PRELIMINARY GEOHAZARD STUDY REPORT

South Bay Galleria
1815 Hawthorne Boulevard
Redondo Beach, California 90278

February 24, 2016

Converse Project No. 16-31-104-01

Prepared For:
Forest City Real Estate Services
949 South Hope Street
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Prepared By:
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February 24, 2016

Mr. Kenneth Lee
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Subject: PRELIMINARY GEOHAZARD STUDY REPORT
South Bay Galleria
1815 Hawthorne Boulevard
Redondo Beach, California
Converse Project No. 16-31-104-01

Dear Mr. Lee:

Converse Consultants (Converse) has prepared the enclosed preliminary geohazard study report for the above-referenced project located at 1815 Hawthorne Boulevard, Redondo Beach, California. The purpose of the report is to present the findings of subsurface soil characteristics and provide preliminary geologic and seismic data in accordance with the current edition of the California Building Code. This report is not intended to provide sufficient information for design purposes. Our services were performed in accordance with our proposal dated January 12, 2016.

We appreciate the opportunity to be of continued service to Forest City Real Estate Services. If you should have any questions, please do not hesitate to contact us at (626) 930-1200.

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1.0 INTRODUCTION

This report contains the findings of our preliminary geohazard study for the South Bay Galleria Project located at 1815 Hawthorne Boulevard, Redondo Beach, California, as shown on Drawing No. 1, Site Location Map.

The purpose of the report is to present the findings of subsurface soil characteristics and provide preliminary geologic and seismic data in accordance with the current edition of California Building Code (CBC). This report is not intended to provide sufficient information for design purposes.

This report is written for the project described herein and is intended for use solely by Forest City Real Estate Services and their design team. This report may be made available to the potential contractors for information on factual data only.

2.0 SITE AND PROJECT DESCRIPTION

2.1 Site Description

The subject site is located at 1815 Hawthorne Boulevard, Redondo Beach, California, and is relatively flat, with surface elevations ranging from approximately 93 to 98 feet relative to mean-sea-level (MSL), toward the north. The site is bordered by Artesia Boulevard to the north, by existing parking lots and South Bay Southern shopping center to the south, by Kingsdale Avenue to the west, and by Hawthorne Boulevard to the east. The location of the subject site is North Latitude 33.8717 and West Longitude 118.3548.

2.2 Site Background

Historic aerial photographs were reviewed from www.HistoricAerials.com, a service provided by Nationwide Environmental Title Research, LLC, a database of aerial photographs from the United States Department of Agriculture (USDA) and United States Geological Survey (USGS). Readily available historic photographs for the site from the years 1952, 1963, 1972, 1980, 1994, 2002, 2003, 2004, 2005, 2009, 2010, and 2012 were viewed as well as topographical maps from the years 1896, 1899, 1905, 1910, 1916, 1922, 1924, 1926, 1927, 1953, 1959, 1966, 1975, and 1982. Based upon our research and review, the subject study area consisted of agricultural fields until the 1960’s. The 1963 photos show existing buildings and a surface parking lot on-site similar to present day conditions. The 1994 photos show the extension including a parking structure and the AMC theatre building on the northwest portion of the site. There has been no significant development since 1994 as observed by later aerial photographs.
2.3  **Project Description**

We understand the proposed project will consist of upgrades of the existing South Bay Galleria site at 1815 Hawthorne Boulevard in Redondo Beach, California. No building additions are planned at this time.

3.0  **SCOPE OF WORK**

The scope of our work included a site reconnaissance, subsurface exploration with soil sampling, laboratory testing, engineering analysis, and preparation of this report.

3.1  **Site Reconnaissance**

During site reconnaissance on January 21, 2016, the surface conditions were noted and the locations of the borings were determined so that drill rig access to all the locations was available. The borings were located and marked using existing boundary features as a guide and should be considered accurate only to the degree implied by the method used. Underground Service Alert (USA) of Southern California was notified of our proposed drilling locations at least 48 hours prior to initiation of the subsurface fieldwork.

3.2  **Subsurface Exploration**

Four (4) exploratory borings (BH-1 through BH-4) were drilled within the project site on January 28, 2016. The borings were advanced using a truck mounted drill rig with an 8-inch diameter hollow stem auger to depths ranging from 25.5 to 81.5 feet below the existing ground surface (bgs). Each boring was visually logged by a Converse geologist and sampled at regular intervals and at changes in subsurface soils. Detailed descriptions of the field exploration and sampling program are presented in Appendix A, *Field Exploration*.

California Modified Sampler (ring samples), Standard Penetration Test samples, and bulk soil samples were obtained for laboratory testing. Standard Penetration Tests (SPTs) were performed in selected borings at selected intervals using a standard (1.4 inches inside diameter and 2.0 inches outside diameter) split-barrel sampler. The bore holes were backfilled and compacted with soil cuttings by reverse spinning of the auger following the completion of drilling, and patched with asphalt to match existing conditions where needed.

The approximate locations of the exploratory borings are shown in Drawing No. 2, *Site Plan and Boring Location Map*. Detailed descriptions of the field exploration and sampling program are presented in Appendix A, *Field Exploration*. 
3.3 **Laboratory Testing**

Representative samples of the onsite soils were tested in the laboratory to aid in classification and to evaluate relevant engineering properties. The tests performed included:

- In Situ Moisture Contents and Dry Densities (ASTM Standard D2216)
- Fines Content/Passing No. 200 Sieve (ASTM D1140)
- Maximum Dry Density and Optimum-Moisture Content Relationship (ASTM Standard D1557)
- Direct Shear (ASTM Standard D3080)
- Consolidation (ASTM Standard D2435)
- Expansion Index (ASTM Standard D4829)
- R-value (ASTM Standard D2844)
- Soil Corrosivity Tests (Caltrans 643, 422, 417, and 532)

For a description of the laboratory test methods and test results, see Appendix B, *Laboratory Testing Program*. For *in-situ* moisture and density data, see the Logs of Borings in Appendix A, *Field Exploration*.

3.4 **Engineering Analyses and Report**

Data obtained from the exploratory fieldwork and laboratory-testing program were analyzed and evaluated. This report was prepared to provide the findings, conclusions and recommendations developed during our investigation and evaluation.

