



A LRB 355, the newest piling and drilling rig from Liebherr, in operation for the construction company Hilti & Jehle.

“With the LRB 355 from Liebherr we have a modern, top-line machine at our disposal. Thanks to its multifunctionality the quality of foundation work is improved and, at the same time, we are more flexible and can work more efficiently,” said Project Manager Markus Maehr from Hilti & Jehle.

The most recent jobsite for the LRB 355 was in St. Gallen, Switzerland. There it was equipped with the double rotary drive type DBA 300. In combination with a Liebherr concrete pump type THS 80 D-K, the piling and drilling rig was used to insert 316 piles for a secant pile wall.

This foundation work is for a multi-story office and apartment building. The piles have a diameter of 900mm and lengths of between 18 and 22m. Despite challenging soil conditions and remarkable drilling depths for this particular type of application, a mere 1.5 hours was required to complete one pile.

In addition to drilling with a double rotary drive, the LRB 355 can also be used for all other common drilling methods, for example, Kelly drilling, full displacement drilling or continuous flight auger drilling. Using the Kelly drilling method the LRB 355 achieves its maximum drilling depth of 60m. Other applications for which it can be used include soil mixing and operation with vibrators and hydraulic hammers.

For information on either the LB 44 or the LRB 335 contact Tobias Froehlich at [tobias.froehlich@liebherr.com](mailto:tobias.froehlich@liebherr.com).

### Loadtest's RIM-Cell Verifies Shaft Performance for the Florida Department of Transportation

The Florida Department of Transportation capitalized on an opportunity to have Loadtest demonstrate use of the innovative Reliability Improvement Method (RIM-Cell) on drilled shafts. Working in cooperation with the University of Florida and the FDOT geotechnical research arm at the Kanapaha site, RIM-Cells were installed in each of two reaction

shafts planned for a conventional top load testing of the subject research shaft. This was an unrelated part of their primary research effort.

FDOT was interested in a demonstration of RIM-Cell as a means for verifying production of drilled shaft performance. They are intrigued by the multiple benefits achieved with the RIM-Cell. When used it becomes simultaneously a quality control proof of performance, a justification of a larger resistance ( $\phi$ ) factor, provides economical stiffening of foundation resistance, and saves time by reducing grouting steps.

Both reaction shafts were built using construction techniques common to Florida karst region soils. The first was built with no construction issues, but the second reaction shaft experienced a number of construction issues, both typical and atypical to the Florida karst region.

The East reaction excavation was surface stabilized with a 6 foot, 46 inch ID surface casing and the excavation was advanced by auger until the water table was encountered at approximately 30 feet below ground surface. A polymer slurry was then introduced and mixed into the excavation. Florida limerock, encountered at 40 feet depth, required a rock auger to advance to planned tip elevation. Base cleanout was accomplished with a cleanout bucket. The excavation bottom was judged satisfactory by weighted tape and the excavation was stable. The SoniCaliper excavation profile taken prior to concrete placement indicated a generally uniform excavation with only a slight inclination.

The West reaction shaft was constructed with techniques similar to those used for the East shaft, but with a different outcome. After reaching the water table, approximately 30 feet depth, the previously used slurry from the east shaft was added so the excavation could continue. As the excavation advanced, a loss of slurry and excavation collapse occurred about 40 feet below ground surface. In an attempt to stabilize the excavation additional slurry along with onsite standing surface water were added.

This fluid addition somewhat stabilized the excavation, allowing for continued advancement to the planned tip depth. During this time, the fluid level held at about 30 feet below the ground surface. As the excavation continued, the bottom of the digging bucket detached becoming permanently lost. After numerous retrieval attempts proved unsuccessful, attention turned to cleaning the excavation base. After appreciable effort, it was deemed that the excavation was ‘as



RIM-Cell attached to the bottom of the reinforcement cage.

good as it will get’ and cleaning efforts ceased. During the cage and concrete placement, the excavation side wall above the fluid level continued

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sloughing into the excavation. SoniCaliper inspection was not performed because of equipment loss risk, given the continuing side wall collapse.

