UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2021
****

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DIVISION 31 - EARTHWORK

SECTION 31 63 16

AUGERED CAST-IN-PLACE PILES

11/20

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****
USACE / NAVFAC / AFCEC / NASA | **UFGS-31 63 16 (November 2020)**

Preparing Activity: USACE | **Superseding UFGS-31 63 16 (November 2008)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2021
****

SECTION 31 63 16

AUGERED CAST-IN-PLACE PILES
11/20

****
NOTE: This guide specification covers the requirements for augered cast-in-place grout piles.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
****

****
NOTE: This guide specification covers the requirements for augered cast in place piles.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

****

****

NOTE: TO DOWNLOAD UFGS GRAPHICS Go to http://www.wbdg.org/ccb/NAVGRAPH/graphtoc.pdf.

****

****

NOTE: The extent and location of the work to be accomplished should be indicated on the project drawings or included in the project specification.

****

****

NOTE: Show the following information on the drawings:

1. Locations and design loads of piles. If both tension and compression piles are contained in design, identify by type.

2. Size, shape, and length of piles.

3. Details of reinforcement.

4. Locations of test piles, if required.

5. Soil data, where required.

6. Identify piles as vertical or battered

****

PART 1 GENERAL

****

NOTE: Special care should be taken when installing augered cast in-place piles in low strength soils such as peat where "necking" of piles can occur, or in soils containing layers or fields of boulders or cobbles, where there may be difficulties extending piles through the materials, or in methane gas producing soils, where gas bubbles and subsequently voids can develop in the piles.

On the drawings, show:

1. Subsurface-soil-data logs

2. Locations and size (diameter) of piles.

3. Design tip elevation for each pile indicated.

4. Reinforcing steel details.

5. Locations of test piles if required.

6. Locations of soil probes if required.

****

****
NOTE: Structural engineer must confirm the structural capacity of piles and provide specific bending moments, lateral loads and other design requirements for pile design.
****

1.1 DESCRIPTION

Design, furnish, install and test augered cast in place piles at the locations indicated on the drawings and specified herein. [Test piles that meet performance requirements can be incorporated into the permanent work.][Assume test pile[s] will be directed to be placed in [a] location[s] that can be incorporated into the work.]

1.2 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.
****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 211.1	(1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 315	(2018) Guide to Presenting Reinforcing Steel Design Details
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
ACI 318M	(2014; ERTA 2015) Building Code Requirements for Structural Concrete & Commentary

ASTM INTERNATIONAL (ASTM)

ASTM A615/A615M	(2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A706/A706M	(2016) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31/C31M	(2019a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2020) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C109/C109M	(2020b) Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens)
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C937	(2016) Grout Fluidifier for Preplaced-Aggregate Concrete
ASTM C939/C939M	(2016a) Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
ASTM C942	(2010) Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1611/C1611M	(2014) Standard Test Method for Slump Flow of Self-Consolidating Concrete

ASTM D942	(2019) Standard Test Method for Oxidation Stability of Lubricating Greases by the Oxygen Pressure Vessel Method
ASTM D1143/D1143M	(2007; R 2013) Piles Under Static Axial Compressive Load
ASTM D3689	(2007; E 2013; R 2013) Standard Test Methods for Deep Foundations Under Static Axial Tensile Load
ASTM D3966/D3966M	(2007; R 2013; E 2013) Standard Test Methods for Deep Foundations Under Lateral Load
ASTM D5882	(2016) Standard Test Method for Low Strain Impact Integrity Testing of Deep Foundations
ASTM D6760	(2016) Standard Test Method for Integrity Testing of Concrete Deep Foundations by Ultrasonic Crosshole Testing
ASTM E329	(2020) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
ASTM E548	(1994; E 1995) Standard Guide for General Criteria Used for Evaluating Laboratory Competence

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-220-01	(2012) Geotechnical Engineering

[1.3 SUBSURFACE DATA

Subsurface soil data logs are [indicated] [appended to the special contract requirements] [provided on the project drawings]. [The subsoil investigation report may be examined at [_____].]

]1.4 SYSTEM DESCRIPTION

****

NOTE: Working load on the pile should be limited to limiting stress per IBC 2015 of 30 percent of the unconfined compressive strength of the grout, as measured by: ASTM C109. (2016). "Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)," ASTM International, West Conshohocken, PA.

****

Submit detail drawings to demonstrate compliance of augering, mixing, and pumping equipment, installation, and installed piles with contract documents. Include with the drawings erection details and reinforcement as specified. Augered cast-in-place piles are formed by the rotation of a continuous flight hollow-shaft auger into the ground to the tip elevation

established by the requirements specified elsewhere in this section. Grout is then injected through the auger shaft as the auger is being withdrawn in such a way as to exert removing pressure on the withdrawing earth-filled auger as well as lateral pressure on the soil surrounding the grout-filled pile hole. Submit evidence to the Contracting Officer that the Contractor has been engaged in the successful installation of auger cast grout piles for at least 5 years.

1.4.1 Equipment

The minimum inside diameter of the hollow shaft of the augerflight must be 31.8 mm 1-1/4 inches. Provide grout injection equipment with a grout pressure gauge in clear view of the equipment operator. Rate of grout injection and rate of auger withdrawal from the soil must be so coordinated as to maintain at all times a positive pressure on this gauge which will, in turn, indicate the existence of a "removing pressure" on the bottom of the augerflight. Magnitude of this pressure and performance of other augering and grouting procedures, such as rate of augering, rate of grout injection, and control of grout return around the augerflight, are dependent on soil conditions and equipment capability and must be at the option of the Contractor, subject to review by the Contracting Officer. The auger hoisting equipment must be capable of withdrawing the auger smoothly and at a constant rate.

1.4.2 Grout Pump

Provide a positive displacement grout pump of an approved design capable of providing a positive displacement pressure not less than 2.4 MPa 350 psi. The pump discharge capacity must be calibrated at the beginning of the work to determine the volume of grout pumped per stroke in strokes per cubic meter foot or revolutions per cubic meter foot by a method approved by the Contracting Officer. The pump must be periodically recalibrated when deemed necessary by the Contracting Officer or the Contractor's Geotechnical Engineer during the project. Remove oil or other rust inhibitors from mixing drums and pressure grout pumps prior to mixing and pumping.

1.5 BASIS OF BID

****
NOTE: Select one of the following options:
****

****
NOTE: NOTE: Use "Lump Sum" paragraph below for lump (principal) sum bidding of piles. Use this in all projects except those where exact pile lengths cannot be practically determined prior to the actual work. Clearly show number of piles, pile capacity, pile locations, and tip and cutoff elevations on the drawings.

