GEOTECHNICAL ENGINEERING REPORT
SAN MIGUEL MONUMENT GATEWAY SIGN PROJECT
HIGHWAY 101
SAN MIGUEL AREA OF SAN LUIS OBISPO COUNTY
CALIFORNIA

July 14, 2014

Prepared for

Mr. Mike Britton, PE
County of San Luis Obispo

Prepared by

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

Earth Systems Pacific

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

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

July 14, 2014

File No.: SL-17331-SA

Mr. Mike Britton, PE
County of San Luis Obispo
1055 Monterey Street
San Luis Obispo, CA 93408

PROJECT: SAN MIGUEL MONUMENT GATEWAY SIGN PROJECT
HIGHWAY 101
SAN MIGUEL AREA OF SAN LUIS OBISPO COUNTY, CALIFORNIA

SUBJECT: Geotechnical Engineering Report

REF.: Proposal to Provide a Geotechnical Engineering Report, San Miguel Monument Sign Project, Highway 101, San Miguel Area, California, by Earth Systems Pacific, Doc. No. 1405-105.PRP, dated May 20, 2014

Dear Mr. Britton:

In accordance with your authorization of the referenced proposal, this geotechnical engineering report has been prepared for use in the development of project plans and specifications for the San Miguel Gateway Monument Signs to be constructed off of the traveled lanes of Highway 101, both on the north and south sides, in San Miguel California. Preliminary geotechnical recommendations for site preparation, grading, foundations, drainage and maintenance, and observation and testing are presented herein. One bound copy and one electronic copy, via e-mail, of this report have been provided for your use. As per your request, electronic copies are being provided as indicated below.

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

Robert Down, PE
Senior Engineer
7/14/14

Copy to : Mr. Ryan Hayes

Doc. No.: 1407-089.SER/jr

TABLE OF CONTENTS

1.0 INTRODUCTION AND SITE SETTING

Monument signs are proposed for both the northern and the southern off ramps along the shoulder of Highway 101 in San Miguel, California. The signs will be located within the Caltrans right-of-way, but outside of the clear recovery zone. We understand that the new signs will be approximately 20 feet long, 6 feet wide, and 20 feet tall. The signs will be constructed with a combination of concrete and masonry.

Based upon review of the preliminary drawings by Rick Engineering, fills between 5 and 9 feet above existing grade are planned. The fills will be sloped between 1.75:1 and 2:1 (horizontal to vertical. We understand that the areas surrounding the new signs will be landscaped.

The proposed location of the north bound sign is relatively flat with less than 1-foot of relief across the site. The proposed south bound location slopes slightly upward from the paved surface toward the southwest at approximately 3:1 (horizontal to vertical). Both of the sites are currently undeveloped and surfaced with sparse seasonal wild grasses. The locations and dispositions of any utility lines on the site are currently unknown.

2.0 SCOPE OF SERVICES

Our authorized scope of work included a general site reconnaissance, field exploration, geotechnical analysis of the data gathered, and preparation of this report. The analysis and subsequent recommendations were based upon information and preliminary plans provided by Rick Engineering.

This report and recommendations are intended to comply with applicable requirements of Sections 1803.2 through 1803.6, and J104.3 of the California Building Code (CBC) (CBSC 2013), and common geotechnical 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.

Preliminary geotechnical recommendations for site preparation, grading, foundations, drainage and maintenance, and observation and testing are presented as a guide in the development of project plans and specifications. As there may be geotechnical issues yet to be resolved, the geotechnical 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, lead or mold potential, asbestos (either naturally occurring or man-made), radioisotopes, hydrocarbons, or other chemical properties are beyond the scope of this report. Evaluation of ancillary features such as access roads, fences, light and flag poles, 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 the proposed monument signs, 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 are verified or modified by the geotechnical engineer in writing. 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 have been observed by the geotechnical engineer in the field during construction, and the recommendations have been verified as appropriate, or modified by the geotechnical engineer in writing.

3.0 FIELD INVESTIGATION AND LABORATORY TESTING

To assess subsurface conditions and retrieve soil samples, two exploratory borings were drilled at the site; one at each of the proposed sign locations, on June 6, 2014. The borings were drilled to a maximum depth of 16.5 feet. The approximate locations of the borings are shown on the Boring Location Maps in Appendix A. A Mobile Drill rig, Model B-53, equipped with 6-inch outside diameter hollow stem auger and an automatic trip hammer for sampling, was used to drill the borings. As the borings were drilled, soil samples were retrieved using a ring-lined barrel sampler (ASTM D 3550-01/07, with shoe similar to D 2937-04) and Standard Penetration Tests (ASTM D 1586-11) were conducted at selected depths. Bulk soil samples were also obtained from the auger cuttings.

Soils encountered in the borings were categorized and logged in general accordance with the Unified Soil Classification System and ASTM D 2488-09a. Logs of the borings are also presented in Appendix A, along with a boring log legend. In reviewing the boring logs and legend, the reader should recognize 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 excavation. 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 characteristics, possibly resulting in soil descriptions that vary somewhat from the legend.

Ring samples were tested for unit weight and moisture (ASTM D 2937-10, as modified for ring liners). The bulk sample was tested for maximum density and optimum moisture (ASTM D 1557-12, expansion index (ASTM D 4829-11), and shear strength (ASTM D 3080/D 3080M-11). The results of the laboratory tests are presented in Appendix B.

