Central Area Guideway Geotechnical Data Report Phase Two 65% Engineering Design Investigation

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Rev. 1

B0801-C025

Central Area Guideway

Geotechnical Data Report – Phase Two 65% Engineering Design Investigation

December 16, 2008
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GEOTECHNICAL DATA REPORT – PHASE TWO 65% ENGINEERING DESIGN INVESTIGATION

FOR

65% ENGINEERING DESIGN PHASE

Contract No. S03099

Submitted by: HMM/Bechtel SVRT, a Joint Venture

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1.0 Executive Summary

To supplement the 10% Conceptual Engineering geotechnical program (URS, 2003) and the 35% Preliminary Engineering Central Area Guideway (previously Tunnel Segment) geotechnical investigation program (HMM/Bechtel, 2005a), a Phase 2 (P2) 65% Engineering Design geotechnical investigation was carried out from March of 2007 to January of 2008. The P2 field investigation consisted of 19 boreholes and 25 Cone Penetration Tests intended to cover changes in the alignment, explore deeper strata at the locations of station excavations, and determine additional soil parameters for engineering design. In addition, soil samples were sent to several laboratories for general classification tests as well as for specialty testing needed to collect data required for seismic design, for obtaining additional soil strength data, and for estimating construction behavior of soils.

The results of the pumping test program, together with the associated boring and well information, are documented in a separate Pumping Test Data Report (HMM/Bechtel, 2008).

2.0 Introduction

2.1 Scope of Work

The information contained in this report only covers the results from the 19 boreholes, the 25 CPTs and the associated laboratory test results obtained during the P2 phase of the Project. Additional geotechnical data from the investigations listed below, with the exception of 35% PE Investigation Plan and Profile Drawings, are not included. The scope of this report is limited to presenting factual data without engineering interpretation by the Project. The results from the field and laboratory investigation involved interpretation from HMM/Bechtel subcontractors working under the regulations of the Tunnel Segment Design Quality Plan (HMM/Bechtel, 2007). HMM/Bechtel reviewed the subcontractor's work, but it was the responsibility of the engineer(s) in charge at the respective subcontractor firms to ensure that their work was performed under the normal standard of care in their locale of practice.

Additional SVRT sources of geotechnical data pertinent to the Central Area Guideway can be found in the following reports:

- 10% Conceptual Engineering Geotechnical Exploration Finds and Recommendations report (URS, 2003)
- 35% Preliminary Engineering Review of Available Geotechnical Data report (HMM/Bechtel, 2004)
- 35% Preliminary Engineering Geotechnical Data Report (HMM/Bechtel, 2005a)
- 35% Preliminary Engineering Hydrogeology Report (HMM/Bechtel, 2005b)

These reports also reference additional non-SVRT sources, including reports from public agencies, reports from private projects, and files from local geotechnical consulting companies that contain additional data relevant to the Project.

2.2 Report Organization

Chapter 3 of this report describes details of the field investigation and Chapter 4 describes details of the laboratory testing. Chapter 5 summarizes the results and outlines a tentative future geotechnical investigation program to be carried out prior to construction. The chapter also includes an updated version of the plan and profile drawings that were previously presented in Chapter 8 of the 35% PE Tunnel Segment Geotechnical Data Report (HMM/Bechtel, 2005a), incorporating the new borings and CPTs.

Results of the field investigations are presented in three appendices as follows:

Appendix 1: Logs of Borings

Appendix 2: Cone Penetration Test (CPT) Results

Appendix 3: Seismic Cone Penetration Test (SCPT) Results

Appendix 10: Dissolved Gas Sampling and Analysis Report

Laboratory test results are presented in six appendices as follows:

Appendix 4: Laboratory Classification Test Results

Appendix 5: Cyclic Triaxial Test Results

Appendix 6: Large-Scale Direct Shear Test Results

Appendix 7: Sticky Limit Test Results

Appendix 8: Direct Shear Test Results

Appendix 9: Consolidation and Cyclic Shear Test Results

Appendix 11: Soil Abrasion Test Results

Appendix 12: Mineralogy Test Results

2.3 Limitations

The geotechnical data presented in this report are results of the site investigation managed by HMM/Bechtel for the SVRT Project Central Area Guideway Section Phase 2, 65% Engineering Design Investigation. Data obtained by others for the 10% Conceptual Design are not included and results from the 35% PE investigation are only shown in the Plan and Profile Drawings. The number of boreholes and CPTs was based on the level of design at the time of planning this phase of investigation. A future Phase 3 (P3) Investigation will include additional exploration to cover specific locations of the Central Area Guideway alignment that were not finalized at the time of this investigation.

3.0 Field Investigations

3.1 Introduction

The P2 65% Engineering Design Investigation provides additional geotechnical data about the stratigraphy, groundwater, and physical and engineering characteristics of the soil at specific locations along the alignment. Details of the field investigation are described in the following sections.

3.1.1 Team Organization

Several geotechnical engineering, drilling and specialty testing firms contributed to the investigation program. Subcontractors included Fugro West, Parikh Consultants, Pitcher Drilling, URS Corporation, ABE Engineering, and Towill.

Fugro's field investigation scope focused on the CPT explorations, which included seismic cone testing. Pitcher Drilling provided the drill rigs and drill crews necessary to complete all geotechnical borings and soil sampling. PCI provided coordination support and technical oversight for Pitcher Drilling. Field engineers from PCI performed all field logging of borings. URS Corporation provided part-time Quality Assurance support for subcontractor field activities. ABE Engineering calibrated Pitcher Drilling's automatic hammer on the Failing 1500 drill rig. Towill surveyed all borehole and CPT locations.

Kleinfelder, under subcontract to EarthTech for the Central Area Guideway Stations group for preliminary design work, reviewed the scope of the field investigation and observed a partial portion of the field exploration activities at underground Station locations. Kleinfelder also requested exploration at one location to investigate the potential for seismic liquefaction (see Section 3.2.1).

3.1.2 Project Restrictions

Restrictions imposed by local agencies, private property owners, neighborhood organizations, and commercial and residential tenants limited the access to some planned locations and impacted the work schedule.

Encroachment permits were required by several public and private agencies to perform borings and CPTs along different portions of the alignment. These agencies included the City of San Jose (CSJ), the Peninsula Corridor Joint Powers Board (PCJPB), San Jose Water Company, Union Pacific Railroad (UPRR) and Santa Clara Valley Water District (SCVWD). The CSJ also required traffic control permits. The SCVWD required exploration permits.

Design revisions made at the time the field program was on-going, were incorporated into the investigation as needed and when possible. Some of the major design revisions included the following:

- Consideration of north and south alternative tunnel alignments at the Coyote Creek crossing to avoid a deeper alignment at the Coyote Creek Bridge (borings and CPTs drilled north and south of the alignment on adjacent properties);
- Consideration of the locations for the proposed ventilation shaft structures

This report reflects the April 25th, 2008 tunnel alignment.

3.2 Boring Program

The boring program commenced on June 4, 2007. A total of 19 rotary-wash borings were completed as part of P2 65% Engineering Design Investigation (Figure 3-1 and Table 3-1).

One borehole (BH-81) was completed late in the P1 35% Preliminary Engineering Investigation. The boring log and information related to the investigation for BH-81 has been included in Appendix 1 and Table 3-1, respectively, of this report.

The six sonic borings completed as part of the pumping test program are included in Table 3-1. The boring logs and a description of sonic drilling and sampling is included in the Draft Pumping Test Data Report (HMM/Bechtel, 2008).

3.2.1 Overview

Of the 19 borings, six (6) were completed at the two portals, seven (7) were drilled at the three proposed underground stations, and six (6) were drilled at other locations along the tunnel alignment. Boring depths, sampling methods and sampling intervals were chosen based on design needs.

Borings at the two portals were drilled to obtain additional soil information at locations where the alignment had shifted and/or the portal had moved north. Borings were generally drilled to a minimum depth of twenty feet below the maximum depth of the proposed excavation cutoff wall. Soil sampling for portal borings was specified at 5-ft intervals or where changes in formation were observed.

Borings completed at the proposed Alum Rock Station, Downtown San Jose Station and Diridon/Arena Station were generally drilled to a depth of 200-ft, with the exception of BH-105. The depth of drilling and sampling was based on the need to better define soil stratigraphy between 150- and 200 ft, which is the maximum estimated depth of the station cut-off walls. At the request of Central

Area Guideway Stations group, BH-105 was drilled to a depth of 51.5-ft to investigate the potential for seismic liquefaction.

Soil sampling was specified at 10-ft intervals between 0 and 150 ft depths and at 5-ft intervals or where changes in formation were observed between 150- and 200-ft depths. Wider sampling intervals (10-ft) were selected where previous borings had captured enough geotechnical information down to 150-ft depths.

Borings drilled along the proposed tunnel alignment (tunnel borings) were planned based on potential realignments of the tunnel or where access to the planned boring locations were not permitted during the 35% Design Phase. Borings were generally drilled to depths of at least 20 ft below the tunnel invert, based on the tunnel alignment at the time of drilling. Continuous sampling in the "tunnel zone" (from 20 ft above the proposed tunnel crown to 20 ft below invert) was specified at all six (6) borings along the tunnel alignment. At BH-87, the tunnel boring was extended to 201.5 feet to provide preliminary soil information for the proposed FSS Ventilation Shaft structure located along Santa Clara St.

3.2.2 Drill Rig and Hammer Types

The drill rigs used for the project consisted of two types of truck-mounted equipment, a Fraste Multidrill XL drill rig and a Failing 1500 drill rig. The Failing 1500 drill rig is one of several typical rig types commonly used for rotary wash drilling. Fraste Multidrill XL drill rigs are top-drive (rotation and circulation are conducted at the top of the drill string), thus allowing a special type of continuous "geo-barrel" sampling (see Section 3.2.3.1 Sampler Types). The Failing 1500 and Fraste Multidrill XL drill rigs utilized an Automatic Trip Hammer system to advance split-spoon and Modified California samplers.

The drill rigs were equipped with a standard 140-lb hammer to drive thick-walled samplers. ABE Engineering calibrated the efficiency of the automatic hammer (Failing 1500 Rig) at the location of BH-85 (Section 3.2.10).

3.2.3 Sampling Methods and Equipment

3.2.3.1 Sampler Types

Four types of soil samplers were used: driven thick-walled samplers (split-spoon and Modified California), pushed thin-walled samplers (Shelby Tube), rotated thin-walled samplers (Pitcher Barrel) and a wireline soil coring sampler (101 Geo-Barrel Sampler). Bag samples were retrieved at a few selected depths and from split-spoon samplers. Modified California (MC) samples were placed in plastic tubes.

Split-spoon and Modified California samplers were used to obtain penetration resistance data of granular materials such as sandy or gravelly soils. The 140-pound drive hammer used for sample collection, casing installation, and removal was in conformance with ASTM D1586, Standard Method for Penetration Test and Split-Barrel Sampling of Soils. The split-spoon sampler used had an outside diameter of 2 inches and an inside diameter of 1-3/8 inches and was in conformance with ASTM D1587, Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes. The Modified California (MC) sampler used was in general conformance with ASTM D3550, Standard Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils. The MC sampler has an outside diameter of 3 inches and an inside diameter of 2.5 inches. The MC sampler was also used to obtain disturbed samples of sand and gravel soils. The MC sampler was able to retrieve larger gravel particles (up to 2.5 inches) that could not be obtained using the split-spoon sampler.

Soft to stiff clayey soils were generally sampled using a thin-walled Shelby Tube sampler in conformance with ASTM D1587. The Shelby Tube sampler consists of a 3-inch diameter, 36-inch long mild steel thin-walled tube that is hydraulically pushed by the drill rig. The sampler was used to obtain relatively undisturbed samples of clays and silts (fine-grained soils). For each push, the standard length of advancement was 30 inches.

Very dense soils and stiff to very stiff clays were generally sampled using a Pitcher Barrel sampler in conformance with ASTM D1587. Pitcher Barrel samplers consist of double-tube core-barrels; the inner barrel, which consists of a Shelby tube, is affixed to a spring-loaded sampler head that extends or retracts, relative to the cutting bit on the outer barrel, with changes in soil stiffness.

The magnitude and change in hydraulic pressure during Shelby Tube and Pitcher Barrel sampler advancement were recorded on the boring logs. A change in hydraulic pressure qualitatively indicates a change of material type or consistency at each depth or location, but may not be comparable between two separate rigs due to differences of hydraulic systems.

Pitcher Barrel sampling could not be performed in some gravelly formations. Thick drilling fluid is needed to lift the gravelly material from the bottom of the boring during the rotary wash process. The thick drilling fluid reduces the circulation within the sampler and around the drill bit. If the drilling fluid becomes too thick and the circulation ports of the sampler plug, the cutting bit heats up, causing the Pitcher Barrel cutting bit to wear out quickly or fracture.

Special sampling using a 101 Geo-Barrel (2.4-inch inside diameter) system (proprietary sampling system designed by Pitcher Drilling) was performed at a few selected boring locations where continuous sampling using a larger sampler was requested by the tunnel design team. At borings near the corner of Asbury St. and Stockton Ave. (BH-102, BH-

103 and BH-106) and near Coyote Creek tunnel alignment crossing (BH-88), the 101 Geo-Barrel sampling method was attempted so that continuous disturbed samples throughout the tunnel zone could be obtained. A MC sampler was used to obtain disturbed samples of sand and gravel soils at locations where difficulties recovering continuous samples using the 101 Geo-Barrel sampler arose.

3.2.3.2 Sampling Interval

In addition to the sample intervals described in Section 3.2.1, samples were also obtained at depths where material changes were detected for all borings. Cuttings in the drilling fluid were examined to identify changes in the soil conditions between sample locations. Material changes were also identified based on the driller's observations of drill rig response (i.e. chattering of drill rig, loss of fluid, etc.).

Occasionally soil samples could not be recovered due to wet and soft cohesive soils, loose granular soils, or obstructions, such as gravel or slough in the shoe or entrance of the samplers. When this occurred, the field engineer typically directed the driller to drill out the boring interval where sampling had been attempted and to sample below the disturbed zone of material.

3.2.4 Handheld Field Tests

In addition to visual observations of soil consistency, handheld field tests using pocket penetrometer and pocket torvane were performed in the field on the bottom of relatively undisturbed Shelby Tube and Pitcher Barrel samples. The estimated unconfined compressive strengths from pocket penetrometer tests are presented in the material description column on each boring log. Units for unconfined compressive strength are obtained in tons per square foot (tsf). Although the pocket penetrometer was used to estimate the unconfined compressive strength for cohesive soils, readings from the pocket penetrometer were also converted to undrained shear strength in units of kips per square foot, ksf. The pocket torvane was used to directly estimate the undrained shear strength for cohesive soils in ksf units. Both handheld field tests were used as a guide to strength and consistency variations. The undrained shear strength test results from handheld field tests are shown at the corresponding test depths on the boring logs presented in Appendix 1.

3.2.5 Groundwater Level Measurements

Groundwater levels are typically based on the assumption that the drilling fluid/mud reached equilibrium with natural groundwater level overnight and should not be used for design. For design purposes, readings from vibrating wire piezometers and observation wells that were installed to provide groundwater level and pore-water pressure information should be used.

3.2.6 Sample Handling

In order to obtain high-quality undisturbed samples for laboratory testing, every effort was made to minimize disturbance during handling and transportation of Shelby Tube and Pitcher Barrel samplers. Slough was typically removed from the tubes and empty spaces at the top and bottom of the sample tubes were filled with Styrofoam packaging peanuts prior to initial sealing in the field. Shelby Tubes and Pitcher Barrel samples were kept upright in wooden boxes.

Sample preservation and transportation followed ASTM D4220, Standard Practice for Preserving and Transporting Soil Samples. In general, all samples were protected from extreme temperatures and kept out of direct sunlight. Samples were carefully transported from the field to the laboratory and stored in locations where they were not exposed to extreme temperature changes and would not be disturbed.

Waxing of Shelby Tube sample tubes took place at Parikh Consultant's laboratory, generally within three (3) days of drilling. Waxing was performed in accordance with ASTM D4220.

3.2.7 Borehole Completion and Abandonment

Borings were generally terminated at the planned depth. At two locations, BH-102 and BH-103, borings were mistakenly terminated 10 ft shallower than planned. Subsequently, BH-103 was re-drilled down to the previous completed depth of approximately 80 ft and then drilled down to the specified depth of 90.5 ft.

Prior to completion of each boring, the Santa Clara Valley Water District (SCVWD) was contacted for notification of grouting. After the boring was drilled to the planned depth, the borehole was grouted from the bottom up using a tremie pipe per SCVWD requirements. All Investigation Derived Waste (IDW), including loose soil or cuttings from the drilling operation, was placed in 55-gallon drums and removed from the site. All drums containing IDW were characterized, labeled, and disposed of by Parikh Consultants' subcontractor Integrated Waste Management (IWM) in accordance with applicable regulatory requirements.

Pavement removed to drill borings was patched using a non-metallic, non-shrink, quick-setting grout.

3.2.8 Boring Log Organization and Presentation

Soil descriptions were made in general accordance with ASTM D2487, Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System) and ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). The boring logs are presented in Appendix 1. Towill, Inc. surveyed the ground surface elevation of all borehole locations based on NAVD88 (North American Vertical Datum, 1988). The coordinates and surface elevations are shown on each boring log.

Boring logs were prepared for all 19 borings of P2. The Boring Log Key (Figure A1-1) summarizes coarse-grained and fine-grained soils and corresponding group names. General notes, abbreviations, sampler types, soil structure definitions, consistency and relative density terminology and moisture content descriptions that are incorporated into each of the boring logs are also included on the Boring Log Key. Each boring log presents boring specific details including: Field Engineer (Logged By), Quality Control Manager (Checked By), Drilling Start and Completion Dates, Drilling Contractor and Operator Name, Project Location, Drilling Method, Hammer Type and Drill Rig Type. Drilling Start and End Times for each day of drilling are shown within the material description column.

The field engineer for Parikh Consultants recorded the soil conditions encountered as the borings were drilled. At depths where sampling was not performed, field engineers based soil information on soil cuttings recovered during the rotary wash drilling process and driller’s comments regarding drilling response (i.e., “chattering” noise from drill rods during drilling in sands and gravels, changes in drilling pressures at soil layer intervals, etc.). Field engineers recorded handheld field test results from pocket penetrometer and pocket torvane tests on the field boring logs, as well as results of air monitoring tests of the breathing zone using a Photo-Ionization Detector (PID) and Lower Explosive Limit (LEL/O2) meters. The final boring depth was also recorded. The field engineer from Parikh Consultants also recorded observations of caving conditions and locations where loss of drilling fluid occurred. Upon completion of the borings and laboratory testing, information recorded on the field log was entered into a gINT database and printed out using a gINT boring log template.

Soil samples were visually classified in the laboratory (see Section 4.1.1 Laboratory Visual Classification) prior to soil strength and property testing (see Section 4.1.2 through 4.1.7 and Section 4.2). The soil information presented on the gINT boring logs was prepared based on the results of the laboratory visual classification and index tests and were reviewed for Quality Assurance by HMM/Bechtel.

3.2.9 Standard Penetration Test (SPT)

The Standard Penetration Test (SPT) is a measure of the resistance of the soil during sampling using the split-spoon sampler. This resistance is an indicator of the consistency in fine-grained soils and density and strength in coarse-grained soils. The standard penetration resistance of the soil is defined as the number of blows (N) required to drive the sampler one foot into the soil with a 140-pound hammer dropped 30 inches. The hammer is lifted using a mechanical device to elevate the hammer (automatic hammer).

The number of blows required to advance the split-spoon samplers was counted and recorded for each 1-inch interval of driving by the field engineer. The SPT, in accordance with ASTM D1586, was halted if the total number of blows exceeded 100, the number of blows exceeded 50 in any 6-inch increment, or if the sampler was not advanced as a result of 10 consecutive blows. The distance driven for each of these refusal conditions was recorded. When the final penetration increment was less than 6 inches, refusal was indicated and the actual inches-advanced is presented on the logs.

In cases when the sampler did not meet the refusal criteria, the SPT blow count shown on the boring logs is the sum of the blows for the final 12 inches. The first 6-inch interval is not presented on the boring logs unless the sampling interval was 6 inches or less. The Boring Log Key presents a summary of blow count information.

Undisturbed coarse-grained soil samples are not possible to obtain using typical driven thick-walled samplers, pushed thin-walled samplers or 101 Geo-Barrel samplers. It is possible, however, to estimate the in-situ density using the SPT. For the 65% Engineering Design Investigation, the SPT was generally performed only at locations and depths where granular material was expected.

A Modified California (MC) sampler was also used to sample coarse-grained soils at selected depths of chosen borings. The uncorrected blow count using a driven MC sampler was recorded and is shown on the boring logs in Appendix 1. In order to obtain a comparable correlation of strength and density of soils to the SPT blow count (N-value), the Modified California blow count may be corrected by multiplying it by a correction factor. This correction factor is typically a function of sampler size and type of soil being sampled. Uncorrected Modified California blow counts are presented on the boring logs and are enclosed in parentheses to differentiate the values from SPT blow counts.

3.2.10 SPT Energy Calibration

To estimate the energy transfer ratio of the hammer on the Failing 1500 drill rig, ABE Engineering calibrated the efficiency of the automatic hammer during drilling of BH-85. The results of the calibration showed that the mean energy transfer ratio, based on 315 blows of the automatic hammer, was approximately 79% of the theoretical energy (140-lb hammer at 30-inch drop). The results of the energy calibration are presented in Appendix 1 after Logs of Borings. The Automatic Trip Hammer System on the Fraste Multidrill XL drill rig was not calibrated due to the limited number of SPTs performed on that rig. However, a calibration was performed on the Fraste Multidrill XL drill rig on a previous project in San Francisco in July of 2006. The results from that calibration demonstrated that the mean energy transfer ratio was approximately 82% of the theoretical energy (140-lb hammer at 30-inch drop). Although these results were not taken from a calibration performed on the SVRT project, they indicate that the energy transfer ratio is approximately 80 percent for SPTs taken along the alignment using an Automatic Trip Hammer System.

3.2.11 Air and Vapor Monitoring

Air monitoring of the work zone was conducted as part of the Work Plan to protect workers should exposure to contamination occur. The breathing zone around the drilling operations was monitored frequently using a Photo-Ionization Detector (PID) meter and a Low Explosive Limit/Oxygen (LEL/O_2) meter. The PID instrument used was an Environmental Instruments Co. Model "Determinator" Organic Vapor Meter (OVM) with a minimum detectable level of 0.1 parts per million (ppm). Monitoring of specific levels of hydrogen sulfide, ethane, butane and propane was not carried out. Monitoring of specific levels of methane was carried out. The LEL/O_2 meter was a GASTECH Model GT-201 with a minimum detectable level of oxygen (OXY) 0.1 ppm. The instruments were rented from Environmental Instruments, located in Concord, CA.

The initial work plan required air monitoring of the breathing zone surrounding the drill rig operation, primarily for worker safety. Readings were also taken of the soil samples as the sampler was extracted from the borehole. Generally, a minimum of three PID (OVM), LEL/O_2 (OXY) and methane (CH4) readings were each taken during drilling and sampling of all portal, station and tunnel borings. Along the tunnel alignment, three readings were typically taken within the 60-foot tunnel zone.

Readings (OVM, LEL/O_2 and methane) are shown at the corresponding borehole depths on the Logs of Borings (Appendix 1).

3.3 Cone Penetration Testing Program

3.3.1 Overview

The CPT program commenced on March 28, 2007. CPTs were conducted during two sequences March 28, 2007 through April 5, 2007 and August 13, 2007 through August 17, 2007. In addition to continuous CPT soundings, downhole seismic shear wave velocity measurements were obtained at several locations. Of the 25 CPTs, 13 were completed at the portals, six (6) were performed at the three proposed underground stations, and six (6) were completed at locations along the tunnel alignment. CPT frequencies and depths were selected based on design needs. The locations of all of the CPTs are presented in Figure 3-1 and Table 3-2.

3.3.2 Conventional CPTs

A total of 25 CPTs were conducted. The following sections describe the equipment, procedures, locations and results of the CPT program.

3.3.2.1 Equipment

Equipment utilized in conducting CPTs included a self-contained 25-ton CPT rig with hydraulic pushing system, a piezocone, cone rods and casing, a data acquisition system and a support truck and trailer.

The CPTs were performed using an International 25-ton capacity truck mounted rig with a self-contained power supply unit. The rig was equipped with hydraulic jacking systems to lift and level the pushing platform. The "dead weight" of the rig provided the reaction weight necessary for advancing the CPT tools. The conventional instrumented piezocone assembly used for the SVRT project included a cone tip with a 60-degree apex and a cone base area of 15 cm^2, a sleeve segment with a surface area of 200 cm^2, and a pore pressure transducer near the base (shoulder) of the cone tip (designated the u2 location).

Fugro's CPT cone rods are manufactured from high tensile strength steel and have a cross sectional area adequate to sustain up to 700 tsf tip pressure without buckling. A steel casing was generally placed in the upper clayey strata and was typically extended to depths of 20 to 75 ft, when used. The casing provided lateral support to prevent bending or buckling of the slender 10-foot sections of steel rod as they were hydraulically pushed into the ground.

The data acquisition system converted an analog signal from the cone penetrometer to a digital signal, which was monitored, recorded and presented in near-real time on the laptop computer. A support pickup truck/trailer contained a grout pump and mixer to properly abandon CPT holes after completion, a pressure wash system for cleaning the work area and maintaining clean equipment throughout field program, a steam cleaning system for environmental protocol if needed, and tools and supplies for daily operations.

3.3.2.2 Procedures

Prior to testing, the truck was lifted up and leveled on four pads to provide a stable reaction for the cone thrust. During the test, the instrumented cone was hydraulically pushed into the ground at the maximum rate of about 2 centimeters per second (cm/s), and readings of cone tip resistance, sleeve friction, and pore pressure were digitally recorded every second. As the test progressed, the CPT operator monitored the cone resistance and its deviation from verticality. Information collected during a push was stored digitally. The data files included project description and location, operator, data format information, and other pertinent information about the sounding.

After completing a CPT, the hole was backfilled with cement-bentonite grout by the tremie method using a grout pump and mixer. The surface of the CPT holes was finished with rapid setting quickcrete. Grout mix and grouting procedures were completed in accordance with Santa Clara Valley Water District regulations. The work area was cleaned per City of San Jose requirements.

Fugro conducted the CPTs in general accordance with ASTM D5778. The continuous CPT soundings were typically advanced to refusal (500 to 700 tsf tip pressure), which ranged from approximately 34 to 149.9 ft in depth. Each CPT generally lasted between 2 and 5 hours.

More detailed descriptions of the procedures and equipment specifications of the CPT operations can be found in Appendix 2.

3.3.2.3 Locations

CPTs performed along the proposed tunnel alignment ("tunnel CPTs") were spaced at 200 to 300-foot intervals (combining both the 35% and the P2 Programs). CPTs performed at the proposed stations ("station CPTs") were spaced approximately 100 ft apart.

CPTs performed at the two portal locations were performed to obtain additional soil information at locations where the alignment had shifted laterally or moved north. CPTs at the portal locations were generally planned to depths a minimum of twenty feet below the maximum depth of the portal structure or cutoff wall.

CPTs at the proposed Alum Rock Station, Downtown San Jose Station and Diridon/Arena Station were generally planned to depths of 150 ft. At all but one location the CPT probe met refusal at shallower depths, which ranged from 43.7-ft below ground surface (bgs) to 115.5-ft bgs.

Tunnel CPTs were planned based on potential realignments of the tunnel or where previous soil information was not obtained due to tunnel depth changes. CPTs were generally planned to depths of at least 20 ft below the tunnel invert, based on the tunnel alignment at the time of drilling, but were terminated shallower at several locations due to refusal.

3.3.2.4 Results

The CPT logs present the measured cone (tip) resistance in tons per square foot (tsf), the measured sleeve friction in tsf, the friction ratio in percentage (including the Soil Behavior Type according to Robertson and Campanella in 1990 (see CPT correlation chart in Appendix 2, Key to CPT logs), the measured pore pressure in tsf at the u2 sensor location, and the estimated soil undrained shear strength (s_u) in ksf.

Some of the data presented on the CPT logs is interpreted by Fugro and are based on assumptions that need to be verified with site-specific data. The interpreted data include the soil behavior type and the estimated soil undrained shear strength. The soil behavior type and estimated undrained shear strength are influenced by the soil unit weight (and resulting in-situ total stress condition), and the N_k-value. The range of selected N_k values was based on calibrations performed by Fugro comparing the CPT tip resistance with the strength determined from field vane shear testing in adjacent borings. A more detailed discussion regarding the undrained shear strength calibration is presented in Appendix 2.

The CPT logs show the range of undrained shear strengths calculated from CPT cone tip resistances (corrected for unequal end area effects) based on cone bearing capacity factors (N_k) of 12 and 15. CPT sounding logs for the 25 CPTs are presented in Appendix 2.

3.3.3 Seismic CPTs

A total of 12 SCPTs were conducted. The following sections describe the equipment, procedures, locations and results of the SCPT program.

3.3.3.1 Equipment

Downhole seismic shear wave velocity measurements were conducted using Fugro's seismic CPT system. The seismic CPT system includes the basic thrust system, a seismic cone assembly, a seismic wave source, and a digital recording seismograph.

3.3.3.2 Procedures

The seismic cone assembly is similar to the conventional cone assembly, with the addition of a three-component array of geophones. The geophones are orthogonally mounted inside the assembly about 15 cm above the cone tip. The seismic CPT system consists of a heavy metal beam that is positioned parallel to the cone truck and held firmly against the ground by the weight of the beam and additional weights placed on it. The beam is positioned at least 10 ft from the cone rods. Striking each end of the beam with a 12-pound sledgehammer generates seismic waves. The hammer blow from opposite ends of the beam generates shear waves with opposite polarity. Conventional CPT testing was temporarily halted at 5-foot intervals to perform the seismic testing and collect seismic data.

The hammer blows trigger the seismograph to record the time histories of the generated seismic waves as they travel through the soil. If the shear wave signal is clearly defined, the waveform is selected for stacking and the arrival time of the wave is recorded. Additional blows were similarly examined and stacked. A more detailed discussion regarding the signal selection and stacking is presented in Appendix 3.

Waveforms are digitally recorded and saved in the seismograph's hard drive for further processing. After a complete set of seismic data is recorded, the cone is advanced to the next depth, and the procedure is repeated until the hole reaches the required depth or refusal.

The shear wave arrival time at each depth is determined from the recorded "stacked" signals. The average arrival time is determined and based on the horizontal offset of the seismic source from the CPT rods, a strike angle is estimated. The average vertical arrival time is determined by taking the sine of the strike angle. The incremental seismic velocity is the difference in vertical average arrival time between two depth increments, divided by the length of the increment (typically 5 ft). This seismic velocity is presented on the seismic CPT logs (Appendix 2).

Seismic CPT testing was performed in accordance with ASTM D577 and "Seismic Cone Penetration Test," by Robertson, Campanella, and Gillespie (1986).

3.3.3.3 Locations

Seismic shear wave velocity tests were conducted at 12 locations. Tests were performed at both portal locations, at each of the proposed station locations and along two stretches of the tunnel alignment.

Seismic cone testing was successfully performed at the following locations:

- Two Seismic CPTs at the East Portal (CPT-158 and CPT-161)
- Two Seismic CPTs at Alum Rock Station (CPT-162 and CPT-172)
- One Seismic CPT at the proposed Coyote Creek realignment to the south of Santa Clara St. (CPT-165)
- Two Seismic CPTs at Downtown San Jose Station (CPT-167 and CPT-169)
- Two Seismic CPTs at Diridon/Arena Station (CPT-168 and CPT-179)
- One Seismic CPT at the deeper tunnel alignment near the intersection of Asbury St. and Stockton Ave. (CPT-171)
- Two Seismic CPTs at the West Portal (CPT-173 and CPT-174)

The locations of the 12 seismic CPTs are shown in Figure 3-1.

3.3.3.4 Results

CPT sounding logs for the 12 seismic CPTs are presented on the Logs of seismic CPTs in Appendix 3. The seismic CPT logs provide graphical plots of the same data presented on conventional CPT logs, along with measured shear wave velocity in ft per second (fps).

3.3.4 CPT Completion and Abandonment

CPT locations were generally terminated at refusal or at the planned depth.

Prior to completion of the CPT, the Santa Clara Valley Water District (SCVWD) was contacted for notification of grouting. After CPT was performed to the planned depth or was terminated due to refusal, the CPT hole was grouted from the bottom up using a tremie pipe per SCVWD requirements. All Investigation Derived Waste (IDW) and any loose soil or cuttings from the CPT operation were placed in 55-gallon drums and removed from site. All drums containing IDW were characterized, labeled, and disposed of in accordance with applicable regulatory requirements. Integrated Waste Management (IWM), a subcontractor of Fugro West, processed all drums containing IDW.

Pavement removed to perform CPTs was patched using a non-metallic, non-shrink, quick-setting grout.

Table 3-1 Summary of Exploratory Borehole Program

Exploration	Completion Date	Boring	Station	Offset		Structure Type	RW or S*	Purpose
		Depth (ft)	(ft)	(ft)	R/L			
East Portal								
BH-101	6/4/2007	52.5	564+38	22	L	Portal	RW	Obtain info where portal and alignment shifted north and east.
BH-82	6/18/2007	92.5	570+08	22	L	Portal	RW	Obtain info where portal and alignment shifted north and east.
Tunnel from East Portal to Alum Rock Station								
No borings performed.						Tunnel		
Alum Rock Station								
BH-83	8/28/2007	200.0	599+84	26	R	Station	S	Explore deeper strata and obtain info for pumping test program.
BH-84	7/16/2007	207.5	603+12	148	L	Station	RW	Explore deeper strata.
BH-85	7/10/2007	202.5	606+32	51	L	Station	RW	Explore deeper strata. Define sand layer at El. +10. MW location.
BH-86	7/31/2007	190.0	609+08	83	R	Station	S	Explore deeper strata and obtain info for pumping test program.
Tunnel from Alum Rock Station to Crossover/Downtown Station								
BH-87	7/20/2007	201.5	648+42	103	L	Tunnel	RW	Explore deeper strata near proposed vent structure.
BH-88	6/18/2007	112.5	645+03	66	R	Tunnel	RW	Obtain info for potential southern tunnel alignment at Coyote Creek.
Crossover/Downtown Station								
BH-89	6/8/2007	201.5	693+74	72	R	Station	RW	Explore deeper strata and obtain info for pumping test program.
BH-90	6/15/2007	211.5	699+59	16	L	Station	RW	Explore deeper strata.
BH-105	6/23/2007	51.5	701+51	2	R	Station	RW	Investigate for liquefaction at 1st St.
BH-104	10/4/2007	200.0	703+72	78	R	Station	S	Explore deeper strata and obtain info for pumping test program.
BH-91	6/22/2007	196.5	704+16	13	L	Station	RW	Explore deeper strata.
Tunnel from Crossover/Downtown Station to Diridon/Arena Station								
No borings performed.						Tunnel		
Diridon/Arena Station								
BH-92	11/17/2007	200.0	736+62	35	R	Station	S	Explore deeper strata and obtain info for pumping test program.
BH-93	6/27/2007	211.5	738+61	84	L	Station	RW	Station entrances and deeper stratigraphy.
BH-94	8/10/2007	200.0	741+61	82	R	Station	S	Explore deeper strata and obtain info for pumping test program.
Tunnel from Diridon/Arena Station to West Portal								
BH-81**	7/22/2005	150.5	789+62	19	L	Tunnel	RW	Explore deeper strata for stratigraphy and perform vibration monitoring.
BH-95	7/24/2007	101.5	774+14	49	R	Tunnel	RW	Unexplored length of tunnel alignment.
BH-102	6/25/2007	80.0	796+49	19	L	Tunnel	RW	Explore deeper strata for stratigraphy and grain size info.
BH-103	6/27/2007	90.5	798+17	19	L	Tunnel	RW	Explore deeper strata for stratigraphy and grain size info.
BH-106	6/27/2007	90.0	800+21	31	L	Tunnel	RW	Explore deeper strata for stratigraphy and grain size info.
West Portal								
BH-96	9/12/2007	135.0	831+98	5	R	Portal	S	Explore deeper strata and obtain info for pumping test program.
BH-97	6/11/2007	91.5	833+53	6	R	Portal	RW	Obtain info where portal moved north.
BH-98	7/3/2007	61.5	836+41	42	R	Portal	RW	Obtain info where portal moved north.
BH-99	6/29/2007	81.5	838+21	9	L	Portal	RW	Obtain info where portal moved north.
BH-100***	7/3/2007	41.5	842+89	15	L	Portal	RW	Obtain info where portal moved north.

Note: Stations and offsets based on the April 25, 2008 S1 track alignment.

* RW = Rotary Wash Boring, S = Sonic Boring. Sonic boring logs are included in the Pumping Tests Data Report (HMM/Bechtel, 2008).

** BH-81 was completed near the end of 35% design phase and therefore could not be included in the 35% GDR. Information from BH-81 is included in this Phase Two - 65% Engineering Design - Geotechnical Data Report.

*** Stationing for BH-100 shown is based on Western Area Guideway alignment stationing (outside of Central Area Guideway alignment stationing).

Table 3-2 Summary of Exploratory Cone Penetration Testing Program

Exploration	Completion Date	CPT Depth (ft)	Station (ft)	Offset		Structure Type	Seismic Cone?	Purpose
				(ft)	R/L			
East Portal								
CPT-158	04/03/07	45.0	562+47.2	30.3	L	Portal	Y	Obtain info where portal and alignment shifted north and east.
CPT-159	04/04/07	45.4	563+47.5	29.3	L	Portal	N	Obtain info where portal and alignment shifted north and east.
CPT-160	04/04/07	45.4	565+38.8	36.8	L	Portal	N	Obtain info where portal and alignment shifted north and east.
CPT-161	04/03/07	105.0	568+89.3	26.0	L	Portal	Y	Obtain info where portal and alignment shifted north and east.
Tunnel from East Portal to Alum Rock Station								
No CPTs performed.						Tunnel		
Alum Rock Station								
CPT-162	08/13/07	73.2	600+71.5	139.5	L	Station	Y	Obtain additional deeper info on soil stratigraphy.
CPT-172	08/16/07	113.4	607+63.3	65.5	R	Station	Y	Obtain additional info at station entrance location.
Tunnel from Alum Rock Station to Crossover/Downtown Station								
CPT-163	03/31/07	95.1	636+29.4	181.7	L	Tunnel	N	Obtain info for potential southern tunnel alignment at Coyote Creek.
CPT-164	03/28/07	86.0	639+53.6	203.5	L	Tunnel	N	Obtain info for potential southern tunnel alignment at Coyote Creek.
CPT-165	08/16/07	77.4	642+20.2	205.4	L	Tunnel	Y	Obtain info for potential southern tunnel alignment at Coyote Creek.
CPT-166	03/29/07	89.2	649+27.5	193.6	L	Tunnel	N	Obtain info for potential southern tunnel alignment at Coyote Creek.
Crossover								
No CPTs performed.						Station		
Downtown Station (Note: See below; additional CPTs planned based on finalized station entrance locations)								
CPT-167	04/02/07	90.7	701+08.6	10.8	R	Station	Y	Investigate for liquefaction at 1st St.
CPT-169	08/17/07	85.4	706+79.2	145.1	L	Station	Y	Obtain additional info at station entrance location.
Tunnel from Crossover/Downtown Station to Diridon/Arena Station								
No CPTs performed.						Tunnel		
Diridon/Arena Station								
CPT-168	04/05/07	149.9	734+51.2	100	L	Station	Y	Obtain additional deeper info on soil stratigraphy.
CPT-179	08/14/07	115.5	740+58.3	109	L	Station	Y	Obtain additional info at station entrance location.
Tunnel from Diridon/Arena Station to West Portal								
CPT-170	03/30/07	43.7	793+76.9	48.2	R	Tunnel	N	Investigate deeper stretch of alignment along Taylor St.
CPT-171	03/30/07	74.8	794+95.9	41.8	R	Tunnel	Y	Investigate deeper stretch of alignment along Taylor St.
West Portal								
CPT-173	03/29/07	38.4	828+05.7	91.3	L	Portal	Y	Investigate stretch of alignment with limited data.
CPT-173A	03/31/07	33.8	828+02.5	92.6	L	Portal	N	Investigate stretch of alignment with limited data.
CPT-173B	03/31/07	81.5	828+00.0	94.9	L	Portal	N	Investigate stretch of alignment with limited data.
CPT-174	03/31/07	55.6	834+47.1	20.8	L	Portal	Y	Obtain info where portal moved north.
CPT-174A	03/31/07	33.8	834+50.1	20.8	L	Portal	N	Obtain info where portal moved north.
CPT-175	03/28/07	80.5	835+67.9	20.0	L	Portal	N	Obtain info where portal moved north.
CPT-176	03/28/07	45.5	837+51.4	16.4	L	Portal	N	Obtain info where portal moved north.
CPT-177	03/30/07	45.5	838+85.9	18.7	L	Portal	N	Obtain info where portal moved north.
CPT-178*	03/29/07	45.5	841+50.2	15.4	L	Portal	N	Obtain info where portal moved north.

Note: Stations and offsets based on the April 25, 2008 S1 track alignment.

* Stationing shown is based on Western Area Guideway alignment stationing (outside of Central Area Guideway alignment stationing).

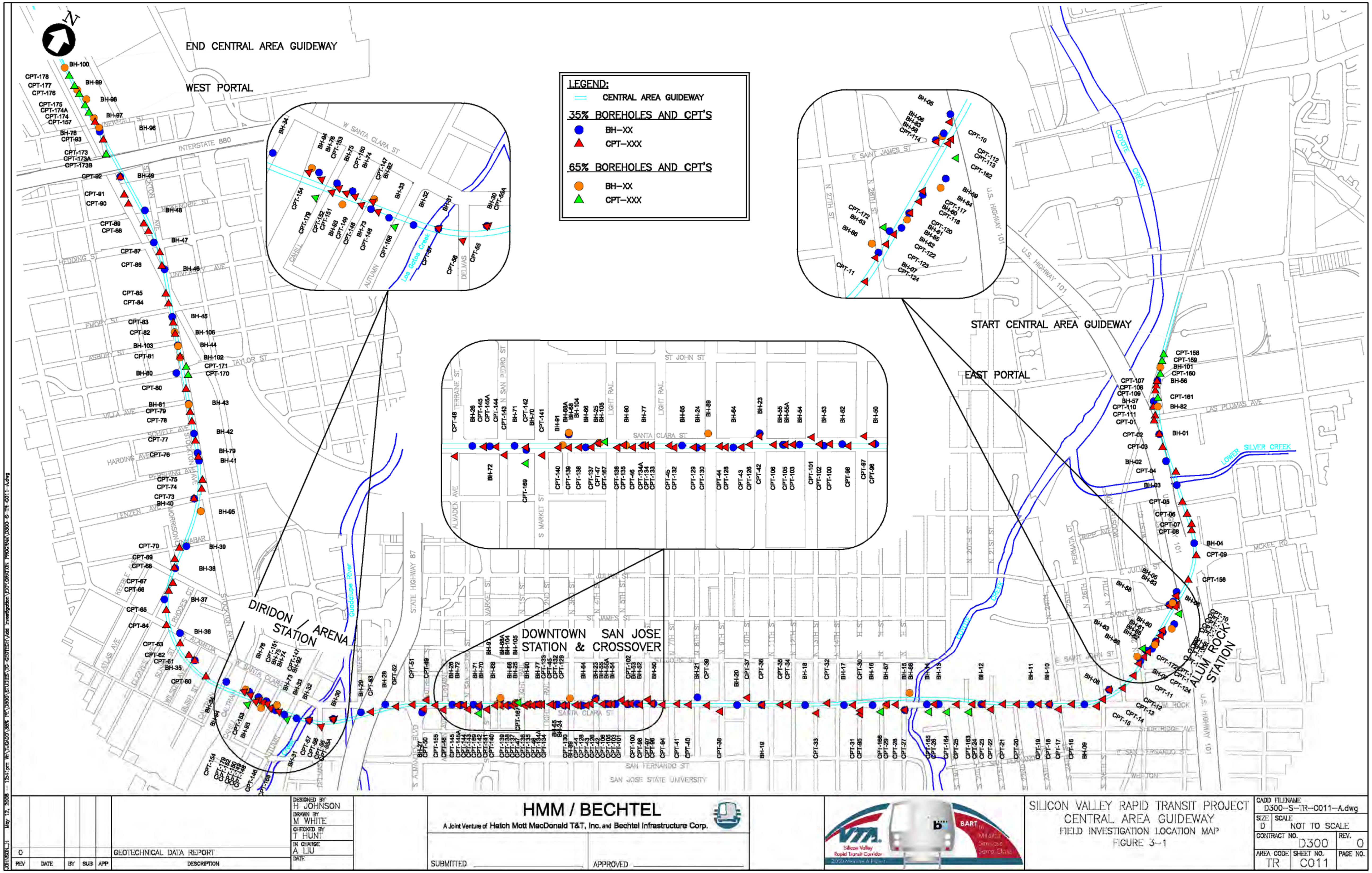

Figure 3-1 Field Investigation Location Map

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3.4 Groundwater Dissolved Gas Sampling

Locus Technologies performed two phases of groundwater sampling and laboratory analyses for 30 groundwater wells during 65% ED geotechnical investigation phase. Phase 1 consisted of sampling and testing groundwater from 12 wells on May 21st and 22nd, 2008. Phase 2 consisted of sampling and testing groundwater samples from the remaining 18 wells on July 22nd and 23rd, 2008. The samples were obtained using low-flow purge methods in accordance with Environmental Protection Agency (EPA) "Ground-Water Sampling Guidelines for Supefund and RCRA Project Manager (2002)". All samples were obtained in airtight bottles. In addition to test samples, duplicate, "rinsate blank", and "travel blank" samples were also collected for quality control purposes. The phase 1 samples were shipped to Bioremediation Consulting, Inc. (BCI) in Watertown, Massachusetts and Gusmer Enterprise, Inc. (Gusmer) in Napa, California for laboratory analysis. Phase 2 samples were sent only to BCI.

BCI analyzed the water samples for methane, ethane, ethanethiol, argon, nitrogen, carbon monoxide, carbon dioxide, ammonia-nitrogen, sulfide, oxygen, hydrogen, and hydrogen sulfide. Gusmer analysed the samples for free and total Sulphur dioxide. Phase 2 samples, tested after Phase 1 samples, were analyzed for methane, nitrogen, carbon dioxide and sulfide by BCI.

A short summary report including the summary of sampling, laboratory analysis, and quality control review is provided in Appendix 10. Field activity logs, water sampling logs, chain of custody records, and laboratory analytical reports are presented in the attachments to the report, which are also included in the Appendix. The laboratory test results are summarized in Tables 3-3a and 3-3b.

Table 3-3a Summary of Phase 1 Laboratory Test Results

			Sample ID																	
	Det. Lim.	**Units**	**4767**	**4768**	**4769**	**MW-2E**	**MW-**	**MW-3D-(r)**	**MW-3D-(r)-dup**	**MW-5A**	**MW-6J**	**ST-3**	**ST-5**	**TW-2B**	**TW-2B-**	**TW-5A**	**TW-6A**	**TW-6B**	**TW-8A**	**Trip Bl**
Dissolved Gas, water matrix																				
Methane	0.2	**µg/L**	4.4	0.2	0.2	2.9	4.6	98	107	9.2	16	6.9	6.1	75	70	0.5	95	0.5	31	0.6
Eth**a**ne	0.2	**µg/L**	0.3	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 0.2	0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 0.2	< 0.2
Ethanethiol	0.07	**mg**/L	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07
Argon	2	**mg**/L	< 2	< 2	< 2	< 2	< 2	2	1.6 J	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	n.a.
Nitrogen	7	**mg**/L	34	15	15	33	36	34	28	25	24	33	32	33	29	34	24	24	33	21
Carbon monoxide	0.5	**mg**/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carbon dioxide	0.2	**mg**/L	16	0.4	0.4	17	17	20	20	8	20	23	21	16	15	32	49	20	17	< 0.5
Free SO2		**ppm**	<5	<5	<5	<5	<5	<5		<5	<5	<5	<5	<5		<5 ppm	<5 ppm	<5 ppm	<5 ppm	
Total SO2		**ppm**	<5	<5	<5	<5	<5	<5		<5	<5	<5	<5	<5		<5 ppm	<5 ppm	<5 ppm	<5 ppm	
Chemical Tests																				
NH3-N Hach 8155	0.02	**mg/L**	0.03	< 0.02	< 0.02	< 0.02	< 0.0	0.06		0.10	0.02	< 0.02	0.08	0.03		0.10	0.04	0.52	0.03	
sulfide Hach 8131	0.003	**mg/L**	0.004	< 0.003	< 0.003	0.007	0	0.008		0	0.010	0.01	< 0.00	0.01		0.005	0.005	< 0.003	0.009	n.a.
Dissolved O2 Hach 8166		**mg/L**	n.a.	8.3	9.8	n.a.	n.a.	n.a.		n.a.	n.a.	n.a.	n.a.	n.a.		n.a.	n.a.	n.a.	n.a.	
Dissolved H2, water matrix																				
Sample Dilution			*1*	*1*	*1*	*1*	*1*	*1*		*1*	*1*	*1*	*1*	*1*		*1*	*1*	*1*	*1*	
Sample Result	0.3	**nM**	1.6	4.9	2.8	1.1	0.9	0.4		1.0	0.5	1.3	< 2	0.8		0.9	0.8	1.2	0.7	
Field DO			2.92	n.a.	n.a.	2.8	2.9	2.98		1.74	4.45	4.01	2.62	2.58		1.81	1.37	4.98	1.97	

Table 3-3b Summary of Phase 2 Laboratory Test Results

			Sample ID														
	Det. Lim.	**Units**	**4783**	**4784**	**4785**	**4786**	**MW-1**	**MW-5B**	**MW-6D**	**NW-01**	**NW-05**	**NW-6**	**ST-10**	**ST-11**	**ST-12**	**ST-13**	**Trip Bl**
Dissolved Gas, water matrix																	
Methane	0.2	**µg/L**	35	0.7	1.8	1.0	0.5	0.9	1.9	2.0	2.1	2.1	0.1	0.4	1.0	1.0	0.4
Nitrogen	7	**mg**/L	27	15	22	18	17	28	21	35	20	26	27	27	23	27	29
Carbon dioxide	0.2	**mg**/L	23	< 0.2	66	< 0.2	1.5	37	72	11	2.7	12	17	17	110	56	0.7
Chemical Test																	
sulfide Hach 8131	0.01	**mg**/L	0.012	< 0.01	0.017	< 0.01	0.019	< 0.01	0.010	0.025	< 0.11 (1)	0.011	< 0.01	< 0.01	< 0.01	0.015	< 0.01

(1) interference from turbidity;
Hach turbidity interference correction
procedure unsuccessful

			Sample ID									
	Det. Lim.	**Units**	**MW-2C**	**MW-2G**	**MW-3C**	**MW-4A**	**MW-4A lab**	**ST-1**	**ST-2**	**ST-7**	**ST-8**	**ST-8 lab**
Dissolved Gas, water matrix, Headspace GC, EPA meth 5021A												
Methane	0.2	**µg/L**	7.7	39	9.9	8.3	8.2	2.0	31	1.5	1.7	1.3
Nitrogen	7	**mg/L**	32	26	35	24	24	28	22	31	37	37
Carbon dioxide	0.2	**mg/L**	< 0.2	24	22	< 0.2	< 0.2	38	3.7	29	31	31
Chemical Test												
sulfide Hach 8131	0.01	**mg/L**	< 0.01	0.028	< 0.01	0.033		< 0.01	0.017	< 0.01	< 0.01	

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4.0 Laboratory Testing

4.1 Introduction

The laboratory soil testing program for the Phase 2 65% Design Investigation expands the information gained from the 10% Conceptual Engineering (CE) Investigation (URS, 2003) and the 35% Preliminary Engineering (PE) Investigation (HMM/Bechtel, 2005a). The laboratory tests were performed from July 2007 through November 2007. In general, the majority of soil samples tested for classification purposes were selected from the strata that were relatively unexplored in previous investigations. Parikh Consultants, Inc. (PCI) in Milpitas, CA, performed the majority of index and classification testing, such as visual classifications, natural moisture contents, fines content, sieve analyses, sieve and hydrometer analyses, Atterberg Limits, and unit weights.

Additional specialty soil testing was performed on selected samples at various laboratories throughout the United States and outside the country. Some of these laboratories also performed classification and index tests on the samples used in the specialty testing. The soil tests, and the laboratories where they were performed, are summarized in Table 4-1. The testing program is discussed in subsequent sections. The test results are provided in the Appendices listed in Table 4-1.

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Table 4-1 Laboratory Testing Program – List of Appendices

Test Type	Parikh Consultants, Inc., Milpitas, CA	Fugro Consultants, Inc. (Fugro), Houston, TX	SGI Testing Services (SGI), Norcross, CA	Shanon & Wilson, Inc. (S&W), Seattle, WA	Cooper Testing Laboratory (Cooper), Palo Alto, CA	Praad Geotechnical, Inc. (Praad), and UCLA, Los Angeles, CA	CAMET Research, Inc. (CAMET), Goleta, CA	Chemistry of Concrete, Goleta, CA	Twining Laboratories of Southern California, Long Beach, CA	Pacific Materials Laboratory, Goleta, CA	SINTEF, Trondheim, Norway	Analytic Consulting Group, Inc., Ventura, CA	University of Texas at Austin, Geotechnical Laboratory, TX
Visual Classification	Appendix 4												
Moisture Content	Appendix 4	Appendix 5		Appendix 7		Appendix 9							
Unit Weight	Appendix 4	Appendix 5				Appendix 9							
Sieve Analyses	Appendix 4		Appendix 6		Appendix 8						Appendix 11		
Consolidation						Appendix 9							
Sieve Analysis and Hydrometer	Appendix 4									Appendix 12			
Materials Finer than No, 200 Sieve	Appendix 4												
Atterberg Limits	Appendix 4	Appendix 5		Appendix 7		Appendix 9					Appendix 11		
X-Ray Radiography		Appendix 5											
Cyclic Simple Shear						Appendix 9							
Cyclic Triaxial Shear		Appendix 5											
Large Scale Direct Shear			Appendix 6										
Direct Shear					Appendix 8								
Sticky Limit				Appendix 7									
Maximum Index Density			Appendix 6		Appendix 8								
Minimum Index Density			Appendix 6		Appendix 8								
Petrography												Appendix 12	
X-ray Fluorescence (XRF)								Appendix 12					
X-ray powder Diffraction (XRD)							Appendix 12						
Clay ID							Appendix 12						
Durability									Appendix 12				
Soil Abrasion											Appendix 11		Appendix 11

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4.1.1 Laboratory Visual Classification

Laboratory visual classification of soils was carried out in general accordance with ASTM D2487, Test Method for Classification of Soils for Engineering Purposes, and ASTM D2488, Practice for Description and Identification of Soils (Visual-Manual Procedures). Visual classification of soils collected in undisturbed Shelby tubes was performed on the soil at the bottom of the tube after removing excess disturbed material.

101 Geo-barrel samples were obtained as continuous cores, and were classified at regular intervals or when there was a change in material type. Field classifications were adjusted based on laboratory visual classifications and supplemented with results of laboratory testing. Final classifications appear in the boring logs (Appendix 1), and in the laboratory classification tests results (Appendix 4) of this report.

4.1.2 Moisture Content

Moisture content testing was performed in general accordance with ASTM D2216, Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures. The tests were assigned to a selected portion of samples from each boring at varying depths.

The moisture content tests were generally conducted within three (3) days of the samples arriving at PCI’s laboratory. The moisture content tests on specialty test samples were not performed within three (3) days because more time was required for their selection and testing. Shelby tube samples that were not tested, or that were stored for future testing, were sealed with heated microcrystalline wax. The 101 Geo-barrel core samples were not tested for moisture content because their sampling method kept them exposed for some time during sampling. Moisture content data appears at the corresponding sample depth on the boring logs in Appendix 1 and Figures and Tables in Appendices 4, 5, 7 and 9 (for PCI, Fugro West, Inc. (FWI), Shannon & Wilson, Inc. (S&W), and Praad Geotechnical/UCLA (PGI/UCLA) data, respectively).

4.1.3 Unit Weight

Unit weight testing was performed in general accordance with U.S. Army Corps of Engineers "Engineer Manual", EM 1110-2-1906 (1970). The tests were assigned to portions of the tube samples from each boring at varying depths.

The total unit weight was obtained by dividing the weight of a sample by the volume of the sample container. The dry unit weight was obtained by oven drying the sample and measuring the change in weight. This change in weight was used to determine the moisture content. The 101 Geo-barrel core samples were not tested for unit weight because their sampling and storing methods do not allow accurate determination of volumes. Dry unit weight data appear at the corresponding sample depth on the boring logs in Appendix 1 and figures and tables in Appendices 4, 5 and 9 (for PCI, FWI and PGI/UCLA data, respectively).

4.1.4 Sieve Analysis

Sieve analysis testing was carried out in general accordance with ASTM D422, Standard Method for Particle-Size Analysis of Soils. Sieve analyses were assigned for granular samples obtained at varying depths.

As applicable, test results included percentage by weight finer than each of the ASTM Sieves 3 in., 2 in., 1-1/2 in., 1 in., 3/4 in., 1/2 in., 3/8 in., No. 4, No. 10, No. 20, No. 40, No. 60, No. 100, and No. 200 for each sample tested. Test results for sieve analyses in the form of gradation curves (particle size versus percent passing by dry unit weight) can be found in Appendices 4, 6 and 8 (for PCI, SGI and Cooper Testing Laboratory (CTL) data, respectively). Also, the fines content determined by the percentage (by weight) of material passing the No. 200 sieve is indicated in the boring logs (Appendix 1).

4.1.5 Sieve and Hydrometer Analysis

Combined sieve and hydrometer analyses were performed in general accordance with ASTM D422. These tests were performed on a limited number of fine-grained and coarse-grained samples obtained at varying depths.

The results are presented in a summary table and as gradation curves in Appendix 4. The fines content determined by the percentage of material (by weight) passing the No. 200 sieve is also reported in the boring logs (Appendix 1).

4.1.6 Atterberg Limits

The Liquid Limit, Plastic Limit, and Plasticity Index were determined in general accordance with ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. These tests were assigned for fine-grained soils obtained at varying depths.

The test results are shown on the boring logs in Appendix 1 (for PCI's data, respectively), and Figures and Tables in Appendices 4, 5, 7 and 9 (for PCI, FWI, Shannon & Wilson and PGI/UCLA data, respectively).

4.1.7 Materials Finer than No. 200 Sieve

The determination of the total amount of material finer than the No. 200 Sieve was performed in general accordance with ASTM D1140, Standard Test Method for Amount of Material in Soils Finer than the No. 200 Sieve. The test results are presented on the boring logs in Appendix 1 as well as on the gradation curves in Appendix 4.

4.2 Specialty Geotechnical Testing

Specialty geotechnical testing consisted of evaluating shear strength properties and maximum/minimum index densities of sandy and gravelly soils, dynamic soil properties of silty sand to sandy silt and clayey soils, and adhesive properties of high-plasticity clays.

4.2.1 Direct Shear (Conventional)

Direct shear tests were performed on sand samples to measure the drained shear strength parameters, friction angle (ϕ') and cohesion (c'). The tests were performed in general accordance with ASTM D 3080, Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Condition.

Three (3) disturbed sand samples were collected from borings MW-2D, MW-6K, and MW-4A that were performed for the pumping test. The boring logs and laboratory test results for these borings are presented in Pumping Test Data Report (HMM/Bechtel, 2008). The samples were then transported to CTL for testing. Maximum and Minimum index density tests and sieve analyses were performed on the samples before performing direct shear tests (See Sections 4.2.4 and 4.1.4, respectively). A total of 27 initial direct shear tests were performed: three (3) samples at three (3) relative densities under (3) confining pressures. Four additional tests were performed for one sample (MW-4A) at four different confining pressures. Gravel size particles greater than 4.75 mm were sieved out from the specimens to eliminate boundary effects of test apparatus. Each specimen was prepared by compacting to a specified relative density ranging from 65 % to 95 % based on the minimum and maximum densities determined. The specimen was then subjected to a specified surcharge pressure before testing at a constant rate of strain. It should be noted that one of the samples (MW-6K) yielded a fines content greater than 15%, thus invalidating the maximum density. Thus, the relative density values for this sample will be biased and therefore correlations between relative density and strength should not be used. The test results are provided in Appendix 8.

Additionally, one (1) disturbed sand sample obtained using Modified California sampler was also shipped to CTL to perform three (3) direct shear tests at different normal pressures.

4.2.2 Large Scale Direct Shear

Larger scale direct shear tests were performed on gravel samples to measure the drained shear strength parameters, friction angle (ϕ') and cohesion (c'). The tests were performed in general accordance with ASTM D 3080. The difference between conventional and large-scale direct shear tests is the size of the test specimens. The test specimens in large-scale direct shear tests were 1-foot square in cross-section and 5 inches thick. The larger specimen size allowed the testing of gravel size particle up to 1.25 inches. Testing of specimens containing larger than 1.25 inches gravel size particles is not conventionally performed in United States.

Three (3) disturbed gravel samples from the borings performed for the pumping test program were transported to SGI Laboratories for testing. Approximately 100 lb of material was collected for each specimen. Maximum/Minimum index density tests, and sieve analyses were performed on the samples before performing direct shear tests (See Sections 4.2.4 and 4.1.4, respectively). A total of 11 direct shear tests were performed. Each specimen was prepared by compacting to a specified relative density ranging from 65 % to 95 %. The specimen was then subjected to a specified surcharge pressure before testing at constant rate of strain. The test results are provided in Appendix 6.

4.2.3 Sticky Limit

High plasticity (fat) clay is expected to adhere or stick to metal surfaces under certain conditions of plasticity and water content, thus affecting tunneling and excavation operations. Therefore, for high plasticity clays, the concept of adhesion or sticky limit has been introduced and is defined as the lowest water content at which soil adheres to metal tools. This test is not standardized by the ASTM and is uncommon in typical geotechnical applications. The tests were performed following the procedure developed by S & W (Appendix 7).

A total of 32 samples were tested for sticky limits. The samples were tested in two batches. The first batch consisted of 15 samples from the 35% PE and Phase 2 65% Engineering Design investigation. The samples, classified as lean and fat clay visually and/or by laboratory tests by PCI, were sent to S&W who also determined Atterberg Limits. Lean clay samples were included for comparison with fat clays. The second batch consisted of 17 clay samples from Phase Two 65% Engineering Design investigation and Pumping Test investigation (Pumping Test Data Report, HMM/Bechtel, 2008). Sticky limit tests were not performed on lean clay samples from the second batch. The samples from 35% PE investigations and Pumping Test investigations were used because relatively few high plasticity clay samples were found in the Phase 2 65% Engineering Design Investigation. The test results are provided in Appendix 7.

4.2.4 Maximum and Minimum Index Density

Maximum and minimum index density tests were performed on sand and gravel samples prior to direct shear tests by CTL and SGI, respectively. For test specimens at CTL, gravel size particles retained on No. 4 (4.75 mm) sieve were removed. For test specimens at SGI, particles retained on 1.25-inch sieve were removed. The maximum index density tests were performed in general accordance with ASTM D 4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table. The minimum index density tests were performed in general accordance with ASTM D 4254, Standard

Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

Three (3) disturbed sand and three (3) gravel samples were sent for testing to CTL and SGI, respectively. For maximum index density, each oven-dried test specimen was placed in a mold and subjected to a constant surcharge of 2 pound per square inch (psi). The specimen was then electromagnetically vibrated for 8 to 10 minutes. The maximum density was calculated by dividing the mass of the densified soil by its volume (average height of densified soil times area of mold). For minimum index density, each specimen was poured into a container of known volume in such a manner that bulking and particle segregation was prevented and compaction minimized. The test results for gravels and sands are provided in Appendices 6 and 8, respectively. As discussed in Section 4.2.1, one of the samples sent to CTL had a fines content greater than 15%, thus nullifying the maximum index density test. For more details, refer to Appendix 8.

4.2.5 Shipping and X-ray of Relatively Undisturbed Samples

Relatively undisturbed Shelby tube samples were sent to PGI/UCLA in Los Angeles and FWI's laboratory in Houston, Texas. Six (6) sealed Shelby Tubes were shipped by car to PGI and UCLA, and three (3) were shipped via air to FWI's laboratory in specially fabricated, padded containers designed to minimize disturbance of the samples and that maintained the tubes in a vertical position. The soil samples sent to the laboratory consisted of silty sand, clayey sand, silty, clayey sand, and lean clay with sand. The Shelby tubes received by FWI's laboratory were X-rayed to determine the availability and quality of the material inside the tubes. Interpretation of soils using X-ray radiographs were performed in accordance with ASTM D4452, Methods for X-Ray Radiography of Soil Samples, with the slight modifications that are described in detail in Appendix 5. Images of the X-ray sample radiography are presented in Appendix 5.

4.2.6 Cyclic Triaxial Shear

Cyclic triaxial shear tests were performed by FWI on silty sand, clayey sand, silty, clayey sand, and lean clay with sand samples. The samples were tested to evaluate the ability of soil to resist the shear stresses induced in soil mass due to cyclic loading. The tests were performed in general accordance with ASTM D 5311, Standard Test Method for Load Controlled Cyclic Triaxial Strength of Soil.

Nine (9) cyclic triaxial shear tests were performed. Each selected test specimen was water saturated followed by isotropic consolidation in a consolidation cell. Each specimen was then subjected to sinusoidally varying axial load to produce a specific cyclic stress ratio. Pore water pressures generated under undrained conditions during the tests were recorded. The test results are provided in Appendix 5. Index and classification tests such as natural moisture content, unit weight, Atterberg Limits and fines content were also performed on the samples.

4.2.7 Cyclic Simple Shear

Cyclic simple shear tests were performed by PGI/UCLA on clay samples to measure the rate of straining effect on the cyclic shear strength. To increase saturation levels, the soil samples were soaked under a vertical stress corresponding to the in-situ vertical stresses for 24 to 48 hours while still inside the tubes. A suite of shear tests consisting of monotonic loading and cyclic stress-strain applications were then performed over the extruded and trimmed specimens. The test results are provided in Appendix 9. Details of the testing apparatus are described in Duku et al. (2007). In addition, index and classification tests such as natural moisture content, unit weight, Atterberg Limits and fine content were also performed on the samples

Although strain-dependent modulus degradation and damping ratio increase with strain could also be obtained from this type of tests, limitations of the equipment used did not permit to fully saturate the specimen under back pressure. Thus the test results are questionable and should not be taken into consideration for design purposes.

4.2.8 Soil Abrasion

Soil Abrasion Testing (SAT) was performed to determine the abrasiveness of soil to the Tunnel Boring Machine (TBM) disc cutter steel. This test is not standardized by ASTM, but is currently under development. The test procedure consists of measuring the cutter steel wear. The test is based on the NTNU Abrasion test (AV/AVS) for measuring steel wear due to hard rock. It was performed in general accordance with “New test methodology for estimating the abrasiveness of soils for TBM tunneling” (Nilsen B. et al. 2007). The testing was performed between August 12 and September 9, 2008.

Four bulk soil samples were sent for testing at SINTEF Rock and Soil Mechanics laboratory in Trondheim, Norway. The soil samples consisted of four soil types: Lean Clay (USCS: CL), Clayey Sand (SC), Poorly Graded Sand (SP), and Poorly-graded Gravel with Silt and Sand (GP-GM). The soil samples were selected from 35% PE phase and 65% ED phase geotechnical investigations. Although clays are known to be non-abrasive, the clay sample was included as a baseline comparison. The tests were performed on the portions of samples passing through 1 mm sieve size. Prior to the tests, Atterberg Limits were determined for clay sample, and gradation analysis performed on sand and gravel samples.

In addition to the four soil samples sent to SINTEF, a portion of gravel sample was sent to the geotechnical laboratory at University of Texas at Austin (UT). The purpose of sending a specimen for similar testing at UT was to compare the effect of grinding the bigger size soil particles on test results, and also to verify if SAT could be carried out at an alternative laboratory within United States for any future testing for the project. The testing at UT included testing on virgin as well as modified soil specimens passing through 1mm and 4mm size sieves. The modified soil specimens consisted of gravel-size particles grinded to less than 1 and 4mm size. UT performed testing on specimens passing through 1mm size sieve after they observed problems during testing on specimens passing through 4mm size sieve. The details and results of abrasion tests are provided in Appendix 11.

4.2.9 Mineralogy

The mineralogy testing program consisted of X-ray powder diffraction analysis (XRD), wavelength dispersive X-ray flourescense analysis (XRF), clay ID; and petrography. The testing program also included sieve and hydrometer analyses, and durability testing on selected cohesionless samples. The XRD, XRF, and Clay ID measurements were performed according to generally accepted industry standards[*]. The Clay ID measurements were performed only on cohesive samples. Petrography analyses were performed in accordance with ASTM C295; durability testing: ASTM D 3744; and sieve and hydrometer analyses: ASTM D422. The testing program was conducted from April through June 2008, and results provided to us in July.

A total of 11 samples were selected from 35% PE and 65% ED investigation phases, and sent to CAMET Research (CAMET) located in Goleta, California. CAMET performed XRD and Clay ID testing on a portion of the provided samples, and sent the remaining portions to the following California laboratories for different testing: Chemistry of Concrete laboratory in Goleta carried out XRF measurements, Analytical Consulting Group, Inc. in Ventura carried out petrography analyses, Twining Laboratories of Southern California in Long Beach performed durability testing, and Pacific Materials Laboratory in Goleta conducted sieve and hydrometer analyses. These laboratories performed the testing under the overview of CAMET.

The samples included both cohesive and cohesionless soils. The XRD, XRF, Clay ID and petrography tests consisted of determining mineralogical composition of soil samples using spectrometers. The durability tests were performed to determine the resistance of soil samples to generating fines on mechanical agitation in the presence of water. Though the durability testing is not conventional for tunneling purposes; CAMET performed the tests due to insufficiency of samples for Los Angeles Abrasion testing. Sieve and hydrometer analyses were performed to determine the USCS classification of cohesionless soil samples. The test results are provided in Appendix 12.

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[*] The references for testing are mentioned in CAMET's report in Appendix 12.

5.0 Summary and Future Data Reports

The content of this report summarizes the data from 19 boreholes, 25 CPTs, and associated laboratory tests conducted during the Phase Two 65% Engineering Design Investigation. Sticky Limit, mineralogy and soil abrasion tests were performed on samples from the 35% PE Investigation and the 65% Engineering Design Investigation. The Plan and Profile Drawings presented in Figures 5-1 through 5-43 of this report are updated from those presented in the 35% Preliminary Engineering Geotechnical Data Report (HMM/Bechtel, 2005a) to include the information from the additional borings and CPTs.

The Plan and Profile Drawings include information from the six sonic borings completed during the pumping test program. The Pumping Test Data Report (HMM/Bechtel, 2008) presents the boring logs and summarizes the sonic drilling, sampling and laboratory samples obtained from the sonic borings.

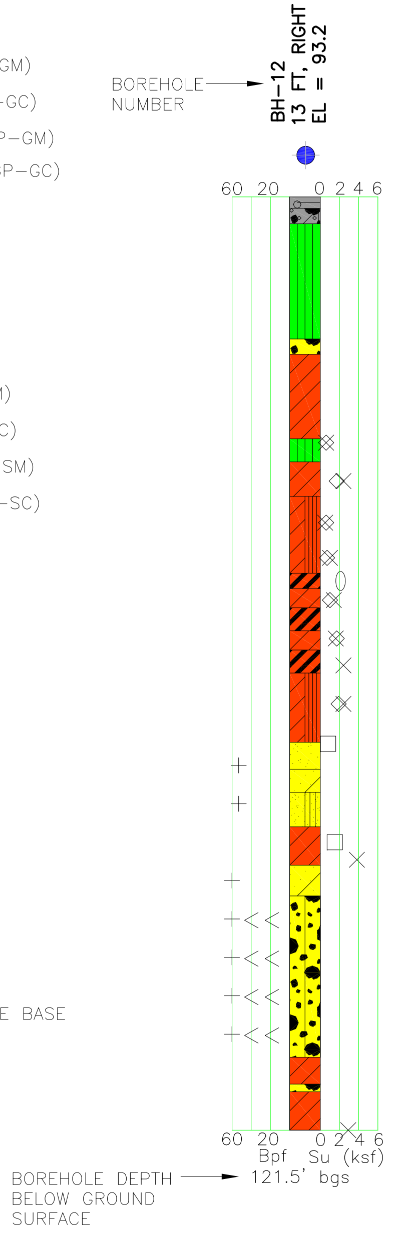
A Phase Three (P3) Geotechnical Investigation Data Report will be prepared to include information from the boreholes advanced during the final stages of design.

Figure 5-1 Geotechnical Plan and Profile Legend

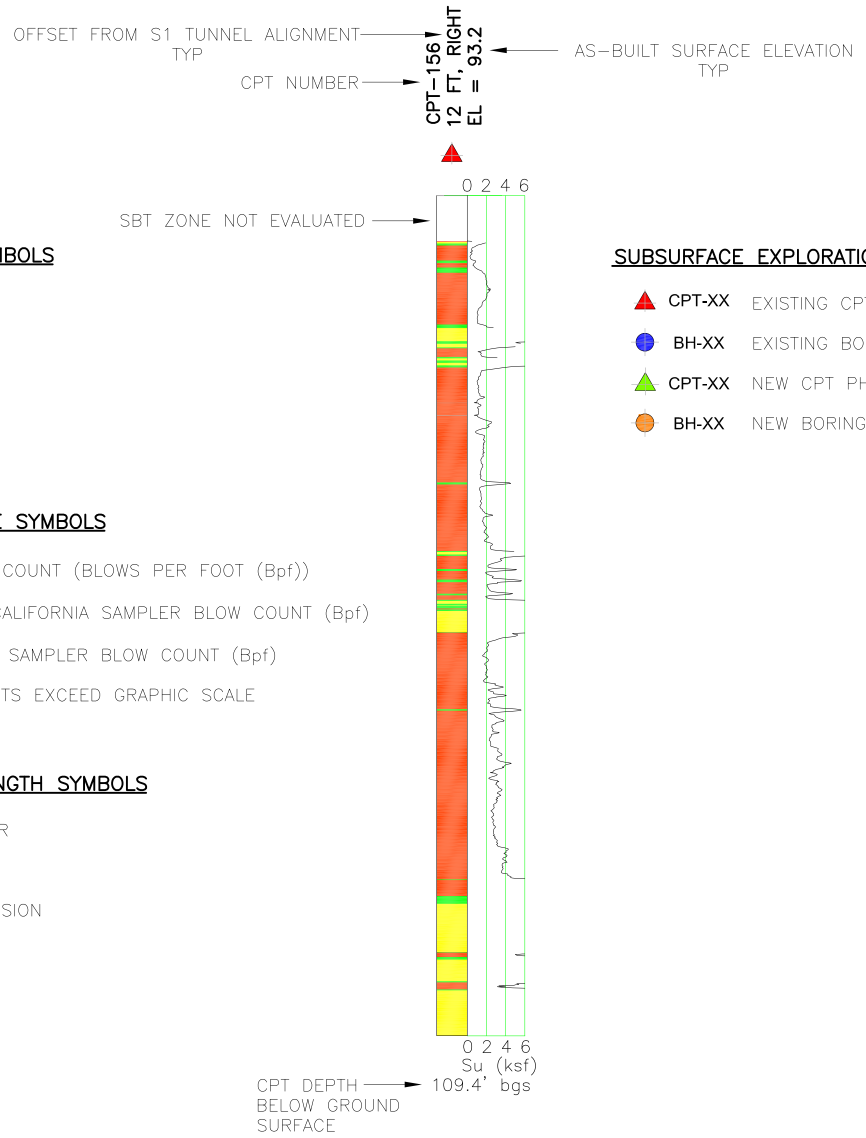
SOIL TYPE:

- ▨ WELL-GRADED GRAVEL (GW)
- ▨ POORLY-GRADED GRAVEL (GP)
- ▨ WELL-GRADED GRAVEL WITH SILT (GW-GM)
- ▨ WELL-GRADED GRAVEL WITH CLAY (GW-GC)
- ▨ POORLY-GRADED GRAVEL WITH SILT (GP-GM)
- ▨ POORLY-GRADED GRAVEL WITH CLAY (GP-GC)
- ▨ CLAYEY GRAVEL (GC)
- ▨ SILTY GRAVEL (GM)
- ▨ SILTY, CLAYEY GRAVEL (GC-GM)
- ▨ WELL-GRADED SAND (SW)
- ▨ POORLY-GRADED SAND (SP)
- ▨ WELL-GRADED SAND WITH SILT (SW-SM)
- ▨ WELL-GRADED SAND WITH CLAY (SW-SC)
- ▨ POORLY-GRADED SAND WITH SILT (SP-SM)
- ▨ POORLY-GRADED SAND WITH CLAY (SP-SC)
- ▨ SILTY SAND (SM)
- ▨ CLAYEY SAND (SC)
- ▨ SILTY, CLAYEY SAND (SC-SM)
- ▨ SILTY SAND/SANDY SILT (SM-ML)
- ▨ CLAYEY SAND/LEAN CLAY (SC/CL)
- ▨ SILT (ML)
- ▨ LEAN CLAY (CL)
- ▨ SILTY CLAY (CL-ML)
- ▨ LOW PLASTICITY ORGANICS (OL)
- ▨ ELASTIC SILT (MH)
- ▨ FAT CLAY (CH)
- ▨ CLAY (CH-MH)
- ▨ HIGH PLASTICITY ORGANICS (OH)
- ▨ PAVEMENT WITH OR WITHOUT AGGREGATE BASE
- ▨ FILL
- ☐ NO DATA

SOIL BORING LITHOLOGY WITH UNDRAINED SHEAR STRENGTH (Su) EXAMPLE



CPT SOUNDING WITH INTERPRETED LITHOLOGY AND UNDRAINED SHEAR STRENGTH (Su) EXAMPLE



CLASSIFICATION TEST SYMBOLS

γ = DRY DENSITY (pcf)

ω = WATER CONTENT (%)

LL = LIQUID LIMIT (%)

PI = PLASTICITY INDEX (%)

PENETRATION RESISTANCE SYMBOLS

+ = MEASURED SPT BLOW COUNT (BLOWS PER FOOT (Bpf))

⊖ = MEASURED MODIFIED CALIFORNIA SAMPLER BLOW COUNT (Bpf)

▽ = MEASURED CALIFORNIA SAMPLER BLOW COUNT (Bpf)

<< = INDICATES BLOW COUNTS EXCEED GRAPHIC SCALE

UNDRAINED SHEER STRENGTH SYMBOLS

× = POCKET PENETROMETER

◇ = TORVANE

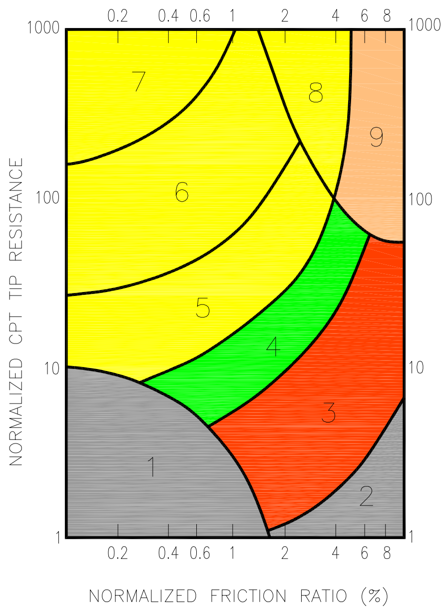
□ = UNCONFINED COMPRESSION

0 = FIELD VANE

○ = MINI VANE

SUBSURFACE EXPLORATIONS

▲	CPT-XX	EXISTING CPT PHASE 1
●	BH-XX	EXISTING BORING PHASE 1
▲	CPT-XX	NEW CPT PHASE 2
●	BH-XX	NEW BORING PHASE 2



ZONE	SOIL BEHAVIOR TYPE (SBT)
1	SENSITIVE FINE-GRAINED
2	ORGANIC MATERIAL
3	CLAY TO SILTY CLAY
4	CLAYEY SILT TO SILTY CLAY
5	SILTY SAND TO SANDY SILT
6	CLEAN SANDS TO SILTY SANDS
7	GRAVELLY SAND TO SAND
8	VERY STIFF SAND TO CLAYEY SAND*
9	VERY STIFF FINE-GRAINED*

*OVERCONSOLIDATED OR CEMENTED

CPT CORRELATION CHART
(MODIFIED FROM ROBERTSON, 1990)

LEGEND

— — — — EXISTING GROUND SURFACE

———— TUNNEL EXTENTS

—— - —— TUNNEL SPRINGLINE

—— —— EXCAVATION BOUNDERIES

NOTES:

1. STATIONING AND PROFILE ARE RELATIVE TO S1 TUNNEL ALIGNMENT DATED APRIL 25, 2008.
2. ELEVATIONS ARE BASED ON 1988 NAVD.
3. MAXIMUM UNDRAINED SHEAR STRENGTH CAPACITY OF FIELD VANE IS ~ 2.0 ksf.
4. MAXIMUM UNDRAINED SHEAR STRENGTH CAPACITY OF POCKET PENETROMETER IS 4.5 ksf.
5 MAXIMUM UNDRAINED SHEAR STRENGTH CAPACITY OF TORVANE IS ~ 2.0 ksf.
6. CPT UNDRAINED SHEAR STRENGTH VALUES TRUNCATED AT 6.0 ksf.
7. CPT UNDRAINED SHEAR STRENGTH NOT APPLICABLE FOR SBT ZONES 5, 6, 7, AND 8, HENCE NOT SHOWN.
8. BORING LOGS FOR BH-83, BH-86, BH-92, BH-94, BH-96 AND BH-104 ARE INCLUDED IN PUMPING TEST DATA REPORT (HMM/BECHTEL, FEBRUARY 2008).
9. FOR BORINGS BH-24, BH-52, BH-58, BH-70 AND BH-74, CLASSIFICATION TEST RESULTS ARE NOT SHOWN AT CORRECT DEPTHS. REFER TO BORING LOGS IN APPENDIX 1 OF THIS PHASE TWO – 65% ENGINEERING DESIGN INVESTIGATION GEOTECHNICAL DATA REPORT.

