

PERFORMANCE SPECIFICATION FOR Drive Rite HELICAL PILE FOUNDATIONS

1. SCOPE

- 1.1. The work consists of designing, furnishing, installing, post-tensioning and testing Drive Rite helical piles and ancillary materials (e.g. sacrificial anodes, load transfer devices, etc.), according to the plans provided and these specifications. The Drive Rite contractor shall provide all labor, tools, equipment and materials necessary to accomplish the work.
- 1.2. The owner will provide right of entry to the construction site for the Drive Rite contractor's personnel and equipment. Unless specifically noted otherwise on the plans, the owner will remove and replace any structures, utilities, pavements, landscaping or other surficial improvements in the work area as necessary to facilitate the work. The owner will be responsible for overall construction oversight to preclude the development of unsafe conditions. The work does not include any post-construction monitoring of pile performance unless specifically noted otherwise on the plans.

2. Definitions

- 2.1. Some of the terms used in this publication may be unfamiliar to the reader, or may be used with a specific meaning not commonly known outside the helical pile industry. In determining the meaning of any term used herein, a definition contained in the following list shall take precedence, followed by a definition contained in the latest edition of "Glossary of Foundation Terms" published by the Deep Foundations Institute, then by customary usage.
 - 2.1.1. **Pile Foundation:** A combination of installed pile and the ground in which it is embedded which together resist tension loads applied to the unit.
 - 2.1.2. **Bearing Stratum:** Any soil layer which provides a significant portion of the axial resistance of an installed helical pile through bearing on one or more of the pile's helices.
 - 2.1.3. **Crowd:** Axial compressive force applied to the upper end of a helical pile's shaft as needed to ensure the pile progresses into the ground a distance approximately equal to the helix pitch each revolution.
 - 2.1.4. **Effective Torsional Resistance:** For compression loads, the final torsional resistance, provided the resistance has not decreased significantly while the pile was advancing its last three diameters (i.e., a distance of three times the pile's largest helix diameter) of embedment. For tension loads, the average of at least three torsional resistance readings taken at evenly spaced positions while the pile was advancing its last three diameters of embedment.

- 2.1.5. **Extension Section:** Helical pile component installed between the lead section and the structure connection means, allowing installation of the helices to such depth as may be necessary to attain the required load capacity. May be *plain* (without helix plates) or *helical* (including one or more helix plates). Helical extensions typically follow immediately behind the lead section. Extension shaft ends are adapted to interconnect with helical lead sections, other extension sections and the structure connecting means.
- 2.1.6. **Helical Pile (a.k.a. screw pile):** Consists of one or more helically deformed plates ("helix plates") attached to a central shaft and connector means for attachment to a structure. May also include surface coating or other corrosion protection means. Installed by screwing into the soil with down pressure ("crowd"), and thereafter resists tensile loads through bearing of the helical plates on the soil in which they are embedded.
- 2.1.7. **Helix Plate:** Generally round steel plate formed into a helical spiral. When rotated about its central axis in the ground, the helical shape provides thrust along the axis thus aiding in pile installation. The plate also transfers axial load to soil through bearing.
- 2.1.8. **Lead Section:** The first helical pile component installed into the soil, consisting of one or more helical plates welded to a steel shaft.
- 2.1.9. **Reveal:** The distance from ground surface to the end of the last installed extension of a helical pile, measured along the pile's longitudinal axis.
- 2.1.10. **Ultimate Instability:** A rapid progressive movement of a pile head in the direction of loading under a constant or decreasing load. The load at which ultimate instability occurs is not interchangeable with "ultimate load" or "capacity", which are often used to refer to the load at which a pile head moves some particular distance in the direction of loading.

3. Performance Requirements

- 3.1. Helical foundations shall be designed to support the design load(s) as shown on the project plans.
- 3.2. Except where noted otherwise on the plans, all pile components shall be designed to provide a minimum factor of safety against ultimate mechanical failure of ____.
- 3.3. Except where noted otherwise on the plans, all helical piles shall be installed to provide minimum factors of safety against ultimate axial or lateral instability and maximum pile head movements at design working loads as shown in Table 1.

Table 1. Safety factor and pile head movement requirements.

