INFORMATION HANDOUT

For Contract No. 12-0N78U4
At 12-ORA-5,22,57,73,133,etc-Various

Identified by
Project ID 1215000036

MATERIALS INFORMATION

Aerially Deposit Lead

Foundation Report

Earth Mechanics, Inc.
Geotechnical & Earthquake Engineering

TECHNICAL MEMORANDUM

EMI PROJECT NO: 15-107

DATE: June 8, 2015

TO: Mr. Andrew Oshrin, Chief
Design Branch D

FROM: Lino Cheang and Ranjan Gunaranjan, Earth Mechanics, Inc.

SUBJECT: ***Hazardous Waste Assessment / Aerially Deposited Lead (ADL)***
Closed Circuit Television Poles, I-405 Communication System Improvements
City of Irvine, Orange County, California
12-Ora-405, PM 0.2/8.7
Caltrans Project No. 1212000058 (EA 0N78U)

This memorandum has been prepared to document the ADL test results and recommendations for reuse of onsite soils.

Summary of Laboratory Soil Test Results and Caltrans Classification of Onsite Soils

Based on the results of the laboratory testing on 40 soil samples collected from ten soil borings (designated as HA-15-001 through HA-15-010), ADL is present in the soil and the average lead concentrations are below 1,000 mg/kg total lead and below 5 mg/L soluble lead that is considered to be Soil Type "X", which is non-hazardous.

Therefore, the excavated soil containing ADL at the project site is considered to be non-hazardous and can be reused onsite without any restriction.

Sincerely,
EARTH MECHANICS, INC.

REGISTERED PROFESSIONAL ENGINEER
GNANAPRAGASAM J. GUNARANJAN
No. GE2970
Exp: 12-31-15
GEOTECHNICAL
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(Ranjan) G. J. Gunaranjan, GE 2970
Project Engineer

Lino Cheang, GE 2345
Project Manager

AERIALLY DEPOSITED LEAD REPORT

Closed Circuit Television Poles
I-405 Communication System Improvements
City of Irvine, Orange County, California
12-Ora-405, PM 0.2/8.7
Caltrans Project No. 1212000058 (EA OH2260)

EMI Project No. 15-107
Date: April 13, 2015

EARTH MECHANICS, INC.

Geotechnical and Earthquake Engineering

AERIALLY DEPOSITED LEAD REPORT
CLOSED CIRCUIT TELEVISION POLES
I-405 COMMUNICATION SYSTEM IMPROVEMENTS
CITY OF IRVINE, ORANGE COUNTY, CALIFORNIA
12-ORA-405, PM 0.2/8.7
CALTRANS PROJECT NO. 1212000058 (EA OH2260)

Prepared for:

RBF Consulting, a Michael Baker International Company
14725 Alton Parkway
Irvine, CA 92618

Prepared by:

Earth Mechanics, Inc.
17800 Newhope Street, Suite B
Fountain Valley, California 92708

EMI Project No. 15-107

April 13, 2015

Earth Mechanics, Inc.
Geotechnical & Earthquake Engineering

Earth Mechanics, Inc.
Geotechnical & Earthquake Engineering

April 13, 2015

EMI Project No. 15-107

RBF Consulting, a Michael Baker International Company
14725 Alton Parkway
Irvine, CA 92618

Attention: Mr. Carlos Ortiz, P.E.

Subject: ***Aerially Deposited Lead Report***
Closed Circuit Television Poles, I-405 Communication System Improvements
City of Irvine, Orange County, California
12-Ora-405, PM 0.2/8.7
Caltrans Project No. 1212000058 (EA OH2260)

Dear Mr. Oritz:

Attached is our Aerially Deposited Lead (ADL) Report for the new Closed Circuit Television (CCTV) poles as part of the I-405 Communication System Improvements project. This report presents the results of our field and laboratory investigation including analyses and recommendations for handling, disposal and re-use of potentially lead-contaminated soils as part of the proposed improvements for the subject project.

Please submit this report to Caltrans for review. All review comments and approved responses will be incorporated into a final report later.

We appreciate the opportunity to provide geotechnical design services for this project. If you have any questions, please call us.

Sincerely,

EARTH MECHANICS, INC.

REGISTERED PROFESSIONAL ENGINEER
GNANAPRAGASAM J. GUNARANJAN
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1.0 INTRODUCTION

1.1 Purpose and Scope of Work

This Aerially Deposited Lead (ADL) Report presents the findings and conclusions of the ADL investigation conducted by Earth Mechanics, Inc. (EMI) for the proposed Closed Circuit Television (CCTV) poles as a part of the Interstate I-405 (I-405) Communication System Improvements Project located in the City of Irvine, Orange County, California. This report presents results of the field investigation and laboratory testing and provides recommendations to aid RBF Consulting (RBF) in preparing the project plans, specifications, and cost estimates. A site location map is presented in Figure 1.

EMI is a subconsultant to RBF. The geotechnical services provided for this project included the following tasks:

- Field exploration consisting of excavating and sampling ten (10) exploratory borings;
- Laboratory testing of soil samples;
- Statistical analysis to characterize the test data and evaluate the level of lead contamination of site soils; and
- Preparation of this report presenting our findings, conclusions, and recommendations.

1.2 Project Description

A Traffic Management Plan (TMP) was prepared for the full limits of the project and the following proposed improvements were included in the TMP:

1) Upgrade of existing analog CCTV cameras to high definition CCTV cameras along Routes I-5, SR-73, SR-133, SR-241, and SR-261 in the cities of Costa Mesa, Irvine, Newport Beach, Laguna Beach, Aliso Viejo, San Juan Capistrano, San Clemente, Mission Viejo, Rancho Santa Margarita, Laguna Woods, Lake Forest, Santa Ana, Anaheim, and Buena Park.

2) Convert existing communication system to an Internet Protocol communication system that will provide effective communications from the various field elements (CCTV Cameras, Changeable Message Signs, Traffic Signals, Ramp Metering Systems, Traffic Monitoring Stations, and Communication Hubs, along Routes SR-22, SR-57, and I-405) to District 12 Transportation Management Center.

3) Upgrade of fiber optic cable and CCTV cameras along I-405 from I-5 to SR-55. This work includes the following tasks:

a. Replace existing fiber optic cable on both NB and SB I-405 at the various locations between PM 0.2 and 8.7 (from I-5 to SR-55). The proposed fiber optic will be installed in the existing conduits. There will be no modification to existing conduits. Installation of fiber optic inside the existing conduits will be in conformance with the procedures specified by the cable manufacturer for the specific cables being installed.

b. Replace six (6) existing CCTV's on existing 45 feet high poles/CIDH foundations. The upgraded CCTV's and equipment will be installed at the same locations where the existing CCTVs are located.

c. Install two (2) new CCTV cameras poles and foundations on SB I-405 at PM 2.63 near Sand Canyon Avenue and at PM 2.03 near SR-133. A cabinet, foundation, gravel pad, and maintenance vehicle pullout will be constructed at each new CCTV location.

The proposed improvements will increase the capability to transmit and receive data and video information between the Department's Traffic Management Center (TMC) and field elements, to help monitor and manage traffic information more efficiently, resulting in improving traffic flow and reducing traffic delay.

As identified above in item 3c, two new CCTVs are proposed to be constructed on SB 1-405 at PM 2.63 near Sand Canyon Avenue and at PM 2.03 near SR-133. The CCTV poles near the Sand Canyon Avenue and SR-133 sites are 45 and 90 feet tall, respectively. This report is prepared to presents the findings and conclusions of the ADL investigation conducted for these two new CCTVs.

1.3 Pre-Field Activities

EMI conducted pre-field activities including:

- Preparing a boring location map,
- Marking the proposed boring locations,
- Notifying Underground Services Alert for utility clearance on the proposed borings,
- Preparing a schedule for the field work, and
- Coordinating work with drilling/soil sampling subcontractors and Caltrans.

2.0 INVESTIGATIVE METHODS AND RESULTS

2.1 Existing Information

It is our understanding that there have not been any previous ADL studies conducted for the project improvements described in this report.

2.2 Field Exploration

The field investigation, accomplished on February 27, 2015, included excavating ten shallow borings (5 borings at each of the two CCTV sites) to collect near-surface samples of on-site soils specifically for ADL testing. The approximate locations of the borings are shown on the attached Boring Location Plans (Figure 2 and Figure 3). Boring locations were selected behind the outside shoulder in the vicinity of the proposed CCTV locations. Borings were performed by a 3-inch diameter stainless steel hand auger. Borings were excavated to a depth up to 4 feet below existing grade. A triple-rinse method was used to decontaminate the samplers before collecting the soil samples. Soil samples were collected from depths of about 6, 18, 36, and 48 inches below existing grade. A total of 40 soil samples were collected and tested for ADL content.

Soil samples retrieved from the hand auger bailer were immediately placed in clean glass jars with teflon lids. Jars were labeled with project information including the project name and number, boring number, sample number, depth from which sample was collected, date and time of sampling. All samples were entered on the chain-of-custody forms and transported to a laboratory for testing. Copies of the chain-of-custody forms are provided in Appendix A.

2.3 Laboratory Testing

Soil samples collected from the field investigation were forwarded to Alpha Scientific Corporation (ASC) of Cerritos, California, a California Certified Analytical Laboratory, to be analyzed for total lead (TTLC), soluble lead content by the California Waste Extraction Test using CITRATE (STLC) as the leaching compound, and soluble lead using the toxicity characteristic leashing procedure (TCLP), and pH.

Laboratory testing on the selected soil samples was assigned as follows:

(1) all samples were tested for total lead,

(2) six samples that contained greater than 15 mg/kg of total lead were tested for soluble lead using the CITRATE method,

(3) six samples that contained greater than 15 mg/kg of total lead were tested for leachable lead using the IPA Toxic Characteristic Leaching Procedure (TCLP), and

(4) a randomly selected seven samples were tested for pH.

2.4 Ground Water

No groundwater was encountered down to a depth of 4 feet below the ground surface during the ADL soil boring investigation conducted in February, 2015.

3.0 STATISTICAL DATA EVALUATION - METHODOLOGY

The purpose of the statistical evaluation of the laboratory test results is to determine the applicability of the Department of Toxic Substance's Control (DTSC) variance and the appropriate waste classification(s) for any excess soils generated due to remedial excavations and general earthwork for construction of the proposed two CCTV poles.

3.1 Data Distribution and Goodness-of-Fit Tests

The primary statistical element used to classify ADL-impacted soils is the upper confidence limit (UCL) on the mean. There are several different methods to calculate the 95% UCL on the mean consisting of parametric methods that are dependent on the distribution of data, and non-parametric methods that are independent of the distribution of data.

Caltrans ADL Guidance (Caltrans, 2007) recommends specific methodology for calculation of the UCL for three different parametric distributions (normal distribution, log-normal distribution and gamma distribution) and for non-parametric distributions. The advantage of using parametric tests is their assumptions are more stringent, thereby requiring less qualification of the results in drawing conclusions about the data. Non-parametric methods enable data to be reduced that otherwise would be unsuitable for statistical analysis.

Goodness-of-fit tests are performed to determine the distribution of the sample data. Based on the number of samples and the distribution of data, the appropriate statistical method is selected to calculate the 95% UCL on the mean. If the data do not appear to be distributed normally, log-normally or as a gamma distribution, application of a non-parametric method is required to determine the 95% UCL on the mean.

Goodness-of-fit tests performed on the sample data presented herein and determination of the data distribution was performed using the U.S. Environmental Protection Agency statistical program ProUCL V5.0.00 (EPA, 2013a).

3.2 Upper Confidence Limit (UCL)

The method of calculation of the UCL was based upon the recommendations provided in the Caltrans ADL Guidelines and determined using the statistical program ProUCL V5.0.00. For normally-distributed data, the 95% UCL on the mean is determined using the Student's-t distribution. For log-normally-distributed data, the H-statistic based UCL is used if the standard deviation is less than 2.0; otherwise, either a UCL computation based upon a gamma distribution, a non-parametric bootstrap or Chebyshev method is used to determine the UCL. For gamma-distributed data, either a gamma method, adjusted gamma method, Bootstrap-t or Hall's Bootstrap method may be used to determine the UCL. For data that are not normally-, log-normally-, or gamma-distributed, a variety of non-parametric distributions may be used including Hall's Bootstrap UCL, the Chebyshev UCL, and the modified-t statistic.

3.3 Regression Analysis

The regression analysis consists of creating a least-squares-fit approximation of the soluble lead and total lead data and obtaining a correlation coefficient "r". If the regression analysis yields a correlation coefficient "r", a value of 0.8 or greater, the 95% UCL for total lead can be correlated to the 95% UCL for soluble lead. To determine the correlation coefficient "r", a line is fit to the data using the equation:

$$y = mx + b$$

where:

y = soluble lead, milligrams per liter
x = total lead concentration, milligrams per kilogram
b = y-intercept
$m = \text{slope} = (r \times s_t)/s_s$

where:

r = correlation coefficient
s_t = standard deviation of the total lead concentrations
s_s = standard deviation of the soluble lead concentrations

The applicability of the correlation is directly related to "r", which should be greater than or equal to 0.8. If "r" is less than 0.8, then the determination of the 95% UCL on the mean for soluble lead may not be achievable by this method.

3.4 Incorporation of Non-Detects (ND's)

As part of the Associated Documents of the Caltrans ADL Guidance (2007), Section 3.0 of the "Statistical Analysis of ADL Data" indicates that if the number of non-detect or "Not Detected" (ND) results within a population is less than 15% of the data, reliable statistical results can be obtained by replacing each ND sample with a value equal to one-half the detectible limit (DL/2). However, the Caltrans ADL Guidance recommends the use of the statistical software available from the U.S. EPA which recommends in Sections 1.11.1 and 2.8 of the ProUCL V5.0.00 User Guide (EPA, 2013b) that ND's be replaced with a value equal to the detectible limit of the analysis. It should be noted that the DL/2 method of incorporating ND values is no longer appropriate due to improved methods of statistical analysis available in ProUCL V5.0.00.

For the analyses presented herein, where ND samples are included in the sample data, ND samples are incorporated consistent with the ProUCL V5.0.00 user guide recommendations and replaced with a value equal to the detectible limit of the analysis.

4.0 ANALYSES AND RECOMMENDATIONS

4.1 Caltrans Aerially Deposited Lead Soil Management

Caltrans specifications classify soils based on total and soluble lead concentrations to provide guidance on appropriate management of these materials. The soil classifications and associated criteria for each classification per Caltrans Aerially Deposited Lead Soil Management can be downloaded from the Caltrans website http://www.dot.ca.gov/hq/env/haz/pdfs/adl/h306.pdf. This Caltrans ADL Soil Management classification is duplicated below in Table 1.

Table 1. Caltrans Aerially Deposited Lead Soil Management (2014)

SOLUBLE LEAD (mg/l)	**TOTAL LEAD** (mg/kg)	**SOIL TYPE**	**HANDLING**
California Testing			
STLC < 5.0	TTLC < 1000	X	Non-hazardous. Notify and require Lead Compliance Plan for worker safety.
	1000 ≤ TTLC <1411 & DI WET < 1.5 mg/l	Y1	Hazardous Variance applies – cover with minimum 1 foot of clean soil*.
	1411 ≤ TTLC < 3397 & DI WET < 150 mg/l	Y2	Hazardous Variance applies – cover with pavement structure*.
	1000 ≤ TTLC < 3397 but Surplus	Z2	Surplus - Hazardous Dispose at Class 1 disposal site.
	3397 ≤ TTLC or 1000 ≤ TTLC < 3397 and DI WET > 150 mg/l	Z2	Hazardous – not reusable under Variance. Dispose at Class 1 disposal site.
STLC > 5.0	TTLC < 1411 & DI WET < 1.5 mg/l	Y1	Hazardous Variance applies – cover with minimum of 1 foot of clean soil*.
	1411 ≤ TTLC < 3397 & DI WET < 150 mg/l	Y2	Hazardous Variance applies – cover with pavement structure*.
	TTLC < 3397 & DI WET < 150 mg/l but Surplus	Z2	Surplus – Hazardous Dispose at Class 1 disposal site.
	3397 ≤ TTLC or DI WET > 150 mg/l	Z2	Hazardous – not reusable under Variance Dispose at Class 1 disposal site.
Federal Testing TCLP > 5.0 mg/l	N/A	Z3	RCRA Hazardous Waste Dispose at Class 1 disposal site as a RCRA waste regardless of TTLC and STLC results.
**Note: For hazardous waste levels of lead – if pH is less than 5.5 soil must be placed under a pavement structure. If pH is less than 5.0 variance cannot be used and the soil must be disposed as Z-2 material.*			

4.2 Results of Laboratory Testing

The results of the laboratory testing for the CCTV poles near SR-133 and Sand Canyon Avenue are presented in Table 2 and Table 3, respectively, and also duplicated in Figure 2 and Figure 3, respectively. Copies of original laboratory test results for the soil samples are presented in Appendix B.

4.2.1 CCTV Location Near SR-133

A total of 20 soil samples were collected for lead content testing for the proposed CCTV near SR-133. All samples were tested for Total Lead content. Total Lead content ranged from ND (not detected) to 53.2 mg/kg and the average Total Lead content is 12.81 mg/kg. Only one of the 20 samples was found to contain Total Lead content greater than 50 mg/kg. A total of eleven samples tested contained Total Lead content less than 5 mg/kg, including four samples contained less than 2 mg/kg (the detectible limit).

Three samples that contained Total Lead content greater than 30 mg/kg were tested to determine Soluble Lead content using the CITRATE method as the leaching compound. The maximum and minimum of Soluble Lead content are 2.05 and 1.8 mg/L, respectively.

Table 2. Summary of Laboratory Soil Test Results for CCTV Pole Near SR-133

Sample ID	Sample Depth (feet)	Total Lead (TTLC) (mg/kg)	Wet-Citric (STLC) (mg/L)	DI-WET (mg/L)	TCLP (mg/L)	pH
HA-15-001-1	0.5	25.9				8.03
HA-15-001-2	1.5	13.6				
HA-15-001-3	3.0	2.6				
HA-15-001-4	4.0	3.8				
HA-15-002-1	0.5	2.6				
HA-15-002-2	1.5	22.4				8.13
HA-15-002-3	3.0	18.3				
HA-15-002-4	4.0	3.7				
HA-15-003-1	0.5	ND				
HA-15-003-2	1.5	ND				
HA-15-003-3	3.0	6.8				8.23
HA-15-003-4	4.0	2.4				
HA-15-004-1	0.5	42.1	2.05		ND	
HA-15-004-2	1.5	33.8	1.84		ND	
HA-15-004-3	3.0	3.8				
HA-15-004-4	4.0	2.7				7.93
HA-15-005-1	0.5	53.2	1.80		ND	
HA-15-005-2	1.5	10.5				
HA-15-005-3	3.0	ND				
HA-15-005-4	4.0	ND				

ND – Not Detected.

Three samples that contained Total Lead content greater than 30 mg/kg were also tested to determine Soluble Lead content using the toxicity characteristic leaching procedure (TCLP). The soluble lead content of the all three samples tested using the TCLP method contain less than 0.1 mg/L (the detectible limit).

Four soil samples were tested for pH and the test results are all greater than 7.9.

4.2.2 CCTV Location Near Sand Canyon Avenue

A total of 20 soil samples were collected for lead content testing for the proposed CCTV near Sand Canyon Avenue. All samples were tested for Total Lead content. Total Lead content ranged from ND (not detected) to 31 mg/kg and the average Total Lead content is 6.35 mg/kg. A total of thirteen samples tested contained Total Lead content less than 5 mg/kg, including seven samples contained less than 2 mg/kg (the detectible limit).

Three samples that contained Total Lead content greater than 15 mg/kg were tested to determine Soluble Lead content using the CITRATE method as the leaching compound. The maximum and minimum of Soluble Lead content are 0.71 and 0.34 mg/L, respectively.

Table 3. Summary of Laboratory Soil Test Results for CCTV Pole Near Sand Canyon Avenue

Sample ID	Sample Depth (feet)	Total Lead (TTLC) (mg/kg)	Wet-Citric (STLC) (mg/L)	DI-WET (mg/L)	TCLP (mg/L)	pH
HA-15-006-1	0.5	15.5	0.48		ND	7.28
HA-15-006-2	1.5	2.8				
HA-15-006-3	3.0	ND				
HA-15-006-4	4.0	ND				
HA-15-007-1	0.5	17.3	0.34		ND	
HA-15-007-2	1.5	3.5				
HA-15-007-3	3.0	ND				
HA-15-007-4	4.0	2.7				
HA-15-008-1	0.5	31.0	0.71		ND	
HA-15-008-2	1.5	8.0				
HA-15-008-3	3.0	4.3				
HA-15-008-4	4.0	ND				7.55
HA-15-009-1	0.5	7.0				
HA-15-009-2	1.5	6.8				
HA-15-009-3	3.0	3.6				
HA-15-009-4	4.0	ND				
HA-15-010-1	0.5	8.3				
HA-15-010-2	1.5	ND				
HA-15-010-3	3.0	2.1				7.58
HA-15-010-4	4.0	ND				

ND – Not Detected.

Three samples that contained Total Lead content greater than 15 mg/kg were also tested to determine Soluble Lead content using the toxicity characteristic leaching procedure (TCLP). The soluble lead content of the all three samples tested using the TCLP method contain less than 0.1 mg/L (the detectible limit).

Three soil samples were tested for pH and the test results are all greater than 7.2.

4.3 Results of Statistical Analyses

Results of the statistical analyses for the proposed two CCTVs located near SR-133 and Sand Canyon Avenue are summarized in Table 4. The statistical calculations performed are included in Appendix C.

Statistical results of the total lead samples for the CCTV located near SR-133 indicate that the sample distribution is non-parametric with a mean of 3.8 mg/kg and a standard deviation of 15.21 mg/kg. The upper-limit of the 95% UCL calculated by the Chebyshev method is 27.64 mg/kg.

Statistical results of the total lead samples for the CCTV located near Sand Canyon Avenue indicate that the sample distribution is non-parametric with a mean of 6.34 mg/kg and a standard deviation of 7.31 mg/kg. The upper-limit of the 95% UCL calculated by the Chebyshev method is 13.47 mg/kg.

