ADDENDUM 2 - JULY 14, 2015

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MEMORANDUM

DATE: January 17, 2013

TO: Christine Wood, P.E.
David McDonnold, P.E.

FROM: Rebecca Russo, P.E.

COPY: Clint Jumper, P.E.
Chuck Berry, P.E.
Rick Nannenga (URS Portland)

SUBJECT: **Geotechnical Design Memorandum 1.0**
City of El Paso Streetcar Project
Maintenance Facility Building
El Paso, Texas

Submitted herewith are geotechnical findings and recommendations pertaining to the Maintenance Facility for the above referenced project. This memorandum was previously issued on November 21, 2012 in a preliminary format in order to advance design. Although findings and recommendations presented herein are similar to that previously submitted, this letter report supersedes that previously submitted.

The purpose of this report is to provide specific geotechnical recommendations for construction of the Maintenance Facility building. Our understanding of the project is based on the information provided by Ms. Christine Wood, P.E., the project structural engineer in the URS Dallas office. The following sections present the understanding of the project, anticipated subsurface conditions, and recommendations for foundation design and slab on grade construction.

Project Information

The proposed Maintenance Facility will have approximate plan dimensions of 134 feet by 120 feet, and slightly triangular shape. The facility will include 3 overhead bays to facilitate maintenance on the streetcars (cars), where each bay will include a pit approximately 5 feet deep beneath the cars. The cars will enter the building at ground level, therefore, the pits will be approximately 5 feet below grade, with foundation bearing approximately 7 feet below existing grade. Two types of pits are planned: 1) a slender pit for work beneath the car with approximate plan dimensions of 10-ft wide by 75 feet long, and 2) a wider pit for work beneath the car and wheels with approximate plan dimensions of 20-ft wide by 75-ft in length. In the wider pit, the rails will be supported by interior columns supported on the pit floor.

Structural loading will include one CMU (concrete masonry unit) block wall and the remaining walls will be studded with exterior veneers. Interior column loads will have maximum loads on the order of 200 kips or less. The ground floor will be concrete, and the structure will include one mezzanine level.

According to available contour information, the existing ground surface is relatively flat and was estimated to approximate elevation 3710 feet. The building site is currently an at-grade parking lot, but has been previously occupied by a structure. According to historical aerial images viewed in Google Earth Professional, the building occupied approximately ½ of the Maintenance Facility building footprint along Santa Fe Street. Existing foundations and other below grade structures such as utility vaults may be encountered during foundation construction of the proposed structure.

Subsurface Conditions

According to published geologic maps, the site is underlain by Holocene age alluvium and low terrace deposits. Alluvium and terrace deposits consist of intermixed sand, silt, clay and gravel of variable thickness. Wide tidal flat sand and clay deposits are common near this lagoon side of the nearby Rio Grande River. The River is approximately 1500 feet to the southwest of the site and is concrete lined. As mentioned above, the proposed building site has a history of a previous structure(s) associated with the bus transfer facility, and possibly the adjoining electrical substation site.

Geotechnical borings were drilled by PSI, Inc. (PSI). Two borings, designated B-33 and B-34, were drilled within the planned building footprint, and one relatively shallow boring, designated B-35, was drilled along the maintenance loop rail. Approximate boring locations are shown the attached Plate 1. Detailed soil descriptions and laboratory test results are shown on the boring logs, prepared by PSI and appended to this report.

Building Borings. Boring B-33 was drilled to the 50-ft depth, and boring B-34 was drilled to the 35-ft depth. The borings encountered a pavement section at the ground surface consisting of 2 inches of asphaltic concrete underlain by 8 inches of base material. Beneath the surficial pavement, the borings encountered 7.5 and 10 feet of rubble-laden fill material containing concrete, brick, and asphalt debris. Standard penetration test (SPT) N-values ranged from 2 to 28 blows per foot (bpf) in this stratum. Higher blow counts are likely amplified due to the rubble/gravel content. The upper fill material is classified as clayey sand (B-33) and poorly graded sand (B-34). Percent fines (material passing the No. 200 sieve) measured on recovered SPT samples of fill ranged from 2.5 to 12.6 (average 6.1) indicating a sandy cohesionless material.

In boring B-33, additional fill described as poorly graded sand to silty sand was encountered to a depth of 25 feet below grade. Standard penetration test N-values were 30 and 38 bpf but were likely amplified due to the gravel or debris content. It should be noted that it is sometimes difficult to discern between fill (consisting of reworked native soils) and undisturbed native soils (alluvium) due to the depositional processes of the soils. Therefore, some soils referred to as fill may be native alluvial soils, and some soils not referred to fill may have been placed by man's grading activities. Further, fill thickness was variable in the borings, and likely varies in depth over short distances.

Soils described as poorly graded sand, silty sand, and sandy lean clay were encountered in the borings to the boring termination depths. Standard penetration text N-values ranged from 8 to 46 bpf, but were typically above 20 bpf indicating medium dense to dense consistency.

Hydrocarbon odors were noted in boring B-34 from the 15 feet depth to the bottom of borehole at the 35-ft depth. The odor was noted in the SPT samples, as well. Boreholes were backfilled upon completion and the surface was covered with asphalt. Groundwater was not encountered in either boring.

Rail Loop Boring. Boring B-35 was drilled along the proposed maintenance rail loop. The boring encountered early refusal on suspected concrete at a depth of 2.6 feet below grade. Considering the previous grading history of the site, the refusal material is likely remnant of a previous structure or large debris. The overburden soil was described as black fine sand.

Foundation Recommendations

The borings encountered 7.5 to 10 feet of rubble-laden fill material underlain by approximately 15 feet of additional fill material (B-33), further underlain by native alluvial soils to the boring termination depths. Based on the subsurface conditions encountered in the borings and our understanding of the proposed construction, shallow foundation design is recommended with substantial improvements to the soil subgrade. Due to the known history of the site, and the erratic composition of the upper fill soils encountered in the borings, we recommend removal of existing fill and replacement with at least 5 feet of compacted structural fill beneath the deepest foundation bearing elevation. This will likely require an excavation approximately 12 feet below existing grade within the pit footprints, and approximately 7 feet below the remaining building footprint. Existing concrete debris and rubble-laden fill should be completely removed where it is encountered in the excavation. The geotechnical engineer should be consulted if rubble-laden fill or other buried structures are encountered beneath the planned excavation depth.

It is understood that the third bay (wash bay) is being considered to include a sump pit access. Removal of rubble fill and replacement with structural fill as described herein will be required in this area for proper foundation support. If a third bay is designed, consideration should be given to mass excavation beneath the entire building footprint to a depth of approximately 10 feet below existing grade, and replacement with properly selected and placed structural fill. It is noted that mass excavation of the footprint will require temporary shoring and excavation bracing of existing pavement, roadway and adjoining structures.

Upon excavation and backfilling with compacted structural fill, the building may be designed as a grid beam stiffened slab with shallow foundation support at grid beam intersections. Interior columns may be supported at grid beam intersections that have been widened, deepened and sized for the recommended allowable bearing pressure. The slab may be subgrade supported atop the structural fill pad. The following sections provide

specific recommendations for Building Pad Preparation, Grid Beam Stiffened Slabs and Footings, and Below Grade Walls.

Building Pad Preparation

As described previously, it is recommended that the upper 7 to 12 feet of existing soil be removed and replaced with structural fill meeting the following composition and compaction requirements.

1. Within the building footprint and for a distance of at least 5 feet beyond the footprint, remove and dispose of existing rubble-laden fill to a minimum depth of 7 feet below the main building, and 12 feet below the sump pit footprint. The additional excavation for the sump pits should extend at least 3 feet (in plan) beyond the combined footprint, and may be stepped up in benches of 2 vertical feet by 2 horizontal feet to the 7 feet undercut depth limits.
2. If a third bay is planned and mass excavation beneath the entire building footprint is likely, a remove and replace depth of 10 feet below existing grade will be sufficient. Excavation will require temporary shoring and bracing support of surrounding structures and pavements.
3. The geotechnical engineer should observe the undercut excavation to document that sufficient unsuitable material has been removed, and that the pre-fill subgrade is suitable for the intended backfill. If additional utilities or underground vaults are present below the planned undercut depths, these structures should be shown to the geotechnical engineer at the time of the subgrade inspection.
4. Upon approval by the geotechnical engineer, the excavation may be backfilled using structural fill material meeting the requirements of Texas Department of Transportation, 2004 Standard Specifications for Construction of Highways, Streets and Bridges, Item 247, Type A or B, Grade 3 or better.
5. Compact structural fill to at least 98% of the maximum dry density as determined using TxDOT Test Method TEX-113-E. Hold water contents within ±2% of the optimum water content, and maintain compacted lift thicknesses to six inches or less.
6. If moisture migration through the slab is a potential concern, place a capillary moisture barrier/drainage layer (minimum thickness 4 inches) of free-draining, clean, crushed stone with sizes ranging mostly between ½ and ¾ inch and no more

than 5% passing the No. 200 sieve. Durable crushed stone aggregate, ASTM C33 Size No. 57 or 67 gradations, is suggested.

7. Place a vapor barrier with a thickness of at least 8 mils and of sufficient strength and durability to resist puncture during reinforcing steel and concrete placement. Placement of the vapor barrier should be in accordance with manufacturer's recommendations.

Grid Beam Stiffened Slab and Footings

Provided the subgrade is prepared and brought to grade as recommended above, grid beam stiffened slabs on grade foundations may be designed in accordance with the following:

1. Grid beams generally should be placed along the exterior building perimeter and beneath load bearing walls or concentrated loads. The grid should be as regular as wall and any concentrated load locations permit. Heavier concentrated loads may be supported at widened beam intersections.
2. For beams bearing in structural fill placed in accordance with the Building Pad Preparation section of this report, foundations may be sized using an allowable bearing pressure of 2,500 psf. Beams widths should be at least 18 inches.
3. If the slab-on-ground design requires a modulus of subgrade reaction use 100 pci.
4. The perimeter exterior beams or footings should bear at least 2 feet below the surrounding ground surface, and at least 18 inches below the bottom of slab for interior footings. Depending on interior wall and equipment loads, the interior of the slab should be stiffened with grid-beams on a regular grid pattern or thickened, as required.
5. Total settlements associated with fill placement and foundation bearing should be on the order of 1 inch or less. Differential settlements are typically ½ of total settlement, and may occur over short distances between loaded foundation walls and footings. Frequent jointing in interior and exterior masonry walls is recommended.
6. Grading around the structures should be such that future ponding or standing water around the structures does not occur. All surface drainage measures should be designed to positively direct water well away from the structures.

7. Foundation excavations should be observed by the geotechnical engineer prior to concrete and reinforcing steel placement to confirm suitable bearing conditions and that the footing bottom is free of any loose materials.

Retaining Walls

The deformation condition imposed by a wall on the soil it retains has a significant influence on the coefficient of horizontal earth pressure. The two general deformation conditions are "yielding" and "nonyielding". Yielding walls are those that move enough to allow the retained soil to reach a state of limit equilibrium. The active state of limit equilibrium is approached as the wall moves away from the retained soil. Nonyielding walls are those that do not move or move very little usually because of restraint at the top so that they are not free to tilt. Since deformation is prevented, the state of limit equilibrium is not approached, the shear strength of the soil is not developed and the earth pressure remains equal to the at-rest pressure.

The type of backfill also has an important influence on the coefficient of horizontal earth pressure. A clean, granular, free-draining material is the preferred backfill. Additionally, the accumulation of water in the backfilled cuts adjacent to the structure walls will influence the horizontal earth pressure. The high permeability of clean, granular, free-draining materials combined with adequate drainage above the water table prevents the buildup of hydrostatic pressure.

Use the recommended equivalent fluid unit weights set forth below for nonyielding below ground walls.

1. With the use of structural fill as below grade wall backfill material selected and placed in accordance with recommendations presented herein, use an equivalent fluid unit weight of 60 pcf if drained and 90 pcf if undrained.
2. With the use of on-site material that classifies as a CL, SC, or GC, with a PI less than 15 and maximum particle size of 3 inches, use an equivalent fluid unit weight of 75 pcf if drained, and 110 pcf if undrained.
3. The granular backfill should consist of a material meeting the requirements of Texas Department of Transportation, 2004 Standard Specifications for Construction of Highways, Streets and Bridges, Item 247, Type A or B, Grade

3 or better. Alternatively, a free draining granular material such as ASTM C33 Size No. 57 or 67 gradation may also be used in confined backfill areas.

4. Structural backfill material should be compacted to at least 95% of the maximum dry density as determined using TxDOT Test Method TEX-113-E. Hold water contents within ±2% of the optimum water content, and maintain compacted lift thicknesses to six inches or less.
5. If the design involves any uniform vertical surcharge adjacent to the wall, use a coefficient of horizontal earth pressure of 0.5. A minimum surcharge of 200 psf is suggested for the planned maintenance facility floor slab adjacent to the sump pit walls.

Seismic Design

Based on geologic and site specific boring information, the site classifies as Site Class D in accordance with Table 1615.1.1 of the 2009 International Building Code.

Excavation Potential

Excavation through the surficial pavements and fill material should proceed without significant difficulty. Due to the previous use of the site, the excavation may encounter existing foundation, utilities, and or vault structures which may present difficult excavation conditions. The contractor should be made aware of the potential presence of underground obstructions requiring difficult excavation techniques such as use of large track mounted equipment, hydraulic rams, and other demolition-type equipment to break debris into sizes that can be removed from the site.

It is noted that hydrocarbon odors were detected during drilling and sampling at boring B-34 from the 15- to 36.5-foot depths. Although recommended undercut depths do not extend to this depth, the project team should be made aware that excavations extending generally below 15 feet may encounter similar conditions. Review of the project environmental reports is suggested, prior to planning of excavations greater than 15 feet.

Temporary Excavation Support

The planned below grade excavations for foundation improvement may require both sloping and bracing to provide temporary excavation support. The presence of nearby existing structures may require near-vertical excavation bracing and underpinning. The

design of temporary excavation support systems is the responsibility of the contractor's registered professional engineer in conformance with OSHA requirements. Excavation bracing should be designed including any underpinning support requirements of nearby utilities and/or structures.

If temporary sloping is feasible, the following suggestions are set forth below in accordance with OSHA[1] for classifying soil and rock encountered in our investigation. It is stressed that these are suggestions only for planning purposes, and excavation safety and bracing design is the responsibility of the contractor.

Soil Type	OHSA Classification	Recommended OSHA Slope
Fill (SC, SP, SM)	Type C	1.5H to 1V*
SC – Clayey sand (Unified Soil Classification System) SP – Poorly graded sand SM – Silty sand * If groundwater or caving soils are encountered, flatter slopes or a dewatering plan will be required to maintain excavation safety. This flatter slope will control the sloping of the excavation and should be continued to the ground surface.		

Fill soils encountered in the borings had 2.5 and 4.0 percent fines (percent passing the No. 200 sieve) in the upper 10 feet. The contractor should be made aware of the likely presence of caving or "running" soils that will be especially problematic following rain events.

Construction Monitoring

It is recommend that a qualified representative of the Geotechnical Engineer be present on-site during construction to observe, monitor construction activities and perform quality control tests. Construction monitoring performed by qualified personnel independent of the Contractor is recommended because the performance of foundations and other structures constructed during this project will be directly related to the Contractor's adherence to the recommendations presented in this report and to the specifications prepared by the Designer. Additionally, unanticipated soil and/or subsurface conditions

[1] Code of Federal Regulations Title 29 Part 1926 (2003), "Labor", Occupational Safety and Health Administration, Department of Labor, Subpart P - Excavations, pgs 373 – 410.

may be encountered during construction. Qualified geotechnical personnel observing construction on-site can monitor construction activities and may aid in recognizing unanticipated subsurface conditions and assist in reconciling these conditions with design recommendations.

Conditions

Since some variation was found in subsurface conditions at the boring locations, all parties involved should take notice that even more variation may be encountered between boring locations. Statements in the report as to subsurface variation over given areas are intended only as estimations from the data obtained at specific boring locations.

The professional services that form the basis for this report have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in the same locality. No other warranty, express or implied, is made as the professional advice set forth. This scope of work did not include and investigation, detection, or design related to the presence of any recognized environmental pollutants.

* * *

The following attachments complete this report:

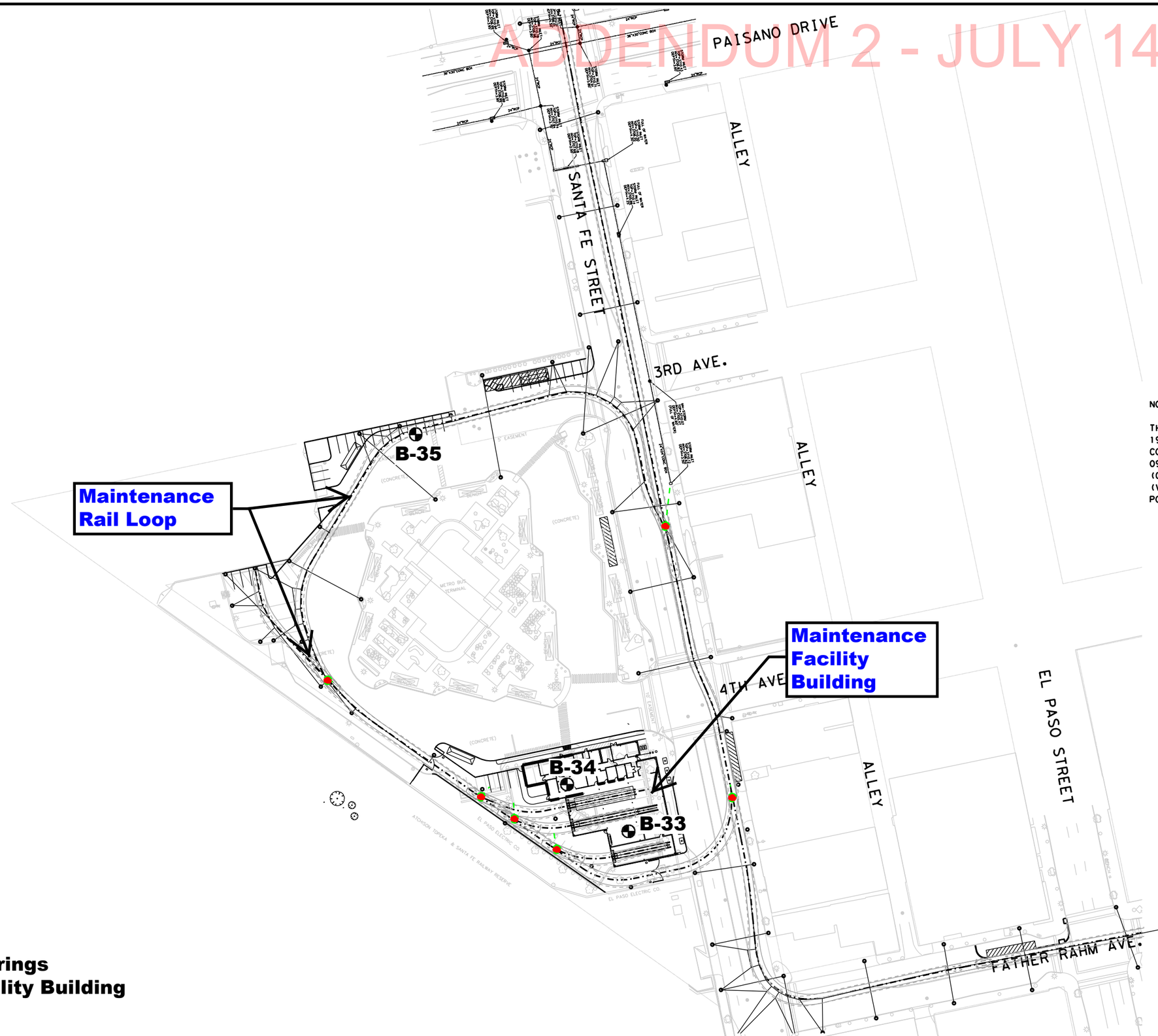
Partial Plan of Borings	Plate 1
Generalized Subsurface Profile	Plate 2

PSI Boring Logs B-33, B-34 and B-35 (3)

ADDENDUM 2 - JULY 14, 2015

ATTACHMENTS

ADDENDUM 2 - JULY 14, 2015



NOTE:

THE CONTROL DATA HEREON IS NAD 1983 ZONE 4302 (STATE PLAN CORRECTIONS) USING A GOEID OF 09, COMPILED BY USING GPS (GLOBAL POSITIONING SYSTEM) VRS (VIRTUAL REFERENCE STATION) POSITIONS.

NO	DATE	REVISION	APPROVED
	/ /		
	/ /		
	/ /		
	/ /		

URS
2829 Montana Suite 206
El Paso, Texas 79903
(915) 493-6468
TBPE REGISTRATION NO. F-3162

COEP STREETCAR
PROPOSED
MSF & SANTA FE
LAYOUT

© 2012 Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
0924	06	446	VARIOUS
DIST		COUNTY	SHEET NO.
EL PASO		EL PASO	

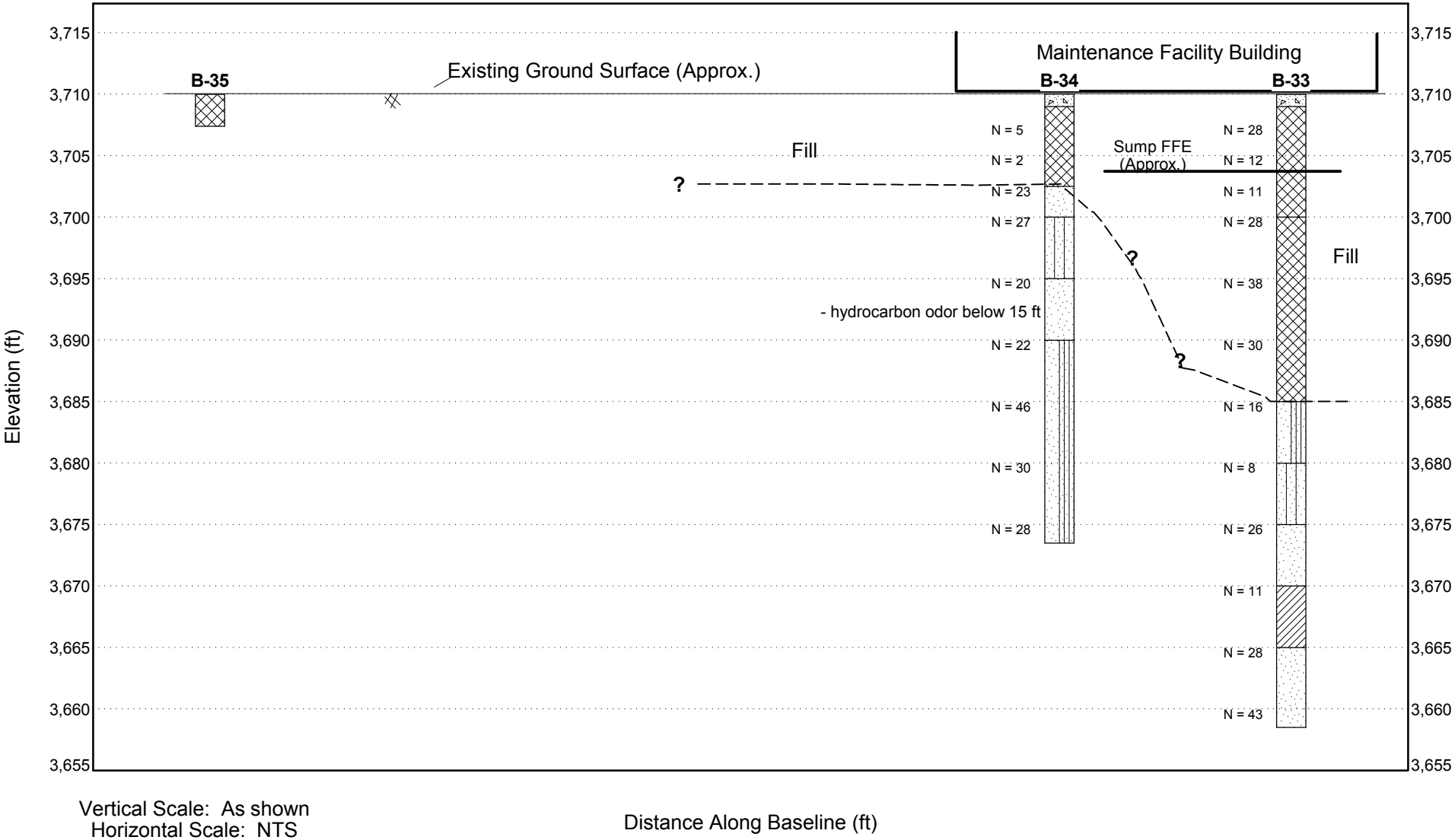
DN: URS CK: URS DW: URS CK: URS

DATE: $DATE$ $TIME$
FILE: $FILE$

Partial Plan of Borings
Maintenance Facility Building
El Paso, Texas

Plate 1

ADDENDUM 2 - JULY 14, 2015



Vertical Scale: As shown
Horizontal Scale: NTS

Distance Along Baseline (ft)

URS

City of El Paso Streetcar Project

Maintenance Facility Building

GENERALIZED SUBSURFACE PROFILE

El Paso, Texas

Project No.
41010530.052

PLATE 2

SIMPLE FENCE - A SIZE (W/DATA) PSI.GPJ FUGRO DALLAS DATA TEMPLATE.GDT 01/09/13 14:37

FIGURE: 33

ADDENDUM 2 - JULY 14, 2015

BORING B33

DATE STARTED:	10/27/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	10/27/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	51.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3710 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75272°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.4885°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

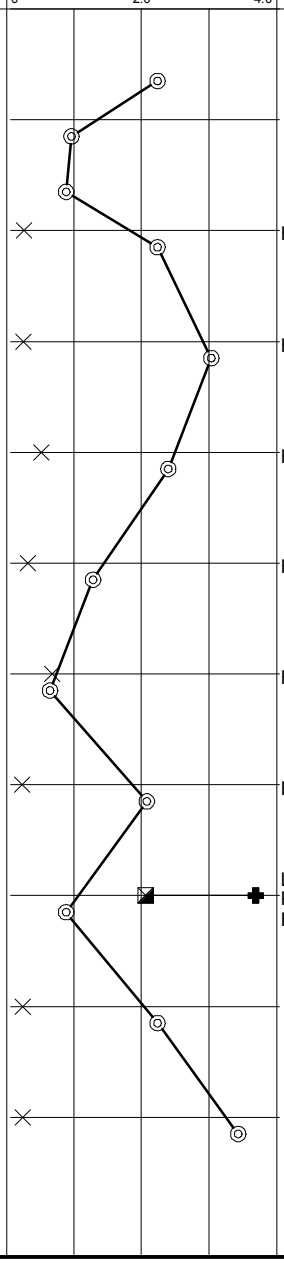
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**ASPHALT** - 2 inches thick				
				PAVEMENT BASE - 8 inches thick				
		SS1	18	**FILL** - Silty Clayey Sand (SC-SM), dark brown, moist, with asphalt and brick debris		14-13-15 N=28		
3705	5	SS2	14	**FILL** - Clayey Sand (SC), dark brown, medium dense, moist, with concrete debris with asphalt, brick, and concrete debris		4-6-6 N=12		
		SS3	12	**FILL** - Poorly Graded Sand (SP), reddish brown, medium dense, moist, with brick debris		11-7-4 N=11		
3700	10	SS4	18	**FILL** - Poorly Graded Sand with Silt (SP-SM), brown, medium dense, moist		7-15-13 N=28	3	Fines=2.5%
3695	15	SS5	18	dense, moist, with concrete debris		6-20-18 N=38	3	Fines=5.5%
3690	20	SS6	18	**FILL** - Silty Sand (SM), brown, medium dense, moist, with clay lenses		2-11-19 N=30	6	Fines=12.6%
3685	25	SS7	17	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	3-6-10 N=16	4	Fines=5.9%
3680	30	SS8	18	**SILTY SAND** - brown, loose, moist, with clay lenses	SM	5-3-5 N=8	8	Fines=19.7%
3675	35	SS9	16	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	12-14-12 N=26	3	Fines=3.1%
3670	40	SS10	18	**SANDY LEAN CLAY** - brown, stiff, moist	CL	4-5-6 N=11	26	LL = 46 PL = 26 Fines=63.0%
3665	45	SS11	18	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	10-17-11 N=28	3	
3660	50	SS12	18			18-22-21 N=43	3	
				Boring terminated at 51.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 34

ADDENDUM 2 - JULY 14, 2015

BORING B34

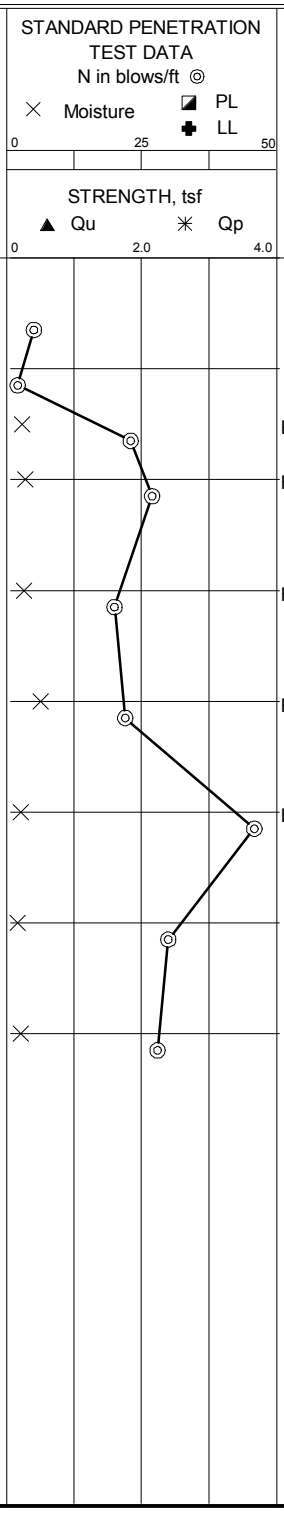
DATE STARTED:	10/27/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	10/27/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	36.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3710 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75285°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.8991°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 2 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	12	**FILL** - Poorly Graded Sand (SP), black, moist, with asphalt, concrete, brick, and deleterious debris		6-3-2 N=5		
3705	5			SS2	14	**FILL** - Poorly Graded Sand (SP), black, loose, moist, with asphalt, concrete, brick, and deleterious debris		1-1-1 N=2		
				SS3	11	**FILL** - Clayey Sand (SC), black, very loose moist, with asphalt, concrete, brick, and deleterious debris	SP	6-10-13 N=23	3	Fines=4.0%
3700	10			SS4	18	**SAND** - Poorly Graded, brown, medium dense, moist	SM	9-13-14 N=27	3	Fines=32.4%
						SILTY SAND - brown, medium dense, moist				
3695	15			SS5	18	**SAND** - Poorly Graded, grey, medium dense, moist, with hydrocarbon odor	SP	5-8-12 N=20	3	Fines=2.6%
3690	20			SS6	18	**SAND** - Poorly Graded with Silt and Gravel, grey, medium dense, moist, with hydrocarbon odor		3-11-11 N=22	6	Fines=10.8%
3685	25			SS7	18	dense, moist, with hydrocarbon odor	SP-SM	8-18-28 N=46	3	Fines=5.3%
3680	30			SS8	18	medium dense, moist, with hydrocarbon odor		12-14-16 N=30	2	
3675	35			SS9	18	**SAND** - Poorly Graded with Silt, grey, medium dense, moist, with hydrocarbon odor	SP-SM	11-13-15 N=28	3	
						Boring terminated at 36.5 feet below grade				



Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 35

ADDENDUM 2 - JULY 14, 2015

BORING B35

DATE STARTED:	11/13/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/13/12	**DRILLER:** AB	**LOGGED BY:** TP
COMPLETION DEPTH	3.0 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3711.12 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75387°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48965°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ (× Moisture, ◪ PL, ✚ LL; 0–25–50) / STRENGTH, tsf (▲ Qu, ✳ Qp; 0–2.0–4.0)	Additional Remarks
3710	0					**SAND, VERY FINE**, black, loose, moist					
				SS1	0	Concrete - Auger Refusal Boring terminated 2.6 Feet		50(0)		>>◎	

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Austin, Texas 78729
Phone: 512.419.5863
Fax: 512.454.8807

MEMORANDUM

DATE: January 18, 2013

TO: David McDonnold, P.E.
Jonathan Weise (LTK)

FROM: Rebecca Russo, P.E.

COPY: Clint Jumper, P.E.
Chuck Berry, P.E.
Derek Benedict, P.E.
Lourdes Cardenas, P.E. (Walter P Moore)

SUBJECT: **Geotechnical Design Memorandum 2.0**
City of El Paso Streetcar Project
OCS Pole Foundation Recommendations
El Paso, Texas

Submitted herewith are the findings and recommendations pertaining to the OCS (Overhead Contact System) pole foundation design for the above referenced project. This geotechnical scope of work was performed based on OCS pole load information provided by LTK Engineering Services (LTK) and subsurface information provided by PSI.

The purpose of this memorandum is to provide the design team with foundation recommendations for OCS Poles for use by the project structural engineers in sizing foundations and reinforcing steel. The following sections present our understanding of the proposed construction, generalized subsurface conditions, and recommendations for foundation support.

Project Information

Four pole types are planned, referred to as Pole 1, 2, 3 and 4, and are referenced on the design plans as P1, P2, P3 and P4. Proposed shear and bending moments for each pole type were provided by LTK. A summary of the provided information is presented in Table 1.

Table 1 – OCS Pole Foundation Load Information

Pole	Applied Shear	Applied Bending Moment	Bolt Circle Plate Diameter
1	3 kips	29 kip-ft	15
2	3 kips	47 kip-ft	16
3	6 kips	112 kip-ft	17
4	10 kips	195 kip -ft	20

Numerous OCS poles are planned, approximately one pole every 100 feet of rail with closer pole spacing at bends in the rail alignment. It is noted that OCS poles at the two bridge crossings (Oregon Street and Stanton Street) will be addressed under separate cover.

Subsurface Conditions

Field Investigation. Geotechnical borings were drilled and logs provided by PSI. At the time of this report, a total of 34 borings were drilled, designated B-1 through B-35 (B-22 omitted), to depths of 2.5 to 50 feet below existing grade. Site plans showing the boring locations are presented on Plates 1, 2 and 3. Boring logs prepared and submitted by PSI are included in Appendix A.

Geology. To better define area geology, a geologic map is presented on Plate 4. Published geologic mapping indicates the site is underlain by alluvial soils, bolson deposits, and intrusive volcanic rock along Oregon Street. The alluvial deposits consist of unconsolidated clay, silt, sand, and gravel of various proportions. Relatively older alluvial sediments (Pleistocene age) are mapped beneath Stanton Street and relatively younger deposits (Holocene age) are mapped beneath the downtown loop. A band of bolson deposits are mapped near the middle of the alignment, and are described as deep soil deposits at the foothills of nearby mountains (colluvium), and may contain lenses of cemented gravel and boulder conglomerate. The bolson deposits are relatively older (Pliocene age) than the adjacent alluvium, and may be extensive in depth.

Intrusive volcanic rock is mapped as having surface outcropping along Oregon Street. The volcanic rock is of Eocene age (oldest formations discussed herein) and mainly composed of basalt, but often referred to locally as andesite. This refusal material was not sampled in this investigation. However, PSI has provided boring logs that were drilled in July 2008 for the Glory Road Transit Terminal building project. The Terminal structure is located at the northeast quadrant of the intersection of Glory Road and Oregon Street, and is completely constructed at the time of this report. The provided boring log data is subsequently discussed herein, and presented on a Generalized Subsurface Profile.

Site Stratigraphy. Beneath a surficial pavement, the borings encountered fill, alluvium, disintegrated rock and refusal material. Generalized subsurface profiles and a keymap are presented on Plates 5 through 10. The borings more or less confirm mapped geology, where shallow refusal (presumably rock) was encountered in borings along Oregon Street (B-30 through B-24, Section 2 - Plate 7), medium to dense consistency soils were encountered along Stanton Street (B-1 through B-6, Section 1 – Plate 6), and medium to low consistency soils were generally encountered in the "downtown loop" (B-9 through B-21, B-33, and B-34, Sections 3 and 4 – Plates 8 and 9).

The generalized subsurface profile presented on Plate 10 presents the boring data provided by PSI for the Glory Road Transit Terminal (a former and separate project from the subject project presented herein), and nearby boring B-30 drilled for this Streetcar project. This information is included in this letter report to illustrate rock quality information of the refusal material. The reader is cautioned that this information was provided by PSI as a courtesy to the project team, for information purposes only, and was not collected or purchased for this Streetcar project.

Based on published geologic mapping and site specific borings, we have characterized the project site as generally having two foundation conditions referred to as the "Uptown Loop" and the "Downtown Loop." The foundation conditions for "Uptown Loop" generally consist of medium dense to very dense soils and shallow refusal material. The foundation conditions along the "Downtown Loop" consist of relatively lower consistency soils, modeled as medium to low consistency clay and sand. Foundation installation in areas where early refusal was encountered in borings will require excavation through both soil and rock for foundation installation and to achieve minimum foundation embedment.

Foundation Recommendations

Based on the proposed foundation loading and subsurface conditions encountered in the borings, we recommend that the OCS poles be supported by straight sided drilled shaft foundations embedded a minimum of 10 feet below existing grade. Foundation recommendations for minimum embedment are based on pole type and foundation conditions referred to as "Uptown Loop" and "Downtown Loop". Accordingly, foundations planned for the "Downtown Loop" portion of the project should follow embedment recommendations set up for that modeled subsurface condition, and likewise for the "Uptown Loop".

The two "Downtown Loop" and "Uptown Loop" areas are generally defined on Plate 5. This delineation is an approximation based on boring data and geologic information. Conditions may vary from that interpreted herein and that presented on the generalized subsurface profiles. A geotechnical engineer should be retained and oversee drilled shaft excavations to assess conditions encountered that are different than modeled herein. In such case, the design and construction techniques may need to be re-evaluated.

Analyses. The software program LPILE V6.0 by Ensoft, Inc. was used to analyze proposed drilled shaft foundations for the given loading conditions and based on the two foundation conditions described herein. Estimated soil properties and LPILE input parameters for each foundation condition are summarized in the following Tables 2 and 3.

Table 2 - LPILE v6.0 Parameters Used to Model "Uptown Loop"

0 – 3 ft	1 (soft clay)	115	---	---	---	0.02
3 – 15 ft	4 (sand)	120	33	140	---	---
15 – 25 ft	3 (Stiff Clay)	120	---	1,000	3,000	0.005

Soil Code = LPILE Soil Type
γ = Effective Unit Weight
k = Soil-Modulus Parameter (cyclic)
native = undisturbed site soils
ε_{50}=strain at 50% of maximum stress
k = Soil-Modulus Parameter (static)
c_u = Undrained Shear Strength
ϕ = internal friction angle

Table 3 - LPILE v6.0 Parameters Used to Model "Downtown Loop"						
Layer Description	**Soil Type**	**γ (pcf)**	**ϕ (deg)**	***k* (pci)**	**c_u (psf)**	**ε_{50} (in/in)**
0 – 3 ft	1 (soft clay)	115	---	---	---	0.02
3 – 10 ft	1 (soft clay)	115	---	---	1,000	0.01
10 – 25 ft	4 (Sand)	120	27	90	---	---
Soil Code = LPILE Soil Type γ = Effective Unit Weight *k* = Soil-Modulus Parameter (cyclic) native = undisturbed site soils			ε_{50}=strain at 50% of maximum stress *k* = Soil-Modulus Parameter (static) c_u = Undrained Shear Strength ϕ = internal friction angle			

It is noted that the soil strength parameters estimated for the "Uptown Loop" condition presented in Table 2 are based on soil parameters, and did not include a rock stratum design. For this investigation, the "refusal" material was not sampled, it was encountered at variable depths in the borings, and is known to contain alternating layers of hard rock and weathered (disintegrated rock). There, a characterization of rock material was not included in this analysis for determination of minimum embedment depths. However, recommendations for rock excavation, if encountered are provided in the following Construction section of this report. In general, if rock is encountered in shaft excavations, the embedment may be reduced so that the shafts extend a minimum of 6 feet into sound rock. However, the minimum overall shaft length shall not be less than 10 feet.

Design. The LPILE analyses were based on the two foundation conditions given above ("Uptown Loop" and "Downtown Loop"), and the four (4) OCS pole types with different maximum moment and shear loadings described herein. It is understood that 36-inch diameter shafts are planned due to requirements for anchor bolt plate dimensions; therefore, only 36-inch diameter foundation recommendations are presented herein. If 30-inch diameter foundations are considered feasible, we can provide supplemental recommendations, if requested.

Embedment depths were selected based on limiting deflection (as measured from the top of the shaft at the ground surface) to less than ½ inch for a LF of 1.0, and less than 1.0 inch for a load factor of 1.5. The load factor of 1.5 was determined by increasing the provided external shear and moment loads by a factor of 1.5 in the LPILE model. The recommended

embedment depths are presented in Table 4 for the 2 foundation conditions based on the above stated limiting deflection criteria. The maximum internal moment and internal shear imposed on the drilled shaft, as computed in LPILE, for a LF of 1.0, are also presented in the following Table 4.0. Maximum internal load values for moment and shear for a LF of 1.5 are included in the computer output, included in Appendix B, reported as "Load Case 2".

Table 4 – OCS Pole Foundation Recommendations
36-inch Diameter Drilled Shafts

Pole Type	UT Embedment bgs	Maximum Moment (kip-ft)	Maximum Shear (kips)	DT Embedment bgs	Maximum Moment (kip-ft)	Maximum Shear (kips)
1	10 ft	40.86	12.13	11 ft	39.63	10.0
2	11 ft	58.91	15.94	12 ft	57.58	12.56
3	14 ft	138.67	26.23	16 ft	135.49	21.54
4	17 ft	244.52	34.46	20 ft	241.16	30.44

UT – OCS pole foundations situated in region defined as "Uptown Loop" on Plate 5.
DT – OCS pole foundations situated in region defined as "Downtown Loop" on Plate 5.
bgs – Below the ground surface
Maximum moment and maximum shear values are based on a LF=1.0.

The embedment depths reported above are considered minimum penetration depths. The geotechnical engineer should be consulted if drilled shaft lengths less than that recommended above are being contemplated. The structural engineer should use the reported maximum moment and shear loads internally imposed on the shaft to size reinforcing steel. The computer output are included in Appendix B. Digital LPILE computer files can be submitted, if requested.

Construction. Drilled shafts should be designed and constructed in accordance with the following recommendations:

1. Minimum shaft lengths should be 10 ft or as shown in Table 4 for the pole type. Minimum shaft diameters of 36 inches and minimum reinforcement steel area of 0.5 percent of the gross area of the shaft are recommended. The geotechnical engineer should be consulted to provide supplemental recommendations if 30-inch diameter shafts are being contemplated for more lightly loaded pole types 1 and 2.

2. Contract documents should include pay items for constructing drilled shafts on a unit price basis for both shaft quantities in both soil and rock.
3. Contract documents should provide for the use of temporary casing for proper installation of drilled shafts should detrimental groundwater or caving soil conditions are encountered. Caving soil conditions, consisting of loose fill and or cohesionless sands and gravels, were encountered in the "Downtown Loop" borings which may require temporary casing to maintain an open excavation for proper reinforcing steel and concrete placement. A unit price for the use of casing should be identified for temporary casing on the bid tabulation form in the contract documents.
4. Early refusal was encountered in borings B-3, B-5, and B-24 through B-30 ("Uptown Loop"). The refusal material will likely require use of a rock core barrel to advance drilled shaft excavations. The contractor should be made aware of this difficult excavation condition. It is noted that the refusal material may be interbedded with weathered soil layers that will further complicate drilled shaft excavation techniques.
5. Although not encountered in borings drilled along the roadways, concrete debris and other foundation remnants were encountered in borings B-33, B-34 and B-35 associated with the Maintenance Facility. The contractor should be made aware of the presence of rubble laden fill for pole installation in the vicinity of the Maintenance Facility. The presence of rubble laden fill may require temporary casing and or difficult excavation techniques.
6. In order to promote shaft-to-soil bonding, drilled-shaft concrete should be specified as a high slump concrete (7- to 8-inch slump, preferably superplasticized), which still has the proper characteristics of normal concrete such as workability, durability, cohesiveness, and strength.
7. To prevent deterioration of the sides and bottoms of shaft excavations, reinforcement and concrete should be placed the same day drilling operations are completed. Before placement, shafts should be inspected to assure bottoms and sidewalls are free of deleterious soil spall and free water.
8. Centralizing chutes, tremies, and/or concrete pumps may be necessary to prevent the concrete from striking the sides of reinforcement and thus segregating. The desired maximum free fall of concrete should be about 10 ft, but greater heights

are allowable if segregation can be eliminated and if the shaft excavation is dry and sidewalls stable.

9. The drilled shaft operations should be inspected, on a full-time basis, by a qualified geotechnical engineer to a) verify desired penetration into the bearing stratum, b) verify shaft dimensions and proper reinforcement, c) monitor cleanness and amount of water in shaft excavations, d) monitor placement of concrete and use of tremie or pumps, e) monitor the extraction of casing, if used, and f) maintain accurate records.
10. As the design of any foundation relies heavily on generalizations drawn from subsurface conditions determined at a limited number of boring locations, verification of these generalizations at any given location should not be dictated by criteria based on depth or drilling resistance. The sides and bottoms of shafts should be examined by the geotechnical engineer of record to assure that appropriate subsurface conditions and shaft bottoms bear in the desired stratum.
11. In addition to construction recommendations contained herein, the shafts should be constructed in general accordance with ACI 336.3R, Chapters 4 and 5.

Construction Monitoring

It is recommend that a qualified geotechnical engineer be present on-site during construction to observe, monitor construction activities and perform quality control tests. Construction monitoring performed by qualified personnel independent of the Contractor is recommended because the performance of foundations and other structures constructed during this project will be directly related to the Contractor's adherence to the recommendations presented in this report and to the specifications prepared by the Designer. Additionally, unanticipated soil and/or subsurface conditions may be encountered during construction that must be mitigated. Qualified geotechnical personnel observing construction on-site can monitor construction activities and may aid in recognizing unanticipated subsurface conditions and assist in confirming these conditions with design recommendations.

Conditions

Since some variation was found in subsurface conditions at the boring locations, all parties involved should take notice that subsurface conditions may vary significantly between boring locations. Statements in the report as to subsurface variation over given areas are intended only as estimations from the data obtained at specific boring locations.

ADDENDUM 2 - JULY 14, 2015

The professional services that form the basis for this report have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in the same locality. No other warranty, express or implied, is made as the professional advice set forth. This scope of work did not include and investigation, detection, or design related to the presence of any recognized environmental pollutants.

* * *

The following attachments complete this report:

Geotech Plan of Borings (sheet 1 of 3)	Plate 1
Geotech Plan of Borings (sheet 2 of 3)	Plate 2
Geotech Plan of Borings (sheet 3 of 3)	Plate 3
Geologic Map	Plate 4
Geotech Key Map	Plate 5
Generalized Subsurface Profile – Section 1	Plate 6
Generalized Subsurface Profile – Section 2	Plate 7
Generalized Subsurface Profile – Section 3	Plate 8
Generalized Subsurface Profile – Section 4	Plate 9
Generalized Subsurface Profile – Transit Terminal	Plate 10

Appendix A	Boring Logs from PSI (B-1 through B-34 excluding B-22)
Appendix B	LPILE Computer Output

ADDENDUM 2 - JULY 14, 2015

FIGURES

ADDENDUM 2 - JULY 14, 2015

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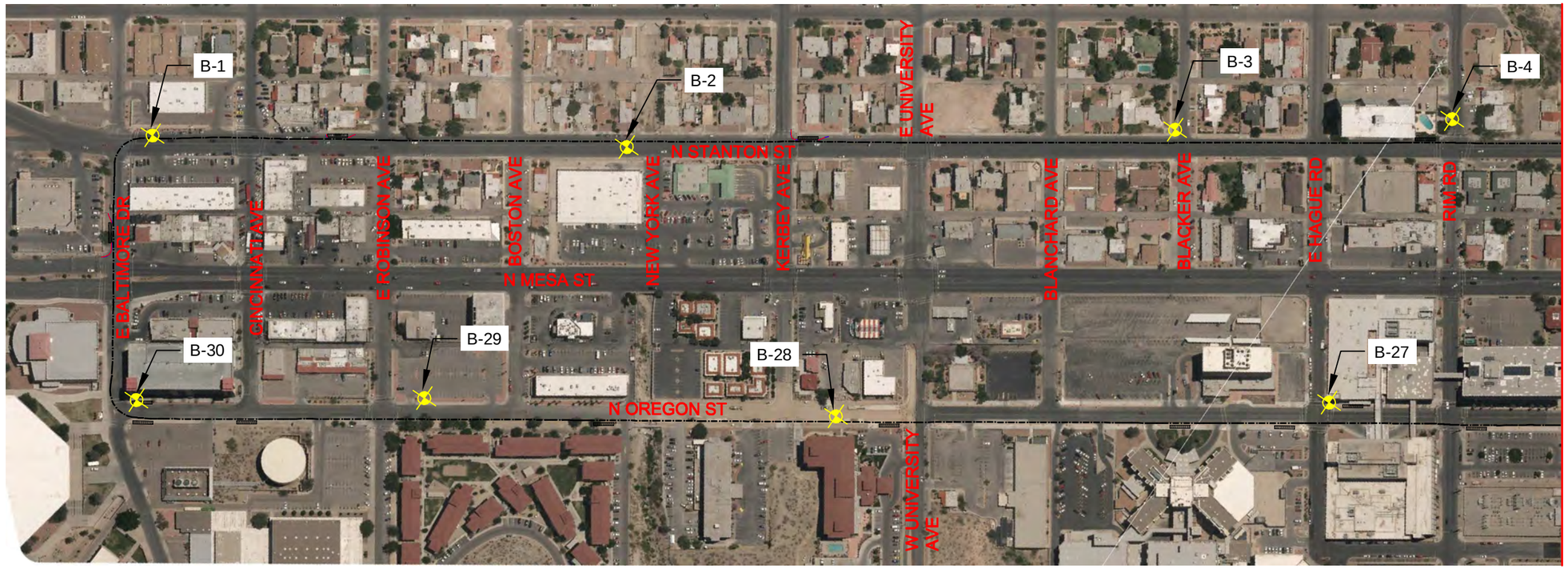

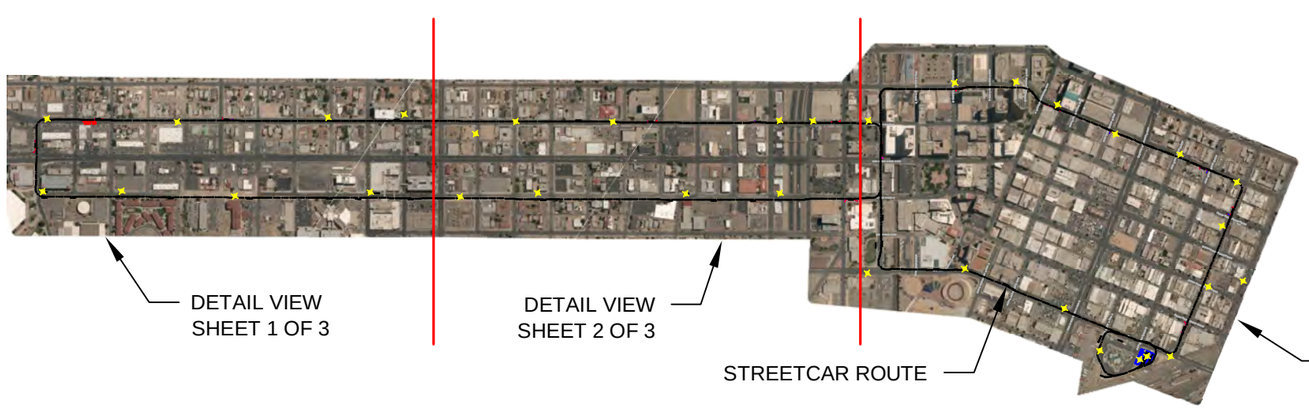

LEGEND

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URS
9400 Amberglen Blvd
Austin, Texas 78729
(512) 454-4797
TBPE REGISTRATION NO. F-3162

COEP STREETCAR

GEOTECH BORINGS
KEY MAP
SHEET 1 OF 3

© 2012
Texas Department of Transportation

CONT	SECT	JOB	HIGHWAY
DIST		COUNTY	SHEET NO.

THE CITY OF EL PASO TEXAS

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Plate 1

ADDENDUM 2 - JULY 14, 2015

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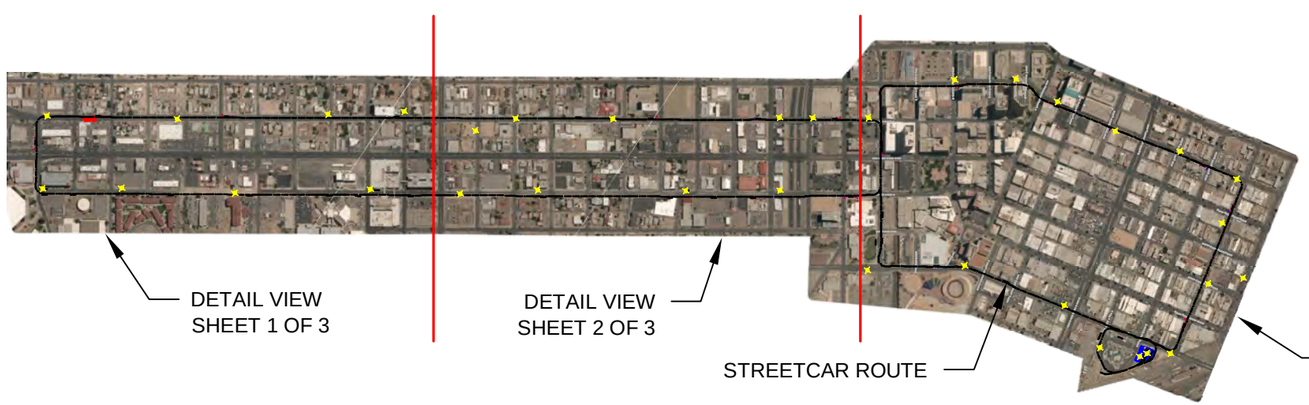

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- GEOTECH BORING LOCATION

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9400 Amberglen Blvd
Austin, Texas 78729
(512) 454-4797
TBPE REGISTRATION NO. F-3162

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GEOTECH BORINGS
KEY MAP
SHEET 2 OF 3

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CONT	SECT	JOB	HIGHWAY
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Plate 2

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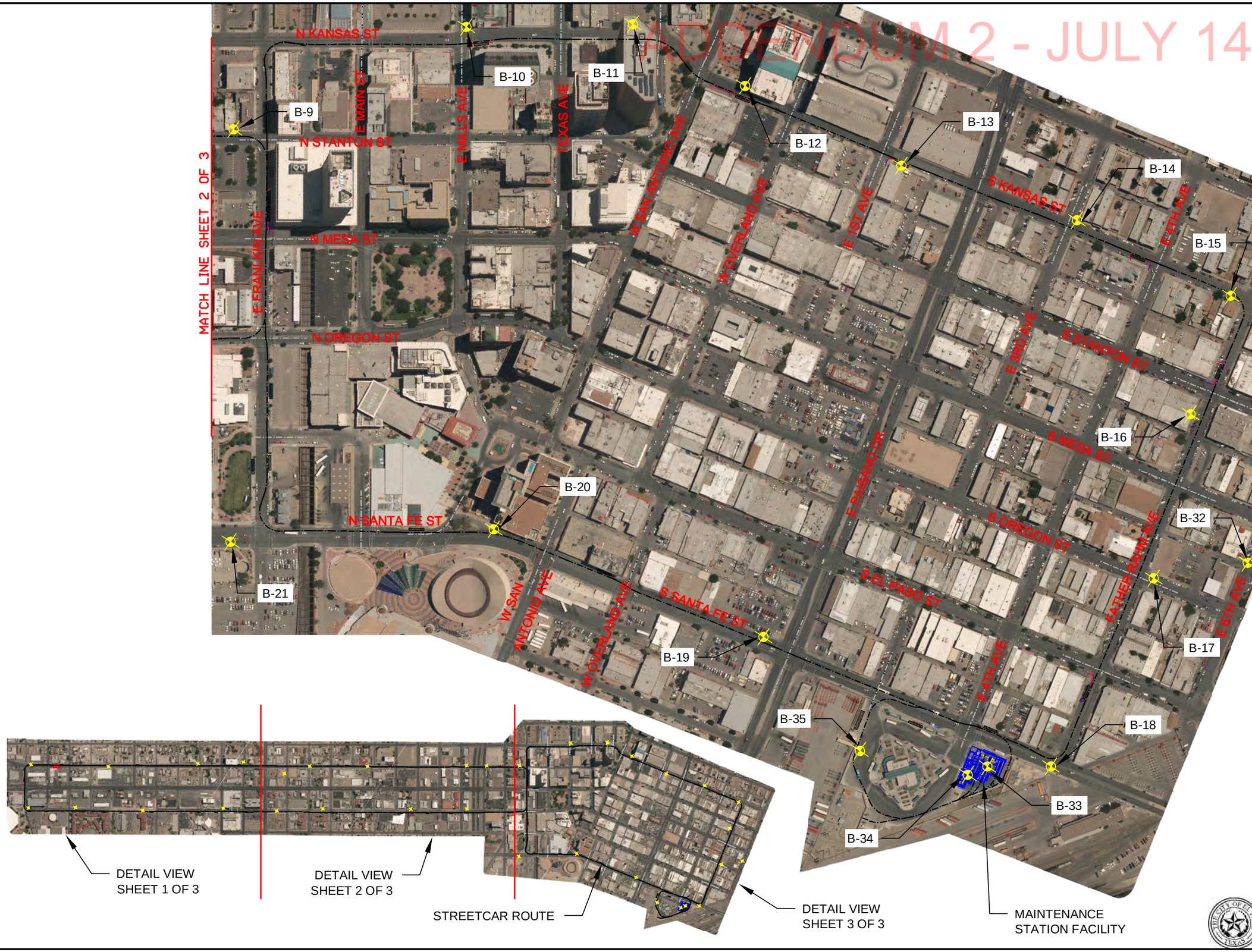

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GEOTECH BORINGS KEY MAP SHEET 3 OF 3

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CONT	SECT	JOB	HIGHWAY
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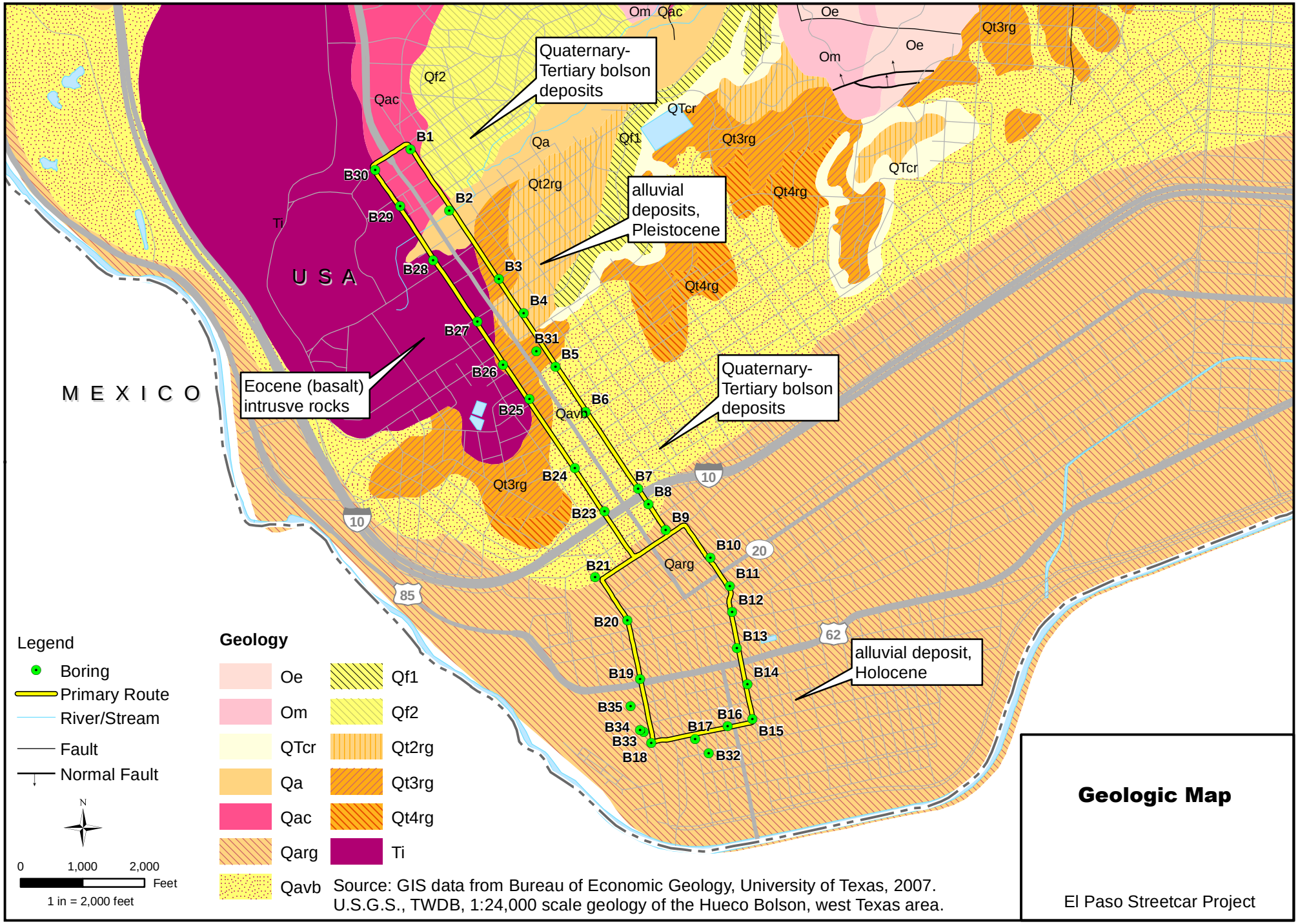
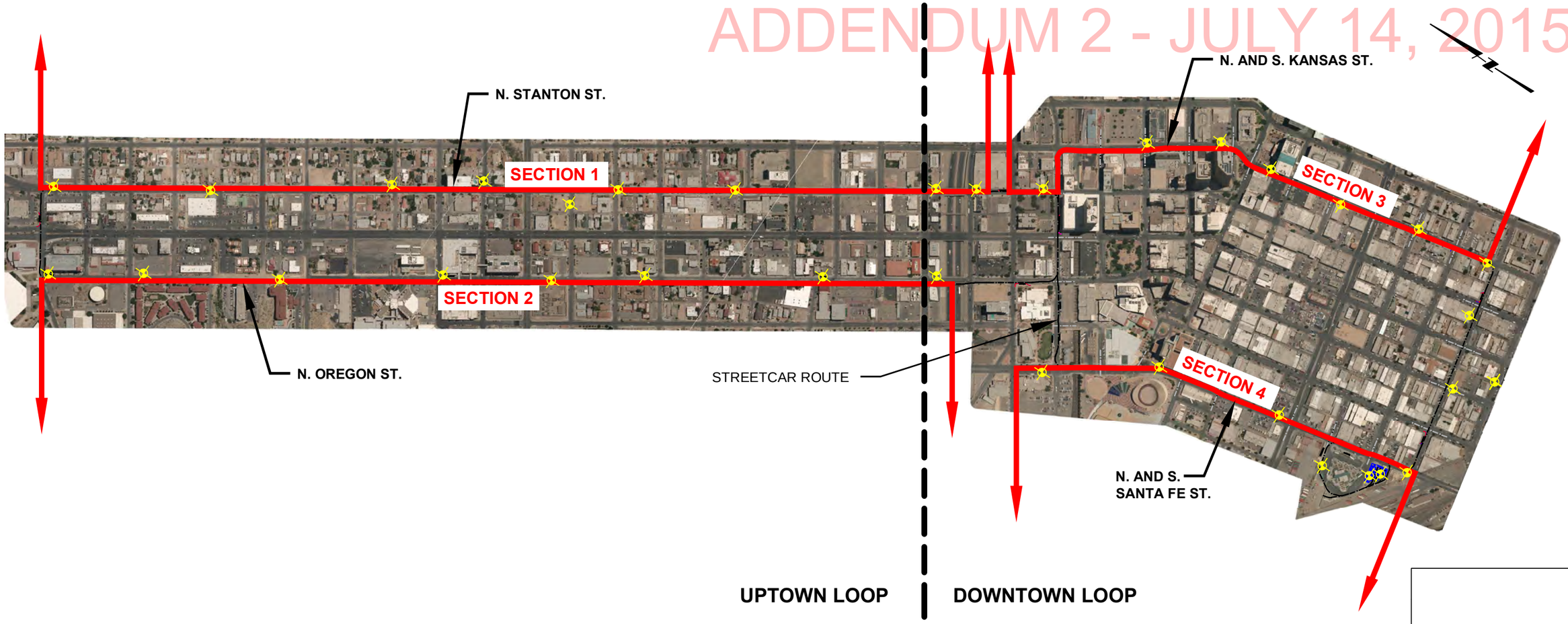


Plate 4

ADDENDUM 2 - JULY 14, 2015



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GEOTECH BROING LOCATION

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Austin, Texas 78729
(512) 454-4797
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GEOTECH PROFILE
KEY MAP
SHEET 1 OF 5

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CONT	SECT	JOB	HIGHWAY
DIST	COUNTY		SHEET NO.

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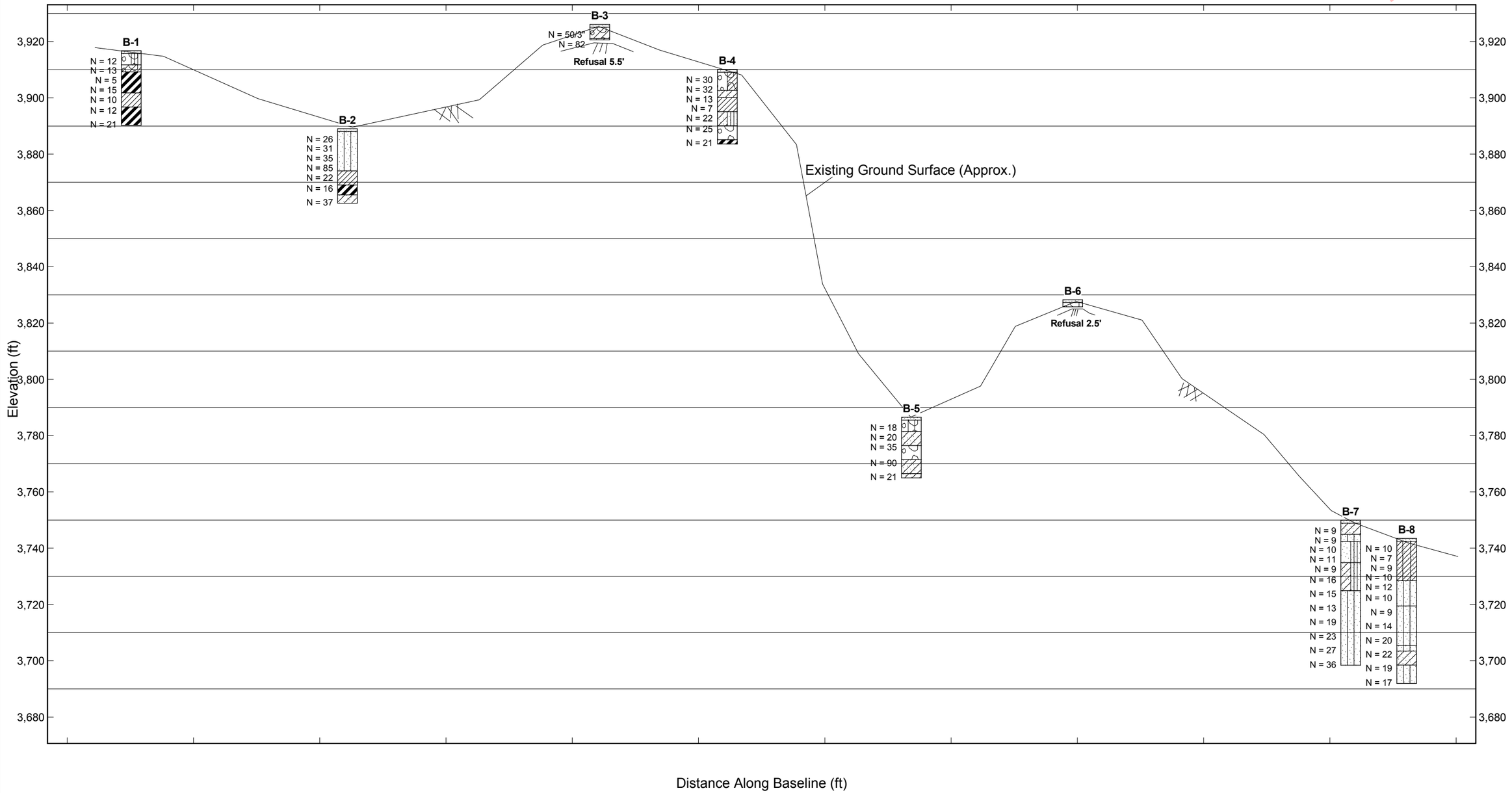

URS

Vertical Scale 1" = 35.0'
Horizontal Scale NTS

LITHOLOGY GRAPHICS

- Concrete
- USCS Poorly-graded Gravel with Silt
- USCS Clayey Gravel
- USCS High Plasticity Clay
- USCS Low Plasticity Clay
- USCS Silty Sand
- USCS Clayey Sand
- USCS Poorly-graded Gravel with Clay
- USCS Clayey Sand
- USCS Poorly-graded Gravel
- USCS Silty Gravel
- USCS Poorly-graded Sand with Silt
- Silty Clayey Sand

GENERALIZED SUBSURFACE PROFILE

Project: City of El Paso Streetcar
Location: Section 1
Number: 41010530.052

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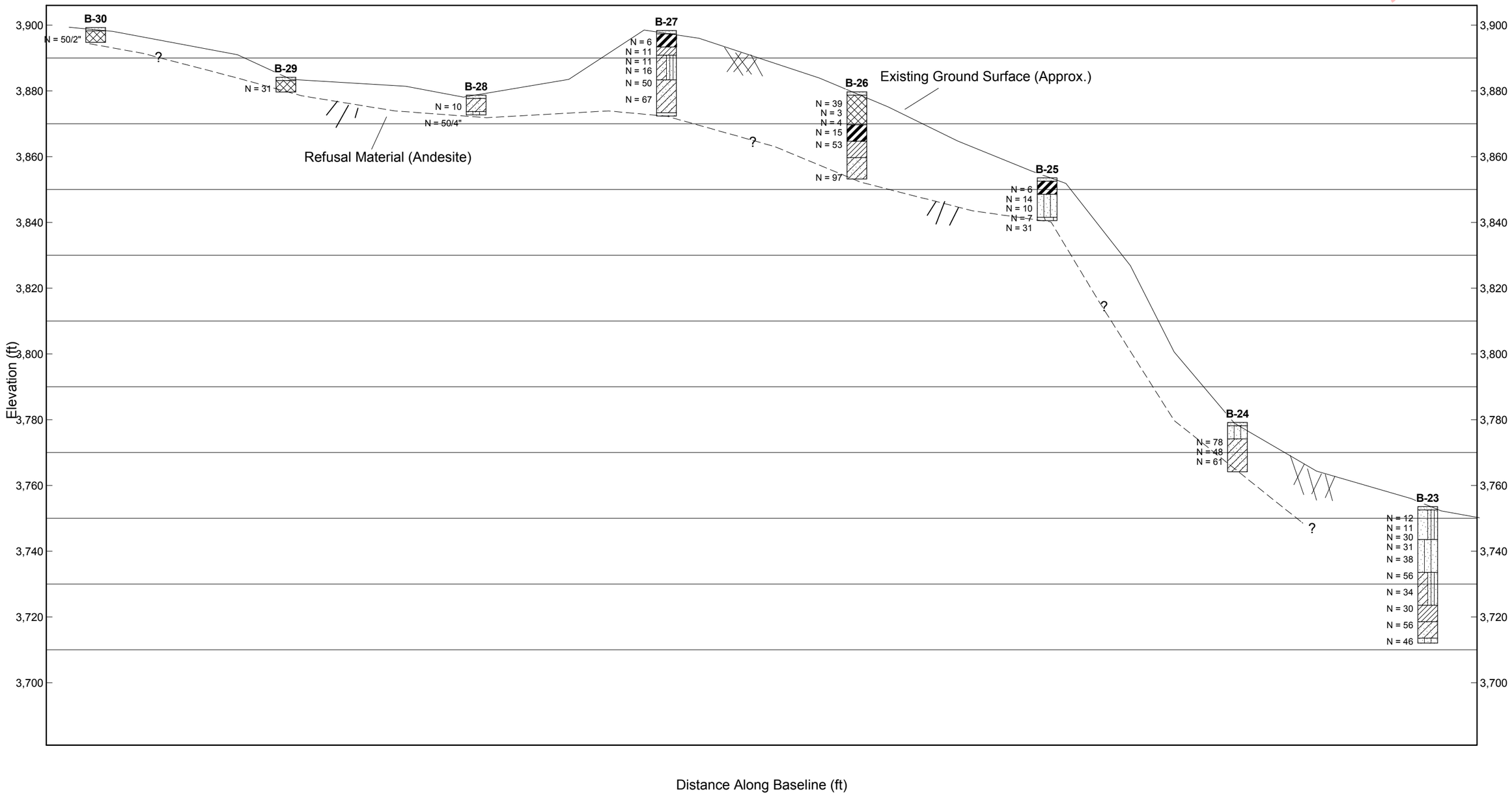
ADDENDUM 2 - JULY 14, 2015



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LITHOLOGY GRAPHICS

- Concrete
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- USCS Silty Sand
- USCS Clayey Sand
- USCS Low Plasticity Clay
- USCS Clayey Sand
- USCS High Plasticity Clay
- USCS Poorly-graded Gravel
- Fill (made ground)
- Andesite

GENERLIZED SUBSURFACE PROFILE

Project: City of El Paso Streetcar

Location: Section 2

Number: 41010530.052

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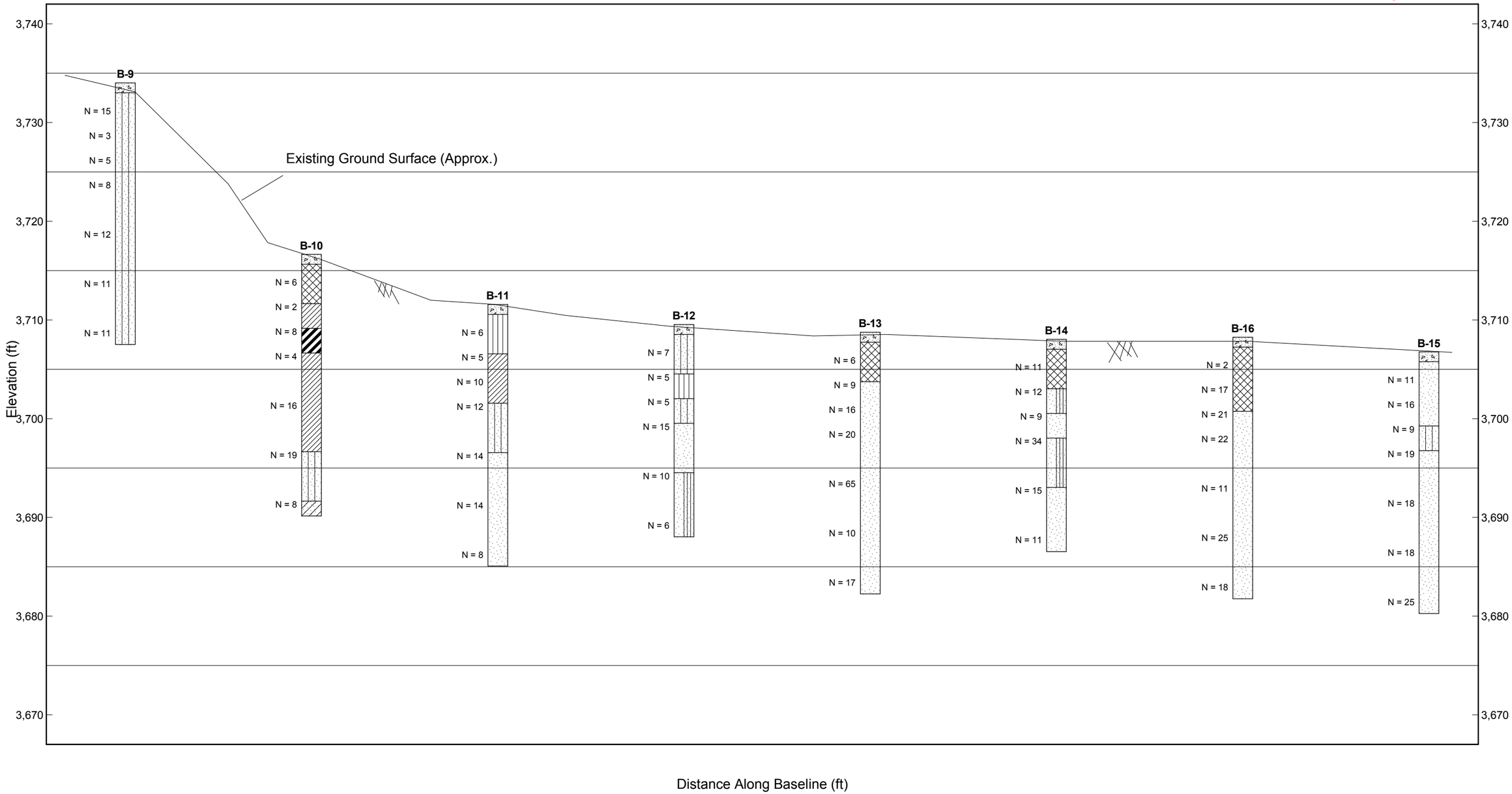

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LITHOLOGY GRAPHICS

- Concrete
- USCS Silty Sand
- Fill (made ground)
- USCS Low Plasticity Clay
- USCS High Plasticity Clay
- USCS Clayey Sand
- USCS Silt
- USCS Poorly-graded Sand
- USCS Poorly-graded Sand with Silt

GENERALIZED SUBSURFACE PROFILE

Project: City of El Paso Streetcar

Location: Section 3

Number: 41010530.052

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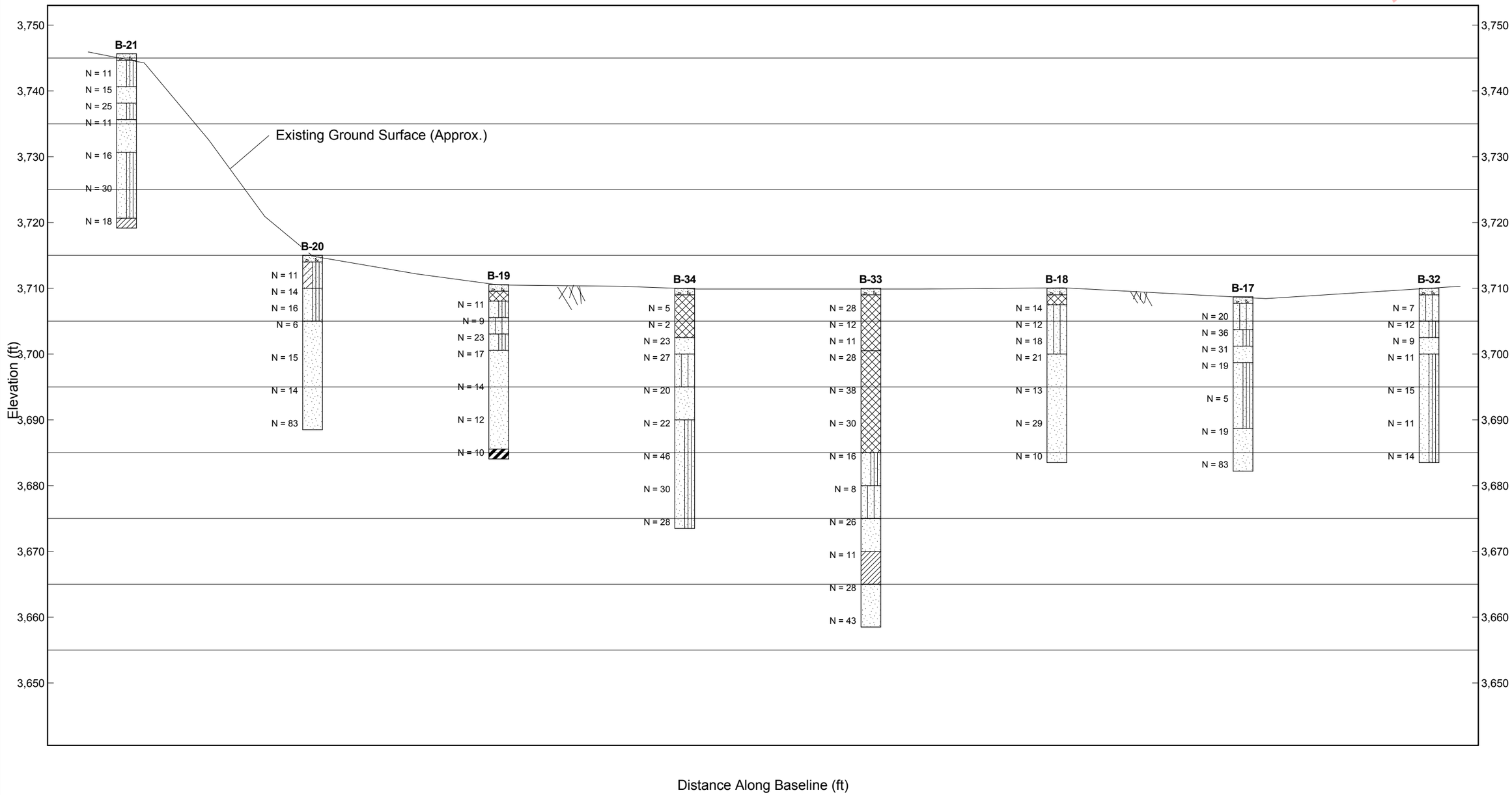
ADDENDUM 2 - JULY 14, 2015



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LITHOLOGY GRAPHICS

- Concrete
- USCS Silty Sand
- USCS Poorly-graded Sand with Silt
- USCS Poorly-graded Sand
- Fill (made ground)
- USCS High Plasticity Clay
- USCS Clayey Sand
- USCS Low Plasticity Clay

GENERALIZED SUBSURFACE PROFILE

Project: City of El Paso Streetcar
Location: Section 4
Number: 41010530.052

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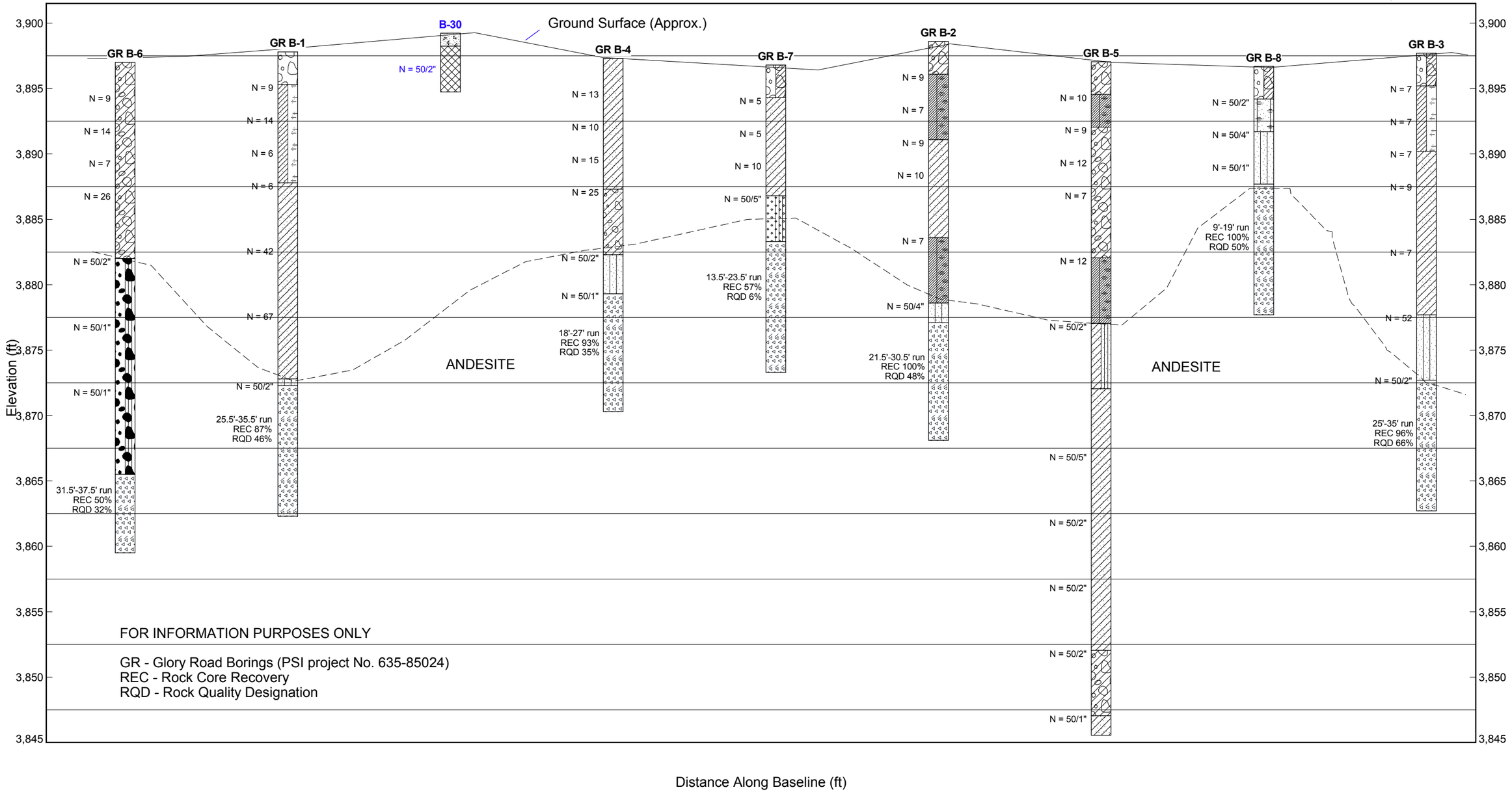
ADDENDUM 2 - JULY 14, 2015



FOR INFORMATION PURPOSES ONLY

GR - Glory Road Borings (PSI project No. 635-85024)
REC - Rock Core Recovery
RQD - Rock Quality Designation

URS

Vertical Scale: As shown
Horizontal Scale: NTS

LITHOLOGY GRAPHICS

Concrete	Fill (made ground)	USCS Poorly-graded Gravel	Clayey sand and Gravel	USCS Clayey Sand
USCS Silty Sand	Andesite	USCS Clayey Gravel	Clayey sand to gravelly sand	USCS Poorly-graded Gravel with Clay
Clay with some sand and gravel	USCS Clayey Sand	USCS Well-graded Gravel with Silt	USCS Well-graded Sand with Silt	Silty Sand with gravel

GENERALIZED SUBSURFACE PROFILE

Project: City of El Paso Streetcar
Location: Glory Road Transit Terminal
Number: 41010530.052

SIMPLE FENCE 11X17 PSI.GPJ FUGRO AUSTIN DATA TEMPLATE.GDT 01/10/13 10:56

ADDENDUM 2 - JULY 14, 2015

APPENDIX A

PSI Boring Logs
B-1 through B-35, excluding B-22

FIGURE: 1

ADDENDUM 2 - JULY 14, 2015

BORING B1

DATE STARTED:	11/14/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/14/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3916.75 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77804°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.50269°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