Load Type	Requirements at Design Working Loads	
	Minimum Factor of Safety vs. Ultimate	Maximum Pile Head Movement (in.)
Tension		
Compression		
Shear		
Overturning		

- 3.4. Except where noted otherwise on the plans, each helical pile and associated coating and/or auxiliary corrosion protection system, if any, shall be designed to meet the foregoing requirements for a life of ___ years.
- 3.5. The helical pile design(s) shall take into account such pile spacing, soil stratification, corrosion and strain compatibility issues as are present for the project.
- 3.6. If on-site testing is to be performed, the foundations shall be designed such that the maximum test load does not exceed ___% of the pile manufacturer's rated ultimate mechanical strength of any pile component or load transfer device.

4. Placement Requirements

- 4.1. When helical pile placement is shown on the plans, production piles shall be placed such that the pile head is within ___ inches laterally and ___ inches longitudinally of the design pile location, and the pile shaft alignment is within ___ degrees of the design inclination angle, as shown on the plans. When pile placement is not shown on the plans, the placements, alignments and their respective tolerances shall be included as part of the design submittal.

5. Pre-Construction Submittals

- 5.1. The Drive Rite contractor shall submit to the owner or owner's representative a proposal including the following documentation. Work shall not begin until all the submittals have been received and approved by the owner or owner's representative. All costs associated with incomplete or unacceptable submittals shall be the responsibility of the Drive Rite contractor. Documents to be submitted:

- 5.1.1. Evidence of Drive Rite contractor's competence and safety record:

- 5.1.1.1. Drive Rite certificate of competency in installation of helical piles from the pile manufacturer; or

- 5.1.1.2. A list of at least three projects completed within the previous three years wherein the Drive Rite contractor

installed helical piles in comparable ground conditions and for design loads similar to those shown in the plans, such list to include names and phone numbers of owner's representatives who can verify the Drive Rite contractor's participation in those projects; or

- 5.1.1.3. Documentation of intent by a third party to provide on-site supervision of the pile installation, together with evidence of said third party's competency as described in 5.1.1.1 or 5.1.1.2 above.
 - 5.1.1.4. In addition to 5.1.1.1, 5.1.1.2 or 5.1.1.3 above, a listing of all safety violations lodged within the previous three years against the Drive Rite contractor and any third party supervisor, and the current status or final resolutions thereof. Descriptions of safety improvements instituted within the previous three years may also be submitted, at the Drive Rite contractor's discretion.
- 5.1.2. Evidence of helical pile foundation designer's competence:
- 5.1.2.1. Drive Rite certificate of competence in design of helical pile foundations; or
 - 5.1.2.2. A list of at least three projects completed within the previous three years wherein the designer designed helical pile foundations for comparable ground conditions and for design loads similar to those shown in the plans, such list to include names and phone numbers of owner's representatives who can verify the engineer's participation in those projects.

6. Design Documentation Submittals

- 6.1. Within ___ weeks of receiving the contract award, the Drive Rite contractor or engineer shall submit the following helical pile foundation design documentation:
- 6.2. A helical pile hardware schedule showing, for each category of foundation:
 - 6.2.1. Product designations for helix and extension sections and all ancillary products to be supplied at each foundation.
 - 6.2.2. Individual foundation design loads.
 - 6.2.3. Individual foundation post-tensioning requirements (if any).
 - 6.2.4. Published minimum ultimate mechanical strengths for the Drive Rite pile assemblies, including load transfer devices.
 - 6.2.5. Calculated ultimate capacities of piles for all types of specified design load (tension, compression, etc.).

- 6.2.6. Minimum effective torsional resistance criteria.
- 6.2.7. Maximum allowable installation torque rating for the Drive Rite pile.
- 6.2.8. Minimum embedment lengths and inclinations, and such other site specific embedment depth requirements as may be appropriate for the site soil profiles given in the project plans.
- 6.3. If pile placements are not shown on the plans, drawings showing the proposed pile placements and placement tolerances. Such rights of way and obstructions as are given in the plans or otherwise known by the Drive Rite installing contractor or pile foundation designer shall be shown to demonstrate how the piles will be installed to miss these items.
- 6.4. Proposed production quality control plan, including method and equipment to be used to measure torsional resistance during installation.
- 6.5. Procedures and acceptance criteria for any proposed performance and/or proof testing.
- 6.6. Certification by the pile foundation designer that the selected piles can be installed with ordinary skill to achieve the requirements of the plans and this specification.
- 6.7. Certification by a registered professional engineer that the proposed post-tensioning and test equipment (if any) can be safely used to apply and hold the proposed loads.
- 6.8. Copies of certified calibration reports for torque measuring equipment and load measuring equipment to be used on the project. The calibrations shall have been performed within one (1) year of the proposed starting date for helical pile installation.

