

SUPERSEDED BY EB 15-031 EFFECTIVE 9/28/15		New York State Department of Transportation ENGINEERING INSTRUCTION	EI 11-008
Title: REVISIONS TO STANDARD SPECIFICATIONS SECTION 551 PILES AND PILE DRIVING EQUIPMENT, §720-04 STEEL H-PILES AND §720-06 MECHANICAL PILE SPLICES			
Target Audience: ☒ Manufacturers (18) ☐ Surveyors (33) ☒ Local Govt. (31) ☒ Consultants (34) ☒ Agencies (32) ☒ Contractors (39)		Approved:  Arthur P. Yannotti, P.E. Acting Deputy Chief Engineer (Structures) 7-6-11 Date	

ADMINISTRATIVE INFORMATION:

- This Engineering Instruction (EI) is effective beginning with projects submitted for the letting of January 12, 2012.
- This EI does not supersede any other issuances.
- These revisions will be incorporated into a future update of the Standard Specifications.

PURPOSE: The purpose of this EI is to introduce a pay item for splices for Cast-in-Place (CIP) piles, and make updates to Section 551 *Piles and Pile Driving Equipment*, §720-04 *Steel H-Piles* and 720-06 *Mechanical Pile Splices*.

IMPLEMENTATION:

Beginning with projects submitted for the letting of 01/12/12, the Design Quality Assurance Bureau (DQAB) will insert the attached revised specifications into contract proposals containing Section 551 items. The following items are new items:

<u>Item No.</u>	<u>Item Description</u>	<u>Pay Unit</u>
551.12	Splices for Steel H-Piles	Each
551.15	Splices for CIP Piles	Each
551.01xyyy	Steel H-Piles (HP Size)	Meter (Foot)

The following items are disapproved:

<u>Item No.</u>	<u>Item Description</u>	<u>Pay Unit</u>
551.10xx	Steel Bearing Piles	Meter (Foot)

TRANSMITTED MATERIALS: This EI transmits revised Standard Specifications in USC and Metric units for Section 511 - *Piles and Pile Driving Equipment*, §720-04 *Steel H-Piles*, and §720-06 *Mechanical Pile Splices*.

BACKGROUND: Currently, only splices for steel H-Piles have a pay item. Splices for CIP piles were paid for under the C.I.P. pile item. When there were pile overruns, and additional pile splices were required, the contractor was only paid for the splices made to steel H-Piles. Under this new specification, all pile splices will have a pay item.

CONTACT: For additional information contact John Neidhart in the Office of Structures, Bridge Foundation and Construction Support Unit at (518) 457-8160 or via email at jneidhart@dot.state.ny.us

PILES AND PILE DRIVING EQUIPMENT

Make the following changes to Standard Specifications Construction and Materials of May 4, 2006:

Page 317-322, delete SECTION 551 in its entirety and replace with the following:

SECTION 551 - PILES AND PILE DRIVING EQUIPMENT

551-1 DESCRIPTION

551-1.01 General. This work shall consist of furnishing and installing piles of the type and size and at the locations indicated in the contract documents, or as directed by the Engineer. Timber piles are not covered under this specification.

551-1.02 Steel H-Piles. This work shall consist of furnishing and installing steel H-Piles of the type and size and at the locations indicated in the contract documents, or as directed by the Engineer.

551-1.03 Cast-In-Place Concrete Piles. This work shall consist of furnishing and installing cast-in-place concrete piles of the type and size and at the locations indicated in the contract documents, or as directed by the Engineer.

551-1.04 Furnishing Equipment for Driving Piles. This work shall consist of furnishing equipment at the site for driving piles.

551-1.05 Dynamic Pile Load Testing. This work shall consist of furnishing equipment and personnel for dynamic pile tests conducted by the Department.

551-1.06 Splices. These are contingent items and shall apply only when the Engineer directs the Contractor to drive a pile more than 3 meters beyond the estimated length provided in the Contract Plans.

551-2 MATERIALS

551-2.01 General. Materials for piling shall conform to the requirements of the following subsections of Section 700 *Materials and Manufacturing*:

Bar Reinforcement, Grade 420	709-01
Casings for Cast-in-Place Concrete Piles	720-03
Steel H-Piles	720-04
Pile Shoes	720-05
Mechanical Pile Splices	720-06

551-2.02 Steel H-Piles. Steel H-Piles shall meet the requirements of §720-04 *Steel H-Piles*.

551-2.03 Cast-In-Place Concrete Piles

A. Casings for Cast-In-Place Concrete Piles. Casings for Cast-In-Place Concrete Piles shall meet the requirements of §720-03 *Casings for Cast-In-Place Concrete Piles*.

B. Concrete for Cast-In-Place Piles. Concrete placed in the Cast-In-Place Piles shall comply with requirements specified for Class A Concrete in Section 501 *Portland Cement Concrete*.

PILES AND PILE DRIVING EQUIPMENT

C. Cast-In-Place Concrete Pile Dimensions. Pile dimensions, including the rate of taper for tapered piles, shall be as shown in the contract documents, or as approved by the DCES. In no case, however, shall the outside diameter at the toe be less than 200 mm nor shall the outside diameter at the section to be cut off be less than 300 mm.