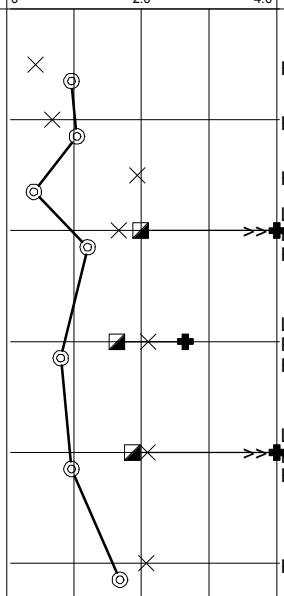
Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 4 inches thick				
						GRADED GRAVEL BASE - 8 inches thick				
3915				SS1	12	**GRAVEL** - Poorly Graded with Silt and Sand, brown, medium dense, moist	GP-GM	8-7-5 N=12	5	Fines=9.7%
	5			SS2	4	**CLAYEY GRAVEL** - with Sand, brown, medium dense, moist	GC	4-6-7 N=13	8	Fines=17.8%
3910				SS3	10	**FAT CLAY** - with Sand, brown, medium, moist	CH	2-3-2 N=5	24	Fines=71.0%
	10			SS4	18	stiff		4-7-8 N=15	21	LL = 61 PL = 25 Fines=80.9%
3905										
	15			SS5	18	**LEAN CLAY** - brown, stiff, moist	CL	3-5-5 N=10	26	LL = 33 PL = 20 Fines=94.0%
3900										
	20			SS6	18	**FAT CLAY** - brown, stiff, moist	CH	3-5-7 N=12	26	LL = 70 PL = 23 Fines=92.8%
3895										
	25			SS7	18	very stiff		4-9-12 N=21	26	Fines=93.2%
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 2

ADDENDUM 2 - JULY 14, 2015

BORING B2

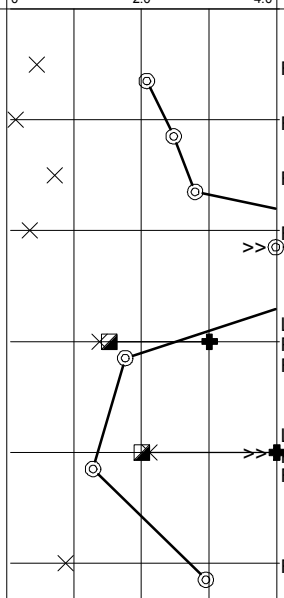
DATE STARTED:	11/14/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/14/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3889.04 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77539°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.505048°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 4 inches thick				
						GRADED GRAVEL BASE - 8 inches thick				
3885				SS1	10	**SILTY SAND** - with Gravel, brown, medium dense, moist	SM	11-12-14 N=26	6	Fines=17.5%
	5			SS2	12	brown, dense, dry		31-17-14 N=31	2	Fines=13.6%
3880				SS3	16	brown (sand) to gray (gravels), dense, moist		5-12-23 N=35	9	Fines=29.4%
	10			SS4	16	light brown, very dense, moist, some calcareous staining		11-45-40 N=85	4	Fines=17.3%
3875	15			SS5	16	**SANDY LEAN CLAY** - brown, very stiff, moist	CL	10-8-14 N=22	17	LL = 38 PL = 19 Fines=76.3%
3870	20			SS6	18	**FAT CLAY** - brown, very stiff, moist	CH	5-6-10 N=16	27	LL = 84 PL = 25 Fines=97.4%
3865	25			SS7	16	**CLAYEY SAND** - brown, dense, moist	SC	8-13-24 N=37	11	Fines=27.3%
						Boring terminated at 26.5 feet below grade				



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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 3

ADDENDUM 2 - JULY 14, 2015

BORING B3

DATE STARTED:	11/14/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/14/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	5.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3926.08 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77249°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49773°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ (× Moisture, ◪ PL, ✚ LL; 0–25–50) / STRENGTH, tsf (▲ Qu, ✳ Qp; 0–2.0–4.0)	Additional Remarks
3925	0					**ASPHALT** - 5.5 inches thick					
						GRADED GRAVEL BASE - 8 inches thick					
				SS1	10	**CLAYEY GRAVEL** - with Sand, brown to light brown, very dense, moist	GC	15-50 (3")	4	>>◎	Fines=16.7%
	5			SS2	16	**CLAYEY SAND** - with Gravel, light brown, very dense, moist	SC	28-42-40 N=82	3	>>◎	Fines=12.3%
						Boring terminated at Auger and Split Spoon Refusal at 5.5 feet below grade					

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FIGURE: 4

ADDENDUM 2 - JULY 14, 2015

BORING B4

DATE STARTED:	11/12/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/12/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3910.11 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77103°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49633°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 3.5 inches thick **CONCRETE** - 8 inches thick **PAVEMENT BASE** - 6 inches thick				
				SS1	6	**GRAVEL** - Poorly Graded with Clay and Sand, grey, medium dense, moist	GP-GC	21-16-14 N=30	4	Fines=8.7%
3905	5			SS2	2			13-16-16 N=32	6	Fines=10.4%
				SS3	8	**CLAYEY SAND** - with Gravel, brown, medium dense, moist	SC	10-7-6 N=13	9	Fines=26.0%
3900	10			SS4	10	**LEAN CLAY** - with Sand, brown, medium, moist	CL	3-2-5 N=7	27	Fines=75.2%
3895	15			SS5	10	**SILTY CLAYEY SAND** - brown, medium dense, moist, with clay lenses	SC-SM	16-11-11 N=22	17	Fines=46.2%
3890	20			SS6	8	**GRAVEL** - Poorly Graded, grey, medium dense, moist	GP	17-12-13 N=25	5	
3885	25			SS7	18	**FAT CLAY** - brown, very stiff, moist	CH	4-8-13 N=21	22	LL = 50 PL = 19 Fines=93.4%
						Boring terminated at 26.5 feet below grade				

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FIGURE: 5

ADDENDUM 2 - JULY 14, 2015

BORING B5

DATE STARTED:	11/12/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/12/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	21.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3786.48 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76872°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49454°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0 – 25 – 50) STRENGTH, tsf ▲ Qu ✳ Qp (0 – 2.0 – 4.0)	Additional Remarks
	0					**ASPHALT** - 8 inches thick					
						PAVEMENT BASE - 6 inches thick					
3785				SS1	12	**SILTY GRAVEL** - with Sand, brown, medium dense, moist	GM	6-8-10 N=18	6		Fines=20.5%
	5			SS2	8	**CLAYEY SAND** - with Gravel, brown, medium dense, moist	SC	5-8-12 N=20	5		Fines=22.5%
3780				SS3	12	dense		16-22-13 N=35	5		Fines=22.1%
	10			SS4	0	**GRAVEL** - Poorly Graded with Sand, multicolored, very dense, moist	GP	50 (6")	3	>>	Fines=3.3%
3775											
	15			SS5	12	**CLAYEY SAND** - with Gravel, brown, very dense, moist	SC	40-35-44 N=79	5	>>	LL = 32 PL = 19 Fines=26.7%
3770											
	20			SS6	15	**CLAYEY SAND** - brown, medium dense, moist	SC	8-10-11 N=21	11		LL = 38 PL = 19 Fines=30.3%
3765						Boring terminated at 21.5 feet below grade					

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FIGURE: 6

ADDENDUM 2 - JULY 14, 2015

BORING B6

DATE STARTED:	11/12/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/12/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	2.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3828.27 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.7668°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49285°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ (× Moisture, ◪ PL, ✚ LL; 0–25–50) / STRENGTH, tsf (▲ Qu, ✳ Qp; 0–2.0–4.0)	Additional Remarks
	0					**ASPHALT** - 6.5 inches thick					
						PAVEMENT BASE - 4.5 inches thick	GP				
				SS1	6	**GRAVEL** - Poorly Graded with Sand, brown, very dense, moist		50 (5.5")	4	× >>◎	Fines=9.8%
						Boring terminated at Auger and Split Spoon Refusal at 2.5 feet below grade					

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FIGURE: 7

ADDENDUM 2 - JULY 14, 2015

BORING B7

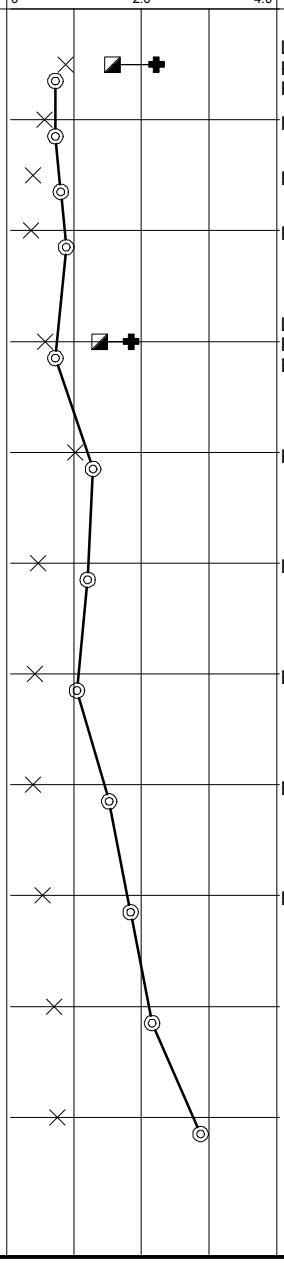
DATE STARTED:	11/9/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/9/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	51.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3749.89 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76353°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.4899°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**ASPHALT** - 3.25 inches thick				
				PAVEMENT BASE - 8 inches thick				
		SS1	10	**CLAYEY SAND** - brown, loose, moist	SC	15-6-3 N=9	11	LL = 28 PL = 20 Fines=39.3%
3745	5	SS2	14	**SILTY SAND** - brown, loose, moist	SM	3-5-4 N=9	7	Fines=18.3%
		SS3	16	**SAND** - Poorly Graded with Silt, brown, loose, moist	SP-SM	6-5-5 N=10	5	Fines=8.6%
3740	10	SS4	17	medium dense, moist		6-6-5 N=11	5	Fines=9.6%
3735	15	SS5	17	**SILTY CLAYEY SAND** - brown, loose, moist	SC-SM	6-5-4 N=9	7	LL = 23 PL = 17 Fines=35.0%
3730	20	SS6	15	medium dense, moist, with clay lenses		3-7-9 N=16	13	Fines=%
3725	25	SS7	18	**SILTY SAND** - brown, medium dense, moist	SM	4-7-8 N=15	6	Fines=21.3%
3720	30	SS8	18			7-6-7 N=13	5	Fines=22.9%
3715	35	SS9	18			7-11-8 N=19	5	Fines=19.2%
3710	40	SS10	18			8-12-11 N=23	7	Fines=20.8%
3705	45	SS11	18			13-13-14 N=27	9	
3700	50	SS12	18	brown, dense, moist		8-12-24 N=36	9	
				Boring terminated at 51.5 feet below grade				



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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 8

ADDENDUM 2 - JULY 14, 2015

BORING B8

DATE STARTED:	11/9/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/9/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	51.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3743.44 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76286°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48932°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**ASPHALT** - 9.5 inches thick				
				PAVEMENT BASE - 4.5 inches thick				
3740		SS1	10	**SILTY CLAYEY SAND** - brown, loose, moist	SC-SM	9-7-3 N=10	9	Fines=26.3%
	5	SS2	12			3-3-4 N=7	9	Fines=27.7%
3735		SS3	17			3-4-5 N=9	9	Fines=27.2%
	10	SS4	15			3-4-6 N=10	9	Fines=25.7%
3730								
	15	SS5	16	**SILTY SAND** - brown, medium dense, moist	SM	5-6-6 N=12	6	Fines=20.7%
3725								
	20	SS6	18	loose, moist		5-4-6 N=10	5	Fines=15.2%
3720								
	25	SS7	17	loose, moist, with clay lenses		4-4-5 N=9	10	Fines=36.6%
3715								
	30	SS8	18	medium dense, moist		6-5-9 N=14	9	
3710								
	35	SS9	18			7-10-10 N=20	6	
3705								
	40	SS10	18	**CLAYEY SAND** - brown, medium dense, moist	SC	11-10-12 N=22	12	LL = 29 PL = 15 Fines=34.4%
3700								
	45	SS11	18	**SILTY SAND** - brown, medium dense, moist	SM	5-9-10 N=19	8	Fines=18.3%
3695								
	50	SS12	18			9-10-7 N=17	12	Fines=22.2%
				Boring terminated at 51.5 feet below grade				

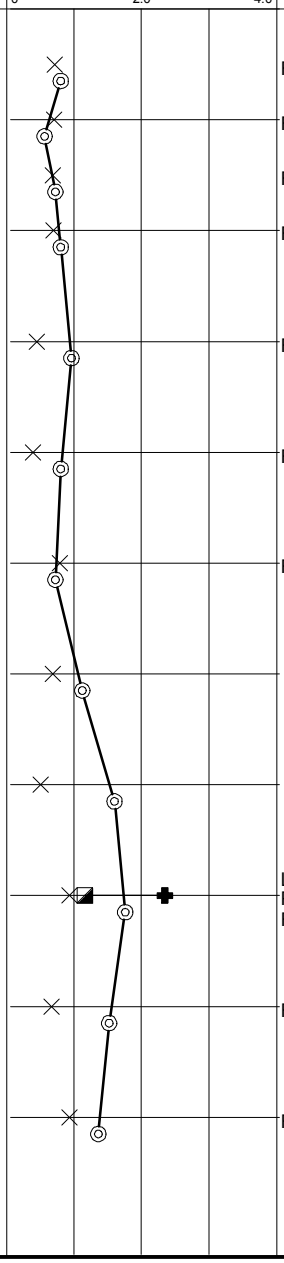

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FIGURE: 9

ADDENDUM 2 - JULY 14, 2015

BORING B9

DATE STARTED:	11/7/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/7/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3734.02 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76177°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48834°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

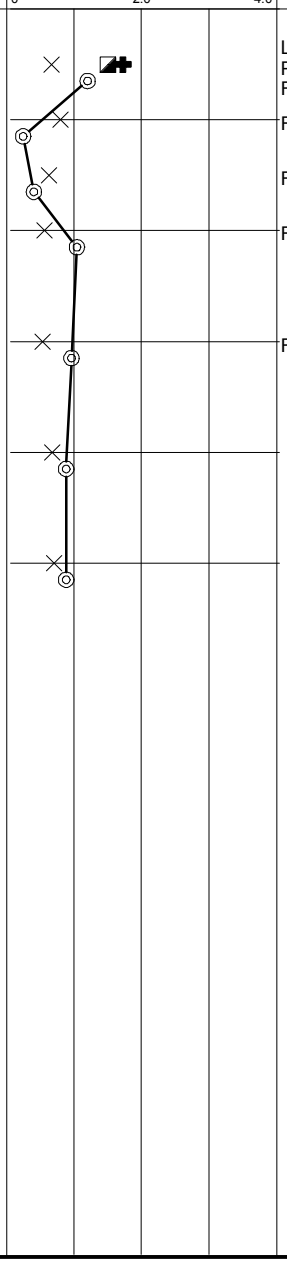
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**CONCRETE** - 9.5 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	16	**SILTY SAND** - brown, medium dense, moist		4-6-9 N=15	8	LL = 22 PL = 19 Fines=26.6%
3730	5			SS2	17	very loose, moist		2-1-2 N=3	10	Fines=32.8%
				SS3	18	loose, moist		2-2-3 N=5	8	Fines=35.0%
3725	10			SS4	16	medium dense, moist		3-4-9 N=13	7	Fines=30.8%
3720							SM			
	15			SS5	8			7-5-7 N=12	7	Fines=29.7%
3715	20			SS6	18			5-6-5 N=11	8	
3710	25			SS7	18			5-6-5 N=11	9	
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 10

ADDENDUM 2 - JULY 14, 2015

BORING B10

DATE STARTED:	11/7/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/7/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3716.65 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76064°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48596°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

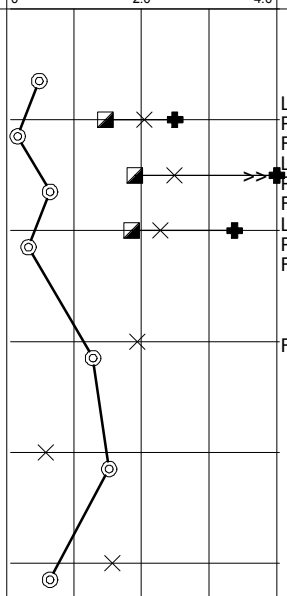
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 7.5 inches thick				
3715						**PAVEMENT BASE** - 8 inches thick				
				SS1	16	**FILL** - Clayey Sand with Gravel (SC), brown, loose, moist, with asphalt fragments		6-3-3 N=6		
	5			SS2	12	**LEAN CLAY** - with Sand, brown, soft, moist	CL	2-1-1 N=2	26	LL = 31 PL = 18 Fines=70.8%
3710				SS3	18	**FAT CLAY** - brown, stiff, moist	CH	2-4-4 N=8	31	LL = 58 PL = 24 Fines=93.6%
	10			SS4	16	**LEAN CLAY** - brown, soft, moist		2-2-2 N=4	29	LL = 42 PL = 23 Fines=90.9%
3705										
	15			SS5	16	very stiff, moist	CL	3-6-10 N=16	24	Fines=81.7%
3700										
	20			SS6	17	**SILTY SAND** - brown, medium dense, moist	SM	6-9-10 N=19	7	
3695										
	25			SS7	18	**CLAYEY SAND** - brown, loose, moist	SC	3-3-5 N=8	20	
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



Professional Service Industries, Inc.
4601 Ripley Drive
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Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 11

ADDENDUM 2 - JULY 14, 2015

BORING B11

DATE STARTED:	11/7/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/7/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3711.57 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75944°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48486°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

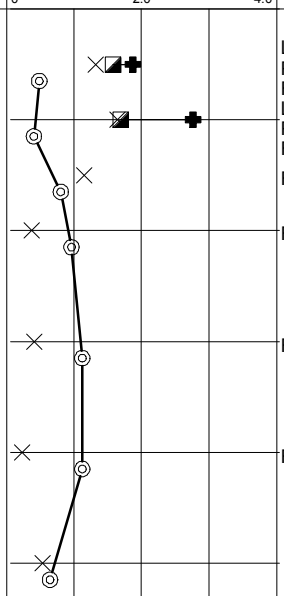
REMARKS: None

Water

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 8 inches thick				
3710						**PAVEMENT BASE** - 6 inches thick				
				SS1	18	**SANDY SILT** - brown, medium, moist	ML	3-2-4 N=6	16	LL = 23 PL = 20 Fines=62.0%
	5			SS2	17	**LEAN CLAY** - brown, medium, moist	CL	3-2-3 N=5	20	LL = 34 PL = 21 Fines=95.5%
3705				SS3	18	stiff, moist		4-5-5 N=10	14	Fines=61.1%
	10			SS4	17	**SILTY SAND** - brown, medium dense, moist	SM	3-6-6 N=12	5	Fines=19.1%
3700										
	15			SS5	18	**SAND** - Poorly Graded, brown, medium dense, moist	SP	4-5-9 N=14	5	Fines=3.6%
3695										
	20			SS6	18	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	6-5-9 N=14	3	Fines=2.9%
3690										
	25			SS7	18	**SAND** - Poorly Graded, brown, loose, moist	SP	2-3-5 N=8	7	
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 12

ADDENDUM 2 - JULY 14, 2015

BORING B12

DATE STARTED:	11/7/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/7/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	21.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3709.53 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75828°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48466°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

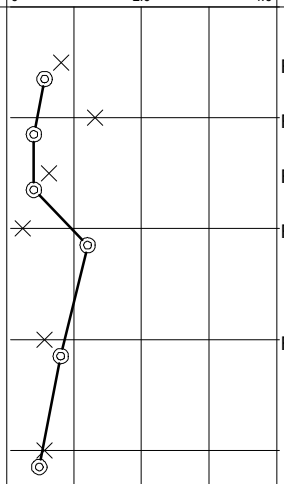
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 2 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	15	**SILTY SAND** - brown, loose, moist	SM	3-4-3 N=7	10	Fines=37.8%
3705	5			SS2	18	**SANDY SILT** - brown, medium, moist	ML	2-2-3 N=5	16	Fines=56.4%
				SS3	18	**SILTY SAND** - brown, loose, moist	SM	3-2-3 N=5	8	Fines=23.5%
3700	10			SS4	18	**SAND** - Poorly Graded, brown, medium dense, moist	SP	4-6-9 N=15	3	Fines=3.7%
3695	15			SS5	18	**SAND** - Poorly Graded with Silt, brown, loose, moist	SP-SM	5-5-5 N=10	7	Fines=11.0%
3690	20			SS6	18	loose, moist, with clay lenses		2-3-3 N=6	7	
						Boring terminated at 21.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 13

ADDENDUM 2 - JULY 14, 2015

BORING B13

DATE STARTED:	11/6/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/6/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3708.75 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.7567°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48433°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

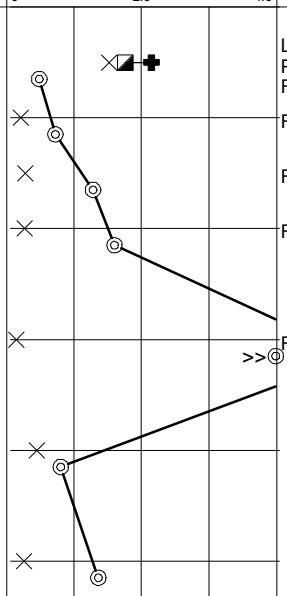
Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 2.75 inches thick				
						PAVEMENT BASE - 8 inches thick				
3705				SS1	15	**FILL** - Silt with Sand (ML), brown, loose, moist, with asphalt fragments		3-4-2 N=6	19	LL = 27 PL = 22 Fines=81.8%
	5			SS2	17	**SAND** - Poorly Graded, brown, loose, moist		2-3-6 N=9	3	Fines=3.2%
3700				SS3	18	medium dense, moist		3-6-10 N=16	3	Fines=3.7%
	10			SS4	17	medium dense, moist	SP	7-10-10 N=20	3	Fines=5.1%
3695										
	15			SS5	15	**SAND** - Poorly Graded with Gravel, brown, very dense, moist	SP	12-30-35 N=65	2	Fines=4.6% >>
3690										
	20			SS6	17	**SAND** - Poorly Graded, brown, loose, moist, with clay lenses	SP	4-3-7 N=10	6	
3685										
	25			SS7	17	medium dense, moist, with clay lenses		2-9-8 N=17	3	
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 14

ADDENDUM 2 - JULY 14, 2015

BORING B14

DATE STARTED:	11/6/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/6/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	21.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3708.04 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75512°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48363°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

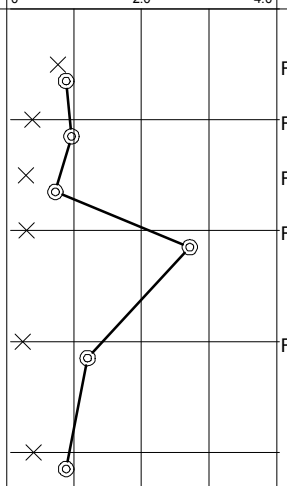
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 3.25 inches thick				
						PAVEMENT BASE - 8 inches thick				
3705				SS1	12	**FILL** - Silty Sand with Gravel (SM), dark brown, medium dense, moist, with brick and asphalt fragments		4-5-6 N=11	10	Fines=28.6%
	5			SS2	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	5-7-5 N=12	5	Fines=6.1%
3700				SS3	17	**SAND** - Poorly Graded, brown, loose, moist	SP	2-4-5 N=9	4	Fines=1.3%
	10			SS4	16	**SAND** - Poorly Graded with Silt, brown, dense, moist	SP-SM	6-14-20 N=34	4	Fines=9.7%
3695										
	15			SS5	14	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist, with clay lenses	SP	10-12-3 N=15	3	Fines=3.1%
3690										
	20			SS6	18	**SAND** - Poorly Graded, brown, medium dense, moist, with clay lenses	SP	3-4-7 N=11	5	
						Boring terminated at 21.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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PROJECT: El Paso Streetcar
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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 15

ADDENDUM 2 - JULY 14, 2015

BORING B15

DATE STARTED:	11/5/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/5/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3706.76 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75358°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48331°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

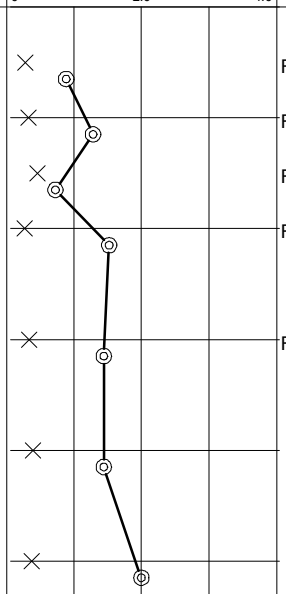
Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 2.5 inches thick				
						PAVEMENT BASE - 8 inches thick				
3705				SS1	16	**SAND** - Poorly Graded with Silt, dark brown, medium dense, moist	SP	3-6-5 N=11	3	Fines=5.8%
	5			SS2	18	**SAND** - Poorly Graded, brown, medium dense, moist	SP	4-7-9 N=16	4	Fines=3.8%
3700				SS3	18	**SILTY SAND** - brown, loose, moist, with clay lenses	SM	3-4-5 N=9	6	Fines=13.6%
	10			SS4	18	**SAND** - Poorly Graded, brown, medium dense, moist	SP	4-8-11 N=19	3	Fines=3.0%
3695										
	15			SS5	16	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	5-9-9 N=18	4	Fines=3.8%
3690										
	20			SS6	18	**SAND** - Poorly Graded, brown, medium dense, moist	SP	4-8-10 N=18	5	
3685										
	25			SS7	16	medium dense, moist		7-12-13 N=25	5	
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 16

ADDENDUM 2 - JULY 14, 2015

BORING B16

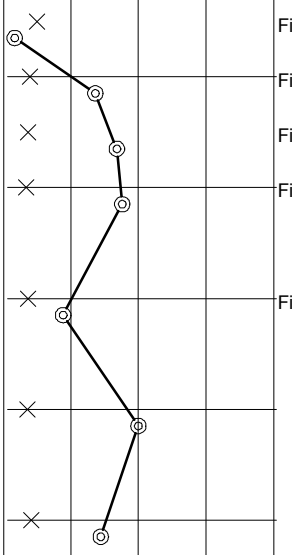
DATE STARTED:	11/5/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/5/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3708.25 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75322°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48458°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 3 inches thick				
						PAVEMENT BASE - 8 inches thick				
3705				SS1	18	**FILL** - Poorly Graded Sand with Silt (SP), brown, very loose, moist		2-1-1 N=2	6	Fines=11.5%
	5			SS2	18	**FILL** - Poorly Graded Sand with Silt and Gravel (SP), brown, medium dense, moist, with asphalt fragments		3-7-10 N=17	5	Fines=10.4%
3700				SS3	18	**SAND** - Poorly Graded, brown, medium dense, moist		5-9-12 N=21	5	Fines=2.6%
	10			SS4	18			5-10-12 N=22	4	Fines=2.8%
3695										
	15			SS5	18		SP	5-6-5 N=11	4	Fines=3.6%
3690										
	20			SS6	18	medium dense, moist, with clay lenses		4-13-12 N=25	4	
3685										
	25			SS7	18	medium dense, moist		5-8-10 N=18	5	
						Boring terminated at 26.5 feet below grade				



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PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 17

ADDENDUM 2 - JULY 14, 2015

BORING B17

DATE STARTED:	11/5/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/5/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3708.70 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75258°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48622°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0 – 25 – 50) STRENGTH, tsf ▲ Qu ✳ Qp (0 – 2.0 – 4.0)	Additional Remarks
	0					**ASPHALT** - 3 inches thick					
						PAVEMENT BASE - 8 inches thick					
3705				SS1	18	**SILTY SAND** - brown, medium dense, moist	SM	6-9-11 N=20	3		Fines=13.2%
	5			SS2	18	**SAND** - Poorly Graded with Silt, brown, dense, moist	SP-SM	4-28-8 N=36	4		Fines=11.0%
3700				SS3	18	**SAND** - Poorly Graded, brown, dense, moist		6-15-16 N=31	3		Fines=3.3%
	10			SS4	18	medium dense, moist	SP	6-9-10 N=19	4		Fines=4.0%
3695											
	15			SS5	18	**SAND** - Poorly Graded with Silt, brown, loose, moist	SP-SM	2-3-2 N=5	6		Fines=10.3%
3690											
	20			SS6	12	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	8-9-10 N=19	2		
3685											
	25			SS7	14	very dense, moist		30-43-40 N=83	2	>>	
						Boring terminated at 26.5 feet below grade					

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LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 18

ADDENDUM 2 - JULY 14, 2015

BORING B18

DATE STARTED:	11/1/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/1/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3709.99 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75229°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48832°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

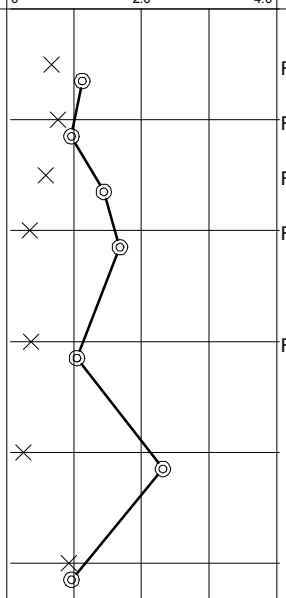
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**CONCRETE** - 8.5 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	18	**FILL** - Poorly Graded Sand (SP), dark brown, moist, with asphalt fragments		5-7-7 N=14	8	Fines=23.7%
3705	5			SS2	18	**SILTY SAND** - brown, medium dense, moist	SM	4-5-7 N=12	10	Fines=22.4%
				SS3	18			5-9-9 N=18	7	Fines=17.8%
3700	10			SS4	18	**SAND** - Poorly Graded, brown, medium dense, moist		4-9-12 N=21	4	Fines=4.1%
3695	15			SS5	16	medium dense, moist, with clay lenses	SP	3-5-8 N=13	4	Fines=6.1%
3690	20			SS6	18	medium dense, moist		8-13-16 N=29	3	
3685	25			SS7	18	medium dense, moist, with clay lenses		2-4-8 N=12	11	
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



Professional Service Industries, Inc.
4601 Ripley Drive
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Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 19

ADDENDUM 2 - JULY 14, 2015

BORING B19

DATE STARTED:	11/1/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/1/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3710.54 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75501°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49202°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
3710	0					**CONCRETE** - 8.5 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	18	**FILL** - Poorly Graded Sand (SP), dark brown, moist, with asphalt fragments	SP-SM	3-6-5 N=11	5	Fines=8.3%
3705	5			SS2	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SM	2-4-5 N=9	6	Fines=16.9%
						SILTY SAND - brown, loose, moist				
				SS3	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	5-11-12 N=23	5	Fines=8.1%
3700	10			SS4	18	**SAND** - Poorly Graded, brown, medium dense, moist	SP	7-10-7 N=17	4	Fines=2.2%
3695	15			SS5	14	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	5-7-7 N=14	3	Fines=3.4%
3690	20			SS6	15			2-3-9 N=12	6	
3685	25			SS7	18	**FAT CLAY** - brown, stiff, moist	CH	2-5-5 N=10	30	LL = 74 PL = 28 Fines=95.4%
						Boring terminated at 26.5 feet below grade				

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FIGURE: 20

ADDENDUM 2 - JULY 14, 2015

BORING B20

DATE STARTED:	11/2/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/2/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.3 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3715.01 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75766°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49007°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 3.25 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	17	**SILTY CLAYEY SAND** - with Gravel, brown, medium dense, moist	SC-SM	4-6-5 N=11	10	LL = 24 PL = 18 Fines=30.4%
3710	5			SS2	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	2-7-7 N=14	9	Fines=6.7%
				SS3	12			4-8-8 N=16	6	Fines=9.3%
3705	10			SS4	17	**SAND** - Poorly Graded, brown, loose, moist	SP	3-3-3 N=6	3	Fines=1.5%
3700	15			SS5	16	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist		4-5-10 N=15	3	Fines=2.1%
3695	20			SS6	16		SP	9-8-6 N=14	2	
3690	25			SS7	12	very dense, moist		21-33-50 (3")	3	
						Boring terminated 26.3 feet below grade				

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FIGURE: 21

ADDENDUM 2 - JULY 14, 2015

BORING B21

DATE STARTED:	11/2/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/2/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3745.64 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75951°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49191°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
3745	0					**CONCRETE** - 8.5 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	4-5-6 N=11	4	Fines=4.7%
3740	5			SS2	18	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	5-7-8 N=15	3	Fines=2.8%
				SS3	14	**SAND** - Poorly Graded with Silt and Gravel, brown, medium dense, moist	SP-SM	5-13-12 N=25	2	Fines=6.8%
3735	10			SS4	16	**SAND** - Poorly Graded, brown, medium dense, moist	SP	5-6-5 N=11	2	Fines=6.3%
3730	15			SS5	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist		5-8-8 N=16	5	Fines=5.7%
3725	20			SS6	16	medium dense, moist, with clay lenses	SP-SM	2-14-16 N=30	7	
3720	25			SS7	18	**LEAN CLAY** - with Sand, brown, very stiff, moist	CL	6-7-11 N=18	19	LL = 39 PL = 21 Fines=73.8%
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

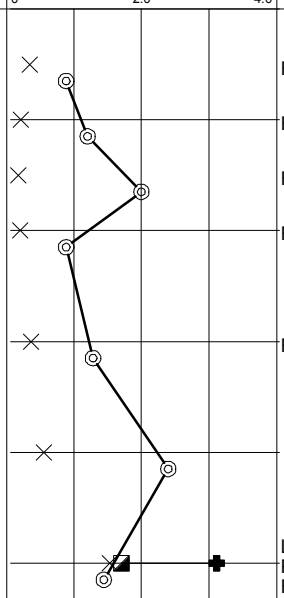

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FIGURE: 23

ADDENDUM 2 - JULY 14, 2015

BORING B23

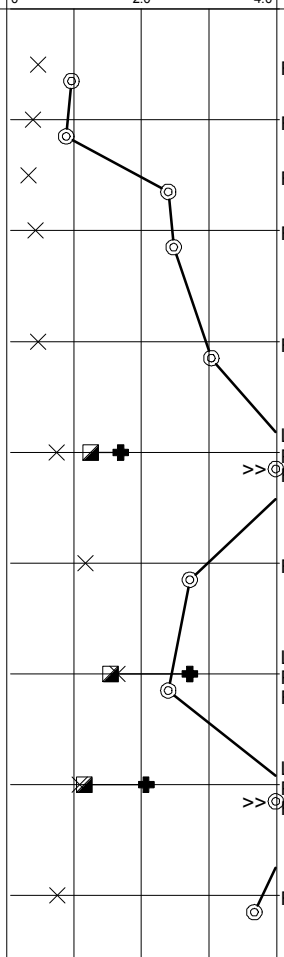
DATE STARTED:	11/12/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/12/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	41.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3753.53 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76243°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49157°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**CONCRETE** - 9 inches thick				
3750		SS1	16	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	6-6-6 N=12	6	Fines=10.4%
	5	SS2	17			3-6-5 N=11	5	Fines=7.7%
3745		SS3	18	**SAND** - Poorly Graded with Silt and Gravel, brown, medium dense, moist	SP-SM	9-17-13 N=30	4	Fines=10.4%
	10	SS4	17	**SILTY SAND** - brown, dense, moist		13-14-17 N=31	5	Fines=12.4%
3740								
	15	SS5	18	dense, moist	SM	8-16-22 N=38	6	Fines=12.8%
3735								
	20	SS6	18	**SILTY CLAYEY SAND** - brown, very dense, moist, with clay lenses		12-24-32 N=56	9	LL = 21 PL = 16 >> Fines=29.8%
3730								
	25	SS7	18	dense, moist	SC-SM	14-16-18 N=34	15	Fines=20.3%
3725								
	30	SS8	18	**SANDY LEAN CLAY** - brown, very stiff, moist	CL	8-12-18 N=30	21	LL = 34 PL = 19 Fines=64.0%
3720								
	35	SS9	18	**CLAYEY SAND** - brown, very dense, moist, with calcareous material	SC	3-16-40 N=56	14	LL = 26 PL = 14 >> Fines=40.6%
3715								
	40	SS10	18	**SILTY SAND** - brown, dense, moist	SM	9-20-26 N=46	9	Fines=33.7%
				Boring terminated at 41.5 feet below grade				



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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 24

ADDENDUM 2 - JULY 14, 2015

BORING B24

DATE STARTED:	11/8/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/8/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	15.3 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3779.16 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76429°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49323°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0–25–50) STRENGTH, tsf ▲ Qu ✳ Qp (0–2.0–4.0)	Additional Remarks
	0					**ASPHALT** - 9.5 inches thick					
						PAVEMENT BASE - 4.5 inches thick					
				SS1	6	**SILTY SAND** - with Gravel, brown, very dense, moist	SM	50 (6")	5		>>◎Fines=14.5%
3775	5			SS2	14	**CLAYEY SAND** - brown, very dense, moist	SC	17-31-47 N=78	11		LL = 31 PL = 20 >>◎Fines=39.6%
				SS3	16	dense, moist		13-23-25 N=48	9		LL = 35 PL = 19 ◎Fines=24.3%
3770	10			SS4	18	very dense, moist		14-31-30 N=61	7		Fines=17.9% >>◎
3765	15			SS5	4	Boring terminated at Auger and Split Spoon Refusal at 15.3 feet below grade		50 (4")	8		>>◎Fines=28.9%

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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 25

ADDENDUM 2 - JULY 14, 2015

BORING B25

DATE STARTED:	11/8/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/8/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	13.0 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3853.54 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76722°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.4958°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0 – 25 – 50) STRENGTH, tsf ▲ Qu ✳ Qp (0 – 2.0 – 4.0)	Additional Remarks
	0					**CONCRETE** - 9.5 inches thick					
						PAVEMENT BASE - 4 inches thick					
3850				SS1	16	**FAT CLAY** - with Sand, brown, medium, moist	CH	2-2-4 N=6	26		LL = 62 PL = 23 Fines=83.6%
	5			SS2	17	**SILTY SAND** - with Gravel, brown, medium dense, moist	SM	7-7-7 N=14	9		Fines=26.7%
3845				SS3	4	loose, moist		7-6-4 N=10	10		Fines=32.5%
	10			SS4	6	**SILTY SAND** - brown, loose, moist	SM	5-3-4 N=7	9		Fines=24.9%
				SS5	11	**GRAVEL** - Poorly Graded, grey, dense, dry	GP	32-20-11 N=31			
						Boring terminated at Auger Refusal at 13 feet below grade					

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FIGURE: 26

ADDENDUM 2 - JULY 14, 2015

BORING B26

DATE STARTED:	11/8/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/8/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.3 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3879.71 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76869°	**HAMMER TYPE:**	Automatic
LONGITUDE:	106.49725°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) / STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					**ASPHALT** - 9.5 inches thick					
						PAVEMENT BASE - 4 inches thick					
				SS1	18	**FILL** - Poorly Graded Sand with Silt (SP), brown, dense, moist		13-17-22 N=39	11		Fines=5.8%
3875	5			SS2	6	**FILL** - Poorly Graded Sand with Gravel (SP), brown, very loose, moist		7-1-2 N=3			
				SS3	16	**FILL** - Poorly Graded Gravel, black, very loose, moist, with asphalt debris		2-2-2 N=4			
3870	10			SS4	18	**FAT CLAY** - with Sand, brown, stiff, moist	CH	3-6-9 N=15	20	>>	LL = 51 PL = 19 Fines=71.7%
3865	15			SS5	16	**SANDY LEAN CLAY** - brown, hard, moist, with calcareous material	CL	7-15-38 N=53	12	>>	LL = 27 PL = 19 Fines=59.0%
3860	20			SS6	11	**CLAYEY SAND** - reddish brown, very dense, moist	SC	15-50 (5.5")	7	>>	Fines=24.0%
3855	25			SS7	12	brown, very dense, moist		33-47-50 (3")	6		Fines=29.0%
						Boring terminated at Split Spoon Refusal at 26.3 feet below grade					

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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 27

ADDENDUM 2 - JULY 14, 2015

BORING B27

DATE STARTED:	11/8/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/8/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	25.2 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3898.36 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77055°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49872°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

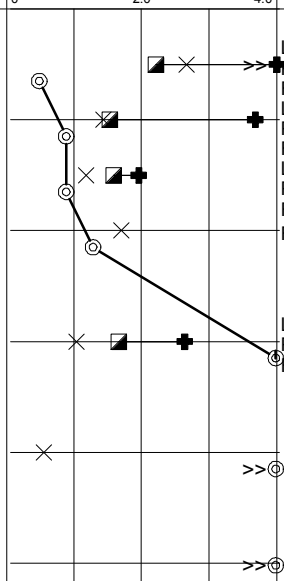
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 4 inches thick				
						PAVEMENT BASE - 8 inches thick				
3895				SS1	14	**FAT CLAY** - with Sand, brown, medium, moist	CH	7-3-3 N=6	33	LL = 64 PL = 28 Fines=79.2%
	5			SS2	16	**LEAN CLAY** - with Sand, brown, stiff, moist	CL	4-5-6 N=11	18	LL = 46 PL = 19 Fines=70.9%
3890				SS3	14	**SILTY CLAYEY SAND** - brown, medium dense, moist		3-5-6 N=11	15	LL = 24 PL = 20 Fines=38.2%
	10			SS4	15		SC-SM	4-7-9 N=16	21	Fines=24.4%
3885										
	15			SS5	18	**SANDY LEAN CLAY** - brown, hard, moist		6-18-32 N=50	13	LL = 33 PL = 21 Fines=61.0%
3880										
	20			SS6	18	hard, moist	CL	6-23-44 N=67	7	
3875										
	25			SS7	2	**ANDESITE** - with Silty Sand, brown, very dense, dry		50 (2.5")		

Boring terminated at Auger and Split Spoon Refusal at 25.2 feet below grade



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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 28

ADDENDUM 2 - JULY 14, 2015

BORING B28

DATE STARTED:	11/13/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/13/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	6.1 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3878.70 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77315°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.50116°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					**ASPHALT** - 3.75 inches thick					
						GRADED GRAVEL BASE - 8 inches thick					
3875				SS1	12	**CLAYEY SAND** - brown, loose, moist	SC	4-3-7 N=10	17		LL = 39 PL = 23 Fines=35.7%
	5			SS2	7	**SILTY SAND** - brown, very dense, moist	SM	17-50 (1.75")	8		Fines=22.1%
				SS3	1	Boring terminated at Auger and Split Spoon Refusal at 6.1 feet below grade		50 (1")		>>◎ >>◎	

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FIGURE: 29

ADDENDUM 2 - JULY 14, 2015

BORING B29

DATE STARTED:	11/13/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/13/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	4.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3884.17 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77546°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.50304°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0 – 25 – 50) STRENGTH, tsf ▲ Qu ✳ Qp (0 – 2.0 – 4.0)	Additional Remarks
	0					**ASPHALT** - 2.5 inches thick **GRADED GRAVEL BASE** - 8 inches thick					
3880				SS1	12	**FILL** - Clayey Sand with Gravel (SC), brown, dense, moist, some construction debris - brick, asphalt, glass scattered throughout upper soil Boring terminated at Auger and Split Spoon Refusal at 4.5 feet below grade		5-23-8 N=31	10	× ◪ ✚ ◎	LL = 27 PL = 17 Fines=28.7%

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PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 30

ADDENDUM 2 - JULY 14, 2015

BORING B30

DATE STARTED:	11/13/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/13/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	5.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3899.24 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77701°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.50444°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ (× Moisture, ◪ PL, ✚ LL; 0–25–50) / STRENGTH, tsf (▲ Qu, ✳ Qp; 0–2.0–4.0)	Additional Remarks
	0					**CONCRETE** - 9 inches thick					
						GRADED GRAVEL BASE - 8 inches thick					
				SS1	12	**FILL** - Clayey Sand with Gravel (SC), brown, dense, moist		5-23-8 N=31	11		LL = 29 PL = 16 Fines=26.5%
3895	5					loose, moist			10		Fines=23.1%
						Boring terminated at Auger and Split Spoon Refusal at 4.5 feet below grade					

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FIGURE: 31

ADDENDUM 2 - JULY 14, 2015

BORING B31

DATE STARTED:	11/12/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/12/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	21.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3863.48 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.81937°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49557°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					**ASPHALT** - 3.5 feet below grade					
						PAVEMENT BASE - 8 inches thick					
3860				SS1	12	**SANDY LEAN CLAY** - brown, very stiff, moist	CL	17-9-6 N=15	15		LL = 40 PL = 18 Fines=59.0%
	5			SS2	14			9-8-15 N=23	14		LL = 40 PL = 18 Fines=54.0%
3855				SS3	16			10-10-13 N=23	16		LL = 41 PL = 17 Fines=65.6%
	10			SS4	17	**CLAYEY SAND** - brown, dense, moist		8-15-16 N=31	10		Fines=37.1%
3850											
	15			SS5	18	dense, moist, with calcareous material	SC	7-18-16 N=34	12		LL = 52 PL = 18 Fines=30.2%
3845											
	20			SS6	16			7-13-18 N=31	10		Fines=35.5%
						Boring terminated at 21.5 feet below grade					

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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 32

ADDENDUM 2 - JULY 14, 2015

BORING B32

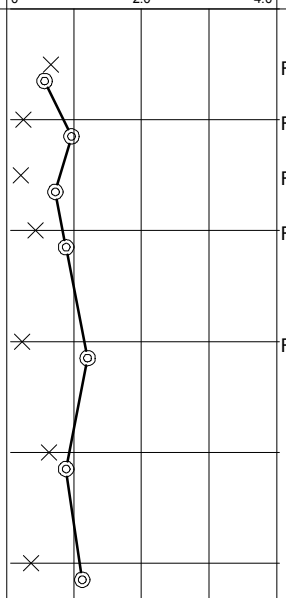
DATE STARTED:	11/13/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/13/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3710 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75198°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48548°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 2.5 inches thick				
						Graded Gravel Base - 8 inches thick				
				SS1	16	**SILTY SAND** - brown, loose, moist	SM	4-3-4 N=7	8	Fines=28.7%
3705	5			SS2	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	3-6-6 N=12	3	Fines=6.3%
				SS3	16	**SAND** - Poorly Graded, brown, loose, moist	SP	3-5-4 N=9	3	Fines=3.0%
3700	10			SS4	16	**SAND** - Poorly Graded with Silt, brown, medium dense, moist		4-5-6 N=11	5	Fines=8.7%
3695	15			SS5	17			6-8-7 N=15	3	Fines=5.0%
3690	20			SS6	18	medium dense, moist, with clay lenses	SP-SM	3-5-6 N=11	8	
3685	25			SS7	18			6-8-6 N=14	4	
						Boring terminated at 26.5 feet below grade				



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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 33

ADDENDUM 2 - JULY 14, 2015

BORING B33

DATE STARTED:	10/27/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	10/27/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	51.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3710 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75272°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.4885°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

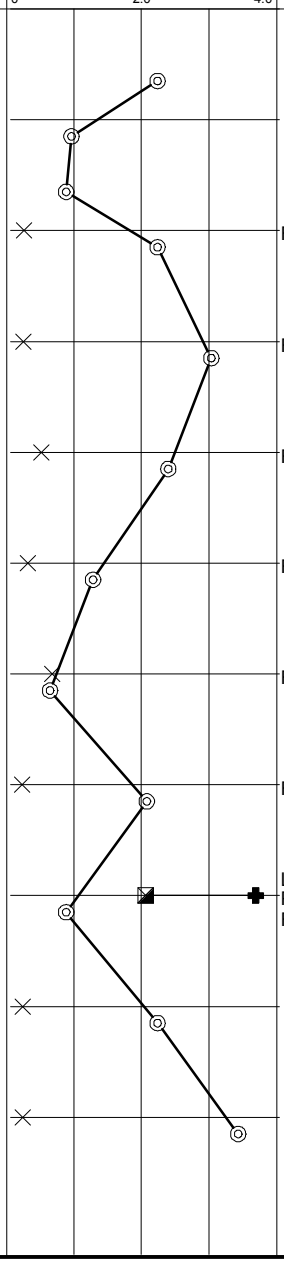
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**ASPHALT** - 2 inches thick				
				PAVEMENT BASE - 8 inches thick				
		SS1	18	**FILL** - Silty Clayey Sand (SC-SM), dark brown, moist, with asphalt and brick debris		14-13-15 N=28		
3705	5	SS2	14	**FILL** - Clayey Sand (SC), dark brown, medium dense, moist, with concrete debris with asphalt, brick, and concrete debris		4-6-6 N=12		
		SS3	12	**FILL** - Poorly Graded Sand (SP), reddish brown, medium dense, moist, with brick debris		11-7-4 N=11		
3700	10	SS4	18	**FILL** - Poorly Graded Sand with Silt (SP-SM), brown, medium dense, moist		7-15-13 N=28	3	Fines=2.5%
3695	15	SS5	18	dense, moist, with concrete debris		6-20-18 N=38	3	Fines=5.5%
3690	20	SS6	18	**FILL** - Silty Sand (SM), brown, medium dense, moist, with clay lenses		2-11-19 N=30	6	Fines=12.6%
3685	25	SS7	17	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	3-6-10 N=16	4	Fines=5.9%
3680	30	SS8	18	**SILTY SAND** - brown, loose, moist, with clay lenses	SM	5-3-5 N=8	8	Fines=19.7%
3675	35	SS9	16	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	12-14-12 N=26	3	Fines=3.1%
3670	40	SS10	18	**SANDY LEAN CLAY** - brown, stiff, moist	CL	4-5-6 N=11	26	LL = 46 PL = 26 Fines=63.0%
3665	45	SS11	18	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	10-17-11 N=28	3	
3660	50	SS12	18			18-22-21 N=43	3	
				Boring terminated at 51.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 34

ADDENDUM 2 - JULY 14, 2015

BORING B34

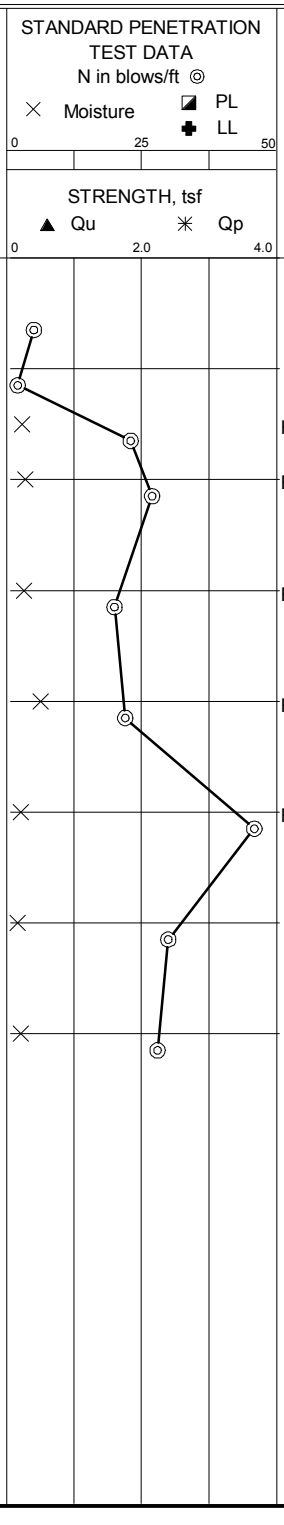
DATE STARTED:	10/27/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	10/27/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	36.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3710 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75285°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.8991°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 2 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	12	**FILL** - Poorly Graded Sand (SP), black, moist, with asphalt, concrete, brick, and deleterious debris		6-3-2 N=5		
3705	5			SS2	14	**FILL** - Poorly Graded Sand (SP), black, loose, moist, with asphalt, concrete, brick, and deleterious debris		1-1-1 N=2		
				SS3	11	**FILL** - Clayey Sand (SC), black, very loose moist, with asphalt, concrete, brick, and deleterious debris	SP	6-10-13 N=23	3	Fines=4.0%
3700	10			SS4	18	**SAND** - Poorly Graded, brown, medium dense, moist	SM	9-13-14 N=27	3	Fines=32.4%
						SILTY SAND - brown, medium dense, moist				
3695	15			SS5	18	**SAND** - Poorly Graded, grey, medium dense, moist, with hydrocarbon odor	SP	5-8-12 N=20	3	Fines=2.6%
3690	20			SS6	18	**SAND** - Poorly Graded with Silt and Gravel, grey, medium dense, moist, with hydrocarbon odor		3-11-11 N=22	6	Fines=10.8%
3685	25			SS7	18	dense, moist, with hydrocarbon odor	SP-SM	8-18-28 N=46	3	Fines=5.3%
3680	30			SS8	18	medium dense, moist, with hydrocarbon odor		12-14-16 N=30	2	
3675	35			SS9	18	**SAND** - Poorly Graded with Silt, grey, medium dense, moist, with hydrocarbon odor	SP-SM	11-13-15 N=28	3	
						Boring terminated at 36.5 feet below grade				



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LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 35

ADDENDUM 2 - JULY 14, 2015

BORING B35

DATE STARTED:	11/13/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/13/12	**DRILLER:** AB	**LOGGED BY:** TP
COMPLETION DEPTH	3.0 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3711.12 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75387°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48965°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ (× Moisture, ◪ PL, ✚ LL; 0–25–50) / STRENGTH, tsf (▲ Qu, ✳ Qp; 0–2.0–4.0)	Additional Remarks
3710	0					**SAND, VERY FINE**, black, loose, moist					
				SS1	0	Concrete - Auger Refusal Boring terminated 2.6 Feet		50(0)		>>◎	

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ADDENDUM 2 - JULY 14, 2015

APPENDIX B

LPILE OUTPUT

ADDENDUM 2 - JULY 14, 2015

uptown_pole1_36 inch_10ft

==========

LPile Plus for Windows, Version 2012-06.035

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This copy of LPile is licensed to:

URS
URS Austin

Serial Number of Security Device: 500126253
Company Name Stored in Security Device: URS Corporation

Files Used for Analysis

Path to file locations: P:\AUS Geotech\Projects\41010530.052 City of El Paso\OCS Design\LPILE runs_RAR\
Name of input data file: uptown_pole1_36 inch_10ft.lp6d
Name of output report file: uptown_pole1_36 inch_10ft.lp6o
Name of plot output file: uptown_pole1_36 inch_10ft.lp6p
Name of runtime messeage file: uptown_pole1_36 inch_10ft.lp6r

---

Date and Time of Analysis

Date: January 17, 2013 Time: 15:05:15

Problem Title

Project Name: El Paso Streetcar

Job Number: 41010530

Client: City of El Paso

Engineer: R. Russo

Description: OCS Pole Foundations

ADDENDUM 2 - JULY 14, 2015

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:
- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments	=	100	
- Maximum number of iterations allowed	=	500	
- Deflection tolerance for convergence	=	1.0000E-05	in
- Maximum allowable deflection	=	100.0000	in

Pile Response Output Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 10.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	36.0000000
2	10.000000	36.0000000

Input Structural Properties:

Pile Section No. 1:

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uptown_pole1_36 inch_10ft

```
   Section Type                                        =    Elastic Pile
   Cross-sectional Shape                               =        Circular
   Section Length                                      =     10.00000000 ft
   Top Width                                           =     36.00000000 in
   Bottom Width                                        =     36.00000000 in
   Top Area                                            =   1017.87601976 Sq. in
   Bottom Area                                         =   1017.87601976 Sq. in
   Moment of Inertia at Top                            =          82448. in^4
   Moment of Inertia at Bottom                         =          82448. in^4
   Elastic Modulus                                     =        3604997. lbs/in^2


--------------------------------------------------------------------------------
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                     =        0.000 degrees
                                                       =        0.000 radians

Pile Batter Angle                                      =        0.000 degrees
                                                       =        0.000 radians



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer           =       0.0000 ft
   Distance from top of pile to bottom of layer        =      3.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Undrained cohesion at top of layer                  =      1.00000 psf
   Undrained cohesion at bottom of layer               =      1.00000 psf
   Epsilon-50 at top of layer                          =      0.02000
   Epsilon-50 at bottom of layer                       =      0.02000


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =      3.00000 ft
   Distance from top of pile to bottom of layer        =     15.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Friction angle at top of layer                      =     33.00000 deg.
   Friction angle at bottom of layer                   =     33.00000 deg.
   Subgrade k at top of layer                          =    140.00000 pci
   Subgrade k at bottom of layer                       =    140.00000 pci


Layer 3 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer           =     15.00000 ft
   Distance from top of pile to bottom of layer        =     25.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Undrained cohesion at top of layer                  =   3000.00000 psf
```

ADDENDUM 2 - JULY 14, 2015


```
   Undrained cohesion at bottom of layer                =   3000.00000 psf
   Epsilon-50 at top of layer                           =      0.00500
   Epsilon-50 at bottom of layer                        =      0.00500
   Subgrade k at top of layer                           =   1000.00000 pci
   Subgrade k at bottom of layer                        =   1000.00000 pci


   (Depth of lowest soil layer extends   15.00 ft below pile tip)


--------------------------------------------------------------------------------
                           Summary of Soil Properties
--------------------------------------------------------------------------------

                      Layer                      Layer      Effective    Undrained
Angle of      Strain
Layer               Soil Type                   Depth       Unit Wt.    Cohesion
Friction      Factor        kpy
 Num.         (p-y Curve Criteria)               ft           pcf          psf
   deg.     Epsilon 50      pci
-----   ----------------------------------   ----------   ----------   ----------
----------   ----------   ----------
  1     Soft Clay                                  0.00      120.000        1.000
   --          0.02000       --
                                                  3.000      120.000        1.000
   --          0.02000       --
  2     Sand (Reese, et al.)                       3.000      120.000       --
   33.000       --          140.000
                                                 15.000      120.000       --
   33.000       --          140.000
  3     Stiff Clay w/o Free Water, using k        15.000      120.000     3000.000
   --          0.00500     1000.000
                                                 25.000      120.000     3000.000
   --          0.00500     1000.000


--------------------------------------------------------------------------------
                                   Loading Type
--------------------------------------------------------------------------------

Static loading criteria were used when computing p-y curves for all analyses.


--------------------------------------------------------------------------------
               Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------

Number of loads specified = 2

Load    Load         Condition                Condition            Axial Thrust
     Compute
 No.    Type             1                        2                 Force, lbs
Top y vs. Pile Length
-----   ----   --------------------   ------------------------   ----------------
---------------------
   1     1     V =   3000.00000 lbs   M =      348000. in-lbs         0.0000000
       Yes
   2     1     V =   4500.00000 lbs   M =      522000. in-lbs         0.0000000
       Yes
```

ADDENDUM 2 - JULY 14, 2015

uptown_pole1_36 inch_10ft

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

---

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 3000.000 lbs
Applied moment at pile head = 348000.000 in-lbs
Axial thrust load on pile head = 0.000 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. Lat. Load lb/inch	Distrib. p lb/in
0.00	0.3333	348000.	3000.0000	-0.003601	75.9752	2.972E+11	-0.2137	0.3848	0.000
0.10000	0.3290	351600.	2999.4896	-0.003600	76.7611	2.972E+11	-0.6385	2.3287	0.000
0.200	0.3247	355199.	2998.7242	-0.003598	77.5468	2.972E+11	-0.6357	2.3493	0.000
0.300	0.3204	358797.	2997.9631	-0.003597	78.3323	2.972E+11	-0.6328	2.3704	0.000
0.400	0.3161	362394.	2997.2054	-0.003595	79.1177	2.972E+11	-0.6300	2.3919	0.000
0.500	0.3117	365990.	2996.4512	-0.003594	79.9028	2.972E+11	-0.6271	2.4139	0.000
0.600	0.3074	369585.	2995.7004	-0.003592	80.6877	2.972E+11	-0.6242	2.4364	0.000
0.700	0.3031	373180.	2994.9532	-0.003591	81.4724	2.972E+11	-0.6213	2.4595	0.000
0.800	0.2988	376773.	2994.2095	-0.003589	82.2570	2.972E+11	-0.6183	2.4831	0.000
0.900	0.2945	380366.	2993.4693	-0.003588	83.0413	2.972E+11	-0.6153	2.5072	0.000
1.000	0.2902	383958.	2992.7327	-0.003586	83.8254	2.972E+11			

ADDENDUM 2 - JULY 14, 2015


```
-0.6123     2.5319      0.000
     1.100      0.2859     387548.  2991.9998  -0.003585    84.6094  2.972E+11
-0.6093     2.5573      0.000
     1.200      0.2816     391138.  2991.2705  -0.003583    85.3932  2.972E+11
-0.6062     2.5833      0.000
     1.300      0.2773     394727.  2990.5449  -0.003582    86.1767  2.972E+11
-0.6031     2.6099      0.000
     1.400      0.2730     398316.  2989.8231  -0.003580    86.9601  2.972E+11
-0.6000     2.6372      0.000
     1.500      0.2687     401903.  2989.1051  -0.003578    87.7433  2.972E+11
-0.5968     2.6652      0.000
     1.600      0.2644     405490.  2988.3908  -0.003577    88.5263  2.972E+11
-0.5936     2.6940      0.000
     1.700      0.2601     409075.  2987.6804  -0.003575    89.3091  2.972E+11
-0.5904     2.7235      0.000
     1.800      0.2558     412660.  2986.9739  -0.003573    90.0917  2.972E+11
-0.5871     2.7539      0.000
     1.900      0.2515     416244.  2986.2714  -0.003572    90.8742  2.972E+11
-0.5838     2.7851      0.000
     2.000      0.2473     419827.  2985.5728  -0.003570    91.6564  2.972E+11
-0.5805     2.8172      0.000
     2.100      0.2430     423409.  2984.8783  -0.003568    92.4385  2.972E+11
-0.5771     2.8502      0.000
     2.200      0.2387     426991.  2984.1878  -0.003567    93.2204  2.972E+11
-0.5737     2.8842      0.000
     2.300      0.2344     430571.  2983.5015  -0.003565    94.0021  2.972E+11
-0.5702     2.9192      0.000
     2.400      0.2301     434151.  2982.8193  -0.003563    94.7837  2.972E+11
-0.5668     2.9552      0.000
     2.500      0.2259     437730.  2982.1413  -0.003561    95.5650  2.972E+11
-0.5632     2.9924      0.000
     2.600      0.2216     441308.  2981.4675  -0.003560    96.3462  2.972E+11
-0.5597     3.0307      0.000
     2.700      0.2173     444886.  2980.7981  -0.003558    97.1272  2.972E+11
-0.5560     3.0703      0.000
     2.800      0.2131     448462.  2980.1331  -0.003556    97.9081  2.972E+11
-0.5524     3.1112      0.000
     2.900      0.2088     452038.  2979.4725  -0.003554    98.6887  2.972E+11
-0.5487     3.1534      0.000
     3.000      0.2045     455613.  2958.8455  -0.003552    99.4692  2.972E+11
-33.8297   198.4895      0.000
     3.100      0.2003     459139.  2908.6840  -0.003550   100.2391  2.972E+11
-49.7729   298.2482      0.000
     3.200      0.1960     462594.  2839.2773  -0.003549   100.9933  2.972E+11
-65.9049   403.4964      0.000
     3.300      0.1917     465953.  2750.4238  -0.003547   101.7267  2.972E+11
-82.1844   514.3380      0.000
     3.400      0.1875     469195.  2641.9711  -0.003545   102.4344  2.972E+11
-98.5701   630.8851      0.000
     3.500      0.1832     472294.  2513.8167  -0.003543   103.1110  2.972E+11
-115.0204   753.2590      0.000
     3.600      0.1790     475228.  2365.9083  -0.003541   103.7515  2.972E+11
-131.4937   881.5905      0.000
     3.700      0.1747     477972.  2198.2433  -0.003539   104.3507  2.972E+11
-147.9479  1016.0217      0.000
     3.800      0.1705     480504.  2010.8698  -0.003537   104.9034  2.972E+11
-164.3412  1156.7069      0.000
     3.900      0.1662     482798.  1803.8864  -0.003535   105.4043  2.972E+11
-180.6312  1303.8142      0.000
     4.000      0.1620     484833.  1577.4425  -0.003533   105.8485  2.972E+11
-196.7753  1457.5271      0.000
     4.100      0.1578     486584.  1331.7387  -0.003531   106.2309  2.972E+11
-212.7310  1618.0463      0.000
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ADDENDUM 2 - JULY 14, 2015


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     4.200      0.1535     488029.  1067.0270  -0.003529   106.5463  2.972E+11
-228.4552  1785.5923       0.000
     4.300      0.1493     489145.   783.5433  -0.003527   106.7899  2.972E+11
-244.0176  1961.3152       0.000
     4.400      0.1451     489910.   481.2149  -0.003525   106.9569  2.972E+11
-259.8632  2149.6042       0.000
     4.500      0.1408     490300.   160.0150  -0.003523   107.0421  2.972E+11
-275.4698  2347.1321       0.000
     4.600      0.1366     490294.  -179.7466  -0.003521   107.0407  2.972E+11
-290.7995  2554.4137       0.000
     4.700      0.1324     489869.  -537.7148  -0.003519   106.9479  2.972E+11
-305.8140  2772.0249       0.000
     4.800      0.1282     489003.  -913.4878  -0.003518   106.7590  2.972E+11
-320.4744  3000.6110       0.000
     4.900      0.1239     487676. -1306.6171  -0.003516   106.4693  2.972E+11
-334.7412  3240.8989       0.000
     5.000      0.1197     485867. -1716.6064  -0.003514   106.0743  2.972E+11
-348.5743  3493.7092       0.000
     5.100      0.1155     483556. -2142.9106  -0.003512   105.5698  2.972E+11
-361.9327  3759.9729       0.000
     5.200      0.1113     480724. -2584.9350  -0.003510   104.9515  2.972E+11
-374.7746  4040.7500       0.000
     5.300      0.1071     477353. -3042.0338  -0.003508   104.2154  2.972E+11
-387.0568  4337.2534       0.000
     5.400      0.1029     473424. -3513.5089  -0.003506   103.3576  2.972E+11
-398.7352  4650.8778       0.000
     5.500      0.0987     468920. -3998.6083  -0.003504   102.3744  2.972E+11
-409.7637  4983.2351       0.000
     5.600      0.0945     463827. -4496.5235  -0.003502   101.2625  2.972E+11
-420.0950  5336.1994       0.000
     5.700      0.0903     458129. -5006.3879  -0.003500   100.0184  2.972E+11
-429.6791  5711.9631       0.000
     5.800      0.0861     451812. -5525.9913  -0.003498    98.6393  2.972E+11
-436.3266  6083.3114       0.000
     5.900      0.0819     444866. -6045.0706  -0.003497    97.1230  2.972E+11
-428.8055  6284.9114       0.000
     6.000      0.0777     437303. -6554.2853  -0.003495    95.4719  2.972E+11
-419.8858  6486.5114       0.000
     6.100      0.0735     429136. -7051.9580  -0.003493    93.6887  2.972E+11
-409.5686  6688.1114       0.000
     6.200      0.0693     420379. -7536.4118  -0.003491    91.7769  2.972E+11
-397.8545  6889.7114       0.000
     6.300      0.0651     411048. -8005.9712  -0.003490    89.7399  2.972E+11
-384.7445  7091.3114       0.000
     6.400      0.0609     401164. -8458.9614  -0.003488    87.5820  2.972E+11
-370.2392  7292.9114       0.000
     6.500      0.0567     390747. -8893.7086  -0.003486    85.3077  2.972E+11
-354.3394  7494.5114       0.000
     6.600      0.0526     379819. -9308.5397  -0.003485    82.9220  2.972E+11
-337.0458  7696.1114       0.000
     6.700      0.0484     368406. -9701.7825  -0.003483    80.4303  2.972E+11
-318.3588  7897.7114       0.000
     6.800      0.0442     356535.    -10072.  -0.003482    77.8386  2.972E+11
-298.2792  8099.3114       0.000
     6.900      0.0400     344234.    -10417.  -0.003480    75.1531  2.972E+11
-276.8073  8300.9114       0.000
     7.000      0.0358     331535.    -10735.  -0.003479    72.3805  2.972E+11
-253.9437  8502.5114       0.000
     7.100      0.0317     318470.    -11025.  -0.003478    69.5281  2.972E+11
-229.6887  8704.1114       0.000
     7.200      0.0275     305074.    -11286.  -0.003476    66.6035  2.972E+11
-204.0426  8905.7114       0.000
     7.300      0.0233     291384.    -11514.  -0.003475    63.6148  2.972E+11
```

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```
-177.0059  9107.3114      0.000
     7.400      0.0192    277439.    -11710.  -0.003474    60.5704  2.972E+11
-148.5786  9308.9114      0.000
     7.500      0.0150    263281.    -11870.  -0.003473    57.4793  2.972E+11
-118.7609  9510.5114      0.000
     7.600      0.0108    248951.    -11994.  -0.003472    54.3509  2.972E+11
-87.5531  9712.1114      0.000
     7.700    0.006652    234496.    -12079.  -0.003471    51.1950  2.972E+11
-54.9551  9913.7114      0.000
     7.800    0.002487    219961.    -12125.  -0.003470    48.0217  2.972E+11
-20.9670     10115.      0.000
     7.900   -0.001676    205396.    -12129.  -0.003469    44.8419  2.972E+11
14.4113     10317.      0.000
     8.000   -0.005839    190851.    -12089.  -0.003468    41.6666  2.972E+11
51.1798     10519.      0.000
     8.100     -0.0100    176381.    -12005.  -0.003468    38.5074  2.972E+11
89.3387     10720.      0.000
     8.200     -0.0142    162039.    -11874.  -0.003467    35.3763  2.972E+11
128.8882     10922.      0.000
     8.300     -0.0183    147883.    -11695.  -0.003466    32.2857  2.972E+11
169.8284     11123.      0.000
     8.400     -0.0225    133971.    -11466.  -0.003466    29.2485  2.972E+11
212.1596     11325.      0.000
     8.500     -0.0266    120365.    -11185.  -0.003465    26.2780  2.972E+11
255.8821     11527.      0.000
     8.600     -0.0308    107127.    -10851.  -0.003465    23.3879  2.972E+11
300.9962     11728.      0.000
     8.700     -0.0350     94323.    -10462.  -0.003464    20.5925  2.972E+11
347.5023     11930.      0.000
     8.800     -0.0391     82019.    -10016.  -0.003464    17.9063  2.972E+11
395.4007     12131.      0.000
     8.900     -0.0433     70284. -9511.9765  -0.003464    15.3444  2.972E+11
444.6918     12333.      0.000
     9.000     -0.0474     59190. -8947.9359  -0.003464    12.9223  2.972E+11
495.3760     12535.      0.000
     9.100     -0.0516     48809. -8322.2381  -0.003463    10.6560  2.972E+11
547.4536     12736.      0.000
     9.200     -0.0557     39217. -7633.2108  -0.003463     8.5618  2.972E+11
600.9252     12938.      0.000
     9.300     -0.0599     30489. -6879.1810  -0.003463     6.6564  2.972E+11
655.7911     13139.      0.000
     9.400     -0.0640     22707. -6058.4753  -0.003463     4.9573  2.972E+11
712.0516     13341.      0.000
     9.500     -0.0682     15949. -5169.4200  -0.003463     3.4820  2.972E+11
769.7072     13543.      0.000
     9.600     -0.0724     10300. -4210.3409  -0.003463     2.2487  2.972E+11
828.7580     13744.      0.000
     9.700     -0.0765  5844.2707 -3199.4615  -0.003463     1.2759  2.972E+11
856.0410     13426.      0.000
     9.800     -0.0807  2621.2664 -2158.9276  -0.003463     0.5723  2.972E+11
878.1821     13063.      0.000
     9.900     -0.0848   662.8443 -1092.1943  -0.003463     0.1447  2.972E+11
899.7067     12728.      0.000
    10.000     -0.0890      0.000      0.000  -0.003463      0.000  2.972E+11
920.6171  6207.8075      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

```
Pile-head deflection              =      0.3333218 inches
Computed slope at pile head       =     -0.0036010 radians
```

ADDENDUM 2 - JULY 14, 2015

uptown_pole1_36 inch_10ft

```
Maximum bending moment           =        490300. inch-lbs
Maximum shear force              =        -12129. lbs
Depth of maximum bending moment  =     54.0000000 inches below pile head
Depth of maximum shear force     =     94.8000000 inches below pile head
Number of iterations             =             14
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =           3000. lbs
Moment     =         348000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
10.0000	0.3333218	490300.	-12129.
9.5000	0.5188273	488288.	-13652.
9.0000	0.9591156	485395.	-15504.
8.5000	2.0414488	481503.	-17313.
8.0000	4.9744797	479054.	-19231.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                              =        4500.000 lbs
Applied moment at pile head                           =      522000.000 in-lbs
Axial thrust load on pile head                        =           0.000 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. Lat. Load lb/inch	Distrib. p lb/in
0.00	0.9174	522000.	4500.0000	-0.009755	113.9628	2.972E+11	-0.2995	0.1959	0.000
0.10000	0.9057	527400.	4499.2829	-0.009753	115.1417	2.972E+11	-0.8948	1.1856	0.000
0.200	0.8940	532798.	4498.2120	-0.009750	116.3203	2.972E+11	-0.8909	1.1959	0.000
0.300	0.8823	538195.	4497.1452	-0.009748	117.4986	2.972E+11	-0.8870	1.2065	0.000
0.400	0.8706	543591.	4496.0832	-0.009746	118.6766	2.972E+11	-0.8831	1.2173	0.000
0.500	0.8589	548986.	4495.0259	-0.009744	119.8544	2.972E+11	-0.8791	1.2283	0.000
0.600	0.8472	554379.	4493.9734	-0.009742	121.0319	2.972E+11			

ADDENDUM 2 - JULY 14, 2015


```
-0.8751     1.2396      0.000
     0.700      0.8355     559772.  4492.9257  -0.009739   122.2091  2.972E+11
-0.8711     1.2511      0.000
     0.800      0.8238     565163.  4491.8829  -0.009737   123.3860  2.972E+11
-0.8670     1.2629      0.000
     0.900      0.8121     570552.  4490.8450  -0.009735   124.5627  2.972E+11
-0.8629     1.2750      0.000
     1.000      0.8004     575941.  4489.8121  -0.009732   125.7391  2.972E+11
-0.8587     1.2873      0.000
     1.100      0.7888     581328.  4488.7842  -0.009730   126.9152  2.972E+11
-0.8545     1.3000      0.000
     1.200      0.7771     586714.  4487.7613  -0.009728   128.0910  2.972E+11
-0.8503     1.3130      0.000
     1.300      0.7654     592098.  4486.7436  -0.009725   129.2666  2.972E+11
-0.8460     1.3263      0.000
     1.400      0.7537     597482.  4485.7310  -0.009723   130.4420  2.972E+11
-0.8417     1.3400      0.000
     1.500      0.7421     602864.  4484.7236  -0.009721   131.6170  2.972E+11
-0.8373     1.3540      0.000
     1.600      0.7304     608245.  4483.7215  -0.009718   132.7918  2.972E+11
-0.8329     1.3684      0.000
     1.700      0.7188     613625.  4482.7247  -0.009716   133.9663  2.972E+11
-0.8284     1.3831      0.000
     1.800      0.7071     619004.  4481.7333  -0.009713   135.1406  2.972E+11
-0.8239     1.3983      0.000
     1.900      0.6954     624381.  4480.7473  -0.009711   136.3146  2.972E+11
-0.8194     1.4139      0.000
     2.000      0.6838     629757.  4479.7669  -0.009708   137.4884  2.972E+11
-0.8148     1.4299      0.000
     2.100      0.6721     635133.  4478.7919  -0.009706   138.6619  2.972E+11
-0.8101     1.4463      0.000
     2.200      0.6605     640507.  4477.8226  -0.009703   139.8351  2.972E+11
-0.8054     1.4633      0.000
     2.300      0.6489     645879.  4476.8589  -0.009700   141.0081  2.972E+11
-0.8007     1.4807      0.000
     2.400      0.6372     651251.  4475.9011  -0.009698   142.1808  2.972E+11
-0.7958     1.4987      0.000
     2.500      0.6256     656622.  4474.9490  -0.009695   143.3533  2.972E+11
-0.7910     1.5173      0.000
     2.600      0.6139     661991.  4474.0027  -0.009693   144.5256  2.972E+11
-0.7860     1.5364      0.000
     2.700      0.6023     667359.  4473.0625  -0.009690   145.6975  2.972E+11
-0.7810     1.5561      0.000
     2.800      0.5907     672726.  4472.1283  -0.009687   146.8693  2.972E+11
-0.7760     1.5764      0.000
     2.900      0.5791     678092.  4471.2002  -0.009684   148.0408  2.972E+11
-0.7709     1.5974      0.000
     3.000      0.5674     683457.  4444.2384  -0.009682   149.2120  2.972E+11
-44.1654    93.3979      0.000
     3.100      0.5558     688758.  4378.6849  -0.009679   150.3694  2.972E+11
-65.0906   140.5256      0.000
     3.200      0.5442     693966.  4287.8280  -0.009676   151.5063  2.972E+11
-86.3374   190.3734      0.000
     3.300      0.5326     699049.  4171.3121  -0.009673   152.6161  2.972E+11
-107.8558   243.0053      0.000
     3.400      0.5210     703977.  4028.8414  -0.009670   153.6920  2.972E+11
-129.5953   298.4899      0.000
     3.500      0.5094     708718.  3860.1815  -0.009668   154.7271  2.972E+11
-151.5047   356.9009      0.000
     3.600      0.4978     713242.  3665.1592  -0.009665   155.7146  2.972E+11
-173.5326   418.3178      0.000
     3.700      0.4862     717515.  3443.6632  -0.009662   156.6475  2.972E+11
-195.6273   482.8262      0.000
```

ADDENDUM 2 - JULY 14, 2015

3.800	0.4746	721506.	3195.6452	-0.009659	157.5189	2.972E+11	-217.7362	550.5189
3.900	0.4630	725184.	2921.1196	-0.009656	158.3219	2.972E+11	-239.8064	621.4963
4.000	0.4514	728517.	2620.1651	-0.009653	159.0495	2.972E+11	-261.7845	695.8674
4.100	0.4399	731473.	2292.9246	-0.009650	159.6948	2.972E+11	-283.6162	773.7509
4.200	0.4283	734020.	1939.6068	-0.009647	160.2509	2.972E+11	-305.2469	855.2763
4.300	0.4167	736128.	1560.4438	-0.009644	160.7111	2.972E+11	-326.6913	940.7879
4.400	0.4051	737765.	1155.5047	-0.009641	161.0685	2.972E+11	-348.2072	1031.3883
4.500	0.3936	738901.	724.9114	-0.009638	161.3165	2.972E+11	-369.4484	1126.4684
4.600	0.3820	739505.	269.0233	-0.009635	161.4484	2.972E+11	-390.3652	1226.2765
4.700	0.3704	739547.	-211.7402	-0.009632	161.4575	2.972E+11	-410.9073	1331.0895
4.800	0.3589	738997.	-716.8988	-0.009629	161.3374	2.972E+11	-431.0236	1441.2169
4.900	0.3473	737826.	-1245.9102	-0.009626	161.0819	2.972E+11	-450.6621	1557.0065
5.000	0.3358	736007.	-1798.1694	-0.009623	160.6846	2.972E+11	-469.7700	1678.8495
5.100	0.3242	733511.	-2373.0071	-0.009620	160.1397	2.972E+11	-488.2929	1807.1886
5.200	0.3127	730311.	-2969.6881	-0.009617	159.4412	2.972E+11	-506.1754	1942.5259
5.300	0.3012	726383.	-3587.4095	-0.009614	158.5837	2.972E+11	-523.3604	2085.4341
5.400	0.2896	721702.	-4225.2993	-0.009612	157.5616	2.972E+11	-539.7892	2236.5694
5.500	0.2781	716243.	-4882.4132	-0.009609	156.3697	2.972E+11	-555.4007	2396.6869
5.600	0.2666	709984.	-5557.7326	-0.009606	155.0033	2.972E+11	-570.1316	2566.6611
5.700	0.2550	702904.	-6250.1609	-0.009603	153.4577	2.972E+11	-583.9156	2747.5105
5.800	0.2435	694983.	-6958.5892	-0.009600	151.7285	2.972E+11	-596.7981	2940.9952
5.900	0.2320	686203.	-7682.1678	-0.009597	149.8116	2.972E+11	-609.1663	3150.9932
6.000	0.2205	676546.	-8419.9230	-0.009595	147.7033	2.972E+11	-620.4256	3376.8468
6.100	0.2090	665996.	-9170.4736	-0.009592	145.3998	2.972E+11	-630.4921	3620.6862
6.200	0.1975	654537.	-9932.3338	-0.009589	142.8982	2.972E+11	-639.2750	3885.0929
6.300	0.1859	642158.	-10704.	-0.009587	140.1956	2.972E+11	-646.6741	4173.2286
6.400	0.1744	628848.	-11483.	-0.009584	137.2897	2.972E+11	-652.5788	4489.0112
6.500	0.1629	614598.	-12269.	-0.009581	134.1787	2.972E+11	-656.8642	4837.3613
6.600	0.1515	599402.	-13059.	-0.009579	130.8611	2.972E+11	-659.3884	5224.5526
6.700	0.1400	583256.	-13850.	-0.009577	127.3363	2.972E+11	-659.9868	5658.7243
6.800	0.1285	566161.	-14642.	-0.009574	123.6039	2.972E+11	-658.4655	6150.6481
6.900	0.1170	548117.	-15429.	-0.009572	119.6646	2.972E+11		

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```
-654.5910  6714.9178      0.000
     7.000      0.1055    529130.    -16211.  -0.009570   115.5194  2.972E+11
-648.0760  7371.8599      0.000
     7.100      0.0940    509210.    -16983.  -0.009568   111.1705  2.972E+11
-638.5564  8150.7450      0.000
     7.200      0.0825    488371.    -17734.  -0.009566   106.6209  2.972E+11
-612.5041  8905.7114      0.000
     7.300      0.0711    466650.    -18425.  -0.009564   101.8787  2.972E+11
-539.2598  9107.3114      0.000
     7.400      0.0596    444152.    -19026.  -0.009562    96.9670  2.972E+11
-462.1766  9308.9114      0.000
     7.500      0.0481    420988.    -19532.  -0.009560    91.9100  2.972E+11
-381.2547  9510.5114      0.000
     7.600      0.0366    397276.    -19938.  -0.009559    86.7331  2.972E+11
-296.4942  9712.1114      0.000
     7.700      0.0252    373136.    -20241.  -0.009557    81.4630  2.972E+11
-207.8953  9913.7114      0.000
     7.800      0.0137    348698.    -20435.  -0.009556    76.1275  2.972E+11
-115.4579     10115.      0.000
     7.900   0.002231     324093.    -20516.  -0.009554    70.7558  2.972E+11
-19.1819     10317.       0.000
     8.000  -0.009233     299460.    -20479.  -0.009553    65.3780  2.972E+11
80.9329     10519.      0.000
     8.100    -0.0207     274944.    -20319.  -0.009552    60.0256  2.972E+11
184.8867     10720.       0.000
     8.200    -0.0322     250694.    -20033.  -0.009551    54.7314  2.972E+11
292.6799     10922.       0.000
     8.300    -0.0436     226866.    -19614.  -0.009550    49.5292  2.972E+11
404.3129     11123.       0.000
     8.400    -0.0551     203620.    -19060.  -0.009549    44.4541  2.972E+11
519.7862     11325.       0.000
     8.500    -0.0665     181122.    -18365.  -0.009548    39.5425  2.972E+11
639.1003     11527.       0.000
     8.600    -0.0780     159545.    -17524.  -0.009547    34.8317  2.972E+11
762.2558     11728.       0.000
     8.700    -0.0894     139065.    -16579.  -0.009547    30.3606  2.972E+11
811.6501     10889.       0.000
     8.800    -0.1009     119754.    -15580.  -0.009546    26.1446  2.972E+11
853.5415     10151.       0.000
     8.900    -0.1124     101672.    -14531.  -0.009546    22.1970  2.972E+11
895.7184  9566.1910       0.000
     9.000    -0.1238      84880.    -13432.  -0.009546    18.5310  2.972E+11
936.4108  9075.5556       0.000
     9.100    -0.1353      69436.    -12284.  -0.009545    15.1593  2.972E+11
975.8162  8656.6246       0.000
     9.200    -0.1467      55398.    -11090.  -0.009545    12.0945  2.972E+11
1014.0798  8293.7831      0.000
     9.300    -0.1582      42820. -9850.9945  -0.009545     9.3484  2.972E+11
1051.3091  7975.6582      0.000
     9.400    -0.1696      31756. -8567.6581  -0.009545     6.9329  2.972E+11
1087.5848  7693.7569      0.000
     9.500    -0.1811      22257. -7241.3272  -0.009545     4.8592  2.972E+11
1122.9668  7441.6006      0.000
     9.600    -0.1925      14376. -5873.0474  -0.009544     3.1387  2.972E+11
1157.4996  7214.1552      0.000
     9.700    -0.2040  8162.1650 -4463.8184  -0.009544     1.7820  2.972E+11
1191.2154  7007.4467      0.000
     9.800    -0.2154  3663.2581 -3014.6070  -0.009544     0.7998  2.972E+11
1224.1369  6818.2928      0.000
     9.900    -0.2269   927.1082 -1526.3575  -0.009544     0.2024  2.972E+11
1256.2789  6644.1134      0.000
    10.000    -0.2384      0.000      0.000  -0.009544      0.000  2.972E+11
1287.6503  3241.3965      0.000
```

ADDENDUM 2 - JULY 14, 2015

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      0.9173608 inches
Computed slope at pile head      =     -0.0097547 radians
Maximum bending moment           =        739547. inch-lbs
Maximum shear force              =        -20516. lbs
Depth of maximum bending moment  =     56.4000000 inches below pile head
Depth of maximum shear force     =     94.8000000 inches below pile head
Number of iterations             =             28
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =           4500. lbs
Moment     =         522000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
10.0000	0.9173608	739547.	-20516.
9.5000	1.7127294	734190.	-22572.
9.0000	3.3649963	729355.	-24420.
8.5000	21.2604001	728264.	-29901.

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type	Pile-head Shear V(lbs)	Pile-head Condition 1 or Pile-head y(inches)	Pile-head Condition 2 in-lb, rad., or Rotation in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs
				radians			

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```
                              uptown_pole1_36 inch_10ft
  1     1   V =  3000.0000  M =    348000.      0.0000000     0.33332178
490300.        -12129.    -0.00360101
  2     1   V =  4500.0000  M =    522000.      0.0000000     0.91736084
739547.        -20516.    -0.00975466

The analysis ended normally.
```

ADDENDUM 2 - JULY 14, 2015

uptown_pole2_36 inch_12ft

==========

LPile Plus for Windows, Version 2012-06.035

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

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URS
URS Austin

Serial Number of Security Device: 500126253
Company Name Stored in Security Device: URS Corporation

Files Used for Analysis

Path to file locations: P:\AUS Geotech\Projects\41010530.052 City of El Paso\OCS Design\LPILE runs_RAR\
Name of input data file: uptown_pole2_36 inch_12ft.lp6d
Name of output report file: uptown_pole2_36 inch_12ft.lp6o
Name of plot output file: uptown_pole2_36 inch_12ft.lp6p
Name of runtime messeage file: uptown_pole2_36 inch_12ft.lp6r

---

Date and Time of Analysis

Date: January 17, 2013 Time: 15:22:12

Problem Title

Project Name: El Paso Streetcar

Job Number: 41010530

Client: City of El Paso

Engineer: R. Russo

Description: OCS Pole Foundations

ADDENDUM 2 - JULY 14, 2015

uptown_pole2_36 inch_12ft

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:
- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments	=	100	
- Maximum number of iterations allowed	=	500	
- Deflection tolerance for convergence	=	1.0000E-05	in
- Maximum allowable deflection	=	100.0000	in

Pile Response Output Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 12.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	36.0000000
2	12.000000	36.0000000

Input Structural Properties:

Pile Section No. 1:

ADDENDUM 2 - JULY 14, 2015

uptown_pole2_36 inch_12ft

```
   Section Type                                        =    Elastic Pile
   Cross-sectional Shape                               =        Circular
   Section Length                                      =     12.00000000 ft
   Top Width                                           =     36.00000000 in
   Bottom Width                                        =     36.00000000 in
   Top Area                                            =   1017.87601976 Sq. in
   Bottom Area                                         =   1017.87601976 Sq. in
   Moment of Inertia at Top                            =          82448. in^4
   Moment of Inertia at Bottom                         =          82448. in^4
   Elastic Modulus                                     =        3604997. lbs/in^2


--------------------------------------------------------------------------------
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                     =        0.000 degrees
                                                       =        0.000 radians

Pile Batter Angle                                      =        0.000 degrees
                                                       =        0.000 radians



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer           =       0.0000 ft
   Distance from top of pile to bottom of layer        =      3.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Undrained cohesion at top of layer                  =      1.00000 psf
   Undrained cohesion at bottom of layer               =      1.00000 psf
   Epsilon-50 at top of layer                          =      0.02000
   Epsilon-50 at bottom of layer                       =      0.02000


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =      3.00000 ft
   Distance from top of pile to bottom of layer        =     15.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Friction angle at top of layer                      =     33.00000 deg.
   Friction angle at bottom of layer                   =     33.00000 deg.
   Subgrade k at top of layer                          =    140.00000 pci
   Subgrade k at bottom of layer                       =    140.00000 pci


Layer 3 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer           =     15.00000 ft
   Distance from top of pile to bottom of layer        =     25.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Undrained cohesion at top of layer                  =   3000.00000 psf
```

ADDENDUM 2 - JULY 14, 2015

uptown_pole2_36 inch_12ft

```
   Undrained cohesion at bottom of layer                =   3000.00000 psf
   Epsilon-50 at top of layer                           =      0.00500
   Epsilon-50 at bottom of layer                        =      0.00500
   Subgrade k at top of layer                           =   1000.00000 pci
   Subgrade k at bottom of layer                        =   1000.00000 pci


   (Depth of lowest soil layer extends   13.00 ft below pile tip)


--------------------------------------------------------------------------------
                           Summary of Soil Properties
--------------------------------------------------------------------------------

                      Layer                      Layer      Effective    Undrained
Angle of      Strain
Layer               Soil Type                   Depth       Unit Wt.    Cohesion
Friction      Factor        kpy
 Num.         (p-y Curve Criteria)               ft           pcf          psf
   deg.     Epsilon 50      pci
-----   ----------------------------------   ----------   ----------   ----------
----------   ----------   ----------
  1     Soft Clay                                  0.00      120.000        1.000
   --          0.02000       --
                                                  3.000      120.000        1.000
   --          0.02000       --
  2     Sand (Reese, et al.)                       3.000      120.000       --
   33.000       --          140.000
                                                 15.000      120.000       --
   33.000       --          140.000
  3     Stiff Clay w/o Free Water, using k        15.000      120.000     3000.000
   --          0.00500     1000.000
                                                 25.000      120.000     3000.000
   --          0.00500     1000.000


--------------------------------------------------------------------------------
                                   Loading Type
--------------------------------------------------------------------------------

Static loading criteria were used when computing p-y curves for all analyses.