7. Pile Installation

- 7.1. Before entering the construction site to begin work, the Drive Rite contractor shall provide proof of insurance coverage as stated in the general specifications and/or contract.
- 7.2. The Drive Rite contractor shall furnish and install all helical piles per the plans and approved foundation design documentation. In the event of conflict between the plans and the approved foundation design documentation, Drive Rite contractor shall not begin construction on any affected items until such conflict has been resolved.
- 7.3. The Drive Rite contractor shall conduct his construction operations in a manner to insure the safety of persons and property in the vicinity of the work. The Drive Rite contractor's personnel shall comply with safety procedures in accordance with OSHA standards and any established project safety plan.

- 7.4. The Drive Rite contractor shall request marking of underground utilities by an underground utility location service as required by law, and shall avoid contact with all marked underground facilities.
- 7.5. The portion of the construction site occupied by the Drive Rite contractor, his equipment and his material stockpiles shall be kept reasonably clean and orderly.
- 7.6. Representatives of the owner may observe installation of helical piles for quality assurance purposes. The Drive Rite contractor shall give the owner's representative at least 24 hours prior notice of pile installation operations. All helical pile sections and ancillary products shall be marked as necessary to allow correlation with the foundation design documentation, before shipment from Drive Rite.
- 7.7. The minimum overall length criteria and the minimum effective torsional resistance criteria as specified in the Design Documentation Submittals are both to be satisfied prior to terminating the pile installation. In the event any helical anchorage fails these production quality control criteria, the following pre-qualified remedies are authorized:
 - 7.7.1. If the installation fails to meet the minimum effective torsional resistance criterion at the minimum embedment length:
 - 7.7.1.1. Continue the installation to greater depths until the torsional resistance criterion is met, provided that, if a maximum length constraint is applicable, continued installation does not exceed said maximum length constraint, or
 - 7.7.1.2. Demonstrate acceptable anchorage performance through proof testing, or
 - 7.7.1.3. Replace the pile with one having a different helix configuration. The replacement pile must not exceed any applicable maximum embedment length and either (A) meet the minimum effective torsional resistance criterion and all applicable embedment criteria shown in Table 2 for the design load type(s), or (B) pass proof testing.

Table 2. Replacement pile embedment criteria

Design Load Type	Replacement Pile Embedment Criterion
Tension	The last helix must be embedded at least three times its own diameter beyond the position of the first helix of the replaced pile.
Compression	The last helix must be embedded beyond the position of the first helix of the replaced pile.
Shear/Overturning	Embedment must satisfy the specified minimum.

7.7.2. If the torsional resistance during installation reaches the helical pile's allowable torque rating prior to satisfaction of the minimum embedment length criterion:

7.7.2.1. Replace the pile with one having a shaft of the same lateral dimension but a higher torsional strength rating. This replacement pile must be installed to satisfy the minimum embedment length criterion. It must also be embedded to a length that satisfies all applicable criteria in Table 2 for the design load(s) without exceeding any applicable maximum embedment length requirements and it must meet the minimum effective torsional resistance criterion. Or,

7.7.2.2. Replace the pile with one having a different helix configuration. This replacement pile must be installed to satisfy the minimum embedment length criterion. It must also be embedded to a length that satisfies all applicable criteria in Table 2 for the design load(s) without exceeding any applicable maximum embedment length requirements, and it must meet the minimum effective torsional resistance criterion. Or,

7.7.2.3. If allowed by the pile location tolerance or approved by the owner's representative, remove and reinstall the pile at a position at least three times the diameter of the largest helix away from the initial location. Original embedment length and torsional resistance criteria must be met. This pile repositioning may require the installation of additional helical piles with design loads adjusted for these spacing changes. If the abandoned position of the pile will be within six shaft diameters of any pile and in the path of a design lateral load for that pile, the abandoned position must be remediated to the full depth of disturbance by tamping the backfill or filling with concrete.