4.0 GENERAL SUBSURFACE PROFILE

Subsurface conditions were quite consistent across the site. Alluvial deposits were encountered within each of the borings from the surface to the maximum depth explored. The alluvium consisted of clayey sand and well graded sand with varying amounts of gravel and clay. The alluvium was logged as being loose within the upper 2 to 9 feet then transitioned to medium dense to dense with depth.

Moisture conditions ranged from slightly moist to moist. No free subsurface water was found in the borings.

5.0 CONCLUSIONS

In our opinion the site is suitable, from a geotechnical engineering standpoint, for the proposed monument signs, provided the recommendations contained herein are implemented in the design and construction. From a geotechnical engineering standpoint, the primary concerns are the stability of the proposed fill slopes, the potential for differential settlement, and the erodible nature of the site soils.

Slope Stability

Slope stability analysis was performed for each of the proposed fill slopes; one at a 1.75:1 gradient and one at a 2:1 gradient. The slope stability analyses were performed using the computer program, SLIDE6, to determine the safety factor for potential failure surfaces. Minimum safety factors of 1.5 and 1.1 were used to evaluate the results of the static and seismic stability analyses, respectively. The Modified Bishop method of slices for the circular failure surfaces was the analysis method used.

Input parameters for the slope stability analyses include soil strength, subsurface profile, horizontal seismic acceleration, and water surface profile. Soil and rock strength input parameters included unit weight, cohesion, and angle of internal friction as determined by the direct shear test performed on the retrieved samples. The subsurface profile used in the

analysis was derived from Boring 2. To simulate the accelerations produced by an earthquake, a horizontal seismic acceleration of 0.15g was used in the pseudo static stability analysis. This acceleration is recommended in Special Publication 117A (California Division of Mines and Geology 2008).

The results of the slope stability analyses performed indicate that both of the proposed 1.75:1 and 2:1 slopes are not stable under both static and seismic conditions. The factors of safety obtained for the 1.75:1 and 2:1 slopes were 1.10 and 1.24 under static conditions and 0.96 and 1.05 under seismic conditions, respectively. The analyzed scenarios and resulting factors of safety are below the accepted minimum factors of safety of 1.5 and 1.1 under static and seismic conditions, respectively.

A second set of slope stability analyses were performed for the proposed 1.75:1 and 2:1 fill slopes; this time incorporating the use of geogrid reinforcement within the slopes. The geogrid used in the analyses was a Mirafi 3XT, with a long term design strength of 1,705 lbs/ft, and at a vertical spacing of 1.5 feet. The analyzed scenarios, with the use of geogrid, resulted in factors of safety which exceeded the accepted minimum factors of safety. The factors of safety obtained for the 1.75:1 and 2:1 slopes with the use of geogrid reinforcement were 1.636 and 1.966 under static conditions and 1.387 and 1.567 under seismic conditions, respectively. Therefore, it is recommended that Mirafi 3XT geogrid, or equivalent, be placed within the fill slopes at a vertical spacing of 1.5 feet and the fill slopes be constructed at a gradient no steeper than 1.75:1. Additional recommendations for the placement of geogrid within the fill slopes are addressed in the "Grading" section of this report.

Differential Settlement

The borings indicated that the site is underlain by loose soil in the upper 2 to 9 feet. As fill will be constructed to elevate and support the signs, there is a potential for differential settlement across the length of the signs. Differential settlement occurs when the foundation of a particular structure spans two materials having different settlement potential, such as loose soils and/or variable fill depths. The portion of the structure supported on a thicker layer of fill and/or loose soil will settle more than the portion of the structure supported on less fill and/or dense soils; a situation that can stress and possibly damage foundations. To reduce this potential, we recommended that the signs be founded on a uniform thickness of compacted fill reinforced with geogrid as discussed above.

Erosion Potential

The site soils are considered erodible. Caution should be exercised to protect the soil from erosion during and following construction.

General

The site soils were tested to have an expansion index of 3. This value indicates the site soils are non-expansive per the CBC. Based on our experience in this area, the underlying alluvial soils are known to become increasingly dense with depth and groundwater is known to be in excess of 50 feet below the surface. Given this anticipated increase in density with depth and significant depth to groundwater, in our opinion, the potential for liquefaction at the site is considered to be low.

6.0 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

The following recommendations are for the proposed monument signs as described in the "Introduction and Site Setting" section of this report. If locations, elevations, etc., change, the recommendations contained herein may require modification.

Unless otherwise noted, the following definitions presented are used in the recommendations presented below. Where terms are not specifically defined, common definitions used in the construction industry are intended.

- **Foundation Areas:** The area extending a minimum of 5 feet beyond footprint of the sign foundations.
- **Grading Areas:** The entire area to be graded, including the foundation areas.
- **Pad Grade:** The uppermost elevation of the constructed fill pads as shown on the grading plan; if no elevation is shown on the grading plan.
- **Existing Grade:** The elevation of the ground surface that existed as of the date of this report.
- **Scarified:** Plowed or ripped in two orthogonal directions to a depth of not less than 12 inches.
- **Moisture Conditioned:** Soil moisture content adjusted to optimum moisture content, or just above, prior to application of compactive effort.
- **Compacted / Recompacted:** Soils placed in level lifts not exceeding 8 inches in loose thickness and compacted to a minimum of 95 percent of maximum dry density. The standard tests used to establish maximum dry density and field density should be ASTM D 1557-12 and ASTM D 6938-10, respectively, or other methods acceptable to the geotechnical engineer and jurisdiction.