4.0 **SUBSURFACE CONDITIONS**

4.1 **Regional Geologic Setting**

The project site is located in the northwestern portion of the Torrance 7.5-minute quadrangle, as shown on Drawing No. 3, *Regional Geologic Map*. The region includes a northwest-trending coastal plain, otherwise known as the Torrance Plain. This plain consists of dense silty sand covered with moderately dense silty sand of older alluvial deposits. The Torrance Plain is covered with locally derived sandy silt and sandy clay of younger alluvial deposits. The project site is underlain by deep alluvial deposits. Extensive estuarine deposits were present at the mouth of Bixby Slough, Dominguez Channel, and the Los Angeles River preceding the development of Los Angeles Harbor. These organic tidal muds have since been covered with artificial fill.

4.2 **Subsurface Profile of Subject Site**

Based on our exploratory soil borings, the site soils consist of existing fill soils placed during previous site grading operations and natural alluvial soils, as encountered in the
borings drilled to the maximum depth explored of 81.5 feet below the ground surface (bgs). Borings that were drilled in the existing parking lot had up to 4 inches of asphalt concrete over up to 3 inches of base. The observed fill soils consist primarily of sandy silts. The depth of the fill ranges from approximately three (3) feet to eight (8) feet. The alluvial sediments consist predominately of silty sand, sandy silt, and clayey sand soils to a depth of approximately 81.5 feet below ground surface.

Subsurface geologic conditions beneath the subject site are depicted on Drawing Nos. 4a and 4b, Geologic Cross-Sections A-A’ & B-B’. The geologic cross-sections show the interpreted extent and limits of the different types of subsurface materials encountered during our study. For additional information on the subsurface conditions, see the Logs of Boring data in Appendix A, Field Exploration.

4.3 Groundwater

Groundwater was encountered during our subsurface exploration at a depth of approximately 60 feet below the ground surface in boring BH-1. Based on our review of Historically Highest Groundwater Map, Plate No. 1.2 in the Seismic Hazard Zone Report for the Torrance 7.5-minute Quadrangle (1998), the historic high groundwater level is greater than 15 below existing ground surface as shown on Drawing No. 5, Historically Highest Ground Water Map. Groundwater is not anticipated to be encountered during site improvements.

In general, groundwater levels fluctuate with the seasons and local zones of perched groundwater may be present at various depths due to local conditions or during rainy seasons. Groundwater conditions below any given site vary depending on numerous factors including seasonal rainfall, local irrigation, groundwater recharge, and groundwater pumping, among other factors.

4.4 Subsurface Variations

Based on the results of subsurface exploration and our experience, some variations in the continuity and nature of subsurface conditions within the natural soils should be anticipated. Because of the uncertainties involved in the nature of undocumented fill near modern improvements and the depositional characteristics of alluvial deposits, care should be exercised in interpolating or extrapolating subsurface conditions between or beyond boring locations. Additional geotechnical exploration will be required during the design of the project.

5.0 FAULTING AND GEOLOGIC HAZARDS

Geologic hazards are defined as geologically related conditions that may present a potential danger to life and property. Typical geologic hazards in Southern California
EXISTING AMC THEATERS
EXISTING 3 STORY MALL
EXISTING GRADE

LIMITS OF WORK

KINGSDALE AVE.
LIMITS OF WORK

BH-1

BH-2

HAWTHORNE BLVD.
LIMITS OF WORK

ELEVATION IN FEET

PROFILE
HORIZONTAL: 1"=80'
VERTICAL: 1"=20'

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SOUTH BAY GALLERIA
1815 HAWTHORNE BLVD.
REDONDO BEACH, CA
FOR: FOREST CITY

Project No. 16-31-104-01
Drawing No. 4a
CROSS SECTION B-B'

BH-2
TD=26.5'

BH-3
TD=26.5'

LIMITS OF WORK

PARKING LOT AREA

EXISTING GRADE

FILL (A1)

FILL (A1)

ALLUVIUM (Gal)

ELEVATION IN FEET

PROFILE
HORIZONTAL: 1"=80'
VERTICAL: 1"=20'

GEOLOGIC CROSS SECTION B-B'

Converse Consultants

SOUTHBAY GALLERIA
1815 HAWTHORNE BLVD.
REDDONDO BEACH, CA
FOR: FOREST CITY

Project No. 16-31-104-01
Drawing No. 4b
SITE LOCATION

Plate 1.2 Historically Highest Ground Water Contours and Borehole Log Data Locations, Torrance Quadrangle.

- Borehole Site
- Depth to ground water in feet
- X Site of historical earthquake-generated liquefaction. See "Areas of Past Liquefaction" discussion in text.

SCALE

ONE MILE
include ground shaking, fault surface rupture, landslides, and earthquake related phenomena including liquefaction and tsunamis.

5.1 **Fault Surface Rupture and Active Faults**

The project site is not located within a currently designated State of California Earthquake Fault Zone (Alquist-Priolo Special Studies Zones) for surface fault rupture (Special Studies Zone, Los Angeles Quadrangle, 1977). No surface faults are known to project through or towards the site. The closest known fault to the project site with a mappable surface expression is the Newport Inglewood Fault, mapped approximately 5.9 miles southeast of the project site.

**Newport Inglewood Fault**

The Newport Inglewood fault zone is located at approximately 5.9 miles northeast of the project site. The Newport Inglewood fault system is about 66 km long on shore and extends northwest from Huntington Beach through Long Beach to Culver City and Cheviot Hills. The Newport Inglewood fault continues offshore to the southeast of Huntington Beach and makes landfall in La Jolla as the Rose Canyon fault. The Newport Inglewood fault is characterized by a series of uplifts and anticlines including Newport Mesa, Huntington Beach Mesa, Bolsa Chica Mesa, Alamitos Heights and Landing Hill, Signal Hill and Reservoir Hill, Dominguez Hills and Baldwin Hills.

Several earthquakes have occurred along the fault zone including the March 10, 1933 “Long Beach” earthquake of Mw 6.4, with its epicenter off Newport Beach, and smaller earthquakes at Inglewood on June 20, 1920 (M 4.9), Gardena on November 14, 1941 (M 5.4). These earthquakes show evidence of right-lateral strike slip focal mechanisms.

The Newport Inglewood fault is considered to be active and considered capable of producing a maximum moment magnitude (Mw) 7.1 earthquake. The slip rate is considered to be about 1.0 mm/year but may range up to 2 to 3 mm/year along isolated segments (Cao et al., 2003).

Seismic hazard fault models for the Los Angeles Basin and vicinity will continue to be refined as new information and technology develops and becomes available through time.

