# GEOTECHNICAL ENGINEERING INVESTIGATION REPORT
# PROPOSED SENIOR/COMMUNITY CENTER
# EAST 14TH STREET AND 138TH AVENUE
# SAN LEANDRO, CALIFORNIA

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CONTRACT DOCUMENTS



February 20, 2008
File No.: 91148/PW~~HAZ~~-GEO

**KLEINFELDER**
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February 20, 2008
File No.: 91148/PWGEO

Mr. Mark Goralka
Associate Engineer
Engineering and Transportation Department
835 East 14th Street
San Leandro, California 94577

**SUBJECT: Geotechnical Investigation Report for the Proposed San Leandro Senior/Community Center at East 14th Street in San Leandro, California**

Dear Mr. Goralka:

Kleinfelder is pleased to submit our geotechnical investigation report for the proposed San Leandro Senior/Community Center located at East 14th Street and 138th Avenue in San Leandro, California. We have performed our investigation in general accordance with our revised proposal dated January 7, 2008. The enclosed report provides a description of the investigation performed and geotechnical recommendations for the site grading and foundation design. Submittal of this report completes our agreed upon scope of services.

We appreciate the opportunity to be of service to City of San Leandro on this project. If you have any questions regarding this report, please contact us at (925) 484-1700.

Sincerely,

**KLEINFELDER WEST, INC.**

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Staff Engineer

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# Important Information About Your

# Geotechnical Engineering Report

*Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes*

*The following information is provided to help you manage your risks.*

## Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

## Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

## A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from alight industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

## Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

## Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ-sometimes significantly from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

## A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

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## LIST OF PLATES AND APPENDICES

# 1 INTRODUCTION

This report presents the results of our geotechnical investigation for the proposed San Leandro Senior/Community Center located at E 14th Street in San Leandro, California. A Vicinity Map showing the site location is presented on Plate 1.

## 1.1 PROJECT DESCRIPTION

We understand the proposed project will involve construction of a one-story building encompassing approximately 21,000 square feet in total floor plan area. The planned building will consist of a steel-braced frame structure with concrete slab-on-grade floors. No basements are planned. Maximum anticipated column loads will be about 65 kip dead load plus 10 kip live load. Other site improvements will include new underground utilities, asphalt-concrete paved parking lots, driveways, exterior flatwork, and landscaping. Brown & Mills, Inc. of Sacramento, California had previously prepared a geotechnical report (2006) for the project site which was reviewed by Kleinfelder in the preparation of this report. Copies of the Brown & Mills boring logs are presented in Appendix E of this report.

If the actual project differs significantly from that described above, we should be contacted so that we can review our recommendations regarding their applicability to any changes in design.

## 1.2 PURPOSE AND SCOPE OF SERVICES

As detailed in our revised proposal dated January 7, 2008, the purpose of this geotechnical investigation was to explore and evaluate the subsurface conditions at the project site, and to provide geotechnical recommendations for design and construction of the proposed improvements.

Our scope of services for this geotechnical investigation included site reconnaissance, subsurface exploration, laboratory testing, engineering analysis and preparation of this report as detailed below:

- Conduct a site reconnaissance to mark the locations of the exploratory test borings;
- Review available information to aid this investigation, including:
    - Preliminary project plans;
    - Geologic information and other literature pertaining to the site;
    - Previously prepared geotechnical investigation report by Brown & Mills (2006);
- Perform a subsurface exploration program which consisted of two (2) test borings and one (1) cone penetration test;
- Perform laboratory tests of selected soil samples;
- Perform engineering analyses; and
- Preparation of this report

Details of the above scope of services are contained in the following sections of this report.

This investigation specifically excludes the assessment of site environmental characteristics, particularly those involving hazardous substances

# 2 FIELD EXPLORATION

## 2.1 GENERAL

The purpose of the field exploration program was to obtain site specific geotechnical information the proposed improvement area. We performed a site reconnaissance to evaluate general site conditions and possible constraints for planning a field exploration program. The selected locations of borings and CPT were not surveyed; rather, we established the locations by estimating distances from known features. The number, locations and depths of the explorations were selected by us. The approximate exploratory locations are shown on Plate 2.

## 2.2 PERMITTING AND UTILITY LOCATING

Prior to drilling our borings we obtained a drilling permit from the Alameda County Public Works Agency. We visited the site to mark the proposed boring locations in the field using white marking paint. We notified Underground Service Alert (USA) more than 48 hours prior to our field exploration as required.

## 2.3 EXPLORATORY SOIL BORINGS

During the field exploration, we retrieved and compiled information on soil classification, site stratigraphy and the presence and depth of groundwater. The field exploration program consisted of drilling, logging, and sampling two borings, designated B-1 through B-2. The borings were drilled to depths of 35 and 50 feet below the existing ground surface for boring B-1 and B-2, respectively. The logs of the borings are presented in Appendix A. Plate A-1 in Appendix A contains a legend to the terms and symbols used on the boring logs.

The borings were drilled on January 18, 2008, by Exploration Geoservices, Inc. of San Jose, California, using a truck-mounted drill rig with 8-inch hollow-stem augers.

Kleinfelder field representative recorded a log of the soils encountered in the borings and obtained samples for visual examination, classification, and laboratory tests.

Soil samples were obtained from the borings first starting at the depth of 3.5 feet below the ground surface and then at 5 foot intervals thereafter. Soils were sampled by driving a 2.5-inch outside diameter (OD), 2.0-inch inside diameter (ID), split-spoon 'Modified California Sampler' into the subsurface. The samplers were driven 18 inches into the soil using a 140-pound automatic-trip hammer, falling 30 inches. The number of blows required to drive the samplers the last 12 inches is noted on the boring logs. Note that the blow counts shown on the logs are uncorrected field blow count values that have not been adjusted for such factors as sampler type, hammer energy, overburden stress and fines content.

Soils at 30 feet below the ground surface at boring location B-1 were sampled using the 'Standard Penetration Sampler' (SPT) which consists of a 2.0-inch OD, 1.4-inch ID split-spoon sampler.

Two bulk sample of surface soils ranging from depths of 1.5 to 3 feet each at boring location B-1 and B-2, was also obtained for Resistance-value (R-value) test and corrosion tests.

Our field geologist removed the samples from the split spoon samplers and visually classified them using the 'Unified Soil Classification System' (USCS). The undrained shear strength of cohesive soils samples was estimated using a hand-held 'pocket penetrometer' (pocket pen). Penetrometer readings are included on the boring logs. Note that the pocket penetrometer values shown on the boring logs relate to unconfined compressive strength in units of tons per square foot (tsf). The value is equivalent to undrained shear strength ($S_u$) in units of kips per square foot (ksf). Soil samples were packaged and transported to our laboratory for further evaluation and testing.

## 2.4 CONE PENETRATION TESTS (CPT)

We also performed one CPT, designated CPT-1 on October 23, 2007. CPT-1 was advanced to a depth of 50 feet and its location is shown on Site Plan presented on Plate 2. The CPT logs are presented in Appendix C of this report.

The CPTs were performed by hydraulically pushing a 1.4-inch diameter (ten square centimeters), cone-tipped probe into the ground. The cone at the end of the probe measured tip resistance, and a friction sleeve above the cone tip measured frictional resistance. Electrical strain gauges within the cone measured soil parameters continuously for the entire depth advanced. Soil data, including tip resistance and frictional resistance, were transferred to a computer while conducting each test. Accumulated data were processed by computer to provide engineering information, such as the types and approximate strength characteristics of the soil encountered.

## 2.5 EXPLORATION COMPLETION AND ABANDONMENT

As required by Alameda County Environmental Health, we backfilled all holes with cement grout. The upper few inches of the borings were filled and tamped with temporary asphalt-concrete cold-patch.

# 3 SITE CONDITIONS

## 3.1 SURFACE

The project site consists of a rectangularly-shaped parcel located southwest of the intersection of E. 14th Street and 138th Avenue in San Leandro, California. The site is bounded to the northeast by E. 14th Street, to the southeast by commercial development, and to the southwest and to the northwest by asphalt concrete paved parking and driveway areas. At the time of our field investigation, the site was mostly occupied by existing asphalt concrete paved parking and driveway areas. Existing topography within the immediate site area was relatively level.

## 3.2 SUBSURFACE

The following description provides a general summary of the subsurface conditions encountered during the field exploration. For a more thorough description of the actual conditions encountered at specific boring/CPT locations, refer to the boring/CPT logs presented in Appendix A (Plates A-2 through A-3) and Appendix C of this report.

Pavement sections at the test locations consisted of approximately 3 inches of asphalt concrete overlying about 6 to 8 inches of aggregate. Below the pavement, the soil profile encountered at boring location B-1 consists of approximately 15 feet of firm lean clay (CL) overlying about 12 feet of loose to medium dense clayey/silty sand underlain by soft lean clay to an exploratory depth of 35 feet. At boring location B-2, similar materials as encountered at boring location B-1 was encountered except only 3.5 feet of loose to medium dense clayey sand was encountered from a depth of approximately 17 feet to a depth of approximately 20.5 feet. From 35 feet to the exploratory depth of 50 feet of Boring B-2, firm to hard lean clay was encountered. The materials interpreted from CPT logs match that encountered at two boring locations.

It should be noted that the soil and subsurface conditions can deviate from those conditions encountered at the boring locations. If significant variation in the subsurface conditions is encountered during construction, it may be necessary for Kleinfelder to review the recommends presented herein and recommend adjustments as necessary.

### 3.3 GROUNDWATER

Groundwater was measured at a depth of approximately 29.5 feet below the ground surface at boring location B-1 about 2 hours after it was drilled. No groundwater was encountered at boring location B-2 during drilling. It is likely that the depth to groundwater will vary with such factors as seasonal variations in rainfall and runoff, regional trends with well pumping and land use.

# 4 LABORATORY TESTING

Geotechnical laboratory tests were performed to assist in classifying the subsurface soils and assessing their strength characteristics. The laboratory tests were performed by Kleinfelder's geotechnical laboratory in Pleasanton, California, in accordance with applicable American Society for Testing and Materials (ASTM) procedures.

Laboratory tests included natural water content, in-situ dry unit weight, Atterberg limits, particle-size (sieve) analyses, R-value test, and triaxial compression tests.

The results of the geotechnical laboratory testing program are included on the boring logs. The Atterberg limits, particle-size, and triaxial compression tests are also presented in graphic form in Appendix C.

The corrosivity testing and evaluation was performed by CERCO Analytical of Pleasanton, California using standard ASTM Test Methods. CERCO Analytical's report and results are presented in Appendix D, and are discussed in the conclusions section of this report.

# 5 GEOLOGIC AND SIESMIC SETTING

## 5.1 GEOLOGIC SETTING

The geologic units within the San Leandro 7.5 Minute Quadrangle include late Quaternary alluvial and fluvial sedimentary deposits and artificial fill, which are generally susceptible to liquefaction. About half of the onshore region of the San Leandro 7.5 Minute Quadrangle is covered by Holocene alluvial fan and associated deposits. The other half is covered by either Holocene Bay Mud or artificial fill overlying Bay Mud along parts of the San Francisco Bay margin. Jurassic-Cretaceous bedrock is also exposed in the northeastern corner of the quadrangle. There are small bodies of engineered fill underlying some freeways and train tracks. A small area of Quaternary dune sand is exposed just northwest of the Oakland airport (CGS, 2003).

Helley & Graymer's (1997) geology map covering Alameda County and surrounding areas, part of which is presented as the Area Geology Map, Plate 4, the Holocene alluvial fan deposits have been subdivided into Qhaf and Qhl. Qhaf are alluvial fan deposits mapped along the western boundary, and Qhl are natural levee deposits mapped along the eastern boundary of the site.

## 5.2 SEISMIC SETTING

This site is in the seismically active San Francisco Bay Area. Therefore, it can be expected that the project site will experience minor earthquakes and possibly a major earthquake (Moment magnitude greater than 7.0) on one of the nearby active faults during the life of the proposed development. For each of the active faults in the Bay Area, the distance from the site and the estimated maximum moment magnitude (Working Group on California earthquake Probabilities 1999 and California Division of Mines an Geology 1996) are summarized in Table 1.

Generalized site-specific geologic hazards associated with earthquakes are discussed in the next section.

## Table 1

## Regional Faults and Seismicity

| Fault Name | Closest Distance to Site(km) | Magnitude of Maximum Earthquake * |
|---|---|---|
| Hayward – Rodgers Creek (HS + HN + RC) | 1.7 | 7.26 |
| Calaveras (CS + CC +CN) | 16 | 6.9 |
| Mount Diablo Thrust | 21** | 6.6 |
| Concord – Green Valley (CON + GVS + GVN) | 24 | 6.7 |
| San Andreas (SAS + SAP + SAN + SAO) | 27 | 7.9 |
| Monte Vista–Shannon | 32 | 6.7 |
| Greenville (GS + GN) | 33 | 6.9 |
| San Gregorio (SGS + SGN) | 37 | 7.4 |
| Great Valley (segment 5) | 45 | 6.5 |
| Great Valley (segment 7) | 48 | 6.7 |
| West Napa | 51 | 6.5 |
| Great Valley (segment 4) | 63 | 6.6 |
| Point Reyes | 65 | 7.0 |
| Zayante-Vergeles | 71 | 7.0 |
| Hunting Creek-Berryessa | 82 | 7.1 |
| Great Valley (segment 8) | 85 | 6.6 |
| Monterey Bay – Tularcitos | 88 | 7.3 |
| Ortigalita | 90 | 7.1 |

* *Moment magnitude: An estimate of an earthquake's magnitude based on the seismic moment (measure of an earthquake's size utilizing rock rigidity, amount of slip, and area of rupture).*

** *Closest horizontal distance to the vertical projection of the potential rupture.*

# 6 SEISMIC HAZARDS AND SEISMIC DESIGN CONSIDERATIONS

Seismic hazards reviewed for this project include seismic shaking, fault ground rupture, liquefaction, cyclic densification, and landslides. In addition, this section also provides 2007 California Building Code seismic design parameters. More detailed seismic hazards are discussed in our separate report, Geologic and Seismic Hazards Assessment.

