UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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DIVISION 31 - EARTHWORK

SECTION 31 62 13.13

CAST-IN-PLACE CONCRETE PILES

04/06, CHG 2: 05/22

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USACE / NAVFAC / AFCEC / NASA	**UFGS-31 62 13.13 (April 2006)**
	Change 2 - 05/22

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UNIFIED FACILITIES GUIDE SPECIFICATIONS

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SECTION 31 62 13.13

CAST-IN-PLACE CONCRETE PILES
04/06, CHG 2: 05/22

****
NOTE: This guide specification covers the requirements for procurement, installation, and testing of cast-in-place concrete piles, steel casing.

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: Requirements for materials and procedures for special or unusual design should be added as necessary to fit specific projects. It is expected that cast-in-place concrete will be used elsewhere on the project and therefore Section 03 30 00 CAST-IN-PLACE CONCRETE will be a part of the specification.
****

****
NOTE: The following information shall be shown on the project drawings:

1. Locations, dimensions, shape, length, and design strength of piles.

2. Locations and lengths of test piles and load tests, if either is required.

3. Soil data, where required.

****

PART 1 GENERAL

1.1 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 WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A252	(2010) Standard Specification for Welded and Seamless Steel Pipe Piles
ASTM D1143/D1143M	(2007; R 2013) Piles Under Static Axial Compressive Load

1.2 REQUIREMENTS

****

NOTE: Select the applicable paragraph(s) from the following:

****

1.2.1 [Pile Lengths and Quantity

****

NOTE: Use this option for lump-sum contracts. This

method should be used in all but special cases. Fill in Table 1 as required selecting columns applicable to project. Generally, pile capacity, location, and tip elevation are shown on the plans.
****

Base bids upon the [number, size, capacity, and length of piles as indicated.] [following Table 1:]

Table 1				
[Location]	Number	Size	[Capacity]	Length

When the total number of piles or the number of each length vary from that specified as the basis for bidding, an adjustment in the contract price or time for completion will be made in accordance with Contract Clause, "changes." Adjustments in the contract will not be made for [pile splices;] cutting off piles; for a portion of a pile remaining above the cut-off elevation; or for broken, damaged, or rejected piles.

]1.2.2 Measurement and Payment

See SF 1442, "Solicitation, Offer and Award" and "Schedule of Bid Items."

****
NOTE: For NAVFAC LANT projects, use the following.
****

[Payment will be for the total length of completed and accepted piling, measuring from tip elevation to cutoff elevation. Payment will be by the contract unit price for furnishing labor, materials, tools, equipment, and incidentals, and for doing the work involved in furnishing and driving piling. Driving piling includes furnishing and driving piling including [test piles] [jetting or drilling] [pile splices] [excavation and backfill around piling] pile cutoff, [redriving, and replacement of broken, or rejected piles]. [Payment will be separate contract unit price for furnishing labor, materials, tools, equipment, and incidentals for doing the work involved in performing load tests on piles.]]

1.3 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.

****

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-02 Shop Drawings

Piles and pile cap

Show placement of steel. Show casing details, closures, and splices. [Show placement of and calculations for reinforcement.]

SD-04 Samples

Test piles

SD-06 Test Reports

Test pile data

[Load tests]

****

NOTE: Delete sentence in brackets when test piles are not driven.

****

For load tests, submit test data and results. [Submit test pile data from steel cased cast-in-place concrete test piles, from which the Government will determine and list the "calculated" tip elevations and the driving resistances for all piles. Use this list as the basis for ordering piles. Do not order piles until list is provided by the Government.]

SD-07 Certificates

****

NOTE: Mill certificates are generally required only

when casings are used as structural members. Use bracketed sentence only when steel shell casing is used as a structural member.
****

Pipe piles

Concrete testing results

[Steel shell casings]

Show name and location of steel mill and fabricating plant for pipe piles.

Data on pile driving equipment

Include in data for driving equipment, make, model, and type of pile hammer; manufacturer's specification sheet on pile hammer; and detail drawings of driving helmets, hammer cushion or capblock with records of successful use.

SD-11 Closeout Submittals

Pile driving records

1.4 QUALITY ASSURANCE

1.4.1 Welding

Shop and field welding, qualification of welders, and inspection of welds shall be in accordance with AWS D1.1/D1.1M.

