10 September 2015

Mr. Peter Solar
Alliance Realty Partners, LLC
477 Pacific Avenue, Suite One
San Francisco, California 94133

Subject: Preliminary Geotechnical Evaluation
Broadway & 28th Street
Oakland, California
Langan Project No.: 750631701

Dear Mr. Solar:

This letter report presents the results of our preliminary geotechnical evaluation for the proposed development at Broadway & 28th Street in Oakland, California. Our services were performed in general accordance with our proposal dated 7 August 2015. Our preliminary conclusions and recommendations may be used for preliminary design and pricing exercises. The intent of this letter is to inform you regarding the geotechnical conditions at the site for use in your due diligence. During final design, we should perform a geotechnical investigation which will allow us to evaluate the conditions across the site and develop final geotechnical and foundation conclusions and recommendations for the project.

As shown on Figure 1, the proposed development is planned for two blocks, one on the west and the other on the east side of Broadway. The eastern development area includes the properties at 2800 and 2820 Broadway and is bound by several one-story buildings on the north, Broadway on the west, 28th Street and an 11-story residential building on the South, and Valdez Street on the East. This parcel is currently occupied by several one- and two-story buildings on the western portion of the development area and a parking lot associated with a Hyundai Dealership. At this time we do not have information regarding basements or foundations of the existing buildings.

The western development area is at 2855 Broadway and is bound by Broadway on the east, a one story building on the north, Webster Street to the west, and a one story building on the south. This parcel is currently an asphalt paved parking lot used as a Hyundai car lot. The approximate location of the proposed development areas are shown on the attached Site Plan, Figure 2.

PROPOSED DEVELOPMENT

Based on our correspondence with you and a review of site concept plans by BAR architects, we understand that the proposed development on the two parcels will include seven-story buildings, consisting of a two-level concrete podium and five-levels of wood framing. The western building will be constructed over one below-grade parking level and the eastern building will have one below-grade parking level which will include parking stackers.

SCOPE OF SERVICES

Our scope of services included using the available geologic information as well as performing a preliminary subsurface exploration on each of the two parcels.. This information was used to developed preliminary geotechnical and foundation conclusions and recommendations regarding:

- soil and groundwater conditions at the site
- site seismicity and seismic hazards, including liquefaction and lateral spreading
- anticipated depth to suitable bearing strata
- probable foundation type(s) for the proposed buildings
- preliminary design criteria for foundations, including appropriate depth and bearing pressures
- estimated settlement behavior for the proposed foundation types
- probable shoring and underpinning types
- 2013 California Building Code (CBC) seismic design criteria.

Field Exploration

To evaluate the subsurface in some portions of the site, we performed three cone penetration tests (CPTs) for this preliminary investigation. The approximate locations of the CPTs are shown on the Site Plan, Figure 2. Prior to performing our field investigation, we obtained a soil boring permit from the Water Resources Wells Section of the Alameda County Department of Public Works Agency (ACDPWA), notified Underground Service Alert (USA), and retained a private underground utility locating service to check that locations of exploratory points were clear of existing utilities.

On 28 August 2015, Middle Earth Geotesting, Inc. of Fremont, California, advanced three CPTs at the site, designated CPT-1, CPT-2, and CPT-3, to depths of 68, 75, 68 feet bgs, respectfully. The CPTs were performed by hydraulically pushing a 1.4-inch-diameter, cone-tipped probe, with a projected area of 10 square centimeters, into the ground. The cone tip measures tip resistance, and the friction sleeve behind the cone tip measures frictional resistance. Electrical strain gauges or load cells within the cone continuously measured the cone tip resistance and frictional resistance during the entire depth of each probing. Accumulated data is processed by computer to provide engineering information, such as the types and approximate strength characteristics of the soil encountered. The CPT logs, showing tip resistance, side friction, friction ratio, interpreted SPT N-values, and interpreted soil classification, are presented in Appendix A. Shear wave velocities were measured at CPT-2 and pore water dissipation tests were performed in CPT-1 and CPT-3, results are presented in Appendix A.

Soil cuttings were not generated during the CPTs. Upon completion of the CPT holes were backfilled with cement grout in accordance with the requirements of ACDPWA.

SITE AND SUBSURFACE CONDITION

Data from our preliminary exploration indicates that the near-surface soils consist of clays with varying amounts of sand and silt. The upper soils are generally underlain by heterogeneous mixtures of sand, silt, and clay. Regional geology maps (Graymer, 1987) indicated this material is referred to as basin and alluvial fan deposits comprised of generally stiff to very stiff clay with sand lenses.

The eastern edge of the site is mapped within a liquefaction hazard zone, as designated by the California Geological Survey (*State of California Seismic Hazard Zones, Oakland West Quadrangle*, 2003 (Figure 3). This area of potential liquefaction was delineated as being near a former creek that was buried during the development in this part of Oakland.

The groundwater level was estimated from pore pressure dissipation tests in CPT-1 and CPT-3. The groundwater level is estimated to be 15½ and 12 feet bgs in CPT-1 and CPT-3, respectively. The varying levels measured at the time of our investigation are likely not representative of stabilized groundwater levels. Seasonal fluctuations in rainfall influence groundwater levels and may cause several feet of variation.

SEISMICITY

The major active faults in the area are the Hayward, Mount Diablo Thrust, Calaveras and San Andreas faults. These and other faults of the region are shown on Figure 4. For each of the active faults within about 55 kilometers of the site, the distance from the site and estimated mean characteristic Moment magnitude[1] [Working Group on California Earthquake Probabilities (WGCEP) (2008) and Cao et al. (2003)] are summarized in Table 1.

1 Moment magnitude is an energy-based scale and provides a physically meaningful measure of the size of a faulting event. Moment magnitude is directly related to average slip and fault rupture area.

TABLE 1

Regional Faults and Seismicity

Fault Name	Approximate Distance from Fault (kilometers)	Direction from Site	Mean Characteristic Moment Magnitude, M_w
Total Hayward	4.3	East	7.00
Total Hayward-Rodgers Creek	4	East	7.33
Mount Diablo Thrust	21	East	6.70
Total Calaveras	22	East	7.03
N. San Andreas - Peninsula	25	West	7.23
N. San Andreas (1906 event)	25	West	8.05
Green Valley Connected	26	East	6.80
N. San Andreas - North Coast	28	West	7.51
San Gregorio Connected	31	West	7.50
Rodgers Creek	34	Northwest	7.07
Greenville Connected	39	East	7.00
West Napa	39	North	6.70
Monte Vista-Shannon	42	South	6.50
Great Valley 5, Pittsburg Kirby Hills	43	East	6.70

Figure 4 also shows the earthquake epicenters for events with magnitude greater than 5.0 from January 1800 through August 2014. In 1868 an earthquake with an estimated maximum intensity of X on the MM scale occurred on the southern segment (between San Leandro and Fremont) of the Hayward Fault. The estimated M_w for the earthquake is 7.0. In 1861, an earthquake of unknown magnitude (probably an M_w of about 6.5) was reported on the Calaveras Fault. The most recent significant earthquake on this fault was the 1984 Morgan Hill earthquake (M_w = 6.2).

Since 1800, four major earthquakes have been recorded on the San Andreas Fault. In 1836 an earthquake with an estimated maximum intensity of VII on the Modified Mercalli (MM) scale (Figure 5) occurred east of Monterey Bay on the San Andreas Fault (Toppozada and Borchardt 1998). The estimated Moment magnitude, $M_{w,}$ for this earthquake is about 6.25. In 1838, an earthquake occurred with an estimated intensity of about VIII-IX (MM), corresponding to an M_w of about 7.5. The San Francisco Earthquake of 1906 caused the most significant damage in the history of the Bay Area in terms of loss of lives and property damage. This earthquake created a surface rupture along the San Andreas Fault from Shelter Cove to San Juan Bautista approximately 470 kilometers in length. It had a maximum intensity of XI (MM), an M_w of about

7.9, and was felt 560 kilometers away in Oregon, Nevada, and Los Angeles. The most recent earthquake on the San Andreas Fault was the Loma Prieta Earthquake of 17 October 1989, in the Santa Cruz Mountains with an M_w of 6.9, approximately 93 km from the site.

The most recent earthquake felt in the Bay Area occurred on 24 August 2014 and was located on the West Napa fault with a M_W of 6.0.