## 6.1 SEISMIC SHAKING

Historically, the site has been subjected to intense seismic activity and site will likely be subjected to at least one moderate to severe earthquake and associated seismic shaking during the project lifetime.

## 6.2 SURFACE FAULT RUPTURE

Based on the data provided in Bryant and Hart (1997), the site is not situated within an Alquist-Priolo Earthquake Fault Zone and based on the reviewed published geologic and seismologic reports, maps, and aerial photographs, no known active or potentially active faults cross or project toward the site. Additionally, no evidence of active faulting was visible on the site during our site reconnaissance. The closest zoned active fault is the Hayward and it is located more than 1.5 km to the east. Therefore, it is our opinion that the potential for fault-related surface rupture at the site is low to nil.

## 6.3 2007 CBC SEISMIC DESIGN PARAMETERS

The Maximum Considered Earthquake's (MCE's) spectral accelerations for 0.2 second and 1-second periods ($S_S$ and $S_1$) were estimated using Section 1613A of the 2007 CBC. The mapped acceleration values and associated soil amplification factors ($F_a$ and $F_v$) based on the 2007 CBC are presented below. Corresponding design spectral accelerations ($S_{DS}$ and $S_{D1}$) are also presented below.

**Table 2**

**2007 CBC Seismic Design Parameters**

| Parameter | Value | 2007 CBC Reference |
|---|---|---|
| $S_S$ | 1.877g | Section 1613A.5.1 |
| $S_1$ | 0.714g | Section 1613A.5.1 |
| Site Class | D | Table 1613A.5.2 |
| $F_a$ | 1.0 | Table 1613A.5.3(1) |
| $F_v$ | 1.5 | Table 1613A.5.3(2) |
| $S_{MS}$ | 1.877g | Section 1613A.5.3 |
| $S_{M1}$ | 1.07g | Section 1613A.5.3 |
| $S_{DS}$ | 1.252g | Section 1613A.5.4 |
| $S_{D1}$ | 0.714g | Section 1613A.5.4 |

## 6.4 LIQUEFACTION AND LATERAL SPREADING

Soil liquefaction is a condition where saturated, granular soils undergo a substantial loss of strength and deformation due to pore pressure increase resulting from cyclic stress application induced by earthquakes. In the process, the soil acquires mobility sufficient to permit both horizontal and vertical movements if the soil mass is not confined. Soils most susceptible to liquefaction are saturated, loose, clean, uniformly graded, and fine-grained sand deposits. If liquefaction occurs, foundations resting on or within the liquefiable layer may undergo settlements. This will result in reduction of foundation stiffness and capacities.

The site lies within the San Leandro Quadrangle, which has been mapped by the CGS as part of its ongoing effort to map landslide and liquefaction related hazards throughout the San Francisco Bay Area. According to the CGS, the project site is located within an area where historical occurance of liquefaction, or local geological, and ground-water conditions indicate a potential for permanent displacements such that mitigation as defined in California Public Resources Code Section 2693© would be required (CGS, 2003). According to Youd and Hoose (1978), ground cracks associated with sand boils and miscellaneous effects were recorded less than 1 km to the site during 1868 (m7.0) Hayward earthquake. This feature was described as the opening of fissures in the earth and appearance of new spring of water. No historic ground failures were reported within approximately 6 km of the site by Holzer (1998) as a result of the 1989 M6.9 Loma Prieta earthquake.

The project site lies within a Seismic Hazard Zone associated with potential liquefaction as determined by the CGS (2003). Based on the borings and CPT advanced at the site, the site is generally underlain by firm to hard clayey soils overlaying interbedded layers of loose to dense poorly graded sand and gravel. Groundwater was encountered within the borings as shallow as 29 feet, even though historical groundwater levels are about 22 feet according to the Seismic Hazard Zone report by the CGS for the San Leandro Quadrangle. The poorly graded sand and gravels are considered to be potentially liquefiable. Based on that information, we performed liquefaction analysis using the methods proposed in Youd et al. (2001). For our analysis, we used a peak ground acceleration of 0.567g, associated with an earthquake magnitude of M7.26. We assumed groundwater to be at a depth of 22 feet below ground surface for our analysis. The results of our analyses show that layers between the depths of 27 to 32 feet would probably liquefy during the design seismic event. Based on Tokimatsu and Seed, (1987), the estimated total liquefaction induced settlement is on the order of about 1 inch. Based on Martin and Lew (1999), differential settlements may be taken as half of the total settlements between adjacent supports.

The potentially liquefiable layer encountered at Boring B-1 has a thicknesses of about 5 feet. Based on Ishihara (1985) and Youd and Garris (1995), we believe that the potential for ground surface disruption (such as sand boils, ground fissures, etc.) to occur at the site is low due to the presence of the non-liquefiable bridging clayey soils in the upper 15+ feet below the ground surface, the interlayering between liquefiable and non-liquefiable layers, and the lateral discontinuity of the liquefiable layers.

Lateral spreading is a potential hazard commonly associated with liquefaction where extensional ground cracking and settlement occur as a response to lateral migration of subsurface liquefiable material. These phenomena typically occur adjacent to free faces such as slopes and creek channels. No such features are present in the immediate vicinity of the site. Therefore, we believe that the potential for lateral spreading to take place at the site is negligible.

## 6.5 DYNAMIC COMPACTION

Another type of seismically induced ground failure, which can occur as a result of seismic shaking, is dynamic compaction, or seismic settlement. Such phenomena typically occur in unsaturated, loose granular material or uncompacted fill soils. The subsurface conditions encountered in the recent borings and CPT performed at the site are not conducive to such seismically induced ground failures. For this reason we conclude that the potential for shaking related random ground cracking to affect the site and surrounding areas is low. Our concurrent geotechnical engineering study for the site will provide recommendations and mitigation measures to address soil expansion.

## 6.6 SEISMICALLY-INDUCED LANDSLIDES

The proposed Senior/Community Center site is relatively flat, with little to no topography relief. Therefore, it is our opinion that the potential for seismically induced (or otherwise) landslides and slope failure to occur at the site is considered low.

# 7 DISCUSSIONS & CONCLUSIONS

Based on our review of the field exploration and engineering analyses, we believe that the project as currently proposed is feasible from a geotechnical standpoint, provided that the recommendations presented in this report are incorporated into the design. The discussions and conclusions that follow are based on design information provided by Structural Engineer, the results of our field investigations, our engineering analyses, and our professional judgment. Recommendations regarding site grading and foundation design are presented in the "Recommendations" section of this report.

## 7.1 SEISMIC HAZARDS

There are no known active faults crossing through the project. Therefore, the risk of surface fault rupture is low. However, as the building is less than 2 km from the active Hayward fault zone, structures should be designed for seismic near-source effects per the 2007 California Building Code.

The liquefaction potential at the site is considered moderate with maximum liquefaction-induced settlement on the order of about 1 inch. Maximum differential settlement due to liquefaction is anticipated to be less than ½ inch between adjacent columns.

## 7.2 FOUNDATION SETTLEMENT

We anticipate total and differential settlements due to foundation pressures from shallow spread footings to be less than ½ inches and ¼ inches over a horizontal distance of about 50 feet, respectively, provided that the design recommendations contained in the "Recommendations" section of this report are followed. Foundation settlements should be primarily elastic in nature, with a majority of the estimated settlement occurring upon the application of the load during the construction. In additional to the elastic settlements, maximum liquefaction-induced settlement of 1 inch is likely to occur at the site during a seismic event as discussed in the "Seismic hazards" section of this report.

### 7.3 EXPANSION POTENTIAL OF NEAR-SURFACE SOILS

One of the geotechnical concerns for the proposed development at the site is the presence of highly expansive surficial soils. To address the presence of such soils at the site, the foundations for the planned building will need to extend deeper than usual. Continuous footings should be used around the perimeter of the building to reduce the potential for moisture content fluctuations within the expansive soils underlying the building footprints.

The concrete on-grade slabs should be underlain by either "non-expansive" fill materials or lime-treated native soils with a minimum R-value of 50. In a similar fashion, either "non-expansive" fill materials or lime-treated native soils should be used to support asphalt concrete paved areas.

Specific recommendations for mitigating expansion potential of near-surface soils are presented in the "Recommendations" section of this report.

### 7.4 CORROSIVITY

Based on the Corrosivity testing performed by others, both samples are classified as "corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending on the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion. Appendix E presents a brief analysis of the soil corrosivity with recommended mitigation measures provided by a subcontracted corrosion engineer.

It is noted that Kleinfelder is not a corrosion expert. The above conclusions are general discussions only based on test results for two soils samples obtained at boring B-1. we recommend that a competent corrosion engineer be retained to evaluate the corrosion potential of the site soils to proposed improvements, and to recommend further testing as required, and to provide specific methods for corrosion mitigation that are appropriate for the project. The corrosion potential for any imported fill and backfill should also be checked.

# 8 RECOMMENDATIONS

The recommendations presented in this section are based on design information provided to us by Structural Engineer, the results of our field investigation and laboratory testing, our engineering evaluations and analyses, and our professional judgment.

## 8.1 SHALLOW FOUNDATION

The proposed building can be supported on shallow spread footings consisting of isolated column and continuous wall footings. An allowable bearing pressure (dead plus live) of 3,500 pounds per square foot (psf) may be used, with a one-third increase for transient loads such as wind and seismic loads. The dead plus live load bearing pressure includes a safety factor of at least 3.

The continuous footings should be a minimum of 18 inches wide, while isolated (interior) column footings should be at least 18 inches by 18 inches. Continuous footings should be used around the perimeter of the building to reduce potential moisture change in the soils beneath the building. Footings should be embedded a minimum of 24 inches below the lowest adjacent grade. Adjacent grade is defined as the bottom of the adjacent floor slab or the adjacent exterior finished grade, which ever results in a deeper footing.

Where footings are located adjacent to below-grade structures or near major underground utilities, the footings should extend below a 1:1 (horizontal to vertical) plane projected upward from the structure's footing or bottom of the underground utility to avoid surcharging the below-grade structure and underground utility with building loads. Also, where utilities cross the perimeter footings line, the trench backfill should consist of a vertical barrier of impervious type of material or lean concrete, as explained in the "Earthwork" section of this report. Utility plans should be reviewed by Kleinfelder prior to trenching for conformance to this requirement.

## 8.2 LATERAL RESISTANCE

Lateral loads on foundations resulting from earth pressures and seismic and/or wind forces should be resisted by a combination of: 1) friction between the base of the foundation and the supporting subgrade and 2) passive resistance acting against the vertical faces of the foundation perpendicular to the direction of load. An allowable friction coefficient of 0.35 is considered applicable for friction between the foundation and supporting subgrade, and a passive resistance equal to an equivalent fluid pressure (unit weight) of 350 pounds per cubic foot (pcf) acting against the foundation. These values can be used concurrently. These values may be increased by one-third for short term wind and/or seismic loading. It should be noted that the lateral load resistance values discussed above assume that the concrete for footings are either placed directly against undisturbed soils or that the voids created from the use of forms are properly backfilled and compacted with soil or other approved material (e.g. lean concrete).

Passive resistance in the upper foot of soil cover below finished grades should be neglected unless the ground surface is protected from erosion (or other disturbance that could remove this upper foot) by concrete slabs, pavements, or other such positive protection.

## 8.3 SLABS-ON-GRADE

### 8.3.1 Concrete Floor Slabs

Slabs-on-grade for this project will consist of concrete floor slabs and exterior flatwork. As previously discussed, the near-surface soils at the site are highly expansive, and will be subjected to shrink/swell cycles with fluctuations in moisture content. To reduce these potentially adverse effects, we recommend that concrete floor slabs be underlain by 24 inches of "non-expansive" engineered fill placed on the subgrade prepared as described in the "Earthwork" section of this report. The "non-expansive" fill should have the properties meeting the criteria listed in the "Earthwork" section of this report, and should extend a minimum of 5 feet beyond the building limits, where feasible.

In order to provide enhanced subgrade support, we recommend that the upper portion of 24 inches of "non-expansive" fill to underlie the concrete floor slabs consist of a minimum of 6 inches of 3/4–inch compacted crushed rock. If this layer is desired to also serve as a capillary break, it should contain less than 5 percent by weight of material passing the No.4 sieve. The granular layer may replace an equivalent thickness of non-expansive fill. If desired, the non-expansive fill layer can be replaced by an equivalent lime treated section as described below. It is important that the crushed rock material be placed as soon as possible after moisture conditioning and compaction of the "non-expansive" subgrade materials to reduce drying of the pad subgrade. A representative of Kleinfelder should be present to assess the subgrade condition and observe/test the preparation of the subgrade prior to slab construction.

Slab thickness and reinforcing should be designed by a Structural Engineer.

### 8.3.2 Exterior flatwork

Concrete exterior flatwork at grade will be constructed on soils subjected to swell/shrink cycles. Some of the adverse effects of swelling and shrinking can be reduced with proper moisture treatment. The intent is to reduce the fluctuations in moisture content by moisture conditioning the soils, sealing the moisture in, and controlling it. Near-surface soils to receive exterior flatwork should be moisture conditioned according to the recommendations in Exhibit 1 in Appendix A. In addition, all exterior flatwork should be supported on a minimum of 6 inches of "non-expansive" fill. Where concrete flatwork is to be exposed to vehicular traffic, the upper 6 inches of the "non-expansive" fill should consist of Class 2 Aggregate Base, as specified in the latest edition of the California Department of Transportation Standard Specifications. Even with the 6 inches of "non-expansive" material, some movement of the exterior slabs may occur. This can be further reduced by increasing the "non-expansive" fill to 12 inches, and by increasing the amount of reinforcement. Exterior flatwork will be subjected to edge effects due to the drying out of subgrade soils.

In lieu of non-expansive fill, lime-treatment of the subgrade soils may be used to counteract the expansion potential of near-surface soils. Specific recommendations are presented in the "Lime Treated Subgrade Soils" section of this report.

