

**CONSTRUCTION INSPECTOR'S CHECKLIST
FOR
PILING**

This checklist has been prepared to provide for the field inspector a summary of easy-to-read step-by-step requirements for the installation and inspection of foundation piling ([Section 512](#)). The following questions are based on the requirements found in the Standard and Supplemental Specifications, Highway Standards and appropriate sections of the Construction Manual.

1. PLAN AND SPECIFICATION REVIEW

Prior to starting work on an item, have you checked the contract Special Provisions and plans to see if any changes or modifications have been made to the Standard and Supplemental Specifications? _____

On bridge construction and reconstruction contracts have you checked the proposed or existing span lengths prior to starting work? (The contract may make this the responsibility of the Contractor.) _____

On bridge construction and reconstruction contracts have you checked the existing or proposed vertical or horizontal clearances? _____

Prior to the start of construction, have you checked the plan elevations of the bottom of footings, intermediate substructure components and bearing seat elevations of abutments and piers to ensure they correspond to the appropriate top of deck elevations and dimensions shown on the superstructure plans? _____

Have you reviewed the appropriate sections of the Construction Manual (Structures), [Documentation Section](#), [Project Procedures Guide](#) and [Forms](#)? _____

Has the structure been surveyed to establish the baseline of the structure, bearing lines of piers and backs of abutments? Has an independent check of your calculations and layout been performed before the Contractor starts work? (Construction Manual [Survey Section](#)) _____

2. DETERMINE HAMMER ENERGY REQUIREMENTS

Has the contractor provided you with the data and necessary correlation charts for determining the energy "E" developed by the hammer per blow for the pile hammer proposed for driving piles? _____

If the contract indicates a Wave Equation analysis will be used to drive the project piles, have you submitted the contractor's analysis to central Bureau of Bridges and Structures for their review and approval? _____

If the plans do not indicate a WAVE Equation analysis is required,

Does the hammer meet the following energy requirements: _____

A. Minimum Hammer Energy:

$E \geq 0.082 \times [R_N + 100]^2$ (English)

$E \geq 0.005 \times [R_N + 550]^2$ (metric)

B. Maximum Hammer Energy:

$E \leq 0.193 \times [R_N + 100]^2$ (English)

$E \leq 0.012 \times [R_N + 550]^2$ (metric)

Where:

R_N = Nominal Required bearing in kips (kN)

E = Energy developed by the hammer per blow in ft-lbs. (J)

Additional Hammer Requirements (by Hammer type):

Air/Steam Hammers

Is the total weight of the striking parts least 1.4 tons (1.3 metric tons) and not less than 1/3 the weight (mass) of the Pile and drive cap? _____

Diesel Hammers

Is the hammers either equipped with a device to measure ram impact velocity or speed of operation (with the necessary correlation charts) or designed such that the stroke height can be directly observed? _____

If the hammer is closed-end (double acting) is it equipped with a bounce chamber pressure gauge that is easily readable? _____

Has the Contractor shall provided the correlation chart and hammer data to determine the energy developed by the hammer with each blow? _____

Drop Hammers

Shall not be used for driving:

 Precast and Precast Prestressed Concrete Piles.

 Piles with a Nominal Required Bearing (R_N) > 120 kips (533kN)

Is the hammer ram weight (mass) at least 1 ton (0.9 metric tons)? _____

Is the Ram weight at least equal to the combined weight of the pile and drive cap? _____

Does the fall of the ram not exceed 15 ft. (4.6 m)? _____

Hydraulic Hammers:

Is the hammer equipped with an energy reading device? _____

Has the contractor provided a wave equation analysis for the proposed hammer? (The modified Gates formula is NOT acceptable) _____

3. DETERMINE THE NUMBER OF REQUIRED HAMMER BLOWS

Have you determined minimum number of blows/inch (blows/25mm) “N_b”, to obtain a Nominal Driven Bearing (R_{NDB}) of the pile equal to or exceeding the Nominal Required Bearing (R_N) shown on the plans? _____

$$N_b = \frac{10 \left[\frac{R_N + 100}{1.75\sqrt{E}} \right]}{10} \quad (\text{English}) \qquad N_b = \frac{10 \left[\frac{R_N + 550}{7\sqrt{E}} \right]}{10} \quad (\text{Metric})$$

Where:

- R_N is the Nominal Required Bearing in kips (kN)
- E is the Energy developed by the hammer per Blow in Ft-lbs (J)
- N_b is the number of hammer blows per inch (25mm) of pile penetration