The WGCEP at the U.S. Geologic Survey (USGS) predicted a 63 percent chance of a magnitude 6.7 or greater earthquake occurring in the San Francisco Bay Area in 30 years. More specific estimates of the probabilities for different faults in the Bay Area are presented in Table 2.

TABLE 2

WGCEP (2008) Estimates of 30-Year Probability of a Magnitude 6.7 or Greater Earthquake

Fault	Probability (percent)
Hayward-Rodgers Creek	31
N. San Andreas	21
Calaveras	7
San Gregorio	6
Concord-Green Valley	3
Greenville	3
Mount Diablo Thrust	1

SEISMIC HAZARDS

The site is in a seismically active area and will be subject to strong shaking during a major earthquake on a nearby fault. Strong shaking during an earthquake can result in ground failure such as that associated with soil liquefaction[2] and lateral spreading[3]. Each of these conditions has been evaluated based on our literature review, field investigation, and studies, and is discussed in this section.

[2] Liquefaction is a transformation of soil from a solid to a liquefied state during which saturated soil temporarily loses strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced cyclic loading. Soil susceptible to liquefaction includes loose to medium dense sand and gravel, low-plasticity silt, and some low-plasticity clay deposits.

[3] Lateral spreading is a phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. Upon reaching mobilization, the surficial blocks are transported downslope or in the direction of a free face by earthquake and gravitational forces.

Liquefaction and Lateral Spreading

If a soil liquefies during an earthquake, it experiences a significant temporary loss of strength. Flow failure, lateral spreading, differential settlement, loss of bearing, ground fissures, and sand boils are evidence of excess pore pressure generation and liquefaction. The eastern portion site is on the site is partially in a liquefaction hazard zone as shown on Figure 3.

Following the 1989 Loma Prieta Earthquake and 1906 San Francisco Earthquake studies of the bay area were conducted to quantify and record damages caused by liquefaction. Reports by Holzer in 1998 and Youd & Hoose in 1978 do not indicate liquefaction was recorded at the site.

CGS has recommended the content for site investigation reports within seismic hazard zones in Special Publication 117A titled "Guidelines for Evaluating and Mitigating Seismic Hazards in California", published in 2008. Our evaluation of site seismic hazards was performed in general accordance with these guidelines. We used the results of the three CPTs to evaluate subsurface characteristics and liquefaction potential of the subsurface soils. The CPTs encountered several interbedded layers of potentially liquefiable material in layers that were classified with the behavior description of clayey silt to silty clay and silty sand to sandy silt below the water table. These materials are typically considered marginally liquefiable materials based on their likely plasticity. Clay material could experience some material softening during large ground motions caused by a significant earthquake, but don't typically exhibit complete strength loss associated with classic liquefaction.

The procedures presented in the Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on the Evaluation of Liquefaction Resistance of Soils and developed by Tokimatsu and Seed (1984) were used to estimate the volumetric strain of the potentially liquefiable soil layers during a large earthquake. Per the building code (2013 California Building Code) liquefaction analyses are based on a peak ground acceleration based on the geometric mean maximum considered earthquake (MCEg) of 0.72g. The majority of the potentially liquefiable soils encountered were between the depths of about 12 to 30 feet bgs. The bottom of the potentially liquefiable material or material that may experience softening during an earthquake was encountered at depths of 53 to 62 feet in the CPTs. The results of our analysis indicated ground surface settlement could be on the order of 2 to 4 inches resulting from liquefaction of the soils.

Lateral Spreading

Lateral spreading is a phenomenon in which a surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. The surficial blocks are transported downslope or in the direction of a free face, such as a channel, by earthquake and gravitational forces. Lateral spreading is generally the most pervasive and damaging type of liquefaction-induced ground failure generated by earthquakes.

According to Youd, Hansen, and Bartlett (1999), for significant lateral spreading displacements to occur, the soils should consist of saturated cohesionless sandy sediments with $(N_1)_{60}$ less than 15, where liquefaction of the soils is likely to occur based on standard liquefaction analysis. The potentially liquefiable fills underlying the site were determined to consist of clayey silt to silty clay and silty sand to sandy silt below the water table with $(N_1)_{60}$ greater than 15. Because the potentially liquefiable soils beneath the site have sufficient density and/or strength to resist lateral spreading, we conclude the potential of lateral spreading at the site is low.

PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

On the basis of our preliminary investigation, we conclude that from a geotechnical standpoint, the site can be developed as planned. The primary geotechnical concerns are: 1) the support of the sides of the excavation, including adjacent buildings, during construction of the basements, 2) foundation support for the proposed buildings, and 3) building settlement during an earthquake.

Foundations and Settlement

The primary factor influencing the selection of a safe, economical foundation system for the proposed structures is the potentially liquefiable material beneath the proposed structures. This material may settle or soften significantly during a major earthquake on a nearby fault. Therefore, we preliminarily conclude the proposed structures should be supported on a deep foundations gaining support below the potentially liquefiable materials. The bottom of the potentially liquefiable material or material that may experience softening during an earthquake is at about a depth of 52 to 62 feet in the CPTs. Foundations can gain support in dense to very dense sand or very stiff clay below the potentially liquefiable materials.

Feasible deep foundation options include auger-cast piles, drilled-in-place steel pipe and tube piles, and drilled piers. Our preliminary recommendation is that auger-cast piles be used to support the proposed buildings. Auger-cast piles are typically the most economical pile for projects of this size in the Bay Area. Auger-cast piles are designed and installed by specialty and often-times design-build contractors. However, they should be designed and detailed in accordance with the 2013 California Building Code (2013 CBC) requirements.

Use of auger-cast piles will require installation of indicator piles and pile load tests to evaluate production pile lengths and confirm pile capacities. Total and differential settlement for a foundation supported on deep foundations gaining support in dense to very dense sand or very stiff clay should be on the order of 1 inch and ½ inch between adjacent columns, respectively.

<u>Auger-Cast Piles</u>

Auger-cast piles can be installed by drilling to the required depth with a drill mandrel, often with an auger displacement tool at the bottom. When the tip reaches the required depth or refusal, as indicated by pre-determined refusal criteria, grout is injected through the ports in the displacement tool. Grout is injected under pressure as the auger is slowly withdrawn. While the grout is still fluid, a steel reinforcing cage or steel beam is inserted into the shaft. Auger-cast piles can range in diameter; 16-inch- and 18-inch-diameter auger-cast piles are typical.

Pile design capacities and lengths should be determined by the pile installation contractor and their engineers following completion of the final geotechnical investigation, and load tests should be performed to confirm their capacities. All piles should be spaced at least three pile diameters center-to-center, to avoid vertical capacity reductions due to pile interaction effects.

On the basis of our discussions with pile contractors we anticipate typical auger-cast piles extending 70 to 85 feet below the ground surface into competent clay and sand below the potentially liquefiable or softening material. Piles to these depths can develop an allowable axial capacity of about 150 to 250 kips. We anticipate sixteen-inch to eighteen-inch diameter, auger pressure grouted piles embedded 10 to 20 feet below the potentially liquefiable or softening material can achieve these allowable axial capacities. The contractor's designer should determine pile capacities, required lengths and evaluate pile settlements. Once designed, an indicator pile program should be established and piles load tested to confirm the design parameters used.

Pile load tests should be performed on the indicator piles to confirm the axial compressive capacity. The number of load tests will depend on the proposed number of piles. For the selected pile type, we recommend a minimum of two compression load tests be performed for each proposed production pile installation methodology (i.e. rig type, predrilling depth and diameter, pile length, etc.). If piles are required to resist tension, at least one tension test should be performed. The test piles should be selected by the Geotechnical Engineer and approved by the Structural Engineer. The load tests should be performed in accordance with latest version of ASTM D1143 (Test Methods for Deep Foundations Under Static Axial Compressive Load) or ASTM D3689 (Test Method for Deep Foundations Under Static Axial Tensile Load). Equipment used for the test (load frame, jacks, and reaction piles) should be capable of applying at least 2 times the allowable dead plus live design load, and 2 times the allowable total load.

Shoring and Underpinning

The proposed one level of basement will require excavations on the order of 12 to 22 feet below the existing ground surface. We anticipate the deeper excavation will be in areas of car stacker parking pits. Considering the depth of the excavation, the excavation will need to be shored to protect the surrounding improvements. There are several key considerations in selecting a suitable shoring system. Those we consider of primary concern are:

- protection of surrounding improvements, including roadways, utilities, and nearby structures
- control of groundwater inflow
- the ability of the shoring system to reduce potential for ground movement
- the presence of existing foundations or other obstructions
- cost.

