APPENDIX

Pile Dynamic Analysis, Static Pile Load Testing and Field Acceptance Criteria

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### Pile Load Test (PLT) Request Form

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name:</td>
<td></td>
</tr>
<tr>
<td>Request By:</td>
<td></td>
</tr>
<tr>
<td>Dist/Co/Rte/PM:</td>
<td></td>
</tr>
<tr>
<td>EA No. &amp; Activity Code:</td>
<td></td>
</tr>
<tr>
<td>Bridge No:</td>
<td></td>
</tr>
<tr>
<td>Date of Request:</td>
<td></td>
</tr>
<tr>
<td>Abutment or Bent Location</td>
<td></td>
</tr>
<tr>
<td>Pile Numbers</td>
<td></td>
</tr>
<tr>
<td>Pile Diameter</td>
<td></td>
</tr>
<tr>
<td>Max. Test Load</td>
<td></td>
</tr>
<tr>
<td>Date Ready for Testing</td>
<td></td>
</tr>
<tr>
<td>Status:</td>
<td></td>
</tr>
<tr>
<td>Estimated Date</td>
<td></td>
</tr>
<tr>
<td>Actual Date</td>
<td></td>
</tr>
<tr>
<td>Estimated Date</td>
<td></td>
</tr>
<tr>
<td>Actual Date</td>
<td></td>
</tr>
<tr>
<td>Estimated Date</td>
<td></td>
</tr>
<tr>
<td>Actual Date</td>
<td></td>
</tr>
</tbody>
</table>

#### Type of Pile Load Test to be Performed

- [ ] Compression
- [ ] Tension
- [ ] Lateral

#### Nature of Pile Load Test

- [ ] Required by Specifications
- [ ] Pile Load Test Indicator Program
- [ ] Emergency Construction Capacity Verification

Have the test pile and anchor pile load test connections already been installed? Yes [ ] / No [ ]

Please submit forms to the above FAX number by 11:00 am Friday for testing to be scheduled during the following week. Please update all Estimated dates as dates can be confirmed or as piles become ready for testing.

<table>
<thead>
<tr>
<th>Tracking Number</th>
<th>FT&amp;I Rep</th>
<th>Date Tested</th>
<th>Date of Report</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:**

For individuals with sensory disabilities, this document can be made available in Braille, large print, audio cassette or computer disk upon request. To obtain one of these alternate formats, please call (916) 227-8185 or TTY 711 or write to the EEG Office, Division of Engineering Services, P.O. Box 168041, Mail Stop 9 Room 509, Sacramento, CA 95816-0041.

---

**Figure F-1. FTB Pile Load Test Request Form.**
### Pile Driving Analysis (PDA) Test Request Form

<table>
<thead>
<tr>
<th>Abutment or Bent Location</th>
<th>Pile Numbers</th>
<th>Pile Diameter</th>
<th>Pile Length</th>
<th>Date Ready for Testing</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**This work to be performed for the Purpose of:**

- [ ] Dynamic Monitoring Only
- [ ] Field Acceptance Criteria
- [ ] Hammer Energy Verification
- [ ] SPT Hammer Efficiency

**Have the PDA bolt holes already been installed?** Yes [ ] / No [ ]

**Comments:**

---

Please submit forms to the above FAX number by 11:00 am Friday for testing to be scheduled during the following week. Please update all Estimated dates as dates can be confirmed or as piles become ready for testing.

<table>
<thead>
<tr>
<th>Tracking Number</th>
<th>FT&amp;I Rep</th>
<th>Date Tested</th>
<th>Date of Report</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:**

---

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---

**Figure F-2.** FTB Pile Driving Analysis Test Request Form.
Figure F-3. Pile Load Test 5 Pile Group.
Figure F-4. Pile Load Test 3 Pile Group.
APPENDIX F–PILE DYNAMIC ANALYSIS, STATIC PILE LOAD TESTING
AND FIELD ACCEPTANCE CRITERIA

OCTOBER 2015

State of California  
Department of Transportation

M em o r a n d u m

To:  JOHN ZEHNDER  
Structure Representative  
405/22 Separation Project

Date:  December 13, 2013

File:  12-ORA-22.405-PM20.66  
12-071624 (1200000036)  
405-22 HOV Connector Separation  
Bridge No. 55-1103E

From:  DEPARTMENT OF TRANSPORTATION  
Division of Engineering Services  
Geotechnical Services - MS 5

Subject

Pile Dynamic Analysis (PDA) test results: Pile 19 at Bent 3L

Introduction

This report presents the results of Pile Dynamic Analysis (PDA) performed on the Pile 19 at Bent 3L of the above-referenced project. A site location map is provided for reference in Appendix A. The Pile 19 at Bent 3L was a production pile and would be incorporated into the structure. This driven pile at Bent 3L is in the control location of Bent 2 of Bridge number 55-1103E, so the same acceptance criteria needs to be used for this location. The PDA and PLT (Pile Load Test) test results along with Acceptance Criteria for the test piles at Bent 2 of Bridge number 55-1103E were provided in the report from this Office dated August 9, 2011. Pile 19 at Bent 3L was open-ended steel pipe pile of 48 inch diameter and 0.75 inch thickness spiral weld. The total length of the subject pile was 109.75 ft.

Pile Installation Summary

The subject pile was installed at Bent 3L by using vibratory hammer and then by Delmag 62-22 open ended diesel hammer. During driving by vibratory hammer top of pile at location of jaws was damaged, so contractor did remove the damaged part of pile and resurfaced top of pile.

“Caltrans improves mobility across California”
Because of this the approximate distance from top of pile to instruments remains 7.75 ft instead of 8.0 ft (2 x diameter of pile). According to Structure Construction, the elevation of the ground at the location of pile installation is about 15.5 ft and first 40 ft of the pile was driven using vibratory hammer. According to Contractor, the maximum fuel setting of the hammer was used during the PDA monitoring of the pile. PDA monitoring of the pile was conducted during initial drive on November 26, 2013; and during restrike on December 11, 2013 by Jason Wahleithner, Toua Vang, Wendy Tkachoff of the Foundation Testing Branch. By mistake the instruments F3 and F4 were swapped with each other, and A1 and A2 were left on in the machine, which was corrected during data analysis. The PDA instruments were attached approximately at 7.75 feet below the top of pile, and PDA test pile was longer than other production piles to attach the PDA instruments.

