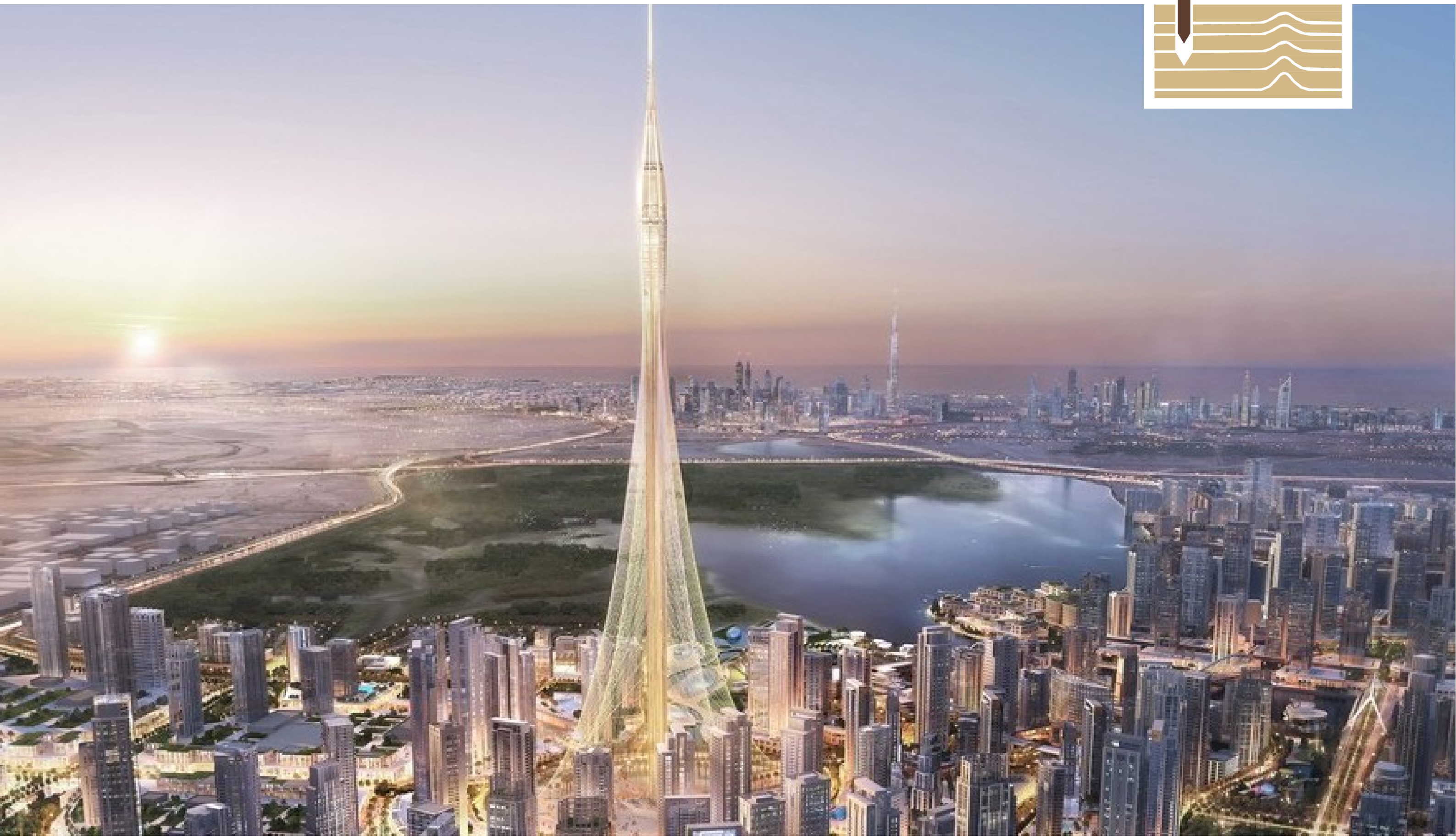


FUGRO LOADTEST

Dubai Creek Tower

A joint venture from Emaar Properties and Dubai Holding, Dubai Creek Harbour will be both a financially viable and ecologically responsible city built with future generations in mind. Offering the best infrastructure, it is a place where people will live, work and play, a community where families can achieve their aspirations for generations to come.

Dubai Creek Harbour project sits abreast of Ras Al Khor Wildlife Sanctuary, home to over 67 species of water birds, protected under the UNESCO Ramsar Convention. As Dubai Creek Harbour develops, this sanctuary will remain sacrosanct, with a new visitor centre bringing a message of sustainable biodiversity to new generations.