7.7.3. If the installation fails to meet the minimum effective torsional resistance criterion before reaching a specified maximum embedment length:

7.7.3.1. If allowed by the pile location tolerance or approved by the owner's representative, remove and reinstall the pile at a position at least three times the diameter of the largest helix away from the initial location. Original embedment length and torsional resistance criteria must be met. This pile repositioning may require the installation of additional helical piles with design loads adjusted for these spacing changes and/or remediation of the abandoned anchor location as described in 7.7.2.3 above. Or,

7.7.3.2. Demonstrate acceptable foundation performance through proof testing.

- 7.7.4. If a helical pile fails to meet acceptance criteria in a performance or proof test:
 - 7.7.4.1. Install the pile to a greater depth and retest provided that, if a maximum embedment length constraint is applicable, continued installation will not exceed said maximum length constraint, or
 - 7.7.4.2. Replace the pile with one having more and/or larger helices. It must be embedded to a length that satisfies all applicable criteria in Table 2 for the design load(s) without exceeding any applicable maximum embedment length requirements. This replacement pile must be re-tested. Or,
 - 7.7.4.3. If approved by the owner's representative, de-rate the load capacity of the helical pile and install additional piles. Additional piles must be installed at positions that are at least three times the diameter of the largest helix away from any other pile locations and are approved by the owner's representative.
- 7.7.5. Proof testing to qualify a pile under any of the foregoing remedial actions shall not be used to satisfy proof testing frequency requirements shown in the plans or the design documentation.
- 7.7.6. If a helical pile fails a production quality control criterion for any other reason, the owner's representative must approve any proposed remedy prior to its implementation at the project site.

8. Installation Record Submittals

- 8.1. The Drive Rite contractor shall provide the Owner, or his authorized representative, copies of individual helical pile installation records within 24 hours after each installation is completed. Formal copies shall be submitted within _____ days of pile installation. These installation records shall include, but are not necessarily limited to, the following information:
 - 8.1.1. Date and time of installation
 - 8.1.2. Unique identifier and location of helical pile
 - 8.1.3. Pile reveal
 - 8.1.4. Actual helical pile type and configuration
 - 8.1.5. Total length of installed pile
 - 8.1.6. Actual inclination of pile
 - 8.1.7. Actual effective torsional resistance

- 8.1.8. Calculated ultimate axial capacities based on actual torsional resistance
- 8.1.9. Comments pertaining to interruptions, obstructions, or other relevant information

9. Pile Testing

- 9.1. If pile testing is required, the Drive Rite contractor shall furnish all labor, equipment and pre-production helical piles necessary to accomplish the testing as shown in the approved pile design documentation. The Drive Rite contractor shall apply the specified loads for the specified durations and record the specified data, for the specified number of piles. No deviations from the test plan(s) will be allowed without explicit approval in writing from the owner's representative.
- 9.2. The Drive Rite contractor shall provide the owner, or owner's representative, copies of raw field test data or reports within 24 hours after completion of each load test. Formal test reports shall be submitted within ____ days following test completion. Formal test reports shall include, but are not limited to, the following information:
 - 9.2.1. Name of project and Drive Rite contractor
 - 9.2.2. Name of Drive Rite contractor's supervisor during installation
 - 9.2.3. Name of third party test agency, if any
 - 9.2.4. Date, time, and duration of test
 - 9.2.5. Unique identifier and location of helical pile tested
 - 9.2.6. Type of test (performance, proof, etc)
 - 9.2.7. Description of calibrated testing equipment and test set-up
 - 9.2.8. Actual helical pile type and configuration
 - 9.2.9. Steps and duration of each load increment
 - 9.2.10. Cumulative pile-head movement at each load step
 - 9.2.11. Signatures as required by local jurisdiction

10. Cleanup

- 10.1. Within ____ days of completion of the work, the Drive Rite contractor shall remove any and all material, equipment, tools, building materials, concrete forms, debris, or other items belonging to the Drive Rite contractor or used under the Drive Rite contractor's direction.