SP-150349
(New)

SPECIAL PROVISIONS
FOR
HELICAL PILE

Harrison County
NHSN-030-1(161)--2R-43

Effective Date
January 17, 2018

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.

150349.01 DESCRIPTION.

This work consists of furnishing all design, materials, tools, equipment, labor and supervision, and installation techniques necessary to install helical piles as detailed on the plan sheets, including connection details.

A. Quality Assurance.

1. Helical piles shall be installed by a Contractor certified by the helical pile manufacturer. The Contractor shall have satisfied the certification requirements relative to the technical aspects of the product and installation procedures as required by the manufacturer.

2. The Contractor shall employ an adequate number of skilled workers who are experienced in the necessary crafts and who are familiar with the specified requirements and methods needed for proper performance of the work of this specification.

3. All helical piles shall be installed in the presence of a designated representative of the Engineer unless said representative informs the Contractor otherwise.

4. Helical pile components as specified shall be manufactured by a facility whose quality systems comply with ISO (International Organization of Standards) 9001 requirements. Certificates of Registration denoting ISO Standards Number shall be presented upon request to the Engineer or their representative.

B. The Contractor shall be responsible for the design of the helical piles. Helical piles shall be designed to meet the specified loads and acceptance criteria as shown on the plans. These loads shall include vertical and longitudinal loads as indicated on the plans. In addition, the Helical Piles shall be designed to resist lateral loads due to overtopping of the bridge, as determined by the manufacturer of the pre-engineered steel truss pedestrian bridge. Coordinate the lateral loads

from the manufacturer of the pre-engineered steel truss pedestrian bridge in their design. Verify all bridge reaction loads on the plans with the manufacturer of the pre-engineered steel truss pedestrian bridge in their design. The calculations and shop drawings required from the Contractor or helical pile engineer shall be submitted to the Contracting Authority for review and acceptance in accordance to Article 150349.01, D.

1. Provide documentation to demonstrate the helical piles are designed adequately to support the design loads as indicated on the plans with a suitable factor of safety for permanent structures. This documentation shall include, but is not limited to, engineering calculations for the helical piles, factor of safety used, analytical and test data for past performance of helical piles, and load charts correlating drive torque to bearing capacity. This documentation shall be approved by the Contracting Authority prior to installation of the helical piles.

2. Helical Pile capacity in soil shall not be relied upon from any soil layers identified as incapable of contributing to the pile capacity as identified in the geotechnical reports.

3. The helical pile attachment (pile cap) shall distribute the design load to the concrete foundation such that the concrete bearing stress does not exceed those in the ACI Building Code and the stresses in the steel plates/welds does not exceed AISC allowable stresses for steel members.

C. Ground Conditions.

1. The geotechnical report, including logs of soil borings, shall be considered to be representative of the in-situ subsurface conditions likely to be encountered on the project site. The geotechnical report shall be used as the basis for helical pile design using generally accepted engineering judgment and methods. The Contractor may conduct additional geotechnical investigations at no additional cost to the Contracting Authority.

2. The geotechnical report shall be provided for purposes of bidding. If during helical pile installation, subsurface conditions of a type and location are encountered of a frequency that were not reported, inferred and/or expected at the time of preparation of the bid, the additional costs required to overcome such conditions shall be considered as extras to be paid for.

D. Submittals.

1. Prepare and submit to the Engineer, for review, working drawings and design calculations for the helical pile foundation intended for use at least 14 calendar days prior to planned start of construction. All submittals shall be signed and sealed by a Professional Engineer licensed in the State of Iowa.

2. Submit a detailed description of the construction procedures proposed for use to the Engineer for review. This shall include a list of major equipment to be used. The working drawings shall include the following:
- **a.** Helical pile number, location and pattern by assigned identification number
- **b.** Helical pile design load
- **c.** Type and size of central steel shaft
- **d.** Helix configuration (number and diameter of helical plates)
- **e.** Minimum effective installation torque
- **f.** Minimum overall length
- **g.** Inclination angle (-0- for vertical piles)
- **h.** Minimum cased length, if applicable
- **i.** Cut-off elevation

3. Submit shop drawings for all helical pile components, including casing components and pile top attachment to the Engineer for review. This includes helical pile lead and extension section identification (manufacturer's catalog numbers).

4. Submit certified mill test reports for the central steel shaft, as the material is delivered, to the Engineer for record purposes. The ultimate strength, yield strength, % elongation, and chemistry composition shall be provided.

5. Submit to the Engineer copies of calibration reports for each torque indicator and all load test equipment to be used on the project. The calibration tests shall have been performed within one year of the date submitted. helical pile installation and testing shall not proceed until the Engineer has received the calibration reports. These calibration reports shall include, but are not limited to, the following information:
   a. Name of project and Contractor
   b. Name of testing agency
   c. Identification (serial number) of device calibrated
   d. Description of calibrated testing equipment
   e. Date of calibration
   f. Calibration data

6. Work shall not begin until all the submittals have been received and reviewed by the Engineer. Allow the Engineer a reasonable time to review, comment, and return the submittal package after a complete set has been received. All costs associated with incomplete or unacceptable submittals shall be the responsibility of the Contractor.

