Three Steps

MANAGING RISK WITH FUGRO LOADTEST'S INNOVATIVE SOLUTIONS

Fugro Loadtest is dedicated to advancing the deep foundation industry managing risk with O-Cell®, SONICaliper™, and RIM-Cell® technologies to provide safe, efficient, and innovative foundation solutions worldwide.

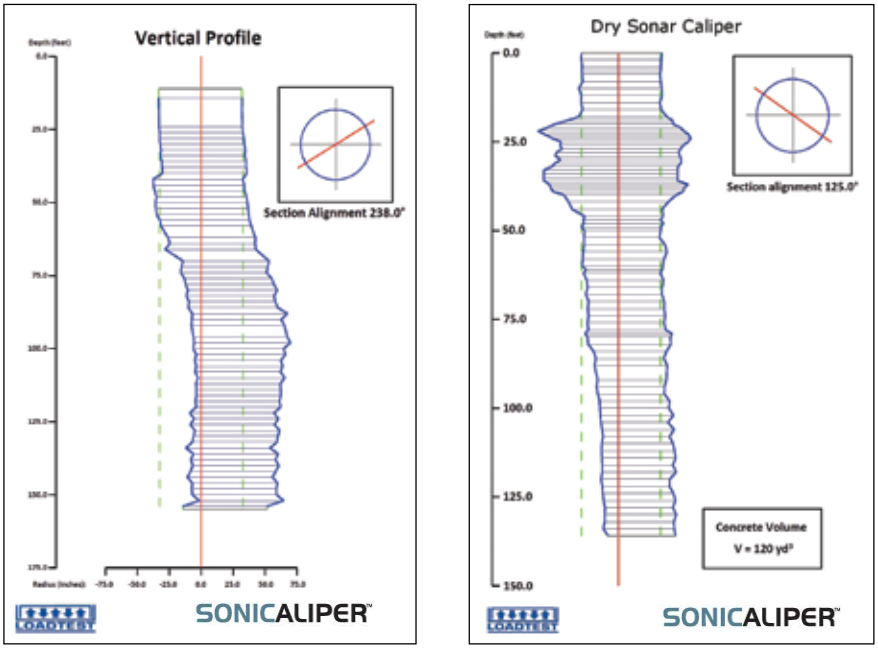
O-CELL – DESIGN CALIBRATION

The Osterberg Cell (O-Cell) is the premier foundation element static load testing method. No project is too big or too small to recognize economic benefit from use of the O-Cell. They have been successfully used to test a variety of foundation elements including drilled shafts, auger cast piles, barrettes, driven piles, and helical piles. To date, Loadtest has conducted thousands of successful O-Cell tests in over 60 countries. Loadtest is approaching a quarter century of foundation performance advancement as demonstrated by the increasing world record load test history, including the current 2013 Louisville, KY 72,600 kip record. This demonstrates the ability of the O-Cell to measure true geotechnical capacity allowing for designs to be pushed to more economic performance levels. Many ultra-high capacity foundations are designed today as a direct result of Loadtest's ability to calibrate and verify foundation performance.

The O-Cell's ability to provide geotechnical failure in the foundation materials makes it the optimal risk management tool for establishing key design calibration information. Foundation design optimization seeks economy by maximizing the use of available materials strengths. This calibration approach requires the consideration of risk in quality construction and final product performance. The risk management approach to construction quality considers the question of construction influences and identifies construction issues to prevent.

SONICALIPER – CONSTRUCTION RISK MANAGEMENT

Managing drilled foundation element construction risk requires understanding how defects, which affect foundation performance, can occur in the manufacturing process. Excavation conditions prior to concrete placement influence foundation element quality. This directly relates to the foundation's ability to safely service the needed loads.



SONICaliper output depicting shaft excavation misalignment and out of plumbness.

Interpreting load test data from excavations with cross sectional area variations was the incentive for SONICaliper development. As with many developments additional beneficial uses become apparent after implementation.

SONICaliper measures the excavation shape and determines the actual excavation volume as compared to theoretical plans volume, information which assures sufficient concrete delivery. This information allows for planning assuring proper tremie embedment, minimizing potential for cold joints or defects from tremie broaching.

Physics dictate that a decrease in SONICaliper return is directly related to presence of particulate in the slurry column; an indication of a need for rechecking the excavation slurry cleanliness parameters against specification requirements. Slurry cleanliness is of import as settling particulate can aggregate at the excavation tip reducing end bearing capacity and/or settle on the top of the concrete column, becoming deposited as defects causing reduced lateral capacity.

