APPENDIX E

GEOTECHNICAL INVESTIGATION

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July 15, 2020

Duke Realty
200 Spectrum Center Drive, Suite 1600
Irvine, California 92618

Attention: Mr. Bob Close
Preconstruction Director

Project No.: **19G186-2R**

Subject: **Limited Geotechnical Investigation**
Amazon Distribution Center
6400 Katella Avenue
Cypress, California

Mr. Close:

In accordance with your request, we are pleased to present the findings of the limited geotechnical investigation which we performed at the subject site. This limited investigation was performed in accordance with our Change Order No. 19G186-COR, dated October 28, 2019.

Site and Project Description

The subject site is located at the southwest corner of Katella Avenue and Holder Street, at the address of 6400 Katella Avenue in Cypress, California. The site is bounded to the north by Katella Avenue, to the east by Holder Street, to the south by the Stanton Storm Channel, and to the west by three commercial/industrial buildings.

The site consists of a rectangular-shaped parcel, 22.3± acres in size. The site is presently occupied by Mitsubishi Motors and is developed with a 3-story office building, three (3) industrial buildings, and a warehouse. The office building possesses a footprint of approximately 60,000± ft^2 and is located in the northern area of the site. Turf grass is present north of the existing office building, along Katella Avenue. The three (3) industrial buildings are located in the west-central area of the site and range from 10,800± ft^2 to 25,000± ft^2 in size. The warehouse possesses a footprint of 140,000± ft^2 in size and is located in the southwestern area of the site. It is assumed that all the buildings are supported on conventional shallow foundations with concrete slab-on-grade floors. A tennis court is located to the east of the warehouse. Exposed soil and decomposed turf grass are also present east of the existing warehouse. The ground surface cover in the remaining areas of the site consists of asphaltic concrete pavements in the parking and drive lanes, Portland cement concrete pavements in the loading dock areas, and landscape planters throughout the site.

Detailed topographic information was not available at the time of this report. However, based on topographic information obtained from Google Earth, the site topography ranges from 42± feet mean sea level (msl) in the east-central area, to 35± feet msl in the southeastern area of the site. The paved areas of the site gently slope downward to the west, from 1± percent in the southwestern and east-central areas to 3± percent in the northwestern corner of the site. The decomposed turf plot east of the warehouse slopes at <1± percent to the southeast.

Based on our review of the site plan that was provided to our office by the client, the site will be utilized as an Amazon Distribution Faculty. The 3-story office building, located along Katella Avenue, and the southwest warehouse will remain with the new development. The remaining buildings located in the west-central region of the site will be demolished in order to allow for a new parking lot for automobiles and trucks. The existing warehouse will be surrounded by asphaltic concrete pavements in the automobile parking and drive areas, and Portland cement concrete pavements in the truck traffic areas. Areas of landscaped planters and concrete flatwork are expected throughout the site. It is our understanding that new racking systems will be installed within the existing warehouse on the existing floor-slab.

Scope of Services

Southern California Geotechnical, Inc. (SCG) has been requested to evaluate the thickness of the existing pavements in the parking lot and the existing building concrete slab. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to provide recommendations for preparing the design of new pavements at the subject site and to provide geotechnical information to aid the racking designer or structural engineer to design new racking system on the existing building floor slab. The proposed pavement thickness designs were determined based on the results of the laboratory testing and assumed traffic volumes.

The scope of services included determining the pavement thicknesses at four (4) locations and determining the thickness of the existing building floor slab at two (2) locations.

Field Exploration

The subsurface exploration conducted for this project consisted of six (6) borings at the site (identified as Boring Nos. B-9 through B-14). Boring No. B-9 and B-10 were drilled within the existing warehouse to a depth of 6± feet. The remaining four (4) borings were drilled within the proposed parking lot area to a depth of 5± feet. All of the borings were logged during drilling by a member of our staff.

A portable coring rig equipped with a 5-inch-diameter diamond-tipped core barrel was used to core through the asphaltic pavements and sections of Portland Cement Concrete. The thickness of the concrete and underlying base was determined at all of the core locations. The cores from each location were taken back to the laboratory for cataloguing.

Representative bulk and relatively undisturbed soil samples were taken during drilling. Relatively undisturbed samples were taken with a split barrel "California Sampler" containing a series of one inch long, 2.416± inch diameter brass rings at 2-foot intervals. The relatively undisturbed ring samples were placed in molded plastic sleeves that were then sealed and transported to our laboratory. Bulk samples were also collected from auger cuttings and placed into plastic bags to retain their in-place moisture content.

The approximate locations of the borings are indicated on the Boring Location Plan, included as Plate 2 in this report. The Boring Logs, which illustrate the conditions encountered at the boring locations, as well as the results of some of the laboratory testing, are included with this report.

Existing Building Slab

The slab section encountered at Boring Nos. B-9 and B-10 consists of 5½± inches of Portland cement concrete (PCC). The reinforcement of the PCC slab appears to consist of welded wire mesh.

