ORIGINATION FORM
Proposed Revisions to the Specifications
(Please provide all information - incomplete forms will be returned)

Date: 7/17/23

Office: SDO

Originator: Larry Jones

Specification Section: 455

Telephone: 850 414-4305

Article/Subarticle: 455-1 through 455-12

email: Larry.Jones@dot.state.fl.us

Associated Section(s) Revisions: 105 (Add 105-8.13)

Will the proposed revision require changes to the following Publications:

Publication	Yes	No	Office Staff Contacted	Date
Standard Plans Index	○	◉	Rick Jenkins/Joshua Turley	7/17/23
Traffic Engineering Manual	○	◉	Mariano Amicarelli	7/17/23
FDOT Design Manual	○	◉	DeWayne Carver	7/17/23
Construction Project Administration Manual	◉	○	Patrick Overton	7/13/23
Basis of Estimate/Pay Items	◉	○	Ryan Gray	6/26/23
Structures Design Guidelines	◉	○	Ben Goldsberry	7/17/23
Approved Product List	○	◉	Karen Byram	7/17/23
Materials Manual	○	◉	David Horhota	7/17/23
Maintenance Specs	○	◉	Deanna Hutchison	7/17/23

Will this revision necessitate any of the following:

Design Bulletin ☐ **Construction (DCE Memo)** ☐ **Estimates Bulletin** ☐ **Materials Bulletin** ☐

Have all references to internal and external publications in this Section been verified for accuracy? (Select)

Synopsis: Summarize the changes:

Replace pay factors with pay items.
Implement Design-Build model for pile installation, certification and verification.

Justification: Why does the existing language need to be changed?

FTBA requested changes to the way many pile installation items were paid, this revision reflects the results of several months of coordinated meeings.

FDOT Management requested implementing the DB model for pile installation, certification and verification.

Do the changes affect either of the following types of specifications (Hover over type to go to site.):

Special Provisions ☐ **Developmental Specifications** ☐

List Specifications Affected: (ex. SP3270301, Dev330TL, Dev334TL etc.)

Contact the State Specifications Office for assistance completing this form.

Daniel Strickland 850-414-4130 Daniel.Strickland@dot.state.fl.us, Darla Hunsicker 850-414-4114 Darla.Hunsicker@dot.state.fl.us,
Jennifer Burnsed 850-414-4101 Jennifer.Burnsed@dot.state.fl.us, MaryElizabeth Parker 850-414-4155 MaryElizabeth.Parker@dot.state.fl.us

1. Are changes in line with promoting and making meaningful progress on improving safety, enhancing mobility, inspiring innovation, and fostering talent; explain how?

Yes, these changes implement an innovative approach to installing and verifying the acceptability of driven piles.

2. What financial impact does the change have; project costs, pay item structure, or consultant fees?

Bids should become more transparent as separate pay items are used for Department required ac

3. What impacts does the change have on production or construction schedules?

Construction schedules should be reduced.

4. How does this change improve efficiency or quality?

Construction efficiency should be improved just as in the Design-Build process pile installation efficiency is improved.

5. Which FDOT offices does the change impact?

Central and District Construction Offices and District Geotechnical Offices.

6. What is the impact to districts with this change?

Changes to the Specification reduce decision times and turnaround times for pile related acceptance.

7. Does the change shift risk and to who?

Risk for unforeseen work, shifts from the contractor to the Department.

8. Provide summary and resolution of any outstanding comments from the districts or industry.

Comments and Responses are available on the Track the Status of Revisions hyperlink located on the Specifications landing page: https://www.fdot.gov/programmanagement/Specs.shtm

9. What is the communication plan?

Through the established specification revision process (e.g., Internal and Industry Review)

10. What is the schedule for implementation?

The Standard Specifications eBook and Workbook are effective July 1st every year.

STRUCTURES FOUNDATIONS.
(REV 8-25-23)

SUBARTICLE 455-2.1 is deleted and the following substituted:

455-2 Static Compression Load Tests.

455-2.1 General: Employ a professional testing laboratory, or Specialty Engineer with prior load test experience on at least three projects, to conduct the load test in compliance with these Specifications, to record all data, and to submit reports of the test results to the Engineer except when the Contract Documents show that the Department will supply a Geotechnical Engineer to provide these services.

Perform the load test by applying a load up to the load required in the Contract Documents or to the failure load, whichever occurs first.

Do not apply test loads to piles sooner than 48 hours (or the time interval shown in the Plans) after driving of the test pile or reaction piles, whichever occurs last.

~~Allow up to four weeks after the last load test for the analysis of the load test data and to provide all the estimated production tip elevations. If the Contractor is willing to construct production foundation elements in areas designated by the Engineer, tip elevations will be determined in these areas beginning seven days after the receipt of the load test data which represents the designated area.~~ Do not begin static load testing of drilled shafts until the concrete has attained a compressive strength of 3,400 psi. The Contractor may use high early strength concrete to obtain this strength at an earlier time to prevent testing delays.

Load test piles/shafts in the order directed by the Engineer. Unless shown otherwise in the Contract Documents, provide all equipment, materials, labor, and technical personnel required to conduct the load tests, including determination of anchor reaction member depths. In this case, provide a loading apparatus designed to accommodate the maximum load plus an adequate safety factor.

While performing the load test, provide safety equipment, and employ safety procedures consistent with the latest approved practices for this work. Include with these safety procedures, adequate support for the load test plates and jack to prevent them from falling in the event of a release of load due to hydraulic failure, test pile/shaft failure, or any other cause.

Include in the bid the cost of transporting load test equipment and instrumentation supplied by the Department from their storage location to the job site and back. Handle these items with care. The Contractor is responsible for the safe return of these items. After completion of the static load tests, return all Department furnished equipment in satisfactory operating condition. Repair all damage to the test equipment furnished by the Department to the satisfaction of the Engineer. Clean all areas of rust on structural steel items, and recoat those areas in accordance with Section 560. Return all load test equipment supplied by the Department within 30 days after completing the load tests.

The Contractor is responsible for the equipment from the time it leaves its storage area until the time it is returned. During this time, insure the equipment against loss or damage for the replacement cost thereof (the greater of $150,000 or the amount shown in the Plans) or for the full insurable value if replacement cost insurance is not available.

Notify the Engineer at the preconstruction conference, or no later than 30 days before beginning test pile installation, of the proposed testing schedule so that items supplied by

the Department may be reserved. Notify the Department at least ten working days before pick-up or return of the equipment. During pick-up, the Department will complete a checklist of all equipment placed in the Contractor's possession. The Department will later use this checklist to verify that the Contractor has returned all equipment. Provide personnel and equipment to load or unload the equipment at the Department's storage location. Provide lifting tongs or nylon slings to handle Department owned test girders. Do not perform cutting, welding, or drilling on Department owned girders, jacks, load cells, or other equipment.

SUBARTICLE 455-2.8 is deleted and the following substituted:

455-2.8 Required Reports: ~~Submit a preliminary static load test report to the Engineer within five days after completing the load test. When the Contract Documents do not require internal instrumentation, submit the final report within ten days after completing the load test. Submit the final report of test results for internally instrumented shafts within 30 days after completing the load test.~~ Include in the report of the load test the following information:

1. A tabulation of the time of, and the amount of, the load and settlement readings, and the load and recovery readings taken during the loading and unloading of the pile/shaft.

2. A graphic representation of the test results, during loading and unloading of pile/shaft top movement as measured by the average of the dial gauge readings, from wireline readings and from level readings.

3. A graphic representation of the test results, when using telltales, showing pile/shaft compression and pile/shaft tip movement.

4. The estimated failure and safe loads according to the criteria described herein.

5. Remarks concerning any unusual occurrences during the loading of the pile/shaft.

6. The names of those making the required observations of the results of the load test, the weather conditions prevailing during the load test, and the effect of weather conditions on the load test.

7. All supporting data including jack and load cell calibrations and certificates and other equipment requiring calibration.

8. When the Contract Document requires internal instrumentation of the pile/shaft, furnish all of the data taken during the load test together with instrument calibration certifications. In addition, submit a report showing an analysis of the results of axial load and lateral load tests in which soil resistance along and against the pile/shaft is reported as a function of deflection.

Submit the necessary reports prepared by the Specialty Engineer responsible for collection and interpretation of the data, except when the Contract Documents show that the Department will provide a Geotechnical Engineer.

ARTICLE 455-3 is deleted and the following substituted:

455-3 Description.

Furnish and install concrete, steel, or ~~wood~~ timber piling including driving, jetting, preformed pile holes, cutting off, splicing, dynamic load testing, and static load testing of piling. Prior to driving, clearly mark the piles to facilitate inspection. Provide individual straight-line marks at 1-ft intervals legibly numbered at least every 5 ft. Use markers or lumber crayons or paint marks that can be easily observed by the inspector. Ensure marks are spaced uniformly and perpendicular to the face of the pile. Face pile so that the pile markings are ~~easily visible to~~readable by the pile inspector. When set checks or practical refusal checks are required, provide inch marks as directed by the Engineer.

In the event a pile is broken or otherwise damaged by the Contractor to the extent that the damage is irreparable, in the opinion of the Engineer, the Contractor shall extract and replace the pile at no additional expense to the Department. In the event that a pile is mislocated by the Contractor, the Contractor shall extract and replace the pile, at no expense to the Department, except when a design change proposed by the Contractor is approved by the Department as provided in 455-5.16.5.

SUBARTICLE 455-5.1 is deleted and the following substituted:

455-5 General Requirements.