--------------------------------------------------------------------------------
               Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------

Number of loads specified = 2

Load    Load         Condition                Condition            Axial Thrust
     Compute
 No.    Type             1                        2                 Force, lbs
Top y vs. Pile Length
-----   ----   --------------------   ------------------------   ----------------
---------------------
   1     1     V =   3000.00000 lbs   M =      564000. in-lbs         0.0000000
       Yes
   2     1     V =   4500.00000 lbs   M =      846000. in-lbs         0.0000000
       Yes
```

ADDENDUM 2 - JULY 14, 2015

uptown_pole2_36 inch_12ft

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

---

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 3000.000 lbs
Applied moment at pile head = 564000.000 in-lbs
Axial thrust load on pile head = 0.000 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Soil Spr. Distrib. p lb/in	Es*h lb/inch	Lat. Load lb/inch
0.00	0.1825	564000.	3000.0000	-0.001785	123.1322	2.972E+11	-0.1749	0.6899	0.000
0.120	0.1799	568320.	2999.4983	-0.001782	124.0753	2.972E+11	-0.5221	4.1785	0.000
0.240	0.1774	572639.	2998.7481	-0.001779	125.0182	2.972E+11	-0.5196	4.2187	0.000
0.360	0.1748	576956.	2998.0017	-0.001776	125.9608	2.972E+11	-0.5171	4.2598	0.000
0.480	0.1723	581273.	2997.2588	-0.001773	126.9032	2.972E+11	-0.5146	4.3018	0.000
0.600	0.1697	585588.	2996.5197	-0.001771	127.8454	2.972E+11	-0.5120	4.3448	0.000
0.720	0.1672	589903.	2995.7842	-0.001768	128.7873	2.972E+11	-0.5095	4.3889	0.000
0.840	0.1646	594216.	2995.0525	-0.001765	129.7290	2.972E+11	-0.5069	4.4340	0.000
0.960	0.1621	598529.	2994.3245	-0.001762	130.6705	2.972E+11	-0.5042	4.4802	0.000
1.080	0.1595	602840.	2993.6003	-0.001759	131.6117	2.972E+11	-0.5016	4.5275	0.000
1.200	0.1570	607150.	2992.8799	-0.001756	132.5527	2.972E+11			

ADDENDUM 2 - JULY 14, 2015


```
-0.4989     4.5760      0.000
     1.320      0.1545    611459.  2992.1634  -0.001753   133.4935  2.972E+11
-0.4962     4.6258      0.000
     1.440      0.1520    615768.  2991.4508  -0.001750   134.4341  2.972E+11
-0.4935     4.6768      0.000
     1.560      0.1494    620075.  2990.7421  -0.001747   135.3744  2.972E+11
-0.4908     4.7292      0.000
     1.680      0.1469    624381.  2990.0374  -0.001744   136.3145  2.972E+11
-0.4880     4.7830      0.000
     1.800      0.1444    628686.  2989.3367  -0.001741   137.2544  2.972E+11
-0.4852     4.8383      0.000
     1.920      0.1419    632990.  2988.6400  -0.001738   138.1941  2.972E+11
-0.4824     4.8950      0.000
     2.040      0.1394    637293.  2987.9474  -0.001735   139.1336  2.972E+11
-0.4795     4.9534      0.000
     2.160      0.1369    641595.  2987.2589  -0.001732   140.0728  2.972E+11
-0.4767     5.0134      0.000
     2.280      0.1344    645897.  2986.5746  -0.001729   141.0118  2.972E+11
-0.4738     5.0752      0.000
     2.400      0.1319    650197.  2985.8946  -0.001726   141.9507  2.972E+11
-0.4708     5.1388      0.000
     2.520      0.1294    654496.  2985.2187  -0.001723   142.8893  2.972E+11
-0.4678     5.2043      0.000
     2.640      0.1270    658794.  2984.5472  -0.001719   143.8276  2.972E+11
-0.4648     5.2718      0.000
     2.760      0.1245    663091.  2983.8800  -0.001716   144.7658  2.972E+11
-0.4618     5.3414      0.000
     2.880      0.1220    667388.  2983.2172  -0.001713   145.7038  2.972E+11
-0.4587     5.4132      0.000
     3.000      0.1196    671683.  2961.7407  -0.001710   146.6416  2.972E+11
-29.3698   353.7222      0.000
     3.120      0.1171    675918.  2907.4555  -0.001706   147.5660  2.972E+11
-46.0262   565.9704      0.000
     3.240      0.1146    680057.  2829.0154  -0.001703   148.4696  2.972E+11
-62.9183   790.2529      0.000
     3.360      0.1122    684065.  2726.1233  -0.001700   149.3448  2.972E+11
-79.9874  1026.5798      0.000
     3.480      0.1098    687908.  2598.5661  -0.001697   150.1837  2.972E+11
-97.1753  1274.9613      0.000
     3.600      0.1073    691549.  2446.2147  -0.001693   150.9787  2.972E+11
-114.4239  1535.4078      0.000
     3.720      0.1049    694953.  2269.0235  -0.001690   151.7218  2.972E+11
-131.6751  1807.9303      0.000
     3.840      0.1024    698084.  2067.0301  -0.001686   152.4053  2.972E+11
-148.8713  2092.5404      0.000
     3.960      0.1000    700906.  1840.3550  -0.001683   153.0215  2.972E+11
-165.9551  2389.2508      0.000
     4.080      0.0976    703384.  1589.2013  -0.001680   153.5625  2.972E+11
-182.8694  2698.0758      0.000
     4.200      0.0952    705483.  1313.8541  -0.001676   154.0207  2.972E+11
-199.5573  3019.0314      0.000
     4.320      0.0928    707168.  1014.4882  -0.001673   154.3886  2.972E+11
-216.2286  3356.2698      0.000
     4.440      0.0904    708405.   690.8506  -0.001669   154.6586  2.972E+11
-233.2680  3717.1715      0.000
     4.560      0.0880    709158.   342.8277  -0.001666   154.8230  2.972E+11
-250.0972  4094.1479      0.000
     4.680      0.0856    709392.   -29.2444  -0.001663   154.8741  2.972E+11
-266.6696  4487.7031      0.000
     4.800      0.0832    709073.  -424.2059  -0.001659   154.8046  2.972E+11
-281.8880  4880.2051      0.000
     4.920      0.0808    708170.  -836.0278  -0.001656   154.6074  2.972E+11
-290.0870  5170.5091      0.000
```

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```
     5.040      0.0784     706666. -1258.9771  -0.001652   154.2789  2.972E+11
-297.3425  5460.8131      0.000
     5.160      0.0760     704544. -1691.6970  -0.001649   153.8158  2.972E+11
-303.6574  5751.1171      0.000
     5.280      0.0737     701794. -2132.8352  -0.001645   153.2152  2.972E+11
-309.0346  6041.4211      0.000
     5.400      0.0713     698402. -2581.0436  -0.001642   152.4748  2.972E+11
-313.4771  6331.7251      0.000
     5.520      0.0689     694360. -3034.9782  -0.001639   151.5924  2.972E+11
-316.9876  6622.0291      0.000
     5.640      0.0666     689661. -3493.2989  -0.001635   150.5665  2.972E+11
-319.5690  6912.3331      0.000
     5.760      0.0642     684299. -3954.6699  -0.001632   149.3959  2.972E+11
-321.2240  7202.6371      0.000
     5.880      0.0619     678272. -4417.7591  -0.001629   148.0800  2.972E+11
-321.9554  7492.9411      0.000
     6.000      0.0595     671576. -4881.2385  -0.001625   146.6182  2.972E+11
-321.7659  7783.2451      0.000
     6.120      0.0572     664214. -5343.7836  -0.001622   145.0108  2.972E+11
-320.6579  8073.5491      0.000
     6.240      0.0549     656186. -5804.0739  -0.001619   143.2583  2.972E+11
-318.6341  8363.8531      0.000
     6.360      0.0525     647498. -6260.7923  -0.001616   141.3615  2.972E+11
-315.6970  8654.1571      0.000
     6.480      0.0502     638155. -6712.6253  -0.001613   139.3217  2.972E+11
-311.8488  8944.4611      0.000
     6.600      0.0479     628166. -7158.2627  -0.001610   137.1408  2.972E+11
-307.0920  9234.7651      0.000
     6.720      0.0456     617539. -7596.3977  -0.001607   134.8209  2.972E+11
-301.4288  9525.0691      0.000
     6.840      0.0433     606288. -8025.7264  -0.001604   132.3645  2.972E+11
-294.8612  9815.3731      0.000
     6.960      0.0410     594425. -8444.9483  -0.001601   129.7746  2.972E+11
-287.3914     10106.      0.000
     7.080      0.0386     581967. -8852.7655  -0.001598   127.0547  2.972E+11
-279.0213     10396.      0.000
     7.200      0.0363     568929. -9247.8829  -0.001595   124.2084  2.972E+11
-269.7529     10686.      0.000
     7.320      0.0341     555333. -9629.0081  -0.001592   121.2400  2.972E+11
-259.5877     10977.      0.000
     7.440      0.0318     541198. -9994.8512  -0.001590   118.1540  2.972E+11
-248.5276     11267.      0.000
     7.560      0.0295     526547.    -10344.  -0.001587   114.9556  2.972E+11
-236.5740     11557.      0.000
     7.680      0.0272     511407.    -10676.  -0.001585   111.6501  2.972E+11
-223.7284     11848.      0.000
     7.800      0.0249     495802.    -10988.  -0.001582   108.2432  2.972E+11
-209.9922     12138.      0.000
     7.920      0.0226     479762.    -11280.  -0.001580   104.7413  2.972E+11
-195.3665     12428.      0.000
     8.040      0.0204     463316.    -11550.  -0.001577   101.1510  2.972E+11
-179.8525     12718.      0.000
     8.160      0.0181     446498.    -11797.  -0.001575    97.4793  2.972E+11
-163.4511     13009.      0.000
     8.280      0.0158     429341.    -12020.  -0.001573    93.7335  2.972E+11
-146.1632     13299.      0.000
     8.400      0.0136     411881.    -12217.  -0.001571    89.9216  2.972E+11
-127.9896     13589.      0.000
     8.520      0.0113     394155.    -12388.  -0.001569    86.0518  2.972E+11
-108.9309     13880.      0.000
     8.640   0.009043      376204.    -12530.  -0.001567    82.1326  2.972E+11
-88.9876      14170.      0.000
     8.760   0.006788      358067.    -12644.  -0.001566    78.1731  2.972E+11
```

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```
-68.1601     14460.      0.000
     8.880   0.004534    339790.    -12726.  -0.001564    74.1828  2.972E+11
-46.4488     14751.      0.000
     9.000   0.002284    321416.    -12777.  -0.001562    70.1715  2.972E+11
-23.8538     15041.      0.000
     9.120  3.523E-05    302993.    -12794.  -0.001561    66.1493  2.972E+11
-0.3751      15331.      0.000
     9.240  -0.002211    284569.    -12777.  -0.001559    62.1270  2.972E+11
23.9872      15621.      0.000
     9.360  -0.004456    266195.    -12724.  -0.001558    58.1156  2.972E+11
49.2334      15912.      0.000
     9.480  -0.006698    247923.    -12635.  -0.001557    54.1264  2.972E+11
75.3636      16202.      0.000
     9.600  -0.008939    229807.    -12507.  -0.001556    50.1714  2.972E+11
102.3781     16492.      0.000
     9.720    -0.0112   211904.    -12339.  -0.001555    46.2627  2.972E+11
130.2775     16783.      0.000
     9.840    -0.0134   194270.    -12131.  -0.001554    42.4130  2.972E+11
159.0623     17073.      0.000
     9.960    -0.0157   176967.    -11880.  -0.001553    38.6353  2.972E+11
188.7329     17363.      0.000
    10.080    -0.0179   160054.    -11587.  -0.001552    34.9430  2.972E+11
219.2901     17654.      0.000
    10.200    -0.0201   143597.    -11248.  -0.001551    31.3500  2.972E+11
250.7346     17944.      0.000
    10.320    -0.0224   127659.    -10864.  -0.001550    27.8705  2.972E+11
283.0672     18234.      0.000
    10.440    -0.0246   112309.    -10432.  -0.001550    24.5192  2.972E+11
316.2887     18524.      0.000
    10.560    -0.0268    97614. -9952.4026  -0.001549    21.3110  2.972E+11
350.4000     18815.      0.000
    10.680    -0.0290    83646. -9422.6252  -0.001549    18.2615  2.972E+11
385.4019     19105.      0.000
    10.800    -0.0313    70477. -8841.8032  -0.001549    15.3864  2.972E+11
421.2953     19395.      0.000
    10.920    -0.0335    58181. -8208.6521  -0.001548    12.7021  2.972E+11
458.0813     19686.      0.000
    11.040    -0.0357    46836. -7521.8860  -0.001548    10.2252  2.972E+11
495.7605     19976.      0.000
    11.160    -0.0380    36518. -6780.2180  -0.001548     7.9727  2.972E+11
534.3340     20266.      0.000
    11.280    -0.0402    27309. -5982.3597  -0.001548     5.9620  2.972E+11
573.8025     20557.      0.000
    11.400    -0.0424    19289. -5127.0218  -0.001547     4.2112  2.972E+11
614.1668     20847.      0.000
    11.520    -0.0447    12543. -4212.9138  -0.001547     2.7384  2.972E+11
655.4277     21137.      0.000
    11.640    -0.0469  7155.9138 -3238.7442  -0.001547     1.5623  2.972E+11
697.5857     21428.      0.000
    11.760    -0.0491  3215.3790 -2203.2207  -0.001547     0.7020  2.972E+11
740.6414     21718.      0.000
    11.880    -0.0513   810.6382 -1116.4511  -0.001547     0.1770  2.972E+11
768.7609     21564.      0.000
    12.000    -0.0536     0.000      0.000  -0.001547      0.000  2.972E+11
781.8656     10510.      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

```
Pile-head deflection              =      0.1824993 inches
Computed slope at pile head       =     -0.0017845 radians
```

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uptown_pole2_36 inch_12ft

```
Maximum bending moment           =        709392. inch-lbs
Maximum shear force              =        -12794. lbs
Depth of maximum bending moment  =     56.1600000 inches below pile head
Depth of maximum shear force     =    109.4400000 inches below pile head
Number of iterations             =              8
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =           3000. lbs
Moment     =         564000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
12.0000	0.1824993	709392.	-12794.
11.4000	0.2353316	708438.	-13919.
10.8000	0.3293213	706287.	-15438.
10.2000	0.5388617	703910.	-17573.
9.6000	1.0746806	700676.	-20112.
9.0000	2.4442767	696025.	-22515.
8.4000	8.2115460	694556.	-26193.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                                =        4500.000 lbs
Applied moment at pile head                             =      846000.000 in-lbs
Axial thrust load on pile head                          =           0.000 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. Lat. Load lb/inch	Distrib. p lb/in
0.00	0.3506	846000.	4500.0000	-0.003373	184.6983	2.972E+11	-0.2174	0.4464	0.000
0.120	0.3457	852480.	4499.3761	-0.003369	186.1130	2.972E+11	-0.6491	2.7035	0.000
0.240	0.3409	858958.	4498.4436	-0.003365	187.5274	2.972E+11	-0.6461	2.7291	0.000
0.360	0.3360	865435.	4497.5155	-0.003361	188.9414	2.972E+11	-0.6430	2.7552	0.000
0.480	0.3312	871911.	4496.5918	-0.003357	190.3552	2.972E+11	-0.6399	2.7820	0.000
0.600	0.3264	878385.	4495.6726	-0.003352	191.7687	2.972E+11			

ADDENDUM 2 - JULY 14, 2015


```
-0.6368     2.8094      0.000
     0.720      0.3216    884859.  4494.7580  -0.003348   193.1819  2.972E+11
-0.6336     2.8374      0.000
     0.840      0.3167    891330.  4493.8479  -0.003344   194.5948  2.972E+11
-0.6304     2.8661      0.000
     0.960      0.3119    897801.  4492.9424  -0.003339   196.0075  2.972E+11
-0.6272     2.8955      0.000
     1.080      0.3071    904270.  4492.0415  -0.003335   197.4198  2.972E+11
-0.6240     2.9256      0.000
     1.200      0.3023    910738.  4491.1453  -0.003331   198.8319  2.972E+11
-0.6207     2.9565      0.000
     1.320      0.2975    917205.  4490.2539  -0.003326   200.2437  2.972E+11
-0.6174     2.9882      0.000
     1.440      0.2927    923670.  4489.3672  -0.003322   201.6552  2.972E+11
-0.6141     3.0207      0.000
     1.560      0.2880    930134.  4488.4853  -0.003317   203.0664  2.972E+11
-0.6107     3.0540      0.000
     1.680      0.2832    936597.  4487.6083  -0.003313   204.4774  2.972E+11
-0.6073     3.0882      0.000
     1.800      0.2784    943058.  4486.7362  -0.003308   205.8880  2.972E+11
-0.6039     3.1234      0.000
     1.920      0.2737    949519.  4485.8691  -0.003304   207.2984  2.972E+11
-0.6004     3.1595      0.000
     2.040      0.2689    955978.  4485.0070  -0.003299   208.7086  2.972E+11
-0.5969     3.1966      0.000
     2.160      0.2642    962435.  4484.1499  -0.003294   210.1184  2.972E+11
-0.5934     3.2348      0.000
     2.280      0.2594    968892.  4483.2980  -0.003290   211.5280  2.972E+11
-0.5898     3.2741      0.000
     2.400      0.2547    975347.  4482.4512  -0.003285   212.9374  2.972E+11
-0.5862     3.3146      0.000
     2.520      0.2500    981801.  4481.6097  -0.003280   214.3464  2.972E+11
-0.5826     3.3562      0.000
     2.640      0.2452    988254.  4480.7734  -0.003275   215.7552  2.972E+11
-0.5789     3.3991      0.000
     2.760      0.2405    994706.  4479.9425  -0.003271   217.1638  2.972E+11
-0.5752     3.4434      0.000
     2.880      0.2358   1001157.  4479.1170  -0.003266   218.5720  2.972E+11
-0.5714     3.4891      0.000
     3.000      0.2311   1007606.  4453.5857  -0.003261   219.9800  2.972E+11
-34.8887   217.3746      0.000
     3.120      0.2264   1013983.  4389.0479  -0.003256   221.3723  2.972E+11
-54.7472   348.1723      0.000
     3.240      0.2217   1020246.  4295.6722  -0.003251   222.7397  2.972E+11
-74.9412   486.6687      0.000
     3.360      0.2171   1026354.  4173.0235  -0.003246   224.0732  2.972E+11
-95.4041   632.9073      0.000
     3.480      0.2124   1032265.  4020.7625  -0.003241   225.3635  2.972E+11
-116.0695   786.9339      0.000
     3.600      0.2077   1037934.  3838.6456  -0.003236   226.6013  2.972E+11
-136.8707   948.7968      0.000
     3.720      0.2031   1043320.  3626.5249  -0.003231   227.7771  2.972E+11
-157.7414  1118.5470      0.000
     3.840      0.1984   1048379.  3384.3483  -0.003226   228.8815  2.972E+11
-178.6150  1296.2386      0.000
     3.960      0.1938   1053067.  3112.1594  -0.003221   229.9051  2.972E+11
-199.4252  1481.9293      0.000
     4.080      0.1891   1057342.  2810.0974  -0.003216   230.8383  2.972E+11
-220.1054  1675.6806      0.000
     4.200      0.1845   1061160.  2478.3971  -0.003211   231.6719  2.972E+11
-240.5895  1877.5584      0.000
     4.320      0.1799   1064479.  2117.2212  -0.003206   232.3966  2.972E+11
-261.0437  2089.4964      0.000
```

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```
     4.440      0.1753   1067258.  1726.3790  -0.003200   233.0032  2.972E+11
-281.7927  2314.9303      0.000
     4.560      0.1707   1069451.  1305.8190  -0.003195   233.4821  2.972E+11
-302.3185  2550.5538      0.000
     4.680      0.1661   1071018.   855.9025  -0.003190   233.8242  2.972E+11
-322.5655  2796.7007      0.000
     4.800      0.1615   1071916.   377.0711  -0.003185   234.0203  2.972E+11
-342.4781  3053.7402      0.000
     4.920      0.1569   1072104.  -130.1539  -0.003180   234.0613  2.972E+11
-362.0010  3322.0822      0.000
     5.040      0.1523   1071541.  -665.1712  -0.003174   233.9384  2.972E+11
-381.0786  3602.1829      0.000
     5.160      0.1478   1070189. -1227.2997  -0.003169   233.6431  2.972E+11
-399.6554  3894.5512      0.000
     5.280      0.1432   1068007. -1815.7783  -0.003164   233.1668  2.972E+11
-417.6759  4199.7565      0.000
     5.400      0.1387   1064959. -2429.7658  -0.003159   232.5014  2.972E+11
-435.0844  4518.4379      0.000
     5.520      0.1341   1061009. -3068.3404  -0.003154   231.6390  2.972E+11
-451.8249  4851.3155      0.000
     5.640      0.1296   1056122. -3730.5001  -0.003149   230.5721  2.972E+11
-467.8413  5199.2028      0.000
     5.760      0.1250   1050265. -4415.1613  -0.003144   229.2934  2.972E+11
-483.0771  5563.0229      0.000
     5.880      0.1205   1043407. -5121.6101  -0.003139   227.7960  2.972E+11
-498.1018  5951.3122      0.000
     6.000      0.1160   1035515. -5849.2082  -0.003133   226.0732  2.972E+11
-512.4511  6361.0996      0.000
     6.120      0.1115   1026561. -6596.8423  -0.003128   224.1183  2.972E+11
-525.9296  6792.3942      0.000
     6.240      0.1070   1016516. -7363.2166  -0.003124   221.9253  2.972E+11
-538.4791  7247.0504      0.000
     6.360      0.1025   1005355. -8146.9504  -0.003119   219.4886  2.972E+11
-550.0401  7727.2204      0.000
     6.480      0.0980    993053. -8946.5764  -0.003114   216.8029  2.972E+11
-560.5516  8235.4169      0.000
     6.600      0.0935    979589. -9760.5376  -0.003109   213.8633  2.972E+11
-569.9500  8774.5926      0.000
     6.720      0.0891    964943.    -10587.  -0.003104   210.6658  2.972E+11
-578.1696  9348.2413      0.000
     6.840      0.0846    949098.    -11419.  -0.003100   207.2065  2.972E+11
-576.6138  9815.3731      0.000
     6.960      0.0801    932057.    -12239.  -0.003095   203.4862  2.972E+11
-562.3671     10106.      0.000
     7.080      0.0757    913850.    -13037.  -0.003091   199.5113  2.972E+11
-546.3690     10396.      0.000
     7.200      0.0712    894510.    -13811.  -0.003086   195.2891  2.972E+11
-528.6225     10686.      0.000
     7.320      0.0668    874075.    -14558.  -0.003082   190.8276  2.972E+11
-509.1304     10977.      0.000
     7.440      0.0624    852583.    -15276.  -0.003078   186.1355  2.972E+11
-487.8953     11267.      0.000
     7.560      0.0579    830080.    -15962.  -0.003074   181.2226  2.972E+11
-464.9198     11557.      0.000
     7.680      0.0535    806612.    -16614.  -0.003070   176.0992  2.972E+11
-440.2062     11848.      0.000
     7.800      0.0491    782232.    -17229.  -0.003066   170.7765  2.972E+11
-413.7565     12138.      0.000
     7.920      0.0447    756994.    -17804.  -0.003062   165.2666  2.972E+11
-385.5728     12428.      0.000
     8.040      0.0403    730956.    -18338.  -0.003059   159.5820  2.972E+11
-355.6567     12718.      0.000
     8.160      0.0359    704181.    -18827.  -0.003055   153.7365  2.972E+11
```

ADDENDUM 2 - JULY 14, 2015


```
-324.0099     13009.      0.000
     8.280     0.0315    676734.    -19270.  -0.003052   147.7443  2.972E+11
-290.6336     13299.      0.000
     8.400     0.0271    648684.    -19663.  -0.003049   141.6205  2.972E+11
-255.5290     13589.      0.000
     8.520     0.0227    620105.    -20004.  -0.003045   135.3810  2.972E+11
-218.6972     13880.      0.000
     8.640     0.0183    591072.    -20292.  -0.003043   129.0425  2.972E+11
-180.1389     14170.      0.000
     8.760     0.0139    561665.    -20522.  -0.003040   122.6225  2.972E+11
-139.8546     14460.      0.000
     8.880   0.009552    531969.    -20693.  -0.003037   116.1391  2.972E+11
-97.8448      14751.      0.000
     9.000   0.005180    502069.    -20802.  -0.003035   109.6115  2.972E+11
-54.1096      15041.      0.000
     9.120   0.000812    472057.    -20848.  -0.003032   103.0594  2.972E+11
-8.6491      15331.      0.000
     9.240  -0.003552    442028.    -20826.  -0.003030    96.5033  2.972E+11
38.5368      15621.      0.000
     9.360  -0.007914    412078.    -20735.  -0.003028    89.9647  2.972E+11
87.4485      15912.      0.000
     9.480    -0.0123    382310.    -20573.  -0.003026    83.4657  2.972E+11
138.0865      16202.      0.000
     9.600    -0.0166    352828.    -20337.  -0.003024    77.0292  2.972E+11
190.4514      16492.      0.000
     9.720    -0.0210    323741.    -20023.  -0.003023    70.6789  2.972E+11
244.5440      16783.      0.000
     9.840    -0.0253    295161.    -19631.  -0.003021    64.4393  2.972E+11
300.3652      17073.      0.000
     9.960    -0.0297    267203.    -19157.  -0.003020    58.3357  2.972E+11
357.9161      17363.      0.000
    10.080    -0.0340    239988.    -18599.  -0.003018    52.3942  2.972E+11
417.1978      17654.      0.000
    10.200    -0.0384    213638.    -17954.  -0.003017    46.6415  2.972E+11
478.2115      17944.      0.000
    10.320    -0.0427    188280.    -17220.  -0.003016    41.1052  2.972E+11
540.9585      18234.      0.000
    10.440    -0.0471    164044.    -16395.  -0.003016    35.8139  2.972E+11
605.4403      18524.      0.000
    10.560    -0.0514    141062.    -15476.  -0.003015    30.7967  2.972E+11
671.6582      18815.      0.000
    10.680    -0.0557    119474.    -14459.  -0.003014    26.0835  2.972E+11
739.6137      19105.      0.000
    10.800    -0.0601     99419.    -13344.  -0.003014    21.7052  2.972E+11
809.3082      19395.      0.000
    10.920    -0.0644     81043.    -12148.  -0.003013    17.6932  2.972E+11
851.8193      19039.      0.000
    11.040    -0.0688     64433.    -10906.  -0.003013    14.0669  2.972E+11
873.1072      18284.      0.000
    11.160    -0.0731     49633. -9634.3754  -0.003013    10.8358  2.972E+11
893.3417      17597.      0.000
    11.280    -0.0774     36686. -8334.1333  -0.003012     8.0092  2.972E+11
912.5502      16969.      0.000
    11.400    -0.0818     25631. -7006.9558  -0.003012     5.5957  2.972E+11
930.7519      16389.      0.000
    11.520    -0.0861     16506. -5654.2840  -0.003012     3.6035  2.972E+11
947.9589      15851.      0.000
    11.640    -0.0905  9346.3346 -4277.5455  -0.003012     2.0405  2.972E+11
964.1780      15349.      0.000
    11.760    -0.0948  4186.3289 -2878.1608  -0.003012     0.9140  2.972E+11
979.4117      14879.      0.000
    11.880    -0.0991  1057.2314 -1453.5864  -0.003012     0.2308  2.972E+11
999.1638      14514.      0.000
```

ADDENDUM 2 - JULY 14, 2015

uptown_pole2_36 inch_12ft

```
    12.000    -0.1035      0.000      0.000  -0.003012      0.000  2.972E+11
1019.7062  7095.9601      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      0.3505950 inches
Computed slope at pile head      =     -0.0033732 radians
Maximum bending moment           =       1072104. inch-lbs
Maximum shear force              =        -20848. lbs
Depth of maximum bending moment  =     59.0400000 inches below pile head
Depth of maximum shear force     =    109.4400000 inches below pile head
Number of iterations             =             17
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =           4500. lbs
Moment     =         846000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
12.0000	0.3505950	1072104.	-20848.
11.4000	0.5320680	1068797.	-23244.
10.8000	0.9186429	1063330.	-25934.
10.2000	1.7899962	1057419.	-28699.
9.6000	3.7926061	1053408.	-31480.

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 Shear V(lbs) or Pile-head y(inches)	Pile-head Condition 2 in-lb, rad., or Rotation in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs

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```
                                uptown_pole2_36 inch_12ft
          lbs           radians
----  ----  --------------  --------------  -------------  -------------
-------------  -------------  -------------
  1     1   V =  3000.0000  M =    564000.      0.0000000     0.18249931
709392.        -12794.    -0.00178452
  2     1   V =  4500.0000  M =    846000.      0.0000000     0.35059501
1072104.        -20848.    -0.00337323

The analysis ended normally.
```

ADDENDUM 2 - JULY 14, 2015

uptown_pole3_36 inch_15ft

==========

LPile Plus for Windows, Version 2012-06.035

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Serial Number of Security Device: 500126253
Company Name Stored in Security Device: URS Corporation

Files Used for Analysis

Path to file locations: P:\AUS Geotech\Projects\41010530.052 City of El Paso\OCS Design\LPILE runs_RAR\
Name of input data file: uptown_pole3_36 inch_15ft.lp6d
Name of output report file: uptown_pole3_36 inch_15ft.lp6o
Name of plot output file: uptown_pole3_36 inch_15ft.lp6p
Name of runtime messeage file: uptown_pole3_36 inch_15ft.lp6r

---

Date and Time of Analysis

Date: January 17, 2013 Time: 15:22:58

Problem Title

Project Name: El Paso Streetcar

Job Number: 41010530

Client: City of El Paso

Engineer: R. Russo

Description: OCS Pole Foundations

ADDENDUM 2 - JULY 14, 2015

uptown_pole3_36 inch_15ft

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:
- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments	=	100	
- Maximum number of iterations allowed	=	500	
- Deflection tolerance for convergence	=	1.0000E-05	in
- Maximum allowable deflection	=	100.0000	in

Pile Response Output Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 15.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	36.0000000
2	15.000000	36.0000000

Input Structural Properties:

Pile Section No. 1:

ADDENDUM 2 - JULY 14, 2015

uptown_pole3_36 inch_15ft

```
   Section Type                                        =    Elastic Pile
   Cross-sectional Shape                               =        Circular
   Section Length                                      =     15.00000000 ft
   Top Width                                           =     36.00000000 in
   Bottom Width                                        =     36.00000000 in
   Top Area                                            =   1017.87601976 Sq. in
   Bottom Area                                         =   1017.87601976 Sq. in
   Moment of Inertia at Top                            =          82448. in^4
   Moment of Inertia at Bottom                         =          82448. in^4
   Elastic Modulus                                     =        3604997. lbs/in^2


--------------------------------------------------------------------------------
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                     =        0.000 degrees
                                                       =        0.000 radians

Pile Batter Angle                                      =        0.000 degrees
                                                       =        0.000 radians



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer           =       0.0000 ft
   Distance from top of pile to bottom of layer        =      3.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Undrained cohesion at top of layer                  =      1.00000 psf
   Undrained cohesion at bottom of layer               =      1.00000 psf
   Epsilon-50 at top of layer                          =      0.02000
   Epsilon-50 at bottom of layer                       =      0.02000


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =      3.00000 ft
   Distance from top of pile to bottom of layer        =     15.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Friction angle at top of layer                      =     33.00000 deg.
   Friction angle at bottom of layer                   =     33.00000 deg.
   Subgrade k at top of layer                          =    140.00000 pci
   Subgrade k at bottom of layer                       =    140.00000 pci


Layer 3 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer           =     15.00000 ft
   Distance from top of pile to bottom of layer        =     25.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Undrained cohesion at top of layer                  =   3000.00000 psf
```

ADDENDUM 2 - JULY 14, 2015

uptown_pole3_36 inch_15ft

```
Undrained cohesion at bottom of layer                =   3000.00000 psf
Epsilon-50 at top of layer                           =      0.00500
Epsilon-50 at bottom of layer                        =      0.00500
Subgrade k at top of layer                           =   1000.00000 pci
Subgrade k at bottom of layer                        =   1000.00000 pci

(Depth of lowest soil layer extends   10.00 ft below pile tip)
```

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	Strain Factor Epsilon 50	kpy pci
1	Soft Clay	0.00	120.000	1.000	--	0.02000	--
		3.000	120.000	1.000	--	0.02000	--
2	Sand (Reese, et al.)	3.000	120.000	--	33.000	--	140.000
		15.000	120.000	--	33.000	--	140.000
3	Stiff Clay w/o Free Water, using k	15.000	120.000	3000.000	--	0.00500	1000.000
		25.000	120.000	3000.000	--	0.00500	1000.000

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	1	V = 6000.00000 lbs	M = 1344000. in-lbs	0.0000000	Yes
2	1	V = 9000.00000 lbs	M = 2016000. in-lbs	0.0000000	Yes

ADDENDUM 2 - JULY 14, 2015

uptown_pole3_36 inch_15ft

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

---

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 6000.000 lbs
Applied moment at pile head = 1344000.000 in-lbs
Axial thrust load on pile head = 0.000 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. p lb/in	Distrib. Lat. Load lb/inch
0.00	0.2182	1344000.	6000.0000	-0.002003	293.4215	2.972E+11	-0.1856	0.7654	0.000
0.150	0.2146	1354800.	5999.3346	-0.001995	295.7792	2.972E+11	-0.5537	4.6437	0.000
0.300	0.2111	1365598.	5998.3406	-0.001986	298.1366	2.972E+11	-0.5506	4.6961	0.000
0.450	0.2075	1376394.	5997.3523	-0.001978	300.4936	2.972E+11	-0.5475	4.7498	0.000
0.600	0.2039	1387188.	5996.3696	-0.001970	302.8503	2.972E+11	-0.5444	4.8048	0.000
0.750	0.2004	1397981.	5995.3925	-0.001961	305.2065	2.972E+11	-0.5412	4.8612	0.000
0.900	0.1969	1408771.	5994.4212	-0.001953	307.5623	2.972E+11	-0.5380	4.9190	0.000
1.050	0.1934	1419561.	5993.4557	-0.001944	309.9178	2.972E+11	-0.5348	4.9783	0.000
1.200	0.1899	1430348.	5992.4959	-0.001936	312.2729	2.972E+11	-0.5316	5.0391	0.000
1.350	0.1864	1441134.	5991.5420	-0.001927	314.6276	2.972E+11	-0.5283	5.1016	0.000
1.500	0.1829	1451917.	5990.5940	-0.001918	316.9820	2.972E+11			

ADDENDUM 2 - JULY 14, 2015


```
-0.5250     5.1657      0.000
     1.650      0.1795   1462700.  5989.6520  -0.001909   319.3359  2.972E+11
-0.5217     5.2316      0.000
     1.800      0.1761   1473480.  5988.7159  -0.001900   321.6895  2.972E+11
-0.5184     5.2993      0.000
     1.950      0.1727   1484259.  5987.7859  -0.001892   324.0428  2.972E+11
-0.5150     5.3689      0.000
     2.100      0.1693   1495036.  5986.8620  -0.001883   326.3956  2.972E+11
-0.5116     5.4405      0.000
     2.250      0.1659   1505812.  5985.9442  -0.001873   328.7481  2.972E+11
-0.5082     5.5142      0.000
     2.400      0.1625   1516586.  5985.0327  -0.001864   331.1003  2.972E+11
-0.5047     5.5900      0.000
     2.550      0.1592   1527358.  5984.1273  -0.001855   333.4521  2.972E+11
-0.5012     5.6681      0.000
     2.700      0.1558   1538129.  5983.2283  -0.001846   335.8035  2.972E+11
-0.4977     5.7486      0.000
     2.850      0.1525   1548898.  5982.3357  -0.001836   338.1546  2.972E+11
-0.4941     5.8316      0.000
     3.000      0.1492   1559665.  5953.9291  -0.001827   340.5053  2.972E+11
-31.0688   374.7605      0.000
     3.150      0.1459   1570332.  5878.0403  -0.001818   342.8341  2.972E+11
-53.2521   656.7789      0.000
     3.300      0.1427   1580826.  5761.8229  -0.001808   345.1252  2.972E+11
-75.8783   957.2377      0.000
     3.450      0.1394   1591074.  5604.5807  -0.001798   347.3626  2.972E+11
-98.8353  1275.8742      0.000
     3.600      0.1362   1601002.  5405.8182  -0.001789   349.5301  2.972E+11
-122.0119  1612.3961      0.000
     3.750      0.1330   1610535.  5165.2395  -0.001779   351.6113  2.972E+11
-145.2978  1966.4789      0.000
     3.900      0.1298   1619597.  4882.7462  -0.001769   353.5897  2.972E+11
-168.5836  2337.7634      0.000
     4.050      0.1266   1628113.  4558.4365  -0.001759   355.4489  2.972E+11
-191.7606  2725.8526      0.000
     4.200      0.1235   1636008.  4192.6024  -0.001750   357.1724  2.972E+11
-214.7216  3130.3082      0.000
     4.350      0.1203   1643206.  3785.3055  -0.001740   358.7441  2.972E+11
-237.8305  3557.6815      0.000
     4.500      0.1172   1649635.  3336.0948  -0.001730   360.1475  2.972E+11
-261.2925  4012.7684      0.000
     4.650      0.1141   1655216.  2844.8723  -0.001720   361.3661  2.972E+11
-284.5102  4488.2039      0.000
     4.800      0.1110   1659876.  2312.1540  -0.001710   362.3834  2.972E+11
-307.3990  4984.0885      0.000
     4.950      0.1079   1663540.  1738.6070  -0.001699   363.1833  2.972E+11
-329.8754  5500.5315      0.000
     5.100      0.1049   1666135.  1125.0480  -0.001689   363.7499  2.972E+11
-351.8568  6037.6522      0.000
     5.250      0.1019   1667590.   472.4410  -0.001679   364.0675  2.972E+11
-373.2620  6595.5825      0.000
     5.400      0.0989   1667836.  -218.1046  -0.001669   364.1212  2.972E+11
-394.0108  7174.4688      0.000
     5.550      0.0959   1666805.  -945.3361  -0.001659   363.8961  2.972E+11
-414.0242  7774.4751      0.000
     5.700      0.0929   1664433. -1707.8600  -0.001649   363.3782  2.972E+11
-433.2245  8395.7865      0.000
     5.850      0.0899   1660657. -2504.5150  -0.001639   362.5538  2.972E+11
-451.9476  9046.8706      0.000
     6.000      0.0870   1655417. -3334.3388  -0.001629   361.4098  2.972E+11
-470.0789  9727.9903      0.000
     6.150      0.0841   1648653. -4185.3274  -0.001619   359.9332  2.972E+11
-475.4639     10182.      0.000
```

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6.300	0.0812	1640349.	-5044.7787	-0.001609	358.1203	2.972E+11	-479.4819	10635.
6.450	0.0783	1630492.	-5910.2437	-0.001599	355.9683	2.972E+11	-482.1459	11089.
6.600	0.0754	1619072.	-6779.2970	-0.001589	353.4752	2.972E+11	-483.4688	11542.
6.750	0.0725	1606087.	-7649.5356	-0.001579	350.6401	2.972E+11	-483.4630	11996.
6.900	0.0697	1591534.	-8518.5793	-0.001570	347.4630	2.972E+11	-482.1411	12450.
7.050	0.0669	1575420.	-9384.0699	-0.001560	343.9449	2.972E+11	-479.5151	12903.
7.200	0.0641	1557752.	-10244.	-0.001551	340.0876	2.972E+11	-475.5968	13357.
7.350	0.0613	1538542.	-11095.	-0.001541	335.8939	2.972E+11	-470.3977	13810.
7.500	0.0585	1517809.	-11936.	-0.001532	331.3674	2.972E+11	-463.9290	14264.
7.650	0.0558	1495573.	-12764.	-0.001523	326.5128	2.972E+11	-456.2016	14718.
7.800	0.0531	1471859.	-13577.	-0.001514	321.3355	2.972E+11	-447.2258	15171.
7.950	0.0503	1446695.	-14373.	-0.001505	315.8418	2.972E+11	-437.0118	15625.
8.100	0.0476	1420116.	-15149.	-0.001496	310.0390	2.972E+11	-425.5693	16078.
8.250	0.0450	1392158.	-15904.	-0.001488	303.9352	2.972E+11	-412.9075	16532.
8.400	0.0423	1362862.	-16635.	-0.001480	297.5393	2.972E+11	-399.0352	16986.
8.550	0.0396	1332273.	-17339.	-0.001471	290.8612	2.972E+11	-383.9608	17439.
8.700	0.0370	1300440.	-18016.	-0.001463	283.9115	2.972E+11	-367.6923	17893.
8.850	0.0344	1267416.	-18662.	-0.001456	276.7016	2.972E+11	-350.2371	18346.
9.000	0.0317	1233257.	-19276.	-0.001448	269.2441	2.972E+11	-331.6021	18800.
9.150	0.0291	1198023.	-19855.	-0.001441	261.5519	2.972E+11	-311.7938	19254.
9.300	0.0266	1161780.	-20397.	-0.001434	253.6392	2.972E+11	-290.8182	19707.
9.450	0.0240	1124594.	-20901.	-0.001427	245.5208	2.972E+11	-268.6807	20161.
9.600	0.0214	1086538.	-21363.	-0.001420	237.2124	2.972E+11	-245.3862	20614.
9.750	0.0189	1047686.	-21783.	-0.001414	228.7304	2.972E+11	-220.9392	21068.
9.900	0.0163	1008119.	-22158.	-0.001407	220.0921	2.972E+11	-195.3435	21522.
10.050	0.0138	967919.	-22485.	-0.001401	211.3156	2.972E+11	-168.6025	21975.
10.200	0.0113	927172.	-22764.	-0.001396	202.4199	2.972E+11	-140.7191	22429.
10.350	0.008786	885970.	-22991.	-0.001390	193.4246	2.972E+11	-111.6956	22882.
10.500	0.006289	844406.	-23165.	-0.001385	184.3503	2.972E+11	-81.5338	23336.
10.650	0.003801	802577.	-23283.	-0.001380	175.2183	2.972E+11	-50.2350	23790.
10.800	0.001322	760586.	-23344.	-0.001375	166.0508	2.972E+11	-17.8000	24243.
10.950	-0.001149	718537.	-23346.	-0.001371	156.8707	2.972E+11		

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```
15.7708     24697.      0.000
    11.100  -0.003613    676540.    -23287.  -0.001366   147.7018  2.972E+11
50.4776     25150.      0.000
    11.250  -0.006068    634705.    -23164.  -0.001362   138.5686  2.972E+11
86.3209     25604.      0.000
    11.400  -0.008517    593151.    -22975.  -0.001359   129.4964  2.972E+11
123.3018     26058.      0.000
    11.550    -0.0110    551996.    -22719.  -0.001355   120.5115  2.972E+11
161.4217     26511.      0.000
    11.700    -0.0134    511364.    -22393.  -0.001352   111.6407  2.972E+11
200.6825     26965.      0.000
    11.850    -0.0158    471382.    -21995.  -0.001349   102.9119  2.972E+11
241.0863     27418.      0.000
    12.000    -0.0183    432181.    -21524.  -0.001346    94.3536  2.972E+11
282.6358     27872.      0.000
    12.150    -0.0207    393896.    -20977.  -0.001344    85.9952  2.972E+11
325.3336     28326.      0.000
    12.300    -0.0231    356665.    -20352.  -0.001342    77.8670  2.972E+11
369.1830     28779.      0.000
    12.450    -0.0255    320631.    -19647.  -0.001339    69.9999  2.972E+11
414.1873     29233.      0.000
    12.600    -0.0279    285938.    -18859.  -0.001338    62.4258  2.972E+11
460.3500     29686.      0.000
    12.750    -0.0303    252737.    -17988.  -0.001336    55.1773  2.972E+11
507.6748     30140.      0.000
    12.900    -0.0327    221180.    -17031.  -0.001335    48.2880  2.972E+11
556.1655     30594.      0.000
    13.050    -0.0351    191426.    -15985.  -0.001333    41.7920  2.972E+11
605.8260     31047.      0.000
    13.200    -0.0375    163634.    -14863.  -0.001332    35.7246  2.972E+11
640.9207     30746.      0.000
    13.350    -0.0399    137919.    -13699.  -0.001331    30.1105  2.972E+11
651.9710     29398.      0.000
    13.500    -0.0423    114317.    -12517.  -0.001331    24.9576  2.972E+11
661.9533     28158.      0.000
    13.650    -0.0447     92859.    -11317.  -0.001330    20.2729  2.972E+11
670.8960     27010.      0.000
    13.800    -0.0471     73575.    -10102.  -0.001329    16.0628  2.972E+11
678.8212     25940.      0.000
    13.950    -0.0495     56490. -8874.3443  -0.001329    12.3329  2.972E+11
685.7461     24938.      0.000
    14.100    -0.0519     41627. -7634.6572  -0.001329     9.0881  2.972E+11
691.6841     23995.      0.000
    14.250    -0.0543     29005. -6385.1603  -0.001329     6.3325  2.972E+11
696.6457     23102.      0.000
    14.400    -0.0567     18641. -5127.6046  -0.001328     4.0696  2.972E+11
700.6385     22254.      0.000
    14.550    -0.0591     10546. -3863.7279  -0.001328     2.3024  2.972E+11
703.6688     21445.      0.000
    14.700    -0.0615  4731.3164 -2595.2591  -0.001328     1.0329  2.972E+11
705.7410     20672.      0.000
    14.850    -0.0638  1203.1503 -1314.2546  -0.001328     0.2627  2.972E+11
717.5974     20232.      0.000
    15.000    -0.0662      0.000      0.000  -0.001328      0.000  2.972E+11
742.6854     10092.      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

```
Pile-head deflection              =      0.2182421 inches
Computed slope at pile head       =     -0.0020029 radians
```

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uptown_pole3_36 inch_15ft

```
Maximum bending moment           =       1667836. inch-lbs
Maximum shear force              =        -23346. lbs
Depth of maximum bending moment  =     64.8000000 inches below pile head
Depth of maximum shear force     =    131.4000000 inches below pile head
Number of iterations             =             11
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =           6000. lbs
Moment     =        1344000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
15.0000	0.2182421	1667836.	-23346.
14.2500	0.2712132	1665736.	-25360.
13.5000	0.3676861	1660519.	-27955.
12.7500	0.5642732	1653644.	-31224.
12.0000	0.9941581	1645220.	-34924.
11.2500	1.9653382	1635166.	-38661.
10.5000	4.6038923	1631307.	-43315.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                                =        9000.000 lbs
Applied moment at pile head                             =     2016000.000 in-lbs
Axial thrust load on pile head                          =           0.000 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. Lat. Load lb/inch	Distrib. p lb/in
0.00	0.4623	2016000.	9000.0000	-0.004039	440.1322	2.972E+11	-0.2384	0.4641	0.000
0.150	0.4550	2032200.	8999.1452	-0.004027	443.6689	2.972E+11	-0.7113	2.8140	0.000
0.300	0.4478	2048397.	8997.8683	-0.004015	447.2051	2.972E+11	-0.7075	2.8442	0.000
0.450	0.4406	2064592.	8996.5981	-0.004002	450.7408	2.972E+11	-0.7037	2.8752	0.000
0.600	0.4334	2080785.	8995.3349	-0.003990	454.2759	2.972E+11	-0.6999	2.9069	0.000
0.750	0.4262	2096975.	8994.0786	-0.003977	457.8106	2.972E+11			

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```
-0.6960     2.9394      0.000
     0.900      0.4190   2113163.  8992.8294  -0.003964   461.3448  2.972E+11
-0.6921     2.9728      0.000
     1.050      0.4119   2129349.  8991.5872  -0.003951   464.8786  2.972E+11
-0.6881     3.0070      0.000
     1.200      0.4048   2145533.  8990.3521  -0.003938   468.4118  2.972E+11
-0.6842     3.0420      0.000
     1.350      0.3977   2161715.  8989.1243  -0.003925   471.9445  2.972E+11
-0.6801     3.0780      0.000
     1.500      0.3907   2177894.  8987.9036  -0.003912   475.4768  2.972E+11
-0.6761     3.1149      0.000
     1.650      0.3837   2194071.  8986.6903  -0.003899   479.0086  2.972E+11
-0.6720     3.1529      0.000
     1.800      0.3767   2210246.  8985.4844  -0.003886   482.5399  2.972E+11
-0.6679     3.1918      0.000
     1.950      0.3697   2226419.  8984.2859  -0.003872   486.0707  2.972E+11
-0.6638     3.2319      0.000
     2.100      0.3627   2242589.  8983.0949  -0.003859   489.6011  2.972E+11
-0.6596     3.2731      0.000
     2.250      0.3558   2258758.  8981.9115  -0.003845   493.1310  2.972E+11
-0.6553     3.3155      0.000
     2.400      0.3489   2274924.  8980.7358  -0.003831   496.6604  2.972E+11
-0.6511     3.3591      0.000
     2.550      0.3420   2291089.  8979.5677  -0.003818   500.1894  2.972E+11
-0.6468     3.4041      0.000
     2.700      0.3351   2307251.  8978.4075  -0.003804   503.7179  2.972E+11
-0.6424     3.4503      0.000
     2.850      0.3283   2323411.  8977.2551  -0.003790   507.2460  2.972E+11
-0.6380     3.4981      0.000
     3.000      0.3215   2339569.  8942.5109  -0.003775   510.7736  2.972E+11
-37.9667   212.5740      0.000
     3.150      0.3147   2355604.  8849.6524  -0.003761   514.2744  2.972E+11
-65.2094   372.9739      0.000
     3.300      0.3079   2371428.  8707.1621  -0.003747   517.7290  2.972E+11
-93.1132   544.2603      0.000
     3.450      0.3012   2386950.  8513.9653  -0.003733   521.1177  2.972E+11
-121.5498   726.3542      0.000
     3.600      0.2945   2402078.  8269.2184  -0.003718   524.4205  2.972E+11
-150.3911   919.1649      0.000
     3.750      0.2878   2416719.  7972.3082  -0.003703   527.6169  2.972E+11
-179.5092  1122.5898      0.000
     3.900      0.2812   2430778.  7622.8508  -0.003689   530.6864  2.972E+11
-208.7768  1336.5123      0.000
     4.050      0.2746   2444161.  7220.6914  -0.003674   533.6081  2.972E+11
-238.0670  1560.8011      0.000
     4.200      0.2680   2456773.  6765.9030  -0.003659   536.3615  2.972E+11
-267.2534  1795.3082      0.000
     4.350      0.2614   2468518.  6258.4496  -0.003644   538.9258  2.972E+11
-296.5837  2042.4412      0.000
     4.500      0.2548   2479303.  5697.9532  -0.003629   541.2803  2.972E+11
-326.1901  2304.0319      0.000
     4.650      0.2483   2489031.  5084.3741  -0.003614   543.4041  2.972E+11
-355.5645  2577.4540      0.000
     4.800      0.2418   2497607.  4418.2234  -0.003599   545.2764  2.972E+11
-384.6031  2862.7990      0.000
     4.950      0.2354   2504937.  3700.1978  -0.003584   546.8766  2.972E+11
-413.2031  3160.1677      0.000
     5.100      0.2289   2510928.  2931.1783  -0.003569   548.1845  2.972E+11
-441.2629  3469.6718      0.000
     5.250      0.2225   2515489.  2112.2280  -0.003554   549.1804  2.972E+11
-468.6818  3791.4352      0.000
     5.400      0.2161   2518532.  1244.5901  -0.003538   549.8447  2.972E+11
-495.3602  4125.5959      0.000
```

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```
     5.550      0.2098   2519969.   329.6864  -0.003523   550.1585  2.972E+11
-521.1995  4472.3085      0.000
     5.700      0.2034   2519718.  -630.8854  -0.003508   550.1038  2.972E+11
-546.1024  4831.7466      0.000
     5.850      0.1971   2517698. -1635.7517  -0.003493   549.6627  2.972E+11
-570.4156  5208.1517      0.000
     6.000      0.1909   2513830. -2683.9508  -0.003477   548.8182  2.972E+11
-594.2501  5604.0880      0.000
     6.150      0.1846   2508036. -3774.0790  -0.003462   547.5533  2.972E+11
-617.0034  6015.4990      0.000
     6.300      0.1784   2500243. -4904.1106  -0.003447   545.8519  2.972E+11
-638.5872  6442.9293      0.000
     6.450      0.1722   2490381. -6071.8613  -0.003432   543.6989  2.972E+11
-658.9137  6886.9970      0.000
     6.600      0.1661   2478384. -7274.9899  -0.003417   541.0797  2.972E+11
-677.8958  7348.4066      0.000
     6.750      0.1599   2464191. -8510.9988  -0.003402   537.9811  2.972E+11
-695.4475  7827.9643      0.000
     6.900      0.1538   2447745. -9777.2364  -0.003387   534.3905  2.972E+11
-711.4831  8326.5971      0.000
     7.050      0.1477   2428993.    -11071.  -0.003372   530.2967  2.972E+11
-725.9178  8845.3755      0.000
     7.200      0.1417   2407890.    -12389.  -0.003358   525.6893  2.972E+11
-738.6670  9385.5420      0.000
     7.350      0.1356   2384393.    -13730.  -0.003343   520.5595  2.972E+11
-750.9551  9965.9103      0.000
     7.500      0.1296   2358463.    -15092.  -0.003329   514.8985  2.972E+11
-763.1683     10597.      0.000
     7.650      0.1237   2330060.    -16476.  -0.003314   508.6976  2.972E+11
-773.6524     11262.      0.000
     7.800      0.1177   2299151.    -17876.  -0.003300   501.9495  2.972E+11
-782.3150     11964.      0.000
     7.950      0.1118   2265707.    -19290.  -0.003287   494.6481  2.972E+11
-789.0610     12708.      0.000
     8.100      0.1059   2229706.    -20715.  -0.003273   486.7884  2.972E+11
-793.7923     13497.      0.000
     8.250      0.1000   2191134.    -22146.  -0.003260   478.3673  2.972E+11
-796.4064     14337.      0.000
     8.400      0.0941   2149981.    -23580.  -0.003246   469.3829  2.972E+11
-796.7956     15237.      0.000
     8.550      0.0883   2106247.    -25012.  -0.003234   459.8348  2.972E+11
-794.8455     16203.      0.000
     8.700      0.0825   2059937.    -26439.  -0.003221   449.7245  2.972E+11
-790.4329     17248.      0.000
     8.850      0.0767   2011066.    -27854.  -0.003209   439.0551  2.972E+11
-781.7956     18346.      0.000
     9.000      0.0709   1959663.    -29224.  -0.003197   427.8326  2.972E+11
-740.9164     18800.      0.000
     9.150      0.0652   1905858.    -30519.  -0.003185   416.0861  2.972E+11
-697.3603     19254.      0.000
     9.300      0.0595   1849795.    -31733.  -0.003174   403.8463  2.972E+11
-651.1371     19707.      0.000
     9.450      0.0538   1791621.    -32861.  -0.003163   391.1459  2.972E+11
-602.2556     20161.      0.000
     9.600      0.0481   1731496.    -33898.  -0.003152   378.0195  2.972E+11
-550.7237     20614.      0.000
     9.750      0.0424   1669587.    -34841.  -0.003142   364.5035  2.972E+11
-496.5487     21068.      0.000
     9.900      0.0368   1606069.    -35683.  -0.003132   350.6363  2.972E+11
-439.7366     21522.      0.000
    10.050      0.0311   1541127.    -36422.  -0.003122   336.4581  2.972E+11
-380.2929     21975.      0.000
    10.200      0.0255   1474952.    -37050.  -0.003113   322.0108  2.972E+11
```

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-318.2218	22429.	0.000					
10.350	0.0199	1407746.	-37565.	-0.003104	307.3385	2.972E+11	
-253.5269	22882.	0.000					
10.500	0.0144	1339719.	-37961.	-0.003096	292.4868	2.972E+11	
-186.2110	23336.	0.000					
10.650	0.008798	1271088.	-38233.	-0.003088	277.5034	2.972E+11	
-116.2757	23790.	0.000					
10.800	0.003246	1202081.	-38377.	-0.003081	262.4378	2.972E+11	
-43.7221	24243.	0.000					
10.950	-0.002292	1132932.	-38388.	-0.003073	247.3412	2.972E+11	
31.4497	24697.	0.000					
11.100	-0.007818	1063885.	-38261.	-0.003067	232.2669	2.972E+11	
109.2403	25150.	0.000					
11.250	-0.0133	995192.	-37992.	-0.003061	217.2698	2.972E+11	
189.6511	25604.	0.000					
11.400	-0.0188	927113.	-37576.	-0.003055	202.4069	2.972E+11	
272.6842	26058.	0.000					
11.550	-0.0243	859918.	-37008.	-0.003049	187.7369	2.972E+11	
358.3422	26511.	0.000					
11.700	-0.0298	793884.	-36284.	-0.003044	173.3204	2.972E+11	
446.6286	26965.	0.000					
11.850	-0.0353	729297.	-35398.	-0.003040	159.2198	2.972E+11	
537.5471	27418.	0.000					
12.000	-0.0408	666451.	-34346.	-0.003036	145.4994	2.972E+11	
631.1022	27872.	0.000					
12.150	-0.0462	605651.	-33124.	-0.003032	132.2254	2.972E+11	
727.2987	28326.	0.000					
12.300	-0.0517	547207.	-31778.	-0.003028	119.4659	2.972E+11	
768.1171	26758.	0.000					
12.450	-0.0571	491251.	-30367.	-0.003025	107.2497	2.972E+11	
798.9310	25177.	0.000					
12.600	-0.0626	437884.	-28903.	-0.003022	95.5987	2.972E+11	
828.0197	23824.	0.000					
12.750	-0.0680	387200.	-27388.	-0.003020	84.5333	2.972E+11	
855.5599	22648.	0.000					
12.900	-0.0734	339288.	-25824.	-0.003018	74.0732	2.972E+11	
881.6842	21612.	0.000					
13.050	-0.0789	294232.	-24215.	-0.003016	64.2367	2.972E+11	
906.4932	20690.	0.000					
13.200	-0.0843	252114.	-22562.	-0.003014	55.0414	2.972E+11	
930.0638	19862.	0.000					
13.350	-0.0897	213009.	-20868.	-0.003013	46.5040	2.972E+11	
952.4545	19110.	0.000					
13.500	-0.0951	176990.	-19134.	-0.003011	38.6403	2.972E+11	
973.7101	18423.	0.000					
13.650	-0.1006	144126.	-17363.	-0.003010	31.4654	2.972E+11	
993.8643	17791.	0.000					
13.800	-0.1060	114481.	-15557.	-0.003010	24.9935	2.972E+11	
1012.9420	17206.	0.000					
13.950	-0.1114	88119.	-13718.	-0.003009	19.2381	2.972E+11	
1030.9611	16660.	0.000					
14.100	-0.1168	65097.	-11847.	-0.003009	14.2120	2.972E+11	
1047.9339	16149.	0.000					
14.250	-0.1222	45471.	-9946.1889	-0.003008	9.9271	2.972E+11	
1063.8678	15668.	0.000					
14.400	-0.1276	29291.	-8017.8182	-0.003008	6.3948	2.972E+11	
1078.7664	15214.	0.000					
14.550	-0.1330	16606.	-6063.5617	-0.003008	3.6255	2.972E+11	
1092.6297	14782.	0.000					
14.700	-0.1385	7462.1277	-4085.2851	-0.003008	1.6291	2.972E+11	
1105.4554	14371.	0.000					
14.850	-0.1439	1899.4523	-2072.8133	-0.003008	0.4147	2.972E+11	
1130.6244	14145.	0.000					

ADDENDUM 2 - JULY 14, 2015

uptown_pole3_36 inch_15ft

```
    15.000    -0.1493      0.000      0.000  -0.003008      0.000  2.972E+11
1172.5014  7068.5261      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      0.4622724 inches
Computed slope at pile head      =     -0.0040393 radians
Maximum bending moment           =       2519969. inch-lbs
Maximum shear force              =        -38388. lbs
Depth of maximum bending moment  =     66.6000000 inches below pile head
Depth of maximum shear force     =    131.4000000 inches below pile head
Number of iterations             =             20
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =           9000. lbs
Moment     =        2016000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
15.0000	0.4622724	2519969.	-38388.
14.2500	0.6578610	2512221.	-41964.
13.5000	1.0274586	2500487.	-45878.
12.7500	1.7505055	2485035.	-49944.
12.0000	3.2272982	2474632.	-54323.

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 Shear V(lbs) or Pile-head y(inches)	Pile-head Condition 2 in-lb, rad., or Rotation in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs

ADDENDUM 2 - JULY 14, 2015

```
                                uptown_pole3_36 inch_15ft
          lbs           radians
----  ----  --------------  --------------  -------------  -------------
-------------  -------------  -------------
  1     1   V =  6000.0000  M =   1344000.      0.0000000     0.21824208
1667836.        -23346.    -0.00200287
  2     1   V =  9000.0000  M =   2016000.      0.0000000     0.46227235
2519969.        -38388.    -0.00403927

The analysis ended normally.
```

ADDENDUM 2 - JULY 14, 2015

uptown_pole4_36 inch_18ft

==========

LPile Plus for Windows, Version 2012-06.035

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Serial Number of Security Device: 500126253
Company Name Stored in Security Device: URS Corporation

Files Used for Analysis

Path to file locations: P:\AUS Geotech\Projects\41010530.052 City of El Paso\OCS Design\LPILE runs_RAR\
Name of input data file: uptown_pole4_36 inch_18ft.lp6d
Name of output report file: uptown_pole4_36 inch_18ft.lp6o
Name of plot output file: uptown_pole4_36 inch_18ft.lp6p
Name of runtime messeage file: uptown_pole4_36 inch_18ft.lp6r

---

Date and Time of Analysis

Date: January 17, 2013 Time: 15:24:03

Problem Title

Project Name: El Paso Streetcar

Job Number: 41010530

Client: City of El Paso

Engineer: R. Russo

Description: OCS Pole Foundations

ADDENDUM 2 - JULY 14, 2015

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:
- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments	=	100	
- Maximum number of iterations allowed	=	500	
- Deflection tolerance for convergence	=	1.0000E-05	in
- Maximum allowable deflection	=	100.0000	in

Pile Response Output Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 18.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	36.0000000
2	18.000000	36.0000000

Input Structural Properties:

Pile Section No. 1:

ADDENDUM 2 - JULY 14, 2015

uptown_pole4_36 inch_18ft

```
   Section Type                                        =    Elastic Pile
   Cross-sectional Shape                               =        Circular
   Section Length                                      =     18.00000000 ft
   Top Width                                           =     36.00000000 in
   Bottom Width                                        =     36.00000000 in
   Top Area                                            =   1017.87601976 Sq. in
   Bottom Area                                         =   1017.87601976 Sq. in
   Moment of Inertia at Top                            =          82448. in^4
   Moment of Inertia at Bottom                         =          82448. in^4
   Elastic Modulus                                     =        3604997. lbs/in^2


--------------------------------------------------------------------------------
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                     =        0.000 degrees
                                                       =        0.000 radians

Pile Batter Angle                                      =        0.000 degrees
                                                       =        0.000 radians



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer           =       0.0000 ft
   Distance from top of pile to bottom of layer        =      3.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Undrained cohesion at top of layer                  =      1.00000 psf
   Undrained cohesion at bottom of layer               =      1.00000 psf
   Epsilon-50 at top of layer                          =      0.02000
   Epsilon-50 at bottom of layer                       =      0.02000


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =      3.00000 ft
   Distance from top of pile to bottom of layer        =     15.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Friction angle at top of layer                      =     33.00000 deg.
   Friction angle at bottom of layer                   =     33.00000 deg.
   Subgrade k at top of layer                          =    140.00000 pci
   Subgrade k at bottom of layer                       =    140.00000 pci


Layer 3 is stiff clay with water-induced erosion

   Distance from top of pile to top of layer           =     15.00000 ft
   Distance from top of pile to bottom of layer        =     25.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Undrained cohesion at top of layer                  =   3000.00000 psf
```

ADDENDUM 2 - JULY 14, 2015

uptown_pole4_36 inch_18ft

```
Undrained cohesion at bottom of layer                =   3000.00000 psf
Epsilon-50 at top of layer                           =      0.00500
Epsilon-50 at bottom of layer                        =      0.00500
Subgrade k at top of layer                           =   1000.00000 pci
Subgrade k at bottom of layer                        =   1000.00000 pci


(Depth of lowest soil layer extends    7.00 ft below pile tip)
```

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	Strain Factor Epsilon 50	kpy pci
1	Soft Clay	0.00	120.000	1.000	--	0.02000	--
		3.000	120.000	1.000	--	0.02000	--
2	Sand (Reese, et al.)	3.000	120.000	--	33.000	--	140.000
		15.000	120.000	--	33.000	--	140.000
3	Stiff Clay w/o Free Water, using k	15.000	120.000	3000.000	--	0.00500	1000.000
		25.000	120.000	3000.000	--	0.00500	1000.000

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	1	V = 10000.00000 lbs	M = 2340000. in-lbs	0.0000000	Yes
2	1	V = 15000. lbs	M = 3510000. in-lbs	0.0000000	Yes

ADDENDUM 2 - JULY 14, 2015

uptown_pole4_36 inch_18ft

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

---

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 10000.000 lbs
Applied moment at pile head = 2340000.000 in-lbs
Axial thrust load on pile head = 0.000 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. p lb/in	Distrib. Lat. Load lb/inch
0.00	0.2091	2340000.	10000.0000	-0.002001	510.8677	2.972E+11	-0.1830	0.9451	0.000
0.180	0.2048	2361600.	9999.2136	-0.001983	515.5833	2.972E+11	-0.5451	5.7496	0.000
0.360	0.2005	2383197.	9998.0402	-0.001966	520.2984	2.972E+11	-0.5413	5.8309	0.000
0.540	0.1963	2404791.	9996.8751	-0.001949	525.0129	2.972E+11	-0.5375	5.9143	0.000
0.720	0.1921	2426383.	9995.7182	-0.001931	529.7268	2.972E+11	-0.5337	6.0000	0.000
0.900	0.1880	2447973.	9994.5697	-0.001914	534.4402	2.972E+11	-0.5298	6.0880	0.000
1.080	0.1838	2469560.	9993.4296	-0.001896	539.1531	2.972E+11	-0.5259	6.1785	0.000
1.260	0.1798	2491144.	9992.2979	-0.001878	543.8655	2.972E+11	-0.5220	6.2715	0.000
1.440	0.1757	2512726.	9991.1747	-0.001859	548.5773	2.972E+11	-0.5180	6.3672	0.000
1.620	0.1717	2534306.	9990.0600	-0.001841	553.2885	2.972E+11	-0.5141	6.4656	0.000
1.800	0.1678	2555883.	9988.9539	-0.001823	557.9993	2.972E+11			

ADDENDUM 2 - JULY 14, 2015


```
-0.5101     6.5669      0.000
     1.980      0.1639   2577458.  9987.8564  -0.001804   562.7095  2.972E+11
-0.5061     6.6711      0.000
     2.160      0.1600   2599031.  9986.7676  -0.001785   567.4192  2.972E+11
-0.5021     6.7784      0.000
     2.340      0.1562   2620601.  9985.6874  -0.001766   572.1284  2.972E+11
-0.4980     6.8890      0.000
     2.520      0.1524   2642169.  9984.6161  -0.001747   576.8371  2.972E+11
-0.4940     7.0029      0.000
     2.700      0.1486   2663735.  9983.5535  -0.001728   581.5453  2.972E+11
-0.4899     7.1203      0.000
     2.880      0.1449   2685298.  9982.4998  -0.001708   586.2530  2.972E+11
-0.4858     7.2414      0.000
     3.060      0.1412   2706859.  9939.1412  -0.001689   590.9602  2.972E+11
-39.6611   606.5961      0.000
     3.240      0.1376   2728235.  9824.7550  -0.001669   595.6270  2.972E+11
-66.2520  1039.9954      0.000
     3.420      0.1340   2749302.  9652.3460  -0.001649   600.2264  2.972E+11
-93.3859  1505.1302      0.000
     3.600      0.1305   2769933.  9420.9416  -0.001629   604.7306  2.972E+11
-120.8775  2001.0881      0.000
     3.780      0.1270   2790001.  9129.9659  -0.001609   609.1116  2.972E+11
-148.5444  2526.8288      0.000
     3.960      0.1235   2809375.  8779.2349  -0.001589   613.3414  2.972E+11
-176.2066  3081.1725      0.000
     4.140      0.1201   2827927.  8368.9499  -0.001568   617.3917  2.972E+11
-203.6869  3662.7866      0.000
     4.320      0.1168   2845529.  7899.4031  -0.001547   621.2345  2.972E+11
-231.0787  4275.1131      0.000
     4.500      0.1134   2862052.  7369.9487  -0.001527   624.8419  2.972E+11
-259.1569  4934.9150      0.000
     4.680      0.1102   2877367.  6780.1479  -0.001506   628.1854  2.972E+11
-286.9549  5626.7126      0.000
     4.860      0.1069   2891343.  6130.7504  -0.001485   631.2366  2.972E+11
-314.3390  6349.8599      0.000
     5.040      0.1037   2903852.  5422.7913  -0.001464   633.9676  2.972E+11
-341.1787  7103.6077      0.000
     5.220      0.1006   2914769.  4657.5840  -0.001443   636.3510  2.972E+11
-367.3466  7887.0924      0.000
     5.400      0.0975   2923972.  3836.7136  -0.001421   638.3603  2.972E+11
-392.7186  8699.3235      0.000
     5.580      0.0945   2931344.  2962.0293  -0.001400   639.9696  2.972E+11
-417.1742  9539.1707      0.000
     5.760      0.0915   2936768.  2035.6376  -0.001379   641.1539  2.972E+11
-440.5960     10405.      0.000
     5.940      0.0885   2940138.  1058.7937  -0.001358   641.8895  2.972E+11
-463.8891     11321.      0.000
     6.120      0.0856   2941342.    39.2712  -0.001336   642.1525  2.972E+11
-480.1132     12115.      0.000
     6.300      0.0827   2940307. -1007.4506  -0.001315   641.9265  2.972E+11
-489.0736     12769.      0.000
     6.480      0.0799   2936990. -2071.9666  -0.001293   641.2023  2.972E+11
-496.5893     13422.      0.000
     6.660      0.0771   2931356. -3151.2008  -0.001272   639.9724  2.972E+11
-502.7017     14075.      0.000
     6.840      0.0744   2923377. -4242.1671  -0.001251   638.2303  2.972E+11
-507.4522     14728.      0.000
     7.020      0.0717   2913030. -5341.9677  -0.001230   635.9714  2.972E+11
-510.8816     15381.      0.000
     7.200      0.0691   2900300. -6447.7925  -0.001208   633.1921  2.972E+11
-513.0303     16035.      0.000
     7.380      0.0665   2885176. -7556.9185  -0.001187   629.8902  2.972E+11
-513.9382     16688.      0.000
```

ADDENDUM 2 - JULY 14, 2015

7.560	0.0640	2867654.	-8666.7082	-0.001167	626.0649	2.972E+11	-513.6448	17341.	0.000
7.740	0.0615	2847735.	-9774.6084	-0.001146	621.7163	2.972E+11	-512.1888	17994.	0.000
7.920	0.0590	2825427.	-10878.	-0.001125	616.8460	2.972E+11	-509.6084	18647.	0.000
8.100	0.0566	2800742.	-11975.	-0.001105	611.4567	2.972E+11	-505.9409	19300.	0.000
8.280	0.0543	2773696.	-13063.	-0.001084	605.5520	2.972E+11	-501.2231	19954.	0.000
8.460	0.0519	2744311.	-14139.	-0.001064	599.1367	2.972E+11	-495.4909	20607.	0.000
8.640	0.0497	2712615.	-15202.	-0.001045	592.2168	2.972E+11	-488.7790	21260.	0.000
8.820	0.0474	2678638.	-16250.	-0.001025	584.7990	2.972E+11	-481.1217	21913.	0.000
9.000	0.0452	2642416.	-17280.	-0.001006	576.8911	2.972E+11	-472.5518	22566.	0.000
9.180	0.0431	2603990.	-18290.	-0.000987	568.5019	2.972E+11	-463.1016	23220.	0.000
9.360	0.0410	2563403.	-19279.	-0.000968	559.6410	2.972E+11	-452.8018	23873.	0.000
9.540	0.0389	2520703.	-20245.	-0.000949	550.3188	2.972E+11	-441.6825	24526.	0.000
9.720	0.0369	2475943.	-21186.	-0.000931	540.5468	2.972E+11	-429.7722	25179.	0.000
9.900	0.0349	2429178.	-22101.	-0.000913	530.3370	2.972E+11	-417.0985	25832.	0.000
10.080	0.0329	2380466.	-22988.	-0.000896	519.7023	2.972E+11	-403.6876	26485.	0.000
10.260	0.0310	2329872.	-23844.	-0.000879	508.6565	2.972E+11	-389.5645	27139.	0.000
10.440	0.0291	2277459.	-24670.	-0.000862	497.2138	2.972E+11	-374.7529	27792.	0.000
10.620	0.0273	2223298.	-25462.	-0.000846	485.3894	2.972E+11	-359.2751	28445.	0.000
10.800	0.0255	2167461.	-26221.	-0.000830	473.1991	2.972E+11	-343.1522	29098.	0.000
10.980	0.0237	2110023.	-26944.	-0.000814	460.6592	2.972E+11	-326.4036	29751.	0.000
11.160	0.0220	2051062.	-27631.	-0.000799	447.7869	2.972E+11	-309.0477	30405.	0.000
11.340	0.0202	1990659.	-28279.	-0.000784	434.5998	2.972E+11	-291.1010	31058.	0.000
11.520	0.0186	1928898.	-28887.	-0.000770	421.1161	2.972E+11	-272.5789	31711.	0.000
11.700	0.0169	1865865.	-29456.	-0.000756	407.3549	2.972E+11	-253.4953	32364.	0.000
11.880	0.0153	1801650.	-29982.	-0.000743	393.3354	2.972E+11	-233.8624	33017.	0.000
12.060	0.0137	1736343.	-30465.	-0.000730	379.0777	2.972E+11	-213.6911	33671.	0.000
12.240	0.0121	1670040.	-30905.	-0.000718	364.6023	2.972E+11	-192.9909	34324.	0.000
12.420	0.0106	1602836.	-31298.	-0.000706	349.9303	2.972E+11	-171.7695	34977.	0.000
12.600	0.009095	1534830.	-31646.	-0.000695	335.0834	2.972E+11	-150.0333	35630.	0.000
12.780	0.007607	1466125.	-31946.	-0.000684	320.0837	2.972E+11	-127.7873	36283.	0.000
12.960	0.006142	1396823.	-32198.	-0.000673	304.9538	2.972E+11	-105.0349	36936.	0.000
13.140	0.004699	1327032.	-32399.	-0.000663	289.7169	2.972E+11			

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```
-81.7779     37590.      0.000
    13.320   0.003277   1256858.    -32550.  -0.000654   274.3967  2.972E+11
-58.0170     38243.      0.000
    13.500   0.001874   1186414.    -32649.  -0.000645   259.0174  2.972E+11
-33.7511     38896.      0.000
    13.680   0.000490   1115813.    -32696.  -0.000637   243.6038  2.972E+11
-8.9779     39549.      0.000
    13.860  -0.000876   1045170.    -32688.  -0.000629   228.1810  2.972E+11
16.3063     40202.      0.000
    14.040  -0.002226    974603.    -32625.  -0.000621   212.7748  2.972E+11
42.1066     40856.      0.000
    14.220  -0.003561    904232.    -32505.  -0.000615   197.4115  2.972E+11
68.4294     41509.      0.000
    14.400  -0.004881    834180.    -32328.  -0.000608   182.1179  2.972E+11
95.2825     42162.      0.000
    14.580  -0.006189    764574.    -32093.  -0.000603   166.9213  2.972E+11
122.6746     42815.      0.000
    14.760  -0.007484    695539.    -31798.  -0.000597   151.8498  2.972E+11
150.6159     43468.      0.000
    14.940  -0.008769    627207.    -31442.  -0.000592   136.9316  2.972E+11
179.1177     44121.      0.000
    15.120    -0.0100   559711.    -30488.  -0.000588   122.1958  2.972E+11
704.0398    151413.      0.000
    15.300    -0.0113   495500.    -28938.  -0.000584   108.1772  2.972E+11
730.7876    139574.      0.000
    15.480    -0.0126   434698.    -27333.  -0.000581    94.9030  2.972E+11
756.0070    129936.      0.000
    15.660    -0.0138   377423.    -25674.  -0.000578    82.3989  2.972E+11
779.9915    121919.      0.000
    15.840    -0.0151   323788.    -23964.  -0.000575    70.6892  2.972E+11
802.9601    115133.      0.000
    16.020    -0.0163   273899.    -22206.  -0.000573    59.7974  2.972E+11
825.0805    109306.      0.000
    16.200    -0.0175   227859.    -20400.  -0.000571    49.7460  2.972E+11
846.4844    104239.      0.000
    16.380    -0.0188   185769.    -18550.  -0.000570    40.5569  2.972E+11
867.2766     99788.      0.000
    16.560    -0.0200   147725.    -16654.  -0.000569    32.2512  2.972E+11
887.5421     95843.      0.000
    16.740    -0.0212   113822.    -14716.  -0.000568    24.8495  2.972E+11
907.3505     92318.      0.000
    16.920    -0.0225    84152.    -12735.  -0.000567    18.3720  2.972E+11
926.7597     89147.      0.000
    17.100    -0.0237    58806.    -10713.  -0.000566    12.8385  2.972E+11
945.8179     86277.      0.000
    17.280    -0.0249    37873. -8649.4756  -0.000566     8.2684  2.972E+11
964.5658     83666.      0.000
    17.460    -0.0261    21440. -6546.0636  -0.000566     4.6808  2.972E+11
983.0379     81278.      0.000
    17.640    -0.0273  9594.0509 -4403.0182  -0.000566     2.0946  2.972E+11
1001.2634     79085.      0.000
    17.820    -0.0286  2419.2788 -2220.8451  -0.000566     0.5282  2.972E+11
1019.2672     77063.      0.000
    18.000    -0.0298     0.000      0.000  -0.000566      0.000  2.972E+11
1037.0708     37596.      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

```
Pile-head deflection              =      0.2091032 inches
Computed slope at pile head       =     -0.0020005 radians
```

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uptown_pole4_36 inch_18ft

```
Maximum bending moment           =       2941342. inch-lbs
Maximum shear force              =        -32696. lbs
Depth of maximum bending moment  =     73.4400000 inches below pile head
Depth of maximum shear force     =    164.1600000 inches below pile head
Number of iterations             =             20
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =          10000. lbs
Moment     =        2340000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
18.0000	0.2091032	2941342.	-32696.
17.1000	0.2569920	2933449.	-34655.
16.2000	0.3566266	2921474.	-38549.
15.3000	0.5476268	2906773.	-43647.
14.4000	0.8516191	2892606.	-48326.
13.5000	1.4839641	2876786.	-53333.
12.6000	2.8299679	2858906.	-58419.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                                =       15000.000 lbs
Applied moment at pile head                             =     3510000.000 in-lbs
Axial thrust load on pile head                          =           0.000 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. Lat. Load lb/inch	Distrib. p lb/in
0.00	0.4473	3510000.	15000.	-0.003922	766.3016	2.972E+11	-0.2358	0.5693	0.000
0.180	0.4388	3542399.	14999.	-0.003896	773.3750	2.972E+11	-0.7028	3.4594	0.000
0.360	0.4304	3574796.	14997.	-0.003870	780.4477	2.972E+11	-0.6983	3.5042	0.000
0.540	0.4221	3607189.	14996.	-0.003844	787.5197	2.972E+11	-0.6937	3.5502	0.000
0.720	0.4138	3639578.	14994.	-0.003818	794.5910	2.972E+11	-0.6892	3.5974	0.000
0.900	0.4056	3671965.	14993.	-0.003791	801.6616	2.972E+11			

ADDENDUM 2 - JULY 14, 2015


```
-0.6846     3.6458      0.000
     1.080      0.3974   3704348.     14992.  -0.003764   808.7315  2.972E+11
-0.6800     3.6955      0.000
     1.260      0.3893   3736728.     14990.  -0.003737   815.8007  2.972E+11
-0.6753     3.7466      0.000
     1.440      0.3813   3769105.     14989.  -0.003710   822.8693  2.972E+11
-0.6706     3.7991      0.000
     1.620      0.3733   3801479.     14987.  -0.003683   829.9371  2.972E+11
-0.6659     3.8531      0.000
     1.800      0.3654   3833849.     14986.  -0.003655   837.0043  2.972E+11
-0.6612     3.9086      0.000
     1.980      0.3575   3866217.     14984.  -0.003627   844.0707  2.972E+11
-0.6564     3.9657      0.000
     2.160      0.3497   3898582.     14983.  -0.003599   851.1366  2.972E+11
-0.6516     4.0245      0.000
     2.340      0.3420   3930943.     14981.  -0.003570   858.2017  2.972E+11
-0.6467     4.0850      0.000
     2.520      0.3343   3963302.     14980.  -0.003541   865.2662  2.972E+11
-0.6419     4.1473      0.000
     2.700      0.3267   3995657.     14979.  -0.003513   872.3300  2.972E+11
-0.6369     4.2116      0.000
     2.880      0.3191   4028010.     14977.  -0.003483   879.3932  2.972E+11
-0.6320     4.2778      0.000
     3.060      0.3116   4060359.     14924.  -0.003454   886.4558  2.972E+11
-48.8077   338.3065      0.000
     3.240      0.3042   4092481.     14783.  -0.003424   893.4686  2.972E+11
-81.7587   580.5426      0.000
     3.420      0.2968   4124222.     14570.  -0.003394   900.3982  2.972E+11
-115.5761   841.0308      0.000
     3.600      0.2895   4155423.     14283.  -0.003364   907.2100  2.972E+11
-150.0473  1119.4012      0.000
     3.780      0.2823   4185924.     13921.  -0.003334   913.8690  2.972E+11
-184.9609  1415.2302      0.000
     3.960      0.2751   4215562.     13484.  -0.003304   920.3396  2.972E+11
-220.1073  1728.0356      0.000
     4.140      0.2680   4244173.     12970.  -0.003273   926.5860  2.972E+11
-255.2785  2057.2707      0.000
     4.320      0.2610   4271594.     12381.  -0.003242   932.5723  2.972E+11
-290.4799  2404.0656      0.000
     4.500      0.2540   4297659.     11715.  -0.003211   938.2628  2.972E+11
-326.2675  2774.3306      0.000
     4.680      0.2471   4322201.     10972.  -0.003179   943.6210  2.972E+11
-361.8219  3162.5822      0.000
     4.860      0.2403   4345056.     10152.  -0.003148   948.6106  2.972E+11
-396.9771  3568.5458      0.000
     5.040      0.2335   4366058.  9257.2667  -0.003116   953.1958  2.972E+11
-431.5701  3991.9083      0.000
     5.220      0.2268   4385047.  8288.4948  -0.003084   957.3415  2.972E+11
-465.4409  4432.3148      0.000
     5.400      0.2202   4401865.  7247.5112  -0.003053   961.0130  2.972E+11
-498.4327  4889.3635      0.000
     5.580      0.2136   4416356.  6136.3808  -0.003021   964.1769  2.972E+11
-530.3918  5362.6014      0.000
     5.760      0.2071   4428374.  4957.4966  -0.002988   966.8005  2.972E+11
-561.1677  5851.5181      0.000
     5.940      0.2007   4437773.  3712.3872  -0.002956   968.8525  2.972E+11
-591.7114  6367.3545      0.000
     6.120      0.1944   4444411.  2402.5292  -0.002924   970.3018  2.972E+11
-621.1201  6902.1868      0.000
     6.300      0.1881   4448152.  1030.6625  -0.002892   971.1184  2.972E+11
-649.1268  7454.2747      0.000
     6.480      0.1819   4448864.  -400.0463  -0.002859   971.2739  2.972E+11
-675.6036  8023.2491      0.000
```

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6.660	0.1757	4446424.	-1886.1583	-0.002827	970.7411	2.972E+11	-700.4261	8608.6924
6.840	0.1697	4440716.	-3423.9696	-0.002795	969.4950	2.972E+11	-723.4733	9210.1329
7.020	0.1637	4431632.	-5009.5191	-0.002762	967.5119	2.972E+11	-744.6281	9827.0397
7.200	0.1577	4419074.	-6638.5966	-0.002730	964.7703	2.972E+11	-763.7770	10459.
7.380	0.1519	4402953.	-8308.9349	-0.002698	961.2507	2.972E+11	-782.8326	11134.
7.560	0.1461	4383180.	-10020.	-0.002666	956.9338	2.972E+11	-801.6102	11853.
7.740	0.1404	4359666.	-11770.	-0.002634	951.8003	2.972E+11	-818.4228	12595.
7.920	0.1347	4332334.	-13553.	-0.002603	945.8332	2.972E+11	-833.1709	13360.
8.100	0.1291	4301115.	-15367.	-0.002572	939.0175	2.972E+11	-845.7584	14149.
8.280	0.1236	4265950.	-17205.	-0.002540	931.3403	2.972E+11	-856.0916	14962.
8.460	0.1181	4226791.	-19063.	-0.002510	922.7910	2.972E+11	-864.0801	15798.
8.640	0.1128	4183600.	-20935.	-0.002479	913.3616	2.972E+11	-869.6366	16660.
8.820	0.1074	4136352.	-22818.	-0.002449	903.0464	2.972E+11	-873.6887	17567.
9.000	0.1022	4085027.	-24711.	-0.002419	891.8413	2.972E+11	-879.0735	18584.
9.180	0.0970	4029602.	-26613.	-0.002389	879.7408	2.972E+11	-882.1680	19648.
9.360	0.0919	3970060.	-28519.	-0.002360	866.7417	2.972E+11	-882.8931	20763.
9.540	0.0868	3906399.	-30424.	-0.002332	852.8432	2.972E+11	-881.1704	21932.
9.720	0.0818	3838627.	-32323.	-0.002304	838.0473	2.972E+11	-876.9212	23162.
9.900	0.0768	3766764.	-34210.	-0.002276	822.3581	2.972E+11	-870.0664	24460.
10.080	0.0719	3690841.	-36079.	-0.002249	805.7826	2.972E+11	-860.5254	25835.
10.260	0.0671	3610903.	-37919.	-0.002222	788.3307	2.972E+11	-843.2707	27139.
10.440	0.0623	3527031.	-39696.	-0.002196	770.0198	2.972E+11	-802.1698	27792.
10.620	0.0576	3439416.	-41382.	-0.002171	750.8918	2.972E+11	-758.9119	28445.
10.800	0.0530	3348261.	-42972.	-0.002146	730.9908	2.972E+11	-713.5289	29098.
10.980	0.0484	3253776.	-44462.	-0.002122	710.3630	2.972E+11	-666.0499	29751.
11.160	0.0438	3156184.	-45847.	-0.002099	689.0567	2.972E+11	-616.5018	30405.
11.340	0.0393	3055716.	-47123.	-0.002077	667.1225	2.972E+11	-564.9089	31058.
11.520	0.0348	2952612.	-48286.	-0.002055	644.6129	2.972E+11	-511.2929	31711.
11.700	0.0304	2847123.	-49330.	-0.002034	621.5825	2.972E+11	-455.6732	32364.
11.880	0.0260	2739507.	-50252.	-0.002013	598.0879	2.972E+11	-398.0665	33017.
12.060	0.0217	2630034.	-51047.	-0.001994	574.1879	2.972E+11	-338.4870	33671.
12.240	0.0174	2518982.	-51712.	-0.001975	549.9431	2.972E+11		

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-276.9463	34324.	0.000					
12.420	0.0132	2406638.	-52242.	-0.001957	525.4162	2.972E+11	
-213.4538	34977.	0.000					
12.600	0.008973	2293298.	-52632.	-0.001940	500.6719	2.972E+11	
-148.0161	35630.	0.000					
12.780	0.004800	2179268.	-52879.	-0.001924	475.7768	2.972E+11	
-80.6378	36283.	0.000					
12.960	0.000662	2064861.	-52978.	-0.001908	450.7995	2.972E+11	
-11.3207	36936.	0.000					
13.140	-0.003444	1950402.	-52926.	-0.001894	425.8108	2.972E+11	
59.9352	37590.	0.000					
13.320	-0.007519	1836222.	-52717.	-0.001880	400.8831	2.972E+11	
133.1324	38243.	0.000					
13.500	-0.0116	1722663.	-52349.	-0.001867	376.0910	2.972E+11	
208.2753	38896.	0.000					
13.680	-0.0156	1610076.	-51815.	-0.001855	351.5110	2.972E+11	
285.3706	39549.	0.000					
13.860	-0.0196	1498820.	-51114.	-0.001844	327.2217	2.972E+11	
364.4265	40202.	0.000					
14.040	-0.0236	1389265.	-50239.	-0.001833	303.3036	2.972E+11	
445.4532	40856.	0.000					
14.220	-0.0275	1281788.	-49228.	-0.001824	279.8393	2.972E+11	
490.7414	38546.	0.000					
14.400	-0.0314	1176600.	-48145.	-0.001815	256.8748	2.972E+11	
512.0024	35189.	0.000					
14.580	-0.0353	1073802.	-47020.	-0.001806	234.4319	2.972E+11	
530.0495	32398.	0.000					
14.760	-0.0392	973476.	-45858.	-0.001799	212.5288	2.972E+11	
545.2707	30021.	0.000					
14.940	-0.0431	875694.	-44642.	-0.001792	191.1812	2.972E+11	
580.5958	29090.	0.000					
15.120	-0.0470	780621.	-42897.	-0.001786	170.4249	2.972E+11	
1035.1184	47596.	0.000					
15.300	-0.0508	690378.	-40630.	-0.001781	150.7230	2.972E+11	
1063.8036	45208.	0.000					
15.480	-0.0547	605098.	-38303.	-0.001776	132.1047	2.972E+11	
1091.5932	43130.	0.000					
15.660	-0.0585	524911.	-35916.	-0.001772	114.5983	2.972E+11	
1118.6146	41302.	0.000					
15.840	-0.0623	449943.	-33471.	-0.001769	98.2313	2.972E+11	
1144.9713	39682.	0.000					
16.020	-0.0661	380316.	-30970.	-0.001766	83.0305	2.972E+11	
1170.7488	38234.	0.000					
16.200	-0.0700	316153.	-28414.	-0.001763	69.0223	2.972E+11	
1196.0183	36931.	0.000					
16.380	-0.0738	257569.	-25804.	-0.001761	56.2323	2.972E+11	
1220.8398	35753.	0.000					
16.560	-0.0776	204681.	-23140.	-0.001759	44.6858	2.972E+11	
1245.2641	34680.	0.000					
16.740	-0.0814	157603.	-20424.	-0.001758	34.4078	2.972E+11	
1269.3348	33700.	0.000					
16.920	-0.0852	116447.	-17657.	-0.001757	25.4227	2.972E+11	
1293.0893	32801.	0.000					
17.100	-0.0889	81325.	-14839.	-0.001756	17.7547	2.972E+11	
1316.5601	31971.	0.000					
17.280	-0.0927	52344.	-11970.	-0.001756	11.4278	2.972E+11	
1339.7752	31204.	0.000					
17.460	-0.0965	29615.	-9051.0360	-0.001755	6.4656	2.972E+11	
1362.7593	30493.	0.000					
17.640	-0.1003	13244.	-6082.8794	-0.001755	2.8914	2.972E+11	
1385.5338	29831.	0.000					
17.820	-0.1041	3337.1333	-3065.7360	-0.001755	0.7286	2.972E+11	
1408.1175	29213.	0.000					

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```
    18.000    -0.1079      0.000      0.000  -0.001755      0.000  2.972E+11
1430.5270     14318.      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      0.4472501 inches
Computed slope at pile head      =     -0.0039216 radians
Maximum bending moment           =       4448864. inch-lbs
Maximum shear force              =        -52978. lbs
Depth of maximum bending moment  =     77.7600000 inches below pile head
Depth of maximum shear force     =    155.5200000 inches below pile head
Number of iterations             =             28
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =          15000. lbs
Moment     =        3510000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
18.0000	0.4472501	4448864.	-52978.
17.1000	0.6529271	4425107.	-58141.
16.2000	1.0173407	4400001.	-64028.
15.3000	1.5442093	4374507.	-69480.
14.4000	2.4251603	4348121.	-74701.
13.5000	4.9321630	4348523.	-83776.

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case	Load Type	Pile-head Condition 1 Shear V(lbs)	Pile-head Condition 2 Pile-head or Rotation in-lb, rad.,	Axial Loading	Pile-head Deflection	Maximum Moment in Pile	Maximum Shear in Pile