Existing Asphaltic Concrete Pavements

Asphaltic concrete pavements were present at the ground surface of Boring Nos. B-11 through B-14. At these locations, the pavement sections consist of 3½ to 4± inches of asphaltic concrete, underlain by 2 to 2½± inches of aggregate base. However, at Boring No. B-12, the aggregate base measured at least 20± inches thick. It should be noted that Boring No. B-12 was terminated within the aggregate base, at a depth of 2± feet below existing site grades, due to refusal on the very dense aggregate base material. A summary of the AC pavement thicknesses is presented below:

EXISTING PAVEMENT THICKNESSES

Boring Location	Asphaltic Concrete Thickness (inches)	Aggregate Base Thickness (inches)
B-11	3½	2
B-12	4	20
B-13	4	2½
B-14	4	2

Artificial Fill

Artificial fill soils were encountered beneath the building floor-slab and exterior pavements at most of the boring locations, extending to depths of 1½ to 5½± feet below existing site grades. The fill soils generally consist of loose to medium dense silty fine sands, fine sandy silts and clayey sands. Additionally, Boring No. B-11 contains a distinctive layer of very dense fine to coarse gravel with trace amounts of fine to medium sand and was terminated within the fill soils. The fill soils possess a disturbed and subtly mottled appearance, resulting in their classification as artificial fill.

Additional soils classified as possible fill were encountered beneath the pavement section at Boring No. B-13. These materials consist of loose to medium dense fine sands, with varying silt content, extending to a depth of 5± feet below existing site grades. The possible fill soils resemble the artificial fill soils described above, but lack obvious indicator of fill, resulting in their classification as possible fill. Boring No. B-13 was terminated within the possible fill soils.

Alluvium

Native alluvial soils were encountered beneath the artificial fill soils at Boring Nos. B-9, B-10 and B-14, extending to the maximum depth explored of 6± feet. The alluvium generally consists of medium dense silty fine sands and fine sandy silts, with some clay content.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static groundwater is considered to have existed at a depth in excess of 6± feet at the time of the subsurface exploration.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the historic groundwater depths in this area is CGS Open File Report 98-10, which indicates that the historic high groundwater level for the site was 11± feet below the ground surface. More recent water level data was obtained from the California State Water Resources Control Board website, https://geotracker.waterboards.ca.gov/. GeoTracker indicates that there are three (3) monitoring wells within the boundaries site. The monitoring wells are located along the west-central property line. Water level readings within these monitoring wells indicates high groundwater levels of 6.82 to 7.10± feet below the ground surface in November 2004.

Laboratory Testing

The soil samples recovered from the subsurface exploration were returned to our laboratory for further testing to determine selected physical and engineering properties of the soils. The tests are briefly discussed below. It should be noted that the test results are specific to the actual samples tested, and variations could be expected at other locations and depths.

R-value

R-value testing was conducted on two (2) composite representative soil samples obtained from cores within the existing parking lot. The R-value was determined in accordance with CA Test Method 301. This test provides a measure of the pavement support characteristics of the soils and is used in the pavement thickness design procedure. The results of the R-value testing are presented below:

Sample ID	R-Value
B-13 @ 0-5 feet	59
B-14 @ 0-5 feet	34

Based on the results of R-value testing, the pavement sections for new pavements are recommended to be designed for an R-value of 30.

Direct Shear

Direct shear testing was performed on two (2) selected soil samples to determine their shear strength parameters. The tests were performed in accordance with ASTM D-3080. The testing apparatus is designed to accept either natural or remolded samples in a one-inch high ring, approximately 2.416 inches in diameter. For tests on remolded soils, three samples of the same soil are prepared by remolding them to 90± percent compaction and near optimum moisture. Each of the three samples are then loaded with different normal loads and the resulting shear strength is determined for that particular normal load. The shearing of the samples is performed at a rate slow enough to permit the dissipation of excess pore water pressure. Porous stones are in contact with the top and bottom of the sample to permit the addition or release of pore water. The results of the direct shear tests are presented on Plate C-1 and C-2.

Conclusions and Recommendations

Seismic Design Parameters

The 2019 California Building Code (CBC) provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of the structure including the structural system and height. The seismic design parameters presented below are based on the soil profile and the proximity of known faults with respect to the subject site.

Based on standards in place at the time of this report, the proposed development is expected to be designed in accordance with the requirements of the 2019 edition of the California Building Code (CBC), which was adopted on January 1, 2020.

The 2019 CBC Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool, a web-based software application available at the website www.seismicmaps.org. This software application calculates seismic design parameters in accordance with several building code reference documents, including ASCE 7-16, upon which the 2019 CBC is based. The application utilizes a database of risk-targeted maximum considered earthquake (MCE_R) site accelerations at 0.01-degree intervals for each of the code documents. The tables below were created using data obtained from the application. The output generated from this program is included as Plate E-1 in this report.

The 2019 CBC requires that a site-specific ground motion study be performed in accordance with Section 11.4.8 of ASCE 7-16 for Site Class D sites with a mapped S_1 value greater than 0.2. However, Section 11.4.8 of ASCE 7-16 also indicates an exception to the requirement for a site-specific ground motion hazard analysis for certain structures on Site Class D sites. The commentary for Section 11 of ASCE 7-16 (Page 534 of Section C11 of ASCE 7-16) indicates that "In general, this exception effectively limits the requirements for site-specific hazard analysis to very tall and or flexible structures at Site Class D sites." **Based on our understanding of the proposed development, the seismic design parameters presented below were calculated assuming that the exception in Section 11.4.8 applies to the proposed structure at this site. However, the structural engineer should verify that this exception is applicable to the proposed structure.** Based on the exception, the spectral response accelerations presented below were calculated using the site coefficients (F_a and F_v) from Tables 1613.2.3(1) and 1613.2.3(2) presented in Section 16.4.4 of the 2019 CBC.