5.2 **Liquefaction Potential**

Liquefaction is the sudden decrease in the strength of cohesionless soils due to dynamic or cyclic shaking. Saturated soils behave temporarily as a viscous fluid (liquefaction) and, consequently, lose their capacity to support the structures founded on them. The potential for liquefaction decreases with increasing clay and gravel content, but increases as the ground acceleration and duration of shaking increase.
Liquefaction potential has been found to be the greatest where the groundwater level and loose sands occur within 50 feet of the ground surface.

The site is not located within a potential liquefaction zone per the State of California Seismic Hazard Zones Map for the Los Angeles Quadrangle as shown in Drawing No. 6, Seismic Hazard Zone Map. Based on the results of our subsurface exploration, including the absence of shallow groundwater, and our experience on similar projects we anticipate liquefaction potential to be very low and seismically-induced settlement to be negligible.

5.3 Lateral Spreading

Seismically induced lateral spreading involves primarily lateral movement of earth materials due to ground shaking. It differs from slope failure in that complete ground failure involving large movement does not occur due to the relatively smaller gradient of the initial ground surface. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. The topography at the project site and in the immediate vicinity of the site is relatively flat, with no nearby descending slopes or embankments. Under these circumstances, the potential for lateral spreading at the subject site is considered negligible.

5.4 Landslides

The project site is relatively flat and not located near any hillside terrain. In the absence of significant ground slopes, the potential for seismically induced landslides to affect the proposed site is considered to be nil.

5.5 Flooding and Inundation

Flooding

Review of the FEMA Flood Insurance Rate Maps (FIRM), Los Angeles County Map Number 06037C1930F, dated September 26, 2008, indicates that the site is located within an area designated as Zone X, described as an area outside a 0.2% annual flood chance. Since the site is not located within a flood plain subject to a 1.0% or greater chance of flooding in any year, the site is not located within a flood hazard area as defined by the CBC.

Tsunamis

Tsunamis are seismic sea waves generated by fault displacement or major ground movement. Based on the location of the site from the ocean (under 5 miles), tsunamis have a low potential to pose a hazard, and the site is not located in a current tsunami inundation zone.
Seiches

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Based on site location away from lakes and reservoirs, seiches do not appear to pose a hazard.

6.0 SEISMIC ANALYSIS

Seismic parameters based on the 2013 California Building Code are calculated using the United States Geological Survey U.S. Seismic Design Maps website application and the site coordinates for (34.0611 degrees North Latitude, 118.2377 degrees West Longitude). These coordinates are in reference to the central portion of the site. The seismic parameters are presented below.

Table No. 1, CBC Seismic Design Parameters

<table>
<thead>
<tr>
<th>Seismic Parameters</th>
<th>2013 CBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Class</td>
<td>D</td>
</tr>
<tr>
<td>Mapped Short period (0.2-sec) Spectral Response Acceleration, $S_s$</td>
<td>1.581 g</td>
</tr>
<tr>
<td>Mapped 1-second Spectral Response Acceleration, $S_1$</td>
<td>0.588 g</td>
</tr>
<tr>
<td>Site Coefficient (from Table 1613.5.3(1)), $F_a$</td>
<td>1.0</td>
</tr>
<tr>
<td>Site Coefficient (from Table 1613.5.3(2)), $F_v$</td>
<td>1.5</td>
</tr>
<tr>
<td>MCE 0.2-sec period Spectral Response Acceleration, $S_{MS}$</td>
<td>1.581 g</td>
</tr>
<tr>
<td>MCE 1-second period Spectral Response Acceleration, $S_{M1}$</td>
<td>0.882 g</td>
</tr>
<tr>
<td>Design Spectral Response Acceleration for short period, $S_{DS}$</td>
<td>1.054 g</td>
</tr>
<tr>
<td>Design Spectral Response Acceleration for 1-second period, $S_{D1}$</td>
<td>0.588 g</td>
</tr>
<tr>
<td>Seismic Design Category</td>
<td>D</td>
</tr>
</tbody>
</table>

7.0 PRELIMINARY FINDINGS AND CONCLUSIONS

7.1 General Geotechnical Considerations

Based on our field exploration data, laboratory results and preliminary analyses, we have concluded the following findings:

- Undocumented fill consisting of sandy silt was encountered ranging from three (3) to eight (8) feet in depth at the site. Deeper artificial fill may exist at the site. The fills are generally moderately dense. Undocumented fill should be excavated and recompacted for new structural improvements. The alluvial sediments consist predominately of silty sand, sandy silt and clayey silt up to a depth of approximately 81.5 feet below ground surface.
• There are no active faults projecting toward or extending across the proposed site. The site is not located within a currently designated State of California Earthquake Fault Zone. Moderate to strong ground shaking from earthquakes associated with the Newport Inglewood Fault and other nearby and distant faults may occur during the lifetime of the project.

• During our exploration, groundwater was encountered at approximately 60 feet below ground surface, and is not anticipated within the zone of construction.

• The site is not located within a potential liquefaction zone per the State of California Seismic Hazard Zones Map for Los Angeles. Based on the results of our subsurface exploration, including the absence of shallow groundwater, and our experience on similar projects, we anticipate liquefaction potential to be very low and seismically-induced settlement to be negligible.

• The upper 5 feet of site soil is considered to be “Very Low” expansive soil.

The site is suitable, from a geotechnical engineering standpoint, for the proposed upgrades of the existing South Bay Galleria provided the findings in this report are assimilated in the design. Additional geotechnical exploration, lab testing and analysis will be required to provide detailed design recommendations.

7.2 Preliminary Design Recommendations

Vertical Capacity

Though not planned at this time, structural additions and improvements can be supported by conventional shallow footings. We recommend continuous and square footings be founded at least 24 inches below lowest adjacent final grade entirely into compacted fill or into native soil. A minimum footing width of 24 inches is recommended for square footings and 18 inches for continuous footings. The allowable bearing value for footings with above minimum sizes founded on compacted fill and competent native soils may be designed for a net bearing pressure of 3,000 pounds per square foot (psf) for dead-plus-live-loads. The net allowable bearing pressure can be increased by 250 psf for each additional foot of excavation depth and by 250 psf for each additional foot of excavation width up to a maximum value of 4,500 psf.

The net allowable bearing values indicated above are for the dead loads and frequently applied live loads and are obtained by applying a factor of safety of 3.0 to the net ultimate bearing capacity.

Lateral Capacity

Resistance to lateral loads can be provided by friction acting at the base of the foundation and by passive earth pressure. A coefficient of friction of 0.30 may be
assumed with normal dead load forces. An allowable passive earth pressure of 250 psf per foot of depth up to a maximum of 2,500 psf may be used for footings poured against properly compacted fill. The values of coefficient of friction and allowable passive earth pressure include a factor of safety of 1.5.

