

SECTION 31 63 33
DRILLED-IN MINI-PILES

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

- A. These specifications are for the design and construction of drilled, steel cased, grout filled piles, reinforced with a vertical reinforcing bar. Concrete may be used in lieu of grout if performance design indicates it to be acceptable.

1.02 DESCRIPTION OF THE WORK

- A. The work shall consist of furnishing all plant, labor, materials, equipment and services for the design and installation of all mini-piles, tested and accepted in accordance with the Drawings and Specifications.
- B. The work includes all design submittals, field drilling, testing, survey work required to establish pile locations, tip and out-off, elevations, as-built drawings and all other operations required for the completion of the work included in this section.

1.03 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Without limiting the generality of other requirements of these specifications, all work specified herein shall conform to the requirements of the 2006 International Building Code and the requirements of any other referenced documents. In the event that the provisions of such documents are in conflict with the requirements of said code, the code shall take precedence.
- B. ASTM: Specifications of the American Society for Testing and Materials.
- C. ACI: American Concrete Institute

1.04 QUALITY ASSURANCE

- A. Comply with all rules, regulations, laws and ordinances of the State of Maine, City or Portland and that of all other authorities having jurisdiction. All labor, materials, equipment and services necessary to make the work comply with such requirements shall be provided without additional cost to the OWNER.
- B. Grout Sampling and Testing
 - 1. The compressive strength of the grout mix used for construction of mini-piles shall be tested by making a set (three cubes) of 2 inch cubes once each day during which piles are grouted. The cubes shall be made and tested in accordance with ASTM C109, except that the grout shall be restrained from expansion by a top plate.
 - 2. The frequency of testing may be varied if the results of the tests and inspection of the grout mixing plant indicate that the grout mix will remain consistent with that which has been previously tested and approved.
- C. Lines and Grades

1. The contractor shall employ a land surveyor licensed in the State of Maine who shall establish all lines and grades required for the work in this section.

D. Qualifications

1. The pile contractor that designs and constructs the foundation system shall have a minimum of five years experience in the type of design and construction required for the work of this section.
2. The pile contractor shall demonstrate that he has sufficient competent personnel to carry out the work specified, that his job superintendent and/or foreman has at least five years construction experience in this type of work and that such supervision will be presented at the job site during pile construction.

E. Records

1. The pile contractor shall keep a daily record of all data pertinent to the installation of micro-piles. The data shall include:
 - a. Pile number
 - b. data of installation
 - c. pile diameter
 - d. pile reinforcing used
 - e. pile length giving pile depth and cut off elevation
 - f. volume of grout placed and type/amount of pressure applied
 - g. grout mix used
 - h. description of any unusual occurrences during pile construction.

1.05 SUBMITTALS

A. Documents Required

1. Geotechnical report, if available from prior building construction, shall be furnished to the pile contractor for design purposes.
2. Performance Design: Contractor shall design and install piles to have a minimum allowable (working) capacity of 80 tons each. Performance design shall meet the requirements of the 2003 International Building Code as well as state and local ordinances. At least 14 days prior to commencing pile installation the contractor shall submit the following for approval:
 - a. Calculations for pile design capacities sealed by a Professional Engineer licensed in the State of Maine.
 - b. Shop drawings showing pile diameters, length, reinforcing steel design, spacing and other pertinent data.

- c. Design mix for pile grout/concrete along with results of compressive strength tests on trial batches of the proposed mix.
 - d. Details of the installation sequence and equipment to be used for pile construction.
 - e. Sample copies of daily pile reports/field reports to be used.
3. During construction the following data shall be submitted on a regular and timely basis:
- a. Record of daily pile installation
 - b. Results of strength tests on grout cubes taken in accordance with Part 1 (1.04 B)
4. Upon completion of the pile installation the following shall be submitted:
- a. As built pile location drawings as outlined in Part 1 (1.04 E)

B. Approvals

1. Approval of design calculations and drawings shall be required before commencing with the work.
2. Approval of the submittals shall not relieve the pile contractor of his responsibility for performing the work in accordance with the plans and specifications.

1.06 MINIMUM CRITERIA

- A. Piles shall have a minimum allowable (working) capacity of 80 tons each in axial compression (200 tons ultimate capacity). Piles shall have a minimum allowable (working) tensile capacity of 75 tons provided solely by central reinforcing bar.
- B. Piles shall be designed as end bearing.
- C. Each pile shall have a minimum outside diameter of 9.625 inches
- D. Each pile shall be socketed into bedrock as required by design (see Part A)
- E. Center reinforcing steel shall be as required by design (see Part A)
- F. Each pile shall be installed with a permanent steel casing. The permanent steel casing shall have a corrosion allowance of 1/8 inch minimum, length determined by design.
- G. Steel core shall be centered in pile and shall extend from the top of the pile through the grout to the bottom of the pile.
- H. All lateral loads shall be taken with battered piles, minimum of 30 degree slope from vertical.
- I. Mating ends of the steel core shall be spliced so as to safely withstand stresses to which they may be subjected. Each core steel section and splice shall be assembled to develop full compressive/tensile strength of the section.
- J. Minimum pile center-to-center spacing shall be 36 inches.