Use "Unit Price" paragraph for unit price bidding of piles. Specify unit price bid items for piles only for projects where exact quantities cannot be practically determined prior to the actual work. Lengths of piles must be determined as accurately as possible, prior to bidding, since the unit price per meter (foot) of the piles varies as the length

increases or decreases. Refer to Standard Test Method for Low Strain Impact Integrity Testing of Deep Foundations (ASTM D5882)

****

1.5.1 Production Pile Acceptance Criteria

Safe design capacity for piles is [____] KN kips. Install piles to [minimum tip elevation] [a minimum depth of [____] m feet below cut-off elevation], and to such additional depth as required to obtain a bearing capacity of not less than [____] KN kips. The Contractor's Geotechnical Consultant will determine the terminal installation criteria based on results of the static load tests [non-destructive testing results].

[1.5.2 Lump Sum Payment

Base bids upon providing the number, size, capacity, and length of piles as indicated on the [drawings.] [following Table I:

Table 1

[Location]	Number	Size	[Capacity]	[Length (Tip to Cut-Off)]	[Maximum Bending Moment]	[Maximum Shear Force]

]

Include the cost of all necessary equipment, tools, material, labor, and supervision required to: install, cut-off, dispose of any spoils, and meet the applicable contract requirements. Include mobilization, and redrilling damaged and heaved piles. If, in redrilling, it is found that any pile is not of sufficient length to provide the capacity specified, notify the Contracting Officer, who reserves the right to increase or decrease the total length of piles to be installed by changing the pile locations or elevations, requiring the installation of additional piles, or directing the omission of piles from the requirements shown and specified. If total number of piles or number of each length vary from that specified as the basis for bidding, an adjustment in the contract price or time for completion, or both, will be made in accordance with the contract documents. Payment for piles will be based on successfully installing piles to both the minimum tip elevation and satisfying the acceptance criteria identified herein. No additional payment will be made for: damaged, rejected, or misplaced piles; redrilled piles; any portion of a pile remaining above the cut-off elevation; build-ups; any cut-off length of piles; or other excesses beyond the assumed pile length indicated for which the Contractor is responsible.[Include payments for vibration monitoring, sound monitoring and precondition construction surveys].

][1.5.3 Unit Price

****

NOTE: Delete this paragraph for lump-sum contracts.

For NAVFAC PAC projects: Where there is unit pricing for piles, use this paragraph and edit applicable attachments from Section 00 22 13.00 20 SUPPLEMENTARY INSTRUCTIONS TO OFFERORS for inclusion in Standard Form 1442, "Solicitation, Offer and Award" and "Schedule of Bid Items."

Select first bracketed text.

For NAVFAC Southeast projects, where there is a need for unit pricing of piles, include this paragraph. Refer to NAVFAC SE Instruction 00010, "Instructions for Preparing Basis of Bid Statement With Unit-Priced Items," for method of specifying unit price bid items. Select first bracketed text.

****

[For unit price bid, see SF 1442, "Solicitation, Offer and Award" and "Schedule of Bid Items."] [Section 00 22 13.00 20 SUPPLEMENTARY INSTRUCTIONS TO OFFERORS.]

****

NOTE: For NAVFAC LANT projects, use the following paragraph for measurement and payment and subsequent sub-parts.

****

Requirements of "FAR 52.211-18, Variation in Estimated Quantity" do not apply to payment for piling. Each pile and test pile acceptably provided will be paid for at the bid unit price per unit length, which will include items incidental to furnishing and installing the piles including mobilization and demobilization, [jetting] [predrilling] [probing], redrilling uplifted piles, [and cutting off piles at the cut-off elevation]and reinforcing steel. [Include the cost for additional length for the test piles in the total unit price cost for the job.] Payment will be made for production [and test piles] at the bid unit price for the length of pile, from tip to final cut-off, actually provided, excluding buildups directed by the Contracting Officer to be made. If the actual cumulative pile length installed (tip to cut-off) varies more than 25 percent from the total pile length specified as a basis for bidding, at the direction of the Contracting Officer, the unit price per unit length will be adjusted in accordance with provisions of "FAR 52.236-2, Differing Site Conditions." [Payments will be made per each at the respective bid unit price for pile cut-offs, pile build-ups and pile loads tests.] [Include payments for vibration monitoring, sound monitoring, construction instrumentation and monitoring, and precondition construction surveys].

][1.6 PAYMENT

****

NOTE: Delete this paragraph for lump-sum contracts.

If Section 01 20 00 PRICE AND PAYMENT PROCEDURES is included in the project specifications, this paragraph title (UNIT PRICES) should be deleted from this section and the remaining appropriately edited subparagraphs below should be inserted into Section 01 20 00 PRICE AND PAYMENT PROCEDURES.

****

1.6.1 Augered Cast in Place Piles Installation

1.6.1.1 Payment

Payment will be made for costs associated with installation of the required lengths of permanent augered cast in place piles, [including

reinforcing steel,] [performing static load test, interpreting data and submitting reports,], compiling and submitting pile installation records, backfilling voids around piles, and any other items incidental to installing piles to the required elevation. No payment will be made for installing piles exceeding required lengths. No payment will be made for piles damaged during installation to the extent that they are rendered unsuitable for the work, in the opinion of the Contracting Officer.

1.6.1.2 Measurement

Permanent augered cast in place piles will be measured for payment for installation on the basis of lengths, to the nearest hundredth tenth of a linear meter foot, along the axis of each pile acceptably in place below the cut-off elevation shown as[determined by the Contracting Officer].

1.6.1.3 Unit of Measure

Linear meter foot.

[1.6.2 Augered Cast-in-Place Test Piles

1.6.2.1 Payment

Payment will be made for costs associated with installation of augered cast-in-place test piles, backfilling voids around piles; compiling pile installation test records[; performing dynamic testing; interpreting data; and submitting reports].

1.6.2.2 Measurement

Augered cast-in-place pile installation tests will be measured for payment on the basis of the applicable contract unit price per pile installation test.

1.6.2.3 Unit of Measure

Each.

][1.6.3 Augered Cast-in-Place Piles for Load Tests

1.6.3.1 Payment

Payment will be made for costs associated with installing, abandoning of load test piles [including structural steel]; backfilling voids around piles; compiling pile installation records[; furnishing, fabricating, and mounting of strain rods and protective assembly][; furnishing, fabricating, and mounting of inclinometer and inclinometer protective assembly][; performing non-destructive testing; interpreting data; and submitting reports]. No additional payment will be made for load test piles incorporated in the permanent work other than as provided.

1.6.3.2 Measurement

Augered cast in place piles for load tests will be measured for payment on the basis of the applicable contract unit price per load test pile.