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SILICON VALLEY RAPID TRANSIT PROJECT
CENTRAL AREA GUIDEWAY
GEOTECHNICAL PLAN AND PROFILE
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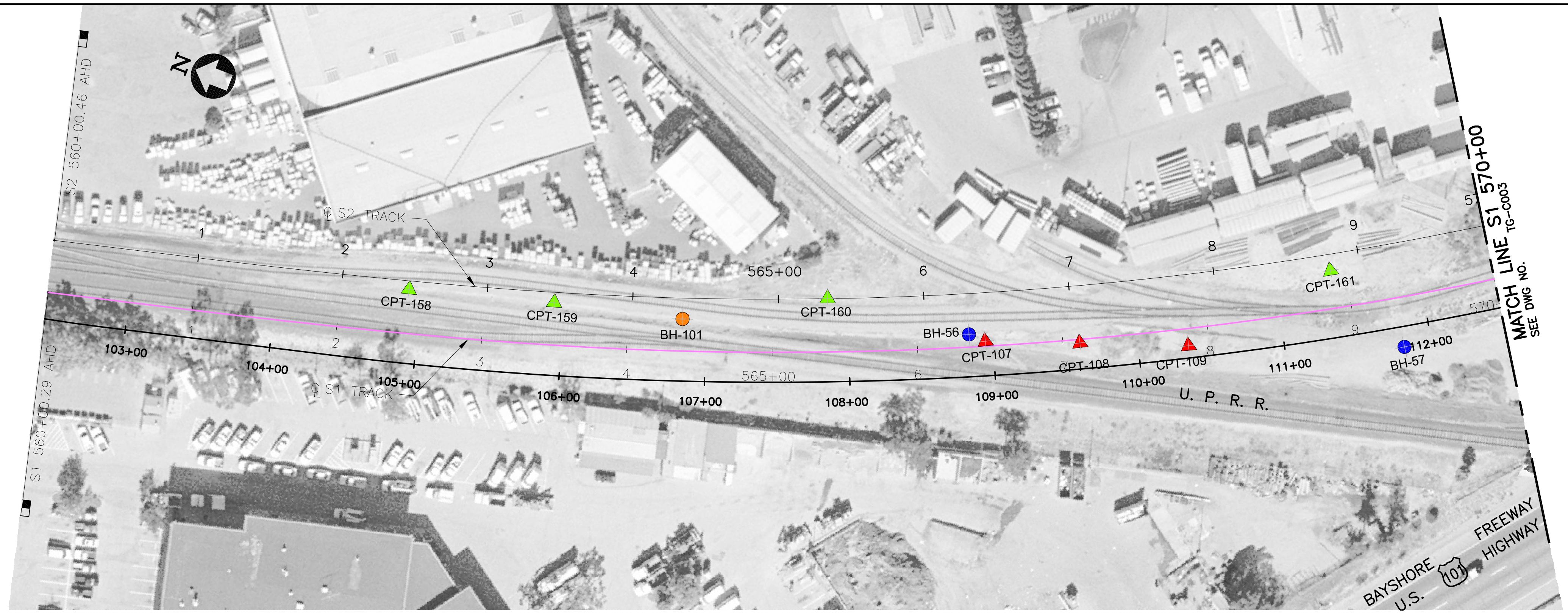
Figure 5-2 Geotechnical Plan and Profile with Classification Test Results: STA 561+00 to STA 570+00



PLAN

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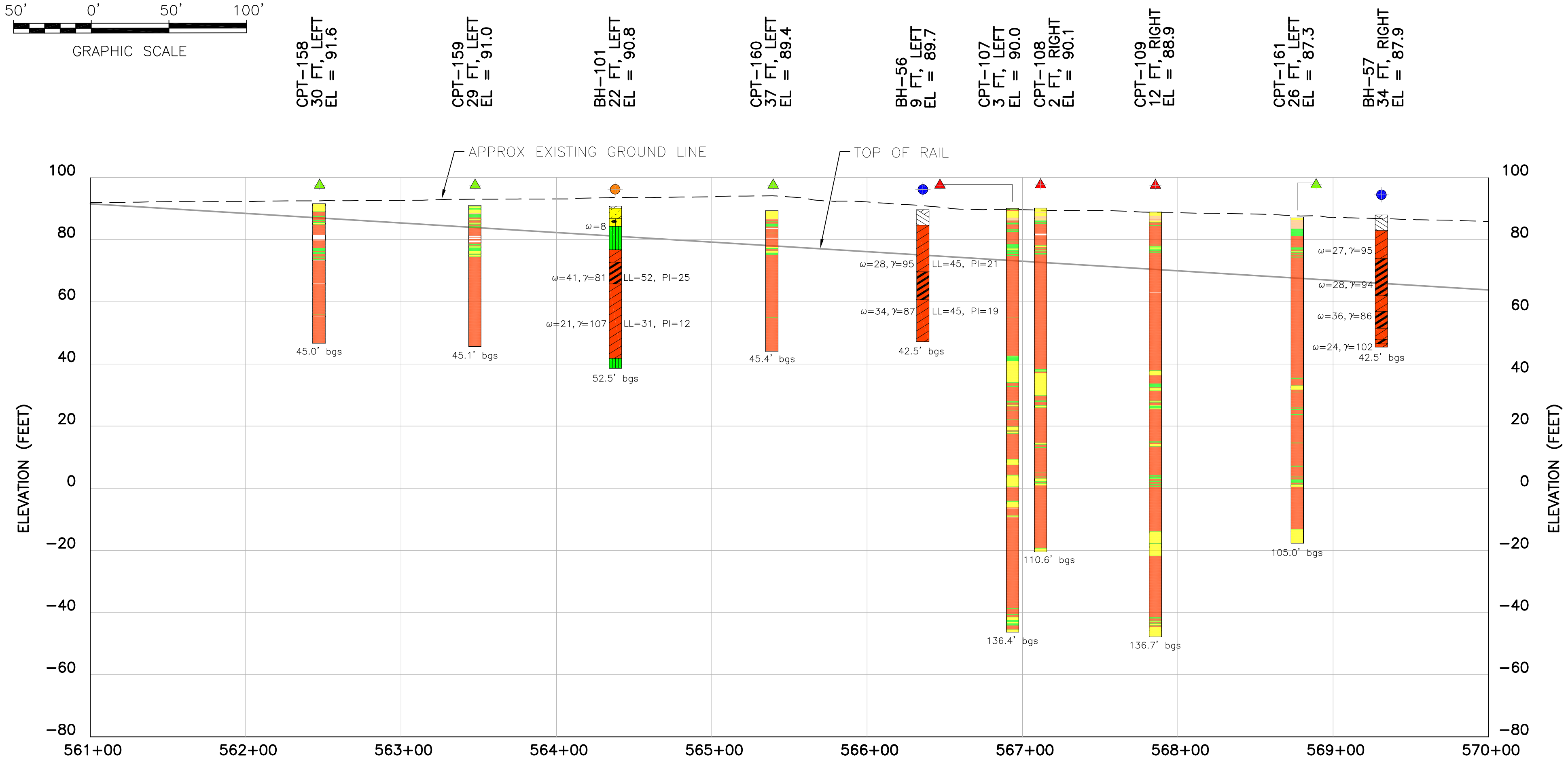

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GEOTECHNICAL PLAN AND PROFILE
With Classification Test Results
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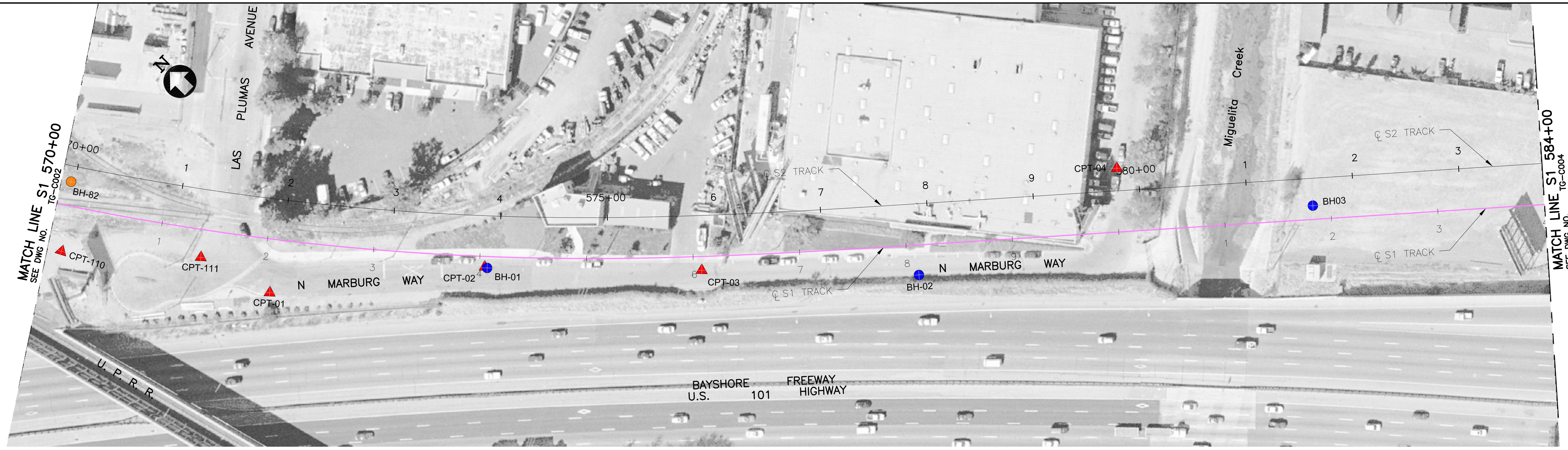
Figure 5-3 Geotechnical Plan and Profile with Classification Test Results: STA 570+00 to STA 584+00



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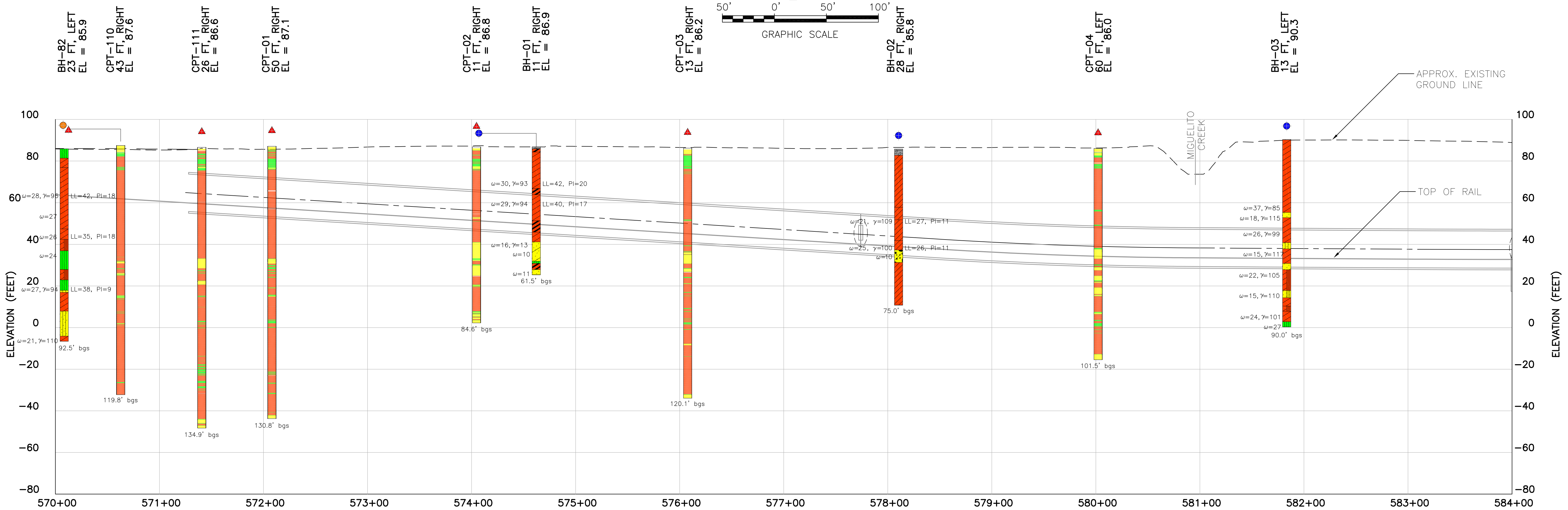

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With Classification Test Results
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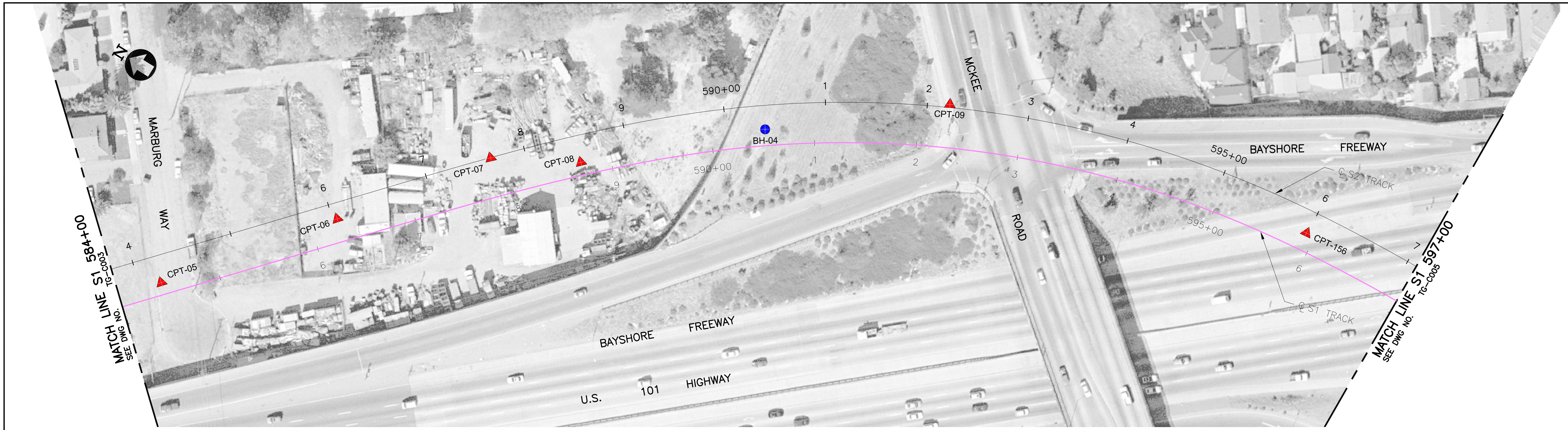
Figure 5-4 Geotechnical Plan and Profile with Classification Test Results: STA 584+00 to STA 597+00



PLAN

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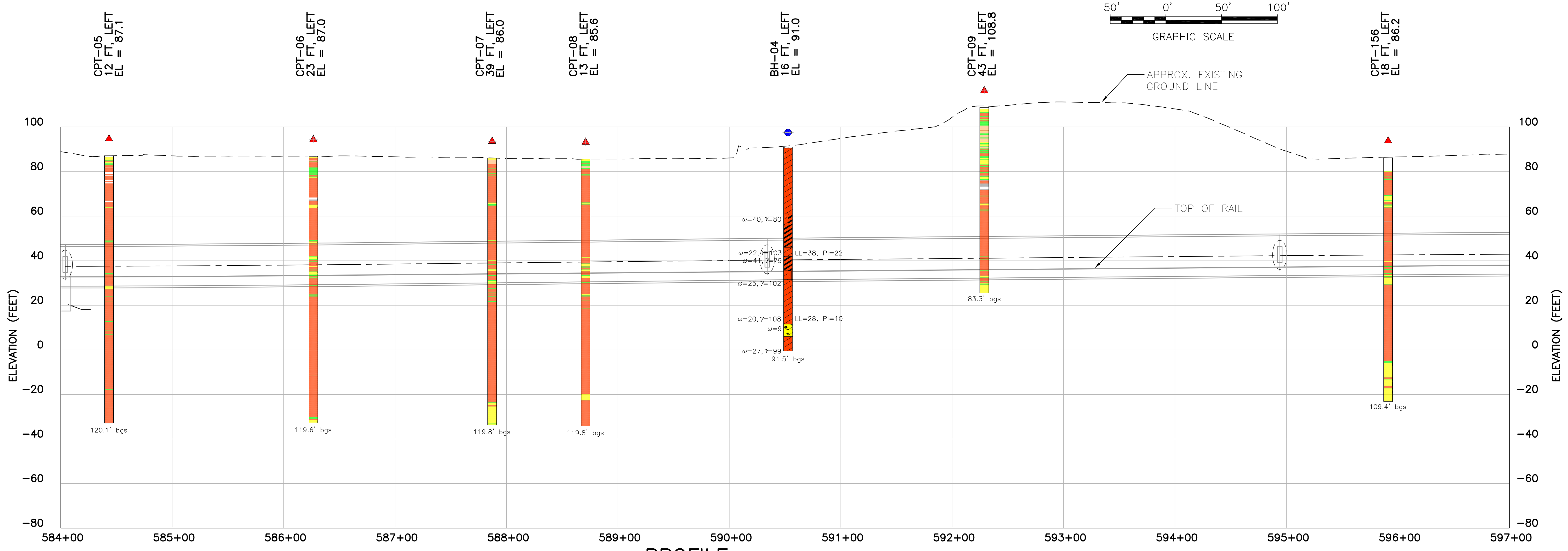

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With Classification Test Results
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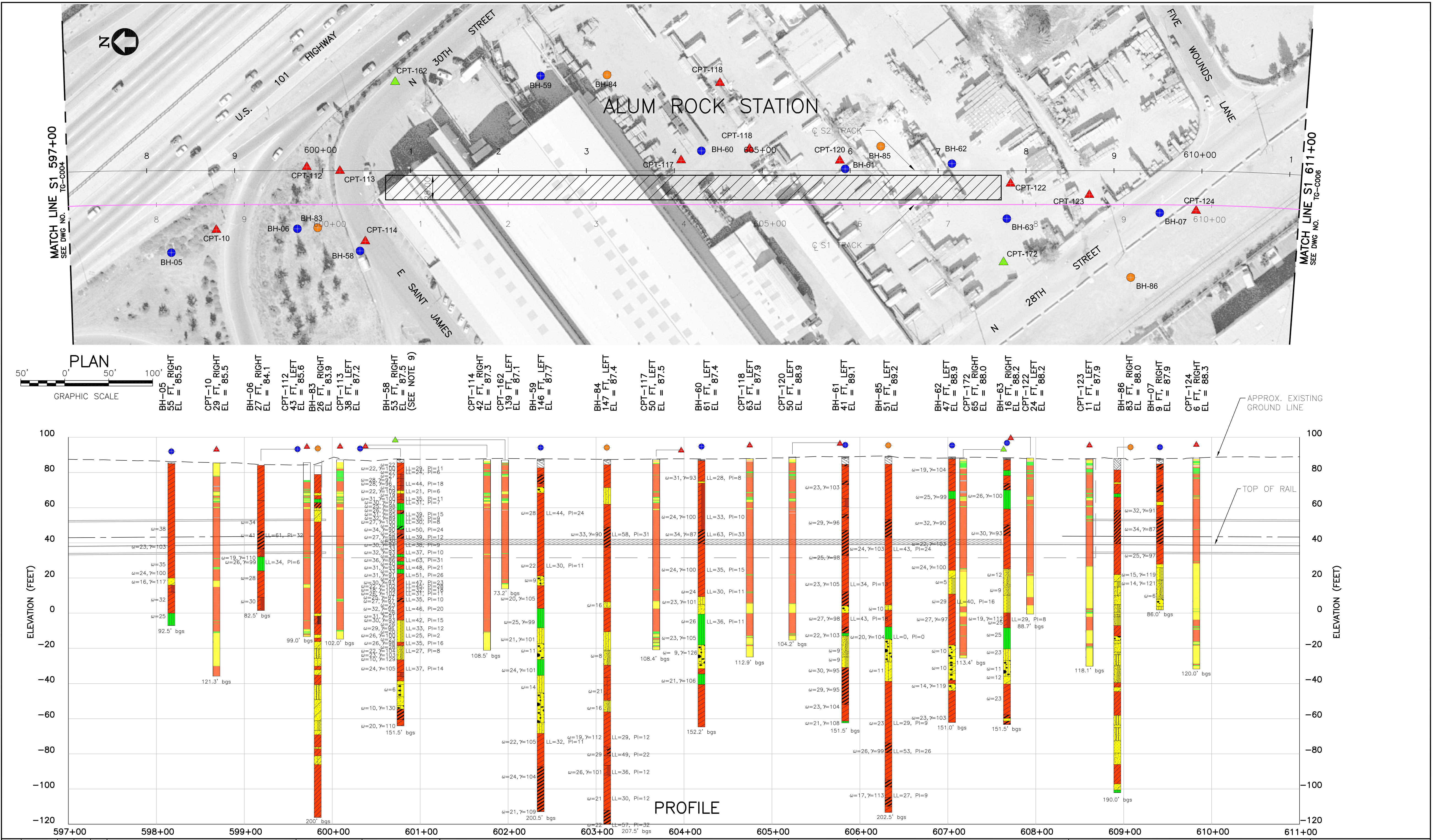
Figure 5-5 Geotechnical Plan and Profile with Classification Test Results: STA 597+00 to STA 611+00



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					CHECKED BY A. LIU		
					IN CHARGE A. LIU		
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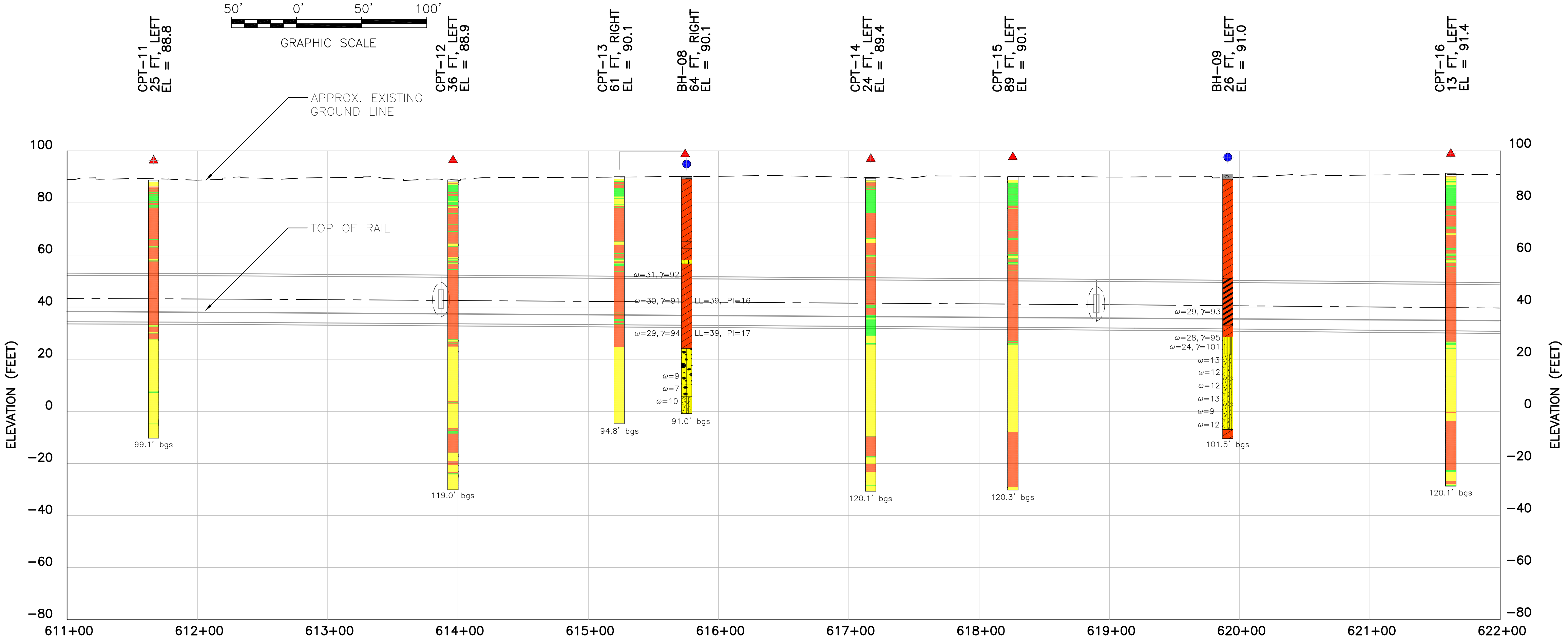
Figure 5-6 Geotechnical Plan and Profile with Classification Test Results: STA 611+00 to STA 622+00

PLAN



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S1 STA 611+00 TO STA 622+00

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REV. A
AREA CODE
SHEET NO. 5–6
PAGE NO.

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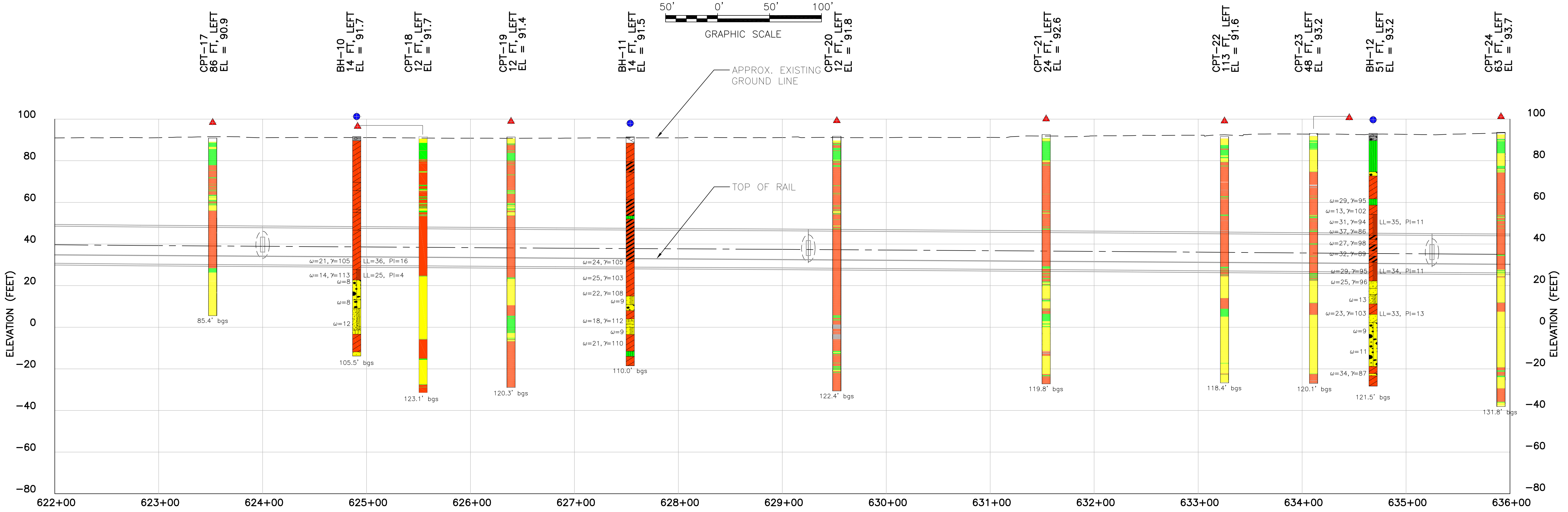
Figure 5-7 Geotechnical Plan and Profile with Classification Test Results: STA 622+00 to STA 636+00

PLAN

50' 0' 50' 100'
GRAPHIC SCALE



PROFILE

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S1 STA 622+00 TO STA 636+00

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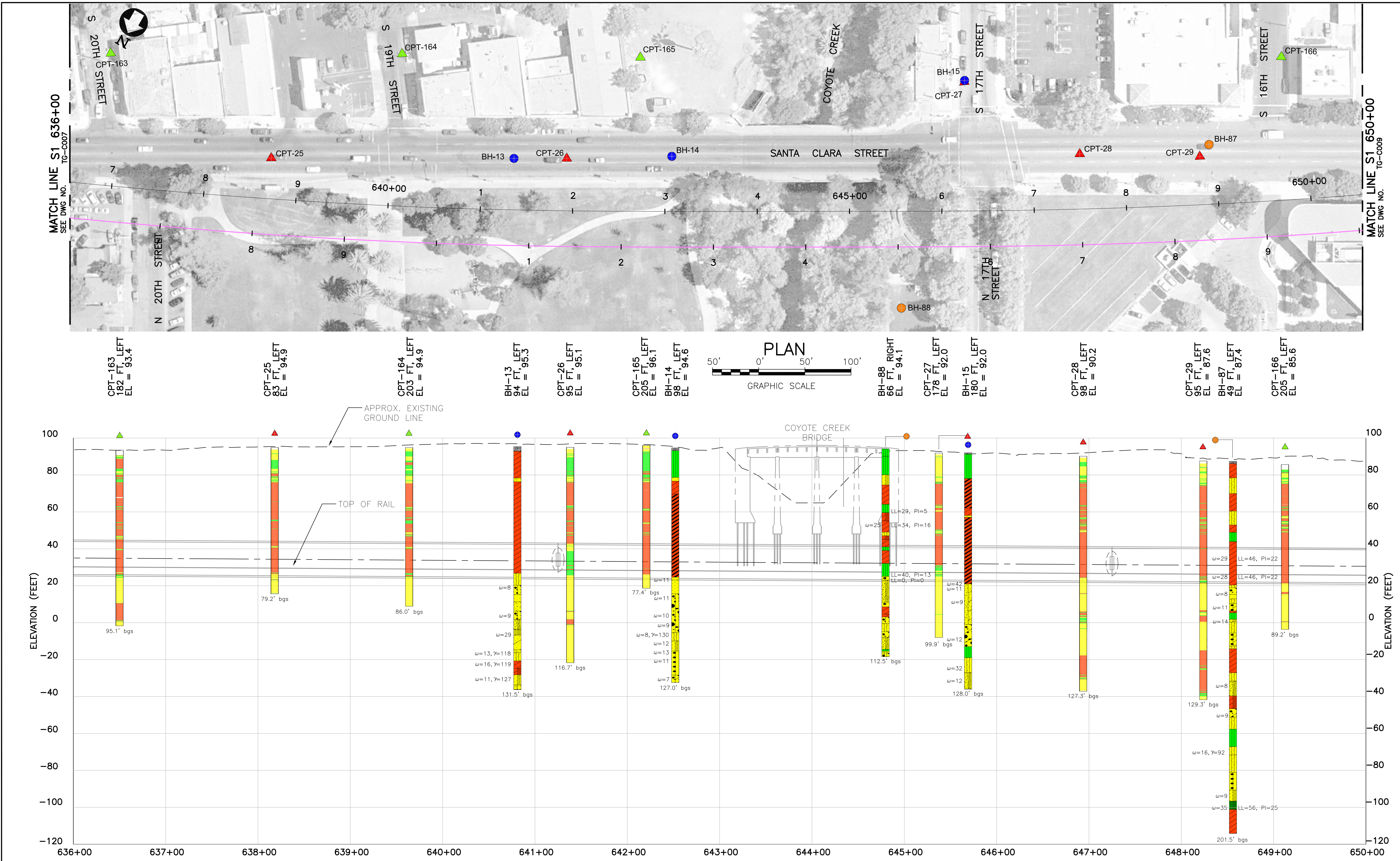
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5-7
PAGE NO.

Figure 5-8 Geotechnical Plan and Profile with Classification Test Results: STA 636+00 to STA 650+00



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With Classification Test Results
S1 STA 636+00 TO STA 650+00

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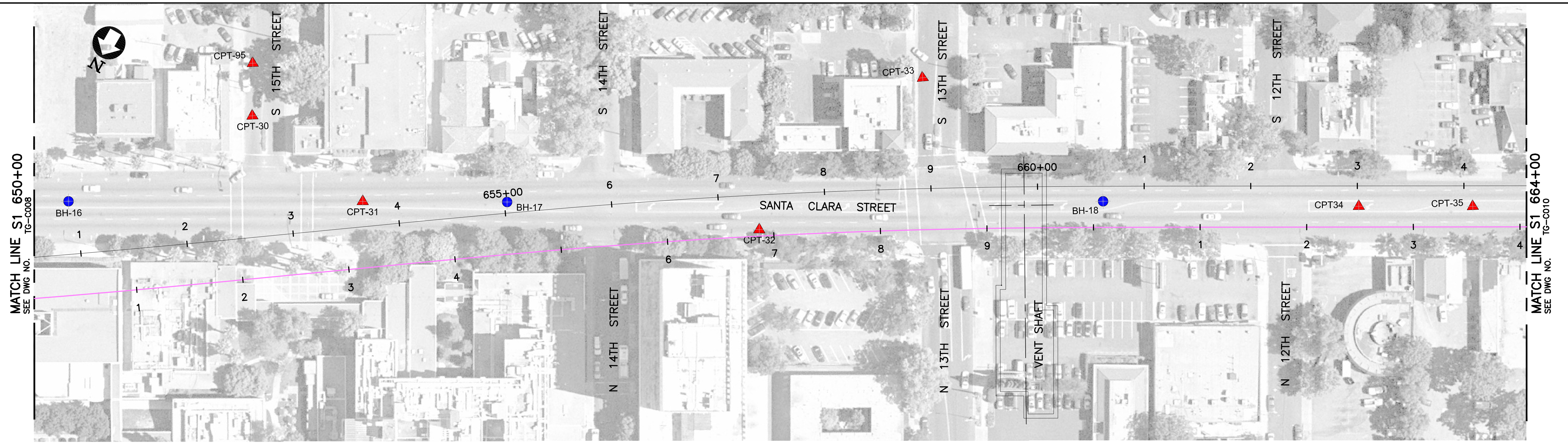
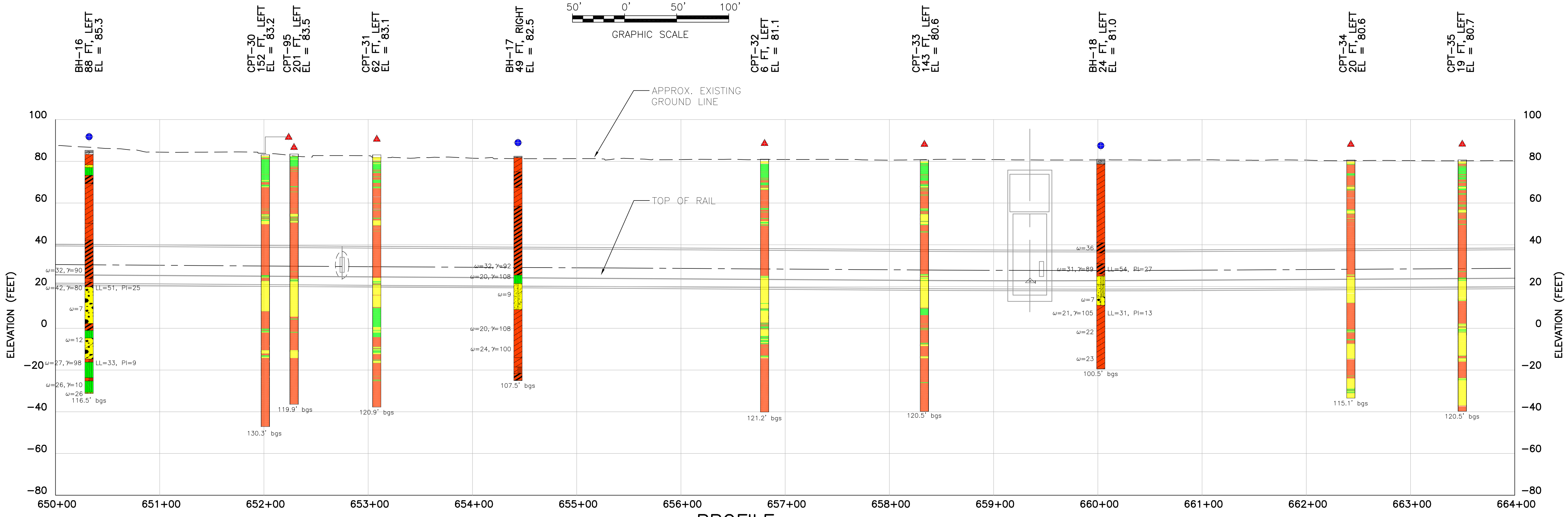
Figure 5-9 Geotechnical Plan and Profile with Classification Test Results: STA 650+00 to STA 664+00



PLAN

50' 0' 50' 100'
GRAPHIC SCALE



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S1 STA 650+00 TO STA 664+00

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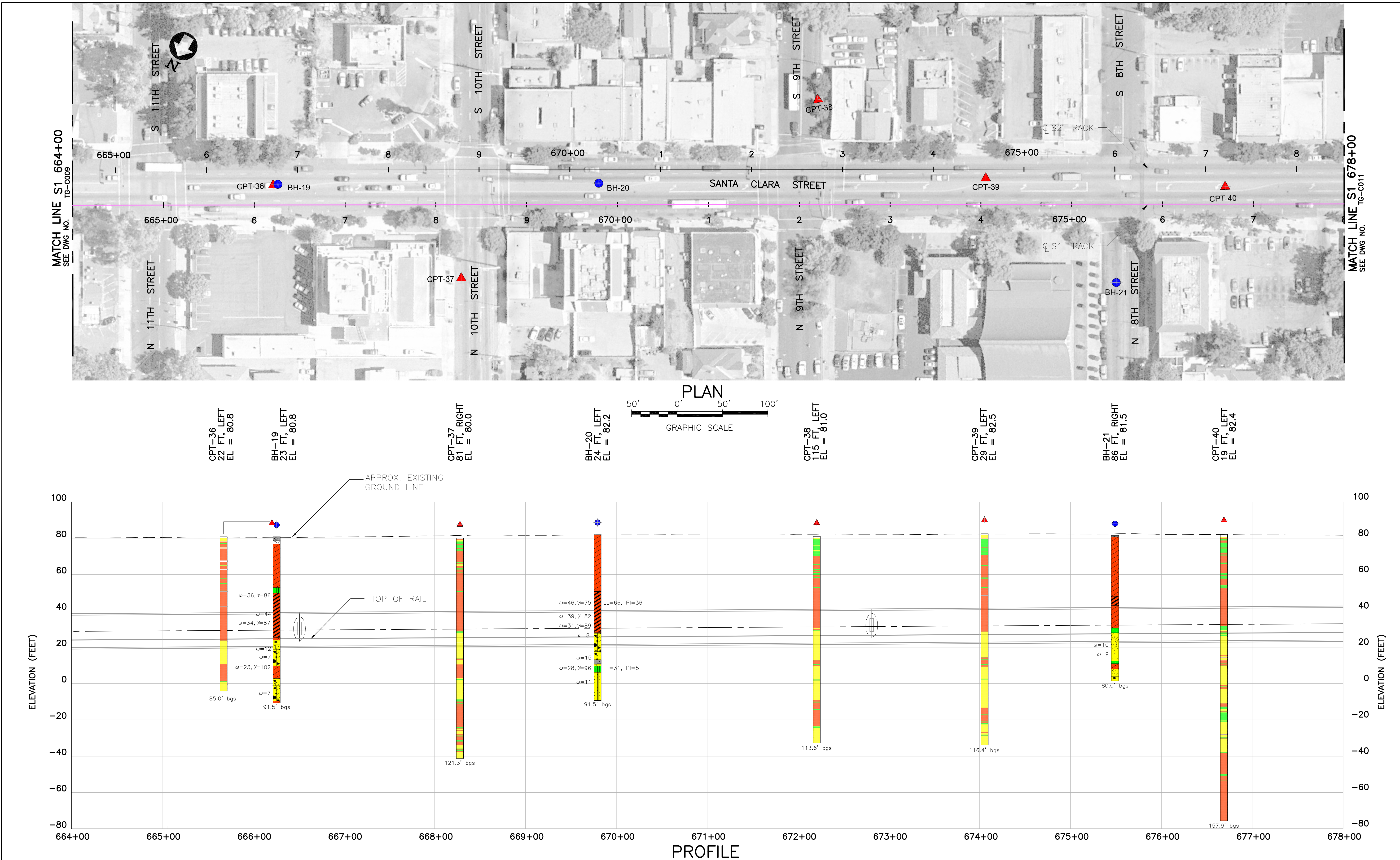
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5-9
PAGE NO.

Figure 5-10 Geotechnical Plan and Profile with Classification Test Results: STA 664+00 to STA 678+00



PLAN

PROFILE

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S1 STA 664+00 TO STA 678+00

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PAGE NO.

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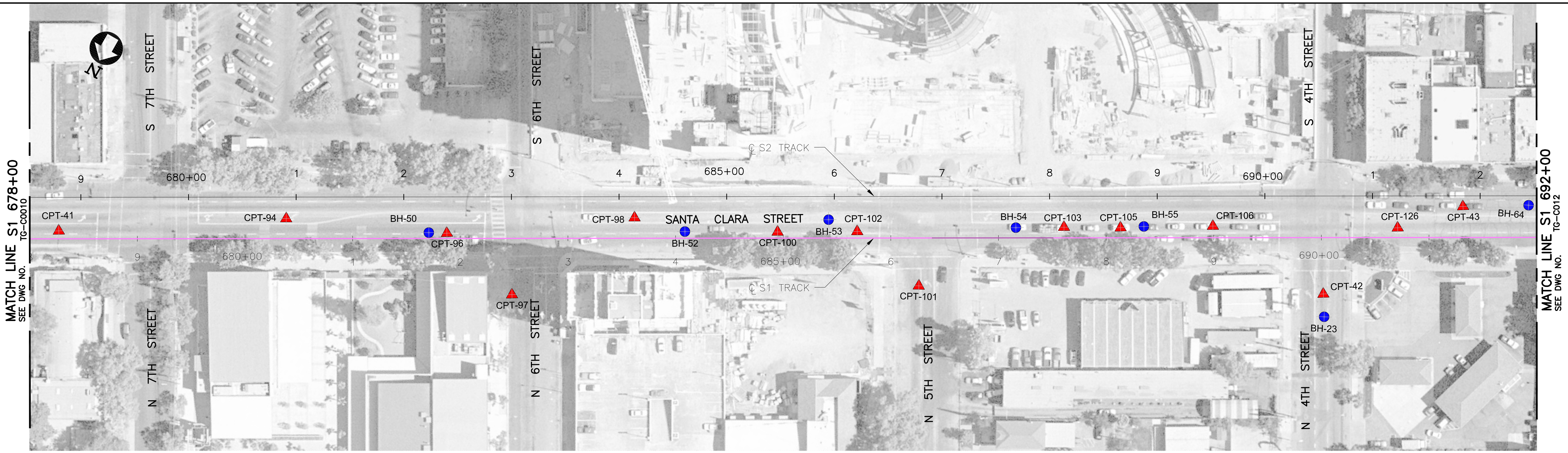
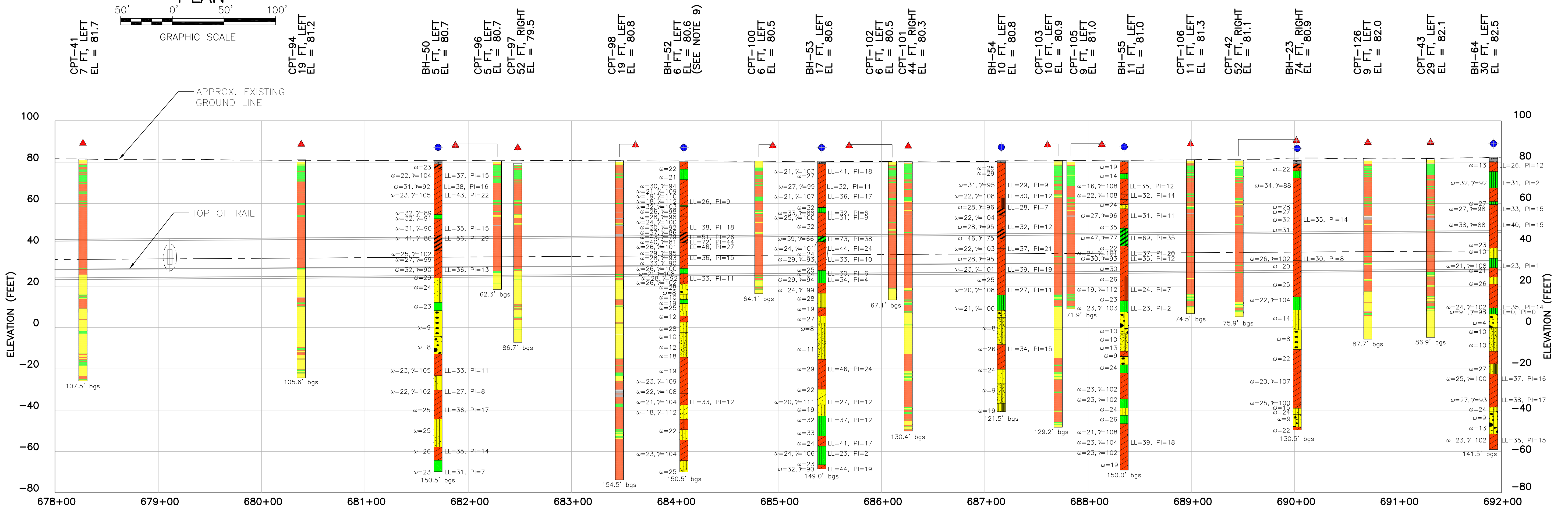
Figure 5-11 Geotechnical Plan and Profile with Classification Test Results: STA 678+00 to STA 692+00



PLAN



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S1 STA 678+00 TO STA 692+00

CADD FILENAME D300-S-TG-C011-A.dwg
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CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5-11
PAGE NO.

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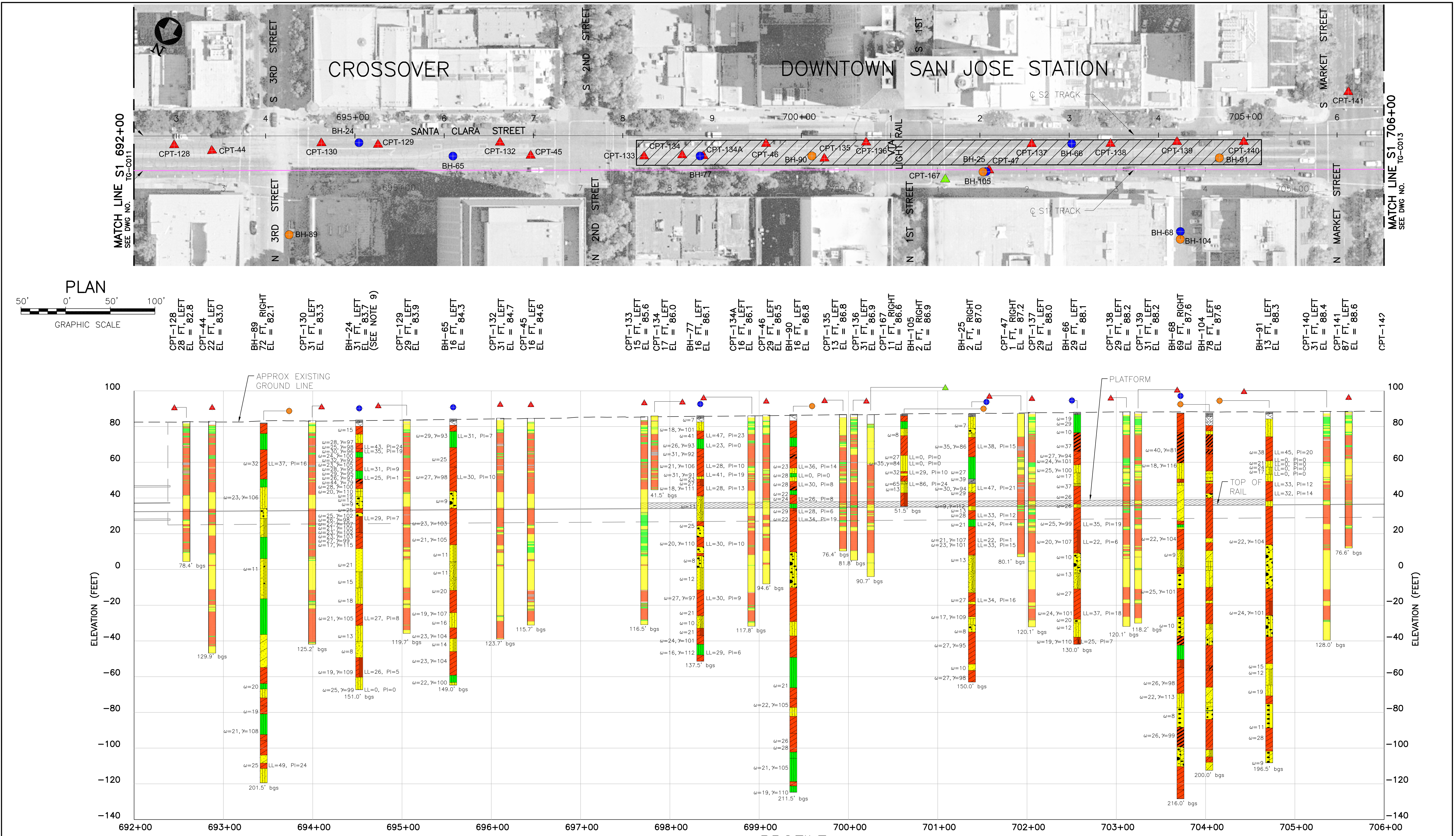
Figure 5-12 Geotechnical Plan and Profile with Classification Test Results: STA 692+00 to STA 706+00



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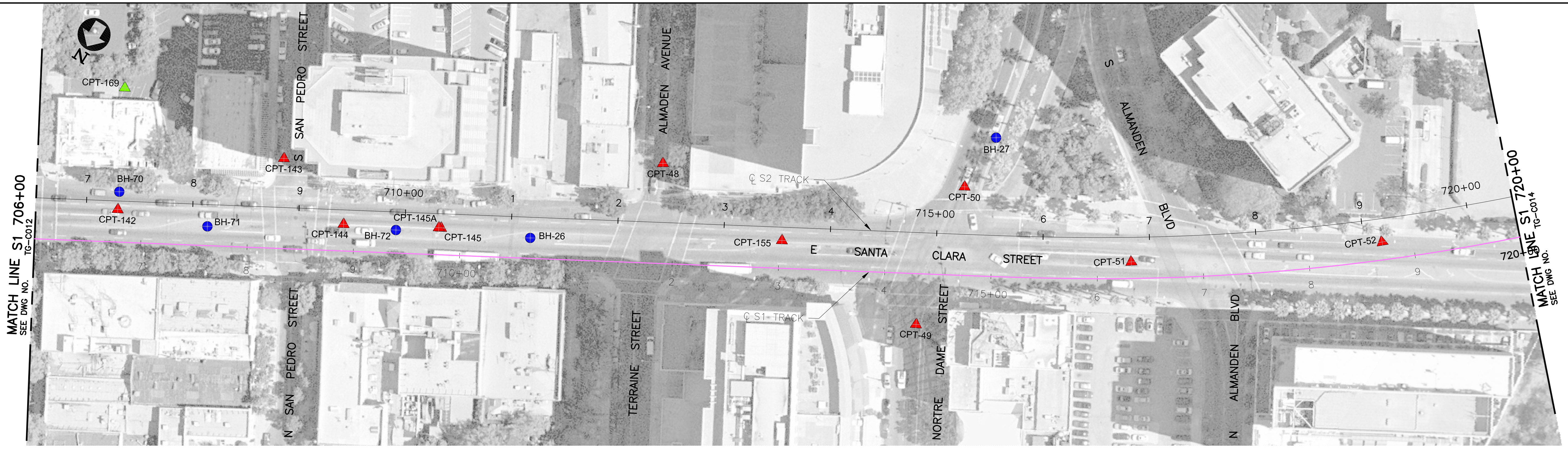
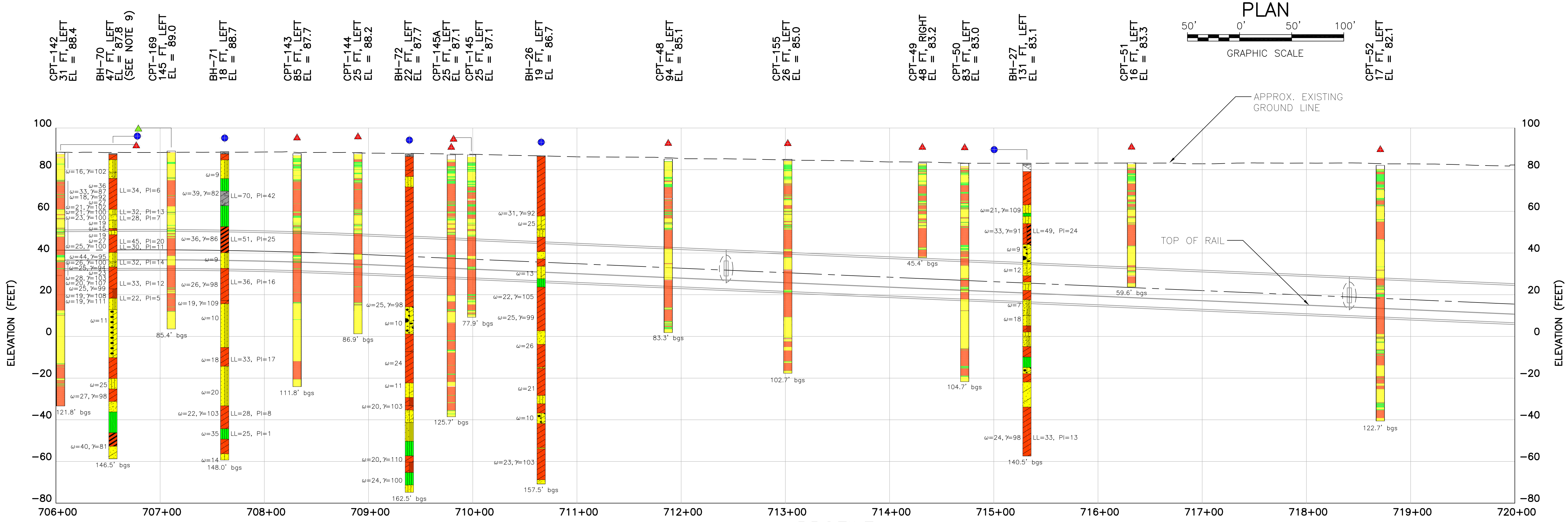
S1 STA 692+00 TO STA 706+00

CADD FILENAME D300–S–TG–C012–A.dwg
SIZE B
SCALE 1"=100'H; 1"=50'V
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5–12
PAGE NO.

Figure 5-13 Geotechnical Plan and Profile with Classification Test Results: STA 706+00 to STA 720+00



PLAN



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With Classification Test Results
S1 STA 706+00 TO STA 720+00

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PAGE NO.

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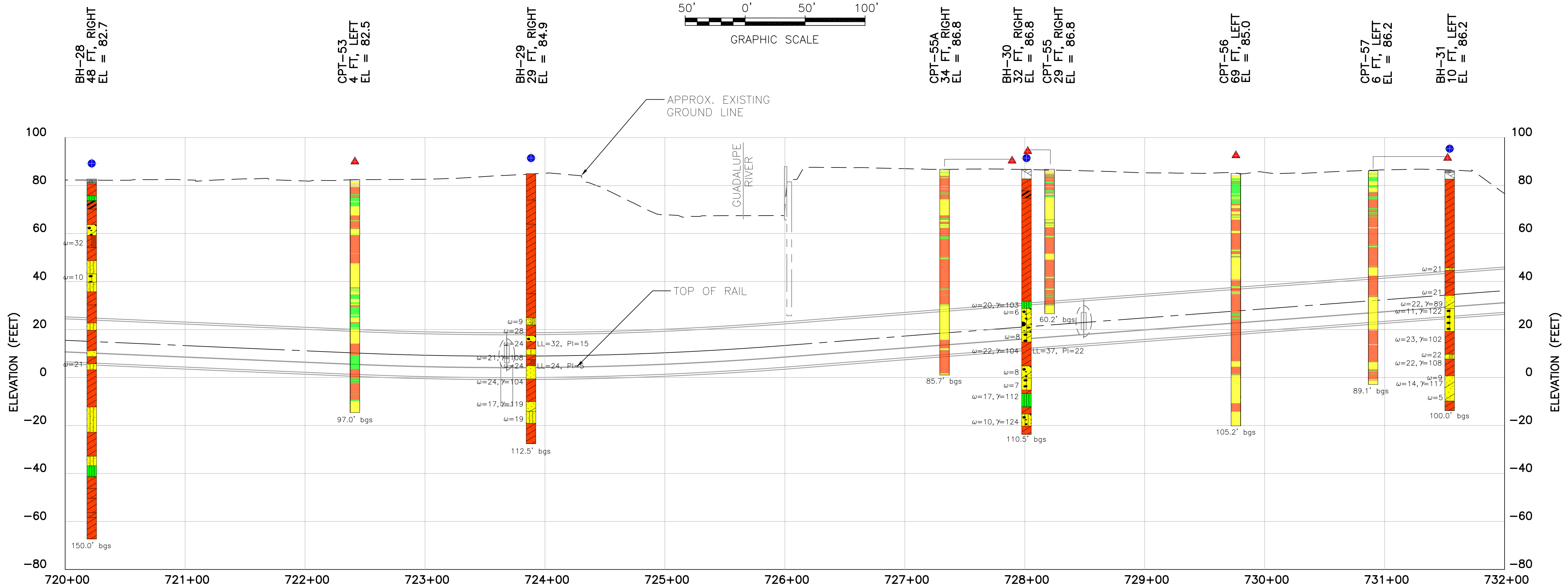
Figure 5-14 Geotechnical Plan and Profile with Classification Test Results: STA 720+00 to STA 732+00

PLAN



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						CHECKED BY A. LIU
						IN CHARGE A. LIU
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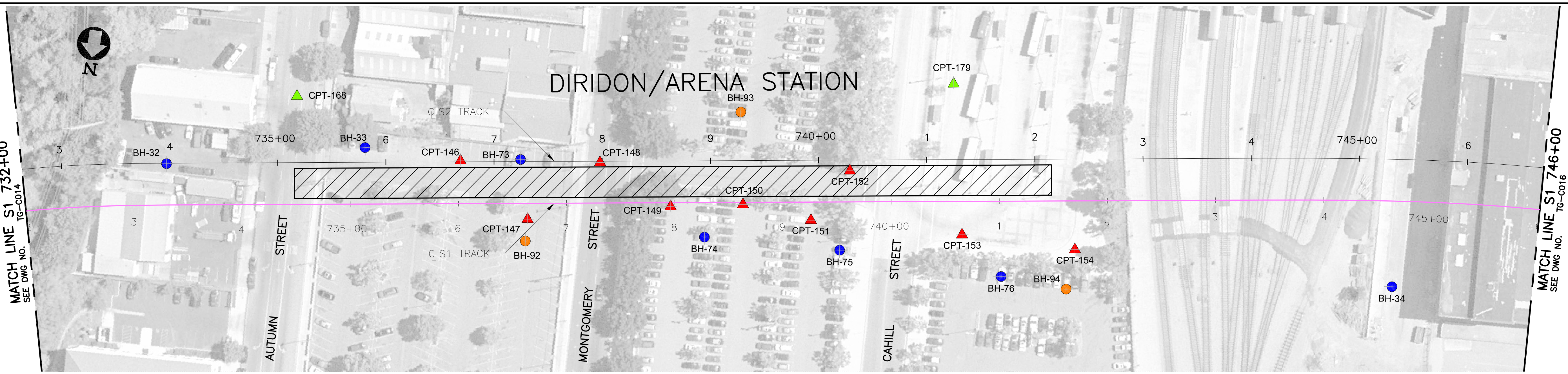
S1 STA 720+00 TO STA 732+00

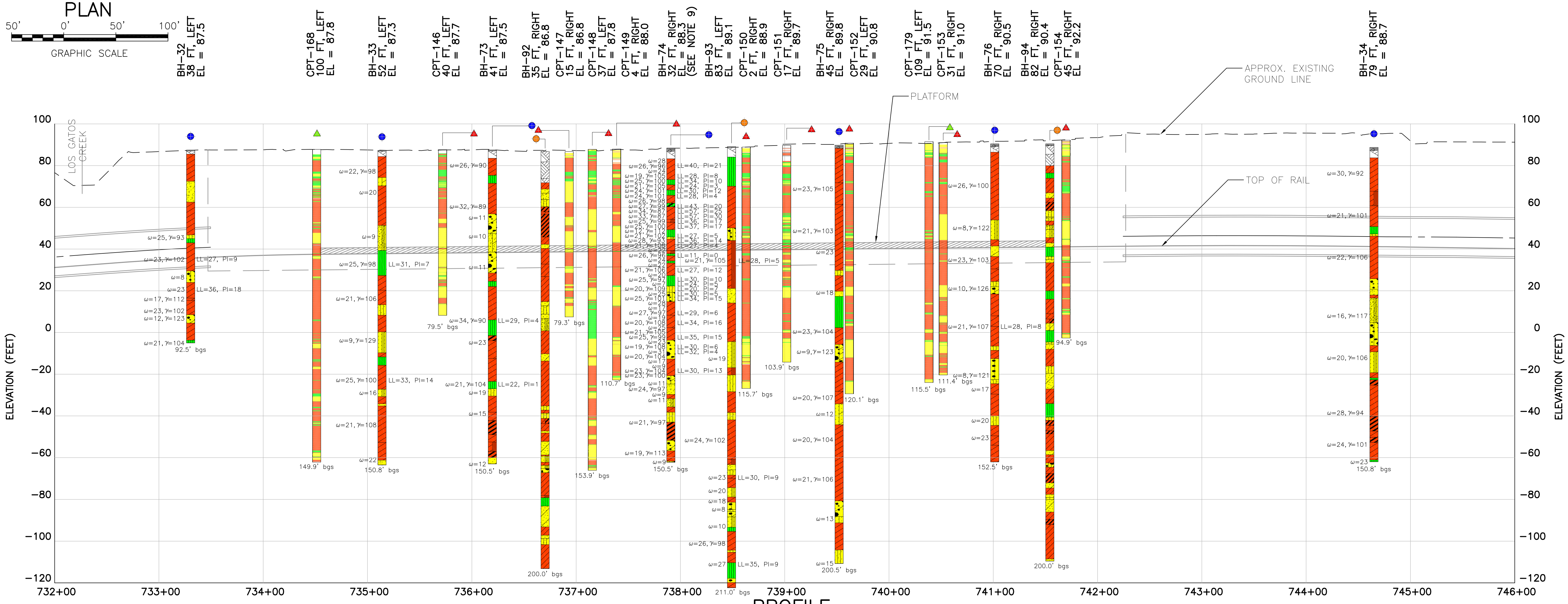
CADD FILENAME D300–S–TG–C035–A.dwg
SIZE B
SCALE 1"=100'H; 1"=50'V
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5–14
PAGE NO.

Figure 5-15 Geotechnical Plan and Profile with Classification Test Results: STA 732+00 to STA 746+00



PLAN

50' 0' 50' 100'
GRAPHIC SCALE



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With Classification Test Results
S1 STA 732+00 TO STA 746+00

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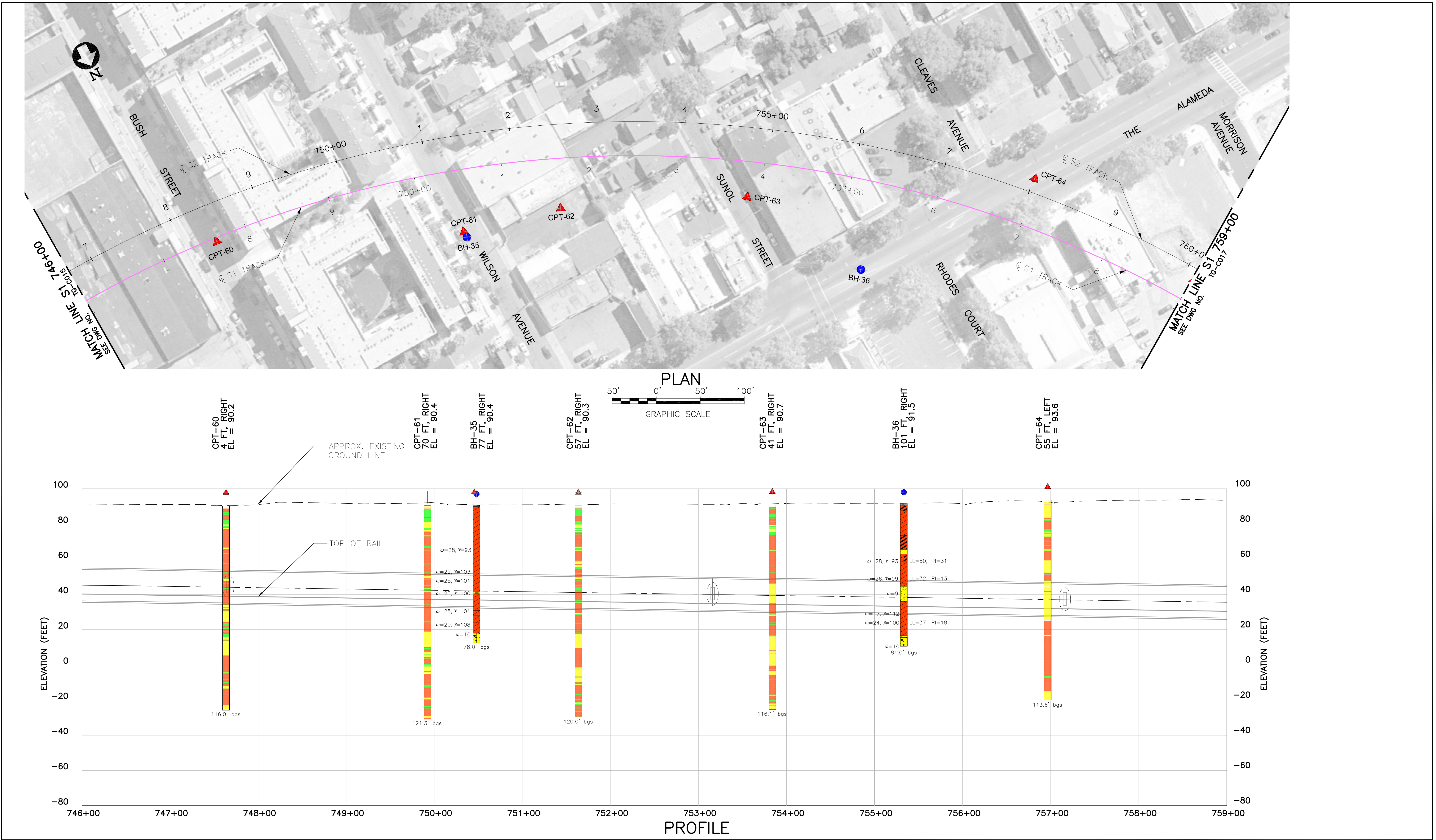
Figure 5-16 Geotechnical Plan and Profile with Classification Test Results: STA 746+00 to STA 759+00



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With Classification Test Results
S1 STA 746+00 TO STA 759+00

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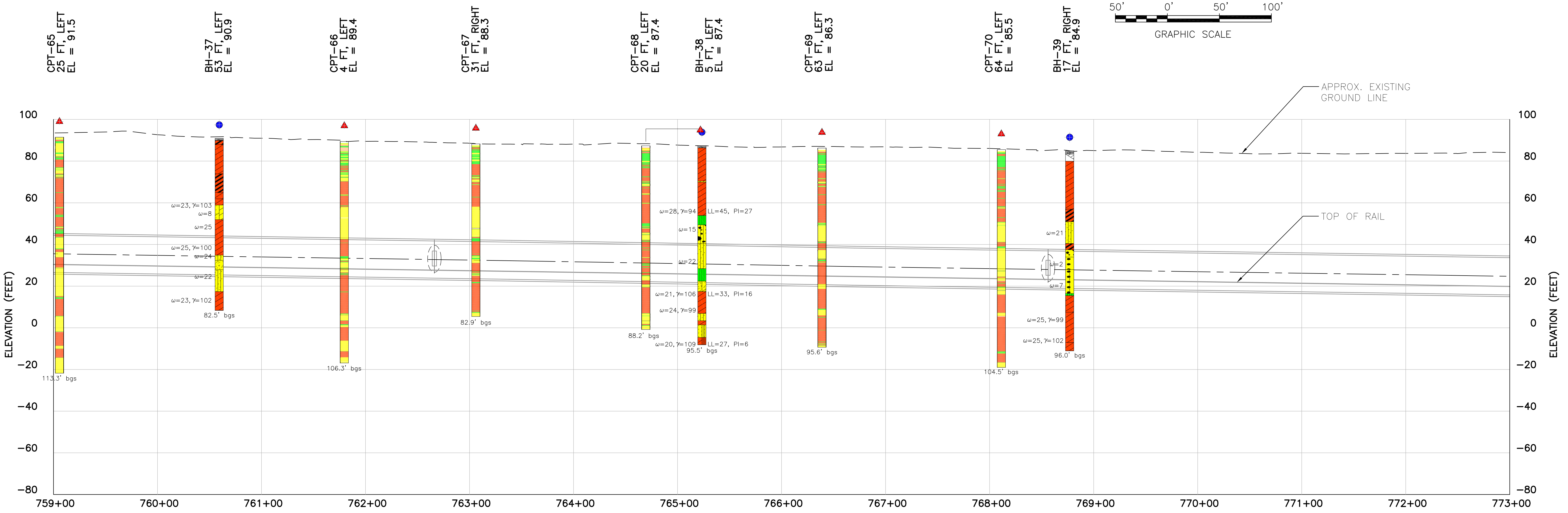
SCALE 1"=100'H; 1"=50'V
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5–16
PAGE NO.

Figure 5-17 Geotechnical Plan and Profile with Classification Test Results: STA 759+00 to STA 773+00

PLAN

50' 0' 50' 100'

GRAPHIC SCALE



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With Classification Test Results
S1 STA 759+00 TO STA 773+00

CADD FILENAME D300-S-TG-C017-A.dwg
SIZE B
SCALE 1"=100'H; 1"=50'V
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REV. A
AREA CODE
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PAGE NO.

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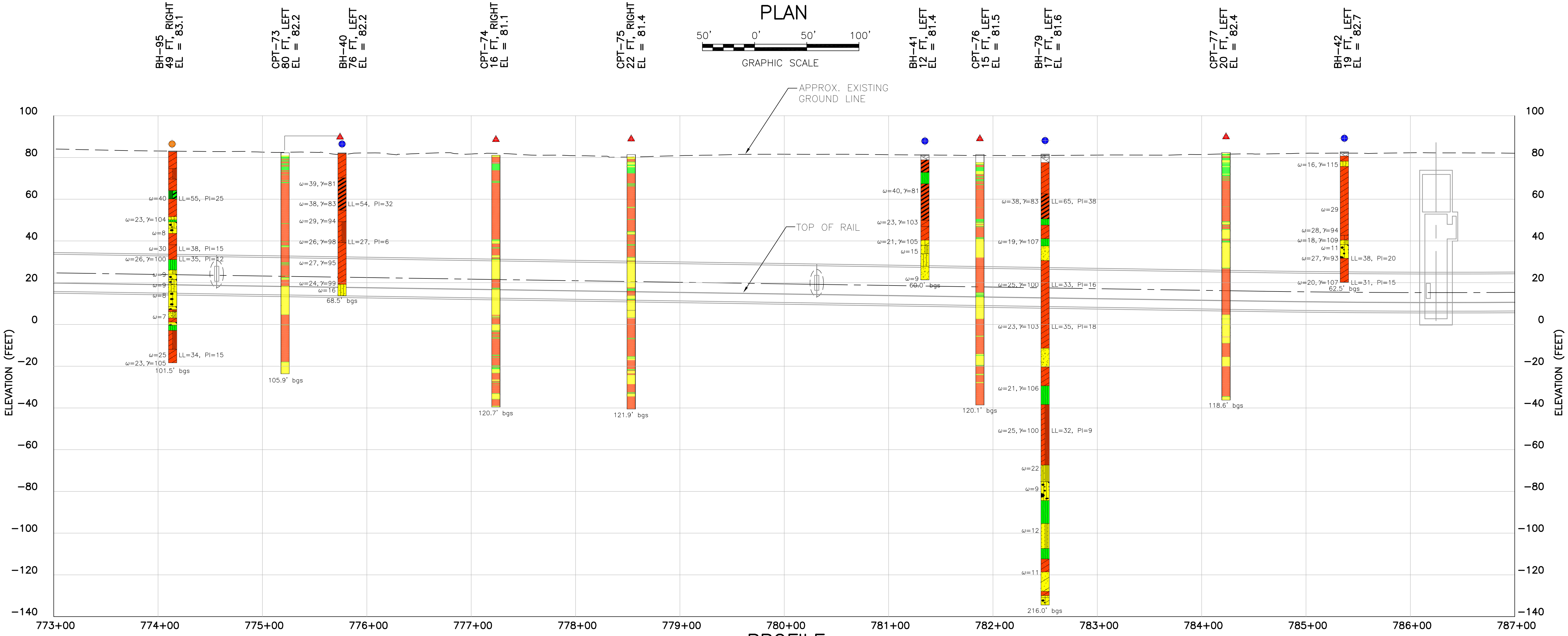
Figure 5-18 Geotechnical Plan and Profile with Classification Test Results: STA 773+00 to STA 787+00

PLAN

50' 0' 50' 100'
GRAPHIC SCALE



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S1 STA 773+00 TO STA 787+00

CADD FILENAME D300-S-TG-C018-A.dwg
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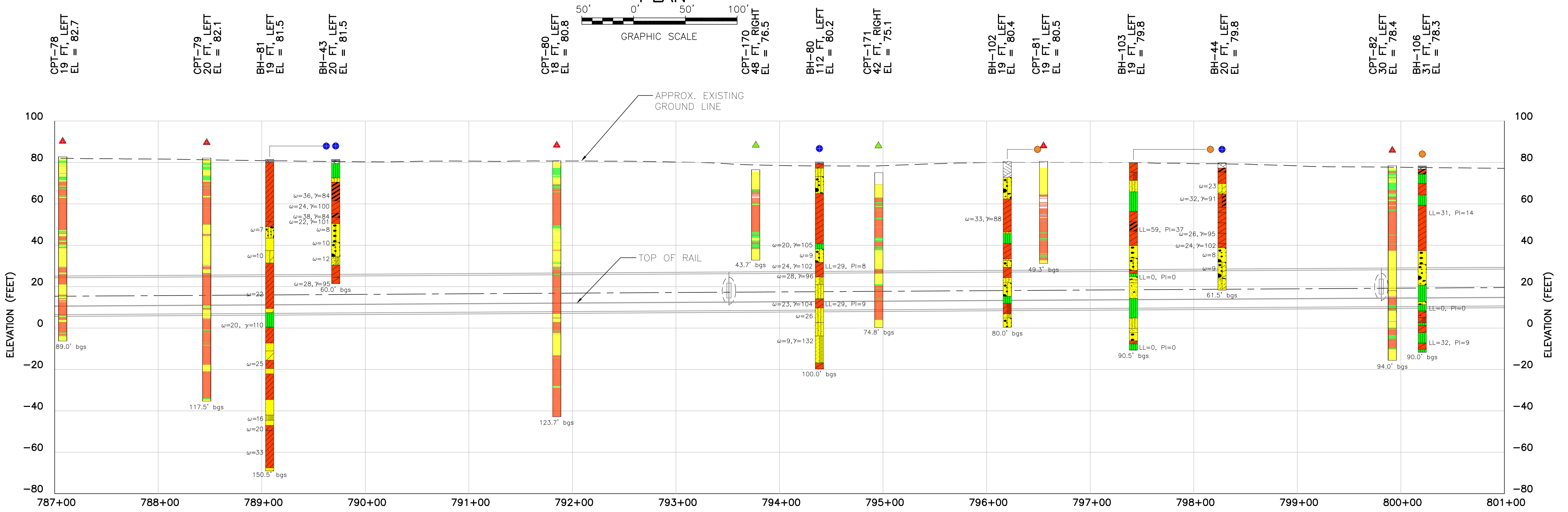
Figure 5-19 Geotechnical Plan and Profile with Classification Test Results: STA 787+00 to STA 801+00

PLAN



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With Classification Test Results
S1 STA 787+00 TO STA 801+00

CADD FILENAME D300-S-TG-C019-A.dwg
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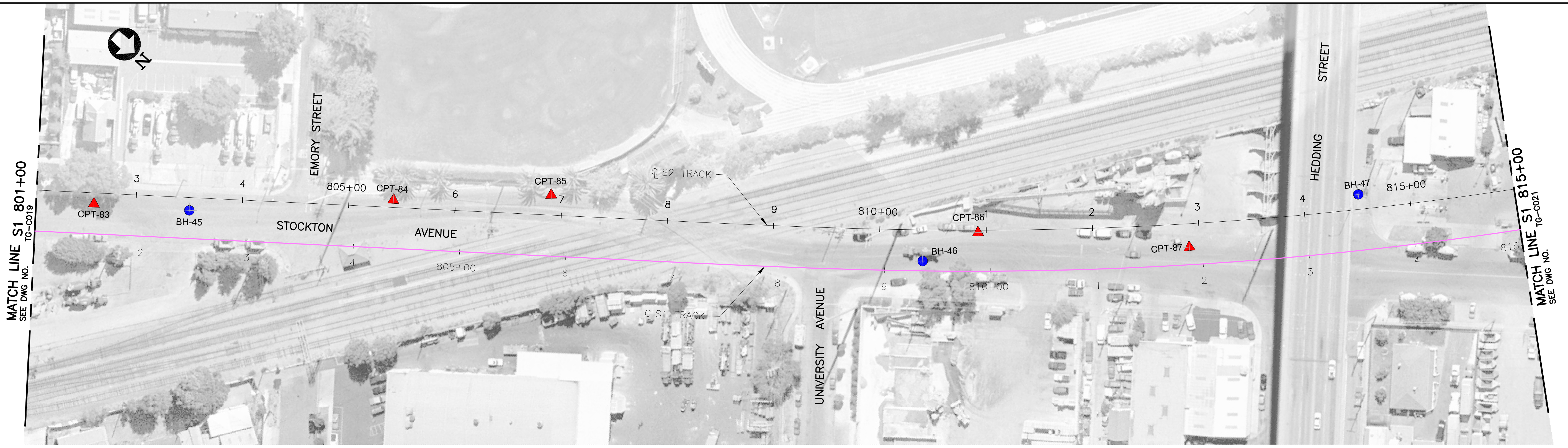
Figure 5-20 Geotechnical Plan and Profile with Classification Test Results: STA 801+00 to STA 815+00



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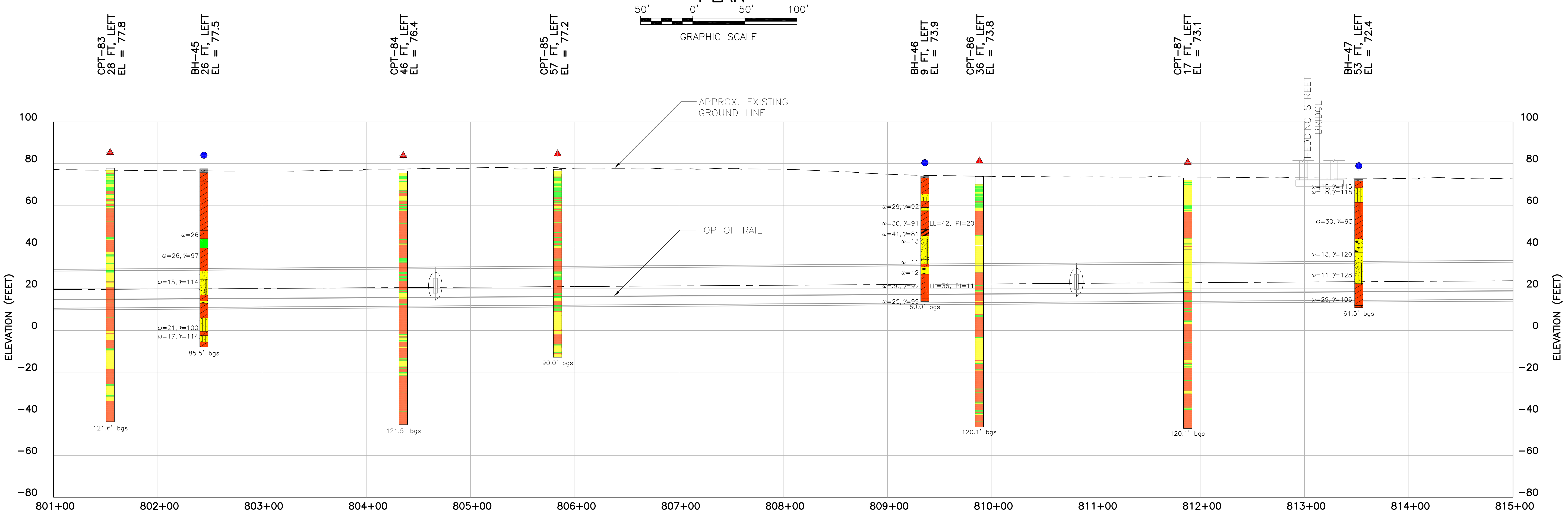

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With Classification Test Results
S1 STA 801+00 TO STA 815+00

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AREA CODE
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PAGE NO.

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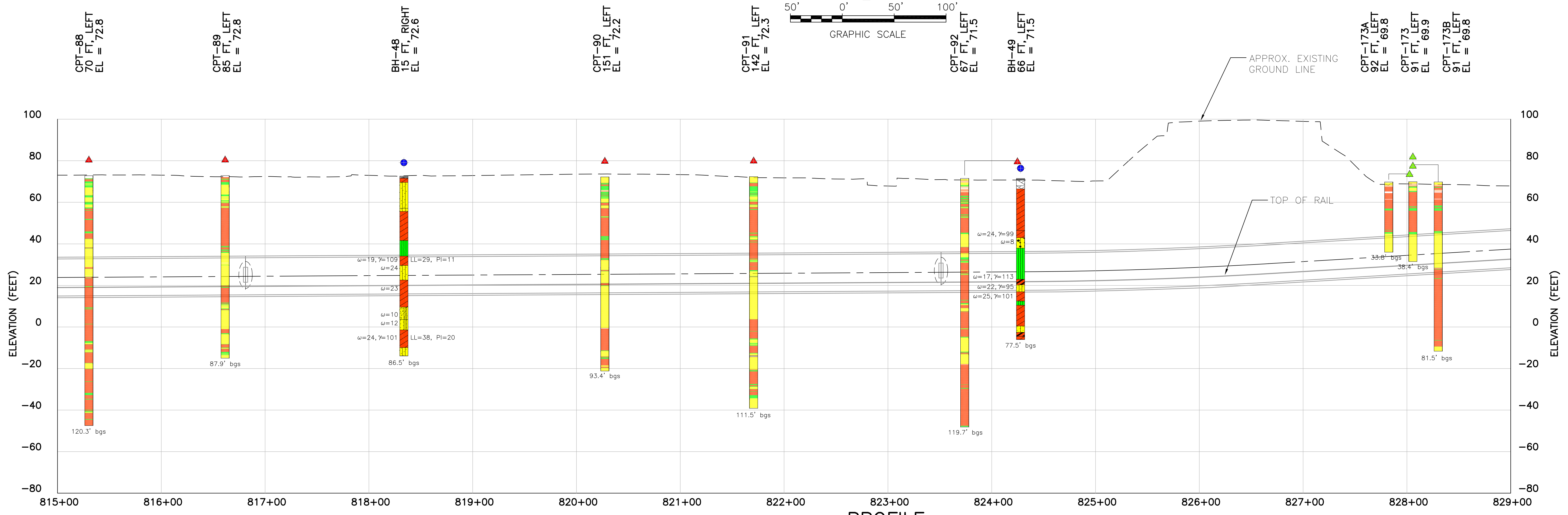
Figure 5-21 Geotechnical Plan and Profile with Classification Test Results: STA 815+00 to STA 829+00

PLAN



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With Classification Test Results
S1 STA 815+00 TO STA 829+00

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CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5-21
PAGE NO.

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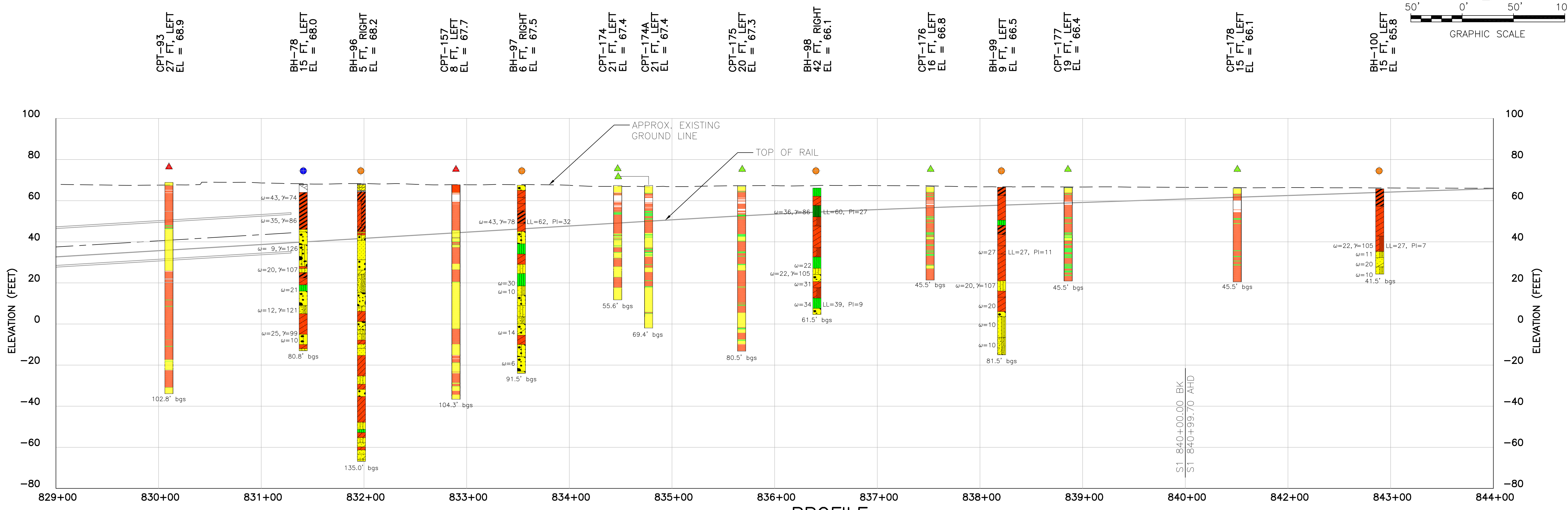
Figure 5-22 Geotechnical Plan and Profile with Classification Test Results: STA 829+00 to STA 843+99

PLAN



PROFILE

						DESIGNED BY A. JAIN
						DRAWN BY R. VILLEGAS
						CHECKED BY A. LIU
						IN CHARGE A. LIU
0	20080429				FOR USE	DATE 20080429
REV	DATE	BY	SUB	APP	DESCRIPTION	

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GEOTECHNICAL PLAN AND PROFILE
With Classification Test Results
S1 STA 829+00 TO STA 843+00

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CONTRACT NO. D300		REV. A
AREA CODE	SHEET NO. 5−22	PAGE NO.