Site Preparation

1. The existing ground surface in the grading areas should be prepared for construction by removing, all vegetation, large roots, debris, and all other deleterious material. Any existing utilities that will not remain in service should be removed, relocated, or properly abandoned. The appropriate method of utility abandonment will depend upon the type and depth of the utility. Recommendations for abandonment can be made as necessary.

2. Voids created by the removal of materials or utilities should be immediately called to the attention of the geotechnical engineer. No fill should be placed unless the underlying soil has been observed by the geotechnical engineer.

Grading

1. The grading areas should be overexcavated to a level plane that is a minimum depth of 4 feet below the planned bottom-of-footing elevation, or 1 foot below existing grade, whichever is deeper. The resulting soil surface should then be scarified, moisture conditioned, and recompacted.

2. Following recompaction of the overexcavation bottom, a layer of Mirafi 3XT geogrid, or equivalent, should be placed along the bottom of the overexcavation surface. The geogrid should extend from the toe of the proposed fill slope a minimum of 20 feet into the slope.

3. After the initial layer of the geogrid has been placed, a maximum of 1.5 feet of fill; placed in thin lifts, moisture conditioned, and compacted, may then be placed above the geogrid. Following compaction, a second layer of geogrid should then be placed across the grading area followed by an additional 1.5 feet of compacted fill. This process should be continued up to 4 feet below pad grade. The uppermost 4 feet of fill within the grading area should not contain any geogrid, but only compacted fill.

4. The on-site soils are considered suitable as fill material. All materials used as fill should be cleaned of all debris and any rocks larger than 3 inches in diameter. When 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.

5. The recommended soil moisture content should be maintained throughout construction. Failure to maintain the soil moisture content can result in cracks and disturbance, which are indications of degradation of the soil compaction. If cracks are

allowed to develop, or if soils near the proposed sign foundations are otherwise disturbed, damage to the signs and/or foundations may result. Soils that have cracked or are otherwise disturbed should be removed, moisture conditioned, and compacted.

6. Permanent fill slopes should not exceed a 1.75:1 (horizontal to vertical) slope angle, unless otherwise recommended by the geotechnical engineer. A brow ditch should be constructed above each cut and fill slopes, or other means should be implemented to assure that runoff will not flow over the faces of the slopes.
7. To reduce the potential for degradation of compaction and disruption of drainage patterns, rodent activity should be aggressively controlled.

Foundations

1. The proposed monument signs should be founded on single spread footings bearing in compacted fill.

2. The footings should have minimum overall depth of 36 inches below the lowest grade within 5 feet of the footing. Foundations should be deepened, if necessary, to maintain a 5 foot minimum setback distance from the bottom of the footing to the outermost face of the slope.

3. The footing should be reinforced in accordance with the requirements of the architect/engineer.

4. Footings bearing in properly compacted fill may be designed using a maximum allowable bearing capacity of 3000 psf (dead plus live load). Using these criteria, maximum and differential settlement is expected to be on the order of 5/8 of-an-inch and 1/2 of-an-inch, respectively.

5. Allowable bearing capacities may be increased by one-third when transient loads such as wind or seismicity are included. Foundations may be designed using the following seismic parameters which are based, in part, on American Society of Civil Engineers Standard 7-10 (ASCE 2013), latitude of 35.7401N and a longitude of 120.6966W, as taken from the Google Earth web site (Europa Technologies 2014). Tools available on the Earthquake Hazards Program website (USGS 2014) were used to calculate the following values:

SEISMIC ACCELERATION SITE PARAMETERS

Mapped Spectral Response Acceleration for Site Class B		Site Coefficients for Site Class D		Adjusted MCE Spectral Response Accelerations for Site Class D		Design Spectral Response Accelerations for Site Class D	
Seismic Parameter	Value (g)	Site Coefficient	Value	Seismic Parameter	Value (g)	Seismic Parameter	Value (g)
S_S	1.471	F_a	1.00	S_{MS}	1.471	S_{DS}	0.980
S_1	0.529	F_v	1.50	S_{M1}	0.794	S_{D1}	0.529
Peak Mean Ground Acceleration (PGA_m): 0.529 g							

6. Lateral loads may be resisted by friction and by passive resistance of the soil acting on foundations. A passive equivalent fluid pressure of 250 pcf, and a friction factor of 0.40, may be used together, without reduction, for resistance to lateral loads. Lateral capacity is based on the assumption that backfill adjacent to foundations is properly compacted.

7. The foundation excavations should be observed by the geotechnical engineer prior to placement of reinforcing steel or concrete. The excavation should be lightly moistened and no cracks should be present prior to concrete placement.

Drainage and Maintenance

1. Unpaved ground surfaces should be *graded during construction* and, per Section 1804.3 of the CBC, *finish graded* to direct surface runoff away from foundations, slopes, and other improvements at a minimum 5 percent grade for a minimum distance of 10 feet. If this is not feasible due to the terrain, property lines, or other factors, swales with improved surfaces, area drains, or other drainage features should be provided to divert drainage away from these areas.

2. The site soils are erodible. To reduce erosion damage it is essential that the surface soils, particularly those disturbed during construction be stabilized by vegetation or other means *during and following construction.* Care should be taken to establish and maintain vegetation.

3. Rodent activity should be aggressively controlled as rodent burrows can disrupt drainage patterns and result in such situations as concentration of runoff, increased erosion, saturated or boggy soil conditions, etc. All of these conditions can cause damage to improvements.

