



September 15, 2015
File No.: 20143390.074A

STATE OF CALIFORNIA
Department of Transportation
Geotechnical Design North
Division of Engineering Services

Attn: Mr. John Huang

SUBJECT:
Foundation Report
State Route 41 Bridge over Kings River
Bridge No. 45-0007
Kings County, California

Dear Mr. Huang:

The attached report presents the results of the geotechnical study for the State Route 41 Bridge over Kings River project located southeast of Stratford, in Kings County, California. This report describes our study and provides conclusions and recommendations for use in seismic rehabilitation evaluation.

We appreciate the opportunity to provide geotechnical engineering services to Caltrans and other project designers. We trust this information meets your current needs. If there are any questions concerning the information presented in this report, please contact this office at your convenience.

Respectfully Submitted,
KLEINFELDER, INC.


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September 15, 2015

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**FOUNDATION REPORT
SR 41 BRIDGE OVER KINGS RIVER
BRIDGE NO. 45-0007
KINGS COUNTY, CALIFORNIA**

A report prepared for:

STATE OF CALIFORNIA
Department of Transportation
Geotechnical Design North
Division of Engineering Services

September 15, 2015
File No.: 20143390.074A

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PROJECT FOR WHICH THIS REPORT WAS PREPARED.**

Prepared For:
STATE OF CALIFORNIA
Department of Transportation
Geotechnical Design North
Division of Engineering Services

FOUNDATION REPORT
STATE ROUTE 41 BRIDGE OVER KINGS RIVER
BRIDGE NO. 45-0007
KINGS COUNTY, CALIFORNIA

Kleinfelder Job No.: 20143390.074A

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September 15, 2015

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1. INTRODUCTION

1.1. GENERAL

This report presents the results of the geotechnical investigation for the proposed seismic retrofit evaluation of the State Route 41 Bridge over Kings River (No. 45-0007), located southeast of Stratford in Kings County, California. The scope of services consisted of a field exploration program, laboratory testing, engineering analysis, and preparation of this written report.

1.2. SCOPE OF SERVICES

The purpose of the Foundation Report is to provide geotechnical recommendations and opinions to aid in project design. The report provides the following:

- ☐ A description of the proposed project;
- ☐ A summary of the field exploration and laboratory testing programs;
- ☐ Comments on the regional geology and site engineering seismology, including the recommended peak ground acceleration and Caltrans Seismic Design Criteria Version 1.7 ARS curve;
- ☐ Comments on liquefaction potential;
- ☐ Available factored nominal axial capacity and t-z and q_u curves for existing pile foundations under Extreme Event loading;
- ☐ Recommended LPILE parameters for use in evaluating the existing pile response to lateral loads and p-y curves for the existing piles;
- ☐ Moment and shear curves for a range of lateral deflections; and
- ☐ Log of Test Borings drawing.

1.3. PROJECT DESCRIPTION

The proposed project will involve the seismic rehabilitation evaluation of State Route 41 Bridge over Kings River. The original 10-span structure is supported by 15-inch diameter, cast-in-place Union fluted steel shell tapered piles. The span lengths center of bearing (c.o.b.) to c.o.b. are 24.75 feet, with a total bridge length of 260 feet. 15-inch Class 70 concrete driven piles were added to both the east and west at each abutment and bent locations as part of a bridge widening conducted in 1986. The overall widening of the bridge totaled 15'-10". Table 1.3-1 provides the data for the existing bridge foundations, as provided in the General Plan, dated June 19, 2015; and foundation data tables provided by Caltrans Structures group.

**TABLE 1.3-1
EXISTING BRIDGE FOUNDATION DATA**

Pile Type	Support	Location	Pile Cut-off Elevation (feet)	Tip Elevation (feet)
Cast-in-Place Union Fluted Steel Shell ¹ And Class 70 ²	Bent 1	203+15	194	100
	Bent 2	203+28	189	100
	Bent 3	203+53	184	100
	Bent 4	203+78	181	100
	Bent 5	204+03	181	100
	Bent 6	204+28	182	100
	Bent 7	204+53	183	100
	Bent 8	204+78	186	100
	Bent 9	205+03	187	100
	Bent 10	205+28	189	100
	Bent 11	205+53	193	100

Notes: 1. Original supports
2. Supports from 1986 widening

1.4. POLICY EXCEPTIONS

No known exceptions to Caltrans policy were made in the geotechnical evaluation for the foundations for this project.

2. FIELD EXPLORATION AND LABORATORY TESTING

2.1. FIELD EXPLORATION AND TESTING

The field exploration for State Route 41 Bridge over Kings River rehabilitation consisted of 1 test boring. Exploration was performed on June 23 and 27, 2015. The test boring was drilled with a Christensen, truck-mounted drill rig using punch core drilling techniques. The boring was drilled to a depth of 151.5 feet below ground surface. The approximate location of the test boring is shown on the Log of Test Borings drawing in Figures 1 and 2 of this report.

The earth materials encountered in the test borings were visually classified in the field and a continuous log was recorded. Along with the continuous core sampling, in-place samples of soil units were collected from the test boring at selected depths by driving a 2-inch I.D. split barrel sampler containing brass liners into the undisturbed soil with a 140-pound automatic safety hammer free falling a distance of 30-inches. In addition, an ASTM D1586 standard penetrometer without liners (barrel I.D. of 1.5 inches) was driven 18-inches in the same manner. This latter sampling procedure generally conformed to the ASTM D1586 test procedure. Resistance to sampler penetration over the last 12-inches is noted on the Log of Test Borings as the "Penetration Index". The penetration indices listed on the Log of Test Borings have not been corrected for the effects of overburden pressure, sampler size, rod length, or hammer efficiency.

Penetration rates determined in general accordance with ASTM D1586 were used to aid in evaluating the consistency, compression, and strength characteristics of the foundation soils. The hammer test measurement was obtained for the drill rig and hammer from Caltrans Drilling Services. The report was prepared June 2015. The hammer energy transfer measurement for the boring is noted on the Log of Test Boring drawing in Figure 2 of this report.

2.2. LABORATORY TESTS

Laboratory tests were performed on selected samples to evaluate certain characteristics and engineering properties. The laboratory testing program was designed with emphasis on the evaluation of geotechnical properties of foundation materials as they pertain to the proposed project. The laboratory testing program included performing the following tests:

- ❑ Moisture Content (ASTM D2216)
- ❑ Unit Weight (ASTM D7263)
- ❑ Material in Soils Finer than No. 200 (75- μ m) Sieve (ASTM D1140)
- ❑ Atterberg Limits (ASTM D4318)
- ❑ Unconfined Compressive Strength (ASTM D2166)

Geotechnical design parameters were based on project specific laboratory data, and interpretation of the area geology. Consideration was also given to correlations with sample penetration rates. Table 2.2-1 provides a summary of geotechnical design parameters and generalized soil profile used.

TABLE 2.2-1
GEOTECHNICAL DESIGN PARAMETERS

Elevation (feet)	Material	γ_t (pcf)¹	γ_b (pcf)²	Φ (degrees)	c (psf)
195 – 178	ML	125	63	27	-
178 – 172	CL	114	52	-	500
172 – 165	SM	125	63	35	-
165 – 138	CL	115	53	-	500
138 – 104	CH	115	53	-	1500
Below 104	CL	115	53	-	1500

Notes: 1. Total unit weight
2. Buoyant unit weight

3. SITE CONDITIONS

3.1 SURFACE CONDITIONS AND TOPOGRAPHY

The existing State Route 41 Bridge over Kings River is a 2-lane paved road approximately at original grade. At the time of the investigation, water was present in the Kings River at an approximate elevation of 189 feet and the banks supported some aquatic vegetation near the water line. The general topography along the State Route 41 alignment is relatively flat on either side of the bridge, with thin approach fills (less than about 2 feet).

3.2 REGIONAL GEOLOGY

The project site lies in the central portion of the San Joaquin Valley in the Great Valley geomorphic province in California. This province was formed by the filling of a large structural trough or downwarp in the underlying bedrock. The trough is situated between the Sierra Nevada Range on the east and south and the Coast Range on the west. Both of these mountain ranges were initially formed by uplifts that occurred during the Jurassic and Cretaceous periods of geologic time (greater than 65 million years ago). Renewed uplift began in the Sierra Nevada during the Tertiary time, and is continuing today. The trough that underlies the valley is asymmetrical, with the greatest depths of sediments near the western margin. The sediments that fill the trough originated as erosion material from the adjacent mountains and foothills.

3.3 EARTH MATERIALS

The following description provides a general summary of the subsurface conditions encountered during the field exploration and further validated by the laboratory testing program. For a more thorough description of the actual conditions encountered at the boring location, refer to the Log of Test Boring presented in Figure 2. All soils have been classified according to the Unified Soil Classification System (ASTM D2487).

The upper soil material consisted primarily of fine grained alluvial fan sediment underlain by recent basin deposits. Alluvial fan sediments of lean to fat clay with thin layers of interspersed

silty sand and sandy silt extends to a depth of approximately 151.5 feet below ground surface. The thickness of the silty sand and sandy silt layers increased with depth.

3.4 GROUNDWATER CONDITIONS

Groundwater was encountered at an elevation of approximately 180 feet or about 15 feet below existing grade during drilling at boring RC-15-006. Groundwater at the site is affected by flow in the Kings River. Groundwater conditions at the site could change at some time in the future due to variations in rainfall, groundwater withdrawal, construction activities, or other factors not apparent at the time the test borings were performed. The design groundwater elevation for the project was 180 feet.

3.5 CHANNEL SCOUR/DEGRADATION

A Structure Hydraulics and Hydrology Final Hydraulics Report for Bridge Number 45-0007 was prepared by Ronald McGaugh and dated August 18, 2015. The report indicates no long term degradation or contraction scour, but notes maximum local pier scour depths at each bent ranging from 1.81 feet to 6.46 feet for an ultimate flow of 6,000 cubic feet per second, as indicated in Table 3.5-1.

TABLE 3.5-1
Local Pier Scour

	Bent 1	Bent 2	Bent 3	Bent 4	Bent 5	Bent 6	Bent 7
Scour Depth (ft.)	0	2.20	5.91	3.66	6.46	3.57	5.81
Ground Elevation (ft.)	192.02	187.32	183.22	181.82	181.82	182.12	183.52
Scour Elevation (ft.)	192.02	185.12	177.31	178.16	175.36	178.55	177.71

	Bent 8	Bent 9	Bent 10	Abut 11
Scour Depth (ft.)	2.87	4.27	1.81	0
Ground Elevation (ft.)	185.22	183.62	189.22	192.92
Scour Elevation (ft.)	182.35	182.35	187.41	192.92

4. CORROSION EVALUATION

Soil samples from boring RC-15-006 (depth of 11.5 to 15 feet) were tested to evaluate the soluble sulfate content, soluble chloride content, pH and minimum resistivity. Specific test results are presented in Table 4.1-1.

**TABLE 4.1-1
CORROSION RELATED TESTING**

Boring No.	Depth (ft)	Soluble Sulfate (mg/kg)	Soluble Chloride (mg/kg)	pH	Minimum Resistivity (ohm-cm)
RC-15-006	11.5 - 15	70	44	7.8	3335

Laboratory tests indicate the soluble chlorides are outside the Caltrans threshold limits. Corrosion is dependent upon a complex variety of conditions, which are beyond the geotechnical practice. Consequently, a qualified corrosion engineer should be consulted if the designer desires more specific recommendations and material types and/or mitigation, particularly with regard to steel piles.

5. SEISMIC RECOMMENDATIONS

5.1 LOCAL FAULTING

There are no known faults, which cut through the local soil at the site. The project site is not located in an Alquist-Priolo Earthquake Fault Zone, as defined by Special Publication 42 (revised 2007) published by the California Geologic Survey (CGS). Numerous faults and shear zones within the region could influence the project site.

5.2 SEISMIC DESIGN CRITERIA

Seismic design parameters were developed in accordance with the Caltrans Seismic Design Criteria Version 1.7.

The project site is located in a region with the potential for relatively moderate seismic activity. The more significant faults that could influence the project site include the Great Valley 14 (Kettleman Hills) (Fault ID No. 210), the San Andreas Fault (Parkfield) (Fault ID No. 214), and the Great Valley 13 (Coalinga) (Fault ID No. 205). According to the Caltrans fault database, the Great Valley 14 (Kettleman Hills) is a reverse fault with a dip angle of 22 degrees towards the west and assigned Maximum Magnitude (M_{Max}) of 7.1, the San Andreas Fault (Parkfield) is strike slip fault with a dip angle of 90 degrees and assigned Maximum Magnitude (M_{Max}) of 7.9, and the Great Valley 13 (Coalinga) is a reverse fault with a dip angle of 15 degrees towards the west and assigned Maximum Magnitude (M_{Max}) of 7.0. The characteristics of these three faults are summarized in Table 5.2-1.

Based on the boring data, the site can be classified as Soil Profile Type D. A V_{s30} of 194 m/s was used for the evaluation. The site is not located within a California deep soil basin region, as defined by Caltrans, so $Z_{1.0}$ and $Z_{2.5}$ were considered not applicable. Site characteristics and governing deterministic faults are summarized in Table 5.2-1.

**TABLE 5.2-1
SITE CHARACTERISTICS AND
GOVERNING DETERMINISTIC FAULTS PARAMETERS**

Site Coordinates	Lat = 36.181 deg, Long = -119.834 deg
Shear Wave Velocity	194 m/s
Depth to $V_s=1.0$ km/s, $Z_{1.0}$	N/A
Depth to $V_s=2.5$ km/s, $Z_{2.5}$	N/A
Fault Name and ID Number	Great Valley 14 (Kettleman Hills), No. 210
Maximum Magnitude (M_{Max})	7.1
Fault Type	Reverse
Fault Dip	22 degrees
Dip Direction	West
Bottom of Rupture Plane	22.50 km
Top of Rupture Plane (Z_{tor})	8.10 km
R_{RUP}^1	21.83 km
R_{JB}^2	20.23 km
R_X^3	20.23 km
F_{norm} (1 for normal, 0 for others)	0
F_{rev} (1 for reverse, 0 for others)	1
Fault Name and ID Number	San Andreas fault (Parkfield), No. 214
Maximum Magnitude (M_{Max})	7.9
Fault Type	Strike Slip
Fault Dip	90 degrees
Dip Direction	Vertical
Bottom of Rupture Plane	6 km
Top of Rupture Plane (Z_{tor})	0 km
R_{RUP}^1	62.30 km
R_{JB}^2	62.30 km
R_X^3	62.30 km
F_{norm} (1 for normal, 0 for others)	0
F_{rev} (1 for reverse, 0 for others)	0
Fault Name and ID Number	Great Valley 13 (Coalinga), No. 205
Maximum Magnitude (M_{Max})	7.0
Fault Type	Reverse
Fault Dip	15 degrees
Dip Direction	West
Bottom of Rupture Plane	15.30 km
Top of Rupture Plane (Z_{tor})	9.10 km
R_{RUP}^1	27.02 km
R_{JB}^2	25.44 km
R_X^3	20.54 km
F_{norm} (1 for normal, 0 for others)	0
F_{rev} (1 for reverse, 0 for others)	1
Notes: ¹ R_{RUP} = Closest distance from the site to the fault rupture plane. ² R_{JB} = Joyner-Boore distance; the shortest horizontal distance to the surface projection of the rupture area. ³ R_X = Horizontal distance from the site to the fault trace or surface projection of the top of the rupture plane.	

5.2.1 Deterministic Response Spectrum

The deterministic response spectrum was developed using ARS Online. The deterministic response spectrum from the Minimum Spectrum for California governed.

5.2.2 Probabilistic Response Spectrum

The probabilistic response spectrum was developed using ARS Online.

5.2.3 Design Response Spectrum

The upper envelope of the deterministic and probabilistic spectral values determines the design response spectrum. The probabilistic response spectra were found to govern for all periods. The recommended acceleration and displacement design response spectra are presented graphically and numerically in Appendix B.

5.2.4 References

Caltrans. Caltrans ARS Online, http://dap3.dot.ca.gov/ARS_Online

Caltrans. Geotechnical Services Manual, January 2013.

Caltrans. Seismic Design Criteria, Appendix B Design Spectrum

Caltrans. Website http://dap3.dot.ca.gov/shake_stable/v2/technical.php

5.3 LIQUEFACTION POTENTIAL

In order for liquefaction of soils due to ground shaking to occur, it is generally accepted that four conditions will exist:

- ☐ The subsurface soils are in a relatively loose state,
- ☐ The soils are saturated,
- ☐ The soils are non-plastic, and

- Ground motion is of sufficient intensity to act as a triggering mechanism.

Based on the ARS curve, the design Peak Horizontal Ground Acceleration (PHGA) is 0.39g, with a Moment Magnitude of 6.8. The potential for liquefaction was evaluated using Youd et. al. (2001). The majority of the upper site soil is sufficiently plastic and is not susceptible to liquefaction. However, interbedded zones of poorly graded sand and silty sand within these plastic layers are subject to liquefaction. The consequence of liquefaction at the site is relatively minor, with little to no surface manifestations of seismically induced settlement. The magnitude of the potential settlement is anticipated to be less than ½ inch.

6. FOUNDATION RECOMMENDATIONS

6.1 GENERAL

Based on the field exploration, laboratory testing, and geotechnical analyses, the soils at the site are suitable to support the existing bridge structure. To support seismic analysis of the structure, axial and lateral capacity have been evaluated for the existing piles.

6.2 PILE FOUNDATIONS

6.2.1 Axial Capacity

Nordlund and alpha methods as outlined in AASHTO for evaluating driven piles were utilized in the analysis for the axial capacity of the 15-inch cast-in-place Union fluted steel shell piles and the 15-inch Class 70 driven piles. Table 6.2-1 provides the estimated nominal capacities and of the existing piles at the provided tip elevations, see Table 1.3-1.

**TABLE 6.2-1
EXISTING BRIDGE FOUNDATION DATA**

Pile Type	Support	Pile Cut-off Elevation (feet)	Tip Elevation (feet)	Estimated Nominal Resistance ³ (kips)	Estimated Uplift Capacity ⁴ (kips)
Cast-in-Place Union Fluted Steel Shell ¹	Bent 1	194	100	140	98
	Bent 2	189	100	140	98
	Bent 3	184	100	140	98
	Bent 4	181	100	140	98
	Bent 5	181	100	140	98
	Bent 6	182	100	140	98
	Bent 7	183	100	140	98
	Bent 8	186	100	140	98
	Bent 9	187	100	140	98
	Bent 10	189	100	140	98
	Bent 11	193	100	140	98
Class 70 ²	Bent 1	194	100	140	98
	Bent 2	189	100	140	98
	Bent 3	184	100	140	98
	Bent 4	181	100	140	98
	Bent 5	181	100	140	98
	Bent 6	182	100	140	98
	Bent 7	183	100	140	98
	Bent 8	186	100	140	98
	Bent 9	187	100	140	98
	Bent 10	189	100	140	98
	Bent 11	193	100	140	98

- Notes: 1. Original supports
 2. Supports from 1986 widening
 3. Estimated nominal resistance may be greater than 200 kips per pile
 4. Estimated geotechnical uplift capacity may exceed structural capacity of pile connection

To assist in evaluation of settlement of piles, t-z and q-z curves are provided graphically and numerically in Appendix C.

6.2.2 Lateral Capacity

The lateral response of pile foundations can be evaluated using LPILE Plus Version 5.0, or greater, for Windows (computer software developed by Ensoft Inc.). The geotechnical parameters summarized in Tables 6.2-2 through 6.2-12 can be used for evaluation of lateral loading of piles at abutments and bents.

