SP-150543
(New)

SPECIAL PROVISIONS
FOR
DRILLED-IN PILES

Dubuque County
NHSX-020-9(226)--3H-31

Effective Date
July 16, 2019

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150543.01 DESCRIPTION.

A. A concrete drilled-in pile foundation consists of a vertical drilled hole with a steel H-pile core set and driven to nominal design bearing in competent bedrock then filled with concrete as shown in the design plans.

B. As shown in the contract documents, the drilled-in piles are encased in concrete up to the bottom of the prebore, then filled with 10 feet of bentonite between the top of the concrete and the bottom of the abutment footing. It is allowable to place sand in lieu of concrete in the zone below the bentonite prebore and above the bedrock. The sand shall be per Section 4133 of the Standard Specifications and the bentonite shall be per Article 2501.03, Q of the Standard Specifications.

C. Elevations, dimensions, and depth of the soil shafts and rock sockets shall be as specified in the contract documents. If bearing strata are encountered at different elevations or are judged to be of a different quality or containing voids, the Engineer will adjust the casing length, drilling and excavation depths of the holes, pile tip elevations, and concrete quantity to allow the steel bearing piles to be driven into competent rock and concreted into a rock socket without voids.

D. Refer to the soil profile (SPS) sheets in the contract plans for the site subsurface profile conditions. Note that karst-like voids and cavities in the rock have been encountered during coring of the borings. It is anticipated that similar conditions will be encountered during installation of the drilled-in piles. If the Contractor is planning to use drilling fluid, he shall be prepared for drilling fluid loss. The Contractor shall be prepared to handle potential concrete quantity overruns during installation of the drilled-in piles.

150543.02 MATERIALS.

A. Drilling Fluid.

Drilling fluid shall comply with Article 2433.02, A of the Standard Specifications except that only bentonite slurry or clean water shall be used.

B. Concrete.

1. All materials, proportioning, air entraining, mixing, slump, and transporting of Portland Cement Concrete (PCC) shall be according to Section 2403 of the Standard Specifications, except as modified herein.

2. Water/cement ratio: not to exceed 0.45.

3. Drilled-in pile construction: use Class D PCC mixture with a slump of 8 inches +/- 1.5 inches.

4. Portland cement: meet the requirements of ASTM C 150 Type I / II.

5. Air entrainment: apply Section 2403 of the Standard Specifications.

6. Retarder is required according to Materials I.M. 403 to maintain workable concrete.

7. The use of fluidizer and anti-shrinkage admixture are required for the drilled-in pile concrete. The contractor shall determine the proper fluidizer and anti-shrinkage admixture product and dosage to be used in the concrete mix design.

8. Do not use Ground Granulated Blast Furnace Slag (GGBFS).

C. Steel H-Pile Core.

1. Conform to Section 4167 of the Standard Specifications.

2. Storing, transporting, and handling shall be performed in a manner to prevent bending stresses or other damage.

3. Pile Order Lengths.

a. The Contractor shall develop his schedule such that all the air-track probes can be performed as early as possible. The record of the air-track probes shall be provided to the Engineer for evaluations and issuance of the final drilled-in piles. The Contractor shall allow the Engineer 15 working days to evaluate and issue the final tip elevations.

b. The Contractor assumes all risk involved with ordering production piles in advance of the Engineer issuing the final drilled-in pile tip elevations.

D. Corrugated Metal Pipe.

Conform to Article 4141.01 of the Standard Specifications.

150543.03 CONSTRUCTION.

A. Construction Sequence.

1. Drill one 2 inch minimum diameter air-track test probe at each pile location.

2. Advance the pile excavation to the tip elevation of the concrete socket per the Engineer-evaluated installation plan. Install corrugated metal pipe (CMP) to support the ground above the top of the competent bedrock to facilitate the placement of concrete, sand, or bentonite as shown in the contract documents.

3. Clean the drilled-in pile excavation to ensure that no fines or sediments are present per the approved installation plan.

4. Place the concrete using tremie pipe immediately after excavation bottom is approved by the Engineer.

B. Air-Track Probes.

1. Drill one air-track test probe at the center of each pile location. As a minimum, probe 5 feet below the elevation specified in the plans. If a void is encountered within the 5 foot interval below the elevation specified, advance the air-track probe an additional 5 feet below the bottom of the void. If additional voids are encountered, continue advancing the air-track probe in 5-foot intervals below the bottom of voids until no voids have been encountered within the deepest 5-foot interval, or until directed otherwise after re-evaluation by the Engineer. The Contractor shall not advance further than 10 feet below the plan elevation of the pile tip without re-evaluating with the Engineer the status of the probing.