On the basis of our understanding of the subsurface conditions and our experience with similar projects, we conclude a soldier-pile-and-lagging system is a viable shoring system for the project. This system consists of steel beams that are placed in predrilled holes; the annulus between the beams and sides of the hole are backfilled with concrete. Wood lagging is placed between the soldier beams as excavation proceeds. For excavation deeper than about 15 feet, tiebacks or internal bracing will likely be required to provide additional lateral resistance and limit shoring deflections. If tiebacks are installed in the City of Oakland's or neighbor's properties, encroachment permits/permission from the neighbor will be required.

We do not have information regarding the type of foundation and embedment depth of the adjacent buildings around the proposed development areas. However, considering the age and height of the adjacent buildings, it is likely these adjacent buildings are supported on shallow footings. This should be confirmed by test pits and/or review of existing foundation drawings. If the excavation for the below-grade level extends below these foundations, then these buildings should be underpinned during construction. Underpinning may consist of hand-excavated, end-bearing piers or slant drilled soldier piles that extended into competent material beneath the planned excavation depth. A monitoring program should be established to evaluate the effects of the construction, if any, on the adjacent buildings.

The proposed bottom of excavation will likely be below the groundwater level; therefore, we expect dewatering will be required.

Seismic Design

We preliminarily conclude that the site is underlain by potentially liquefiable soils, thus is classified as Site Class F in accordance with the 2013 CBC/ASCE 7-10. According to the 2013 CBC, Site Class F sites require a site-specific ground response evaluation be performed to develop the appropriate seismic design values for the project. However, the building code allows for an exception to this rule if the fundamental period of the planned buildings are less than 0.5 seconds. Accordingly, if the proposed buildings have a fundamental period of less than 0.5 seconds, the buildings can be designed in accordance with the criteria for a Site Class D.

For a site class D, the following seismic design parameters may be used in preliminary design:

- Risk Targeted Maximum Considered Earthquake (MCE_R) S_S and S_1 of 1.874g and 0.754g, respectively.
- Site Modification Factors, F_a and F_v of 1.0 and 1.5.
- Risk Targeted MCE_R spectral response acceleration parameters at short periods, S_{MS}, and at one-second period, S_{M1}, of 1.874g and 1.130g, respectively.
- Design Earthquake (DE) spectral response acceleration parameters at short period, S_{DS}, and at one-second period, S_{D1}, of 1.249g and 0.754g, respectively.

Construction Considerations

During excavation debris and concrete rubble may be encountered and should be removed. Hoe-rams, jack-hammers and other similar equipment will likely be needed to remove some of the larger obstacles, if encountered. The soil to be excavated consists predominantly of clay and sand that can likely be excavated with conventional excavation equipment.

A monitoring program should be established to evaluate the effects of the construction on the nearby buildings and improvements. The contractor should install surveying points to monitor the movement of shoring and settlement of nearby structures and the ground surface during excavation. The monitoring should provide timely data which can be used to modify the shoring system if needed. In addition, geotechnical instrumentation including inclinometers should be installed to monitor movement of the shoring system during excavation and construction.

Design Level Investigation and Future Services

If your purchase of the property moves forward, during final design we should perform a geotechnical investigation that would include additional field exploration, collection of soil samples, and laboratory testing, as outlined in our 7 August 2015 proposal. Additionally we should consult with the design team as geotechnical questions arise.

Recognizing that construction observation is the final stage of geotechnical design, quality assurance observation during construction by Langan Treadwell Rollo will be necessary to confirm the design assumptions and design elements, to maintain our continuity of responsibility on this project, and allow us to make changes to our recommendations, as necessary.

LIMITATIONS

The conclusions and recommendations provided in this preliminary geotechnical report result from our interpretation of the geotechnical conditions from our preliminary investigation. Actual subsurface conditions may vary.

Environmental issues (such as permitting or potentially contaminated soil and groundwater) are outside the scope of this study and should be addressed in a separate evaluation.

We trust the foregoing provides the information needed at this time. Should you have any questions, please call.

Sincerely,
Langan Treadwell Rollo

Kristen M. Lease, PE
Project Engineer

Scott A. Walker, GE
Associate

750631701.01_KML_Preliminary Report_Broadway and 28th Street_Oakland

Attachments: Figure 1 – Site Location Map
Figure 2 – Site Plan
Figure 3 – Regional Seismic Hazard Zones Map
Figure 4 – Map of Major Faults and Earthquake Epicenters in the San Francisco Bay Area
Figure 5 – Modified Mercalli Intensity Scale
Appendix A – Cone Penetration Test Results

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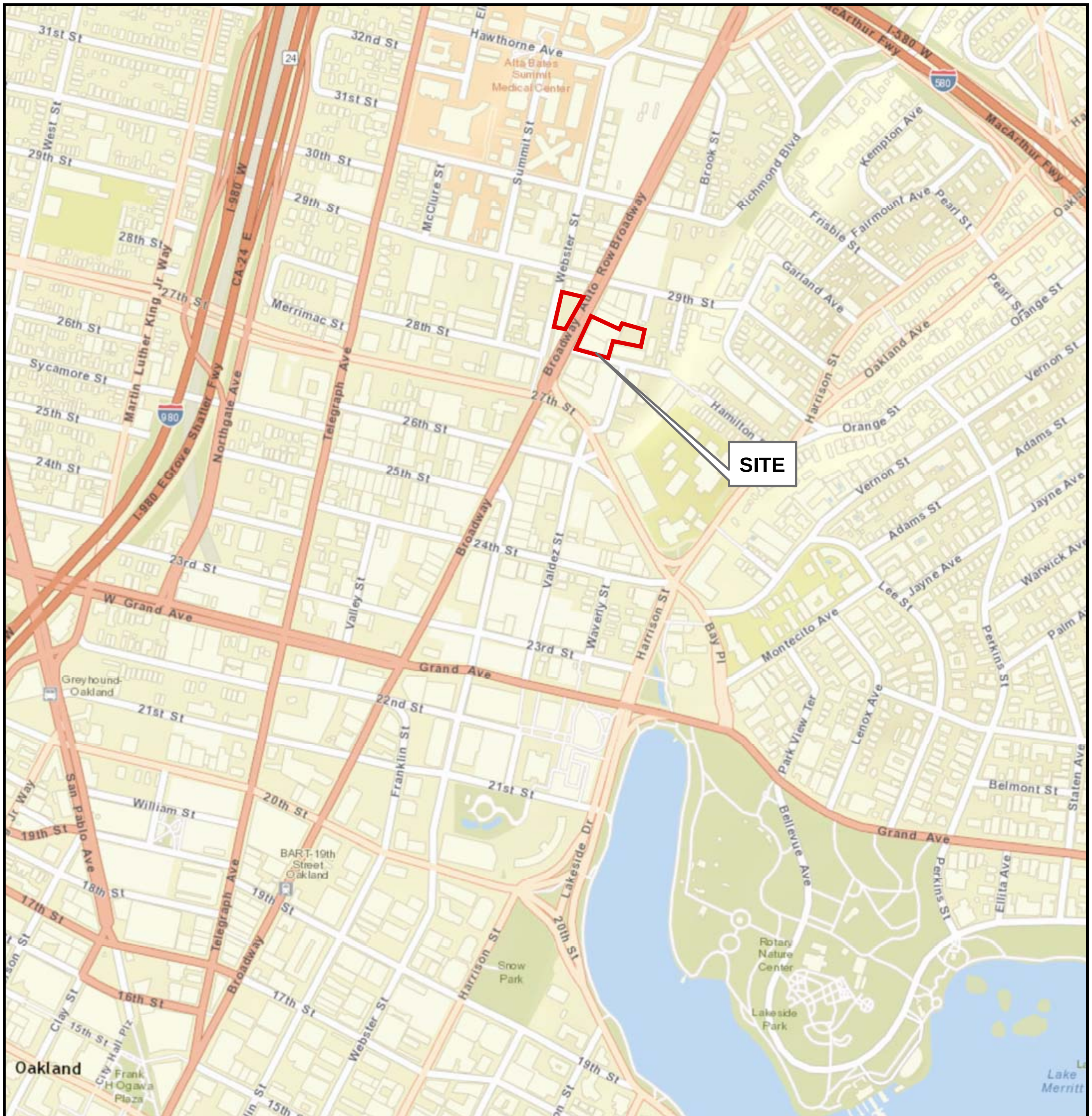
FIGURES



Notes:

1. World street basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online. Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN.
2. Map displayed in California State Plane Coordinate System, Zone III, North American Datum of 1983 (NAD83), US Survey Feet.