2019 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped MCE_R Acceleration at 0.2 sec Period	S_S	1.440
Mapped MCE_R Acceleration at 1.0 sec Period	S_1	0.510
Site Class	---	D*
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.440
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	0.913
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	0.960
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.609

*The 2019 CBC requires that Site Class F be assigned to any profile containing soils vulnerable to potential failure or collapse under seismic loading, such as liquefiable soils. For Site Class F, the site *coefficients* are to be determined in accordance with Section 11.4.7 of ASCE 7-16. However, Section 20.3.1 of ASCE 7-16 indicates that for sites with structures having a fundamental period of vibration equal to or less than 0.5 seconds, the site coefficient factors (F_a and F_v) may be determined using the standard procedures. <u>The seismic design parameters tabulated above were calculated using the site coefficient factors for Site Class D, assuming that the fundamental period of the structures is less than 0.5 seconds.</u> However, the results of the liquefaction evaluation indicate that the subject site is underlain by potentially liquefiable soils. Therefore, if the proposed structures have a fundamental period greater than 0.5 seconds, a site-specific seismic hazards analysis will be required and additional subsurface exploration will be necessary.

It should be noted that the site coefficient F_v and the parameters S_{M1} and S_{D1} were not included in the <u>SEAOC/OSHPD Seismic Design Maps Tool</u> output for the 2019 CBC. We calculated these parameters-based on Table 1613.2.3(2) in Section 16.4.4 of the 2019 CBC using the value of S_1 obtained from the <u>Seismic Design Maps Tool</u>, assuming that a site-specific ground motion hazards analysis is not required for the proposed buildings at this site.

Site Grading Recommendations

The grading recommendations presented below are based on the subsurface conditions encountered at the boring locations and our understanding of the proposed development. We recommend that all grading activities be completed in accordance with the Grading Guide Specifications included as Appendix D of this report, unless superseded by site-specific recommendations presented below.

Demolition and Site Stripping

The proposed development will require demolition of some of the existing pavements and structures. Any existing improvements that will not remain in place for use with the new development should be removed in their entirety. This should include all utilities, and any other subsurface improvements associated with the existing structures. Existing improvements which are to remain in place with the new development should be protected from damage by construction traffic.

Debris resultant from demolition should be disposed of offsite. Concrete and asphalt debris may be re-used within compacted fills, provided they are pulverized to a maximum particle size of less than 1 inch, and thoroughly mixed with the on-site soils. Existing asphalt and concrete materials may also be crushed into miscellaneous base (CMB) and re-used at the site. Alternatively, concrete and asphalt debris may be crushed to particle sizes of 2 to 4 inches and used to stabilize unstable overexcavation subgrades.

Detailed structural information regarding the existing buildings has not been provided to our office. Therefore, the foundation systems supporting the existing building are presently unknown by SCG. If the existing buildings are supported on deep foundation systems, the deep foundation elements located within the proposed building areas should be cut off at a depth of at least 2 feet below the bottom of the planned overexcavation. Where drilled pier foundations are encountered within proposed pavement areas, they should be cut off at a depth of at least 2 feet below the proposed pavement subgrade or at a depth of at least 1 foot below the bottom of any planned utilities.

Demolition of some landscape planters is also expected to be required. Any vegetation or organic soils within these planters should be disposed of off-site. Turf grass and other grass and weed growth should be stripped from the site in its entirety. Removal of some trees may also be required. Where trees are removed, the removal should also include any associated root masses. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

<u>Treatment of Existing Soils: Parking Areas</u>

Based on economic considerations, overexcavation of the existing soils in the new parking and drive areas is not considered warranted, with the exception of areas where lower strength, or unstable soils are identified by the geotechnical engineer during grading. Subgrade preparation in the new parking and drive areas should initially consist of removal of all soils disturbed during stripping and demolition operations.

The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. Any such materials should be removed to a level of firm and unyielding soil. The exposed subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to at least 0 to 4 percent above optimum, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength surficial soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

The grading recommendations presented above for the proposed parking area assume that the owner and/or developer can tolerate minor amounts of settlement within the proposed parking areas. The grading recommendations presented above do not completely mitigate the extent of the existing fill soils and low strength alluvium in the parking areas. As such, settlement and associated pavement distress could occur. Typically, repair of such distressed areas involves significantly lower costs than completely mitigating these soils at the time of construction. If the owner cannot tolerate the risk of such settlements, the flatwork, parking and drive areas should be overexcavated to a depth of 2 feet below proposed pavement subgrade elevation, with the resulting soils replaced as compacted structural fill.

Proposed Racking Systems

We understand that the client intends to support new racking systems on the existing floor slab. Please note that our scope did not include the evaluation of any of the structural aspects of the racking systems, nor did it include the evaluation of the structural adequacy of using the existing floor slab for supporting new racking systems. Such an evaluation is outside of our purview as the geotechnical engineer. We would recommend contracting the services of a licensed structural engineer to provide feedback on these issues.

