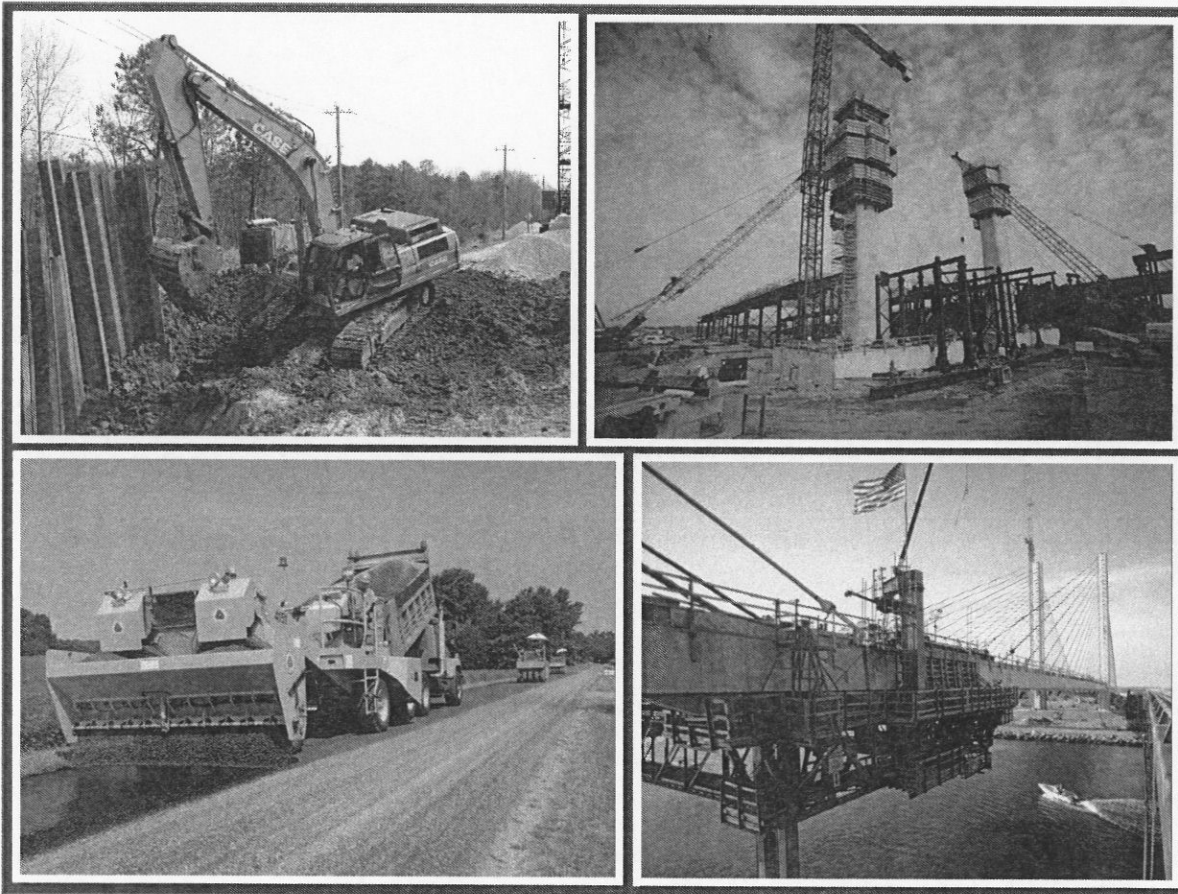


Standard Specifications

for


Road and Bridge Construction

AUGUST 2016



Prepared by

The State of Delaware

 **DEPARTMENT OF TRANSPORTATION**
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Jennifer Cohan, Secretary
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SECTION 606 – DRILLED SHAFTS

606.01 Description. Furnish all Materials, labor, tools, Equipment, services and incidentals necessary to construct the drilled shafts in accordance with the Contract Documents.

606.02 Materials. Provide Materials as specified in the following:

Steel Casings	Section 1034
Reinforcing Steel	Section 1037
Welding	Section 1039
Portland Cement Concrete, Class A or B	Section 1022
Slurry	Section 1035
Access Tubes for Crosshole Sonic Log Testing	Section 1033
Grout	Section 1047

606.03 Construction.

606.03.1 Submittals, Approvals, and Meetings. At the time of bid, submit the qualifications of the Contractor (i.e., the drilled shaft specialty contractor) to verify the successful completion by the Contractor of at least three separate foundation Projects within the last five years with drilled shafts of similar size (diameter and depth) and similar subsurface geotechnical conditions to those shown in the Contract Documents. Include a brief description of each Project and the owner's contact person's name and current phone number for each project listed.

- A. *Experience and Personnel.* At least two weeks prior to the start of drilled shaft construction, submit a list identifying the on-site supervisors and drill rig operators assigned to the Project, to the Engineer for approval. In the list, include a detailed summary of each individual's experience in drilled shaft excavation operations, and placement of assembled reinforcing cages and concrete in drilled shafts.
1. On-site supervisors must have a minimum of two years' experience in supervising construction of drilled shaft foundations of similar size (diameter and depth) and difficulty to those shown in the Contract Documents, and similar geotechnical conditions to those described in the geotechnical report. The work experience must be direct supervisory responsibility for the on-site drilled shaft construction operations. Project management level positions indirectly supervising on-site drilled shaft construction operations are not acceptable for this experience requirement.
 2. Drill rig operators must have a minimum one year experience in construction of drilled shaft foundations.