Table 4. Summary of Statistical Analyses

Parameter	Total Lead (TTLC)	Total Lead with Corresponding Soluble (STLC) Lead Data	Soluble Lead (WET-DI)	Soluble Lead (TCLP)
For CCTV Located Near SR-133				
Number of Data Points	20	3 [5]	0	3 [6]
Minimum Detected Value	2 mg/kg [3]	1.8 mg/L	NA	0.1 mg/L [4]
Maximum Detected Value	53.2 mg/kg	2.05 mg/L	NA	0.1 mg/L
Mean	12.81 mg/kg	1.90 mg/L	NA	0.1 mg/L
Median	3.8 mg/kg	1.84 mg/L	NA	0.1 mg/L
Standard Deviation	15.21 mg/kg	0.134 mg/L	NA	0 mg/L
95% UCL	27.64 mg/kg	NA	NA	NA
95% UCL Method [2]	Chebyshev [1]	NA	NA	NA
Are Data Normal?	No [1]	NA	NA	NA
Are Data Lognormal?	No [1]	NA	NA	NA
Are Data Gamma Distributed?	No [1]	NA	NA	NA
For CCTV Located Near Sand Canyon Avenue				
Number of Data Points	20	3 [5]	0	3 [6]
Minimum Detected Value	2 mg/kg [3]	0.34 mg/L	NA	0.1 mg/L [4]
Maximum Detected Value	31 mg/kg	0.71 mg/L	NA	0.1 mg/L
Mean	6.34 mg/kg	0.51 mg/L	NA	0.1 mg/L
Median	3.15 mg/kg	0.48 mg/L	NA	0.1 mg/L
Standard Deviation	7.31 mg/kg	0.187 mg/L	NA	0 mg/L
95% UCL	13.47 mg/kg	NA	NA	NA
95% UCL Methods [2]	Chebyshev [1]	NA	NA	NA
Are Data Normal?	No [1]	NA	NA	NA
Are Data Lognormal?	Yes [1], [7]	NA	NA	NA
Are Data Gamma Distributed?	No [1]	NA	NA	NA

Notes:

1. *Determined using the EPA statistical program, ProUCL V5.0.00.*
2. *The UCL Method was selected per Caltrans Aerially Deposited Lead (ADL) Guidance (Caltrans, 2007).*
3. *Detectable limits (2 mg/kg), summary statistics calculated with ND samples as the minimum detectable value per ProUCL V5.0.00 User Guide, Section 2.8.*
4. *Detectable limits (0.1 mg/L), summary statistics calculated with ND samples as the minimum detectable value per ProUCL V5.0.00 User Guide, Section 2.8.*
5. *The samples tested contained total lead content greater than 15 mg/kg.*
6. *All six samples tested using the TCLP method contained soluble lead content less than 0.1 mg/L (the detectible limit).*
7. *Data appear approximate lognormal at 5% significance level.*

4.4 Caltrans Classification of Site Soils

Using the statistical analysis discussed earlier, the laboratory test results, and the Caltrans Aerially Deposited Lead Soil Management table, the findings at each CCTV location are presented below.

4.4.1 CCTV Location Near SR-133

A correlation between the 95% UCL on the mean for TTLC and the 95% UCL on the mean for STLC cannot be obtained using regression analysis since a correlation coefficient "r" of 0.8 or greater was not yielded from the regression analysis. As a result, the 95% UCL for TTLC cannot be correlated to the 95% UCL for STLC.

There were 5 borings drilled near SR-133 and a total of 20 samples were tested. Among the 20 samples, only 3 samples with TTLC greater than 30 mg/kg were tested for soluble lead (STLC). All of the test results for TTLC and STLC indicate the soils are well below the "Y1" Classification threshold. Only one of the 20 samples was found to contain Total Lead content greater than 50 mg/kg. A total of eleven samples tested contained Total Lead content less than 5 mg/kg, including four samples contain less than 2 mg/kg (the detectible limit). The maximum TTLC is 53.2 mg/kg and the average TTLC is 12.81 mg/kg; the maximum STLC is 2.05 mg/l and the average STLC is 1.9 mg/l. Therefore, the on-site soils at CCTV location near SR-133 are considered as Soil Type "X", which is non-hazardous. There is no special requirement for on-site reuse and off-site disposal.

4.4.2 CCTV Location Near Sand Canyon Avenue

As shown in Figure 4, a correlation coefficient of 0.88 was obtained in the regression analysis between TTLC and STLC. This indicates that the 95% UCL for TTLC can be correlated to the 95% UCL for STLC. The projected STLC value based on 95% UCL TTLC is about 0.35 mg/L.

Based on the above 95% UCL of TTLC and the projected STLC, the on-site soils at CCTV location near Sand Canyon Avenue are considered as Soil Type "X", which is non-hazardous. There is no special requirement for on-site reuse and off-site disposal.

4.5 Recommendations

Per Caltrans ADL Soil Management and results of the laboratory testing, and statistical and regression analyses, the site soils at both CCTV locations near SR-133 and Sand Canyon Avenue are suitable for use as fill material. No special requirements will be required for on-site reuse and off-site disposal.

Contractors excavating, transporting, or stockpiling soil should prepare a Lead Compliance Plan in accordance with the Caltrans Code of Safety Practices, California Code of Regulations, and Cal-OSHA standards addressing the presence of ADL in the soils within the project area. Lead content testing results contained herein should be given to Contractors handling the soils during construction.

5.0 LIMITATIONS

This report is intended for use by RBF Consulting and the California Department of Transportation for the proposed Closed Circuit Television poles near Sand Canyon Avenue and SR-133 for the I-405 Communication System Improvements project. This report is based on the project as described herein and the information obtained from the exploratory borings at the approximate locations indicated on the attached plans. The findings and recommendations contained in this report are based on the results of the field investigation, laboratory tests, and analyses. Also, soils and subsurface conditions encountered in the exploratory borings are presumed to be representative of the project site; however, subsurface conditions and characteristics of soils between exploratory borings can vary. Findings reflect an interpretation of the direct evidence obtained. Recommendations presented herein are based on the assumption that an appropriate level of quality control and quality assurance (inspections and tests) will be provided during construction. EMI should be notified of any pertinent changes in the project plans or if subsurface conditions are found to vary from those described herein. Modifications to the project plans or variations in subsurface conditions may require re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations contained herein are applicable to the specific design elements and locations which are the subject of this report. Data, opinions, and recommendations herein have no applicability to any other design elements or to any other locations, and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of EMI.

EMI is not responsible for construction means, methods, techniques, sequences, or procedures, or for safety precautions or programs in connection with the construction, for the acts or omissions of the Contractor, or any other person performing any of the construction, or for the failure of any worker to carry out the construction in accordance with the Final construction drawings and specifications.

Services performed by EMI were conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, expressed or implied, and no warranty or guarantee is included or intended.

6.0 REFERENCES

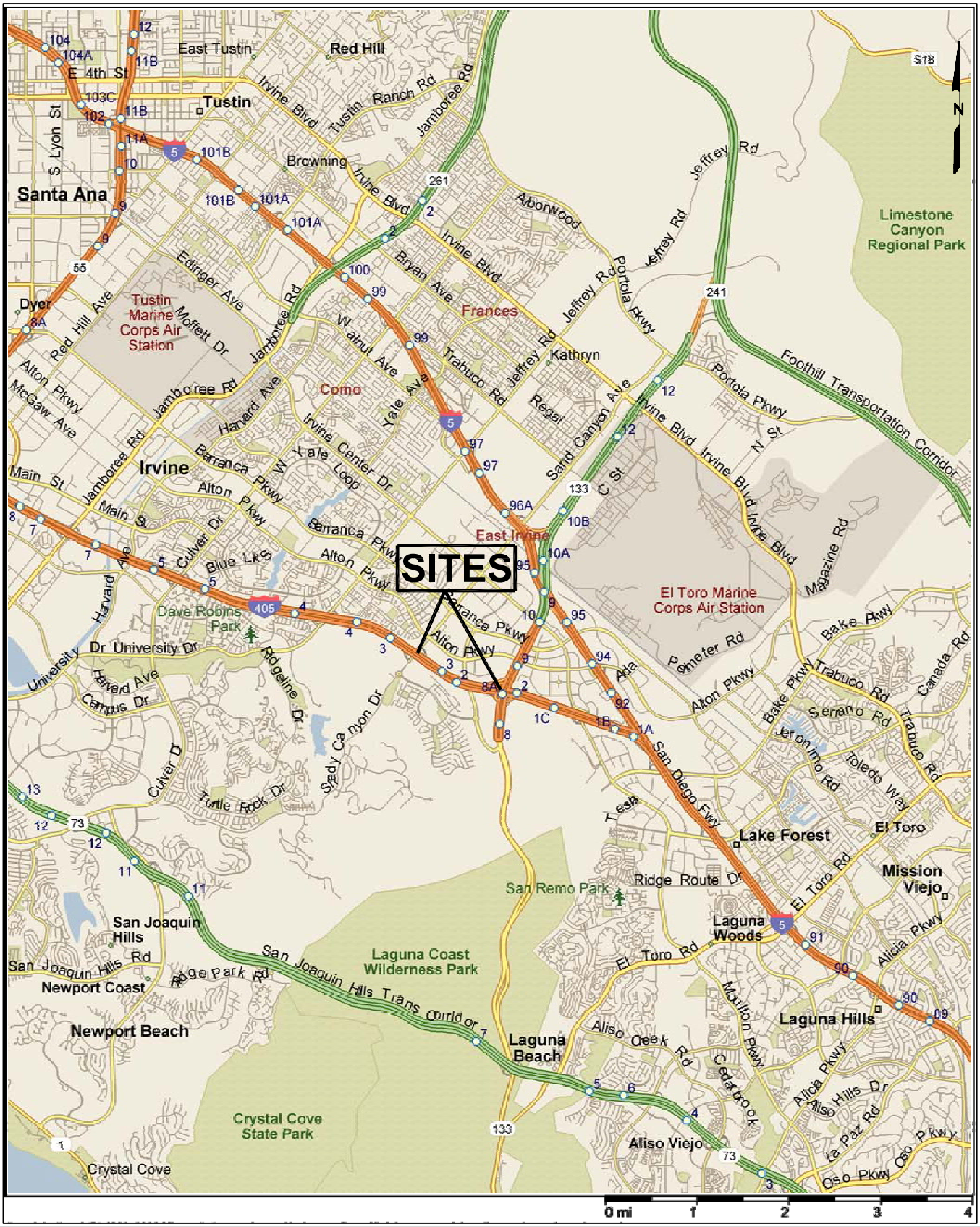
California Environmental Protection Agency, Department of Toxic Substances Control; Variance to Caltrans (All Districts) for Reuse of Lead-Contaminated Soils, Variance No. V09HQSCD006; July 1, 2009.

California Department of Transportation (Caltrans), 2007, Aerially Deposited Lead Guidance, June.

Caltrans, 2014, Aerially Deposited Lead Soil Management, http://www.dot.ca.gov/hq/env/haz/pdfs/adl/h306.pdf, Last Updated August 1.

United States Environmental Protection Agency (EPA), 2013a, ProUCL Version 5.0.00 computer software, September.

United States Environmental Protection Agency (EPA), 2013b, ProUCL Version 5.0 User Guide and Technical Guide, September.



Earth Mechanics, Inc.
Geotechnical & Earthquake Engineering

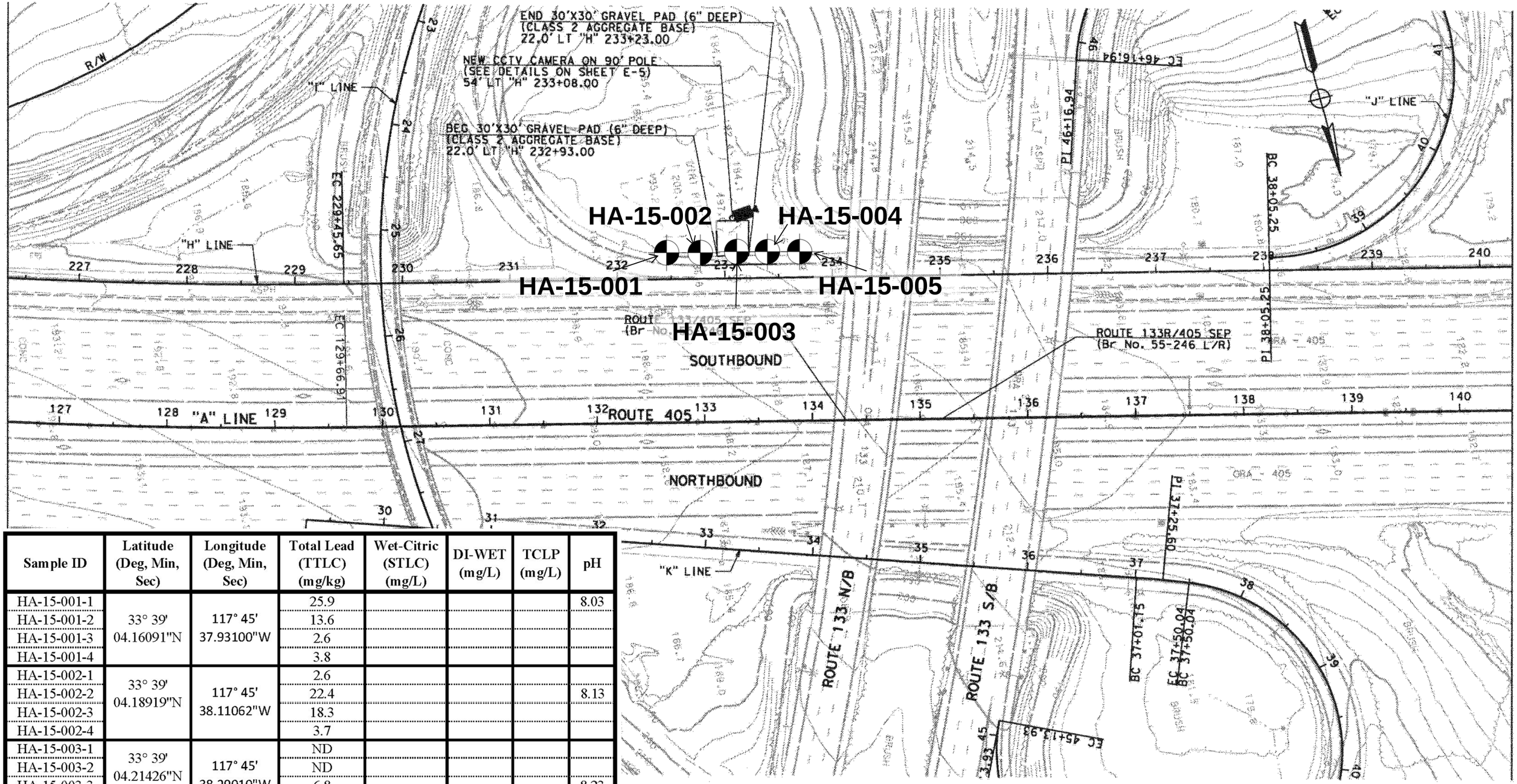
SITE LOCATION MAP

Figure 1

I-405 Communication System Improvements - CCTV

Project No. 15-107

Date: 03-18-15



Sample ID	Latitude (Deg, Min, Sec)	Longitude (Deg, Min, Sec)	Total Lead (TTLC) (mg/kg)	Wet-Citric (STLC) (mg/L)	DI-WET (mg/L)	TCLP (mg/L)	pH
HA-15-001-1	33° 39' 04.16091"N	117° 45' 37.93100"W	25.9				8.03
HA-15-001-2			13.6				
HA-15-001-3			2.6				
HA-15-001-4			3.8				
HA-15-002-1	33° 39' 04.18919"N	117° 45' 38.11062"W	2.6				
HA-15-002-2			22.4				8.13
HA-15-002-3			18.3				
HA-15-002-4			3.7				
HA-15-003-1	33° 39' 04.21426"N	117° 45' 38.29010"W	ND				
HA-15-003-2			ND				
HA-15-003-3			6.8				8.23
HA-15-003-4			2.4				
HA-15-004-1	33° 39' 04.23325"N	117° 45' 38.46642"W	42.1	2.05		ND	
HA-15-004-2			33.8	1.84		ND	
HA-15-004-3			3.8				
HA-15-004-4			2.7				7.93
HA-15-005-1	33° 39' 04.26254"N	117° 45' 38.63889"W	53.2	1.8		ND	
HA-15-005-2			10.5				
HA-15-005-3			ND				
HA-15-005-4			ND				

NOTE:
1. Borehole locations are approximate.

LEGEND

HA-15-001 Borehole location

Earth Mechanics, Inc.
Geotechnical & Earthquake Engineering

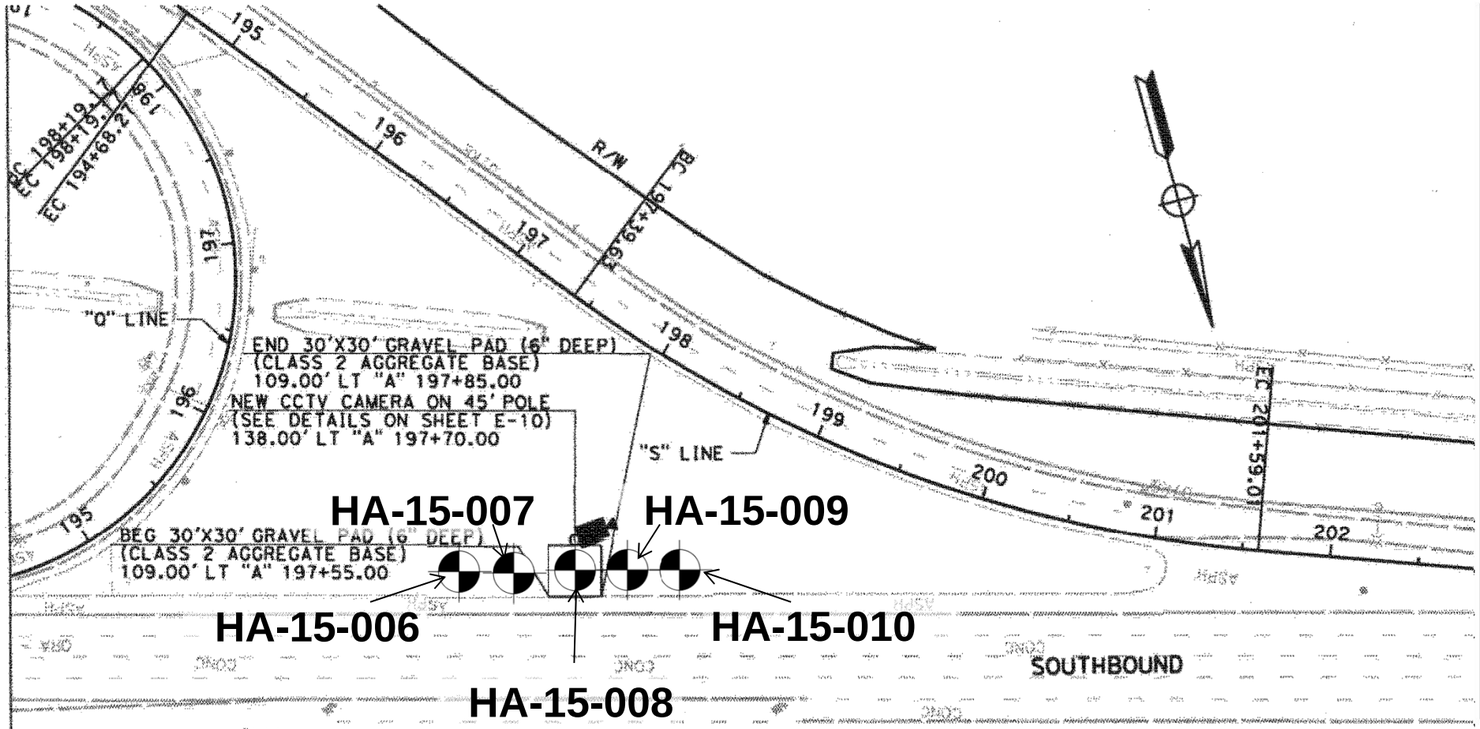
EXPLORATORY BOREHOLE LOCATION MAP (1 OF 2)

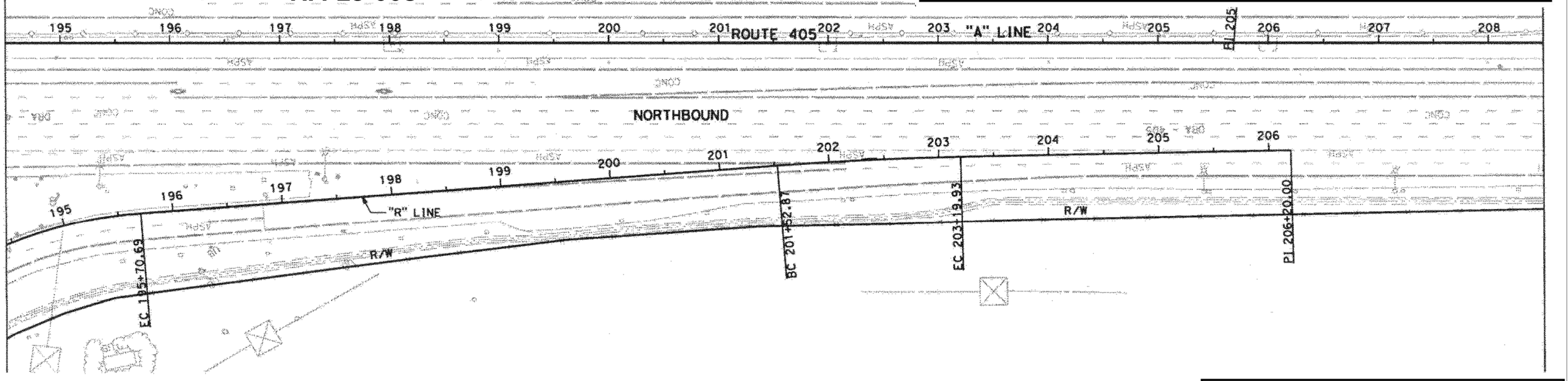
I-405 COMMUNICATION SYSTEM IMPROVEMENTS - CCTV

FIGURE 2

Project No.: 15-107 | Date: 03-18-2015

Sample ID	Latitude (Deg, Min, Sec)	Longitude (Deg, Min, Sec)	Total Lead (TTLC) (mg/kg)	Wet-Citric (STLC) (mg/L)	DI-WET (mg/L)	TCLP (mg/L)	pH
HA-15-006-1	33° 39' 29.76341"N	117° 46' 47.18214"W	15.5	0.48		ND	7.28
HA-15-006-2			2.8				
HA-15-006-3			ND				
HA-15-006-4			ND				
HA-15-007-1	33° 39' 29.83909"N	117° 46' 47.34263"W	17.3	0.34		ND	
HA-15-007-2			3.5				
HA-15-007-3			ND				
HA-15-007-4			2.7				
HA-15-008-1	33° 39' 29.90293"N	117° 46' 47.51372"W	31	0.71		ND	
HA-15-008-2			8				
HA-15-008-3			4.3				
HA-15-008-4			ND				7.55
HA-15-009-1	33° 39' 29.97166"N	117° 46' 47.69041"W	7				
HA-15-009-2			6.8				
HA-15-009-3			3.6				
HA-15-009-4			ND				
HA-15-010-1	33° 39' 30.06961"N	117° 46' 47.77909"W	8.3				
HA-15-010-2			ND				
HA-15-010-3			2.1				7.58
HA-15-010-4			ND				





NOTE:
1. Borehole locations are approximate.

