Earth Systems Pacific

SOILS ENGINEERING REPORT
VISTA DEL RIO ROAD REPAIR
VISTA DEL RIO ROAD AT HUTTON ROAD
NIPOMO, CALIFORNIA

February 10, 2011

Prepared for

The County of San Luis Obispo

Prepared by

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February 10, 2011

FILE NO.: SL-16142-SA

Mr. Glen Marshall, P.E.
County of San Luis Obispo
Public Works Department
County Government Center, Room 208
San Luis Obispo, CA 93408

PROJECT: VISTA DEL RIO ROAD REPAIR
VISTA DEL RIO ROAD AT HUTTON ROAD
NIPOMO, CALIFORNIA

SUBJECT: Soils Engineering Report

Dear Mr. Marshall:

In accordance with your request, a soils engineering report to address the repair of Vista Del Rio Road near Hutton Road in Nipomo, California, has been completed. Preliminary geotechnical recommendations were developed based, in part, upon our discussions regarding this project, and are presented herein. Three bound copies and one email copy of the report are furnished for your use.

We appreciate the opportunity to have provided services for this project and look forward to working with you again in the future. If there are any questions concerning this report, please do not hesitate to contact the undersigned.

Sincerely,

Earth Systems Pacific

Dennis Shallenberger, G.E.

2/10/11

Doc. No.: 1102-059.SER

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APPENDICES

1.0 INTRODUCTION AND BACKGROUND

Vista Del Rio Road was improved from an agricultural road to a two-lane residential street in 2004-2005. The improvement was in conjunction with the Maria Vista Estates residential subdivision in Nipomo, California. A soils engineering report for the subdivision was prepared by GSI Soils, Inc. (GSI). GSI also provided construction observation and testing during the construction phase of the project. Following paving of the roadway cracks in the road developed; the actual timeframe during which this occurred is unknown. Following the bankruptcy of the developer, a bonding company took over the project. The bonding company retained Ninyo & Moore, a geotechnical consulting firm, to conduct an evaluation of the road distress. Ninyo & Moore drilled a series of borings and conducted extensive laboratory analysis.

Subsequent to Ninyo & Moore's work the project was taken over by the County of San Luis Obispo, who retained Asphalt Consulting Services to develop recommendations for repair. Asphalt Consulting Services in turn retained Joslin Geotechnical (Joslin) to conduct a geotechnical investigation and assist them in the development of repair recommendations. Joslin drilled additional borings, and conducted further laboratory analysis; however, no slope stability analysis was performed. In their report dated February 5, 2010, Joslin recommended removal of the road prism to a minimum depth of 4 feet, replacement of the excavated soil, and that the slope be reinforced via high confinement material (geocells) filled with compacted aggregate base.

Due to the estimated cost of the solution recommended by Joslin, the County requested a re-assessment of the road conditions and development of an alternate solution by our firm. Per our discussions with the County, the objective of this re-assessment was to develop a solution to effectively repair the road for a reasonable lifespan but for a pragmatic cost and without "improving" the road beyond the original design. Keeping two lanes of traffic open during the entire repair process is also essential.

2.0 SCOPE OF SERVICES

The scope of work for the soils engineering report included a general site reconnaissance, review of previous geotechnical reports and data as available, field exploration, laboratory testing, geotechnical analysis of data (including slope stability analysis), and the preparation of this report. It should be noted that while the complete reports by GSI and Joslin were available for our review, only a table showing the near-surface soil types and the laboratory test results from

the Ninyo & Moore report were available. The GSI report contained no boring logs for the subject area. Our analysis and subsequent recommendations were based upon verbal information provided by the client and a topographic map by EDA Design Professionals dated May 28, 2010.

This report and recommendations are intended to comply with applicable requirements of Chapter 33 of the 2001 California Building Code, as adopted by San Luis Obispo County, and common soils engineering practice in this area under similar conditions at this time. The test procedures were accomplished in general conformance with the standards noted, as modified by common geotechnical practice in this area under similar conditions at this time.

As there may be geotechnical issues yet to be resolved, the soils engineer should be retained to provide consultation as the design progresses, and to review project plans as they near completion to assist in verifying that pertinent geotechnical issues have been addressed and to aid in conformance with the intent of this report.

It is our intent that this report be used exclusively by the client to form the geotechnical basis of the design of the project and in the preparation of plans and specifications. Application beyond this intent is strictly at the user's risk.

This report does not address issues in the domain of contractors such as, but not limited to, site safety, loss of volume due to stripping of the site, shrinkage of soils during compaction, excavatability, temporary slope angles, construction means and methods, etc. Analyses of site geology and of the soil for corrosivity, asbestos (either naturally occurring or man-made), lead or mold potential, radioisotopes, hydrocarbons, or other chemical properties are beyond the scope of this report. Evaluation of ancillary features such as fences, light and flag poles, utility trenches, signage, and nonstructural fills are all not within our scope and are also not addressed.

In the event that there are any changes in the nature, design, or location of improvements, or if any assumptions used in the preparation of this report prove to be incorrect, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report verified or modified in writing by the soils engineer. The criteria presented in this report are considered preliminary until such time as any peer review or review by any jurisdiction has been completed, conditions are observed by the soils engineer

in the field during construction, and the recommendations have been verified as appropriate, or modified in writing by the soils engineer.

3.0 SITE SETTING

The portion of Vista Del Rio Road addressed in this report is located along the southern edge of the Nipomo Mesa in the County of San Luis Obispo, and extends from the intersection of Vista Del Rio and Hutton Road approximately 750 feet to the west. For the purposes of this report, Vista Del Rio is considered to run east-west. The road consists of two lanes paved with asphalt concrete and divided by discontinuous landscape islands. A cut slope ascends 20 to 25 feet to higher topography to the north. Rural residences and strawberry fields lie above the cut slope. Along the south side of the road is a descending fill slope above a natural slope, in turn above a near vertical cut slope which leads to the Santa Maria Raceway.

At the time of our site reconnaissance, settlement and cracking along the road was apparent. Referencing station numbers, as shown on the topographic map that was provided for our use, the cracks begin at about Station 7+35 and continue in an easterly direction. They are relatively minor until about Station 5+00, then become markedly more intense to the intersection with Hutton Road.

4.0 FIELD INVESTIGATION

As none of the previous geotechnical work performed for the project included analysis of the stability of the descending slope atop which the distressed road lies, it was our opinion that this type of assessment was necessary to aid in the evaluation of the distress. To acquire the soil samples necessary to develop the data upon which to base the analysis, additional exploratory borings were drilled on September 16, 2010. The three borings were drilled along Vista Del Rio using a truck-mounted Mobile Drill, Model B-53 drill rig, equipped with an 8-inch outside diameter hollow stem auger. The borings were extended to depths of up to 21.5 feet below the existing ground surface. As they were drilled, samples were taken using a ring-lined barrel sampler (ASTM D 3550-01/07, with shoe similar to D 2937-04), and Standard Penetration Tests (ASTM D 1586-08a) were conducted at selected depths. The approximate locations of these borings, along with borings drilled previously by Joslin, are shown on the Boring Location Map in Appendix A.

Soils encountered in the borings logged by this firm were categorized and logged in general accordance with the Unified Soil Classification System and ASTM D 2488-09a. Copies of the boring logs, along with a Boring Log Legend, can also be found in Appendix A. In reviewing the boring logs and legend, the reader should realize that the legend is intended as a guideline only, and there are a number of conditions that may influence the soil characteristics as observed during drilling. These include, but are not limited to, the presence of cobbles or boulders, cementation, variations in soil moisture, presence of groundwater, and other factors. Consequently, the logger must exercise judgment in interpreting soil characteristic, possibly resulting in soil descriptions that vary somewhat from the legend. Following our logs in Appendix A, the Joslin legend and boring logs can be found.

5.0 LABORATORY ANALYSIS

The ring samples were tested for unit weight and moisture (ASTM D 2937-04, as modified for ring liners). A bulk sample was tested for optimum moisture vs. optimum density (ASTM D 1557-09, modified), and direct shear tests (ASTM D 3080-04) were performed on four ring samples. The laboratory test results can be found in Appendix B.

6.0 GENERAL SUBSURFACE PROFILE

Beneath a structural section consisting of 2.5 to 2.75 inches of asphalt concrete over 5.5 to 14 inches of aggregate base, fill soils were encountered in the three borings logged by this firm. The fill consisted of light yellow brown to brown silty sand. In Boring 2 it transitioned to yellow brown/grey brown mottled sandy lean clay; in Boring 3 it contained intermittent lenses of clayey sand. The depth of the fill in the areas drilled ranged from 3.5 feet in Boring 1 to 12 feet in Boring 3. The fill sand was logged as being loose to medium dense; the clay was medium stiff.

The fill was underlain by older dune sand that consisted of silty sand, poorly graded sand or clayey sand. The older dune sand was light to dark yellow brown. In Borings 1 and 2 it was logged as loose to very loose; in Boring 3 it was medium dense.

Alluvium was encountered at depths of 7.5 to 17 feet. Generally, the alluvial soils were significantly more clayey than the overlying fill or older dune sand, consisting predominantly of sandy lean clay and clayey sand. In Boring 1, however, poorly graded sand alluvium was found at a depth of 14.5 feet, below the sandy clay. Conditions were logged as medium stiff (or medium dense) to very stiff.

At the time of drilling, the soil conditions were slightly moist to moist. No free subsurface water was encountered.

Soils shown on the Joslin logs are similar to those encountered by this firm; however, the nomenclature varies slightly.

7.0 SLOPE STABILITY ANALYSIS

A cross section A-A' was drawn through the area that encompassed the tallest upslope cut, the deepest fill, and where concentrated cracks were present. The cross section can be found in Appendix A; and its location is shown on the Boring Location Map. The stability analyses were conducted for a variety of possible soil and groundwater conditions using the PCSTABL5 software program and the Modified Bishop and Janbu methods of slices. Local stability of the road fill sitting on top of the older dune sand and alluvium was investigated, as was the global stability from above the ascending cut slope to the level of the raceway. The soil strength and densities parameters used in the analysis were taken from laboratory testing, the results of which are presented in Appendix B. Moisture contents were varied from "moist" to "saturated" for the various horizons as considered to be reasonably plausible in nature.

Under the local conditions analyzed, factor of safety ranged from 1.33 for the fully saturated state to 2.16 for moist fill soil overlying saturated native soils. Under global conditions the factors of safety varied from 1.43 for saturated conditions to 1.62 for moist fill and saturated native soils. These factors of safety indicate that instability is unlikely to be the cause of, or even a factor in, the distress seen in the road. The results of the analysis, presented as Surficial Slope Stability Plots, can be found in Appendix C.

8.0 CONCLUSIONS

In our opinion, based upon the results of the field exploration and laboratory testing of our firm and those before us, and upon our slope stability analysis, it is unlikely that the road distress is due to instability of the slope and is probably primarily due to poorly compacted fill and/or underlying native soils. Borings revealed profiles consisting of fill overlying older dune sand, which was in turn underlain by alluvium. The fill, which ranged from 3.5 to 12 feet, was logged as being in a loose to medium dense condition, and the results of unit weight vs. moisture tests indicated relative compactions as low as 87 percent. The majority of the older dune sands were

also logged as being loose to very loose. Highly variable moisture contents, often found in association with poor compaction, were found in the soil samples; the moisture contents ranged from about 2 percent to over 30 percent.

The slope stability analyses yielded factors of safety that were high enough to indicate that slope instability is unlikely to be a factor in the road distress. Eliminating instability, the analysis leads to the conclusion that the poorly compacted soils are probably settling and deforming in the direction of the free slope face. To our knowledge there are no drains in the fill, and so the soil movement is probably exacerbated by high soil moisture in some of the soil layers.

Several potential solutions for the repair of the road were considered, ranging from complete overexcavation and rebuilding of the roadway and the slope, to lesser overexcavation options and various forms of slope retention, to partial overexcavation without retention. Following a meeting with the client to discuss the various options, a solution of partial overexcavation and reconstruction of the roadbed, incorporating geogrid reinforcement, was agreed upon.

The reconstruction may be to a single uniform depth throughout the length of the project, or may proceed in two phases, each with its own depth. The first phase could extend from Sta. 7+35 +/- to Sta. 5+25 +/-, and would involve only removal of the structural section, recompaction of the subgrade, placement of a geogrid and reconstruction of the structural section. This area would only incorporate the eastbound lane and the area of the landscape islands. From Sta. 5+25 +/- to the intersection with Hutton Road, the area where the cracking is more severe, a deeper overexcavation program would be utilized to remove some of the poorly compacted fill and to replace it with properly compacted fill reinforced with three layers of geogrid to increase the stability and strength of the soil. A back drain would be constructed in the overexcavation area and an edge drain would be installed along the northern edge of the pavement throughout the project. The deeper overexcavation area would encompass the eastbound lane, the landscape islands and as much additional roadway to the north as could be removed while still maintaining two-way traffic.

If a single depth approach is preferred, the deeper overexcavation and reconstruction described for the area from Sta. 5+25 to Hutton Road would simply be extended to the west end of the project at Sta. 7+35 +/-.

With either scenario, prior to the start of work, the existing asphalt concrete (AC) would be ground and used to construct a temporary roadway that will allow two-way traffic to bypass the construction area during the construction period.

9.0 RECOMMENDATIONS

Site Preparation and Grading

1. The site should be prepared for construction by removing the existing landscape islands, debris, and other deleterious materials throughout the project area (i.e. from the western edge of the intersection of Hutton Road to Sta. 7+35 +/-).

2. The existing AC in the project area should then be ground and may be used to build a temporary roadway as wide as necessary to maintain two-way traffic. K-rails and/or other safety measures should be placed as per applicable codes and the engineer's specifications.

3. If a two-depth approach is specified, from Station 7+35 +/- to Station 5+25 +/-, the soil should be removed to a depth of at least 12 inches below planned AC grade and a new subgrade established. The upper foot of the subgrade should be scarified, moisture-conditioned to optimum moisture content, or just above, and recompacted to a minimum of 95 percent of maximum dry density. Once compacted, the subgrade should be proofrolled with heavy rubber-tired grading equipment to verify stability.

4. After a stable subgrade has been confirmed, a single layer of geogrid (Tensar TX-160 or approved equivalent) should be placed upon the prepared subgrade per the manufacturer's recommendations.