The Engineer will approve or reject the Contractor's qualifications and field personnel within ten Working Days after receipt of the submission. Do not start Work on any drilled shaft until the Contractor's qualifications and field personnel are approved by the Engineer. The Engineer may suspend the drilled shaft construction if the Contractor substitutes field personnel without prior approval by the Engineer. The Contractor is fully liable for the additional costs resulting from the suspension of Work, and no Adjustments in Contract Time resulting from such suspension of Work, will be allowed.

B. *Drilled Shaft Installation Plan.* The Engineer will approve or reject the Contractor's qualifications and field personnel within ten Working Days after receipt of the submission. In preparing the narrative, reference the available subsurface geotechnical data provided in the Contract boring logs and any geotechnical report(s) prepared for this Project. In this narrative, provide at a minimum the following information:

1. Description of overall construction operation sequence and the sequence of drilled shaft construction when in groups or lines.
2. A list, description, and capacities of proposed Equipment, including, but not limited to, cranes, drills, augers, bailing buckets, final cleaning Equipment, and drilling unit. As appropriate, describe why the

Securely hold the steel reinforcing cage in position throughout the concrete placement operation. Tie and support the reinforcing steel in the drilled shaft so that the location of the reinforcing steel will remain within allowable tolerance. Use concrete spacers or other approved non-corrosive spacing devices at sufficient intervals (near the bottom, the top and at intervals not exceeding 10 feet vertically) to ensure concentric spacing for the entire cage length. The number of spacers required at each level will be one spacer for each foot of excavation diameter, with a minimum of four spacers at each level. The spacers must be of adequate dimension to ensure an annular space between the outside of the reinforcing cage and the side of the excavation along the entire length of the drilled shaft as shown in the Contract Documents. Provide acceptable feet made of plastic, or concrete (bottom supports) to ensure that the bottom of the cage is maintained at the proper distance above the base of the excavation unless the cage is suspended from a fixed base during the concrete pour.

Remove bracing steel that constricts the interior of the reinforcing cage after lifting the cage if freefall concrete or wet tremie methods of concrete placement are to be used.

Check the elevation of the top of the steel cage before and after the concrete is placed. If the upward displacement of the rebar cage exceeds 2 inches, or if the downward displacement exceeds 6 inches, the drilled shaft will be considered defective. Make corrections to the satisfaction of the Engineer. Do not construct additional drilled shafts until the rebar cage support has been modified in a manner satisfactory to the Engineer.

606.03.10 Concrete Placement, Curing and Protection. Commence the concrete placement as soon as possible after completion of drilled shaft excavation by the Contractor and inspection by the Engineer. Continue the concrete placement in one operation to the top of the drilled shaft, or as shown in the Contract Documents.

If water is not present (a dry shaft), deposit the concrete through the center of the reinforcement cage by a method that prevents segregation of aggregates. Place the concrete such that the free-fall is vertical down the center of the drilled shaft without hitting the sides, the steel reinforcing bars, or the steel reinforcing bar cage bracing.

If water exists in amounts greater than three inches in depth or enters at a rate of more than twelve inches per hour, then fill the drilled shaft excavation with slurry to at least the level specified in Section 606.03.4.D.2. and with concrete placed by tremie methods.

Do not exceed the time limit for concrete placement as defined in the approved Drilled Shaft Installation Plan and demonstrated by a successful technique shaft or test shaft. Commence the concrete placement time at the mixing of the concrete and extend through to the completion of placement of the concrete in the drilled shaft excavation, including removal of any temporary casing. For wet placement methods, the placement time starts at the batching of the initial load of concrete to be placed in the shaft. Prior to concrete placement, provide test results of both a trial mix and a slump loss test conducted by an approved testing laboratory using approved methods to demonstrate that the concrete meets this defined placement time limit. Maintain the concrete mix with a slump of 4 inches or greater over the defined placement time limit as demonstrated by trial mix and slump loss tests. Conduct the trial mix and slump loss tests at ambient temperatures appropriate for site conditions. Ambient air temperature at the time of concrete placement is not permitted to be greater than the ambient temperature at the time of the concrete trial tests and slump loss tests.

Use only concrete mix design approved for use and included with the approved Drilled Shaft Installation Plan. Adjust all admixtures, when approved for use, for the conditions encountered on the job so the concrete remains in a workable plastic state throughout placement.

Throughout the underwater concrete placement operation, the discharge end of the tube must remain immersed in the concrete at a depth to prevent water from entering. The concrete placement must be continuous until the Work is completed, resulting in a seamless, uniform shaft. If the concrete placement operation is interrupted, the Engineer may require the Contractor to prove by core drilling or other tests that the drilled shaft contains no voids or horizontal joints. If testing reveals voids or joints, repair them or replace the drilled shaft at no expense to the Department. Responsibility for coring and testing costs, and calculation of time extension, will be in accordance with Section 606.03.13. of this Specification.

Before placing any fresh concrete against concrete deposited in water or slurry (construction joint), remove all scum, laitance, loose gravel and sediment on the surface of the concrete deposited in water or slurry, and chip off any high