

Drilled Shaft Inspector CBT

Lesson 5 – Contractor and equipment Arrive On-Site

Welcome to the Drilled Shaft Inspector Course. This is Lesson 5, Contractor and equipment Arrive On-Site.

Learning Objectives

In this lesson, we will take a look at the following objectives:

- Identify and understand the Role and Duties of the Inspector
- Verify and Inspect On-site Equipment
- Verify Protection of Existing Structures is implemented
- Identify the applicable 455 Specifications

Inspector's Role

The inspector's role is to serve as a representative of the State and ensure the work is performed in accordance with the approved plans and specifications.

Your functions as an inspector are:

1. To know the specifications, both the State Standard Specifications and the job Plans and Specifications.
2. To record and document activity relative to the Plans and Specifications.
3. Raise a "red flag" soon enough to make a difference if work is performed outside of those specifications.
4. Call the Project Administrator if judgment is needed to interpret a Specification.

Remember that you are representing the Department. Perform your job in a professional manner. Use common sense, do not delay the Contractor unnecessarily or interfere with their operations. They are responsible for constructing the project and any out-of-line delays caused by the inspector can be cause for claims.

You and the Contractor both have the same goal - getting the project built. The Contractor needs to construct it within the budget and schedule and you are there to ensure that the state gets what it pays for and that the project is constructed in general accordance with the approved plans and specifications.

Keep the Project Administrator Informed. Notify the Project Administrator soon enough that appropriate decisions or Corrective Actions can be made or implemented in a timely fashion to reduce the impact to the project schedule, cost or quality.

If you observe that something is going to be performed outside of the approved plans and specifications, notify the Contractor and immediately notify the Project Administrator. For example, if you observed that the casing does not appear to be in accordance with the approved Drilled Shaft Installation Plan, don't wait until the casing is set to say something.

The Inspector is brought in almost at the last moment so it is imperative that you become familiar with the details of the project as quickly as possible. The Inspector should receive the approved Plans and Pile Installation Plan, in advance of the project starting. Review these documents for items that effect you.

Please remember to always check the specification package for the specific project. There may be some differences between what the standard specifications and the specific project specifications. The specifications that were developed for the project always control over the standard specifications.

Inspector's Responsibilities

The inspector needs to record and report. As a recorder, the inspector must: Make accurate and unbiased observations;

Document events: complete & consistent; and Perform your duties promptly. As a reporter, the inspector must: Complete reports & forms accurately; keep forms and diary up-to-date; and Keep Project Administrator informed.

The Inspector should concern himself with making accurate, unbiased observations of all important drilled shaft construction events.

The record kept by the Inspector is the only form of tangible data to make an engineering judgment whenever installation problems arise. Elimination of potential causes can best be made on the basis of accurate and complete data observations.

The Inspector should always be aware that prompt performance of these duties is required so that follow-up work can be performed expeditiously.

Communication & Coordination

The Project Administrator, known as the PA, is the CEO person responsible for the everyday construction activity at the project. He works under the direction of the Resident Engineer/Senior Project Engineer.

It is important that the Inspector and the PA maintain a good working relationship and mutual trust. If a specification interpretation or a clarification is needed, contact the PA. It is not the Inspector's responsibility to make these decisions. The Inspector monitors for conformance.

If work is performed outside the plans and specifications, notify the PA and document out of conformance work. Also notify the Contractor of the condition that is outside the specifications. For items requiring approval, the Inspector does not approve a change in process, procedure or equipment. This is the PA's responsibility.

Talk to the PA daily. Most PAs would welcome getting a brief update at the end of the day and have the opportunity to discuss significant events that occurred during the day. Remember the Chain of Authority; the Project Administrator has someone above them to report to also. Contact the PA soon enough to make a difference and to minimize impacts to cost or schedule.

CPAM 10.5.7 Miscellaneous Shafts

CPAM stands for Construction Procedures Administration Manual. It states procedures that CEI personnel must follow for the proper administration of the project. This particular section 10.5.7 deals with a special requirement CEI personnel must meet in dealing with drilled shafts for miscellaneous structures. Let's read the requirement.

To improve the quality of miscellaneous drilled shafts installation, District Construction Engineers (DCEs) shall obtain technical support from the District Geotechnical Office on drilled shaft projects involving mast arms, cantilever signs, overhead truss signs, high mast light poles or other miscellaneous structures shown in the ***Contract Documents***.