LEGEND

HA-15-001 Borehole location

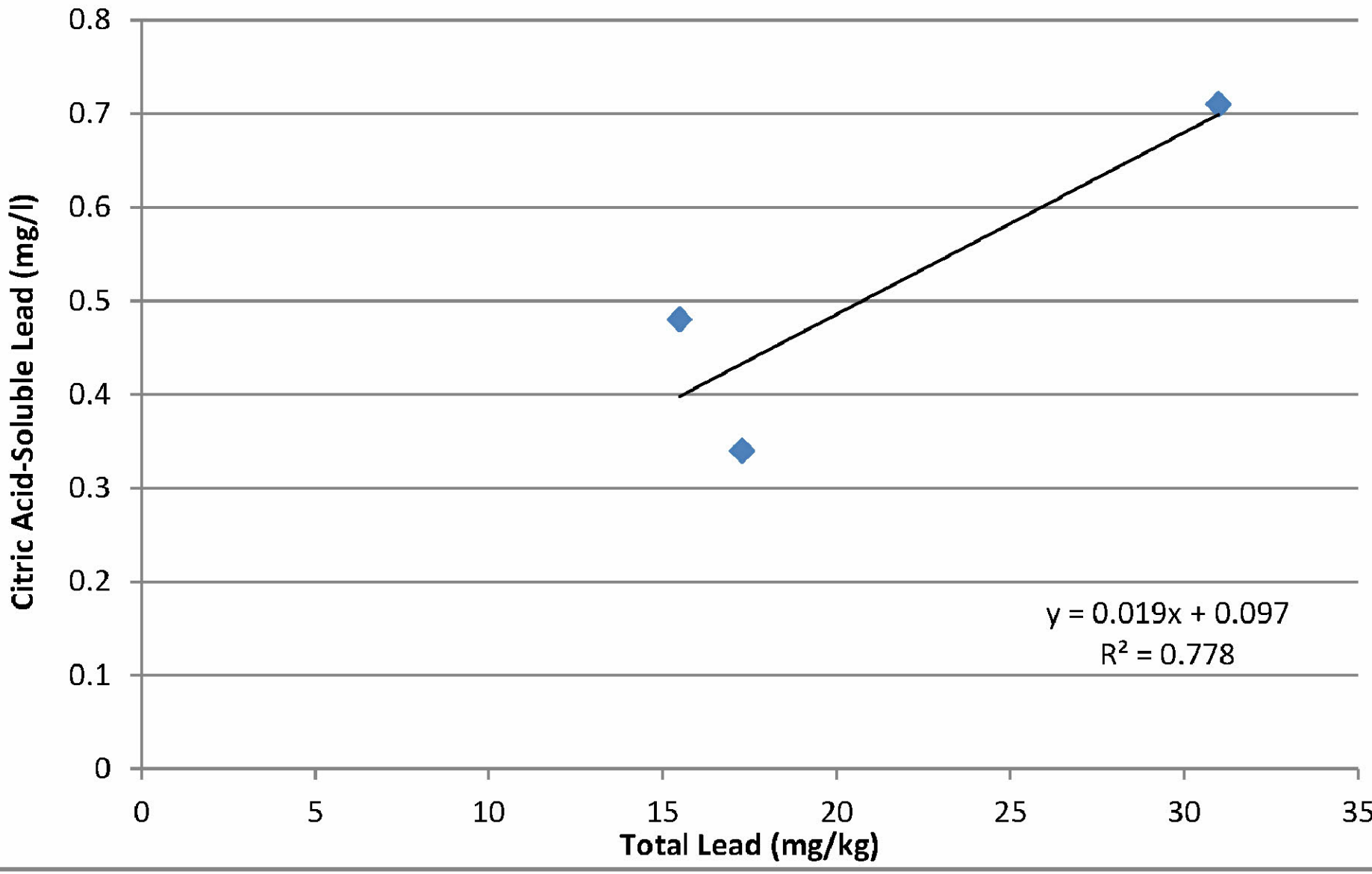
Earth Mechanics, Inc.
Geotechnical & Earthquake Engineering

EXPLORATORY BOREHOLE LOCATION MAP (2 OF 2)

I-405 COMMUNICATION SYSTEM IMPROVEMENTS - CCTV

FIGURE 3

Project No.: 15-107 | Date: 03-18-2015



Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

I-405 COMMUNICATION SYSTEM IMPROVEMENTS - CCTV

Project No. 15-107 Date: 03-18-15

Regression Analysis for CCTV Pole Near Sand Canyon Avenue

Figure 4

APPENDIX A

CHAIN-OF-CUSTODY FORM

ALPHA SCIENTIFIC CORPORATION

CHAIN OF CUSTODY RECORD

Lab Job Number EA502088

Client: EARTH MECHANICS INC.

Address 17800 NEWHOPE ST SUITE B FOUNTAIN VALLEY, CA 92708

Report Attention: LINO

Phone: 714 751-3826

Fax:

Sampled by: KAT

Project Name/No.: I 405 CON 15-107

Project Site: I 405

Analyses Requested

T.A.T. Requested: ☐ 8 hrs ☐ 24 hrs ☐ 48 hrs ☐ 3 days ☒ Normal

Sample Condition: ☐ Chilled ☐ Intact ☐ Sample seals

Client Sample ID	Lab Sample ID	Sample Collection Date	Sample Collection Time	Matrix Type	Sample Preserv	No..type* & size of container	TPH-Gasoline	TPH-Diesel	8260B (BTEX, Oxygenates)	8260B (VOCs)	8270C (SVOCs)	CAM Metals	8082 (PCBs)	TOTAL LEAD 6010B	pH 9045A	STLC (Pb) 6010B	TCLP (Pb) 6010B	Remark
HA-15-001 @ 0.5'	EA502088-1	2/26/15	17:10	SOIL	NONE	JAR												
" @ 1.5	-2		17:20															
" @ 3'	-3		17:30															
" @ 4'	-4		17:40															
HA-15-002 @ 0.5'	-5		16:30															
" @ 1.5'	-6		16:40															
" @ 3'	-7		16:50															
" @ 4'	-8		17:00															
HA-15-003 @ 0.5'	-9		16:50															
" @ 1.5	-10		16:00															
" @ 3'	-11		16:10															
" @ 4'	-12		16:20															
HA-15-004 @ 0.5'	-13		15:10															
" @ 1.5'	-14		15:20															
" @ 3'	-15		15:30															
" @ 4'	-16	↓	15:40	↓	↓	↓												

Relinquished by	Company	Date	Time	Received by	Company	Date	Time
[signature]	EMI	2/27	1410	[signature]	ASC	2/27/15	14:10
Relinquished by	Company	Date	Time	Received by	Company	Date	Time

Container types: M=Metal Tube, A=Air Bag, P=Plastic bottle, G=Glass bottle, V=VOA vial

Alpha Scientific Corporation
16760 Gridley Road
Cerritos, CA 90703

Email: ascorp@verizon.net
Tel: (562) 809-8880
Fax: (562) 809-8801

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.
Distribution: WHITE with report, PINK to courier.

ALPHA SCIENTIFIC CORPORATION

CHAIN OF CUSTODY RECORD

Lab Job Number EA502088

Client: EARTH MECHANICS INC.

Address 17800 NEWHOPE ST. SUITE B FOUNTAIN VALLEY, CA 92708

Report Attention: LINO

Phone: 714 751-3826

Fax:

Sampled by: KAT

Project Name/No.: 15-107

Project Site: I 405 CCTV

Analyses Requested

T.A.T. Requested: ☐ 8 hrs ☐ 24 hrs ☐ 48 hrs ☐ 3 days ☒ Normal

Sample Condition: ☐ Chilled ☐ Intact ☐ Sample seals

Client Sample ID	Lab Sample ID	Sample Collection Date	Sample Collection Time	Matrix Type	Sample Preserv	No.,type* & size of container	TPH-Gasoline	TPH-Diesel	8260B (BTEX, Oxygenates)	8260B (VOCs)	8270C (SVOCs)	CAM Metals	8082 (PCBs)	TOTAL LEAD 6010B	pH 9045A	STLC Pb	TCLP Pb	Remark
HA-15-005 @ 0.5'	EA502088-17	2/26/15	14:25	SOIL	NONE	JAR								/		/	/	
" @ 1.5	-18		14:35											/				
" @ 3'	-19		14:45											/				
" @ 4'	-20		15:00											/				
HA-15-006 @ 0.5'	-21		10:00											/	/	/	/	
" @ 1.5'	-22		10:10											/				
" @ 3'	-23		10:20											/				
" @ 4	-24		10:30											/				
HA-05-007 @ 0.5	-25		10:45											/		/	/	
" @ 1.5	-26		10:55											/				
" @ 3'	-27		11:05											/				
" @ 4'	-28		11:15											/				
HA-15-008 @ 0.5'	-29		11:30											/		/	/	
" @ 1.5'	-30		11:40											/				
" @ 3'	-31		11:50											/				
" @ 4'	-32	↓	12:00	↓	↓	↓								/	/			

Relinquished by	Company	Date	Time	Received by	Company	Date	Time
[signature]	EMI	2/27	14:10	[signature]	ASC	2/27/15	14:10
Relinquished by	Company	Date	Time	Received by	Company	Date	Time

Container types: M=Metal Tube, A=Air Bag, P=Plastic bottle, G=Glass bottle, V=VOA vial

Alpha Scientific Corporation
16760 Gridley Road
Cerritos, CA 90703

Email: ascorp@verizon.net
Tel: (562) 809-8880
Fax: (562) 809-8801

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.
Distribution: WHITE with report, PINK to courier.

ALPHA SCIENTIFIC CORPORATION

CHAIN OF CUSTODY RECORD

Lab Job Number EA502088

Client: EARTH MECHANICS INC.			
Address 17800 NEWHOPE ST. SUITE B FOUNTAIN VALLEY, CA 92708			
Report Attention LINO	Phone 714 751-3826	Fax	Sampled by KAT
Project Name/No. 15-107	Project Site I-405 CCTV		

T.A.T. Requested: ☐ 8 hrs ☐ 24 hrs ☐ 48 hrs ☐ 3 days ☒ Normal

Sample Condition: ☒ Chilled ☒ Intact ☐ Sample seals

Client Sample ID	Lab Sample ID	Sample Collection Date	Sample Collection Time	Matrix Type	Sample Preserv	No.,type* & size of container	TPH-Gasoline	TPH-Diesel	8260B (BTEX, Oxygenates)	8260B (VOCs)	8270C (SVOCs)	CAM Metals	8082 (PCBs)	TOTAL LEAD 6010B	PH 9045A	STLC Pb	TCLP Pb	Remark
HA-15-008 @ 0.5'	EA502088-	2/26/15		SOIL	NONE	JAR								/	/			See page 2
" @ 1.5'	-													/				
" @ 3'														/				
" @ 4'														/	/			
HA-15-009 @ 0.5'	-37		13:00											/				
" 1.5'	-38		13:10											/				
" 3'	-39		13:20											/				
" 4'	-40		13:10											/				
HA-15-010 @ 0.5'	-41		13:25											/				
" 1.5'	-42		13:45											/				
" 3'	-43		13:55											/	/			
" 4'	-44	↓	14:05	↓	↓	↓								/				

Relinquished by	Company	Date	Time	Received by	Company	Date	Time
[signature]	EMI	2/27	14 10	[signature]	ASC	2/27/15	14:10
Relinquished by	Company	Date	Time	Received by	Company	Date	Time

Container types: M=Metal Tube, A=Air Bag, P=Plastic bottle, G=Glass bottle, V=VOA vial

Alpha Scientific Corporation
16760 Gridley Road
Cerritos, CA 90703

Email: ascorp@verizon.net
Tel: (562) 809-8880
Fax: (562) 809-8801

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.
Distribution: WHITE with report, PINK to courier.

APPENDIX B

LABORATORY SOIL TEST RESULTS

Alpha Scientific Corporation
Environmental Laboratories

03-05-2015

Mr. Lino Cheang
Earth Mechanics Inc.
17800 Newhope Street, Suite B
Fountain Valley, CA 92708

Project: 15-107
Project Site: I 405 CCTV
Sample Date: 02-26-2015
Lab Job No.: EA502088

Dear Mr. Cheang:

Enclosed please find the analytical report for the sample(s) received by Alpha Scientific Corporation on 02-27-2015 and analyzed by the following EPA methods:

EPA 6010B (Total Lead)
EPA 9045 (pH)

All analyses have met the QA/QC criteria of this laboratory.

The sample(s) arrived in good conditions (i.e., chilled, intact) and with a chain of custody record attached.

Alpha Scientific Corporation is a CA DHS certified laboratory (Certificate Number 2633). Thank you for giving us the opportunity to serve you. Please feel free to call me at (562) 809-8880 if our laboratory can be of further service to you.

Sincerely,

Roger Wang, Ph.D.
Laboratory Director

Enclosures

This cover letter is an integral part of this analytical report.

Client: Earth Mechanics Inc.
Project: 15-107
Project Site: I 405 CCTV
Matrix: Soil
Digestion Method: EPA 3050B
Batch No.: 0302-MS1

Lab Job No.: EA502088

Date Sampled: 02-26-2015
Date Received: 02-27-2015
Date Digested: 02-27-2015
Date Analyzed: 03-02-2015
Date Reported: 03-05-2015

EPA 6010B for Total Lead
Reporting Units: mg/kg (ppm)

Sample ID	Lab ID	Total Lead	Reporting Limit
Method Blank		ND	2
HA-15-001@0.5'	EA502088-1	25.9	2
HA-15-001@1.5'	EA502088-2	13.6	2
HA-15-001@3'	EA502088-3	2.6	2
HA-15-001@4'	EA502088-4	3.8	2
HA-15-002@0.5'	EA502088-5	2.6	2
HA-15-002@1.5'	EA502088-6	22.4	2
HA-15-002@3'	EA502088-7	18.3	2
HA-15-002@4'	EA502088-8	3.7	2
HA-15-003@0.5'	EA502088-9	ND	2
HA-15-003@1.5'	EA502088-10	ND	2
HA-15-003@3'	EA502088-11	6.8	2
HA-15-003@4'	EA502088-12	2.4	2
HA-15-004@0.5'	EA502088-13	42.1	2
HA-15-004@1.5'	EA502088-14	33.8	2
HA-15-004@3'	EA502088-15	3.8	2
HA-15-004@4'	EA502088-16	2.7	2
HA-15-005@0.5'	EA502088-17	53.2	2
HA-15-005@1.5'	EA502088-18	10.5	2
HA-15-005@3'	EA502088-19	ND	2
HA-15-005@4'	EA502088-20	ND	2

ND: Not Detected (at the specified limit).

Client:	Earth Mechanics Inc.	Lab Job No.:	EA502088
Project:	15-107		
Project Site:	I 405 CCTV	Date Sampled:	02-26-2015
Matrix:	Soil	Date Received:	02-27-2015
Digestion Method:	EPA 3050B	Date Digested:	02-27-2015
Batch No.:	0303-MS1	Date Analyzed:	03-03-2015
		Date Reported:	03-05-2015

EPA 6010B for Total Lead
Reporting Units: mg/kg (ppm)

Sample ID	Lab ID	Total Lead	Reporting Limit
Method Blank		ND	2
HA-15-006@0.5'	EA502088-21	15.5	2
HA-15-006@1.5'	EA502088-22	2.8	2
HA-15-006@3'	EA502088-23	ND	2
HA-15-006@4'	EA502088-24	ND	2
HA-15-007@0.5'	EA502088-25	17.3	2
HA-15-007@1.5'	EA502088-26	3.5	2
HA-15-007@3'	EA502088-27	ND	2
HA-15-007@4'	EA502088-28	2.7	2
HA-15-008@0.5'	EA502088-29	31.0	2
HA-15-008@1.5'	EA502088-30	8.0	2
HA-15-008@3'	EA502088-31	4.3	2
HA-15-008@4'	EA502088-32	ND	2
HA-15-009@0.5'	EA502088-37	7.0	2
HA-15-009@1.5'	EA502088-38	6.8	2
HA-15-009@3'	EA502088-39	3.6	2
HA-15-009@4'	EA502088-40	ND	2
HA-15-010@0.5'	EA502088-41	8.3	2
HA-15-010@1.5'	EA502088-42	ND	2
HA-15-010@3'	EA502088-43	2.1	2
HA-15-010@4'	EA502088-44	ND	2

ND: Not Detected (at the specified limit).

Client:	Earth Mechanics Inc.	Lab Job No.:	EA502088
Project:	15-107		
Project Site:	I 405 CCTV	Date Sampled:	02-26-2015
Matrix:	Soil	Date Received:	02-27-2015
Batch No.:	0227-PH1	Date Analyzed:	02-27-2015
		Date Reported:	03-05-2015

EPA Method 9045 (Soil pH)
Reporting Units: pH Unit

Sample ID	Lab ID	pH	Temperature (^{O}C)	Reporting Limit
HA-15-001@0.5'	EA411043-1	8.03	23.9	---
HA-15-002@1.5'	EA411043-6	8.13	23.9	---
HA-15-003@3'	EA411043-11	8.23	23.9	---
HA-15-004@4'	EA411043-16	7.93	23.9	---
HA-15-006@0.5'	EA411043-21	7.28	23.9	---
HA-15-008@4'	EA411043-32	7.55	23.9	---
HA-15-010@3'	EA411043-43	7.58	23.9	---

03-05-2015

EPA 6010B (Total Lead)
Batch QA/QC Report

Client:	Earth Mechanics Inc.	Lab Job No:	EA502088
Project:	15-107		
Matrix:	Soil	Lab Sample ID:	SS502027-1
Batch No.:	0302-MS1	Date Analyzed:	03-02-2015

I. MS/MSD Report
Unit: ppm

Analyte	EPA Method	MB Conc.	Spike Conc.	MS %Rec.	MSD %Rec.	% RPD	%RPD Accept. Limit	%Rec Accept. Limit
Lead (Pb)	6010B	ND	4.0	105.9	106.3	0.4	30	70-130

II. LCS Result
Unit: ppm

Analyte	EPA Method	LCS Value	True Value	Rec.%	Accept. Limit
Lead (Pb)	6010B	4.020	4.0	100.5	80-120

ND:Not Detected (at the specified limit).

03-05-2015

EPA 6010B (Total Lead)
Batch QA/QC Report

Client:	Earth Mechanics Inc.	Lab Job No:	EA502088
Project:	15-107		
Matrix:	Soil	Lab Sample ID:	EA502088-21
Batch No.:	0303-MS1	Date Analyzed:	03-03-2015

I. MS/MSD Report
Unit: ppm

Analyte	EPA Method	MB Conc.	Spike Conc.	MS %Rec.	MSD %Rec.	% RPD	%RPD Accept. Limit	%Rec Accept. Limit
Lead (Pb)	6010B	ND	4.0	88.4	94.8	1.3	30	70-130

II. LCS Result
Unit: ppm

Analyte	EPA Method	LCS Value	True Value	Rec.%	Accept. Limit
Lead (Pb)	6010B	3.299	4.0	82.5	80-120

ND:Not Detected (at the specified limit).

03-10-2014

Mr. Lino Cheang
Earth Mechanics Inc.
17800 Newhope Street, Suite B
Fountain Valley, CA 92708

Project: 15-107
Project Site: I 405 CCTV
Sample Date: 02-26-2015
Lab Job No.: EA502088A

Dear Mr. Cheang:

Enclosed please find the analytical report for the sample(s) received by Alpha Scientific Corporation on 02-27-2015 and analyzed by the following EPA methods:

EPA 6010B (STLC Pb)
EPA 6010B (TCLP Pb)

All analyses have met the QA/QC criteria of this laboratory.

The sample(s) arrived in good conditions and with a chain of custody record attached.

Alpha Scientific Corporation is a CA DHS certified laboratory (Certificate Number 2633). Thank you for giving us the opportunity to serve you. Please feel free to call me at (562) 809-8880 if our laboratory can be of further service to you.

Sincerely,

Roger Wang, Ph.D.
Laboratory Director

Enclosures

This cover letter is an integral part of this analytical report.

Client:	Earth Mechanics Inc.	Lab Job No.:	EA502088A
Project:	15-107		
Project Site:	I 405 CCTV	Date Sampled:	02-26-2015
Matrix:	Soil	Date Received:	02-27-2015
Batch No.:	0309-MS1	Date Analyzed:	03-09-2015
		Date Reported:	03-10-2014

EPA 6010B (Pb, STLC)
Reporting Unit: mg/L (ppm)

Sample ID	Lab ID	Lead, STLC	MDL	PQL
Method Blank		ND	0.1	0.2
HA-15-004@0.5'	EA502088-13	2.05	0.1	0.2
HA-15-004@1.5'	EA502088-14	1.84	0.1	0.2
HA-15-005@0.5'	EA502088-17	1.80	0.1	0.2
HA-15-006@0.5'	EA502088-21	0.48	0.1	0.2
HA-15-007@0.5'	EA502088-25	0.34	0.1	0.2
HA-15-008@0.5'	EA502088-29	0.71	0.1	0.2

Note: Sample Preparation: Extraction Procedures, STLC Metals, Title 22, Chapter 11, Appendix II-1, 48 hours (03-6 to 03-08-2015).

