

FOR CONTRACT NO.: 03-1F1804

INFORMATION HANDOUT

FOUNDATION REPORT DATED June 7, 2010

ROUTE: 03-Sac-5-28.8/29.5

M e m o r a n d u m*Flex your power!
Be energy efficient!*

To: MR. JEFF SIMS, CHIEF
Bridge Design Branch 1
Office of Bridge Design North

Date: June 7, 2010

File: 03-SAC-5 PM 29.02
03-1F180K
ERS Br. # 24E0013

Attention: Mr. Eric Watson

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
Geotechnical Services – MS 5
Office of Geotechnical Design – North

Subject: Foundation Report

At your request, the Office of Geotechnical Design North (OGD-N) prepared this foundation report for the above-referenced structures. These walls will be part of the road widening project in Sacramento, California along Interstate 5 from post mile 28.7 to 29.4. A site vicinity map is attached as Plate 1. These walls will stabilize the proposed cut into the approach fill below Del Paso Road overcrossing.

As a part of this study, two mud rotary borings and one hand auger boring were drilled to determine the subsurface materials. A description of the subsurface conditions encountered during the drilling program is describe below and will shown on the “Log-of-Test Borings” (LOTB) and will be forwarded when complete. An aerial photo depicting approximate boring locations is attached as Plate 2.

Proposed Structure Description

The proposed retaining walls will consist of two different wall types; a ±90-ft. long (maximum height ±14 ft.) Tieback wall, a ±45-ft. long (maximum height ±12 ft.) Type 1 wall located on the south end of the Tieback wall and a ±67-ft. long (maximum height ±12 ft.) Type 1 wall located on the north end of the Tieback wall. The details of these walls are shown on the “General Plan” dated May 5, 2010. A copy of the General Plan has been attached.

Physical Setting

The physical setting of the project site and the surrounding area was reviewed to provide climate, topography and drainage, man-made and natural features, geology and seismicity characteristics to aid in project design and construction. The site itself is located within the city of Sacramento, California along Interstate 5. The following is a discussion of the above review:

Climate

According to the National Weather Service (Reference 2), California Climate Normal's for 1941-2009, the average annual precipitation in the Sacramento, California area, is about 17 in. The average annual air temperature is approximately 61°F with average monthly extremes of 38°F in January and 93°F in July.

Topography and Drainage

According to Taylor Monument Quadrangle (Reference 3) and observations in the field, the site is located in flat alluvial drainage valley of the Sacramento River. The average highway elevation in the project area is approximately 17ft. above mean sea level. The existing highway is generally flat and trends approximately north/south within the project limits.

Numerous residential and commercial structures were observed during our site reconnaissance, but typically a minimum of 0.1 to 0.2 miles away from the highway interchange. No overhead utilities are depicted on the map, nor observed during our site reconnaissance. Underground utilities were observed in the shoulder area and within the vacant area on the west side of I-5, bounded by I-5, Del Paso Road and the south bound onramp to I-5.

Regional Geology and Seismicity

The project site is located within the Great Valley geomorphic province. The Great Valley province within Sacramento County is typically made up of unconsolidated alluvial sediments comprised of deposits of clay, silts, sands and gravels (Reference 1). According to the California Geological Survey (CGS) "Geologic Map of the Sacramento Quadrangle", 1987 (Reference 4) the site is in an area of Quaternary age Basin Deposits. Material encountered in the subsurface borings compares favorably with those described on the CGS map.

We have reviewed the CGS Map of California Showing Principal Asbestos Deposits and the Caltrans DOT "Asbestos Location Map, District 3" (Reference 5&6). According to both maps and the geologic maps reviewed, the site is not in an area of naturally occurring asbestos. In addition, the presence of ultramafic rock was not observed in the field during our site reconnaissance.

We reviewed the Caltrans California Seismic Hazard Map (Reference 7). The map indicated that the Battle Creek fault is located approximately 18 mi. west-northwest of the site. This fault could produce a maximum credible earthquake of magnitude 6.6 and has a reverse style orientation. The map indicated that the maximum credible earthquake from this fault would result in a peak horizontal bedrock acceleration of

approximately 0.1g at the site. Depth to bedrock is deep below ground surface in the area of the proposed retaining wall for this project. The potential for surface rupture at the site due to fault movement is considered insignificant since there are no known faults projecting towards or passing directly through the project site.

National Resource Conservation Service Soil Survey

Our review of the Soil Survey of Sacramento County Area, California (Reference 8) indicates the site soils consist of the Clear Lake Clay.

The Clear Lake Clay (0 to 1% slopes) consists of well-drained soils. Surface runoff is high. Erosion K-factor is reported as 0.24. Corrosion potential is considered high for uncoated steel and low for concrete (pH 6.1-8.4). Permeability is exceedingly slow (0.05 to 0.22in/hr). The Clear Lake Clay has been assigned to the Hydrologic group "D".

Subsurface Exploration

Subsurface exploration was performed at the site to assess foundation conditions for the proposed walls. The Office of Geotechnical Design – North (OGDN) drilled two mud-rotary borings to define subsurface conditions and completed one hand auger boring to define the soils condition of the approach fill for Del Paso Road over crossing. The borings were terminated at a maximum depth of 43.5 feet below the existing ground surface. The location of these borings are shown on the Site Plan of Plate 2 as R-10-001, R-10-002 and HA-10-003, and also shown on the project Log-of-Test Borings (LOTBs). The borings for this project were completed by our Office in March 2010.

Samples were collected at various depths by advancing a "Standard Penetration Test" (SPT) sampler (2.0 inch O.D.) under a standard striking force weight (140 lb) dropped 30 inches. In addition, "relatively undisturbed" continuous samples were obtained utilizing punch core between SPT samples with a roughly (2.5 inch) I.D. bit. All recovered material was stored in brass tubes, plastic bags and core boxes and returned to the lab for reference and testing. Minimal loss of circulation occurred during the drilling process, this can likely be attributed to the high groundwater conditions in the area.

An open stand pipe was installed in borehole of R-10-001 for monitoring of ground water elevations at the site.

Subsurface Soil and Rock Conditions

Based on the results of our subsurface investigation, field observations and laboratory testing, the soil materials at this site consist of an approximate 17 foot thick approach fill, that was classified as stiff to very stiff, clay with minor varying amounts of sand (estimated effective strength parameters $\gamma=120$ pcf, $\phi=28^\circ$, $c=680$ psf). Below the approach fill is what is assumed to be an additional layer of fill associated with I-5 corridor, which is classified as stiff lean to fat-clay (estimated effective strength parameters $\gamma=120$ pcf, $\phi=28^\circ$, $c=680$ psf). Below the fill is native layered soil consisting of deposits of silts and clays with varying amounts of sand mixed in. These silts and clays are classified as a stiff to very stiff clay and silts (effective strength parameters varied from $\gamma=110$ to 120 pcf, $\phi=26^\circ$ to 39° , $c=0$ to 680 psf). Bedrock was not encountered in any of the borings completed for this project.

A more detailed description of the subsurface conditions encountered during our subsurface exploration is presented on the project LOTB's which will be forwarded upon completion.

Laboratory Testing

Representative soil samples were chosen for testing from the borings for this investigation. A total of twenty soil samples were selected for testing to determine classification properties. Six mechanical analysis (MA) and Atterberg Limits (PI) were completed on selected samples from borings R-10-001&002 to classify the subsurface materials and an additional four MA's and PI's being completed on selected samples from HA-10-003 to classify the approach fill materials. In addition, four tri-axial shear tests were completed to determine phi angle and cohesion of the subsurface materials. The test results are attached and will be shown on the project LOTB's.

Groundwater

At this site groundwater elevation could not be determine at the time drilling due to the type of drilling method utilized. Measurement of ground water elevation in the placed open stand-pipe was taken on 5/26/10, at that time ground water was encountered at 18.5 feet below existing ground surface. The open stand-pipe is currently in place should subsequent ground water elevation measurements be needed. It should be anticipated that groundwater elevations will fluctuate depending on the time of year and annual rainfall variations.

Corrosion

We have reviewed the previous Foundation Report for Del Paso Road OC, dated May 22, 1963. No corrosion testing was completed for the 1963 report. In addition, we have reviewed the Foundation Report and boring logs for “Stadium Boulevard Overcrossing” (Arena Blvd. OC), dated June 22, 2000, and located approximately 0.95 miles south of Del Paso Road, which includes corrosion testing. Our review of the boring logs indicates that the subsurface materials encountered for the Arena Blvd. project are similar to those encountered in our subsurface investigation for this project. Based on the results of the corrosion testing reviewed it is our opinion that the subsurface materials at the project site should be considered non-corrosive.

The Department considers a site to be corrosive to foundation elements if one or more of the following conditions exist: Chloride concentration is greater than or equal to 500 ppm, sulfate concentration is greater than or equal to 2000 ppm, or the pH is 5.5 or less. The corrosion tests reviewed indicate chloride values ranging from 28-60 ppm, sulfate values ranging from 13.1-19.7 ppm and pH values ranging from 7.05-7.65.

Conclusions and Recommendations

General

Based on information provided by Structures Design, the proposed walls will be located roughly 105 to 111 ft. left of the existing I-5 centerline. The walls will consist of two Standard Plan Type 1 retaining wall extending from project Station 10+00 to 10+45.08 and Station 11+41.19 to 12+08.36 with a Tie-back wall located between the two Type 1 walls. The total lineal length of the walls would be approximately 208 feet, stretching between “RW LOL” STA 10+00 and STA 12+08.36 (see attached General Plan).

Based upon our findings of our literature review, subsurface investigation, analyses, and interaction with OSD, we are providing the recommendations presented below for design of the proposed retaining walls. These recommendations have been made available to the designers over the last few weeks.

Standard Plan Walls

Based on our review of the General Plan provided by OSD and the Caltrans Standard Plans for Type 1 Walls our Office recommends the following information be utilized for Construction and Design.

Retaining Wall Location*	Wall Type*	Loading Condition	Maximum Wall Height*	Footing Elevation (Bottom)*	Footing Size	Required Bearing Capacity per Standard Plans	Allowable Bearing Capacity
STA: 10+00-10+45.08	Type 1	Case II	12 ft.	18.3 ft.	4' 11"	2.7 Ksf	3.0 Ksf
STA: 11+41.19-12+08.36	Type1	Case II	12 ft.	18.3 ft.	4' 11"	2.7 Ksf	2.0 Ksf

*Information provided by OSD on General Plans dated May 5, 2010

Loose soil conditions were encountered at the bottom of footing elevation for the Type 1 wall proposed between project stations 11+41.19 to 12+08.36. Our Office recommends that the bottom of footing for this wall be over-excavated 2 ft. The over-excavated area should be replaced with compacted structure backfill to the bottom of footing elevation to provide adequate bearing capacity for the proposed wall.

Tie-Back Wall

Based on the results of our surface investigation and laboratory testing our Office recommends the following soil parameters be utilized for design of the proposed Tie-back wall: $\gamma=120$ pcf, $\phi=28^\circ$, $c=680$ psf.

Our Office recommends the un-bonded length for tie-backs extend a minimum of 5 ft. beyond the critical failure envelope for the existing bridge abutment as determined by the structures engineer and as shown on the plans.

Construction Considerations

Groundwater will likely be encountered during drilling and installation of the tie-backs. The tie-back installations will require dewatering or the placement of concrete and grout in wet conditions. If the contractor opts to place the concrete and grout in wet conditions, the specifications should require the displacement of water via a closed system using a pump or a tremie tube to place concrete and grout at the bottom of the hole.

Miscellaneous

Instrumentation and Site Monitoring

As previously noted, an open stand-pipe ground water monitoring well was constructed at the location of boring R-10-001. We recommend that the ground water monitoring well be abandoned at the end of the project. Abandonment can either be completed by the contractor as a portion of the contract or our Office maybe contacted to complete the abandonment. Should the our Office be utilized to complete the abandonment, an additional 50 hours should be resourced to the for unit 59-322 and an additional 20 hour resourced to unit 59-323 for activity 270.

Project Information

Standard Special Provisions S5-280, "Project Information," discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

A. *None*

Data and information included in the Information Handout provided to the bidders and Contractors are:

A. *Foundation Report for ERS Br. # 24E0013, dated June 7, 2010*

Data and information available for inspection at the District Office:

A. *None*

Data and information available for inspection at the Transportation Laboratory:

A. *None*

If any conceptual changes are made during final project design, the Office of Geotechnical Design North should review those changes to determine if these foundation recommendations are still applicable.

MR. JEFF SIMS
ERS Br. # 24E0013
June 7, 2010

03-SAC-5 PM 29.02
03-1F1801
Page 8

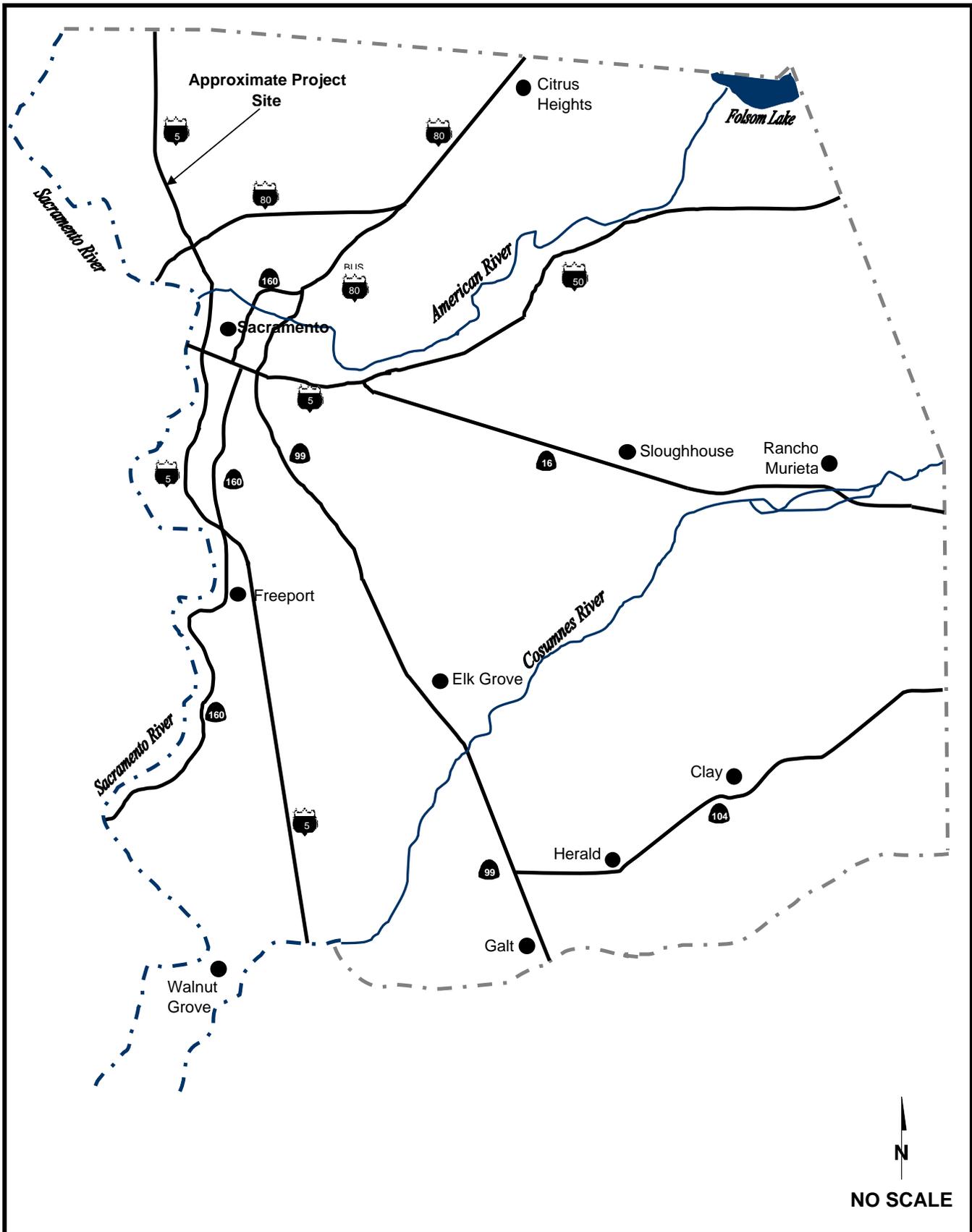
If you have any additional questions, please call me at (916) 227-1041.