455-5.1 Predrilling of Pile Holes: Predrilled pile holes are either starter holes to the depth described in this Subarticle or holes drilled through embankment/fill material down to the natural ground surface ~~at no additional cost to the Department~~. When using low displacement steel piling such as structural shapes, drive them through the compacted fill without the necessity of drilling holes through the fill except when the requirements for predrilling are shown in the Plans. When using concrete or other high displacement piles, drill pile holes through fill, new or existing, to at least the elevation of the natural ground surface. Use ~~the range of~~a drill with a ~~diameters~~ diameter not greater than the largest dimension of the pile. ~~listed below for square concrete piles.~~

~~12 inch square piles ..... 15 to 17 inches~~
~~14 inch square piles ..... 18 to 20 inches~~
~~18 inch square piles ..... 22 to 26 inches~~
~~20 inch square piles ..... 24 to 29 inches~~
~~24 inch square piles ..... 30 to 34 inches~~
~~30 inch square piles ..... 36 to 43 inches~~

~~For other pile sizes, use the diameter of the drills shown in the Plans or approved by the Engineer.~~ Accurately drill the pile holes with the hole centered over the Plan location of the piling. Maintain the location and vertical alignment within the tolerances allowed for the piling.

For predrilled holes required through rock or other hard ~~(i.e. debris, obstructions, etc.)~~ materials shown in the Plans that may damage the pile during installation, predrill hole diameters approximately 2 inches larger than the largest dimension across the pile cross-section.

Fill the annular space around the piles as described in 455-5. 10.1 with clean ~~A-3~~ sand ~~or sand meeting the requirements of 902-3.3~~.

In the setting of permanent and test piling, the Contractor may initially predrill holes to a depth up to 20% of the test pile length, unless ~~required~~ approved otherwise by the Engineer or required by the Plans. Predrill holes for production piles in the same manner as the test piles. ~~Where installing piles in compacted fill, predrill the holes to the elevation of the natural ground surface.~~ With prior written authorization from the Engineer, the Contractor may predrill holes to greater depths to minimize the effects of vibrations on existing structures adjacent to the work and/or for other reasons the Contractor proposes.

SUBARTICLE 455-5.3 is deleted and the following substituted:

455-5.3 Pile Hammers: All equipment is subject to satisfactory field performance during and without dynamic testing. Use a variable energy hammer to drive concrete piles. Hammers will be rated based on the theoretical energy of the ram at impact. Supply driving equipment which provides the required resistance at a blow count ranging from 3 blows per inch (36 blows per foot) to 10 blows per inch (120 blows per foot) at the end of initial drive, unless approved otherwise by the Engineer after satisfactory field trial. Ensure the hammer is capable of driving to a resistance equal to at least 2.0 times the factored design load plus the scour and down drag resistance shown in the Contract Documents, without overstressing the piling in compression or tension and without reaching or exceeding 20 blows per inch. When the Engineer determines the stroke height or bounce chamber pressure readings do not adequately determine the energy of the hammer, provide and maintain a device to measure the velocity of the ram at impact. Determine the actual hammer energy in the field so that it is consistent with the hammer energy used for each bearing capacity determination. When requested, submit to the Engineer all technical specifications and operating instructions related to hammer equipment.

455-5.3.1 Air~~/steam~~: Variable energy air~~/steam~~ hammers shall be capable of providing at least two ram stroke lengths. The short ram stroke length shall be approximately half of the full stroke for hammers with strokes up to 4 feet and no more than 2 feet for hammers with maximum strokes lengths over 4 feet. Operate and maintain air~~/steam~~ hammers within the manufacturer's specified ranges. Use a plant and equipment for ~~steam and~~ air hammers with sufficient capacity to maintain, under working conditions, the hammer, volume and pressure specified by the manufacturer. Equip the plant and equipment with accurate pressure gauges which are easily accessible to the Engineer. The Engineer will not accept final bearing on piles the Contractor drives with air~~/steam~~ hammers unless the Contractor operates the hammers within 10% of the manufacturer's rated speed in blows per minute, unless otherwise authorized by the Engineer. Provide and maintain in working order for the Engineer's use an approved device to automatically determine and display the blows per minute of the hammer.

455-5.3.2 Diesel: Variable energy diesel hammers shall have at least three fuel settings that will produce reduced strokes. Operate and maintain diesel hammers within the manufacturer's specified ranges. Determine the rated energy of diesel hammers using measured ram stroke length multiplied by the weight of the ram for open end hammers and by methods recommended by the manufacturer for closed end hammers.

~~Provide and maintain in working order for the Engineer's use an approved device to automatically determine and display ram stroke for open-end diesel hammers.~~

Equip closed-end (double acting) diesel hammers with a bounce chamber pressure gauge, in good working order, mounted near ground level so the Engineer can easily read it. Also, submit to the Engineer a chart, calibrated to actual hammer performance within 30 days prior to initial use, equating bounce chamber pressure to either equivalent energy or stroke for the closed-end diesel hammer to be used.

455-5.3.3 Hydraulic: Variable energy hydraulic hammers shall have at least three hydraulic control settings that provide for predictable energy or equivalent ram stroke. The shortest stroke shall be a maximum of 2 feet for the driving of concrete piles. The remaining strokes shall include full stroke and approximately halfway between minimum and maximum stroke.

Supply hammer instrumentation with electronic read out, and control unit that allows the Engineer to monitor, and the operator to read and adjust the hammer energy or equivalent ram stroke. When pressure measuring equipment is required to determine hammer energy, calibrate the pressure measuring equipment before use.

455-5.3.4 Vibratory: Vibratory hammers of sufficient capacity (force and amplitude) may be used to drive steel sheet piles and, with approval of the Engineer, to drive steel bearing piles a sufficient distance to get the impact hammer on the pile (to stick the pile). The Engineer will determine the allowable depth of driving using the vibratory hammer based on site conditions. However, in all cases, use a power impact hammer for the last 15 feet or more of the final driving of steel bearing piles for bearing determinations after all piles in the bent/pier have been driven with a vibratory hammer. Do not use vibratory hammers to install concrete piles, or to install support or reaction piles for a load test.

455-5.3.5 Pile Inspection Device: Provide a pile inspection device that displays and stores electronically for every hammer blow along with a timestamp: stroke for open-ended diesel hammers and blows per foot and blows per minute for all hammers. The device must auto-generate the Department's Pile Driving Record form and export the non-editable electronic data in a format compatible with the Pile Driving Record form. Use this device during the inspection of test piles and production piles.

SUBARTICLE 455-5.4.1 is deleted and the following substituted:

455-5.4 Cushions and Pile Helmet:

455-5.4.1 Capblock: Provide a capblock (also called the hammer cushion) as recommended by the hammer manufacturer. Use commercially manufactured capblocks constructed of durable manmade materials with uniform known properties. Do not use wood chips, wood blocks, rope, or other material which permit excessive loss of hammer energy. Do not use capblocks constructed of asbestos materials. Obtain the Engineer's approval for all proposed capblock materials and proposed thickness for use. Maintain capblocks in good condition, and replace them when charred, melted, or otherwise significantly deteriorated. The Engineer will inspect the capblock before driving begins and ~~weekly or~~ at appropriate intervals determined by the Engineer based on field trial. Replace or repair any capblock which loses more than 25% of its original thickness, in accordance with the manufacturer's instructions, before permitting further driving.

SUBARTICLE 455-5.4.2 is deleted and the following substituted:

455-5.4.2 Pile Cushion: Provide a pile cushion that is adequate to protect the pile from being overstressed in compression and tension during driving. Use a pile cushion sized so that it will fully fill the lateral dimensions of the pile helmet minus one inch but does not cover any void or hole extending through the top of the pile. Determine the thickness based upon the hammer-pile-soil system. For driving concrete piles, use a pile cushion made from pine plywood or oak lumber. Alternative materials may be used with the approval of the Engineer. ~~Obtain the Engineer's approval for all pile cushions.~~ Do not use materials previously soaked, saturated or treated with oil. Maintain pile cushions in good condition and replace them when charred, splintered, excessively compressed, or otherwise deteriorated to the point it will not protect the pile against overstressing in tension or compression. Protect cushions from the weather, and keep them dry. Do not soak the cushions in any liquid. Provide a new cushion for each pile unless approved otherwise by the Engineer after satisfactory field trial during dynamic testing.

During dynamic load tests, replace the pile cushion when any of the pile stress measurements exceed the maximum allowed pile stress determined by 455-5.12.2. When driving a pile without dynamic testing, replace the pile cushion when the cushion is either compressed more than one-half the original thickness, begins to burn, or as directed by the Engineer after field performance.

Reuse pile cushions in good condition to perform all set-checks and redrives. Use the same cushion to perform the set-check or redrive as was used during the initial driving, unless this cushion is unacceptable due to deterioration, in which case use a similar cushion.

SUBARTICLE 455-5.8 is deleted and the following substituted:

455-5.8 Water Jets: Use jet pumps, supply lines, and jet pipes that provide adequate pressure and volume of water to freely erode the soil. Do not perform jetting without prior approval by the Engineer or unless allowed by the Plans.

Do not perform jetting in the embankment or for end bents. Where conditions warrant, with approval by the Engineer, perform jetting on the holes first, place the pile therein, then drive the pile to secure the last few feet of penetration. Only use one jet for prejetting (jetting before setting the pile). Use at-least two jets when jetting and driving. ~~or jetting through piles constructed with a center jet hole. Use two jets when using external jets. When jetting and driving, position~~ Position the jet(s) slightly behind the advancing pile tip (approximately 3 feet or as approved by the Engineer). Use at-least two jets when jetting and driving. When using water jets in the driving, determine the pile bearing only from the results of driving after withdrawing the jets, except where using jets to continuously eliminate soil resistance through the scour zone, ensure that they remain in place as directed by the Engineer and operating during pile bearing determination. Where practical, perform jetting on all piles in a pile group before driving begins. When large pile groups or pile spacing and batter make this impractical, or when the Plans specify a jet-drive sequence, set check a sufficient number of previously driven piles in a pile group to confirm their capacity after completing all jetting.

