Korbmacher Engineering, Inc.
Geotechnical Environmental Material Testing Special Inspection
480 Preston Court, Suite B, Livermore, CA 94551, PO Box 405, Livermore, CA 94551 925.454.9033

16 January 2019

Mr. Dave Mordick
Robinson Oil Corporation
955 Martin Avenue
Santa Clara, California 95050

Subject:

GEOTECHNICAL STUDY
Rotten Robbie #11
2305 Story Road
San Jose, California
Project No. 18126

Dear Mr. Mordick:

Korbmacher Engineering, Inc. has completed the geotechnical study for the proposed project to be located in the City of San Jose, California. The results of the study are attached, including the plot plan, laboratory test results, boring logs, and geotechnical recommendations.

We appreciate being of service to you in the geotechnical study phase of this project. If design conditions change, or if you have questions concerning this report or any of our testing, design and consulting services, please do not hesitate to contact us. We look forward to working with you on future projects.

Respectfully submitted,
KORBMACHER ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER BRUNO KORBMACHER C 045888 EXP. 12/31/20 CIVIL STATE OF CALIFORNIA

Bruno Korbmacher, PE

Copies: Addressee (email)

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Appendix A - Corrosivity Analysis

1.0 INTRODUCTION

This report presents the results of a geotechnical study performed at the subject site for the proposed convenience store. The project is located at 2305 Story Road in San Jose, California, as shown on the Vicinity Map, Figure 1.

1.1 Purpose

The purpose of this study was to evaluate the soil and geologic characteristics relevant to the design of the proposed development. General soil and foundation engineering design and recommendations are provided based on the physical characteristics of the subsurface materials and the geotechnical limitations created by the site's surface features.

1.2 Proposed Project Development

We understand the proposed project will consist of constructing a new convenience store at the subject site. The proposed convenience store will be located in the vacant lot immediately west of the existing fuel center. Maximum structural wall loads are anticipated to be about 2,000 pounds per lineal foot. Site grading is anticipated to be minimal for preparation of the building pad.

Please contact our office if the conditions of the project change. We may need to revise our recommendations if changes occur in the project's configuration, the type of construction, or the proposed loads.

1.3 Scope of Services

The scope of work for the proposed development included the following:

- Reviewing project documents provided by the client,
- Exploring the subsurface soil conditions with two exploratory borings,
- Sampling and performing laboratory testing of soil obtained from the borings,
- Analyzing the soil data compiled during the exploration, and
- Reporting our findings and providing recommendations for site development.

This study does not include an environmental assessment or investigation for the presence or absence of hazardous or toxic material in structures, soil, surface water, groundwater, or air on, below or around the project site.

2.0 SITE EXPLORATION AND LABORATORY TESTING

2.1 Site Exploration

The subsurface conditions of the site were explored on 4 December 2018. The exploration consisted of drilling two exploratory boring to approximately 50 feet and 20 feet below the existing site grade. The boring locations drilled at the project site are shown in Figures 2 and 3, Boring Location Map and Boring Site Map. The borings were drilled using a truck-mounted, CME 45 drilling rig.

Soils encountered during drilling were logged and samples were obtained to aid in material classification and for laboratory testing. Soil samples were recovered in either a 3-inch or 2.5-inch outside diameter (OD) California sampler or a Standard Penetration Sampler driven by a 140-pound hammer free-falling 30 inches. The number of blows applied to advance the sampler was recorded for each 6 inches of penetration. Blow counts from the bottom 12 inches of penetration were recorded on the logs as blows per foot and recorded on the boring log.

Figure 4, Boring Log Legend, illustrates the Unified Soil Classification System which was used to identify subsurface soil during drilling. The log describing the material encountered in the boring was recorded in the field by our representative and is shown on Figures 5 through 7.

2.2 Laboratory Testing

Laboratory testing was conducted on selected samples to obtain data on density, moisture content, and classification of the soil. Test results are shown on the Boring Logs.

Atterberg limits testing was performed on samples of the surface soil. The tests were performed according to American Society for Testing and Materials (ASTM) test methods and procedures. The test results indicate moderate to high expansion potential for the near surface soils. The test results are shown on the Boring Logs and in Figure 8, Plasticity Chart.

A moisture/density relationship curve (compaction curve) was performed on a representative a bulk sample of the probable subgrade soils. The compaction test was performed according to ASTM D-1557 test methods and procedures. The test results are shown in Figure 9, Moisture/Density Relationship.

Corrosivity Analysis was performed on a sample of the near surface soil. The tests were performed according to American Society for Testing and Materials (ASTM) test methods and procedures. The test results indicate the soil is “corrosive” to buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron base on resistivity measurements. Furthermore, the redox test results indicated a potentially "slightly corrosive" soils resulting from anaerobic soil conditions. The test results and brief evaluation is presented in Appendix A - Corrosivity Analysis.

A resistance value (R-Value) test was performed on a representative a bulk sample of the probable pavement subgrade soils. The R-Value test was performed according to California Department of Transportation (Caltrans) test methods. The test results indicate an R-Value of 12 as shown in Figure 10, R-Value Test Results.

3.0 SUBSURFACE CONDITIONS

3.1 Surface

At the time of our field exploration, the subject site consists of a fenced vacant lot with seasonal vegetation adjacent to an existing fuel station, as shown in Figure 2, Boring Location Map and as shown in Figure 11, Photographs of Project Site. The existing site development includes a convenience store, canopy, fuel pumps and underground storage tanks. The entire property is approximately 150 feet square and is bounded by Story Road to the southeast, South Jackson Avenue to the southwest, and residential property to the northwest and northeast. The existing fuel station is paved and drains toward the streets. The new convenience store will be located in the open lot northwest of the existing fuel station. The lot is approximately 120 feet long and 40 feet wide.

3.2 Subsurface

We did not observe any material that were obvious fill materials. There may be fill in areas beyond and between our exploratory borings.

In general, the native soils consisted of soft to very stiff silty clay. Laboratory testing indicates that the near-surface soils have a to high expansion potential.

Groundwater was initially encountered at a depth of approximately 25 feet below existing grade in borings at the time of drilling. Groundwater was measured at a depth of 18 feet below existing grade prior to backfilling the borings. We expect groundwater levels to fluctuate due to variations in rainfall, groundwater recharge, and site conditions.

4.0 SEISMIC/GEOLOGIC CONSIDERATIONS

4.1 Seismic

Geologic references indicate that no fault trace designated active or potentially active passes through the subject property. Table 1 lists the approximate distance and the maximum magnitude for local faults. To determine these values, provided to solely illustrate the distance between the subject faults and the subject site, we used the

USGS website, 2008 National Seismic Hazard Maps - Source Parameters. Seismic design criteria is discussed in a later section (Section 6.2.2) of this report.

Table 1
ACTIVE FAULTS AND CHARACTERISTICS

Fault	Distance (mi)	M_w
Calaveras; CN+CC+CS	5.18	7.03
Hayward-Rogers Creek; RC+HN+HS	7.42	7.33
Monte Vista-Shannon	9.29	6.50
Northern San Andreas; SAO+SAN+SAP+SAS	14.95	7.94

4.2 Geotechnical Hazards

Risk of geotechnical hazards will always exist due to uncertainties of geologic conditions and the unpredictability of seismic activity in the area. However, in our opinion, based on available data, there are no indications of geotechnical hazards that would preclude use of the site for the proposed development. The proposed structures should be designed to meet current *Uniform Building Code* (UBC)*/California Building Code* (CBC) requirements to limit potential damage from ground shaking.

4.2.1 Liquefaction

Liquefaction is a phenomenon in which granular material is transformed from a solid state to a liquefied state as a consequence of increased pore-water pressure and reduced effective stress. Increased pore-water pressure is induced by the tendency of granular materials to densify when subjected to cyclic shear stresses associated with earthquakes. This change of state occurs most readily in loose, saturated, cohesionless materials.

A review of the referenced Earthquake Zones of Required Investigation map prepared by the California Geologic Survey indicates that the subject site is in an area requiring a liquefaction investigation according to Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California of the California Division of Mines and Geology (CDMG).

4.2.1.1 Screening Investigation

Special Publication 117A recommends the following screening criteria to determine if further quantitative evaluation of liquefaction hazard potential is required:

- If it can be demonstrated that any potentially liquefiable materials present at the site: (a) are currently unsaturated, (b) have not previously been saturated (e.g., are above the historic-high water table), and are highly unlikely to become saturated, then such soils generally do not constitute a liquefaction hazard.

- If soil densities are sufficiently high to preclude liquefaction based on direct in-situ relative density measurements, such as standard penetration test blow counts.

As stated in Special Publication 117A, cohesive soils are generally not considered susceptible to soil liquefaction. Although soils having a plasticity index greater than 7 are generally expected to behave like clays, the referenced study by Bray and Sancio, *Assessment of the Liquefaction Susceptibility of Fine-Grained Soils*, found that some fine-grained soils may be susceptible to liquefaction or seismically induced deformation. According to the study, fine-grained soils considered potentially susceptible to liquefaction or seismically induced deformation are as follows:

- Low plasticity (PI$<$12) fine-grained soils at w_c/LL $>$0.85.
- Moderate plasticity (12$<$PI$<$18) fine-grained soils at w_c/LL $>$0.80.
- Sensitive soils with a PI $>$18.

