GEOTECHNICAL INVESTIGATION
PROPOSED MULTI-PURPOSE DEVELOPMENT
10290/10296 SAN PABLO AVENUE
EL CERRITO, CALIFORNIA

PROJECT 1741-23C

Prepared for
Branagh Development
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Prepared by
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December 2016
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GEOTECHNICAL INVESTIGATION
PROPOSED MULTI-PURPOSE DEVELOPMENT
10290/10296 SAN PABLO AVENUE
EL CERRITO, CALIFORNIA

INTRODUCTION

This report presents the results of the geotechnical investigation we conducted at the site for the proposed multi-purpose development. The site comprises of two parcels with the addresses of 10290 and 10296 San Pablo Avenue. The two parcels are located at the southeast corner of the intersection of Eureka Avenue with San Pablo Avenue El Cerrito, California. The general location of the site is shown on the attached Vicinity Map, Figure 1. Parcel 1 is currently occupied by an existing two story commercial building with at-grade parking. The building is located along San Pablo Avenue. Parcel 2 is occupied by a two story commercial building and a single story structure consisting of a series of garages along Eureka Avenue.

PLANNED CONSTRUCTION

The current development on both parcels is to be demolished to make room for the planned development. The planned development will consist of the construction of one residential building and another structure housing a transformer and a trash enclosure. The three building will 14 units. Driveways and parking for the new development will be at grade. Access to the new development will be from Eureka Avenue. No further information was available at the time of preparing this report. Preliminary architectural drawings made available to us show that extensive flatwork will be constructed as part of the development. We have assumed that the proposed structures will be of wood frame construction. Expected building loads were not available at the time of preparing this report. The proposed buildings have a combination of concrete and wood frame construction. The layout of the proposed development is shown on the Site Plan, Figure 2.

INFORMATION PROVIDED

We were provided with a set of pdf copies of preliminary drawings consisting of a proposed site plan, and ground floor plans for the three buildings. The drawings dated July 14, 2016, were prepared by Ward Young Architecture & Planning. We were also provided with a copy of an ALTA land title survey map prepared by Carlson, Barbee & Gibson, Inc., with a revised date of July 8, 2016. A copy of the ALTA survey plan was used to prepare our Site Plan, Figure 2. Figure 2 also shows the approximate location of the exploration holes that we excavated as part of this investigation.
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SCOPE OF WORK

Our scope of work was to evaluate the site conditions (surface and subsurface) from a geotechnical engineering viewpoint and to develop information for the design and construction of the proposed building foundations and other geotechnically related portions of the planned development. We should note that we did not perform any environmental assessment neither did we perform any chemical analyses of the samples we obtained from the field exploration. Specifically, we performed the following work:

1. Made a couple of site reconnaissance visits to evaluate the existing site conditions at the property and plan the field exploration program.

2. Reviewed geologic and geotechnical information in our files pertinent to the site and the surrounding area.

3. Reviewed in-house files for projects done in the vicinity of the site.

4. Explored, sampled and classified foundation soils at the site by means of three small diameter exploratory holes to such depths as were deemed pertinent. The holes were logged by an engineer on staff who obtained samples for laboratory testing.

5. Performed laboratory testing on selected soil samples obtained from the field exploration to measure their pertinent index and mechanical properties.

6. Reviewed and analyzed the field and laboratory test data obtained.

7. Based on the findings of the six items listed above, collated and analyzed the data to develop geotechnical recommendations for site preparation, grading and compaction including the demolition of the existing building foundations and site excavations; provided geotechnical information for the design and construction of the proposed building foundations, concrete slabs-on-grade, retaining walls, if any, and temporary shoring; provided recommendations for utility trench backfilling and site drainage.

8. Prepared this report summarizing our findings, conclusions and recommendations.
FINDINGS

Surface Conditions

The rectangularly shaped parcel of land is bounded on the north by Eureka Avenue, on the west by San Pablo Avenue, on the east by existing residential development and on the south by an existing at-grade parcing for a commercial development. The existing two story commercial building is located along the western area of the property. The single story structures are located along the north property line. The remainder of the ground surface at the property is paved with asphaltic concrete. A cyclone fence separates the subject property from adjacent properties on the east and south. The ground surface elevation at the site is about 56 feet above Mean Sea Level.