SUBARTICLE 455-5.9 is deleted and the following substituted:

455-5.9 Penetration Requirements: Measure the penetration of piles from the elevation of the natural ground, the existing surface, the deepest scour elevation shown in the Pile Data Table, or the bottom of excavation, whichever is lowest. When the Contract Documents show a minimum pile tip elevation, drive the tip of the pile to this minimum elevation. The Engineer will accept the bearing of a pile only if the Contractor achieves the required bearing when the tip of the pile is at or below the specified minimum tip elevation and below the bottom of the preformed or predrilled pile hole.

~~When the Plans do not show a minimum tip elevation, ensure that the penetration is at least 10 feet into firm bearing material or at least 20 feet into soft material unless otherwise permitted by the Engineer. The Engineer may accept a penetration between 15 feet and 20 feet when there is an accumulation of five consecutive feet or more of firm bearing material. Firm bearing material is any material offering a driving resistance greater than or equal to 30 tons per square foot of gross pile area as determined by the Dynamic Load Testing (455-5.12.4). Soft material is any material offering less than these resistances. The gross pile area is the actual pile tip cross-sectional area for solid concrete piles, the product of the width and depth for H piles, and the area within the outside perimeter for pipe piles and voided concrete piles.~~

Do not drive piles beyond practical refusal. To meet the requirements in this Subarticle, provide penetration aids, such as jetting or preformed pile holes, when piles cannot be driven to the required penetration without reaching practical refusal.

If the Contractor encounters unforeseeable, isolated obstructions that the Contractor cannot practically penetrate by driving, jetting, or preformed pile holes, and the Contractor must remove the pile to obtain the required pile penetration, the Department will pay the costs for such removal as Unforeseeable Work.

SUBARTICLE 455-5.10 is deleted and the following substituted:

455-5.10 Preformed Pile Holes:

455-5.10.1 Description: Preformed pile holes serve as a penetration aid when all other pile installation methods fail to ~~produce the desired penetration and~~ achieve the minimum tip elevation shown in the Plans or, when authorized by the Engineer, to minimize the effects of vibrations on adjacent structures. ~~Preformed pile holes are necessary when the presence of rock or strong strata of soils will not permit the installation of piles to the desired penetration by driving or a combination of jetting and driving, when determined necessary by the Engineer, or when authorized by the Engineer to minimize the effects of vibrations on adjacent existing structures.~~ The Engineer may require preformed holes for any type of pile. Drive all piles installed in preformed pile holes to determine that the bearing requirements have been met. The bottom of the preformed hole is considered the lowest elevation the preforming operation matched the largest dimension of the pile.

For preformed holes which are required through material that caves during driving to the extent that the preformed hole does not serve its intended purpose, case the hole from the surface through caving material in accordance with the Contract Documents. After installing the pile to the bottom of the casing, remove the casings unless shown otherwise in the Plans. Determine bearing of the pile after removing the casing unless shown otherwise in the

Plans. Fill all voids between the pile and soil remaining after driving through preformed holes with clean ~~A-3~~ sand ~~or sand meeting the requirements of 902-3.3,~~ after the pile has achieved the required minimum tip elevation, unless grouting of preformed pile holes is shown in the Plans. If pile driving is interrupted during sand placement, drive the pile at least 20 additional blows after filling all of the voids between the pile and soil with sand at no additional cost to the Department.

455-5.10.2 Provisions for Use of Preformed Pile Holes: The Department will ~~generally anticipates~~ anticipate the necessity for preformed pile holes and include~~s~~ directions in the ~~Contract Documents~~Plans. ~~The Department will pay for preformed pile holes when the Contractor establishes that the required results cannot be obtained when driving the load bearing piles with specified driving equipment, or if jetting is allowed, while jetting the piles and then driving or while jetting the piles during driving.~~

~~**455-5.10.3 Conditions Under Which Payment Will Be Made:** The Department will make payment for preformed pile holes shown in the Plans, required by the Engineer or where the Contractor demonstrates that such work is necessary to achieve the required penetration without overstressing the pile.~~ The Department considers, but does not limit to, the following conditions as reasons for preformed pile holes:

1. Inability to drive piles to the required penetration with driving and jetting equipment.
2. To penetrate a hard layer or layers of rock or strong stratum that the Engineer considers not sufficiently thick to support the structure.
3. To obtain greater penetration into dense (strong) material and into dense material containing holes, cavities or unstable soft layers.
4. To obtain penetration into a stratum in which it is desired to found the structure.
5. To minimize the effects of vibrations or heave on adjacent existing structures.
6. To minimize the effects of ground heave on adjacent piles.

455-5.10.3 Conditions Under Which Payment Will Be Made: The Department will make payment for preformed pile holes shown in the Plans, required by the Engineer or where the Contractor demonstrates that such work is necessary to achieve the required penetration without overstressing the pile. ~~The Department considers, but does not limit to, the following conditions as reasons for preformed pile holes:~~

~~1. Inability to drive piles to the required penetration with driving and jetting equipment.~~

~~2. To penetrate a hard layer or layers of rock or strong stratum that the Engineer considers not sufficiently thick to support the structure.~~

~~3. To obtain greater penetration into dense (strong) material and into dense material containing holes, cavities or unstable soft layers.~~

~~4. To obtain penetration into a stratum in which it is desired to found the structure.~~

~~5. To minimize the effects of vibrations or heave on adjacent existing structures.~~

~~6. To minimize the effects of ground heave on adjacent piles.~~

455-5.10.4 Construction Methods: Construct preformed pile holes by drilling, or driving and withdrawing a suitable punch or chisel guided by a template at the locations of the

piles. Construct a hole that is equal to or slightly greater than the largest pile dimension for the entire length of the hole and of sufficient depth to obtain the required penetration. ~~Carefully form the preformed hole by using a drill or punch guided by a template or other suitable device, and do~~ Do not exceed the minimum dimensions necessary to achieve the required penetration of the pile. When the Plans call for grouting the preformed pile holes, provide a ~~minimum~~ pile hole dimension 2 to 4 inches larger than the largest pile dimension. Construct the holes at the Plan position of the pile and the tolerances in location, and ensure the hole is straight and that the batter is the same as specified for the pile. Loose material may remain in the preformed pile hole if the conditions in 455-5.10.1 are satisfied.

455-5.10.5 Grouting of Pile Holes: Clean and grout preformed pile holes for bearing piles, when the Plans require grouting after driving. Use grout that meets the requirements of 455-40 to 455-42 and has a minimum compressive strength of 3,000 psi at 28 days or as specified in the Plans. Prepare cylinders and perform QC testing in accordance with 455-43. LOT size and verification will be in accordance with 455-43. Pump the grout through three or more grout pipes initially placed at the bottom of the preformed hole.~~The Contractor may r~~Raise the grout pipes when necessary to prevent clogging and to complete the grouting operations. Maintain the grout pipes below the surface of the previously placed grout. Continue grouting until the grout reaches the ground surface all around the pile. Provide divers to monitor grouting operations when the water depth is such that it is impractical to monitor from the ground surface. ~~When grouting is shown in the Plans, include the cost in the price for piles.~~ In the event that the Engineer determines the Contractor must grout and the required grouting is not shown in the Plans, the Department will pay for the grouting work as Unforeseeable Work.

SUBARTICLE 455-5.11 is deleted and the following substituted:

455-5.11 Bearing Requirements:

455-5.11.1 General: Drive piles to provide the bearing required for carrying the loads shown in the Plans. For all types of bearing piles, consider the driving resistance as determined by the methods described herein sufficient for carrying the specified loads as the minimum bearing which is accepted for any type of piles. Determine pile bearing using the method described herein or as shown in the Plans.

For foundations requiring 100% dynamic testing of production piles, ~~the Engineer may accept a driven pile when the~~ ensure each pile has achieved minimum penetration and the minimum required bearing for 6 inches of consecutive driving, or when the minimum penetration is achieved, driving has reached practical refusal in firm material and the bearing capacity is obtained in all the refusal blows.

For foundations not requiring 100% dynamic testing of production piles, ~~the Engineer may accept a driven pile when the pile has achieved minimum penetration~~ ensure each pile has achieved minimum penetration, the blow count is generally the same or increasing and the minimum required bearing capacity obtained for 24 inches of consecutive driving with less than 1/4 inches rebound per blow, or the minimum penetration is achieved, and driving has reached practical refusal in accordance with 455-5.11.3~~. At the discretion of the Engineer, the driven pile may be accepted when the minimum penetration is achieved and driving has reached practical refusal in firm material.~~

~~The Engineer~~ With concurrence of the Engineer, the Dynamic Testing Engineer (DTE) may modify the scour resistance shown in the Plans if the dynamic load test is used to determine the actual soil resistance through the scour zone. ~~Also, the Engineer may make modifications in scour resistance when the Contractor proposes drilling and/or jetting to reduce the soil resistance in the scour zone.~~

455-5.11.2 Bearing Criteria: For foundations requiring 100% dynamic testing, the ~~Engineer~~ DTE will determine the bearing of all piles using the data received from dynamic load testing equipment utilizing internally or externally mounted sensors according to the methods described in 455-5.12.1.

