Appendix G

Geotechnical Engineering Report

CITY OF LOS ANGELES

DEPARTMENT OF PUBLIC WORKS

BUREAU OF ENGINEERING

GEOTECHNICAL ENGINEERING DIVISION

GEOTECHNICAL ENGINEERING REPORT
LOS ANGELES RIVER WAY
SAN FERNANDO COMPLETION PROJECT
LOS ANGELES, CALIFORNIA

W.O. #E190752B
GED FILE # 12-125
SEPTEMBER 28, 2018

TABLE OF CONTENTS

1.0 INTRODUCTION

The City of Los Angeles, Department of Public Works, Bureau of Engineering, Geotechnical Engineering Division (GED) has prepared this geotechnical report for the Los Angeles River Way – San Fernando Completion project. The project site, as shown on Figure 1 –Vicinity Map, consists of the Los Angeles River between Wilbur Avenue and the Orange Line Metro crossing in the Reseda area of Los Angeles. The purposes of this investigation were to evaluate the nature and engineering properties of the subsurface materials and develop geotechnical recommendations for design and construction of the project. This report was prepared in response to the Architectural Division's request on January 30, 2018.

2.0 PROJECT DESCRIPTION

The project includes construction of a standard Class I bikeway and greenway along the banks of the Los Angeles River and undercrossings through the existing trapezoidal channel(s) in order to make a continuous bike path. We understand a total of six (6) undercrossings are proposed at this time: 1) Wilbur Avenue, 2) Reseda Boulevard, 3) Victory Boulevard, 4) Lindley Avenue, 5) White Oak Avenue, and 6) Orange Line Metro crossing. All undercrossings, except the Orange Line Metro crossing, will be constructed on the south side of the channel.

As part of the undercrossing construction, retaining walls up to approximately 7 feet high are proposed; therefore, a Section 408 Permit is required from the United States Army Corps of Engineers (USACE). We expect the proposed retaining wall footings for the undercrossings will be at least 5 feet above the bottom of the river channel. Final site grades along the river channel, and particularly at the proposed undercrossing locations, are expected to be within 7 feet of the existing ones. Final site grades adjacent to the top of the channel are expected to be within 1 foot of the existing ones. If significant changes to the project are proposed, the findings and recommendations in this report may not be applicable, and a supplemental report may be required.

3.0 GEOTECHNICAL INVESTIGATION

Leighton Consulting, Inc. (Leighton) completed field exploration and laboratory testing programs for the GED and presented the results in a Geotechnical Exploration Data report dated August 30, 2018. A copy of Leighton's report is included in Appendix A of this report. The findings and recommendations presented in this report are based on the information contained in Leighton's data report. The GED has reviewed Leighton's report, concurs with the findings, and accepts responsibility for the use of its contents.

3.1 FIELD EXPLORATION

Leighton drilled eleven (11) hollow-stem auger (HSA) borings and one (1) mud-rotary boring. Each of the 11 HSA borings was advanced to a total depth of approximately 31½ feet below existing ground surface (bgs) and the mud rotary boring was advanced to a total depth of 66½ feet bgs.

All borings were drilled near the top of the existing river channel slopes. The boring locations are presented on Plate 1 Geotechnical Map at the end of Leighton's data report. The subsurface conditions are discussed in Section 4.1 of this report.

3.2 LABORATORY TESTING

Laboratory tests were performed on selected soil samples to evaluate the geotechnical engineering properties of the subsurface materials. The following tests were performed:

- Soil classification (ASTM D2488),
- In-situ moisture content and dry density determination (ASTM D2216 and ASTM
- D2937),
- Particle-size analyses (ASTM D422),
- Fines content (ASTM D1140),
- Expansion Index (ASTM D4829-11),
- Atterberg Limits (ASTM D4318);
- Direct shear (ASTM D3080),
- Unconfined-Undrained Triaxial Compression (ASTM D2850), and
- Consolidation (ASTM D2435).

The individual laboratory tests are included in Appendix B of Leighton's report. The laboratory test results are discussed in Section 4.3 of this report

4.0 DISCUSSION OF FINDINGS

The subsurface conditions, groundwater conditions, and laboratory tests results are discussed in the following sections.

4.1 SUBSURFACE CONDITIONS

Wilbur Avenue: Borings HSA-1 and HSA-2b encountered undocumented fill that ranges in thickness from approximately 5 to 11 feet. The thicker fill was encountered in HSA-2b, which was drilled on the east side of Wilbur Avenue. The fill is comprised of lean clay to lean clay with sand. The native soil consists of silt and lean clay to a depth of approximately 30 feet in HSA-1 and 25 feet in HSA-2b. The underlying soil consists of well graded sand with gravel to the maximum explored depth.

Reseda Boulevard: Borings HSA-3 and HSA-4 both encountered approximately 6½ feet of undocumented fill. The fill is mostly comprised of sandy silt and lean clay. The native soil mostly consists of fat and lean clay with varying amounts of sand to the maximum explored depth.

Victory Boulevard: Borings HSA-5 and HSA-6 encountered undocumented fill that ranges in thickness from approximately 5 to 6 feet. The fill is mostly comprised of sandy silt. The native soil mostly consists of sandy lean to sandy fat clay and sandy silt to a depth of approximately 15 feet in HSA-5, and to the maximum explored depth in HSA-6. The underlying native soil in HSA-5 consists of interbedded silty sand, sandy silt, and poorly graded sand with silt.

Lindley Avenue: Borings HSA-7 and HSA-8 encountered undocumented fill that ranges in thickness from approximately 7½ to 10 feet. The thicker fill was encountered in HSA-7, which was drilled on the west side of Lindley Avenue. The fill in HSA-7 and HSA-8 is mostly comprised of lean clay with sand and sandy silt, respectively. The native soil in HSA-7 mostly consists of sandy lean clay to the maximum explored depth. The native soil in HSA-8 mostly consists of sandy lean clay to sandy silt with interbeds of silty and clayey sand. Also, a layer of poorly graded sand was encountered in HSA-8 at a depth of approximately 30 feet.

White Oak Avenue: Borings HSA-9 and HSA-10 encountered undocumented fill that ranges in thickness from approximately 17 to 22 feet. The thicker fill was encountered in HSA-9, which was drilled on the west side of the White Oak Avenue. The fill is mostly comprised of sandy lean clay, sandy silt, and clayey sand. The native soil mostly consists of silt to sandy silt to the maximum explored depth.

Orange Line Metro Crossing: Borings HSA-11 and MR-1 encountered undocumented fill that ranges in thickness from approximately 7½ to 12½ feet. The thicker fill was encountered in HSA-11, which was drilled on the west side of the crossing. The fill is mostly comprised of clayey sand to sandy lean clay and silt with varying amounts of sand. The native soil mostly consists of silt and lean clay with varying amounts of sand to a depth of approximately 35 feet. The native soil below 35 feet (see MR-1) mostly consists of poorly graded sand, poorly graded gravel, and silty sand.

4.2 Groundwater Conditions

As presented in Section 5.3 of Leighton's report (Appendix A), groundwater was encountered in five of the twelve borings at a depth ranging from approximately 25 to 33 feet bgs. It is important to note that the groundwater depth in HSA-1 rose to 20 feet within 10 minutes upon completion of the drilling.

Groundwater levels are expected to fluctuate with seasonal rainfalls, dry weather (i.e. drought conditions), and pumping activities in the vicinity of the proposed undercrossing sites. Nevertheless, groundwater is not expected to affect the proposed retaining walls foundations if the foundation elements are at least 5 feet above the bottom of the river channel.

4.3 Laboratory Test Results

In-situ moisture content and dry density tests were performed on forty samples of the fill and native soil to evaluate the total unit weight. Most of the samples tested were collected from depths between 5 and 15 feet bgs. Test results indicate the moisture content and dry unit weight ranges from approximately 8 to 41 percent and 78 to 109 pounds per cubic foot (pcf), respectively. The average moisture content is approximately 19 percent. The total unit weight of the native soil ranges from approximately 96 to 127 pcf with an average value of 117 pcf.

Fines content tests were performed on thirteen samples of soil collected from depths between 5 and 15 feet bgs. The test results indicate the fines content ranges from 35 to 92 percent with an average value of 70. The remaining fines content and gradation test results

on the samples from Boring MR-1 are presented in Leighton's report.

Expansion index (EI) tests were performed on four bulk samples of the existing fill material from the upper 5 feet. The test results indicate the EI ranges from 51 to 76, which indicates the soil has a moderate potential for shrink-swell behavior.

Atterberg Limit tests were performed on eight samples of soil collected from depths between 7½ and 15 feet bgs. The test results indicate the plasticity index of these materials ranges from 5 to 35. The average plasticity index of these eight samples is 25. Atterberg Limit tests were also performed on four samples from MR-1 that were collected at depths between 20 and 32½ feet bgs. The results are presented in Leighton's report.

Direct shear tests were performed on nine relatively undisturbed samples of soil collected from depths between 5 and 15 feet bgs. Based on Leighton's interpretation of the direct shear test results, the ultimate friction angle and cohesion value ranges from 25 to 34 degrees and 52 to 369 pounds per square foot (psf), respectively. Based on the GED's interpretation of all test results, and as shown on Figure 2, the ultimate friction angle and cohesion value is 30 degrees and 100 psf, respectively.

Unconsolidated-undrained triaxial tests were performed on seven relatively undisturbed samples of soil collected from depths between 10 and 25 feet bgs. The test results indicate the undrained shear strength ranges from approximately 1225 psf to 4400 psf. The compressive strength values presented in Section 4.7 of Leighton's report represent the deviator stress at failure, and not the actual undrained shear strength (½ of the deviator stress at failure).

5.0 RECOMMENDATIONS

Based on the results of our investigation, the proposed project is considered geotechnically feasible provided the recommendations presented in this report are incorporated into the design and construction. If changes in the design are made, or variations or changed conditions are encountered during construction, the GED should be notified to determine if supplemental recommendations are required.

An important design consideration for this project is the potential for long term settlement to occur in the existing fill. Another important design consideration for this project is the potential for shrink-swell behavior associated with expansive clayey soil. Recommendations to mitigate the effects of long-term static settlement and expansive soils are provided in the following sections.

5.1 EARTHWORK

All earthwork shall be performed in accordance with the geotechnical recommendations presented in this report and the USACE's requirements. Furthermore, all earthwork should be performed under the observation and testing of the GED or their representative.

5.1.1 Site Preparation

Site preparation will initially involve the demolition of the existing concrete along the river channel. Following demolition, the construction area should be cleared of any

miscellaneous debris and other deleterious material. Vegetation and organic matter, if encountered, should not be incorporated into the compacted fill.

Any utilities, whether active or inactive, shall be identified and, if required, properly abandoned or relocated. Any depressions resulting from removal of any existing foundations or utility lines shall be properly backfilled and compacted in accordance with the recommendations in the following sections.

5.1.2 Temporary Excavations

Vertical excavations shall not exceed more than 5 feet. Excavations greater than 5 feet to a maximum of 15 feet shall be sloped no steeper than 1:1 horizontal:vertical (H:V), beginning from the base of the excavation to the top of the slope. If excavations greater than 15 feet are proposed, the GED shall have an opportunity to review them and check the temporary stability.

5.1.3 Temporary Shoring

Temporary shoring may be required to facilitate construction of the retaining walls along the channel slopes. The actual shoring plans shall be prepared by the shoring designer. The GED shall be provided an opportunity to review the shoring plans and details prior to installation/construction. Also, the installation of temporary shoring systems shall be performed under the GED's observation

General

Cantilever or braced shoring may be considered at this site as an alternative to temporary excavations. Shoring deflections shall be limited to ½-inch. Sheet piles, box shoring (i.e. trench shields), and/or speed shores are not acceptable.

Prior to excavation, it is recommended that walls, structures, or portions of structures within a horizontal distance of 1½ times the depth of the excavation be inspected to determine their present condition. For documentation purposes, photographs should be taken of preconstruction conditions and level surveys should be performed.

Lateral Earth Pressures

Cantilever or braced shoring shall be designed for the lateral earth pressures shown on Figure 3. These values are based on the assumption that (1) the shored soil material is level at ground surface, (2) the exposed height of the shoring is no greater than 15 feet, and (3) the shoring is temporary, and will not be required to support the soil longer than about six months. Surcharge coefficients of 0.32 and 0.48 may be used with uniform vertical surcharges for cantilever and braced shoring lateral earth pressures, respectively. These surcharge pressures shall be added to the lateral earth pressures shown on Figure 3.

For conditions where the shored soil material is not relatively level at the ground surface (i.e. surcharged), cantilever shoring shall be used. The table below provides the active earth pressures.

Backfill Slope Inclination	Lateral Earth Pressure (pounds per cubic foot of equivalent fluid pressure)
Level to 4:1	50
4:1 to 3:1	55
3:1 to 2:1	65

Soldier Piles and Lagging Design

Drilled holes for soldier piles shall be backfilled with Controlled Low Strength Material (CLSM) per Greenbook Section 201, from the bottom of lagging (i.e. proposed excavation depth) to the ground surface. The CLSM shall contain a minimum of one sack of Portland cement per cubic yard of slurry and a maximum of two sacks of Portland cement per cubic yard of slurry. Drilled holes below the excavation bottom shall be backfilled with either structural concrete or CLSM. To reduce the potential for sloughing and caving of the soils, continuous lagging shall be installed between the soldier piles. All lumber shall be pressure-treated in accordance with Specification C-2 of the American Wood Preservers Association.

Soldier Pile and Lagging Construction Considerations

Based on the results of the geotechnical investigation, we don't anticipate soil caving during pile excavation; however, if it occurs, steel casing shall be used to support the sides of the excavation. The inside diameter of the casing shall be at least as large as the diameter of the shoring pile. Drilling shall be accomplished within the casing. Even though the piles will be used for temporary shoring, it will be necessary for the contractor to remove loose soil from the bottom of the pile excavation. Upon completion of drilling, secure covers shall be placed over the excavations. Concrete placement shall be completed within 12 hours of drilling and drilled holes shall not be left open overnight. Drilled excavations shall be observed and approved by the GED prior to installation of steel reinforcement.

Groundwater will likely be encountered if the piles extend below the bottom of the river channel. Concrete placement by the pumping and tremie method will be required if groundwater is present in the drilled holes. The tremie pipe should extend to the bottom of the pile excavation. During concrete placement, the bottom of the tremie pipe shall remain embedded at all times in at least 3 feet of concrete. During concrete placement, the casing shall be removed slowly. Furthermore, the casing shall extend above ground surface and shall always be filled with a sufficient head of concrete above the bottom of the casing before it is pulled out.

5.1.4 Over-Excavation and Subgrade Preparation

As discussed in Section 4.3, the average moisture content of the soil tested is approximately 19 percent, which is relatively high. Excavation bottoms will likely be soft

and/or wet (i.e. unstable) in some areas. Over-excavation is not required if firm and unyielding subgrade is encountered. If unstable subgrade is encountered, the amount of over-excavation and recompaction will be determined by the GED.

At a minimum, all subgrade soils beneath retaining wall footings and the bikeway path shall be scarified at least 6 inches, moisture conditioned to within 3 percent above the optimum moisture content, and compacted to at least 90 percent relative compaction (RC).

Also, if unstable subgrade is encountered at the base of excavations, disturbance in these areas shall be minimized. This can be accomplished by limiting the use of equipment and selecting the appropriate equipment to complete the work. At the first signs of pumping, the contractor shall take precautionary measures to avoid further disturbance.

5.1.5 Fill Materials

Fill materials beneath retaining walls and the bike path may consist of the onsite soils or approved import soil. Due to the relatively high moisture content of the onsite clayey soil, a thorough drying and blending effort may be required to achieve adequate compaction. The onsite soils shall not be used as retaining wall backfill.

Import fill shall be predominantly granular (minimum 80% passing number 4 sieve and between 10% and 35% passing the number 200 sieve), non-expansive (EI less than 20), and shall be free of organic or inorganic debris, contamination and materials with any dimension larger than 3 inches. Proposed import soil shall be reviewed by the GED for approval prior to delivery to the job site. The GED shall be notified a minimum of three working days prior to scheduled importing of soil to the project site.

5.1.6 Fill Placement and Compaction

Fill material shall be placed in loose lifts not exceeding 8 inches in thickness and mechanically compacted. The onsite soils shall be moisture-conditioned to within 1 to 4 percent above the optimum moisture content. Import fill, if used, shall be moisture conditioned to within 3 percent above the optimum moisture content. All fill, except for crushed aggregate base (CAB) shall be compacted to a minimum of 90 percent RC, as determined by ASTM Test Method D1557. All CAB and crushed miscellaneous base (CMB) shall be moisture conditioned to within 3 percent above optimum and compacted to a minimum of 95 percent RC.

Fill placement and compaction shall be observed and tested by the GED. Compacted fill soils shall be kept moist, (at or slightly above the specified moisture content at the time of compaction) but not flooded, until covered with subsequent construction. If compacted fill soils become softened or disturbed, they shall be replaced or recompacted at the discretion of the GED before additional fill or construction is placed. Certification and inspection approvals for compromised soils are void and invalid.

5.2 RETAINING WALL FOUNDATIONS

As mentioned, retaining walls up to approximately 7 feet high are proposed as part of the undercrossing construction. Recommendations for bearing capacity and settlement, lateral load resistance, lateral earth pressures, backfill criteria, and drainage are presented below.

5.2.1 Bearing Capacity and Settlement

The retaining wall footings shall be a minimum of 2 feet below lowest adjacent grade, and bear entirely on at least 6 inches of compacted fill. The actual footing dimensions will depend on the lateral load analysis, which shall be performed by the project structural engineer.

Footings placed on compacted fill may be designed using an allowable (net) bearing capacity of 1,500 psf. The allowable bearing value applies to combined dead and sustained live loads. The allowable bearing pressure may be increased by one-third when considering transient live loads, including seismic and wind forces.

Based on the allowable bearing value recommended above, the total static settlement of the retaining wall footings is anticipated to be less than 1 inch. The structural engineer shall confirm that the proposed walls cannot tolerate this amount of settlement.

We did not evaluate the potential impact of dynamic (i.e. seismically-induced) settlement on the proposed crossings. To eliminate the potential for seismically-induced settlement would likely be impractical and cost prohibitive. The City understands the retaining walls for this project, including the paths, could undergo some level of distress during an earthquake and consider this to be a matter of maintenance. Repairs may be required following an earthquake. The intent of the earthwork and foundations recommendations in this report is to help reduce or attenuate the effects of static settlement only. We do not expect dynamic settlement to result in a failure of the walls.

5.2.2 Lateral Load Resistance

Lateral load resistance will be developed by passive soil pressure against the sides of footings below grade and by friction acting at the base of the footings bearing on compacted fill. An allowable passive pressure of 250 psf per foot of depth may be used for design purposes if the soil in front of the walls is relatively flat (inclination of 5:1 or flatter). If the soil in front of the wall descends towards the river channel, you may begin applying full passive resistance (i.e. 250 pcf) at a depth where there is at least 5 feet from the edge of the footing to the face of the slope.

An allowable coefficient of friction of 0.35 may be used for dead and sustained live load forces to compute the frictional resistance of the footings constructed directly on compacted fill.

A factor of safety of 1.5 has been incorporated in development of allowable passive and frictional resistance values, respectively. Under seismic and wind loading conditions, the passive pressure and frictional resistance may be increased by one-third.

5.2.3 Lateral Earth Pressures

We assume the retaining walls will be free to rotate at the top (i.e. not restrained). If this is not the case, supplemental recommendations will be required. We also assume the

retaining wall backfill will be non-expansive. The wedge of non-expansive compacted backfill shall extend no steeper than 1:1 (H:V), beginning from the base of the excavation to the top of the wall.

The wall shall be designed to withstand "active" pressures based on an equivalent fluid pressure of 40 pcf. This recommended lateral earth pressure value (40 pcf) assumes that the surface of the backfill behind the retaining walls is 4:1 (H:V) or flatter. For conditions where the shored soil material is not relatively level at the ground surface (i.e. surcharged), cantilever shoring shall be used. The table below provides the active earth pressures.

Backfill Slope Inclination	**Lateral Earth Pressure (pounds per cubic foot of equivalent fluid pressure)**
Level to 4:1	40
4:1 to 3:1	50
3:1 to 2:1	60

The backfill slope inclination shall not exceed 2:1 (H:V) or supplemental recommendations will be required.

Surcharge loads (live or dead) shall be added to the lateral earth pressures above by applying a uniform (rectangular) pressure. Lateral earth pressure coefficients for a uniform vertical surcharge load applied behind walls are 0.32 for active (cantilever wall).

5.2.4 Backfill and Drainage

Wall backfill shall be protected against infiltration of surface water. Backfill adjacent to walls should be sloped so that surface water drains freely away from the wall and will not pond. The lateral earth pressures provided in Section 5.2.3 assume no buildup of hydrostatic pressure behind the wall. To prevent hydrostatic pressures, a subsurface drainage system should be installed behind the wall. The subsurface drainage system should consist of granular filter material and a perforated subdrain pipe. A 12-inch-thick layer of filter material should be placed against the wall and extended up to approximately 12 inches below the backfill surface. The filter material should be a clean, well-graded mixture of sand and gravel meeting the following grading requirements:

Sieve Size	**Percentage Passing Sieve**
1"	100
¾"	90-100
⅜"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

An alternative to graded filter material is to use clean gravel (¾-inch size) with a geotextile placed between the gravel and backfill soil. The geotextile should be Mirafi 140NC or equivalent.

The perforated subdrain pipe shall be installed within the filter material near the bottom of the wall. The pipe should be at least 4 inches in diameter and be placed with the perforations downward. The pipe should be surrounded with granular material. The subdrain pipe should lead to a free discharge outlet. Weep holes are acceptable provided they are constructed with wire mesh to prevent rodents from entering.

6.0 SUPPLEMENTAL GEOTECHNICAL SERVICES

6.1 REVIEW OF PLANS AND SPECIFICATIONS

The final civil and structural plans/details, including the specifications, should incorporate the recommendations presented in this report. The GED shall be provided an opportunity to review the plans and specifications to ensure proper interpretation and application of our recommendations.

6.2 GEOTECHNICAL OBSERVATION AND TESTING DURING CONSTRUCTION

All grading, excavation, and construction of foundations should be performed under the observation and testing of the GED at the following stages:

- During demolition;
- Upon completion of site clearing;
- During site excavation;
- During installation of shoring, if utilized;
- During subgrade preparation;
- During fill placement and compaction;
- During excavation of footings and immediately prior to placement of foundation concrete;
- When any unusual or unexpected geotechnical conditions are encountered.

7.0 CLOSURE

If you have any questions regarding this report, please contact Mircea Pop at (213) 847-0484.

10/03/18

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10-3-18

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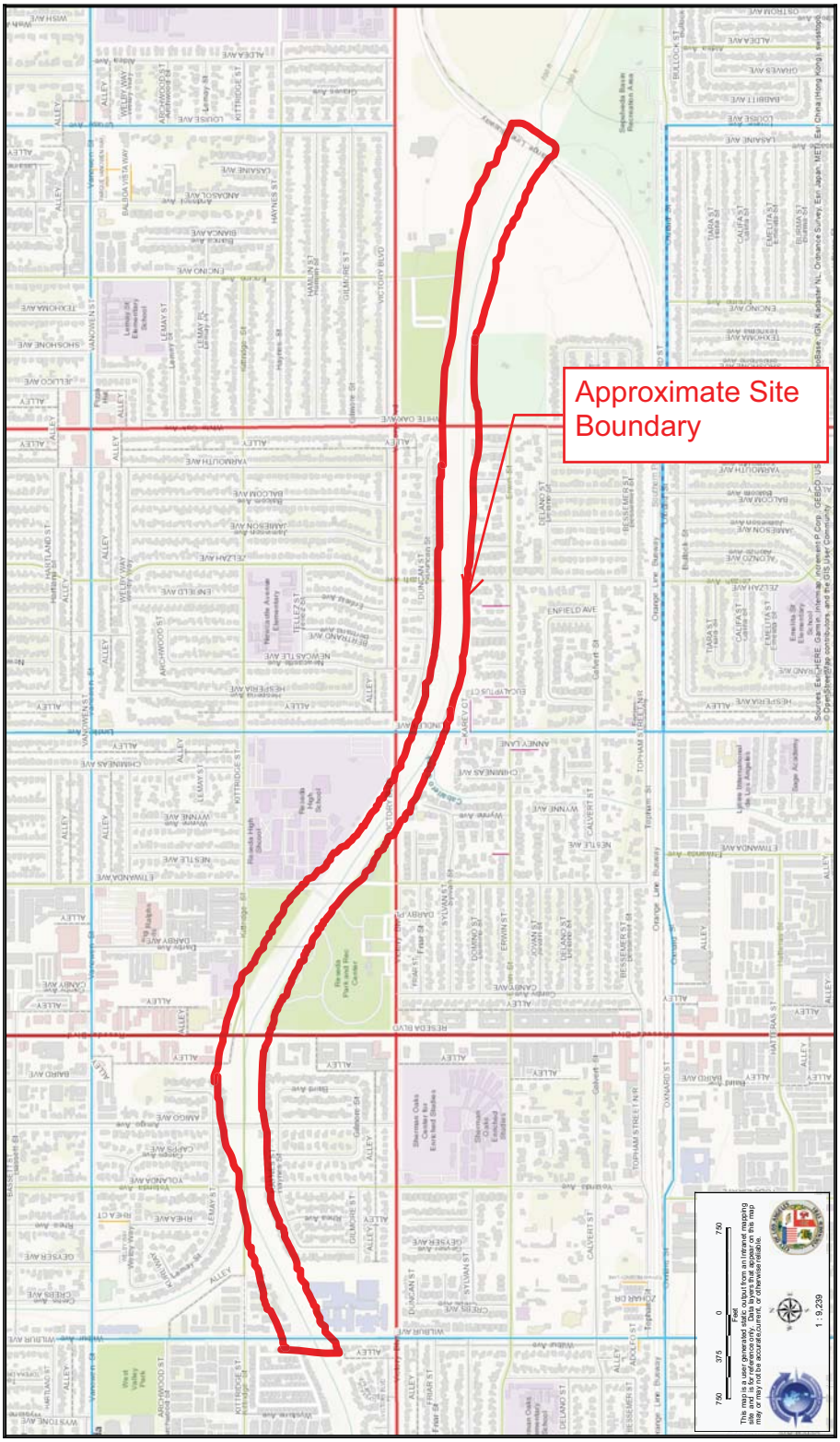
Civil Engineering Associate I

FIGURES



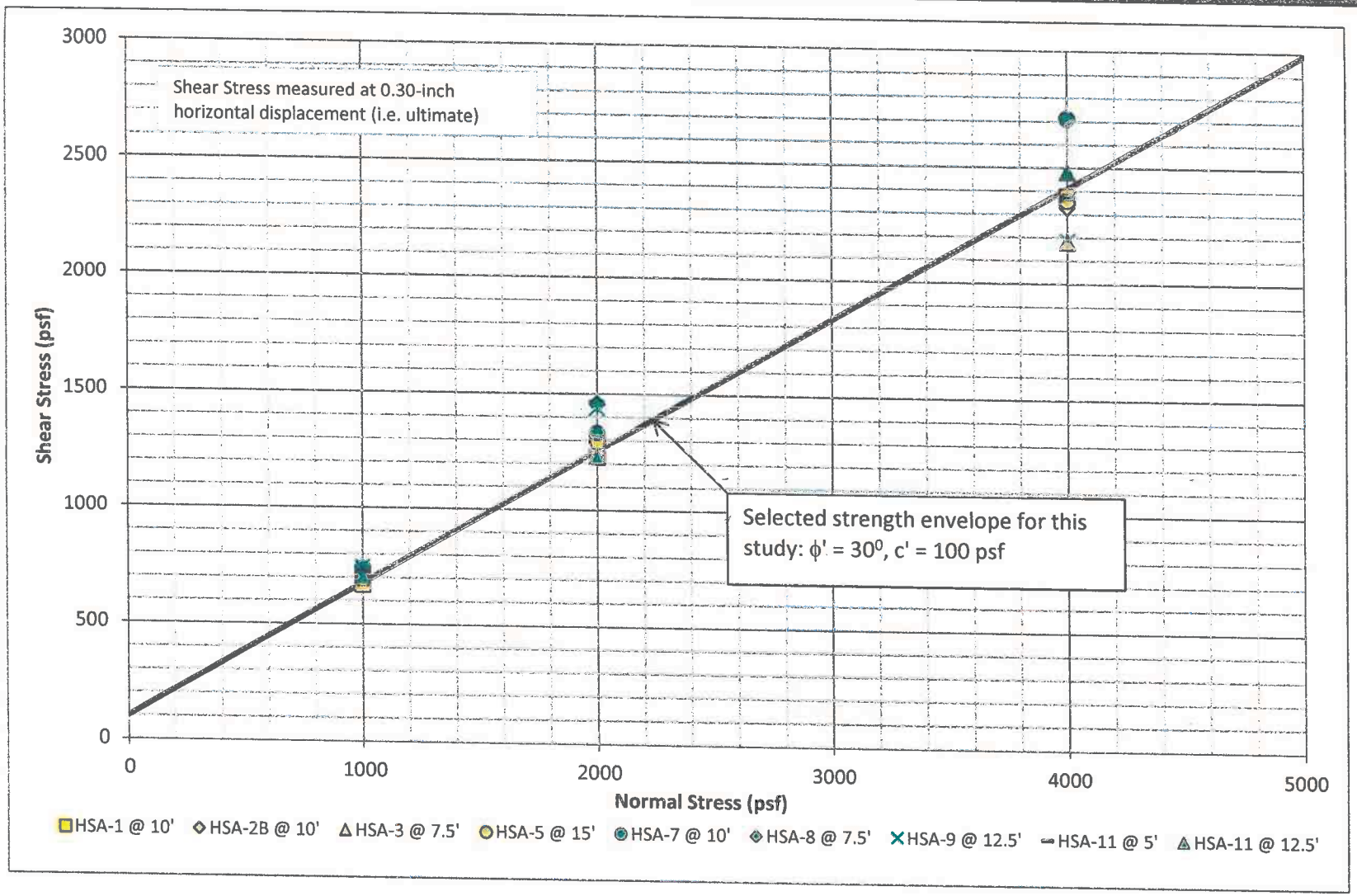
Vicinity Map

LOS ANGELES RIVER WAY
SAN FERNANDO COMPLETION PROJECT
LOS ANGELES, CALIFORNIA

Bureau Of Engineering
Geotechnical Engineering Division
GED File No. : 12-125

Date: 09/28/2018

Figure 1

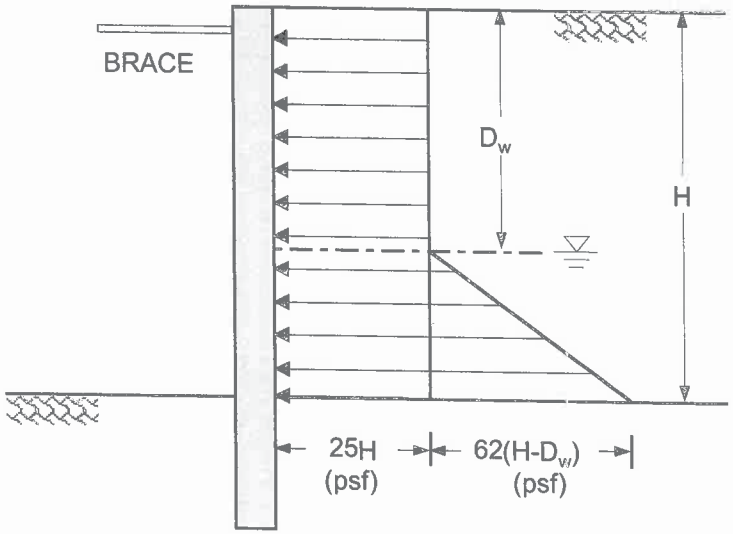


Drained Shear Strength Envelope of Fill and Native Soil (Upper 15 feet)

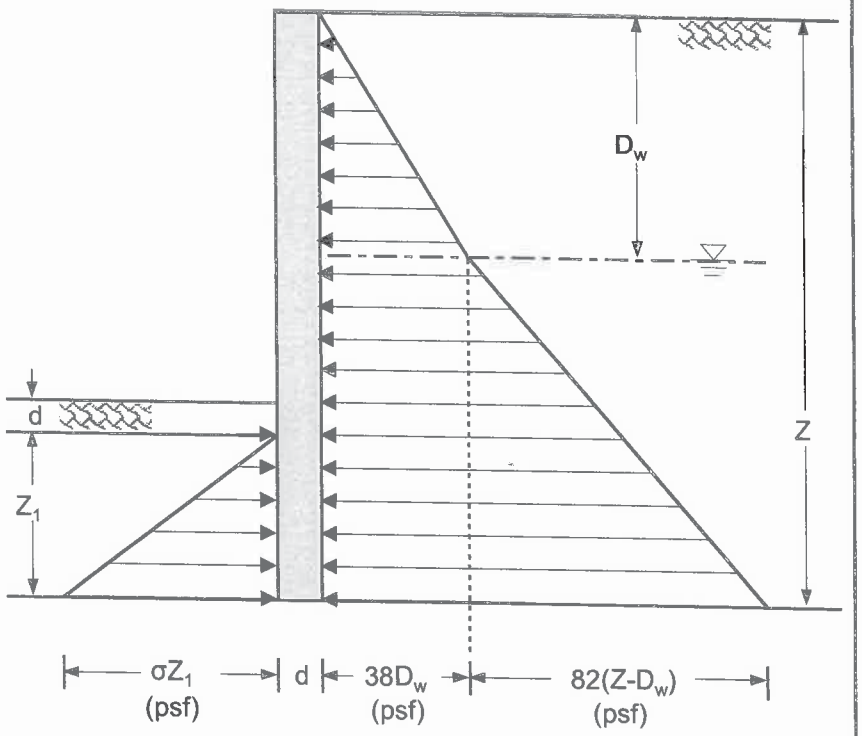
LA RIVER BIKEWAY
SAN FERNANDO COMPLETION PROJECT
LOS ANGELES, CALIFORNIA

BUREAU OF ENGINEERING
GEOTECHNICAL ENGINEERING DIVISION (GED)
GED FILE No.: 12-125
SEPTEMBER 2018

Figure No. 2



BRACED SHORING



CANTILEVER SHORING

σ = 500 pcf for soldier piles spaced at least 2.5d apart above water table
σ = 261 pcf for soldier piles spaced at least 2.5d apart below water table
σ = 250 pcf for soldier piles spaced less than 2.5d apart above water table
σ = 130 pcf for soldier piles spaced less than 2.5d apart below water table

Notes:
1. Dimensions are in feet.
2. Pressure Included hydrostatic pressure
3. D_w is the depth to groundwater and may experience seasonal fluctuations.
4. "d" is one pile diameter or 5 feet to the face of the channel slope, whichever is greater.
5. The earth pressures shown are based on level backfill conditions behind shoring.

LATERAL EARTH PRESSURES FOR TEMPORARY SHORING SYSTEMS

Los Angeles River Way - San Fernando Completion Los Angeles, California

By: ERF	Date: 9/27/18	GED File No.: 12-125
City of Los Angeles, DPW, BOE, "GED"		Figure 3

APPENDIX A

Geotechnical Exploration Data Report by Leighton Consulting, Inc. dated August 30, 2018

GEOTECHNICAL EXPLORATION DATA REPORT
LOS ANGELES RIVER WAY-
SAN FERNANDO COMPLETION PROJECT
LOS ANGELES, CALIFORNIA
WO# E190752B, GED FILE NO. 12-125

Prepared for:

CITY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS

Bureau of Engineering, Geotechnical Engineering Division (GED)
1149 South Broadway, Suite 120
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Project No. 11957.004

August 30, 2018

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

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A LEIGHTON GROUP COMPANY

August 30, 2018

Project No. 11957.004

City of Los Angeles Department of Public Works
Bureau of Engineering, Geotechnical Engineering Group (GEO)
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Attention: Mr. Patrick J. Schmidt, P.E., G.E.
Division Manager, Geotechnical Engineering Division

Subject: Geotechnical Exploration Data Report
Los Angeles River Way-San Fernando Completion Project
Los Angeles, California
W.O. #E190752B, GEO FILE #12-125

In accordance with our proposal dated April 11, 2018, and the subsequent Notice to Proceed issued April 30, 2018, Leighton Consulting, Inc. (Leighton) is pleased to present this Geotechnical Data Report which summarizes the results of our field exploration and laboratory testing program in support of the Los Angeles River Way-San Fernando Completion Project.

Respectfully submitted,

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TABLE OF CONTENTS

TABLES

Leighton

ATTACHMENTS

Figure 1 – Site Vicinity Map

Appendix A – Exploration Logs
Appendix B – Geotechnical Laboratory Test Results

Plate 1 – Geotechnical Map

1.0 INTRODUCTION

This data report presents the results of our geotechnical exploration for the proposed Los Angeles River Way-San Fernando Completion Project. The project alignment is shown on Figure 1, *Site Vicinity Map.*

1.1 Project Description

Our understanding of the project is based on the Geotechnical Engineering Division (GED) March 21, 2018 Task Order Solicitation (TOS); WO# E1907787, GED File No. 12-125. We understand the City of Los Angeles, intends to construct a new Class I bikeway and greenway along the banks of the Los Angeles River. The proposed bikeway and green way are proposed in two segments. Segment 1 extends from approximately Vanalden Avenue on the west to White Oak Avenue on the east. Segment 2 extends from White Oak Avenue on the west to the Orange Line Busway on the east. The two segments combine for a total approximate length of 2.3 miles. (see Figure 1 – *Site Vicinity Map*).

2.0 PRE-EXPLORATION AND UTILITY CLEARANCE

Prior to commencing field work, Leighton met with a GED representative to discuss project details, coordinate site access, and walk the proposed project alignment. Boring locations were marked in the field, and Underground Service Alert (DigAlert-USA) was notified on May 10, 2018.

3.0 FIELD EXPLORATION

Field exploration was performed on May 16 through May 18, 2018 and June 1, 2018. The explorations consisted of eleven (11) hollow-stem auger borings (HSA-1 through HSA-11) and one (1) mud-rotary boring (MR-1). The hollow-stem auger borings were each advanced to a total depth of approximately 31½ feet below existing ground surface (bgs) and the mud rotary boring was advanced to a total depth of 66½ feet bgs. At the request of GED, three attempts were made to advance boring HSA-2 and shallow refusal was encountered on buried debris. Step outs were performed at 5-foot intervals in an easterly direction until HSA-2B successfully penetrated the buried debris. A list of the borings performed as a part of this study along with pertinent location and depth information is presented in the following table.

Table 1: Boring Location Data Table

Boring	Drilling Method	Depth (ft)	Latitude	Longitude	Vicinity
HSA-1	HSA	31.5	34.1883	-118.5453	South of Wilbur Ave.
HSA-2B		31.5	34.1889	-118.5444	North of Wilbur Ave.
HSA-3		31.5	34.1889	-118.5353	South of Reseda Blvd.
HSA-4		31.5	34.1897	-118.5356	North of Reseda Blvd.
HSA-5		31.5	34.1869	-118.5303	West of Victory Blvd.
HSA-6		31.5	34.1864	-118.5294	East of Victory Blvd.
HSA-7		31.5	34.1867	-118.5278	South of Lindley Ave.
HSA-8		31.5	34.1853	-118.5269	North of Lindley Ave.
HSA-9		31.5	34.1850	-118.5192	South of White Oak Ave.
HSA-10		31.5	34.1847	-118.5178	North of White Oak Ave.
HSA-11		31.5	34.1842	-118.5108	North of Orange Line Busway
MR-1	Mud Rotary	66.5	34.1839	-118.5097	South of Orange Line Busway

Boring locations are shown on Plate 1, *Geotechnical Map*. The borings were drilled using conventional truck mounted hollow-stem auger and mud-rotary drill rigs. Bulk and relatively undisturbed drive soil samples were collected using a Modified-California ring sampler at selected intervals within the hollow-stem auger borings for geotechnical and analytical laboratory testing. Standard Penetration Tests (SPTs) were conducted at selected intervals within the mud-rotary boring and the samples were retained for geotechnical laboratory testing. Upon completion of drilling, hollow-stem auger borings

(HSA-1 through HSA-11) were backfilled with tamped soil cuttings and completed at the surface to match existing conditions (i.e. concrete, asphalt, soil). The mud-rotary boring (MR-1) was backfilled with cement-bentonite grout to the existing ground surface.

3.1 Sampling

Leighton personnel obtained bulk, relatively undisturbed, and Standard Penetration Test (SPT) samples from the borings for geotechnical laboratory testing. The samples were obtained at the depths indicated on the boring logs (Appendix A).

Relatively undisturbed samples were obtained from each hollow-stem auger boring (HSA-1 through HSA-11) at intervals of approximately 2.5 to 5 feet. Samples were collected at each interval by driving a Modified California Split-Spoon Sampler (3.0-inch outside diameter) below the furthest extent of the hollow stem auger. The barrel of the sampler was lined with 1-inch-high by 2.41-inch inside diameter brass sampling rings. Ring samples were procured in plastic cans for transport to our geotechnical laboratory.