MDL: Method Detection Limit; PQL: Practical Quantitation Limit;
ND: Not Detected (at the specified limit); J: Trace concentration, result between MDL and PQL.

Client:	Earth Mechanics Inc.	Lab Job No.:	EA502088A
Project:	15-107		
Project Site:	I 405 CCTV	Date Sampled:	02-26-2015
Matrix:	Soil	Date Received:	02-27-2015
Batch No.:	0309-MS1	Date Analyzed:	03-09-2015
		Date Reported:	03-10-2014

EPA 6010B (Pb, TCLP)
Reporting Unit: mg/L (ppm)

Sample ID	Lab ID	Lead, TCLP	MDL	PQL
Method Blank		ND	0.1	0.2
HA-15-004@0.5'	EA502088-13	ND	0.1	0.2
HA-15-004@1.5'	EA502088-14	ND	0.1	0.2
HA-15-005@0.5'	EA502088-17	ND	0.1	0.2
HA-15-006@0.5'	EA502088-21	ND	0.1	0.2
HA-15-007@0.5'	EA502088-25	ND	0.1	0.2
HA-15-008@0.5'	EA502088-29	ND	0.1	0.2

Note: Sample Preparation Method: EPA 1311, 18 hours (03-07 to 03-08-2015).

MDL: Method Detection Limit; PQL: Practical Quantitation Limit;
ND: Not Detected (at the specified limit); J: Trace concentration, result between MDL and PQL.

03-10-2014

EPA 6010B (Lead, STLC)
Batch QA/QC Report

Client:	Earth Mechanics Inc.	Lab Job No:	EA502088A
Project:	13-102		
Matrix:	Soil	Lab Sample ID:	EA502088-13 STLC
Batch No.:	0309-MS1	Date Analyzed:	03-09-2015

I. MS/MSD Report
Unit: ppm

Analyte	EPA Method	MB Conc.	Spike Conc.	MS %Rec.	MSD %Rec.	% RPD	%RPD Accept. Limit	%Rec Accept. Limit
Lead (Pb)	6010B	ND	0.5	88.1	90.6	2.8	30	70-130

II. LCS Result
Unit: ppm

Analyte	EPA Method	LCS Value	True Value	Rec.%	Accept. Limit
Lead (Pb)	6010B	0.4544	0.5	90.9	80-120

ND:Not Detected (at the specified limit).

APPENDIX C

STATISTICAL CALCULATIONS

1	**UCL Statistics for Uncensored Full Data Sets**											
2												
3	User Selected Options											
4	Date/Time of Computation			3/19/2015 4:51:27 PM								
5	From File			Lab Results for ProUCL.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	**TTLC for SR-133**											
12												
13	**General Statistics**											
14	Total Number of Observations			20			Number of Distinct Observations			15		
15							Number of Missing Observations			0		
16	Minimum			2			Mean			12.81		
17	Maximum			53.2			Median			3.8		
18	SD			15.21			Std. Error of Mean			3.402		
19	Coefficient of Variation			1.188			Skewness			1.524		
20												
21	**Normal GOF Test**											
22	Shapiro Wilk Test Statistic			0.752			**Shapiro Wilk GOF Test**					
23	5% Shapiro Wilk Critical Value			0.905			Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic			0.273			**Lilliefors GOF Test**					
25	5% Lilliefors Critical Value			0.198			Data Not Normal at 5% Significance Level					
26	**Data Not Normal at 5% Significance Level**											
27												
28	**Assuming Normal Distribution**											
29	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
30	95% Student's-t UCL			18.69			95% Adjusted-CLT UCL (Chen-1995)			19.64		
31							95% Modified-t UCL (Johnson-1978)			18.89		
32												
33	**Gamma GOF Test**											
34	A-D Test Statistic			1.292			**Anderson-Darling Gamma GOF Test**					
35	5% A-D Critical Value			0.773			Data Not Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic			0.268			**Kolmogrov-Smirnoff Gamma GOF Test**					
37	5% K-S Critical Value			0.2			Data Not Gamma Distributed at 5% Significance Level					
38	**Data Not Gamma Distributed at 5% Significance Level**											
39												
40	**Gamma Statistics**											
41	k hat (MLE)			0.894			k star (bias corrected MLE)			0.793		
42	Theta hat (MLE)			14.33			Theta star (bias corrected MLE)			16.15		
43	nu hat (MLE)			35.76			nu star (bias corrected)			31.73		
44	MLE Mean (bias corrected)			12.81			MLE Sd (bias corrected)			14.38		
45							Approximate Chi Square Value (0.05)			19.86		

Adjusted Level of Significance	0.038	Adjusted Chi Square Value 19.11
Assuming Gamma Distribution		
95% Approximate Gamma UCL (use when n>=50))	20.47	95% Adjusted Gamma UCL (use when n<50) 21.26
Lognormal GOF Test		
Shapiro Wilk Test Statistic	0.863	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.905	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.235	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.198	Data Not Lognormal at 5% Significance Level
Data Not Lognormal at 5% Significance Level		
Lognormal Statistics		
Minimum of Logged Data	0.693	Mean of logged Data 1.896
Maximum of Logged Data	3.974	SD of logged Data 1.165
Assuming Lognormal Distribution		
95% H-UCL	28.36	90% Chebyshev (MVUE) UCL 23.63
95% Chebyshev (MVUE) UCL	28.69	97.5% Chebyshev (MVUE) UCL 35.71
99% Chebyshev (MVUE) UCL	49.5	
Nonparametric Distribution Free UCL Statistics		
Data do not follow a Discernible Distribution (0.05)		
Nonparametric Distribution Free UCLs		
95% CLT UCL	18.41	95% Jackknife UCL 18.69
95% Standard Bootstrap UCL	18.27	95% Bootstrap-t UCL 20.81
95% Hall's Bootstrap UCL	19.53	95% Percentile Bootstrap UCL 18.79
95% BCA Bootstrap UCL	19.3	
90% Chebyshev(Mean, Sd) UCL	23.02	95% Chebyshev(Mean, Sd) UCL 27.64
97.5% Chebyshev(Mean, Sd) UCL	34.05	99% Chebyshev(Mean, Sd) UCL 46.66
Suggested UCL to Use		
95% Chebyshev (Mean, Sd) UCL	27.64	
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.		
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)		
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.		
For additional insight the user may want to consult a statistician.		

1	**UCL Statistics for Uncensored Full Data Sets**										
2											
3	User Selected Options										
4	Date/Time of Computation	3/19/2015 4:56:10 PM									
5	From File	Lab Results for ProUCL.xls									
6	Full Precision	OFF									
7	Confidence Coefficient	95%									
8	Number of Bootstrap Operations	2000									
9											
10											
11	**TTLC for Sand Canyon**										
12											
13	**General Statistics**										
14	Total Number of Observations	20			Number of Distinct Observations	14					
15					Number of Missing Observations	0					
16	Minimum	2			Mean	6.345					
17	Maximum	31			Median	3.15					
18	SD	7.308			Std. Error of Mean	1.634					
19	Coefficient of Variation	1.152			Skewness	2.44					
20											
21	**Normal GOF Test**										
22	Shapiro Wilk Test Statistic	0.655			**Shapiro Wilk GOF Test**						
23	5% Shapiro Wilk Critical Value	0.905			Data Not Normal at 5% Significance Level						
24	Lilliefors Test Statistic	0.276			**Lilliefors GOF Test**						
25	5% Lilliefors Critical Value	0.198			Data Not Normal at 5% Significance Level						
26	**Data Not Normal at 5% Significance Level**										
27											
28	**Assuming Normal Distribution**										
29	**95% Normal UCL**				**95% UCLs (Adjusted for Skewness)**						
30	95% Student's-t UCL	9.171			95% Adjusted-CLT UCL (Chen-1995)	9.986					
31					95% Modified-t UCL (Johnson-1978)	9.319					
32											
33	**Gamma GOF Test**										
34	A-D Test Statistic	1.57			**Anderson-Darling Gamma GOF Test**						
35	5% A-D Critical Value	0.761			Data Not Gamma Distributed at 5% Significance Level						
36	K-S Test Statistic	0.219			**Kolmogrov-Smirnoff Gamma GOF Test**						
37	5% K-S Critical Value	0.198			Data Not Gamma Distributed at 5% Significance Level						
38	**Data Not Gamma Distributed at 5% Significance Level**										
39											
40	**Gamma Statistics**										
41	k hat (MLE)	1.353			k star (bias corrected MLE)	1.183					
42	Theta hat (MLE)	4.689			Theta star (bias corrected MLE)	5.362					
43	nu hat (MLE)	54.12			nu star (bias corrected)	47.34					
44	MLE Mean (bias corrected)	6.345			MLE Sd (bias corrected)	5.833					
45					Approximate Chi Square Value (0.05)	32.55					

46	Adjusted Level of Significance					0.038	Adjusted Chi Square Value					31.58
47												
48	**Assuming Gamma Distribution**											
49	95% Approximate Gamma UCL (use when n>=50))					9.228	95% Adjusted Gamma UCL (use when n<50)					9.511
50												
51	**Lognormal GOF Test**											
52	Shapiro Wilk Test Statistic					0.838	**Shapiro Wilk Lognormal GOF Test**					
53	5% Shapiro Wilk Critical Value					0.905	Data Not Lognormal at 5% Significance Level					
54	Lilliefors Test Statistic					0.192	**Lilliefors Lognormal GOF Test**					
55	5% Lilliefors Critical Value					0.198	Data appear Lognormal at 5% Significance Level					
56	**Data appear Approximate Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59	Minimum of Logged Data					0.693	Mean of logged Data					1.435
60	Maximum of Logged Data					3.434	SD of logged Data					0.853
61												
62	**Assuming Lognormal Distribution**											
63	95% H-UCL					9.717	90% Chebyshev (MVUE) UCL					9.59
64	95% Chebyshev (MVUE) UCL					11.26	97.5% Chebyshev (MVUE) UCL					13.58
65	99% Chebyshev (MVUE) UCL					18.14						
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
69												
70	**Nonparametric Distribution Free UCLs**											
71	95% CLT UCL					9.033	95% Jackknife UCL					9.171
72	95% Standard Bootstrap UCL					8.933	95% Bootstrap-t UCL					11.57
73	95% Hall's Bootstrap UCL					11.83	95% Percentile Bootstrap UCL					9.165
74	95% BCA Bootstrap UCL					10.02						
75	90% Chebyshev(Mean, Sd) UCL					11.25	95% Chebyshev(Mean, Sd) UCL					13.47
76	97.5% Chebyshev(Mean, Sd) UCL					16.55	99% Chebyshev(Mean, Sd) UCL					22.6
77												
78	**Suggested UCL to Use**											
79	95% Chebyshev (Mean, Sd) UCL					13.47						
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
84	For additional insight the user may want to consult a statistician.											
85												

FOUNDATION REPORT

Closed Circuit Television Pole
I-405 Communication System Improvements
City of Irvine, Orange County, California
12-Ora-405, PM 0.2/8.7
Caltrans Project No. 1212000058 (EA OH2260)
EMI Project No. 15-107
Date: April 13, 2015

EARTH MECHANICS, INC.

Geotechnical and Earthquake Engineering

Earth Mechanics, Inc.
Geotechnical & Earthquake Engineering

April 13, 2015

EMI Project No. 15-107

RBF Consulting, a Michael Baker International Company
14725 Alton Parkway
Irvine, CA 92618

Attention: Mr. Carlos Ortiz, P.E.

Subject: Foundation Report for Closed Circuit Television Pole
I-405 Communication System Improvements
City of Irvine, Orange County, California
12-Ora-405, PM 0.2/8.7
Caltrans Project No. 1212000058 (EA OH2260)

Dear Mr. Ortiz:

Attached please find the Foundation Report for the new Closed Circuit Television (CCTV) pole for the I-405 Communication System Improvements project. This report presents the findings and conclusions of our field investigation and laboratory testing program. This report also presents the results of our analyses and recommendations for design and construction of the foundation for the proposed CCTV pole.

Please submit this report to Caltrans for review. All review comments and approved responses will be incorporated into a final report later.

We appreciate the opportunity to provide geotechnical design services for this project. If you have any questions, please call us.

Sincerely,

EARTH MECHANICS, INC.

REGISTERED PROFESSIONAL ENGINEER
GNANAPRAGASAM J. GUNARANJAN
No. GE2970
Exp: 12-31-15
GEOTECHNICAL
STATE OF CALIFORNIA

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17800 Newhope Street, Suite B, Fountain Valley, California 92708 Tel: (714) 751-3826 Fax: (714) 751-3928

FOUNDATION REPORT

CLOSED CIRCUIT TELEVISION POLE
I-405 COMMUNICATION SYSTEM IMPROVEMENTS
CITY OF IRVINE, ORANGE COUNTY, CALIFORNIA
12-ORA-405, PM 0.2/8.7
CALTRANS PROJECT NO. 1212000058 (EA OH2260)

Prepared for:

RBF Consulting, a Michael Baker International Company
14725 Alton Parkway
Irvine, CA 92618

Prepared By:

Earth Mechanics, Inc.
17800 Newhope Street, Suite B
Fountain Valley, California 92708

EMI Project No. 15-107

April 13, 2015

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APPENDICES

1.0 INTRODUCTION

1.1 Purpose and Scope of Study

This Foundation Report presents the findings and conclusions of a geotechnical investigation conducted by Earth Mechanics, Inc. (EMI) for the proposed Closed Circuit Television (CCTV) pole as a part of the Interstate I-405 (I-405) Communication System Improvements Project located in Orange County, California. It presents results of our foundation evaluation and provides design and construction recommendations to assist RBF Consulting (RBF) designers in preparing the project Plans, Specifications, and Estimates (PS&E). A site location map is presented in Figure 1-1.

EMI is a subconsultant to RBF. The geotechnical services provided for this project included the following tasks:

- Field exploration consisting of drilling and logging one exploratory boring;
- Laboratory testing of selected bulk and relatively undisturbed soil samples;
- Engineering calculations and analysis to develop foundation design and construction recommendations; and
- Preparation of this report presenting our findings, conclusions, and recommendations.

1.2 Project Description

The subject project, a federally funded project, is proposed to be funded in fiscal year 2014/2015 from the State Highway Operation and Protection Program (SHOPP). A Traffic Management Plan (TMP) was prepared for the full limits of the project and the following proposed improvements were included in the TMP:

1) Upgrade of existing analog CCTV cameras to high definition CCTV cameras along Routes I-5, SR-73, SR-133, SR-241, and SR-261 in the cities of Costa Mesa, Irvine, Newport Beach, Laguna Beach, Aliso Viejo, San Juan Capistrano, San Clemente, Mission Viejo, Rancho Santa Margarita, Laguna Woods, Lake Forest, Santa Ana, Anaheim, and Buena Park.

2) Convert existing communication system to an Internet Protocol communication system that will provide effective communications from the various field elements (CCTV Cameras, Changeable Message Signs, Traffic Signals, Ramp Metering Systems, Traffic Monitoring Stations, and Communication Hubs, along Routes SR-22, SR-57, and I-405) to District 12 Transportation Management Center.

3) Upgrade of fiber optic cable and CCTV cameras along I-405 from I-5 to SR-55. This work includes the following tasks:

a. Replace existing fiber optic cable on both NB and SB I-405 at the various locations between PM 0.2 and 8.7 (from I-5 to SR-55). The proposed fiber optic will be installed in the existing conduits. There will be no modification to existing conduits. Installation of fiber

optic inside the existing conduits will be in conformance with the procedures specified by the cable manufacturer for the specific cables being installed.

b. Replace six (6) existing CCTV's on existing 45 feet high poles/CIDH foundations. The upgraded CCTV's and equipment will be installed at the same locations where the existing CCTVs are located.

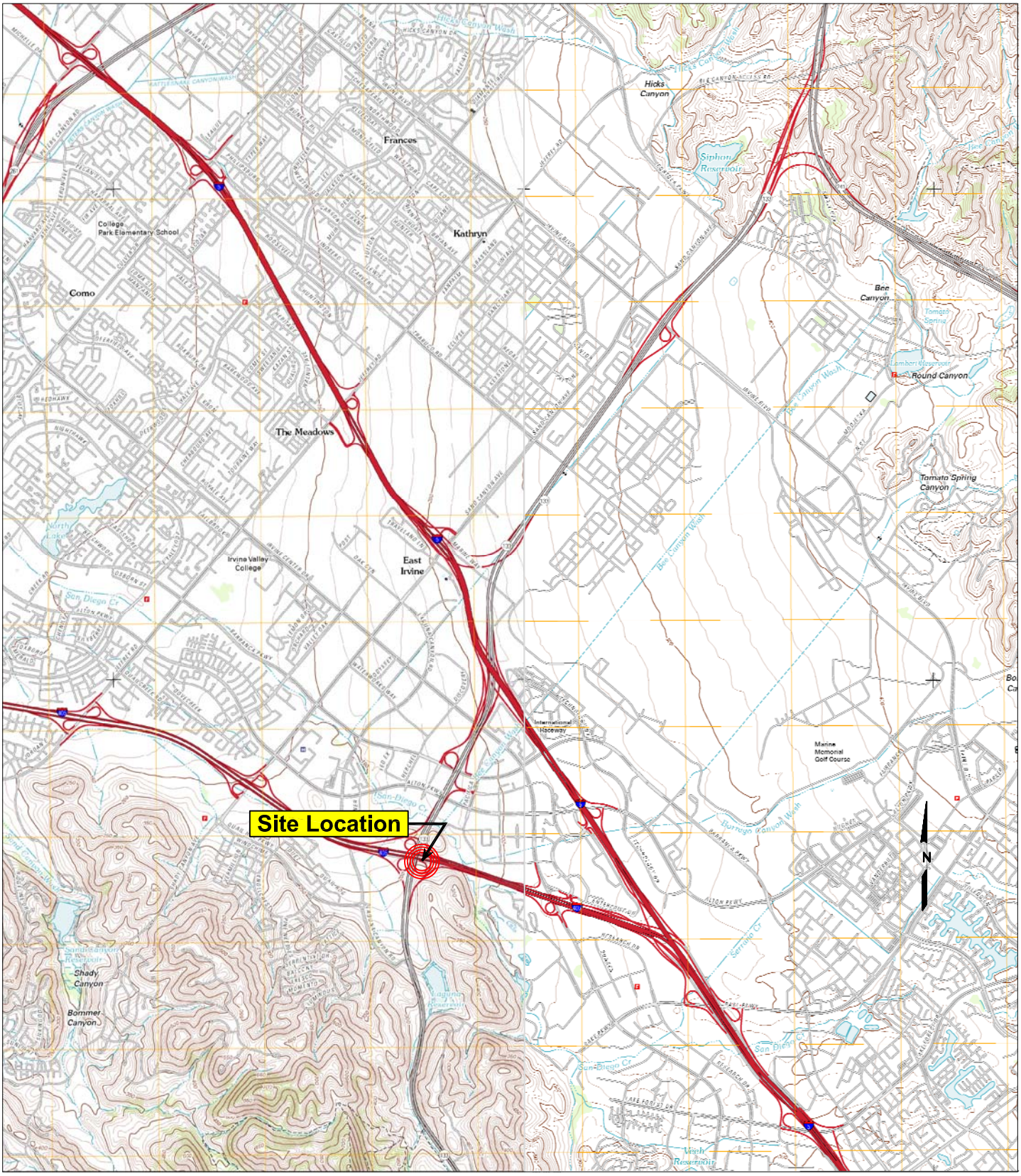
c. Install two (2) new CCTV cameras poles and foundations on SB I-405 at PM 2.63 near Sand Canyon Avenue and at PM 2.03 near SR-133. A cabinet, foundation, gravel pad, and maintenance vehicle pullout will be constructed at each new CCTV location.

The proposed improvements will increase the capability to transmit and receive data and video information between the Department's Traffic Management Center (TMC) and field elements, to help monitor and manage traffic information more efficiently, resulting in improving traffic flow and reducing traffic delay.

As identified above in item 3c, two new CCTVs are proposed to be constructed on SB 1-405 at PM 2.63 near Sand Canyon Avenue and at PM 2.03 near SR-133. The CCTV poles near the Sand Canyon Avenue and SR-133 sites are 45 and 90 feet tall, respectively. This report is prepared to address the design and construction of the foundation supporting the 90-foot tall pole.

1.3 Proposed CCTV Structures

The proposed CCTV structure near SR-133 has a 90-foot high mast pole. The CCTV structure will be supported on a standard cast-in-drilled-hole (CIDH) pile per Caltrans Standard Plans (Caltrans, 2010a), Sheet ES-16C. The diameter and depth of the CIDH pile are selected based on the type and height of the pole.



0 5,000 10,000 FEET

SCALE 1" = 5,000'

REFERENCE: USGS Topographic 7.5 Minute Quadrangle Maps - Tustin Quadrangle (2012) and Lake Forest Quadrangle (2012)

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Caltrans I-405 CCTV Project

SITE LOCATION MAP

Project No. 15-107 | Date: March 2015

Figure 1-1

2.0 FIELD INVESTIGATION AND LABORATORY TESTING

2.1 Site-Specific Field Investigation

A geotechnical field investigation was conducted on February 27, 2015. One exploratory boring was accomplished under the supervision of EMI. Exploration information, including boring number, station, offset, ground surface elevation, boring depth, and groundwater elevation are summarized in Table 2-1. Location of the exploratory boring is shown on the Log-of-Test-Borings (LOTB) sheet provided in Appendix A.

Table 2-1. Geotechnical Exploration Information

Boring No.	Station Line	Approx. Station	Approx. Offset (feet)	Approx. GSE (feet)	Approx. GWE (feet)	Boring Depth (feet)
A-15-001	"A" Line	133+31	162' LT	+186.5	+151.4	45.7

Notes: GSE = Ground Surface Elevation; GWE = Groundwater Elevation.

