

SECTION 00921 - MAJOR SIGN SUPPORT DRILLED SHAFTS

(Follow all instructions and make all edits with "Track Changes" turned on. If there are no instructions [purple text] above a subsection, paragraph, sentence, or bullet, then include it in the Project. Delete all purple text before preparing the final document. All other modifications to this Section will require ODOT Technical Resource and State Specifications Engineer approval.)

Comply with Section 00921 of the Standard Specifications modified as follows:

(Use the following subsection .00 when traffic signal 60 foot through 75 foot mast arm supports are included in the Project. Check with the Traffic Signal designer.)

Add the following paragraph to the end of this subsection:

00921.00 Scope - This Work also consists of excavating and constructing drilled, cast-in-place, reinforced concrete shafts and footings for traffic signal 60 foot through 75 foot mast arm supports according to the Specifications and the Plans.

00921.10 Materials - Replace this subsection, except for the subsection number and title, with the following:

Furnish Materials meeting the following requirements:

Concrete	02001
Reinforcement	02510

Furnish Class 4000 - 3/8" drilled shaft concrete for the drilled shaft. Water may be added to the concrete mix at the Project Site only if allowed by the approved mix design.

Furnish concrete and anchor bolts according to 00920.10 for the drilled shaft cap.

00921.14(b) Synthetic Slurries - Replace this subsection, except for the subsection number and title, with the following:

Select synthetic slurries from the QPL. Use synthetic slurries according to the manufacturer's recommendations and the Contractor's quality control plan. Provide a Sand content of synthetic slurry at less than 2.0 percent (API 13B-1, Section 5) prior to final cleaning and immediately prior to concrete placement.

00921.15 Crosshole Sonic Log Access Tubes - Replace the bullet that begins "Steel access tubes ..." with the following bullet:

- Furnish steel access tubes at least 1 1/2 inch inside diameter Schedule 40 pipe according to ASTM A53, Grade A or B, Type E, F, or S.

Replace the bullet that begins "Access tube acceptance ..." with the following bullet:

- Access tube acceptance is based on manufacturer's certification that the furnished material meets the requirements of this specification.

00921.18 Crosshole Sonic Log Cement Grout - Replace this subsection, except for the subsection number and title, with the following:

Furnish non-epoxy grout or tendon grout from the QPL or furnish a pumpable CSL cement grout consisting of neat cement and water that has a water-cement ratio between 0.38 and 0.45. Furnish portland cement for the pumpable CSL cement grout meeting the requirements of Section 02010.

00921.30 Personnel Qualifications - Replace this subsection, except for the subsection number and title, with the following:

Perform the drilled shaft construction Work using a company and personnel experienced in drilled shaft construction work. Submit a list to the Engineer for approval identifying the on-site supervisors and drill rig operators assigned to the Project and the companies experience relevant to the Project. Submit experience relevant to the anticipated subsurface materials, groundwater conditions, shaft size, depth and any special construction techniques required. Also provide the experience qualifications of the company performing the CSL testing. Before the preconstruction conference, provide the following information to verify the firm's experience and the qualifications of personnel scheduled to perform the drilled shaft construction and CSL testing:

- Submit a project reference list of at least three separate foundation projects, successfully completed in the last 5 years, with Drilled Shafts of diameters and depths equal to or larger than those shown and in ground conditions similar to those indicated. Include a brief description of each project and the owner's contact person's name and current phone number for each project listed.
- Submit a resume for on-site supervisors with at least 2 years' experience in supervising construction of drilled shaft foundations of similar diameter and depth and scope to those shown and in similar geotechnical conditions to those described in the geotechnical report. Submit experience that includes the direct supervisory responsibility for the on-site construction operations.
- Submit a resume for drill operators that have at least 1 year experience in the construction of drilled shaft foundations.
- Perform CSL testing using an independent testing organization retained by the Contractor and approved by the Agency. Provide personnel experienced in operating the CSL testing equipment. Submit the CSL testing firm qualifications according to 00921.40(a). Provide a CSL testing firm that has successfully performed CSL testing on a minimum of five projects during the last 3 years. Ensure the CSL testing personnel have been trained in the operation of the CSL equipment and have at least 1 year of experience in operating CSL testing equipment on a minimum of 10 shafts.