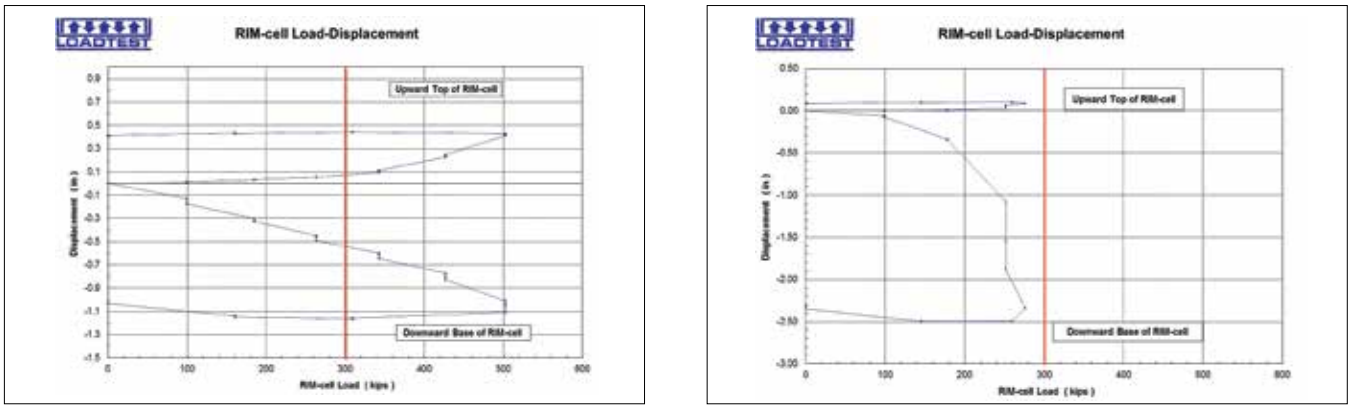
SONICaliper measurement of excavation alignment is quality critical as reinforcement steel placement can drag side wall materials into the excavation also producing soft toes and defects in the lateral resistance area.

The SONICaliper is a cost-effective construction risk management tool for QA/QC of deep foundation elements such as drilled shafts, slurry walls (barrettes) and secant walls.

RIM-CELL – PERFORMANCE VERIFICATION

Reliability Improvement Method, or RIM-Cell, is the latest technology in drilled shaft load confirmation and performance QA/QC. The RIM-Cell provides proof-loading of production foundation elements confirming, as constructed, design performance. The RIM-Cell is designed with drilled shafts constructability in mind with its large open center to minimize shaft toe disturbance and concrete flow obstruction during placement. Lightweight and simple, the RIM-Cell attaches easily to the tip of the reinforcing cage.

The use of grout as the pressurizing fluid restores pile integrity after verifying foundation



RIM-Cell Verification adjoining shafts, same plans dimensions; first shaft did not verify for 600 kip capacity (red line), second shaft verified for 600 kip capacity (red line).

element performance. Applied as a two stage process; stage one, the grout, confined in the rim, applies pressure at the pile toe and along the pile shaft verifying performance; stage two, grouts the annulus crack created in the first stage restoring integrity.

Proof of foundation element performance to 1.2-1.3 times the required code loading (design, service, or resistance) verifies the design and minimizes two of the most troubling sources of uncertainty: site variability and construction defects. Use RIM-Cell as a statistical tool to verify foundation element design performance matches the LRFD code logic. It simultaneously reduces uncertainty and improves reliability. Knowledgeable upfront application confirms economical optimized geotechnical design parameters via lower factors of safety for ASD or higher resistance factors for LRFD codes.

A secondary risk management benefit from RIM-Cell verification is its action as a post-construction stressing device. Unlike traditional base-grouting, the RIM-Cell's grout pressure confinement offers high static pressure and a known load in every soil condition. This post-construction stressing engages the shaft end bearing resistance, reduction of settlement, and consolidation of loose material at the shaft toe, producing a stiffer initial response. Additionally, it reverses direction of the initial skin friction response, pre-loading it also providing an initial stiffer load response.

Fugro Loadtest's O-Cell, SONICaliper, and RIM-Cell technologies combine to provide opportunity for foundation optimization from the design and construction into service. This three-step risk management approach of design calibration, construction quality and verification together produces the most economical efficient foundation possible. ■