This process includes review of Drilled Shaft Installation Plans, conducted at the earliest pre-drill/pre-concrete pour meetings, as required for quality assurance checks and inspector assistance etc. Project Administrators shall notify the District Geotechnical Offices of the construction schedules of the miscellaneous drilled shafts for the projects so they can schedule time to assist.

Communication & Coordination

It is essential that a Pre-Drilling meeting be held and attended by the Project Administrator, Shaft Designer, Geotechnical Engineer and the Inspector. This is in addition to the general pre-construction meeting. This will allow for review of the Contractor's Installation Plan submitted to see if there are any concerns.

It will alert the Inspector as to potential problem areas that could affect the installation. The Designer should point out the operation or equipment that is critical for acceptance of the shaft. This meeting will open up the communication between the team and enhance communication.

In this meeting you will have the chance to:

- Review the approved Drilled Shaft Installation. Plan, and have any questions answered

- Discuss applicable Special Provisions
- Discuss administrative issues
- Discuss and resolve any conflicts.
- Discuss any special site considerations

It is important to communicate and coordinate your responsibilities with the Contractor. In performing your duties keep in mind the following points:

- Remember, you are a team
- Do Not direct the Contractor in their work. The Contractor is responsible for building the project.
- If you observe potential non-conformance, notify the Contractor, in advance, to avoid the situation occurring
- Avoid delaying Contractor

Inspector's Role on Drilled Shafts

This graphic shows the phases to drilled shaft construction and the Inspector duties on each phase. The Inspector will have a role in checking the Contractor set-up, shaft excavation and cleaning, placing steel, concrete operations and the post-installation activities. We will cover these later in more detail.

Assemble Your "Toolbox"

Prior to going out to the project, it is the Inspector's responsibility to ensure that they have all of the up-to-date project documentation and forms. As any other type of work, you can't do the job properly if you don't have the tools.

Tool's Checklist

Checklists can assist us in remembering the many items needed to be the properly outfitted Drilled Shaft Inspector.

Checklist

A Drilled Shaft Inspection Checklist can assist the inspector in performing some of their duties. Here we can see a checklist for the early requirements. Spend a few moments

going over these items. After reviewing the items, select the continue button or press shift+N on your keyboard to continue.

Project Document Check

In the following slides there will be a list of documents that you should become familiar with and check. If you find that any issues are unclear or that you think are incorrect, please discuss it with the PA.

Plan revisions. Always check for revised sheets to see if there are any changes that affect the shaft construction. Key Sheet: Does Project ID No., location, etc. agree with the information you were provided? Summary of Pay Items: Do the pay quantities and items agree?

Utilities: Does there appear to be any conflicts with production or test shafts? If so, are there provisions for addressing these conflicts? Traffic Control: Does there appear to be any conflicts with production or test shafts? Does the sequence of shaft installation conflict? If so, are there provisions for addressing these conflicts?

Structural Plan Sheet Check

General Notes: Compare with the Drilled Shaft Data Table. Do any "Notes" contain changes to the specifications or specification applications? General Plan & Elevation: Does the number of bent/piers or shaft locations match the Drilled Shaft Data Table? Do the elevations shown compare favorably with the Drilled Shaft Data Table?

Report of Core Borings: Are water tables and piezometric levels shown? Do the boring(s) extend beyond the proposed bottom of shaft elevations? Foundation Layout: Does the foundation layout match the Drilled Shaft Installation Plan relating to number, sequencing, elevations, etc.?

Contractor and Equipment Arrive

Contractor and Equipment Arrive On-site.

Inspector's Checklist

Once again, the checklist can be used to assist in performing our duties when the Contractor and equipment arrive on-site.

When the Contractor and their equipment arrive on-site, there are a variety of items that you, the Inspector, are responsible for checking and verifying. From verifying the equipment on-site matches that in the approved Drilled Shaft Installation Plan to assessing Contractor compliance with any required Protection of Existing Structures.

Verify Equipment

Before the equipment arrives to the site the Contractor must have provided detailed information on their equipment and the Inspector needs to verify that what is in the field matches the Drilled Shaft Installation Plan. This plan can be used to verify the equipment brought to the site. The Inspector must check rig, augers, bits, casings, tremie, pumps, buckets, etc. for comparison in size, type and condition.