5. A minimum of 9 inches of Class 2 aggregate base should then be placed, moisture conditioned, and compacted to a minimum of 95 percent of maximum dry density. The aggregate base should be firm and unyielding when proofrolled with heavy, rubber-tired grading equipment in a manner similar to the subgrade.

6. From Station 5+25 +/- to the western edge of the intersection with Hutton Road, the soil should be overexcavated to a minimum depth of 5 feet below the planned AC surface. The resulting surface should be scarified to a minimum depth of 1 foot, moisture

conditioned to optimum moisture content, or just above, and recompacted to a minimum of *95 percent* of maximum dry density. A back drain should then be placed within the excavation; please see Appendix D for a typical back drain detail.

7. The same type of geogrid as described previously should then be placed, per the manufacturer's recommendations, throughout the excavation with at least 8 feet of extra material on the outer edge. Two feet of fill soil should be placed on the geogrid, in maximum 8-inch thick loose lifts. Each lift should be moisture conditioned, and compacted to a minimum of *95 percent* of maximum dry density.

8. Following compaction of 2 feet of fill in the excavation, the geogrid fabric should be wrapped around the face of the fill, and extended a minimum of 6 feet back on the compacted fill surface. Another layer of geogrid should then be placed, again with an extra 8 feet of material along the outer edge. Additional fill should then be placed, moisture conditioned, and compacted to subgrade elevation. Once compacted, the subgrade should be proofrolled as described previously.

9. Following proofrolling of the subgrade, the geogrid should be wrapped around the face of the fill and 6 feet back onto the subgrade. One last layer of geogrid should be placed on top of the compacted subgrade; no extra material will be needed along the outer edge of this layer.

10. A minimum of 9 inches of Class 2 aggregate base should be placed on the geogrid/subgrade, moisture conditioned, and compacted to a minimum of 95 percent of maximum dry density. The base should be proofrolled to verify stability as described previously.

11. An edge drain should be installed along the entire north side of the road bed. A detail of a typical edge drain can also be found in Appendix D.

12. If a single-depth overexcavation program is preferred, the deeper program (i.e. that recommended from Sta. 5+25 +/- to Hutton Road) should be extended throughout the entire project.

13. All geogrid should placed in accordance with manufacturer's recommendations.

14. Once the road fill and base has been reconstructed, the entire project should be paved with a minimum of 3 inches of AC.

15. The overexcavated soils may be re-used as fill soil. In general, all materials used as fill should be cleaned of all debris, and any rocks larger than 3 inches in diameter. If fill material includes rocks, the rocks should be placed in a sufficient soil matrix to ensure that voids caused by nesting of the rocks will not occur and that the fill can be properly compacted.

16. All fill should be placed with moisture contents at optimum moisture content or just above. Moisture contents well in excess of optimum should be avoided, as unstable conditions could result. Fill should be placed in maximum lifts of 8 inches in loose thickness and, unless otherwise stated, compacted to a minimum of *95 percent* of maximum dry density.

17. The recommended soil moisture content should be maintained throughout construction. Failure to maintain the soil moisture content can result in desiccation cracks and disturbance, which are an indication of degradation of soil compaction. Soils that have cracked due to desiccation or are otherwise disturbed should be removed, moisture conditioned, and recompacted.

18. Stabilization of surface soils *during and following construction* is essential to reduce the potential for erosion damage. The soils should be protected through erosion matting, vegetation, or other erosion control measures. Care should be taken to establish and maintain vegetation.

19. To reduce the potential for disruption of drainage patterns, rodent activity should be aggressively controlled.

Observation and Testing

1. It must be recognized that the recommendations contained in this report are based on a limited number of borings drilled at the site and rely on continuity of the subsurface conditions encountered.

2. Unless otherwise stated, the terms "compacted" and "recompacted" refer to soils placed in level lifts not exceeding 8 inches in loose thickness and compacted to a minimum of 95 percent of maximum dry density.

3. Unless otherwise stated, "moisture conditioning" refers to the moistening or drying of soils to optimum moisture content, or just above, prior to application of compactive effort.

4. The standard tests used to define maximum dry density and field density should be ASTM D 1557-09 and ASTM D 6938-08a, respectively, or other methods acceptable to the soils engineer and jurisdiction.

5. At a minimum, the following items should be reviewed, tested, or observed by the soil engineer:
   - Review of grading and improvement plans as they near completion to verify conformance with the recommendations presented in this report
   - Professional observation during grading
   - Observation of geogrid placement
   - Observation of back drain and edge drain construction
   - Oversight of compaction testing during grading
   - Oversight of soil special inspection during grading

6. The following items should be verified by the site inspector or soil special inspector:
   - Removal of AC, landscape islands, and vegetation
   - Overexcavation to the correct depth
   - Scarification, moisture conditioning and recompaction of the bottoms of the overexcavation areas.
   - Fill quality, placement, moisture conditioning, and compaction.
   - Geogrid placement
   - Back drain and edge drain placement

7. A program of quality control should be developed prior to the beginning of the project. The client should determine if any additional items need to be inspected.

8. Locations and frequency of compaction tests should be as per the recommendation of the client or soils engineer at the time of construction. The recommended test location and frequency may be subject to modification, based upon soil and moisture conditions encountered, size and type of equipment used by the contractor, the general trend of the results of compaction tests, or other factors.

9. A preconstruction conference among the client, the soils engineer, and the contractor is recommended to discuss planned construction procedures and quality control requirements.

10.0 CLOSURE

Our intent was to perform the investigation in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the locality of this project under similar conditions. No representation, warranty, or guarantee is either expressed or implied. This report is intended for the exclusive use by the client as discussed in the "Scope of Services" section. Application beyond the stated intent is strictly at the user's risk.

This report is valid for conditions as they exist at this time for the type of project described herein. The conclusions and recommendations contained in this report could be rendered invalid, either in whole or in part, due to changes in building codes, regulations, standards of geotechnical or construction practice, changes in physical conditions, or the broadening of knowledge.

If changes with respect to project type or location become necessary, if items not addressed in this report are incorporated into plans, or if any of the assumptions used in the preparation of this report are not correct, the soils engineer shall be notified for modifications to this report. Any items not specifically addressed in this report should comply with Chapter 33 of the 2001 California Building Code (CBC) as adopted by the County, and the requirements of the governing jurisdiction.

The preliminary recommendations of this report are based upon geotechnical conditions encountered at the site, and may be augmented by additional requirements of the architect/engineer, or by additional recommendations provided by the soils engineer based on peer or jurisdictional reviews, or conditions exposed at the time of construction.

Thank you for this opportunity to have been of service. If you have any questions, please feel free to contact this office at your convenience.

End of Text

APPENDIX A

Boring Location Map

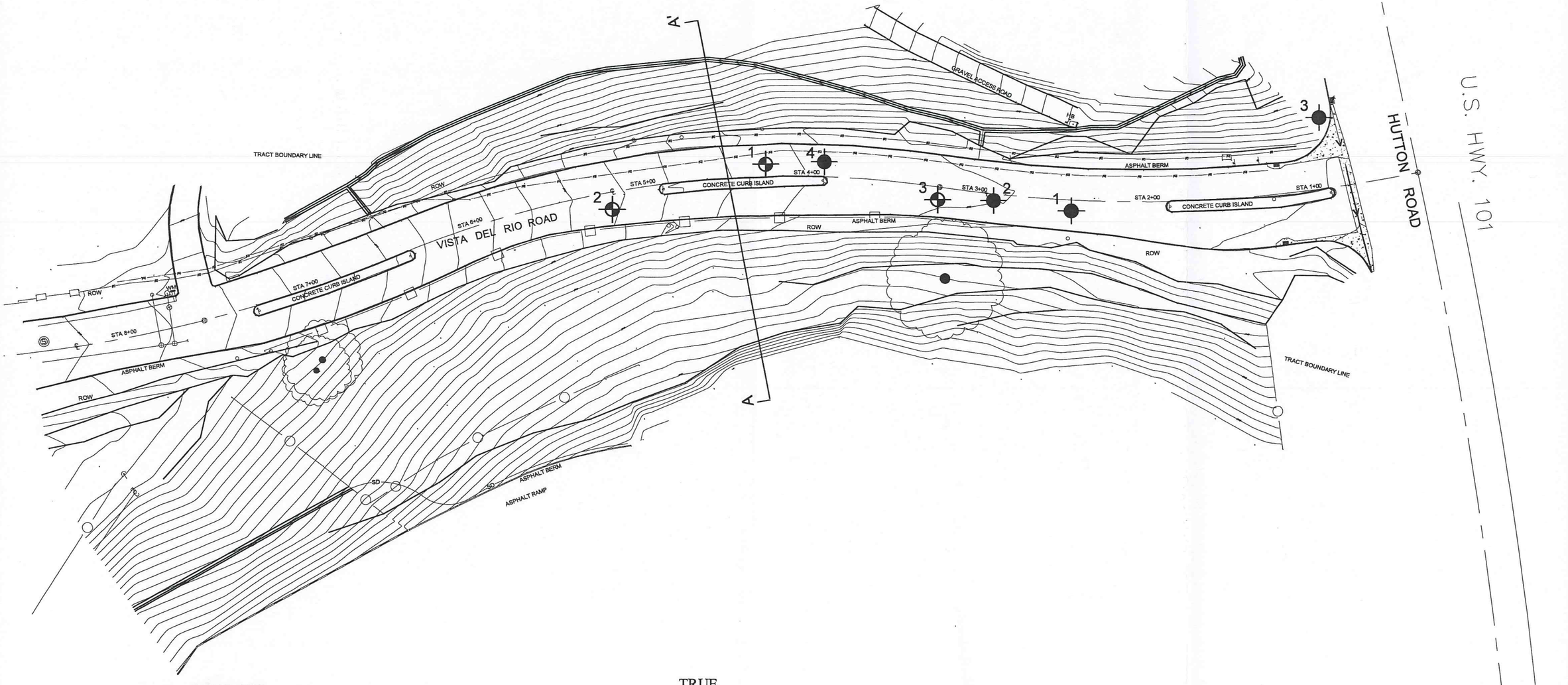
Boring Log Legend (Earth Systems Pacific)

Boring Logs (Earth Systems Pacific)

Boring Log Legend (Joslin Geotechnical)

Boring Logs (Joslin Geotechnical)

Cross Section A-A'



LEGEND

3 Boring Location (Approx.), Earth Systems Pacific

4 Boring Location (Approx.), Joslin Geotechnical

A A' Cross Section

TRUE NORTH

NOT TO SCALE

PROJECT NORTH

BASE MAP PROVIDED BY EDA

BORING LOCATION MAP

VISTA DEL RIO ROAD REPAIR

Vista Del Rio Road at Hutton Road
Nipomo, California

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November 23, 2010

VISTA DEL RIO REPAIR-112310borings.dwg

Earth Systems Pacific

BORING LOG LEGEND

SAMPLE / SUBSURFACE WATER SYMBOLS	GRAPH. SYMBOL
CALIFORNIA MODIFIED	
STANDARD PENETRATION TEST (SPT)	
SHELBY TUBE	
BULK	
SUBSURFACE WATER DURING DRILLING	
SUBSURFACE WATER AFTER DRILLING	

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS	GROUP SYMBOL	TYPICAL DESCRIPTIONS	GRAPH. SYMBOL
COARSE GRAINED SOILS (MORE THAN HALF OF MATERIAL IS TESTED OR JUDGED TO BE LARGER THAN #200 SIEVE SIZE)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
	GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES	
	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
	SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
	SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES	
FINE GRAINED SOILS (HALF OR MORE OF MATERIAL IS TESTED OR JUDGED TO BE SMALLER THAN #200 SIEVE SIZE)	ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY, CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY	
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY, SILTY SOILS, ELASTIC SILTS	
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

OBSERVED MOISTURE CONDITION

DRY	SLIGHTLY MOIST	MOIST	VERY MOIST	WET
LITTLE/NO MOISTURE	JUDGED BELOW OPTIMUM	JUDGED ABOUT OPTIMUM	JUDGED OVER OPTIMUM	SATURATED

TYPICAL CONSISTENCY

COARSE GRAINED SOILS

BLOWS/FOOT		DESCRIPTIVE TERM
SPT	CA SAMPLER	
0-10	0-16	LOOSE
11-30	17-50	MEDIUM DENSE
31-50	51-83	DENSE
OVER 50	OVER 83	VERY DENSE

FINE GRAINED SOILS

BLOWS/FOOT		DESCRIPTIVE TERM
SPT	CA SAMPLER	
0-2	0-3	VERY SOFT
3-4	4-7	SOFT
5-8	8-13	MEDIUM STIFF
9-15	14-25	STIFF
16-30	26-50	VERY STIFF
OVER 30	OVER 50	HARD

GRAIN SIZES

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENING		
# 200	# 40	# 10	# 4	3/4"	3"	12"

SILT & CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

TYPICAL ROCK HARDNESS

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
EXTREMELY HARD	CORE, FRAGMENT, OR EXPOSURE CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CAN ONLY BE CHIPPED WITH REPEATED HEAVY HAMMER BLOWS
VERY HARD	CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CORE OR FRAGMENT BREAKS WITH REPEATED HEAVY HAMMER BLOWS
HARD	CAN BE SCRATCHED WITH KNIFE OR SHARP PICK WITH DIFFICULTY (HEAVY PRESSURE); HEAVY HAMMER BLOW REQUIRED TO BREAK SPECIMEN
MODERATELY HARD	CAN BE GROOVED 1/16 INCH DEEP BY KNIFE OR SHARP PICK WITH MODERATE OR HEAVY PRESSURE; CORE OR FRAGMENT BREAKS WITH LIGHT HAMMER BLOW OR HEAVY MANUAL PRESSURE
SOFT	CAN BE GROOVED OR GOUGED EASILY BY KNIFE OR SHARP PICK WITH LIGHT PRESSURE, CAN BE SCRATCHED WITH FINGERNAIL; BREAKS WITH LIGHT TO MODERATE MANUAL PRESSURE
VERY SOFT	CAN BE READILY INDENTED, GROOVED OR GOUGED WITH FINGERNAIL, OR CARVED WITH KNIFE; BREAKS WITH LIGHT MANUAL PRESSURE