Based on previous experience with providing information to other members of our design teams regarding racking design, we have been asked to provide information regarding the thickness of the existing floor slab and the design modulus of subgrade reaction of the soils beneath the existing floor slab. Based on the results of our subsurface exploration and laboratory testing, the allowable modulus of subgrade reaction for the soils located directly beneath the existing floor slab is 100 psi/in and the thickness of the existing building located in the southwest corner of the site was measured at 5½ inches at our two coring locations. If additional geotechnical information is needed, our office should be contacted in order to prepare a proposal for additional services.

Pavement Design Parameters

Site preparation in the pavement area should be completed as previously recommended in the ***Site Grading Recommendations*** section of this report. The subsequent pavement recommendations assume proper drainage and construction monitoring, and are based on either PCA or CALTRANS design parameters for a twenty (20) year design period. However, these designs also assume a routine pavement maintenance program to obtain the anticipated 20-year pavement service life.

Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of scarified, thoroughly moisture conditioned and recompacted existing soils. The near surface soils generally consist of silty fine sands and fine sandy silts. These soils are generally considered to possess fair to good pavement support characteristics. Results of laboratory testing indicate these materials to possess R-values ranging from 34 to 59. Based on the slight variability of the near-surface soils, the subsequent pavement design is therefore based upon an R-value of 30. Any fill material imported to the site should have support characteristics equal to or greater than that of the on-site soils and be placed and compacted under engineering-controlled conditions. It may be desirable to perform R-value testing after the completion of rough grading to verify the R-value of the as-graded parking subgrade.

Presented below are the thicknesses for flexible pavement structures consisting of asphaltic concrete over a granular base. The pavement designs are based on the traffic indices (TI's) indicated. The client and/or civil engineer should verify that these TI's are representative of the anticipated traffic volumes. If the client and/or civil engineer determine that the expected traffic volume will exceed the applicable traffic index, we should be contacted for supplementary recommendations. The design traffic indices equate to the following approximate daily traffic volumes over a 20-year design life, assuming six operational traffic days per week.

Traffic Index	No. of Heavy Trucks per Day
5.0	1
6.0	3
7.0	11
8.0	35
9.0	93

For the purpose of the traffic volumes indicated above, a truck is defined as a 5-axle tractor trailer unit with one 8-kip axle and two 32-kip tandem axles. All of the traffic indices allow for 1,000 automobiles per day.

ASPHALT PAVEMENTS (R = 30)					
Materials	**Thickness (inches)**				
	Auto Drive Lanes (TI = 5.0)	Truck Traffic			
		(TI = 6.0)	(TI = 7.0)	(TI = 8.0)	(TI = 9.0)
Asphalt Concrete	3	3½	4	5	5½
Aggregate Base (95% minimum compaction)	6	8	10	11	13
Compacted Subgrade (90% minimum compaction)	12	12	12	12	12

The aggregate base course should be compacted to at least 95 percent of the ASTM D-1557 maximum dry density. The asphaltic concrete should be compacted to at least 95 percent of the Marshall maximum density, as determined by ASTM D-2726. The aggregate base course may consist of crushed aggregate base (CAB) or crushed miscellaneous base (CMB), which is a recycled gravel, asphalt and concrete material. The gradation, R-Value, Sand Equivalent, and Percentage Wear of the CAB or CMB should comply with appropriate specifications contained in the current edition of the "Greenbook" Standard Specifications for Public Works Construction.

New Portland Cement Concrete Pavements

The preparation of the subgrade soils within new PCC pavement areas should be performed as previously described for new asphalt pavement areas. The minimum recommended thicknesses for the Portland Cement Concrete pavement sections are as follows:

PORTLAND CEMENT CONCRETE PAVEMENTS (R = 30)					
Materials	**Thickness (inches)**				
	Auto Parking and Drive Areas (TI = 5.0)	Truck Traffic Areas (TI =6.0)	Truck Traffic Areas (TI =7.0)	Truck Traffic Areas (TI =8.0)	Truck Traffic Areas (TI =9.0)
PCC	5	5	5½	6½	8
Compacted Subgrade (95% minimum compaction)	12	12	12	12	12

The concrete should have a 28-day compressive strength of at least 3,000 psi. Reinforcing within all pavements should be designed by the structural engineer. The maximum joint spacing within all of the PCC pavements is recommended to be equal to or less than 30 times the pavement thickness. The actual joint spacing and reinforcing of the Portland cement concrete pavements should be determined by the structural engineer.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Pablo Montes Jr.
Staff Engineer

Robert G. Trazo, M.Sc., GE 2655
Principal Engineer

Enclosures: Plate 1: Site Location Map
Plate 2: Boring Location Plan
Plates B-1 through B-6: Boring Logs
Plates C-1 and C-2: Direct Shear Test Results