For foundations not requiring 100% dynamic testing, the ~~Engineer~~ DTE ~~will determine the number of blows required to provide the required bearing according to the methods described herein. Determine the pile bearing by computing the penetration per blow with less than 1/4 inches rebound averaged through 12 inches of penetration. When it is considered necessary by the Engineer, determine the average penetration per blow by averaging the penetration per blow through the last 10 to 20 blows of the hammer.~~ shall forward a signed and sealed driving criteria letter indicating the minimum blow counts at each hammer stroke expected during driving to safely install the pile based on the test pile data and analyses to the Engineer at least one working day before driving the piles. The letter will contain an itemized list of the blow count criteria for acceptance of the piles, maximum strokes, criteria to replace cushions and any other conditions and limitations deemed appropriate for the safe installation of the piles. Drive all piles to the blow count criteria established by the DTE using the methods described herein and presented in the driving criteria letter.

~~The Engineer will accept piles within two Working Days after the final drive is performed, including any instrumented restrikes performed to ensure bearing has been met and that any potential relaxation will not reduce the required capacity to less than the required nominal bearing resistance (NBR).~~ If the pile is driven to approximately 12 inches above cut-off without reaching the required resistance, interrupt driving to perform an instrumented set-check at the end of the day.

455-5.11.3 Practical Refusal: Practical refusal is defined as 20 blows per inch or less than one inch penetration, with the hammer operating at the highest setting determined by the ~~Engineer~~ DTE for driving piles without damage and less than 1/4 inches rebound per blow. Stop driving as soon as ~~the Engineer determines that~~ the pile has reached practical refusal.

455-5.11.4 Set-checks and Pile Redrive:

1. Set-checks: ~~In the event that the Contractor has driven the pile to approximately 12 inches above cut-off without reaching the required resistance, the Engineer may require the Contractor to interrupt driving to perform a set-check~~ Set-checks consist of redriving the pile after certain period of time, typically up to 24 hours. Perform set-checks as required and at the waiting periods shown in the Contract Documents~~.~~. Provide an engineer's level or other suitable equipment for elevation determinations to determine accurate pile penetration during the set-checks. ~~In the event the results of the initial set-checks are not satisfactory, the Engineer may direct additional set-checks. The Engineer may accept the pile as driven~~ A pile may be accepted when a set-check shows that ~~the Contractor~~it has achieved the minimum required pile bearing and has met all other requirements of this Section.

2. Pile Redrive: Pile redrive consists of redriving the pile after the following working day from initial driving to determine time effects, to reestablish pile capacity

due to pile heave, or for other reasons ~~determined by the Engineer. Redrive piles as directed by the Engineer~~.

3. Uninstrumented Set-Checks and Uninstrumented Pile Redrive: ~~The Engineer may use,~~ Piles may be accepted based on uninstrumented set-checks or uninstrumented pile redrives ~~to determine whether a pile has sufficient bearing~~ only when the piles are redriven for at least 24 inches. ~~The Engineer~~In these cases, the piles may be considered ~~the pile~~ to have sufficient bearing resistance when the specified blow count criteria is achieved in accordance with 455-5.11.1 and 455-5.11.2. Unless practical refusal is obtained as defined in 455-5.11.3, set-checks or redrives for piles redriven less than 24 inches must be instrumented for pile acceptance.

4. Instrumented Set-Checks and Instrumented Pile Redrive: Use~~When considered necessary by the Engineer,~~ dynamic load tests using at least 6 hammer blows ~~will~~to determine whether the pile bearing is sufficient. The pile may be considered ~~Engineer may consider the pile~~ to have sufficient bearing resistance when dynamic measurements demonstrate the static pile resistance exceeds the required pile resistance for at least one hammer blow and the average static pile resistance during the next five hammer blows exceeds 95% of the required pile resistance. If the pile is advanced farther, the static pile resistance during all subsequent blows must exceed 90% of the required pile resistance.

455-5.11.5 Pile Heave: Pile heave is the upward movement of a pile from its originally driven elevation. Drive the piles in an approved sequence to minimize the effects of heave and lateral displacement of the ground. Monitor piles previously driven in a pile group for possible heave during the driving of the remaining piles. ~~When required by the Engineer, t~~Take elevation measurements to determine the magnitude of the movement of piles and the ground surface resulting from the driving process. Redrive all piles that have heaved 1/4 inches or more ~~unless the Engineer determines that the heave is not detrimental to pile capacity~~. ~~The Department will pay for all work in conjunction with redriving piles due to pile heave under the pile redrive item.~~

455-5.11.6 Piles with Insufficient Bearing: ~~In the case that the Engineer determines that~~ When the ~~safe~~ bearing capacity of any pile is less than the required bearing capacity, the Contractor may splice the pile and continue driving or may extract the pile and drive a pile of greater length, or, if so ordered by the Engineer, drive additional piles.

455-5.11.7 Optional Soil Set-up approach: If the Contractor so desires, it may consider soil set-up. Production piles that are driven to less than the Nominal Bearing Resistance (NBR) may be accepted based on the anticipated soil setup without set checks on all piles, only if the following criteria are met:

~~(a)~~1. Pile tip penetration satisfies the minimum penetration requirement following 455-5.9.

~~(b)~~2. End of Initial Drive (EOID) resistance exceeds 1.10 times the Factored Design Load for the pile bent/pier, as determined by the dynamic testing or blow count criteria.

~~(c)~~3. The Resistance Factor for computing NBR is taken from the following table:

Table 455-1
Resistance Factors for Pile Installation Using Soil Setup (all structures)

Loading	Design Method	Construction QC Method	Resistance Factor, φ	
			Blow Count Criteria[4]	100% Dynamic Testing[5]
Compression	Davisson Capacity	EDC[1], or PDA/GPC[2]	0.55	0.60
		Static Load Testing[3]	0.65	0.70
		Statnamic Load Testing[3]	0.60	0.65
Uplift	Skin Friction	EDC[1], or PDA/GPC[2]	0.45	0.50
		Static Load Testing[3]	0.55	0.55

1. Using the analysis methods published by Tran et al (2012).
2. Dynamic Load Testing and Signal Matching Analysis.
3. Used to confirm the results of Dynamic Load Testing and Signal Matching Analysis.
4. Initial drive of production piles using Blow Count Criteria.
5. Initial drive of all piles accepted by results of Dynamic Testing of all blows.

~~(d)~~4. At least one test pile is driven at each bent/pier with a successful set check at the anticipated production pile tip elevations and one of the following sets of dynamic load testing conditions are met at each bent/pier.

~~1~~a. The bearing of at least 10% of piles in the bent/pier (round up to the next whole number) is confirmed by instrumented set-check, and all test piles and instrumented set-checks demonstrate the pile resistance exceeds the NBR within seven days after EOID

~~2~~b. The bearing of at least 20% of piles in the bent/pier (round up to the next whole number) is confirmed by instrumented set-check, and all test piles and instrumented set-checks demonstrate the pile resistance exceeds the NBR within 21 days after EOID.

~~(e)~~5. All uninstrumented piles are driven deeper and to a greater EOID resistance than the EOID resistance of all instrumented production piles in the same bent/pier.

SUBARTICLE 455-5.12.1 is deleted and the following substituted:

455-5.12 Methods to Determine Pile Capacity:

455-5.12.1 General: Dynamic load tests using an externally mounted instrument system and signal matching analyses or embedded gauges will be used to determine pile capacity for all structures or projects unless otherwise shown on the Plans. ~~When necessary, the Engineer may require static load tests to confirm pile capacities. When the Contract Documents do not include items for static load tests, the Engineer will consider all required static load testing Unforeseeable Work.~~ Notify the Engineer two working days prior to placement of piles within the template and at least one working day prior to driving piles. Do not drive piles without the presence of the Engineer.

If the internally mounted system fails to communicate properly with the receiving system, allow the Engineer sufficient time to mobilize back-up equipment for performing dynamic load testing.

SUBARTICLE 455-5.12.3 is deleted and the following substituted:

455-5.12.3 Temporary Piles: Submit for the Engineers review, an analysis signed and sealed by a Specialty Engineer which establishes the pile lengths for temporary piles required for structures which affect public safety. Submit for the Engineers approval, a Wave Equation analysis signed and sealed by a Specialty Engineer which establishes the driving criteria for temporary piles at least five working days prior to driving temporary production piles. The required driving resistance is equal to the sum of the factored design load plus the scour and down drag resistances shown in the Plans, divided by the appropriate resistance factor or the nominal bearing resistance shown in the Plans, whichever is higher.

The maximum resistance factor is 0.45 when only wave equation analysis is performed. However, a larger resistance factor may be applicable when additional testing is provided by the Specialty Engineer in accordance with Section 3.5.6 of Volume 1 of the FDOT Structures Manual. If the Contractor elects to perform 100% dynamic load testing submit a certification package prepared by the Specialty Engineer. The certification package shall include a signed and sealed letter by the Specialty Engineer that certifies the piles meet the load requirements and have no integrity deficiencies. The package shall also include the dynamic load test records, all signal matching analysis performed to determine pile capacities and a summary table that indicates the final capacity of every pile.

SUBARTICLE 455-5.12.7 is deleted and the following substituted:

455-5.12.7 Structures Without Test Piles: For structures without 100% dynamic testing or test piles, the ~~Engineer~~ DTE will dynamically test the first pile(s) in each bent or pier at locations shown in the Plans to determine the blow count criteria for the remaining piles. The DTE shall forward the driving criteria letter to the Engineer in accordance with 455-5.11.2, except that the letter may be submitted as soon as the driving criteria is determined if piles are driven the same day.~~When locations are not shown in the Plans, allow for dynamic load tests at~~ The DTE will dynamically test or perform an instrumented set-check on at least 5% of the piles at each bent or pier (rounded up to the next whole number).~~If the Engineer requires additional dynamic load tests for comparison purposes, the Contractor will be paid for an additional dynamic load test as authorized by the Engineer in accordance with 455-11.5.~~

SUBARTICLE 455-5.13.2 is deleted and the following substituted:

455-5.13.2 Location of Test Piles: Drive all test piles in the position of permanent piles at the ~~designated~~ locations shown in the Plans. Ensure that all test piles designated to be statically load tested are plumb. In the event that all the piles are battered at a static load test site, the Engineer will designate an out-of-position location for driving a plumb pile for the static load test.