Subsurface Conditions

The descriptions given below pertain only to the subsurface conditions found at the site at the time of our subsurface exploration on September 19, 2016. Subsurface conditions, particularly ground water levels and the consistency of the near-surface soils, will vary with time and the seasons.

Subsurface conditions at the site were explored by means of three small diameter exploration borings to a maximum depth of 17½ feet below the existing ground surface. Within the depth of our exploration, the exploratory holes encountered man-made fill cap, clay, silt, sand and gravel.

Fill consisting of asphalt concrete and aggregate base material was encountered in all the exploratory holes. The combined thickness of both the asphalt concrete and the aggregate base material varies between eight and 12 inches at the borings. The man-made fill cap is underlain by older alluvial deposits (Thomas W. Dibblee, Jr., Preliminary Geologic Map of The Richmond Quadrangle, Alameda and Contra Costa Counties, California, 1980) consisting of dark brown sandy clay that is moist to very moist. The near-surface clay is of moderate to high plasticity and is underlain by light yellowish-brown to tan lean sandy clay to a depth of about 15 feet below the ground surface. The clay is moist and very stiff to hard and is underlain by older alluvial deposits consisting of dense gravel and sand.

Groundwater was encountered in one of the three exploratory holes at a depth of 15 feet below the ground surface. The groundwater stabilized at that depth. We should note that depth to groundwater is expected to fluctuate with time and the seasons.

Detailed descriptions of the materials encountered in the borings are given on the appended boring logs together with the results of some of the laboratory tests performed on selected
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samples obtained from the borings. The results of the laboratory tests are shown on the boring logs. The other laboratory tests are attached separately.

Seismic Considerations

This site is located within the seismically active San Francisco Bay region (very close to the active Hayward fault) but outside of any of the Alquist-Priolo Earthquake Fault Zones.

Type A and Type B faults close to the site are listed in the following table.

<table>
<thead>
<tr>
<th>Fault</th>
<th>Type</th>
<th>Maximum Moment Magnitude</th>
<th>Slip Rate (mm/yr)</th>
<th>Distance (miles/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hayward (Total Length)</td>
<td>A</td>
<td>7.1</td>
<td>9</td>
<td>0.62/1.0</td>
</tr>
<tr>
<td>Concord-Green Valley</td>
<td>B</td>
<td>6.9</td>
<td>6</td>
<td>14.9/24</td>
</tr>
<tr>
<td>Calaveras (North of Calaveras Reservoir)</td>
<td>B</td>
<td>6.8</td>
<td>6</td>
<td>11.2/18</td>
</tr>
</tbody>
</table>

* California Division of Mines & Geology Open File Report 96-08

Seismic hazards can be divided into two general categories, hazards due to ground rupture and hazards due to ground shaking. Since no active faults are known to cross this property, the risk of earthquake-induced ground rupture occurring across the project site appears to be remote.

Should a major earthquake with an epicentral location close to the site occur, ground shaking at the site will undoubtedly be severe, as will be for other properties in the general vicinity of the property. Even under the influence of severe ground shaking, the soils that underlie the area proposed for the development are unlikely to liquefy.

The following general site seismic design parameters may be used for design in accordance with the 2013 California Building Code:

Site Coordinates: Latitude = 37.9; Longitude = -122.3
Site Class: C
Fa = 1.0, and Fv = 1.3

Spectral Response Accelerations SMs and SM1
SMs = FaSs and SM1 = FvS1
For Site Class C with Fa = 1.0, and Fv = 1.3
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Period Sa
(sec) (g)
0.2 2.373 (SMs, Site Class C)
1.0 1.283 (SM1, Site Class C)

SDs = 2/3 x SMs and SD1 = 2/3 x SM1
For Site Class C with Fa = 1.0, Fv = 1.3

Period Sa
(sec) (g)
0.2 1.582 (SDs, Site Class C)
1.0 0.856 (SD1, Site Class C)

DISCUSSION

The principal geotechnical item that will impact the proposed development is the presence of the near-surface fill soil.