1.6.3.3 Unit of Measure

Each.

][1.6.4 Augered Cast-in-Place Pile Static Axial Compressive Load Tests

1.6.4.1 Payment

Payment will be made for costs associated with augered cast in place pile static axial compressive load tests in accordance with ASTM D1143/D1143M, including material and labor for fabricating and furnishing load frames; calibrating load cells and hydraulic jacks; furnishing specified test equipment; installing strain rods; placing and removing test loads and test equipment; recording, reducing, and submitting test data; and compiling and submitting pile load test reports. No payment will be made for rejected pile static axial compressive load tests.

1.6.4.2 Measurement

Augered cast in place pile static axial compressive load tests will be measured for payment on the basis of the applicable contract unit price per load test.

1.6.4.3 Unit of Measure

Each.

][1.6.5 Augered Cast-in-Place Pile Static Tensile Load Tests

1.6.5.1 Payment

Payment will be made for costs associated with augered cast-in-place pile static tensile load tests in accordance with ASTM D3689, including material and labor for fabricating and furnishing load frames; calibrating load cells and hydraulic jacks; furnishing specified test equipment; installing strain rods; placing and removing test loads and test equipment; recording, reducing, and submitting test data; and compiling and submitting pile load test reports. No payment will be made for rejected pile static tensile load tests.

1.6.5.2 Measurement

Augered cast in place pile tensile load tests will be measured for payment on the basis of the applicable contract unit price per number of tensile load test.

1.6.5.3 Unit of Measure

Each.

][1.6.6 Augered Cast-in-Place Pile Lateral Load Tests

1.6.6.1 Payment

Payment will be made for costs associated with augered cast-in-place pile lateral load tests in accordance with ASTM D3966/D3966M, including material and labor for fabricating and furnishing load frames; calibrating load cells and hydraulic jacks; furnishing specified test equipment; installing inclinometers; placing and removing test loads and test equipment; recording, reducing, and submitting test data; and compiling and submitting pile load test reports. No payment will be made for rejected pile lateral load tests.

1.6.6.2 Measurement

Augered cast in place pile lateral load tests will be measured for payment on the basis of the applicable contract unit price per lateral load test.

1.6.6.3 Unit of Measure

Each.

][1.6.7 Low Integrity Impact Test

1.6.7.1 Payment

Payment will be made for costs associated with Low Integrity Impact Testing.

1.6.7.2 Measurement

Low Integrity Impact Test will be measured for payment on the basis of the applicable contract unit price per test cost.

1.6.7.3 Unit of Measure

Each.

][1.6.8 Sonic Logging

1.6.8.1 Payment

Payment will be made for costs associated with Sonic Logging Testing.

1.6.8.2 Measurement

Sonic Logging testing will be measured for payment on the basis of the applicable contract unit price per test cost.

1.6.8.3 Unit of Measure

Each.

][1.6.9 Vibration Monitoring

1.6.9.1 Payment

Payment will be made for costs associated with vibration monitoring.

1.6.9.2 Measurement

Vibration monitoring will be measured for payment on the basis of the applicable contract unit price per vibration monitoring point.

1.6.9.3 Unit of Measure

Each.

][1.6.10 Sound Monitoring

1.6.10.1 Payment

Payment will be made for costs associated with sound monitoring.

1.6.10.2 Measurement

Sound monitoring will be measured for payment on the basis of the applicable contract unit price per sound monitoring point.

1.6.10.3 Unit of Measure

Each.

][1.6.11 Preconstruction Condition Survey

1.6.11.1 Payment

Payment will be made for costs associated with preconstruction condition surveys.

1.6.11.2 Measurement

Preconstruction condition survey will be measured for payment on the basis of the applicable contract unit price per structure to be surveyed.

1.6.11.3 Unit of Measure

Each.

][1.6.12 Construction Instrumentation and Monitoring

1.6.12.1 Payment

Payment will be made for costs associated with construction instrumentation and monitoring.

1.6.12.2 Measurement

Construction instrumentation and monitoring will be measured as a single pay item.

1.6.12.3 Unit of Measure

One.

]]1.7 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's

Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

Under SD-07, from 3 to 5 years experience in installation of auger cast grout piles should be required.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Installation Procedures; G[, [_____]]

[Contractor's Geotechnical Consultant Documentation; G[, [_____]]

] Load Tests Procedures; G[, [_____]]

Grout Mix Design; G[, [_____]]

Field Quality Control Procedures; G[, [_____]]

SD-02 Shop Drawings

Augered Cast-in-Place Piles; G[, [_____]]

Load Tests; G

SD-03 Product Data

Test Piles; G[, [_____]]

Grout Pump

Materials

Grout Specimens for Laboratory Tests

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Test Piles

Load Tests

Flow Cone Test

SD-07 Certificates

Augered Cast-in-Place Piles

SD-11 Closeout Submittals

Pile Records

1.8 DAMAGED PILES

Piles which are damaged during installation to the extent they are rendered unsuitable for the work, in the opinion of the Contracting Officer, will be rejected, or may be re-drilled, if approved, at no cost to the Government.

Any pile damaged by reason of improper installation must be corrected by one of the following methods approved by the Contracting Officer for the pile in question:

a. The pile is re-drilled and re-grouted, if practicable, and, if necessary, drilled deeper.

b. One or more replacement piles are installed adjacent to the defective pile.

c. Low strain integrity non-destructuve testing must be performed by the Contractor's Geotechnical Consultant to assess the structural integrity of the pile(s)in question.

A pile installed below the specified butt elevation must be corrected by one of the following methods approved by the Engineer:

a. A sufficient portion of the footing is extended down to properly embed the pile.

b. Build up the pile butt by the use of casings.

A pile installed out of its proper location or out of plumb as approved by the Engineer, must be corrected by one of the following methods approved by the engineer:

a. One or more replacement piles are installed next to the pile in question.

b. As directed by the structural engineer.

1.9 QUALITY CONTROL

1.9.1 Field Quality Control Procedures

Submit the field quality control procedures. Provide instructions and procedures on how the Contractor will assist the Government in the processes of [Pile Load Testing,], Inspection and Monitoring of piles during installation and testing.

1.9.2 Installation Procedures

Submit information on the type of equipment proposed to be used, proposed methods of operation, pile installation plan including proposed sequence of installation, and details of all pile installation equipment and accessories.

[1.9.3 Contractor's Geotechnical Consultant Documentation

Hire the services of an independent, Registered Professional Geotechnical Engineer, experienced in soil mechanics and augered cast in place pile installation, to observe test pile installation and production pile installation as specified herein. The Contractor's Geotechnical Consultant must be independent of the Contractor and must have no employee or employer relationship which could constitute a conflict of interest.

