piles.

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