

### Lesson 3 – Construction Documents Transcript

Welcome to the Pile Driving Inspector Course. This is Lesson 3 – Construction Documents. To begin, select the start button or press Shift+N on your keyboard.

In this lesson we will cover the following topics:

- Locate Plan Sheet Details Related to Pile Driving
- Identify key elements of the Pile Installation Plan
- Learn how to fill the Pile Driving Record
- Identify & interpret applicable 455 Specifications

A Plans & Specification Checklist is useful to ensure that you remember to check all of the relevant documents.

The Pile Driving Inspector should have this brief list of items in his or her possession prior to start of the pile driving.

- Approved Pile Driving Installation Plan
- Complete set of Project Plans with Pay Items
- Minutes of Previous Meetings
- Special Provisions
- Technical Special provisions for project
- Standard Specifications
- Supplemental Specifications
- Design Standards
- This class Notebook

Here is the governing order of the specifications. Section 5-2 of the Standard Specifications for Road and Bridge Construction sets the following governing order:

- Special Provisions
- Technical Special Provisions

- Plans
- Design Standards
- Developmental Standards
- Supplemental Specifications.
- Standard Specifications

Also, as we have seen in the previous lesson, the specs refers frequently to “the Engineer”. Remember, the Engineer is the Director of the Office of Construction, acting directly or through his duly designated representatives

Here are some key parts of the plans that can contain information needed by the Inspector. When you are finished reading this information, select the continue button or press Shift+N on your keyboard to continue.

This is a continuation of the key parts of the plans that you can review. Remember, Inspectors must check the General Notes and the Foundation Notes for special requirements that may apply to foundations. When you are finished reading this information, select the continue button or press Shift+N on your keyboard to continue.

Scour is the erosion and undermining of the ground caused by moving water. In general, pile tip elevations on the plans should be below the noted scour elevations. Scour can create significant holes around foundations of bridges.

This picture illustrates a bridge that was founded on short timber piles. A 50-year storm caused scour around the pier to about half the length of the piles. The remaining pile embedment was inadequate to resist the applied structure and water forces. The downstream piles plunged and the pier rotated, broke the upstream piles and fell into the scour hole.

This photo shows that even abutments that are protected by riprap can be subjected to scour forces.

We will now review a Sample Plan Set.

This is the Key Sheet, which is the first sheet of the set of plans. We will enlarge couple of areas of this sheet and discuss them in more detail.

The key sheet shows a location map with the limits of the project, financial project number, county and state road number.

Let's take a look at another area of the key sheet that will also include what specifications are applicable and what design standards were used. It will also list the revisions that were performed during the development of the plans.

This is the Summary of Pay Items. Let's enlarge an area where pile items are included. We can see within this enlarged view some pay items related to pile driving, such as prestressed concrete piling and Test Piles (prestressed concrete piling).

This is the General Notes Sheet. Let's enlarge the general notes area. You may want to always check and review the General Notes. There may be some specific requirements and restrictions that impact the pile driving. However, in this particular plan there is nothing related to pile driving.

This is the Report of Core Borings Sheet. In this particular case the Report of core borings presents borings taken in land. The information contained in this sheet can be beneficial for the inspector. Here is where the soil borings taken during the design phase are represented. Depending on the size of the project and the amount of borings taken - the report of core borings may actually consists of several sheets.

The Report of Core Borings contains a legend explaining what the soil symbols mean. In addition the definition of symbols and numbers are explained in this area.

The report of core borings will contain a boring location plan, indicating where the soil borings were performed in relation to the proposed structure or foundations.

This enlargement shows the details at a particular boring. It includes soil information encountered at every particular location, testing, date, stationing and offset of the boring, elevation, and type of hammer used in the SPT N value determination.

The numbers you see at the left of the boring under the "N" heading represent the N value in blows per foot. This is determined based on the procedure described in the previous lesson. The blocks represent soil lab data of basic properties such as fines content or passing 200 percentage (-200 in the drawing), natural moisture content (NMC), liquid limit (LL) and plastic index (PI).

The report of core boring may contain relevant notes that may impact constructability. These notes may refer to variability of the ground, special conditions, obstructions or features that the contractor may have encountered. In this particular drawing, the geotechnical engineer has placed a note regarding the potential of encountering artesian water conditions.

This is a Report of Core Borings Sheet for borings taken in water. Water borings are typically taken from a barge. The information is presented in a similar way.