At the heart of the 6 sq km Dubai Creek Harbour is Dubai Creek Tower, which will include a 360 viewing deck 'The Pinnacle Room', and a VIP observation deck with landscaping meant to recreate the "splendour of the Hanging Gardens of Babylon."

The vast slender structure is a feat of engineering genius. Described as both a piece of art, and as using the most advanced mathematics, engineering and physics known to man, it is expected to be one of the most significant structures ever created.

Dubai Creek Tower will also feature fully glazed rotating balconies that extend outward, rotating outside the skin of the tower for visitors and the structural core and tension cables will be gently and dynamically illuminated.

PROJECT DETAILS

Project: Dubai Creek Tower

Location: Dubai, United Arab Emirates

Foundation Design and Construction: Soletanche Bachy

Geotechnical Consultant: Aurecon

Developer: Emaar Properties PJSC

PROJECT

Following one of the most comprehensive geotechnical investigations undertaken in the region, actual in-situ performance of the proposed foundations was desired to optimise the final design of the core and the cable anchorage foundation design.

For this, Fugro carried out three multilevel bi-directional O-cell® tests in the centre core of the foundations in parallel with the geotechnical investigations. Nominal dimensions for the section of the barrettes were 2800 mm x 1200 mm and of 50 m, 80 m and 90 m depth.

In addition, three fully instrumented conventional tension and lateral tests were proposed to simulate the pile behaviour from the pull out effect of the tension cables.

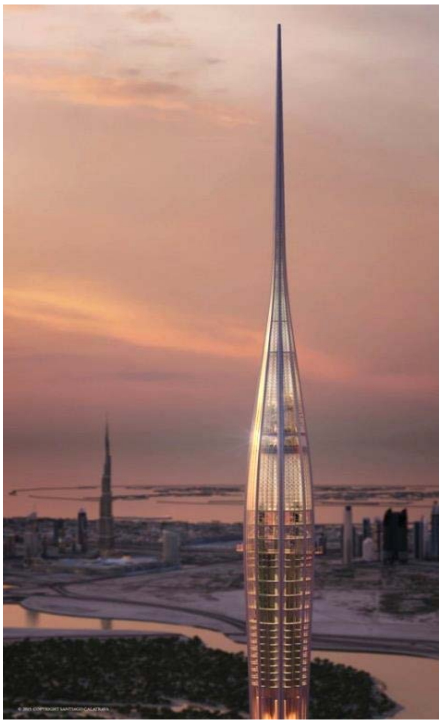
Installation of reinforcement with O-cell arrangement

SUMMARY

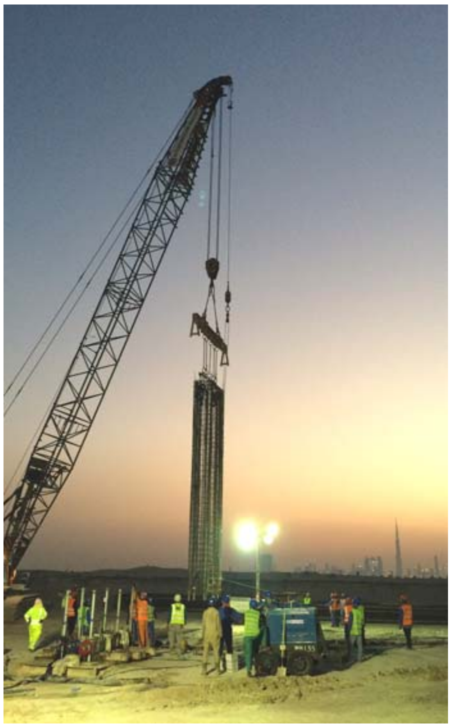
By using the bi-directional O-cell technique, Fugro mobilised a total reaction of 320 MN, 360 MN and 363 MN using two levels of 3 x 890 mm O-cells in each of the tests, breaking the previous World Record for the highest test load in a single foundation element (which was 323 MN in a test pile in rock). The ultimate capacity of the barrettes was higher than the maximum test load applied.

Sister bar vibrating wire strain gauges were installed along the test barrettes and piles allowing a profile of mobilised unit skin friction at various levels. Fiber Optic distributed strain and temperature sensors helped to determine the distribution of load throughout the foundation length.

The test results provided detailed geotechnical information for use in the foundation design. Many ultra-high capacity piles and barrettes are being designed today as a direct result of Fugro Loadtest's ability to verify their capacity.



Artist impression of the tower.