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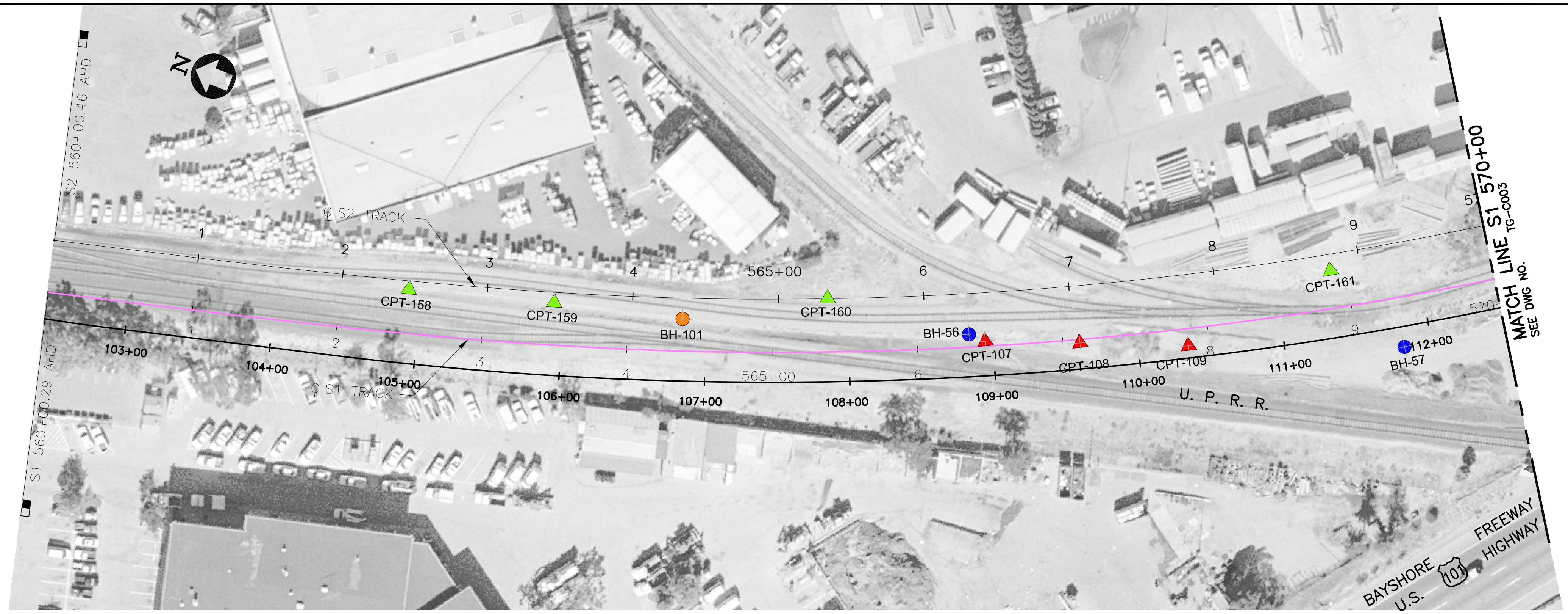
Figure 5-23 Geotechnical Plan and Profile with Strength Parameters: STA 561+00 to STA 570+00

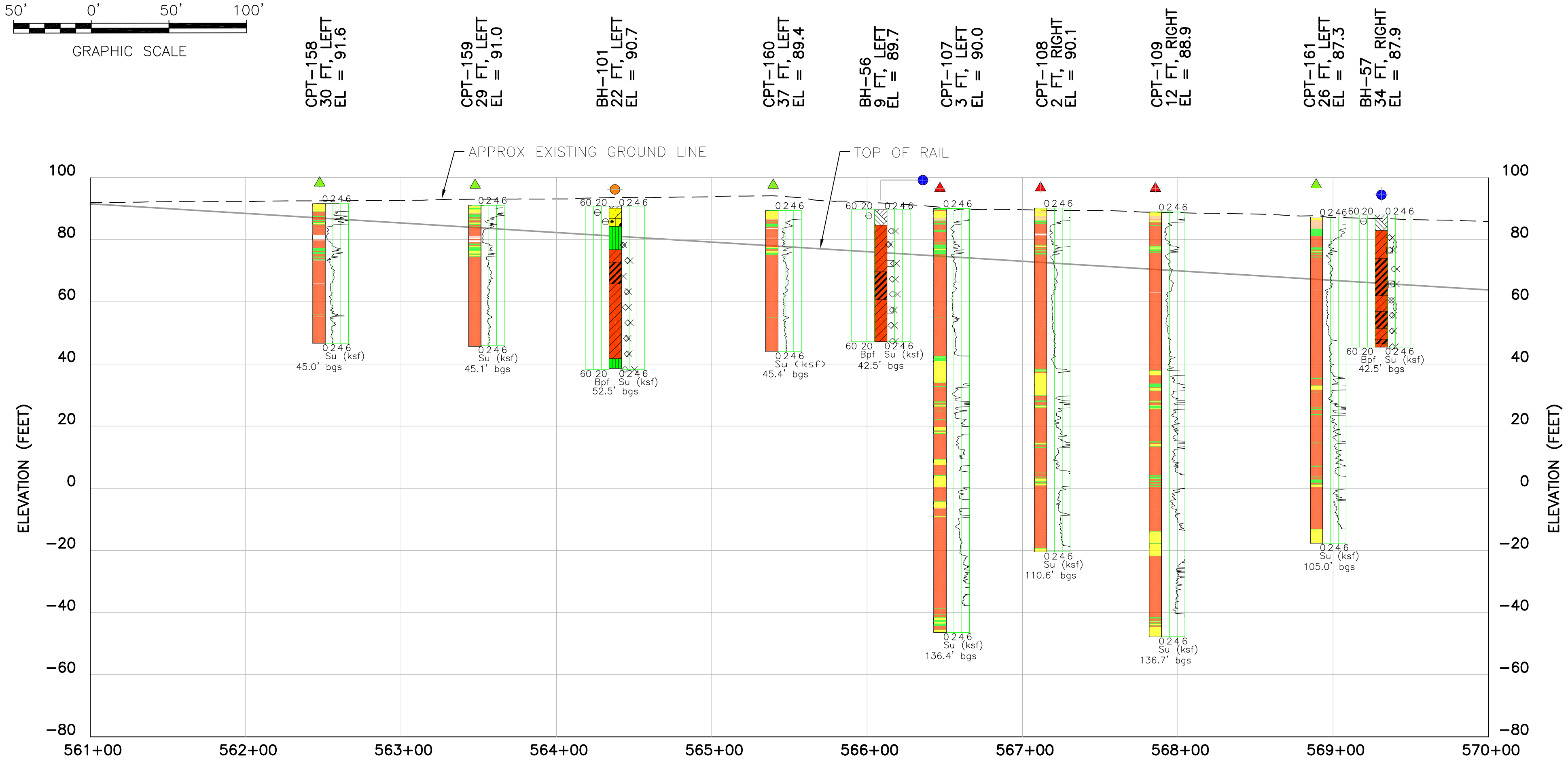
VILLEGAS_R May 01, 2008 – 12:36pm W:\TUCADD\35% PE\D300\STUDIES\TG-GEOTECH\CDR1_REV1_DRAWINGS\D300-S-TG-C023-A.dwg



PLAN

50' 0' 50' 100'

GRAPHIC SCALE



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GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 561+00 TO STA 570+00

CADD FILENAME
D300–S–TG–C023–A.dwg
SIZE
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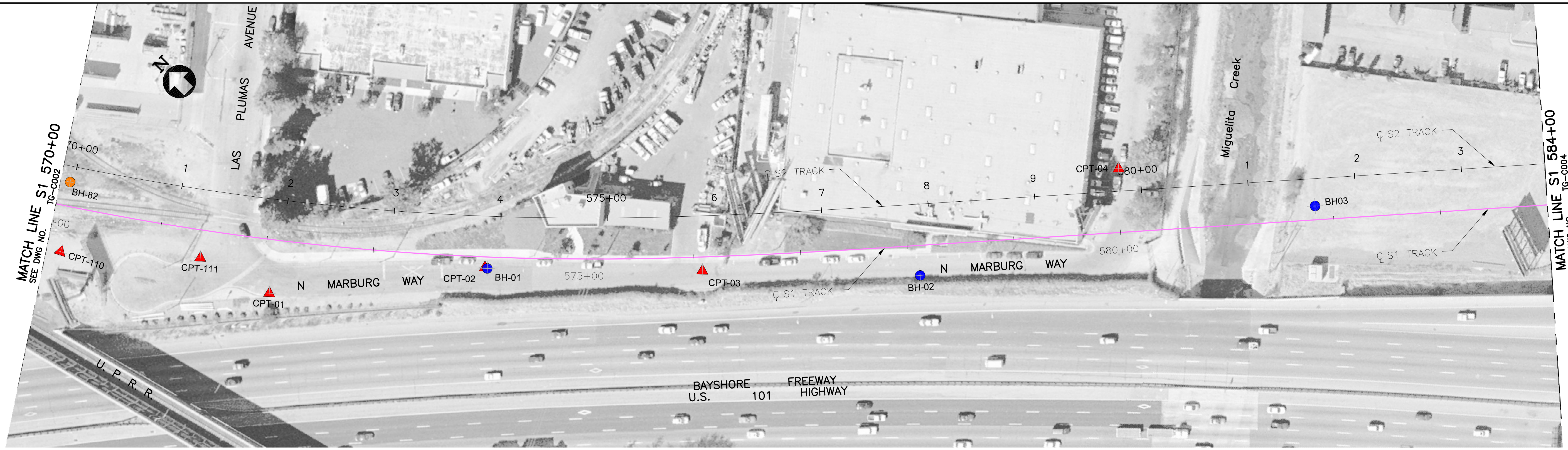
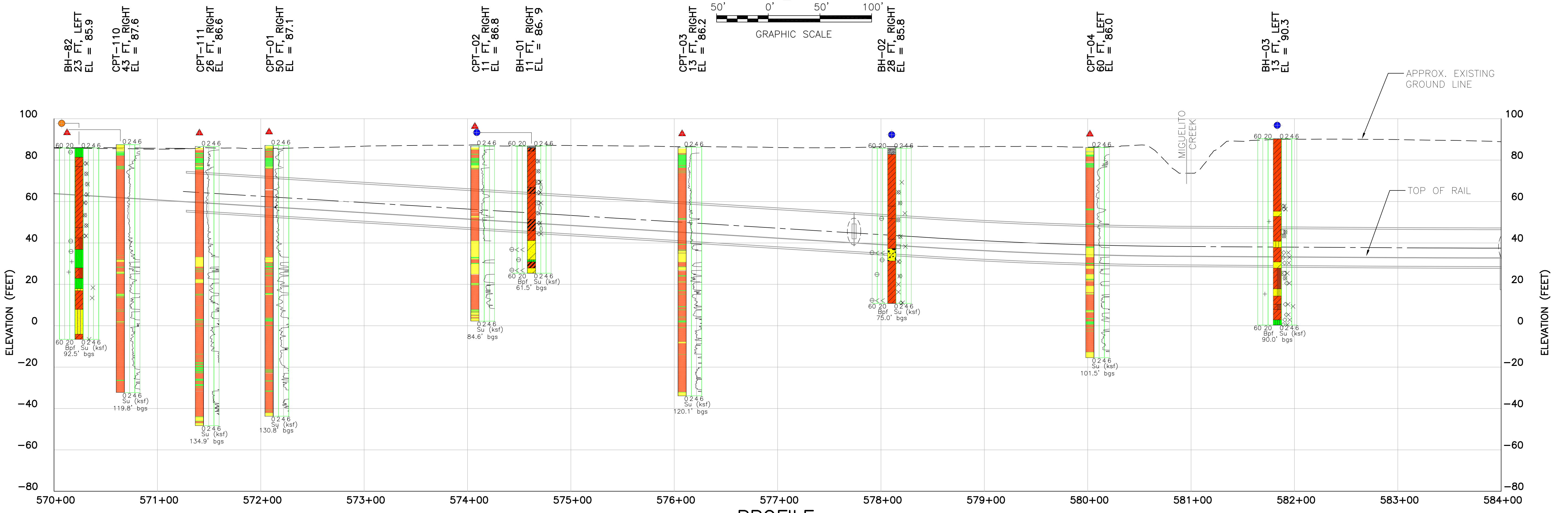
SCALE
1"=100'H; 1"=50'V
CONTRACT NO.
D300
REV.
A
AREA CODE
SHEET NO.
5–23
PAGE NO.

Figure 5-24 Geotechnical Plan and Profile with Strength Parameters: STA 570+00 to STA 584+00



PLAN

50' 0' 50' 100'
GRAPHIC SCALE



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With Strength Parameters
S1 STA 570+00 TO STA 584+00

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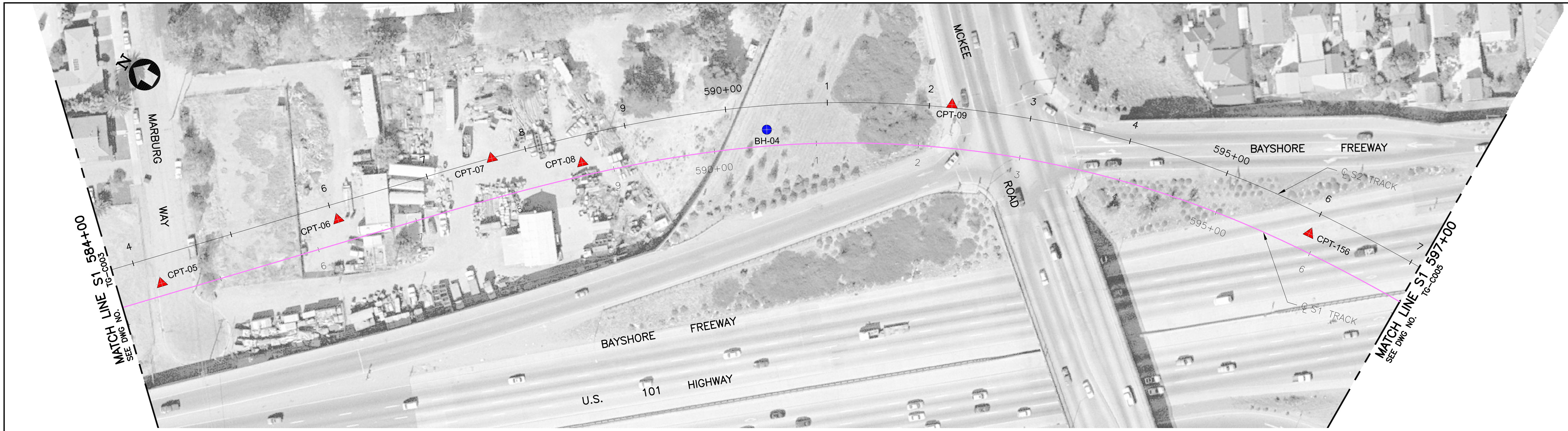
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5–24
PAGE NO.

Figure 5-25 Geotechnical Plan and Profile with Strength Parameters: STA 584+00 to STA 597+00



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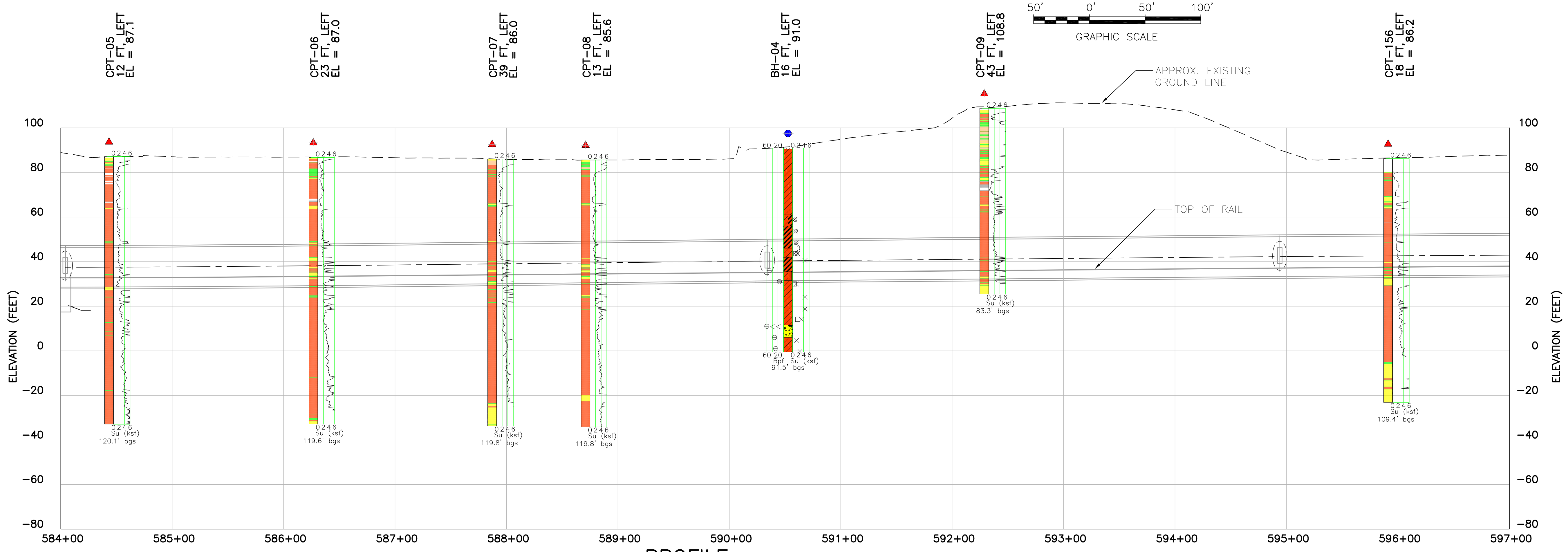

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With Strength Parameters
S1 STA 584+00 TO STA 597+00

CADD FILENAME D300−S−TG−C025−A.dwg
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AREA CODE
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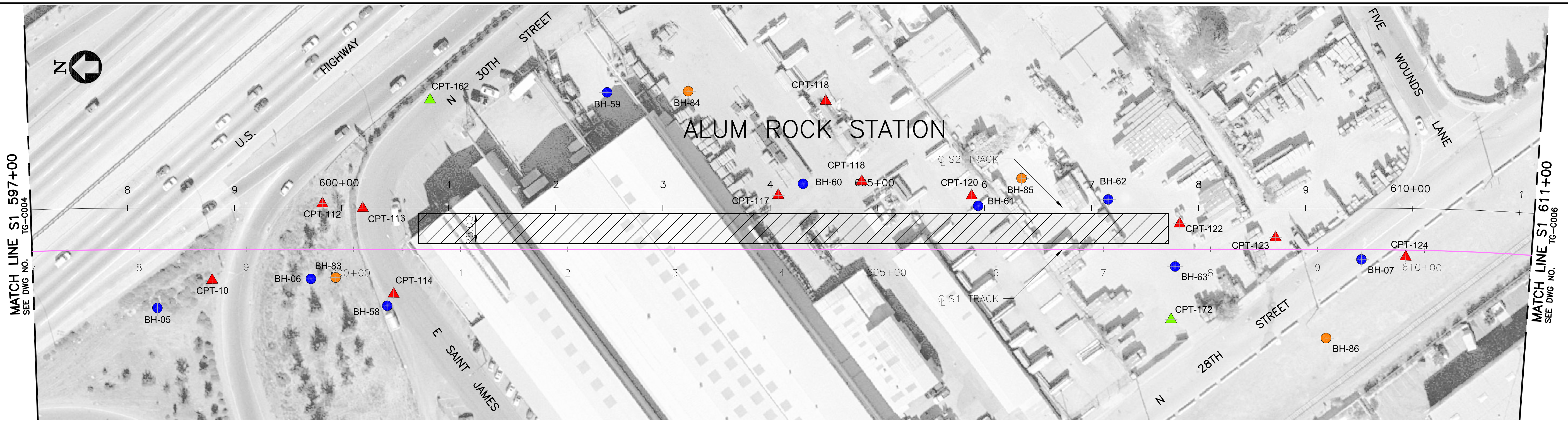
Figure 5-26 Geotechnical Plan and Profile with Strength Parameters: STA 597+00 to STA 611+00



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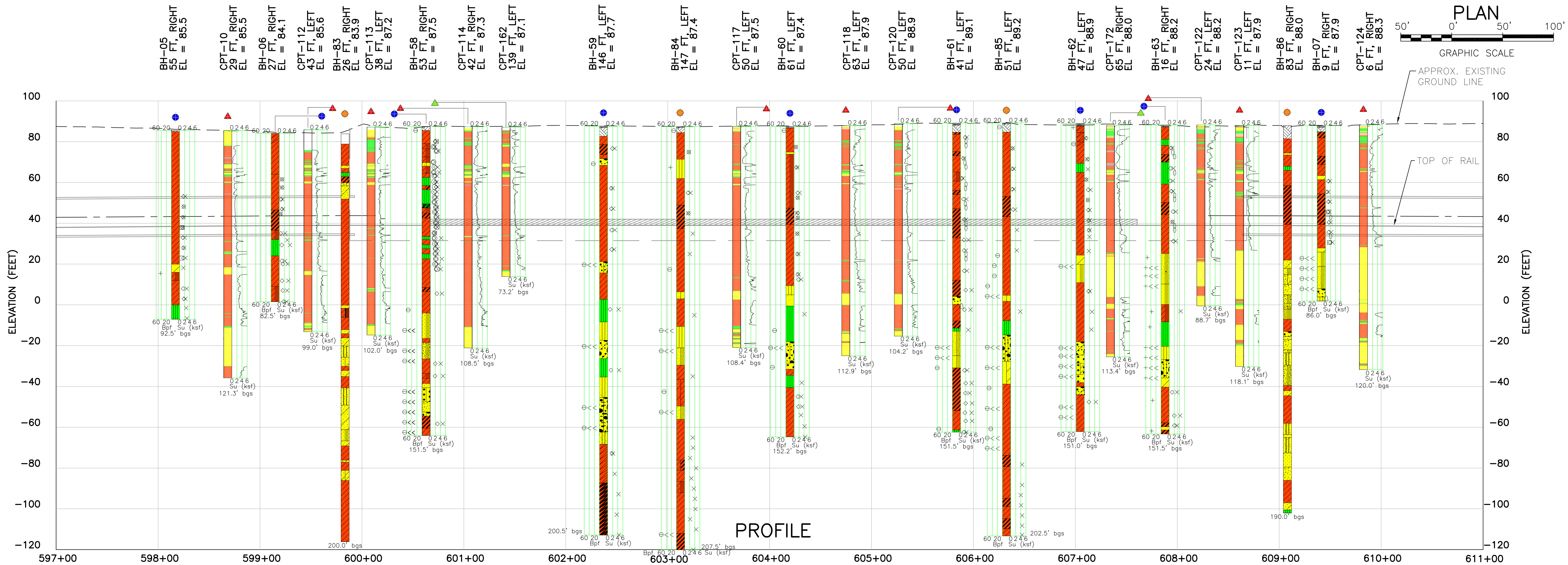

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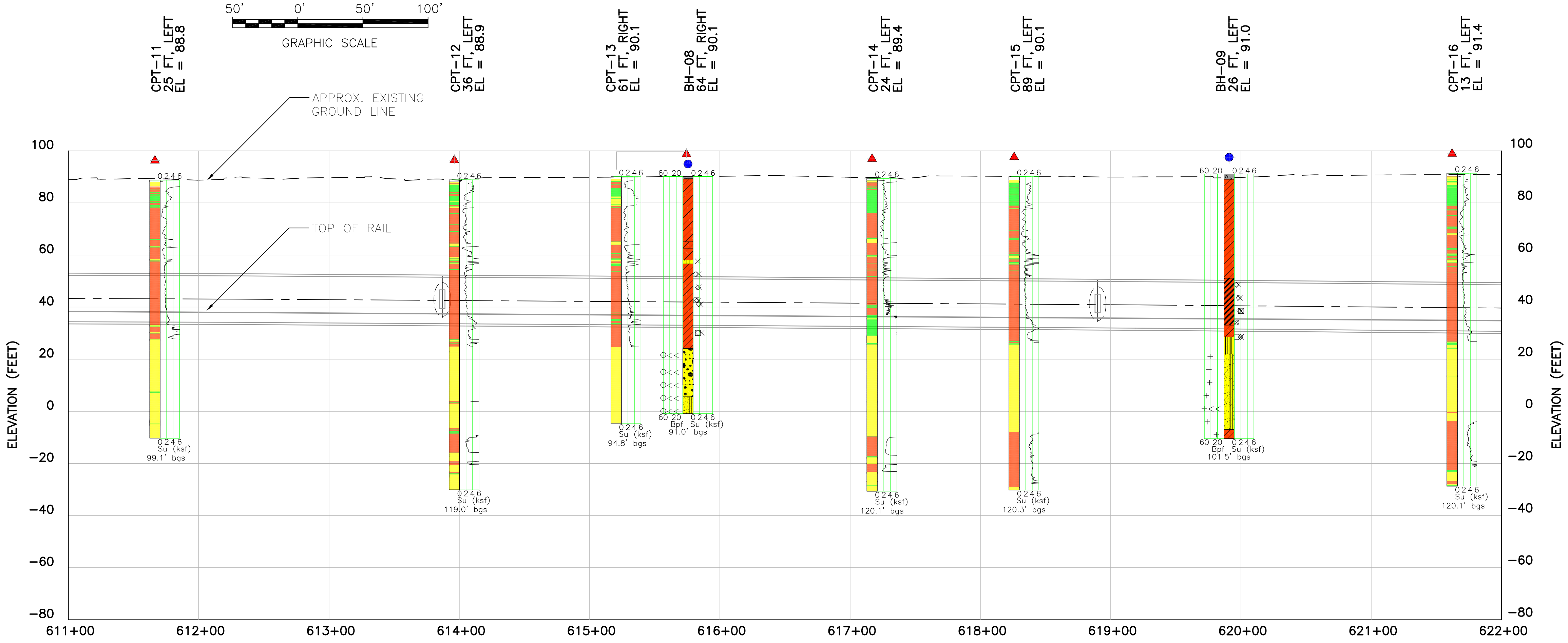
With Strength Parameters
S1 STA 597+00 TO STA 611+00

CADD FILENAME D300-S-TG-C026-A.dwg
SIZE B
SCALE 1"=100'H; 1"=50'V
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5–26
PAGE NO.

Figure 5-27 Geotechnical Plan and Profile with Strength Parameters: STA 611+00 to STA 622+00

PLAN



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With Strength Parameters
S1 STA 611+00 TO STA 622+00

CADD FILENAME D300–S–TG–C027–A.dwg
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SCALE 1"=100'H; 1"=50'V
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REV. A
AREA CODE
SHEET NO. 5–27
PAGE NO.

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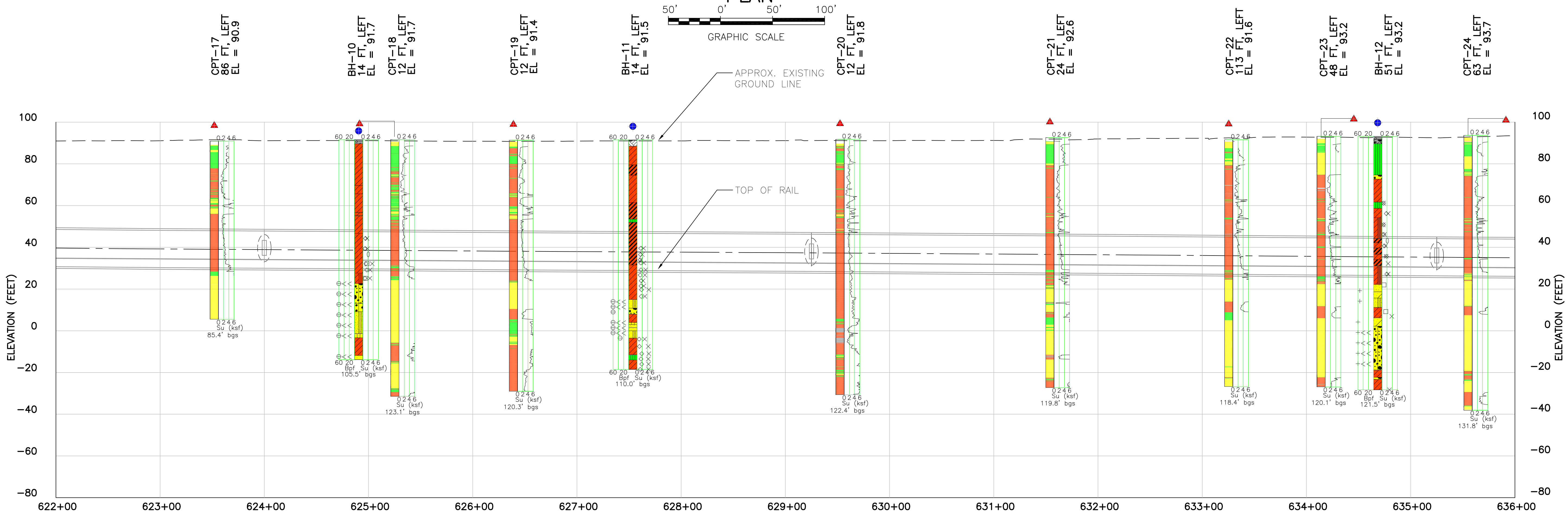
Figure 5-28 Geotechnical Plan and Profile with Strength Parameters: STA 622+00 to STA 636+00

PLAN



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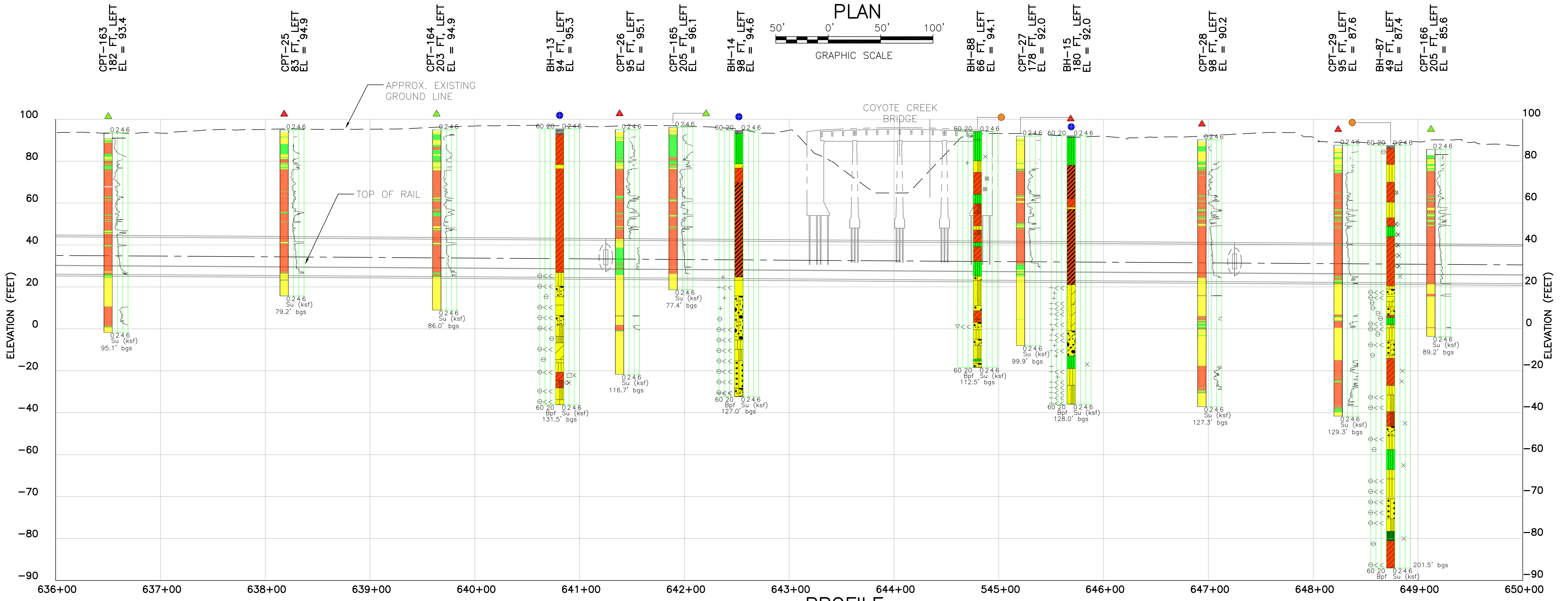
With Strength Parameters
S1 STA 622+00 TO STA 636+00

CADD FILENAME D300–S–TG–C028–A.dwg
SIZE B
SCALE 1"=100'H; 1"=50'V
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5–28
PAGE NO.

Figure 5-29 Geotechnical Plan and Profile with Strength Parameters: STA 636+00 to STA 650+00

PLAN



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With Strength Parameters
S1 STA 636+00 TO STA 650+00

CADD FILENAME
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SIZE
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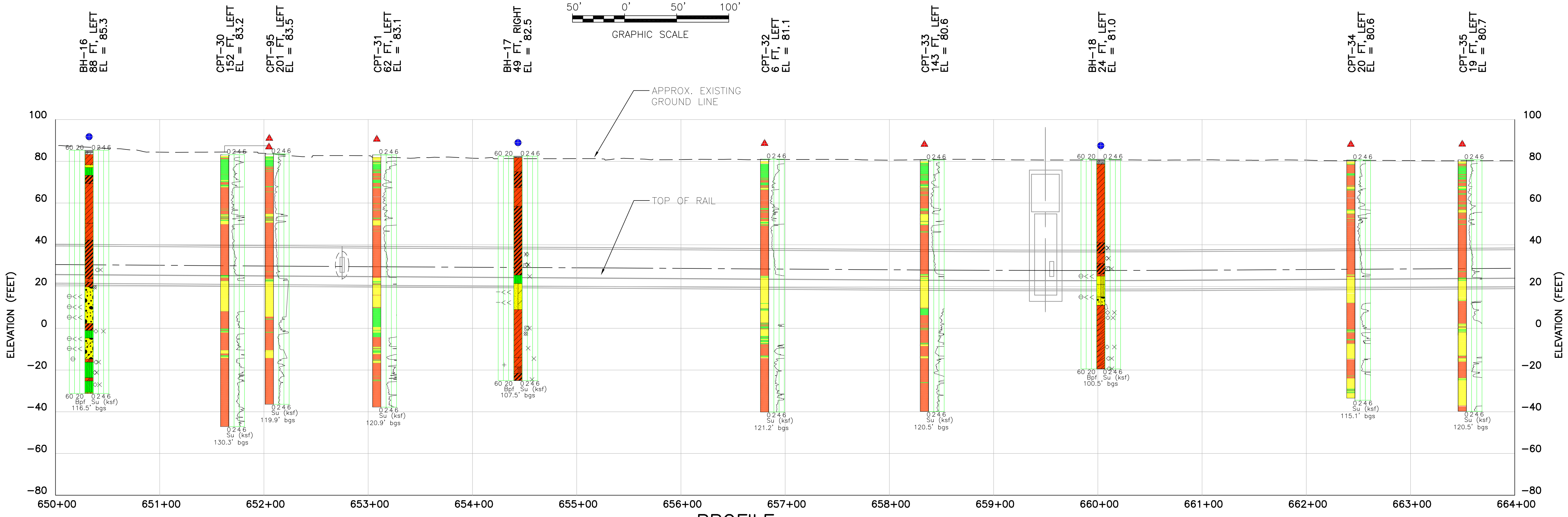
SCALE
1"=100'H; 1"=50'V
CONTRACT NO.
D300
REV.
A
AREA CODE
SHEET NO.
5-29
PAGE NO.

Figure 5-30 Geotechnical Plan and Profile with Strength Parameters: STA 650+00 to STA 664+00

PLAN



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GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 650+00 TO STA 664+00

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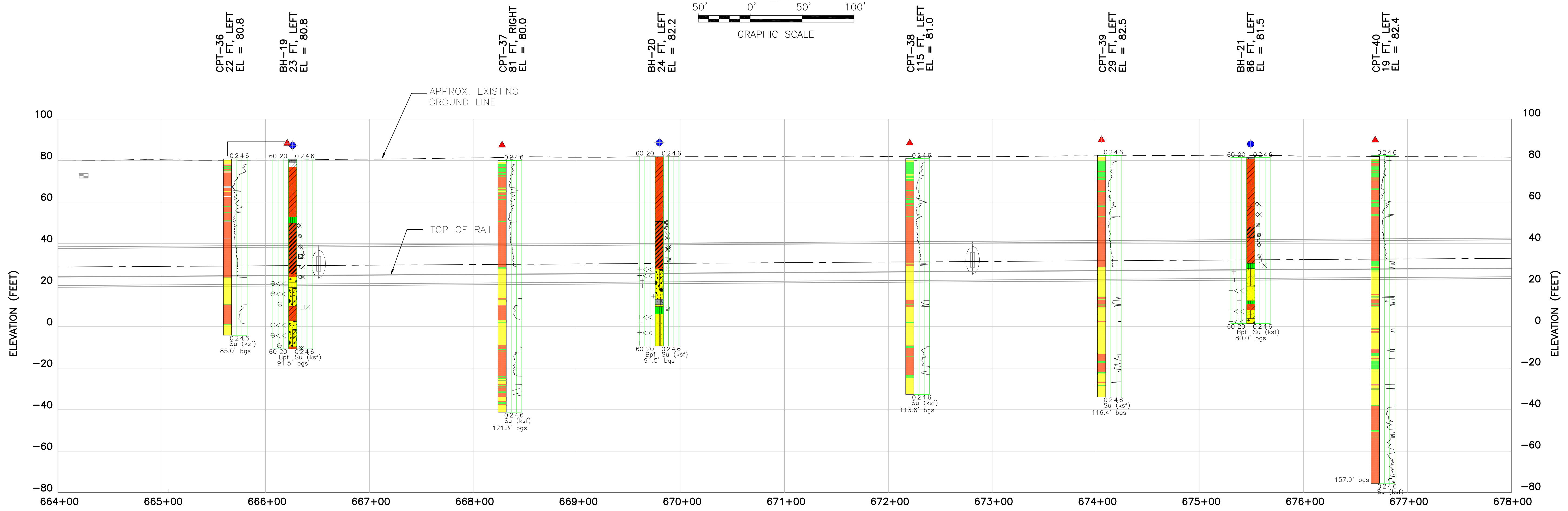
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5–30
PAGE NO.

Figure 5-31 Geotechnical Plan and Profile with Strength Parameters: STA 664+00 to STA 678+00

PLAN



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With Strength Parameters
S1 STA 664+00 TO STA 678+00

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SIZE B
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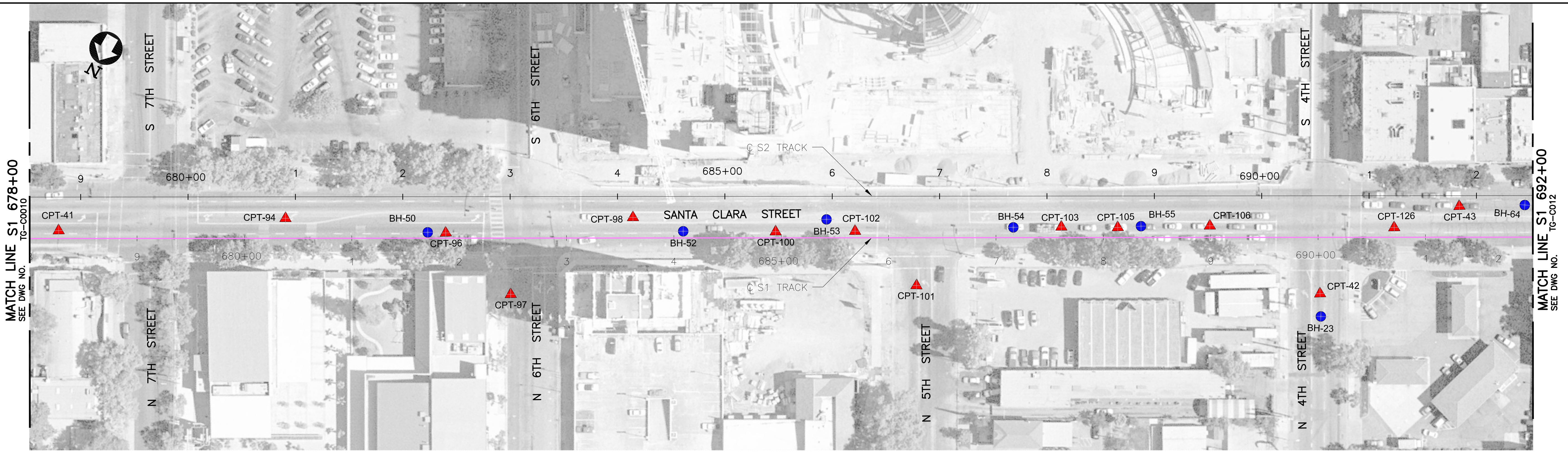
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5–31
PAGE NO.

Figure 5-32 Geotechnical Plan and Profile with Strength Parameters: STA 678+00 to STA 692+00



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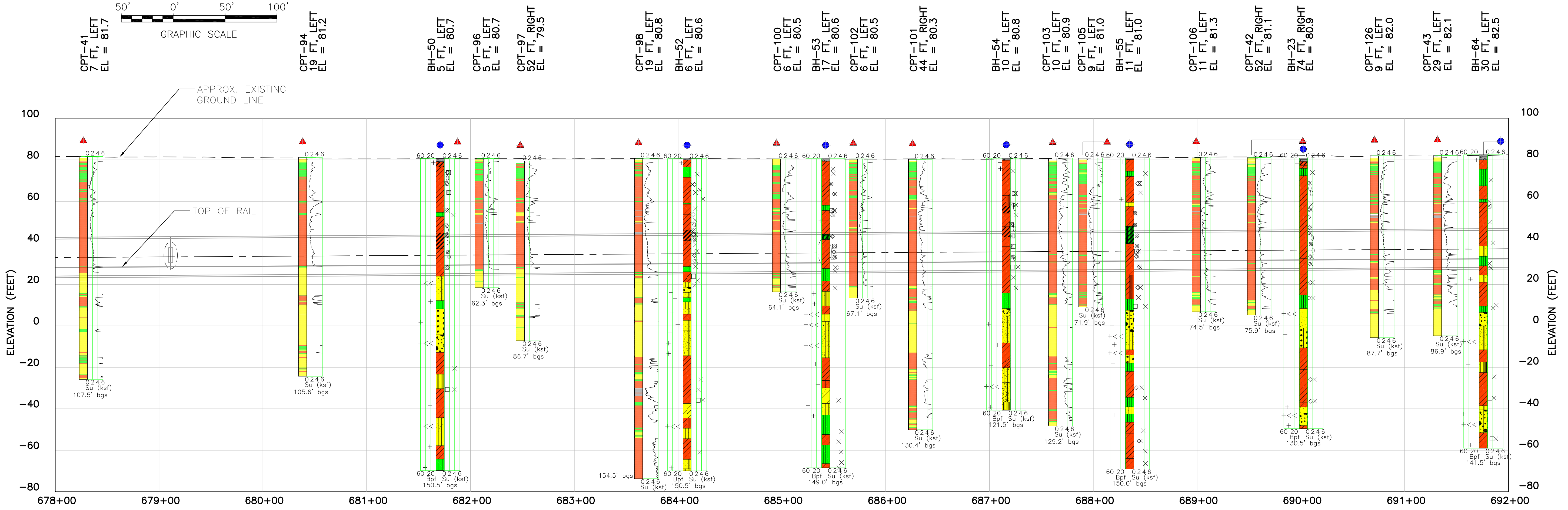

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GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 678+00 TO STA 692+00

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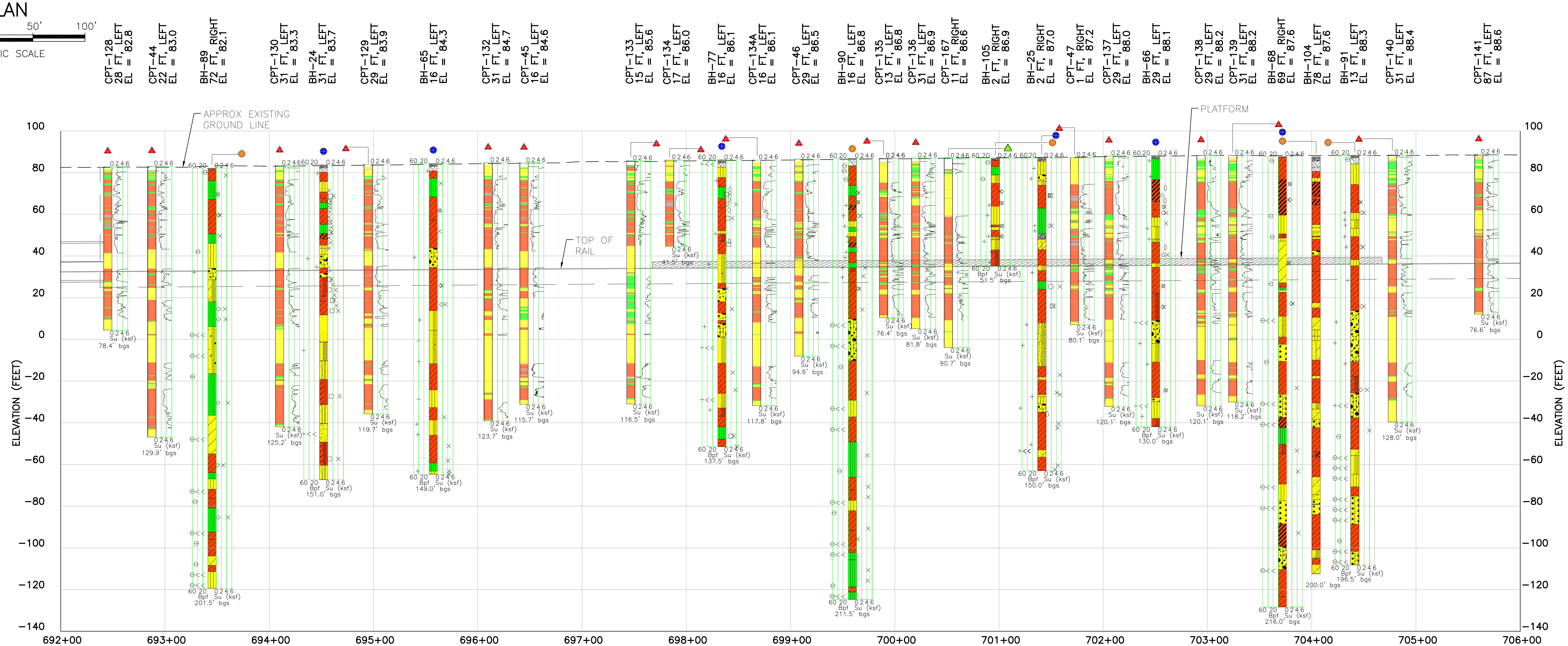
SIZE B
SCALE 1"=100'H; 1"=50'V
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5–32
PAGE NO.

Figure 5-33 Geotechnical Plan and Profile with Strength Parameters: STA 692+00 to STA 706+00

PLAN

50' 0' 50' 100'

GRAPHIC SCALE



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GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 692+00 TO STA 706+00

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PAGE NO.

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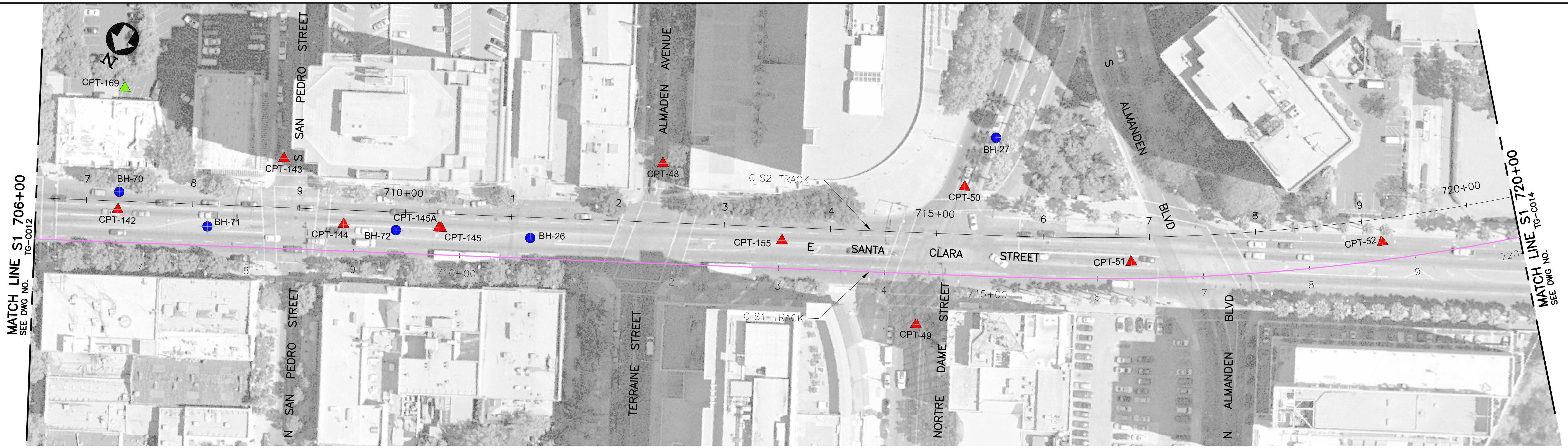
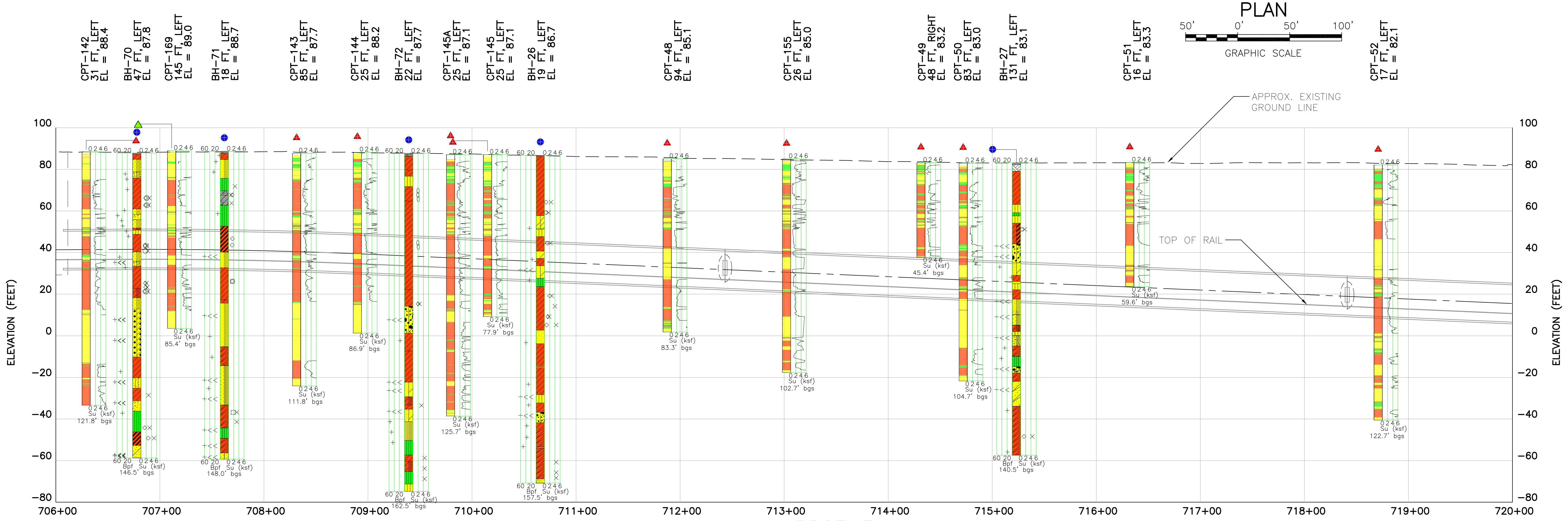
Figure 5-34 Geotechnical Plan and Profile with Strength Parameters: STA 706+00 to STA 720+00



PLAN

50' 0' 50' 100'
GRAPHIC SCALE



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GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 706+00 TO STA 720+00

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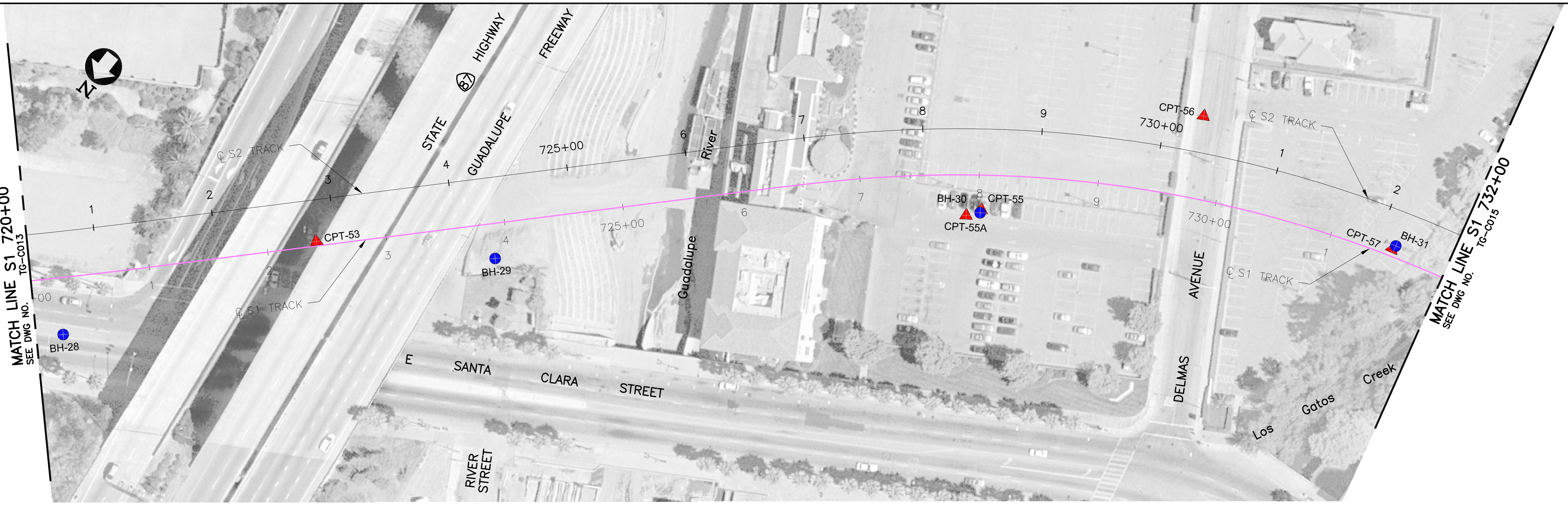
Figure 5-35 Geotechnical Plan and Profile with Strength Parameters: STA 720+00 to STA 732+00



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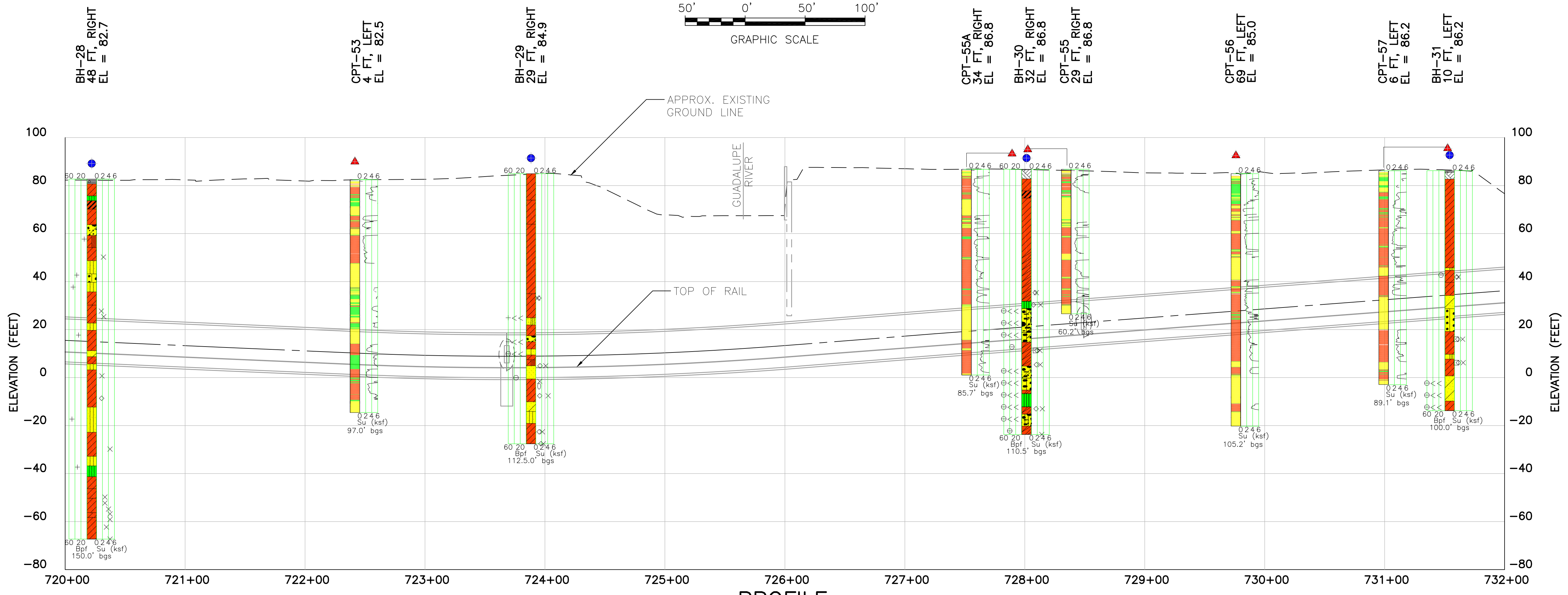

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GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 720+00 TO STA 732+00

CADD FILENAME D300−S−TG−C035−A.dwg
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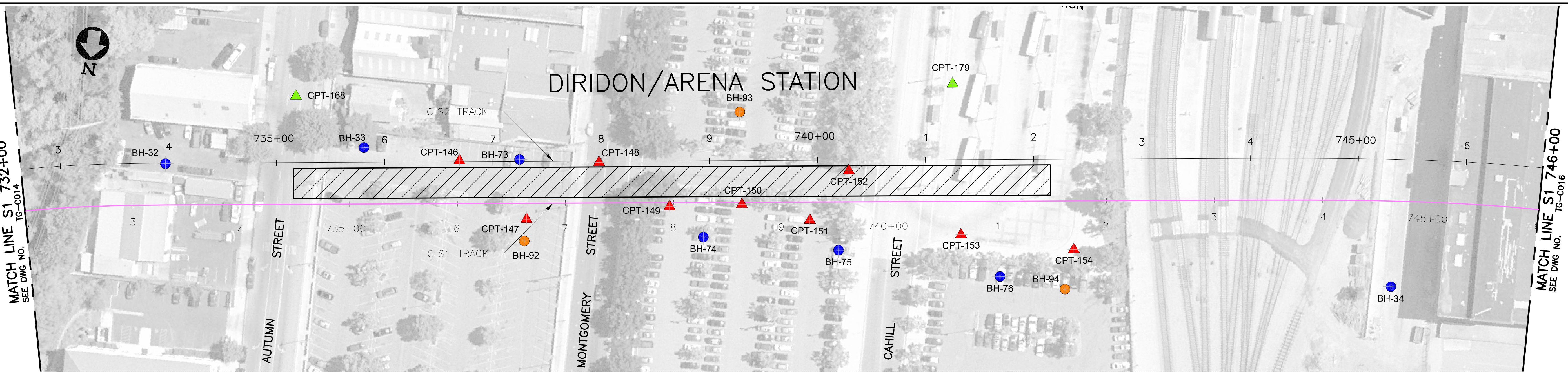
SHEET NO. 5−35
PAGE NO.

VILLEGAS_R May 01, 2008 − 1:23pm W:\TUCADD\35% PE\D300\STUDIES\TG−GEOTECH\GDR1_REV1_DRAWINGS\D300−S−TG−C035−A.dwg

Figure 5-36 Geotechnical Plan and Profile with Strength Parameters: STA 732+00 to STA 746+00



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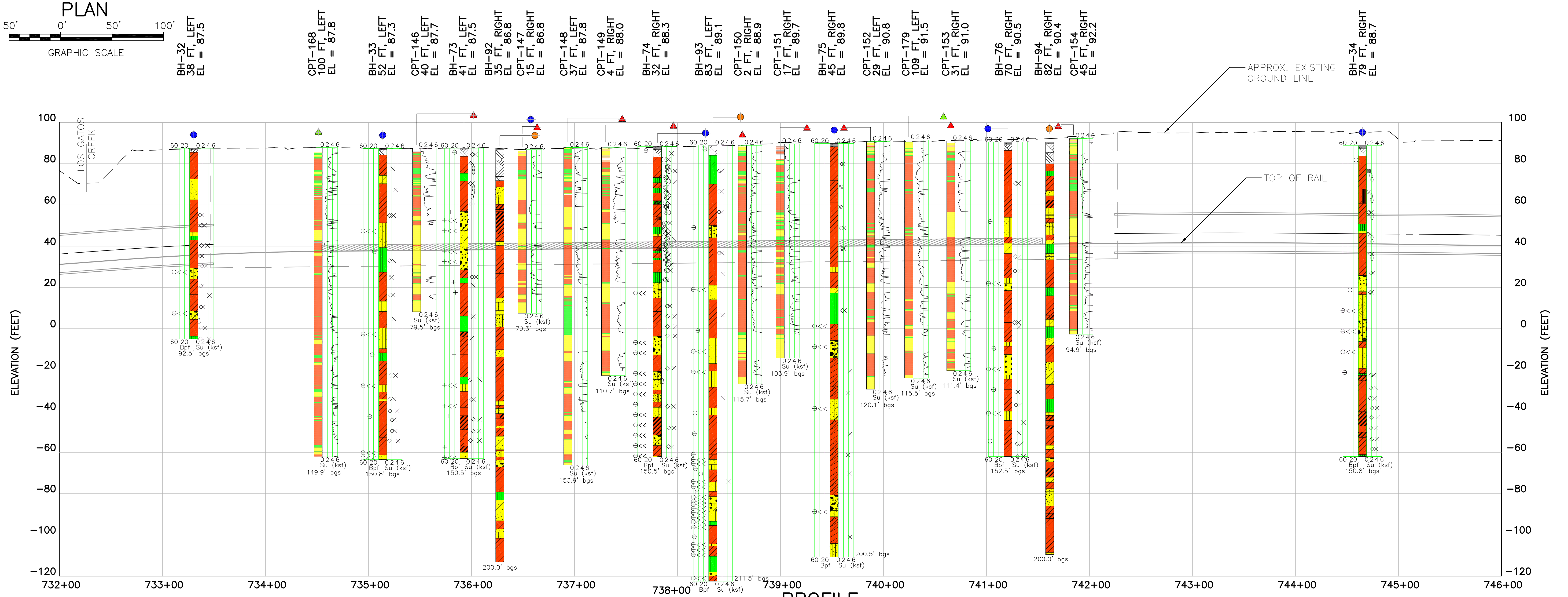

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VTA® Silicon Valley Rapid Transit Corridor
2000 Measure A Project
BART to Milpitas San Jose Santa Clara

SILICON VALLEY RAPID TRANSIT PROJECT
CENTRAL AREA GUIDEWAY
GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 732+00 TO STA 746+00

CADD FILENAME D300−S−TG−C036−A.dwg
SIZE B
SCALE 1"=100'H; 1"=50'V
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5−36
PAGE NO.

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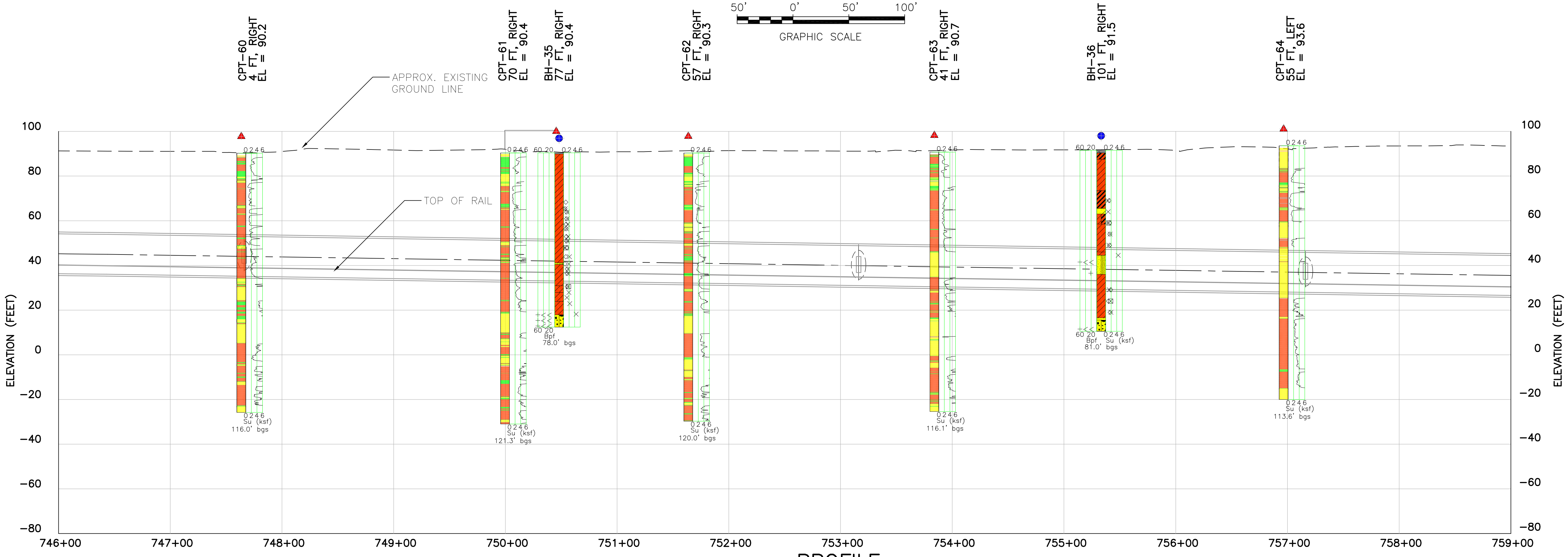
Figure 5-37 Geotechnical Plan and Profile with Strength Parameters: STA 746+00 to STA 759+00

PLAN

50' 0' 50' 100'
GRAPHIC SCALE



PROFILE

REV	DATE	BY	SUB	APP	DESCRIPTION
0	20080429				FOR USE

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DRAWN BY R. VILLEGAS
CHECKED BY A. LIU
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GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 746+00 TO STA 759+00

CADD FILENAME D300−S−TG−C037−A.dwg
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CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5−37
PAGE NO.

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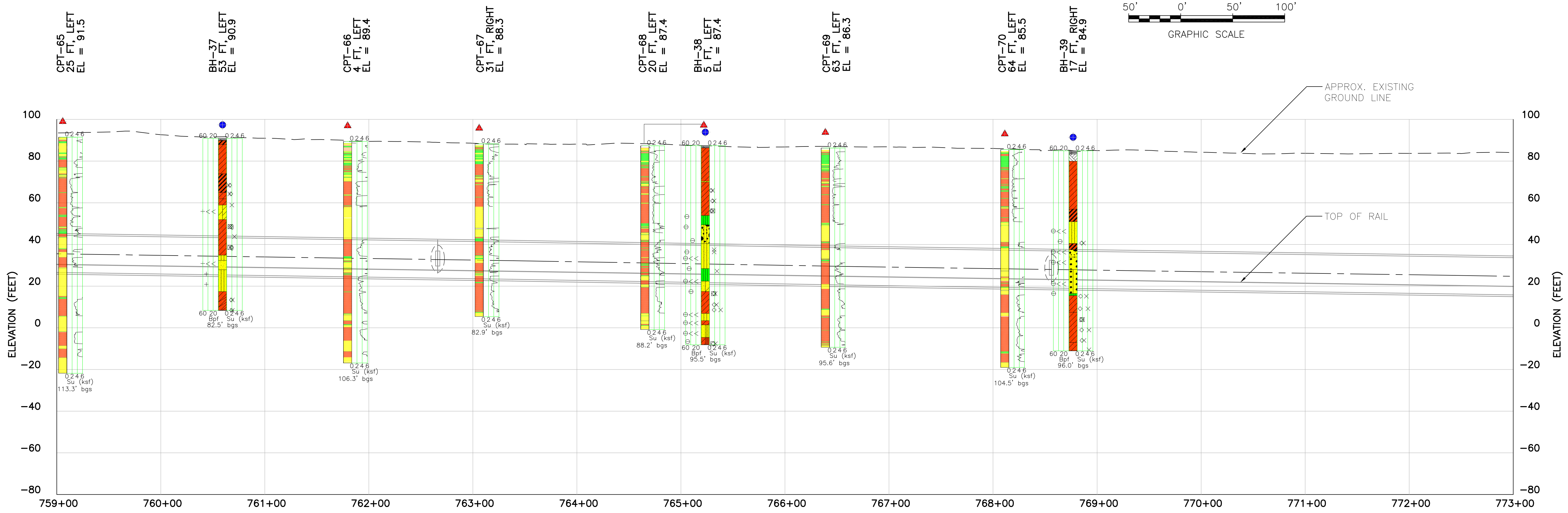
Figure 5-38 Geotechnical Plan and Profile with Strength Parameters: STA 759+00 to STA 773+00

PLAN



PROFILE

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GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 759+00 TO STA 773+00

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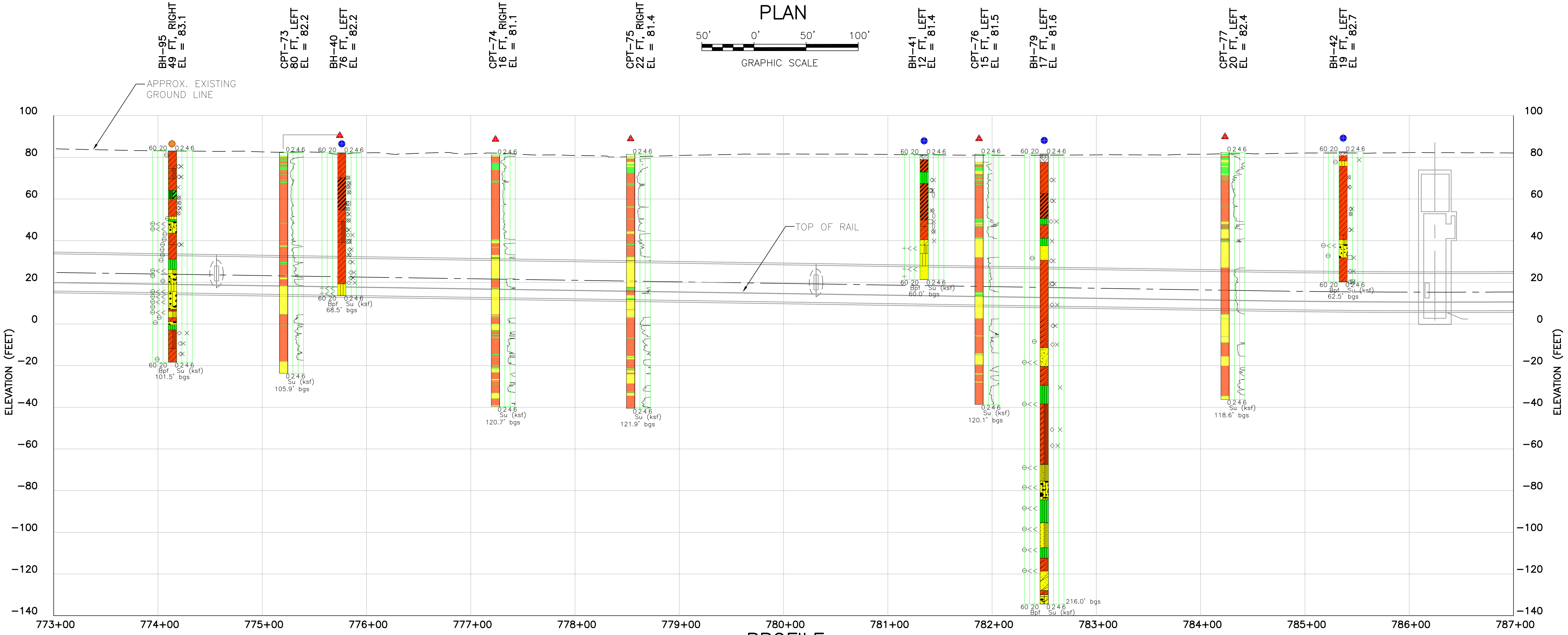
SCALE 1"=100'H; 1"=50'V
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5-38
PAGE NO.

Figure 5-39 Geotechnical Plan and Profile with Strength Parameters: STA 773+00 to STA 787+00

PLAN



PROFILE

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						DRAWN BY R. VILLEGAS
						CHECKED BY A. LIU
						IN CHARGE A. LIU
0	20080429				FOR USE	DATE 20080429
REV	DATE	BY	SUB	APP	DESCRIPTION	

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GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 773+00 TO STA 787+00

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AREA CODE
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PAGE NO.

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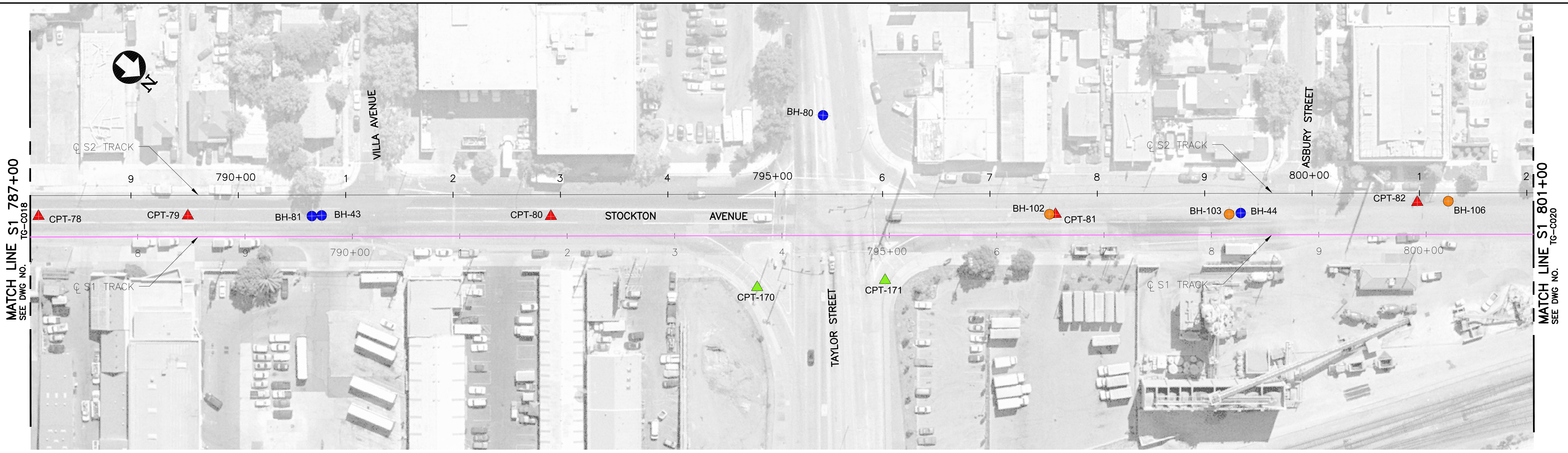
Figure 5-40 Geotechnical Plan and Profile with Strength Parameters: STA 787+00 to STA 801+00



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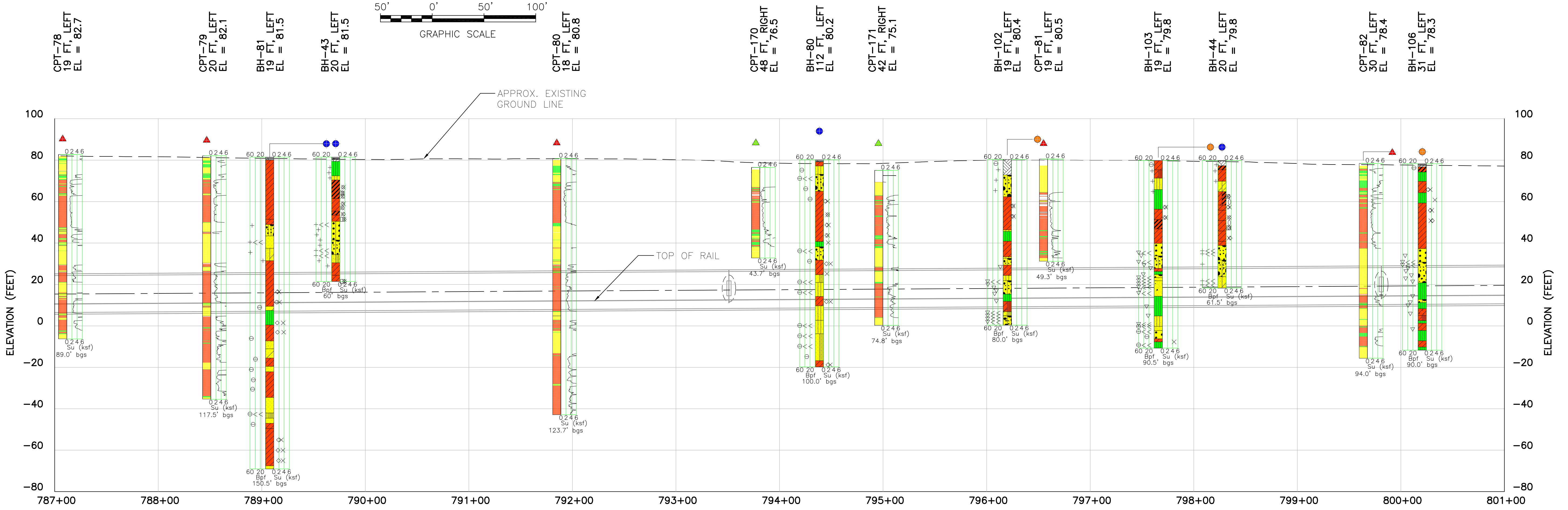

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CENTRAL AREA GUIDEWAY
GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 787+00 TO STA 801+00

CADD FILENAME D300–S–TG–C040–A.dwg
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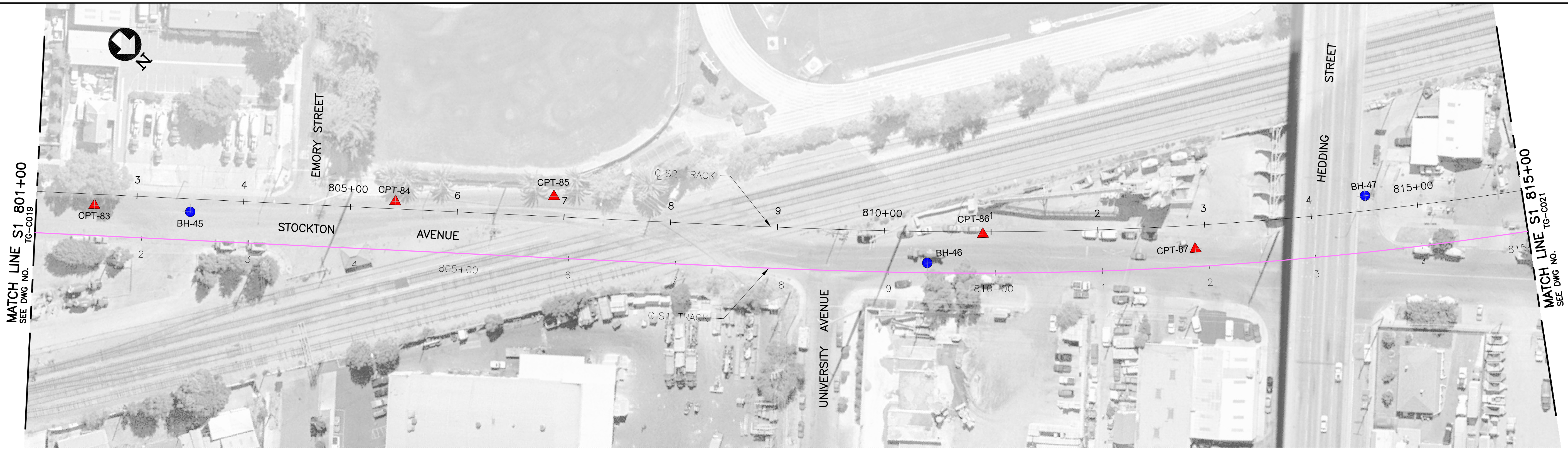
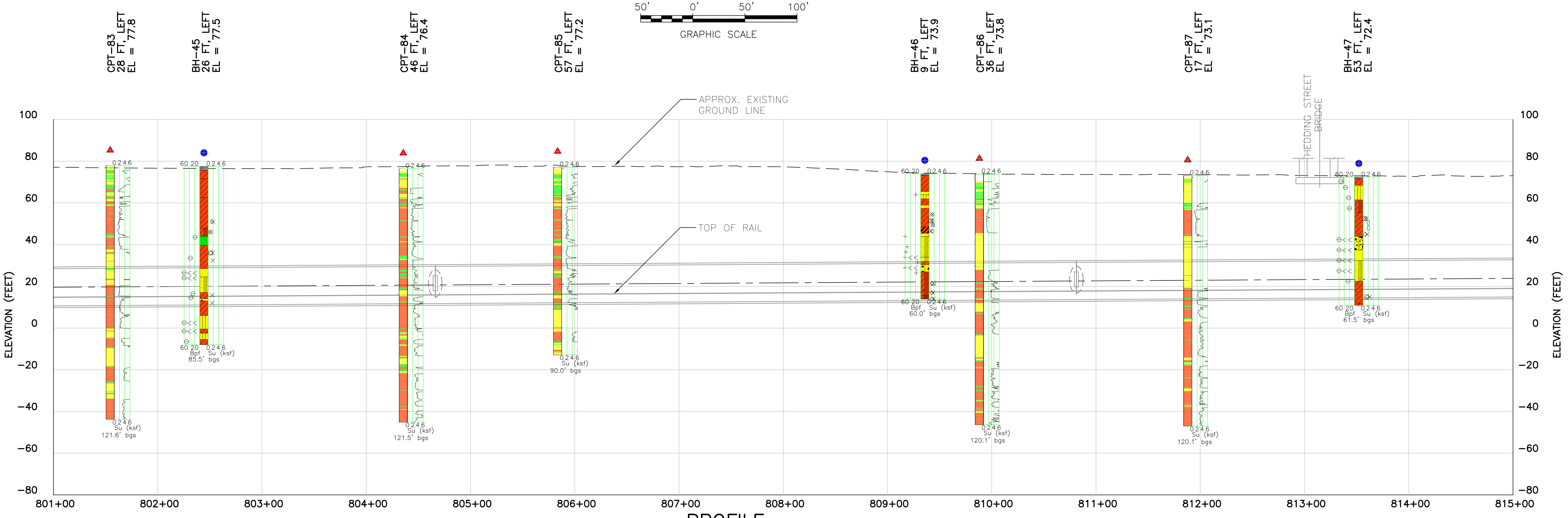
SCALE 1"=100'H; 1"=50'V
CONTRACT NO. D300
REV. A
AREA CODE
SHEET NO. 5–40
PAGE NO.

Figure 5-41 Geotechnical Plan and Profile with Strength Parameters: STA 801+00 to STA 815+00



PLAN

50' 0' 50' 100'
GRAPHIC SCALE



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CENTRAL AREA GUIDEWAY
GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 801+00 TO STA 815+00

CADD FILENAME D300−S−TG−C041−A.dwg
SIZE B
SCALE 1"=100'H; 1"=50'V
CONTRACT NO. D300
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AREA CODE
SHEET NO. 5−41
PAGE NO.

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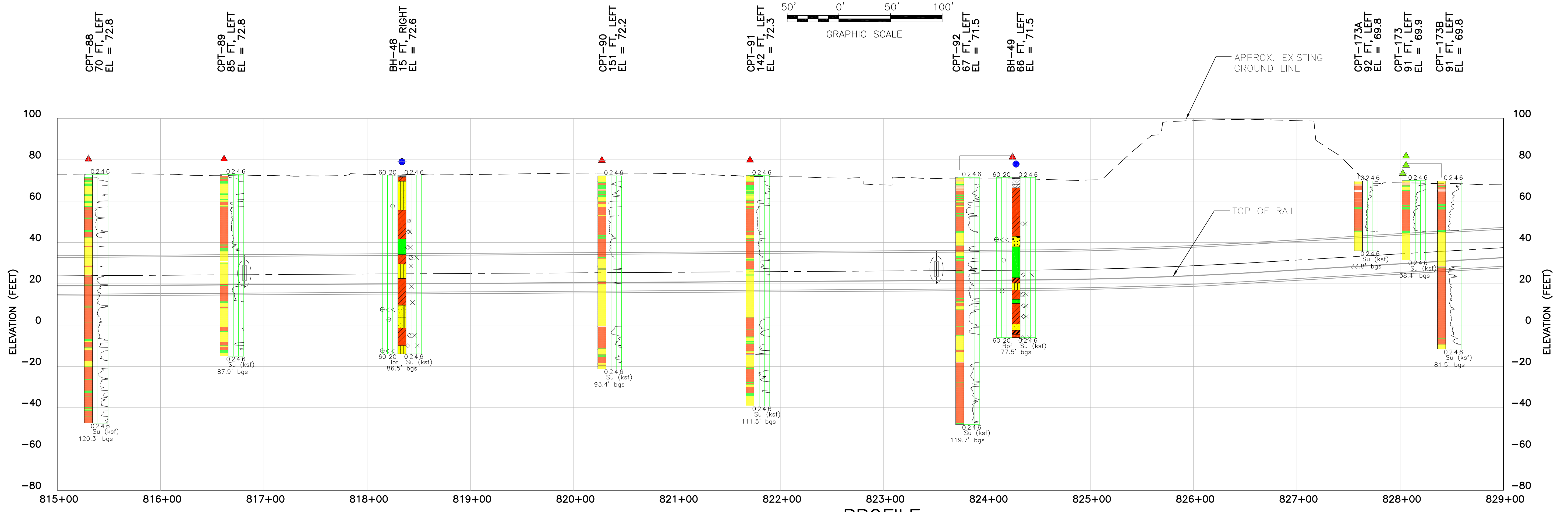
Figure 5-42 Geotechnical Plan and Profile with Strength Parameters: STA 815+00 to STA 829+00

PLAN



PROFILE

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GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 815+00 TO STA 829+00

CADD FILENAME D300-S-TG-C042-A.dwg
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REV. A
AREA CODE
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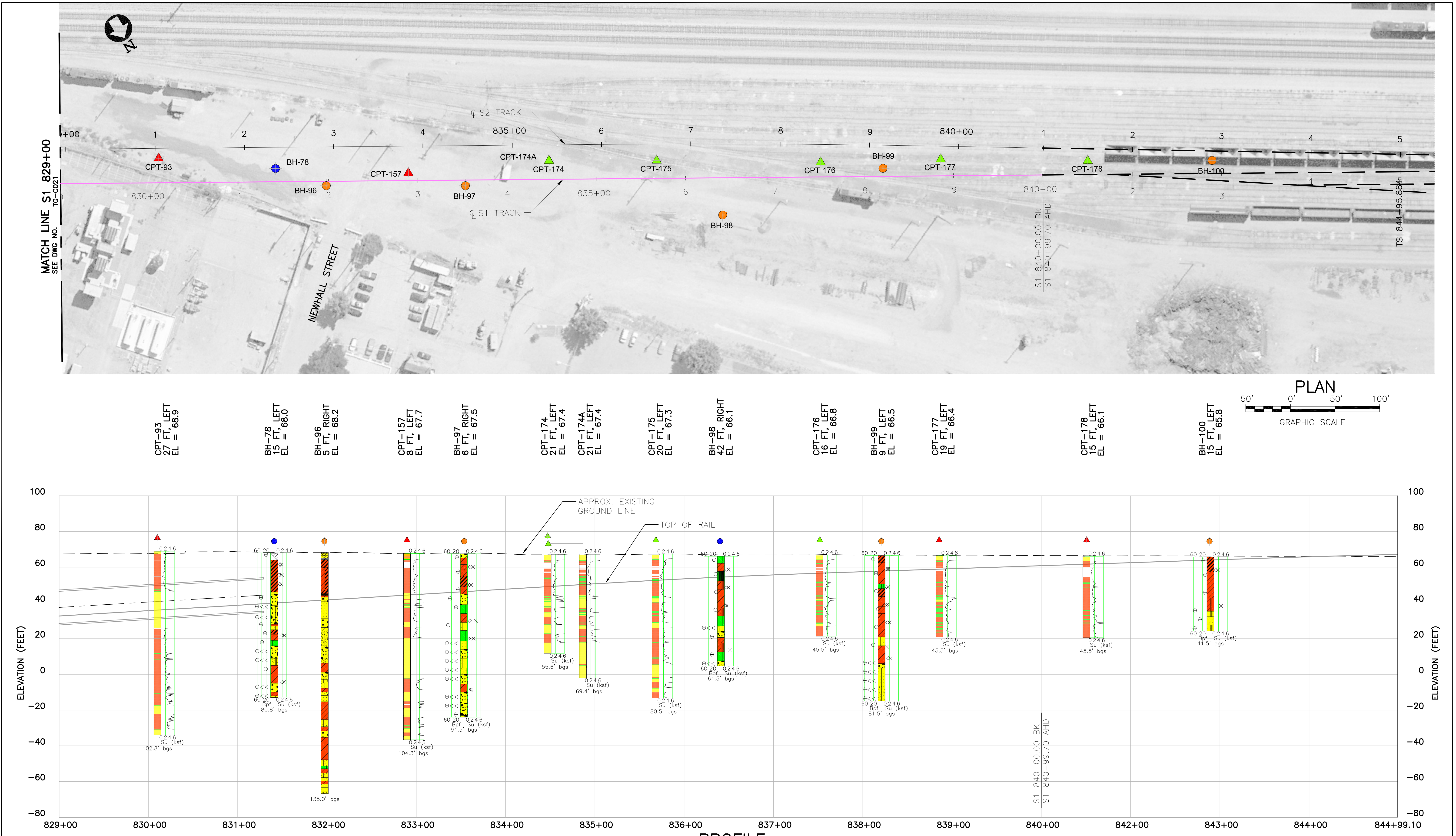
Figure 5-43 Geotechnical Plan and Profile with Strength Parameters: STA 829+00 to STA 843+99



REV	DATE	BY	SUB	APP	DESCRIPTION
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R. VILLEGAS
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CENTRAL AREA GUIDEWAY
GEOTECHNICAL PLAN AND PROFILE
With Strength Parameters
S1 STA 829+00 TO STA 843+00

CADD FILENAME
D300–S–TG–C043–A.dwg
SIZE
B
SCALE
1"=100'H; 1"=50'V
CONTRACT NO.
D300
REV.
A
AREA CODE
SHEET NO.
5–43
PAGE NO.