Atterberg Limits were performed for the selected fine-grained soils encountered at the site to evaluate the liquefaction potential. Based on the test results and the Bray and Sancio criteria, it is our opinion that there is a potential for liquefaction or seismically induced deformation in the site fine-grained soils.

Grain-size analysis testing was performed on selected samples to determine the clay content of the site soils. Results of the testing are shown on the boring logs.

The depth to historically high groundwater was estimated to be approximately 9 feet according to Plate 1.2 of the referenced Seismic Hazard Zone Report. Soils below the historically high groundwater were evaluated for liquefaction potential.

Based on our screening investigation, the soils encountered at the site may be considered non-liquefiable clayey soils except for the silty clay layer encountered at a depth of approximately 10 feet below existing grade. Therefore, a quantitative analysis is required to evaluate the liquefaction potential of these layers.

4.2.1.2 Liquefaction Analysis

The subject site's liquefaction potential was evaluated using the LiquefyPro computer program by Civiltech Engineering. This program determines the factor of safety against liquefaction and calculates the associated settlement of the soil deposits. The analysis is based on Seed's simplified method (1971), which gives a Cyclic Stress Ratio (CSR, earthquake "load") that is compared with the Cyclic Resistance Ratio (CRR, soil "strength") of the soil. The CRR calculation is based on the input data from common in-situ tests such as SPT and CPT. The program estimates the earthquake induced settlements using the results from the liquefaction evaluation.

Input for the evaluation included a maximum moment magnitude of 6.4 based on the USGS Interactive Deaggregation program and an estimated peak horizontal ground acceleration (PHGA) of 0.517g based on the USGS, Seismic Design Maps Tool. The site provides peak ground accelerations that have a 10 percent probability of being exceeded in 50 years based on probabilistic seismic hazard maps.

As discussed earlier, the depth to historically high groundwater was estimated to be approximately 9 feet according to Plate 1.2 of the referenced Seismic Hazard Zone Report. Soils below the historically high groundwater were evaluated for liquefaction potential.

4.2.1.3 Surface Manifestations

Studies have shown that the presence of a non-liquefiable surface layer may prevent the observable effects of an at-depth liquefaction from reaching the surface. Ishihara (1985) developed an empirical relation which provides approximate boundaries for liquefaction-induced surface damage for soil profiles consisting of a liquefiable layer overlain by a resistant surface layer, based on data from case studies in Japan and China. According to his work, there was no evidence of liquefaction where there was an overlying, non-liquefiable surface layer with a thickness greater than 3 meters over a stratum of loose sand with blow counts less than 10. If the thickness of the underlying liquefiable stratum was less than 3 meters, an even thinner surface layer apparently prevented the observable effects of liquefaction from reaching the surface.

Youd and Garris (1995) conducted a study to evaluate and verify Ishihara's criteria. They tested Ishihara's conclusions using data taken from a wider range of earthquake magnitudes and site conditions than those considered by Ishihara. The study validated Ishihara's previous work for level ground sites where lateral spreading was not observed.

4.2.1.4 Liquefaction Results and Conclusions

Results of the analysis indicate that there is potentially liquefiable layer below the site under the assumed conditions. Based on the analysis, the total settlement due to liquefaction is estimated to be about 0.25 inches. The zone was encountered at approximately 10 feet below existing grade and had a thickness of approximately 15 feet as shown on Figure 12, Liquefaction Results. As indicated on Figure 12, surface manifestations would not be expected for a 5-foot-thick liquefiable layer overlain by a minimum of approximately 10 feet of non-liquefiable material. Therefore, it is our opinion that there is a low potential for surface manifestations due to soil liquefaction at the site. Also, no mitigation measures are warranted.

Special Publication 117A states that it is very difficult to reliably estimate the amount of localized differential settlement likely to occur as part of the overall settlement. Special Publication 117A recommends "localized differential settlements on the order of up to two-thirds of the total settlement should be assumed." Therefore, it is our opinion the total and differential settlements due to liquefaction shall be less than 1 inch.

4.2.2 Lateral Spreading

Lateral spreading/lurching is a situation in which soil mass deforms laterally toward a free face, such as a stream bank, during a seismic event. The failure occurs along a liquefiable/weak subsurface layer. It is our opinion that the potential for lateral spreading/lurching at the site is low.

4.2.3 Flooding

Based on our review of the referenced FEMA Flood Insurance Map, the site appears to be located in Zone AO as indicating "Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet". The Project Civil Engineer should evaluate the site for flooding potential.

5.0 DISCUSSIONS

5.1 General

The recommendations contained in this report are based on the assumption that the soil conditions encountered during construction are similar to those disclosed by our exploration. If variations are noted during construction, Korbmacher Engineering, Inc. should be notified so that we can supplement our recommendations, as applicable.

Final grading plans were not available at the time of preparing this report. We recommend the final grading plans be reviewed by our office prior to starting the earthwork operations.

Our primary concern is the laboratory test results indicate the near surface soils have a moderate to high expansion potential and could be subject to movements with increased moisture content. Another concern is the potential for settlement due to liquefaction from a potential seismic event.

These surface soils are not the best material for support of foundations, building floor slabs, trash enclosure, and exterior flatwork/sidewalks in their present state. To help reduce the potential for heaving clayey soils and settlement, and the potential for settlement in the event of seismic occurrence, the on-site soils should be over-excavated, moisture-conditioned, and recompacted in the foundation areas as recommended in the earthwork section of this report. In addition, we recommend placing imported Class II material beneath concrete slabs-on-grade for the building pad and trash enclosure areas.

Provided the earthwork recommendations are followed, it is our opinion that the proposed convenience store and trash enclosure may be supported on a conventional foundation system established on compacted, engineered fill.

Proper drainage must be provided to prevent moisture from penetrating beneath foundations, concrete slabs-on-grade, and pavements. If moisture penetrates the soils beneath these areas, there could be some movement and resulting cracking/distress. Recommendations to help reduce the movement of the foundations and concrete slab-on-grade floors/flatwork are discussed in later sections of this report.

6.0 RECOMMENDATIONS

6.1 Earthwork

6.1.1 General

As previously stated, final grading plans were not available during preparation of this report. We recommend that final grading plans be reviewed by our office prior to starting the grading operations.

We recommend the foundation subgrade soils be over-excavated a minimum of 24 inches below the bottom of the proposed footing elevation for the foundation areas (includes trash enclosure area), moisture-conditioned, and recompacted in the foundation area and at least 5 feet beyond the structure and exterior flatwork/sidewalk areas in plan view, if practicable. Deeper sub-excavation may be required depending on soil conditions encountered during grading. Figure 13, Foundation Subgrade Preparation, presents the details for over-excavating and replacing the soil with compacted, engineered fill within the building limits. Compaction recommendations are discussed in Section 6.1.4 Fill Placement and Compaction.

To help reduce the expansion and shrinkage potential of the clayey soil and to provide improved support for floor slabs, and exterior flatwork, we recommend the supporting soils be a minimum of 18 inches of non-expansive compacted fill, Class II material placed on moisture-conditioned, compacted fill. The non-expansive fill should extend at least 5 feet beyond the building pad area and, where practicable, and/or 2 feet beyond exterior flatwork, whichever is greater.

6.1.2 Site Clearing

All grading must be observed by our representative. It is especially important that our representative be present during the demolition, stripping and scarification process to observe whether undesirable materials are encountered. Loose, soft, uncontrolled fill, or disturbed native soils must be removed from all structural areas, beneath adjacent walks and slabs, beneath areas to receive fill, and beneath areas to be paved. Excavations must extend at least 5 feet beyond the structure and slab areas, if practicable. The term uncontrolled fill refers to any existing fill that was not properly inspected or tested by an engineering firm.

6.1.3 Excavations and Utility Trenches

As discussed earlier, soft to very stiff silty clay was encountered at the time of drilling. We anticipate that the native soils may be excavated utilizing conventional equipment. Contractors, especially those digging utilities, should satisfy themselves as to the hardness of deposits and equipment required. If construction requires personnel to enter the excavation, the contractor must comply with the Occupational Health and Safety Administration regulations set forth in 29 CFR 1926.

Utility trenches that parallel the sides of the buildings should be placed so that they do not extend below a line sloped down and away at a slope of 2H:1V (horizontal to vertical) from the bottom outside edge of the perimeter foundations. All trenches should be backfilled with native materials compacted uniformly to the relative compaction specified in the following section. If local building codes require use of sand as the trench backfill, all utility trenches entering the building should be provided with an impervious seal of either cohesive soil or lean concrete where the trench passes under the building perimeter. The impervious plug should extend 4 feet into, and out of, the building perimeter. Jetting of trench backfill is not recommended as it may result in an unsatisfactory degree of compaction.

6.1.4 Fill Placement and Compaction

After performing the required excavations and/or prior to foundation excavations, the exposed subgrade soil should be carefully inspected to verify removal of all unsuitable deposits. The exposed subgrade soil should then be scarified to a depth of 12 inches, moisture-conditioned, and compacted to a minimum of 90 percent relative compaction at a minimum of 3 percent over optimum moisture content according to the latest ASTM test methods and procedures. After compacting the subgrade soil, all required fill should be placed in loose lifts a maximum of 8 inches in thickness.