2. Drill air-track probe at all pile locations prior to the start of pile excavation. Provide the logs to the Engineer. The probe log shall record rate of advance per foot, down pressure applied if any, rod drops, and any observation regarding the cuttings.

3. If voids, soil seams, or solution channels are detected, the Engineer shall be contacted for potential deeper probing.

4. After each test probing is completed, fill the hole with sand to the surface elevation to minimize/prevent collapsing of the soil strata below.

5. Pile installation shall not proceed until the Engineer issues the final tip elevation based on the results of the probing.

C. Drilled-In Pile Installation Plan.

1. After test probing, and 15 working days prior to the start of pile installation, submit a list containing at least three drilled shafts or drilled-in pile projects with rock socket, of similar diameter and length to those shown on the plans, completed in the last three years. In the list of projects include names and phone numbers of owner's representatives who can verify the Contractor's participation on those projects. In addition, submit a signed statement that the Contractor has inspected the project site and all the subsurface information made available in the contract documents.

2. Upon issuance of the final pile tip elevation by the Engineer, and no later than 15 working days prior to constructing drilled-in pile, submit a drilled-in pile installation plan for the Engineer to review. In this plan provide the following information:

- **a.** Name and experience record of firm(s) and associated personnel for the following:
  - **1)** Driller
  - **2)** Drilled-in pile superintendent.
  - **3)** Site exploration.
  - **4)** Confirmation air-track information
- **b.** List of proposed equipment to be used, including cranes, drills, augers, bailing buckets, grooving equipment, scouring equipment, final cleaning equipment, core sampling equipment, confirmation boring equipment, test probe equipment, tremies, casing, airlift pumps, etc.
- **c.** Details of overall construction operation sequence and the sequence of drilled-in pile construction in bents or groups.
- **d.** Details of excavation methods.
- **e.** Details of casing and forms, including installation and removal.
- **f.** Details of methods to clean the excavation, including air lift methods and spin bucket methods as applicable.

g. Details of H-pile core placement, including support and centering methods.
h. Details of concrete placement including procedures for tremie and method to prevent water or sediment intrusion at the discharge end.
i. Concrete mix proposal.
j. Details of methods to control cuttings, water, etc. with adjacent traffic conditions (vehicular or railroad if applicable).
k. Details of final discharge of concrete at top of drilled-in pile, of removing contaminated concrete, and verifying concrete uniformity for site specific conditions.
l. When casing is required, include details on casing to be used, including:
- Specific length/depth of all casing proposed.
- Specific evaluation and determination of casing (size, depth, etc.) required to prevent all drilled-in pile installation procedures from having an effect or impact on adjacent structures, railroads, etc.

m. Contingency Plan: At the minimum, the contingency plan shall be developed to address the following situations:
- Loss of drilling fluid during pile installation
- Grout/concrete loss during pile installation
- Loss of air track rods during probing

3. The Engineer will evaluate the drilled-in pile installation plan for conformance with the contract documents. Within 14 calendar days after receipt of the plan, the Engineer will notify the Contractor of additional information required or changes necessary to meet the contract requirements, or both. Field test the Engineer's procedural approvals. These approvals do not relieve the Contractor of the responsibility to satisfactorily complete the work as detailed in the contract documents.

4. A pre-construction conference, in which the Engineer, Contractor, and drilling staff discuss the anticipated drilled-in pile process, will be required for this work prior to the start of excavation.

D. Control and Disposal of Materials.
Dispose of excavated material including water removed from the excavation. Collect and properly dispose off-site all water displaced during final cleaning and concrete placement. Open pits for collection of materials will not be allowed. Control all excavated material, water, and other matter so that at no time it enters or encroaches upon the nearby ditches, waterways, etc.

E. Drilled-in Pile Excavation.

1. General.
a. Construct drilled-in pile excavation by either the dry or casing method as necessary to produce sound, durable concrete foundation free of defects. These methods are described below.
b. Remove surface and subsurface obstructions. Special tools and/or procedures may be required. No separate payment will be made for removing obstructions.
c. If the Engineer determines that the material encountered during excavation and/or present at tip elevation is unsuitable and/or differs from that anticipated in the design of the drilled-in pile, extend the drilled-in pile tip elevations.
d. Maintain a drilling log during soil and rock socket excavation. In the log, place information such as elevation, depth of penetration, drilling time in each of the strata, material description, and remarks. Furnish the log (signed by the Contractor) to the Engineer within 1 week after completion of the excavation.
e. After the excavation has been completed, immediately proceed with drilled-in pile construction.

