

SAMPLE GUIDE SPECIFICATIONS FOR OSTERBERG CELL LOAD TESTING OF DRILLED SHAFTS

1.0 DESCRIPTION

This work shall consist of furnishing all materials and labor necessary for conducting an Osterberg Cell (O-cell) Load Test and reporting the results. The Contractor will be required to supply material and labor as hereinafter specified and including prior to, during and after the load test. The drilled shaft used for the load test program will be instrumented by LOADTEST, Inc. (the Osterberg Cell supplier) or others, as approved by the Engineer. The Osterberg cell load test will be conducted by LOADTEST, Inc. or others, as approved by the Engineer, with the Contractor providing auxiliary equipment and services as detailed herein. The O-cell load test is a non-destructive test and is suitable for both dedicated test shafts and production test shafts. If the test shaft is constructed at a production shaft location (intended to carry structural service loads) it shall be left in a condition suitable for use as a production shaft in the finished structure.

2.0 MATERIALS

The Contractor shall supply all materials required to install the Osterberg cell, conduct the load test, and remove the load test apparatus as required.

2.1 Osterberg Cell Assembly - The Contractor shall furnish one (1) or more Osterberg Cell assemblies as required for each load test, to be supplied by:

LOADTEST, Inc.
2631-D NW 41st Street
Gainesville, FL 32606

Phone: **(800) 368-1138**
 (352) 378-3717
Fax: **(352) 378-3934**

The Osterberg cell assemblies to be provided shall have a capacity of at least ___ kips in each direction and shall be equipped with all necessary hydraulic lines, fittings, pressure source, pressure gage and telltale devices.

2.2 Required materials include, but are not limited to the following:

- a) Fresh, clean, potable water from an approved source to be used as hydraulic fluid to pressurize the Osterberg Cell(s).
- b) Materials sufficient to construct and shade a stable reference beam system for monitoring movements of the shaft during testing. The system shall be supported at a minimum distance of 3 shaft diameters from the center of the test shaft to minimize disturbance of the reference system. A tripod shall be provided to support an automated digital survey level used to monitor movement of the reference system during testing.

Alternatively, two survey levels located in excess of three shaft diameters may be used to monitor the top of shaft displacement in lieu of the beam. In this case, two tripods and weather protection (Quikshade) shall be provided.

- c) Materials sufficient to construct a protected work area (including provisions such as a tent or shed for protection from inclement weather for the load test equipment and personnel) of size and type required by the Engineer and LOADTEST, Inc. In the case of cold weather, the protected work area shall be maintained at a temperature above 40° F in order to insure

proper operation of the load testing equipment.

- d) Stable electric power source, as required for lights, welding, instruments, etc.
- e) Materials such as angle or channel iron, steel bearing plates and/or other devices needed to attach O-cell assembly to rebar cage or carrying frame, as required.

2.3 Materials supplied which do not become a part of the finished structure become the responsibility of the Contractor at the conclusion of the load test and shall be removed from the job site.

3.0 EQUIPMENT

The Contractor shall supply equipment required to install the Osterberg cell assembly, conduct the load test, and remove the load test apparatus as required. Required equipment includes but is not limited to:

- a) Welding equipment, qualified welding personnel and labor, as required, to assemble the test equipment under the supervision of LOADTEST, Inc. personnel, attach instrumentation to the Osterberg cell(s), and prepare the work area.
- b) Equipment and labor to construct the steel reinforcing cage and/or placement frame including any steel bearing plates required for the test shaft.
- c) Equipment and operators for handling the Osterberg cell, instrumentation and placement frame or steel reinforcing cage during the installation of the Osterberg cell and during the conduct of the test, including but not limited to a crane or other lifting device, manual labor, and hand tools as required by LOADTEST, Inc. and the Engineer.
- d) Equipment and labor sufficient to erect the protected work area and reference beam system, to be constructed to the requirements of the Engineer and LOADTEST, Inc.
- e) Air compressor (minimum 185 cfm, 125 psi) for pump operation during the load test.

4.0 PROCEDURE

4.1 For the drilled shaft(s) selected for testing by the Engineer, the Contractor shall construct the drilled shaft using the approved shaft installation techniques until the drilled shaft excavation has been completed. This includes both dry and wet (slurry) methods.