The Engineer will respond within 21 Calendar Days after receipt of the submittal. Do not begin Work on any Drilled Shafts until the qualifications have been approved. The Engineer may suspend the drilled shaft construction if the Contractor substitutes unapproved personnel during construction. Submit requests for substitution of either on-site supervisors, drill

operators, or CSL testing personnel to the Engineer, who will have 7 Calendar Days to respond to each request. Additional costs resulting from the suspension of Work due to the changing of personnel is the Contractor's responsibility, and no adjustment in Contract Time resulting from the suspension of Work is allowed.

~~*(Use the following subsection 40(a) when the foundation will be embedded in rock or there is another reason to have additional reinforcing cage length. Check with designer. Delete (s) or parentheses and the words in parentheses as needed.)*~~

00921.40(a) Drilled Shaft Installation Plan - Replace the paragraph that begins "The Engineer will approve ..." with the following paragraph:

The Engineer will approve or reject the drilled shaft installation plan within 21 Calendar Days after receipt of all submissions. Provide any additional information and submit a revised plan, if requested, for review and approval. All procedural approvals given by the Engineer are subject to trial in the field and will not relieve the Contractor of the responsibility to satisfactorily complete the Work. Submit requests for modification of adopted procedures to the Engineer. Allow 21 Calendar Days for approval of modifications. Do not begin drilled shaft construction Work until all drilled shaft submittals have been approved.

~~*(Use the following subsection 40(a) two paragraphs when the foundation will be embedded in rock or there is another reason to have additional reinforcing cage length. Check with designer. Delete (s) or parentheses and the words in parentheses as needed.)*~~

Add the following sentence to the bullet that begins "Unstamped reinforcing steel shop..."

For site(s) (insert site name) (and) (insert site name) only, include details of the method for supporting the reinforcement on the bottom of the shaft excavation

00921.41 Drill Shaft Coordination Meeting - Replace the paragraph that begins "Hold a drilled shaft ..." with the following paragraph:

Hold a drilled shaft coordination meeting at least 7 Calendar Days before beginning any shaft construction Work at the site to discuss construction procedures, schedules, staging, personnel, Equipment to be used, and other elements of the approved shaft installation plan as specified in 00921.40. If synthetic slurry is used to construct the shafts, discuss the frequency of scheduled site visits to the Project Site by the synthetic slurry manufacturer's representative. Those attending the meeting include:

Replace the bullet that begins "Representing the Contractor ..." with the following bullet:

- **Representing the Contractor** - The superintendent, on-site supervisors, and all supervisors in charge of excavating the shaft, placing the casing, mixing and installing slurry as applicable, placing the steel reinforcing bars, and placing the concrete. If synthetic slurry is used, include the slurry manufacturer's representative and a Contractor's employee trained in the use of the synthetic slurry.

00921.42 Construction Tolerances - Replace the bullet that begins "Top of Steel Reinforcement ..." with the following bullet:

Top of Steel Reinforcement - Plus 3 minus 0 inches from the plan top of steel reinforcement elevation. Maintain 3 inches of cover.

Replace the paragraph that begins "Frequently check the plumbness ..." with the following paragraph:

Frequently check the plumbness, alignment, and dimensions of the shaft during construction. Correct all out-of-tolerance shaft excavations and completed shafts to the satisfaction of the Engineer. Materials and Work necessary to complete corrections for out-of-tolerance Drilled Shafts are at no additional cost to the Agency, and no extension of the Project completion date will be granted. Materials and Work necessary to complete corrections for out-of-tolerance Drilled Shafts resulting from the removal of unexpected drilled shaft obstructions is paid for according to 00195.20.

