Osterberg Load Cell Finding Applications

by S. Scot Litke

Several years ago, Dr. Jorj Osterberg, then at Northwestern University, Evanston, Illinois, developed a relatively low-cost, simple down hole load test device now known as the Osterberg Load Cell (see August 1984 issue of FOUNDATION DRILLING Magazine). Osterberg currently resides in Aurora, Colorado, having retired from a full time academic life. He has, however, continued to vigorously pursue his career as a consulting geotechnical engineer and to refine his innovative deep foundation load test device.

In every one of these cases, the shear value assumed in bond for the design was greatly under the values found by using the test results with a suitable factor of safety, allowing considerable savings by using shorter depths of sockets.

The most frequent use of the device has been to test the bond/friction between concrete and rock in a drilled shaft rock socket. Tests have been made on weak shale, medium strength shale, sandstone, sandy coral

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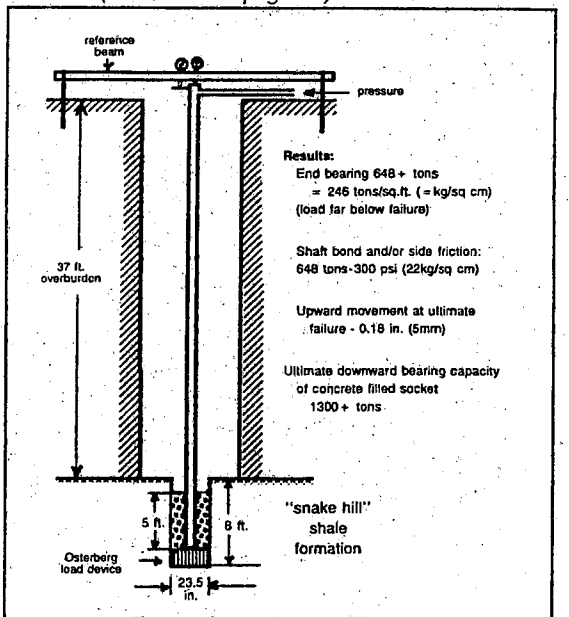
Summary of Load Test Results Using The Osterberg Load Cell

Pipe piles

Type	Location Soil Profile	Embedded Length	Hammer	Final Blows/in	Failure Mode
18" O.D. x 0.50" wall	Sangus River Mass. 105ft. soft clay over hard till	105 ft.	Delmag D62-26 105,600 ft. lbs.	10 per ½in.	friction 142 tons 570 lbs/sq.ft.
18" O.D. x 0.50" wall	Pines River Mass. 90 ft. soft clay over hard till	93 ft.	Delmag D36-13 83,100 ft. lbs.	10 per ½in.	friction 218 tons 770 lbs/ sq.ft.

Drilled Shafts (Caissons) (Bored Piles)

Location	Soil Profile	Hole Diam.	Embed. Length	Rock Embed.	Failure Mode	Ultimate Capacity
Port Orange, Florida	71 ft. silty sandy to stiff clay over weak sandy coral limestone	36 in.	82 ft.	10.8 ft.	end bearing 180 tons 24.8 tons /sq. ft.	920 tons
Port Orange, Florida	75 ft. silty sandy to stiff clay over weak sandy coral limestone	54 in.	80 ft.	14.9 ft.	end bearing 350 tons 24.4 tons /sq. ft.	700+ tons
Jacksonville, Florida - four 36 inch shafts socketed in soft sandy coral limestone. Failure loads all in end bearing. Varied from 210 to 640 tons. Report in preparation. Full details not yet available.						
Latham, New York	37 ft. overburden cased off. 8 ft. socket drilled in shale. 5 ft. length concrete filled over load cell	23.5 in.	8 ft.	5 ft.	side friction 648 tons 21 tons /sq. ft.	1300+ tons
Edison, New Jersey	37 ft. overburden cased off. 7 ft. socket drilled in highly weathered fractured shale 6 ft. of concrete in socket over load cell	36 in.	7 ft.	6 ft.	side friction 210 tons 3.7 tons /sq. ft.	900+ tons
Rochester New York	21 ft. overburden cased off. 7.5 ft. socket drilled in sandstone. 5.8 ft. of concrete filled over load cell	23 in.	7.5 ft.	5.8 ft.	side friction 450 tons 13 tons /sq. ft.	900+ tons



Test to determine bond between concrete and shale
Latham, New York

limestone, and granite. In every one of these cases, the shear value assumed in bond for the design was greatly under the values found by using the test results with a suitable factor of safety, allowing considerable savings by using shorter depths of sockets.