0 300 600 1,200
Feet

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BROADWAY AND 28TH STREET Oakland, California	**SITE LOCATION MAP**
LANGAN TREADWELL ROLLO	Date 09/09/15 | Project No. 750631701 | Figure 1

EXPLANATION

CPT-1 ◮ Approximate location of cone penetration test by Langan Treadwell Rollo, August 2015

Site Boundary

0 50 Feet

Approximate scale

REFERENCE: GIS Esri Digital Globe, 2015.

BROADWAY AND 28TH STREET
Oakland, California

LANGAN TREADWELL ROLLO

SITE PLAN

Date 09/09/15	Project No. 750631701	Figure 2

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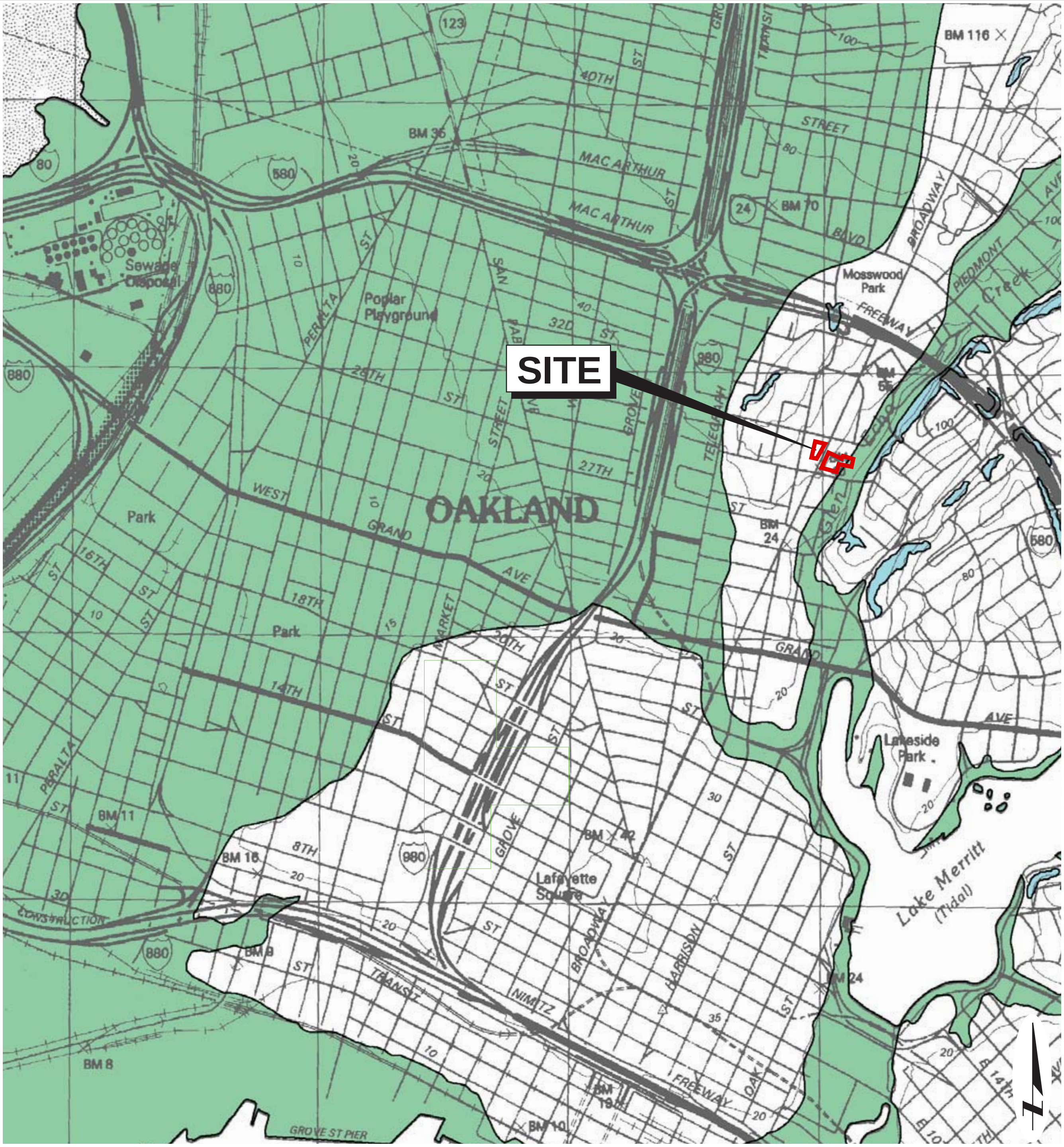


EXPLANATION

Liquefaction; Areas where historic occurence of liquefaction, or local topographic, geological, geotechnical, and subsurface water conditions indicate a potential for permanent ground displacements.

Earthquake-Induced Landslides; Areas where previous occurence of landslide movement, or local topographic, geological, geotechnical, and subsurface water conditions indicate a potential for permanent ground displacements.

0 2,000 4,000 Feet

Approximate scale

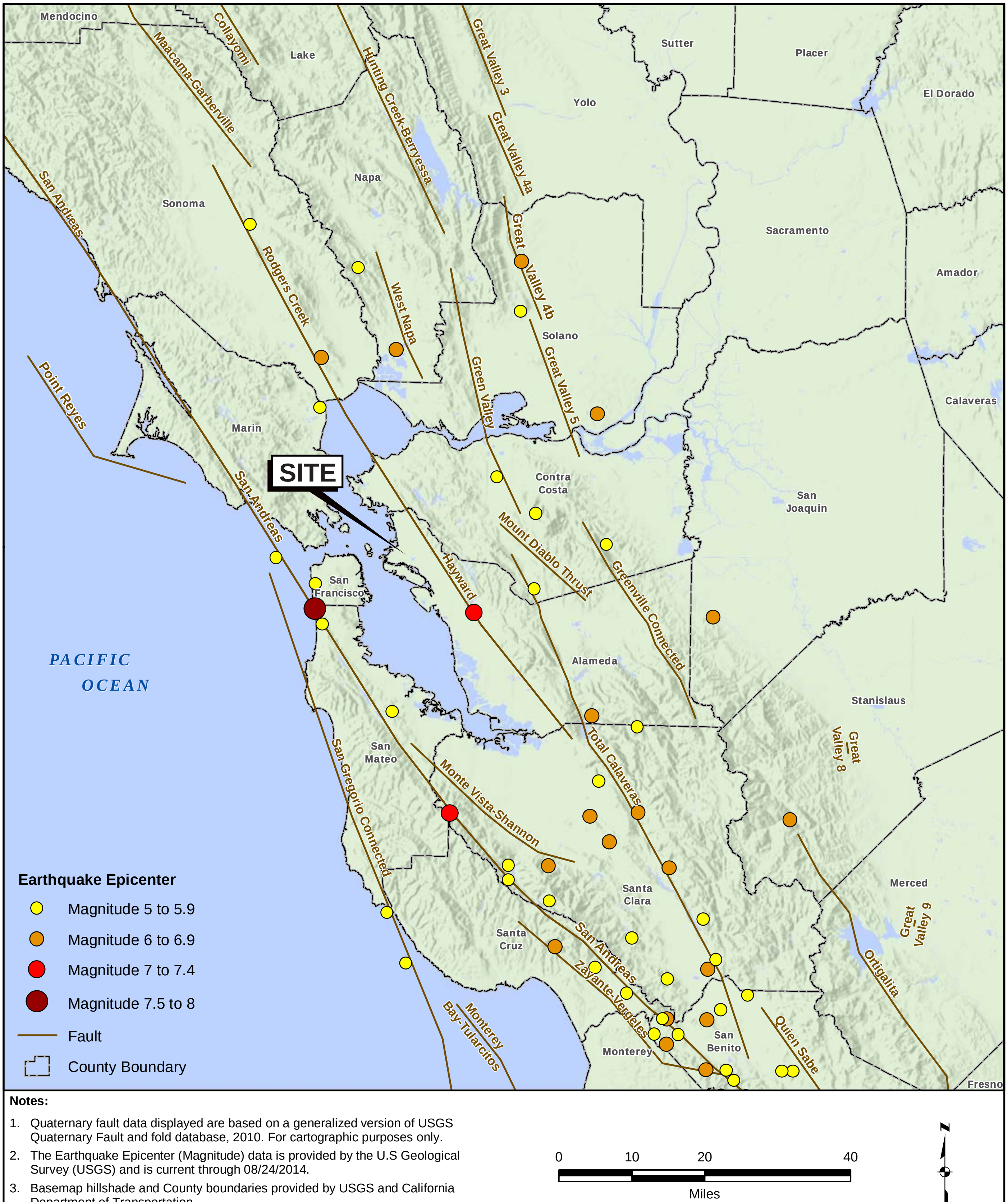
Reference:
State of California "Seismic Hazard Zones"
Oakland West Quadrangle.
Released on February 14, 2003