**TABLE 6.2-2
LPILE PARAMETERS FOR BENT 1**

Elevation (feet)	Recommended P-Y Curve	γ (pci)	ϕ (degree)	c (psi)	k (pci)	ϵ_{50}
194 – 180	Sand (Reese)	0.072	27	-	50	-
180 – 178	Sand (Reese)	0.036	27	-	50	-
178 – 172	Soft Clay w/ Groundwater	0.030	-	3.5	-	0.020
172 – 165	Sand (Reese)	0.036	35	-	60	-
165 – 138	Soft Clay w/ Groundwater	0.031	-	3.5	-	0.020
138 – 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007
Below 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007

**TABLE 6.2-3
LPILE PARAMETERS FOR BENT 2**

Elevation (feet)	Recommended P-Y Curve	γ (pci)	ϕ (degree)	c (psi)	k (pci)	ϵ_{50}
189 – 180	Sand (Reese)	0.072	27	-	50	-
180 – 178	Sand (Reese)	0.036	27	-	50	-
178 – 172	Soft Clay w/ Groundwater	0.030	-	3.5	-	0.020
172 – 165	Sand (Reese)	0.036	35	-	60	-
165 – 138	Soft Clay w/ Groundwater	0.031	-	3.5	-	0.020
138 – 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007
Below 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007

**TABLE 6.2-4
LPILE PARAMETERS FOR BENT 3**

Elevation (feet)	Recommended P-Y Curve	γ (pci)	ϕ (degree)	c (psi)	k (pci)	ϵ_{50}
184 – 180	Sand (Reese)	0.072	27	-	50	-
180 – 178	Sand (Reese)	0.036	27	-	50	-
178 – 172	Soft Clay w/ Groundwater	0.030	-	3.5	-	0.020
172 – 165	Sand (Reese)	0.036	35	-	60	-
165 – 138	Soft Clay w/ Groundwater	0.031	-	3.5	-	0.020
138 – 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007
Below 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007

**TABLE 6.2-5
LPILE PARAMETERS FOR BENT 4**

Elevation (feet)	Recommended P-Y Curve	γ (pci)	ϕ (degree)	c (psi)	k (pci)	ϵ_{50}
181 – 178	Sand (Reese)	0.072	27	-	50	-
180 – 178	Sand (Reese)	0.036	27	-	50	-
178 – 172	Soft Clay w/ Groundwater	0.030	-	3.5	-	0.020
172 – 165	Sand (Reese)	0.036	35	-	60	-
165 – 138	Soft Clay w/ Groundwater	0.031	-	3.5	-	0.020
138 – 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007
Below 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007

**TABLE 6.2-6
LPILE PARAMETERS FOR BENT 5**

Elevation (feet)	Recommended P-Y Curve	γ (pci)	ϕ (degree)	c (psi)	k (pci)	ϵ_{50}
181 – 180	Sand (Reese)	0.072	27	-	50	-
180 – 178	Sand (Reese)	0.036	27	-	50	-
178 – 172	Soft Clay w/ Groundwater	0.030	-	3.5	-	0.020
172 – 165	Sand (Reese)	0.036	35	-	60	-
165 – 138	Soft Clay w/ Groundwater	0.031	-	3.5	-	0.020
138 – 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007
Below 104	Stiff Clay w/	0.031	-	10.4	350	0.007

	Groundwater					
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**TABLE 6.2-7
LPILE PARAMETERS FOR BENT 6**

Elevation (feet)	Recommended P-Y Curve	γ (pci)	ϕ (degree)	c (psi)	k (pci)	ϵ_{50}
182 – 178	Sand (Reese)	0.072	27	-	50	-
180 – 178	Sand (Reese)	0.036	27	-	50	-
178 – 172	Soft Clay w/ Groundwater	0.030	-	3.5	-	0.020
172 – 165	Sand (Reese)	0.036	35	-	60	-
165 – 138	Soft Clay w/ Groundwater	0.031	-	3.5	-	0.020
138 – 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007
Below 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007

**TABLE 6.2-8
LPILE PARAMETERS FOR BENT 7**

Elevation (feet)	Recommended P-Y Curve	γ (pci)	ϕ (degree)	c (psi)	k (pci)	ϵ_{50}
183 – 180	Sand (Reese)	0.072	27	-	50	-
180 – 178	Sand (Reese)	0.036	27	-	50	-
178 – 172	Soft Clay w/ Groundwater	0.030	-	3.5	-	0.020
172 – 165	Sand (Reese)	0.036	35	-	60	-
165 – 138	Soft Clay w/ Groundwater	0.031	-	3.5	-	0.020
138 – 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007
Below 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007

**TABLE 6.2-9
LPILE PARAMETERS FOR BENT 8**

Elevation (feet)	Recommended P-Y Curve	γ (pci)	ϕ (degree)	c (psi)	k (pci)	ϵ_{50}
186 – 180	Sand (Reese)	0.072	27	-	50	-
180 – 178	Sand (Reese)	0.036	27	-	50	-
178 – 172	Soft Clay w/ Groundwater	0.030	-	3.5	-	0.020
172 – 165	Sand (Reese)	0.036	35	-	60	-
165 – 138	Soft Clay w/ Groundwater	0.031	-	3.5	-	0.020
138 – 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007
Below 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007

**TABLE 6.2-10
LPILE PARAMETERS FOR BENT 9**

Elevation (feet)	Recommended P-Y Curve	γ (pci)	ϕ (degree)	c (psi)	k (pci)	ϵ_{50}
187 – 178	Sand (Reese)	0.072	27	-	50	-
180 – 178	Sand (Reese)	0.036	27	-	50	-
178 – 172	Soft Clay w/ Groundwater	0.030	-	3.5	-	0.020
172 – 165	Sand (Reese)	0.036	35	-	60	-
165 – 138	Soft Clay w/ Groundwater	0.031	-	3.5	-	0.020
138 – 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007
Below 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007

**TABLE 6.2-11
LPILE PARAMETERS FOR BENT 10**

Elevation (feet)	Recommended P-Y Curve	γ (pci)	ϕ (degree)	c (psi)	k (pci)	ϵ_{50}
189 – 180	Sand (Reese)	0.072	27	-	50	-
180 – 178	Sand (Reese)	0.036	27	-	50	-
178 – 172	Soft Clay w/ Groundwater	0.030	-	3.5	-	0.020
172 – 165	Sand (Reese)	0.036	35	-	60	-
165 – 138	Soft Clay w/ Groundwater	0.031	-	3.5	-	0.020
138 – 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007
Below 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007

**TABLE 6.2-12
LPILE PARAMETERS FOR BENT 11**

Elevation (feet)	Recommended P-Y Curve	γ (pci)	ϕ (degree)	c (psi)	k (pci)	ϵ_{50}
193 – 180	Sand (Reese)	0.072	27	-	50	-
180 – 178	Sand (Reese)	0.036	27	-	50	-
178 – 172	Soft Clay w/ Groundwater	0.030	-	3.5	-	0.020
172 – 165	Sand (Reese)	0.036	35	-	60	-
165 – 138	Soft Clay w/ Groundwater	0.031	-	3.5	-	0.020
138 – 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007
Below 104	Stiff Clay w/ Groundwater	0.031	-	10.4	350	0.007

Figures 6.2-1 through 6.2-4 present the anticipated deflection of the pile head in response to a lateral load applied at the bridge deck connection elevation for the 15.5-inch cast-in-place Union fluted steel shell piles and the 15-inch Class 70 driven piles. Data are presented for both free and fixed head conditions.

**FIGURE 6.2-1
LATERAL LOAD DEFLECTION CURVES
ORIGINAL 15.5" FLUTED STEEL SHELL PILES
BENTS 1, 2, 10, AND 11**

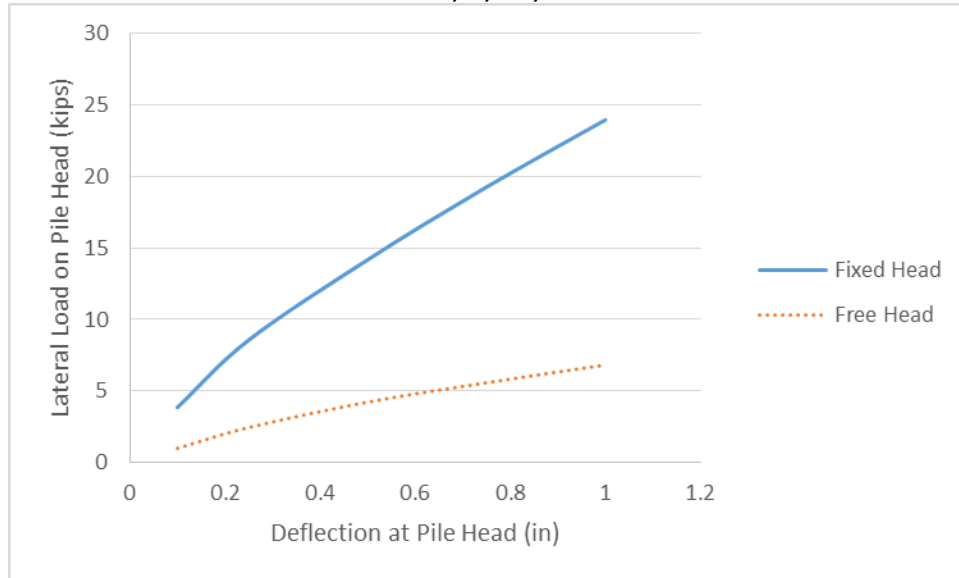


**FIGURE 6.2-2
LATERAL LOAD DEFLECTION CURVES
ORIGINAL 15.5" FLUTED STEEL SHELL PILES
BENTS 3-9**

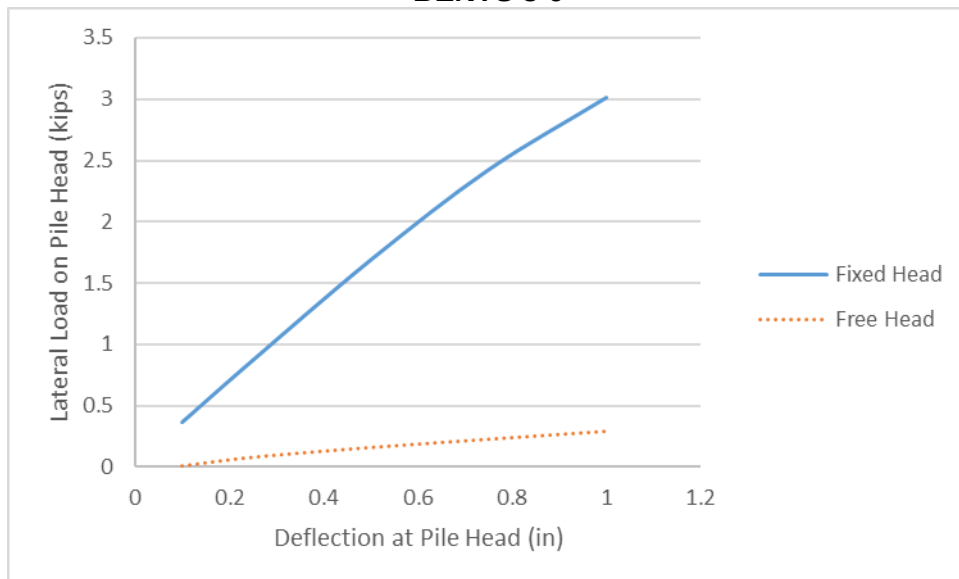


FIGURE 6.2-3

**LATERAL LOAD DEFLECTION CURVES
WIDEN 15" CLASS 45 PILES
BENTS 1, 2, 10, AND 11**

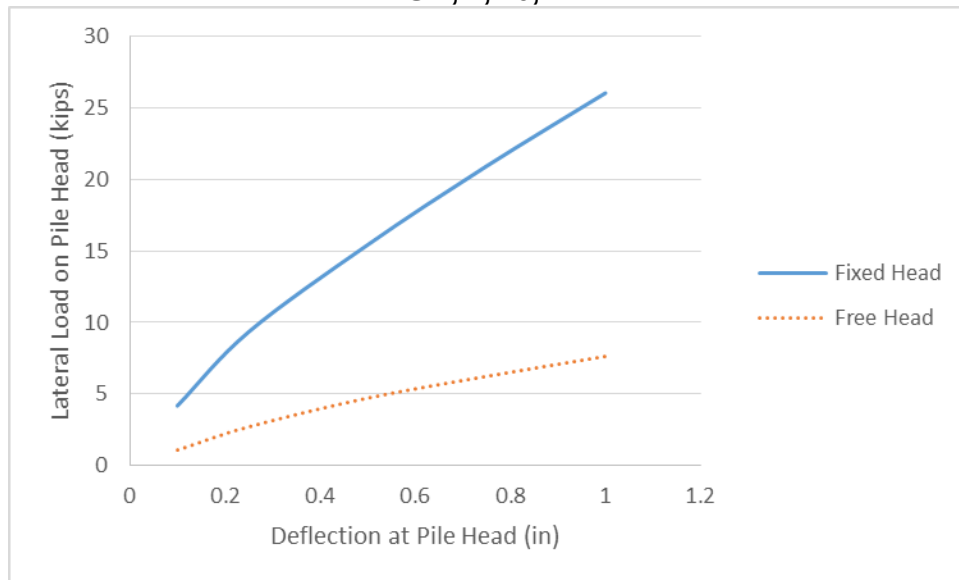
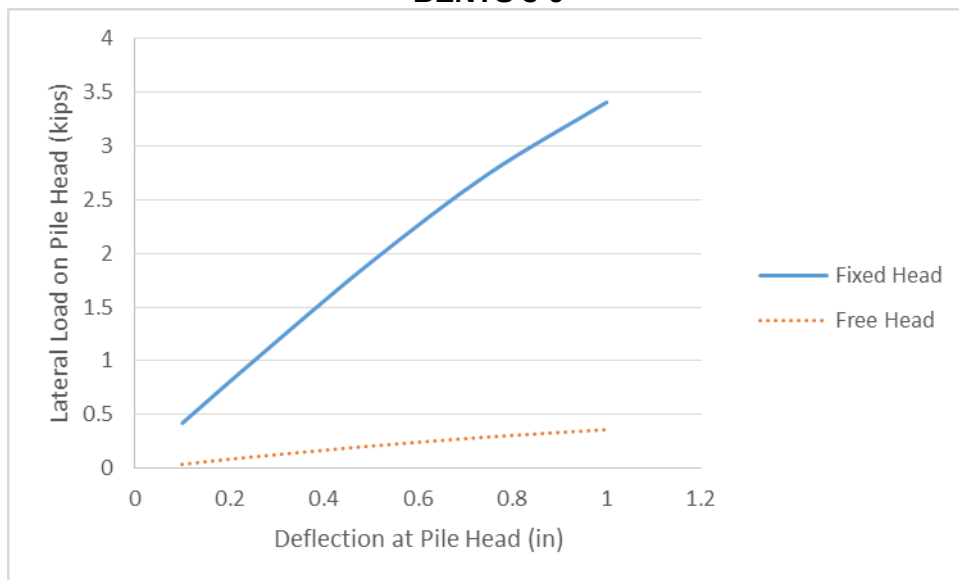


**FIGURE 6.2-4
LATERAL LOAD DEFLECTION CURVES
WIDEN 15" CLASS 45 PILES
BENTS 3-9**



When considering the lateral capacity of a pile group, it will be necessary to reduce the single pile capacity of trailing piles. The reduction in capacity due to the effects of shaft interaction will

be dependent upon the center-to-center (CTC) pile spacing. It is understood Ensoft GROUP program will be utilized to determine lateral capacity of pile groups, which incorporates pile spacing effects.

6.2.3 Lateral Deflection Data

Provided in Appendix C are estimated p-y (lateral) curves for the existing piles, as well as moment and shear diagrams for a range of lateral deflections up to 1 inch.

7. CLOSURE

The conclusions and recommendations in this report are for the seismic rehabilitation evaluation of the State Route 41 Bridge over Kings River, located in Kings County, California, as described in the text of this report. The findings, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted geotechnical engineering practice. No warranty, express or implied, is made. The field exploration program and this report were based on the proposed project information provided to Kleinfelder. If any change (i.e., structure type, location, etc.) is implemented which materially alters the project, additional geotechnical services may be required, which could include revisions to the recommendations given herein.

This report is intended for use by Caltrans and their subconsultants within a reasonable time from its issuance. Noncompliance with the recommendations of the report or misuse of the report will release Kleinfelder from any liability.

The scope of the geotechnical services did not include an environmental site assessment for the presence or absence of hazardous/toxic materials in the soil, surface water, groundwater or atmosphere, or the presence of wetlands.

FIGURES

DISTCOUNTYROUTEPOST MILESTOTAL PROJECTSHEETNoTOTAL SHEETS

06KIN41VARIOUS

Nathan Dahlen

REGISTERED CIVIL ENGINEER

9/15/15

DATE

9/22/15

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER

No. 71344

Exp. 12/31/15

CIVIL

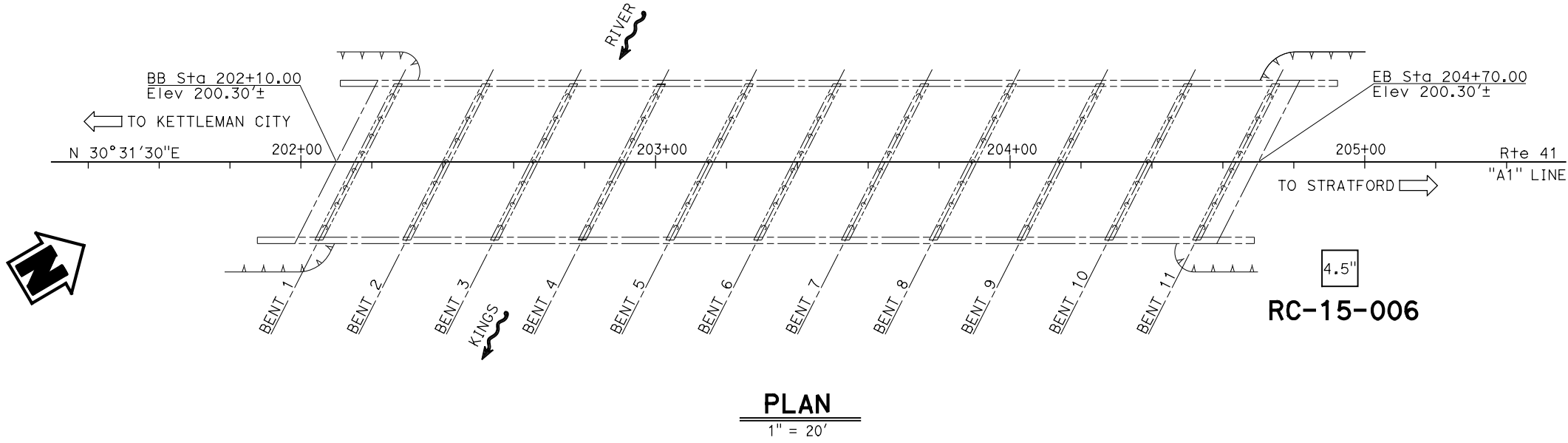
STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

KLEINFELDER

5125 N. GATES AVE., SUITE 102

FRESNO, CA 93722



BENCHMARKS

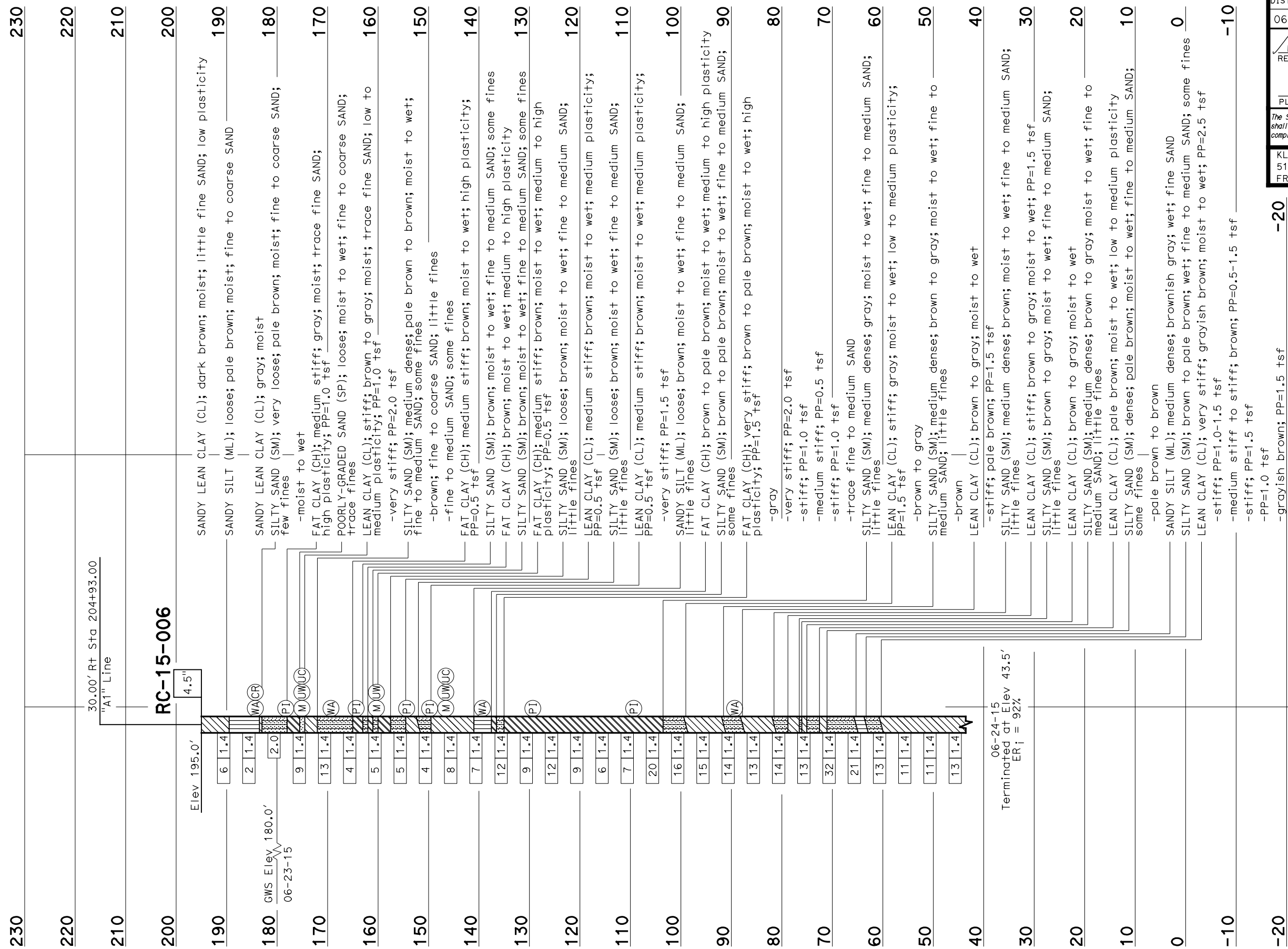
STATION	OFFSET	N	E	ELEV	DESCRIPTION
2+85.68	22.52' Rt	1,949,691.05	6,315,334.68	199.15	DNK0341. Found 1" Iron pipe w/ red CT plug and tack
6+59.54	34.08' Rt	1,950,009.80	6,315,530.10	198.32	DNK0342. Found 1" Iron pipe w/ red CT plug and tack

SURVEY CONTROL
1. Coordinates bearing and distances are based on the California State Plane Coordinate system of NAD 83 (1986). Elevations are based on NGVD29 for Plan. Elevations are based on NAVD88 for borings.