All deep excavations should be shored both for short term basis during construction and on permanent basis where the excavations will be permanent. The proposed buildings may be supported on shallow footing-type foundations or structural slab/mat foundation. Details are provided below.

RECOMMENDATIONS

The following recommendations, which are presented as guidelines to be used by project planners and designers, have been prepared assuming FRIAR ASSOCIATES, INCORPORATED will be commissioned to review the grading and foundation plans prior to construction, and to observe and test during site grading and foundation construction. This additional opportunity to inspect the project site will allow us to compare subsurface conditions exposed during construction with those that were observed during this investigation.

Site Preparation, Grading and Compaction

The existing development including the buildings is to be demolished. After the demolition of the existing structures, we recommend that all associated foundation elements and any underground structures be removed and hauled off site. The existing asphalt concrete should be
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removed to expose the underlying aggregate base material. The asphalt concrete should be hauled off-site or may be stockpiled to be used as structural fill, provided it is broken down into small pieces (three inches in largest dimensions). The aggregate base material may be stockpiled for reuse as structural fill. Any fill soil in proposed building and pavement areas should be excavated to expose the native soil and replaced as structural fill.

The area of the site to be built on paved should be cleared of debris and other unsuitable materials. The site surface should be stripped to remove organic-laden topsoil. Soils containing more than 2% by weight of organic matter should be considered organic. Any subsurface structure including old utility lines and buried pipes such as, electrical lines, sanitary sewers and storm drains that may exist at the property should be excavated out, removed and hauled off-site or relocated away from the proposed building and pavement sites. The resulting depressions from these operations should be backfilled with structural fill.

Trees that are designated on the project plans for removal should be felled and their root system should be grubbed. Soil surfaces exposed by excavations of loose fills and stripping and removal of surface vegetation should be scarified to a depth of eight inches, conditioned with water (or allowed to dry, as necessary) to produce a soil water content of between three and five percent above the optimum water content and then compacted to 90 percent of the maximum dry density as determined by ASTM Test D1557-09.

Structural fill may then be placed up to design grades in the proposed building and pavement areas. Structural fill using on-site inorganic soil, or approved import, should be placed in layers, each not exceeding eight inches thick (before compaction), conditioned with water (or allowed to dry, as necessary) to produce a soil water content of between three and five percent above the optimum water content and then compacted to 90 percent relative compaction based on ASTM Test D1557-09. The upper eight inches of pavement subgrades should be compacted to about 92 percent relative compaction based on ASTM Test D1557-09.

On-site soils proposed for use as structural fill should be inorganic, free from deleterious materials, and should contain no more than 15% by weight of rocks larger than three inches (a largest dimension) and no rocks larger than six inches. The suitability of the existing fill soil for reuse as structural fill should be determined by a member of our staff at the time of grading. Based on the data obtained from the field exploration, we expect that most of the existing fill soil will be suitable for reuse as structural fill. If import soil is required for use as structural fill, it should be inorganic, should preferably have a low expansion potential and should be free from clods or rocks larger than four inches in largest dimensions. Prior to delivery to the site, proposed import should be tested in our laboratory to verify its suitability for use as structural fill and, if found to be suitable, further tested to estimate the water content and density at which it should be placed.
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Earth Pressures

Excavations deeper than five feet should be shored. Lateral pressures to be used will depend on whether the excavations will be temporary or permanent. In addition to the lateral earth pressures, lateral loads due to surcharge on adjacent ground should be considered during lateral load analyses. Appropriate lateral earth pressures are provided in a section below under “Retaining Walls.”

Building Foundations

The proposed buildings may be supported on conventional, shallow foundations bearing on properly compacted fill as recommended above under “Site Preparation, Grading and Compaction” or bearing on competent native, competent “undisturbed” soil or the proposed buildings may be supported on a mat foundation.