**PDA Monitoring and Analysis**

The Contractor utilized DELMAG 62-22 diesel hammer to drive the subject pile, and manufacturer’s published specifications as available in the GRLWEAP Hammer Database File are shown in Table I.

<table>
<thead>
<tr>
<th>Hammer</th>
<th>Rated Energy</th>
<th>Ram Weight</th>
<th>Max. Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>DELMAG 62-22</td>
<td>164.6 (kip-ft)/kw</td>
<td>13.6 kips</td>
<td>12.05 ft</td>
</tr>
</tbody>
</table>

* Source: GRLWEAP Hammer Database File.

Pile Dynamic Analysis (PDA) monitoring was performed by utilizing a Pile Driving Analyzer® Model PAX 1, manufactured by Pile Dynamics Inc. and as per ASTM D4945-08. Elevation information is based on information provided by Structure Construction. Four strain sensors and two accelerometers were used to monitor the pile driving. The sensors used for the test pile are summarized in Table II.
Table II: PDA Sensor Data

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>ID No.</th>
<th>Calibration Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerometer A3</td>
<td>855</td>
<td>5/14/2013</td>
</tr>
<tr>
<td>Accelerometer A3**</td>
<td>855</td>
<td></td>
</tr>
<tr>
<td>Accelerometer A4</td>
<td>837</td>
<td>5/14/2013</td>
</tr>
<tr>
<td>Accelerometer A4**</td>
<td>837</td>
<td></td>
</tr>
<tr>
<td>Strain Gauge F1</td>
<td>7343</td>
<td>6/8/2012</td>
</tr>
<tr>
<td>Strain Gauge F1**</td>
<td>7343</td>
<td></td>
</tr>
<tr>
<td>Strain Gauge F2</td>
<td>5152</td>
<td>6/8/2012</td>
</tr>
<tr>
<td>Strain Gauge F2**</td>
<td>5152</td>
<td></td>
</tr>
<tr>
<td>Strain Gauge F3</td>
<td>7346</td>
<td>6/8/2012</td>
</tr>
<tr>
<td>Strain Gauge F3**</td>
<td>6197</td>
<td>6/8/2012</td>
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<tr>
<td>Strain Gauge F4</td>
<td>5156</td>
<td>5/13/2013</td>
</tr>
<tr>
<td>Strain Gauge F4**</td>
<td>6199</td>
<td>6/8/2012</td>
</tr>
</tbody>
</table>

* Calibration required per ASTM every two years.
** Instruments used during restrike.

Measured strains and accelerations induced in the pile as a result of driving were used to determine various engineering parameters of interest. Some of the more significant attributes derived for each hammer blow include the maximum energy transferred from the hammer, maximum compressive stresses, and the blow count. Plots depicting these parameters as a function of penetration depth are presented in Appendix B. The PDA-monitoring results of driving the subject pile are summarized in Table III.

Table III: PDA Monitoring Results: Pile 19 at Bent 3L

<table>
<thead>
<tr>
<th>Approx Elevation of Pile Tip at Start of Monitoring (ft)*</th>
<th>Initial Drive</th>
<th>Restrike</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-59.5</td>
<td>-83.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transferred Energy (EMX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near End of Initial Drive (k-ft)</td>
</tr>
<tr>
<td>Near Beginning of Restrike (k-ft)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum Average Compressive Stress (CSX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>During Initial Drive (ksi)</td>
</tr>
<tr>
<td>During Restrike (ksi)</td>
</tr>
</tbody>
</table>
Table III (continued): PDA Monitoring Results; Pile 19 at Bent 3L

<table>
<thead>
<tr>
<th>Maximum Individual Compressive Stress (CSI)</th>
<th>PDA Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>During Initial Drive (ksi)</td>
<td>29.7</td>
</tr>
<tr>
<td>During Restrike (ksi)</td>
<td>31.1</td>
</tr>
<tr>
<td><strong>Approx Blow Counts During Driving</strong></td>
<td></td>
</tr>
<tr>
<td>Near End of Initial Drive</td>
<td>60 Blows/ft</td>
</tr>
<tr>
<td>During Restrike*</td>
<td>200 Blows/ft</td>
</tr>
<tr>
<td><strong>Stroke Length (ft)</strong></td>
<td></td>
</tr>
<tr>
<td>Near End of Initial Drive</td>
<td>10.3</td>
</tr>
<tr>
<td>Near Beginning of Restrike</td>
<td>11.7</td>
</tr>
</tbody>
</table>

*Extrapolated from first 1/10th of foot driving during restrike.

Maximum CSX and CSI are within allowable limits (90% of 50 ksi) during initial and restrike PDA monitoring. According to the Acceptance Criteria (Pile 10 at Bent 2, Bridge number 55-1103E report dated August 9, 2011), Pile 19 at Bent 3L during initial driving near tip of pile with approximately 60 blows/ft and 10.3 ft stroke length have reached the required capacity of 1800 kips.

**Recommendations**

This Office recommends Structure Construction, Geotechnical and Structure designers to review the results of PDA testing in this report and use as needed. Any questions or comments regarding the change in design or tip elevations should be directed to Structure Construction personnel or designers.
If you have any questions or comments regarding this memorandum please contact Tejinderjit Singh, P.E. at (916) 227-1052.

TEJINDERJIT SINGH, P.E.
Transportation Engineer
Foundation Testing Branch
Office of Geotechnical Support

RONNIE GU, P.E.
Senior Transportation Engineer (Acting)
Foundation Testing Branch
Office of Geotechnical Support

Attachments
C:  R. Stott - SC (Email)
    B. Alsamman - SC (Email)
    S. K. Amiri - OGDSI (Email)
    S. Kim - SC (Email)
APPENDIX A

Location Map

405/22 HOV Connector Separation
Bridge No. 55-1103E
APPENDIX F–PILE DYNAMIC ANALYSIS, STATIC PILE LOAD TESTING AND FIELD ACCEPTANCE CRITERIA

OCTOBER 2015

Foundation Testing Branch

Bent 3L Pile 19 Testing Location

BEGIN CONSTRUCTION (ROUTE 405)
Sta "NB405" 296+83 PM 20.4

LIMIT OF WORK
(WEST OF WHIPPLE ST.)
Sta 297+35 PM

SEAL BEACH

WESTMINSTER

GARDEN GROVE

END CONSTRUCTION
Sta "E" 3333+00 PM

United States Naval Wasp

GENERAL SITE LOCATION MAP
405-22 HOV Connector Separation Bridge
Pile 19 at Bent 3L - PDA-Monitored Drive