- Notes:
- 1.4" samples were taken using a SPT split-barrel sampler with an inside diameter (ID) of 1.4" and an outside diameter (OD) of 2".
 - 2.0" samples were taken using a CAL split-barrel sampler with an inside diameter (ID) of 2.0" and an outside diameter (OD) of 2.5"
 - An automatic hammer (140 lb) with a 30" drop was used to advance the sampler.
 - Blowcounts noted for boring are field blowcounts and have not been corrected.
 - Blowcounts 50/5 means 50 blows per 5" penetration.
 - This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2010)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).



	205+00	206+00
-20		
-30		
-40		
-50		

PROFILE

HOR. 1"=20'

VER. 1"=10'

-PP=1.0 tsf

-grayish brown; PP=1.5 tsf

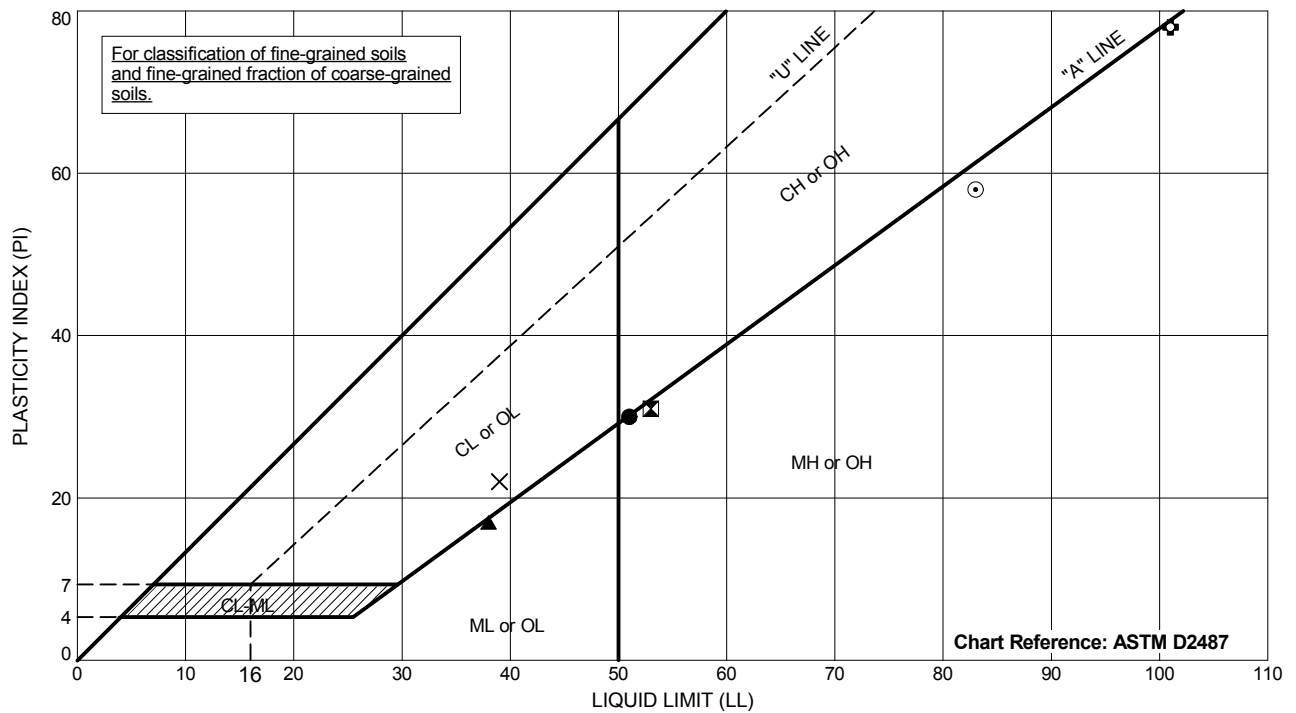
J. Huang DESIGN OVERSIGHT 9/22/15 SIGN OFF DATE		DRAWN BY A. Sanchez CHECKED BY N. Dahlen	R. Shiplee FIELD INVESTIGATION BY: DATE: 6/24/15	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION		N. Dahlen PROJECT ENGINEER	BRIDGE NO. 45-0007 POST MILES 32.26	ROUTE 41 KINGS RIVER BRIDGE SEISMIC RETROFIT LOG OF TEST BORINGS 2 OF 2					
GS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 03/14/12)				ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0123		UNIT: PROJECT NUMBER & PHASE: 36040612000110 CONTRACT NO.: 06-OK8001		DISREGARD PRINTS BEARING EARLIER REVISION DATES 9/23/15		REVISION DATES		SHEET X	OF X

APPENDIX A

Exploration ID	Depth (ft.)	Sample Description	Water Content (%)	Dry Unit Wt. (pcf)	Sieve Analysis (%)			Atterberg Limits			Additional Tests
					Passing 3/4"	Passing #4	Passing #200	Liquid Limit	Plastic Limit	Plasticity Index	
RC-15-006	10.0 - 11.5	SANDY SILT (ML)					53				
RC-15-006	17.0 - 19.0	FAT CLAY (CH)						51	21	30	
RC-15-006	18.0 - 18.5	FAT CLAY (CH)	38.9	82.0							Unconfined Compressive Strength= q _u : 1170 psf Strain at Failure: 7.8%
RC-15-006	25.0 - 26.5	SILTY SAND (SM)					20				
RC-15-006	30.0 - 31.5	FAT CLAY (CH)						53	22	31	
RC-15-006	34.0 - 34.5	SILTY SAND (SM)	39.3	82.0							
RC-15-006	40.0 - 41.5	LEAN CLAY (CL)						38	21	17	
RC-15-006	45.0 - 46.5	LEAN CLAY (CL)						39	17	22	
RC-15-006	47.0 - 47.5	LEAN CLAY (CL)	32.8	90.3							Unconfined Compressive Strength= q _u : 1954 psf Strain at Failure: 15.0%
RC-15-006	55.0 - 56.5	SANDY SILT (ML)					64				
RC-15-006	65.0 - 66.5	FAT CLAY (CH)						83	25	58	
RC-15-006	85.0 - 86.5	FAT CLAY (CH)						101	23	78	
RC-15-006	105.0 - 106.5	SILTY SAND (SM)					27				



Refer to the Geotechnical Evaluation Report or the supplemental plates for the method used for the testing performed above. NP = NonPlastic		PROJECT NO.: 20143390	LABORATORY TEST RESULT SUMMARY	TABLE A-1
		DRAWN BY: MAP		
		CHECKED BY: BC	HIGHWAY 41 BRIDGE OVER KINGS RIVER KINGS COUNTY, CALIFORNIA	
DATE: 9/3/2015				
REVISED: -				



Exploration ID	Depth (ft.)	Sample Description	Passing #200	LL	PL	PI
● RC-15-006	17 - 19	FAT CLAY (CH)	NM	51	21	30
▣ RC-15-006	30 - 31.5	FAT CLAY (CH)	NM	53	22	31
▲ RC-15-006	40 - 41.5	LEAN CLAY (CL)	NM	38	21	17
✕ RC-15-006	45 - 46.5	LEAN CLAY (CL)	NM	39	17	22
⊙ RC-15-006	65 - 66.5	FAT CLAY (CH)	NM	83	25	58
⊛ RC-15-006	85 - 86.5	FAT CLAY (CH)	NM	101	23	78

Testing performed in general accordance with ASTM D4318.
 NP = Nonplastic
 NM = Not Measured

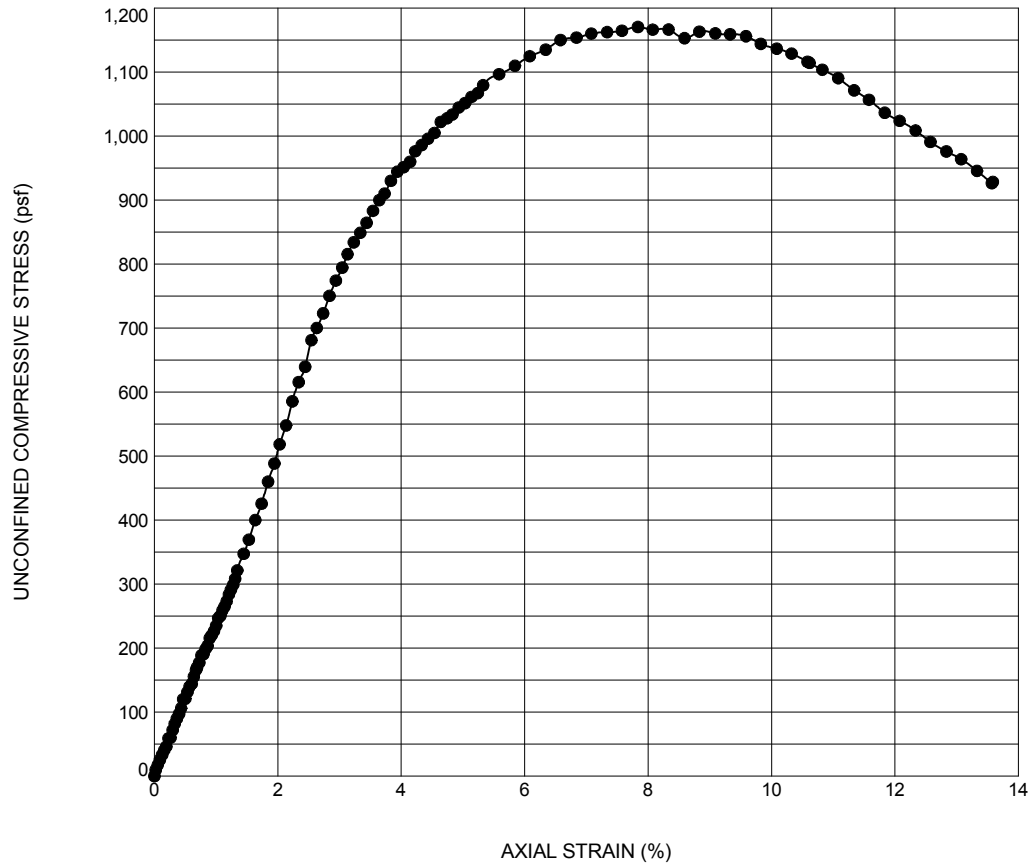


PROJECT NO.: 20143390
 DRAWN BY: MAP
 CHECKED BY: BC
 DATE: 9/3/2015
 REVISED: -

ATTERBERG LIMITS

HIGHWAY 41 BRIDGE
 OVER KINGS RIVER
 KINGS COUNTY, CALIFORNIA

FIGURE
A-2



Exploration ID		Depth (ft.)		Sample Description									
RC-15-006		18 - 18.5		FAT CLAY (CH)									
Time to Failure (min)		Average Rate of Strain to Failure (%/min)			Shear Strength (psf)			Unconfined Compressive Strength (psf)			Strain at Failure (%)		
3.9		2.0			585.0			1170			7.8		
Specimen No.	Sample Condition Type	Initial Sample Dia. (mm)	Initial Height (mm)	Initial Height to Diameter Ratio	Initial Water Content (%)	Initial Dry Unit Wt. (pcf)	Initial Saturation (%)	Initial Void Ratio	Specific Gravity (Assumed)	Passing #200	LL	PL	PI
1	Undisturbed	61.7	112.0	1.8:1	38.9	82.0	100.6	1.055	2.70	NM	NM	NM	NM

Testing performed in general accordance with ASTM D2166.
 NP = Nonplastic
 NM = Not Measured

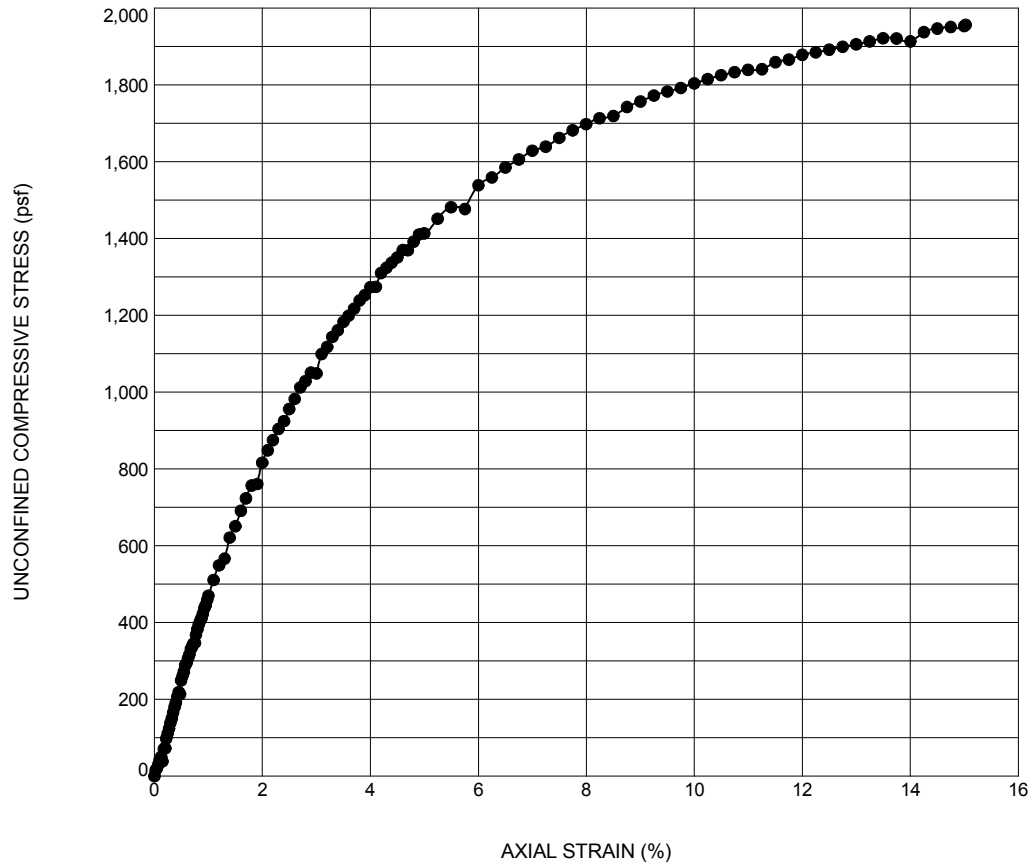


PROJECT NO.: 20143390
 DRAWN BY: MAP
 CHECKED BY: BC
 DATE: 9/3/2015
 REVISED: -

UNCONFINED COMPRESSIVE STRENGTH

HIGHWAY 41 BRIDGE
 OVER KINGS RIVER
 KINGS COUNTY, CALIFORNIA

FIGURE
A-3



Exploration ID		Depth (ft.)		Sample Description									
RC-15-006		47 - 47.5		LEAN CLAY (CL)									
Time to Failure (min)		Average Rate of Strain to Failure (%/min)			Shear Strength (psf)			Unconfined Compressive Strength (psf)			Strain at Failure (%)		
15.0		1.0			977.0			1954			15.0		
Specimen No.	Sample Condition Type	Initial Sample Dia. (mm)	Initial Height (mm)	Initial Height to Diameter Ratio	Initial Water Content (%)	Initial Dry Unit Wt. (pcf)	Initial Saturation (%)	Initial Void Ratio	Specific Gravity (Assumed)	Passing #200	LL	PL	PI
1	Undisturbed	60.5	122.4	2:1	32.8	90.3	101.8	0.900	2.70	NM	NM	NM	NM

Testing performed in general accordance with ASTM D2166.
 NP = Nonplastic
 NM = Not Measured



PROJECT NO.: 20143390
 DRAWN BY: MAP
 CHECKED BY: BC
 DATE: 9/3/2015
 REVISED: -

UNCONFINED COMPRESSIVE STRENGTH

HIGHWAY 41 BRIDGE
 OVER KINGS RIVER
 KINGS COUNTY, CALIFORNIA

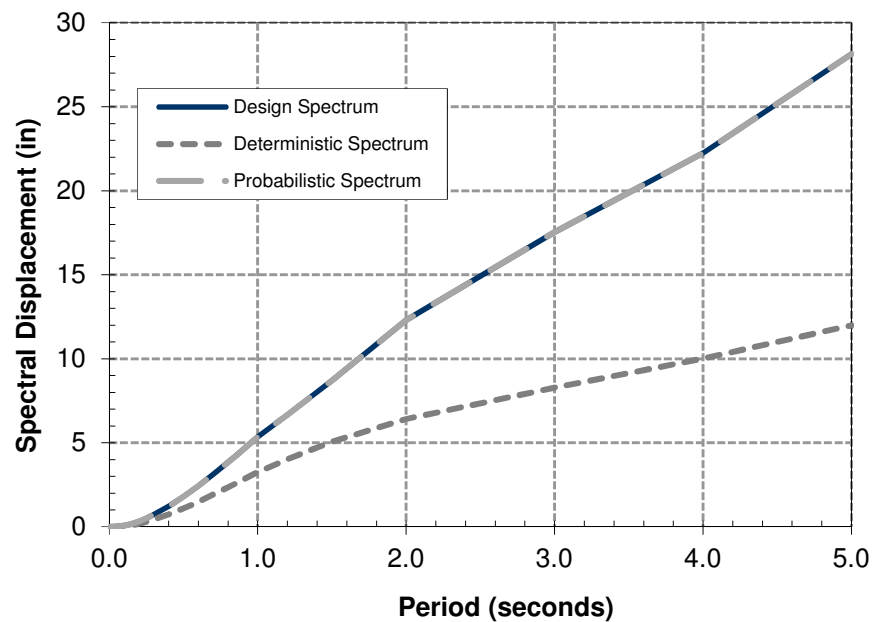
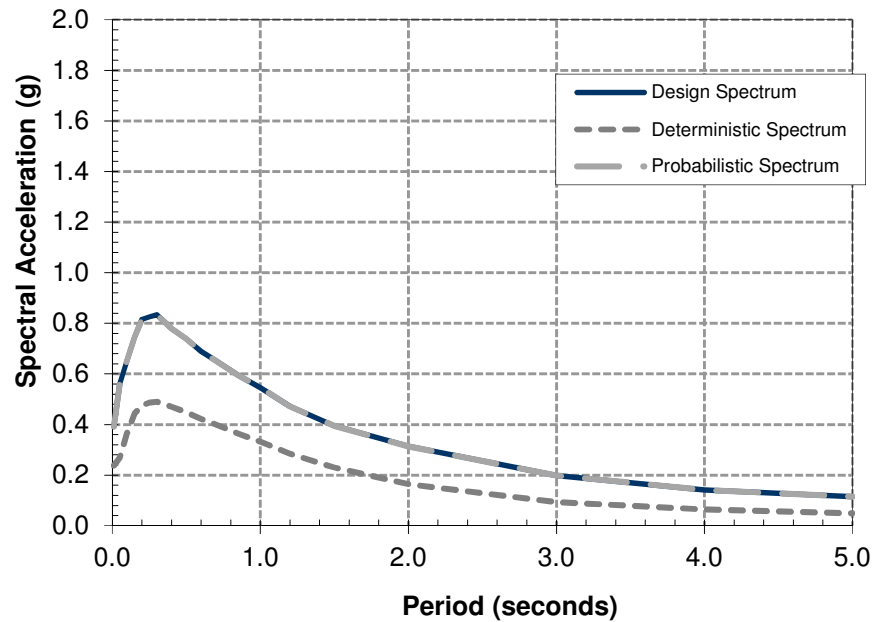
FIGURE
A-4