4. TEST PILES

When test piles are specified, are the following requirements being met:

- a. Location: Are the test piles being located at the substructure foundation designated in the plans? _____
 - Within the designated substructure foundation, are you locating the test pile as far as possible away from the nearest soil boring? _____
 - Test piles driven in a production location cut off as production piles? _____
 - Are steel test piles driven in a production location painted when painting is specified for the production steel piles? _____
 - Are test piles not driven as production piles cutoff or pulled as directed by the Engineer? (512.15) _____
- b. Driving Elevation: Keep the excavation at the test pile location completed to an elevation no more than 2 ft (60 mm) above the plan bottom of footing elevation? (512.15) _____
- c. Pile Material: Is the test pile the same material and size as specified for the production piles? (512.15) _____
 - If pile shoes are specified for the production piles, is the test pile driven with the required pile shoe? _____
- d. Length: Is the test pile at least 10 ft (3 m) longer than the estimated length of the production piles shown on the plans? (512.15) _____

e. Hammer: Is the hammer proposed to drive the test pile the same hammer that will be used to drive the production pile? (512.15) _____

f. Notification: Are you notifying the District Office prior to driving the test pile? _____

g. Bearing: Is the test pile being driven to a Nominal Driven Bearing ($R_{NDB} = 1.1 \times \text{Nominal Required Bearing } (R_N)$) shown on the plans? (512.15) _____

Is the Nominal Driven Bearing (R_{NDB}) being determined by the appropriate formula (modified Gates or Wave)? (512.14) _____

Is the Nominal Driven Bearing ($R_{NDB} \geq$ the Nominal Required Bearing (R_N) indicated on the plans? (512.11(a)) _____

Does the pile penetrate to at least the minimum pile tip elevation specified, or if none is specified, at least 3 m (10 ft) below the bottom of footing elevation or 3 m (10 ft) below undisturbed earth? (512.11(b)) _____

h. Records: Are the test piles marked off in 1 ft (300 mm) increments and the blows per 1 ft (300 mm) foot recorded on Form BC 757, Test Pile Driving Record, for each 1 ft (300 mm) of test pile driven? (512.15) _____

i. Length Determination: Are the lengths of the production piles being determined from the test pile data? _____

Is the Contractor being furnished a written itemized list of pile lengths to be ordered? (512.16) _____

Is a copy of this list being retained in the contract documentation files? _____

Are you preparing and sending a copy of the BC 757 to BBS? _____

5. STORAGE AND HANDLING

a. Timber Piles: Are the treated timber piles stored at the site of the work in accordance with the requirements of 1007.13 and handled in accordance with Articles 507.05 and 1007.13? (512.08(a)) _____

Are the piles being stored off the ground on solid timbers of size and so arranged as to support treated materials without producing noticeable distortion and not subjected to standing water? (1007.13/AWPA Std M4) _____

Are the piles being handled with rope slings and in accordance with Article 507.05(a) and 1007.13? (512.08(a)) _____

b. Precast Concrete Piles: Are precast and precast prestressed concrete piles being lifted and stored at the bridle points shown on the plans? 512.08(b) _____

- c. Steel piles: Are steel H-piles being supported on skids or other supports sufficiently spaced to keep the piles clean and free from injury? (512.08)(c) / 505.08(c) & Construction Manual [Section 512.10](#)) _____
 - d. Metal Shell Piles. Are metal shell piles being stored off the ground and in a manner to prevent dirt, water or other foreign material from entering the shell? (512.08(d)) _____
- Are metal shell piles being stored on sufficient wood cribbing to prevent bending, distortion or other damage to the shell? (512.08(d)) _____

6. PREPARATION FOR DRIVING

- a. Prior to the start of driving piling, has the footing been excavated to grade? (512.09) _____
- b. Have cross sections been taken to determine pay quantities for structure excavation? _____
- c. Have the pile locations been staked and checked? _____
- d. Has the entire length of all precast concrete piles been kept saturated at least six hours prior to driving? (512.09(b)) _____
- e. If pre-coring of the embankment is specified on the plans, has the contractor pre-cored to the required depth and diameter shown on the plans? _____

7. PILING DOCUMENTATION

Are you preparing a field book or other record so that a permanent record can be made of the following: (Construction Manual [Section 512.11](#)) _____