Bridge No. 55-1103E
Contract No. 12-071624
12-ORA-22,405-PM20.75

CISS 48X0.75 inch Steel Pipe Piles
Installed: 11/28/2013
APPENDIX B

PILE DYNAMIC ANALYSIS PLOT

405/22 HOV Connector Separation
Bridge No. 55-1103E
APPENDIX C

Pile Information

405/22 HOV Connector Separation
Bridge No. 55-1103E
To: Binh Ngo
Oversight Structure Representative
405 / Wilmington Avenue
Interchange Improvements

Date: June 3, 2015

File: 07-LA-405-9 3/9.9
07-234004 (0700000394)
Dominguez Channel Bridge
Bridge No. 53-1166

From: DEPARTMENT OF TRANSPORTATION
Division of Engineering Services
Geotechnical Services - MS 5

Subject: Pile Dynamic Monitoring Results and Bearing Acceptance Criteria: Bents 4 and 6 Control Locations

Introduction
This memorandum presents the dynamic monitoring results and bearing acceptance criteria, prepared in accordance with Section 10-1.55 “PILING” of the Special Provisions, for the control locations identified in the Special Provisions (page 227) as Bents 4 and 6 of the Dominguez Channel Bridge (Widen), Bridge No. 53-1166.

Foundation Description
The Dominguez Channel Bridge (Widen) pile foundations include open-ended Cast-In-Steel-Shell Concrete Piling (CISS 24” x 0.5”). Specified tip elevations are controlled by compression demands. Pile data specified in the Contract Plans (Appendix C) for the control location is shown below in Table 1.

Table 1: Pile Data

<table>
<thead>
<tr>
<th>Location</th>
<th>Pile Type (in.)</th>
<th>Nominal Resistance Compression (Kips)</th>
<th>Nominal Resistance Tension (Kips)</th>
<th>Cut-off Elevation (ft)</th>
<th>Specified Tip Elevation (ft)</th>
<th>Pile Length (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bent 4</td>
<td>CISS 24 x 0.5</td>
<td>860</td>
<td>0</td>
<td>28.2</td>
<td>-87.0</td>
<td>115.2</td>
</tr>
<tr>
<td>Bent 6</td>
<td>CISS 24 x 0.5</td>
<td>820</td>
<td>0</td>
<td>27.5</td>
<td>-80.0</td>
<td>107.5</td>
</tr>
</tbody>
</table>

(1) Pile Cut-Off Elevation obtained from Log Pile Sheets.

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Subsurface Conditions

The subsurface conditions at the test pile locations are characterized by Geotechnical Log of Test Boring (LOTB) R-07-017 (October 2007), located between the two test piles. For a complete description of the subsurface conditions, please refer to the LOTB included in Appendix D.

Test Pile Installation

Bents 4 and 6 test piles were driven at the location of production piles. Exact location of the test piles within the bent layout is the outside pile, as marked on the Contract Plan sheet Foundation Plan included in Appendix C. Pile material consisted of A252 Grade 3 steel pipe based on field observation. The driving system consisted of an APE D46-32 single-acting diesel hammer based on field observation and discussions with field inspectors. The APE D46-32 has an approximate rated energy of 114 Kip-ft, a stroke of 11.25 feet at maximum rated energy, and a ram weight of 10.14 Kips. The driving system submitted to the project identified a Delmag D46-32 hammer. Both the APE and Delmag D46-32 hammers have an equivalent ram weight of 10.14 Kips.

Each test pile was driven in two pieces and included one field welded splice. The hammer was operated at the maximum fuel setting at the Bent 6 test pile. At Bent 4 the fuel setting was adjusted from fuel setting 3 to the maximum fuel setting during the initial drive. Pre-drilling occurred at both test pile locations prior to installation of the first pile piece. Approximately 16.7 feet of pre-drilling occurred at Bent 4 and approximately 21.4 feet of pre-drilling occurred at Bent 6 according to field inspectors. Center-relief drilling was not used during test pile installation. The depth to soil plug within the open-ended piles following driving to specified tip elevation was not measured due to the approximate 30 feet of pile extension above grade.

Table II: Test Pile Driving Information

<table>
<thead>
<tr>
<th>Location</th>
<th>Date of Initial Drive</th>
<th>Date of Restrike</th>
<th>Test Pile Length (ft)</th>
<th>Length of Pile Penetration (ft)</th>
<th>Approx. Depth to Soil Plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bent 4</td>
<td>5-26-15</td>
<td>5-27-15</td>
<td>117.0</td>
<td>85.7</td>
<td>n/a</td>
</tr>
<tr>
<td>Bent 6</td>
<td>5-28-15</td>
<td>5-29-15</td>
<td>109.5</td>
<td>76.4</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Initial drive defined as continuous driving event to within one foot of specified tip after pile splicing.

*Not available due to over 30 feet of pile extension above grade following drive to tip elevation.

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Pile Dynamic Monitoring

Dynamic Monitoring was conducted utilizing a Pile Driving Analyzer manufactured by Pile Dynamics, Inc. Monitoring of the test piles was conducted by Engineers Jason Wahleithner and Jeremy Peterson-Self of the Caltrans Foundation Testing Branch (FTB). Calibration dates for strain gages and accelerometers used in monitoring are listed in Table III.

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>ID No.</th>
<th>Date of Calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerometer A3</td>
<td>K1291</td>
<td>10-28-2014</td>
</tr>
<tr>
<td>Accelerometer A4</td>
<td>K1298</td>
<td>10-28-2014</td>
</tr>
<tr>
<td>Strain Gauge F3</td>
<td>7342</td>
<td>10-14-2014</td>
</tr>
<tr>
<td>Strain Gauge F4</td>
<td>3664</td>
<td>10-14-2014</td>
</tr>
</tbody>
</table>

(1) Calibration recommended every two years by ASTM 4945.

Monitoring was performed during the final approximate 29 feet of initial driving at Bent 4 and the final approximate 23 feet of initial driving at Bent 6. Additional monitoring was also performed during a one foot restrike at each location. Results from dynamic monitoring are summarized in Table IV and included in Appendix B. Corresponding elevations, estimated to nearest tenth of a foot, were derived from temporary bench marks placed on existing columns and identified by field inspectors.