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 1557-12 and ASTM D 6938-10, respectively, or other methods acceptable to the geotechnical engineer and jurisdiction.

5. At a minimum, the geotechnical engineer should be retained to provide:
   - Review of grading and foundation plans, notes and details as they near completion
   - Professional observation during grading
   - Oversight of compaction testing and special inspection during grading and backfill

6. Special inspection of any significant grading should be provided as per Section 1705.6 and Table 1705.6 of the CBC; the soils special inspector should be under the direction of the geotechnical engineer. In our opinion, the all grading operations required for this project should be considered to be of a minor nature and should be subject to *periodic* special inspection; subject to approval by the building official:
   - Stripping and clearing of existing vegetation, large roots, and debris
   - Overexcavation, scarification, moisture conditioning, and recompaction
   - Geogrid placement
   - Fill quality, placement, moisture conditioning, and compaction
   - Foundation excavations

7. A program of quality control should be developed prior to the beginning of the project. The contractor or project manager should determine if any additional inspection items are required by the architect/engineer or the governing jurisdiction.

8. A preconstruction conference among the County, the geotechnical engineer, the special inspector, the architect/engineer, and contractors is recommended to discuss planned construction procedures and quality control requirements.

9. The geotechnical engineer should be notified at least 48 hours prior to beginning construction operations. If Earth Systems Pacific is not retained to provide construction observation and testing services, it shall not be responsible for the interpretation of the information by others or any consequences arising there from.

7.0 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, this firm shall be notified for modifications to this report. Any items not specifically addressed in this report should comply with the CBC and the requirements of the governing jurisdiction.

The preliminary recommendations of this geotechnical report are based upon the geotechnical conditions encountered at the site, and may be augmented by additional requirements of the architect/engineer, or by additional recommendations provided by this firm based on peer or jurisdiction 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.

TECHNICAL REFERENCES

ASCE (American Society of Civil Engineers). 2013. *Minimum Design Loads for Buildings and other Structures (7-10, third printing), Standards ASCE/SEI 7-10.*

ASTM (American Society for Testing Materials). 2013. *Annual Book of ASTM Standards.*

California Division of Mines and Geology. [1997] 2008. *Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication* 117A.

CBSC (California Building Standards Commission). 2013. *California Building Code (CBC).*

Europa Technologies. 2014. Google Earth [website], retrieved from: http://www.google.com/earth/index.html

USGS (United States Geological Survey). 2014. Earthquake Hazards Program, retrieved from: http://earthquake.usgs.gov/hazards/designmaps/

APPENDIX A

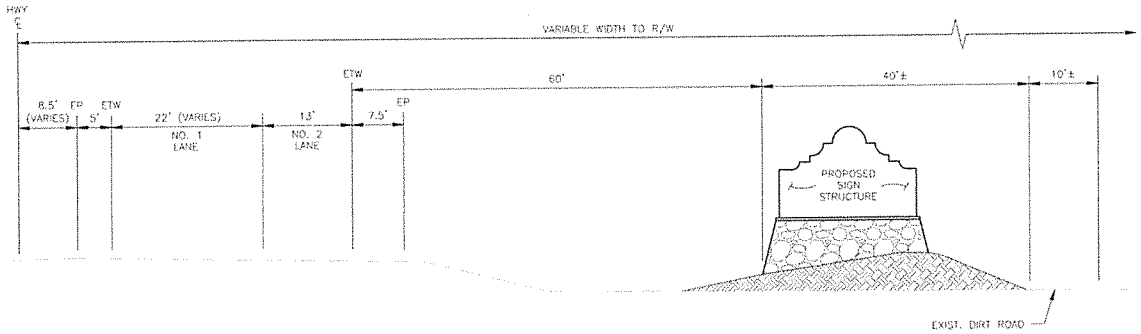
Boring Location Maps
Boring Log Legend
Boring Logs

BORING LOCATION MAP

SAN MIGUEL MONUMENT GATEWAY SIGN PROJECT

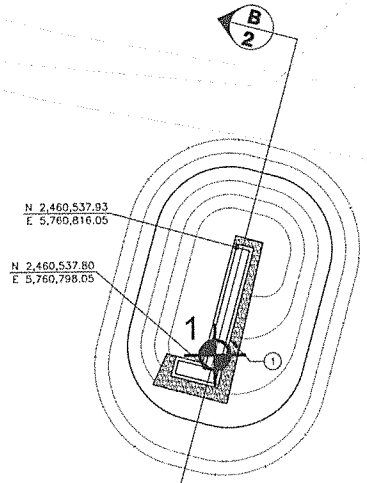
Highway 101

San Miguel Area of San Luis Obispo County, California



SECTION B-B

NOT TO SCALE



HWY. 101 NB NO. 2 LANE

LEGEND

2 Boring Location (Approx.)

N

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: esp@earthsys.com

June 10, 2014

QF

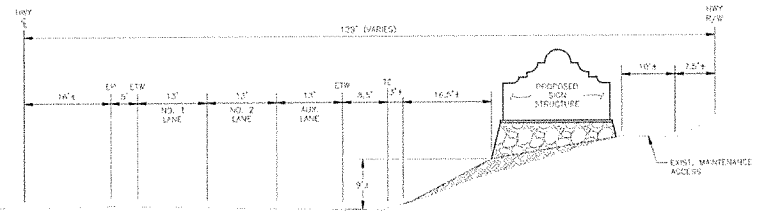
SL-17331-SA

BORING LOCATION MAP

SAN MIGUEL MONUMENT GATEWAY SIGN PROJECT

Highway 101

San Miguel Area of San Luis Obispo County, California



SECTION A-A

NOT TO SCALE

LEGEND

2 Boring Location (Approx.)

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: esp@earthsys.com

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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			FINE GRAINED SOILS		
BLOWS/FOOT		DESCRIPTIVE TERM	BLOWS/FOOT		DESCRIPTIVE TERM
SPT	CA SAMPLER		SPT	CA SAMPLER	
0-10	0-16	LOOSE	0-2	0-3	VERY SOFT
11-30	17-50	MEDIUM DENSE	3-4	4-7	SOFT
31-50	51-83	DENSE	5-8	8-13	MEDIUM STIFF
OVER 50	OVER 83	VERY DENSE	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 Legend091608.dwg