Distribution: (1) Addressee

SOURCE: LOS ANGELES COUNTY
THOMAS GUIDE, 2013

SITE LOCATION MAP

AMAZON DISTRIBUTION CENTER

CYPRESS, CALIFORNIA

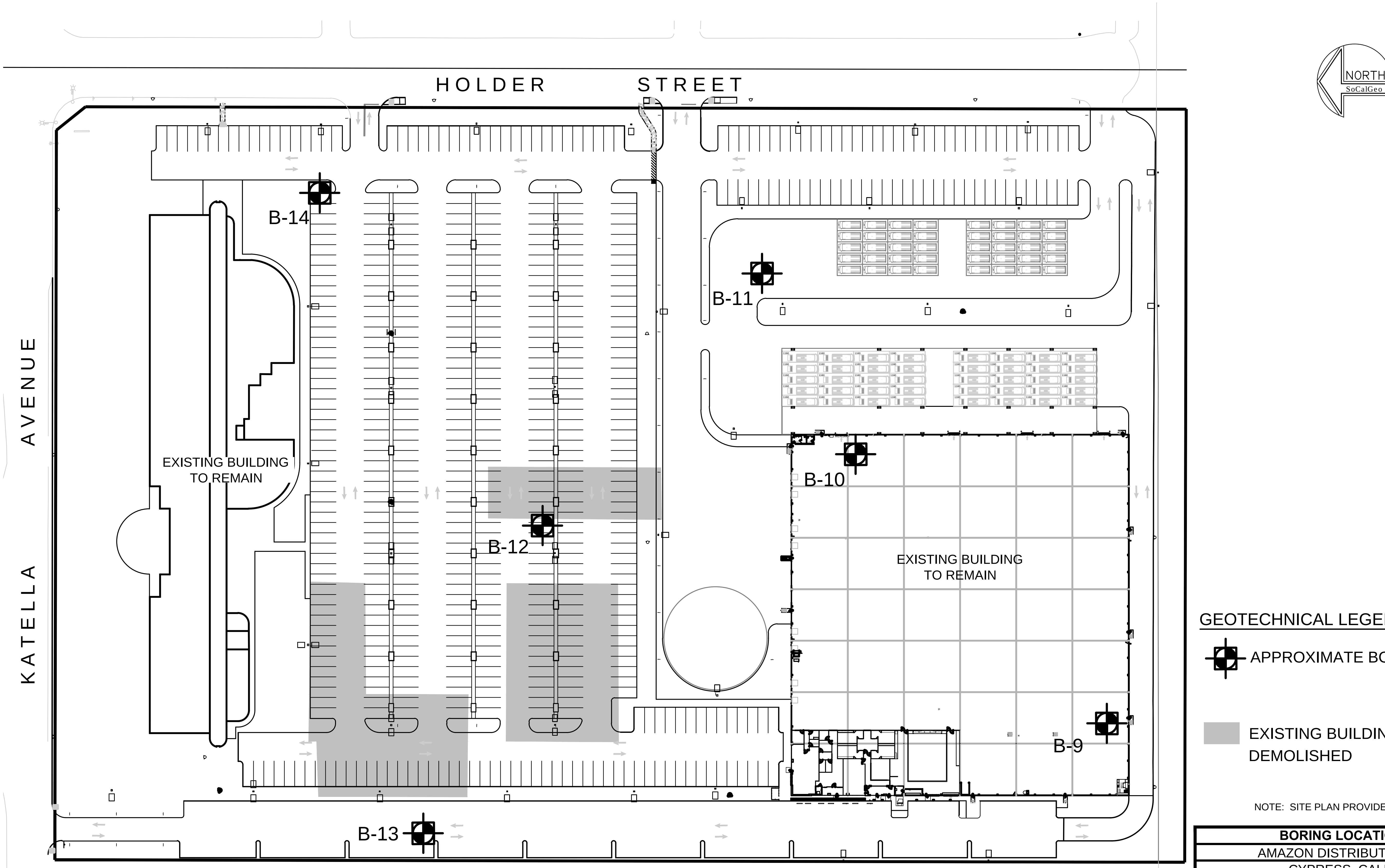
SCALE: 1" = 2400'

DRAWN: JH
CHKD: RGT

SCG PROJECT
19G186-2R

PLATE 1

SoCalGeo
SOUTHERN
CALIFORNIA
GEOTECHNICAL



GEOTECHNICAL LEGEND

APPROXIMATE BORING LOCATION

EXISTING BUILDING TO BE DEMOLISHED

NOTE: SITE PLAN PROVIDED BY THE CLIENT.

BORING LOCATION PLAN

AMAZON DISTRIBUTION CENTER

CYPRESS, CALIFORNIA

SCALE: 1" = 100'

DRAWN: PM
CHKD: RGT

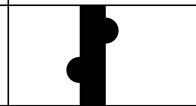
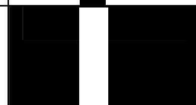
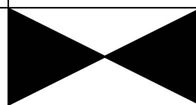
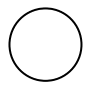
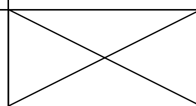
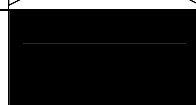
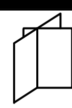
SCG PROJECT
19G186-2R

PLATE 2

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3” indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN 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 WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-9

JOB NO.: 19G186-2R
PROJECT: Amazon Distribution Center
LOCATION: Cypress, California