The Inspector must check the augers and bits the Contractor has brought on-site. The Inspector should verify that the augers and bits are detailed in the Drilled Shaft Installation Plan. They should be checked for diameter, condition and length.

The condition of the augers and bits should be noted because it may become important later. Bits should be checked for missing or broken teeth, and types on site. Augers checked for broken or missing cutting blades, damaged flights, etc. It is important to measure the height of these tools as you will need this information when determining depths.

The Inspector typically does not have the authority to reject the Contractor's tools, however, it is the Inspector's responsibility to document the condition of the equipment and tools. The Inspector must document all of the tools, as questions may arise at a later time concerning drilling difficulties, etc.

Document any changing of or repairing of tools, such as changing teeth on a bit, etc. Let's take a look at this slide. Is this equipment in good shape? What could happen if this bent kelly bar is used?

The Kelly bar is not in good shape and may create some issues in the alignment, producing an eccentric hole as the auger will wobble and excavation caving. If cutting hard material, it does not apply pressure correctly, thereby taking longer to cut, giving the appearance of harder material than reported in the boring log. The Inspector should document the condition and in this case, notify the Project Administrator immediately.

Inspectors should also check templates, buckets, etc. for conformance to the DSIP.

Inspectors should also check the tremie, if concrete is going to be placed by the tremie method. Verify the tremie is made out of the proper material, will have sufficient length, connections are water tight and that the tremie meet the minimum diameter requirements. Section 400 of the Standard Specifications states that tremies are to be a minimum of 10 inches in diameter.

Casings must be checked for diameter and wall thickness. This is important as there is a requirement for extra depth and a modified pay factor in the event the casing ID is smaller than the planned shaft diameter (commonly called OD casing).

This slide shows the relationship between Outside diameter (OD), internal diameter (ID) and the wall thickness.

Casings can be bent or deformed at the tip during installation into hard strata. The Contractor then has difficulty removing the drilling tool from the hole making it difficult to remove the cuttings. The auger will catch on the bent portion of the casing. The Inspector should document this condition.

Should the Contractor not remove the damaged section, the PA should be notified as this can be very detrimental to the shaft excavation. If the Contractor removes the damaged section, remember to measure for the new correct length.

455-15.7 - Casing

Let's review the specification on Casings. Ensure that casings are metal, of ample strength to withstand handling and driving stresses and the pressure of concrete and of the surrounding earth materials, and that they are smooth and water tight.

Ensure that the inside diameter of casing is not less than the specified size of the shaft except as provided below. The Department will not allow extra compensation for concrete required to fill an oversize casing or oversize excavation.

455-1.1 – Protection of Existing Structure

Let's Review now the specification on Protection of Existing Structures. When the Plans require excavation or foundation construction operations in close proximity to existing structures, take all reasonable precautions to prevent damage to such structures.

The requirements described herein apply to all types of structures (on or off the right-of-way) that may be adversely affected by foundation construction operations (including phase construction) due to vibrations, ground loss, ground heave, or dewatering. Protect utilities as described in-the applicable provisions of Section 7.

Survey and monitor structures for settlement in a manner approved by the Engineer, recording elevations to 0.001 foot. Employ a qualified Specialty Engineer to inspect and document the condition of structures prior to and after construction of excavations and foundation construction. Inspect and monitor the following structures:

1. shown in the plans.

2. within a distance of ten shaft diameters or the estimated depth of excavation, whichever is greater.
3. within a distance of three times the depth of excavation for the footing.

The specs changed recently and now the requirement of monitoring for settlement and the preconstruction and post-construction survey are covered in the same paragraph.

Take elevation;

- (1) before beginning construction,
- (2) daily during the driving of any casings, piling, or sheeting,
- (3) weekly for two weeks after stopping driving,
- (4) during excavation,
- (5) during blasting,
- (6) or as directed by the Engineer.

Notify the Engineer of any movements detected and immediately take any remedial measures required to prevent damage to the existing structures.

Distance from Shaft is to be monitored and surveyed, pre and post construction. $D = 10$ Shaft diameters or Depth of Excavation.

The Department will make the necessary arrangements to provide right-of-way entry to the existing structures. Adequately document the condition of the structures and all existing cracks with descriptions and pictures.