BROADWAY AND 28TH STREET
Oakland, California

LANGAN TREADWELL ROLLO

REGIONAL SEISMIC HAZARD ZONES MAP

Date 09/09/15	Project No. 750631701	Figure 3



Notes:

1. Quaternary fault data displayed are based on a generalized version of USGS Quaternary Fault and fold database, 2010. For cartographic purposes only.
2. The Earthquake Epicenter (Magnitude) data is provided by the U.S Geological Survey (USGS) and is current through 08/24/2014.
3. Basemap hillshade and County boundaries provided by USGS and California Department of Transportation.
4. Map displayed in California State Coordinate System, California (Teale) Albers, North American Datum of 1983 (NAD83), Meters.

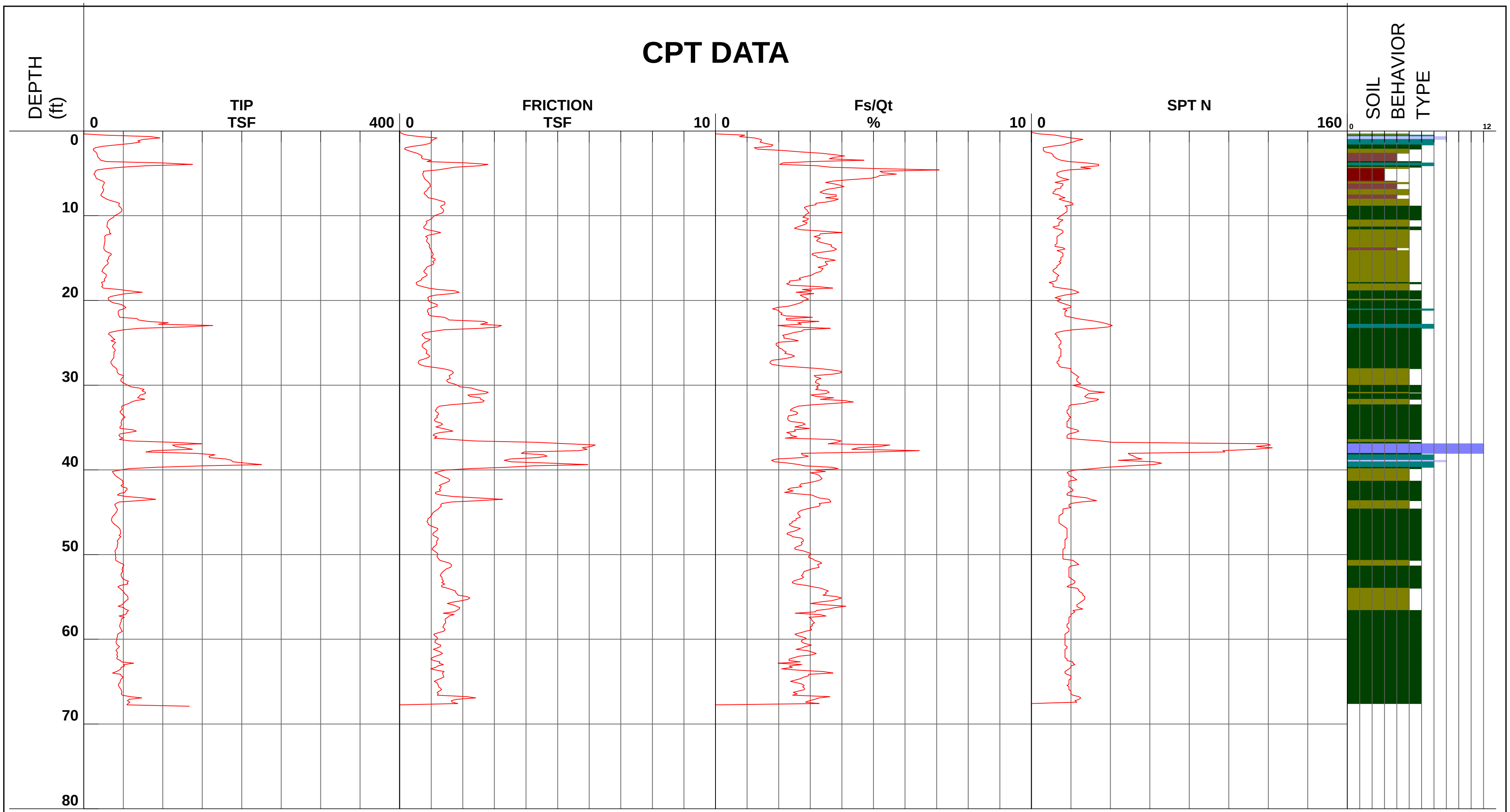
BROADWAY AND 28TH STREET Oakland, California	MAP OF MAJOR FAULTS AND EARTHQUAKE EPICENTERS IN THE SAN FRANCISCO BAY AREA		
LANGAN TREADWELL ROLLO	Date 01/29/15	Project No. 750631701	Figure 4