]1.9.4 Grout Mix Design

Certify, using a Government-approved independent commercial testing laboratory, that proportioning of mix is in accordance with ACI 211.1 or ACI 318M ACI 318 for specified strength and is based on aggregate data which has been determined by laboratory tests during last twelve months. Submit a complete list of materials including type; brand; source and amount of cement, fly ash, pozzolan, ground slag, and admixtures; and applicable reference specifications. Submit additional data regarding fine aggregates if the source of aggregate changes. Submittal must clearly indicate where each mix design will be used when more than one mix design is submitted.

[1.9.5 Load Test Supporting Data

Submit Jack calibration records, a testing arrangement description and diagram, and the proposed loading sequence.

]1.9.6 Silica Fume Manufacturer's Representative

Provide statement that the manufacturer's representative will be present at plant to ensure proper mix, including high range water reducer (HRWR), and batching methods.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Grout

****
NOTE: Insert the ultimate compressive strength required by the design (20.7 MPa 3,000 psi minimum).Select a minimum flow rate of 11 seconds unless otherwise dictated by project specific requirements.
****

Provide grout consisting of a mixture of portland cement, a pozzolanic material when approved, fluidifier, sand, and water proportioned and mixed to produce a grout capable of being pumped with an ultimate compressive strength of [_____] MPa psi at 28 days. Consistency must not be less than [11] [_____] seconds when tested in accordance with paragraph FLOW CONE TEST. Other admixtures must not be used.

2.1.1.1 Portland Cement

Portland cement must conform to ASTM C150/C150M.

2.1.1.2 Pozzolan

Pozzolan must be a fly ash or other approved pozzolanic material conforming to ASTM C618, Class C or F.

2.1.1.3 Grout Fluidifier

Grout fluidifier must conform to ASTM C937, except that expansion must not exceed 4 percent. The fluidifier must be a compound possessing characteristics which will increase the flowability of the mixture, assist in the dispersal of cement grains, and neutralize the setting shrinkage of the high-strength cement mortar.

2.1.1.4 Chemical Admixtures

Chemical Admixtures must conform to ASTM C494/C494M and must consist of, but not be limited to, water reducers and/or set retarders.

2.1.1.5 Water

Water must be fresh, clean, and free from sewage, oil, acid, alkali, salts, organic matter, or other substances deleterious to grout or steel.

2.1.1.6 Fine Aggregate

****
NOTE: To be used as alternate requirement.
****

Fine aggregate must meet the requirements of ASTM C33/C33M. The sand must consist of hard, dense, durable, uncoated rock particles and be free from injurious amounts of silt, loam, lumps, soft or flaky particles, shale, alkali, organic matter, mica, and other deleterious substances. If washed, a washing method must be used that will not remove desirable

fines, and the sand must subsequently be permitted to drain until the residual-free moisture is reasonably uniform and stable. The sand must be well-graded from fine to coarse, with fineness modulus between 1.30 and 3.40. The fineness modulus is defined as the total divided by 100 of the cumulative percentages retained on U.S. Standard Sieve 1.18, 0.600, 0.300 and 0.150 mm Numbers 16, 30, 50, and 100.

2.1.1.7 Aggregate

****

NOTE: For exposed piles in areas where reactive aggregates are likely to be supplied, provide for additional tests and certification to insure that reactive aggregates will not be used. While not wholly conclusive, petrographic examination (ASTM C295/C295M), chemical test (ASTM C289/C289M), and mortar bar method (ASTM C227) are valuable indicators.

While more reliable, the concrete prism test (ASTM C1293) takes 1 to 2 years to complete and is not practical. The accelerated mortar bar method (ASTM C1260) is similarly reliable and takes only 16 days to yield results. In areas where reactive aggregates can not be avoided, specify use of low alkali cement, and/or cements modified to mitigate alkali-silica reactivity. Service records of concrete made with these materials along with tests should be used in evaluating these materials.

****

****

NOTE: Include modification to ASTM C33/C33M when reactive aggregates could be encountered. More modifications may be required. Additional tests and certifications may be required in the submittal paragraphs.

****

Aggregate must meet the requirements of ASTM C33/C33M, for fine aggregate, except as to grading. The sand must consist of hard, dense, durable, uncoated rock fragments and must be free from injurious amounts of silt, lumps, loam, soft, or flaky particles, shale, alkali, organic matter, mica, and other deleterious substances. If washed, the method must not remove other desirable fines, and the sand must be permitted to drain until the residual free moisture is reasonably uniform and stable. Sand grading must be reasonably consistent and must conform to the following requirements as delivered to the grout mixer:

U.S. Standard Sieve Number	Cumulative Percent by Weight Passing	Cumulative Percent by Weight Retained
2.36 mm8	100	0
1.18 mm16	95-100	0-5
0.600 mm30	55-80	20-45

U.S. Standard Sieve Number	Cumulative Percent by Weight Passing	Cumulative Percent by Weight Retained
0.300 mm50	30-55	45-70
0.150 mm100	10-30	70-90
0.075 mm200	0-10	90-100

The sand must have a fineness modulus of not less than 1.30 nor more than 2.10. Sand grading shown above may be modified with the approval of the Contracting Officer. Mortar test specimens made with the modified sand must exhibit compressive strength equal to or greater than that exhibited by similar specimens made with sand meeting grading and other requirements shown above.

2.1.2 Reinforcement

Materials, assembly, and placement of reinforcement must conform to the requirements of Section [03 30 00 CAST-IN-PLACE CONCRETE] [_____].

2.1.3 Reinforcement

All Steel must conform to ASTM A1064/A1064M for spirals and ASTM A615/A615M [ASTM A706/A706M] for ties. Reinforcing bars must conform to the requirements of ASTM A615/A615M, Grade 60. Reinforcing steel assemblies must be detailed and fabricated in accordance with the latest manual of Standard Practice for Detailing Reinforced Concrete Structures ACI 315. Splicing details must be determined by the Designer and detailed on the plans. Single bars and cages should be equipped with a centralizer of acceptable size. More than one centering device must be used on long bars/cages. Centralizers must be spaced not greater than about 6 m 20 feet for vertical bars/cages, and about 3 m 10 feet for bars/cages installed in battered piles; actual spacing must be modified as necessary depending on the ground conditions or as directed by the Contracting Officer.

2.1.4 Casings

Submit a description of the materials to be used and the proposed methods of operations. Casings must be approved [steel] [_____] as soil warrants. Cylinder casings must be of sufficient strength and rigidity to withstand all installation stresses, to prevent distortion caused by placing adjacent piles, and to prevent collapse due to soil or hydrostatic pressure.