APPENDIX B

SITE DATA

Latitude:	36.1807	Shear Wave Velocity	194 m/s
Longitude:	-119.8344	Depth to Vs = 1.0 km/s:	N/A
		Depth to Vs = 2.5 km/s:	N/A

Period (s)	SA (g)	SD (in)
0.01 (PGA)	0.392	0.00
0.05	0.561	0.01
0.1	0.655	0.06
0.15	0.745	0.16
0.2	0.815	0.32
0.25	0.826	0.51
0.3	0.834	0.73
0.4	0.779	1.22
0.5	0.738	1.81
0.6	0.689	2.43
0.7	0.651	3.12
0.85	0.594	4.20
1	0.546	5.34
1.2	0.472	6.65
1.5	0.395	8.70
2	0.314	12.29
3	0.199	17.53
4	0.142	22.24
5	0.115	28.14



PROJECT NO	20143390
DRAWN:	7/1/15
DRAWN BY:	B. Campbell
CHECKED BY:	NP
FILE NAME:	

CALTRANS ARS CURVES

HIGHWAY 41 BRIDGE OVER KINGS RIVER
KINGS COUNTY, CALIFORNIA

PLATE

B-1

Boring
ID:

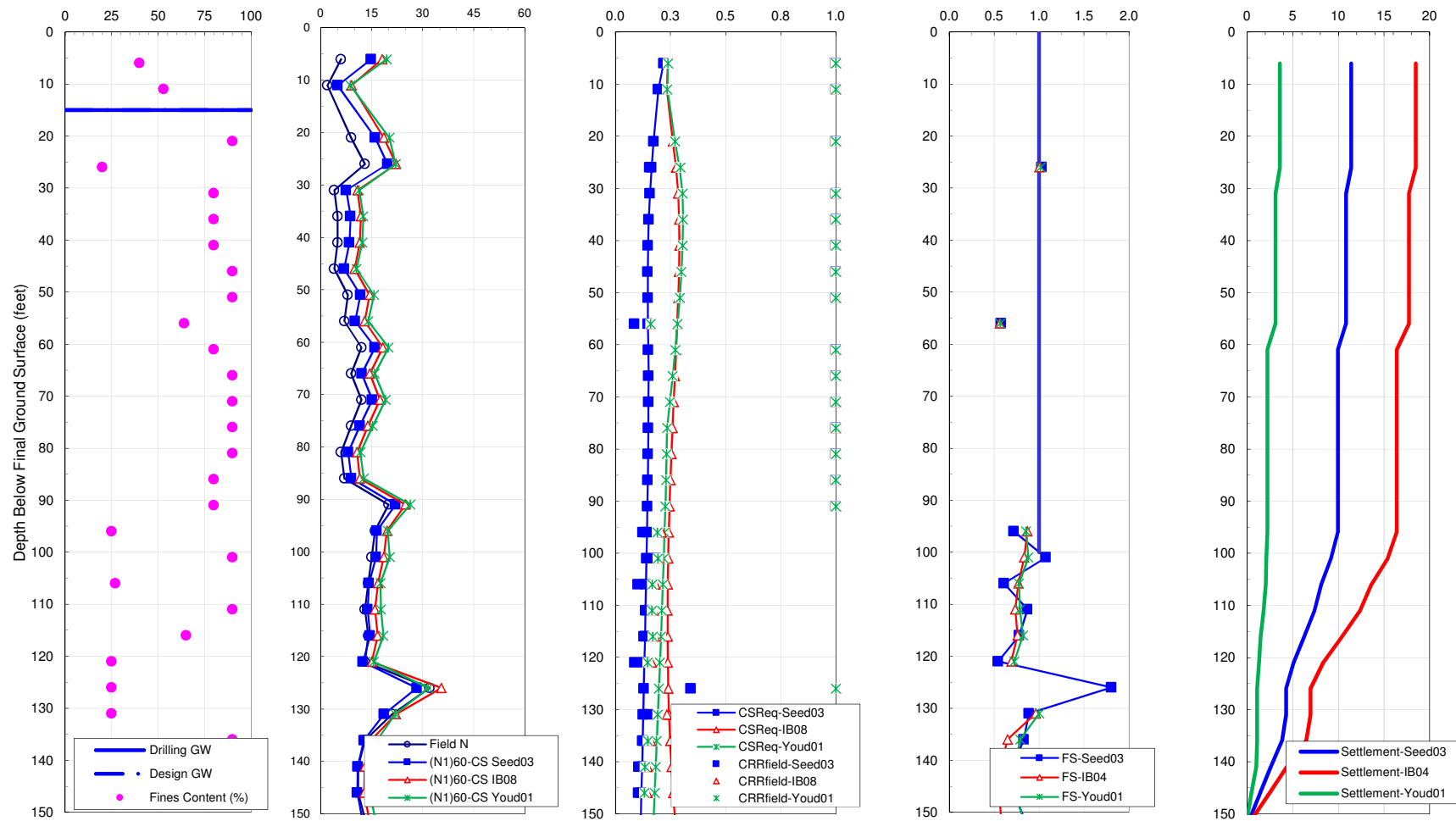
RC-15-006

$M_w = 6.8$
 $PGA = 0.37g$

Groundwater Depth During Drilling (ft) = **15.0 ft**
Design Groundwater Depth (ft) = **15.0 ft**

Existing Ground Elevation = **195.0 ft**
Final Ground Elevation = **195.0 ft**

Ana. by: Brock Campbell
Checked by: Neva Popenoe



1. (N₁)_{60-CS} capped at 60; 2. CRRfield = 1 for non-liquefiable soils; 3. FS is capped at 2.0 for liquefiable soils and not plotted for non-liquefiable soils including soils above G.W.T.



1330 Broadway, #1200
Oakland, California 94612
t: 510 628 9000 f: 510 628 9009

Project Name: Hwy 41 at Kings River
Project No.: 20143390
Project Location: Kings County, CA

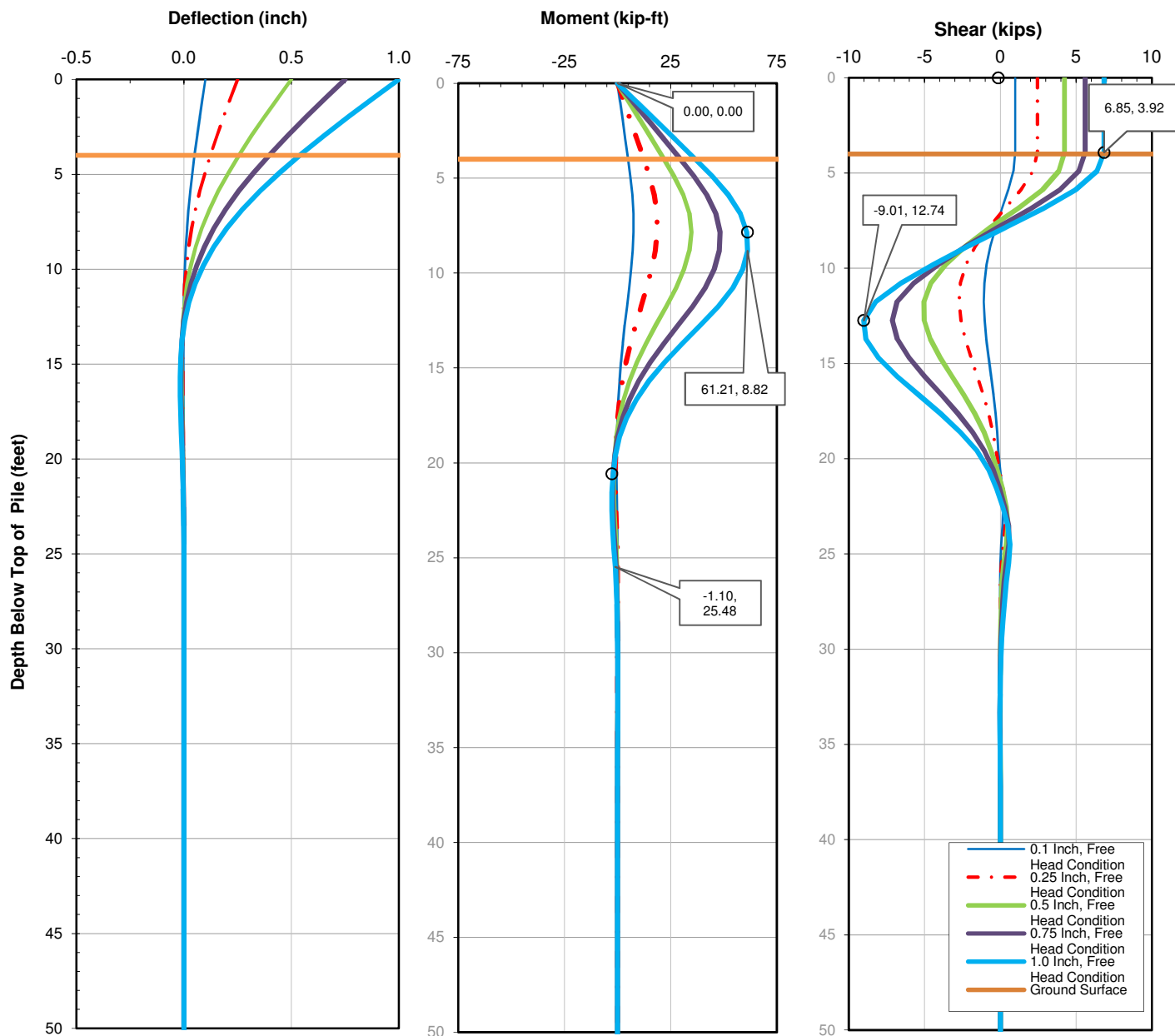
LIQUEFACTION ANALYSIS

Date

7/1/2015

FIGURE B-2

APPENDIX C



These results are based on the following assumptions and conditions. Piles with conditions different from those assumed should be re-evaluated by Kleinfelder:

1. Original Tapered Monotube 15.5 inch Pile (98-foot length)
2. 0.0 Depth represents the top of the pile, Elevation 198



BY: NAS

REV. BY:

PROJECT NO. 20143390

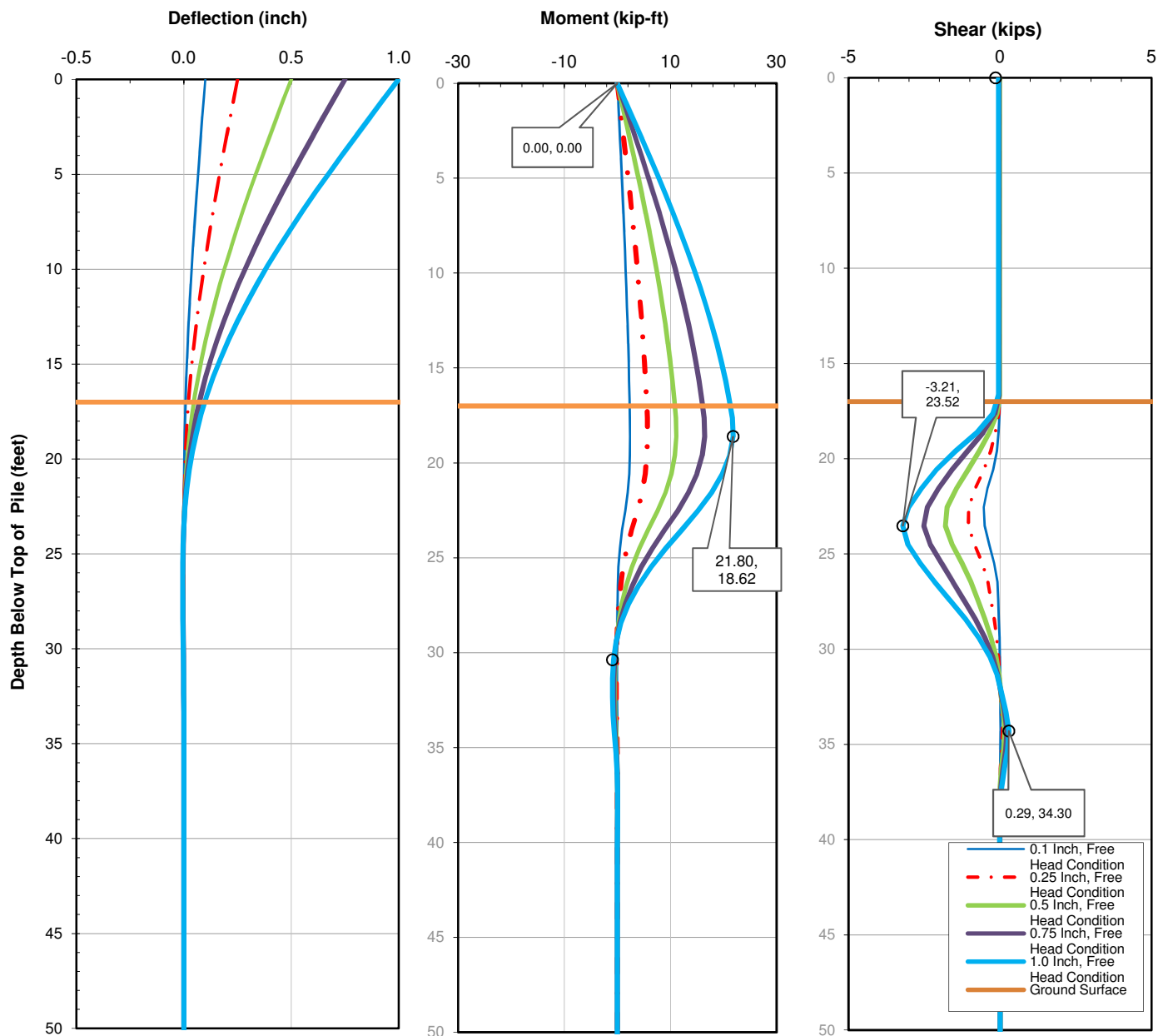
8/24/2015

Lateral Pile Analysis (LPILE) Results
Bents 1,2,10,11, Original Tapered Monotube
Free Head Condition

SR 41 Over Kings River
 Bridge No. 45-0007
 Kings County, CA

PLATE

C-1



These results are based on the following assumptions and conditions. Piles with conditions different from those assumed should be re-evaluated by Kleinfelder:

1. Original Tapered Monotube 15.5 inch Piles (98-foot length)
2. 0.0 Depth represents the top of the pile, Elevation 198



BY: NAS

REV. BY:

PROJECT NO. 20143390

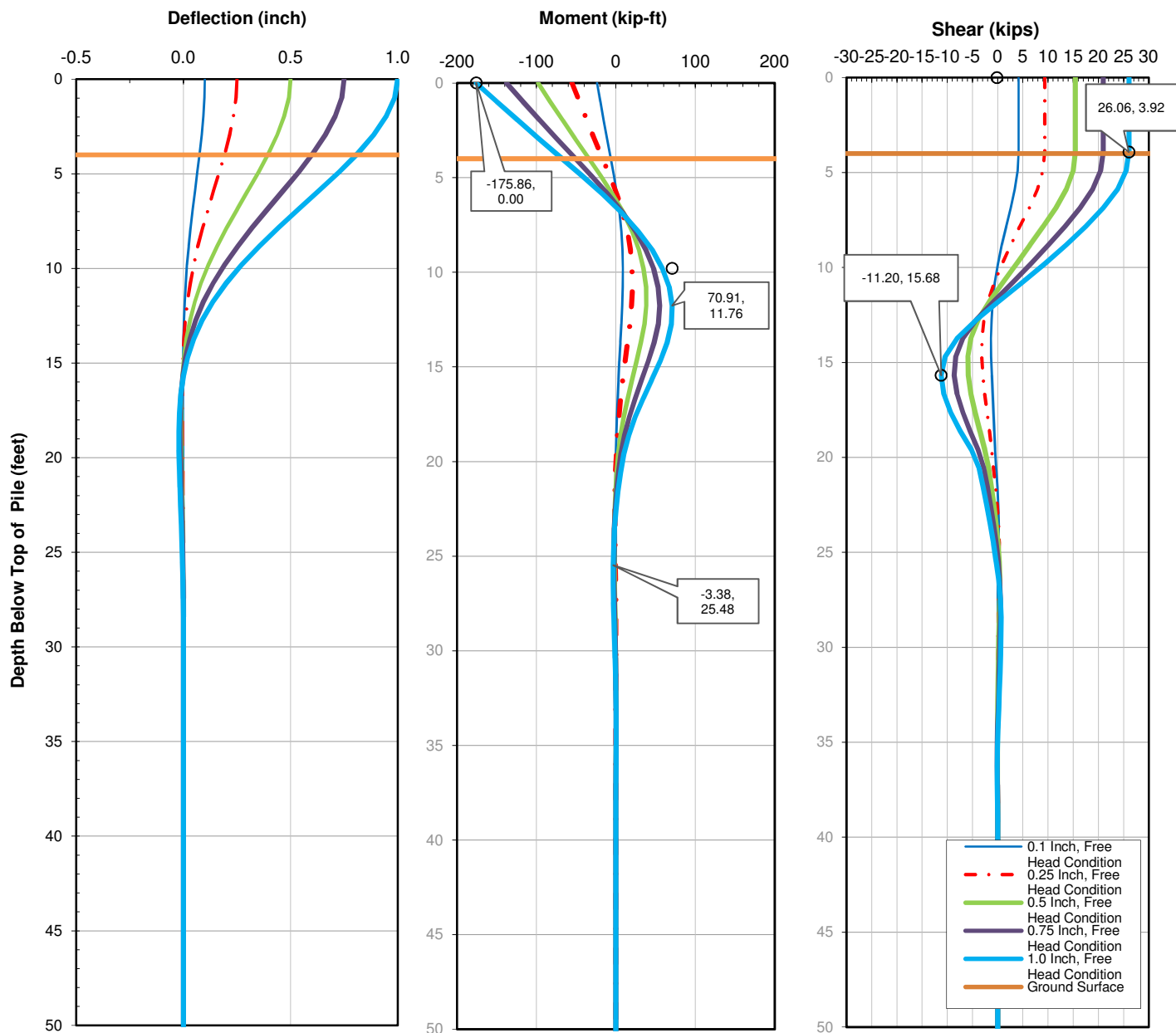
8/24/2015

Lateral Pile Analysis (LPILE) Results
Bents 3 - 9, Original Tapered Monotube
Free Head Condition

SR 41 Over Kings River
 Bridge No. 45-0007
 Kings County, CA

PLATE

C-2



These results are based on the following assumptions and conditions. Piles with conditions different from those assumed should be re-evaluated by Kleinfelder:

1. Class 70, 15 inch octagonal Piles (98-foot length)
2. 0.0 Depth represents the top of the pile, Elevation 198



BY: NAS

REV. BY:

PROJECT NO. 20143390

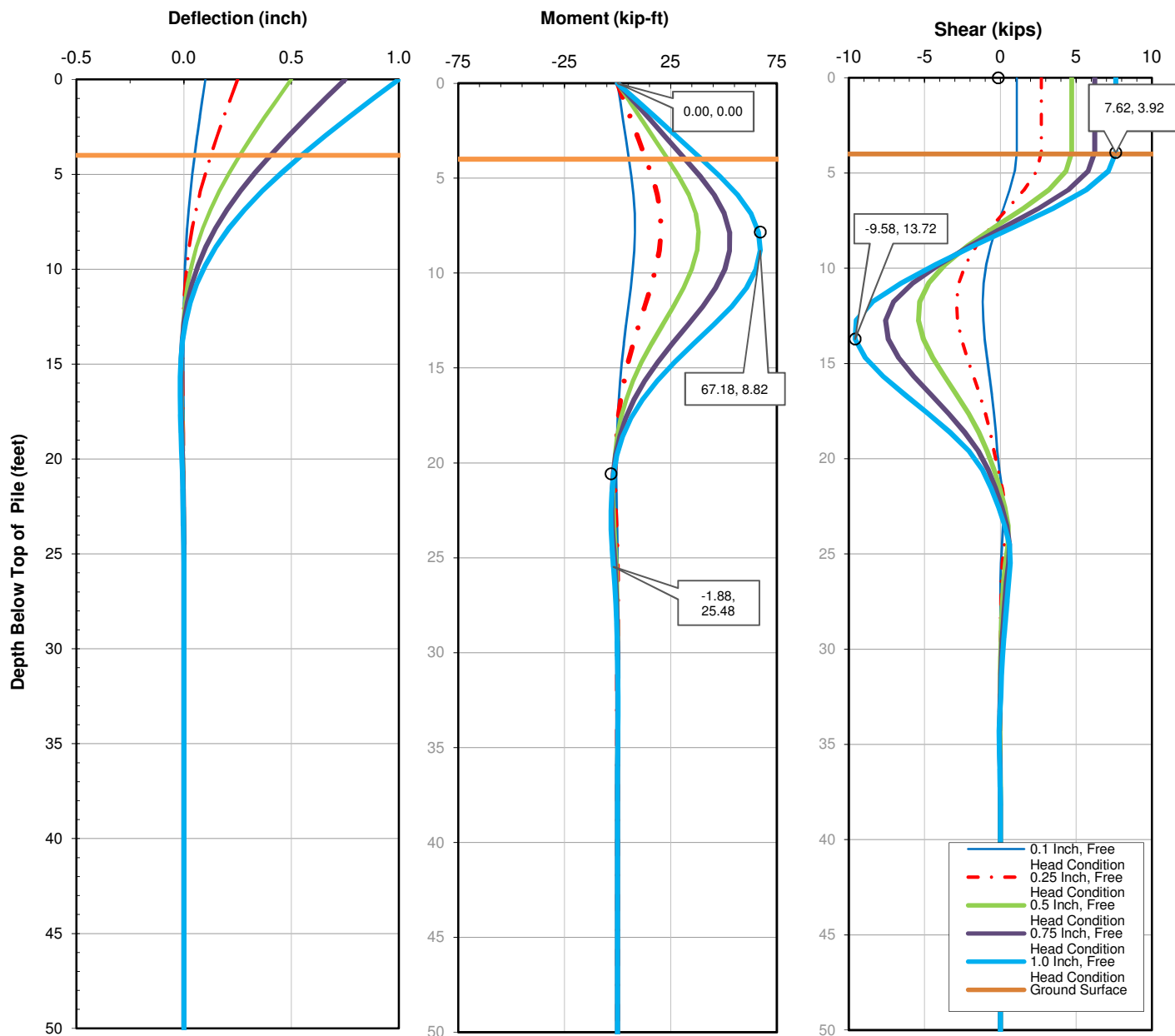
8/24/2015

Lateral Pile Analysis (LPILE) Results
Bents 1,2,10,11, Widen Class 70
Fixed Head Condition

SR 41 Over Kings River
 Bridge No. 45-0007
 Kings County, CA

PLATE

C-3a



These results are based on the following assumptions and conditions. Piles with conditions different from those assumed should be re-evaluated by Kleinfelder:

1. Class 70, 15 inch octagonal Piles (98-foot length)
2. 0.0 Depth represents the top of the pile, Elevation 198



BY: NAS

REV. BY:

PROJECT NO. 20143390

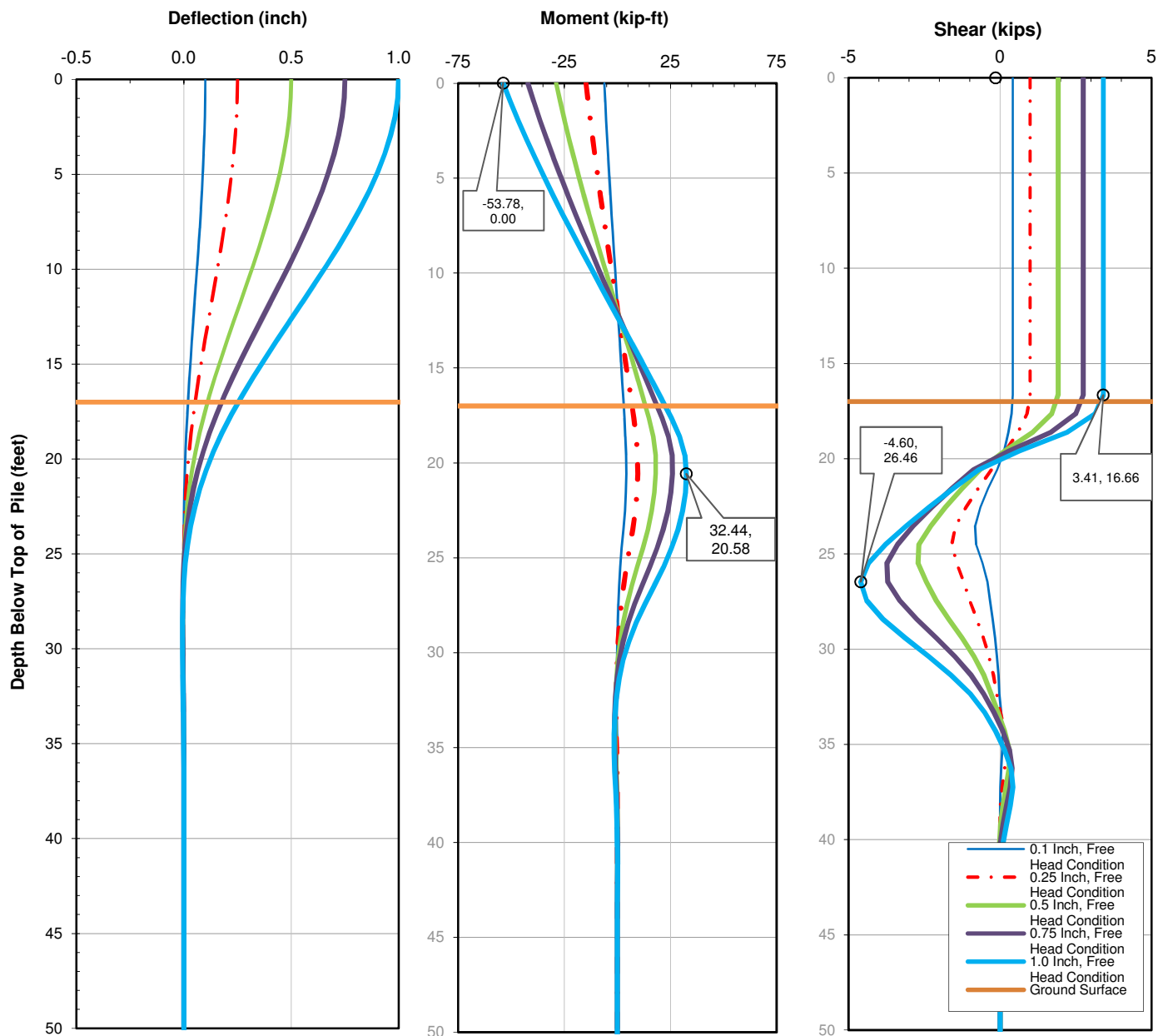
8/24/2015

Lateral Pile Analysis (LPILE) Results
Bents 1,2,10,11, Widen Class 70
Free Head Condition

SR 41 Over Kings River
 Bridge No. 45-0007
 Kings County, CA

PLATE

C-3b



These results are based on the following assumptions and conditions. Piles with conditions different from those assumed should be re-evaluated by Kleinfelder:

1. Class 70, 15 inch octagonal piles (98-foot length)
2. 0.0 Depth represents the top of the pile, Elevation 198



BY: NAS

REV. BY:

PROJECT NO. 20143390

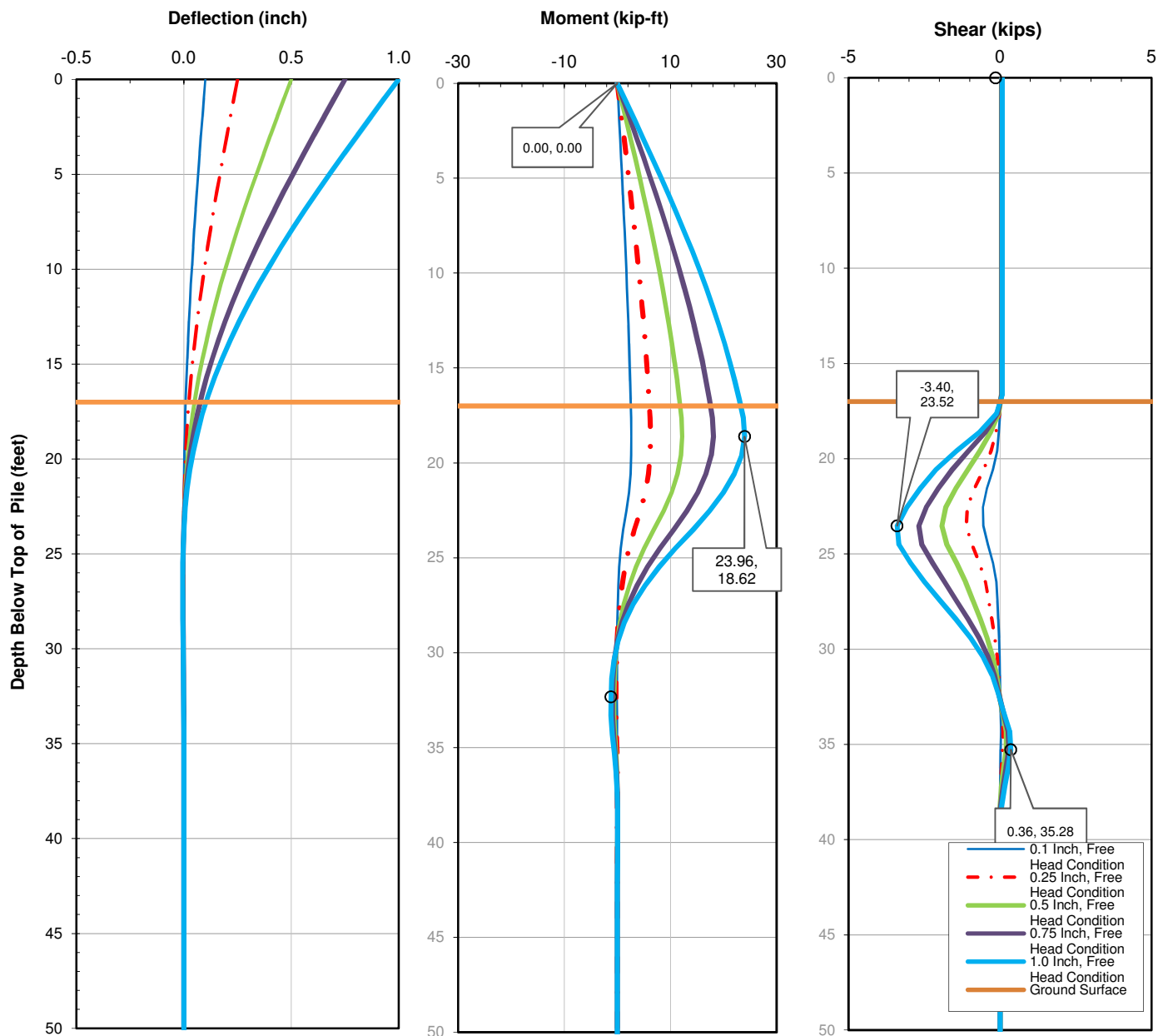
8/24/2015

Lateral Pile Analysis (LPILE) Results
Bents 3 - 9, Widen Class 70
Fixed Head Condition

SR 41 Over Kings River
 Bridge No. 45-0007
 Kings County, CA

PLATE

C-4a



These results are based on the following assumptions and conditions. Piles with conditions different from those assumed should be re-evaluated by Kleinfelder:

1. Class 70, 15 inch octagonal piles (98-foot length)
2. 0.0 Depth represents the top of the pile, Elevation 198



BY: NAS

REV. BY:

PROJECT NO. 20143390

8/24/2015

Lateral Pile Analysis (LPILE) Results
Bents 3 - 9, Widen Class 70
Free Head Condition