TYPICAL ROCK WEATHERING

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
FRESH	NO DISCOLORATION, NOT OXIDIZED
SLIGHTLY WEATHERED	DISCOLORATION OR OXIDATION IS LIMITED TO SURFACE OF, OR SHORT DISTANCE FROM; SOME FRACTURES PRESENT; FELDSPAR CRYSTALS ARE DULL
MODERATELY WEATHERED	DISCOLORATION OR OXIDATION EXTENDS FROM FRACTURES, USUALLY THROUGHOUT; Fe-Mg MINERALS ARE "RUSTY"; FELDSPAR CRYSTALS ARE "CLOUDY"
INTENSELY WEATHERED	DISCOLORATION OR OXIDATION THROUGHOUT; FELDSPAR AND Fe-Mg MINERALS ARE ALTERED TO CLAY TO SOME EXTENT OR CHEMICAL ALTERATION PRODUCES IN SITU DISAGGREGATION
DECOMPOSED	DISCOLORATION OR OXIDATION THROUGHOUT, BUT RESISTANT MINERALS SUCH AS QUARTZ MAY BE UNALTERED; FELDSPAR AND Fe-Mg MINERALS ARE COMPLETELY ALTERED TO CLAY

drafting/masters/Boring Log Legend091600.dwg

Earth Systems Pacific

Boring No. 1
PAGE 1 OF 1

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem
STA 4+25, 13ft South of North Curb Face
JOB NO.: SL-16142-SA
DATE: 09/16/10

VISTA DEL RIO ROAD REPAIR
Vista Del Rio Road at Hutton Road
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			2.5" AC OVER 5.5" AGGREGATE BASE					
1	SM		SILTY SAND: light yellow/brown mottled, medium dense, moist (fill)	1.0–2.5	■			12 13 11
2								
3								2
4	SM		SILTY SAND: dark yellow brown, loose to very loose, moist (older dune sand)	3.5–5.0	■	101.9	6.1	3 5
5				5.0–6.5	■	107.9	4.2	3 4 5
6			intermittent lenses of clayey sand to 2" thick					
7								
8								
9				9.0–10.5	■			2 4 6
10	CL		SANDY LEAN CLAY: grey brown, medium stiff, moist (alluvium)	10.5–12.0	■	80.6	36.5	2 6 8
11								
12			stiff					
13								3
14				13.5–15.0	■			8 9
15	SP		POORLY GRADED SAND: light yellow brown/yellow brown mottled, medium dense, moist, slightly cemented					
16								
17								
18								
19								
20			End of Boring @ 19.0' No subsurface water encountered					
21								
22								
23								
24								
25								
26								

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 2
PAGE 1 OF 1

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem
STA 5+16, 9ft North of South Curb Face
JOB NO.: SL-16142-SA
DATE: 09/24/10

VISTA DEL RIO ROAD REPAIR
Vista Del Rio Road at Hutton Road
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			2.75" AC OVER 6.0" AGGREGATE BASE					
1	SM		SILTY SAND: yellow brown, loose, moist, trace clay (fill)	2.0–3.5	■	99.2	17.7	2 3 4
2				2.0–3.5	○			
3								
4	CL		SANDY LEAN CLAY: yellow brown/grey brown mottled, medium stiff, moist, interbedded lenses of clayey sand to 3" thick	4.0–5.5	■			1 5 7
5								
6	SC		CLAYEY SAND: yellow brown, loose, moist (older dune sand)	6.0–7.5	■	82.2	34.5	3 3 6
7								
8	SC		CLAYEY SAND: grey brown, medium dense, moist (alluvium)					
9				9.0–10.5	■	107.8	15.5	3 8 16
10			grey brown/red brown mottled, medium dense, moist, moderately cemented					
11								
12								
13								5
14			intermittent pockets of poorly graded sand, slightly moist	13.5–15.0	■			11 30
15								
16								
17								
18			dense, trace coarse shale gravel					
19								
20				20.0–21.5	●			8 15 20
21								
22			End of Boring @ 21.5' No subsurface water encountered					
23								
24								
25								
26								

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 3
PAGE 1 OF 1

LOGGED BY: J. King
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem
STA 3+25, 10ft North of South Curb Face
JOB NO.: SL-16142-SA
DATE: 09/24/10

VISTA DEL RIO ROAD REPAIR
Vista Del Rio Road at Hutton Road
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			2.75" AC OVER 14.0" AGGREGATE BASE					
2	SM		SILTY SAND: brown, medium dense, moist (fill)	2.0–3.5	■	107.1	11.1	7, 10, 8
3				3.5–5.0	■			2, 6, 12
4			intermittent lenses of clayey sand					
5				5.0–6.5	■	100.6	5.6	4, 10, 16
8				8.0–9.5	■			5, 10, 11
10				10.0–11.5	■			4, 7, 10
12	SP		POORLY GRADED SAND: light yellow brown, medium dense, moist, trace clay, slightly cemented (older dune sand)					
13				13.5–15.0	■	104.2	2.1	7, 7, 17
16			increasing clay content					
17	CL		SANDY LEAN CLAY: grey brown/red brown mottled, very stiff, moist, trace fine shale gravel (alluvium)					
18				18.5–20.0	■	89.6	32.0	5, 12, 18
20				20.0–21.5	●			4, 7, 9
22			End of Boring @ 21.5' No subsurface water encountered					

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

PRIMARY DIVISIONS			Group Symbol	SECONDARY DIVISIONS
COARSE GRAINED SOILS more than half of material is larger than No. 200 sieve size	GRAVELS more than half of coarse fraction is larger than No. 4 sieve	clean gravels (less than 5% fines)	GW	well graded gravels, gravel-sand mixtures, little or no fines
			GP	poorly graded gravels or gravel-sand mixtures, little or no fines.
		Gravel with fines	GM	silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	clayey gravels, gravel-sand-clay mixtures plastic fines.
	SANDS more than half of coarse fraction is smaller than No. 4 sieve	clean Sands (less than 5% fines)	SW	well graded sands, gravelly sands, little or no fines
			SP	poorly graded sands or gravelly sands, little or no fines.
		Sands with fines	SM	silty sands, sand-silt mixtures, nonplastic fines.
			SC	clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS more than half of material is smaller than No. 200 sieve size	SILTS AND CLAYS liquid limit is less than 50%		ML	inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	inorganic clays of low to medium plasticity gravelly clays, silty clays, lean clays.
			OL	organic silts and organic clays of low plasticity
	SILTS AND CLAYS liquid limit is greater than 50%		MH	inorganic silty, micaceous or diatomaceous fine sandy or silty soils, elastic
			CH	inorganic clays of high plasticity, fat clays.
HIGHLY ORGANIC SOILS			PT	peat and other high organic soils.

DEFINITION OF TERMS

U.S. Standard Series Sieve: 200 | 40 | 10 | 4 — Clear Square Sieve Openings: 3/4" | 3' | 12"

SILT & CLAYS	SAND			GRAVEL		COBBLE	BOULDER
	fine	medium	coarse	fine	coarse		

GRAIN SIZE

SANDS, GRAVELS, AND NON- PLASTIC SILTS	STANDARD PENETRATION Blows/ Ft.
very loose	0-4
loose	4-10
medium dense	10-30
dense	30-50
very dense	over 50

RELATIVE DENSITY

PLASTIC SILTS AND CLAYS	Unconfined Compressive Strength	STANDARD PENETRATION Blows / ft.
very soft	0-1/4	0-2
soft	1/4-1/2	2-4
firm	1/2-1	4-8
stiff	1-2	8-16
very stiff	2-4	16-32
hard	over 4	over 32

CONSISTENCY

JOSLIN GEOTECHNICAL
924 Stockton Street
P.O. Box 193
Dutch Flat, Calif. 95714

KEY TO EXPLORATORY BORING LOGS
Unified Soil Classification System (ASTM D-2487)

VISTA DEL RIO

Project No.	Date	
669	2-7-10	Figure 2

JOSLIN GEOTECHNICAL

PROJECT NAME:	Vista Del Rio Road Evaluation	Project No.:	669
Logged by:	RDJ	Log of:	B-1
Equipment:	Mobil B-53 with 8" Hollow Stem Auger	Date:	12/8/2009

Depth ft.	Sample No. and Type	Symbol	MATERIAL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
0			2-1/2" of Asphalt Concrete	AC					
-1-			Aggregate Base - gray brown Silty Sandy Grave	GM					
			dense, moist (9")						
-2-									
	111	M	FILL: Light to medium brown, Clayey						
-3-	112	O	Fine Sand, loose, moist	SC			99.9	9.8	
	113	D			12		107.2	15.2	-200 29%
-4-	121	I							
	122	F	above, intermixed with: Gray Silty Clay(CL-CH)				105.3	18.7	
-5-	123	I			13				
	131	E							
-6-	132	D	NATIVE						
	133		Brown Silty Fine Sand, loose, moist	SM/	15		107	6.8	
-7-	141	C		SP					
	142	A							
-8-	143	L	Pale orange-brown Silty Fine sand, loose, moist	SM/	10		107.5	8.6	
	151	I		SP					
-9-	152	F	Brown Silty Fine Sand, loose, moist						
	153	O		SM/	11		107..1	6.7	
-10-	161	R		SP					
	162	N							
-11-	163	I	Light gray to gray Silty Clay, soft, moist to wet	CL	8		97.3	16.6	
	171	A							
-12-	172	"							
	173	"			12				
-13-	181	"	Very light brown-pale yellow brown Fine Sand,	SP					
	182	"	moist, loose						
-14-	183	"			10		83.6	36.4	
	191	S	Light blue-gray (gleyed) Silty Clay, intermixed	CL					
-15-	192	P	with fine sand, moist, soft						
	193	T			9*STP				
-16-									
			End of Hole @ 15.5 feet, No free ground water						
-18-			surface (GWS)						
-19-									
			LOCATION: STA. 2+42, 9'NORTH OF SOUTH						
-20-			CURB						
-21-									
-22-									
-23-									

Stratification line represent the approximate boundary between the engineer's description of material types and the actual transitions may be gradual and vary with time or location.

FIGURE No. 3

JOSLIN GEOTECHNICAL

PROJECT NAME:	Vista Del Rio Road Evaluation	Project No.:	669
Logged by:	RDJ	Log of:	B-2
Equipment:	Mobil B-53 with 8" Hollow Stem Auger	Date:	12/8/2009

Depth ft.	Sample No. and Type	Symbol	MATERIAL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu--t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
			3" of Asphalt Concrete	AC					
-1-			Aggregate Base - gray brown Silty Sandy Grave	GM					
			dense, moist (19")						
-2-									
	211	M	FILL: Light to medium brown, Silty Fine Sand w	SM/		**			
-3-	212	O	occ gravel (AB) (in upper few inches), loose,	SP			108.6	12.3	
	213	D	moist		12		100.5	22	
-4-	221	I							
	222	F							
-5-	223	I	Brown Clayey Fine Sand to Fine Sandy Clay,		13				
	231	E	loose, moist	CL					
-6-	232	D							
	233				23		112.5	7.4	-200
-7-	241	C	NATIVE	SM/					15%
	242	A	Brown Silty Fine Sand, medium dense, moist	SP					
-8-	243	L			22				
	251	I	Pale orange-brown slightly Silty Fine Sand,						
-9-	252	F	medium dense, dry to moist				112.2	4.3	-200
	253	O		SM/	14				10%
-10-	261	R		SP					
	262	N							
-11-	263	I	Light brown to pale orange brown Silty Fine	SM/SP	12		101.9	3.3	
	271	A	Sand, loose to medium dense, dry						
-12-	272	"							
	273	"			17				
-13-									
-14-									
-15-			End of Hole @ 12.5 feet, No free ground water						
			surface (GWS)						
-16-									
-18-									
-19-									
-20-			LOCATION: STA. 2+82, 10' 'NORTH OF SOUTH						
			CURB						
-21-									
-22-									
-23-									

Stratification line represent the approximate boundary between the engineer's description of material types and the actual transitions may be gradual and vary with time or location.

FIGURE No. 4

JOSLIN GEOTECHNICAL

PROJECT NAME: Vista Del Rio Road Evaluation — Project No.: 669

Logged by: RDJ — Log of: B-3

Equipment: Mobil B-53 with 8" Hollow Stem Auger — Date: 12/8/2009

Depth ft.	Sample No. and Type	Symbol	MATERIAL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
0			3 1/2" of Asphalt Concrete	AC					
-1-			Aggregate Base - gray brown Silty Sandy Gravel, dense, moist (8")	GM					
-2-									
	311	M	Gray-blue- brown (gleyed) Clay, soft to very	CL/					R value
-3-	312	O	soft, wet	CH					5
	313	D			11				
-4-	321								
	322	C	stiff						
-5-	323	A			20				
	331	L	Pale orange-brown slightly Silty to Silty Fine	SM/					
-6-	332		Sand, very loose, wet	SP					
	333	S			4		92.6	22.4	
-7-	341	T	Gray to blue gray (gleyed) Clay, very soft to	CL/					
	342	D	soft, wet, some redox mottling	CH					
-8-	343		some orange-brown mottled inclusions		5				
	351	P	grades to pale orange-brown Clay, soft, wet						
-9-	352	E							
	353	N			7				
-10-									
-11-									
-12-									
-13-			NOTE: sample interval 341 was a "push" under hammer weight, no blow necessary to seat tube 6".						
-14-									
-15-			Note: top of hole in cut area, 5' deep, End of Hole @ 9.5 feet, No free ground water surface (GWS,)						
-16-			some free water noted in tube sample tips						
-18-									
-19-									
-20-			LOCATION: STA. 0+50, 75' 'NORTH OF SOUTH CURB						
-21-									
-22-									
-23-									

Stratification line represent the approximate boundary between the engineer's description of material types and the actual transitions may be gradual and vary with time or location.