On-site soil generated by site grading may be used as structural fill provided the soil is free of deleterious and organic materials and is approved for use as fill by our representative.

Native building pad backfill should be compacted a minimum of 90 percent relative compaction at a minimum of 3 percent over the optimum moisture content according to the latest ASTM test methods and procedures.

Native general fill and trench backfill should be compacted to a minimum of 90 percent relative compaction at a minimum of 3 percent over the optimum moisture content according to the latest ASTM test methods and procedures.

Import non-expansive fill should be compacted to a minimum of 90 percent relative compaction at a minimum of the optimum moisture content according to the latest ASTM test methods and procedures. The import fill should be non-expansive, free of deleterious materials, and meet the requirements in Table 2.

Table 2
IMPORTED MATERIAL REQUIREMENTS

Sieve Size	Percent Passing
6 inches (155 mm)	100
4 inches (100 mm)	95 - 100
# 200	5 - 25
Plasticity (PI) = 12 or less	
Liquid Limit (LL) = 30 or less	

The upper 12 inches of pavement subgrade soils should be scarified, moisture-conditioned as necessary, and recompacted to a minimum of 95 percent relative compaction.

If pumping subgrade soils are encountered, we recommend over-excavating to firm, non-yielding soil and placing recompacted fill as recommended in Section 6.1.4. If non-yielding soil is not encountered within 2 feet below the proposed subgrade elevation, an acceptable option is to place a woven geotextile at the base of the excavation and backfill with a granular material. The geotextile should consist of Mirafi® HP370 or an approved equivalent. A test area should be prepared to evaluate the performance of the method. If a non-yielding pavement subgrade is not achieved, deeper excavation may be necessary.

Soils that are not pumping but are determined to be too wet to properly compact may be prepared by ripping the soil and allowing the soil to dry, excavating and replacing, or lime treating.

All import fill must be compacted to a minimum relative compaction of 90 percent of the maximum dry density and moisture-conditioned to a minimum of 2 percent over the optimum moisture content according to ASTM test methods and procedures. The import fill should be non-expansive, free of deleterious materials, and meet the requirements in Table 2.

Samples of any proposed import fill planned for use on this project should be submitted to our representative for approval and appropriate testing no less than 4 working days before the expected delivery to the job site.

Clay soils should not be allowed to dry out and crack. Any dried clay soils should be wetted until they reach acceptable moisture contents or they can be excavated and replaced with acceptable properly compacted fill.

6.2 Foundations

6.2.1 Conventional Foundation System

If the earthwork recommendations included in this report are complied with, the proposed convenience store and trash enclosure may be supported by conventional foundations established on compacted, engineered fill. Settlement of the proposed structures, supported as recommended, should be less than 1 inch. However, overall settlements will potentially be about 1.5 inches in the event of a seismic occurrence due to soils liquefaction. Recommendations for footing depths and foundation details are included in Table 3.

Table 3
FOUNDATION DESIGN CRITERIA
CONTINUOUS STRIP AND ISOLATED FOOTINGS

Item	Criteria
Width:	
Wall Footings (Continuous)	Minimum 12 inches
Column Footings (Isolated)	Minimum 24 inches
Embedment Depth[1]	
Compacted, Engineered Fill	Minimum 18 inches
Allowable Bearing Capacity[1]	
Compacted, Engineered Soil	2,500 psf
Coefficient of Sliding Friction	0.30

1. Footing embedment depth is measured from the lowest adjacent soil grade to the bottom of the footing.
2. The recommendations above are for a foundation designed for net dead plus live loads. These bearing pressures may be increased by one-third for wind or seismic loads.

The excavations for footings must be cleaned of all loose materials and debris, and moistened prior to placement of concrete. All footing excavations must be observed by our representative to verify the condition of the bearing material. If any localized areas of loose or soft undesirable subsoil are observed in footing excavations, the excavation for the footings must be over-excavated to firm soil and backfilled with compacted fill under the observations and testing of our representative.

All footings should be reinforced with top and bottom reinforcement to provide structural continuity and to permit spanning of local irregularities. The reinforcement of the footing should be designed by a structural engineer.

6.2.2 Seismic Design Site Coefficients

Based on the California Building Code (CBC 2013) and the USGS "Design Maps Summary Report," which are based on the ASCE7-10 Standard and IBC 2012, we present the following Table 5, 2013 CBC Earthquake Load Values.

Table 5
2013 CBC EARTHQUAKE LOAD VALUES

Classification/Parameters	Value
Latitude	37.3474265
Longitude	-121.8324859
Site Class Definition	D
Risk Category	I/II/III
Spectral Response Acceleration at 0.2-second, S_S	1.500
Spectral Response Acceleration at 1.0-second, S_1	0.600
Site Coefficient, F_A	1.0
Site Coefficient, F_V	1.5
Maximum Considered Earthquake Spectral Response Acceleration for short period, S_{MS}	1.500
Maximum Considered Earthquake Spectral Response Acceleration for 1-second period, S_{M1}	0.900
Spectral Response Acceleration at short periods, S_{DS}	1.000
Spectral Response Acceleration at 1-second period, S_{D1}	0.600

6.3 Lateral Load Design Criteria

Lateral loads may be resisted by soil friction and by the passive resistance of the soils. For engineered fill, we recommend the following lateral load design criteria:

- Coefficient of Friction. 0.30
- Passive Pressure. . . . . 300 psf/ft

The passive pressure and the frictional resistance of the soils may be combined without reduction in determining the total lateral resistance. These values are ultimate and an appropriate factor of safety should be applied by the structural engineer.

6.4 Concrete Slabs-on-Grade

If the earthwork recommendations are complied with, concrete slabs-on-grade may be protected from unwanted moisture vapor by an underlainment of a 4-inch thick capillary break of Class 2 drain rock, clean ½ by ¾-inch crushed drain rock, or pea gravel. Class 2 base rock may not be used as the capillary break. If the potential for a damp slab is undesirable or if moisture sensitive floor coverings are used, we recommend that a vapor retarder membrane of 10-mil minimum thickness be placed on the drain rock and overlain by a minimum of 2 inches of clean sand to assist in the proper curing of the slab. The select material or sand should be moistened but not saturated prior to placement of concrete.

The American Concrete Institute (ACI) currently recommends placing the slab in direct contact with the membrane to eliminate the potential for water becoming trapped in the sand layer and transmitting through the slab. If the Project Engineer chooses to design the slab without the sand layer, the Engineer should be familiar with the ACI recommendations (ACI 302.1R-15) which include discussion of the potential problems associated with this design.

It should be noted that the intention of the membrane is to limit moisture transmission through the slab, not to eliminate moisture transmission through the slab. A membrane will not eliminate moisture transmission which can cause mold growth. The membrane must be constructed properly to effectively limit moisture transmission. Proper construction includes sealing the perimeter of the membrane as well as all seams and penetrations. For best results, the membrane should meet the requirements of ASTM E-1745.

If greater resistance to moisture transmission is desired, we recommend sealing the slab with an approved concrete sealant. We also recommend reducing the water-cement ratio of the concrete mix design for slabs as low as possible to help further reduce the potential for moisture passing through the slab The structural engineer should determine the final requirements of the concrete mix design.

We recommend concrete slab-on-grade floors and exterior flatwork be a minimum thickness of 4 inches. The trash enclosure area slab and pavement area should be a minimum thickness of 5 ½ inches at with a concrete compressive strength of a minimum of 3,500 pounds per square inch (psi). The actual slab thicknesses must be determined by the project structural engineer. The trash enclosure area and pavement section should be designed according to the recommendations presented in Section 6.6 Pavements.

We recommend reinforcing the concrete slab-on-grade floors with a minimum of either, (1) No. 3 reinforcing bars spaced at 24 inches on center, or (2) with an alternate steel reinforcement as required by the project structural engineer. In general, the steel reinforcement should be supported by concrete dobies to maintain the minimum requirement for clearance according to the latest standards. The project structural engineer should determine the acceptable concrete cover. Crack control joints should be located as recommended by the project Structural Engineer.

Recommendations presented in the American Concrete Institute manual should be complied with for all concrete placement and curing operations. Improper curing techniques and/or excessive slump (water-cement ratio) could cause excessive shrinkage, cracking or curling. Concrete slabs should be allowed to cure adequately before placing vinyl or other moisture sensitive floor coverings

6.5 Drainage

It is important that foundation soils not be allowed to become saturated during or after construction. Furthermore, surface water must not be allowed to pond adjacent to building foundations. To preclude drainage problems, we recommend continuous roof gutter for the proposed structures. It will be necessary to direct all water collected from roof downspouts into closed conduits that lead to acceptable discharge points away from the structures.

Grades should be such that drainage is away from the structures. Water and sewer utility lines should be properly installed to avoid becoming possible sources for subsurface saturation. It is important that all utility trenches be properly backfilled. If practicable, planters and/or landscaping should not be adjacent to or near the structures. If vegetation must be planted adjacent to or near structures, plants that require very little moisture with drip irrigation systems should be used. Sprinkler heads should not be placed where they could saturate foundation soil.

6.6 Pavements

Based on an R-value test result of 12, we recommend the pavement sections listed in Table 6, on the next page.

