POST TENSIONED HOLLOW COMPOSITE MICROPILES FOR SEISMIC RETROFIT PROJECTS IN CALIFORNIA

CALTRANS FIELD TESTS

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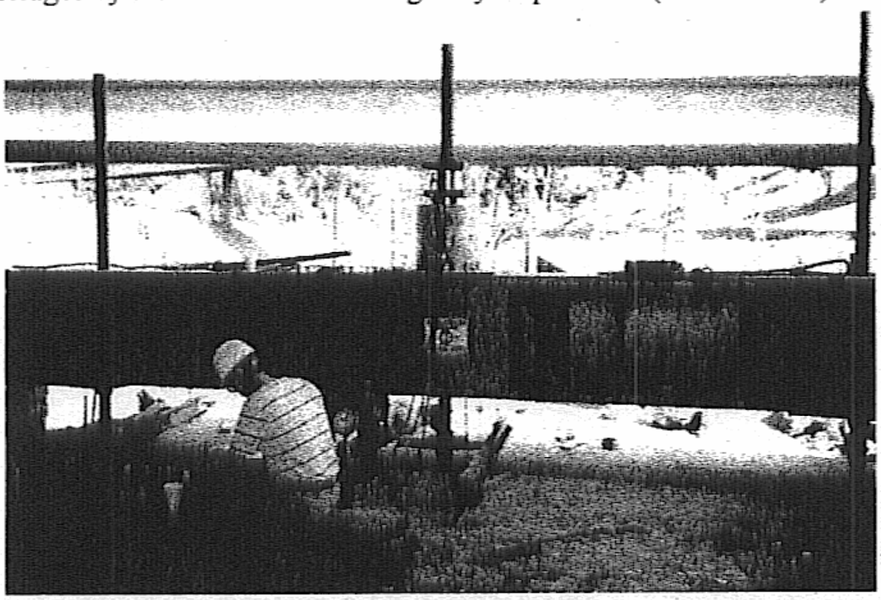
1. Overview

The Loma Prieta Earthquake in the San Francisco Area on October 17^{th} 1989 and the Northridge Earthquake in Los Angeles on January 17^{th} 1994 prompted a vast review of all bridges by the California State Highway Department (CALTRANS). It was found that with an inventory of 11,000 bridges, most required seismic upgrading.



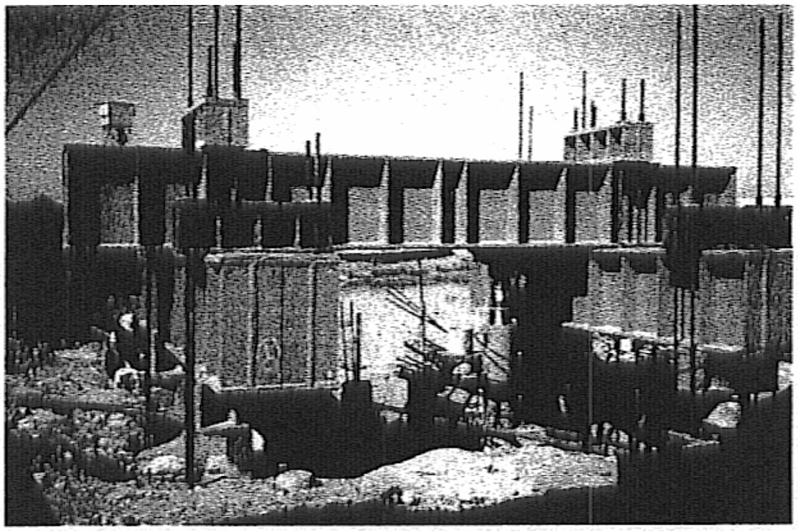
A new approach of combing two approved methods was presented to Caltrans.

Seismic forces apply dynamic horizontal loads on structures which generate eccentric bending moments in the foundations, resulting into twisting of the structure and opening of the joint between footing and ground.This opening of the joint shall be eliminated or minimized by post tensioning (compressing). The dynamic horizontal seismic shocks shall be resisted by elastic (spring system) post tensioned strand tendons, without uplift of the footing.

For this reason the existing footing will be strengthened (reinforced) with the Ischebeck TITAN hollow self drilling, self grouting injection bore pin piles for compression loads and combined with inside strand tendons, for tension (uplift) loads.