SR 41 Over Kings River
 Bridge No. 45-0007
 Kings County, CA

PLATE

C-4b

**FIGURE C.1-1
P-Y CURVES
ORIGINAL 15.5" FLUTED STEEL SHELL PILES
BENTS 1, 2, 10, AND 11**

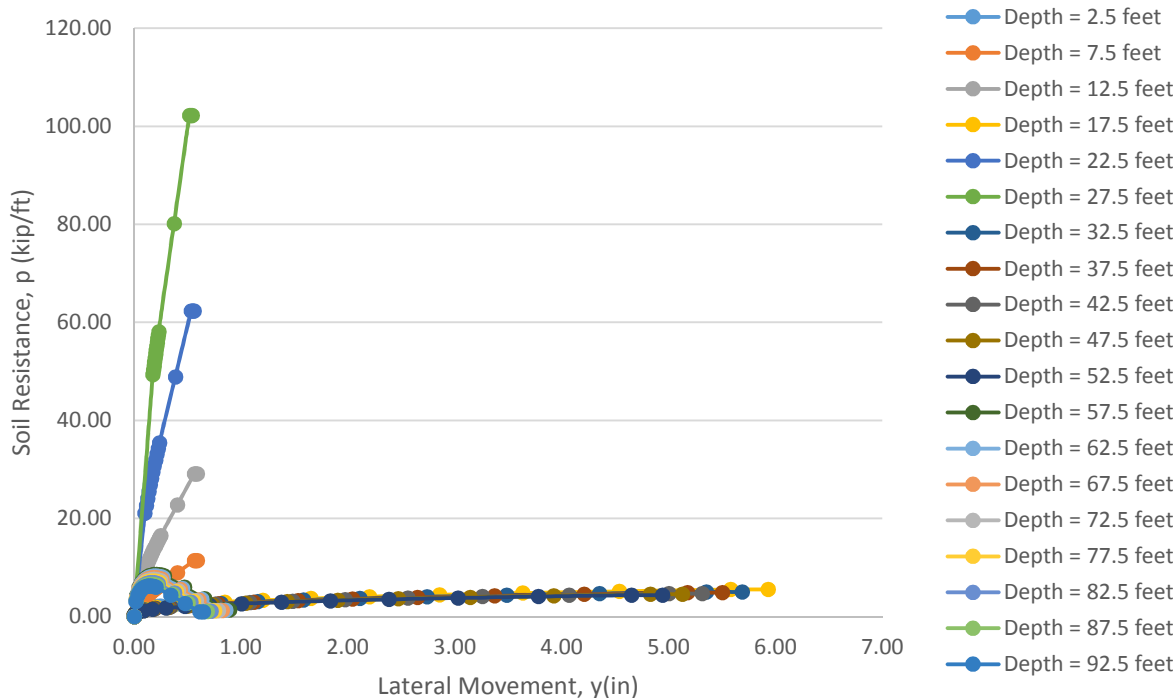


**FIGURE C.1-2
P-Y CURVES
ORIGINAL 15.5" FLUTED STEEL SHELL PILES
BENTS 3-9**

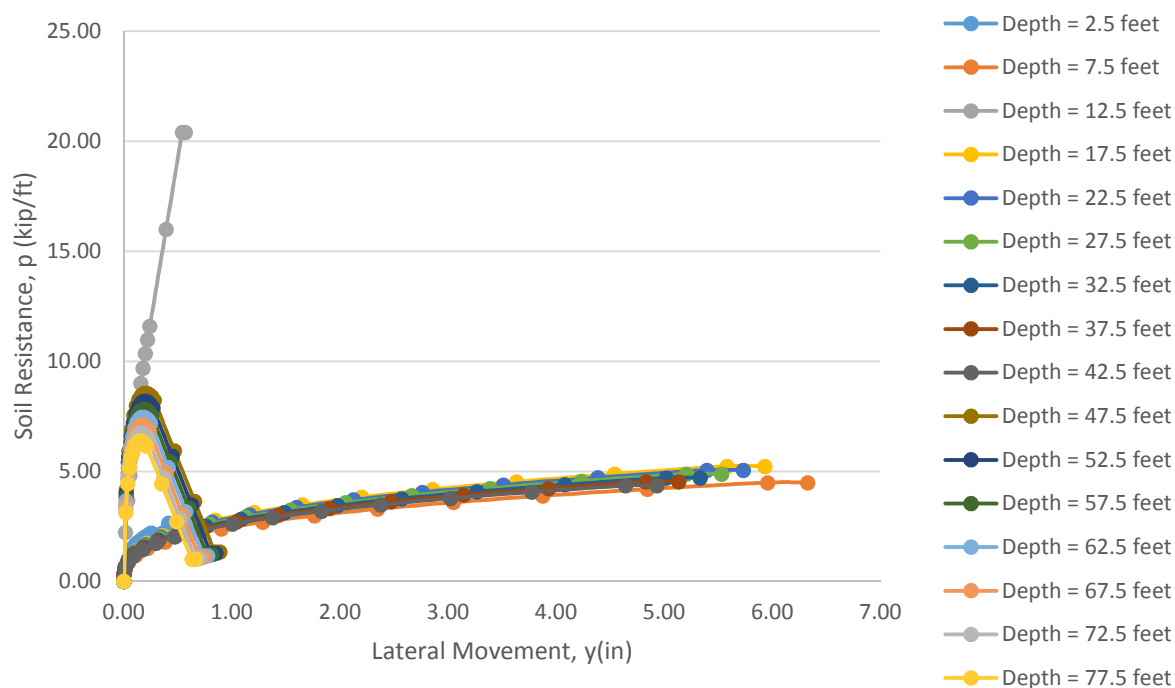


**FIGURE C.1-3
P-Y CURVES
WIDEN 15" CLASS 70 PILES
BENTS 1, 2, 10, AND 11**

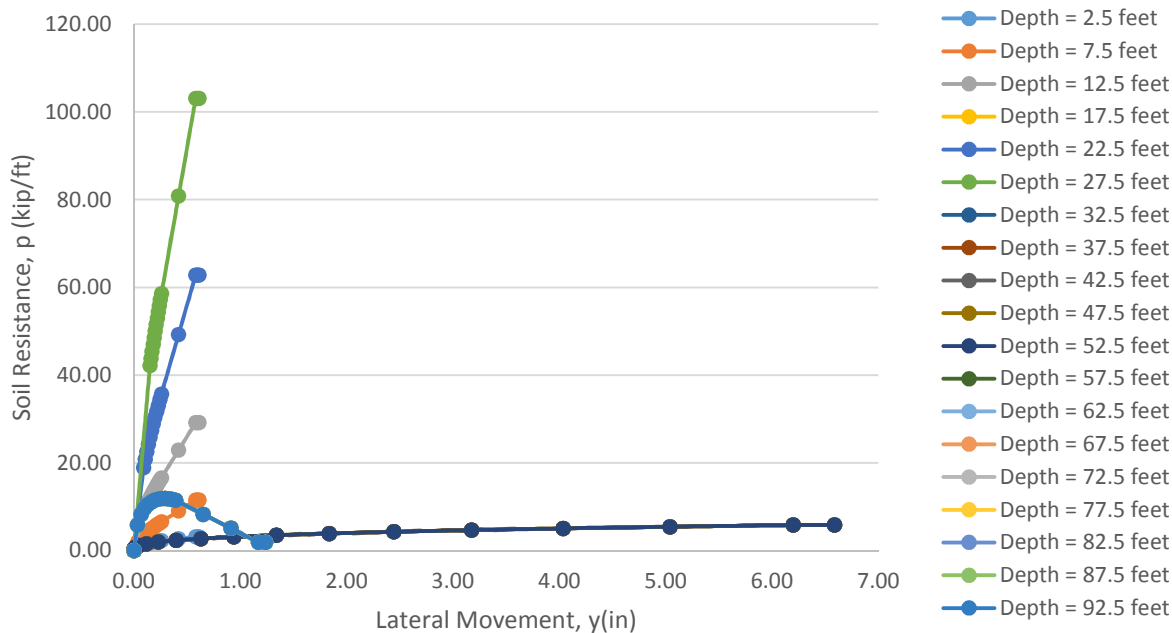


**FIGURE C.1-4
P-Y CURVES
WIDEN 15" CLASS 70 PILES
BENTS 3-9**

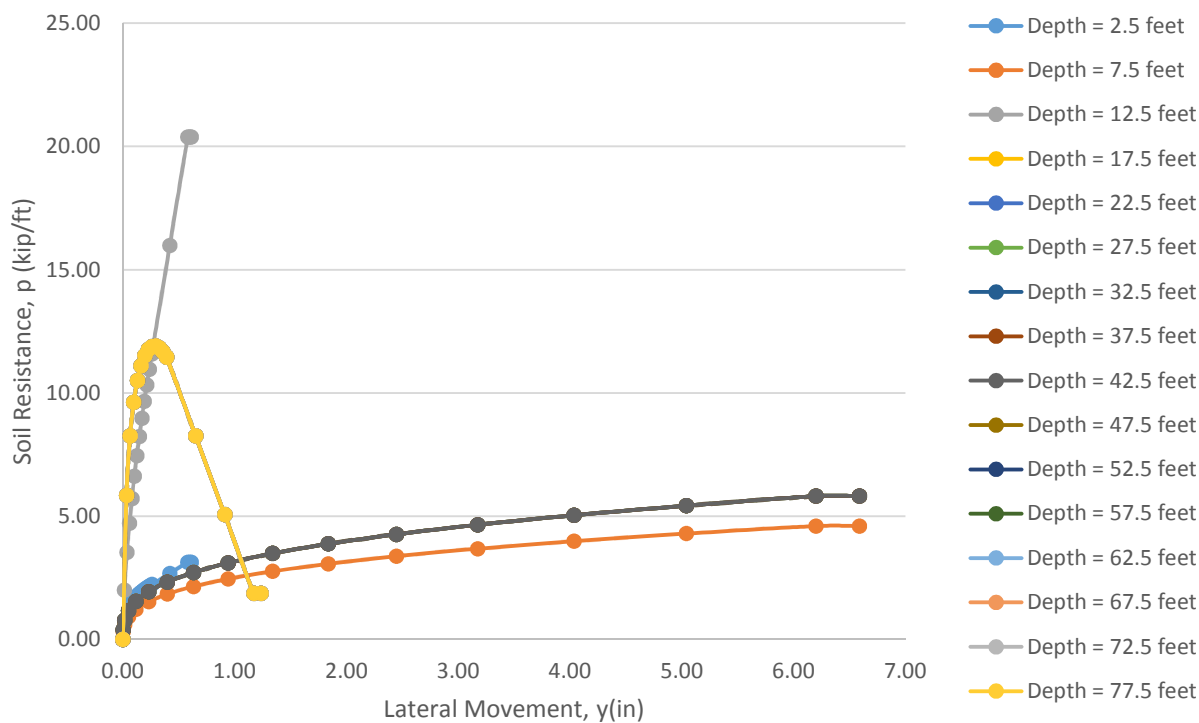


**FIGURE C.3-1
Q-U CURVES
ORIGINAL 15.5" FLUTED STEEL PILES**

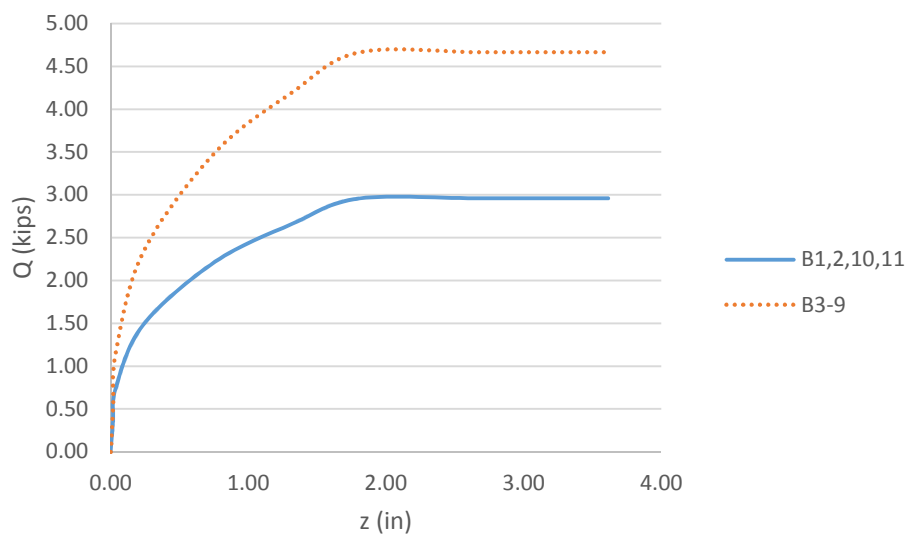
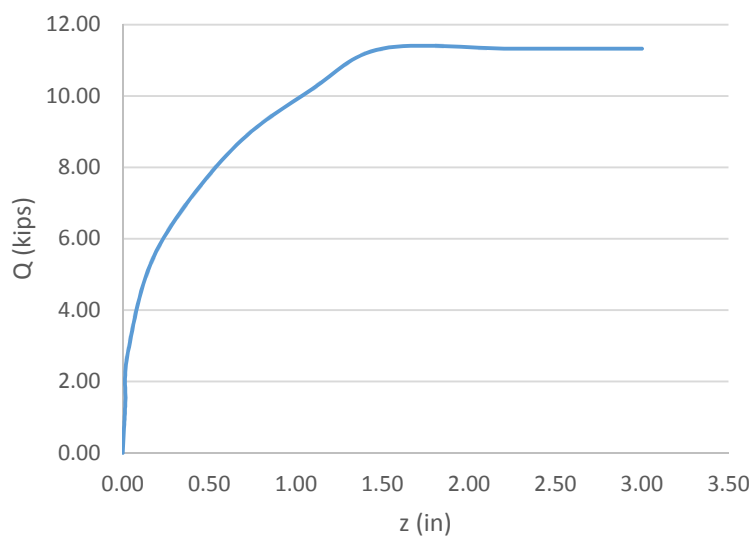


**FIGURE C.3-2
Q-U CURVES
WIDEN 15" CLASS 70 PILES**



Data: t-z Curves

Br. Name:	Hwy 41 over Kings River	Elevation (ft)	194	Pile Type:	Monotube
Br. No. =	45-0007	FG	194	Pile Dia.:	15.5" Diameter
		Pile Cut-Off=		Extension Pile Perimeter:	50
Support(s):	Bents 1,2,10, and 11	GW Elev. =	180		

Note: All depths are in feet.

Layer 0-5 feet	
@Depth 2.5 ft	
@Elevation 191.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.010	0.127
0.020	0.255
0.040	0.509
0.060	0.764
0.080	1.018
0.090	1.145
0.100	1.273
0.500	1.273
2.000	1.273

Layer 5-10 feet	
@Depth 7.5 ft	
@Elevation 186.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.010	0.218
0.020	0.436
0.040	0.872
0.060	1.309
0.080	1.745
0.090	1.964
0.100	2.182
0.500	2.182
2.000	2.182

Layer 10-16 feet	
@Depth 12.5 ft	
@Elevation 181.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.687
0.047	1.145
0.086	1.717
0.120	2.061
0.150	2.290
0.300	2.061
0.450	2.061
0.750	2.061
3.000	2.061

Layer 16-20 feet	
@Depth 17.5 ft	
@Elevation 176.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.497
0.056	0.829
0.103	1.243
0.145	1.492
0.181	1.659
0.361	1.492
0.542	1.492
0.904	1.492
3.614	1.492

Layer 20-23 feet	
@Depth 22.5 ft	
@Elevation 171.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.010	1.529
0.020	3.058
0.040	6.118
0.060	9.176
0.080	12.235
0.090	13.764
0.100	15.294
0.500	15.294
2.000	15.294

Layer 23-30 feet	
@Depth 27.5 ft	
@Elevation 166.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.413
0.056	0.689
0.103	1.033
0.145	1.240
0.181	1.378
0.361	1.240
0.542	1.240
0.904	1.240
3.614	1.240

Layer 30-35 feet	
@Depth 32.5 ft	
@Elevation 161.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.391
0.056	0.652
0.103	0.979
0.145	1.175
0.181	1.305
0.361	1.175
0.542	1.175
0.904	1.175
3.614	1.175

Layer 35-40 feet	
@Depth 37.5 ft	
@Elevation 156.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.337
0.056	0.562
0.103	0.842
0.145	1.010
0.181	1.123
0.361	1.010
0.542	1.010
0.904	1.010
3.614	1.010

Layer 40-45 feet	
@Depth 42.5 ft	
@Elevation 151.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.301
0.056	0.503
0.103	0.754
0.145	0.904
0.181	1.005
0.361	0.904
0.542	0.904
0.904	0.904
3.614	0.904

Layer 45-50 feet	
@Depth 47.5 ft	
@Elevation 146.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.268
0.056	0.447
0.103	0.670
0.145	0.804
0.181	0.893
0.361	0.804
0.542	0.804
0.904	0.804
3.614	0.804

Layer 50-57 feet	
@Depth 52.5 ft	
@Elevation 141.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.322
0.056	0.536
0.103	0.804
0.145	0.965
0.181	1.072
0.361	0.965
0.542	0.965
0.904	0.965
3.614	0.965

Layer 57-60 feet	
@Depth 57.5 ft	
@Elevation 136.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.506
0.056	0.844
0.103	1.266
0.145	1.519
0.181	1.688
0.361	1.519
0.542	1.519
0.904	1.519
3.614	1.519

Layer 60-65 feet	
@Depth 62.5 ft	
@Elevation 131.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.439
0.056	0.732
0.103	1.097
0.145	1.317
0.181	1.463
0.361	1.317
0.542	1.317
0.904	1.317
3.614	1.317

Layer 65-70 feet	
@Depth 67.5 ft	
@Elevation 126.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.376
0.056	0.627
0.103	0.941
0.145	1.129
0.181	1.254
0.361	1.129
0.542	1.129
0.904	1.129
3.614	1.129

Layer 70-75 feet	
@Depth 72.5 ft	
@Elevation 121.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.514
0.056	0.856
0.103	1.283
0.145	1.540
0.181	1.711
0.361	1.540
0.542	1.540
0.904	1.540
3.614	1.540

Layer 75-80 feet	
@Depth 77.5 ft	
@Elevation 116.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.265
0.056	0.442
0.103	0.663
0.145	0.795
0.181	0.884
0.361	0.795
0.542	0.795
0.904	0.795
3.614	0.795

Layer 80-85 feet	
@Depth 82.5 ft	
@Elevation 111.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.217
0.056	0.361
0.103	0.542
0.145	0.650
0.181	0.722
0.361	0.650
0.542	0.650
0.904	0.650
3.614	0.650

Layer 85-91 feet	
@Depth 87.5 ft	
@Elevation 106.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.173
0.056	0.288
0.103	0.432
0.145	0.519
0.181	0.577
0.361	0.519
0.542	0.519
0.904	0.519
3.614	0.519

Layer 91-95 feet	
@Depth 92.5 ft	
@Elevation 101.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.144
0.056	0.240
0.103	0.360
0.145	0.432
0.181	0.480
0.361	0.432
0.542	0.432
0.904	0.432
3.614	0.432

Data: t-z Curves

Br. Name:	Hwy 41 over Kings River	Elevation (ft)	181	Pile Type:	Monotube
Br. No. =	45-0007	FG	181	Pile Dia.:	15.5" Diameter
		Pile Cut-Off=		Extension Pile Perimeter:	50
Support(s):	Bents 3-9	GW Elev. =	180		

Note: All depths are in feet.

Layer 0-5 feet	
@Depth 2.5 ft	
@Elevation 178.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.515
0.056	0.859
0.103	1.288
0.145	1.546
0.181	1.718
0.361	1.546
0.542	1.546
0.904	1.546
3.614	1.546

Layer 5-10 feet	
@Depth 7.5 ft	
@Elevation 173.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.471
0.056	0.785
0.103	1.179
0.145	1.414
0.181	1.572
0.361	1.414
0.542	1.414
0.904	1.414
3.614	1.414

Layer 10-16 feet	
@Depth 12.5 ft	
@Elevation 168.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.429
0.056	0.716
0.103	1.074
0.145	1.289
0.181	1.432
0.361	1.289
0.542	1.289
0.904	1.289
3.614	1.289

Layer 16-20 feet	
@Depth 17.5 ft	
@Elevation 163.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.390
0.056	0.649
0.103	0.974
0.145	1.169
0.181	1.298
0.361	1.169
0.542	1.169
0.904	1.169
3.614	1.169

Layer 20-23 feet	
@Depth 22.5 ft	
@Elevation 158.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.351
0.056	0.586
0.103	0.879
0.145	1.054
0.181	1.172
0.361	1.054
0.542	1.054
0.904	1.054
3.614	1.054

Layer 23-30 feet	
@Depth 27.5 ft	
@Elevation 153.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.771
0.056	1.285
0.103	1.927
0.145	2.313
0.181	2.570
0.361	2.313
0.542	2.313
0.904	2.313
3.614	2.313

Layer 30-35 feet	
@Depth 32.5 ft	
@Elevation 148.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.688
0.056	1.146
0.103	1.719
0.145	2.063
0.181	2.292
0.361	2.063
0.542	2.063
0.904	2.063
3.614	2.063

Layer 35-40 feet	
@Depth 37.5 ft	
@Elevation 143.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.609
0.056	1.015
0.103	1.522
0.145	1.826
0.181	2.029
0.361	1.826
0.542	1.826
0.904	1.826
3.614	1.826

Layer 40-45 feet	
@Depth 42.5 ft	
@Elevation 138.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.535
0.056	0.891
0.103	1.337
0.145	1.604
0.181	1.782
0.361	1.604
0.542	1.604
0.904	1.604
3.614	1.604

Layer 45-50 feet	
@Depth 47.5 ft	
@Elevation 133.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.465
0.056	0.775
0.103	1.163
0.145	1.396
0.181	1.551
0.361	1.396
0.542	1.396
0.904	1.396
3.614	1.396

Layer 50-57 feet	
@Depth 52.5 ft	
@Elevation 128.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.401
0.056	0.668
0.103	1.002
0.145	1.202
0.181	1.336
0.361	1.202
0.542	1.202
0.904	1.202
3.614	1.202

Layer 57-60 feet	
@Depth 57.5 ft	
@Elevation 123.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.341
0.056	0.568
0.103	0.852
0.145	1.023
0.181	1.137
0.361	1.023
0.542	1.023
0.904	1.023
3.614	1.023

Layer 60-65 feet	
@Depth 62.5 ft	
@Elevation 118.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.286
0.056	0.477
0.103	0.715
0.145	0.858
0.181	0.953
0.361	0.858
0.542	0.858
0.904	0.858
3.614	0.858

Layer 65-70 feet	
@Depth 67.5 ft	
@Elevation 113.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.253
0.056	0.422
0.103	0.633
0.145	0.760
0.181	0.845
0.361	0.760
0.542	0.760
0.904	0.760
3.614	0.760

Layer 70-75 feet	
@Depth 72.5 ft	
@Elevation 108.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.374
0.056	0.624
0.103	0.936
0.145	1.123
0.181	1.248
0.361	1.123
0.542	1.123
0.904	1.123
3.614	1.123

Layer 75-81 feet	
@Depth 77.5 ft	
@Elevation 103.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.029	0.193
0.056	0.322
0.103	0.482
0.145	0.579
0.181	0.643
0.361	0.579
0.542	0.579
0.904	0.579
3.614	0.579

Data: t-z Curves

Br. Name:	Hwy 41 over Kings River	Elevation (ft)	194	Pile Type:	Octagonal Piles
Br. No. =	45-0007	FG	194	Pile Dia.:	15" Diameter
		Pile Cut-Off=		Extension Pile Perimeter:	50
Support(s):	Bents 1,2,10, and 11	GW Elev. =	180		

Note: All depths are in feet.

Layer 0-5 feet	
@Depth 2.5 ft	
@Elevation 191.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.010	0.127
0.020	0.255
0.040	0.509
0.060	0.764
0.080	1.018
0.090	1.145
0.100	1.273
0.500	1.273
2.000	1.273

Layer 5-10 feet	
@Depth 7.5 ft	
@Elevation 186.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.010	0.218
0.020	0.436
0.040	0.872
0.060	1.309
0.080	1.745
0.090	1.964
0.100	2.182
0.500	2.182
2.000	2.182

Layer 10-16 feet	
@Depth 12.5 ft	
@Elevation 181.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.687
0.047	1.145
0.086	1.717
0.120	2.061
0.150	2.290
0.300	2.061
0.450	2.061
0.750	2.061
3.000	2.061

Layer 16-20 feet	
@Depth 17.5 ft	
@Elevation 176.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.625
0.047	1.042
0.086	1.562
0.120	1.875
0.150	2.083
0.300	1.875
0.450	1.875
0.750	1.875
3.000	1.875

Layer 20-23 feet	
@Depth 22.5 ft	
@Elevation 171.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.010	0.850
0.020	1.700
0.040	3.401
0.060	5.102
0.080	6.804
0.090	7.650
0.100	8.502
0.500	8.502
2.000	8.502

Layer 23-30 feet	
@Depth 27.5 ft	
@Elevation 166.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.625
0.047	1.042
0.086	1.562
0.120	1.875
0.150	2.083
0.300	1.875
0.450	1.875
0.750	1.875
3.000	1.875

Layer 30-35 feet	
@Depth 32.5 ft	
@Elevation 161.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.625
0.047	1.042
0.086	1.562
0.120	1.875
0.150	2.083
0.300	1.875
0.450	1.875
0.750	1.875
3.000	1.875

Layer 35-40 feet	
@Depth 37.5 ft	
@Elevation 156.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.625
0.047	1.042
0.086	1.562
0.120	1.875
0.150	2.083
0.300	1.875
0.450	1.875
0.750	1.875
3.000	1.875

Layer 40-45 feet	
@Depth 42.5 ft	
@Elevation 151.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.625
0.047	1.042
0.086	1.562
0.120	1.875
0.150	2.083
0.300	1.875
0.450	1.875
0.750	1.875
3.000	1.875

Layer 45-50 feet	
@Depth 47.5 ft	
@Elevation 146.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.625
0.047	1.042
0.086	1.562
0.120	1.875
0.150	2.083
0.300	1.875
0.450	1.875
0.750	1.875
3.000	1.875

Layer 50-57 feet	
@Depth 52.5 ft	
@Elevation 141.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.851
0.047	1.418
0.086	2.127
0.120	2.552
0.150	2.836
0.300	2.552
0.450	2.552
0.750	2.552
3.000	2.552

Layer 57-60 feet	
@Depth 57.5 ft	
@Elevation 136.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 60-65 feet	
@Depth 62.5 ft	
@Elevation 131.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 65-70 feet	
@Depth 67.5 ft	
@Elevation 126.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 70-75 feet	
@Depth 72.5 ft	
@Elevation 121.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 75-80 feet	
@Depth 77.5 ft	
@Elevation 116.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 80-85 feet	
@Depth 82.5 ft	
@Elevation 111.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 85-91 feet	
@Depth 87.5 ft	
@Elevation 106.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 91-95 feet	
@Depth 92.5 ft	
@Elevation 101.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Data: t-z Curves

Br. Name:	Hwy 41 over Kings River	Elevation (ft)	181	Pile Type:	Octagonal Piles
Br. No. =	45-0007	FG	181	Pile Dia.:	15" Diameter
		Pile Cut-Off=		Extension Pile Perimeter:	50
Support(s):	Bents 3-9	GW Elev. =	180		

Note: All depths are in feet.