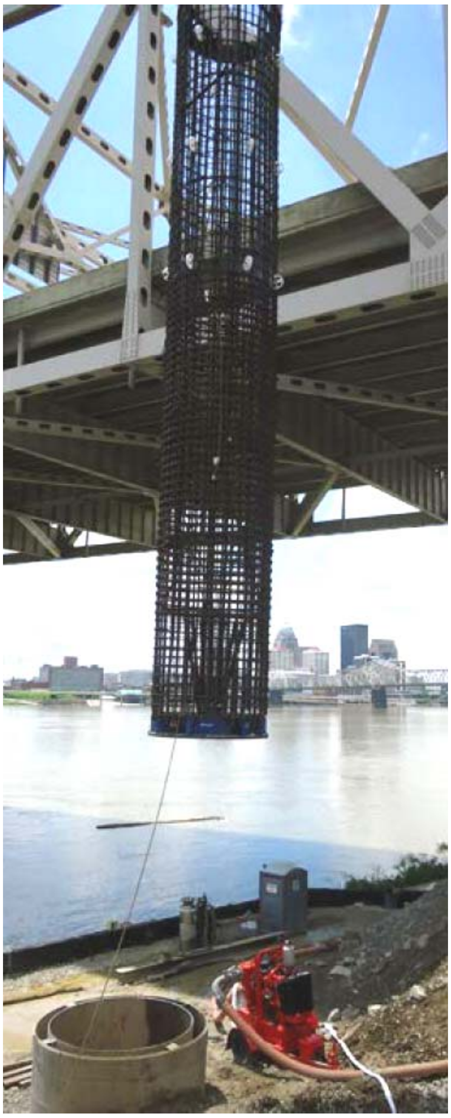


Lifting of the reinforcement.

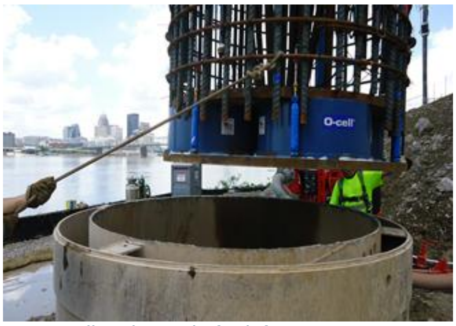
Fugro
E: loadtest@fugro.com
www.fugro.com

WORLD RECORD STATIC LOAD TEST
Ohio River Bridges Downtown Crossing USA

Project:	Ohio River Bridges Downtown Crossing
Location:	Louisville-Southern Indiana - USA
Foundation design :	Jacobs Engineering
Main Contractor:	Walsh Construction Company
Owner:	INDOT and KYTC joint project



Reinforcement cage installation with O-cells



O-cell at the end of reinforcement cage

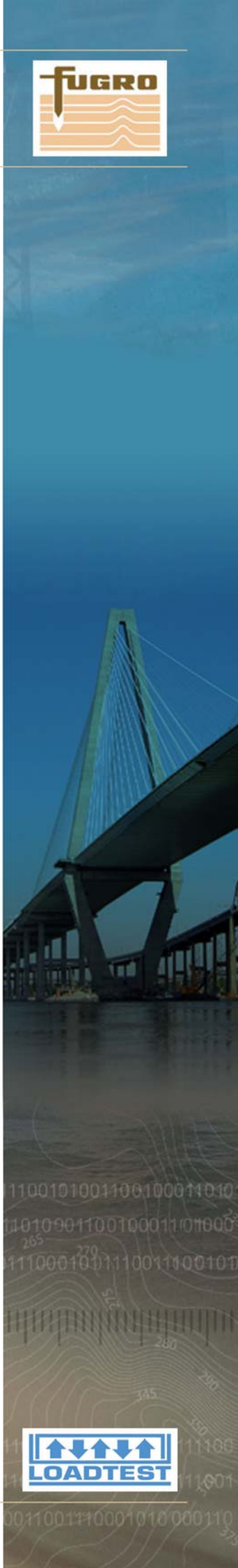
Project Overview

The Louisville-Southern Indiana Ohio River Bridges Project is a major design-build infrastructure project intended to improve road safety and alleviate traffic congestion by connecting highways across the river to provide major economic stimulus to the entire region. The project includes both the Downtown and East End Crossings over the Ohio River along with the associated highways that connect them. With a project budget at approximately $2.5 billion, this will be the largest transportation project ever constructed connecting the two states.

Project Summary

The foundations for both the Downtown and the East End Crossings were tested using O-cell® bi-directional static testing technique to confirm the geotechnical parameters and allow for both economising of the design and risk management.