2. The method

Inside the hollow pile, strand tendons with a long free (unbonded) length are grouted. The strands will stress the micro pile and the ground.



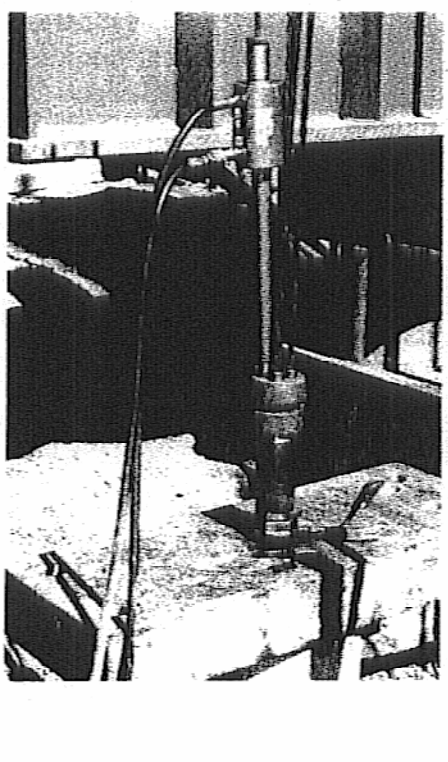
If the foundation under seismic loads wants to lift off, the pre-tensioned strand tendon will be further loaded and the joint between footing and pile unloaded. Only if the seismic uplift load exceeds the prestress load, the joint between pile and footing will start to open. This is the design load for the strand tendon.

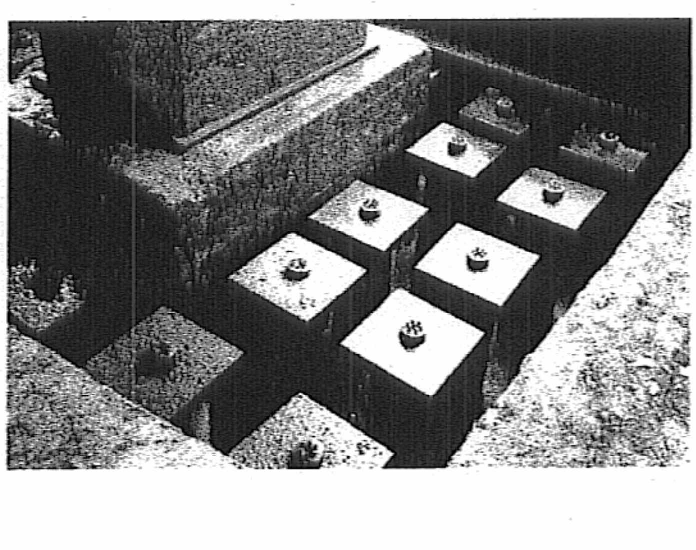
The described interrelation of the coupled spring system will function best, if the strain reduction of the strand tendon is small (relatively long free stressing length), and the one of the pile is very steep; or if the e-modulus of the strand is low and that of the pile is high. The same principle is realized for many years in prestressed concrete.