2.1.1 Soil Borings

Exploratory soil boring was drilled by 2R Drilling, under a subcontract with EMI, using a truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers. Sampling was performed by using either a Modified California Drive (MCD) sampler or a Standard Penetration Test (SPT) sampler. The soil sampling interval is 5 feet. Relatively undisturbed soil samples were obtained using a 3.25-inch outer diameter MCD sampler lined with brass rings. Each of these brass rings is 1-inch long with a 2.5-inch outside diameter. The SPT sampler (1.4-inch inside diameter) was also used to obtain soil samples. The MCD and SPT samplers were driven 18 inches into the ground or until refusal was encountered, whichever occurs first, using a 140-lb hammer free falling from a height of 30 inches. The numbers of blows to advance the sampler each 6 inches of penetration was recorded. The numbers of blows for the final 12 inches or shorter of driving was recorded on the LOTB sheet.

Charts published by Winterkorn and Fang (1975) can be used to determine a reduction factor used to convert blowcounts recorded using the MCD sampler into SPT blowcounts. Using those charts, we obtained a reduction factor of 0.5 which was used for this project.

2.2 Laboratory Testing

Soil samples considered representative of the subsurface conditions were tested to obtain or derive relevant physical and engineering soil properties. The following laboratory tests were conducted to supplement the observations recorded during the field investigation:

- Visual Soil Classification
- In-situ Moisture Content and Unit Weight
- Minimum Resistivity, pH, Sulfate Content, and Chloride Content

The laboratory tests were conducted in general accordance with California Test Methods or American Society for Testing and Materials (ASTM) Standards. Laboratory test results are included in Appendix B.

3.0 REGIONAL GEOLOGY, SEISMICITY, AND SUBSURFACE CONDITIONS

3.1 Physiography

The site area is in the Los Angeles physiographic basin, a large, relatively flat, low-lying, coastal area surrounded by mountains on the north, east, and southeast. The basin is bounded on the north by the Santa Monica Mountains, on the east by the Repetto-Puente-Santa Ana ranges, and on the south by San Joaquin Hills. The western margin of the basin is bordered by the sea and the Palos Verdes Hills.

The site area is in the southern part of the basin known as the Tustin Plain, and is near the margin of the San Joaquin Hills and the Tustin Plain. The major drainage in this part of the basin is San Diego Creek, which flows northwesterly from the southern part of the plain, around the northern end of the San Joaquin Hills, into Newport Bay.

3.2 Stratigraphy

The subsurface materials comprise a wide range of clays, silts, and sands with very little apparent bedding continuity. These materials appear to be Quaternary-age alluvium deposited in discontinuous lenses. Bedrock is shallow and consists of siltstone and sandstone. The regional geological map (Greenwood and Miller, 1991) indicates these rocks are Miocene- to Oligocene-age Topanga and Vaqueros/Sespe formations intruded by a dike of volcanic rock.

During the site-specific field investigation, olive-brown to olive-yellow silty fine sandstone interbedded with sandy claystone (Vaqueros Formation) was encountered at approximately 10 feet below existing grade. This sedimentary bedrock is generally poorly indurated and slightly weathered to fresh. The Vaqueros formation is known to consist of highly cemented beds that may cause refusal during a drilling investigation. The bedrock is overlain by brown silty sand and clayey sand.

3.3 Geologic Structure

The geologic structure at the site is characterized by relatively flat-lying Quaternary sediments overlying dipping and faulted Tertiary sedimentary and volcanic rocks. There are several nearby geological faults within the bedrock of the San Joaquin Hills, but most of these are not known to be active. According to regional maps, local bedding within sedimentary units at the site are dipping at shallow to moderate angles in the northwest direction.

The nearest major active or potentially active surface faults are San Joaquin Hills blind thrust fault, Whittier fault, and Newport-Inglewood Structural Zone. The San Joaquin Hills blind thrust is located beneath the San Joaquin Hills as it is believed to have created the uplift within the hills as a fold and thrust belt. As a result, the blind thrust is located beneath the project site vicinity, though no surface expression of fault rupture has been mapped. The nearest mapped Quaternary fault is the Pelican Hill fault, but this is a minor feature that is overshadowed by the Newport-Inglewood fault. The Newport-Inglewood Structural Zone is a northwesterly trending series of faults and folds southwest of the site. The Whittier fault extends northwesterly along the eastern flank of the Santa Ana Mountains northeast of the site.

3.4 Geologic Hazards

The geological hazards present at the site include earthquake shaking. The site lies outside identified tsunami inundation zones, and there are no large bodies of water within the project area that could generate a seiche. There are no volcanos in the region and there are no known active surface faults within the project area so ground rupture is not a factor. The California Geological Survey (CGS, 2001) has indicated that the site locations for the project are not located within a seismic hazard (liquefaction and seismically induced earthquakes) zone (Figure 3-1). Low to moderate shaking should be anticipated at the site during an earthquake along one of the controlling faults for the project site.

3.5 Seismicity

The site area is in seismically active southern California. The largest historical earthquake in the Los Angeles basin was the 1933 Long Beach event which had a magnitude of about 6.3. This earthquake did not rupture the surface, but is believed to have been centered near the Huntington Beach-Newport Beach area and associated with the Newport-Inglewood Structural Zone (Hauksson and Gross, 1991). Although maps of historical earthquake activity indicate alignment of earthquakes along the Newport-Inglewood Structural Zone, most of these events represent aftershocks of the 1933 earthquake, and there is little significant ongoing earthquake activity presently associated with the zone.

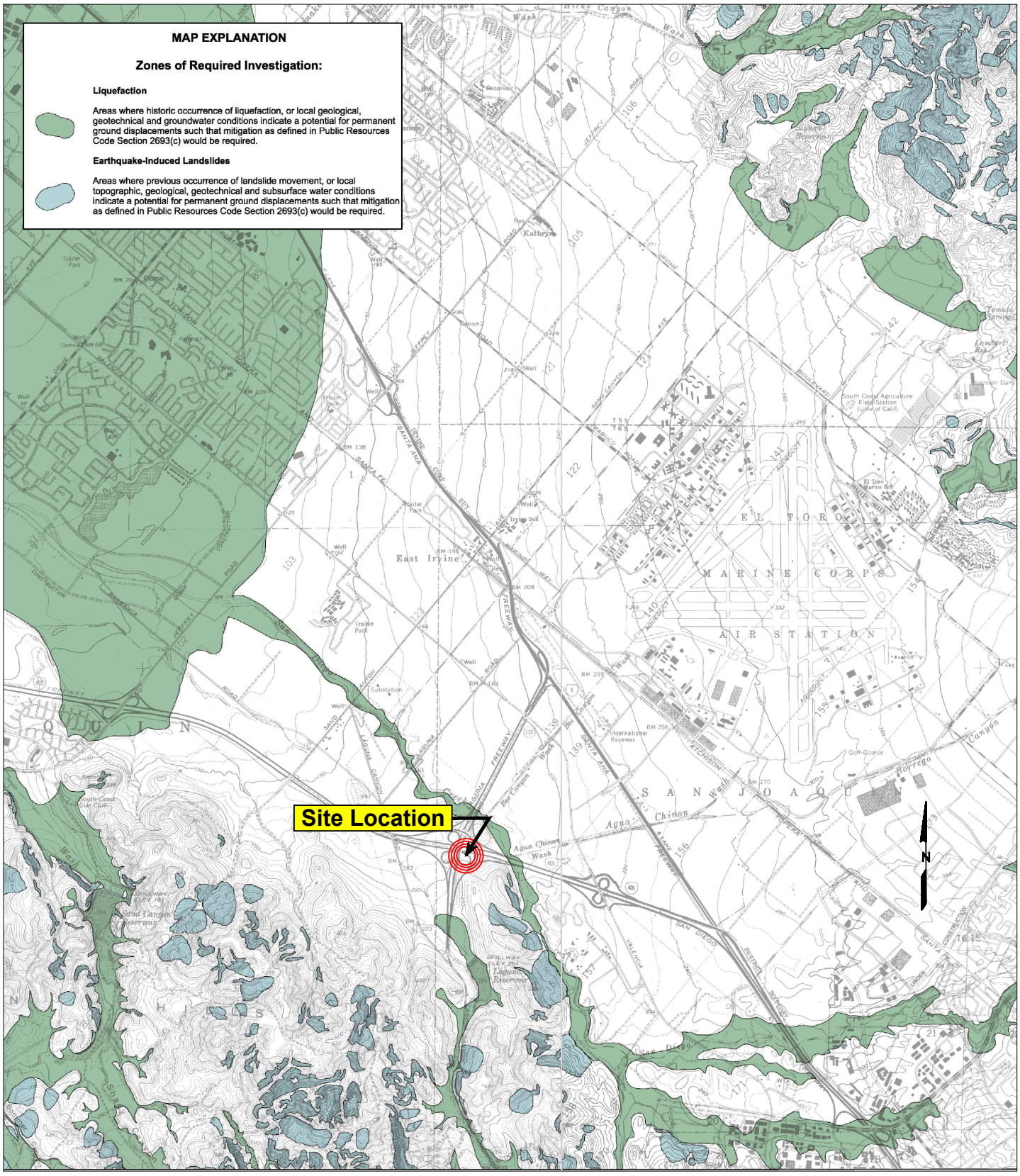
The 1987 Whittier earthquake (M=5.9) occurred at depth on a thrust or reverse fault dipping northerly from the Los Angeles Basin, below the Puente Hills and the San Gabriel Basin. This event probably occurred on one of the faults within the Coyote Hills fault zone which includes the Norwalk fault and the Puente Hills fault of Shaw and Shearer (1999).

There is no clustering or alignment of earthquakes in proximity to the site. This apparent lack of earthquake activity suggests that the site area is tectonically stable and suggests that there are no unrecognized active faults at the site.

3.6 Subsurface Soil/Bedrock Conditions

Recent site-specific field investigation indicates that the upper 10-foot thick subsurface materials consist predominately of medium dense to very dense silty sand and clayey sand underlain by sedimentary rock of the Vaqueros Formation. The formation consists generally of slightly to moderately weathered olive-brown to olive-yellow silty sandstone interbedded with sandy claystone materials.

The above soil and bedrock descriptions are general and are intended to describe the subsurface in very broad terms. The descriptions above should not be construed to mean that the subsurface profile is uniform and soil and bedrock is homogeneous within the project area. For details on stratigraphy at the borehole location, refer to the LOTB sheet in Appendix A.



REFERENCE: CGS, Seismic Hazard Zone Map of Tustin Quadrangle (2001) and El Toro Quadrangle (2001)

Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

Caltrans I-405 CCTV Project

SEISMIC HAZARD MAP

Project No. 15-107 | Date: March 2015

Figure 3-1

The idealized soil profile and design strength parameters are presented in Table 3-1. The design strength parameters are based on correlation with SPT blowcounts (Lam and Martin, 1986). It should be noted that the design strength parameters in Table 3-1 are relatively conservative as compared to the strength values obtained from the SPT correlation.

As shown on Sheet ES-16C of the Caltrans Standard Plans (2010a), the length of the CIDH pile is 14 feet for a Pole Type HM CCTV 90. For this reason, the idealized soil profile and strength parameters in Table 3-1 were limited to a depth of no more than El. +160 feet.

Table 3-1. Idealized Soil Profile and Strength Parameters

Approximate Elevation (feet)	Predominant Soil / Bedrock Type	Equivalent SPT Blowcount (blows/foot)	Total Unit Weight (pcf)	Friction Angle (degree)
+186.5 to +181.5	Silty Sand	-	110	30
+181.5 to +176.5	Clayey Sand	39	110	35
+176.5 to +160.0	Silty Sandstone interbedded with Sandy Claystone	> 70	115	38

3.7 Groundwater Conditions

Based on California Geological Survey, Division of Mines and Geology (CGS, 1998 and CGS, 2000), the highest historical groundwater at the project site is greater than 40 feet below the ground surface. Based on California Department of Water Resources (CDWR), between 1994 and 2000, the recorded highest groundwater in the nearest wells (Well #06S08W06Q01S and Well #06S08W08E01S) is at about El. +162 feet. During the site-specific field investigation, groundwater was encountered at about 35.1 feet below existing grade (about El. +151.4 feet). Based on the above information, a design groundwater elevation of +162 feet is recommended.

Soil moisture content and groundwater level can fluctuate due to variations in seasonal rainfall, nearby irrigation, changes in or addition of flood control improvements, groundwater injection or extraction activities, construction activities, or numerous other man-made or natural conditions. Therefore, groundwater during construction may be higher or lower than the design groundwater elevation of +162 feet.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Seismic Design Criteria

The design ARS curve was determined based on the 2013 Seismic Design Criteria (SDC) (Caltrans, 2013 and 2012) procedures. The peak ground acceleration (PGA) is the zero-period spectral acceleration in the ARS curve and it is equal to 0.674g.

4.2 Liquefaction

Liquefaction analysis was performed using the subsurface information collected from the site-specific soil boring and the design groundwater elevation. Since the project area is composed of predominantly dense sand and bedrock, and due to the absence of a shallow static groundwater table, liquefaction is unlikely and is not considered a design issue. As a result, seismically-induced settlement is anticipated to be negligible and not expected to adversely impact the proposed CCTV foundation.

4.3 Soil Corrosivity

Two soil samples recovered from the site-specific boring were tested for pH, minimum resistivity, soluble chloride content, and soluble sulfate content. The test results are summarized in Table 4-1.

Table 4-1. Soil Corrosion Test Results

Boring No.	Station Line	Approx. Station	Approx. Offset (feet)	Sample Depth (feet)	Soil/ Bedrock Type	Minimum Resistivity (ohm-cm)	pH	Soluble Sulfate Content (ppm)	Soluble Chloride Content (ppm)
A-15-001	“A” Line	133+31	162’ LT	5	SC	6,500	7.9	480	43
A-15-001	“A” Line	133+31	162’ LT	15	Silty Sandstone	2,200	8.2	310	60

Minimum resistivities were 2,200 and 6,500 ohm-cm. The pH values were 7.9 and 8.2. The soluble sulfate measurements were 310 and 480 parts per million (ppm), and the soluble chloride measurements were 43 and 60 ppm.

Based on the Caltrans Corrosion Guidelines (Caltrans, 2003), soils are considered corrosive if the pH is 5.5 or less, or the chloride concentration is 500 ppm or greater, or the sulfate concentration is 2,000 ppm or greater. Based on the test results and the Caltrans criteria, the on-site soils are considered to be non-corrosive to bare metals and concrete.

4.4 Foundation Design for CCTV Pole

According to RBF, the applicable Caltrans Standard Plan Sheet is ES-16C for a Pole Type HM CCTV 90 (Caltrans, 2010a). Based on this plan sheet, CCTV pole seats on a mortar and is connected using anchor bolts and a base plate to a single Cast-in-Drilled-Hole (CIDH) concrete

pile. The diameter and length of the CIDH pile are 4 and 14 feet, respectively. Foundation design recommendations for the CIDH pile are provided in the following sections.

4.4.1 Pile Foundation Demand

Single pile-top demands are provided by the structural designers and presented in Table 4-2.

Table 4-2. Foundation Information for CCTV

Load Combination	Pile-Head Shear (kips)	Pile-Head Moment (kips-ft)
Wind Load (Service-I Limit State)	1.7	77.4
Seismic Load (Extreme Event Limit State)	9.4	426.9

4.4.2 Pile Design

Axial Pile Analysis: Based on discussions with RBF, the axial pile demand is relatively small and the pile design is controlled by lateral loading. As a result, a determination of the axial pile capacity is not necessary.

Lateral Pile Analyses: Lateral pile analysis was performed using the computer program LPILE (Ensoft, 2010) and soil strength parameters provided in Table 3-1. A free-head condition and a cracked sectional modulus (EI) of one-half the gross value were used in the analysis.

The lateral pile analysis for a 4-foot diameter and 14-foot long CIDH pile was conducted using the load combinations shown in Table 4-2. Results of the lateral pile analysis are summarized in Table 4-3 and the LPILE output is included in Appendix C.

Table 4-3. Lateral Pile Solutions

Load Case	Max. Pile-Head Deflection (inch)	Max. Pile-Head Slope (rad)	Max. Bending Moment (kip-ft)	Depth to Max. Bending Moment from Pile Top (feet)	Max. Shear (kip)	Depth to Max. Shear from Pile Top (feet)
Service	0.06	0.0006	80.9	3.1	12.9	10.4
Extreme Event	0.34	0.0034	447.2	3.2	72.1	10.4

Structural designers should use the values provided in Table 4-3 to evaluate the adequacy of the reinforcement details shown on Sheet ES-16C of the Caltrans Standard Plans (Caltrans, 2010a).

4.5 Global Stability Analyses

The proposed CCTV structure is founded on a relatively flat area; therefore, global stability of the ground supporting the CCTV structure under static and pseudo static conditions is not considered to be a design issue.

5.0 CONSTRUCTION RECOMMENDATIONS

5.1 Earthwork

Earthwork activities should be performed in accordance with Section 19 of the Caltrans Standard Specifications (2010b). Appropriate measures should be taken to prevent damage to existing adjacent structures and utilities. Any design and construction of temporary slopes, sheeting, or shoring should be made the contractor's responsibility. It should be noted that it is the responsibility of the contractor to oversee the safety of workers in the field during construction. The contractor shall conform to all applicable occupational and health standards, rules, regulations, and orders established by the State of California. In addition, other State, County, or Municipal regulations may supersede the recommendations presented in this section. If a trench shoring design plan is required, the geotechnical consultant should review the plan to confirm that recommendations presented in this report have been applied to the design.

Heavy construction equipment should not be used immediately adjacent to shoring due to large lateral pressures induced by such equipment unless the shoring is designed to accommodate such pressures. Excavated soil or construction materials should not be stockpiled adjacent to shoring or open excavations. Stockpiled soil and construction materials should be set back a distance at least equal to the height of the excavation.

5.2 Groundwater

Based on California Department of Water Resources (CDWR), between 1994 and 2000, the recorded highest groundwater in the nearest wells is about 25 feet deep. During the site-specific field investigation in 2015, groundwater was encountered at about 35 feet below existing grade. Therefore, groundwater is not expected to be encountered during pile and footing construction. However, groundwater level can fluctuate due to seasonal rainfall amount, local irrigation and groundwater recharge program and other man-made conditions. If groundwater is encountered, a wet construction will be required for the CIDH pile.

5.3 Pile Construction

A 4-foot diameter CIDH pile will be used to support the proposed CCTV pole. The CIDH pile should be constructed in accordance with Section 49-3, "Cast-in-Place Concrete Piling" of the Caltrans Standard Specifications (2010b). It is recommended that the latest version of the Caltrans Standard Special Provisions for CIDH pile construction be used for this project.

Per California Amendments to AASHTO LRFD Bridge Design Specifications (Caltrans, 2014), 4 inches of concrete cover over reinforcement should be provided to improve the construction of the 4-foot diameter CIDH pile.

Onsite near-surface soils are generally granular soils. These granular soils are susceptible to caving. The use of temporary casing is at the contractor's discretion. If a casing is deployed, vibratory techniques for casing installation are not allowed. The temporary casing should be placed tight in the borehole. The casing should be pulled as the concrete is being poured while always maintaining at least a 5-foot head of concrete inside the casing. The near-surface granular

soils are underlain by sedimentary bedrock. The bedrock contact is estimated to be near El. +176.5 feet; actual bedrock contact can be higher or lower than El. +176.5 feet. The bedrock is predominantly sandstone, slightly weathered to fresh and cemented. Advancement into the bedrock will be slow and difficult, as indicated by the "rig chattering" note on the LOTB sheet. Contractor shall be prepared to deploy core barrels, rock augers, and other tools necessary for the removal of the borehole materials. Bedrock contact is known to be dipping sharply in the vicinity. As a result, Contractor should anticipate an inclined bedrock contact surface inside the borehole. This inclined surface could trigger "running" (horizontal translation) of the excavation (cutting) device, and Contractor should be prepared to handle this condition. In addition, drilling equipment shall provide sufficient torqueing power, similar to drilling equipment used in rock coring for large-diameter CIDH pile construction.

In the event that any boring becomes bell-shaped and cannot be advanced due to severe caving, all loose material should be removed from the bottom of the boring and the caved region filled with a low strength sand-cement slurry. Drilling may continue when the slurry has reached its initial set.

5.4 Review of Construction Plans

Recommendations contained in this report are based on preliminary plans. The geotechnical consultant should review the final construction plans and specifications in order to confirm that the general intent of the recommendations contained in this report have been incorporated into the final construction documents. Recommendations contained in this report may require modification or additional recommendations may be necessary based on the final design.

5.5 Geotechnical Observation and Testing

It is recommended that inspections and testing be performed by the geotechnical consultant during the following stages of construction:

- Grading operations, including excavations and placement of compacted fill
- Shoring installation, if any.
- Pile construction
- When any unusual subsurface conditions are encountered

6.0 LIMITATIONS

This report is intended for the use of RBF Consulting and Caltrans for the proposed Closed Circuit Television pole on a CIDH pile foundation near SR-133 for the I-405 Communication System Improvements project. This report is based on the project as described and the information obtained from the exploratory boring at the approximate location indicated on the attached plans. The findings and recommendations contained in this report are based on the results of the field investigation, laboratory tests, and engineering analyses. In addition, soils and subsurface conditions encountered in the exploratory boring are presumed to be representative of the project site. However, subsurface conditions and characteristics of soils in exploratory boring can vary. The findings reflect an interpretation of the direct evidence obtained. The recommendations presented in this report are based on the assumption that an appropriate level of quality control and quality assurance (inspections and tests) will be provided during construction. EMI should be notified of any pertinent changes in the project plans or if subsurface conditions are found to vary from those described herein. Such changes or variations may require a re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations contained in this report are applicable to the specific design element(s) and location(s) which is (are) the subject of this report. They have no applicability to any other design elements or to any other locations and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of EMI.

EMI has no responsibility for construction means, methods, techniques, sequences, or procedures; for safety precautions or programs in connection with the construction; for the acts or omissions of the CONTRACTOR or any other person performing any of the construction; or for the failure of any worker to carry out the construction in accordance with the Final Construction Drawings and Specifications.

Services performed by EMI have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, expressed or implied, and no warranty or guarantee is included or intended.