1.5 EQUIPMENT

1.5.1 Pile Hammers

****
NOTE: Insert driving energy of hammer. Select hammer based on results of wave equation analysis such that hammer is compatible with pile type and capacity and hammer/cushion/pile system are capable of obtaining required capacity.
****

Furnish a hammer having a capacity at least equal to the hammer manufacturer's recommendation for the total weight of pile and character of subsurface material to be encountered. Obtain required driving energy of hammer, except for diesel hammers, by use of a heavy ram and a short stroke with low impact velocity. [For driving use the same type pile hammer, operated at same rate and in same manner, as that used for driving testing piles.]

1.5.2 Driving Helmets (Caps) and Cushion (Capblocks)

Use a hammer cushion or capblock between the helmet, driving cap or driving head and hammer ram. Driving cap and hammer cushion combination shall be capable of protecting head of pile, minimizing energy absorption and dissipation, and transmitting hammer energy uniformly to top of pile. When driving helmet or cap is used, it shall fit loosely around top of

pile so that the pile may rotate slightly without binding within helmet or cap. [During test pile period demonstrate to satisfaction of the Contracting Officer that equipment to be used on the project performs the above function.] Hammer cushion or capblock may be a solid hardwood block at least 150 mm 6 inches thick with grain parallel to pile axis and enclosed in a close-fitting steel housing or may consist of aluminum and micarta (or equal) discs stacked alternately in a steel housing. Use steel plates at the top and bottom of the capblock assembly. Under no circumstances will use of wood blocks, wood chips, rope or other material permitting excessive loss of hammer energy be permitted.

PART 2 PRODUCTS

2.1 PILING

2.1.1 Casings

****

NOTE: There are generally three types of casing or pipe used. Open-end and closed-end structural casings (usually steel pipe) and a closed-end non-structural casing (usually light gage shells). Non-structural casings must be driven with a mandrel. Specify the minimum thickness for any structural casing. Thickness of non-structural casings (light gage shells) is the responsibility of the Contractor as the shell is simply a form for the concrete. Ensure minimum nominal diameter at tip and two-third points above tip are indicated on drawings. In general, use closed-end casings except in the following conditions where open-end structural casings should be considered:

1. It is important to avoid soil displacement as in piles driven adjacent to existing structures.

2. Soil condition indicate a dense or clayey soil, or extremely coarse granular soil is present, such as gravel.

****

Provide a circular cross section throughout casing length whether or not modified by helical corrugations or flutings. Leave casing permanently in place. Provide casing with closed tips [, except for steel pipe casings conforming to ASTM A252 that may be open-end driven]. Provide watertight joint and tip connections. [Provide non-mandrel driven casings of steel with a wall thickness of [_____] mm [_____] inches.] Provide any one of the following types or combination of types of casings [, but provide only one type or combination of casing throughout the project].

2.1.1.1 Uniform Taper

Diameter shall increase from tip to cut-off at a uniform rate. Minimum nominal diameter at tip and two-third points above tip shall be as indicated.

2.1.1.2 Step-Taper

Section increments shall increase in diameter uniformly. Minimum nominal

diameter at tip and two-third points above tip shall be as indicated.

2.1.1.3 Constant Section

Diameter shall be constant from tip to cut-off. Steel pipe piles, conforming to ASTM A252, Grade 2, may be used in lieu of casings of constant-diameter section. Minimum nominal diameter shall be as indicated.

2.1.1.4 Combination Type

Combination type cast-in-place concrete piles, steel casing, may be any of the following combinations.

a. Steel pipe lower section with metal casing taper or constant-diameter upper section.

b. Constant-diameter or tapered lower section with tapered upper section.

c. Tapered lower section with constant-diameter upper section.

2.1.2 Piling

Provide steel cased cast-in-place concrete piles.

2.1.3 Reinforcement

****
NOTE: Ensure that reinforcing steel size is always indicated. Length must be indicated if less than full pile length.
****

Materials shall conform to the requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE.

2.1.4 Concrete

****
NOTE: Normal usage would reference all concrete work to Section 03 30 00 CAST-IN-PLACE CONCRETE. If a mix design for this piling section is not or will not be specified in one of these sections, add the optional sentence to provide the required mix design. Insert the ultimate compressive strength required by the design. Fill in blank for slump if different values are required by mix design or pile diameter.
****

Material shall conform to the requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE.[Provide concrete with a minimum compressive strength of [_____] MPa [_____] psi at 28 days, a slump of [from [100 to 150 mm] [4 to 6 inches] [_____], and a maximum aggregate size of 19 mm 3/4 inch].]