The Contractor shall furnish the type of pile casing shown in the contract documents. No used pipe or shell will be permitted.

551-2.04 Furnishing Equipment for Driving Piles. None Specified

551-2.05 Dynamic Pile Load Testing. None Specified

551-2.06 Splices. Mechanical Pile Splices shall meet the requirements of §720-06 *Mechanical Pile Splices*

551-3 CONSTRUCTION DETAILS

551-3.01 General. The method of storing and handling of piles shall be such as to avoid damage to the piles. Piles shall not be driven until after the excavation is completed to the elevation required for the bottom of the footing or bottom of tremie. Unless otherwise shown on the Plans, any material forced up or depressions made by the driving shall be removed or filled and the correct elevation of foundation established before any concrete is placed.

The driving of piles shall be done with an air/steam, diesel, or hydraulic hammer. Piles shall be driven starting from the center of the foundation and proceeding outward from this point, or starting at the outside row and driving progressively across the foundation.

The length of piles will be determined in the field by driving to the driving criteria determined by the DCES. Piles may be completely driven in one operation or, if directed by the DCES, be partially driven and allowed to set from 2 to 24 hours (or as indicated on the Plans) before driving is resumed.

Piles shall be vertical or accurately battered as indicated on the Contract Plans. The top of any pile driven its full length into the ground shall not vary from the plan location by more than 100 mm, unless otherwise shown on the Plans. The top of any pile partially exposed or included in an integral abutment shall not vary from the plan location by more than 25 mm, unless otherwise shown on the Plans. Piles may have a variation at their tip of not more than 20 mm per meter from the vertical or from the batter shown on the Plans or permitted by the DCES.

All piles forced up by any cause shall be driven again, at no additional cost to the State.

The following shall be causes for rejection of a pile:

- Pile location or batter is incorrect.
- Pile damaged from any cause whatsoever.
- Pile fails to attain the driving resistance determined by the DCES, or the driving resistance set forth in the contract documents.
- Pile tip elevation is not within the limits called for in the contract documents.
- Pile is unserviceable for other reasons related to the furnishing and installing of the pile.
- Cast-In-Place Concrete Pile Casing not free from water.

No footing concrete shall be placed until all piles within the footing are inspected by the Engineer. The Contractor shall remove rejected piles, or at the option of the Department, a second pile may be driven adjacent thereto, if this can be done without impairing the structure.

The tops of all piles and pile casings shall be cut off at the elevation indicated on the Plans, or as established by the Engineer. The cut shall be clean, level, and to a true plane, in accordance with the detail shown on the Plans.

All cavities left by the pile driving operation shall be backfilled.

PILES AND PILE DRIVING EQUIPMENT

551-3.02 Steel H-Piles. Steel H-Piles shall be furnished with a shoe, fabricated as detailed on the Plans, or as approved by the DCES. Substitution of commercial shoes for those detailed on the Plans may be permitted subject to the approval of the DCES. Unless shown on the Plans, the shoes shall be attached by a NYSDOT Certified Welder with an 8 mm minimum fillet weld along the entire outside edge of the flanges.

551-3.03 Cast-In-Place Concrete Piles. Pile casings which do not hold their original form during driving, which fracture, or fail during driving due to manufacturer defect, fabrication, or Contractor's operations, unless otherwise directed, shall be replaced at no additional cost to the State. If, at any time during the driving or placing of the pile casings, the DCES determines from the results of the driving that the pile casings of the type or thickness being used cannot be satisfactorily placed, the Contractor shall remove the casings, and replace them with casings of the type and thickness directed at the expense of the State.

All pile casings shall be equipped with a toe treatment as shown on the Plans.

Cast-in-place concrete piles shall be reinforced as shown on the Plans and the reinforcement secured in such a manner as to ensure its proper location in the finished piles.

Cast-in-place concrete pile casings shall be inspected immediately prior to placing concrete in the casing. All casings in the footing shall be satisfactorily placed and dry before concrete is placed. Each casing shall be filled with a continuous pour of Class A concrete, mixed and placed in accordance with Section 555 *Concrete for Structures*, except that the slump of the concrete shall not exceed 125 mm.

Care shall be exercised in filling the piles to prevent honeycomb and air pockets from forming in the concrete. Internal vibrators and other means shall be used to the maximum depth practicable to consolidate the concrete.

All exposed pile or pile casing surfaces not embedded in concrete shall be painted in accordance with the Contract Documents.

551-3.04 Furnishing Equipment for Driving Piles. The Contractor shall submit to the DCES for approval Form BD 138 *Pile Driving Equipment Data* a minimum of 21 calendar days prior to beginning pile driving work. Each separate combination of pile and pile driving equipment proposed by the Contractor shall require the submission of a corresponding Form BD 138.

Piles shall be driven only with equipment which has the prior approval of the DCES. All malfunctioning equipment shall be removed from the site and be replaced with equipment which is satisfactory to the DCES. The minimum rated striking energy of the hammer to be used in driving Steel H-Piles and Cast-In-Place Concrete Piles shall be 17.6 kJ per blow.

