DETAILS

FIRST OSTERBERG CELL TEST IN ARGENTINA

A world class construction project undertaken by the **Puentes del Litoral S.A.** (P.d.L.S.A.) joint venture partnership will provide a new crossing over the Parana River in Argentina. The 60 km river crossing will connect the two cities of **Rosario** and **Victoria**. A cable suspension bridge will span the main river channel and seven smaller bridges connected by embankments will cross the remaining channels and wetlands.

Following initial discussions with **Maria Elisabet Pardini** of **Comisión Transitoria,** the supervising agency for this project, and with **Enrique Hermann** of **Puentes del Litoral, S.A., LOADTEST, Inc.** (LTI) was asked to carry out the first O-cell™ test in Argentina to assess the end bearing capacity of a very stiff clay stratum in which most of the bored piles for this project are founded.

With great coordination by the **Puentes del Litoral** group and great cooperation from Trevi Icos, LTI performed three load tests on one 2000 mm and two 1800 mm bored piles. The 2000 mm pile had five cage sections (four splices) with a 27 MN O-cell™ located at its base. The 1800 mm piles had four cage sections (3 splices) both with 16 MN O-cells™ located at their base. Each splice and lowering operation took an average of 2.5 hours. **Michael Ahrens** and **Santiago Perazzo** assisted in the assembly and installation of the piles and carried out the testing.

Test loads of 15.7 MN and 13.0 MN were applied to the 2000 mm and 1800 mm piles respectively, confirming that relatively high unit end bearing values could be used for the founding design.

LOADTEST

ANOTHER SINGAPORE SUCCESS STORY

When **Marco Lucchi (Technical Manager)** of **TREVI Singapore** needed a proof load test performed from well above concrete cut-off level (COL) on a congested site, he knew that the O-cell™ method was the only way to go. The pile was located at the proposed Farrer Park Station for Singapore's new **Mass Rail Transit - North East Line**.

Fitted with three 330mm diameter O-cells™, this 1.2 meter diameter pile was designed to be tested to 12.7 MN. The test pile was initially constructed from street level, almost 10 meters above concrete cut-off level (COL), and (after a few inevitable delays) less than a week ahead of proposed excavation of that area. Due to the ambitious excavation schedule, it quickly became apparent that testing would have to be performed after excavation to COL! Construction required an extremely large, braced excavation to depths approaching 20 meters below street level. Fortunately for all parties, this was of no consequence for the performance of the Osterberg Cell test.

Testing proceeded approximately one month after installation but to everyone's surprise, the upper side shear approached ultimate capacity at an applied load of 5.9 MN- only 56% of the assumed ultimate side shear capacity of the silty clays at the site. The **Hyundai-Zublin** design team feverishly set to work on a solution for providing an additional 170 tonne reaction necessary to test the pile to the required 1.5 times design load. Given the restrictive 2-meter clearance imposed by the massive structural bracing, **Hyundai-Zublin** soon came up with the only solution that would work. Construct part of the pile cap to use as reaction.

In June 1999, over 6 months after the pile was installed, Part II of the load test was performed. Thanks to O-cell™ technology and performance, the pile was successfully loaded to 170% of the design load and the settlements were well within the acceptable tolerances.

Denton Kort

DEEP IN THE HEART OF TEXAS

LOADTEST, Inc. recently performed two axial load tests and one lateral load test for the **Hays Power Project** in San Marcos, Texas. **ATS Drilling** (an ADSC member) was the drilled shaft contractor and **TIC-The Industrial Company,** the general contractor. **Drash Consulting Engineers, Inc.** were the project geotechnical engineers. The shafts were constructed dry in progressively harder consolidated clay.

The first axial test was designed to obtain ultimate side shear (SS) values and the second to obtain ultimate end bearing (EB) values. The shafts were 30 inches in diameter and positioned 10 feet apart (on-center) for lateral testing. Both shafts were monitored during the lateral test and the EB test shaft data used for analysis. The EB test shaft moved upward very little during the axial testing, and therefore had little impact on the results of the lateral test.

After reaching the 900 kip nominal O-cell™ capacity, the top of the side shear test shaft had moved only 0.08 inches. In the interest of getting the ultimate shear data, the testing team decided to proceed beyond nominal capacity. We loaded the test shaft to 1,312 kips and although still not at ultimate, it had moved 0.76 inches, was beginning to creep and had exceeded the design load by a factor of 10. The EB test shaft was loaded to 900 kips at 10,000 psi without reaching ultimate. Since it had moved 1.38 inches downward, no more useful information could be gained by applying additional loads. The lateral load test approached its maximum design deflection of 0.25 inches after applying four times the design load (80 kips).

This testing program was highly cost-effective. Time and money were saved by using the axial test shafts for the lateral load test and by having LOADTEST Inc. personnel install, test and prepare reports. The installation, testing and reporting was completed within five days (with two of three reports completed before LTI engineers left the site).