00921.43(a) General - Replace the paragraph that begins "Excavate Drilled Shafts to ..." with the following paragraph:

Excavate Drilled Shafts to the dimensions and elevations shown or as directed. Provide and maintain stabilized drilled shaft sidewalls and bottoms for the full depth of the excavation, using approved Materials, Equipment and methods. If caving or other unstable conditions occur during any construction procedure, stop further construction, notify the Engineer, and stabilize the shaft excavation by approved methods and submit a revised installation plan that addresses the problem and prevents further instability. Do not continue with shaft construction until any damage that occurred has been repaired according to the Specifications and until receiving the Engineer's approval of the revised shaft installation plan.

00921.43(d) Unexpected Drilled Shaft Obstructions - Replace this subsection, except for the subsection number and title, with the following:

Remove any natural or manmade object encountered that was not revealed by the Agency's site investigation, and that would cause a significant decrease in the rate of advancement if removed using the techniques and Equipment used successfully to excavate the shaft. The Engineer is the sole judge of the significance of any reduced rate of shaft advancement and the classification of any unexpected obstructions. Removal of unexpected obstructions from the shaft excavation is paid according to 00195.20.

00921.43(e) Lost Tools - Replace this subsection, except for the subsection number and title, with the following:

Promptly remove drilling tools lost in the excavation. Lost tools will not be considered unexpected obstructions. Remove lost tools without additional compensation. Drilling tools lost during the course of removing unexpected drilled shaft obstructions are paid according to 00195.20.

00921.43(f) Drilling Slurry Installation - Replace the paragraph that begins "If synthetic drilling slurry is ..." with the following paragraph:

If synthetic drilling slurry is selected, provide a manufacturer's representative to provide technical assistance at the site prior to use of the slurry, who remains at the site during construction and completion of a minimum of one drilled shaft to adjust the slurry mix for the

specific site subsurface conditions. After the manufacturer's representative is no longer at the site, provide the approved personnel trained in the use of the synthetic slurry for the remainder of the shaft slurry operations to supervise the proper slurry mix design and quality control procedures.

Replace the paragraph that begins "All in-hole drilling ..." with the following paragraph:

Ensure all in-hole drilling slurry meets the required slurry Specifications during excavation and prior to concrete placement. Clean, recirculate, de-sand or replace the slurry to maintain the required slurry properties.

00921.43(g) Drilling Slurry Inspection and Testing - Replace the paragraph that begins "Mix and thoroughly hydrate ..." with the following paragraph:

Mix and thoroughly hydrate all drilling slurries in an appropriate storage facility. Collect sample sets from the storage facility and perform tests to ensure the slurry conforms to the specified material properties before introduction into the drilled shaft excavation. A sample set is composed of samples taken at mid-depth and within 24 inches of the bottom of the storage facility.

Replace the paragraph that begins "Sample and test all ..." with the following paragraph:

Sample and test all slurry in the presence of the Engineer, unless otherwise directed. The sample sets of slurry within the excavation consist of samples taken at mid-depth of the excavation and within 24 inches of the bottom of the excavation. Collect and test sample sets during the drilling operation as necessary to ensure the specified properties of the slurry are maintained. Clean, recirculate, de-sand, or replace the slurry as necessary to maintain the specified slurry properties. Final cleaning of the excavation and placement of concrete is not allowed until the test results indicate the slurry properties are as specified.

00921.43(h) Clean Out - Replace the paragraph that begins "Use appropriate means ..." with the following paragraph:

Use appropriate means, such as a cleanout bucket, pump or air lift, to clean the bottom of the drilled shaft excavations. No more than 1 inch of loose or disturbed material is allowed at the bottom of the excavation.

(Use the following subsection .45(a) when the foundation will be embedded in rock or there is another reason to have additional reinforcing cage length. Check with designer. Delete (s) or parentheses and the words in parentheses as needed.)

00921.45(a) Placement - Add the following paragraph and bullets to the end of this subsection:

For site(s) (insert site name) (and) (insert site name) only:

- In each shaft, place reinforcing steel extending from 6 inches above the bottom of the shaft excavation to the elevation shown. The reinforcing cage may be supported on the bottom of the shaft excavation if approved. Support the reinforcing cage to prevent distortion or settlement during concrete placement. Support the reinforcing

cage such that the supporting mechanism does not obstruct the center of the shaft and allows concrete placement vertically down the center of the shaft. If concrete placement does not immediately follow cage placement, remove the reinforcing cage from the excavation and rectify the integrity of the excavation prior to reinstallation of the cage.