Because of the presence of near-surface expansive soils, flatwork should have control joints on a minimum of 8 foot on centers. To protect against edge effects adjacent to unprotected areas, such as vacant or landscaped areas, lateral cutoffs such as inverted curbs are recommended. Prior to construction of the flatwork, the "non-expansive" fill should be moisture conditioned to near optimum moisture content. If the "non-expansive" fill is not covered within 30 days after placement, the soils below this material will need to be checked to confirm that their moisture content is 2 to 5 percent over optimum. If the moisture is found to be below this level, the flatwork areas will need to be soaked until the proper moisture content is reached. Where flatwork is adjacent to curbs, reinforcing bars should be placed between the flatwork and the curbs. Expansion joint material should be used between flatwork and buildings.

#### 8.3.3 Slab moisture

Subsurface moisture and moisture vapor naturally migrate upward through soil and, where the soil is covered by a building or pavement, this subsurface moisture will collect. To reduce the impact of the subsurface moisture and potential impact of future introduced moisture (such as landscape irrigation or precipitation) the current industry standard is to place a vapor retarder on the compacted crushed rock layer. This membrane typically consists of visqueen or polyvinyl plastic sheeting at leat 10 mil in thickness. It should be noted that although vapor retarder systems are currently the industry standard, this system may not be completely effective in preventing floor slab moisture problems. These systems typically do not assure that floor slab moisture transmission rates meet floor-covering manufacturer standards and that indoor humidity levels will be appropriate to inhabit mold growth. The design and construction of such systems are dependent on the proposed use and design of the proposed building and al elements of building design and function should be considered in the slab on grade floor design. Building design and construction have a greater role in perceived moisture problems because sealed building/rooms or inadequate ventilation may produce excessive moisture in a building and affect indoor air quality.

Various factors, such as surface grades, adjacent planter areas, quality of the concrete slab, and the permeability of the on-site soils affect slab moisture and can control future performance. In many cases, floor moisture problems are the result of either improper curing of floor slabs or improper application of floor adhesives. We recommend contacting a flooring consultant experienced in the area of concrete slab-on-grade floors for specific recommendations regarding your proposed flooring applications.

Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could lead to excessive shrinkage, cracking, or curling of the slabs. High water-cement ratio and/or improper curing also greatly increase the water vapor permeability of the concrete. We recommend that all concrete placement and curing operations be performed in accordance with the American Concrete Institute (ACI) manual.

It is emphasized that we are not floor moisture proofing experts. We make no guarantee nor provide any assurance that use of capillary break/vapor retarder system will reduce concrete slab-on-grade floor moisture penetration to any specific rate or level, particularly those required by floor covering manufacturers. The builder and designers should consider all available measures for floor slab moisture protection

Exterior grading will have an impact on potential moisture beneath the floor slab. Recommendations for exterior drainage are provided in the "Site Drainage" section of this report.

## 8.4 EARTHWORK

Final grading plans were not available to us at the time this report was prepared. However, based on the preliminary drawings, we anticipate that grading will consist of cuts and fills less than 2 feet to create subgrade for the new development and to achieve proper site drainage. Final grading plans should be reviewed by Kleinfelder for conformance to our design recommendations prior to construction bidding. In addition, it is important that a representative of Kleinfelder observe and evaluate the competency of existing soils or new fills underlying structures, slabs-on-grade, and pavements. In general, if soft or unsuitable materials are encountered, these should be over-excavated, removed and replaced with compacted engineered fill material.

### 8.4.1 Site Preparation and Grading

Prior to grading, existing pavements, any abandoned shallow foundations, abandoned utilities, roots and other organic matter and debris should be removed. Depressions left from removal of below-grade obstructions should be excavated to unyielding soil and backfilled with properly-compacted fill. Site drainage should also be provided.

The stripped materials should not be reused as engineered fill and should be removed from the site, or used in landscaped areas, as appropriate. However, asphalt and concrete can be reused as engineered fill as long as the gradation of this recycled material meets our recommended fill criteria and is approved by us prior to use. Stripping should extend a minimum of 5 feet laterally, outside the proposed buildings pavements, curbs, and flatwork, respectively.

All active or inactive utilities within the construction area should be protected, relocated, or abandoned. Active utilities to be reused should be carefully located and protected during construction. Abandoned utility lines should be removed and the area properly backfilled and compacted in the engineered fill.

Prior to placement of engineered fill or following excavation to reach desired subgrade levels in proposed buildings, the exposed subgrade should be scarified to a minimum depth of 12 inches. Scarification should extend laterally a minimum of 5 feet beyond proposed building limits, pavement and flatwork areas. Scarified areas should be moisture conditioned to above-optimum and re-compacted as specified in Table 1. Fills should be placed in lifts no greater than 8 inches in uncompacted thickness. Laboratory maximum density and optimum moisture relationships should be determined by the current ASTM Test Designation D 1557.

The on-site soils, if free of organic matter or other deleterious materials, are suitable for use as general engineered fill. Maximum particle size for fill material should be limited to 3 inches, with at least 90 percent by weight passing the 1 inch sieve.

If imported material is needed, it is recommended that it be granular in nature, adhere to the above gradation recommendations and conform to the following minimum criteria:

| | |
|---|---|
| Percent passing the No.200 Sieve | Less than 50 percent |
| Plasticity Index | 15 or less |
| Maximum particle dimension | 3-inches or less, with 90% passing the 1-inch sieve |
| Expansion Index | 30 or less |

Highly pervious materials such as pea gravel or clean sands are not recommended because these permit transmission of water to the underlying soils.

Due to the highly expansive nature of the near-surface soils at the site, proper moisture conditioning is important. The moisture conditioning should be performed in accordance with Exhibit 1. Where low expansion potential soils or aggregate baserock in paved areas is used, it should be placed immediately over the prepared subgrade to avoid drying of the subgrade. Prior to the placement of the capillary break or crushed rock material over the "non-expansive" fill subgrade for the building pads, the subgrade should be conditioned to the moisture content indicated in Exhibit 1. The subgrade for exterior concrete flatwork should be conditioned to the required moisture content prior to their construction, and may require additional conditioning if allowed to dry.

All on-site or import fill material should be compacted to the general recommendations provided for engineered fill (Exhibit 1). Onsite and Import material should be compacted at or slightly above the optimum moisture content. Grading operations during the wet season, or in areas where the soils are saturated, may require provisions for drying of soil prior to compaction. If the project necessitates fill placement and compaction in wet conditions, we could provide alternatives for drying the soil. Conversely, additional moisture may be required during the dry months. Water trucks should be available in sufficient number to provide adequate water during compaction.

All site preparation including fill placement and compaction should be observed by Kleinfelder. It is important that during the stripping and scarification process, a representative of Kleinfelder be present to observe whether any undesirable material is encountered in the construction area and whether exposed soils are similar to those encountered during the geotechnical site exploration.

### 8.4.2 Lime Treated Subgrade Soils

One of the geotechnical concerns for the proposed development at the site is the presence of highly expansive surficial soils. To reduce the potentially adverse effects of expansive soils, lime-treated, in-situ soils may be used instead of using the imported "non-expansive" engineered fills. At least 12 inches of lime-treated soils may be considered as an option below the exterior flatwork.

It should be understood that extensive quality control is needed during lime-treatment. We anticipated that about 4 percent lime by weight is needed for the treatment. We will need to perform additional laboratory tests to refine this lime content estimate. The negative impact of lime-treatment on future vegetation should be considered in whether it should be used, and what mitigation measures are needed.

It should be emphasized that the lime-treated pad should be covered within 2 weeks following lime-treatment. Keeping the pad moist on a daily basis can extend this time frame. The purpose of covering the lime-treated soil is to reduce excessive drying and cracking. The pad can be covered with 4 to 6 inches of capillary break material or base rock, or a curing seal as specified in section 24-1.09 of CALTRANS Standard Specifications.

The lime-treated soil should extend a minimum horizontal distance of 5 feet beyond all building areas, including the outer edge of perimeter footings and footings extending beyond perimeter walls, where flatwork is planned, and 3 feet elsewhere. It is important that slabs be constructed as soon as possible after lime-treating, as subgrades will dry out. A representative of Kleinfelder should be present to observe the condition of the subgrade and observe and test the installation of the lime-treated soils prior to slab construction.

### 8.4.3 Excavation and Backfill

Excavations for footings, utility trenches, or other excavations are anticipated to be made with either a backhoe or trencher. We expect the walls of trenches less than 5 feet deep to be able to stand temporarily near vertical without support.

Where trenches or other excavations are extended deeper than 5 feet, the excavation may become unstable and should be evaluated to monitor stability prior to personnel entering the trenches. Shoring or sloping of any deep trench wall may be necessary to protect personnel and to provide stability. All trenches should conform to the current OSHA requirements for work safety. Excavations should be located so that no structures, foundations, or slabs are located above a plane projected 45 degrees upward from any point in an excavation, regardless of whether it is shored or unshored.

Backfills for trenches or other small excavations beneath slabs should be compacted as noted in Table 1. Special care should be taken in the control of utility trench backfilling under structural, pavement, and slab areas. Poor compaction may cause excessive settlements resulting in damage to overlying structures and slabs.

Where utility trenches extend from the exterior to the interior limits of the building, clayey soils or lean concrete should be used as backfill material for a distance of approximately 2 feet laterally on each side of the exterior building line to reduce the potential for the trench acting as a conduit for the exterior surface water. Utility trenches located in landscaped areas should also be capped with a minimum of 12 inches compacted clayey soils.

## 8.5 PAVEMENTS

Pavements for this project will consist of asphalt concrete access driveways and parking areas. We performed engineering analyses for the project's pavement designs assuming the pavement subgrade soil will be similar to the near surface soils described in the boring logs. This assumption is based on our anticipation that grading and soil removal in the paved areas will be minimal. If site grading exposes soil other than that assumed, or import fill is used to construct pavement subgrade, we should perform additional tests to confirm or revise the recommended pavement sections for actual field conditions.

Pavement sections for this project have been calculated using Caltrans Flexible Pavement Design Method. Based on the Resistance (R)-value test performed on near surface soil samples obtained at the site, an R-value of 5 was used to develop recommendations for the pavement sections.

Various alternative pavement sections for various different Traffic Indices (TIs) are presented below. Each TI represents a different level of use. The owner or project civil engineer should determine which level of use best reflects the project and select appropriate pavement sections. Two alternative pavement sections are given for the various TIs in the following Table 3. They include a) asphalt over Class 2 Aggregate Base (AB), and b) asphalt over AB over Class 2 Aggregate Base (ASB).

Table 3
Pavement Design Sections
(R-value of subgrade = 5)

| Traffic Index | Alternative 1 | | Alternative 2 | | | Alternative 3 (Lime Treatment) | | |
|---|---|---|---|---|---|---|---|---|
| | AC | AB | AC | AB | ASB | AC | AB | Lime-Treated SG |
| 4.0 | 2.5 | 8.5 | 2.5 | 4.5 | 6.0 | - | - | - |
| 4.5 | 2.5 | 10.0 | 2.5 | 4.5 | 6.0 | - | - | - |
| 5.0 | 2.5 | 11.0 | 2.5 | 5.5 | 6.0 | 2.5 | 4.0 | 12 |
| 5.5 | 3.0 | 11.5 | 3.0 | 5.5 | 7.0 | 3.0 | 4.5 | 12 |
| 6.0 | 3.0 | 14.0 | 3.0 | 7.0 | 8.0 | 3.0 | 4.5 | 12 |
| 6.5 | 3.5 | 14.0 | 3.5 | 6.5 | 9.0 | 3.0 | 5.0 | 12 |
| 7.0 | 3.5 | 16.0 | 3.5 | 7.0 | 10.5 | 3.5 | 6.0 | 12 |

Note: Thicknesses shown are in inches.
AC = Type B Asphalt Concrete
AB = Class 2 Aggregate Base (Minimum R-Value = 78)
ASB = Class 2 Aggregate Subbase (Minimum R-Value = 50)
Lime-Treated SG = Lime-treated subgrade (minimum R-Value = 76)

We recommend that the subgrade soil over which the pavement sections are to be placed be moisture conditioned and compacted according to the recommendations in the "Earthwork" section of this report. Subgrade preparation should extend a minimum of 5 feet laterally beyond the back of curb or edge of pavement.

Paved areas should be sloped and drainage gradients maintained to carry all surface water to appropriate collection points. Surface water ponding should not be allowed anywhere on the site during or after construction. We recommend that the pavement section be isolated from non-developed areas and areas of intrusion of irrigation water from landscaped areas. Concrete curbs should extend a minimum of 2 inches below the baserock and into the subgrade to provide a barrier against drying of the subgrade soils, or reduction of migration of landscape water, into the pavement section. Weep holes, 4 feet on centers, should also be provided. In lieu of the weep holes, a subdrain behind the curbs can be installed.

In addition, we recommend that all pavements conform to the following criteria:

- All trench backfills, including utility and sprinkler lines, crossing pavement areas should be properly placed and adequately compacted to provide a stable subgrade.
- An adequate drainage system should be provided to prevent surface water or subsurface seepage from saturating the subgrade soil.

The aggregate base and asphalt concrete materials should conform to ASTM test procedures and work should be performed in accordance with Caltrans Standard Specifications, latest edition.

## 8.6 SITE DRAINAGE

Proper site drainage is important for the long-term performance of the planned structure. The site should be graded so as to carry surface water away from the building foundations, at a minimum slope of 2 percent at least 5 feet laterally from the building. In addition, all roof gutters should be connected directly into a storm drainage system, or drain onto impervious surfaces that drain away from the buildings, provided that a safety hazard is not created.

## 8.7 WET WEATHER CONSTRUCTION

If site grading and construction is to be performed during the winter rainy months, the owner and contractors should be aware of the potential impact of wet weather. Rainstorms can cause delay to construction and damage to previously completed work by saturating compacted pads or subgrades, or flooding excavations.

The grading contractor should be responsible to protect his work to avoid damage by rainwater. Standing pools of water should be pumped out immediately. Construction during wet weather conditions should be addressed in the project construction bid documents and/or specifications. We recommend the grading contractor submit a wet weather construction plan outlining procedures they will employ to protect their work and to reduce damage to their work by rainstorms.