SPT samples were obtained from the mud-rotary boring (MR-1) at intervals of 2.5 to 5 feet as shown on the boring logs. No ring samples were collected from the mud-rotary boring. The SPTs were performed in general accordance with ASTM Test Method D1586. Samples of the materials obtained from the SPT sampler were placed in plastic bags for transport to our geotechnical laboratory.

In all cases, samples were driven with 140-pound hammer automatic hammer falling 30 inches drop for a total sample drive length of 18 inches. Blow counts were recorded for every 6 inches of advancement and are presented on the boring logs.

3.2 Logging and Classification

Each boring was logged and coordinated by a State of California Professional Geologist (PG). Visual observations were made of the subsurface materials at each sampling depth. The earth materials were classified visually in substantial accordance with the Unified Soil Classification System (USCS).

Stratification lines on the boring logs represent the approximate boundaries between predominant soil types, with transitions generally occurring gradually.

Density and stiffness correlations based on blowcounts are summarized for each sample. Boring logs are presented in Appendix A, *Exploration Logs*.

3.3 Volatile Organic Compound Screening

Soil samples collected above groundwater were field screened for volatile organic compounds (VOCs) using a Photo Ionization Detector (PID). PID readings recorded for each sample are presented on the boring logs in Appendix A.

4.0 GEOTECHNICAL LABORATORY TESTING

Geotechnical laboratory tests were performed on selected soil samples obtained during field exploration. Laboratory tests were selected and scheduled by GED. The following laboratory tests were performed on soil samples to evaluate geotechnical engineering properties of the subsurface materials:

- Soil classification (ASTM D2488);
- In-situ moisture content and dry density determination(ASTM D2216 and ASTM D2937);
- Particle-size analyses (ASTM D422);
- Fines content (ASTM D1140);
- Expansion Index (ASTM D4829-11)
- Atterberg Limits (ASTM D4318);
- Direct shear (ASTM D3080);
- Unconfined-Undrained Triaxial Compression (ASTM D2850);
- Consolidation (ASTM D2435) and;

All laboratory tests were performed in general conformance with ASTM and California Test procedures. The results of the in-situ moisture tests are presented on the geotechnical boring logs (Appendix A). Detailed results of laboratory testing are presented in Appendix B – *Geotechnical Laboratory Test Results.* Test results are summarized as follows:

4.1 Soil Classification

Classifying soils in accordance with standardized methods enables their properties and characteristics to be evaluated in a broad-based manner, and to correlate soils found on various sites. Visual classifications made in the field are often refined after more detailed observations of the materials are made in the laboratory, and after subsequent laboratory testing. ASTM Test Method D2488 was used to perform the visual classification of selected soil samples in the laboratory.

The determined classifications of each soil sample are shown on the boring logs in Appendix A. The classifications of specific specimens that were tested in the laboratory are indicated with the respective test results in Appendix B. Because

the types of in-situ materials may change abruptly, there may be apparent discrepancies between the classifications as indicated on the boring logs and in the test-result documentation.

4.2 In-situ Moisture Content and Dry Density Determination

The in-situ moisture content and dry density were performed in accordance with ASTM Test Methods D2216 and D2937, respectively. The in-situ moisture content serves to establish a correlation between the properties and behavior of a soil and the in-situ dry density provides a measure of the degree of densification of a material. The in-situ moisture content (as a percentage of dry weight of soil) and dry density (in pounds per cubic foot, pcf) were determined for relatively undisturbed specimens. The test results are presented on the boring logs in Appendix A.

4.3 Particle Size Analysis

The particle-size distributions of selected soil samples were evaluated by performing mechanical (sieve) and hydrometer analyses. The data was used to refine the Unified Soil Classification for the tested soil samples. The results of the tests are presented graphically in Appendix B and summarized in the table below.

Table 2: Sieve Analysis Results

Sieve Analysis (ASTM D422)				
Boring ID	**Depth (feet)**	**Gravel (%)**	**Sand (%)**	**Fines (%)**
MR-1	35	1	51	48
	45	11	36	53

4.4 Fines Content

Selected soil samples were wet-wash sieved through a No. 200 U.S. Standard brass sieve in accordance with ASTM Test Method D1140 to determine the percentage of fines (silts and clays). This data was used to refine the Unified Soil Classification for the tested samples. The results are presented in Appendix B and summarized in the table below.

Table 3: Percent Passing No. 200 Sieve Results

Percent Passing No. 200 (ASTM D1140)			
Boring ID	**Depth (feet)**	**Fines (%)**	**Sand (%)**
HSA-1	10	90.1	9.9
HSA-2B	7.5	86.4	13.6
	12.5	91.3	8.7
HSA-3	7.5	74.5	25.5
HSA-4	12.5	92.4	7.6
HSA-5	10	77.6	22.4
HSA-6	7.5	62.8	37.2
	12.5	77.4	22.6
HSA-7	12.5	51.3	48.7
HSA-8	10	60.4	39.6
	15	35.1	64.9
HSA-10	10	65.7	34.3
HSA-11	5	47.6	52.4
MR-1	20	75.8	24.2
	22.5	46.6	53.4
	25	75.2	24.8
	30	71.6	27.4
	32.5	61.4	38.6

4.5 Atterberg Limits

The plasticity of selected samples was evaluated by performing the liquid limit (LL), plastic limit (PL) and plasticity index (PI) tests (ASTM D4318), commonly referred to as Atterberg Limits. The results are presented in Appendix B and summarized in the table below.

Table 4: Atterberg Limits Results

Boring ID	Depth (feet)	USCS	Atterberg Limits		
			Liquid Limit	Plastic Limit	Plasticity Index
HSA-1	12.5	CL	46	20	26
HSA-2B	12.5	CL	43	20	23
HSA-3	12.5	CL	49	20	29
HSA-4	7.5	CH	58	23	35
HSA-5	10	CH	53	19	34
HSA-6	15	CL	38	17	21
HSA-7	12.5	CL-ML	26	21	5
HSA-10	12.5	CL	43	18	25
MR-1	20	CL	35	19	16
	25	CL	34	19	15
	30	CL	42	20	22
	32.5	CH	64	26	38

4.6 Direct Shear

Shear strength parameters of selected soil samples were obtained by direct shear tests in accordance with ASTM D3080. Detailed results of the shear tests are presented in Appendix B and summarized in the table below.

Table 5: Direct Shear Results

Boring ID	Depth (feet)	C (psf)	Φ (°)
HSA-1	10	96	30
HSA-2B	10	163	28
HSA-3	7.5	225	26
HSA-5	15	180	29
HSA-7	10	52	33
HSA-8	7.5	85	34
HSA-9	12.5	369	25
HSA-11	5	196	29
	12.5	86	31

4.7 Unconsolidated-Undrained Triaxial Compression

Unconsolidated undrained (UU) triaxial compression tests were performed on selected undisturbed samples in accordance with ASTM Method D2850. The samples were encased in a membrane to prevent drainage during testing, and then loaded into a triaxial test chamber. A confining pressure was then applied. The samples were sheared under compression at a constant rate of axial strain of approximately 0.060 inches per minute. Detailed test results are presented in Appendix B and summarized in the table below.

Table 6: Unconsolidated-Undrained Triaxial Compression Results

Boring ID	Depth (feet)	Compressive Strength (psi)
HSA-1	12.5	35.75
HSA-3	10	61.74
HSA-6	20	51.00
HSA-7	7.5	20.68
HSA-9	15	40.63
HSA-11	10	52.19
	25	17.02

4.8 Consolidation

Consolidation testing was performed on relatively undisturbed ring samples in accordance with ASTM D2435. These tests were performed to evaluate the compressibility and moisture sensitivity of site soils under load. This test involved loading the specimen into a consolidometer, which contained porous stones at the top and bottom of the device to accommodate vertical drainage from the specimen during testing. Normal vertical axial loads were applied to the specimen and the resulting deflections were recorded at various time periods. Normal loads were applied at a constant load-increment ratio, successive loads being generally twice the preceding load. Samples were tested at field and submerged moisture contents. The results are presented graphically in Appendix B.

4.9 Expansion Index

Expansion Index (EI) tests were performed on representative bulk soil samples from the site, in general accordance with ASTM D4829. Detailed test results are presented in Appendix B and summarized in the table below.

Table 7: Expansion Index Results

Boring ID	Depth (feet)	USCS	Expansion Index
HSA-1	0-5	CL	69
HSA-3	0-5	CL	76
HSA-9	0-5	CL	65
HSA-11	0-5	CL	51

5.0 FINDINGS

5.1 Regional Geology

The project site is located along the banks of the Los Angeles River in the San Fernando Valley. The San Fernando Valley is an east-west trending structural trough within the Transverse Ranges Geomorphic Province that is bounded by the San Gabriel Mountains to the north and the Santa Monica Mountains to the south. The mountains that bound the valley to the north and the south are actively deforming anticlinal ridges bounded on their sides by thrust faults. As these ranges have risen and been deformed, the San Fernando Valley has subsided and filled with sediment (CGS, 1997). The Transverse Ranges are composed of parallel, east-west trending mountain ranges and broad intervening sediment-filled valleys.

The site is located in an area of complex geology as the relatively northwestward moving Peninsular Ranges Province collides with the Transverse Ranges Province (San Gabriel Mountains) to the north. Several active and potentially active faults have been mapped in the region and are believed to accommodate compression associated with this collision.

The site, located on the southern margin of the San Fernando Valley, is underlain by thick accumulations of alluvial sediments consisting of clay, silt, sand and gravel (Yerkes and Campbell, 2005). These sediments were eroded from the mountains and deposited in the site vicinity by the Los Angeles River and smaller drainage courses originating in the Santa Monica Mountains to the south.

5.2 Site-Specific Geology

5.2.1 Artificial Fill (afu)

Artificial fill of varying thickness mantles the majority of the project alignment. Based on our subsurface explorations, fill varies from approximately 5 feet to 22 feet in thickness. The thickest accumulation of fill was encountered in Boring HSA-9, located to the east of White Oak Avenue. In general, the encountered fill materials consist predominantly of firm to very stiff clay with variable amounts of silt and sand and occasional miscellaneous debris.

5.2.2 Quaternary Alluvium (Qa)

Below the overlying artificial fill materials, native alluvial materials were encountered at depths of 5 to 22 feet below existing grade at our exploration locations. The thickest accumulation of fill (22 feet thick) was encountered in boring HSA-9. The Quaternary age alluvial soils that underlie the site consist primarily of clay, sandy clay, clay with silt, clayey sand, silty sand, sand, and minor amounts of gravel. Locally the materials consist of olive brown to reddish brown, stiff/medium dense to very stiff/dense, thickly bedded to laminated alluvial deposits with abundant oxidation staining and carbonate stringers.

5.3 Groundwater Conditions

According to groundwater information obtained through the California Geological Survey (CGS) and presented in the Seismic Hazard Zone Report for the Canoga Park Quadrangle (CGS, 1997), the historically shallowest groundwater depth in the vicinity of the project site is less than 10 feet bgs. Groundwater was encountered in five (5) of the subsurface explorations. Where encountered, the approximate depth to groundwater was measured and recorded on the boring logs. The depths to groundwater as encountered in the borings while drilling are presented in the following table:

Table 8: Groundwater Conditions

Boring	Depth to Groundwater (ft bgs)
HSA-1	25
HSA-2B	25
HSA-3	NE
HSA-4	29.5
HSA-5	NE
HSA-6	NE
HSA-7	NE
HSA-8	NE
HSA-9	NE
HSA-10	NE
HSA-11	31
MR-1	33

*NE-Not encountered to maximum depth explored

6.0 LIMITATIONS

This report presents the data obtained during our geotechnical exploration and laboratory testing and does not present any conclusions or recommendations regarding the subject site and the data obtained.

The findings from our site exploration are considered valid as of the date of this report. The data provided in this report was obtained from a limited number of exploration locations (each of which were prescribed by GED) and, therefore, may not completely define all subsurface conditions throughout the site. The nature of many sites is that differing geotechnical or geological conditions can occur within small distances and under varying climactic conditions. Furthermore, changes in subsurface conditions can and do occur over time. The data in this report should be used with these statements in mind.

Leighton's work was performed using the degree of care and skill ordinarily exercised by reputable geotechnical consultants practicing in this or similar localities at the time the work was performed. No other warranty, either expressed or implied, is made as to the conclusions, recommendations, and professional opinions presented in this report.

7.0 REFERENCES

California Geological Survey, 1997, Seismic Hazard Zone Report for the Canoga Park 7.5 Minute Quadrangle, Los Angeles County, California, Seismic Hazard Zone Report 07.

Yerkes, R.F., and Campbell, R.H., 2005, Preliminary Geologic Map of the Los Angeles 30' x 60' Quadrangle, Southern California, United States Geological Survey: Open-File Report 2005-1019, Version 1.0, Map Scale 1:100,000.

Project: 11957.004	Eng/Geol: EMH
Scale:1 " = 2,000 '	Date: August 2018

Base Map: ESRI ArcGIS Online 2018
Thematic Information: Leighton
Author: Leighton Geomatics (btran)

SITE VICINITY

Los Angeles River Way-San Fernando Completion
Los Angeles, California

Figure 1

Leighton

Map Saved as V:\Drafting\11957\004\Maps\11957-004_F01_VM_2018-08-30.mxd on 8/30/2018 9:32:33 AM

APPENDIX A

EXPLORATION LOGS

Leighton

GEOTECHNICAL BORING LOG HSA-1

Project No.	11957.004	**Date Drilled**	5-16-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	733'
Location	*See Plate 1- Geotechnical Map*; 34.1883, -118.5453	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
730	0			BB-1				CL	@0': 3-inches of asphalt, no base. **Artificial Fill, undocumented (Afu)**: CLAY with silt, brown, slightly moist, trace fine sand, low to moderate plasticity.	EI
	5		0.0	R1	3 5 8			ML	**Quaternary Alluvium (Qa)**: @5': Clayey SILT, olive brown, stiff, slightly moist, low plasticity, carbonate stringers.	
725			0.0	R2	3 5 9				@7.5': Clayey SILT with sand, olive brown, stiff, slightly moist, low plasticity, fine sand, with carbonate stringers.	
	10		0.0	R3	4 7 10	98	23	CL	@10': CLAY with silt, olive brown, stiff, slightly moist, low to moderate plasticity, little fine sand, carbonate stringers.	-200
720			0.0	R4	2 5 9	95	25		@12.5': Less carbonate, medium plasticity with lens of highly plastic material.	AL, UU
	15		0.0	R5	4 6 7	94	26	ML	@15': SILT with sand, olive brown, stiff, moist, fine sand, micaceous, minor gleying and oxidation, little clay, low to medium plasticity.	
715										
	20		0.0	R6	3 4 7			ML	@20': Interbedded SILT with sand and CLAY with silt, mottled olive brown, grayish brown, reddish brown, firm, moist, minor gleying, MnO spotting.	
710										
	25		0.0	R7	5 8 9				@25': Stiff, wet	
705										
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG HSA-1

Project No.	11957.004	**Date Drilled**	5-16-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	733'
Location	*See Plate 1- Geotechnical Map*; 34.1883, -118.5453	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30			R8	8 11 35			SW	@30': Gravelly SAND, dark tan brown, dense, wet, medium to coarse sand, grades coarser with fine gravel, well graded.	
700	35								Total Depth: 31.5 feet bgs Groundwater encountered during drilling at 25 feet bgs, measured at 20.23 feet bgs 10 minutes after drilling. Boring Backfilled with tamped soil cuttings and asphalt patched upon completion	
695	40									
690	45									
685	50									
680	55									
675	60									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG HSA-2

Project No.	11957.004	**Date Drilled**	5-16-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	735'
Location	*See Plate 1- Geotechnical Map*	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log	PID	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S								*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
735	0									@0': 3-inches of asphalt, no base. **Artificial Fill, undocumented (Afu)**: CLAY with silt, brown, moist, some sand and fine gravel, medium plasticity.	
730	5		0.0	R1		5 10 11			CL	@5': CLAY, brown, moist, with miscellaneous debris. @6': Possible concrete, stepped off 5-feet.	
										Total Depth: 6.5 feet bgs Boring Backfilled with tamped soil cuttings and asphalt patched upon completion	
725	10										
720	15										
715	20										
710	25										
705	30										

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG HSA-2A

Project No.	11957.004	**Date Drilled**	5-18-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	735'
Location	*See Plate 1- Geotechnical Map*	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log	PID	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
735	0	N S							*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
									@0': 2-inches of asphalt, no base, step off from HSA-2.	
									Artificial Fill, undocumented (Afu):	
									CLAY with silt, brown, moist, some sand and fine gravel, medium plasticity.	
730	5		0.0	R-1 (Bulk Driven)	7 18 20			ML	@5': Sandy SILT with clay, brown, very stiff, moist, some sand and fine gravel.	
									@6.5': Concrete	
									Total Depth: 6.5 feet bgs	
									Refusal on concrete.	
									Boring Backfilled with tamped soil cuttings and asphalt patched upon completion	
725	10									
720	15									
715	20									
710	25									
705	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG HSA-2B

Project No.	11957.004	**Date Drilled**	5-16-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	735'
Location	*See Plate 1- Geotechnical Map*; 34.1889, -118.5444	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
735	0			BB-1					@0': 2-inches asphalt concrete, no base. **Aritificial Fill, undocumented (Afu)**: CLAY with silt, brown, moist, some sand and fine gravel, medium plasticity.	
730	5		0.0	R1	2 5 10			CL	@5': CLAY, brown, stiff, moist, medium to high plasticity, trace silt.	
			0.0	R2	4 6 9	99	22		@7.5': CLAY with silt, brown, stiff, moist, medium plasticity.	-200
725	10		0.0	R3	2 4 9	98	26	CL-ML	@10': CLAY with silt, olive brown, stiff, moist, mottled with rootlets, grades to olive brown, low to medium plasticity, carbonate stringers.	DS
									Quaternary Alluvium (Qa)	
			0.0	R4	4 8 10				@12.5': CLAY with silt, olive brown, stiff, moist, low to medium plasticity, carbonate stringers.	-200, AL, CN
720	15		0.0	R5	3 6 8	101	21		@15': Increase in silt content.	
715	20		0.0	R6	7 10 10			SM CL	@20': Lamination of silty SAND, olive brown, medium dense, moist, fine sand, micaceous, MnO spotting, grades back into CLAY with silt, very moist, highly plastic.	
710	25			R7	5 12 17			SW	@25': SAND with gravel, dark tannish brown, medium dense, wet, fine to coarse sand, fine gravel, well graded, with lamination of SILT/silty SAND.	
705	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG HSA-2B

Project No.	11957.004	**Date Drilled**	5-16-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	735'
Location	*See Plate 1- Geotechnical Map*; 34.1889, -118.5444	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
705	30			R8	1 2 4			ML	@30': Clayey SILT with sand, greenish brown to reddish brown, soft, wet, fine sand, heavily oxidized, medium to high plasticity.	
									Total Depth: 31.5 feet bgs Groundwater encountered during drilling at 25 feet bgs, measured at 27 feet bgs after drilling. Boring Backfilled with tamped soil cuttings and asphalt patched upon completion	
700	35									
695	40									
690	45									
685	50									
680	55									
675	60									

The Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG HSA-3

Project No.	11957.004	**Date Drilled**	5-16-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	730'
Location	*See Plate 1- Geotechnical Map*; 34.1889, -118.5353	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
730	0			BB-1				CL	@0': 5-inches of asphalt concrete, no base **Aritificial Fill, undocumented (Afu)**: CLAY, dark brown, moist, some silt, trace sand and fine gravel.	
725	5		0.0	R1	6 10 13				@5': CLAY with silt, brown, stiff, moist, some silt, medium plasticity.	
									Quaternary Alluvium (Qa):	
			0.0	R2	4 6 9	101	15	CL	@7.5': CLAY with silt, olive brown, stiff, some sand, carbonate blebs, low plasticity, grades to CLAY, olive brown, medium high plasticity.	AL
720	10		0.0	R3	3 8 11	101	19		@10': CLAY with silt, olive brown, stiff, slightly moist, trace sand, carbonate stringers, medium plasticity.	CN
			0.0	R4	5 8 13	93	24		@12.5': Dark brown, slightly moist, decrease in carbonate stringers.	-200
715	15		0.0	R5	5 9 11				@15': CLAY, olive brown, stiff, moist, little silt, medium plasticity, trace carbonate.	
710	20		0.0	R6	6 11 13				@20': CLAY, olive brown, moist, very stiff, medium to high plasticity, carbonate blebs and stringers.	
705	25		0.0	R7	10 11 22				@25': CLAY with silt, olive brown, mottled, very stiff, low to medium plasticity, MnO spotting, carbonate blebs.	
700	30									

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG HSA-3

Project No.	11957.004	**Date Drilled**	5-16-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	730'
Location	*See Plate 1- Geotechnical Map*; 34.1889, -118.5353	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
700	30		0.0	R8		3 10 11				@30': CLAY, olive brown, moist, stiff, medium plasticity, MnO spotting, carbonate stringers, sampler wet.	
										Total Depth: 31.5 feet bgs No groundwater encountered during drilling. Boring Backfilled with tamped soil cuttings and asphalt patched upon completion	
695	35										
690	40										
685	45										
680	50										
675	55										
670	60										

Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG HSA-4

Project No.	11957.004	**Date Drilled**	5-16-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	732'
Location	*See Plate 1- Geotechnical Map*; 34.1897, -118.5356	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
	0			BB-1				ML	@0': Grass. **Aritificial Fill, undocumented (Afu)**: Sandy SILT, brown, slightly moist, fine sand, trace clay.	
730										
	5		0.0	R1	5 8 18				@5': SILT with sand, brown, very stiff, slightly moist, fine sand, trace clay.	
725									**Quaternary Alluvium (Qa)**:	
			0.0	R2	16 19 22	105	18	CH	@7.5': CLAY, brown, very stiff, slightly moist, medium plasticity, some silt, carbonate stringers.	AL
	10		25	R3	7 10 12	100	16	CL	@10': CLAY with silt, olive brown, stiff, slightly moist, low plasticity, abundant carbonate.	CN
720			4.1	R4	7 9 12	101	18		@12.5': Less carbonate, tree root in bottom ring.	-200
	15		0.1	R5	7 12 17				@15': CLAY with silt, olive brown, very stiff, slightly moist, trace sand, medium plasticity.	
715										
	20		19.5	R6	7 12 17				@20': CLAY, olive brown, very stiff, moist, trace silt, medium plasticity.	
710										
	25		1.7	R7	4 8 15				@25': CLAY with silt, olive brown, very stiff, moist, medium plasticity, carbonate blebs, MnO spotting.	
705										
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG HSA-4

Project No.	11957.004	**Date Drilled**	5-16-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	732'
Location	*See Plate 1- Geotechnical Map*; 34.1897, -118.5356	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30		0.0	R8		0 2 2			CL	@30': CLAY, olive brown, soft, wet, high plasticity.	
700										Total Depth: 31.5 feet bgs Groundwater encountered at 29.8 feet bgs during drilling (0755), measured at 29.5 feet bgs (0808) Boring Backfilled with tamped soil cuttings and asphalt patched upon completion	
	35										
695											
	40										
690											
	45										
685											
	50										
680											
	55										
675											
	60										

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG HSA-5

Project No.	11957.004	**Date Drilled**	5-18-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	727'
Location	*See Plate 1- Geotechnical Map*; 34.1869, -118.5303	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N S)	PID	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0									*This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	
				BB-1					ML	@0': 5-inches of asphalt concrete over 2.5-inches base **Artificial Fill, undocumented (Afu)**: Sandy SILT with Clay, brown, moist, fine sand, trace gravel	
725											
	5		0.0	R1		5 9 14	97	11		@5': Sandy SILT, brown, stiff, moist, fine sand, trace gravel.	
									CL	@6': **Quaternary Alluvium (Qa)**: Silty CLAY, olive brown, slightly moist, some fine sand, low plasticity, carbonate stringers.	
720			0.0	R2		13 19 23			ML	@7.5': Sandy SILT, brown, very stiff, fine sand, carbonate, grades to SILT with clay, dark olive brown, low plasticity, abundant carbonate	
	10		0.0	R3		8 13 15	104	18	CH	@10': CLAY with silt, dark olive brown, very stiff, slightly moist, abundant carbonate veins.	-200, AL
715			0.0	R4		7 15 22			ML	@12.5': SILT with clay, mottled tannish brown to olive brown, very stiff, slightly moist, low plasticity, abundant carbonate veins.	DS
	15		0.0	R5		8 9 12	102	8	SM	@15': Silty SAND, yellowish brown, medium dense, slightly moist, fine to medium sand, trace coarse sand and fine gravel, carbonate stringers, pinhole porosity (>1mm), high silt content.	
710											
	20		0.0	R6		11 13 18			ML	@20': Grades to sandy SILT, yellowish brown, very stiff, slightly moist, low plasticity, carbonate stringers.	
705											
	25		0.0	R7		12 14 19			SP-SM	@25': SAND with silt, yellowish brown to orange brown, slightly moist, mostly fine sand, some medium sand, friable, poorly graded.	
700											
	30										

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG HSA-5

Project No.	11957.004	**Date Drilled**	5-18-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	727'
Location	*See Plate 1- Geotechnical Map*; 34.1869, -118.5303	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
695	30		0.0	R8	34 24 12				@30': SAND with silt, yellowish brown, moist, mostly fine sand, some medium sand, grades coarser with coarse sand and fine gravel, cobble in barrel, disturbed.	
690	35								Total Depth: 31.5 feet bgs No groundwater encountered during drilling. Boring Backfilled with tamped soil cuttings and asphalt patched upon completion	
685	40									
680	45									
675	50									
670	55									
	60									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG HSA-6

Project No.	11957.004	**Date Drilled**	5-17-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	728'
Location	*See Plate 1- Geotechnical Map*; 34.1864, -118.5294	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N–S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			BB-1				ML	@0': 1-inch asphalt concrete, no base. **Aritificial Fill, undocumented (Afu)**: Sandy SILT, brown, slightly moist, fine sand, trace clay.	
725										
	5		0.0	R1	7 11 12			ML	**Quaternary Alluvium (Qa)** @5': SILT with clay, brown, stiff, slightly moist, little fine sand, carbonate stringers, top ring disturbed.	
720			0.0	R2	10 13 14	102	10	CL	@7.5': Sandy CLAY, light brown, stiff, slightly moist, fine sand, grades to SILT with clay.	-200
	10		1.0	R3	9 14 16	109	16	ML	@10': SILT with clay, mottled brown and olive brown, very stiff, slightly moist, some fine sand, rootlets, carbonate stringers, grades to CLAY with silt, olive brown, slightly moist, low to medium plasticity.	
715			0.8	R4	7 10 12	105	16	CL	@12.5': CLAY with silt and sand, olive brown, stiff, slightly moist, fine sand, low plasticity, carbonate stringers.	-200
	15		0.0	R5	5 7 9				@15': Sandy CLAY with silt, olive brown, stiff, slightly moist, fine sand, carbonate stringers	AL
710										
	20		0.0	R6	6 6 13	97	25		@20': CLAY with silt,olive brown, stiff, moist, low plasticity, carbonate blebs.	, UU
705										
	25		0.0	R7	4 7 10			ML	@25': SILT with sand, olive brown, stiff, moist, fine sand, pinhole pores, carbonate blebs, MnO spotting, grades to CLAY with silt, olive brown, moist, low to medium plasticity.	
700										
	30									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG HSA-6

Project No.	11957.004	**Date Drilled**	5-17-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	728'
Location	*See Plate 1- Geotechnical Map*; 34.1864, -118.5294	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30		0.0	R8	4 9 8			CL	@30': CLAY with silt, greenish brown, stiff, moist, abundant MnO spotting, rootlets.	
695									Total Depth: 31.5 feet bgs No groundwater encountered during drilling. Boring Backfilled with tamped soil cuttings and asphalt patched upon completion	
	35									
690										
	40									
685										
	45									
680										
	50									
675										
	55									
670										
	60									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG HSA-7

Project No.	11957.004	**Date Drilled**	5-17-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	726'
Location	*See Plate 1- Geotechnical Map*; 34.1847, -118.5178	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
725	0			BB-1				CL	@0': 7.5-inches asphalt concrete, no base. **Artificial Fill, undocumented (Afu)**: CLAY with silt and sand, dark brown, moist, fine sand, low to medium plasticity.	
720	5		0.0	R1	6 4 4				@5': No recovery.	
			0.0	R2	3 2 2	90	25	CL	@7.5': CLAY with silt, brown to reddish brown, moist, trace fine sand, minor oxidation, lamination of sandy SILT few asphalt debris.	UU
715	10		0.0	R3	2 4 5	98	13	ML	**Quaternary Alluvium (Qa)**: @10': Sandy SILT with clay, mottled brown to reddish brown, medium stiff, slightly oxidized, grades to silty SAND, reddish brown, loose, slightly moist, fine to medium sand.	DS
			0.0	R4	6 10 12			CL-ML	@12.5': Silty CLAY, dark olive brown to reddish brown, moist, oxidized, slightly micaceous, grades to thinly laminated silty SAND and SILT.	-200, AL
710	15		0.0	R5	5 8 12	100	23	CL	@15': CLAY with silt, olive brown, mottled, stiff, moist, trace sand, oxidized, carbonate stringers.	CN
705	20		0.3	R6	3 7 11			CL	@20': CLAY, olive brown to reddish brown, stiff, moist, medium plasticity, carbonate stringers, MnO spotting.	
700	25		0.0	R7	5 11 16				@25': CLAY with silt, olive brown, very stiff, moist, low to medium plasticity, carbonate blebs and stringers, MnO spotting.	
	30									

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG HSA-7

Project No.	11957.004	**Date Drilled**	5-17-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	726'
Location	*See Plate 1- Geotechnical Map*; 34.1847, -118.5178	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
695	30		0.0	R8	2 5 5				@30': CLAY, mottled olive brown, reddish brown and grayish brown, oxidized, some silt, very slightly micaceous, medium to high plasticity, MnO spotting.	
690	35								Total Depth: 31.5 feet bgs No groundwater encountered during drilling. Boring Backfilled with tamped soil cuttings and asphalt patched upon completion	
685	40									
680	45									
675	50									
670	55									
	60									

The soil description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG HSA-8

Project No.	11957.004	**Date Drilled**	5-17-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	727'
Location	*See Plate 1- Geotechnical Map*; 34.1853, -118.5269	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			BB-1					ML	@0': **Artificial Fill, undocumented (Afu)**: Sandy SILT to SILT with clay, brown to olive brown, slightly moist, fine to coarse sand, trace fine gravel.	
725											
	5		0.0	R1		18 17 14			ML	@5': Sandy SILT, brown, very stiff, mottled, with layers of silty SAND with gravel.	
720											
			0.0	R2		4 4 8	84	15		**Quaternary Alluvium (Qa)**: @7.5': Sandy SILT, mottled brown, medium stiff, fine sand, pinhole pores.	DS
	10		0.0	R3		4 7 10	83	16	CL	@10': Grades to thinly laminated CLAY and sandy SILT, slightly moist, mild oxidation	-200
715											
			0.0	R4		3 6 14	92	12	SM	@12.5': Silty SAND, light brown to orange brown, medium dense, slightly moist, faint oxidation, grades to SILT, brown, some clay.	
	15		0.0	R5		8 9 13	100	10	SC	@15': Clayey SAND, tan, medium dense, slightly moist, fine to medium sand, friable, disturbed upper rings, predominantly quartz and feldspar, subangular, trace coarse sand.	-200
710											
	20		0.0	R6		5 10 12			ML	@20': SILT with clay, mottled olive brown to orange brown, stiff, slightly moist, carbonate stringers, minor MnO spotting.	
705											
	25		0.0	R7		8 15 15			MLs	@25': Sandy SILT, light olive brown, very stiff, slightly moist, fine to coarse sand, trace fine gravel, debris flow, slightly oxidized, grades to sandy SILT, yellowish brown to orange brown, laminated.	
700											
	30										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG HSA-8

Project No.	11957.004	**Date Drilled**	5-17-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	727'
Location	*See Plate 1- Geotechnical Map*; 34.1853, -118.5269	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30		0.0	R8		4 13 15			SP	@30': SAND, yellow brown to orange brown, medium dense, slightly moist, laminated, with oxidized laminations, mostly fine to medium sand, some coarse sand, trace fine gravel, grades to silty SAND.	
695											
	35									Total Depth: 31.5 feet bgs No groundwater encountered during drilling. Boring Backfilled with tamped soil cuttings and asphalt patched upon completion	
690											
	40										
685											
	45										
680											
	50										
675											
	55										
670											
	60										

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

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GEOTECHNICAL BORING LOG HSA-9

Project No.	11957.004	**Date Drilled**	5-17-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	728'
Location	*See Plate 1- Geotechnical Map*; 34.1850, -118.5192	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N–S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
725	0			BB-1				CL	@0': 2-inches asphalt concrete over 2-inches base. **Artificial Fill, undocumented (Afu)**: CLAY with silt, dark brown, moist, some sand, medium plasticity.	CN, EI
	5		0.0	R1	3 7 12			SM	@5': Silty SAND with gravel, dark brown, medium dense, slightly moist, fine to coarse sand, fine gravel, grades to CLAY with silt, mottled olive brown, stiff, moist, medium plasticity.	
720			0.0	R2	4 9 13	106	19	CL	@7.5': CLAY with silt, mottled olive brown, stiff, moist, carbonate stringers, trace gravels, asphalt fragment.	
	10		0.0	R3	3 9 14				@10': CLAY, mottled dark brown and olive brown, moist, medium plasticity, some sand and fine gravel, chunk of concrete.	
715			0.0	R4	4 7 10	100	22	ML	@12.5': Sandy SILT with clay, mottled brown and dark brown, stiff, moist, low plasticity.	DS
	15		0.0	R5	4 9 14	101	23	CL	@15': CLAY with silt, mottled olive brown and brown, stiff, medium plasticity, carbonate blebs.	UU
710										
	20		0.0	R6	3 4 8			ML	@20': Sandy SILT with clay, dark grayish brown, firm, moist, fine sand, low plasticity, massive.	
705									**Quaternary Alluvium (Qa)**:	
	25		0.0	R7	2 7 13			ML	@25': Sandy SILT, olive brown to orange brown, stiff, moist, faintly laminated, high sand content, heavily oxidized contact above with gray silt.	
700	30									

SAMPLE TYPES:

B	BULK SAMPLE
C	CORE SAMPLE
G	GRAB SAMPLE
R	RING SAMPLE
S	SPLIT SPOON SAMPLE
T	TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG HSA-9

Project No.	11957.004	**Date Drilled**	5-17-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	728'
Location	*See Plate 1- Geotechnical Map*; 34.1850, -118.5192	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30		0.0	R8	3 10 13			SM	@30': Silty SAND, orange brown to tan, medium dense, moist, fine sand, very heavily oxidized.	
695									Total Depth: 31.5 feet bgs No groundwater encountered during drilling. Boring Backfilled with tamped soil cuttings and asphalt patched upon completion	
	35									
690										
	40									
685										
	45									
680										
	50									
675										
	55									
670										
	60									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG HSA-10

Project No.	11957.004	**Date Drilled**	5-18-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	728'
Location	*See Plate 1- Geotechnical Map*; 34.1867, -118.5278	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			BB-1				CL	@0': 1.5-inches of asphalt concrete over 4-inches of base. **Artificial Fill, undocumented (Afu)**: Sandy CLAY with silt, dark brown, moist, fine to coarse sand, low to medium plasticity.	
725										
	5		0.0	R1	5 8 13			SC	@5': Clayey SAND with gravel, dark brown, medium dense, moist, fine to coarse sand, fine gravel, asphalt, grades to CLAY with silt, olive brown, moist, medium plasticity.	
720			0.0	R2	4 11 18	106	20	CL	@7.5': CLAY with silt, mottled brown to olive brown, very stiff, moist, some fine gravel, medium plasticity.	
	10		0.0	R3	8 12 17	105	18	SC	@10': Clayey SAND, olive brown, stiff, moist, fine to medium sand, grades to CLAY with silt, mottled olive brown, carbonate stringers, medium plasticity.	-200
715			0.0	R4	6 16 22	107	19	CL	@12.5': CLAY with silt, mottled olive brown, hard, moist, trace carbonate.	AL
	15		0.0	R5	5 13 21				@15': Increase in carbonate, trace sand.	
710									**Quaternary Alluvium (Qa)**:	
	20		0.0	R6	3 5 7			ML	@20': SILT, olive brown to orange brown, medium stiff, moist, heavily oxidized, some fine sand and clay, MnO spotting, grades to CLAY with silt, olive brown, mottled, medium plasticity.	
705										
	25		0.0	R7	3 7 7				@25': Sandy SILT with clay, olive brown to reddish brown, stiff, moist, fine sand, grades to silty SAND, yellowish brown, faint oxidation, fine sand. (5-ring recovery)	
700										
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG HSA-10

Project No.	11957.004	**Date Drilled**	5-18-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	728'
Location	*See Plate 1- Geotechnical Map*; 34.1867, -118.5278	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30		0.0	R8	3 6 8			CL	@30': CLAY with silt, olive brown to greenish brown, stiff, very moist, carbonate blebs, MnO spotting, medium to high plasticity.	
695									Total Depth: 31.5 feet bgs No groundwater encountered during drilling. Boring Backfilled with tamped soil cuttings and asphalt patched upon completion	
	35									
690										
	40									
685										
	45									
680										
	50									
675										
	55									
670										
	60									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

GEOTECHNICAL BORING LOG HSA-11

Project No.	11957.004	**Date Drilled**	5-18-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	710'
Location	*See Plate 1- Geotechnical Map*; 34.1842, -118.5108	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
710	0			BB-1				CL	@0': 4.5-inches concrete, no base. **Artificial Fill, undocumented (Afu)**: Sandy CLAY, dark brown, moist, fine to coarse sand, trace fine gravel.	EI
705	5		0.0	R1	4 5 5	97	11	SC	@5': Silty clayey SAND, mottled brown, medium stiff, with debris and gravel, medium to high plasticity.	-200
			0.0	R2	2 7 11	94	26	ML	@7.5': Sandy SILT with clay, brown, stiff, moist, fine sand, grades to CLAY, brown, moist, medium plasticity, carbonate stringers.	
700	10		0.0	R3	4 11 15	105	20	CL	@10': CLAY with silt, brown, moist, very stiff, medium plasticity, carbonate blebs, increasing silt content with depth.	UU
			0.0	R4	3 7 11	96	21	ML	**Quaternary Alluvium (Qa)**: @12.5': SILT with clay, olive brown, stiff, moist, some fine sand, low to medium plasticity, faintly laminated, carbonate stringers and veining.	DS
695	15		0.0	R5	4 8 14	106	16		@15': Sandy SILT, olive brown to faint reddish brown, stiff, fine to medium sand, nonplastic, faint gleying, carbonate blebs, some clay, some fine laminations.	
690	20		0.0	R6	3 7 10				@20': with sand rich laminations.	
685	25		0.0	R7	2 3 4	78	41	CL	@25': CLAY, olive brown, medium stiff, very moist, high plasticity, some silt, MnO spotting, carbonate blebs.	UU
680	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG HSA-11

Project No.	11957.004	**Date Drilled**	5-18-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	Martini Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger	**Ground Elevation**	710'
Location	*See Plate 1- Geotechnical Map*; 34.1842, -118.5108	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
680	30			R8	2 4 5	96	24	SM-ML	@30': Sandy SILT, olive brown, firm, very moist, fine to medium sand, grades to silty SAND, olive brown, loose, wet, fine sand, some clay.	
									Total Depth: 31.5 feet bgs Groundwater encountered at 31 feet bgs during drilling, no rise after drilling.	
675	35									
670	40									
665	45									
660	50									
655	55									
650	60									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG MR-1