I	**Not felt by people, except under especially favorable circumstances. However, dizziness or nausea may be experienced.** Sometimes birds and animals are uneasy or disturbed. Trees, structures, liquids, bodies of water may sway gently, and doors may swing very slowly.
II	**Felt indoors by a few people, especially on upper floors of multi-story buildings, and by sensitive or nervous persons.** As in Grade I, birds and animals are disturbed, and trees, structures, liquids and bodies of water may sway. Hanging objects swing, especially if they are delicately suspended.
III	**Felt indoors by several people, usually as a rapid vibration that may not be recognized as an earthquake at first. Vibration is similar to that of a light, or lightly loaded trucks, or heavy trucks some distance away. Duration may be estimated in some cases.** Movements may be appreciable on upper levels of tall structures. Standing motor cars may rock slightly.
IV	**Felt indoors by many, outdoors by a few. Awakens a few individuals, particularly light sleepers, but frightens no one except those apprehensive from previous experience. Vibration like that due to passing of heavy, or heavily loaded trucks. Sensation like a heavy body striking building, or the falling of heavy objects inside.** Dishes, windows and doors rattle; glassware and crockery clink and clash. Walls and house frames creak, especially if intensity is in the upper range of this grade. Hanging objects often swing. Liquids in open vessels are disturbed slightly. Stationary automobiles rock noticeably.
V	**Felt indoors by practically everyone, outdoors by most people. Direction can often be estimated by those outdoors. Awakens many, or most sleepers. Frightens a few people, with slight excitement; some persons run outdoors.** Buildings tremble throughout. Dishes and glassware break to some extent. Windows crack in some cases, but not generally. Vases and small or unstable objects overturn in many instances, and a few fall. Hanging objects and doors swing generally or considerably. Pictures knock against walls, or swing out of place. Doors and shutters open or close abruptly. Pendulum clocks stop, or run fast or slow. Small objects move, and furnishings may shift to a slight extent. Small amounts of liquids spill from well-filled open containers. Trees and bushes shake slightly.
VI	**Felt by everyone, indoors and outdoors. Awakens all sleepers. Frightens many people; general excitement, and some persons run outdoors.** Persons move unsteadily. Trees and bushes shake slightly to moderately. Liquids are set in strong motion. Small bells in churches and schools ring. Poorly built buildings may be damaged. Plaster falls in small amounts. Other plaster cracks somewhat. Many dishes and glasses, and a few windows break. Knickknacks, books and pictures fall. Furniture overturns in many instances. Heavy furnishings move.
VII	**Frightens everyone. General alarm, and everyone runs outdoors.** People find it difficult to stand. Persons driving cars notice shaking. Trees and bushes shake moderately to strongly. Waves form on ponds, lakes and streams. Water is muddied. Gravel or sand stream banks cave in. Large church bells ring. Suspended objects quiver. Damage is negligible in buildings of good design and construction; slight to moderate in well-built ordinary buildings; considerable in poorly built or badly designed buildings, adobe houses, old walls (especially where laid up without mortar), spires, etc. Plaster and some stucco fall. Many windows and some furniture break. Loosened brickwork and tiles shake down. Weak chimneys break at the roofline. Cornices fall from towers and high buildings. Bricks and stones are dislodged. Heavy furniture overturns. Concrete irrigation ditches are considerably damaged.
VIII	**General fright, and alarm approaches panic.** Persons driving cars are disturbed. Trees shake strongly, and branches and trunks break off (especially palm trees). Sand and mud erupts in small amounts. Flow of springs and wells is temporarily and sometimes permanently changed. Dry wells renew flow. Temperatures of spring and well waters varies. Damage slight in brick structures built especially to withstand earthquakes; considerable in ordinary substantial buildings, with some partial collapse; heavy in some wooden houses, with some tumbling down. Panel walls break away in frame structures. Decayed pilings break off. Walls fall. Solid stone walls crack and break seriously. Wet grounds and steep slopes crack to some extent. Chimneys, columns, monuments and factory stacks and towers twist and fall. Very heavy furniture moves conspicuously or overturns.
IX	**Panic is general.** Ground cracks conspicuously. Damage is considerable in masonry structures built especially to withstand earthquakes; great in other masonry buildings - some collapse in large part. Some wood frame houses built especially to withstand earthquakes are thrown out of plumb, others are shifted wholly off foundations. Reservoirs are seriously damaged and underground pipes sometimes break.
X	**Panic is general.** Ground, especially when loose and wet, cracks up to widths of several inches; fissures up to a yard in width run parallel to canal and stream banks. Landsliding is considerable from river banks and steep coasts. Sand and mud shifts horizontally on beaches and flat land. Water level changes in wells. Water is thrown on banks of canals, lakes, rivers, etc. Dams, dikes, embankments are seriously damaged. Well-built wooden structures and bridges are severely damaged, and some collapse. Dangerous cracks develop in excellent brick walls. Most masonry and frame structures, and their foundations are destroyed. Railroad rails bend slightly. Pipe lines buried in earth tear apart or are crushed endwise. Open cracks and broad wavy folds open in cement pavements and asphalt road surfaces.
XI	**Panic is general.** Disturbances in ground are many and widespread, varying with the ground material. Broad fissures, earth slumps, and land slips develop in soft, wet ground. Water charged with sand and mud is ejected in large amounts. Sea waves of significant magnitude may develop. Damage is severe to wood frame structures, especially near shock centers, great to dams, dikes and embankments, even at long distances. Few if any masonry structures remain standing. Supporting piers or pillars of large, well-built bridges are wrecked. Wooden bridges that "give" are less affected. Railroad rails bend greatly and some thrust endwise. Pipe lines buried in earth are put completely out of service.
XII	**Panic is general.** Damage is total, and practically all works of construction are damaged greatly or destroyed. Disturbances in the ground are great and varied, and numerous shearing cracks develop. Landslides, rock falls, and slumps in river banks are numerous and extensive. Large rock masses are wrenched loose and torn off. Fault slips develop in firm rock, and horizontal and vertical offset displacements are notable. Water channels, both surface and underground, are disturbed and modified greatly. Lakes are dammed, new waterfalls are produced, rivers are deflected, etc. Surface waves are seen on ground surfaces. Lines of sight and level are distorted. Objects are thrown upward into the air.

BROADWAY AND 28TH STREET Oakland, California	**MODIFIED MERCALLI INTENSITY SCALE**		
LANGAN TREADWELL ROLLO	Date 08/13/15	Project No. 750631701	Figure 5

APPENDIX A

CONE PENETRATION TEST RESULTS



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

Terminated at 67.91 feet below the ground surface
Groundwater estimated at 15.50 feet (see Figure A-2)
Date performed: 08/28/15

BROADWAY AND 28TH STREET
Oakland, California

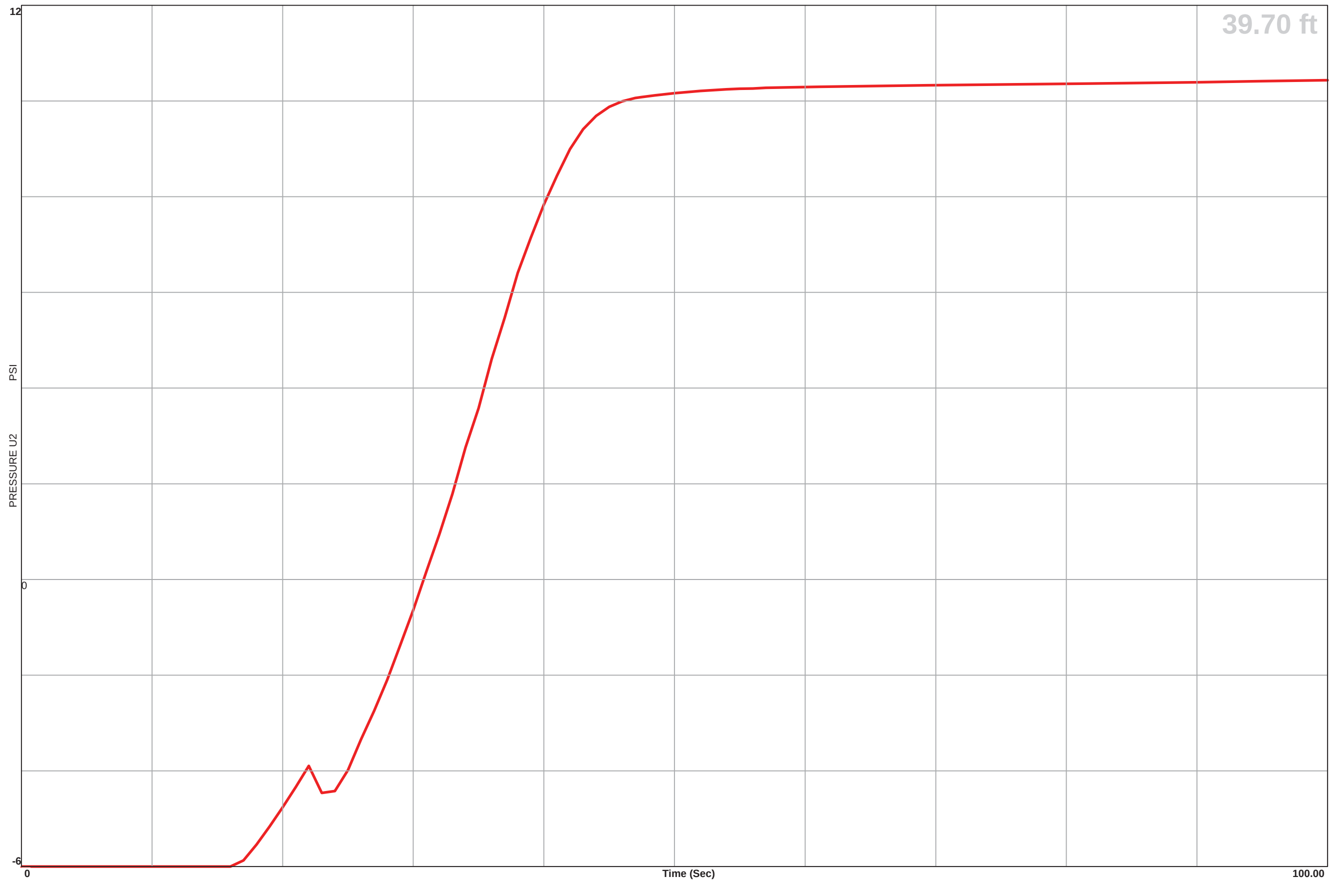
LANGAN TREADWELL ROLLO

CONE PENETRATION TEST RESULTS CPT-1

Date 09/09/15	Project No. 750631701	Figure A-1

Location	28th and Broadway	Operator	CB
Job Number	750631700	Cone Number	DDG1333
Hole Number	CPT-01	Date and Time	8/28/2015 8:23:16 AM
Equilized Pressure	10.4	EST GW Depth During Test	15.5