Geotechnical conditions throughout the bridge location indicated the presence of a significant layer of high strength limestone into which the bridge bearing piles could be founded. Accommodating the lateral design loading of the bridges required a minimum rock socket length. With a standard geotechnical design approach, the axial design loads required socket lengths deeper than those required for the lateral loading conditions. As the conventional design was thought to be over conservative, the design and build team sought to overcome some of this conservatism by carrying out a full scale load test. The O-cell® bi-directional load testing technique was the ideal technology to be able to achieve their goal.



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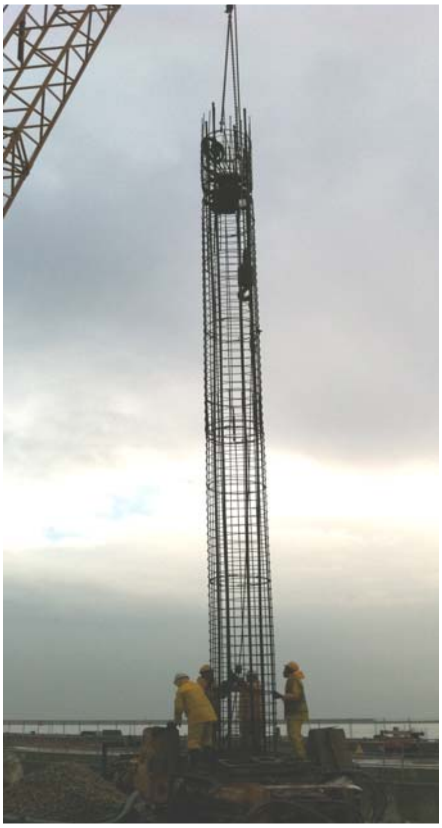
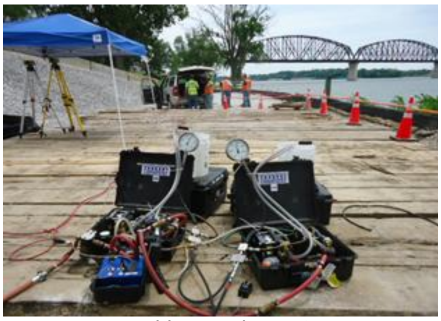
WORLD RECORD STATIC LOAD TEST
Ohio River Bridges Downtown Crossing - USA



Installation of the O-cell cage



New World Record Test Set-up

Bi-directional load test arrangement

The test pile required at the Downtown Crossing was to not only test the pile capacity but also the piling technique. The dedicated test pile was drilled though overburden soils and socketed into the underlying limestone. The loading arrangement configuration in the test pile used four 860 mm diameter O-cells arranged in a single level located 1.1 metres above the pile toe to provide the maximum test load required of 213 MN at rated capacities.

Test results

Fugro Loadtest performed the bi-directional static load test using the O-Cell® method and exceeded the rated load capacity and achieved a maximum test load of **322 MN** by overpressurising the O-cells, creating a new **World Record** for a static load test of a single foundation element.

Conclusions

Although a new World Record load was achieved, the rock was far from failure and additional pile capacity was available, and illustrates the magnitude of conservatism often used in pile design in rock.

Using the O-cell technique it is possible to achieve very high average unit skin friction and end bearing resistances in hard rock formations. This allows the design to be optimised, resulting in shorter rock sockets, more economical foundation construction and reductions in program time.

Rendering of Downtown Crossing courtesy of http://kyinbridges.com/

LOADTEST
O-Cell® Technology in St. Louis, MO

Project	I-70 Bridge over the Mississippi River
Location	St. Louis, Missouri
Client	Massman, Traylor Bros. and Alberici, JV
Project Description	

With a main span of 1,500 feet, the new Mississippi River Bridge in St. Louis, Missouri will be the third longest cable-stayed bridge in the United States. But it did set a new world record for the highest load ever recorded during a static load test. The previous world record of 62,700 kips (278 MN) was set in South Korea by Loadtest at the site of the new Incheon Bridge. The old record was surpassed by 9,400 kips on July 17, 2010. The maximum load applied during the St. Louis load test was 72,100 kips (320 MN).

Lowering Reinforcing Cage

The Mississippi River crossings in downtown St. Louis and southwestern Illinois are some of the busiest in the U.S. where several interstates carry traffic across the river. The new bridge is expected to transport up to 55,000 vehicles daily, re-routing Interstate 70 from an overly-congested nearby bridge.

When the massive eight-lane original bridge design was deemed uneconomical, co-owners Missouri DOT and Illinois DOT opted for a sleek 1,500ft main deck carrying four lanes across the Mississippi, although the design calls for room to restripe to six lanes as needed.