Project No.	11957.004	**Date Drilled**	6-1-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	SoCal Drilling	**Hole Diameter**	4"
Drilling Method	Rotary Wash	**Ground Elevation**	711'
Location	*See Plate 1- Geotechnical Map*; 34.1839, -118.5097	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
710	0							ML	@0': **Artificial Fill, undocumented (Afu):** SILT with Sand and Clay, brown, slightly moist, fine to medium sand, very low plasticity	
				S1	5 6 10				@2.5': Stiff	
705	5		0.0	S2	3 3 4				@5': SILT with Clay, brown, stiff, slightly moist, with some fine sand, low plasticity	
			0.0	S3	2 3 5			ML	**Quaternary Alluvium (Qa):** @7.5': SILT, olive brown, stiff, moist, with some fine sand, nonplastic, carbonate blebs	
700	10		0.0	S4	4 4 5				@10': SILT with Clay, olive brown, stiff, moist, some fine sand, low to medium plasticity, with abundant carbonate blebs	
			0.0	S5	5 7 9			CL	@12.5': CLAY with Silt to SILT with Clay, olive brown, very stiff, moist, medium plasticity, with siltier laminations, with carbonate blebs	
695	15		0.0	S6	4 4 5			ML	@15': SILT with Clay, olive brown, stiff, moist, low plasticity, abundant carbonate stringers	
				S7	3 4 7				@17.5': SILT, olive brown, stiff, moist, some fine sand to silt, faintly laminated, abundant carbonate stringers	
690	20		0.0	S8	3 6 7			CL	@20': CLAY with sand, olive brown, stiff, moist, fine sand, non to low plasticity, trace clay, carbonate stringers	-200, AL
				S9	4 8 11			SM	@22.5': Silty SAND, olive brown, medium dense, moist, fine sand, slightly micaceous	-200
685	25		0.0	S10	1 2 2			CL	@25': CLAY, brown, soft, moist, some fine sand, low plasticity, slightly micaceous, some silt	-200, AL
				S11	1 2 2			CL	@27.5': CLAY with Silt, olive brown to reddish brown, soft, moist, heavily oxidized zones, medium plasticity	
	30									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG MR-1

Project No.	11957.004	**Date Drilled**	6-1-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	SoCal Drilling	**Hole Diameter**	4"
Drilling Method	Rotary Wash	**Ground Elevation**	711'
Location	*See Plate 1- Geotechnical Map*; 34.1839, -118.5097	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30		0.0	S12	Push 2 2			CL	@30': Grades to CLAY, olive brown, soft, very moist, medium to high plasticity, oxidized, with MnO spotting, little silt	-200, AL
680				S13	1 1 2			CH	@32.5': CLAY with Silt, olive brown, soft, very moist to wet, grades to Silty SAND, reddish brown, wet, fine sand	-200, AL
	35			S14	3 2 7			SM	@35': Silty SAND, reddish brown to grayish brown, loose, wet, fine sand, gleyed with laminations of gray brown, oxidized SILT with Clay	SA
675										
	40			S15	11 14 18			SP	@40': SAND with Gravel, grayish brown, dense, wet, medium to coarse sand, fine gravel, with laminations of gray clay, well graded	
670										
	45			S16	5 3 4			CL	@45': Sandy CLAY, reddish brown to grayish brown, firm, wet, fine to coarse sand, grades to CLAY, grayish brown, heavily oxidized	SA
665										
	50			S17	12 19 21			SP	@50': SAND, grayish brown, dense, wet, mostly fine to medium sand with some coarse sand and fine gravel, with laminations of gray CLAY, grades to medium to coarse sand with gravel @52': Rig chatter	
660										
	55			S18	24 26 20			GP	@55': GRAVEL, grayish brown, dense, wet, fine to coarse gravel, with clayey laminations, poor recovery	
655										
	60									

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
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- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG MR-1

Project No.	11957.004	**Date Drilled**	6-1-18
Project	Los Angeles River Bikeway-San Fernando Completion	**Logged By**	EMH
Drilling Co.	SoCal Drilling	**Hole Diameter**	4"
Drilling Method	Rotary Wash	**Ground Elevation**	711'
Location	*See Plate 1- Geotechnical Map*; 34.1839, -118.5097	**Sampled By**	EMH

Elevation Feet	Depth Feet	Graphic Log (N / S)	PID	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
650	60			S19	9 14 16			SM	@60': Silty SAND, mottled orange brown to grayish brown, medium dense, wet, fine sand, low silt content	
645	65			S20	14 20 21			SP-SM	@65': SAND with Silt, grayish brown, dense, wet, mostly fine sand, some medium sand, trace coarse sand and fine gravel	
640	70								Total Depth of Boring: 66.5 feet bgs Groundwater encountered @ 33 feet bgs, measured @ 33.2 feet bgs 20 minutes after drilling Boring backfilled with cement bentonite grout	
635	75									
630	80									
625	85									
	90									

The description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
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- H HYDROMETER
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- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

APPENDIX B

GEOTECHNICAL LABORATORY TEST RESULTS

Leighton

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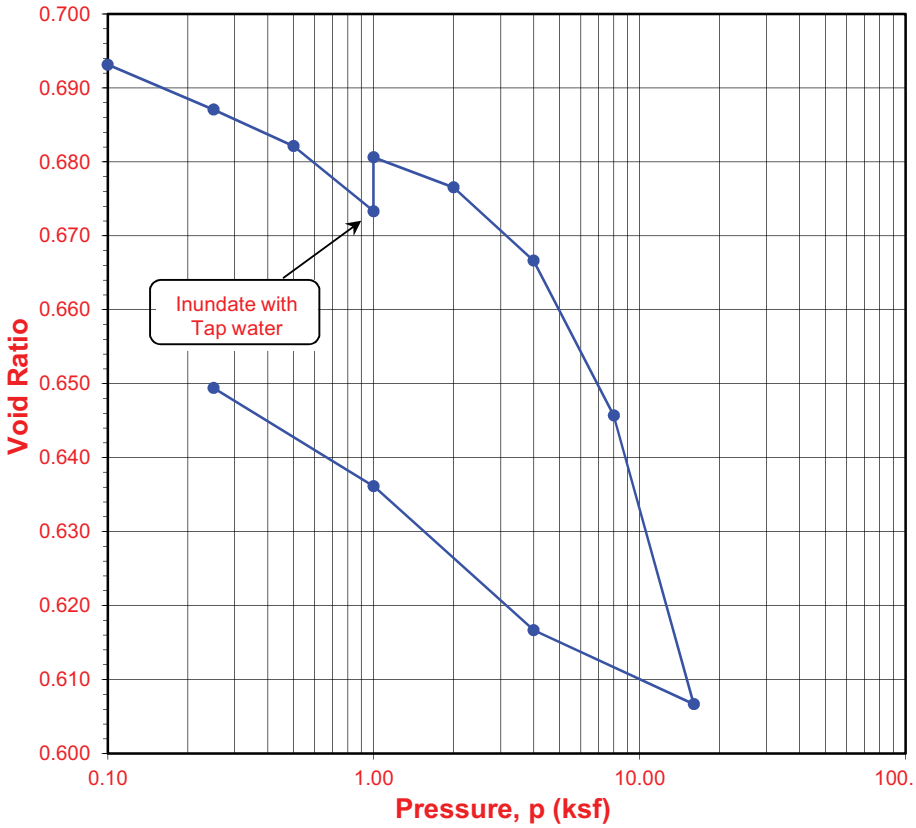
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Project Name:	San Fernando Completion	Tested By: G. Bathala	Date: 06/21/18
Project No.:	11957.004	Checked By: J. Ward	Date: 07/25/18
Boring No.:	HSA-2B	Depth (ft.): 12.5	
Sample No.:	R-4	Sample Type: Ring	
Soil Identification:	Light olive brown lean clay (CL)		

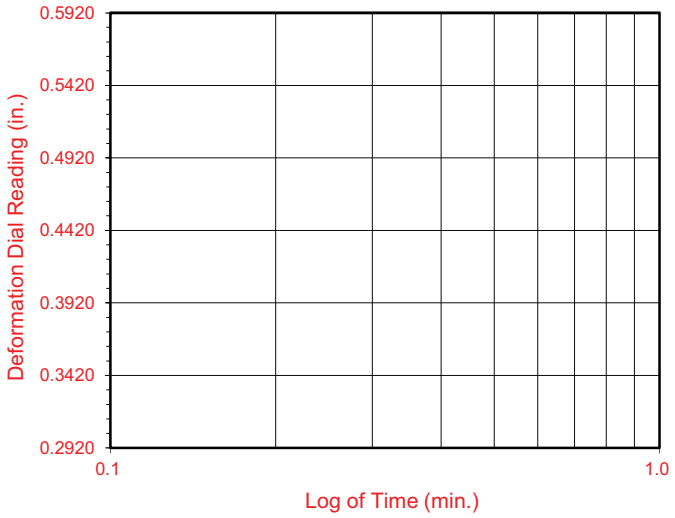
Sample Diameter (in.)	2.415
Sample Thickness (in.)	1.000
Wt. of Sample + Ring (g)	191.14
Weight of Ring (g)	44.22
Height after consol. (in.)	0.9735
Before Test	
Wt.Wet Sample+Cont. (g)	563.66
Wt.of Dry Sample+Cont. (g)	482.40
Weight of Container (g)	126.32
Initial Moisture Content (%)	22.8
Initial Dry Density (pcf)	99.5
Initial Saturation (%)	89
Initial Vertical Reading (in.)	0.2937
After Test	
Wt.of Wet Sample+Cont. (g)	250.57
Wt. of Dry Sample+Cont. (g)	223.17
Weight of Container (g)	59.27
Final Moisture Content (%)	22.89
Final Dry Density (pcf)	102.2
Final Saturation (%)	95
Final Vertical Reading (in.)	0.2652
Specific Gravity (assumed)	2.70
Water Density (pcf)	62.43

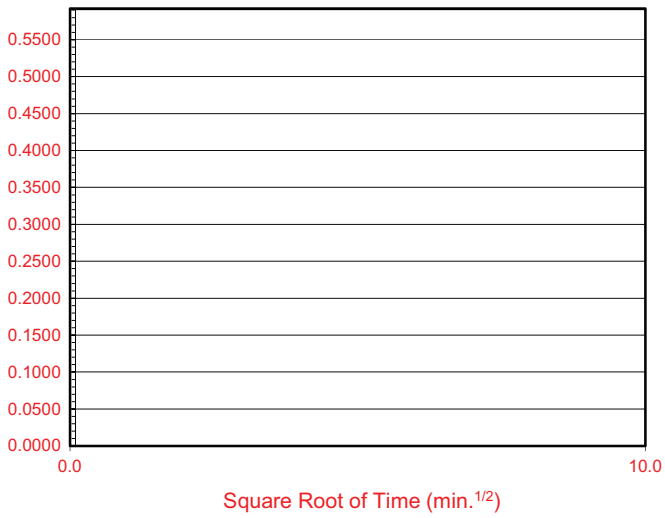


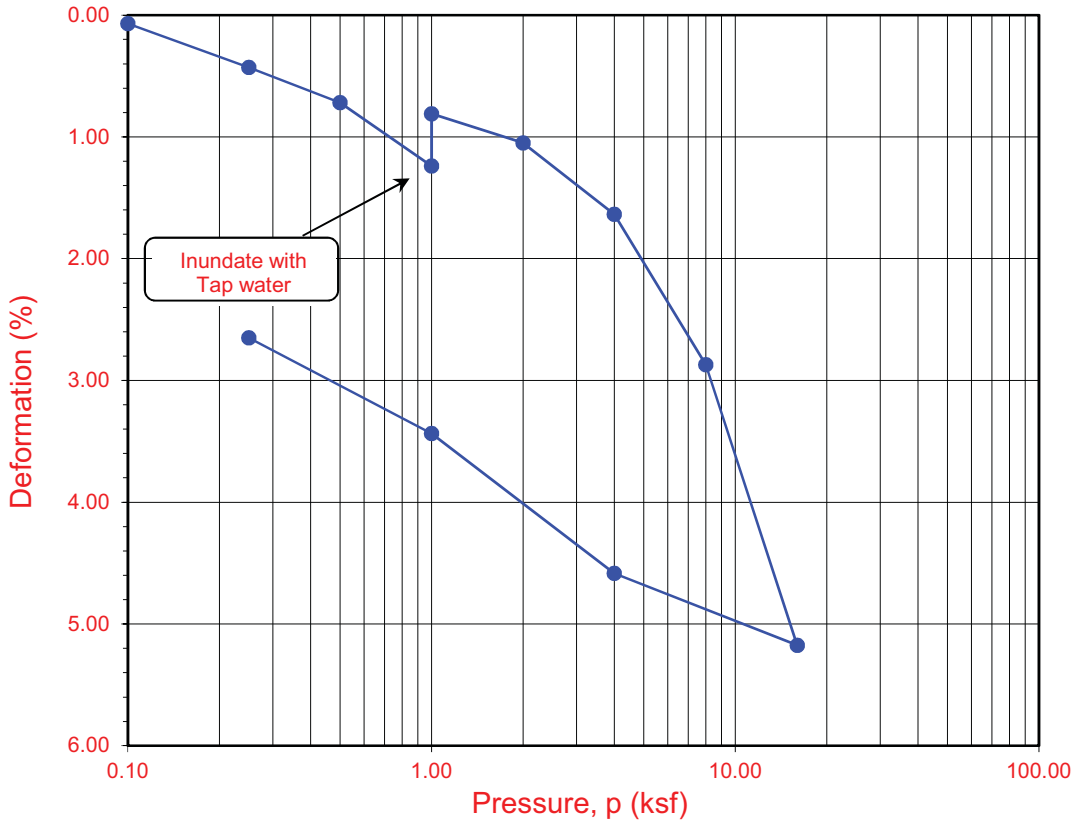
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.2930	0.9993	0.00	0.07	0.693	0.07
0.25	0.2887	0.9950	0.07	0.50	0.687	0.43
0.50	0.2852	0.9915	0.13	0.85	0.682	0.72
1.00	0.2792	0.9855	0.21	1.45	0.673	1.24
1.00	0.2835	0.9898	0.21	1.02	0.681	0.81
2.00	0.2801	0.9864	0.31	1.36	0.677	1.05
4.00	0.2731	0.9794	0.43	2.07	0.667	1.64
8.00	0.2590	0.9653	0.60	3.47	0.646	2.87
16.00	0.2334	0.9397	0.86	6.04	0.607	5.18
4.00	0.2426	0.9489	0.53	5.12	0.617	4.59
1.00	0.2558	0.9621	0.36	3.80	0.636	3.44
0.25	0.2652	0.9715	0.20	2.85	0.649	2.65

Time Readings				
Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)

Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HSA-2B	**R-4**	**12.5**	**22.8**	**22.9**	**99.5**	**102.2**	**0.694**	**0.649**	**89**	**95**

Soil Identification: Light olive brown lean clay (CL)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 11957.004

San Fernando Completion

07-18

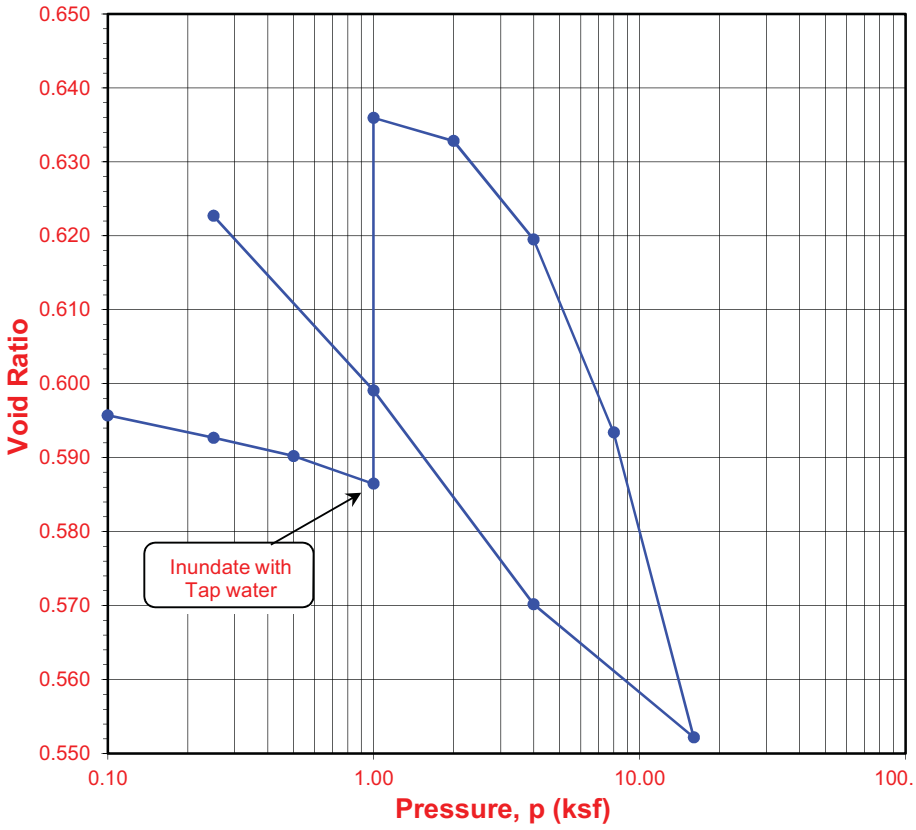
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Leighton

Project Name:	San Fernando Completion	Tested By: G. Bathala	Date: 06/21/18
Project No.:	11957.004	Checked By: J. Ward	Date: 07/25/18
Boring No.:	HSA-4	Depth (ft.): 10.0	
Sample No.:	R-3	Sample Type: Ring	
Soil Identification:	Olive brown lean clay (CL), caliche noted		

Sample Diameter (in.)	2.415
Sample Thickness (in.)	1.000
Wt. of Sample + Ring (g)	188.48
Weight of Ring (g)	41.74
Height after consol. (in.)	1.0169
Before Test	
Wt.Wet Sample+Cont. (g)	191.38
Wt.of Dry Sample+Cont. (g)	174.72
Weight of Container (g)	67.45
Initial Moisture Content (%)	15.5
Initial Dry Density (pcf)	105.6
Initial Saturation (%)	70
Initial Vertical Reading (in.)	0.2993
After Test	
Wt.of Wet Sample+Cont. (g)	263.80
Wt. of Dry Sample+Cont. (g)	233.16
Weight of Container (g)	67.94
Final Moisture Content (%)	24.81
Final Dry Density (pcf)	101.0
Final Saturation (%)	100
Final Vertical Reading (in.)	0.3125
Specific Gravity (assumed)	2.70
Water Density (pcf)	62.43

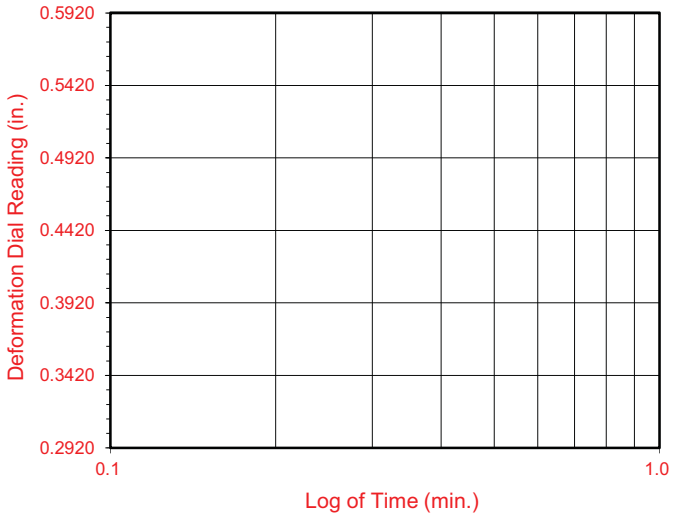


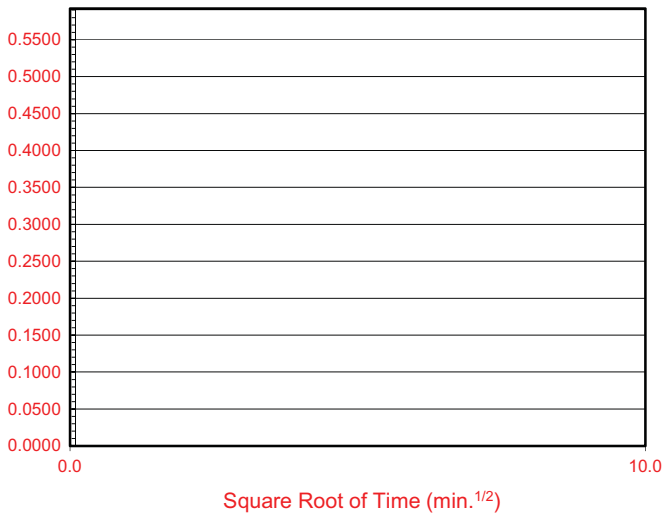
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.2993	1.0000	0.00	0.00	0.596	0.00
0.25	0.2971	0.9978	0.03	0.22	0.593	0.19
0.50	0.2947	0.9954	0.12	0.47	0.590	0.35
1.00	0.2905	0.9912	0.30	0.88	0.586	0.58
1.00	0.3215	1.0222	0.30	-2.22	0.636	-2.52
2.00	0.3181	1.0188	0.45	-1.88	0.633	-2.33
4.00	0.3078	1.0085	0.64	-0.85	0.620	-1.49
8.00	0.2898	0.9905	0.81	0.95	0.593	0.14
16.00	0.2621	0.9628	0.99	3.72	0.552	2.73
4.00	0.2754	0.9761	0.79	2.39	0.570	1.60
1.00	0.2959	0.9966	0.55	0.34	0.599	-0.21
0.25	0.3125	1.0132	0.37	-1.32	0.623	-1.69

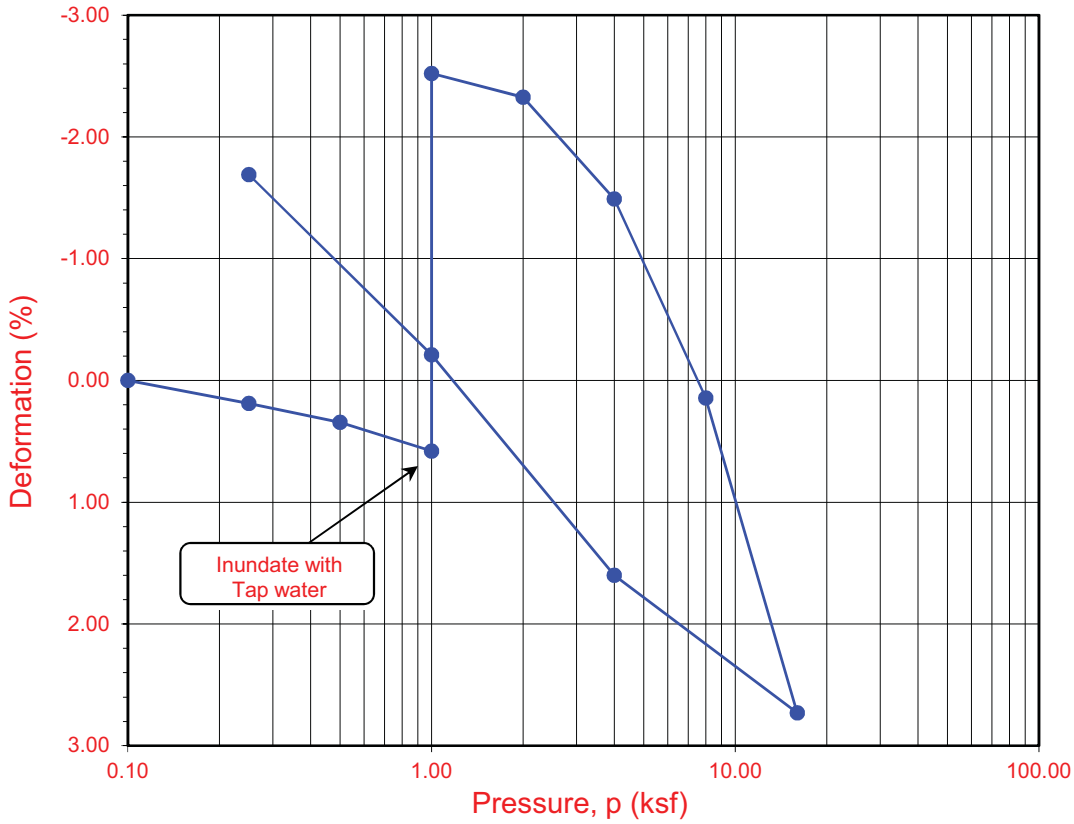
Time Readings

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)

Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HSA-4	**R-3**	**10.0**	**15.5**	**24.8**	**105.6**	**101.0**	**0.596**	**0.623**	**70**	**100**

Soil Identification: Olive brown lean clay (CL), caliche noted

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 11957.004

San Fernando Completion

07-18

Leighton

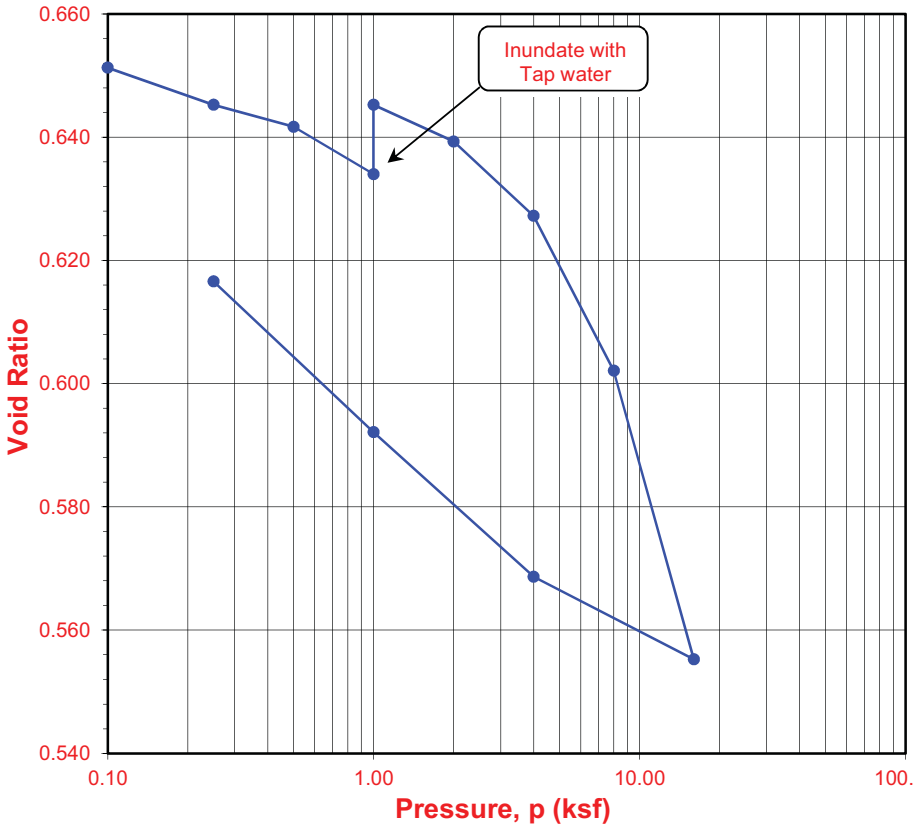
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Project Name: San Fernando Completion
Project No.: 11957.004
Boring No.: HSA-7
Sample No.: R-5
Soil Identification: Olive brown silty clay (CL-ML)

Tested By: G. Bathala Date: 06/21/18
Checked By: J. Ward Date: 07/25/18
Depth (ft.): 15.0
Sample Type: Ring

Sample Diameter (in.)	2.415
Sample Thickness (in.)	1.000
Wt. of Sample + Ring (g)	193.57
Weight of Ring (g)	42.68
Height after consol. (in.)	0.9785
Before Test	
Wt.Wet Sample+Cont. (g)	175.45
Wt.of Dry Sample+Cont. (g)	150.03
Weight of Container (g)	37.26
Initial Moisture Content (%)	22.5
Initial Dry Density (pcf)	102.4
Initial Saturation (%)	94
Initial Vertical Reading (in.)	0.2705
After Test	
Wt.of Wet Sample+Cont. (g)	259.50
Wt. of Dry Sample+Cont. (g)	231.47
Weight of Container (g)	65.41
Final Moisture Content (%)	22.72
Final Dry Density (pcf)	104.9
Final Saturation (%)	100
Final Vertical Reading (in.)	0.2464
Specific Gravity (assumed)	2.71
Water Density (pcf)	62.43

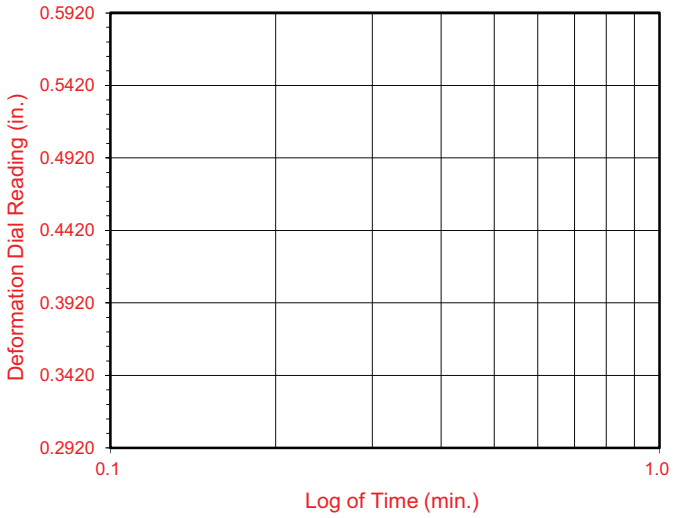


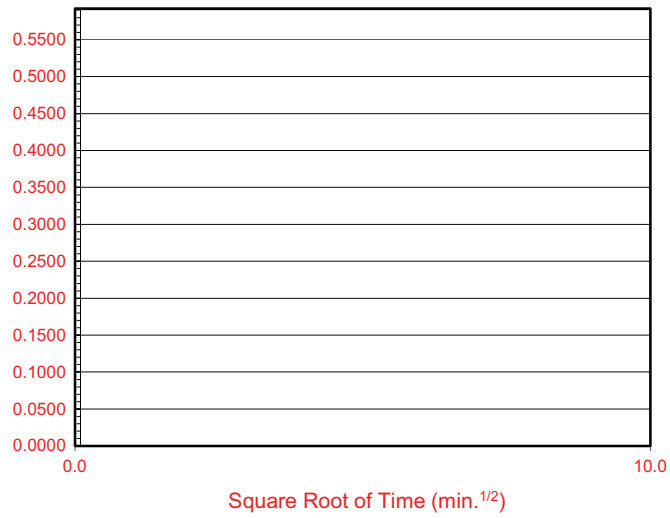
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.2700	0.9995	0.00	0.05	0.651	0.05
0.25	0.2660	0.9955	0.04	0.46	0.645	0.42
0.50	0.2628	0.9923	0.14	0.77	0.642	0.63
1.00	0.2572	0.9867	0.24	1.34	0.634	1.10
1.00	0.2640	0.9935	0.24	0.66	0.645	0.42
2.00	0.2594	0.9889	0.34	1.12	0.639	0.77
4.00	0.2510	0.9805	0.45	1.96	0.627	1.51
8.00	0.2342	0.9637	0.61	3.64	0.602	3.03
16.00	0.2041	0.9336	0.78	6.64	0.555	5.86
4.00	0.2144	0.9439	0.56	5.61	0.569	5.05
1.00	0.2302	0.9597	0.40	4.03	0.592	3.63
0.25	0.2464	0.9759	0.26	2.41	0.617	2.15

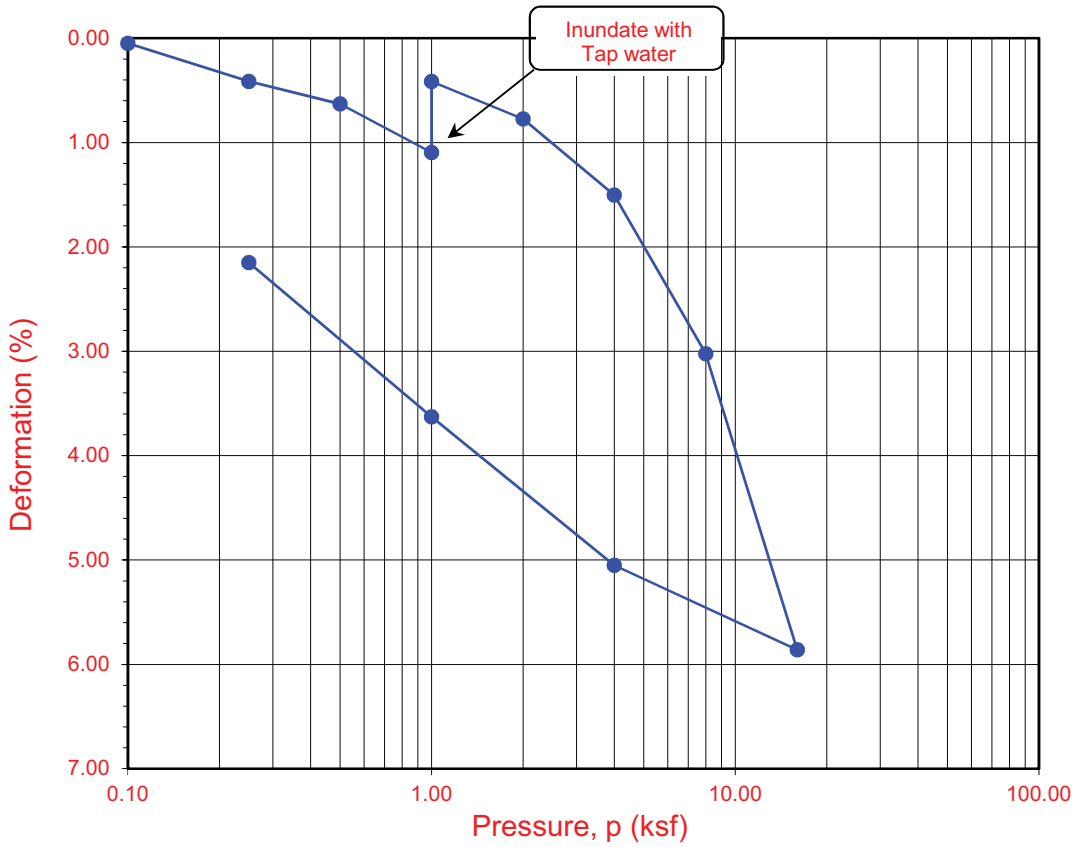
Time Readings

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)

Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HSA-7	**R-5**	**15.0**	**22.5**	**22.7**	**102.4**	**104.9**	**0.652**	**0.617**	**94**	**100**

Soil Identification: Olive brown silty clay (CL-ML)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 11957.004

San Fernando Completion

07-18

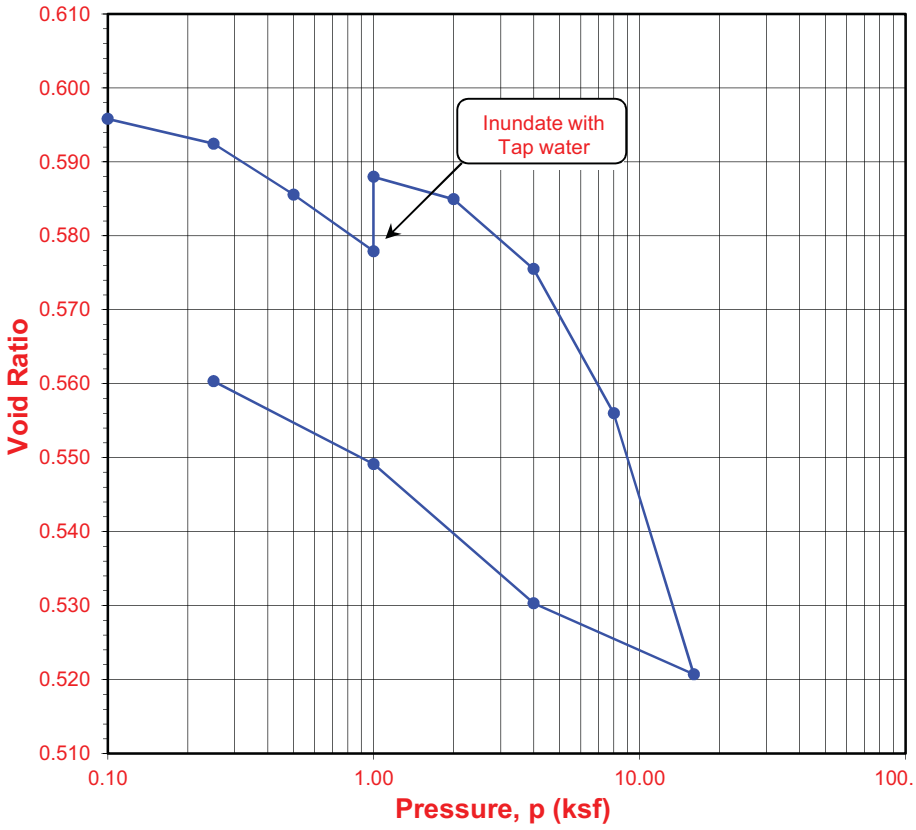
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Leighton

Project Name:	San Fernando Completion	Tested By: G. Bathala	Date: 06/27/18
Project No.:	11957.004	Checked By: J. Ward	Date: 07/25/18
Boring No.:	HSA-9	Depth (ft.): 7.5	
Sample No.:	R-2	Sample Type: Ring	
Soil Identification:	Dark olive gray lean clay (CL)		

Sample Diameter (in.)	2.415
Sample Thickness (in.)	1.000
Wt. of Sample + Ring (g)	194.61
Weight of Ring (g)	42.55
Height after consol. (in.)	0.9765
Before Test	
Wt.Wet Sample+Cont. (g)	213.01
Wt.of Dry Sample+Cont. (g)	187.67
Weight of Container (g)	57.31
Initial Moisture Content (%)	19.4
Initial Dry Density (pcf)	105.9
Initial Saturation (%)	88
Initial Vertical Reading (in.)	0.2703
After Test	
Wt.of Wet Sample+Cont. (g)	272.02
Wt. of Dry Sample+Cont. (g)	244.63
Weight of Container (g)	77.42
Final Moisture Content (%)	21.97
Final Dry Density (pcf)	106.2
Final Saturation (%)	100
Final Vertical Reading (in.)	0.2428
Specific Gravity (assumed)	2.71
Water Density (pcf)	62.43

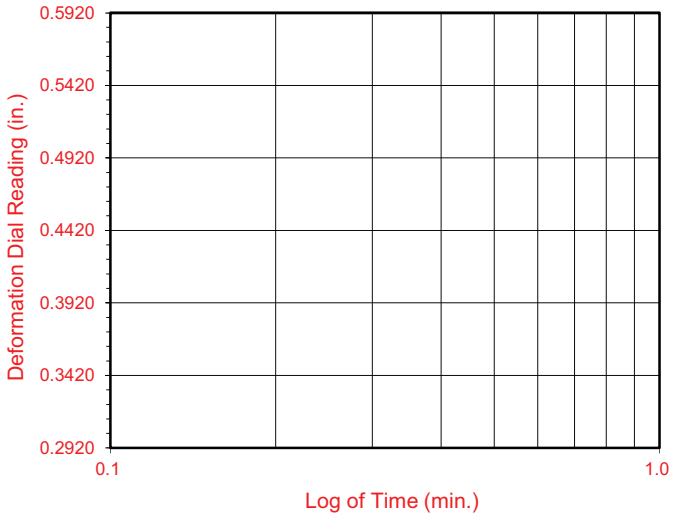


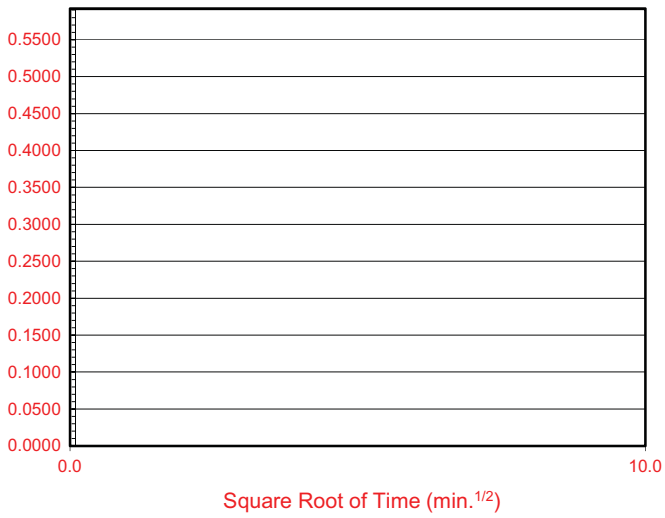
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.2690	0.9987	0.00	0.13	0.596	0.13
0.25	0.2665	0.9962	0.04	0.38	0.592	0.34
0.50	0.2612	0.9909	0.14	0.91	0.586	0.77
1.00	0.2550	0.9847	0.28	1.53	0.578	1.25
1.00	0.2613	0.9910	0.28	0.90	0.588	0.62
2.00	0.2575	0.9872	0.47	1.28	0.585	0.81
4.00	0.2496	0.9793	0.67	2.07	0.576	1.40
8.00	0.2351	0.9648	0.90	3.52	0.556	2.62
16.00	0.2102	0.9399	1.18	6.01	0.521	4.83
4.00	0.2192	0.9489	0.88	5.11	0.530	4.23
1.00	0.2335	0.9632	0.63	3.68	0.549	3.05
0.25	0.2428	0.9725	0.40	2.75	0.560	2.35