# 9 ADDITIONAL SERVICES AND LIMITATIONS

## 9.1 ADDITIONAL SERVICES

Variations in soil types and conditions are possible and may be encountered during construction. To permit correlation between the soil data obtained during this investigation and the actual soil conditions encountered during construction, we recommend that Kleinfelder be retained to provide observation and testing services during site earthwork and foundation construction. This will allow us the opportunity to compare actual conditions exposed during construction with those encountered in our investigation and to provide supplemental recommendations if warranted by the exposed conditions. Earthwork should be performed in accordance with the recommendations presented in this report, or as recommended by Kleinfelder during construction.

The geotechnical review of plans and specifications, and geotechnical field observation and testing during construction by Kleinfelder are an integral part of the conclusions and recommendations provided in this report. If Kleinfelder is not retained for these geotechnical construction phase services, the client will be assuming Kleinfelder's responsibility for any potential claims that may arise during or after construction due to the misinterpretation of the recommendations presented herein. In addition to plan review services, recommended tests, observations, and consultations by Kleinfelder during construction include, but are not limited to:

- Geotechnical observations during site grading, including stripping and engineered fill construction;
- Geotechnical observations during foundation construction;
- Geotechnical in-place density testing of fills, backfills and finished subgrades.

## 9.2 LIMITATIONS

The services provided under this contract as described in this report include professional opinions and judgments based on the data collected. These services have been performed according to generally accepted geotechnical engineering practices that exist in the San Francisco Bay Area at the time the report was written. No other warranty is expressed or implied. This report is issued with the understanding that Valero chooses the risk they wish to bear by the expenditures involved with the construction alternatives and scheduling that is chosen.

The conclusions and recommendations of this report are for the San Leandro Senior/Community Center project, as described in the text of this report. The conclusions and recommendations in this report are invalid if:

- the proposed structures, as described, change,
- the structures are relocated,
- the report is used for adjacent or other property,
- the Additional Services section of this report is not followed,
- if changes of grades occur between the issuance of this report and construction, or
- any other change is implemented which materially alters the project from that proposed at the time this report is prepared.

The conclusions and recommendations presented in this report are based on information obtained from the following:

- 2 geotechnical borings drilled at the site;
- 1 cone penetration test performed at the site;
- the observations of our Certified Engineering Geologist;
- the results of laboratory tests;
- our concurrent Geohazards Assessment Study; and
- our experience in the area and with similar projects.

The boring logs do not provide a warranty as to the conditions that may exist at the entire site. The extent and nature of subsurface soil and groundwater variations may not become evident until construction begins. It is possible that variations in soil conditions between borings could exist between or beyond the points of exploration or that groundwater elevations may change, both of which may require additional studies, consultation, and possible design revisions. If conditions are encountered in the field during construction which differ from those described in this report, our firm should be contacted immediately to provide any necessary revisions to these recommendations.

It is City of San Leandro's responsibility to see that all parties to the project including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety, including the Additional Services and Limitations sections.

This report may be used only by the client and only for the purposes stated within a reasonable time from its issuance, but in no event later than one year from the date of the report. Land or facility use, on and off-site conditions, regulations, or other factors may change over time, and additional work may be required with the passage of time. Any party other than Valero who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued.

# EXHIBIT 1

## SUMMARY OF COMPACTION RECOMMENDATIONS

| Area | Compaction Recommendation (1),(2),(3),(4),(5) |
|---|---|
| General Engineered Fill | Compact to at least 88 percent compaction at least 2 percent above optimum moisture content for native clayey and silty soils and 90 percent at near optimum moisture content for imported granular soils. |
| Imported Fill | Compact to at least 90 percent compaction at near or above optimum moisture content. |
| Trenches(6) | Compact to at least 88 percent compaction at least 2 percent above optimum moisture content for native clayey or silty soils and 90 percent at near optimum moisture content for imported granular soils. |
| Concrete Floor Slabs | Compact upper 12 inches of subgrade to a minimum of 88 percent at least 2 percent above optimum moisture content in clayey or silty soils |
| Exterior Flatwork | Compact upper 12 inches of subgrade to a minimum of 88 percent at least 2 percent above optimum moisture content in clayey or silty soils or upper 12 inches of subgrade to a minimum of 90 percent at near optimum for sandy or gravelly soils. |
| Parking and Access Driveways | Compact upper 8 inches of subgrade to a minimum of 92 percent compaction at least 2 percent above optimum moisture content. Compact baserock to a minimum of 95 percent compaction near optimum moisture content. |

Notes:
(1) All compaction requirements refer to relative compaction as a percentage of the laboratory standard described by ASTM D1557.
(2) Depths are below finished subgrade elevation.
(3) Fill material should be compacted in lifts not exceeding 8 inches in loose thickness.
(4) All subgrades should be firm and unyielding.
(5) Fills greater than 7 feet in depth should be compacted to a minimum of 95 percent below 7 feet.
(6) In landscaping areas <u>only</u>, percent compaction in trenches may be reduced to 85 percent.


N

2000 1000 0 2000
APPROXIMATE SCALE (feet)

REFERENCE:

**KLEINFELDER**

7133 Koll Center Parkway, Suite 100
Pleasanton, CA 94566
PH. (925) 484-1700 FAX. (925) 484-5838
www.kleinfelder.com

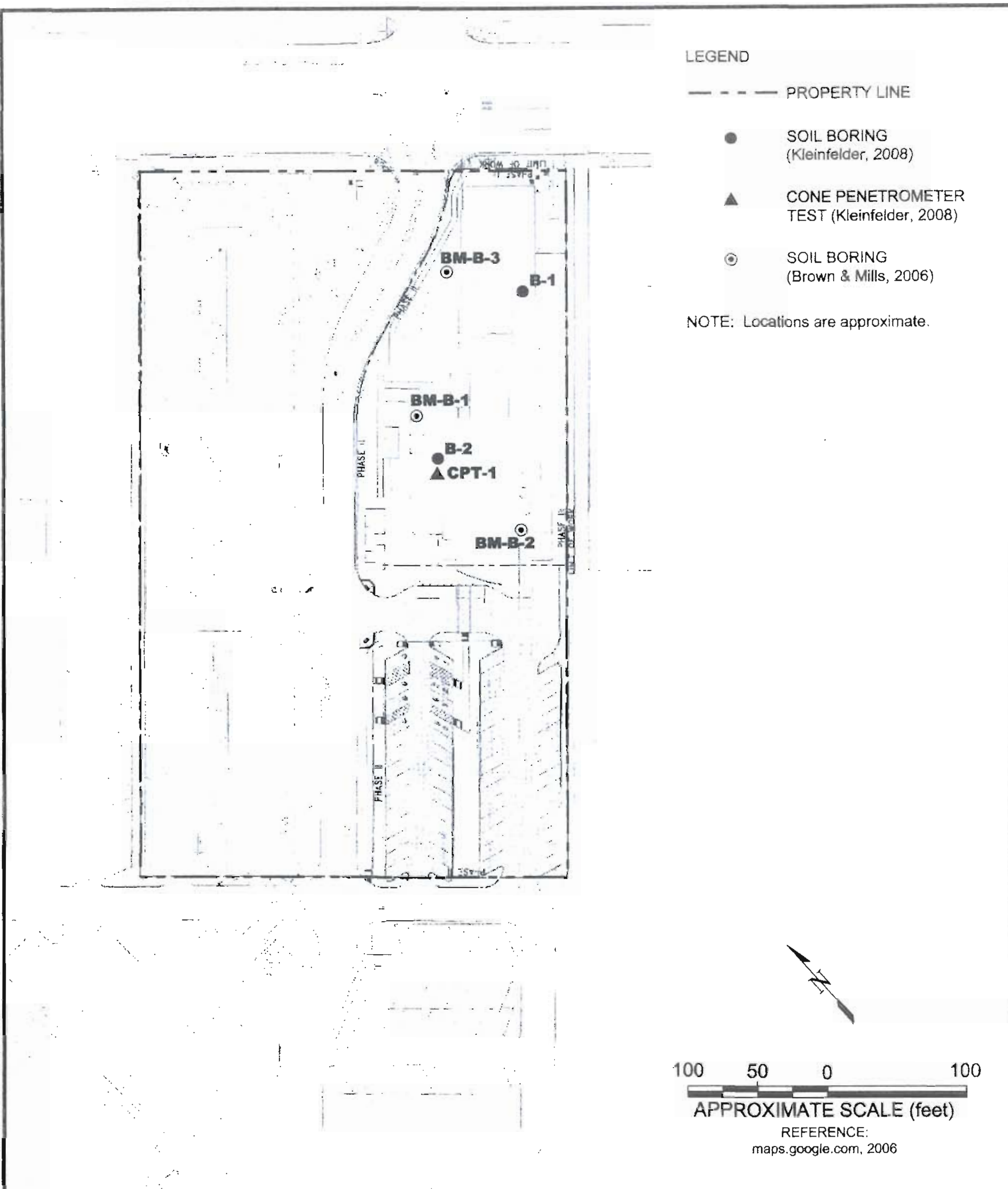
## SITE VICINITY MAP

SAN LEANDRO SENIOR / COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

| | |
|---|---|
| DRAWN BY: | LGS |
| REVISED BY: | |
| CHECKED BY: | SMD |
| PLATE | 1 |

DRAWN: FEB 2008 | APPROVED BY: | PROJECT NO. 91148 | FILE NAME: PWGEO.dwg

ATTACHED IMAGES: Images: 20080204104638.jpg Images: AERIAL.jpg Images: SITE-VIC.jpg Images: SITEPLAN.jpg
ATTACHED XREFS: XRef: Style A_08x11
L:\2008\08PROJ CAD FILE: L:\2008\08Projects\91148\GRAPHICs\PWGEO\ LAYOUT: SITE-VIC




**KLEINFELDER**

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## SITE PLAN

SAN LEANDRO SENIOR / COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

| | |
|---|---|
| DRAWN BY: | LGS |
| REVISED BY: | |
| CHECKED BY: | SMD |
| PLATE | 2 |

DRAWN: FEB 2008 | APPROVED BY: | PROJECT NO. 91148 | FILE NAME: PWGEO.dwg

ATTACHED IMAGES: Images: 20080204104638.jpg Images: AERIAL.jpg Images: SITE-VIC.jpg Images: SITEPLAN.jpg
ATTACHED XREFS: XRef: Style A_08x11
L:\2008\08PROJ CAD FILE: L:\2008\08Projects\91148\GRAPHICS\PWGEO\ LAYOUT: SITEPLAN

# UNIFIED SOIL CLASSIFICATION SYSTEM

| MAJOR DIVISIONS | | LTR | ID | DESCRIPTION |
|---|---|---|---|---|
| COARSE GRAINED SOILS | GRAVEL AND GRAVELLY | GW | | Well-graded gravels or gravel with sand, little or no fines. |
| | | GP | | Poorly-graded gravels or gravel with sand, little or no fines |
| | | GM | | Silty gravels, silty gravel with sand mixture. |
| | | GC | | Clayey gravels, clayey gravel with sand mixture. |
| | SAND AND SANDY | SW | | Well-graded sands or gravelly sands, little or no fines. |
| | | SP | | Poorly-graded sands or gravelly sands, little or no fines. |
| | | SM | | Silty sand. |
| | | SC | | Clayey sand. |

| MAJOR DIVISIONS | | LTR | ID | DESCRIPTION |
|---|---|---|---|---|
| FINE GRAINED SOILS | SILTS AND CLAYS | ML | | Inorganic silts and very fine sands, rock flour or clayey silts with slight plasticity. |
| | | CL | | Inorganic lean clays of low to medium plasticity, gravelly clays, sandy clays, silty clays. |
| | | OL | | Organic silts and organic silt-clays of low plasticity. |
| | SILTS AND CLAYS | MH | | Inorganic elastic silts, micaceous or diatomaceous or silty soils. |
| | | CH | | Inorganic fat clays (high plasticity). |
| | | OH | | Organic clays of medium high to high plasticity. |
| HIGHLY ORGANIC SOILS | | Pt | | Peat and other highly organic soils. |

Standard Penetration Split Spoon Sampler 2.0 inch O.D., 1.4 inch I.D.

Modified California Sampler 2.5 inch O.D., 2.0 inch I.D.

Bulk Sample

California Sampler, 3.0 inch O.D., 2.5 inch I.D.

Shelby Tube 3.0 inch O.D.

▽ 0745, 5/31 Approximate water level first observed in boring. Time recorded in reference to a 24 hour clock.

▼ 0800, 5/31 Approximate water level observed in boring following drilling

| | |
|---|---|
| PEN | Pocket Penetrometer reading, in tsf |
| TV:Su | Torvane shear strength, in ksf |

| | | | |
|---|---|---|---|
| LL | LIQUID LIMIT | TX | TRIAXIAL SHEAR |
| PI | PLASTICITY INDEX | CONSOL | CONSOLIDATION |
| %-#200 | SIEVE ANALYSIS (#200 SCREEN) | R-Value | RESISTANCE VALUE |
| DS | DIRECT SHEAR | SE | SAND EQUIVALENT |
| C | COHESION (PSF) | EI | EXPANSION INDEX |
| PHI | FRICTION ANGLE | FS | FREE SWELL (U.S.B.R.) |

Notes: Blow counts represent the number of blows a 140-pound hammer falling 30 inches required to drive a sampler through the last 12 inches of an 18 inch penetration, unless otherwise noted.

The lines separating strata on the logs represent approximate boundaries only. The actual transition may be gradual. No warranty is provided as to the continuity of soil strata between borings. Logs represent the soil section observed at the boring location on the date of drilling only.