FIGURE No. 5

JOSLIN GEOTECHNICAL

PROJECT NAME:	Vista Del Rio Road Evaluation	Project No.:	669
Logged by:	RDJ	Log of:	B-4
Equipment:	Mobil B-53 with 8" Hollow Stem Auger	Date:	12/8/2009

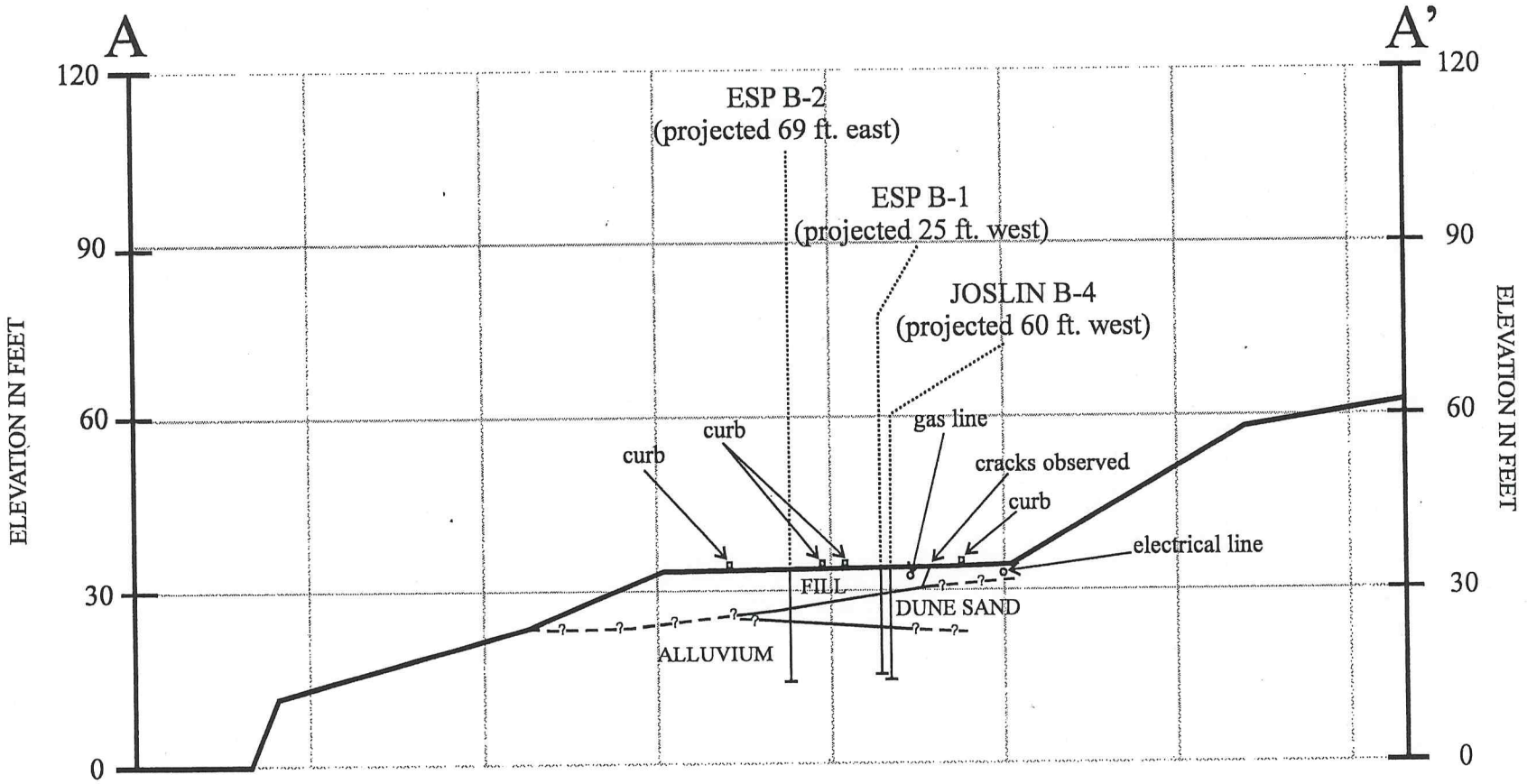
Depth ft.	Sample No. and Type	Symbol	MATERIAL DESCRIPTION	Unified Soil Classification	Blows/foot 350 ft-lbs.	Qu - t.s.f. Penetrometer	Dry Density p.c.f.	Moisture % dry wt.	MISC. LAB RESULTS
-1-			3" of Asphalt Concrete	AC					
			Aggregate Base - gray brown Silty Sandy Grave dense, moist (6-1/2")	GM					
-2-									
	411	STAND	FILL: Medium brown to pale orange brown,						
-3-	412		slightly Silty Fine Sand, medium dense, moist	SP					
	413				19		bad sample		
-4-	421						stick in tube		
	422								
-5-	423	ARD	Brown to Gray Brown Clay, very soft to soft,	CL	9				
	431		moist to wet						
-6-	432	PENETRATION SAMPLER							
	433		Medium brown slightly Silty Fine Sand, loose	SM/	6		96	4.9	
-7-	441		to very loose, dry to slightly moist	SP					
	442								
-8-	443		grades to Pale orange slightly Silty Fine Sand,	SM/	5		96.6	4.2	
	451		very loose, dry to slightly moist	SP					
-9-	452								
	453				4		97.9	5.8	
-10-	461								
	462								
-11-	463				4		90.9	1.9	
	471								
-12-	472								
	473				4				
-13-	481								
	482								
-14-	483				4				
-15-									
-16-									
-18-									
-19-	491								
	492								
-20-	493				8				
-21-									
			End of Hole @ 20.0 feet, No free ground water						
-22-			surface (GWS)						
-23-			LOCATION: STA. 3+87 , at Bullnose,						
			4' NORTH OF ISLAND BULLNOSE						

Stratification line represent the approximate boundary between the engineer's description of material types and the actual transitions may be gradual and vary with time or location.

FIGURE No. 6

CROSS SECTION A-A'

VISTA DEL RIO ROAD REPAIR
Vista Del Rio Road at Hutton Road
Nipomo, California



Approx. Scale: 1" = 30'

Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
February 2, 2011

(805) 544-3276 - (805) 544-1786 Fax
www.earthsys.com
SL-16142-SA
VISTA DEL RIO ROAD-111010cross section.cdr

APPENDIX B

Laboratory Test Results

Vista Del Rio Road Repair

SL-16142-SA

BULK DENSITY TEST RESULTS

ASTM D 2937-04 (modified for ring liners)

October 11, 2010

BORING NO.	DEPTH feet	MOISTURE CONTENT, %	WET DENSITY, pcf	DRY DENSITY, pcf
1	4.5 - 5.0	6.1	108.1	101.9
1	6.0 - 6.5	4.2	112.4	107.9
1	11.5 - 12.0	36.5	110.1	80.6
2	3.0 - 3.5	17.7	116.8	99.2
2	7.0 - 7.5	34.5	110.5	82.2
2	10.0 - 10.5	15.5	124.5	107.8
3	3.0 - 3.5	11.1	118.9	107.1
3	6.0 - 6.5	5.6	106.2	100.6
3	14.5 - 15.0	2.1	106.4	104.2
3	19.5 - 20.0	32.0	118.2	89.6

Vista Del Rio Road Repair

SL-16142-SA

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-09 (Modified)

PROCEDURE USED: A

PREPARATION METHOD: Moist

RAMMER TYPE: Mechanical

SPECIFIC GRAVITY: 2.65 (assumed)

October 11, 2010

Boring #2 @ 2.0 - 3.5'

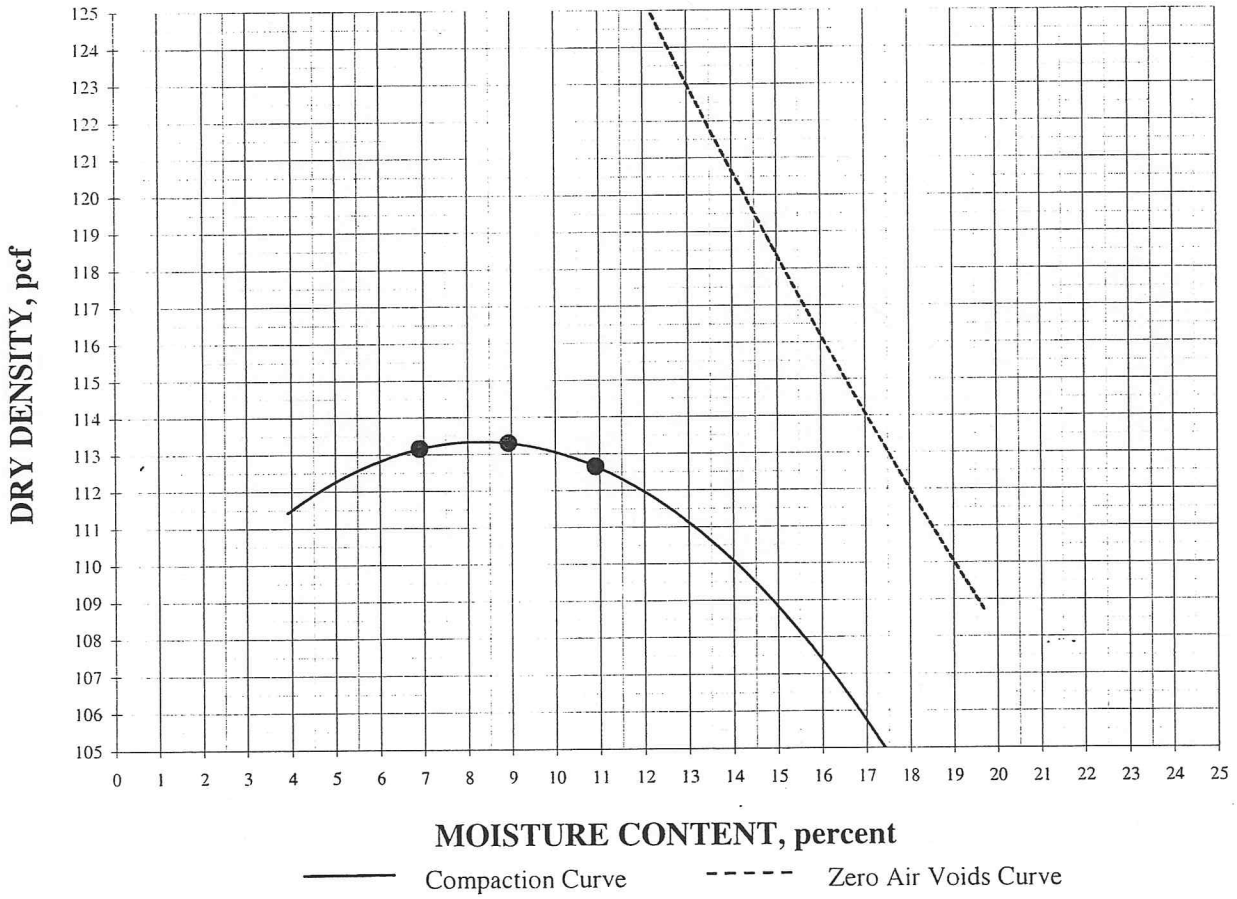
Yellow Brown Silty Sand (SM)

SIEVE DATA:

Sieve Size	% Retained
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 113.3 pcf

OPTIMUM MOISTURE: 8.3%



Vista Del Rio Road Repair

SL-16142-SA

DIRECT SHEAR

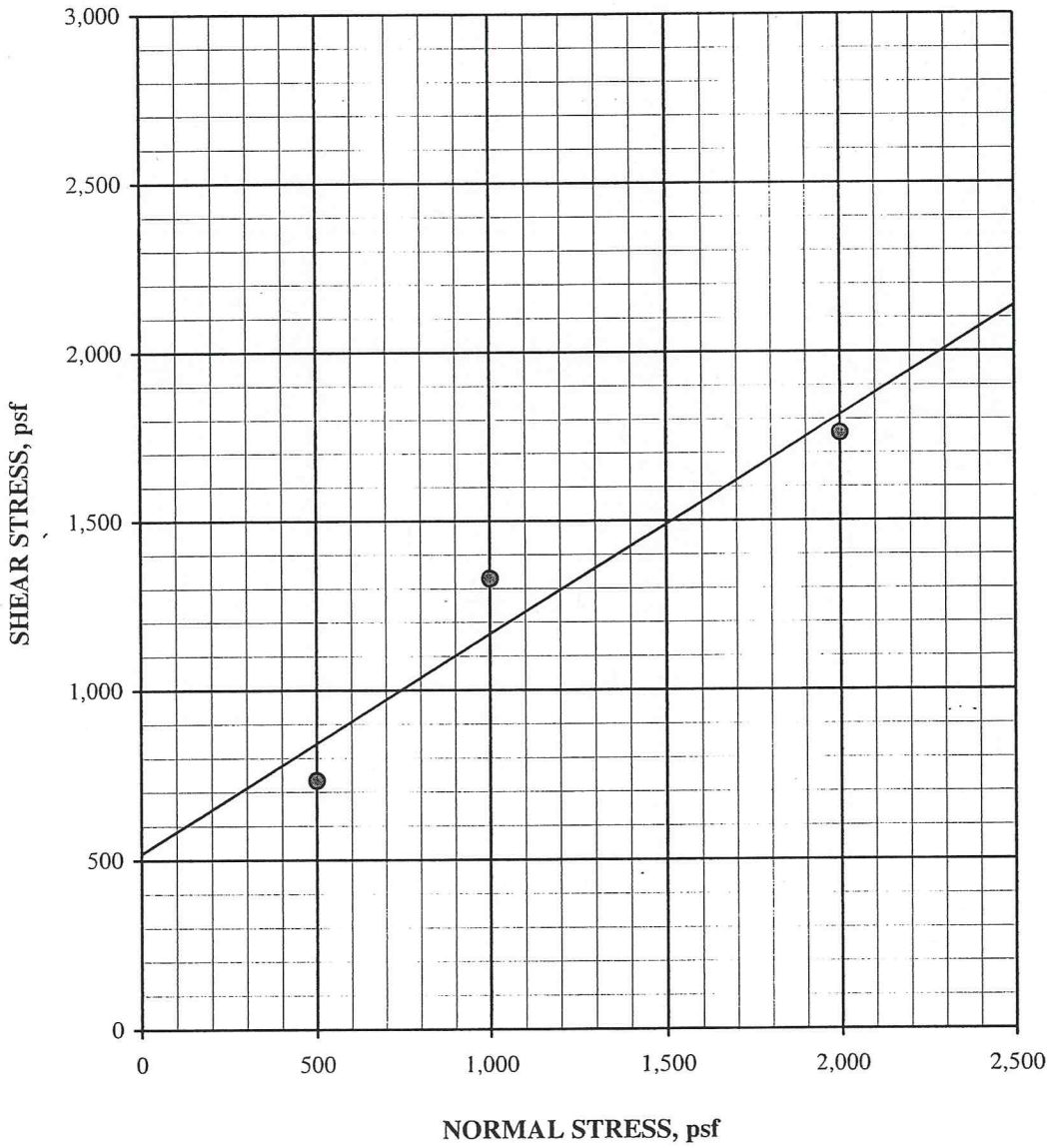
ASTM D 3080-04 (modified for consolidated, undrained conditions)