"Provide a safe, sustainable, integrated and efficient transportation system to enhance California’s economy and livability."
Table IV Pile Dynamic Monitoring Results

<table>
<thead>
<tr>
<th></th>
<th>Bent 4</th>
<th>Bent 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial Drive</td>
<td>Restrike</td>
</tr>
<tr>
<td>Pile Tip Elevation At Start of Monitoring (ft)</td>
<td>-57.3</td>
<td>-96.0</td>
</tr>
<tr>
<td>Pile Tip Elevation At End of Monitoring (ft)</td>
<td>-86.0</td>
<td>-87.0</td>
</tr>
<tr>
<td>Transferred Energy: End Initial Drive [EMX] (Kip-ft)</td>
<td>41.2</td>
<td>--</td>
</tr>
<tr>
<td>Transferred Energy: Begin Restrike [EMX] (Kip-ft)</td>
<td>--</td>
<td>63.4</td>
</tr>
<tr>
<td>Peak Max Average Compressive Stress [CSX] (Ksi)</td>
<td>28.6</td>
<td>32.8</td>
</tr>
<tr>
<td>Peak Max Individual Compressive Stress [CSI] (Ksi)</td>
<td>31.8</td>
<td>33.7</td>
</tr>
<tr>
<td>Stroke at End of Initial Drive [STK] (ft)</td>
<td>8.5</td>
<td>--</td>
</tr>
<tr>
<td>Blow Count at End of Initial Drive [BLC] (Blows/ft)</td>
<td>92</td>
<td>--</td>
</tr>
<tr>
<td>Stroke at Beginning of Restrike [STK] (ft)</td>
<td>--</td>
<td>10.5</td>
</tr>
<tr>
<td>Blow Count at Beginning of Restrike [BLC] (Blows/ft)</td>
<td>--</td>
<td>460</td>
</tr>
<tr>
<td>Blow Count for Entire Restrike [BLC] (Blows/ft)</td>
<td>--</td>
<td>290</td>
</tr>
</tbody>
</table>

(1) Exemplified from blow count over first 0.1 foot of restrike.

Discussion of Dynamic Monitoring Results

The test piles appear to have been driven without damage while being monitored with a PDA. The pile driving stresses measured by the PDA during initial driving and restrike did not exceed the allowable driving stress of 40.5 ksi which represents 90% of the minimum yield stress for the A252 Grade 3 pipe material. Substantial difference between the average compressive stress of both strain gages and the peak compressive stress of any individual strain gage indicates that uneven stresses were induced in the pile. Pile and hammer alignment must be properly maintained to impart maximum energy to the pile and limit the potential for pile damage.

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Wave equation analysis was performed utilizing the pile driving analysis software CAPWAP Version 2006 in order to predict test pile capacity at the end of initial drive and the beginning of restrike. The CAPWAP derived pile capacities are presented in Table V.

### Table V. CAPWAP Derived Pile Capacity

<table>
<thead>
<tr>
<th></th>
<th>Bent 4</th>
<th>Bent 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity at End of Initial Drive</td>
<td>(Kips)</td>
<td>775</td>
</tr>
<tr>
<td>Capacity at Beginning of Restrike</td>
<td>(Kips)</td>
<td>1,143</td>
</tr>
</tbody>
</table>

### Pile Bearing Acceptance Criteria

Bearing acceptance criteria was developed by this Office based on the results of wave equation analysis correlated to pile dynamic measurements for the test piles driven at Bents 4 and 6. Wave equation analysis was performed utilizing the pile driving analysis software CAPWAP Version 2006 and GRL-WEAP Version 2010-4. According to the Special Provisions, the bearing acceptance criteria for the Bents 4 and 6 Control Locations shall be used for field acceptance of production pile driving. Bearing Acceptance Criteria Charts depicting estimated pile nominal compressive resistance (pile capacity) as a function of blow count and hammer stroke are presented in Appendix A. Estimated setup factors were calculated from initial drive and restrike monitoring and are also provided in Appendix A.

Bearing acceptance criteria presented in this report relate driving resistance to stroke and blow count. Bearing acceptance criteria are valid only for the APE D46-32, single-acting diesel hammer when operating properly for the installation of CISS (24” x 0.5”) piling. The influence of uneven or eccentric blows is not addressed by these charts but should be considered. The values identified for stroke have been correlated to effective energy transferred to the pile for the driving event monitored. This field acceptance criteria will not be valid if the performance of the hammer is altered or if the construction practice is altered in a way that affects imparted energy.

*Provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability.*
Recommendations

This Office recommends review of the attached dynamic monitoring results by the Dominguez Channel Bridge (Widen) geotechnical designer when considering release of production piles within the subject control zones.

The derived pile driving resistance relationship plot presented may be used to estimate pile driving resistance from observed blow count and stroke height for initial driving. The field acceptance criteria presented are pile type, site and hammer specific and should not be applied to piles outside the control zone. If the driving system is modified or if a new driving system is utilized, additional dynamic monitoring should be performed to verify dynamic characteristics and develop revised bearing acceptance criteria.

If you have any questions or comments regarding this report, please contact Jason Wahleithner at (916) 227-1059.

JASON D. WAHLEITHNER, P.E.
Transportation Engineer, Civil
Foundation Testing Branch
Office of Geotechnical Support

c: V. Francis – OSC (Email)
    T. Liu – OGDS1 (Email)
    Z. Saleh – Hill International (Email)

"Provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability."
APPENDIX A

Bearing Curve and Setup Curve

Dominguez Channel Bridge (Widen)
Bridge No. 53-1166

Bents 4 and 6 Control Locations
Bent 4 Control Location
For Use With APE D46-32 and 24"x 1/2" CISS Pile

Foundation Testing Branch

Bearing Acceptance Criteria Chart
Derived from Wave Equation Analysis Program (WEAP)

EA Number 07-234004
Bridge Number 53-1166
07-LA-405-9.3/9.9

Bent 4 Control Location
Dominguez Channel Bridge (Widen)
Bent 4 Control Location
For Use With APE D46-32 and
24"x 1/2" CISS Pile

