LOADTEST
Triple Level O-Cell® Technology on the Missouri River

Triple Project:	**Amelia Earhart Memorial Bridge**
Location:	Missouri River near Atchison, Kansas
Client:	Kansas Department Of Transportation
Project Description:	Named in honor of the pioneering aviator, the original Amelia Earhart Memorial Bridge, spanning the Missouri River near her birthplace in Atchison, KS, was built in 1938. Nearing the end of its service life, the steel cantilever truss structure is slated for replacement by the Kansas DOT (KDOT). In order to facilitate the design of a new bridge, and possibly eliminate the mid-river support column of the current bridge, KDOT called on LOADTEST to perform a first-ever triple-level O-cell test.

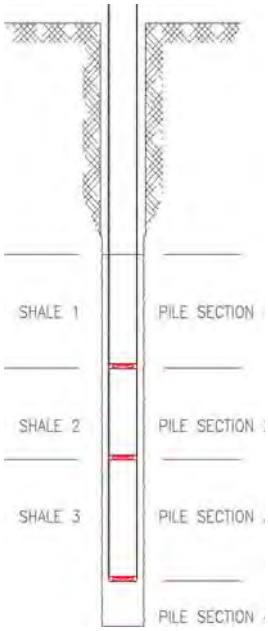
Amelia Earhart

Summary

The primary purpose of the test program was to assess shear capacities of the three distinct underlying shale layers, to facilitate the design of the replacement bridge foundations. Given the high anticipated capacity of the 1525 mm (60 inch) diameter, 48.7 m (160 foot) deep test pile and the need to fully mobilize all sections of the test pile, a first-ever triple-level O-cell test configuration was selected.

Bi-directional load test arrangement

Three levels of 27 MN (3000 tons) capacity O-cells were installed on a purpose-built carrying frame, along with the necessary instrumentation. The top and middle O-cells were positioned at the boundary between the upper, middle and lower shales. The bottom O-cell was positioned near the pile toe to gain information about the bearing capacity of the lower shale layer. In order to match the design assumptions regarding scour (always a possibility on the fast-moving, flood-prone Missouri River), the concrete was only poured up to the top of the shale, with a temporary casing through the overburden used to keep the shaft open until completion of the test.



Schematic elevation of test pile showing position of three levels of O-cells and deep concrete cut-off

Pile Test Results

The combined load reached during four stages of testing ranged was 158 MN (17,800 tons), the second-highest pile test load ever achieved in North America. The maximum displacement of any of the four pile sections was 10.7 mm (0.42 inch).

Analysis

The resulting four load-movement curves, along with the estimated pile stiffness and other design parameters were supplied as inputs to a commercially-available geotechnical Finite-Element Analysis (FEA) program. A top-down load analysis was run in order to estimate the settlements due to an axial top-down load. Use of the FEA allowed the load-movement properties of the four pile sections, which were isolated and measured independently by the O-cell test, to be re-integrated to produce a single load-settlement curve. In addition to integrating the test data into a load-settlement prediction, a copy of the FEA input file can be made available to the client, allowing him to investigate other design scenarios and optimize the pile foundation design, using actual measured response as the model input.

Artist's Rendering of Completed Bridge *Source: City of Atchison*