150349.02 MATERIALS.
Material for the helical piles shall be manufactured by a helical pile manufacturer meeting the requirements of this specification. Submit the selected manufacturer to the Engineer for approval.

A. The Contractor shall be experienced in performing design and construction of helical piles and shall furnish all materials, labor, and supervision to perform the work. The Contractor shall be trained and certified by the helical pile system manufacturer in the proper methods of design and installation of helical piles. Provide names of on-site personnel materially involved with the work, including those who carry documented certification from the helical pile system manufacturer. At a minimum, these personnel shall include foreman, machine operator, and project engineer/manager.

B. Components of the helical pile system shall be in accordance with the following:

C. Central Steel Shaft.
The central steel shaft, consisting of lead sections, helical extensions, and plain extensions, shall comply with the following minimum requirements:

1. Round-Cornered-Square (RCS) solid steel bars: Shall be hot rolled RCS solid steel bars meeting dimensional and workmanship requirements of ASTM A29. The bar shall be either modified medium carbon steel grade (similar to AISI 1044) with improved strength due to fine grain size or high strength low alloy (HSLA), low to medium carbon steel grade with improved strength due to fine grain size.
   - Minimum torsional strength rating= 5500 foot-pounds
   - Minimum yield strength = 70 ksi
   - RCS solid steel bars shall only be used in conjunction with a grout column of 4 to 10 inches to provide lateral stability to the central shaft. The grout shall be a neat grout with a compressive capacity of no less than 4000 psi. All appropriate displacement plates and spacings shall be shown in the shop drawings.
2. Structural steel tube or pipe: Shall be seamless or straight-seam welded, per ASTM A53, A252, ASTM A500, or ASTM A618.

- Minimum wall thickness is 0.300 inches (schedule 80).
- Torsional strength rating= 11,000 foot-pounds
- Minimum yield strength= 50 ksi

D. Helical Bearing Plate.
Shall be hot rolled carbon steel sheet, strip, or plate formed on matching metal dies to true helical shape and uniform pitch. Bearing plate material shall conform to the following ASTM specifications: ASTM A36, ASTM A572, A1018, or A656 with minimum yield strength of 50 ksi. Minimum plate thickness is 3/8 inches.

E. Bolts.
The size and type of bolts used to connect the central steel shaft sections together shall conform to the following ASTM specifications:
- For use with solid square shafts: 3/4 inch diameter bolts per ASTM A320 Grade L7.
- For use with solid square shafts: 7/8 inch diameter bolts per ASTM A193 Grade B7.
- For use with solid square shafts: 1 1/8 inch diameter bolts per ASTM A193 Grade B7.
- For use with solid square shafts: 1 1/4 inch diameter bolts per ASTM A193 Grade B7.
- For use with steel tube or pipe shafts: 3/4 inch diameter bolts per SAE J429 Grade S.

F. Couplings.
Shall be formed as integral part of the plain and helical extension material. The couplings shall be hot upset forged sockets or hot forge expanded sockets.

G. Plates, Shapes, or Pier Caps.
Structural steel plates and shapes for helical pile top attachments shall conform to ASTM A36 or ASTM A572 Grade 50.

150349.03 CONSTRUCTION.

A. Installation Records.
Provide the Contracting Authority copies of helical pile installation records within 24 hours after each installation is completed. Records shall be prepared in accordance with these specifications. Formal copies shall be submitted on a weekly basis. These installation records shall include, but are not limited to, the following information.
- Name of project and Contractor
- Name of Contractor's supervisor during installation
- Date and time of installation
- Name and model of installation equipment
- Type of torque indicator used
- Location of helical pile by assigned identification number
- Actual helical pile type and configuration – including lead section (number and size of helix plates), number and type of extension sections (manufacturer's SKU numbers)
- Total length of installed helical pile
- Cut-off elevation
- Inclination of helical pile
- Installation torque at one-foot intervals for the final 10 feet
- Comments pertaining to interruptions, obstructions, or other relevant information
- Rated load capacities

B. Warranty.
Submit, for Contracting Authority's Acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights the Contracting Authority may have under the contract document.

C. Site Conditions.

1. Prior to commencing helical pile installation, inspect the work of all other trades and verify that all said work is completed to the point where Helical Piles may commence without restriction.

2. Verify that all helical piles may be installed in accordance with all pertinent codes and regulations regarding such items as underground obstructions, right-of-way limitations, utilities, etc.