DRILLING DATE: 11/5/19
DRILLING METHOD: Hand Auger
LOGGED BY: Ross Kovtun

WATER DEPTH: N/A
CAVE DEPTH: N/A
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					5½± inches Portland Cement Concrete							
	X				FILL: Brown Silty fine Sand, loose to medium dense-moist	113	8					
	X				FILL: Dark Gray Brown fine Sandy Silt, little Clay, medium dense-moist to very moist	108	14					
5	X					106	16					
					ALLUVIUM: Dark Gray Brown Silty fine Sand, trace to little Clay, medium dense-very moist							
					Boring Terminated at 6'							

TBL 19G186-2R.GPJ SOCALGEO.GDT 7/16/20

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-10

JOB NO.: 19G186-2R	DRILLING DATE: 11/5/19	WATER DEPTH: N/A
PROJECT: Amazon Distribution Center	DRILLING METHOD: Hand Auger	CAVE DEPTH: N/A
LOCATION: Cypress, California	LOGGED BY: Ross Kovtun	READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					5½± inches Portland Cement Concrete							
	X				FILL: Light Brown fine Sand, little Silt, trace medium Sand, loose to medium dense-moist	117	7					
					FILL: Dark Gray fine Sandy Clay, trace Silt, stiff-moist							
	X				FILL: Dark Gray Brown Silty fine Sand, trace to little Clay, medium dense-moist	91	9					
5	X				ALLUVIUM: Gray Brown fine Sandy Silt, little Clay, medium dense-very moist	103	18					

Boring Terminated at 6'

TBL 19G186-2R.GPJ SOCALGEO.GDT 7/16/20

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-11

JOB NO.: 19G186-2R	DRILLING DATE: 11/5/19	WATER DEPTH: N/A
PROJECT: Amazon Distribution Center	DRILLING METHOD: Hand Auger	CAVE DEPTH: N/A
LOCATION: Cypress, California	LOGGED BY: Ross Kovtun	READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					3½± inches Asphaltic concrete; 2± inches of Aggregate base							
	○				FILL: Gray fine to coarse Gravel, trace fine to medium Sand, very dense-dry							
					Boring Terminated at 1½' due to refusal on very dense gravel layer							

TBL 19G186-2R.GPJ SOCALGEO.GDT 7/16/20

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-12

JOB NO.: 19G186-2R
PROJECT: Amazon Distribution Center
LOCATION: Cypress, California

DRILLING DATE: 11/5/19
DRILLING METHOD: Hand Auger
LOGGED BY: Ross Kovtun

WATER DEPTH: N/A
CAVE DEPTH: N/A
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					4± inches Asphaltic concrete 20± inches of Aggregate base							
					Boring Terminated at 2' due to refusal on very dense Aggregate base material							

TBL 19G186-2R.GPJ SOCALGEO.GDT 7/16/20

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-13

JOB NO.: 19G186-2R
PROJECT: Amazon Distribution Center
LOCATION: Cypress, California

DRILLING DATE: 11/5/19
DRILLING METHOD: Hand Auger
LOGGED BY: Ross Kovtun

WATER DEPTH: N/A
CAVE DEPTH: N/A
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					4± inches Asphaltic concrete; 2½± inches of Aggregate base							
					POSSIBLE FILL: Light Brown to Brown fine Sand, trace to little Silt, loose to medium dense-damp to moist							
5												
					Boring Terminated at 5'							

TBL 19G186-2R.GPJ SOCALGEO.GDT 7/16/20

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-14

JOB NO.: 19G186-2R
PROJECT: Amazon Distribution Center
LOCATION: Cypress, California