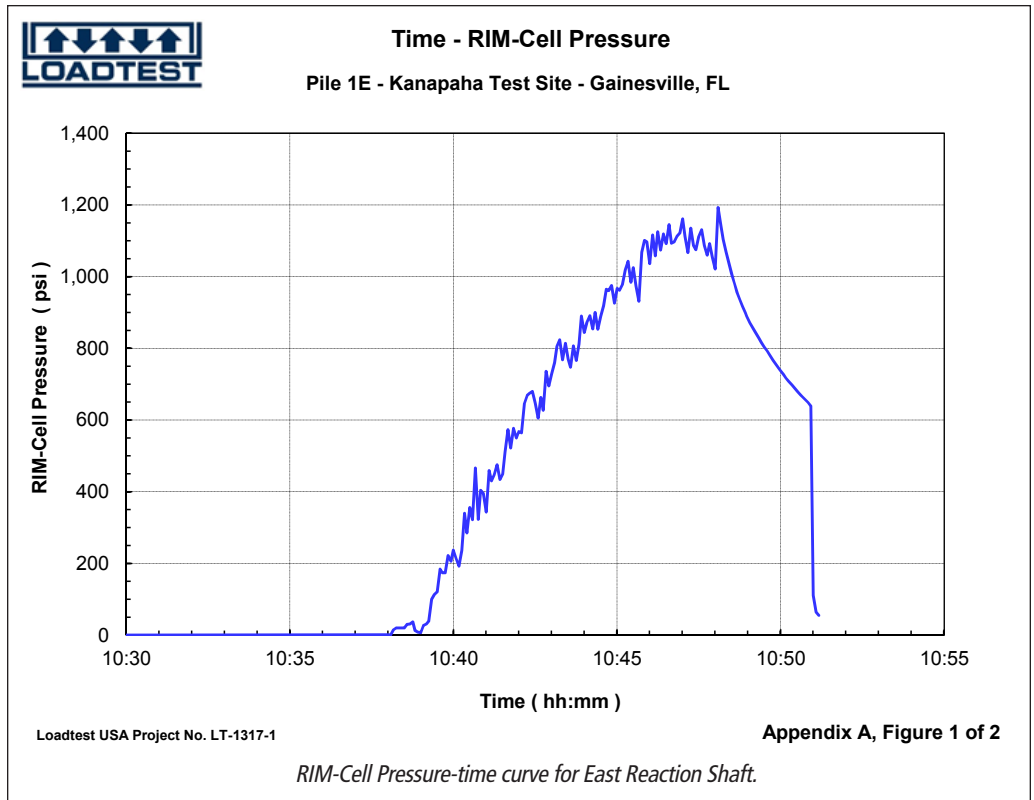
The West excavation bottom exhibited a very soft response to a weighted tape as compared to the East excavation. A condition confirmed by the RIM-Cell proof loading response.

Placement of both reinforcement cages with the attached RIM-Cells was done smoothly and concrete was successfully placed using standard shaft concreting techniques. The East shaft poured at about 15 cubic yards while the West shaft over poured, from a theoretical 13 cubic yards, at just over 23 cubic yards.

RIM-Cell proof loading commenced approximately two months after construction at which time a concrete unconfined compressive strength indicated as 6000 PSI. The East shaft RIM-Cell procedure required merely 10 minutes to complete with a downward displacement of only 0.2 inches, as demonstrated in the shown RIM-Cell pressure-time curve. The West shaft, with its soft base response required significantly more grout due to the excessive downward displacement, even requiring a brief pause to mix ad-

ditional grout. Even with the unexpected delays and the additional grout volume,

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## VERIFY WITH RIM-Cell®

### Performance Verification Proof Loading

Improve confidence in drilled shaft performance by proof loading with Loadtest's Reliability Improvement Method (RIM-Cell). Our advanced technology replaces questionable shaft base grouting techniques and verifies shaft performance while accomplishing results hoped for with base grouting. RIM-Cell improves drilled shaft reliability by managing site variability and construction issues.