KLEINFELDER

PROJECT NO. **91148/PWGEO**

## BORING LOG LEGEND

SAN LEANDRO SENIOR / COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

*PLATE*

**A-1**

1/31/2008 7:25:33 AM

Date Completed: 1/18/08
Logged By: J. Walker
Total Depth: Approximately 35.0 ft

Drilling method: 8" Hollow Stem Auger
Hammer Wt: 140 lbs., 30" drop
Notes: Asphaltic-Concrete pavement

| Depth, ft | FIELD: Sample | FIELD: Blows/ft | LABORATORY: Dry Density pcf | LABORATORY: Moisture Content % | LABORATORY: Compress. Strength tsf | LABORATORY: Other Tests | Pen, tsf | DESCRIPTION (Surface Elevation: Estimated 47 feet (MSL)) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **ASPHALT**- approximately 3 inches thick |
| | | | | | | | | **AGGREGATE BASEROCK**- approximately 6 inches thick |
| | | | | | | | | **SANDY LEAN CLAY (CL)**- dark olive-brown, moist, firm, medium plasticity |
| 5 | | 19 | 108 | 19.1 | 3.17 @ 15.0% | | 3.0 | |
| 10 | | 11 | 102 | 22.3 | 1.57 @ 15.0% | | 2.5 | |
| 15 | | 13 | | | | | 2.3 | |
| | | | | | | | | **CLAYEY SAND with SILT (SC)**- brown, moist, loose to medium dense, fine grained sand, medium plasticity |
| 20 | | 13 | 104 | 14.7 | | Passing -#200=7% | | - grading to CLAYEY SAND (SC) at 19.5 feet |
| 25 | | 10 | | | | Passing -#200=68% | | **SANDY SILT (ML)**- yellowish-brown, moist, loose, oxide-stained |
| | | | | | | | | **POORLY GRADED SAND with CLAY and GRAVEL (SP-SC)** yellowish-brown, wet, medium dense |
| 30 | | 25 | | | | LL=41; PI=28 | | |

**KLEINFELDER**

PROJECT NO. 91148/PWGEO

## LOG OF BORING NO. B-1

SAN LEANDRO SENIOR / COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

PLATE A-2

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2/20/2008 9:45:42 AM

| Depth, ft | Sample | Blows/ft | Dry Density pcf | Moisture Content % | Compress. Strength tsf | Other Tests | Pen, tsf | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | *(Continued from previous plate)* |
| | | 13 | | | | Passing -#200=9% | | **POORLY GRADED SAND with CLAY and GRAVEL (SP-SG)** continued |
| 35 | | 9 | 99 | 26.1 | | | 0.8 | **LEAN CLAY with SILT (CL)**- red-brown, wet, firm, medium plasticity |
| | | | | | | | | Boring terminated at approximately 35 feet below ground surface. Boring backfilled with cement grout. |
| 40 | | | | | | | | |
| 45 | | | | | | | | |
| 50 | | | | | | | | |
| 55 | | | | | | | | |
| 60 | | | | | | | | |

KLEINFELDER

PROJECT NO. 91148/PWGEO

**LOG OF BORING NO. B-1**

SAN LEANDRO SENIOR / COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

PLATE

**A-2**
**(cont'd)**

| | | | |
|---|---|---|---|
| *Date Completed:* 1/18/08 | | *Drilling method:* 8" Hollow Stem Auger | |
| *Logged By:* J. Walker | | | |
| | | *Hammer Wt:* 140 lbs., 30" drop | |
| *Total Depth:* Approximately 50.0 ft | | *Notes:* Asphaltic-Concrete pavement | |

| Depth, ft | FIELD: Sample | FIELD: Blows/ft | LABORATORY: Dry Density pcf | LABORATORY: Moisture Content % | LABORATORY: Compress. Strength tsf | LABORATORY: Other Tests | Pen, tsf | DESCRIPTION (*Surface Elevation:* Estimated 47 feet (MSL)) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **ASPHALT**- approximately 3 inches thick |
| | | | | | | | | **AGGREGATE BASEROCK**- approximately 8 inches thick |
| | | | | | | | | **SANDY LEAN CLAY (CL)**- dark olive-brown, moist, hard, medium plasticity |
| 5 | | 26 | 110 | 18.0 | 4.71 @ 15.0% | LL=43; PI=29 | 4.0 | |
| | | | | | | | | **LEAN CLAY with SAND (CL)**- dark olive-brown, moist, firm, medium plasticity, root casts |
| 10 | | 18 | | | | LL=36; PI=21 | 3.5 | |
| 15 | | 13 | 103 | 22.3 | | | 2.5 | |
| | | | | | | | | **CLAYEY SAND (SC)**- brown, moist, loose to medium, dense fine grained |
| 20 | | 12 | | | | Passing #200=48% | | |
| | | | | | | | | **LEAN CLAY with SILT (CL)**- red-brown, moist, soft to firm, medium plasticity, oxide-stained |
| 25 | | 8 | 100 | 13.5 | | | 0.8 | |
| | | | | | | | | **SANDY LEAN CLAY with SILT (CL)** brown, moist, soft to firm, medium plasticity |
| 30 | | 9 | | | | | 0.8 | |

**KLEINFELDER**

*PROJECT NO.* 91148/PWGEO

## LOG OF BORING NO. B-2

SAN LEANDRO SENIOR / COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

*PLATE* **A-3**

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| Depth, ft | Sample | Blows/ft | Dry Density pcf | Moisture Content % | Compress. Strength tsf | Other Tests | Pen, tsf | DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | *(Continued from previous plate)* |
| | | | | | | | | **SANDY LEAN CLAY with SILT (CL)** continued, trace coarse sand |
| 35 | ■ | 11 | | | | | 1.0 | |
| 40 | ■ | 18 | | | | | 3.0 | - oxide stains<br>- at 39.5: sandy/lean clay |
| 45 | ■ | 37 | | | | | 4.0 | - hard |
| 50 | ■ | 13 | | | | | 1.0 | |
| | | | | | | | | Boring terminated at approximately 50 feet below ground surface.<br>No groundwater encountered during drilling.<br>Boring backfilled with cement grout. |
| 55 | | | | | | | | |
| 60 | | | | | | | | |

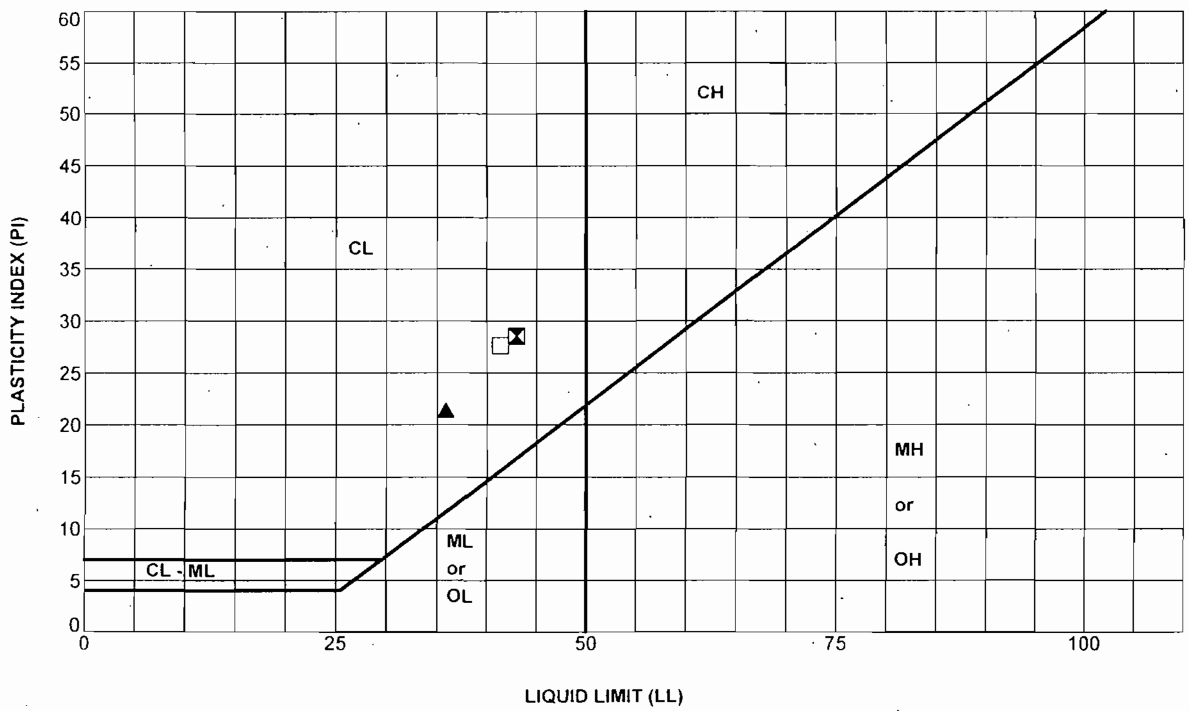
KLEINFELDER

PROJECT NO. 91148/PWGEO

**LOG OF BORING NO. B-2**

SAN LEANDRO SENIOR / COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

PLATE **A-3 (cont'd)**




| SYMBOL | BORING | DEPTH, ft | LL | PL | PI | SAMPLE DESCRIPTION |
|---|---|---|---|---|---|---|
| □ | B-1 | 29.0 | 41 | 14 | 27 | Yellowish Brown Poorly Graded Sand with Clay and Gravel (SP-SC) |
| ⊠ | B-2 | 4.0 | 43 | 14 | 29 | Dark Olive Brown Sandy Lean Clay (CL) |
| ▲ | B-2 | 9.0 | 36 | 15 | 21 | Dark Olive Brown Lean Clay with Sand (CL) |

## Unified Soil Classification

Fine Grained Soil Groups

| Symbol | LL < 50 | Symbol | LL > 50 |
|---|---|---|---|
| ML | Inorganic clayey silts to very fine sands of slight plasticity | MH | Inorganic silts and clayey silts of high plasticity |
| CL | Inorganic clays of low to medium plasticity | CH | Inorganic clays of high plasticity |
| OL | Organic silts and organic silty clays of low plasticity | OH | Organic clays of medium to high plasticity, organic silts |

*PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318 (DRY PREP)

KLEINFELDER

PROJECT NO. 91148/PWGEO

**ATTERBERG LIMITS***

SAN LEANDRO SENIOR / COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

PLATE

**B-1**

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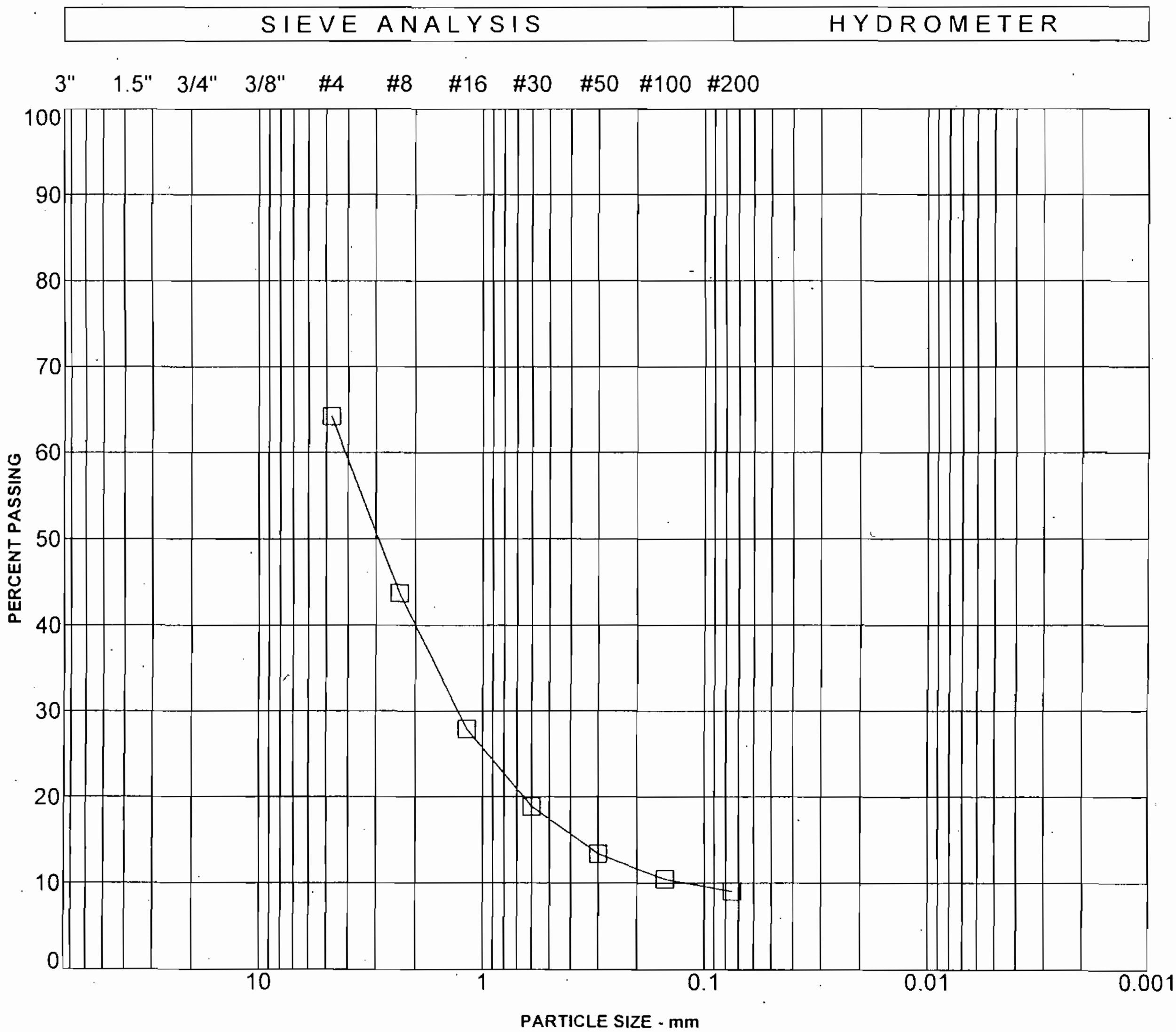


| GRAVEL | | SAND | | | SILT | CLAY |
|---|---|---|---|---|---|---|
| coarse | fine | coarse | medium | fine | | |

| SYMBOL | BORING | DEPTH, ft | SAMPLE DESCRIPTION |
|---|---|---|---|
| □ | B-1 | 29.0 | Yellowish Brown Poorly Graded Sand with Clay and Gravel (SP-SC) |

*PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

**KLEINFELDER**

*PROJECT NO. 91148/PWGEO*

**PARTICLE SIZE ANALYSIS***

SAN LEANDRO SENIOR / COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

*PLATE*

**B-2**

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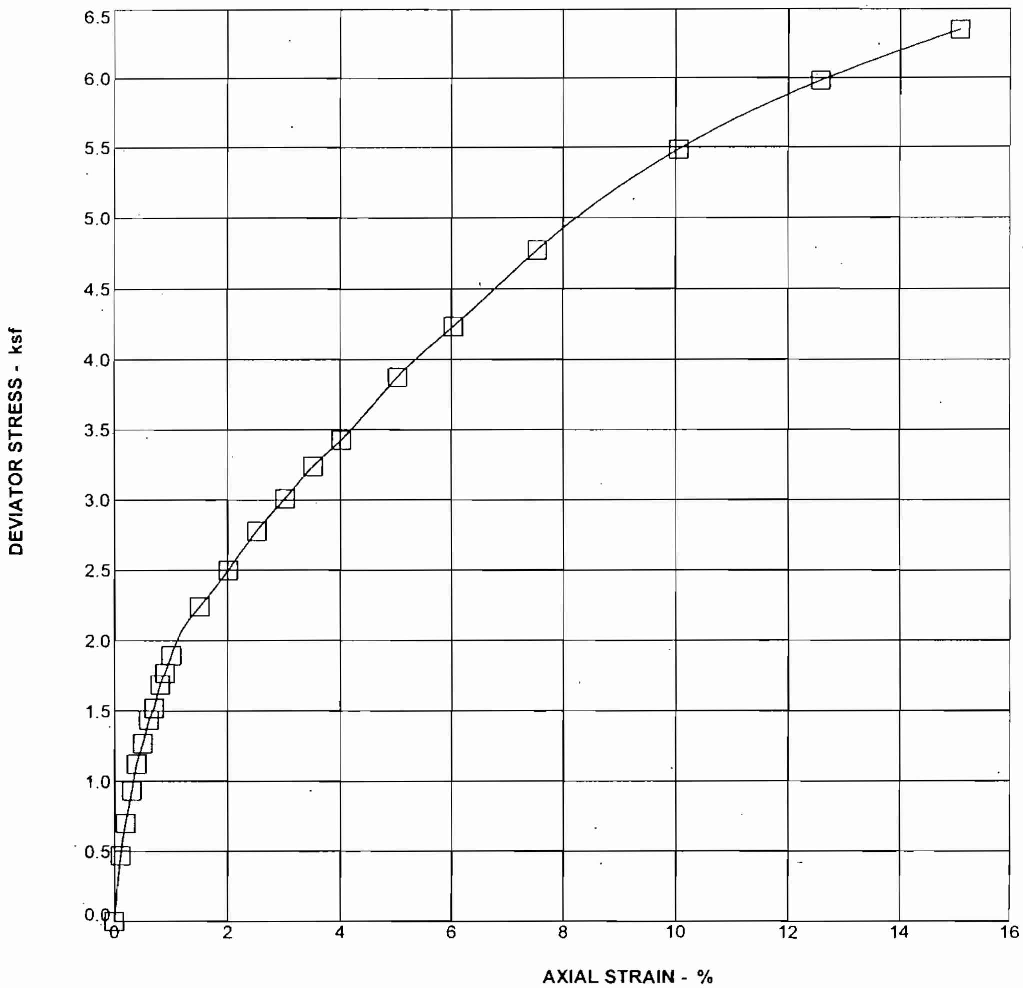


| | | | |
|---|---|---|---|
| **BORING NO.** | B-1 | **DRY DENSITY - pcf** | 108 |
| **DEPTH - ft** | 4.5 | **WATER CONTENT - %** | 19.1 |
| **SAMPLE DESCRIPTION** | Dark Yellowish Brown Sandy Lean Clay (CL) | | |
| **CONFINING STRESS - ksf** | 1.0 | | |

**MAXIMUM DEVIATOR STRESS= 6.34 ksf at 15.0 % STRAIN**

*PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2850

KLEINFELDER

*PROJECT NO.* *91148/PWGEO*

**UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION***

SAN LEANDRO SENIOR / COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

*PLATE*

**B-3**

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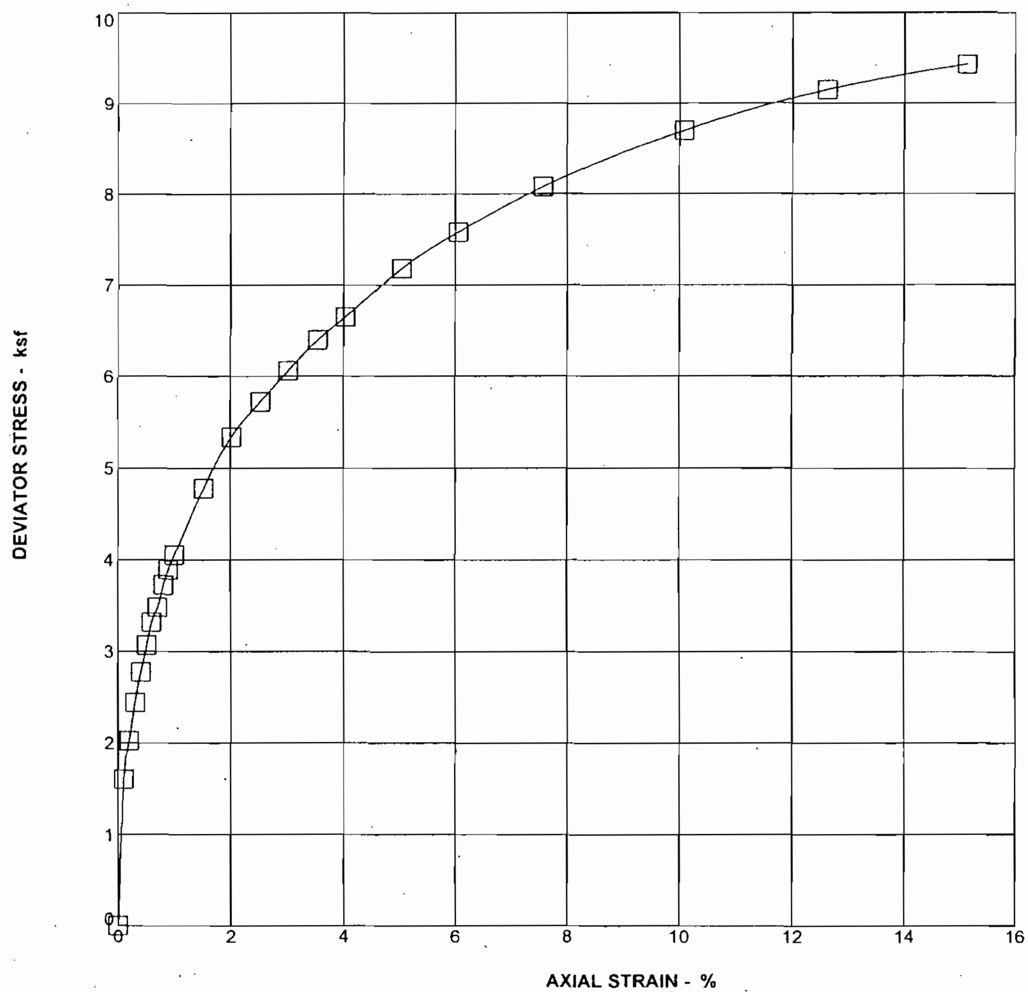


| | | | |
|---|---|---|---|
| **BORING NO.** | B-2 | **DRY DENSITY - pcf** | 110 |
| **DEPTH - ft** | 4.5 | **WATER CONTENT - %** | 18.0 |
| **SAMPLE DESCRIPTION** | Dark Olive Brown Sandy Lean Clay (CL) | | |
| **CONFINING STRESS - ksf** | 1.0 | | |

**MAXIMUM DEVIATOR STRESS= 9.41 ksf at 15.0 % STRAIN**

*PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2850

KLEINFELDER

*PROJECT NO.* *91148/PWGEO*

**UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION***

SAN LEANDRO SENIOR / COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

*PLATE*

**B-4**

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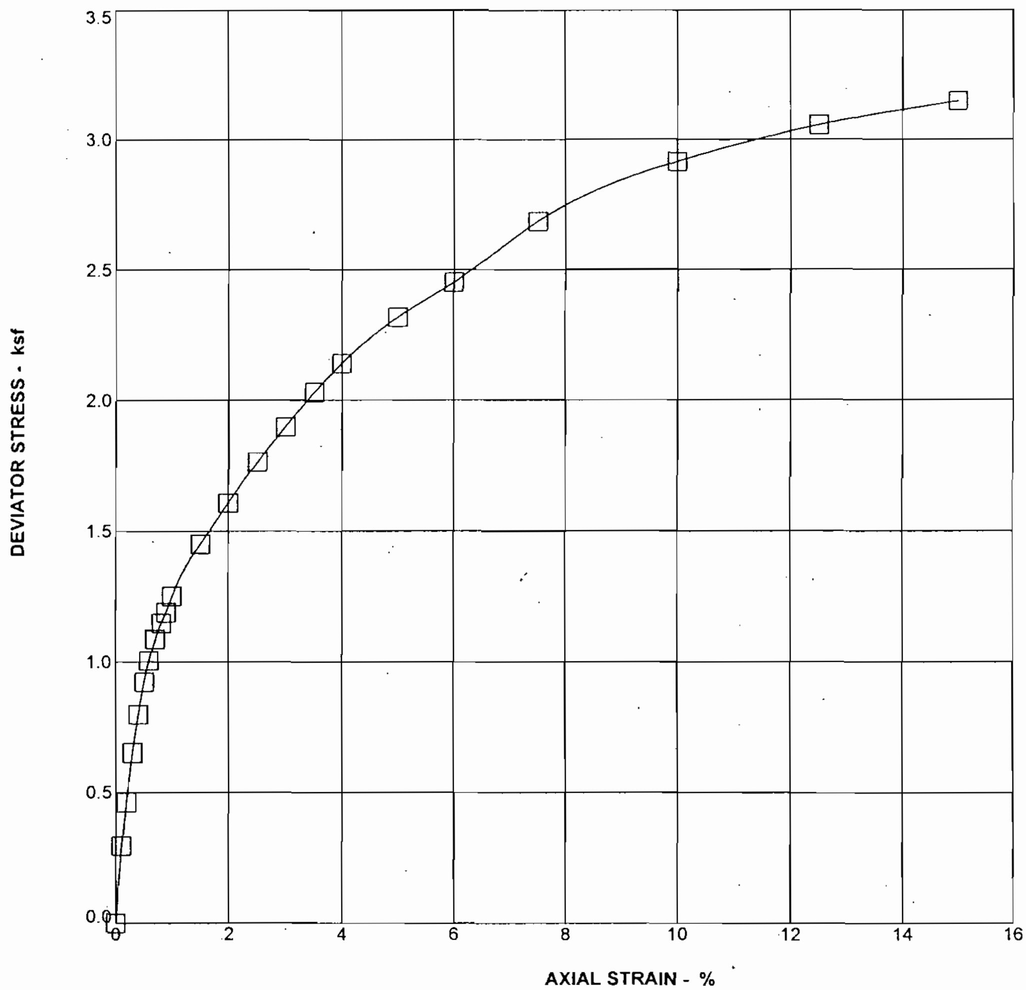


| | | | |
|---|---|---|---|
| **BORING NO.** | B-1 | **DRY DENSITY - pcf** | 102 |
| **DEPTH - ft** | 9.5 | **WATER CONTENT - %** | 22.3 |
| **SAMPLE DESCRIPTION** | Dark Yellowish Brown Sandy Lean Clay (CL) | | |
| **CONFINING STRESS - ksf** | 1.0 | | |

**MAXIMUM DEVIATOR STRESS= 3.15 ksf at 15.0 % STRAIN**

*PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2850

KLEINFELDER

*PROJECT NO.* *91148/PWGEO*

**UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION***

SAN LEANDRO SENIOR / COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

*PLATE*

**B-5**

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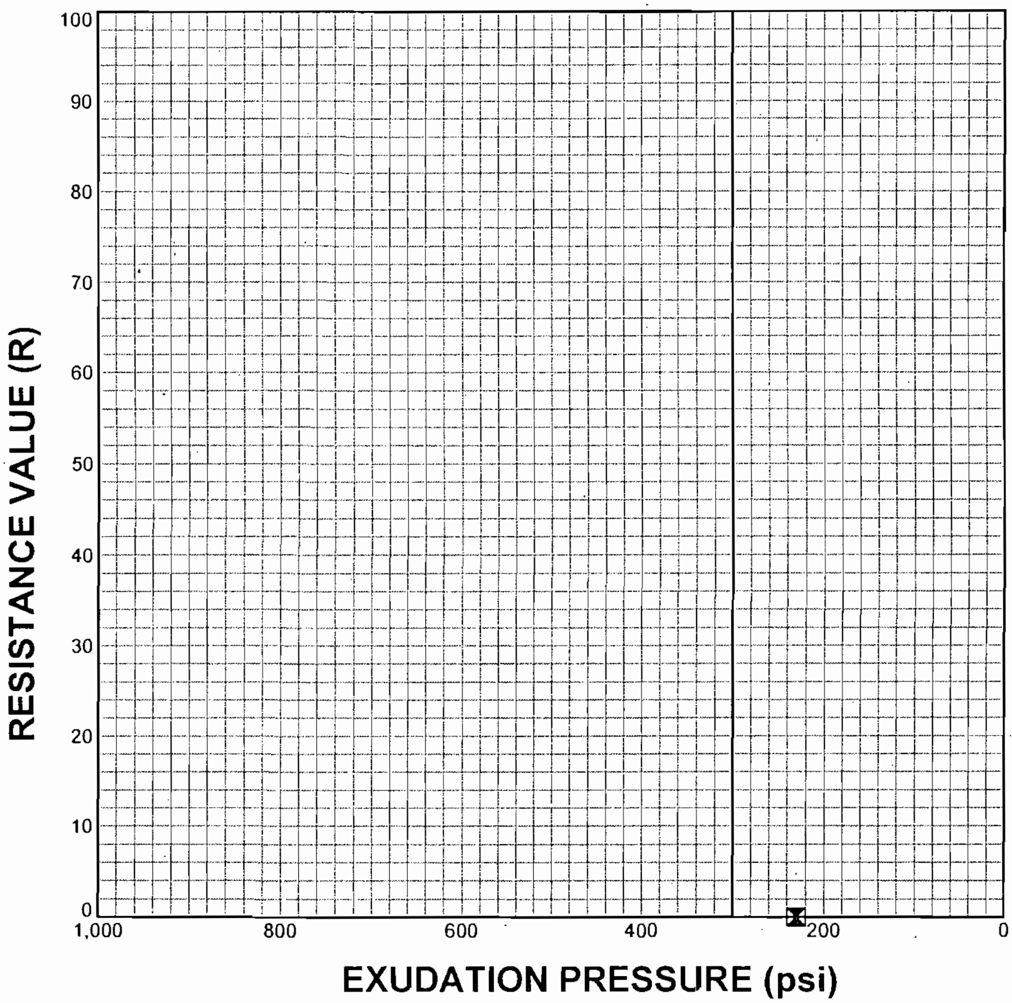



| SPECIMEN NO. | ☒ | | |
|---|---|---|---|
| MOISTURE CONTENT (%) | 19.8 | | |
| DRY DENSITY (PCF) | 106.8 | | |
| EXUDATION PRESSURE (PSI) | 230 | | |
| EXPANSION PRESSURE (PSF) | 35 | | |
| RESISTANCE VALUE (R) | 0 | | |