**Settlement**

The static settlement of structures supported on continuous and/or spread footings founded on compacted fill and native soil will depend on the actual footing dimensions and the imposed vertical loads. Most of the footing settlement at the project site is expected to occur immediately after the application of the load. Based on the maximum allowable net bearing pressures presented above, static settlement is anticipated to be less than 0.5 inch. Differential settlement is expected to be up to one-half of the total settlement over a 30-foot span.

**Dynamic Increases**

Bearing values indicated above are for total dead load and frequently applied live loads. The above vertical bearing may be increased by 33% for short durations of loading which will include the effect of wind or seismic forces. The allowable passive pressure may be increased by 33% for lateral loading due to wind or seismic forces.

### 7.3 Slabs-on-grade

Slabs-on-grade should have a minimum thickness of four inches nominal for support of normal ground-floor live loads. Minimum reinforcement for slabs-on-grade should be No. 3 reinforcing bars, spaced at 18 inches on-center each way. The thickness and reinforcement of more heavily loaded slabs will be dependent upon the anticipated loads and should be designed by a structural engineer. A static modulus of subgrade reaction equal to 150 pounds per square inch per inch may be used in structural design of concrete slabs-on-grade.

It is critical that the exposed subgrade soils should not be allowed to desiccate prior to the slab pour. Care should be taken during concrete placement to avoid slab curling. Slabs should be designed and constructed as promulgated by the ACI and Portland Cement Association (PCA). Prior to the slab pour, all utility trenches should be properly backfilled and compacted.

In areas where a moisture-sensitive floor covering (such as vinyl tile or carpet) is used, a 10-mil-thick moisture retarder/barrier between the bottom of slab and subgrade that meets the performance criteria of ASTM E1745 Class A material. Retarder/barrier sheets should be overlapped a minimum of six inches, and should be taped or otherwise sealed per the product specifications.
7.4 Modulus of Subgrade Reaction

For the subject project, design of the structures supported on compacted fill subgrade prepared in accordance with the recommendations provided in this report may be based on a soil modulus of subgrade reaction of \((k_s)\) of 150 pounds per square inch per inch.

7.5 Lateral Earth Pressure

Although not anticipated, the following provisional design values may be used for any utility vaults and/or walls below grade that are less than 6 feet high. As we understand, basement walls are not currently planned, but there may be some subsurface utility vaults.

The earth pressure behind any buried wall depends primarily on the allowable wall movement, type of soil behind the wall, backfill slopes, wall inclination, surcharges, and any hydrostatic pressure. The following earth pressures are recommended for vertical walls with no hydrostatic pressure.

**Table No. 2, Lateral Earth Pressures for Retaining Wall Design**

<table>
<thead>
<tr>
<th>Backfill Slope (H:V)</th>
<th>Cantilever Wall Equivalent Fluid Pressure (pcf)</th>
<th>Restrained Wall (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>35 (triangular pressure distribution)</td>
<td>55 (triangular pressure distribution)</td>
</tr>
</tbody>
</table>

The recommended lateral pressures assume that the walls are fully back-drained to prevent build-up of hydrostatic pressure. Adequate drainage could be provided by means of permeable drainage materials wrapped in filter fabric installed behind the walls. The drainage system should consist of perforated pipe surrounded by a minimum of one (1) square foot per lineal feet of free draining, uniformly graded, \(\frac{3}{4}\) -inch washed, crushed aggregate, and wrapped in filter fabric such as Mirafi 140N or equivalent. The filter fabric should overlap approximately 12 inches or more at the joints. The subdrain pipe should consist of perforated, four-inch diameter, rigid ABS (SDR-35) or PVC A-2000, or equivalent, with perforations placed down. Alternatively, a prefabricated drainage composite system such as the Miradrain G100N or equivalent can be used. The subdrain should be connected to solid pipe outlets, with a maximum outlet spacing of 100 feet. Waterproofing membranes should be added to the subterranean wall levels for moisture sensitive areas to mitigate moisture migration through the walls.

In addition, walls with inclined backfill should be designed for an additional equivalent fluid pressure of one (1) pound per cubic foot for every two (2) degrees of slope inclination. Walls subjected to surcharge loads located within a distance equal to the height of the wall should be designed for an additional uniform lateral pressure equal to one-third or one-half the anticipated surcharge load for unrestrained or restrained walls,
respectively. These values are applicable for backfill placed between the wall stem and an imaginary plane rising 45 degrees from below the edge (heel) of the wall footings.

Retaining walls taller than 6 feet should be designed to resist additional earth pressure caused by seismic ground shaking based on Section 1615A.1.6 of CBC 2010. A seismic earth pressure of 20H (psf), based on an inverted triangular distribution, can be used for design of wall.

7.6 Soil Corrosivity Evaluation

Based on our review of soil corrosivity test results (see Appendix B), the soluble sulfate concentration, pH, chloride content, and minimum saturated resistivity are not in the corrosive range to concrete in accordance with the Caltrans Corrosive Guidelines (2012). Protections of underground metal pipe are not anticipated.

7.7 Over-Excavation

Though not planned at this time, for new structural improvements, prior to the start of construction, all loose soil, undocumented fill and soil disturbed during demolition should be removed to firm acceptable native material or compacted fill.

Due to the undocumented fill encountered at the site, we recommend the future planned building site be over-excavated to a depth of 5 feet below the existing grade, 3 feet below bottom of footings or depth of undocumented fill, whichever is deeper. Over-excavation should extend at least five (5) feet laterally beyond the limits of perimeter footings where feasible. The on-site soil has a “Very Low” expansive potential and is not considered suitable for re-use as regular compacted fill without mitigation.

Over-excavation for retaining walls, if any, should be two (2) feet below bottom of footings and should extend three (3) feet laterally beyond the retaining wall area. The upper 24 inches of site soils should be removed in areas of sidewalks and surface parking. If loose, disturbed, or otherwise unsuitable materials are encountered at the bottom of excavation, deeper removal will be required until firm native soils are encountered. The over-excavation should extend two (2) feet laterally beyond the sidewalk and surface parking areas. If loose, disturbed, or otherwise unsuitable materials are encountered at the bottom of excavation, deeper removal will be required until firm native soils are encountered.

Excavation activities should not disturb adjacent utilities or undermine any adjacent buildings and structures to remain. Existing utilities should be removed and adequately capped at the project boundary line, or salvaged/rerouted as designed.
The actual depth of removal should be based on recommendations and observations made during grading. Therefore, some variations in the depth and lateral extent of over-excavation recommended in this report should be anticipated.