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APPENDICES

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Appendix 1: Logs of Borings

INTRODUCTION

Parikh Consultants, Inc. (PCI), was retained to perform subsurface exploration for 65 % Engineering Design phase of Silicon Valley Rapid Transit (SVRT) project. They performed the exploration from June 4, 2007 through August 1, 2007. The work was performed in general accordance with the project scope and technical specifications prepared by us.

PURPOSE AND SCOPE

The purpose of this exploration was to obtain and provide subsurface data along the proposed tunnel alignment for the project. The scope included performing 19 rotary wash borings to different depths. The depths of borings ranged from 40 feet to 210.5 feet. The summary of exploration program is provided in Table A1-1. Pitcher Drilling Company (Pitcher) was retained as the driller. One to two drilling crews were utilized. A similar methodology used during 35 % Preliminary Engineering phase was employed for rotary wash drilling, sampling and logging, as described in Appendix 1 of '*Tunnel Segment Geotechnical Data Report, Vol. II of VI, P0503-D300-RPT-GEO-002, Rev. 0 (HMM/Bechtel, September 2005)*. In addition to the samplers used during 35% phase, a geo-barrel and California samplers were also used to obtain disturbed samples during this phase of investigations. Specifications of these samplers are noted on Figure A1-1. The boring logs were presented to us in gINT database software format. The gINT database software acts as a repository of the borings data. We provided the gINT templates. The gINT produced boring logs are provided in Figures A1-2 through A1-21. The boring log for BH-81, which was performed near the end of 35% engineering design phase, is also included.

Table A1-1 Summary of Exploratory Borehole Program - Phase 2 65% Engineering Design Investigation
Silicon Valley Rapid Transit Project - Central Area Guideway

Exploration	Boring Depth (ft)	Surface Elevation (ft)	Station (ft)	Offset		Structure Type	Driling Type
				(ft)	R / L		
East Portal							
BH-101	52.5	90.8	564+38	22	L	Portal	RW
BH-082	92.5	85.9	570+08	22	L	Portal	RW
Alum Rock Station							
BH-083[#]	200.0	83.9	599+84	26	R	Station	S
BH-084	207.5	87.4	603+12	148	L	Station	RW
BH-085	202.5	89.2	606+32	51	L	Station	RW
BH-086[#]	190.0	88.0	609+08	83	R	Station	S
Tunnel from Alum Rock Station to Crossover/Downtown Station							
BH-087	201.5	87.4	648+42	103	L	Tunnel	RW
BH-088	112.5	94.1	645+03	66	R	Tunnel	RW
Crossover/Downtown Station							
BH-089	201.5	82.1	693+74	72	R	Station	RW
BH-090	211.5	86.8	699+59	16	L	Station	RW
BH-105	51.5	86.9	701+51	2	R	Station	RW
BH-104[#]	200.0	87.6	703+72	78	R	Station	S
BH-091	196.5	88.3	704+16	13	L	Station	RW
Diridon/Arena Station							
BH-092[#]	200.0	86.8	736+62	35	R	Station	S
BH-093	211.5	89.1	738+61	84	L	Station	RW
BH-094[#]	200.0	90.4	741+61	82	R	Station	S
Tunnel from Crossover/Downtown Station to West Portal							
BH-081*	150.5	81.5	789+62	19	L	Tunnel	RW
BH-095	101.5	83.1	774+14	49	R	Tunnel	RW
BH-102	80.0	80.4	796+49	19	L	Tunnel	RW
BH-103	90.5	79.8	798+17	19	L	Tunnel	RW
BH-106	90.0	78.3	800+21	31	L	Tunnel	RW
West Portal							
BH-096[#]	135.0	68.2	831+98	5	R	Portal	S
BH-097	91.5	67.5	833+53	6	R	Portal	RW
BH-098	61.5	66.1	836+41	42	R	Portal	RW
BH-099	81.5	66.5	838+21	9	L	Portal	RW
BH-100**	41.5	65.8	842+89	15	L	Portal	RW

Notes

A. Stations and offsets are based on the April 25, 2008 S1 track alignment.

B. RW = Rotary Wash, S = Sonic, R/L = Right/Left of S1 track alignment.

C. * BH-81 was completed near the end of 35% engineeting design phase, and therefore could not be included in the ‘Tunnel Segment Geotechnical Data Report (HMM/Bechtel, 2005a)’. Information from BH-81 is included in this Phase Two - 65% Engineering Design Report.

D. ** Stationing for BH-100 shown is based on Western Area Guideway alignment stationing (outside of tunnel alignment stationing).

E. [#] Part of pumping test program, and included in 'Pumping Test Data Report (HMM/Bechtel, Feb 2008)'.

MAJOR DIVISIONS			GROUP NAMES	
COARSE-GRAINED SOILS More than 50% retained on the No. 200 sieve	GRAVELS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	Clean gravels less than 5% fines	**GW**	Well-Graded Gravel
			GP	Poorly Graded Gravel
		Gravels with 5-12% fines	**GW-GM**	Well-Graded Gravel with Silt
			GW-GC	Well-Graded Gravel with Clay (or Silty Clay)
			GP-GM	Poorly Graded Gravel with Silt
			GP-GC	Poorly Graded Gravel with Clay (or Silty Clay)
		Gravels with more than 12% fines	**GM**	Silty Gravel
			GC	Clayey Gravel
			GC-GM	Silty, Clayey Gravel
	SANDS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	Clean sand less than 5% fines	**SW**	Well-Graded Sand
			SP	Poorly Graded Sand
		Sands with 5-12% fines	**SW-SM**	Well-Graded Sand with Silt
			SW-SC	Well-Graded Sand with Clay (or Silty Clay)
			SP-SM	Poorly Graded Sand with Silt
			SP-SC	Poorly Graded Sand with Clay (or Silty Clay)
		Sands with more than 12% fines	**SM**	Silty Sand
			SC	Clayey Sand
			SC-SM	Silty, Clayey Sand
FINE-GRAINED SOILS 50% or more passes the No. 200 sieve	SILTS AND CLAYS Liquid Limit Less than 50%		**ML**	Silt
			CL	Lean Clay
			CL-ML	Silty Clay
			OL	Organic Silt
	SILTS AND CLAYS Liquid Limit Greater than 50%		**MH**	Elastic Silt
			CH	Fat Clay
			OH	Organic Clay
HIGHLY ORGANIC SOILS			**PT**	Peat or Highly Organic Soils
			FILL	Debris or Mixed Fill
			AC	Asphalt Concrete Pavement with Aggregate Base
			BASE	Aggregate Base
			CONCRETE	Cement Concrete

GENERAL NOTES

Classification of Soils per ASTM D2487 or D2488

Geologic Formation noted in bold font at the top of interpreted interval

Uncorrected Blowcounts for Modified California Liner Sampler shown in ( ) "

Length of sample symbol approximates recovery length

"X" in Sample No. column indicates that there was no recovery during sampling.

SAMPLER DRIVING RESISTANCE

Number of blows with 140 lb. hammer, falling 30-in. to drive sampler 1-ft. after seating sampler 6-in.; for example,

Blows/ft	Description
25	25 blows drove sampler 12" after initial 6" of seating
50/7"	50 blows drove sampler 7" after initial 6" of seating
Ref/3"	50 blows drove sampler 3" during initial 6" seating interval (Ref=Refusal)

STRENGTH TEST METHOD

U = Unconfined Compression
Q = Unconsolidated Undrained Triaxial
T = Pocket Torvane (tv)
P = Pocket Penetrometer (pp)
M = Miniature Vane Shear Test
V = Field Vane Shear Test (vs)

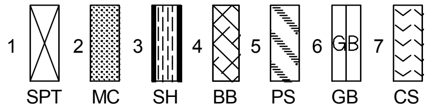
OTHER TESTS

k = Permeability
Consol = Consolidation
Gs = Specific Gravity
MA = Particle Size Analysis
PM = Pressuremeter
LEL = Lower Explosive Limit
OXY = Oxygen Level Reading (%)
CO2 = Carbon dioxide Level Reading (ppm)
CH4 = Methane Level Reading (ppm)
H2S = Hydrogen Sulphide Level Reading (ppm)
EI = Expansion Index
OVM = Organic Vapor Measurement

WATER LEVEL SYMBOLS

∇ Measured Depth to Water
∿ Seepages encountered

SAMPLER TYPE



Samplers and sampler dimensions (unless otherwise noted in report text) are as follows:

1 SPT Sampler, driven (SPT) 1 3/8" ID, 2" OD
2 MOD CA Liner Sampler (MC) 2.416" ID, 3" OD
3 Thin-walled Tube, pushed (SH) 2 7/8" ID, 3" OD
4 Bulk Bag Sample (from cuttings (BB))
5 Pitcher Sampler (PS) 2 7/8" ID, 3" OD
6 Geo-Barrel Sampler (GB) 2 2/5" ID, 4 3/4" OD
7 California Sampler (CS) 1.975 " ID, 2.5" OD

SOIL STRUCTURE

Fissured: Containing shrinkage or relief cracks, often filled with fine sand or silt, usually more or less vertical.

Pocket: Inclusion of material of different texture that is smaller than the diameter of the sample.

Parting: Inclusion less than 1/8 inch thick extending through the sample.

Seam: Inclusion 1/8 inch to 3 inches thick extending through the sample.

Layer: Inclusion greater than 3 inches thick extending through the sample.

Laminated: Soil sample composed of alternating partings or seams of different soil types.

Interlayered: Soil sample composed of alternating layers of different soil type.

Intermixed: Soil sample composed of pockets of different soil type, and layered or laminated structure is not evident.

CONSISTENCY

Clays	Blows/Foot SPT	Undrained Shear Strength (ksf)
Very Soft	**< 2**	**0 - 0.25**
Soft	**2 - 4**	**0.25 - 0.5**
Medium	**4 - 8**	**0.5 - 1**
Stiff	**8 - 15**	**1 - 2**
Very Stiff	**15 - 30**	**2 - 4**
Hard	**> 30**	**Over 4**

RELATIVE DENSITY

Sands and Gravels	Blows/Foot SPT
Very Loose	**0 - 4**
Loose	**4 - 10**
Medium Dense	**10 - 30**
Dense	**30 - 50**
Very Dense	**Over 50**

INCREASING VISUAL MOISTURE CONTENT

↓
Dry
Moist
Wet

Information on each boring log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as from laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines on the logs may be transitional and approximate in nature. Water level measurements refer only to those observed at the time and places indicated, and can vary with time, geologic condition, or construction activity.

TERMS AND SYMBOLS USED ON BORING LOGS

FIGURE A1-1

LOCATION: Median of Stockton Ave., between Schiele Ave. and Villa Ave. N 1,949,237 E 6,151,102

SURFACE EL: 81.5 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						5 inches ASPHALT CONCRETE over 12 inches AGGREGATE BASE							
80						LEAN CLAY (CL)							
	5												
75													
	10												
70													
						∇							
	15												
65													
	20												
60													
	25												
55													
	30					SANDY LEAN CLAY (CL)							
50													
			1 10"	☒	52	SILTY GRAVEL WITH SAND (GM), very dense, brown, moist, medium grained sand, subangular gravel up to 1 inch		7	12				
	35												
45													
						POORLY GRADED SAND WITH GRAVEL (SP), very dense, brown, moist, medium grained sand, subangular gravel up to 1 inch (LEL=0.0, OVM=0.0, OXY=19.8)							
	40												
40			2 8"	☒	79								
						WELL-GRADED SAND WITH CLAY AND GRAVEL (SW-SC), very dense, brown, moist, medium to coarse grained sand, subrounded gravel up to 1/2 inch							
	45												
35			3 6"	☒	59			10	11				

Continued

BORING DEPTH: 150.5 ft
DEPTH TO WATER: 14.4 ft., 7/21/05

START DATE: July 20, 2005
COMPLETION DATE: July 22, 2005

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Rope and Cathead
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard
LOGGED BY: F. Li
CHECKED BY: Y. D. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-81

Silicon Valley Rapid Transit Project
San Jose, California

Sheet 2 of 4

LOCATION: Median of Stockton Ave., between Schiele Ave. and Villa Ave. N 1,949,237 E 6,151,102

SURFACE EL: 81.5 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
30			4 0"		10	SANDY LEAN CLAY (CL), stiff, no recovery at 50 ft							Noise and Vibration Test
25	55												
20	60												Noise and Vibration Test
	65		5 30"		150 psi 150 psi	--stiff, gray, moist, low to medium plasticity (pp=1.7/2.2/2.1 tsf, tv=0.65/0.7/0.75 tsf)		22	72			2.0 P 1.4 T	
15	70		6 30"		150 psi 300 psi	-- very stiff, brown, low plasticity (pp=2.5/2.0/2.1 tsf, tv=0.4/0.5/0.6 tsf) (LEL=0.0, OVM=0.0, OXY=19.9) --Ended drilling on 7/20/05 at 70 ft --Began drilling on 7/21/05 at 70 ft						2.2 P 1.0 T	Noise and Vibration Test
10			7 0"		(23)	CLAYEY SAND (SC), medium dense, no recovery in MC sampler at 72.5 ft							
5	75					SANDY SILT (ML), very stiff, gray, moist, low plasticity							
	80		8 30"		245 psi 245 psi	--(pp=3.5/3.5/3.7 tsf, tv=0.65/0.62/0.67 tsf)	110	20	72			3.6 P 1.3 T	Noise and Vibration Test
0	85		9 24"		300 psi 400 psi	SANDY LEAN CLAY (CL), hard, brown, moist, low to medium plasticity, trace fine gravel --(pp=3.7/3.5/4.0 tsf, tv=0.65/0.7/0.75 tsf) refusal after 24 inches			70			3.8 P 1.4 T	
-5			10 12"		(55)								
-10	90					WELL-GRADED SAND WITH GRAVEL (SW), very dense, brown, moist, subrounded gravel up to 1 inch (LEL=0.0, OVM=0.0, OXY=20.0)							Noise and Vibration Test
-15	95		11 0"			CLAYEY SAND/ CLAYEY GRAVEL (SC/GC), no recovery, interbedded zone of clay and sand/ fine gravel (could not advance the sampler due to gravelly slough)							
			12 15"		(39)	LEAN CLAY WITH SAND (CL), hard, light brown, moist, medium plasticity		25	82				

Continued

BORING DEPTH: 150.5 ft
DEPTH TO WATER: 14.4 ft., 7/21/05

START DATE: July 20, 2005
COMPLETION DATE: July 22, 2005

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Rope and Cathead
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard
LOGGED BY: F. Li
CHECKED BY: Y. D. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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LOG OF BORING NO. BH-81

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-2b

LOCATION: Median of Stockton Ave., between Schiele Ave. and Villa Ave. N 1,949,237 E 6,151,102

SURFACE EL: 81.5 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
											Noise and Vibration Test
-20		13 13"	(55)	WELL-GRADED SAND (SW), dense, brown, moist,							
-25	105	14 14"	(47)	LEAN CLAY (CL), hard, brown to gray, moist, medium plasticity, trace fine gravel --light brown (LEL=0.0, OVM=0.0, OXY=21.0) --Ended drilling on 7/21/05 at 109 ft --Began drilling on 7/22/05 at 109 ft							Noise and Vibration Test
-30	110 115	15 16"	(50)	--brown, trace coarse grained sand							
-35 -40	120	16 5"	(50/6")	POORLY GRADED SAND WITH GRAVEL (SP), very dense, brown, moist, subrounded gravel up to 1 inch			3				Noise and Vibration Test
	125	17 14"	(68)	SANDY SILT TO SILTY SAND (ML/SM), hard, gray, moist, low plasticity (LEL=0.0, OVM=0.0, OXY=20.9)		16	45				
-45				POORLY GRADED SAND WITH GRAVEL (SP), sand and gravel from cuttings							
	130	18 15"	(48)	SANDY LEAN CLAY (CL), hard, gray, moist, medium plasticity		20	69				
-50 -55	135	19 30"	300 psi 400 psi	LEAN CLAY (CL), very stiff, gray, moist, medium plasticity --(pp=3.0/2.7/3.0 tsf, tv=0.9/0.9/0.95 tsf)						2.9 P 1.8 T	
-60	140	20 30"	300 psi 400 psi	--light brown (pp=3.5/3.5/3.0 tsf, tv=0.7/0.8/0.9 tsf)		33	98			3.5 P 1.6 T	
-65	145	21 30"	300 psi 350 psi	--low to medium plasticity (pp=3.5/3.0/3.5 tsf, tv=0.8/0.9/0.9 tsf) (LEL=0.0, OVM=0.0, OXY=20.8)						3.5 P 1.8 T	
		22	400 psi								

Continued

BORING DEPTH: 150.5 ft
DEPTH TO WATER: 14.4 ft., 7/21/05

START DATE: July 20, 2005
COMPLETION DATE: July 22, 2005

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Rope and Cathead
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard
LOGGED BY: F. Li
CHECKED BY: Y. D. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-81

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: Median of Stockton Ave., between Schiele Ave. and Villa Ave. N 1,949,237 E 6,151,102

SURFACE EL: 81.5 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		▨	15"	▥	400 psi	CLAYEY SAND WITH GRAVEL (SC), dense, brown, moist, fine to medium grained sand, subrounded gravel up to 1/2 inch							
-70													
	155												
-75													
	160												
-80													
	165												
-85													
	170												
-90													
	175												
-95													
	180												
-100													
	185												
-105													
	190												
-110													
	195												
-115													

BORING DEPTH: 150.5 ft
DEPTH TO WATER: 14.4 ft., 7/21/05

START DATE: July 20, 2005
COMPLETION DATE: July 22, 2005

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Rope and Cathead
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard
LOGGED BY: F. Li
CHECKED BY: Y. D. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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LOG OF BORING NO. BH-81

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: Approx. 150 feet NW of Las Plumas Ave., 30 feet NE of UPRR tracks N 1,956,149 E 6,163,187

SURFACE EL: 85.9 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
85				SILT (ML), stiff, light brown, moist, low plasticity							
		1 10"	(17)								
80	5	2 24"	180 psi	LEAN CLAY (CL), stiff, gray, moist, low plasticity (pp=1/1.5/1.25 tsf, tv=0.4,0.5,0.45 tsf)						1.3 P 0.9 T	
				--Began rotary wash, set casing to 8 1/2 ft							
75	10	3 32"	150 psi	LEAN CLAY (CL), stiff, brown, moist, medium plasticity (pp=1.25/1.5/1.25 tsf, tv=0.6/0.65/0.6 tsf) (OVM=0 ppm, OXY=20.9%, CH4=2 ppm)						1.3 P 1.2 T	
70	15	4 32"	250 psi	--yellowish brown (pp=1.75/1.5/1.75 tsf, tv=0.75/0.8/0.75 tsf)						1.7 P 1.5 T	
65	20	5 28"	180 psi	--brown (pp=1.5/1.75/1.5 tsf, tv=0.65/0.7/0.65 tsf)	96	28	98	42	18	1.6 P 1.3 T	Hydrometer test
60	25	6 33"	125 psi	--medium (pp=0.5/0.75/0.5 tsf, tv=0.35/0.45/0.4 tsf)						0.6 P 0.9 T	
55	30	7 33"	100 psi	--(pp=0.5/0.75/0.5 tsf, tv=0.35/0.4/0.35 tsf)		27				0.6 P 0.7 T	
50	35	8 33"	180 psi	--stiff, dark brown (pp=1.5/1.5/1.0 tsf, tv=0.55/0.7/0.6 tsf)						1.3 P 1.2 T	
45	40	9 30"	180 psi	LEAN CLAY WITH SAND (CL), stiff, light brown, moist to wet, low plasticity (pp=1.5/1.0/0.75 tsf, tv=0.25/0.3/0.33 tsf) (OVM=0 ppm, OXY=20.9%, CH4=2 ppm)		26	72	35	18	1.1 P 0.6 T	Hydrometer test
				SILTY CLAY (CL-ML), stiff, grayish brown, moist							
40	45	10 16"	(16)								
				SANDY SILT (ML), stiff, light gray, moist, low							

Continued

BORING DEPTH: 92.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 18, 2007
COMPLETION DATE: June 18, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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LOG OF BORING NO. BH-82

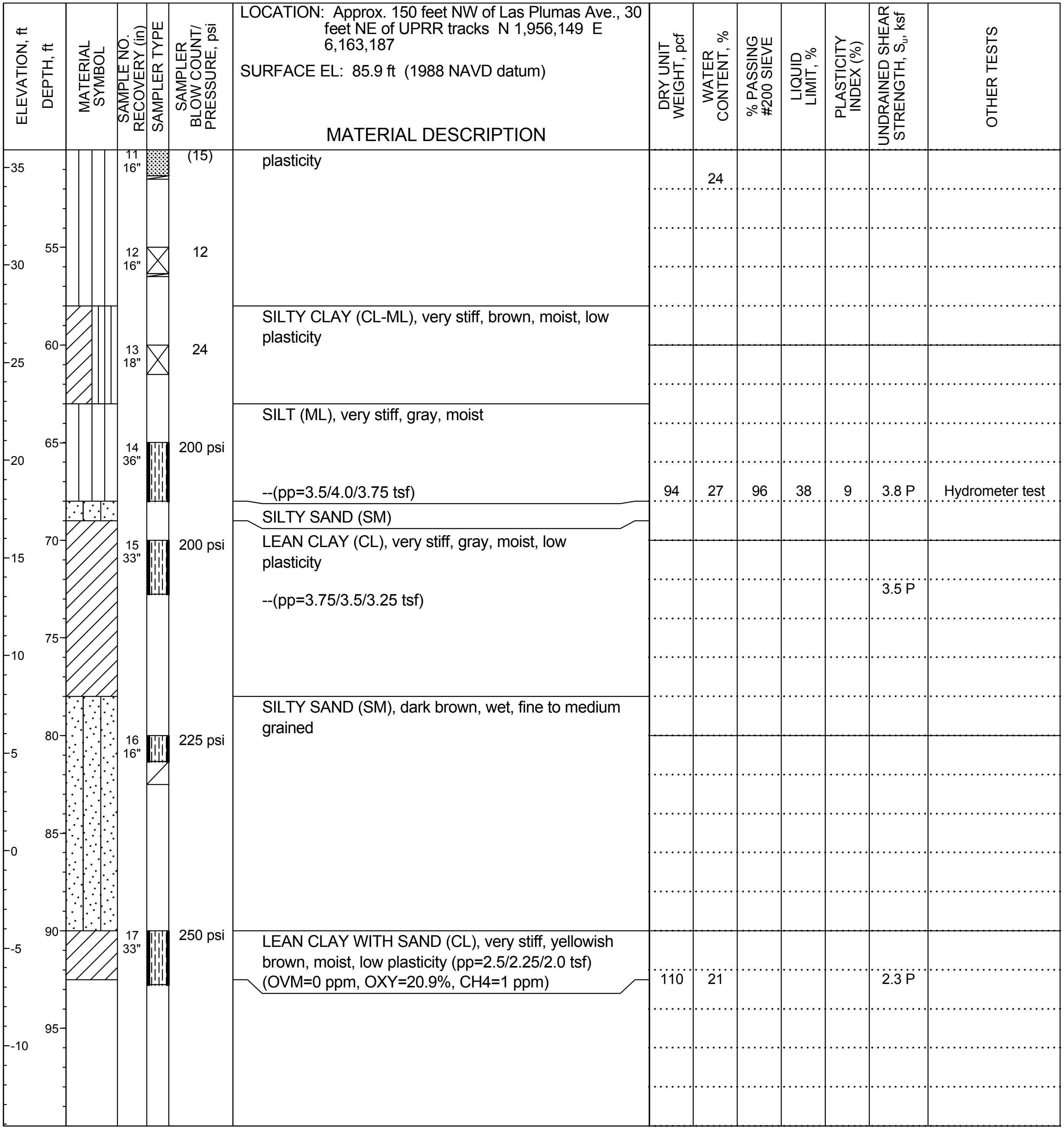
Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-3a

Sheet 2 of 2

LOCATION: Approx. 150 feet NW of Las Plumas Ave., 30 feet NE of UPRR tracks N 1,956,149 E 6,163,187

SURFACE EL: 85.9 ft (1988 NAVD datum)



SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
11 16"	(15)	plasticity		24					
12 16"	12								
		SILTY CLAY (CL-ML), very stiff, brown, moist, low plasticity							
13 18"	24								
		SILT (ML), very stiff, gray, moist							
14 36"	200 psi								
		--(pp=3.5/4.0/3.75 tsf)	94	27	96	38	9	3.8 P	Hydrometer test
		SILTY SAND (SM)							
15 33"	200 psi	LEAN CLAY (CL), very stiff, gray, moist, low plasticity							
		--(pp=3.75/3.5/3.25 tsf)						3.5 P	
		SILTY SAND (SM), dark brown, wet, fine to medium grained							
16 16"	225 psi								
17 33"	250 psi	LEAN CLAY WITH SAND (CL), very stiff, yellowish brown, moist, low plasticity (pp=2.5/2.25/2.0 tsf) (OVM=0 ppm, OXY=20.9%, CH4=1 ppm)	110	21				2.3 P	

BORING DEPTH: 92.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 18, 2007
COMPLETION DATE: June 18, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-82

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-3b

Sheet 1 of 5

LOCATION: Approx. 100 feet SW of 30th St., Approx. 300 ft. SE of St. James St. N 1,953,475 E 6,164,953

SURFACE EL: 87.4 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						1/2 inches of ASPHALT CONCRETE							
85			1 15"		(11)	SILTY SAND WITH GRAVEL (SM), brown, dry to moist (FILL) (OXY=20.9%, CH4=0 ppm, PID=0 ppm)							
	5					LEAN CLAY (CL), medium, brown, moist, low plasticity							
80						--driller noticed silty materials at 6 ft --Began rotary wash, set casing to 8 1/2 ft.							
	10		2 26"		220 psi	--gray, low plasticity, (pp=1.75/1.50/1.75 tsf, tv=0.8 tsf)							
75												1.7 P 1.6 T	
	15												
70						SILTY SAND WITH GRAVEL (SM), medium dense, brown, moist, coarse grained --gravelly drilling and lost drilling fluid at 17 1/2 feet (20 gallons)							
	20		3 9"		24								
65						--lost drilling fluid at 23 feet (20 gallons)							
	25												
						LEAN CLAY (CL), very stiff, brown, moist, low plasticity							
60													
	30		4 28"		190 psi								
55						--(pp=1.75/2.5/2.75 tsf, tv=0.63 tsf)						2.3 P 1.3 T	
	35												
50						--driller noticed silty material from 36 to 38 1/2 ft							
						FAT CLAY (CH), stiff, brown, moist, medium to high plasticity (pp=1.25/1.5/1.5 tsf, tv=0.75 tsf)							
	40		5 27"		125 psi								
45							90	33		58	31	1.4 P 1.5 T	
	45					--lost drilling fluid at 44 feet (10 gallons)							
40													

Continued

BORING DEPTH: 207.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 14, 2007
COMPLETION DATE: July 16, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, W. Baker/L. Willard/J. Musich
LOGGED BY: G. Tripathi
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-84

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-4a

LOCATION: Approx. 100 feet SW of 30th St., Approx. 300 ft. SE of St. James St. N 1,953,475 E 6,164,953

SURFACE EL: 87.4 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
35		6 30"	250 psi	LEAN CLAY WITH SAND (CL), very stiff, gray, moist, low to medium plasticity (pp=3.5/2.75/3.0/3.5 tsf)						3.2 P	
30	55			LEAN CLAY (CL), stiff, brown, moist, low to medium plasticity							
25	60	7 30"	100 psi	--(pp=1.75/2.25/2.0 tsf) --lost drilling fluid at 62 1/2 feet (15 gallons)						2.0 P	
20	65										
15	70	8 18"	(27)	--very stiff							
10	75										
5	80	9 30"	150 psi	WELL-GRADED SAND WITH CLAY AND GRAVEL (SW-SC), yellowish brown, moist, subangular gravel up to 3/4 inch		16	10				
0	85			LEAN CLAY (CL), very stiff, brownish gray, moist, low to medium plasticity							
-5	90	10 26"	125 psi	--(pp=3.75/3.5/4.0 tsf)						3.8 P	
-10	95			--encountered gravel at 98 ft SILTY SAND WITH GRAVEL (SM), very dense,							

Continued

BORING DEPTH: 207.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 14, 2007
COMPLETION DATE: July 16, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, W. Baker/L. Willard/J. Musich
LOGGED BY: G. Tripathi
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-84

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: Approx. 100 feet SW of 30th St., Approx. 300 ft. SE of St. James St. N 1,953,475 E 6,164,953

SURFACE EL: 87.4 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			11 15"		(91)	brown, moist, medium grained sand							
-15													
	105					--lost drilling fluid at 104 feet (5 gallons)							
-20													
						--encountered clay lens, approximately 1 foot thick at 108 feet							
	110		12 12"		(92)	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), very dense, brown, moist, medium grained, subangular gravel up to 1 inch		8	6				
-25													
	115					--lost of drilling fluid at 116 feet (20 gallons)							
-30						LEAN CLAY (CL), very stiff, gray, moist, low plasticity							
	120		13 30"		125 psi								
-35						--(pp=3.25/3.0/3.25 tsf) --driller noticed sandy material at 124 ft						3.2 P	
	125					SANDY LEAN CLAY (CL)/CLAYEY SAND (SC), hard, gray, moist, medium grained sand							
-40													
	130		14 12"		(49)	--(OXY=20.9%, CH4=0 ppm, PID=0 ppm)		21	56				Hydrometer Test
-45						--Ended drilling on 7/14/07 at 131 1/2 ft --Began drilling on 7/15/07 at 131 1/2 ft.							
	135												
-50						WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), very dense, dark brown, moist, medium grained, subangular gravel up to 1 inch							
	140		15 8"		(77/6")			16	12				
-55						LEAN CLAY WITH SAND (CL), light brown, moist							
	145					--trace organic materials from circulation at 147 ft							
-60													

Continued

BORING DEPTH: 207.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 14, 2007
COMPLETION DATE: July 16, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, W. Baker/L. Willard/J. Musich
LOGGED BY: G. Tripathi
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-84

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-4c

LOCATION: Approx. 100 feet SW of 30th St., Approx. 300 ft. SE of St. James St. N 1,953,475 E 6,164,953

SURFACE EL: 87.4 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			16 30"		125 psi	--very stiff, light brown, moist, low plasticity (pp=3.0/3.25/3.0/3.5 tsf)							
-65												3.2 P	
	155		17 30"		100 psi	--brown (pp=3.25/3.5/3.25 tsf)							
-70							112	19		29	12	3.3 P	
	160		18 21"		100 psi	--(pp=2.0/2.0/2.25/2.0 tsf)							
-75												2.1 P	
						LEAN CLAY (CL)/FAT CLAY (CH), hard, brownish gray, moist							
	165		19 30"		150 psi								
-80						--(pp=>4.5/>4.5/>4.5 tsf)		29		49	22	>4.5 P	
						LEAN CLAY (CL), very stiff, yellowish brown, moist							
	170		20 30"		160 psi								
-85						--(pp=2.5/2.5/2.75 tsf)						2.6 P	
						LEAN CLAY (CL)/SILT (ML), very stiff, gray, moist, low plasticity (pp=3.5/3.75/3.5/3.75 tsf)							
	175		21 30"		125 psi								
-90							101	26		36	12	3.6 P	
	180		22 30"		120 psi	LEAN CLAY (CL), very stiff, brown, moist, medium plasticity (pp=3.5/4.0/4.0/4.5 tsf)							
-95												4.0 P	
	185		23 30"		120 psi	--hard (pp=4.0/4.25/4.25/4.0 tsf)							
-100						--Ended drilling on 7/15/07 at 187 1/2 ft. --Began drilling on 7/16/07 at 187 1/2 ft.						4.2 P	
	190		24 30"		150 psi								
-105						--very stiff, brown, low plasticity (pp=2.0/2.25/2.0 tsf) (OXY=20.9%, CH4=0 ppm, PID=0 ppm)		21		30	12	2.1 P	
	195		25 30"		290 psi	--hard, brown, some coarse grained sand and fine gravel (pp=>4.5/>4.5/>4.5 tsf)							
-110												>4.5 P	

Continued

BORING DEPTH: 207.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 14, 2007
COMPLETION DATE: July 16, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, W. Baker/L. Willard/J. Musich
LOGGED BY: G. Tripathi
CHECKED BY: F. Wang

NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-84

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: Approx. 100 feet SW of 30th St., Approx. 300 ft. SE of St. James St. N 1,953,475 E 6,164,953

SURFACE EL: 87.4 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		▨	26 15"		(87)	FAT CLAY (CH), hard, brown, moist, medium to high plasticity							
-115		▨											
	205	▨	27 31"		190 psi	--very stiff, trace gravel (pp=3.5/3.25/3.5/3.5 tsf)							
-120								22		57	32	3.4 P	
	210												
-125													
	215												
-130													
	220												
-135													
	225												
-140													
	230												
-145													
	235												
-150													
	240												
-155													
	245												
-160													

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BORING DEPTH: 207.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 14, 2007
COMPLETION DATE: July 16, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, W. Baker/L. Willard/J. Musich
LOGGED BY: G. Tripathi
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-84

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-4e

LOCATION: Approx. 550 ft. SE of St. James St. and approx. 300 ft. SW of 30th St. N 1,953,155 E 6,164,854

SURFACE EL: 89.2 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						4 1/2 to 6 inches of ASPHALT CONCRETE							
			1 15"		(12)	POORLY GRADED GRAVEL WITH CLAY AND SAND (GP-GC), loose, gray, dry, coarse grained sand (FILL)							
85	5					LEAN CLAY (CL), medium, yellowish brown, moist, low plasticity							
80						--Began rotary wash, set casing to 8 1/2 ft.							
	10		2 30"		50 psi								
						--(pp=0.5/0.75/1.0 tsf, tv=0.35/0.3/0.4 tsf)						0.8 P 0.7 T	
75	15												
70	20		3 32"		100 psi								
						--stiff, yellowish brown, moist, medium plasticity (pp=1.5/1.0/1.0 tsf, tv=0.35/0.4/0.4 tsf)						1.2 P 0.8 T	
65	25					--(OVM=0 ppm, OXY=20.9%, CH4=0 ppm)							
						--Per driller, the hole had taken approximately 30 more gallons than normal with one sack of drilling mud. Polymer was added at 30 ft.							
60	30		4 32"		150 psi								
						--grayish brown (pp=1.5/1.25/1.0 tsf, tv=0.35/0.35/0.4 tsf)						1.3 P 0.7 T	
55	35												
						FAT CLAY (CH), stiff, dark gray, moist, medium to high plasticity							
50	40		5 26"		180 psi								
						--(pp=1.75/2.0/1.5 tsf, tv=0.4/0.5/0.55 tsf)						1.8 P 1.0 T	
45	45												
						LEAN CLAY (CL), very stiff, gray, moist							
40													

Continued

BORING DEPTH: 202.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 8, 2007
COMPLETION DATE: July 10, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-85

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-5a

LOCATION: Approx. 550 ft. SE of St. James St. and approx. 300 ft. SW of 30th St. N 1,953,155 E 6,164,854

SURFACE EL: 89.2 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			6 28"		200 psi	--(pp=2.5/2.75/2.25 tsf)	103	24		43	24	2.5 P	
-35	55												
-30	60		7 33"		200 psi	--brown, low plasticity (pp=2.25/2.5/2.5 tsf)						2.4 P	
-25	65		8 18"		(19)	--stiff, gray, moist, low plasticity							
-20	70		9 18"		(32)	--very stiff, grayish brown, medium plasticity							
-15	75		10 16"		(32)								
-10	80		11 16"		(58)	--hard							
-5	85		12 12"		(91)	WELL-GRADED SAND WITH CLAY AND GRAVEL (SW-SC), very dense, light brown, wet, coarse grained gravel up to 2 inches		10	8				
						LEAN CLAY (CL), very stiff, brownish gray, moist, medium plasticity							
0	90		13 28"			--(pp=4.0/3.5/4.0 tsf)						3.8 P	
-5	95												
-10						SANDY SILT (ML), gray, moist, fine to medium grained sand							

Continued

BORING DEPTH: 202.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 8, 2007
COMPLETION DATE: July 10, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-85

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: Approx. 550 ft. SE of St. James St. and approx. 300 ft. SW of 30th St. N 1,953,155 E 6,164,854

SURFACE EL: 89.2 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		14 33"		--(OVM=1.2 ppm, OXY=20.9%, CH4=0 ppm)	104	20	59				Hydrometer Test
-15	105			SILTY GRAVEL WITH SAND (GM), very dense, brown, wet, coarse grained gravel up to 1 1/2 inches							
-20	110	15 15"	(109)	--Ended drilling on 7/8/07 at 111 1/2 ft. --Began drilling on 7/9/07 at 109 ft (Hole caved in about 2 1/2 feet) Additional drilling mud (1/4 sack) and 10 gallons of water was added.							
-25	115										
				POORLY-GRADED SAND WITH CLAY AND GRAVEL (SP-SC), very dense, brown, wet, dense, coarse grained							
-30	120	16 15"	(81)			11	8				
-35	125										
				SANDY LEAN CLAY (CL), hard, gray, moist, medium plasticity							
-40	130	17 18"	(53)								
-45	135										
-50	140	18 18"	(74)								
-55	145										
-60											

Continued

BORING DEPTH: 202.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 8, 2007
COMPLETION DATE: July 10, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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LOG OF BORING NO. BH-85

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-5c

LOCATION: Approx. 550 ft. SE of St. James St. and approx. 300 ft. SW of 30th St. N 1,953,155 E 6,164,854

SURFACE EL: 89.2 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			19 18"		(46)	--brown, moist, low plasticity		23		29	9		
-65	155		20 15"		(76/9")	--medium plasticity							
-70	160		21 18"		(73)								
-75	165		22 33"			FAT CLAY (CH), hard, brown, moist, medium to high plasticity --(pp=>4.5/>4.5/>4.5 tsf) (OVM=0 ppm, OXY=20.9%, CH4=0 ppm)	99	26		53	26	>4.5 P	
-80	170		23 4.5"			LEAN CLAY (CL), yellowish brown --(poor recovery, slough)							
-85	175		24 33"			--hard, low plasticity (pp=>4.5/>4.5/>4.5 tsf) --Ended drilling on 7/9/07 at 177 1/2 ft. --Began drilling on 7/10/07 at 177 1/2 ft.						>4.5 P	
-90	180		25 32"			--very stiff, brown (pp=3.75/4.0/4.25 tsf)						4.0 P	
-95	185		26 28"			FAT CLAY (CH), hard, brown, moist, medium to high plasticity (pp=4.25/4.25/3.75 tsf)						4.1 P	
-100	190		27 26"			SANDY LEAN CLAY (CL), hard, gray, moist, fine to medium grained sand (pp=>4.5/>4.5/>4.5 tsf)	113	17	60	27	9	>4.5 P	Hydrometer Test
-105	195		28 27"			FAT CLAY (CH), hard, gray, moist, medium to high plasticity (pp=>4.5 tsf)						>4.5 P	
-110						LEAN CLAY WITH SAND (CL), hard, yellowish							

Continued

BORING DEPTH: 202.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 8, 2007
COMPLETION DATE: July 10, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-85

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-5d

LOCATION: Approx. 550 ft. SE of St. James St. and approx. 300 ft. SW of 30th St. N 1,953,155 E 6,164,854

SURFACE EL: 89.2 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		▨	29 33"	▨		brown, moist, fine to medium grained sand (pp=>4.5 tsf)						>4.5 P	
-115	205												
-120	210												
-125	215												
-130	220												
-135	225												
-140	230												
-145	235												
-150	240												
-155	245												
-160													

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BORING DEPTH: 202.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 8, 2007
COMPLETION DATE: July 10, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

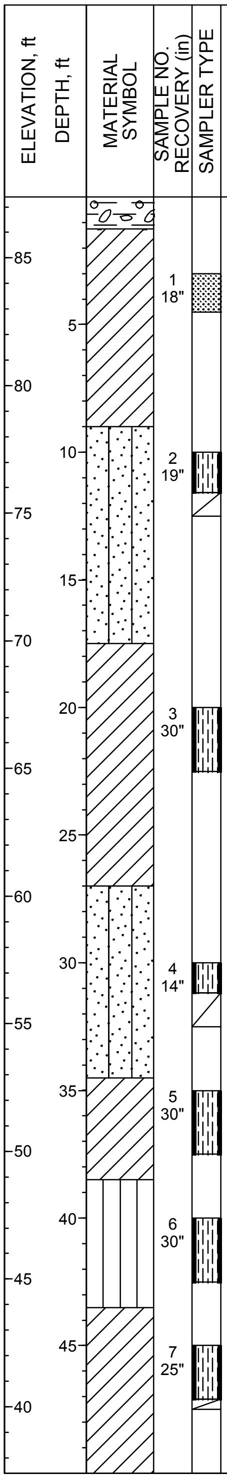
LOG OF BORING NO. BH-85

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-5e

LOCATION: Median of Santa Clara St., approx. 50 ft. E of 16th St. N 1,950,479 E 6,161,946

SURFACE EL: 87.4 ft (1988 NAVD datum)



SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		8 inches of ASPHALT CONCRETE over 8 inches of CONCRETE							
1 18"	(11)	LEAN CLAY (CL), medium, brown, dry, low plasticity, trace fine-grained sand (OXY=20.9%, CH4=0 ppm, PID=0 ppm) --Began rotary wash, set casing to 8 1/2 ft							
2 19"	50 psi 100 psi	SILTY SAND (SM), brown, moist, poorly-graded, fine grained sand --lost drilling fluid at 10 1/2 feet (20 gallons)							
3 30"		LEAN CLAY (CL), medium, brown, moist, low plasticity (pushing pressure was not recorded) --(pp=0.5/0.75/0.5 tsf, tv=0.25 tsf)						0.6 P 0.5 T	
4 14"	100 psi	SILTY SAND (SM), dark brown, moist, fine grained							
5 30"	75 psi	LEAN CLAY (CL), soft, gray, moist, low plasticity (pp=0.25/0.5/0.5 tsf, tv=1.9 tsf)						0.4 P 0.9 T	
6 30"	75 psi	SANDY SILT (ML), stiff, dark brown, moist (pp=1.5/0.75/1.0/1.5 tsf, tv=0.38 tsf)						1.2 P 0.8 T	
7 25"	125 psi	LEAN CLAY (CL), stiff, gray, moist (pp=1.25/1.0/1.25 tsf, tv=0.38 tsf)						1.2 P 0.8 T	

Continued

BORING DEPTH: 201.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 17, 2007
COMPLETION DATE: July 20, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: F. Wang/G. Tripathi
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-87

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: Median of Santa Clara St., approx. 50 ft. E of 16th St. N 1,950,479 E 6,161,946

SURFACE EL: 87.4 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
35			8 28"		160 psi	--gray, medium plasticity (pp=1.75/1.5/1.5 tsf, tv=0.44 tsf)		29		46	22	1.6 P 0.9 T	
30	55		9 30"		200 psi	--(pp=1.25/1.75/1.50 tsf, tv=0.44 tsf)						1.5 P 0.9 T	
25	60		10 27"		200 psi	--(pp=1.75/2.5/1.75/2.0 tsf)		28		46	22	2.0 P	
	65		11 24"		350 psi								
20						SILTY SAND (SM), brown, moist							
	70		12 15"		(62)	WELL-GRADED GRAVEL WITH SAND (GW), dense, brown, moist, subrounded gravel up to 1 1/2 inches, medium grained --lost drilling fluid at 72 feet (40 to 50 gallons)		8	4				
15			13 15"		(74)	CLAYEY SAND WITH GRAVEL (SC), dense, yellowish brown, moist, fine-grained, subrounded gravel up to 1 inch							
	75		14 12"		(55)	SILTY SAND WITH GRAVEL (SM), dense, brown, moist							
10			15 6"		(52)	POORLY-GRADED GRAVEL WITH CLAY AND SAND (GP-GC), dense, brown, moist, medium grained gravel		11	7				
	80		16 12"		(32)								
5			17 15"		(22)	LEAN CLAY (CL), stiff, brown, moist, low plasticity --Ended drilling on 7/17/07 at 81 1/2 ft. --Began drilling on 7/18/07 at 81 1/2 ft.							
	85		18 18"		(87)	SILT (ML), stiff, gray, moist (OXY=20.9%, CH4=0 ppm, PID=0 ppm)		14	8				Hydrometer Test
0			19 15"		(84)	POORLY-GRADED SAND WITH SILT (SP-SM), very dense, yellowish brown, moist, medium grained, some gravel up to 1/2 inch							
	90		20 15"		(33)	SILTY SAND (SM), very dense, brown, moist, some gravel up to 3/4 inch							
-5						--medium dense, fine-grained, no gravel --lost drilling fluid at 93 feet (10 gallons)							
	95		21 12"		(61/6")	POORLY-GRADED GRAVEL WITH CLAY AND SAND (GP-GC), very dense, yellowish brown, moist, subrounded gravel up to 3/4 inch							
-10						--rig chatter and lost drilling fluid at 99 feet (15							

Continued

BORING DEPTH: 201.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 17, 2007
COMPLETION DATE: July 20, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: F. Wang/G. Tripathi
CHECKED BY: F. Wang

NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-87

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-6b

LOCATION: Median of Santa Clara St., approx. 50 ft. E of 16th St. N 1,950,479 E 6,161,946

SURFACE EL: 87.4 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			22 11.25		(53)	gallons)							
-15						SILTY SAND WITH GRAVEL (SM), dense, yellowish brown, moist							
	105		23 30"		240 psi	LEAN CLAY (CL), very stiff, yellowish brown, moist, low plasticity							
-20						--(pp=2.5/3.0/3.25/3.0 tsf)						2.9 P	
	110		24 30"		200 psi	--(pp=2.5/2.75/2.5 tsf)							
-25												2.6 P	
	115		25 30"		350 psi	SILTY SAND (SM), brownish gray, moist							
-30													
						--lost drilling fluid at 119 feet (10 gallons)							
	120		26 15"		(108)	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), very dense, yellowish brown, moist, subangular gravel up to 1 inch, medium grained		8	6				
-35						--lost drilling fluid at 121 feet (10 gallons)							
	125		27 15"		(102)	--coarse grained							
-40						SILTY CLAY (CL-ML), hard, brown, moist, low plasticity							
	130		28 30"		250 psi								
-45						--(pp=3.5/4.0/4.0/4.25 tsf) --Ended drilling on 7/18/07 at 132 1/2 ft.						3.9 P	
						--Began drilling on 7/19/07 at 132 1/2 ft.							
	135		29 19"		450 psi	CLAYEY GRAVEL WITH SAND (GC), light gray, moist, gravel up to 3/4 inch							
-50								9	13				Hydrometer Test
	140		30 15"		(98)	SILTY SAND (SM), very dense, brown, moist, fine-grained sand, subrounded gravel up to 1 inch, lost drilling fluid at 141 ft. (15 gallons) (OXY=20.9%, CH4=0 ppm, PID=0 ppm)							
-55													
	145		31 18"		(47)	SILT (ML), hard, light brown, moist, low plasticity							
-60													

Continued

BORING DEPTH: 201.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 17, 2007
COMPLETION DATE: July 20, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: F. Wang/G. Tripathi
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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LOG OF BORING NO. BH-87

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-6c

Project No. 213213

Sheet 4 of 5

LOCATION: Median of Santa Clara St., approx. 50 ft. E of 16th St. N 1,950,479 E 6,161,946

SURFACE EL: 87.4 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
-65		32 30"	375 psi	--very stiff, brown (pp=3.25/3.0/3.25/3.5 tsf)						3.3 P	
-70	155	33 12"	250 psi	SILTY SAND (SM), dense, yellowish brown, moist, fine-grained	92	16	24				Hydrometer Test
-75	160	34 12"	(REF/5")	SILTY SAND WITH GRAVEL (SM), very dense, yellowish brown, moist, medium-grained, subrounded gravel up to 2 inches --lost drilling fluid at 163 feet (15 gallons)							
-80	165	35 13"	(REF/6")	--coarse-grained, subrounded gravel up to 1 inch							
-85	170	36 12"	(62/6")	POORLY-GRADED GRAVEL WITH SILT AND SAND (GP-GM), very dense, yellowish brown, moist, gravel up to 1 inch (OXY=20.9%, CH4=0 ppm, PID=0 ppm) --Ended drilling on 7/19/07 at 171 ft. --Began drilling on 7/20/07 at 171 ft.							
-90	175	37 12"	(108/11")	--fine-grained, some subrounded gravel --added cement (Type II-V)							
-95	180	38 12"	(56/6")	POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM), yellowish brown, moist, coarse-grained, subrounded and subangular gravel up to 1 inch		9	6				Hydrometer Test
-100	185	39 16"	400 psi	ELASTIC SILT (MH)/FAT CLAY (CH), very stiff, brown, moist, high plasticity (pp=3.5/3.25/3.5 tsf)		35		56	25	3.4 P	
-105	190	40 0"	(50)	LEAN CLAY (CL), very stiff (No Recovery, Classification per driller)							
-110	195										

Continued

BORING DEPTH: 201.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 17, 2007
COMPLETION DATE: July 20, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: F. Wang/G. Tripathi
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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LOG OF BORING NO. BH-87

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-6d

LOCATION: Median of Santa Clara St., approx. 50 ft. E of 16th St. N 1,950,479 E 6,161,946

SURFACE EL: 87.4 ft (1988 NAVD datum)

ELEVATION, ft / DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
	▨	41 18"	▩	(77)	--hard. yellowish brown, moist							
-115												
205												
-120												
210												
-125												
215												
-130												
220												
-135												
225												
-140												
230												
-145												
235												
-150												
240												
-155												
245												
-160												

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BORING DEPTH: 201.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 17, 2007
COMPLETION DATE: July 20, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: F. Wang/G. Tripathi
CHECKED BY: F. Wang

NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-87

Silicon Valley Rapid Transit Project
San Jose, California

Sheet 1 of 3

LOCATION: Approx. 170 ft NW of Santa Clara St, 65 ft NE of N. 17th St (within SJ Water lot) N 1,950,798 E 6,162,147

SURFACE EL: 94.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		1 15"		(12)	SILT (ML), medium, brown, moist, low plasticity, trace fine grained gravel and sand							
90	5	2 29"		800 psi	SANDY SILT (ML), brown, moist, low plasticity							
85	10	3 20"		1500 psi	--stiff, increasing sand at the bottom of the sample (pp=1.25/1.75/1.25 tsf)						1.4 P	
80	15	4 4"		23	POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM), medium dense, brown, subangular gravel up to 1 inch (from the slough)							
75	20	5 22"		1000 psi	LEAN CLAY (CL), very stiff, yellowish brown, moist, low plasticity (pp=2.25/1.75/2.0 tsf, tv=1.0 tsf)						2.0 P 2.0 T	
70	25	6 30"		300 psi	--stiff, yellowish brown, wet (pp=1.5/1.25/1.25 tsf, tv=0.6 tsf) (OVM=0.001 ppm, OXY=20.9%, CH4=0 ppm)						1.3 P 1.2 T	
65	30	7 9"	GB		SILT (ML), yellowish brown, moist			90	29	5		Hydrometer Test
60	35	8 22" 9 16"	GB GB		SILTY CLAY (CL-ML), brown, moist, low plasticity, subangular gravel up to 1 inch							
55	40	10 17" 11 16"	GB GB		LEAN CLAY (CL), yellowish brown, moist, low plasticity		25		34	16		
50		12 20"	GB		--gray							
	45	13 0"			SILTY SAND (SM), no recovery from Geo-Barrel (classification per drilling and soil cuttings)							
45		14 24" 15	GB GB		SILTY CLAY (CL-ML), dark brown, wet, low plasticity							

Continued

BORING DEPTH: 112.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 18, 2007
COMPLETION DATE: June 18, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Fraste XL
DRILLED BY: Pitcher Drilling, R. Medina/A. Bazan
LOGGED BY: G. Tripathi
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-88

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-7a

LOCATION: Approx. 170 ft NW of Santa Clara St, 65 ft NE of N. 17th St (within SJ Water lot) N 1,950,798 E 6,162,147

SURFACE EL: 94.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		19"	GB		LEAN CLAY (CL), gray, moist, medium plasticity							
		16 24"	GB									
40		17 24"	GB		SILT (ML), gray, moist							
	55	18 22"	GB		LEAN CLAY (CL), gray, moist							
		19 24"	GB									
35	60	20 30"	GB									
30		21 30"	GB		SILT (ML), gray, moist, low plasticity --stiff, gray							
	65	22 35"	GB		--yellowish brown --Ended drilling on 6/18/07 at 68 ft							
25		23 12"	GB		--Began drilling on 6/19/07 at 68 ft			100	40	13		Hydrometer test
	70	24 14"	GB		--dark brown (OVM=0 ppm, OXY=20.9%, CH4=0 ppm)							
		25 17"	GB		POORLY-GRADED GRAVEL WITH SILT AND SAND (GP-GM), brown			11	NP	NP		Hydrometer test
20		26 0"			WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), brown, medium grained, subrounded gravel up to 1 inch							
	75	27 24"	GB		--no recovery from Geo-Barrel							
15		28 0"			--no recovery from Geo-Barrel							
	80	29 13"	GB		--subangular and subrounded gravel up to 1 inch							
		30 18"	GB		--gravel up to 3 inches			7				
10		31 8"	GB		POORLY-GRADED GRAVEL WITH SAND (GP), gray, moist, angular gravel up to 2 inches							
	85	32 15"	GB		--lost drilling fluid at 85.0 feet							
		33 24"	GB		LEAN CLAY WITH GRAVEL (CL), yellowish brown, low plasticity, trace fine gravels							
5	90	34 27"	GB		--greenish brown, increasing plasticity (OVM=0.1 ppm, OXY=20.8%, CH4=0 ppm)							
		35 7"	GB		--increasing sand							
0		36 18"		(80)	SANDY LEAN CLAY (CL), stiff, yellowish brown, moist, fine to medium grained sand							
	95	37 6"	GB		WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM), gray, subangular gravel up to 2 inches			5				Hydrometer test
		38 17"	GB		--very dense, medium grained, trace medium angular gravel							
		39 9"	GB									
-5		40 11"			SILTY SAND WITH GRAVEL (SM), brown, moist,							

Continued

BORING DEPTH: 112.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 18, 2007
COMPLETION DATE: June 18, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Fraste XL
DRILLED BY: Pitcher Drilling, R. Medina/A. Bazan
LOGGED BY: G. Tripathi
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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LOG OF BORING NO. BH-88

Silicon Valley Rapid Transit Project
San Jose, California

Sheet 3 of 3

LOCATION: Approx. 170 ft NW of Santa Clara St, 65 ft NE of N. 17th St (within SJ Water lot) N 1,950,798 E 6,162,147

SURFACE EL: 94.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		41 11"	GB		medium grained, gravel up to 2 inches --angular gravel up to 2 inches, lost drilling fluid at 97 feet							
		42 7"	GB		CLAYEY GRAVEL WITH SAND (GC), brown, moist, lost drilling fluid at 100 feet							
-10	105	43 6"	GB		WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), grayish brown, lost drilling fluid at 102 1/2 feet --gravel up to 3 inches --lost drilling fluid at 104 1/2 feet			7				
		44 9"	GB									
-15		45 20"	GB		SILT (ML), yellowish brown							
	110	46 18"	GB		SILTY SAND (SM), brown, wet, medium grained SILTY GRAVEL (GM), brown, wet, trace sand (OVM=1.2 ppm, OXY=16.7%, CH4=0 ppm)							
-20	115											
-25	120											
-30	125											
-35	130											
-40	135											
-45	140											
-50	145											
-55												

BORING DEPTH: 112.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 18, 2007
COMPLETION DATE: June 18, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Fraste XL
DRILLED BY: Pitcher Drilling, R. Medina/A. Bazan
LOGGED BY: G. Tripathi
CHECKED BY: F. Wang

NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-7c

LOCATION: SW side of N 3rd Street. Approx. 40 ft NW of Santa Clara St N 1,948,303 E 6,157,960

SURFACE EL: 82.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						5 inches of ASPHALT CONCRETE (core) (OXY=21.2%, CH4=2 ppm, PID=0.0005 ppm)							
80			1 14"		(11)	SANDY LEAN CLAY (CL), very stiff, brown, moist, some sand (pp=4.0/3.5/3.5 tsf)						3.7 P	
	5												
75						SILT (ML), medium, brown, very moist, low plasticity --Began rotary wash, set casing to 8 1/2 ft							
	10		2 27"		100 psi								
70						--(pp=0.5/0.5/0.5 tsf, tv=0.3/0.3/0.35 tsf)						0.5 P 0.6 T	
	15					LEAN CLAY (CL), stiff, brown, wet							
65													
	20		3 27"		50 psi								
60						--(pp=1.5/1.0/1.5 tsf, tv=0.5/0.45/0.4 tsf) (OXY=21.2%, PID=0.0005 ppm)		32		37	16	1.3 P 0.9 T	
	25					--color change from brown to gray at approximately 25 feet							
55													
	30		4 27"		50 psi								
50						SILT (ML), stiff, dark brown, moist, low plasticity (pp=1.5/1.5/1.25 tsf)						1.4 P	
	35												
45						SILTY SAND (SM), medium dense, yellowish brown, wet, fine to medium grained, large gravel at the bottom of the sampler							
	40		5 16"		(38)		106	23	47				Direct Shear
40													
	45												
35						--lost drilling fluid at 47 1/2 feet --gravelly drilling							
						WELL-GRADED GRAVEL WITH SILT AND SAND							

Continued

BORING DEPTH: 201.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 5, 2007
COMPLETION DATE: June 8, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: L Bhangoo/R Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-89

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-8a

LOCATION: SW side of N 3rd Street. Approx. 40 ft NW of Santa Clara St N 1,948,303 E 6,157,960

SURFACE EL: 82.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
30			6 10"		53	(GW-GM), very dense, brown, wet, fine to coarse grained sand			9				
25 20	55 60					SILTY CLAYEY SAND (SC-SM), gray (no sample was taken at 60 feet due to caving from 57 feet to 65 feet)							
15	65		7 22"		180 psi	SILT (ML), very stiff, dark brown, moist (sample obtained from second attempt) (pp=3.25/3.25/3.5 tsf, tv=0.5/0.5/0.5 tsf)						3.3 P 1.0 T	
10	70 75		8 28"		225 psi	--light brown/yellowish brown, wet (pp=3.5/3.75/3.5 tsf, tv=0.5/0.45/0.45 tsf)						3.6 P 0.9 T	
5 0	80		9 10"		(100)	POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM), very dense, yellowish brown, wet, some subangular gravel up to 1 1/2 inches (OXY=21.2%, PID=0.0005 ppm)		11	7				Hydrometer Test
-5 -10 -15	85 90 95		10 10"		(91)	--gravel up to 1 inch --Ended drilling on 6/15/07 at 91 1/2 ft. --Began drilling on 6/16/07 at 91 1/2 ft.							
						SANDY SILT (ML), hard, gray, wet (OXY=20.9%,							

Continued

BORING DEPTH: 201.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 5, 2007
COMPLETION DATE: June 8, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: L Bhangoo/R Vedantham
CHECKED BY: F. Wang

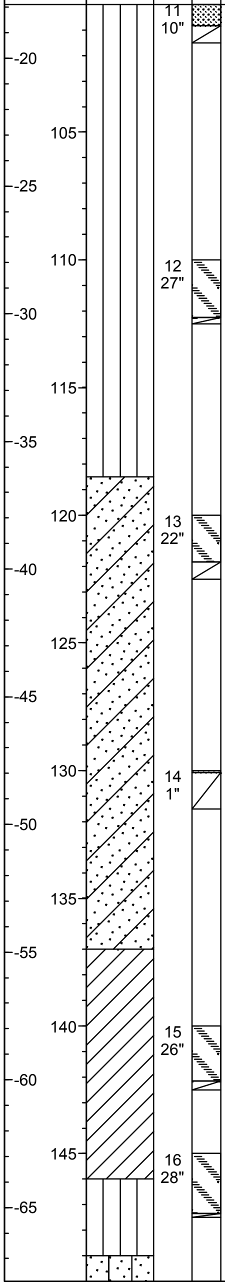
NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-89

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: SW side of N 3rd Street. Approx. 40 ft NW of Santa Clara St N 1,948,303 E 6,157,960

SURFACE EL: 82.1 ft (1988 NAVD datum)



SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
11 10"	(59)	LEL=0%, PID=0 ppm)							
12 27"		--(pp=>4.5/>4.5/>4.5 tsf, tv=0.45/0.45/0.40 tsf)						>4.5 P 0.7 T	
		--some gravel							
		CLAYEY SAND WITH GRAVEL (SC), brown, moist, some subrounded gravel up to 1 inch (OXY=20.9%, LEL=0%, PID=0 ppm)							
13 22"									
14 1"	(62)	--dense, gray (mostly slough in sampler)							
		SANDY LEAN CLAY (CL), very stiff, yellowish brown, wet							
15 26"		--(pp=2.5/3.0/2.5 tsf, tv=0.25/0.30/0.25 tsf) (OXY=20.9%, LEL=0%, PID=0 ppm)						2.7 P 0.5 T	
16 28"									
		SILT WITH SAND (ML), yellowish brown, wet, fine grained sand		20	79				Hydrometer Test
		SILTY SAND (SM), yellowish brown, fine to medium							

Continued

BORING DEPTH: 201.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 5, 2007
COMPLETION DATE: June 8, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: L Bhangoo/R Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-89

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: SW side of N 3rd Street. Approx. 40 ft NW of Santa Clara St N 1,948,303 E 6,157,960

SURFACE EL: 82.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
-70			17 12"			grained sand --Ended drilling on 6/6/07 at 152 1/2 ft. --Began drilling on 6/7/07 at 152 1/2 ft.							
-75	155		18 16"		(83)	LEAN CLAY (CL), very stiff, light gray, wet, low plasticity							
-80	160		19 18"		(49)	SANDY LEAN CLAY (CL), hard, gray (OXY=20.9%, LEL=0%, PID=0 ppm)		19	67				Hydrometer Test
-85	165		20 16"			SANDY SILT (ML), hard, gray, wet (pp=>4.5/>4.5/>4.5 tsf, tv=0.45/0.40/0.40 tsf)						>4.5 P 0.8 T	
-90	170		21 28"			--subrounded gravel up to 1/2 inch	108	21	53				
-95	175		22 16"		(67)	LEAN CLAY (CL), hard, gray, wet, low plasticity							
-100	180		23 16"		(44)	SANDY LEAN CLAY (CL), very stiff, light brown, wet (OXY=20.9%, LEL=0%, PID=0 ppm)							
-105	185		24 2"			--yellowish brown, moist CLAYEY SAND (SC), gravel up to 3/4 inch in cuttings, lost drilling fluid at 186 feet							
-110	190		25 14"		(46)	LEAN CLAY (CL), very stiff, gray, wet, medium plasticity --Ended drilling on 6/7/07 at 191 1/2 ft. --Began drilling on 6/8/07 at 191 1/2 ft.		25	98	49	24		Hydrometer Test
-115	195		26 14"		(62)	SILTY SAND (SM), dense, gray, wet							

Continued

BORING DEPTH: 201.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 5, 2007
COMPLETION DATE: June 8, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: L Bhangoo/R Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-89

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: SW side of N 3rd Street. Approx. 40 ft NW of Santa Clara St N 1,948,303 E 6,157,960

SURFACE EL: 82.1 ft (1988 NAVD datum)

ELEVATION, ft DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		27 16"		(64)	--dense							
-120												
205												
-125												
210												
-130												
215												
-135												
220												
-140												
225												
-145												
230												
-150												
235												
-155												
240												
-160												
245												
-165												

BORING DEPTH: 201.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 5, 2007
COMPLETION DATE: June 8, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: L Bhangoo/R Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-89

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-8e

Project No. 213213

Sheet 1 of 5

LOCATION: At the median of Santa Clara St., approximately 80 feet E of 1st St. N 1,947,935 E 6,157,496

SURFACE EL: 86.8 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						6 inches of ASPHALT CONCRETE							
85						old concrete and wood pieces (FILL)							
			1 15"		(14)	SANDY LEAN CLAY (CL), stiff, yellowish brown, moist, low plasticity							
	5												
			2 15"		(15)								
80						--(OXY=20.9%, CH4=2 ppm, OVM=0 ppm)							
	10		3 15"		(8)								
						--medium							
75													
						SANDY SILT (ML), medium, brown, moist							
	15		4 25"		300 psi								
70						--(pp=0.75/0.5/0.75 tsf, tv=0.15/0.15 tsf)						0.7 P 0.3 T	
						LEAN CLAY (CL), medium, gray, moist, medium plasticity (pp=0.5/0.75/0.5 tsf, tv=0.25/0.23/0.25 tsf)							
	20		5 26"		50 psi							0.6 P 0.5 T	
65													
			6 16"		8	FAT CLAY (CH), medium, dark gray, moist, medium plasticity							
	25		7 24"		200 psi	LEAN CLAY (CL), stiff, light grayish brown, moist (pp=1.5/1.5/1.5 tsf, tv=0.35/0.4/0.35 tsf)							
60													
			8 17"		18							1.5 P 0.7 T	
						--very stiff, brown		23	89	36	14		
	30		9 28.5"		150 psi	SILTY SAND (SM), yellowish brown, moist, fine-grained							
55													
			10 16"		13								
						SANDY SILT (ML), stiff, brown, moist		28	70	NP	NP		
	35		11 9"		125 psi	SILTY SAND (SM), brown, moist, fine to medium grained							
50													
			12 18"		4	LEAN CLAY (CL), soft, dark gray, moist, low plasticity		28	81	30	8		
	40		13 18"		0								
						FAT CLAY (CH), very soft, dark gray, moist, high plasticity, some organics							
45													
			14 30"		100 psi	SANDY SILT (ML), gray, moist							
	45		15 18"		8			22					
						LEAN CLAY WITH SAND (CL), medium, gray, moist, some organics		24	70	26	8		
40													
			16 18"		12	--stiff, brown							

Continued

BORING DEPTH: 211.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 12, 2007
COMPLETION DATE: June 15, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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LOG OF BORING NO. BH-90

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-9a

LOCATION: At the median of Santa Clara St., approximately 80 feet E of 1st St. N 1,947,935 E 6,157,496

SURFACE EL: 86.8 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		17 30"	250 psi	SANDY SILT (ML), very stiff, brown, moist, low plasticity (pp=2.75/3.5/3.75 tsf)							
35										3.3 P	
		18 18"	22	SILTY CLAY WITH SAND (CL-ML), very stiff, brown, moist, low to medium plasticity							
		19 18"	400 psi			29	78	28	6		
	55			--Ended drilling on 6/12/07 at 54 feet --Began drilling on 6/13/07 at 54 feet							
										2.6 P	
30		20 18"	22	SANDY LEAN CLAY (CL), very stiff, gray, wet, medium plasticity (pp=2.5/2.75/2.5 tsf)		22	65	34	19		
	60	21 26.5"	50 psi	LEAN CLAY (CL), medium, grayish brown, wet (pp=0.75/1.0/1.25 tsf, tv=0.35/0.3/0.33 tsf)							
25										1.0 P 0.7 T	
	65			--with sand							
20											
	70	22 34"	125 psi								
15				--very stiff (pp=1.75/2.25/2.5 tsf)						2.2 P	
	75										
10				SILTY GRAVEL WITH SAND (GM), dense, brown, wet, gravel up to 2 inches							
	80	23 16"	(72)								
5											
	85										
0											
	90	24 18"	(89)								
-5				--very dense							
	95										
-10				LEAN CLAY WITH GRAVEL (CL), very stiff, light gray, wet, low plasticity, gravel up to 1 1/2 in.							

Continued

BORING DEPTH: 211.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 12, 2007
COMPLETION DATE: June 15, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-90

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: At the median of Santa Clara St.,
approximately 80 feet E of 1st St. N 1,947,935
E 6,157,496

SURFACE EL: 86.8 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			25 16"		(28)								
-15													
	105												
-20													
	110		26 34"		250 psi	--very stiff, brown, moist (pp=3.75/4.0/4.25 tsf)							
-25												4.0 P	
	115												
-30						SILTY SAND WITH GRAVEL (SM), very dense, yellowish brown, wet, coarse grained gravel up to 1 1/4 inches							
	120		27 12"		(99)								
-35													
	125					LEAN CLAY (CL), very stiff, gray, wet, low plasticity							
-40													
	130		28 18"		(69)								
-45													
	135												
-50						SILT WITH SAND (ML), hard, gray, wet, fine-grained, low plasticity							
	140		29 30"		375 psi								
-55						--(pp=3.75/4.0/4.5 tsf)						4.1 P	
	145												
-60													

Continued

BORING DEPTH: 211.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 12, 2007
COMPLETION DATE: June 15, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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LOG OF BORING NO. BH-90

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-9c

LOCATION: At the median of Santa Clara St., approximately 80 feet E of 1st St. N 1,947,935 E 6,157,496

SURFACE EL: 86.8 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
-65			30	18"		(33)	--very stiff		21	47				Hydrometer Test
							--Ended drilling on 6/13/07 at 151 1/2 ft.							
							--Began drilling on 6/14/07 at 151 1/2 ft.							
	155		31	33"			LEAN CLAY (CL), hard, gray, wet, low plasticity, trace gravel							
-70							--(pp=>4.5/>4.5/4.0 tsf)						>4.5 P	
	160		32	30"			LEAN CLAY WITH SAND (CL), hard, gray, moist, low plasticity							
-75							--(pp=>4.5/>4.5/>4.5 tsf)	105	22	73			>4.5 P	Hydrometer Test
	165		33	18"		(68)	SILTY SAND (SM), dense, gray, moist, fine grained							
-80														
	170		34	18"		(54)	LEAN CLAY (CL), hard, brown, moist, medium plasticity							
-85														
	175		35	33"			--hard, light brown (pp=>4.5/>4.5/>4.5 tsf) (OXY=20.9%, CH4=0 ppm, OVM=0 ppm)							
-90													>4.5 P	
	180		36	14"			SANDY LEAN CLAY WITH GRAVEL (CL), medium, yellowish brown, moist, medium to coarse grained sand, low plasticity (disturbed) (pp=0.5 tsf)							
-95									26	63			0.5 P	
	185		37	8"		(98/10")	--increasing plasticity (rock at bottom of sample)							
-100									28	70				Hydrometer Test
	190		38	15"		(101/10")	SILT WITH SAND (ML), hard, brown, moist, fine to medium grained sand							
-105							SANDY SILT (ML), hard, dark gray, wet, low plasticity							
	195		39	33"										
-110							--(pp=>4.5/>4.5/>4.5 tsf)	105	21	66			>4.5 P	Hydrometer Test

Continued

BORING DEPTH: 211.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 12, 2007
COMPLETION DATE: June 15, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-90

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: At the median of Santa Clara St., approximately 80 feet E of 1st St. N 1,947,935 E 6,157,496

SURFACE EL: 86.8 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			40 27"			--hard, gray, medium grained sand (pp=4.0/4.25/>4.5 tsf) (OXY=20.9%, CH4=1 ppm, OVM=0 ppm)							
-115												4.3 P	
	205		41 18"		(59)								
-120						LEAN CLAY (CL), hard, gray, wet, medium plasticity							
						SILT (ML), hard, brown, wet, low plasticity							
	210		42 18"		(87)								
-125							110	19					
	215												
-130													
	220												
-135													
	225												
-140													
	230												
-145													
	235												
-150													
	240												
-155													
	245												
-160													

BORING DEPTH: 211.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 12, 2007
COMPLETION DATE: June 15, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

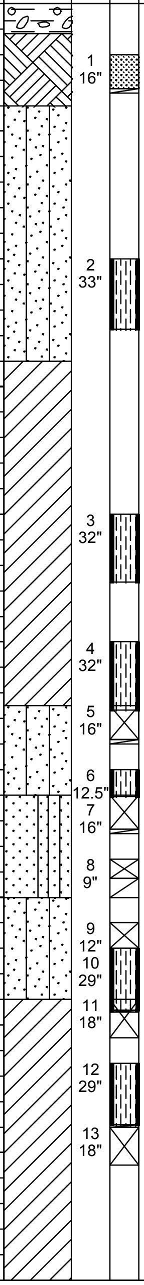
LOG OF BORING NO. BH-90

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-9e

LOCATION: Median of Santa Clara St., approx. 130 ft. NE of Market St. N 1,947,710 E 6,157,099

SURFACE EL: 88.3 ft (1988 NAVD datum)



ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
				8 inches of ASPHALT CONCRETE over 6 inches of CONCRETE							
85		1 16"	(12)	LEAN CLAY WITH GRAVEL (CL), medium, brown, moist, low plasticity, trace broken asphalt concrete pieces (FILL)							
	5			SILTY SAND (SM), dark brown, moist, fine grained							
80				--Began rotary wash, set casing to 8 1/2 ft.							
	10	2 33"	150 psi	--(OVM=0 ppm, OXY=20.9%, CH4=1 ppm)							
75											
	15			LEAN CLAY WITH SAND (CL), medium, black, moist, low to medium plasticity							
70											
	20	3 32"									
65				--(pp=0.5/0.75/0.5 tsf, tv=0.35/0.35/0.3 tsf) (downward pressure was not recorded)		38		45	20	0.6 P 0.3 T	
	25	4 32"	200 psi	--stiff, light brownish gray (pp=2.0/1.5/2.0 tsf, tv=0.45/0.55/0.55 tsf)							
60		5 16"	23	SILTY SAND (SM), medium dense, grayish brown, moist, fine to medium grained sand				NP	NP	1.8 P 1.0 T	
						24	37	NP	NP		
	30	6 12.5"		--wet, medium to coarse grained sand							
		7 16"	23	POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM), medium dense, greenish black, moist, fine to medium grained sand		24	35	NP	NP		
						17	9	NP	NP		
55		8 9"	20	--wet, coarse grained sand							
	35	9 12"		SILTY SAND (SM), brown, wet, fine to medium grained, trace organic material							
50		10 29"	100 psi	(Sample No. 9 was advanced only 12 inches by 4 blows with SPT sampler. See bottom of the boring for more detail.)							
	40	11 18"	23				82	33	12		
		12 29"		LEAN CLAY (CL), very stiff, gray, wet, medium plasticity, some medium-grained sand							
45		13 18"	16	--stiff, (pp=1.25/1.5/1.75 tsf, tv=0.3/0.1/0.45 tsf)						1.5 P 0.6 T	
	45			--very stiff, moist, trace, organic materials			75	32	14		Hydrometer Test
40											

Continued

BORING DEPTH: 196.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 19, 2007
COMPLETION DATE: June 22, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-91

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-10a

LOCATION: Median of Santa Clara St., approx. 130 ft. NE of Market St. N 1,947,710 E 6,157,099

SURFACE EL: 88.3 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			14 7"		350 psi	SILTY SAND (SM), gray, wet, fine to medium grained							
35						LEAN CLAY (CL), stiff, light gray, moist, medium plasticity							
	55												
30													
	60		15 18"		11								
25													
	65												
20													
	70		16 34"		225 psi								
						--(pp=1.75/2.0/1.75 tsf, tv=0.4/0.45/0.6 tsf)	104	22				1.8 P 1.0 T	
15													
						--increasing gravel at 74 1/2 ft							
	75					CLAYEY GRAVEL (GC), very dense, brownish gray, moist, coarse-grained sand							
10													
	80		17 16"		55								
5													
	85												
						--lost drilling fluid at 86 feet							
0													
	90		18 15"		60								
						--brown, gravel up to 1/2 inch							
-5						--Ended drilling on 6/19/07 at 91 1/2 ft.							
						--Began drilling on 6/20/07 at 91 1/2 ft.							
	95												
-10													
						LEAN CLAY (CL), stiff, light gray, moist, low							

Continued

BORING DEPTH: 196.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 19, 2007
COMPLETION DATE: June 22, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-91

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-10b

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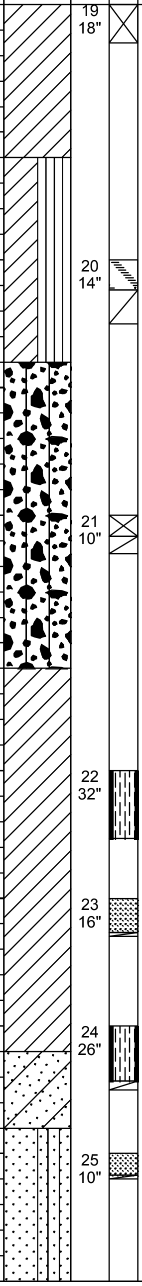
LOCATION: Median of Santa Clara St., approx. 130 ft. NE of Market St. N 1,947,710 E 6,157,099

SURFACE EL: 88.3 ft (1988 NAVD datum)



ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		19 18"	21	plasticity							
-15											
	105			--minor gravel lens encountered from 105 feet to 106 feet depth							
				SILTY CLAY (CL-ML), very stiff, yellowish brown, moist, low plasticity							
-20	110	20 14"									
				--(pp=2.0/3.5/3.5 tsf, tv=0.35 tsf)	101	24				3.0 P 0.7 T	
-25	115			SILTY GRAVEL WITH SAND (GM), very dense, brown, wet, medium to coarse grained sand							
-30	120	21 10"	71								
-35	125			LEAN CLAY (CL), hard, yellowish brown, moist, low plasticity							
-40	130	22 32"	400 psi								
				--(pp=4.0/3.5/4.5 tsf)						4.0 P	
-45	135	23 16"	(46)	--light brown							
-50	140	24 26"	400 psi								
				CLAYEY SAND WITH GRAVEL (SC), brown, wet, coarse-grained sand		15	39				Hydrometer Test
-55	145	25 10"	(68/6")	POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM), very dense, brown, wet, gravel up to 1 inch		12	8				
-60											

Continued

BORING DEPTH: 196.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 19, 2007
COMPLETION DATE: June 22, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-91

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: Median of Santa Clara St., approx.
130 ft. NE of Market St. N 1,947,710 E
6,157,099

SURFACE EL: 88.3 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			26 10"		(74/6")	--Ended drilling on 6/20/07 at 151 1/2 ft. --Began drilling on 6/21/07 at 151 1/2 ft.							
-65						SILTY SAND (SM), very dense, reddish brown, moist, fine to medium grained							
	155		27 12"		(113)			19	15				Hydrometer Test
-70						LEAN CLAY WITH SAND (CL), yellowish brown, moist							
	160		28 5"			--lost drilling fluid at 163 1/2 feet							
-75						POORLY-GRADED GRAVEL WITH SILT AND SAND (GP-GM), very dense, brown, wet, coarse grained							
	165		29 9"		(62/6")								
-80													
	170		30 10"		(65/6")	--gravel up to 1 inch							
-85						--lost drilling fluid at 173 feet --very dense, gravel up to 1 1/2 inches							
	175		31 12"		(116)			11	9				
						LEAN CLAY (CL), very stiff, light brownish gray, moist, low plasticity							
-90													
	180		32 20"		400 psi			28	99				Hydrometer Test
-95						--Ended drilling on 6/21/07 at 182 1/2 ft. --Began drilling on 6/22/07 at 182 1/2 ft.							
	185		33 12"		(43)	--greenish gray							
-100													
	190		34 10"		(68/4")	POORLY GRADED GRAVEL WITH CLAY AND SAND (GP-GC), very dense, gray, moist, gravel up to 2 inches							
-105													
	195		35 12"		(93/6")			9	7				
-110						Note: Sample No. 9 was advanced with SPT sampler for 12 inches. The sampler was then retrieved and Shelby Sampler was used according							

Continued

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BORING DEPTH: 196.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 19, 2007
COMPLETION DATE: June 22, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-91

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: Median of Santa Clara St., approx. 130 ft. NE of Market St. N 1,947,710 E 6,157,099

SURFACE EL: 88.3 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						to the sampling schedule per Kleinfelder.							
-115													
	205												
-120													
	210												
-125													
	215												
-130													
	220												
-135													
	225												
-140													
	230												
-145													
	235												
-150													
	240												
-155													
	245												
-160													

SVRT BORING LOG 011108 Z:\TUGENERAL\USERS\JAIN_A\GINT\SVRT_PHASE 2_050208.GPJ TEST LIBRARY-DOWNTOWN_PARIKH_01_02_08.GLB 5/5/08 09:49 a

BORING DEPTH: 196.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 19, 2007
COMPLETION DATE: June 22, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-91

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-10e

Sheet 1 of 5

LOCATION: Approx. 370 ft. S of Santa Clara St. and approx. 100 ft. W of Montgomery St. N 1,945,972 E 6,154,178

SURFACE EL: 81.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
				6 inches of ASPHALT CONCRETE							
80		1 15"	(15)	LEAN CLAY WITH GRAVEL (CL), stiff, dark brown, moist, low plasticity (FILL)							
75	5			SILT (ML), very stiff, brown, moist, low plasticity							
				--Began rotary wash, set casing to 8 1/2 ft							
70	10	2 33"	200 psi	--(pp=2.0/2.5/2.0 tsf, tv=0.4/0.45/0.375 tsf) (OVM=0 ppm, OXY=21%, CH4=2 ppm)						2.1 P 0.9 T	
65	15										
60	20	3 32"	125 psi	LEAN CLAY (CL), stiff, brown, moist, low plasticity (pp=2.0/1.75/2.0 tsf, tv=0.35/0.4/0.45 tsf)						1.9 P 0.8 T	
55	25										
50	30	4 33"	225 psi	--yellowish brown, low plasticity (pp=1.75/2.0/1.75 tsf, tv=0.4/0.38/0.35 tsf)						1.8 P 0.8 T	
45	35										
40	40	5 12"	(58)	WELL-GRADED GRAVEL WITH SILT AND SAND (GM), dense, brown, wet, coarse grained gravel							
35	45			SILTY CLAY (CL-ML), very stiff, gray, moist, low plasticity							

Continued

BORING DEPTH: 211.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 25, 2007
COMPLETION DATE: June 27, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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LOG OF BORING NO. BH-93

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-11a

LOCATION: Approx. 370 ft. S of Santa Clara St. and approx. 100 ft. W of Montgomery St. N 1,945,972 E 6,154,178

SURFACE EL: 81.1 ft (1988 NAVD datum)

DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
	6 33"	300 psi	--very stiff, increasing sand (pp=2.0/2.25/1.75 tsf, tv=0.4/0.45/0.4 tsf)	105	21		28	5	2.0 P 0.8 T	
60	7 33"	225 psi	--yellowish brown (pp=2.25/2.0/2.25 tsf)						2.2 P	
			WELL-GRADED SAND WITH GRAVEL (SW), dense, brown, moist, coarse grained gravel up to 2 inches							
70	8 10"	(68)								
75			LEAN CLAY (CL), very stiff, dark gray, moist, trace fine grained sand, low plasticity							
80	9 33"	225 psi	--(pp=2.25/2.0/2.25 tsf) (OVM=0 ppm, OXY=21.5%, CH4=1 ppm)						2.2 P	
90	10 15"	(42)								
			POORLY-GRADED SAND WITH SILT (SP-SM), reddish brown, moist, medium grained sand							

Continued

BORING DEPTH: 211.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 25, 2007
COMPLETION DATE: June 27, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-93

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-11b

LOCATION: Approx. 370 ft. S of Santa Clara St. and approx. 100 ft. W of Montgomery St. N 1,945,972 E 6,154,178

SURFACE EL: 81.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			11 16"		(76)								
-20						--very dense		19	11				Hydrometer Test
	105												
-25						SILTY CLAY (CL-ML)							
	110		12 15"		(103)	SILTY SAND WITH GRAVEL (SM), very dense, light brown, moist, coarse grained sand							
-30													
	115												
-35													
						LEAN CLAY (CL), very stiff, dark gray, moist, low plasticity							
	120		13 32"		250 psi								
-40													
						--(pp=2.25/2.5/2.25 tsf)	102	24				2.3 P	
	125												
-45													
						SILTY SAND WITH GRAVEL (SM), dense, gray, moist							
	130		14 16"		(53)								
-50						LEAN CLAY (CL), hard, grayish brown, moist, low plasticity							
	135												
-55													
	140		15 18"		(56)								
-60													
	145												
-65													

Continued

BORING DEPTH: 211.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 25, 2007
COMPLETION DATE: June 27, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-93

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-11c

SVRT BORING LOG 011108 Z:\TUGENERAL\USERS\JAIN_A\GINT\SVRT_PHASE 2_050208.GPJ TEST LIBRARY-DOWNTOWN_PARIKH_01_02_08.GLB 5/5/08 09:50 a

LOCATION: Approx. 370 ft. S of Santa Clara St. and approx. 100 ft. W of Montgomery St. N 1,945,972 E 6,154,178

SURFACE EL: 81.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft
-70	
	155
-75	
	160
-80	
	165
-85	
	170
-90	
	175
-95	
	180
-100	
	185
-105	
	190
-110	
	195
-115	

SAMPLE NO.	RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
16	18"	(60)							
17	10"	(99/12")							
18	15"	(72)							
19	18"	(52)		23	83	30	9		Hydrometer Test
20	18"	(31)							
21	13"	450 psi						>4.5 P	
22	15"	(102)		20	6				Hydrometer Test
23	16"	(101)							
24	18"	(45)		18	54				Hydrometer Test
25	15"	(70/6")							
26	6"	(REF/4 1/2")		8	6				
27	10"	(92/6")							
28	10"	(74/6")							
29	15"	(130)							
30	10"	(87/7")		10	6				
31	15"	(78)							
32	18"	(67)							
33	30"	400 psi	98	26					
34	18"	(56)							
35	17"	400 psi							
36	17"	(124)							
37	18"	(100)							
38	15"	(114/9")							

MATERIAL DESCRIPTION

SILTY CLAY (CL-ML), hard, yellowish brown, moist

--Ended drilling on 6/25/07 at 151 1/2 ft.
--Began drilling on 6/26/07 at 70 ft. (hole caved in overnight)

WELL-GRADED SAND WITH GRAVEL (SW), dense, brown, wet, coarse grained gravel up to 2 inches

SILTY SAND (SM), dense, light brown, wet, medium grained

LEAN CLAY WITH SAND (CL), hard, light brown, moist, medium plasticity

LEAN CLAY (CL), very stiff, gray, moist, medium plasticity
--hard, grayish brown, trace, fine grained sand (pp>4.5tsf)

POORLY-GRADED SAND WITH SILT (SP-SM), very dense, grayish brown, moist, fine to medium grained

LEAN CLAY WITH GRAVEL (CL), very stiff, grayish brown, moist, low plasticity, gravel up to 1/2 inch

POORLY-GRADED GRAVEL WITH SILT AND SAND (GP-GM), very dense, brown, wet, coarse grained gravel up to 1 1/2 inches
--gravel up to 2 inches