SUBARTICLE 455-5.14 is deleted and the following substituted:

455-5.14 Dynamic Load Tests: The Engineer will take dynamic measurements during the driving of piles designated in the Plans or authorized by the Engineer. For concrete piles, install instruments prior to driving and assist the Engineer in monitoring all blows delivered to the pile. For steel production piles, the Engineer may accept instrumented set-checks or redrives. The Engineer will perform dynamic load tests to evaluate any or all of the following:

1. Suitability of the Contractor's driving equipment, including hammer, capblock, pile cushion, and any proposed follower.
2. Pile capacity.
3. Pile stresses.
4. Energy transfer to pile.
5. Distribution of soil resistance.
6. Soil variables including quake and damping.
7. Hammer-pile-soil system for Wave Equation analyses.
8. Pile installation problems.
9. Other.

Either supply and install embedded gauges in the piles in accordance with Standard Plans, Index 455-003 or attach instruments (strain transducers to measure force and accelerometers to measure acceleration) with bolts to the pile for dynamic testing.

Make each follower and pile to be dynamically tested with externally attached instruments available to drill holes for attaching instrumentation and for wave speed measurements. Support the pile with timber blocks placed at appropriate intervals. Ensure that the pile is in a horizontal position and does not contact adjacent piles. Provide a sufficient clear distance at the sides of the pile for drilling the holes. The Engineer will furnish the equipment, materials, and labor necessary for drilling holes and taking the wave speed measurements. If the Engineer directs dynamic load testing, instrumented set-checks or instrumented redrives, provide the Engineer safe access to the top of the piles for drilling the attachment holes. After placing the leads provide the Engineer safe access to the piles to attach the instruments and for removal of the instruments after completing the pile driving.

The Engineer will monitor the stresses in the piles with the dynamic test equipment during driving to ensure the Contractor does not exceed the maximum allowed stresses. If necessary, add additional cushioning, replace the cushions, or reduce the hammer stroke to maintain stresses below the maximum allowable. If dynamic test equipment measurements indicate non-axial driving, immediately realign the driving system. If the cushion is compressed to the point that a change in alignment of the hammer will not correct the problem, add cushioning or change the cushion as directed by the Engineer.

Drive the pile to the required penetration and resistance or as directed by the Engineer.

When directed by the Engineer, perform instrumented set-checks or redrives. Do not use a cold diesel hammer for a set-check or redrive unless in the opinion of the Engineer it is impractical to do otherwise. ~~Generally, w~~Warm up the hammer by driving another pile or applying at least 20 blows to a previously driven pile or to timber mats placed on the ground.

SUBARTICLE 455-5.15.2.1 is deleted and the following substituted:

455-5.15.2 Production Pile Length:

455-5.15.2.1 Structures with Test Piles: When test pile lengths are shown in the Plans, the production pile ~~lengths are~~bid quantity is based on information available during design and ~~are approximate~~estimated pile lengths. ~~The Engineer will determine final pile lengths in the field which may vary significantly from the lengths or quantities shown in the Plans.~~ Production pile lengths shall be recommended by the DTE for the Engineer's approval based on all information available before the driving of the permanent piles, including, but not limited to, information gained from the driving of test piles, dynamic load testing, static load testing, supplemental soil testing, etc. When authorized by the Department, soil freeze information obtained during set checks and pile redrives may be used to determine authorized pile lengths for sites with extreme soil conditions.

After completion of the test pile program, production pile lengths shall be recommended in a letter signed and sealed by the DTE. Submit the letter and load test reports to the Engineer including the following electronic files (Windows 10 compatible): dynamic testing date data, signal matching data and results, and Wave Equation data and results.

SUBARTICLE 455-5.15.3 is deleted and the following substituted:

455-5.15.3 Authorized Pile Lengths: The authorized pile lengths are the lengths determined by the Engineer~~based on~~ after reviewing the pile lengths recommended by the DTE.~~all information available before the driving of the permanent piles, including, but not limited to, information gained from the driving of test piles, dynamic load testing, static load testing, supplemental soil testing, etc. When authorized by the Department, soil freeze information obtained during set checks and pile redrives may be used to determine authorized pile lengths for sites with extreme soil conditions.~~ The Contractor may elect to provide piling with lengths longer than authorized to suit his method of installation or schedule. When the Contractor elects to provide longer than authorized pile lengths, the Department will pay for the furnished length as either the originally authorized length or the length between cut-off elevation and the final accepted pile tip elevation, whichever is the longer length.

~~Within five working days after driving all the test piles, completing all load tests, completing all redrives, and receiving all test reports, t~~The Engineer will provide an itemized list of authorized pile lengths within ~~five~~ three working days after receipt of all test reports and the DTE's recommended pile lengths. Use these lengths for furnishing the permanent piling for the structure. If the Contractor is willing to start the pile driving operations in zones consisting of at least four test piles designated by the Engineer, and if the Contractor so requests in writing at the beginning of the test pile program, the Department will provide pile lengths for these designated phases within ~~five~~ three working days after ~~driving all the test piles, completing all load tests, completing all redrives, and~~ receiving all test reports and the DTE's recommended pile lengths for those designated zones. ~~The Engineer will provide the driving criteria for piles within three working days of furnishing pile lengths.~~

On multiple phase projects, the Engineer will not provide pile lengths on subsequent phases until completing the piling on initial phases.

SUBARTICLE 455-5.16.4 is deleted and the following substituted:

455-5.16.4 Elevation: Ensure that the final elevation of the pile head is no more than 1-1/2 inches above, or more than 4 inches below, the elevation shown in the Plans, however in no case shall the pile be embedded less than 8 inches into the cap or footing.

For fender piles, cut off piles at the elevation shown in the Plans to a tolerance of plus 0~~.0~~ inches to minus 2~~.0~~ inches using sawing or other means as approved by the Engineer to provide a smooth level cut.

SUBARTICLE 455-5.16.5 is deleted and the following substituted:

455-5.16.5 Deviation from Above Tolerances: When the Contractor has failed to meet the above tolerances for position of axial alignment, the Contractor may propose a redesign to incorporate out of tolerance piles into pile caps or footings, at no expense to the Department. Ensure the Contractor's Engineer of Record performs any redesign and signs and seals the redesign drawings and computations. Do not begin any proposed construction until the redesign has been reviewed for acceptability and approved by the Engineer. Utilize Standard Plans for treatment of piles driven more than 4 inches below cutoff elevation.

SUBARTICLE 455-5.17.1 is deleted and the following substituted:

455-5.17 Disposition of Pile Cut-offs, Test Piles, and Load Test Materials:

455-5.17.1 Pile Cut-offs:

~~1. Steel Piling: Unless shown otherwise in the Plans or directed by the Engineer, take ownership of cut-off sections, or portions of cut-off sections, and unused piling. Remove them from the job, and dispose of them.~~

~~2. Other Pile Types:~~ Upon completion of all work under the Contract in connection with piling, unless shown otherwise in the Plan, take ownership of any unused cut-off lengths remaining, and remove them from the right-of-way. Provide areas for their disposal.

ARTICLE 455-5 is expanded by the following new Subarticles:

455-5.18 Recording: Provide pile inspectors in accordance with 105-8.13. The qualified pile inspector shall inspect and record all the pile installation activities, including but not limited to handling, jetting, predrilling, preforming and driving on the Department's Pile Driving Record form. Steel piles and dynamically tested concrete piles in accordance with 455-5.14 will not require inspection during handling. Keep a pile driving log for each pile installed whether it is, or is not, instrumented. Within one working day after completing the installation of each pile, submit the Pile Driving Record and dynamic testing records to the Engineer.

455-5.19 Foundation Certification Packages: Submit certification packages of pile foundations to the Engineer prior to Pile Verification Testing. A separate Foundation Certification Package must be submitted for each foundation unit. A foundation unit is defined as all the piles within one bent or pile footing for a specific bridge for each phase of construction.

Each Foundation Certification Package shall contain an original certification letter signed and sealed by the DTE certifying the piles have the required minimum tip elevation, axial capacity including compression and uplift, ~~lateral stability~~, pile integrity, ~~settlements will not affect the functionality of the structure,~~ and that the inspection of the pile installation was performed under the supervision of the DTE. The package shall also include all pile driving logs, ~~EDC~~ dynamic testing records, all supplemental dynamic testing raw data and analyses for the foundation unit, and the signed and sealed evaluation performed to address out of tolerance piles in accordance with 455-5.16.5. The certification shall not be contingent on any future repair or testing, or any approval by the Engineer.

455-5.20 Verification: One working day, excluding weekends and Department observed holidays, after receipt of the Foundation Certification Package, the Engineer will determine whether a pile in that foundation unit will be selected for verification testing. Based on its review of the certification package, the Engineer may or may not choose a pile for verification testing in any or all foundation units. For the pile selected by the Engineer for verification testing, the Engineer will provide the dynamic load test equipment and personnel for the Pile Verification Testing. Provide the driving equipment and pile driving crew for the Pile Verification Testing and provide support as needed to prepare the piles for testing. The Engineer will provide the results of the verification testing and identify additional needs for verification testing within one working day of testing.

