ITEM 551.00010001 - CROSSHOLE SONIC LOGGING (CSL) OF DRILLED SHAFTS

DESCRIPTION

This work shall consist of conducting testing and reporting on the results of crosshole sonic logging (CSL) of drilled shafts in accordance with the contract documents and as directed by the Engineer. The selection of the testing organization is subject to the approval of the D.C.E.T.S. The CSL test is used to evaluate the integrity of the shaft concrete by measuring the response of an ultrasonic pulse traveling from a signal source in one access pipe to a receiver in another access pipe.

MATERIALS

Provide schedule 40 steel access pipes with the material and dimensions specified in the contract documents. Provide pipes with a round and constant internal diameter free of defects or obstructions, including any at pipe joints. Use watertight pipes free from corrosion with clean internal and external surfaces. Equip each pipe with a watertight threaded cap on the bottom and a removable threaded cap on the top.

Provide cement or sand-cement grout for filling access pipes. The Contractor's proposed grouting methods and grout mixes are subject to the approval of the Engineer. All grout constituents must meet the material requirements of Section 700.

Provide water that meets the requirements of Subsection 712-01.

CONSTRUCTION DETAILS

EQUIPMENT

Provide CSL equipment which consists of the following components:

- A microprocessor based CSL system for display of individual CSL records, analog-digital conversion and recording of CSL data, analysis of receiver responses and printing of CSL logs.

- Ultrasonic source and receiver probes for 1.5 in. or 2.0 in I.D. pipe, as appropriate.

- An ultrasonic voltage pulser to excite the source with a synchronized triggering system to start the recording system.

- A measurement device to determine the depth of records.
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- Appropriate filter/amplification and cable systems for CSL testing.

PROCEDURE

Install the access pipes in the shafts specified to be tested as per the contract plans. The number of pipes per shaft and the location of the pipes within the shaft are detailed on the plans. Secure the pipes to the rebar cage prior to the placement of the cage in the shaft.

After placement of the reinforcement cage, fill the pipes with water before or immediately after concrete placement and cap the pipe tops. The pipes shall be parallel to the longitudinal axis of shaft. Exercise care in the removal of caps from the pipes after installation of the shaft concrete so as not to apply excess stress that may break the bond between the pipes and the concrete.

Provide the shaft toe and top elevations, along with construction dates to the testing organization prior to the CSL testing. Conduct CSL tests between pairs of pipes, in the pair configurations shown on the plans. Additional tests may be conducted in the event any anomalies are detected in the specified logs.

Remove slack from the cables prior to raising the probes to provide for accurate depth measurement in the CSL records. Raise the probes simultaneously, starting from the bottom of the access pipes. Take CSL measurements from the toe to the top of each shaft at intervals of 2 3/8 in. Conduct the CSL testing with the source and receiver probes in the same horizontal plane unless test results indicate potential anomalies/defects in which case the questionable zone may be further evaluated with angled tests (source and receiver vertically offset in the pipes). Report anomalies/defects indicated by longer pulse arrival times and significantly lower energy/amplitude signals to the Engineer at the time of testing.

Provide a preliminary report to the D.C.E.T.S. within two working days and final report within five working days of completion of the testing at each substructure. The CSL results shall be presented to the Engineer in a report. The report shall include recommendations as to the acceptability, unacceptability, soundness, etc., of the drilled shaft. The report shall be checked, stamped approved, and signed by a Professional Engineer registered in New York. The report shall be submitted directly to the Engineer. The test results shall include CSL logs with analyses of:

a. Initial pulse arrival time versus depth
b. Pulse energy/amplitude versus depth

A CSL log shall be presented for each tube pair tested with any defect zones indicated on the logs and discussed in the test report as appropriate. If the CSL test reveals defects in the concrete, the defects will be accessed by coring and will be repaired. The repair procedure is subject to the approval of the Engineer. CSL testing will be conducted at the Contractor's expense to verify the repair of the defects.
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Upon completion of the CSL testing and acceptance of the drilled shafts by the D.C.E.T.S., remove the water from the access pipes and fill the pipes to the top of the drilled shaft with a cement or sand-cement grout. Cut off the pipes flush with the top of the drilled shaft.

**Core Drilling of Drilled Shaft Concrete.** Production or demonstration drilled shafts that are determined to be unacceptable by the CSL tests may be cored to determine the quality of the shaft. The required number and depth of cores will be determined by the Engineer.

The core bit used for core drilling shall be warranted by the manufacturer as being adequately capable of coring the concrete. A new bit or new core barrel will be required at any time the Engineer determines that the equipment may not be capable of obtaining good quality cores. The minimum diameter of the cores shall be 3.0 inches.

An accurate log of cores shall be kept and the cores shall be placed in a crate and properly marked showing the shaft depth at each interval of core recovery. The cores along with three copies of the coring log shall be transported to the Department’s lab for inspection.

Construction shall not proceed above a drilled shaft until the quality of the shaft, as represented by the core samples, is determined to be acceptable and notification to continue construction is provided by the Engineer.

If the quality of the drilled shaft is determined to be unacceptable, the Contractor shall construct another foundation to carry the load that will be placed on the shaft or perform corrective work as required by the Department. This foundation or the corrective work shall be constructed without compensation from the Department. The details of the replacement foundation shall be submitted in accordance with the requirements given in Subsection 105-16 for Shop Drawings.

**Cross Hole Tomography.** If the CSL records are inconclusive or show an anomaly, the Engineer may require coring or the performance of Crosshole Tomography to verify the shaft condition. The details of the Crosshole Tomography, if directed by the Engineer, shall be submitted to him for review and approval. The Crosshole Tomography analysis shall include the development of three dimensional volumetric images for the entire shaft. This shall be presented in color and coded to indicate variations in sonic velocity. The images and complete discussion of the data shall be presented in the report by the testing firm.

**METHOD OF MEASUREMENT**

This work will be measured as the number of drilled shafts on which crosshole sonic logging (CSL) testing is performed and found to be void free in accordance with the specification.
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BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily perform CSL testing and report the results. The cost of repairing possible defects in the shaft concrete and additional CSL testing to verify the effectiveness of the repairs is at the Contractor's expense.