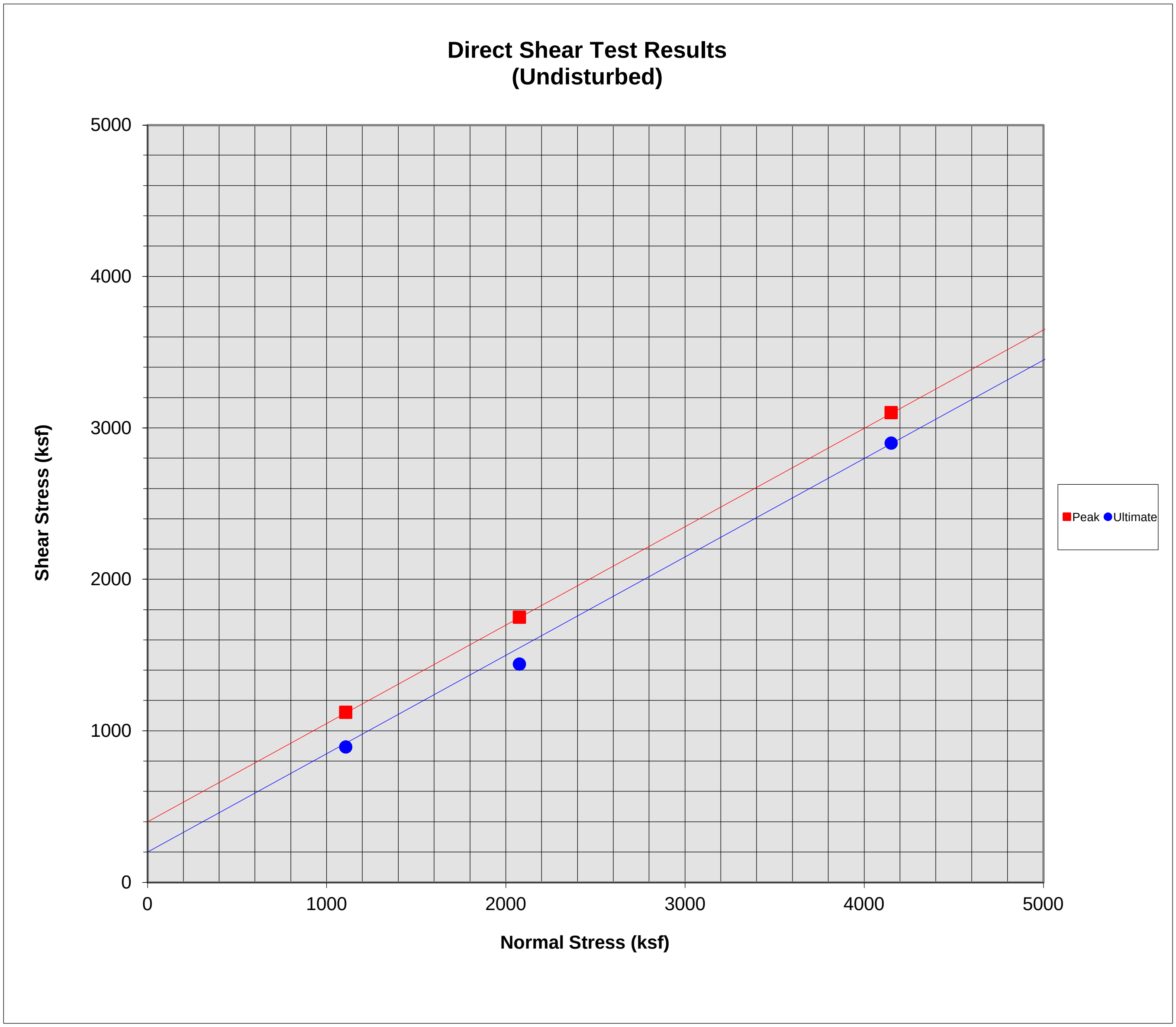
DRILLING DATE: 11/5/19
DRILLING METHOD: Hand Auger
LOGGED BY: Ross Kovtun

WATER DEPTH: N/A
CAVE DEPTH: N/A
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					4± inches Asphaltic concrete; 2± inches of Aggregate base							
					FILL: Dark Gray Clayey fine Sand, trace medium to coarse Sand, trace fine Gravel, medium dense-very moist							
	Hand						16					
					ALLUVIUM: Gray to Dark Gray Brown Silty fine Sand, trace to little Clay, trace medium Sand, medium dense-very moist							
5	Hand						14					

Boring Terminated at 5'

TBL 19G186-2R.GPJ SOCALGEO.GDT 7/16/20



Sample Description: B-9 @ 1 to 2 feet

Classification: Brown Silty fine Sand

Sample Data		Test Results		
Initial Moisture Content	8.0			
Final Moisture Content	17.0		Peak	Ultimate
Initial Dry Density	113.0	ϕ (°)	33.0	33.0
Final Dry Density	---	C (psf)	400	200
Specimen Diameter (in)	2.4			
Specimen Thickness (in)	1.0			