```
                                uptown_pole4_36 inch_18ft
 No.   No.    y(inches)     or in-lb/rad.        lbs          inches         in-lbs
         lbs          radians
----  ----  --------------  --------------  -------------  -------------
-------------  -------------  -------------
  1     1   V = 10000.0000  M =   2340000.      0.0000000     0.20910320
2941342.        -32696.    -0.00200054
  2     1   V =     15000.  M =   3510000.      0.0000000     0.44725005
4448864.        -52978.    -0.00392162

The analysis ended normally.
```

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downtown_pole1_36 inch_15ft

==========

LPile Plus for Windows, Version 2012-06.035

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

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Serial Number of Security Device: 500126253
Company Name Stored in Security Device: URS Corporation

Files Used for Analysis

Path to file locations: P:\AUS Geotech\Projects\41010530.052 City of El Paso\OCS Design\LPILE runs_RAR\
Name of input data file: downtown_pole1_36 inch_15ft.lp6d
Name of output report file: downtown_pole1_36 inch_15ft.lp6o
Name of plot output file: downtown_pole1_36 inch_15ft.lp6p
Name of runtime messeage file: downtown_pole1_36 inch_15ft.lp6r

---

Date and Time of Analysis

Date: January 17, 2013 Time: 15:01:08

Problem Title

Project Name: El Paso Streetcar

Job Number: 41010530

Client: City of El Paso

Engineer: R.Russo

Description: OCS Pole Foundations

ADDENDUM 2 - JULY 14, 2015

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:
- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments	=	100	
- Maximum number of iterations allowed	=	500	
- Deflection tolerance for convergence	=	1.0000E-05	in
- Maximum allowable deflection	=	100.0000	in

Pile Response Output Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 15.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	36.0000000
2	15.000000	36.0000000

Input Structural Properties:

Pile Section No. 1:

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downtown_pole1_36 inch_15ft

```
   Section Type                                          =    Elastic Pile
   Cross-sectional Shape                                 =        Circular
   Section Length                                        =     15.00000000 ft
   Top Width                                             =     36.00000000 in
   Bottom Width                                          =     36.00000000 in
   Top Area                                              =   1017.87601976 Sq. in
   Bottom Area                                           =   1017.87601976 Sq. in
   Moment of Inertia at Top                              =          82448. in^4
   Moment of Inertia at Bottom                           =          82448. in^4
   Elastic Modulus                                       =        3604997. lbs/in^2


--------------------------------------------------------------------------------
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                       =        0.000 degrees
                                                         =        0.000 radians

Pile Batter Angle                                        =        0.000 degrees
                                                         =        0.000 radians



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer             =       0.0000 ft
   Distance from top of pile to bottom of layer          =      3.00000 ft
   Effective unit weight at top of layer                 =    120.00000 pcf
   Effective unit weight at bottom of layer              =    120.00000 pcf
   Undrained cohesion at top of layer                    =      1.00000 psf
   Undrained cohesion at bottom of layer                 =      1.00000 psf
   Epsilon-50 at top of layer                            =      0.02000
   Epsilon-50 at bottom of layer                         =      0.02000


Layer 2 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer             =      3.00000 ft
   Distance from top of pile to bottom of layer          =     10.00000 ft
   Effective unit weight at top of layer                 =    115.00000 pcf
   Effective unit weight at bottom of layer              =    115.00000 pcf
   Undrained cohesion at top of layer                    =   1000.00000 psf
   Undrained cohesion at bottom of layer                 =   1000.00000 psf
   Epsilon-50 at top of layer                            =      0.01000
   Epsilon-50 at bottom of layer                         =      0.01000


Layer 3 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer             =     10.00000 ft
   Distance from top of pile to bottom of layer          =     25.00000 ft
   Effective unit weight at top of layer                 =    120.00000 pcf
   Effective unit weight at bottom of layer              =    120.00000 pcf
   Friction angle at top of layer                        =     27.00000 deg.
```

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downtown_pole1_36 inch_15ft

Friction angle at bottom of layer = 27.00000 deg.
Subgrade k at top of layer = 90.00000 pci
Subgrade k at bottom of layer = 90.00000 pci

(Depth of lowest soil layer extends 10.00 ft below pile tip)

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	Strain Factor Epsilon 50	kpy pci
1	Soft Clay	0.00	120.000	1.000	--	0.02000	--
		3.000	120.000	1.000	--	0.02000	--
2	Soft Clay	3.000	115.000	1000.000	--	0.01000	--
		10.000	115.000	1000.000	--	0.01000	--
3	Sand (Reese, et al.)	10.000	120.000	--	27.000	--	90.000
		25.000	120.000	--	27.000	--	90.000

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	1	V = 3000.00000 lbs	M = 348000. in-lbs	0.0000000	Yes
2	1	V = 4500.00000 lbs	M = 522000. in-lbs	0.0000000	Yes

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head

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downtown_pole1_36 inch_15ft

y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

---

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 3000.000 lbs
Applied moment at pile head = 348000.000 in-lbs
Axial thrust load on pile head = 0.000 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. p lb/in	Distrib. Lat. Load lb/inch
0.00	0.0482	348000.	3000.0000	-0.000490	75.9752	2.972E+11	-0.1122	2.0937	0.000
0.150	0.0474	353400.	2999.5978	-0.000488	77.1541	2.972E+11	-0.3347	12.7174	0.000
0.300	0.0465	358799.	2998.9973	-0.000486	78.3327	2.972E+11	-0.3326	12.8767	0.000
0.450	0.0456	364196.	2998.4005	-0.000483	79.5111	2.972E+11	-0.3305	13.0403	0.000
0.600	0.0448	369593.	2997.8075	-0.000481	80.6893	2.972E+11	-0.3284	13.2085	0.000
0.750	0.0439	374988.	2997.2183	-0.000479	81.8673	2.972E+11	-0.3263	13.3813	0.000
0.900	0.0430	380383.	2996.6330	-0.000477	83.0450	2.972E+11	-0.3241	13.5591	0.000
1.050	0.0422	385776.	2996.0515	-0.000474	84.2225	2.972E+11	-0.3219	13.7420	0.000
1.200	0.0413	391169.	2995.4740	-0.000472	85.3997	2.972E+11	-0.3198	13.9302	0.000
1.350	0.0405	396560.	2994.9004	-0.000470	86.5768	2.972E+11	-0.3176	14.1240	0.000
1.500	0.0396	401950.	2994.3307	-0.000467	87.7536	2.972E+11	-0.3153	14.3237	0.000
1.650	0.0388	407339.	2993.7651	-0.000465	88.9302	2.972E+11			

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```
-0.3131    14.5294      0.000
     1.800      0.0380    412728.  2993.2036  -0.000462    90.1065  2.972E+11
-0.3108    14.7416      0.000
     1.950      0.0371    418115.  2992.6461  -0.000460    91.2827  2.972E+11
-0.3086    14.9605      0.000
     2.100      0.0363    423501.  2992.0928  -0.000457    92.4586  2.972E+11
-0.3063    15.1864      0.000
     2.250      0.0355    428887.  2991.5436  -0.000455    93.6343  2.972E+11
-0.3039    15.4197      0.000
     2.400      0.0347    434271.  2990.9986  -0.000452    94.8098  2.972E+11
-0.3016    15.6608      0.000
     2.550      0.0339    439654.  2990.4579  -0.000449    95.9851  2.972E+11
-0.2992    15.9100      0.000
     2.700      0.0330    445036.  2989.9215  -0.000447    97.1602  2.972E+11
-0.2968    16.1679      0.000
     2.850      0.0322    450418.  2989.3894  -0.000444    98.3350  2.972E+11
-0.2944    16.4348      0.000
     3.000      0.0314    455798.  2940.7599  -0.000441    99.5097  2.972E+11
-53.7384  3075.9235      0.000
     3.150      0.0307    461005.  2781.2252  -0.000438   100.6463  2.972E+11
-123.5224  7252.8916      0.000
     3.300      0.0299    465811.  2558.2929  -0.000436   101.6956  2.972E+11
-124.1801  7483.5655      0.000
     3.450      0.0291    470214.  2334.2167  -0.000433   102.6570  2.972E+11
-124.7934  7722.6247      0.000
     3.600      0.0283    474214.  2109.0770  -0.000430   103.5302  2.972E+11
-125.3618  7970.5844      0.000
     3.750      0.0275    477807.  1882.9554  -0.000427   104.3146  2.972E+11
-125.8845  8228.0012      0.000
     3.900      0.0268    480993.  1655.9348  -0.000424   105.0101  2.972E+11
-126.3607  8495.4773      0.000
     4.050      0.0260    483769.  1428.0995  -0.000421   105.6161  2.972E+11
-126.7896  8773.6674      0.000
     4.200      0.0253    486134.  1199.5357  -0.000418   106.1325  2.972E+11
-127.1702  9063.2843      0.000
     4.350      0.0245    488087.   970.3313  -0.000415   106.5589  2.972E+11
-127.5013  9365.1074      0.000
     4.500      0.0238    489627.   740.5766  -0.000412   106.8951  2.972E+11
-127.7817  9679.9906      0.000
     4.650      0.0230    490753.   510.3638  -0.000409   107.1409  2.972E+11
-128.0102     10009.      0.000
     4.800      0.0223    491464.   279.7879  -0.000406   107.2962  2.972E+11
-128.1853     10353.      0.000
     4.950      0.0216    491760.    48.9464  -0.000403   107.3608  2.972E+11
-128.3053     10713.      0.000
     5.100      0.0208    491640.  -182.0601  -0.000401   107.3347  2.972E+11
-128.3686     11090.      0.000
     5.250      0.0201    491105.  -413.1277  -0.000398   107.2178  2.972E+11
-128.3732     11487.      0.000
     5.400      0.0194    490153.  -644.1491  -0.000395   107.0100  2.972E+11
-128.3172     11904.      0.000
     5.550      0.0187    488786.  -875.0130  -0.000392   106.7115  2.972E+11
-128.1982     12343.      0.000
     5.700      0.0180    487003. -1105.6039  -0.000389   106.3223  2.972E+11
-128.0139     12806.      0.000
     5.850      0.0173    484806. -1335.8017  -0.000386   105.8425  2.972E+11
-127.7614     13296.      0.000
     6.000      0.0166    482194. -1565.4809  -0.000383   105.2724  2.972E+11
-127.4378     13814.      0.000
     6.150      0.0159    479170. -1794.5107  -0.000380   104.6121  2.972E+11
-127.0398     14365.      0.000
     6.300      0.0152    475734. -2022.7539  -0.000377   103.8620  2.972E+11
-126.5637     14951.      0.000
```

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```
     6.450     0.0146    471888. -2250.0663  -0.000374   103.0224  2.972E+11
-126.0056     15576.      0.000
     6.600     0.0139    467634. -2476.2960  -0.000371   102.0936  2.972E+11
-125.3608     16245.      0.000
     6.750     0.0132    462973. -2701.2826  -0.000368   101.0761  2.972E+11
-124.6243     16962.      0.000
     6.900     0.0126    457909. -2924.8559  -0.000366    99.9705  2.972E+11
-123.7904     17735.      0.000
     7.050     0.0119    452444. -3146.8346  -0.000363    98.7773  2.972E+11
-122.8526     18569.      0.000
     7.200     0.0113    446581. -3367.0253  -0.000360    97.4972  2.972E+11
-121.8037     19475.      0.000
     7.350     0.0106    440323. -3585.2201  -0.000357    96.1310  2.972E+11
-120.6351     20462.      0.000
     7.500   0.009971    433674. -3801.1951  -0.000355    94.6794  2.972E+11
-119.3371     21543.      0.000
     7.650   0.009335    426638. -4014.7072  -0.000352    93.1435  2.972E+11
-117.8986     22735.      0.000
     7.800   0.008703    419221. -4225.4917  -0.000350    91.5241  2.972E+11
-116.3063     24056.      0.000
     7.950   0.008076    411426. -4433.2574  -0.000347    89.8224  2.972E+11
-114.5445     25531.      0.000
     8.100   0.007453    403261. -4637.6825  -0.000345    88.0398  2.972E+11
-112.5945     27193.      0.000
     8.250   0.006835    394731. -4838.4075  -0.000342    86.1774  2.972E+11
-110.4334     29084.      0.000
     8.400   0.006221    385843. -5035.0273  -0.000340    84.2370  2.972E+11
-108.0331     31259.      0.000
     8.550   0.005611    376605. -5227.0794  -0.000338    82.2202  2.972E+11
-105.3581     33798.      0.000
     8.700   0.005005    367025. -5414.0284  -0.000335    80.1288  2.972E+11
-102.3631     36811.      0.000
     8.850   0.004404    357114. -5595.2441  -0.000333    77.9650  2.972E+11
-98.9877     40460.      0.000
     9.000   0.003806    346882. -5769.9681  -0.000331    75.7312  2.972E+11
-95.1500     44999.      0.000
     9.150   0.003212    336342. -5937.2622  -0.000329    73.4301  2.972E+11
-90.7324     50845.      0.000
     9.300   0.002622    325508. -6095.9234  -0.000327    71.0648  2.972E+11
-85.5577     58740.      0.000
     9.450   0.002035    314397. -6244.3268  -0.000325    68.6390  2.972E+11
-79.3350     70173.      0.000
     9.600   0.001452    303029. -6380.1015  -0.000323    66.1571  2.972E+11
-71.5257     88687.      0.000
     9.750   0.000872    291429. -6499.2858  -0.000321    63.6246  2.972E+11
-60.9013    125761.      0.000
     9.900   0.000295    279631. -6592.7239  -0.000320    61.0490  2.972E+11
-42.9188    262033.      0.000
    10.050  -0.000279    267695. -6629.1846  -0.000318    58.4430  2.972E+11
2.4069     15530.      0.000
    10.200  -0.000850    255766. -6620.2954  -0.000316    55.8388  2.972E+11
7.4700     15822.      0.000
    10.350  -0.001418    243862. -6602.1486  -0.000315    53.2398  2.972E+11
12.6931     16113.      0.000
    10.500  -0.001983    231998. -6574.4564  -0.000313    50.6498  2.972E+11
18.0760     16405.      0.000
    10.650  -0.002546    220194. -6536.9311  -0.000312    48.0726  2.972E+11
23.6187     16696.      0.000
    10.800  -0.003107    208466. -6489.2853  -0.000311    45.5121  2.972E+11
29.3211     16988.      0.000
    10.950  -0.003665    196832. -6431.2313  -0.000310    42.9723  2.972E+11
35.1833     17280.      0.000
    11.100  -0.004221    185313. -6362.4815  -0.000308    40.4575  2.972E+11
```

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```
41.2054     17571.      0.000
    11.250  -0.004775    173927. -6282.7477  -0.000307    37.9717  2.972E+11
47.3877     17863.      0.000
    11.400  -0.005327    162695. -6191.7416  -0.000306    35.5195  2.972E+11
53.7303     18154.      0.000
    11.550  -0.005878    151637. -6089.1740  -0.000305    33.1053  2.972E+11
60.2336     18446.      0.000
    11.700  -0.006426    140774. -5974.7554  -0.000304    30.7337  2.972E+11
66.8981     18738.      0.000
    11.850  -0.006974    130128. -5848.1954  -0.000304    28.4095  2.972E+11
73.7242     19029.      0.000
    12.000  -0.007519    119721. -5709.2025  -0.000303    26.1374  2.972E+11
80.7123     19321.      0.000
    12.150  -0.008064    109575. -5557.4847  -0.000302    23.9223  2.972E+11
87.8630     19612.      0.000
    12.300  -0.008607     99714. -5392.7487  -0.000302    21.7694  2.972E+11
95.1770     19904.      0.000
    12.450  -0.009149     90161. -5214.7001  -0.000301    19.6839  2.972E+11
102.6548     20196.      0.000
    12.600  -0.009691     80941. -5023.0435  -0.000300    17.6710  2.972E+11
110.2970     20487.      0.000
    12.750    -0.0102     72078. -4817.4821  -0.000300    15.7360  2.972E+11
118.1045     20779.      0.000
    12.900    -0.0108     63598. -4597.7181  -0.000300    13.8847  2.972E+11
126.0778     21070.      0.000
    13.050    -0.0113     55526. -4363.4522  -0.000299    12.1225  2.972E+11
134.2177     21362.      0.000
    13.200    -0.0118     47889. -4114.3839  -0.000299    10.4552  2.972E+11
142.5249     21654.      0.000
    13.350    -0.0124     40714. -3850.2115  -0.000299     8.8888  2.972E+11
151.0001     21945.      0.000
    13.500    -0.0129     34029. -3570.6317  -0.000298     7.4291  2.972E+11
159.6441     22237.      0.000
    13.650    -0.0135     27860. -3275.3403  -0.000298     6.0824  2.972E+11
168.4575     22528.      0.000
    13.800    -0.0140     22237. -2964.0316  -0.000298     4.8549  2.972E+11
177.4410     22820.      0.000
    13.950    -0.0145     17190. -2636.3989  -0.000298     3.7528  2.972E+11
186.5953     23112.      0.000
    14.100    -0.0151     12746. -2293.2439  -0.000298     2.7828  2.972E+11
194.6880     23256.      0.000
    14.250    -0.0156  8933.9520 -1937.5272  -0.000298     1.9505  2.972E+11
200.5528     23134.      0.000
    14.400    -0.0161  5771.2984 -1571.2430  -0.000298     1.2600  2.972E+11
206.4296     23021.      0.000
    14.550    -0.0167  3277.4770 -1194.3696  -0.000298     0.7155  2.972E+11
212.3186     22917.      0.000
    14.700    -0.0172  1471.5679  -806.8852  -0.000298     0.3213  2.972E+11
218.2195     22820.      0.000
    14.850    -0.0177   372.6901  -408.7689  -0.000298     0.0814  2.972E+11
224.1320     22731.      0.000
    15.000    -0.0183      0.000      0.000  -0.000298      0.000  2.972E+11
230.0556     11324.      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

```
Pile-head deflection              =      0.0482477 inches
Computed slope at pile head       =     -0.0004899 radians
Maximum bending moment            =        491760. inch-lbs
Maximum shear force               =  -6629.1846301 lbs
```

downtown_pole1_36 inch_15ft

```
Depth of maximum bending moment  =     59.4000000 inches below pile head
Depth of maximum shear force     =    120.6000000 inches below pile head
Number of iterations             =             21
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =           3000. lbs
Moment     =         348000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
15.0000	0.0482477	491760.	-6629.1846301
14.2500	0.0629010	490582.	-7174.3566160
13.5000	0.0805942	487061.	-7704.0615907
12.7500	0.1068020	482951.	-8260.9016050
12.0000	0.1510612	480103.	-8913.6434937
11.2500	0.2265409	476546.	-9532.1297651
10.5000	0.4594503	472622.	-10145.
9.7500	1.1767959	467462.	-11311.
9.0000	2.5663557	465945.	-12577.
8.2500	5.9539713	463230.	-14100.
7.5000	15.7800170	460456.	-16109.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                                =        4500.000 lbs
Applied moment at pile head                             =      522000.000 in-lbs
Axial thrust load on pile head                          =           0.000 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. Lat. Load lb/inch	Distrib. p lb/in
0.00	0.1214	522000.	4500.0000	-0.001078	113.9628	2.972E+11	-0.1526	1.1319	0.000
0.150	0.1194	530100.	4499.4527	-0.001075	115.7311	2.972E+11	-0.4555	6.8644	0.000
0.300	0.1175	538198.	4498.6351	-0.001071	117.4991	2.972E+11	-0.4530	6.9394	0.000
0.450	0.1156	546295.	4497.8219	-0.001068	119.2668	2.972E+11	-0.4505	7.0163	0.000
0.600	0.1137	554390.	4497.0133	-0.001065	121.0342	2.972E+11			

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downtown_pole1_36 inch_15ft

-0.4480	7.0950	0.000						
0.750	0.1117	562484.	4496.2091	-0.001061	122.8013	2.972E+11		
-0.4455	7.1758	0.000						
0.900	0.1098	570577.	4495.4096	-0.001058	124.5680	2.972E+11		
-0.4429	7.2586	0.000						
1.050	0.1079	578668.	4494.6146	-0.001054	126.3344	2.972E+11		
-0.4404	7.3436	0.000						
1.200	0.1060	586757.	4493.8243	-0.001051	128.1006	2.972E+11		
-0.4378	7.4308	0.000						
1.350	0.1042	594845.	4493.0387	-0.001047	129.8664	2.972E+11		
-0.4351	7.5204	0.000						
1.500	0.1023	602932.	4492.2578	-0.001044	131.6319	2.972E+11		
-0.4325	7.6124	0.000						
1.650	0.1004	611017.	4491.4817	-0.001040	133.3970	2.972E+11		
-0.4299	7.7069	0.000						
1.800	0.0985	619101.	4490.7104	-0.001036	135.1619	2.972E+11		
-0.4272	7.8040	0.000						
1.950	0.0967	627184.	4489.9439	-0.001032	136.9265	2.972E+11		
-0.4245	7.9039	0.000						
2.100	0.0948	635265.	4489.1823	-0.001029	138.6908	2.972E+11		
-0.4217	8.0067	0.000						
2.250	0.0930	643345.	4488.4257	-0.001025	140.4548	2.972E+11		
-0.4190	8.1125	0.000						
2.400	0.0911	651424.	4487.6741	-0.001021	142.2185	2.972E+11		
-0.4162	8.2214	0.000						
2.550	0.0893	659501.	4486.9274	-0.001017	143.9819	2.972E+11		
-0.4134	8.3336	0.000						
2.700	0.0875	667576.	4486.1859	-0.001013	145.7450	2.972E+11		
-0.4105	8.4492	0.000						
2.850	0.0856	675651.	4485.4495	-0.001009	147.5078	2.972E+11		
-0.4077	8.5685	0.000						
3.000	0.0838	683724.	4418.0292	-0.001005	149.2703	2.972E+11		
-74.5038	1599.7912	0.000						
3.150	0.0820	691556.	4196.6557	-0.001001	150.9802	2.972E+11		
-171.4668	3762.8509	0.000						
3.300	0.0802	698832.	3886.9952	-0.000996	152.5687	2.972E+11		
-172.6005	3872.5845	0.000						
3.450	0.0784	705549.	3575.3411	-0.000992	154.0351	2.972E+11		
-173.6818	3985.7550	0.000						
3.600	0.0767	711703.	3261.7885	-0.000988	155.3787	2.972E+11		
-174.7100	4102.5522	0.000						
3.750	0.0749	717291.	2946.4335	-0.000983	156.5987	2.972E+11		
-175.6844	4223.1790	0.000						
3.900	0.0731	722310.	2629.3736	-0.000979	157.6945	2.972E+11		
-176.6043	4347.8527	0.000						
4.050	0.0714	726757.	2310.7078	-0.000975	158.6653	2.972E+11		
-177.4688	4476.8063	0.000						
4.200	0.0696	730629.	1990.5369	-0.000970	159.5106	2.972E+11		
-178.2768	4610.2913	0.000						
4.350	0.0679	733923.	1668.9633	-0.000966	160.2298	2.972E+11		
-179.0272	4748.5789	0.000						
4.500	0.0661	736637.	1346.0920	-0.000961	160.8223	2.972E+11		
-179.7188	4891.9629	0.000						
4.650	0.0644	738769.	1022.0299	-0.000957	161.2877	2.972E+11		
-180.3502	5040.7620	0.000						
4.800	0.0627	740317.	696.8866	-0.000952	161.6256	2.972E+11		
-180.9201	5195.3230	0.000						
4.950	0.0610	741278.	370.7743	-0.000948	161.8354	2.972E+11		
-181.4268	5356.0240	0.000						
5.100	0.0593	741651.	43.8083	-0.000943	161.9170	2.972E+11		
-181.8687	5523.2787	0.000						
5.250	0.0576	741436.	-283.8931	-0.000939	161.8699	2.972E+11		
-182.2439	5697.5401	0.000						

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```
     5.400      0.0559     740629.  -612.2080  -0.000935   161.6939  2.972E+11
-182.5505  5879.3065       0.000
     5.550      0.0542     739232.  -941.0111  -0.000930   161.3887  2.972E+11
-182.7862  6069.1268       0.000
     5.700      0.0525     737242. -1270.1726  -0.000926   160.9543  2.972E+11
-182.9489  6267.6077       0.000
     5.850      0.0509     734659. -1599.5589  -0.000921   160.3904  2.972E+11
-183.0359  6475.4221       0.000
     6.000      0.0492     731483. -1929.0314  -0.000917   159.6971  2.972E+11
-183.0446  6693.3180       0.000
     6.150      0.0476     727715. -2258.4464  -0.000912   158.8743  2.972E+11
-182.9720  6922.1303       0.000
     6.300      0.0459     723353. -2587.6547  -0.000908   157.9221  2.972E+11
-182.8150  7162.7939       0.000
     6.450      0.0443     718399. -2916.5011  -0.000903   156.8405  2.972E+11
-182.5699  7416.3599       0.000
     6.600      0.0427     712853. -3244.8239  -0.000899   155.6298  2.972E+11
-182.2331  7684.0142       0.000
     6.750      0.0411     706718. -3572.4539  -0.000895   154.2903  2.972E+11
-181.8003  7967.1012       0.000
     6.900      0.0395     699993. -3899.2143  -0.000891   152.8221  2.972E+11
-181.2668  8267.1519       0.000
     7.050      0.0379     692680. -4224.9194  -0.000886   151.2257  2.972E+11
-180.6277  8585.9176       0.000
     7.200      0.0363     684783. -4549.3739  -0.000882   149.5015  2.972E+11
-179.8773  8925.4132       0.000
     7.350      0.0347     676303. -4872.3718  -0.000878   147.6501  2.972E+11
-179.0093  9287.9695       0.000
     7.500      0.0331     667242. -5193.6953  -0.000874   145.6721  2.972E+11
-178.0168  9676.2994       0.000
     7.650      0.0315     657605. -5513.1133  -0.000870   143.5681  2.972E+11
-176.8920     10094.       0.000
     7.800      0.0300     647395. -5830.3796  -0.000866   141.3390  2.972E+11
-175.6261     10544.       0.000
     7.950      0.0284     636616. -6145.2314  -0.000862   138.9857  2.972E+11
-174.2092     11031.       0.000
     8.100      0.0269     625272. -6457.3865  -0.000858   136.5092  2.972E+11
-172.6298     11560.       0.000
     8.250      0.0253     613369. -6766.5410  -0.000855   133.9105  2.972E+11
-170.8751     12139.       0.000
     8.400      0.0238     600913. -7072.3655  -0.000851   131.1910  2.972E+11
-168.9300     12775.       0.000
     8.550      0.0223     587909. -7374.5017  -0.000847   128.3520  2.972E+11
-166.7768     13477.       0.000
     8.700      0.0208     574365. -7672.5565  -0.000844   125.3950  2.972E+11
-164.3951     14259.       0.000
     8.850      0.0192     560288. -7966.0964  -0.000840   122.3218  2.972E+11
-161.7603     15136.       0.000
     9.000      0.0177     545687. -8254.6391  -0.000837   119.1341  2.972E+11
-158.8427     16129.       0.000
     9.150      0.0162     530571. -8537.6432  -0.000834   115.8340  2.972E+11
-155.6062     17265.       0.000
     9.300      0.0147     514951. -8814.4940  -0.000831   112.4239  2.972E+11
-152.0057     18581.       0.000
     9.450      0.0132     498839. -9084.4848  -0.000828   108.9063  2.972E+11
-147.9840     20129.       0.000
     9.600      0.0117     482247. -9346.7905  -0.000825   105.2839  2.972E+11
-143.4667     21985.       0.000
     9.750      0.0103     465190. -9600.4289  -0.000822   101.5601  2.972E+11
-138.3538     24262.       0.000
     9.900   0.008788      447685. -9844.2027  -0.000819    97.7385  2.972E+11
-132.5060     27140.       0.000
    10.050   0.007317      429751.    -10020.  -0.000816    93.8231  2.972E+11
```

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```
-63.1252     15530.      0.000
    10.200   0.005850    411612.    -10123.  -0.000814    89.8630  2.972E+11
-51.4165     15822.      0.000
    10.350   0.004387    393307.    -10205.  -0.000811    85.8666  2.972E+11
-39.2726     16113.      0.000
    10.500   0.002929    374875.    -10264.  -0.000809    81.8424  2.972E+11
-26.6940     16405.      0.000
    10.650   0.001475    356355.    -10301.  -0.000807    77.7994  2.972E+11
-13.6809     16696.      0.000
    10.800  2.472E-05    337792.    -10313.  -0.000805    73.7466  2.972E+11
-0.2333     16988.      0.000
    10.950  -0.001422    319228.    -10301.  -0.000803    69.6937  2.972E+11
13.6488     17280.      0.000
    11.100  -0.002865    300708.    -10264.  -0.000801    65.6504  2.972E+11
27.9656     17571.      0.000
    11.250  -0.004305    282279.    -10200.  -0.000799    61.6270  2.972E+11
42.7174     17863.      0.000
    11.400  -0.005741    263988.    -10110.  -0.000797    57.6337  2.972E+11
57.9047     18154.      0.000
    11.550  -0.007175    245884. -9991.2180  -0.000796    53.6814  2.972E+11
73.5279     18446.      0.000
    11.700  -0.008606    228019. -9844.4138  -0.000794    49.7811  2.972E+11
89.5878     18738.      0.000
    11.850    -0.0100    210445. -9668.3082  -0.000793    45.9442  2.972E+11
106.0851     19029.      0.000
    12.000    -0.0115    193213. -9462.1130  -0.000792    42.1823  2.972E+11
123.0207     19321.      0.000
    12.150    -0.0129    176381. -9225.0385  -0.000791    38.5074  2.972E+11
140.3954     19612.      0.000
    12.300    -0.0143    160003. -8956.2933  -0.000790    34.9319  2.972E+11
158.2104     19904.      0.000
    12.450    -0.0157    144138. -8655.0841  -0.000789    31.4682  2.972E+11
176.4665     20196.      0.000
    12.600    -0.0171    128845. -8320.6156  -0.000788    28.1294  2.972E+11
195.1651     20487.      0.000
    12.750    -0.0186    114184. -7952.0905  -0.000787    24.9286  2.972E+11
214.3072     20779.      0.000
    12.900    -0.0200    100218. -7548.7094  -0.000787    21.8794  2.972E+11
233.8940     21070.      0.000
    13.050    -0.0214     87009. -7109.6706  -0.000786    18.9957  2.972E+11
253.9268     21362.      0.000
    13.200    -0.0228     74623. -6634.1705  -0.000785    16.2916  2.972E+11
274.4067     21654.      0.000
    13.350    -0.0242     63126. -6128.6681  -0.000785    13.7816  2.972E+11
287.2626     21345.      0.000
    13.500    -0.0256     52559. -5610.1145  -0.000785    11.4748  2.972E+11
288.9081     20285.      0.000
    13.650    -0.0270     42929. -5089.1176  -0.000784     9.3723  2.972E+11
289.9773     19297.      0.000
    13.800    -0.0285     34239. -4566.6993  -0.000784     7.4750  2.972E+11
290.4873     18372.      0.000
    13.950    -0.0299     26489. -4043.8528  -0.000784     5.7831  2.972E+11
290.4533     17502.      0.000
    14.100    -0.0313     19681. -3518.8477  -0.000784     4.2967  2.972E+11
292.8856     16852.      0.000
    14.250    -0.0327     13821. -2981.8458  -0.000784     3.0175  2.972E+11
303.7832     16725.      0.000
    14.400    -0.0341  8946.1552 -2425.1828  -0.000784     1.9531  2.972E+11
314.7311     16611.      0.000
    14.550    -0.0355  5090.6905 -1848.7660  -0.000784     1.1114  2.972E+11
325.7320     16509.      0.000
    14.700    -0.0369  2290.5976 -1252.4978  -0.000784     0.5001  2.972E+11
336.7882     16417.      0.000
```

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```
    14.850    -0.0383   581.6985  -636.2771  -0.000784     0.1270  2.972E+11
347.9014     16335.      0.000
    15.000    -0.0397      0.000      0.000  -0.000784      0.000  2.972E+11
359.0731  8130.5060      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      0.1213709 inches
Computed slope at pile head      =     -0.0010777 radians
Maximum bending moment           =        741651. inch-lbs
Maximum shear force              =        -10313. lbs
Depth of maximum bending moment  =     61.2000000 inches below pile head
Depth of maximum shear force     =    129.6000000 inches below pile head
Number of iterations             =             24
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =           4500. lbs
Moment     =         522000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
15.0000	0.1213709	741651.	-10313.
14.2500	0.1601850	739555.	-11195.
13.5000	0.2089391	733877.	-12024.
12.7500	0.2871120	727089.	-12825.
12.0000	0.4289205	721936.	-13783.
11.2500	0.7018109	715543.	-14417.
10.5000	1.5117405	709121.	-15191.
9.7500	3.9647607	701197.	-16968.
9.0000	8.6553142	698919.	-18866.
8.2500	22.2574656	696027.	-21460.

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

ADDENDUM 2 - JULY 14, 2015

```
                              downtown_pole1_36 inch_15ft
                Pile-head      Pile-head                                          Maximum
        Maximum
Load  Load    Condition 1    Condition 2        Axial        Pile-head       Moment
         Shear         Pile-head
Case  Type    V(lbs) or     in-lb, rad.,       Loading      Deflection       in Pile
        in Pile       Rotation
 No.   No.    y(inches)     or in-lb/rad.        lbs          inches         in-lbs
          lbs           radians
----  ----  --------------  --------------  -------------  -------------
-------------  -------------  -------------
  1     1   V =  3000.0000  M =    348000.      0.0000000     0.04824765
491760.     -6629.1846    -0.00048993
  2     1   V =  4500.0000  M =    522000.      0.0000000     0.12137090
741651.        -10313.    -0.00107774

The analysis ended normally.
```

ADDENDUM 2 - JULY 14, 2015

downtown_pole2_36 inch_15ft

==========

LPile Plus for Windows, Version 2012-06.035

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This copy of LPile is licensed to:

URS
URS Austin

Serial Number of Security Device: 500126253
Company Name Stored in Security Device: URS Corporation

Files Used for Analysis

Path to file locations: P:\AUS Geotech\Projects\41010530.052 City of El Paso\OCS Design\LPILE runs_RAR\
Name of input data file: downtown_pole2_36 inch_15ft.lp6d
Name of output report file: downtown_pole2_36 inch_15ft.lp6o
Name of plot output file: downtown_pole2_36 inch_15ft.lp6p
Name of runtime messeage file: downtown_pole2_36 inch_15ft.lp6r

---

Date and Time of Analysis

Date: January 17, 2013 Time: 15:02:26

Problem Title

Project Name: El Paso Streetcar

Job Number: 41010530

Client: City of El Paso

Engineer: R. Russo

Description: OCS Pole Foundations

ADDENDUM 2 - JULY 14, 2015

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:
- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments	=	100	
- Maximum number of iterations allowed	=	500	
- Deflection tolerance for convergence	=	1.0000E-05	in
- Maximum allowable deflection	=	100.0000	in

Pile Response Output Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 15.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	36.0000000
2	15.000000	36.0000000

Input Structural Properties:

Pile Section No. 1:

ADDENDUM 2 - JULY 14, 2015

downtown_pole2_36 inch_15ft

```
   Section Type                                        =    Elastic Pile
   Cross-sectional Shape                               =        Circular
   Section Length                                      =     15.00000000 ft
   Top Width                                           =     36.00000000 in
   Bottom Width                                        =     36.00000000 in
   Top Area                                            =   1017.87601976 Sq. in
   Bottom Area                                         =   1017.87601976 Sq. in
   Moment of Inertia at Top                            =          82448. in^4
   Moment of Inertia at Bottom                         =          82448. in^4
   Elastic Modulus                                     =        3604997. lbs/in^2


--------------------------------------------------------------------------------
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                     =        0.000 degrees
                                                       =        0.000 radians

Pile Batter Angle                                      =        0.000 degrees
                                                       =        0.000 radians



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer           =       0.0000 ft
   Distance from top of pile to bottom of layer        =      3.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Undrained cohesion at top of layer                  =      1.00000 psf
   Undrained cohesion at bottom of layer               =      1.00000 psf
   Epsilon-50 at top of layer                          =      0.02000
   Epsilon-50 at bottom of layer                       =      0.02000


Layer 2 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer           =      3.00000 ft
   Distance from top of pile to bottom of layer        =     10.00000 ft
   Effective unit weight at top of layer               =    115.00000 pcf
   Effective unit weight at bottom of layer            =    115.00000 pcf
   Undrained cohesion at top of layer                  =   1000.00000 psf
   Undrained cohesion at bottom of layer               =   1000.00000 psf
   Epsilon-50 at top of layer                          =      0.01000
   Epsilon-50 at bottom of layer                       =      0.01000


Layer 3 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =     10.00000 ft
   Distance from top of pile to bottom of layer        =     25.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Friction angle at top of layer                      =     27.00000 deg.
```

ADDENDUM 2 - JULY 14, 2015

downtown_pole2_36 inch_15ft

```
   Friction angle at bottom of layer                    =     27.00000 deg.
   Subgrade k at top of layer                           =     90.00000 pci
   Subgrade k at bottom of layer                        =     90.00000 pci


   (Depth of lowest soil layer extends   10.00 ft below pile tip)


--------------------------------------------------------------------------------
                           Summary of Soil Properties
--------------------------------------------------------------------------------

                      Layer                      Layer      Effective    Undrained
Angle of      Strain
Layer               Soil Type                   Depth       Unit Wt.    Cohesion
Friction      Factor        kpy
 Num.         (p-y Curve Criteria)               ft           pcf          psf
   deg.     Epsilon 50      pci
-----   ----------------------------------   ----------   ----------   ----------
----------   ----------   ----------
  1     Soft Clay                                 0.00      120.000        1.000
   --          0.02000       --
                                                 3.000      120.000        1.000
   --          0.02000       --
  2     Soft Clay                                 3.000      115.000     1000.000
   --          0.01000       --
                                                10.000      115.000     1000.000
   --          0.01000       --
  3     Sand (Reese, et al.)                     10.000      120.000       --
   27.000       --           90.000
                                                25.000      120.000       --
   27.000       --           90.000


--------------------------------------------------------------------------------
                                  Loading Type
--------------------------------------------------------------------------------

Static loading criteria were used when computing p-y curves for all analyses.


--------------------------------------------------------------------------------
               Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------

Number of loads specified = 2

Load    Load         Condition                Condition            Axial Thrust
     Compute
 No.    Type             1                        2                  Force, lbs
Top y vs. Pile Length
-----   ----   --------------------   ------------------------   ----------------
---------------------
   1     1     V =   3000.00000 lbs   M =      564000. in-lbs         0.0000000
       Yes
   2     1     V =   4500.00000 lbs   M =      846000. in-lbs         0.0000000
       Yes

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
```

ADDENDUM 2 - JULY 14, 2015

downtown_pole2_36 inch_15ft

y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

---

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 3000.000 lbs
Applied moment at pile head = 564000.000 in-lbs
Axial thrust load on pile head = 0.000 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. p lb/in	Distrib. Lat. Load lb/inch
0.00	0.0849	564000.	3000.0000	-0.000817	123.1322	2.972E+11	-0.1355	1.4362	0.000
0.150	0.0834	569400.	2999.5143	-0.000813	124.3111	2.972E+11	-0.4042	8.7182	0.000
0.300	0.0820	574798.	2998.7890	-0.000810	125.4897	2.972E+11	-0.4018	8.8214	0.000
0.450	0.0805	580195.	2998.0679	-0.000806	126.6680	2.972E+11	-0.3994	8.9274	0.000
0.600	0.0791	585591.	2997.3512	-0.000803	127.8460	2.972E+11	-0.3970	9.0360	0.000
0.750	0.0776	590986.	2996.6388	-0.000799	129.0238	2.972E+11	-0.3946	9.1475	0.000
0.900	0.0762	596379.	2995.9308	-0.000796	130.2012	2.972E+11	-0.3921	9.2621	0.000
1.050	0.0748	601771.	2995.2272	-0.000792	131.3784	2.972E+11	-0.3896	9.3797	0.000
1.200	0.0734	607162.	2994.5281	-0.000788	132.5553	2.972E+11	-0.3872	9.5005	0.000
1.350	0.0719	612552.	2993.8334	-0.000785	133.7320	2.972E+11	-0.3847	9.6248	0.000
1.500	0.0705	617940.	2993.1433	-0.000781	134.9083	2.972E+11	-0.3821	9.7525	0.000
1.650	0.0691	623327.	2992.4578	-0.000777	136.0844	2.972E+11			

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```
-0.3796     9.8840      0.000
     1.800      0.0677    628713.  2991.7769  -0.000773   137.2603  2.972E+11
-0.3770    10.0193      0.000
     1.950      0.0663    634097.  2991.1006  -0.000770   138.4358  2.972E+11
-0.3744    10.1586      0.000
     2.100      0.0650    639481.  2990.4290  -0.000766   139.6111  2.972E+11
-0.3718    10.3022      0.000
     2.250      0.0636    644863.  2989.7622  -0.000762   140.7861  2.972E+11
-0.3692    10.4501      0.000
     2.400      0.0622    650244.  2989.1001  -0.000758   141.9609  2.972E+11
-0.3665    10.6027      0.000
     2.550      0.0609    655624.  2988.4428  -0.000754   143.1354  2.972E+11
-0.3638    10.7602      0.000
     2.700      0.0595    661002.  2987.7904  -0.000750   144.3097  2.972E+11
-0.3611    10.9228      0.000
     2.850      0.0582    666380.  2987.1430  -0.000746   145.4837  2.972E+11
-0.3583    11.0907      0.000
     3.000      0.0568    671756.  2927.9190  -0.000742   146.6574  2.972E+11
-65.4460  2073.3351      0.000
     3.150      0.0555    676920.  2733.5471  -0.000738   147.7849  2.972E+11
-150.5228  4883.0191      0.000
     3.300      0.0542    681597.  2461.8012  -0.000734   148.8059  2.972E+11
-151.4171  5032.1310      0.000
     3.450      0.0528    685783.  2188.4906  -0.000730   149.7197  2.972E+11
-152.2614  5186.2859      0.000
     3.600      0.0515    689475.  1913.7058  -0.000725   150.5259  2.972E+11
-153.0551  5345.7783      0.000
     3.750      0.0502    692672.  1637.5384  -0.000721   151.2238  2.972E+11
-153.7976  5510.9241      0.000
     3.900      0.0489    695370.  1360.0814  -0.000717   151.8129  2.972E+11
-154.4879  5682.0638      0.000
     4.050      0.0477    697568.  1081.4296  -0.000713   152.2928  2.972E+11
-155.1252  5859.5653      0.000
     4.200      0.0464    699263.   801.6794  -0.000709   152.6629  2.972E+11
-155.7084  6043.8271      0.000
     4.350      0.0451    700454.   520.9291  -0.000704   152.9229  2.972E+11
-156.2363  6235.2824      0.000
     4.500      0.0438    701139.   239.2795  -0.000700   153.0723  2.972E+11
-156.7077  6434.4030      0.000
     4.650      0.0426    701316.   -43.1666  -0.000696   153.1109  2.972E+11
-157.1212  6641.7045      0.000
     4.800      0.0413    700983.  -326.3033  -0.000692   153.0384  2.972E+11
-157.4752  6857.7513      0.000
     4.950      0.0401    700141.  -610.0223  -0.000687   152.8545  2.972E+11
-157.7681  7083.1639      0.000
     5.100      0.0389    698787.  -894.2120  -0.000683   152.5589  2.972E+11
-157.9982  7318.6252      0.000
     5.250      0.0376    696922. -1178.7574  -0.000679   152.1517  2.972E+11
-158.1634  7564.8901      0.000
     5.400      0.0364    694544. -1463.5401  -0.000675   151.6325  2.972E+11
-158.2617  7822.7950      0.000
     5.550      0.0352    691653. -1748.4373  -0.000670   151.0014  2.972E+11
-158.2908  8093.2698      0.000
     5.700      0.0340    688249. -2033.3224  -0.000666   150.2583  2.972E+11
-158.2481  8377.3519      0.000
     5.850      0.0328    684333. -2318.0637  -0.000662   149.4033  2.972E+11
-158.1311  8676.2025      0.000
     6.000      0.0316    679904. -2602.5245  -0.000658   148.4364  2.972E+11
-157.9365  8991.1269      0.000
     6.150      0.0304    674964. -2886.5626  -0.000654   147.3578  2.972E+11
-157.6613  9323.5977      0.000
     6.300      0.0293    669513. -3170.0294  -0.000650   146.1677  2.972E+11
-157.3019  9675.2836      0.000
```

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6.450	0.0281	663552.	-3452.7699	-0.000646	144.8663	2.972E+11	-156.8542	10048.	0.000
6.600	0.0269	657083.	-3734.6213	-0.000642	143.4540	2.972E+11	-156.3140	10444.	0.000
6.750	0.0258	650107.	-4015.4126	-0.000638	141.9311	2.972E+11	-155.6764	10866.	0.000
6.900	0.0246	642627.	-4294.9639	-0.000634	140.2981	2.972E+11	-154.9361	11317.	0.000
7.050	0.0235	634645.	-4573.0848	-0.000630	138.5555	2.972E+11	-154.0871	11799.	0.000
7.200	0.0224	626164.	-4849.5738	-0.000626	136.7039	2.972E+11	-153.1228	12318.	0.000
7.350	0.0213	617187.	-5124.2161	-0.000622	134.7440	2.972E+11	-152.0354	12877.	0.000
7.500	0.0201	607717.	-5396.7829	-0.000619	132.6765	2.972E+11	-150.8166	13482.	0.000
7.650	0.0190	597759.	-5667.0286	-0.000615	130.5024	2.972E+11	-149.4564	14141.	0.000
7.800	0.0179	587316.	-5934.6889	-0.000611	128.2225	2.972E+11	-147.9438	14860.	0.000
7.950	0.0168	576394.	-6199.4775	-0.000608	125.8380	2.972E+11	-146.2658	15650.	0.000
8.100	0.0157	564998.	-6461.0831	-0.000604	123.3500	2.972E+11	-144.4071	16522.	0.000
8.250	0.0146	553134.	-6719.1646	-0.000601	120.7599	2.972E+11	-142.3501	17493.	0.000
8.400	0.0136	540809.	-6973.3459	-0.000598	118.0691	2.972E+11	-140.0736	18583.	0.000
8.550	0.0125	528030.	-7223.2089	-0.000595	115.2792	2.972E+11	-137.5519	19815.	0.000
8.700	0.0114	514805.	-7468.2841	-0.000591	112.3920	2.972E+11	-134.7539	21225.	0.000
8.850	0.0104	501144.	-7708.0390	-0.000588	109.4095	2.972E+11	-131.6405	22858.	0.000
9.000	0.009310	487056.	-7941.8617	-0.000585	106.3339	2.972E+11	-128.1624	24779.	0.000
9.150	0.008259	472553.	-8169.0377	-0.000582	103.1676	2.972E+11	-124.2553	27081.	0.000
9.300	0.007213	457648.	-8388.7171	-0.000580	99.9134	2.972E+11	-119.8328	29904.	0.000
9.450	0.006172	442354.	-8599.8638	-0.000577	96.5745	2.972E+11	-114.7746	33471.	0.000
9.600	0.005136	426688.	-8801.1749	-0.000574	93.1544	2.972E+11	-108.9044	38165.	0.000
9.750	0.004105	410670.	-8990.9400	-0.000572	89.6572	2.972E+11	-101.9457	44703.	0.000
9.900	0.003078	394321.	-9166.7695	-0.000569	86.0879	2.972E+11	-93.4205	54630.	0.000
10.050	0.002056	377669.	-9266.8091	-0.000567	82.4526	2.972E+11	-17.7347	15530.	0.000
10.200	0.001037	360960.	-9290.9746	-0.000565	78.8047	2.972E+11	-9.1158	15822.	0.000
10.350	2.258E-05	344222.	-9299.3608	-0.000563	75.1503	2.972E+11	-0.2022	16113.	0.000
10.500	-0.000988	327483.	-9291.4374	-0.000561	71.4958	2.972E+11	9.0060	16405.	0.000
10.650	-0.001995	310773.	-9266.6744	-0.000559	67.8477	2.972E+11	18.5085	16696.	0.000
10.800	-0.002999	294122.	-9224.5419	-0.000557	64.2127	2.972E+11	28.3054	16988.	0.000
10.950	-0.004000	277564.	-9164.5101	-0.000555	60.5977	2.972E+11	38.3967	17280.	0.000
11.100	-0.004997	261130.	-9086.0486	-0.000553	57.0098	2.972E+11			

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```
48.7827     17571.      0.000
    11.250  -0.005992    244854. -8988.6270  -0.000552    53.4565  2.972E+11
59.4636     17863.      0.000
    11.400  -0.006984    228771. -8871.7138  -0.000550    49.9452  2.972E+11
70.4399     18154.      0.000
    11.550  -0.007974    212916. -8734.7769  -0.000549    46.4838  2.972E+11
81.7121     18446.      0.000
    11.700  -0.008961    197326. -8577.2833  -0.000548    43.0801  2.972E+11
93.2808     18738.      0.000
    11.850  -0.009946    182038. -8398.6987  -0.000547    39.7425  2.972E+11
105.1465     19029.      0.000
    12.000    -0.0109    167091. -8198.4877  -0.000546    36.4792  2.972E+11
117.3102     19321.      0.000
    12.150    -0.0119    152523. -7976.1133  -0.000545    33.2988  2.972E+11
129.7725     19612.      0.000
    12.300    -0.0129    138377. -7731.0372  -0.000544    30.2103  2.972E+11
142.5344     19904.      0.000
    12.450    -0.0139    124692. -7462.7192  -0.000543    27.2226  2.972E+11
155.5967     20196.      0.000
    12.600    -0.0148    111511. -7170.6178  -0.000542    24.3450  2.972E+11
168.9605     20487.      0.000
    12.750    -0.0158     98877. -6854.1893  -0.000542    21.5869  2.972E+11
182.6267     20779.      0.000
    12.900    -0.0168     86836. -6512.8886  -0.000541    18.9580  2.972E+11
196.5963     21070.      0.000
    13.050    -0.0178     75431. -6146.1685  -0.000541    16.4681  2.972E+11
210.8705     21362.      0.000
    13.200    -0.0187     64710. -5753.4798  -0.000540    14.1274  2.972E+11
225.4502     21654.      0.000
    13.350    -0.0197     54719. -5334.2719  -0.000540    11.9461  2.972E+11
240.3364     21945.      0.000
    13.500    -0.0207     45506. -4887.9919  -0.000540     9.9349  2.972E+11
255.5302     22237.      0.000
    13.650    -0.0217     37122. -4426.0382  -0.000539     8.1044  2.972E+11
257.7517     21424.      0.000
    13.800    -0.0226     29572. -3963.0830  -0.000539     6.4563  2.972E+11
256.6431     20417.      0.000
    13.950    -0.0236     22855. -3502.5226  -0.000539     4.9896  2.972E+11
255.0907     19459.      0.000
    14.100    -0.0246     16963. -3042.6665  -0.000539     3.7034  2.972E+11
255.8605     18748.      0.000
    14.250    -0.0255     11901. -2574.4071  -0.000539     2.5982  2.972E+11
264.4277     18639.      0.000
    14.400    -0.0265  7695.5359 -2090.6947  -0.000539     1.6801  2.972E+11
273.0305     18542.      0.000
    14.550    -0.0275  4374.5947 -1591.4645  -0.000539     0.9551  2.972E+11
281.6698     18454.      0.000
    14.700    -0.0284  1966.2638 -1076.6500  -0.000539     0.4293  2.972E+11
290.3462     18374.      0.000
    14.850    -0.0294   498.6546  -546.1844  -0.000539     0.1089  2.972E+11
299.0601     18301.      0.000
    15.000    -0.0304      0.000      0.000  -0.000539      0.000  2.972E+11
307.8115  9117.9174      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

```
Pile-head deflection              =      0.0849112 inches
Computed slope at pile head       =     -0.0008167 radians
Maximum bending moment            =        701316. inch-lbs
Maximum shear force               =  -9299.3607953 lbs
```

downtown_pole2_36 inch_15ft

```
Depth of maximum bending moment  =     55.8000000 inches below pile head
Depth of maximum shear force     =    124.2000000 inches below pile head
Number of iterations             =             24
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =           3000. lbs
Moment     =         564000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
15.0000	0.0849112	701316.	-9299.3607953
14.2500	0.1115214	700688.	-10122.
13.5000	0.1463190	697397.	-10815.
12.7500	0.2002782	693613.	-11624.
12.0000	0.2979922	690985.	-12563.
11.2500	0.4902108	687510.	-13295.
10.5000	1.0864372	684125.	-14161.
9.7500	2.9414289	679832.	-15962.
9.0000	6.5778875	678905.	-17833.
8.2500	15.7181165	676695.	-20087.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                                =        4500.000 lbs
Applied moment at pile head                             =      846000.000 in-lbs
Axial thrust load on pile head                          =           0.000 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. Lat. Load lb/inch	Distrib. p lb/in
0.00	0.2221	846000.	4500.0000	-0.001894	184.6983	2.972E+11	-0.1867	0.7566	0.000
0.150	0.2187	854100.	4499.3306	-0.001889	186.4667	2.972E+11	-0.5572	4.5865	0.000
0.300	0.2153	862198.	4498.3302	-0.001884	188.2346	2.972E+11	-0.5543	4.6346	0.000
0.450	0.2119	870294.	4497.3351	-0.001879	190.0021	2.972E+11	-0.5514	4.6838	0.000
0.600	0.2085	878388.	4496.3453	-0.001873	191.7693	2.972E+11	-0.5484	4.7342	0.000

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0.750	0.2052	886481.	4495.3608	-0.001868	193.5360	2.972E+11	-0.5455	4.7859
0.000								
0.900	0.2018	894571.	4494.3816	-0.001862	195.3024	2.972E+11	-0.5425	4.8388
0.000								
1.050	0.1984	902660.	4493.4079	-0.001857	197.0684	2.972E+11	-0.5395	4.8931
0.000								
1.200	0.1951	910748.	4492.4396	-0.001852	198.8340	2.972E+11	-0.5364	4.9487
0.000								
1.350	0.1918	918833.	4491.4769	-0.001846	200.5992	2.972E+11	-0.5333	5.0058
0.000								
1.500	0.1885	926917.	4490.5196	-0.001840	202.3641	2.972E+11	-0.5302	5.0644
0.000								
1.650	0.1852	934999.	4489.5680	-0.001835	204.1285	2.972E+11	-0.5271	5.1245
0.000								
1.800	0.1819	943079.	4488.6220	-0.001829	205.8926	2.972E+11	-0.5240	5.1863
0.000								
1.950	0.1786	951158.	4487.6817	-0.001823	207.6564	2.972E+11	-0.5208	5.2498
0.000								
2.100	0.1753	959235.	4486.7471	-0.001818	209.4197	2.972E+11	-0.5176	5.3150
0.000								
2.250	0.1720	967310.	4485.8184	-0.001812	211.1827	2.972E+11	-0.5144	5.3820
0.000								
2.400	0.1688	975384.	4484.8954	-0.001806	212.9454	2.972E+11	-0.5111	5.4510
0.000								
2.550	0.1655	983456.	4483.9784	-0.001800	214.7076	2.972E+11	-0.5078	5.5221
0.000								
2.700	0.1623	991526.	4483.0674	-0.001794	216.4696	2.972E+11	-0.5045	5.5952
0.000								
2.850	0.1591	999595.	4482.1624	-0.001788	218.2311	2.972E+11	-0.5011	5.6705
0.000								
3.000	0.1559	1007662.	4399.2620	-0.001782	219.9923	2.972E+11	-91.6104	1058.0322
0.000								
3.150	0.1527	1015432.	4126.9959	-0.001776	221.6887	2.972E+11	-210.9075	2486.9150
0.000								
3.300	0.1495	1022519.	3746.0417	-0.001770	223.2359	2.972E+11	-212.3750	2557.6798
0.000								
3.450	0.1463	1028918.	3362.5016	-0.001763	224.6329	2.972E+11	-213.7807	2630.5702
0.000								
3.600	0.1431	1034624.	2976.4875	-0.001757	225.8787	2.972E+11	-215.1238	2705.7014
0.000								
3.750	0.1400	1039633.	2588.1127	-0.001751	226.9723	2.972E+11	-216.4037	2783.1960
0.000								
3.900	0.1368	1043941.	2197.4920	-0.001744	227.9128	2.972E+11	-217.6193	2863.1852
0.000								
4.050	0.1337	1047544.	1804.7419	-0.001738	228.6994	2.972E+11	-218.7697	2945.8093
0.000								
4.200	0.1306	1050438.	1409.9811	-0.001732	229.3312	2.972E+11	-219.8535	3031.2193
0.000								
4.350	0.1274	1052620.	1013.3303	-0.001725	229.8076	2.972E+11	-220.8696	3119.5777
0.000								
4.500	0.1243	1054086.	614.9129	-0.001719	230.1277	2.972E+11	-221.8164	3211.0601
0.000								
4.650	0.1213	1054834.	214.8550	-0.001713	230.2909	2.972E+11	-222.6925	3305.8566
0.000								
4.800	0.1182	1054860.	-186.7147	-0.001706	230.2965	2.972E+11	-223.4961	3404.1734
0.000								
4.950	0.1151	1054162.	-589.6640	-0.001700	230.1441	2.972E+11	-224.2253	3506.2349
0.000								
5.100	0.1121	1052737.	-993.8573	-0.001694	229.8331	2.972E+11	-224.8784	3612.2855
0.000								
5.250	0.1090	1050584.	-1399.1556	-0.001687	229.3630	2.972E+11	-225.4530	3722.5925
0.000								
5.400	0.1060	1047700.	-1805.4156	-0.001681	228.7334	2.972E+11		

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```
-225.9470  3837.4486      0.000
     5.550      0.1030   1044084. -2212.4900  -0.001674   227.9440  2.972E+11
-226.3579  3957.1756      0.000
     5.700      0.1000   1039735. -2620.2267  -0.001668   226.9945  2.972E+11
-226.6829  4082.1277      0.000
     5.850      0.0970   1034652. -3028.4688  -0.001662   225.8847  2.972E+11
-226.9193  4212.6959      0.000
     6.000      0.0940   1028833. -3437.0538  -0.001656   224.6143  2.972E+11
-227.0640  4349.3139      0.000
     6.150      0.0910   1022278. -3845.8137  -0.001649   223.1833  2.972E+11
-227.1136  4492.4630      0.000
     6.300      0.0880   1014988. -4254.5739  -0.001643   221.5917  2.972E+11
-227.0645  4642.6803      0.000
     6.450      0.0851   1006962. -4663.1533  -0.001637   219.8394  2.972E+11
-226.9127  4800.5662      0.000
     6.600      0.0821    998200. -5071.3633  -0.001631   217.9267  2.972E+11
-226.6539  4966.7954      0.000
     6.750      0.0792    988705. -5479.0070  -0.001625   215.8536  2.972E+11
-226.2835  5142.1278      0.000
     6.900      0.0763    978476. -5885.8790  -0.001619   213.6204  2.972E+11
-225.7964  5327.4241      0.000
     7.050      0.0734    967516. -6291.7640  -0.001613   211.2276  2.972E+11
-225.1869  5523.6626      0.000
     7.200      0.0705    955826. -6696.4363  -0.001607   208.6754  2.972E+11
-224.4489  5731.9611      0.000
     7.350      0.0676    943409. -7099.6583  -0.001602   205.9645  2.972E+11
-223.5756  5953.6030      0.000
     7.500      0.0647    930267. -7501.1797  -0.001596   203.0954  2.972E+11
-222.5593  6190.0704      0.000
     7.650      0.0619    916404. -7900.7356  -0.001590   200.0690  2.972E+11
-221.3917  6443.0850      0.000
     7.800      0.0590    901824. -8298.0453  -0.001585   196.8859  2.972E+11
-220.0634  6714.6597      0.000
     7.950      0.0561    886531. -8692.8098  -0.001579   193.5471  2.972E+11
-218.5638  7007.1648      0.000
     8.100      0.0533    870530. -9084.7102  -0.001574   190.0537  2.972E+11
-216.8811  7323.4132      0.000
     8.250      0.0505    853826. -9473.4045  -0.001569   186.4070  2.972E+11
-215.0015  7666.7713      0.000
     8.400      0.0477    836426. -9858.5247  -0.001564   182.6081  2.972E+11
-212.9097  8041.3064      0.000
     8.550      0.0448    818336.    -10240.  -0.001559   178.6587  2.972E+11
-210.5879  8451.9842      0.000
     8.700      0.0420    799563.    -10616.  -0.001554   174.5602  2.972E+11
-208.0151  8904.9376      0.000
     8.850      0.0393    780117.    -10988.  -0.001549   170.3147  2.972E+11
-205.1672  9407.8422      0.000
     9.000      0.0365    760005.    -11355.  -0.001544   165.9240  2.972E+11
-202.0152  9970.4463      0.000
     9.150      0.0337    739239.    -11715.  -0.001540   161.3904  2.972E+11
-198.5247     10605.      0.000
     9.300      0.0309    717830.    -12069.  -0.001535   156.7164  2.972E+11
-194.6535     11329.      0.000
     9.450      0.0282    695791.    -12416.  -0.001531   151.9047  2.972E+11
-190.3496     12164.      0.000
     9.600      0.0254    673134.    -12754.  -0.001527   146.9584  2.972E+11
-185.5475     13141.      0.000
     9.750      0.0227    649877.    -13083.  -0.001523   141.8808  2.972E+11
-180.1625     14305.      0.000
     9.900      0.0199    626035.    -13402.  -0.001519   136.6758  2.972E+11
-174.0824     15721.      0.000
    10.050      0.0172    601630.    -13692.  -0.001515   131.3476  2.972E+11
-148.4056     15530.      0.000
```

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10.200	0.0145	576744.	-13940.	-0.001512	125.9144	2.972E+11	-127.2445	15822.
10.350	0.0118	551445.	-14149.	-0.001508	120.3913	2.972E+11	-105.2569	16113.
10.500	0.009046	525806.	-14318.	-0.001505	114.7937	2.972E+11	-82.4434	16405.
10.650	0.006340	499899.	-14445.	-0.001502	109.1378	2.972E+11	-58.8043	16696.
10.800	0.003639	473802.	-14529.	-0.001499	103.4403	2.972E+11	-34.3398	16988.
10.950	0.000943	447594.	-14568.	-0.001496	97.7185	2.972E+11	-9.0496	17280.
11.100	-0.001748	421356.	-14561.	-0.001494	91.9902	2.972E+11	17.0663	17571.
11.250	-0.004435	395174.	-14506.	-0.001491	86.2741	2.972E+11	44.0085	17863.
11.400	-0.007117	369134.	-14402.	-0.001489	80.5891	2.972E+11	71.7777	18154.
11.550	-0.009795	343326.	-14247.	-0.001487	74.9549	2.972E+11	100.3746	18446.
11.700	-0.0125	317844.	-14040.	-0.001485	69.3916	2.972E+11	129.8003	18738.
11.850	-0.0151	292783.	-13779.	-0.001483	63.9202	2.972E+11	160.0558	19029.
12.000	-0.0178	268240.	-13463.	-0.001481	58.5620	2.972E+11	191.1424	19321.
12.150	-0.0205	244316.	-13090.	-0.001480	53.3390	2.972E+11	223.0614	19612.
12.300	-0.0231	221115.	-12659.	-0.001478	48.2738	2.972E+11	255.8144	19904.
12.450	-0.0258	198743.	-12168.	-0.001477	43.3895	2.972E+11	289.4029	20196.
12.600	-0.0285	177309.	-11617.	-0.001476	38.7100	2.972E+11	323.8284	20487.
12.750	-0.0311	156924.	-11009.	-0.001475	34.2595	2.972E+11	350.6898	20293.
12.900	-0.0338	137675.	-10371.	-0.001474	30.0571	2.972E+11	359.0441	19143.
13.050	-0.0364	119589.	-9717.7206	-0.001473	26.1086	2.972E+11	366.5250	18118.
13.200	-0.0391	102691.	-9051.9819	-0.001472	22.4194	2.972E+11	373.1847	17196.
13.350	-0.0417	87002.	-8374.9578	-0.001472	18.9942	2.972E+11	379.0643	16357.
13.500	-0.0444	72541.	-7688.0228	-0.001471	15.8371	2.972E+11	384.1968	15588.
13.650	-0.0470	59325.	-6992.4979	-0.001471	12.9518	2.972E+11	388.6086	14879.
13.800	-0.0497	47368.	-6289.6611	-0.001471	10.3414	2.972E+11	392.3212	14221.
13.950	-0.0523	36682.	-5580.7551	-0.001470	8.0085	2.972E+11	395.3522	13605.
14.100	-0.0550	27277.	-4863.7501	-0.001470	5.9552	2.972E+11	401.3200	13145.
14.250	-0.0576	19173.	-4126.8243	-0.001470	4.1858	2.972E+11	417.4864	13047.
14.400	-0.0602	12421.	-3360.6999	-0.001470	2.7117	2.972E+11	433.7630	12960.
14.550	-0.0629	7074.2350	-2565.1730	-0.001470	1.5444	2.972E+11	450.1557	12884.
14.700	-0.0655	3186.1760	-1740.0301	-0.001470	0.6956	2.972E+11	466.6697	12817.
14.850	-0.0682	810.1269	-885.0489	-0.001470	0.1769	2.972E+11		

ADDENDUM 2 - JULY 14, 2015

downtown_pole2_36 inch_15ft

```
483.3093     12759.      0.000
    15.000    -0.0708      0.000      0.000  -0.001470      0.000  2.972E+11
500.0783  6354.3621      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      0.2220798 inches
Computed slope at pile head      =     -0.0018941 radians
Maximum bending moment           =       1054860. inch-lbs
Maximum shear force              =        -14568. lbs
Depth of maximum bending moment  =     57.6000000 inches below pile head
Depth of maximum shear force     =    131.4000000 inches below pile head
Number of iterations             =             25
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =           4500. lbs
Moment     =         846000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
15.0000	0.2220798	1054860.	-14568.
14.2500	0.3038968	1053210.	-15732.
13.5000	0.4117926	1047958.	-16828.
12.7500	0.5867528	1041617.	-18010.
12.0000	0.9166917	1037191.	-19153.
11.2500	1.5753790	1031620.	-19957.
10.5000	3.4834913	1026473.	-21190.
9.7500	9.9171234	1019750.	-23944.
9.0000	33.5041902	1020256.	-28094.

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

```
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians
```

Pile-head Pile-head Maximum Maximum

```
                              downtown_pole2_36 inch_15ft
Load  Load    Condition 1    Condition 2        Axial        Pile-head       Moment
        Shear        Pile-head
Case  Type    V(lbs) or     in-lb, rad.,       Loading      Deflection       in Pile
       in Pile       Rotation
 No.   No.    y(inches)     or in-lb/rad.        lbs          inches         in-lbs
         lbs          radians
----  ----  --------------  --------------  -------------  -------------
-------------  -------------  -------------
  1     1   V =  3000.0000  M =    564000.      0.0000000     0.08491119
701316.     -9299.3608    -0.00081669
  2     1   V =  4500.0000  M =    846000.      0.0000000     0.22207981
1054860.        -14568.    -0.00189409

The analysis ended normally.
```

ADDENDUM 2 - JULY 14, 2015

downtown_pole3_36 inch_20ft

==========

LPile Plus for Windows, Version 2012-06.035

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

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URS
URS Austin

Serial Number of Security Device: 500126253
Company Name Stored in Security Device: URS Corporation

Files Used for Analysis

Path to file locations: P:\AUS Geotech\Projects\41010530.052 City of El Paso\OCS Design\LPILE runs_RAR\
Name of input data file: downtown_pole3_36 inch_20ft.lp6d
Name of output report file: downtown_pole3_36 inch_20ft.lp6o
Name of plot output file: downtown_pole3_36 inch_20ft.lp6p
Name of runtime messeage file: downtown_pole3_36 inch_20ft.lp6r

---

Date and Time of Analysis

Date: January 17, 2013 Time: 15:03:20

Problem Title

Project Name: El Paso Streetcar

Job Number: 41010530

Client: City of El Paso

Engineer: R. Russo

Description: OCS Pole Foundations

ADDENDUM 2 - JULY 14, 2015

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:
- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments	=	100	
- Maximum number of iterations allowed	=	500	
- Deflection tolerance for convergence	=	1.0000E-05	in
- Maximum allowable deflection	=	100.0000	in

Pile Response Output Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 20.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	36.0000000
2	20.000000	36.0000000

Input Structural Properties:

Pile Section No. 1:

ADDENDUM 2 - JULY 14, 2015

downtown_pole3_36 inch_20ft

```
   Section Type                                          =    Elastic Pile
   Cross-sectional Shape                                 =        Circular
   Section Length                                        =     20.00000000 ft
   Top Width                                             =     36.00000000 in
   Bottom Width                                          =     36.00000000 in
   Top Area                                              =   1017.87601976 Sq. in
   Bottom Area                                           =   1017.87601976 Sq. in
   Moment of Inertia at Top                              =          82448. in^4
   Moment of Inertia at Bottom                           =          82448. in^4
   Elastic Modulus                                       =        3604997. lbs/in^2


--------------------------------------------------------------------------------
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                       =        0.000 degrees
                                                         =        0.000 radians

Pile Batter Angle                                        =        0.000 degrees
                                                         =        0.000 radians



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer             =       0.0000 ft
   Distance from top of pile to bottom of layer          =      3.00000 ft
   Effective unit weight at top of layer                 =    120.00000 pcf
   Effective unit weight at bottom of layer              =    120.00000 pcf
   Undrained cohesion at top of layer                    =      1.00000 psf
   Undrained cohesion at bottom of layer                 =      1.00000 psf
   Epsilon-50 at top of layer                            =      0.02000
   Epsilon-50 at bottom of layer                         =      0.02000


Layer 2 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer             =      3.00000 ft
   Distance from top of pile to bottom of layer          =     10.00000 ft
   Effective unit weight at top of layer                 =    115.00000 pcf
   Effective unit weight at bottom of layer              =    115.00000 pcf
   Undrained cohesion at top of layer                    =   1000.00000 psf
   Undrained cohesion at bottom of layer                 =   1000.00000 psf
   Epsilon-50 at top of layer                            =      0.01000
   Epsilon-50 at bottom of layer                         =      0.01000


Layer 3 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer             =     10.00000 ft
   Distance from top of pile to bottom of layer          =     25.00000 ft
   Effective unit weight at top of layer                 =    120.00000 pcf
   Effective unit weight at bottom of layer              =    120.00000 pcf
   Friction angle at top of layer                        =     27.00000 deg.
```

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downtown_pole3_36 inch_20ft

Friction angle at bottom of layer = 27.00000 deg.
Subgrade k at top of layer = 90.00000 pci
Subgrade k at bottom of layer = 90.00000 pci

(Depth of lowest soil layer extends 5.00 ft below pile tip)

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	Strain Factor Epsilon 50	kpy pci
1	Soft Clay	0.00	120.000	1.000	--	0.02000	--
		3.000	120.000	1.000	--	0.02000	--
2	Soft Clay	3.000	115.000	1000.000	--	0.01000	--
		10.000	115.000	1000.000	--	0.01000	--
3	Sand (Reese, et al.)	10.000	120.000	--	27.000	--	90.000
		25.000	120.000	--	27.000	--	90.000

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Compute Top y vs. Pile Length	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	Yes	V = 6000.00000 lbs	M = 1344000. in-lbs	0.0000000
2	1	Yes	V = 9000.00000 lbs	M = 2016000. in-lbs	0.0000000

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head

ADDENDUM 2 - JULY 14, 2015

downtown_pole3_36 inch_20ft

y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

---

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 6000.000 lbs
Applied moment at pile head = 1344000.000 in-lbs
Axial thrust load on pile head = 0.000 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. p lb/in	Distrib. Lat. Load lb/inch
0.00	0.1343	1344000.	6000.0000	-0.001227	293.4215	2.972E+11	-0.1579	1.4108	0.000
0.200	0.1313	1358400.	5999.2464	-0.001216	296.5652	2.972E+11	-0.4701	8.5905	0.000
0.400	0.1284	1372796.	5998.1223	-0.001205	299.7083	2.972E+11	-0.4666	8.7195	0.000
0.600	0.1256	1387191.	5997.0066	-0.001193	302.8508	2.972E+11	-0.4631	8.8522	0.000
0.800	0.1227	1401582.	5995.8994	-0.001182	305.9927	2.972E+11	-0.4596	8.9888	0.000
1.000	0.1199	1415971.	5994.8006	-0.001171	309.1341	2.972E+11	-0.4560	9.1294	0.000
1.200	0.1171	1430357.	5993.7104	-0.001159	312.2749	2.972E+11	-0.4525	9.2742	0.000
1.400	0.1143	1444741.	5992.6288	-0.001148	315.4151	2.972E+11	-0.4489	9.4233	0.000
1.600	0.1116	1459122.	5991.5559	-0.001136	318.5548	2.972E+11	-0.4453	9.5770	0.000
1.800	0.1089	1473500.	5990.4916	-0.001124	321.6939	2.972E+11	-0.4416	9.7354	0.000
2.000	0.1062	1487876.	5989.4361	-0.001112	324.8324	2.972E+11	-0.4380	9.8987	0.000
2.200	0.1035	1502249.	5988.3894	-0.001100	327.9704	2.972E+11			

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```
-0.4343    10.0672      0.000
     2.400      0.1009   1516620.  5987.3516  -0.001088   331.1078  2.972E+11
-0.4306    10.2411      0.000
     2.600      0.0983   1530989.  5986.3227  -0.001076   334.2447  2.972E+11
-0.4268    10.4206      0.000
     2.800      0.0957   1545355.  5985.3028  -0.001063   337.3811  2.972E+11
-0.4231    10.6061      0.000
     3.000      0.0932   1559718.  5892.1760  -0.001051   340.5169  2.972E+11
-77.1825  1987.4206      0.000
     3.200      0.0907   1573637.  5585.7895  -0.001038   343.5557  2.972E+11
-178.1396  4713.7861      0.000
     3.400      0.0882   1586530.  5156.2645  -0.001025   346.3705  2.972E+11
-179.7980  4891.1924      0.000
     3.600      0.0858   1598387.  4722.8512  -0.001012   348.9591  2.972E+11
-181.3797  5074.8784      0.000
     3.800      0.0834   1609200.  4285.7334  -0.000999   351.3197  2.972E+11
-182.8851  5265.1870      0.000
     4.000      0.0810   1618959.  3845.0943  -0.000986   353.4503  2.972E+11
-184.3141  5462.4795      0.000
     4.200      0.0786   1627656.  3401.1173  -0.000973   355.3491  2.972E+11
-185.6667  5667.1390      0.000
     4.400      0.0763   1635284.  2953.9861  -0.000960   357.0145  2.972E+11
-186.9426  5879.5729      0.000
     4.600      0.0740   1641835.  2503.8854  -0.000947   358.4447  2.972E+11
-188.1413  6100.2158      0.000
     4.800      0.0718   1647303.  2051.0008  -0.000934   359.6384  2.972E+11
-189.2625  6329.5327      0.000
     5.000      0.0695   1651680.  1595.5192  -0.000920   360.5940  2.972E+11
-190.3055  6568.0227      0.000
     5.200      0.0673   1654961.  1137.6293  -0.000907   361.3104  2.972E+11
-191.2695  6816.2221      0.000
     5.400      0.0652   1657141.   677.5213  -0.000894   361.7862  2.972E+11
-192.1538  7074.7091      0.000
     5.600      0.0631   1658213.   215.3875  -0.000880   362.0204  2.972E+11
-192.9576  7344.1082      0.000
     5.800      0.0610   1658175.  -248.5774  -0.000867   362.0119  2.972E+11
-193.6798  7625.0953      0.000
     6.000      0.0589   1657020.  -714.1764  -0.000853   361.7599  2.972E+11
-194.3194  7918.4042      0.000
     6.200      0.0569   1654746. -1181.2098  -0.000840   361.2635  2.972E+11
-194.8751  8224.8327      0.000
     6.400      0.0549   1651350. -1649.4748  -0.000827   360.5220  2.972E+11
-195.3457  8545.2506      0.000
     6.600      0.0529   1646829. -2118.7654  -0.000813   359.5349  2.972E+11
-195.7298  8880.6088      0.000
     6.800      0.0510   1641180. -2588.8721  -0.000800   358.3017  2.972E+11
-196.0258  9231.9494      0.000
     7.000      0.0491   1634402. -3059.5814  -0.000787   356.8220  2.972E+11
-196.2320  9600.4175      0.000
     7.200      0.0472   1626494. -3530.6756  -0.000774   355.0955  2.972E+11
-196.3465  9987.2752      0.000
     7.400      0.0453   1617455. -4001.9324  -0.000761   353.1221  2.972E+11
-196.3674     10394.      0.000
     7.600      0.0435   1607285. -4473.1242  -0.000748   350.9017  2.972E+11
-196.2924     10822.      0.000
     7.800      0.0418   1595984. -4944.0179  -0.000735   348.4345  2.972E+11
-196.1190     11273.      0.000
     8.000      0.0400   1583554. -5414.3742  -0.000722   345.7207  2.972E+11
-195.8446     11749.      0.000
     8.200      0.0383   1569995. -5883.9471  -0.000709   342.7606  2.972E+11
-195.4661     12252.      0.000
     8.400      0.0366   1555311. -6352.4827  -0.000696   339.5547  2.972E+11
-194.9803     12785.      0.000
```

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8.600	0.0349	1539503.	-6819.7191	-0.000684	336.1036	2.972E+11	-194.3834	13350.
8.800	0.0333	1522576.	-7285.3849	-0.000672	332.4081	2.972E+11	-193.6715	13950.
9.000	0.0317	1504533.	-7749.1985	-0.000659	328.4690	2.972E+11	-192.8399	14590.
9.200	0.0302	1485380.	-8210.8666	-0.000647	324.2875	2.972E+11	-191.8835	15272.
9.400	0.0286	1465121.	-8670.0829	-0.000635	319.8646	2.972E+11	-190.7967	16003.
9.600	0.0271	1443764.	-9126.5265	-0.000624	315.2018	2.972E+11	-189.5730	16786.
9.800	0.0256	1421314.	-9579.8600	-0.000612	310.3006	2.972E+11	-188.2050	17629.
10.000	0.0242	1397780.	-10053.	-0.000601	305.1627	2.972E+11	-206.0832	20467.
10.200	0.0227	1373059.	-10539.	-0.000590	299.7657	2.972E+11	-198.8155	20985.
10.400	0.0213	1347194.	-11007.	-0.000579	294.1187	2.972E+11	-191.1693	21503.
10.600	0.0200	1320227.	-11456.	-0.000568	288.2312	2.972E+11	-183.1571	22022.
10.800	0.0186	1292204.	-11886.	-0.000557	282.1135	2.972E+11	-174.7911	22540.
11.000	0.0173	1263176.	-12295.	-0.000547	275.7759	2.972E+11	-166.0825	23059.
11.200	0.0160	1233190.	-12682.	-0.000537	269.2295	2.972E+11	-157.0421	23577.
11.400	0.0147	1202300.	-13048.	-0.000527	262.4856	2.972E+11	-147.6798	24095.
11.600	0.0135	1170560.	-13391.	-0.000517	255.5560	2.972E+11	-138.0051	24614.
11.800	0.0122	1138024.	-13710.	-0.000508	248.4529	2.972E+11	-128.0266	25132.
12.000	0.0110	1104751.	-14005.	-0.000499	241.1887	2.972E+11	-117.7522	25651.
12.200	0.009830	1070800.	-14275.	-0.000490	233.7765	2.972E+11	-107.1892	26169.
12.400	0.008664	1036231.	-14519.	-0.000482	226.2295	2.972E+11	-96.3442	26687.
12.600	0.007518	1001107.	-14737.	-0.000474	218.5613	2.972E+11	-85.2230	27206.
12.800	0.006391	965493.	-14928.	-0.000466	210.7860	2.972E+11	-73.8308	27724.
13.000	0.005283	929453.	-15091.	-0.000458	202.9178	2.972E+11	-62.1720	28243.
13.200	0.004193	893055.	-15226.	-0.000451	194.9714	2.972E+11	-50.2503	28761.
13.400	0.003120	856368.	-15332.	-0.000444	186.9619	2.972E+11	-38.0689	29279.
13.600	0.002064	819461.	-15409.	-0.000437	178.9044	2.972E+11	-25.6302	29798.
13.800	0.001024	782407.	-15455.	-0.000430	170.8148	2.972E+11	-12.9358	30316.
14.000	-1.031E-06	745278.	-15470.	-0.000424	162.7088	2.972E+11	0.0132	30835.
14.200	-0.001012	708150.	-15454.	-0.000418	154.6029	2.972E+11	13.2164	31353.
14.400	-0.002009	671097.	-15407.	-0.000413	146.5136	2.972E+11	26.6739	31871.
14.600	-0.002993	634198.	-15326.	-0.000407	138.4579	2.972E+11	40.3866	32390.
14.800	-0.003964	597532.	-15212.	-0.000402	130.4529	2.972E+11		

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```
54.3558     32908.      0.000
    15.000  -0.004924    561179.    -15065.  -0.000398   122.5163  2.972E+11
68.5835     33427.      0.000
    15.200  -0.005873    525221.    -14883.  -0.000393   114.6660  2.972E+11
83.0721     33945.      0.000
    15.400  -0.006812    489741.    -14666.  -0.000389   106.9201  2.972E+11
97.8246     34463.      0.000
    15.600  -0.007742    454825.    -14413.  -0.000385    99.2972  2.972E+11
112.8444     34982.      0.000
    15.800  -0.008663    420559.    -14124.  -0.000382    91.8162  2.972E+11
128.1354     35500.      0.000
    16.000  -0.009575    387031.    -13798.  -0.000379    84.4964  2.972E+11
143.7018     36019.      0.000
    16.200    -0.0105    354330.    -13434.  -0.000376    77.3572  2.972E+11
159.5483     36537.      0.000
    16.400    -0.0114    322549.    -13031.  -0.000373    70.4187  2.972E+11
175.6797     37055.      0.000
    16.600    -0.0123    291780.    -12590.  -0.000370    63.7012  2.972E+11
192.1012     37574.      0.000
    16.800    -0.0132    262117.    -12112.  -0.000368    57.2252  2.972E+11
205.9524     37569.      0.000
    17.000    -0.0140    233640.    -11606.  -0.000366    51.0081  2.972E+11
215.6574     36870.      0.000
    17.200    -0.0149    206405.    -11075.  -0.000364    45.0623  2.972E+11
227.0865     36542.      0.000
    17.400    -0.0158    180479.    -10514.  -0.000363    39.4021  2.972E+11
240.6442     36583.      0.000
    17.600    -0.0167    155938. -9919.8346  -0.000362    34.0444  2.972E+11
254.4347     36661.      0.000
    17.800    -0.0175    132864. -9292.3497  -0.000360    29.0067  2.972E+11
268.4694     36771.      0.000
    18.000    -0.0184    111335. -8630.8758  -0.000359    24.3067  2.972E+11
282.7588     36910.      0.000
    18.200    -0.0192     91435. -7934.7901  -0.000359    19.9621  2.972E+11
297.3126     37072.      0.000
    18.400    -0.0201     73248. -7203.4478  -0.000358    15.9915  2.972E+11
312.1394     37257.      0.000
    18.600    -0.0210     56859. -6436.1833  -0.000357    12.4134  2.972E+11
327.2477     37462.      0.000
    18.800    -0.0218     42355. -5632.3123  -0.000357     9.2468  2.972E+11
342.6448     37684.      0.000
    19.000    -0.0227     29824. -4791.1332  -0.000357     6.5111  2.972E+11
358.3378     37921.      0.000
    19.200    -0.0235     19357. -3911.9282  -0.000356     4.2260  2.972E+11
374.3331     38174.      0.000
    19.400    -0.0244     11047. -2993.9644  -0.000356     2.4117  2.972E+11
390.6367     38439.      0.000
    19.600    -0.0252  4986.0680 -2036.4959  -0.000356     1.0886  2.972E+11
407.2538     38717.      0.000
    19.800    -0.0261  1271.3688 -1038.7642  -0.000356     0.2776  2.972E+11
424.1893     39006.      0.000
    20.000    -0.0270      0.000      0.000  -0.000356      0.000  2.972E+11
441.4475     19653.      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