7.8 Structural Preparation

All exposed subgrade soil surfaces should be observed by a Converse representative prior to placement of fill, base materials or slabs. The exposed subgrade should be scarified at least 6 inches, moisture conditioned as needed to 3 percent above optimum moisture content, and compacted to 90 percent relative compaction. The upper 12 inches of subgrade below new pavement should be compacted to 95 percent relative compaction.

If loose, yielding soil conditions are encountered at the excavation bottom, the following options can be considered:

a. Over-excavate until firm bottom is reached.

b. Over-excavate additional 18 inches deep below subgrade, and then place at least 18-inch-thick compacted base material (CAB or equivalent) to bridge the soft bottom. Base should be compacted to 95% relative compaction.

c. Over-excavate additional 18 inches deep below subgrade, then place a layer of geogrid (i.e. Mirafi HP570, X600 or equivalent), and place 18-inch-thick compacted base material (CAB or equivalent) to bridge the soft bottom. Base should be compacted to 95% relative compaction. An additional layer of geogrid may be needed on top of base depending on the actual site conditions.

7.9 Engineered Fill

All engineered fill should be placed on competent, scarified and compacted bottom as evaluated by the geotechnical engineer and in accordance with the specifications presented in this section. Excavated site soils, free of deleterious materials and rock particles larger than three (3) inches in the largest dimension, should be suitable for placement as compacted fill. Any proposed import fill should be evaluated and approved by Converse prior to import to the site. Import fill material should have an expansion index less than 20.

Prior to compaction, fill materials should be thoroughly mixed and moisture conditioned to three (3) percent above the optimum moisture content. Fill soils shall be evenly spread in maximum 8-inch lifts, watered or dried as necessary, mixed and compacted to at least the density specified below. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer. All fill, if not specified otherwise elsewhere in this report, should be compacted to at least 90 percent of the laboratory dry density in accordance with the ASTM Standard D2922 test method.
7.10 **Expansive Soil**

The on-site shallow soils at the subject site have a “Very Low” expansion potential. Mitigation for expansive soils is not considered necessary. The on-site soil materials will be mixed during the grading and the expansion potential might change. Therefore, the expansion potential of site soils should be verified after the grading as slabs, foundations and pavement placed directly on expansive subgrade soil will likely crack over time.

The recommendations contained in this report are based on the anticipated expansion soil conditions. Any proposed import fill should have an expansion index less than 20, and should be evaluated and approved by Converse prior to import to the site.

8.0 **CLOSURE**

The findings of this preliminary geohazard report were prepared in accordance with generally accepted professional engineering and engineering geologic principles and practice. We make no other warranty, either expressed or implied. Our findings and conclusions are based on the results of the background review of published geologic and geotechnical data, and preliminary seismic analysis. Subsurface exploration, soil sampling, laboratory testing, and geotechnical engineering analyses will be needed to formulate appropriate recommendations for foundation design and construction.

This preliminary report was prepared for Forest City Real Estate Services and their design team for the subject project described herein. Additional geotechnical studies and analyses may be required to further evaluate the site for final project designs. Converse is not responsible for technical interpretations made by others of our preliminary information. Specific questions or interpretations concerning the findings and conclusions presented herein may require a written clarification to avoid any misunderstandings.
9.0 REFERENCES


California Division of Mines and Geology staff, 1998, Seismic Hazard Evaluation of the Torrance 7.5-minute quadrangle, Los Angeles County, California: California Division of Mines and Geology, Open-File Report 98-26, scale 1:24,000.


APPENDIX A

FIELD EXPLORATION
APPENDIX A

FIELD EXPLORATION

Our field investigation included a reconnaissance of the site and a subsurface exploration program consisting of drilling soil borings. During the site reconnaissance on January 21, 2016, the surface conditions were noted and the locations of the borings were determined. The borings were located using existing boundary features as a guide and should be considered accurate only to the degree implied by the method used.

Four (4) exploratory borings (BH-1 through BH-4) were drilled within the project site on January 28, 2016. The borings were advanced using a truck mounted drill rig with an 8-inch diameter hollow stem auger to depths ranging from 25.5 to 80.5 feet below the existing ground surface (bgs). Soils were logged by a Converse geologist and classified in the field by visual examination in accordance with the Unified Soil Classification System. The field descriptions have been modified where appropriate to reflect the laboratory test results.

Ring samples of the subsurface materials were obtained at frequent intervals in the exploratory borings using a drive sampler (2.4-inches inside diameter and 3.0-inches outside diameter) lined with sample rings. The steel ring sampler was driven into the bottom of the borehole with successive drops of a 140-pound driving weight falling 30 inches, using an automatic hammer. Samples were retained in brass rings (2.4-inches inside diameter and 1.0-inch in height). The central portion of the sample was retained and carefully sealed in waterproof plastic containers for shipment to the Converse laboratory. Blow counts for each sample interval are presented on the logs of borings. Bulk samples of typical soil types were also obtained.

Standard Penetration Tests (SPT) were also performed using a standard (1.4-inches inside diameter and 2.0-inches outside diameter) split-barrel sampler. The mechanically driven hammer for the SPT sampler was 140 pounds, failing 30 inches for each blow. The recorded blow counts for every six inches for a total of 1.5 feet of sampler penetration are shown on the Logs of Borings in the “BLOWS” column. The standard penetration test was performed in accordance with the ASTM Standard D1586 test method. The soil retrieved from the spoon sampler was carefully sealed in waterproof plastic bags for shipment to the laboratory.