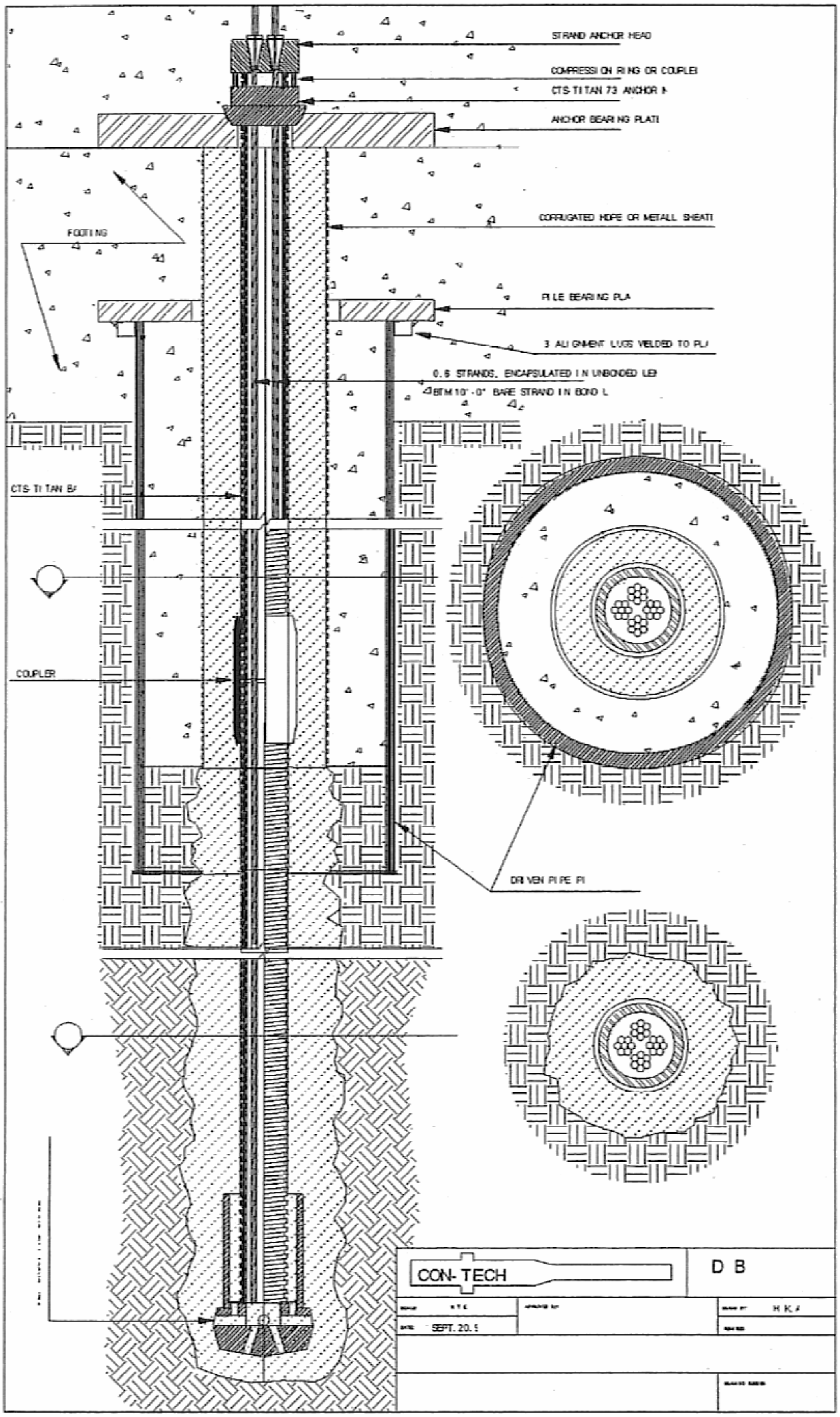
3. The result

Test Report of El Cerrito Bridge Albany California

Max elastic movement under compression and / or tension 0,5“ (12,7 mm) at 200 Kips (1000 kN) in tension and 400 Kips (2000 kN) in compression






STRAND ANCHOR HEAD
COMPRESSION RING OR COUPLE
CTS-TITAN 73 ANCHOR N
ANCHOR BEARING PLATE
CORRUGATED HDPE OR METALL SHEATI
FOOTING
PILE BEARING PLA
3 ALIGNMENT LUGS WELDED TO PL
0.6 STRANDS, ENCAPSULATED IN UNBONDED LEN
BTM 10'-0" BARE STRAND IN BOND L
CTS-TITAN BA
COUPLER
DRIVEN PIPE PI
CON-TECH
D B
SEPT. 20.
H K

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Pile Load Test Report
El Cerrito SOH
Bridge No. 33-0051L
Bent 15W, Pile 3C, 3D, 3E, and 3F
Albany, California