```
Pile-head deflection              =      0.1342731 inches
Computed slope at pile head       =     -0.0012265 radians
Maximum bending moment            =       1658213. inch-lbs
Maximum shear force               =        -15470. lbs
```

downtown_pole3_36 inch_20ft

```
Depth of maximum bending moment  =     67.2000000 inches below pile head
Depth of maximum shear force     =    168.0000000 inches below pile head
Number of iterations             =             18
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =           6000. lbs
Moment     =        1344000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
20.0000	0.1342731	1658213.	-15470.
19.0000	0.1583431	1648259.	-16711.
18.0000	0.2008376	1642541.	-18211.
17.0000	0.2673713	1635192.	-19820.
16.0000	0.3771210	1625799.	-21540.
15.0000	0.5753989	1620221.	-23605.
14.0000	0.9128052	1612009.	-25333.
13.0000	1.5844141	1606679.	-27257.
12.0000	2.7488741	1591749.	-28899.
11.0000	6.6050735	1588591.	-31065.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                                =        9000.000 lbs
Applied moment at pile head                             =     2016000.000 in-lbs
Axial thrust load on pile head                          =           0.000 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. Lat. Load lb/inch	Distrib. p lb/in
0.00	0.2689	2016000.	9000.0000	-0.002235	440.1322	2.972E+11	-0.1990	0.8879	0.000
0.200	0.2636	2037599.	8999.0496	-0.002219	444.8478	2.972E+11	-0.5930	5.3990	0.000
0.400	0.2583	2059195.	8997.6312	-0.002202	449.5626	2.972E+11	-0.5890	5.4727	0.000
0.600	0.2530	2080788.	8996.2225	-0.002185	454.2767	2.972E+11	-0.5850	5.5484	0.000
0.800	0.2478	2102377.	8994.8234	-0.002169	458.9900	2.972E+11	-0.5809	5.6261	0.000

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```
     1.000      0.2426   2123963.  8993.4341  -0.002151   463.7027  2.972E+11
-0.5768     5.7059       0.000
     1.200      0.2375   2145546.  8992.0546  -0.002134   468.4146  2.972E+11
-0.5727     5.7880       0.000
     1.400      0.2324   2167125.  8990.6850  -0.002117   473.1257  2.972E+11
-0.5686     5.8724       0.000
     1.600      0.2273   2188701.  8989.3254  -0.002099   477.8362  2.972E+11
-0.5644     5.9592       0.000
     1.800      0.2223   2210274.  8987.9757  -0.002081   482.5460  2.972E+11
-0.5603     6.0486       0.000
     2.000      0.2173   2231843.  8986.6362  -0.002064   487.2550  2.972E+11
-0.5560     6.1405       0.000
     2.200      0.2124   2253410.  8985.3067  -0.002045   491.9634  2.972E+11
-0.5518     6.2352       0.000
     2.400      0.2075   2274973.  8983.9875  -0.002027   496.6710  2.972E+11
-0.5475     6.3327       0.000
     2.600      0.2027   2296533.  8982.6786  -0.002009   501.3780  2.972E+11
-0.5433     6.4332       0.000
     2.800      0.1979   2318090.  8981.3799  -0.001990   506.0843  2.972E+11
-0.5389     6.5368       0.000
     3.000      0.1931   2339643.  8862.6588  -0.001971   510.7899  2.972E+11
-98.3953  1222.8250       0.000
     3.200      0.1884   2360630.  8471.8312  -0.001952   515.3717  2.972E+11
-227.2944  2895.3302       0.000
     3.400      0.1837   2380308.  7923.5449  -0.001933   519.6678  2.972E+11
-229.6108  2999.0544       0.000
     3.600      0.1791   2398663.  7369.8082  -0.001914   523.6751  2.972E+11
-231.8364  3106.1627       0.000
     3.800      0.1746   2415683.  6810.8387  -0.001894   527.3909  2.972E+11
-233.9715  3216.8350       0.000
     4.000      0.1700   2431355.  6246.8539  -0.001875   530.8124  2.972E+11
-236.0159  3331.2605       0.000
     4.200      0.1656   2445668.  5678.0717  -0.001855   533.9372  2.972E+11
-237.9693  3449.6393       0.000
     4.400      0.1611   2458610.  5104.7110  -0.001835   536.7627  2.972E+11
-239.8313  3572.1835       0.000
     4.600      0.1568   2470171.  4526.9919  -0.001815   539.2866  2.972E+11
-241.6012  3699.1190       0.000
     4.800      0.1524   2480340.  3945.1365  -0.001795   541.5066  2.972E+11
-243.2783  3830.6874       0.000
     5.000      0.1481   2489107.  3359.3687  -0.001775   543.4208  2.972E+11
-244.8615  3967.1471       0.000
     5.200      0.1439   2496465.  2769.9151  -0.001755   545.0270  2.972E+11
-246.3498  4108.7758       0.000
     5.400      0.1397   2502403.  2177.0048  -0.001735   546.3235  2.972E+11
-247.7421  4255.8721       0.000
     5.600      0.1356   2506914.  1580.8698  -0.001715   547.3084  2.972E+11
-249.0370  4408.7584       0.000
     5.800      0.1315   2509991.   981.7458  -0.001695   547.9801  2.972E+11
-250.2330  4567.7829       0.000
     6.000      0.1274   2511627.   379.8718  -0.001674   548.3372  2.972E+11
-251.3287  4733.3233       0.000
     6.200      0.1234   2511815.  -224.5092  -0.001654   548.3782  2.972E+11
-252.3222  4905.7894       0.000
     6.400      0.1195   2510549.  -831.1498  -0.001634   548.1019  2.972E+11
-253.2117  5085.6274       0.000
     6.600      0.1156   2507825. -1439.7982  -0.001613   547.5072  2.972E+11
-253.9952  5273.3244       0.000
     6.800      0.1118   2503638. -2050.1972  -0.001593   546.5931  2.972E+11
-254.6706  5469.4129       0.000
     7.000      0.1080   2497984. -2662.0844  -0.001573   545.3588  2.972E+11
-255.2354  5674.4771       0.000
     7.200      0.1042   2490860. -3275.1915  -0.001553   543.8034  2.972E+11
```

ADDENDUM 2 - JULY 14, 2015

-255.6871	5889.1595	0.000				
7.400	0.1005	2482263.	-3889.2435	-0.001533	541.9266	2.972E+11
-256.0229	6114.1687	0.000				
7.600	0.0968	2472192.	-4503.9589	-0.001513	539.7278	2.972E+11
-256.2398	6350.2885	0.000				
7.800	0.0932	2460644.	-5119.0480	-0.001493	537.2067	2.972E+11
-256.3345	6598.3888	0.000				
8.000	0.0897	2447620.	-5734.2133	-0.001473	534.3633	2.972E+11
-256.3033	6859.4381	0.000				
8.200	0.0862	2433120.	-6349.1479	-0.001453	531.1976	2.972E+11
-256.1423	7134.5188	0.000				
8.400	0.0827	2417144.	-6963.5352	-0.001434	527.7098	2.972E+11
-255.8472	7424.8448	0.000				
8.600	0.0793	2399695.	-7577.0476	-0.001414	523.9003	2.972E+11
-255.4132	7731.7832	0.000				
8.800	0.0759	2380775.	-8189.3457	-0.001395	519.7696	2.972E+11
-254.8352	8056.8801	0.000				
9.000	0.0726	2360386.	-8800.0766	-0.001376	515.3184	2.972E+11
-254.1073	8401.8922	0.000				
9.200	0.0693	2338534.	-9408.8730	-0.001357	510.5477	2.972E+11
-253.2231	8768.8250	0.000				
9.400	0.0661	2315224.	-10015.	-0.001338	505.4585	2.972E+11
-252.1755	9159.9806	0.000				
9.600	0.0629	2290461.	-10619.	-0.001320	500.0523	2.972E+11
-250.9566	9578.0159	0.000				
9.800	0.0597	2264252.	-11220.	-0.001301	494.3304	2.972E+11
-249.5575	10026.	0.000				
10.000	0.0566	2236606.	-12099.	-0.001283	488.2947	2.972E+11
-482.9906	20467.	0.000				
10.200	0.0536	2206178.	-13241.	-0.001265	481.6517	2.972E+11
-468.4897	20985.	0.000				
10.400	0.0506	2173051.	-14346.	-0.001247	474.4195	2.972E+11
-453.0511	21503.	0.000				
10.600	0.0476	2137315.	-15414.	-0.001230	466.6176	2.972E+11
-436.6964	22022.	0.000				
10.800	0.0447	2099063.	-16441.	-0.001213	458.2666	2.972E+11
-419.4466	22540.	0.000				
11.000	0.0418	2058396.	-17426.	-0.001196	449.3880	2.972E+11
-401.3212	23059.	0.000				
11.200	0.0389	2015417.	-18367.	-0.001180	440.0048	2.972E+11
-382.3390	23577.	0.000				
11.400	0.0361	1970235.	-19261.	-0.001164	430.1408	2.972E+11
-362.5175	24095.	0.000				
11.600	0.0333	1922966.	-20106.	-0.001148	419.8210	2.972E+11
-341.8728	24614.	0.000				
11.800	0.0306	1873727.	-20901.	-0.001133	409.0712	2.972E+11
-320.4203	25132.	0.000				
12.000	0.0279	1822643.	-21643.	-0.001118	397.9185	2.972E+11
-298.1738	25651.	0.000				
12.200	0.0252	1769841.	-22331.	-0.001103	386.3908	2.972E+11
-275.1462	26169.	0.000				
12.400	0.0226	1715454.	-22963.	-0.001089	374.5172	2.972E+11
-251.3488	26687.	0.000				
12.600	0.0200	1659620.	-23536.	-0.001075	362.3274	2.972E+11
-226.7919	27206.	0.000				
12.800	0.0174	1602479.	-24050.	-0.001062	349.8525	2.972E+11
-201.4847	27724.	0.000				
13.000	0.0149	1544178.	-24503.	-0.001050	337.1241	2.972E+11
-175.4350	28243.	0.000				
13.200	0.0124	1484866.	-24892.	-0.001037	324.1752	2.972E+11
-148.6492	28761.	0.000				
13.400	0.009929	1424698.	-25215.	-0.001026	311.0394	2.972E+11
-121.1328	29279.	0.000				

ADDENDUM 2 - JULY 14, 2015

13.600	0.007482	1363832.	-25472.	-0.001014	297.7512	2.972E+11	-92.8899	29798.	0.000
13.800	0.005061	1302431.	-25660.	-0.001004	284.3462	2.972E+11	-63.9236	30316.	0.000
14.000	0.002665	1240662.	-25778.	-0.000993	270.8608	2.972E+11	-34.2357	30835.	0.000
14.200	0.000293	1178696.	-25824.	-0.000983	257.3324	2.972E+11	-3.8269	31353.	0.000
14.400	-0.002056	1116708.	-25796.	-0.000974	243.7991	2.972E+11	27.3032	31871.	0.000
14.600	-0.004383	1054877.	-25692.	-0.000965	230.3002	2.972E+11	59.1560	32390.	0.000
14.800	-0.006690	993387.	-25511.	-0.000957	216.8757	2.972E+11	91.7339	32908.	0.000
15.000	-0.008978	932425.	-25251.	-0.000949	203.5665	2.972E+11	125.0402	33427.	0.000
15.200	-0.0112	872183.	-24910.	-0.000942	190.4146	2.972E+11	159.0791	33945.	0.000
15.400	-0.0135	812858.	-24486.	-0.000935	177.4627	2.972E+11	193.8559	34463.	0.000
15.600	-0.0157	754649.	-23993.	-0.000929	164.7546	2.972E+11	217.5615	33180.	0.000
15.800	-0.0180	697693.	-23447.	-0.000923	152.3201	2.972E+11	237.4128	31727.	0.000
16.000	-0.0202	642105.	-22854.	-0.000918	140.1841	2.972E+11	256.7413	30553.	0.000
16.200	-0.0224	587996.	-22215.	-0.000913	128.3710	2.972E+11	275.6694	29583.	0.000
16.400	-0.0245	535475.	-21531.	-0.000908	116.9046	2.972E+11	294.2883	28771.	0.000
16.600	-0.0267	484648.	-20802.	-0.000904	105.8082	2.972E+11	312.6673	28080.	0.000
16.800	-0.0289	435623.	-20030.	-0.000900	95.1050	2.972E+11	330.8606	27487.	0.000
17.000	-0.0310	388504.	-19214.	-0.000897	84.8179	2.972E+11	348.9114	26973.	0.000
17.200	-0.0332	343394.	-18353.	-0.000894	74.9696	2.972E+11	369.3566	26705.	0.000
17.400	-0.0353	300411.	-17438.	-0.000891	65.5857	2.972E+11	392.7627	26675.	0.000
17.600	-0.0375	259691.	-16467.	-0.000889	56.6957	2.972E+11	416.5637	26679.	0.000
17.800	-0.0396	221371.	-15438.	-0.000887	48.3296	2.972E+11	440.7805	26710.	0.000
18.000	-0.0417	185589.	-14351.	-0.000886	40.5177	2.972E+11	465.4318	26766.	0.000
18.200	-0.0439	152488.	-13203.	-0.000884	33.2912	2.972E+11	490.5344	26844.	0.000
18.400	-0.0460	122213.	-11995.	-0.000883	26.6815	2.972E+11	516.1038	26940.	0.000
18.600	-0.0481	94910.	-10725.	-0.000882	20.7208	2.972E+11	542.1541	27054.	0.000
18.800	-0.0502	70730.	-9392.4749	-0.000882	15.4418	2.972E+11	568.6981	27182.	0.000
19.000	-0.0523	49826.	-7995.1399	-0.000881	10.8781	2.972E+11	595.7478	27324.	0.000
19.200	-0.0544	32354.	-6532.2656	-0.000881	7.0635	2.972E+11	623.3141	27478.	0.000
19.400	-0.0566	18471.	-5002.6001	-0.000881	4.0327	2.972E+11	651.4072	27643.	0.000
19.600	-0.0587	8341.3114	-3404.8681	-0.000880	1.8211	2.972E+11	680.0362	27819.	0.000
19.800	-0.0608	2128.1323	-1737.7732	-0.000880	0.4646	2.972E+11			

ADDENDUM 2 - JULY 14, 2015

downtown_pole3_36 inch_20ft

```
709.2095     28003.      0.000
    20.000    -0.0629      0.000      0.000  -0.000880      0.000  2.972E+11
738.9348     14098.      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      0.2689484 inches
Computed slope at pile head      =     -0.0022350 radians
Maximum bending moment           =       2511815. inch-lbs
Maximum shear force              =        -25824. lbs
Depth of maximum bending moment  =     74.4000000 inches below pile head
Depth of maximum shear force     =    170.4000000 inches below pile head
Number of iterations             =             17
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =           9000. lbs
Moment     =        2016000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
20.0000	0.2689484	2511815.	-25824.
19.0000	0.3347667	2492878.	-27797.
18.0000	0.4540912	2479961.	-30047.
17.0000	0.6469705	2464691.	-32396.
16.0000	0.9791310	2447064.	-34728.
15.0000	1.5873254	2435847.	-37328.
14.0000	2.6644245	2421484.	-39498.
13.0000	4.7899130	2412257.	-41696.
12.0000	9.0267912	2388011.	-43675.

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

```
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians
```

```
                Pile-head      Pile-head                                        Maximum
       Maximum
```

```
                              downtown_pole3_36 inch_20ft
Load  Load    Condition 1    Condition 2        Axial        Pile-head       Moment
        Shear        Pile-head
Case  Type    V(lbs) or     in-lb, rad.,       Loading      Deflection       in Pile
       in Pile       Rotation
 No.   No.    y(inches)     or in-lb/rad.        lbs          inches         in-lbs
         lbs          radians
----  ----  --------------  --------------  -------------  -------------
-------------  -------------  -------------
  1     1   V =  6000.0000  M =   1344000.      0.0000000     0.13427309
1658213.        -15470.    -0.00122650
  2     1   V =  9000.0000  M =   2016000.      0.0000000     0.26894840
2511815.        -25824.    -0.00223501

The analysis ended normally.
```

ADDENDUM 2 - JULY 14, 2015

downtown_pole4_36 inch_25ft

==========

LPile Plus for Windows, Version 2012-06.035

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

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URS
URS Austin

Serial Number of Security Device: 500126253
Company Name Stored in Security Device: URS Corporation

Files Used for Analysis

Path to file locations: P:\AUS Geotech\Projects\41010530.052 City of El Paso\OCS Design\LPILE runs_RAR\
Name of input data file: downtown_pole4_36 inch_25ft.lp6d
Name of output report file: downtown_pole4_36 inch_25ft.lp6o
Name of plot output file: downtown_pole4_36 inch_25ft.lp6p
Name of runtime messeage file: downtown_pole4_36 inch_25ft.lp6r

---

Date and Time of Analysis

Date: January 17, 2013 Time: 15:04:17

Problem Title

Project Name: El Paso Streetcar

Job Number: 41010530

Client: City of El Paso

Engineer: R. Russo

Description: OCS Pole Foundations

ADDENDUM 2 - JULY 14, 2015

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:
- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments	=	100	
- Maximum number of iterations allowed	=	500	
- Deflection tolerance for convergence	=	1.0000E-05	in
- Maximum allowable deflection	=	100.0000	in

Pile Response Output Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 25.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	36.0000000
2	25.000000	36.0000000

Input Structural Properties:

Pile Section No. 1:

ADDENDUM 2 - JULY 14, 2015

downtown_pole4_36 inch_25ft

```
   Section Type                                        =    Elastic Pile
   Cross-sectional Shape                               =        Circular
   Section Length                                      =     25.00000000 ft
   Top Width                                           =     36.00000000 in
   Bottom Width                                        =     36.00000000 in
   Top Area                                            =   1017.87601976 Sq. in
   Bottom Area                                         =   1017.87601976 Sq. in
   Moment of Inertia at Top                            =          82448. in^4
   Moment of Inertia at Bottom                         =          82448. in^4
   Elastic Modulus                                     =        3604997. lbs/in^2


--------------------------------------------------------------------------------
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------

Ground Slope Angle                                     =        0.000 degrees
                                                       =        0.000 radians

Pile Batter Angle                                      =        0.000 degrees
                                                       =        0.000 radians



--------------------------------------------------------------------------------
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using 3 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer           =       0.0000 ft
   Distance from top of pile to bottom of layer        =      3.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Undrained cohesion at top of layer                  =      1.00000 psf
   Undrained cohesion at bottom of layer               =      1.00000 psf
   Epsilon-50 at top of layer                          =      0.02000
   Epsilon-50 at bottom of layer                       =      0.02000


Layer 2 is soft clay, p-y criteria by Matlock, 1970

   Distance from top of pile to top of layer           =      3.00000 ft
   Distance from top of pile to bottom of layer        =     10.00000 ft
   Effective unit weight at top of layer               =    115.00000 pcf
   Effective unit weight at bottom of layer            =    115.00000 pcf
   Undrained cohesion at top of layer                  =   1000.00000 psf
   Undrained cohesion at bottom of layer               =   1000.00000 psf
   Epsilon-50 at top of layer                          =      0.01000
   Epsilon-50 at bottom of layer                       =      0.01000


Layer 3 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =     10.00000 ft
   Distance from top of pile to bottom of layer        =     25.00000 ft
   Effective unit weight at top of layer               =    120.00000 pcf
   Effective unit weight at bottom of layer            =    120.00000 pcf
   Friction angle at top of layer                      =     27.00000 deg.
```

ADDENDUM 2 - JULY 14, 2015

downtown_pole4_36 inch_25ft

```
   Friction angle at bottom of layer                    =     27.00000 deg.
   Subgrade k at top of layer                           =     90.00000 pci
   Subgrade k at bottom of layer                        =     90.00000 pci


   (Depth of lowest soil layer extends    0.00 ft below pile tip)


--------------------------------------------------------------------------------
                           Summary of Soil Properties
--------------------------------------------------------------------------------

                      Layer                      Layer      Effective    Undrained
Angle of      Strain
Layer               Soil Type                   Depth       Unit Wt.    Cohesion
Friction      Factor        kpy
 Num.         (p-y Curve Criteria)               ft           pcf          psf
   deg.     Epsilon 50      pci
-----   ----------------------------------   ----------   ----------   ----------
----------   ----------   ----------
  1     Soft Clay                                 0.00      120.000        1.000
   --          0.02000       --
                                                 3.000      120.000        1.000
   --          0.02000       --
  2     Soft Clay                                 3.000      115.000     1000.000
   --          0.01000       --
                                                10.000      115.000     1000.000
   --          0.01000       --
  3     Sand (Reese, et al.)                     10.000      120.000       --
   27.000       --           90.000
                                                25.000      120.000       --
   27.000       --           90.000


--------------------------------------------------------------------------------
                                  Loading Type
--------------------------------------------------------------------------------

Static loading criteria were used when computing p-y curves for all analyses.


--------------------------------------------------------------------------------
               Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------

Number of loads specified = 2

Load    Load         Condition                Condition            Axial Thrust
     Compute
 No.    Type             1                        2                  Force, lbs
Top y vs. Pile Length
-----   ----   --------------------   ------------------------   ----------------
---------------------
   1     1     V =  10000.00000 lbs   M =     2340000. in-lbs         0.0000000
       Yes
   2     1     V =       15000. lbs   M =     3510000. in-lbs         0.0000000
       Yes

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
```

ADDENDUM 2 - JULY 14, 2015

downtown_pole4_36 inch_25ft
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
---

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

---
Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 10000.000 lbs
Applied moment at pile head = 2340000.000 in-lbs
Axial thrust load on pile head = 0.000 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. p lb/in	Distrib. Lat. Load lb/inch
0.00	0.2096	2340000.	10000.	-0.001956	510.8677	2.972E+11	-0.1831	1.3106	0.000
0.250	0.2038	2369999.	9998.9090	-0.001933	517.4171	2.972E+11	-0.5442	8.0127	0.000
0.500	0.1980	2399993.	9997.2841	-0.001909	523.9655	2.972E+11	-0.5390	8.1674	0.000
0.750	0.1923	2429983.	9995.6748	-0.001884	530.5127	2.972E+11	-0.5338	8.3277	0.000
1.000	0.1867	2459968.	9994.0811	-0.001860	537.0590	2.972E+11	-0.5286	8.4939	0.000
1.250	0.1812	2489947.	9992.5033	-0.001835	543.6042	2.972E+11	-0.5233	8.6662	0.000
1.500	0.1757	2519923.	9990.9414	-0.001809	550.1483	2.972E+11	-0.5180	8.8451	0.000
1.750	0.1703	2549893.	9989.3954	-0.001784	556.6915	2.972E+11	-0.5126	9.0307	0.000
2.000	0.1650	2579859.	9987.8656	-0.001758	563.2336	2.972E+11	-0.5072	9.2236	0.000
2.250	0.1597	2609820.	9986.3520	-0.001732	569.7747	2.972E+11	-0.5018	9.4240	0.000
2.500	0.1546	2639777.	9984.8547	-0.001705	576.3149	2.972E+11	-0.4964	9.6323	0.000
2.750	0.1495	2669729.	9983.3738	-0.001678	582.8541	2.972E+11			

ADDENDUM 2 - JULY 14, 2015

downtown_pole4_36 inch_25ft

```
-0.4909     9.8491      0.000
     3.000      0.1445   2699677.  9848.6389  -0.001651   589.3923  2.972E+11
-89.3324  1854.3335      0.000
     3.250      0.1396   2728821.  9404.6799  -0.001624   595.7550  2.972E+11
-206.6403  4440.3098      0.000
     3.500      0.1348   2756105.  8781.2659  -0.001596   601.7116  2.972E+11
-208.9690  4651.2677      0.000
     3.750      0.1300   2781509.  8151.0702  -0.001568   607.2577  2.972E+11
-211.1614  4871.6316      0.000
     4.000      0.1254   2805012.  7514.5005  -0.001540   612.3889  2.972E+11
-213.2183  5102.0188      0.000
     4.250      0.1208   2826596.  6871.9628  -0.001512   617.1011  2.972E+11
-215.1401  5343.0863      0.000
     4.500      0.1163   2846244.  6223.8622  -0.001483   621.3906  2.972E+11
-216.9269  5595.5374      0.000
     4.750      0.1119   2863939.  5570.6041  -0.001454   625.2538  2.972E+11
-218.5785  5860.1273      0.000
     5.000      0.1076   2879667.  4912.5946  -0.001425   628.6876  2.972E+11
-220.0945  6137.6700      0.000
     5.250      0.1033   2893415.  4250.2415  -0.001396   631.6889  2.972E+11
-221.4743  6429.0452      0.000
     5.500      0.0992   2905169.  3583.9543  -0.001367   634.2551  2.972E+11
-222.7172  6735.2059      0.000
     5.750      0.0951   2914918.  2914.1446  -0.001337   636.3836  2.972E+11
-223.8226  7057.1868      0.000
     6.000      0.0912   2922653.  2241.2267  -0.001308   638.0724  2.972E+11
-224.7894  7396.1139      0.000
     6.250      0.0873   2928366.  1565.6178  -0.001278   639.3194  2.972E+11
-225.6166  7753.2148      0.000
     6.500      0.0835   2932047.   887.7380  -0.001249   640.1232  2.972E+11
-226.3033  8129.8311      0.000
     6.750      0.0798   2933692.   208.0109  -0.001219   640.4823  2.972E+11
-226.8481  8527.4321      0.000
     7.000      0.0762   2933295.  -473.1361  -0.001190   640.3957  2.972E+11
-227.2499  8947.6306      0.000
     7.250      0.0727   2930853. -1155.2717  -0.001160   639.8625  2.972E+11
-227.5072  9392.2007      0.000
     7.500      0.0692   2926364. -1837.9603  -0.001130   638.8824  2.972E+11
-227.6186  9863.0995      0.000
     7.750      0.0659   2919825. -2520.7617  -0.001101   637.4549  2.972E+11
-227.5824     10362.      0.000
     8.000      0.0626   2911239. -3203.2307  -0.001071   635.5804  2.972E+11
-227.3969     10893.      0.000
     8.250      0.0595   2900606. -3884.9164  -0.001042   633.2590  2.972E+11
-227.0602     11457.      0.000
     8.500      0.0564   2887930. -4565.3622  -0.001013   630.4914  2.972E+11
-226.5703     12057.      0.000
     8.750      0.0534   2873214. -5244.1051  -0.000984   627.2787  2.972E+11
-225.9249     12697.      0.000
     9.000      0.0505   2856465. -5920.6748  -0.000955   623.6221  2.972E+11
-225.1215     13381.      0.000
     9.250      0.0476   2837690. -6594.5933  -0.000926   619.5231  2.972E+11
-224.1575     14113.      0.000
     9.500      0.0449   2816897. -7265.3739  -0.000898   614.9837  2.972E+11
-223.0297     14897.      0.000
     9.750      0.0423   2794098. -7932.5206  -0.000869   610.0061  2.972E+11
-221.7348     15739.      0.000
    10.000      0.0397   2769302. -8772.5283  -0.000841   604.5928  2.972E+11
-338.2703     25563.      0.000
    10.250      0.0372   2741462. -9770.6881  -0.000813   598.5148  2.972E+11
-327.1695     26373.      0.000
    10.500      0.0348   2710678.    -10735.  -0.000786   591.7940  2.972E+11
-315.4807     27183.      0.000
```

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10.750	0.0325	2677054.	-11663.	-0.000759	584.4533	2.972E+11	-303.2623	27993.
0.000								
11.000	0.0303	2640701.	-12554.	-0.000732	576.5167	2.972E+11	-290.5710	28803.
0.000								
11.250	0.0281	2601733.	-13406.	-0.000705	568.0092	2.972E+11	-277.4617	29613.
0.000								
11.500	0.0260	2560268.	-14218.	-0.000679	558.9565	2.972E+11	-263.9872	30423.
0.000								
11.750	0.0240	2516427.	-14989.	-0.000654	549.3851	2.972E+11	-250.1982	31233.
0.000								
12.000	0.0221	2470334.	-15719.	-0.000629	539.3221	2.972E+11	-236.1433	32043.
0.000								
12.250	0.0203	2422116.	-16406.	-0.000604	528.7951	2.972E+11	-221.8690	32853.
0.000								
12.500	0.0185	2371900.	-17049.	-0.000580	517.8322	2.972E+11	-207.4194	33663.
0.000								
12.750	0.0168	2319819.	-17650.	-0.000556	506.4617	2.972E+11	-192.8366	34473.
0.000								
13.000	0.0151	2266001.	-18206.	-0.000533	494.7123	2.972E+11	-178.1600	35283.
0.000								
13.250	0.0136	2210580.	-18719.	-0.000510	482.6129	2.972E+11	-163.4271	36093.
0.000								
13.500	0.0121	2153689.	-19187.	-0.000488	470.1923	2.972E+11	-148.6728	36903.
0.000								
13.750	0.0107	2095459.	-19611.	-0.000467	457.4796	2.972E+11	-133.9295	37713.
0.000								
14.000	0.009285	2036024.	-19991.	-0.000446	444.5038	2.972E+11	-119.2276	38523.
0.000								
14.250	0.007978	1975516.	-20326.	-0.000426	431.2937	2.972E+11	-104.5947	39333.
0.000								
14.500	0.006730	1914066.	-20618.	-0.000406	417.8781	2.972E+11	-90.0564	40143.
0.000								
14.750	0.005541	1851806.	-20867.	-0.000387	404.2855	2.972E+11	-75.6356	40953.
0.000								
15.000	0.004407	1788865.	-21072.	-0.000369	390.5443	2.972E+11	-61.3531	41763.
0.000								
15.250	0.003328	1725373.	-21235.	-0.000351	376.6825	2.972E+11	-47.2272	42573.
0.000								
15.500	0.002301	1661455.	-21356.	-0.000334	362.7280	2.972E+11	-33.2741	43383.
0.000								
15.750	0.001324	1597237.	-21435.	-0.000318	348.7081	2.972E+11	-19.5075	44193.
0.000								
16.000	0.000396	1532844.	-21473.	-0.000302	334.6498	2.972E+11	-5.9390	45003.
0.000								
16.250	-0.000486	1468398.	-21471.	-0.000287	320.5799	2.972E+11	7.4220	45813.
0.000								
16.500	-0.001323	1404018.	-21429.	-0.000272	306.5246	2.972E+11	20.5683	46623.
0.000								
16.750	-0.002118	1339824.	-21348.	-0.000258	292.5097	2.972E+11	33.4945	47433.
0.000								
17.000	-0.002873	1275931.	-21228.	-0.000245	278.5606	2.972E+11	46.1976	48243.
0.000								
17.250	-0.003589	1212453.	-21071.	-0.000232	264.7022	2.972E+11	58.6764	49053.
0.000								
17.500	-0.004268	1149504.	-20877.	-0.000221	250.9592	2.972E+11	70.9314	49863.
0.000								
17.750	-0.004912	1087193.	-20646.	-0.000209	237.3555	2.972E+11	82.9652	50673.
0.000								
18.000	-0.005523	1025629.	-20379.	-0.000199	223.9149	2.972E+11	94.7819	51483.
0.000								
18.250	-0.006103	964918.	-20077.	-0.000189	210.6605	2.972E+11	106.3874	52293.
0.000								
18.500	-0.006654	905164.	-19741.	-0.000179	197.6151	2.972E+11		

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```
117.7890     53103.      0.000
    18.750  -0.007178    846471.    -19371.  -0.000170   184.8011  2.972E+11
128.9956     53913.      0.000
    19.000  -0.007676    788938.    -18967.  -0.000162   172.2407  2.972E+11
140.0174     54723.      0.000
    19.250  -0.008150    732666.    -18531.  -0.000154   159.9553  2.972E+11
150.8659     55533.      0.000
    19.500  -0.008602    677751.    -18063.  -0.000147   147.9664  2.972E+11
161.5538     56343.      0.000
    19.750  -0.009033    624291.    -17562.  -0.000141   136.2949  2.972E+11
172.0947     57153.      0.000
    20.000  -0.009446    572379.    -17030.  -0.000135   124.9615  2.972E+11
182.5033     57963.      0.000
    20.250  -0.009841    522110.    -16467.  -0.000129   113.9868  2.972E+11
192.7951     58773.      0.000
    20.500    -0.0102    473576.    -15874.  -0.000124   103.3908  2.972E+11
202.9863     59583.      0.000
    20.750    -0.0106    426868.    -15249.  -0.000120    93.1937  2.972E+11
213.0937     60393.      0.000
    21.000    -0.0109    382079.    -14595.  -0.000115    83.4153  2.972E+11
223.1345     61203.      0.000
    21.250    -0.0113    339298.    -13911.  -0.000112    74.0754  2.972E+11
233.1262     62013.      0.000
    21.500    -0.0116    298615.    -13196.  -0.000109    65.1935  2.972E+11
243.0867     62823.      0.000
    21.750    -0.0119    260120.    -12452.  -0.000106    56.7892  2.972E+11
253.0337     63633.      0.000
    22.000    -0.0122    223902.    -11678.  -0.000103    48.8821  2.972E+11
262.9849     64443.      0.000
    22.250    -0.0125    190051.    -10874.  -0.000101    41.4918  2.972E+11
272.9579     65253.      0.000
    22.500    -0.0128    158656.    -10040. -9.946E-05    34.6378  2.972E+11
282.9696     66063.      0.000
    22.750    -0.0131    129809. -9176.3501 -9.800E-05    28.3398  2.972E+11
293.0367     66873.      0.000
    23.000    -0.0134    103598. -8282.0325 -9.683E-05    22.6175  2.972E+11
303.1750     67683.      0.000
    23.250    -0.0137     80116. -7357.1711 -9.590E-05    17.4910  2.972E+11
313.3993     68493.      0.000
    23.500    -0.0140     59455. -6401.4868 -9.519E-05    12.9802  2.972E+11
323.7236     69303.      0.000
    23.750    -0.0143     41707. -5414.6606 -9.468E-05     9.1056  2.972E+11
334.1605     70113.      0.000
    24.000    -0.0146     26967. -4396.3379 -9.434E-05     5.8875  2.972E+11
344.7213     70923.      0.000
    24.250    -0.0149     15329. -3346.1324 -9.412E-05     3.3467  2.972E+11
355.4156     71733.      0.000
    24.500    -0.0151  6890.4218 -2263.6320 -9.401E-05     1.5043  2.972E+11
366.2513     72543.      0.000
    24.750    -0.0154  1747.6567 -1148.4036 -9.397E-05     0.3815  2.972E+11
377.2343     73353.      0.000
    25.000    -0.0157      0.000      0.000 -9.396E-05      0.000  2.972E+11
388.3682     37082.      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

```
Pile-head deflection              =      0.2095944 inches
Computed slope at pile head       =     -0.0019564 radians
Maximum bending moment            =       2933692. inch-lbs
Maximum shear force               =        -21473. lbs
```

downtown_pole4_36 inch_25ft

```
Depth of maximum bending moment  =     81.0000000 inches below pile head
Depth of maximum shear force     =    192.0000000 inches below pile head
Number of iterations             =             13
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =          10000. lbs
Moment     =        2340000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
25.0000	0.2095944	2933692.	-21473.
23.7500	0.2185066	2924752.	-22964.
22.5000	0.2373630	2925039.	-25226.
21.2500	0.2766693	2917652.	-27872.
20.0000	0.3398355	2893890.	-30436.
18.7500	0.4817511	2873328.	-33412.
17.5000	0.7525400	2855493.	-36689.
16.2500	1.2279645	2827436.	-39833.
15.0000	2.1561879	2797252.	-42879.
13.7500	4.2081788	2780282.	-45972.
12.5000	9.8944030	2765276.	-49199.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                                =       15000.000 lbs
Applied moment at pile head                             =     3510000.000 in-lbs
Axial thrust load on pile head                          =           0.000 lbs
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. Es*h lb/inch	Soil Spr. Lat. Load lb/inch	Distrib. p lb/in
0.00	0.3643	3510000.	15000.	-0.003184	766.3016	2.972E+11	-0.2202	0.9066	0.000
0.250	0.3548	3554999.	14999.	-0.003149	776.1257	2.972E+11	-0.6547	5.5361	0.000
0.500	0.3454	3599992.	14997.	-0.003113	785.9486	2.972E+11	-0.6489	5.6360	0.000
0.750	0.3361	3644979.	14995.	-0.003076	795.7702	2.972E+11	-0.6430	5.7393	0.000
1.000	0.3269	3689961.	14993.	-0.003039	805.5906	2.972E+11			

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```
-0.6371     5.8462      0.000
     1.250      0.3179   3734937.     14991.  -0.003002   815.4096  2.972E+11
-0.6312     5.9568      0.000
     1.500      0.3089   3779907.     14989.  -0.002964   825.2275  2.972E+11
-0.6252     6.0713      0.000
     1.750      0.3001   3824871.     14987.  -0.002925   835.0441  2.972E+11
-0.6192     6.1898      0.000
     2.000      0.2914   3869830.     14985.  -0.002886   844.8595  2.972E+11
-0.6131     6.3127      0.000
     2.250      0.2828   3914783.     14984.  -0.002847   854.6737  2.972E+11
-0.6070     6.4401      0.000
     2.500      0.2743   3959731.     14982.  -0.002807   864.4867  2.972E+11
-0.6009     6.5721      0.000
     2.750      0.2659   4004674.     14980.  -0.002767   874.2985  2.972E+11
-0.5947     6.7092      0.000
     3.000      0.2577   4049611.     14817.  -0.002727   884.1092  2.972E+11
-108.3244  1261.0747      0.000
     3.250      0.2496   4093573.     14278.  -0.002686   893.7070  2.972E+11
-250.7869  3014.5425      0.000
     3.500      0.2416   4135278.     13521.  -0.002644   902.8120  2.972E+11
-253.8374  3152.1828      0.000
     3.750      0.2337   4174699.     12755.  -0.002602   911.4183  2.972E+11
-256.7345  3295.5075      0.000
     4.000      0.2260   4211809.     11981.  -0.002560   919.5202  2.972E+11
-259.4793  3444.8688      0.000
     4.250      0.2184   4246584.     11198.  -0.002517   927.1121  2.972E+11
-262.0724  3600.6386      0.000
     4.500      0.2109   4279000.     10409.  -0.002474   934.1892  2.972E+11
-264.5138  3763.2121      0.000
     4.750      0.2035   4309035.  9611.5927  -0.002431   940.7465  2.972E+11
-266.8036  3933.0113      0.000
     5.000      0.1963   4336669.  8807.9755  -0.002387   946.7796  2.972E+11
-268.9412  4110.4877      0.000
     5.250      0.1892   4361883.  7998.1743  -0.002343   952.2842  2.972E+11
-270.9262  4296.1261      0.000
     5.500      0.1822   4384658.  7182.6481  -0.002299   957.2565  2.972E+11
-272.7579  4490.4483      0.000
     5.750      0.1754   4404979.  6361.8580  -0.002255   961.6929  2.972E+11
-274.4354  4694.0170      0.000
     6.000      0.1687   4422829.  5536.2681  -0.002210   965.5900  2.972E+11
-275.9579  4907.4403      0.000
     6.250      0.1621   4438196.  4706.3451  -0.002165   968.9450  2.972E+11
-277.3242  5131.3763      0.000
     6.500      0.1557   4451067.  3872.5590  -0.002120   971.7550  2.972E+11
-278.5332  5366.5390      0.000
     6.750      0.1494   4461432.  3035.3836  -0.002076   974.0177  2.972E+11
-279.5838  5613.7040      0.000
     7.000      0.1433   4469280.  2195.2960  -0.002030   975.7311  2.972E+11
-280.4746  5873.7157      0.000
     7.250      0.1372   4474603.  1352.7778  -0.001985   976.8933  2.972E+11
-281.2043  6147.4950      0.000
     7.500      0.1313   4477396.   508.3144  -0.001940   977.5031  2.972E+11
-281.7713  6436.0485      0.000
     7.750      0.1256   4477653.  -337.6038  -0.001895   977.5592  2.972E+11
-282.1742  6740.4782      0.000
     8.000      0.1200   4475371. -1184.4819  -0.001850   977.0609  2.972E+11
-282.4112  7061.9937      0.000
     8.250      0.1145   4470546. -2031.8196  -0.001805   976.0076  2.972E+11
-282.4806  7401.9252      0.000
     8.500      0.1091   4463180. -2879.1112  -0.001760   974.3993  2.972E+11
-282.3804  7761.7395      0.000
     8.750      0.1039   4453272. -3725.8449  -0.001715   972.2362  2.972E+11
-282.1087  8143.0574      0.000
```

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9.000	0.0989	4440825.	-4571.5028	-0.001670	969.5188	2.972E+11	-281.6632	8547.6754
9.250	0.0939	4425843.	-5415.5601	-0.001625	966.2479	2.972E+11	-281.0416	8977.5894
9.500	0.0891	4408331.	-6257.4847	-0.001580	962.4249	2.972E+11	-280.2414	9435.0241
9.750	0.0844	4388298.	-7096.7363	-0.001536	958.0511	2.972E+11	-279.2597	9922.4668
10.000	0.0799	4365751.	-8363.0786	-0.001492	953.1287	2.972E+11	-564.9685	21215.
10.250	0.0755	4338119.	-10045.	-0.001448	947.0962	2.972E+11	-556.1657	22105.
10.500	0.0712	4305482.	-11696.	-0.001404	939.9709	2.972E+11	-544.8261	22955.
10.750	0.0671	4267942.	-13310.	-0.001361	931.7751	2.972E+11	-530.9679	23754.
11.000	0.0630	4225622.	-14878.	-0.001318	922.5359	2.972E+11	-514.6294	24491.
11.250	0.0591	4178672.	-16400.	-0.001276	912.2857	2.972E+11	-499.8599	25353.
11.500	0.0554	4127222.	-17879.	-0.001234	901.0532	2.972E+11	-486.1061	26331.
11.750	0.0517	4071397.	-19314.	-0.001192	888.8656	2.972E+11	-470.3576	27269.
12.000	0.0482	4011340.	-20698.	-0.001152	875.7538	2.972E+11	-452.6954	28158.
12.250	0.0448	3947207.	-22027.	-0.001111	861.7525	2.972E+11	-433.2205	28986.
12.500	0.0416	3879176.	-23295.	-0.001072	846.9000	2.972E+11	-412.0552	29742.
12.750	0.0384	3807437.	-24497.	-0.001033	831.2379	2.972E+11	-389.3437	30413.
13.000	0.0354	3732193.	-25629.	-0.000995	814.8107	2.972E+11	-365.2528	30985.
13.250	0.0324	3653662.	-26687.	-0.000958	797.6659	2.972E+11	-339.9721	31445.
13.500	0.0296	3572072.	-27667.	-0.000921	779.8530	2.972E+11	-313.7146	31777.
13.750	0.0269	3487658.	-28568.	-0.000886	761.4238	2.972E+11	-286.7156	31967.
14.000	0.0243	3400663.	-29387.	-0.000851	742.4312	2.972E+11	-259.2328	32000.
14.250	0.0218	3311335.	-30138.	-0.000817	722.9292	2.972E+11	-241.1443	33182.
14.500	0.0194	3219837.	-30844.	-0.000784	702.9534	2.972E+11	-229.8054	35535.
14.750	0.0171	3126271.	-31515.	-0.000752	682.5261	2.972E+11	-217.4219	38150.
15.000	0.0149	3030748.	-32147.	-0.000721	661.6716	2.972E+11	-203.9414	41094.
15.250	0.0128	2933390.	-32725.	-0.000691	640.4163	2.972E+11	-181.2398	42573.
15.500	0.0107	2834400.	-33230.	-0.000662	618.8050	2.972E+11	-155.3572	43383.
15.750	0.008801	2734012.	-33657.	-0.000634	596.8883	2.972E+11	-129.6436	44193.
16.000	0.006941	2632458.	-34008.	-0.000607	574.7170	2.972E+11	-104.1230	45003.
16.250	0.005161	2529966.	-34282.	-0.000581	552.3410	2.972E+11	-78.8155	45813.
16.500	0.003458	2426765.	-34481.	-0.000556	529.8102	2.972E+11	-53.7374	46623.
16.750	0.001828	2323080.	-34605.	-0.000532	507.1738	2.972E+11		

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```
-28.9013     47433.      0.000
    17.000   0.000268   2219136.    -34655.  -0.000509   484.4806  2.972E+11
-4.3163     48243.      0.000
    17.250  -0.001224   2115152.    -34631.  -0.000487   461.7790  2.972E+11
20.0121     49053.      0.000
    17.500  -0.002652   2011348.    -34535.  -0.000466   439.1166  2.972E+11
44.0818     49863.      0.000
    17.750  -0.004020   1907942.    -34367.  -0.000446   416.5409  2.972E+11
67.8940     50673.      0.000
    18.000  -0.005329   1805146.    -34128.  -0.000427   394.0986  2.972E+11
91.4532     51483.      0.000
    18.250  -0.006584   1703173.    -33819.  -0.000410   371.8360  2.972E+11
114.7668     52293.      0.000
    18.500  -0.007787   1602233.    -33440.  -0.000393   349.7988  2.972E+11
137.8451     53103.      0.000
    18.750  -0.008942   1502534.    -32992.  -0.000377   328.0326  2.972E+11
160.7013     53913.      0.000
    19.000    -0.0101   1404281.    -32476.  -0.000363   306.5820  2.972E+11
183.3513     54723.      0.000
    19.250    -0.0111   1307679.    -31892.  -0.000349   285.4918  2.972E+11
205.8132     55533.      0.000
    19.500    -0.0121   1212928.    -31241.  -0.000336   264.8059  2.972E+11
228.1074     56343.      0.000
    19.750    -0.0131   1120231.    -30524.  -0.000325   244.5683  2.972E+11
250.2567     57153.      0.000
    20.000    -0.0141   1029786.    -29740.  -0.000314   224.8223  2.972E+11
272.2855     57963.      0.000
    20.250    -0.0150    941791.    -28890.  -0.000304   205.6114  2.972E+11
294.2199     58773.      0.000
    20.500    -0.0159    856445.    -27975.  -0.000295   186.9786  2.972E+11
316.0876     59583.      0.000
    20.750    -0.0168    773943.    -26994.  -0.000286   168.9668  2.972E+11
337.9176     60393.      0.000
    21.000    -0.0176    694482.    -25947.  -0.000279   151.6190  2.972E+11
359.7398     61203.      0.000
    21.250    -0.0185    618259.    -24835.  -0.000272   134.9781  2.972E+11
381.5849     62013.      0.000
    21.500    -0.0193    545471.    -23658.  -0.000266   119.0869  2.972E+11
403.4843     62823.      0.000
    21.750    -0.0201    476314.    -22414.  -0.000261   103.9886  2.972E+11
425.4696     63633.      0.000
    22.000    -0.0208    410986.    -21105.  -0.000257    89.7262  2.972E+11
447.5723     64443.      0.000
    22.250    -0.0216    349686.    -19729.  -0.000253    76.3432  2.972E+11
469.8238     65253.      0.000
    22.500    -0.0224    292614.    -18285.  -0.000250    63.8834  2.972E+11
492.2548     66063.      0.000
    22.750    -0.0231    239973.    -16775.  -0.000247    52.3908  2.972E+11
514.8954     66873.      0.000
    23.000    -0.0238    191966.    -15196.  -0.000245    41.9099  2.972E+11
537.7744     67683.      0.000
    23.250    -0.0246    148799.    -13548.  -0.000243    32.4857  2.972E+11
560.9189     68493.      0.000
    23.500    -0.0253    110680.    -11830.  -0.000242    24.1636  2.972E+11
584.3546     69303.      0.000
    23.750    -0.0260     77820.    -10041.  -0.000241    16.9897  2.972E+11
608.1047     70113.      0.000
    24.000    -0.0267     50434. -8180.6208  -0.000240    11.0107  2.972E+11
632.1900     70923.      0.000
    24.250    -0.0275     28737. -6247.3930  -0.000240     6.2738  2.972E+11
656.6285     71733.      0.000
    24.500    -0.0282     12949. -4240.2981  -0.000240     2.8271  2.972E+11
681.4348     72543.      0.000
```

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downtown_pole4_36 inch_25ft

```
    24.750    -0.0289  3294.8583 -2158.2160  -0.000240     0.7193  2.972E+11
706.6199     73353.      0.000
    25.000    -0.0296      0.000      0.000  -0.000240      0.000  2.972E+11
732.1907     37082.      0.000
```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      0.3642926 inches
Computed slope at pile head      =     -0.0031844 radians
Maximum bending moment           =       4477653. inch-lbs
Maximum shear force              =        -34655. lbs
Depth of maximum bending moment  =     93.0000000 inches below pile head
Depth of maximum shear force     =    204.0000000 inches below pile head
Number of iterations             =             17
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =          15000. lbs
Moment     =        3510000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
25.0000	0.3642926	4477653.	-34655.
23.7500	0.4033065	4453380.	-37724.
22.5000	0.4718898	4441331.	-41160.
21.2500	0.6009410	4416512.	-44888.
20.0000	0.7907800	4371708.	-48466.
18.7500	1.1916505	4333132.	-52800.
17.5000	1.9558828	4300482.	-57556.
16.2500	3.3252103	4254034.	-61975.
15.0000	6.0115863	4205438.	-66262.
13.7500	23.9406360	4182805.	-73726.

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

```
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians
```

ADDENDUM 2 - JULY 14, 2015

```
                              downtown_pole4_36 inch_25ft
                Pile-head      Pile-head                                          Maximum
        Maximum
Load  Load    Condition 1    Condition 2        Axial        Pile-head       Moment
         Shear         Pile-head
Case  Type    V(lbs) or     in-lb, rad.,       Loading      Deflection       in Pile
        in Pile       Rotation
 No.   No.    y(inches)     or in-lb/rad.        lbs          inches         in-lbs
          lbs           radians
----  ----  --------------  --------------  -------------  -------------
-------------  -------------  -------------
  1     1   V = 10000.0000  M =   2340000.      0.0000000     0.20959436
2933692.        -21473.    -0.00195641
  2     1   V =     15000.  M =   3510000.      0.0000000     0.36429264
4477653.        -34655.    -0.00318442

The analysis ended normally.
```

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Austin, Texas 78729
Phone: 512.419.5863
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MEMORANDUM

DATE: April 25, 2013

TO: David McDonnold, P.E.

FROM: Rebecca Russo, P.E.
Lance Finnefrock, P.E.

COPY: Clint Jumper, P.E.
Chuck Berry, P.E.
Derek Benedict, P.E.

SUBJECT: **Geotechnical Design Memorandum 2.1**
City of El Paso Streetcar Project
OCS Pole Foundation Recommendations
Stanton Street and Oregon Street Bridges over IH-10
El Paso, Texas

Submitted herewith are the findings and recommendations pertaining to the elevated OCS (Overhead Contact System) pole foundation design at the Stanton and Oregon Street bridges over IH-10 for the above referenced project. This geotechnical scope of work was based on OCS pole load information provided by LTK Engineering Services (LTK) and subsurface information provided by PSI.

The purpose of this memorandum is to provide the design team with supplemental recommendations for elevated OCS Poles at the bridges for use by the structural engineers in sizing foundations and reinforcing steel. The following sections present our understanding of the proposed construction, discussion of subsurface conditions, results of LPILE analyses and geotechnical recommendations for foundation design and construction.

Project Information

Elevated OCS poles are planned at the Stanton Street and Oregon Street bridges over IH-10. It is understood that the base of the steel poles will be located at the same elevation as the existing bridge deck surface, and will be connected to a free-standing 36-inch diameter concrete column extending down to the IH-10 roadway surface below, further founded by a drilled shaft. The heights of the concrete columns from the bridge deck to the IH-10 roadway surface are approximately 22 feet for the Stanton Street and Oregon Street bridges. We understand that two poles are planned near the middle of the Stanton Street bridge (Stations 208+26 and 208+27), and one pole is planned near the middle of the Oregon Street bridge (Station 351+19). Preliminary partial plan sheets dated 12/14/12 for the two bridges are attached to the report.

Two pole types, P1 and P2 are shown on the design plans for the bridges. Proposed shear and bending moments for each pole type were provided by LTK and summarized in Table 1 below. It is understood that provided loads are applied at the pole base/concrete column connection at the bridge deck elevation.

Table 1 – OCS Pole Foundation Load Information Applied at Pole Base / Bridge Deck Elevation

Bridge	Pole Type	Applied Shear	Applied Bending Moment	Bolt Circle Plate Diameter
Stanton Street	P2	3 kips	47 kip-ft	16
Oregon Street	P1	3 kips	29 kip-ft	15

Subsurface Conditions

Geotechnical borings were drilled and logs provided by PSI for this streetcar project. Salient to this OCS Pole foundation design at the two bridges, we have included boring logs B-7, B-8 and B-36 for the Stanton Street bridge, and B-23 and B-37 at the Oregon Street bridge for this analysis. Borings B-36 and B-37 were drilled at the IH-10 roadway elevation adjacent to the Stanton Street and Oregon Street bridge overpass. A plan showing the boring locations is presented on Figure 1. A generalized subsurface profile at the Stanton Street bridge is shown on Figure 2, and the Oregon Street bridge on Figure 3.

Detailed descriptions of the subsurface conditions are given on the boring logs which are attached to this report in Appendix A. In general, the borings encountered primarily sand with varying proportions of sand, silt, clay, and gravel.

Subsurface conditions at the Stanton Street bridge generally consist of very loose silty clayey sand in the upper 10 feet becoming slightly compact from 10 to 20 feet, compact (medium dense) clayey sand from 20 to 25 feet, and compact to very dense silty sand to depth of 55 feet bgs (below the ground surface).

Subsurface conditions at the Oregon Street bridge generally consist of compact to very dense silty clayey sand in the upper 15 feet, and very stiff/dense to very hard/very dense sandy lean clay and clayey sand from 15 feet to 55 feet bgs.

Pole Foundation Analysis

The OCS poles will be founded by 36-inch diameter straight sided drilled shafts embedded below the IH-10 roadway elevation. The foundation analyses were performed using the software program LPILE V6.0 by Ensoft, Inc. based on the provided loads (P1 and P2 OCS Poles) and subsurface conditions encountered in the borings. The following tables present the LPILE soil parameters used for this analysis.

Table 2 - LPILE v6.0 Soil Parameters Used for Stanton Street Bridge

Soil Layer	P-Y Soil Type (Code)	γ (pcf)	ϕ (deg)	*k* (pci)
0 – 3 ft	Neglect*	-	-	-
3 – 10 ft	Sand (4)	120	20	25
10 – 30 ft	Sand (4)	120	30	90

γ = Effective Unit Weight
k = Soil-Modulus Parameter (static)
ϕ = internal friction angle
*Lateral resistance neglected; modeled as soft clay with negligible strength.

Table 3 - LPILE v6.0 Soil Parameters Used for Oregon Street Bridge				
Soil Layer	**P-Y Soil Type (Code)**	**γ (pcf)**	**ϕ (deg)**	***k* (pci)**
0 – 3 ft	Neglect*	-	-	-
3 – 30 ft	Sand (4)	120	30	90
γ = Effective Unit Weight *k* = Soil-Modulus Parameter (static) ϕ = internal friction angle *Lateral resistance neglected; modeled as soft clay with negligible strength.				

Pole Foundation Design Recommendations

The following Table 4 presents the results of the LPILE analyses including minimum drilled shaft embedment depths, and internal maximum loading. The recommended embedment depths were selected based on limiting deflection (as measured from the top of the concrete column at the bridge deck elevation) to less than ¾ inch for a LF of 1.0, and less than 1.5 inch for a load factor of 1.5.

Table 4 – OCS Pole Foundation Recommendations at IH-10 Bridge Locations 36-inch Diameter Drilled Shafts (LF=1.0)					
Bridge Location	**Pole Type**	**Embedment Depth bgs (ft)**	**Maximum Deflection* (inches)**	**Maximum Moment (kip-ft)**	**Maximum Shear (kips)**
Stanton Street	P2	21 ft	0.7	129.7	16.1
Oregon Street	P1	20 ft	0.5	109.5	12.1
*As measured at the top of 22-ft tall concrete columns at bridge deck elevation. bgs – Below the ground surface at IH-10 roadway elevation Maximum moment and maximum shear values are based on a LF=1.0.					

The embedment depths reported above are considered minimum penetration depths. The geotechnical engineer should be consulted if shaft lengths less than that recommended above are being contemplated. The structural engineer should use the reported maximum moment and shear loads to size internal steel reinforcing. Computer output are included in Appendix B. Digital LPILE computer files can be submitted, if requested.

The load factor of 1.5 was determined by increasing the provided external shear and moment loads by a factor of 1.5 in the LPILE model. The maximum internal load values shown in Table 4 above are for a load factor of 1.0. Maximum internal load values for LF of 1.5 are included in the computer output (Appendix B), and reported as "Load Case 2".

Pole Foundation Construction Recommendations

Drilled shafts should be designed and constructed in accordance with the following recommendations:

1. Minimum drilled shaft embedment lengths should be as shown in Table 4 for each pole type. Minimum shaft diameters of 36 inches and minimum reinforcement steel area of 0.5 percent of the gross area of the shaft are recommended. The geotechnical engineer should be consulted to provide supplemental recommendations if smaller diameter or shorter shafts are being contemplated.
2. Contract documents should include pay items for constructing drilled shafts on a unit price basis for both shaft quantities in soil and rock. The contractor should be made aware of the potential for encountering cemented gravel layers and/or conglomerate boulders within the medium dense to dense sand strata. The geotechnical engineer should be consulted if hard layers are encountered that cannot be penetrated with a soil auger with rock teeth or rock core barrel.
3. Contract documents should provide for the use of temporary casing for proper installation of drilled shafts should detrimental groundwater or caving soil conditions are encountered. Caving soil conditions, consisting of loose fill and or cohesionless sands and gravels, may require temporary casing to maintain an open excavation for proper reinforcing steel and concrete placement. A unit price for the use of casing should be identified for temporary casing on the bid tabulation form in the contract documents.
4. In order to promote shaft-to-soil bonding, drilled-shaft concrete should be specified as a high slump concrete (7- to 8-inch slump, preferably superplasticized), which still has the proper characteristics of normal concrete such as workability, durability, cohesiveness, and strength.
5. To prevent deterioration of the sides and bottoms of shaft excavations, reinforcement and concrete should be placed the same day drilling operations are

completed. Before placement, shafts should be inspected to assure bottoms and sidewalls are free of deleterious soil spall and free water.

6. Centralizing chutes, tremies, and/or concrete pumps may be necessary to prevent the concrete from striking the sides of reinforcement and thus segregating. The desired maximum free fall of concrete should be about 10 ft, but greater heights are allowable if segregation can be eliminated and if the shaft excavation is dry and sidewalls stable.
7. The drilled shaft operations should be inspected, on a full-time basis, by a qualified geotechnical engineer to a) verify desired penetration into the bearing stratum, b) verify shaft dimensions and proper reinforcement, c) monitor cleanness and amount of water in shaft excavations, d) monitor placement of concrete and use of tremie or pumps, e) monitor the extraction of casing, if used, and f) maintain accurate records.
8. As the design of any foundation relies heavily on generalizations drawn from subsurface conditions determined at a limited number of boring locations, verification of these generalizations at any given location should not be dictated by criteria based on depth or drilling resistance. The sides and bottoms of shafts should be examined by the geotechnical engineer of record to assure that appropriate subsurface conditions and shaft bottoms bear in the desired stratum.
9. In addition to construction recommendations contained herein, the shafts should be constructed in general accordance with ACI 336.3R, Chapters 4 and 5.

Construction Monitoring

It is recommend that a qualified geotechnical engineer be present on-site during construction to observe, monitor construction activities and perform quality control tests. Construction monitoring performed by qualified personnel independent of the Contractor is recommended because the performance of foundations and other structures constructed during this project will be directly related to the Contractor's adherence to the recommendations presented in this report and to the specifications prepared by the Designer. Additionally, unanticipated soil and/or subsurface conditions may be encountered during construction that must be mitigated. Qualified geotechnical personnel observing construction on-site can monitor construction activities and may aid in recognizing unanticipated subsurface conditions and assist in confirming these conditions with design recommendations.

Conditions

Since some variation was found in subsurface conditions at the boring locations, all parties involved should take notice that subsurface conditions may vary significantly between boring locations. Statements in the report as to subsurface variation over given areas are intended only as estimations from the data obtained at specific boring locations.

The professional services that form the basis for this report have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in the same locality. No other warranty, express or implied, is made as the professional advice set forth. This scope of work did not include and investigation, detection, or design related to the presence of any recognized environmental pollutants.

* * *

The following attachments complete this report:

Plan of Borings	Figure 1
Generalized Subsurface Profile – Stanton Street Bridge	Figure 2
Generalized Subsurface Profile – Oregon Street Bridge	Figure 3
Partial Plan Sheets (Sheet Nos. 971 and 1007, dated 12/14/12)	

Appendix A	Boring Logs (B-7, B-8, B-36, B-23 and B-37)
Appendix B	LPILE Computer Output

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FIGURES

ADDENDUM 2 - JULY 14, 2015

N

0 75 150 Feet

1 in = 150 feet

Legend

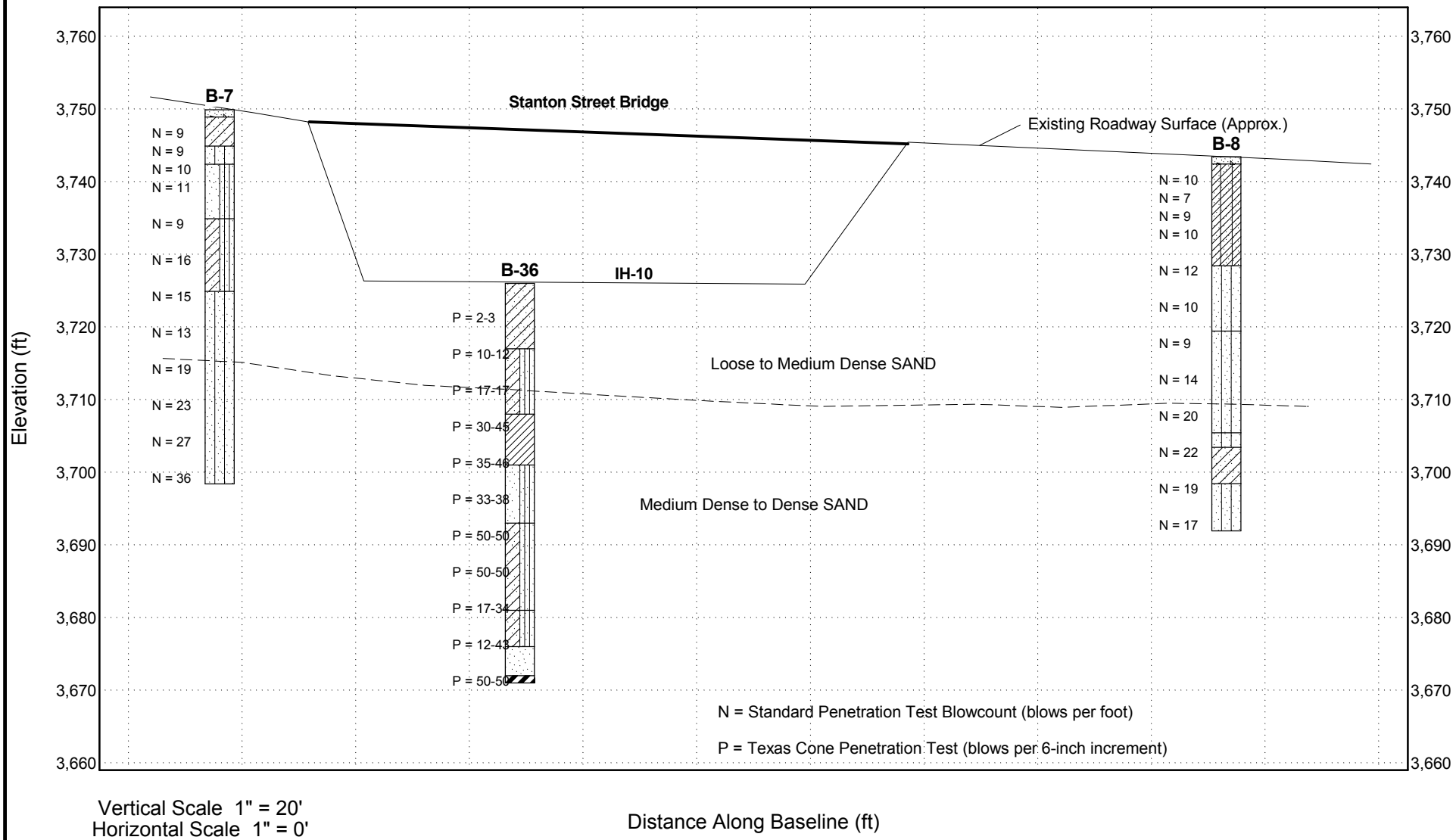
Primary Route

Boring drilled by PSI for this curent study

Figure 1
Plan of Borings
Stanton Street Bridge
and
Oregon Street Bridge

El Paso Streetcar Project

ADDENDUM 2 - JULY 14, 2015



Vertical Scale 1" = 20'
Horizontal Scale 1" = 0'

Distance Along Baseline (ft)

URS

City of El Paso Streetcar Project

Stanton Street Bridge

GENERALIZED SUBSURFACE PROFILE

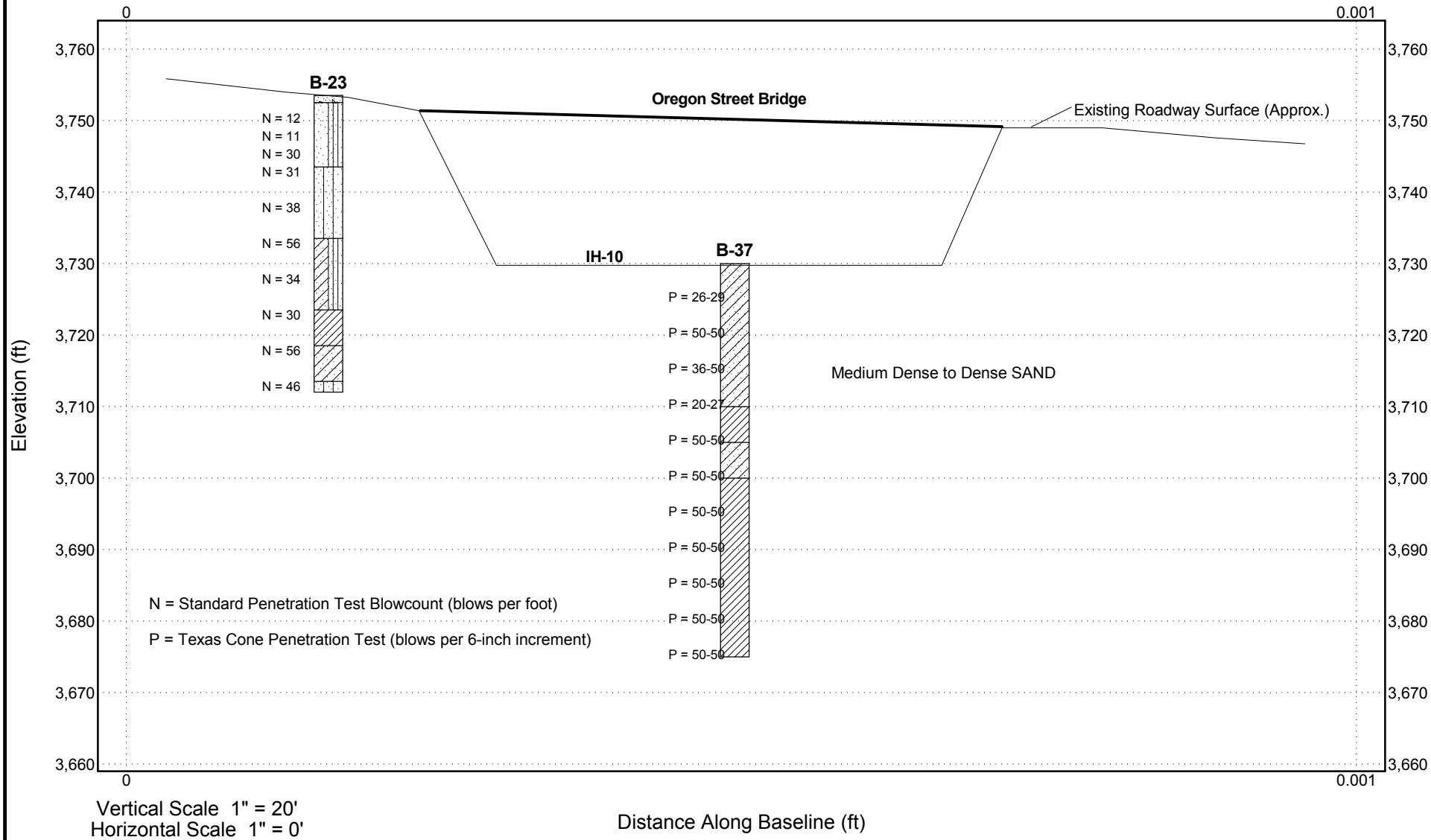
El Paso, Texas

Project No.
41010530.092

Figure 2

SIMPLE FENCE (URS) PSI.GPJ FUGRO DALLAS DATA TEMPLATE.GDT 03/06/13 13:40

ADDENDUM 2 - JULY 14, 2015



URS

City of El Paso Streetcar

Oregon Street Bridge

GENERALIZED SUBSURFACE PROFILE

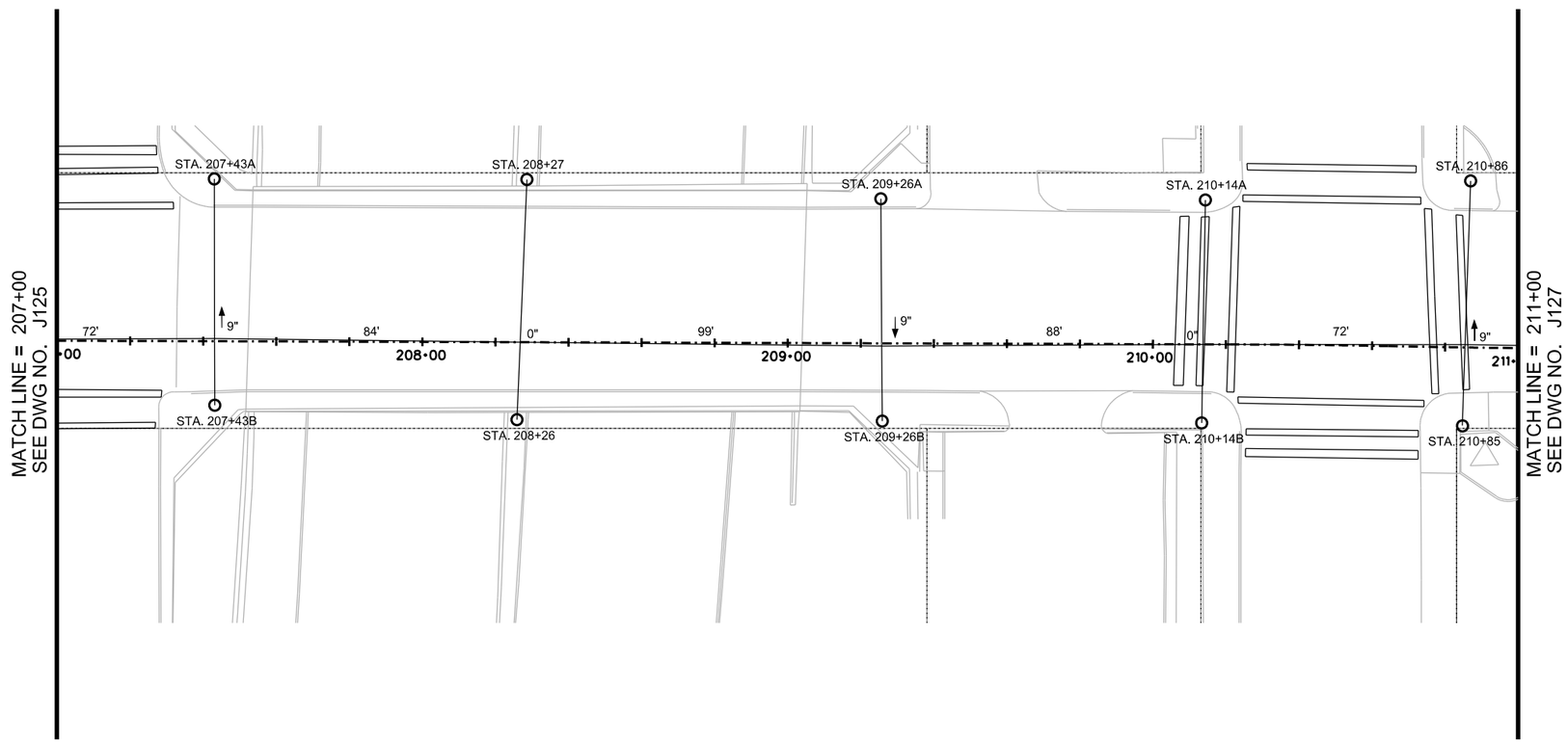
El Paso, Texas

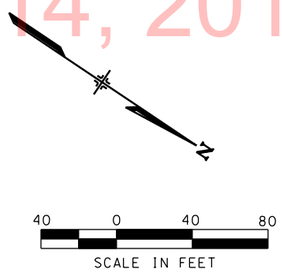
Project No. **41010530.092**

Figure 3

SIMPLE FENCE (URS) PSI.GPJ FUGRO DALLAS DATA TEMPLATE.GDT 03/06/13 14:43

ADDENDUM 2 - JULY 14, 2015





NOTE:
1. FOR POLE USE AND POLE TYPE DETAILS REFER TO POLE ASSEMBLY REFERENCE DRAWING.

STATION	POLE USE	POLE TYPE	POLE OFFSET	REFERENCE TRACK	FOUNDATION TYPE	WIRE RUN NUMBER	CW HT. (FT.-IN.)	TERMINATION HT. (FT.-IN.)	SPAN (FT.)	STAGGER (IN.)	SUPPORT TYPE	IN-SPAN ASSEMBLY	POLE BRACKET	MISC. ASSEMBLY	REMARKS
207+43A	O	P2-28-O													
207+43B	O	P2-26-O													
208+26	O	P2-26-O													
208+27	O	P2-28-O													
209+26A	O	P2-28-O													
209+26B	O	P2-26-O													
210+14A	O	P2-28-O													
210+14B	O	P2-26-O													
210+85	O	P2-26-O													
210+86	O	P2-28-O													

NO	DATE	REVISION	APPROVED
	/ /		
	/ /		
	/ /		
	/ /		

PRE-FINAL
FOR REVIEW ONLY
Not for construction, bidding, or permit purposes.
LTK Engineering Services
TBPE REG. # F-1389
Engineer Lamont C. Smith
P.E. No. 112273 Date 12/14/12

LTK Engineering Services
TBPE REGISTRATION NO. F-1389

URS
2829 Montana Suite 206
El Paso, Texas 79903
(915) 493-6468
TBPE REGISTRATION NO. F-3162

COEP STREETCAR

OVERHEAD CONTACT SYSTEM
OCS WIRING LAYOUT PLAN
STA. 207+00 TO STA. 211+00

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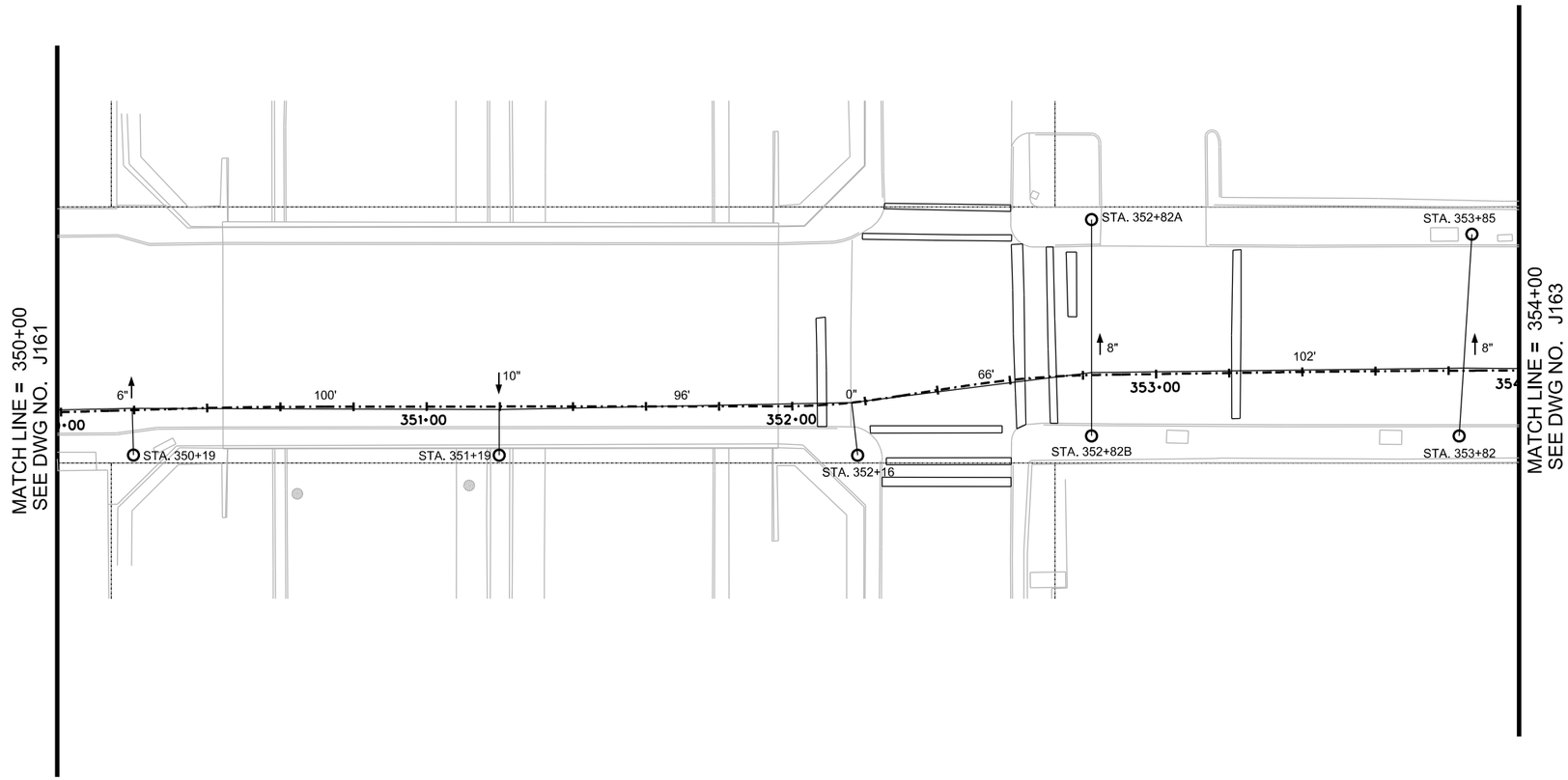
J126

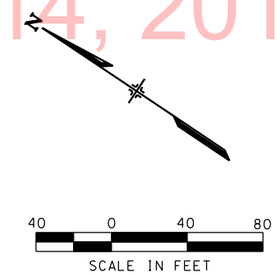
CONT	SECT	JOB	HIGHWAY
0924	06	446	VARIOUS
DIST		COUNTY	SHEET NO.
EL PASO		EL PASO	971

DATE: 12/12/2012 3:50:07 PM
FILE: W:\Projects\El Paso Streetcar\CADD\OCS\SHEETS\J126.dgn

DN: URS CK: URS DW: URS CK: URS

ADDENDUM 2 - JULY 14, 2015





NOTE:
1. FOR POLE USE AND POLE TYPE DETAILS REFER TO POLE ASSEMBLY REFERENCE DRAWING.

STATION	POLE USE	POLE TYPE	POLE OFFSET	REFERENCE TRACK	FOUNDATION TYPE	WIRE RUN NUMBER	CW HT. (FT.-IN.)	TERMINATION HT. (FT.-IN.)	SPAN (FT.)	STAGGER (IN.)	SUPPORT TYPE	IN-SPAN ASSEMBLY	POLE BRACKET	MISC. ASSEMBLY	REMARKS
350+19	L,O	P1-26-LO													
351+19	L,O	P1-26-LO													
352+16	L,O	P1-26-LO													
352+82A	L,O	P3-28-LO													
352+82B	L,O	P2-26-LO													
353+82	L,O	P2-26-LO													
353+85	L,O	P2-28-LO													

NO	DATE	REVISION	APPROVED
	/ /		
	/ /		
	/ /		
	/ /		

PRE-FINAL
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LTK
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TBPE REG. # F-1389
Engineer Lamont C. Smith
P.E. No. 112273 Date 12/14/12

LTK
LTK Engineering Services
TBPE REGISTRATION NO. F-1389

URS
2829 Montana Suite 206
El Paso, Texas 79903
(915) 493-6468
TBPE REGISTRATION NO. F-3162

COEP STREETCAR

OVERHEAD CONTACT SYSTEM
OCS WIRING LAYOUT PLAN
STA. 350+00 TO STA. 354+00

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J162

CONT	SECT	JOB	HIGHWAY
0924	06	446	VARIOUS
DIST		COUNTY	SHEET NO.
EL PASO		EL PASO	1007

DATE: 12/12/2012 4:37:31 PM
FILE: W:\Projects\El Paso Streetcar\CADD\OCS\SHEETS\J162.dgn

DN: URS CK: URS DW: URS CK: URS

ADDENDUM 2 - JULY 14, 2015

APPENDIX A

Boring Logs

FIGURE: 7

ADDENDUM 2 - JULY 14, 2015

BORING B7

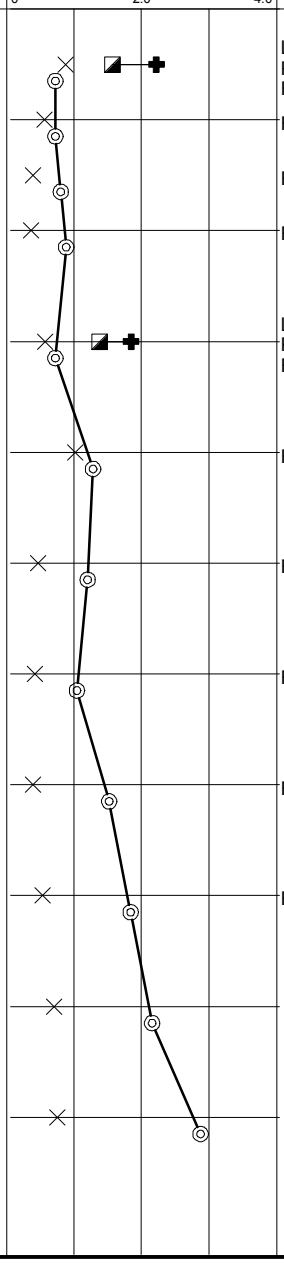
DATE STARTED:	11/9/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/9/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	51.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3749.89 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76353°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.4899°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**ASPHALT** - 3.25 inches thick				
				PAVEMENT BASE - 8 inches thick				
		SS1	10	**CLAYEY SAND** - brown, loose, moist	SC	15-6-3 N=9	11	LL = 28 PL = 20 Fines=39.3%
3745	5	SS2	14	**SILTY SAND** - brown, loose, moist	SM	3-5-4 N=9	7	Fines=18.3%
		SS3	16	**SAND** - Poorly Graded with Silt, brown, loose, moist	SP-SM	6-5-5 N=10	5	Fines=8.6%
3740	10	SS4	17	medium dense, moist		6-6-5 N=11	5	Fines=9.6%
3735	15	SS5	17	**SILTY CLAYEY SAND** - brown, loose, moist	SC-SM	6-5-4 N=9	7	LL = 23 PL = 17 Fines=35.0%
3730	20	SS6	15	medium dense, moist, with clay lenses		3-7-9 N=16	13	Fines=%
3725	25	SS7	18	**SILTY SAND** - brown, medium dense, moist	SM	4-7-8 N=15	6	Fines=21.3%
3720	30	SS8	18			7-6-7 N=13	5	Fines=22.9%
3715	35	SS9	18			7-11-8 N=19	5	Fines=19.2%
3710	40	SS10	18			8-12-11 N=23	7	Fines=20.8%
3705	45	SS11	18			13-13-14 N=27	9	
3700	50	SS12	18	brown, dense, moist		8-12-24 N=36	9	
				Boring terminated at 51.5 feet below grade				



Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 8

ADDENDUM 2 - JULY 14, 2015

BORING B8

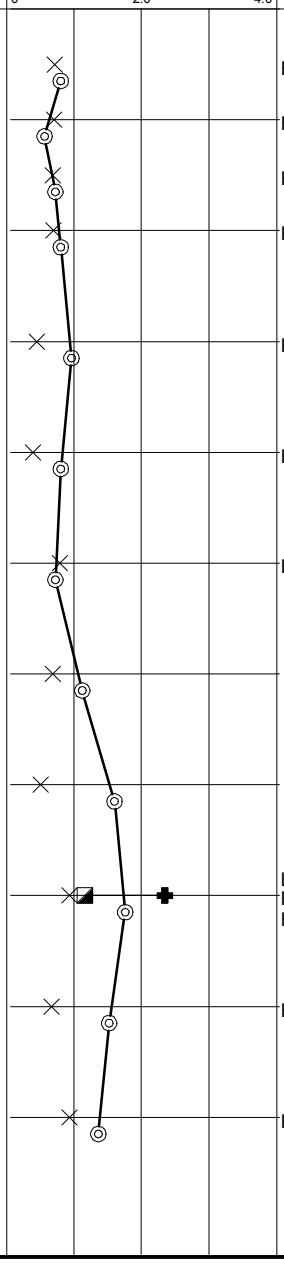
DATE STARTED:	11/9/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/9/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	51.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3743.44 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76286°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48932°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**ASPHALT** - 9.5 inches thick				
				PAVEMENT BASE - 4.5 inches thick				
3740		SS1	10	**SILTY CLAYEY SAND** - brown, loose, moist	SC-SM	9-7-3 N=10	9	Fines=26.3%
	5	SS2	12			3-3-4 N=7	9	Fines=27.7%
3735		SS3	17			3-4-5 N=9	9	Fines=27.2%
	10	SS4	15			3-4-6 N=10	9	Fines=25.7%
3730								
	15	SS5	16	**SILTY SAND** - brown, medium dense, moist	SM	5-6-6 N=12	6	Fines=20.7%
3725								
	20	SS6	18	loose, moist		5-4-6 N=10	5	Fines=15.2%
3720								
	25	SS7	17	loose, moist, with clay lenses		4-4-5 N=9	10	Fines=36.6%
3715								
	30	SS8	18	medium dense, moist		6-5-9 N=14	9	
3710								
	35	SS9	18			7-10-10 N=20	6	
3705								
	40	SS10	18	**CLAYEY SAND** - brown, medium dense, moist	SC	11-10-12 N=22	12	LL = 29 PL = 15 Fines=34.4%
3700								
	45	SS11	18	**SILTY SAND** - brown, medium dense, moist	SM	5-9-10 N=19	8	Fines=18.3%
3695								
	50	SS12	18			9-10-7 N=17	12	Fines=22.2%
				Boring terminated at 51.5 feet below grade				



Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 36

ADDENDUM 2 - JULY 14, 2015

BORING B36

DATE STARTED:	1/23/13	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	1/23/13	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	55.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3751 ft	**SAMPLING METHOD:**	TC
LATITUDE:	31.763198°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.489828°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:
I-10 West below
overpass of N. Stanton Street

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Texas Cone (TC)	Moisture, %	Additional Remarks
3750	0			**CONCRETE** - 13 inches thick				
				ASPHALT - 2 inches thick				
				SILTY CLAYEY SAND - moist, brown				
3745	5	TC1	16	very loose		2-3	14	LL = 24 PL = 18 Fines=32.5%
3740	10	TC2	18	slightly compact	CL-ML	10-12	12	
3735	15	TC3	16			17-17	8	LL = 20 PL = 14 Fines=28.8%
3730	20	TC4	12	**CLAYEY SAND** - compact, dry, brown	SC	30-46	7	LL = 30 PL = 15 Fines=27.7%
3725	25	TC5	14	**SILTY SAND** - dense, dry, brown		35-46	7	Fines=16.0%
3720	30	TC6	16	compact		33-38	7	
3715	35	TC7	12	very dense, moist		50-50(3")	9	Fines=23.8%
3710	40	TC8	14		SM	50(5.5")-50(4")	8	Fines=30.3%
3705	45	TC9	14	compact		17-34	19	Fines=29.3%
3700	50	TC10	14			12-43	12	
	55	TC11		**LEAN CLAY** - very hard, moist, brown Boring terminated 55.5 feet below grade	CL	50(3")-50(0.5")	24	LL = 29 PL = 16 Fines=65.1%

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 23

ADDENDUM 2 - JULY 14, 2015

BORING B23

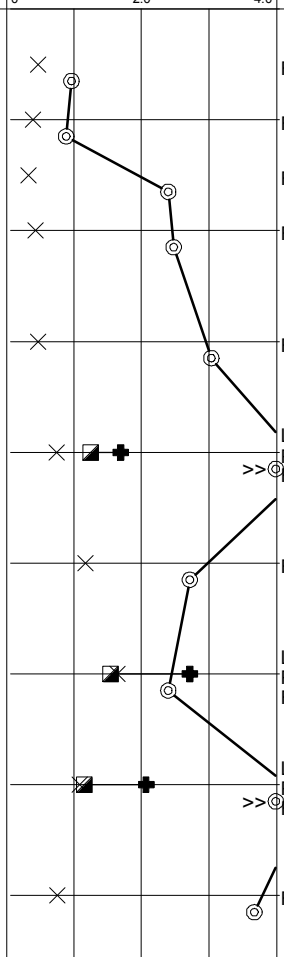
DATE STARTED:	11/12/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/12/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	41.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3753.53 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76243°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49157°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**CONCRETE** - 9 inches thick				
3750		SS1	16	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	6-6-6 N=12	6	Fines=10.4%
	5	SS2	17			3-6-5 N=11	5	Fines=7.7%
3745		SS3	18	**SAND** - Poorly Graded with Silt and Gravel, brown, medium dense, moist	SP-SM	9-17-13 N=30	4	Fines=10.4%
	10	SS4	17	**SILTY SAND** - brown, dense, moist		13-14-17 N=31	5	Fines=12.4%
3740								
	15	SS5	18	dense, moist	SM	8-16-22 N=38	6	Fines=12.8%
3735								
	20	SS6	18	**SILTY CLAYEY SAND** - brown, very dense, moist, with clay lenses		12-24-32 N=56	9	LL = 21 PL = 16 >> Fines=29.8%
3730								
	25	SS7	18	dense, moist	SC-SM	14-16-18 N=34	15	Fines=20.3%
3725								
	30	SS8	18	**SANDY LEAN CLAY** - brown, very stiff, moist	CL	8-12-18 N=30	21	LL = 34 PL = 19 Fines=64.0%
3720								
	35	SS9	18	**CLAYEY SAND** - brown, very dense, moist, with calcareous material	SC	3-16-40 N=56	14	LL = 26 PL = 14 >> Fines=40.6%
3715								
	40	SS10	18	**SILTY SAND** - brown, dense, moist	SM	9-20-26 N=46	9	Fines=33.7%
				Boring terminated at 41.5 feet below grade				



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El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 37

ADDENDUM 2 - JULY 14, 2015

BORING B37

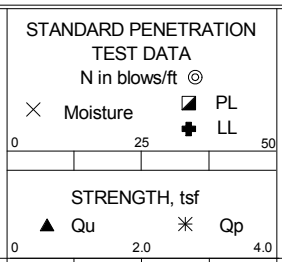
DATE STARTED:	1/22/13	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	1/22/13	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	55.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3759 ft	**SAMPLING METHOD:**	TC
LATITUDE:	31.762105°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.491531°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:
I-10 West below
overpass of N. Oregon Street

Elevation (feet)	Depth, (feet)	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Texas Cone (TC)	Moisture, %	Additional Remarks
	0				**CONCRETE** - 13 inches thick				
					ASPHALT - 2 inches thick				
					SILTY CLAYEY SAND - moist, brown				
3755	5		TC1		compact	CL-ML	26-29	16	LL = 24, PL = 17, Fines=26.5%
3750	10		TC2		very dense		50(4")-50(3")	7	Fines=28.3%
3745	15		TC3		**CLAYEY SAND** - dense, moist, brown	SC	36-50(3.5")	10	LL = 26, PL = 15, Fines=47.9%
3740	20		TC4		**LEAN CLAY** - with Sand, very stiff, moist, brown	CL	20-27	18	LL = 47, PL = 19, Fines=82.2%
3735	25		TC5		**CLAYEY SAND** - very dense, moist, brown	SC	50(4") -50(2.5")	12	Fines=45.6%
3730	30		TC6		**SANDY LEAN CLAY** - very hard, moist, brown		50(1")-50(.5")	8	
3725	35		TC7				50(2")-50(1")	11	LL = 29, PL = 15, Fines=57.5%
3720	40		TC8			CL	50(2")-50(1.5")	11	
3715	45		TC9				50(1.5")-50(1")	14	LL = 43, PL = 19, Fines=66.2%
3710	50		TC10				50(2")-50(1.5")	23	
3705	55		TC11		**SILTY CLAYEY SAND** - very dense, moist, brown	CL-ML	50(1.5")-50(1")	10	LL = 22, PL = 16, Fines=22.4%
					Boring terminated 55.5 feet below grade				



Professional Service Industries, Inc.
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Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

ADDENDUM 2 - JULY 14, 2015

APPENDIX B

LPILE OUTPUT

ADDENDUM 2 - JULY 14, 2015

Summary of LPILE Loading Cases

Bridge	Pole Type	Load Factor (LF)	Applied Shear	Applied Bending Moment	Axial Load
Stanton Street	P2	1.0 1.5	3.0 kips 4.5 kips	47.0 kip-ft (564,000 lb-inch) 70.5 kip-ft (846,000 lb-inch)	0.0 kips 0.0 kips
Oregon Street	P1	1.0 1.5	3.0 kips 4.5 kips	29.0 kip-ft (348,000 lb-inch) 43.5 kip-ft (522,000 lb-inch)	0.0 kips 0.0 kips

ADDENDUM 2 - JULY 14, 2015

==========

LPile Plus for Windows, Version 2012-06.035

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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==========

This copy of LPile is licensed to:

URS Corporation
Austin, TX

Serial Number of Security Device: 500126253
Company Name Stored in Security Device: URS Corporation

Files Used for Analysis

Path to file locations: L:\AGE\Projects\INFR\AUS Geotech\Projects\41010530.092 City of El Paso\OCS Design\2.1 Memo - OCS Bridges\LPILE for Bridges_rev20130423\Final\
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Name of output report file: oregon_elevated pole1_36 inch_RAR.lp6o
Name of plot output file: oregon_elevated pole1_36 inch_RAR.lp6p
Name of runtime messeage file: oregon_elevated pole1_36 inch_RAR.lp6r

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Date and Time of Analysis

Date: April 23, 2013 Time: 10:23:32

Problem Title

Project Name: El Paso Streetcar

Job Number: 41010530

Client: City of El Paso

Engineer: RAR

Description: OCS Pole Foundations - Oregon St. Bridge

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                                Program Options
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Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear
moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:
- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:
- Number of pile increments                              =          100
- Maximum number of iterations allowed                   =          500
- Deflection tolerance for convergence                   =   1.0000E-05  in
- Maximum allowable deflection                           =     100.0000  in

Pile Response Output Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points)  = 1


--------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
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Total number of pile sections                            =          1

Total length of pile                                     =      42.00 ft

Depth of ground surface below top of pile                =      22.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile.

Point         Depth              Pile
                X              Diameter
                ft                in
-----       ---------        -----------
  1           0.00000         36.0000000
  2          42.000000        36.0000000
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Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Circular
Section Length	=	42.00000000 ft
Top Width	=	36.00000000 in
Bottom Width	=	36.00000000 in
Top Area	=	1017.87601976 Sq. in
Bottom Area	=	1017.87601976 Sq. in
Moment of Inertia at Top	=	82448. in^4
Moment of Inertia at Bottom	=	82448. in^4
Elastic Modulus	=	3604997. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	22.00000 ft
Distance from top of pile to bottom of layer	=	25.00000 ft
Effective unit weight at top of layer	=	120.00000 pcf
Effective unit weight at bottom of layer	=	120.00000 pcf
Undrained cohesion at top of layer	=	0.0010000 psf
Undrained cohesion at bottom of layer	=	0.0010000 psf
Epsilon-50 at top of layer	=	0.02000
Epsilon-50 at bottom of layer	=	0.02000

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	25.00000 ft
Distance from top of pile to bottom of layer	=	60.00000 ft
Effective unit weight at top of layer	=	120.00000 pcf
Effective unit weight at bottom of layer	=	120.00000 pcf
Friction angle at top of layer	=	30.00000 deg.
Friction angle at bottom of layer	=	30.00000 deg.
Subgrade k at top of layer	=	90.00000 pci
Subgrade k at bottom of layer	=	90.00000 pci

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(Depth of lowest soil layer extends 18.00 ft below pile tip)

Summary of Soil Properties

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	Strain Factor Epsilon 50	kpy pci
1	Soft Clay	22.000	120.000	1.00E-03	--	0.02000	--
		25.000	120.000	1.00E-03	--	0.02000	--
2	Sand (Reese, et al.)	25.000	120.000	--	30.000	--	90.000
		60.000	120.000	--	30.000	--	90.000

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	1	V = 3000.00000 lbs	M = 348000. in-lbs	0.0000000	Yes
2	1	V = 4500.00000 lbs	M = 522000. in-lbs	0.0000000	Yes

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

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Moment-curvature properties were derived from elastic section properties

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Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 3000.000 lbs
Applied moment at pile head = 348000.000 in-lbs
Axial thrust load on pile head = 0.000 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.4660	348000.	3000.0000	-0.001635	75.9752	2.972E+11	0.000	0.000	0.000
0.420	0.4578	363120.	3000.0000	-0.001629	79.2762	2.972E+11	0.000	0.000	0.000
0.840	0.4496	378240.	3000.0000	-0.001622	82.5772	2.972E+11	0.000	0.000	0.000
1.260	0.4415	393360.	3000.0000	-0.001616	85.8782	2.972E+11	0.000	0.000	0.000
1.680	0.4333	408480.	3000.0000	-0.001609	89.1792	2.972E+11	0.000	0.000	0.000
2.100	0.4252	423600.	3000.0000	-0.001602	92.4802	2.972E+11	0.000	0.000	0.000
2.520	0.4172	438720.	3000.0000	-0.001595	95.7811	2.972E+11	0.000	0.000	0.000
2.940	0.4092	453840.	3000.0000	-0.001587	99.0821	2.972E+11	0.000	0.000	0.000
3.360	0.4012	468960.	3000.0000	-0.001579	102.3831	2.972E+11	0.000	0.000	0.000
3.780	0.3932	484080.	3000.0000	-0.001571	105.6841	2.972E+11	0.000	0.000	0.000
4.200	0.3853	499200.	3000.0000	-0.001563	108.9851	2.972E+11	0.000	0.000	0.000
4.620	0.3775	514320.	3000.0000	-0.001554	112.2861	2.972E+11	0.000	0.000	0.000
5.040	0.3697	529440.	3000.0000	-0.001545	115.5871	2.972E+11	0.000	0.000	0.000
5.460	0.3619	544560.	3000.0000	-0.001536	118.8881	2.972E+11	0.000	0.000	0.000
5.880	0.3542	559680.	3000.0000	-0.001527	122.1891	2.972E+11	0.000	0.000	0.000
6.300	0.3465	574800.	3000.0000	-0.001517	125.4901	2.972E+11	0.000	0.000	0.000
6.720	0.3389	589920.	3000.0000	-0.001507	128.7911	2.972E+11	0.000	0.000	0.000
7.140	0.3313	605040.	3000.0000	-0.001497	132.0921	2.972E+11	0.000	0.000	0.000
7.560	0.3238	620160.	3000.0000	-0.001487	135.3930	2.972E+11	0.000	0.000	0.000
7.980	0.3163	635280.	3000.0000	-0.001476	138.6940	2.972E+11	0.000	0.000	0.000
8.400	0.3089	650400.	3000.0000	-0.001465	141.9950	2.972E+11	0.000	0.000	0.000
8.820	0.3016	665520.	3000.0000	-0.001454	145.2960	2.972E+11	0.000	0.000	0.000
9.240	0.2943	680640.	3000.0000	-0.001443	148.5970	2.972E+11	0.000	0.000	0.000
9.660	0.2870	695760.	3000.0000	-0.001431	151.8980	2.972E+11	0.000	0.000	0.000
10.080	0.2798	710880.	3000.0000	-0.001419	155.1990	2.972E+11	0.000	0.000	0.000
10.500	0.2727	726000.	3000.0000	-0.001407	158.5000	2.972E+11	0.000	0.000	0.000
10.920	0.2657	741120.	3000.0000	-0.001395	161.8010	2.972E+11	0.000	0.000	0.000
11.340	0.2587	756240.	3000.0000	-0.001382	165.1020	2.972E+11	0.000	0.000	0.000
11.760	0.2517	771360.	3000.0000	-0.001369	168.4030	2.972E+11	0.000	0.000	0.000
12.180	0.2449	786480.	3000.0000	-0.001356	171.7040	2.972E+11	0.000	0.000	0.000
12.600	0.2381	801600.	3000.0000	-0.001342	175.0049	2.972E+11	0.000	0.000	0.000
13.020	0.2313	816720.	3000.0000	-0.001329	178.3059	2.972E+11	0.000	0.000	0.000
13.440	0.2247	831840.	3000.0000	-0.001315	181.6069	2.972E+11	0.000	0.000	0.000
13.860	0.2181	846960.	3000.0000	-0.001300	184.9079	2.972E+11	0.000	0.000	0.000
14.280	0.2116	862080.	3000.0000	-0.001286	188.2089	2.972E+11	0.000	0.000	0.000
14.700	0.2051	877200.	3000.0000	-0.001271	191.5099	2.972E+11	0.000	0.000	0.000
15.120	0.1987	892320.	3000.0000	-0.001256	194.8109	2.972E+11	0.000	0.000	0.000

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15.540	0.1925	907440.	3000.0000	-0.001241	198.1119	2.972E+11	0.000	0.000	0.000
15.960	0.1862	922560.	3000.0000	-0.001225	201.4129	2.972E+11	0.000	0.000	0.000
16.380	0.1801	937680.	3000.0000	-0.001210	204.7139	2.972E+11	0.000	0.000	0.000
16.800	0.1740	952800.	3000.0000	-0.001194	208.0149	2.972E+11	0.000	0.000	0.000
17.220	0.1681	967920.	3000.0000	-0.001177	211.3158	2.972E+11	0.000	0.000	0.000
17.640	0.1622	983040.	3000.0000	-0.001161	214.6168	2.972E+11	0.000	0.000	0.000
18.060	0.1564	998160.	3000.0000	-0.001144	217.9178	2.972E+11	0.000	0.000	0.000
18.480	0.1506	1013280.	3000.0000	-0.001127	221.2188	2.972E+11	0.000	0.000	0.000
18.900	0.1450	1028400.	3000.0000	-0.001110	224.5198	2.972E+11	0.000	0.000	0.000
19.320	0.1395	1043520.	3000.0000	-0.001092	227.8208	2.972E+11	0.000	0.000	0.000
19.740	0.1340	1058640.	3000.0000	-0.001074	231.1218	2.972E+11	0.000	0.000	0.000
20.160	0.1286	1073760.	3000.0000	-0.001056	234.4228	2.972E+11	0.000	0.000	0.000
20.580	0.1234	1088880.	3000.0000	-0.001038	237.7238	2.972E+11	0.000	0.000	0.000
21.000	0.1182	1104000.	3000.0000	-0.001019	241.0248	2.972E+11	0.000	0.000	0.000
21.420	0.1131	1119120.	3000.0000	-0.001000	244.3258	2.972E+11	0.000	0.000	0.000
21.840	0.1081	1134240.	3000.0000	-0.000981	247.6268	2.972E+11	0.000	0.000	0.000
22.260	0.1032	1149360.	2999.9989	-0.000962	250.9277	2.972E+11	-0.000434	0.0212	0.000
22.680	0.0984	1164480.	2999.9967	-0.000942	254.2287	2.972E+11	-0.000427	0.0219	0.000
23.100	0.0937	1179600.	2999.9946	-0.000922	257.5297	2.972E+11	-0.000420	0.0226	0.000
23.520	0.0891	1194720.	2999.9925	-0.000902	260.8307	2.972E+11	-0.000413	0.0234	0.000
23.940	0.0846	1209840.	2999.9904	-0.000882	264.1317	2.972E+11	-0.000406	0.0242	0.000
24.360	0.0802	1224960.	2999.9884	-0.000861	267.4327	2.972E+11	-0.000399	0.0251	0.000
24.780	0.0759	1240080.	2999.9864	-0.000840	270.7336	2.972E+11	-0.000392	0.0260	0.000
25.200	0.0717	1255200.	2960.8003	-0.000819	274.0346	2.972E+11	-15.5497	1092.4775	0.000
25.620	0.0677	1269925.	2807.3141	-0.000798	277.2494	2.972E+11	-45.3575	3378.6215	0.000
26.040	0.0637	1283497.	2512.6048	-0.000776	280.2126	2.972E+11	-71.5906	5664.7655	0.000
26.460	0.0598	1295252.	2094.3126	-0.000754	282.7788	2.972E+11	-94.3984	7950.9095	0.000
26.880	0.0561	1304608.	1569.3197	-0.000732	284.8214	2.972E+11	-113.9321	10237.	0.000
27.300	0.0525	1311070.	953.7424	-0.000710	286.2323	2.972E+11	-130.3445	12523.	0.000
27.720	0.0489	1314222.	262.9262	-0.000688	286.9203	2.972E+11	-143.7889	14809.	0.000
28.140	0.0455	1313721.	-488.5568	-0.000665	286.8109	2.972E+11	-154.4186	17095.	0.000
28.560	0.0422	1309297.	-1286.9056	-0.000643	285.8452	2.972E+11	-162.3864	19382.	0.000
28.980	0.0390	1300749.	-2119.0846	-0.000621	283.9789	2.972E+11	-167.8434	21668.	0.000
29.400	0.0360	1287937.	-2972.8145	-0.000599	281.1818	2.972E+11	-170.9383	23954.	0.000
29.820	0.0330	1270783.	-3836.5575	-0.000577	277.4367	2.972E+11	-171.8168	26240.	0.000
30.240	0.0301	1249264.	-4699.4994	-0.000556	272.7388	2.972E+11	-170.6204	28526.	0.000
30.660	0.0274	1223412.	-5551.5265	-0.000535	267.0947	2.972E+11	-167.4856	30812.	0.000
31.080	0.0248	1193305.	-6383.1988	-0.000515	260.5218	2.972E+11	-162.5431	33098.	0.000
31.500	0.0222	1159069.	-7185.7188	-0.000495	253.0474	2.972E+11	-155.9172	35385.	0.000
31.920	0.0198	1120873.	-7950.8969	-0.000475	244.7084	2.972E+11	-147.7249	37671.	0.000
32.340	0.0174	1078924.	-8671.1123	-0.000457	235.5502	2.972E+11	-138.0749	39957.	0.000
32.760	0.0152	1033468.	-9339.2715	-0.000439	225.6263	2.972E+11	-127.0676	42243.	0.000
33.180	0.0130	984784.	-9948.7635	-0.000422	214.9976	2.972E+11	-114.7943	44529.	0.000
33.600	0.0109	933185.	-10493.	-0.000405	203.7324	2.972E+11	-101.3363	46815.	0.000
34.020	0.008906	879011.	-10967.	-0.000390	191.9052	2.972E+11	-86.7654	49102.	0.000
34.440	0.006978	822633.	-11365.	-0.000376	179.5968	2.972E+11	-71.1427	51388.	0.000
34.860	0.005119	764448.	-11682.	-0.000362	166.8939	2.972E+11	-54.5192	53674.	0.000
35.280	0.003327	704878.	-11912.	-0.000350	153.8886	2.972E+11	-36.9355	55960.	0.000
35.700	0.001594	644370.	-12052.	-0.000338	140.6786	2.972E+11	-18.4215	58246.	0.000
36.120	-8.351E-05	583394.	-12096.	-0.000328	127.3663	2.972E+11	1.0030	60532.	0.000
36.540	-0.001711	522443.	-12040.	-0.000319	114.0596	2.972E+11	21.3278	62818.	0.000
36.960	-0.003294	462035.	-11879.	-0.000310	100.8712	2.972E+11	42.5524	65105.	0.000
37.380	-0.004838	402707.	-11608.	-0.000303	87.9188	2.972E+11	64.6852	67391.	0.000
37.800	-0.006347	345022.	-11224.	-0.000296	75.3251	2.972E+11	87.7424	69677.	0.000
38.220	-0.007826	289566.	-10722.	-0.000291	63.2179	2.972E+11	111.7477	71963.	0.000
38.640	-0.009281	236949.	-10095.	-0.000287	51.7305	2.972E+11	136.7307	74249.	0.000
39.060	-0.0107	187804.	-9340.7658	-0.000283	41.0014	2.972E+11	162.7260	76535.	0.000
39.480	-0.0121	142794.	-8452.4712	-0.000280	31.1747	2.972E+11	189.7718	78821.	0.000

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39.900	-0.0135	102604.	-7425.1175	-0.000278	22.4004	2.972E+11	217.9082	81108.	0.000
40.320	-0.0149	67949.	-6253.1073	-0.000277	14.8345	2.972E+11	247.1753	83394.	0.000
40.740	-0.0163	39572.	-4930.6446	-0.000276	8.6394	2.972E+11	277.6115	85680.	0.000
41.160	-0.0177	18248.	-3451.7501	-0.000275	3.9838	2.972E+11	309.2514	87966.	0.000
41.580	-0.0191	4778.6125	-1810.2870	-0.000275	1.0433	2.972E+11	342.1229	90252.	0.000
42.000	-0.0205	0.000	0.000	-0.000275	0.000	2.972E+11	376.2450	46269.	0.000

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =      0.4660369 inches
Computed slope at pile head      =     -0.0016347 radians
Maximum bending moment           =       1314222. inch-lbs
Maximum shear force              =        -12096. lbs
Depth of maximum bending moment  =    332.6400000 inches below pile head
Depth of maximum shear force     =    433.4400000 inches below pile head
Number of iterations             =              6
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =           3000. lbs
Moment     =         348000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
42.0000	0.4660369	1314222.	-12096.
39.9000	0.5452691	1306383.	-13903.
37.8000	0.7372648	1297354.	-16291.
35.7000	1.2382053	1293733.	-20038.
33.6000	4.7919221	1286047.	-27958.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