William Webster CEG. #2485
Engineering Geologist
Geotechnical Design - North

c: RMowry PM
OGDN Files
MWilliam GS Corporate
DBrittsan
RE Pending File
KHolden DES Office Engineer
JPeterson DME D-3

References:

1. Robert M. Norris and Robert W. Webb (1990) "Geology of California" Second Edition
2. Western Regional Climate Center, <http://www.wrcc.dri.edu/> , May 2010
3. United States Geological Survey (USGS) 7.5 minute Topographic Map "Taylor Monument Quadrangle," 1980
4. D.L. Wagner, C.W. Jennings, T.L. Bedrossian and E.J. Bortugno (1987) "Geologic Map of the Sacramento, Quadrangle", Second Printing, California Department of Conservation, Division of Mines and Geology, Scale 1:250,000.
5. CGS, Open File Report 2000-19 "A General Guide for Ultramafic Rocks in California - Areas More Likely to Contain Naturally Occurring Asbestos", 2000.
6. Caltrans DOT, "Asbestos Locations Map District 3", 2001.
7. Mualchin, L. (1996) "California Seismic Hazard Map 1996, Based on Maximum Credible Earthquake (MCE)", Office of Earthquake Engineering, California Department of Transportation..
8. Natural Resource Conservation Service United States Department of Agriculture "Soil Survey of Sacramento County, California", <http://websoilsurvey.nrcs.usda.gov/app/> , May 2010
9. Caltrans "Foundation Report" Del Paso Road OC Br. No. 24-195, May 22, 1963.
10. Wallace Kuhl and Associates Inc. "Geotechnical Engineering Report Stadium Boulevard Overcrossing", June 22, 2000.



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 Engineering Services
 Office of Geotechnical Services
 Geotechnical Design Branch - North

EA: 03-1F1801
 Date: May 2010

VICINITY MAP

03-SAC- 5 PM 29.02
Foundation Report

PLATE NO.
1



Copyright 2003 California Department of Transportation

● Denotes Approximate Boring Location



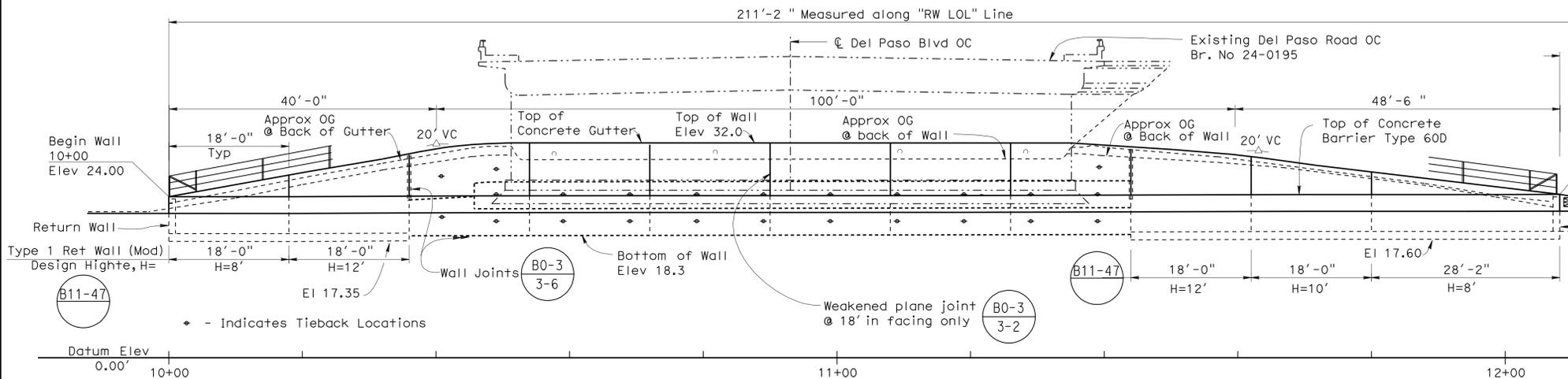
NO SCALE



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 Office of Geotechnical Services
 Geotechnical Design Branch - North

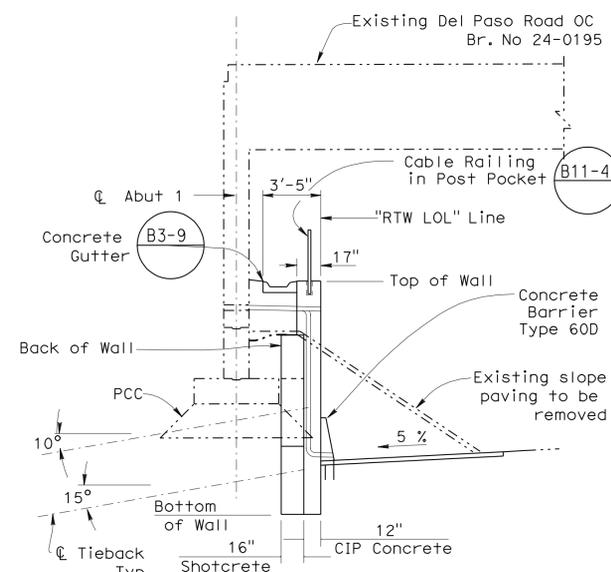
EA: 03-1F1801	BORING LOCATION MAP
Date: May 2010	
03-SAC-5 PM 29.02	PLATE NO.
Foundation Report	2

DIST.	COUNTY	ROUTE	POST MILE
03	Sac	5	

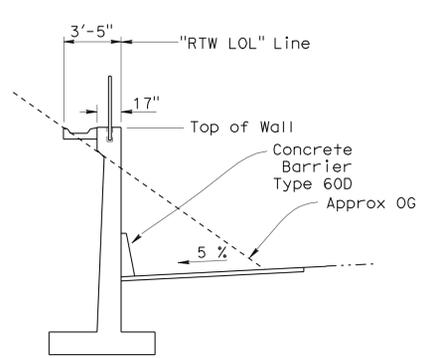


ELEVATION
1" = 20'

DATE OF ESTIMATE	=	- -
BRIDGE REMOVAL	=	N/A
STRUCTURE DEPTH	=	N/A
LENGTH	=	211'-2"
WIDTH	=	N/A
AREA	=	N/A
COST/□ INCLUDING 10% MOBILIZATION & 25% CONTINGENCY	=	
TOTAL COST	=	



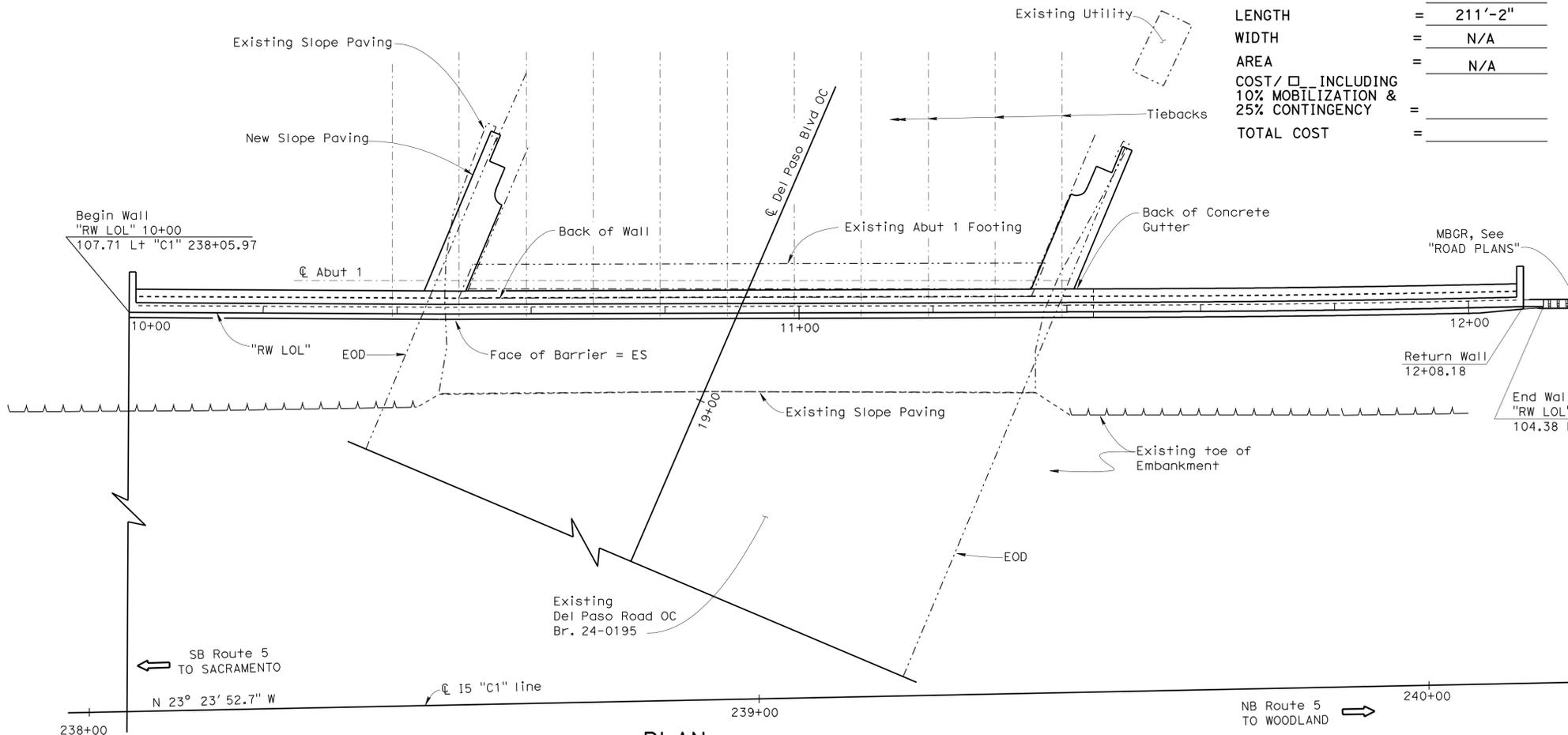
THROUGH TIEBACK WALL



THROUGH TYPE 1

TYPICAL SECTION

1" = 10'



PLAN
1" = 20'

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

DESIGNED BY Eric Watson	DATE 02/16/10
DRAWN BY Jinrong Zhou	DATE 02/16/10
CHECKED BY X	DATE X
APPROVED X	DATE X

STRUCTURE DESIGN BRANCH
1

PLANNING STUDY	
DEL PASO ROAD OC RETAINING WALL	
BRIDGE NO. 24EXXXX	CU 03
SCALE: AS SHOWN	EA 1F180K

Particle Size Analysis Test Report

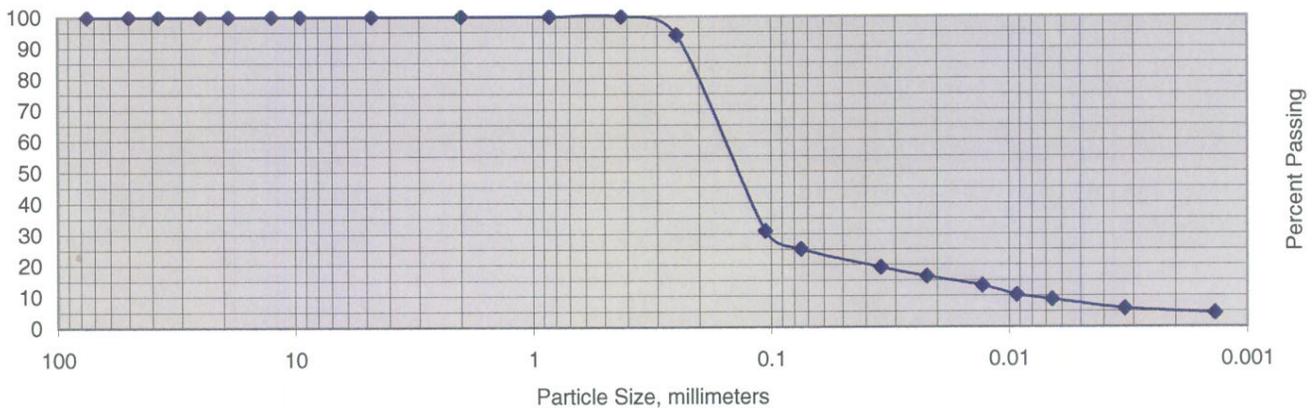
Project Name:	Caltrans TO58940
Project No.:	93276-40LAB
Boring No.:	R-10-001
Sample No.:	12
Depth, ft.:	30-31.5
Description, ASTM D 2488:	Silty sand
Report Date:	May 13, 2010

Particle Size Analysis (ASTM D 422)

(Sieve Analysis)	
U.S. Standard Sieve Size	% Passing
3 Inch	100
2 Inch	100
1 1/2 Inch	100
1 Inch	100
3/4 Inch	100
1/2 Inch	100
3/8 Inch	100
No. 4	100
No. 10	100
No. 20	100
No. 40	100
No. 60	94
No. 140	31
No. 200	25.1

Hydrometer Analysis	
Particle Size, mm	% Passing
0.035	19.2
0.022	16.3
0.013	13.3
0.009	10.4
0.007	8.9
0.003	5.9
0.001	4.4

Specific Gravity	2.65
	Assumed



Limitations:

As the samples tested were sampled and/or transported to our laboratory by parties other than Kleinfelder staff, this report makes no representation of whether the samples are representative of the material onsite.

Pursuant to applicable building codes, the results presented in this report are for the exclusive use of the client and the registered design professional in responsible charge. The results apply only to the samples tested. If changes to the specifications were made and not communicated to Kleinfelder, Kleinfelder assumes no responsibility for pass/fail statements (meets/did not meet), if provided.



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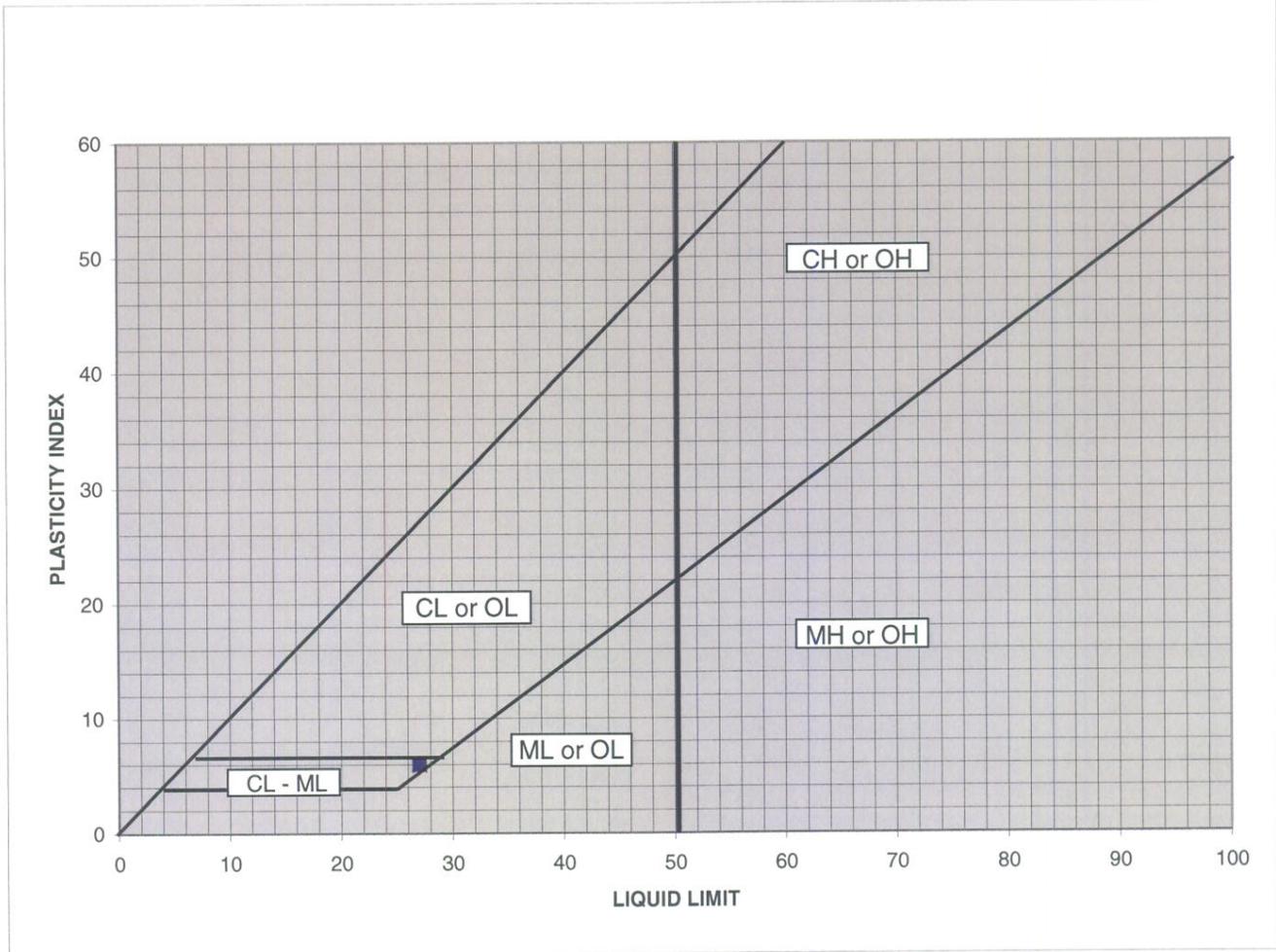
Reviewed By,

[Signature]

Plasticity Index Test Report

Project Name:	Caltrans TO58940
Project No.:	93276-40LAB
Boring No.:	R-10-001
Sample No.:	5 (6)
Depth, ft.:	10-15
Description:	Sandy silty clay
Report Date:	May 6, 2010

Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D 4318)