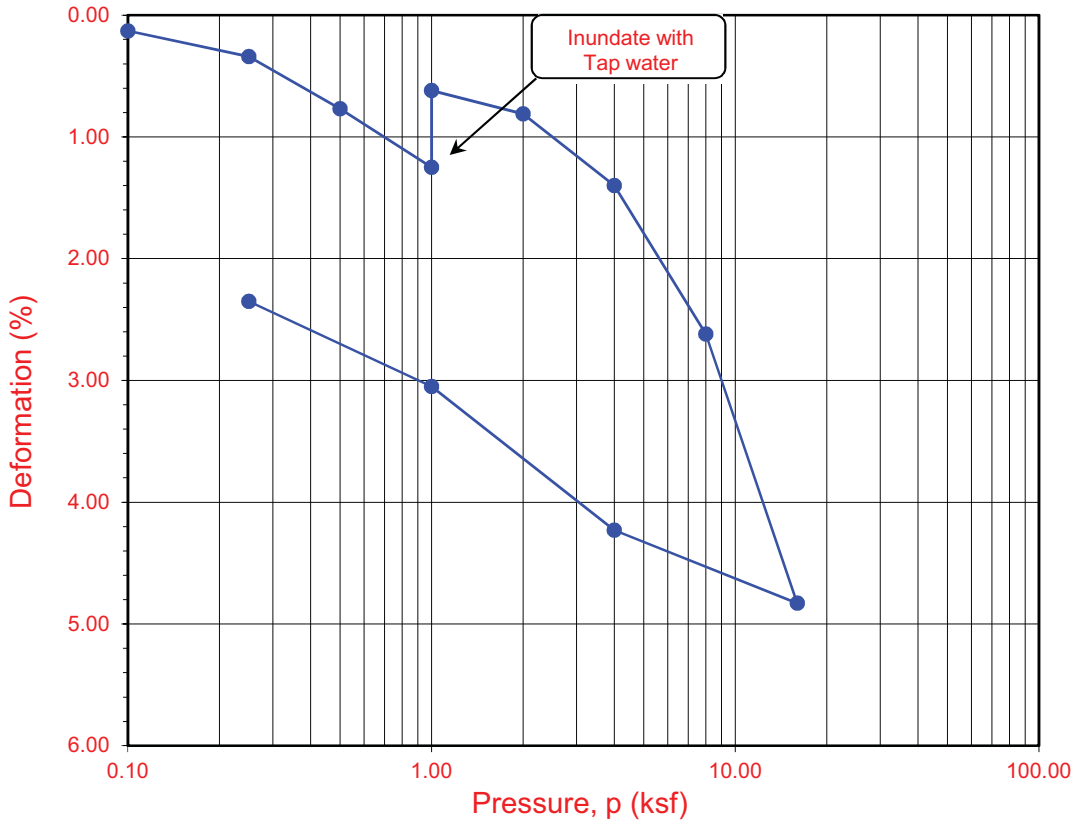
Time Readings

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)

Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HSA-9	**R-2**	**7.5**	**19.4**	**22.0**	**105.9**	**106.2**	**0.598**	**0.560**	**88**	**100**

Soil Identification: Dark olive gray lean clay (CL)

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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 11957.004

San Fernando Completion

07-18

Leighton

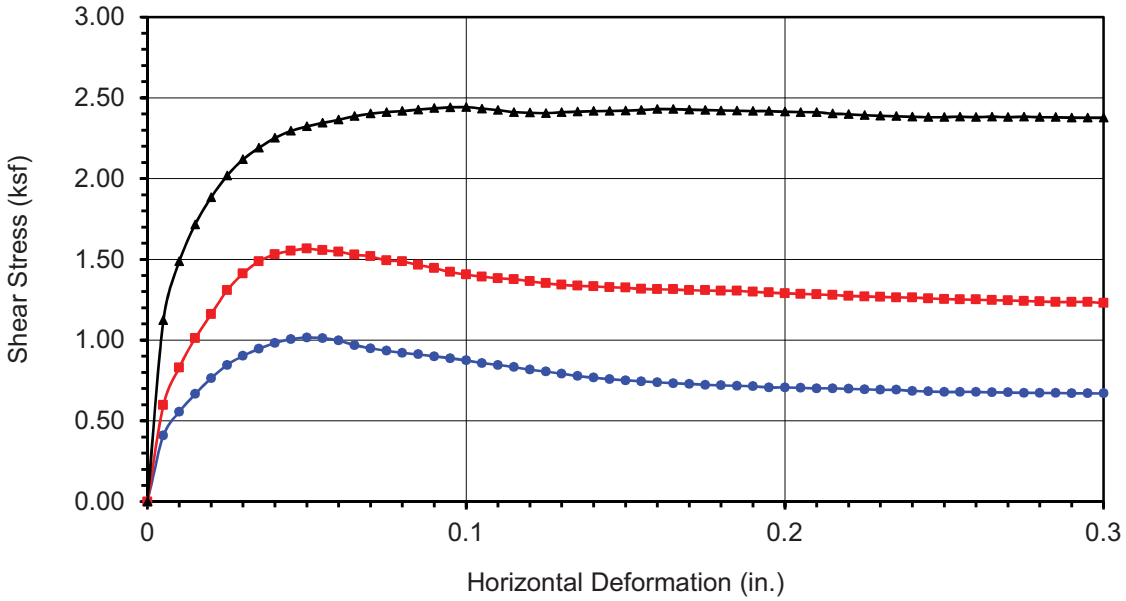
DIRECT SHEAR TEST

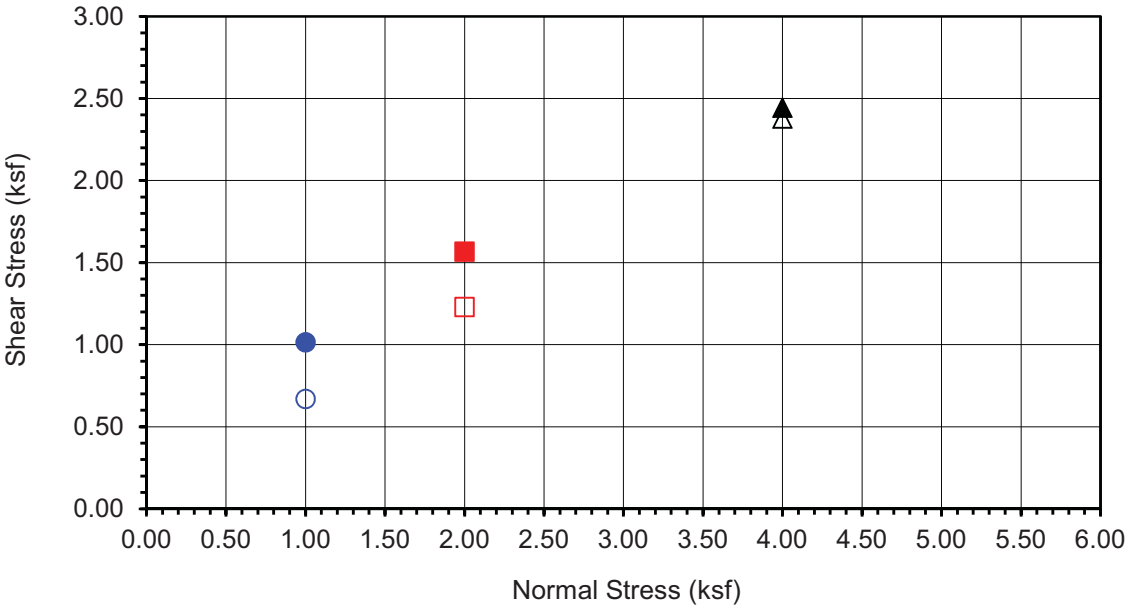
Consolidated Drained - ASTM D 3080

Project Name:	San Fernando Completion	Tested By:	G. Bathala	Date:	06/26/18
Project No.:	11957.004	Checked By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-1	Sample Type:	Ring		
Sample No.:	R-3	Depth (ft.):	10.0		

Soil Identification: Light olive brown silty clay (CL-ML)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	191.63	192.23	195.59
Weight of Ring(gm):	45.82	45.94	46.04
Before Shearing			
Weight of Wet Sample+Cont.(gm):	425.47	425.47	425.47
Weight of Dry Sample+Cont.(gm):	373.77	373.77	373.77
Weight of Container(gm):	144.78	144.78	144.78
Vertical Rdg.(in): Initial	0.2574	0.2561	0.2806
Vertical Rdg.(in): Final	0.2603	0.2674	0.2963
After Shearing			
Weight of Wet Sample+Cont.(gm):	206.53	187.08	189.43
Weight of Dry Sample+Cont.(gm):	175.78	156.58	160.80
Weight of Container(gm):	58.97	39.03	39.92
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**HSA-1**
Sample No.	**R-3**
Depth (ft)	**10**
Sample Type: Ring	
Soil Identification: Light olive brown silty clay (CL-ML)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.015	■ 1.566	▲ 2.443
Shear Stress @ End of Test (ksf)	○ 0.670	□ 1.229	△ 2.377
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	22.58	22.58	22.58
Dry Density (pcf)	98.9	99.3	101.5
Saturation (%)	86.6	87.3	92.2
Soil Height Before Shearing (in.)	0.9971	0.9887	0.9843
Final Moisture Content (%)	26.3	25.9	23.7

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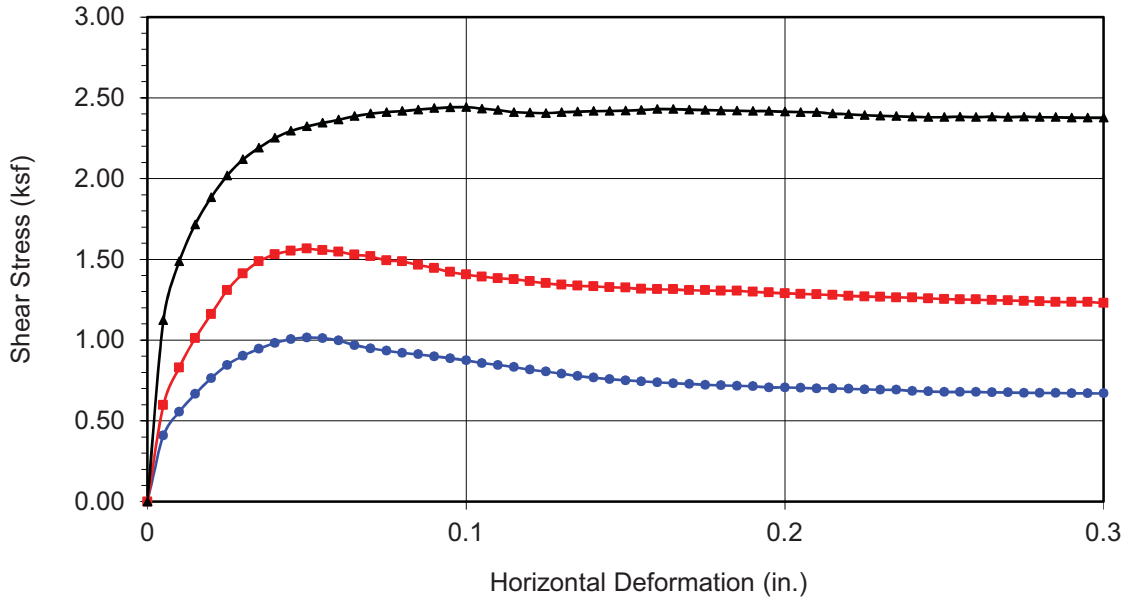
DIRECT SHEAR TEST RESULTS

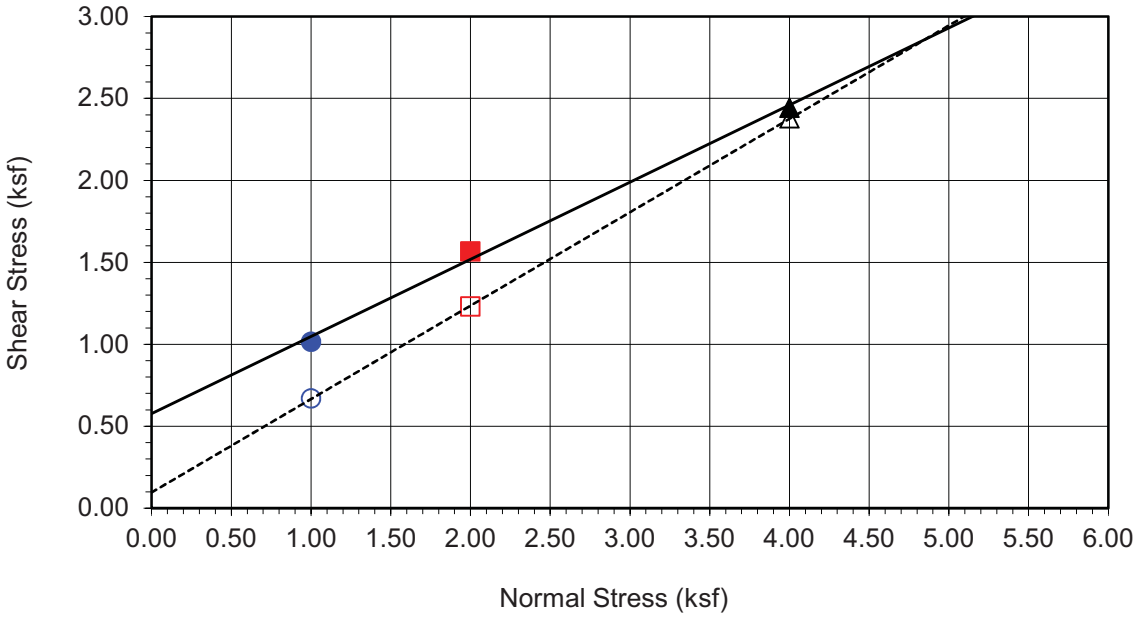
Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18





Boring No.	**HSA-1**
Sample No.	**R-3**
Depth (ft)	**10**
Sample Type:	Ring
Soil Identification: Light olive brown silty clay (CL-ML)	

Strength Parameters

	C (psf)	ϕ (°)
Peak	577	25
Ultimate	96	30

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.015	■ 1.566	▲ 2.443
Shear Stress @ End of Test (ksf)	○ 0.670	□ 1.229	△ 2.377
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	22.58	22.58	22.58
Dry Density (pcf)	98.9	99.3	101.5
Saturation (%)	86.6	87.3	92.2
Soil Height Before Shearing (in.)	0.9971	0.9887	0.9843
Final Moisture Content (%)	26.3	25.9	23.7

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18

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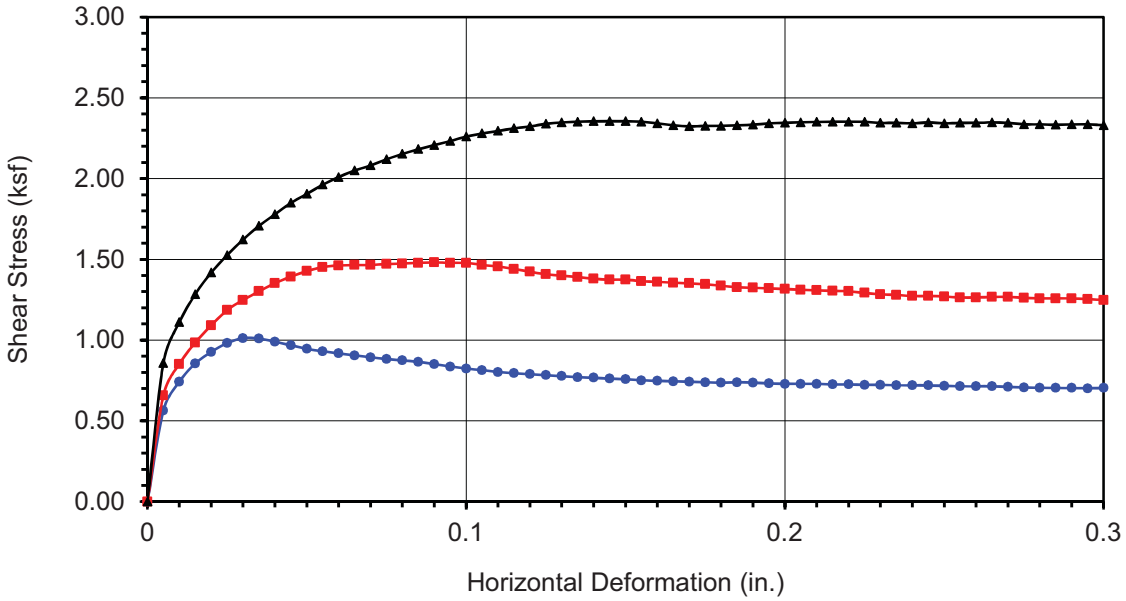
DIRECT SHEAR TEST

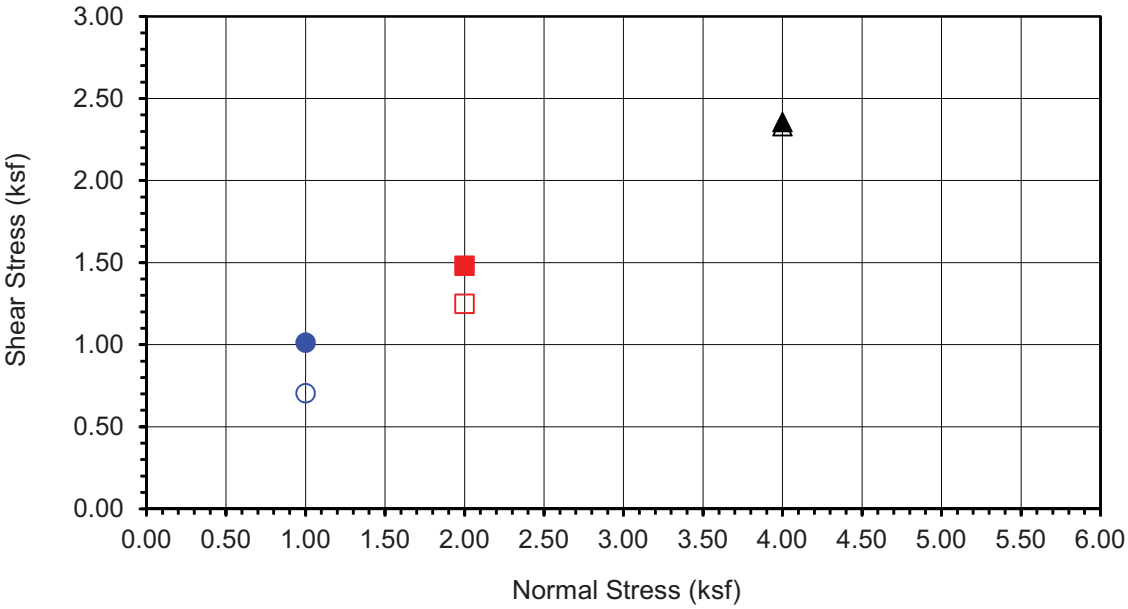
Consolidated Drained - ASTM D 3080

Project Name:	San Fernando Completion	Tested By:	G. Bathala	Date:	06/27/18
Project No.:	11957.004	Checked By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-2B	Sample Type:	Ring		
Sample No.:	R-3	Depth (ft.):	10.0		

Soil Identification: Olive brown silty clay (CL-ML)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	193.38	194.23	196.15
Weight of Ring(gm):	43.00	43.62	44.76
Before Shearing			
Weight of Wet Sample+Cont.(gm):	196.57	196.57	196.57
Weight of Dry Sample+Cont.(gm):	168.12	168.12	168.12
Weight of Container(gm):	57.88	57.88	57.88
Vertical Rdg.(in): Initial	0.2376	0.2616	0.2590
Vertical Rdg.(in): Final	0.2459	0.2790	0.2965
After Shearing			
Weight of Wet Sample+Cont.(gm):	204.92	203.28	212.17
Weight of Dry Sample+Cont.(gm):	176.39	174.92	184.54
Weight of Container(gm):	54.24	54.35	65.35
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**HSA-2B**
Sample No.	**R-3**
Depth (ft)	**10**
Sample Type: Ring	
Soil Identification: Olive brown silty clay (CL-ML)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.012	■ 1.481	▲ 2.355
Shear Stress @ End of Test (ksf)	○ 0.704	□ 1.248	△ 2.330
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	25.81	25.81	25.81
Dry Density (pcf)	99.4	99.6	100.1
Saturation (%)	100.2	100.5	101.8
Soil Height Before Shearing (in.)	0.9917	0.9826	0.9625
Final Moisture Content (%)	23.4	23.5	23.2

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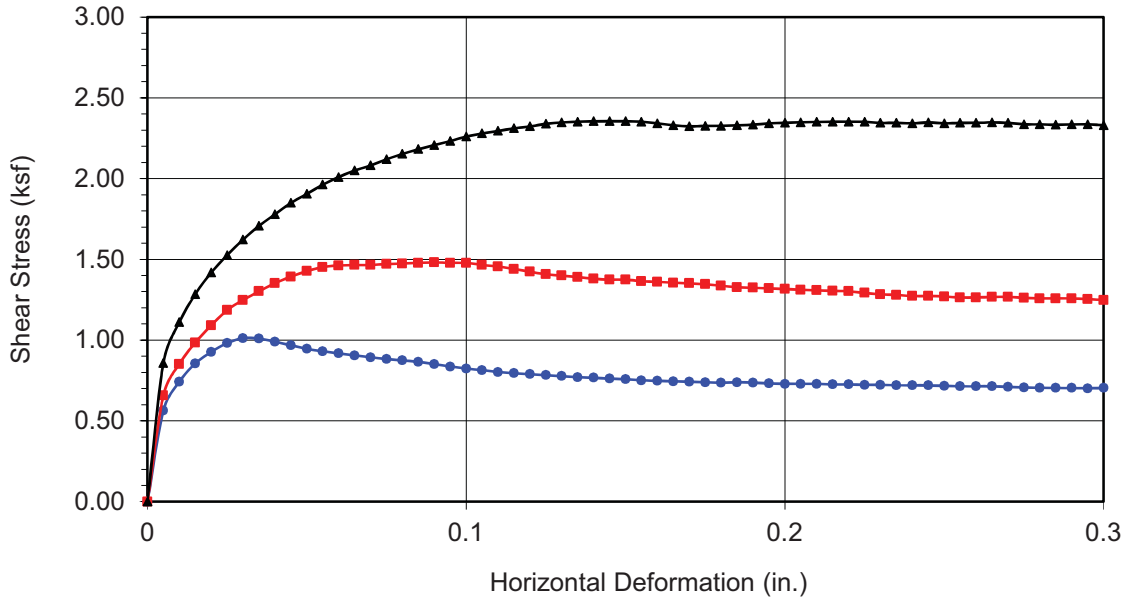
DIRECT SHEAR TEST RESULTS

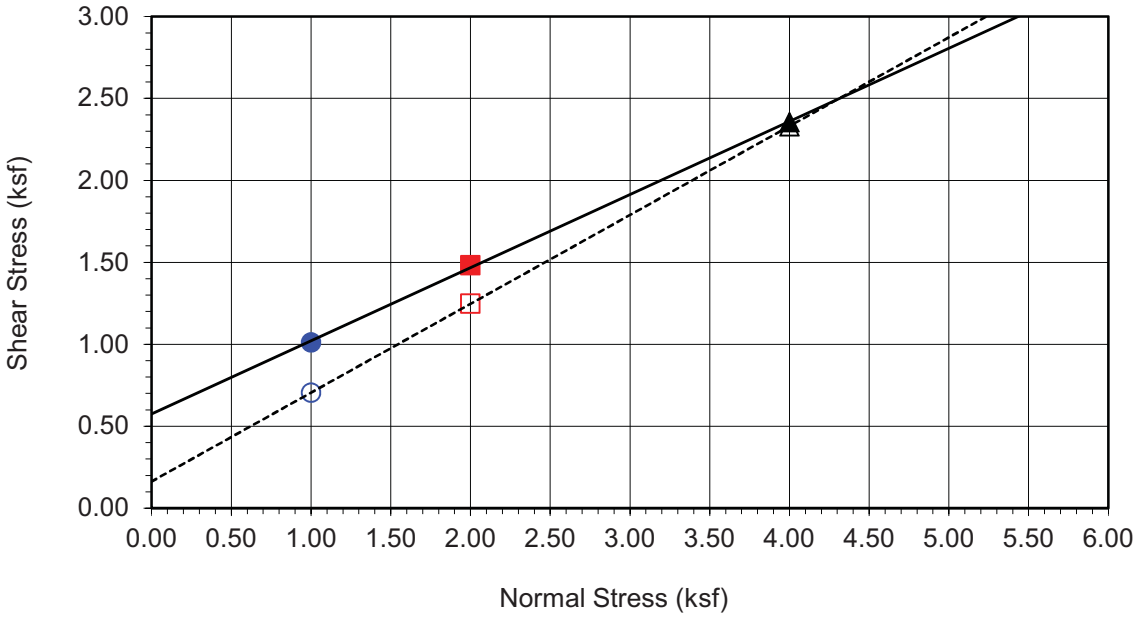
Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18





Boring No.	**HSA-2B**
Sample No.	**R-3**
Depth (ft)	**10**
Sample Type:	Ring
Soil Identification: Olive brown silty clay (CL-ML)	

Strength Parameters

	C (psf)	ϕ (°)
Peak	575	24
Ultimate	163	28

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.012	■ 1.481	▲ 2.355
Shear Stress @ End of Test (ksf)	○ 0.704	□ 1.248	△ 2.330
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	25.81	25.81	25.81
Dry Density (pcf)	99.4	99.6	100.1
Saturation (%)	100.2	100.5	101.8
Soil Height Before Shearing (in.)	0.9917	0.9826	0.9625
Final Moisture Content (%)	23.4	23.5	23.2

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18

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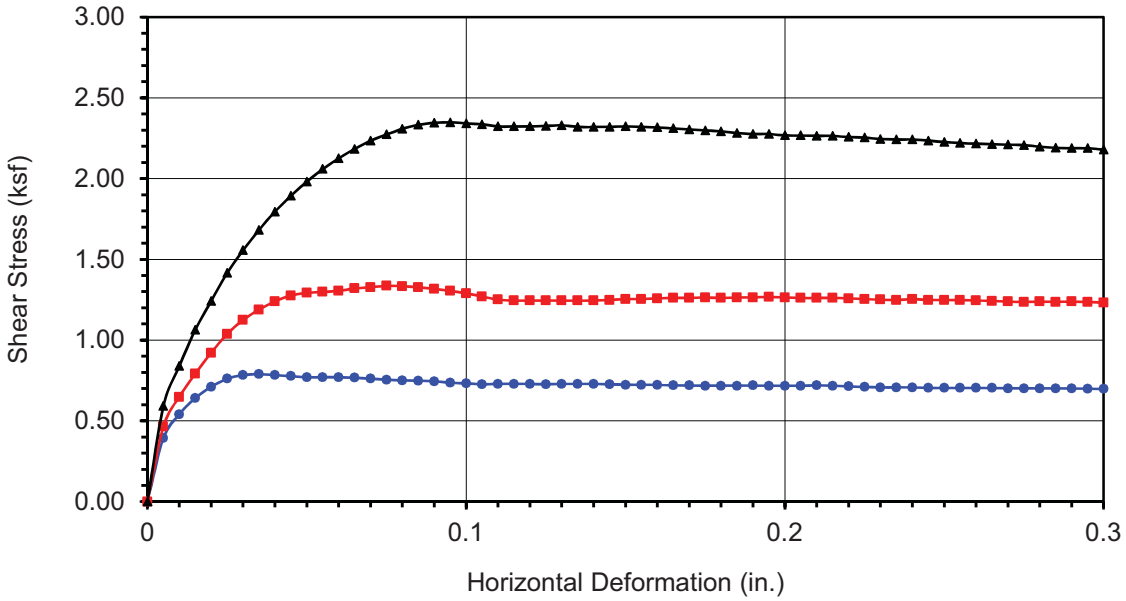
DIRECT SHEAR TEST

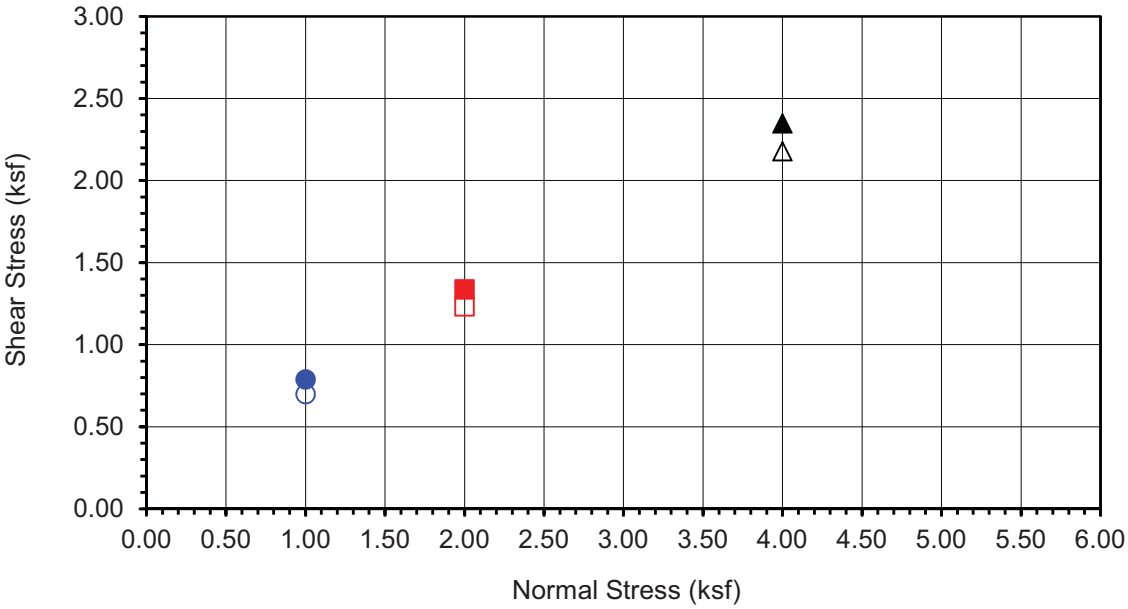
Consolidated Drained - ASTM D 3080

Project Name:	San Fernando Completion	Tested By:	G. Bathala	Date:	06/26/18
Project No.:	11957.004	Checked By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-3	Sample Type:	Ring		
Sample No.:	R-2	Depth (ft.):	7.5		

Soil Identification: Light olive brown silty clay with sand (CL-ML)s

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	185.42	187.73	189.25
Weight of Ring(gm):	42.87	42.64	43.45
Before Shearing			
Weight of Wet Sample+Cont.(gm):	391.16	391.16	391.16
Weight of Dry Sample+Cont.(gm):	357.72	357.72	357.72
Weight of Container(gm):	140.44	140.44	140.44
Vertical Rdg.(in): Initial	0.2803	0.2552	0.2779
Vertical Rdg.(in): Final	0.2873	0.2645	0.2943
After Shearing			
Weight of Wet Sample+Cont.(gm):	206.90	207.58	206.31
Weight of Dry Sample+Cont.(gm):	179.22	179.87	177.11
Weight of Container(gm):	57.90	57.18	58.20
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**HSA-3**
Sample No.	**R-2**
Depth (ft)	**7.5**
Sample Type: Ring	
Soil Identification: Light olive brown silty clay with sand (CL-ML)s	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.789	■ 1.336	▲ 2.348
Shear Stress @ End of Test (ksf)	○ 0.698	□ 1.232	△ 2.179
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	15.39	15.39	15.39
Dry Density (pcf)	102.7	104.6	105.1
Saturation (%)	64.9	67.9	68.8
Soil Height Before Shearing (in.)	0.9930	0.9907	0.9836
Final Moisture Content (%)	22.8	22.6	24.6

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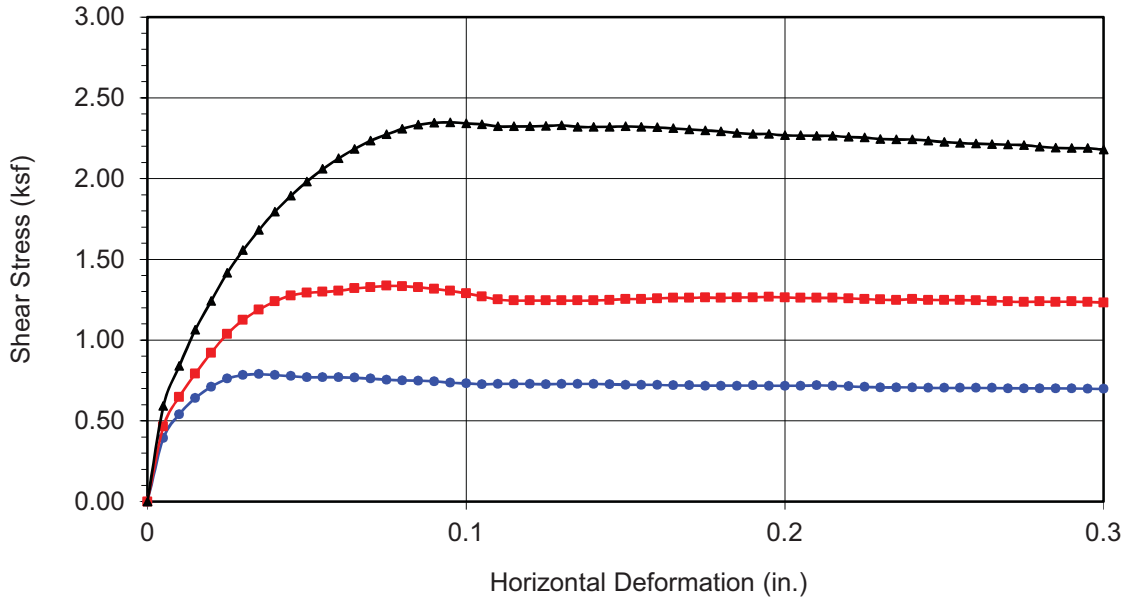
DIRECT SHEAR TEST RESULTS

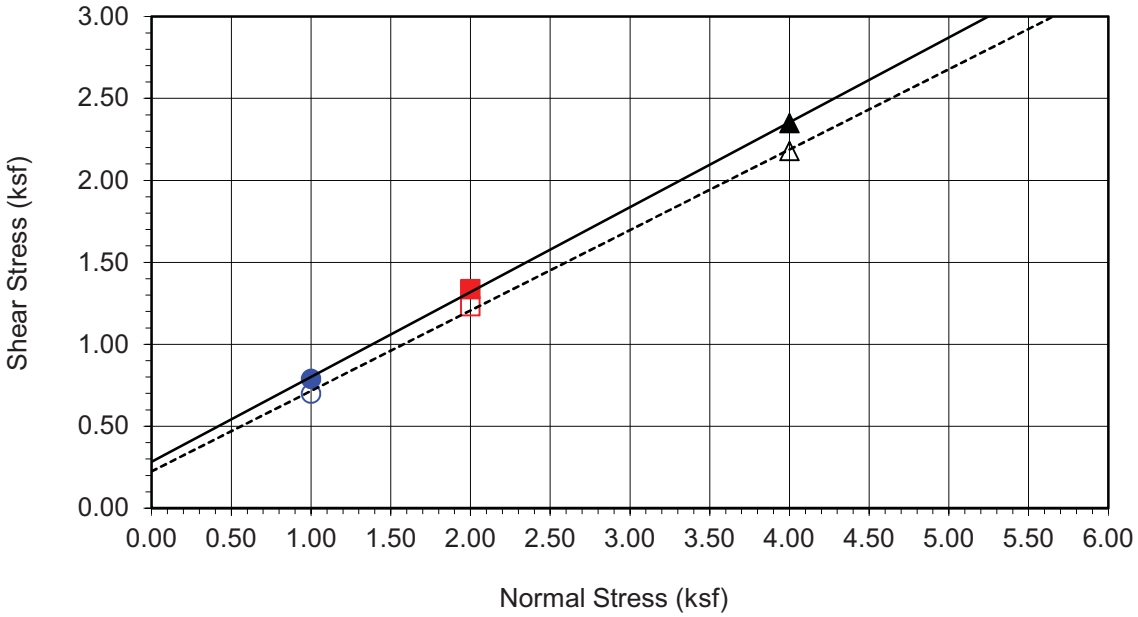
Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18





Boring No.	**HSA-3**
Sample No.	**R-2**
Depth (ft)	**7.5**
Sample Type:	Ring
Soil Identification: Light olive brown silty clay with sand (CL-ML)s	

Strength Parameters

	C (psf)	ϕ (°)
Peak	283	27
Ultimate	225	26

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.789	■ 1.336	▲ 2.348
Shear Stress @ End of Test (ksf)	○ 0.698	□ 1.232	△ 2.179
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	15.39	15.39	15.39
Dry Density (pcf)	102.7	104.6	105.1
Saturation (%)	64.9	67.9	68.8
Soil Height Before Shearing (in.)	0.9930	0.9907	0.9836
Final Moisture Content (%)	22.8	22.6	24.6

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18

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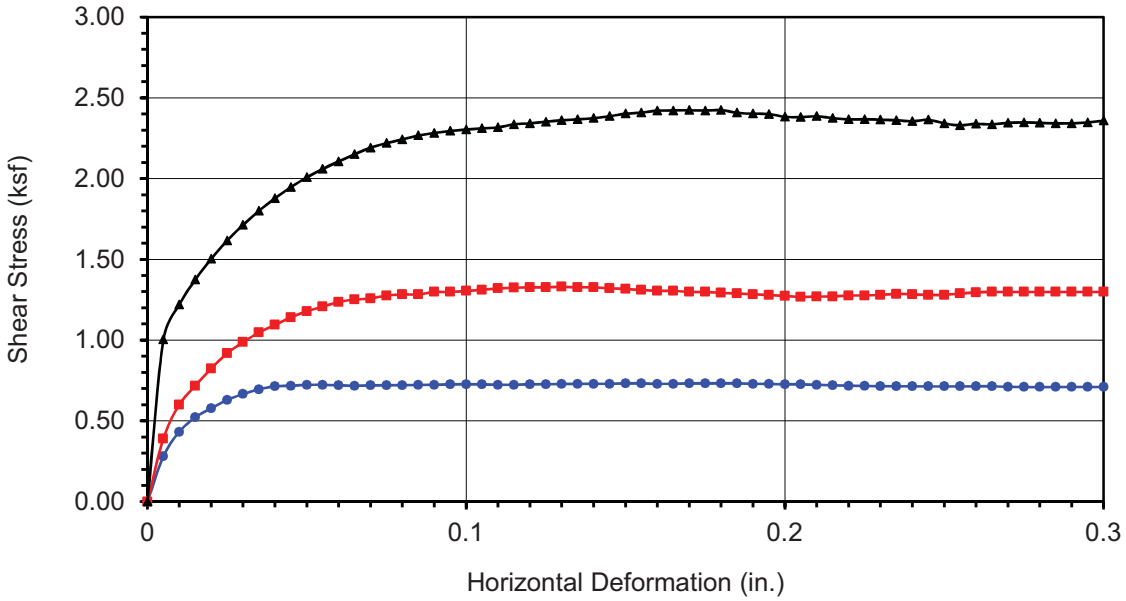
DIRECT SHEAR TEST

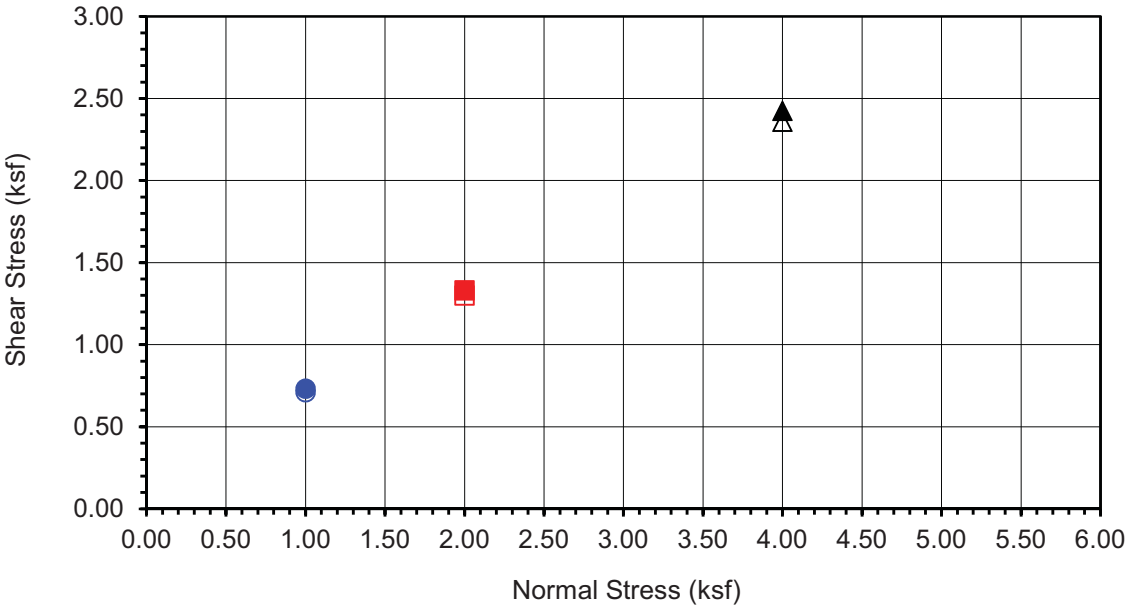
Consolidated Drained - ASTM D 3080

Project Name:	San Fernando Completion	Tested By:	G. Bathala	Date:	06/27/18
Project No.:	11957.004	Checked By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-5	Sample Type:	Ring		
Sample No.:	R-5	Depth (ft.):	15.0		