October 11, 2010

Boring #1 @ 6.0 - 6.5'
Silty Sand (SM)
Ring sample, saturated

INITIAL DRY DENSITY: 112.2 pcf
INITIAL MOISTURE CONTENT: 4.2 %
PEAK SHEAR ANGLE (Ø): 33°
COHESION (C): 519 psf

SHEAR vs. NORMAL STRESS



Vista Del Rio Road Repair

SL-16142-SA

DIRECT SHEAR continued

ASTM D 3080-04 (modified for consolidated, undrained conditions)

Boring #1 @ 6.0 - 6.5'

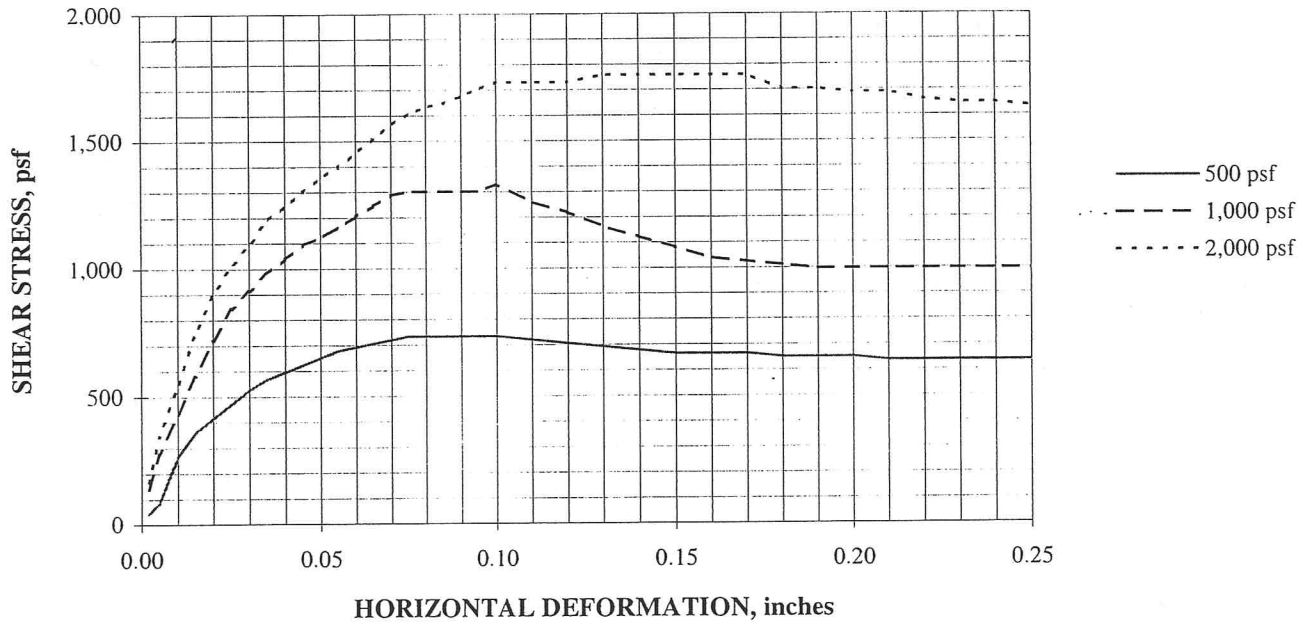
October 11, 2010

Silty Sand (SM)

Ring sample, saturated

SPECIFIC GRAVITY: 2.65 (assumed)

SAMPLE NO.:	1	2	3	AVERAGE
INITIAL				
WATER CONTENT, %	4.2	4.2	4.2	4.2
DRY DENSITY, pcf	111.6	114.9	110.2	112.2
SATURATION, %	23.1	25.3	22.2	23.5
VOID RATIO	0.482	0.439	0.501	0.474
DIAMETER, inches	2.375	2.375	2.375	
HEIGHT, inches	1.00	1.00	1.00	
AT TEST				
WATER CONTENT, %	14.2	10.8	14.0	
DRY DENSITY, pcf	111.6	116.0	113.3	
SATURATION, %	78.2	67.2	80.6	
VOID RATIO	0.482	0.425	0.459	
HEIGHT, inches	1.00	0.99	0.97	



Vista Del Rio Road Repair

SL-16142-SA

DIRECT SHEAR

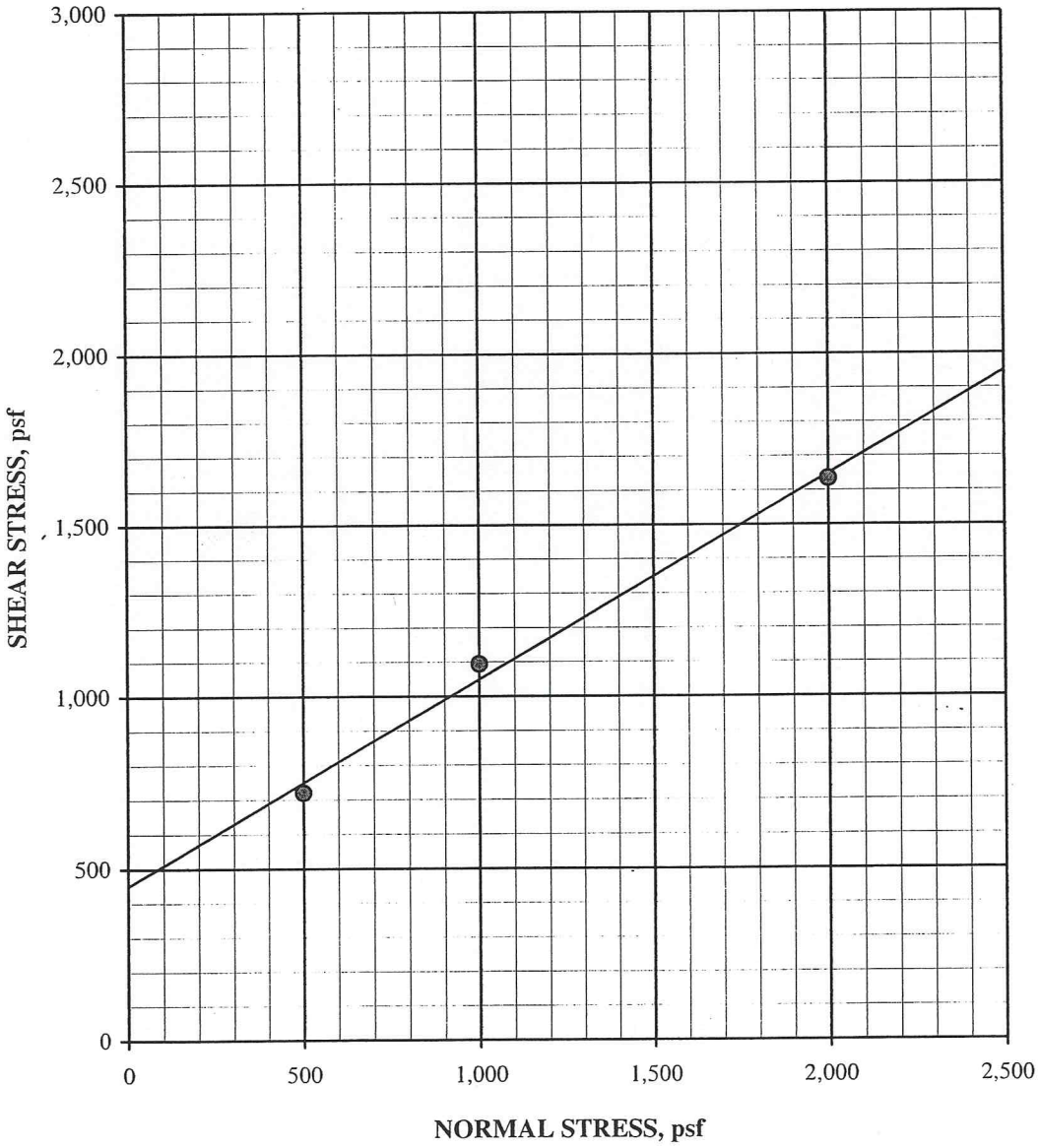
ASTM D 3080-04 (modified for consolidated, undrained conditions)

October 11, 2010

Boring #2 @ 10.0 - 10.5'
Clayey Sand (SC)
Ring sample, saturated

INITIAL DRY DENSITY: 98.1 pcf
INITIAL MOISTURE CONTENT: 15.5 %
PEAK SHEAR ANGLE (Ø): 31°
COHESION (C): 450 psf

SHEAR vs. NORMAL STRESS



Vista Del Rio Road Repair

SL-16142-SA

DIRECT SHEAR continued

ASTM D 3080-04 (modified for consolidated, undrained conditions)

Boring #2 @ 10.0 - 10.5'

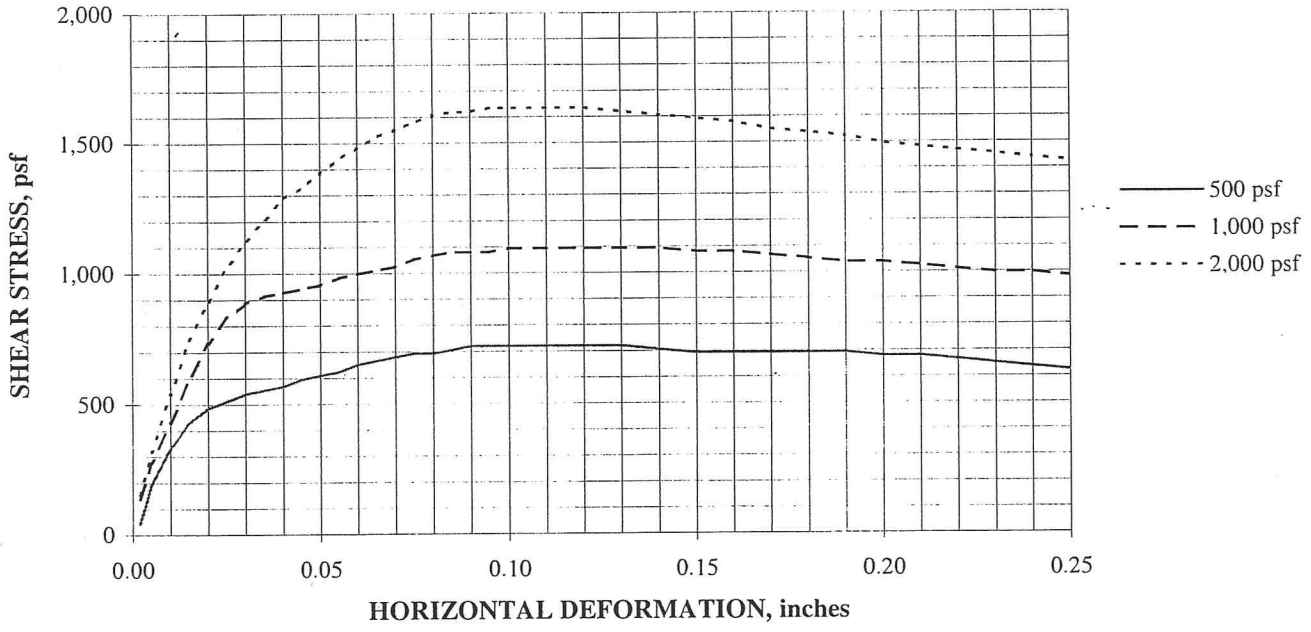
October 11, 2010

Clayey Sand (SC)

Ring sample, saturated

SPECIFIC GRAVITY: 2.65 (assumed)

SAMPLE NO.:	1	2	3	AVERAGE
INITIAL				
WATER CONTENT, %	15.5	15.5	15.5	15.5
DRY DENSITY, pcf	97.8	98.5	97.8	98.1
SATURATION, %	59.5	60.5	59.5	59.8
VOID RATIO	0.690	0.679	0.690	0.686
DIAMETER, inches	2.375	2.375	2.375	
HEIGHT, inches	1.00	1.00	1.00	
AT TEST				
WATER CONTENT, %	30.6	25.2	23.3	
DRY DENSITY, pcf	97.8	99.5	105.5	
SATURATION, %	100.0	100.0	100.0	
VOID RATIO	0.690	0.662	0.567	
HEIGHT, inches	1.00	0.99	0.93	