If the capacity or integrity of any pile is found to be deficient, the Engineer will reject the entire certification package for the foundation unit, and the Contractor shall:

1. Correct the deficiency;
2. Correct the process that led to the deficiency;
3. Demonstrate to the Engineer that the remainder of the piles in the foundation unit are acceptable, including additional dynamic load tests to verify pile capacity and integrity, and;
4. Recertify the foundation unit.

One working day, excluding weekends and Department observed holidays, after receipt of the recertification, the Engineer shall then determine whether additional verification testing is required in that foundation unit. If the capacity or integrity of a verification pile is found to be deficient, additional cycles of deficiency correction and verification testing shall be completed until no more pile capacity or integrity deficiencies are detected. Piles shall not be cut-off nor bent/pier caps placed prior to successful completion of the Pile Verification Testing Program for that foundation unit. In case of disagreement of dynamic testing results, the Engineer's results will be final and will be used for acceptance.

On land foundation units or water foundation units when the pile cutoff is at least six feet above mean high water, the Contractor may cut-off piles prior to a complete submittal of the Certification Package or to a successful completion of the Pile Verification Testing Program at its own risk. If any piles in a foundation unit are cut-off prior to the submittal of a certification package or completion of the Pile Verification Testing Program and the Engineer determines that verification testing is required, the Contractor shall perform, at no expense to the Department, any work and labor required to expose any pile selected for verification to allow the installation of the instruments in dry conditions and to provide references and access to the Engineer for such testing. Piles experiencing damage during the verification testing or requiring build-up after the verification shall be repaired by the Contractor at no expense to the Department. No pile bent/cap

shall be poured prior to successful completion of the Pile Verification Testing Program for that foundation unit or notification by the Engineer that no verification will be required.

SUBARTICLE 455-6.3.3 is deleted and the following substituted:

455-6.3.3 Shoes: Provide piles shod with metal shoes, of a design satisfactory to the Engineer~~, at no expense to the Department~~. Shape pile tips to receive the shoe and install according to the manufacturer's directions.

SUBARTICLE 455-7.1 is deleted and the following substituted:

455-7 Prestressed Concrete Piling.

455-7.1 Description: Provide prestressed concrete piles that are manufactured, cured, and driven in accordance with the Contract Documents. When the required lengths are less than or equal to the maximum length as shown in the Standard Plans, ~~Provide~~ provide piles full length without splices ~~when transported by barge or the pile length is less than or equal to 120 feet~~. When ~~piles are transported by truck and~~ the pile length exceeds ~~120 feet or~~ the maximum length ~~for a 3-point pick-up~~ according to Standard Plans, ~~Index 455-001,~~ and splicing is required, the piles may be spliced and splices will be paid for in accordance with 455-~~-~~11.8.

When splices are desired for convenience of the Contractor, provide ~~minimal~~ mechanical splices at no additional cost. Include the cost of ~~the~~ these splices in the cost of the pile.

SUBARTICLE 455-7.7.1 is deleted and the following substituted:

455-7.7 Extensions and Build-ups used to Increase Production Lengths:

455-7.7.1 General: Where splices, extensions and build-ups for concrete piles are necessary, construct them in accordance with the Standard Plans~~, Index 455-002~~.

These requirements are not applicable to specially designed piling. Make splices for special pile designs as shown in the Plans.

SUBARTICLE 455-7.7.2 is deleted and the following substituted:

455-7.7.2 Extensions to be Driven or those 21 feet or Longer: Construct extensions to be driven or extensions 21 feet or longer in length in accordance with the details shown in the Standard Plans and in a manner including the requirements, sequences, and procedures outlined below:

1. Cast a splice section in accordance with Section 450 with the dowel steel in the correct position and alignment as shown in the Standard Plans.
2. Drill dowel holes using an approved steel template that will position and align the drill bit during drilling. Drill holes a minimum of 2 inches deeper than the length of the dowel to be inserted.

3. Clean the drilled dowel holes by inserting a high pressure air hose to the bottom of the hole and blowing the hole clean from the bottom upward. Eliminate any oil, dust, water, and other deleterious materials from the holes and the concrete surfaces to be joined.

4. Place forms around joints between the pile sections.

5. Mix the adhesive components in accordance with the manufacturer's directions. Do not mix sand or any other filler material with the epoxy components unless it is prepackaged by the manufacturer for this specific purpose. Use adhesives meeting the requirements of Section 926 for Type AB epoxy compounds.

6. After ensuring that all concrete surfaces are dry, fill the dowel holes with the adhesive material.

7. Insert the dowels of the spliced section into the adhesive filled holes of the bottom section and position the spliced section so that the axes of the two sections are in concentric alignment and the ends of the abutting sections are spaced 1/2 inches apart. The Contractor may use small steel spacers of the required thickness provided they have 3 inches or more of cover after completing the splice. Fill the space between the abutting sections completely with the adhesive.

8. Secure the spliced sections in alignment until the adhesive is cured in accordance with the manufacturer's directions for the time appropriate with the prevailing ambient temperatures. ~~Do not utilize the crane to secure the pile extension during the adhesive cure time.~~ Utilize alignment braces to maintain the proper pile alignment during the epoxy cure time.

9. After curing is completed, remove alignment braces and forms and clean and dress the spliced area to match the pile dimensions.

When dowel splices need to be driven, assist the Engineer in performing dynamic instrumentation during the driving of each dowel spliced pile to monitor and control the stresses and verify the splicing integrity. ~~Replace any damaged pile splices in accordance with 455-3.~~ Provide the Engineer ~~48 hours~~ two working days advance notification prior to driving spliced piles.

SUBARTICLE 455-7.8 is deleted and the following substituted:

455-7.8 Pre-Planned Splices: Construct splices in accordance with the dowel splice method contained in the Standard Plans ~~Indexes~~ or using proprietary splices which are listed on the Department's Approved Product List (APL). Splice test piles in the same manner as the production piles. Include in the pile installation plan, the chosen method of splicing and the approximate locations of the splice. Generally, place the splice at approximately the midpoint between the estimated pile tip and the ground surface, considering scour if applicable. Stagger the splice location between adjacent piles by a minimum of 10 feet. Obtain the Engineer's approval prior to constructing any pile sections.~~Construct piles which are to be spliced using the dowel splice with preformed dowel holes in the bottom section and embedded dowels in the upper section.~~

When dowel splices need to be driven, comply with the requirements of 455-7.7.2.~~assist the Engineer in performing dynamic instrumentation during the driving of each dowel spliced pile to monitor and control the stresses and verify the splicing integrity. Replace~~

~~any damaged pile splices in accordance with 455-3. Provide the Engineer 48 hours advance notification prior to driving spliced piles.~~

Mechanical pile splices must be capable of developing the following capacities in the pile section unless shown otherwise in the Plans and capable of being installed without damage to the pile or splice:

1. Compressive strength = (Pile Cross sectional area) x (28 day concrete strength)

2. Tensile Strength = (Pile Cross sectional area) x 900 psi

Table 455-1	
Pile Size (inches)	Bending Strength (kip-feet)
18	245
~~20~~	~~325~~
24	600
30	950

SUBARTICLE 455-7.9 is deleted and the following substituted:

455-7.9 Pile Cut-offs: After the completion of driving, cut piles off which extend above the cut-off elevation with an abrasive saw. Make the cut the depth necessary to cleanly cut through the prestressed strands. ~~Take ownership and dispose of cut-off sections not used elsewhere as allowed by this Section.~~

ARTICLE 455-8 is deleted and the following substituted:

455-8 Steel Piling.

455-8.1 Description: Furnish, splice, drive, and cut off structural steel shapes to form bearing piles. Include in this work the preparation of a smooth and square pile top meeting the requirements of ASTM A252 or API 5L prior to driving, installation of structural steel bracing by bolting or welding, construction of splices and the filling of pipe piles with the ~~specified~~ materials specified in 455-8.9.

455-8.2 Material: For the material in steel piles, ~~pile bracing, scabs, wedges,~~ and splices, meet the requirements of Section 962.

455-8.3 Pile Splices: Order and use the full authorized pile length where practicable. Do not splice to obtain authorized lengths less than 450 feet except when shown in the Plans. Locate all field splices in the authorized pile length in portions of the pile expected to be at least 15 feet below the final ground surface after driving. When it is not practicable to provide authorized pile lengths longer than 450 feet in a single length, use no more than one field splice per additional 450 feet of authorized pile length. Shop splices may be used to join single lengths of pile which are at least 20 feet in length. One shorter segment of pile may be used to achieve the authorized pile length when needed.

Where the pile length authorized is not sufficient to obtain the required bearing value or penetration, ~~order~~ provide an additional length of pile as directed by the Engineer and splice it to the original length.

Make all splices in accordance with details shown in the Plans and in compliance with the general requirements of AWS D1.1 or American Petroleum Institute Specification 5L (API 5L).

455-8.4 Welding: Make all welded connections to steel piles by electric arc welding, in accordance with details shown in the Plans and in compliance with the general requirements of AWS D1.5. Electroslag welding is not permitted. Welds will be inspected by visual methods.

455-8.5 Pile Heads and Tips: Cut off all piles at the elevation shown in the Plans. If using a cutting torch, make the surface as smooth as practical.

Where foundation material is so dense that the Contractor cannot drive the pile to the required penetration and firmly seat it without danger of crumpling the tip, reinforce the tips with approved cast steel point protectors, as shown in the Plans or required by the Engineer. Construct point protectors in one piece of cast steel meeting the requirements of ASTM A27, Grade 65-35 heat treated to provide full bearing for the piles. Attach points by welding according to the recommendations of the manufacturer.