The recommended sections are based on the assumed Traffic Indices (TI). The recommended pavement section should be revised if site grading changes the characteristic of the near surface soil condition or a different TI is desired.

Subgrade for the on-site paved areas should be properly prepared as discussed in the Earthwork section of this report and as recommended below prior to placing asphalt or aggregate base materials. Proper drainage of paved areas should be provided to prevent water from entering beneath the pavement to help increase the life of the pavement and help avoid possible premature failure.

TABLE 6
PAVEMENT DESIGN CRITERIA

TRAFFIC INDEX	ASPHALT (inches)	AGGREGATE BASE (inches)
Flexible Pavement		
4.5	3	7
5.0	3	8½
5.5	3½	9½
Full Depth Asphalt Concrete		
4.5	6½	--
5.0	7	--
5.5	8	--
Rigid Pavement	**CONCRETE** (inches)	**AGGREGATE BASE** (inches)
Concrete Pavement (3,500 psi min.)	6	6

To perform to its greatest efficiency, the pavement section requires the following construction criteria:

a. Remove organic and deleterious materials from all pavement subgrade.

b. Moisture-condition and compact the upper 12 inches of subgrade soil to a minimum relative compaction of 95 percent at a minimum moisture content of 2 percent above the optimum moisture content. All pavement subgrade should be stable with no "pumping" at the time the base rock is placed. Refer to Section 6.1.4, Fill Placement and Compaction, for additional recommendations.

c. Use only good quality materials of the type and minimum thickness specified. All base rock should meet the *Standard Specifications* of the State of California for Class 2 baserock and should be angular in shape.

d. Compact the baserock uniformly to a minimum relative compaction of 95 percent.

e. Place the asphalt concrete only during periods of fair weather when the free air temperature is within the prescribed limits as set forth by the Asphalt Concrete Institute.

f. Compact all trench backfill under the pavement to minimize pavement damage resulting from settlement. Mechanical compaction is recommended because material placed by jetting or ponding will probably not attain satisfactory densities.

g. Provide adequate drainage or V-ditch systems to prevent surface water from migrating into the subgrade pavement soil from behind curb-and-gutter sections. For areas where pavement abuts landscaping, we recommend extending the concrete curb a minimum of 3 inches below the bottom of the base rock layer to form a cut-off wall to prevent water from migrating into the base rock. If vegetation will be planted adjacent to the pavement, plants that require very little moisture with drip irrigation systems should be used.

h. Butt-type joints, relying on aggregate interlock for load transfer, are acceptable for parking lots serving light vehicles. For heavy truck traffic, dowels should be considered. Dowels should consist of plain (smooth) dowels and should be aligned and lubricated properly for proper joint function (ref. ACI 330R-08).

i. We recommend reinforcing concrete pavement that will receive significant truck traffic. Reinforcement should also be considered for odd-shaped slabs, such as a slabs that taper to a sharp angle, slabs with a length to width ratio greater than 1.5, or slabs that are neither square or rectangular. The function of the reinforcement is to hold together the fracture faces when cracks form. Reinforcement should be discontinued at contraction/construction joints (ref. ACI 330R-08).

j. Joint spacing for unreinforced concrete pavement should be at a maximum of 15 feet. Joint spacing for reinforced concrete pavement may be designed in accordance with ACI recommendations (ref. ACI 330R-08).

k. Automobile traffic should not be allowed on pavement until the concrete has attained a strength of 3,000 psi. Alternatively, automobile traffic should not be allowed on pavement slabs for 3 days, and all other traffic should be kept off pavement slab for at least 7 days (ref. ACI 330R-08). In addition, traffic should avoid unsupported slab edges.

l. The design and construction of concrete pavement section should be according to the latest Portland Cement Association (ref. PCA publication “Design and Control of Concrete Mixtures”) and ACI recommendations.

6.7 Miscellaneous

Our exploration did not reveal the presence of buried items such as leaching fields, wells, storage tanks, etc other than previously discussed. It is possible, however, that such items may be present. If such items are encountered during grading or during excavations of foundations, our firm should be notified immediately to provide recommendations for proper procedures. Also, this study did not include investigations for toxic substances or groundwater contamination of any type. If such conditions are encountered during site development, additional studies will be required.

6.8 Plan Review

Before submitting design drawings and construction documents to the appropriate local agency for approval, copies of the documents should be reviewed by our firm to ensure that the recommendations in this report have been effectively incorporated.

6.9 Construction Observations

We recommend that our representative be present during grading and foundation excavation to observe that the work performed is in conformance with specifications and recommendations provided here. We will also perform testing as necessary to evaluate the quality of the materials and their relative compaction. Records will be maintained of our site visits and test results.

At the completion of site grading and foundation excavation, we will submit a summary of our observation and test results along with any necessary supplemental recommendations. To assure that our personnel are at the site when needed, we require that you notify us at least 2 working days before the task begins.

7.0 LIMITATIONS

This report has been prepared for the exclusive use of the Client and the Client's consultants for specific application to the proposed development. If changes occur in the nature, design location, or configuration of the proposed development, the conclusions and recommendations contained here shall not be considered valid. Changes must be reviewed by our firm.

The analysis, opinions, conclusions and recommendations submitted in this report are based in part on the referenced materials, site visit and evaluation, and subsurface exploration. The nature and extent of variation among exploratory borings may not become evident until construction. If variations appear, it will be necessary to re-evaluate or revise recommendations made in this report.

The recommendations in this report are contingent on conducting an adequate testing and observation program during construction of the proposed development. Unless the construction observation and testing program is provided by or coordinated with our firm, Korbmacher Engineering, Inc. will not be held responsible for compliance with design recommendations presented in this report and other supplemental reports submitted as part of this report.

Our services have been provided in accordance with generally accepted geotechnical engineering practices. No warranties are made, express or implied, as to the professional opinions or advice provided. Recommendations contained in this report are valid for a period of 1 year; after 1 year they must be reviewed by this firm to determine whether or not they still apply.

8.0 REFERENCES

American Concrete Institute, ACI 330R-08, Guide for the Design and Construction of Concrete Parking Lots, Reported by ACI Committee 330. June 2008.

California Department of Transportation, Highway Design Manual, http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm, updated 24 July 2009.

California Building Code, 2013 California Building Code, Title 24, Part 2 Volume 2 of 2, based on the 2012 International Building Code, effective date 1 January 2014.

CDMG, Special Publication 117A, Guidelines For Evaluating And Mitigating Seismic Hazards In California, 2008.

California Department Of Conservation, Division Of Mines And Geology (CDMG), Seismic Hazard Zone Report for the San Jose West 7.5-Minute Quadrangle, Santa Clara Counties, California, 2002.

California Geological Survey, Earthquake Zones of Required Investigation, San Jose West Quadrangle, Official Map, Released: February 7, 2002.

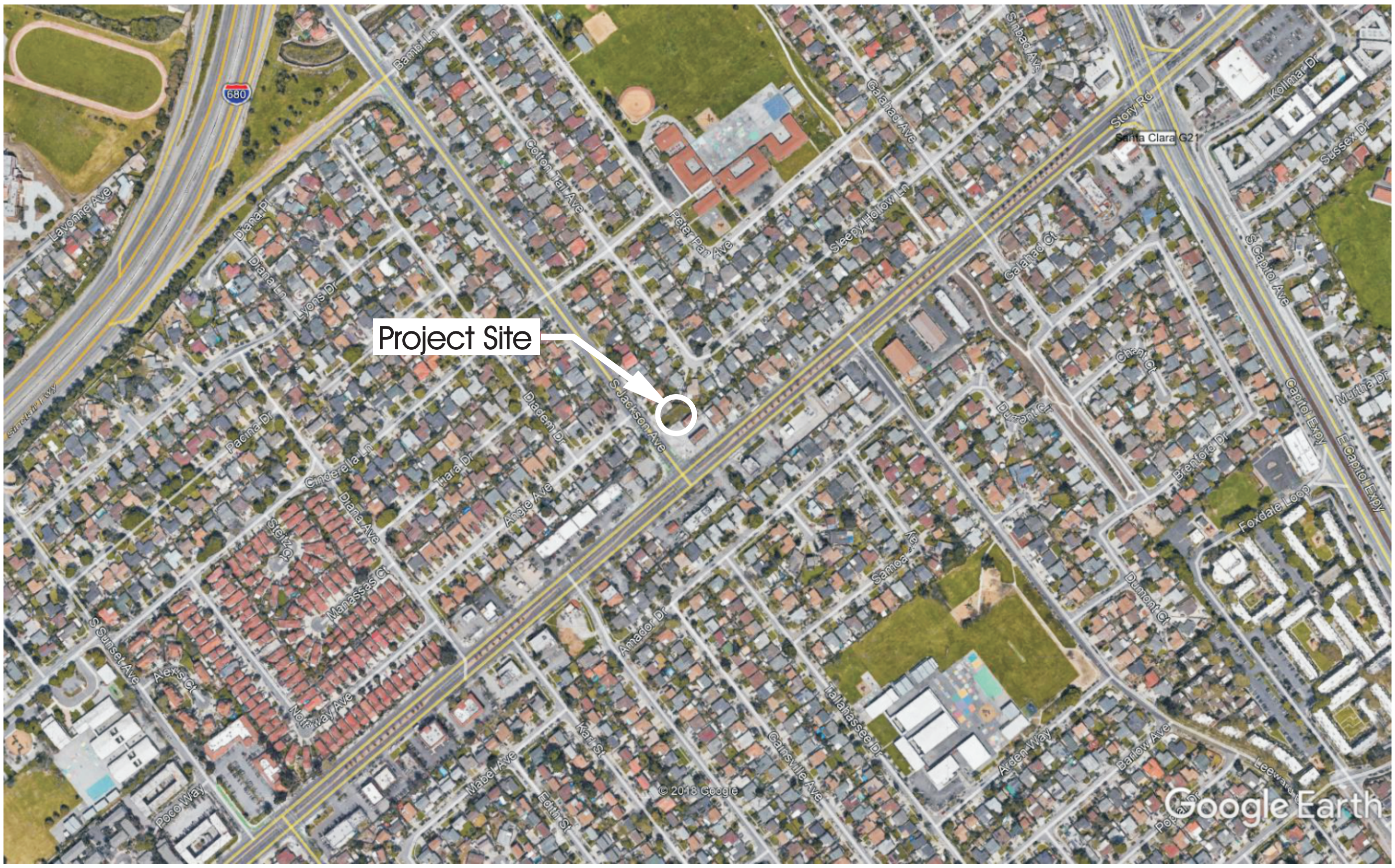
Federal Emergency Management Agency (FEMA), National Flood Insurance Map, Santa Clara County, California and Incorporated Areas, Map Number 06085C0252J, Map Effective Date February 19, 2014.