LIQUID LIMIT	27
PLASTIC LIMIT	21
PLASTICITY INDEX	6

GROUP SYMBOL: ASTM D 2487	CL-ML
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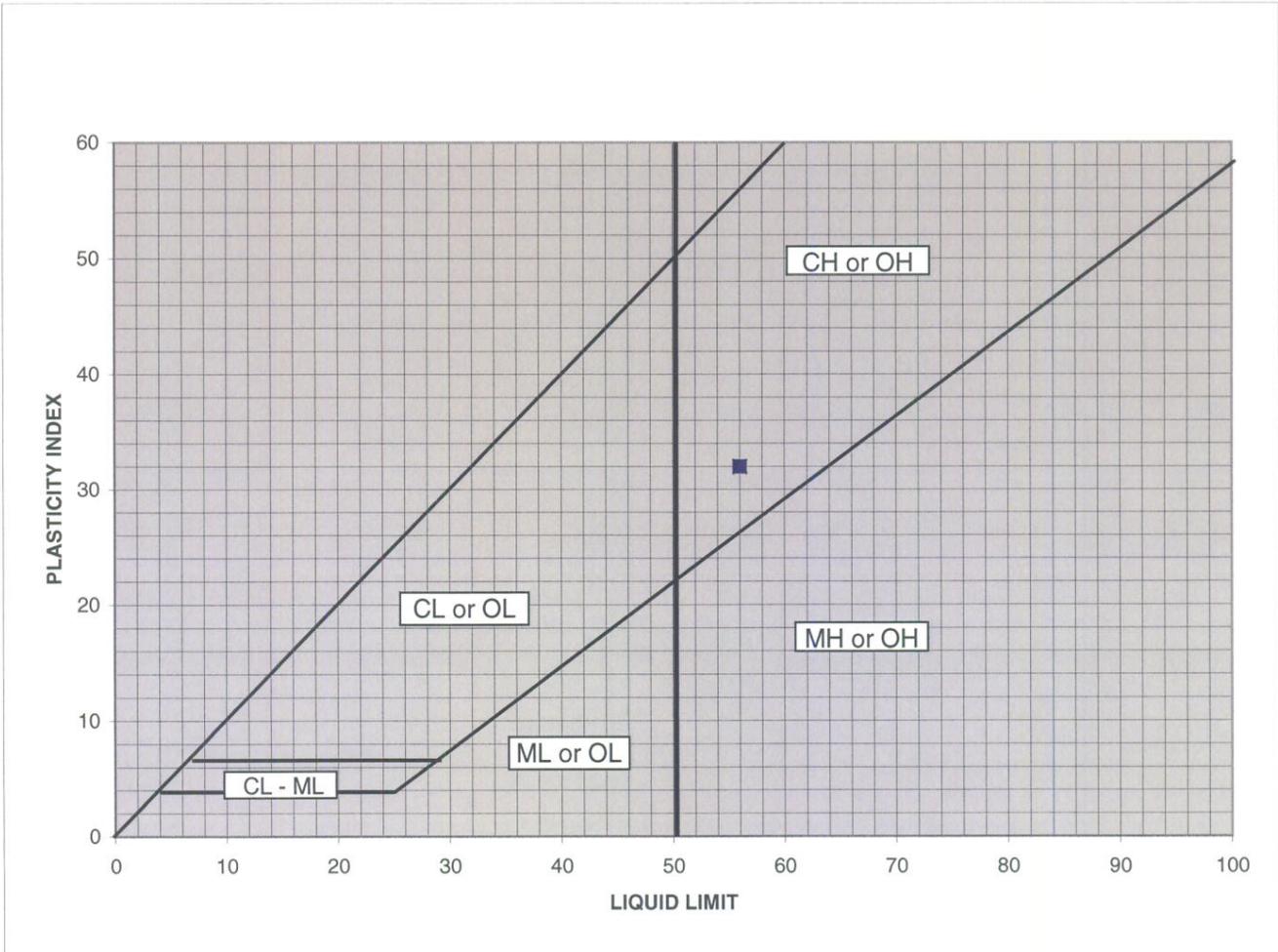
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Plasticity Index Test Report

Project Name:	Caltrans TO58940
Project No.:	93276-40LAB
Boring No.:	R-10-001
Sample No.:	7 (5)
Depth, ft.:	15-20
Description:	Fat clay
Report Date:	May 6, 2010

Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D 4318)



LIQUID LIMIT	56
PLASTIC LIMIT	24
PLASTICITY INDEX	32

GROUP SYMBOL: ASTM D 2487	CH
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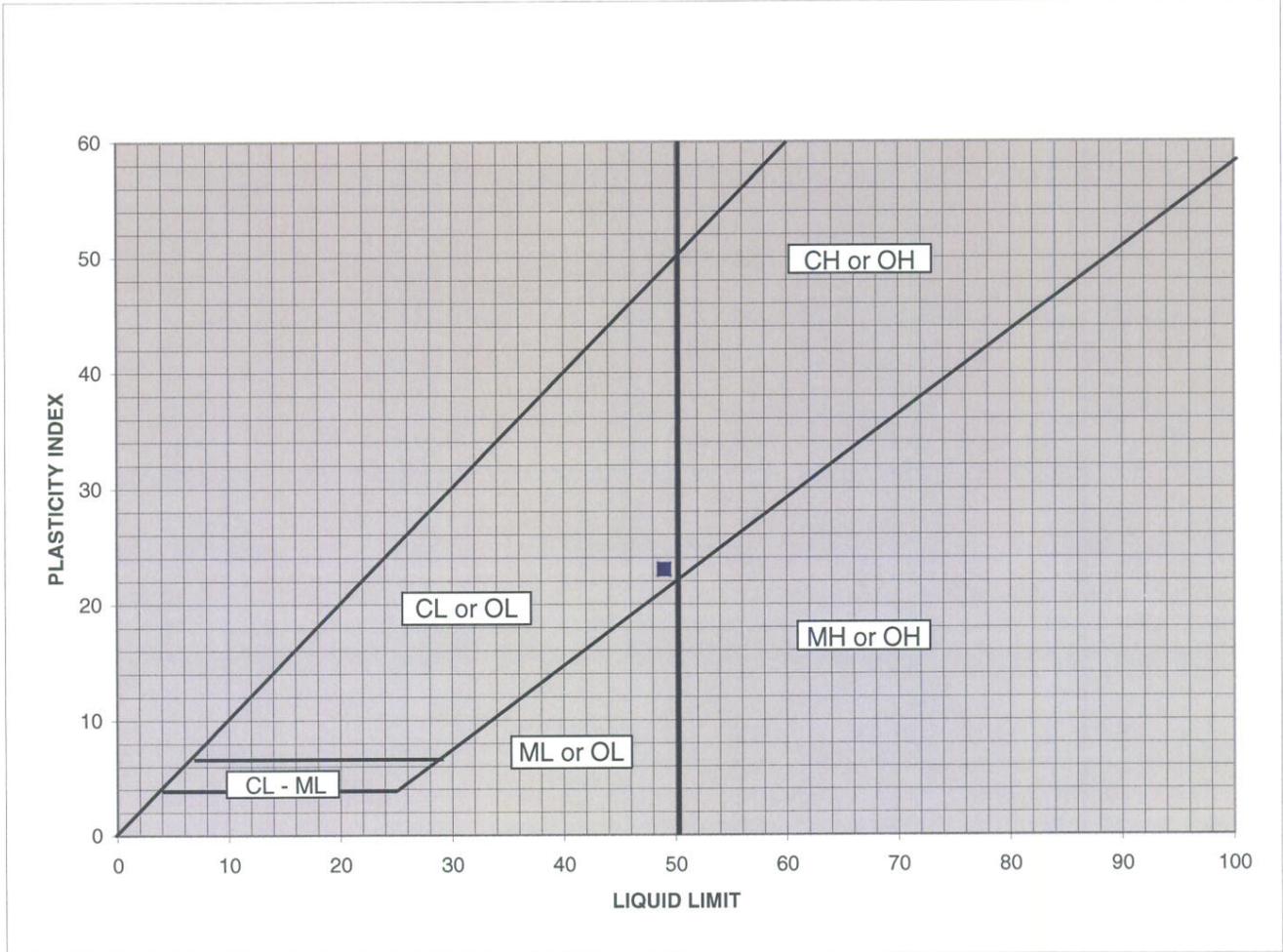
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Plasticity Index Test Report

Project Name:	Caltrans TO58940
Project No.:	93276-40LAB
Boring No.:	R-10-001
Sample No.:	15 (7)
Depth, ft.:	35-40
Description:	Lean clay
Report Date:	May 6, 2010

Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D 4318)



LIQUID LIMIT	49
PLASTIC LIMIT	26
PLASTICITY INDEX	23

GROUP SYMBOL: ASTM D 2487	CL
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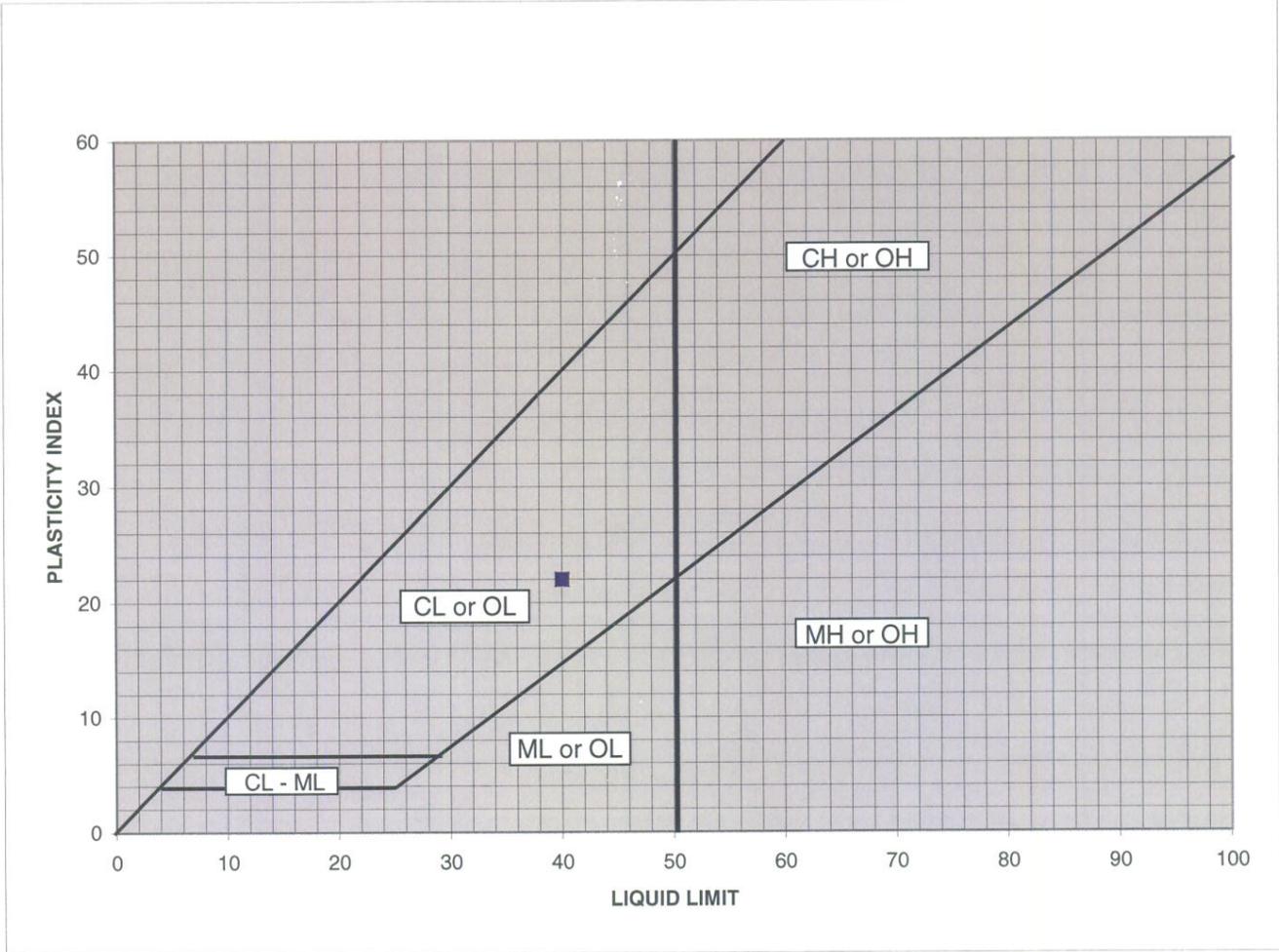
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Plasticity Index Test Report

Project Name:	Caltrans TO58940
Project No.:	93276-40LAB
Boring No.:	R-10-002
Sample No.:	1 (9)
Depth, ft.:	0-5
Description:	Lean clay
Report Date:	May 6, 2010

Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D 4318)



LIQUID LIMIT	40
PLASTIC LIMIT	18
PLASTICITY INDEX	22

GROUP SYMBOL: ASTM D 2487	CL
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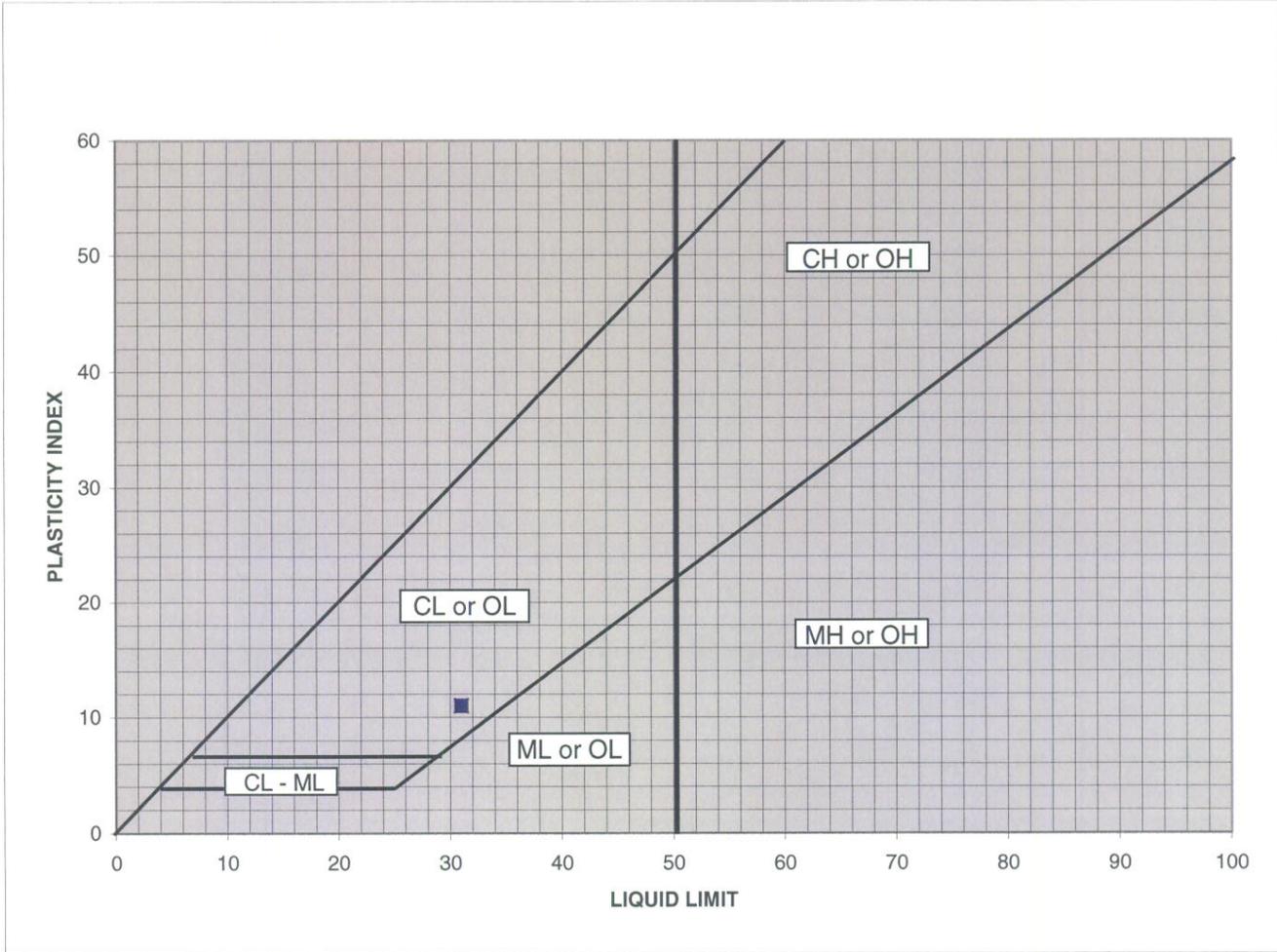
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Plasticity Index Test Report

Project Name:	Caltrans TO58940
Project No.:	93276-40LAB
Boring No.:	R-10-002
Sample No.:	7 (5)
Depth, ft.:	16.5-21.5
Description:	Lean clay
Report Date:	May 6, 2010

Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D 4318)