```
Shear force at pile head                              =        4500.000 lbs
Applied moment at pile head                           =      522000.000 in-lbs
Axial thrust load on pile head                        =           0.000 lbs
```

Depth X	Deflect. y	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil Res. p	Soil Spr. Es*h	Distrib. Lat. Load

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feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/in	lb/inch	lb/inch
0.00	0.6991	522000.	4500.0000	-0.002452	113.9628	2.972E+11	0.000	0.000	0.000
0.420	0.6868	544680.	4500.0000	-0.002443	118.9143	2.972E+11	0.000	0.000	0.000
0.840	0.6745	567360.	4500.0000	-0.002434	123.8658	2.972E+11	0.000	0.000	0.000
1.260	0.6623	590040.	4500.0000	-0.002424	128.8173	2.972E+11	0.000	0.000	0.000
1.680	0.6501	612720.	4500.0000	-0.002414	133.7687	2.972E+11	0.000	0.000	0.000
2.100	0.6379	635400.	4500.0000	-0.002403	138.7202	2.972E+11	0.000	0.000	0.000
2.520	0.6258	658080.	4500.0000	-0.002392	143.6717	2.972E+11	0.000	0.000	0.000
2.940	0.6138	680760.	4500.0000	-0.002381	148.6232	2.972E+11	0.000	0.000	0.000
3.360	0.6018	703440.	4500.0000	-0.002369	153.5747	2.972E+11	0.000	0.000	0.000
3.780	0.5899	726120.	4500.0000	-0.002357	158.5262	2.972E+11	0.000	0.000	0.000
4.200	0.5781	748800.	4500.0000	-0.002345	163.4777	2.972E+11	0.000	0.000	0.000
4.620	0.5663	771480.	4500.0000	-0.002332	168.4292	2.972E+11	0.000	0.000	0.000
5.040	0.5546	794160.	4500.0000	-0.002318	173.3806	2.972E+11	0.000	0.000	0.000
5.460	0.5429	816840.	4500.0000	-0.002305	178.3321	2.972E+11	0.000	0.000	0.000
5.880	0.5314	839520.	4500.0000	-0.002291	183.2836	2.972E+11	0.000	0.000	0.000
6.300	0.5198	862200.	4500.0000	-0.002276	188.2351	2.972E+11	0.000	0.000	0.000
6.720	0.5084	884880.	4500.0000	-0.002261	193.1866	2.972E+11	0.000	0.000	0.000
7.140	0.4970	907560.	4500.0000	-0.002246	198.1381	2.972E+11	0.000	0.000	0.000
7.560	0.4858	930240.	4500.0000	-0.002231	203.0896	2.972E+11	0.000	0.000	0.000
7.980	0.4746	952920.	4500.0000	-0.002215	208.0411	2.972E+11	0.000	0.000	0.000
8.400	0.4634	975600.	4500.0000	-0.002198	212.9925	2.972E+11	0.000	0.000	0.000
8.820	0.4524	998280.	4500.0000	-0.002182	217.9440	2.972E+11	0.000	0.000	0.000
9.240	0.4415	1020960.	4500.0000	-0.002164	222.8955	2.972E+11	0.000	0.000	0.000
9.660	0.4306	1043640.	4500.0000	-0.002147	227.8470	2.972E+11	0.000	0.000	0.000
10.080	0.4198	1066320.	4500.0000	-0.002129	232.7985	2.972E+11	0.000	0.000	0.000
10.500	0.4091	1089000.	4500.0000	-0.002111	237.7500	2.972E+11	0.000	0.000	0.000
10.920	0.3985	1111680.	4500.0000	-0.002092	242.7015	2.972E+11	0.000	0.000	0.000
11.340	0.3880	1134360.	4500.0000	-0.002073	247.6530	2.972E+11	0.000	0.000	0.000
11.760	0.3776	1157040.	4500.0000	-0.002054	252.6044	2.972E+11	0.000	0.000	0.000
12.180	0.3673	1179720.	4500.0000	-0.002034	257.5559	2.972E+11	0.000	0.000	0.000
12.600	0.3571	1202400.	4500.0000	-0.002014	262.5074	2.972E+11	0.000	0.000	0.000
13.020	0.3470	1225080.	4500.0000	-0.001993	267.4589	2.972E+11	0.000	0.000	0.000
13.440	0.3370	1247760.	4500.0000	-0.001972	272.4104	2.972E+11	0.000	0.000	0.000
13.860	0.3272	1270440.	4500.0000	-0.001951	277.3619	2.972E+11	0.000	0.000	0.000
14.280	0.3174	1293120.	4500.0000	-0.001929	282.3134	2.972E+11	0.000	0.000	0.000
14.700	0.3077	1315800.	4500.0000	-0.001907	287.2648	2.972E+11	0.000	0.000	0.000
15.120	0.2982	1338480.	4500.0000	-0.001884	292.2163	2.972E+11	0.000	0.000	0.000
15.540	0.2887	1361160.	4500.0000	-0.001862	297.1678	2.972E+11	0.000	0.000	0.000
15.960	0.2794	1383840.	4500.0000	-0.001838	302.1193	2.972E+11	0.000	0.000	0.000
16.380	0.2702	1406520.	4500.0000	-0.001815	307.0708	2.972E+11	0.000	0.000	0.000
16.800	0.2611	1429200.	4500.0000	-0.001791	312.0223	2.972E+11	0.000	0.000	0.000
17.220	0.2521	1451880.	4500.0000	-0.001766	316.9738	2.972E+11	0.000	0.000	0.000
17.640	0.2433	1474560.	4500.0000	-0.001741	321.9253	2.972E+11	0.000	0.000	0.000
18.060	0.2346	1497240.	4500.0000	-0.001716	326.8767	2.972E+11	0.000	0.000	0.000
18.480	0.2260	1519920.	4500.0000	-0.001691	331.8282	2.972E+11	0.000	0.000	0.000
18.900	0.2175	1542600.	4500.0000	-0.001665	336.7797	2.972E+11	0.000	0.000	0.000
19.320	0.2092	1565280.	4500.0000	-0.001638	341.7312	2.972E+11	0.000	0.000	0.000
19.740	0.2010	1587960.	4500.0000	-0.001611	346.6827	2.972E+11	0.000	0.000	0.000
20.160	0.1930	1610640.	4500.0000	-0.001584	351.6342	2.972E+11	0.000	0.000	0.000
20.580	0.1851	1633320.	4500.0000	-0.001557	356.5857	2.972E+11	0.000	0.000	0.000
21.000	0.1773	1656000.	4500.0000	-0.001529	361.5372	2.972E+11	0.000	0.000	0.000
21.420	0.1697	1678680.	4500.0000	-0.001501	366.4886	2.972E+11	0.000	0.000	0.000
21.840	0.1622	1701360.	4500.0000	-0.001472	371.4401	2.972E+11	0.000	0.000	0.000
22.260	0.1548	1724040.	4499.9987	-0.001443	376.3916	2.972E+11	-0.000497	0.0162	0.000
22.680	0.1476	1746720.	4499.9963	-0.001414	381.3431	2.972E+11	-0.000489	0.0167	0.000
23.100	0.1406	1769400.	4499.9938	-0.001384	386.2946	2.972E+11	-0.000481	0.0172	0.000

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23.520	0.1337	1792080.	4499.9914	-0.001354	391.2461	2.972E+11	-0.000473	0.0178	0.000
23.940	0.1269	1814760.	4499.9891	-0.001323	396.1975	2.972E+11	-0.000465	0.0185	0.000
24.360	0.1203	1837440.	4499.9867	-0.001292	401.1490	2.972E+11	-0.000457	0.0191	0.000
24.780	0.1139	1860120.	4499.9845	-0.001261	406.1005	2.972E+11	-0.000448	0.0198	0.000
25.200	0.1076	1882800.	4443.1585	-0.001229	411.0520	2.972E+11	-22.5495	1055.9720	0.000
25.620	0.1015	1904907.	4214.8477	-0.001197	415.8784	2.972E+11	-68.0500	3378.6215	0.000
26.040	0.0956	1925285.	3772.6940	-0.001164	420.3274	2.972E+11	-107.4078	5664.7655	0.000
26.460	0.0898	1942936.	3145.1264	-0.001132	424.1808	2.972E+11	-141.6269	7950.9095	0.000
26.880	0.0842	1956988.	2357.4721	-0.001098	427.2488	2.972E+11	-170.9343	10237.	0.000
27.300	0.0787	1966699.	1433.9095	-0.001065	429.3688	2.972E+11	-195.5588	12523.	0.000
27.720	0.0734	1971442.	397.4605	-0.001032	430.4043	2.972E+11	-215.7305	14809.	0.000
28.140	0.0683	1970705.	-730.0128	-0.000998	430.2435	2.972E+11	-231.6795	17095.	0.000
28.560	0.0634	1964083.	-1927.8051	-0.000965	428.7978	2.972E+11	-243.6349	19382.	0.000
28.980	0.0586	1951273.	-3176.3597	-0.000932	426.0010	2.972E+11	-251.8233	21668.	0.000
29.400	0.0540	1932066.	-4457.2539	-0.000899	421.8077	2.972E+11	-256.4680	23954.	0.000
29.820	0.0495	1906344.	-5753.1777	-0.000866	416.1921	2.972E+11	-257.7875	26240.	0.000
30.240	0.0452	1874074.	-7047.9065	-0.000834	409.1469	2.972E+11	-255.9938	28526.	0.000
30.660	0.0411	1835301.	-8326.2666	-0.000803	400.6821	2.972E+11	-251.2919	30812.	0.000
31.080	0.0371	1790145.	-9574.0949	-0.000772	390.8236	2.972E+11	-243.8780	33098.	0.000
31.500	0.0333	1738794.	-10778.	-0.000742	379.6127	2.972E+11	-233.9385	35385.	0.000
31.920	0.0297	1681501.	-11926.	-0.000713	367.1045	2.972E+11	-221.6486	37671.	0.000
32.340	0.0261	1618577.	-13007.	-0.000685	353.3670	2.972E+11	-207.1718	39957.	0.000
32.760	0.0227	1550391.	-14009.	-0.000658	338.4807	2.972E+11	-190.6586	42243.	0.000
33.180	0.0195	1477362.	-14924.	-0.000633	322.5370	2.972E+11	-172.2457	44529.	0.000
33.600	0.0164	1399958.	-15741.	-0.000608	305.6381	2.972E+11	-152.0555	46815.	0.000
34.020	0.0134	1318691.	-16452.	-0.000585	287.8960	2.972E+11	-130.1953	49102.	0.000
34.440	0.0105	1234117.	-17050.	-0.000564	269.4319	2.972E+11	-106.7572	51388.	0.000
34.860	0.007683	1146831.	-17525.	-0.000543	250.3757	2.972E+11	-81.8175	53674.	0.000
35.280	0.004993	1057467.	-17871.	-0.000525	230.8657	2.972E+11	-55.4369	55960.	0.000
35.700	0.002393	966695.	-18080.	-0.000508	211.0484	2.972E+11	-27.6605	58246.	0.000
36.120	-0.000123	875220.	-18146.	-0.000492	191.0776	2.972E+11	1.4818	60532.	0.000
36.540	-0.002565	783783.	-18062.	-0.000478	171.1151	2.972E+11	31.9752	62818.	0.000
36.960	-0.004940	693158.	-17820.	-0.000465	151.3299	2.972E+11	63.8186	65105.	0.000
37.380	-0.007256	604154.	-17415.	-0.000454	131.8986	2.972E+11	97.0246	67391.	0.000
37.800	-0.009520	517614.	-16839.	-0.000445	113.0053	2.972E+11	131.6177	69677.	0.000
38.220	-0.0117	434418.	-16085.	-0.000437	94.8420	2.972E+11	167.6332	71963.	0.000
38.640	-0.0139	355480.	-15145.	-0.000430	77.6083	2.972E+11	205.1157	74249.	0.000
39.060	-0.0161	281753.	-14013.	-0.000425	61.5121	2.972E+11	244.1172	76535.	0.000
39.480	-0.0182	214226.	-12681.	-0.000420	46.7697	2.972E+11	284.6947	78821.	0.000
39.900	-0.0203	153931.	-11139.	-0.000417	33.6062	2.972E+11	326.9084	81108.	0.000
40.320	-0.0224	101940.	-9381.2073	-0.000415	22.2555	2.972E+11	370.8187	83394.	0.000
40.740	-0.0245	59369.	-7397.2068	-0.000414	12.9613	2.972E+11	416.4831	85680.	0.000
41.160	-0.0266	27376.	-5178.5066	-0.000413	5.9768	2.972E+11	463.9534	87966.	0.000
41.580	-0.0287	7169.1729	-2715.8995	-0.000413	1.5652	2.972E+11	513.2716	90252.	0.000
42.000	-0.0307	0.000	0.000	-0.000413	0.000	2.972E+11	564.4662	46269.	0.000

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

```
Pile-head deflection              =      0.6991293 inches
Computed slope at pile head       =     -0.0024523 radians
Maximum bending moment            =       1971442. inch-lbs
Maximum shear force               =        -18146. lbs
Depth of maximum bending moment   =    332.6400000 inches below pile head
Depth of maximum shear force      =    433.4400000 inches below pile head
Number of iterations              =              6
```

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Number of zero deflection points = 1

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

Shear = 4500. lbs
Moment = 522000. in-lbs
Axial Load = 0. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
42.0000	0.6991293	1971442.	-18146.
39.9000	0.8425940	1961246.	-21111.
37.8000	1.2248897	1955514.	-25507.
35.7000	2.7749469	1946508.	-33076.
33.6000	16.1842934	1933571.	-43738.

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 in-lb, rad., or in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs	Maximum Shear in Pile lbs	Pile-head Rotation radians
1	1	V = 3000.0000	M = 348000.	0.0000000	0.46603693	1314222.	-12096.	-0.00163472
2	1	V = 4500.0000	M = 522000.	0.0000000	0.69912930	1971442.	-18146.	-0.00245226

The analysis ended normally.

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LPile Plus for Windows, Version 2012-06.035

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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This copy of LPile is licensed to:

URS Corporation
Austin, TX

Serial Number of Security Device: 500126253
Company Name Stored in Security Device: URS Corporation

Files Used for Analysis

Path to file locations: L:\AGE\Projects\INFR\AUS Geotech\Projects\41010530.092 City of El Paso\OCS Design\2.1 Memo - OCS Bridges\LPILE for Bridges_rev20130423\Final\
Name of input data file: stanton_elevated pole2_36 inch_RAR.lp6d
Name of output report file: stanton_elevated pole2_36 inch_RAR.lp6o
Name of plot output file: stanton_elevated pole2_36 inch_RAR.lp6p
Name of runtime messeage file: stanton_elevated pole2_36 inch_RAR.lp6r

---

Date and Time of Analysis

Date: April 23, 2013 Time: 10:40:30

Problem Title

Project Name: El Paso Streetcar

Job Number: 41010530

Client: City of El Paso

Engineer: RAR

Description: OCS Pole Foundations - Stanton St. Bridge

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```
--------------------------------------------------------------------------------
                                Program Options
--------------------------------------------------------------------------------

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear
moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:
- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:
- Number of pile increments                              =          100
- Maximum number of iterations allowed                   =          500
- Deflection tolerance for convergence                   =   1.0000E-05  in
- Maximum allowable deflection                           =     100.0000  in

Pile Response Output Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points)  = 1


--------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Total number of pile sections                            =          1

Total length of pile                                     =      43.00 ft

Depth of ground surface below top of pile                =      22.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile.

Point         Depth              Pile
                X              Diameter
                ft                in
-----       ---------        -----------
  1           0.00000         36.0000000
  2          43.000000        36.0000000
```

ADDENDUM 2 - JULY 14, 2015

Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Circular
Section Length	=	43.00000000 ft
Top Width	=	36.00000000 in
Bottom Width	=	36.00000000 in
Top Area	=	1017.87601976 Sq. in
Bottom Area	=	1017.87601976 Sq. in
Moment of Inertia at Top	=	82448. in^4
Moment of Inertia at Bottom	=	82448. in^4
Elastic Modulus	=	3604997. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970

Distance from top of pile to top of layer	=	22.00000 ft
Distance from top of pile to bottom of layer	=	25.00000 ft
Effective unit weight at top of layer	=	120.00000 pcf
Effective unit weight at bottom of layer	=	120.00000 pcf
Undrained cohesion at top of layer	=	0.0010000 psf
Undrained cohesion at bottom of layer	=	0.0010000 psf
Epsilon-50 at top of layer	=	0.02000
Epsilon-50 at bottom of layer	=	0.02000

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	25.00000 ft
Distance from top of pile to bottom of layer	=	32.00000 ft
Effective unit weight at top of layer	=	120.00000 pcf
Effective unit weight at bottom of layer	=	120.00000 pcf
Friction angle at top of layer	=	20.00000 deg.
Friction angle at bottom of layer	=	20.00000 deg.
Subgrade k at top of layer	=	25.00000 pci
Subgrade k at bottom of layer	=	25.00000 pci

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Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	32.00000	ft
Distance from top of pile to bottom of layer	=	60.00000	ft
Effective unit weight at top of layer	=	120.00000	pcf
Effective unit weight at bottom of layer	=	120.00000	pcf
Friction angle at top of layer	=	30.00000	deg.
Friction angle at bottom of layer	=	30.00000	deg.
Subgrade k at top of layer	=	90.00000	pci
Subgrade k at bottom of layer	=	90.00000	pci

(Depth of lowest soil layer extends 17.00 ft below pile tip)

Summary of Soil Properties

Layer Num.	Layer Soil Type (p-y Curve Criteria)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf	Angle of Friction deg.	Strain Factor Epsilon 50	kpy pci
1	Soft Clay	22.000	120.000	1.00E-03	--	0.02000	--
		25.000	120.000	1.00E-03	--	0.02000	--
2	Sand (Reese, et al.)	25.000	120.000	--	20.000	--	25.000
		32.000	120.000	--	20.000	--	25.000
3	Sand (Reese, et al.)	32.000	120.000	--	30.000	--	90.000
		60.000	120.000	--	30.000	--	90.000

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length
1	1	V = 3000.00000 lbs	M = 564000. in-lbs	0.0000000	Yes
2	1	V = 4500.00000 lbs	M = 846000. in-lbs	0.0000000	Yes

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis

ADDENDUM 2 - JULY 14, 2015

S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

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Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

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Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 3000.000 lbs
Applied moment at pile head = 564000.000 in-lbs
Axial thrust load on pile head = 0.000 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	0.7115	564000.	3000.0000	-0.002332	123.1322	2.972E+11	0.000	0.000	0.000
0.430	0.6995	579480.	3000.0000	-0.002322	126.5118	2.972E+11	0.000	0.000	0.000
0.860	0.6876	594960.	3000.0000	-0.002312	129.8914	2.972E+11	0.000	0.000	0.000
1.290	0.6757	610440.	3000.0000	-0.002301	133.2710	2.972E+11	0.000	0.000	0.000
1.720	0.6638	625920.	3000.0000	-0.002291	136.6506	2.972E+11	0.000	0.000	0.000
2.150	0.6520	641400.	3000.0000	-0.002280	140.0302	2.972E+11	0.000	0.000	0.000
2.580	0.6403	656880.	3000.0000	-0.002268	143.4097	2.972E+11	0.000	0.000	0.000
3.010	0.6286	672360.	3000.0000	-0.002257	146.7893	2.972E+11	0.000	0.000	0.000
3.440	0.6170	687840.	3000.0000	-0.002245	150.1689	2.972E+11	0.000	0.000	0.000
3.870	0.6054	703320.	3000.0000	-0.002233	153.5485	2.972E+11	0.000	0.000	0.000
4.300	0.5940	718800.	3000.0000	-0.002221	156.9281	2.972E+11	0.000	0.000	0.000
4.730	0.5825	734280.	3000.0000	-0.002208	160.3077	2.972E+11	0.000	0.000	0.000
5.160	0.5712	749760.	3000.0000	-0.002195	163.6873	2.972E+11	0.000	0.000	0.000
5.590	0.5599	765240.	3000.0000	-0.002182	167.0668	2.972E+11	0.000	0.000	0.000
6.020	0.5487	780720.	3000.0000	-0.002169	170.4464	2.972E+11	0.000	0.000	0.000
6.450	0.5375	796200.	3000.0000	-0.002155	173.8260	2.972E+11	0.000	0.000	0.000
6.880	0.5264	811680.	3000.0000	-0.002141	177.2056	2.972E+11	0.000	0.000	0.000
7.310	0.5154	827160.	3000.0000	-0.002127	180.5852	2.972E+11	0.000	0.000	0.000
7.740	0.5045	842640.	3000.0000	-0.002112	183.9648	2.972E+11	0.000	0.000	0.000
8.170	0.4936	858120.	3000.0000	-0.002097	187.3444	2.972E+11	0.000	0.000	0.000
8.600	0.4828	873600.	3000.0000	-0.002082	190.7239	2.972E+11	0.000	0.000	0.000
9.030	0.4721	889080.	3000.0000	-0.002067	194.1035	2.972E+11	0.000	0.000	0.000
9.460	0.4615	904560.	3000.0000	-0.002052	197.4831	2.972E+11	0.000	0.000	0.000

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9.890	0.4509	920040.	3000.0000	-0.002036	200.8627	2.972E+11	0.000	0.000	0.000
10.320	0.4405	935520.	3000.0000	-0.002020	204.2423	2.972E+11	0.000	0.000	0.000
10.750	0.4301	951000.	3000.0000	-0.002003	207.6219	2.972E+11	0.000	0.000	0.000
11.180	0.4198	966480.	3000.0000	-0.001987	211.0015	2.972E+11	0.000	0.000	0.000
11.610	0.4096	981960.	3000.0000	-0.001970	214.3811	2.972E+11	0.000	0.000	0.000
12.040	0.3995	997440.	3000.0000	-0.001952	217.7606	2.972E+11	0.000	0.000	0.000
12.470	0.3894	1012920.	3000.0000	-0.001935	221.1402	2.972E+11	0.000	0.000	0.000
12.900	0.3795	1028400.	3000.0000	-0.001917	224.5198	2.972E+11	0.000	0.000	0.000
13.330	0.3697	1043880.	3000.0000	-0.001899	227.8994	2.972E+11	0.000	0.000	0.000
13.760	0.3599	1059360.	3000.0000	-0.001881	231.2790	2.972E+11	0.000	0.000	0.000
14.190	0.3503	1074840.	3000.0000	-0.001863	234.6586	2.972E+11	0.000	0.000	0.000
14.620	0.3407	1090320.	3000.0000	-0.001844	238.0382	2.972E+11	0.000	0.000	0.000
15.050	0.3312	1105800.	3000.0000	-0.001825	241.4177	2.972E+11	0.000	0.000	0.000
15.480	0.3219	1121280.	3000.0000	-0.001805	244.7973	2.972E+11	0.000	0.000	0.000
15.910	0.3126	1136760.	3000.0000	-0.001786	248.1769	2.972E+11	0.000	0.000	0.000
16.340	0.3034	1152240.	3000.0000	-0.001766	251.5565	2.972E+11	0.000	0.000	0.000
16.770	0.2944	1167720.	3000.0000	-0.001746	254.9361	2.972E+11	0.000	0.000	0.000
17.200	0.2854	1183200.	3000.0000	-0.001725	258.3157	2.972E+11	0.000	0.000	0.000
17.630	0.2766	1198680.	3000.0000	-0.001705	261.6953	2.972E+11	0.000	0.000	0.000
18.060	0.2678	1214160.	3000.0000	-0.001684	265.0749	2.972E+11	0.000	0.000	0.000
18.490	0.2592	1229640.	3000.0000	-0.001663	268.4544	2.972E+11	0.000	0.000	0.000
18.920	0.2507	1245120.	3000.0000	-0.001641	271.8340	2.972E+11	0.000	0.000	0.000
19.350	0.2423	1260600.	3000.0000	-0.001619	275.2136	2.972E+11	0.000	0.000	0.000
19.780	0.2340	1276080.	3000.0000	-0.001597	278.5932	2.972E+11	0.000	0.000	0.000
20.210	0.2258	1291560.	3000.0000	-0.001575	281.9728	2.972E+11	0.000	0.000	0.000
20.640	0.2177	1307040.	3000.0000	-0.001552	285.3524	2.972E+11	0.000	0.000	0.000
21.070	0.2097	1322520.	3000.0000	-0.001530	288.7320	2.972E+11	0.000	0.000	0.000
21.500	0.2019	1338000.	3000.0000	-0.001507	292.1115	2.972E+11	0.000	0.000	0.000
21.930	0.1942	1353480.	3000.0000	-0.001483	295.4911	2.972E+11	0.000	0.000	0.000
22.360	0.1866	1368960.	2999.9986	-0.001460	298.8707	2.972E+11	-0.000528	0.0146	0.000
22.790	0.1791	1384440.	2999.9959	-0.001436	302.2503	2.972E+11	-0.000521	0.0150	0.000
23.220	0.1718	1399920.	2999.9933	-0.001411	305.6299	2.972E+11	-0.000514	0.0154	0.000
23.650	0.1646	1415400.	2999.9906	-0.001387	309.0095	2.972E+11	-0.000507	0.0159	0.000
24.080	0.1575	1430880.	2999.9880	-0.001362	312.3890	2.972E+11	-0.000499	0.0164	0.000
24.510	0.1505	1446360.	2999.9855	-0.001337	315.7686	2.972E+11	-0.000492	0.0169	0.000
24.940	0.1437	1461840.	2999.9829	-0.001312	319.1482	2.972E+11	-0.000484	0.0174	0.000
25.370	0.1370	1477320.	2960.5619	-0.001287	322.5277	2.972E+11	-15.2790	575.5966	0.000
25.800	0.1304	1492393.	2840.2147	-0.001261	325.8185	2.972E+11	-31.3672	1241.2366	0.000
26.230	0.1240	1506631.	2641.1001	-0.001235	328.9269	2.972E+11	-45.8090	1906.8766	0.000
26.660	0.1177	1519649.	2371.5777	-0.001208	331.7690	2.972E+11	-58.6570	2572.5166	0.000
27.090	0.1115	1531105.	2039.7357	-0.001182	334.2702	2.972E+11	-69.9640	3238.1566	0.000
27.520	0.1055	1540699.	1653.3875	-0.001155	336.3647	2.972E+11	-79.7834	3903.7966	0.000
27.950	0.0996	1548168.	1220.0696	-0.001129	337.9954	2.972E+11	-88.1692	4569.4366	0.000
28.380	0.0938	1553290.	747.0403	-0.001102	339.1136	2.972E+11	-95.1755	5235.0766	0.000
28.810	0.0882	1555878.	241.2782	-0.001075	339.6785	2.972E+11	-100.8563	5900.7166	0.000
29.240	0.0827	1555780.	-290.5174	-0.001048	339.6572	2.972E+11	-105.2660	6566.3566	0.000
29.670	0.0774	1552880.	-841.9260	-0.001021	339.0240	2.972E+11	-108.4583	7231.9966	0.000
30.100	0.0722	1547091.	-1406.8045	-0.000994	337.7603	2.972E+11	-110.4869	7897.6366	0.000
30.530	0.0671	1538361.	-1979.2845	-0.000967	335.8543	2.972E+11	-111.4046	8563.2766	0.000
30.960	0.0622	1526665.	-2553.7691	-0.000940	333.3008	2.972E+11	-111.2638	9228.9166	0.000
31.390	0.0574	1512006.	-3124.9286	-0.000914	330.1006	2.972E+11	-110.1158	9894.5566	0.000
31.820	0.0528	1494416.	-3687.6952	-0.000888	326.2602	2.972E+11	-108.0108	10560.	0.000
32.250	0.0483	1473949.	-4656.5364	-0.000862	321.7920	2.972E+11	-267.5091	28601.	0.000
32.680	0.0439	1446360.	-6026.7893	-0.000837	315.7687	2.972E+11	-263.5967	30997.	0.000
33.110	0.0396	1411753.	-7368.5163	-0.000812	308.2133	2.972E+11	-256.4525	33393.	0.000
33.540	0.0355	1370317.	-8665.4515	-0.000788	299.1670	2.972E+11	-246.2355	35790.	0.000
33.970	0.0315	1322326.	-9902.1227	-0.000764	288.6895	2.972E+11	-233.0944	38186.	0.000
34.400	0.0276	1268127.	-11064.	-0.000742	276.8570	2.972E+11	-217.1665	40582.	0.000

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34.830	0.0238	1208147.	-12136.	-0.000720	263.7621	2.972E+11	-198.5762	42979.	0.000
35.260	0.0202	1142880.	-13107.	-0.000700	249.5130	2.972E+11	-177.4346	45375.	0.000
35.690	0.0166	1072888.	-13961.	-0.000681	234.2324	2.972E+11	-153.8385	47771.	0.000
36.120	0.0132	998800.	-14688.	-0.000663	218.0576	2.972E+11	-127.8694	50167.	0.000
36.550	0.009777	921308.	-15275.	-0.000646	201.1395	2.972E+11	-99.5936	52564.	0.000
36.980	0.006484	841163.	-15710.	-0.000631	183.6424	2.972E+11	-69.0619	54960.	0.000
37.410	0.003267	759180.	-15982.	-0.000617	165.7439	2.972E+11	-36.3095	57356.	0.000
37.840	0.000117	676231.	-16079.	-0.000604	147.6344	2.972E+11	-1.3562	59753.	0.000
38.270	-0.002972	593245.	-15990.	-0.000593	129.5169	2.972E+11	35.7926	62149.	0.000
38.700	-0.006007	511212.	-15704.	-0.000584	111.6076	2.972E+11	75.1456	64545.	0.000
39.130	-0.008997	431180.	-15209.	-0.000576	94.1350	2.972E+11	116.7241	66942.	0.000
39.560	-0.0119	354256.	-14494.	-0.000569	77.3409	2.972E+11	160.5605	69338.	0.000
39.990	-0.0149	281607.	-13546.	-0.000563	61.4802	2.972E+11	206.6969	71734.	0.000
40.420	-0.0178	214461.	-12354.	-0.000559	46.8210	2.972E+11	255.1826	74131.	0.000
40.850	-0.0206	154109.	-10906.	-0.000556	33.6451	2.972E+11	306.0716	76527.	0.000
41.280	-0.0235	101907.	-9189.3694	-0.000554	22.2484	2.972E+11	359.4199	78923.	0.000
41.710	-0.0264	59275.	-7220.6520	-0.000552	12.9409	2.972E+11	403.6489	79041.	0.000
42.140	-0.0292	27390.	-5046.7707	-0.000551	5.9798	2.972E+11	438.9408	77572.	0.000
42.570	-0.0320	7192.4002	-2654.0897	-0.000551	1.5702	2.972E+11	488.4549	78659.	0.000
43.000	-0.0349	0.000	0.000	-0.000551	0.000	2.972E+11	540.2620	39955.	0.000

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =      0.7115354 inches
Computed slope at pile head      =     -0.0023320 radians
Maximum bending moment           =       1555878. inch-lbs
Maximum shear force              =        -16079. lbs
Depth of maximum bending moment  =    345.7200000 inches below pile head
Depth of maximum shear force     =    454.0800000 inches below pile head
Number of iterations             =              7
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

```
Shear      =           3000. lbs
Moment     =         564000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
43.0000	0.7115354	1555878.	-16079.
40.8500	0.9242143	1539565.	-18438.
38.7000	1.3496626	1524166.	-20941.
36.5500	2.7795672	1516732.	-24883.
34.4000	17.7440539	1509569.	-31852.

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Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 4500.000 lbs
Applied moment at pile head = 846000.000 in-lbs
Axial thrust load on pile head = 0.000 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Es*h lb/inch	Distrib. Lat. Load lb/inch
0.00	1.0907	846000.	4500.0000	-0.003554	184.6983	2.972E+11	0.000	0.000	0.000
0.430	1.0724	869220.	4500.0000	-0.003539	189.7677	2.972E+11	0.000	0.000	0.000
0.860	1.0542	892440.	4500.0000	-0.003524	194.8371	2.972E+11	0.000	0.000	0.000
1.290	1.0361	915660.	4500.0000	-0.003508	199.9065	2.972E+11	0.000	0.000	0.000
1.720	1.0180	938880.	4500.0000	-0.003492	204.9758	2.972E+11	0.000	0.000	0.000
2.150	1.0000	962100.	4500.0000	-0.003475	210.0452	2.972E+11	0.000	0.000	0.000
2.580	0.9821	985320.	4500.0000	-0.003459	215.1146	2.972E+11	0.000	0.000	0.000
3.010	0.9643	1008540.	4500.0000	-0.003441	220.1840	2.972E+11	0.000	0.000	0.000
3.440	0.9466	1031760.	4500.0000	-0.003424	225.2534	2.972E+11	0.000	0.000	0.000
3.870	0.9290	1054980.	4500.0000	-0.003405	230.3227	2.972E+11	0.000	0.000	0.000
4.300	0.9115	1078200.	4500.0000	-0.003387	235.3921	2.972E+11	0.000	0.000	0.000
4.730	0.8941	1101420.	4500.0000	-0.003368	240.4615	2.972E+11	0.000	0.000	0.000
5.160	0.8767	1124640.	4500.0000	-0.003349	245.5309	2.972E+11	0.000	0.000	0.000
5.590	0.8595	1147860.	4500.0000	-0.003329	250.6003	2.972E+11	0.000	0.000	0.000
6.020	0.8424	1171080.	4500.0000	-0.003309	255.6696	2.972E+11	0.000	0.000	0.000
6.450	0.8254	1194300.	4500.0000	-0.003288	260.7390	2.972E+11	0.000	0.000	0.000
6.880	0.8084	1217520.	4500.0000	-0.003267	265.8084	2.972E+11	0.000	0.000	0.000
7.310	0.7916	1240740.	4500.0000	-0.003246	270.8778	2.972E+11	0.000	0.000	0.000
7.740	0.7749	1263960.	4500.0000	-0.003224	275.9472	2.972E+11	0.000	0.000	0.000
8.170	0.7584	1287180.	4500.0000	-0.003202	281.0165	2.972E+11	0.000	0.000	0.000
8.600	0.7419	1310400.	4500.0000	-0.003180	286.0859	2.972E+11	0.000	0.000	0.000
9.030	0.7255	1333620.	4500.0000	-0.003157	291.1553	2.972E+11	0.000	0.000	0.000
9.460	0.7093	1356840.	4500.0000	-0.003133	296.2247	2.972E+11	0.000	0.000	0.000
9.890	0.6932	1380060.	4500.0000	-0.003110	301.2941	2.972E+11	0.000	0.000	0.000
10.320	0.6772	1403280.	4500.0000	-0.003085	306.3634	2.972E+11	0.000	0.000	0.000
10.750	0.6614	1426500.	4500.0000	-0.003061	311.4328	2.972E+11	0.000	0.000	0.000
11.180	0.6456	1449720.	4500.0000	-0.003036	316.5022	2.972E+11	0.000	0.000	0.000
11.610	0.6300	1472940.	4500.0000	-0.003010	321.5716	2.972E+11	0.000	0.000	0.000
12.040	0.6146	1496160.	4500.0000	-0.002985	326.6410	2.972E+11	0.000	0.000	0.000
12.470	0.5992	1519380.	4500.0000	-0.002959	331.7103	2.972E+11	0.000	0.000	0.000
12.900	0.5840	1542600.	4500.0000	-0.002932	336.7797	2.972E+11	0.000	0.000	0.000
13.330	0.5690	1565820.	4500.0000	-0.002905	341.8491	2.972E+11	0.000	0.000	0.000
13.760	0.5541	1589040.	4500.0000	-0.002878	346.9185	2.972E+11	0.000	0.000	0.000
14.190	0.5393	1612260.	4500.0000	-0.002850	351.9879	2.972E+11	0.000	0.000	0.000
14.620	0.5247	1635480.	4500.0000	-0.002822	357.0572	2.972E+11	0.000	0.000	0.000
15.050	0.5102	1658700.	4500.0000	-0.002793	362.1266	2.972E+11	0.000	0.000	0.000
15.480	0.4958	1681920.	4500.0000	-0.002764	367.1960	2.972E+11	0.000	0.000	0.000
15.910	0.4816	1705140.	4500.0000	-0.002735	372.2654	2.972E+11	0.000	0.000	0.000
16.340	0.4676	1728360.	4500.0000	-0.002705	377.3348	2.972E+11	0.000	0.000	0.000
16.770	0.4537	1751580.	4500.0000	-0.002675	382.4041	2.972E+11	0.000	0.000	0.000
17.200	0.4400	1774800.	4500.0000	-0.002644	387.4735	2.972E+11	0.000	0.000	0.000
17.630	0.4264	1798020.	4500.0000	-0.002613	392.5429	2.972E+11	0.000	0.000	0.000

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18.060	0.4130	1821240.	4500.0000	-0.002582	397.6123	2.972E+11	0.000	0.000	0.000
18.490	0.3998	1844460.	4500.0000	-0.002550	402.6817	2.972E+11	0.000	0.000	0.000
18.920	0.3867	1867680.	4500.0000	-0.002517	407.7510	2.972E+11	0.000	0.000	0.000
19.350	0.3738	1890900.	4500.0000	-0.002485	412.8204	2.972E+11	0.000	0.000	0.000
19.780	0.3611	1914120.	4500.0000	-0.002452	417.8898	2.972E+11	0.000	0.000	0.000
20.210	0.3485	1937340.	4500.0000	-0.002418	422.9592	2.972E+11	0.000	0.000	0.000
20.640	0.3361	1960560.	4500.0000	-0.002385	428.0286	2.972E+11	0.000	0.000	0.000
21.070	0.3239	1983780.	4500.0000	-0.002350	433.0979	2.972E+11	0.000	0.000	0.000
21.500	0.3119	2007000.	4500.0000	-0.002316	438.1673	2.972E+11	0.000	0.000	0.000
21.930	0.3000	2030220.	4500.0000	-0.002281	443.2367	2.972E+11	0.000	0.000	0.000
22.360	0.2883	2053440.	4499.9984	-0.002245	448.3061	2.972E+11	-0.000611	0.0109	0.000
22.790	0.2768	2076660.	4499.9953	-0.002209	453.3754	2.972E+11	-0.000603	0.0112	0.000
23.220	0.2655	2099880.	4499.9922	-0.002173	458.4448	2.972E+11	-0.000594	0.0116	0.000
23.650	0.2544	2123100.	4499.9892	-0.002136	463.5142	2.972E+11	-0.000586	0.0119	0.000
24.080	0.2435	2146320.	4499.9862	-0.002099	468.5836	2.972E+11	-0.000578	0.0122	0.000
24.510	0.2327	2169540.	4499.9832	-0.002062	473.6529	2.972E+11	-0.000569	0.0126	0.000
24.940	0.2222	2192760.	4499.9803	-0.002024	478.7223	2.972E+11	-0.000560	0.0130	0.000
25.370	0.2119	2215980.	4439.0054	-0.001986	483.7916	2.972E+11	-23.6331	575.5966	0.000
25.800	0.2017	2238570.	4252.8444	-0.001947	488.7236	2.972E+11	-48.5223	1241.2366	0.000
26.230	0.1918	2259869.	3944.8183	-0.001908	493.3735	2.972E+11	-70.8676	1906.8766	0.000
26.660	0.1820	2279281.	3527.8511	-0.001869	497.6115	2.972E+11	-90.7476	2572.5166	0.000
27.090	0.1725	2296276.	3014.4591	-0.001829	501.3220	2.972E+11	-108.2416	3238.1566	0.000
27.520	0.1631	2310390.	2416.7467	-0.001789	504.4033	2.972E+11	-123.4299	3903.7966	0.000
27.950	0.1540	2321217.	1746.4034	-0.001749	506.7671	2.972E+11	-136.3931	4569.4366	0.000
28.380	0.1451	2328413.	1014.7011	-0.001708	508.3380	2.972E+11	-147.2124	5235.0766	0.000
28.810	0.1364	2331689.	232.4931	-0.001668	509.0532	2.972E+11	-155.9690	5900.7166	0.000
29.240	0.1279	2330812.	-589.7863	-0.001627	508.8618	2.972E+11	-162.7439	6566.3566	0.000
29.670	0.1196	2325602.	-1442.1199	-0.001587	507.7244	2.972E+11	-167.6179	7231.9966	0.000
30.100	0.1115	2315929.	-2314.9057	-0.001547	505.6127	2.972E+11	-170.6711	7897.6366	0.000
30.530	0.1036	2301712.	-3198.9526	-0.001507	502.5088	2.972E+11	-171.9827	8563.2766	0.000
30.960	0.0960	2282916.	-4085.4748	-0.001467	498.4052	2.972E+11	-171.6306	9228.9166	0.000
31.390	0.0885	2259550.	-4966.0857	-0.001427	493.3040	2.972E+11	-169.6914	9894.5566	0.000
31.820	0.0812	2231666.	-5832.7890	-0.001388	487.2164	2.972E+11	-166.2401	10560.	0.000
32.250	0.0742	2199356.	-7322.2738	-0.001350	480.1624	2.972E+11	-411.0796	28601.	0.000
32.680	0.0673	2156100.	-9425.8690	-0.001312	470.7188	2.972E+11	-404.2674	30997.	0.000
33.110	0.0606	2102081.	-11481.	-0.001275	458.9254	2.972E+11	-392.3265	33393.	0.000
33.540	0.0541	2037616.	-13462.	-0.001239	444.8513	2.972E+11	-375.4926	35790.	0.000
33.970	0.0478	1963153.	-15344.	-0.001205	428.5946	2.972E+11	-353.9852	38186.	0.000
34.400	0.0417	1879264.	-17104.	-0.001171	410.2802	2.972E+11	-328.0063	40582.	0.000
34.830	0.0357	1786643.	-18718.	-0.001139	390.0591	2.972E+11	-297.7381	42979.	0.000
35.260	0.0299	1686094.	-20166.	-0.001109	368.1073	2.972E+11	-263.3422	45375.	0.000
35.690	0.0243	1578533.	-21425.	-0.001081	344.6247	2.972E+11	-224.9584	47771.	0.000
36.120	0.0188	1464983.	-22477.	-0.001054	319.8345	2.972E+11	-182.7032	50167.	0.000
36.550	0.0134	1346568.	-23301.	-0.001030	293.9822	2.972E+11	-136.6702	52564.	0.000
36.980	0.008161	1224515.	-23878.	-0.001008	267.3355	2.972E+11	-86.9291	54960.	0.000
37.410	0.003016	1100146.	-24189.	-0.000988	240.1834	2.972E+11	-33.5265	57356.	0.000
37.840	-0.002031	974885.	-24215.	-0.000970	212.8365	2.972E+11	23.5138	59753.	0.000
38.270	-0.006990	850250.	-23937.	-0.000954	185.6263	2.972E+11	84.1896	62149.	0.000
38.700	-0.0119	727857.	-23336.	-0.000940	158.9054	2.972E+11	148.5190	64545.	0.000
39.130	-0.0167	609418.	-22395.	-0.000928	133.0479	2.972E+11	216.5381	66942.	0.000
39.560	-0.0215	496745.	-21092.	-0.000919	108.4491	2.972E+11	288.2986	69338.	0.000
39.990	-0.0262	391748.	-19410.	-0.000911	85.5261	2.972E+11	363.8647	71734.	0.000
40.420	-0.0309	296438.	-17408.	-0.000905	64.7183	2.972E+11	412.0726	68907.	0.000
40.850	-0.0355	212101.	-15159.	-0.000901	46.3058	2.972E+11	459.5844	66774.	0.000
41.280	-0.0402	140000.	-12664.	-0.000898	30.5647	2.972E+11	507.2040	65180.	0.000
41.710	-0.0448	81404.	-9923.6568	-0.000896	17.7721	2.972E+11	555.1140	63968.	0.000
42.140	-0.0494	37588.	-6932.3983	-0.000895	8.2062	2.972E+11	604.2885	63124.	0.000
42.570	-0.0540	9861.5122	-3642.2399	-0.000894	2.1530	2.972E+11	670.9667	64100.	0.000

ADDENDUM 2 - JULY 14, 2015

43.000	-0.0586	0.000	0.000	-0.000894	0.000	2.972E+11	740.7542	32599.	0.000

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      1.0907373 inches
Computed slope at pile head      =     -0.0035539 radians
Maximum bending moment           =       2331689. inch-lbs
Maximum shear force              =        -24215. lbs
Depth of maximum bending moment  =    345.7200000 inches below pile head
Depth of maximum shear force     =    454.0800000 inches below pile head
Number of iterations             =              9
Number of zero deflection points =              1
```

Pile-head Deflection vs. Pile Length for Load Case 2

Boundary Condition Type 1, Shear and Moment

```
Shear      =           4500. lbs
Moment     =         846000. in-lbs
Axial Load =              0. lbs
```

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
43.0000	1.0907373	2331689.	-24215.
40.8500	1.4451476	2307198.	-27652.
38.7000	2.3289854	2295821.	-32587.
36.5500	7.5519611	2278965.	-40093.

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 in-lb, rad., or in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs	Maximum Shear in Pile lbs	Pile-head Rotation radians

ADDENDUM 2 - JULY 14, 2015


```
----  ----  --------------  --------------  -------------  --------------  --------------  -------------  -------------
  1     1   V =  3000.0000  M =    564000.      0.0000000     0.71153545       1555878.        -16079.    -0.00233200
  2     1   V =  4500.0000  M =    846000.      0.0000000     1.09073732       2331689.        -24215.    -0.00355393
```

The analysis ended normally.

ADDENDUM 2 - JULY 14, 2015

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Austin, Texas 78729
Phone: 512.419.5863
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MEMORANDUM

DATE: April 12, 2013 (Revised)

TO: David McDonnold, P.E.

FROM: Rebecca Russo, P.E.
Lance Finnefrock, P.E.

COPY: Clint Jumper, P.E.
Chuck Berry, P.E.
Derek Benedict, P.E.

SUBJECT: **Geotechnical Design Memorandum 3.0**
Bridge Foundation Investigation
City of El Paso Streetcar Project
Stanton Street and Oregon Street Bridges over IH-10
El Paso, Texas

Submitted herewith are the findings and recommendations pertaining to evaluation of foundation conditions for the existing bridge overpasses for the above referenced project. The streetcar alignment will cross Stanton Street bridge heading northwest, and Oregon Street bridge heading southeast, in which both bridges span over IH-10. This geotechnical investigation was performed to assess the load carrying capability of the existing bridge structures with the addition of the streetcar. Foundation design and recommendations for the Overhead Contact System (OCS) poles at the bridges will be addressed under separate cover.

The purpose of this memorandum is to provide a geotechnical evaluation of the existing foundations at the bridge bents and abutments to withstand proposed loading conditions, and comments regarding foundation improvement, where needed. The following sections

present available project information about the bridges, results of the field investigation and generalized subsurface conditions, and geotechnical recommendations for proper foundation support.

Project Information

Two bridges were specifically considered for this project. URS has provided a Technical Memorandum Confirming Feasibility of Affected Overpasses dated July 6, 2012. In that letter, the original design plans for the overpass construction, dated June 1967, include Bridge Layout sheets for the Stanton Street (IH-10) Underpass and the Oregon Street (IH-10) Underpass, as well as Structural, Abutment, and Bent detail sheets. The partial set of those provided plans are attached to this report in Appendix A, for ease of reference.

The bridges were built in 1969. The Stanton Street bridge is constructed at a slight skew angle, and the Oregon Street bridge is constructed at a normal angle perpendicular to IH-10. The Stanton Street bridge currently operates as a one-way bridge with 3 lanes of traffic. The Oregon Street bridge operates as a two-way bridge with one lane in each direction and a center turn late. Both bridges have 2-span continuous supported decks with 5 foot wide sidewalks on the exterior edges and 11 inch tall barrier curbs protecting the pedestrian traffic. A brief discussion of foundation loads for each bridge are provided in the following sections.

Stanton Street Bridge. The Stanton Street bridge spans approximately 152 feet and is supported by one center bent and two abutments. The abutments are supported by vertical and battered steel H-piles (12BP53). The plans show a design load of 40.4 tons per pile.

The center bent is reportedly supported by individual spread footings at each column location. Three footings are shown, with the interior footing having plan dimensions of 10 feet by 10 feet, and the outer footings have plan dimensions of 9.5 feet by 9.5 feet. Although the plans are hard to discern design load information, we have estimated that the maximum design load of 2.5 tons per square foot (tsf) was used to size the footings. The footing is shown to be 2 feet in height (thickness) and bear an estimated 3 feet below grade.

Test borings No. 17, No. 16, and No 15, were drilled by TxDOT prior to IH-10 construction and are shown as lithographic stick logs with TCP (Texas Cone Penetration) Test blowcounts. The geotechnical information was included in our assessment of the subsurface

conditions, and is shown on the subsurface profiles presented herein. It is noted that the elevation datum used on the original plan set is 9.81 feet below the datum currently used for this project. Accordingly, the boring elevations shown on the plans were adjusted in the subsurface profiles.

Oregon Street Bridge. The Oregon Street bridge also spans approximately 152 feet and is supported by one center bent and two abutments. The abutments are supported by vertical and battered steel H-piles (12BP53) with a design load of 41.0 tons per pile shown on the original design plans (Appendix A).

The center bent is reportedly supported by individual spread footings at each column location. Three footings are shown, with the interior footing having plan dimensions of 10 feet by 10 feet, and the outer footings have plan dimensions of 9.5 feet by 9.5 feet. Although the plans are hard to discern design load information, the allowable design load of 2.3 tons per square foot (tsf) appears to be the maximum bearing pressure used to size the footings. The footing is shown to be 2 feet in height (thickness) and bear an estimated 3 feet below grade.

Test borings No. 24 and No. 26 were drilled by TxDOT prior to IH-10 construction and are shown as lithographic stick logs with TCP (Texas Cone Penetration) Test blowcounts. The geotechnical information was included in our assessment of the subsurface conditions, and is shown on the subsurface profiles presented herein. It is noted that the elevation datum used on the original plan set is 9.81 feet below the datum currently used for this project. Accordingly, the boring elevations shown on the plans were adjusted in the subsurface profiles.

Subsurface Conditions

As part of the original field investigation for this project, three borings were drilled at the Stanton Street bridge and Oregon Street bridge abutments to assess subsurface foundation conditions. The drilling was performed by PSI, Inc. in November 2012, at the locations indicated by URS. Following drilling and lab testing, and based on results of abutment borings, additional subsurface information was needed at the lower IH-10 level to further assess the center bent spread footing foundation conditions. On January 22 and 23, 2013, two additional borings were drilled near the center bent, one boring at each bridge. A

generalized description of the subsurface conditions for each of the bridges is presented in the following sections.

Stanton Street Bridge. Borings B-7 and B-8 were initially drilled at each abutment for the Stanton Street bridge. The borings generally encountered loose to medium dense silty sand to the boring termination depths of 51.5 feet. Standard penetration test (SPT) N-values ranged from 7 to 36 blows per foot (bpf) but were generally less than 15 bpf in the upper 35 feet of the boring. Due to the presence of the marginal consistency soils encountered in the borings, a third boring, designated B-36, was drilled to the 55.5 foot depth at the IH-10 elevation near the center bent. The boring encountered very loose to slightly compact silty sand in the upper 20 feet, and soil consistency increased from compact to dense below that depth. Applicable boring logs B-7, B-8 and B-36 are included in Appendix B.

The boring locations are shown on the Plan of Borings, Figure 1. A Generalized Subsurface Profile is presented on Figure 2. Also shown on the profile are the original TxDOT "Test Hole" logs based on the stratigraphy shown on the as-built plans (included in Appendix A). The subgrade elevation shown for the IH-10 was obtained from the project plan set, sheet K-127. It can be seen that boring B-36 indicates relatively lower consistency soils than previous borings Test Hole 17, 16 and 15. It should be noted that boring B-36 was drilled approximately 22 feet south of the southern-most bridge column and 7.3 feet north of the median barrier, as shown on Figure 1.

Oregon Street Bridge. Boring B-23 was drilled near the north abutment of the Oregon Street bridge. Boring B-37 was drilled at the IH-10 elevation near the center bent. In general, the borings encountered medium consistency to dense sand, silty sand, sandy lean clay to the boring termination depths of 41.5 feet (B-23) and 55.5 feet (B-37).

Detailed descriptions of the subsurface conditions are presented in the boring logs included in Appendix B. PSI provided boring logs for a separate but nearby geotechnical investigation performed by PSI for a different client. Three of those logs (designated B-2, B-4 and B-5) were provided to the URS design team for use in evaluation of the subsurface conditions at this bridge. The borings were drilled on the parcel located at the southeast quadrant of the intersection of Wyoming and Oregon Street as part of the planned Artspace project. The boring information was provided to this team as a courtesy and should not be relied upon for design. A boring plan and boring logs for B-2, B-4 and B-5 are included in

Appendix B. The nearby borings indicate similar soil conditions encountered in B-23 and B-37 consisting of medium dense to dense silty sand and clay.

The boring locations are shown on the Plan of Borings, Figure 3. A Generalized Subsurface Profile is presented on Figure 4. Also shown on the profile are the original TxDOT "Test Hole" logs based on the stratigraphy shown on the as-built plans (included in Appendix A). The subgrade elevation shown for the IH-10 was obtained from the project plan set, sheet K-163. It can be seen that borings indicate similar soil conditions consisting of dense sands and gravels, and lower very hard clay.

Foundation Capacity Analyses

Foundation capacity analysis of the abutment piles and spread footings were calculated using design charts presented in the 2006 TxDOT Geotechnical Manual. The charts are used to obtain allowable unit skin friction and allowable point bearing pressures based on Texas Cone Penetration (TCP) blow counts (N), inches of penetration, and a correction factor (C) based on soil type. Two sets of charts are provided; one set for N < 100 for 12" of penetration and one set for N > 100 for 12" of penetration. The values obtained from the charts are based on a Factor of Safety of 2.0.

As shown on the as-built plans included in Appendix A, foundations consist of H-piles supporting the abutments and spread footings supporting columns at the center bent. A brief discussion of our analyses and results are provided in the following sections for the abutments and the center bent.

Abutment Piles. For this project, the subsurface profile was first discretized into individual layers corresponding with the reported N values. The allowable unit skin friction and allowable point bearing for each layer was determined individually. Next, the total length of pile capable of developing skin friction resistance was estimated. In each case, this was considered to be the length of pile founded at and below the elevation of IH-10 roadway surface (neglect the contribution of sloping embankments). The skin friction resistance from each layer soil layer acting on the pile was summed, and point bearing resistance of soil at the foundation base was selected to determine a total allowable axial pile capacity neglecting battered piles.

The structural properties and dimensions for 12BP53 steel H-piles were not readily available, so dimensions for similar 12HP53 steel H-piles were used in this analysis. The total allowable pile capacity was computed considering both skin friction and point bearing.

Total allowable skin friction capacity was calculated as follows:

$$Q_{F,allowable} = P\sum L_i \times S_{F,i}$$

where: P = pile perimeter, or surface area per unit length = *5.81 ft*
L = incremental length of pile within each soil layer
S_F = allowable unit skin friction [tsf] for each soil layer = N/C_F

Total allowable point bearing capacity was calculated as follows:

$$Q_{PB,allowable} = A_t \times S_{PB}$$

where: A_t = cross-sectional area of pile = *15.5 square-inches = 0.108 square-feet*
S_{PB} = allowable point bearing [tsf] of soil below pile tip = N/C_{PB}

The total allowable capacity $Q_{T,allowable}$ is calculated by summing the full values of $Q_{F,allowable}$ and $Q_{PB,allowable.}$. Due to the relatively lower consistency of soils at the Stanton Bridge, capacities were calculated for this bridge only.

- <u>NW Abutment Pile Foundations</u>
  - Allowable Skin Friction Capacity = 47.9 tons/pile
  - Allowable Point Bearing Capacity = 0.33 tons/pile
  - Total Allowable Capacity = 48.3 tons/pile > 40.4 tons/pile shown on 1967 drawings

- <u>SE Abutment Pile Foundations</u>
  - Allowable Skin Friction Capacity = 52.7 tons/pile
  - Allowable Point Bearing Capacity = 0.39 tons/pile
  - Total Allowable Capacity = 53.0 tons/pile > 40.4 tons/pile shown on 1967 drawings

Accordingly, the available vertical load carrying capacity at the Stanton bridge abutments is approximately 16 to 23% higher than current loading. Since structural loadings are similar at the Oregon Street bridge, and geotechnical subsurface conditions (i.e. soil composition

and consistency) are equivalent or better, load carrying capacity for that bridge will be similar. Reported load increase due to the concrete slab overlay and the streetcar at the abutments is about 10% which is within the allowable range.

Center Bent. The dimensions of the spread footing bridge bent foundation are known based on the 1967 record drawings. The 2 outer footings are smaller (9.5-ft x 9.5-ft) than the middle footing (10-ft x 10-ft) at the center column. Consequently, the outer footings have a lower bearing area, and thus were used for this analysis. The capacity of the spread footings are derived entirely from point bearing, and were calculated as follows:

$$Q_{T,allowable} = A_t \times S_{PB}$$

where: A_t = area of footing in contact with soil = *90.25 square-feet*

S_{PB} = allowable point bearing [tsf] of soil below the footing = N/C_{PB}

Using the Test Hole No. 16 data, and a TCP blowcount of 48 bpf, an allowable bearing capacity of 2.58 tsf is calculated using the TxDOT capacity charts. However, using blowcounts from the upper 20 feet of boring B-36, the capacity could be as low as 1 tsf. Evaluating allowable bearing pressure using conventional methods based on SPT (Schmertmann, Meyerhof) yields an allowable bearing pressure on the order of 2.2 tsf for 1 inch of settlement, based on the following TCP blowcounts (N_{TCP}) to SPT blowcounts (N_{SPT}) correlation:

$$N_{TCP} = 2N_{SPT}$$

Boring B-36 would indicate that the footings are bearing on soils susceptible to settlement. Foundation improvement is recommended at the Stanton Street bridge center bent.

Foundation Evaluation and Recommendations

It is understood from the structural engineer, David McDonnold, P.E., that the addition of a concrete layer (currently designed as 2.8 inches thick) over the entire bridge deck will increase foundation loads by 11 to 16 percent. It is also understood that the live loading on the bridge deck by the streetcar is within the H20-44 loading used for the original design.

Based on the boring information presented herein and foundation capacity calculations using TxDOT capacity charts, we offer the following conclusions and recommendations regarding the subject bridges:

- **Abutments.** Based on our calculations and understanding of the proposed loading, the abutments at the Stanton Street bridge and the Oregon Street bridge can accommodate additional loads on the order of 11 to 16% and maintain a suitable factor of safety.

  A 2.8-inch thick concrete overlay is planned over the existing approach slabs. Additional load on the subgrade soils at the abutments/approach slabs is reported to be on the order of 12% due to the concrete overlay. Existing subgrade soils should be able to sufficiently support the intended loads. However, some settlement has been occurring as evidenced by shifting pedestrian sidewalks relative to the sidewalks over the bridge, and recent repairs to sidewalk crosswalks. The planned 12-inch thick track slab should be continued up to the existing approach slab. Design drawings should include details for a structural transition between the slabs, such as steel dowels, to accommodate differential movements beneath the load bearing slabs.

- **Center Bent – Oregon Street Bridge.** Based on reported TCP data and calculations presented herein, the center bent at the Oregon Street bridge can accommodate loads on the order of 2.58 tsf and higher using TxDOT capacity charts. Reported additional load from the streetcar construction will impose foundation bearing stress of 2.78 tsf at the outer footings and 2.18 tsf at the center footing (average bearing stress per footing of 2.66 tsf). Referring to the average bearing stress of 2.66 tsf, this stress slightly exceeds the allowable bearing pressure with a factor of safety of 2.0. Loading this foundation approximately 8% higher than current will lower the factor of below 2.0. Typically, a safety factor of 2.0 (and sometimes 3.0) is applied to limit settlement to 1 inch or less. Increasing the foundation stress at the center bent at the Oregon Street bridge may induce settlement. Referring to measured blowcounts in boring B-37 (Figure 4), the calculated settlement will be on the order of ½ inch or less for the proposed 8% increase in foundation loading.

- **Center Bent – Stanton Street Bridge.** Boring data obtained for this project at the Stanton Street bridge indicate low to moderate consistency soils at the bearing elevation of the center bent footings to a depth of at least 1B (one times the footing width). Comparison of the as-built survey information (1969) and the current project survey indicate that the bridge is nearly at the same elevation as when it was built, and no appreciable sag or deflection distress is noted, other than settlement at the abutments which is typical for bridge approaches. However, based on the boring data, we recommend that the foundation conditions beneath the center bent of the Stanton Street bridge be improved.

  After considering several foundation improvement options, we recommend that the foundation soils supporting the center bent at the Stanton Street bridge be stiffened by pressure grout injection. The pressure grout program will be designed to stabilize existing soils by increasing the mass stiffness of the bearing soils. The program will be designed to limit injection pressures to 1 psi per foot of depth/overburden.

  A plan showing the general grout hole location layout is presented on Figure 5. This exhibit shows grout hole locations on either side of the center bent columns along the bent centerline (on top of the vertical barrier wall) and two grout holes in between the footings. These grout holes are numbers G1 through G8. It is understood that this vertical barrier wall may require removal for retrofitting of columns on top of the spread footing.

  Two additional grout lines are recommended along the base of the vertical barrier wall, on either side of the bent. The grout holes are numbers G9 to G14 along the north side, and G15 to G20 along the south side of the bent. The location of the footings beneath the columns (shown as dotted lines) was approximate based on the 1969 foundation drawings, and survey data of the barrier wall obtained for this project. Because this plan is approximate, grout holes along the north and south sides of the center bent may or may not encounter the footing (i.e. G9, G10) but are sufficiently close to the footing in order to improve bearing conditions.

The recommended pressure grout program will include improvement of foundation soils approximately 10 feet below the footing depth which will be about 13 to 15 feet below the existing roadway surface. The grout will likely consist of neat cement (1 bag cement per 5 gallons of water) with a minimum 28-day compressive strength of 3,000 psi. Cored holes through the concrete pavement and footing will be 4-inches in diameter, and grout hole diameter will be about 1-inch. The grout holes will be drilled vertically, and grout probes will be fixed to the concrete surface during injection. Maximum grout pressures will be limited to the overburden depth, estimated 5 to 15 psi. Survey control points will be established at the center bent columns and monitored during grouting to confirm that the bent is not being lifted by the injection process.

Conditions

Since some variation was found in subsurface conditions at the boring locations, all parties involved should take notice that subsurface conditions may vary significantly between boring locations. Statements in the report as to subsurface variation over given areas are intended only as estimations from the data obtained at specific boring locations.

The professional services that form the basis for this report have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in the same locality. No other warranty, express or implied, is made as the professional advice set forth. This scope of work did not include and investigation, detection, or design related to the presence of any recognized environmental pollutants.

Technical review by Mr. Subal Sarkar, P.E., Principal Engineer, URS Dallas.