Prepare two reports documenting the condition of the structures: one report before beginning foundation construction operations and a second report after completing foundation construction operations. The Department will take ownership of both reports. Do not perform pre-driving and post-driving surveys of the condition of bridges owned by the Department except when shown in the Contract Documents.

When shown in the Contract Documents, employ a qualified Specialty Engineer to monitor and record vibration levels during the driving of casings, piling, sheeting, or blasting operations. Provide vibration monitoring equipment capable of detecting velocities of 0.1 in/s or less.

Upon detecting settlement or heave of 0.005 foot, vibration levels reaching 0.5 in/s, levels otherwise shown in the Contract Documents, or damage to the structure, immediately stop the source of vibrations, backfill any open drilled shaft excavations, and contact the Engineer for instructions.

455-1.2 – Excavation

Now let's talk about the excavation requirements in the specs. Complete all excavation of the foundations prior to installing piles or shafts unless otherwise authorized by the Engineer. Note: The excavation here refers to the excavation required to build the footing cap if the shafts are part of a pier group. The footing cap must be done before starting any individual drilled construction.

455-1.2.1 – Abutment (End Bent) Fill

Let's review the highlighted portion of the slide, because items 1 and 2 belong to piles. When installing piles/shafts or casing prior to placing fill, take necessary precautions to prevent displacement of piles/shafts during placing and compacting fill materials within 15 feet of the piles/shafts or casing. Reference and check the position of the piles/shafts or casing at three approximately equal intervals during construction of the embankment.

Provide permanent casings installed prior to placement of the fill, for all drilled shafts through mechanically stabilized fills (for example, behind proprietary retaining walls) for shafts installed after fill placement. Install temporary casings through the completed conventional fill when permanent casings are not required.

Typically the shafts are constructed prior to approach embankments in the abutment area. However there are special cases in which the embankment needs to be build prior to installing a casing.

For example, in the case of artesian water, an embankment needs to be constructed to get to an elevation high enough, above the piezometric elevation, so that the shaft excavation and construction may proceed under hydrostatic water conditions. If an MSE wall is to be constructed around the end bent shafts, then the contractor is required to provide permanent casings prior to placing and compact the reinforced MSE wall fill.

The embankment is constructed around the permanent casings. Once the top of the embankment elevation is reached, the contractor may place the drill rig at the top and proceed the excavation through the permanent casing installed in advance. The casings cannot be removed to prevent problems in the MSE wall.

If there is no MSE wall around the end bents, but only conventional fill in the abutment, then temporary casings will be required. The embankment is constructed around the temporary casings. Once the top of embankment elevation is reached, the contractor can drill and construct the shafts.

Provide permanent casings, if required, before the fill is placed extending a sufficient distance into the existing ground to provide stability to the casings during construction of the abutment fill.

455-1.2.1 – Cofferdams

A Cofferdam is a closed temporary wall, typically built with steel sheet piles and which allows the protected area to be dewatered and be constricted in the dry. In FDOT projects, cofferdams are used to construct pier foundations for bridges and in special drainage structure construction. The following slides illustrate a cofferdam installed for the construction of a bridge pier. Even though it is mostly temporary, in some cases the cofferdam is left in place as it is not practical or cannot be removed.

Let's read the specifications for cofferdams. Construct cofferdams as detailed in the plans. When cofferdams are not detailed in the plans, employ a Specialty Engineer to design cofferdams, and to sign and seal the plans and specification requirements.

Send the designs to the Engineer for his records before beginning construction. Provide a qualified diver and a safety diver to inspect the conditions of the foundation enclosure or cofferdam when the Contract Documents require a seal for construction.

455-1.3 – Cofferdams

Equip these divers with suitable voice communications, and have them inspect the foundation enclosure and cofferdam periphery including each sheeting indentation and around each piling or drilled shaft to ensure that no layers of mud or other undesirable materials were left above the bottom of the seal elevation during the excavation process. Also, have the divers check to make sure the surfaces of the piles or drilled shafts are sufficiently clean to allow the bond of the concrete down to the minimum bottom of seal elevation.

Topics Covered

In this lesson we have covered the following topics:

- Identify and understand the Role and Duties of the Inspector
- Verify and Inspect On-site Equipment

- Verify Protection of Existing Structures is implemented
- Identify the applicable 455 Specifications

End of Lesson

This is the end of lesson 5. Please select the next lesson button on this page to continue to the next lesson.