Bearing Acceptance Criteria: Setup Relationship
Derived from CapWap Capacities

EA Number 07-234004
Bridge Number 53-1166
07-LA-405-9.3/9.9

Dominguez Channel Bridge (Widen)
Bent 6 Control Location
For Use With APE D46-32
and 24"x 1/2" CISS Pile

Blow Count (Blows per Foot)

Nominal Driving Resistance (Kips)

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000

Bearing Acceptance Criteria Chart
Derived from Wave Equation Analysis Program (WEAP)

EA Number 07-234004
Bridge Number 53-1166
07-LA-405-9.3/9.9

Bent 6 Control Location
Domínguez Channel Bridge (Widen)
Foundation Testing Branch

Bent 6 Control Location
For Use With APE D46-32
and
24" x 1/2" CISS Pile

Percentage of Ultimate Compressive Capacity (%)

0.1 1 10 100
Time (Days)

Bearing Acceptance Criteria: Setup Relationship
Derived from CapWap Capacities

EA Number 07-234004
Bridge Number 53-1166
07-LA-405-9.3/9.9

Bent 6 Control Location
Dominguez Channel Bridge (Widen)
The following presents an example of how to use the “Time-Setup Relationship” Curve at Bent 4. Use the same method for Bent 6 but with the setup factor from the Bent 6 time-setup relationship.

1) The production pile was driven to within 1 foot from the specified tip elevation.

2) 30 blows per foot were recorded with an 8.0 ft stroke at this depth. According to the Bearing Acceptance Criteria Chart (Bearing Graph), a Nominal Compressive Resistance of 585 kips is obtained (this is at 68% of the ultimate compressive capacity according to the time-setup relationship).

3) After a setup period of 1 day, the projected Nominal Compressive Resistance can be extrapolated as:
   585 kips × (1/0.68) = 860 kips
APPENDIX B

Pile Dynamic Monitoring Results

Dominguez Channel Bridge (Widen)
Bridge No. 53-1166

Bents 4 and 6 Control Locations
APPENDIX F–PILE DYNAMIC ANALYSIS, STATIC PILE LOAD TESTING AND FIELD ACCEPTANCE CRITERIA  
OCTOBER 2015

CALTRANS • FOUNDATION MANUAL  F - 34
APPENDIX C

Contract Plan Pile Data Table and Foundation Plan

Dominguez Channel Bridge (Widen)
Bridge No. 53-1166

Bents 4 and 6 Control Locations
APPENDIX D

Pile Log Sheet
Log of Test Borings

Dominguez Channel Bridge (Widen)
Bridge No. 53-1166

Bents 4 and 6 Control Locations
## PDA Testing

**Wilmington Ave Interchange Modification at 405 Fwy**

**Federal Aid Project No. H626-5403-87**

**Contract No. 07-2365**

**Engineer** D. Martinez

<table>
<thead>
<tr>
<th></th>
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<td>11</td>
<td>-68</td>
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**STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION**

**LOG PILE SHEET**

**Bridge Name:** Berriques Channel Bridge (Widen)  
**Sheet No.:** (2/2)

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<th>Sheet No.</th>
<th>APE Make</th>
<th>Reference Data</th>
<th>Pile Length</th>
<th>Pile Diameter</th>
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<td></td>
<td></td>
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<td>115.24</td>
<td>5.26, 15</td>
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<thead>
<tr>
<th>Date(Drive)</th>
<th>Drive</th>
<th>Tip Elev</th>
<th>Blowoff</th>
<th>Stroke/Min</th>
<th>Stroke/Min</th>
<th>Time</th>
<th>Remarks</th>
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<tr>
<td>5.26.15</td>
<td></td>
<td>29</td>
<td>84</td>
<td>05</td>
<td>05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.27.15</td>
<td></td>
<td>30</td>
<td>07</td>
<td>300</td>
<td>0.5</td>
<td></td>
<td>Stopped at 29.7 ±</td>
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**APPENDIX F–PILE DYNAMIC ANALYSIS, STATIC PILE LOAD TESTING AND FIELD ACCEPTANCE CRITERIA**

**OCTOBER 2015**
STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
LOG PIECE SHEET
3C-4800 (Form FH C/20) (REV, 10/17/13)

**APPENDIX F—PILE DYNAMIC ANALYSIS, STATIC PILE LOAD TESTING AND FIELD ACCEPTANCE CRITERIA**

**Wilmington Ave Interchange**
**Modification at 405 Fwy**
**Federal Aid Project No. HPEUL-5403(07)**
**Contract No. DT-232416**

**PDA Testing**

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<th>Time</th>
<th>Remarks</th>
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</tr>
<tr>
<td>05, 29, 15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Bridge Name**

**Pontevecch Eannel Bridge (Widen)**

**Sheet No.**

**Log Pile Sheet**

**Bridge No.**

**53-1108**

**Hammer Make**

**Atlas**

**Model**

**DAB-32**

**Reference Elev**

**Elev. -3.63**

**Pile Tip Elev**

**-56.06**

**Pile Type**

**C155**

**Pile Cutoff Elev**

**27.45**

**Pile Length**

**107.45**

**Debit(s) Driven**

**05, 28, 15 & 05, 29, 15**

**Penetration**

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**10**

**11**

**12**

**13**

**14**

**15**

**16**

**17**

**18**

**19**

**20**

**21**

**22**

**23**

**24**

**Tip Elev**

**-57.06**

**-58**

**-59**

**-60**

**-61**

**-62**

**-63**

**-64**

**-65**

**-66**

**-67**

**-68**

**-69**

**-70**

**-71**

**-72**

**-73**

**-74**

**-75**

**-76**

**-77**

**-78**

**-79**

**Notes:**

- **Welded Connection**
- **Elev. -5.06**
- **Elev. -5.06**
- **Elev. -25.0**
- **Elev. -3.63**
- **Top of Pad**
- **52.43**
- **52.9**
- **STIE**

**Remarks:**

- **Remarks:**

**Blow/Min:**

**30**

**32**

**27**

**32**

**27**

**29**

**30**

**30**

**31**

**28**

**29**

**33**

**39**

**48**

**51**

**62**

**69**

**66**

**75**

**67**

**77**

**87**

**77**

**8.5**

**8.6**

**Blow/Min:**

**-57.06**

**-58**

**-59**

**-60**

**-61**

**-62**

**-63**

**-64**

**-65**

**-66**

**-67**

**-68**

**-69**

**-70**

**-71**

**-72**

**-73**

**-74**

**-75**

**-76**

**-77**

**-78**

**-79**

**-80.00**

**145**

**Remarks:**

- **Remarks:**

**Blow/Min:**
Memorandum

To: MANO MIRZAI
Structure Representative
Fresno Field Construction Office

From: DEPARTMENT OF TRANSPORTATION
Division of Engineering Services
Geotechnical Services - MS 5

Date: April 3, 2013

File: 06-Fre,Mad-99-26.7/R31.6,
R0.0/R1.6
06-442624 (06 0000 0972)
San Joaquin River Bridge (Replace)
Bridge No. 41-0090

Subject: Pile Dynamic Analysis, Pile Load Test Results, and Pile Field Acceptance Criteria: Test Pile at Pier 3

Attached is a report from this Office containing the Pile Dynamic Analysis, Pile Load Test results, and the Pile Field Acceptance Criteria for the Test Pile at Pier 3 of the above-referenced project.