*Date Received: 1/24/2008*

| SAMPLE SOURCE | CLASSIFICATION | SAND EQUIVALENT | EXPANSION PRESSURE | R-VALUE |
|---|---|---|---|---|
| (PL11966) | Brown Clayey Silt w/Trace of Gravel | --- | --- | <5 |

**NOTE:** Boring No. B-1 Dpeth: 1' - 3.5'

**ASTM D 2844, Cal Test 301**

# RESISTANCE VALUE TEST DATA

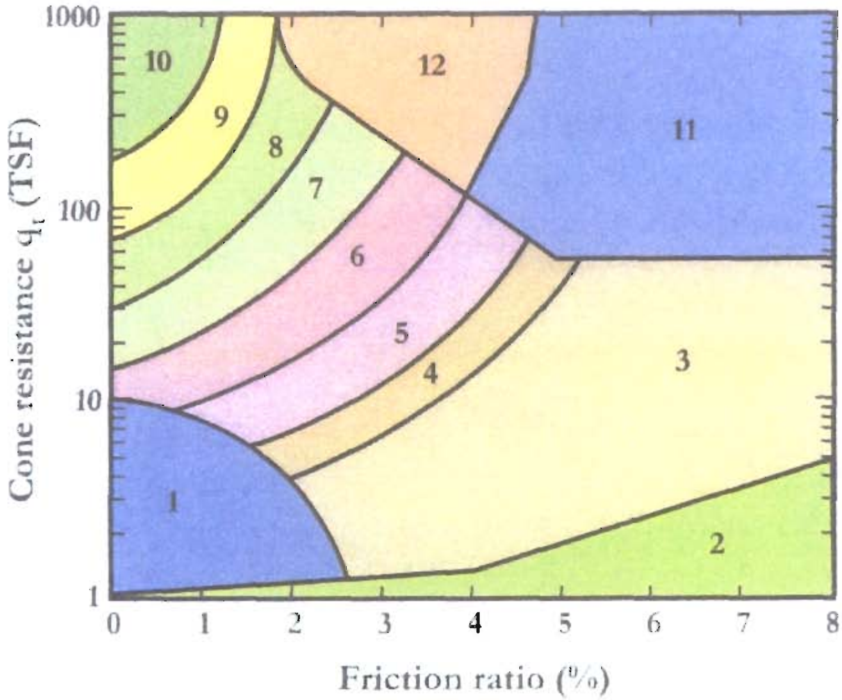
KLEINFELDER

*PROJECT NO.* 91148/PWGEO

SAN LEANDRO SENIOR / COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

*PLATE*

B-6




| Zone | Soil Behavior Type |
|---|---|
| 1 | sensitive fine grained |
| 2 | organic material |
| 3 | clay |
| 4 | silty clay to clay |
| 5 | clayey silt to silty clay |
| 6 | sandy silt to clayey silt |
| 7 | silty sand to sandy silt |
| 8 | sand to silty sand |
| 9 | sand |
| 10 | gravelly sand to sand |
| 11 | very stiff fine grained (overconsolidated or cemented) |
| 12 | sand to clayey sand (overconsolidated or cemented) |

Source: Robertson, P.K., Campanella, R.G., Gillespie, D., and Greig, J., 1986, Use of Piezometer Cone Data. Proceedings of the ASCE Specialty Conference In Situ 86: Use of In Situ Tests in Geotechnical Engineering.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

## Soil Behavior Type (SBT) Model

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

California Push Technologies Inc.
[illegible] Constitution Drive [illegible]
[illegible], CA [illegible]

office: [illegible]
fax: [illegible]

www.cptinc.com

**Cone penetration testing and soil sampling methods description.**

**Rig Description**

Our services are based on the state-of-the-art, Geoprobe Model 6625CPT rig, a limited-access, self-anchoring, 20-ton push capacity, track-mounted push platform for dedicated Geotechnical CPT applications with the unique and valuable added ability to quickly perform intermittent or continuous soil sampling.

Weight = ~ 9,500 pounds
Surface load = ~ 4.5 psi
Push capacity = ~ 20 tons; self-anchoring achieved using 10- or 15-inch diameter helical soil anchors driven 4- to 10-feet into the soil
Sampling hammer percussion rate = 32 Hz & 20,000 lbs force/blow
Length = ~ 12 feet; Width = ~ 7 feet
Height (folded) = 7 feet; Height (unfolded) = 14 feet

**CPT Description**

Our Geoprobe 6625CPT incorporates the Swedish-made Geotech AB Cone Penetration Testing tools which meet the ASTM D-5778 Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils. Cones have 10 $cm^2$ tips and 150 $cm^2$ friction sleeves, and include a porous filter and pressure sensor located in the $u_2$ position directly behind the cone. The cone and porous filter are saturated under vacuum with glycerin to promote rapid equilibration with in-situ pore pressures. Cones are advanced at the ASTM standard rate of 2 cm/second. Baseline readings are performed both before and after each push to determine temperature and load cell drift. The cone measures bearing (max load = 100 MPa ~ 1044 TSF), friction sleeve (max load = 1.0 MPa ~ 10.4 TSF), and dynamic pore pressure (max load = 2.5 MPa ~ 363 psi) at 2 cm intervals and this data is plotted in real-time and recorded on a laptop computer adjacent to the push platform. Holes are grouted upon completion of each push, or at the end of each day, as site conditions and regulations warrant.

**Sampling Description**

Geoprobe® brand Dual Tube Sampling Systems are efficient methods of collecting continuous soil cores with the added benefit of a cased hole. Dual tube sampling uses two sets of probe rods to collect continuous soil cores. One set of rods is driven into the ground as an outer casing. These rods receive the driving force from the hammer and provide a sealed hole from which soil samples may be recovered without the threat of cross contamination. The second, smaller set of rods are placed inside the outer casing. The smaller rods hold a sample liner in place as the outer casing is driven one sampling interval. The small rods are then retracted to retrieve the filled liner. Soil samples are collected in 1.85-inch diameter or 1.125-inch diameter clear PVC sample sheaths.

**Interpretations**
Soil behavior type (SBT), SPT N60 energy ratio, undrained shear strength, and unit weights are calculated and/or are interpretations generated by the CPT-Pro software based on algorithms presented in the following references;

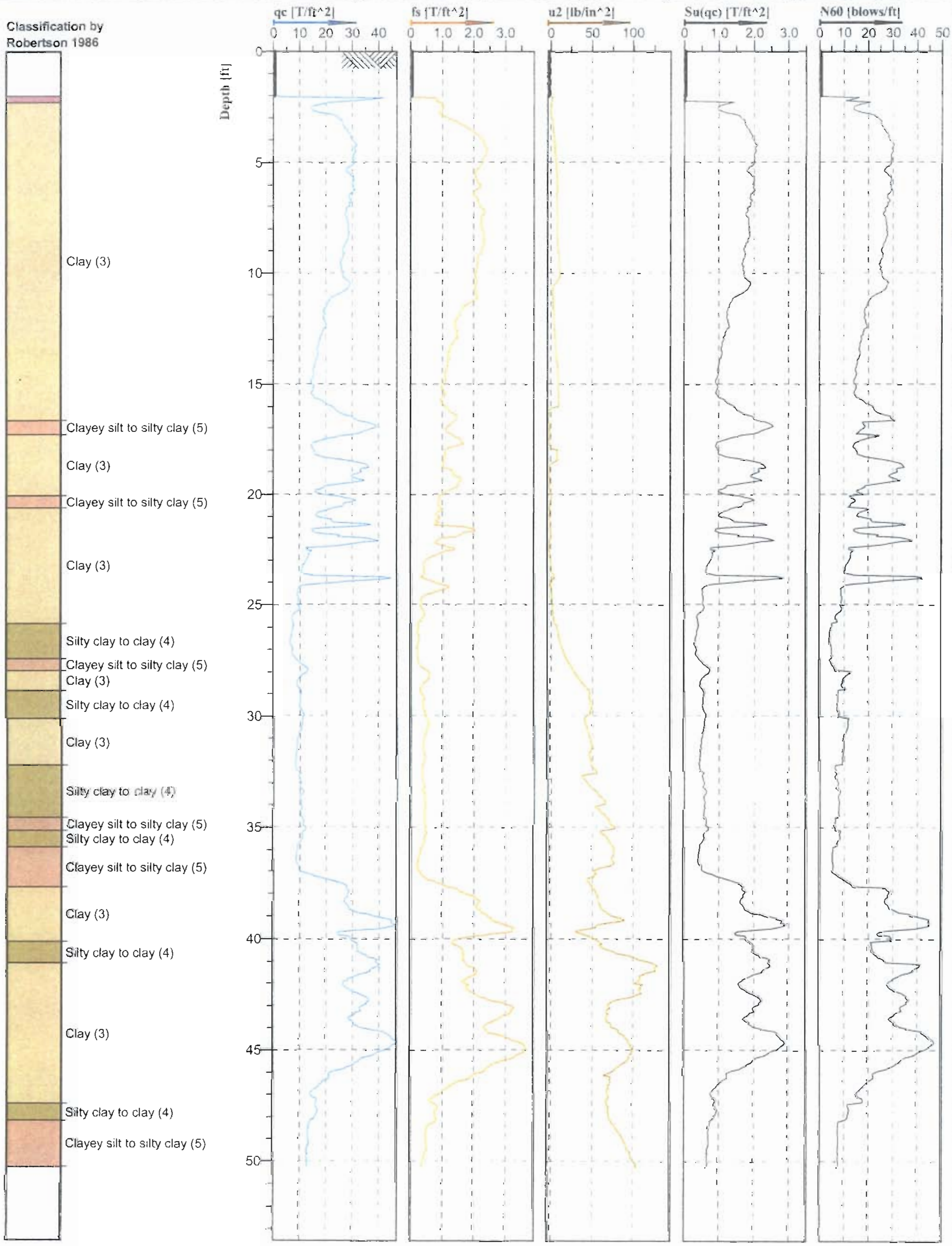
> P.K. Robertson, R.G. Campanella, D. Gillespie, and J. Greig, 1986, Use of Piezometer Cone Data, Proceedings of the ASCE Specialty Conference In Situ `86: Use of In Situ Tests in Geotechnical Engineering; pp. 1263-1280.
>
> P.K. Roberston, 1990, Soil Classification Using the Cone Penetration Test, Canadian Geotechnical Journal, 27(1), pp. 151-158.
>
> T. Lunne, P.K. Robertson, and J.J.M. Powell, 1997, Cone Penetration in Geotechnical Practice, Taylor and Francis Publishing.

CPT Inc. makes no recommendation on which soil behavior type analysis is "most-correct". The engineer should be aware of the limitations of using CPT data to derive soil behavior type and other engineering parameters and is encouraged to review the above references to better understand the applicability and limitations of CPT data. It is sometimes not possible to determine soil type based solely on tip resistance, sleeve friction, and excess pore pressure, and confirmatory samples may be required.

Please do not hesitate to contact CPT Inc. if you have questions.

Sincerely,
John Rogie

President
California Push Technologies, Inc.




CALIFORNIA PUSH TECHNOLOGIES

Cone No: 3794
Tip area [cm2]: 10
Sleeve area [cm2]: 150

| Location: San Leandro, California | Position: | Ground level: | Test no: CPT-1 |
|---|---|---|---|
| Project ID: 91148/PWHAZ | Client: Kleinfelder | Date: 1/16/2008 | Scale: 1 : 75 |
| Project: San Leandro Senior-Community Center | | Page: 1/1 | Fig: |
| | | File: CPT-1.cpd | |

*California State Certified Laboratory No.2153*

CERCO
analytical, inc.

*3942-A Valley Avenue*
*Pleasanton, CA 94566-4715*
*925.462.2771 • Fax: 925.462.2775*
*www.cercoanalytical.com*

31 January, 2008

Job No.0801206
Cust. No.10527

Mr. John Liao
Kleinfelder
7133 Koll Center Parkway
Pleasanton, CA 94566

Subject: Project No.: 91148
Project Name: San Leandro Senior/Community Center
Corrosivity Analysis – ASTM Test Methods

Dear Mr. Liao:

Pursuant to your request, CERCO Analytical has analyzed the soil samples submitted on January 24, 2008. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurements, both samples are classified as "corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentrations reflect none detected with a detection limit of 15 mg/kg.