2. Wet Method.

a. The wet method consists of:
- Keeping the shaft filled with slurry a minimum of 4 feet above the highest expected water table during drilling and excavation,
- Desanding the slurry when required,
- Final cleaning of the excavation by means of a bailing bucket, air lift, pump or other approved device, and
- Placing shaft concrete which displaces the slurry.

b. In the event that layers susceptible to cave-ins are encountered which cannot be controlled by slurry, install temporary removable casing according to Article 2433.03, D, 3 of the Standard Specifications.

3. Dry Method.

a. The dry method consists of:
- Drilling the excavation,
- Removing accumulated water and loose material from the excavation,
- Placing the steel H-pile core, and
- Concreting the drilled-in pile in a relatively dry excavation.

b. Use the dry method only at sites where:
- The ground water level and soil and rock conditions are suitable to permit construction of the drilled-in pile in a relatively dry excavation, and
- The Engineer can visually inspect the sides and bottom of the excavation prior to placing the concrete.

c. The Engineer will approve the dry method only if the drilled-in pile excavation demonstrates:
- Less than 12 inches of water accumulates above the base over a 1 hour period when no pumping is permitted,
- The sides and bottom of the hole remain stable without detrimental caving, sloughing, or swelling between completion of excavation and concrete placement, and
- All loose material and water can be satisfactorily removed prior to inspection and concrete placement (less than 3 inches of water will be permitted in the bottom of the excavation at the time of concrete placement).

d. Use the casing method for excavations that do not meet the dry method requirements.

4. Casing Method.

a. The casing method is used to advance the excavation through unstable material. Over-reaming to the outside diameter of the casing may be required. Before the casing is to be removed, the level of fresh concrete must be a minimum of 5 feet above the bottom of the casing so that fluid trapped behind the casing is displaced upward. As the casing is withdrawn, maintain the concrete level so that fluid trapped behind the casing is displaced upward without contamination or displacing drilled-in pile concrete.

b. Determine the appropriate depth to terminate the temporary casing to ensure the stability of the excavation. The purpose of the temporary casing is to stabilize the excavation walls during drilling to prevent cave-ins as the result of potential vibrations. The purpose of the casing is also to prevent drilled-in pile installation procedures from having an impact on adjacent structures, railroads, and so forth.

F. Final Cleaning.

1. Clean the bottom of excavation via method of scouring or air lift pump usage.

2. Clean the base of each excavation so that the base will have less than 1/2 inch of sediment or debris at the time of concrete placement.

3. The geotechnical inspector will visually inspect excavations.

G. Excavation Inspection.

Provide equipment for checking the dimensions and alignment of each excavation. Under the direction of the geotechnical inspector, verify the dimensions and alignment of the drilled-in pile under construction. After final cleaning, use a suitable weighted tape or other approved methods to measure final excavation depths.

H. Placement of Steel H-Pile Cores.

1. First, construct a pile template that is capable of maintaining alignment and position of the H-pile core during installing within tolerances specified herein.

2. The steel H-pile cores shall be placed within 8 hours of the completion of the excavation.

3. The steel H-piles core shall be placed in the excavation to the length shown on the plans.

4. The steel H-piles core shall be placed and maintained in the center of the excavation.

5. The steel H-piles core shall be furnished and installed full length per Section 2501 of the Standard Specifications.

6. Steel sections damaged during transportation, handling or installation shall be removed.

7. Steel sections spacing shall be +/- 3 inches from plan location and shall not be more than 1% off from vertical.

8. All cuts of steel H-pile sections shall be perpendicular to the axis of the pile.

I. Concrete Placement.

1. General.

a. Place drilled-in pile concrete within 24 hours of the start of excavation of the rock socket. Place concrete within 8 hours of placing the steel H-pile.

b. Coordinate concrete batching and delivery with the batch plant so the time limits, as stated in the contract documents, between batching and delivery are not exceeded.

c. Place concrete in a continuous manner. Continue concrete placement after the excavation is full until good quality concrete is evident at the plan top elevation.

d. Calculate the volume of concrete needed to fill rock socket in competent rock and submit to Engineer for approval.

e. Record the top elevation of concrete and the volume of placed concrete. The volume of concrete in the contract plans is estimated based on the target elevation of competent rock. If the volume has changed, determine the cause of the difference and notify the Engineer immediately.

f. Place concrete through a tremie.

g. Complete placement of the concrete in the drilled-in pile within 3 hours. Adjust admixtures, when approved for use, for the conditions encountered on the job so the concrete remains in a workable plastic state throughout the 3 hour placement limit.