SILTY SAND (SM), very dense, brown, wet

POORLY-GRADED GRAVEL WITH CLAY AND SAND (GP-GC), very dense, brown, moist, gravel up to 2 inches

POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), very dense, brown, moist

SILT (ML), hard, yellowish brown, moist, fine grained sand

LEAN CLAY (CL), very stiff, yellowish brown, moist, low plasticity

--Ended drilling on 6/26/07 at 190 ft.
--Began drilling on 6/27/07 at 190 ft.
--hard, grayish brown, trace, coarse grained sand (OVM=0 ppm, OXY=22.2%, CH4=1 ppm)

SILTY SAND (SM), very dense, reddish brown, moist, fine grained

LEAN CLAY (CL), hard, reddish brown, wet

Continued

BORING DEPTH: 211.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 25, 2007
COMPLETION DATE: June 27, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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LOG OF BORING NO. BH-93

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: Approx. 370 ft. S of Santa Clara St. and
approx. 100 ft. W of Montgomery St. N
1,945,972 E 6,154,178

SURFACE EL: 81.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
-120		▥				SILT WITH SAND (ML), hard, grayish brown, wet, medium to coarse grained sand and subangular to subrounded gravel		27	75	35	9		Hydrometer Test
	205	▥											
-125		▥				--interbedded clay/sand to 207 feet							
		●				POORLY-GRADED GRAVEL (GP), gravel lens from 207 feet to 209 feet							
	210	▨	39 18"	▒	(87)	LEAN CLAY (CL), hard, reddish brown, moist, medium plasticity, trace sand							
-130													
	215												
-135													
	220												
-140													
	225												
-145													
	230												
-150													
	235												
-155													
	240												
-160													
	245												
-165													

BORING DEPTH: 211.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 25, 2007
COMPLETION DATE: June 27, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-93

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-11e

LOCATION: Approx. 350 ft SE of Lenzen Ave. Approx. 75 ft SW of Stockton Ave. N 1,947,990 E 6,152,019

SURFACE EL: 83.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
				4 1/4 inches of ASPHALT CONCRETE							
80		1 16"	(7)	LEAN CLAY (CL), medium, yellowish brown, moist, medium plasticity							
75	5	2 30"	225 psi	--stiff, light brown, low plasticity (pp=1.75/1.75/1.75 tsf, tv=0.35/0.35/0.35 tsf) (OXY=20.9%, CH4=0 ppm, OVM=0 ppm) --Began rotary wash, set casing to 8 1/2 ft						1.8 P 0.7 T	
70	10	3 30"	100 psi	SILTY CLAY (CL-ML), stiff, brown, moist, low plasticity (pp=1.75/1.75/1.75 tsf, tv=0.35 tsf)						1.8 P 0.8 T	
65	15	4 29"	100 psi	LEAN CLAY (CL), medium, dark brown, moist (pp=0.5/0.75/0.5 tsf)						0.6 P	
	20	5 32"	125 psi	ORGANIC SILT (MH)/FAT CLAY (CH), medium, grayish brown, moist, medium plasticity (pp=0.5/0.75/1.0 tsf, tv=0.4 tsf)							
60		6 30"	150 psi	LEAN CLAY (CL), medium, brown, moist, low to medium plasticity (pp=1.0/0.75/0.75 tsf, tv=0.5 tsf)		40		55	25	0.8 P 0.8 T	
	25	7 29"	125 psi	--stiff (pp=1.25/1.5/1.0 tsf, tv=0.4 tsf)						0.8 P 1.0 T	
55		8 29"	125 psi	--medium, low plasticity (pp=0.5/0.75/0.5 tsf, tv=0.35 tsf)						1.3 P 0.8 T	
	30	9 25"	375 psi							0.6 P 0.7 T	
50		10 15"	(3)	SILTY SAND (SM), grayish brown, moist, medium to coarse grained, lost drilling fluid at 31 feet (10 gallons)	104	23	39				
	35	11 12"	(67)	SANDY SILT WITH GRAVEL (ML), very soft, dark brown, moist, fine grained sand, lost drilling fluid at 33 feet (10 gallons)							
45		12 15"	(79)	WELL-GRADED GRAVEL WITH SAND (GW), dense, gray, wet, coarse grained gravel up to 2 inches		8	5				
	40	13 0"	(13)								
40		14	(16)	POORLY-GRADED GRAVEL WITH SILT AND SAND (GP-GM), very dense, gray, wet, coarse grained gravel							
		15 18"	150 psi								
	45	16 15"	(22)	SILTY CLAY (CL-ML), stiff, gray, moist, low to medium plasticity (disturbed sample obtained on second attempt)		30		38	15	1.9 P 0.9 T	
35		17 16"	(24)	--low plasticity (pp=1.75/2.0/2.0 tsf, tv=0.45 tsf)							

Continued

BORING DEPTH: 101.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 23, 2007
COMPLETION DATE: July 24, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: G. Tripathi/R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-95

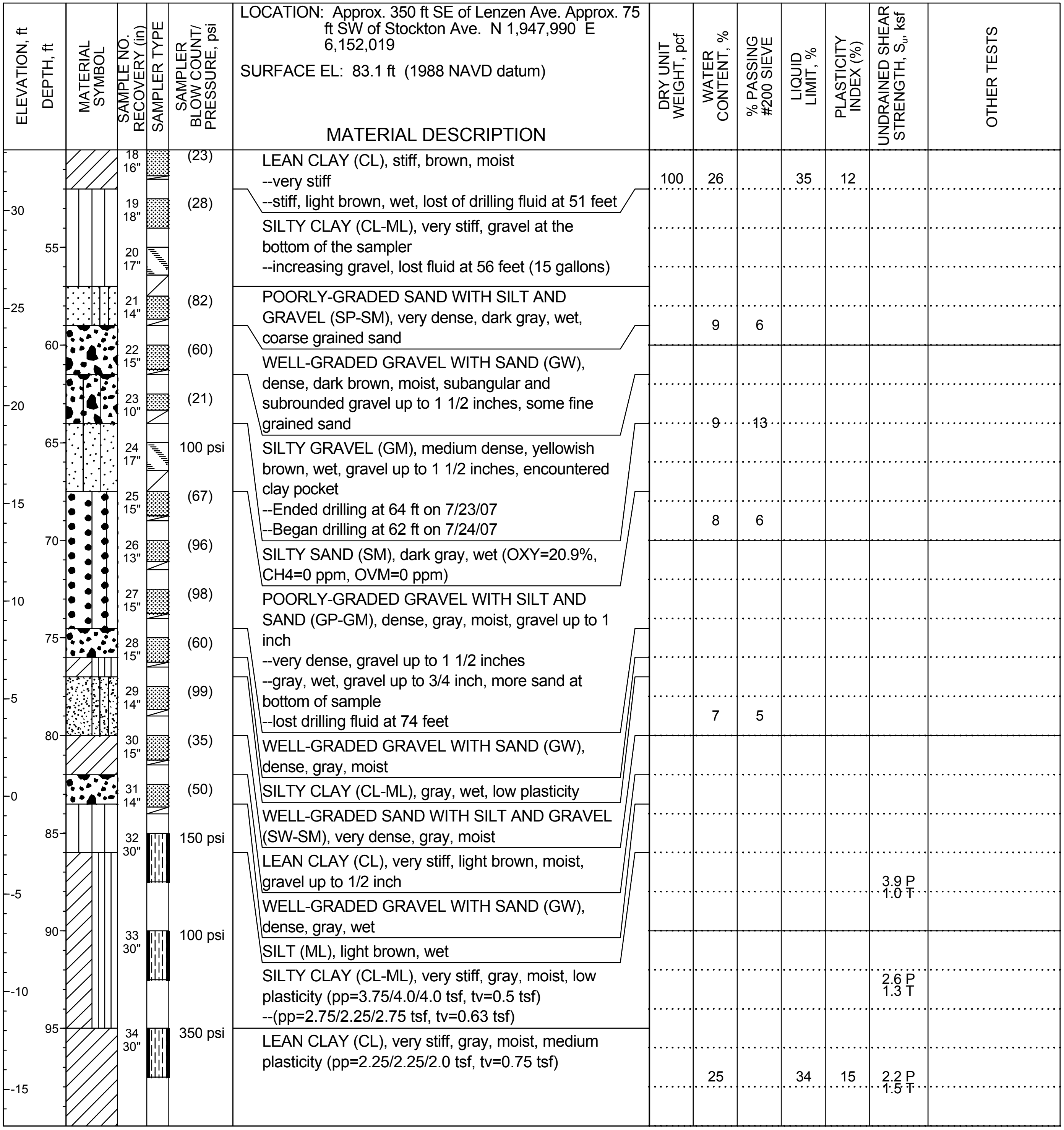
Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-12a

Sheet 2 of 3

LOCATION: Approx. 350 ft SE of Lenzen Ave. Approx. 75 ft SW of Stockton Ave. N 1,947,990 E 6,152,019

SURFACE EL: 83.1 ft (1988 NAVD datum)



SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
18 16"	(23)	100	26		35	12		
19 18"	(28)							
20 17"								
21 14"	(82)		9	6				
22 15"	(60)							
23 10"	(21)		9	13				
24 17"	100 psi							
25 15"	(67)		8	6				
26 13"	(96)							
27 15"	(98)							
28 15"	(60)							
29 14"	(99)		7	5				
30 15"	(35)							
31 14"	(50)							
32 30"	150 psi						3.9 P 1.0 T	
33 30"	100 psi						2.6 P 1.3 T	
34 30"	350 psi		25		34	15	2.2 P 1.5 T	

MATERIAL DESCRIPTION

LEAN CLAY (CL), stiff, brown, moist
--very stiff
--stiff, light brown, wet, lost of drilling fluid at 51 feet

SILTY CLAY (CL-ML), very stiff, gravel at the bottom of the sampler
--increasing gravel, lost fluid at 56 feet (15 gallons)

POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM), very dense, dark gray, wet, coarse grained sand

WELL-GRADED GRAVEL WITH SAND (GW), dense, dark brown, moist, subangular and subrounded gravel up to 1 1/2 inches, some fine grained sand

SILTY GRAVEL (GM), medium dense, yellowish brown, wet, gravel up to 1 1/2 inches, encountered clay pocket
--Ended drilling at 64 ft on 7/23/07
--Began drilling at 62 ft on 7/24/07

SILTY SAND (SM), dark gray, wet (OXY=20.9%, CH4=0 ppm, OVM=0 ppm)

POORLY-GRADED GRAVEL WITH SILT AND SAND (GP-GM), dense, gray, moist, gravel up to 1 inch
--very dense, gravel up to 1 1/2 inches
--gray, wet, gravel up to 3/4 inch, more sand at bottom of sample
--lost drilling fluid at 74 feet

WELL-GRADED GRAVEL WITH SAND (GW), dense, gray, moist

SILTY CLAY (CL-ML), gray, wet, low plasticity

WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), very dense, gray, moist

LEAN CLAY (CL), very stiff, light brown, moist, gravel up to 1/2 inch

WELL-GRADED GRAVEL WITH SAND (GW), dense, gray, wet

SILT (ML), light brown, wet

SILTY CLAY (CL-ML), very stiff, gray, moist, low plasticity (pp=3.75/4.0/4.0 tsf, tv=0.5 tsf)
--(pp=2.75/2.25/2.75 tsf, tv=0.63 tsf)

LEAN CLAY (CL), very stiff, gray, moist, medium plasticity (pp=2.25/2.25/2.0 tsf, tv=0.75 tsf)

Continued

BORING DEPTH: 101.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 23, 2007
COMPLETION DATE: July 24, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: G. Tripathi/R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-12b

LOCATION: Approx. 350 ft SE of Lenzen Ave. Approx. 75 ft SW of Stockton Ave. N 1,947,990 E 6,152,019

SURFACE EL: 83.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		▨	35 18"	▒	(43)	--light brown (OXY=20.9%, CH4=0 ppm, OVM=0 ppm)	105	23					
-20													
	105												
-25													
	110												
-30													
	115												
-35													
	120												
-40													
	125												
-45													
	130												
-50													
	135												
-55													
	140												
-60													
	145												
-65													

BORING DEPTH: 101.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 23, 2007
COMPLETION DATE: July 24, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: G. Tripathi/R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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San Jose, California

FIGURE A-12c

Sheet 1 of 2

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	LOCATION: Approx. 550 ft SW of Stockton Ave., Approx. 110 ft NW of Newhall St. N 1,952,134 E 6,147,865 SURFACE EL: 67.5 ft (1988 NAVD datum) MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						CLAYEY GRAVEL (GC), loose, dark gray, moist							
65			1 14"		(16)								
						SANDY LEAN CLAY (CL), stiff, black, moist, trace gravel							
	5		2 23"		250 psi								
						LEAN CLAY (CL), very stiff, dark brown, moist (pp=2.5/2.5/2.5 tsf, tv=0.55/0.5/0.5 tsf)							
60												2.5 P 1.0 T	
						--Began rotary wash at 7 1/2 feet, set casing at 8 1/2 ft							
	10		3 12"		(9)	SANDY LEAN CLAY (CL), medium, dark brown, moist							
55						FAT CLAY (CH), stiff, yellowish brown, moist, medium to high plasticity							
	15		4 24"		100 psi								
50						--(pp=1.5/1.75/1.5 tsf, tv=0.55/0.5/0.5 tsf)	78	43	99	62	32	1.6 P 1.0 T	Hydrometer Test
						LEAN CLAY (CL), medium, dark brown, moist (OXY=20.9% CH4=2.0 ppm, OVM=0 ppm)							
	20		5 16"		(9)								
45						WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM), dense, brown, wet, medium to coarse grained gravel to 1 inch							
	25		6 16"		(45)								
40													
						SANDY SILT (ML), stiff, gray, moist, low plasticity							
	30		7 15"		(19)								
35													
						SANDY LEAN CLAY (CL), very stiff, light brown, wet							
	35		8 28"		100 psi								
30					300 psi	--(pp=3.5/4.0/3.5 tsf, tv=0.45/0.5/0.5 tsf)						3.7 P 1.0 T	
						SILTY SAND (SM), dense, light brown, moist, fine to medium grained sand, some gravel up to 1 inch							
	40		9 14"		(54)								
25													
						SILT (ML), very stiff, grayish yellow, moist,							
	45		10 26"		150 psi								
20						--(pp=2.5/2.5/3.0 tsf, tv=0.30/0.35/0.30 tsf)		30				2.7 P 0.6 T	#200 wash
						POORLY-GRADED SAND WITH SILT AND							

Continued

BORING DEPTH: 91.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 11, 2007
COMPLETION DATE: June 11, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: L Bhangoo/R Vedamtham
CHECKED BY: F. Wang

NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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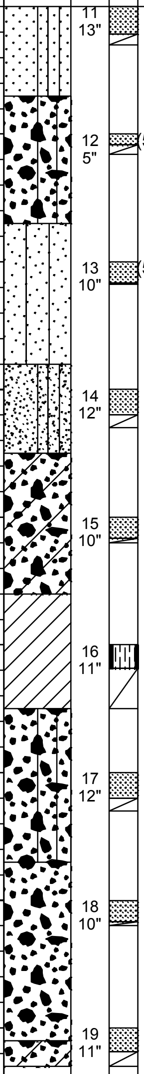
Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-13a

LOCATION: Approx. 550 ft SW of Stockton Ave., Approx. 110 ft NW of Newhall St. N 1,952,134 E 6,147,865

SURFACE EL: 67.5 ft (1988 NAVD datum)



ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		11 13"	(86)	GRAVEL (SP-SM), very dense, grayish brown, moist, coarse grained sand, gravel up to 3/4 inch		10	7				
15											
	55	12 5"	(52/4 1/2")	WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM), very dense, gray, moist to wet, gravel up to 1 inch							
10											
	60	13 10"	(50/4 1/2")	SILTY SAND WITH GRAVEL (SM), very dense, brown, wet, medium to coarse grained sand							
5											
	65	14 12"	(79)	WELL-GRADED SAND WITH SILT (SW-SM), very dense, gray, moist, subangular gravel in the slough up to 2 1/2 inches							
0				CLAYEY GRAVEL WITH SAND (GC), very dense, gray, moist, coarse grained gravel up to 1 inch							
	70	15 10"	(66/6")			14	24				
-5				SANDY LEAN CLAY (CL), stiff, yellowish brown, wet, fine grained sand, low plasticity (pp=1.5/1.25/1.75 tsf, tv=0.65/0.95/0.95 tsf)							
	75	16 11"	350 psi							1.5 P 1.7 T	
-10				WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM), very dense, brown, moist, coarse grained gravel 1/2 inch to 2 inches							
	80	17 12"	(83)								
-15				WELL-GRADED GRAVEL (GW), very dense, gray, wet, coarse grained gravel from 1/2 inch to 2 inches							
	85	18 10"	(63/6")			6	1				
-20											
	90	19 11"	(21)	CLAYEY GRAVEL (GC), medium dense, gray, moist (OXY=20.9%, CH4=0 ppm, OVM=0 ppm)							
-25											
	95										
-30											

BORING DEPTH: 91.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 11, 2007
COMPLETION DATE: June 11, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: L Bhangoo/R Vedamtham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-13b

Sheet 1 of 2

LOCATION: Approx. 550 ft SW of Stockton Ave. Approx. 400 ft NW of Newhall St. N 1,952,314 E 6,147,638

SURFACE EL: 66.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
65			1	6"		(14)	SANDY SILT WITH GRAVEL (ML), stiff, brown, moist, coarse grained sand							
60	5		2	10"		225 psi	LEAN CLAY (CL), stiff, grayish brown, moist, low plasticity (pp=1.5/1.75/2.0 tsf, tv=0.6/0.45/0.4 tsf) (OXY=21%, CH4=0 ppm, OVM=0 ppm) --Began rotary wash, set casing to 8 1/2 ft						1.8 P 1.0 T	
55	10		3	13"		(7)	ELASTIC SILT (MH), medium, dark mottled bluish brown, moist, medium to high plasticity	86	36		60	27		
50	15		4	30"		125 psi	SILTY CLAY (CL-ML), stiff, grayish brown, moist, medium plasticity (pp=1.5/2.0/1.75 tsf, tv=0.3/0.4/0.35 tsf)						1.8 P 0.7 T	
45	20		5	15"		(5)	LEAN CLAY (CL), soft, light gray, moist							
40	25		6	26"		100 psi	--medium, dark brown, low plasticity (pp=0.5/1.0/0.75 tsf, tv=0.2/0.35/0.3 tsf)						0.8 P 0.6 T	
35	30		7	16"		(8)	SILTY CLAY (CL-ML), medium, gray, moist, low plasticity							
30	35		8	32"		200 psi	SANDY SILT (ML), gray, moist, fine grained sand		22	51				Hydrometer Test
25	40		9	15"		(70)	SILTY SAND (SM), very dense, light brown and gray, moist, fine to medium grained	105	22	21				Hydrometer Test
							SILTY CLAYEY GRAVEL (GC), medium dense, coarse grained --lost drilling fluid at 45 feet (30 gallons)							
20	45		10	12"		(25)	LEAN CLAY (CL), very stiff, yellowish brown, moist		31	90				Hydrometer Test
							SILTY CLAY (CL-ML), very stiff, grayish brown,							

Continued

BORING DEPTH: 61.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 3, 2007
COMPLETION DATE: July 3, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-14a

Sheet 2 of 2

LOCATION: Approx. 550 ft SW of Stockton Ave. Approx. 400 ft NW of Newhall St. N 1,952,314 E 6,147,638

SURFACE EL: 66.1 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
15			11 32"		200 psi	moist, low plasticity --(pp=2.5/2.0/2.25 tsf)						2.3 P	
10	55		12 17"		(25)	SILT (ML), very stiff, light brown, moist, low plasticity		34		39	9		
5	60		13 15"		(102)	WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM), very dense, brown, moist, coarse grained gravel up to 1 1/2 inches							
0	65												
-5	70												
-10	75												
-15	80												
-20	85												
-25	90												
-30	95												

BORING DEPTH: 61.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 3, 2007
COMPLETION DATE: July 3, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-14b

Sheet 1 of 2

LOCATION: Approx. 600 ft SW of Stockton Ave. Approx. 500 ft NW of Newhall St. N 1,952,365 E 6,147,458

SURFACE EL: 66.5 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
65			1 16"		(22)	FAT CLAY WITH SAND (CH), stiff, black, dry to moist, medium to high plasticity, trace fine grained sand (OXY=21.8%, PID=0 ppm)							
60	5		2 32"		150 psi	LEAN CLAY (CL), stiff, grayish black, moist, medium plasticity (pp=1.5/1.5/0.5 tsf, tv=0.5/0.7/0.7 tsf)						1.3 P 1.3 T	
						--Began rotary wash, set casing at 8 1/2 ft							
55	10		3 12"		(9)	--medium, dark gray							
50	15		4 28"		125 psi	SILT (ML), stiff, gray, moist to wet, low plasticity, trace fine grained sand (pp=1.5/1.25/1.0 tsf, tv=0.2/0.3/0.35 tsf)						1.3 P 0.6 T	
45	20		5 18"		(8)	FAT CLAY (CH), medium, dark gray and black, moist, high plasticity --color changed to brown at 23 feet							
						LEAN CLAY (CL), medium to stiff, yellowish brown, wet, low plasticity							
40	25		6 29"		125 psi	--(pp=0.75/1.2/1.0 tsf, tv=0.5/0.35/0.65 tsf)						1.0 P 1.0 T	
35	30		7 18"		(0)	SANDY LEAN CLAY (CL), very soft, light gray, moist to wet		27	61	27	11		
						LEAN CLAY (CL), stiff, yellowish brown, moist							
30	35		8 29"		75 psi	--(pp=1.7/2.2/2.0 tsf, tv=0.5/0.45/0.5 tsf)						2.0 P 1.0 T	
25	40		9 18"		(8)	--medium, light gray, low to medium plasticity							
20	45		10 28"		190 psi	SILTY SAND (SM), gray, wet, fine to medium grained	107	20	27				Hydrometer Test

Continued

BORING DEPTH: 81.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 29, 2007
COMPLETION DATE: June 29, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: P. Chan
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-15a

Sheet 2 of 2

LOCATION: Approx. 600 ft SW of Stockton Ave. Approx. 500 ft NW of Newhall St. N 1,952,365 E 6,147,458

SURFACE EL: 66.5 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
15			11 18"		(21)	LEAN CLAY (CL), stiff, gray, wet						0.8 P	
10	55		12 31"		100 psi	SANDY LEAN CLAY (CL), very stiff, yellowish brown, moist, trace gravels --(pp=2.5/2.65/2.0 tsf, tv=0.7/0.65/0.7 tsf)		20	72			2.4 P 1.4 T	
5	60		13 12"		(58/6")	WELL-GRADED GRAVEL WITH SAND (GW), very dense, grayish brown, wet, subrounded gravel up to 1 1/2 inches							
0	65		14 16"		(112)	POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM), very dense, grayish brown, wet, subangular gravel up to 1 1/2 inches		10	5				Hydrometer Test
-5	70		15 16"		(67)	--dense, subangular gravel up to 1 inch							
-10	75		16 18"		(70)	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), dense, brownish gray, wet, subangular gravel up to 1 inch --lost drilling fluid at 76 feet		10	7				
-15	80		17 18"		(114)	--very dense							
-20	85												
-25	90												
-30	95												

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BORING DEPTH: 81.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 29, 2007
COMPLETION DATE: June 29, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: P. Chan
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-15b

LOCATION: Approx. 600 ft SW of Stockton Ave. Approx. 750 ft NW of Newhall St N 1,952,553 E 6,147,141

SURFACE EL: 65.8 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. / RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
65		1 15"	(19)	FAT CLAY (CH), stiff, dark mottled brown, moist, high plasticity							
60	5	2 28"	200 psi	--(pp=1.5/2.0/1.75 tsf, tv=0.4/0.35/0.45 tsf) (OXY=20.9%, CH4=0 ppm, OVM=0 ppm)						1.8 P 0.8 T	
				--Began rotary wash, set casing to 8 1/2 ft							
55	10	3 15"	(7)	LEAN CLAY (CL), medium, grayish brown, moist, medium plasticity							
50	15	4 30"	125 psi								
45	20	5 16"	(10)	--gray							
				SILTY CLAY (CL-ML), very stiff, gray, moist, low plasticity (pp=2.5/3.25/3.5 tsf)							
40	25	6 33"	150 psi		105	22		27	7	3.1 P	
35	30	7 16"	(54)	POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM), dense, brown, moist, coarse grained gravel up to 1 inch		11	8				
				CLAYEY SAND (SC), medium dense, grayish brown, moist, medium to coarse grained							
30	35	8 16"	(32)			20	45				Hydrometer Test
				POORLY-GRADED SAND WITH SILT (SP-SM), dense, grayish brown, moist, medium to coarse grained							
25	40	9 16"	(55)			10	11				Hydrometer Test
20	45										

BORING DEPTH: 41.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: July 3, 2007
COMPLETION DATE: July 3, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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San Jose, California

FIGURE A-16

LOCATION: Approx. 700 feet NW of Las Plumas Ave., 10 feet NE of UPRR tracks N 1,956,655 E 6,162,937

SURFACE EL: 90.8 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
90				Cored through 8 inches of ballast (OXY=20.9%, CH4=110 ppm, PID=0 ppm)							
		1 16"	(30)	CLAYEY SAND WITH GRAVEL (SC), medium dense, brown, moist, some angular gravel up to 1 inch							
85	5	2 12"	(9)	POORLY-GRADED GRAVEL WITH SILT AND SAND (GP-GM), loose, gray, moist, some angular gravel up to 1 1/2 to 2 inches		8	5				
80	10	3 27"	150 psi	SILT (ML), medium, brown, moist, trace sand (pp=0.5/0.5/0.75 tsf, tv=0.2 tsf) --Began rotary wash, set casing to 8 1/2 ft						0.6 P 0.4 T	
75	15	4 28"	200 psi	LEAN CLAY (CL), very stiff, brown, moist (pp=2.0/2.25/2.25 tsf, tv=0.8 tsf)						2.2 P 1.6 T	
70	20	5 26"	200 psi	FAT CLAY (CH), medium, brown, moist, medium to high plasticity (pp=0.5/0.5/0.5 tsf) (OXY=20.9%, CH4=15 ppm, PID=0 ppm) (disturbed sample from second attempt)	81	41		52	25	0.5 P	
65	25	6 23"	50 psi	LEAN CLAY (CL), stiff, brown, wet, low plasticity (pp=1.5/2.0/2.0 tsf, tv=0.7 tsf)						1.8 P 1.4 T	
60	30	7 25"	180 psi	--gray (pp=2.0/2.0/1.5 tsf, tv=0.5 tsf)						1.8 P 1.0 T	
55	35	8 28"	190 psi	--very stiff, yellowish gray (pp=2.25/2.25/2.25 tsf, tv=0.8 tsf)	107	21		31	12	2.3 P 1.6 T	
50	40	9 28"	180 psi	--stiff, brown (pp=2.0/1.5/1.5 tsf, tv=0.65 tsf) (OXY=20.9%, CH4=15 ppm, PID=0 ppm)						1.7 P 1.3 T	
45	45	10 22"	190 psi	--(pp=2.0/2.0/2.0 tsf, tv=0.75 tsf)						2.0 P 1.5 T	
				SANDY SILT (ML), very stiff, brown, moist,							

Continued

BORING DEPTH: 52.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 4, 2007
COMPLETION DATE: June 4, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: L Bhangoo/R Vedamtham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-101

Silicon Valley Rapid Transit Project
San Jose, California

Sheet 2 of 2

LOCATION: Approx. 700 feet NW of Las Plumas Ave., 10 feet NE of UPRR tracks N 1,956,655 E 6,162,937

SURFACE EL: 90.8 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
-40			11 27"		200 psi	increasing sand at the bottom (pp=3.0/3.5/3.5 tsf, tv=0.45 tsf)						3.3 P 0.9 T	
-35	55												
-30	60												
-25	65												
-20	70												
-15	75												
-10	80												
-5	85												
-0	90												
-5	95												

BORING DEPTH: 52.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 4, 2007
COMPLETION DATE: June 4, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: L Bhangoo/R Vedamtham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

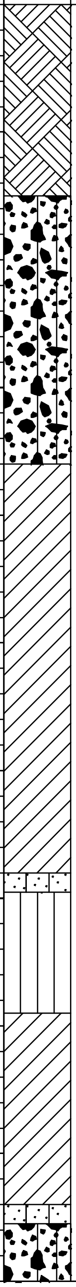
LOG OF BORING NO. BH-101

Silicon Valley Rapid Transit Project
San Jose, California

Sheet 1 of 2

LOCATION: At the median of Stockton Ave. approx. 170 ft. NW of Taylor St. N 1,949,762 E 6,150,659

SURFACE EL: 80.4 ft (1988 NAVD datum)



ELEVATION, ft	DEPTH, ft	SAMPLE NO.	RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
80						POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM), medium dense, brown to gray, moist, gravel up to 1 inch, medium grained sand (FILL)							
		1	18"	▨	(28)								
75	5	2	18"	☒	19	--Begin rotary wash, set casing to 3 1/2 ft							
						--lost drilling fluid at 7 1/2 feet							
						WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM), medium dense, brown, moist, gravel up to 1/2 inch, fine grained sand							
70	10	3	18"	☒	27								
65	15	4	18"	☒	30	--increasing clay content							
						LEAN CLAY (CL), medium, gray, moist, low to medium plasticity, fine grained sand (pp=0.5/0.75/0.75 tsf, tv=0.25 tsf) --Extended casing to 18 1/2 ft.							
60	20	5	29"	▨	50 psi							0.7 P 0.5 T	
55	25	6	24"	▨	500 psi	--less sand (pp=0.75/0.75/1.0 tsf, tv=0.25 tsf)	88	33	94			0.8 P 0.5 T	Hydrometer Test
50	30	7	34"	GB		--dark brown and gray, low plasticity							
		8	29"	GB		--increasing sand							
						SILTY SAND (SM), fine grained							
45	35					SANDY SILT (ML), gray, moist, low plasticity, some sand							
		9	24"	GB									
40	40	10	34"	GB		LEAN CLAY (CL), gray, moist, low plasticity							
		11	45"	GB									
35	45	12	33"	GB		SILTY SAND (SM), fine sand							
		13		GB		WELL-GRADED GRAVEL WITH SILT AND SAND			7				

Continued

BORING DEPTH: 80.0 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 22, 2007
COMPLETION DATE: June 25, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Fraste XL
DRILLED BY: Pitcher Drilling, R. Medina/A. Bazan
LOGGED BY: G. Tripathi/O. Gouthier
CHECKED BY: F. Wang

NOTES:
1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-102

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-18a

LOCATION: At the median of Stockton Ave. approx. 170 ft. NW of Taylor St. N 1,949,762 E 6,150,659

SURFACE EL: 80.4 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
-30			15"	GB		(GW-GM)							
			14 0"			--lost drilling fluid at 50 1/2 feet							
			15 14"		(11)	LEAN CLAY (CL) (OXY=20.9%, CH4=0 ppm, PID=0 ppm)							
-25	55		16 18"	GB		--medium, brown, low plasticity							
			17 18"	GB		SILTY SAND WITH GRAVEL (SM), brown, wet							
			18 0"			--lost drilling fluid at 57 feet							
			19 15"		(82)	WELL GRADED GRAVEL WITH SILT AND SAND							
-20	60		20 13"		(59)	(GW-GM), very dense, brown, wet, gravel up to 2 inches (OVM=0 ppm, OXY=20.9%, CH4=0 ppm)			4				
			21 10"		(36)	--Ended drilling on 6/22/07 at 61 1/2 ft.							
			22 14"		(26)	--Began drilling on 6/25/07 at 60 1/2 ft. --dense, lost drilling fluid at 62 feet							
-15	65		23 15"		(33)	--medium dense, gravel up to 1 1/2 inches							
			24 0"			SILT (ML), very stiff, grayish brown, wet, low plasticity, no recovery from Geo-barrel sampler			72				Hydrometer Test
			25 18"		(26)	SILTY CLAY (CL-ML), very stiff, brown, moist, low							
-10	70		26 23"	GB		plasticity							
			27 19"	GB									
			28 16"		(69)	POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM), very dense, gravel up to 1 inch							
-5	75		29 17"		(83)	--lost drilling fluid at 75 feet							
			30 16"		(72)	WELL-GRADED GRAVEL WITH SILT AND SAND							
			31 15"		(61)	(GW-GM), very dense, brown, moist, subrounded gravel up to 1 inch			9				
0	80					--dense							
-5	85												
-10	90												
-15	95												

BORING DEPTH: 80.0 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 22, 2007
COMPLETION DATE: June 25, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Fraste XL
DRILLED BY: Pitcher Drilling, R. Medina/A. Bazan
LOGGED BY: G. Tripathi/O. Gouthier
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-102

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: Median of Stockton Ave., approx. 330 ft. NW of Taylor St. N 1,949,890 E 6,150,551

SURFACE EL: 79.8 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		1 16"		(11)	LEAN CLAY (CL), medium, dark brown, moist, low plasticity (OVM=0 ppm, OXY=20.9%, CH4=0 ppm) --began rotary wash, set casing to 3 1/2 ft.							
75	5	2 16"		8	SILTY CLAY (CL-ML), medium, brown, moist, low plasticity							
70	10	3 16"		6	SANDY SILT (ML), medium, brown, moist, fine-grained sand							
65	15	4 16"		4	SILT (ML), soft, brown to gray, moist, low to medium plasticity							
60	20	5 30"		50 psi	--stiff, dark gray, moist, (pp=1.0/1.5/1.5 tsf, tv=0.5 tsf)						1.3 P 1.0 T	
55	25	6 26"		400 psi	LEAN CLAY (CL), stiff, brown, moist, medium plasticity, (pp=1.25/1.5/1.0 tsf, tv=0.5 tsf)						1.3 P 1.0 T	
50	30	7 14"	GB		FAT CLAY (CH), dark gray, moist, medium to high plasticity							
		8 24"	GB					90	59	37		Hydrometer Test
45	35	9 24"	GB		LEAN CLAY (CL), yellowish gray, moist, fine-grained sand							
		10 24"	GB		--brown, medium plasticity							
		11 22"	GB									
40	40	12 0"			POORLY-GRADED GRAVEL (GP), no recovery							
		13 0"			--lost drilling fluid at 42 feet							
		14 0"			--lost drilling fluid at 43 feet							
35	45	15 2"		(75)	--very dense, dark mottled brown, fine to medium grained sand							
		16 14"		(50)	WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM), dense, brown, moist, lost drilling fluid at							
		17 0"						5				
		18		(87)								

Continued

BORING DEPTH: 90.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 20, 2007
COMPLETION DATE: June 27, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Fraste XL
DRILLED BY: Pitcher Drilling, R. Medina/A. Bazan
LOGGED BY: G. Tripathi/O. Gouthier
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

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LOG OF BORING NO. BH-103

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-19a

Sheet 2 of 2

LOCATION: Median of Stockton Ave., approx. 330 ft. NW of Taylor St. N 1,949,890 E 6,150,551

SURFACE EL: 79.8 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			8"									
		19	10"		(39)							
		20	18"		(14)							
		21	15"	GB								
25	55	22	16"		(42)			65	NP	NP		
		23	15"		(74)							
		24	14"		(66)							
20	60	25	10"		(87/11")							
		26	11"		(62)							
		27	11"		(55)			3				
15	65	28	12"		(85)							
		29	0"									
		30	0"									
10	70											
		31	18"		(29)							
		32	35"	GB				55				Hydrometer Test
5	75	33	18"		(23)							
		34	6"	GB				13				
0	80	35	11"		(50/5")							
		36	16"		(98)							
		37	15"		(73)			4				
-5	85	38	9"		(28)							
		39	22"		1500 psi						>4.5 P	
-10	90	40	13"		(72)			52	NP	NP		
-15	95											

MATERIAL DESCRIPTION

46 1/2 feet
--lost drilling fluid at 48 feet (OVM=0 ppm, OXY=20.9%, CH4=0 ppm)
--very dense, mottled brown, subangular and subrounded gravel up to 2 inches
--medium dense

--Ended drilling on 6/20/07 at 52 ft.
--Began drilling on 6/21/07 at 52 ft.
LEAN CLAY (CL), stiff, light gray, low plasticity, fine grained sand at bottom

SANDY SILT (ML), gray, medium grained, lost drilling fluid at 54 feet

WELL-GRADED GRAVEL WITH SAND (GW), dense, browm, moist, medium grained, sand and gravel up to 1/2 inch

POORLY-GRADED SAND WITH GRAVEL (SP), very dense, medium grained, gravel up to 3/4 inch

WELL-GRADED SAND WITH GRAVEL (SW), very dense, grayish brown, moist, medium grained, gravel up to 3/4 inch
--lost drilling fluid at 60 feet
--dense, lost drilling fluid at 61 1/2 feet
--dense, gravel up to 1 1/2 inches, lost drilling fluid at 63 feet
--lost drilling fluid at 64 1/2 feet

SANDY SILT (ML)
--medium, grayish brown, fine-grained sand

SILTY SAND (SM), medium dense, grayish brown, moist, gravel up to 1 1/2 inches
--very dense (OVM=0 ppm, OXY=20.9%, CH4=0 ppm)

WELL-GRADED SAND WITH GRAVEL (SW), very dense, brown, gravel up to 1 1/2 inches, medium grained sand
--Ended drilling on 6/21/07 at 80 1/2 ft
--Began drilling on 6/27/07 at 80 1/2 ft

POORLY GRADED GRAVEL WITH SAND (GP), dense, brown, moist
--medium dense

LEAN CLAY WITH SAND (CL), hard, brown (pp=>4.5 tsf)

SANDY SILT (ML), hard, brown, moist, some sand, low plasticity
--hard, low plasticity

BORING DEPTH: 90.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 20, 2007
COMPLETION DATE: June 27, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Fraste XL
DRILLED BY: Pitcher Drilling, R. Medina/A. Bazan
LOGGED BY: G. Tripathi/O. Gouthier
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-103

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-19b

Sheet 1 of 2

LOCATION: NE side of Santa Clara Street, approx. 30 feet SE of 1st Street N 1,947,855 E 6,157,321

SURFACE EL: 86.9 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
				11 inches of ASPHALT CONCRETE							
85		1 15"	(13)	SANDY LEAN CLAY (CL), stiff, brown, moist, low plasticity							
80	5	2 19"	400 psi	SILT WITH GRAVEL (ML), brown, moist, low plasticity							
75	10	3 10"	(32)	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), medium dense, brown, wet, coarse grained up to 3/4 inch		8	12				
				LEAN CLAY (CL), medium, dark gray, moist, medium plasticity							
70	15	4 30"	150 psi	--(pp=0.5/0.25/0.25 tsf, tv=0.4/0.45/0.35 tsf)						0.3 P 0.8 T	
65	20	5 30"	100 psi	--trace fine grained sand (pp=1.0/1.0/0.5 tsf, tv=0.3/0.35/0.4 tsf)						0.8 P 0.7 T	
		6 14"	8	SILTY SAND (SM), loose, black, moist, fine-grained		27	50	NP	NP		
	25	7 31"	50 psi								
60		8 18"	14	--medium dense, wet	84	35	34	NP	NP		
55	30	9 30"	100 psi								
		10 10"	0	LEAN CLAY (CL), medium, gray, moist, low to medium plasticity (pp=0.75/.075/0.75 tsf, tv=0.45/0.5/0.5 tsf)		32	45	29	10	0.8 P 1.0 T	
				CLAYEY SAND (SC), very loose, gray, wet, fine-grained							
50	35	11 34"	40 psi								
		12 18"	10	LEAN CLAY (CL), medium, mottled brown, moist, low plasticity, trace fine grained sand and root (pp=0.5/0.75/0.5 tsf, tv=0.35/0.4/0.4 tsf)						0.6 P 0.8 T	
						65	48	86	24		
45	40	13 9"	27	SILTY SAND (SM)/SANDY ORGANIC SILT (OH), medium dense, gray with reddish brown, moist, trace rotten root and organic material		13	10				
	45	14 18"	0	WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), medium dense, dark gray, wet, coarse-grained							
40				SILTY CLAY (CL-ML), very soft, light brown, wet, low plasticity							

Continued

BORING DEPTH: 51.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 23, 2007
COMPLETION DATE: June 23, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-105

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: NE side of Santa Clara Street, approx. 30 feet SE of 1st Street N 1,947,855 E 6,157,321

SURFACE EL: 86.9 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		▨	15 15"	☒	4	--soft, light brown							
35													
	55												
30													
	60												
25													
	65												
20													
	70												
15													
	75												
10													
	80												
5													
	85												
0													
	90												
-5													
	95												
-10													

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BORING DEPTH: 51.5 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 23, 2007
COMPLETION DATE: June 23, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Failing 1500
DRILLED BY: Pitcher Drilling, L. Willard/J. Musich
LOGGED BY: R. Vedantham
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-105

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: SW side of Stockton Ave., approx. 150 ft NW of Asbury St. N 1,950,038 E 6,150,410

SURFACE EL: 78.3 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						6 inches of ASPHALT CONCRETE (OVM=0 ppm, OXY=20.8%, CH4=0 ppm)							
75			1 9"		(16)	SANDY LEAN CLAY (CL), brown, dry (FILL)							
	5		2 30"		1000 psi	FAT CLAY (CH), stiff, dark brown, dry to moist, high plasticity --Began rotary wash, set casing to 3 1/2 ft.							
70						SANDY SILT (ML), very stiff, light brown, dry, trace fine grained sand, non-plastic							
	10		3 30"		100 psi	LEAN CLAY (CL), stiff, light brown, moist, low plasticity							
65						--(pp=1.5/1.75/1.5 tsf, tv=0.25/0.50/0.125 tsf)						1.5 P 0.6 T	
	15		4 24"		400 psi	SANDY SILT (ML), very stiff, light brown, moist, non-plastic (pp=3.0/3.5/3.5 tsf)							
60												3.3 P	
	20		5 27"		400 psi	LEAN CLAY (CL), very stiff, black, moist, medium plasticity							
55						--brown, (pp=2.0/1.5/2.0 tsf, tv=0.75 tsf)				31	14	2.1 P 1.5 T	
	25		6 30"		400 psi								
50						--stiff (pp=1.5/2.0/1.5 tsf, tv=1.1 tsf)						1.7 P 2.3 T	
	30		7 36"	GB		--black, trace fat clay pocket at depth 30 feet --trace organic material, lost drilling fluid at 33 feet							
45			8 34"	GB		--gray, low plasticity							
	35		9 19"	GB									
40	40		10 30"	GB		--brown, moist to wet							
			11 10"	GB		POORLY-GRADED GRAVEL WITH SAND (GP), medium dense, brown, wet, angular gravel up to 2 inches							
35			12 10"	GB					4				
	45		13 10"		(50)	--medium grained sand							
			14 9"	GB		--more medium grained sand							
30			15 12"		(64)	WELL-GRADED GRAVEL WITH SAND (GW), very dense, brown, wet, gravel up to 3/4 inch							
			16		(62)				5				

Continued

BORING DEPTH: 90.0 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 26, 2007
COMPLETION DATE: June 27, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Fraste XL
DRILLED BY: Pitcher Drilling, R. Medina/A. Bazan
LOGGED BY: G. Tripathi/O. Gouthier
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-106

Silicon Valley Rapid Transit Project
San Jose, California

LOCATION: SW side of Stockton Ave., approx. 150 ft NW of Asbury St. N 1,950,038 E 6,150,410

SURFACE EL: 78.3 ft (1988 NAVD datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO. RECOVERY (in)	SAMPLER TYPE	SAMPLER BLOW COUNT/ PRESSURE, psi	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX (%)	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
		14"										
		17 6"		(39)	--lost drilling fluid at 49 feet							
		18 12"		(47)	--very dense, gravel up to 1 inch							
25					--dense, dark brown							
		19 10"		(26)	--brown, moist							
	55				--lost drilling fluid at 54 feet							
		20 6"		(48)								
		21 15"		(21)	--increasing fines							
20		22 5"	GB		SILT (ML), very stiff, dark gray, wet, low plasticity			90				Hydrometer Test
					--trace SILTY CLAY lense from 57 1/2 to 58 feet							
	60				--gray							
		23 0"										
15					No recovery from Geo-barrel							
		24 17"		(21)								
	65				--dark gray							
		25 6"	GB		WELL GRADED GRAVEL WITH SILT AND SAND(GW-GM), dark gray, wet							
		26 18"		(30)								
10		27 18"		(39)	SANDY SILT (ML), very stiff, brown, wet, gravel up to 1/2 inch (OVM=0 ppm, OXY=20.9%, CH4=0 ppm)			51	NP	NP		Hydrometer Test
	70	28 18"	GB		--Ended drilling on 6/26/07 at 68 1/2 ft.							
5		29 13"		(30)	--Began drilling on 6/27/07 at 63 1/2 ft. due to cave in							
	75	30 30"	GB		--moist, trace gravel (OVM=0 ppm, OXY=20.9%, CH4=0 ppm)							
					SANDY LEAN CLAY WITH GRAVEL(CL), very stiff, brown, moist, angular gravel							
0		31 0"										
	80	32 19"		(21)	SILTY CLAY WITH SAND (CL-ML), very stiff, brown, moist							
					SILT (ML), brown, moist							
-5		33 20"	GB		LEAN CLAY (CL), brown, moist, trace organic materials (No recovery)							
	85	34 12"	GB		SILT (ML), very stiff, gray, moist				32	9		
					--light brown, some angular gravel up to 1 inch, trace silty clay lense							
-10		35 22"	GB		--trace SILTY SAND pocket from 84 1/4 to 85 feet							
					LEAN CLAY (CL), gray, wet, low plasticity							
	90				SANDY SILT WITH GRAVEL (ML), yellowish brown, moist, round gravel up to 1 1/2 inches.							
-15												
	95											
-20												

BORING DEPTH: 90.0 ft
DEPTH TO WATER: Not Measured
BACKFILL: Neat Cement Grout
START DATE: June 26, 2007
COMPLETION DATE: June 27, 2007

DRILLING METHOD: 5-in. dia. Rotary Wash
HAMMER TYPE: Automatic Trip
RIG TYPE: Fraste XL
DRILLED BY: Pitcher Drilling, R. Medina/A. Bazan
LOGGED BY: G. Tripathi/O. Gouthier
CHECKED BY: F. Wang

NOTES: 1. Terms and symbols defined on Plate A-1.
2. Groundwater levels measured at the time of drilling may not be representative of actual groundwater conditions and should not be used for design purposes. For applicable groundwater information, please refer to piezometer and observation well data.

LOG OF BORING NO. BH-106

Silicon Valley Rapid Transit Project
San Jose, California

FIGURE A-21b

Appendix 2: Cone Penetration Test (CPT) Results

FUGRO WEST, INC.

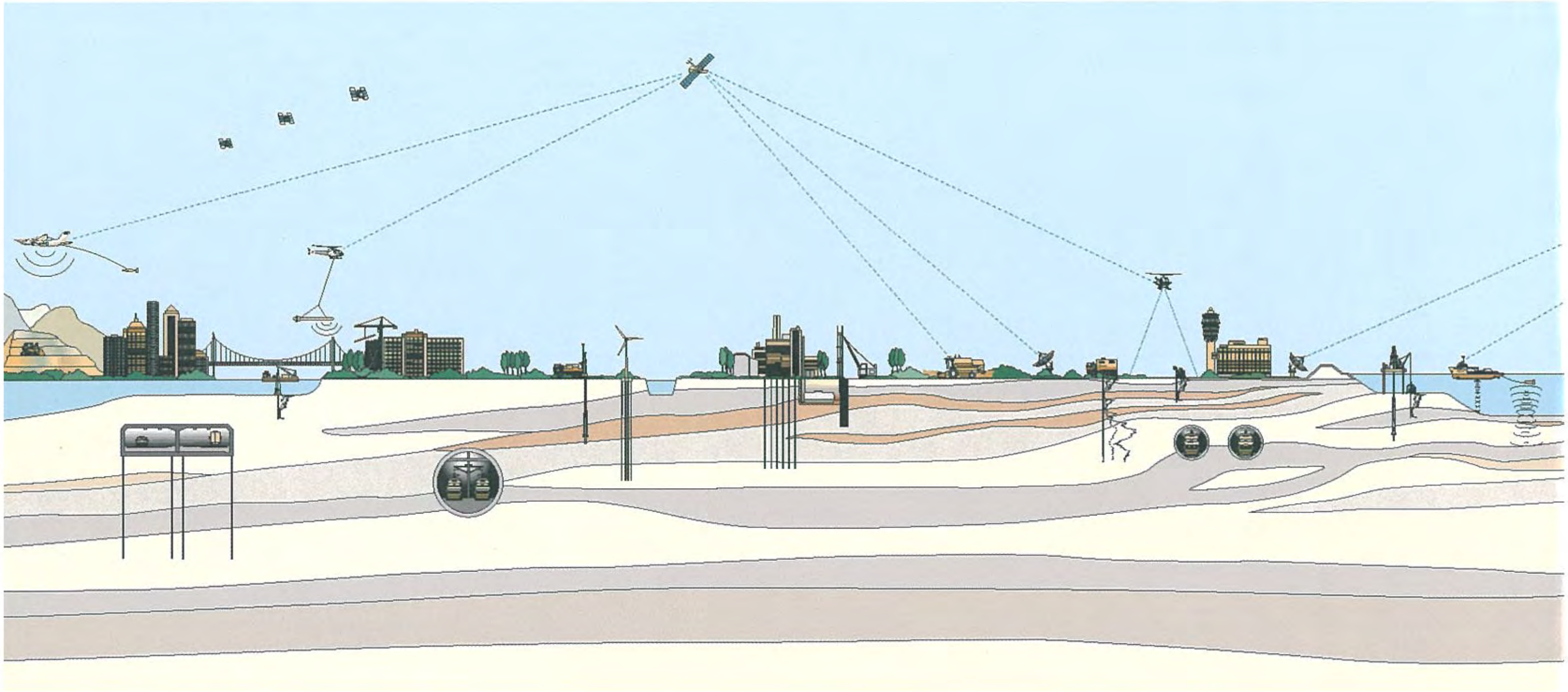
APPENDIX 2
CONE PENETRATION TEST (CPT) RESULTS GEOTECHNICAL EXPLORATION PROGRAM CENTRAL AREA GUIDEWAY

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
SAN JOSE, CALIFORNIA

Prepared for:
HMM/Bechtel

JANUARY 2008

Fugro Project No. 1637.001



REPORT DOCKET

APPROVAL

This document is approved by the following:

Name	Title	Signature	Issue Date
Michael Paquette, P.E.	Project Engineer		1/21/08
Edwin Woo, P.E., G.E.	Principal Engineer	Edwin P. Woo	1/21/08

REVISION HISTORY

Revision	Date	Change	Approval
0	November 12, 2007	Draft Report: Appendix 8 Cone Penetration Test (CPT) Results. Incorporating Phase 2 (2007) CPTs	MP
1	January 21, 2008	Appendix 2 Cone Penetration Test (CPT) Results. Incorporating Phase 2 (2007) CPTs	MP

January 21, 2008
Project No. 1637.001

HMM/Bechtel
3103 North First Street
San Jose, California 95134

Attention: Mr. Thomas Hunt, P.E.

Subject: Appendix 2 – Cone Penetration Test (CPT) Results, Central Area Guideway of SVRT Project, San Jose, California

Dear Mr. Hunt:

Fugro is pleased to submit this copy of “Appendix 2 – Cone Penetration Test (CPT) Results,” describing the CPT test equipment, procedures and results for the Central Area Guideway of the SVRT Project in San Jose, California.

We appreciate this opportunity to be of continued service to HMM/Bechtel. Please contact Michael Paquette at (510) 267-4441 if you have any questions regarding the information presented in this appendix.

Sincerely,

FUGRO WEST, INC.

Michael Paquette

Michael Paquette, P.E.
Project Engineer

Edwin P. Woo

Edwin P. Woo, P.E., G.E.
Principal Engineer

MP/EW:ej

Copies Submitted: (PDF) Addressee

CONTENTS

TABLES

LOGS OF CPTS

1.0 INTRODUCTION

This appendix describes the equipment, procedures and results of cone penetration tests (CPTs) conducted by Fugro West, Inc. (Fugro) for the proposed Central Area Guideway of the Silicon Valley Rapid Transit (SVRT) Project. The CPTs were conducted at locations along the Central Area Guideway alignment, as shown on Figure 3-1 of the main report.

1.1 PROJECT DESCRIPTION

The Santa Clara Valley Transportation Authority (VTA) intends to construct the SVRT Project in San Jose, California. This will be a 26.2-km (16.3-mile) extension of the Bay Area Rapid Transit (BART) heavy rail rapid transit system from the planned terminus at the end of the Warms Springs Extension in Fremont, to San Jose. The proposed alignment currently includes several new stations and vehicle storage and maintenance facilities. The alignment is composed of two major segments:

1) The “Northern Area” that will be approximately 11.5 miles of at-grade, elevated and cut-and-cover track from Warm Springs to San Jose; and

2) The “Central Area Guideway”, a 5.1-mile-long tunnel, consisting of twin bored tunnels and cut-and-cover structures through downtown San Jose.

As currently planned, the Central Area Guideway includes at-grade and open cut track, cut-and-cover stations, and a cut-and-cover track crossover structure. The cut-and-cover stations and the crossover structures have a cumulative length of approximately 4,970 feet. The remaining 4.14 miles of the alignment will be twin 19.5-foot-diameter tunnels.

This investigation and report cover the 5.1-mile-long Central Area Guideway only.

1.2 GEOTECHNICAL EXPLORATION PROGRAM OVERVIEW

The joint venture of Hatch Mott MacDonald T & T, Inc., and Bechtel Infrastructure Corporation (HMM/Bechtel) is providing engineering design services for the Central Area Guideway of the SVRT Project to the VTA. HMM/Bechtel has subcontracted with a number of companies to conduct the geotechnical field exploration program for the project. HMM/Bechtel’s primary subcontractors for the geotechnical exploration program include: Fugro, Parikh Consultants (Parikh) and Pitcher Drilling Company (Pitcher).

The three companies, Fugro, Parikh, and Pitcher, conducted the majority of the geotechnical field exploration program for the Central Area Guideway of the SVRT Project from October 2004 to March 2005. This supplementary geotechnical field investigation was performed between March 2007 and August 2007. The intent of the field investigation program was to obtain geotechnical data that would aid in the design and construction of the proposed tunnel and cut-and-cover structures.

In general, the geotechnical field investigations explored subsurface conditions along the proposed Central Area Guideway. The explorations were within the vicinity of the proposed Eastern and Western Portals, at the two proposed ventilation structures, and at the proposed stations, including Alum Rock Station, Downtown San Jose Station and Diridon/Arena Station. The geotechnical exploration program included:

- 2004 / 2005 Investigation
  - 76 Rotary Wash Borings (by others); and
  - 146 CPTs (by Fugro).
- 2007 Investigation
  - 18 Rotary Wash Borings (by others); and
  - 22 CPTs (by Fugro).

Figure 3-1 in the main report provides a map of the exploration locations. These locations were selected by HMM/Bechtel based on the following considerations: 1) the requirements of the tunnel designer, 2) the location of existing geotechnical data, 3) reducing impacts on private property, and 4) the avoidance of existing underground and overhead utilities. The locations of the 2007 explorations were chosen to fill in gaps in the data along the tunnel alignment. A subcontractor to HMM/Bechtel surveyed the CPT locations. HMM/Bechtel provided the surveyed coordinates to Fugro.

1.3 CPT PROGRAM OVERVIEW

Fugro West, Inc. and Fugro Consultants, Inc. (formerly Fugro Geosciences, Inc.) conducted the CPTs using a Fugro truck-mounted 25-ton cone apparatus. The CPTs were performed in general accordance with ASTM D5778. The continuous CPT soundings were typically advanced to refusal, which ranged from approximately 34 to 116 feet in depth. In addition to continuous CPT soundings, Fugro also performed downhole seismic shear wave velocity measurements. Downhole seismic shear (S) wave velocity measurements were successfully conducted at 12 CPT locations during the 2007 investigation to obtain profiles of shear wave velocity versus depth. Detailed information regarding the downhole seismic CPTs, including field procedures, data interpretation and results are discussed in Appendix 3 – Seismic Cone Testing.

Detailed procedures and equipment specifications on the CPT operations are discussed in the following sections. Table 1 summarizes the 2007 CPT field testing program and indicates the test location, date of completion, termination depth and additional tests performed for each CPT.

2.0 CPT TEST EQUIPMENT AND PROCEDURES

2.1 CPT EQUIPMENT

Equipment used in conducting CPTs includes:

- A self-contained 25-ton CPT rig. The rig contains the hydraulic pushing system, a power supply unit and other tools, equipment and necessary materials;
- A piezocone (CPTu) capable of measuring tip resistance, sleeve resistance, probe inclination and dynamic pore pressure;
- Cone rods pre-strung with electrical 10-pin copper cable and casing;
- A data acquisition system including an Analog-Digital (A/D) Conversion System and a data logging laptop computer; and
- A support truck and trailer containing a grout pump and mixer, steam cleaning equipment, and a pressure washer.

2.1.1 CPT Rig

The CPTs were performed using a Fugro 25-ton capacity truck-mounted rig with a self-contained power supply unit. The rig was equipped with hydraulic jacking systems to lift and level the pushing platform. The “dead weight” of the rig provided the reaction weight necessary to advance the CPT into the ground.

2.1.2 Piezocone

The conventional instrumented piezocone assembly used for this project included a cone tip with a 60-degree apex and a base area of 15 square centimeters (cm^2), a sleeve segment with a surface area of 200 cm^2, an area ratio of 0.59 to 0.61, and a pore pressure transducer near the base (shoulder) of the cone tip (designated the u2 location).

2.1.3 Cone Rods and Casing

Fugro’s CPT cone rods are manufactured from high tensile strength steel and have a cross sectional area adequate to sustain, without buckling, the thrust required to advance the penetrometer tip. Prior to testing, a 10-pin electrical cable is pre-strung through the cone rods, and is connected by a crossover cable to the data acquisition system. Push rods are 1-meter long, and are secured together to bear against one another at the joints to form a rigid jointed string.

The push rods were protected from bending by a steel casing (2 1/8-inch outside diameter and 1 7/8-inch inside diameter), when needed. The casing was used to ensure that the maximum possible depth of testing was reached. The steel casing was generally placed in the upper clayey strata and was extended to depths of 5 to 27 feet, when used.

2.1.4 Data Acquisition System

The data acquisition system used in conducting the CPTs consisted of an electronic signal conditioner, a three-pen analog strip chart recorder, a portable laptop computer, and a printer.

The data acquisition system converts the analog signal from the cone penetrometer to a digital signal. The signal is monitored, recorded and presented in near-real time on the laptop computer. As stipulated in ASTM D-5778-95, a three-pen strip chart recorder monitors and displays in real time the analog signals directly from the cone penetrometer. This provides an accurate recording of the collected data, regardless of the analog to digital conversion. Upon completion of testing, the strip chart record of the analog readings is compared to the digital readings recorded on the laptop computer. This comparison of analog to digital signals provides a quality control system that ensures accurate and highly reliable data including the initial and final calibration zeros.

2.1.5 Support Equipment

The support equipment consisted of a pickup truck and trailer containing the following necessities:

- Grout pump and mixer, to properly abandon the CPT holes after completion;
- Pressure wash system, for cleaning work area when appropriate and maintaining clean equipment throughout exploration program;
- Steam cleaning system, for environmental protocol (as needed); and
- Tools and supplies, for daily operations.

2.2 FIELD PROCEDURES

Prior to the start of testing, the truck was jacked up and leveled on four pads to provide a stable reaction for the cone thrust. During the test, the instrumented cone was hydraulically pushed into the ground at a rate of about 2 centimeters per second (cm/s), and readings of cone tip resistance, sleeve friction, and pore pressure were digitally recorded every second. As the cone advanced, additional cone rods were added such that a "string" of rods continuously advanced through the soil. As the test progressed, the CPT operator monitored the cone resistance and the deviation from vertical alignment.

Information collected during a push was stored digitally as ASCII formatted data on magnetic disks readable by MS-DOS or Windows-based programs that read text files. The data files include project description, location, operator, data format information, and other pertinent information about the sounding.

Following each push, the data collected are presented in a graphical format. The preliminary field logs include:

- Cone tip resistance in tons per square foot (tsf) versus depth in feet;
- Friction sleeve resistance in tsf versus depth in feet;
- Friction ratio in percentage versus depth in feet; and
- Pore pressure in tsf versus depth in feet.

As stipulated in ASTM D-5778-95, the vertical axis on the plots is designated for depth, and the horizontal axis displays the magnitude of the test values recorded. Final plotting scales are determined after all the tests are completed, and takes into consideration maximum test values and depths recorded for the project.

2.3 CPT COMPLETION AND ABANDONMENT

Upon completion of the CPTs, the CPT rig was moved off the location. The holes were backfilled with cement-bentonite grout by the tremie method, starting from the bottom of the hole and filling upward using the grout pump and mixer. When grout approached the surface, the tremie pipe was removed, and the sounding holes were topped off with rapid setting “quickcrete”. Grout mix and grouting procedures were completed in accordance with Santa Clara Valley Water District regulations. The work area was then cleaned per City of San Jose requirements and left in about the same or better condition than prior to testing.

3.0 CPT SOUNDING RESULTS AND DISCUSSION

3.1 INTRODUCTION

The CPT logs are attached to this appendix. The CPT logs provide graphical plots versus depth showing:

- Measured cone tip resistance, in tsf;
- Measured sleeve friction, in tsf;
- Friction ratio, in percentage, including color coding denoting the Soil Behavior Type according to Robertson (1990) (see CPT correlation chart);
- Measured pore pressure at the u2 location, in tsf;
- Estimated soil undrained shear strength, in ksf. The sounding logs show the range of undrained shear strengths calculated from CPT cone tip resistance (corrected for unequal end area effects) based on cone bearing capacity factors (N_k) of 12 and 15.

Please note that some of the data presented on the CPT logs are interpreted and based on assumptions that need to be verified with the data from the boring program. The interpreted data presented on the CPT logs include the soil behavior type and the estimated soil undrained shear strength. The estimated soil behavior type and undrained shear strength are influenced by the soil unit weight (and resulting total stress condition). Undrained shear strength is also influence by the N_k value. These items are discussed in detail below.

3.2 ESTIMATION OF TOTAL IN SITU STRESS FROM CPT DATA

As discussed above, a reasonable estimate of the in situ total stress is required to evaluate the soil behavior type and undrained shear strength using CPT data. To reasonably estimate total stress, a site-specific CPT correlation with unit weight was developed during the 35 percent study. The basic approach to developing the site-specific correlation was to compare measured unit weight from all correlation borings (borings that were located directly adjacent to a CPT) with the CPT zone as determined from the Robertson et al. (1986) soil behavior chart. The unit weight data from the borings were then sorted by zone and averaged to determine a reasonable estimate of unit weight for each zone on the chart. For CPT zones where no laboratory data were available, the zone was assigned a unit weight based on modified estimates of the unit weight correlations provided in Lunne et al. (1997). The following table provides a summary of the site-specific unit weight correlations for each zone of the Robertson et al. (1986) CPT tip resistance-based chart.

Table A8-2. Summary of Site-Specific Unit Weight/CPT Correlations from 35 Percent Study – Fugro (2005)

Zone Number	Material Description	Site-Specific Unit Weight Correlation (lbs/ft^3)
1	Sensitive fine grained	115
2	Organic material	85
3	Clay	122
4	Silty clay to clay	124
5	Clayey silt to silty clay	124
6	Sandy silt to clayey silt	126
7	Silty sand to sandy silt	127
8	Sand to silty sand	127
9	Sand	130
10	Gravelly sand to sand	135
11	Very stiff fine grained	127
12	Sand to clayey sand	127

Note: Zone number and material description are based on Robertson et al. (1986) proposed soil behavior classification system (tip resistance and friction ratio).

The unit weight correlations above were used to develop a unit weight profile for each CPT from which the total stress profile was developed. To verify the above unit weight correlation and confirm that these values resulted in reasonable estimates of total stress, profiles of unit weight and total stress were developed as part of the 35 percent study, and summarized in Fugro (2005).

3.3 EVALUATION OF SOIL BEHAVIOR TYPE (SBT)

The Soil Behavior Type (SBT) shown on the CPT logs was evaluated using the Robertson (1990) correlation. The Robertson (1990) correlation requires two corrections be applied to the recorded cone data. The first correction is for pore pressures behind the cone and the second correction is for overburden.

The first correction is calculated using the following expression:

$$q_t = q_c + u(1 - a)$$

Where: q_t = Corrected cone resistance, tsf
q_c = Measured cone resistance, tsf
u = Measured pore pressure, tsf
a = Cone area ratio, dimensionless

The second correction calculates a normalized cone penetration resistance and a normalized friction ratio. The normalized cone penetration resistance is calculated using the following expression:

$$Q_t = \frac{q_t - \sigma_{vo}}{\sigma'_{vo}}$$

Where: Q_t = Normalized cone penetration resistance, dimensionless
q_t = Corrected cone resistance, tsf
σ_{vo} = Estimated in situ total vertical stress, tsf
σ'_{vo} = Estimated in situ effective vertical stress, tsf

The normalized friction ratio is calculated using the following expression:

$$F_r = \left(\frac{f_s}{q_t - \sigma_{vo}} \right) \times 100\%$$

Where F_r = Normalized friction ratio, percent
f_s = Measured sleeve friction, tsf
q_t = Corrected cone resistance, tsf
σ_{vo} = Estimated in situ total vertical stress, tsf

The normalized tip resistance and friction ratio are plotted on the Robertson (1990) chart, as shown on the attached Key to CPT Logs, to estimate the Soil Behavior Type.

3.4 EVALUATION OF UNDRAINED SHEAR STRENGTH FROM CPT DATA

Undrained shear strength has been estimated from the CPT measurements using the following expression:

$$S_u = \frac{q_t - \sigma_{vo}}{N_k}$$

Where: S_u = Undrained shear strength, ksf

q_t = Cone tip resistance, ksf

σ_{vo} = Estimated in situ total vertical stress, ksf

N_k = Empirical cone bearing factor, dimensionless

In order to estimate the soil's undrained shear strength using the above relationship, the cone bearing factor (N_k) and in situ total stress (σ_{vo}) need to be determined. The following discussion summarizes the approaches used to reasonably estimate these quantities.

3.4.1 Evaluation of Cone Bearing Factor (N_k)

A range of interpreted undrained shear strength (Su) from CPT tip resistances for empirical cone bearing factor (N_k) ranging from 12 to 15, are plotted on the CPT logs. The range of selected N_k values was based on a comparison of Su estimated from the CPT tip resistance and the Su determined from vane shear testing in the borings. This comparison was completed as part of the 35 percent study, as summarized in Fugro (2005).

4.0 LIMITATIONS

Our services consist of subsurface field explorations and data evaluations that are made in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

The data provided in this appendix are based on the subsurface explorations conducted for this study. These explorations indicate subsurface conditions only at specific locations and times, and only to the depths penetrated. Variations may exist and conditions not observed or described in this report could be encountered during construction. Our results are based on our standard practices and specific data obtained.

This appendix has been prepared for the exclusive use of HMM/Bechtel and their consultants for specific application to the SVRT project as described herein. In the event that there are any changes in the ownership, nature, design, or location of the proposed project, or if any future additions are planned, the results contained in this appendix should not be considered valid unless: 1) the project changes are reviewed by Fugro, and 2) results presented in this appendix are modified or verified in writing. Reliance on this report by others must be at their risk unless we are consulted on the use or limitations. We cannot be responsible for the impacts of any changes in geotechnical standards, practices, or regulations subsequent to performance of services without our further consultation. We can neither vouch for the accuracy of information supplied by others, nor accept consequences for unconsulted use of segregated portions of this report.

5.0 REFERENCES

Fugro West, Inc. (2005), "Appendix 8 Cone Penetration Test (CPT) Results, Geotechnical Exploration Program, Tunnel Segment of Silicon Valley Rapid Transit (SVRT) Project, San Jose, California" Prepared for HMM/Bechtel, Fugro Project No. 1637.001

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Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J. (1986), "Use of Piezocone Data," Proceedings of the ASCE Specialty Conference In Situ 1986: Use of In Situ Tests in Geotechnical Engineering, Blacksburg, pp.1263-80.

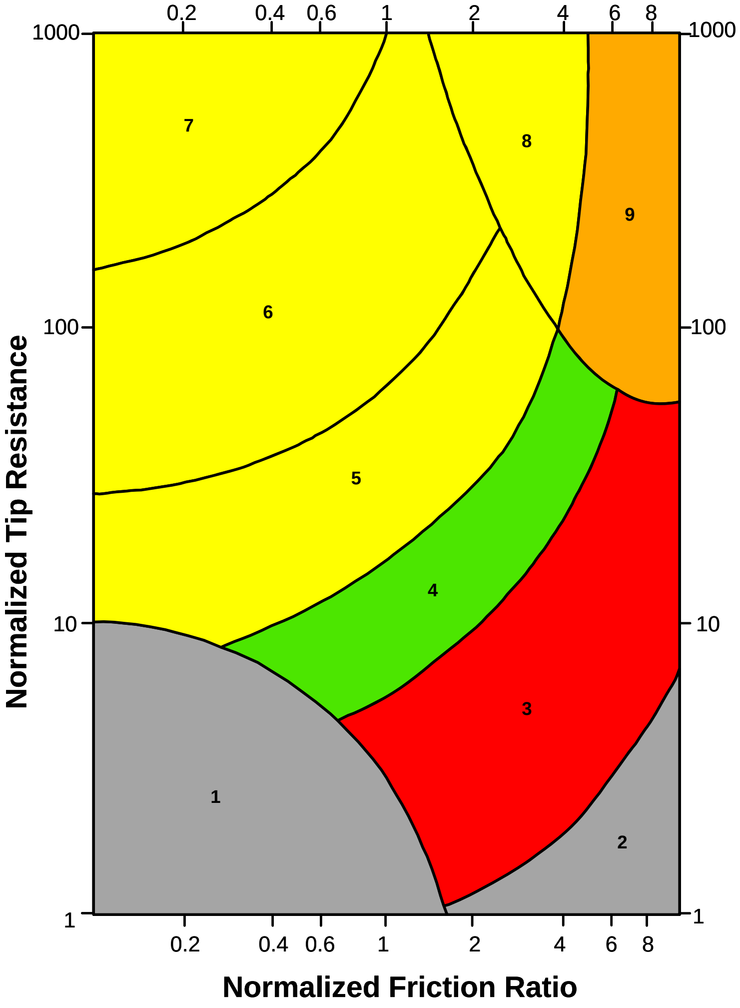
Robertson, P.K., (1990), "Soil Classification using the Cone Penetration Test," *Canadian Geotechnical Journal,* 27

CPT No.	Station	Offset		Coordinates			In-Situ Test	Insitu Test Depths (ft)	CPT Completed	Casing Depth (ft)	Final Depth (ft)	Comments
		(ft)	R/L	Northing	Easting	Elev.						
CPT - 158	562+47	30	L	1956837	6162889	91.6	Seismic	Every 3 ft.	4/3/2007		45.0	
CPT - 159	563+48	29	L	1956741	6162916	91.1			4/4/2007		45.4	
CPT - 160	565+39	37	L	1956567	6162986	89.4			4/4/2007		45.4	
CPT - 161	568+89	26	L	1956251	6163128	87.3	Seismic	Every 3 ft.	4/3/2007		105.0	
CPT - 162	600+72	140	L	1953716	6164945	87.1	Seismic	Every 3 ft.	8/13/2007		73.2	
CPT - 163	636+50	66	L	1950985	6163027	93.4			3/31/2007		95.1	
CPT - 164	639+64	50	L	1950828	6162753	94.9			3/28/2007		86.0	
CPT - 165	642+21	41	L	1950703	6162527	96.1	Seismic	Every 3 ft.	8/16/2007		77.4	
CPT - 166	649+12	48	L	1950358	6161926	85.6			3/29/2007		89.2	
CPT - 167	701+09	11	R	1947883	6157354	86.7	Seismic	Every 5 ft.	4/1/2007		90.7	
CPT - 168	734+51	100	L	1946017	6154586	87.8	Seismic	Every 3 ft.	4/5/2007		149.9	
CPT - 169	706+79	145	L	1947464	6156937	89.0	Seismic	Every 3 ft.	8/17/2007		85.4	
CPT - 170	793+77	48	R	1949598	6150886	76.5			3/30/2007	5 ft.	43.7	
CPT - 171	794+96	42	R	1949684	6150804	75.1	Seismic	Every 3 ft.	3/30/2007		74.8	
CPT - 172	607+63	66	R	1953024	6164741	88.0	Seismic	Every 3 ft.	8/16/2007		113.4	
CPT - 173	828+06	91	L	1951765	6148281	69.9	Seismic	Every 3 ft.	3/29/2007		38.4	CPT redone due to early refusal.
CPT - 173A	828+02	92	L	1951762	6148283	69.8			3/31/2007		33.8	
CPT - 173B	Not Surveyed								3/31/2007		81.5	Piezo Cone used after refusal of Seismic Cone
CPT - 174	834+47	21	L	1952160	6147771	67.4	Seismic	Every 3 ft.	3/31/2007		55.6	
CPT - 174A	Not Surveyed								3/31/2007	27 ft.	69.4	Piezo Cone used after refusal of Seismic Cone
CPT - 175	835+68	20	L	1952223	6147669	67.3			3/28/2007		80.5	
CPT - 176	837+51	16	L	1952322	6147514	66.8			3/28/2007		45.5	
CPT - 177	838+86	19	L	1952391	6147398	66.4			3/30/2007		45.5	
CPT - 178	841+50	15	L	1952479	6147259	66.1			3/29/2007		45.5	
CPT - 179	740+58	109	L	1945918	6153987	91.5	Seismic	Every 3 ft.	8/14/2007		115.5	

Table A2-1

SUMMARY OF CONE PENETRATION TEST (CPT) PROGRAM
Central Area Guideway of Silicon Valley Rapid Transit (SVRT) Project
San Jose, California

LOGS OF CPTs



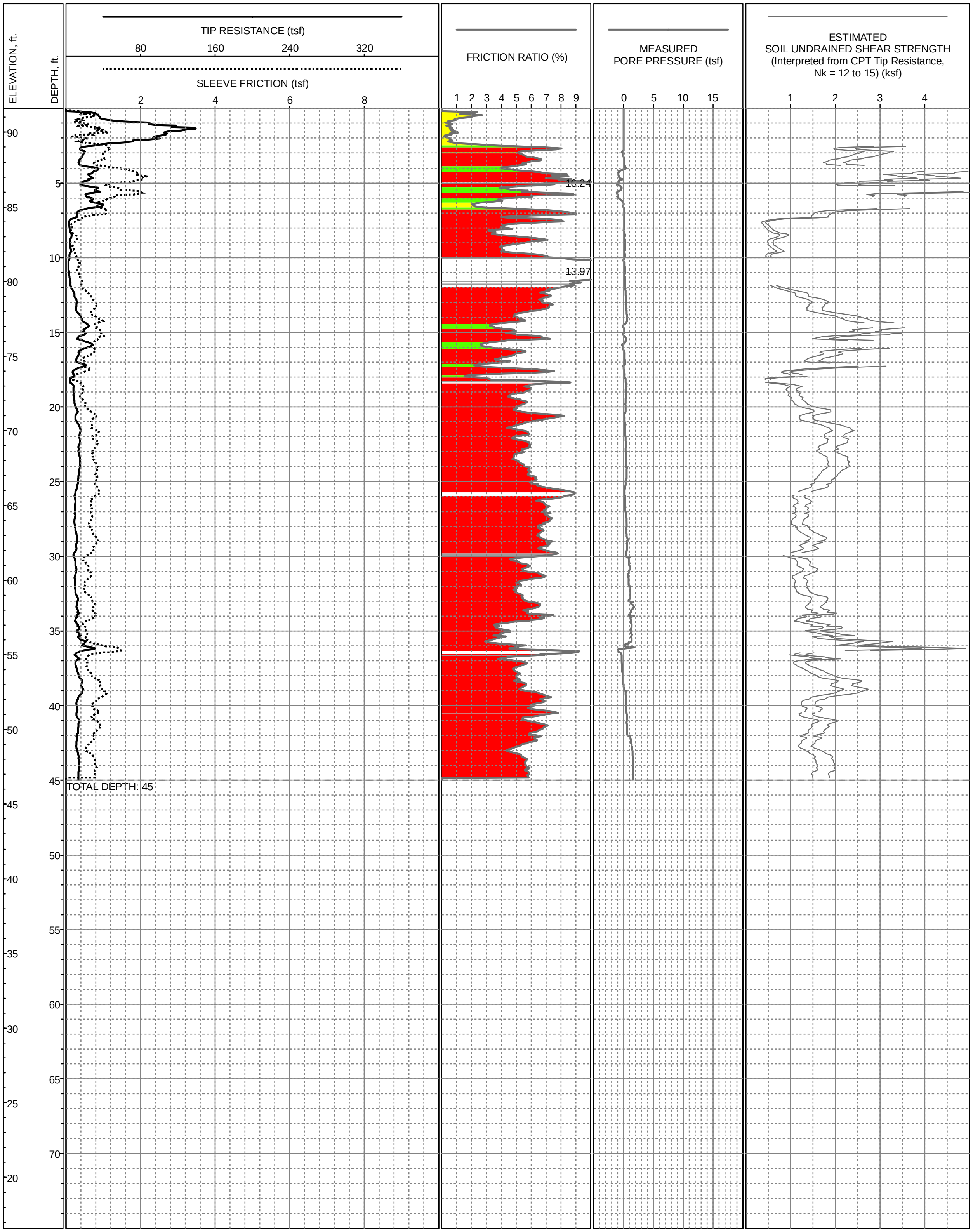
Zone	Soil Behavior Type
1	Sensitive Fine-grained
2	Organic Material
3	Clay to Silty Clay
4	Clayey Silt to Silty Clay
5	Silty Sand to Sandy Silt
6	Clean Sands to Silty Sands
7	Gravelly Sand to Sand
8	Very Stiff Sand to Clayey Sand *
9	Very Stiff Fine-grained *

*overconsolidated or cemented

CPT CORRELATION CHART

(Modified from Robertson, 1990)

KEY TO CPT LOGS
Central Area Guideway of SVRT Project
San Jose, California

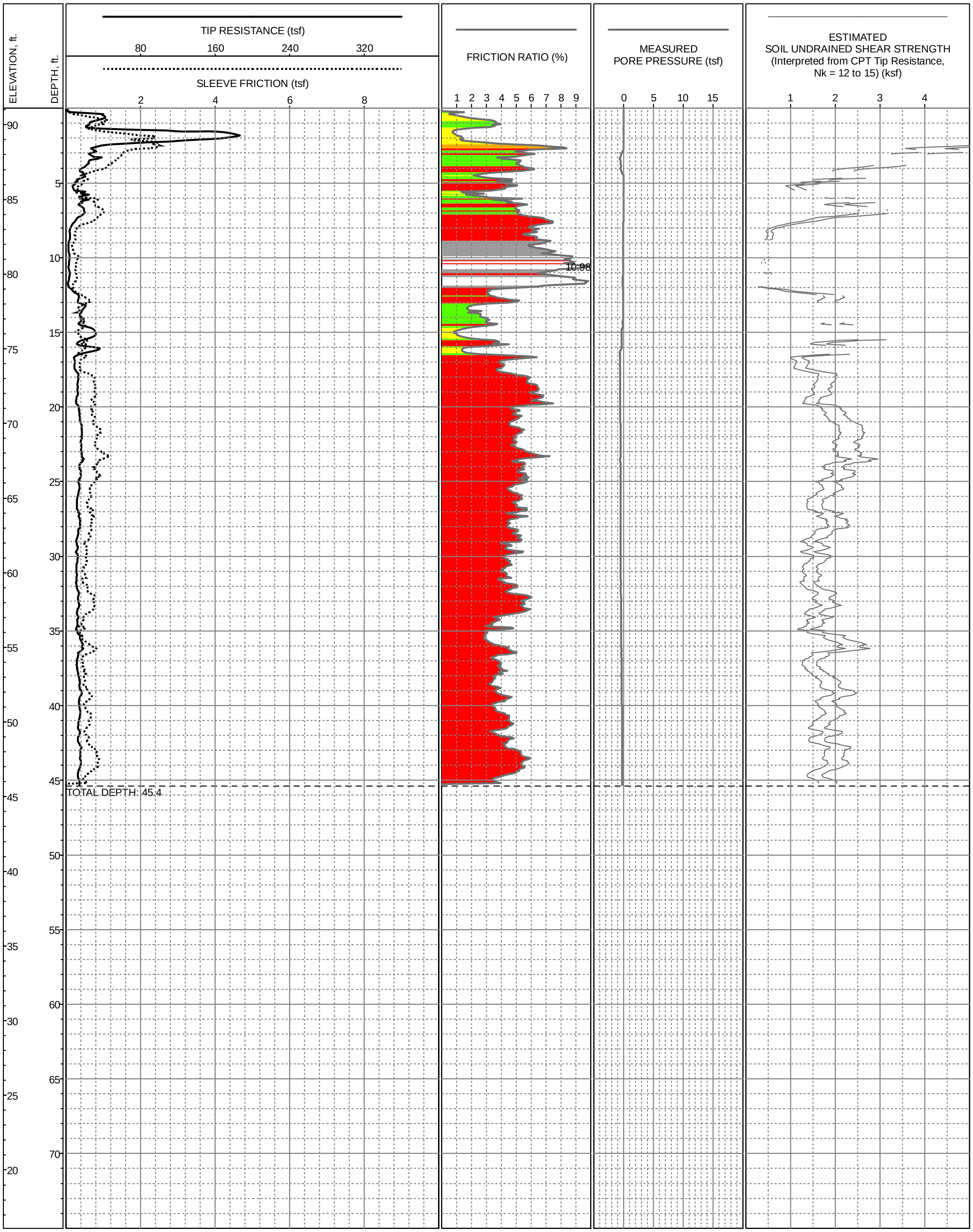


LOCATION: E6162888.9 N1956837.2 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 91.6ft (NAVD88)
COMPLETION DEPTH: 45ft
TEST DATE: 4/3/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-158

Central Area Guideway of SVRT Project
San Jose, California

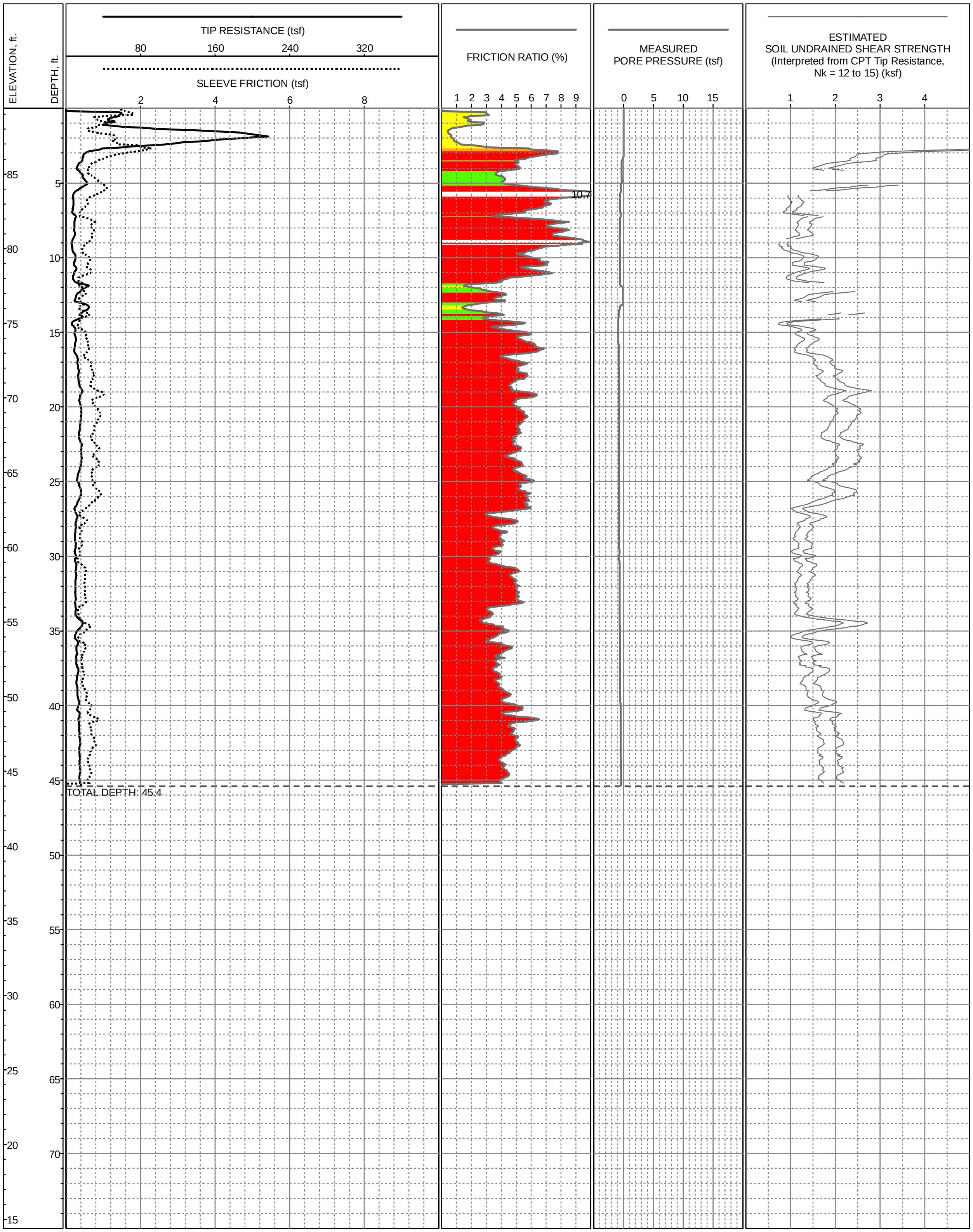


LOCATION: E6162916.2 N1956740.9 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 91.1ft (NAVD88)
COMPLETION DEPTH: 45.4ft
TEST DATE: 4/4/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-159