International Code Council, Inc., International Building Code, 2012

Journal of Geotechnical and Geoenvironmental Engineering, "Assessment of the Liquefaction Susceptibility of Fine-Grained Soils," ASCE, prepared by Jonathan D. Bray and Rodolfo B. Sancio, September 2006.

USGS, Earthquake Hazards Program, 2008 National Seismic Hazard Maps - Source Parameters, <https://earthquake.usgs.gov/cfusion/hazfaults_2008_search/query_main.cfm>

USGS, US Seismic Design Maps, https://earthquake.usgs.gove/hazards/designmaps



Not to scale

Korbmacher Engineering Inc.

PROJECT NO. 18126

DATE 12/4

VICINITY MAP

Rotten Robbie #11
2305 Story Road
San Jose, California

FIGURE NO.

1

Files\Reports 2018\18125\Figure2

Not to scale

BORING LOCATION MAP

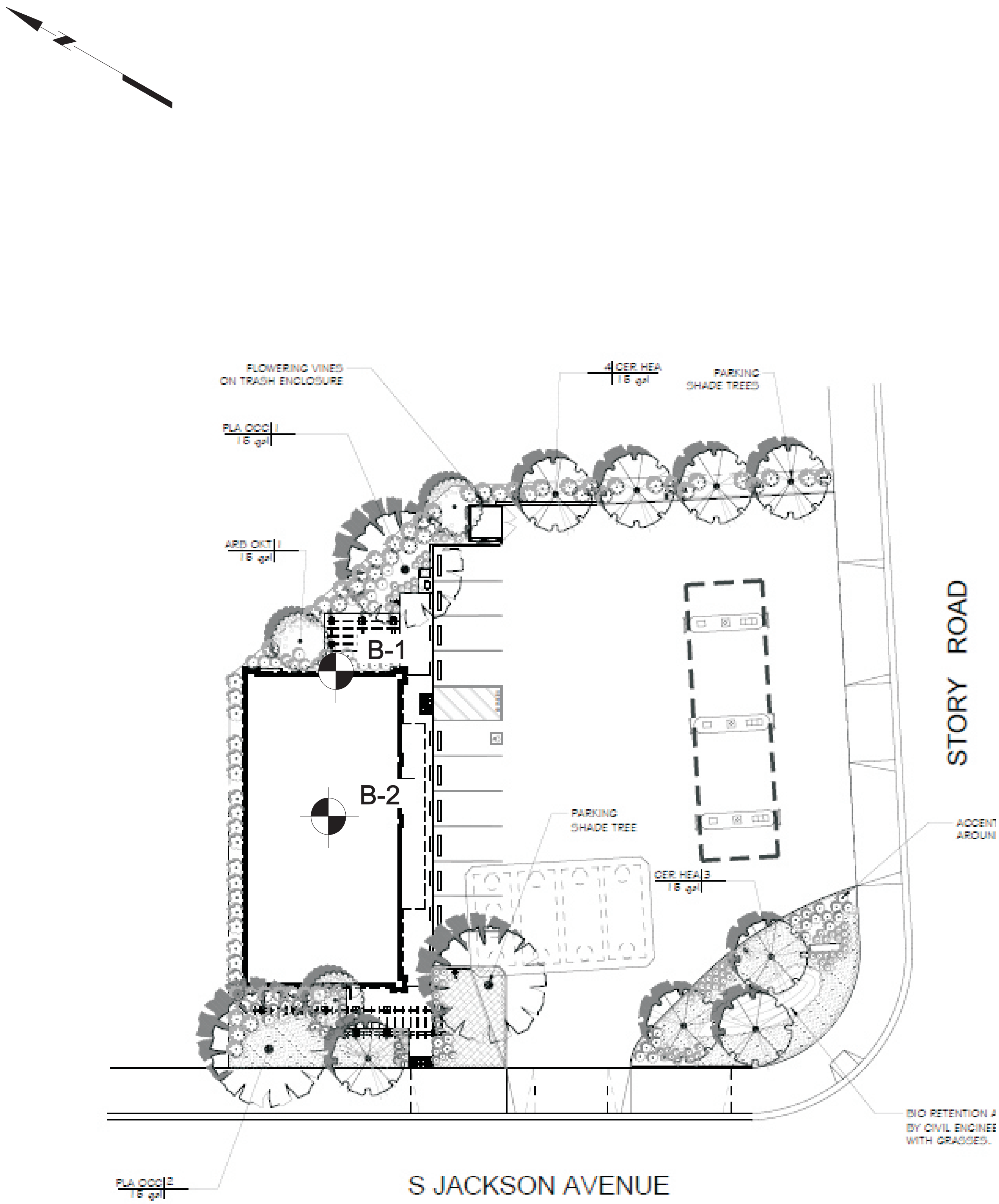
Rotten Robbie #11
2305 Story Road
San Jose, California

FIGURE NO. 2

Korbmacher Engineering Inc.

PROJECT NO. 18126 | DATE 12/4

Files\Reports 2018\18126\Figure2



Not to scale

Korbmacher Engineering Inc.

PROJECT NO. 18126

DATE 12/4

BORING LOCATION MAP

Rotten Robbie #11
2305 Story Road
San Jose, California

FIGURE NO.

3

Files\Reports 2018\18126\Figure3

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		LTR	DESCRIPTION
COARSE-GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	WELL-GRADED GRAVELS OR GRAVEL SAND MIXTURES. LITTLE OR NO FINES
		GP	POORLY-GRADED GRAVELS OR GRAVEL SAND MIXTURE, LITTLE OR NO FINES
		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
		GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
		SP	POORLY-GRADED SANDS, OR GRAVELLY SANDS, LITTLE OR NO FINES
		SM	SILTY SANDS, SAND-SILT MIXTURES
		SC	CLAYEY SANDS, SAND-CLAY MIXTURES

MAJOR DIVISIONS		LTR	DESCRIPTION
FINE-GRAINED SOILS	SILTS AND CLAYS LL < 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LL > 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE, SANDY OR SILTY SOILS, ELASTIC SILTS
		CH	INORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS		Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

NOTES

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.

KEY TO SYMBOLS

■	MODIFIED CALIFORNIA SAMPLER, 2.0-ID
⧄	MODIFIED CALIFORNIA SAMPLER, 2.5-ID
I	SHELBY TUBE SAMPLE
SP	STANDARD PENETRATION SPLIT-SPOON SAMPLE
▼	WATER LEVEL OBSERVED IN BORING
✳	NO RECOVERY
NFWE	NO FREE WATER ENCOUNTERED

Korbmacher Engineering Inc.

PROJECT NO. 18126 | DATE 12/4

BORING LOG LEGEND

Rotten Robbie #11
2305 Story Road
San Jose, California

FIGURE NO. 4

Files\Reports 2018\18126\Figure4

Logged By: R. Dean
Drill Rig: CME 45
Type of Hammer: Automatic
Date Drilled: 4 December 2018

Boring Elev: Existing Grade
Boring Diam: 8 in.
Wt. of Hammer/Drop: 140 lbs/30 in.

Depth, ft	Soil Description	Consistency	USCS Symbol	Sample (FIELD)	Blows per ft. (FIELD)	Moisture Content % (LABORATORY)	Dry Density, pcf (LABORATORY)	Plasticity Index % LL	Plasticity Index % PI	Unc. Compression Laboratory/*Pocket Penetrometer*	% Fines (#200 Sieve)
0	Silty CLAY, brown with some iron oxide staining, damp	Medium Stiff to Stiff	CL								
2.5				■	50	20	96			*>9000*	
6.5				■	19	18	106			3500	
9	Silty CLAY, brownish gray, moist	Medium Stiff	CL								
11.5				■	7	27	111			600	
13	Hydrocarbon odor										
16.5				■	9	41	77			*500*	
20	Silty CLAY, brownish gray, moist	Medium Stiff	CL	■	6	25	110			*<500*	
21.5	Bottom of boring at 21-1/2 feet. No free water encountered at time of drilling. Boring backfilled with cement grout.										