2. Concrete Placement by Tremie.

a. For the tremie, comply with the following:

- The tremie shall be constructed so that it is watertight and will readily discharge concrete.
- The concrete shall be placed via a concrete pump or gravity tremie. A tremie shall have a hopper at the top that empties into a watertight tube at least 8 inches in diameter. If a pump is used, a watertight tube shall be used with a minimum diameter of four inches.
- Have no aluminum parts shall come into contact with concrete.

- The discharge end of the tremie shall be constructed to prevent water intrusion and permit the free flow of concrete during placement operations.
- The tremie shall have sufficient mass so that it will rest on the excavation bottom before the start of concrete placement.
- Have sufficient length to extend to the bottom of the excavation.

b. Maintain the discharge orifice between 5 feet and 10 feet below the surface of the fluid concrete.

c. Support the tremie so that it can be raised to increase the discharge of concrete and lowered to reduce the discharge of concrete.

d. Maintain a continuous flow of concrete. Ensure the concrete in the tremie maintains a positive pressure differential at all times to prevent introduction of air pockets or contaminants into the concrete.

3. Concrete Placement by Pump line.
Concrete placement by pump is not permitted without the use of a tremie pipe.

J. Construction Tolerances.
Drilled-in pile excavations and completed drilled-in piles not constructed within the required tolerances will be considered unacceptable. Correct all unacceptable excavations and completed drilled-in piles to the Engineer's satisfaction. Furnish materials and work necessary, including engineering analysis and redesign, to complete corrections for out of tolerance excavations (without either cost to the Contracting Authority or an extension of the completion dates of the project).

1. Ensure the drilled-in pile is within 3 inches of plan position at the top of drilled-in pile.

2. Ensure the vertical alignment of the excavation does not vary from the plan alignment by more than 1%.

3. Set full depth steel H-pile core section at the bottom of the excavation prior to concrete placement.

4. Casing dimensions are subject to American Pipe Institute tolerances applicable to regular steel pipe.

5. The top elevation of the concrete may have a tolerance of +/- 3 inches from the plan top of concrete elevation. Ensure there is sufficient steel H-pile core section length for embedment into abutment.

6. Use excavation equipment and methods that ensure the completed excavation will have a planar bottom. Ensure the excavation equipment cutting edges are normal to the equipment's vertical axis within a tolerance of 3/8 inch per foot of diameter.

150543.04 METHOD OF MEASUREMENT.

Measurement will be as follows:

A. Air-track Probe.
Feet, to the nearest 0.1 foot, measured down from the top of the abutment berm. Any drilling above this elevation is considered incidental.

B. Drilled-In Pile in Soil.
Feet, to the nearest 0.5 foot, constructed in soil.

C. Drilled-In Pile in Rock.
Feet, to the nearest 0.5 foot, constructed in rock.

D. Permanent Casing.
Feet, to the nearest 0.5 foot.

150543.05 BASIS OF PAYMENT.
Payment will be the contract unit prices as follows:

A. Air-track Probe.

1. Per foot.

2. Payment is full compensation for all equipment, labor, and materials necessary to satisfactorily complete the air-track probe including:
- Drilling and excavation with air-track probe
- Furnishing and placing of grout backfill
- Disposal of excavated materials, water, and all other materials

B. Drilled-In Pile in Soil.

1. Per foot.

2. Payment is full compensation for all equipment, labor, and materials (except steel H- Pile Core) necessary to satisfactorily construct the drilled-in pile including:
- Drilling and excavation in soil
- Use of drilling fluid and all fluid loss during drilling (no additional compensation for fluid loss)
- Furnishing and placing concrete and/or sand required to support the ground to facilitate the installation of the drilled-in pile.
- Disposal of excavated materials, water, and all other materials

C. Drilled-In Pile in Rock.

1. Per foot.

2. Payment is full compensation for all equipment, labor, and materials (except steel H- Pile Core) necessary to satisfactorily construct the drilled-in pile including:
- Drilling and excavation of rock socket
- Use of drilling fluid and all fluid loss during drilling (no additional compensation for fluid loss)
- Furnishing and placing concrete,
- Disposal of excavated materials, water, and all other materials

D. Permanent Casing.

1. Per foot.

2. If needed, payment is full compensation for all equipment, labor, and materials to install CMP permanent casing required to support the ground to facilitate construction of the drilled-in piles.