It should be noted that the exact depths at which material changes occur cannot always be established accurately. Changes in material conditions that occur between driven samples are indicated in the logs at the top of the next drive sample. A key to soil symbols and terms is presented as Drawing No. A-1, Soil Classification Chart. The logs of the exploratory borings are presented in Drawing Nos. A-2a through A-5, Log of Borings.
### Soil Classification Chart

#### Major Divisions

<table>
<thead>
<tr>
<th>GRAVEL AND GRAVELLY SOILS</th>
<th>CLEAN GRAVELS</th>
<th>GW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(LITTLE OR NO FINES)</td>
<td></td>
</tr>
<tr>
<td>COARSE GRAINED SOILS</td>
<td>GRAVELS WITH FINES</td>
<td>GM</td>
</tr>
<tr>
<td></td>
<td>(APPRICABLE AMOUNT OF FINES)</td>
<td>GC</td>
</tr>
<tr>
<td></td>
<td>CLEAN SANDS</td>
<td>SW</td>
</tr>
<tr>
<td></td>
<td>(LITTLE OR NO FINES)</td>
<td></td>
</tr>
<tr>
<td>SAND AND SANDY SOILS</td>
<td>SANDS WITH FINES</td>
<td>SM</td>
</tr>
<tr>
<td></td>
<td>(APPRICABLE AMOUNT OF FINES)</td>
<td>SC</td>
</tr>
<tr>
<td>FINE GRAINED SOILS</td>
<td>SILTS AND CLAYS</td>
<td>ML</td>
</tr>
<tr>
<td></td>
<td>LIQUID LIMIT LESS THAN 50</td>
<td>CL</td>
</tr>
<tr>
<td></td>
<td>LIQUID LIMIT GREATER THAN 50</td>
<td>MH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OH</td>
</tr>
<tr>
<td>hochy ORGANIC SOILS</td>
<td></td>
<td>PT</td>
</tr>
</tbody>
</table>

#### Symbols

- **GW**: Well-graded gravels, gravel - sand mixtures, little or no fines
- **GP**: Poorly-graded gravels, gravel - sand mixtures, little or no fines
- **GM**: Silty gravels, gravel - sand - silt mixtures
- **GC**: Clayey gravels, gravel - sand - clay mixtures
- **SW**: Well-graded sands, gravelly sands, little or no fines
- **SP**: Poorly-graded sands, gravelly sand, little or no fines
- **SM**: Silty sands, sand - silt mixtures
- **SC**: Clayey sands, sand - clay mixtures
- **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
- **MH**: Inorganic silts, micaeous or diatomaceous fine sand or silty soils
- **CH**: Inorganic clays of high plasticity
- **OH**: Organic clays of medium to high plasticity, organic silts
- **PT**: Peat, humus, swamp soils with high organic contents

#### Boring Log Symbols

- **Standard Penetration Test**
  - Split barrel sampler in accordance with ASTM D-1586-84 Standard Test Method
  - 2.42" I.D. sampler
  - Drive Sample: No recovery
- **Bulk Sample**
- **Grab Sample**
- **Groundwater While Drilling**
- **Groundwater After Drilling**

#### Laboratory Testing Abbreviations

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pocket Penetrometer</td>
<td>p</td>
</tr>
<tr>
<td>Direct Shear</td>
<td>ds</td>
</tr>
<tr>
<td>Direct Shear (single point)</td>
<td>ds'</td>
</tr>
<tr>
<td>Unconfined Compression</td>
<td>uc</td>
</tr>
<tr>
<td>Triaxial Compression</td>
<td>tx</td>
</tr>
<tr>
<td>Vane Shear</td>
<td>vs</td>
</tr>
<tr>
<td>Consolidation</td>
<td>c</td>
</tr>
<tr>
<td>Collapse Test</td>
<td>col</td>
</tr>
<tr>
<td>Resistance (R) Value</td>
<td>r</td>
</tr>
<tr>
<td>Chemical Analysis</td>
<td>ca</td>
</tr>
<tr>
<td>Electrical Resistivity</td>
<td>er</td>
</tr>
</tbody>
</table>

#### Unified Soil Classification and Key to Boring Log Symbols

**Project Name**: SOUTH BAY GALLERIA  
**Address**: 1815 HAWTHORNE BLVD. REDONDO BEACH, CA  
**Project No.**: 16-31-104-01  
**For**: FOREST CITY

**Project ID**: 16-31-104-01.GPJ; **Template**: KEY
### SUMMARY OF SUBSURFACE CONDITIONS

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>3&quot; ASPHALT CONCRETE OVER 2.5&quot; BASE</th>
<th>FILL (A1): SANDY SILT (ML): fine-grained sand, brown.</th>
<th>ALLUVIUM (Qal): SILTY SAND (SM): fine-grained, light brown to brown.</th>
<th>11/12/19</th>
<th>11</th>
<th>99</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14/15/24</td>
<td>11</td>
<td>106</td>
<td>wa(fc=16%)</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14/17/20</td>
<td>6</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17/15/28</td>
<td>10</td>
<td>103</td>
<td>wa(fc=13%)</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24/50(6&quot;)</td>
<td>4</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13/20/25</td>
<td></td>
<td></td>
<td>wa(fc=8%)</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Log of Boring No. BH-1**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>Summary of Subsurface Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td></td>
<td><strong>Silty Sand (SM):</strong> fine-grained, light brown to brown.</td>
</tr>
<tr>
<td>20-30</td>
<td></td>
<td><strong>BULK</strong> BLOWS/FT <strong>MOISTURE (%)</strong> <strong>DRY UNIT WT. (pcf)</strong> <strong>TEST</strong></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>8/10/16 wa(fc=13%)</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>11/14/14</td>
</tr>
<tr>
<td>30</td>
<td>24/36/34</td>
<td>23/29/23</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td>14/32/34</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>13/14/18</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td>-groundwater encountered at 60 feet depth during drilling.</td>
</tr>
<tr>
<td>65</td>
<td></td>
<td>-grayish brown with trace clay</td>
</tr>
</tbody>
</table>

**Equipment:** 8" Hollow Stem Auger

**Driving Weight and Drop:** 140 lbs / 30 in

**Ground Surface Elevation (ft):** N/A

**Depth to Water (ft):** 60

---

**LOG:**

<table>
<thead>
<tr>
<th>Dates Drilled:</th>
<th>1/28/2016</th>
<th>Logged by: WB</th>
<th>Checked By: SKS</th>
</tr>
</thead>
</table>

**Sample Data:**

- Sample depth: 8/10/16 (wa(fc=13%))
- Sample depth: 11/14/14
- Sample depth: 23/29/23
- Sample depth: 14/32/34
- Sample depth: 13/14/18

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.
## Log of Boring No. BH-1

**Dates Drilled:** 1/28/2016  
**Logged by:** WB  
**Checked By:** SKS

**Equipment:** 8" HOLLOW STEM AUGER  
**Driving Weight and Drop:** 140 lbs / 30 in

**Ground Surface Elevation (ft):** N/A  
**Depth to Water (ft):** 60

### SUMMARY OF SUBSURFACE CONDITIONS

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>CLAYEY SILT (ML): with sand, fine-grained sand, grayish brown to brown.</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td></td>
<td>10/23/33</td>
</tr>
<tr>
<td>80</td>
<td></td>
<td>SILTY SAND (SM): fine-grained, gray.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12/15/38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>29/42/50</td>
</tr>
</tbody>
</table>

End of boring at 81.5 feet. Groundwater encountered at 60 feet. Borehole backfilled with soil cuttings and patched with asphalt on 1-28-16.