Central Area Guideway of SVRT Project
San Jose, California

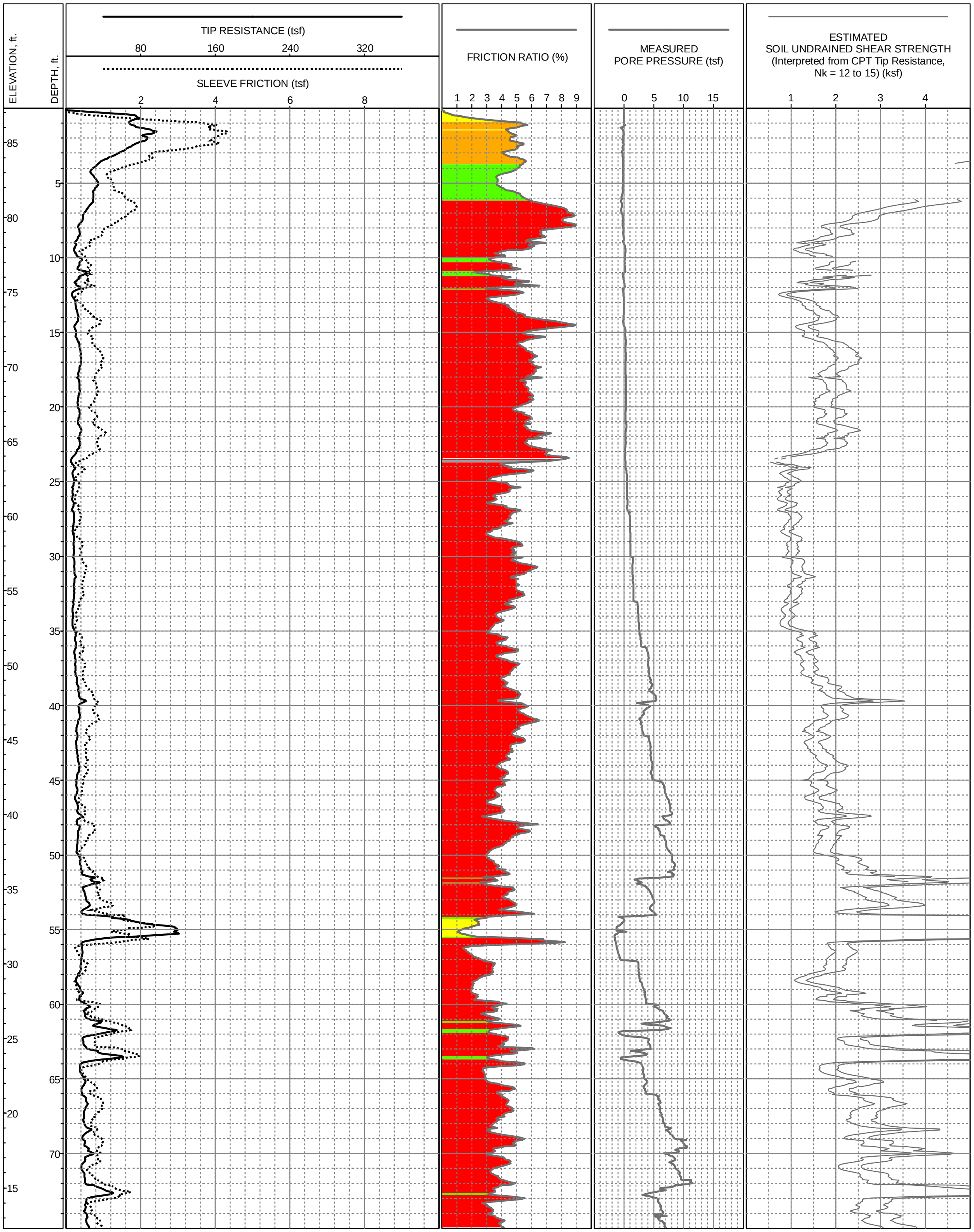


LOCATION: E6162986.4 N1956566.5 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 89.4ft (NAVD88)
COMPLETION DEPTH: 45.4ft
TEST DATE: 4/4/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-160

Central Area Guideway of SVRT Project
San Jose, California

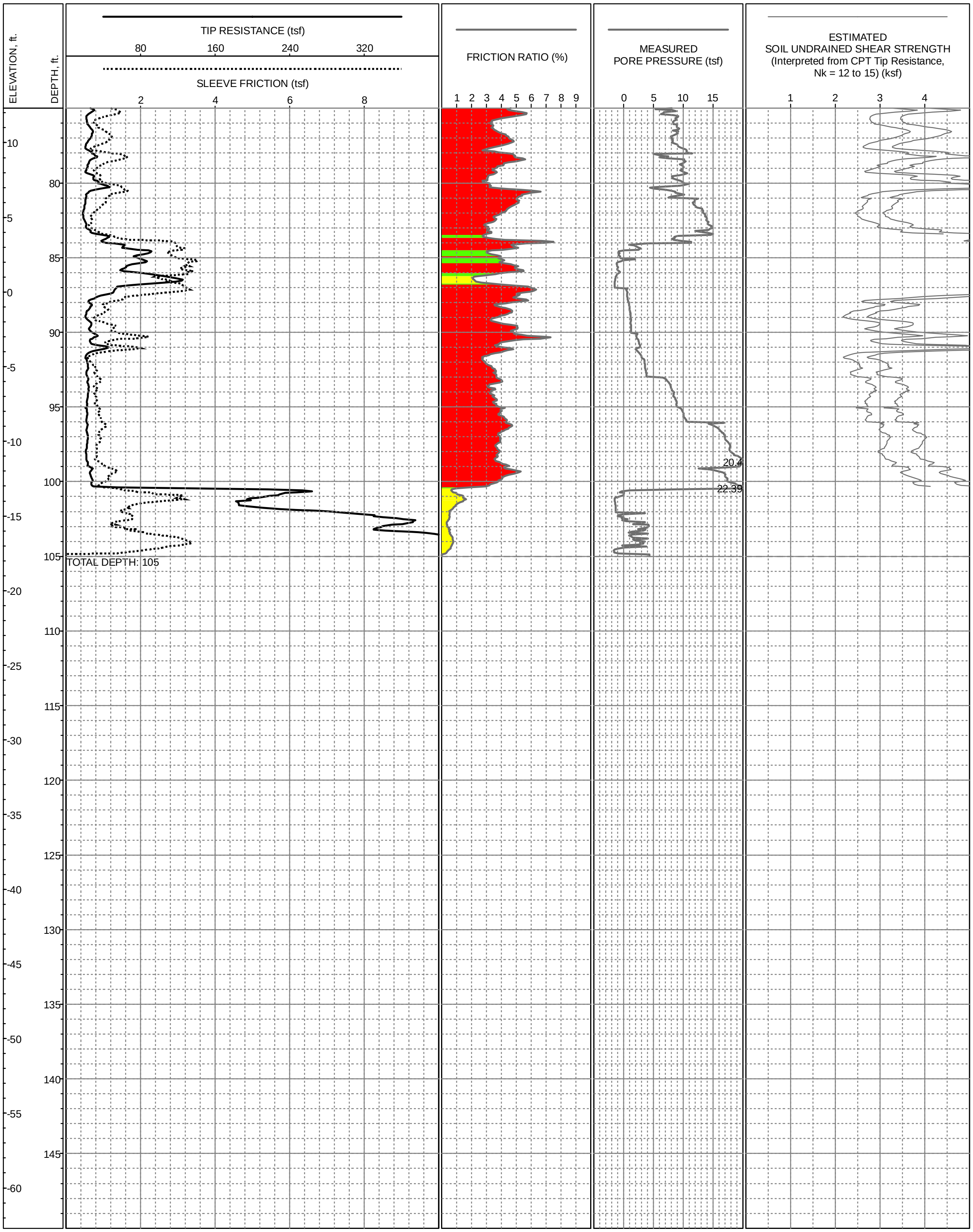


LOCATION: E6163128.3 N1956250.6 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 87.3ft (NAVD88)
COMPLETION DEPTH: 105ft
TEST DATE: 4/3/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-161

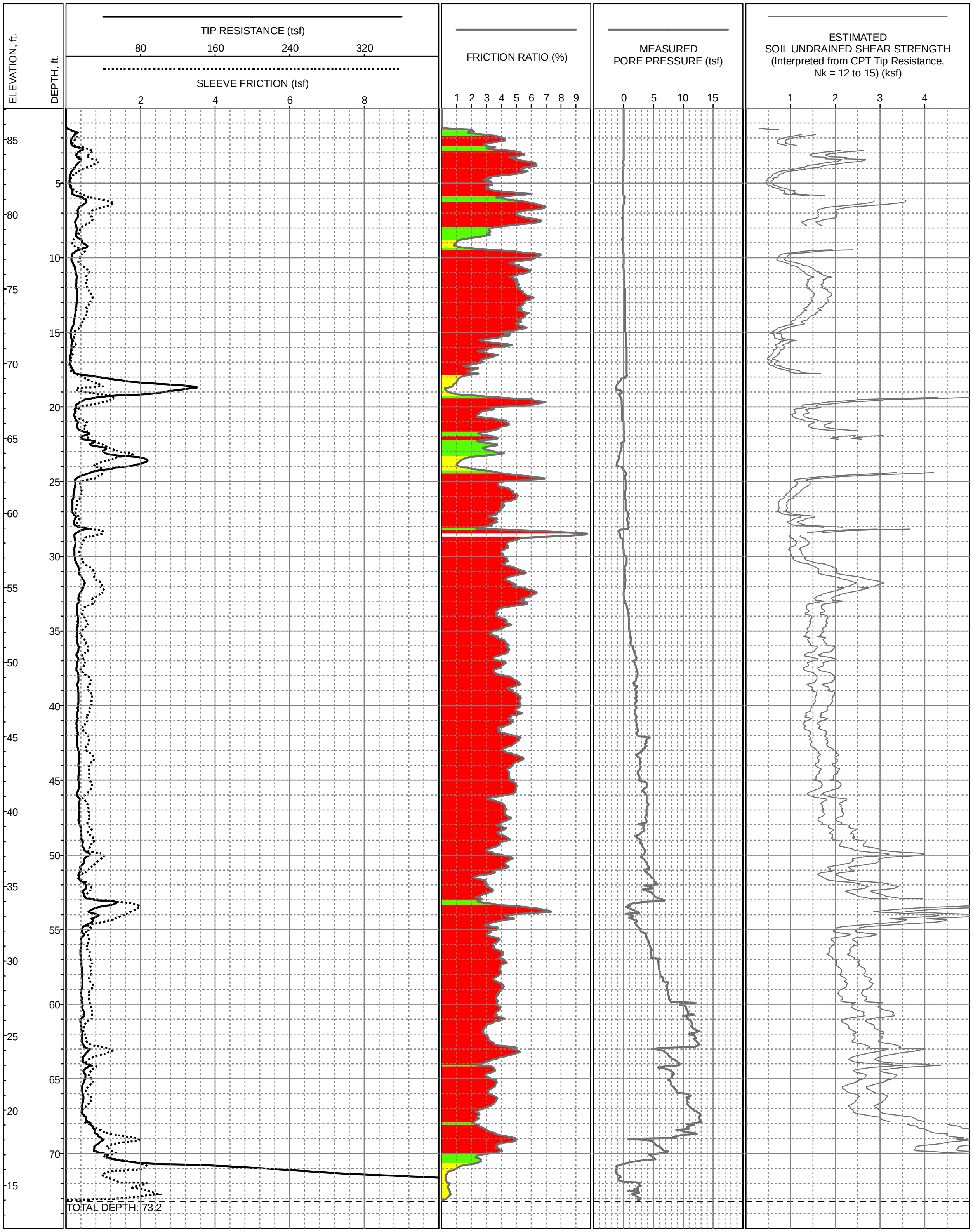
Central Area Guideway of SVRT Project
San Jose, California



LOCATION: E6163128.3 N1956250.6 (NAD83, CA State Plane Zone III, Feet)	CONE: F7.5CKESW1645
SURFACE EL: 87.3ft (NAVD88)	PERFORMED BY: Fugro Consultants, Inc.
COMPLETION DEPTH: 105ft	OPERATOR: D Garza & R Norris
TEST DATE: 4/3/2007	REVIEWED BY: M Paquette

LOG OF CPT-161

Central Area Guideway of SVRT Project
San Jose, California

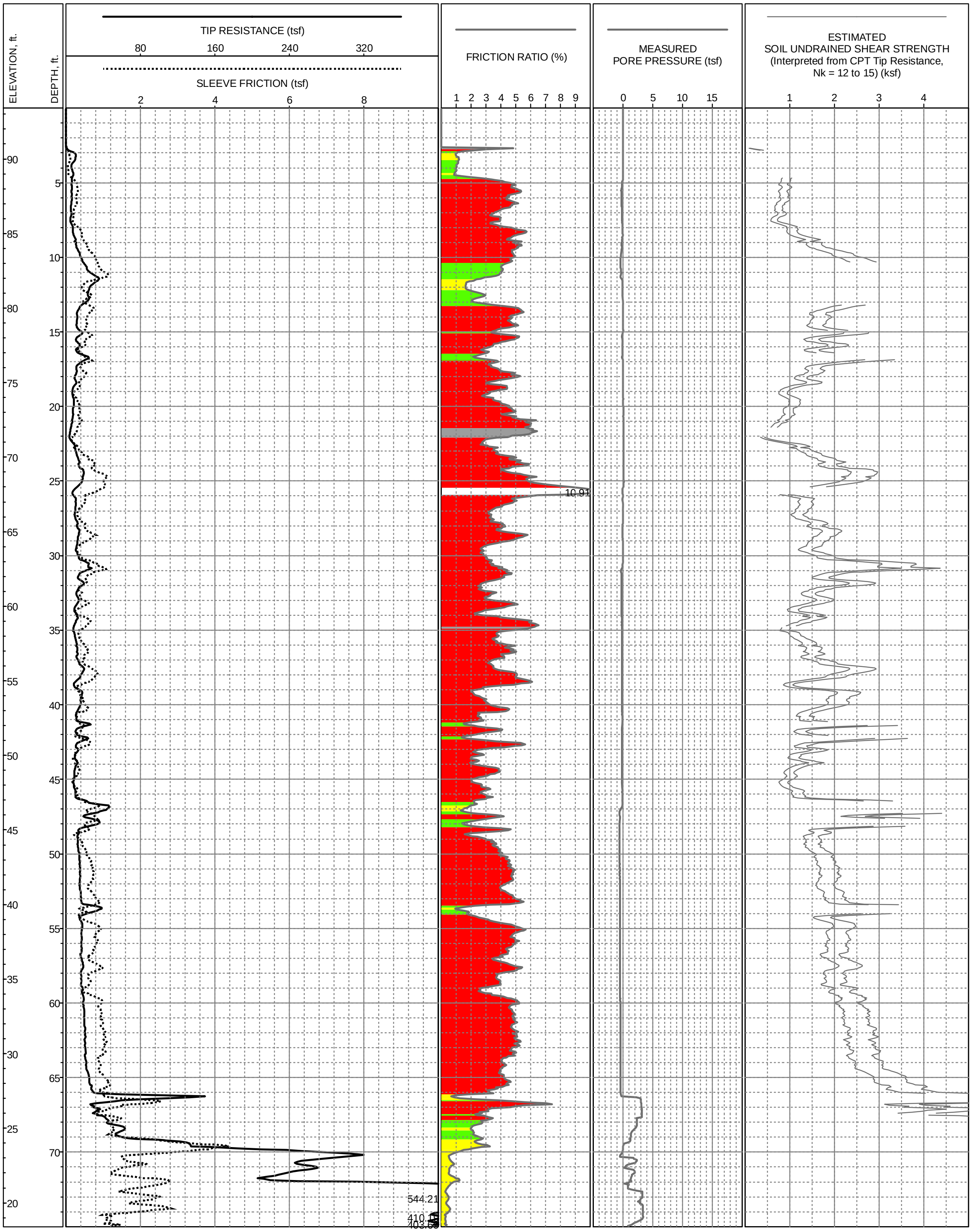


LOCATION: E6164944.9 N1953715.9 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 87.1ft (NAVD88)
COMPLETION DEPTH: 73.2ft
TEST DATE: 8/13/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

LOG OF CPT-162

Central Area Guideway of SVRT Project
San Jose, California

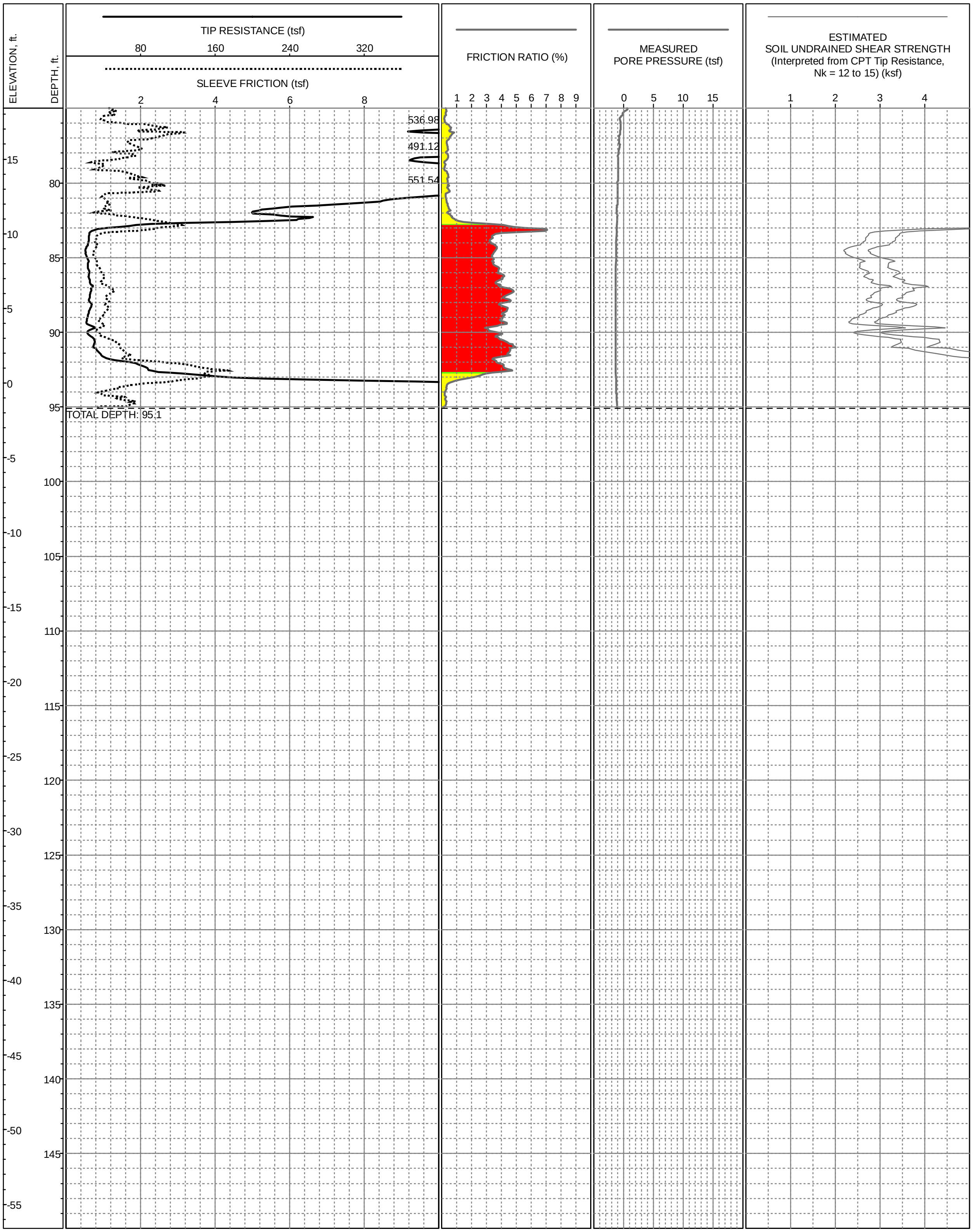


LOCATION: E6163027.2 N1950984.9 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 93.4ft (NAVD88)
COMPLETION DEPTH: 95.1ft
TEST DATE: 3/31/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-163

Central Area Guideway of SVRT Project
San Jose, California

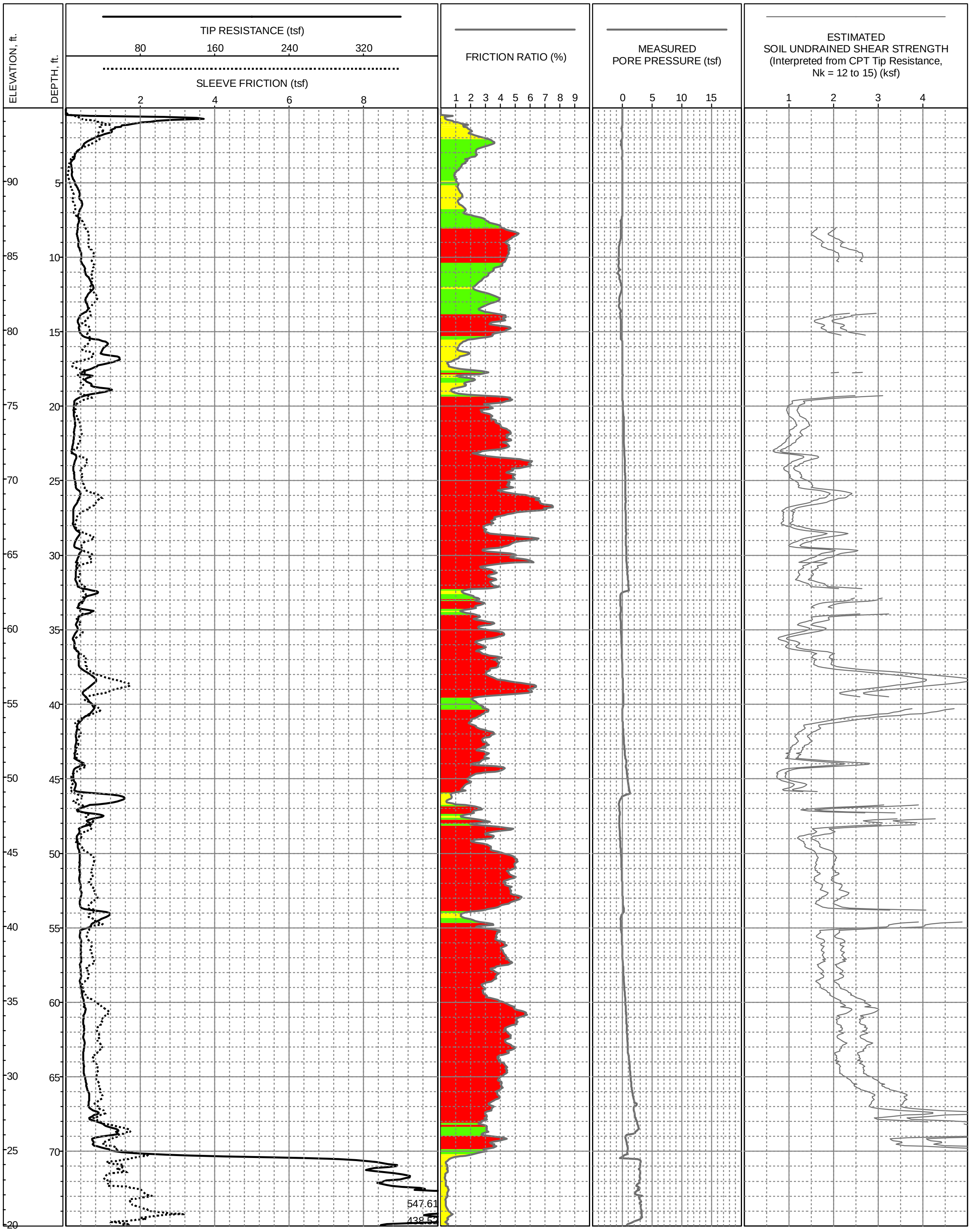


LOCATION: E6163027.2 N1950984.9 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 93.4ft (NAVD88)
COMPLETION DEPTH: 95.1ft
TEST DATE: 3/31/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-163

Central Area Guideway of SVRT Project
San Jose, California

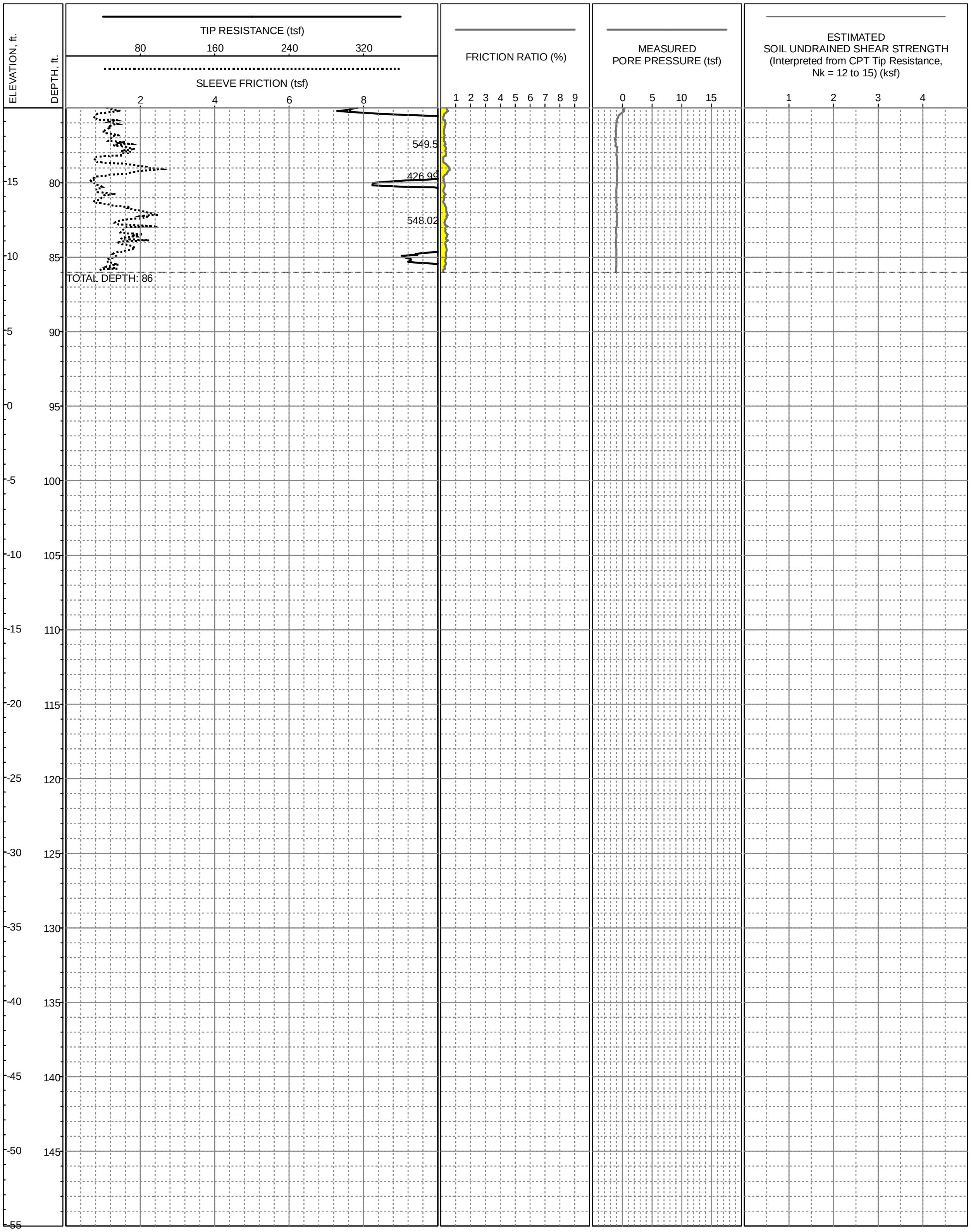


LOCATION: E6162753.1 N1950828.5 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 94.9ft (NAVD88)
COMPLETION DEPTH: 86ft
TEST DATE: 3/28/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-164

Central Area Guideway of SVRT Project
San Jose, California

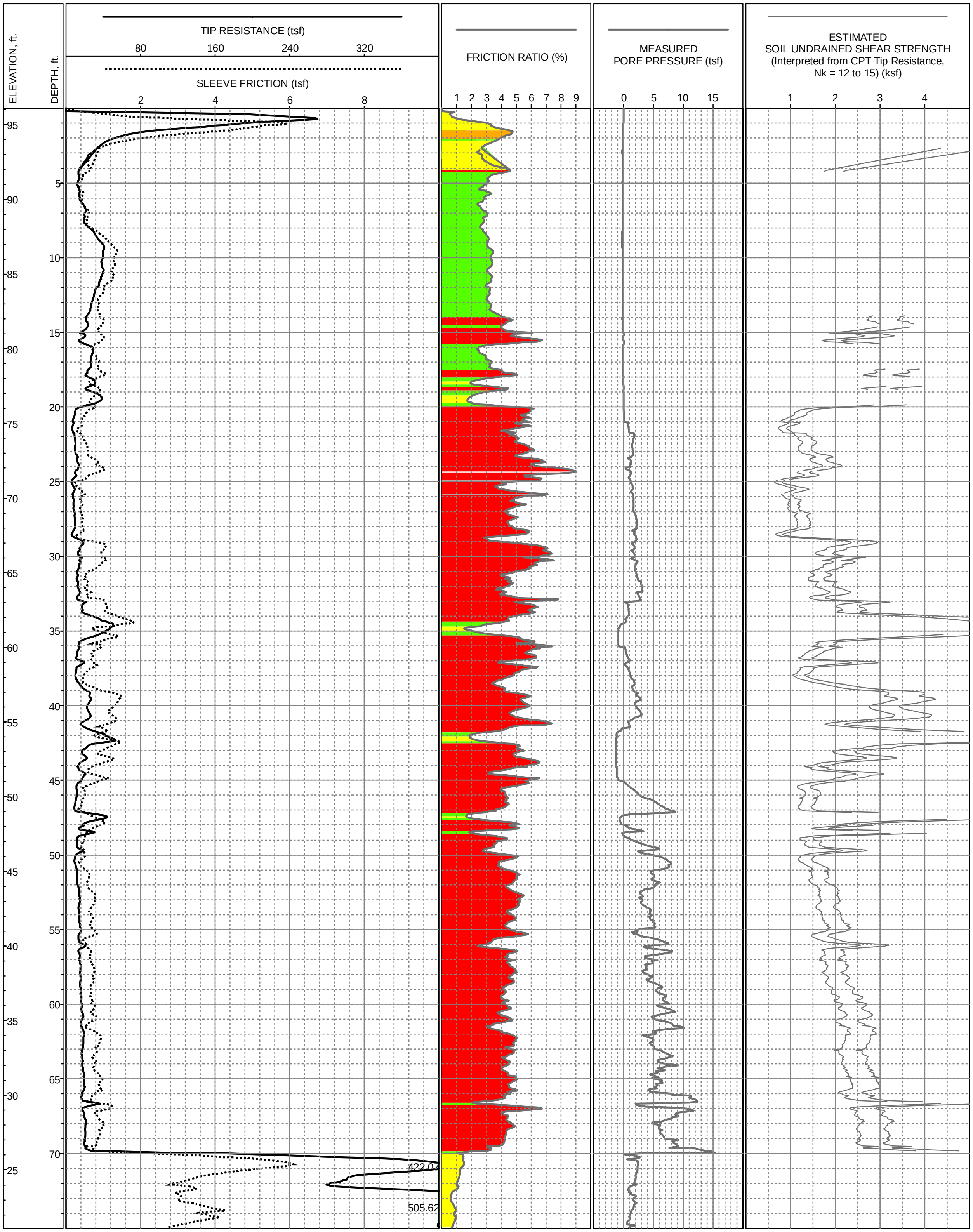


LOCATION: E6162753.1 N1950828.5 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 94.9ft (NAVD88)
COMPLETION DEPTH: 86ft
TEST DATE: 3/28/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-164

Central Area Guideway of SVRT Project
San Jose, California

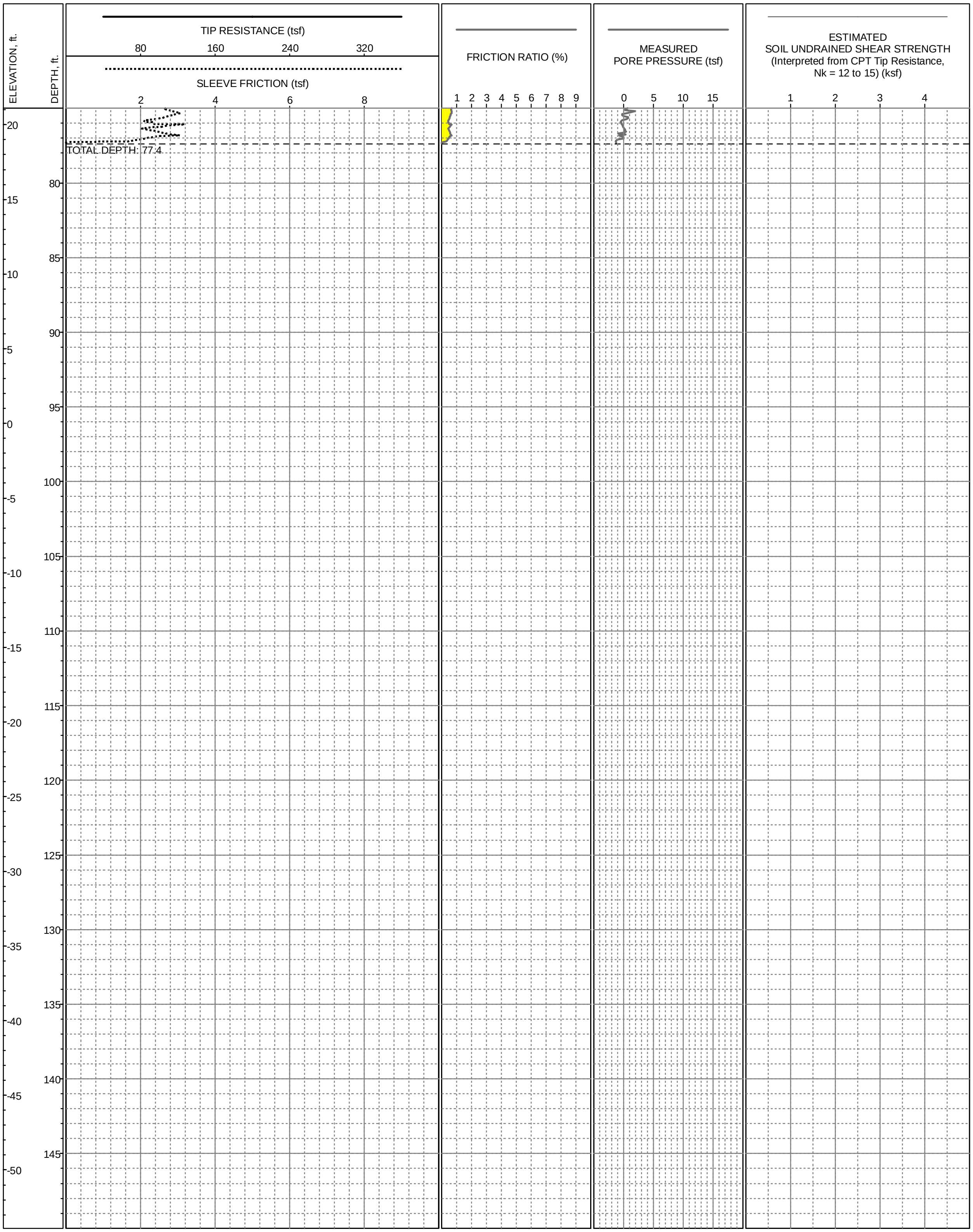


LOCATION: E6162527.2 N1950703.4 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 96.1ft (NAVD88)
COMPLETION DEPTH: 77.4ft
TEST DATE: 8/16/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

LOG OF CPT-165

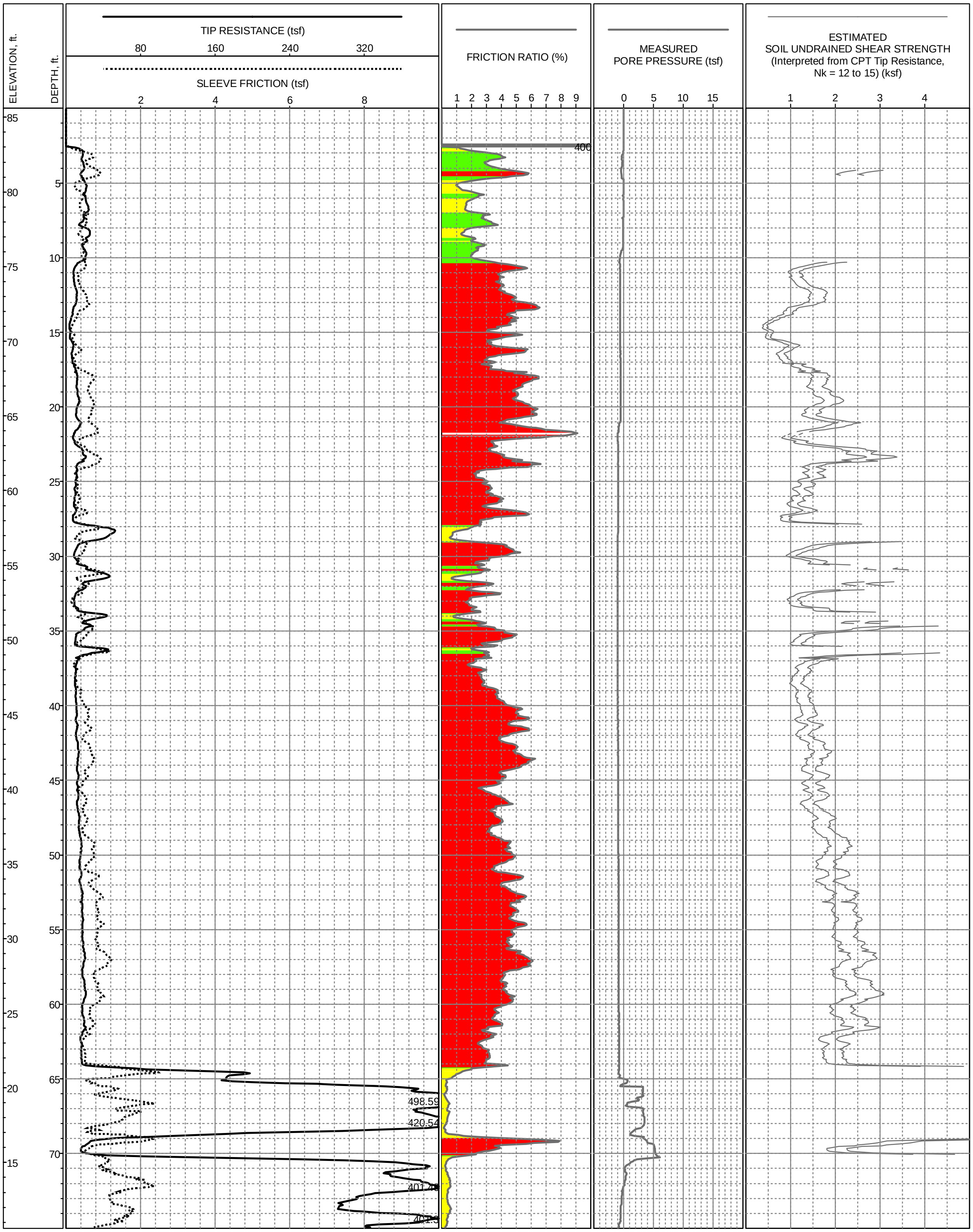
Central Area Guideway of SVRT Project
San Jose, California



LOCATION: E6162527.2 N1950703.4 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 96.1ft (NAVD88)
COMPLETION DEPTH: 77.4ft
TEST DATE: 8/16/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

LOG OF CPT-165
Central Area Guideway of SVRT Project
San Jose, California



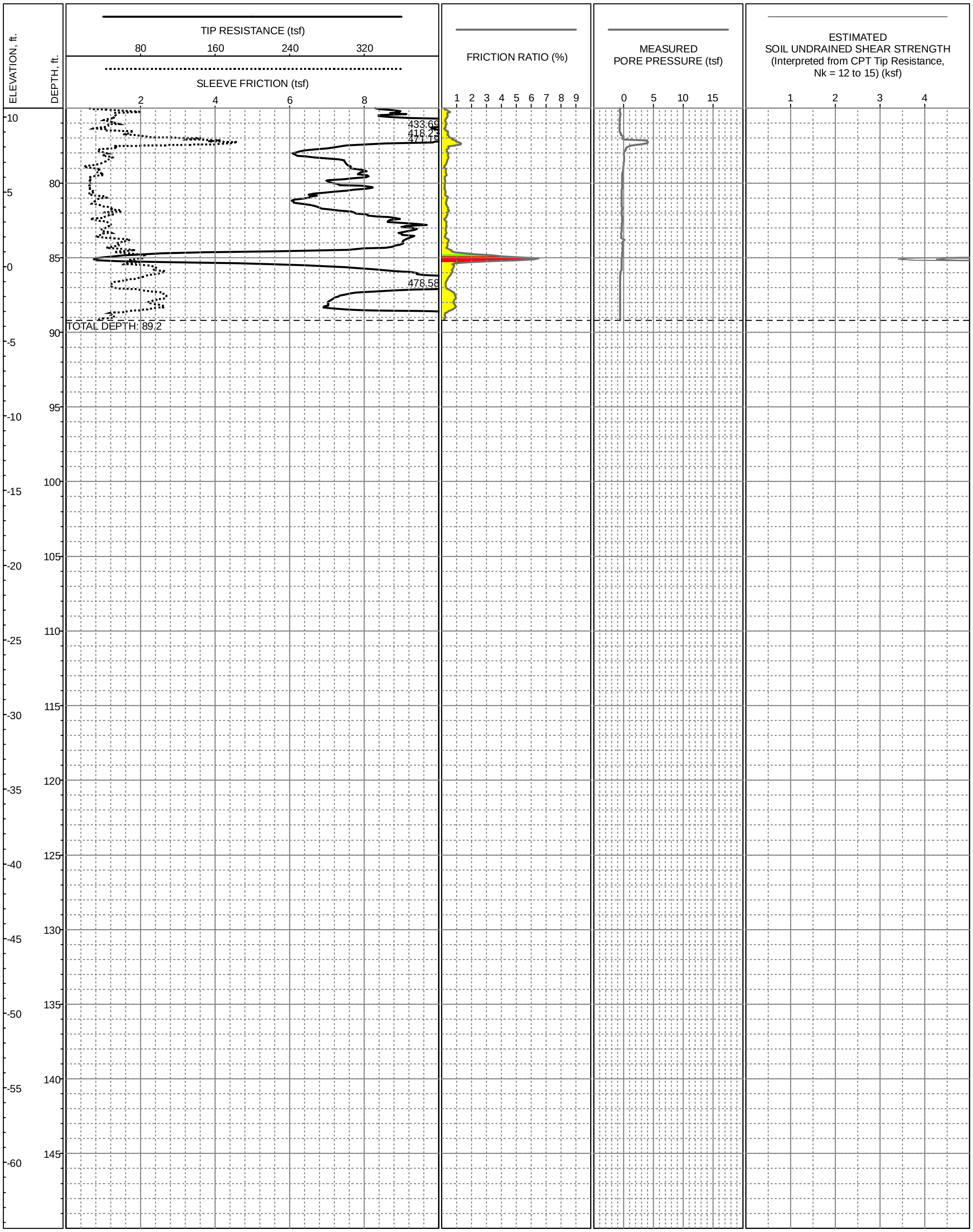
LOCATION: E6161925.6 N1950357.8 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 85.6ft (NAVD88)
COMPLETION DEPTH: 89.2ft
TEST DATE: 3/29/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-166

Central Area Guideway of SVRT Project
San Jose, California

HMM/Bechtel
Project No. 1637.001

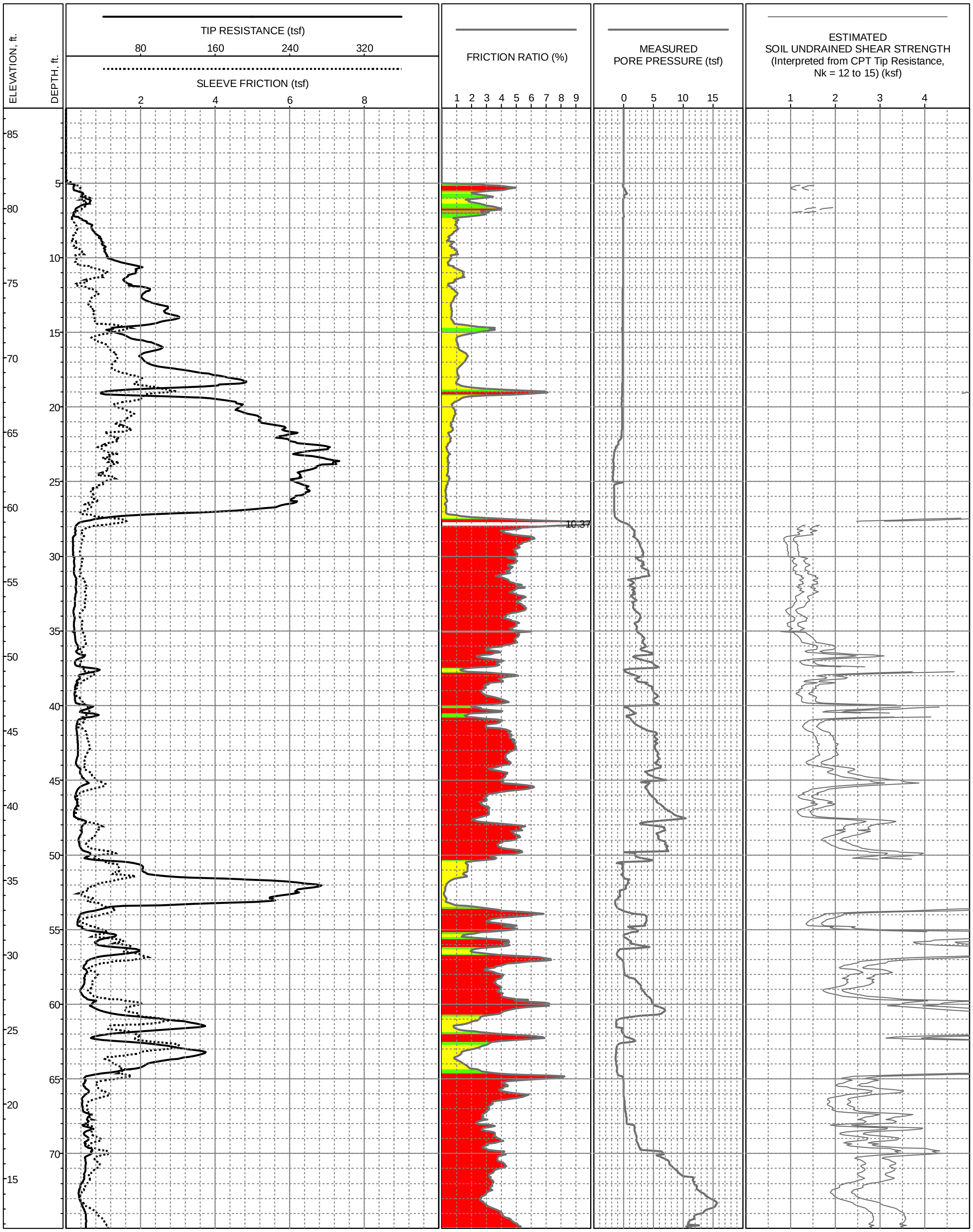


LOCATION: E6161925.6 N1950357.8 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 85.6ft (NAVD88)
COMPLETION DEPTH: 89.2ft
TEST DATE: 3/29/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-166

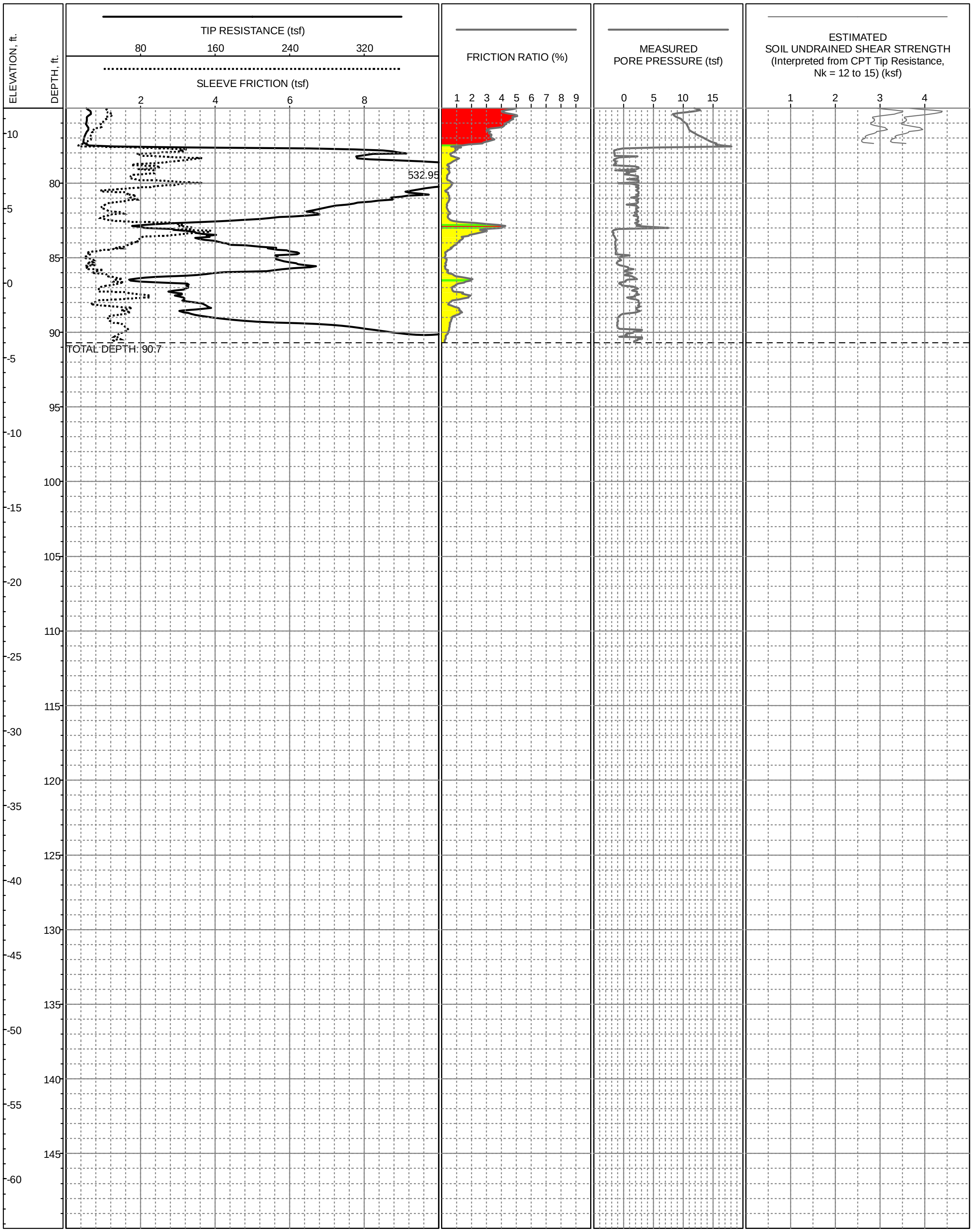
Central Area Guideway of SVRT Project
San Jose, California



LOCATION: E6157353.8 N1947883.5 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 86.7ft (NAVD88)
COMPLETION DEPTH: 90.7ft
TEST DATE: 4/1/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-167
Central Area Guideway of SVRT Project
San Jose, California

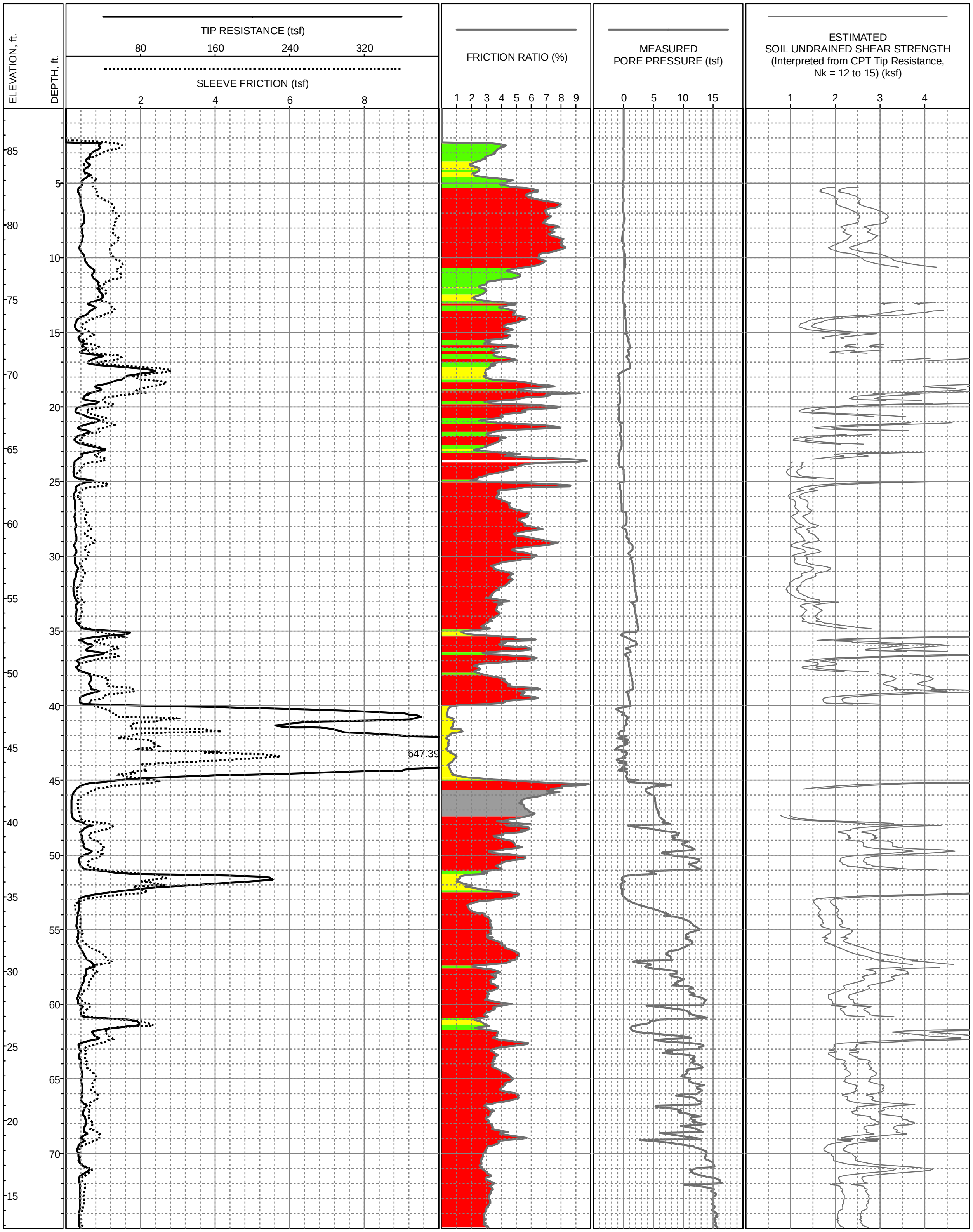


LOCATION: E6157353.8 N1947883.5 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 86.7ft (NAVD88)
COMPLETION DEPTH: 90.7ft
TEST DATE: 4/1/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-167

Central Area Guideway of SVRT Project
San Jose, California

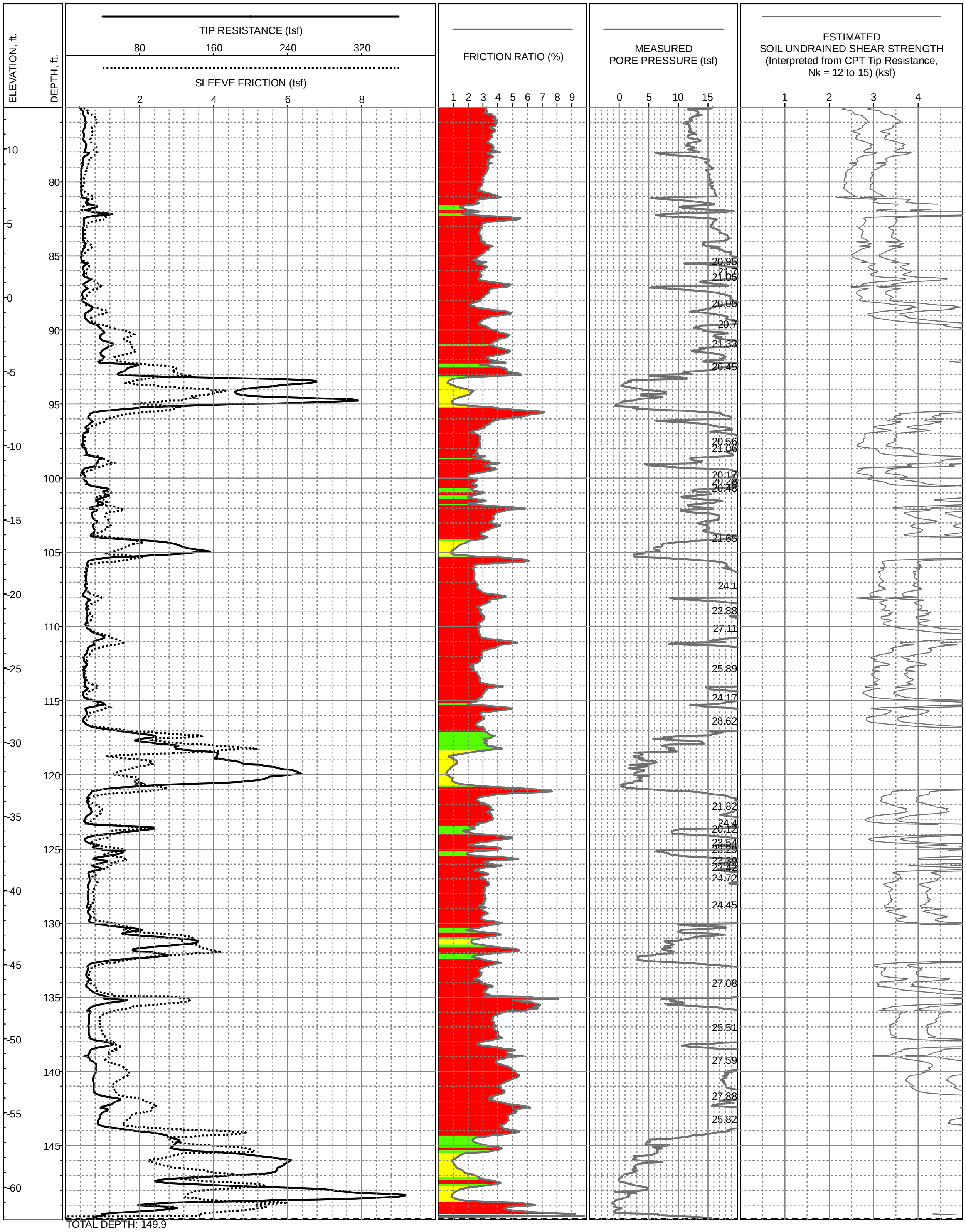


LOCATION: E6154586 N1946016.7 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 87.8ft (NAVD88)
COMPLETION DEPTH: 149.9ft
TEST DATE: 4/5/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-168

Central Area Guideway of SVRT Project
San Jose, California

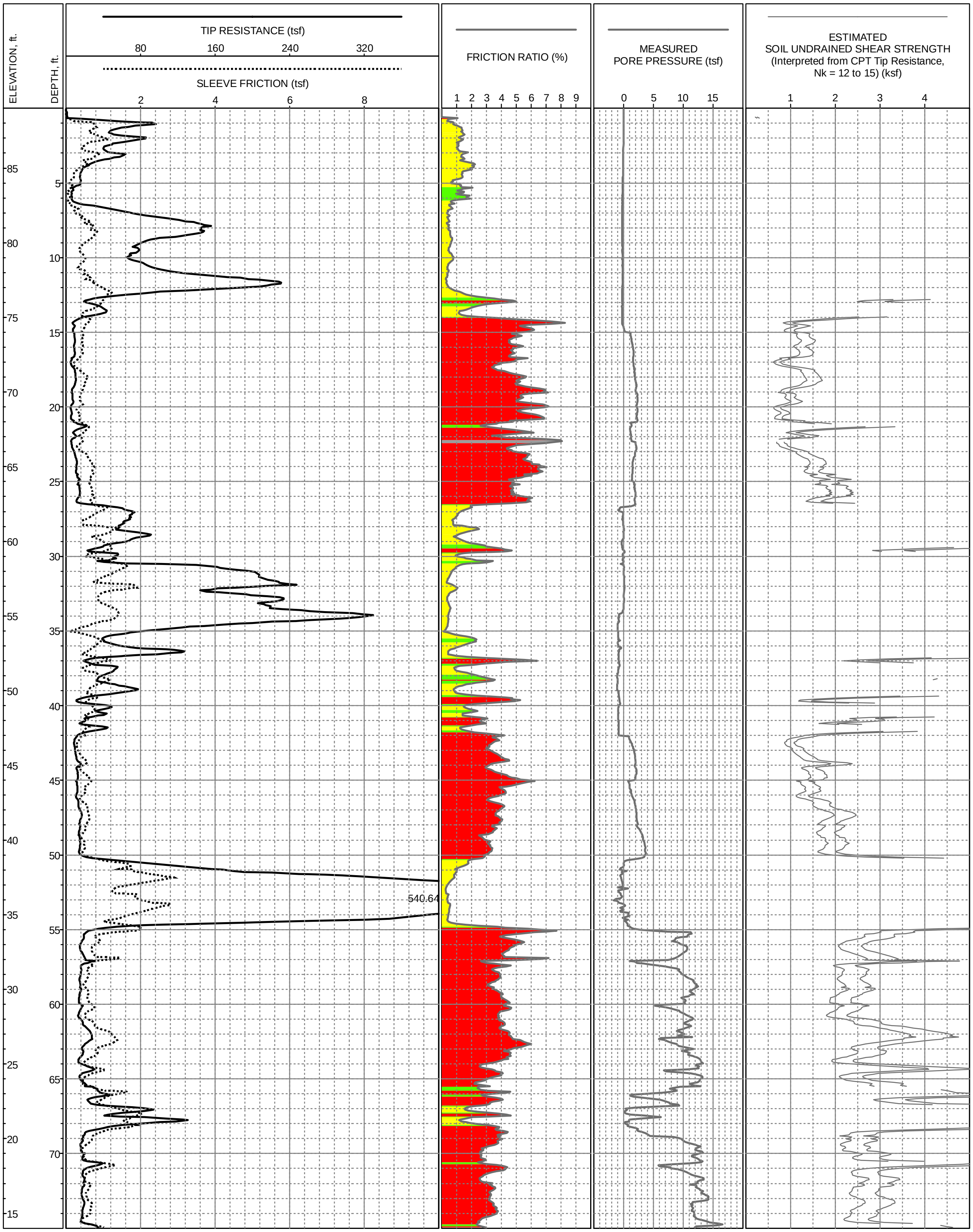


LOCATION: E6154586 N1946016.7 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 87.8ft (NAVD88)
COMPLETION DEPTH: 149.9ft
TEST DATE: 4/5/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-168

Central Area Guideway of SVRT Project
San Jose, California

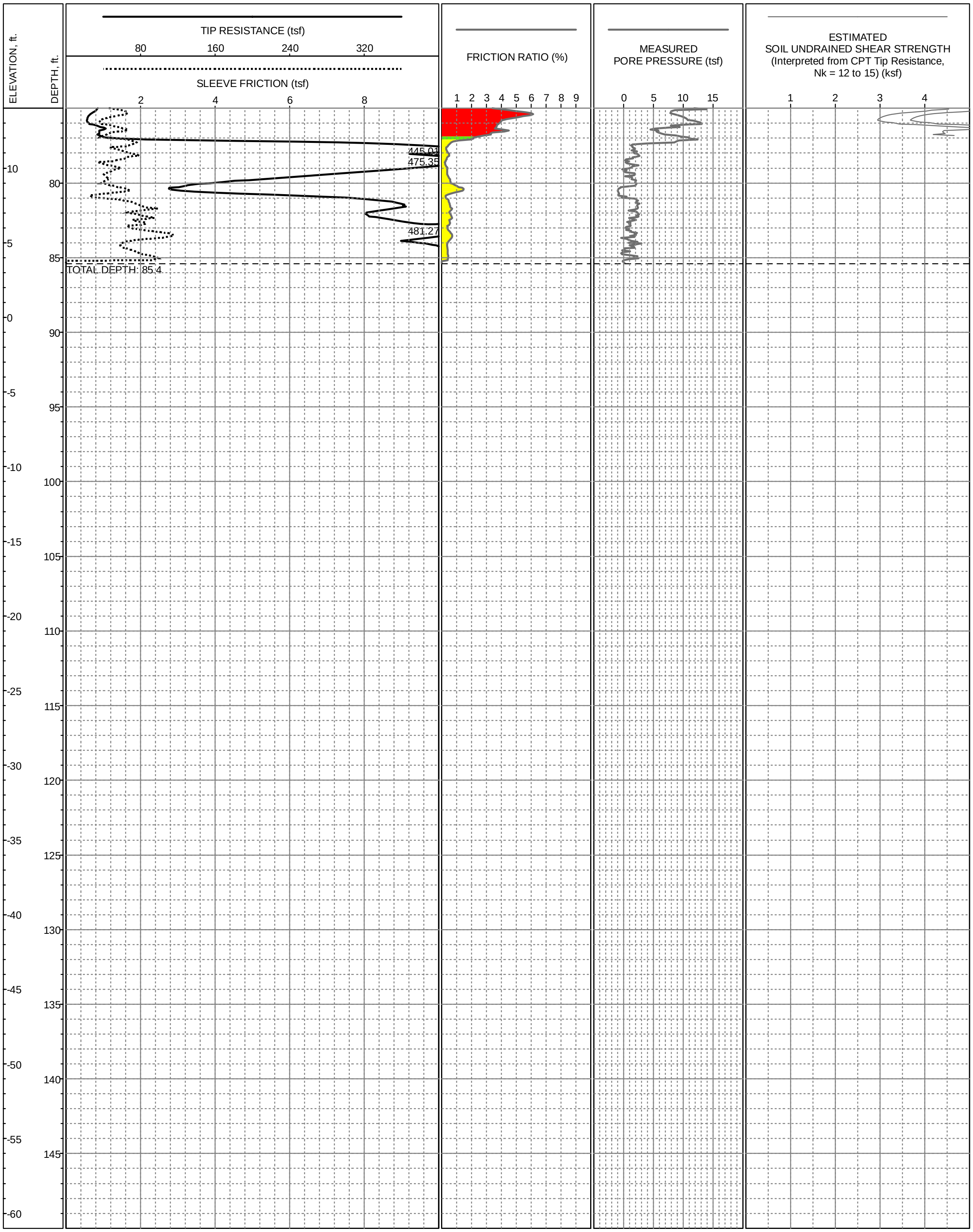


LOCATION: E6156936.7 N1947464 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 89ft (NAVD88)
COMPLETION DEPTH: 85.4ft
TEST DATE: 8/17/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

LOG OF CPT-169

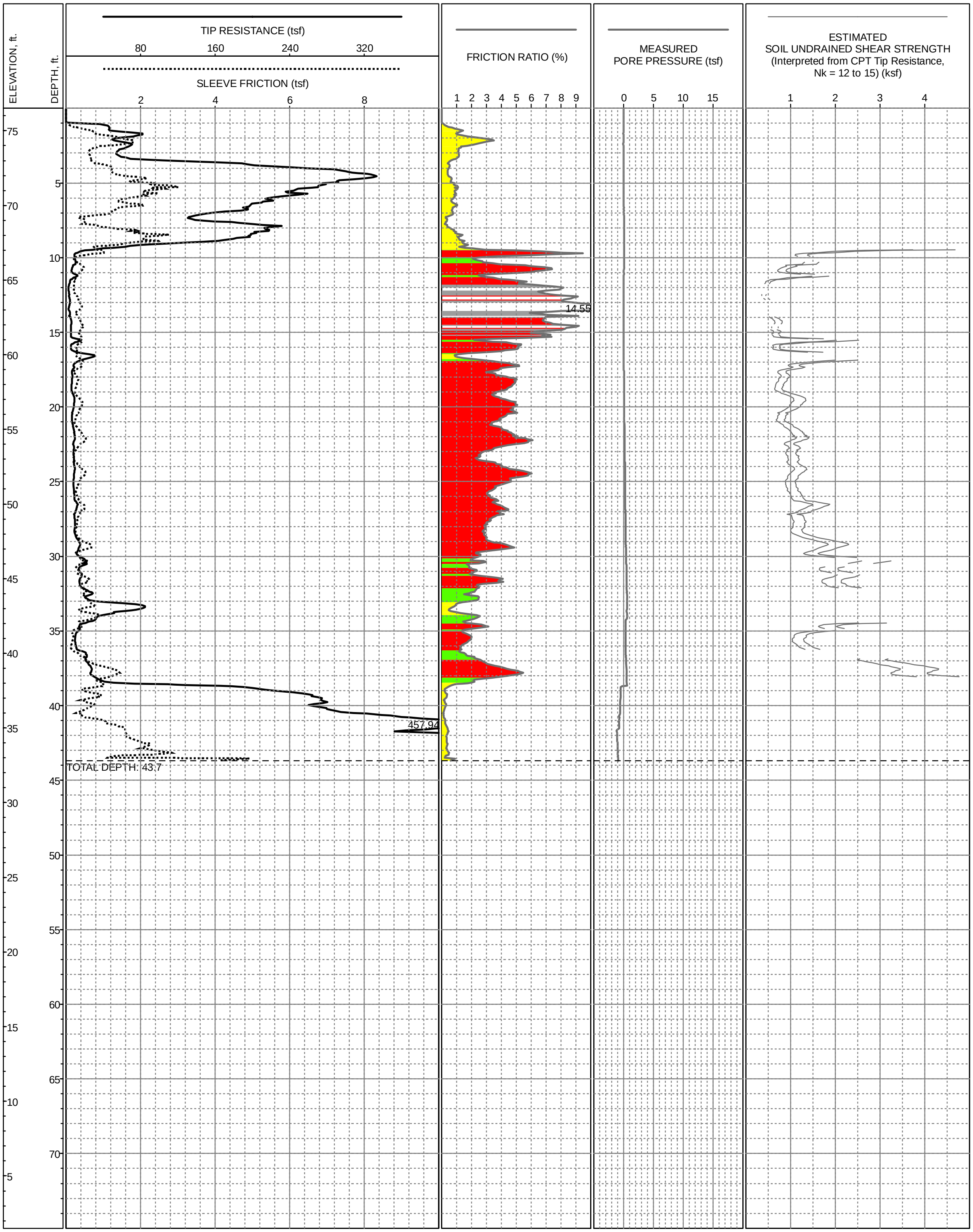
Central Area Guideway of SVRT Project
San Jose, California



LOCATION: E6156936.7 N1947464 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 89ft (NAVD88)
COMPLETION DEPTH: 85.4ft
TEST DATE: 8/17/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

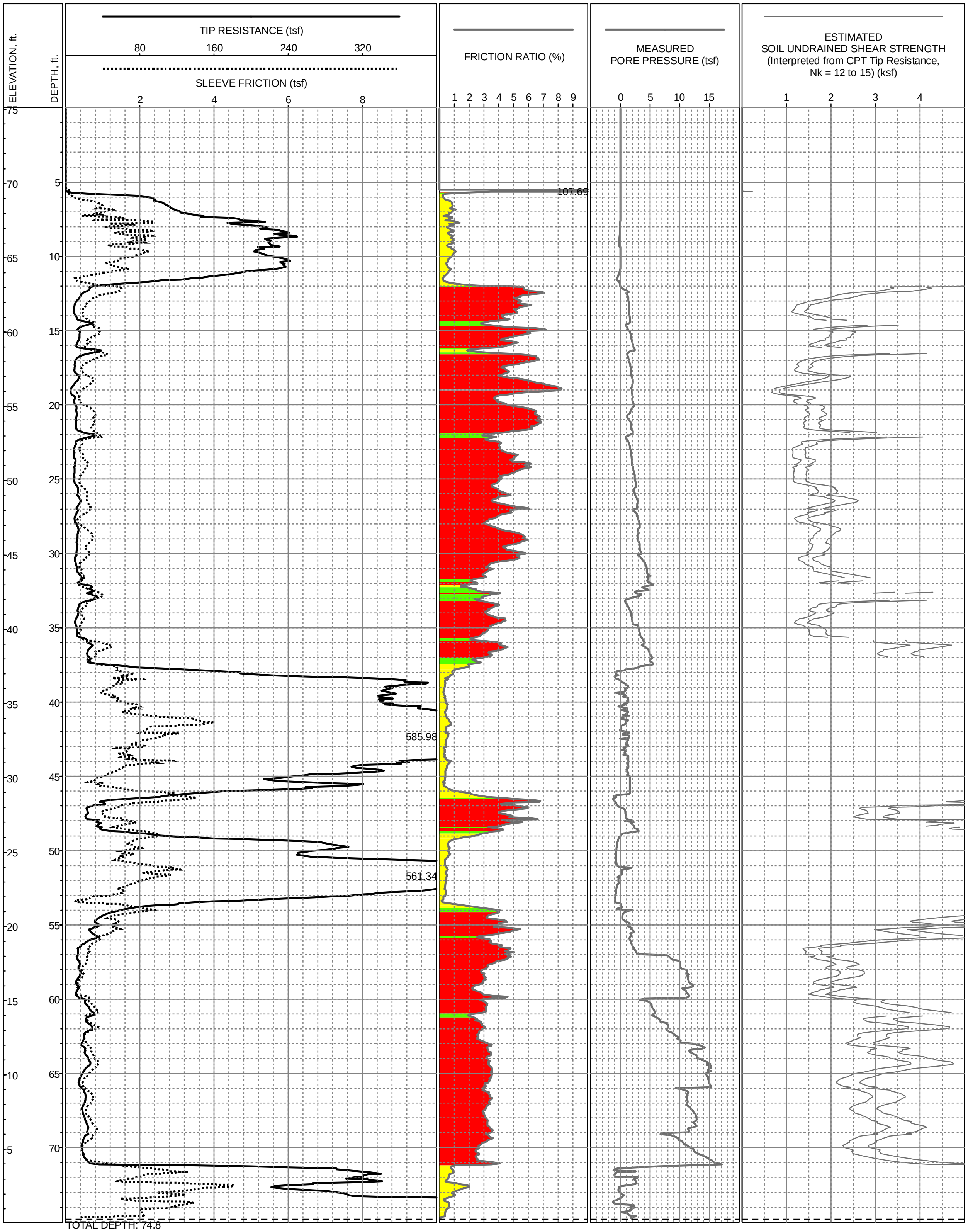
LOG OF CPT-169
Central Area Guideway of SVRT Project
San Jose, California



LOCATION: E6150886 N1949597.6 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 76.5ft (NAVD88)
COMPLETION DEPTH: 43.7ft
TEST DATE: 3/30/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

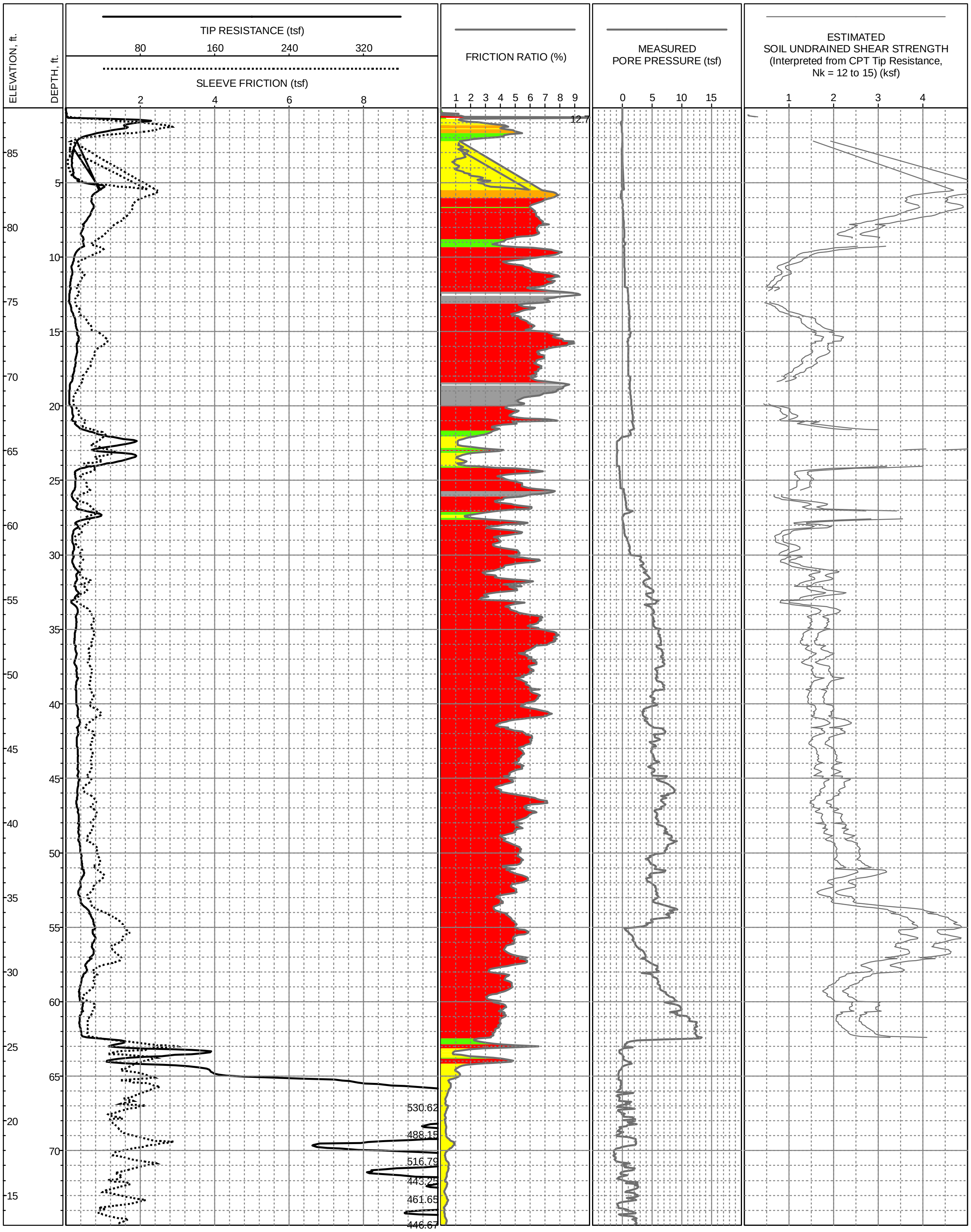
LOG OF CPT-170
Central Area Guideway of SVRT Project
San Jose, California



LOCATION: E6150804.4 N1949684.3 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 75.1ft (NAVD88)
COMPLETION DEPTH: 74.8ft
TEST DATE: 3/30/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-171
Central Area Guideway of SVRT Project
San Jose, California

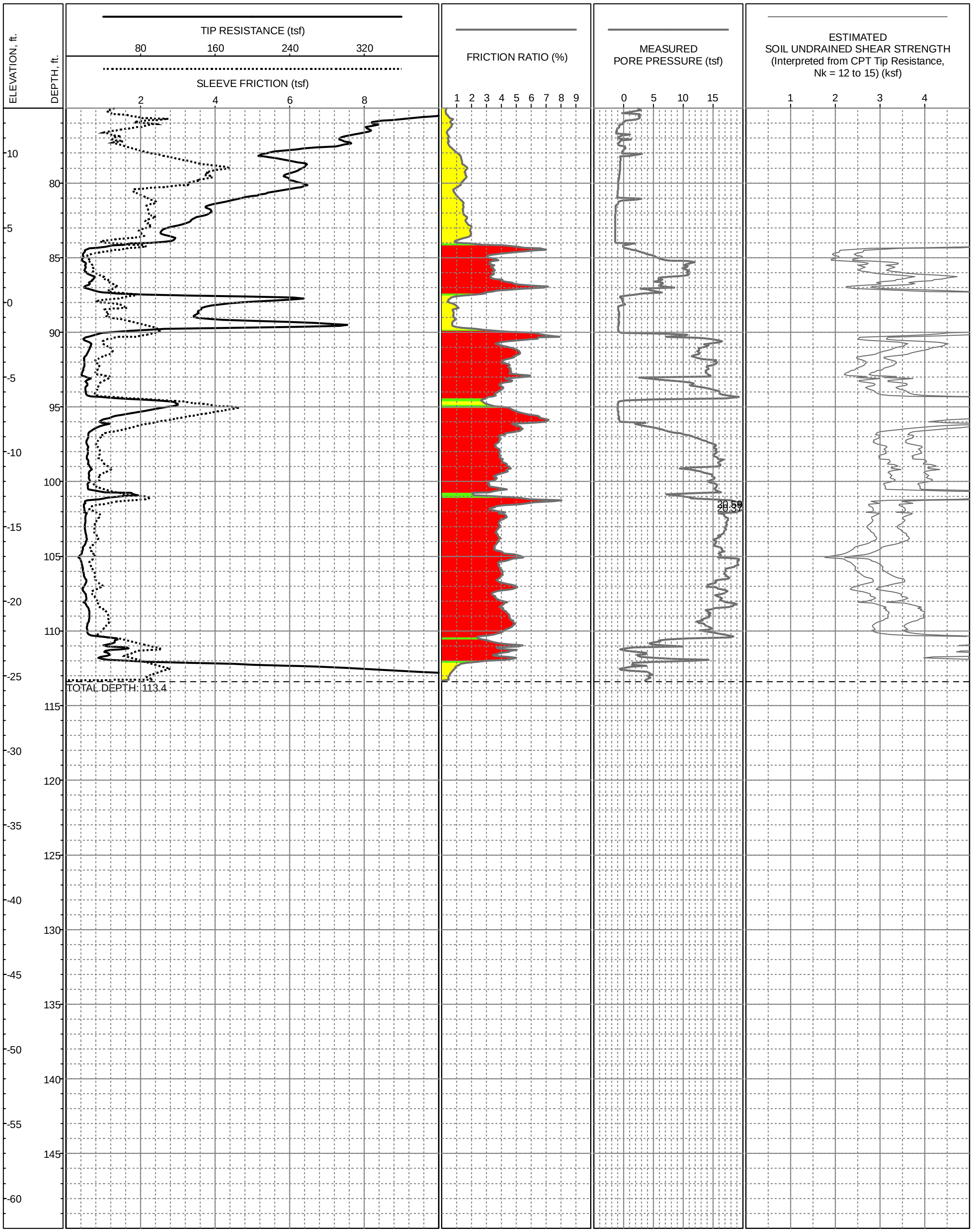


LOCATION: E6164740.58 N1953023.9 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 88ft (NAVD88)
COMPLETION DEPTH: 113.4ft
TEST DATE: 8/16/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

LOG OF CPT-172

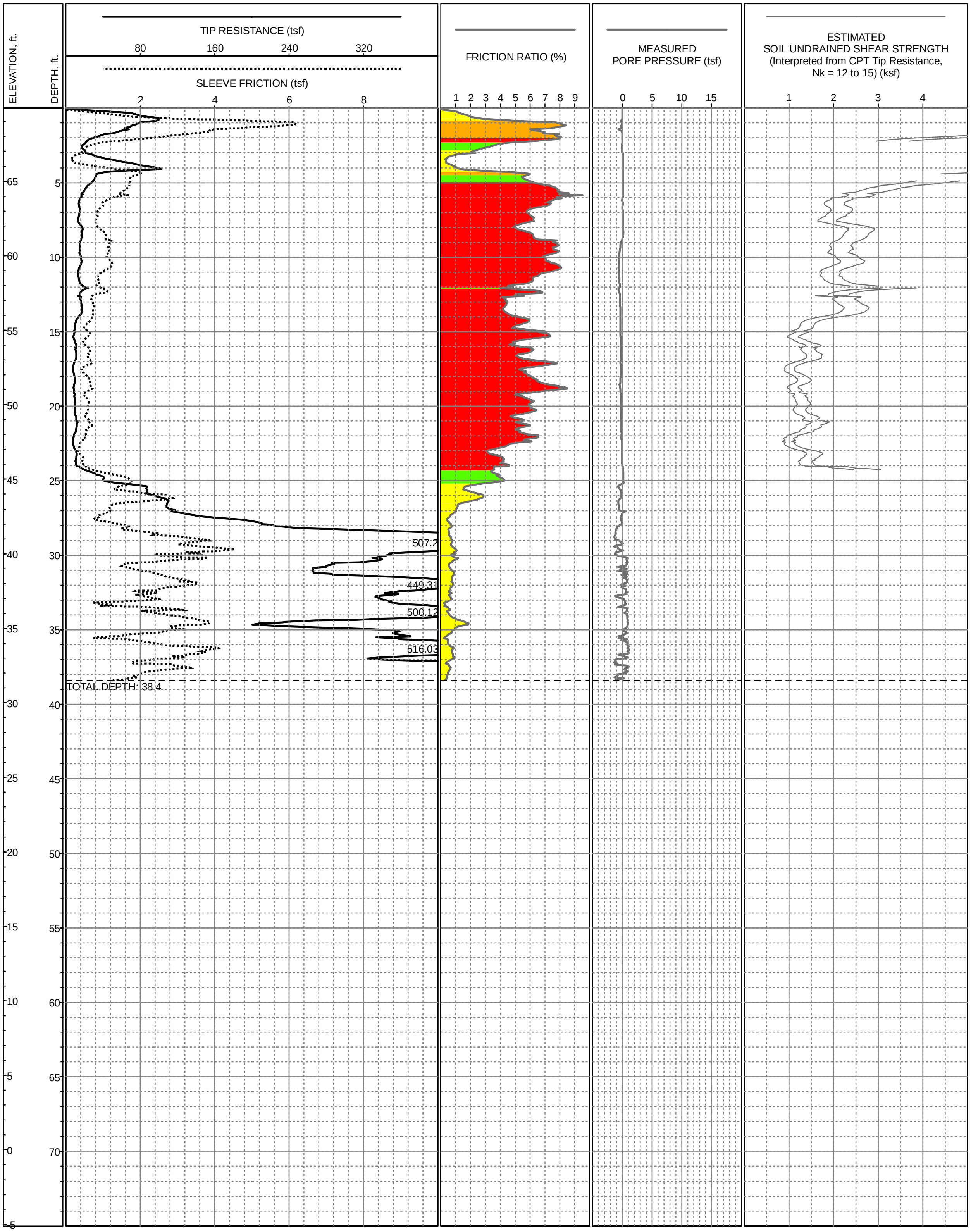
Central Area Guideway of SVRT Project
San Jose, California



LOCATION: E6164740.58 N1953023.9 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 88ft (NAVD88)
COMPLETION DEPTH: 113.4ft
TEST DATE: 8/16/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

