

## **ITEM 551.96 17 - CROSSHOLE SONIC LOGGING (CSL) OF DRILLED SHAFTS**

### **DESCRIPTION**

Conduct Crosshole Sonic Logging (CSL) on drilled shafts where indicated on the plans or where ordered by the Engineer and report the results. 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 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 40 mm or 50 mm 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.
- 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 location of the pipes within the shaft is 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.

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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 60 mm. 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. Include in the test results CSL logs with analyses of:

- Initial pulse arrival time or compression wave velocity versus depth.
- Pulse energy/amplitude versus depth.

Present a CSL log for each pipe pair tested and discuss any anomaly/defect zones in the 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.

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.

### **METHOD OF MEASUREMENT**

The work is measured by each drilled shaft on which CSL testing is performed and found to be void free in accordance with the specification.

### **BASIS OF PAYMENT**

The unit price bid for the CSL testing on each pile includes the cost of all labor, materials and equipment necessary to 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.