Vista Del Rio Road Repair

SL-16142-SA

DIRECT SHEAR

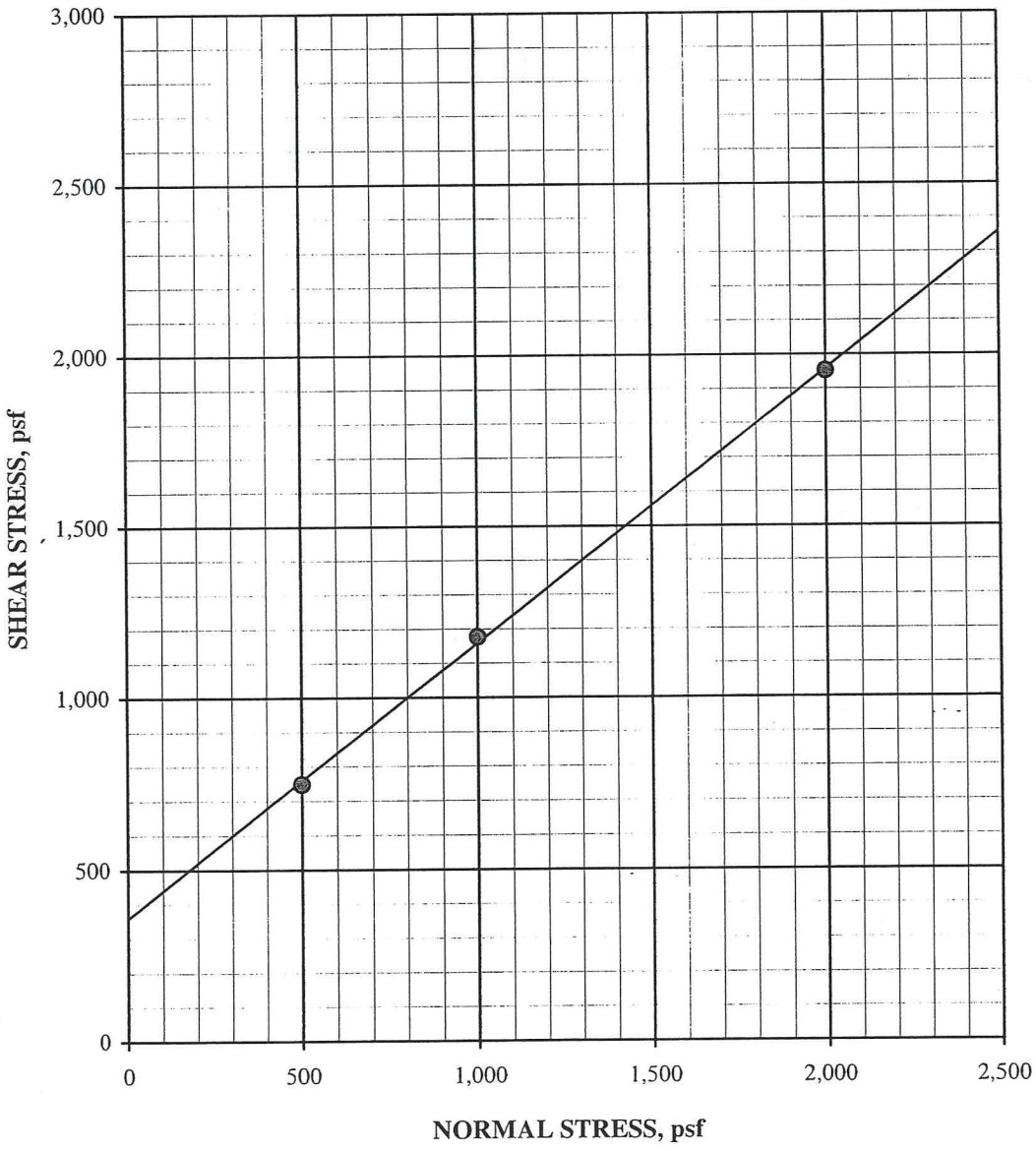
ASTM D 3080-04 (modified for consolidated, undrained conditions)

October 11, 2010

Boring #3 @ 14.5 - 15.0'
Poorly Graded Sand (SP)
Ring sample, saturated

INITIAL DRY DENSITY: 100.3 pcf
INITIAL MOISTURE CONTENT: 2.1 %
PEAK SHEAR ANGLE (Ø): 39°
COHESION (C): 360 psf

SHEAR vs. NORMAL STRESS



Vista Del Rio Road Repair SL-16142-SA

DIRECT SHEAR continued

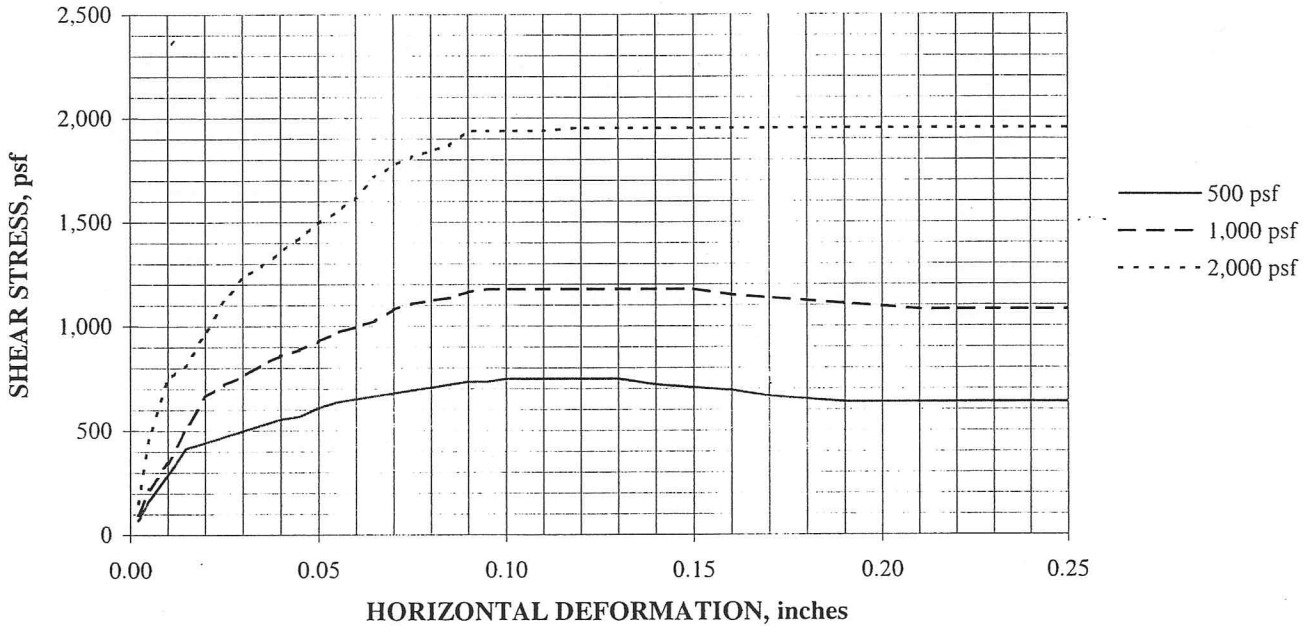
ASTM D 3080-04 (modified for consolidated, undrained conditions)

Boring #3 @ 14.5 - 15.0' October 11, 2010

Poorly Graded Sand (SP)

Ring sample, saturated SPECIFIC GRAVITY: 2.65 (assumed)

SAMPLE NO.:	1	2	3	AVERAGE
INITIAL				
WATER CONTENT, %	2.1	2.1	2.1	2.1
DRY DENSITY, pcf	99.7	100.4	100.6	100.3
SATURATION, %	8.5	8.6	8.7	8.6
VOID RATIO	0.658	0.647	0.643	0.649
DIAMETER, inches	2.375	2.375	2.375	
HEIGHT, inches	1.00	1.00	1.00	
AT TEST				
WATER CONTENT, %	19.3	18.4	18.7	
DRY DENSITY, pcf	99.9	101.2	102.4	
SATURATION, %	78.3	76.8	80.5	
VOID RATIO	0.655	0.634	0.615	
HEIGHT, inches	1.00	0.99	0.98	



Vista Del Rio Road Repair

SL-16142-SA

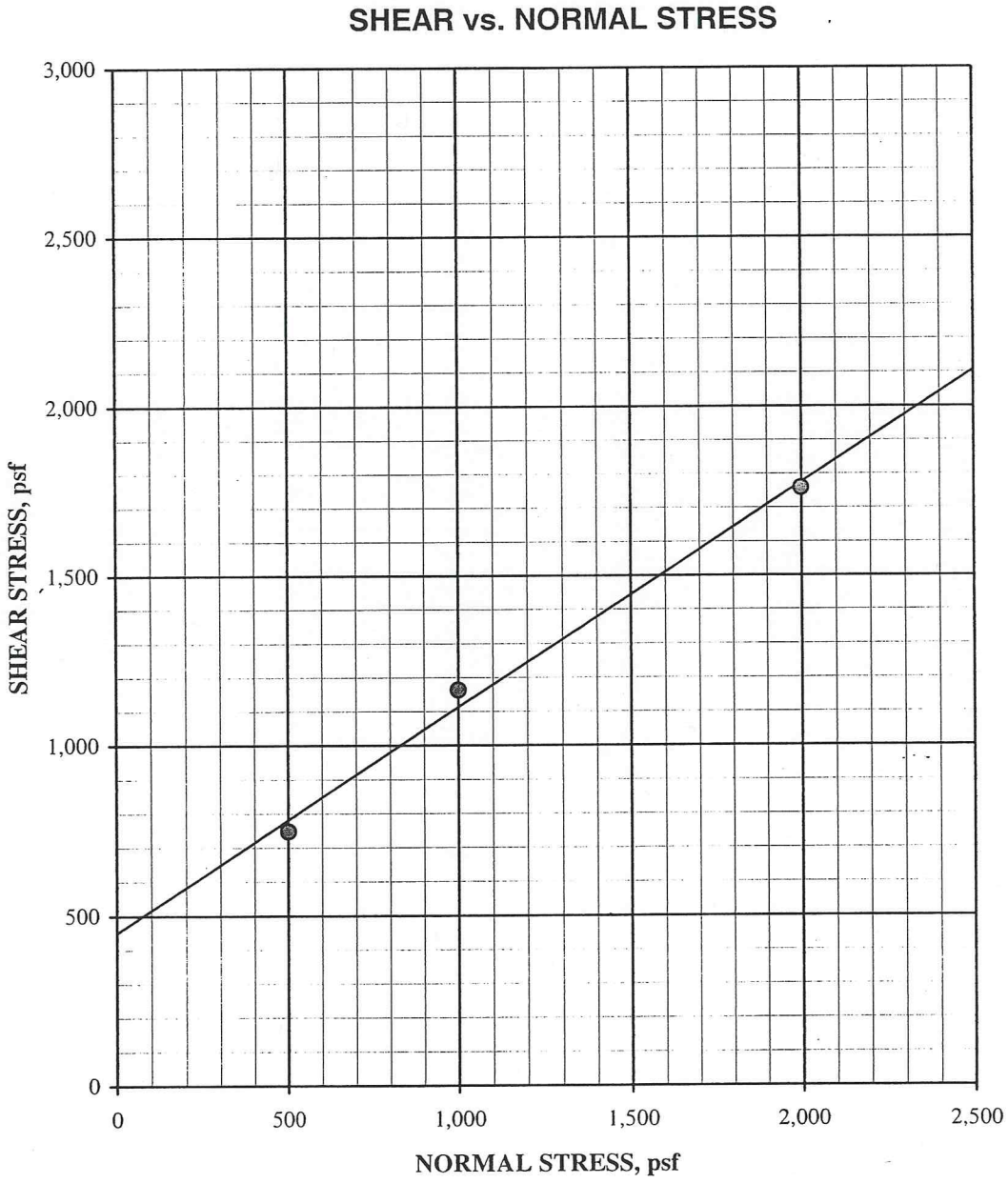
DIRECT SHEAR

ASTM D 3080-04 (modified for consolidated, undrained conditions)

October 11, 2010

Boring #3 @ 19.5 - 20.0'
Sandy Lean Clay (CL)
Ring sample, saturated

INITIAL DRY DENSITY: 86.8 pcf
INITIAL MOISTURE CONTENT: 32.0 %
PEAK SHEAR ANGLE (Ø): 34°
COHESION (C): 450 psf



Vista Del Rio Road Repair

SL-16142-SA

DIRECT SHEAR continued

ASTM D 3080-04 (modified for consolidated, undrained conditions)

Boring #3 @ 19.5 - 20.0'

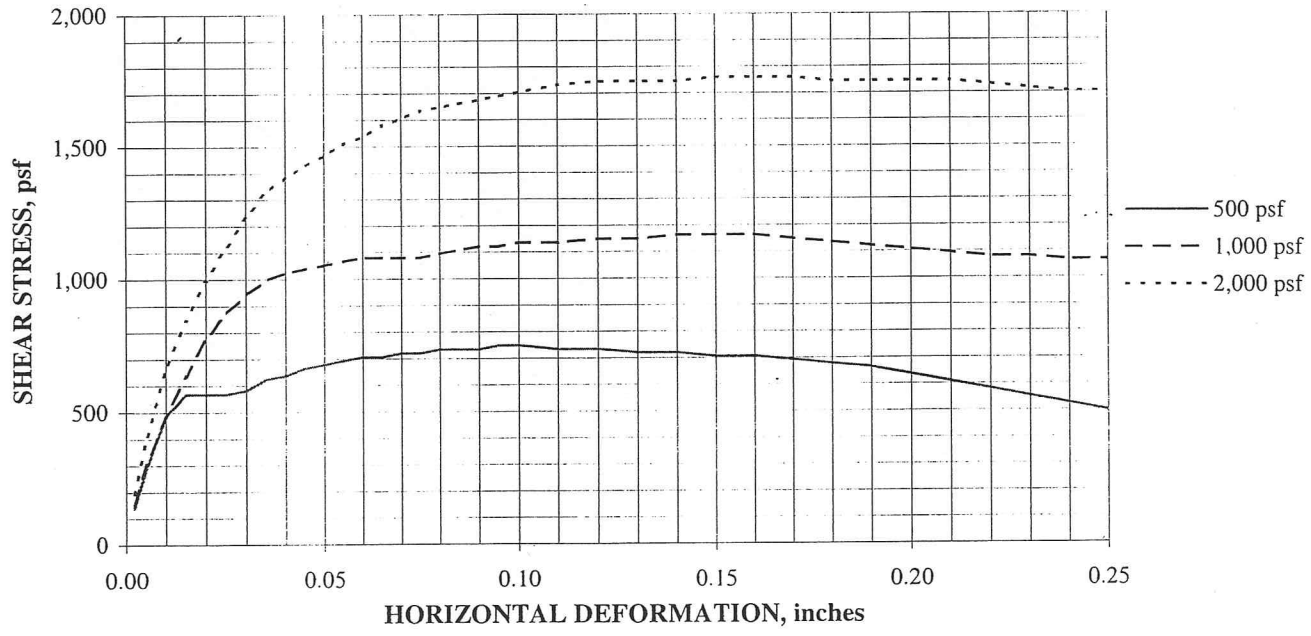
October 11, 2010

Sandy Lean Clay (CL)

Ring sample, saturated

SPECIFIC GRAVITY: 2.70 (assumed)