The sulfate ion concentrations range from 61 to 70 mg/kg and are determined to be insufficient to damage reinforced concrete structures and cement mortar-coated steel at these locations.

The pH for both samples is 7.4 which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potentials range from 450 to 460-mV, which is indicative of aerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
**CERCO ANALYTICAL, INC.**

Cheryl McMillen for

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

*California State Certified Laboratory No.2153*

# CERCO analytical, inc.

*3942-A Valley Avenue*
*Pleasanton, CA 94566-4715*
*925.462.2771 • Fax: 925.462.2775*
*www.cercoanalytical.com*

Client: Kleinfelder
Client's Project No.: 91148
Client's Project Name: San Leandro Senior/Community Center
Date Sampled: Not Indicated
Date Received: 24-Jan-08
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 30-Jan-2008

| Job/Sample No. | Sample I.D. | Redox (mV) | pH | Conductivity (umhos/cm)* | Resistivity (100% Saturation) (ohms-cm) | Sulfide (mg/kg)* | Chloride (mg/kg)* | Sulfate (mg/kg)* |
|---|---|---|---|---|---|---|---|---|
| 0801206-001 | B-2, S2 @ 1-3.5' | 460 | 7.4 | - | 1,700 | N.D. | N.D. | 70 |
| 0801206-002 | B-1, S1 @ 1-3.5' | 450 | 7.4 | - | 2,000 | N.D. | N.D. | 61 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method: | ASTM D1498 | ASTM D4972 | ASTM D1125M | ASTM G57 | ASTM D4658M | ASTM D4327 | ASTM D4327 |
| Detection Limit: | - | - | 10 | - | 50 | 15 | 15 |
| Date Analyzed: | 24-Jan-2008 | 25-Jan-2008 | - | 24-Jan-2008 | 30-Jan-2008 | 25-Jan-2008 | 25-Jan-2008 |

* Results Reported on "As Received" Basis

N.D. - None Detected

Cheryl McMillen
Laboratory Director

**Quality Control Summary** - All laboratory quality control parameters were found to be within established limits

# UNIFIED SOIL CLASSIFICATION SYSTEM

| MAJOR DIVISIONS | | | SYM. | DESCRIPTION |
|---|---|---|---|---|
| COARSE-GRAINED SOILS<br>MORE THAN 50% OF MATERIAL IS GREATER THAN NO. 200 SIEVE | GRAVELS<br>MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | GRAVELS (LITTLE OR NO FINES) | GW | Well-graded gravels, gravel-sand mixtures, little or no fines |
| | | | GP | Poorly-graded gravels, gravel-sand mixtures, little or no fines |
| | | GRAVELS (APPRECIABLE FINES) | GM | Silty gravels, poorly-graded gravel-sand-silt mixtures |
| | | | GC | Clayey gravels, poorly-graded gravel-sand-clay mixtures |
| | SANDS<br>MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE | SANDS (LITTLE OR NO FINES) | SW | Well-graded sands, gravelly sands, little or no fines |
| | | | SP | Poorly-graded sands, gravelly sands, little or no fines |
| | | SANDS (APPRECIABLE FINES) | SM | Silty sands, poorly-graded sand-gravel-silt mixtures |
| | | | SC | Clayey sands, poorly-graded sand-gravel-clay mixtures |
| FINE-GRAINED SOILS<br>MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE | SILTS AND CLAYS<br>LIQUID LIMIT LESS THAN 50 | | ML | Inorganic silts and very fine sands, silty or clayey fine sands, clayey silts with slight plasticity |
| | | | CL | Inorganic clays of low-to-medium plasticity, gravelly clays, sandy clays, silty clays, lean clays |
| | | | OL | Organic silts and clays of low plasticity |
| | SILTS AND CLAYS<br>LIQUID LIMIT GREATER THAN 50 | | MH | Inorganic silts, micaceous or diatomaceous fine sands or silts |
| | | | CH | Inorganic clays of high plasticity, fat clays |
| | | | OH | Organic silts and clays of high plasticity |
| HIGHLY ORGANIC SOILS | | | PT | Peat, humus, swamp soils with high organic content |

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

# LOG SYMBOLS AND DEFINITIONS

| FIELD | LABORATORY | |
|---|---|---|
| STANDARD PENETRATION SPLIT-SPOON SAMPLER (2-INCH OUTSIDE DIAMETER) | -4 | % PASSING NO. 4 SIEVE (ASTM TEST METHOD C 136) |
| CALIFORNIA SAMPLER (3-INCH OUTSIDE DIAMETER) | -200 | % PASSING NO. 200 SIEVE (ASTM TEST METHOD C 117) |
| MODIFIED CALIFORNIA SAMPLER (2.5-INCH OUTSIDE DIAMETER) | LL | LIQUID LIMIT (ASTM TEST METHOD D 4318) |
| BAG/BULK | PI | PLASTICITY INDEX (ASTM TEST METHOD D 4318) |
| THIN-WALLED SHELBY TUBE (3-INCH OUTSIDE DIAMETER) | R-VAL | RESISTANCE VALUE (CALTRANS TEST 301) |
| WATER LEVEL (LEVEL ESTABLISHED AS NOTED ON LOGS) | EI | EXPANSION INDEX (UBC STANDARD 29-2) |
| WATER OR SEEPAGE ENCOUNTERED (LEVEL NOT ESTABLISHED) | COL | COLLAPSE POTENTIAL (ASTM TEST METHOD D 5333) |
| | SP | SWELL POTENTIAL (under a specified load) (ASTM TEST METHOD D 4546) |
| | SL | SWELL PRESSURE (no consolidation) (ASTM TEST METHOD D 4546) |

GENERAL NOTES:

1. Lines separating soil or rock strata on logs are approximate boundaries only. Actual transitions may be gradual and, in the case of selectively sampled borings, may vary by as much as the sample interval.
2. In general, Unified Soil Classification designations were evaluated using visual methods only. Actual designations (based on laboratory tests) may vary.
3. Logs represent general soil conditions on the date and at the location indicated. No warranty is provided as to the continuity of soil conditions between individual sample locations.
4. Unconfined compressive strengths reported on the logs (if any) were obtained using a pocket penetrometer.

LOG LEGEND
PROPOSED SENIOR/COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

PLATE 3

BMI PROJECT NO. ▶ 06S-270

| EXPLORATION DATE | LOGGED BY | TOTAL DEPTH | BORING NO. |
|---|---|---|---|
| October 12, 2006 | Peter Schurman | 41-1/2 feet | B-1 |
| EXPLORATION EQUIPMENT | | BACKFILL MATERIAL | |
| CME 45B equipped with a 6-inch-diameter, hollow-stem auger | | Drill cuttings | |

**SURFACE CONDITIONS:** Asphalt concrete pavement (about 4 inches of asphalt concrete underlain by about 5 inches of aggregate base)

**GROUNDWATER CONDITIONS:** Free groundwater encountered at a depth of approximately 31 feet below existing site grade.

**APPROX. GROUND SURFACE ELEVATION (IN FEET):** N/A

| FIELD: DEPTH (IN FEET) | SAMPLE TYPE | SAMPLE NO. | BLOWS/FOOT | UNCONFINED COMP. STRENGTH (TSF) | USCS LETTER SYMBOL | DESCRIPTION | LABORATORY: DRY DENSITY (PCF) | MOISTURE CONTENT (%) | OTHER LAB TESTS SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ASPHALT CONCRETE PAVEMENT | | | |
| | | | | | CL | *Silty CLAY/Sandy CLAY:* Brown to yellow-brown, moist, very stiff, weakly cemented, fine grained | | | |
| 5 | | 1 | 8 | 3.5 | | | | | |
| 10 | | 2 | 5 | 3.0 | | | | | |
| | | | | | CL | *Silty CLAY:* Gray-brown, moist, very stiff, with some fine sand | | | |
| 15 | | 3 | 6 | 3.0 | | | | | |
| | | | | | SM/ML | *Silty SAND/Sandy SILT:* Yellow-brown, moist, medium dense, weakly cemented, fine grained, with some clay | | | |
| 20 | | 4 | 12 | | | | | | |

Log continued on next page

LOG OF EXPLORATORY BORING
PROPOSED SENIOR/COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

PLATE 4A

BMI PROJECT NO. 06S-270

| EXPLORATION DATE | LOGGED BY | TOTAL DEPTH | BORING NO. |
|---|---|---|---|
| October 12, 2006 | Peter Schurman | 41-1/2 feet | B-1 |
| EXPLORATION EQUIPMENT: CME 45B equipped with a 6-inch-diameter, hollow-stem auger | | BACKFILL MATERIAL: Drill cuttings | |

| FIELD | | | | | | DESCRIPTION | LABORATORY | | |
|---|---|---|---|---|---|---|---|---|---|
| DEPTH (IN FEET) | SAMPLE TYPE | SAMPLE NO. | BLOWS/FOOT | UNCONFINED COMP. STRENGTH (TSF) | USCS LETTER SYMBOL | Continuation from previous page | DRY DENSITY (PCF) | MOISTURE CONTENT (%) | OTHER LAB TESTS SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS |
| | | 4 | 12 | | SM/ML | *Silty SAND/Sandy SILT:* Yellow-brown, moist, medium dense, weakly cemented, fine grained, with some clay | | | |
| 25 | | 5 | 4 | 1.0 | CL | *Silty CLAY:* Yellow-brown, moist-to-wet, medium-stiff-to-stiff, with some fine sand | | | |
| 30 | | 6 | 20 | | SC | *Clayey SAND:* Brown, wet, medium dense, fine-to-coarse grained, with some silt and trace fine gravel ▽ | | | |
| 35 | | 7 | 6 | 1.5 | CL | *Silty CLAY:* Yellow-brown, moist, stiff, with some fine sand | | | |
| 40 | | 8 | 12 | 3.5 | | grades very stiff | | | |

BMI

BMI PROJECT NO. ▶ 06S-270

LOG OF EXPLORATORY BORING
PROPOSED SENIOR/COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

PLATE 4B

| EXPLORATION DATE | LOGGED BY | TOTAL DEPTH | BORING NO. |
|---|---|---|---|
| October 12, 2006 | Peter Schurman | 16-1/2 feet | B-2 |
| EXPLORATION EQUIPMENT | | BACKFILL MATERIAL | |
| CME 45B equipped with a 6-inch-diameter, hollow-stem auger | | Drill cuttings | |

SURFACE CONDITIONS: Asphalt concrete pavement (about 4 inches of asphalt concrete underlain by about 8 inches of aggregate base)

GROUNDWATER CONDITIONS: No free groundwater encountered

APPROX. GROUND SURFACE ELEVATION (IN FEET): N/A

| DEPTH (IN FEET) | SAMPLE TYPE | SAMPLE NO. | BLOWS/FOOT | UNCONFINED COMP. STRENGTH (TSF) | USCS LETTER SYMBOL | DESCRIPTION | DRY DENSITY (PCF) | MOISTURE CONTENT (%) | OTHER LAB TESTS (SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ASPHALT CONCRETE PAVEMENT | | | |
| | | 1 | | | CL | *Silty CLAY/Sandy CLAY:* Brown to yellow-brown, moist, very stiff, weakly cemented, fine grained | | | -200=81% LL=36 PI=18 R-VAL=8 pH=7.2 REST=1800 ohm-cm CL=55 ppm SO4=44 ppm |
| 5 | | 2 | 5 | 3.0 | | | | | |
| 10 | | 3 | 6 | 3.0 | | | | | |
| | | | | | CL | *Silty CLAY:* Gray-brown, moist, very stiff, with some fine sand | | | |
| 15 | | 4 | 9 | 3.5 | | | | | |
| 20 | | | | | | | | | |

BMI

BMI PROJECT NO. 06S-270

LOG OF EXPLORATORY BORING
PROPOSED SENIOR/COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

PLATE 5

| EXPLORATION DATE | LOGGED BY | TOTAL DEPTH | BORING NO. |
|---|---|---|---|
| October 12, 2006 | Peter Schurman | 16-1/2 feet | B-3 |
| EXPLORATION EQUIPMENT | | BACKFILL MATERIAL | |
| CME 45B equipped with a 6-inch-diameter, hollow-stem auger | | Drill cuttings | |

SURFACE CONDITIONS: Asphalt concrete pavement (about 4 inches of asphalt concrete underlain by about 8 inches of aggregate base)

GROUNDWATER CONDITIONS: No free groundwater encountered

APPROX. GROUND SURFACE ELEVATION (IN FEET): N/A

| DEPTH (IN FEET) | SAMPLE TYPE | SAMPLE NO. | BLOWS/FOOT | UNCONFINED COMP. STRENGTH (TSF) | USCS LETTER SYMBOL | DESCRIPTION | DRY DENSITY (PCF) | MOISTURE CONTENT (%) | OTHER LAB TESTS SEE LOG LEGEND FOR ABBREVIATION DEFINITIONS |
|---|---|---|---|---|---|---|---|---|---|
| 0–1 | | | | | | *ASPHALT CONCRETE PAVEMENT* | | | |
| | | | | | CL | *Silty CLAY/Sandy CLAY:* Brown to yellow-brown, moist, very stiff, weakly cemented, fine grained | | | |
| 5 | ▼ | 1 | 5 | 2.0 | | | | | |
| | | | | | CL | *Silty CLAY:* Gray-brown, moist, stiff, with some fine sand | | | |
| 10 | ▼ | 2 | 8 | 1.5 | | | | | pH=7.5 REST=1580 ohm-cm CL=31 ppm SO4=73 ppm |
| 15 | ▼ | 3 | 9 | 1.5 | | | | | |
| 20 | | | | | | | | | |

BMI PROJECT NO. 06S-270

LOG OF EXPLORATORY BORING
PROPOSED SENIOR/COMMUNITY CENTER
EAST 14TH STREET
SAN LEANDRO, CALIFORNIA

PLATE 6