7.0 REFERENCES

American Association of State Highway and Transportation Officials (AASHTO), 2012, AASHTO LRFD Bridge Design Specification, 6th Edition, Washington, DC: AASHTO.

American Society for Testing and Materials (ASTM), 2007, Annual Book of Standards, Soil and Rock; Dimension Stone; Geosynthetics. Vol. 04.08.

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Greenwood, R.B., and Miller, R.V., 1991, Geologic Map of the Santa Ana 1:100,000 Quadrangle, California: California Department of Conservation, Division of Mines and Geology, Open File Report 91-17.

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Shaw, J.H., and Shearer, P.M., 1999, An Elusive Blind-Thrust Fault Beneath Metropolitan Los Angeles: Science, v. 283, p.1516, March 5.

Winterkorn, H.F. and Fang, H.Y., 1975, Foundation Design Handbook, Van Nostrand Reinhold Company, New York, NY.

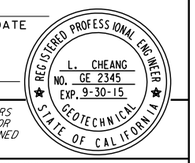
Appendix A

LOG OF TEST BORINGS SHEET

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	405	0.2/8.7		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE



EARTH MECHANICS, INC.
17800 NEWHOPE STREET, SUITE B
FOUNTAIN VALLEY, CA 92708

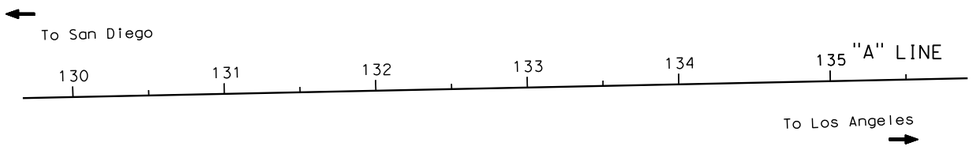
ORANGE COUNTY
TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

BENCHMARKS:

Elevations as shown hereon are in terms of the North American Vertical Datum of 1988 (NAVD88) based locally upon the following Benchmarks/Control Stations as published by the County of Orange:

Name	NAVD88 Elevation (ft.)	Year Leveled
1528 OCS BM 3K-47-92 3-3/4" Disk set in top of 4X4 catch basin n'ely corner of intersection of PCH and cameo highlands	145.128	2011

8" A-15-001



PLAN

1" = 50'

BASIS OF COORDINATES:

Bearings and coordinates as shown hereon are in terms of the California Coordinate System of 1983 (CCS83, Epoch 2007.00), Zone 6; based locally upon the following Control Stations as published by the County of Orange (OCS):

Name	Northing	Easting
1528 OCS GPS 1528	2161894.01	6071882.76
FVPK CORS FVPK	2188768.54	6048757.12
SACY CORS SACY	2218015.22	6061433.12
TRAK CORS TRAK	2171991.67	6088762.07
SBCC CORS SBCC	2147750.80	6131652.60

All coordinates and distances are in terms of the U.S. Survey Foot (1 meter = 39.37/12 feet)

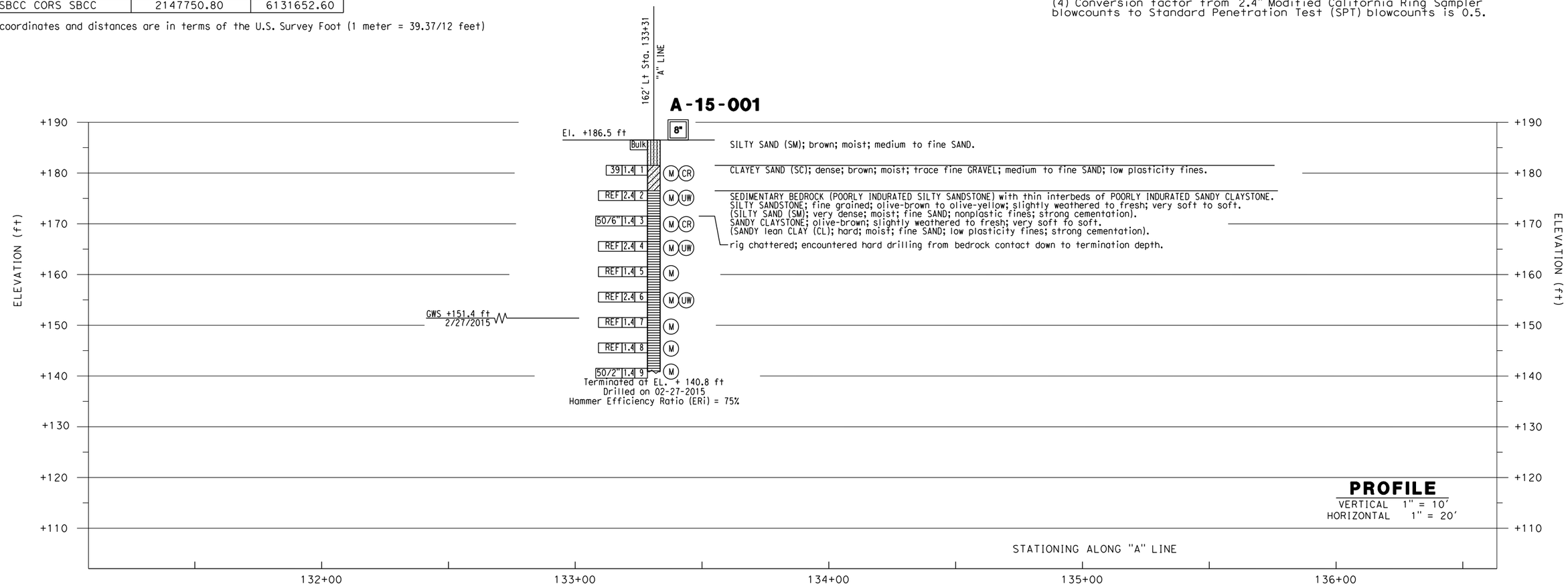
NOTES:

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

(2) 2.4" samples were taken using a California Modified Sampler.

(3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive sampler.

(4) Conversion factor from 2.4" Modified California Ring Sampler blowcounts to Standard Penetration Test (SPT) blowcounts is 0.5.



PROFILE

VERTICAL 1" = 10'
HORIZONTAL 1" = 20'

MODIFY COMMUNICATION SYSTEM

LOG OF TEST BORINGS 1 OF 1

SCALE AS SHOWN

X

REVISED BY | DATE REVISED

JIANMIN FANG | RANJAN GUNARANJAN

CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: LINO CHEANG

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 03-10-15 | DATE PLOTTED => $DATE | TIME PLOTTED => $TIME

BORDER LAST REVISED 7/2/2010 | USERNAME => $USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0000 | PROJECT NUMBER & PHASE 1215000036

Appendix B

LABORATORY TEST RESULTS

TABLE A-1 SUMMARY OF LABORATORY TEST RESULTS

Project No. : *15-107* **Project Name :** RBF, Caltrans I-405 CCTV Project

Boring No .	Sample No.	Sample Depth (ft)	Soil Identification (group symbol) ASTM D2488/D2487	Moisture Content ASTM D2216 (%)	Total Unit Weight ASTM D2937 (pcf)	Pocket Penetrometer (tsf)	Torvane Shear (tsf)	Grain Size Distribution GR:SA:FI (%)	Sand Equivalent (CT-217)	Atterberg Limits ASTM D4318 (LL/PL/PI)	Soil-Minimum Resistivity CT-643 (ohm-cm)	Soil-pH CT-643	Soil-Soluble Sulfate Content CT-417 (ppm)	Soil-Moisture Free Chloride Content CT-422 (ppm)
A-15-001	*S-1*	5	SC	7.4							6500	7.9	480	43
A-15-001	*D-2*	10	SC	10.3	112.9									
A-15-001	*S-3*	15	CL	16.1							2200	8.2	310	60
A-15-001	*D-4*	20	SM	13.9	111.0									
A-15-001	*S-5*	25	SM	18.1										
A-15-001	*D-6*	30	CL	20.7	115.4									
A-15-001	*S-7*	35	CL	17.8										
A-15-001	*S-8*	40	CL	17.5										
A-15-001	*S-9*	45	CL	20.4										

Appendix C

DESIGN CALCULATIONS

LATERAL PILE CALCULATIONS

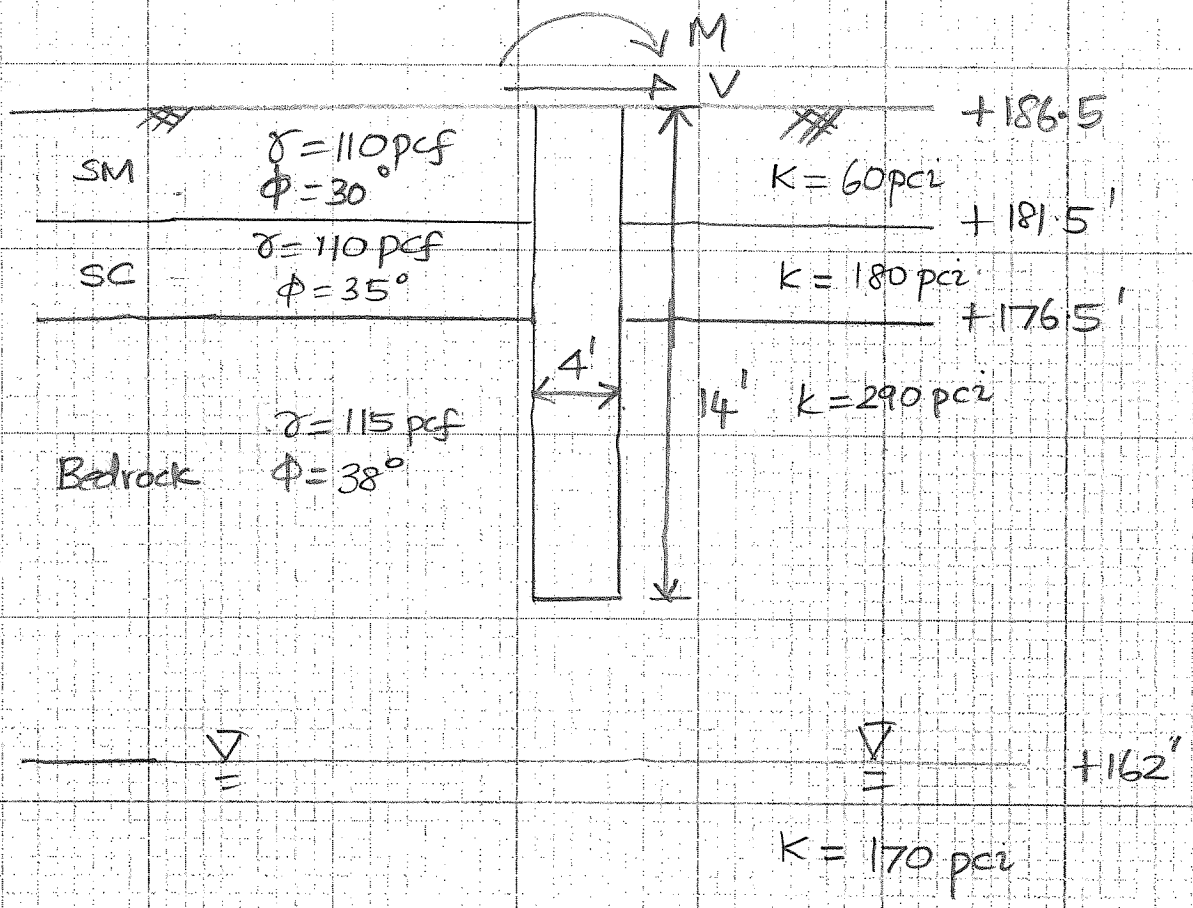
Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

17800 Newhope Street, Suite B, Fountain Valley, CA 92708
(714) 751-3826, Fax (714) 751-3928

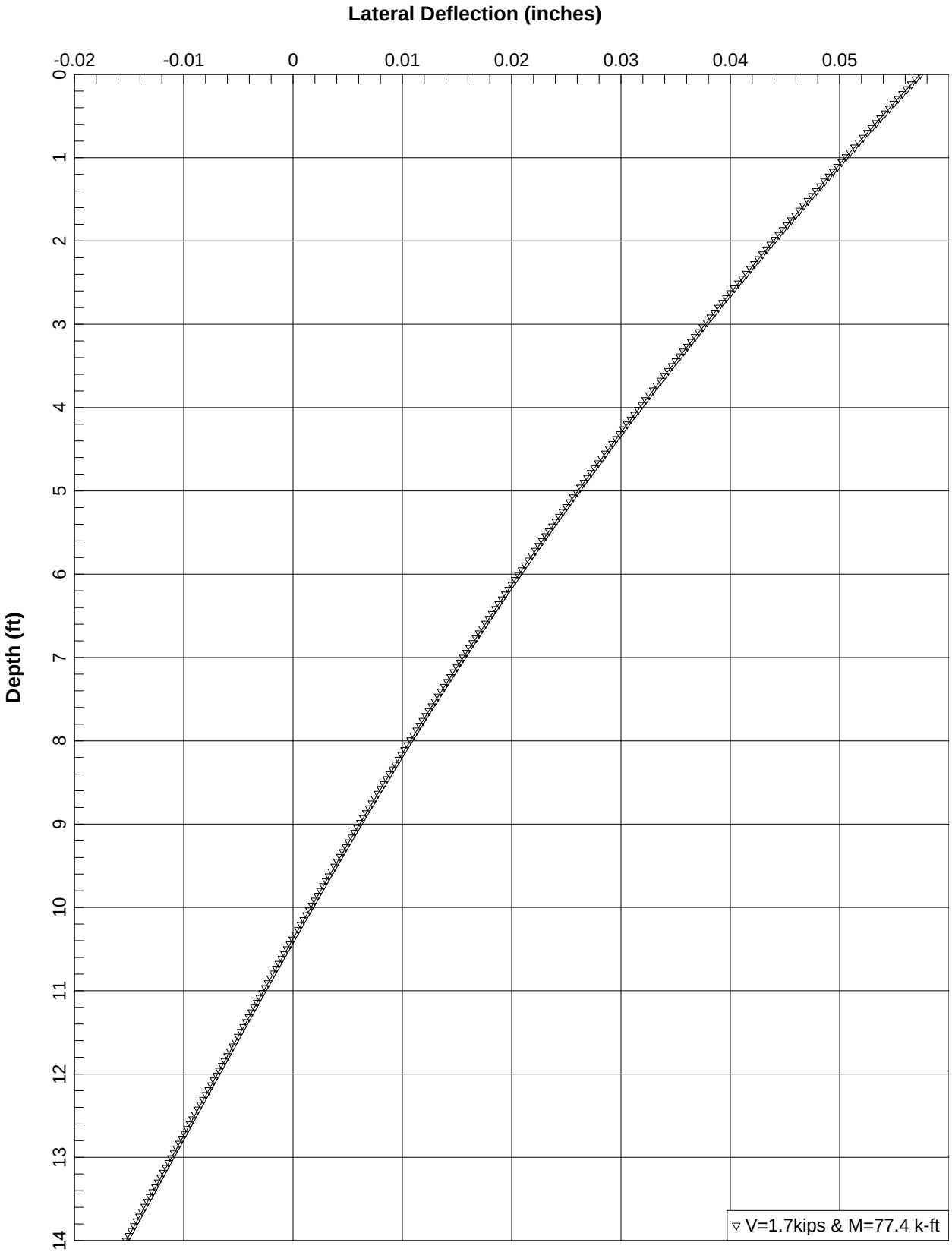
Project I-405 CCTV Project No. 15407

By Ranjan Date 3/10/15 Checked By Lino Lee Date 3/12/15 Sheet 1 of 1

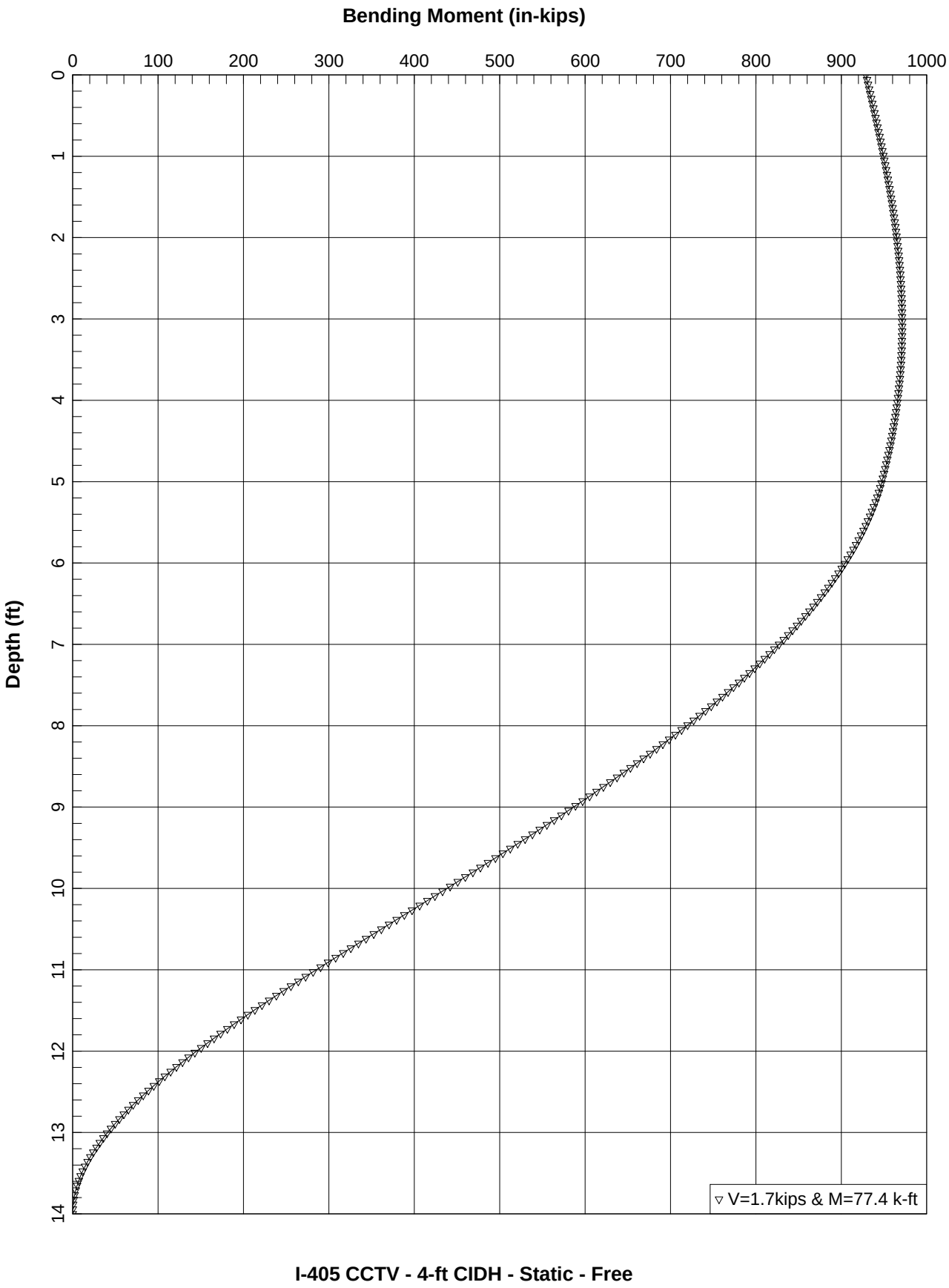
Lateral Pile Calculations



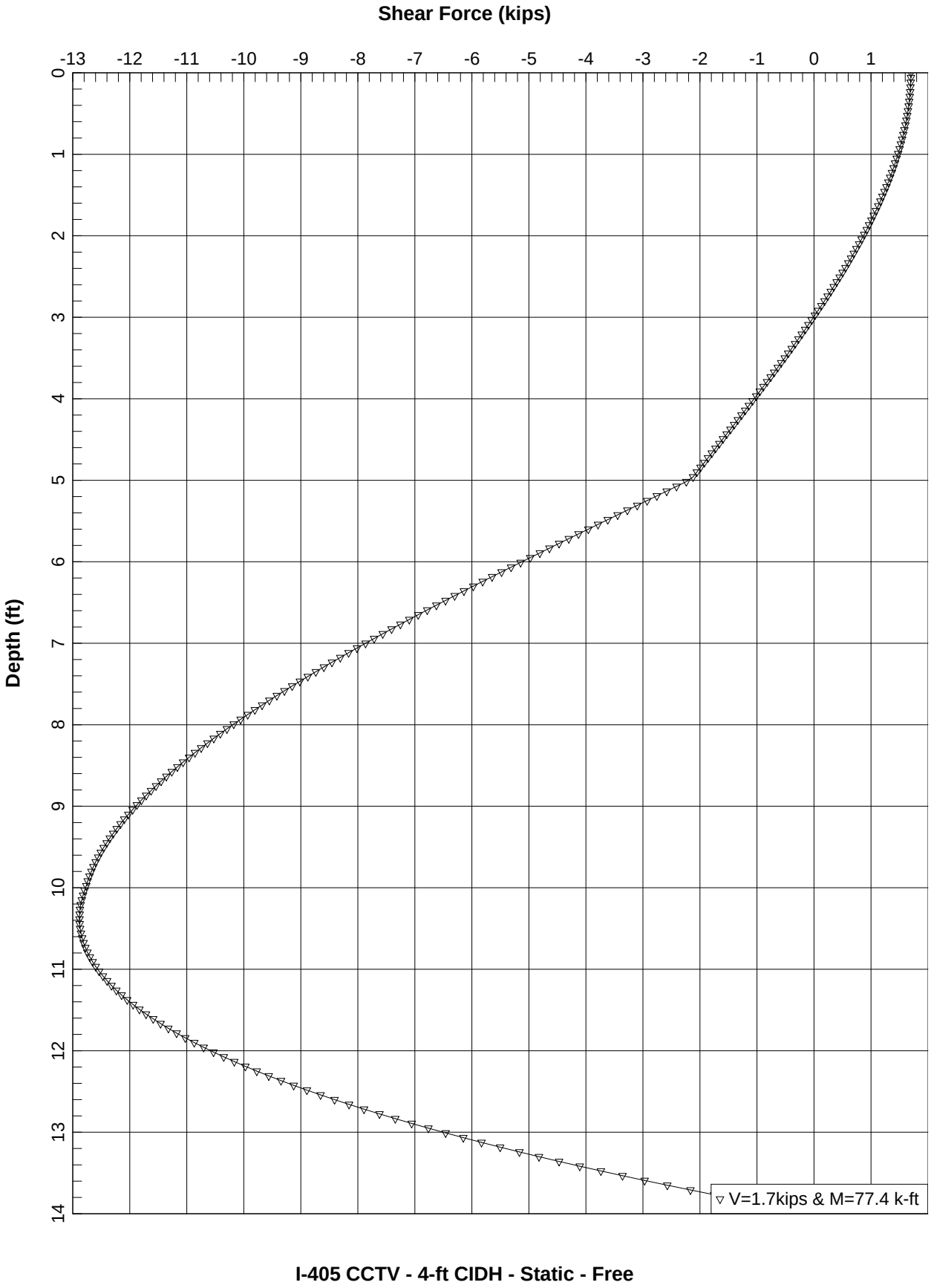
- Free-head condition
- Service
  - V = 1.7 kips
  - M = 77.4 kip-ft
- Extreme Event
  - V = 9.4 kips
  - M = 427 kip-ft