Prepared for
Caltrans

October 22, 1996

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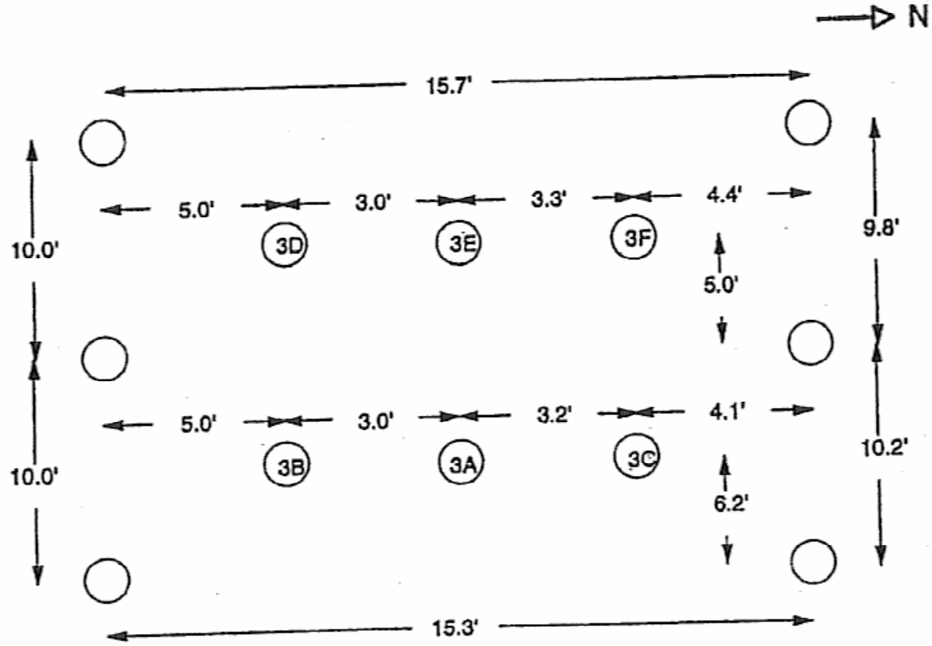
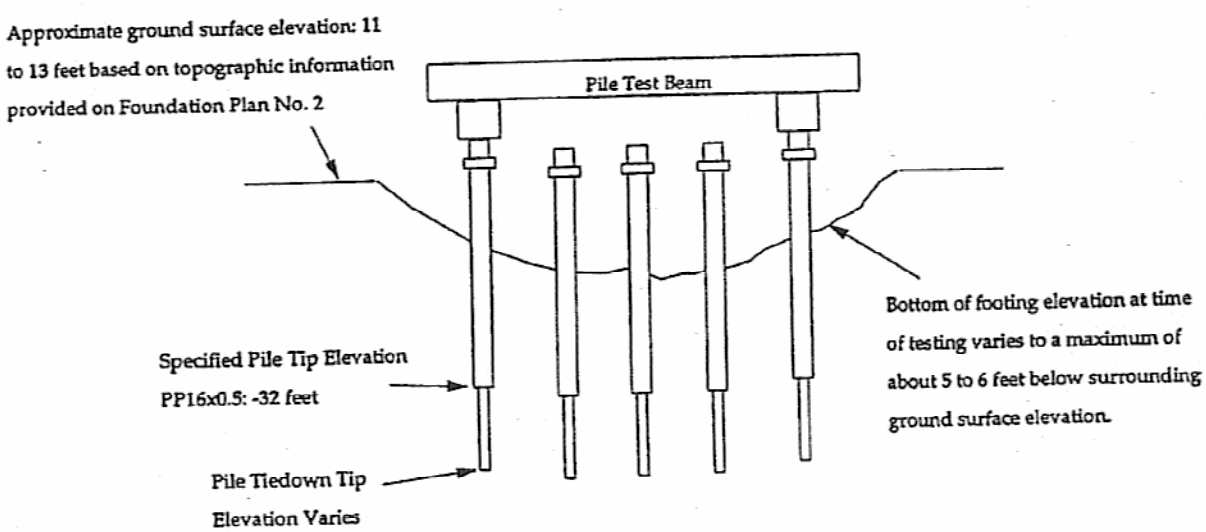
Pile Layout and Load Test Details