Layer 0-3 feet	
@Depth 2.5 ft	
@Elevation 178.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.625
0.047	1.042
0.086	1.562
0.120	1.875
0.150	2.083
0.300	1.875
0.450	1.875
0.750	1.875
3.000	1.875

Layer 3-10 feet	
@Depth 7.5 ft	
@Elevation 173.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.625
0.047	1.042
0.086	1.562
0.120	1.875
0.150	2.083
0.300	1.875
0.450	1.875
0.750	1.875
3.000	1.875

Layer 10-17 feet	
@Depth 12.5 ft	
@Elevation 168.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.625
0.047	1.042
0.086	1.562
0.120	1.875
0.150	2.083
0.300	1.875
0.450	1.875
0.750	1.875
3.000	1.875

Layer 17-20 feet	
@Depth 17.5 ft	
@Elevation 163.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.625
0.047	1.042
0.086	1.562
0.120	1.875
0.150	2.083
0.300	1.875
0.450	1.875
0.750	1.875
3.000	1.875

Layer 20-25 feet	
@Depth 22.5 ft	
@Elevation 158.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	0.625
0.047	1.042
0.086	1.562
0.120	1.875
0.150	2.083
0.300	1.875
0.450	1.875
0.750	1.875
3.000	1.875

Layer 25-30 feet	
@Depth 27.5 ft	
@Elevation 153.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.303
0.047	2.171
0.086	3.256
0.120	3.907
0.150	4.341
0.300	3.907
0.450	3.907
0.750	3.907
3.000	3.907

Layer 30-35 feet	
@Depth 32.5 ft	
@Elevation 148.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 35-40 feet	
@Depth 37.5 ft	
@Elevation 143.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 40-44 feet	
@Depth 42.5 ft	
@Elevation 138.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 44-50 feet	
@Depth 47.5 ft	
@Elevation 133.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 50-55 feet	
@Depth 52.5 ft	
@Elevation 128.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 55-60 feet	
@Depth 57.5 ft	
@Elevation 123.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 60-65 feet	
@Depth 62.5 ft	
@Elevation 118.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 65-70 feet	
@Depth 67.5 ft	
@Elevation 113.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 70-75 feet	
@Depth 72.5 ft	
@Elevation 108.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

Layer 75-81 feet	
@Depth 77.5 ft	
@Elevation 103.5 ft	
z (in)	t(kips/ft)
0.000	0.000
0.024	1.528
0.047	2.547
0.086	3.820
0.120	4.585
0.150	5.094
0.300	4.585
0.450	4.585
0.750	4.585
3.000	4.585

TABLE C.2-1
P-Y CURVES TABULAR DATA
ORIGINAL 15.5" FLUTED STEEL PILE
BENTS 1, 2, 10, & 11

All depths are measured below ground surface.

Layer 1 0'-5'		
Depth = 2.5 feet		
Elevation = 191.5 feet		
y (in)	p (kip/ft)	
-0.59	-3.01	
-0.58	-3.01	
-0.56	-3.01	
-0.41	-2.57	
-0.25	-2.14	
-0.23	-2.09	
-0.22	-2.05	
-0.20	-2.00	
-0.19	-1.95	
-0.17	-1.90	
-0.16	-1.84	
-0.14	-1.78	
-0.13	-1.72	
-0.11	-1.65	
-0.10	-1.57	
-0.08	-1.49	
0.00	0.00	
0.08	1.49	
0.10	1.57	
0.11	1.65	
0.13	1.72	
0.14	1.78	
0.16	1.84	
0.17	1.90	
0.19	1.95	
0.20	2.00	
0.22	2.05	
0.23	2.09	
0.25	2.14	
0.41	2.57	
0.56	3.01	
0.58	3.01	
0.59	3.01	

Layer 2 5'-10'		
Depth = 7.5 feet		
Elevation = 186.5 feet		
y (in)	p (kip/ft)	
-0.59	-11.40	
-0.58	-11.40	
-0.56	-11.40	
-0.41	-8.94	
-0.25	-6.48	
-0.23	-6.17	
-0.21	-5.85	
-0.19	-5.52	
-0.17	-5.18	
-0.15	-4.82	
-0.13	-4.45	
-0.12	-4.05	
-0.10	-3.62	
-0.08	-3.16	
-0.06	-2.66	
-0.04	-2.08	
0.00	0.00	
0.04	2.08	
0.06	2.66	
0.08	3.16	
0.10	3.62	
0.12	4.05	
0.13	4.45	
0.15	4.82	
0.17	5.18	
0.19	5.52	
0.21	5.85	
0.23	6.17	
0.25	6.48	
0.41	8.94	
0.56	11.40	
0.58	11.40	
0.59	11.40	

Layer 3 10'-16'		
Depth = 12.5 feet		
Elevation = 181.5 feet		
y (in)	p (kip/ft)	
-0.59	-29.06	
-0.58	-29.06	
-0.56	-29.06	
-0.41	-22.78	
-0.25	-16.51	
-0.24	-16.01	
-0.23	-15.49	
-0.21	-14.97	
-0.20	-14.43	
-0.19	-13.88	
-0.18	-13.32	
-0.16	-12.73	
-0.15	-12.14	
-0.14	-11.52	
-0.13	-10.88	
-0.11	-10.21	
0.00	0.00	
0.11	10.21	
0.13	10.88	
0.14	11.52	
0.15	12.14	
0.16	12.73	
0.18	13.32	
0.19	13.88	
0.20	14.43	
0.21	14.97	
0.23	15.49	
0.24	16.01	
0.25	16.51	
0.41	22.78	
0.56	29.06	
0.58	29.06	
0.59	29.06	

Layer 4 16'-20'		
Depth = 17.5 feet		
Elevation = 176.5 feet		
y (in)	p (kip/ft)	
-5.93	-5.51	
-5.58	-5.51	
-4.54	-5.14	
-3.63	-4.78	
-2.86	-4.41	
-2.20	-4.04	
-1.65	-3.67	
-1.21	-3.31	
-0.85	-2.94	
-0.57	-2.57	
-0.36	-2.20	
-0.21	-1.84	
-0.11	-1.47	
-0.04	-1.10	
-0.01	-0.73	
0.00	-0.37	
0.00	0.00	
0.00	0.37	
0.01	0.73	
0.04	1.10	
0.11	1.47	
0.21	1.84	
0.36	2.20	
0.57	2.57	
0.85	2.94	
1.21	3.31	
1.65	3.67	
2.20	4.04	
2.86	4.41	
3.63	4.78	
4.54	5.14	
5.58	5.51	
5.93	5.51	

Layer 5 20'-23'		
Depth = 22.5 feet		
Elevation = 171.5 feet		
y (in)	p (kip/ft)	
-0.56	-62.31	
-0.55	-62.31	
-0.53	-62.31	
-0.39	-48.86	
-0.24	-35.40	
-0.23	-34.27	
-0.21	-33.11	
-0.20	-31.92	
-0.19	-30.71	
-0.18	-29.46	
-0.16	-28.17	
-0.15	-26.85	
-0.14	-25.49	
-0.13	-24.07	
-0.11	-22.60	
-0.10	-21.07	
0.00	0.00	
0.10	21.07	
0.11	22.60	
0.13	24.07	
0.14	25.49	
0.15	26.85	
0.16	28.17	
0.18	29.46	
0.19	30.71	
0.20	31.92	
0.21	33.11	
0.23	34.27	
0.24	35.40	
0.39	48.86	
0.53	62.31	
0.55	62.31	
0.56	62.31	

Layer 6 23'-30'		
Depth = 27.5 feet		
Elevation = 166.5 feet		
y (in)	p (kip/ft)	
-0.54	-102.21	
-0.53	-102.21	
-0.52	-102.21	
-0.37	-80.15	
-0.23	-58.08	
-0.23	-57.32	
-0.22	-56.55	
-0.22	-55.77	
-0.21	-54.99	
-0.21	-54.20	
-0.20	-53.41	
-0.20	-52.61	
-0.19	-51.79	
-0.19	-50.97	
-0.18	-50.15	
-0.18	-49.31	
0.00	0.00	
0.18	49.31	
0.18	50.15	
0.19	50.97	
0.19	51.79	
0.20	52.61	
0.20	53.41	
0.21	54.20	
0.21	54.99	
0.22	55.77	
0.22	56.55	
0.23	57.32	
0.23	58.08	
0.37	80.15	
0.52	102.21	
0.53	102.21	
0.54	102.21	

Layer 7 30'-35'		
Depth = 32.5 feet		
Elevation = 161.5 feet		
y (in)	p (kip/ft)	
-5.69	-5.02	
-5.35	-5.02	
-4.35	-4.68	
-3.48	-4.35	
-2.74	-4.01	
-2.11	-3.68	
-1.59	-3.35	
-1.16	-3.01	
-0.81	-2.68	
-0.54	-2.34	
-0.34	-2.01	
-0.20	-1.67	
-0.10	-1.34	
-0.04	-1.00	
-0.01	-0.67	
0.00	-0.33	
0.00	0.00	
0.00	0.33	
0.01	0.67	
0.04	1.00	
0.10	1.34	
0.20	1.67	
0.34	2.01	
0.54	2.34	
0.81	2.68	
1.16	3.01	
1.59	3.35	
2.11	3.68	
2.74	4.01	
3.48	4.35	
4.35	4.68	
5.35	5.02	
5.69	5.02	

Layer 8 35'-40'		
Depth = 37.5 feet		
Elevation = 156.5 feet		
y (in)	p (kip/ft)	
-5.50	-5.18	-4.85
-5.18	-4.85	-4.53
-4.21	-3.88	-3.56
-3.37	-4.21	-3.88
-2.65	-2.04	-1.53
-2.04	-3.56	-3.24
-1.53	-2.91	-2.59
-1.12	-2.27	-1.94
-0.79	-1.62	-1.29
-0.53	-0.97	-0.65
-0.33	-0.32	0.00
-0.19	0.00	0.32
-0.10	0.01	0.65
-0.04	0.04	0.97
-0.01	0.10	1.29
0.00	0.19	1.62
0.00	0.33	1.94
0.00	0.53	2.27
0.00	0.79	2.59
0.00	1.12	2.91
0.00	1.53	3.24
0.00	2.04	3.56
0.00	2.65	3.88
0.00	3.37	4.21
0.00	4.21	4.53
0.00	5.18	4.85
0.00	5.50	4.85

TABLE C.2-2
P-Y CURVES TABULAR DATA
ORIGINAL 15.5" FLUTED STEEL PILES
BENTS 3 THROUGH 9

All depths are measured below ground surface.

Layer 1 0'-3'		
Depth = 2.5 feet		
Elevation = 184.5 feet		
y (in)	p (kip/ft)	
-0.60	-3.10	
-0.59	-3.10	
-0.58	-3.10	
-0.42	-2.65	
-0.26	-2.20	
-0.24	-2.16	
-0.23	-2.11	
-0.21	-2.06	
-0.19	-2.01	
-0.18	-1.96	
-0.16	-1.90	
-0.15	-1.84	
-0.13	-1.78	
-0.12	-1.70	
-0.10	-1.63	
-0.09	-1.54	
0.00	0.00	
0.09	1.54	
0.10	1.63	
0.12	1.70	
0.13	1.78	
0.15	1.84	
0.16	1.90	
0.18	1.96	
0.19	2.01	
0.21	2.06	
0.23	2.11	
0.24	2.16	
0.26	2.20	
0.42	2.65	
0.58	3.10	
0.59	3.10	
0.60	3.10	

Layer 2 3'-9'		
Depth = 7.5 feet		
Elevation = 179.5 feet		
y (in)	p (kip/ft)	
-6.33	-4.49	
-5.96	-4.49	
-4.84	-4.19	
-3.88	-3.89	
-3.05	-3.59	
-2.35	-3.29	
-1.76	-2.99	
-1.29	-2.70	
-0.90	-2.40	
-0.61	-2.10	
-0.38	-1.80	
-0.22	-1.50	
-0.11	-1.20	
-0.05	-0.90	
-0.01	-0.60	
0.00	-0.30	
0.00	0.00	
0.00	0.30	
0.01	0.60	
0.05	0.90	
0.11	1.20	
0.22	1.50	
0.38	1.80	
0.61	2.10	
0.90	2.40	
1.29	2.70	
1.76	2.99	
2.35	3.29	
3.05	3.59	
3.88	3.89	
4.84	4.19	
5.96	4.49	
6.33	4.49	

Layer 3 9'-16'		
Depth = 12.5 feet		
Elevation = 174.5 feet		
y (in)	p (kip/ft)	
-0.57	-20.40	
-0.55	-20.40	
-0.54	-20.40	
-0.39	-16.00	
-0.24	-11.59	
-0.22	-10.98	
-0.20	-10.35	
-0.18	-9.70	
-0.16	-9.01	
-0.14	-8.29	
-0.12	-7.52	
-0.10	-6.70	
-0.08	-5.81	
-0.06	-4.82	
-0.04	-3.68	
-0.02	-2.23	
0.00	0.00	
0.02	2.23	
0.04	3.68	
0.06	4.82	
0.08	5.81	
0.10	6.70	
0.12	7.52	
0.14	8.29	
0.16	9.01	
0.18	9.70	
0.20	10.35	
0.22	10.98	
0.24	11.59	
0.39	16.00	
0.54	20.40	
0.55	20.40	
0.57	20.40	

Layer 4 16-20'		
Depth = 17.5 feet		
Elevation = 169.5 feet		
y (in)	p (kip/ft)	
-5.93	-5.23	
-5.58	-5.23	
-4.54	-4.88	
-3.63	-4.53	
-2.86	-4.19	
-2.20	-3.84	
-1.65	-3.49	
-1.21	-3.14	
-0.85	-2.79	
-0.57	-2.44	
-0.36	-2.09	
-0.21	-1.74	
-0.11	-1.40	
-0.04	-1.05	
-0.01	-0.70	
0.00	-0.35	
0.00	0.00	
0.00	0.35	
0.01	0.70	
0.04	1.05	
0.11	1.40	
0.21	1.74	
0.36	2.09	
0.57	2.44	
0.85	2.79	
1.21	3.14	
1.65	3.49	
2.20	3.84	
2.86	4.19	
3.63	4.53	
4.54	4.88	
5.58	5.23	
5.93	5.23	

Layer 5 20'-25'		
Depth = 22.5 feet		
Elevation = 164.5 feet		
y (in)	p (kip/ft)	
-5.73	-5.06	
-5.39	-5.06	
-4.39	-4.72	
-3.51	-4.38	
-2.76	-4.05	
-2.13	-3.71	
-1.60	-3.37	
-1.17	-3.03	
-0.82	-2.70	
-0.55	-2.36	
-0.35	-2.02	
-0.20	-1.69	
-0.10	-1.35	
-0.04	-1.01	
-0.01	-0.67	
0.00	-0.34	
0.00	0.00	
0.00	0.34	
0.01	0.67	
0.04	1.01	
0.10	1.35	
0.20	1.69	
0.35	2.02	
0.55	2.36	
0.82	2.70	
1.17	3.03	
1.60	3.37	
2.13	3.71	
2.76	4.05	
3.51	4.38	
4.39	4.72	
5.39	5.06	
5.73	5.06	

Layer 6 25'-30'		
Depth = 27.5 feet		
Elevation = 159.5 feet		
y (in)	p (kip/ft)	
-5.53	-4.88	
-5.21	-4.88	
-4.23	-4.56	
-3.39	-4.23	
-2.67	-3.90	
-2.05	-3.58	
-1.54	-3.25	
-1.12	-2.93	
-0.79	-2.60	
-0.53	-2.28	
-0.33	-1.95	
-0.19	-1.63	
-0.10	-1.30	
-0.04	-0.98	
-0.01	-0.65	
0.00	-0.33	
0.00	0.00	
0.00	0.33	
0.01	0.65	
0.04	0.98	
0.10	1.30	
0.19	1.63	
0.33	1.95	
0.53	2.28	
0.79	2.60	
1.12	2.93	
1.54	3.25	
2.05	3.58	
2.67	3.90	
3.39	4.23	
4.23	4.56	
5.21	4.88	
5.53	4.88	

Layer 7 30'-35'		
Depth = 32.5 feet		
Elevation = 154.5 feet		
y (in)	p (kip/ft)	
-5.33	-4.71	
-5.02	-4.71	
-4.08	-4.39	
-3.27	-4.08	
-2.57	-3.76	
-1.98	-3.45	
-1.49	-3.14	
-1.08	-2.82	
-0.76	-2.51	
-0.51	-2.20	
-0.32	-1.88	
-0.19	-1.57	
-0.10	-1.25	
-0.04	-0.94	
-0.01	-0.63	
0.00	-0.31	
0.00	0.00	
0.00	0.31	
0.01	0.63	
0.04	0.94	
0.10	1.25	
0.19	1.57	
0.32	1.88	
0.51	2.20	
0.76	2.51	
1.08	2.82	
1.49	3.14	
1.98	3.45	
2.57	3.76	
3.27	4.08	
4.08	4.39	
5.02	4.71	
5.33	4.71	

Layer 8 35'-40'		
Depth = 37.5 feet		
Elevation = 149.5 feet		
y (in)	p (kip/ft)	
-5.13	-4.53	
-4.83	-4.53	
-3.93	-4.23	
-3.14	-3.93	
-2.47	-3.62	
-1.91	-3.32	
-1.43	-3.02	
-1.04	-2.72	
-0.73	-2.42	
-0.49	-2.11	
-0.31	-1.81	
-0.18	-1.51	
-0.09	-1.21	
-0.04	-0.91	
-0.01	-0.60	
0.00	-0.30	
0.00	0.00	
0.00	0.30	
0.01	0.60	
0.04	0.91	
0.09	1.21	
0.18	1.51	
0.31	1.81	
0.49	2.11	
0.73	2.42	
1.04	2.72	
1.43	3.02	
1.91	3.32	
2.47	3.62	
3.14	3.93	
3.93	4.23	
4.83	4.53	
5.13	4.53	

Layer 9 40'-43'		
Depth = 42.5 feet		
Elevation = 144.5 feet		
y (in)	p (kip/ft)	
-4.93	-4.35	
-4.64	-4.35	
-3.78	-4.06	
-3.02	-3.77	
-2.38	-3.48	
-1.83	-3.19	
-1.38	-2.90	
-1.00	-2.61	
-0.70	-2.32	
-0.47	-2.03	
-0.30	-1.74	
-0.17	-1.45	
-0.09	-1.16	
-0.04	-0.87	
-0.01	-0.58	
0.00	-0.29	
0.00	0.00	
0.00	0.29	
0.01	0.58	
0.04	0.87	
0.09	1.16	
0.17	1.45	
0.30	1.74	
0.47	2.03	
0.70	2.32	
1.00	2.61	
1.38	2.90	
1.83	3.19	
2.38	3.48	
3.02	3.77	
3.78	4.06	
4.64	4.35	
4.93	4.35	

Layer 10 43'-49'		
Depth = 47.5 feet		
Elevation = 139.5 feet		
y (in)	p (kip/ft)	
-0.89	-1.34	
-0.84	-1.34	
-0.63	-1.49	
-0.47	-1.54	
-0.28	-1.24	
-0.26	-1.39	
-0.23	-1.50	
-0.21	-1.55	
-0.19	-1.54	
-0.16	-1.45	
-0.14	-1.27	
-0.12	-1.28	
-0.09	-1.25	
-0.07	-1.21	
-0.05	-1.16	
-0.02	-1.10	
0.00	0.00	
0.02	1.10	
0.05	1.16	
0.07	1.21	
0.09	1.25	
0.12	1.28	
0.14	1.27	
0.16	1.45	
0.19	1.54	
0.21	1.55	
0.23	1.50	
0.26	1.39	
0.28	1.24	
0.47	1.54	
0.66	1.44	
0.84	1.34	
0.89	1.34	

Layer 11 49'-55'		
Depth = 52.5 feet		
Elevation = 134.5 feet		
y (in)	p (kip/ft)	
-0.85	-1.29	
-0.81	-1.29	
-0.63	-1.49	
-0.45	-1.59	
-0.27	-1.89	
-0.25	-1.84	
-0.22	-1.81	
-0.20	-1.89	
-0.18	-1.88	
-0.16	-1.80	
-0.13	-1.78	
-0.11	-1.75	
-0.09	-1.72	
-0.07	-1.62	
-0.04	-1.58	
-0.02	-1.42	
0.00	0.00	
0.02	1.42	
0.04	1.58	
0.07	1.62	
0.09	1.72	
0.11	1.75	
0.13	1.78	
0.16	1.80	
0.18	1.88	
0.20	1.89	
0.22	1.84	
0.25	1.84	
0.27	1.89	
0.45	1.59	
0.63	1.49	
0.81	1.29	
0.85	1.29	

Layer 12 55'-60'		
Depth = 57.5 feet		
Elevation = 129.5 feet		
y (in)	p (kip/ft)	

TABLE C.2-3
P-Y CURVES TABULAR DATA
WIDEN 15" CLASS 70 PILES
BENTS 1, 2, 10, and 11

All depths are measured below ground surface.