D. Installation Equipment.

1. Shall be rotary type, hydraulic power driven torque motor with clockwise and counterclockwise rotation capabilities. The torque motor shall be capable of continuous adjustment to revolutions per minute (RPM's) during installation. Percussion drilling equipment shall not be permitted. The torque motor shall have torque capacity 15% greater than the torsional strength rating of the central steel shaft to be installed.

2. Equipment shall be capable of applying adequate down pressure (crowd) and torque simultaneously to suit project soil conditions and load requirements. The equipment shall be capable of continuous position adjustment to maintain proper helical pile alignment.

E. Installation Tooling.

1. Installation tooling should be maintained in good working order and safe to operate at all times. Flange bolts and nuts should be regularly inspected for proper tightening torque. Bolts, connecting pins, and retainers should be periodically inspected for wear and/or damage and replaced with identical items provided by the manufacturer. Heed all warning labels. Worn or damaged tooling should be replaced.

2. A torque indicator shall be used during helical pile installation. The torque indicator can be an integral part of the installation equipment or externally mounted in-line with the installation tooling.
   - **a.** Shall be capable of providing continuous measurement of applied torque throughout the installation.
   - **b.** Shall be capable of torque measurements in increments of at least 500 foot-pounds.
   - **c.** Shall be calibrated prior to pre-production testing or start of work. Torque indicators which are an integral part of the installation equipment, shall be calibrated on-site. Torque indicators which are mounted in-line with the installation tooling, shall be calibrated either on-site or at an appropriately equipped test facility. Indicators that measure torque as a function of hydraulic pressure shall be calibrated at normal operating temperatures.
   - **d.** Shall be re-calibrated, if in the opinion of the Engineer and/or Contractor reasonable doubt exists as to the accuracy of the torque measurements.

F. Central Steel Shaft Installation Procedures.

1. The helical pile installation technique shall be such that it is consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project.

2. The lead section shall be positioned at the location as shown on the working drawings. The helical pile sections shall be engaged and advanced into the soil in a smooth, continuous manner at a rate of rotation of 5 to 20 RPM's. Extension sections shall be provided to obtain the required minimum overall length and installation torque as shown on the working drawings. Connect sections together using coupling bolt and nut torqued to 40 foot-pounds.

3. Sufficient down pressure shall be applied to uniformly advance the helical pile sections approximately 3 inches per revolution. The rate of rotation and magnitude of down pressure shall be adjusted for different soil conditions and depths.

G. Termination Criteria.

1. The torque as measured during the installation shall not exceed the torsional strength rating of the central steel shaft.

2. The minimum installation torque and minimum overall length criteria as shown on the working drawings shall be satisfied prior to terminating the helical pile.

3. If the torsional strength rating of the central steel shaft and/or installation equipment has been reached prior to achieving the contractor specified minimum overall length required, the Contractor shall have the following options:
- **a.** Terminate the installation at the depth obtained subject to the review and acceptance of the helical pile design representative.
- **b.** Remove the existing helical pile and install a new one with fewer and/or smaller diameter helical plates. The new helix configuration shall be subject to review and acceptance of the Engineer. If re-installing in the same location, the top-most helix of the new helical pile shall be terminated at least 3 feet beyond the terminating depth of the original helical pile. Shaft section shall not be reused after it has been permanently twisted during a previous installation.

4. If the minimum installation torque as shown on the working drawings is not achieved at the minimum overall length, and there is no maximum length constraint, the Contractor shall have the following options:
- **a.** Install the helical pile deeper using additional extension sections, displacement plates, casing if required, and grout.
- **b.** Remove the existing helical pile and install a new one with additional and/or larger diameter helical plates. The new helix configuration shall be subject to review and acceptance of the Engineer. If re-installing in the same location, the top-most helix of the new helical pile shall be terminated at least 3 feet beyond the terminating depth of the original helical pile.
- **c.** De-rate the load capacity of the helical pile and install additional pile(s). The de-rated capacity and additional pile location shall be subject to the review and acceptance of the Engineer.

5. If the helical pile is refused or deflected by a subsurface obstruction, the installation shall be terminated and the pile removed. The obstruction shall be removed, if feasible, and the helical pile re-installed. If obstruction can't be removed, the helical pile shall be installed at an adjacent location, subject to review and acceptance of the Engineer.

6. The average torque for the last 3 feet of penetration shall be used as the basis of comparison with the minimum installation torque as shown on the working drawings. The average torque shall be defined as the average of the last three readings recorded at 1 foot intervals.

150349.04 METHOD OF MEASUREMENT.
Helical Pile will be measured for all Helical Piles engineered, furnished and installed as a lump sum unit.

150349.05 BASIS OF PAYMENT.
For all Helical Piles engineered, furnished and installed, the Contractor will be paid the lump sum contract price. This payment shall be full compensation for furnishing all design, materials, tools, equipment, labor and supervision, and installation techniques necessary to install Helical Piles complete as detailed on the plans, including connection details.