Earth Systems Pacific

Boring No. 1
PAGE 1 OF 1

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53
AUGER TYPE: 6" Hollow Stem Auger

JOB NO.: SL-17331-SA
DATE: 06/06/14

SAN MIGUEL MONUMENT GATEWAY SIGN PROJECT
Highway 101
San Miguel Area of San Luis Obispo County, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SC		CLAYEY SAND: light brown, loose, slightly moist, fine grained (Alluvium)					
2			light orange brown, medium dense, moist	0.0 - 5.0	○			
5				5.0 - 6.5	■	105.9	7.0	9 12 15
7	SW		WELL GRADED SAND: orange brown, medium dense, moist, some fine to coarse gravel					
8				7.0 - 10.0	○			
10				10.0 - 11.5	■	108.4	4.0	6 15 19
14	SC		CLAYEY SAND: orange brown, very dense, moist, fine grained					
15				15.0 - 16.5	●			22 31 20
16			End of Boring @ 16.5' 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.

Earth Systems Pacific

Boring No. 2
PAGE 1 OF 1

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53
AUGER TYPE: 6" Hollow Stem Auger

JOB NO.: SL-17331-SA
DATE: 06/06/14

SAN MIGUEL MONUMENT GATEWAY SIGN PROJECT
Highway 101
San Miguel Area of San Luis Obispo County, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SW - SC		WELL GRADED SAND WITH CLAY AND GRAVEL: orange brown, loose, slightly moist (Alluvium)	0.0 - 5.0	○			
4			moist	5.0 - 6.5	■	108.0	5.3	2 6 7
9			medium dense, very moist	10.0 - 11.5	■	117.3	10.9	5 9 10
13			increasing clay					
15	SW		WELL GRADED SAND: light brown, medium dense, moist, trace fine gravel	15.0 - 16.5	●			5 9 9
16.5			End of Boring @ 16.5' 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.

APPENDIX B

Laboratory Test Results

San Miguel Monument
Gateway Sign Project

SL-17331-SA

BULK DENSITY TEST RESULTS

ASTM D 2937-10 (modified for ring liners)

June 11, 2014

BORING NO.	DEPTH feet	MOISTURE CONTENT, %	WET DENSITY, pcf	DRY DENSITY, pcf
1	6.0 - 6.5	7.0	113.3	105.9
1	11.0 - 11.5	4.0	112.8	108.4
2	6.0 - 6.5	5.3	113.8	108.0
2	11.0 - 11.5	10.9	130.0	117.3

EXPANSION INDEX TEST RESULTS

ASTM D 4829-11

BORING NO.	DEPTH feet	EXPANSION INDEX
1	0.0 - 5.0	3

San Miguel Monument
Gateway Sign Project

SL-17331-SA

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12

PROCEDURE USED: A

PREPARATION METHOD: Moist

RAMMER TYPE: Mechanical

SPECIFIC GRAVITY: 2.65 (assumed)

June 11, 2014

Boring #1 @ 0.0 - 5.0'