Depth scale: 5, 10, 15, 20, 25, 30

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PROJECT NO. 18126 | DATE 12/4

LOG OF BORING NO. B-1

Rotten Robbie #11
2305 Story Road
San Jose, California

FIGURE NO. 5

Files\Reports 2018\18126\Figure5

Logged By: R. Dean

Drill Rig: CME 45

Type of Hammer: Automatic

Date Drilled: 4 December 2018

Boring Elev: Existing Grade

Boring Diam: 8 in.

Wt. of Hammer/Drop: 140 lbs/30 in.

Depth, ft	Soil Description	Consistency	USCS Symbol	Sample (FIELD)	Blows per ft. (FIELD)	Moisture Content %	Dry Density, pcf	Plasticity Index % LL	Plasticity Index % PI	Unc. Compression Laboratory/*Pocket Penetrometer*	% Fines (#200 Sieve)
0	Silty CLAY, brown, with trace angular fine grain gravel, damp	Stiff	CL								
				■	53	7	116			*>9000*	
5	Silty CLAY, brown with some black mottling and some iron oxide staining, moist	Stiff to Medium Stiff	CL	■	14	9	112			>9000	
10				■	6	35	89	39	16	700	100
15	Silty CLAY, brownish gray with some iron oxide staining, moist	Soft to Medium Stiff	CL	■	5	31	97			*1000*	
			▽								
20				■	6	25	103	32	12	*500*	98
			▼								
25				■	5						
30											

Files\Reports 2018\18126\Figure6

Korbmacher Engineering Inc.

PROJECT NO. 18126 DATE 12/4

LOG OF BORING NO. B-2

Rotten Robbie #11
2305 Story Road
San Jose, California

FIGURE NO. 6

Logged By: R. Dean
Drill Rig: CME 45
Type of Hammer: Automatic
Date Drilled: 4 December 2018

Boring Elev: Existing Grade
Boring Diam: 8 in.
Wt. of Hammer/Drop: 140 lbs/30 in.

Depth, ft	Soil Description	Consistency	USCS Symbol	FIELD Sample	FIELD Blows per ft.	LABORATORY Moisture Content %	Dry Density, pcf	Plasticity Index % LL	Plasticity Index % PI	Unc. Compression Laboratory/*Pocket Penetrometer*	% Fines (#200 Sieve)
30	Silty CLAY, gray with trace iron oxide staining, moist	Medium Stiff	CL	■	12	34	97	48	23	*4000*	99
35				■	17						
40				■	18						
45	Silty CLAY, gray to dark gray, moist	Stiff to Very Stiff	CL	■	15	27	102	48	23	*3000*	99
50				■	34						
	Bottom of boring at 51-1/2 feet. Groundwater encountered at about 22 feet during drilling. Groundwater measured at 17 feet below grade prior to backfilling. Boring backfilled with cement grout.										
55											

Korbmacher Engineering Inc.

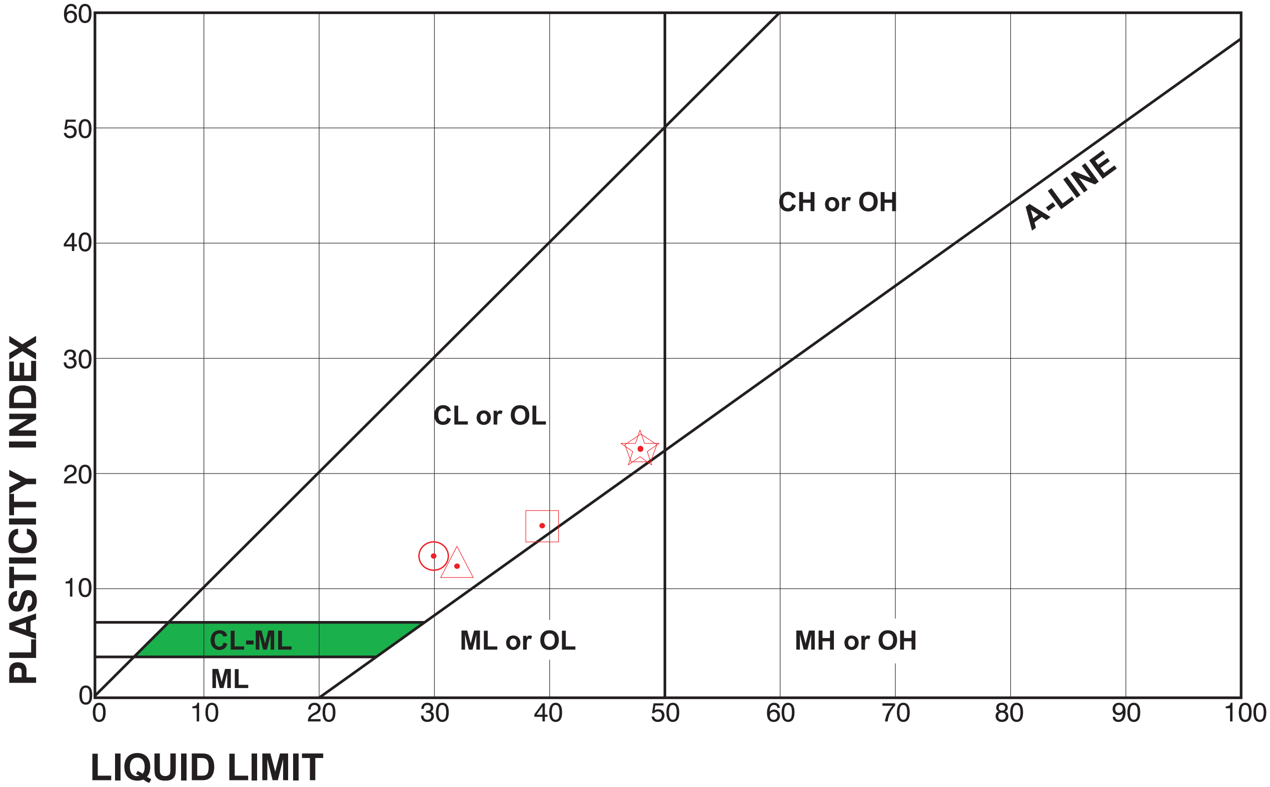
PROJECT NO. 18126 DATE 12/4

LOG OF BORING NO. B-2, CONT'D

Rotten Robbie #11
2305 Story Road
San Jose, California

FIGURE NO. 7

Files\Reports 2018\18126\Figure7



TEST SYMBOL	BORING NO.	SAMPLE DEPTH	LIQUID LIMIT	PLASTICITY INDEX	CLASSIFICATION
⊙	—	Surface	30	13	Silty CLAY, brown (CL)
⊡	B-2	11	39	16	Silty CLAY, brown (CL)
△	B-2	21	32	12	Silty CLAY, brownish gray (CL)
⬠	B-2	31	48	23	Silty CLAY, gray (CL)
☆	B-2	46	48	23	Silty CLAY, dark gray (CL)

Files\Reports 2018\18126\Figure8

Korbmacher Engineering Inc.

PROJECT NO. 18126 | DATE 12/4

PLASTICITY CHART

Rotten Robbie #11
2305 Story Road
San Jose, California

FIGURE NO. 8

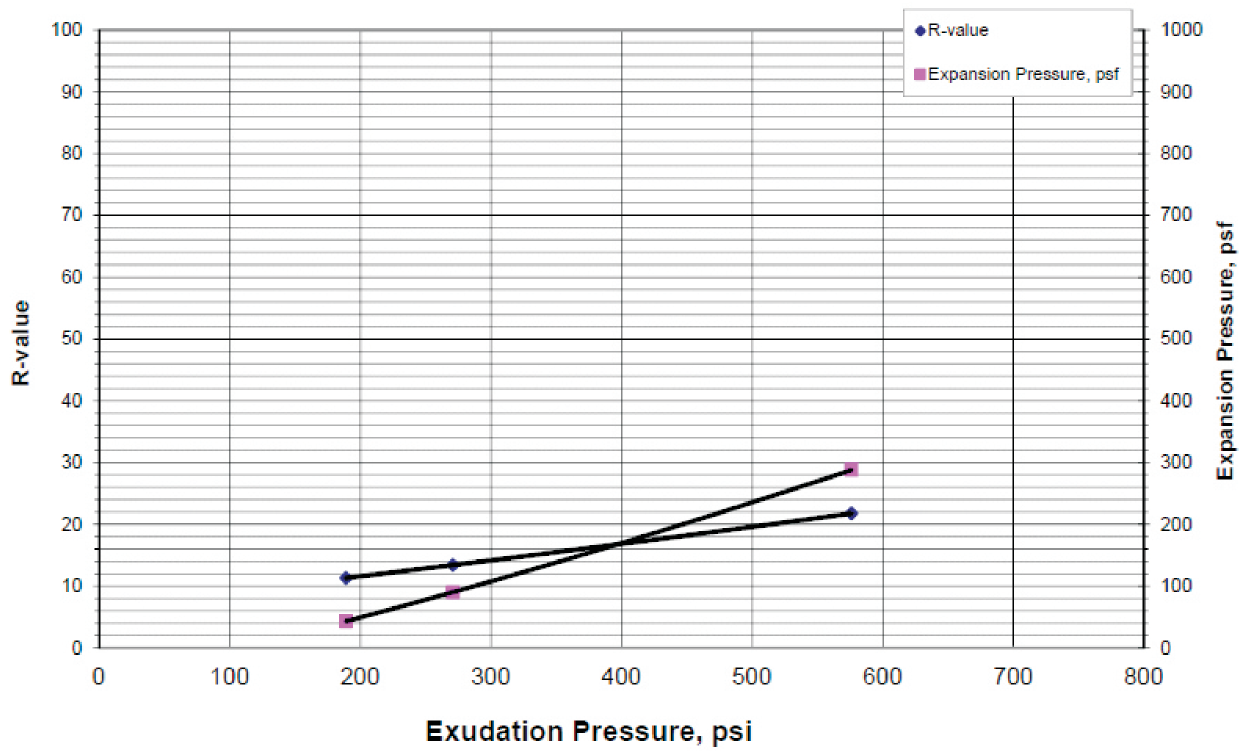
COOPER TESTING LABORATORY

R-value Test Report (Caltrans 301)