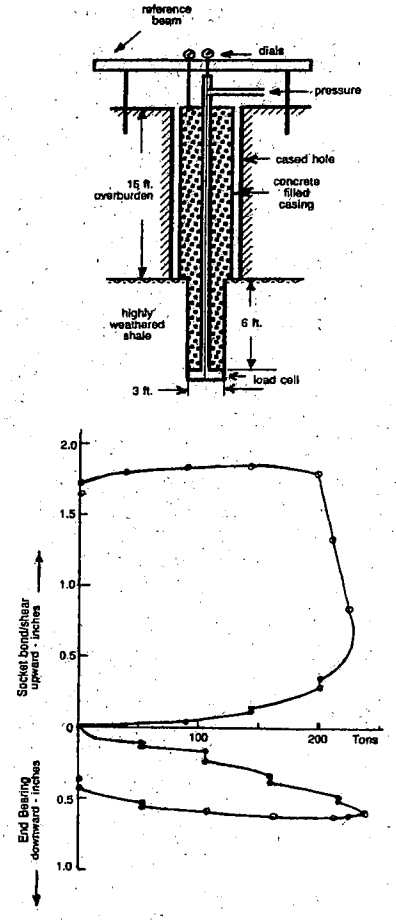
The Osterberg Load Cell has been employed in static load tests in the United States and Hong Kong.

Chart 1 presents a summary of tests conducted through 1990. Charts 2, 3, and 4 detail three separate applications.

Dr. Osterberg reports that future tests are planned. He will be providing an expanded treatment of progress to date later this year. Those results will be published in a future issue of FOUNDATION DRILLING Magazine.□

Menlo Park Shopping Mall, Edison, New Jersey

Contractor: Case Foundations, Intl.
Geotechnical Consultants: STS Engineers
Testing: American Equipment & Fabricating Corp.



Rock Tested: Red brown moderately to highly weathered shale, fractured. Recovery 60 to 100% RQD 7%

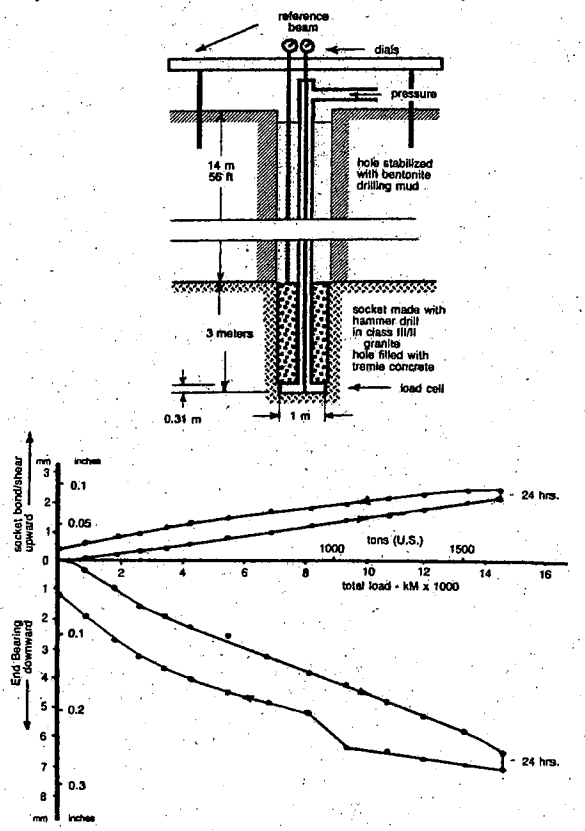
16 feet of overburden removed and a 48 inch casing inserted to rock. 3 foot diameter hole cored in shale and 6 feet of concrete placed over device. Hole then filled to grade with concrete in a 42 inch corrugated pipe standing freely inside casing.

Failure load in bond between concrete and shale:
210 tons = 3.7 tons/sq. ft. = 51 psi
Ultimate end bearing capacity:
240+ tons = 34 tons/sq. ft.
Total bearing capacity of socketed shaft:
450+ tons

Note: Data corrected for 16 tons weight of concrete over device.

Hung Tung Lau Hong Kong

Owner: Kowloon Canton Railway Corp.
Engineers: Ove Arup & Partners
Contractor: Franki Kier Ltd.
Load Test: Fugro-Mclelland Geotechnical Services (HK) Ltd.



Testing Required
Load to minimum of 2 x design load of 700 kPa in friction only or 6,600 kN = 749 tons (U.S.)

Results
Test essentially linear with very small deflection in end bearing and friction to a total load (up + down) of 29,400 kN = 3,280 tons Factor of safety = 4.5+

Details
Maximum downward load in end bearing = 14,700 kN = 18,700 kN/sq. m. or 1,640 tons = 194 tons/sq. ft. = 2,700 psi Total deflection = 7.0 mm = 0.28 in.

Maximum upward load = 14,700 kN in friction and socket bond = 1,740 kN/sq. m. or 1,640 tons = 18.0 tons/sq. ft. = 250 psi Total deflection = 1.4 mm. = 0.093 in.