SAMPLE NO.:	1	2	3	AVERAGE
INITIAL				
WATER CONTENT, %	32.0	32.0	32.0	32.0
DRY DENSITY, pcf	87.2	86.7	86.4	86.8
SATURATION, %	92.8	91.6	91.0	91.8
VOID RATIO	0.931	0.943	0.949	0.941
DIAMETER, inches	2.375	2.375	2.375	
HEIGHT, inches	1.00	1.00	1.00	
AT TEST				
WATER CONTENT, %	43.2	44.3	44.9	
DRY DENSITY, pcf	88.1	90.8	94.9	
SATURATION, %	100.0	100.0	100.0	
VOID RATIO	0.912	0.856	0.775	
HEIGHT, inches	0.99	0.96	0.91	



APPENDIX C

Surficial Slope Stability Plots

Vista Del Rio Slope Repair Local, Worst Water, Typical Soil

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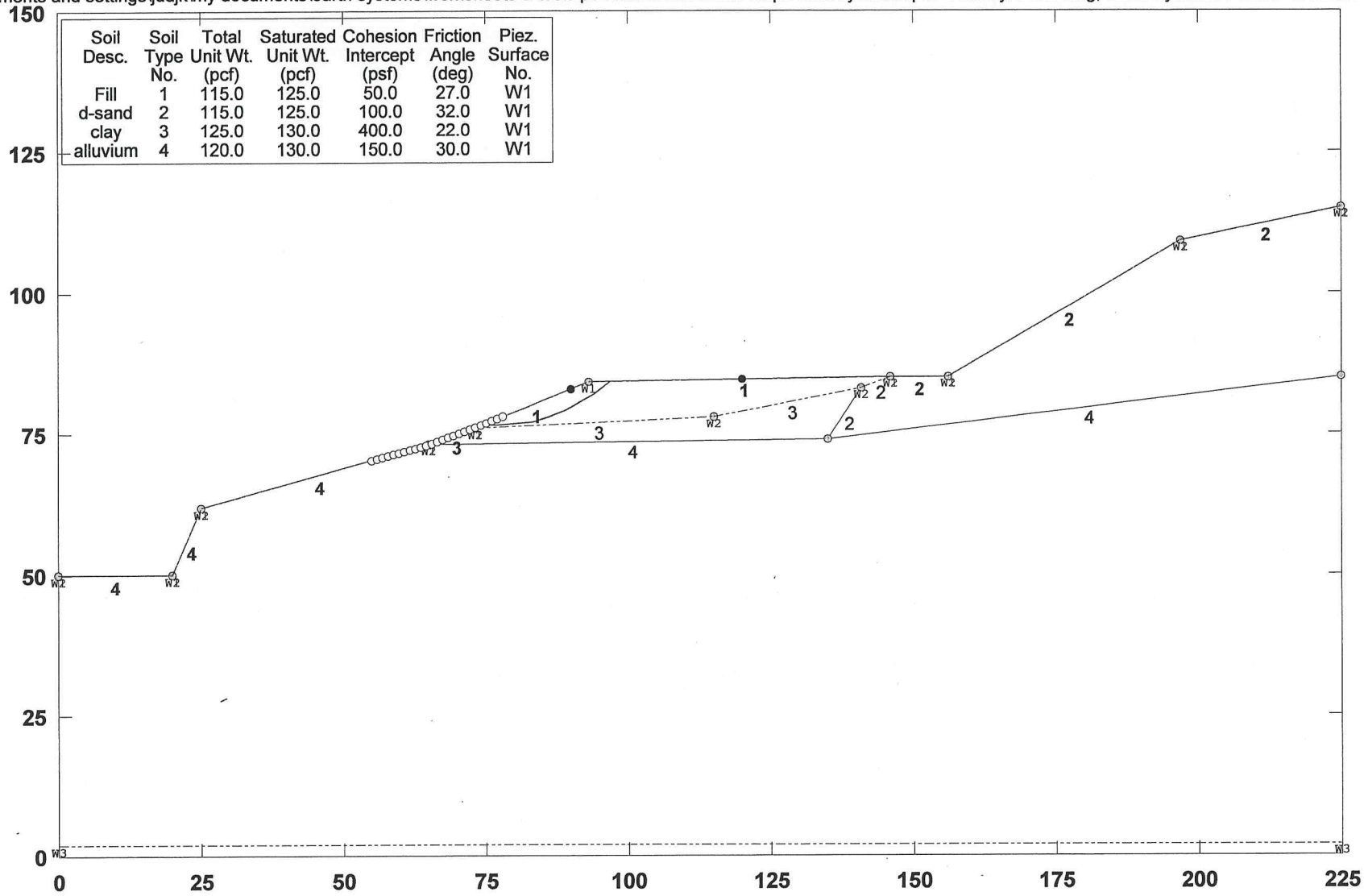
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	115.0	125.0	50.0	27.0	W1
d-sand	2	115.0	125.0	100.0	32.0	W1
clay	3	125.0	130.0	400.0	22.0	W1
alluvium	4	120.0	130.0	150.0	30.0	W1



PCSTABL5M/si FSmin=1.33

Safety Factors Are Calculated By The Modified Bishop Method

Vista Del Rio Slope Repair Local, Moderate Water, Typical Soil

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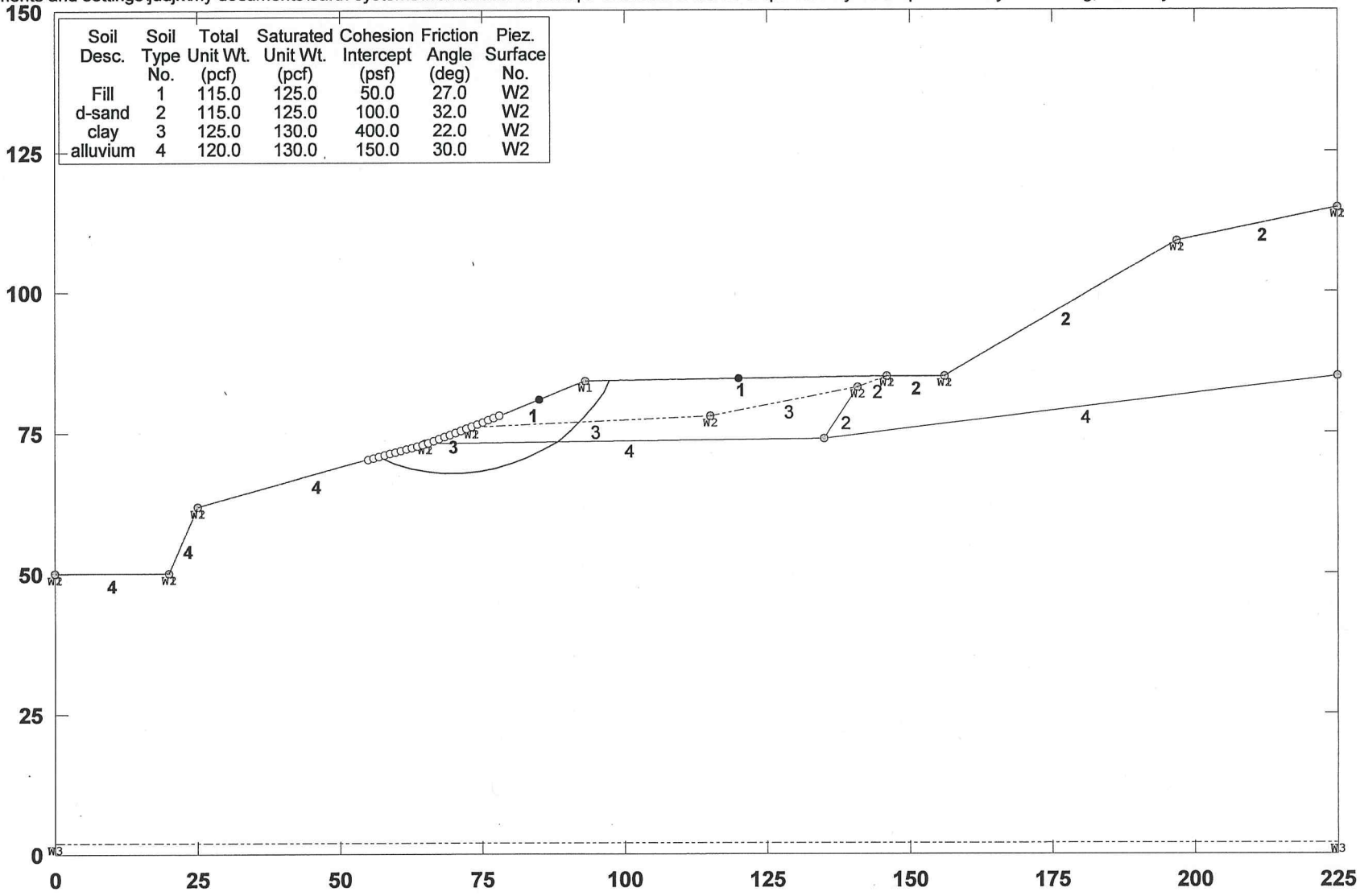
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	115.0	125.0	50.0	27.0	W2
d-sand	2	115.0	125.0	100.0	32.0	W2
clay	3	125.0	130.0	400.0	22.0	W2
alluvium	4	120.0	130.0	150.0	30.0	W2



PCSTABL5M/si FSmin=2.16

Safety Factors Are Calculated By The Modified Bishop Method

Vista Del Rio Slope Repair Global, Moderate Water, Worst Soil

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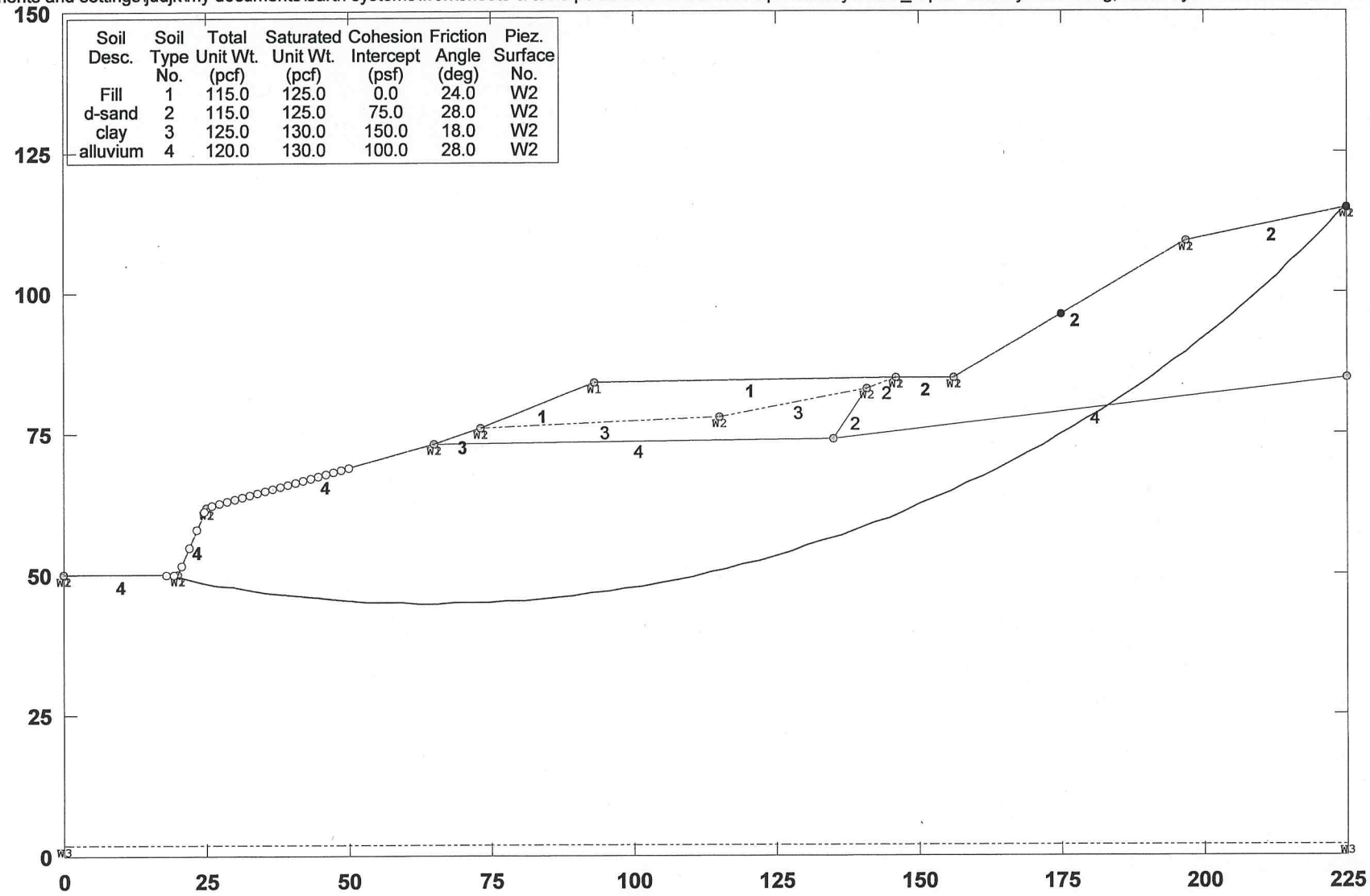