2.2 MATERIAL SUSTAINABILITY CRITERIA

For materials used, where applicable and to the extent allowed by performance criteria, provide and document the following in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING:

a. Recycled content for fly ash and pozzolan

b. Recycled content for Ground Iron Blast-Furnace Slag

c. Recycled content for Silica Fume

d. Minimum [75 percent] recycled content for steel used for stressed tendon reinforcing

PART 3 EXECUTION

3.1 GROUT VOLUME

The volume of grout per linear meter foot of pile must be not less than the theoretical volume of grout per meter foot of test piles. Volume of placed grout must at least [120] [____] percent of theoretical volume for every 1.5 m 5 foot interval. If less than required volume is placed for any given 1.5 m 5 foot interval, lower auger a minimum of 1.5 m 5 foot, or to bottom of pile if less than 1.5 m 5 foot. Monitor pumped grout volumes using stroke counter or other means of accurately measuring the quantity of the grout placed. All volume measurements must be made and recorded by the Contractor's Geotechnical representative.

3.2 INSTALLATION

Install piles after rough grading at pile locations have been completed. The ground surface at each pile location at the time of augering and grouting must be at least 300 mm 12 inches higher than the required pile cutoff elevation, unless a steel casing will be used, and the augered hole must be completely filled with grout.

The grout must consist of Portland cement, fine aggregate, and water, and may also contain a mineral admixture and approved fluidifier. All materials must be fed to the mixer accurately measured by weight, except water that may be measured by volume. The order of placing the materials must be in accordance with the ASTM standards. Mineral admixtures, if used, must be flyash or natural pozzolan and must conform to ASTM C618, Class C or Class F. Chemical Admixtures supplied by the ready-mix producer must conform to ASTM C494/C494M and might consist of, but not be limited to, water reducers and/or set retarders. Grout fluidifier, when utilized, must conform to ASTM C937.

Time of mixing must not be less than 1 minute. [Do not proceed with the installation of contract piles within any area of substantially different subsoil conditions until a satisfactory load test has been performed in that area.]

3.2.1 Casings Placement

Casings "can" must be approved by the Contracting Officer and must be left in place and filled with grout. The casings must be rotated by the auger drive unit or weighted or jetted to the required depth. Casings should be of proper diameter and at least 450 mm 18 inches in length to establish the pile cut-off level and to keep surface spoil from entering the grout column before it sets. After the casing is in place, the casing and hole must be cleared of water, sediment, and debris prior to pouring the grout. [When the cut-off level is above the drilling grade, extend the pile by using a sheet metal or fiber cylindrical "can" or sleeve placed part in and part out of the pile.]

3.2.2 Drilling Refusal

****
NOTE: Delete the sentence in brackets when test piles, load tests, and soil probes are not used.
****

Except where auger withdrawal is required or directed by the Contracting Officer, each pile hole must be drilled and filled with grout in an uninterrupted operation. Drill each pile hole to the required tip elevation [or until the specified refusal criteria is satisfied]. [Should the required tip elevation shown on the drawings differ from the calculated tip elevation, an adjustment in the contract requirements will be made.] Advance the auger at a continuous rate which prevents removal of excess soil. Stop rotation of auger after reaching the required pile tip elevation or refusal. Auger refusal is defined as a rate of auger penetration of less than 76 [___] mm per 5 [___] minute of drilling 3 [___] inches per 5 [___] minutes of drilling.

3.2.3 Grouting and Auger Removal

At the start of pumping grout, raise the auger from 152 to 300 mm 6 to 12 inches and after grout pressure builds up, indicating discharge of grout, redrill auger to the required tip elevation, and fill pile hole with grout without interruption. When the auger is withdrawn to check the soil profile, it must be reinserted in the pile hole to the required tip elevation and the pile hole then filled with grout without interruption. Coordinate rate of grout injection and rate of auger removal from the soil in such a manner as to maintain a positive pressure on the grout pressure gauge. The gauge indicates the existence of a removing pressure on the bottom of the auger flight. If the auger jumps upward during withdrawal, or if the grouting process is interrupted, or if there is decreased grouting pressure, reinsert it to the original tip elevation and decrease the rate of withdrawal to prevent further jumping. The auger may rotate very slowly during withdrawal. However, counterclockwise rotation is not permitted.

3.2.4 Pile Butts

Unless a permanent steel casing is provided as specified in paragraph entitled "Casings," place a steel sleeve at top of pile to form the pile butt. For pile cutoff above ground surface, the steel sleeve must extend from the pile cutoff elevation to a point not less than 300 mm one foot below the ground surface. For pile cutoff at or below ground surface, the steel sleeve must extend from the ground surface to a point not less than 300 mm one foot below the pile cutoff elevation. Pump excess grout to displace as much potential laitance as possible. Lower pile butt to required cutoff elevation or to sound grout, whichever is lower.

3.2.5 Placement Tolerances

****
NOTE: Refer to the DFI, Augered Cast in Place Manual for maximum permissible placement variation.
****

Locate piles where indicated. The maximum permissible variation of the center of each pile from the required location is [___] mm inches at the ground surface. No pile must be out of required axial alignment by more than 2 percent. Periodically check the required axial alignment of each pile during the drilling operation and after reaching required tip elevation with not less than 1.5 m 5 feet of the auger flight extending above ground surface. Abandon piles which are damaged, mislocated, or out of alignment beyond the maximum tolerance and provide additional piles where directed.

As-installed pile surveys must be performed after 35 percent, 65 percent, and 100 percent of the piles have been installed. The as-installed surveys must measure the actual location and top elevation of each acceptably installed pile. Measurements must be performed in such a manner as to provide the horizontal deviation from plan location in two perpendicular directions and the top of pile elevation to the nearest 13 mm 1/2 inch. Provide each interim as-installed survey to the Contracting Officer within 3 days following the surveying work for each increment. The as-installed surveys must be submitted and approved prior to performing any pile cut-off work or beginning any pile cap/grade beam installation work.

3.2.6 Cutoff

Removal of pile butts above the indicated cutoff elevation may be accomplished by dipping the grout from the pile, while grout is fluid, but not less than one hour after installation. At the option of the Contractor, and as approved prior to pile installation, grout may be allowed to harden at its initial top elevation and then carefully trimmed off to the indicated cutoff elevation with hand operated chipping guns.

3.2.7 Disposal of Excavated Material

Do not leave any piles partially completed overnight. Completely grout and protect piles at the termination of each day's operation. Dispose of excavated material, resulting from augering, [within the area indicated] [off Government property] [_____].