- To accommodate variations in shaft length, furnish steel reinforcing bar cages, including CSL access tubes if specified, 4 feet longer than the lengths shown. Add the increased length to the bottom of the cage. Following bottom cleanliness approval, trim the bottom of the steel reinforcing bar cage to the proper length prior to placing it in the excavation. Shift or trim CSL access tubes (if present) to the revised cage length. If CSL tubes are cut, adapt the ends of the tubes to receive the watertight caps as specified.

00921.46 Crosshole Sonic Log Test Access Tubes - Replace the paragraph that begins "Furnish and install access ..." with the following paragraph:

Furnish and install access tubes for CSL testing as shown. Attach CSL access tubes securely to the interior of the reinforcement cage as near to parallel as possible in each drilled shaft and in the pattern shown. Extend the access tubes from the bottom of the reinforcement cage to at least 24 inches above the top of the shaft. Ensure joints required to achieve full-length access tubes are watertight. Do not damage the access tubes during reinforcement cage installation and concrete placement. Fill the tubes with potable water, according to 02020.10(b), as soon as possible, but no more than 1 hour after concrete placement and reinstall the top watertight caps. Check water level and top off as needed.

00921.47(a) Concrete Placement - Replace the paragraph that begins "Allow a maximum of ..." with the following paragraph:

Allow a maximum of 60 minutes between concrete placements and use no concrete older than 90 minutes from batch time. Use procedures for concrete placement ensuring that the concrete within the shaft becomes a monolithic, homogeneous unit.

00921.47(b) Dry Shaft Concrete Placement - Replace the paragraph that begins "Under free-fall placement ..." with the following paragraph:

Under free-fall placement, deposit concrete through the center of the reinforcement cage by a method that prevents segregation of Aggregates and splashing of concrete on the reinforcement cage. Place concrete so that the free-fall is vertical down the center of the shaft without hitting the sides, the steel reinforcing bars or steel cage bracing.

00921.47(e) Casing Removal - Replace this subsection, except for the subsection number and title, with the following:

Remove all temporary casing during or after completion of concrete placement. Do not start temporary casing removal until the level of fresh concrete within the casing has reached a depth of at least 10 feet or the level necessary to adequately counteract the external hydrostatic pressure head. As the temporary casing is withdrawn, maintain a minimum 5 feet head of concrete above the bottom of the casing. A slight downward movement of the casing while exerting downward pressure, or hammering or vibrating the casing is allowed to facilitate extraction. Extract the casing so that concrete is cast directly against the surrounding

in-situ material. Check the elevation of the top of the reinforcing cage before and after temporary casing extraction for conformance with the construction tolerance criteria of 00921.42. Casing that cannot be extracted during, or immediately after, the concrete placement operation may be cause for rejection of the shaft.

00921.48 Drilled Shaft Testing and Acceptance - Replace the paragraph that begins "Acceptance of Drilled Shafts ..." with the following paragraph:

Acceptance of Drilled Shafts is based on the Engineer's review of the results of CSL, or other, integrity testing if conducted, field inspection reports and visual observations during drilled shaft construction. The Engineer has final authority on the approval of Drilled Shafts. For shafts that are integrity tested, the Engineer will determine final acceptance of each tested shaft, based on the integrity test results and inspection reports and will provide a response to the Contractor within 5 Calendar Days after receiving the CSL test report.

00921.48(a) Crosshole Sonic Log Testing - Replace the paragraph that begins "Provide crosshole sonic ..." with the following paragraph:

Provide crosshole sonic log testing Equipment and perform crosshole sonic log testing and analysis on the first drilled shaft completed at each foundation and subsequent shafts as specified or designated for testing by the Engineer. Provide CSL testing Equipment according to the requirements of ASTM D6760 and approved by the Engineer. Provide all necessary access and other support to the CSL testing firm necessary to do the CSL testing Work.