In this particular case you will see water being represented in the top of the ground. This is because the borings are taken from a barge. This boring, in particular, has several layers of sand (symbol SP and SP-SM), clayey sand (symbol SC), plastic clay (symbol CH) and limestone from approximately EI 22 down (the brick symbol).

The N values in the sand layers vary from 3 to 5 blows per foot and in the clay the N value is 2 blows per foot. In the rock (limestone), it varies from 7 to refusal (50 blows per 3"). There is a symbol indicating loss of drilling fluid completely at around EI -20 (note the 100 with an arrow).

The hammer used for the SPT in this boring was a safety hammer which is a manual type of SPT hammer. Note the date of the boring. As of January 2014, consultants are required to use automatic hammers in FDOT projects.

One additional note: As per FDOT Soils and Foundation Handbook the report of core borings must include individual descriptions for every layer. So instead of the SP, CH, SP-SM symbols; you will typically see actual text describing the materials observed during the performance of the soil borings.

This is the Bridge Hydraulic Sheet. This plan is prepared by a Hydraulics Engineer who will estimate water levels and predict scour elevations.

Here we see a detail that shows the scour elevations. It is important for the Inspector to verify that the 100 Year Scour on this sheet matches that in the Pile Data Table. If you find a discrepancy please communicate it to the Project Administrator as soon as possible. We will cover the pile data table within the next few slides.

This is the Foundation Layout Sheet. In most of the cases, the foundation layout sheet could consist of more than one sheet. In this drawing you will find the location of the bents or piers, the location and spacing of the individual piles. It may also include information of the existing piles.

The foundation layout will include notes and a legend. In this particular case, they are widening the bridge and the foundation of the widened bents consists of 4 piles. Note that there are battered piles. Battered is a term to describe inclined piles. Note also the test pile with the black symbol.

In this detail, we can observe the location of the bents or piers, the location and spacing of the individual piles, and the information of the existing piles.

This is the Pile Data Table. It is part of the Foundation layout Plans. You must have this available at all times. The Pile Data Table will include notes that define load resistance requirements, scour, minimum tip elevations and other pertinent pile driving requirements.

Indicated in the Pile Data Table are the pile cut-off elevations for each bent and pile. Scour, load estimates, down-drag and scour resistance are in the design criteria section. In the Installation criteria you will see the nominal bearing capacity required, the tension capacity required, the minimum tip elevation required, the test pile lengths, the required jet elevation and the required preformed elevation.

This is the End Bent 1 details sheet. The end bent details sheet includes information such as the elevation of the top of piles, bent dimensions, elevations of important bent elements, reinforcement information and pile embedment within the bent. This embedment is typically 1 foot.

This is the Intermediate Bent details sheet. The intermediate bent details sheet includes information such as the top of piles, bent dimensions, elevations of important bent elements, reinforcement information and pile embedment within the bent. The typical embedment of the piles within the bent is 1 foot.

The Pile Installation Plan (PIP) is a shop drawing describing in detail the Contractor's tools and methods of installing the pile foundation. Section 455-10.1, Pile Installation Plan describes the minimum requirements of the Plan. The idea behind having the Contractor submit this plan is to make him put thought and planning into the project.

The Contractor would benefit himself if proper planning is given to the methods of installation and equipment ahead of time, minimizing some of the unknown factors. A smooth and successful start will usually be carried

all the way through the job. As a Pile Driving Inspector you must receive a copy of the Contractor's Pile Installation Plan. You should be familiar with the installation plan well in advance of the start of pile driving.

This flow chart from the Construction procedures Administration Manual (CPAM) chapter 10.1, illustrates the Pile Installation review Process. An observation on the CPAM. The CPAM is a manual that sets policies regarding how to administer a construction project. The CEI personnel must follow this manual. However this manual is not part of a construction contract document and therefore the contractor is not required to comply with it.

For example in this procedure 10.1, the manual establishes some requirements and processes that the CEI and geotechnical personnel working for the Department must comply. This particular slide shows how the PIP submittal must flow after the contractor has submitted.

Complete the Pile Driving Installation Plan form provided by the Engineer. Return the Pile Driving Installation Plan information to the Engineer at the preconstruction conference or no later than 30 days before driving the first pile. Ensure the Pile. In the following slides, we will be covering one by one the items required by the specs to be included in the Pile Installation Plan.

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. This information is usually in the Department's Pile Driving Installation Form, form 700-20-01. This form assists contractors in filling the required information. Note that there is also a checklist of items that should be attached as part of the PIP package.