3.3 FLOW CONE TEST

The quantity of water used must produce a grout having a consistency of not less than 21 seconds when tested with a flow cone in accordance with ASTM C939/C939M. [For specified flow cone rates in the range of 10 to 25 seconds, the flow cone must be modified by removal of the 13 mm 1/2 inch orifice allowing grout to pass through the 19 mm 3/4 inch hole in bottom of cone.] Water retentive grouts that demonstrate cohesive or thixotropic properties may be more accurately tested for workability with a standard slump cone using Slump Flow (commonly referred to as a "spread" test) as described in ASTM C1611/C1611M. The Slump Flow or "Spread" test employs the use of the standard concrete slump cone.

Conduct tests at the beginning of grout injection and at subsequent intervals to ensure specification requirements are met.

3.4 GROUT SPECIMENS

Conduct grout tests in accordance with ASTM C31/C31M, ASTM C39/C39M and ASTM D942. Prepare test specimens of grout by pouring grout into 50 mm 2 inch cubes. Cure and test in accordance with ASTM C109/C109M. Cube specimens must be restrained from expansion as described in ASTM C942. Prepare test specimens of grout by pouring grout [150 mm by 305 mm 6 inch by 12 inch cylinders], [76 mm by 150 mm 3 inch by 6 inch], [50 mm by 100 mm 2 inch by 4 inch] cylinders. Provide molds with a top cover plate so designed as to restrain grout expansion and to permit escape of air and water.

Not less than one set of cylinders must be collected for each 38 m3 50 cy of grout placed, or at least one set for each day during which piles are placed. Test 2 [___] cubes at 7 [___] days, 2 [___] cubes tested at 28

[___] days, and 2 [___] cubes held in reserve. One set must consist of six [___] cubes [cylinders]. Any set of cubes [cylinders] of which one or more cylinders test at 10 percent or more below the required strength must be cause for rejection of the pile group.

3.5 DEPTH

****

NOTE: The requirement of this paragraph may be waived by those agencies that so desire. Insert the total number of pile holes requiring withdrawal of auger before inserting the mortar. Withdrawal and examination of the auger to verify soil profile should be required at all test pile locations and at 10 percent of the remaining pile locations to supplement the soil boring information.

****

For all test piles, the auger must be withdrawn after reaching the "calculated" tip elevation and before grout is pumped. The Contracting Officer will be present to check the soil conditions and will have the right to increase the test pile length if soil conditions warrant. In such cases, the Contracting Officer may require additional auger withdrawals after drilling to the lower tip elevation. Such additional auger withdrawals must be included in the total number of auger withdrawals made. The pile hole must not be filled with grout until the Contracting Officer has approved the final tip elevation.

3.5.1 Rejected Piles

Replace or redrill damaged piles during installation, piles with low grout volume, piles that heave or drop, mislocated, or installed out of alignment beyond the maximum tolerance. Replace rejected piles with new piles installed as directed. Perform all work in connection with rejected piles at no additional cost to the Government.

3.6 SOIL PROFILE

****

NOTE: The requirement of this paragraph may be waived by those agencies other than NAVFAC that wish to do so. Indicate on the drawings pile holes requiring soil probes. Soil probes should be required at all test pile locations, and at 10 percent of the remaining pile locations.

****

At [_____] pile holes, in addition to the test piles, the auger must be withdrawn from the ground before the grout is pumped to check the soil profiles. Drill soil probes within a radius of 6 m 20 feet of their associated test pile. The Contracting Officer will be present to verify the soil condition at the "calculated" pile tip elevation and has the right to increase the soil probe length or require additional soil probes, if soil conditions warrant. After soil conditions have been inspected and approved by the Contracting Officer, install test pile[s]. Soil probes that are located within the tolerances indicated for piles must be filled with grout and may be used in the finished work, if approved by the Contracting Officer and if satisfactorily load tested.

3.7 PROTECTION OF PILES

The sequence of pile installation must be such that adjacent piles show no evidence of disturbance. This evidence would actually appear as a drop in the grout surface. The load applied to the soil by the drilling equipment must be far enough away from the pile being drilled to avoid compressing or shearing of the soil which may in turn displace or squeeze-off the grout column. No piles must be placed within [1.5 m 5 feet][_]of adjacent piles until the grout in the piles has set for [24] [___] hours, unless otherwise directed by the Contracting Officer.

When large pile clusters or piles are installed with very close spacing, take periodic elevations on the tops of all piles to observe and determine pile heave or drop. Pile heave or drop must not exceed 13 mm 1/2 inch.

3.8 PILE RECORDS

Keep complete and accurate records of all augered cast in place piles. Indicate the pile location, diameter, length, elevation of tip and top of pile, quantity of grout material actually pumped in each pile hole, and the rated load capacity of the pile. Determine grout quantity by recording grout pump displacement [and by automated monitoring equipment equipped with a display and recording unit, depth sensor, magnetic flow meter, rotary head pressure sensor, rotation sensor and pressure sensor.] [The automated monitoring equipment must not replace recording of the grout pump displacement manually.] Record and report immediately any unusual conditions encountered during pile installation. Submit specified records upon completion of work.

3.8.1 Protection of Existing Structures

****

NOTE: Include this paragraph only when protection of existing structures from pile installationdriving activities is required.

The designer must indicate on the drawings all structures and facilities for which protection is required. The designer must also provide a project specific document that details design criteria, requirements for preconstruction condition surveys, post construction condition surveys, geotechnical instrumentation to measure ground movements and any other requirements.

Add any additional requirements as necessary.

****

Mitigate impact on existing facilities due to pile installation activities in accordance with the [project specific document].

3.9 FIELD QUALITY CONTROL

3.9.1 Test Piles

Submit a complete and accurate record of all auger cast grout piles (both test piles and production piles), indicating the pile location, diameter, length, elevation of tip and top of pile, and the quantity and strength of grout material actually pumped in each pile hole.

3.9.2 Test Piles Placement

****

NOTE: Specify load tests when needed to confirm design capacities. The requirement for performing load tests would depend on the degree of variations in subsoil conditions. A minimum of one test pile should be load tested in each area of substantially different subsoil conditions. The requirement of performing the load tests under the direct supervision of a registered Professional Engineer may be waived at the discretion of the design agency.

Insert the grout strength required at the time the test load is applied which could be the specified 28-day strength if Type III (high-early strength) cement is used or 75 percent of the specified 28-day strength if regular cement is used.