Hammers having greater striking energy may be used upon approval by the DCES. These hammers shall produce a minimum of 7 blows/decimeter and a maximum of 40 blows/decimeter at the Nominal Pile Resistance shown on the Contract Plans. However, if, in the opinion of the DCES, satisfactory results are not obtained with the hammer furnished by the Contractor, a hammer meeting the approval of the DCES shall be furnished and used.

Water jets and vibratory hammers shall not be used in driving any pile, unless written approval is given by the DCES. Piles installed with a water jet or vibratory hammer shall be impact driven to secure the final penetration.

A. Air/Steam Hammers. Sufficient boiler or compressor capacity shall be provided at all times to maintain the rated speed of air/steam hammers during the full time of pile driving. The valve mechanism and other parts of a single or double-acting hammer shall be maintained such that the number of blows per minute for which the hammer is designated, is satisfied.

B. Diesel Hammers. Single acting hammers' valves, pumps, ports, rings, and other hammer parts shall be maintained such that the length of stroke, or blows per minute is satisfied.

PILES AND PILE DRIVING EQUIPMENT

All diesel hammers shall be provided with an acceptable means of measuring hammer energy.

C. Hydraulic Hammers. Hydraulic hammers that have enclosed rams, shall be equipped with an electronic printout. Those which have exposed rams, shall be visually inspected.

D. Hammer Cushion. An approved hammer cushion block shall be used to transfer pile hammer energy to the pile. Each hammer shall be equipped with a helmet/drive head to fit the type of pile to be driven.

The hammer cushion will be inspected for compliance with the description in the BD 138 prior to driving the first pile, and thereafter every 100 hours of driving. The hammer cushion will be re-inspected if a hammer with a different serial number is brought to the project.

E. Pile Driving Leads. Pile driving leads shall be constructed in such a manner as to afford freedom of movement of the hammer. The use of either swinging or hanging leads will be permitted provided the pile or leads are properly supported during driving and the required final position and batter of pile is achieved. If the use of swinging or hanging leads produces unsatisfactory results, the Contractor shall hold the leads in position with guys or braces to give the required support or use equipment having fixed leads.

Pile driving leads shall be of sufficient length so that the use of a follower will not be necessary. The driving of piles with followers will generally not be permitted and shall be done only with written permission and direction of the DCES.

When directed by the Engineer, approved steel spuds shall be used to penetrate consolidated material or obstructions in the upper 3 meters in order to assist in driving the piles to the required depth and resistance. Augers may be used for this purpose with written approval from the DCES.

551-3.05 Dynamic Pile Load Testing. Dynamic pile load tests will be conducted by the Department under the direction of the DCES. The Contractor shall furnish a source of electrical power, a suitable test enclosure to perform field testing of piles and evaluate pile hammer efficiency and all incidental labor and material necessary to make the work area accessible.

Tests shall be performed at the locations indicated on the Contract Plans and where directed by the Engineer. A Dynamic Pile Load Testing Procedure, known as the "Impact Driving Method", will be used. This procedure entails the following steps:

1. Prior to being struck with the pile driving hammer, each pile to be tested will be instrumented with strain and acceleration transducers by State personnel, aided by the Contractor's forces.
2. Dynamic measurements resulting from the pile hammer blows will be automatically recorded on a pile driving analyzer supplied by the State and operated by State personnel.
3. Upon determination by the Engineer that valid data has been recorded, State personnel, assisted by the Contractor's forces, will remove the instrumentation.

The Contractor will schedule equipment movements to ensure that testing is done as part of the normal driving schedule, insofar as it is possible.

551-3.06 Splices. Full length piles shall always be used where practicable. Pile splices shall be constructed as shown in the contract documents, or as approved by the DCES. Where splices are unavoidable, their number, locations, and details will be subject to the approval of the DCES. Pile splices at less than 3 meters beyond the estimated length shall be installed at no additional cost to the State. A second splice may be used at 9 meters beyond the estimated length, subject to DCES approval.

Splices to steel H-Piles, and steel pile casings shall be welded in conformance with the provisions of the Steel Construction Manual (SCM) These requirements include, but are not limited to, a NYS certified welder and a DCES approved welding procedure.

PILES AND PILE DRIVING EQUIPMENT

Where design considerations and soil characteristics permit, the DCES may approve the use of a mechanical splice in lieu of a welded splice. The mechanical couplings used for such splices shall be subject to the provisions of §715-01 *Structural Steel*. A seal weld shall be provided completely around the pile casing.

551-4 METHOD OF MEASUREMENT

551-4.01 General. The length of piles will be determined in the field by driving to the resistance required by the Contract Documents, or DCES at the time of driving. The pile lengths indicated on the Plans are for estimating purposes only.

551-4.02 Steel H-Piles. The quantity of Steel H-Piles to be measured for payment will be in meters of acceptable piles driven, measured to the nearest 0.1 meters below the cut off elevation.

551-4.03 Cast-in-Place Concrete Piles. The quantity of Cast-in-Place Concrete Piles to be measured for payment will be in meters of acceptable piles driven, measured to the nearest 0.1 meters below the cut off elevation.