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. This is a device to determine strokes on open ended Diesel hammers.

3. Detailed drawings of any proposed followers. See figure in the slide. 4. Detailed drawings of templates. See figure in the slide. 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. Proposed schedule for test pile program and production pile driving.

8. Details of proposed features and procedures for protection of existing structures. Featured here, is a vibration monitor used to verify that the construction activities do not produce harmful vibrations on adjacent structures. 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 void or cylinder pile due to interior water pressure.

An important part of your job is to record information about pile driving operations. To make it easier to record and process the necessary information, you should be given a field book like the one shown.

Fill in every blank on the form. If it does not apply put N/A or a long dash. Use pencil/ink - but never erase. If you need to change something, strike a single line through the item and insert the correct information above it. If there is insufficient room to make a note, footnote the item and go to the bottom or back of the page. Fill in the heading before driving starts.



We will review how to complete the pile driving record. The Department does not produce books anymore. Blank forms can be downloaded from the web site. The link to this form is indicated at the bottom of the webpage.

Let's cover the fields of this log:

1. Structure Number – Fill in the Structure Number of bridge. It should be in the structural plans.
2. FIN Project ID Number – The financial project number. It should be indicated on plans.
3. Date – The date that pile is driven.
4. Station Number – Station location of the pile driven to the nearest measured unit.
5. Pile Size – Size of the pile driven as indicated in the plans.
6. Actual/Authorized Length – Authorized pile length (any deviation in the length from the authorized pile length should be explained in the bottom of the page).
7. Bent/Pier Number – Number assigned to the bent/pier, which includes the pile being driven - as indicated in the plans.
8. Pile Number – Pile number within the bent/pier as indicated in the plans or assigned by the project engineer.
9. Hammer Make/Model – Type hammer, including manufacturer name and model number, used to drive the pile. If this type differs from the type accepted in the PIP, explain in the Notes section of the page.
10. Rated Energy – As accepted in the PIP. Note any changes from the PIP in the notes section.
11. Operating Rate – As approved in the PIP. Note any changes from the PIP in the notes section.
12. Reference Elevation – Elevation of the top of the template or reference to the nearest appropriate unit as approved in the PIP.
13. Minimum Tip Elevation – As indicated in the plans, or authorized by the engineer. Not applicable in all cases.

14. Pile Cutoff Elevation – As authorized by the engineer, or as indicated in the plans.
15. Driving Criteria – Input a summary of the blow count criteria provided by the District or Consultant Geotechnical Engineer. (Referring to a letter is not enough.)
16. Pile Cushion Thickness and Material – As accepted in the PIP. Note any changes in the "Notes" section.
17. Hammer Cushion Thickness and Material – As accepted in the PIP. Note any changes in the "Notes" section.
18. Weather – Weather conditions at time of driving - does not include temperature (Example: partly cloudy, cloudy, clear, etc.).
19. Temperature – The ambient (air) temperature at the time of driving.
20. Start Time – The time of day that actual driving commences.
21. Stop Time – The time of day that actual driving ceases.
22. Pay Item Number – As indicated by contract documents.
23. Work Order Number – The number of the transfer or release form certified by authorized personnel inspecting the pile casting operation. Concrete pile only.
24. Manufactured By – Name of the company that manufactured the pile being driven.
25. T.B.M. /B.M. Elevation – The elevation of the temporary benchmark or benchmark used to establish all pertinent elevations.
26. Ground Rod Reading – Actual level rod reading of shot taken beside the driven pile.
27. Date Cast – As shown on the work order described in number should match the date shown on the pile.
28. Rod Reading – Actual level rod reading of shot taken on the B.M. or T.B.M. described in number 25.
29. Pile Head Rod Reading – Actual level rod reading on top of pile after driving.
30. Manufacturer's Pile Number – As shown on the work order described in number.
31. H.I. – The height of the instrument taking the level reading.
32. Pile Head Elevation – Actual elevation of the pile head after driving.