PART 3 EXECUTION

3.1 DRIVING

3.1.1 Driving Casing

****

NOTE: Delete items in brackets when test piles or load tests are not used.

****

Drive casing to or below the ["calculated"] tip elevation [to reach a driving resistance in accordance with the schedule which the Government will prepare from the test-pile driving data]. When a pile fails to reach the ["calculated"] tip elevation, [or when a pile reaches the ["calculated"] tip elevation without reaching the required driving resistance,] notify the Government and perform corrective measures as directed by the Contracting Officer.

3.1.2 Tolerance in Driving

****

NOTE: Pile butt tolerance may be increased if the design allows. Location within 100 mm 4 inches of indicated position is a strict tolerance.

****

Drive casing with a variation of not more than 21 mm per meter 0.25 inch per foot of pile length from the required axial alignment. Locate butts within [100] [_____] mm [4] [_____] inches of position indicated. Do not force casings into position. Check casings for heave after all piles are driven in a cluster within a 4.50 meters 15 foot radius. Redrive to required tip elevation or penetration resistance those casings found to have heaved. Maintain center of gravity of each group of footing piles with templates or other approved means. Where casings are damaged, mislocated, or driven out of alignment, replace or drive additional casing as directed.

3.1.3 Jetting or Predrilling of Casings

****

NOTE: Drilling may be used, providing the drill diameter is at least 50 mm 2 inches in diameter smaller than the pile, and the Contractor can demonstrate a procedure that will not detract from the carrying capacity of the pile. Jetting or predrilling should generally not be permitted in the following conditions:

1. For piles dependent on side friction in fine-grained, low-permeability soils (high clay or silt content) where considerable time is required for soil to reconsolidate around the piles;

2. For piles subject to uplift;

3. For piles adjacent to existing structures;

4. For piles in closely spaced clusters unless the

load capacity is confirmed by test and unless all jetting is done before final driving of any pile in the cluster.
****

[Jetting or predrilling of pile casing [will] [shall not] be permitted.] Discontinue jetting or predrilling approximately 1.5 meters 5 feet above the [bearing stratum] [calculated] [pile tip elevation]. Drive casing [the final 1.5 meters 5 feet of penetration] [to calculated pile tip elevation]. Before starting [final] driving firmly seat casing in place by application of a number of reduced energy hammer blows.

3.2 SPLICING AND CUTTING

3.2.1 Splicing of Load Bearing Casings

****
NOTE: Restrict number of splices where design indicates splicing will cause structural weakness. In general uplift piles using a structural casing should have as few splices as possible.
****

Splices may be used when approved by the Contracting Officer. [Do not use more than two splices per full length of casing]. Splices shall be able to transmit vertical and lateral forces, and in addition, shall develop 100 percent of the flexural capacity of the ordinary pile casing cross section. Make lateral joints with a full penetration groove weld in a butt joint in accordance with AWS D1.1/D1.1M or as approved by the Contracting Officer.

3.2.2 Cut-Off

Cut-off casings by oxyfuel cutting, sawing or other means approved by the Contracting Officer, to within 25 mm one inch of the designated cut-off elevation.

3.3 CONCRETING

Cast-in-place concrete is included in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.3.1 Preparation

****
NOTE: Insert the radius distance 3 to 6 meters 10 to 20 feet. Where open end casings are required, do not place concrete until all soil, water, and foreign material is removed.
****

Do not place concrete in a pile casing until all other casings within a radius of [_____] meters [_____] feet or within heave range have been driven and inspected. Clean inside of casing by removing soil and other foreign material. Remove free water until the maximum depth of water in the casing is 100 mm 4 inches. Inspect each casing after installation and before placing [reinforcement and] concrete. Verify the integrity of the casing throughout its length. Verify the absence of distortion and that any reduction of area does not exceed 10 percent.

3.3.2 [Reinforcement

Reinforce unsupported sections of piles, uplift or tension piles [throughout their entire length] [as indicated], piles exposed to high bending stresses not resisted by batter piles, and between top of pile and pile cap or slab. Assemble and place reinforcement in casing as a preassembled unit. Secure reinforcement prior to placement of concrete.

]3.3.3 Concrete

Deposit concrete in casing in a continuous operation by means of a funnel or hopper.