- a. A numbered diagram of the location of piles in each substructure location. _____
- b. The authorized length to be furnished as per the written itemized list provided to the Contractor. _____
- c. The actual measured length of piling delivered. _____
- d. The length of cutoff (top of pile elevation -- cutoff elevation) _____
- e. The length driven (length of pile furnished-- cutoff length) _____
- f. The hammer blows per inch (25 mm) "N_b", Hammer energy "E" imparted and corresponding calculated Nominal Driven Bearing (R_{NDB}) at the final bearing. _____

8. MATERIAL INSPECTION

- a. Have you inspected all piling to see if they have been approved prior to shipment? (Construction Manual [Section 512.08](#) & PPG) _____

- b. Are you inspecting piling delivered for possible damage in transit? _____
- c. If pile shoes are specified, do they meet the requirements of (512.05(c) & 1006.05(e))? _____

9. EQUIPMENT

- a. Drive Head: Are the heads of all piles being protected with a suitable driving head? (512.10(b)) _____
- b. Pile Cushion: Are the heads of all Timber, Precast Concrete and Precast Prestressed Concrete piles being protected by a Pile cushion? _____

Is the thickness of the Pile head cushion at least 3 inches (75mm)? _____

Are you requiring the contractor to replace the cushion when it compresses to less than 60% of its original thickness or begins to burn? _____
- c. Hammer Cushion: Are you inspecting the Hammer cushion, when one is required by the manufacturer prior to driving and after each 50 hours of operation? _____

Is the hammer cushion being replaced when it is reduced to less than 75% of its original thickness? _____
- d. Leads: Is the pile and hammer being held in accurate alignment with pile leads which are blocked in position on the pile? (512.10(d)) _____

If swinging leads are used, are they firmly toed into the ground prior to starting the pile driving operation? _____
- e. Followers: If the contractor requests permission to use a follower to drive pile, have you agreed to its use in writing? _____

Is the first pile in every group of ten being driven without a follower and the data from that pile used to determine the average Nominal Driven Bearing (R_{NDB}) of the other piles in the group? _____
- f. Jets: If jets are proposed, have you approved their use? _____

Following termination of use of jets in a substructure unit, are you further driving each pile in that unit to ensure the Nominal Driven Bearing (R_{NDB}) is equal to or greater than the Nominal Required Bearing (R_N)? _____

10. TOLERANCES IN DRIVING

- a. Are foundation piles being driven with a variation from the vertical or required batter alignment of not more than $1/4$ in/ft (20 mm/m). (512.12) _____

- b. Are piles driven such that no visible portion of the pile is more than 6 inches (150mm) out of plan position, when such alignment does not require a design modification and forcing in to this position does not result in injury to the pile?.(512.12) _____

11. PENETRATION REQUIREMENTS

- a. Are you observing the hammer blow per inch (25mm) to ensure the piling is driven to a Nominal Driven Bearing (R_{NDB}) equal to or larger than the Nominal Required Bearing (R_N) shown on the plans? _____

- b. If the pile has not achieved Nominal Required Bearing (R_N) at the full furnished length, but has achieved at least 85% of R_N , are you allowing the pile to set for 24 hours to achieve soil setup? (512.11) _____

If soil setup is needed for the Nominal Driven Bearing (R_{NDB}) to equal or exceed the Nominal Required Bearing (R_N), before setting back on the pile, has the hammer been warmed up by applying at least 20 blows to another pile? _____

Has Nominal Required Bearing been determined by driving the pile over an additional 3 inch (75mm) distance? _____

- c. When a minimum tip elevation is shown on the plans, is the penetration of all foundation piles below the minimum tip elevation? (512.11) _____

When a minimum tip elevation is not shown on the plans are the piles being driven to a penetration at least 10 ft (3 m) below the bottom of footing or into undisturbed earth, whichever is greater? (512.11) _____

Note: If you are having problems achieving this penetration with timber piles, are you asking the Contractor to point the piles or allowing water and/or air jets (512.10(f) in combination with the hammer? _____

- d. Are you checking that piles in stream beds or on banks of streams, where erosion or scour is expected, (as shown on the scour table shown on the plans) that the pile tip penetrates to the required elevation? _____

12. FIELD SPLICING OF PILES

When it becomes necessary to splice onto a partially driven pile because it has become damaged in driving or because Nominal Required Bearing (R_N) shown on the plans has not yet been reached, is the splice being performed in accordance with the plan details and the following? _____

- a. Precast or Precast Prestressed Concrete Piles:
NO splices are allowed in Precast or Precast Prestressed Concrete Piles. _____

If an extension is required, it should be constructed as shown on the plans. (Pile is NOT redriven following constructing the extension) (512.03(c))

If the Nominal Required Bearing (R_N) cannot be achieved, have you notified your supervisor to contact the Bureau of Bridges and Structures for further instructions?

b. Metal Shell Piles.