455-8.6 Pile Bent Bracing Members: ~~Place structural steel sway and cross bracing, and all other steel tie bracing, on steel pile bents and bolt or weld in place as indicated in the Plans.~~ Where piles are not driven into position in exact alignment as shown in the Plans, ~~the Engineer may require the use of fills and shims between the bracing and the flanges of the pile. F~~furnish and place all fills and shims required to square and line up faces of flanges for cross bracing at no additional expense to the Department.

455-8.7 Coating: Coat exposed parts of steel piling, wedging, bracing, and splices as shown in the Plans~~in accordance with the provisions for coating structural steel as specified in Section 560~~.

455-8.8 Storage and Handling: While handling or transporting the piles from the point of origin and into the leads, store and handle in the manner necessary to avoid damage due to bending stresses. In general, lift steel piles by means of a suitable bridge or a sling attached to the pile at appropriate points to prevent damage. Lift the pile from the horizontal position in a manner that will prevent damage due to bending of the flanges and/or web.

455-8.9 Filling Pipe Piles: Ensure closed-end pipe piles are watertight. When required by the Plans, fill pipe piles with the specified materials. ~~Use clean concrete sands and concrete meeting the requirements of Section 346.~~ Place concrete in open ended pipes containing water using methods in accordance with 455-15.9 with modified tremie and pump line sizes. Concrete may be placed directly into pipes which are dry. Construct and place reinforcement cages in accordance with 455-16 except the minimum number of spacers per level is three. Reinforcement cages may be installed before concrete placement or after concrete placement is completed if proper alignment and position is obtainable.

SUBARTICLE 455-9.4.3 is deleted and the following substituted:

455-9.4.3 Method of Installation: Jet concrete sheet piling to grade where practical. ~~The Engineer will require a minimum of two jets.~~ Provide water at the nozzles of sufficient volume and pressure to freely erode material adjacent to the piles. Where encountering rock or strong material, such that the sheet piles cannot be set to grade by jetting, remove the strong materials by other acceptable means, such as excavation and backfilling, drilling or by punching with a suitable punch. When the Plans do not indicate the existence of rock or strong

material and the piles cannot be set by jetting, the Department will pay for the work of removing, drilling or punching the strong material or rock as Unforeseeable Work.

ARTICLE 455-10 is deleted and the following substituted:

455-10 Pile Installation Plan (PIP).

455-10.1 General: Submit the completed Pile Driving Installation Plan Form (Form No. 700-020-01) with the following information at the preconstruction conference or no later than 30 days before driving the first pile.

1. ~~List and size of proposed equipment including cranes, barges, driving equipment, jetting equipment, compressors, and preformed pile hole equipment. Include manufacturer's data sheets on hammers.~~The names of the CTQP qualified inspectors assigned to inspect the pile installation. If the Dynamic Testing Engineer is also a CTQP qualified pile driving inspector and is able to perform both operations, then an additional pile driving inspector is not required when driving piles.

2. ~~Methods to determine hammer energy in the field for determination of pile capacity. Include in the submittal necessary charts and recent calibrations for any pressure measuring equipment.~~The quality control processes to ensure the required capacity is achieved in all piles. Include in the PIP the steps and analyses that would be performed when driving conditions change (such as unanticipated tip elevations, hammer modifications, presence of temporary piles and structures, preforming, changes, etc.).

3. ~~Detailed drawings of any proposed followers.~~ The name and contact information for the single representative of the Contractor, independent of field operations personnel, to resolve to the Engineer's satisfaction conflicts in the driving procedures or interpretations of the driving criteria. This person shall be available within two hours notice, and shall have the authority to refer issues to higher levels (corporate, if needed).

4. ~~Detailed drawings of templates.~~ A letter from the DTE certifying concurrence with the PIP.

~~5. Details of proposed load test equipment and procedures, including recent calibrations of jacks and required load cells.~~

~~6. Sequence of driving of piles for each different configuration of pile layout.~~

~~7. Details of proposed features and procedures for protection of existing structures.~~

~~8. Proposed plan for monitoring settlements and vibrations of adjacent structures, identifying the proposed equipment, the structures and the specific points that will be monitored.~~

~~9. Required shop drawings for piles, cofferdams, etc.~~

~~10. Methods and equipment proposed to prevent displacement of piles during placement and compaction of fill within 15 feet of the piles.~~

~~11. Methods to prevent deflection of battered piles due to their own weight and to maintain their as-driven position until casting of the pile cap is complete.~~

~~12. Proposed pile splice locations and details of any proprietary splices anticipated to be used.~~

~~13. Methods and equipment proposed to prevent damage to voided or cylinder piles due to interior water pressure.~~ Notify the Engineer of any test pile driving and production pile driving at least one week prior to beginning the installation operations of any pile.

455-10.2 Acceptance of Equipment and Procedures: The Engineer will evaluate the PIP for conformance with the Contract Documents. Within five working days, excluding weekends and Department observed holidays, after receipt of the plan, the Engineer will notify the Contractor of any comments and additional information required and/or changes that may be necessary to satisfy the Contract Documents. Submit changes and respond to the Engineer's comments and allow at least two working days, excluding weekends and Department observed holidays, for the Engineer to review the revised PIP.

All equipment and procedures are subject to satisfactory field performance. Make required changes to correct unsatisfactory field performance. The Engineer will give final acceptance after the Contractor makes necessary modifications. Do not make any changes in the driving system after acceptance without~~authorization~~ a revised PIP with concurrence of the DTE and acceptance by ~~of~~ the Engineer. A hammer repaired on site or removed from the site and returned is considered to have its performance altered (efficiency increased or decreased), which is considered a change in the driving system. ~~and is subject to~~ Perform a dynamic load test in accordance with 455-5.14 on the first pile driven with this hammer to confirm the driving criteria is still appropriate at no additional compensation.

Acceptance of the PIP by the Engineer does not relieve the Contractor of the responsibility to perform the work in accordance with the Contract Documents. The Engineer's acceptance is not a guarantee that the chosen methods and equipment are capable of obtaining the required results; this responsibility lies with the Contractor.

SUBARTICLE 455-11.2.2 is deleted and the following substituted:

455-11.2.2 ~~Driving~~ Monitoring of Unplanned Epoxy-Bonded Dowel Splice During Driving: If a pile is driven below cut-off and satisfactory bearing is not obtained, and additional driving is required after construction of a satisfactory splice, ~~an additional 10 feet of piling will be paid for the additional driving. This compensation for driving of splice, however, will not be allowed for test piles that are spliced and redriven.~~ splicing and additional driving will be paid as Unforeseeable Work.

SUBARTICLE 455-11.2.3 is deleted and the following substituted:

455-11.2.3 Extracting Piles: In the event that a pile is driven below cut-off without obtaining the required bearing, and the Engineer elects to have the pile extracted and a longer pile substituted, the pile extraction will be paid for as Unforeseeable Work. In the event a pile is damaged or mislocated, and the damage or mislocation is determined to be the Department's responsibility, and the Engineer elects to have the pile extracted, the pile extraction will be paid for as Unforeseeable Work. If a replacement pile is required, compensation will be made under the item for piling, for both the original pile and replacement pile. ~~Redriving of an extracted and undamaged pile will be paid for at 30% of the Contract unit price for piling.~~

The Contractor may substitute a longer pile in lieu of splicing and building-up a pile. In this event, the Contractor will be paid for the original authorized length of the pile, plus any additional length furnished by the Contractor up to the authorized length of the build-up, as piling. The Contractor will be paid ~~3~~50 ~~feet~~% of the Contract unit price for piling as full compensation for extracting the original pile.

SUBARTICLE 455-11.5 is deleted and the following substituted:

455-11.5 Dynamic Load Tests: Payment will be based on the number of and type of dynamic load tests shown in the Plans, ~~authorized~~ required by the Engineer, or required in 455-~~-~~5.12.7, completed and accepted in accordance with the Contract Documents. No separate payment will be made for dynamic load tests used to evaluate changes in the Contractor's driving equipment. ~~No payment will be made for dynamic load tests used to evaluate the integrity of a pre-planned epoxy-bonded dowel splice.~~ Include all costs associated with dynamically testing production piles with epoxy-bonded dowel splices under Pay Item No. 455-~~34~~17. ~~No payment will be made for dynamic load tests on test piles.~~

~~For structures with 100% dynamic testing, the cost of supplying and installing embedded gauges or attaching external gauges to each pile for dynamic load tests is included in the cost of the pile and no separate payment will be made.~~

~~For structures without 100% dynamic testing, the cost of supplying and installing embedded gauges or attaching external gauges to each production pile for dynamic load testing prior to initial driving, authorized by the Engineer, will be 20 feet of additional pile. No payment will be made for attaching dynamic testing equipment for set checks or redrives. No payment will be made for dynamic load testing performed when driving using followers. No payment will be made for any dynamic load testing performed on temporary piles.~~

Payment for internal gauges, when shown in the Plans, will be the number of piles with internal gauges successfully installed and used for dynamic testing.

SUBARTICLE 455-11.6 is deleted and the following substituted:

455-11.6 Steel Sheet Piling: The quantity to be paid for will be the plan quantity area, in square feet, measured from top of pile elevation to the bottom of pile elevation and beginning and end wall limits as shown in the Plans with no allowance for variable depth surface profiles. Approved alternate support structures would be paid for as plan quantity computed for sheet pile. No separate payment will be made for s~~S~~heet piling used in cofferdams and to incorporate the Contractor's specific means and methods, and not ordered by the Engineer~~, will be paid for as required in Section 125~~.