---

**Converse Consultants**  
**Project Name:** SOUTH BAY GALLERIA  
**Project No.:** 16-31-104-01  
**Drawing No.:** A-2c

**Project ID:** 16-31-104-01.GPJ; **Template:** LOG
**Log of Boring No. BH-2**

Dates Drilled: 1/28/2016  
Logged by: WB  
Checked By: SKS  
Equipment: 8" HOLLOW STEM AUGER  
Driving Weight and Drop: 140 lbs / 30 in  
Ground Surface Elevation (ft): N/A  
Depth to Water (ft): N/A  

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>SUMMARY OF SUBSURFACE CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot; ASPHALT CONCRETE WITH NO BASE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>4&quot; ASPHALT CONCRETE WITH NO BASE</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>4&quot; ASPHALT CONCRETE WITH NO BASE</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>4&quot; ASPHALT CONCRETE WITH NO BASE</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>4&quot; ASPHALT CONCRETE WITH NO BASE</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>4&quot; ASPHALT CONCRETE WITH NO BASE</td>
<td></td>
</tr>
<tr>
<td>26.5</td>
<td>4&quot; ASPHALT CONCRETE WITH NO BASE</td>
<td>End of boring at 26.5 feet. Groundwater not encountered during drilling. Borehole backfilled with soil cuttings and patched with asphalt on 1/28/16.</td>
</tr>
</tbody>
</table>

**FILL (Af):**
- SANDY SILT (ML): fine to medium-grained sand, brown.

**ALLUVIUM (QaI):**
- SANDY SILT (ML): fine to medium-grained sand, reddish brown.

**SILTY SAND (SM):** fine to medium-grained, light brown to reddish brown.

Converse Consultants  
SOUTH BAY GALLERIA  
1815 HAWTHORNE BLVD.  
REDONDO BEACH, CA  
FOR: FOREST CITY  

Project No. 16-31-104-01  
Drawing No. A-3  

---

**SAMPLES**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Drive</th>
<th>BULK</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/7/12</td>
<td>9</td>
<td>102</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9/7/12</td>
<td>9</td>
<td>102</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/13/21</td>
<td>10</td>
<td>106</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14/26/15</td>
<td>11</td>
<td>89</td>
<td></td>
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<tr>
<td>12/31/46</td>
<td>12</td>
<td>106</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.
## SUMMARY OF SUBSURFACE CONDITIONS

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

### 3.5" ASPHALT CONCRETE OVER 2" BASE

**FILL (AI):**
**SANDY SILT (ML):** fine to medium-grained sand, brown.

- asphalt fragments still present

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>BLENDS/FT</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td>8/9/13</td>
<td>6</td>
</tr>
</tbody>
</table>

### ALLUVIUM (Qal):

**SANDY SILT (ML):** fine-grained sand, light brown to brown.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>BLENDS/FT</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>18/50(6&quot;)</td>
<td>51</td>
<td>106</td>
</tr>
</tbody>
</table>

### SILTY SAND (SM):

fine-grained, light brown to brown reddish brown.

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>BLENDS/FT</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>17/27/37</td>
<td>2</td>
<td>82</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>BLENDS/FT</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>24/30/38</td>
<td>2</td>
<td>82</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>BLENDS/FT</th>
<th>MOISTURE (%)</th>
<th>DRY UNIT WT. (pcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>12/34/50(4&quot;)</td>
<td>2</td>
<td>82</td>
</tr>
</tbody>
</table>

End of boring at 26.5 feet.
Groundwater not encountered during drilling.
Borehole backfilled with soil cuttings and patched with asphalt on 1/28/16.
Log of Boring No. BH-4

Dates Drilled: 1/28/2016  Logged by: WB  Checked By: SKS

Equipment: 8" HOLLOW STEM AUGER  Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A  Depth to Water (ft): N/A

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>SUMMARY OF SUBSURFACE CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td><strong>3.5&quot; ASPHALT CONCRETE WITH 3&quot; BASE</strong></td>
</tr>
<tr>
<td></td>
<td><strong>FILL (Af):</strong> SANDY SILT (ML): fine to medium-grained sand, brown.</td>
</tr>
<tr>
<td></td>
<td><strong>ALLUVIUM (Qal):</strong> SILTY SAND (SM): fine to medium-grained, brown to orangish brown.</td>
</tr>
<tr>
<td>5-10</td>
<td>-light brown</td>
</tr>
<tr>
<td></td>
<td>6/12/18 13 106 c</td>
</tr>
<tr>
<td>10-15</td>
<td>-light brown to orangish brown</td>
</tr>
<tr>
<td></td>
<td>14/26/34 11 103</td>
</tr>
<tr>
<td>15-20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10/17/18 5 90</td>
</tr>
<tr>
<td>20-25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18/25/42 6 97</td>
</tr>
<tr>
<td>25-26.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13/25/23</td>
</tr>
</tbody>
</table>

End of boring at 26.5 feet.
Groundwater not encountered during drilling.
Borehole backfilled with soil cuttings and patched with asphalt on 1/28/16.
APPENDIX B

LABORATORY TESTING PROGRAM
APPENDIX B

LABORATORY TESTING PROGRAM

Tests were conducted in our laboratory on representative soil samples for the purpose of classification and evaluation of their relevant physical characteristics and engineering properties. The amount and selection of tests were based on the geotechnical requirements of the project. Test results are presented herein and on the Logs of Borings in Appendix A, Field Exploration. The following is a summary of the laboratory tests conducted for this project.

**Moisture Content and Dry Density**

Results of moisture content and dry density tests, performed on relatively undisturbed ring samples, were used to aid in the classification of the soils and to provide quantitative measure of the in situ dry density. Data obtained from this test provides qualitative information on strength and compressibility characteristics of site soils. For test results, see the Logs of Borings in Appendix A, Field Exploration.

**Percent Finer than Sieve No. 200**

The percent finer than sieve No. 200 tests were performed on four (4) representative soil samples to aid in the classification of the on-site soils and to estimate other engineering parameters. Testing was performed in general accordance with the ASTM Standard D1140 test method. Test results are presented in the Logs of Borings in Appendix A, Field Exploration.

**Maximum Dry Density Test**

One (1) laboratory maximum dry density-moisture content relationship test was performed on a representative bulk sample. The test was conducted in accordance with ASTM Standard D1557 laboratory procedure. The test results are presented on Drawing No. B-1, Moisture-Density Relationship Results.