Soil Identification: Light olive brown silty, clayey sand (SC-SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	173.81	174.92	176.17
Weight of Ring(gm):	44.81	43.41	42.62
Before Shearing			
Weight of Wet Sample+Cont.(gm):	217.82	217.82	217.82
Weight of Dry Sample+Cont.(gm):	206.81	206.81	206.81
Weight of Container(gm):	65.43	65.43	65.43
Vertical Rdg.(in): Initial	0.2548	0.2490	0.2368
Vertical Rdg.(in): Final	0.2609	0.2614	0.2691
After Shearing			
Weight of Wet Sample+Cont.(gm):	211.74	182.92	202.23
Weight of Dry Sample+Cont.(gm):	184.50	158.33	176.76
Weight of Container(gm):	67.94	39.03	58.20
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**HSA-5**
Sample No.	**R-5**
Depth (ft)	**15**
Sample Type: Ring	
Soil Identification: Light olive brown silty, clayey sand (SC-SM)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.732	■ 1.330	▲ 2.424
Shear Stress @ End of Test (ksf)	○ 0.710	□ 1.298	△ 2.358
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	7.79	7.79	7.79
Dry Density (pcf)	99.5	101.5	103.0
Saturation (%)	30.3	31.8	33.1
Soil Height Before Shearing (in.)	0.9939	0.9876	0.9677
Final Moisture Content (%)	23.4	20.6	21.5

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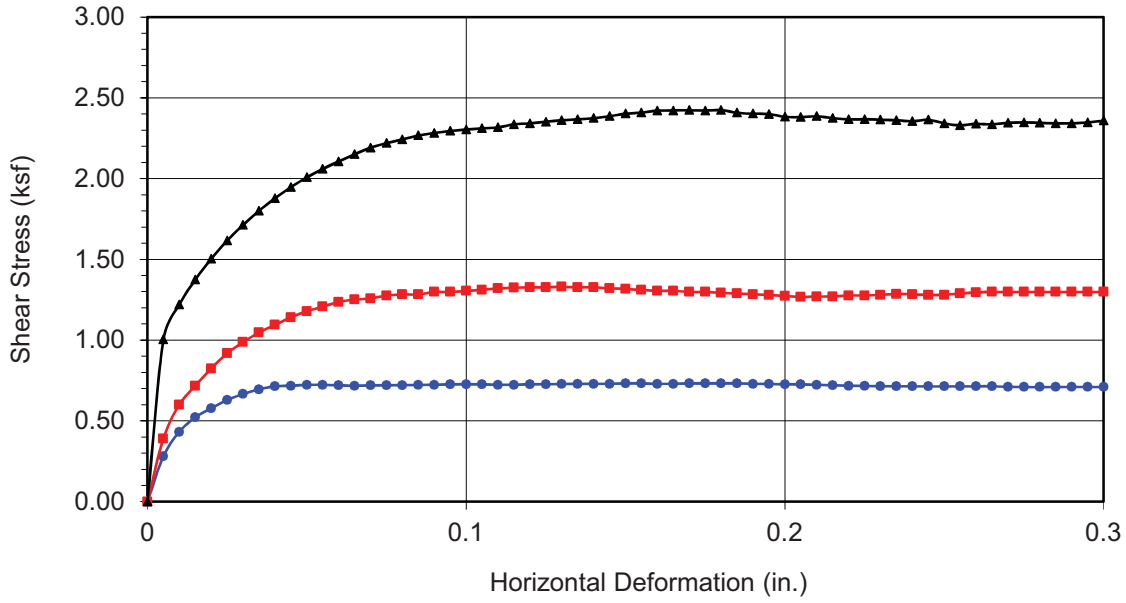
DIRECT SHEAR TEST RESULTS

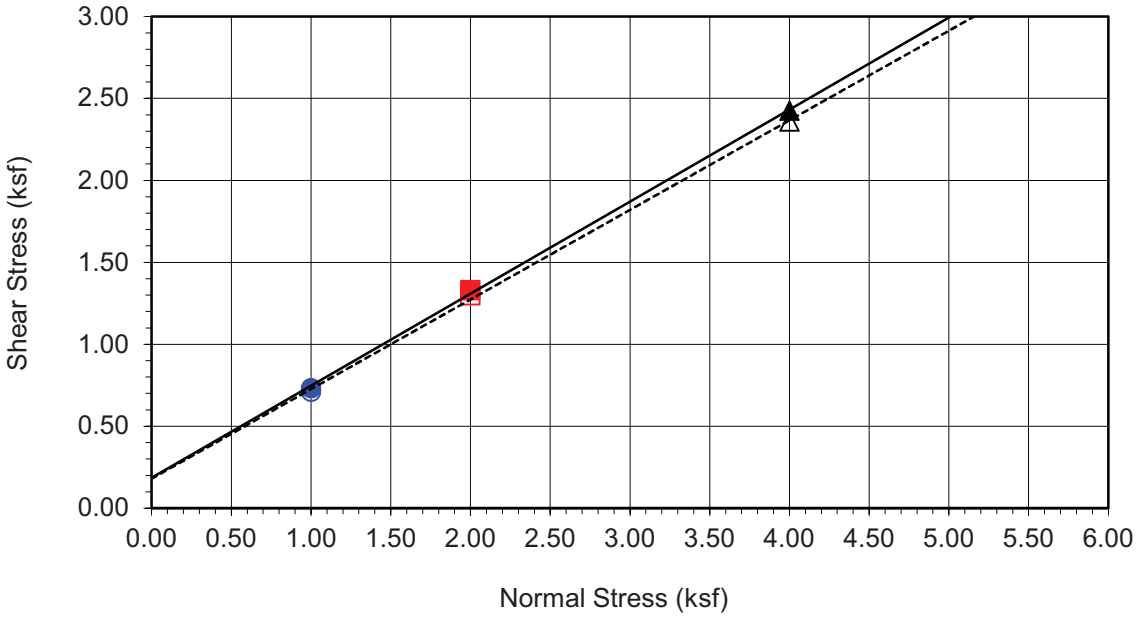
Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18





Boring No.	**HSA-5**
Sample No.	**R-5**
Depth (ft)	**15**
Sample Type:	Ring
Soil Identification: Light olive brown silty, clayey sand (SC-SM)	

Strength Parameters

	C (psf)	ϕ (°)
Peak	185	29
Ultimate	180	29

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.732	■ 1.330	▲ 2.424
Shear Stress @ End of Test (ksf)	○ 0.710	□ 1.298	△ 2.358
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	7.79	7.79	7.79
Dry Density (pcf)	99.5	101.5	103.0
Saturation (%)	30.3	31.8	33.1
Soil Height Before Shearing (in.)	0.9939	0.9876	0.9677
Final Moisture Content (%)	23.4	20.6	21.5

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18

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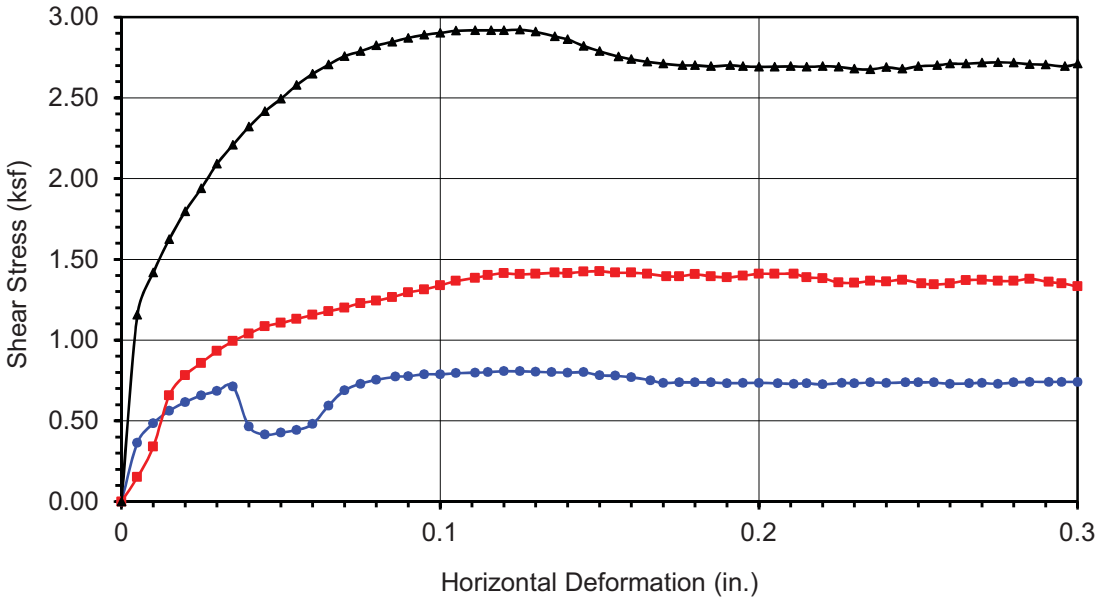
DIRECT SHEAR TEST

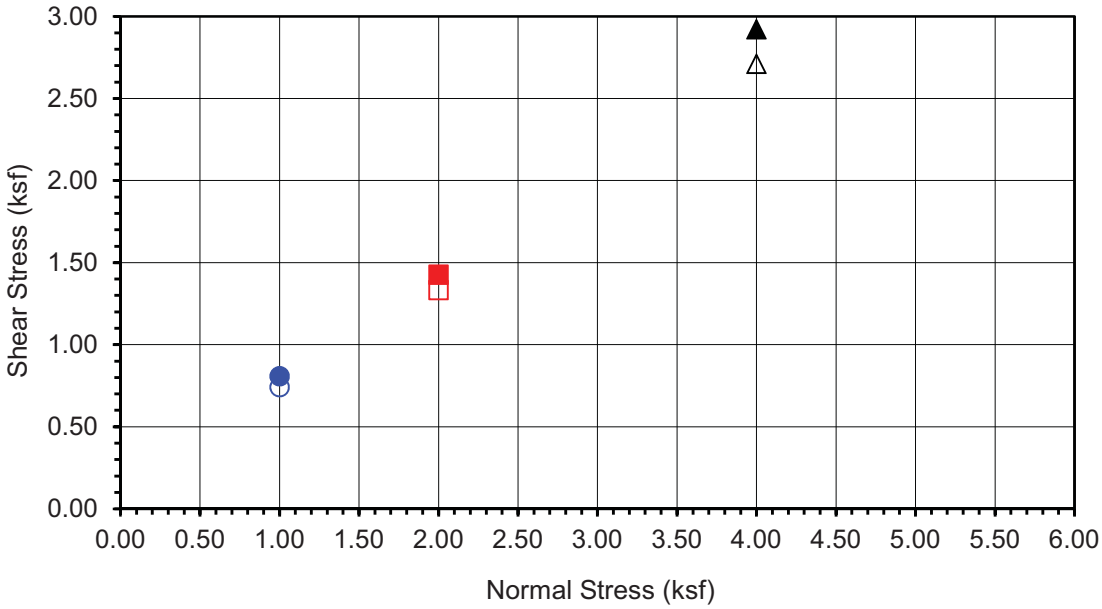
Consolidated Drained - ASTM D 3080

Project Name:	San Fernando Completion	Tested By:	M. Vinet	Date:	06/29/18
Project No.:	11957.004	Checked By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-7	Sample Type:	Ring		
Sample No.:	R-3	Depth (ft.):	10.0		

Soil Identification: Dark brown clayey sand (SC)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	173.16	170.05	175.91
Weight of Ring(gm):	42.98	42.34	44.86
Before Shearing			
Weight of Wet Sample+Cont.(gm):	236.40	236.40	236.40
Weight of Dry Sample+Cont.(gm):	215.48	215.48	215.48
Weight of Container(gm):	50.51	50.51	50.51
Vertical Rdg.(in): Initial	0.0000	0.2500	0.2500
Vertical Rdg.(in): Final	-0.0241	0.3022	0.3014
After Shearing			
Weight of Wet Sample+Cont.(gm):	190.81	187.13	192.23
Weight of Dry Sample+Cont.(gm):	162.70	159.89	166.42
Weight of Container(gm):	50.61	50.05	50.82
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**HSA-7**
Sample No.	**R-3**
Depth (ft)	**10**
Sample Type:	
Ring	
Soil Identification:	
Dark brown clayey sand (SC)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.807	■ 1.426	▲ 2.921
Shear Stress @ End of Test (ksf)	○ 0.741	□ 1.332	△ 2.711
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	12.68	12.68	12.68
Dry Density (pcf)	96.1	94.3	96.7
Saturation (%)	45.4	43.4	46.1
Soil Height Before Shearing (in.)	0.9759	0.9478	0.9486
Final Moisture Content (%)	25.1	24.8	22.3

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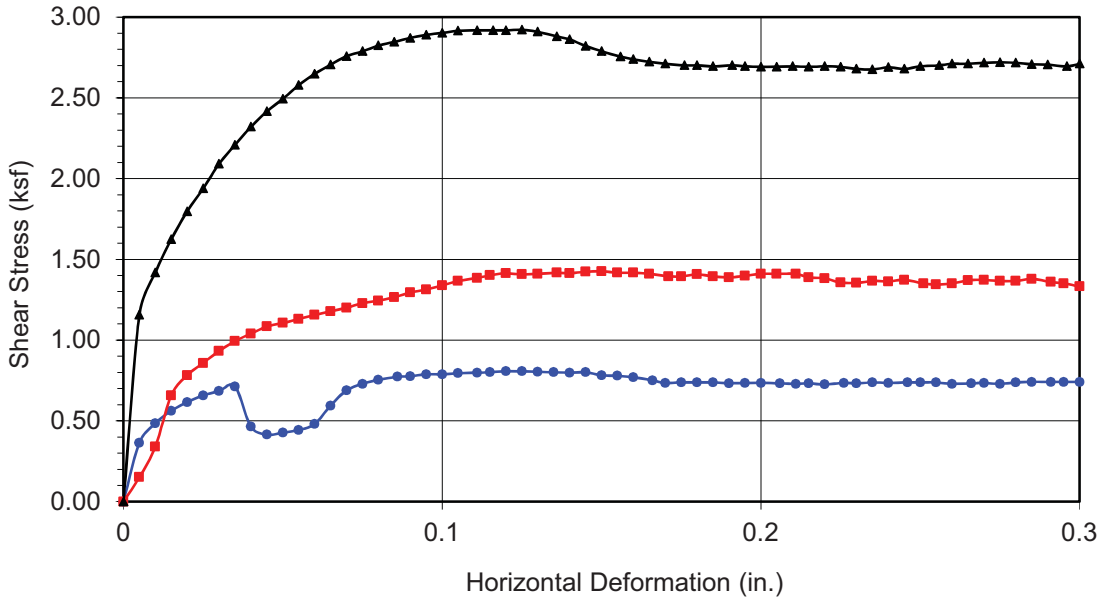
DIRECT SHEAR TEST RESULTS

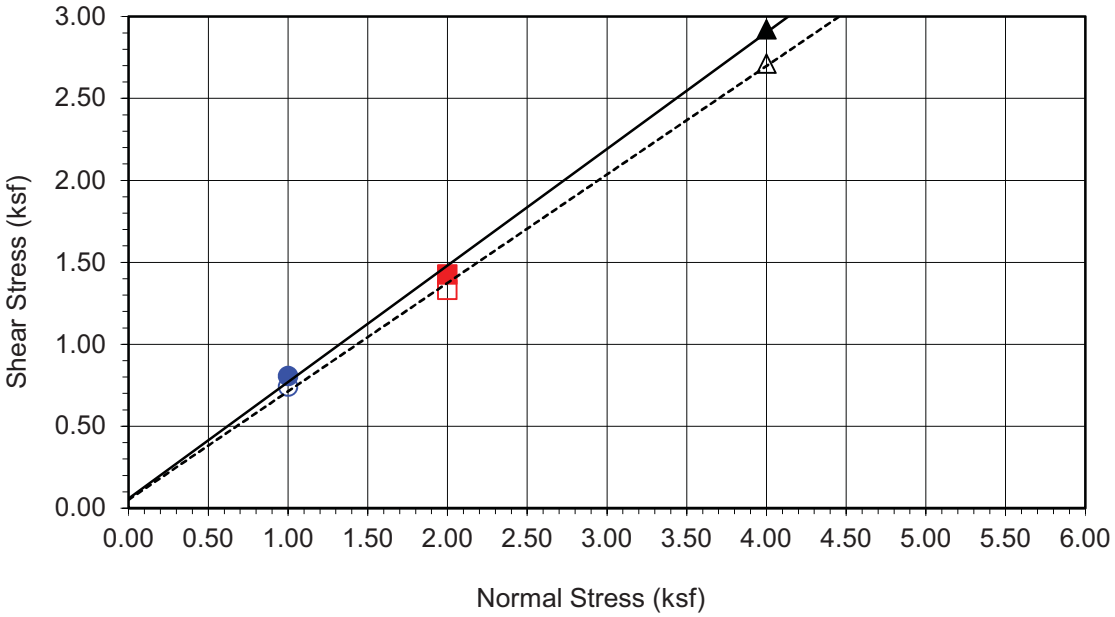
Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18





Boring No.	**HSA-7**
Sample No.	**R-3**
Depth (ft)	**10**
Sample Type:	Ring

Soil Identification:
Dark brown clayey sand (SC)

Strength Parameters

	C (psf)	ϕ (^{o})
Peak	60	35
Ultimate	52	33

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.807	■ 1.426	▲ 2.921
Shear Stress @ End of Test (ksf)	○ 0.741	□ 1.332	△ 2.711
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	12.68	12.68	12.68
Dry Density (pcf)	96.1	94.3	96.7
Saturation (%)	45.4	43.4	46.1
Soil Height Before Shearing (in.)	0.9759	0.9478	0.9486
Final Moisture Content (%)	25.1	24.8	22.3

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DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18

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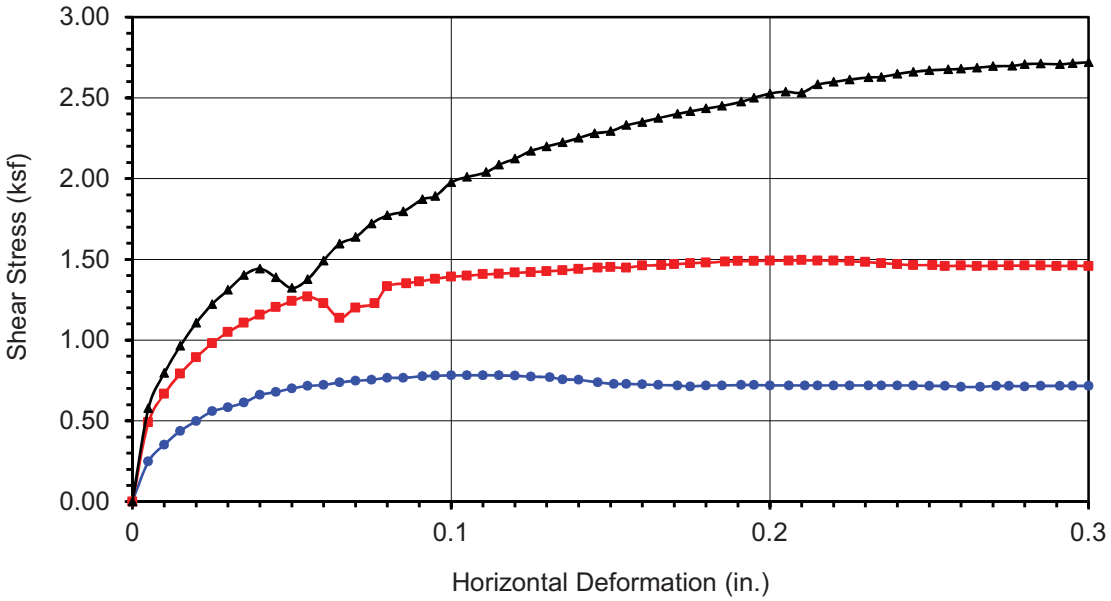
DIRECT SHEAR TEST

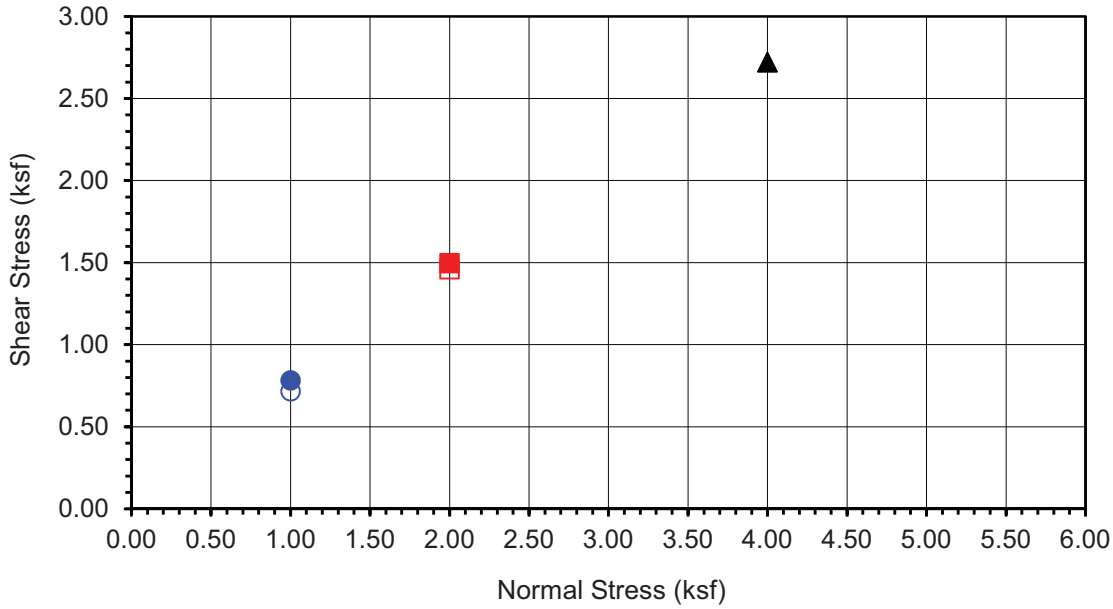
Consolidated Drained - ASTM D 3080

Project Name:	San Fernando Completion	Tested By:	M. Vinet	Date:	06/29/18
Project No.:	11957.004	Checked By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-8	Sample Type:	Ring		
Sample No.:	R-2	Depth (ft.):	7.5		

Soil Identification: Dark brown clayey sand (SC)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	171.50	172.25	153.27
Weight of Ring(gm):	43.73	43.13	43.26
Before Shearing			
Weight of Wet Sample+Cont.(gm):	222.30	222.30	222.30
Weight of Dry Sample+Cont.(gm):	200.10	200.10	200.10
Weight of Container(gm):	50.10	50.10	50.10
Vertical Rdg.(in): Initial	0.0000	0.2500	0.2500
Vertical Rdg.(in): Final	-0.0187	0.3003	0.3290
After Shearing			
Weight of Wet Sample+Cont.(gm):	188.88	189.35	167.09
Weight of Dry Sample+Cont.(gm):	161.49	159.77	142.41
Weight of Container(gm):	50.44	50.41	50.34
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**HSA-8**
Sample No.	**R-2**
Depth (ft)	**7.5**
Sample Type: Ring	
Soil Identification: Dark brown clayey sand (SC)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.782	■ 1.495	▲ 2.720
Shear Stress @ End of Test (ksf)	○ 0.716	□ 1.458	△ 2.720
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	14.80	14.80	14.80
Dry Density (pcf)	92.6	93.5	79.7
Saturation (%)	48.7	49.8	35.8
Soil Height Before Shearing (in.)	0.9813	0.9497	0.9210
Final Moisture Content (%)	24.7	27.0	26.8

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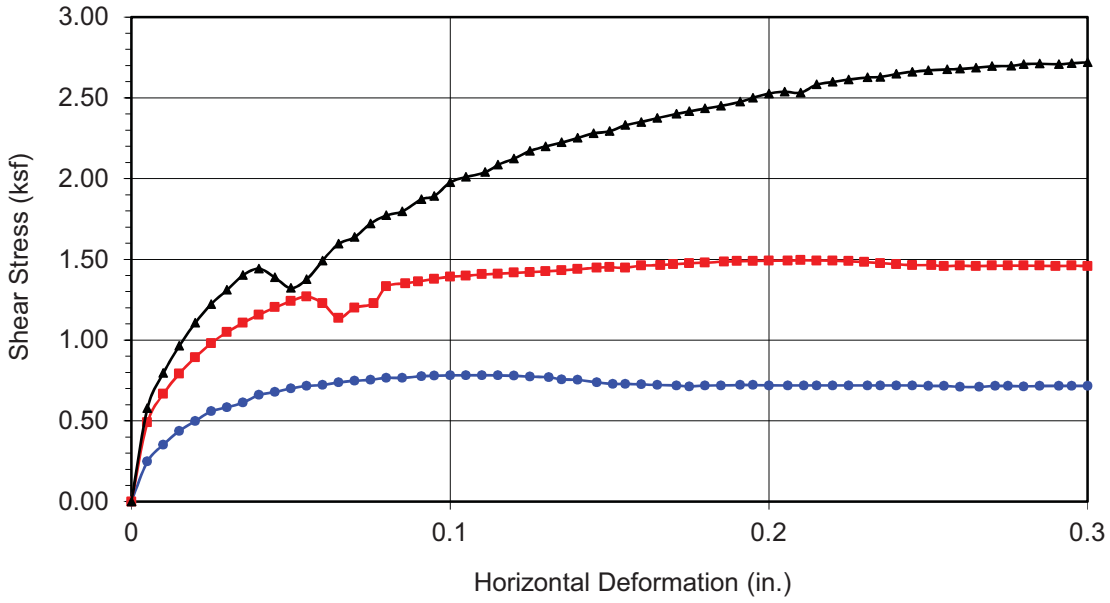
DIRECT SHEAR TEST RESULTS

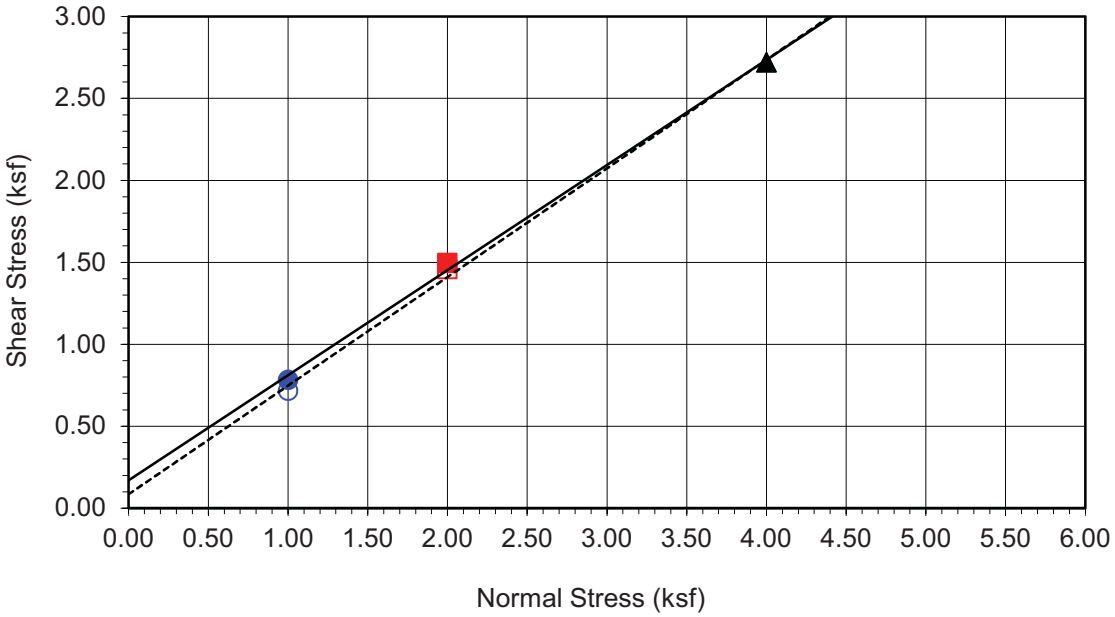
Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18





Boring No.	**HSA-8**
Sample No.	**R-2**
Depth (ft)	**7.5**
Sample Type:	Ring
Soil Identification:	Dark brown clayey sand (SC)

Strength Parameters

	C (psf)	ϕ (^{o})
Peak	170	33
Ultimate	85	34

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.782	■ 1.495	▲ 2.720
Shear Stress @ End of Test (ksf)	○ 0.716	□ 1.458	△ 2.720
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	14.80	14.80	14.80
Dry Density (pcf)	92.6	93.5	79.7
Saturation (%)	48.7	49.8	35.8
Soil Height Before Shearing (in.)	0.9813	0.9497	0.9210
Final Moisture Content (%)	24.7	27.0	26.8

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18

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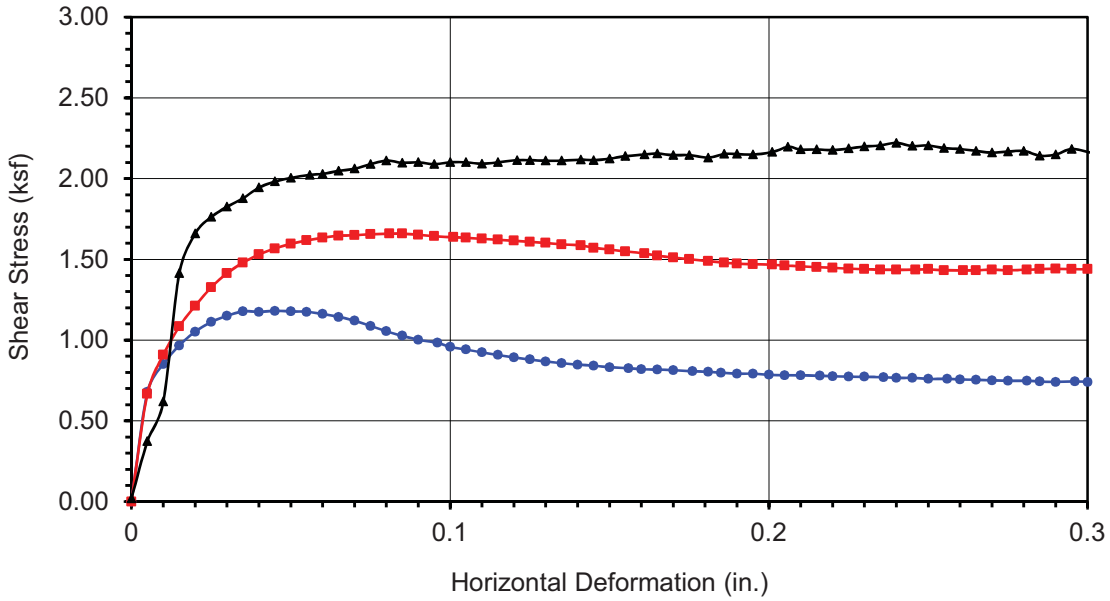
DIRECT SHEAR TEST

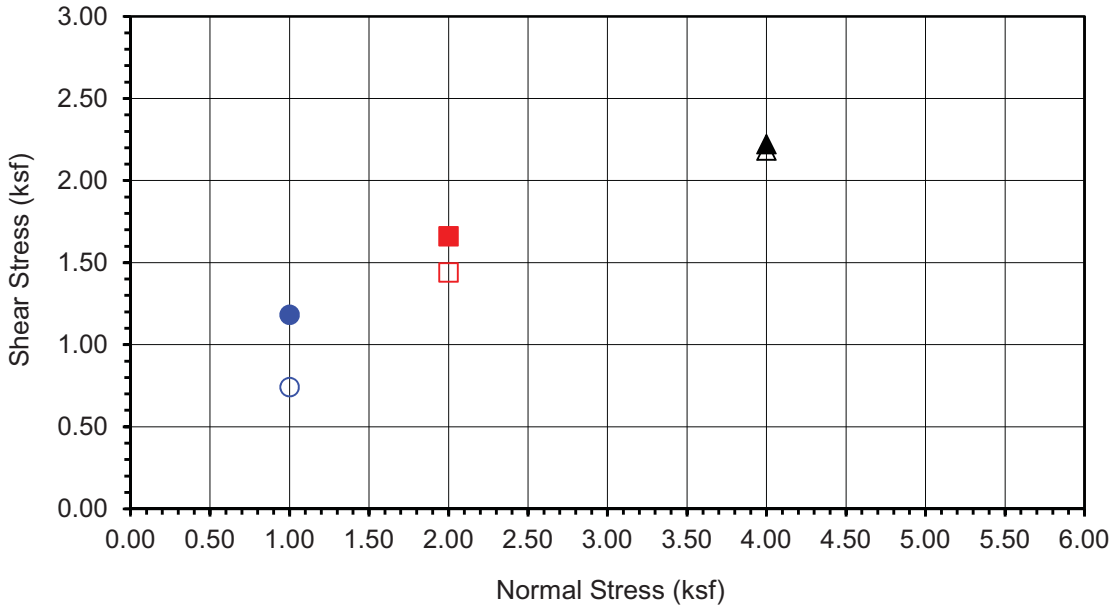
Consolidated Drained - ASTM D 3080

Project Name:	San Fernando Completion	Tested By:	M. Vinet	Date:	06/29/18
Project No.:	11957.004	Checked By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-9	Sample Type:	Ring		
Sample No.:	R-4	Depth (ft.):	12.5		

Soil Identification: Dark brown lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	194.53	197.57	194.30
Weight of Ring(gm):	43.24	44.74	44.92
Before Shearing			
Weight of Wet Sample+Cont.(gm):	201.40	201.40	201.40
Weight of Dry Sample+Cont.(gm):	174.64	174.64	174.64
Weight of Container(gm):	50.40	50.40	50.40
Vertical Rdg.(in): Initial	0.0000	0.2500	0.2500
Vertical Rdg.(in): Final	-0.0158	0.2713	0.2997
After Shearing			
Weight of Wet Sample+Cont.(gm):	205.54	205.17	199.46
Weight of Dry Sample+Cont.(gm):	176.69	176.81	171.88
Weight of Container(gm):	51.25	49.61	50.42
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**HSA-9**
Sample No.	**R-4**
Depth (ft)	**12.5**
Sample Type:	
Ring	
Soil Identification:	
Dark brown lean clay (CL)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.181	■ 1.659	▲ 2.221
Shear Stress @ End of Test (ksf)	○ 0.741	□ 1.439	△ 2.183
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	21.54	21.54	21.54
Dry Density (pcf)	103.5	104.6	102.2
Saturation (%)	92.6	95.1	89.6
Soil Height Before Shearing (in.)	0.9842	0.9787	0.9503
Final Moisture Content (%)	23.0	22.3	22.7

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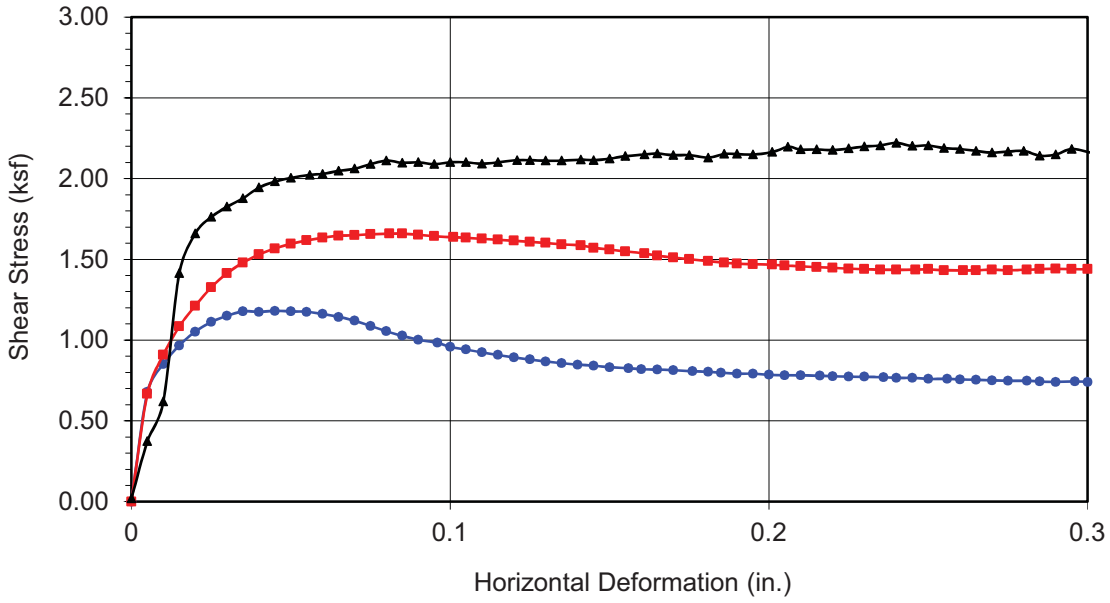
DIRECT SHEAR TEST RESULTS

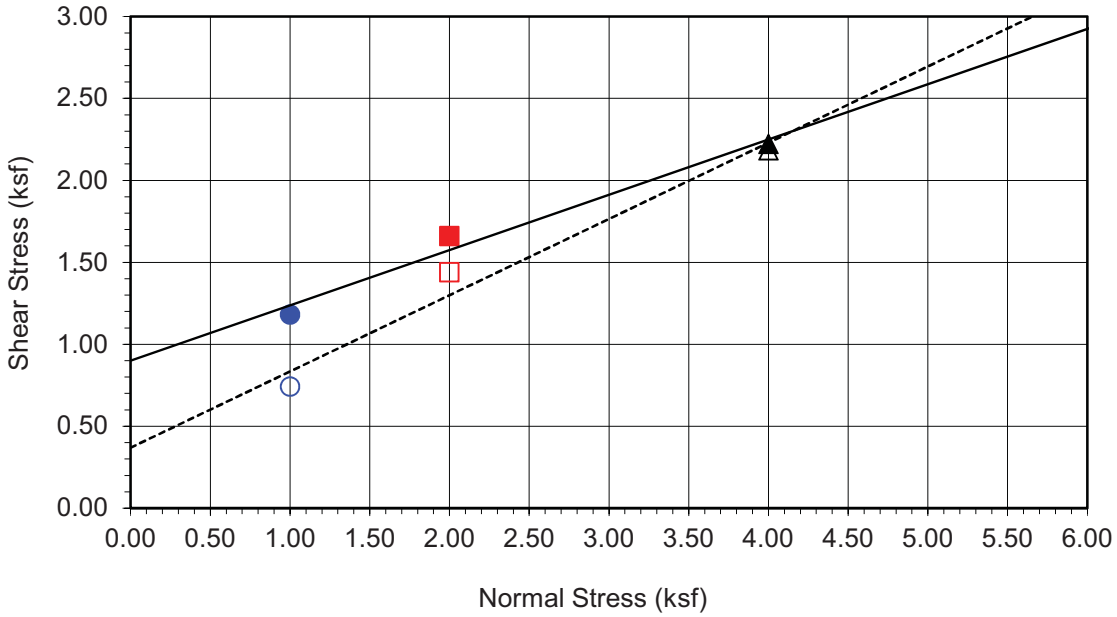
Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18





Boring No.	**HSA-9**
Sample No.	**R-4**
Depth (ft)	**12.5**
Sample Type:	Ring
Soil Identification:	Dark brown lean clay (CL)

Strength Parameters

	C (psf)	ϕ (°)
Peak	900	19
Ultimate	369	25

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.181	■ 1.659	▲ 2.221
Shear Stress @ End of Test (ksf)	○ 0.741	□ 1.439	△ 2.183
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	21.54	21.54	21.54
Dry Density (pcf)	103.5	104.6	102.2
Saturation (%)	92.6	95.1	89.6
Soil Height Before Shearing (in.)	0.9842	0.9787	0.9503
Final Moisture Content (%)	23.0	22.3	22.7