LIQUID LIMIT	31
PLASTIC LIMIT	20
PLASTICITY INDEX	11

GROUP SYMBOL: ASTM D 2487	CL
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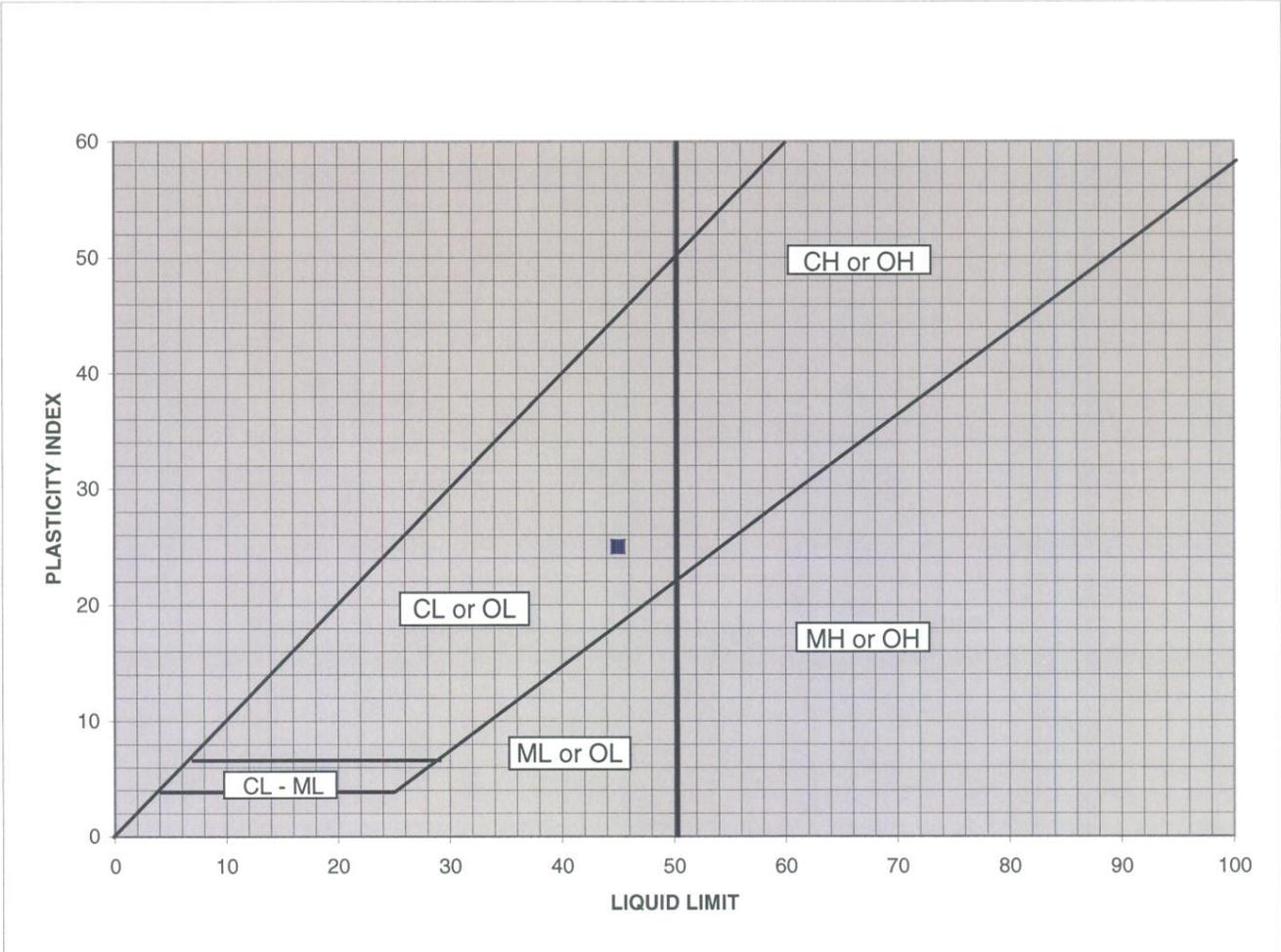
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f| 916.366.7013
kleinfelder.com

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Plasticity Index Test Report

Project Name:	Caltrans TO58940
Project No.:	93276-40LAB
Boring No.:	HA-10-003
Sample No.:	1
Depth, ft.:	3-3.5
Description:	Lean clay with sand
Report Date:	May 13, 2010

Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D 4318)



LIQUID LIMIT	45
PLASTIC LIMIT	20
PLASTICITY INDEX	25

GROUP SYMBOL: ASTM D 2487	CL
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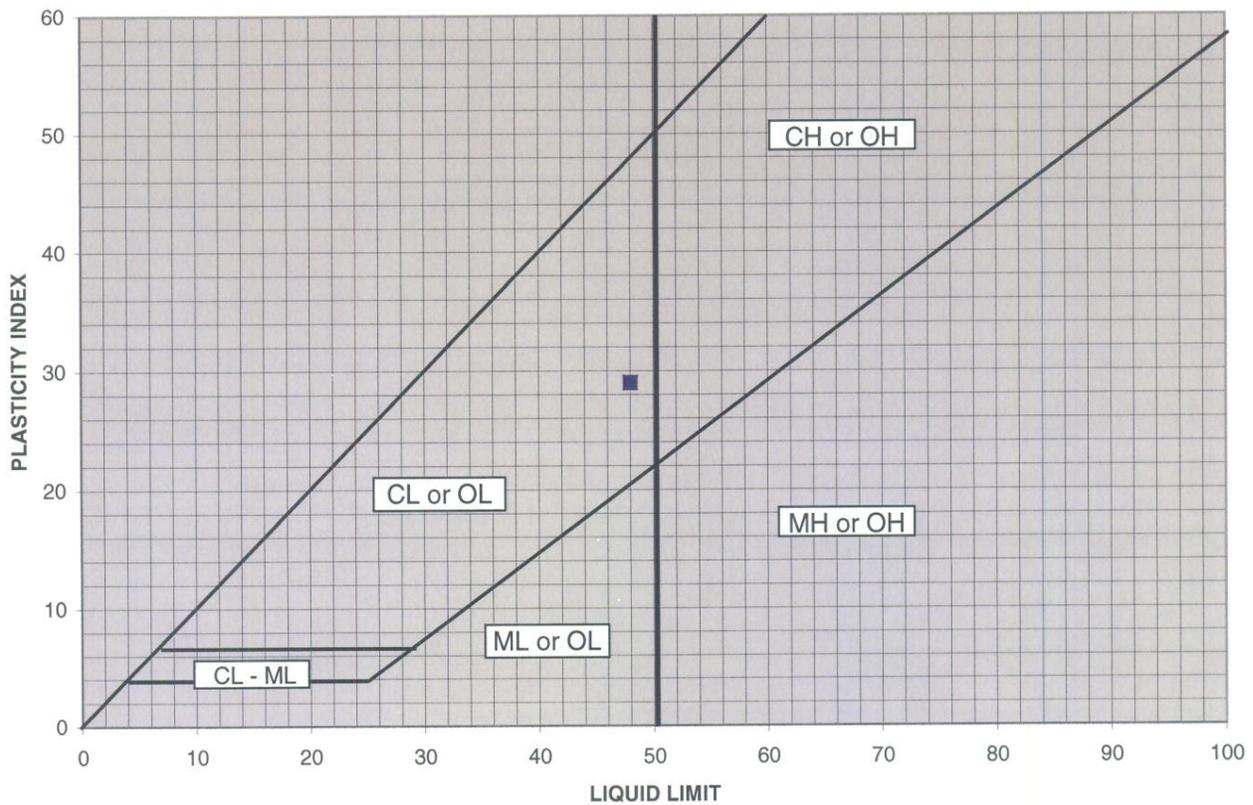
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Plasticity Index Test Report

Project Name:	Caltrans TO58940
Project No.:	93276-40LAB
Boring No.:	HA-10-003
Sample No.:	2
Depth, ft.:	5-5.5
Description:	Lean clay with sand
Report Date:	May 13, 2010

Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D 4318)



LIQUID LIMIT	48
PLASTIC LIMIT	19
PLASTICITY INDEX	29

GROUP SYMBOL: ASTM D 2487	CL
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Limitations:

As the samples tested were sampled and/or transported to our laboratory by parties other than Kleinfelder staff, this report makes no representation of whether the samples are representative of the material onsite.

Pursuant to applicable building codes, the results presented in this report are for the exclusive use of the client and the registered design professional in responsible charge. The results apply only to the samples tested. If changes to the specifications were made and not communicated to Kleinfelder, Kleinfelder assumes no responsibility for pass/fail statements (meets/did not meet), if provided.



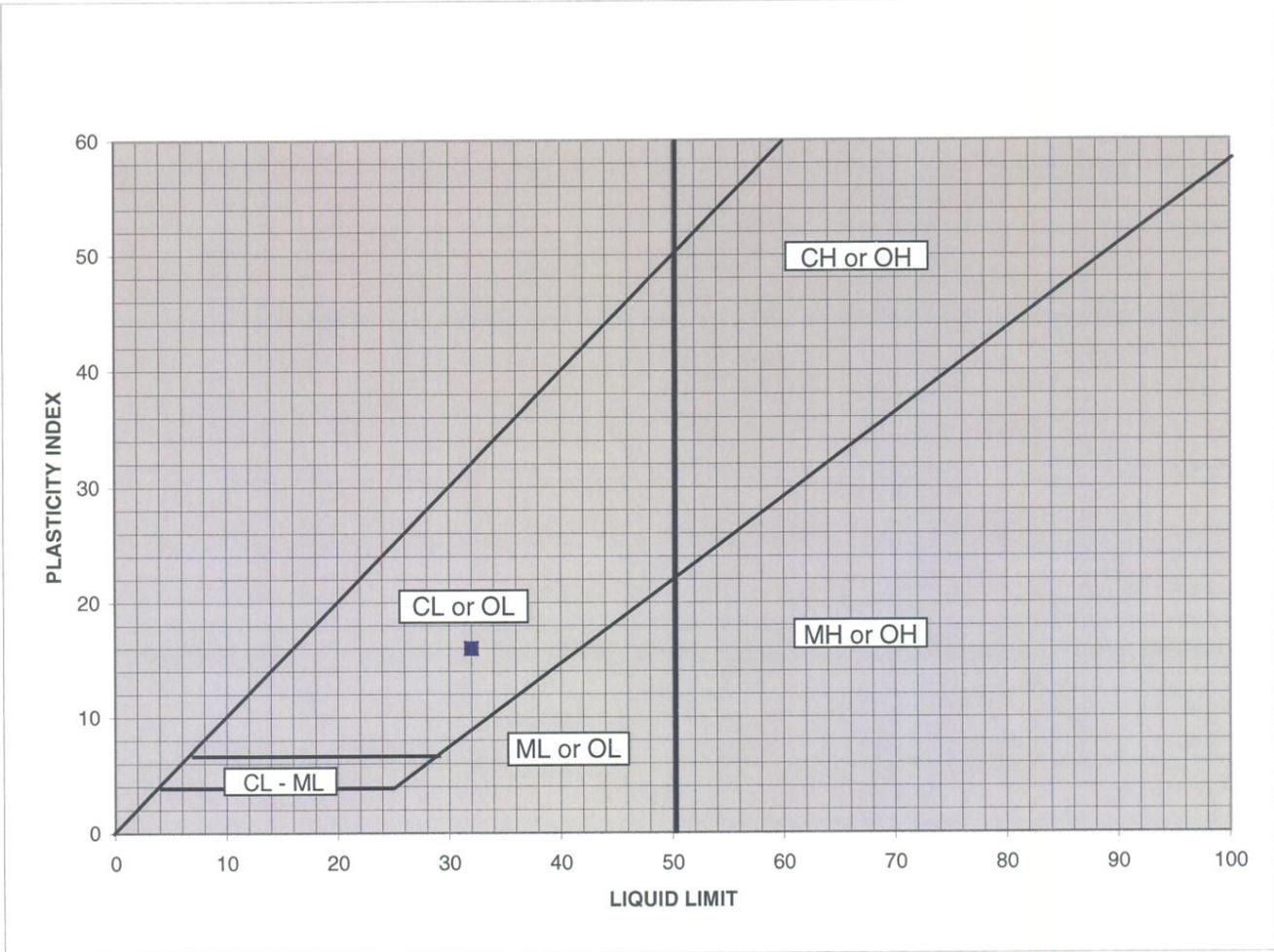
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Reviewed By,

Plasticity Index Test Report

Project Name:	Caltrans TO58940
Project No.:	93276-40LAB
Boring No.:	HA-10-003
Sample No.:	3
Depth, ft.:	8-8.5
Description:	Sandy lean clay
Report Date:	May 13, 2010

Liquid Limit, Plastic Limit, and Plasticity Index of Soils (ASTM D 4318)



LIQUID LIMIT	32
PLASTIC LIMIT	16
PLASTICITY INDEX	16

GROUP SYMBOL: ASTM D 2487	CL
------------------------------	-----------

Limitations:

As the samples tested were sampled and/or transported to our laboratory by parties other than Kleinfelder staff, this report makes no representation of whether the samples are representative of the material onsite.

Pursuant to applicable building codes, the results presented in this report are for the exclusive use of the client and the registered design professional in responsible charge. The results apply only to the samples tested. If changes to the specifications were made and not communicated to Kleinfelder, Kleinfelder assumes no responsibility for pass/fail statements (meets/did not meet), if provided.

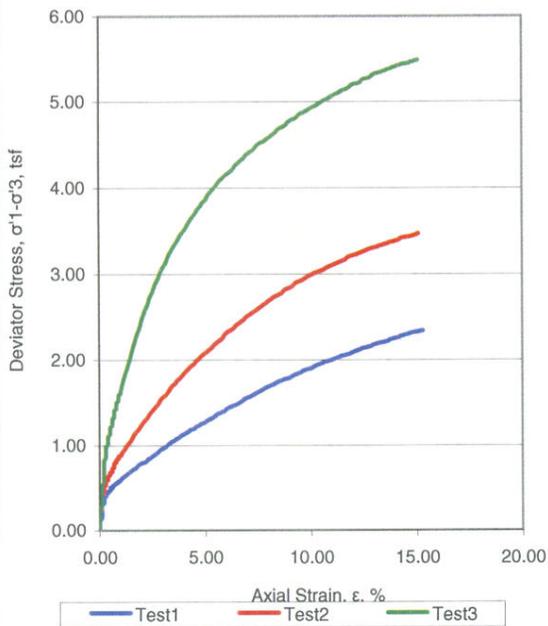
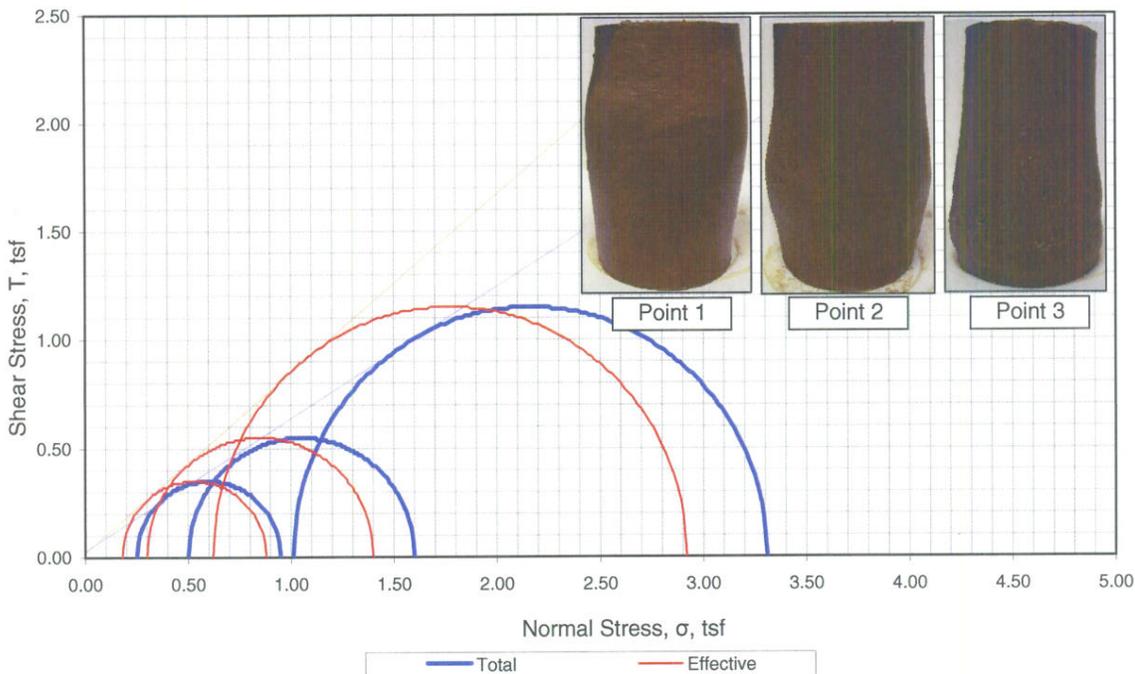


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Total		Effective	
c =	0.03 tsf	c' =	0.02 tsf
φ =	31.3 Deg.	φ' =	39.6 Deg.
tan φ =	0.61	tan φ' =	0.83

Specimen Shear Picture



Specimen No.		1	2	3
Initial	Water Content, %	ω ₀ 22.7	21.2	16.9
	Dry Density, lbs/ft ³	γ _{d0} 102.9	106.6	113.6
	Saturation, %	S ₀ 96.0	98.5	94.4
	Void Ratio	e ₀ 0.64	0.58	0.48
Before Shear	Water Content, %	ω _f 23.1	21.9	18.2
	Dry Density, lbs/ft ³	γ _{dc} 103.7	105.9	113.0
	Saturation, %	S _c 100.0	100.0	100.0
	Void Ratio	e _c 0.63	0.59	0.49
Final Back Pressure, tsf		U ₀ 3.6	3.6	3.6
Minor Principal Stress, tsf		σ ₃ 0.25	0.50	1.01
Maximum Deviator Stress, tsf		(σ ₁ -σ ₃) _{max} 0.70	1.10	2.31
Time to (σ ₁ -σ ₃) _{max} , min		t _f 45.1	48.1	54.1
Deviator Stress @ 15% Axial Strain, tsf		(σ ₁ -σ ₃) _{15%} 2.33	3.47	5.49
Axial Strain at failure, %		ε 1.5	1.6	1.8
Peak Pore Pressure at failure, tsf		U 3.678	3.804	4.004
Δ Pore Pressure at failure (ΔU), tsf		ΔU 0.074	0.199	0.395

Rate of strain, %/hr: 2.0

Description of Specimen 1: Olive Brown Clayey Sand

Description of Specimen 2: Olive Brown Clayey Sand

Description of Specimen 3: *Olive Brown Clayey Sand

Amount of Material Finer than the No. 200, %: no test

LL: no test | PL: no test | PI: no test | G_s: 2.70 Assumed

Initial Diameter, in	D ₀	2.365	2.365	2.375
Initial Height, in	H ₀	4.967	4.970	4.997
Type of Specimens:	Undisturbed			
Type of Test:	ASTM D-4767			

Remarks: Membrane correction applied. B Parameter >= 0.96

Peak Strength selected at maximum effective stress ratio (obliquity)

*Bottom of Specimen 3 is sandy lean clay.