TYPICAL PILE LOAD TEST SETUP

Not to Scale, Reported Distances and Elevations are Approximate

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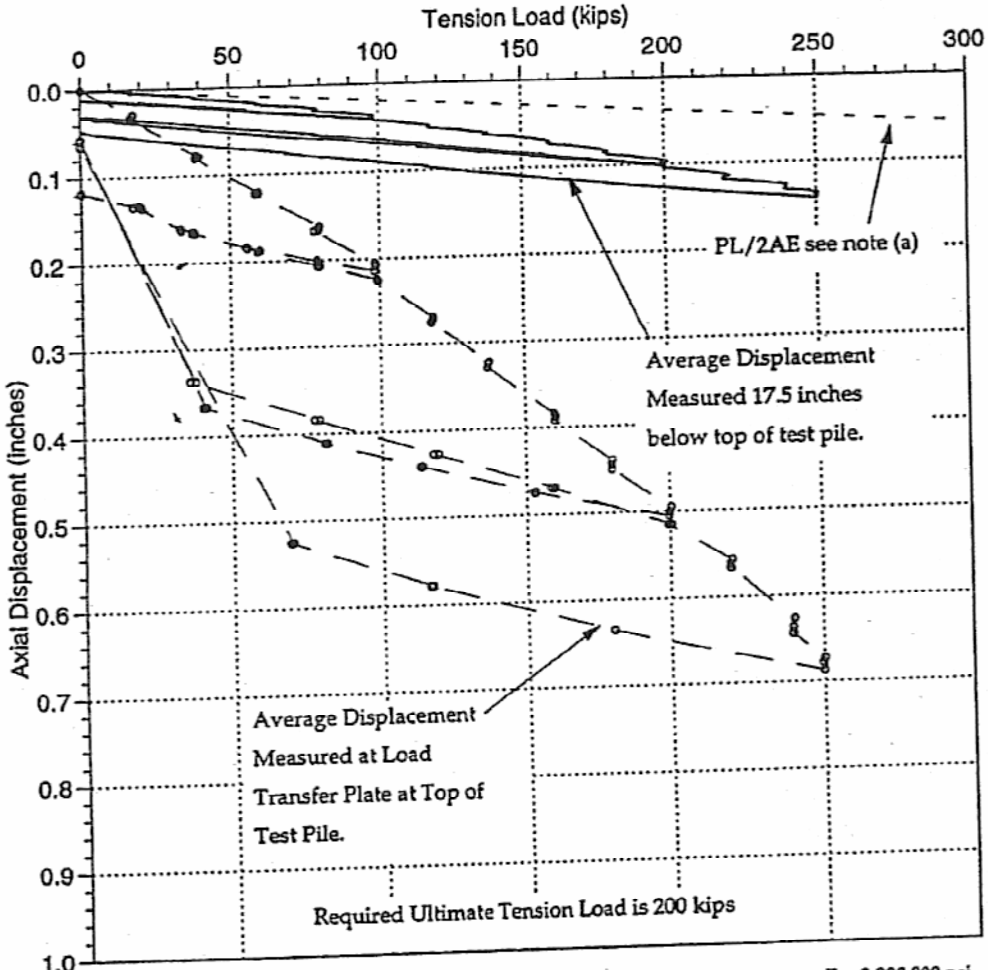
FIGURE 3

Tension Load Displacement Plot

District 4, Alameda, Route 80
El Cerrito SOH
Bridge No. 33-0051L, Bent 15W
Pile 3F



Note (a): PP16x0.5 used for pile length, pipe pile assumed to be filled with concrete E = 3,000,000 psi.