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18

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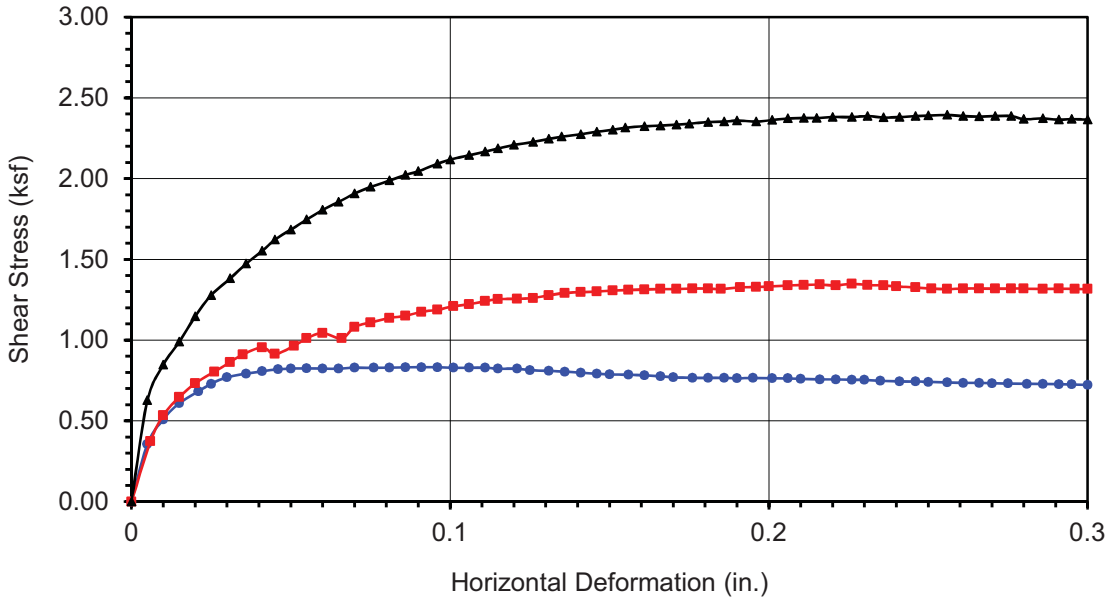
DIRECT SHEAR TEST

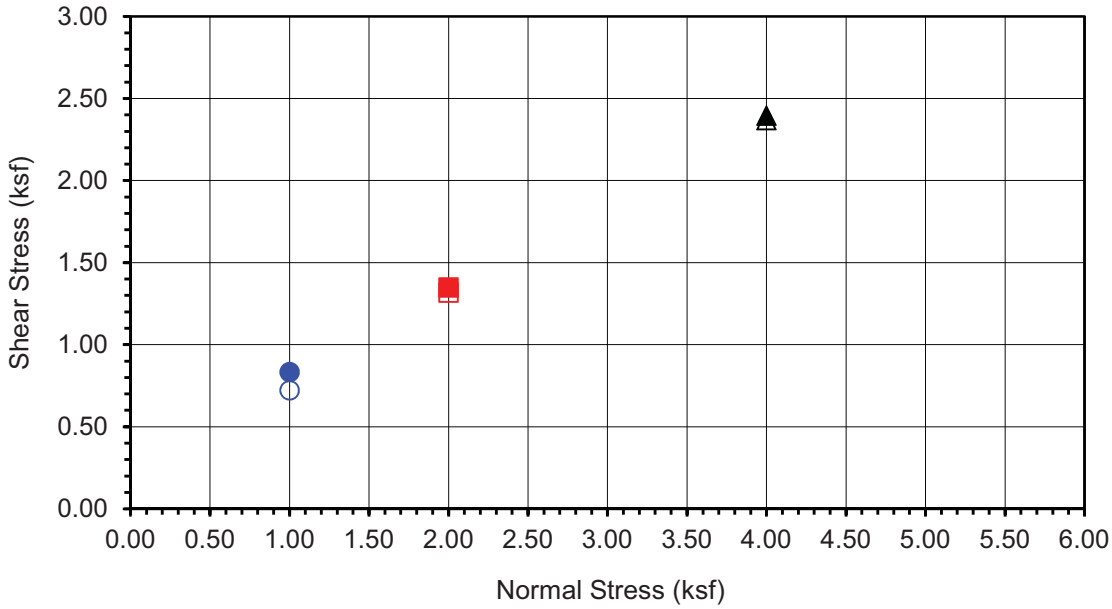
Consolidated Drained - ASTM D 3080

Project Name:	San Fernando Completion	Tested By:	M. Vinet	Date:	06/29/18
Project No.:	11957.004	Checked By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-11	Sample Type:	Ring		
Sample No.:	R-1	Depth (ft.):	5.0		

Soil Identification: Olive brown silty, clayey sand (SC-SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	180.50	171.58	168.86
Weight of Ring(gm):	40.95	43.84	42.30
Before Shearing			
Weight of Wet Sample+Cont.(gm):	187.30	187.30	187.30
Weight of Dry Sample+Cont.(gm):	172.59	172.59	172.59
Weight of Container(gm):	39.00	39.00	39.00
Vertical Rdg.(in): Initial	0.0000	0.2500	0.2500
Vertical Rdg.(in): Final	-0.0082	0.3188	0.3557
After Shearing			
Weight of Wet Sample+Cont.(gm):	181.30	179.56	177.25
Weight of Dry Sample+Cont.(gm):	148.85	151.03	150.14
Weight of Container(gm):	39.05	50.38	50.42
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**HSA-11**
Sample No.	**R-1**
Depth (ft)	**5**
Sample Type: Ring	
Soil Identification: Olive brown silty, clayey sand (SC-SM)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.832	■ 1.348	▲ 2.394
Shear Stress @ End of Test (ksf)	○ 0.722	□ 1.316	△ 2.368
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	11.01	11.01	11.01
Dry Density (pcf)	104.5	95.7	94.8
Saturation (%)	48.6	39.0	38.2
Soil Height Before Shearing (in.)	0.9918	0.9312	0.8943
Final Moisture Content (%)	29.6	28.3	27.2

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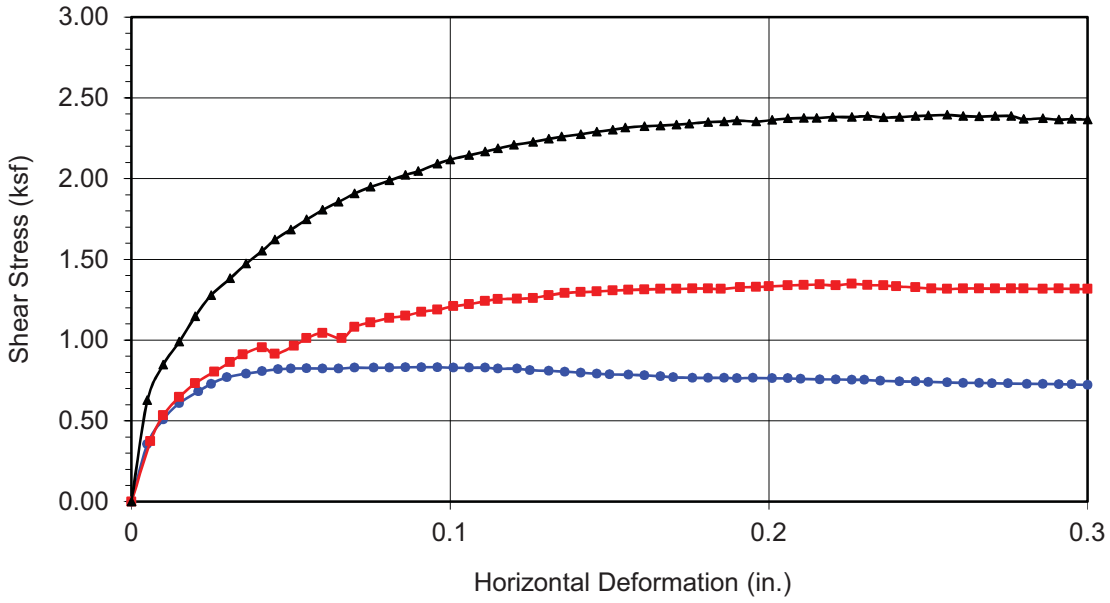
DIRECT SHEAR TEST RESULTS

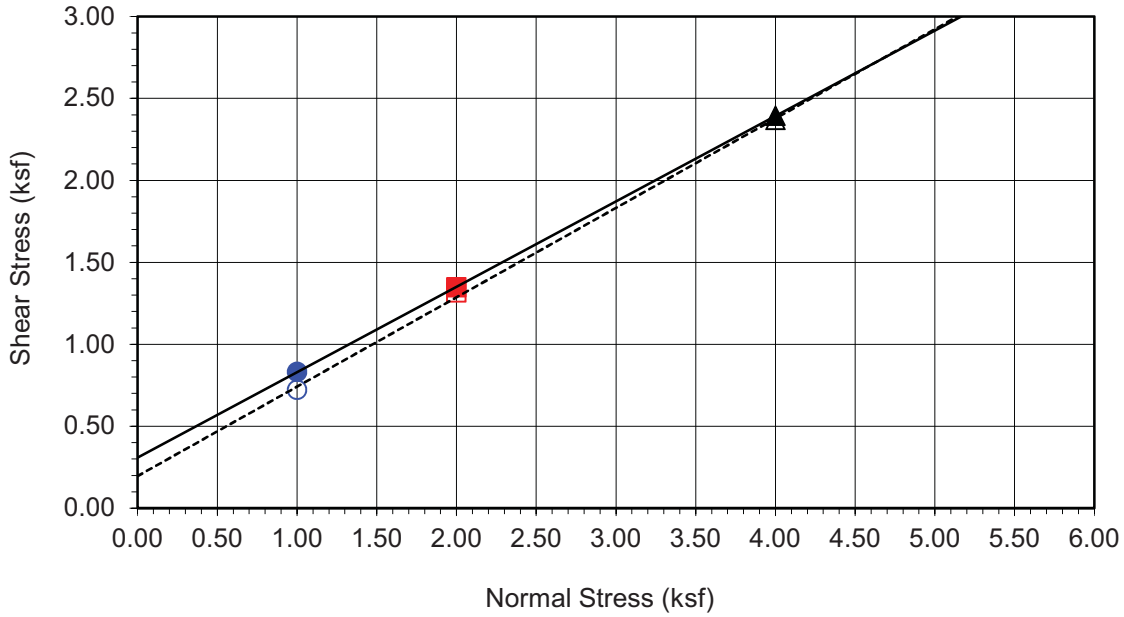
Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18





Boring No.	**HSA-11**
Sample No.	**R-1**
Depth (ft)	**5**
Sample Type:	Ring
Soil Identification:	Olive brown silty, clayey sand (SC-SM)

Strength Parameters

	C (psf)	ϕ (°)
Peak	309	28
Ultimate	196	29

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.832	■ 1.348	▲ 2.394
Shear Stress @ End of Test (ksf)	○ 0.722	□ 1.316	△ 2.368
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	11.01	11.01	11.01
Dry Density (pcf)	104.5	95.7	94.8
Saturation (%)	48.6	39.0	38.2
Soil Height Before Shearing (in.)	0.9918	0.9312	0.8943
Final Moisture Content (%)	29.6	28.3	27.2

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

06-18

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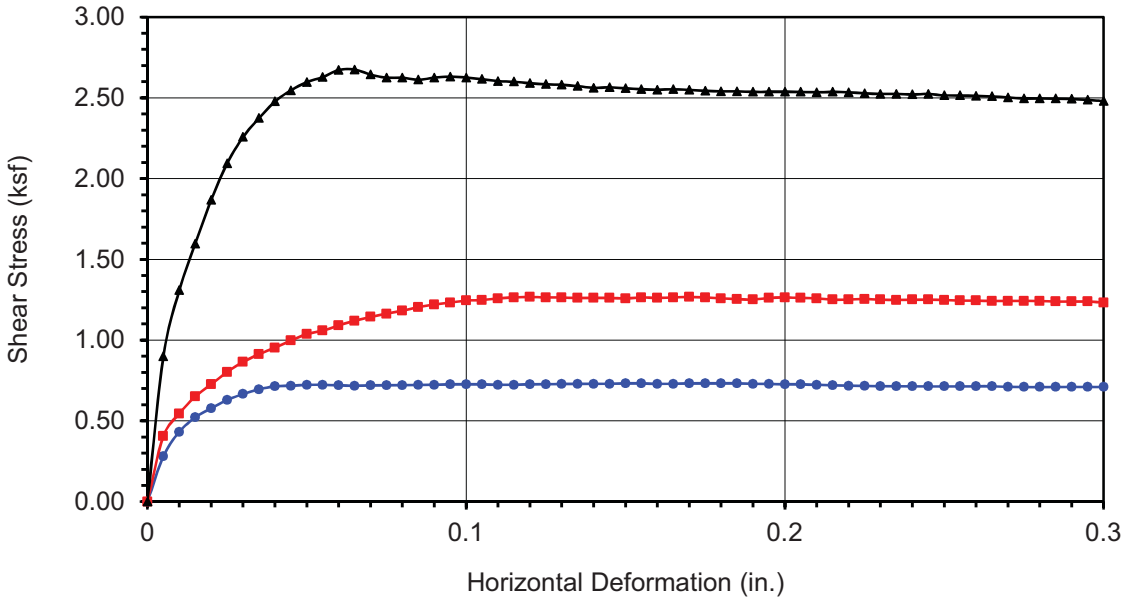
DIRECT SHEAR TEST

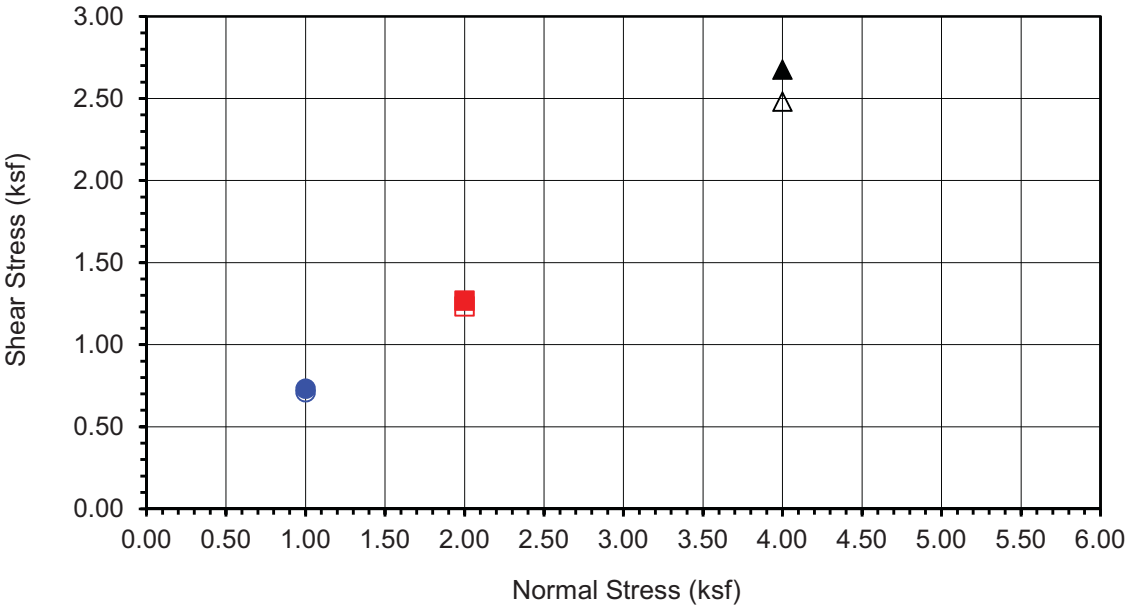
Consolidated Drained - ASTM D 3080

Project Name:	San Fernando Completion	Tested By:	G. Bathala	Date:	07/11/18
Project No.:	11957.004	Checked By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-11	Sample Type:	Ring		
Sample No.:	R-4	Depth (ft.):	12.5		

Soil Identification: Olive brown silty clay (CL-ML)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	173.81	177.21	191.02
Weight of Ring(gm):	44.81	44.81	42.77
Before Shearing			
Weight of Wet Sample+Cont.(gm):	191.00	191.00	191.00
Weight of Dry Sample+Cont.(gm):	166.70	166.70	166.70
Weight of Container(gm):	50.10	50.10	50.10
Vertical Rdg.(in): Initial	0.2548	0.0000	0.2699
Vertical Rdg.(in): Final	0.2609	-0.0184	0.2897
After Shearing			
Weight of Wet Sample+Cont.(gm):	211.74	191.64	207.01
Weight of Dry Sample+Cont.(gm):	184.50	161.29	178.95
Weight of Container(gm):	67.94	53.71	57.72
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**HSA-11**
Sample No.	**R-4**
Depth (ft)	**12.5**
Sample Type: Ring	
Soil Identification: Olive brown silty clay (CL-ML)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.732	■ 1.267	▲ 2.675
Shear Stress @ End of Test (ksf)	○ 0.710	□ 1.232	△ 2.480
Deformation Rate (in./min.)	0.0025	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	20.84	20.84	20.84
Dry Density (pcf)	88.8	91.1	102.0
Saturation (%)	62.6	66.2	86.3
Soil Height Before Shearing (in.)	0.9939	0.9816	0.9802
Final Moisture Content (%)	23.4	28.2	23.1

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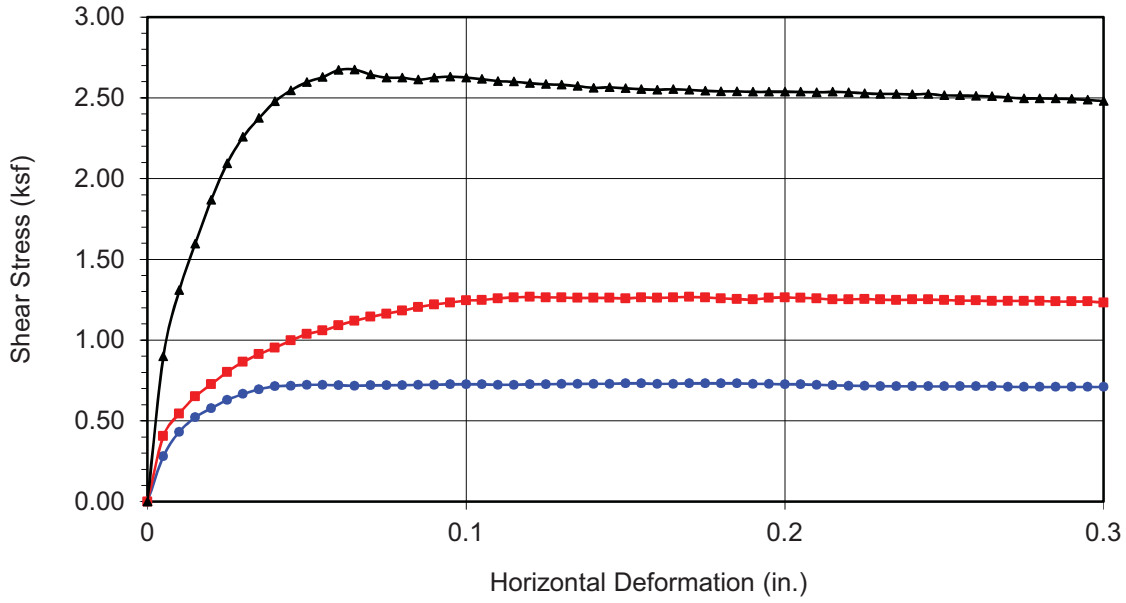
DIRECT SHEAR TEST RESULTS

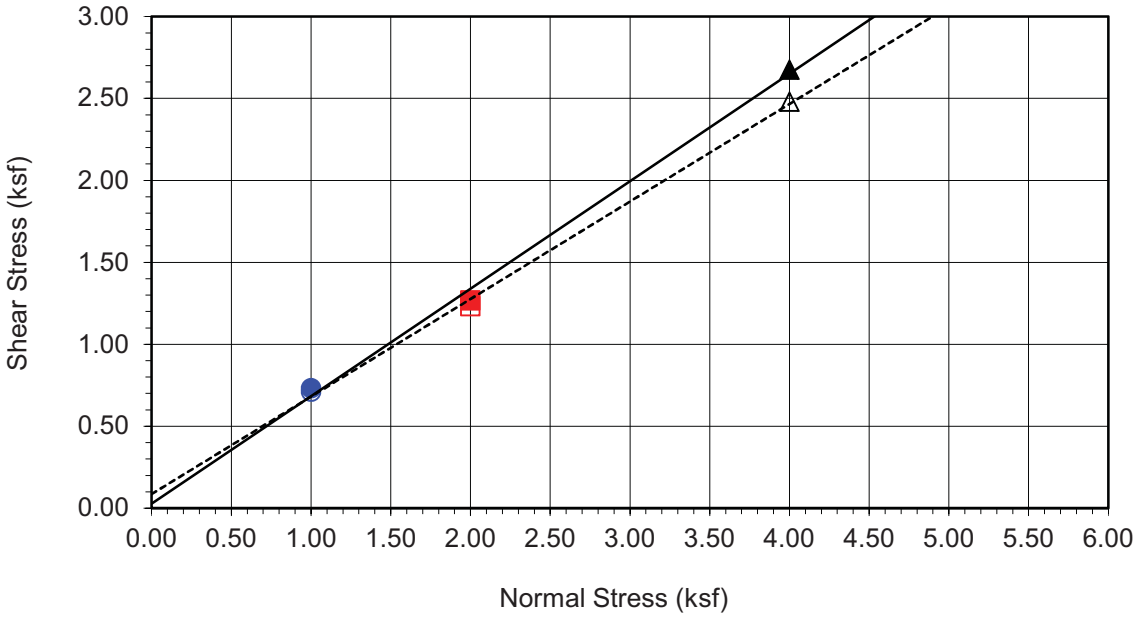
Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

07-18





Boring No.	**HSA-11**
Sample No.	**R-4**
Depth (ft)	**12.5**
Sample Type:	Ring

Soil Identification:
Olive brown silty clay (CL-ML)

Strength Parameters

	C (psf)	ϕ (°)
Peak	28	33
Ultimate	86	31

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.732	■ 1.267	▲ 2.675
Shear Stress @ End of Test (ksf)	○ 0.710	□ 1.232	△ 2.480
Deformation Rate (in./min.)	0.0025	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	20.84	20.84	20.84
Dry Density (pcf)	88.8	91.1	102.0
Saturation (%)	62.6	66.2	86.3
Soil Height Before Shearing (in.)	0.9939	0.9816	0.9802
Final Moisture Content (%)	23.4	28.2	23.1

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DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 11957.004

San Fernando Completion

07-18

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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	San Fernando Completion	Tested By:	S. Felter	Date:	07/10/18
Project No.:	11957.004	Checked By:	J. Ward	Date:	07/25/18
Boring No.:	HSA-1	Depth (ft.):	0-5		
Sample No.:	BB-1				
Soil Identification:	Brown lean clay with sand (CL)s				

Dry Wt. of Soil + Cont. (g)	1000.00
Wt. of Container No. (g)	0.00
Dry Wt. of Soil (g)	1000.00
Weight Soil Retained on #4 Sieve	0.00
Percent Passing # 4	100.00

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0690
Wt. Comp. Soil + Mold (g)	556.60	426.45
Wt. of Mold (g)	166.30	0.00
Specific Gravity (Assumed)	2.70	2.70
Container No.	O	O
Wet Wt. of Soil + Cont. (g)	778.10	592.75
Dry Wt. of Soil + Cont. (g)	701.00	517.90
Wt. of Container (g)	0.00	166.30
Moisture Content (%)	11.00	21.29
Wet Density (pcf)	117.7	120.3
Dry Density (pcf)	106.1	99.2
Void Ratio	0.589	0.699
Total Porosity	0.371	0.411
Pore Volume (cc)	76.8	91.1
Degree of Saturation (%) [S_{meas}]	**50.4**	82.2

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
07/10/18	12:52	1.0	0	0.1160
07/10/18	13:02	1.0	10	0.1160
Add Distilled Water to the Specimen				
07/10/18	13:39	1.0	37	0.1530
07/11/18	6:36	1.0	1054	0.1850
07/11/18	8:03	1.0	1141	0.1850

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**69**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	San Fernando Completion	Tested By:	S. Felter	Date:	07/10/18
Project No.:	11957.004	Checked By:	J. Ward	Date:	07/25/18
Boring No.:	HSA-3	Depth (ft.):	0-5		
Sample No.:	BB-1				
Soil Identification:	Brown lean clay with sand (CL)s				

Dry Wt. of Soil + Cont. (g)	1000.00
Wt. of Container No. (g)	0.00
Dry Wt. of Soil (g)	1000.00
Weight Soil Retained on #4 Sieve	0.00
Percent Passing # 4	100.00

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0765
Wt. Comp. Soil + Mold (g)	549.00	425.76
Wt. of Mold (g)	162.40	0.00
Specific Gravity (Assumed)	2.70	2.70
Container No.	O	O
Wet Wt. of Soil + Cont. (g)	783.90	588.16
Dry Wt. of Soil + Cont. (g)	708.20	511.66
Wt. of Container (g)	0.00	162.40
Moisture Content (%)	10.69	21.90
Wet Density (pcf)	116.6	119.3
Dry Density (pcf)	105.4	97.9
Void Ratio	0.600	0.723
Total Porosity	0.375	0.419
Pore Volume (cc)	77.6	93.5
Degree of Saturation (%) [S meas]	**48.1**	81.8

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
07/10/18	13:20	1.0	0	0.0545
07/10/18	13:30	1.0	10	0.0550
Add Distilled Water to the Specimen				
07/10/18	13:40	1.0	10	0.0680
07/11/18	6:35	1.0	1025	0.1310
07/11/18	8:05	1.0	1115	0.1310

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**76**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	San Fernando Completion	Tested By:	S. Felter	Date:	07/11/18
Project No.:	11957.004	Checked By:	J. Ward	Date:	07/25/18
Boring No.:	HSA-9	Depth (ft.):	0-5		
Sample No.:	BB-1				
Soil Identification:	Brown lean clay with sand (CL)s				

Dry Wt. of Soil + Cont. (g)	1000.00
Wt. of Container No. (g)	0.00
Dry Wt. of Soil (g)	1000.00
Weight Soil Retained on #4 Sieve	0.00
Percent Passing # 4	100.00

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0650
Wt. Comp. Soil + Mold (g)	554.80	427.97
Wt. of Mold (g)	163.30	0.00
Specific Gravity (Assumed)	2.70	2.70
Container No.	O	O
Wet Wt. of Soil + Cont. (g)	782.00	591.27
Dry Wt. of Soil + Cont. (g)	705.80	516.64
Wt. of Container (g)	0.00	163.30
Moisture Content (%)	10.80	21.12
Wet Density (pcf)	118.1	121.2
Dry Density (pcf)	106.6	100.1
Void Ratio	0.582	0.685
Total Porosity	0.368	0.406
Pore Volume (cc)	76.1	89.6
Degree of Saturation (%) [S meas]	**50.1**	83.3

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
07/11/18	9:04	1.0	0	0.0530
07/11/18	9:14	1.0	10	0.0530
Add Distilled Water to the Specimen				
07/11/18	13:44	1.0	270	0.1155
07/12/18	6:42	1.0	1288	0.1180
07/12/18	7:50	1.0	1356	0.1180

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**65**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	San Fernando Completion	Tested By:	S. Felter	Date:	07/11/18
Project No.:	11957.004	Checked By:	J. Ward	Date:	07/25/18
Boring No.:	HSA-11	Depth (ft.):	0-5		
Sample No.:	BB-1				
Soil Identification:	Brown sandy lean clay s(CL)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0505
Wt. Comp. Soil + Mold (g)	569.20	435.69
Wt. of Mold (g)	166.20	0.00
Specific Gravity (Assumed)	2.70	2.70
Container No.	O	O
Wet Wt. of Soil + Cont. (g)	802.30	601.89
Dry Wt. of Soil + Cont. (g)	730.70	533.26
Wt. of Container (g)	0.00	166.20
Moisture Content (%)	9.80	18.70
Wet Density (pcf)	121.6	125.1
Dry Density (pcf)	110.7	105.4
Void Ratio	0.523	0.599
Total Porosity	0.343	0.375
Pore Volume (cc)	71.1	81.5
Degree of Saturation (%) [S_{meas}]	**50.6**	84.2

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
07/11/18	9:47	1.0	0	0.0340
07/11/18	9:57	1.0	10	0.0340
Add Distilled Water to the Specimen				
07/11/18	13:45	1.0	228	0.0800
07/12/18	6:43	1.0	1246	0.0845
07/12/18	7:52	1.0	1315	0.0845

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**51**

Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	San Fernando Completion	Tested By:	R. Manning	Date:	07/10/18
Project No. :	11957.004	Input By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-1	Checked By:	J. Ward		
Sample No.:	R-4	Depth (ft.)	12.5		
Soil Identification:	Brown lean clay (CL)				

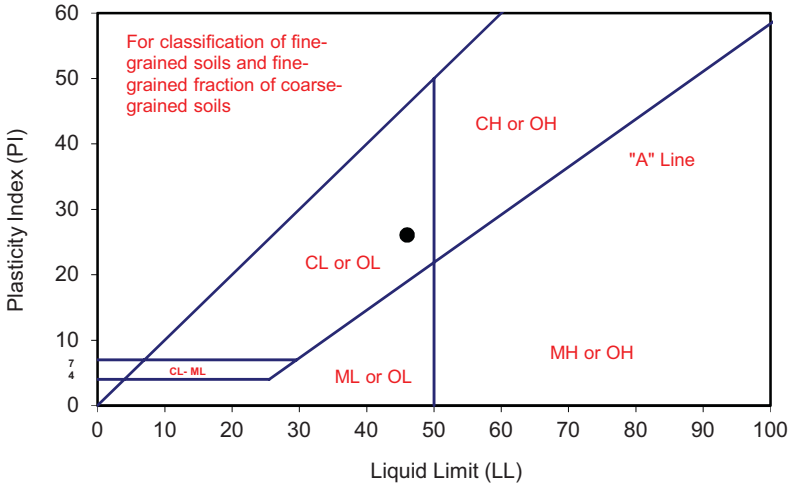
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	25	18	
Wet Wt. of Soil + Cont. (g)	18.43	18.56	25.23	24.22	25.00	
Dry Wt. of Soil + Cont. (g)	17.32	17.34	21.63	20.88	21.34	
Wt. of Container (g)	11.75	11.21	13.54	13.56	13.60	
Moisture Content (%) [Wn]	19.93	19.90	44.50	45.63	47.29	

Liquid Limit	**46**
Plastic Limit	**20**
Plasticity Index	**26**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 18.98

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



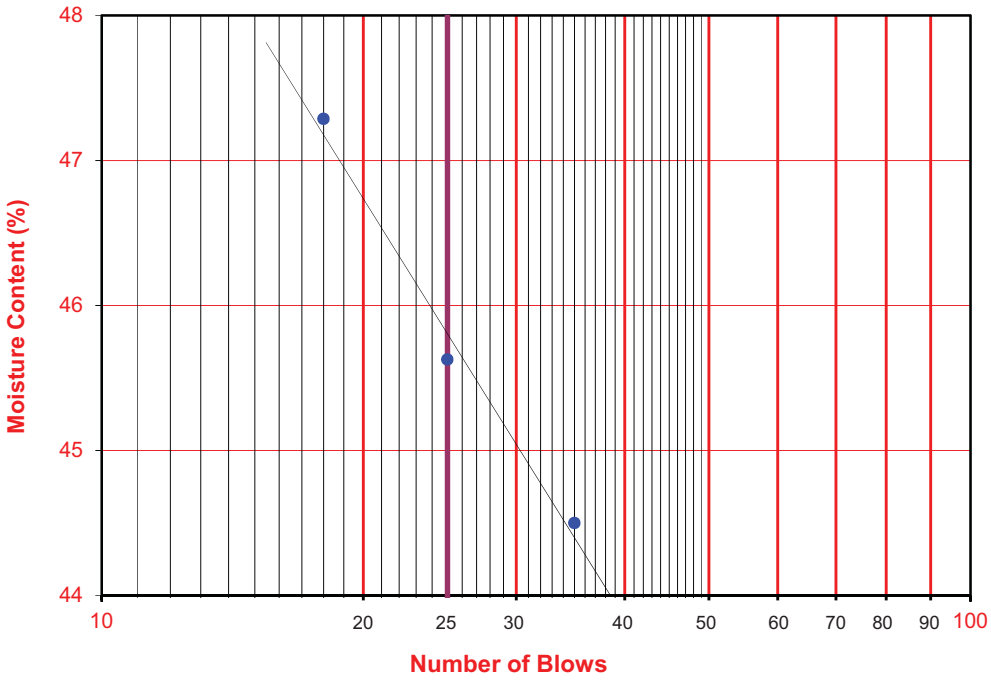
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	San Fernando Completion	Tested By:	R. Manning	Date:	07/01/18
Project No. :	11957.004	Input By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-2B	Checked By:	J. Ward		
Sample No.:	R-4	Depth (ft.)	12.5		
Soil Identification:	Light olive brown lean clay (CL)				

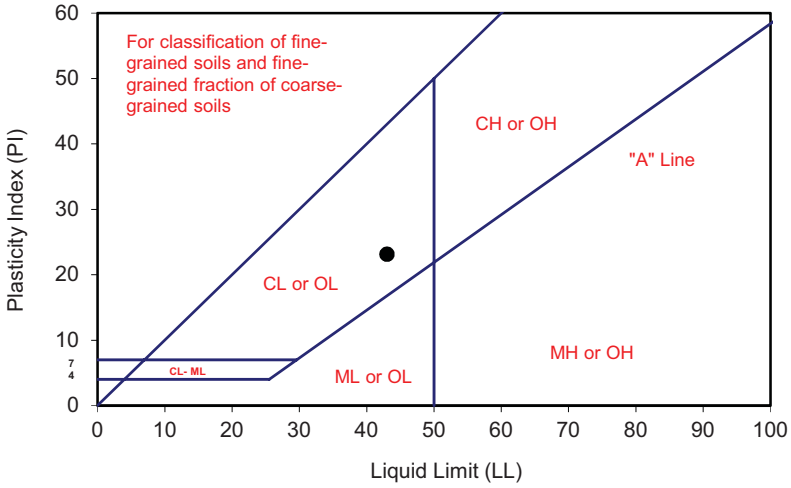
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	26	15	
Wet Wt. of Soil + Cont. (g)	18.02	17.92	24.37	22.98	27.31	
Dry Wt. of Soil + Cont. (g)	16.86	16.79	21.21	20.16	23.03	
Wt. of Container (g)	11.05	11.08	13.51	13.56	13.63	
Moisture Content (%) [Wn]	19.97	19.79	41.04	42.73	45.53	

Liquid Limit	**43**
Plastic Limit	**20**
Plasticity Index	**23**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 16.79

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



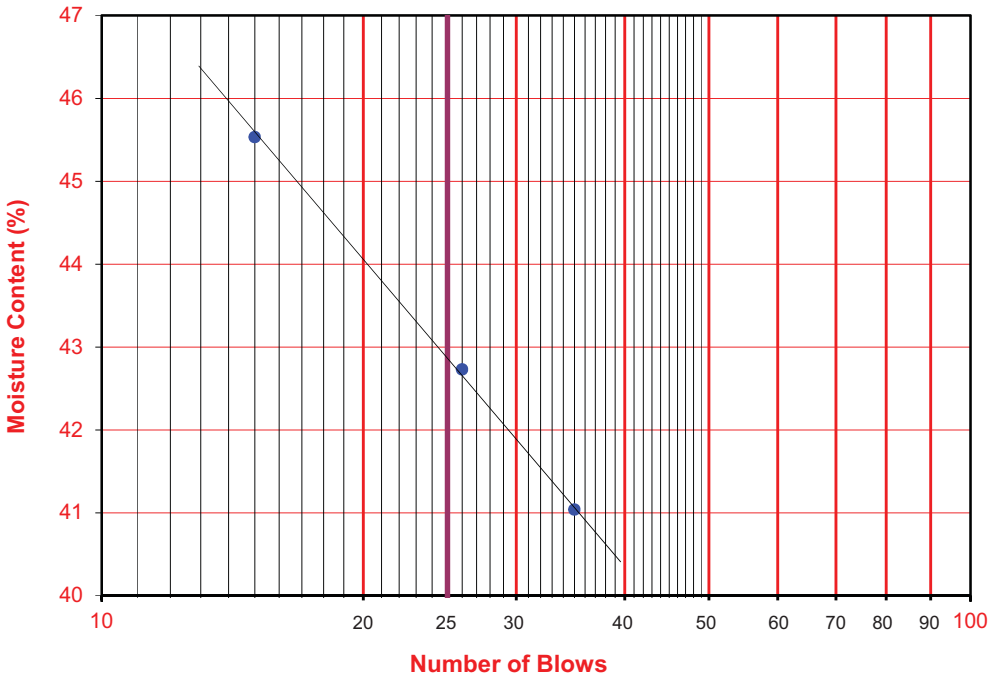
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	San Fernando Completion	Tested By:	R. Manning	Date:	07/09/18
Project No. :	11957.004	Input By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-3	Checked By:	J. Ward		
Sample No.:	R-4	Depth (ft.)	12.5		
Soil Identification:	Light brown lean clay (CL)				

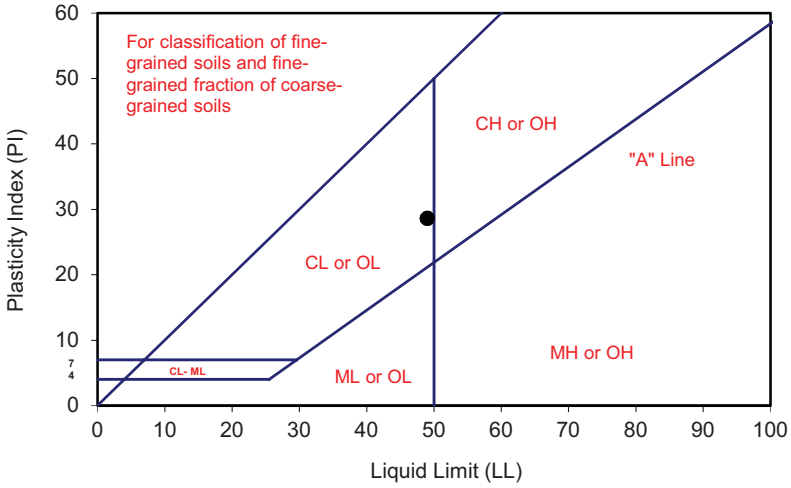
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	26	18	
Wet Wt. of Soil + Cont. (g)	18.42	18.88	24.59	26.46	24.85	
Dry Wt. of Soil + Cont. (g)	17.19	17.54	21.10	22.27	21.07	
Wt. of Container (g)	11.08	11.05	13.70	13.59	13.55	
Moisture Content (%) [Wn]	20.13	20.65	47.16	48.27	50.27	

Liquid Limit	**49**
Plastic Limit	**20**
Plasticity Index	**29**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 21.17

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



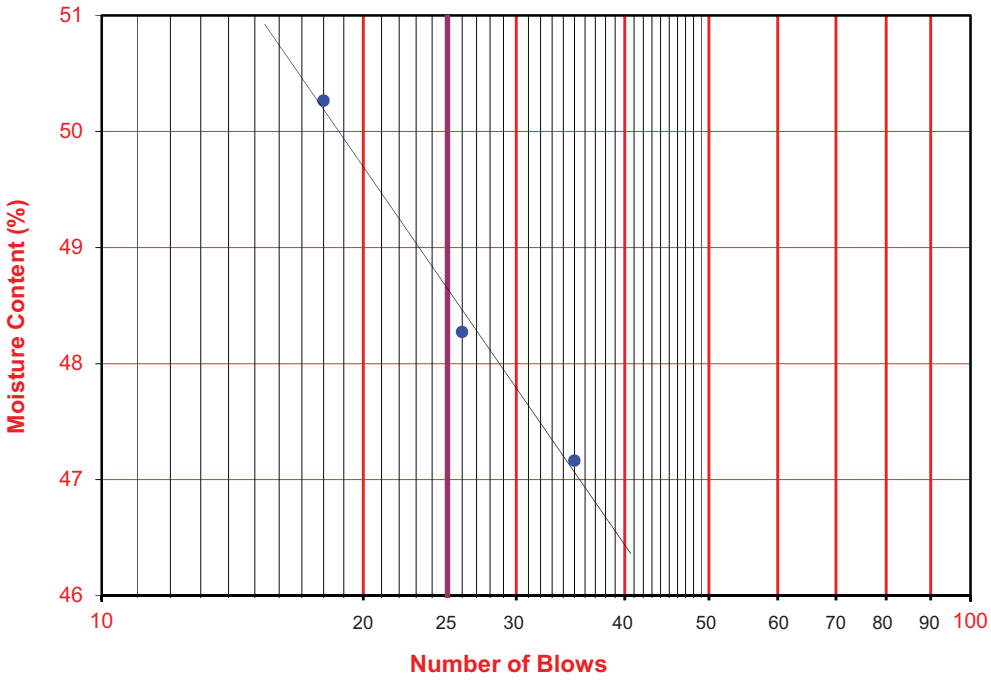
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	San Fernando Completion	Tested By:	R. Manning	Date:	07/10/18
Project No. :	11957.004	Input By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-4	Checked By:	J. Ward		
Sample No.:	R-2	Depth (ft.)	7.5		
Soil Identification:	Dark brown fat clay (CH)				