SUBARTICLE 455-11.7 is deleted and the following substituted:

455-11.7 Concrete Sheet Piling: The quantity to be paid for will be the plan quantity area, in square feet, with no area reduction for chamfered bottom ends or top recesses, measured from top of pile elevation to the bottom of pile elevation and beginning and end wall limits as shown in the Plans~~product of the number of such piles satisfactorily completed, in place, times~~

~~their lengths in feet as shown in the Plans or authorized by the Engineer. This quantity will be based upon piles 2-1/2 feet wide~~

SUBARTICLE 455-11.8 is deleted and the following substituted:

455-11.8 Pile Splices: The quantity to be paid for will be the number of authorized drivable splices and build-ups greater than 5 feet in length in concrete piling, and test piling, which are made for the purpose of obtaining authorized pile lengths longer than shown as the maximum length in the Standard Plans ~~Indexes~~, for obtaining greater lengths than originally authorized by the Engineer, to incorporate test piling in the finished structure, for further driving of test piling, or for splices shown in the Plans~~, will be 30 feet of additional prestressed concrete piling under Pay Item No. 455-34~~.

~~For concrete piles and test piles, where the build-up is 5 feet or less in length, the quantity to be paid for will be 9 feet of prestressed concrete piling under Pay Item No. 455-34 as compensation for drilling and grouting the dowels and all other costs for which provision has not otherwise been made.~~

The quantity to be paid for will be the number of authorized splices in steel piling and test piling, for the purpose of obtaining lengths longer than the lengths originally authorized by the Engineer~~, will be 20 feet of additional steel piling under Pay Item No. 455-35~~.

SUBARTICLE 455-11.9 is deleted and the following substituted:

455-11.9 Set-Checks and Redrives:

455-11.9.1 Set Checks/Test Piles: There will be no separate payment for the initial four set-checks performed the day of and the working day following initial driving.~~For e~~Each additional set-check ordered by the Engineer ~~and performed within the following working day of initial driving, an additional quantity of 10 feet of piling~~ will be paid as a redrive.

455-11.9.2 Set Checks/Production Piles: There will be no separate payment for the initial ~~two~~ set-check~~s~~ performed the day of ~~and the working day following~~ initial driving. ~~For each~~ Each additional set-check ordered by the Engineer ~~and performed within the following working day of initial driving, an additional quantity of 10 feet of piling~~ will be paid as a redrive.

455-11.9.3 Redrives: The quantity of redrives to be paid for, when shown in the Plans, will be the number of redrives, each, authorized by the Engineer. ~~Payment for any pile redrive (test pile or production pile) ordered by the Engineer will consist of 20 feet of additional piling.~~Redrives required by the Engineer, when not shown in the Plans, will be paid for as Unforeseeable Work.

SUBARTICLE 455-11.12 is deleted and the following substituted:

455-11.12 Preformed Pile Holes: The quantity ~~added to the payment for piling will be 30% of~~ to be paid for will be the length of completed preformed pile holes from existing surface or the bottom of any required excavation, whichever is lower, to the bottom of preformed hole shown in the Plans acceptably provided, ~~complete~~ for the installation of the bearing piles, regardless of the type of pile (test pile or production pile) installed therein. Only those holes

authorized to be paid for, as provided in 455-5.10.3, will be included in the measurement for payment. The Engineer will authorize payment for preformed pile holes only when the pile has been placed in proper position and has achieved the required penetration. When preformed pile holes are not shown in the Plans, the work will be considered Unforeseeable Work.

SUBARTICLE 455-11.13 is deleted and the following substituted:

455-11.13 Grouted Preformed Pile Holes: The quantity to be paid will be ~~added to the payment for piling will be 70% of~~ the length of grouted preformed pile holes from the bottom of preformed hole acceptably provided to the required top of grouting, regardless of the type of pile (test pile or production pile) installed therein. Only those holes required to be grouted, will be included in the measurement for payment.

ARTICLE 455-11 is expanded by the following new Subarticles:

455-11.14 Casing for Preformed Pile Holes: The quantity to be paid will be the cased length of preformed pile holes authorized by the Engineer or shown in the Plans, regardless of the type of pile (test pile or production pile) installed therein. When casing for preformed pile holes is not shown in the Plans, the work will be considered Unforeseeable Work.

455-11.15 Preformed Pile Holes For Sheet Piles: The quantity to be paid for will be the area, in square feet, completed and accepted, bounded by the existing ground surface or the bottom of any required excavation, whichever is lower, to the preform elevation and beginning and end limits of required preforming.

455-11.16 Pile Inspection: The quantity to be paid will be the number of piles and test piles inspected, driven, and accepted by a dedicated, qualified inspector.

455-11.17 Verification Test: The quantity to be paid will be the number of piles tested and accepted.

SUBARTICLE 455-12.2 is deleted and the following substituted:

455-12.2 Prestressed Concrete Piling: Price and payment will be full compensation for all labor, equipment, and materials required for furnishing, pile marking and installing all concrete piling~~reinforcing steel~~, predrilling pile holes described in 455-5.1, and furnishing the material for and wrapping pile clusters with wire cable where so shown in the Plans ~~and grouting of preformed pile holes when shown in the Plans~~.

SUBARTICLE 455-12.4 is deleted and the following substituted:

455-12.4 Test Piles: Price and payment will be full compensation for all incidentals necessary to complete all the work of this item except splices, build-ups, pile extractions and preformed pile holes authorized by the Engineer and paid for under other pay items or payment methods. ~~The cost of all additional work not listed above necessary to ensure required~~

~~penetration and attain required bearing of the test piles will be included in the price bid per foot of test pile, including driving and all other related costs.~~

SUBARTICLE 455-12.5 is deleted and the following substituted:

455-12.5 Dynamic Load Tests:

455-12.5.1 Dynamic Load Tests/Test Piles: All test piles will require dynamic load tests. Include all costs associated with ~~assisting the Engineer in~~ engaging a specialty engineer and perform~~ing~~ the dynamic load tests in the pay items for test piles.

455-12.5.2 Dynamic Load Tests/Production Piles: Payment will be full compensation for all costs associated with ~~assisting the Engineer in~~ engaging a specialty engineer and perform~~ing~~ the dynamic load tests.

455-12.5.3 Dynamic Load Tests/Internal Gauges: Payment will be full compensation for all costs associated with supplying and installing internal gauges for dynamic testing.

SUBARTICLE 455-12.6.1 is deleted and the following substituted:

455-12.6 Steel Sheet Piling:

455-12.6.1 Permanent Sheet Piling: Price and payment will be full compensation for all labor, equipment, and materials required for furnishing and installing steel sheet piling ~~including preformed holes~~ and coating~~,~~ but will not include furnishing and placing anchors when an anchored wall system is designed and detailed in the Plans. In such cases, furnishing and installing anchors will be paid separately.

SUBARTICLE 455-12.7 is deleted and the following substituted:

455-12.7 Concrete Sheet Piling: Price and payment will be full compensation for all labor, equipment, and materials required for furnishing and installing concrete sheet piling, including reinforcing steel, grouting, filter fabric~~, preformed holes~~ and installation.

SUBARTICLE 455-12.8 is deleted and the following substituted:

455-12.8 Preformed Pile Holes: Payment will be full compensation for all labor, equipment, ~~casings~~ and materials required to perform this work.

455-12.8.1 Grouted Preformed Pile Holes: Payment will be full compensation for all labor, equipment, and materials required to perform this work.

455-12.8.2 Casing for Preformed Pile Holes: Payment will be full compensation for all labor, equipment, and materials required to perform this work.

SUBARTICLE 455-12.12 is deleted and the following substituted:

455-12.12 ~~Payment Items~~ Pile Redrives: Payment will be ~~made under:~~full compensation for all labor, equipment, and materials required to perform this work.

~~Item No. 455- 2- Treated Timber Piling - per foot.~~
~~Item No. 455- 14- Concrete Sheet Piling - per foot.~~
~~Item No. 455- 34- Prestressed Concrete Piling - per foot.~~
~~Item No. 455- 35- Steel Piling - per foot.~~
~~Item No. 455- 36- Concrete Cylinder Piling - per foot.~~
~~Item No. 455-119- Test Loads - each.~~
~~Item No. 455-120- Point Protection - each.~~
~~Item No. 455-133- Sheet Piling - per square foot.~~
~~Item No. 455-143- Test Piles (Prestressed Concrete) - per foot.~~
~~Item No. 455-144- Test Piles (Steel) - per foot.~~
~~Item No. 455-145- Test Piles (Concrete Cylinder) - per foot.~~

ARTICLE 455-12 is expanded by the following new Subarticles:

455-12.13 Pile Inspection: Price and payment will be full compensation for all labor, equipment, and incidentals required to perform this work, including providing the pile inspection device, data collection and submitting the records.

455-12.14 Verification Tests: Payment will be full compensation for all costs associated with assisting the Engineer in performing the dynamic load tests to verify the resistance and integrity of the tested pile.

455-12.~~12~~ 15 Payment Items: Payment will be made under:

Item No. 455- 2-	Treated Timber Piling - per foot.
Item No. 455- 14-	Concrete Sheet Piling - per square foot.
Item No. 455- 15-	Preformed Pile Holes
Item No. 455- 17-	Pre-planned Pile Splices - each.
Item No. 455- 20-	Pile Inspection - each.
Item No. 455- 34-	Prestressed Concrete Piling - per foot.
Item No. 455- 35-	Steel Piling - per foot.
Item No. 455- 36-	Concrete Cylinder Piling - per foot.
Item No. 455-115-	Pile Redrive - each.
Item No. 455-119-	Test Loads - each.
Item No. 455-120-	Point Protection - each.
Item No. 455-133-	Sheet Piling - per square foot.
Item No. 455-137-	Dynamic Load Tests - each.
Item No. 455-143-	Test Piles (Prestressed Concrete) - per foot.
Item No. 455-144-	Test Piles (Steel) - per foot.
Item No. 455-145-	Test Piles (Concrete Cylinder) - per foot.