****

Provide test piles of the required type placed in the manner specified elsewhere in this section for all piling. Install test piles [at the locations indicated] [in vicinity of soil boring test holes Nos. [_____,] [_____,] and [_____]]. Install test piles to [indicated tip elevation] [indicated bidding lengths]. The Government will use test pile and load test data in addition to test reports on soil samples to determine "calculated" pile tip elevations. Piles immediately adjacent to the test pile must be placed after placing test pile and prior to load testing. Test piles that are located within the tolerances indicated for all piles and provide a safe design capacity as determined by the results of a satisfactory load test may be used in the finished work. Test loads must not be applied to the piles until the grout has obtained the design strength. Report immediately any unusual conditions encountered during pile installation to the Contracting Officer. Modify installation procedures as required based upon recommendation of [Contracting Officer] [Contractor's Geotechnical Consultant and approval of the Contracting Officer].

3.9.3 Static Load Tests

****

NOTE: NOTE: If pile load tests are required and approved by the Contracting Officer, specify number and location of piles. Select method of load test. In ASTM D1143/D1143M, permit anchor piles only if approved by the Contracting Officer's Technical Representative (Geotechnical Branch). Insert figure KN(kips) corresponding to 200 percent of the design load. Select appropriate acceptance criteria according to UFC 3-220-01.

****

Perform compressive load tests on [_____] test piles in accordance with ASTM D1143/D1143M (standard loading procedure) as modified herein. Allow a minimum of [7] [___] days following final test pile installation until the grout has obtained the maximum design strength to load testing. Provide apparatus for applying vertical loads as required by method, using load from weighted box or platform [or reaction frame attached to

sufficient uplift piles to safely take required load] applied to pile by hydraulic jack. Increase load in increments until rapid progressive settlement takes place or until application of total compressive load of [_____] KN kips [200 percent of the designed pile capacity] for compressive load tests. Consider load test satisfactory when [after one hour at full test load gross settlement of pile butt is not greater than gross elastic pile compression plus 4 mm 0.15 inch plus one percent of pile tip diameter or width in [_____] mm inches,] [slope of gross load-settlement curve under full test load does not exceed 1.5 mm per metric ton 0.05 inches per ton,] [net settlement after removal of test load does not exceed 19 mm 3/4 inch.] Perform load tests at locations [as proposed by the Contractor's Geotechnical Consultant and] as directed by the Contracting Officer. Additional load tests, at Government expense, may be required by the Contracting Officer. Perform the loading, testing, and recording and analysis under the direct supervision of a Registered Professional Engineer, registered in the state of project location, and provided and paid for by the Contractor. Submit test set-up.

3.9.3.1 Safe Design Capacity

Determine the safe design capacity of a test pile as determined from the results of load tests according to UFC 3-220-01.

3.9.4 Tensile Load Test

Perform tensile load tests on [_____] test piles in accordance with ASTM D3689, as modified [and] in paragraph LOAD TESTS. Apply a tensile load of [_____] kN kips to each tensile load test pile. In performing the tension load test, apply the ultimate load equal to one and one-half times the safe tension capacity, and employ the Standard Loading Procedure.

3.9.5 Lateral Load Test

Perform lateral load tests on [_____] piles in accordance with ASTM D3966/D3966M, as modified [and] in paragraph LOAD TESTS. Lateral load tests must consist of jacking two piles apart with a hydraulic jack, with one pile serving as the reaction pile for the other. Apply a lateral load of [_____] kN kips to each pair of lateral load test piles. Record required movement readings for each pile.

3.9.6 Pile Records

****

NOTE: Omit reference to load test when not required in project. Omit reference to test piles and "calculated tip elevation" when test piles are not installed. Where special or unusual soil conditions are expected, consultation with the Contracting Officer's Technical Representative (Geotechnical Branch) regarding special engineering supervision of installing, testing, recording and analysis of data for project may be useful.

****

****

NOTE: NOTE: The Specifier must attach the specifications pile installation log graphic (for all pile installation projects) and the pile testing equipment data form to the end of this specification

section.
****

Keep a complete and accurate record of each pile installed. Indicate the pile location, deviations from pile location, cross section shape and dimensions, length, ground elevation, tip elevation, cut-off elevations, [batter alignment,] theoretical and actual grout volume for every 1524 mm 5 feet interval, and reinforcement details. Include in the record the beginning and ending times of each operation during installation of pile, installation equipment, grout pump type, and pump calibration. Record unusual occurrences during pile installation such as heaving, obstructions, and any installation interruptions. A preprinted pile log for recording pile installation data[and pile installation equipment data form], which can be downloaded at: http://www.wbdg.org/ccb/NAVGRAPH/graphtoc.pdf.

[3.9.7 Low-Strain Integrity Testing

[Test [_____] piles for post-construction non-destructive low strain integrity testing to verify the pile integrity.] [Specific piles must be selected based on a review of the manual or automated monitoring equipment installation records for that pile.] Perform test(s) in accordance with ASTM D5882 standard. Low-Strain Integrity Testing should be limited to piles with length to diameter (L/D) ratios of approximately 30 or less. This test is typically limited to detecting defects/discontinuities that are equal to or greater than about 0.3 m 1 foot. The equipment must have been calibrated within [6] [____] months prior to the start of the testing operations and thereafter throughout the contract duration. Employ an independent inspection firm, hereinafter referred to as the "Contractor's Geotechnical Consultant", experienced in the pile Low-Strain Integrity Testing[, monitoring of test pile installation,].

][3.9.8 Sonic Logging

[Test [____] piles for post-construction non-destructive sonic logging testing to verify the pile integrity.] [Specific piles must be selected based on a review of the manual or automated monitoring equipment installation records for that pile.] Perform test(s) in accordance with ASTM D6760 standard. Perform sonic logging [3] [____] days after the pile has been installed to both allow for the grout to initially cure and to reduce the potential for de-bonding between access pipe and pile grout. The equipment must have been calibrated within [6] [____] months prior to the start of the testing operations and thereafter throughout the contract duration. Employ an independent inspection firm, hereinafter referred to as the "Contractor's Geotechnical Consultant", experienced in the pile Low-Strain Integrity Testing[, monitoring of test pile installation].

][3.9.9 Testing Agency Qualifications

Engage an independent testing agency qualified according to ASTM C1077 and ASTM E329 for testing indicated, as documented according to ASTM E548, and approved by the Contracting Officer.

][3.10 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

****

NOTE: Include this paragraph only when special inspection and testing for seismic-resisting systems is required by the International Building Code (IBC).

This paragraph will be applicable to both new buildings designed and to existing building seismic rehabilitation designs done according to UFC 1-200-01, "General Building Requirements", UFC 3-301-01, "Structural Engineering", and 3-301-02, "Design of Risk Category V Structures, National Strategic Military Assets".

The designer must indicate on the drawings all locations and all features for which special inspection and testing is required in accordance with Chapter 17 of the IBC. This includes indicating the locations of all structural components and connections requiring inspection.