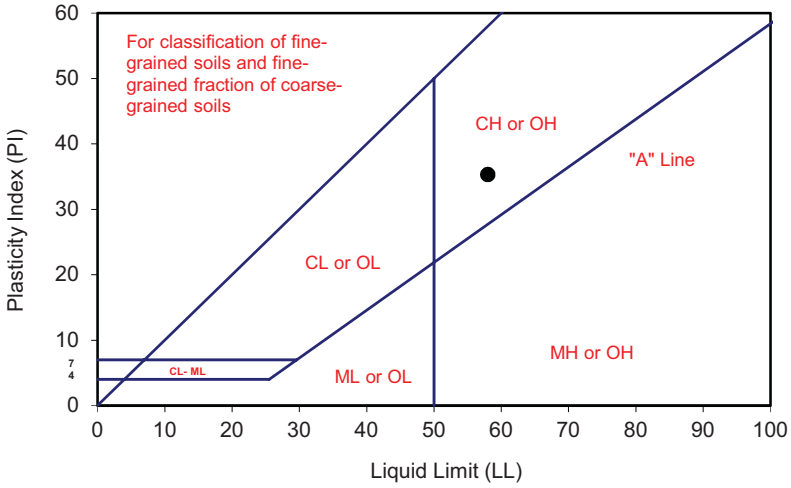
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	25	17	
Wet Wt. of Soil + Cont. (g)	18.44	17.85	22.68	23.88	24.43	
Dry Wt. of Soil + Cont. (g)	17.20	16.67	19.42	20.09	20.34	
Wt. of Container (g)	11.75	11.46	13.51	13.55	13.56	
Moisture Content (%) [Wn]	22.75	22.65	55.16	57.95	60.32	

Liquid Limit	**58**
Plastic Limit	**23**
Plasticity Index	**35**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 27.74

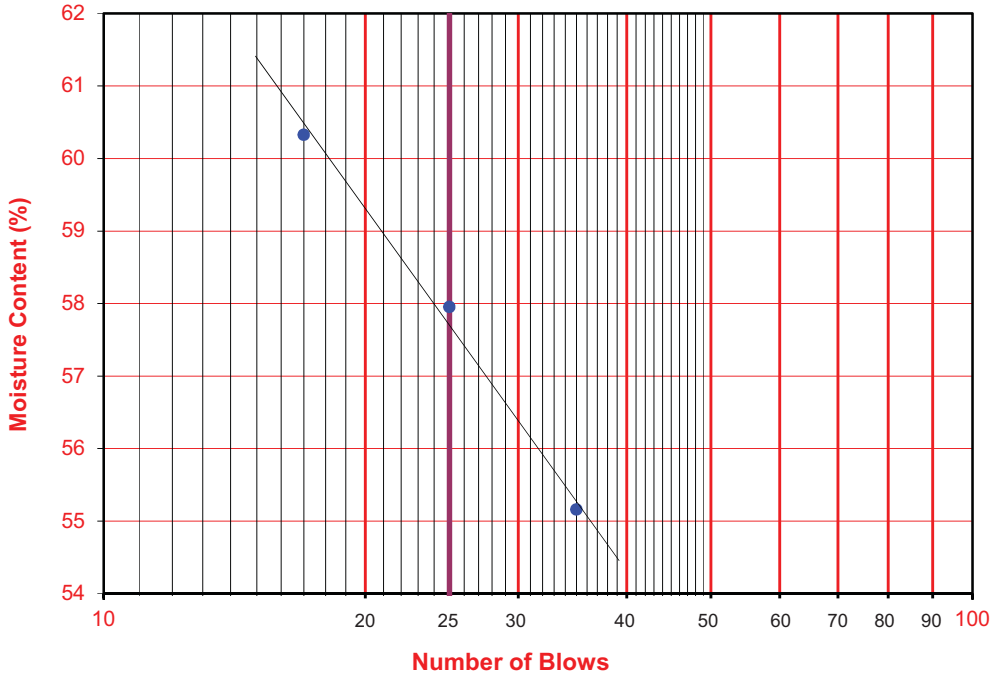
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

	Wet Preparation
	Multipoint - Wet
X	Dry Preparation
	Multipoint - Dry
X	Procedure A
	Multipoint Test
	Procedure B
	One-point Test



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ATTERBERG LIMITS

ASTM D 4318

Project Name:	San Fernando Completion	Tested By:	R. Manning	Date:	07/09/18
Project No. :	11957.004	Input By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-5	Checked By:	J. Ward		
Sample No.:	R-3	Depth (ft.)	10.0		
Soil Identification:	Yellowish brown fat clay with sand (CH)s				

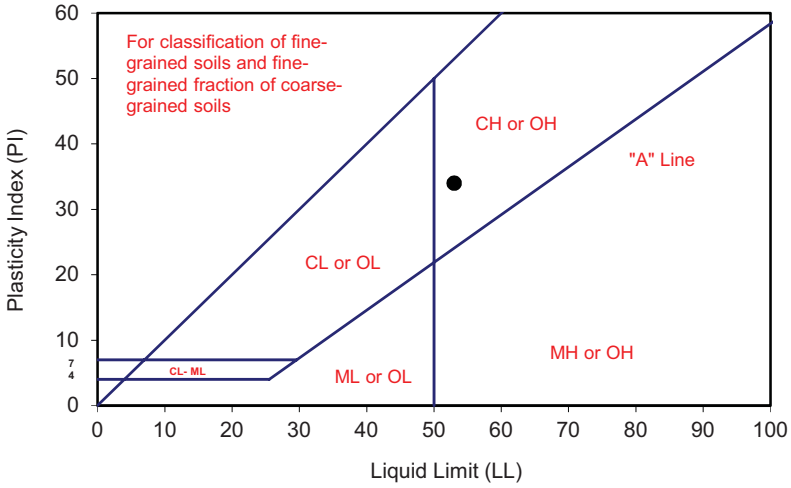
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	25	19	
Wet Wt. of Soil + Cont. (g)	17.75	17.32	25.02	26.64	25.57	
Dry Wt. of Soil + Cont. (g)	16.70	16.34	21.21	22.15	21.39	
Wt. of Container (g)	11.12	11.23	13.69	13.65	13.69	
Moisture Content (%) [Wn]	18.82	19.18	50.66	52.82	54.29	

Liquid Limit	**53**
Plastic Limit	**19**
Plasticity Index	**34**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 24.09

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



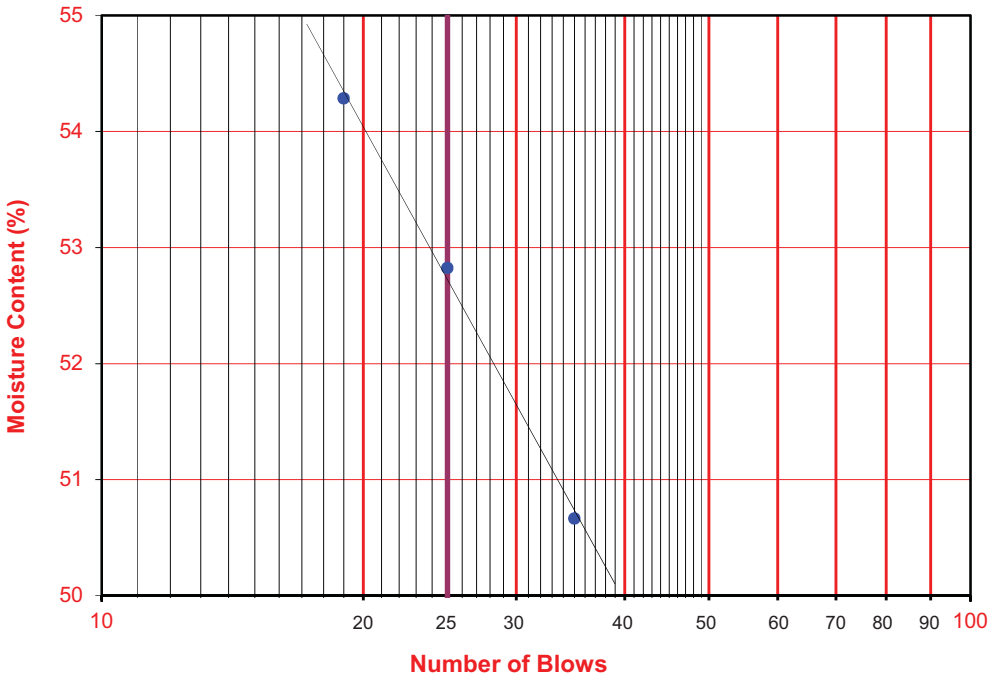
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



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ATTERBERG LIMITS

ASTM D 4318

Project Name:	San Fernando Completion	Tested By:	R. Manning	Date:	07/10/18
Project No. :	11957.004	Input By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-6	Checked By:	J. Ward		
Sample No.:	R-5	Depth (ft.)	15.0		
Soil Identification:	Pale brown lean clay (CL)				

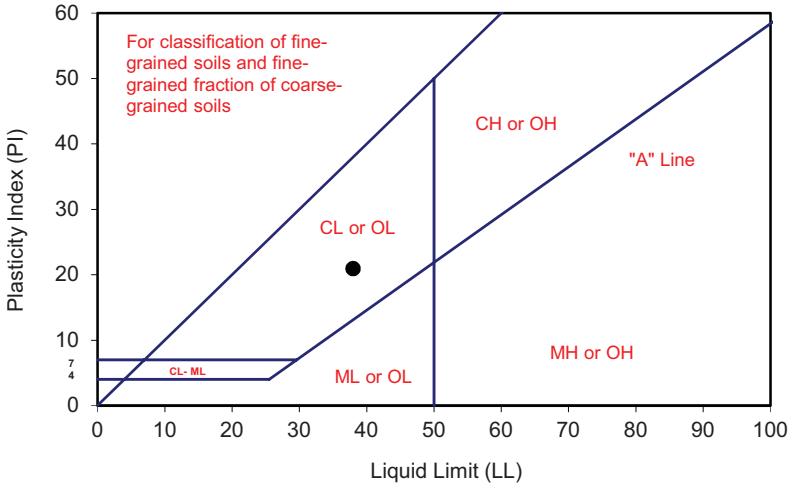
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			32	26	16	
Wet Wt. of Soil + Cont. (g)	18.50	17.91	26.18	26.82	26.78	
Dry Wt. of Soil + Cont. (g)	17.44	16.92	22.79	23.16	23.02	
Wt. of Container (g)	11.21	11.12	13.54	13.58	13.73	
Moisture Content (%) [Wn]	17.01	17.07	36.65	38.20	40.47	

Liquid Limit	**38**
Plastic Limit	**17**
Plasticity Index	**21**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 13.14

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



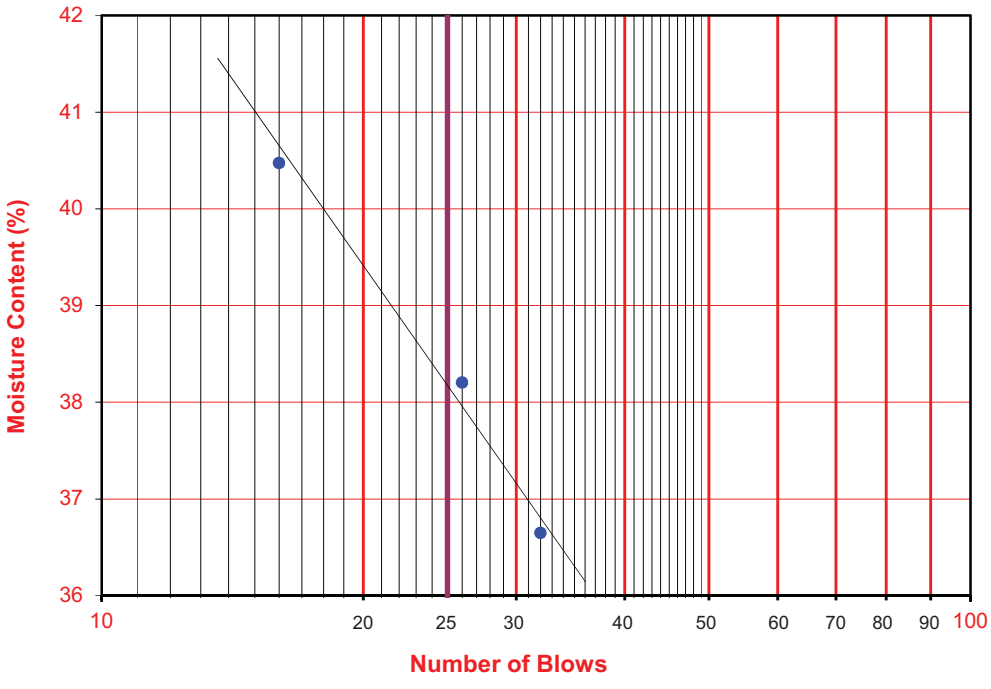
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



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ATTERBERG LIMITS

ASTM D 4318

Project Name:	San Fernando Completion	Tested By:	R. Manning	Date:	07/10/18
Project No. :	11957.004	Input By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-7	Checked By:	J. Ward		
Sample No.:	R-4	Depth (ft.)	12.5		
Soil Identification:	Yellowish brown sandy silty clay s(CL-ML)				

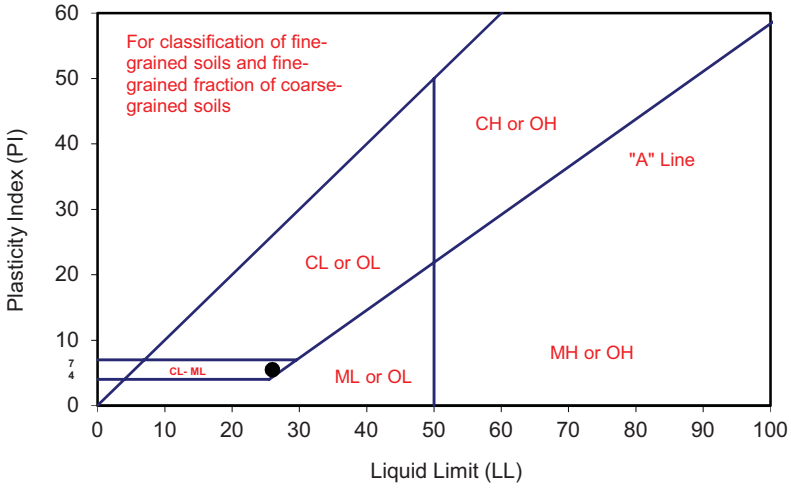
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			30	21	15	
Wet Wt. of Soil + Cont. (g)	19.70	20.44	30.68	25.17	27.53	
Dry Wt. of Soil + Cont. (g)	18.23	18.85	27.19	22.34	24.49	
Wt. of Container (g)	11.05	11.11	13.61	11.73	13.52	
Moisture Content (%) [Wn]	20.47	20.54	25.70	26.67	27.71	

Liquid Limit	**26**
Plastic Limit	**21**
Plasticity Index	**5**
Classification	**CL-ML**

PI at "A" - Line = 0.73(LL-20) 4.38

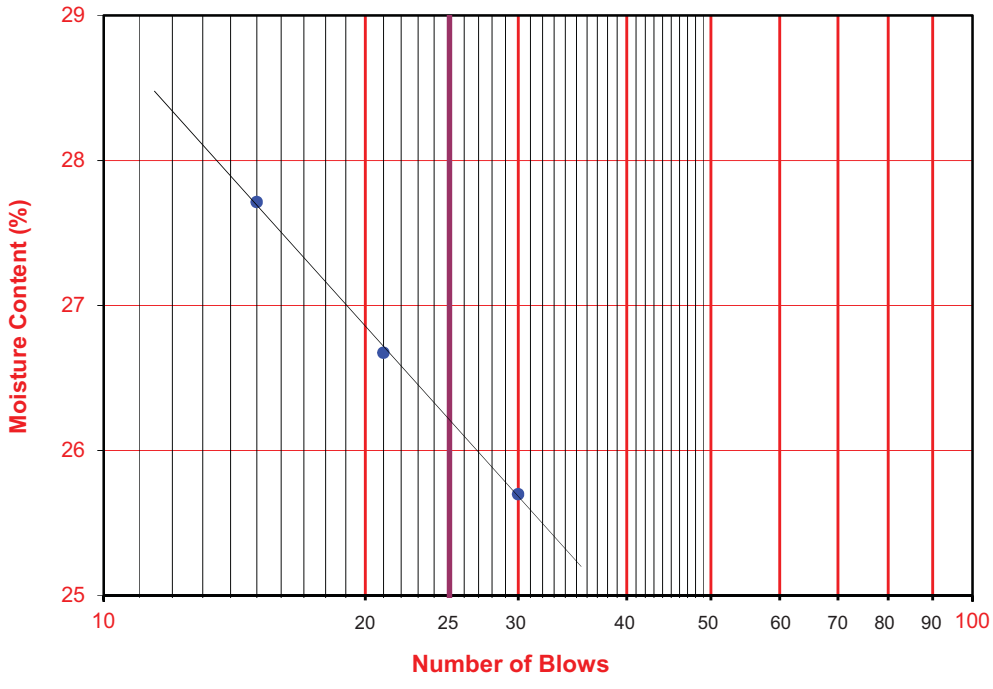
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



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ATTERBERG LIMITS

ASTM D 4318

Project Name:	San Fernando Completion	Tested By:	R. Manning	Date:	07/10/18
Project No. :	11957.004	Input By:	J. Ward	Date:	07/24/18
Boring No.:	HSA-10	Checked By:	J. Ward		
Sample No.:	R-4	Depth (ft.)	12.5		
Soil Identification:	Dark yellowish brown lean clay (CL)				

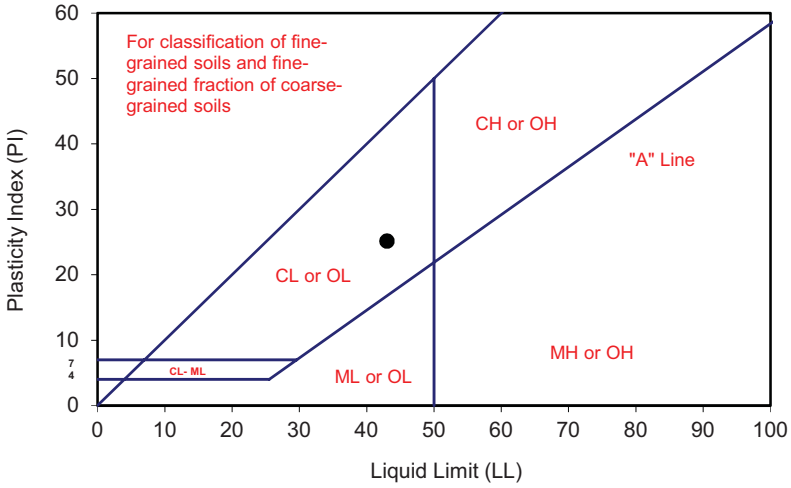
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			28	21	16	
Wet Wt. of Soil + Cont. (g)	18.40	17.80	24.68	24.55	25.49	
Dry Wt. of Soil + Cont. (g)	17.31	16.78	21.44	21.24	21.85	
Wt. of Container (g)	11.23	11.04	13.75	13.59	13.61	
Moisture Content (%) [Wn]	17.93	17.77	42.13	43.27	44.17	

Liquid Limit	**43**
Plastic Limit	**18**
Plasticity Index	**25**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 16.79

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



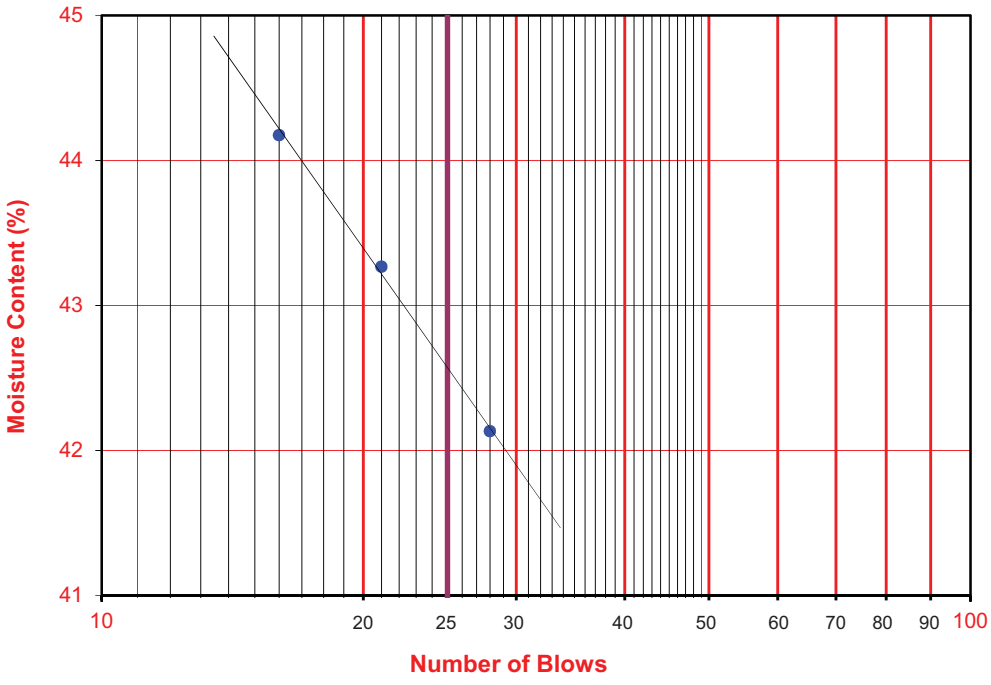
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	San Fernando Completion	Tested By:	R. Manning	Date:	07/01/18
Project No. :	11957.004	Input By:	J. Ward	Date:	07/23/18
Boring No.:	MR-1	Checked By:	J. Ward		
Sample No.:	S-8	Depth (ft.)	20.0		
Soil Identification:	Olive brown lean clay with sand (CL)s				

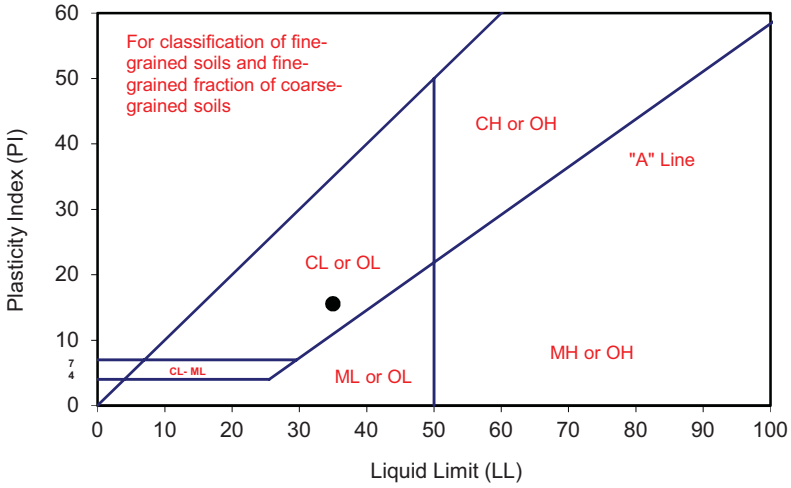
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	23	15	
Wet Wt. of Soil + Cont. (g)	18.22	18.97	25.73	26.99	24.54	
Dry Wt. of Soil + Cont. (g)	17.06	17.68	22.85	23.39	21.35	
Wt. of Container (g)	11.05	11.08	13.77	13.55	13.52	
Moisture Content (%) [Wn]	19.30	19.55	31.72	36.59	40.74	

Liquid Limit	**35**
Plastic Limit	**19**
Plasticity Index	**16**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 10.95

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



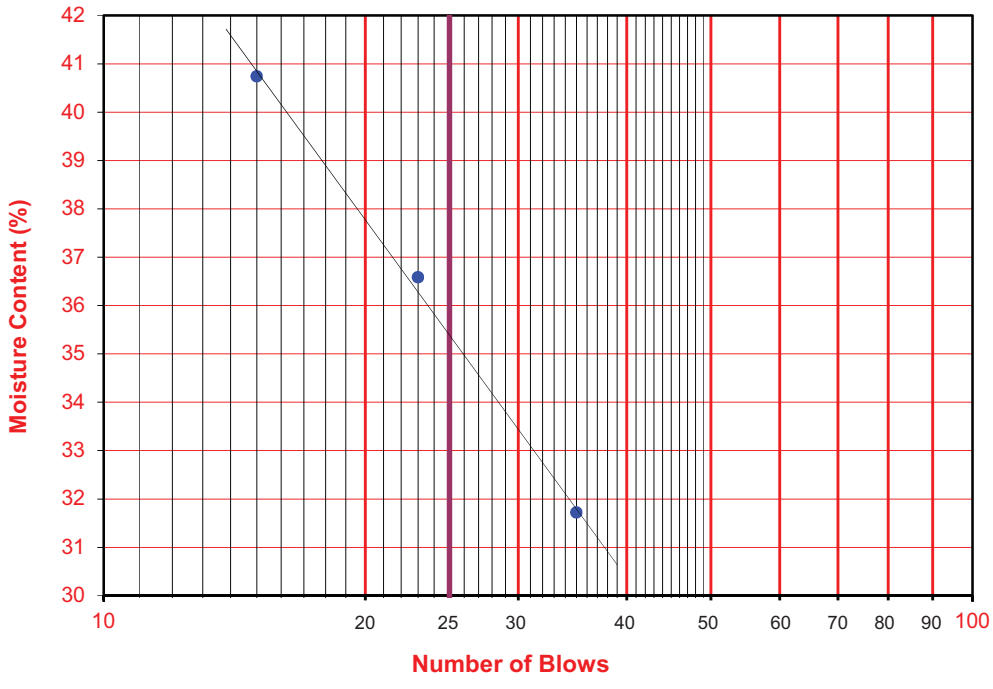
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	San Fernando Completion	Tested By:	R. Manning	Date:	06/29/18
Project No. :	11957.004	Input By:	J. Ward	Date:	07/23/18
Boring No.:	MR-1	Checked By:	J. Ward		
Sample No.:	S-10	Depth (ft.)	25.0		
Soil Identification:	Olive lean clay with sand (CL)s				

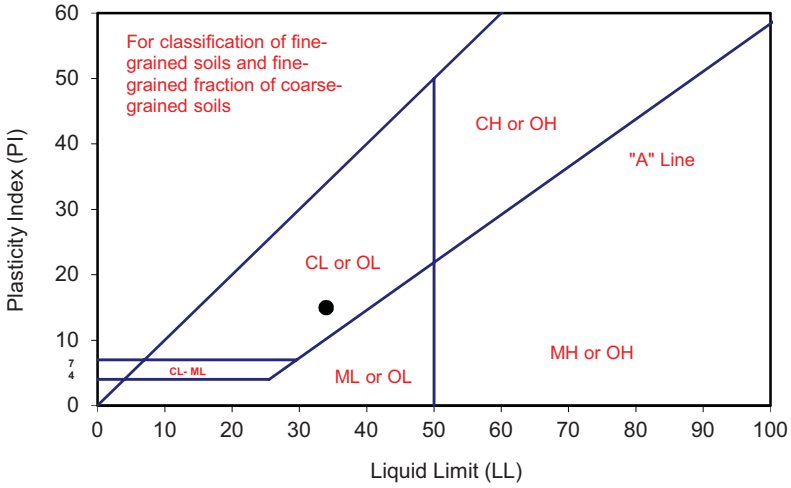
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	22	15	
Wet Wt. of Soil + Cont. (g)	18.01	18.57	25.10	23.93	24.57	
Dry Wt. of Soil + Cont. (g)	16.91	17.47	22.27	21.29	21.69	
Wt. of Container (g)	11.12	11.71	13.49	13.56	13.73	
Moisture Content (%) [Wn]	19.00	19.10	32.23	34.15	36.18	

Liquid Limit	**34**
Plastic Limit	**19**
Plasticity Index	**15**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 10.22

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



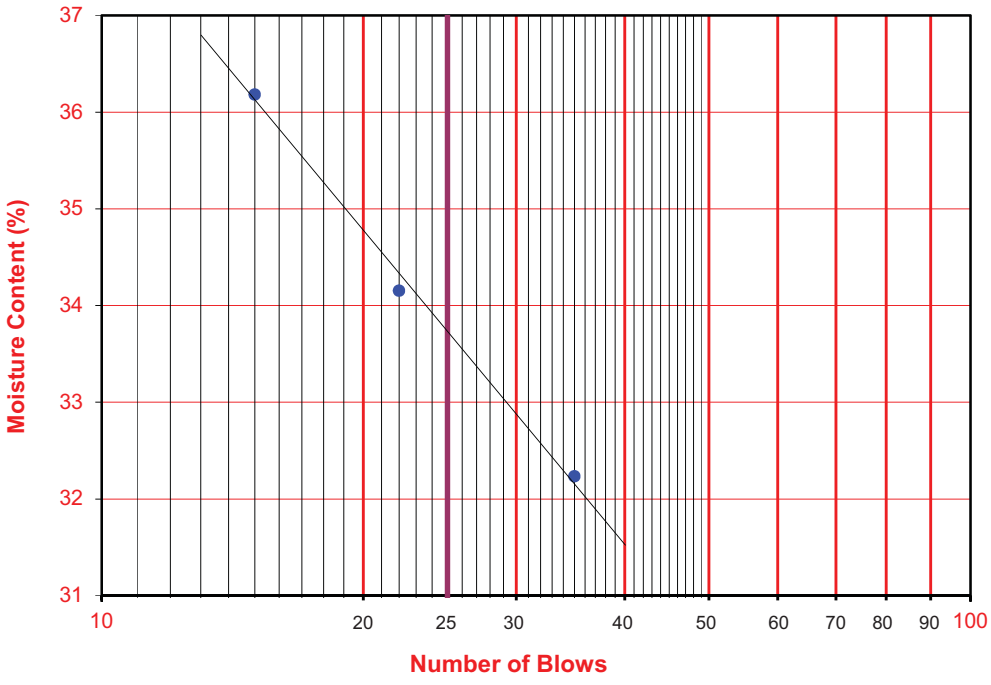
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	San Fernando Completion	Tested By:	R. Manning	Date:	06/29/18
Project No. :	11957.004	Input By:	J. Ward	Date:	07/23/18
Boring No.:	MR-1	Checked By:	J. Ward		
Sample No.:	S-12	Depth (ft.)	30.0		
Soil Identification:	Olive lean clay with sand (CL)s				

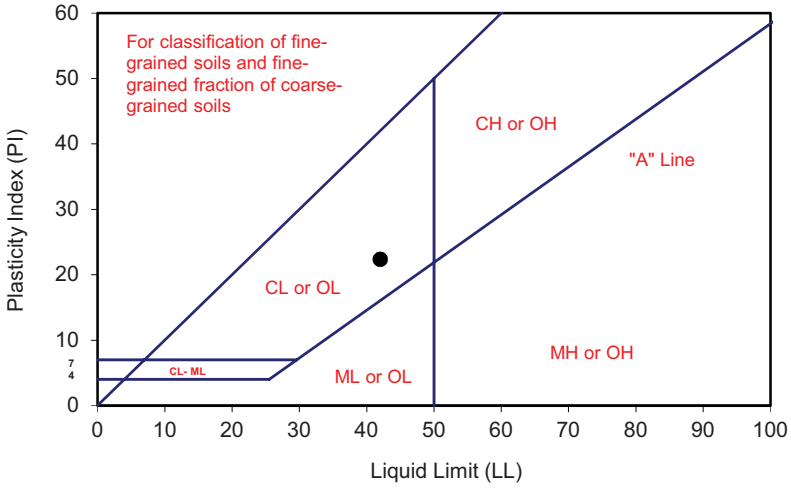
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			33	26	20	
Wet Wt. of Soil + Cont. (g)	17.95	17.94	24.48	27.05	26.65	
Dry Wt. of Soil + Cont. (g)	16.84	16.82	21.41	23.09	22.58	
Wt. of Container (g)	11.23	11.08	13.55	13.60	13.50	
Moisture Content (%) [Wn]	19.79	19.51	39.06	41.73	44.82	

Liquid Limit	**42**
Plastic Limit	**20**
Plasticity Index	**22**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 16.06

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



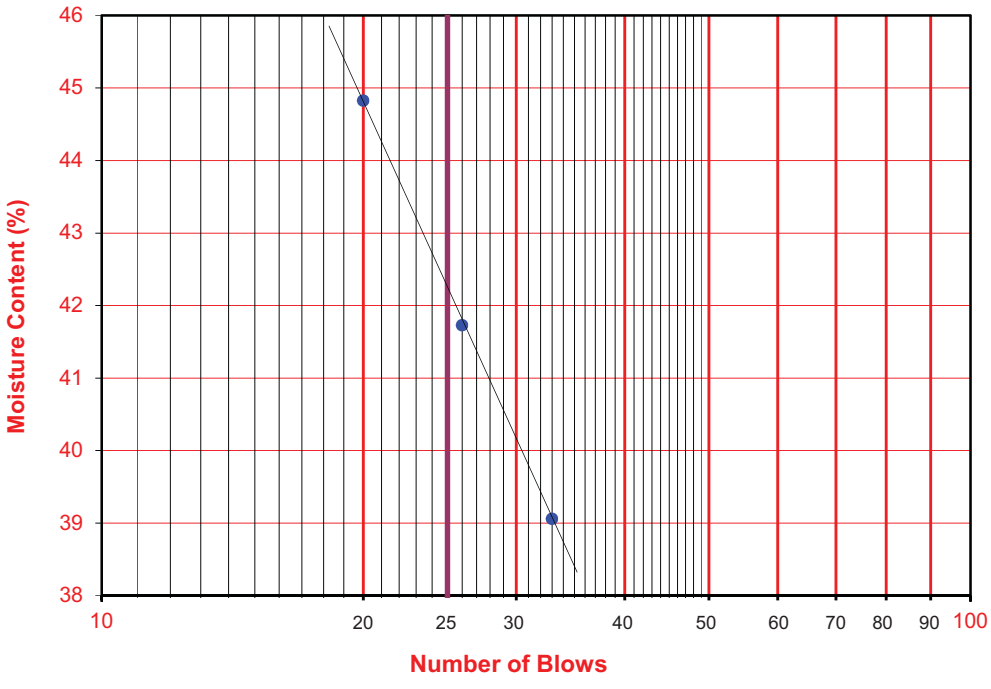
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	San Fernando Completion	Tested By:	R. Manning	Date:	06/30/18
Project No. :	11957.004	Input By:	J. Ward	Date:	07/23/18
Boring No.:	MR-1	Checked By:	J. Ward		
Sample No.:	S-13	Depth (ft.)	32.5		
Soil Identification:	Olive brown sandy fat clay s(CH)				

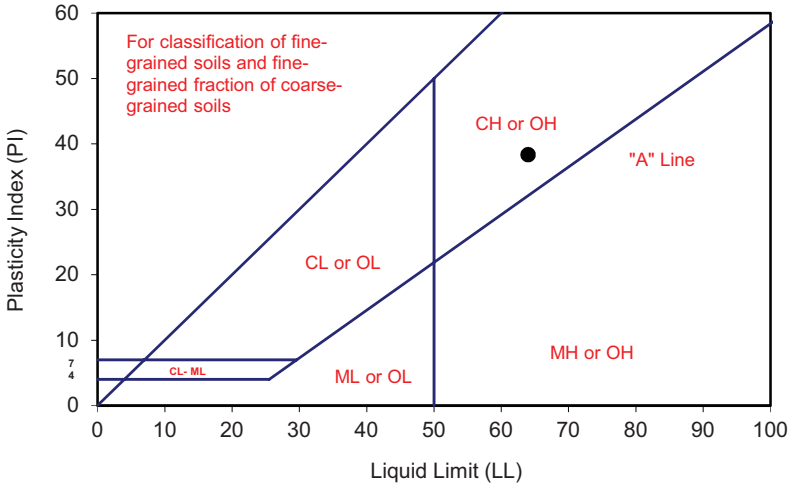
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	26	15	
Wet Wt. of Soil + Cont. (g)	18.46	18.28	23.45	24.48	22.68	
Dry Wt. of Soil + Cont. (g)	17.08	16.82	19.78	20.22	18.92	
Wt. of Container (g)	11.71	11.12	13.68	13.59	13.60	
Moisture Content (%) [Wn]	25.70	25.61	60.16	64.25	70.68	

Liquid Limit	**64**
Plastic Limit	**26**
Plasticity Index	**38**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 32.12

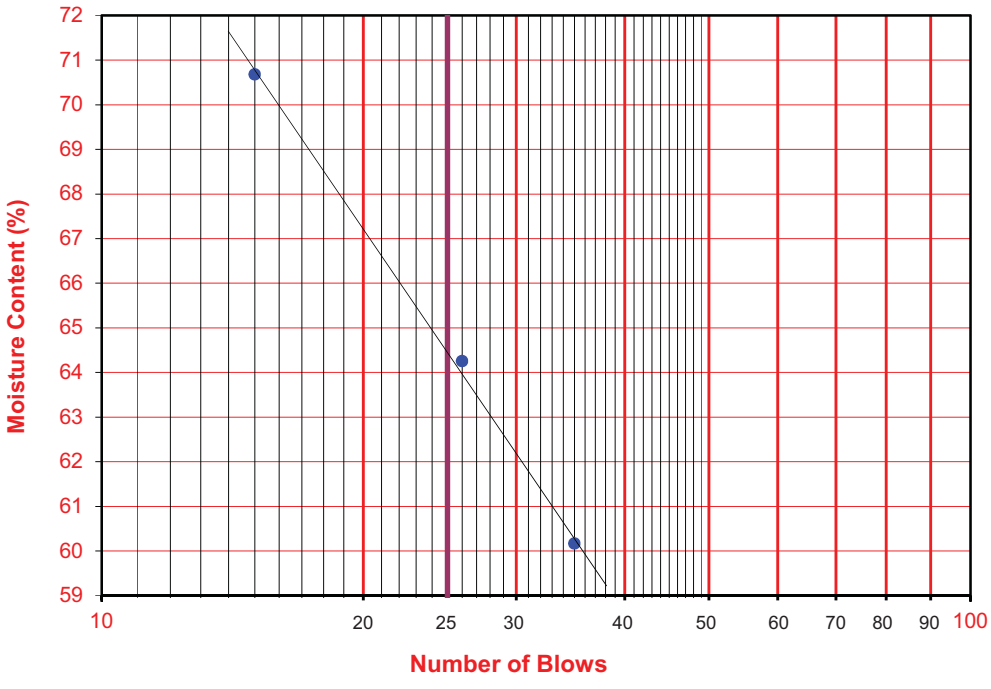
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



Leighton

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D 6913

Project Name: San Fernando Completion
Project No.: 11957.004
Boring No.: MR-1
Sample No.: S-14
Soil Identification: Olive silty sand (SM)

Tested By: A. Santos Date: 06/27/18
Checked By: J. Ward Date: 07/23/18
Depth (feet): 35.0

		Moisture Content of Total Air - Dry Soil	
Container No.:	PH	Wt. of Air-Dry Soil + Cont. (g)	0.0
Wt. of Air-Dried Soil + Cont.(g)	485.2	Wt. of Dry Soil + Cont. (g)	0.0
Wt. of Container (g)	202.6	Wt. of Container No._____ (g)	1.0
Dry Wt. of Soil (g)	282.6	Moisture Content (%)	0.0

