



**SPECIAL PROVISIONS
FOR
DRILLED-IN PILES**

**Cerro Gordo County
BRFN-122-1(24)--39-17**

**Effective Date
December 19, 2023**

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

230070.01 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 contract documents.
- B.** As shown in the contract documents, the drilled-in piles are encased in concrete in the rock socket embedded in the bedrock, then filled with bentonite between the top of the concrete and the bottom of the abutment footing. 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.** Site Conditions. Refer to the soil profile (SPS) sheets in the contract plans for the site subsurface profile conditions.

230070.02 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 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. Use Class D PCC mixture with a slump of 8 inches \pm 1.5 inches.
4. Retarder is required according to Materials I.M. 403 to maintain workable concrete.
5. Water reducer and anti-shrinkage admixture are required. Determine the proper product and dosage to be used in the concrete mix design.
6. Do not use GGBFS.

C. Steel H-Pile Core.

1. Conform to Section 4167 of the Standard Specifications.
2. Store, transport, and handle in a manner to prevent bending stresses or other damage.

D. Corrugated Metal Pipe.

Conform to Article 4141.01 of the Standard Specifications.

230070.03 CONSTRUCTION.

A. Construction Sequence.

1. Advance the pile excavation to the tip elevation of the concrete socket per the Engineer-evaluated installation plan. Install CMP, or other approved casing, to support the ground above the top of the competent bedrock to facilitate the placement of concrete or bentonite, as shown in the contract documents.
2. Clean the drilled-in pile excavation to ensure that no fines or sediments are present per the approved installation plan.
3. Place the concrete using tremie pipe immediately after excavation bottom is approved by the Engineer.

B. Drilled-In Pile Installation Plan.

1. 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.
 - 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, 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. 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.
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.

C. Drilled-in Pile Excavation.

1. General.

- a. Construct drilled-in pile excavation by either the wet, dry, or casing method as necessary to produce sound, durable concrete foundation free of defects. These methods are described below.
- b. A flat bottom excavation tool shall be required.
- 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. Certify the log and furnish 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.

D. Final Cleaning.

Clean the bottom of excavation via method of scouring or flat bottom tool.

E. 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.

F. 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 shall be seated with an approved pile driving hammer to confirm capacity.
3. The steel H-pile cores shall be placed within 8 hours of the completion of the excavation.
4. The steel H-piles core shall be placed in the excavation to the length shown on the plans.
5. The steel H-piles core shall be placed and maintained in the center of the excavation.
6. The steel H-piles core shall be furnished and installed full length per Section 2501 of the Standard Specification.

7. Remove steel sections damaged during transportation, handling or installation.
8. Steel sections spacing shall be ± 3 inches from plan location and shall not be more than 1% off from vertical.
9. Cut all steel H-pile sections perpendicular to the axis of the pile.

G. 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 18 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.
- f. Place concrete through a tremie.

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 4 inches.
 - Aluminum parts shall not be in 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 always maintains a positive pressure differential 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.

H. 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 footing.
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.

230070.04 METHOD OF MEASUREMENT.

Measurement will be as follows:

- A. Drilled-In Pile in Soil.**
Feet, to the nearest 0.5 foot, constructed in soil.
- B. Drilled-In Pile in Rock.**
Feet, to the nearest 0.5 foot, constructed in rock.
- C. Permanent Casing**
Feet, to the nearest 0.5 foot.

230070.05 BASIS OF PAYMENT.

Payment will be the contract unit prices as follows:

- A. 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
- B. 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

C. Permanent Casing

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