33. Pile Head Chamfer – Per Standard Index or Plans. Indicate any changes in 'notes' section.
34. Pile Tip Elevation – Actual elevation of the pile tip after driving. Note: Take batter into account.
35. Pile Tip Chamfer – See number 33.
36. Ground Elevation – Actual elevation of ground at the base of the driven pile.
37. For Open Ended Pipe Piles – The length between top of pile and top of the soil plug in feet.
38. Pile Driving Inspector – Printed name of the CTQP qualified technician or engineer present and inspecting the driving of the pile.
39. TIN # – Training Identification Number of CTQP technician.
40. Splice Each – The number of splices used in the driving of the pile.
41. Preformed Hole – Indicate the length in feet of the preformed hole.
42. Dynamic Load Test – Indicate use of the Pile Dynamic Analyzer with a one, nonuse with a zero.
43. Pay Set Check – Number of set checks to be paid as per specifications as additional pile length.
44. No Pay Set Check – Number of set checks performed that do not incur in additional compensation as per specifications.
45. Pile Re-drive – Indicate the number of re-drives performed.
46. Extraction – If the pile is extracted, indicate with a (1). If not, indicate with a zero (0). Note details of any extraction in the 'Notes' section.
47. Driving of Splice – If splice was driven indicate with (1), If not, indicate with a zero (0).
48. Pile Type Code: Place the corresponding number in this field. 1. Prestressed Concrete 2. Steel  
5. -Concrete Cylinder Pile 3. Composite 4. Timber
49. Batter - The front end of the batter ratio (xxx.xxx:1). To three decimal places. Example: 001.500:1, 002.000:1 etc.
50. Total Pile Length with Extension(s) – Total length includes the original pile length and the extension/build-ups. To two decimal places.

52. Penetration Below Ground – The actual length of the pile installed below the existing ground. To two decimal places.

53. Extension/Build up, Authorized - The total length of the extension and/or buildup authorized by the engineer. To two decimal places.

54. Extension/Build up, Actual - The total length of the extension and/or buildup used on the pile. To two decimal places.

55. Extension/Build-up – When the build-up is more than four inches and up to 5 feet and is poured into a cap, circle the word "build-up" and indicate the number of feet under the "Authorized" and under "Actual". If longer than 5 feet circle "Extension" and indicate the "Authorized" and "Actual".

56. Notes - Write all information relating to changes to construction documents and site conditions here. Also note all interruptions and milestones in the driving of the pile. If there is insufficient space in this section for all notes, continue the notes on the next (grid) page.

57. Trainee – A person inspecting the pile under full supervision of a qualified inspector, in order to meet the experience requirements of the CTQP qualification.

Here is the pile driving part of the log.

1. Depth: The total length of pile driven at any point of the pile driving sequence, in the unit applicable. (1 foot intervals.)
2. Blows: The number of blows required to drive the pile 1 foot.
3. Stroke/Pressure: Only one number need be entered here. This number should be the total length of stroke for a single-acting diesel hammer, the chamber pressure for a double-acting diesel hammer, or either the stroke length OR the gauge pressure for an air/steam hammer. Use the "Notes" section to document any changes in the fuel setting.

4. Notes: When things happen during the driving of the pile that warrant a note, place a number in the column. Correlate the number with a number in the “Notes” section of the opposite page, and write the actual note there.

Here are some Examples:

- Intermediate stops and starts.
- Example reasons for stops: pile cushion change; hammer break down; template in the way.
- Blows Per Minute (BPM)
- Stroke or Bounce Pressure Chamber (BPC)
- Changes in Hammer Energy
- Pile Damage
- Clarification of Blow Count Increment
- Rebound
- Reason for Acceptance
- Attachment or detachment of dynamic testing equipment
- Show Splice
- Warnings/recommendations to Contractor.

Here is a short checklist of things to ask yourself about the completion of the Pile Driving Record.

- Have you filled in all pre-driving data in the Pile Driving Information page of the log?
- Have you recorded pile placement data including jetting or preforming depths prior to driving?
- Have you recorded an average stroke height (or bounce chamber pressure) for each corresponding foot of driving?
- Have you made notes on the log at the corresponding foot marks?
- Have you made general notes of observations on the driving log?

Here is a sample of a driving record. This is the Pile Driving Information page. Just spend a minute to go over the information. When you are finished reading this information, select the continue button or press Shift+N on your keyboard to continue.

Here is the Pile Driving log page of the record. Just spend a minute to go over the information. When you are finished reading this information, select the continue button or press Shift+N on your keyboard to continue.

We have covered the important plan sheets, details and notes that you need to be familiar with when dealing with Pile Driving, we have identified key elements of the Pile Installation Plan, PIP, and covered the specifications requirements regarding the PIP, and we learned how to fill the Pile Driving Record

This concludes Lesson 3, please continue to lesson 4 by selecting the next lesson button on this page.