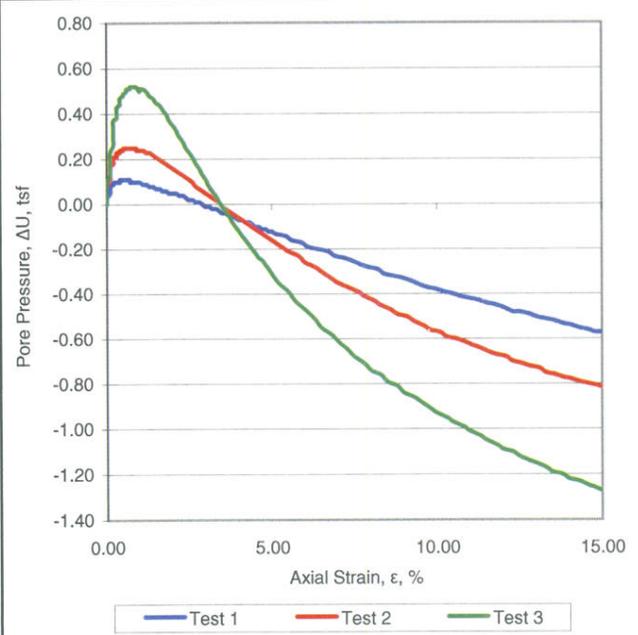
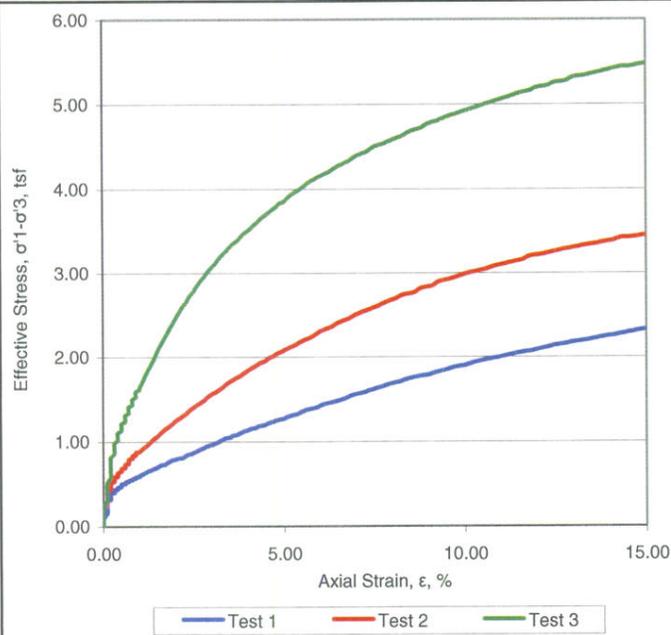
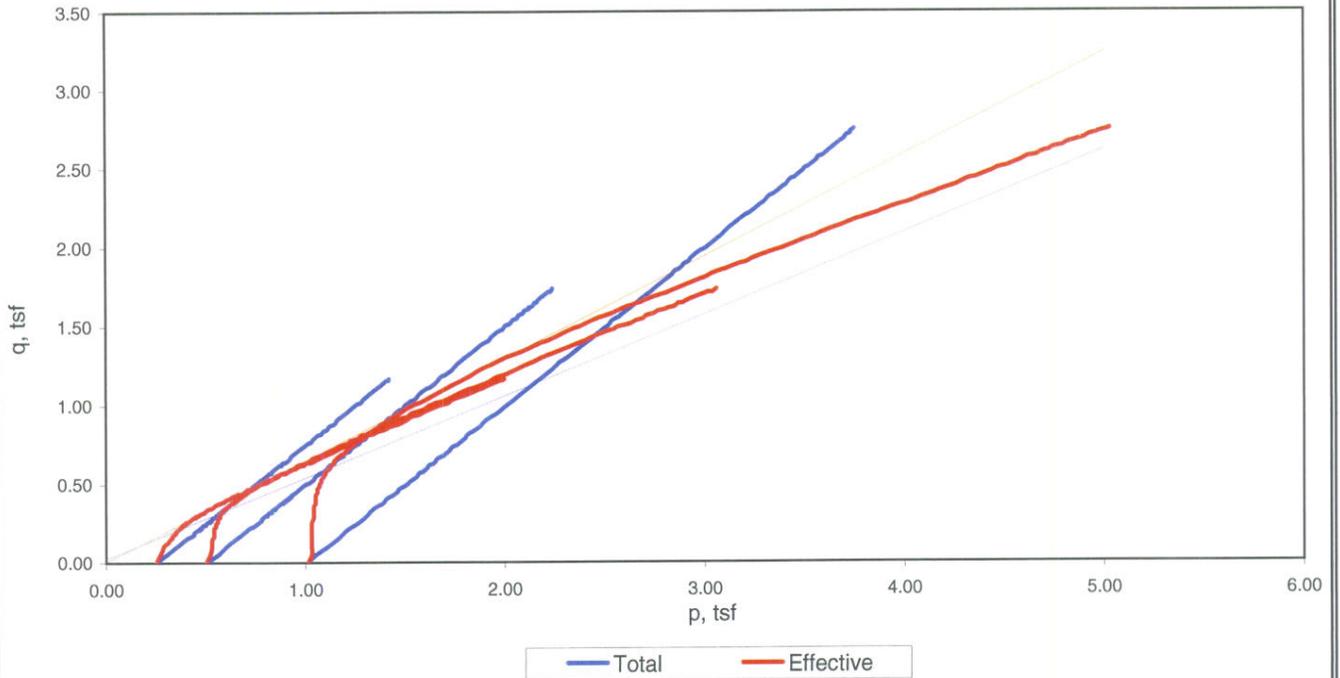
Method of Saturation: Wet Mounted


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Project:	Caltrans TO58940
Project No.:	93276-40LAB
Boring:	R-10-001
Sample:	5 (7, 8, 9)
Depth, ft.:	10-15'
Date:	May 14, 2010

PLATE
 X of X
X-XX

Total		Effective	
a =	0.03 tsf	a =	0.00 tsf
ψ =	27.4 Deg.	ψ =	32.9 Deg.
Tan ψ =	0.52	Tan ψ =	0.65



Rate of strain, % / hr: 2.0

Description of Specimen 1 Olive Brown Clayey Sand

Description of Specimen 2 Olive Brown Clayey Sand

Description of Specimen 3 *Olive Brown Clayey Sand

Amount of Material Finer than the No. 200, %: no test

LL: no test | PL: no test | PI: no test | G_s: 2.70 Assumed | Type of Specimen: Undisturbed | Type of Test: ASTM D-4767

Remarks: Membrane correction applied. B Parameter >= 0.96

Peak Strength selected at maximum effective stress ratio (obliquity)

*Bottom of Specimen 3 is sandy lean clay.

Method of Saturation: Wet Mounted

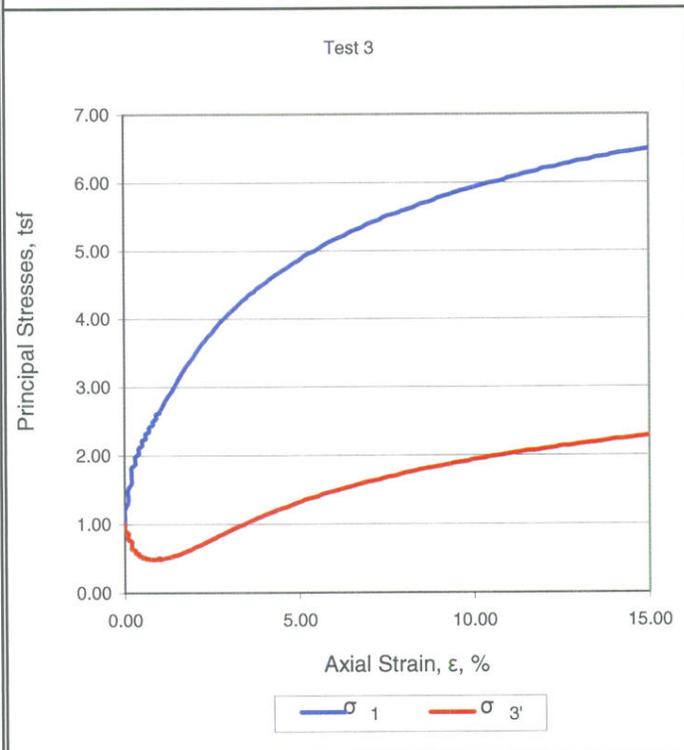
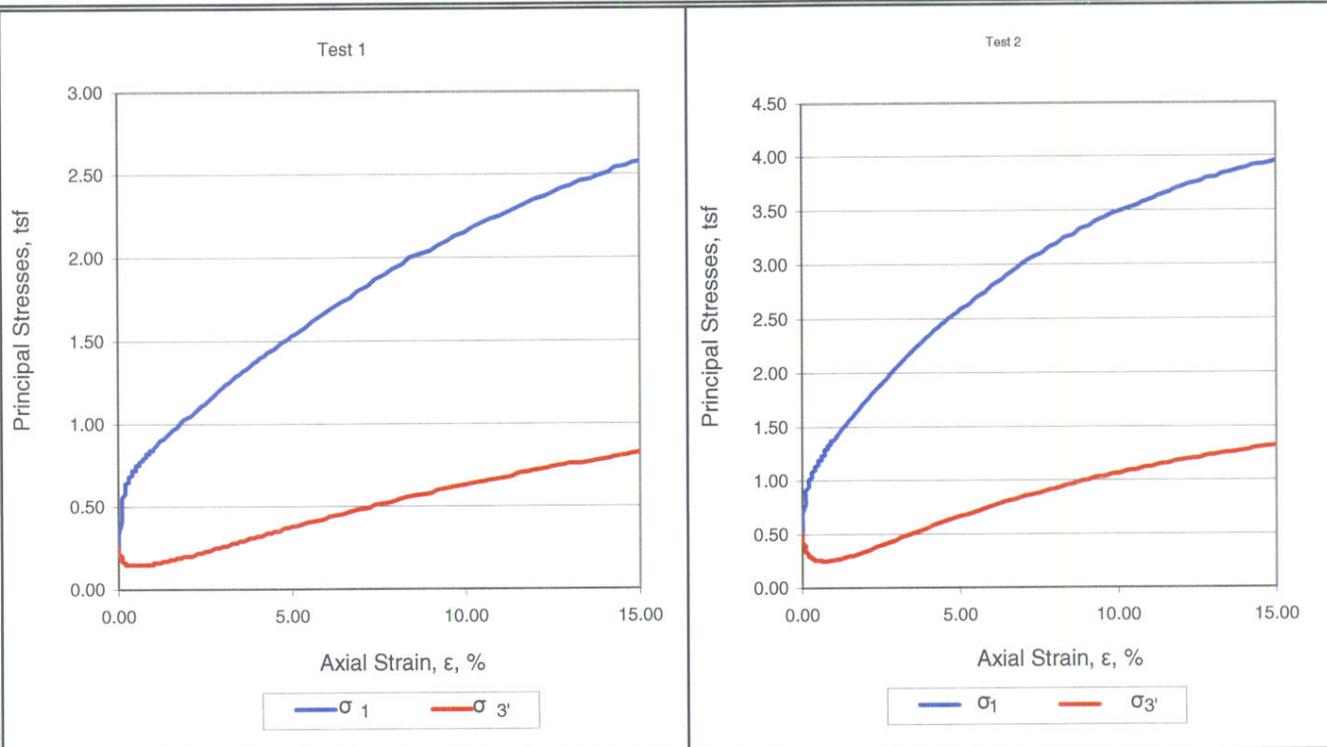
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Project:	Caltrans TO58940
Project No.:	93276-40LAB
Boring:	R-10-001
Sample:	5 (7, 8, 9)
Depth, ft.:	10-15'
Date:	May 14, 2010

PLATE
X of X

X-XX



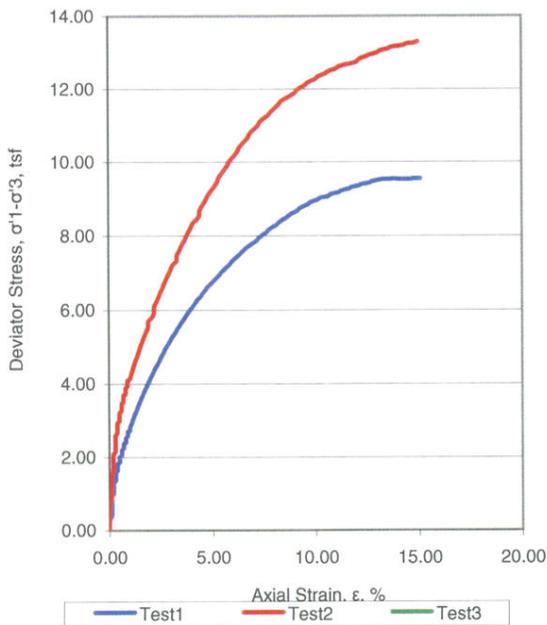
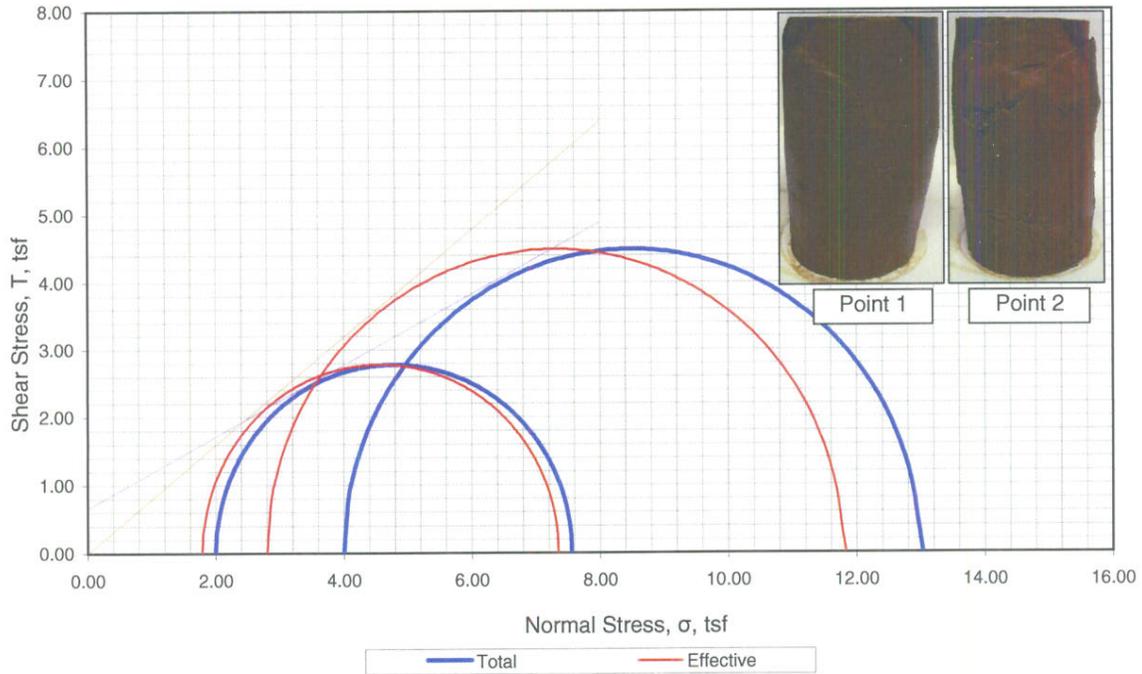
Rate of strain, % / hr: 2.0
 Description of Specimen 1 Olive Brown Clayey Sand
 Description of Specimen 2 Olive Brown Clayey Sand
 Description of Specimen 3 *Olive Brown Clayey Sand
 Amount of Material Finer than the No. 200, %: no test
 LL: no test | PL: no test | PI: no test | G_s: 2.70 Assumed | Type of Specimen: Undisturbed | Type of Test: ASTM D-4767