LOG OF CPT-172
Central Area Guideway of SVRT Project
San Jose, California



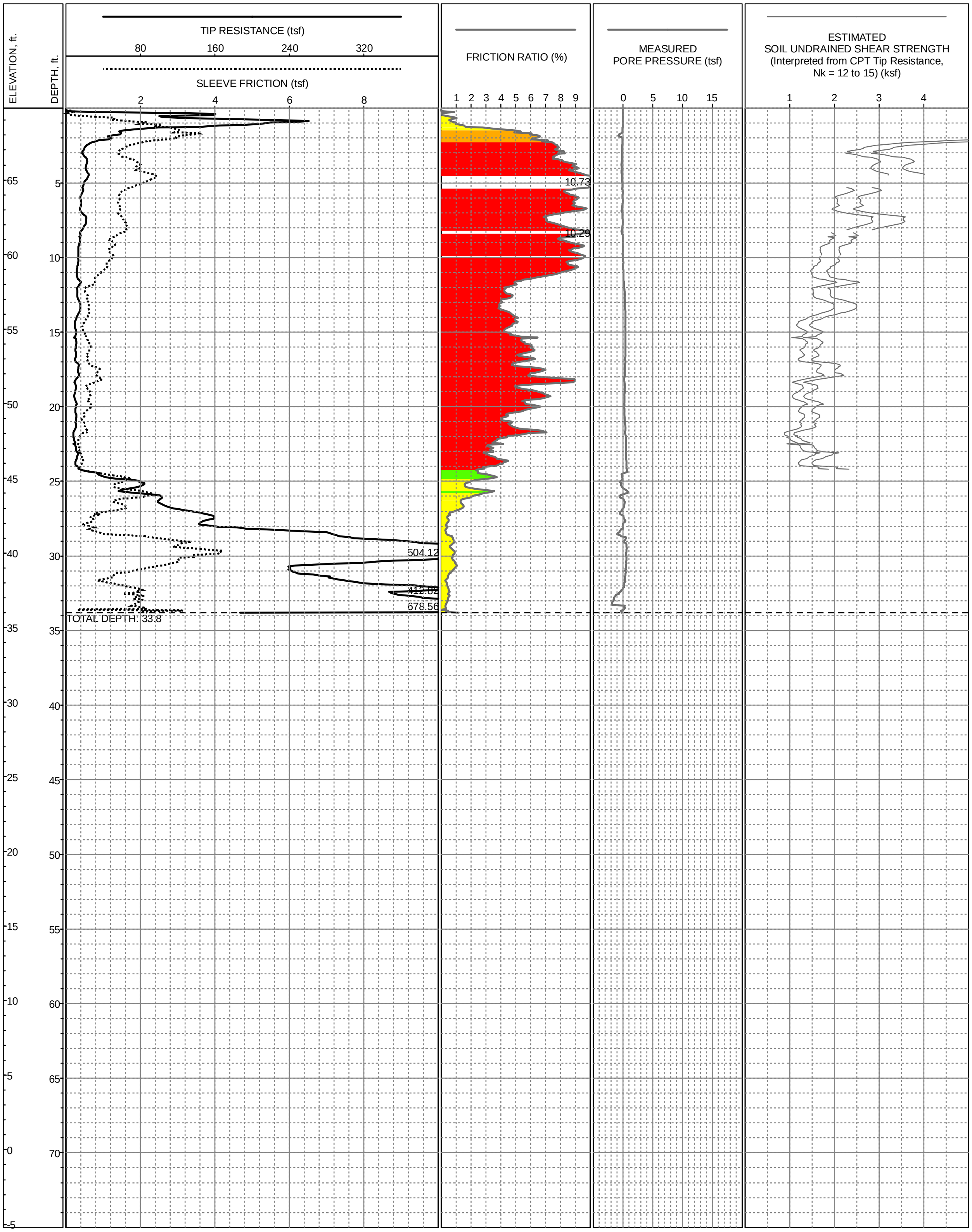
LOCATION: E6148281.4 N1951764.6 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 69.9ft (NAVD88)
COMPLETION DEPTH: 38.4ft
TEST DATE: 3/29/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-173

Central Area Guideway of SVRT Project
San Jose, California

HMM/Bechtel
Project No. 1637.001

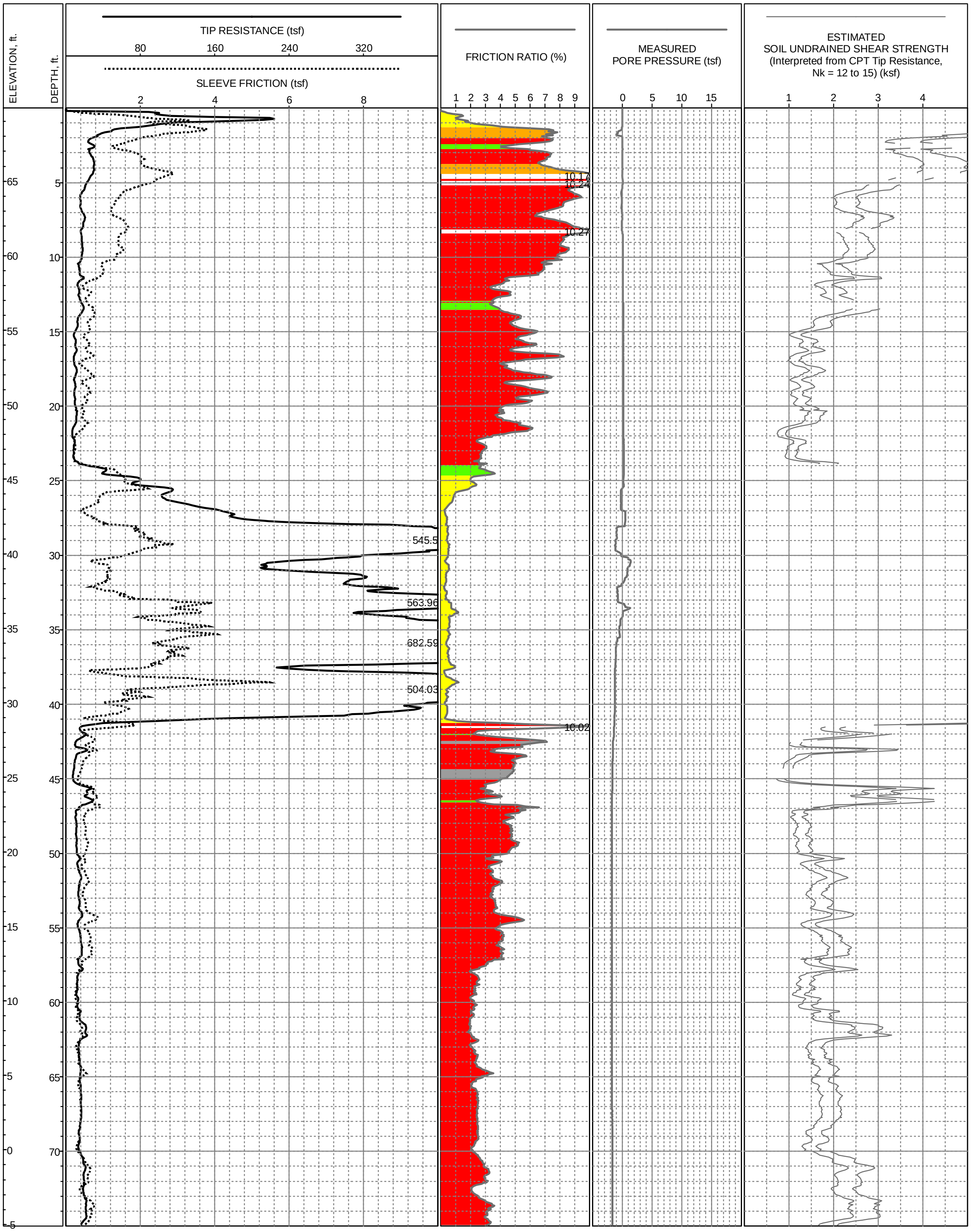


LOCATION: E6148283.5 N1951761.8 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 69.8ft (NAVD88)
COMPLETION DEPTH: 33.8ft
TEST DATE: 3/31/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-173a

Central Area Guideway of SVRT Project
San Jose, California

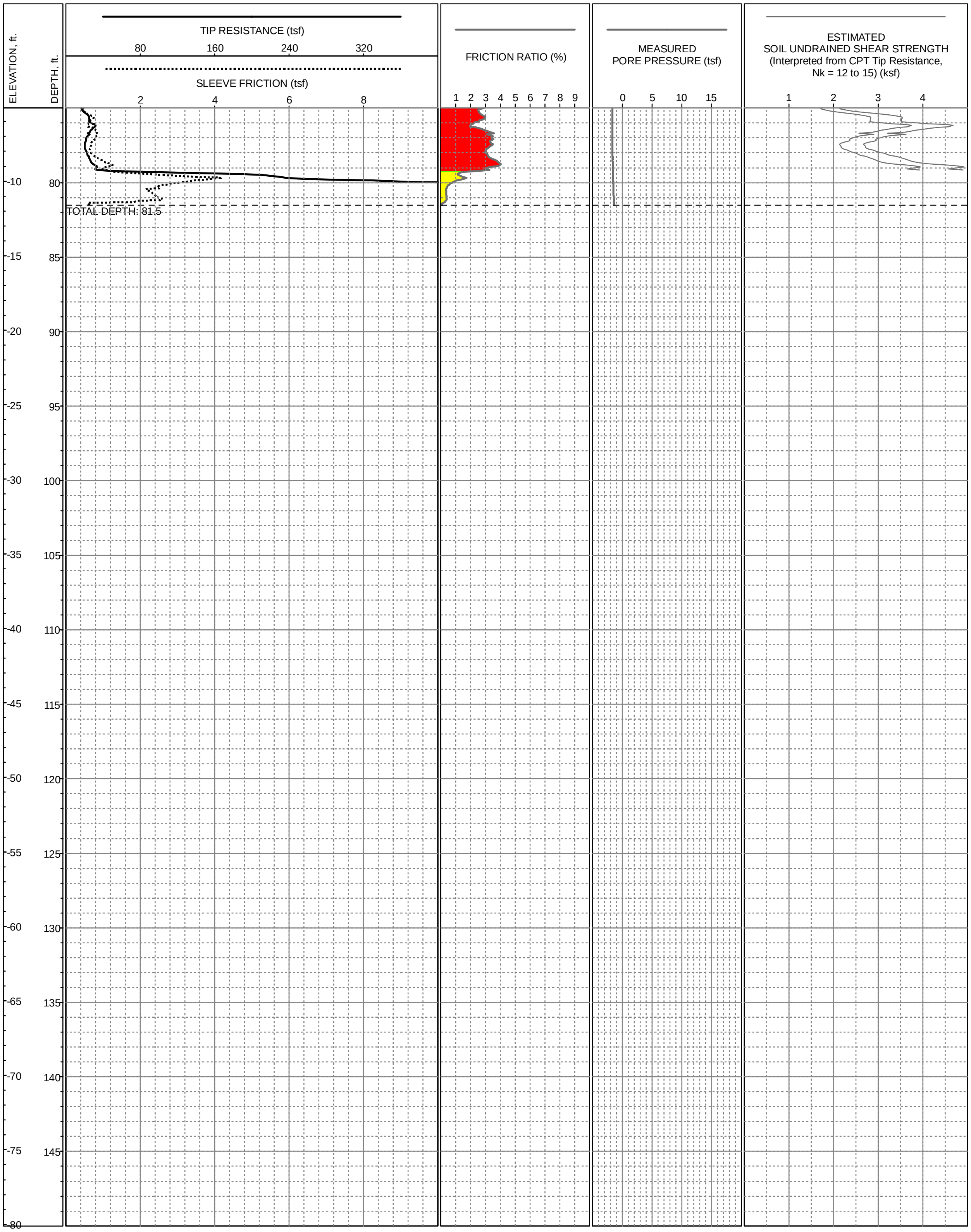


LOCATION: E6148259 N1951737 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 69.9ft (NAVD88)
COMPLETION DEPTH: 81.5ft
TEST DATE: 3/31/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-173b

Central Area Guideway of SVRT Project
San Jose, California

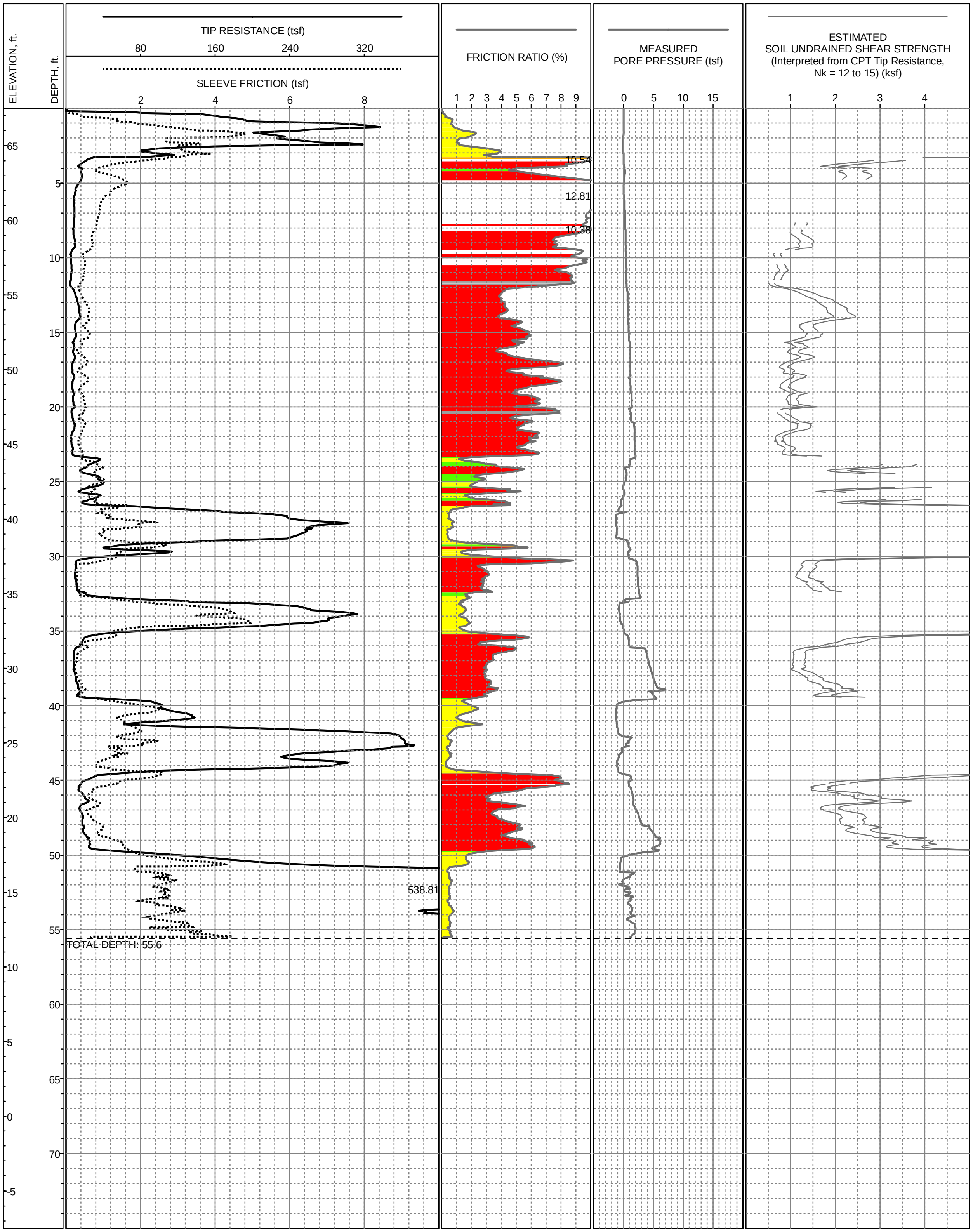


LOCATION: E6148259 N1951737 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 69.9ft (NAVD88)
COMPLETION DEPTH: 81.5ft
TEST DATE: 3/31/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-173b

Central Area Guideway of SVRT Project
San Jose, California

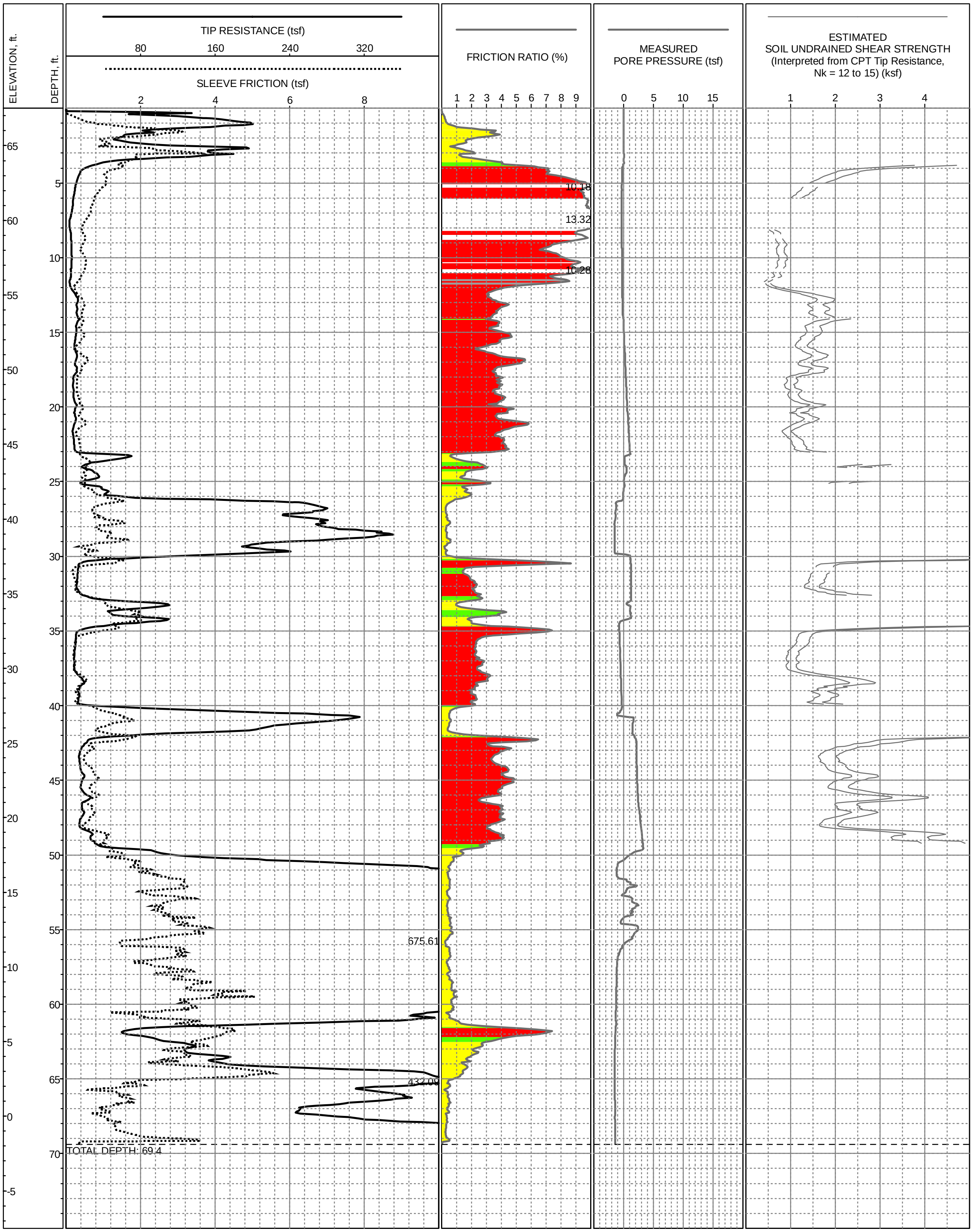


LOCATION: E6147771.2 N1952159.6 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 67.5ft (NAVD88)
COMPLETION DEPTH: 55.6ft
TEST DATE: 3/31/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-174

Central Area Guideway of SVRT Project
San Jose, California

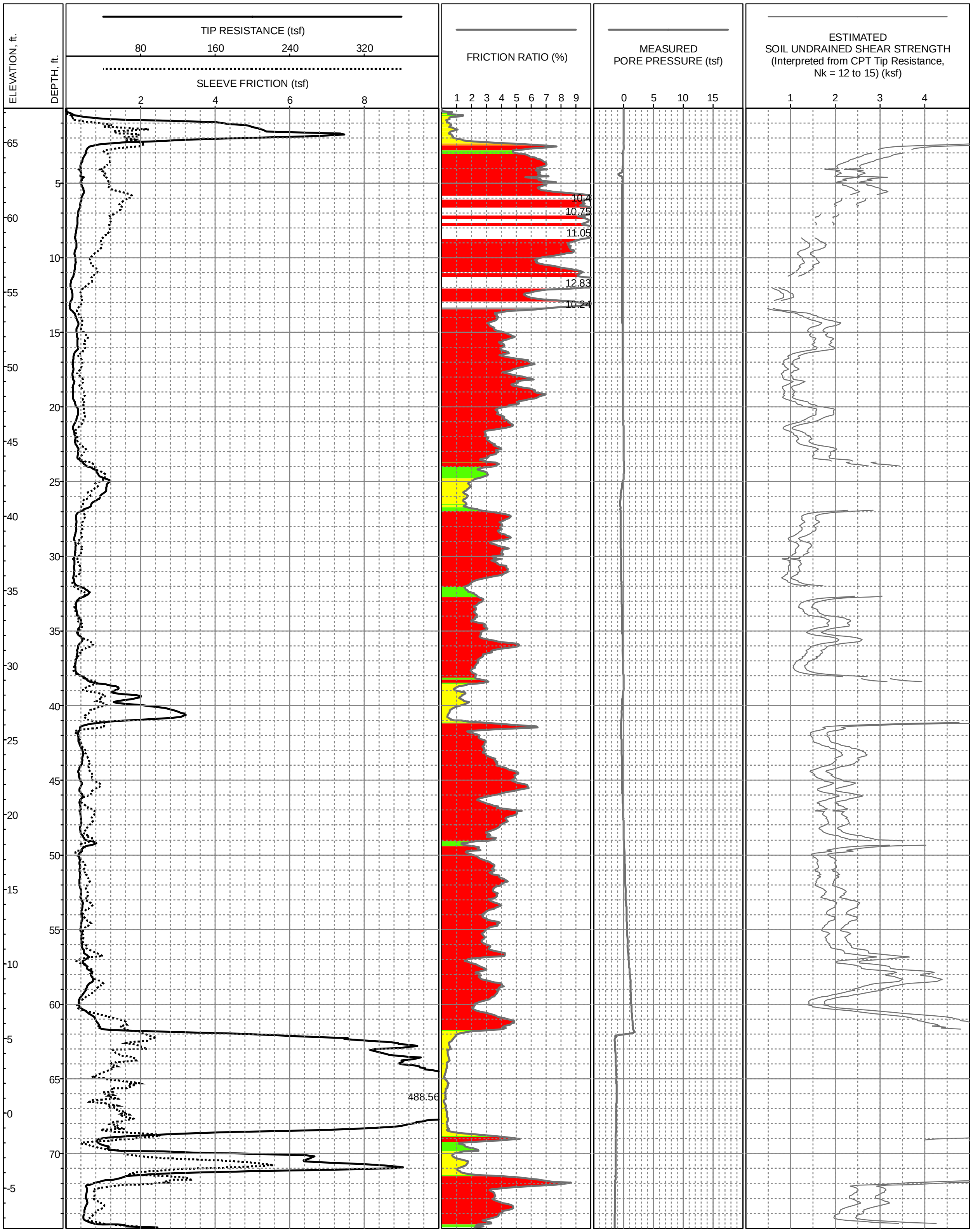


LOCATION: E6147774.2 N1952162.6 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 67.5ft (NAVD88)
COMPLETION DEPTH: 69.4ft
TEST DATE: 3/31/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-174a

Central Area Guideway of SVRT Project
San Jose, California

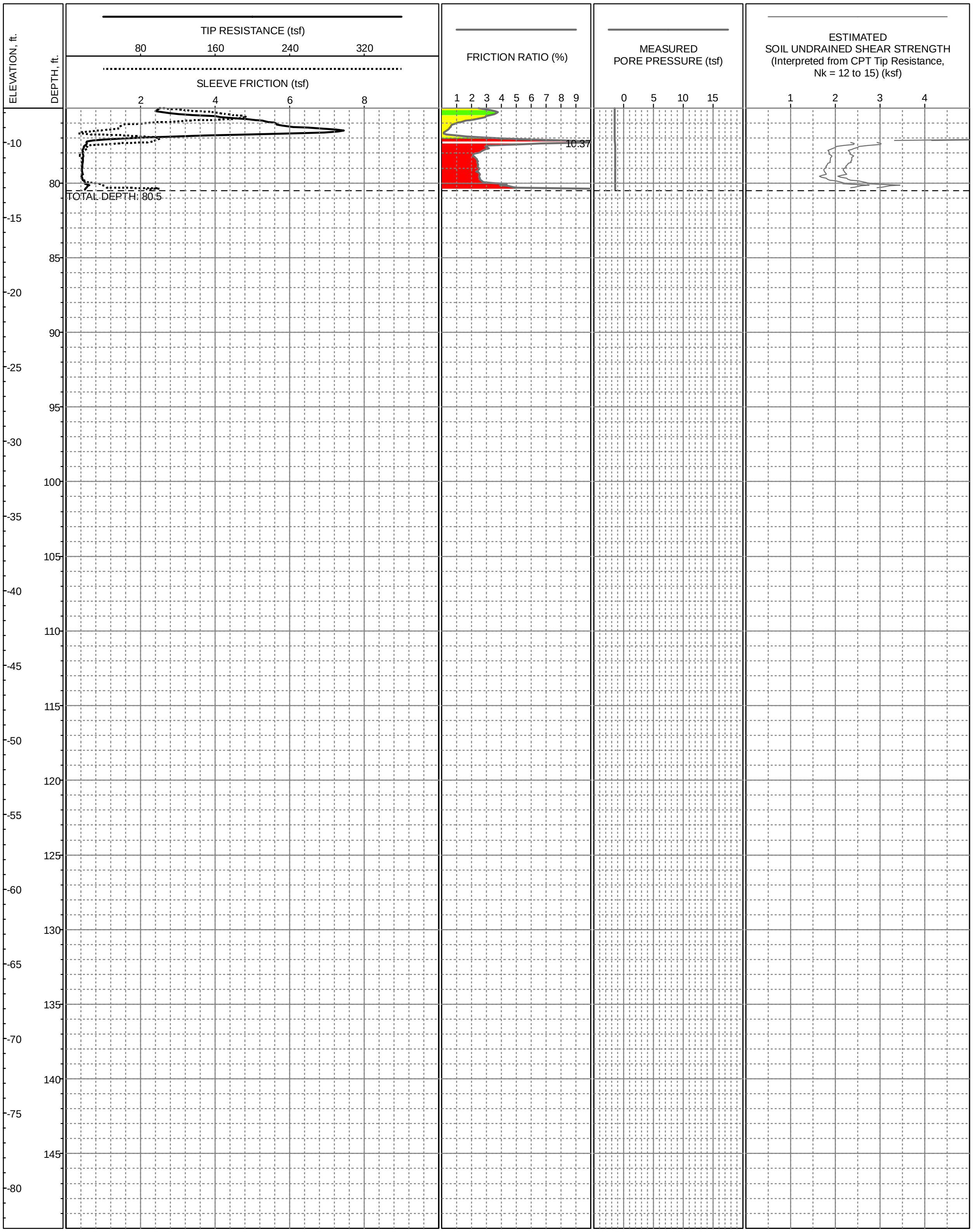


LOCATION: E6147668.7 N1952223.4 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 67.3ft (NAVD88)
COMPLETION DEPTH: 80.5ft
TEST DATE: 3/28/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-175

Central Area Guideway of SVRT Project
San Jose, California

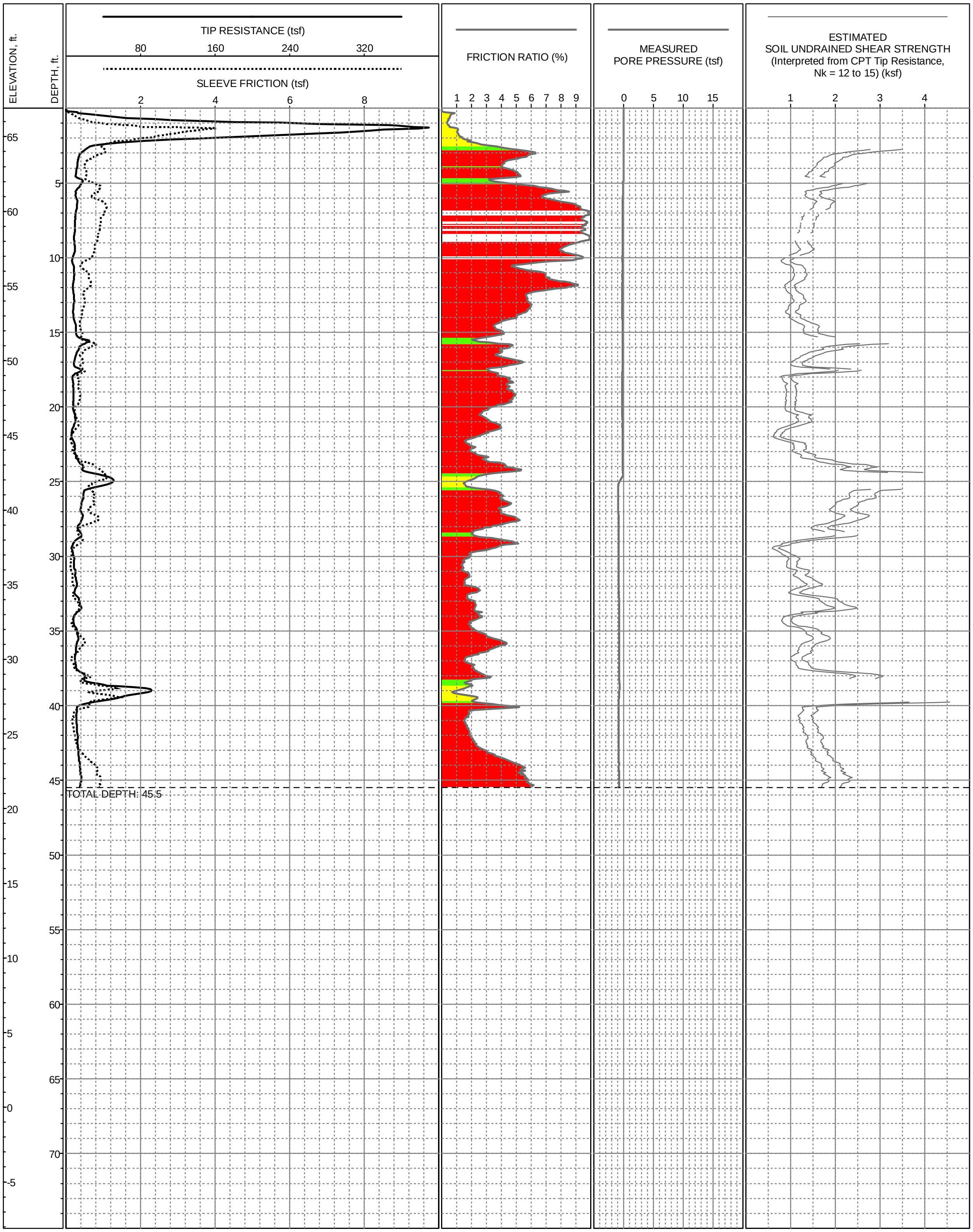


LOCATION: E6147668.7 N1952223.4 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 67.3ft (NAVD88)
COMPLETION DEPTH: 80.5ft
TEST DATE: 3/28/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-175

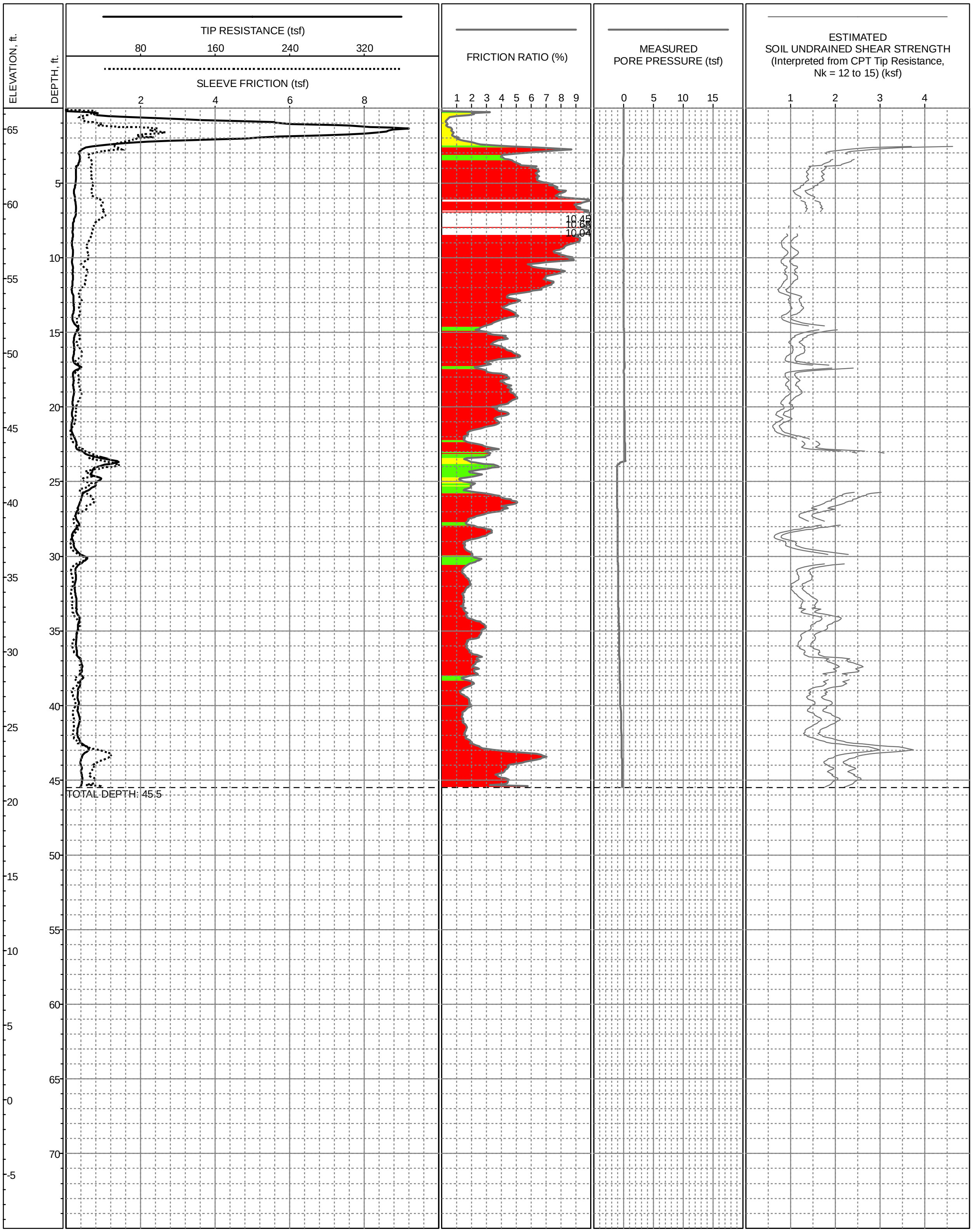
Central Area Guideway of SVRT Project
San Jose, California



LOCATION: E6147514 N1952322.3 (NAD83, CA State Plane Zone III, Feet)	CONE: F7.5CKEW1689
SURFACE EL: 66.9ft (NAVD88)	PERFORMED BY: Fugro Consultants, Inc.
COMPLETION DEPTH: 45.5ft	OPERATOR: D Garza & R Norris
TEST DATE: 3/28/2007	REVIEWED BY: M Paquette

LOG OF CPT-176

Central Area Guideway of SVRT Project
San Jose, California

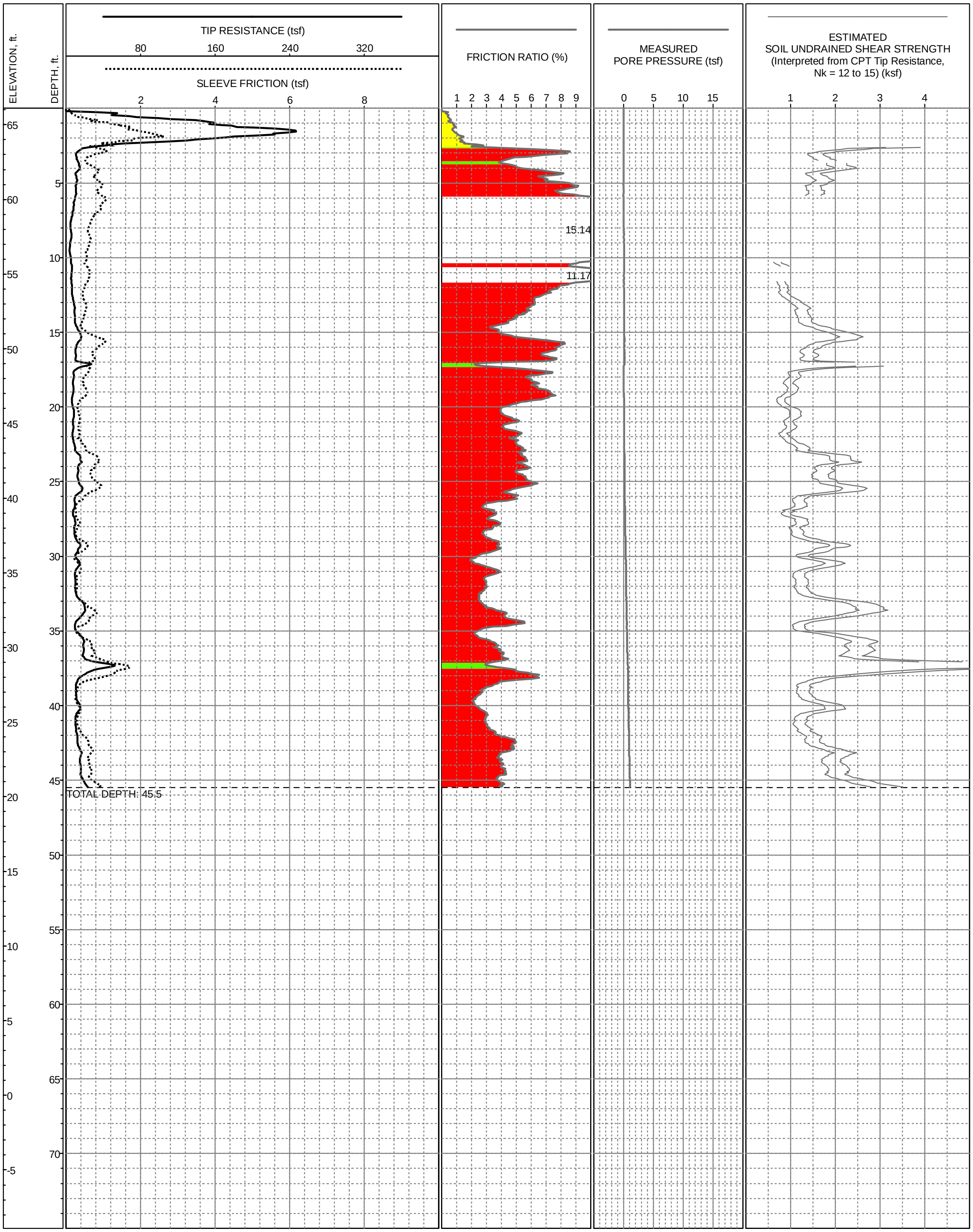


LOCATION: E6147398.2 N1952390.6 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 66.4ft (NAVD88)
COMPLETION DEPTH: 45.5ft
TEST DATE: 3/30/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-177

Central Area Guideway of SVRT Project
San Jose, California

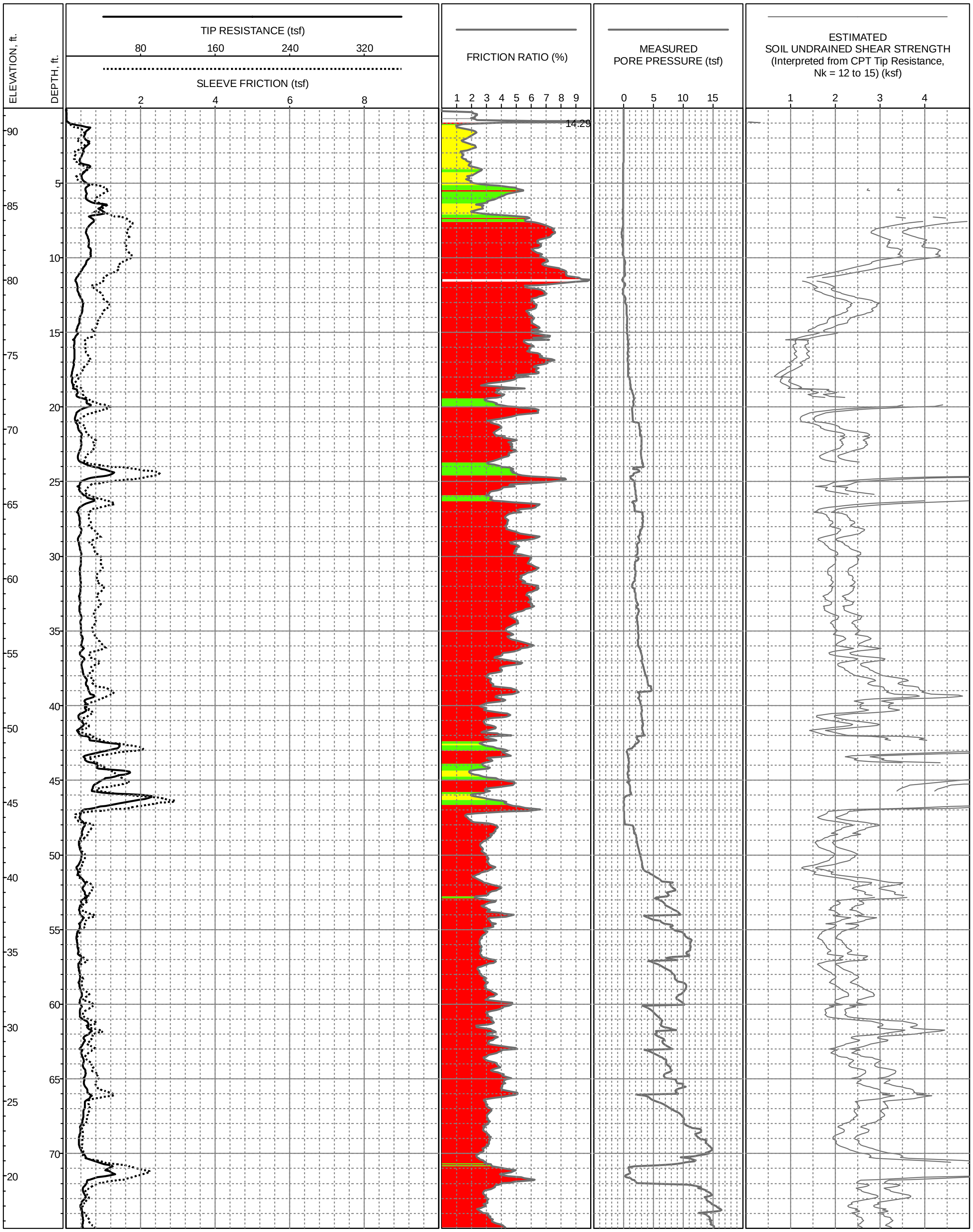


LOCATION: E6147259.5 N1952479.4 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 66.1ft (NAVD88)
COMPLETION DEPTH: 45.5ft
TEST DATE: 3/29/2007

CONE: F7.5CKEW1689
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-178

Central Area Guideway of SVRT Project
San Jose, California

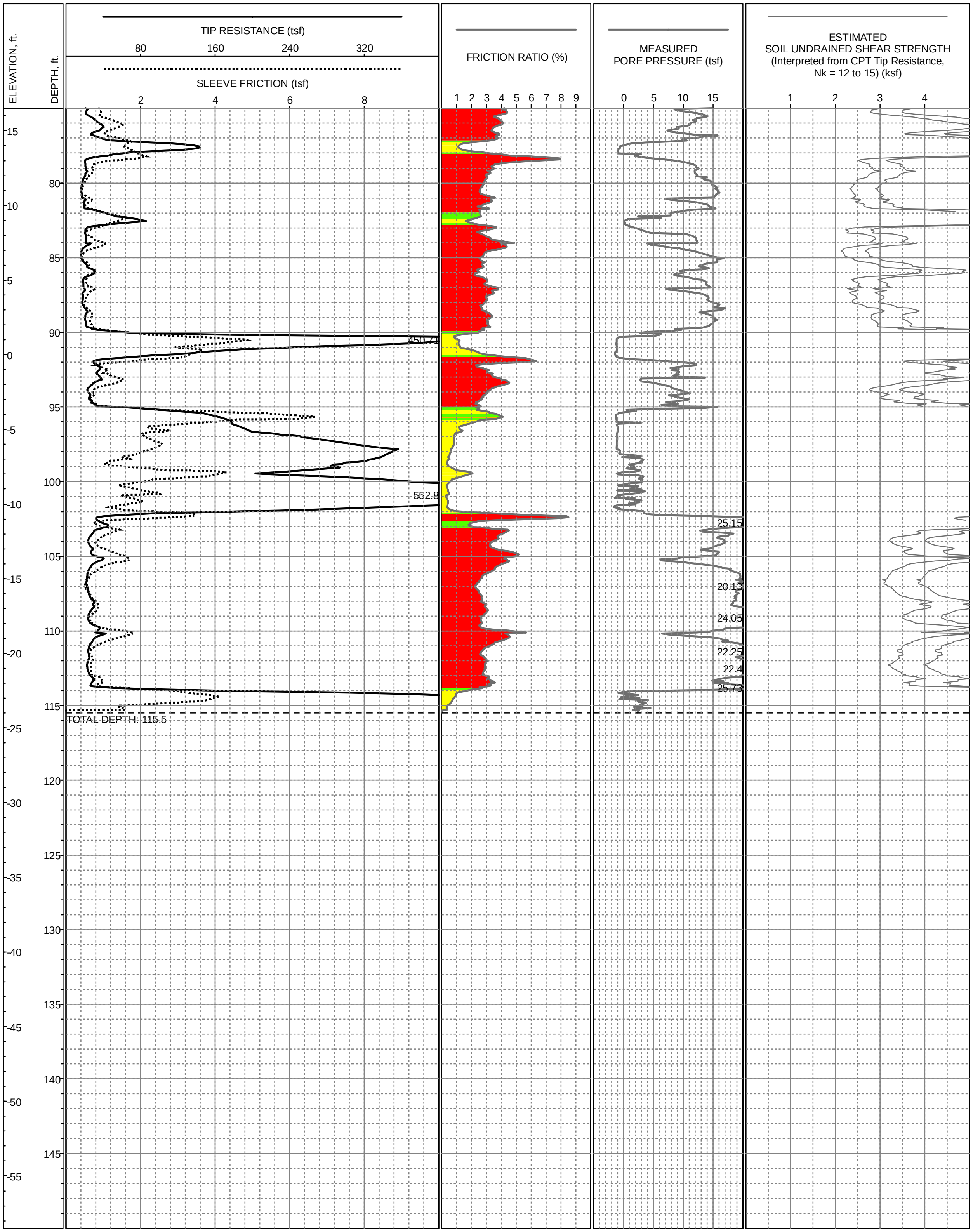


LOCATION: E6153986.9 N1945918.4 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 91.5ft (NAVD88)
COMPLETION DEPTH: 115.5ft
TEST DATE: 8/14/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

LOG OF CPT-179

Central Area Guideway of SVRT Project
San Jose, California



LOCATION: E6153986.9 N1945918.4 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 91.5ft (NAVD88)
COMPLETION DEPTH: 115.5ft
TEST DATE: 8/14/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

LOG OF CPT-179

Central Area Guideway of SVRT Project
San Jose, California

Appendix 3: Seismic Cone Penetration Test (SCPT) Results

FUGRO WEST, INC.

APPENDIX 3
SEISMIC CONE PENETRATION TEST (SCPT) RESULTS

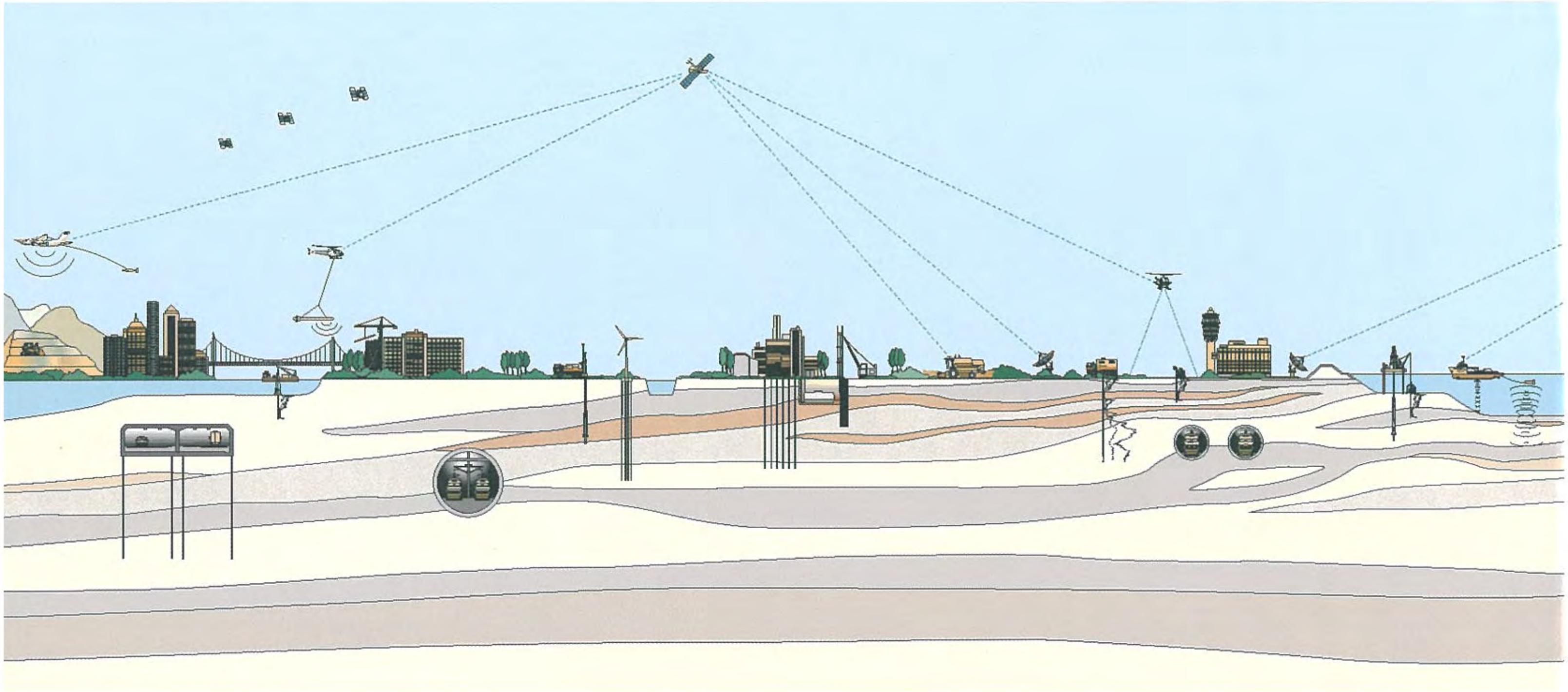
GEOTECHNICAL EXPLORATION PROGRAM CENTRAL AREA GUIDEWAY

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
SAN JOSE, CALIFORNIA

Prepared for:
HMM/Bechtel

JANUARY 2008

Fugro Project No. 1637.001



REPORT DOCKET

APPROVAL

This document is approved by the following:

Name	Title	Signature	Issue Date
Michael Paquette, P.E.	Project Engineer		1/21/08
Edwin Woo, P.E., G.E.	Principal Engineer	Edwin P. Woo	1/21/08

REVISION HISTORY

Revision	Date	Change	Approval
0	November 26, 2007	Draft Report: Appendix 9 Seismic Cone Penetration Test (SCPT) Results. Incorporating Phase 2 (2007) SCPTs	MP
1	January 21, 2008	Appendix 3 Seismic Cone Penetration Test (SCPT) Results Incorporating Phase 2 (2007) SCPTS	MP

January 21, 2008
Project No. 1637.001

HMM/Bechtel
3103 North First Street
San Jose, California 95134

Attention: Mr. Thomas Hunt, P.E.

Subject: Appendix 3 – Seismic Cone Penetration Test (SCPT) Results, Central Area Guideway of SVRT Project, San Jose, California

Dear Mr. Hunt:

Fugro is pleased to submit this copy of “Appendix 3 – Seismic Cone Penetration Test (SCPT) Results,” describing the seismic CPT test equipment, procedures and results for the Central Area Guideway of the SVRT Project in San Jose, California.

We appreciate this opportunity to be of continued service to HMM/Bechtel. Please contact Michael Paquette at (510) 267-4441 if you have any questions regarding the information presented in this appendix.

Sincerely,

FUGRO WEST, INC.

Michael Paquette, P.E.
Project Engineer

Edwin P. Woo

Edwin P. Woo, P.E., G.E.
Principal Engineer

MP/EW:ej

Copies Submitted: (PDF) Addressee

CONTENTS

TABLES

LOGS OF CPTS

1.0 INTRODUCTION

This appendix describes the equipment, procedures and results of the seismic cone penetration testing (SCPT) conducted by Fugro West, Inc., (Fugro) for the Central Area Guideway of the Silicon Valley Rapid Transit (SVRT) Project. The SCPTs were conducted at locations along the Central Area Guideway alignment of the SVRT Project, as shown on Figure 3-1 of the main report.

1.1 PROJECT DESCRIPTION

The Santa Clara Valley Transportation Authority (VTA) intends to construct the SVRT Project in San Jose, California. This will be a 26.2-km (16.3-mile) extension of the Bay Area Rapid Transit (BART) heavy rail rapid transit system from the planned terminus at the end of the Warms Springs Extension in Fremont, to San Jose. The proposed alignment currently includes several new stations and vehicle storage and maintenance facilities. The alignment is composed of two major segments:

1) The “Northern Area” that will be approximately 11.5 miles of at-grade, elevated and cut-and-cover track from Warm Springs to San Jose; and

2) The “Central Area Guideway”, a 5.1-mile-long tunnel, consisting of twin bored tunnels and cut-and-cover structures through downtown San Jose.

As currently planned, the Central Area Guideway includes at-grade and open cut track, cut-and-cover stations, and a cut-and-cover track crossover structure. The cut-and-cover stations and the crossover structures have a cumulative length of approximately 4,970 feet. The remaining 4.14 miles of the alignment will be twin 19.5-foot-diameter tunnels.

This investigation and report cover the 5.1-mile-long Central Area Guideway only.

1.2 GEOTECHNICAL EXPLORATION PROGRAM OVERVIEW

The joint venture of Hatch Mott MacDonald T & T, Inc., and Bechtel Infrastructure Corporation (HMM/Bechtel) is providing engineering design services for the Central Area Guideway of the SVRT Project to the VTA. HMM/Bechtel has subcontracted with a number of companies to conduct the geotechnical field exploration program for the project. HMM/Bechtel’s primary subcontractors for the geotechnical exploration program include: Fugro, Parikh Consultants (Parikh) and Pitcher Drilling Company (Pitcher).

The three companies, Fugro, Parikh, and Pitcher, conducted the majority of the geotechnical field exploration program for the Central Area Guideway of the SVRT Project from October 2004 to March 2005. This supplementary geotechnical field investigation was performed between March 2007 and August 2007. The intent of the field investigation program was to obtain geotechnical data that would aid in the design and construction of the proposed tunnel and cut-and-cover structures.

In general, the geotechnical field investigations explored subsurface conditions along the proposed Central Area Guideway. The explorations were within the vicinity of the proposed Eastern and Western Portals, at the two proposed ventilation structures, and at the proposed stations, including Alum Rock Station, Downtown San Jose Station and Diridon/Arena Station. The geotechnical exploration program included:

- 2004 / 2005 Investigation
    - 76 Rotary Wash Borings (by others); and
    - 146 CPTs (by Fugro).
- 2007 Investigation
    - 18 Rotary Wash Borings (by others); and
    - 22 CPTs (by Fugro).

Figure 3-1 in the main report provides a map of the exploration locations. These locations were selected by HMM/Bechtel based on the following considerations: 1) the requirements of the tunnel designer, 2) the location of existing geotechnical data, 3) reducing impacts on private property, and 4) the avoidance of existing underground and overhead utilities. The locations of the 2007 explorations were chosen to fill in gaps in the data along the tunnel alignment. A subcontractor to HMM/Bechtel surveyed the CPT locations. HMM/Bechtel provided the surveyed coordinates to Fugro.

1.3 CPT PROGRAM OVERVIEW

Fugro West, Inc. and Fugro Consultants, Inc. (formerly Fugro Geosciences, Inc.) conducted the CPTs using a Fugro truck-mounted 25-ton cone apparatus. The CPTs were performed in general accordance with ASTM D5778. The continuous CPT soundings were typically advanced to refusal, which ranged from approximately 34 to 116 feet in depth. For detailed procedures and equipment specifications on the 2007 CPT operations, refer to Appendix 2 – CPT Testing. Downhole seismic shear (S) wave velocity measurements were successfully conducted at 12 CPT locations to obtain profiles of shear wave velocity versus depth as part of the 2007 investigation. Detailed information regarding the downhole SCPTs, including field procedures, data interpretation and results are discussed in the following sections.

1.4 SEISMIC CONE PENETRATION TEST (SCPT) PROGRAM OVERVIEW

Prior to initiation of the fieldwork, Fugro obtained the appropriate permits from the Santa Clara Valley Water District and City of San Jose. Seismic shear wave velocity tests were completed at a total of 12 locations as part of the 2007 study. Table A3-1 summarizes the Seismic CPT program.

Table A3-1. Summary of Seismic CPT Program

CPT	Proposed Structure	Location					Final Seismic Test Depth (ft)	Final CPT Test Depth (ft)
		Northing	Easting	Elev.	Station	Offset		
158	East Portal	1956837	6162889	91.6	562+47	30 L	44	45
161	East Portal	1956251	6163128	87.3	568+89	26 L	104	105
162	Alum Rock Station	1953716	6164945	87.1	600+71	140 L	72	73
165	Tunnel	1950703	6162527	96.1	642+21	41 L	76	77
167	Downtown Station	1947884	6157354	86.7	701+09	11 R	89	91
168	Diridon Station	1946017	6154586	87.8	734+51	100 L	149	150
169	Tunnel	1947464	6156937	89.0	706+79	145 L	83	85
171	Tunnel	1949684	6150804	75.1	794+96	42 R	74	75
172	Tunnel	1953024	6164741	88.0	607+63	66 R	112	113
173	West Portal	1951765	6148281	69.9	828+06	92 L	35	82
174	West Portal	1952160	6147771	67.5	834+47	21 L	53	69
179	Downtown Station	1945918	6153987	91.5	740+58	109 L	114	116

2.0 SCPT TEST EQUIPMENT AND PROCEDURES

2.1 FIELD EQUIPMENT

Downhole seismic shear wave velocity measurements were conducted using Fugro's SCPT system. The SCPT system includes the basic thrust system, a seismic cone assembly, a seismic wave source, and a digital recording seismograph. SCPT testing was performed in accordance with ASTM test designation D-5778-95.

The seismic cone assembly is similar to the conventional cone assembly, but also includes a three-component array of geophones. The geophones are orthogonally mounted inside the cone assembly at about 15 cm above the cone tip. The cone tip area of the seismic cone is 15 cm^2, with an area ratio of 0.59 to 0.61 and a cylindrical sleeve area of 200 cm^2.

The seismic source consisted of a heavy metal beam held firmly against the ground by the weight of the beam and additional weights placed on top of the beam. Seismic waves were generated at each test depth (3 to 5 foot intervals) by alternately striking each end of the beam with a 12-pound sledgehammer. A SmartSeis 100 Seismograph (manufactured by Geomatrics) was integrated with Fugro's CPT equipment and was used for the seismic wave recording.

2.2 FIELD PROCEDURES

For CPT soundings in which seismic data were collected, conventional CPT testing was temporarily halted at either 3-foot or 5-foot intervals to collect seismic data. Shear waves were generated by striking a heavy steel beam on the ground with a 12-pound sledgehammer. The beam was positioned parallel to the cone truck, at least 10 feet from the cone rods, and was coupled to the ground surface by the weight of the beam and additional weights on top of the beam to prevent the beam from moving when struck. The beam was struck alternatively at opposite sides, generating shear waves with opposite polarity. Hammer blows on the beam triggered the seismograph to record the time histories of the generated seismic waves as they travel through the soil and are detected by the geophones, which monitor the waveform arrivals. Each side of the beam was struck several times, and each signal produced by a blow was closely examined for signal and noise content. If the signal appeared clean (i.e., the shear wave signal is clearly defined) that waveform was selected for stacking and the arrival time of the shear wave was picked and recorded. Further signals generated by additional blows were similarly examined and stacked to minimize noise detected and improve the overall signal to noise ratio. As a standard procedure, a minimum of three stacks, per side of the beam, per depth were recorded. However, in a noisy environment, the beam is struck continuously until a clean and consistent signal is obtained for stacking. As such, the beam may have been struck more times than the actual number of signals chosen for stacking. Waveforms were digitally recorded and saved in the seismograph's hard drive for further processing. After a complete set of seismic data was recorded, the cone was advanced to the next depth, and the procedure was repeated until the hole was complete.

2.3 INTERPRETATION OF SEISMIC DATA

The seismic data at each SCPT location were interpreted as follows:

- The shear wave arrival time at each depth is first determined from the recorded "stacked" signals using software on the seismograph;
- Arrival times are determined for each of the two sides of the beam that are struck and are designated "east" and "west" arrival times;
- The east and west arrival times are checked in the field to ensure that consistent arrival times are recorded between the two strike directions;
- The average arrival time is determined from the east and west arrival times; and
- A strike angle is determined based on the horizontal offset of the seismic source from the CPT rods and the average vertical arrival time is determined by taking the sine of the strike angle;

- The incremental seismic velocity is determined by taking the difference in vertical average arrival time between two depth increments, and dividing by the length of the increment (typically 3 to 5 feet);

3.0 RESULTS AND DISCUSSION

3.1 DATA PLOTS

CPT sound logs for the 12 SCPTs performed in 2007 are attached to this appendix. The CPT logs provide graphical plots versus depth showing:

- Measured cone tip resistance, in tons per square foot (tsf);
- Measured sleeve friction, in tsf;
- Friction ratio, in percentage, including color coding denoting the Soil Behavior Type according to Robertson, 1990 (see CPT correlation chart);
- Measured pore pressure at the u2 location, in tsf; and
- Measured shear wave velocity, in feet per second.

4.0 LIMITATIONS

Our services consist of subsurface field explorations and data evaluations that are made in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

The data provided in this appendix are based on the subsurface explorations conducted for this study. These explorations indicate subsurface conditions only at specific locations and times, and only to the depths penetrated. Variations may exist and conditions not observed or described in this report could be encountered during construction. Our results are based on our standard practices and specific data obtained.

This appendix has been prepared for the exclusive use of HMM/Bechtel and their consultants for specific application to the SVRT project as described herein. In the event that there are any changes in the ownership, nature, design, or location of the proposed project, or if any future additions are planned, the results contained in this appendix should not be considered valid unless: 1) the project changes are reviewed by Fugro, and 2) results presented in this appendix are modified or verified in writing. Reliance on this report by others must be at their risk unless we are consulted on the use or limitations. We cannot be responsible for the impacts of any changes in geotechnical standards, practices, or regulations subsequent to performance of services without our further consultation. We can neither vouch for the accuracy of information supplied by others, nor accept consequences for unconsulted use of segregated portions of this report.

5.0 ADDITIONAL REFERENCE MATERIAL

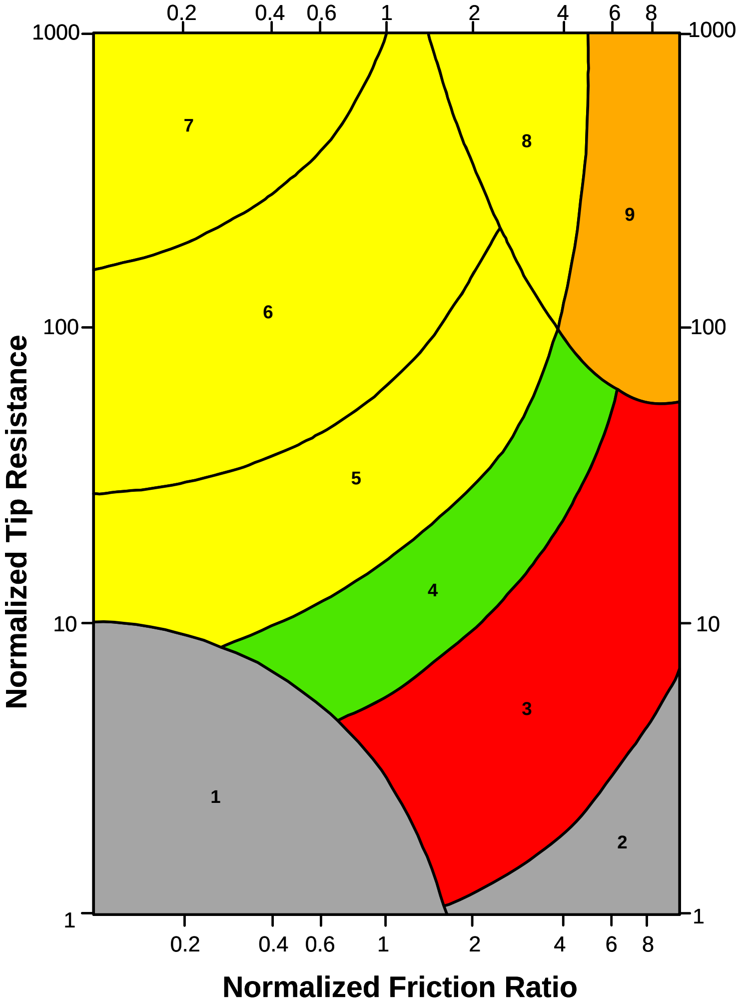
Fugro West, Inc. (2005), "Appendix 9 Seismic Cone Penetration Test (SCPT) Results, Geotechnical Exploration Program, Tunnel Segment of Silicon Valley Rapid Transit (SVRT) Project, San Jose, California" Prepared for HMM/Bechtel, Fugro Project No. 1637.001

Lunne, Robertson & Powell (1997), Cone Penetration Testing in Geotechnical Practice, Blackie Academic & Professional, London, UK.

Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J. (1986), "Use of Piezocone Data," Proceedings of the ASCE Specially Conference In Situ 1986: Use of In Situ Tests in Geotechnical Engineering, Blacksburg, pp.1263-80.

Robertson, P.K., (1990), "Soil Classification using the Cone Penetration Test," *Canadian Geotechnical Journal,* 27

LOGS OF SEISMIC CPTs



Zone	Soil Behavior Type
1	Sensitive Fine-grained
2	Organic Material
3	Clay to Silty Clay
4	Clayey Silt to Silty Clay
5	Silty Sand to Sandy Silt
6	Clean Sands to Silty Sands
7	Gravelly Sand to Sand
8	Very Stiff Sand to Clayey Sand *
9	Very Stiff Fine-grained *

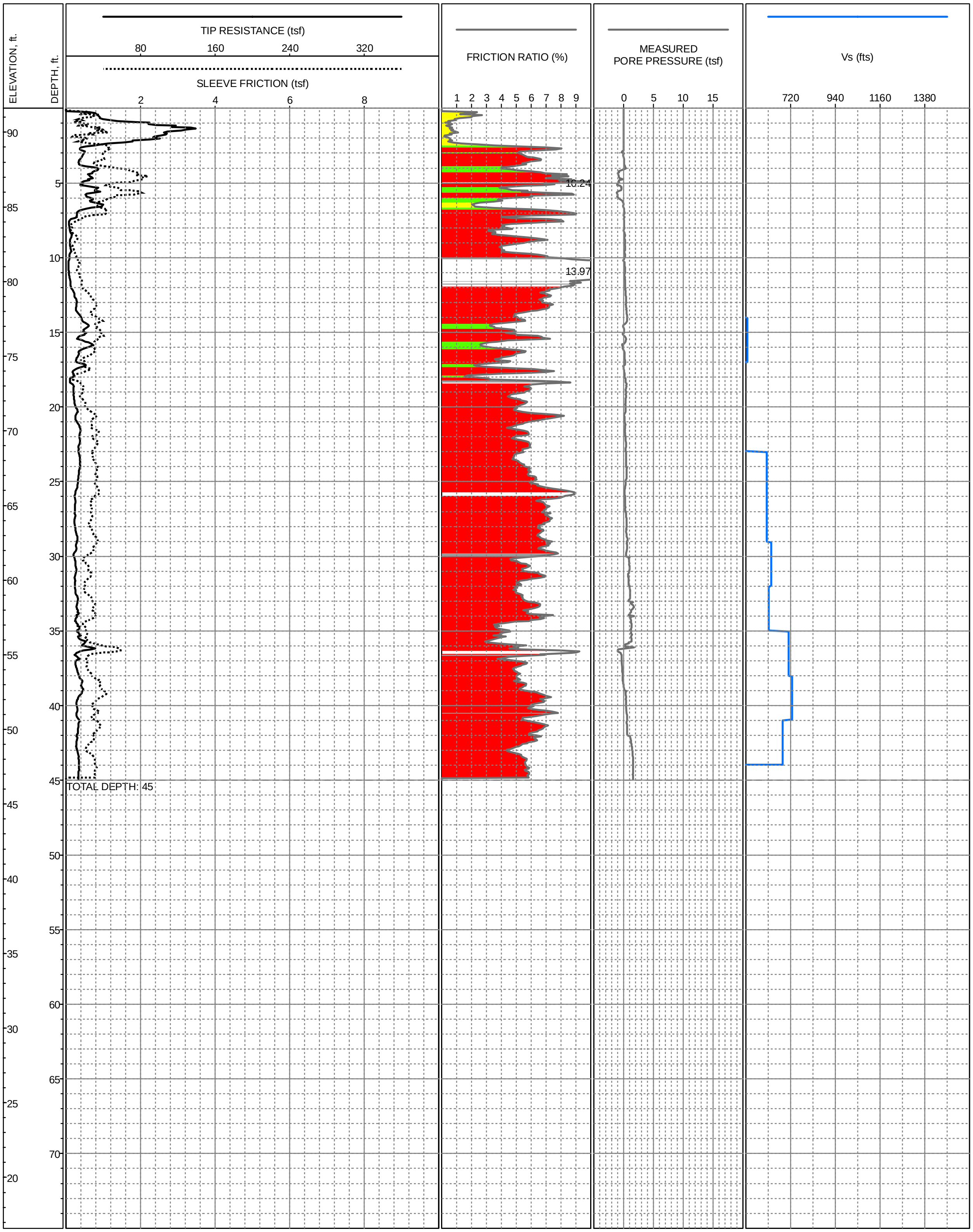
*overconsolidated or cemented

CPT CORRELATION CHART

(Modified from Robertson, 1990)

KEY TO CPT LOGS

Central Area Guideway of SVRT Project
San Jose, California

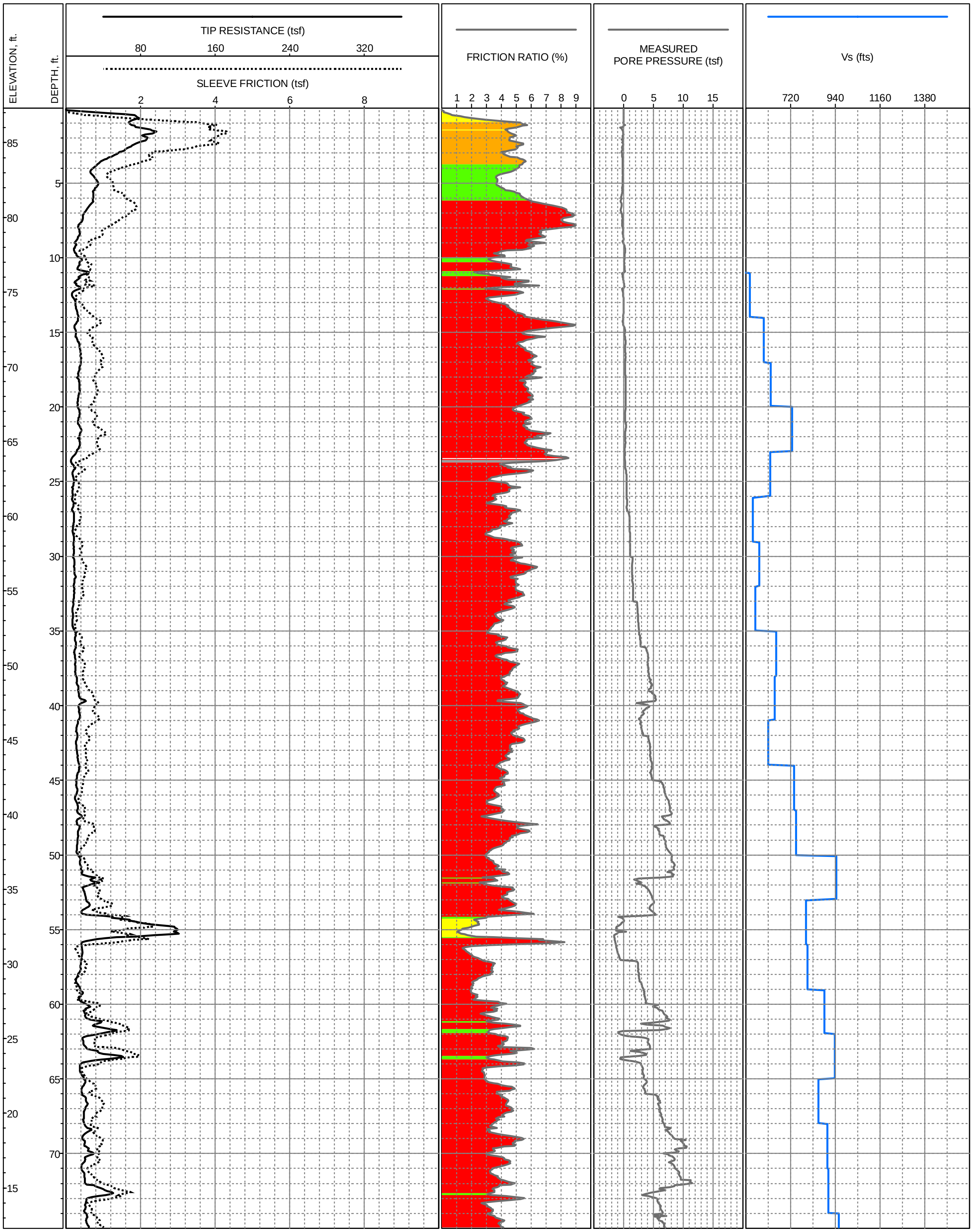


LOCATION: E6162888.9 N1956837.2 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 91.6ft +/- (NAVD88)
COMPLETION DEPTH: 45ft
TEST DATE: 4/3/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-158

Central Area Guideway of SVRT Project
San Jose, California

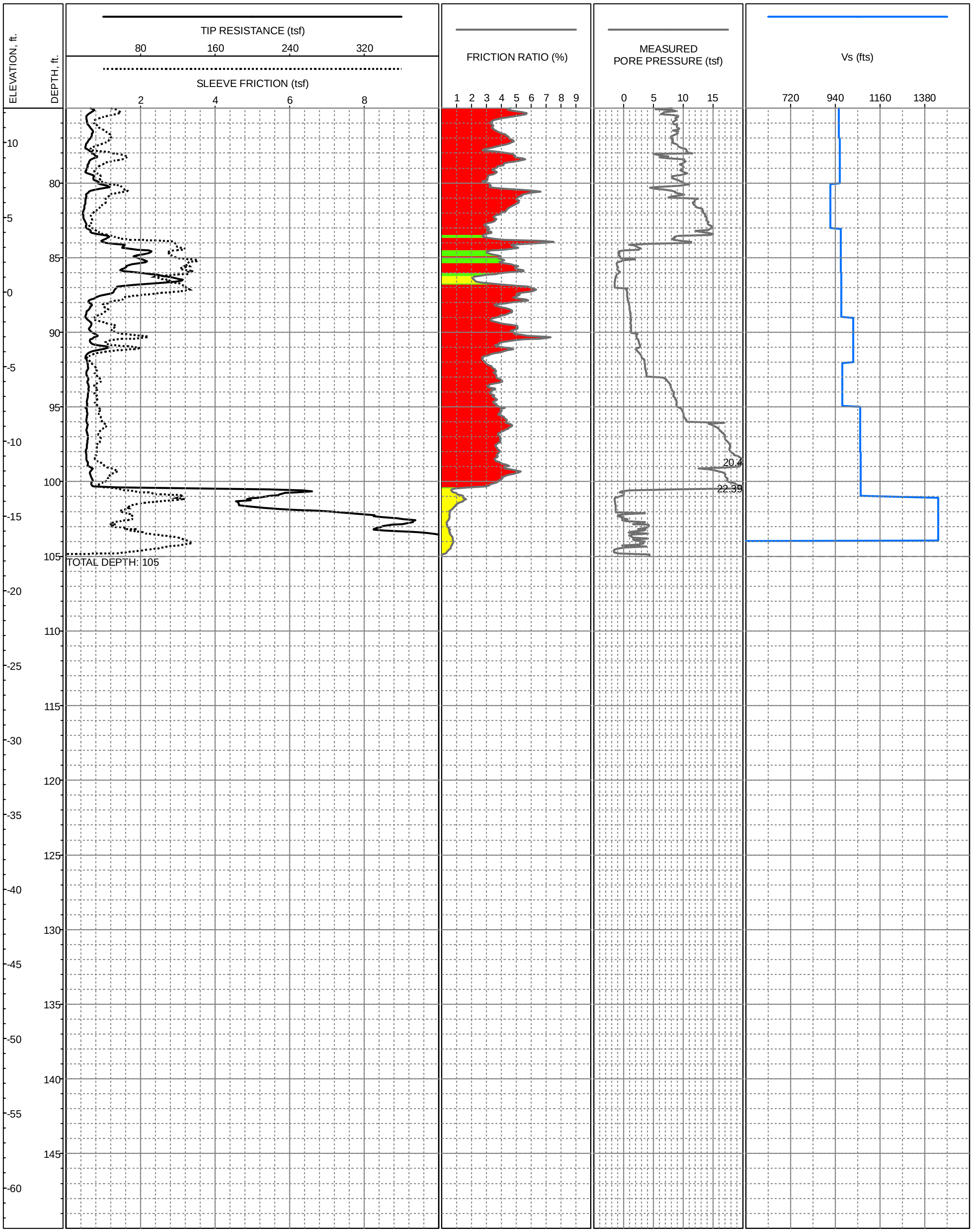


LOCATION: E6163128.3 N1956250.6 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 87.3ft +/- (NAVD88)
COMPLETION DEPTH: 105ft
TEST DATE: 4/3/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

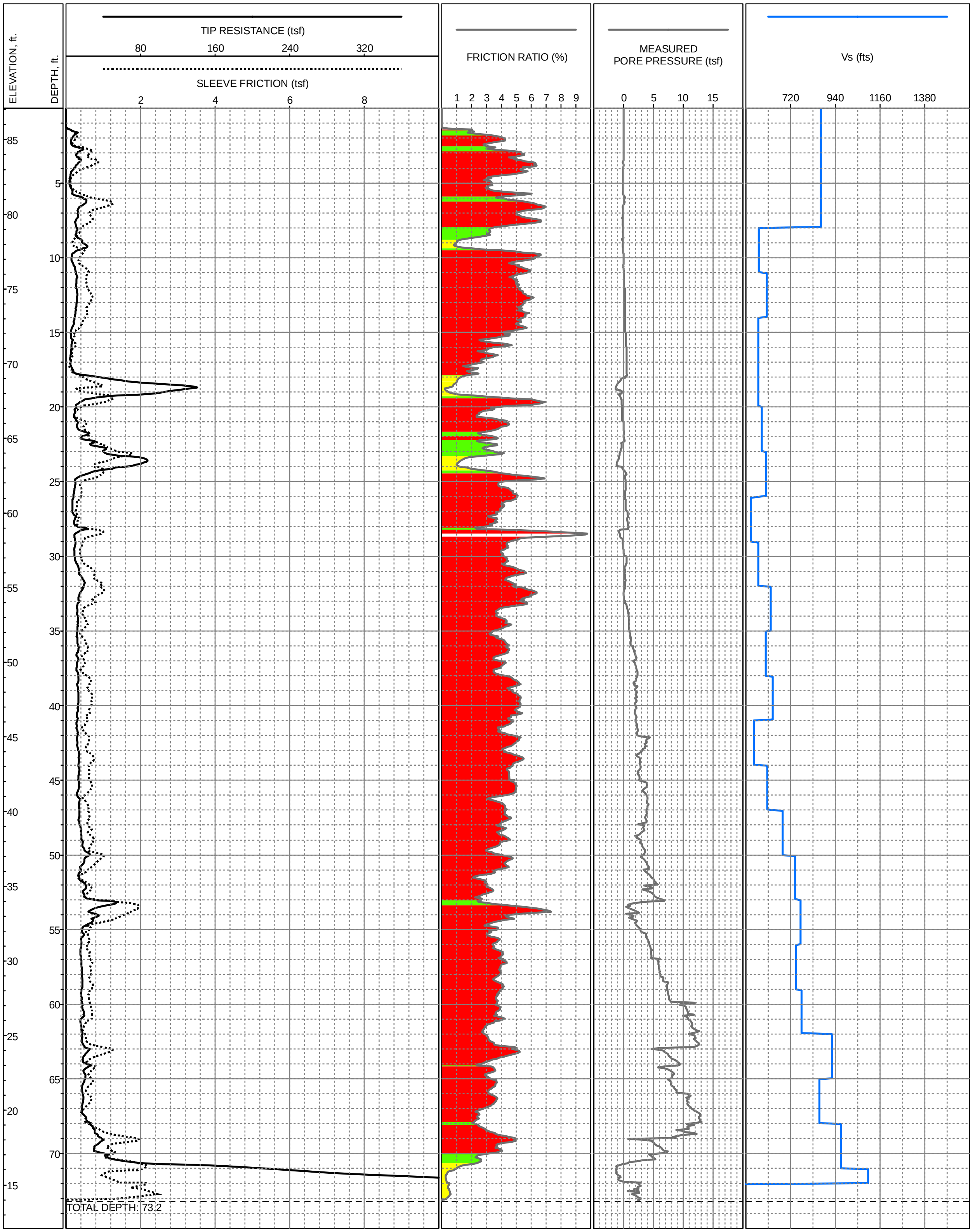
LOG OF CPT-161

Central Area Guideway of SVRT Project
San Jose, California



LOCATION: E6163128.3 N1956250.6 (NAD83, CA State Plane Zone III, Feet)	CONE: F7.5CKESW1645
SURFACE EL: 87.3ft +/- (NAVD88)	PERFORMED BY: Fugro Consultants, Inc.
COMPLETION DEPTH: 105ft	OPERATOR: D Garza & R Norris
TEST DATE: 4/3/2007	REVIEWED BY: M Paquette

LOG OF CPT-161
Central Area Guideway of SVRT Project
San Jose, California

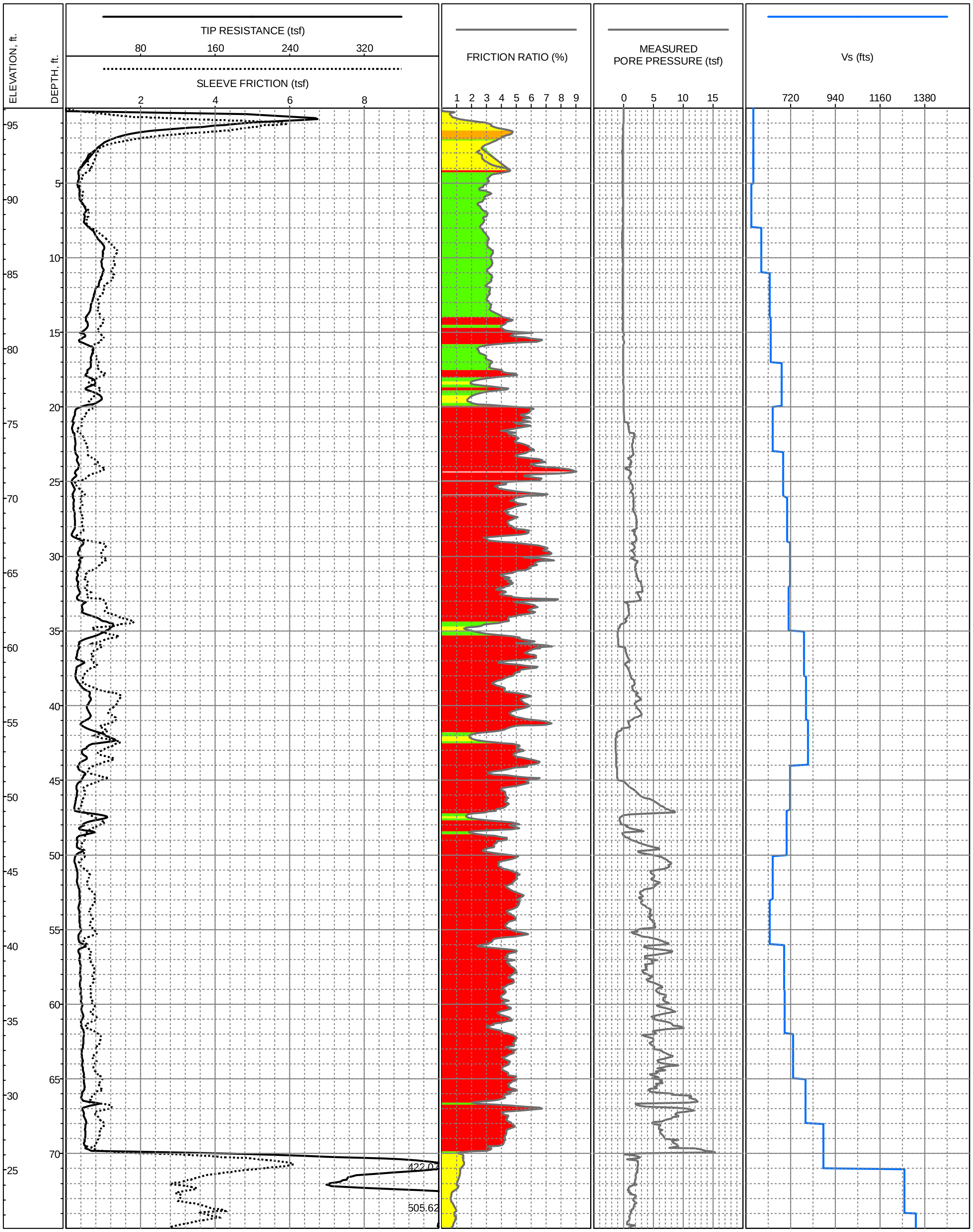


LOCATION: E6164944.9 N1953715.9 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 87.1ft +/- (NAVD88)
COMPLETION DEPTH: 73.2ft
TEST DATE: 8/13/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