551-4.04 Furnishing Equipment for Driving Piles. The work under Furnishing Equipment for Driving Piles will be measured on a lump sum basis.

551-4.05 Dynamic Pile Load Testing. The quantity of Dynamic Pile Tests to be measured for payment will be the number of pile tests performed. If the pile requires re-driving within 28 hours after the initial test, this shall be considered as one Dynamic Pile Test. If re-driving is more than 28 hours after the initial test, this shall be considered as an additional test.

551-4.06 Splices. The quantity of splices to be measured for payment will be the number of splices installed, which meet the requirements of §551-1.06 and §551-3.06.

551-5 BASIS OF PAYMENT

551-5.01 General. The unit price bid per meter for piles shall include the cost of removal of any material forced up above the bottom of footing by the driving of piles, backfilling of all cavities left by the extraction of damaged piles or from auger holes or soil deformations necessary to place piles, and furnishing and using pile shoes, followers, augers, or spuds.

No payment will be made for piles rejected in accordance with requirements under §551-3.01.

551-5.02 Steel H-Piles. The unit price bid per meter for steel H-Piles shall include the cost of furnishing all labor, including the manipulation of pile driving equipment, materials and equipment necessary to satisfactorily complete the work.

551-5.03 Cast-in-Place Concrete Piles. The unit price bid per meter for cast-in-place concrete piles shall include the cost of furnishing all labor, including the manipulation of pile driving equipment, materials and equipment necessary to satisfactorily complete the work, including concrete, reinforcement, and steel casings. Progress payments will be made, at the unit price bid, for 60% of the quantity after the casings have been satisfactorily driven. The balance of the quantity will be paid for after completion of the work, including cutting off piles, placing concrete in the pile, and painting of exposed pile and pile casings.

551-5.04 Furnishing Equipment for Driving Piles. The lump sum price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

PILES AND PILE DRIVING EQUIPMENT

Progress payments will be made at seventy-five percent (75%) of the lump sum bid when the equipment for driving piles is furnished and driving of satisfactory piles has commenced. The remainder will be paid when pile driving is completed.

551-5.05 Dynamic Pile Load Testing. The unit price bid shall include the cost of furnishing labor, materials and equipment necessary to satisfactorily support the performance of Dynamic Pile Load Tests.

551-5.06 Splices. The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

Payment will be made under:

Item No.	Item Description	Pay Unit
551.010042	Steel H-Piles (HP 250x62)	Meter
551.010057	Steel H-Piles (HP 250x85)	Meter
551.012053	Steel H-Piles (HP 310x53)	Meter
551.012063	Steel H-Piles (HP 310x63)	Meter
551.012074	Steel H-Piles (HP 310x74)	Meter
551.012084	Steel H-Piles (HP 310x84)	Meter
551.014073	Steel H-Piles (HP 360x108)	Meter
551.014089	Steel H-Piles (HP 360x132)	Meter
551.014102	Steel H-Piles (HP 360x152)	Meter
551.014117	Steel H-Piles (HP 360x174)	Meter
551.016088	Steel H-Piles (HP 410x131)	Meter
551.016101	Steel H-Piles (HP 410x150)	Meter
551.016121	Steel H-Piles (HP 410x180)	Meter
551.016141	Steel H-Piles (HP 410x210)	Meter
551.016162	Steel H-Piles (HP 410x241)	Meter
551.016183	Steel H-Piles (HP 410x272)	Meter
551.018135	Steel H-Piles (HP 460x201)	Meter
551.018157	Steel H-Piles (HP 460x233)	Meter
551.018181	Steel H-Piles (HP 460x269)	Meter
551.018204	Steel H-Piles (HP 460x303)	Meter
551.11	Cast-In-Place Concrete Piles	Meter
551.12	Splices for Steel H-Piles	Each
551.13	Furnishing Equipment for Driving Piles	Lump Sum
551.14	Dynamic Pile Load Testing	Each
551.15	Splices for CIP Piles	Each

STEEL H-PILES

Page 912-913, delete all of §720-04 and **replace** with the following:

720-04 STEEL H-PILES

SCOPE. This specification covers the material requirements for steel H-Piles.

GENERAL. All steel H-Piles shall be rolled HP sections of standard dimensions. Steel for bearing piles shall be new and unused and shall conform to the requirements of 715-01 *Structural Steel*. Stock steel may be used.

BASIS OF ACCEPTANCE. Material acceptance will be by material certification. The certifying statement must accompany each heat and must verify that the material and workmanship comply with the current ASTM standards for ASTM A709M Grade 345, or A992M Grade 345. Two copies shall be furnished to the Engineer. *Buy America requirements apply.*

MECHANICAL PILE SPLICES

Page 913, delete all of §720-06 and replace with the following:

720-06 MECHANICAL PILE SPLICES

SCOPE. This specification covers the requirements for mechanical splices for steel H-Piles.

GENERAL. Steel used in the mechanical pile splices shall meet the requirements of §715-01 *Structural Steel*.

BASIS OF APPROVAL. The material will be evaluated for conformance with the material requirements, and product samples may be required to be submitted for testing.