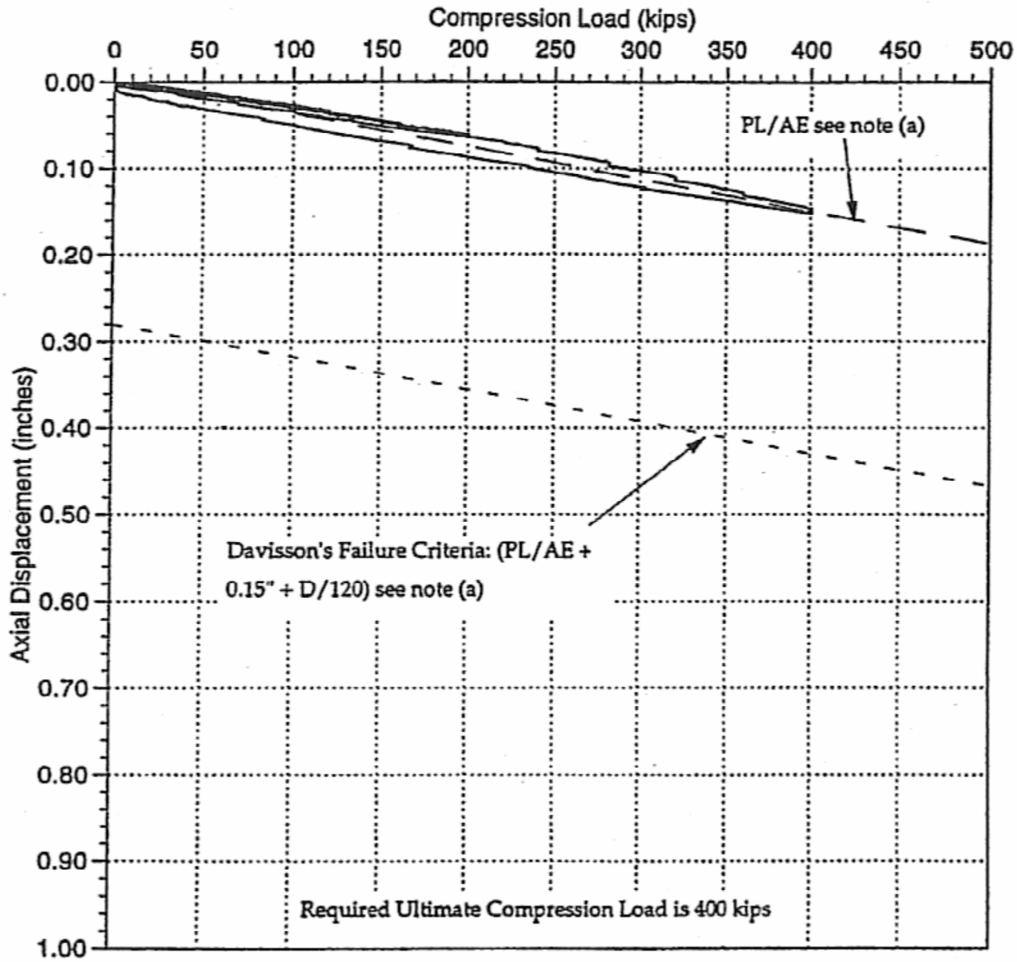
Pile Information

Pile Type: PP16x0.5 with tiedown
Hammer: Delmag D30-32
Date PP 16x0.5 Installed: unkown
Date Tested: 10-15-96
Tiedown Strands and Grout Installed: unknown
Tiedown Type: Titan Bar

Ground Surface Elevation: 11 to 13 feet
Base of Excavation Elevation: 5 to 13 feet
Pipe Pile Tip Elevation: -29.8 feet
Tiedown Tip Elevation: -57.0 feet
Tiedown Installation Method: Drill/Grout Injection
Tiedown Lockoff Load: 0 kips

Compression Load Displacement Plot

District 4, Alameda, Route 80
El Cerrito SOH
Bridge No. 33-0051L, Bent 15W
Pile 3F



Note (a): PP16x0.5 used for pile length, pipe pile assumed to be filled with concrete E = 3,000,000 psi.

<u>Pile Information</u>

Pile Type: PP16x0.5 with tiedown	Ground Surface Elevation: 11 to 13 feet
Hammer: Delmag D30-32	Base of Excavation Elevation: 5 to 13 feet
Date PP 16x0.5 Installed: unkown	Pipe Pile Tip Elevation: -29.8 feet
Date Tested: 10-14-96	Tiedown Tip Elevation: -57.0 feet
Tiedown Strands and Grout Installed: unknown	Tiedown Installation Method: Drill/Grout Injection
Tiedown Type: Titan Bar	Tiedown Lockoff Load: 0 kips