Add any additional requirements as necessary.
****

Perform special inspections and testing for seismic-resisting systems and components in accordance with and Section 01 45 35 SPECIAL INSPECTIONS.

][3.11 VIBRATION CONTROL

****
NOTE: Include this paragraph when vibration monitoring is required. Add any additional criteria or requirements as necessary to the particular project. This section can normally be deleted for most augered cast in place pile projects.
****

Perform vibration monitoring at the locations [shown in the plan] [decided by the Contracting Officer] during the pile installation operations. Perform vibration monitoring [using] [seismographs] [and geophones] within a distance of 61 meters 200 feet from the pile installation activity. [Engage the services of a qualified, independent vibration consultant, acceptable to the Government, to conduct the vibration monitoring. The vibration consultant must have minimum of [five] years of experience in vibration monitoring. A minimum of [28] days before the installation of vibration monitors, submit to the Government the name of the vibration consultant and a list of at least [three] previously completed projects of similar scope and purpose.]

Prior to the pile installation activities, obtain baseline readings of ambient vibrations. The vibration during the pile installation activities must be limited to [a peak particle velocity of not more than 5 cm 2 inches per second.] [the limits mentioned in the [contract documents]]. [Determine appropriate vibration limits as per [US Bureau of Mines] [American Association of State Highway and Transportation Officials (AASHTO)] guidelines.]During pile installation activities, monitor the vibrations to ensure the limits are not exceeded. If the limits are exceeded, cease the pile installation activity causing the vibration until [the Vibration consultant and the Contracting Officer] are on site to observe the structures nearest to the vibration monitor which has exceeded the limits.

The Contractor must be responsible for all damages resulting from the pile installation operations and must take whatever measures necessary to

maintain peak particle velocity within the specified limit. After completion of the project, remove the vibration monitors off the site and off Government property and restore the monitoring locations back to their original condition.

][3.12 NOISE CONTROL

****
NOTE: Include this paragraph when noise monitoring is required. Add any additional criteria, references or requirements as necessary to the particular project. This section can normally be deleted for most augered cast in place pile projects.
****

Perform noise monitoring at the locations [shown in the plan] [decided by the Contracting Officer] [at noise sensitive public areas] during the pile installation operations. [Perform noise monitoring using [noise meters][, and] [_____]]. [Engage the services of a qualified, independent noise consultant, acceptable to the Government, to conduct the noise monitoring. The noise consultant must have minimum of [five] years of experience in noise monitoring. A minimum of [28] days before the installation of noise monitors, submit to the Government the name of the noise consultant and a list of at least [three] previously completed projects of similar scope and purpose.]

Prior to the pile installation activities, obtain baseline readings of ambient noise levels. [The noise limits are mentioned in the [plan] [contract documents]]. [Determine appropriate noise limits as per [local agency] [Occupation Safety and Health Administration] guidelines]. During pile installation activities, monitor the noise to ensure the limits are not exceeded. If the limits are exceeded, cease the pile installation activity and install noise mitigation measures.

The Contractor must be responsible for all damages resulting from the pile installation operations and must take whatever measures necessary to maintain noise within the specified limit. After completion of the project, remove the noise monitors off the site and off Government property and restore the monitoring locations back to their original condition.

][3.13 PRECONSTRUCTION CONDITION SURVEY

****
NOTE: Add any additional criteria, references or requirements as necessary to the particular project.
****

Perform preconstruction condition survey of [structures] [and utilities] [within 61 meters 200 feet of the pile installation activity] [specified in the plans] [decided by the Contracting Officer]. Perform outreach to the owner of the structures [28] days before performing the preconstruction condition survey. The Contractor must obtain written permission from the owner of the structure prior to accessing the structure. The preconstruction condition survey must include video and photographic documentation of the exterior and interior of above ground structures and of the interior of underground structures. Video documentation must be in high definition, and show existing conditions and highlight, where possible, existing cracks, deteriorated concrete, exposed

and corroded reinforcement, cracked or broken brick or mortar, and other signs of distress. For utilities, perform the survey when the greatest extent of the interior is exposed. Provide supplementary artificial lighting as needed. The video must include annotation with location and structure nomenclature which describes any areas of distress over the video and time code superimposed on the video. Photographs must be accompanied by sketches or descriptions that indicate the location and direction of each photograph. For each structure surveyed, provide a Pre-Construction Condition Survey Report following completion of the survey. The report must contain all documentation associated with the survey including DVD copies. In the report, include notes, sketches, photographs, and videos. Provide general information, such as location details and structure type, as well as particular information on materials, condition, existing damage, aperture and persistence of cracks, and disrepair observed during visual survey. Provide a graphical depiction of locations of damage or other features of concern. Submit the Preconstruction Condition Survey Reports no later than [28] days before the commencement of pile installation activity. Accept responsibility for damages to existing adjacent or adjoining structures created by pile installation work, and repair any damages to these structures without cost to the Government.

][3.14 CONSTRUCTION INSTRUMENTATION AND MONITORING PROGRAM

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NOTE: Include this section if instrumentation is to be installed due to concerns about vibration, settlement, lateral movement, etc. during pile installation activities. Instrumentation should be specified and included in the specification. This section can be deleted if there are no instrumentation requirements.

Add any additional criteria or requirements as necessary for the particular project.

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Prepare a geotechnical instrumentation program to monitor settlement [and lateral movement] of temporary and permanent structures, utilities, [embankments] [and excavations] during pile installation. The design and distribution of instrumentation must demonstrate an understanding of the need, purpose and application of each proposed type.[Perform noise and vibration monitoring in accordance with NOISE CONTROL and VIBRATION CONTROL sections.]

Monitoring must extend before, during and for a period after completion of construction activities related to pile installation when long-term performance issues are a concern. The monitoring plan must be designed to protect adjacent structures and utilities against damage due to the pile installation activities. Establish limiting values of vertical [and horizontal] movement [and angular distortion] [and vibration] for each structure and utility within the zone of influence, subject to review by the Government.

Prepare a report detailing the proposed program of instrumentation and monitoring, establishing threshold values of monitored parameters, and describing the response plans that will be implemented when threshold parameters are exceeded. The report must include details about instrumentation consultant's experience, appropriate types, quantities,

locations and monitoring frequencies of the instruments.

Upon acceptance of the instrumentation and monitoring program, provide, install and monitor the instrumentation and interpret the data. Submit instrumentation data reports not less than every [_____] days after the monitoring program has begun. Take corrective actions, as necessary, based on the field instrumentation data and as defined in the instrumentation and monitoring program.

] -- End of Section --