Manufacturers may submit their product for evaluation to the DCES. The submission shall include copies of installation drawings, specifications, welding procedures meeting the requirements of the Steel Construction Manual, engineering calculations, test results, and quality control procedures for the splice manufacturer.

Stamped engineering calculations, performed by a New York State Licensed Professional Engineer with current registration, shall show that the spliced pile has a theoretical bending capacity of at least 95% of the unspliced pile.

Test results by an independent testing agency shall show that the bending strength on both the strong and weak axes of the spliced pile is at least as great as the calculated capacity of the splice. The tests shall be third point loadings of a spliced pile with the splice in the middle of the span. The tests shall be continued to failure. A minimum of two pile sizes shall be tested in each direction to prove the engineering calculations.

If the submission is acceptable, the installation drawings will be stamped approved, returned to the manufacturer and the product will be placed on the Approved List. Any changes to the product, product manufacturing, or installation procedure will require re-submission and re-approval.

BASIS OF ACCEPTANCE. The Contractor shall provide the Engineer with an installation drawing approved by the DCES showing the sizes and types of welds that are required. Mechanical pile splices will be accepted based on the product appearing on the Approved List and a material certification that the supplied product has the same chemical composition and mechanical properties as the product used in the testing. *Buy America requirements apply.*

PILES AND PILE DRIVING EQUIPMENT

Make the following changes to Standard Specifications Construction and Materials of May 1, 2008:

Page 321-326, delete SECTION 551 in its entirety and replace with the following:

SECTION 551 - PILES AND PILE DRIVING EQUIPMENT

551-1 DESCRIPTION

551-1.01 General. This work shall consist of furnishing and installing piles of the type and size and at the locations indicated in the contract documents, or as directed by the Engineer. Timber piles are not covered under this specification.

551-1.02 Steel H-Piles. This work shall consist of furnishing and installing steel H-Piles of the type and size and at the locations indicated in the contract documents, or as directed by the Engineer.

551-1.03 Cast-In-Place Concrete Piles. This work shall consist of furnishing and installing cast-in-place concrete piles of the type and size and at the locations indicated in the contract documents, or as directed by the Engineer.

551-1.04 Furnishing Equipment for Driving Piles. This work shall consist of furnishing equipment at the site for driving piles.

551-1.05 Dynamic Pile Load Testing. This work shall consist of furnishing equipment and personnel for dynamic pile tests conducted by the Department.

551-1.06 Splices. These are contingent items and shall apply only when the Engineer directs the Contractor to drive a pile more than 10 feet beyond the estimated length provided in the Contract Plans.

551-2 MATERIALS

551-2.01 General. Materials for piling shall conform to the requirements of the following subsections of Section 700 *Materials and Manufacturing*:

Bar Reinforcement, Grade 60	709-01
Casings for Cast-in-Place Concrete Piles	720-03
Steel H-Piles	720-04
Pile Shoes	720-05
Mechanical Pile Splices	720-06

551-2.02 Steel H-Piles. Steel H-Piles shall meet the requirements of §720-04 *Steel H-Piles*.

551-2.03 Cast-In-Place Concrete Piles

A. Casings for Cast-In-Place Concrete Piles. Casings for Cast-In-Place Concrete Piles shall meet the requirements of §720-03 *Casings for Cast-In-Place Concrete Piles*.

B. Concrete for Cast-In-Place Piles. Concrete placed in the Cast-In-Place Piles shall comply with requirements specified for Class A Concrete in Section 501 *Portland Cement Concrete*.

PILES AND PILE DRIVING EQUIPMENT

C. Cast-In-Place Concrete Pile Dimensions. Pile dimensions, including the rate of taper for tapered piles, shall be as shown in the contract documents, or as approved by the DCES. In no case, however, shall the outside diameter at the toe be less than 8 inches nor shall the outside diameter at the section to be cut off be less than 12 inches.

The Contractor shall furnish the type of pile casing shown in the contract documents. No used pipe or shell will be permitted.

551-2.04 Furnishing Equipment for Driving Piles. None Specified

551-2.05 Dynamic Pile Load Testing. None Specified

551-2.06 Splices. Mechanical Pile Splices shall meet the requirements of §720-06 *Mechanical Pile Splices*

551-3 CONSTRUCTION DETAILS

551-3.01 General. The method of storing and handling of piles shall be such as to avoid damage to the piles. Piles shall not be driven until after the excavation is completed to the elevation required for the bottom of the footing or bottom of tremie. Unless otherwise shown on the Plans, any material forced up or depressions made by the driving shall be removed or filled and the correct elevation of foundation established before any concrete is placed.

The driving of piles shall be done with an air/steam, diesel, or hydraulic hammer. Piles shall be driven starting from the center of the foundation and proceeding outward from this point, or starting at the outside row and driving progressively across the foundation.

The length of piles will be determined in the field by driving to the driving criteria determined by the DCES. Piles may be completely driven in one operation or, if directed by the DCES, be partially driven and allowed to set from 2 to 24 hours (or as indicated on the Plans) before driving is resumed.