If you have any questions or comments regarding this report, please contact James L. Ta, P.E. at (916) 227-1050.

DOUGLAS E. BRITTSAN, G.E.
Senior Transportation Engineer
Foundation Testing Branch

Attachments

c: R. Stott - SC (Email)
B. Alsamman - SC (Email)
K. Low - SC (Email)
N. Quiroz - SC (Email)
R. Simmons - SD (Email)
Q. Huang - OGDN (Email)
W. Bertucci - OGDN (Email)
T. Shantz - DRI (Email)
Geodog

"Caltrans improves mobility across California"
FOUNDATION TESTING BRANCH

April 3, 2013

06-Fre,Mad-99-26.7/R31.6,R0.0/R1.6
06-442624

San Joaquin River Bridge (Replace)
Bridge No. 41-0090

Pile Dynamic Analysis, Pile Load Test Results,
and Pile Field Acceptance Criteria:

Test Pile at Pier 3
April 3, 2013

Project Information

06-Fre,Mad-99-26.7/R31.6,R0.0/R1.6
06-442624
San Joaquin River Bridge (Replace)
Bridge No. 41-0090

Subject

Pile Dynamic Analysis, Pile Load Test Results, and Pile Field Acceptance Criteria:
Test Pile at Pier 3

Introduction

This report presents the pile dynamic analysis (PDA), pile load test (PLT) results, and pile field acceptance criteria for the Test Pile at Pier 3 of the San Joaquin River Bridge replacement structure. Static axial load testing was conducted on the 74.5-inch diameter by 1.25-inch thick Cast-in-Steel-Shell (CISS) open ended steel pipe pile with respect to two different pile installation methods. The subject Test Pile is identified on the contract plans as Pile No. 1 at Pier 3. The compression load test used four reaction anchor piles each consist of a 48-inch diameter by 1.0-inch thick steel pipe piling. The Test Pile and four anchor piles were driven using the APE D180-42 and Pileco D225-22-32, open ended, single acting diesel impact hammers. A site location map of the Test Pile is provided in Appendix A.

The Test Pile at Pier 3 is a production pile that will be incorporated into the San Joaquin River Bridge foundations. Based on the contract plans, the four anchor piles used for PLT are non-production piles that will be cut below grade and leave in-placed.

The criteria detailed herein are designed to provide pile compressive acceptance criteria for the 74.5-inch diameter CISS piling based on wave equation analysis and PDA data with correlations to the static axial test results of the measured load-displacement behavior of the Test Pile. As
such, the Test Pile at Pier 3 is intended to be representative of the CISS piling for the control locations of Piers 2 to 6 of the San Joaquin River Bridge replacement foundations.

Foundation Description

The replacement San Joaquin River Bridge is a six-span structure. Based on contract plans, Abutments 1 and 7 are designed to be supported by Class 140 Alt W piling. Piers 2 to 6 are designed to be supported by a five-column pier with CISS piling. A total of twenty-five (25) 74.5-inch diameter by 1.25-inch thick Cast-in-Steel-Shell (CISS) piles are planned to be installed at the proposed new bridge structure. The specified “designed” nominal resistance in compression for the production piles (Piers 2 to 6) at the San Joaquin River Bridge ranges from 4070 kips to 6230 kips with zero demand for tension. Nominal driving resistance ranges from 4230 kips to 6640 kips were shown on the plans (referred to Pile Data Table for specific support location).

Subsurface Conditions

Stratigraphy at the San Joaquin River Bridge load test site can be characterized by Geotechnical Boring RC-11-001 (boring dated 05-25-11). The site stratigraphy consists of granular materials of loose to medium dense to very dense silty sand, sand, silt, and sandy silt. Trace of gravel was encountered within the granular soil matrix. Very stiff to hard silty/lean clay, sandy clay, and silt were encountered and interbedded within the soil matrix. For complete description of the subsurface conditions at the test site, please refer to the Log of Test Boring provided in Appendix E.

Pile Installation Summary

The Test Pile at Pier 3 utilized for the compressive static axial load testing was a 74.5-inch diameter with 1.25-inch shell thickness, open ended steel pipe pile. Each of the four (4) anchor piles consist of a 48-inch diameter with 1.0-inch shell thickness, open ended steel pipe pile. All piling conformed to ASTM A252, Grade 3 and were manufactured by XKT Engineering, Inc. of Vallejo, CA. At Pier 3, the anchor pile (AKA Pile A, utilized for PDA monitoring) was driven with the APE D180-42 diesel hammer (max Fuel Setting during PDA monitoring) and the Test
Pile was driven with the Pileco D225-22/32 diesel hammer (Fuel Setting set from minimum to maximum during PDA monitoring) to approximate tip elevation of 52 feet (as reported). Original Grade (OG) elevation at the location of the Test Pile was estimated to be approximately elevation 237.5 feet.

**Pile Dynamic Analysis - Test Pile & Anchor Pile**

The contractor installed the isolation CMP casing. Clean out inside the CMP casing was provided to near casing tip. The first and second pipe sections (80 feet each) of the Test Pile were driven with the APE D180-42 hammer followed by field welding. Pile driving installations of the third-section of the steel pipe (76 feet) were utilized by both the APE D180-42 and Pileco D225-22/32 hammers. PDA monitoring (Pileco D225-22/32) was performed on March 8, 2013 for Test Pile and was driven to approximate tip elevation of 52 feet. The initial PDA monitoring of the Test Pile was referenced to penetration depths of 168.5 ft to 173.2 ft (elevation 56.7 ft to elevation 52 ft) with datum referenced to ground surface inside CMP casing (estimated at elevation 225.2 ft).