Job No.:	907-027	Date:	12/12/18	Initial Moisture,	11.4
Client:	Korbmacher Engineering	Tested	PJ	R-value	12
Project:	18126	Reduced	RU	Expansion Pressure	105 psf
Sample	B-1 @ Surface	Checked	DC		
Soil Type:	Reddish Brown Sandy CLAY w/ Gravel				

Specimen Number	A	B	C	D
Exudation Pressure, psi	576	271	189	
Prepaired Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	33	45	67	
Weight of Soil & Mold, grams	3204	3143	3104	
Weight of Mold, grams	2113	2099	2064	
Height After Compaction, in.	2.45	2.41	2.43	
Moisture Content, %	14.5	15.6	17.7	
Dry Density, pcf	117.9	113.6	110.3	
Expansion Pressure, psf	288	90	43	
Stabilometer @ 1000				
Stabilometer @ 2000	118	128	132	
Turns Displacement	3.20	3.86	4.04	
R-value	22	13	11	

Remarks:



Korbmacher Engineering Inc.

R-VALUE TEST RESULTS

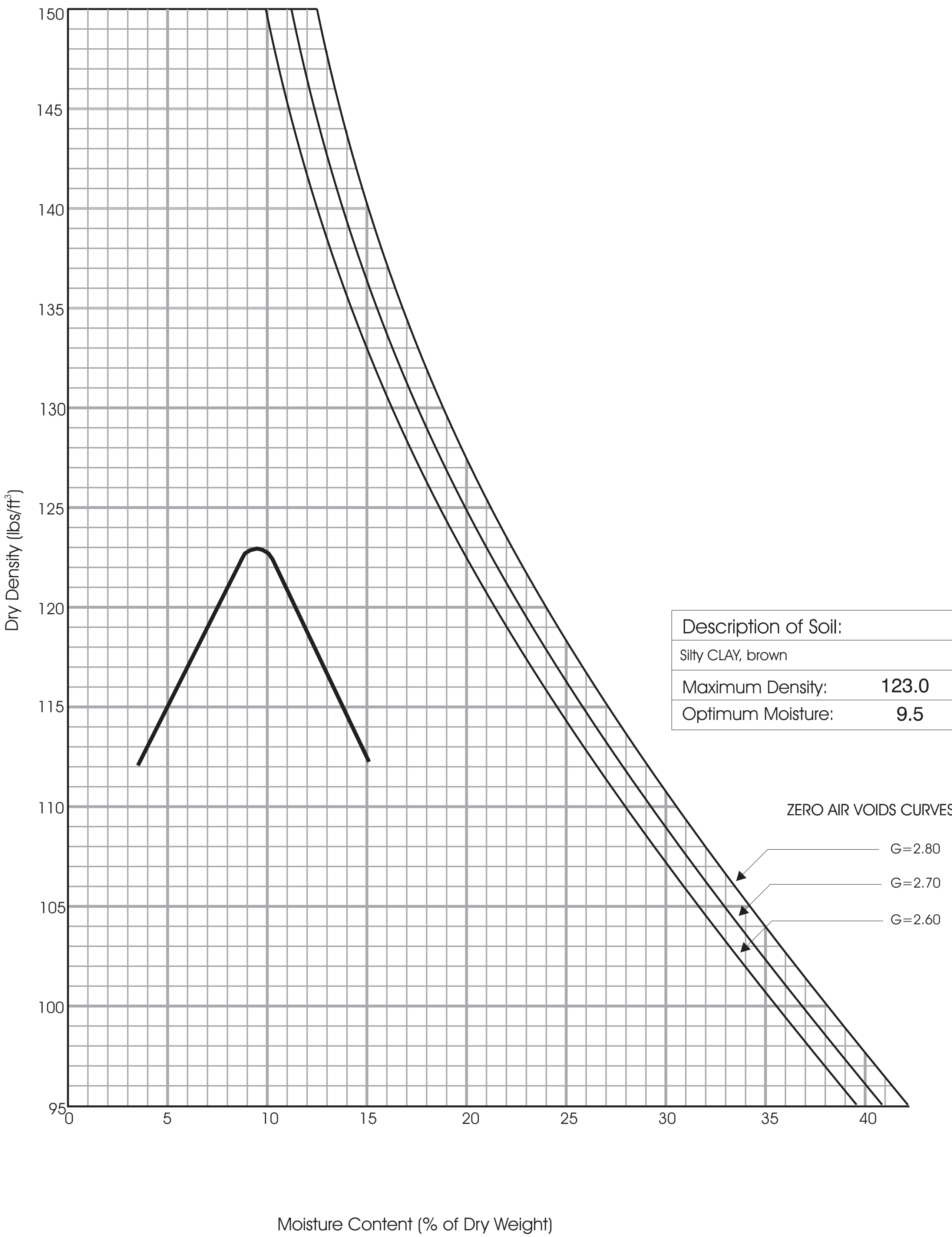
Rotten Robbie #11
2305 Story Road
San Jose, California

FIGURE NO. 9

PROJECT NO. 18126 | DATE 12/4

Files\Reports 2018\18126\Figure9

ASTM Test Method D 1557



Description of Soil:	
Silty CLAY, brown	
Maximum Density:	123.0
Optimum Moisture:	9.5

Korbmacher Engineering Inc.

PROJECT NO. 18126 | DATE 12/4

MOISTURE/DENSITY RELATIONSHIP

Rotten Robbie #11
2305 Story Road
San Jose, California

FIGURE NO. 10

Files\Reports 2018\18126\Figure10

Borings, Facing Northwest

Borings, Facing Southwest

Not to Scale

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PROJECT NO. 18126 | DATE 12/4