Piles shall be vertical or accurately battered as indicated on the Contract Plans. The top of any pile driven its full length into the ground shall not vary from the plan location by more than 4 inches, unless otherwise shown on the Plans. The top of any pile partially exposed or included in an integral abutment shall not vary from the plan location by more than 1 inch, unless otherwise shown on the Plans. Piles may have a variation at their tip of not more than ¼ inch per foot from the vertical or from the batter shown on the Plans or permitted by the DCES.

All piles forced up by any cause shall be driven again, at no additional cost to the State.

The following shall be causes for rejection of a pile:

- Pile location or batter is incorrect.
- Pile damaged from any cause whatsoever.
- Pile fails to attain the driving resistance determined by the DCES, or the driving resistance set forth in the contract documents.
- Pile tip elevation is not within the limits called for in the contract documents.
- Pile is unserviceable for other reasons related to the furnishing and installing of the pile.
- Cast-In-Place Concrete Pile Casing not free from water.

No footing concrete shall be placed until all piles within the footing are inspected by the Engineer. The Contractor shall remove rejected piles, or at the option of the Department, a second pile may be driven adjacent thereto, if this can be done without impairing the structure.

The tops of all piles and pile casings shall be cut off at the elevation indicated on the Plans, or as established by the Engineer. The cut shall be clean, level, and to a true plane, in accordance with the detail shown on the Plans.

All cavities left by the pile driving operation shall be backfilled.

PILES AND PILE DRIVING EQUIPMENT

551-3.02 Steel H-Piles. Steel H-Piles shall be furnished with a shoe, fabricated as detailed on the Plans, or as approved by the DCES. Substitution of commercial shoes for those detailed on the Plans may be permitted subject to the approval of the DCES. Unless shown on the Plans, the shoes shall be attached by a NYSDOT Certified Welder with a 5/16 inch minimum fillet weld along the entire outside edge of the flanges.

551-3.03 Cast-In-Place Concrete Piles. Pile casings which do not hold their original form during driving, which fracture, or fail during driving due to manufacturer defect, fabrication, or Contractor's operations, unless otherwise directed, shall be replaced at no additional cost to the State. If, at any time during the driving or placing of the pile casings, the DCES determines from the results of the driving that the pile casings of the type or thickness being used cannot be satisfactorily placed, the Contractor shall remove the casings, and replace them with casings of the type and thickness directed at the expense of the State.

All pile casings shall be equipped with a toe treatment as shown on the Plans.

Cast-in-place concrete piles shall be reinforced as shown on the Plans and the reinforcement secured in such a manner as to ensure its proper location in the finished piles.

Cast-in-place concrete pile casings shall be inspected immediately prior to placing concrete in the casing. All casings in the footing shall be satisfactorily placed and dry before concrete is placed. Each casing shall be filled with a continuous pour of Class A concrete, mixed and placed in accordance with Section 555 *Concrete for Structures*, except that the slump of the concrete shall not exceed 5 inches.

Care shall be exercised in filling the piles to prevent honeycomb and air pockets from forming in the concrete. Internal vibrators and other means shall be used to the maximum depth practicable to consolidate the concrete.

All exposed pile or pile casing surfaces not embedded in concrete shall be painted in accordance with the Contract Documents.

551-3.04 Furnishing Equipment for Driving Piles. The Contractor shall submit to the DCES for approval Form BD 138 *Pile Driving Equipment Data* a minimum of 21 calendar days prior to beginning pile driving work. Each separate combination of pile and pile driving equipment proposed by the Contractor shall require the submission of a corresponding Form BD 138.

Piles shall be driven only with equipment which has the prior approval of the DCES. All malfunctioning equipment shall be removed from the site and be replaced with equipment which is satisfactory to the DCES. The minimum rated striking energy of the hammer to be used in driving Steel H-Piles and Cast-In-Place Concrete Piles shall be 13 kip-feet per blow.

Hammers having greater striking energy may be used upon approval by the DCES. These hammers shall produce a minimum of 20 blows/foot and a maximum of 120 blows/foot at the Nominal Pile Resistance shown on the Contract Plans. However, if, in the opinion of the DCES, satisfactory results are not obtained with the hammer furnished by the Contractor, a hammer meeting the approval of the DCES shall be furnished and used.

Water jets and vibratory hammers shall not be used in driving any pile, unless written approval is given by the DCES. Piles installed with a water jet or vibratory hammer shall be impact driven to secure the final penetration.

A. Air/Steam Hammers. Sufficient boiler or compressor capacity shall be provided at all times to maintain the rated speed of air/steam hammers during the full time of pile driving. The valve mechanism and other parts of a single or double-acting hammer shall be maintained such that the number of blows per minute for which the hammer is designated, is satisfied.

B. Diesel Hammers. Single acting hammers' valves, pumps, ports, rings, and other hammer parts shall be maintained such that the length of stroke, or blows per minute is satisfied.

PILES AND PILE DRIVING EQUIPMENT

All diesel hammers shall be provided with an acceptable means of measuring hammer energy.

C. Hydraulic Hammers. Hydraulic hammers that have enclosed rams, shall be equipped with an electronic printout. Those which have exposed rams, shall be visually inspected.