**Direct Shear**

Direct shear tests were performed on two (2) relatively undisturbed samples at soaked moisture conditions. For each test, three samples contained in brass sampler rings were placed, one at a time, directly into the test apparatus and subjected to a range of normal loads appropriate for the anticipated conditions. The samples were then sheared at a constant strain rate of 0.01 inch/minute. Shear deformation was recorded until a maximum of about 0.50-inch shear displacement was achieved. Ultimate strength was selected from the shear-stress deformation data and plotted to determine the shear
strength parameters. For test data, including sample density and moisture content, see Drawing Nos. B-2a through B-2b, *Direct Shear Test Results*, and in the following table:

**Table No. B-2, Direct Shear Test Results**

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Depth (feet)</th>
<th>Soil Classification</th>
<th>Peak Strength Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Friction Angle (degrees)</td>
</tr>
<tr>
<td>BH-1</td>
<td>5</td>
<td>Silty Sand (SM)</td>
<td>27</td>
</tr>
<tr>
<td>BH-2</td>
<td>20</td>
<td>Silty Sand (SM)</td>
<td>22</td>
</tr>
</tbody>
</table>

**Consolidation Test**

A consolidation test was performed on one (1) selected sample. Data obtained from this test performed on a relatively undisturbed soil sample was used to evaluate the settlement characteristics of the foundation soils under load. Preparation for this test involved trimming the sample and placing the one-inch high brass ring into the test apparatus, which contained porous stones, both top and bottom, to accommodate drainage during testing. Normal axial loads were applied to one end of the sample through the porous stones, and the resulting deflections were recorded at various time periods. The load was increased after the sample reached a reasonable state of equilibrium. Normal loads were applied at a constant load-increment ratio, successive loads being generally twice the preceding load. The sample was tested at field and submerged conditions. The test results, including sample density and moisture content, are presented in Drawings Nos. B-3a through B-3b, *Consolidation Test Results*.

**Expansion Index Test**

One (1) representative bulk sample was tested to evaluate the expansion potential of material encountered at the site. The test was conducted in accordance with ASTM D4829 Standard. Test results are presented in the following table:

**Table No. B-3, Expansion Index Test Results**

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Depth (feet)</th>
<th>Soil Description</th>
<th>Expansion Index</th>
<th>Expansion Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH-3</td>
<td>1-5</td>
<td>Sandy Silt (ML)</td>
<td>0</td>
<td>Very Low</td>
</tr>
</tbody>
</table>

**R-value Test**

One (1) representative bulk soil sample was tested for resistance value (R-value) in accordance with State of California Standard Method 301-G. This test is designed to provide a relative measure of soil strength for use in pavement design. The test results are shown in the following table:
Table No. B-4, R-value Test Results

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Depth (feet)</th>
<th>Soil Classification</th>
<th>Measured R-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH-2</td>
<td>1-5</td>
<td>Sandy Silt (ML)</td>
<td>54</td>
</tr>
</tbody>
</table>

Soil Corrosivity

One (1) representative soil sample was tested to determine minimum electrical resistivity, pH, and chemical content, including chloride concentrations, and soluble sulfate. The purpose of these tests is to determine the corrosion potential of site soils when placed in contact with common construction materials. These tests were performed by EGL in Arcadia, California. The test results received from EGL are included in the following table:

Table No. B-5, Corrosivity Test Results

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Sample Depth (feet)</th>
<th>pH (Caltrans 643)</th>
<th>Soluble Chlorides (Caltrans 422) ppm</th>
<th>Soluble Sulfate (Caltrans 417) (%)</th>
<th>Saturated Resistivity (Caltrans 532) Ohm-cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>BH-2</td>
<td>1-5</td>
<td>7.44</td>
<td>95</td>
<td>0.002</td>
<td>9,200</td>
</tr>
</tbody>
</table>

Sample Storage

Soil samples presently stored in our laboratory will be discarded 30 days after the date of this report, unless this office receives a specific request to retain the samples for a longer period of time.
MOISTURE-DENSITY RELATIONSHIP RESULTS

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>BORING NO.</th>
<th>DEPTH (ft)</th>
<th>DESCRIPTION</th>
<th>ASTM TEST METHOD</th>
<th>OPTIMUM WATER, %</th>
<th>MAXIMUM DRY DENSITY, pcf</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BH-1</td>
<td>1-5</td>
<td>SANDY SILT (ML)</td>
<td>D1557 Method A</td>
<td>8.2</td>
<td>114.9</td>
</tr>
</tbody>
</table>

NOTE:
DIRECT SHEAR TEST RESULTS

**Project Name:** SOUTH BAY GALLERIA
**Project No.:** 16-31-104-01
**Drawing No.:** B-2a

**Boiling No.:** BH-1
**Depth (ft):** 5
**Description:** SILTY SAND (SM)

**Cohesion (psf):** 170
**Friction Angle (degrees):** 27

**Moisture Content (%):** 9.9
**Dry Density (pcf):** 97.8

NOTE: Ultimate Strength.
**DIRECT SHEAR TEST RESULTS**

<table>
<thead>
<tr>
<th>BORING NO.</th>
<th>BH-2</th>
<th>DEPTH (ft)</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESCRIPTION</td>
<td>SILTY SAND (SM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COHESION (psf)</td>
<td>230</td>
<td>FRICTION ANGLE (degrees):</td>
<td>22</td>
</tr>
<tr>
<td>MOISTURE CONTENT (%)</td>
<td>10.3</td>
<td>DRY DENSITY (pcf)</td>
<td>87.7</td>
</tr>
</tbody>
</table>

NOTE: Ultimate Strength.
CONSOLIDATION TEST RESULTS

BORING NO. : BH-4
DESCRIPTION : SILTY SAND (SM)

<table>
<thead>
<tr>
<th>MOISTURE CONTENT (%)</th>
<th>DRY DENSITY (pcf)</th>
<th>PERCENT SATURATION</th>
<th>VOID RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>INITIAL</td>
<td>13.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FINAL</td>
<td>16.4</td>
<td>106.7</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

CONVERSE CONSULTANTS

PROJECT NAME
SOUTH BAY GALLERIA
1815 HAWTHORNE BLVD.
REDONDO BEACH, CA
FOR: FOREST CITY

PROJECT ID: 16-31-104-01
TEMPLATE: CONSOLIDATION

Project No. 16-31-104-01
Drawing No. B-3