PDA monitoring was performed on February 22, 2013 for the Anchor Pile (Pile A) and was driven to approximate tip elevation of 106 feet. The initial PDA monitoring of the Anchor Pile was referenced to penetration depths of 104 ft to 130 ft (elevation 132 ft to elevation 106 ft) with datum reference at OG.

Characteristics of the Pileco D225-22/32 and APE D180-42 Diesel hammers are provided in Table I below that include the rated energy, Eq. max stroke, Eq. rate stroke, ram weight, and helmet/cap weight. Manufacturer's published specifications (additional information provided by the Contractor from other project with different hammer ID number) of the diesel hammers utilized to install the piles at the test site are shown in Table I. The below data were utilized for analysis purposes.
Pile Dynamic Analysis (PDA) monitoring was performed on the Test Pile for 4.7 feet of driving, utilizing a Pile Driving Analyzer® Model PAX, Serial No. 3705L, manufactured by Pile Dynamics Inc. Four strain sensors and two accelerometers were used to monitor the Test Pile driving operations. All sensors were mounted on the outer surface of the pile at approximately 12.3 ft below top of pile. The sensor data for the Test Pile at Pier 3 are summarized in Table II.

Measured strains and accelerations induced in the pile as a result of driving were used to determine various engineering parameters of interest. Some of the more significant attributes derived for each hammer blow include the maximum energy transferred from the hammer to the pile, maximum pile compressive stresses, and the blow count. Plots depicting these parameters as a function of penetration depth are presented in Appendix B. PDA test results for the Anchor Pile (Pile A) and Test Pile at Pier 3 are summarized in Tables III(a) and III(b), respectively.
Table III(a). PDA Test Results of Anchor Pile (Pile A) at Pier 3

<table>
<thead>
<tr>
<th>Approx. Elevation of Pile Tip for PDA Monitoring</th>
<th>English Units</th>
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</thead>
<tbody>
<tr>
<td>Start of Initial Drive</td>
<td>132 ft</td>
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<tr>
<td>End of Initial Drive</td>
<td>106 ft</td>
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<tr>
<td>Max Transferred Energy (EMX)</td>
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</tr>
<tr>
<td>End of Initial Drive*</td>
<td>246.179 kip-ft*</td>
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<tr>
<td>Maximum Average Compressive Stress (CSX)</td>
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<tr>
<td>Initial Drive*</td>
<td>26.246 ksi*</td>
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<tr>
<td>Maximum Individual Compressive Stress (CSI)</td>
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<tr>
<td>Initial Drive*</td>
<td>33.739 ksi*</td>
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<tr>
<td>Actual Field Blow Counts</td>
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</tr>
<tr>
<td>End of Initial Drive</td>
<td>28 blows/ft</td>
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Note:
1) *Value based on full depth range of PDA data.
Table III(b). PDA Test Results of Test Pile at Pier 3

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<td>End of Initial Drive</td>
<td>52.0 ft</td>
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<td>Max Transferred Energy (EMX)</td>
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<tr>
<td>End of Initial Drive*</td>
<td>329.06 kip-ft*</td>
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<td>End of Initial Drive**</td>
<td>286.9 kip-ft**</td>
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<td>Maximum Average Compressive Stress (CSX)</td>
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<tr>
<td>Initial Drive*</td>
<td>27.178 ksi*</td>
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<td>26.09 ksi**</td>
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<td>Maximum Individual Compressive Stress (CSI)</td>
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<td>Initial Drive*</td>
<td>29.872 ksi*</td>
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<tr>
<td>Initial Drive**</td>
<td>27.31 ksi**</td>
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<tr>
<td>Actual Field Blow Counts</td>
<td>149 blows/ft</td>
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Notes:
1) *Value based on full depth range of PDA data.
2) **Value based on last ten blows only.

The Test Pile at the San Joaquin River replacement structure project appears to have been driven without observed damage while being monitored by Pile Dynamic Analyzer (PDA). The compressive pile driving stresses measured by PDA did not exceed the allowable stresses within the pile. The maximum compressive stress (CSI) recorded at any sensor was 29.872 ksi, during the initial drive. This represents about 66% of the minimum yield stress of 45 ksi, which is below the 90% allowable for pile installation. The maximum average compressive stress over the pile cross section was observed during initial drive at 27.178 ksi, which is about 60% of the minimum yield stress of 45 ksi.
In order to impart maximum energy to the pile and limit the potential for pile damage, pile and hammer alignment must be properly maintained. The pile experienced no observed bending during installation with the subject hammer system.

It should be noted that ultimate pile capacity has not been shown to be reliably predicted by PDA for large diameter, open ended pipe piles. Therefore, ultimate capacities computed from PDA using the CAPWAP® program are not deemed as a dependable evaluation of the actual CISS pipe pile capacity.

Pile driveability is highly dependent upon soil characteristics, hammer alignment, pile length, pile handling, and adherence to the specifications and industry-accepted driving practices, so engineering judgment should be exercised when applying this information to other piles driven within the control location.

**Static Axial Compressive Load Testing**

Static axial compressive load testing was conducted on March 15, 2013 for the first PLT test and on March 21, 2013 for the second PLT test by personnel (R. Medina, R. Cosato, J. Pattison, A. Valdez and J. Ta) from the Foundation Testing Branch of Geotechnical Services. Test procedures used were in general conformance with ASTM D 1143/D 1143M - 07, contract Special Provisions and specifications developed by this Office. The test frame consisted of a five-pile group, a Test Pile with four anchor piles. Applied load was monitored at the Test Pile utilizing four (4) load cells placed between the hydraulic loading rams and the main beam. Deflection was monitored utilizing four (4) displacement transducers placed (on mirror plate) below the top of the test pile and fastened to a pair of fixed beams. For test frame layout plan and photos, please refer to Appendix E.

Based on requirements from contract Special Provisions (with modifications by the Geotechnical Designers), total of two (2) compressive axial load tests were conducted for two different types of installation methods (first test with no clean out and second test with partial pile clean out). Each test consists of two (2) loading cycles. Cycle #1 was set to 2000 kips (at 30% the nominal resistance in compression) and Cycle #2 was set to 6640 kips (nominal resistance in compression) and increased to maximum test frame capacity of 8000 kips. Table IV summarizes
the results of the static axial compressive load tests. Plot depicting load-displacement behavior for the Test Pile at Pier 3 can be found in Appendix C.