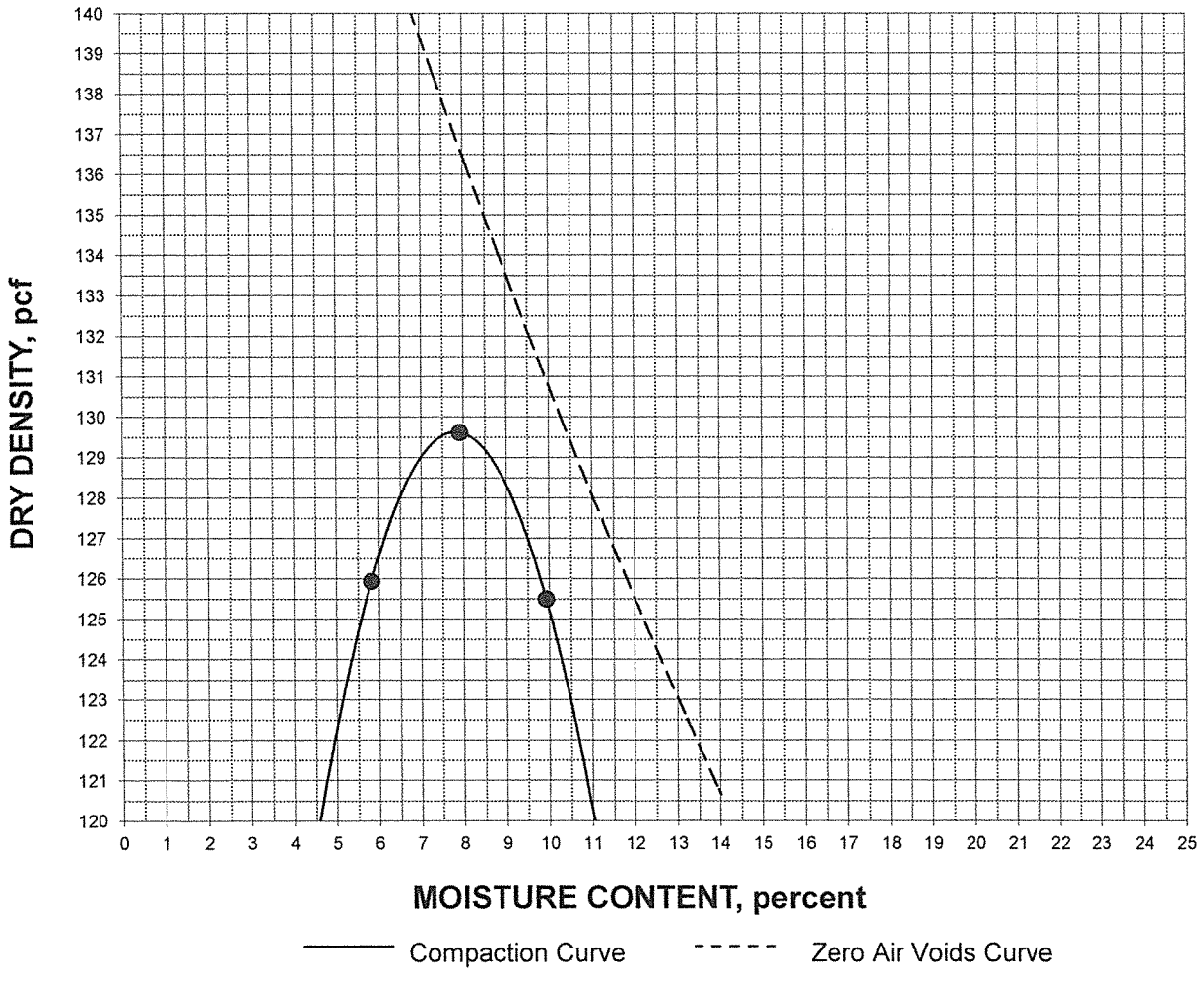
Light Brown Clayey Sand (SC)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 129.6 pcf

OPTIMUM MOISTURE: 7.8%



San Miguel Monument
Gateway Sign Project

SL-17331-SA

DIRECT SHEAR

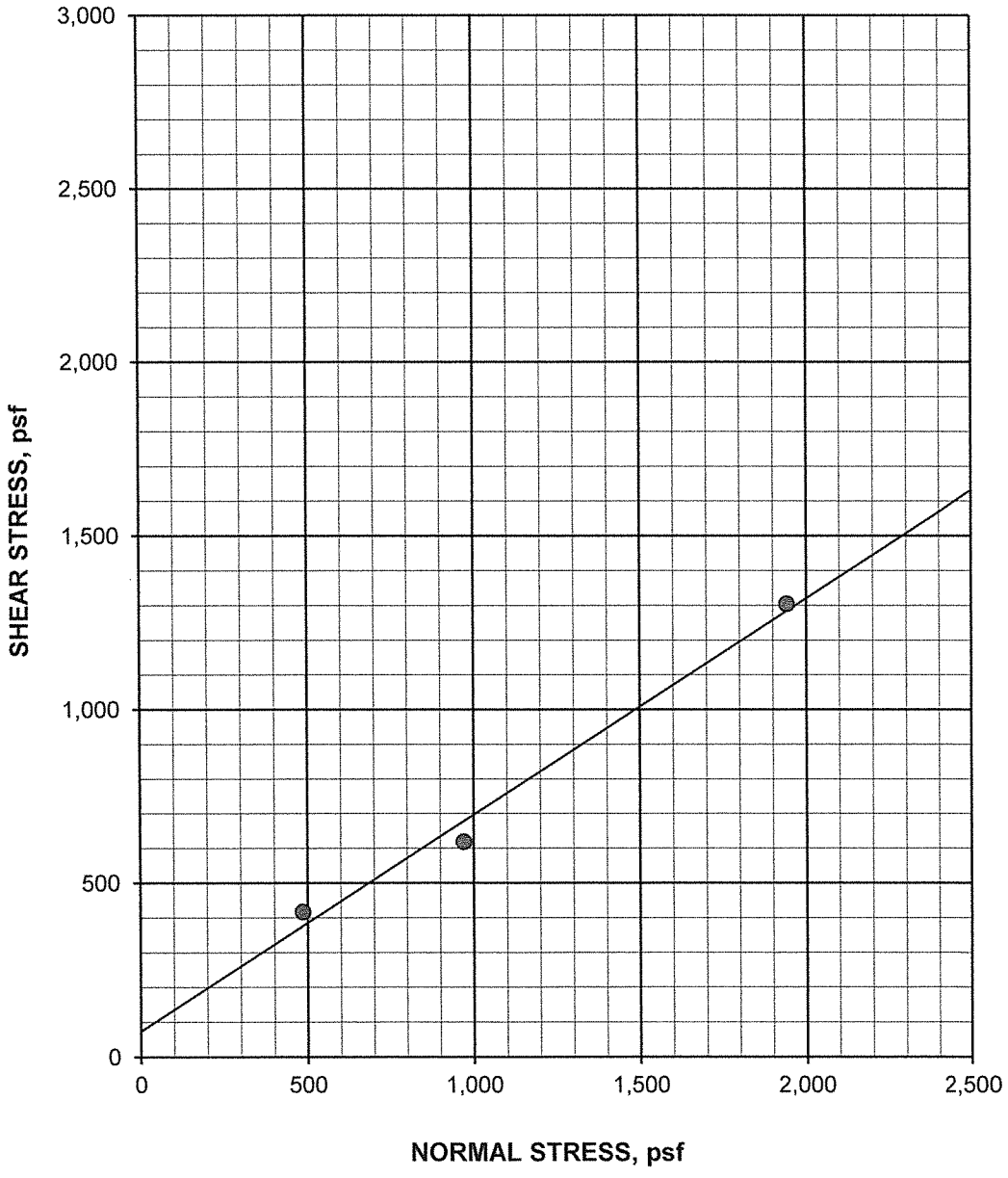
ASTM D 3080/D3080M-11 (modified for consolidated, undrained conditions)