Continuous, reinforced concrete foundations may be designed to impose pressures on foundation soils up to 2500 pounds per square foot from dead plus normal live loading. Continuous foundations should be at least 24 inches wide and should be embedded at least 24 inches below rough pad grade or adjacent finished grade, whichever is lower.

Interior isolated foundations, such as may support column loads, may be designed to impose pressures on foundation soils up to 2500 pounds per square foot from dead plus normal live loading. Interior foundations should be embedded at least 24 inches below rough pad grade and should be at least 24 inches in smallest dimensions. Interior footings that support one-story non-bearing walls may be 12 inches wide and be embedded at least 12 inches below rough pad grade.

The allowable soil pressures given above may be increased by one-third when evaluating the effects of short-term wind or seismic loadings.

Total post-construction settlement of foundations is estimated to be about one inch. Differential settlement between adjacent columns is expected to be one-half inch and one inch.

For design purposes, horizontal passive resistance acting against foundations embedded in level native soil or compacted fill may be calculated assuming an equivalent fluid pressure of 300 pounds per cubic foot. The upper nine inches of embedment should be neglected when calculating horizontal passive resistance of the soil against the foundations unless the ground surface is paved. Alternatively, the ultimate horizontal friction force acting along the base of foundations may be calculated using a soil to concrete friction coefficient of 0.4. When both passive resistance and friction are combined, the lower value of the two should be reduced by 50 percent.
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During foundation construction, care should be taken to minimize evaporation of water from foundation and floor subgrades. Scheduling the construction sequence to minimize the time interval between foundation excavation and concrete placement is important. Concrete should be placed only in foundation excavations that have been kept moist, are free from drying cracks and contain no loose or soft soil or debris.

Concrete Slabs-On-Grade

It is important that clayey subgrade soil at concrete slab areas are properly treated prior to the placement of steel and concrete. Concrete slabs should be constructed on compacted soil subgrades prepared as described in the section on “Site Preparation, Grading and Compaction.”

To minimize floor dampness, a section of capillary break material at least five inches thick and covered with a membrane vapor barrier should be placed between the floor slab and the compacted soil subgrade. The capillary break should be a free-draining material, such as 3/8" pea gravel or a permeable aggregate complying with CALTRANS Standard Specifications, Section 68, Class 1, Type A or Type B. The material proposed for use as a capillary break should be tested in our laboratory to verify its effectiveness as a capillary break. The membrane vapor barrier should be a high quality. A protective cushion of sand or capillary break material at least two inches thick should be placed between the membrane vapor barrier and the floor slab.

If floor dampness is not objectionable, concrete slabs may be constructed directly on a minimum six-inch thick compacted aggregate base over the water-conditioned and compacted soil subgrade. The aggregate base material should be compacted to at least 93 percent relative compaction (ASTM D1557-09).

The concrete slab for the trash and transformer enclosure should be designed to withstand the anticipated wheel loads from trucks.

The following design parameters may be used for a structural concrete floor or mat foundation: a modulus of subgrade reaction \( k \) of 150 tons per cubic foot would be applicable to on site soils; a soil bearing pressure of up to 3000 psf and a plasticity index of 24.0 may be used. The plasticity index value given should be confirmed when the proposed slab subgrades are established.

Retaining Walls

Based on the preliminary architectural drawings made available to us, no retaining walls are planned to be part of the proposed buildings. However, if site retaining walls are required, they should be designed using active soil pressures and design information provided below. In addition to the lateral pressures given below, the walls should be designed to resist additional
lateral pressures resulting from any additional loads caused by surcharge on the adjacent ground surface. A minimum additional uniform pressure equivalent to one-third of the anticipated surcharge load adjacent to the walls should be assumed in the design of the site walls. The following parameters may be used in the design calculations for reinforced concrete retaining walls.