Remarks: Membrane correction applied. B Parameter ≥ 0.96
 Peak Strength selected at maximum effective stress ratio (obliquity)

*Bottom of Specimen 3 is sandy lean clay.		Project:	Caltrans TO58940	PLATE X of X X-XX
Method of Saturation: Wet Mounted		Project No.:	93276-40LAB	
3077 Fite Circle Sacramento, CA 95827 p 916.366.1701 f 916.366.7013 kleinfelder.com		Boring:	R-10-001	
		Sample:	5 (7, 8, 9)	
		Depth, ft.:	10-15'	
		Date:	May 14, 2010	

Total		Effective	
c =	0.66 tsf	c' =	0.00 tsf
φ =	27.9 Deg.	φ' =	38.6 Deg.
tan φ =	0.53	tan φ' =	0.80

Specimen Shear Picture



Specimen No.		1	2	3
Initial	Water Content, %	ω ₀	27.4	23.8
	Dry Density, lbs/ft ³	γ _{d0}	97.6	103.6
	Saturation, %	S ₀	101.9	102.7
Before Shear	Void Ratio	e ₀	0.73	0.63
	Water Content, %	ω _f	27.6	23.7
	Dry Density, lbs/ft ³	γ _{dc}	96.5	102.8
	Saturation, %	S _c	100.0	100.0
	Void Ratio	e _c	0.75	0.64
	Final Back Pressure, tsf	U ₀	2.2	2.2
	Minor Principal Stress, tsf	σ ₃	2.00	4.00
	Maximum Deviator Stress, tsf	(σ ₁ -σ ₃) _{max}	5.56	8.98
	Time to (σ ₁ -σ ₃) _{max} , min	t _f	51.2	72.1
	Deviator Stress @ 15% Axial Strain, tsf	(σ ₁ -σ ₃) _{15%}	9.55	13.31
	Axial Strain at failure, %	ε	3.4	4.7
	Peak Pore Pressure at failure, tsf	U	2.376	3.366
	Δ Pore Pressure at failure (ΔU), tsf	ΔU	0.211	1.203

Rate of strain, %/hr: 4.0

Description of Specimen 1: Olive Brown Silty Sand

Description of Specimen 2: Olive Brown Silty Sand

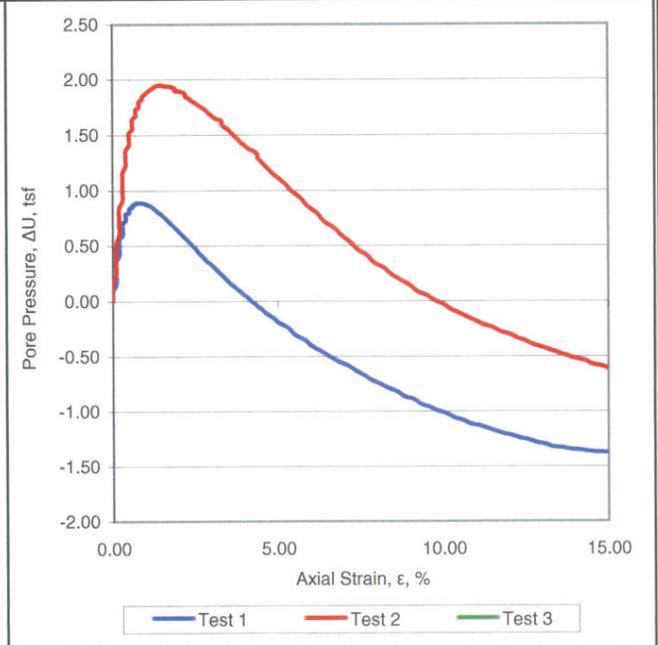
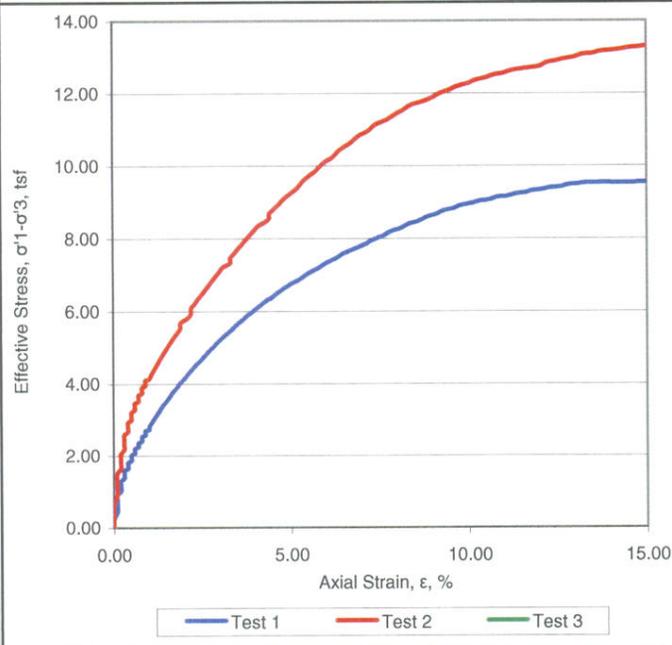
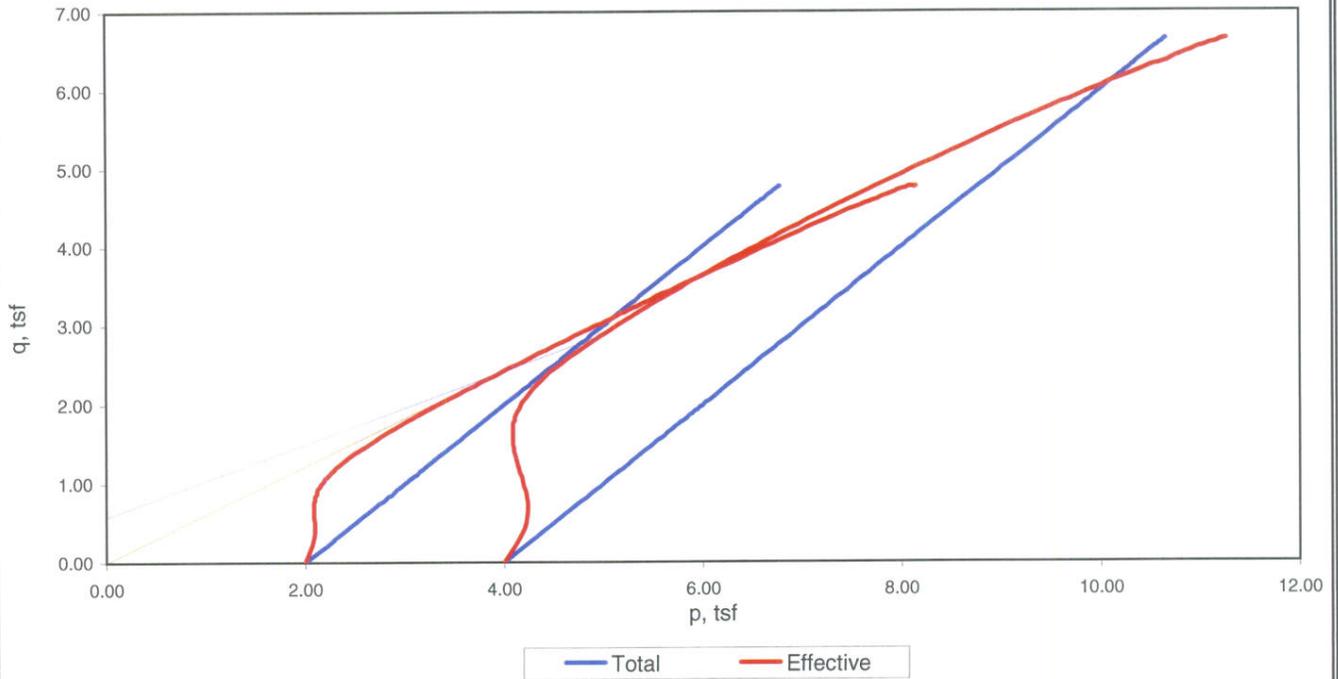
Initial Diameter, in	D ₀	2.368	2.365
Initial Height, in	H ₀	4.950	5.040
Amount of Material Finer than the No. 200, %:	no test		
LL: no test PL: no test PI: no test G _s : 2.70 Assumed	Type of Specimens: Undisturbed	Type of Test: ASTM D-4767	

Remarks: Membrane applied. B Parameter >= 0.96

Peak Strength selected at maximum effective stress ratio (obliquity)

Method of Saturation: Wet Mounted	Project:	Caltrans TO58940	PLATE X of X X-XX
<p>3077 Fite Circle Sacramento, CA 95827 p 916.366.1701 f 916.366.7013 kleinfelder.com</p>	Project No.:	93276-40LAB	
	Boring:	R-10-001	
	Sample:	13 (8,9)	
	Depth, ft.:	30-35	
	Date:	May 17, 2010	

Total		Effective	
a =	0.58 tsf	a =	0.00 tsf
ψ =	24.7 Deg.	ψ =	31.4 Deg.
Tan ψ =	0.46	Tan ψ =	0.61



Rate of strain, % / hr: 4.0

Description of Specimen 1 Olive Brown Silty Sand

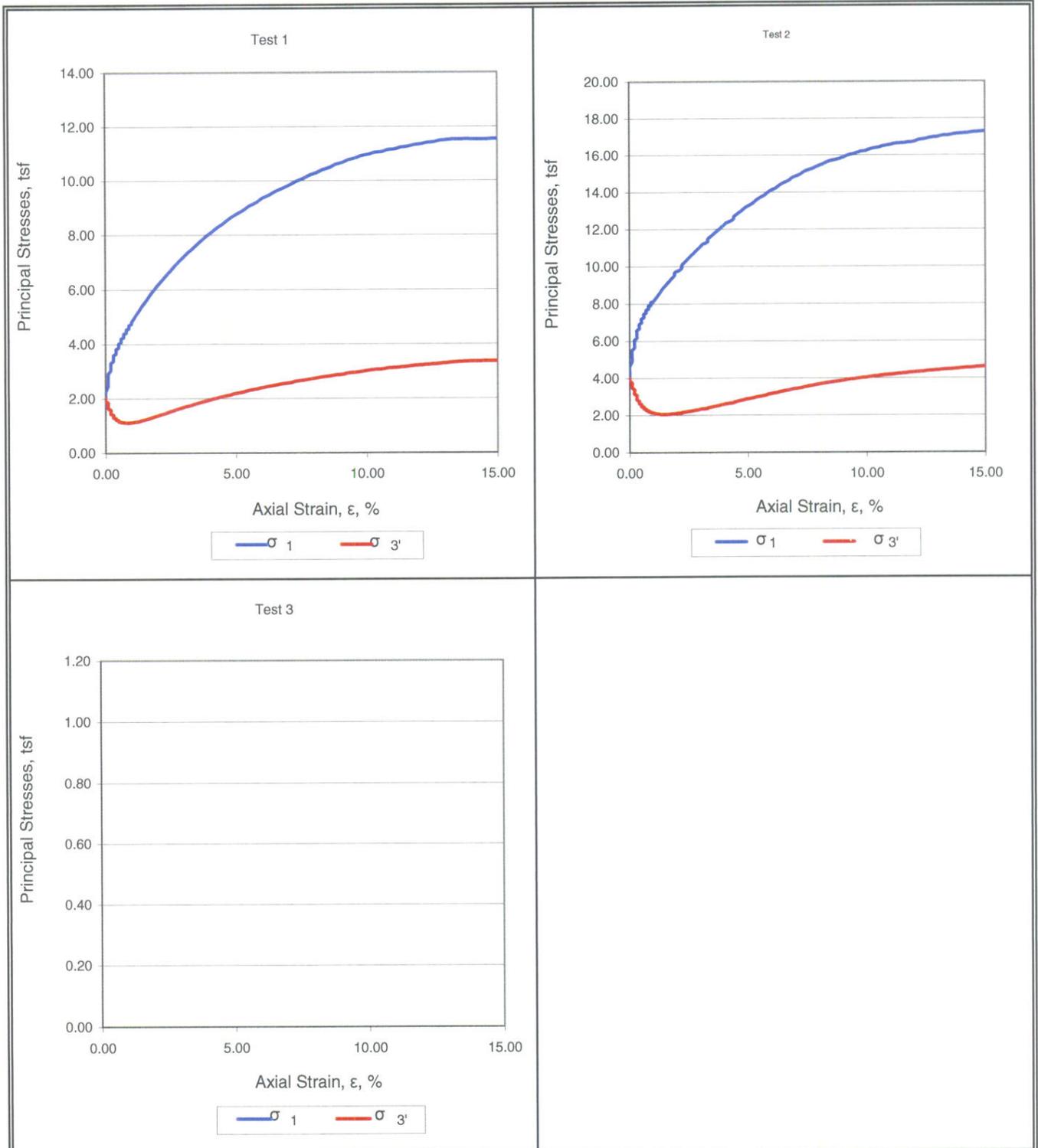
Description of Specimen 2 Olive Brown Silty Sand

Amount of Material Finer than the No. 200, %:	no test		
LL: no test	PL: no test	PI: no test	G _s : 2.70 Assumed
Type of Specimen: Undisturbed		Type of Test: ASTM D-4767	

Remarks: Membrane applied. B Parameter >= 0.96

Peak Strength selected at maximum effective stress ratio (obliquity)

	Method of Saturation: Wet Mounted	Project: Caltrans TO58940	PLATE X of X X-XX
	3077 Fite Circle Sacramento, CA 95827	Project No.: 93276-40LAB	
	p 916.366.1701	Boring: R-10-001	
	f 916.366.7013	Sample: 13 (8,9)	
	kleinfelder.com	Depth, ft.: 30-35	
	Date: May 17, 2010		



Rate of strain, % / hr: 4.0
 Description of Specimen 1 Olive Brown Silty Sand
 Description of Specimen 2 Olive Brown Silty Sand

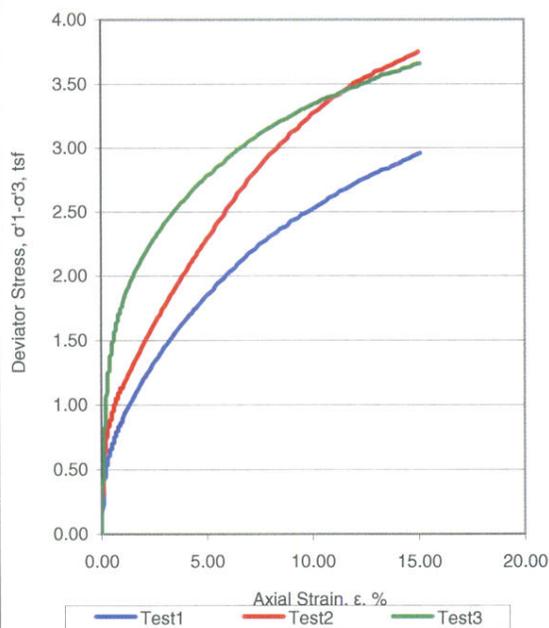
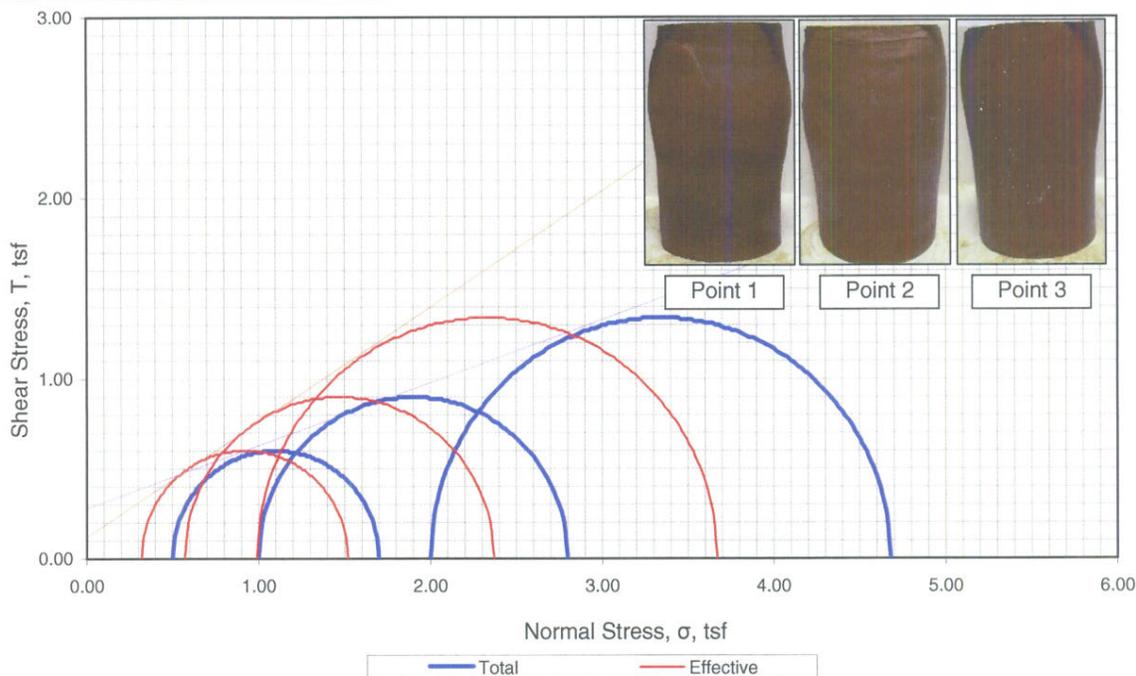
Amount of Material Finer than the No. 200, %: no test
 LL: no test | PL: no test | PI: no test | G_s: 2.70 Assumed | Type of Specimen: Undisturbed | Type of Test: ASTM D-4767