4.2 The Osterberg Cell, hydraulic supply lines and other instruments will be assembled and made ready for installation under the direction of LOADTEST, Inc. and the Engineer, in a suitable area, adjacent to the test shaft, to be provided by the Contractor. The Osterberg Cell assembly shall be welded to the rebar cage or carrying frame. The plane of the bottom plate(s) of the O-cell(s) shall be set at right angles to the long axis of the cage. The Contractor shall use the utmost care in handling the test assembly so as not to damage the instrumentation during installation. The contractor shall limit the deflection of the cage to two (2) feet between pick points while lifting the cage from the horizontal position to vertical. The maximum spacing between pick points shall be 25 feet. The contractor shall provide support bracing, strong backs, etc. to maintain the deflection within the specified tolerance. The O-cell assembly must remain perpendicular to the long axis of the reinforcing cage throughout the lifting and installation process.

4.3 When the test shaft excavation has been completed, inspected and accepted by the Engineer, the O-cell assembly and the reinforcing steel may be installed. A seating layer of concrete shall be placed by an approved method, in the base of the shaft to provide a level base and reaction for the O-cell. The preferred method is to install the O-cell assembly and deliver the seating

layer using a pump line or tremie pipe extending through the O-cell assembly to the base of the shaft. Depending on the configuration of the test assembly, it may be necessary to deliver the seating layer of concrete prior to installing the O-cell. In this case, the O-cell assembly shall be installed while the concrete at the base is still fluid, under the direction of LOADTEST, Inc. and the Engineer. The Osterberg Cell should end up at least partially submerged and firmly seated into the base concrete.

- 4.4** After seating the Osterberg cell, the remainder of the drilled shaft shall be concreted in a manner similar to that specified for production shafts. At least four (4) concrete test cylinders, in addition to those specified elsewhere, shall be made from the concrete used in the test shaft, to be tested at the direction of LOADTEST, Inc. At least one of these test cylinders shall be tested prior to the load test and at least two cylinders shall be tested on the day of the load test.
- 4.5** During the load test, no casings may be vibrated into place in the foundation area near the load test. Drilling may not continue within a 100-foot radius of the test shaft. If test apparatus shows any interference due to construction activities outside of this perimeter, such activities shall cease immediately.
- 4.6** After the completion of the load test, and at the direction of the Engineer, the Contractor shall remove any equipment, material, waste, etc. which are not to be a part of the finished structure. If the load test shaft is constructed at a production location and intended to carry service loads, the Contractor shall grout the interior of the Osterberg cell and annular space around the outside of the Osterberg cell using grouting techniques approved by the Engineer and LOADTEST, Inc.

5.0 TESTING AND REPORTING

The load testing shall be performed by a qualified geotechnical engineer approved in advance by the Engineer. The geotechnical engineer must have a demonstrated knowledge of load testing procedures, and have performed at least 10 Osterberg cell load tests within the past two years.

The load testing shall be performed in general compliance with *ASTM D 1143 Standard Test Method for Piles Under Static Axial Load* using the Quick Load Test Method for Individual Piles. Initially the loads shall be applied in increments equaling 5 to 10% of the anticipated ultimate capacity of the test shaft. The magnitude of the load increments may be increased or decreased depending on the project requirements but should not be changed during the test.

Direct movement indicator measurements should be made of the following: O-cell expansion either directly or with telltales (minimum of 3 indicators required), upward top-of-shaft displacement (minimum of 2 indicators required) and shaft compression above O-cell (minimum of 2 indicators required).

Loads shall be applied at the prescribed intervals until the ultimate capacity of the shaft is reached in either end bearing or side shear, until the maximum capacity or maximum stroke of the O-cell is reached, or unless otherwise directed by the Engineer.

At each load increment, or decrement movement indicators shall be read at 1, 2, 4 and 8-minute intervals while the load is held constant.

During unloading cycles the load decrement shall be such that at least 4 data points are acquired for the load versus movement curve. Additional cycles of loading and unloading using similar procedures may be required by the Engineer following the completion of the initial test cycle.

Displacement sensors used to measure O-cell expansion and top-of-shaft displacement should have a minimum travel of 4 inches and be capable of being read to the nearest 0.001 inch division. When O-cell expansion is measured directly, LVWDTs capable of measuring the full stroke of the Osterberg Cell will be used (typically 6 inches). Displacement sensors used to measure shaft compression should have a minimum travel of 1 inch and be capable of being read to the nearest 0.001 inch division.