I-405 CCTV - 4-ft CIDH - Static - Free



I-405 CCTV - 4-ft CIDH - Static - Free


Shear Force (kips)
-13
-12
-11
-10
-9
-8
-7
-6
-5
-4
-3
-2
-1
0
1
Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
V=1.7kips & M=77.4 k-ft
I-405 CCTV - 4-ft CIDH - Static - Free

```
================================================================================

                  LPile Plus for Windows, Version 6 (6.0.28)

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

                        © 1985-2011 by Ensoft, Inc.
                            All Rights Reserved

================================================================================

This copy of LPile is licensed to:

Ranjan
EMI

Serial Number of Security Device:        157693804
Company Name Stored in Security Device:  Earth Mechanics, Inc

--------------------------------------------------------------------------------
                           Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:        X:\Projects\2015\15-107 - RBF, Caltrans I-405 CCTV Project\Analyses\LPILE\Static-Insitu\
Name of input data file:       CCTV_4ftCIDH.lp6d
Name of output report file:    CCTV_4ftCIDH.lp6o
Name of plot output file:      CCTV_4ftCIDH.lp6p
Name of runtime messeage file: CCTV_4ftCIDH.lp6r

--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 13, 2015     Time:  10:07:18

--------------------------------------------------------------------------------
                             Problem Title
--------------------------------------------------------------------------------

I-405 CCTV, 4'CIDH

Job Number: 15-107

Client: RBF

Engineer: RG

Description:


--------------------------------------------------------------------------------
                             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 selected section types.

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                          =         240
- Maximum number of iterations allowed               =         100
- 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)  = 3


--------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
--------------------------------------------------------------------------------
```

Total Number of Sections = 1

Total Pile Length = 14.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile dimensions used for p-y curve computations defined using 2 points.
p-y curves are computed using values of pile diameter interpolated over
the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	48.0000000
2	14.000000	48.0000000

Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Circular
Section Length	=	14.000 ft
Top Width	=	48.000 in
Bottom Width	=	48.000 in
Top Area	=	1809.557368 sq. in
Bottom Area	=	1809.557368 sq. in
Moment of Inertia at Top	=	260576.261 in^4
Moment of Inertia at Bottom	=	260576.261 in^4
Elastic Modulus	=	1800000. 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 4 layers

Layer 1 is sand, p-y criteria by API RP-2A, 1987

Distance from top of pile to top of layer = 0.000 ft
Distance from top of pile to bottom of layer = 5.000 ft
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of soil layer = 60.000 lbs/in**3

Layer 2 is sand, p-y criteria by API RP-2A, 1987

Distance from top of pile to top of layer = 5.000 ft
Distance from top of pile to bottom of layer = 10.000 ft
p-y subgrade modulus k for top of soil layer = 180.000 lbs/in**3
p-y subgrade modulus k for bottom of soil layer = 180.000 lbs/in**3

Layer 3 is sand, p-y criteria by API RP-2A, 1987

Distance from top of pile to top of layer = 10.000 ft
Distance from top of pile to bottom of layer = 24.000 ft
p-y subgrade modulus k for top of soil layer = 290.000 lbs/in**3
p-y subgrade modulus k for bottom of soil layer = 290.000 lbs/in**3

Layer 4 is sand, p-y criteria by API RP-2A, 1987

Distance from top of pile to top of layer = 24.000 ft
Distance from top of pile to bottom of layer = 100.000 ft
p-y subgrade modulus k for top of soil layer = 170.000 lbs/in**3
p-y subgrade modulus k for bottom of soil layer = 170.000 lbs/in**3

(Depth of lowest layer extends 86.00 ft below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 8 points

Point No.	Depth X ft	Eff. Unit Weight pcf
1	0.00	110.00000
2	5.00	110.00000
3	5.00	110.00000
4	10.00	110.00000
5	10.00	115.00000
6	24.00	115.00000
7	24.00	52.60000
8	100.00	52.60000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	J	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	API Sand	0.00	110.000	--	30.000	--	--	--	--	60.000	--	--	--	--	--
		5.000	110.000	--	30.000	--	--	--	--	60.000	--	--	--	--	--
2	API Sand	5.000	110.000	--	35.000	--	--	--	--	180.000	--	--	--	--	--
		10.000	110.000	--	35.000	--	--	--	--	180.000	--	--	--	--	--
3	API Sand	10.000	115.000	--	38.000	--	--	--	--	290.000	--	--	--	--	--
		24.000	115.000	--	38.000	--	--	--	--	290.000	--	--	--	--	--
4	API Sand	24.000	52.600	--	38.000	--	--	--	--	170.000	--	--	--	--	--
		100.000	52.600	--	38.000	--	--	--	--	170.000	--	--	--	--	--

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 = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 1700.00000 lbs	M = 928800. in-lbs	160000.

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 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)

Horizontal shear force at pile head = 1700.000 lbs
Applied moment at pile head = 928800.000 in-lbs
Axial thrust load on pile head = 160000.000 lbs

Depth X inches	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	0.0574	928800.	1700.0000	-0.000583	173.9652	4.690E+11	0.000	0.000	0.000
2.100	0.0562	932561.	1692.5691	-0.000579	174.3116	4.690E+11	-7.0329	87.6663	0.000
4.200	0.0549	936289.	1670.6812	-0.000575	174.6549	4.690E+11	-13.7688	175.4139	0.000
6.300	0.0537	939955.	1634.9579	-0.000570	174.9926	4.690E+11	-20.2098	263.2317	0.000
8.400	0.0525	943531.	1586.0163	-0.000566	175.3219	4.690E+11	-26.3581	351.1102	0.000
10.500	0.0514	946989.	1524.4683	-0.000562	175.6405	4.690E+11	-32.2162	439.0414	0.000
12.600	0.0502	950304.	1450.9210	-0.000558	175.9458	4.690E+11	-37.7866	527.0184	0.000
14.700	0.0490	953450.	1365.9753	-0.000553	176.2356	4.690E+11	-43.0721	615.0353	0.000
16.800	0.0479	956406.	1270.2267	-0.000549	176.5078	4.690E+11	-48.0755	703.0870	0.000
18.900	0.0467	959148.	1164.2644	-0.000545	176.7604	4.690E+11	-52.7999	791.1690	0.000
21.000	0.0456	961656.	1048.6712	-0.000541	176.9914	4.690E+11	-57.2482	879.2777	0.000
23.100	0.0444	963910.	924.0237	-0.000536	177.1990	4.690E+11	-61.4235	967.4095	0.000
25.200	0.0433	965892.	790.8919	-0.000532	177.3815	4.690E+11	-65.3290	1055.5618	0.000
27.300	0.0422	967585.	649.8390	-0.000528	177.5374	4.690E+11	-68.9679	1143.7319	0.000
29.400	0.0411	968971.	501.4215	-0.000523	177.6651	4.690E+11	-72.3434	1231.9177	0.000
31.500	0.0400	970038.	346.1890	-0.000519	177.7634	4.690E+11	-75.4588	1320.1172	0.000
33.600	0.0389	970770.	184.6842	-0.000515	177.8308	4.690E+11	-78.3175	1408.3287	0.000
35.700	0.0379	971156.	17.4428	-0.000510	177.8663	4.690E+11	-80.9227	1496.5508	0.000
37.800	0.0368	971183.	-155.0062	-0.000506	177.8688	4.690E+11	-83.2777	1584.7822	0.000
39.900	0.0357	970842.	-332.1413	-0.000502	177.8374	4.690E+11	-85.3861	1673.0216	0.000
42.000	0.0347	970123.	-513.4479	-0.000497	177.7712	4.690E+11	-87.2510	1761.2681	0.000
44.100	0.0336	969017.	-698.4181	-0.000493	177.6694	4.690E+11	-88.8758	1849.5208	0.000
46.200	0.0326	967519.	-886.5515	-0.000489	177.5313	4.690E+11	-90.2640	1937.7789	0.000
48.300	0.0316	965621.	-1077.3546	-0.000484	177.3565	4.690E+11	-91.4189	2026.0417	0.000
50.400	0.0306	963318.	-1270.3408	-0.000480	177.1444	4.690E+11	-92.3437	2114.3085	0.000
52.500	0.0296	960607.	-1465.0307	-0.000476	176.8947	4.690E+11	-93.0419	2202.5788	0.000
54.600	0.0286	957484.	-1660.9516	-0.000471	176.6071	4.690E+11	-93.5167	2290.8521	0.000
56.700	0.0276	953947.	-1857.6380	-0.000467	176.2813	4.690E+11	-93.7714	2379.1279	0.000
58.800	0.0266	949995.	-2054.6312	-0.000463	175.9173	4.690E+11	-93.8093	2467.4059	0.000
60.900	0.0256	945554.	-2411.1070	-0.000459	175.5083	4.690E+11	-245.8501	6710.3642	0.000
63.000	0.0247	940102.	-2927.6808	-0.000454	175.0061	4.690E+11	-246.0301	6976.0089	0.000
65.100	0.0237	933563.	-3443.9639	-0.000450	174.4039	4.690E+11	-245.5746	7241.6673	0.000
67.200	0.0228	925941.	-3958.6313	-0.000446	173.7018	4.690E+11	-244.4927	7507.3351	0.000
69.300	0.0219	917239.	-4470.3769	-0.000442	172.9003	4.690E+11	-242.7934	7773.0086	0.000
71.400	0.0209	907465.	-4977.9137	-0.000438	172.0001	4.690E+11	-240.4855	8038.6845	0.000
73.500	0.0200	896629.	-5479.9730	-0.000434	171.0021	4.690E+11	-237.5779	8304.3598	0.000
75.600	0.0191	884744.	-5975.3037	-0.000430	169.9075	4.690E+11	-234.0787	8570.0319	0.000
77.700	0.0182	871826.	-6462.6725	-0.000426	168.7177	4.690E+11	-229.9962	8835.6983	0.000
79.800	0.0173	857893.	-6940.8626	-0.000422	167.4344	4.690E+11	-225.3382	9101.3570	0.000
81.900	0.0164	842965.	-7408.6734	-0.000418	166.0595	4.690E+11	-220.1123	9367.0057	0.000
84.000	0.0156	827065.	-7864.9200	-0.000414	164.5950	4.690E+11	-214.3257	9632.6425	0.000
86.100	0.0147	810218.	-8308.4322	-0.000411	163.0434	4.690E+11	-207.9854	9898.2656	0.000
88.200	0.0138	792454.	-8738.0542	-0.000407	161.4072	4.690E+11	-201.0978	10164.	0.000
90.300	0.0130	773802.	-9152.6434	-0.000404	159.6893	4.690E+11	-193.6693	10429.	0.000
92.400	0.0122	754294.	-9551.0698	-0.000400	157.8926	4.690E+11	-185.7056	10695.	0.000
94.500	0.0113	733967.	-9932.2154	-0.000397	156.0204	4.690E+11	-177.2122	10961.	0.000
96.600	0.0105	712857.	-10295.	-0.000394	154.0761	4.690E+11	-168.1941	11226.	0.000
98.700	0.009664	691005.	-10638.	-0.000390	152.0634	4.690E+11	-158.6559	11492.	0.000
100.800	0.008848	668452.	-10961.	-0.000387	149.9862	4.690E+11	-148.6020	11757.	0.000
102.900	0.008037	645242.	-11262.	-0.000385	147.8485	4.690E+11	-138.0361	12023.	0.000
105.000	0.007233	621424.	-11540.	-0.000382	145.6548	4.690E+11	-126.9616	12288.	0.000
107.100	0.006434	597044.	-11795.	-0.000379	143.4093	4.690E+11	-115.3816	12553.	0.000
109.200	0.005641	572155.	-12025.	-0.000376	141.1170	4.690E+11	-103.2984	12819.	0.000
111.300	0.004853	546810.	-12228.	-0.000374	138.7826	4.690E+11	-90.7143	13084.	0.000
113.400	0.004071	521064.	-12405.	-0.000371	136.4113	4.690E+11	-77.6309	13349.	0.000
115.500	0.003293	494976.	-12554.	-0.000369	134.0084	4.690E+11	-64.0497	13614.	0.000
117.600	0.002520	468604.	-12674.	-0.000367	131.5795	4.690E+11	-49.9713	13879.	0.000
119.700	0.001752	442011.	-12764.	-0.000365	129.1302	4.690E+11	-35.3965	14144.	0.000
121.800	0.000987	415243.	-12842.	-0.000363	126.6648	4.690E+11	-29.1405	20658.	0.000
123.900	0.000227	388347.	-12880.	-0.000361	124.1875	4.690E+11	-6.8360	21085.	0.000
126.000	-0.000530	361420.	-12870.	-0.000360	121.7074	4.690E+11	16.2828	21511.	0.000
128.100	-0.001283	334564.	-12811.	-0.000358	119.2340	4.690E+11	40.2162	21937.	0.000
130.200	-0.002034	307886.	-12701.	-0.000357	116.7768	4.690E+11	64.9648	22362.	0.000
132.300	-0.002781	281494.	-12538.	-0.000355	114.3460	4.690E+11	90.5297	22788.	0.000
134.400	-0.003526	255501.	-12320.	-0.000354	111.9519	4.690E+11	116.9120	23212.	0.000
136.500	-0.004268	230023.	-12046.	-0.000353	109.6054	4.690E+11	144.1132	23636.	0.000
138.600	-0.005008	205181.	-11714.	-0.000352	107.3173	4.690E+11	172.1345	24060.	0.000
140.700	-0.005746	181098.	-11322.	-0.000351	105.0992	4.690E+11	200.9772	24482.	0.000
142.800	-0.006483	157902.	-10869.	-0.000350	102.9627	4.690E+11	230.6421	24904.	0.000
144.900	-0.007218	135722.	-10353.	-0.000350	100.9199	4.690E+11	261.1293	25324.	0.000
147.000	-0.007952	114694.	-9771.9145	-0.000349	98.9832	4.690E+11	292.4502	25745.	0.000
149.100	-0.008684	94956.	-9124.1222	-0.000349	97.1652	4.690E+11	324.6194	26166.	0.000
151.200	-0.009416	76650.	-8407.8911	-0.000348	95.4791	4.690E+11	357.6305	26586.	0.000
153.300	-0.0101	59921.	-7621.4491	-0.000348	93.9383	4.690E+11	391.4875	27006.	0.000
155.400	-0.0109	44918.	-6763.0155	-0.000348	92.5565	4.690E+11	426.1943	27426.	0.000
157.500	-0.0116	31796.	-5830.8023	-0.000348	91.3479	4.690E+11	461.7545	27846.	0.000
159.600	-0.0123	20710.	-4823.0138	-0.000347	90.3268	4.690E+11	498.1712	28265.	0.000
161.700	-0.0131	11821.	-3737.8482	-0.000347	89.5081	4.690E+11	535.4473	28683.	0.000
163.800	-0.0138	5293.3057	-2573.4985	-0.000347	88.9069	4.690E+11	573.5850	29102.	0.000
165.900	-0.0145	1295.7612	-1328.1535	-0.000347	88.5388	4.690E+11	612.5858	29520.	0.000

```
   168.000    -0.0153      0.000      0.000  -0.000347    88.4194  4.690E+11   652.4503     14969.      0.000
```

* This analysis makes computations of pile response using nonlinear moment-curvature relationships.
The above values of total stress are computed for combined axial stress and do not equal the
actual stresses in concrete and steel in the range of nonlinear bending.