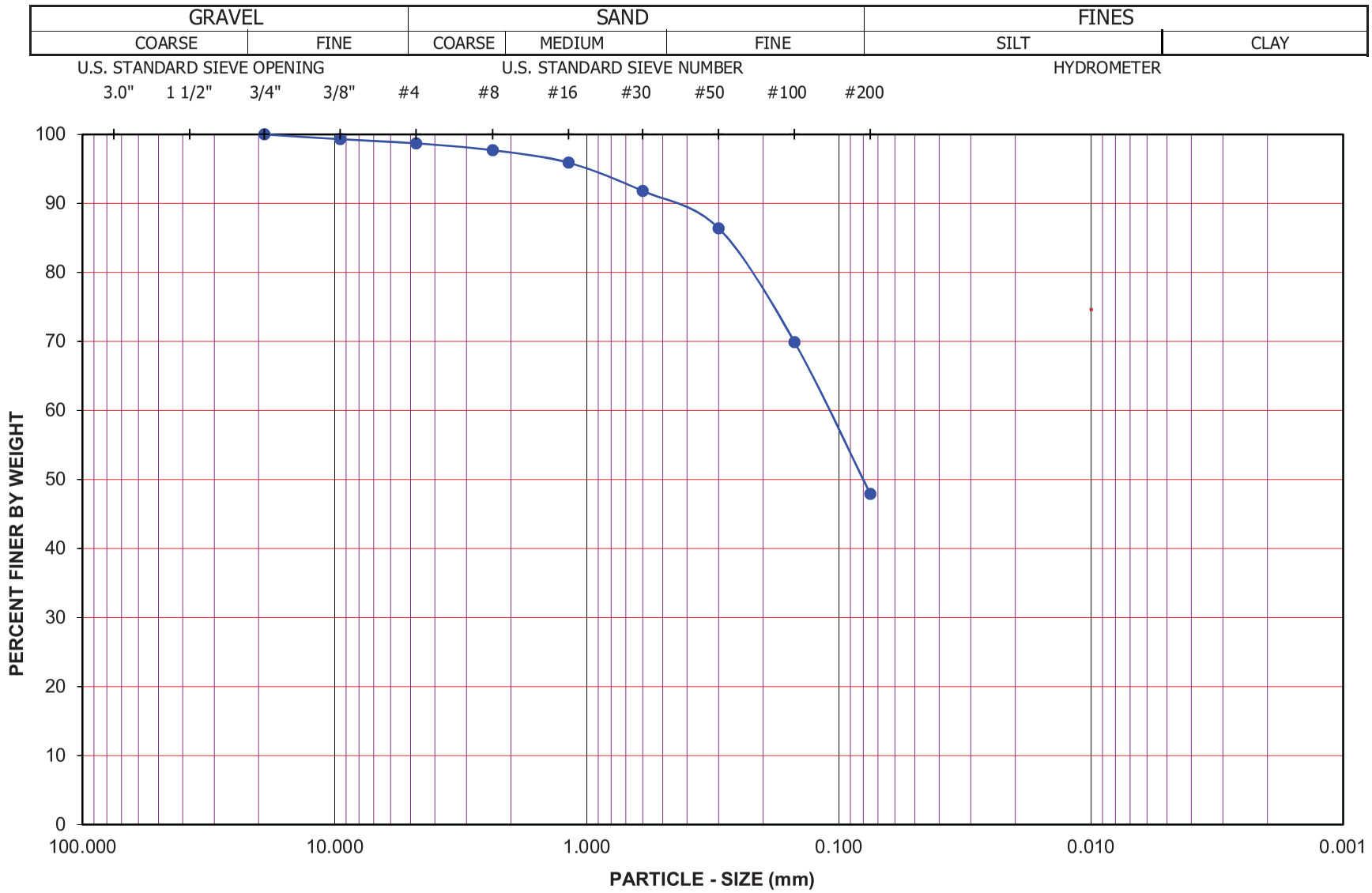
After Wet Sieve	Container No.	PH
	Wt. of Dry Soil + Container (g)	352.6
	Wt. of Container (g)	202.6
	Dry Wt. of Soil Retained on # 200 Sieve (g)	150.0

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
3"	75.0		
1 1/2"	37.5		
3/4"	19.0	0.0	100.0
3/8"	9.5	2.1	99.3
#4	4.75	3.8	98.7
#8	2.36	6.4	97.7
#16	1.18	11.5	95.9
#30	0.600	23.2	91.8
#50	0.300	38.3	86.4
#100	0.150	85.0	69.9
#200	0.075	147.1	47.9
PAN			

GRAVEL: **1 %**
SAND: **51 %**
FINES: **48 %**
GROUP SYMBOL: **SM**

Cu = D60/D10 = _____
Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: San Fernando Completion

Project No.: 11957.004

Boring No.: MR-1 Sample No.: S-14

Depth (feet): 35.0 Soil Type : SM

Soil Identification: Olive silty sand (SM)

GR:SA:FI : (%) 1 : 51 : 48

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

Jul-18

Leighton

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS

ASTM D 6913

Project Name: San Fernando Completion
Project No.: 11957.004
Boring No.: MR-1
Sample No.: S-16
Soil Identification: Olive brown sandy lean clay s(CL)

Tested By: A. Santos Date: 06/27/18
Checked By: J. Ward Date: 07/23/18
Depth (feet): 45.0

		Moisture Content of Total Air - Dry Soil	
Container No.:	PHD	Wt. of Air-Dry Soil + Cont. (g)	0.0
Wt. of Air-Dried Soil + Cont.(g)	562.8	Wt. of Dry Soil + Cont. (g)	0.0
Wt. of Container (g)	215.0	Wt. of Container No._____ (g)	1.0
Dry Wt. of Soil (g)	347.8	Moisture Content (%)	0.0

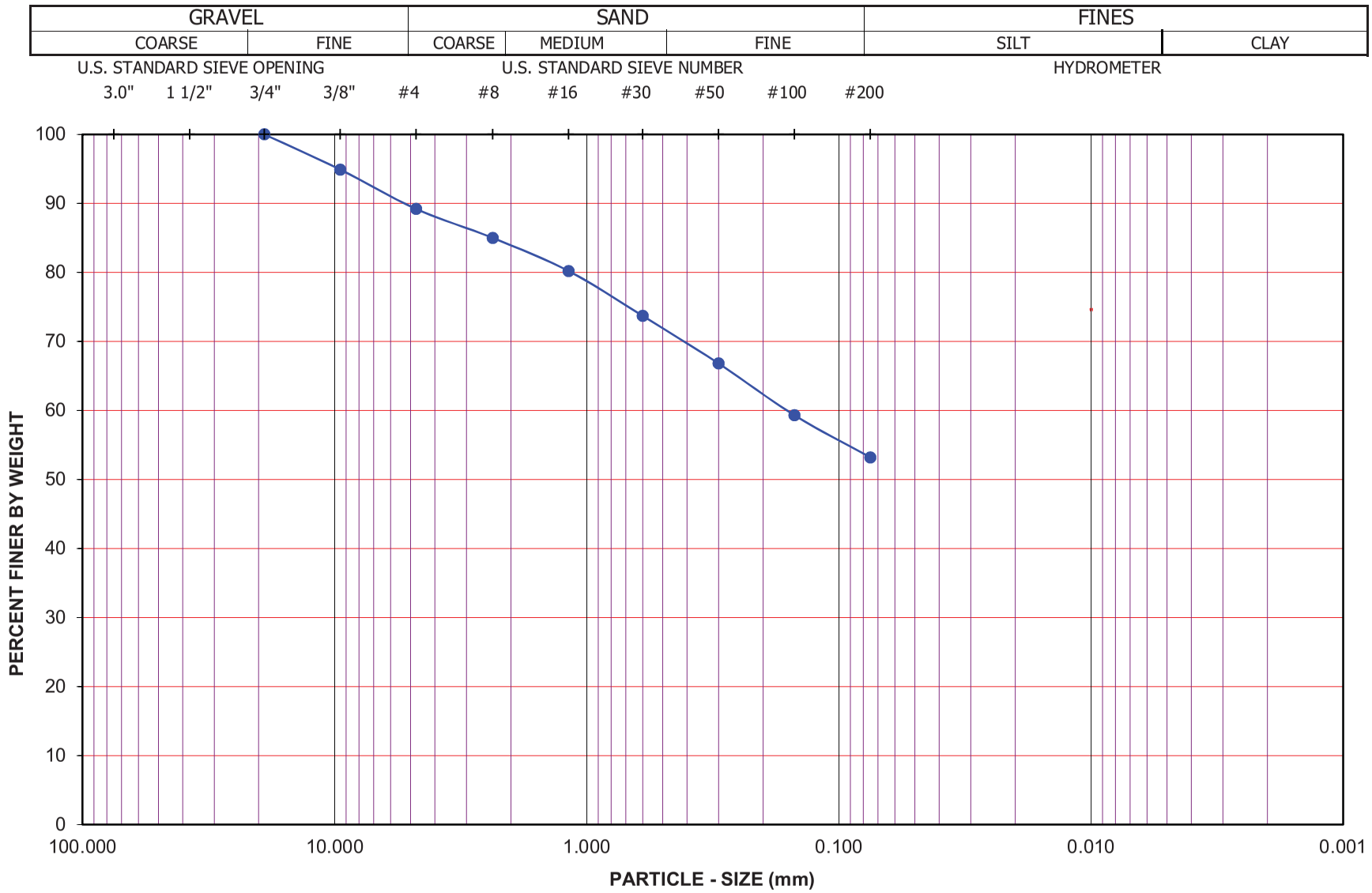
After Wet Sieve	Container No.	PHD
	Wt. of Dry Soil + Container (g)	380.0
	Wt. of Container (g)	215.0
	Dry Wt. of Soil Retained on # 200 Sieve (g)	165.0

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
3"	75.0		
1 1/2"	37.5		
3/4"	19.0	0.0	100.0
3/8"	9.5	17.8	94.9
#4	4.75	37.4	89.2
#8	2.36	52.1	85.0
#16	1.18	68.7	80.2
#30	0.600	91.6	73.7
#50	0.300	115.6	66.8
#100	0.150	141.5	59.3
#200	0.075	162.8	53.2
PAN			

GRAVEL: **11 %**
SAND: **36 %**
FINES: **53 %**
GROUP SYMBOL: **s(CL)**

Cu = D60/D10 = _____
Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: San Fernando Completion

Project No.: 11957.004

Boring No.: MR-1 Sample No.: S-16

Depth (feet): 45.0 Soil Type : s(CL)

Soil Identification: Olive brown sandy lean clay s(CL)

GR:SA:FI : (%) 11 : 36 : 53

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

Jul-18

Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	San Fernando Completion	Tested by:	A. Santos	Date:	07/11/18
Project No:	11957.004	Checked by:	J. Ward	Date:	07/23/18
Boring No.:	HSA-1	Sample Type:	Ring		
Sample No.:	R-4	Depth(ft):	12.5		
Sample Description:	Brown lean clay (CL)				

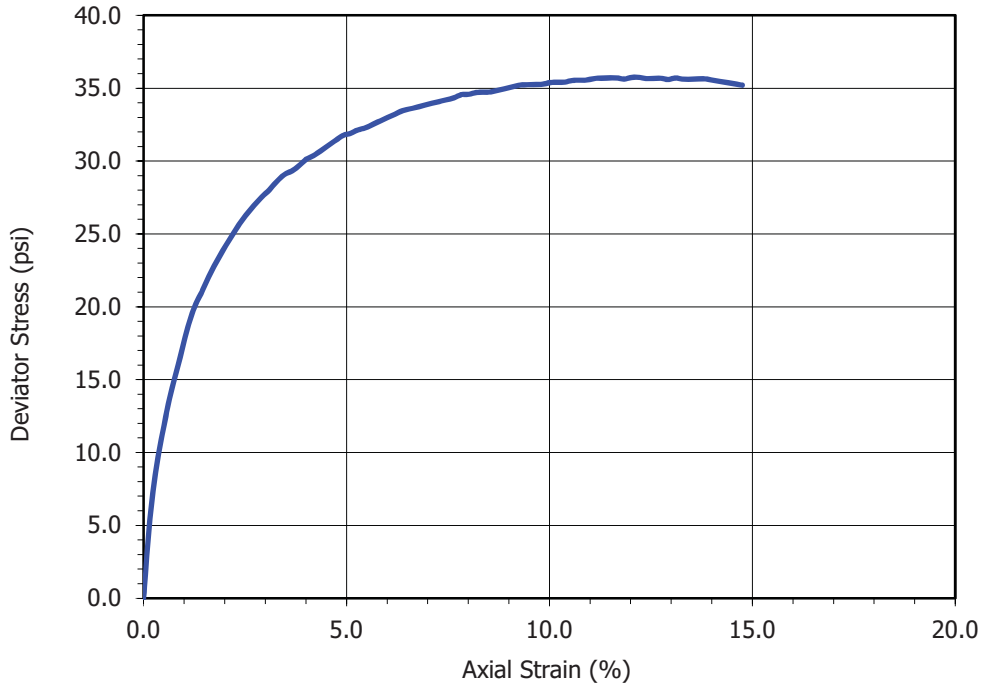
Diameter (in)	1	2.413
	2	2.413
	3	2.413
	Average	2.413
Height (in)	1	5.490
	2	5.491
	3	5.493
	Average	5.491
Weight of Sample + Tube / Rings (g)		789.1
Weight of Tube / Rings (g)		0.0
Weight of Wet Sample + Container (g)		865.5
Weight of Dry Sample + Container (g)		706.0
Weight of Container (g)		77.2
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		6.95
Rate of Deformation (in/min)		0.060

Sample Properties	
Moisture Content (%)	25.37
Dry Density (pcf)	95.5
Void Ratio	0.764
% Saturation	89.6

At Failure*	
Deviator stress (psi)	**35.75**
Minor principal total stress (psi)	**6.95**
Major principal total stress (psi)	**42.70**
Axial strain (%)	**12.20**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	San Fernando Completion	Tested by:	A. Santos	Date:	07/11/18
Project No:	11957.004	Checked by:	J. Ward	Date:	07/23/18
Boring No.:	HSA-3	Sample Type:	Ring		
Sample No.:	R-3	Depth(ft):	10.0		
Sample Description:	Dark brown lean clay (CL)				

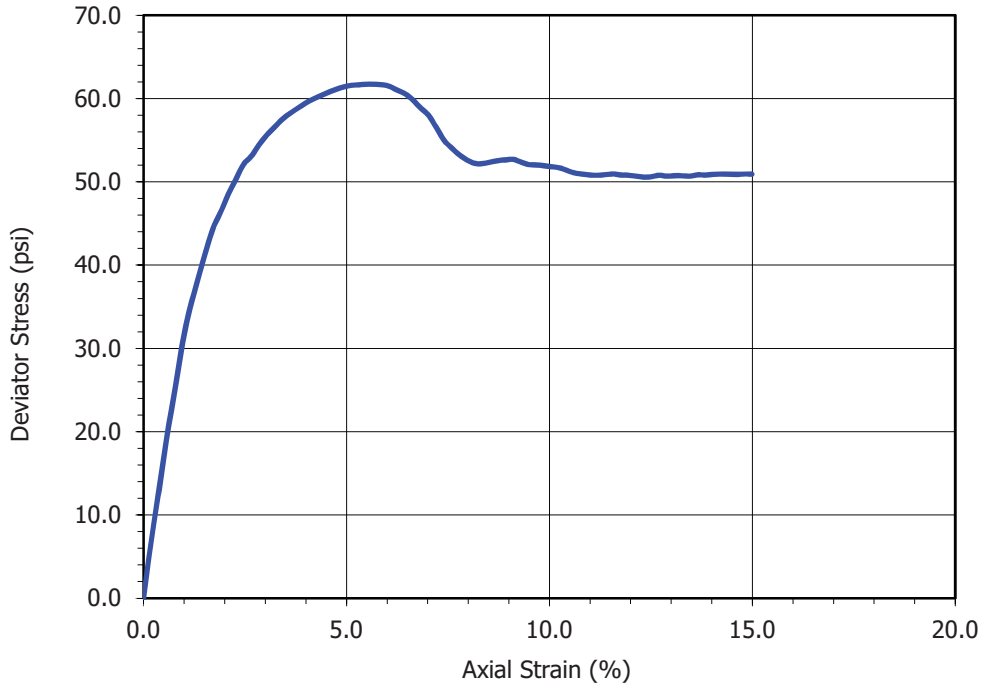
Diameter (in)	1	2.410
	2	2.410
	3	2.411
	Average	2.410
Height (in)	1	5.271
	2	5.271
	3	5.272
	Average	5.271
Weight of Sample + Tube / Rings (g)		764.5
Weight of Tube / Rings (g)		0.0
Weight of Wet Sample + Container (g)		839.8
Weight of Dry Sample + Container (g)		715.9
Weight of Container (g)		75.9
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		6.95
Rate of Deformation (in/min)		0.060

Sample Properties	
Moisture Content (%)	19.36
Dry Density (pcf)	101.4
Void Ratio	0.661
% Saturation	79.1

At Failure*	
Deviator stress (psi)	**61.74**
Minor principal total stress (psi)	**6.95**
Major principal total stress (psi)	**68.69**
Axial strain (%)	**5.50**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	San Fernando Completion	Tested by:	A. Santos	Date:	07/12/18
Project No:	11957.004	Checked by:	J. Ward	Date:	07/23/18
Boring No.:	HSA-6	Sample Type:	Ring		
Sample No.:	R-6	Depth(ft):	20.0		
Sample Description:	Brown lean clay (CL)				

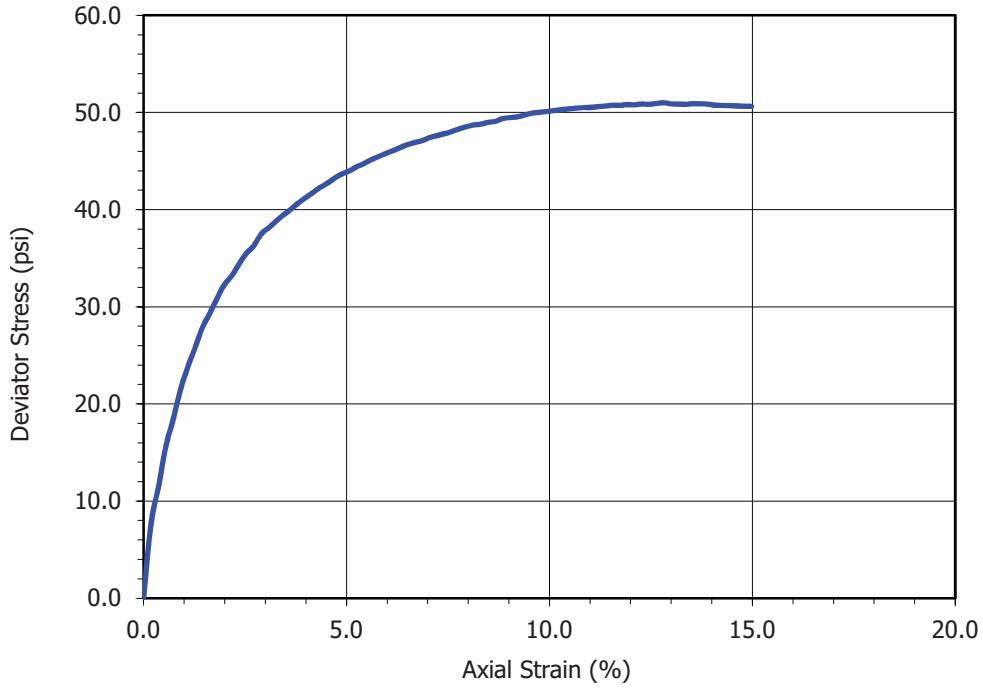
Diameter (in)	1	2.413
	2	2.413
	3	2.413
	Average	2.413
Height (in)	1	5.540
	2	5.540
	3	5.542
	Average	5.541
Weight of Sample + Tube / Rings (g)		810.1
Weight of Tube / Rings (g)		0.0
Weight of Wet Sample + Container (g)		884.2
Weight of Dry Sample + Container (g)		720.6
Weight of Container (g)		74.8
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		6.95
Rate of Deformation (in/min)		0.060

Sample Properties	
Moisture Content (%)	25.33
Dry Density (pcf)	97.2
Void Ratio	0.734
% Saturation	93.2

At Failure*	
Deviator stress (psi)	**51.00**
Minor principal total stress (psi)	**6.95**
Major principal total stress (psi)	**57.95**
Axial strain (%)	**12.81**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	San Fernando Completion	Tested by:	A. Santos	Date:	07/12/18
Project No:	11957.004	Checked by:	J. Ward	Date:	07/23/18
Boring No.:	HSA-7	Sample Type:	Ring		
Sample No.:	R-2	Depth(ft):	7.5		
Sample Description:	Dark olive silty sand (SM)				

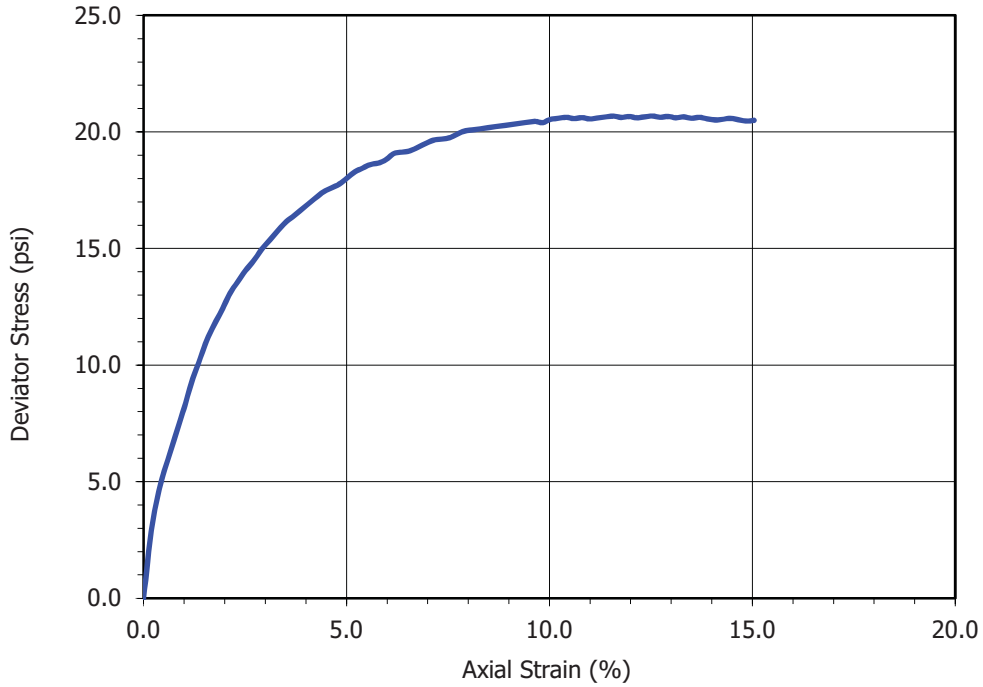
Diameter (in)	1	2.412
	2	2.412
	3	2.413
	Average	2.412
Height (in)	1	5.185
	2	5.185
	3	5.186
	Average	5.185
Weight of Sample + Tube / Rings (g)		702.2
Weight of Tube / Rings (g)		0.0
Weight of Wet Sample + Container (g)		776.7
Weight of Dry Sample + Container (g)		636.6
Weight of Container (g)		75.5
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		6.95
Rate of Deformation (in/min)		0.060

Sample Properties	
Moisture Content (%)	24.97
Dry Density (pcf)	90.3
Void Ratio	0.865
% Saturation	77.9

At Failure*	
Deviator stress (psi)	**20.68**
Minor principal total stress (psi)	**6.95**
Major principal total stress (psi)	**27.63**
Axial strain (%)	**12.54**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	San Fernando Completion	Tested by:	A. Santos	Date:	07/12/18
Project No:	11957.004	Checked by:	J. Ward	Date:	07/23/18
Boring No.:	HSA-9	Sample Type:	Ring		
Sample No.:	R-5	Depth(ft):	15.0		
Sample Description:	Brown lean clay (CL)				

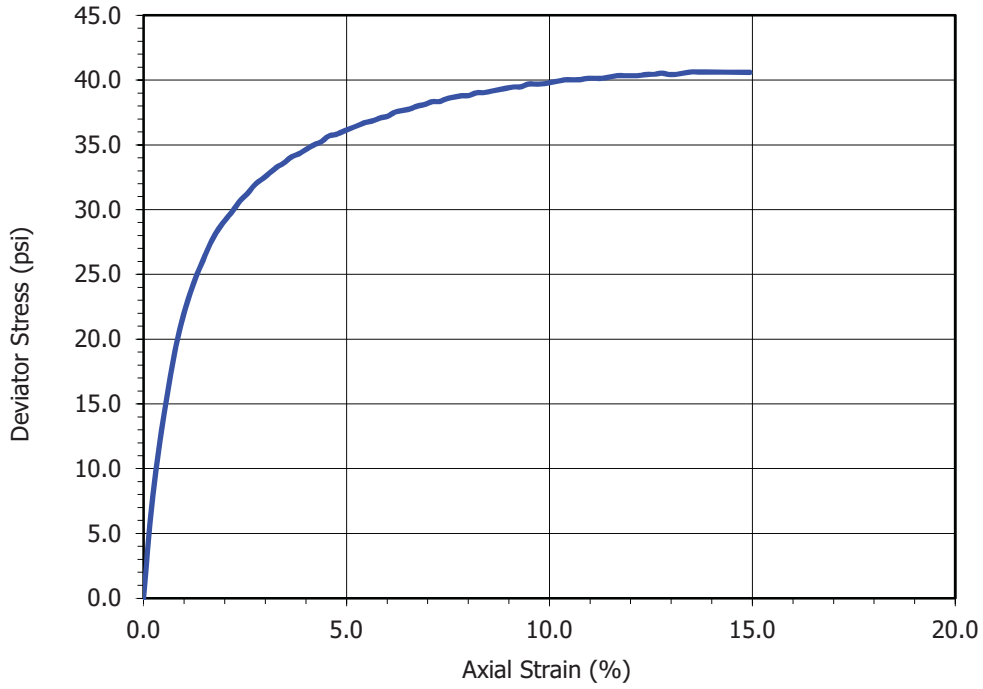
Diameter (in)	1	2.416
	2	2.416
	3	2.416
	Average	2.416
Height (in)	1	5.488
	2	5.488
	3	5.489
	Average	5.488
Weight of Sample + Tube / Rings (g)		825.2
Weight of Tube / Rings (g)		0.0
Weight of Wet Sample + Container (g)		901.5
Weight of Dry Sample + Container (g)		745.0
Weight of Container (g)		76.6
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		6.95
Rate of Deformation (in/min)		0.060

Sample Properties	
Moisture Content (%)	23.41
Dry Density (pcf)	101.2
Void Ratio	0.664
% Saturation	95.2

At Failure*	
Deviator stress (psi)	**40.63**
Minor principal total stress (psi)	**6.95**
Major principal total stress (psi)	**47.58**
Axial strain (%)	**13.48**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	San Fernando Completion	Tested by:	A. Santos	Date:	07/12/18
Project No:	11957.004	Checked by:	J. Ward	Date:	07/23/18
Boring No.:	HSA-11	Sample Type:	Ring		
Sample No.:	R-3	Depth(ft):	10.0		
Sample Description:	Dark brown lean clay (CL)				

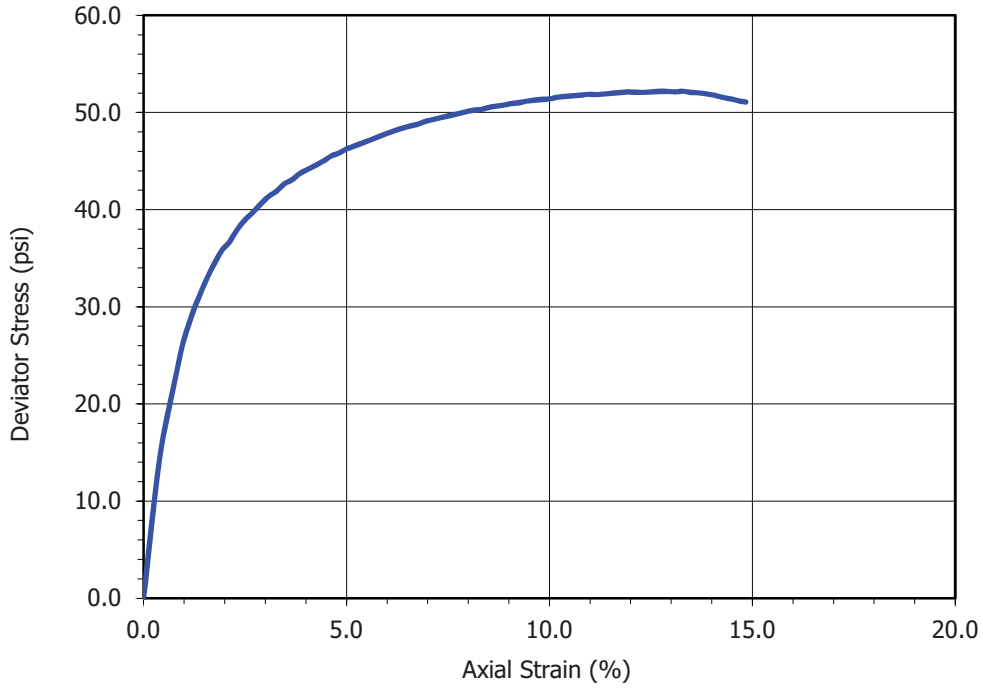
Diameter (in)	1	2.414
	2	2.413
	3	2.413
	Average	2.413
Height (in)	1	5.188
	2	5.189
	3	5.190
	Average	5.189
Weight of Sample + Tube / Rings (g)		785.6
Weight of Tube / Rings (g)		0.0
Weight of Wet Sample + Container (g)		861.6
Weight of Dry Sample + Container (g)		728.5
Weight of Container (g)		76.8
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		6.95
Rate of Deformation (in/min)		0.060

Sample Properties	
Moisture Content (%)	20.42
Dry Density (pcf)	104.7
Void Ratio	0.609
% Saturation	90.5

At Failure*	
Deviator stress (psi)	**52.19**
Minor principal total stress (psi)	**6.95**
Major principal total stress (psi)	**59.14**
Axial strain (%)	**12.72**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	San Fernando Completion	Tested by:	A. Santos	Date:	07/15/18
Project No:	11957.004	Checked by:	J. Ward	Date:	07/23/18
Boring No.:	HSA-11	Sample Type:	Ring		
Sample No.:	R-7	Depth(ft):	25.0		
Sample Description:	Brown lean clay (CL)				

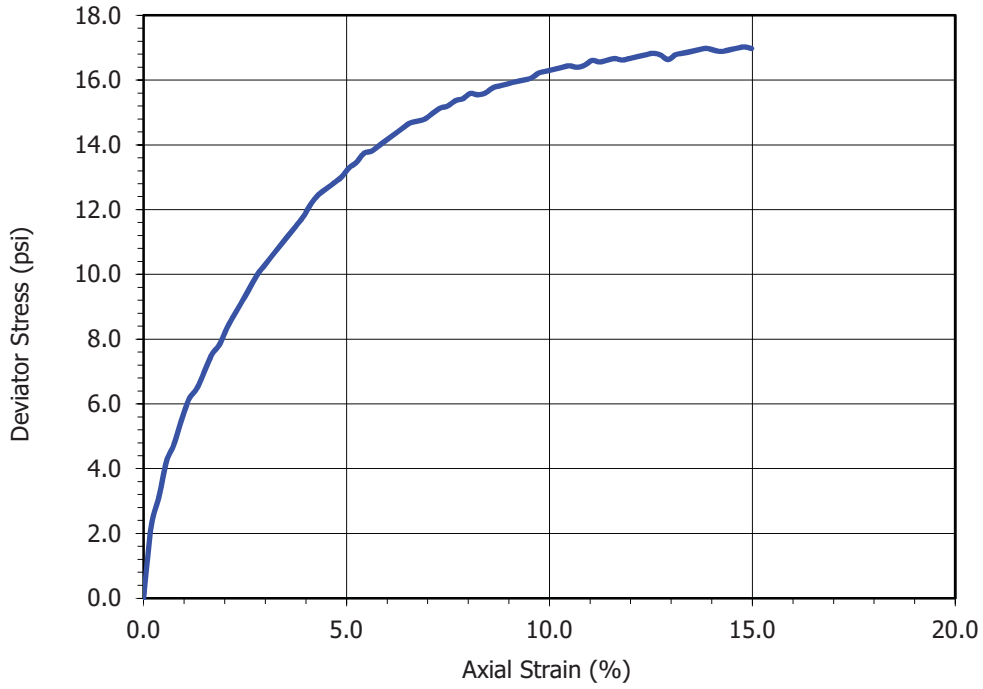
Diameter (in)	1	2.374
	2	2.382
	3	2.385
	Average	2.380
Height (in)	1	5.340
	2	5.343
	3	5.341
	Average	5.341
Weight of Sample + Tube / Rings (g)		684.6
Weight of Tube / Rings (g)		0.0
Weight of Wet Sample + Container (g)		758.0
Weight of Dry Sample + Container (g)		559.8
Weight of Container (g)		74.2
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		6.95
Rate of Deformation (in/min)		0.060

Sample Properties	
Moisture Content (%)	40.82
Dry Density (pcf)	77.9
Void Ratio	1.162
% Saturation	94.8

At Failure*	
Deviator stress (psi)	**17.02**
Minor principal total stress (psi)	**6.95**
Major principal total stress (psi)	**23.97**
Axial strain (%)	**14.79**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Boring No.	HSA-1	HSA-2B	HSA-2B	HSA-3	HSA-4	HSA-5	HSA-6	HSA-6
Sample No.	R-3	R-2	R-4	R-2	R-4	R-3	R-2	R-4
Depth (ft.)	10.0	7.5	12.5	7.5	12.5	10.0	7.5	12.5
Sample Type	Ring	Ring	Ring	Ring	Ring	Ring	Ring	Ring
Soil Identification	Light olive brown silty clay (CL-ML)	Brown lean clay (CL)	Light olive brown lean clay (CL)	Light olive brown silty clay with sand (CL-ML)s	Yellowish brown lean clay (CL)	Yellowish brown fat clay with sand (CH)s	Yellowish brown sandy lean clay s(CL)	Yellowish brown lean clay with sand (CL)s
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weight of Container (g)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Moisture Content (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sample Dry Weight Determination								
Weight of Sample + Container (g)	373.77	415.71	361.17	357.72	445.36	399.83	468.47	462.49
Weight of Container (g)	144.78	75.44	126.32	140.44	77.69	76.23	82.93	77.97
Weight of Dry Sample (g)	228.99	340.27	234.85	217.28	367.67	323.60	385.54	384.52
Container No.:								
After Wash								
Method (A or B)	B	B	B	B	B	B	B	B
Dry Weight of Sample + Cont. (g)	167.39	121.68	146.68	195.78	105.54	148.79	226.42	164.88
Weight of Container (g)	144.78	75.44	126.32	140.44	77.69	76.23	82.93	77.97
Dry Weight of Sample (g)	22.61	46.24	20.36	55.34	27.85	72.56	143.49	86.91
% Passing No. 200 Sieve	**90.1**	**86.4**	**91.3**	**74.5**	**92.4**	**77.6**	**62.8**	**77.4**
% Retained No. 200 Sieve	9.9	13.6	8.7	25.5	7.6	22.4	37.2	22.6

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PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: San Fernando Completion
Project No.: 11957.004
Client Name: City of Los Angeles DPW
Tested By: R. Manning Date: 07/06/18

Boring No.	HSA-7	HSA-8	HSA-8	HSA-10	HSA-11			
Sample No.	R-4	R-3	R-5	R-3	R-1			
Depth (ft.)	12.5	10.0	15.0	10.0	5.0			
Sample Type	Ring	Ring	Ring	Ring	Ring			
Soil Identification	Yellowish brown sandy silty clay s(CL-ML)	Brown sandy lean clay s(CL)	Pale brown clayey sand (SC)	Yellowish brown sandy lean clay s(CL)	Olive brown silty, clayey sand (SC-SM)			
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	828.10			
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	827.20			
Weight of Container (g)	1.00	1.00	1.00	1.00	696.20			
Moisture Content (%)	0.00	0.00	0.00	0.00	0.69			
Sample Dry Weight Determination								
Weight of Sample + Container (g)	391.50	359.20	556.80	464.31	828.10			
Weight of Container (g)	75.65	77.08	76.39	75.63	696.20			
Weight of Dry Sample (g)	315.85	282.12	480.41	388.68	131.00			
Container No.:								
After Wash								
Method (A or B)	B	B	B	B	B			
Dry Weight of Sample + Cont. (g)	229.33	188.74	388.37	209.14	764.90			
Weight of Container (g)	75.65	77.08	76.39	75.63	696.20			
Dry Weight of Sample (g)	153.68	111.66	311.98	133.51	68.70			
% Passing No. 200 Sieve	**51.3**	**60.4**	**35.1**	**65.7**	**47.6**			
% Retained No. 200 Sieve	48.7	39.6	64.9	34.3	52.4			

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PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: San Fernando Completion
Project No.: 11957.004
Client Name: City of Los Angeles DPW
Tested By: RMM/FM Date: 07/06/18

Boring No.	MR-1	MR-1	MR-1	MR-1	MR-1			
Sample No.	S-8	S-9	S-10	S-12	S-13			
Depth (ft.)	20.0	22.5	25.0	30.0	32.5			
Sample Type	SPT	SPT	SPT	SPT	SPT			
Soil Identification	Olive brown lean clay with sand (CL)s	Olive silty sand (SM)	Olive lean clay with sand (CL)s	Olive lean clay with sand (CL)s	Olive brown sandy fat clay s(CH)			
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00			
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00			
Weight of Container (g)	1.00	1.00	1.00	1.00	1.00			
Moisture Content (%)	0.00	0.00	0.00	0.00	0.00			
Sample Dry Weight Determination								
Weight of Sample + Container (g)	385.06	552.30	452.40	509.00	488.50			
Weight of Container (g)	223.26	249.10	108.50	237.60	248.40			
Weight of Dry Sample (g)	161.80	303.20	343.90	271.40	240.10			
Container No.:								
After Wash								
Method (A or B)	B	B	B	B	B			
Dry Weight of Sample + Cont. (g)	262.49	411.10	193.90	314.60	341.10			
Weight of Container (g)	223.26	249.10	108.50	237.60	248.40			
Dry Weight of Sample (g)	39.23	162.00	85.40	77.00	92.70			
% Passing No. 200 Sieve	**75.8**	**46.6**	**75.2**	**71.6**	**61.4**			
% Retained No. 200 Sieve	24.2	53.4	24.8	28.4	38.6			

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PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: San Fernanado Completion
Project No.: 11957.004
Client Name: City of Los Angeles DPW
Tested By: A. Santos Date: 06/27/18

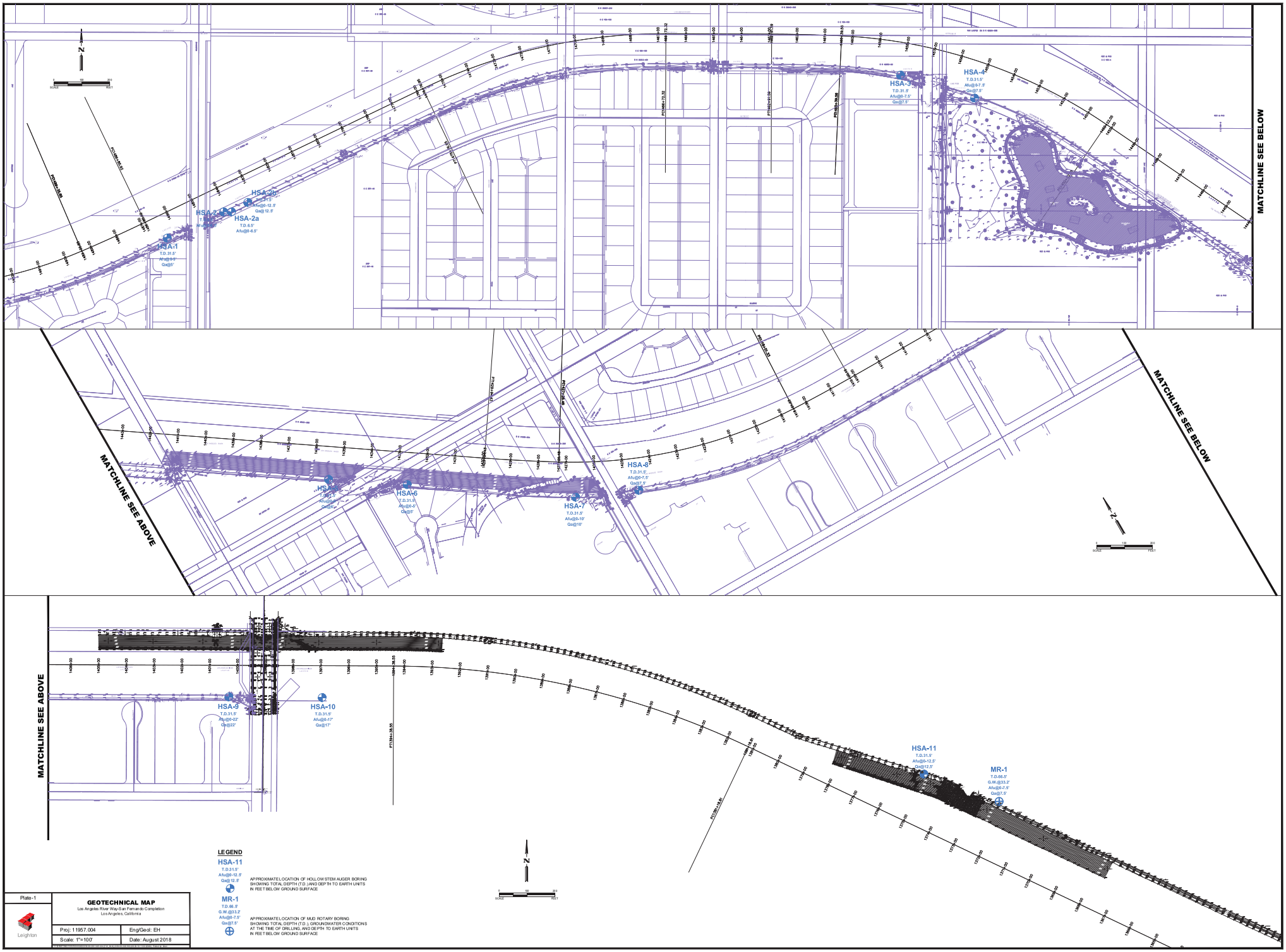

Plate-1

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GEOTECHNICAL MAP

Los Angeles River Way-San Fernando Completion
Los Angeles, California

Proj: 11957.004	Eng/Geol: EH
Scale: 1"=100'	Date: August 2018