D. Hammer Cushion. An approved hammer cushion block shall be used to transfer pile hammer energy to the pile. Each hammer shall be equipped with a helmet/drive head to fit the type of pile to be driven.

The hammer cushion will be inspected for compliance with the description in the BD 138 prior to driving the first pile, and thereafter every 100 hours of driving. The hammer cushion will be re-inspected if a hammer with a different serial number is brought to the project.

E. Pile Driving Leads. Pile driving leads shall be constructed in such a manner as to afford freedom of movement of the hammer. The use of either swinging or hanging leads will be permitted provided the pile or leads are properly supported during driving and the required final position and batter of pile is achieved. If the use of swinging or hanging leads produces unsatisfactory results, the Contractor shall hold the leads in position with guys or braces to give the required support or use equipment having fixed leads.

Pile driving leads shall be of sufficient length so that the use of a follower will not be necessary. The driving of piles with followers will generally not be permitted and shall be done only with written permission and direction of the DCES.

When directed by the Engineer, approved steel spuds shall be used to penetrate consolidated material or obstructions in the upper 10 feet in order to assist in driving the piles to the required depth and resistance. Augers may be used for this purpose with written approval from the DCES.

551-3.05 Dynamic Pile Load Testing. Dynamic pile load tests will be conducted by the Department under the direction of the DCES. The Contractor shall furnish a source of electrical power, a suitable test enclosure to perform field testing of piles and evaluate pile hammer efficiency and all incidental labor and material necessary to make the work area accessible.

Tests shall be performed at the locations indicated on the Contract Plans and where directed by the Engineer. A Dynamic Pile Load Testing Procedure, known as the "Impact Driving Method", will be used. This procedure entails the following steps:

4. Prior to being struck with the pile driving hammer, each pile to be tested will be instrumented with strain and acceleration transducers by State personnel, aided by the Contractor's forces.
5. Dynamic measurements resulting from the pile hammer blows will be automatically recorded on a pile driving analyzer supplied by the State and operated by State personnel.
6. Upon determination by the Engineer that valid data has been recorded, State personnel, assisted by the Contractor's forces, will remove the instrumentation.

The Contractor will schedule equipment movements to ensure that testing is done as part of the normal driving schedule, insofar as it is possible.

551-3.06 Splices. Full length piles shall always be used where practicable. Pile splices shall be constructed as shown in the contract documents, or as approved by the DCES. Where splices are unavoidable, their number, locations, and details will be subject to the approval of the DCES. Pile splices at less than 10 feet beyond the estimated length shall be installed at no additional cost to the State. A second splice may be used at 30 feet beyond the estimated length, subject to DCES approval.

Splices to steel H-Piles, and steel pile casings shall be welded in conformance with the provisions of the Steel Construction Manual (SCM) These requirements include, but are not limited to, a NYS certified welder and a DCES approved welding procedure.

PILES AND PILE DRIVING EQUIPMENT

Where design considerations and soil characteristics permit, the DCES may approve the use of a mechanical splice in lieu of a welded splice. The mechanical couplings used for such splices shall be subject to the provisions of §715-01 *Structural Steel*. A seal weld shall be provided completely around the pile casing.

551-4 METHOD OF MEASUREMENT

551-4.01 General. The length of piles will be determined in the field by driving to the resistance required by the Contract Documents, or DCES at the time of driving. The pile lengths indicated on the Plans are for estimating purposes only.

551-4.02 Steel H-Piles. The quantity of Steel H-Piles to be measured for payment will be in feet of acceptable piles driven, measured to the nearest 1 foot below the cut off elevation.

551-4.03 Cast-In-Place Concrete Piles. The quantity of Cast-in-Place Concrete Piles to be measured for payment will be in feet of acceptable piles driven, measured to the nearest 1 foot below the cut off elevation.

551-4.04 Furnishing Equipment for Driving Piles. The work under Furnishing Equipment for Driving Piles will be measured on a lump sum basis.

551-4.05 Dynamic Pile Load Testing. The quantity of Dynamic Pile Tests to be measured for payment will be the number of pile tests performed. If the pile requires re-driving within 28 hours after the initial test, this shall be considered as one Dynamic Pile Test. If re-driving is more than 28 hours after the initial test, this shall be considered as an additional test.

551-4.06 Splices. The quantity of splices to be measured for payment will be the number of splices installed, which meet the requirements of §551-1.06 and §551-3.06.

551-5 BASIS OF PAYMENT

551-5.01 General. The unit price bid per foot for piles shall include the cost of removal of any material forced up above the bottom of footing by the driving of piles, backfilling of all cavities left by the extraction of damaged piles or from auger holes or soil deformations necessary to place piles, and furnishing and using pile shoes, followers, augers, or spuds.

No payment will be made for piles rejected in accordance with requirements under §551-3.01.

551-5.02 Steel H-Piles. The unit price bid per foot for steel H-Piles shall include the cost of furnishing all labor, including the manipulation of pile driving equipment, materials and equipment necessary to satisfactorily complete the work.