Remarks: Membrane applied. B Parameter >= 0.96
 Peak Strength selected at maximum effective stress ratio (obliquity)

Method of Saturation: Wet Mounted	Project: Caltrans TO58940	PLATE X of X X-XX
3077 Fite Circle Sacramento, CA 95827 p 916.366.1701 f 916.366.7013 kleinfelder.com	Project No.: 93276-40LAB	
	Boring: R-10-001	
	Sample: 13 (8,9)	
	Depth, ft.: 30-35	
	Date: May 17, 2010	

Total		Effective	
c =	0.28 tsf	c' =	0.12 tsf
φ =	19.3 Deg.	φ' =	32.6 Deg.
tan φ =	0.35	tan φ' =	0.64

Specimen Shear Picture



Specimen No.		1	2	3	
Initial	Water Content, %	ω ₀	23.7	23.7	25.9
	Dry Density, lbs/ft ³	γ _{d0}	104.5	104.5	100.7
	Saturation, %	S ₀	107.9	107.8	106.8
	Void Ratio	e ₀	0.58	0.58	0.64
Before Shear	Water Content, %	ω _f	23.4	23.2	24.8
	Dry Density, lbs/ft ³	γ _{dc}	102.0	102.5	99.8
	Saturation, %	S _C	100.0	100.0	100.0
	Void Ratio	e _C	0.62	0.61	0.66
	Final Back Pressure, tsf	U ₀	3.6	3.6	3.6
Minor Principal Stress, tsf		σ ₃	0.50	1.00	2.00
Maximum Deviator Stress, tsf		(σ ₁ -σ ₃) _{max}	1.20	1.79	2.68
Time to (σ ₁ -σ ₃) _{max} , min		t _f	96.1	148.9	211.3
Deviator Stress @ 15% Axial Strain, tsf		(σ ₁ -σ ₃) _{15%}	2.96	3.75	3.66
Axial Strain at failure, %		ε	2.0	3.1	4.4
Peak Pore Pressure at failure, tsf		U	3.776	4.030	4.615
Δ Pore Pressure at failure (ΔU), tsf		ΔU	0.178	0.425	1.013

Rate of strain, %/hr: 1.3

Description of Specimen 1: Light Brown Sandy Silt

Description of Specimen 2: Light Brown Sandy Silt

Description of Specimen 3: Light Brown Sandy Silt

Amount of Material Finer than the No. 200, %: no test

LL: no test PL: no test PI: no test G_s: 2.65 Assumed

Type of Specimens: Undisturbed

Type of Test: ASTM D-4767

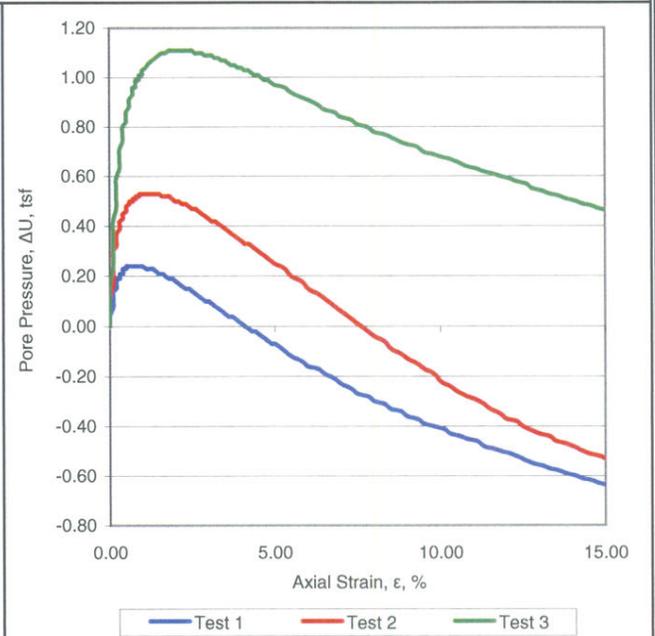
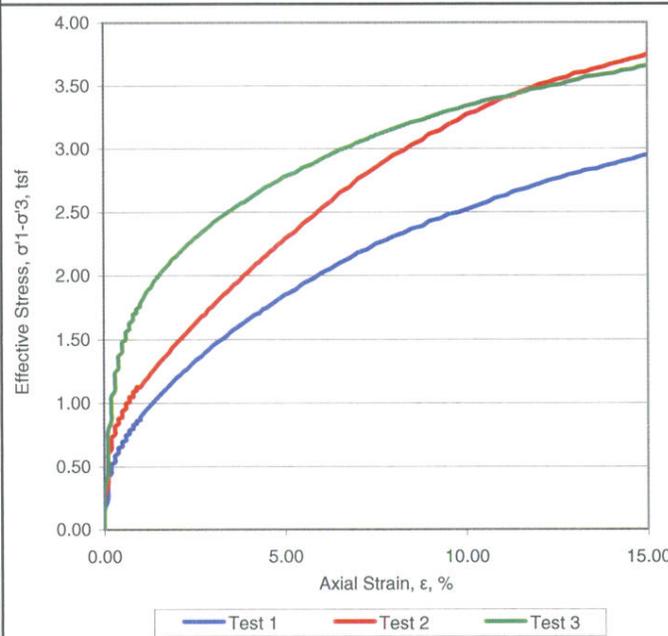
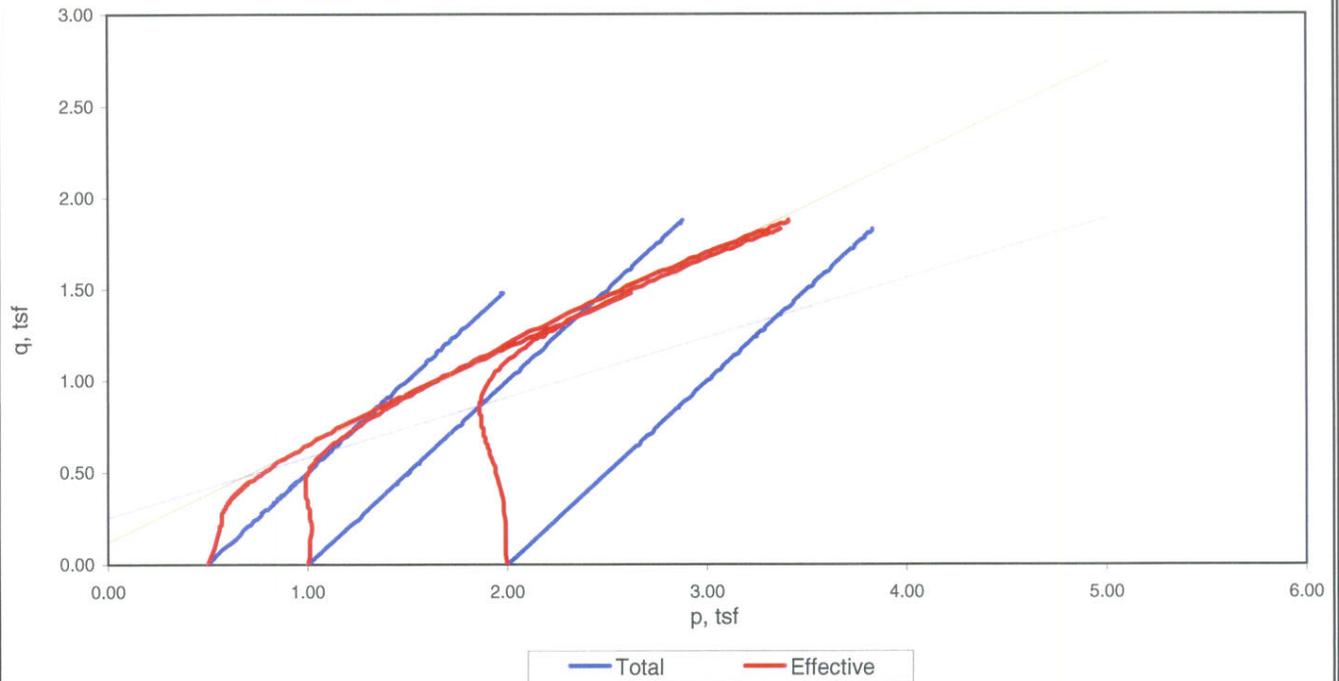
Remarks: Membrane correction applied. B Parameter >= 0.96

Peak Strength selected at maximum effective stress ratio (obliquity)

Method of Saturation: Wet Mounted	Project:	Caltrans TO58904	PLATE X of X X-XX
	Project No.:	93276-40LAB	
	Boring:	R-10-002	
	Sample:	7 (6,7,8)	
	Depth, ft.:	16.5-21.5	
	Date:	May 24, 2010	

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Total		Effective	
a =	0.25 tsf	a =	0.12 tsf
ψ =	18.1 Deg.	ψ =	27.6 Deg.
Tan ψ =	0.33	Tan ψ =	0.52



Rate of strain, % / hr: 1.3

Description of Specimen 1 Light Brown Sandy Silt

Description of Specimen 2 Light Brown Sandy Silt

Description of Specimen 3 Light Brown Sandy Silt

Amount of Material Finer than the No. 200, %: no test

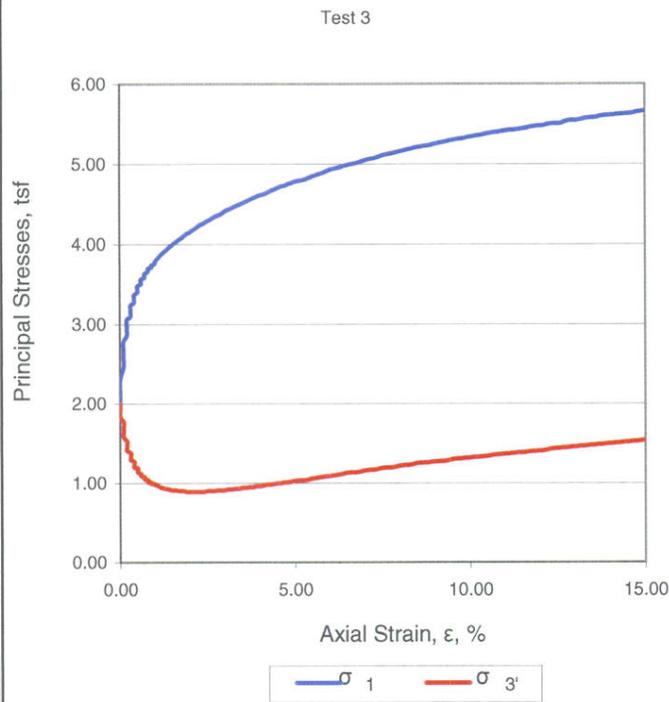
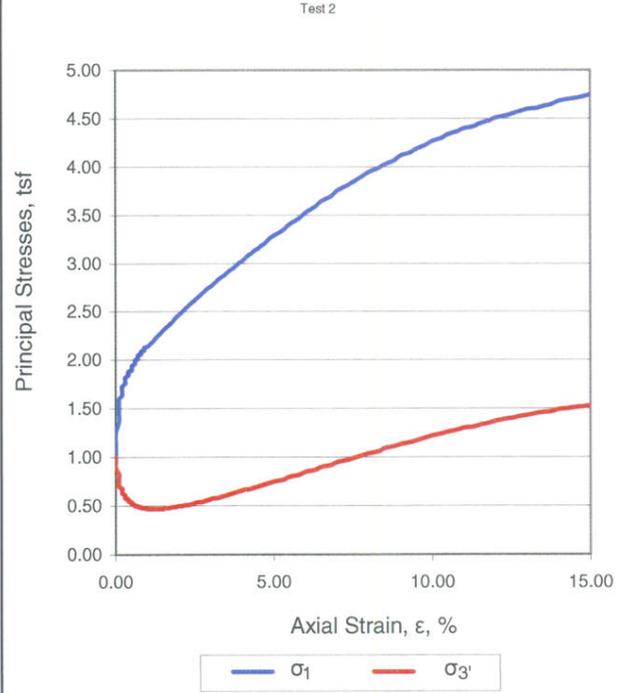
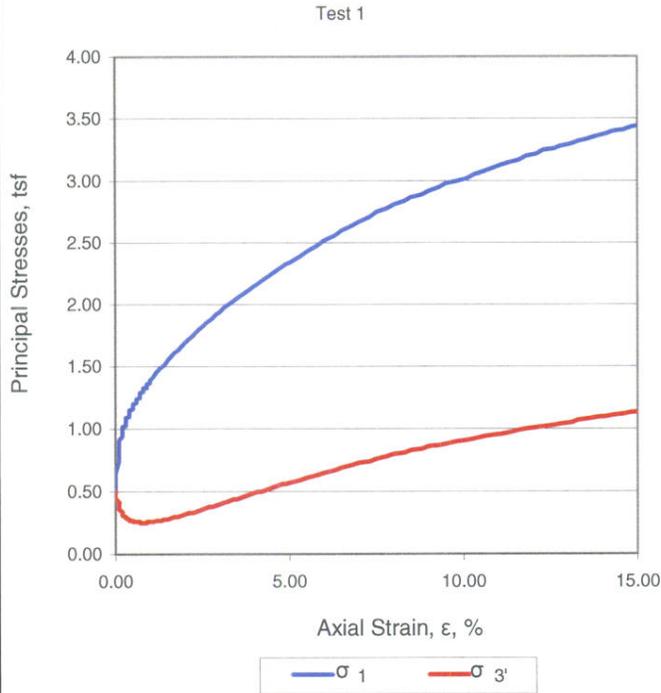
LL: no test | PL: no test | PI: no test | G_s: 2.65 Assumed | Type of Specimen: Undisturbed | Type of Test: ASTM D-4767

Remarks: Membrane correction applied. B Parameter >= 0.96

Peak Strength selected at maximum effective stress ratio (obliquity)

Method of Saturation: Wet Mounted	Project:	Caltrans TO58904	PLATE X of X X-XX
	Project No.:	93276-40LAB	
	Boring:	R-10-002	
	Sample:	7 (6,7,8)	
	Depth, ft.:	16.5-21.5	
	Date:	May 24, 2010	