June 11, 2014

Boring #1 @ 6.0 -6.5'
Clayey Sand (SC)
Ring sample, saturated

INITIAL DRY DENSITY: 101.7 pcf
INITIAL MOISTURE CONTENT: 7.0 %
PEAK SHEAR ANGLE (Ø): 32°
COHESION (C): 74 psf

SHEAR vs. NORMAL STRESS



San Miguel Monument
Gateway Sign Project

SL-17331-SA

DIRECT SHEAR continued

ASTM D 3080/D3080M-11 (modified for consolidated, undrained conditions)

Boring #1 @ 6.0 -6.5'

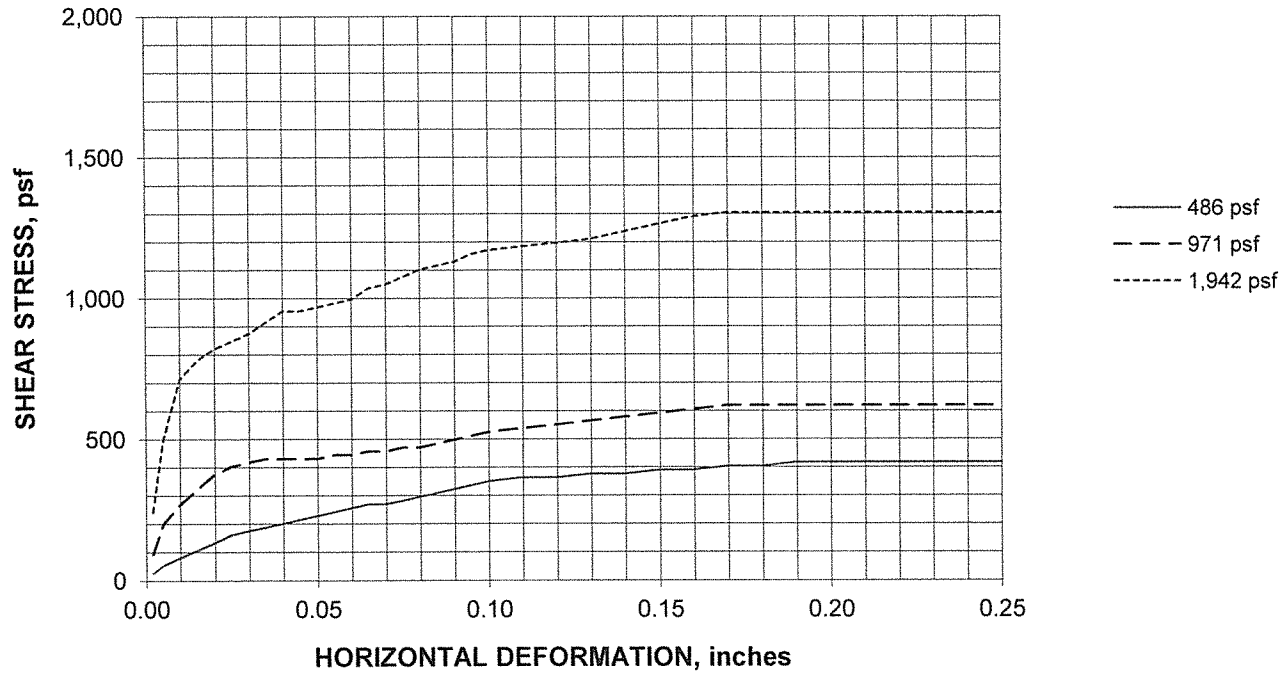
June 11, 2014

Clayey Sand (SC)

Ring sample, saturated

SPECIFIC GRAVITY: 2.65 (assumed)

SAMPLE NO.:	1	2	3	AVERAGE
INITIAL				
WATER CONTENT, %	7.0	7.0	7.0	7.0
DRY DENSITY, pcf	100.7	98.6	106.0	101.7
SATURATION, %	28.9	27.4	33.1	29.8
VOID RATIO	0.642	0.678	0.560	0.627
DIAMETER, inches	2.410	2.410	2.410	
HEIGHT, inches	1.00	1.00	1.00	
AT TEST				
WATER CONTENT, %	23.5	24.4	19.2	
DRY DENSITY, pcf	101.9	101.9	113.1	
SATURATION, %	100.0	100.0	100.0	
VOID RATIO	0.623	0.622	0.462	
HEIGHT, inches	0.99	0.97	0.94	