3.4 FIELD QUALITY CONTROL

3.4.1 Test Piles

****
NOTE: Indicate location of test piles on plans or insert the numbers of appropriate soil boring test holes.
****

****
NOTE: Drilling may be used, providing the drill diameter is at least 50 mm 2 inches in diameter smaller than the pile, and the Contractor can demonstrate a procedure that will not detract from the carrying capacity of the pile. Jetting or predrilling should generally not be permitted in the following conditions:

1. For piles dependent on side friction in fine-grained, low-permeability soils (high clay or silt content) where considerable time is required for soil to reconsolidate around the piles;

2. For piles subject to uplift;

3. For piles adjacent to existing structures;

4. For piles in closely spaced clusters unless the load capacity is confirmed by test and unless all jetting is done before final driving of any pile in the cluster.
****

Use test piles of the type, and drive in the manner specified for all piling elsewhere in this section. The Government will use test pile data to determine the "calculated" pile tip elevation and required driving resistance. Drive test piles [at the locations indicated] [in the vicinity of soil boring test holes Nos. [_____], [_____], and [_____]]. Drive test piles to [indicated tip elevation] [indicated bidding lengths]. Drive piles driven one day an additional 150 mm 6 inches using full rated driving energy hammer on the next work day, unless refusal is encountered. Record an increase or decrease in driving resistance. When there is a decrease in driving resistance, a load test, at the expense of the Government, may be required by the Contracting Officer. Use test

piles, when located properly and offering adequate driving resistance in the finished work. [Jetting is permitted when test piles clearly establish the validity of its use, as directed by the Contracting Officer.]

3.4.2 [Load Tests

****

NOTE: If pile load tests are required, specify number of piles. Select method of load test. Permit methods using anchor piles, see ASTM D1143, only if approved by EFD Code 411, Geotechnical Branch or in EFD's with no Code 411, EFD Code 402, Structural Branch or EFD Code 405, Civil Branch. Insert figures (tons) corresponding to 200 percent of the design load. Select the appropriate acceptance criterion. The first method (offset) is generally recommended for normal size piles. The second method (slope) and the third method (net-settlement) can be combined into one criterion.

****

Perform load tests on [_____] piles. Load tests shall be in accordance with ASTM D1143/D1143M as modified herein. [The use of anchor piles is not permitted.] Provide apparatus for applying the vertical loads as required by the method, either for load supported directly by the pile or load from weighted box or platform [or reaction frame attached to sufficient uplift piles to take safely the required load] applied to the pile by hydraulic jack. Increase the load in increments until rapid progressive settlement takes place or until a total load of [_____] metric tons [_____] tons has been applied. Consider the load test satisfactory when [after one hour at full test load the gross settlement of the pile butt is not greater than the gross elastic pile compression plus 4 mm 0.15 inches plus one percent of the pile tip diameter or width in millimeters inches.] [the slope of the gross load-settlement curve under the full test load does not exceed 1.4 mm per metric ton 0.05 inches per ton.] [the net settlement after removal of test loads does not exceed 19 mm 3/4 inches.] Make load tests at locations shown on driven test piles. Additional load tests, at the expense of the Government, may be required by the Contracting Officer. [Loading, testing, and recording and analysis of data must be under the direct supervision of a registered professional engineer provided and paid for by the Contractor.]

]3.4.3 Concrete Testing

****

NOTE: The following table is recommended for use in determining the number of test cylinders required in relation to the size of each lot of piles to be tested.

Pile Lot	**Number of Test Cylinders**
25	**2**
100	**48**

Pile Lot	Number of Test Cylinders
1,000	20*
5,000	50*
1,000	100*
* Samples taken from random batches of concrete.	

****

Sample and test concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE. Take specimens for every [_____] piles with at least 4 specimens for any one day's operation. Take specimens from a batch chosen at random.

3.4.4 Pile Records

****
NOTE: Omit reference to load test when not required in project.
****

For each pile, keep a record of the number of blows required for each meter foot of penetration and number of blows for the last 150 mm 6 inches of penetration or fraction thereof for test piles, penetration in blows per meter foot for job piles [as required for the "calculated" driving resistance]. Include in record the beginning and ending times of each operation during driving of each pile, type and size of hammer used, rate of operation, stroke or equivalent stroke for diesel hammers, type of driving helmet, and type and dimensions of hammer cushion (capblock) and pile cushion used. Record retap data and any unusual occurrence during pile driving. Notify Contracting Officer 10 days prior to driving of [test] piles [and load test].

-- End of Section --