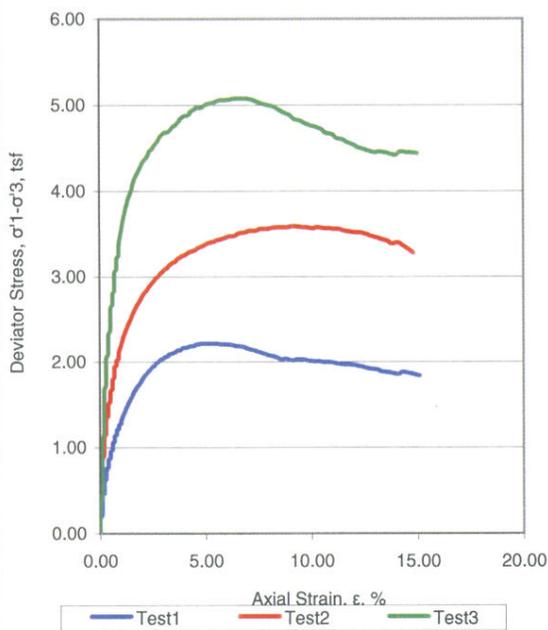
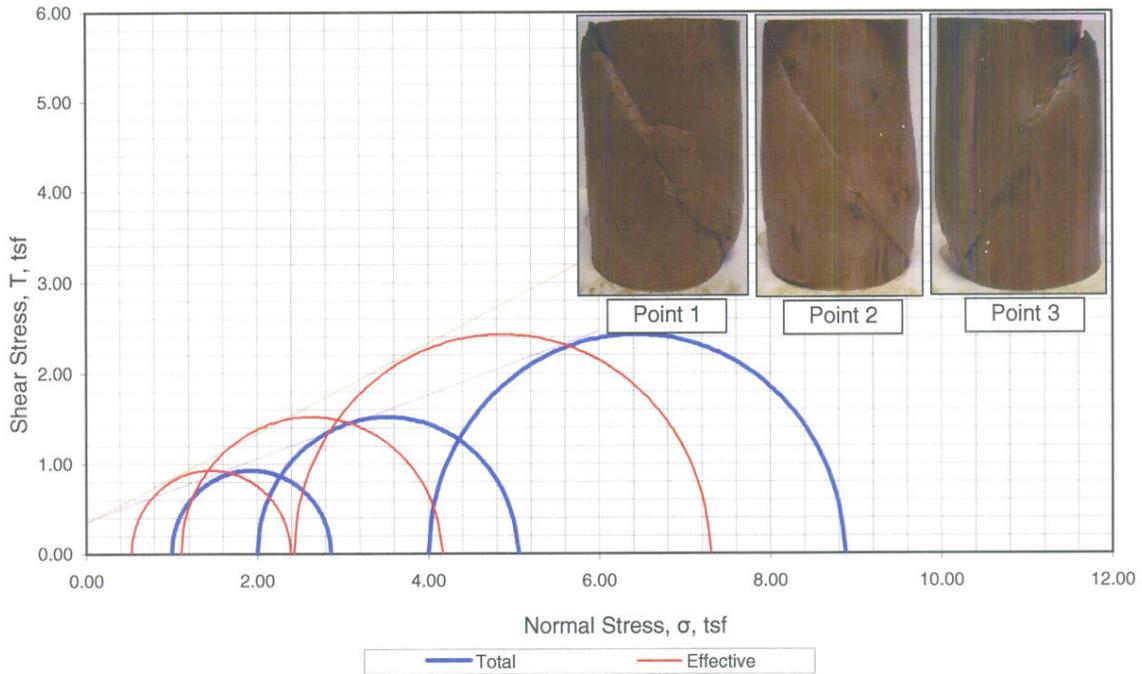
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Rate of strain, % / hr: 1.3	
Description of Specimen 1 Light Brown Sandy Silt	
Description of Specimen 2 Light Brown Sandy Silt	
Description of Specimen 3 Light Brown Sandy Silt	
Amount of Material Finer than the No. 200, %: no test	
LL: no test	PL: no test PI: no test G _s : 2.65 Assumed Type of Specimen: Undisturbed Type of Test: ASTM D-4767
Remarks: Membrane correction applied. B Parameter >= 0.96	
Peak Strength selected at maximum effective stress ratio (obliquity)	
Method of Saturation: Wet Mounted	Project: Caltrans TO58904
<p>3077 Fite Circle Sacramento, CA 95827 p 916.366.1701 f 916.366.7013 kleinfelder.com</p>	Project No.: 93276-40LAB
	Boring: R-10-002
	Sample: 7 (6,7,8)
	Depth, ft.: 16.5-21.5
	Date: May 24, 2010
PLATE X of X X-XX	

Total		Effective	
c =	0.36 tsf	c' =	0.34 tsf
φ =	19.4 Deg.	φ' =	26.5 Deg.
tan φ =	0.35	tan φ' =	0.50

Specimen Shear Picture



Specimen No.			1	2	3
Initial	Water Content, %	ω_0	32.0	29.7	23.6
	Dry Density, lbs/ft ³	γ_{d0}	91.6	93.9	100.8
	Saturation, %	S_0	103.0	101.0	95.2
	Void Ratio	e_0	0.84	0.79	0.67
Before Shear	Water Content, %	ω_f	31.8	29.6	27.4
	Dry Density, lbs/ft ³	γ_{dc}	90.6	93.6	96.8
	Saturation, %	S_c	100.0	100.0	100.0
	Void Ratio	e_c	0.86	0.80	0.74
	Final Back Pressure, tsf	U_0	3.6	3.6	3.6
Minor Principal Stress, tsf		σ_3	1.00	2.00	4.00
Maximum Deviator Stress, tsf		$(\sigma_1 - \sigma_3)_{max}$	1.86	3.04	4.85
Time to $(\sigma_1 - \sigma_3)_{max}$, min		t_f	88.1	120.1	160.2
Deviator Stress @ 15% Axial Strain, tsf		$(\sigma_1 - \sigma_3)_{15\%}$	1.84	3.28	4.44
Axial Strain at failure, %		ϵ	2.2	2.9	3.9
Peak Pore Pressure at failure, tsf		U	4.090	4.503	5.175
Δ Pore Pressure at failure (ΔU), tsf		ΔU	0.472	0.895	1.570

Rate of strain, %/hr: 1.5

Description of Specimen 1: Light Brown Lean Clay

Description of Specimen 2: Light Brown Lean Clay

Description of Specimen 3: Light Brown Lean Clay

Amount of Material Finer than the No. 200, %: no test

LL: no test | PL: no test | PI: no test | G_s : 2.70 Assumed

Type of Specimens: Undisturbed

Type of Test: ASTM D-4767

Remarks: Membrane and filter strip correction applied. B Parameter ≥ 0.98

Peak Strength selected at maximum effective stress ratio (obliquity)

Method of Saturation: Wet Mounted



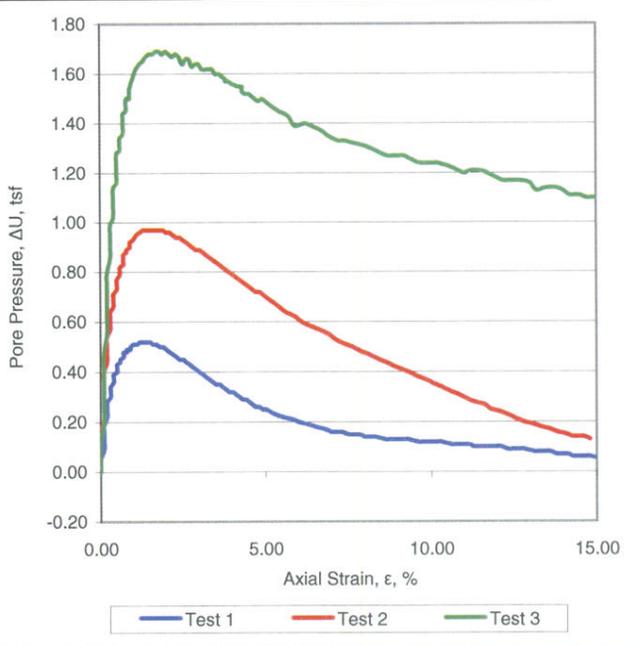
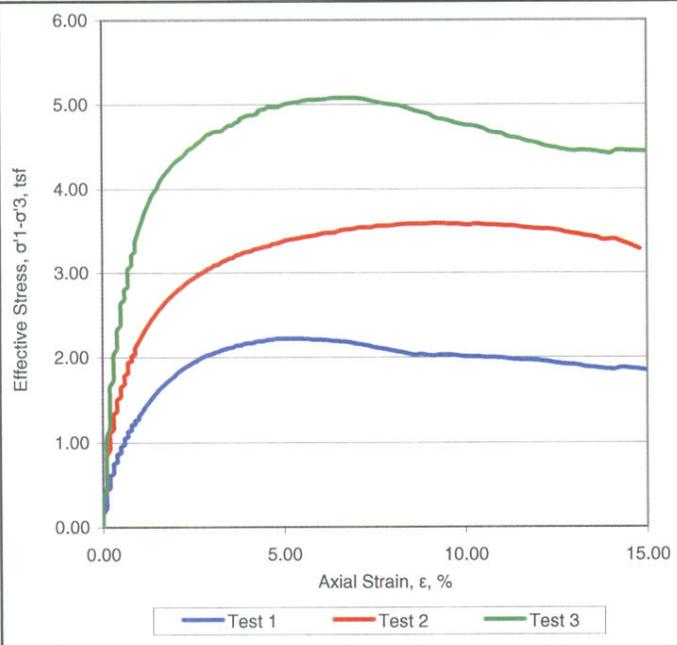
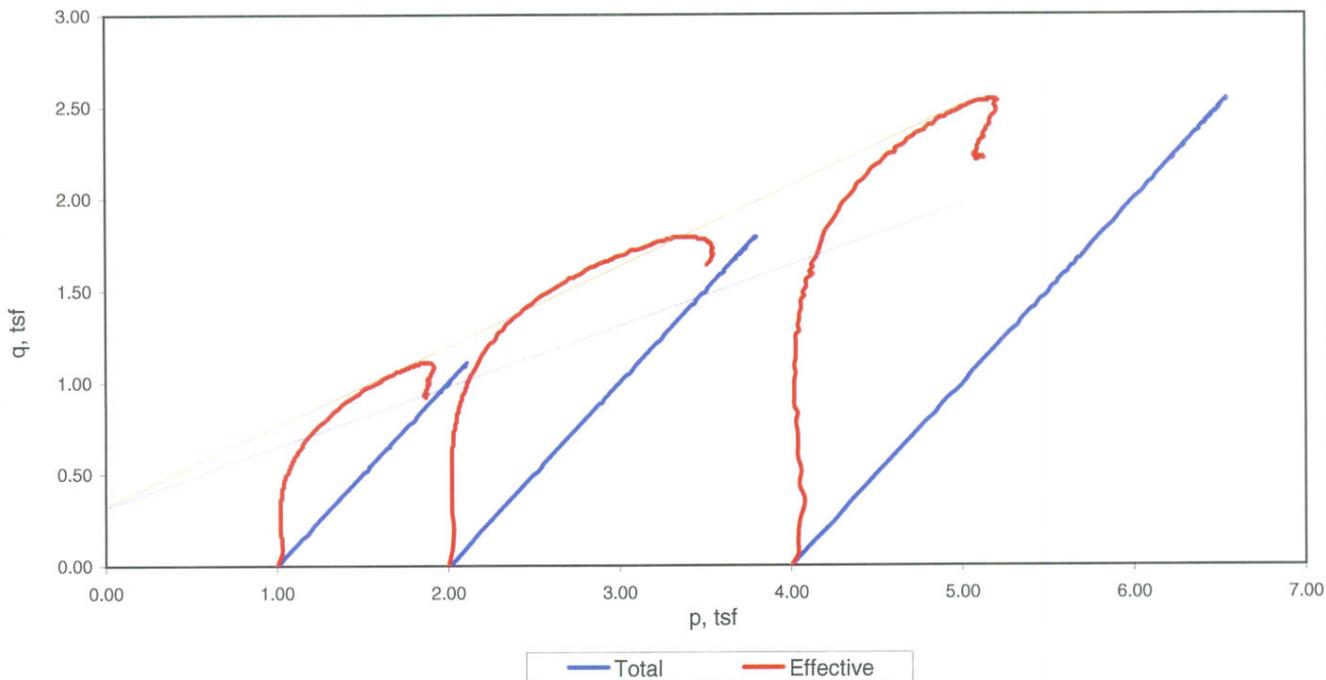
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Project:	Caltrans TO58940
Project No.:	93276-40LAB
Boring:	R-10-002
Sample:	13 (6,7,8)
Depth, ft.:	31.5-36.5'
Date:	May 19, 2010

PLATE
 X of X

X-XX

Total		Effective	
a =	0.32 tsf	a =	0.32 tsf
ψ =	18.3 Deg.	ψ =	23.6 Deg.
Tan ψ =	0.33	Tan ψ =	0.44



Rate of strain, % / hr: 1.5

Description of Specimen 1 Light Brown Lean Clay

Description of Specimen 2 Light Brown Lean Clay

Description of Specimen 3 Light Brown Lean Clay

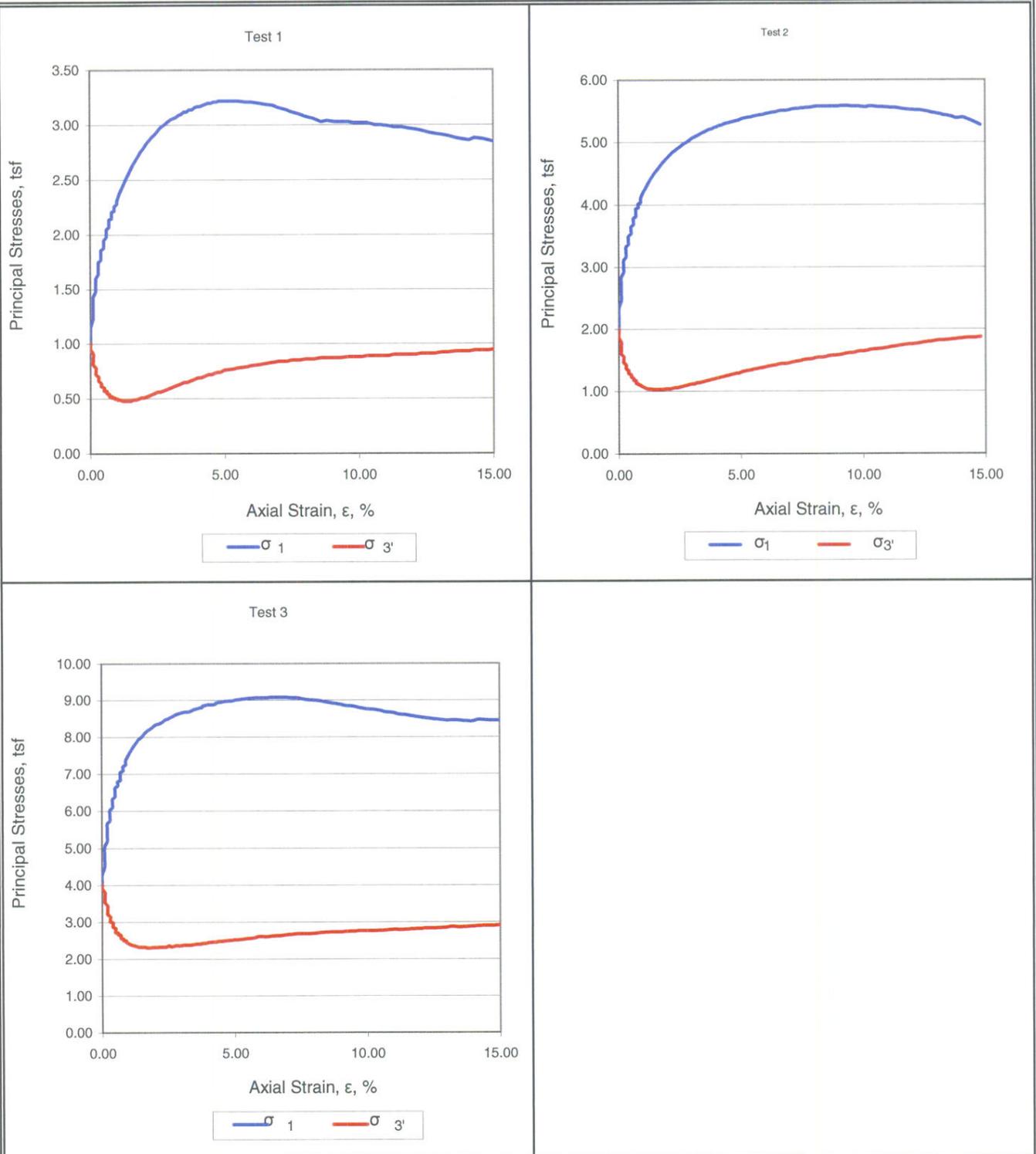
Amount of Material Finer than the No. 200, %: no test

LL: no test | PL: no test | PI: no test | G_s: 2.70 Assumed | Type of Specimen: Undisturbed | Type of Test: ASTM D-4767

Remarks: Membrane and filter strip correction applied. B Parameter >= 0.98

Peak Strength selected at maximum effective stress ratio (obliquity)

Method of Saturation: Wet Mounted	Project:	Caltrans TO58940	PLATE X of X X-XX
	Project No.:	93276-40LAB	
	Boring:	R-10-002	
	Sample:	13 (6,7,8)	
	Depth, ft.:	31.5-36.5'	
	Date:	May 19, 2010	



Rate of strain, % / hr: 1.5	
Description of Specimen 1 Light Brown Lean Clay	
Description of Specimen 2 Light Brown Lean Clay	
Description of Specimen 3 Light Brown Lean Clay	
Amount of Material Finer than the No. 200, %:	no test
LL: no test PL: no test PI: no test G_s : 2.70 Assumed	Type of Specimen: Undisturbed Type of Test: ASTM D-4767
Remarks: Membrane and filter strip correction applied. B Parameter ≥ 0.98	
Peak Strength selected at maximum effective stress ratio (obliquity)	
Method of Saturation: Wet Mounted	Project: Caltrans TO58940
<p>3077 Fite Circle Sacramento, CA 95827 p 916.366.1701 f 916.366.7013 kleinfelder.com</p>	Project No.: 93276-40LAB
	Boring: R-10-002
	Sample: 13 (6,7,8)
	Depth, ft.: 31.5-36.5'
	Date: May 19, 2010
PLATE X of X X-XX	