ADDENDUM 2 - JULY 14, 2015

* * *

The following attachments complete this report:

Plan of Borings (Stanton Street Bridge)	Figure 1
Generalized Subsurface Profile (Stanton)	Figure 2
Plan of Borings (Oregon Street Bridge)	Figure 3
Generalized Subsurface Profile (Oregon)	Figure 4
Pressure Grout Exhibit at Stanton Street Bridge	Figure 5
Appendix A	As-Built Drawings (dated June 1967)
Appendix B	Applicable Boring Logs Plan of Borings (PSI Artspace borings)

ADDENDUM 2 - JULY 14, 2015

FIGURES

ADDENDUM 2 - JULY 14, 2015

N

0 50 100 Feet

1 in = 100 feet

Legend

Primary Route

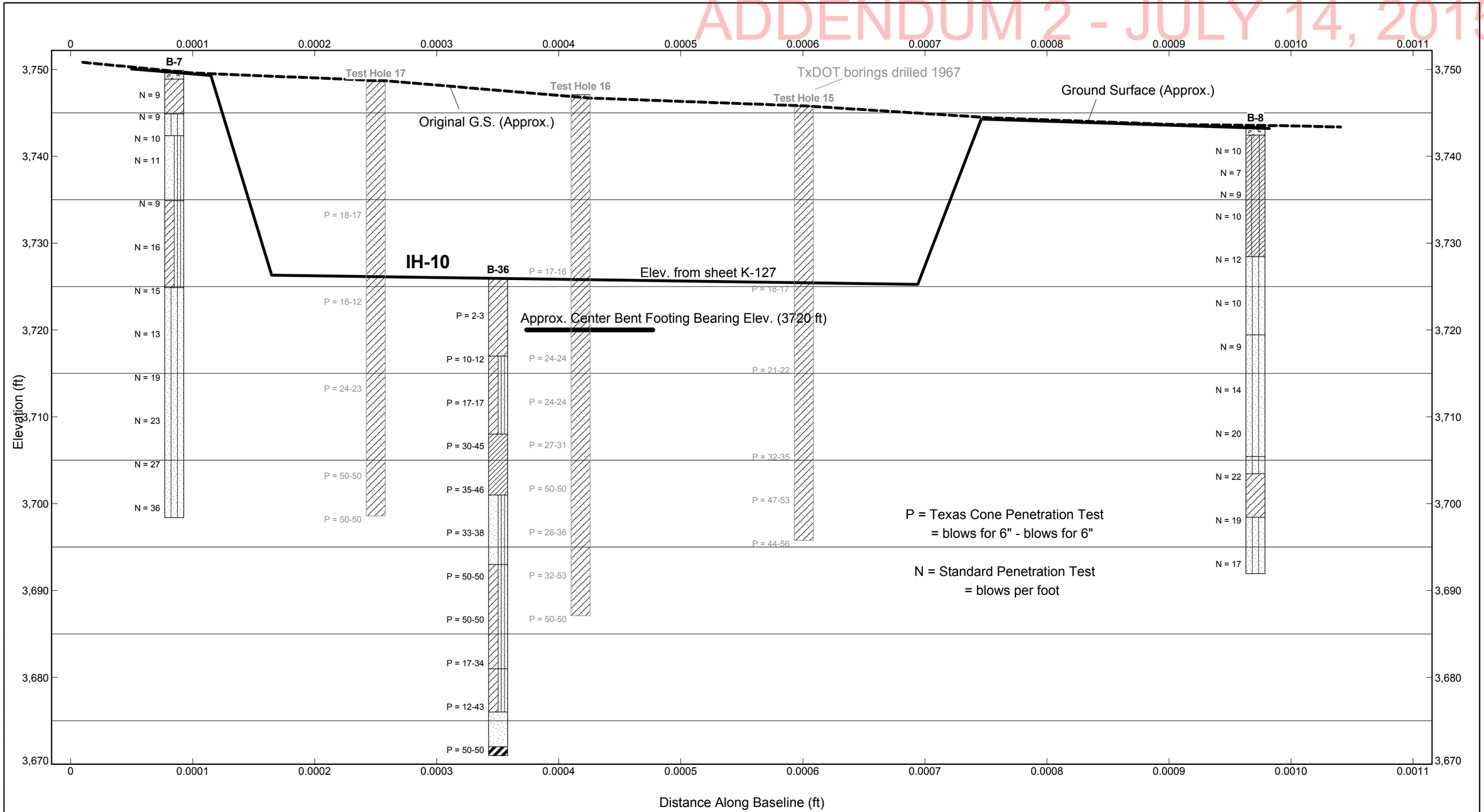
Boring drilled by PSI for this current study

Boring drilled by TxDOT in 1967 for original bridge design and construction

Figure 1
Plan of Borings
Stanton Street Bridge

El Paso Streetcar Project

ADDENDUM 2 - JULY 14, 2015



LITHOLOGY GRAPHICS

- Concrete
- USCS Clayey Sand
- USCS Silty Sand
- USCS Poorly-graded Sand with Silt
- USCS Clayey Sand
- Silty Clayey Sand
- USCS Low Plasticity Clay
- USCS Poorly-graded Sand
- USCS High Plasticity Clay

URS

GENERALIZED SUBSURFACE PROFILE

Project: City of El Paso Streetcar

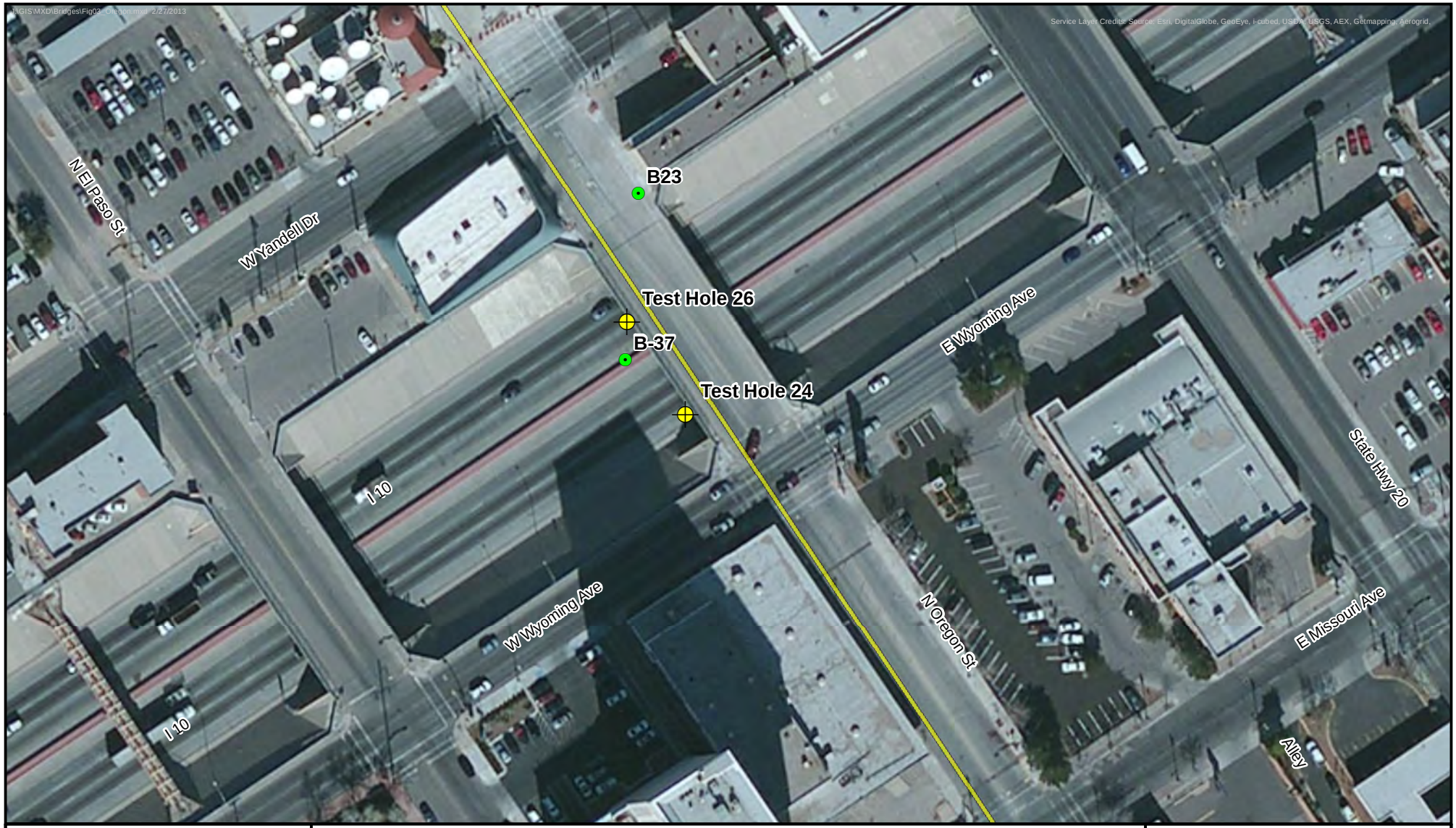
Location: STANTON BRIDGE

Number: 41010530.052

Figure 2

SIMPLE FENCE 11X17 PSI.GPJ FUGRO AUSTIN DATA TEMPLATE.GDT 02/20/13 14:54

ADDENDUM 2 - JULY 14, 2015



N

0 50 100 Feet

1 in = 100 feet

Legend

Primary Route

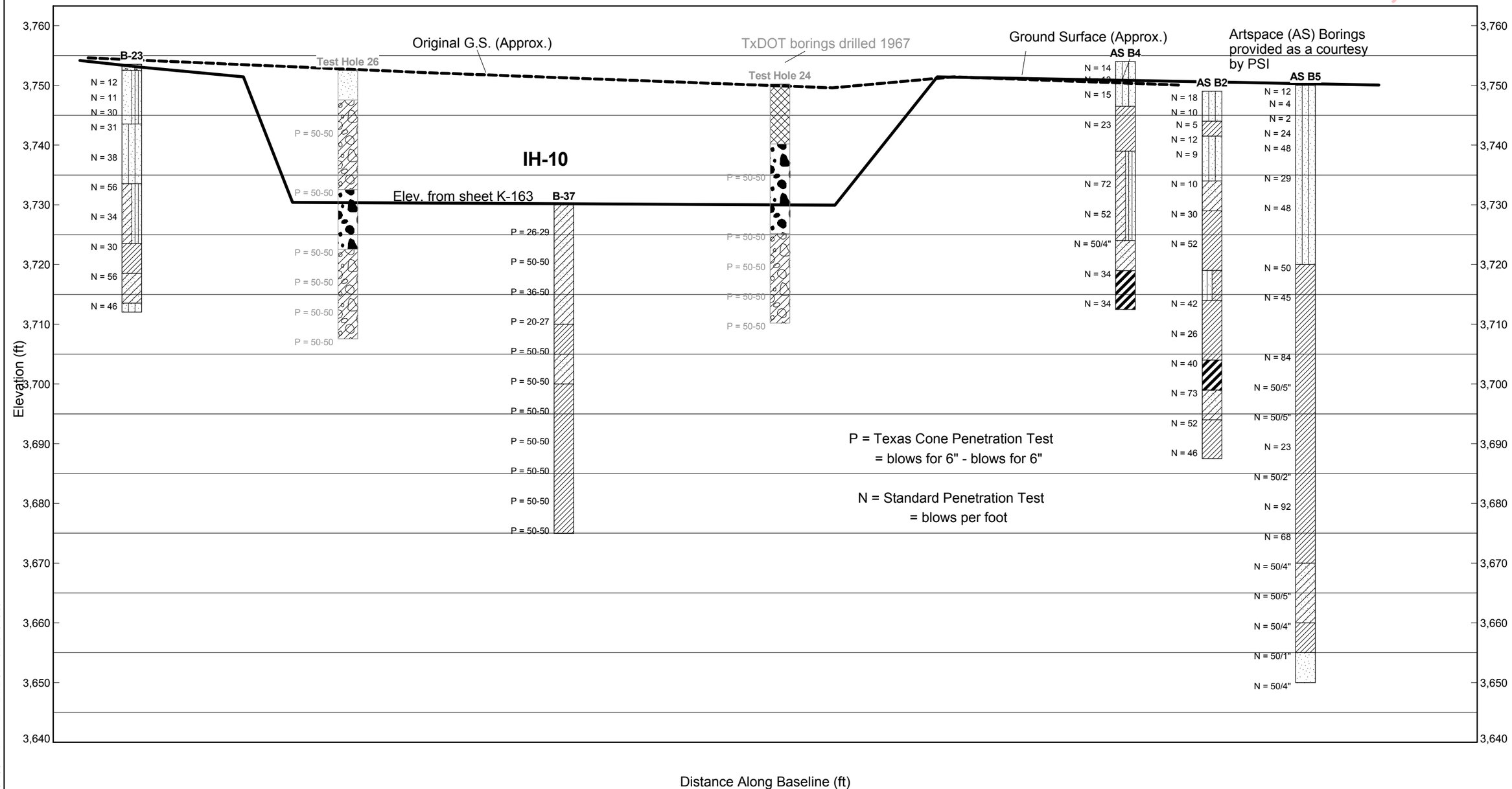
Boring drilled by PSI for this current study

Boring drilled by TxDOT in 1967 for original bridge design and construction

Figure 3
Plan of Borings
Oregon Street Bridge

El Paso Streetcar Project

ADDENDUM 2 - JULY 14, 2015



LITHOLOGY GRAPHICS

- USCS Silty Sand
- USCS Low Plasticity Clay
- USCS Clayey Sand
- Silty Sand to Clayey Sand
- USCS High Plasticity Clay
- USCS Clayey Sand
- USCS Poorly-graded Sand
- Concrete
- USCS Poorly-graded Sand with Silt
- Fill (made ground)
- USCS Well-graded Gravel
- USCS Clayey Gravel

URS

GENERALIZED SUBSURFACE PROFILE

Project: City of El Paso Streetcar

Location: OREGON BRIDGE

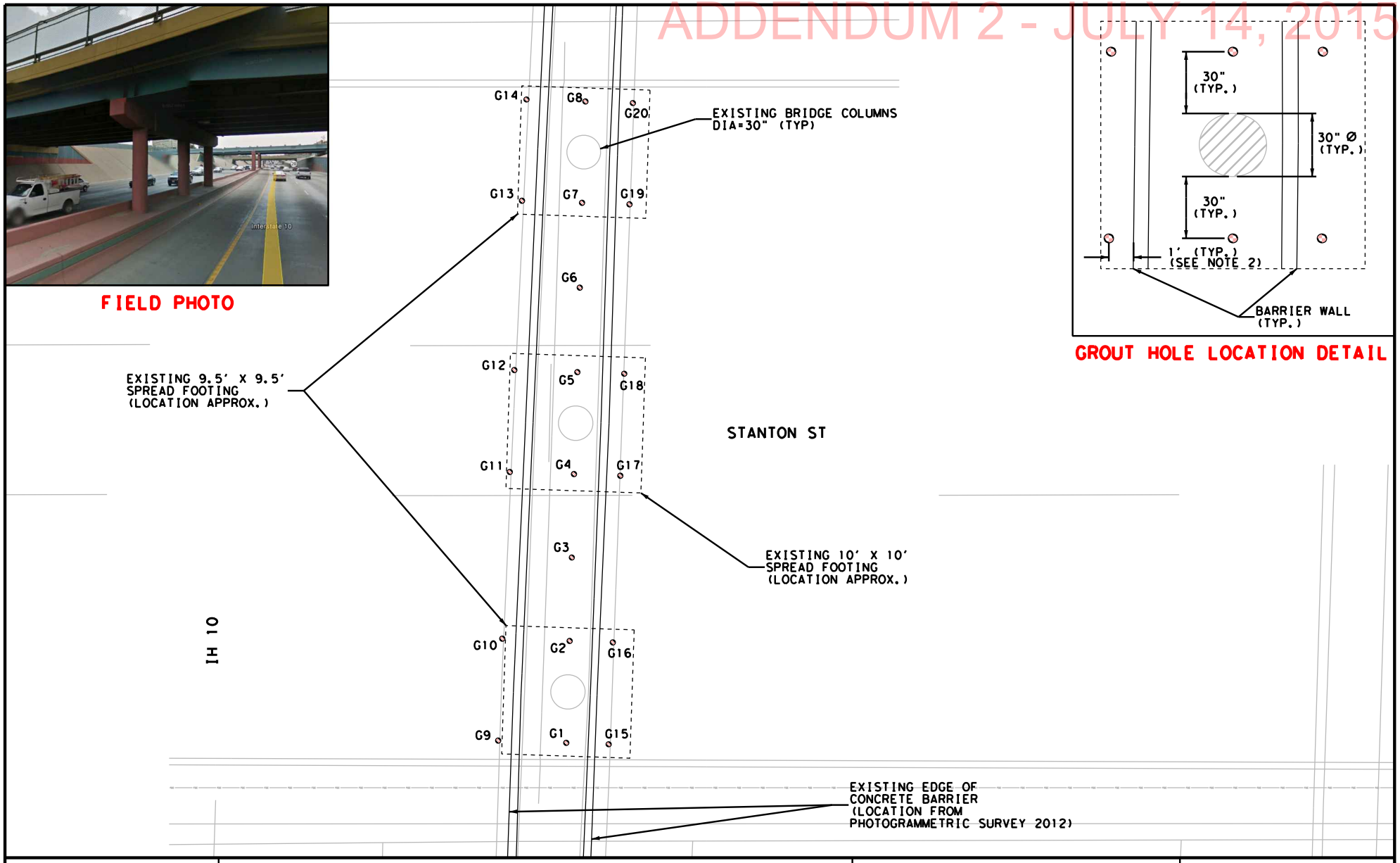
Number: 41010530.052

Figure 4

SIMPLE FENCE 11X17 PSI.GPJ FUGRO AUSTIN DATA TEMPLATE.GDT 02/20/13 16:59

ADDENDUM 2 - JULY 14, 2015

FIELD PHOTO



GROUT HOLE LOCATION DETAIL

URS
9400 AMBERGLEN BOULEVARD
AUSTIN, TEXAS 78729
512.454.4797
TBPE FIRM #3162

FIGURE 5

STANTON BRIDGE PRESSURE GROUTING HOLE EXHIBIT

NOTES:

1. G1-G8 LOCATED TOP OF BARRIER WALL.

2. G9-G20 LOCATED AT 1 FT MINIMUM OFFSET FROM BARRIER WALL TOE AT PAVEMENT SURFACE.

3. GROUT HOLE LOCATIONS MAY VARY BASED ON FIELD CONDITIONS AND APPROVAL OF ENGINEER.

N

0' 5' 10'
SCALE IN FEET

c:\pw*v8i*ged\working\matt*williamson\dms03078\GEO*BRG*02.dgn

ADDENDUM 2 - JULY 14, 2015

APPENDIX A

As-Built Drawings (June 1967)
Partial Plan sheets

ADDENDUM 2 - JULY 14, 2015

NBI

INDEX OF SHEETS

DESCRIPTION	SHEET NO.	DESCRIPTION
Title Sheet	37-41	Parapet Wall Layouts
Basis of Estimate & General Notes	42	Parapet Wall Details
Typical Sections	43	Retaining Wall Layout
Estimate & Quantity Sheet	44-45	Retaining Wall Details
Structure & Parapet Wall Summary Sheet	46-47	Railing Layout (Ty E-3)
Construction Sequence & Traffic Phasing	48-54	Bridges: Santa Fe St & Mesa Ave Underpass
Waste Material Disposal Site	55-62	El Paso, Oregon & Stanton St Underpass
Utility Sheets	63-66	Wingwall Details 58 & 68 Omitted
Horizontal Control Sheets	67-76	Kansas St. Underpass
Vertical Control Sheets	77	Utility Bridge Web Wall Details
Horiz-Vert. Control at Cross Sts.	78-81	Bridge Approach Slab Details
Roadway Details	82-83	Joint Seals, JS-65 & PJS
* Sheet Omitted	84	Combination Rail, C-4 (Mod.)
** Sheets Omitted	85-87	Med. Rail, Ty E-3 W/Adj. Bar Fe
Ground Wer Details	88	Chain Link Ser Fe., CLF-61
Storm Sewer Layout	89	Right of Way Mkr., M-61
Inlet Computations	90	CPCR-S-65 (Spl)
Storm Sewer Computations & Quan.	91	CPCR(DW)-65A(Spl)
Curb & Grate Inlet, Ty B, CG2	92	Riprap Details
Grate Inlet, Ty C, G2	93-94	BW-61 (141)
	95	C15-67
	96	Mat'l Sm Gdfe, GF(TD)-67A

12A, 13: 45A FIELD CHANGE No 7

STATE OF TEXAS
STATE HIGHWAY DEPARTMENT

FINAL

PLANS OF PROPOSED STATE HIGHWAY IMPROVEMENT

FEDERAL AID PROJECT.
I-10-1 (101) 019

SCALES: PLAN 1 IN. = 40 FT. PROFILE 1 IN. HOR. = 40 FT. 1 IN. VERT. = 8 FT. CROSS-SECTIONS 1 IN. HOR. AND VERT. = 5 FT. OTHERS AS NOTED.

NET LENGTH OF PROJECT = 15950 FT = 0.358 MI.

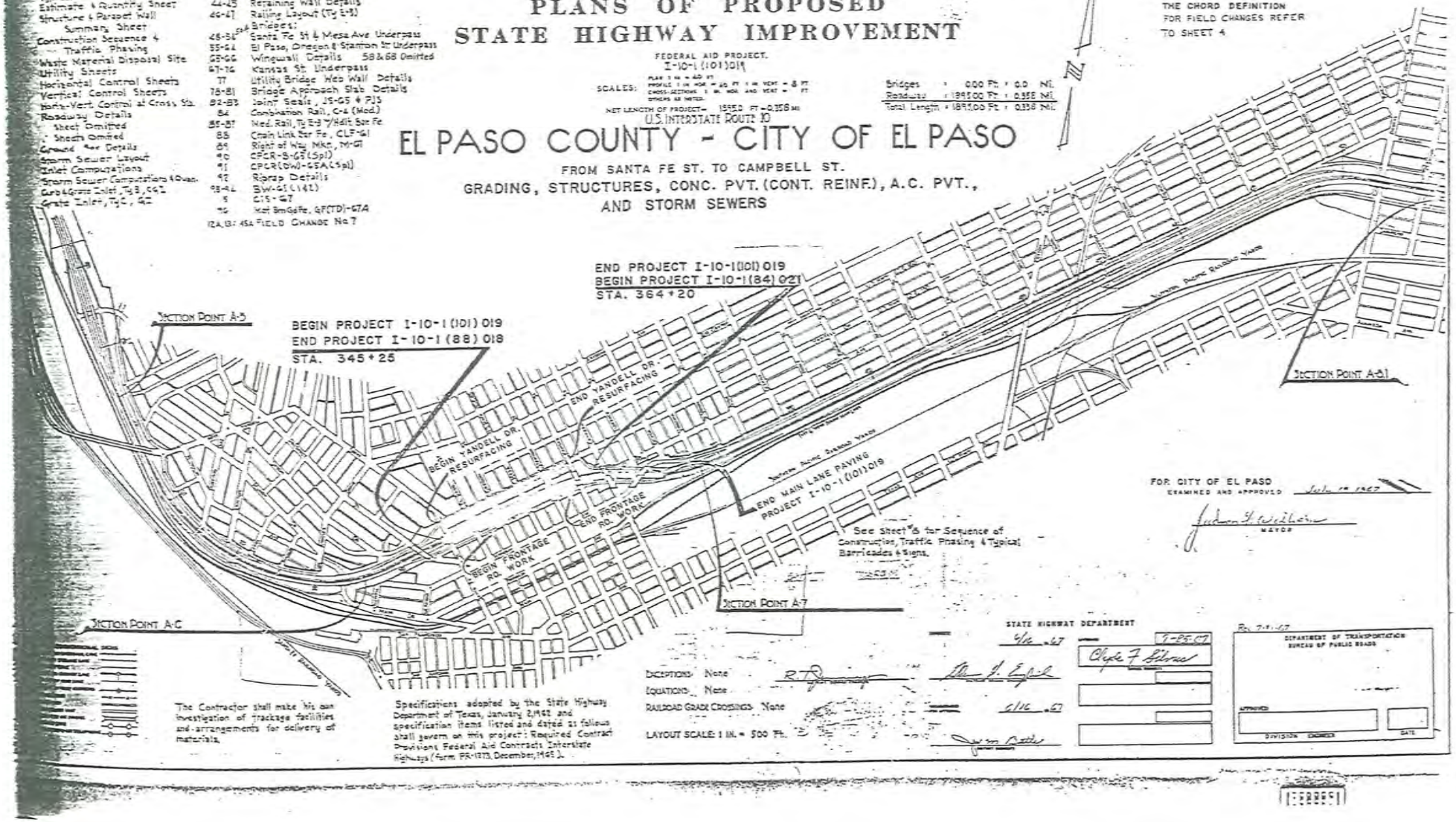
Bridges	=	0.00 Ft.	= 0.0 Mi.
Roadway	=	1895.00 Ft.	= 0.358 Mi.
Total Length	=	1895.00 Ft.	= 0.358 Mi.

U.S. INTERSTATE ROUTE 10

EL PASO COUNTY - CITY OF EL PASO

FROM SANTA FE ST. TO CAMPBELL ST.
GRADING, STRUCTURES, CONC. PVT. (CONT. REINF.), A.C. PVT., AND STORM SEWERS

DESIGN SPEED 50 MPH
ELEVATIONS FOR THIS PROJECT ARE BASED ON CITY DATUM
CURVE DATA IS BASED ON THE CHORD DEFINITION
FOR FIELD CHANGES REFER TO SHEET 4



FOR CITY OF EL PASO
EXAMINED AND APPROVED July 19 1967
Judson H. Walker
MAYOR

STATE HIGHWAY DEPARTMENT
6/16 67
Clyde F. Gibson
6/16 67

DEPARTMENT OF TRANSPORTATION
BUREAU OF PUBLIC ROADS
APPROVED
DIVISION ENGINEER
DATE

EXCEPTIONS: None
EQUATIONS: None
RAILROAD GRADE CROSSINGS: None
LAYOUT SCALE: 1 IN. = 500 FT.

The Contractor shall make his own investigation of trackage facilities and arrangements for delivery of materials.

Specifications adopted by the State Highway Department of Texas, January 2, 1962 and specification items listed and dated as follows shall govern on this project: Required Contract Provisions Federal Aid Contracts Interstate Highways (Form PR-1273, December, 1965).

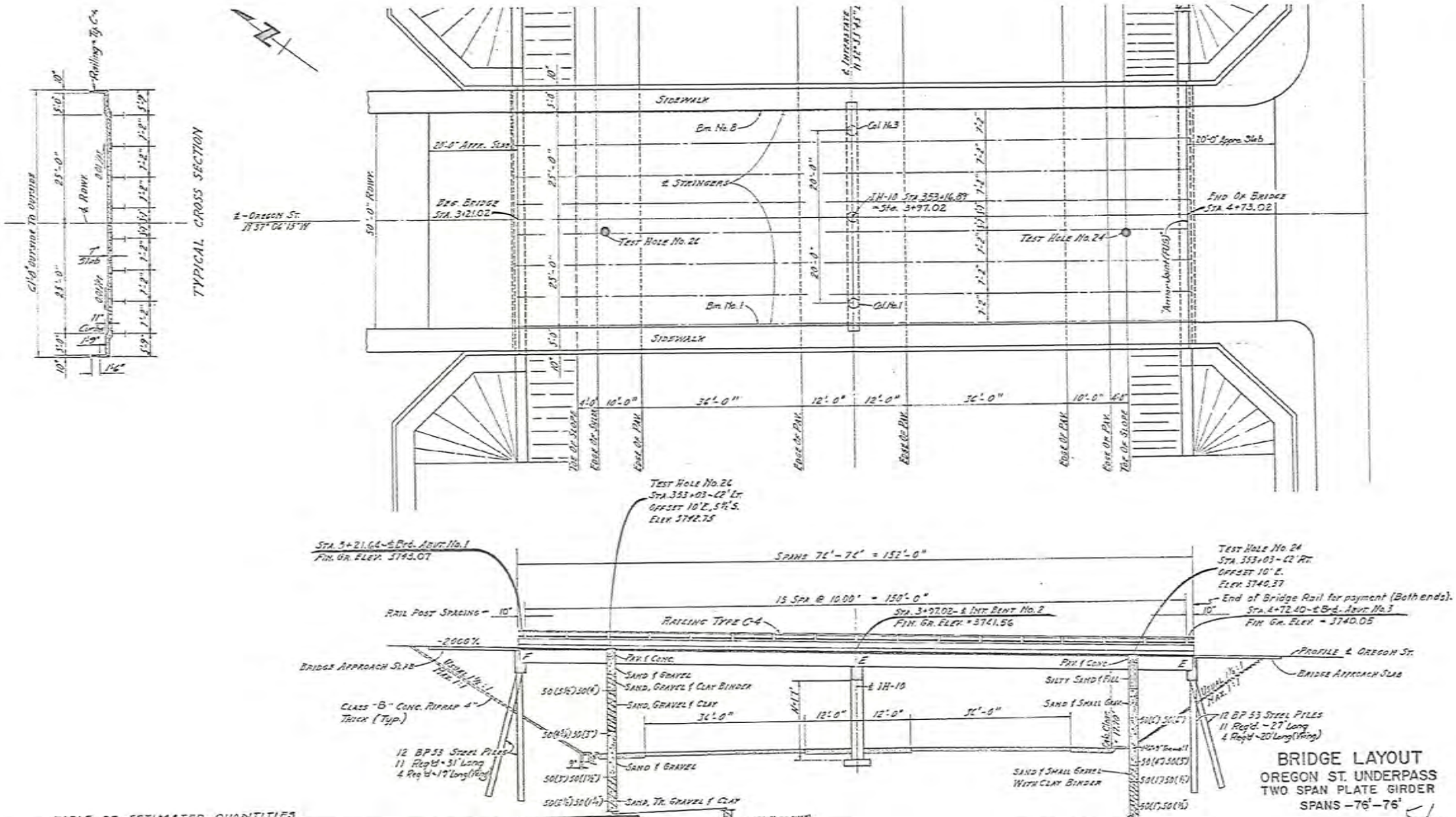
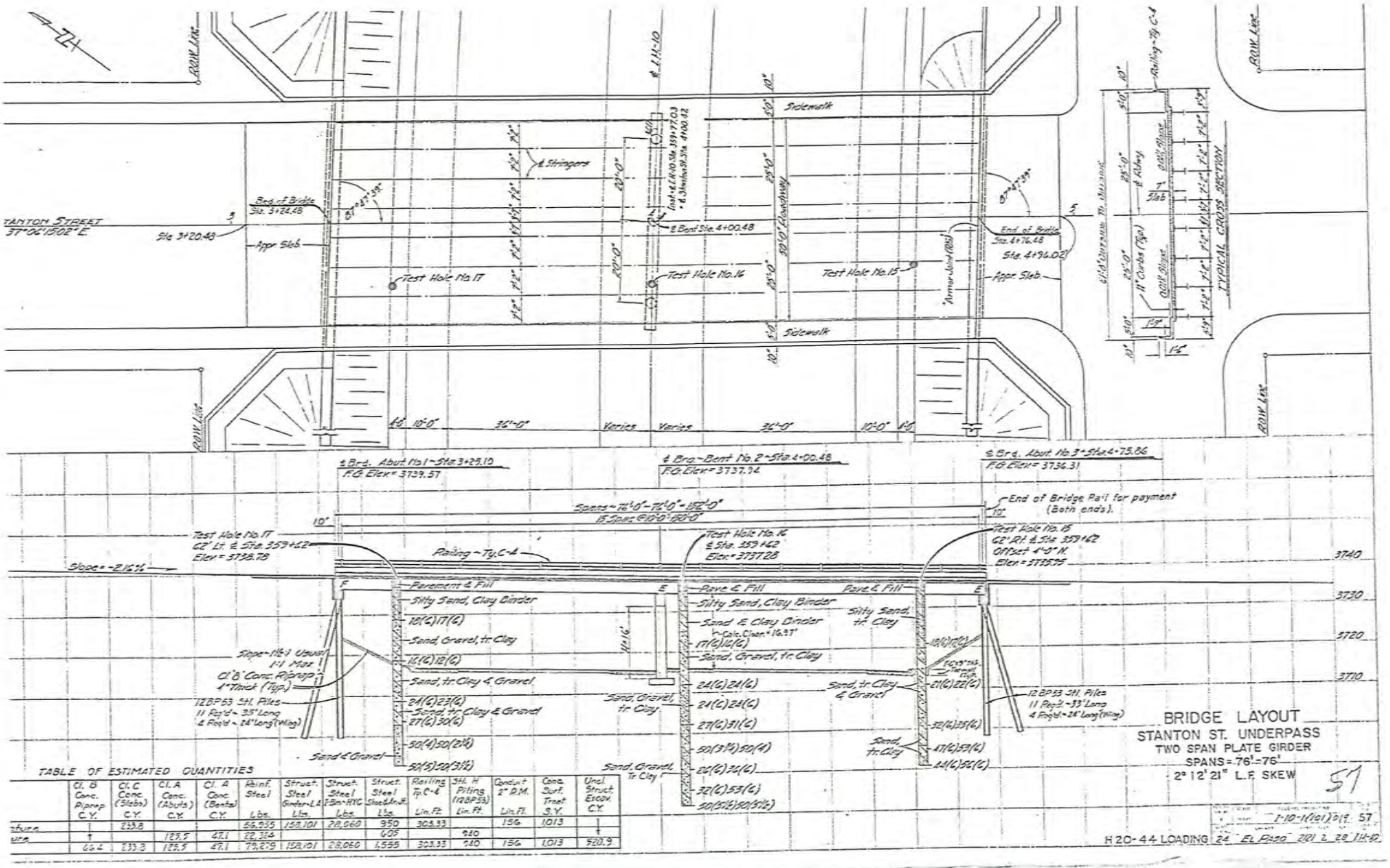


TABLE OF ESTIMATED QUANTITIES

	Cl. B Conc. Riprap C.Y.	Cl. C Conc. (Slabs) C.Y.	Cl. A Conc. (Abuts.) C.Y.	Cl. A Conc. (Bents) C.Y.	Reinf. Steel Lbs.	Struct. Steel Girder-L.A. Lbs.	Struct. Steel Bm.-R.R. Lbs.	Struct. Steel Stop & Ap. P. Lbs.	Railing Tp. C-4 Lin. Ft.	Sil. H Piling (12 BP 53) Lin. Ft.	Conduit 2" R.M. Lin. Ft.	Conc. Surf. Treat. S.Y.	Unclassified Excav. C.Y.
...cture		233.8			56,955	156,101	28,060	950	303.33		156	1013	
...ure			144.0	47.8	24,893			605		794			
	73.0	233.8	144.0	47.8	81,848	156,101	28,060	1,555	303.33	794	156	1013	401.6

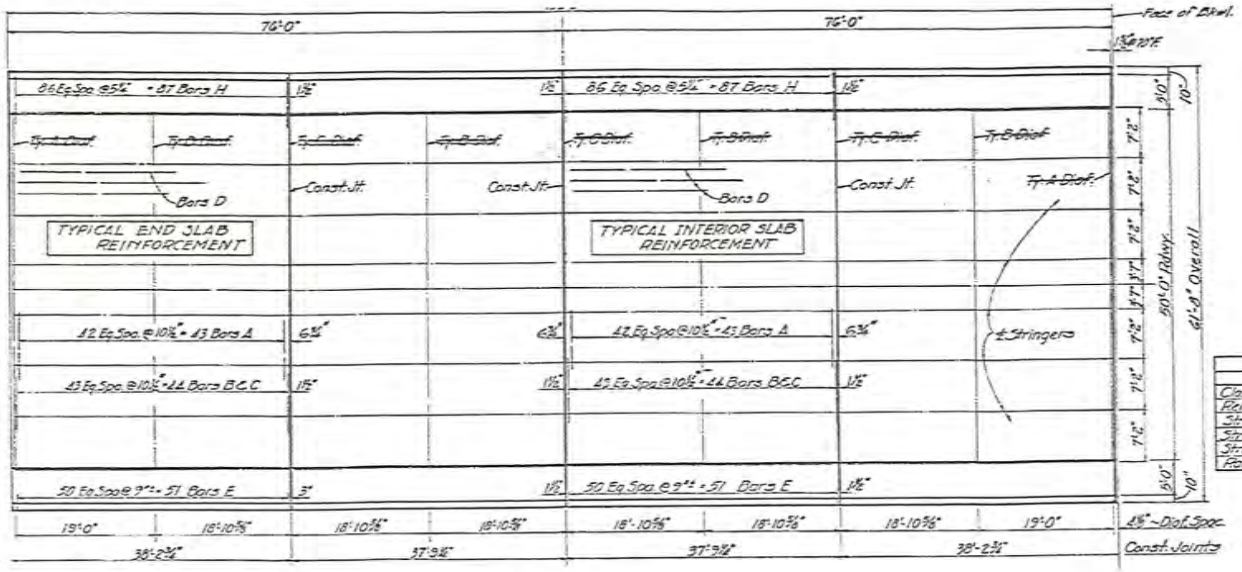
ADDENDUM 2 - JULY 14, 2015



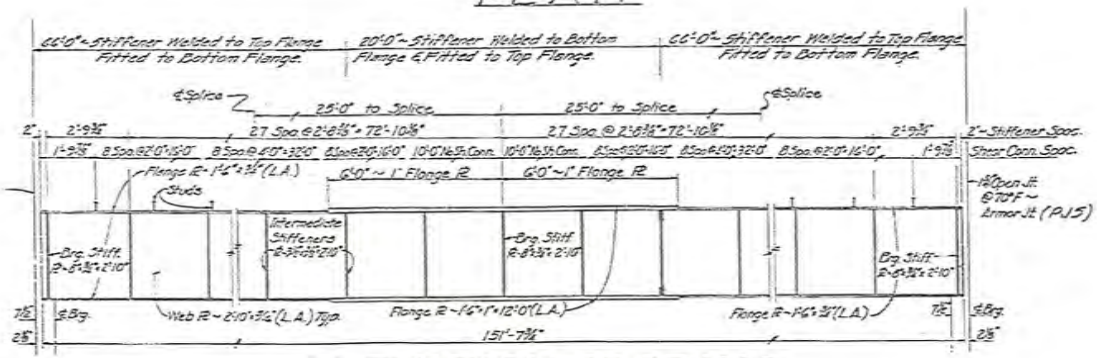
	Cl. B Conc. Riprap C.Y.	Cl. C Conc. (Slabs) C.Y.	Cl. A Conc. (Abuts.) C.Y.	Cl. A Conc. (Bents) C.Y.	Reinf. Steel Lbs.	Struct. Steel Girders & L.B. Lbs.	Struct. Steel T-Bm. & H.C. Lbs.	Struct. Steel Shoes & Anch. Lbs.	Railing Ty. C-4 Lin. Ft.	Stl. H Piling (12BP53) Lin. Ft.	Conduit 2" D.M. Lin. Ft.	Conc. Surf. Treat. S.Y.	Uncl. Struct. Excav. C.Y.
Structure	1	233.8			56,955	158,101	28,060	950	303.33		156	1,013	1
Wing	1		189.5	47.1	22,364			609		240			1
	66.4	233.8	189.5	47.1	79,279	158,101	28,060	1,555	303.33	240	156	1,013	520.9

51

ADDENDUM 2 - JULY 14, 2015

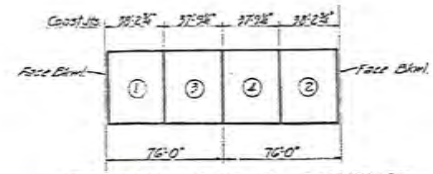


PLAN



ELEVATION OF BEAMS

Note: Plate Girders shall be fabricated from Low Alloy Steel. (L.A.)
On all outside stringers, intermediate stiffeners to be placed on inside of beam only; on all inside stringers, the stiffeners are to be alternated.
All bearing stiffeners milled to bear.
Refer to Specifications for beam splice details.
Refer to Sheet no. (50 A) for Weld details & Diafram details.



CONCRETE PLACING SEQUENCE

CONSTRUCTION PROCEDURE: After all structural steel is erected, an accurate measurement shall be made of elevations of beam flanges at all control points. Subsequent setting of forms, placing and finishing of concrete shall be governed by these measurements only, taking into account the dead load deflections.

ESTIMATED QUANTITIES		
Item	Unit	Quant.
Class "C" Concrete	Cu. Yds.	233.8
Reinforcing Steel	Lbs.	56,955
Struct. Steel (Girder ~ L.A.)	Lbs.	158,101
Struct. Steel (I Beam ~ HYC)	Lbs.	28,060
Struct. Steel (Shoe & Anchor Jt.)	Lbs.	950
Railing (Type C-4)	Lin. Ft.	303.53

BILL OF REINFORCING STEEL					
Bar	No.	Size	Spa.	Length	Weight
A	172	#5	10½"	54'-10"	9,837
B	176	#5	10½"	53'-2"	9,760
C	176	#5	10½"	50'-6"	9,270
D	[illegible]	#5	[illegible]	[illegible]	9,806
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
E	208	#5	9"	5'-4"	5,270
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
H	696	#5	5½"	7'-11"	5,686
D	125	#5	~	154'-5"*	20,132
Total					56,955

*Includes 2~20 dia. Laps.

GENERAL NOTES:
Design: H20-44 Loading in accordance with A.A.S.H.O. 1965 Standard Specifications ~~and Interim Specifications thereto.~~
All concrete shall be Class C. Chamfer all exposed corners ¾" unless otherwise noted.
All dimensions relating to reinforcing steel are to center of bars.
Design stress for reinforcing steel = 20,000 p.s.i.
No concrete shall be placed until all structural steel is erected and all welding completed in the unit.
See layout sheet for the following: Railing, Rail Post Spacing and location of Fixed and Expansion conditions.
See Railing Sheet for Railing Details.
~~Variation of the concrete placing sequence and location of construction joints, including continuous placement with proper retardation will be permitted. Transverse screeding with an approved machine screed will be permitted at the contractors option. For variance of sequence, continuous placement of concrete or for transverse screeding, the contractors detailed construction procedure shall be submitted through the Engineer and approved by the Bridge Division.~~

Note: See Layout for skew on Stanton St. Bridge.
Bearing Stiffeners and Bearing Diaframs are to be Skewed.

SUPERSTRUCTURE DETAILS
TWO SPAN CONT. STEEL UNIT
76'-76'=152'
50' ROADWAY 5' SIDEWALKS

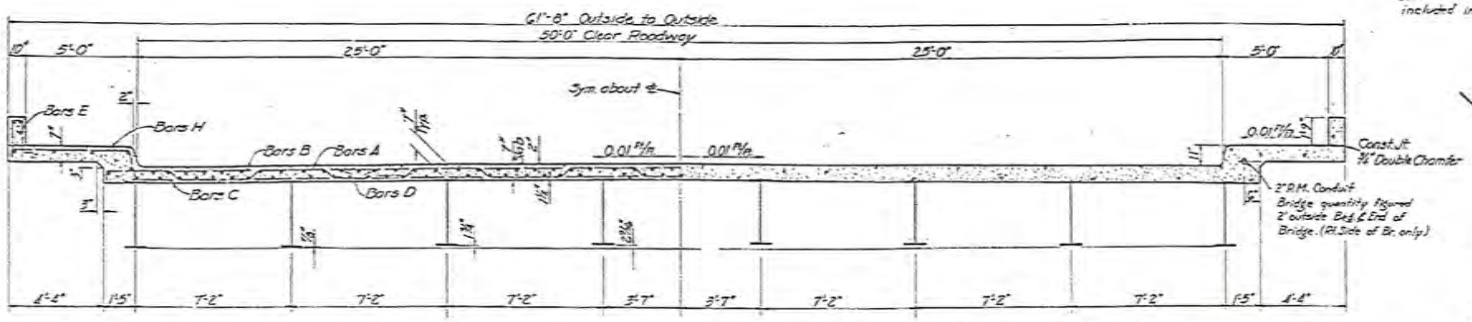
59

H20-44 LOADING
1-10-3(10.1)013 59
24 EL PASO 2013 2 28 EB

Sheet 2 of 3

ADDENDUM 2 - JULY 14, 2015

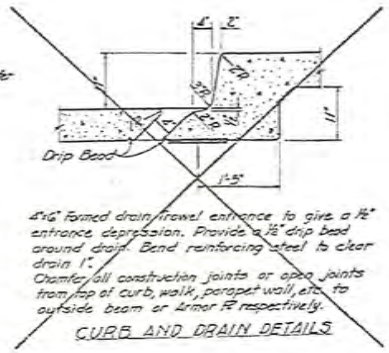
Note: The contractor shall provide and install a commercially manufactured expansion device for electrical conduit at each open joint. The cost of all expansion joints, pull wires, and fittings shall be included in the contract unit price for conduit.



SHOWING TYPICAL REINFORCEMENT

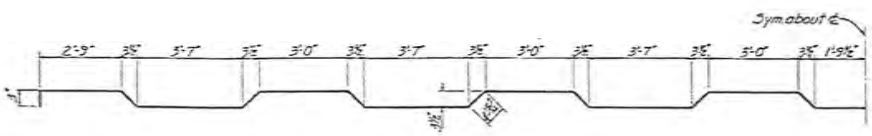
~~SHOWING POWELL'S CONSTRUCTION JOINTS~~

TRANSVERSE SECTION

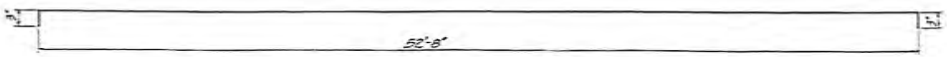


4"x6" Formed drain/travel entrance to give a ½" entrance depression. Provide a ½" drip bead around drain. Bend reinforcing steel to clear drain 1".
Chamfer all construction joints or open joints from top of curb, walk, parapet wall, etc. to outside beam or Armor ⅞ respectively.

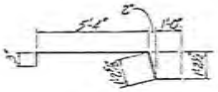
CURB AND DRAIN DETAILS



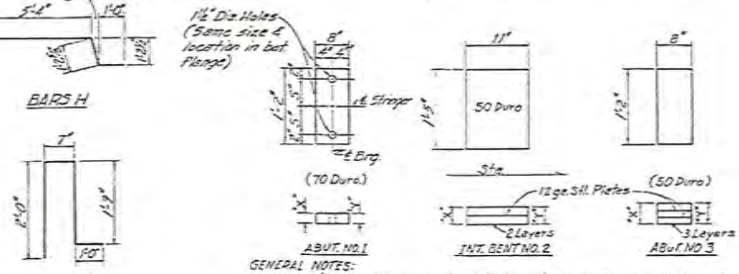
BARS A



BARS B

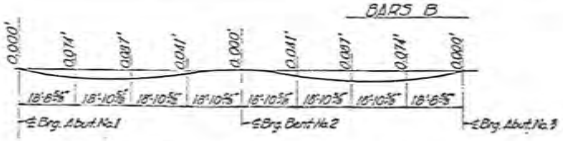


BARS H

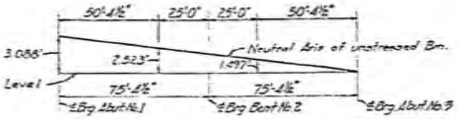


BARS E

GENERAL NOTES:
All parts of a bearing pad shall be vulcanized together to form an integral unit. The top layer of elastomer shall be beveled, if necessary to fit the slope of the erected beam within specified tolerances.
No direct payment shall be made for elastomeric pads; Absorb cost in other bid items.



DEAD LOAD DEFLECTION DIAGRAM
(For Slab & Curb Only)



STRINGER BLOCKING DIAGRAM
EL PASO ST. BRIDGE

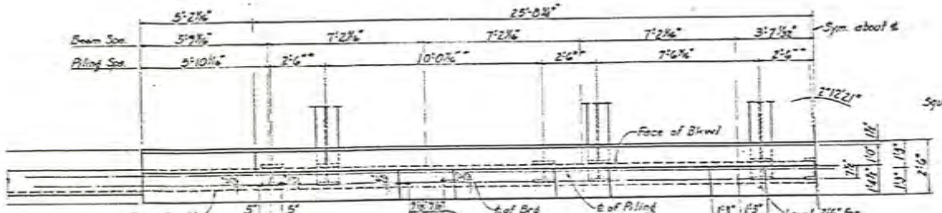
BEARING PAD DIMENSIONS

Bridge	Abut. 1		Bent 2		Abut. 3	
	"X"	"Y"	"X"	"Y"	"X"	"Y"
Stockton	1"	7/8"	1 3/4"	1 1/2"	2 7/8"	2 3/8"
Oregon	1"	7/8"	1 3/4"	1 1/2"	2 1/2"	2 3/8"
El Paso	1"	1 1/2"	1 3/4"	1 1/2"	2 7/8"	2 3/8"

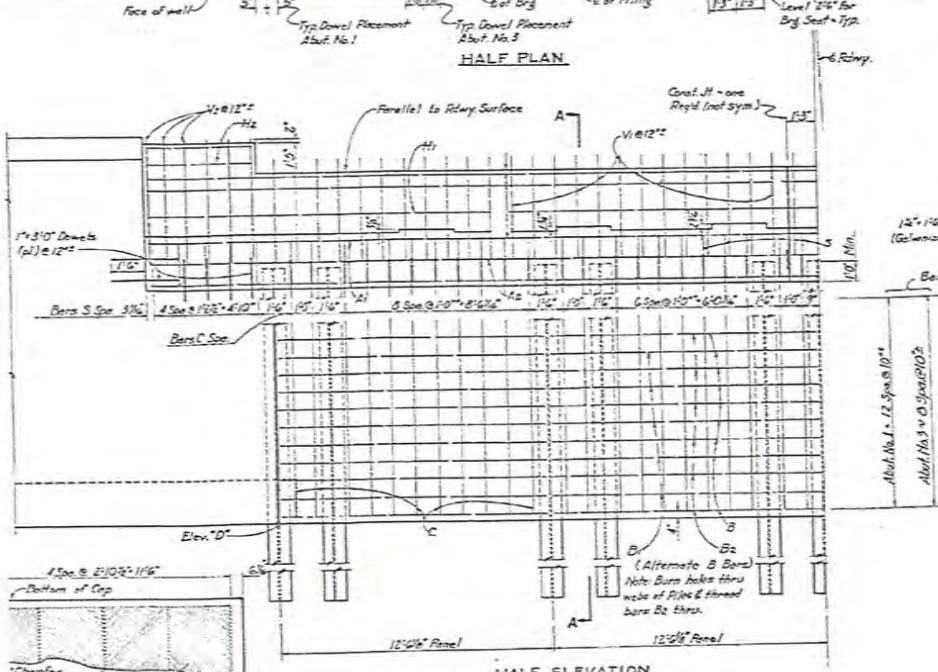
SUPERSTRUCTURE DETAILS
TWO SPAN CONT. STEEL UNIT
76'-76' = 152'
50' ROADWAY 5' SIDEWALKS

60

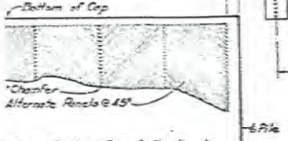
Sheet 3 of 3
F-10-1(101)019 60
H20-44 LOADING 24 EL PASO 2001 2 28 14:10



HALF PLAN



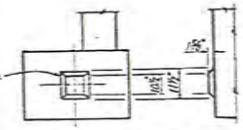
HALF ELEVATION



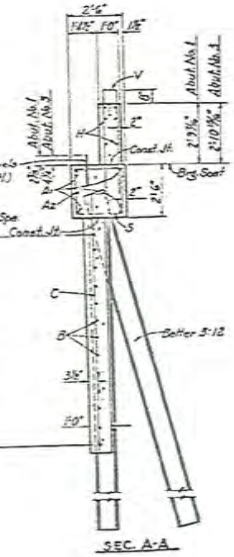
Forms for front face to be lined striated plywood, or other material to be to the Engineer, to produce "Special Finish" pattern as shown. Pattern to be carried to bottom panel.

12'-6 1/8" Panel

ELEVATION 12'-6" PANEL
Showing "Special Finish" Pattern



CONST. JT. DETAILS



SEC. A-A

ADDITIONAL CONCRETE ABUT.

WEST WING .43 × 30.83 × 1.08 × .5 × 27 = 1.27

EAST WING 1.13 × 30.83 × 1.08 × .5 × 27 = 1.04

ABUT. WALL $\frac{.43 + .49}{2}$ × 50.0 × 1.0 × 27 = 1.45

BILL OF REINFORCING STEEL AND TOTAL ESTIMATED QUANTS. ABUTMENT No. 1

Bar	No.	Size	Length	Weight
A_1	4	#8	*63'-0"	673
A_2	1	#5	*62'-5"	65
B_1	24	#6	12'-5"	448
C	44	#8	11'-5"	336
H_1	6	#5	*62'-5"	391
H_2	8	#5	4'-11"	41
S	54	#4	9'-4"	337
V_1	51	#4	10'-6"	358
V_2	12	#4	12'-4"	99
B_2	7	#6	49'-9"	523
Reinf. Stl.			Lbs.	3,871
Cl. A Conc.			C.Y.	40.8
Struct. Stl.			Lbs.	196
Uncl. Struct. Excav.			C.Y.	121.0

*Includes 1-20 dia. Lap.

BILL OF REINFORCING STEEL AND TOTAL ESTIMATED QUANTS. ABUTMENT No. 3

Bar	No.	Size	Length	Weight
A_1	4	#8	*63'-0"	673
A_2	1	#5	*62'-5"	65
B_1	16	#6	12'-5"	298
C1-44	44	#4	8'-8" AV.	245
H_1	6	#5	*62'-5"	391
H_2	8	#5	2'-11"	41
S	54	#4	9'-4"	337
V_1	51	#4	10'-6"	358
V_2	12	#4	12'-4"	99
B_2	5	#6	49'-9"	374
Reinf. Stl.			Lbs.	2,881
Cl. A Conc.			C.Y.	39.5
Struct. Stl.			Lbs.	196
Uncl. Struct. Excav.			C.Y.	109.1

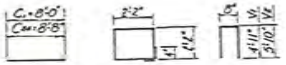
*Includes 1-20 dia. Lap.

General Notes:
Designed according to A.A.S.H.O. 1965 Standard Specifications ~~and Interim Revisions thereto~~.
All concrete shall be Class A. Chamfer exposed corners 3/4" unless otherwise noted.
See Sheets 65 and 66 for Wingwall Details and Quantities.
Calculated pile loads = 40.4 Tons/Pile.

BRG. SEAT ELEVATION

Brg. No.	Abut. 1	Abut. 3
1	37.55.72	37.52.34
2	35.78	32.40
3	35.65	32.47
4	35.92	32.53
5	35.91	32.53
6	35.83	32.45
7	35.75	32.37
8	35.68	32.30

Brgs. are numbered Rt. to Lt.



BARS C, & C_M BARS S BARS V

ELEV. "D"

Station	West Piling	East Piling
Abut. 1	3722.80	3722.96
Abut. 3	3722.81	3722.13

ABUTMENT DETAILS

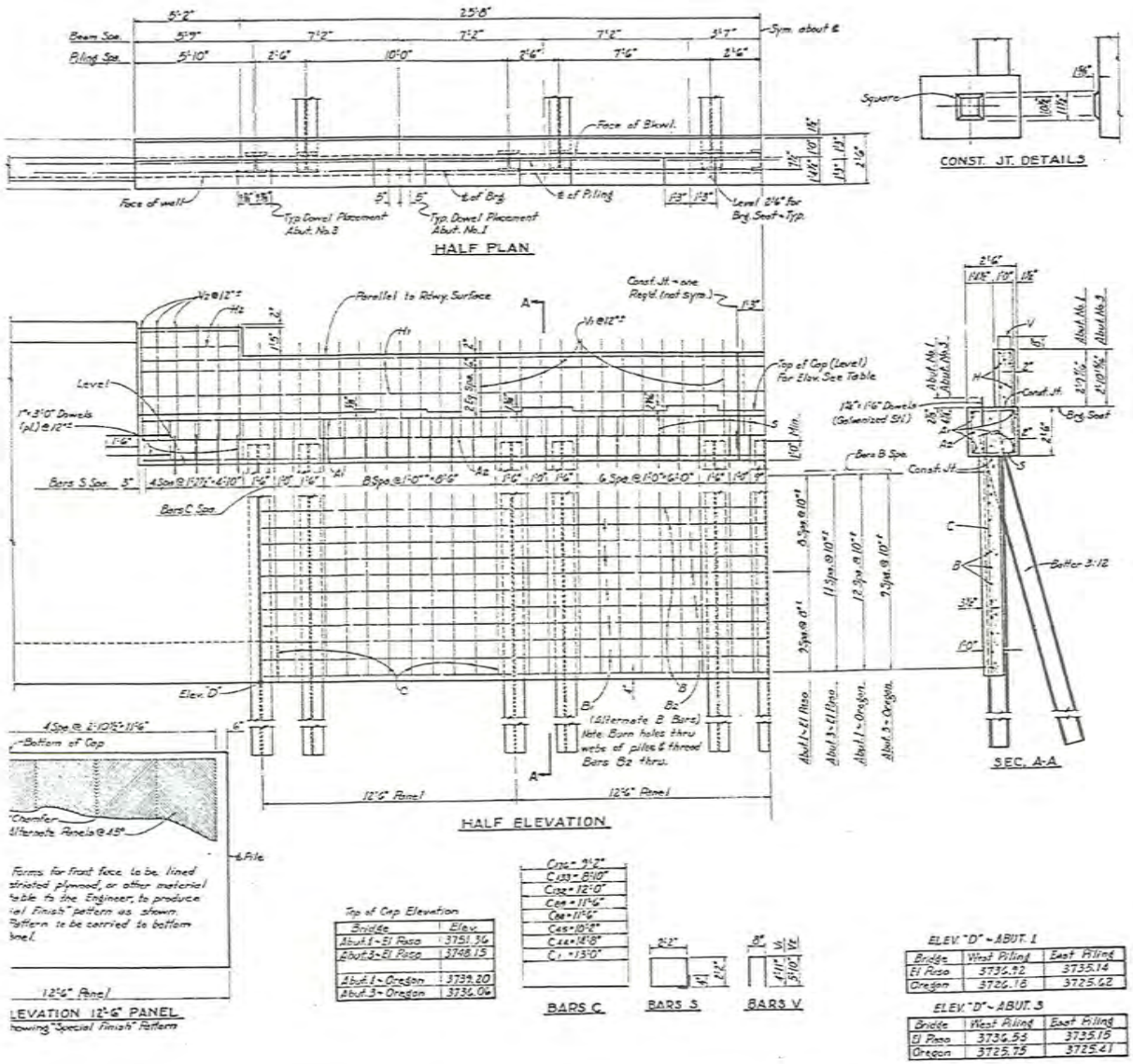
STANTON ST. UNDERPASS

2°12'21" L.F. SKEW

61

H20-44 LOADING

1-10-1	1101	1019	61
24	121	Pasco	2.0



Bridge	Elev.
Abut. 1 - El Paso	3751.36
Abut. 3 - El Paso	3748.15
Abut. 1 - Oregon	3739.20
Abut. 3 - Oregon	3736.06

Top of Cap Elevation

C_{132} =	9'-2"
C_{133} =	8'-10"
C_{132} =	12'-0"
C_{84} =	11'-6"
C_{86} =	11'-6"
C_{45} =	10'-2"
C_{44} =	14'-8"
C_1 =	13'-0"

BARS C

BARS S

BARS V

ELEV. "D" - ABUT. 1

Bridge	West Piling	East Piling
El Paso	3736.92	3735.14
Oregon	3726.18	3725.62

ELEV. "D" - ABUT. 3

Bridge	West Piling	East Piling
El Paso	3736.53	3735.15
Oregon	3725.95	3725.41

BILL OF REINFORCING STEEL AND TOTAL ESTIMATED QUANTITIES

ABUT. NO. 1 - EL PASO ST. BRIDGE

Bar	No.	Size	Length	Weight
A_1	4	#8	*63'-0"	673
A_2	1	#5	*62'-5"	65
B_1	36	#6	12'-5"	671
C_{1-44}	44	#4	13'-10" Av.	407
H_1	6	#5	*62'-5"	391
H_2	8	#5	4'-11"	41
S	54	#4	9'-4"	337
V_1	51	#4	10'-6"	358
V_2	12	#4	12'-4"	99
B_2	9	#6	49'-9"	673
Reinf. Stl.			Lbs.	3,715
Cl. "A" Conc.			C.Y.	45.1
Struct. Stl.			Lbs.	196
Uncl. Struct. Excav.			C.Y.	

*Includes 1-20 dia. Lap.

ABUT. NO. 3 - EL PASO ST. BRIDGE

Bar	No.	Size	Length	Weight
A_1	4	#8	*63'-0"	673
A_2	1	#5	*62'-5"	65
B_1	24	#6	12'-5"	448
C_{1-44}	44	#4	10'-10" Av.	318
H_1	6	#5	*62'-5"	391
H_2	8	#5	4'-11"	41
S	54	#4	9'-4"	337
V_1	51	#4	10'-6"	358
V_2	12	#4	12'-4"	99
B_2	6	#6	49'-9"	448
Reinf. Stl.			Lbs.	3,178
Cl. "A" Conc.			C.Y.	39.7
Struct. Stl.			Lbs.	196
Uncl. Struct. Excav.			C.Y.	

*Includes 1-20 dia. Lap.

ABUT. NO. 1 - OREGON ST. BRIDGE

Bar	No.	Size	Length	Weight
A_1	4	#8	*63'-0"	673
A_2	1	#5	*62'-5"	65
B_1	24	#6	12'-5"	448
C_{1-44}	44	#4	11'-9" Av.	345
H_1	6	#5	*62'-5"	391
H_2	8	#5	4'-11"	41
S	54	#4	9'-4"	337
V_1	51	#4	10'-6"	358
V_2	12	#4	12'-4"	99
B_2	7	#6	49'-9"	523
Reinf. Stl.			Lbs.	3,280
Cl. "A" Conc.			C.Y.	41.3
Struct. Stl.			Lbs.	196
Uncl. Struct. Excav.			C.Y.	

ABUT. NO. 3 - OREGON ST. BRIDGE

Bar	No.	Size	Length	Weight
A_1	4	#8	*63'-0"	673
A_2	1	#5	*62'-5"	65
B_1	20	#6	12'-5"	373
C_{1-44}	44	#4	9'-10"	265
H_1	6	#5	*62'-5"	391
H_2	8	#5	4'-11"	41
S	54	#4	9'-4"	337
V_1	51	#4	10'-6"	358
V_2	12	#4	12'-4"	99
B_2	5	#6	49'-9"	374
Reinf. Stl.			Lbs.	2,916
Cl. "A" Conc.			C.Y.	36.4
Struct. Stl.			Lbs.	196
Uncl. Struct. Excav.			C.Y.	

*Includes 1-20 dia. Lap.

General Notes:
Designed according to A.A.S.H.O. 1965 Standard Specifications ~~and interim Revisions thereto~~.
All concrete shall be Class A. Chamfer exposed corners ¾" unless otherwise noted.
See Sheets 65 and 66 for Wingwall Details and Quantities.
Calculated pile loads = 41.0 Tons/Pile.

ABUTMENT DETAILS

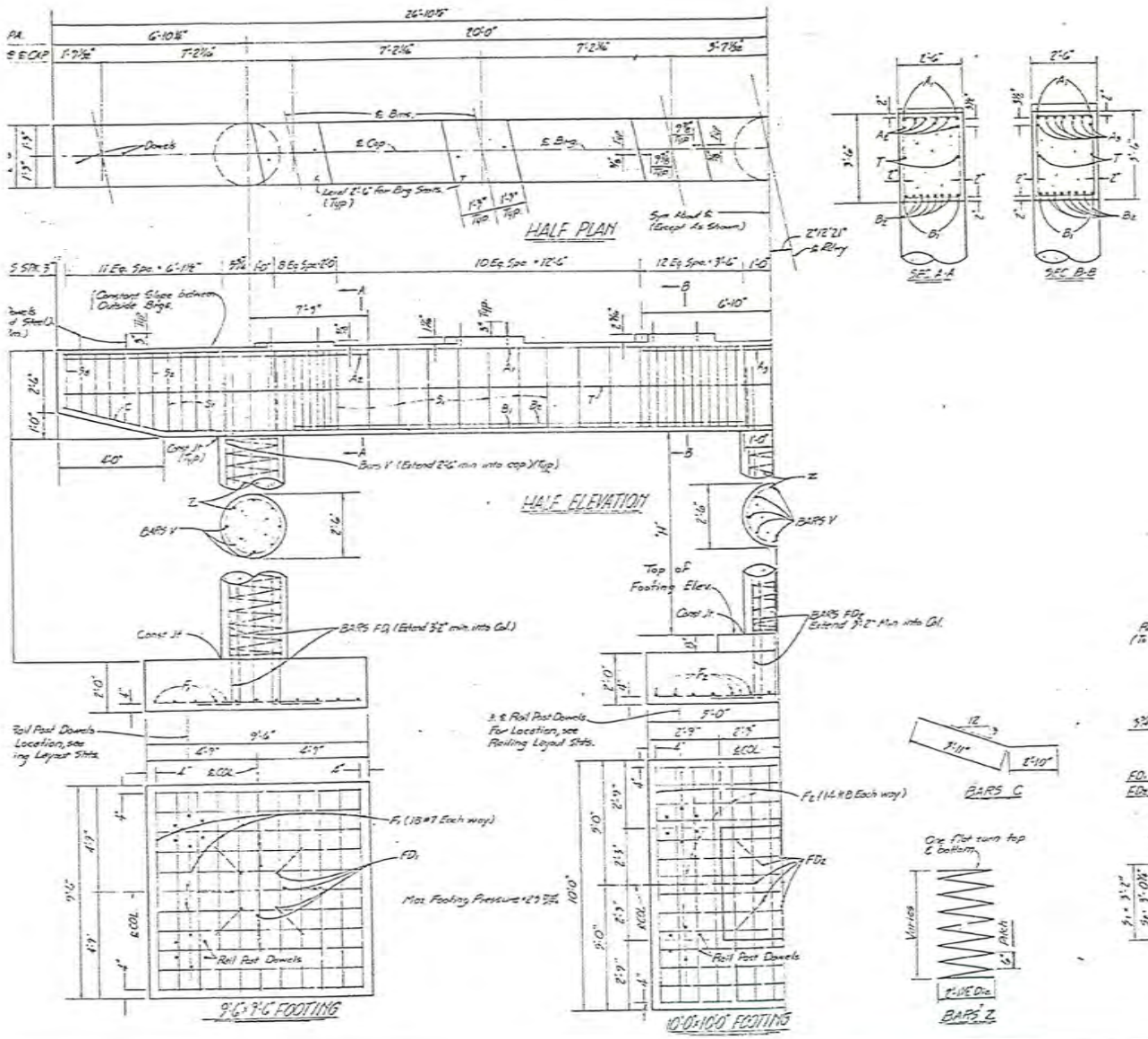
EL PASO ST. UNDERPASS
OREGON ST. UNDERPASS

62

H20-44 LOADING

I-10-1(101)301A 62

24 El Paso 2121 2 28 I-H-10



COL. HEIGHT "H"

COL. 1	COL. 2	COL. 3
16'-0"	16'-0"	16'-0"

BEARING SEAT ELEVATIONS

Brg. No.	Brg. Seat Elev.
1	3733.99
2	3734.06
3	3734.12
4	3734.17
5	3734.18
6	3734.10
7	3734.02
8	3733.95

TOP OF FOOTING ELEVATIONS

Footing No. 1	Footing No. 2	Footing No. 3
3714.49	3714.47	3714.45

See Layout for numbering of Brgs, Cols and Footings.

BILL OF REINFORCING STEEL
BENT CAP

Bar	No.	Size	Spa.	Length	Weight
A_1	2	#11	~	33'-4"	947
A_2	12	#11	~	14'-11"	931
A_3	7	#11	~	13'-8"	508
B_1	2	#10	~	25'-8"	343
B_2	12	#10	~	17'-6"	904
C	4	#6	~	6'-9"	41
S_1	72	#5	Shown	11'-8"	876
S_{2-8}	14	#5	Shown	ac 10'-7½"	155
T	2	#5	~	33'-4"	111
Total					4906

ESTIMATED QUANTITIES
BENT CAP

Item	Unit	Quantity
Reinforcing Steel	Lbs.	4906
Class "A" Concrete	C.Y.	17.1
Struct. Steel	Lbs.	100
Uncl. Struct. Excav.	C.Y.	99.8

BILL OF REINFORCING STEEL
3 SPREAD FOOTINGS

Bar	No.	Size	Spa.	Length	Weight
F_1	72	#7	6"	9'-0"	1325
F_2	28	#8	8½"	9'-6"	710
FD_1	16	#10	~	6'-3"	430
FD_2	8	#10	~	6'-11"	238
					2703

ESTIMATED QUANTITIES
3 SPREAD FOOTINGS

Item	Unit	Quantity
Reinforcing Steel	Lbs.	2703
Class "A" Concrete	C.Y.	21.3
Struct. Steel	Lbs.	113.0

BILL OF REINFORCING STEEL
3 COLUMNS

H	3 Bars Z #3 (Plain)		24 Bars V #10		Reinf. Steel	EST. QUANTITIES 3 COLS. Cl "A" Conc.
Ft.	Length	Weight	Length	Weight	Lbs.	C.Y.
15	210	237	17'-6"	1807	2044	8.2
16	224	253	18'-6"	1911	2164	8.7
17	237	267	19'-6"	2014	2281	9.3

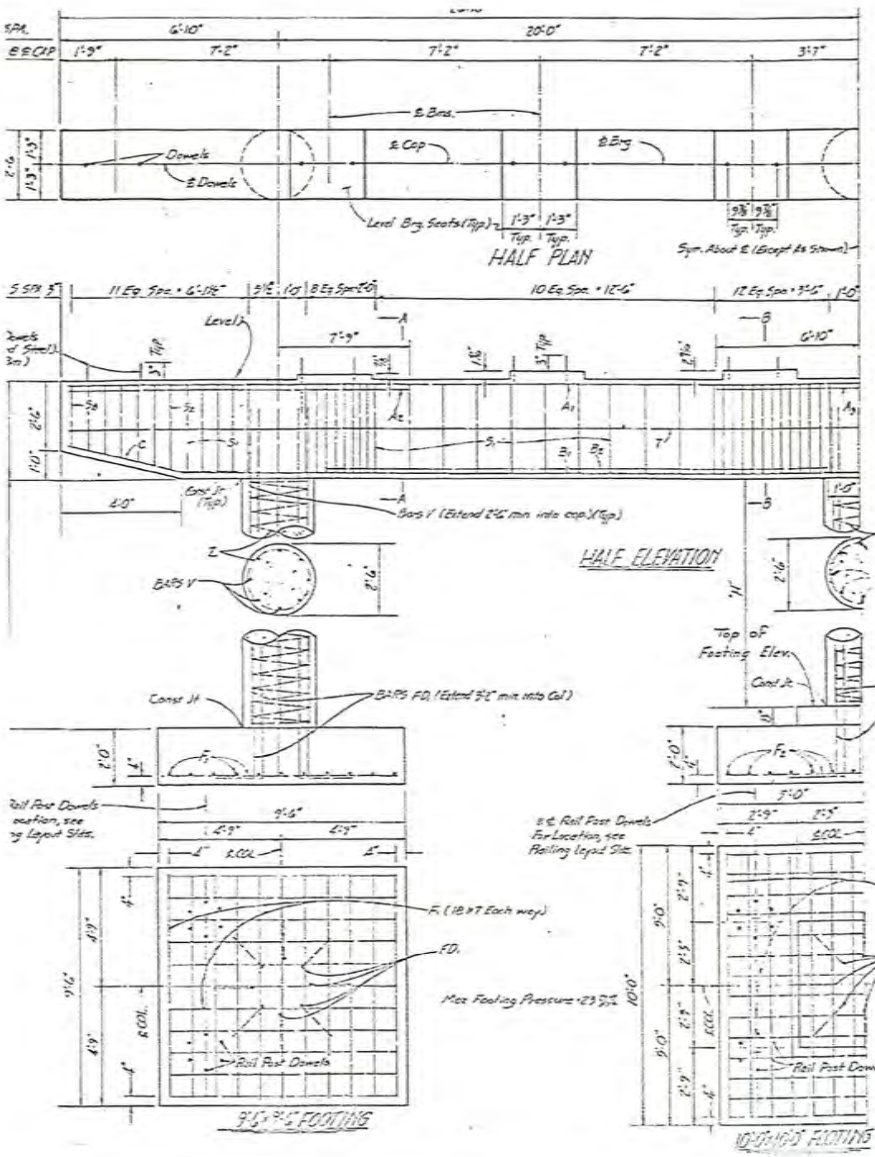
Notes:
For spacing, placement of Rail Post Dowels in Footings, see Railing Layouts.

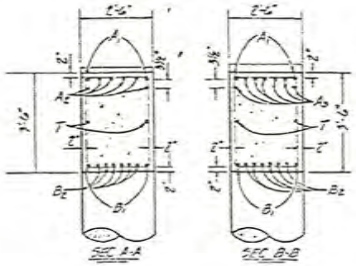
BENT DETAILS
STANTON ST. UNDERPASS
50' ROADWAY 5' SIDEWALKS
2°12'21" L.F. SKEW

63

H20 LOADING

24 EL PASO 2121 2 25 13-10 63





COLUMN HEIGHT "H"

Underpass	COL. 1	COL. 2	COL. 3
El Paso St	21'-0"	21'-0"	21'-0"
Oregon St	11'-0"	11'-0"	11'-0"

BEARING SEAT ELEVATIONS

Brg. No.	El Paso St	Oregon St
1	3750.18	3737.59
2	3750.29	3737.66
3	3750.36	3737.73
4	3750.40	3737.81
5	3750.40	3737.81
6	3750.36	3737.73
7	3750.25	3737.66
8	3750.10	3737.59

TOP OF FOOTING ELEVATIONS

Underpass	Footing 1	Footing 2	Footing 3
El Paso St	3725.68	3725.68	3725.68
Oregon St	3717.09	3717.09	3717.09

See Layouts for numbering of Brg, Cols. and Footings.

UNCLASSIFIED STRUCT EXCAV

	C.Y.
Underpass	
El Paso St	462.1
Oregon St	401.6

BILL OF REINFORCING STEEL
BENT CAP

Bar	No	Size	Spc.	Length	Weight
A_1	2	#11	~	93'-4"	467
A_2	12	#11	~	14'-11"	951
A_3	7	#11	~	13'-8"	508
B_1	2	#10	~	49'-8"	373
B_2	12	#10	~	17'-6"	904
C	4	#6	~	6'-9"	41
S_1	72	#5	Shown	11'-8"	874
S_1-R	16	#5	Shown	10'-7½"	155
T	2	#5	~	53'-4"	111
Total					4506

ESTIMATED QUANTITIES
BENT CAP

Item	Unit	Quantity
Reinforcing Steel	Lbs.	4506
Class "A" Concrete	C.Y.	17.2
Struct. Steel	Lbs.	100

BILL OF REINFORCING STEEL
3 SPREAD FOOTINGS

Bar	No	Size	Spc.	Length	Weight
F_1	72	#7	6"	9'-0"	1325
F_2	28	#8	8½"	9'-6"	710
FD_1	16	#10	~	6'-3"	430
FD_2	8	#10	~	6'-11"	238
Total					2703

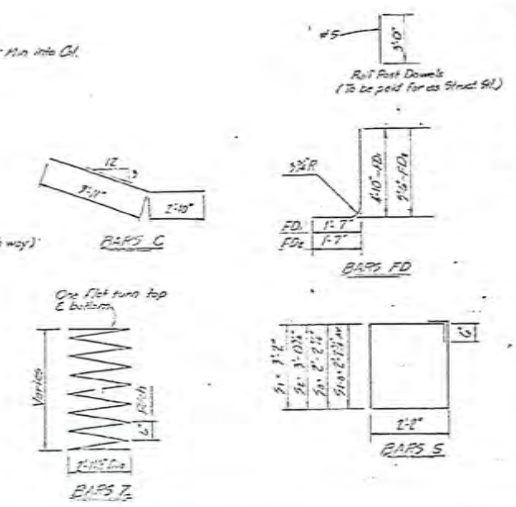
ESTIMATED QUANTITIES
3 SPREAD FOOTINGS

Reinforcing Steel	Lbs.	2703
Class "A" Concrete	C.Y.	21.3
Struct. Steel	Lbs.	113.0

BILL OF REINFORCING STEEL 3 COLUMNS — EST QUANTITIES 3 COLS.

"H"	3 Bars Z #3 (Plain)		24 Bars V #10		Reinf. Steel	Cl. "A" Conc.
Ft	Length	Weight	Length	Weight	Total	Total
17	237	267	19'-6"	2014	2281	9.3
18	250	282	20'-6"	2117	2399	9.8
19	264	298	21'-6"	2220	2518	10.4
20	277	312	22'-6"	2324	2636	10.9
21	290	327	23'-6"	2427	2754	11.5
22	304	343	24'-6"	2530	2873	12.0
23	317	358	25'-6"	2633	2991	12.5

Note:
* For stationing, placement of Rail Post Dowels in Footings, see Railing Layouts.