00921.48(b) Contractor's Crosshole Sonic Log Test Reports - Replace the paragraph that begins "Submit three copies of ..." with the following paragraph:

Submit three copies of a final CSL Test Report for each shaft tested according to ASTM D6760. Provide electronic file copies of the raw CSL data measurements compatible with the Cross Hole Ultrasonic Monitor (CHUM) program, if requested. Summarize the CSL testing performed, data analysis, and interpretation of CSL data with special attention made to the identification and location of any anomalies or possible defects. Provide interpretation of the CSL test data in terms of overall shaft integrity and acceptance. Submit all reports to the Engineer within 5 Calendar Days of the performance of the tests.

00921.48(c) Additional Testing and Investigation - Replace the paragraph that begins "If requested by the Engineer ..." with the following paragraph:

If requested by the Engineer, drill a core hole in any questionable quality shaft to explore the shaft condition. The number, location and depths of the core holes is determined by the Engineer. Submit the method and Equipment used to drill and remove cores from the shaft to the Engineer for review and approval prior to drilling. Use a coring method that provides complete core recovery and minimizes abrasion and erosion of the core. If a defect is confirmed, as determined by the Engineer, all investigation costs associated with identifying the defect is at no additional cost to the Agency and no extension of the Project completion date will be granted, regardless of whether the identified defect is repaired or not.

Replace the paragraph that begins "If no defect is identified ..." with the following paragraph:

If no defect is identified in the investigation Work, and the CSL tubes were satisfactorily installed according to ASTM D6760 and accepted, the Agency will pay for all coring and

excavation costs associated with the additional investigation and grant an appropriate time extension, if required, according to Section 00190 and Section 00195. If it is determined by the Engineer that the CSL tubes were not installed properly thus invalidating the CSL test results, all coring, excavation, and other investigation and evaluation costs is at no additional cost to the Agency and no extension of the Project completion date will be granted.

00921.49 Scheduling and Restrictions - Replace the paragraph that begins "Unless otherwise approved ..." with the following paragraph:

Unless otherwise approved, do not proceed with construction of subsequent shafts until the CSL testing has been completed on the first drilled shaft and the results have been approved and accepted, in writing by the Engineer. Approval to proceed with the construction of subsequent shafts, before receiving approval of the first shaft is based on the Engineer's observations of the Contractor's workmanship during construction of the first shaft and the Engineer's review and assessment of the following:

Replace the paragraph that begins "Written notification ..." with the following paragraph:

Written notification is provided to the Contractor on whether or not to proceed with subsequent shaft construction within 24 hours after completion of the first shaft. If the Engineer determines the first shaft to be of questionable quality, discontinue all shaft construction until the CSL test results of the first shaft are received and reviewed and the shaft accepted, in writing, by the Engineer.

00921.80 Measurement - Add the following to the end of this subsection:

The estimated quantities of Materials for the sign support drilled shaft foundations are:

(Fill in the blanks with the appropriate quantities. Obtain information from the designer.)

Location	Material	Quantity
Structure Type _____ (Br No. _____)	Concrete Class 3600	_____ cu. yds.
	Concrete Class 4000	_____ cu. yds.
	Uncoated Reinforcement Grade 60	_____ pounds
	Drilled Shaft Excavation	_____ cu. yds.
	CSL Tubes	_____ feet
	CSL Test	_____ each

00921.90 Payment - Replace this subsection, except for the subsection number and title, with the following:

The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per foot for the item " _____ Inch Diameter Sign Support Drilled Shaft Foundation".

The diameter of the drilled shaft is inserted in the blank.

Payment will be payment in full for furnishing and placing all Materials, and for providing all Equipment, labor, and Incidentals necessary to complete the Work as specified. Work completed according to Section 00920 is Incidental to this Section.

No separate or additional payment will be made for:

- Providing drilling Equipment
- Temporary casings
- Drilled shaft excavation
- Drilled shaft concrete
- Drilled shaft reinforcement
- CSL Equipment mobilization
- CSL test access tubes
- CSL tests
- Shaft clean out below the bottom of shaft shown