Layer 1 0'-5'		
Depth = 2.5 feet		
Elevation = 191.5 feet		
y (in)	p (kip/ft)	
-0.61	-3.13	
-0.60	-3.13	
-0.58	-3.13	
-0.42	-2.68	
-0.26	-2.23	
-0.24	-2.18	
-0.23	-2.14	
-0.21	-2.09	
-0.20	-2.04	
-0.18	-1.98	
-0.16	-1.92	
-0.15	-1.86	
-0.13	-1.80	
-0.12	-1.73	
-0.10	-1.65	
-0.09	-1.56	
0.00	0.00	
0.09	1.56	
0.10	1.65	
0.12	1.73	
0.13	1.80	
0.15	1.86	
0.16	1.92	
0.18	1.98	
0.20	2.04	
0.21	2.09	
0.23	2.14	
0.24	2.18	
0.26	2.23	
0.42	2.68	
0.58	3.13	
0.60	3.13	
0.61	3.13	

Layer 2 5'-10'		
Depth = 7.5 feet		
Elevation = 186.5 feet		
y (in)	p (kip/ft)	
-0.61	-11.48	
-0.60	-11.48	
-0.58	-11.48	
-0.42	-9.00	
-0.26	-6.52	
-0.24	-6.21	
-0.22	-5.89	
-0.20	-5.55	
-0.18	-5.20	
-0.16	-4.83	
-0.14	-4.45	
-0.12	-4.04	
-0.10	-3.61	
-0.08	-3.13	
-0.06	-2.61	
-0.04	-2.01	
0.00	0.00	
0.04	2.01	
0.06	2.61	
0.08	3.13	
0.10	3.61	
0.12	4.04	
0.14	4.45	
0.16	4.83	
0.18	5.20	
0.20	5.55	
0.22	5.89	
0.24	6.21	
0.26	6.52	
0.42	9.00	
0.58	11.48	
0.60	11.48	
0.61	11.48	

Layer 3 10'-16'		
Depth = 12.5 feet		
Elevation = 181.5 feet		
y (in)	p (kip/ft)	
-0.61	-29.19	
-0.60	-29.19	
-0.58	-29.19	
-0.42	-22.89	
-0.26	-16.58	
-0.24	-16.05	
-0.23	-15.50	
-0.22	-14.94	
-0.20	-14.37	
-0.19	-13.78	
-0.18	-13.17	
-0.16	-12.55	
-0.15	-11.91	
-0.14	-11.24	
-0.12	-10.54	
-0.11	-9.82	
0.00	0.00	
0.11	9.82	
0.12	10.54	
0.14	11.24	
0.15	11.91	
0.16	12.55	
0.18	13.17	
0.19	13.78	
0.20	14.37	
0.22	14.94	
0.23	15.50	
0.24	16.05	
0.26	16.58	
0.42	22.89	
0.58	29.19	
0.60	29.19	
0.61	29.19	

Layer 4 16'-20'		
Depth = 17.5 feet		
Elevation = 176.5 feet		
y (in)	p (kip/ft)	
-0.61	-5.81	
-0.60	-5.81	
-0.58	-5.43	
-0.44	-5.04	
-0.37	-4.65	
-0.245	-4.26	
-0.184	-3.88	
-0.134	-3.49	
-0.094	-3.10	
-0.063	-2.71	
-0.040	-2.33	
-0.023	-1.94	
-0.012	-1.55	
-0.005	-1.16	
-0.001	-0.77	
0.000	-0.39	
0.000	0.00	
0.000	0.39	
0.001	0.77	
0.005	1.16	
0.012	1.55	
0.023	1.94	
0.040	2.33	
0.063	2.71	
0.094	3.10	
0.134	3.49	
0.184	3.88	
0.245	4.26	
0.317	4.65	
0.404	5.04	
0.504	5.43	
0.620	5.81	
0.659	5.81	

Layer 5 20'-23'		
Depth = 22.5 feet		
Elevation = 171.5 feet		
y (in)	p (kip/ft)	
-0.61	-62.83	
-0.60	-62.83	
-0.58	-62.83	
-0.42	-49.27	
-0.26	-35.70	
-0.24	-34.40	
-0.23	-33.08	
-0.21	-31.71	
-0.20	-30.31	
-0.18	-28.86	
-0.17	-27.37	
-0.15	-25.82	
-0.14	-24.21	
-0.12	-22.53	
-0.11	-20.76	
-0.09	-18.89	
0.00	0.00	
0.09	18.89	
0.11	20.76	
0.12	22.53	
0.14	24.21	
0.15	25.82	
0.17	27.37	
0.18	28.86	
0.20	30.31	
0.21	31.71	
0.23	33.08	
0.24	34.40	
0.26	35.70	
0.42	49.27	
0.58	62.83	
0.60	62.83	
0.61	62.83	

Layer 6 23'-30'		
Depth = 27.5 feet		
Elevation = 166.5 feet		
y (in)	p (kip/ft)	
-0.61	-103.07	
-0.60	-103.07	
-0.58	-103.07	
-0.42	-80.82	
-0.26	-58.56	
-0.25	-57.20	
-0.24	-55.81	
-0.23	-54.41	
-0.22	-52.97	
-0.21	-51.52	
-0.20	-50.03	
-0.19	-48.52	
-0.18	-46.98	
-0.17	-45.40	
-0.16	-43.79	
-0.15	-42.13	
0.00	0.00	
0.15	42.13	
0.16	43.79	
0.17	45.40	
0.18	46.98	
0.19	48.52	
0.20	50.03	
0.21	51.52	
0.22	52.97	
0.23	54.41	
0.24	55.81	
0.25	57.20	
0.26	58.56	
0.42	80.82	
0.58	103.07	
0.60	103.07	
0.61	103.07	

Layer 7 30'-35'		
Depth = 32.5 feet		
Elevation = 161.5 feet		
y (in)	p (kip/ft)	
-6.59	-5.81	
-6.20	-5.81	
-5.04	-5.43	
-4.04	-5.04	
-3.17	-4.65	
-2.45	-4.26	
-1.84	-3.88	
-1.34	-3.49	
-0.94	-3.10	
-0.63	-2.71	
-0.40	-2.33	
-0.23	-1.94	
-0.12	-1.55	
-0.05	-1.16	
-0.01	-0.77	
0.00	-0.39	
0.00	0.00	
0.00	0.39	
0.01	0.77	
0.05	1.16	
0.12	1.55	
0.23	1.94	
0.40	2.33	
0.63	2.71	
0.94	3.10	
1.34	3.49	
1.84	3.88	
2.45	4.26	
3.17	4.65	
4.04	5.04	
5.04	5.43	
6.20	5.81	
6.59	5.81	

Layer 8 35'-40'		
Depth = 37.5 feet		
Elevation = 156.5 feet		
y (in)	p (kip/ft)	
-6.59	-5.81	
-6.20	-5.81	
-5.04	-5.43	
-4.04	-5.04	
-3.17	-4.65	
-2.45	-4.26	
-1.84	-3.88	
-1.34	-3.49	
-0.94	-3.10	
-0.63	-2.71	
-0.40	-2.33	
-0.23	-1.94	
-0.12	-1.55	
-0.05	-1.16	
-0.01	-0.77	
0.00	-0.39	
0.00	0.00	
0.00	0.39	
0.01	0.77	
0.05	1.16	
0.12	1.55	
0.23	1.94	
0.40	2.33	
0.63	2.71	
0.94	3.10	
1.34	3.49	
1.84	3.88	
2.45	4.26	
3.17	4.65	
4.04	5.04	
5.04	5.43	
6.20	5.81	
6.59	5.81	

TABLE 3.2-4
P-Y CURVES TABULAR DATA
WIDEN 15" CLASS 70 PILES
BENTS 3 THROUGH 9

All depths are measured below ground surface.

Layer 1 0'-3'		
Depth = 2.5 feet		
Elevation = 178.5 feet		
y (in)	p (kip/ft)	
-0.61	-3.13	
-0.60	-3.13	
-0.58	-3.13	
-0.42	-2.68	
-0.26	-2.23	
-0.24	-2.18	
-0.23	-2.14	
-0.21	-2.09	
-0.20	-2.04	
-0.18	-1.98	
-0.16	-1.92	
-0.15	-1.86	
-0.13	-1.80	
-0.12	-1.73	
-0.10	-1.65	
-0.09	-1.56	
0.00	0.00	
0.09	1.56	
0.10	1.65	
0.12	1.73	
0.13	1.80	
0.15	1.86	
0.16	1.92	
0.18	1.98	
0.20	2.04	
0.21	2.09	
0.23	2.14	
0.24	2.18	
0.26	2.23	
0.42	2.68	
0.58	3.13	
0.60	3.13	
0.61	3.13	

Layer 2 3'-9'		
Depth = 7.5 feet		
Elevation = 173.5 feet		
y (in)	p (kip/ft)	
-6.59	-4.60	
-6.20	-4.60	
-5.04	-4.29	
-4.04	-3.99	
-3.17	-3.68	
-2.45	-3.37	
-1.84	-3.07	
-1.34	-2.76	
-0.94	-2.45	
-0.63	-2.15	
-0.40	-1.84	
-0.23	-1.53	
-0.12	-1.23	
-0.05	-0.92	
-0.01	-0.61	
0.00	-0.31	
0.00	0.00	
0.00	0.31	
0.01	0.61	
0.05	0.92	
0.12	1.23	
0.23	1.53	
0.40	1.84	
0.63	2.15	
0.94	2.45	
1.34	2.76	
1.84	3.07	
2.45	3.37	
3.17	3.68	
4.04	3.99	
5.04	4.29	
6.20	4.60	
6.59	4.60	

Layer 3 9'-16'		
Depth = 12.5 feet		
Elevation = 168.5 feet		
y (in)	p (kip/ft)	
-6.59	-5.81	
-6.20	-5.81	
-5.04	-5.43	
-4.04	-5.04	
-3.17	-4.65	
-2.45	-4.26	
-1.84	-3.88	
-1.34	-3.49	
-0.94	-3.10	
-0.63	-2.71	
-0.40	-2.33	
-0.23	-1.94	
-0.12	-1.55	
-0.05	-1.16	
-0.01	-0.77	
0.00	-0.39	
0.00	0.00	
0.01	0.39	
0.04	3.53	
0.06	4.71	
0.08	5.72	
0.10	6.62	
0.13	7.46	
0.15	8.23	
0.17	8.96	
0.19	9.66	
0.21	10.32	
0.24	10.96	
0.26	11.58	
0.42	15.98	
0.58	20.37	
0.60	20.37	
0.61	20.37	

Layer 4 16'-20'		
Depth = 17.5 feet		
Elevation = 163.5 feet		
y (in)	p (kip/ft)	
-6.59	-5.81	
-6.20	-5.81	
-5.04	-5.43	
-4.04	-5.04	
-3.17	-4.65	
-2.45	-4.26	
-1.84	-3.88	
-1.34	-3.49	
-0.94	-3.10	
-0.63	-2.71	
-0.40	-2.33	
-0.23	-1.94	
-0.12	-1.55	
-0.05	-1.16	
-0.01	-0.77	
0.00	-0.39	
0.00	0.00	
0.00	0.39	
0.01	0.77	
0.05	1.16	
0.12	1.55	
0.23	1.94	
0.40	2.33	
0.63	2.71	
0.94	3.10	
1.34	3.49	
1.84	3.88	
2.45	4.26	
3.17	4.65	
4.04	5.04	
5.04	5.43	
6.20	5.81	
6.59	5.81	

Layer 5 20'-25'		
Depth = 22.5 feet		
Elevation = 158.5 feet		
y (in)	p (kip/ft)	
-6.59	-5.81	
-6.20	-5.81	
-5.04	-5.43	
-4.04	-5.04	
-3.17	-4.65	
-2.45	-4.26	
-1.84	-3.88	
-1.34	-3.49	
-0.94	-3.10	
-0.63	-2.71	
-0.40	-2.33	
-0.23	-1.94	
-0.12	-1.55	
-0.05	-1.16	
-0.01	-0.77	
0.00	-0.39	
0.00	0.00	
0.00	0.39	
0.01	0.77	
0.05	1.16	
0.12	1.55	
0.23	1.94	
0.40	2.33	
0.63	2.71	
0.94	3.10	
1.34	3.49	
1.84	3.88	
2.45	4.26	
3.17	4.65	
4.04	5.04	
5.04	5.43	
6.20	5.81	
6.59	5.81	

Layer 6 25'-30'		
Depth = 27.5 feet		
Elevation = 153.5 feet		
y (in)	p (kip/ft)	
-6.59	-5.81	
-6.20	-5.81	
-5.04	-5.43	
-4.04	-5.04	
-3.17	-4.65	
-2.45	-4.26	
-1.84	-3.88	
-1.34	-3.49	
-0.94	-3.10	
-0.63	-2.71	
-0.40	-2.33	
-0.23	-1.94	
-0.12	-1.55	
-0.05	-1.16	
-0.01	-0.77	
0.00	-0.39	
0.00	0.00	
0.00	0.39	
0.01	0.77	
0.05	1.16	
0.12	1.55	
0.23	1.94	
0.40	2.33	
0.63	2.71	
0.94	3.10	
1.34	3.49	
1.84	3.88	
2.45	4.26	
3.17	4.65	
4.04	5.04	
5.04	5.43	
6.20	5.81	
6.59	5.81	

Layer 7 30'-35'		
Depth = 32.5 feet		
Elevation = 148.5 feet		
y (in)	p (kip/ft)	
-6.59	-5.81	
-6.20	-5.81	
-5.04	-5.43	
-4.04	-5.04	
-3.17	-4.65	
-2.45	-4.26	
-1.84	-3.88	
-1.34	-3.49	
-0.94	-3.10	
-0.63	-2.71	
-0.40	-2.33	
-0.23	-1.94	
-0.12	-1.55	
-0.05	-1.16	
-0.01	-0.77	
0.00	-0.39	
0.00	0.00	
0.00	0.39	
0.01	0.77	
0.05	1.16	
0.12	1.55	
0.23	1.94	
0.40	2.33	
0.63	2.71	
0.94	3.10	
1.34	3.49	
1.84	3.88	
2.45	4.26	
3.17	4.65	
4.04	5.04	
5.04	5.43	
6.20	5.81	
6.59	5.81	

Layer 8 35'-40'		
Depth = 37.5 feet		
Elevation = 143.5 feet		
y (in)	p (kip/ft)	
-6.59	-5.81	
-6.20	-5.81	
-5.04	-5.43	
-4.04	-5.04	
-3.17	-4.65	
-2.45	-4.26	
-1.84	-3.88	
-1.34	-3.49	
-0.94	-3.10	
-0.63	-2.71	
-0.40	-2.33	
-0.23	-1.94	
-0.12	-1.55	
-0.05	-1.16	
-0.01	-0.77	
0.00	-0.39	
0.00	0.00	
0.00	0.39	
0.01	0.77	
0.05	1.16	
0.12	1.55	
0.23	1.94	
0.40	2.33	
0.63	2.71	
0.94	3.10	
1.34	3.49	
1.84	3.88	
2.45	4.26	
3.17	4.65	
4.04	5.04	
5.04	5.43	
6.20	5.81	
6.59	5.81	

Comment & Response Form

(Revised 01/15/13)

General Project Information			Review Phase		Reviewer Information	
Dist: 10 EA: 0k800 EFIS 0612000110 Project Name: Seismic Retrofit Kings River Bridge Structure Design: Sara Yip Phone: (916) 227-8778 e-mail:			☐ PSR/PDS (Review No.) ☐ APS/PSR (Review No.) ☐ APS/PR (Review No.) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☐ PS&E (Review No.) ☐ Construction ☒ Other: FR REVIEW NO 1		Reviewer Name: Javad Massoomi/John Huang Functional Unit: METS/GS Cost Center: 59-3657 Phone Number: 227-1037 e-mail: Date of Review: 9/10/15 Structure Name*: Kings River Bridge, 45-0007 (*Use if necessary to when comment sheets are by individual structure)	
Consultant Information						
Consultant Structure Lead (First and Last Name) Neva Popenoe		Structure Consultant Firm Kleinfelder		Phone Number 559-486-0750		e-mail npopenoe@kleinfelder.com
				Response Date 9/15/15		
#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	✓	
1	FR	ii of iv	Please add a geologist's signature	The geologist responsible for the review of the geology section has been included on the signature page.		
2	FR	7, section 3.4	Please add design groundwater table	The design groundwater elevation has been added to section 3.4.		
3	FR	7, Section 3.5	Please mention the design scour depths, reference to hydraulic report	The design scour depths have been referenced in the report.		
4	FR	18, section 6.2.3	Typo- 2 "in"s	The typo was corrected.		
5	FR	15, Table 6.2.2	This bridge has many support locations; abutments are on fills, and bents are in the water; was this idealized single soil profile the worst case? How the different ground surface elevations was considered? Javad, John (Liao) and Tony need to discuss more on the details and reach agreement based on needs. Thanks	Only one of the six planned borings was completed for this project due to access issues. Soil encountered in the new boring was relatively consistent with the previous drilled borings as shown on the As-Built LOTB. Due to the agreement of the current boring and the previous borings, one soil profile utilizing the current boring was used for analysis.		

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)

P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓ = Comment Resolved
(for Reviewer's use)

Submittal Data (Reviewer to complete)

Dist-EA:_____

Reviewer:_____

Str Name*:_____

Date of Review:_____

Functional Unit:_____

Br No*:_____

*=if applicable

				For clarification, tables for abutments and bents were added.	
6	FR	LOTB	Please follow Caltrans Soil and Rock Logging manual for format, thanks	The LOTB was prepared using the Caltrans Soil and Rock Logging manual, June 2010. Borings were very deep and contained too much information to be aligned vertically, and were rotated to fit the page and placed on separate pages, as permitted in the manual.	
7	Note		FR by Kleinfelder dated 09/03/15, managed through GS contract. Structure Design in house.		
8	Grade		C2 – conditional approval, subject to above comments addressed satisfactorily		
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Comment & Response Form

(Revised 01/15/13)

<u>General Project Information</u>	<u>Review Phase</u>	<u>Reviewer Information</u>
Dist: <u>10</u> EA: <u>0k800</u> EFIS <u>0612000110</u> Project Name: Seismic Retrofit Kings River Bridge Structure Design: <u>Sara Yip</u> Phone: <u>(916) 227-8778</u> e-mail: <u></u>	<u>PSR/PDS (Review No.)</u> <u>APS/PSR (Review No.)</u> <u>APS/PR (Review No.)</u> <u>Type Selection</u> <u>65% PS&E Unchecked Details</u> <u>PS&E (Review No.)</u> <u>Construction</u> <u>X Other: FR REVIEW NO 2</u>	Reviewer Name: <u>Javad Massoomi/John Huang</u> Functional Unit: <u>METS/GS</u> Cost Center: <u>59-3657</u> Phone Number: <u>227-1037</u> e-mail: <u></u> Date of Review: <u>10/5/15</u> Structure Name*: <u>Kings River Bridge, 45-0007</u> (*Use if necessary to when comment sheets are by individual structure)

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	✓
1	FR		No More comments		
2	FR				
3	FR				
4	FR				
5	FR				
6	FR				
7	Note		FR by Kleinfelder dated 09/15/15, managed through GS contract. Structure Design in house.		
8	Grade		C1 – approved		
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Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)

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RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓ = Comment Resolved
(for Reviewer's use)

Submittal Data (Reviewer to complete)

Dist-EA:_____

Reviewer:_____

Str Name*:_____

Date of Review:_____

Functional Unit:_____

Br No*:_____

*=if applicable

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