1. The average bulk density of material placed on the backfill side of the wall will be 110 pcf.

2. The vertical plane extending down from the ground surface to the bottom of the heel of the wall will be subject to pressure that increases linearly with depth as follows.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Slope Behind Wall (degrees)</th>
<th>Design Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active, drained</td>
<td>0</td>
<td>45 pcf</td>
</tr>
<tr>
<td>Active, drained</td>
<td>26.6</td>
<td>55 pcf</td>
</tr>
<tr>
<td>Short-term, active, drained</td>
<td>0</td>
<td>35 pcf</td>
</tr>
</tbody>
</table>

The above values are for non-seismic conditions.

3. The effects of earthquakes may be simulated by applying a horizontal line load surcharge to the stem of the wall at a rate of \(10H^2\) lb/horizontal foot of wall, where \(H\) is the height of the surface of the backfill above the base of the wall. This surcharge should be applied at a height of \(0.6H\) above the base of the wall. The seismic surcharge load may not be applied to retaining walls that are outside of the proposed buildings.

4. A coefficient of "friction" of 0.40 may be used to calculate the ultimate resistance to horizontal sliding of the wall base over the ground beneath the base.

5. An equivalent fluid pressure of 300 psf/ft may be used to calculate the ultimate passive resistance to lateral movement of the ground in front of the toe of the wall and in front of any "key" beneath the toe or stem of the wall.

6. 3000 psf may be used as the maximum allowable bearing pressure for the ground beneath the toe of the wall. This value is for non-seismic conditions and may be increased to 3990 psf when considering additional loads on the wall resulting from earthquakes.

A zone of drainage material at least 12 inches wide should be placed on the backfill side of walls designed for drained condition. This zone should extend up the back of the wall to about 18
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inches down from the proposed ground surface above. The upper 12 inches or so of material above the drainage material should consist of native, clayey soil.

The drainage material and the clayey soil cap should be placed in layers about six inches thick and moderately compacted by hand-operated equipment to eliminate voids and to minimize post-construction settlement. Heavy compaction should not be applied; otherwise, the design pressure on the wall may be exceeded.

The drainage material should consist of either Class 2 Permeable Material complying with Section 68 of the CALTRANS Standard Specifications, latest edition, or 3/4 to 1½ inch clean, durable coarse aggregate. If the coarse aggregate is chosen as the drainage material, it should be separated from all adjacent soil by a filter fabric approved by the project Engineer.

Any water that may accumulate in the drainage material should be collected and discharged by a 6-inch-diameter, perforated pipe placed "holes down" near the bottom of the drainage material. The perforated pipe should have holes no larger that 1/4-inch diameter.

**Utility Trenches**

The attention of contractors, particularly the underground contractor, should be drawn to the requirements of California Code of Regulations, Title 8, Construction Code Section 1540 regarding Safety Orders for "Excavations, Trenches, Earthwork." Any temporary excavation deeper than five feet should be adequately shored. Temporary shoring may be designed using a lateral pressure of 35 pounds per cubic foot.

For purposes of this section of the report, bedding is defined as material placed in a trench up to one foot above any utility pipe and backfill is all material placed in the trench above the bedding.

Unless concrete bedding is required around utility pipes, free-draining sand should be used as bedding. Sand proposed for use in bedding should be tested in our laboratory to verify its suitability and to measure its compaction characteristics. Sand bedding should be compacted by mechanical means to achieve at least 90 percent compaction density based on ASTM Test Method D1557-09.

Approved, on-site, inorganic soil, or imported material may be used as utility trench backfill. Proper compaction of trench backfill will be necessary under and adjacent to structural fill, building foundations, concrete slabs and vehicle pavements. In these areas, backfill should be conditioned with water (or allowed to dry) to produce a soil-water content of about five percent above the optimum value and placed in horizontal layers not exceeding six inches in thickness (before compaction). Each layer should be compacted to 85-90 percent relative compaction based on ASTM Test Method D1557-09. The upper eight inches of pavement subgrades should
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be compacted to about 90 percent relative compaction based on ASTM Test Method D1557-09.