O-cell Assembly Placement

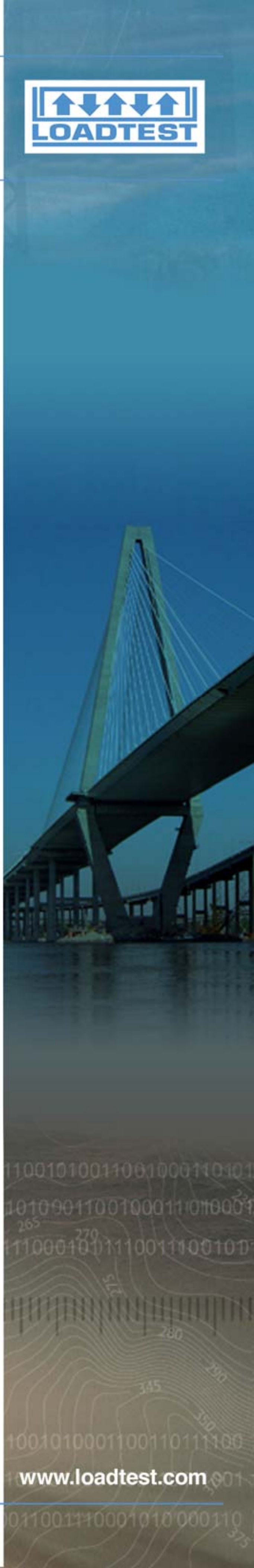
The $640 million project includes the 1.22-mile bridge, supported by symmetrical cable-stayed delta towers, over 400 feet tall. Two large concrete footings, one near each bank, anchor the bridge below. Each pier rests on a series of concrete-filled drilled shafts, extending over 100 feet socketed into the limestone bedrock.

Massman, Traylor Bros. and Alberici (MTA) presented an Alternative Technical Concept that included plans for six 11.5 ft. diameter drilled shafts, as opposed to the fourteen 10 ft. diameter shafts initially proposed. This new design, using fewer but wider supporting columns, is significantly more cost-effective since it halves construction time for the bridge foundation. The design has the additional advantage of a reduced environmental footprint with fewer drilled shafts.

Final Assembly Check

Rendering of the New River Bridge, scheduled to open in early 2014

LOADTEST
O-Cell® Technology in St. Louis, MO



Automated O-cell Test Apparatus

Bi-directional load test arrangement

To perform the world record test, a 119ft deep test shaft was drilled into the sub-surface, which consisted primarily of sand and gravel underlain by solid rock. A core barrel roller bit and core extractor were used to excavate the rock socket, which was then airlifted after drilling was completed. A SONICALIPER was then used to profile the shaft excavation sidewalls.

Four 34in O-cells attached to a steel reinforcing frame were installed at the base of the 11.5ft diameter drilled shaft and reinforced concrete poured in to fill the socket and encase the cell. After concrete curing, the O-cell assembly was pressurized, loading the shaft in 19 loading increments with each successive load increment held constant for eight minutes.

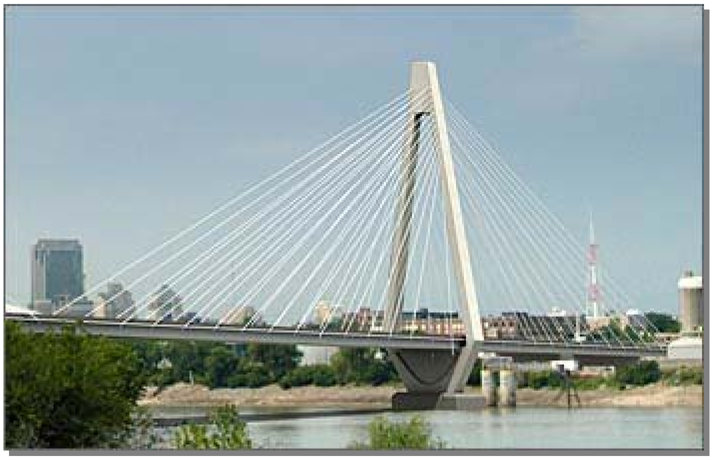
A world record assembly
=
4 x 34" O-cells

The shaft was loaded to a maximum bi-directional load of over 18,000 tons, mobilizing a combined end bearing and side shear resistance of 36,067 tons (321 MN).

Summary

As is the case on many projects, the results of the O-cell test confirmed the use of an optimized engineering design, by verifying MTA's alternative technical concept and allowing them to utilize a much more economical alternative than the original conventional design. Additionally, the testing footprint was minimal, despite the record-breaking loads applied. Loadtest's company objective, which is to provide an accurate, high-quality tool for value-engineering, proved to be an invaluable benefit to this project.

Ready to go!



Architectural rendering of the New River Bridge - St. Louis, MO.