Amazon Distribution Center
Cypress, California
Project No. 19G186-2R
PLATE C-1

SoCalGeo
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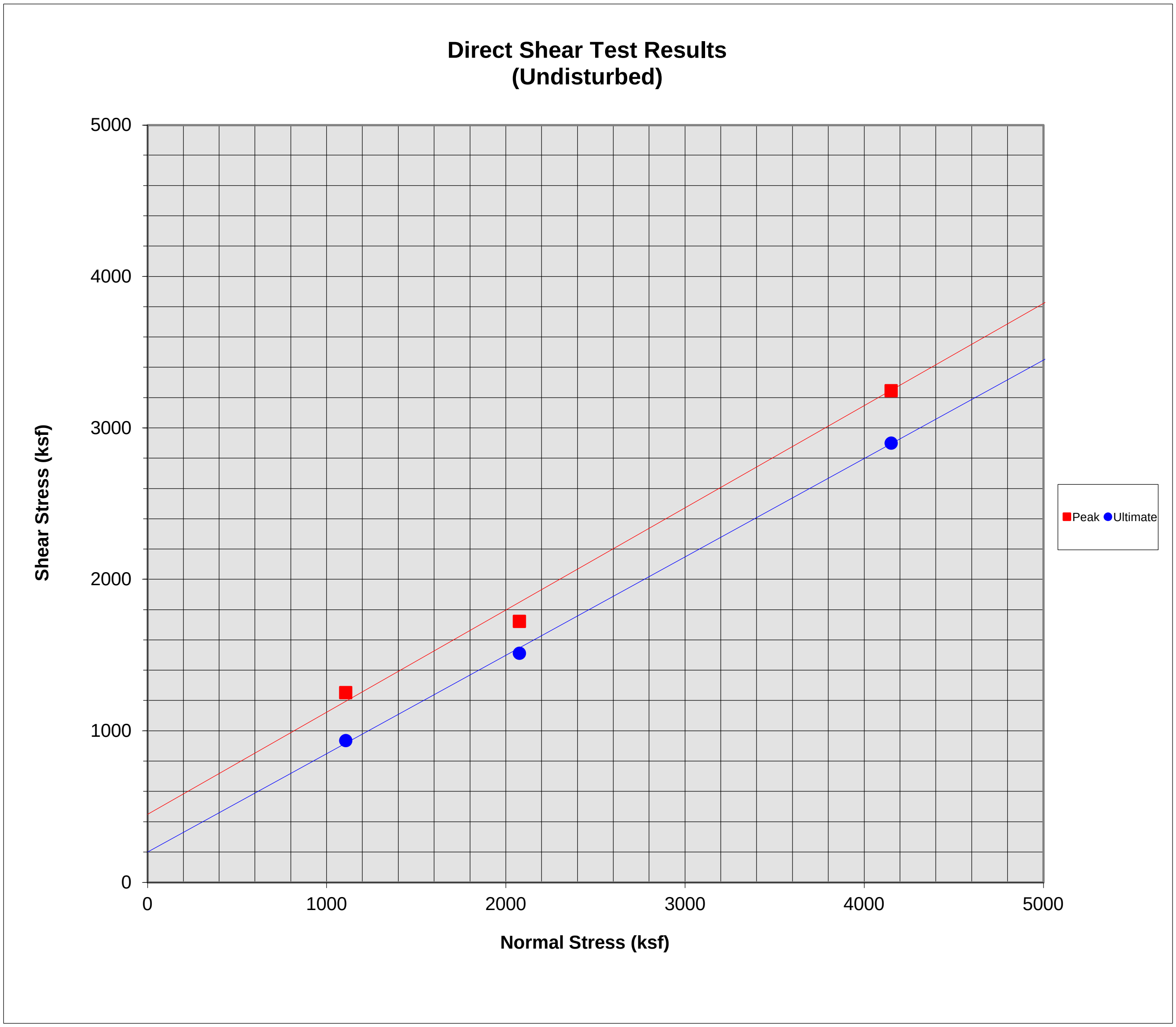
A California Corporation



Sample Description: B-9 @ 3 to 4 feet

Classification: Dark Gray Brown fine Sandy Silt, little Clay

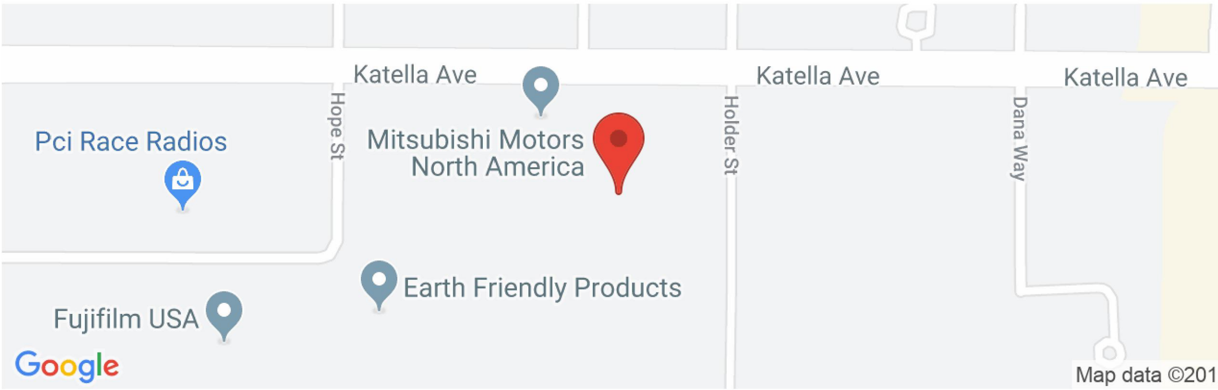
Sample Data	
Initial Moisture Content	14.0
Final Moisture Content	25.0
Initial Dry Density	108.0
Final Dry Density	---
Specimen Diameter (in)	2.4
Specimen Thickness (in)	1.0

Test Results	Peak	Ultimate
ϕ (°)	34.0	33.0
C (psf)	450	200

Amazon Distributin Center
Cypress, California
Project No. 19G186-2R
PLATE C-2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Latitude, Longitude: 33.801729, -118.020989



Date	9/13/2019, 9:41:27 AM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.44	MCE_R ground motion. (for 0.2 second period)
S_1	0.51	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.44	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.96	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.617	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.678	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.44	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.579	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.465	Factored deterministic acceleration value. (0.2 second)
S1RT	0.51	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.557	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.835	Factored deterministic acceleration value. (1.0 second)
PGAd	0.998	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.912	Mapped value of the risk coefficient at short periods
C_{R1}	0.916	Mapped value of the risk coefficient at a period of 1 s

SOURCE: SEAOC/OSHPD Seismic Design Maps Tool
<https://seismicmaps.org/>

SEISMIC DESIGN PARAMETERS - 2019 CBC
AMAZON DISTRIBUTION CENTER
CYPRESS, CALIFORNIA

DRAWN: PM
CHKD: RGT

SCG PROJECT
19G186-2R

PLATE E-1

SOUTHERN CALIFORNIA GEOTECHNICAL