GPS

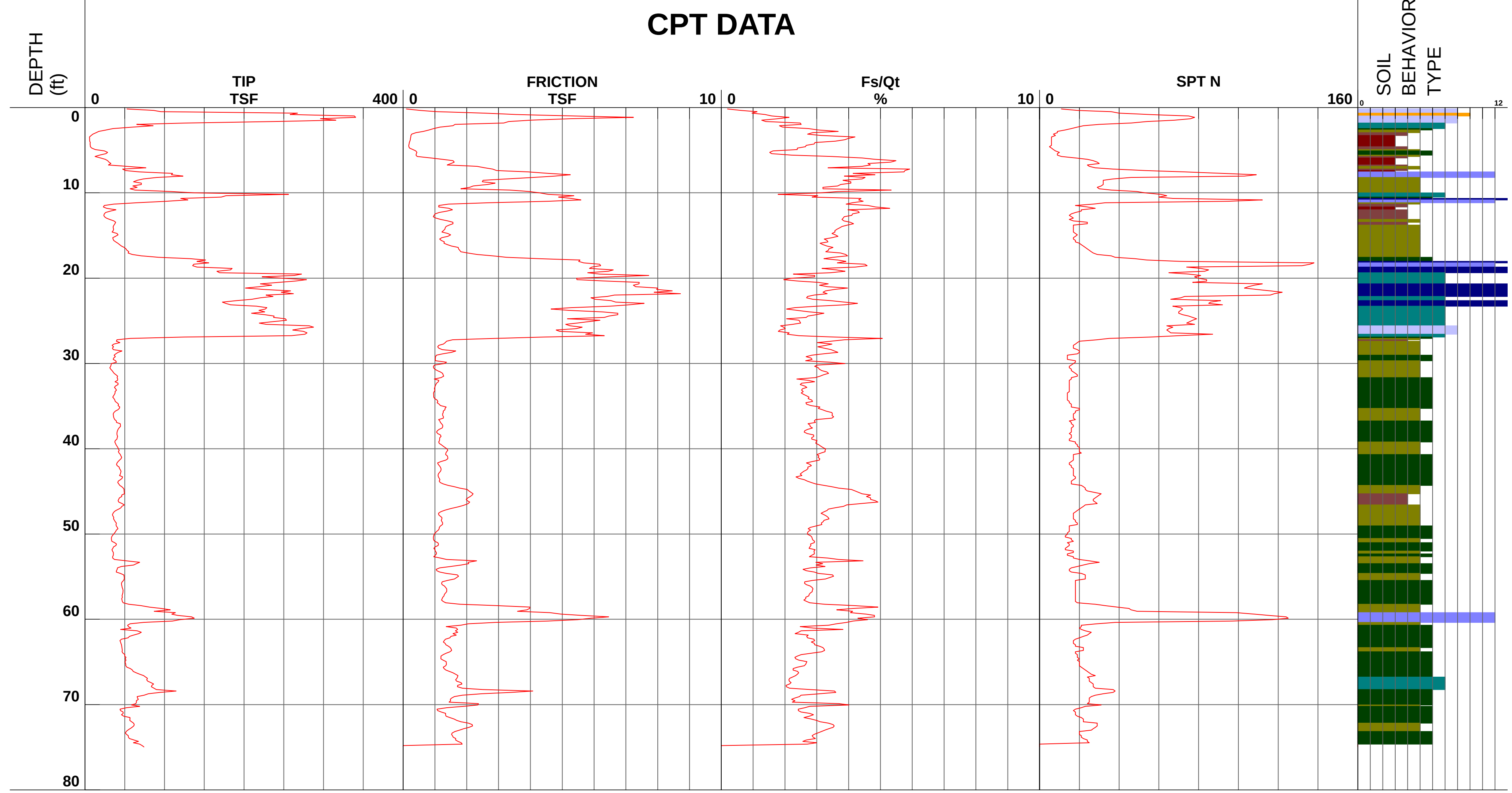


BROADWAY AND 28TH STREET
Oakland, California

PORE PRESSURE DISSIPATION TEST
CPT-1

Date 09/09/15	Project No. 750631701	Figure A-2

LANGAN TREADWELL ROLLO



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

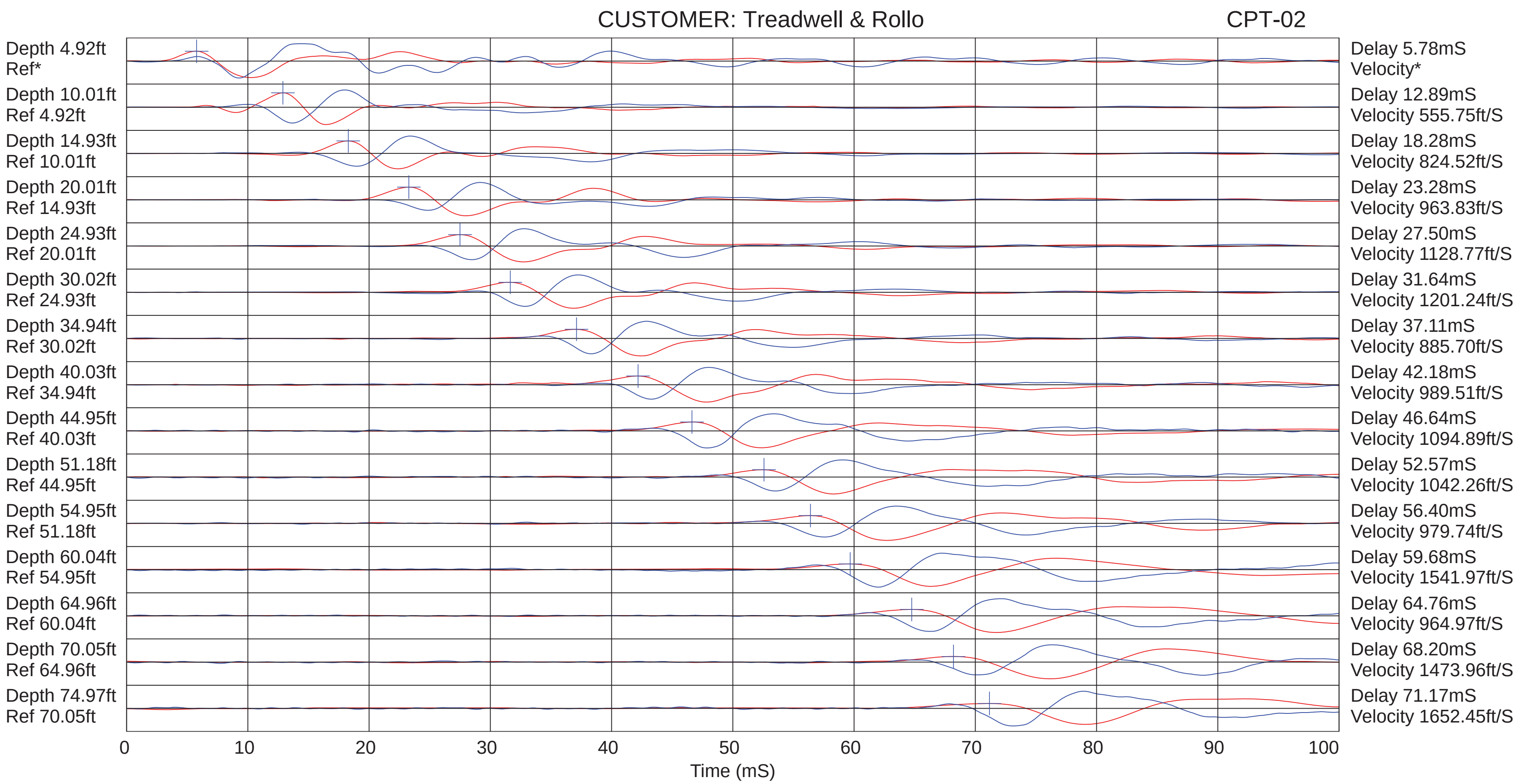
Terminated at 74.97 feet below the ground surface
Date performed: 08/28/15