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proof loading occurred within 20 minutes. The West shaft RIM-Cell pressure-time curve was not included due to space limitations, please contact Bubba Knight of Loadtest if interested in seeing it. Note that the RIM-Cells required only one grout pressurization cycle via each RIM-Cell's two flexible hoses.

The East shaft load deflection curve above demonstrates a clean bottom response to the RIM-Cell proof loading. Shaft performance was verified to a total of 700 kips with skin friction being the major contributor.

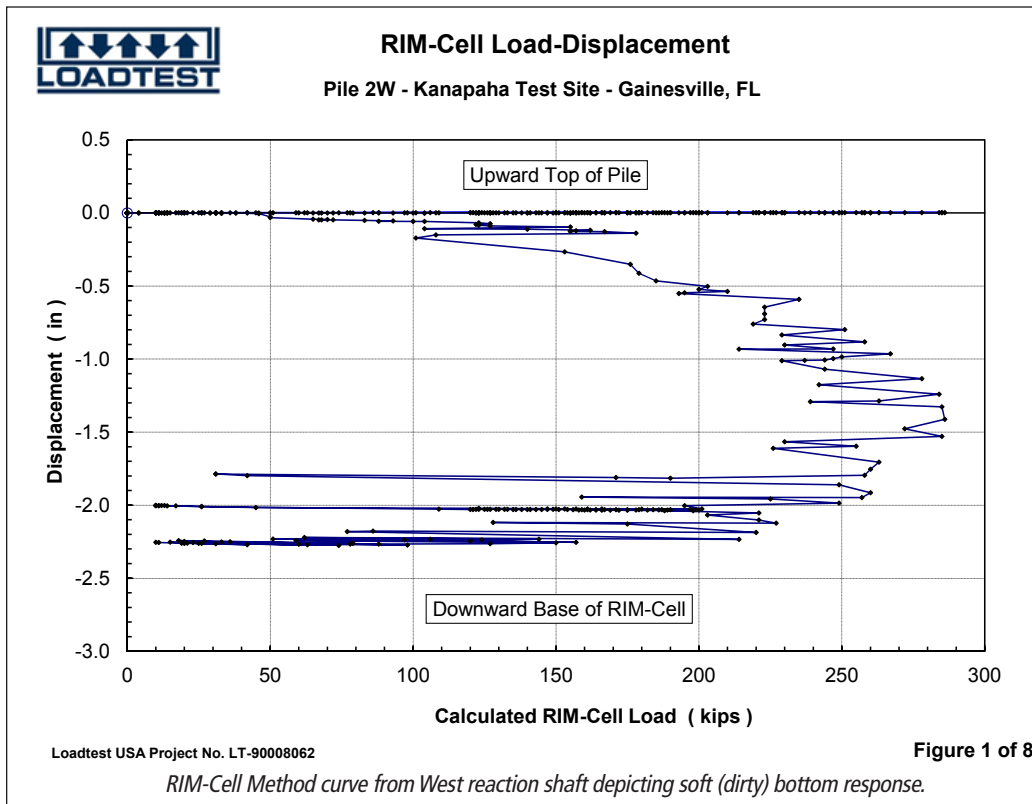
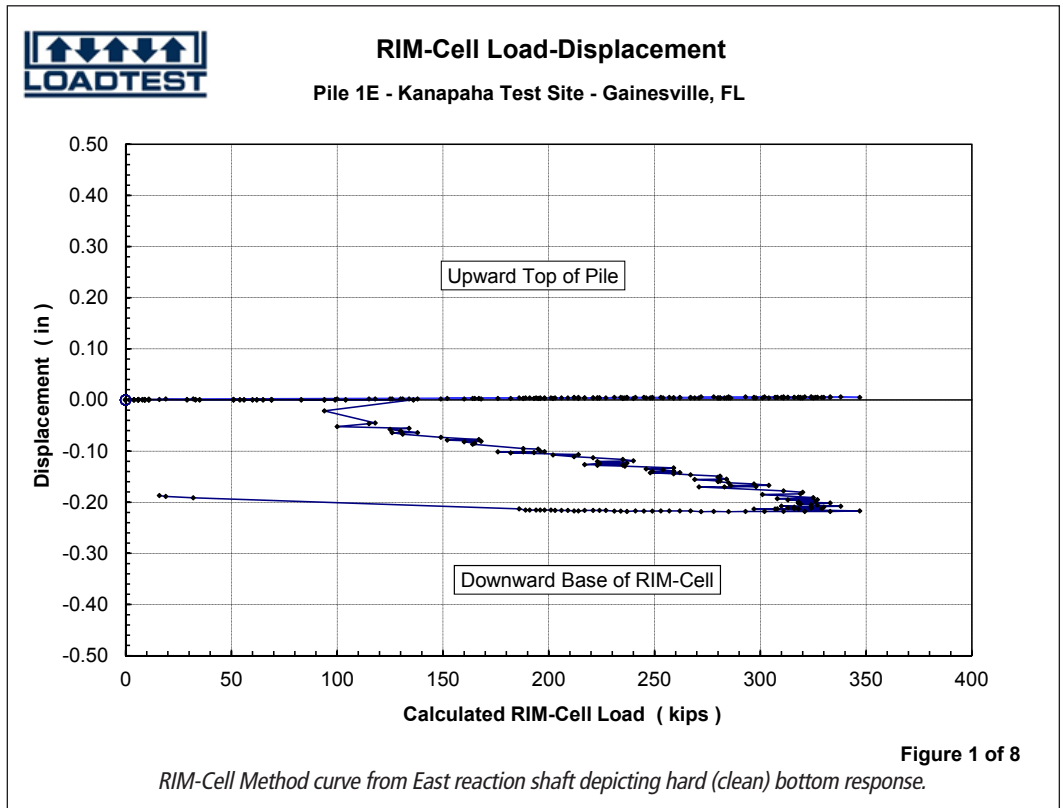
As expected, the West shaft soft bottom response consumed the entire standard RIM-Cell stroke with a large downward displacement during proof loading. Shaft performance was generally confirmed to approximately 550 kips. While some lock-in of skin friction reversal is indicated, the soft bottom response limits this, which indicates a lower capacity than suggested by the initial peak loads. This reinforces the importance of construction quality, especially excavation cleanliness, for optimal shaft performance.

This RIM-Cell demonstration on two otherwise identical shafts constructed within close proximity illustrates both the variability possible as well as the value of the procedure to reveal and quantify the performance of each. In addition, intrinsic benefits are derived from RIM-Cell proof loading with known base stiffening as well as that from shaft fric-

tional resistance reversal above the RIM-Cell. The RIM-Cell preloading overcomes the theorized strain incompatibility between mobilized skin friction and end bearing resistance in drilled shafts.

The Kanapaha site data demonstrated to FDOT the combined ease of construction, timely results and certainty of shaft performance produced by the Reliability Improvement Method. It also demonstrated the RIM-Cell's confined pressurized area, pressurized with smaller known grout volumes, allowed timely and accurate applied load assessment. This demonstrated the RIM-Cell's ability to prove that production drilled shaft performance meets design requirements and to improve confidence in drilled shaft use.

At this time, due to space limitations, a complete presentation of related information was not able to be presented. For additional detailed information on the Reliability Improvement Method, RIM-Cell, please contact Bubba Knight at [bubbaknight@loadtest.com](mailto:bubbaknight@loadtest.com).



**ADSC**