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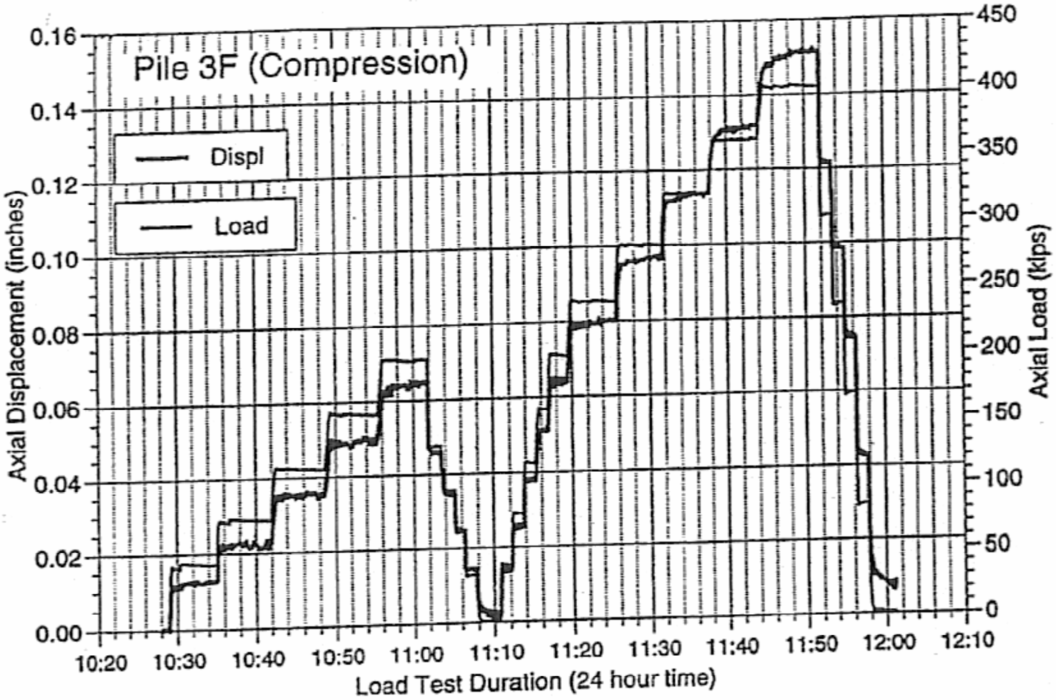
FIGURE 13

District 4, Alameda, Route 80
El Cerrito SOH
Bridge No. 33-0051L, Bent 15W



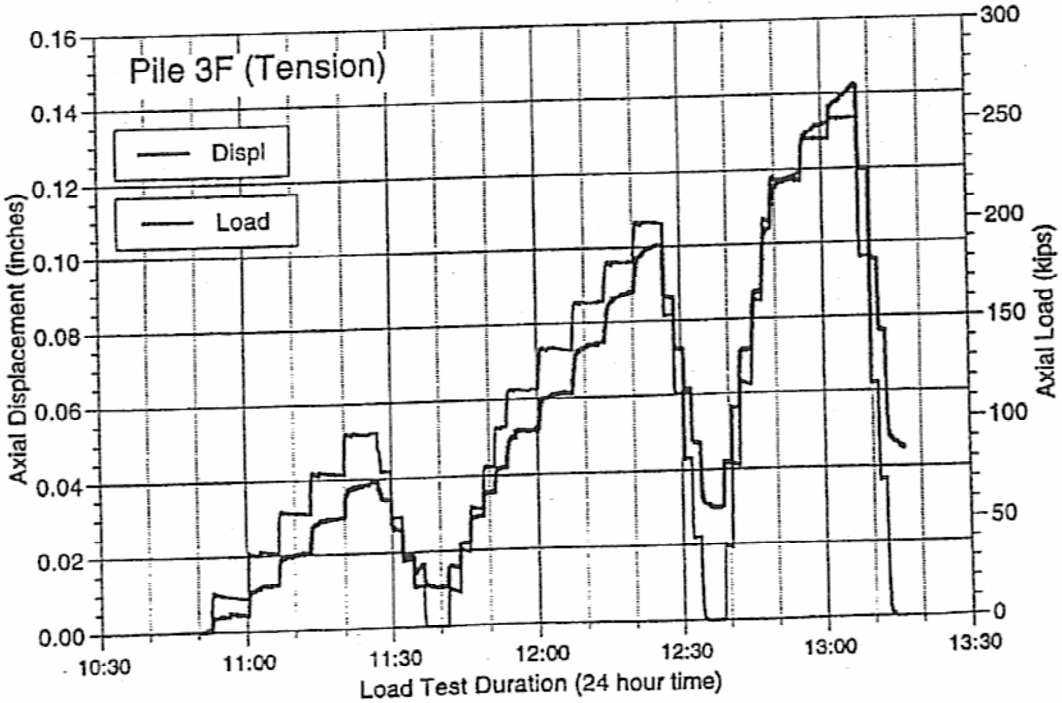


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FIGURE 17