Planned Splice: Is the Minimum length of each segment at least 20 ft (6 m) long? (512.04(a)(1))

Unplanned Splice: Is the minimum length at least 10 ft (3 m) long? (512.04(a)(2))

Is the Splice being accomplished by:

- (1) a Complete Joint Penetration (CJP) weld of the entire cross-section; or
- (2) use of a commercial splicer with a Department approved commercial splicer welding detail?

Is the welder making the splice qualified by test in accordance with the qualification requirements of the American Welding Society (AWS) Standard Specifications (Certification by independent test laboratory required). (512.07)

c. Steel "H" Piles.

Planned Splice: Is the Minimum length of each segment at least 20 ft (6 m) long? (512.04(a)(1))

Unplanned Splice: Is the minimum length at least 10 ft (3 m) long? (512.04(a)(2))

Is the splice being accomplished by:

- (1) a Complete Joint Penetration (CJP) weld of the entire cross-section;
- (2) the Department's standard steel pile field splices; or
- (3) use of a commercial splicer with a Department approved commercial splicer welding detail?

Is the welder making the splice qualified by test in accordance with the qualification requirements of the American Welding Society (AWS) Standard Specifications (Certification by independent test laboratory required). (512.07)

d. Timber Piles. Planned splicing of timber pile is NOT allowed. For an unplanned splice, is the added piece cut flush with and attached to the main pile with the use of at least 4 steel plates or a metal pipe sleeve. (512.06)

13. PILE CUTOFFS

- a. Are you marking each pile at the cutoff elevation so that the Contractor can cut them off square (perpendicular) to the axis of the pile? (512.13) _____
- b. Once you determine that the pile cutoffs will not be needed as splices for any of the other production piles, are you informing the Contractor that the cutoffs are theirs and are to be disposed of at no additional expense to the State? (512.13) _____

14. INSPECTION OF METAL SHELL PILES AFTER DRIVING

- a. Are you inspecting the interior of all driven metal shell piles for bends or other deformations that would impair the strength of the pile with a Contractor-supplied lamp or mirror? (512.04(c)) _____
- b. After you have inspected and approved the metal shell piles, is the Contractor temporarily sealing the top of the metal shell piles to prevent the entrance of water or foreign substance? (512.04(c)) _____

15. FILLING METAL SHELL PILES WITH CONCRETE

- a. If all piles in a bent, pier or abutment cannot be driven before any concrete is placed in the metal shell piles, is driving of the additional piles within 15 feet (4.5 m) being deferred until the concrete in the metal shell piles within this zone is at least 24 hours old? (512.04(b)) _____
- b. If reinforcement is specified on the plans, is the reinforcement rigidly fastened together and lowered into the shell before placing concrete? Are spacers used to maintain the proper clearance into the top of the piles? (512.04(D)) _____
- c. Just prior to filling metal shell piles with Class DS Concrete, are you inspecting the interior with a mirror or lantern to be sure that all water and foreign substance has been removed? (512.04(e)) _____
- d. When filling the metal shell piles with concrete, is the top 10 feet (3 meters) of concrete being consolidated with internal vibration? (512.04(e)) _____

16. BACKFILLING PRECORED HOLES

Are all pre-cored holes being backfilled with loose, dry sand after the piles are driven? (512.09(c)) _____

17. PILING DIAGRAM

Is a [BC 2184](#) being prepared for each footing for submittal to BBS? (CM 512.11) _____

Have you included a diagram numbering the piles driven and indicating their locations and any deviations from plan locations? _____

18. DOCUMENTATION OF FINAL CONTRACT QUANTITIES

TEST PILES - Each
PILE SHOES - Each

Shall be paid for at the contract unit price each. Enter in Quantity Book by date and location.

FURNISHING PILES (Of the various types and sizes specified) - Foot (Meter)

Payment will be made for the total lineal feet (meters) of all piles delivered to the work in accordance with the itemized list of furnished lengths provided by the Engineer. Field measurements of the delivered lengths must be on record.

If cutoffs are used in splicing on additional lengths, no extra length compensation will be allowed.

Other authorized field additions or "build-ups" will be allowed for payment.

DRIVING PILES - Foot (Meter)

Payment will be made for the total lineal feet (meters) of all piles left in place below cutoff elevation. Field measurements must be on record.

Authorized splices will be paid for as extra work in accordance with Article 109.04. Use Form [BC 635](#) to document this work.

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