Unless otherwise specified by the Engineer, the Contractor will supply five (5) copies of a report of each load test, as prepared by LOADTEST, Inc. or others approved by the Engineer. An initial data report containing the load-movement curves and data tables will be provided to the Engineer within ____ working days (*minimum 3 working days*) of the completion of load testing, to allow evaluation of the test results. A final report on the load testing shall be submitted to the Engineer within ____ working days (*minimum 7 working days*) after completion of the load testing.

6.0 POST-TEST GROUTING PROCEDURES FOR PRODUCTION DRILLED SHAFTS TESTED WITH AN OSTERBERG CELL

During the O-cell test, the shaft breaks on a horizontal plane separating the upper section above the O-cell (upper side shear) from the lower section below (combined end bearing and lower side shear). This creates an annular space, the size of which depends on the shaft/O-cell geometry and the expansion of the O-cell.

When a production shaft has been tested, the Engineer may want to include the end bearing component from the lower section in order to obtain sufficient capacity of the production shaft. In such cases the contractor will be required to grout the O-cell™ and the annular space around the O-cell™ in order to allow load transfer to the lower side shear and end bearing.

6.1 POST-TEST GROUTING OF OSTERBERG CELLS (O-CELLS)

- a) The grout shall consist of Portland cement and water only, **NO SAND**. The grout shall be fluid and pumpable. An initial mix consisting of 6 to 7 gallons of water per 95-lb bag of cement is recommended. Adjust water to obtain desired consistency.
- b) The mixing shall be thorough to ensure that there are no lumps of dry cement. Pass the grout through a window screen mesh before pumping.
- c) Connect the grout pump outlet to one hydraulic line of the O-cell. Open the other line and establish a flow of **water** through the system.
- d) Pump the grout through the O-cell hydraulic line while collecting the effluent from the bleed line. Monitor characteristics of effluent material and when it becomes equivalent to the grout being pumped, stop pumping.
- e) Take three samples of the grout for compression testing @ 28 days, if required.

Recommended pre-mixed amount of grout for grouting of O-cell:						
O-cell Diameter (Inches)	9	13	16	21	26	34
Grout Volume (Cubic Feet)	3	4	5	7	9	13

6.2 POST-TEST GROUTING OF ANNULAR SPACE AROUND OSTERBERG CELLS (O-CELLS)

- a) Prepare a fluid grout mix consisting of Portland cement and water only, **NO SAND**. The mixing procedures should be as outlined for grouting the O-cells. The quantity of grout should be at least three (3) times the theoretical volume required to fill the annular space and grout pipes.
- b) Pump **water** and establish a flow through the grout pipes (two per shaft).
- c) Pump the fluid grout through one of the grout pipes until grout is observed flowing from the second grout pipe or until 1.5 times the theoretical volume has been pumped.
- d) If no return of grout is observed from the second grout pipe, transfer the pump to the second pipe and pump grout through it until 1.5 times the theoretical volume has been pumped.
- e) If higher strength grout is deemed necessary, immediately proceed with pumping the higher strength grout (which may be a sand mix). The pumping procedures for this grout will be the same as described above for the initial cement-water grout. The entire grouting operation must be completed before the set time for the initial grout has elapsed.
- f) Take three (3) samples of each type of grout for compression testing @ 28 days.

Recommended pre-mix amount of grout for grouting of annular space:								
Shaft Diameter (Feet)	2	3	4	5	6	7	8	9
Grout Volume (Cubic Feet)	25	30	40	50	65	80	100	125

7.0 METHOD OF PAYMENT

The drilled shaft Osterberg Cell load tests shall be considered as any material, labor, equipment, etc. required above the requirements of drilled shaft installation. This item should include everything necessary to assemble, install, conduct and remove the drilled shaft load test, under the direction of the Engineer and LOADTEST, Inc. representatives. All costs associated with the normal production of the drilled shafts are measured and paid for elsewhere in the contract documents.

8.0 BASIS OF PAYMENT

The complete and accepted "Drilled Shaft Osterberg Cell Load Test" shall be paid for at the contract price bid for "Drilled Shaft Osterberg Cell Load Test", each. This shall constitute full compensation for all costs incurred during the procurement, installation, conducting of the test, and subsequent removal of test apparatus and appurtenances.

Payments shall be made under:

Pay item:

Pay unit:

Drilled Shaft Osterberg Cell Load Test

Each