PHOTOGRAPHS OF PROJECT SITE

Rotten Robbie #11
2305 Story Road
San Jose, California

FIGURE NO. 11

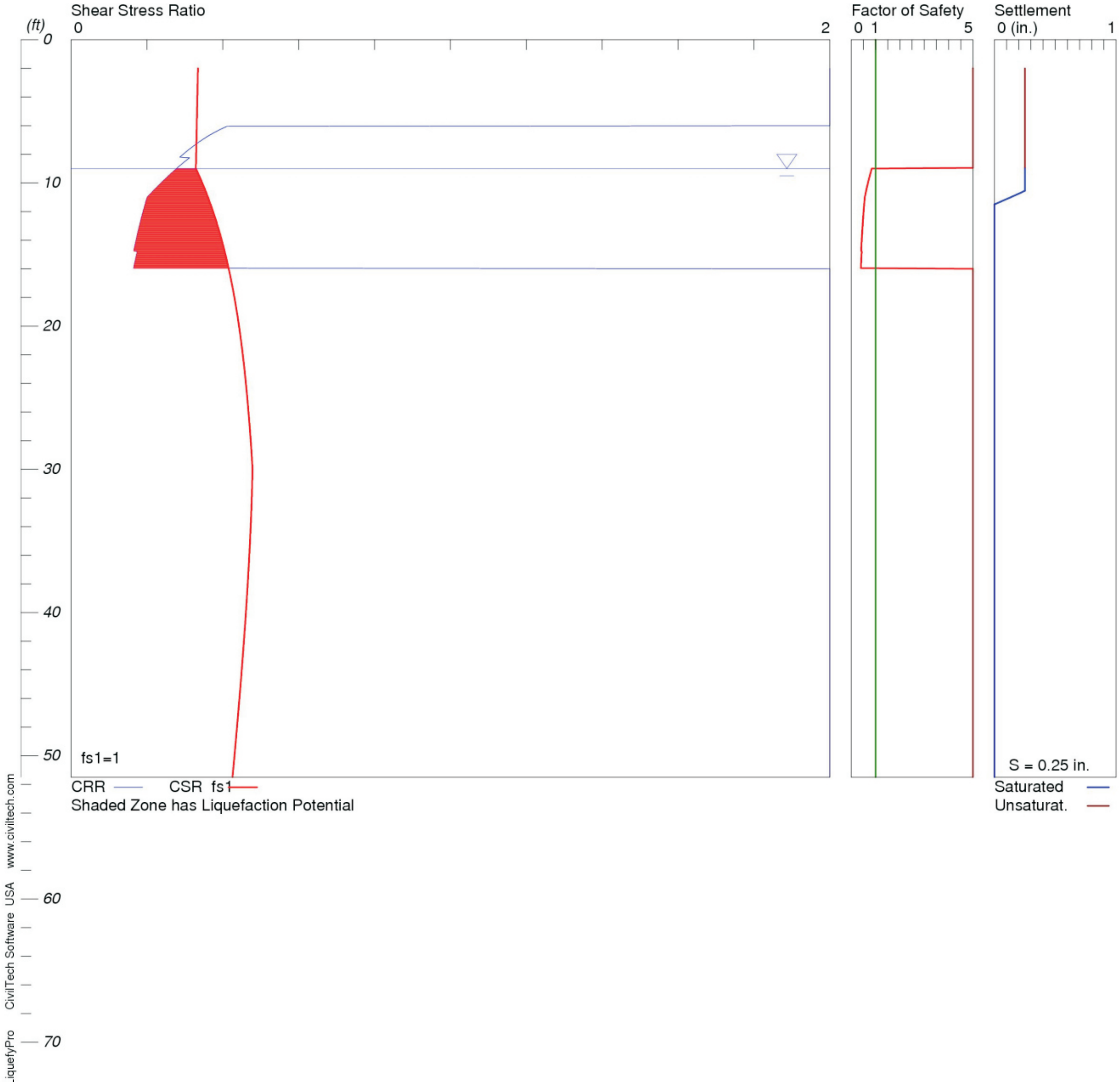
Files\Reports 2018\18126\Figure11

LIQUEFACTION ANALYSIS

Rotten Robbie #11

Hole No.=B-2 Water Depth=9 ft

Magnitude=6.4
Acceleration=0.517g



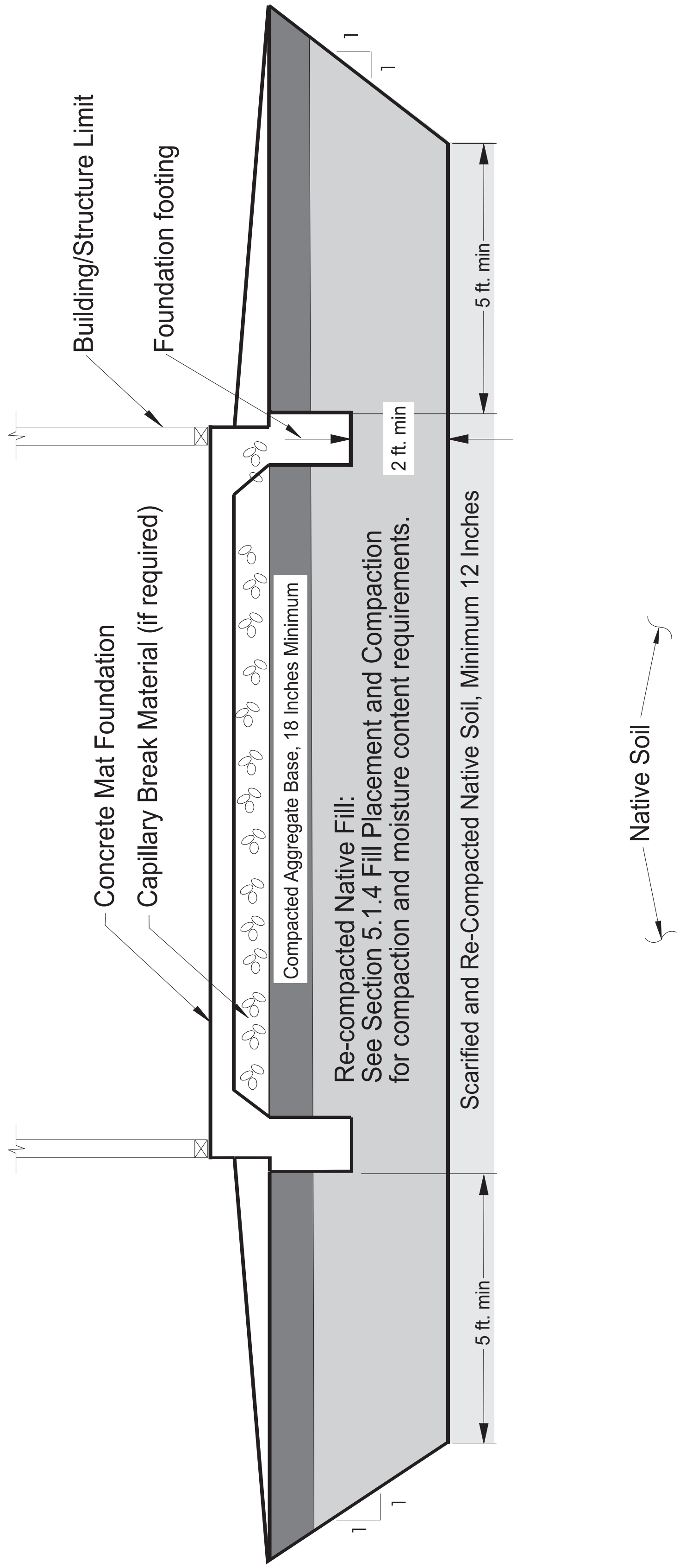
Files\Reports 2018\18126\Figure12

Korbmacher Engineering Inc.

PROJECT NO. 18126	DATE 12/4	LIQUEFACTION ANALYSIS Rotten Robbie #11 2305 Story Road San Jose, California

FIGURE NO.

12



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PROJECT NO. 18126

DATE 12/4

FOUNDATION SUBGRADE PREPARATION

Rotten Robbie #11
2305 Story Road
San Jose, California

FIGURE NO.

13

Files\Reports 2018\18126\Figure13

APPENDIX A
CORROSIVITY ANALYSIS

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 **462 2771** Fax. 925 **462 2775**
www.cercoanalytical.com

17 December, 2018

Job No. 1812034
Cust. No. 10990

Mr. Rick Schneider
Korbmacher Engineering, Inc.
P.O. Box 405
Livermore, CA 94551

Subject: Project No.: 18126
Project Name: 2305 Story Road, San Jose
Corrosivity Analysis – ASTM Test Methods

Dear Mr. Schneider:

Pursuant to your request, CERCO Analytical has analyzed the soil sample submitted on December 05, 2018. Based on the analytical results, a brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurement, this sample is 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 concentration is 68 mg/kg and determined to be insufficient to attack steel embedded in a concrete mortar coating.

The sulfate ion concentration is 180 mg/kg and is determined to be insufficient to damage reinforced concrete structures and cement mortar-coated steel at this location.

The pH of the soil is 8.24, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potential is 260-mV, and is indicative of potentially "slightly corrosive" soils resulting from anaerobic 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.

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

JDH/jdl
Enclosure

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

Client:	Korbmacher Engineering, Inc.
Client's Project No.:	18126
Client's Project Name:	2305 Story Road, San Jose
Date Sampled:	5-Dec-18
Date Received:	5-Dec-18
Matrix:	Soil
Authorization:	Signed Chain of Custody

Date of Report: 17-Dec-2018

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)*
1812034-001	Bag	260	8.24	-	640	-	68	180

	Redox	pH	Conductivity	Resistivity	Sulfide	Chloride	Sulfate
Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	10	-	50	15	75
Date Analyzed:	14-Dec-2018	14-Dec-2018	-	14-Dec-2018	-	14-Dec-2018	14-Dec-2018

* Results Reported on "As Received" Basis

Cheryl McMillen
Laboratory Director

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

Chain of Custody

1100 Willow Pass Court
Concord, CA 94520-1006
925 462 2771
Fax: 925 462 2775

CERCO analytica

Job No.	CU#	Client Project I.D.	Schedule / Analyte	Date Sampled	Date Due
1812034		18126			

Full Name
Rick Schneider

Fax
Phone 925.454.9033

Company
Korbmacher Engineering, Inc.

Cell ☒

Sample Source
2305 Story Road, San Jose

ASTM w/Brief Evaluation — **ANALYSIS**

Lab No.	Sample I.D.	Date	Time	Matrix	Contain.	Size	Preserv.	Qty.	Redox Potential	pH	Sulfate	Chloride	Resistivity-100% Saturated		Brief Evaluation
1	Bag	12/5/18	10:30am	S	Bag				X	X	X	X	X		X

MATRIX
DW - Drinking Water
GW - Ground Water
SW - Surface Water
WW - Waste Water
Water
SL - Sludge
S - Soil
Product

ABBREVIATIONS
HB - Hosebib
PV - Petcock Valve
PT - Pressure Tank
PH - Pump House
RR - Restroom
GL - Glass
PL - Plastic
ST - Sterile

SAMPLE RECEIPT
Total No. of Containers
Rec'd Good Cond/Cold
Conforms to Record
Temp. a t Lab -°C
Sampler

		Date	Time
Relinquished By:	[signature]	12/5	11:00am
Received By:	[signature]	12/5/18	11:15
Relinquished By:	[signature]	12/5/18	01-11
Received By:	[signature]	12/5/18	1312
Relinquished By:			
Received By:			

Comments:
THERE IS AN ADDITIONAL CHARGE FOR METAL/POLY TUBES

8/6/2009