Robert Simpson

COMPRESSIBLE END BEARING APPARATUS (CEBA) DEVELOPED

LOADTEST Inc. performed four Osterberg Cell load tests as part of CALTRANS Seismic Retrofit Program at the **Benicia Martinez Bridge** in the **San Francisco** area. The foundation consisted of adding new drilled shafts to each pier and improving the strength of the existing drilled shafts by boring through them and later inserting grouted pipe piles that surpassed the existing depths. Two drilled shafts (66 and 69 inches in diameter, 102 and 170 feet long) and grouted pipe piles (17 inches in diameter, 83 and 167 feet long) were tested. The purpose of the test was to test the side shear characteristics of the rock sockets for these new foundations.

To meet these requirements, LOADTEST, Inc. engineers developed a compressible end bearing apparatus (CEBA) attached to the tip of the pile or re-bar cage to prevent load transfer to end bearing. The O-cell ™ assembly was placed near the middle of the rock socket in each test, thus allowing downward shear to be measured in one half of the rock socket and upward shear in the other half. The CEBA was composed of foam cylinder, an hydraulic jack in the center and two levels of expandable bladders on the outside. Once the O-cell™ pile assembly was positioned in the shaft, the hydraulic jack was pressurized to support the weight of the pile during grout and concrete placement. The bladders were expanded with water and brought into contact with the walls of the shaft to prevent concrete from entering the zone of compressible end bearing material. The jack and bladders were depressurized just prior to the start of the tests.

FCI Constructors Interbeton, Inc. under the direction of **Mr. Paul Rudloff, Mr. Lynn Davis** and **Mr. Bradley Colton,** constructed the piles and drilled shafts. John (Rick) Usab, Ivan Guzman and Michael Ahrens from **LOADTEST Inc.** assembled and performed the tests. The total applied loads to the sockets on the 17 inch, 83 ft and 167 ft long grouted pipe piles exceeded 2,500 kips and 2,400 kips respectively. The total load applied to the socket of the 66 inch diameter, 102 ft drilled shaft exceeded 18,500 kips and the applied load exceeded 17,900 kips for the socket of the 69 inch diameter, 170 ft shaft. These highly successful tests were observed by representatives of the **California Department of Transportation** and by **Mr. Mike Holloway, P.E. of InSituTech, Ltd.,** Orinda, CA.

Ivan Guzman

LOADTEST, Inc. has performed over 400 O-cell™ tests to date!

AN INNOVATIVE SINGLE-LEVEL O-CELL™ TEST IN FLORIDA

An innovative drilled shaft axial load test was performed by **LOADTEST, Inc.** as part of a bridge widening project over the Hillsborough River in **Tampa, FL.** ADSC member **Coastal Caissons** constructed the test shaft. The purpose of the test was to obtain ultimate skin friction information in the clay layer below the O-cell™ and also in the much stronger limestone layer above the O-cell™. Designed by **Ross McGillivray** of **Ardaman & Associates** and LOADTEST Inc., the test included one O-cell™, positioned approximately midway in the shaft. In addition, there was interest in obtaining end bearing values. The problem was that the creep and strain data for the clay layer would be affected by the end bearing. If a "zero end bearing" device used enough reaction to test, the upper limestone would not be mobilized. Budgetary constraints prevented a multi-level test. The solution devised by LOADTEST, Inc. was to use an isolation device placed at the bottom of the shaft, which allowed the lower portion of the shaft to travel only 1 inch downward before the end-bearing reaction was engaged. After obtaining excellent data for the isolated clay zone, the end bearing was engaged, adding reaction sufficient to exceed the capacity of the upper limestone shear. At the same time the total end bearing resistance was determined. The shaft was tested to 2,580 kips. Once again O-cell™ technology and innovation proved to be cost-effective.

Robert Simpson

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O-CELL™ TESTING PROVES VALUABLE IN BUSY DOWNTOWN ALBANY

Engineers again decided to test the strength of the Snake Hill shale formation that underlies Albany, New York. Drilled shafts seemed the only viable foundation option considering noise and vibration concerns at the congested downtown State Street site location. **Rolf Leininger** of **Stopen Engineering** decided that O-cell™ testing would be the most effective way to determine the unit end bearing and side shear values for the foundation design for the new Office of the State Comptroller. Support and test design by **Wiedlinger Associates, Inc.** and **STS Consultants** made the testing program a reality.

TREVI ICOS Corporation constructed the 36 inch diameter dedicated drilled test shaft with a 12 foot shale rock socket. **LOADTEST, Inc.** performed the test on the rock socket with tremendous results. Although the ultimate capacities were not reached for either end bearing or side shear, the shaft was loaded to a capacity of 4280 kips in each component. With minimal deflections, the drilled shaft was loaded to a combined capacity of 8560 kips. This loading surpassed the anticipated ultimate by a factor of three.

Once again, the O-cell™ proved an invaluable tool for foundation design verification, construction method verification, and value engineering. As a result, design engineers were able to redesign the foundation and reduce the diameters of several of the foundation elements for this project. Information from this test will help in design of future foundations in this area.

John F. (Rick) Usab

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