PART 2 PRODUCTS

2.01 MATERIALS

A. Quality

1. Pile materials shall be new and of uniform quality and shall conform to the specific requirements given herein.

B. Grout

1. Grout used to fill the piles consist of a mixture of Portland Cement, sand and water so proportioned and mixed as to provide a grout capable of maintaining the solids in suspension without appreciable water gain, yet which will provide a flowable mix that will afford good bonding characteristics in the bearing stratum. The hardened grout shall have a minimum ultimate strength of 4,000 PSI at twenty-eight (28) days when tested in accordance with ASTM C109 "Compressive Strength of Hydraulic Cement Mortars using 2 inch cube specimens."
2. Portland Cement shall conform to "Standard Specifications for Portland Cement (ASTM C150), Type I, II or III." The cement shall be fresh and shall not contain any lumps or other indications of hydration.
3. Fine aggregate shall consist of a washed sand having clean, hard, angular durable uncoated grains, free from deleterious substances and shall conform to ASTM C404.
4. Water used in mixing the grout shall be clean, potable, and free of injurious quantities of substances known to be harmful to Portland Cement or reinforcing steel.
5. Admixtures such as mineral fillers, fluidifiers, retarders, etc. may be used upon approval by the Engineer of Record. Admixtures shall be mixed in accordance with the manufacturer's recommendations.

C. Reinforcing Steel Core

1. Reinforcing Bars: ASTM A 615, Grade 75 or 150, threaded.
2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
3. Work of this section shall conform to "Specifications for Structural Concrete for Building", ACI 301, latest edition

D. Casing

1. Casing pipe steel shall conform to ASTM 501 and shall have a minimum yield strength of 36,000 psi.

PART 3 EXECUTION

3.01 PILE DRILLING

- A. Installation equipment shall be capable of drilling the pile hole of the required minimum diameter to the design depth and maintaining the pile open and clear until designated casing and steel reinforcing has been inserted and the required minimum volume of grout has been placed.
- B. Piles may be drilled by rotary or rotary percussive drilling equipment. coring bits, roller bits, drag bits and/or down the hole hammers (DTH) may be utilized to advance the pile hole to the design depth. Flush joint threaded drill casing shall be continuously placed through overburden to prevent collapse of the pile hole.
- C. Drill cuttings shall be eliminated by wash water or other means which will not appreciably alter soil stability or aggravate existing environmental conditions. All debris from the drilling operations shall be removed by the contractor.
- D. Piles shall be drilled minimum 12" into competent bedrock or as required by performance design.
- E. Pile diameters shall be determined by the diameter of the drill bit or casing coring shoe. A minimum 8" pipe shall be considered.
- F. Prior to installing the reinforcing and grout placement, the pile shall be flushed with clean water to remove all contaminated water and cuttings.

3.02 INSTALLING STEEL REINFORCING

- A. The approved reinforcing steel shall be inserted for the full depth of the pile not more than 48 hours prior to grouting.
- B. If required, splicing of reinforcing shall provide for compressive and flexural strength at least equal to that of the reinforcing.

3.03 PILE GROUTING

- A. In general, grouting shall be performed in accordance with the PTI "Recommended Practice for Grouting of Post Tensioned Prestressed Concrete" as applicable.
- B. Grout placement into the pile shall be accomplished by tremie method. A tremie pipe of suitable diameter shall be inserted to the bottom of the pile. Water shall be pumped at a high velocity through the tremie pipe until the wash water at the top of the casing is clear. The hole shall be grouted immediately thereafter.
- C. The approved grout mix shall be pumped through the tremie pipe to the bottom of the pile. Pumping shall continue until all water is displaced and the casing is full to the top of the pile with a homogeneous grout mix. The tremie pipe shall be gradually lifted as the cement is being pumped to facilitate the upward flow of the grout. The end of the tremie pipe shall always be embedded at least five(5) feet into the rising grout within the cased hole. Once the casing is overflowing with grout the tremie pipe shall be fully removed.
- D. The flush joint casings shall be gradually extracted from the pile hole. A positive flow of grout into the pile hole shall be maintained at all times when the casing is being withdrawn. Blockage inside the casing must be prevented in order to maintain a positive flow of grout into the pile hole. The flow of grout shall be equal to or greater than the column represented by the outside diameter of the casing multiplied by the length of the casing withdrawn.

- E. The concrete grout in the casing shall be pressurized either continuously or periodically as the casing is extracted. If the pile contractor elects to use periodic pressurization, no more than 5 feet of casing shall be withdrawn between applications of pressure.
- F. Application of pressure to the pile grout may be accomplished by either pneumatic or specific injection. The amount of pressure applied shall be such that the resulting, pile diameter meets the design requirements and pile bond values are enhanced without causing detrimental side effects.
- G. As the grout column drops in the casing during withdrawal and pressurization, additional grout shall be added to raise the grout level to the top of the casing.
- H. The grouting of the pile shall continue uninterrupted and shall be completed within a time frame not to exceed the initial setting time of the mixture.
- I. The total volume of the grout placed into the pile hole shall be equal to or greater than 110% of the theoretical volume of flush joint casing utilized in pile construction.

3.04 TOLERANCES AND CRITERIA FOR ACCEPTANCE

- A. The piles shall be installed as close as practical to the design location. The lateral deviation from the center of pile design location at cutoff shall not exceed three (3) inches.
- B. The piles shall be installed with a variation from the center line of design alignment of not greater than three (3) percent of the pile length.
- C. Piles which have been improperly installed because of mislocation, misalignment, failure to obtain grout strengths or of failure to meet other specified design installation criteria shall not be accepted. Rejected piles shall be abandoned and additional piles installed as required.

3.05 PILE LOAD TEST

- A. Contractor shall submit load testing procedure conforming to the requirements of the International Building Code (2006 edition) for review by Engineer.

3.06 HANDLING AND DISPOSAL OF EXCAVATED MATERIAL

- A. Drill spoils resulting from drilling through the fill material, marine clay, glacial till and bedrock shall be segregated and legally disposed of at an approved off-site facility in accordance with any and all local regulations.
- B. Additional treatment of water or slurry shall be performed as necessary to comply with any and all permits and applicable regulatory requirements.

END OF SECTION