

# LOADTEST

## el Puente Centenario - Panama Canal, Panama



Project  
Location  
Client  
Period  
Project Description

**el Puente Centenario, Panama**  
Panama Canal  
Ministry of Public Works  
2002



O-cell Assembly Insertion



Culebra Cut

Source: Panama Canal Authority



Cruise Ship in narrow Culebra Cut  
Source: britannica.com

The Panama Canal is one of the world's most famous shipping links providing passage between the Atlantic and Pacific Oceans. Until 2004, the Bridge of the Americas was the only way to cross the canal connecting the Isthmus of Panama. The fantastic engineering challenges of this region, coupled with heroic human effort, only add to the new bridge's notoriety.

In 2002, grading and foundation work began for a new cable-stayed bridge, known simply as El Segundo Puente Sobre el Canal de Panama (Second Bridge over the Panama Canal). Overseeing the US \$93 million contract for construction of this world-class 1200m+ span is Bilfinger-Berger AG for the owner, the Panamanian Ministry of Public Works. The bridge, officially named el Puente Centenario after Panama's centennial, was inaugurated on August 15, 2004.

The new bridge is located a few hundred meters from the infamous Culebra Cut, known to engineers not only as the narrowest point in the canal, but also as the location of a flow slide that actually closed the canal for 24 hours in 1986. For geotechnical engineers, this area has an intimidating reputation stemming from the uncertain geotechnical properties of the subsurface volcanic deposits, locally referred to as the Cucaracha formation.

Samples of the Cucaracha, in addition to exposed sections of the formation, exhibit significant loss of shear strength and ultimate disintegration after being exposed to air. Clearly, designing bridge foundations in an area of such geotechnical uncertainty presented a unique challenge for the project engineers. When engineers face uncertainty of this nature, they typically turn to Osterberg cell (O-cell™) technology, provided by Loadtest.

O-cell testing was specified on three 2000mm drilled shaft foundations to help define ultimate capacities of the foundation elements and provide settlement information at various multiples of the design working loads. The O-cell tests were carried out to loads exceeding 70 MN (8,000 tons). Test results indicated unit side shear resistances varying between 90 kPa and 450 kPa. Measured end bearing values were on the order of 5 MPa at tip displacements of roughly 5 % of the shaft diameter.

While the unit resistance values were much higher than anticipated or predicted by empirical methods, high variability in subsurface conditions over short distances limited the engineers' ability to use the test data to economize on the foundation design. By utilizing O-cell technology and performing the first and only full scale static load tests on drilled shafts in the Panama Canal area, the data provided a level of comfort and confidence that manifests whenever uncertainty is reduced.



Source: Panama Canal Authority

el Puente Centenario,  
completed in 2004