Output Verification: Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =      0.0573766 inches
Computed slope at pile head      =     -0.0005830 radians
Maximum bending moment           =         971215. inch-lbs
Maximum shear force              =         -12882. lbs
Depth of maximum bending moment  =     37.1000000 inches below pile head
Depth of maximum shear force     =    124.6000000 inches below pile head
Number of iterations             =              6
Number of zero deflection points =              1
```

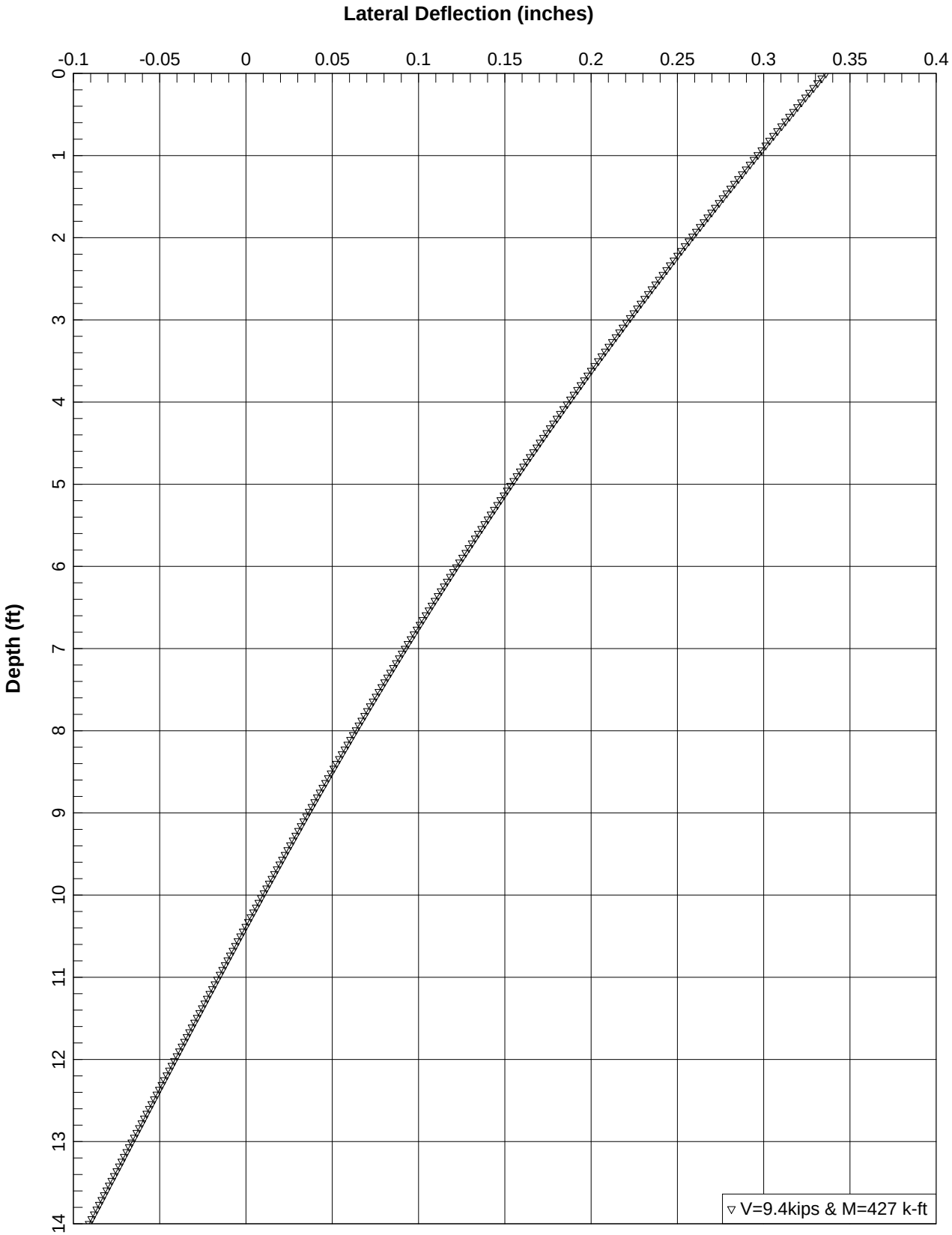
Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

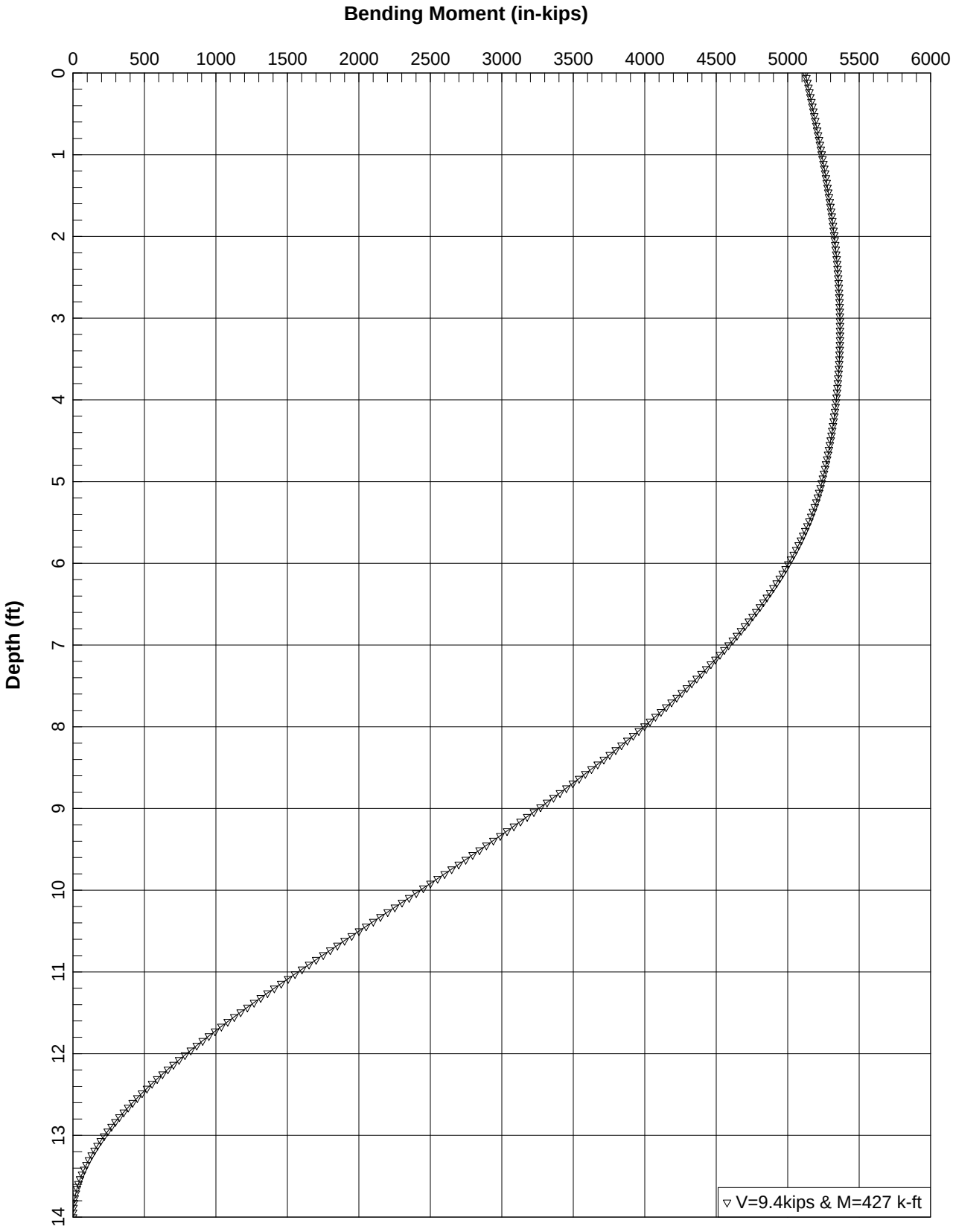
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = 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-lbs	Maximum Shear lbs	Pile-head Rotation radians
1	1	V = 1700.0000	M = 928800.	160000.	0.05737656	971215.	-12882.	-0.00058301

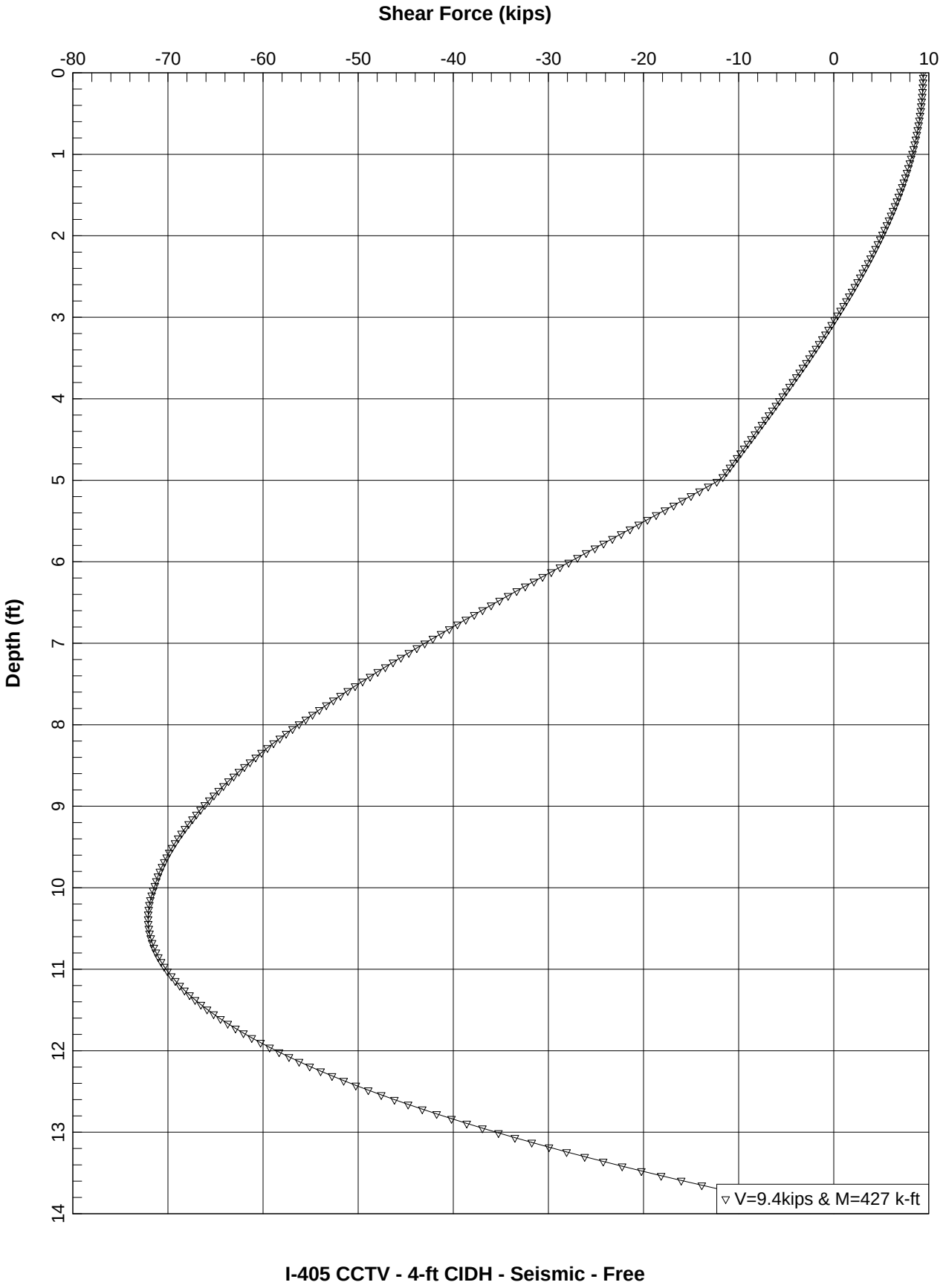
The analysis ended normally.



I-405 CCTV - 4-ft CIDH - Seismic - Free



I-405 CCTV - 4-ft CIDH - Seismic - Free



I-405 CCTV - 4-ft CIDH - Seismic - Free

```
================================================================================

                    LPile Plus for Windows, Version 6 (6.0.28)

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

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================================================================================

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EMI

Serial Number of Security Device:        157693804
Company Name Stored in Security Device:  Earth Mechanics, Inc

--------------------------------------------------------------------------------
                            Files Used for Analysis
--------------------------------------------------------------------------------

Path to file locations:        X:\Projects\2015\15-107 - RBF, Caltrans I-405 CCTV Project\Analyses\LPILE\Seismic-Insitu\
Name of input data file:       CCTV_4ftCIDH.lp6d
Name of output report file:    CCTV_4ftCIDH.lp6o
Name of plot output file:      CCTV_4ftCIDH.lp6p
Name of runtime messeage file: CCTV_4ftCIDH.lp6r

--------------------------------------------------------------------------------
                           Date and Time of Analysis
--------------------------------------------------------------------------------

               Date:  March 13, 2015     Time:  10:09:18

--------------------------------------------------------------------------------
                                Problem Title
--------------------------------------------------------------------------------

I-405 CCTV, 4'CIDH

Job Number: 15-107

Client: RBF

Engineer: RG

Description:


--------------------------------------------------------------------------------
                              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 selected section types.

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:
- Number of pile increments                          =         240
- Maximum number of iterations allowed               =         100
- 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)  = 3
```

Pile Structural Properties and Geometry

Total Number of Sections = 1

Total Pile Length = 14.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile dimensions used for p-y curve computations defined using 2 points.
p-y curves are computed using values of pile diameter interpolated over
the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	48.0000000
2	14.000000	48.0000000

Input Structural Properties:

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Circular
Section Length	=	14.000 ft
Top Width	=	48.000 in
Bottom Width	=	48.000 in
Top Area	=	1809.557368 sq. in
Bottom Area	=	1809.557368 sq. in
Moment of Inertia at Top	=	260576.261 in^4
Moment of Inertia at Bottom	=	260576.261 in^4
Elastic Modulus	=	1800000. 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 4 layers

Layer 1 is sand, p-y criteria by API RP-2A, 1987

Distance from top of pile to top of layer = 0.000 ft
Distance from top of pile to bottom of layer = 5.000 ft
p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3
p-y subgrade modulus k for bottom of soil layer = 60.000 lbs/in**3

Layer 2 is sand, p-y criteria by API RP-2A, 1987

Distance from top of pile to top of layer = 5.000 ft
Distance from top of pile to bottom of layer = 10.000 ft
p-y subgrade modulus k for top of soil layer = 180.000 lbs/in**3
p-y subgrade modulus k for bottom of soil layer = 180.000 lbs/in**3

Layer 3 is sand, p-y criteria by API RP-2A, 1987

Distance from top of pile to top of layer = 10.000 ft
Distance from top of pile to bottom of layer = 24.000 ft
p-y subgrade modulus k for top of soil layer = 290.000 lbs/in**3
p-y subgrade modulus k for bottom of soil layer = 290.000 lbs/in**3

Layer 4 is sand, p-y criteria by API RP-2A, 1987

Distance from top of pile to top of layer = 24.000 ft
Distance from top of pile to bottom of layer = 100.000 ft
p-y subgrade modulus k for top of soil layer = 170.000 lbs/in**3
p-y subgrade modulus k for bottom of soil layer = 170.000 lbs/in**3

(Depth of lowest layer extends 86.00 ft below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 8 points

Point No.	Depth X ft	Eff. Unit Weight pcf
1	0.00	110.00000
2	5.00	110.00000
3	5.00	110.00000
4	10.00	110.00000
5	10.00	115.00000
6	24.00	115.00000
7	24.00	52.60000
8	100.00	52.60000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	J	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	API Sand	0.00	110.000	--	30.000	--	--	--	--	60.000	--	--	--	--	--
		5.000	110.000	--	30.000	--	--	--	--	60.000	--	--	--	--	--
2	API Sand	5.000	110.000	--	35.000	--	--	--	--	180.000	--	--	--	--	--
		10.000	110.000	--	35.000	--	--	--	--	180.000	--	--	--	--	--
3	API Sand	10.000	115.000	--	38.000	--	--	--	--	290.000	--	--	--	--	--
		24.000	115.000	--	38.000	--	--	--	--	290.000	--	--	--	--	--
4	API Sand	24.000	52.600	--	38.000	--	--	--	--	170.000	--	--	--	--	--
		100.000	52.600	--	38.000	--	--	--	--	170.000	--	--	--	--	--

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 = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 9400.00000 lbs	M = 5124000. in-lbs	160000.

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 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)

Horizontal shear force at pile head = 9400.000 lbs
Applied moment at pile head = 5124000.000 in-lbs
Axial thrust load on pile head = 160000.000 lbs

Depth X inches	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	0.3360	5124000.	9400.0000	-0.003373	560.3580	4.690E+11	0.000	0.000	0.000
2.100	0.3289	5144847.	9363.6755	-0.003350	562.2781	4.690E+11	-34.5111	73.4492	0.000
4.200	0.3219	5165534.	9255.5206	-0.003327	564.1835	4.690E+11	-68.3910	148.7256	0.000
6.300	0.3149	5185912.	9076.9880	-0.003304	566.0604	4.690E+11	-101.5207	225.6518	0.000
8.400	0.3080	5205835.	8829.7651	-0.003281	567.8953	4.690E+11	-133.7961	304.0667	0.000
10.500	0.3012	5225160.	8515.7429	-0.003258	569.6753	4.690E+11	-165.1265	383.8237	0.000
12.600	0.2943	5243750.	8136.9899	-0.003234	571.3874	4.690E+11	-195.4335	464.7900	0.000
14.700	0.2876	5261470.	7695.7282	-0.003211	573.0195	4.690E+11	-224.6495	546.8452	0.000
16.800	0.2808	5278192.	7194.3108	-0.003187	574.5597	4.690E+11	-252.7168	629.8806	0.000
18.900	0.2742	5293792.	6635.2032	-0.003163	575.9965	4.690E+11	-279.5863	713.7978	0.000
21.000	0.2676	5308151.	6020.9641	-0.003140	577.3190	4.690E+11	-305.2169	798.5079	0.000
23.100	0.2610	5321157.	5354.2328	-0.003116	578.5169	4.690E+11	-329.5744	883.9307	0.000
25.200	0.2545	5332702.	4637.7129	-0.003092	579.5802	4.690E+11	-352.6309	969.9936	0.000
27.300	0.2480	5342684.	3874.1611	-0.003068	580.4996	4.690E+11	-374.3639	1056.6314	0.000
29.400	0.2416	5351008.	3066.3752	-0.003044	581.2662	4.690E+11	-394.7560	1143.7849	0.000
31.500	0.2352	5357583.	2217.1862	-0.003020	581.8718	4.690E+11	-413.7939	1231.4010	0.000
33.600	0.2289	5362325.	1329.4482	-0.002996	582.3086	4.690E+11	-431.4683	1319.4317	0.000
35.700	0.2226	5365158.	406.0314	-0.002972	582.5695	4.690E+11	-447.7733	1407.8336	0.000
37.800	0.2164	5366008.	-550.1854	-0.002948	582.6478	4.690E+11	-462.7060	1496.5677	0.000
39.900	0.2103	5364809.	-1536.3195	-0.002924	582.5374	4.690E+11	-476.2661	1585.5985	0.000
42.000	0.2041	5361503.	-2549.4905	-0.002900	582.2329	4.690E+11	-488.4558	1674.8944	0.000
44.100	0.1981	5356035.	-3586.8243	-0.002876	581.7293	4.690E+11	-499.2792	1764.4266	0.000
46.200	0.1921	5348358.	-4645.4582	-0.002852	581.0222	4.690E+11	-508.7423	1854.1690	0.000
48.300	0.1861	5338429.	-5722.5423	-0.002828	580.1077	4.690E+11	-516.8525	1944.0984	0.000
50.400	0.1802	5326214.	-6815.2454	-0.002804	578.9827	4.690E+11	-523.6187	2034.1934	0.000
52.500	0.1743	5311682.	-7920.7555	-0.002780	577.6442	4.690E+11	-529.0511	2124.4351	0.000
54.600	0.1685	5294809.	-9036.2827	-0.002757	576.0902	4.690E+11	-533.1607	2214.8060	0.000
56.700	0.1627	5275578.	-10159.	-0.002733	574.3189	4.690E+11	-535.9594	2305.2905	0.000
58.800	0.1570	5253975.	-11286.	-0.002709	572.3292	4.690E+11	-537.4600	2395.8745	0.000
60.900	0.1514	5229628.	-13203.	-0.002686	570.0867	4.690E+11	-1290.8628	5969.7482	0.000
63.000	0.1457	5199946.	-15927.	-0.002663	567.3529	4.690E+11	-1302.9782	6257.9680	0.000
65.100	0.1402	5164511.	-18672.	-0.002639	564.0892	4.690E+11	-1311.2136	6547.6237	0.000
67.200	0.1347	5123287.	-21431.	-0.002616	560.2924	4.690E+11	-1315.5583	6838.5395	0.000
69.300	0.1292	5076255.	-24195.	-0.002594	555.9605	4.690E+11	-1316.0088	7130.5516	0.000
71.400	0.1238	5023413.	-26956.	-0.002571	551.0936	4.690E+11	-1312.5682	7423.5073	0.000
73.500	0.1184	4964777.	-29705.	-0.002549	545.6930	4.690E+11	-1305.2447	7717.2642	0.000
75.600	0.1131	4900378.	-32435.	-0.002527	539.7616	4.690E+11	-1294.0514	8011.6884	0.000
77.700	0.1078	4830266.	-35137.	-0.002505	533.3041	4.690E+11	-1279.0056	8306.6544	0.000
79.800	0.1025	4754508.	-37804.	-0.002483	526.3265	4.690E+11	-1260.1276	8602.0431	0.000
81.900	0.0974	4673186.	-40427.	-0.002462	518.8365	4.690E+11	-1237.4405	8897.7407	0.000
84.000	0.0922	4586402.	-42998.	-0.002441	510.8433	4.690E+11	-1210.9698	9193.6381	0.000
86.100	0.0871	4494272.	-45510.	-0.002421	502.3578	4.690E+11	-1180.7423	9489.6285	0.000
88.200	0.0820	4396929.	-47955.	-0.002401	493.3922	4.690E+11	-1146.7863	9785.6069	0.000
90.300	0.0770	4294523.	-50324.	-0.002382	483.9603	4.690E+11	-1109.1309	10081.	0.000
92.400	0.0720	4187221.	-52610.	-0.002363	474.0774	4.690E+11	-1067.8057	10377.	0.000
94.500	0.0671	4075205.	-54806.	-0.002344	463.7603	4.690E+11	-1022.8407	10672.	0.000
96.600	0.0622	3958673.	-56903.	-0.002326	453.0273	4.690E+11	-974.2659	10967.	0.000
98.700	0.0573	3837840.	-58895.	-0.002309	441.8981	4.690E+11	-922.1113	11262.	0.000
100.800	0.0525	3712935.	-60774.	-0.002292	430.3940	4.690E+11	-866.4069	11555.	0.000
102.900	0.0477	3584206.	-62531.	-0.002276	418.5375	4.690E+11	-807.1827	11848.	0.000
105.000	0.0429	3451912.	-64161.	-0.002260	406.3528	4.690E+11	-744.4690	12139.	0.000
107.100	0.0382	3316331.	-65656.	-0.002245	393.8653	4.690E+11	-678.2965	12430.	0.000
109.200	0.0335	3177755.	-67008.	-0.002230	381.1020	4.690E+11	-608.6967	12719.	0.000
111.300	0.0288	3036491.	-68210.	-0.002216	368.0911	4.690E+11	-535.7028	13006.	0.000
113.400	0.0242	2892862.	-69255.	-0.002203	354.8622	4.690E+11	-459.3502	13291.	0.000
115.500	0.0196	2747203.	-70137.	-0.002190	341.4465	4.690E+11	-379.6776	13574.	0.000
117.600	0.0150	2599866.	-70847.	-0.002178	327.8764	4.690E+11	-296.7285	13855.	0.000
119.700	0.0104	2451219.	-71380.	-0.002167	314.1854	4.690E+11	-210.5526	14132.	0.000
121.800	0.005890	2301531.	-71848.	-0.002156	300.3986	4.690E+11	-173.7594	20650.	0.000
123.900	0.001372	2151076.	-72075.	-0.002146	286.5411	4.690E+11	-41.3342	21084.	0.000

126.000	-0.003125	2000436.	-72018.	-0.002137	272.6667	4.690E+11	96.0302	21508.	0.000
128.100	-0.007604	1850219.	-71668.	-0.002129	258.8311	4.690E+11	238.1300	21921.	0.000
130.200	-0.0121	1701050.	-71015.	-0.002121	245.0922	4.690E+11	384.7268	22320.	0.000
132.300	-0.0165	1553577.	-70049.	-0.002113	231.5094	4.690E+11	535.5407	22705.	0.000
134.400	-0.0209	1408464.	-68762.	-0.002107	218.1440	4.690E+11	690.2404	23072.	0.000
136.500	-0.0254	1266395.	-67147.	-0.002101	205.0589	4.690E+11	848.4333	23419.	0.000
138.600	-0.0298	1128066.	-65197.	-0.002095	192.3183	4.690E+11	1009.6519	23744.	0.000
140.700	-0.0342	994189.	-62905.	-0.002091	179.9877	4.690E+11	1173.3387	24044.	0.000
142.800	-0.0385	865485.	-60267.	-0.002086	168.1337	4.690E+11	1338.8286	24313.	0.000
144.900	-0.0429	742685.	-57281.	-0.002083	156.8233	4.690E+11	1505.3278	24549.	0.000
147.000	-0.0473	626522.	-53944.	-0.002080	146.1243	4.690E+11	1674.2403	24780.	0.000
149.100	-0.0517	517743.	-50246.	-0.002077	136.1054	4.690E+11	1847.4325	25034.	0.000
151.200	-0.0560	417111.	-46183.	-0.002075	126.8368	4.690E+11	2022.7956	25277.	0.000
153.300	-0.0604	325400.	-41749.	-0.002073	118.3899	4.690E+11	2200.2319	25510.	0.000
155.400	-0.0647	243392.	-36940.	-0.002072	110.8366	4.690E+11	2379.6564	25735.	0.000
157.500	-0.0691	171878.	-31753.	-0.002071	104.2500	4.690E+11	2560.9944	25952.	0.000
159.600	-0.0734	111659.	-26183.	-0.002071	98.7036	4.690E+11	2744.1807	26161.	0.000
161.700	-0.0778	63542.	-20226.	-0.002070	94.2718	4.690E+11	2929.1575	26364.	0.000
163.800	-0.0821	28343.	-13879.	-0.002070	91.0299	4.690E+11	3115.8737	26560.	0.000
165.900	-0.0865	6885.0880	-7138.3043	-0.002070	89.0536	4.690E+11	3304.2830	26750.	0.000
168.000	-0.0908	0.000	0.000	-0.002070	88.4194	4.690E+11	3494.3436	13467.	0.000

* This analysis makes computations of pile response using nonlinear moment-curvature relationships.
  The above values of total stress are computed for combined axial stress and do not equal the
  actual stresses in concrete and steel in the range of nonlinear bending.

Output Verification: Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =      0.3359644 inches
Computed slope at pile head      =     -0.0033734 radians
Maximum bending moment           =       5366008. inch-lbs
Maximum shear force              =        -72088. lbs
Depth of maximum bending moment  =     37.8000000 inches below pile head
Depth of maximum shear force     =    124.6000000 inches below pile head
Number of iterations             =              7
Number of zero deflection points =              1
```

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-lbs	Maximum Shear lbs	Pile-head Rotation radians
1	1	V = 9400.0000	M = 5124000.	160000.	0.33596436	5366008.	-72088.	-0.00337338

The analysis ended normally.