551-5.03 Cast-in-Place Concrete Piles. The unit price bid per foot for cast-in-place concrete piles shall include the cost of furnishing all labor, including the manipulation of pile driving equipment, materials and equipment necessary to satisfactorily complete the work, including concrete, reinforcement, and steel casings. Progress payments will be made, at the unit price bid, for 60% of the quantity after the casings have been satisfactorily driven. The balance of the quantity will be paid for after completion of the work, including cutting off piles, placing concrete in the pile, and painting of exposed pile and pile casings.

551-5.04 Furnishing Equipment for Driving Piles. The lump sum price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

PILES AND PILE DRIVING EQUIPMENT

Progress payments will be made at seventy-five percent (75%) of the lump sum bid when the equipment for driving piles is furnished and driving of satisfactory piles has commenced. The remainder will be paid when pile driving is completed.

551-5.05 Dynamic Pile Load Testing. The unit price bid shall include the cost of furnishing labor, materials and equipment necessary to satisfactorily support the performance of Dynamic Pile Load Tests.

551-5.06 Splices. The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

Payment will be made under:

Item No.	Item Description	Pay Unit
551.010042	Steel H-Piles (HP 10x42)	Foot
551.010057	Steel H-Piles (HP 10x57)	Foot
551.012053	Steel H-Piles (HP 12x53)	Foot
551.012063	Steel H-Piles (HP 12x63)	Foot
551.012074	Steel H-Piles (HP 12x74)	Foot
551.012084	Steel H-Piles (HP 12x84)	Foot
551.014073	Steel H-Piles (HP 14x73)	Foot
551.014089	Steel H-Piles (HP 14x89)	Foot
551.014102	Steel H-Piles (HP 14x102)	Foot
551.014117	Steel H-Piles (HP 14x117)	Foot
551.016088	Steel H-Piles (HP 16x88)	Foot
551.016101	Steel H-Piles (HP 16x101)	Foot
551.016121	Steel H-Piles (HP 16x121)	Foot
551.016141	Steel H-Piles (HP 16x141)	Foot
551.016162	Steel H-Piles (HP 16x162)	Foot
551.016183	Steel H-Piles (HP 16x183)	Foot
551.018135	Steel H-Piles (HP 18x135)	Foot
551.018157	Steel H-Piles (HP 18x157)	Foot
551.018181	Steel H-Piles (HP 18x181)	Foot
551.018204	Steel H-Piles (HP 18x204)	Foot
551.11	Cast-In-Place Concrete Piles	Foot
551.12	Splices for Steel H-Piles	Each
551.13	Furnishing Equipment for Driving Piles	Lump Sum
551.14	Dynamic Pile Load Testing	Each
551.15	Splices for CIP Piles	Each

STEEL H-PILES

Page 956, delete all of §720-04 and replace with the following:

720-04 STEEL H-PILES

SCOPE. This specification covers the material requirements for steel H-Piles.

GENERAL. All steel H-Piles shall be rolled HP sections of standard dimensions. Steel for bearing piles shall be new and unused and shall conform to the requirements of 715-01 *Structural Steel*. Stock steel may be used.

BASIS OF ACCEPTANCE. Material acceptance will be by material certification. The certifying statement must accompany each heat and must verify that the material and workmanship comply with the current ASTM standards for ASTM A709 Grade 50, or A992 Grade 50. Two copies shall be furnished to the Engineer. *Buy America requirements apply.*

MECHANICAL PILE SPLICES

Page 956-957, delete all of §720-06 and replace with the following:

720-06 MECHANICAL PILE SPLICES

SCOPE. This specification covers the requirements for mechanical splices for steel H-Piles.

GENERAL. Steel used in the mechanical pile splices shall meet the requirements of §715-01 *Structural Steel*.

BASIS OF APPROVAL. The material will be evaluated for conformance with the material requirements, and product samples may be required to be submitted for testing.

Manufacturers may submit their product for evaluation to the DCES. The submission shall include copies of installation drawings, specifications, welding procedures meeting the requirements of the Steel Construction Manual, engineering calculations, test results, and quality control procedures for the splice manufacturer.

Stamped engineering calculations, performed by a New York State Licensed Professional Engineer with current registration, shall show that the spliced pile has a theoretical bending capacity of at least 95% of the unspliced pile.

Test results by an independent testing agency shall show that the bending strength on both the strong and weak axes of the spliced pile is at least as great as the calculated capacity of the splice. The tests shall be third point loadings of a spliced pile with the splice in the middle of the span. The tests shall be continued to failure. A minimum of two pile sizes shall be tested in each direction to prove the engineering calculations.

If the submission is acceptable, the installation drawings will be stamped approved, returned to the manufacturer and the product will be placed on the Approved List. Any changes to the product, product manufacturing, or installation procedure will require re-submission and re-approval.

BASIS OF ACCEPTANCE. The Contractor shall provide the Engineer with an installation drawing approved by the DCES showing the sizes and types of welds that are required. Mechanical pile splices will be accepted based on the product appearing on the Approved List and a material certification that the supplied product has the same chemical composition and mechanical properties as the product used in the testing. *Buy America requirements apply.*