Table IV. Compression Test Results: Test Pile at Pier 3
74.5-inch diameter at 1.25-inch thick CISS Pile

<table>
<thead>
<tr>
<th>Compression Test</th>
<th>PLT Test #1</th>
<th>PLT Test #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Date</td>
<td>03/15/2013</td>
<td>03/21/2013</td>
</tr>
<tr>
<td>Measured Load at 1.0-inch deflection</td>
<td>4737.2 kips*</td>
<td>4630.7 kips*</td>
</tr>
<tr>
<td>Measured Demand Load</td>
<td>6640.4 kips*</td>
<td>6640.7 kips*</td>
</tr>
<tr>
<td>Displacement at Measured Demand Load</td>
<td>1.51 inches*</td>
<td>1.51 inches*</td>
</tr>
<tr>
<td>Measured Maximum Compressive Load</td>
<td>8011.7 kips*</td>
<td>8006.7 kips*</td>
</tr>
<tr>
<td>Max Displacement at Max Load</td>
<td>2.15 inches*</td>
<td>2.10 inches*</td>
</tr>
<tr>
<td>Required Nominal Compressive Resistance</td>
<td>6640 kips</td>
<td>6640 kips</td>
</tr>
</tbody>
</table>

*Data from Cycle #2.

Pile Field Acceptance Criteria

Field acceptance criteria were developed by this Office based on the results of wave equation analysis correlated to pile load test and pile dynamic measurements. Wave Equation Analysis was performed utilizing the pile driving analysis software GRLWEA™ Version 2010. Plots depicting estimated pile nominal compressive resistance (pile capacity) as a function of blow count and hammer stroke are presented in Appendix D.

The pile field acceptance criteria are considered valid for only the specified pile type driven by the Pileco D225-22/32 hammer system (Field ID as D225-32), operating properly at up to maximum fuel setting. The influence of uneven or eccentric blows is not addressed by these charts and should be considered. If the performance of the hammer is altered, or if the construction practice is altered in a way that affects imparted energy, the pile field acceptance criteria will not be valid.

Results

This Office recommends the Structure Representative, Structural Designer, and Geotechnical Designers to review the submitted PLT report and to utilize the test results in accordance to the design requirements for the 74.5-inch diameter CISS piling at the control locations of Piers 2 to 6 of the San Joaquin River replacement structure, Bridge No. 41-0090.
If you have any questions or comments regarding this report, please contact James L. Ta, P.E. at (916) 227-1050.

JAMES L. TA, P.E.
Associate M & R Engineer
Foundation Testing Branch
Office of Geotechnical Support

04/03/2013
APPENDIX A

LOCATION MAP OF SUBJECT PILING

San Joaquin River Bridge (Replace)
Bridge No. 41-0090

Test Pile at Pier 3
APPENDIX B

PILE DYNAMIC ANALYSIS

San Joaquin River Bridge (Replace)
Bridge No. 41-0090

Test Pile at Pier 3
San Joaquin River Bridge (Replace), Bridge No. 41-0090; Anchor Pile A at Pier 3
Initial Drive: 02/22/2013, Monitored Depth Range: 104 Feet to 130 Feet
APE 410-42 Diesel Hammer
San Joaquin River Bridge (Replace), Bridge No. 41-0090: Test Pile at Pier 3
Initial Drive: 03/08/2013, Monitored Depth Range: 168.5 Feet to 173.2 Feet
Pileco D225-22/32 Diesel Hammer
APPENDIX C

STATIC AXIAL PILE LOAD TEST:
LOAD-DISPLACEMENT BEHAVIOR

San Joaquin River Bridge (Replace)
Bridge No. 41-0090

Test Pile at Pier 3
Load - Displacement Behavior
Pile Load Test

San Joaquin River Bridge (Replace)
(First PLT Test)
Test Pile at Pier 3

Bridge No. 41-0090
EA: 06-442624
06-Fre, Mad-99-26.7/R31.6, R0.0/R1.6
Compression Test Date: 03/15/2013

74.5-inch diameter by 1.25-inch thick
CISS Piling (prior to pile clean out)
Pile Tip Elev. = 52 ft (Reported)
Load - Displacement Behavior
Pile Load Test

San Joaquin River Bridge (Replace)
(Second PLT Test)
Test Pile at Pier 3

Bridge No. 41-0090
EA: 06-442624
06-Fre,Mad-99-26.7/R31.6,R0.0/R1.6
Compression Test Date: 03/21/2013

74.5-inch diameter by 1.25-inch thick
CISS Piling (with partial pile clean out)
Pile Tip Elev. = 52 ft (Reported)
APPENDIX D

PILE FIELD ACCEPTANCE CRITERIA

San Joaquin River Bridge (Replace)
Bridge No. 41-0090

Test Pile at Pier 3
**Field Acceptance Chart: Capacity Relationship**

Derived from Wave Equation Analysis Program (WEAP) and Load Test Results

San Joaquin River Bridge (Replace)
Test Pile at Pier 3

(For Stroke Range: 9.0 feet to 10.5 feet)

Bridge No. 41-0090
06-Fre,Mad-99-26.7/R31.6,R0.0/R1.6
Compression Test Date: 03/15/2013

74.5-inch x 1.25-inch CISS Pile
OG Elev. = 237.5 ft (estimated)
Pile Tip Elev. = 52 ft (reported)
Load-Displacement Behavior

Field Acceptance Chart: Capacity Relationship

Derived from Wave Equation Analysis Program (WEAP) and Load Test Results

San Joaquin River Bridge (Replace)
Test Pile at Pier 3

(For Stroke Range: 10.5 feet to 13.0 feet)

Bridge No. 41-0080
06-Fre.Mad-99-26.7/R31.6,R0.0/R1.6
Compression Test Date: 03/15/2013

74.5-inch x 1.25-inch CISS Pile
OG Elev. = 237.5 ft (estimated)
Pile Tip Elev. = 52 ft (reported)
APPENDIX E

CONTRACT PLANS AND PHOTOS

San Joaquin River Bridge (Replace)
Bridge No. 41-0090

Test Pile at Pier 3