PCSTABL5M/si FSmin=1.43

Safety Factors Are Calculated By The Modified Bishop Method

Vista Del Rio Slope Repair Global, Moderate Water, Typical Soil

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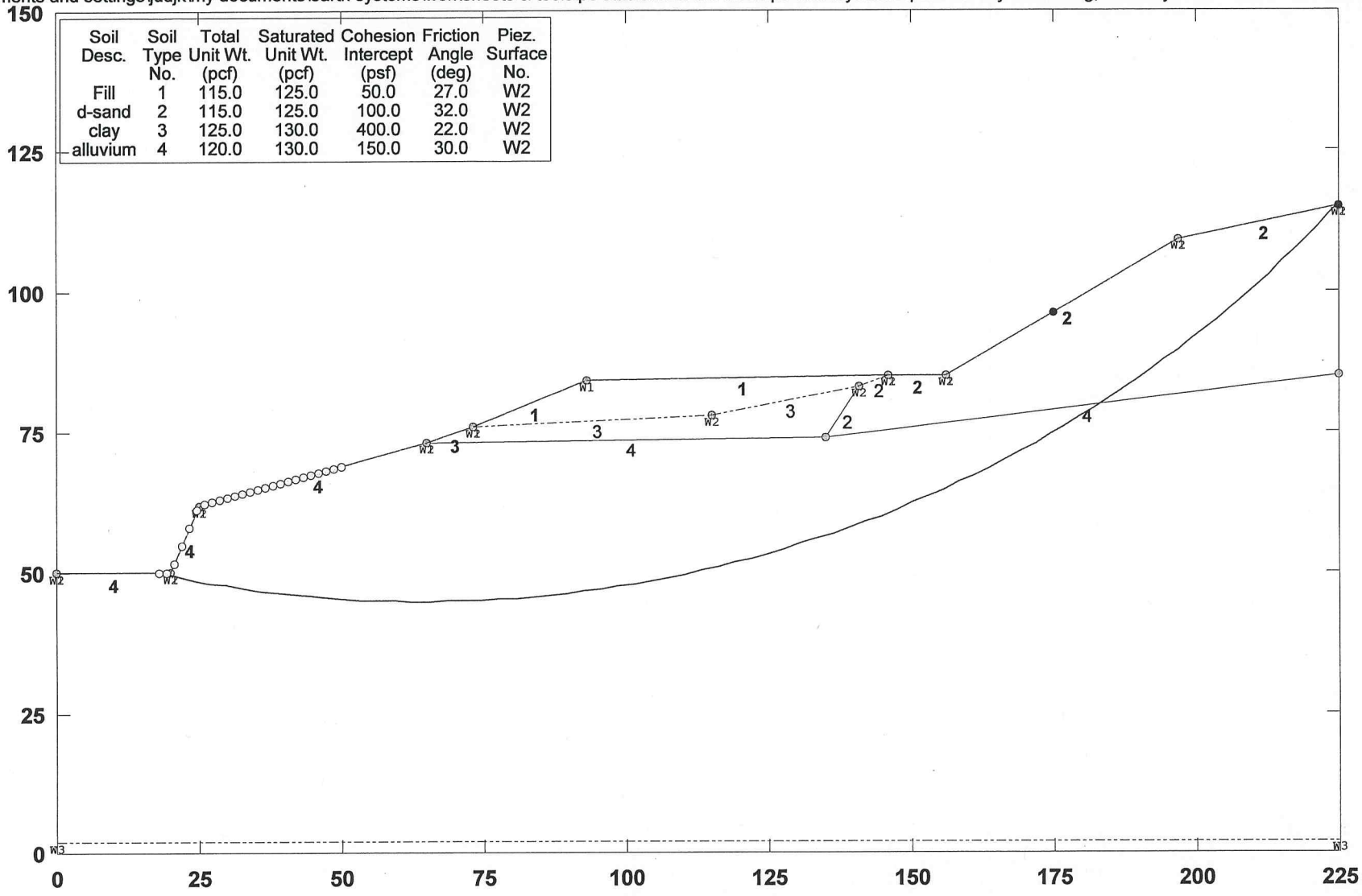
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	115.0	125.0	50.0	27.0	W2
d-sand	2	115.0	125.0	100.0	32.0	W2
clay	3	125.0	130.0	400.0	22.0	W2
alluvium	4	120.0	130.0	150.0	30.0	W2



PCSTABL5M/si FSmin=1.62

Safety Factors Are Calculated By The Modified Bishop Method

APPENDIX D

Overexcavation & Geogrid Detail, Typical

Back Drain Detail, Typical

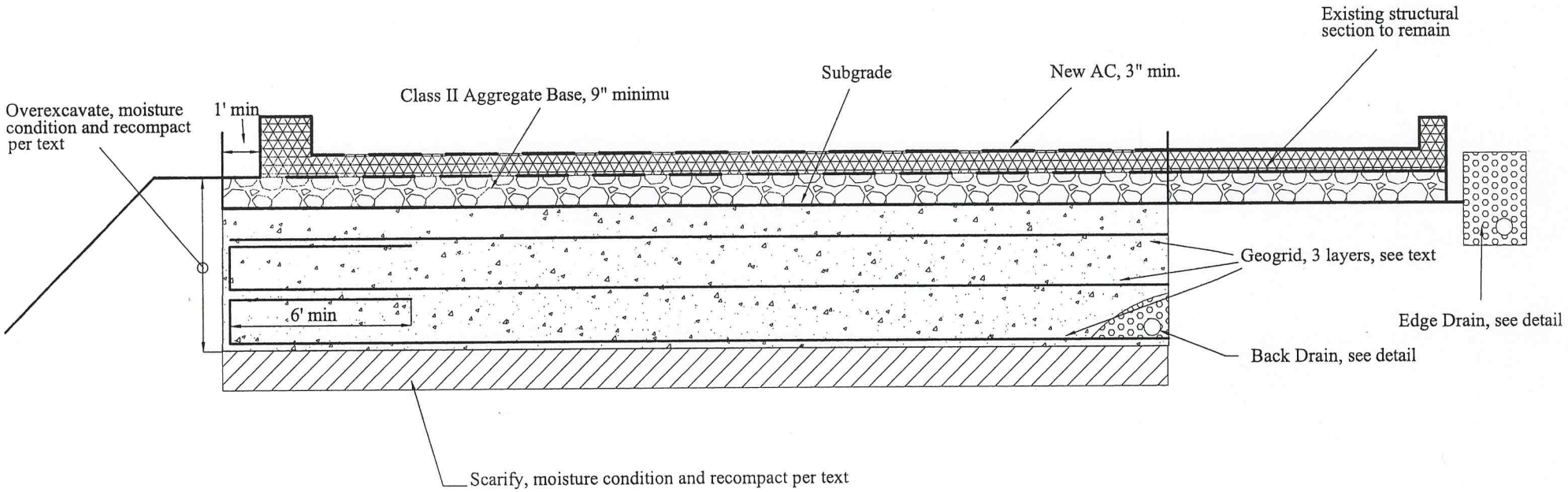
Edge Drain Detail, Typical

OVEREXCAVATION & GEOGRID DETAIL, TYPICAL

VISTA DEL RIO ROAD REPAIR

Vista Del Rio Road at Hutton Road

Nipomo, California



SCHEMATIC ONLY

NOT TO SCALE

Earth Systems Pacific

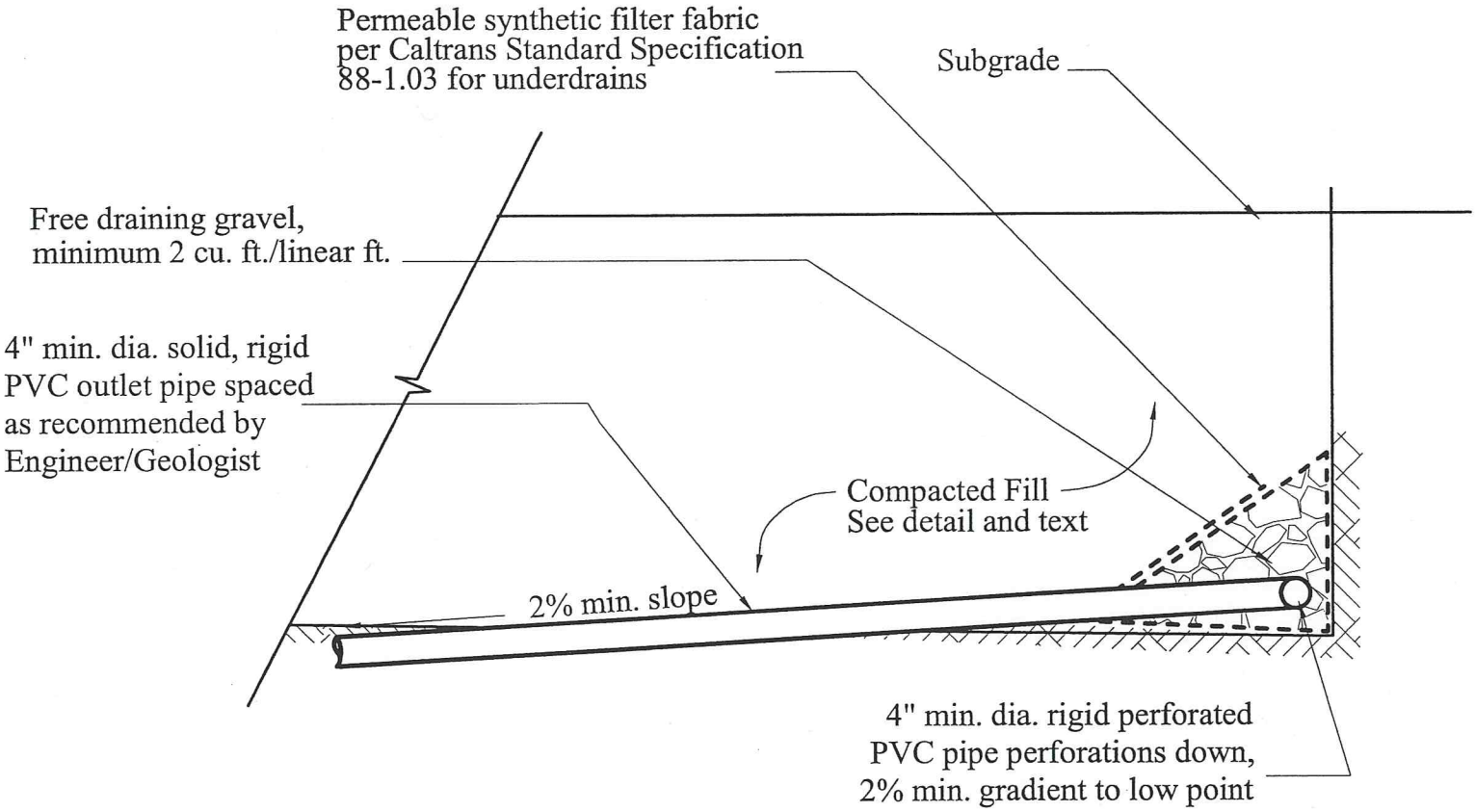
4378 Old Santa Fe Road
San Luis Obispo, CA 93401-8116

(805) 544-3276 • FAX (805) 544-1786
E-mail: esc@earthsys.com

BACK DRAIN DETAIL, TYPICAL

VISTA DEL RIO ROAD REPAIR

Vista Del Rio Road at Hutton Road
Nipomo, California



Note: A prefabricated panel drainage system (Advanedge, Miradrain, etc.) may be substituted for the gravel / pipe system, provided it is installed in accordance with the manufacturer's recommendations

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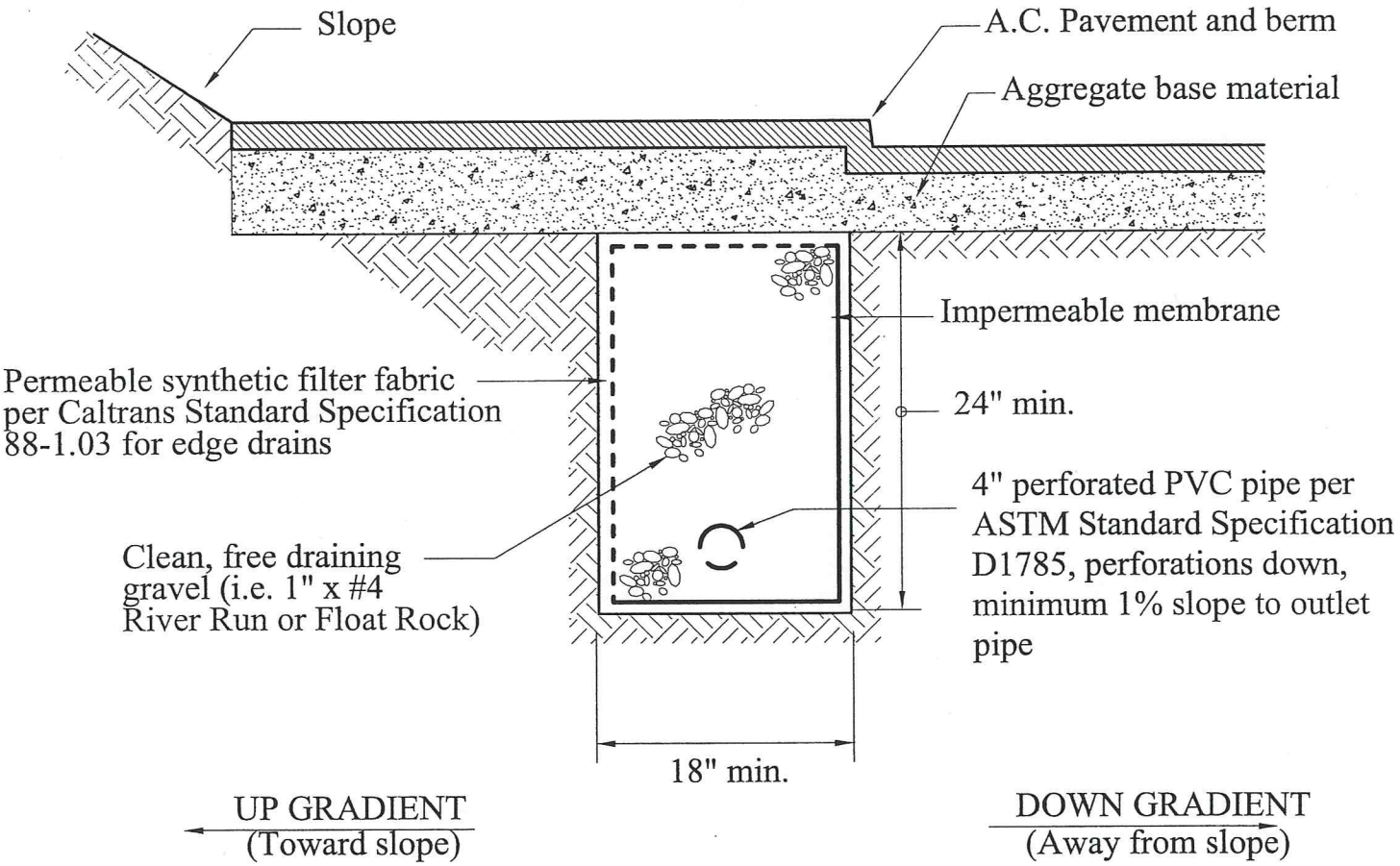
E-mail: esc@earthsys.com

EDGE DRAIN DETAIL, TYPICAL

VISTA DEL RIO ROAD REPAIR

Vista Del Rio Road at Hutton Road
Nipomo, California



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