Where any trench crosses the perimeter foundation line of any building, the trench should be completely plugged and sealed with compacted clay soil for a horizontal distance of at least two feet on either side of the foundation.

**Surface Drainage**

Surface drainage gradients should be planned to prevent ponding and to promote drainage of surface water away from top of slopes, building foundations, slabs, edges of pavements and sidewalks, and towards suitable collection and discharge facilities.

Water seepage or the spread of extensive root systems into the soil subgrades of foundations, slabs, or pavements, could cause differential movements and consequent distress in these structural elements. This potential risk should be given due consideration in the design and construction of landscaping.

**Driveway Pavement**

We have assumed that driveways and parking areas will be constructed with concrete, in which case the recommendations and information provided under “Building Foundations” and “Concrete Slabs-on-Grade” should be used. If an asphaltic concrete driveway and parking will be constructed for at-grade parking and driveways, we recommend that minimum pavement sections shown below on Table 2 be used.

<table>
<thead>
<tr>
<th>Traffic Index (T.I.)</th>
<th>Asphalt Concrete (inches)</th>
<th>Class 2 Aggregate Base (inches)</th>
<th>Total Thickness (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5</td>
<td>2.5</td>
<td>9.0</td>
<td>11.5</td>
</tr>
<tr>
<td>5.0</td>
<td>3.0</td>
<td>9.0</td>
<td>12.0</td>
</tr>
<tr>
<td>5.5</td>
<td>3.5</td>
<td>10.0</td>
<td>13.5</td>
</tr>
<tr>
<td>6.0</td>
<td>4.0</td>
<td>11.0</td>
<td>15.0</td>
</tr>
</tbody>
</table>

Pavement subgrades should be compacted as described above in the section under “Site Preparation Grading and Compaction.”

Curbs and gutters should be constructed directly on the soil subgrade rather than on a layer of aggregate base. This will minimize the amount of surface water that seeps below the curb and
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into the pavement subgrade. The seepage of water into subgrade soils beneath vehicle pavements, can result in subgrade softening and premature pavement distress.

Pavement construction should comply with the requirements of the CALTRANS Standard Specifications, latest editions, except that compaction requirements for pavement soil subgrades and aggregate base should be based on ASTM Test D1557-09, as described in the part of this report dealing with "Site Preparation, Grading and Compaction."

Follow-up Geotechnical Services

Our recommendations are based on the assumption that FRIAR ASSOCIATES, INCORPORATED will be commissioned to perform the following services.

1. Review final grading and drainage plans prior to construction.
2. Review proposed building foundation plans and details.
3. Observe, test and advise during site preparation, grading and placement of structural fill including the removal of the existing building foundations and backfilling of cavities.
4. Observe and advise during foundation excavations and construction.
5. Observe, test and advise during utility trench backfilling.
6. Observe and advise during drainage installation.

LIMITATIONS

The recommendations contained in this report are based on certain plans, information and data that have been provided to us. Any change in those plans, information and data will render our recommendations invalid unless we are commissioned to review the change and to make any necessary modifications and/or additions to our recommendations.

Subsurface exploration of any site is necessarily confined to selected locations. Conditions may, and often do, vary between and around such locations. Should conditions different from those encountered in our explorations come to light during project development, additional exploration, testing and analysis may be necessary; changes in project design and construction may also be necessary.
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Our recommendations have been made in accordance with the principles and practices generally employed by the geotechnical engineering profession. This is in lieu of all other warranties, express or implied.

Should conditions different from those assumed in this report come to light during project development, additional exploration, testing and analysis may be necessary; changes in project design and construction may also be necessary.

All earthwork and associated construction should be observed by our field representative, and tested where necessary, to compare the generalized site conditions assumed in this report with those found at the site at the time of construction, and to verify that construction complies with the intent of our recommendations.

Report prepared by:

FRIAR ASSOCIATES, INCORPORATED

[Signature]

John H. Friar  
CE 52281
APPENDIX A

Key to Exploratory Boring Logs
and
Boring Logs
APPENDIX B

Other Laboratory Test Results