BENT DETAILS

EL PASO ST. UNDERPASS
OREGON ST. UNDERPASS

50' ROADWAY 5' SIDEWALKS

64

H20 LOADING

7-10-15 | 10:17 | 64

EL PASO 21 | 2 | 14-10

ADDENDUM 2 - JULY 14, 2015

APPENDIX B

Applicable Boring Logs

FIGURE: 7

ADDENDUM 2 - JULY 14, 2015

BORING B7

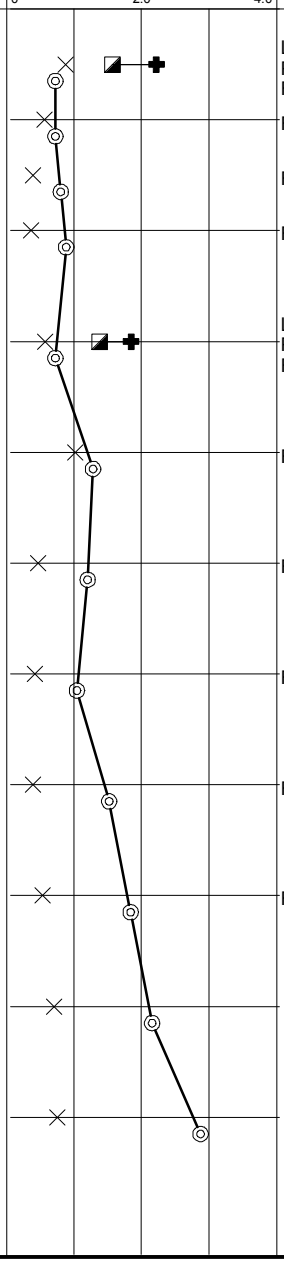
DATE STARTED:	11/9/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/9/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	51.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3749.89 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76353°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.4899°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**ASPHALT** - 3.25 inches thick				
				PAVEMENT BASE - 8 inches thick				
		SS1	10	**CLAYEY SAND** - brown, loose, moist	SC	15-6-3 N=9	11	LL = 28 PL = 20 Fines=39.3%
3745	5	SS2	14	**SILTY SAND** - brown, loose, moist	SM	3-5-4 N=9	7	Fines=18.3%
		SS3	16	**SAND** - Poorly Graded with Silt, brown, loose, moist	SP-SM	6-5-5 N=10	5	Fines=8.6%
3740	10	SS4	17	medium dense, moist		6-6-5 N=11	5	Fines=9.6%
3735	15	SS5	17	**SILTY CLAYEY SAND** - brown, loose, moist	SC-SM	6-5-4 N=9	7	LL = 23 PL = 17 Fines=35.0%
3730	20	SS6	15	medium dense, moist, with clay lenses		3-7-9 N=16	13	Fines=%
3725	25	SS7	18	**SILTY SAND** - brown, medium dense, moist	SM	4-7-8 N=15	6	Fines=21.3%
3720	30	SS8	18			7-6-7 N=13	5	Fines=22.9%
3715	35	SS9	18			7-11-8 N=19	5	Fines=19.2%
3710	40	SS10	18			8-12-11 N=23	7	Fines=20.8%
3705	45	SS11	18			13-13-14 N=27	9	
3700	50	SS12	18	brown, dense, moist		8-12-24 N=36	9	
				Boring terminated at 51.5 feet below grade				



Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 8

ADDENDUM 2 - JULY 14, 2015

BORING B8

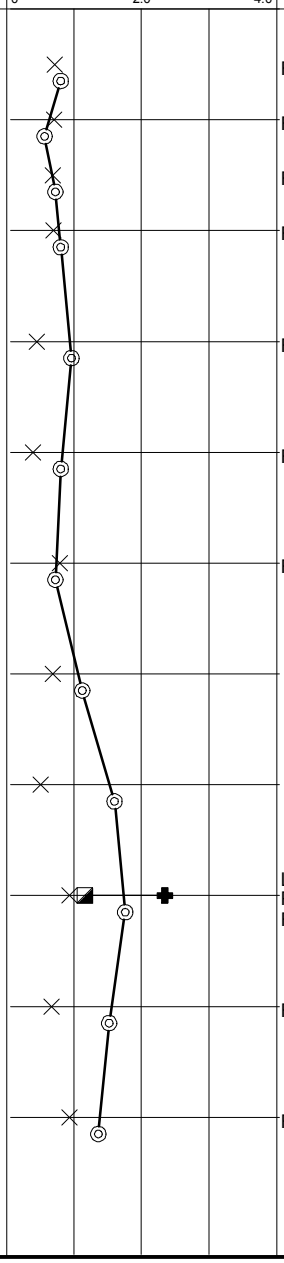
DATE STARTED:	11/9/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/9/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	51.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3743.44 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76286°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48932°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**ASPHALT** - 9.5 inches thick				
				PAVEMENT BASE - 4.5 inches thick				
3740		SS1	10	**SILTY CLAYEY SAND** - brown, loose, moist	SC-SM	9-7-3 N=10	9	Fines=26.3%
	5	SS2	12			3-3-4 N=7	9	Fines=27.7%
3735		SS3	17			3-4-5 N=9	9	Fines=27.2%
	10	SS4	15			3-4-6 N=10	9	Fines=25.7%
3730								
	15	SS5	16	**SILTY SAND** - brown, medium dense, moist	SM	5-6-6 N=12	6	Fines=20.7%
3725								
	20	SS6	18	loose, moist		5-4-6 N=10	5	Fines=15.2%
3720								
	25	SS7	17	loose, moist, with clay lenses		4-4-5 N=9	10	Fines=36.6%
3715								
	30	SS8	18	medium dense, moist		6-5-9 N=14	9	
3710								
	35	SS9	18			7-10-10 N=20	6	
3705								
	40	SS10	18	**CLAYEY SAND** - brown, medium dense, moist	SC	11-10-12 N=22	12	LL = 29 PL = 15 Fines=34.4%
3700								
	45	SS11	18	**SILTY SAND** - brown, medium dense, moist	SM	5-9-10 N=19	8	Fines=18.3%
3695								
	50	SS12	18			9-10-7 N=17	12	Fines=22.2%
				Boring terminated at 51.5 feet below grade				



Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 36

ADDENDUM 2 - JULY 14, 2015

BORING B36

DATE STARTED:	1/23/13	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	1/23/13	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	55.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3751 ft	**SAMPLING METHOD:**	TC
LATITUDE:	31.763198°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.489828°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:
I-10 West below
overpass of N. Stanton Street

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Texas Cone (TC)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ (× Moisture, ◪ PL, ✚ LL; 0–25–50) / STRENGTH, tsf (▲ Qu, ✳ Qp; 0–2.0–4.0)	Additional Remarks
3750	0					**CONCRETE** - 13 inches thick					
						ASPHALT - 2 inches thick					
						SILTY CLAYEY SAND - moist, brown					
3745	5			TC1	16	very loose		2-3	14	>>◎	LL = 24 PL = 18 Fines=32.5%
3740	10			TC2	18	slightly compact	CL-ML	10-12	12	>>◎	
3735	15			TC3	16			17-17	8	>>◎	LL = 20 PL = 14 Fines=28.8%
3730	20			TC4	12	**CLAYEY SAND** - compact, dry, brown	SC	30-46	7	>>◎	LL = 30 PL = 15 Fines=27.7%
3725	25			TC5	14	**SILTY SAND** - dense, dry, brown		35-46	7	>>◎	Fines=16.0%
3720	30			TC6	16	compact		33-38	7	>>◎	
3715	35			TC7	12	very dense, moist		50-50(3")	9	>>◎	Fines=23.8%
3710	40			TC8	14		SM	50(5.5")-50(4")	8	>>◎	Fines=30.3%
3705	45			TC9	14	compact		17-34	19	>>◎	Fines=29.3%
3700	50			TC10	14			12-43	12	>>◎	
	55			TC11		**LEAN CLAY** - very hard, moist, brown Boring terminated 55.5 feet below grade	CL	50(3")-50(0.5")	24	>>◎	LL = 29 PL = 16 Fines=65.1%

Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 23

ADDENDUM 2 - JULY 14, 2015

BORING B23

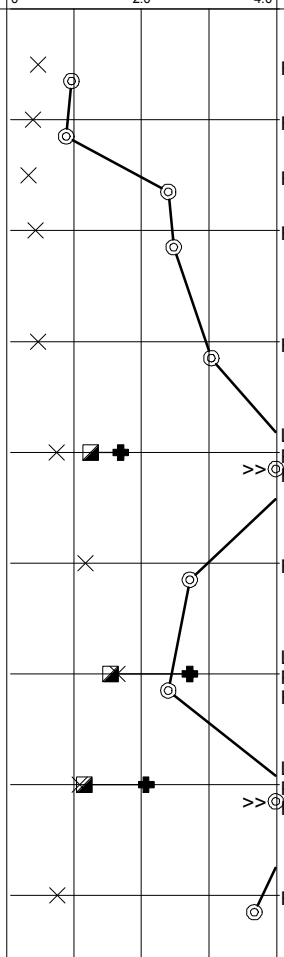
DATE STARTED:	11/12/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/12/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	41.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3753.53 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76243°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49157°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**CONCRETE** - 9 inches thick				
3750		SS1	16	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	6-6-6 N=12	6	Fines=10.4%
	5	SS2	17			3-6-5 N=11	5	Fines=7.7%
3745		SS3	18	**SAND** - Poorly Graded with Silt and Gravel, brown, medium dense, moist	SP-SM	9-17-13 N=30	4	Fines=10.4%
	10	SS4	17	**SILTY SAND** - brown, dense, moist	SM	13-14-17 N=31	5	Fines=12.4%
3740								
	15	SS5	18	dense, moist		8-16-22 N=38	6	Fines=12.8%
3735								
	20	SS6	18	**SILTY CLAYEY SAND** - brown, very dense, moist, with clay lenses	SC-SM	12-24-32 N=56	9	LL = 21 PL = 16 >> Fines=29.8%
3730								
	25	SS7	18	dense, moist		14-16-18 N=34	15	Fines=20.3%
3725								
	30	SS8	18	**SANDY LEAN CLAY** - brown, very stiff, moist	CL	8-12-18 N=30	21	LL = 34 PL = 19 Fines=64.0%
3720								
	35	SS9	18	**CLAYEY SAND** - brown, very dense, moist, with calcareous material	SC	3-16-40 N=56	14	LL = 26 PL = 14 >> Fines=40.6%
3715								
	40	SS10	18	**SILTY SAND** - brown, dense, moist	SM	9-20-26 N=46	9	Fines=33.7%
				Boring terminated at 41.5 feet below grade				



Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 37

ADDENDUM 2 - JULY 14, 2015

BORING B37

DATE STARTED:	1/22/13	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	1/22/13	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	55.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3759 ft	**SAMPLING METHOD:**	TC
LATITUDE:	31.762105°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.491531°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:
I-10 West below overpass of N. Oregon Street

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Texas Cone (TC)	Moisture, %	Additional Remarks
	0			**CONCRETE** - 13 inches thick				
				ASPHALT - 2 inches thick				
				SILTY CLAYEY SAND - moist, brown				
3755	5	TC1		compact	CL-ML	26-29	16	LL = 24 PL = 17 Fines=26.5%
3750	10	TC2		very dense		50(4")-50(3")	7	Fines=28.3%
3745	15	TC3		**CLAYEY SAND** - dense, moist, brown	SC	36-50(3.5")	10	LL = 26 PL = 15 Fines=47.9%
3740	20	TC4		**LEAN CLAY** - with Sand, very stiff, moist, brown	CL	20-27	18	LL = 47 PL = 19 Fines=82.2%
3735	25	TC5		**CLAYEY SAND** - very dense, moist, brown	SC	50(4") -50(2.5")	12	Fines=45.6%
3730	30	TC6		**SANDY LEAN CLAY** - very hard, moist, brown		50(1")-50(.5")	8	
3725	35	TC7				50(2")-50(1")	11	LL = 29 PL = 15 Fines=57.5%
3720	40	TC8			CL	50(2")-50(1.5")	11	
3715	45	TC9				50(1.5")-50(1")	14	LL = 43 PL = 19 Fines=66.2%
3710	50	TC10				50(2")-50(1.5")	23	
3705	55	TC11		**SILTY CLAYEY SAND** - very dense, moist, brown	CL-ML	50(1.5")-50(1")	10	LL = 22 PL = 16 Fines=22.4%
				Boring terminated 55.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Professional Service Industries, Inc.
4601 Ripley Drive
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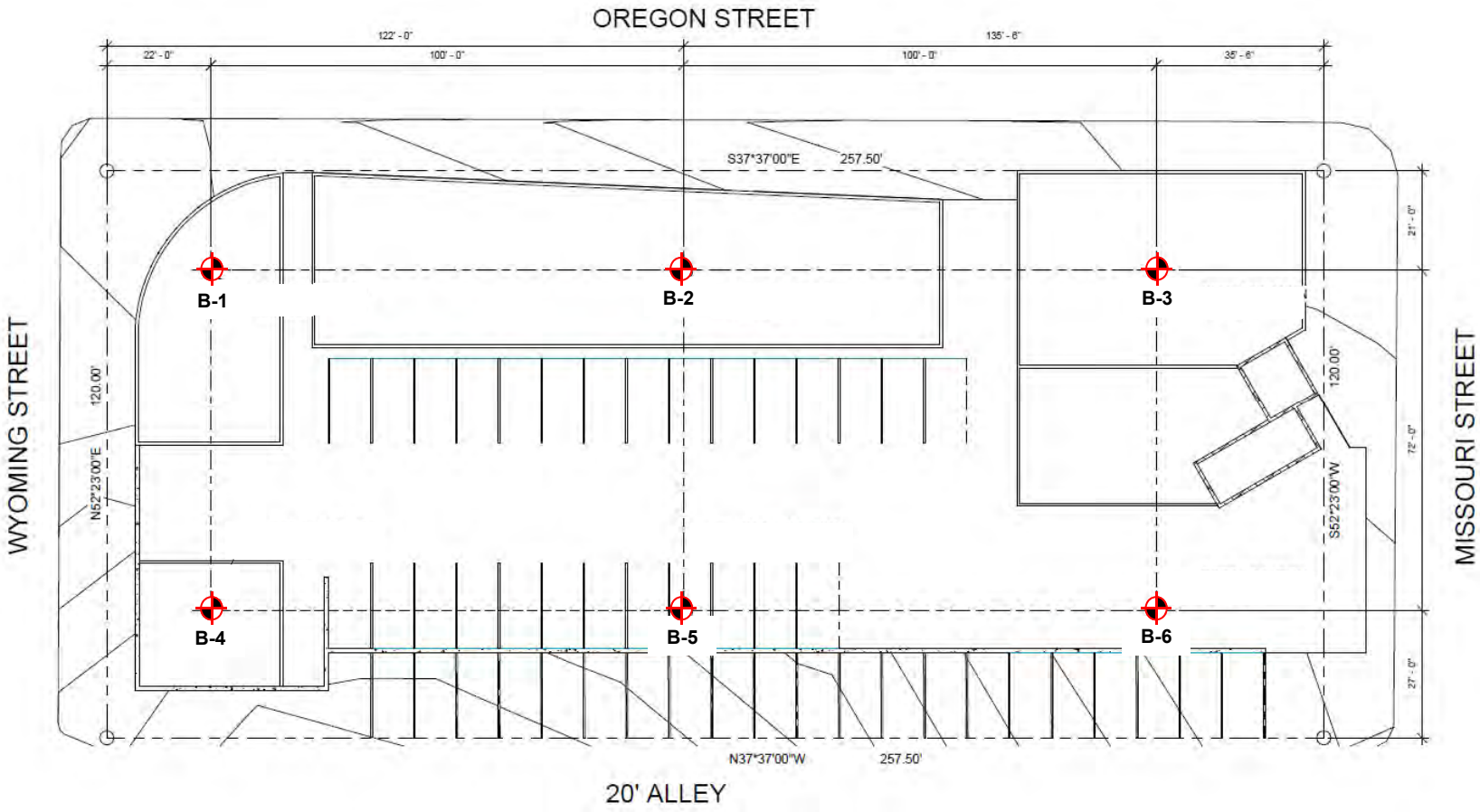
Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

ADDENDUM 2 - JULY 14, 2015



PSI Information To Build On
Engineering • Consulting • Testing

PSI
4601 Ripley Drive
El Paso, Texas 79922

PROJECT NAME: Artspace El Paso
El Paso, Texas
PSI Project No. 0625444

Sheet No. A2
BORING PLAN
Approximate Boring Location
NOT TO SCALE

N

FIGURE: 2

ADDENDUM 2 - JULY 14, 2015

BORING B2

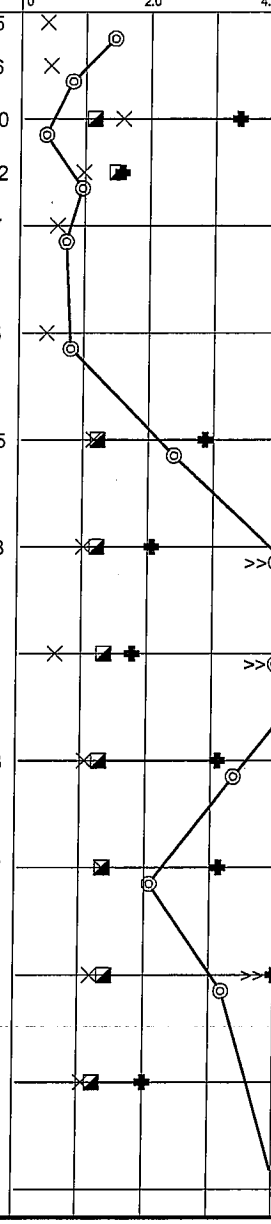
DATE STARTED:	6/28/12	DRILL COMPANY:	PSI, Inc.
DATE COMPLETED:	6/28/12	DRILLER: AB	LOGGED BY: RB
COMPLETION DEPTH	61.5 ft	DRILL RIG:	BK81-HD
BENCHMARK:	N/A	DRILLING METHOD:	Hollow Stem Auger
ELEVATION:	N/A	SAMPLING METHOD:	2-in SS
LATITUDE:		HAMMER TYPE:	Automatic
LONGITUDE:		EFFICIENCY	N/A
STATION: N/A	OFFSET: N/A	REVIEWED BY:	Danny R. Anderson, P.E.
REMARKS:			

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:
NE Portion of Property

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			SS1		**SILTY SAND** - brown, medium dense, moist, with calcareous material and clay lenses	SM	8-7-11 N=18	5	Fines=31.7%
				SS2		loose, moist, with calcareous material		3-5-5 N=10	6	Fines=23.2%
	5			SS3		**LEAN CLAY** - with Sand, brown, firm, moist, with calcareous material, 3.5 tsf by pocket penetrometer	CL	2-2-3 N=5	20	LL = 42 PL = 14 Fines=71.2%
				SS4		**SILTY SAND** - brown, medium dense, moist, with calcareous material and clay lenses, 1 tsf by pocket penetrometer	SM	3-5-7 N=12	12	LL = 20 PL = 19 Fines=45.5%
	10			SS5		loose, moist, with calcareous material and clay lenses		3-4-5 N=9	7	Fines=24.5%
	15			SS6		**CLAYEY SAND** - brown, loose, moist, with calcareous material	SC	2-5-5 N=10	5	Fines=35.6%
	20			SS7		**SANDY LEAN CLAY** - brown, very stiff, moist, with calcareous material, 4.5 tsf by pocket penetrometer	CL	7-15-15 N=30	15	LL = 36 PL = 15 Fines=64.6%
	25			SS8		hard, moist, with calcareous material, 4.5 tsf by pocket penetrometer		7-25-27 N=52	13	LL = 26 PL = 15 >>Fines=62.4%
	30			SS9		**SILTY CLAYEY SAND** - brown, very dense, moist, with calcareous material	SC-SM	10-50 (6")	8	LL = 22 PL = 17 >>Fines=42.0%
	35			SS10		**LEAN CLAY** - with Sand, brown, hard, moist, with calcareous material, 4.5 tsf by pocket penetrometer	CL	7-17-25 N=42	13	LL = 39 PL = 16 Fines=82.7%
	40			SS11		very stiff, moist, with calcareous material, 4.5 tsf by pocket penetrometer		8-8-18 N=26	17	LL = 39 PL = 17 Fines=81.3%
	45			SS12		**SANDY FAT CLAY** - brown, hard, moist, with calcareous material, 4.5 tsf by pocket penetrometer	CH	6-16-24 N=40	15	LL = 50 PL = 18 Fines=67.9%
	50			SS13		**CLAYEY SAND** - brown, very dense, moist, with calcareous material, 2 tsf by pocket penetrometer	SC	7-23-50 (3")	13	LL = 25 PL = 15 Fines=47.2%
	55									

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



Continued Next Page

Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.:	0625444
PROJECT:	Artspace El Paso
LOCATION:	601 N Oregon Street
	El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 2

ADDENDUM 2 - JULY 14, 2015

BORING B2

DATE STARTED:	6/28/12	DRILL COMPANY:	PSI, Inc.
DATE COMPLETED:	6/28/12	DRILLER: AB	LOGGED BY: RB
COMPLETION DEPTH	61.5 ft	DRILL RIG:	BK81-HD
BENCHMARK:	N/A	DRILLING METHOD:	Hollow Stem Auger
ELEVATION:	N/A	SAMPLING METHOD:	2-in SS
LATITUDE:		HAMMER TYPE:	Automatic
LONGITUDE:		EFFICIENCY	N/A
STATION: N/A	OFFSET: N/A	REVIEWED BY:	Danny R. Anderson, P.E.
REMARKS:			

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:
NE Portion of Property

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0 – 25 – 50) STRENGTH, tsf ▲ Qu ✳ Qp (0 – 2.0 – 4.0)	Additional Remarks
	55		X	SS14		**LEAN CLAY** - with Sand, brown, hard, moist, with calcareous material, 4.5 tsf by pocket penetrometer	CL	13-23-29 N=52	18		LL = 47 PL = 18 Fines=76.9%
	60		X	SS15		**SANDY LEAN CLAY** - brown, hard, moist, with calcareous material, 1.5 tsf by pocket penetrometer	CL	6-16-30 N=46	21		LL = 28 PL = 15 Fines=69.2%
						Boring terminated at 61.5 feet below grade					

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Telephone: (915) 584-1317

PROJECT NO.: 0625444
PROJECT: Artspace El Paso
LOCATION: 601 N Oregon Street
El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 4

ADDENDUM 2 - JULY 14, 2015

BORING B4

DATE STARTED:	6/27/12	DRILL COMPANY:	PSI, Inc.
DATE COMPLETED:	6/27/12	DRILLER: AB	LOGGED BY: RB
COMPLETION DEPTH	41.5 ft	DRILL RIG:	BK81-HD
BENCHMARK:	N/A	DRILLING METHOD:	Hollow Stem Auger
ELEVATION:	N/A	SAMPLING METHOD:	2-in SS
LATITUDE:		HAMMER TYPE:	Automatic
LONGITUDE:		EFFICIENCY	N/A
STATION: N/A	OFFSET: N/A	REVIEWED BY:	Danny R. Anderson, P.E.
REMARKS:			

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:
W Portion of Property

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			SS1		**SILTY SAND** - brown, medium dense, moist, with calcareous material and clay lenses	SM	8-6-8 N=14	6	Fines=32.5%
				SS2		with calcareous material	SM	6-6-7 N=13	5	Fines=39.1%
	5			SS3		with calcareous material and clay lenses	SM	6-8-7 N=15	7	Fines=28.0%
				SS4		**SANDY LEAN CLAY** - brown, hard, moist, with calcareous material, 4.5 tsf by pocket penetrometer	CL	21-50 (6")	11	LL = 25 PL = 16 >> Fines=56.9%
	10			SS5		**LEAN CLAY** - with Sand, brown, very stiff, moist, with calcareous material, 4.5 tsf by pocket penetrometer	CL	5-10-13 N=23	15	Fines=74.1%
	15			SS6		**SILTY CLAYEY SAND** - brown, very dense, moist, with calcareous material	SC-SM	25-50 (5")	6	LL = 23 PL = 18 >> Fines=33.8%
	20			SS7			SC-SM	25-33-39 N=72		>>
	25			SS8			SC-SM	14-18-34 N=52		>>
	30			SS9		**CLAYEY SAND** - brown, very dense, moist, with calcareous material	SC	50 (3")		>>
	35			SS10		**SANDY FAT CLAY** - brown, hard, moist, with calcareous material, 4.5 tsf by pocket penetrometer	CH	8-14-20 N=34	14	LL = 58 PL = 22 >> Fines=65.8%
	40			SS11		4.5 tsf by pocket penetrometer	CH	5-15-19 N=34		
						Boring terminated at 41.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.:	0625444
PROJECT:	Artspace El Paso
LOCATION:	601 N Oregon Street
	El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 5

ADDENDUM 2 - JULY 14, 2015

BORING B5

DATE STARTED:	6/21/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	6/23/12	**DRILLER:** AB	**LOGGED BY:** RB
COMPLETION DEPTH	100.8 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger / Mud Rotary
ELEVATION:	N/A	**SAMPLING METHOD:**	2-in SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.
REMARKS:			

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:
SW Portion of Property

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0		☒	SS1		**SILTY SAND** - brown, medium dense, moist, with calcareous material	SM	6-7-5 N=12	4		Fines=24.6%
			☒	SS2		very loose, moist, with calcareous material		3-2-2 N=4	5		Fines=20.2%
	5		☒	SS3		very loose, moist, with calcareous material and clay lenses		2-1-1 N=2	6		
			☒	SS4		**SILTY SAND** - with Gravel, brown, medium dense, moist, with calcareous material and clay lenses	SM	2-4-20 N=24	4		Fines=15.4%
	10		☒	SS5		dense, moist, with calcareous material and clay lenses		10-20-28 N=48	3		Fines=14.1%
	15		☒	SS6		**SILTY SAND** - brown, medium dense, wet, with calcareous material	SM	3-9-20 N=29	12		
	20		☒	SS7		dense, wet, with calcareous material		10-18-30 N=48			
	25		☒	SS8		light brown, very dense, wet		50 (6")		>>	
	30		☒	SS9		**SANDY LEAN CLAY** - light brown, hard, wet, 3 tsf by pocket penetrometer	CL	10-20-30 N=50	18	◪ ✚	LL = 33 PL = 16 Fines=57.8%
	35		☒	SS10		**LEAN CLAY** - with Sand, light brown, hard, wet, 4 tsf by pocket penetrometer	CL	14-17-28 N=45	19	◪ ✚	LL = 44 PL = 18 Fines=72.8%
	40		☒	SS11		1 tsf by pocket penetrometer		14-50 (4")	21	>>	Fines=74.1%
	45		☒	SS12		**SANDY LEAN CLAY** - light brown, hard, wet, 2.5 tsf by pocket penetrometer	CL	20-34-50 (6")	20		Fines=50.4%
	50		☒	SS13		3 tsf by pocket penetrometer		28-50 (5")	18	>>	Fines=53.4%
	55										

Continued Next Page

Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625444
PROJECT: Artspace El Paso
LOCATION: 601 N Oregon Street
El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 5

ADDENDUM 2 - JULY 14, 2015

BORING B5

DATE STARTED:	6/21/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	6/23/12	**DRILLER:** AB	**LOGGED BY:** RB
COMPLETION DEPTH	100.8 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger / Mud Rotary
ELEVATION:	N/A	**SAMPLING METHOD:**	2-in SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.
REMARKS:			

Water

While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:
SW Portion of Property

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	55			SS14		**SANDY LEAN CLAY** - light brown, hard, wet, 2.5 tsf by pocket penetrometer	CL	17-38-50 (4")	17	Fines=56.9%
	60			SS15		**LEAN CLAY** - light brown, hard, moist, with calcareous material, 4.5 tsf by pocket penetrometer	CL	10-10-13 N=23	26	Fines=93.6%
	65			SS16		**SANDY LEAN CLAY** - light brown, hard, wet, with calcareous material, 2.5 tsf by pocket penetrometer	CL	34-50 (2")	20	>> Fines=50.1%
	70			SS17		**LEAN CLAY** - with Sand, light brown, hard, wet, with calcareous material, 4.5 tsf by pocket penetrometer	CL	35-46-46 N=92	16	>> Fines=71.2%
	75			SS18		**LEAN CLAY** - light brown, hard, wet, with calcareous material, 4.5 tsf by pocket penetrometer	CL	18-22-46 N=68	24	>> Fines=86.1%
	80			SS19		**CLAYEY SAND** - light brown, very dense, wet, with calcareous material, 1.5 tsf by pocket penetrometer	SC	31-47-50 (2")	18	Fines=45.4%
	85			SS20		1 tsf by pocket penetrometer		37-46-50 (4")		
	90			SS21		**SANDY LEAN CLAY** - light brown, hard, wet, 2 tsf by pocket penetrometer	CL	12-26-50 (2")		
	95			SS22	0	**SAND** - Poorly Graded, brown, very dense, wet	SP	50 (1")		>>
	100			SS23				40-50 (3")		>>
						Boring terminated due to Split Spoon Refusal at 100.8 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625444
PROJECT: Artspace El Paso
LOCATION: 601 N Oregon Street
El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

ADDENDUM 2 - JULY 14, 2015

9400 Amberglen Blvd.
Austin, Texas 78729
Phone: 512.419.5863
Fax: 512.454.8807

MEMORANDUM

DATE: May 31, 2013

TO: Derek Benedict, P.E.
Chuck Berry, P.E.

FROM: Rebecca Russo, P.E.

COPY: Clint Jumper, P.E.

SUBJECT: **Geotechnical Design Memorandum 4.0**
City of El Paso Streetcar Project
Pavements
El Paso, Texas

Submitted herewith is a summary of geotechnical findings and recommendations for pavements associated with the track slab installation, street and drainage regrading, and pavement replacement and repairs. Our understanding of the project is based on the Civil Design plans (Volume 1), preliminary plans dated December 12, 2012 and final plans dated May 25, 2013. The scope of pavement modifications along the project alignment includes construction of a new concrete track slab, pavement mill and overlay, full depth asphalt pavement reconstruction, full depth concrete pavement reconstruction, and removal/replacement of curbs, gutters, sidewalks and driveways.

URS is providing civil and general design services for the streetcar track slab layout and grading. Moreno Cardenas, Inc. (MCI) is providing the utility and street reconstruction design sheets, and Professional Service Industries, Inc. (PSI) has provided the geotechnical drilling and laboratory testing services. The purposes of this memorandum are to provide 1) a summary of the available geotechnical data obtained along the alignment, and 2) pavement thickness design and construction recommendations for new pavements. It is

noted that pavement design and recommendations presented herein are intended to provide equivalent sections to existing pavements. These findings and recommendations were not intended to serve as a pavement condition survey of existing pavements nor a pavement improvement study. The intent of the following is to provide recommendations for general pavement construction and to qualify minimum pavement sections for full depth replacement.

Borings

A total of 34 borings were drilled along the proposed streetcar track alignment by PSI. The borings were drilled to depths of 2.5 to 50 feet below existing grade, and are designated B-1 through B-35 (B-22 not drilled). A Boring Location Plan is presented on Figure 1. It is noted that borings B-31 through B-35 were drilled for proposed ancillary structures in areas off the streetcar alignment. Boring logs prepared and submitted by PSI are included in the Appendix, for ease of reference. A summary table of the existing pavement sections at the boring locations is given below.

Boring Summary Table Pavement Thicknesses at Boring locations			
Boring No.	**Existing Pavement Section**	**Boring No.**	**Existing Pavement Section**
B-1	Asphalt - 4" Base - 8"	B-18	Concrete - 8.5" Base - 8"
B-2	Asphalt - 4" Base - 8"	B-19	Concrete - 8.5" Base - 8"
B-3	Asphalt – 5.5" Base - 8"	B-20	Asphalt - 3.25" Base - 8"
B-4	Asphalt - 3.5" Concrete - 8" Base - 6"	B-21	Concrete - 8.5" Base - 8"
B-5	Asphalt - 8" Base - 6"	B-22	Not Drilled
B-6	Asphalt – 6.5" Base – 4.5"	B-23	Concrete - 9"
B-7	Asphalt – 3.25" Base - 8"	B-24	Asphalt - 9.5" Base - 4.5"
B-8	Asphalt – 9.5" Base – 4.5"	B-25	Concrete - 9.5" Base - 4"
B-9	Concrete - 9.5" Base - 8"	B-26	Concrete - 9.5" Base - 4"

Boring Summary Table Pavement Thicknesses at Boring locations			
Boring No.	**Existing Pavement Section**	**Boring No.**	**Existing Pavement Section**
B-10	Asphalt - 7.8" Base - 8"	B-27	Asphalt - 4" Base - 8"
B-11	Asphalt - 4" Base - 6"	B-28	Asphalt - 3.75" Base - 8"
B-12	Asphalt - 2" Base - 8"	B-29	Asphalt - 2.5" Base - 8"
B-13	Asphalt - 2.75" Base - 8"	B-30	Concrete - 9" Base - 8"
B-14	Asphalt - 3.25" Base - 8"	B-31	Asphalt - 3.5" Base - 8"
B-15	Asphalt - 2.5" Base - 8"	B-32	Asphalt - 2.5" Base - 8"
B-16	Asphalt - 3" Base - 8"	B-33	Asphalt - 2" Base - 8"
B-17	Asphalt - 3" Base - 8"	B-34	Asphalt - 2" Base - 8"
		B-35	concrete, refusal

It can be seen that existing flexible pavement sections ranged from a minimum of 2 inches of asphalt over 8 inches of base material up to 9.5 inches of asphalt over 4.5 inches of base. Existing rigid pavements ranged from 8.5 to 9.5 inches of concrete over 0 to 8 inches of base.

Subsurface Conditions

Beneath a surficial pavement, the borings encountered fill, alluvium, disintegrated rock and refusal material. Based on site specific borings and published geologic information, the streetcar alignment is generally underlain by two subsurface conditions, referred to as the "Uptown Loop" and the "Downtown Loop", and shown on the Boring Location Plan.

Borings B-1 through B-6 and B-24 through B-30 were drilled along the "Uptown Loop". In general, the borings encountered medium dense to very dense soils and shallow refusal material. Standard penetration test N-values ranged from 3 to over 100 blows per foot (bpf) with an average of 30 bpf in the upper 5 feet of boring. Relatively lower blowcounts were encountered in borings B-25 through B-28 from River Avenue to Kerby Avenue along

Oregon Street. Both mill and overlay, and full depth replacement are planned within this reach of the alignment. Subgrades to receive pavements will require proofrolling as recommended herein.

Borings B-7 through B-23 (and B-32 through B-35 which are off the main streetcar alignment) were drilled along the "Downtown Loop" and encountered relatively lower consistency soils described as medium to low consistency clay and sand. Standard penetration test N-values ranged from 2 to 36 blows per foot in the upper 5 feet, with an average of 10 bpf (excluding B-32 through B-35). Borings B-9 through B-13 had an average blowcount of 6 bpf in the upper 5 feet and may require a thicker base section following proofrolling along Kansas Street from Franklin Avenue to E Paisano Street along the northeastern reach of the "Downtown Loop".

Pavement Recommendations

Recommendations for both flexible and rigid pavements are provided in the following sections. For areas where heavy truck traffic and tight maneuvering is anticipated, such as busy arterial intersections, use of rigid pavements is recommended.

As previously stated, this pavement design is not intended to serve as a pavement condition survey or pavement improvement program, but rather to confirm replaced pavements meet or exceed existing paved conditions. Accordingly, a minimum flexible pavement section consisting of 4 inches of Hot Mix Asphaltic Concrete (HMAC) over 8 inches of Crushed Stone Base (CSB) material was selected for the full depth pavement replacement option.

Traffic Design. Average daily traffic (ADT) counts are available on the TxDOT Statewide (www.dot.state.tx.us/apps/statewide_mapping/StatewidePlanningMap.html). The maps indicate ADT values of 12,400 to 19,000 in the year 2010 within the downtown streets of the City of El Paso. Posted ADT projections for the year 2030 in this same vicinity range from 17,360 to 26,600 with 5.4 to 7.1 percent trucks. Making some assumptions about traffic distributions, the resulting ESALs (Equivalent 18-kip Single Axle Loads) for these Urban Collectors and Arterials range from about 1 to 2 million.

Based on boring data from "Downtown Loop" borings, a resilient modulus (M_r) of 4,000 psi was selected based on blowcount and plasticity data[1]. A "backcalculated" modulus of 12,000 psi can be used in the FPS analysis based on an approximate correlation of 3 to 1 with M_r. The FPS analysis is used to perform a mechanistic check to assess fatigue cracking and rut life of flexible pavements.

Using the 1993 AASHTO Design Procedure, as required in the City of El Paso Design Standards for Construction (2008), and a M_r of 4 ksi, the resulting pavement sections for a 20-year design life range from 4" to 5" of HMAC over 16" to 18" of CSB for design ESALs of 1 to 2 million.

Considering this project is a street reconstruction project for the proposed streetcar, a minimum pavement section of 4" HMAC over 8" CSB was selected for full depth replacement option. This section was selected based on comparison with existing pavement sections and grading required for the 12 inch thick track slab. A pavement section consisting of a minimum of 4" HMAC and 8" CSB will have a similar pavement longevity to that existing; however, it <u>will not meet a 20 year design life</u> for the above estimated traffic loading. If budget allows, additional thickness of CSB will increase pavement longevity. URS would be pleased to provide a proposal for pavement management and design services, if requested.

Flexible Pavement Construction. Construction of the roadways should proceed in accordance with the Texas Department of Transportation 2004 <u>Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges</u>, and the following recommendations:

1. Remove all organics, existing pavements, any deleterious material encountered, and surficial soils to a depth of at least 6 inches and meet lines and grades shown in the drawings.
2. Scarify and compact the cut soil subgrade to at least 95% of the maximum dry density determined using TxDOT Test Method TEX-114-E if clayey soils, and TEX-113-E if gravelly soils. Hold water contents during construction to within ±2% of the optimum water content.

[1] E.J. Yoder & M.W. Witczak "Principles of Pavement Design" John Wiley & Sons; 2nd Edition (1 Jan 1975)

3. Proofroll the prepared subgrade in accordance with Item 216 of the current TxDOT Standard Specifications. The proof rolling operation should be observed by a representative of the geotechnical engineer. Any soft or weak subgrade should be over excavated and replaced with crushed stone base material selected and placed as recommended in Item 4 below.
4. On the prepared subgrade, place the recommended thickness of crushed limestone flexible base, which conforms to Item 247, Type A, Grade 2 or 5 of the TxDOT Standard Specifications. Compact the flexible base to 100% of the maximum dry density determined using TxDOT Test Method TEX-113-E. Hold water contents to within ±2% of the optimum, and maintain compacted lift thicknesses to 6 inches or less.
5. Provide and place the proper thickness tabulated above of hot mix asphaltic concrete which conforms to Type C or D, Item 340, Hot Mix Asphaltic Concrete Pavement, TxDOT 2004 Standard Specifications for the Construction of Highways, Streets and Bridges. Project specifications should dictate that the HMAC thickness specified in the table above be a minimum at any location rather than an average.

Rigid Pavement Construction. Construction of the rigid pavement should proceed in accordance with the following recommendations:

1. Remove all organics, existing pavements, any deleterious material encountered, and surficial soils to a depth of at least 6 inches and meet lines and grades shown in the drawings.
2. Scarify and compact the cut soil subgrade to at least 95% of the maximum dry density determined using TxDOT Test Method TEX-114-E if clayey soils, and TEX-113-E if gravelly soils. Hold water contents during construction to within ±2% of the optimum water content.
3. Proofroll the prepared subgrade in accordance with Item 216 of the current TxDOT Standard Specifications. The proof rolling operation should be observed by a representative of the geotechnical engineer. Any soft or weak subgrade should be over excavated and replaced with crushed limestone base material selected and placed as recommended in Item 4 below.
4. On the prepared subgrade, place the recommended thickness of crushed limestone flexible base which conforms to Item 247, Type A, Grade 3 of the

TxDOT Standard Specifications. Compact the flexible base to 100% of the maximum dry density determined using TxDOT Test Method TEX-113-E. Hold water contents to within ±2% of the optimum, and maintain compacted lift thicknesses to 6 inches or less.

5. The Portland cement concrete pavement should have a 28-day compressive strength of at least 4,000 psi and be reinforced with a minimum of No. 4 bars on 18-inch centers, each way
6. Space transverse and longitudinal contraction joints (induced cracks) at intervals not exceeding 30 times the concrete thickness up to a maximum of 15 feet. The contraction joint pattern should divide the pavement into panels that are approximately square, with the length of any panel no more than 20 percent greater than its width. Depth of joints must be at least one-quarter of the slab thickness. The joints must be saw cut as soon as the concrete has hardened and will not tear or ravel when cut, and not more than 16 hours after placement. Frequent depth checks of the joints is recommended by an independent quality control agency during the saw cutting operation.
7. Support reinforcement steel with chairs or precast concrete blocks about 1 inch below the bottom of the planned contraction joints.
8. Provide load transfer at the interface between areas of concrete placed at different times using tied and keyed construction joints. Place construction joints at planned contraction joint locations. (See ACI Manual of Concrete Practice, Part 2, for further guidance.)
9. Stage pavement construction such that construction traffic, including concrete trucks, do not travel on newly placed concrete pavement until the concrete achieves at least 75 percent of the design strength, usually 7 days.

Pavement Drainage. Control of surface drainage and groundwater is important to the performance and life of pavements. Infiltration of water into the pavement subgrade and pavement structure will result in premature loss of serviceability. Adequate drainage provisions should be included in the pavement design. Additionally, the placement of curbs, islands and irrigation systems should be carefully planned in a manner that will not lead to ponding and saturation of pavement base materials that extend into island areas.

ADDENDUM 2 - JULY 14, 2015

Conditions

Since some variation was found in subsurface conditions at the boring locations, all parties involved should take notice that subsurface conditions may vary significantly between boring locations. Statements in the report as to subsurface variation over given areas are intended only as estimations from the data obtained at specific boring locations.

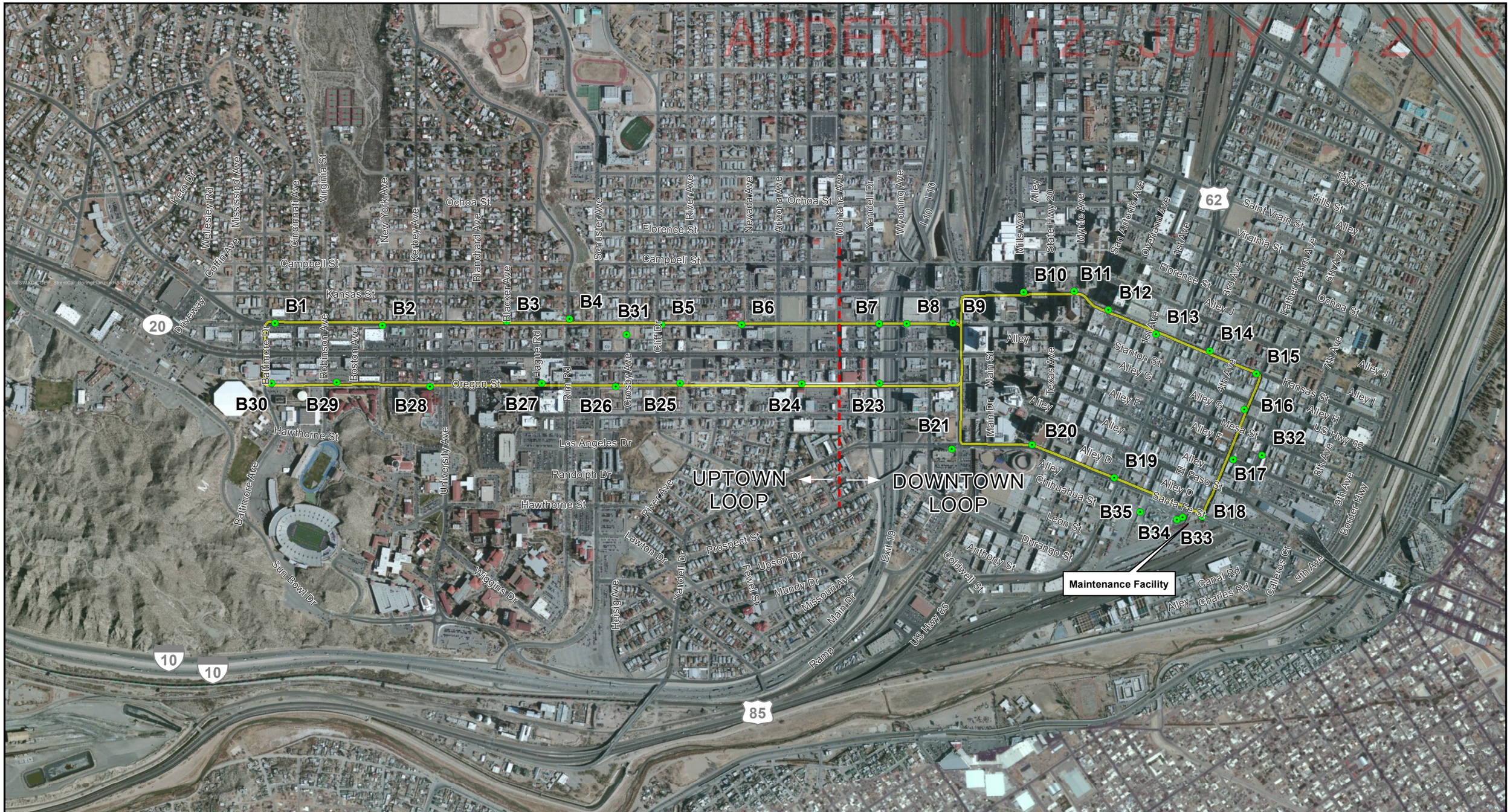
The professional services that form the basis for this report have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in the same locality. No other warranty, express or implied, is made as the professional advice set forth. This scope of work did not include and investigation, detection, or design related to the presence of any recognized environmental pollutants.

* * *

The following attachments complete this report:

Boring Location Plan	Figure 1
Appendix	Boring Logs (B-1 through B-35, omit B-22)

ADDENDUM 2 - JULY 14, 2015



0 600 1,200 Feet

1 in = 1,000 feet

Legend

- Boring Location
- Primary Streetcar Route

URS

Figure 1
Boring Location Plan

El Paso Streetcar Project

ADDENDUM 2 - JULY 14, 2015

APPENDIX

Boring Logs
B-1 through B-35, excluding B-22

FIGURE: 1

ADDENDUM 2 - JULY 14, 2015

BORING B1

DATE STARTED:	11/14/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/14/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3916.75 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77804°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.50269°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

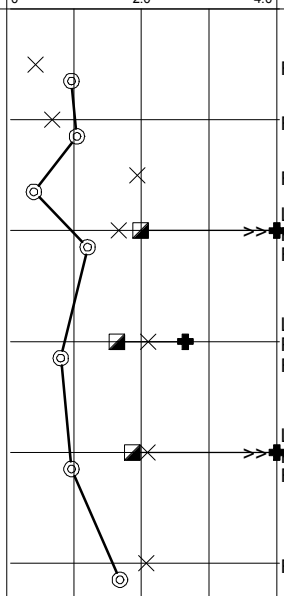
Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 4 inches thick				
						GRADED GRAVEL BASE - 8 inches thick				
3915				SS1	12	**GRAVEL** - Poorly Graded with Silt and Sand, brown, medium dense, moist	GP-GM	8-7-5 N=12	5	Fines=9.7%
	5			SS2	4	**CLAYEY GRAVEL** - with Sand, brown, medium dense, moist	GC	4-6-7 N=13	8	Fines=17.8%
3910				SS3	10	**FAT CLAY** - with Sand, brown, medium, moist	CH	2-3-2 N=5	24	Fines=71.0%
	10			SS4	18	stiff		4-7-8 N=15	21	LL = 61 PL = 25 Fines=80.9%
3905										
	15			SS5	18	**LEAN CLAY** - brown, stiff, moist	CL	3-5-5 N=10	26	LL = 33 PL = 20 Fines=94.0%
3900										
	20			SS6	18	**FAT CLAY** - brown, stiff, moist	CH	3-5-7 N=12	26	LL = 70 PL = 23 Fines=92.8%
3895										
	25			SS7	18	very stiff		4-9-12 N=21	26	Fines=93.2%
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



Professional Service Industries, Inc.
4601 Ripley Drive
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Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 2

ADDENDUM 2 - JULY 14, 2015

BORING B2

DATE STARTED:	11/14/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/14/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3889.04 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77539°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.505048°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 4 inches thick				
						GRADED GRAVEL BASE - 8 inches thick				
3885				SS1	10	**SILTY SAND** - with Gravel, brown, medium dense, moist	SM	11-12-14 N=26	6	Fines=17.5%
	5			SS2	12	brown, dense, dry		31-17-14 N=31	2	Fines=13.6%
3880				SS3	16	brown (sand) to gray (gravels), dense, moist		5-12-23 N=35	9	Fines=29.4%
	10			SS4	16	light brown, very dense, moist, some calcareous staining		11-45-40 N=85	4	Fines=17.3%
3875	15			SS5	16	**SANDY LEAN CLAY** - brown, very stiff, moist	CL	10-8-14 N=22	17	LL = 38 PL = 19 Fines=76.3%
3870	20			SS6	18	**FAT CLAY** - brown, very stiff, moist	CH	5-6-10 N=16	27	LL = 84 PL = 25 Fines=97.4%
3865	25			SS7	16	**CLAYEY SAND** - brown, dense, moist	SC	8-13-24 N=37	11	Fines=27.3%
						Boring terminated at 26.5 feet below grade				

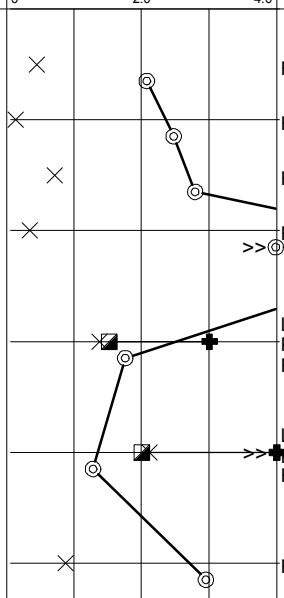

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FIGURE: 3

ADDENDUM 2 - JULY 14, 2015

BORING B3

DATE STARTED:	11/14/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/14/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	5.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3926.08 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77249°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49773°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ (× Moisture, ◪ PL, ✚ LL; 0–25–50) / STRENGTH, tsf (▲ Qu, ✳ Qp; 0–2.0–4.0)	Additional Remarks
3925	0					**ASPHALT** - 5.5 inches thick					
						GRADED GRAVEL BASE - 8 inches thick					
				SS1	10	**CLAYEY GRAVEL** - with Sand, brown to light brown, very dense, moist	GC	15-50 (3")	4	>>◎	Fines=16.7%
	5			SS2	16	**CLAYEY SAND** - with Gravel, light brown, very dense, moist	SC	28-42-40 N=82	3	>>◎	Fines=12.3%
						Boring terminated at Auger and Split Spoon Refusal at 5.5 feet below grade					

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FIGURE: 4

ADDENDUM 2 - JULY 14, 2015

BORING B4

DATE STARTED:	11/12/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/12/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3910.11 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77103°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49633°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 3.5 inches thick **CONCRETE** - 8 inches thick **PAVEMENT BASE** - 6 inches thick				
				SS1	6	**GRAVEL** - Poorly Graded with Clay and Sand, grey, medium dense, moist	GP-GC	21-16-14 N=30	4	Fines=8.7%
3905	5			SS2	2			13-16-16 N=32	6	Fines=10.4%
				SS3	8	**CLAYEY SAND** - with Gravel, brown, medium dense, moist	SC	10-7-6 N=13	9	Fines=26.0%
3900	10			SS4	10	**LEAN CLAY** - with Sand, brown, medium, moist	CL	3-2-5 N=7	27	Fines=75.2%
3895	15			SS5	10	**SILTY CLAYEY SAND** - brown, medium dense, moist, with clay lenses	SC-SM	16-11-11 N=22	17	Fines=46.2%
3890	20			SS6	8	**GRAVEL** - Poorly Graded, grey, medium dense, moist	GP	17-12-13 N=25	5	
3885	25			SS7	18	**FAT CLAY** - brown, very stiff, moist	CH	4-8-13 N=21	22	LL = 50 PL = 19 Fines=93.4%
						Boring terminated at 26.5 feet below grade				

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FIGURE: 5

ADDENDUM 2 - JULY 14, 2015

BORING B5

DATE STARTED:	11/12/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/12/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	21.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3786.48 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76872°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49454°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0 – 25 – 50) STRENGTH, tsf ▲ Qu ✳ Qp (0 – 2.0 – 4.0)	Additional Remarks
	0					**ASPHALT** - 8 inches thick					
						PAVEMENT BASE - 6 inches thick					
3785				SS1	12	**SILTY GRAVEL** - with Sand, brown, medium dense, moist	GM	6-8-10 N=18	6		Fines=20.5%
	5			SS2	8	**CLAYEY SAND** - with Gravel, brown, medium dense, moist	SC	5-8-12 N=20	5		Fines=22.5%
3780				SS3	12	dense		16-22-13 N=35	5		Fines=22.1%
	10			SS4	0	**GRAVEL** - Poorly Graded with Sand, multicolored, very dense, moist	GP	50 (6")	3	>>	Fines=3.3%
3775											
	15			SS5	12	**CLAYEY SAND** - with Gravel, brown, very dense, moist	SC	40-35-44 N=79	5	>>	LL = 32 PL = 19 Fines=26.7%
3770											
	20			SS6	15	**CLAYEY SAND** - brown, medium dense, moist	SC	8-10-11 N=21	11		LL = 38 PL = 19 Fines=30.3%
3765						Boring terminated at 21.5 feet below grade					

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FIGURE: 6

ADDENDUM 2 - JULY 14, 2015

BORING B6

DATE STARTED:	11/12/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/12/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	2.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3828.27 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.7668°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49285°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ (× Moisture, ◪ PL, ✚ LL; 0–25–50) / STRENGTH, tsf (▲ Qu, ✳ Qp; 0–2.0–4.0)	Additional Remarks
	0					**ASPHALT** - 6.5 inches thick					
						PAVEMENT BASE - 4.5 inches thick	GP				
				SS1	6	**GRAVEL** - Poorly Graded with Sand, brown, very dense, moist		50 (5.5")	4	× >>◎	Fines=9.8%
						Boring terminated at Auger and Split Spoon Refusal at 2.5 feet below grade					

Professional Service Industries, Inc.
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PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 7

ADDENDUM 2 - JULY 14, 2015

BORING B7

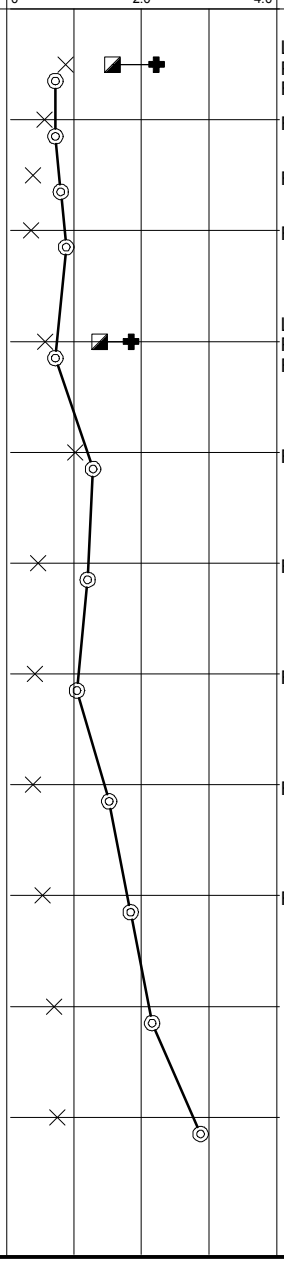
DATE STARTED:	11/9/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/9/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	51.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3749.89 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76353°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.4899°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**ASPHALT** - 3.25 inches thick				
				PAVEMENT BASE - 8 inches thick				
		SS1	10	**CLAYEY SAND** - brown, loose, moist	SC	15-6-3 N=9	11	LL = 28 PL = 20 Fines=39.3%
3745	5	SS2	14	**SILTY SAND** - brown, loose, moist	SM	3-5-4 N=9	7	Fines=18.3%
		SS3	16	**SAND** - Poorly Graded with Silt, brown, loose, moist	SP-SM	6-5-5 N=10	5	Fines=8.6%
3740	10	SS4	17	medium dense, moist		6-6-5 N=11	5	Fines=9.6%
3735	15	SS5	17	**SILTY CLAYEY SAND** - brown, loose, moist	SC-SM	6-5-4 N=9	7	LL = 23 PL = 17 Fines=35.0%
3730	20	SS6	15	medium dense, moist, with clay lenses		3-7-9 N=16	13	Fines=%
3725	25	SS7	18	**SILTY SAND** - brown, medium dense, moist	SM	4-7-8 N=15	6	Fines=21.3%
3720	30	SS8	18			7-6-7 N=13	5	Fines=22.9%
3715	35	SS9	18			7-11-8 N=19	5	Fines=19.2%
3710	40	SS10	18			8-12-11 N=23	7	Fines=20.8%
3705	45	SS11	18			13-13-14 N=27	9	
3700	50	SS12	18	brown, dense, moist		8-12-24 N=36	9	
				Boring terminated at 51.5 feet below grade				



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LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 8

ADDENDUM 2 - JULY 14, 2015

BORING B8

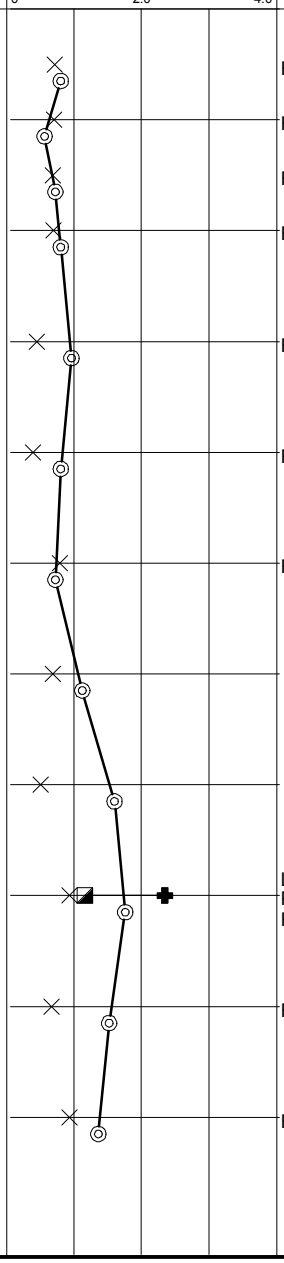
DATE STARTED:	11/9/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/9/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	51.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3743.44 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76286°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48932°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**ASPHALT** - 9.5 inches thick				
				PAVEMENT BASE - 4.5 inches thick				
3740		SS1	10	**SILTY CLAYEY SAND** - brown, loose, moist	SC-SM	9-7-3 N=10	9	Fines=26.3%
	5	SS2	12			3-3-4 N=7	9	Fines=27.7%
3735		SS3	17			3-4-5 N=9	9	Fines=27.2%
	10	SS4	15			3-4-6 N=10	9	Fines=25.7%
3730								
	15	SS5	16	**SILTY SAND** - brown, medium dense, moist	SM	5-6-6 N=12	6	Fines=20.7%
3725								
	20	SS6	18	loose, moist		5-4-6 N=10	5	Fines=15.2%
3720								
	25	SS7	17	loose, moist, with clay lenses		4-4-5 N=9	10	Fines=36.6%
3715								
	30	SS8	18	medium dense, moist		6-5-9 N=14	9	
3710								
	35	SS9	18			7-10-10 N=20	6	
3705								
	40	SS10	18	**CLAYEY SAND** - brown, medium dense, moist	SC	11-10-12 N=22	12	LL = 29 PL = 15 Fines=34.4%
3700								
	45	SS11	18	**SILTY SAND** - brown, medium dense, moist	SM	5-9-10 N=19	8	Fines=18.3%
3695								
	50	SS12	18			9-10-7 N=17	12	Fines=22.2%
				Boring terminated at 51.5 feet below grade				



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LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 9

ADDENDUM 2 - JULY 14, 2015

BORING B9

DATE STARTED:	11/7/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/7/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3734.02 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76177°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48834°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

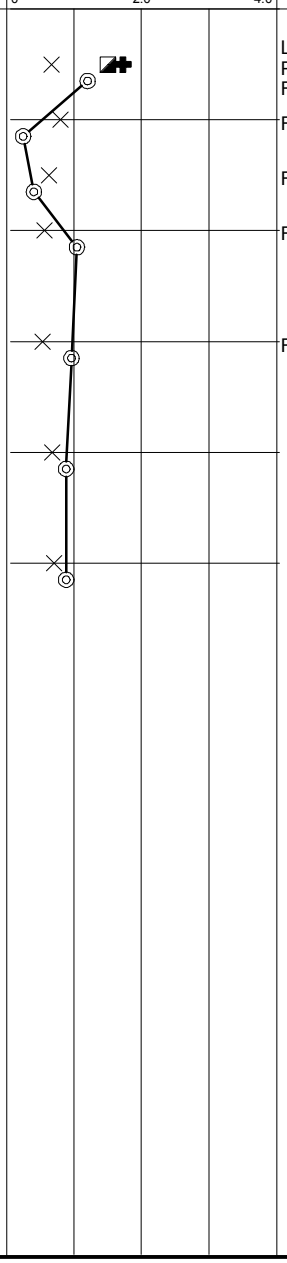
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**CONCRETE** - 9.5 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	16	**SILTY SAND** - brown, medium dense, moist		4-6-9 N=15	8	LL = 22 PL = 19 Fines=26.6%
3730	5			SS2	17	very loose, moist		2-1-2 N=3	10	Fines=32.8%
				SS3	18	loose, moist		2-2-3 N=5	8	Fines=35.0%
3725	10			SS4	16	medium dense, moist		3-4-9 N=13	7	Fines=30.8%
3720							SM			
	15			SS5	8			7-5-7 N=12	7	Fines=29.7%
3715	20			SS6	18			5-6-5 N=11	8	
3710	25			SS7	18			5-6-5 N=11	9	
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 10

ADDENDUM 2 - JULY 14, 2015

BORING B10

DATE STARTED:	11/7/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/7/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3716.65 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76064°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48596°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

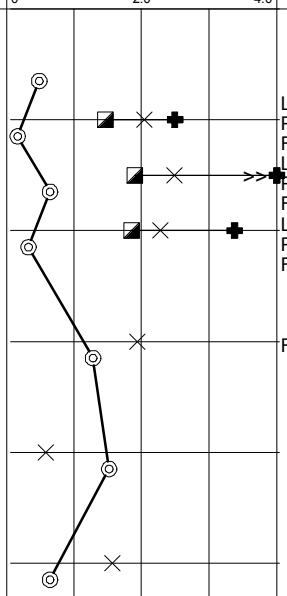
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 7.5 inches thick				
3715						**PAVEMENT BASE** - 8 inches thick				
				SS1	16	**FILL** - Clayey Sand with Gravel (SC), brown, loose, moist, with asphalt fragments		6-3-3 N=6		
	5			SS2	12	**LEAN CLAY** - with Sand, brown, soft, moist	CL	2-1-1 N=2	26	LL = 31 PL = 18 Fines=70.8%
3710				SS3	18	**FAT CLAY** - brown, stiff, moist	CH	2-4-4 N=8	31	LL = 58 PL = 24 Fines=93.6%
	10			SS4	16	**LEAN CLAY** - brown, soft, moist		2-2-2 N=4	29	LL = 42 PL = 23 Fines=90.9%
3705										
	15			SS5	16	very stiff, moist	CL	3-6-10 N=16	24	Fines=81.7%
3700										
	20			SS6	17	**SILTY SAND** - brown, medium dense, moist	SM	6-9-10 N=19	7	
3695										
	25			SS7	18	**CLAYEY SAND** - brown, loose, moist	SC	3-3-5 N=8	20	
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 11

ADDENDUM 2 - JULY 14, 2015

BORING B11

DATE STARTED:	11/7/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/7/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3711.57 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75944°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48486°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

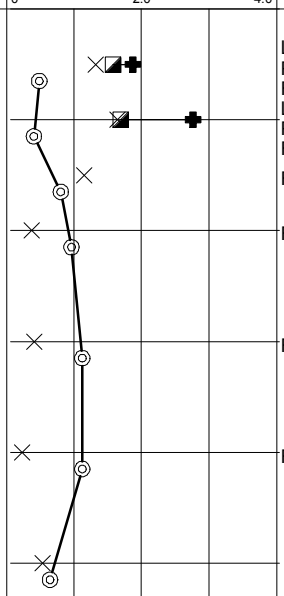
REMARKS: None

Water

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 8 inches thick				
3710						**PAVEMENT BASE** - 6 inches thick				
				SS1	18	**SANDY SILT** - brown, medium, moist	ML	3-2-4 N=6	16	LL = 23 PL = 20 Fines=62.0%
	5			SS2	17	**LEAN CLAY** - brown, medium, moist	CL	3-2-3 N=5	20	LL = 34 PL = 21 Fines=95.5%
3705				SS3	18	stiff, moist		4-5-5 N=10	14	Fines=61.1%
	10			SS4	17	**SILTY SAND** - brown, medium dense, moist	SM	3-6-6 N=12	5	Fines=19.1%
3700										
	15			SS5	18	**SAND** - Poorly Graded, brown, medium dense, moist	SP	4-5-9 N=14	5	Fines=3.6%
3695										
	20			SS6	18	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	6-5-9 N=14	3	Fines=2.9%
3690										
	25			SS7	18	**SAND** - Poorly Graded, brown, loose, moist	SP	2-3-5 N=8	7	
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 12

ADDENDUM 2 - JULY 14, 2015

BORING B12

DATE STARTED:	11/7/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/7/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	21.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3709.53 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75828°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48466°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

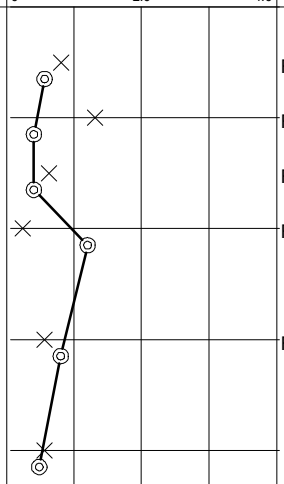
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 2 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	15	**SILTY SAND** - brown, loose, moist	SM	3-4-3 N=7	10	Fines=37.8%
3705	5			SS2	18	**SANDY SILT** - brown, medium, moist	ML	2-2-3 N=5	16	Fines=56.4%
				SS3	18	**SILTY SAND** - brown, loose, moist	SM	3-2-3 N=5	8	Fines=23.5%
3700	10			SS4	18	**SAND** - Poorly Graded, brown, medium dense, moist	SP	4-6-9 N=15	3	Fines=3.7%
3695	15			SS5	18	**SAND** - Poorly Graded with Silt, brown, loose, moist	SP-SM	5-5-5 N=10	7	Fines=11.0%
3690	20			SS6	18	loose, moist, with clay lenses		2-3-3 N=6	7	
						Boring terminated at 21.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 13

ADDENDUM 2 - JULY 14, 2015

BORING B13

DATE STARTED:	11/6/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/6/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3708.75 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.7567°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48433°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

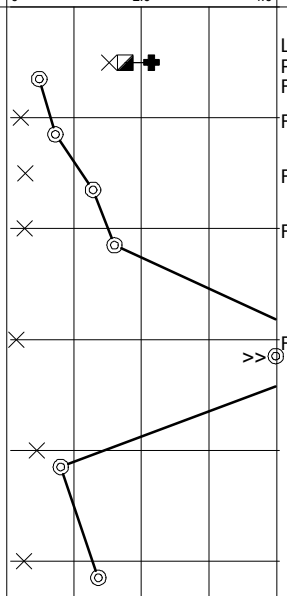
Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 2.75 inches thick				
						PAVEMENT BASE - 8 inches thick				
3705				SS1	15	**FILL** - Silt with Sand (ML), brown, loose, moist, with asphalt fragments		3-4-2 N=6	19	LL = 27 PL = 22 Fines=81.8%
	5			SS2	17	**SAND** - Poorly Graded, brown, loose, moist		2-3-6 N=9	3	Fines=3.2%
3700				SS3	18	medium dense, moist		3-6-10 N=16	3	Fines=3.7%
	10			SS4	17	medium dense, moist	SP	7-10-10 N=20	3	Fines=5.1%
3695										
	15			SS5	15	**SAND** - Poorly Graded with Gravel, brown, very dense, moist	SP	12-30-35 N=65	2	Fines=4.6% >>
3690										
	20			SS6	17	**SAND** - Poorly Graded, brown, loose, moist, with clay lenses	SP	4-3-7 N=10	6	
3685										
	25			SS7	17	medium dense, moist, with clay lenses		2-9-8 N=17	3	
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 14

ADDENDUM 2 - JULY 14, 2015

BORING B14

DATE STARTED:	11/6/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/6/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	21.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3708.04 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75512°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48363°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

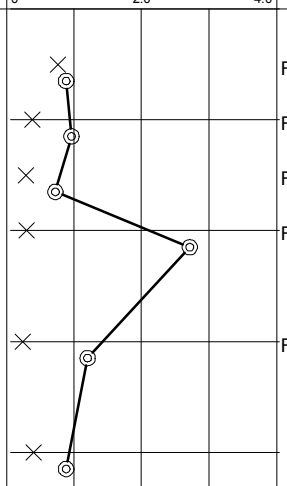
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 3.25 inches thick				
						PAVEMENT BASE - 8 inches thick				
3705				SS1	12	**FILL** - Silty Sand with Gravel (SM), dark brown, medium dense, moist, with brick and asphalt fragments		4-5-6 N=11	10	Fines=28.6%
	5			SS2	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	5-7-5 N=12	5	Fines=6.1%
3700				SS3	17	**SAND** - Poorly Graded, brown, loose, moist	SP	2-4-5 N=9	4	Fines=1.3%
	10			SS4	16	**SAND** - Poorly Graded with Silt, brown, dense, moist	SP-SM	6-14-20 N=34	4	Fines=9.7%
3695										
	15			SS5	14	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist, with clay lenses	SP	10-12-3 N=15	3	Fines=3.1%
3690										
	20			SS6	18	**SAND** - Poorly Graded, brown, medium dense, moist, with clay lenses	SP	3-4-7 N=11	5	
						Boring terminated at 21.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



Professional Service Industries, Inc.
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Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 15

ADDENDUM 2 - JULY 14, 2015

BORING B15

DATE STARTED:	11/5/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/5/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3706.76 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75358°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48331°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

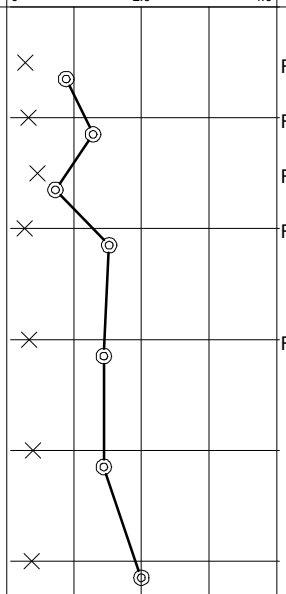
Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 2.5 inches thick				
						PAVEMENT BASE - 8 inches thick				
3705				SS1	16	**SAND** - Poorly Graded with Silt, dark brown, medium dense, moist	SP	3-6-5 N=11	3	Fines=5.8%
	5			SS2	18	**SAND** - Poorly Graded, brown, medium dense, moist	SP	4-7-9 N=16	4	Fines=3.8%
3700				SS3	18	**SILTY SAND** - brown, loose, moist, with clay lenses	SM	3-4-5 N=9	6	Fines=13.6%
	10			SS4	18	**SAND** - Poorly Graded, brown, medium dense, moist	SP	4-8-11 N=19	3	Fines=3.0%
3695										
	15			SS5	16	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	5-9-9 N=18	4	Fines=3.8%
3690										
	20			SS6	18	**SAND** - Poorly Graded, brown, medium dense, moist	SP	4-8-10 N=18	5	
3685										
	25			SS7	16	medium dense, moist		7-12-13 N=25	5	
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50

STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

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FIGURE: 16

ADDENDUM 2 - JULY 14, 2015

BORING B16

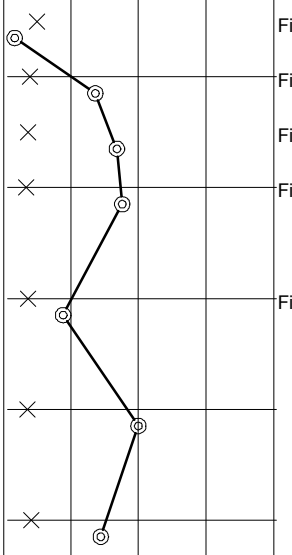
DATE STARTED:	11/5/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/5/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3708.25 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75322°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48458°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 3 inches thick				
						PAVEMENT BASE - 8 inches thick				
3705				SS1	18	**FILL** - Poorly Graded Sand with Silt (SP), brown, very loose, moist		2-1-1 N=2	6	Fines=11.5%
	5			SS2	18	**FILL** - Poorly Graded Sand with Silt and Gravel (SP), brown, medium dense, moist, with asphalt fragments		3-7-10 N=17	5	Fines=10.4%
3700				SS3	18	**SAND** - Poorly Graded, brown, medium dense, moist		5-9-12 N=21	5	Fines=2.6%
	10			SS4	18			5-10-12 N=22	4	Fines=2.8%
3695										
	15			SS5	18		SP	5-6-5 N=11	4	Fines=3.6%
3690										
	20			SS6	18	medium dense, moist, with clay lenses		4-13-12 N=25	4	
3685										
	25			SS7	18	medium dense, moist		5-8-10 N=18	5	
						Boring terminated at 26.5 feet below grade				



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PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

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FIGURE: 17

ADDENDUM 2 - JULY 14, 2015

BORING B17

DATE STARTED:	11/5/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/5/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3708.70 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75258°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48622°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0 – 25 – 50) STRENGTH, tsf ▲ Qu ✳ Qp (0 – 2.0 – 4.0)	Additional Remarks
	0					**ASPHALT** - 3 inches thick					
						PAVEMENT BASE - 8 inches thick					
3705				SS1	18	**SILTY SAND** - brown, medium dense, moist	SM	6-9-11 N=20	3		Fines=13.2%
	5			SS2	18	**SAND** - Poorly Graded with Silt, brown, dense, moist	SP-SM	4-28-8 N=36	4		Fines=11.0%
3700				SS3	18	**SAND** - Poorly Graded, brown, dense, moist		6-15-16 N=31	3		Fines=3.3%
	10			SS4	18	medium dense, moist	SP	6-9-10 N=19	4		Fines=4.0%
3695											
	15			SS5	18	**SAND** - Poorly Graded with Silt, brown, loose, moist	SP-SM	2-3-2 N=5	6		Fines=10.3%
3690											
	20			SS6	12	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	8-9-10 N=19	2		
3685											
	25			SS7	14	very dense, moist		30-43-40 N=83	2	>>	
						Boring terminated at 26.5 feet below grade					

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FIGURE: 18

ADDENDUM 2 - JULY 14, 2015

BORING B18

DATE STARTED:	11/1/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/1/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3709.99 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75229°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48832°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**CONCRETE** - 8.5 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	18	**FILL** - Poorly Graded Sand (SP), dark brown, moist, with asphalt fragments		5-7-7 N=14	8	Fines=23.7%
3705	5			SS2	18	**SILTY SAND** - brown, medium dense, moist	SM	4-5-7 N=12	10	Fines=22.4%
				SS3	18			5-9-9 N=18	7	Fines=17.8%
3700	10			SS4	18	**SAND** - Poorly Graded, brown, medium dense, moist		4-9-12 N=21	4	Fines=4.1%
3695	15			SS5	16	medium dense, moist, with clay lenses	SP	3-5-8 N=13	4	Fines=6.1%
3690	20			SS6	18	medium dense, moist		8-13-16 N=29	3	
3685	25			SS7	18	medium dense, moist, with clay lenses		2-4-8 N=12	11	
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

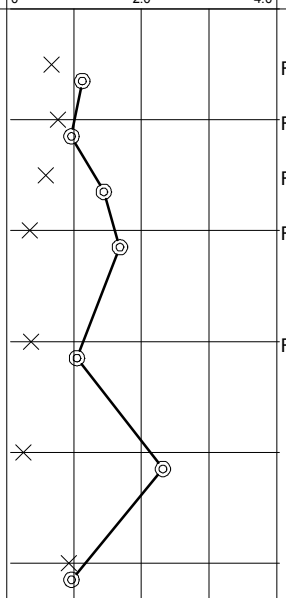

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FIGURE: 19

ADDENDUM 2 - JULY 14, 2015

BORING B19

DATE STARTED:	11/1/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/1/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3710.54 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75501°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49202°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
3710	0					**CONCRETE** - 8.5 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	18	**FILL** - Poorly Graded Sand (SP), dark brown, moist, with asphalt fragments	SP-SM	3-6-5 N=11	5	Fines=8.3%
3705	5			SS2	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SM	2-4-5 N=9	6	Fines=16.9%
						SILTY SAND - brown, loose, moist				
				SS3	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	5-11-12 N=23	5	Fines=8.1%
3700	10			SS4	18	**SAND** - Poorly Graded, brown, medium dense, moist	SP	7-10-7 N=17	4	Fines=2.2%
3695	15			SS5	14	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	5-7-7 N=14	3	Fines=3.4%
3690	20			SS6	15			2-3-9 N=12	6	
3685	25			SS7	18	**FAT CLAY** - brown, stiff, moist	CH	2-5-5 N=10	30	LL = 74 PL = 28 Fines=95.4%
						Boring terminated at 26.5 feet below grade				

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FIGURE: 20

ADDENDUM 2 - JULY 14, 2015

BORING B20

DATE STARTED:	11/2/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/2/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.3 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3715.01 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75766°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49007°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 3.25 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	17	**SILTY CLAYEY SAND** - with Gravel, brown, medium dense, moist	SC-SM	4-6-5 N=11	10	LL = 24 PL = 18 Fines=30.4%
3710	5			SS2	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	2-7-7 N=14	9	Fines=6.7%
				SS3	12			4-8-8 N=16	6	Fines=9.3%
3705	10			SS4	17	**SAND** - Poorly Graded, brown, loose, moist	SP	3-3-3 N=6	3	Fines=1.5%
3700	15			SS5	16	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist		4-5-10 N=15	3	Fines=2.1%
3695	20			SS6	16		SP	9-8-6 N=14	2	
3690	25			SS7	12	very dense, moist		21-33-50 (3")	3	
						Boring terminated 26.3 feet below grade				

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FIGURE: 21

ADDENDUM 2 - JULY 14, 2015

BORING B21

DATE STARTED:	11/2/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/2/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3745.64 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75951°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49191°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

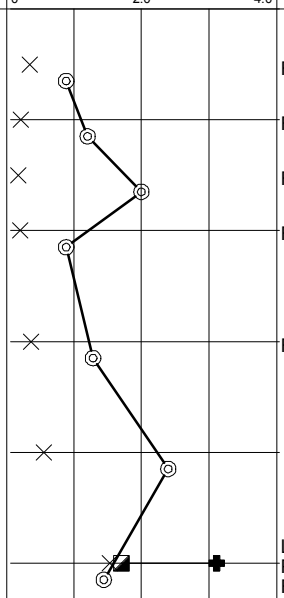
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
3745	0					**CONCRETE** - 8.5 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	4-5-6 N=11	4	Fines=4.7%
3740	5			SS2	18	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	5-7-8 N=15	3	Fines=2.8%
				SS3	14	**SAND** - Poorly Graded with Silt and Gravel, brown, medium dense, moist	SP-SM	5-13-12 N=25	2	Fines=6.8%
3735	10			SS4	16	**SAND** - Poorly Graded, brown, medium dense, moist	SP	5-6-5 N=11	2	Fines=6.3%
3730	15			SS5	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist		5-8-8 N=16	5	Fines=5.7%
3725	20			SS6	16	medium dense, moist, with clay lenses	SP-SM	2-14-16 N=30	7	
3720	25			SS7	18	**LEAN CLAY** - with Sand, brown, very stiff, moist	CL	6-7-11 N=18	19	LL = 39 PL = 21 Fines=73.8%
						Boring terminated at 26.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 23

ADDENDUM 2 - JULY 14, 2015

BORING B23

DATE STARTED:	11/12/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/12/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	41.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3753.53 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76243°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49157°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**CONCRETE** - 9 inches thick				
3750		SS1	16	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	6-6-6 N=12	6	Fines=10.4%
	5	SS2	17			3-6-5 N=11	5	Fines=7.7%
3745		SS3	18	**SAND** - Poorly Graded with Silt and Gravel, brown, medium dense, moist	SP-SM	9-17-13 N=30	4	Fines=10.4%
	10	SS4	17	**SILTY SAND** - brown, dense, moist		13-14-17 N=31	5	Fines=12.4%
3740								
	15	SS5	18	dense, moist	SM	8-16-22 N=38	6	Fines=12.8%
3735								
	20	SS6	18	**SILTY CLAYEY SAND** - brown, very dense, moist, with clay lenses		12-24-32 N=56	9	LL = 21 PL = 16 >> Fines=29.8%
3730								
	25	SS7	18	dense, moist	SC-SM	14-16-18 N=34	15	Fines=20.3%
3725								
	30	SS8	18	**SANDY LEAN CLAY** - brown, very stiff, moist	CL	8-12-18 N=30	21	LL = 34 PL = 19 Fines=64.0%
3720								
	35	SS9	18	**CLAYEY SAND** - brown, very dense, moist, with calcareous material	SC	3-16-40 N=56	14	LL = 26 PL = 14 >> Fines=40.6%
3715								
	40	SS10	18	**SILTY SAND** - brown, dense, moist	SM	9-20-26 N=46	9	Fines=33.7%
				Boring terminated at 41.5 feet below grade				

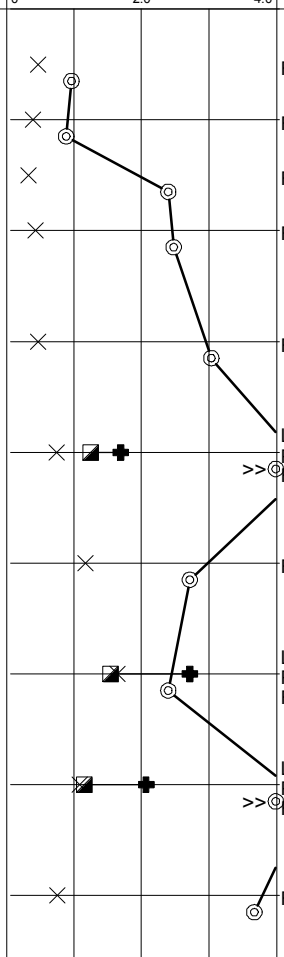

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FIGURE: 24

ADDENDUM 2 - JULY 14, 2015

BORING B24

DATE STARTED:	11/8/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/8/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	15.3 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3779.16 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76429°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49323°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0–25–50) STRENGTH, tsf ▲ Qu ✳ Qp (0–2.0–4.0)	Additional Remarks
	0					**ASPHALT** - 9.5 inches thick					
						PAVEMENT BASE - 4.5 inches thick					
				SS1	6	**SILTY SAND** - with Gravel, brown, very dense, moist	SM	50 (6")	5		>>◎Fines=14.5%
3775	5			SS2	14	**CLAYEY SAND** - brown, very dense, moist	SC	17-31-47 N=78	11		LL = 31 PL = 20 >>◎Fines=39.6%
				SS3	16	dense, moist		13-23-25 N=48	9		LL = 35 PL = 19 ◎Fines=24.3%
3770	10			SS4	18	very dense, moist		14-31-30 N=61	7		Fines=17.9% >>◎
3765	15			SS5	4	Boring terminated at Auger and Split Spoon Refusal at 15.3 feet below grade		50 (4")	8		>>◎Fines=28.9%

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PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 25

ADDENDUM 2 - JULY 14, 2015

BORING B25

DATE STARTED:	11/8/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/8/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	13.0 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3853.54 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76722°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.4958°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0 – 25 – 50) STRENGTH, tsf ▲ Qu ✳ Qp (0 – 2.0 – 4.0)	Additional Remarks
	0					**CONCRETE** - 9.5 inches thick					
						PAVEMENT BASE - 4 inches thick					
3850				SS1	16	**FAT CLAY** - with Sand, brown, medium, moist	CH	2-2-4 N=6	26		LL = 62 PL = 23 Fines=83.6%
	5			SS2	17	**SILTY SAND** - with Gravel, brown, medium dense, moist	SM	7-7-7 N=14	9		Fines=26.7%
3845				SS3	4	loose, moist		7-6-4 N=10	10		Fines=32.5%
	10			SS4	6	**SILTY SAND** - brown, loose, moist	SM	5-3-4 N=7	9		Fines=24.9%
				SS5	11	**GRAVEL** - Poorly Graded, grey, dense, dry	GP	32-20-11 N=31			
						Boring terminated at Auger Refusal at 13 feet below grade					

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FIGURE: 26

ADDENDUM 2 - JULY 14, 2015

BORING B26

DATE STARTED:	11/8/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/8/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.3 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3879.71 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.76869°	**HAMMER TYPE:**	Automatic
LONGITUDE:	106.49725°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) / STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					**ASPHALT** - 9.5 inches thick					
						PAVEMENT BASE - 4 inches thick					
				SS1	18	**FILL** - Poorly Graded Sand with Silt (SP), brown, dense, moist		13-17-22 N=39	11		Fines=5.8%
3875	5			SS2	6	**FILL** - Poorly Graded Sand with Gravel (SP), brown, very loose, moist		7-1-2 N=3			
				SS3	16	**FILL** - Poorly Graded Gravel, black, very loose, moist, with asphalt debris		2-2-2 N=4			
3870	10			SS4	18	**FAT CLAY** - with Sand, brown, stiff, moist	CH	3-6-9 N=15	20	>>	LL = 51 PL = 19 Fines=71.7%
3865	15			SS5	16	**SANDY LEAN CLAY** - brown, hard, moist, with calcareous material	CL	7-15-38 N=53	12	>>	LL = 27 PL = 19 Fines=59.0%
3860	20			SS6	11	**CLAYEY SAND** - reddish brown, very dense, moist	SC	15-50 (5.5")	7	>>	Fines=24.0%
3855	25			SS7	12	brown, very dense, moist		33-47-50 (3")	6		Fines=29.0%
						Boring terminated at Split Spoon Refusal at 26.3 feet below grade					

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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 27

ADDENDUM 2 - JULY 14, 2015

BORING B27

DATE STARTED:	11/8/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/8/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	25.2 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3898.36 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77055°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49872°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 4 inches thick				
						PAVEMENT BASE - 8 inches thick				
3895				SS1	14	**FAT CLAY** - with Sand, brown, medium, moist	CH	7-3-3 N=6	33	LL = 64 PL = 28 Fines=79.2%
	5			SS2	16	**LEAN CLAY** - with Sand, brown, stiff, moist	CL	4-5-6 N=11	18	LL = 46 PL = 19 Fines=70.9%
3890				SS3	14	**SILTY CLAYEY SAND** - brown, medium dense, moist		3-5-6 N=11	15	LL = 24 PL = 20 Fines=38.2%
	10			SS4	15		SC-SM	4-7-9 N=16	21	Fines=24.4%
3885										
	15			SS5	18	**SANDY LEAN CLAY** - brown, hard, moist		6-18-32 N=50	13	LL = 33 PL = 21 Fines=61.0%
3880										
	20			SS6	18	hard, moist	CL	6-23-44 N=67	7	
3875										
	25			SS7	2	**ANDESITE** - with Silty Sand, brown, very dense, dry		50 (2.5")		

Boring terminated at Auger and Split Spoon Refusal at 25.2 feet below grade

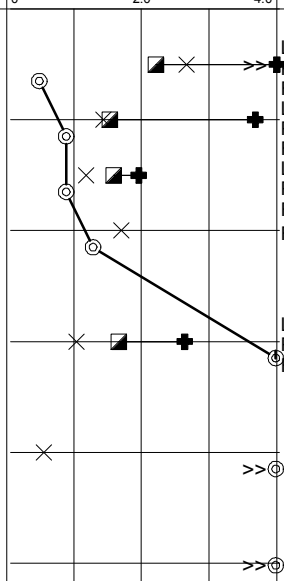

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FIGURE: 28

ADDENDUM 2 - JULY 14, 2015

BORING B28

DATE STARTED:	11/13/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/13/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	6.1 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3878.70 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77315°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.50116°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					**ASPHALT** - 3.75 inches thick					
						GRADED GRAVEL BASE - 8 inches thick					
3875				SS1	12	**CLAYEY SAND** - brown, loose, moist	SC	4-3-7 N=10	17		LL = 39 PL = 23 Fines=35.7%
	5			SS2	7	**SILTY SAND** - brown, very dense, moist	SM	17-50 (1.75")	8		Fines=22.1%
				SS3	1	Boring terminated at Auger and Split Spoon Refusal at 6.1 feet below grade		50 (1")		>>◎ >>◎	

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FIGURE: 29

ADDENDUM 2 - JULY 14, 2015

BORING B29

DATE STARTED:	11/13/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/13/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	4.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3884.17 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77546°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.50304°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0 – 25 – 50) STRENGTH, tsf ▲ Qu ✳ Qp (0 – 2.0 – 4.0)	Additional Remarks
	0					**ASPHALT** - 2.5 inches thick **GRADED GRAVEL BASE** - 8 inches thick					
3880				SS1	12	**FILL** - Clayey Sand with Gravel (SC), brown, dense, moist, some construction debris - brick, asphalt, glass scattered throughout upper soil Boring terminated at Auger and Split Spoon Refusal at 4.5 feet below grade		5-23-8 N=31	10	× ◪ ✚ ◎	LL = 27 PL = 17 Fines=28.7%

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FIGURE: 30

ADDENDUM 2 - JULY 14, 2015

BORING B30

DATE STARTED:	11/13/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/13/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	5.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3899.24 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.77701°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.50444°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ (× Moisture, ◪ PL, ✚ LL; 0–25–50) / STRENGTH, tsf (▲ Qu, ✳ Qp; 0–2.0–4.0)	Additional Remarks
	0					**CONCRETE** - 9 inches thick					
						GRADED GRAVEL BASE - 8 inches thick					
				SS1	12	**FILL** - Clayey Sand with Gravel (SC), brown, dense, moist		5-23-8 N=31	11		LL = 29 PL = 16 Fines=26.5%
3895	5					loose, moist			10		Fines=23.1%
						Boring terminated at Auger and Split Spoon Refusal at 4.5 feet below grade					

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FIGURE: 31

ADDENDUM 2 - JULY 14, 2015

BORING B31

DATE STARTED:	11/12/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/12/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	21.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3863.48 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.81937°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.49557°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					**ASPHALT** - 3.5 feet below grade					
						PAVEMENT BASE - 8 inches thick					
3860				SS1	12	**SANDY LEAN CLAY** - brown, very stiff, moist	CL	17-9-6 N=15	15		LL = 40 PL = 18 Fines=59.0%
	5			SS2	14			9-8-15 N=23	14		LL = 40 PL = 18 Fines=54.0%
3855				SS3	16			10-10-13 N=23	16		LL = 41 PL = 17 Fines=65.6%
	10			SS4	17	**CLAYEY SAND** - brown, dense, moist		8-15-16 N=31	10		Fines=37.1%
3850											
	15			SS5	18	dense, moist, with calcareous material	SC	7-18-16 N=34	12		LL = 52 PL = 18 Fines=30.2%
3845											
	20			SS6	16			7-13-18 N=31	10		Fines=35.5%
						Boring terminated at 21.5 feet below grade					

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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 32

ADDENDUM 2 - JULY 14, 2015

BORING B32

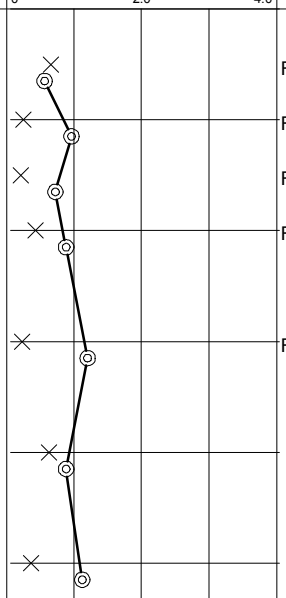
DATE STARTED:	11/13/12	**DRILL COMPANY:**	Speesoil, Inc.
DATE COMPLETED:	11/13/12	**DRILLER:** JDC	**LOGGED BY:** TA / RB
COMPLETION DEPTH	26.5 ft	**DRILL RIG:**	CME 55
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3710 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75198°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48548°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 2.5 inches thick				
						Graded Gravel Base - 8 inches thick				
				SS1	16	**SILTY SAND** - brown, loose, moist	SM	4-3-4 N=7	8	Fines=28.7%
3705	5			SS2	18	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	3-6-6 N=12	3	Fines=6.3%
				SS3	16	**SAND** - Poorly Graded, brown, loose, moist	SP	3-5-4 N=9	3	Fines=3.0%
3700	10			SS4	16	**SAND** - Poorly Graded with Silt, brown, medium dense, moist		4-5-6 N=11	5	Fines=8.7%
3695	15			SS5	17			6-8-7 N=15	3	Fines=5.0%
3690	20			SS6	18	medium dense, moist, with clay lenses	SP-SM	3-5-6 N=11	8	
3685	25			SS7	18			6-8-6 N=14	4	
						Boring terminated at 26.5 feet below grade				



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The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 33

ADDENDUM 2 - JULY 14, 2015

BORING B33

DATE STARTED:	10/27/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	10/27/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	51.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3710 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75272°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.4885°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

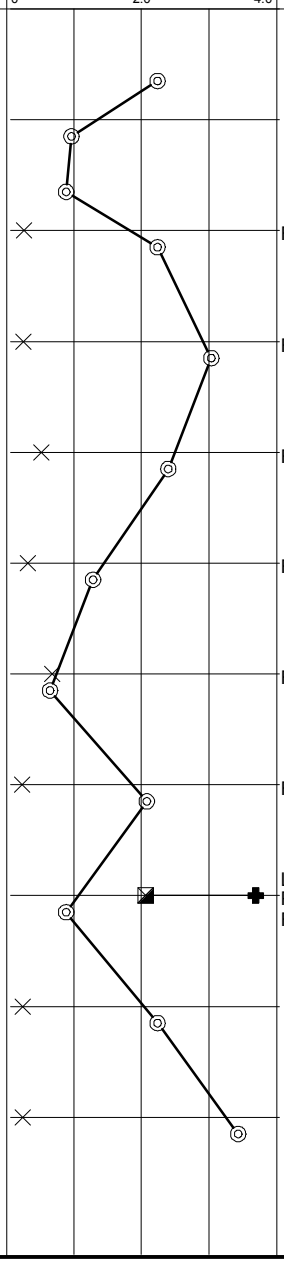
REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			**ASPHALT** - 2 inches thick				
				PAVEMENT BASE - 8 inches thick				
		SS1	18	**FILL** - Silty Clayey Sand (SC-SM), dark brown, moist, with asphalt and brick debris		14-13-15 N=28		
3705	5	SS2	14	**FILL** - Clayey Sand (SC), dark brown, medium dense, moist, with concrete debris with asphalt, brick, and concrete debris		4-6-6 N=12		
		SS3	12	**FILL** - Poorly Graded Sand (SP), reddish brown, medium dense, moist, with brick debris		11-7-4 N=11		
3700	10	SS4	18	**FILL** - Poorly Graded Sand with Silt (SP-SM), brown, medium dense, moist		7-15-13 N=28	3	Fines=2.5%
3695	15	SS5	18	dense, moist, with concrete debris		6-20-18 N=38	3	Fines=5.5%
3690	20	SS6	18	**FILL** - Silty Sand (SM), brown, medium dense, moist, with clay lenses		2-11-19 N=30	6	Fines=12.6%
3685	25	SS7	17	**SAND** - Poorly Graded with Silt, brown, medium dense, moist	SP-SM	3-6-10 N=16	4	Fines=5.9%
3680	30	SS8	18	**SILTY SAND** - brown, loose, moist, with clay lenses	SM	5-3-5 N=8	8	Fines=19.7%
3675	35	SS9	16	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	12-14-12 N=26	3	Fines=3.1%
3670	40	SS10	18	**SANDY LEAN CLAY** - brown, stiff, moist	CL	4-5-6 N=11	26	LL = 46 PL = 26 Fines=63.0%
3665	45	SS11	18	**SAND** - Poorly Graded with Gravel, brown, medium dense, moist	SP	10-17-11 N=28	3	
3660	50	SS12	18			18-22-21 N=43	3	
				Boring terminated at 51.5 feet below grade				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



Professional Service Industries, Inc.
4601 Ripley Drive
El Paso, TX 79922
Telephone: (915) 584-1317

PROJECT NO.: 0625489
PROJECT: El Paso Streetcar
LOCATION: El Paso, TX

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 34

ADDENDUM 2 - JULY 14, 2015

BORING B34

DATE STARTED:	10/27/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	10/27/12	**DRILLER:** AB	**LOGGED BY:** TA / RB
COMPLETION DEPTH	36.5 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3710 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75285°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.8991°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay		N/A

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					**ASPHALT** - 2 inches thick				
						PAVEMENT BASE - 8 inches thick				
				SS1	12	**FILL** - Poorly Graded Sand (SP), black, moist, with asphalt, concrete, brick, and deleterious debris		6-3-2 N=5		
3705	5			SS2	14	**FILL** - Poorly Graded Sand (SP), black, loose, moist, with asphalt, concrete, brick, and deleterious debris		1-1-1 N=2		
				SS3	11	**FILL** - Clayey Sand (SC), black, very loose moist, with asphalt, concrete, brick, and deleterious debris	SP	6-10-13 N=23	3	Fines=4.0%
3700	10			SS4	18	**SAND** - Poorly Graded, brown, medium dense, moist	SM	9-13-14 N=27	3	Fines=32.4%
						SILTY SAND - brown, medium dense, moist				
3695	15			SS5	18	**SAND** - Poorly Graded, grey, medium dense, moist, with hydrocarbon odor	SP	5-8-12 N=20	3	Fines=2.6%
3690	20			SS6	18	**SAND** - Poorly Graded with Silt and Gravel, grey, medium dense, moist, with hydrocarbon odor		3-11-11 N=22	6	Fines=10.8%
3685	25			SS7	18	dense, moist, with hydrocarbon odor	SP-SM	8-18-28 N=46	3	Fines=5.3%
3680	30			SS8	18	medium dense, moist, with hydrocarbon odor		12-14-16 N=30	2	
3675	35			SS9	18	**SAND** - Poorly Graded with Silt, grey, medium dense, moist, with hydrocarbon odor	SP-SM	11-13-15 N=28	3	
						Boring terminated at 36.5 feet below grade				

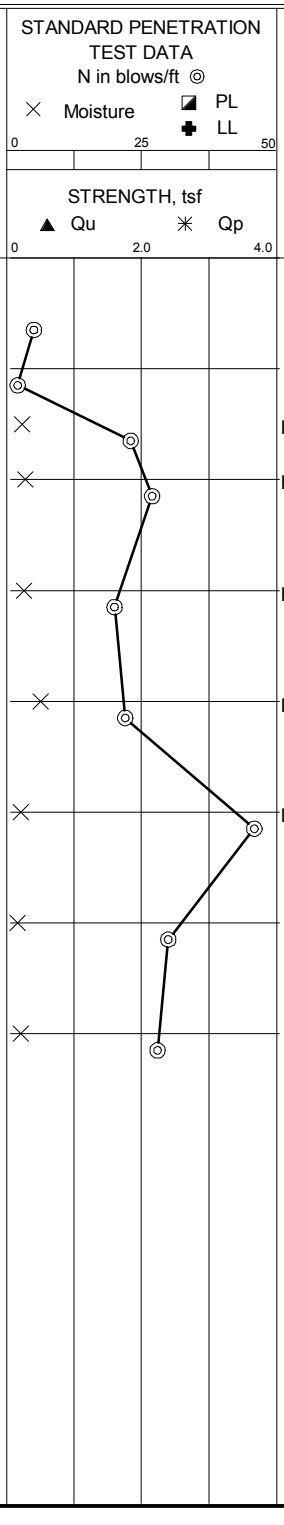


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FIGURE: 35

ADDENDUM 2 - JULY 14, 2015

BORING B35

DATE STARTED:	11/13/12	**DRILL COMPANY:**	PSI, Inc.
DATE COMPLETED:	11/13/12	**DRILLER:** AB	**LOGGED BY:** TP
COMPLETION DEPTH	3.0 ft	**DRILL RIG:**	BK81-HD
BENCHMARK:	N/A	**DRILLING METHOD:**	Hollow Stem Auger
ELEVATION:	3711.12 ft	**SAMPLING METHOD:**	2-in SS
LATITUDE:	31.75387°	**HAMMER TYPE:**	Automatic
LONGITUDE:	-106.48965°	**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	Danny R. Anderson, P.E.

REMARKS: None

Water		
While Drilling	None	feet
Upon Completion	None	feet
Delay	N/A	

BORING LOCATION:

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ (× Moisture, ◪ PL, ✚ LL; 0–25–50) / STRENGTH, tsf (▲ Qu, ✳ Qp; 0–2.0–4.0)	Additional Remarks
3710	0					**SAND, VERY FINE**, black, loose, moist					
				SS1	0	Concrete - Auger Refusal Boring terminated 2.6 Feet		50(0)		>>◎	

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