Gerald Desmond Bridge

Long Beach, CA

Lifting the Assembly

Port of Long Beach Gets Ready

The $1.3 billion Gerald Desmond Bridge Replacement Project will feature one of the tallest cable-stayed bridges in the country, carrying traffic across the Cerritos Channel to Terminal Island at the Port of Long Beach. The wider, taller design of the new superstructure, over 500 feet (50 stories) tall and spanning 1,000 feet across, will easily accommodate large post-Panamax ships as well as allow for smooth high-volume traffic flow.

The bridge's foundation includes nearly 350 cast-in-drilled-hole piles drilled into layers of interspersed silt, clay and sand. Loadtest was utilized in carrying out the full scale load testing for this signature bridge. Testing was initially performed on a 71" diameter pile 177 feet in length. The tip of the shaft was injected with high pressure grout in order to increase the allowable end bearing pressure. The loading assembly consisted of three 3,000 kip O-cells® located approximately 7 feet above the shaft tip.

Loading was performed in two cycles, with the first cycle applying a bi-directional load of 2,746 kips and the second cycle achieving a bi-directional load of 5,991 kips. A maximum unit side shear value of 10.3 ksf was calculated using strain gage data and a maximum unit end bearing pressure of 189 ksf was achieved.

After testing of the initial test shaft was completed, six additional shafts were tested over the next nine months. Tests shafts ranged from 59 inches to 98 inches in diameter and between 157 feet and 188 feet in length.

Project Info	
Owner:	Caltrans
Design Build Team:	Shimmick-FCC-Impregilo J.V.
Engineer:	ARUP and Group Delta
Completion Date:	2017 - 2018
Project Cost:	$1.3 billion
Maximum Load	26,200 kips

Services Provided

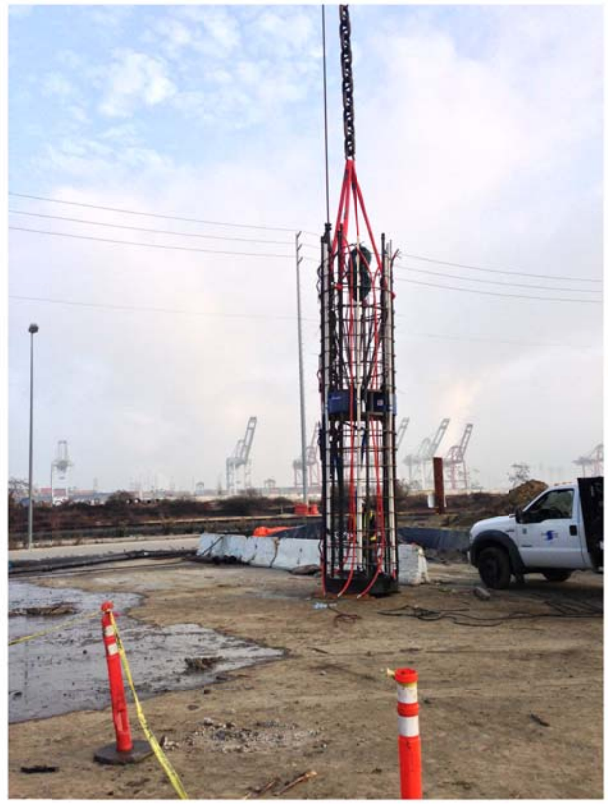
- Single and Multi-Level O-cell Test Design
- Assembling Instrumentation and O-cells
- Installation of Rebar Cage into Test Shaft
- Testing, Analysis and Reporting of Load test Results

Late Night Pour

High pressure tip grouting was performed on all piles prior to testing. The loading assemblies consisted of three O-cells located on single plane for four test piles, four O-cells on a single plane for one test pile, and one multi-level configuration consisting of three O-cells each on two planes.

Total test loads ranged from 8,481 kips to 26,177 kips. Maximum unit end bearing pressures of the tip grouted piles ranged from 110 to 266 ksf.

The testing of multiple piles allowed precise analysis of the different soil conditions encountered on the site. The testing program also provided much needed data with respect to the effects of tip grouting on the capacity of the piles. Modifications and improvements were made to the grouting procedures between each test to refine the procedures. The data provided by Loadtest allowed the pile lengths for the individual bents to be refined to account for the actual side shear and end bearing capacity of the soils.



Lower Cage Section Being Lifted with O-cell and Base Grouting Device Attached

The test piles utilized sectional oscillated casing that reached the tip of the piles. When this method is combined with a tip-grouting device, it is often assumed the piles can remain open for an extended period of time without sacrificing capacity in end-bearing. Loadtest results indicated otherwise. The test piles that showed the best end bearing values were constructed in a manner that did not allow for any wasting of time between reaching tip, installing the rebar cage, and pouring the pile. The dependency on stiffening piles by applying load through a tip-grout device shouldn't allow for maneuverability around sound construction techniques.

Subtle differences in the construction of the test piles can potentially be used to describe anomalies in the test results. Expertise in quality control, drilled pile inspection, etc., during all phases of construction during the Loadtest programs and in production becomes extremely important.