San Miguel Monument
Gateway Sign Project

SL-17331-SA

DIRECT SHEAR

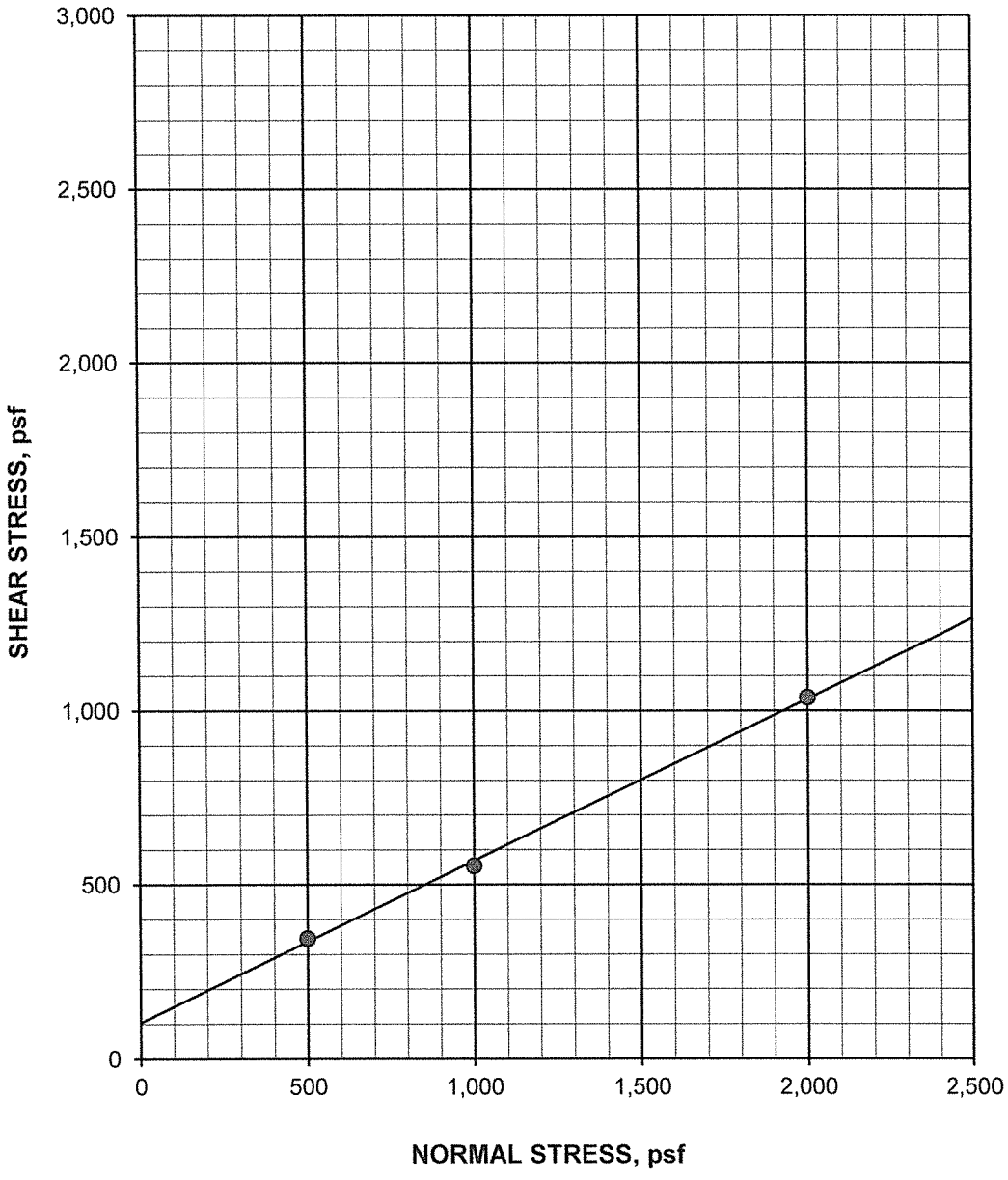
ASTM D 3080/D3080M-11 (modified for consolidated, undrained conditions)

June 11, 2014

Boring #2 @ 6.0 -6.5'
Well Graded Sand with Clay and Gravel (SW-SC)
Ring sample, saturated

INITIAL DRY DENSITY: 107.7 pcf
INITIAL MOISTURE CONTENT: 5.3 %
PEAK SHEAR ANGLE (Ø): 25°
COHESION (C): 104 psf

SHEAR vs. NORMAL STRESS



San Miguel Monument
Gateway Sign Project

SL-17331-SA

DIRECT SHEAR continued

ASTM D 3080/D3080M-11 (modified for consolidated, undrained conditions)

Boring #2 @ 6.0 -6.5'

June 11, 2014

Well Graded Sand with Clay and Gravel (SW-SC)

Ring sample, saturated

SPECIFIC GRAVITY: 2.65 (assumed)

SAMPLE NO.:	1	2	3	AVERAGE
INITIAL				
WATER CONTENT, %	5.3	5.3	5.3	5.3
DRY DENSITY, pcf	107.1	107.4	108.8	107.7
SATURATION, %	25.8	26.0	27.0	26.3
VOID RATIO	0.545	0.540	0.520	0.535
DIAMETER, inches	2.375	2.375	2.375	
HEIGHT, inches	1.00	1.00	1.00	
AT TEST				
WATER CONTENT, %	20.2	19.6	16.5	
DRY DENSITY, pcf	107.7	108.9	115.0	
SATURATION, %	100.0	100.0	100.0	
VOID RATIO	0.535	0.518	0.438	
HEIGHT, inches	0.99	0.99	0.95