BROADWAY AND 28TH STREET
Oakland, California

LANGAN TREADWELL ROLLO

CONE PENETRATION TEST RESULTS
CPT-2

Date 09/09/15 | Project No. 750631701 | Figure A-3



Hammer to Rod String Distance (ft): 5.83
* = Not Determined

LOCATION: 28th and Broadway

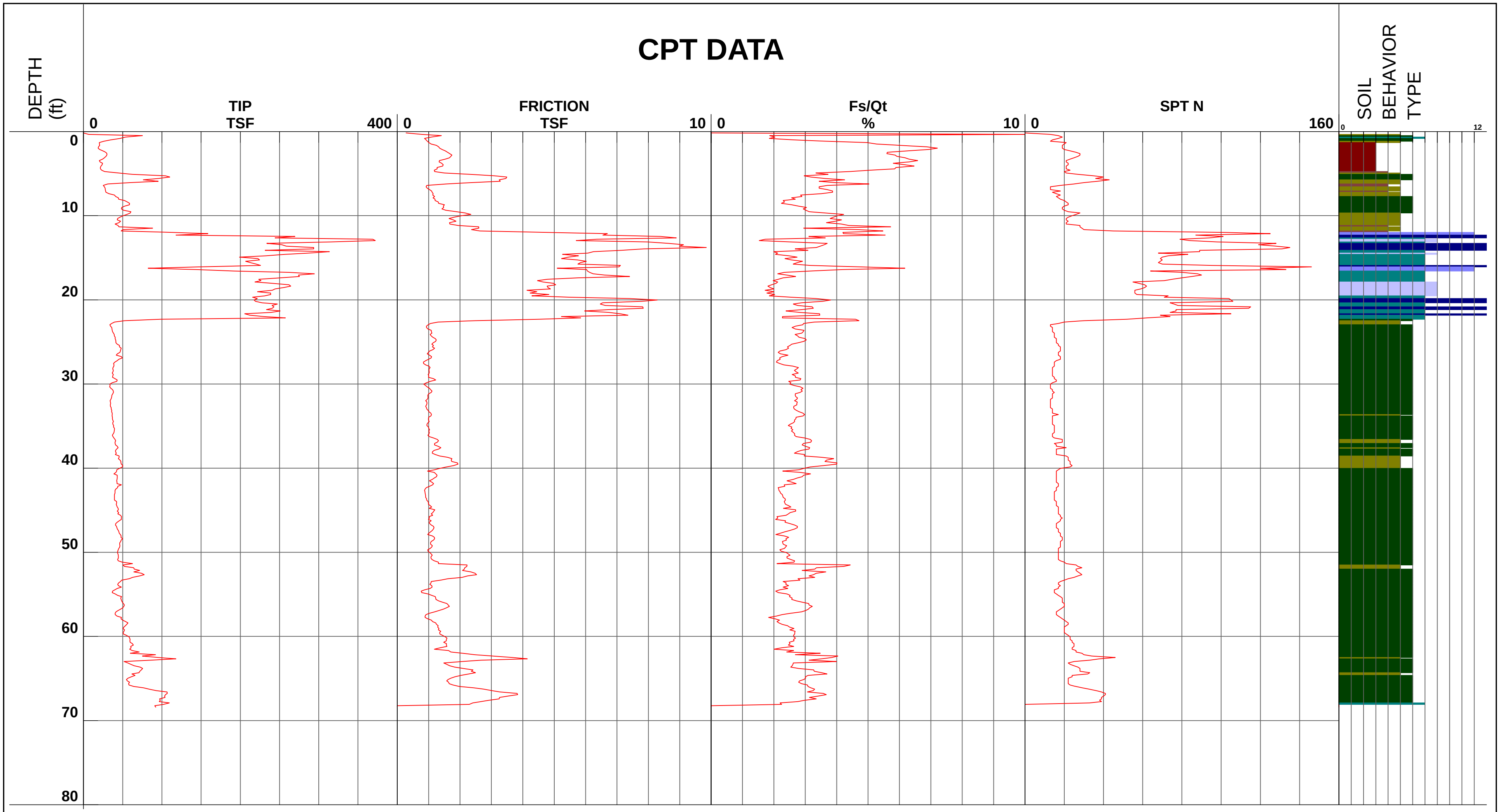
BROADWAY AND 28TH STREET
Oakland, California

LANGAN TREADWELL ROLLO

LOG OF SHEAR WAVE VELOCITY MEASUREMENTS FOR CPT-2

Date 09/09/15	Project No. 750631701	Figure A-4

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

Terminated at 68.40 feet below the ground surface
Groundwater estimated at 12.10 feet (see Figure A-6)
Date performed: 08/28/15

BROADWAY AND 28TH STREET
Oakland, California

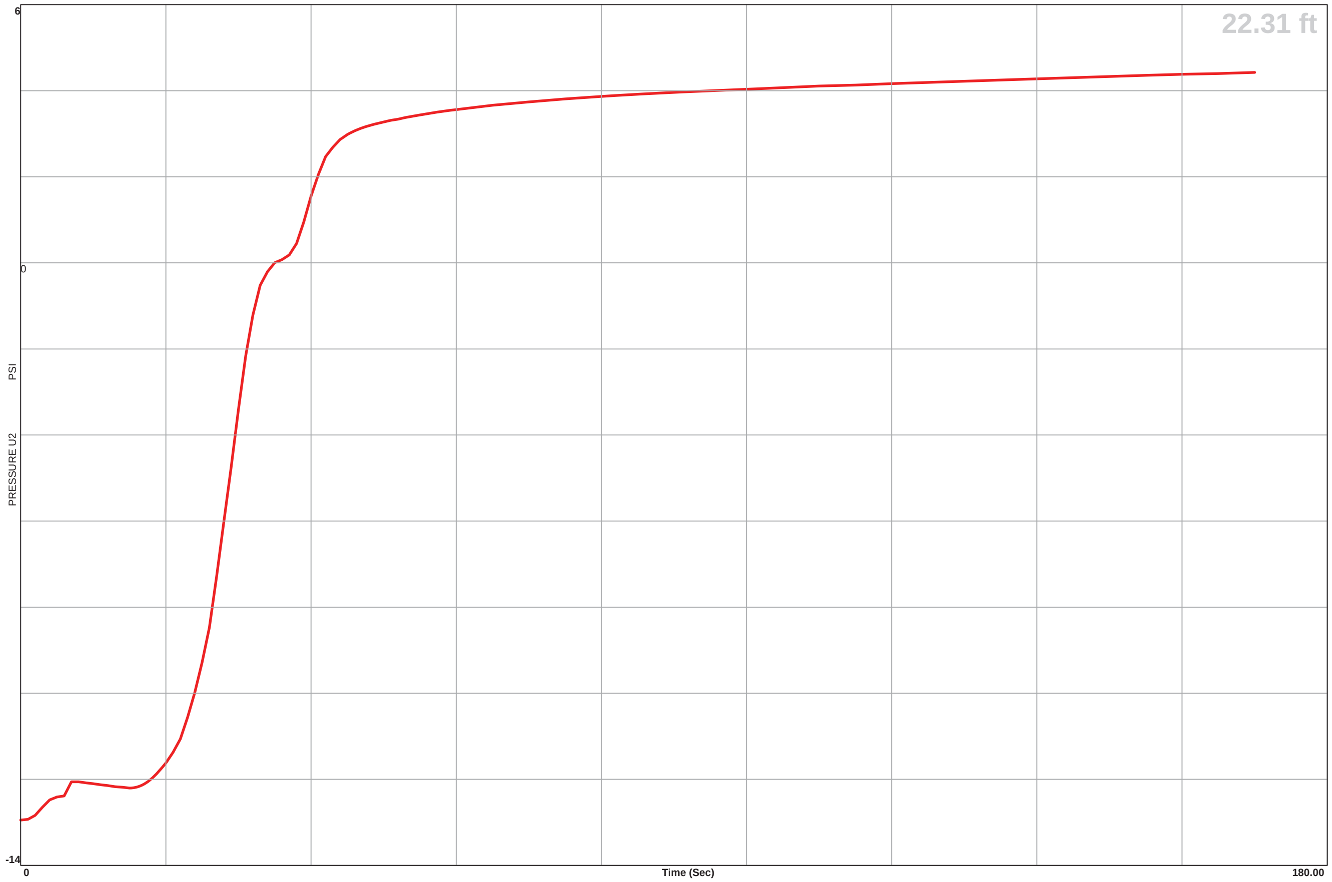
LANGAN TREADWELL ROLLO

CONE PENETRATION TEST RESULTS
CPT-3

Date 09/08/15	Project No. 750631701	Figure A-5

Location	28th and Broadway	Operator	CB
Job Number	750631700	Cone Number	DDG1333
Hole Number	CPT-03	Date and Time	8/28/2015 9:49:27 AM
Equilized Pressure	4.4	EST GW Depth During Test	12.1

GPS



BROADWAY AND 28TH STREET
Oakland, California

PORE PRESSURE DISSIPATION TEST
CPT-3

Date 09/09/15	Project No. 750631701	Figure A-6

LANGAN TREADWELL ROLLO