LOG OF CPT-162

Central Area Guideway of SVRT Project
San Jose, California

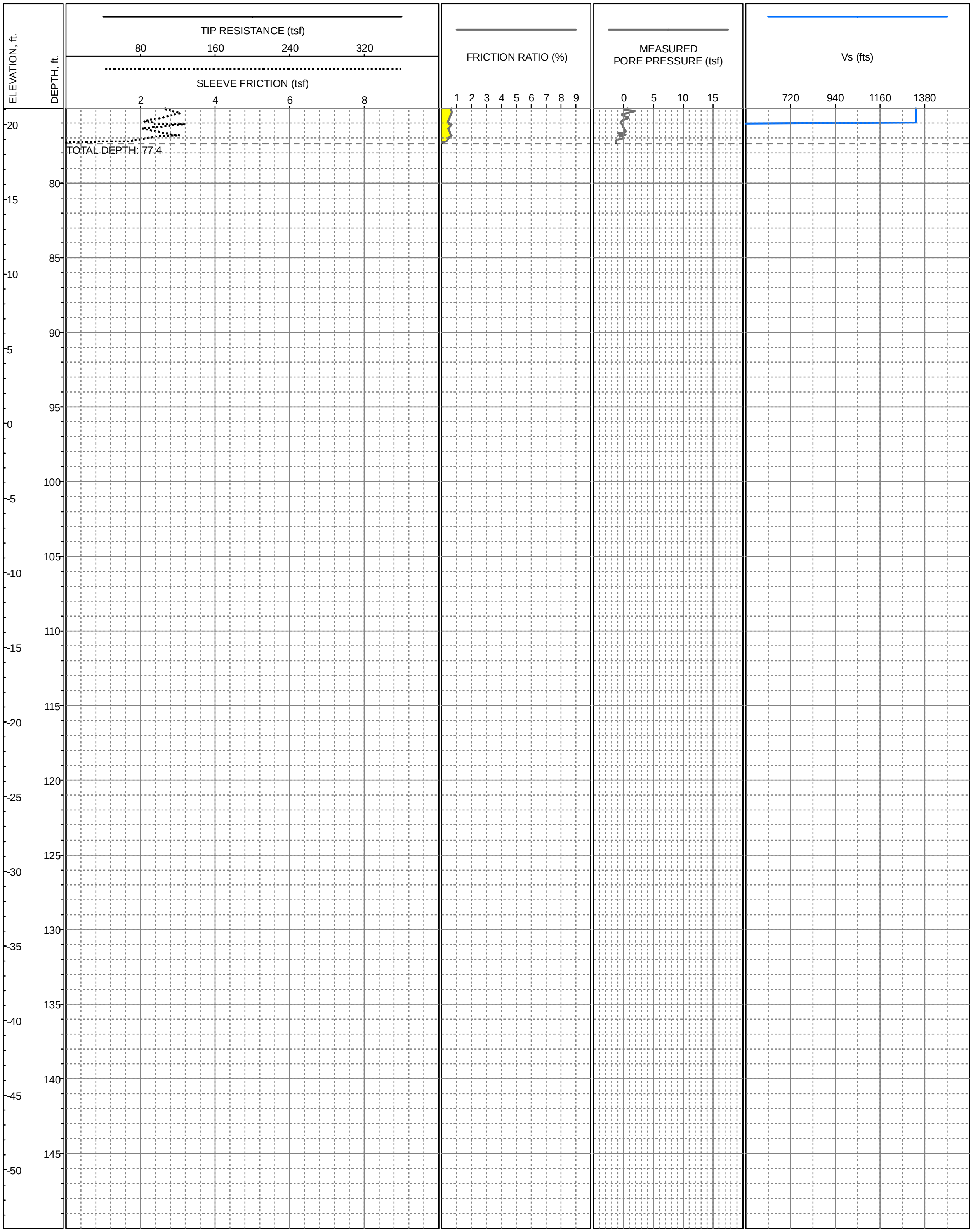


LOCATION: E6162527.2 N1950703.4 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 96.1ft +/- (NAVD88)
COMPLETION DEPTH: 77.4ft
TEST DATE: 8/16/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

LOG OF CPT-165

Central Area Guideway of SVRT Project
San Jose, California

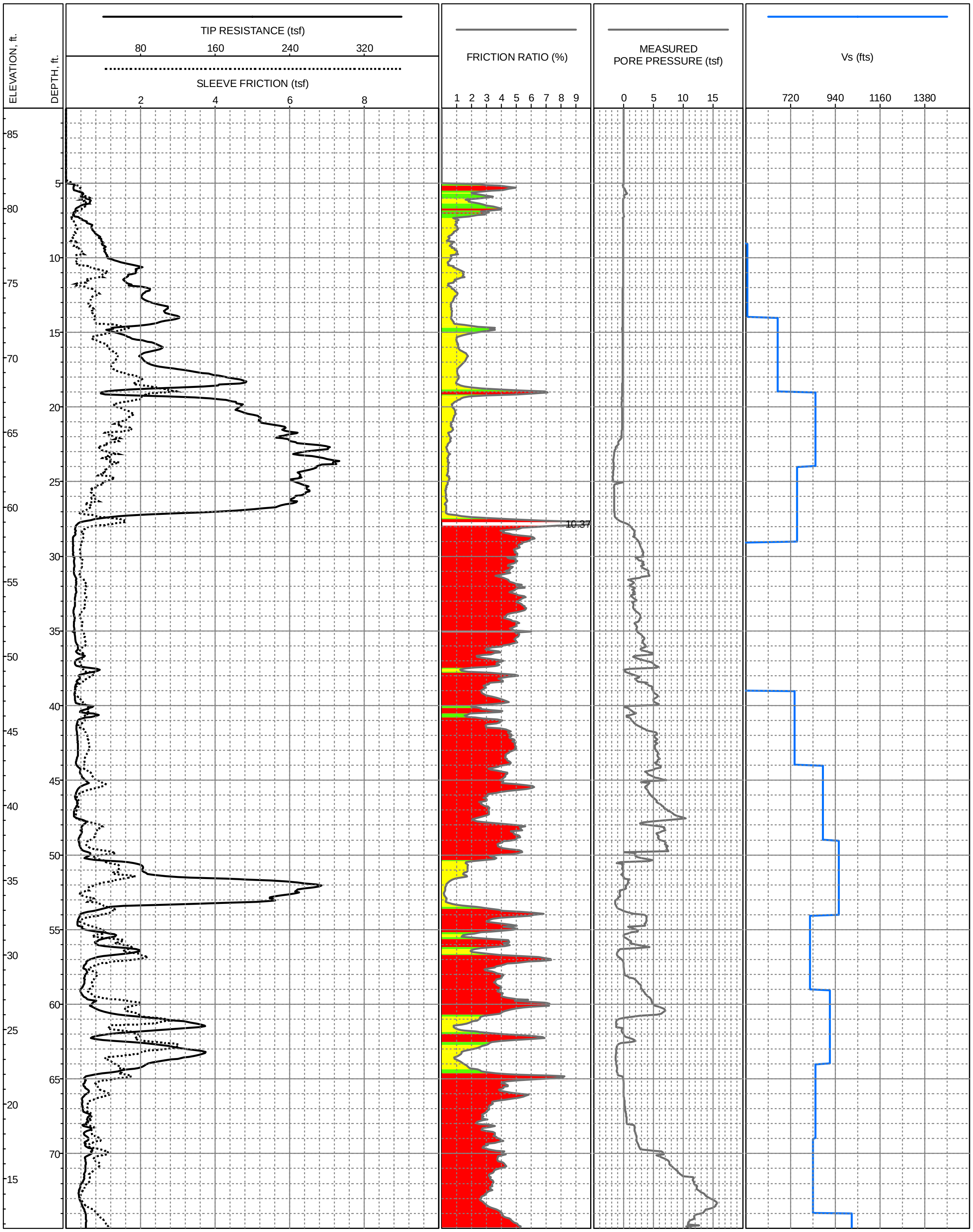


LOCATION: E6162527.2 N1950703.4 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 96.1ft +/- (NAVD88)
COMPLETION DEPTH: 77.4ft
TEST DATE: 8/16/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

LOG OF CPT-165

Central Area Guideway of SVRT Project
San Jose, California

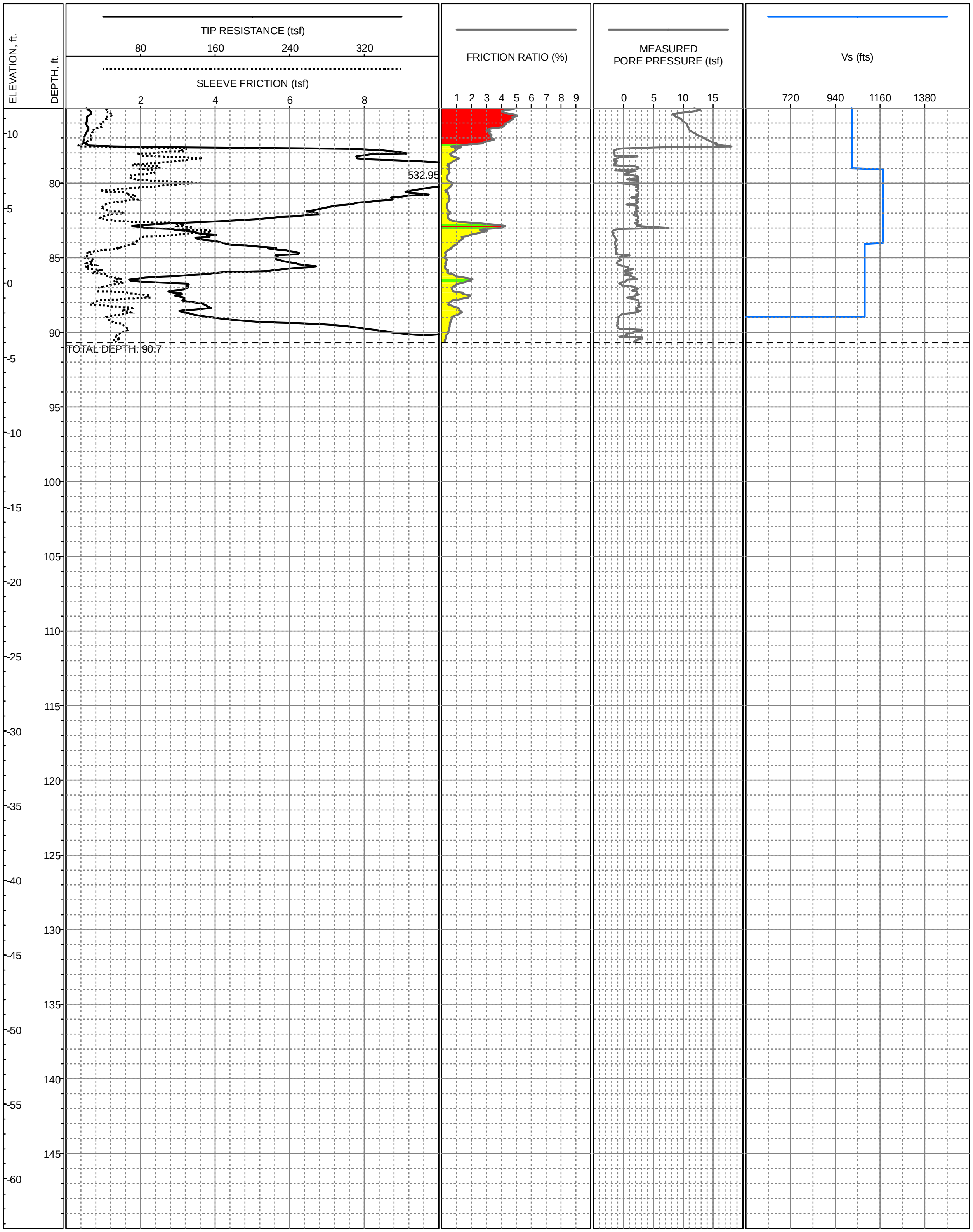


LOCATION: E6157353.8 N1947883.5 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 86.7ft +/- (NAVD88)
COMPLETION DEPTH: 90.7ft
TEST DATE: 4/1/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-167

Central Area Guideway of SVRT Project
San Jose, California

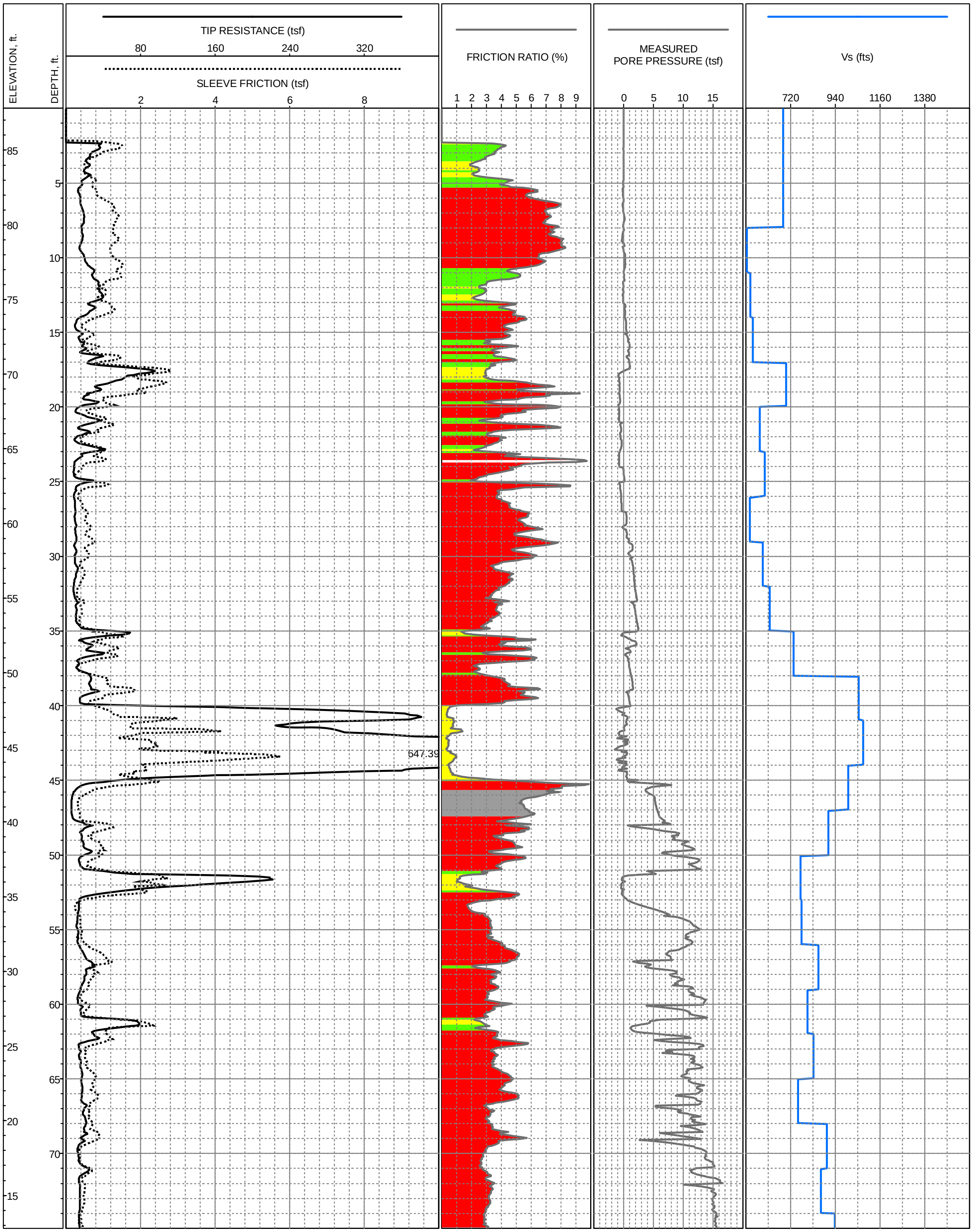


LOCATION: E6157353.8 N1947883.5 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 86.7ft +/- (NAVD88)
COMPLETION DEPTH: 90.7ft
TEST DATE: 4/1/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-167

Central Area Guideway of SVRT Project
San Jose, California

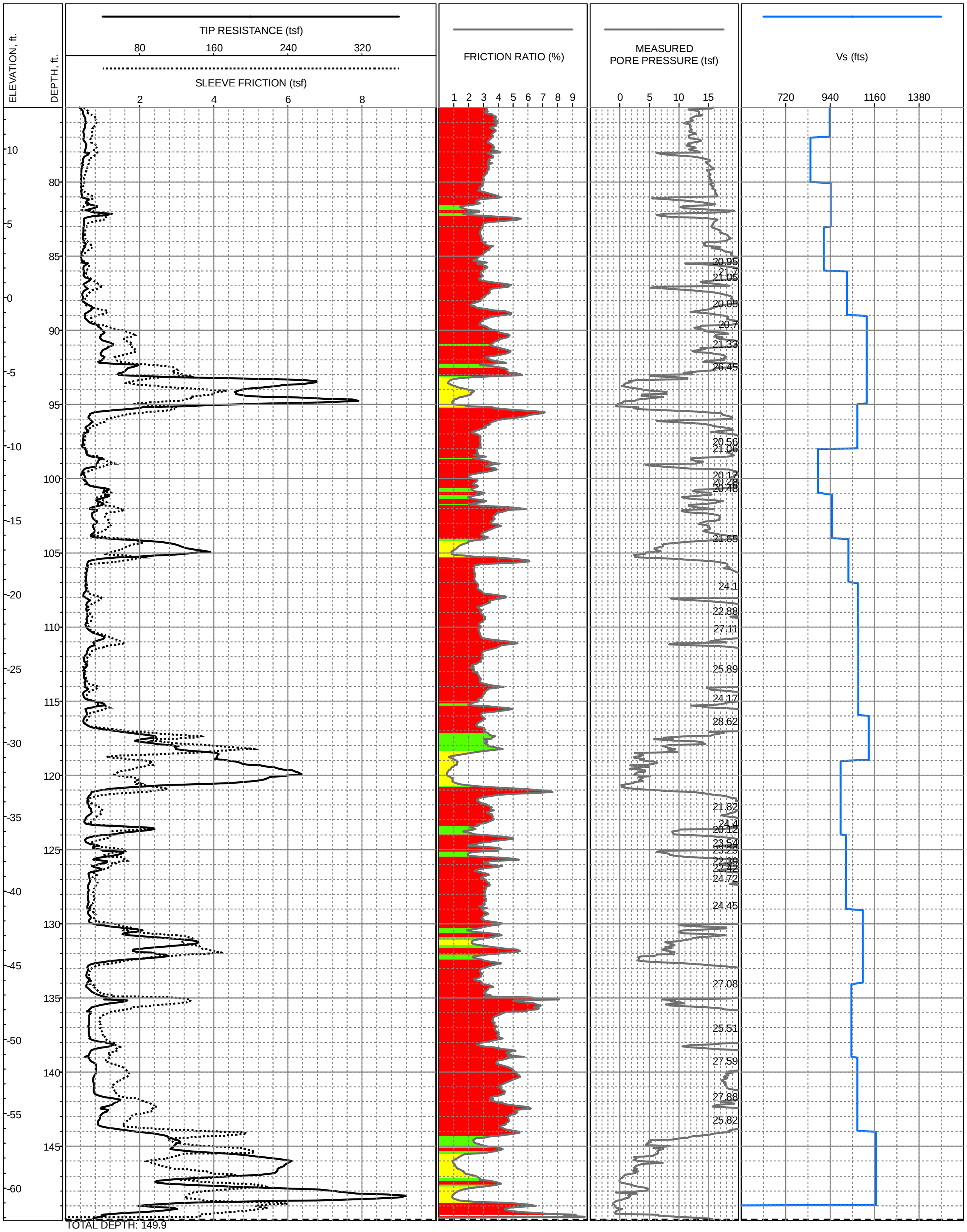


LOCATION: E6154586 N1946016.7 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 87.8ft +/- (NAVD88)
COMPLETION DEPTH: 149.9ft
TEST DATE: 4/5/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-168

Central Area Guideway of SVRT Project
San Jose, California

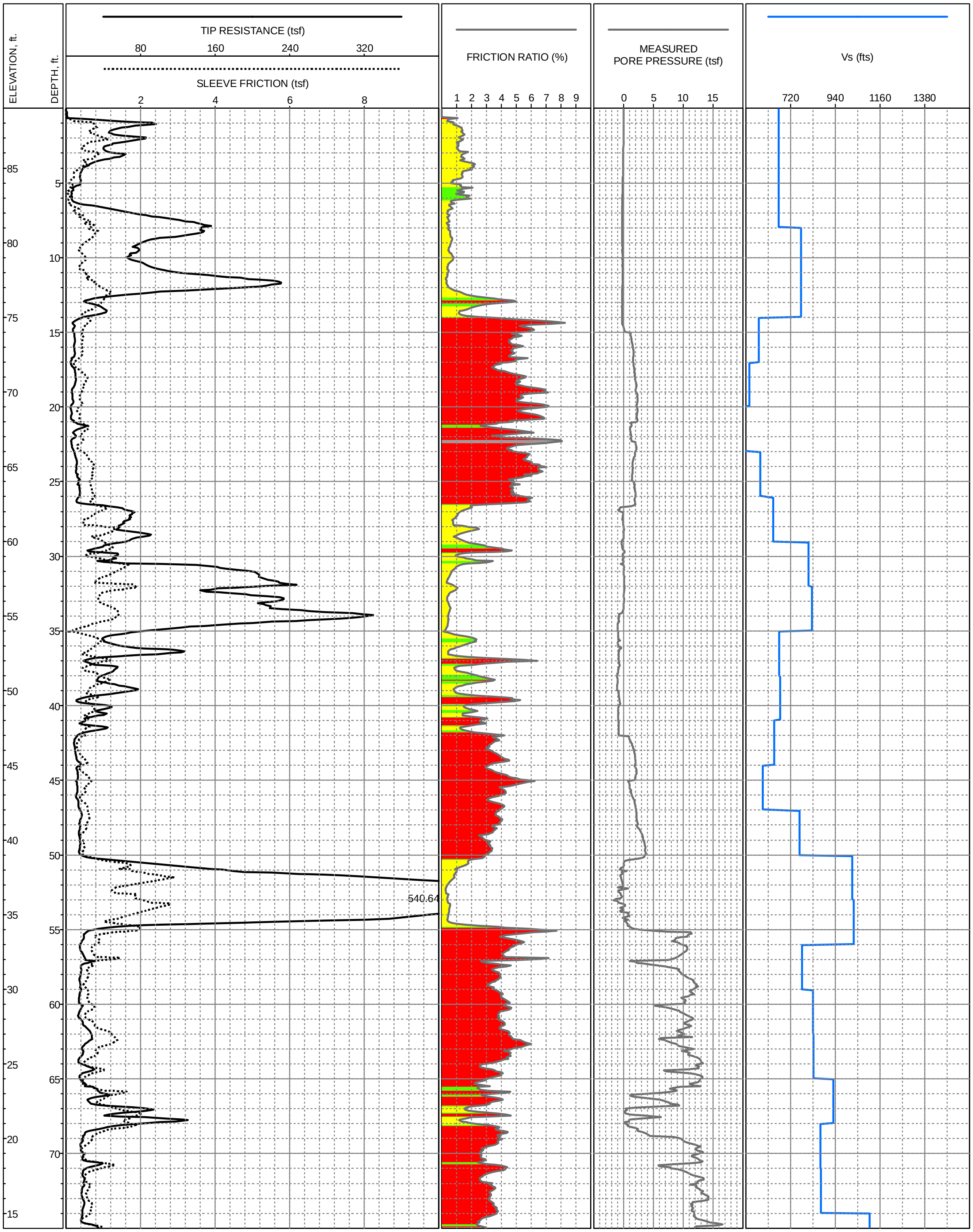


LOCATION: E6154586 N1946016.7 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 87.8ft +/- (NAVD88)
COMPLETION DEPTH: 149.9ft
TEST DATE: 4/5/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

LOG OF CPT-168

Central Area Guideway of SVRT Project
San Jose, California



LOCATION: E6156936.7 N1947464 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 89ft +/- (NAVD88)
COMPLETION DEPTH: 85.4ft
TEST DATE: 8/17/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

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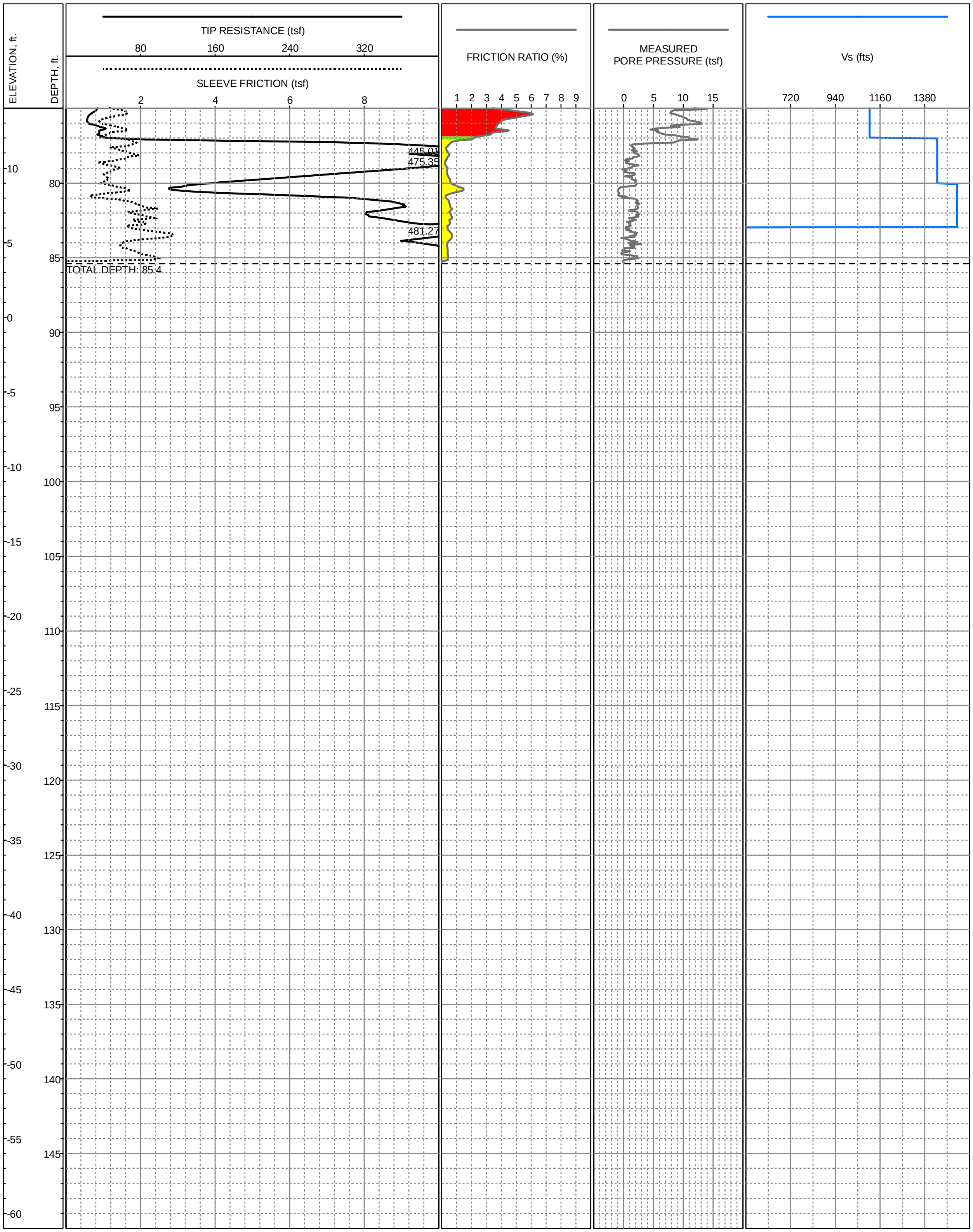
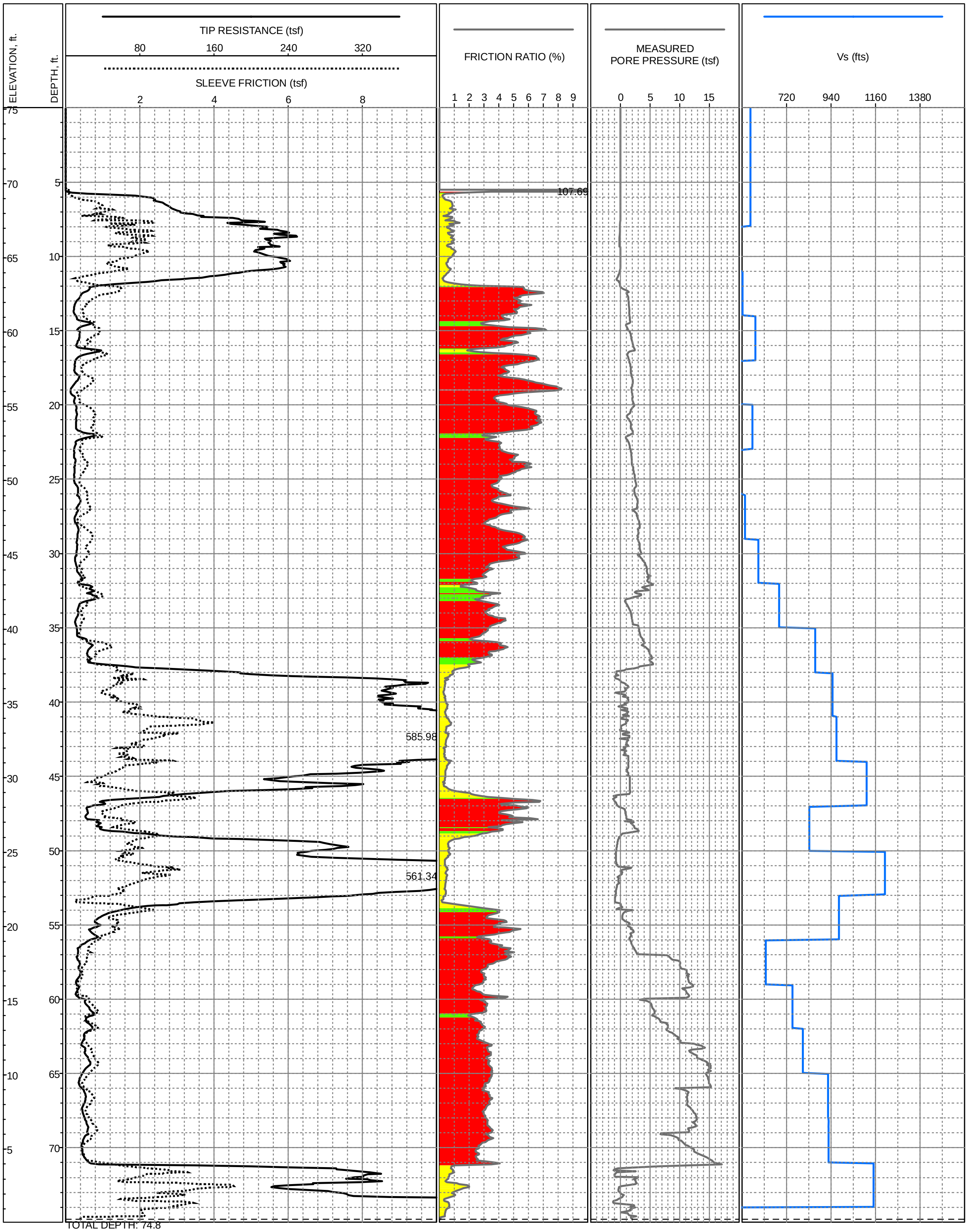
San Jose, California



LOCATION: E6156936.7 N1947464 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 89ft +/- (NAVD88)
COMPLETION DEPTH: 85.4ft
TEST DATE: 8/17/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

LOG OF CPT-169
Central Area Guideway of SVRT Project
San Jose, California



LOCATION: E6150804.4 N1949684.3 (NAD83, CA State Plane Zone III, Feet)	CONE: F7.5CKESW1645
SURFACE EL: 75.1ft +/- (NAVD88)	PERFORMED BY: Fugro Consultants, Inc.
COMPLETION DEPTH: 74.8ft	OPERATOR: D Garza & R Norris
TEST DATE: 3/30/2007	REVIEWED BY: M Paquette

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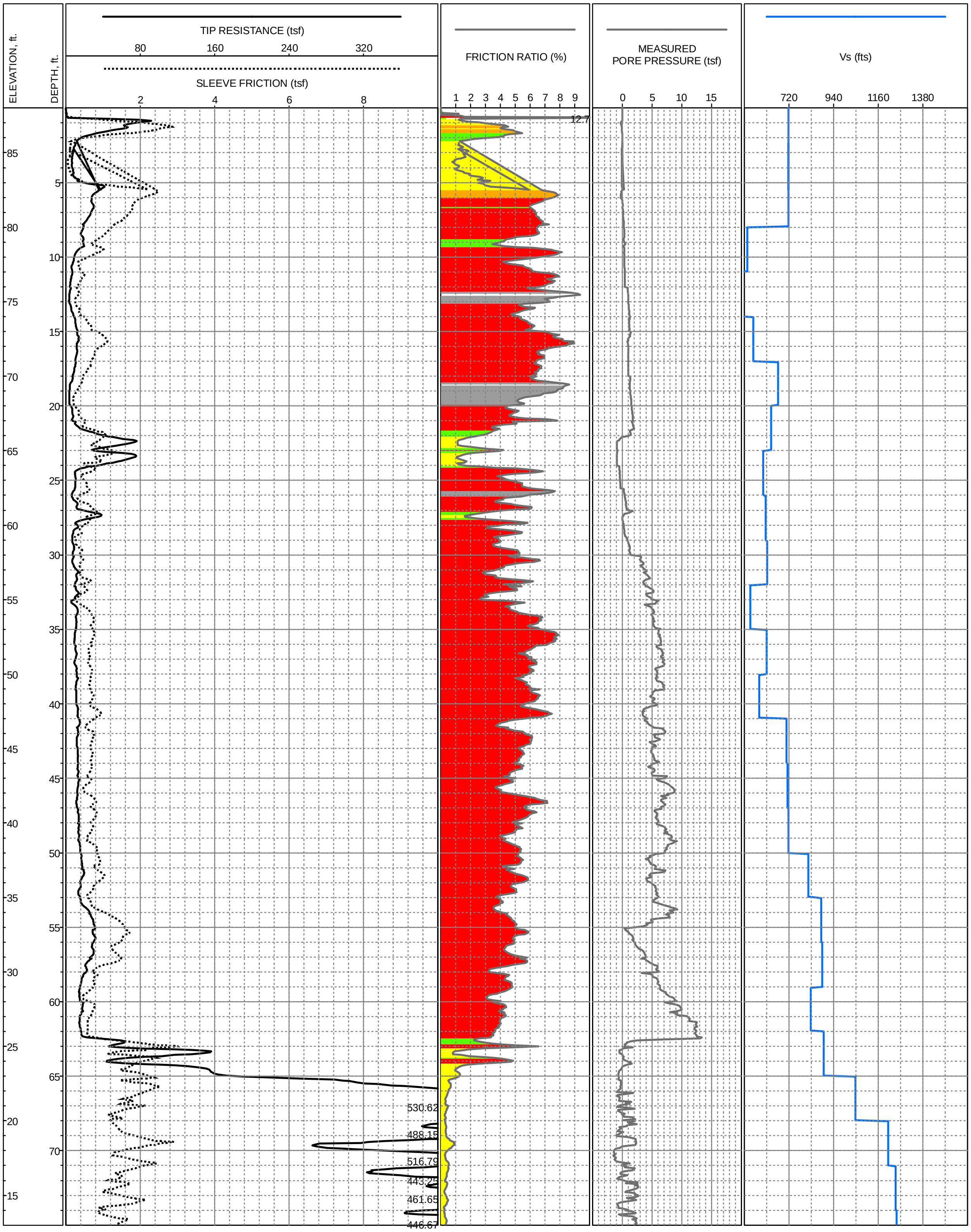

LOCATION: E6164740.58 N1953023.9 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 88ft +/- (NAVD88)
COMPLETION DEPTH: 113.4ft
TEST DATE: 8/16/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

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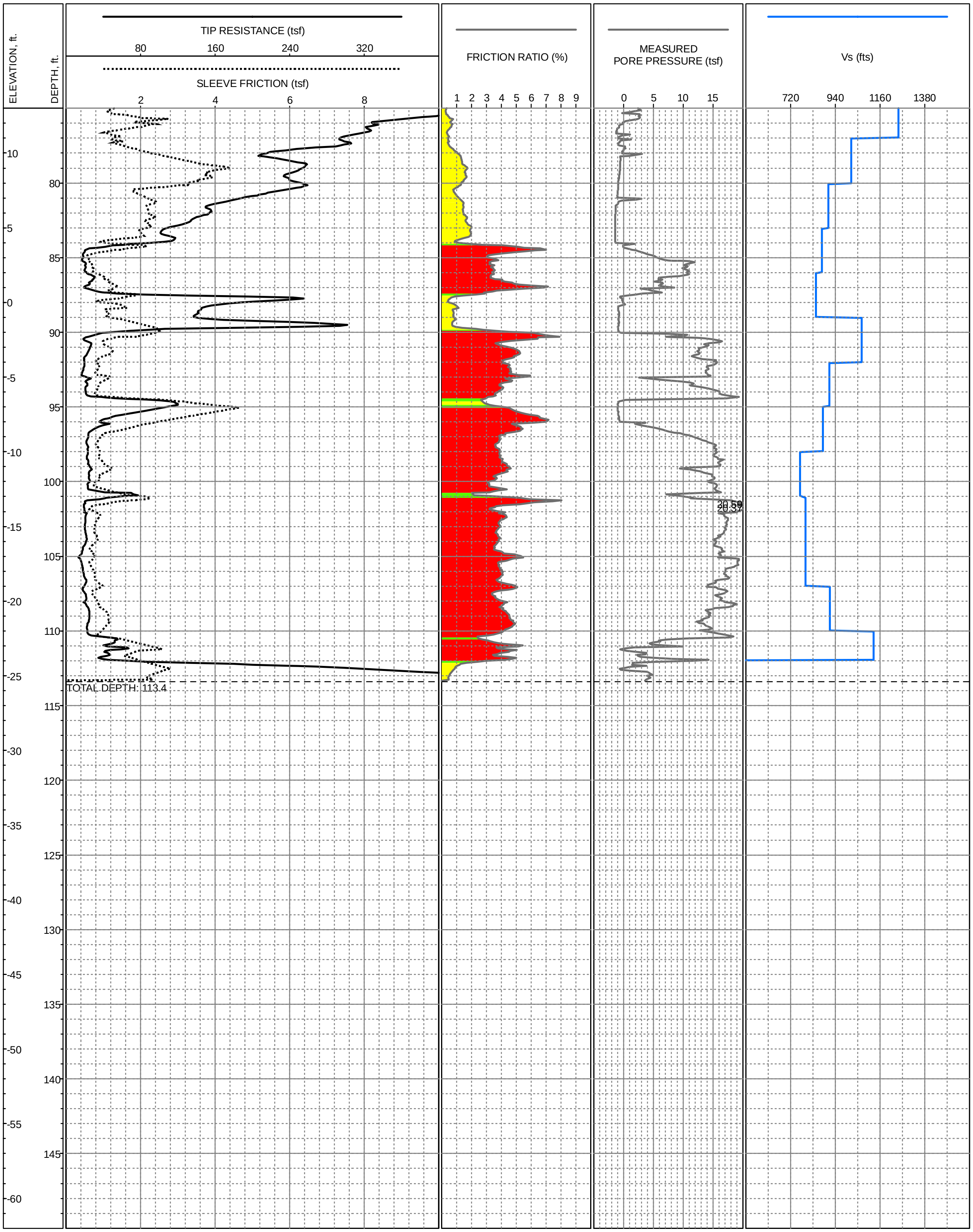

LOCATION: E6164740.58 N1953023.9 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 88ft +/- (NAVD88)
COMPLETION DEPTH: 113.4ft
TEST DATE: 8/16/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

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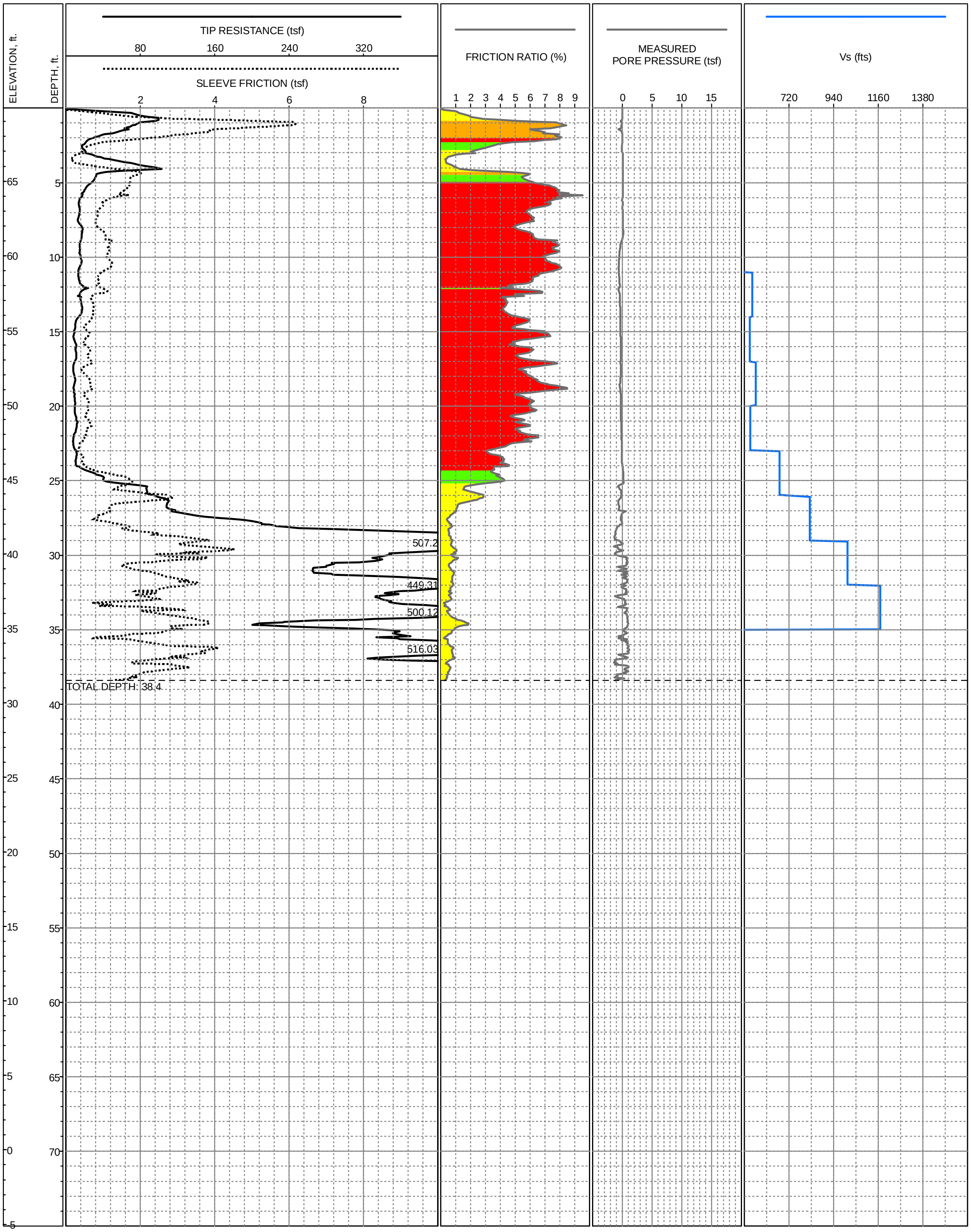

LOCATION: E6148281.4 N1951764.6 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 69.9ft +/- (NAVD88)
COMPLETION DEPTH: 38.4ft
TEST DATE: 3/29/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

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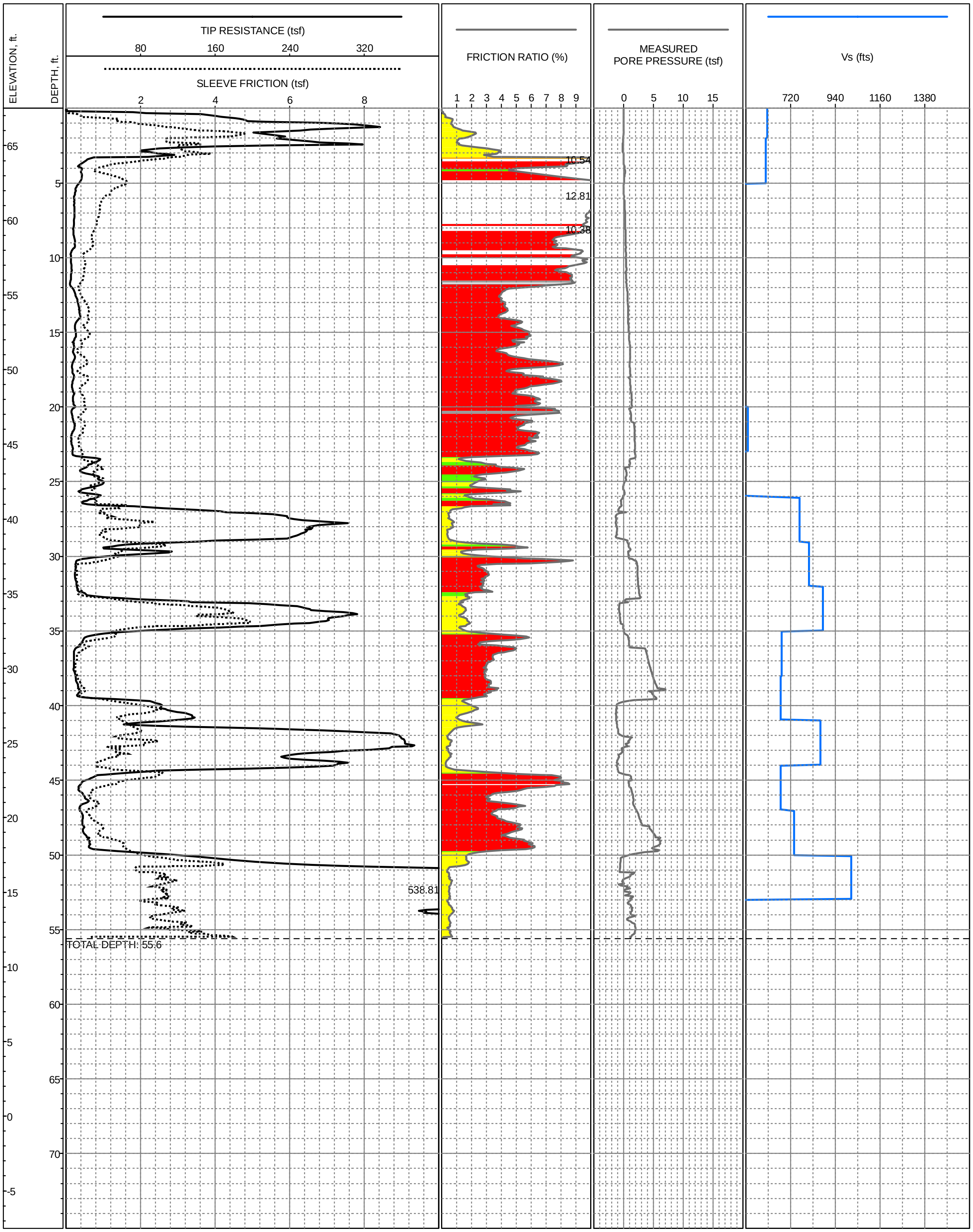

LOCATION: E6147771.2 N1952159.6 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 67.5ft +/- (NAVD88)
COMPLETION DEPTH: 55.6ft
TEST DATE: 3/31/2007

CONE: F7.5CKESW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza & R Norris
REVIEWED BY: M Paquette

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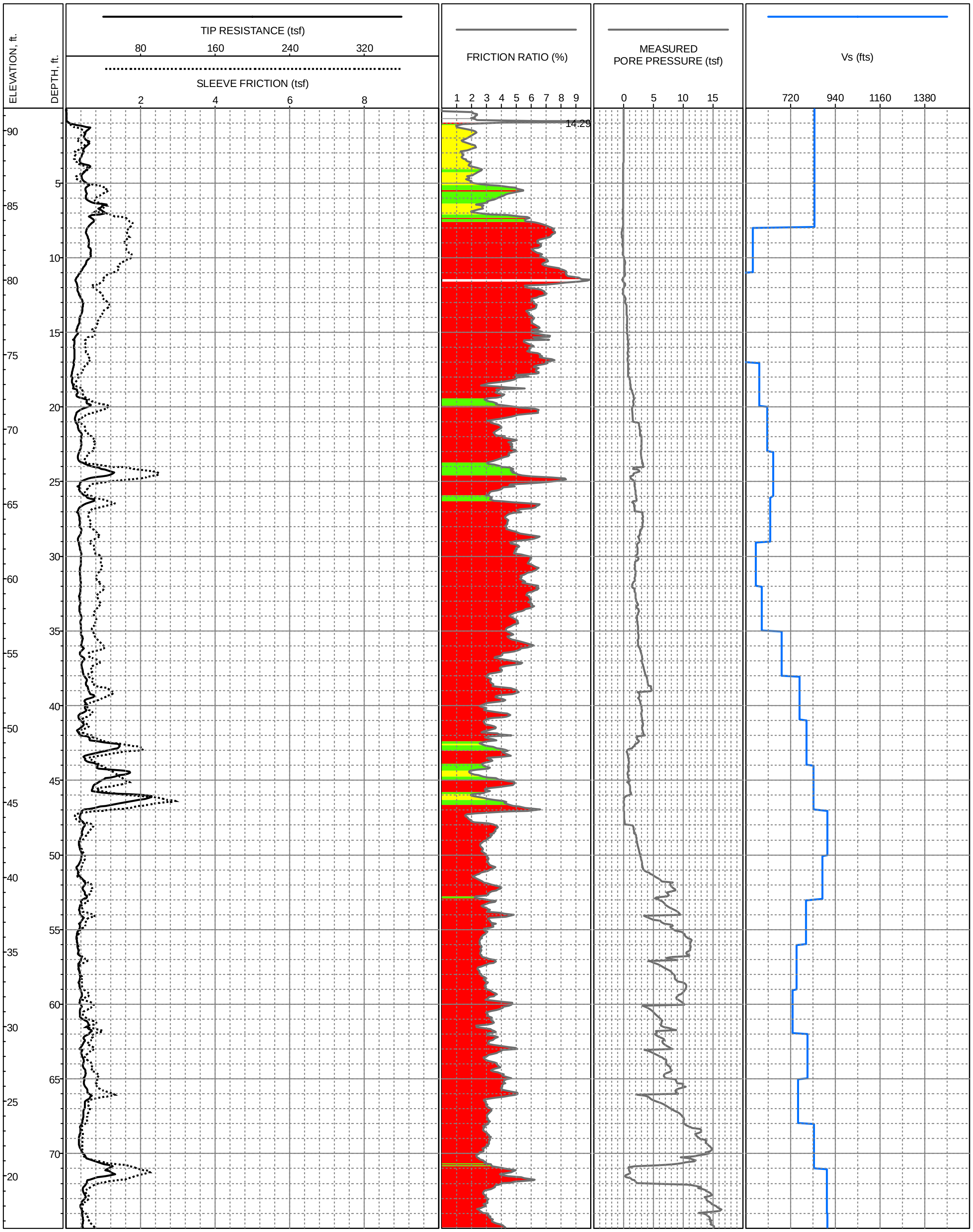
San Jose, California



LOCATION: E6153986.9 N1945918.4 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 91.5ft +/- (NAVD88)
COMPLETION DEPTH: 115.5ft
TEST DATE: 8/14/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

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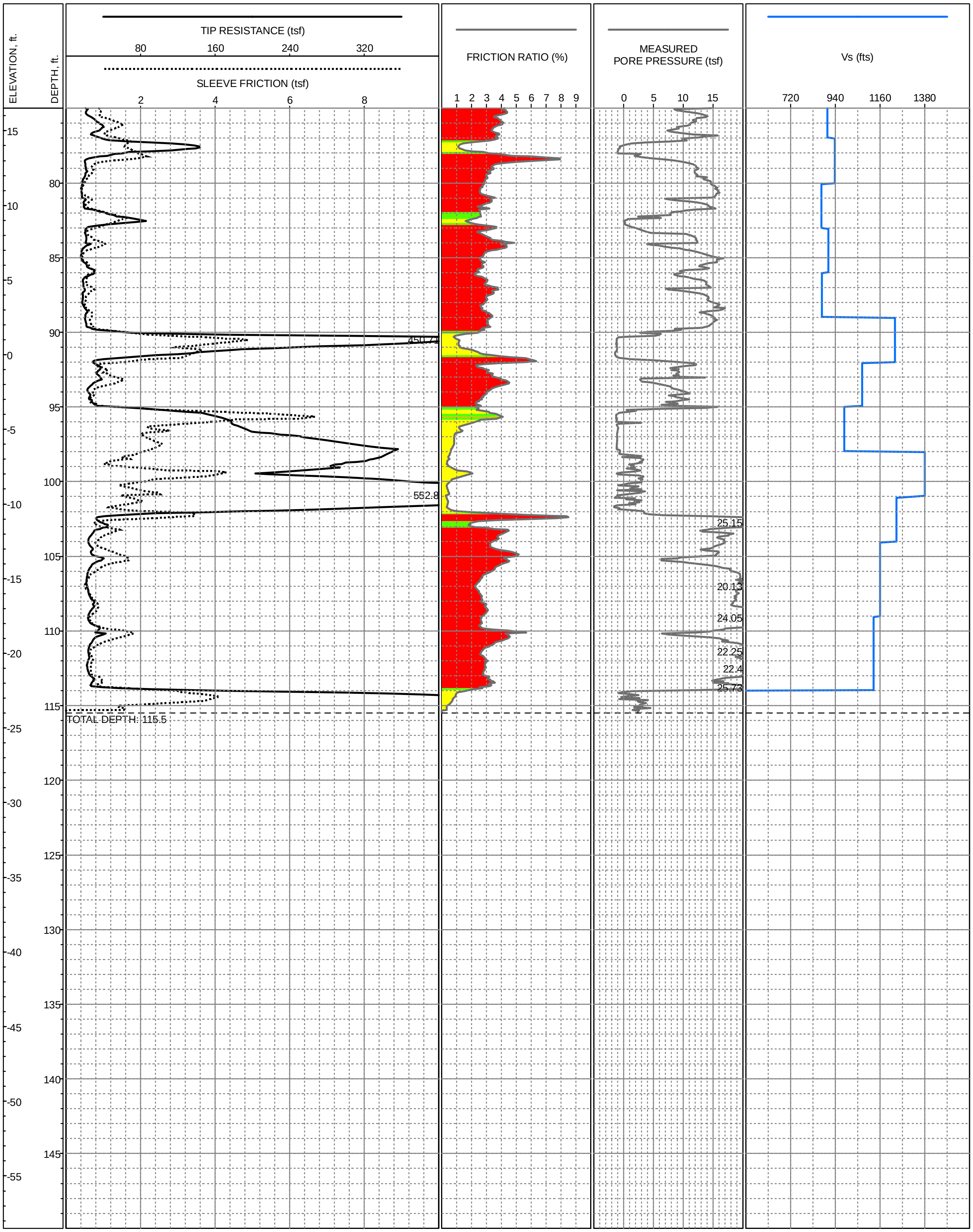
Central Area Guideway of SVRT Project
San Jose, California

HMM/Bechtel
Project No. 1637.001



LOCATION: E6153986.9 N1945918.4 (NAD83, CA State Plane Zone III, Feet)
SURFACE EL: 91.5ft +/- (NAVD88)
COMPLETION DEPTH: 115.5ft
TEST DATE: 8/14/2007

CONE: F7.5CKEGW1645
PERFORMED BY: Fugro Consultants, Inc.
OPERATOR: D Garza
REVIEWED BY: M Paquette

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Central Area Guideway of SVRT Project
San Jose, California

Appendix 4: Laboratory Classification Test Results

INTRODUCTION

Parikh Consultants, Inc. (PCI), was retained to perform laboratory geotechnical tests associated with subsurface exploration for 65 % Engineering Design phase of Silicon Valley Rapid Transit (SVRT) project. They performed the exploration from June 4, 2007 through August 1, 2007. The laboratory tests were performed on samples selected by HMM/Bechtel from June through August, 2007.

PURPOSE AND SCOPE

The purpose of the laboratory tests was to obtain index geotechnical properties of the selected samples. PCI performed the following tests:

- Particle-size distribution with Hydrometer (ASTM D 422)
- Moisture/Density (ASTM D 2216)
- Atterberg Limits (ASTM D 4318)

The samples were classified according to Unified Soil Classification System (USCS) using ASTM D 2487 and ASTM D 2488. The test results were provided to HMM/Bechtel in a gINT database software format. We provided the gINT templates. The moisture/density test results are provided on the boring logs provided in Appendix 1. The Atterberg test results are presented in Figures A4-1 through A4-18. The particle-size distribution graphs are presented in Figures A4-19 through A4-38. The summary of lab test results is presented in Tables A4-1 through A4-32. The laboratory test results for borehole BH-81, which was performed near the end of 35% engineering design phase, is also included.

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-081	1	34.5	GM	48	40	12							7.0	
BH-081	2	42.5	SP											
BH-081	3	47.5	SW-SC	25	64	11							10.0	
BH-081	4	51.5												
BH-081	5	65	CL			72							22.0	
BH-081	6	70	CL											
BH-081	7	74	SC											
BH-081	8	80	ML			72						110.4	20.0	
BH-081	9	84.5	CL			70								
BH-081	10	89	CL											
BH-081	11	95												
BH-081	12	99	CL			82							25.0	
BH-081	13	104	SW											
BH-081	14	109	CL											
BH-081	15	113.5	CL											
BH-081	16	118	SP	34	63	3								
BH-081	17	125.5	ML/SM			45							16.0	
BH-081	18	130.5	SP			69							20.0	
BH-081	19	136.5	CL											
BH-081	20	141.5	CL			98							33.2	
BH-081	21	146.5	CL											
BH-081	22	150.5	SC											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
CENTRAL AREA GUIDEWAY
SAN JOSE, CALIFORNIA

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

Notes:

**USCS - Symbol of Unified Soil Classification System per visual-manual procedures in accordance with ASTM D 2488 or classification based on laboratory test resutls in accordance with ASTM D 2487 when laboratory data is available.

Date: 4/29/2008

Job No.: 204104.10

TABLE A4-1

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-082	1	3.5	ML											
BH-082	2	7.5	CL											
BH-082	3	12.5	CL											
BH-082	4	17.5	CL											
BH-082	5	22.5	CL	0	2	98	42	24	18			96.2	27.8	
BH-082	6	27.5	CL											
BH-082	7	32.5	CL										26.6	
BH-082	8	37.5	CL											
BH-082	9	42.5	CL	1	27	72	35	17	18				25.7	
BH-082	10	46.5	CL-ML											
BH-082	11	51.5	ML										23.6	
BH-082	12	56.5	ML											
BH-082	13	61.5	CL-ML											
BH-082	14	67.5	ML	0	4	96	38	29	9			94.3	26.9	
BH-082	15	72.5	CL											
BH-082	16	82.5	SM											
BH-082	17	92.5	CL									110.1	20.6	

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
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Date: 4/29/2008

Job No.: 204104.10

TABLE A4-2

SVRT - PARIKH LAB TEST SUMMARY SVRT PHASE2 (01252008_WITH USCS).GPJ SVRT-BART.GDT 4/29/08

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-084	1	3.5	SM											
BH-084	2	12.5	CL											
BH-084	3	21.5	SM											
BH-084	4	32.5	CL											
BH-084	5	42.5	CH				58	27	31			89.9	33.0	
BH-084	6	52.5	CL											
BH-084	7	62.5	CL											
BH-084	8	71.5	CL											
BH-084	9	82.5	SW-SC	42	48	10							15.5	
BH-084	10	92.5	SW-SC											
BH-084	11	101.5	SM											
BH-084	12	111.5	SW-SM	46	48	6							8.2	
BH-084	13	122.5	CL											
BH-084	14	131.5	CL/SC	0	44	56							21.3	
BH-084	15	141	SW-SM	4	84	12							15.5	
BH-084	16	152.5	CL											
BH-084	17	157.5	CL				29	17	12			111.7	18.8	
BH-084	18	162.5	CL											
BH-084	19	167.5	CL/CH				49	27	22				28.9	
BH-084	20	172.5	CL											
BH-084	21	177.5	CL/ML				36	24	12			100.8	25.6	
BH-084	22	182.5	CL											
BH-084	23	187.5	CL											
BH-084	24	192.5	CL				30	18	12				20.7	
BH-084	25	197.5	CL											

SUMMARY OF LABORATORY TEST RESULTS

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Date: 4/29/2008

Job No.: 204104.10

TABLE A4-3

SVRT - PARIKH LAB TEST SUMMARY SVRT PHASE2 (01252008_WITH USCS).GPJ SVRT-BART.GDT 4/29/08

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-084	26	201.5	CH											
BH-084	27	207.5	CH				57	25	32				21.6	

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
CENTRAL AREA GUIDEWAY
SAN JOSE, CALIFORNIA

PARIKH CONSULTANTS, INC.

Geotechnical & Materials Engineering

Notes:

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Date: 4/29/2008

Job No.: 204104.10

TABLE A4-4

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-085	1	3.5	GP-GC											
BH-085	2	12.5	CL											
BH-085	3	22.5	CL											
BH-085	4	32.5	CL											
BH-085	5	42.5	CH											
BH-085	6	52.5	CL				43	19	24			103.2	23.5	
BH-085	7	62.5	CL											
BH-085	8	66.5	CL											
BH-085	9	71.5	CL											
BH-085	10	76.5	CL											
BH-085	11	81.5	CL											
BH-085	12	86.5	SW-SC	43	49	8							9.5	
BH-085	13	92.5	CL											
BH-085	14	102.5	ML	0	41	59	NP	NP	NP			104.3	20.3	
BH-085	15	111.5	GM											
BH-085	16	121.5	SP-SC	24	68	8							11.0	
BH-085	17	131.5	CL											
BH-085	18	141.5	CL											
BH-085	19	151.5	CL				29	20	9				23.1	
BH-085	20	155.8	CL											
BH-085	21	161	CL											
BH-085	22	167.5	CH				53	27	26			99.4	26.3	
BH-085	23	172.5	CL											
BH-085	24	177.5	CL											
BH-085	25	182.5	CL											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
CENTRAL AREA GUIDEWAY
SAN JOSE, CALIFORNIA

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TABLE A4-5

SVRT - PARIKH LAB TEST SUMMARY SVRT PHASE2 (01252008_WITH USCS).GPJ SVRT-BART.GDT 4/29/08

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-085	26	187.5	CH											
BH-085	27	192.5	CL	0	40	60	27	18	9			112.8	17.2	
BH-085	28	197.5	CH											
BH-085	29	202.5	CL											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
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TABLE A4-6

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-087	1	4.5	CL											
BH-087	2	12.5	SM											
BH-087	3	22.5	CL											
BH-087	4	32.5	SM											
BH-087	5	37.5	CL											
BH-087	6	42.5	ML											
BH-087	7	47.5	CL											
BH-087	8	52.5	CL				46	24	22				29.0	
BH-087	9	57.5	CL											
BH-087	10	62.5	CL				46	24	22				28.3	
BH-087	11	67.5	CL											
BH-087	12	71.5	GW	69	27	4							8.3	
BH-087	13	74	SC											
BH-087	14	76.5	SM											
BH-087	15	79	GP-GC	65	28	7							10.8	
BH-087	16	81.5	CL											
BH-087	17	84	ML											
BH-087	18	86.5	SP-SM	3	89	8							13.7	
BH-087	19	89	SM											
BH-087	20	91.5	SM											
BH-087	21	96	GP-GC											
BH-087	22	101.5	SM											
BH-087	23	107.5	CL											
BH-087	24	112.5	CL											
BH-087	25	117.5	SM											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
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Date: 4/29/2008

Job No.: 204104.10

TABLE A4-7

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-087	26	121.5	SW-SM	43	51	6							8.3	
BH-087	27	126.5	SW-SM											
BH-087	28	132.5	CL-ML											
BH-087	29	136.25	GC	47	40	13							9.1	
BH-087	30	141.5	SM											
BH-087	31	146.5	ML											
BH-087	32	152.5	ML											
BH-087	33	157.5	SM	0	76	24						91.7	16.2	
BH-087	34	160.8	SM											
BH-087	35	166	SM											
BH-087	36	171	GP-GM											
BH-087	37	176.4	GP-GM											
BH-087	38	181	SP-SM	43	51	6							9.4	
BH-087	39	187.5	MH/CH				56	31	25				35.3	
BH-087	40	191.5	CL											
BH-087	41	201.5	CL											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
CENTRAL AREA GUIDEWAY
SAN JOSE, CALIFORNIA

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Date: 4/29/2008

Job No.: 204104.10

TABLE A4-8

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-088	1	3.5	ML											
BH-088	2	7.5	ML											
BH-088	3	12	ML											
BH-088	4	16.5	SP-SM											
BH-088	5	22.5	CL											
BH-088	6	27.5	CL											
BH-088	7	34.5	ML	0	10	90	29	24	5					
BH-088	8	37	CL-ML											
BH-088	9	39	CL-ML											
BH-088	10	41	CL				34	18	16				25.4	
BH-088	11	43	CL											
BH-088	12	45	CL											
BH-088	13	47	SM											
BH-088	14	49	CL-ML											
BH-088	15	51	CL											
BH-088	16	53	CL											
BH-088	17	55	ML											
BH-088	18	57	CL											
BH-088	19	59	CL											
BH-088	20	62	CL											
BH-088	21	65	ML											
BH-088	22	68	ML	0	0	100	40	27	13					
BH-088	23	69	ML											
BH-088	24	71	GP-GM	51	38	11	NP	NP	NP					
BH-088	25	72.5	SW-SM											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
CENTRAL AREA GUIDEWAY
SAN JOSE, CALIFORNIA

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Date: 4/29/2008

Job No.: 204104.10

TABLE A4-9

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-088	26	75.5	SW-SM											
BH-088	27	78	SW-SM											
BH-088	28	80	SW-SM											
BH-088	29	81.5	SW-SM	43	50	7								
BH-088	30	83	SW-SM											
BH-088	31	84.5	GP											
BH-088	32	86.5	CL											
BH-088	33	88.5	CL											
BH-088	34	91	CL											
BH-088	35	93	GW-GM											
BH-088	36	94.5	GW-GM	51	44	5								
BH-088	37	95	SM											
BH-088	38	96.5	SM											
BH-088	39	98	SM											
BH-088	40	100	SM											
BH-088	41	102	GC											
BH-088	42	104	GC	28	65	7								
BH-088	43	106	GC											
BH-088	44	108	GC											
BH-088	45	110	SM											
BH-088	46	112.5	GM											

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PARIKH CONSULTANTS, INC.
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Notes:

**USCS - Symbol of Unified Soil Classification System per visual-manual procedures in accordance with ASTM D 2488 or classification based on laboratory test resutls in accordance with ASTM D 2487 when laboratory data is available.

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TABLE A4-10

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-089	1	3.5	CL											
BH-089	2	12.5	ML											
BH-089	3	22.5	CL				37	21	16				31.9	
BH-089	4	32.5	ML											
BH-089	5	41.5	SM	0	53	47						106.3	23.0	
BH-089	6	51.5	GW-GM	53	38	9								
BH-089	7	67.5	ML											
BH-089	8	72.5	ML											
BH-089	9	81.5	SP-SM	30	63	7							11.4	
BH-089	10	91.5	SP-SM											
BH-089	11	101.5	ML											
BH-089	12	112.5	ML											
BH-089	13	122.5	SC											
BH-089	14	131.5	SC											
BH-089	15	142.5	CL											
BH-089	16	147.5	ML	0	21	79							20.3	
BH-089	17	152.5	SM											
BH-089	18	156.5	CL											
BH-089	19	151.5	CL	0	33	67							19.3	
BH-089	20	167.5	ML											
BH-089	21	172.5	ML	3	44	53						107.5	21.0	
BH-089	22	176.5	CL											
BH-089	23	181.5	CL											
BH-089	24	187.5	SC											
BH-089	25	191.5	CL	0	2	98	49	25	24				25.2	

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TABLE A4-11

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-089	26	196.5	SM											
BH-089	27	201.5	SM											

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TABLE A4-12

SVRT - PARIKH LAB TEST SUMMARY SVRT PHASE2 (01252008_WITH USCS).GPJ SVRT-BART.GDT 4/29/08

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-090	1	5	CONCRETE											
BH-090	2	7.5	CL											
BH-090	3	11.5	CL											
BH-090	4	17.5	ML											
BH-090	5	22.5	CL											
BH-090	6	24	CH											
BH-090	7	27.5	CL											
BH-090	8	29	CL	0	11	89	36	22	14				23.4	
BH-090	9	32.5	SM											
BH-090	10	34	ML	0	30	70	NP	NP	NP				28.2	
BH-090	11	37.5	SM											
BH-090	12	39	CL	0	19	81	30	22	8				27.8	
BH-090	13	41.5	CH											
BH-090	14	45	ML										22.4	
BH-090	15	46.5	CL	0	30	70	26	18	8				24.4	
BH-090	16	49	CL											
BH-090	17	52.5	ML											
BH-090	18	54	CL-ML	0	22	78	28	22	6				29.4	
BH-090	19	56	CL											
BH-090	20	58.5	CL	1	34	65	34	15	19				21.7	
BH-090	21	62.5	CL											
BH-090	22	72.5	CL											
BH-090	23	81.5	GM											
BH-090	24	91.5	GM											
BH-090	25	101.5	CL											

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TABLE A4-13

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-090	26	112.5	CL											
BH-090	27	121.5	SM											
BH-090	28	131.5	CL											
BH-090	29	142.5	ML											
BH-090	30	151.5	ML	0	53	47							21.3	
BH-090	31	157.5	CL											
BH-090	32	162.5	CL	0	27	73						104.6	21.6	
BH-090	33	166.5	SM											
BH-090	34	171.5	CL											
BH-090	35	177.5	CL											
BH-090	36	182.5	CL	0	37	63							26.4	
BH-090	37	186.33	CL	0	30	70							28.0	
BH-090	38	191.33	ML											
BH-090	39	197.5	ML	0	34	66						104.5	20.5	
BH-090	40	202.5	ML											
BH-090	41	206.5	CL											
BH-090	42	211.5	ML									109.7	18.5	

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TABLE A4-14

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-091	1	3.5	CL											
BH-091	2	12.5	SM											
BH-091	3	22.5	CL				45	25	20				38.0	
BH-091	4	27.5	CL											
BH-091	5	29	SM	0	63	37	NP	NP	NP				24.4	
BH-091	6	31	SM	11	54	35	NP	NP	NP				24.3	
BH-091	7	32.5	SP-SM	16	75	9	NP	NP	NP				16.8	
BH-091	8	35	SP-SM											
BH-091	9	37	SM											
BH-091	10	39	SM											
BH-091	11	40.5	CL	0	18	82	33	21	12					
BH-091	12	44	CL											
BH-091	13	45.5	CL	0	25	75	32	18	14					
BH-091	14	52.5	SM											
BH-091	15	61.5	CL											
BH-091	16	72.5	CL										103.5	22.4	
BH-091	17	81.5	GC											
BH-091	18	91.5	GC											
BH-091	19	101.5	CL											
BH-091	20	112.5	CL-ML									101.2	23.9	
BH-091	21	121.5	GM											
BH-091	22	132	CL											
BH-091	23	136.5	CL											
BH-091	24	142.5	SC	23	38	39							14.9	
BH-091	25	146	SP-SM	31	61	8							12.0	

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SVRT - PARIKH LAB TEST SUMMARY SVRT PHASE2 (01252008_WITH USCS).GPJ SVRT-BART.GDT 4/29/08

TABLE A4-15

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-091	26	151	SP-SM											
BH-091	27	156.5	SM	0	85	15							18.8	
BH-091	28	162.5	CL											
BH-091	29	166	GP-GM											
BH-091	30	171	GP-GM											
BH-091	31	176.5	GP-GM	50	41	9							10.6	
BH-091	32	182.5	CL	0	1	99							28.0	
BH-091	33	186.5	CL											
BH-091	34	190.8	GP-GC											
BH-091	35	196.5	GP-GC	64	29	7							9.0	

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TABLE A4-16

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-093	1	3.5	CL											
BH-093	2	12.5	ML											
BH-093	3	22.5	CL											
BH-093	4	32.5	CL											
BH-093	5	41.5	GM											
BH-093	6	52.5	CL-ML				28	23	5			105.3	21.1	
BH-093	7	62.5	CL-ML											
BH-093	8	71.5	SW											
BH-093	9	82.5	CL											
BH-093	10	91.5	CL											
BH-093	11	101.5	SP-SM	2	87	11							18.5	
BH-093	12	111.5	SM											
BH-093	13	122.5	CL									101.5	23.6	
BH-093	14	131.5	SM											
BH-093	15	141.5	CL											
BH-093	16	151.5	CL-ML											
BH-093	17	153.5	SW											
BH-093	18	156	SM											
BH-093	19	158.5	CL	0	17	83	30	21	9				23.0	
BH-093	20	161	CL											
BH-093	21	163	CL											
BH-093	22	164.7	SP-SM	4	90	6							20.1	
BH-093	23	167.2	SP-SM											
BH-093	24	169.7	CL	9	37	54							17.7	
BH-093	25	171.7	GP-GM											

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TABLE A4-17

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-093	26	173.2	GP-GM	73	21	6							7.7	
BH-093	27	175.2	SM											
BH-093	28	177.2	GP-GC											
BH-093	29	179.7	SP-SM											
BH-093	30	181.8	SP-SM	34	60	6							9.7	
BH-093	31	184.3	ML											
BH-093	32	186.8	CL											
BH-093	33	190	CL									97.6	26.4	
BH-093	34	191.5	CL											
BH-093	35	193.7	CL											
BH-093	36	195.2	SM											
BH-093	37	197.7	CL											
BH-093	38	200	CL	0	25	75	35	26	9				26.9	
BH-093	39	211.5	CL											

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SVRT - PARIKH LAB TEST SUMMARY SVRT PHASE2 (01252008_WITH USCS).GPJ SVRT-BART.GDT 4/29/08

TABLE A4-18

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-095	1	3.5	CL											
BH-095	2	7.5	CL											
BH-095	3	12.5	CL-ML											
BH-095	4	17.5	CL											
BH-095	5	22.5	MH/CH				55	30	25				39.9	
BH-095	6	25	CL											
BH-095	7	27.5	CL											
BH-095	8	30	CL											
BH-095	9	32.5	SM	0	61	39						104	23.3	
BH-095	10	34	ML											
BH-095	11	36.5	GW											
BH-095	12	39	GP-GM	56	39	5							7.5	
BH-095	13	41.5	CL-ML											
BH-095	14	44	CL-ML											
BH-095	15	45	CL											
BH-095	16	46.5					38	23	15				30.4	
BH-095	17	49	CL											
BH-095	18	51.5	CL				35	23	12			100.1	26.1	
BH-095	19	54	CL-ML											
BH-095	20	57.5	SP-SM											
BH-095	21	59	SP-SM	45	49	6							9.0	
BH-095	22	61.5	GW											
BH-095	23	64	GM	75	12	13							9.0	
BH-095	24	67.5	SM											
BH-095	25	69	GP-GM	49	45	6							8.4	

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TABLE A4-19

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-095	26	71.5	GP-GM											
BH-095	27	74	GP-GM											
BH-095	28	76.5	GW											
BH-095	29	79	SW-SM	43	52	5							7.2	
BH-095	30	81.5	CL											
BH-095	31	84	GW											
BH-095	32	87.5	CL-ML											
BH-095	33	92.5	CL-ML											
BH-095	34	97.5	CL				34	19	15				25.0	
BH-095	35	101.5	CL									105.1	22.8	

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TABLE A4-20

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-097	1	3.5	CL											
BH-097	2	7.5	CL											
BH-097	3	11.5	CL											
BH-097	4	17.5	CH	0	1	99	62	30	32			78.4	42.5	
BH-097	5	21.5	CL											
BH-097	6	26.5	GW-GM											
BH-097	7	31.5	ML											
BH-097	8	37.5	CL											
BH-097	9	41.5	SM											
BH-097	10	48	ML										29.5	
BH-097	11	51.5	SP-SM	28	65	7							9.6	
BH-097	12	55.792	GW-GM											
BH-097	13	60.875	GW-GM											
BH-097	14	66.5	SW-SM											
BH-097	15	71.5	GC	41	35	24							13.6	
BH-097	16	77.5	CL											
BH-097	17	81.5	GW-GM											
BH-097	18	86.5	GW	90	9	1							6.3	
BH-097	19	91.5	GC											

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TABLE A4-21

SVRT - PARIKH LAB TEST SUMMARY SVRT PHASE2 (01252008_WITH USCS).GPJ SVRT-BART.GDT 4/29/08

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-098	1	3.5	ML											
BH-098	2	7.5	CL											
BH-098	3	11.5	ML				60	33	27			85.7	35.9	
BH-098	4	17.5	CL-ML											
BH-098	5	21.5	CL											
BH-098	6	27.5	CL											
BH-098	7	31.5	CL-ML											
BH-098	8	37.5	ML	0	49	51							22.0	
BH-098	9	41.5	SM	0	79	21						104.5	21.9	
BH-098	10	46.5	CL	0	10	90							30.7	
BH-098	11	52.5	CL-ML											
BH-098	12	56.5	ML				39	30	9				33.8	
BH-098	13	61.5	GW-GM											

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TABLE A4-22

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-099	1	3.5	CH											
BH-099	2	7.5	CL											
BH-099	3	11.5	CL											
BH-099	4	17.5	ML											
BH-099	5	21.5	CH											
BH-099	6	27.5	CL											
BH-099	7	31.5	CL	0	39	61	27	16	11				26.8	
BH-099	8	37.5	CL											
BH-099	9	41.5	CL											
BH-099	10	47.5	SM	0	73	27						106.5	19.7	
BH-099	11	51.5	CL											
BH-099	12	57.5	CL	0	28	72							20.2	
BH-099	13	61	GW											
BH-099	14	66.5	SP-SM	37	58	5							9.8	
BH-099	15	71.5	SP-SM											
BH-099	16	76.5	SW-SM	31	62	7							10.1	
BH-099	17	81.5	SW-SM											

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**USCS - Symbol of Unified Soil Classification System per visual-manual procedures in accordance with ASTM D 2488 or classification based on laboratory test resutls in accordance with ASTM D 2487 when laboratory data is available.

Date: 4/29/2008

Job No.: 204104.10

TABLE A4-23

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-100	1	3.5	CH											
BH-100	2	7.5	CH											
BH-100	3	11.5	CL											
BH-100	4	17.5	CL											
BH-100	5	21.5	CL											
BH-100	6	27.5	CL-ML				27	20	7			104.7	21.8	
BH-100	7	31.5	SP-SM	31	61	8							11.2	
BH-100	8	36.5	SC	7	48	45							20.1	
BH-100	9	41.5	SP-SM	11	78	11							10.0	

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
CENTRAL AREA GUIDEWAY
SAN JOSE, CALIFORNIA

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Date: 4/29/2008

Job No.: 204104.10

TABLE A4-24

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-101	1	3.5	SC											
BH-101	2	6.5	GP-GM	77	18	5							8.1	
BH-101	3	12.5	ML											
BH-101	4	17.5	CL											
BH-101	5	22.5	CH				52	27	25			81.4	41.0	
BH-101	6	27.5	CL											
BH-101	7	32.5	CL											
BH-101	8	37.5	CL				31	19	12			107.3	20.6	
BH-101	9	42.5	CL											
BH-101	10	47.5	CL											
BH-101	11	52.5	ML											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
CENTRAL AREA GUIDEWAY
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Date: 4/29/2008

Job No.: 204104.10

TABLE A4-25

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-102	1	3.5	SP-SM											
BH-102	2	6.5	SP-SM											
BH-102	3	11.5	GW-GM											
BH-102	4	16.5	GW-GM											
BH-102	5	22.5	CL											
BH-102	6	27.5	CL	0	6	94						87.7	33.2	
BH-102	7	33	CL											
BH-102	8	36	CL											
BH-102	9	39	ML											
BH-102	10	42	CL											
BH-102	11	46	CL											
BH-102	12	49	GW-GM	48	45	7								
BH-102	13	51	GW-GM											
BH-102	14	52	CL											
BH-102	15	53.5	CL											
BH-102	16	56	CL											
BH-102	17	57.5	SM											
BH-102	18	59	GW-GM											
BH-102	19	60.5	GW-GM	66	30	4								
BH-102	20	62	GW-GM											
BH-102	21	63.5	GW-GM											
BH-102	22	65	GW-GM											
BH-102	23	66.5	ML	0	28	72								
BH-102	24	68.5	CL-ML											
BH-102	25	70	CL-ML											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
CENTRAL AREA GUIDEWAY
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Job No.: 204104.10

TABLE A4-26

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-102	26	72	CL-ML											
BH-102	27	74	SP-SM											
BH-102	28	75.5	SP-SM											
BH-102	29	77	GW-GM											
BH-102	30	78.5	GW-GM	46	45	9								
BH-102	31	80	GW-GM											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
CENTRAL AREA GUIDEWAY
SAN JOSE, CALIFORNIA

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Date: 4/29/2008

Job No.: 204104.10

TABLE A4-27

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-103	1	3.5	CL											
BH-103	2	6.5	CL-ML											
BH-103	3	11.5	ML											
BH-103	4	16.5	ML											
BH-103	5	22.5	ML											
BH-103	6	27.5	CL											
BH-103	7	32	CH	0	10	90	59	22	37					
BH-103	8	34	CL											
BH-103	9	36	CL											
BH-103	10	38	CL											
BH-103	11	40	CL											
BH-103	12	41.5	GP											
BH-103	13	43	GP											
BH-103	14	44.5	GP											
BH-103	15	46	GP											
BH-103	16	47.5	GW-GM	59	36	5								
BH-103	17	49	GW-GM											
BH-103	18	50.5	GW-GM											
BH-103	19	52	GW-GM											
BH-103	20	53.5	CL											
BH-103	21	55	ML	0	35	65	NP	NP	NP					
BH-103	22	56.5	SW											
BH-103	23	58	SW											
BH-103	24	59.5	SW											
BH-103	25	61	SW											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
CENTRAL AREA GUIDEWAY
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Date: 4/29/2008

Job No.: 204104.10

TABLE A4-28

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-103	26	62.5	SW	46	51	3								
BH-103	27	64	SW											
BH-103	28	65.5	SW											
BH-103	29	68	ML											
BH-103	30	70.5	ML											
BH-103	31	72	ML	1	44	55								
BH-103	32	75	ML											
BH-103	33	77.5	SM	8	79	13								
BH-103	34	79	SM											
BH-103	35	79.92	SM											
BH-103	36	81.5	SW											
BH-103	37	84	SW	51	45	4								
BH-103	38	86.5	GP											
BH-103	39	89	ML	0	48	52	NP	NP	NP					
BH-103	40	90.5	ML											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
CENTRAL AREA GUIDEWAY
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Date: 4/29/2008

Job No.: 204104.10

TABLE A4-29

SVRT - PARIKH LAB TEST SUMMARY SVRT PHASE2 (01252008_WITH USCS).GPJ SVRT-BART.GDT 4/29/08

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-105	1	3.5	CL											
BH-105	2	7.5	ML											
BH-105	3	11.5	SW-SM	35	53	12							8.2	
BH-105	4	17.5	CL											
BH-105	5	22.5	CL											
BH-105	6	24	SM	0	50	50	NP	NP	NP				27.1	
BH-105	7	27.5	SM	0	66	34	NP	NP	NP			84.1	34.5	
BH-105	8	29	SM											
BH-105	9	32.5	CL	0	55	45	29	19	10				31.9	
BH-105	10	34	SC											
BH-105	11	37.5	CL											
BH-105	12	39	SM	0	52	48	86	62	24				64.6	
BH-105	13	41.5	SW-SM	39	51	10							12.6	
BH-105	14	46.5	CL-ML											
BH-105	15	51.5	CL-ML											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
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Date: 4/29/2008

Job No.: 204104.10

TABLE A4-30

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-106	1	3.5	CL											
BH-106	2	7.5	ML											
BH-106	3	12.5	CL											
BH-106	4	17.5	ML											
BH-106	5	22.5	CL				31	17	14					
BH-106	6	27.5	CL											
BH-106	7	33	CL											
BH-106	8	36	CL											
BH-106	9	39	CL											
BH-106	10	41.5	CL											
BH-106	11	43	GP	51	45	4								
BH-106	12	44.5	GP											
BH-106	13	46	GP											
BH-106	14	47.5	GP											
BH-106	15	49	GW	51	44	5								
BH-106	16	50.5	GW											
BH-106	17	52	GW											
BH-106	18	53.5	GW											
BH-106	19	55.5	GW											
BH-106	20	57	GW											
BH-106	21	58.5	ML	0	10	90								
BH-106	22	62	ML											
BH-106	23	64	ML											
BH-106	24	65.5	ML											
BH-106	25	67	GW-GM											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
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Date: 4/29/2008

Job No.: 204104.10

TABLE A4-31

SVRT - PARIKH LAB TEST SUMMARY SVRT PHASE2 (01252008_WITH USCS).GPJ SVRT-BART.GDT 4/29/08

Boring No.	Sample No.	Depth (ft)	USCS**	Grain Size Analysis			Atterberg Limits			Unconfined Comp. (qu, ksf)	Lab Vane (su, ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL (%)	PL (%)	PI (%)					
BH-106	26	68.5	ML	0	49	51	NP	NP	NP					
BH-106	27	70	ML											
BH-106	28	72.5	ML											
BH-106	29	74	CL											
BH-106	30	77.5	CL-ML											
BH-106	31	80	CL											
BH-106	32	81.5	ML											
BH-106	33	85	ML				32	23	9					
BH-106	34	87.5	CL											
BH-106	35	90	ML											

SUMMARY OF LABORATORY TEST RESULTS

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
CENTRAL AREA GUIDEWAY
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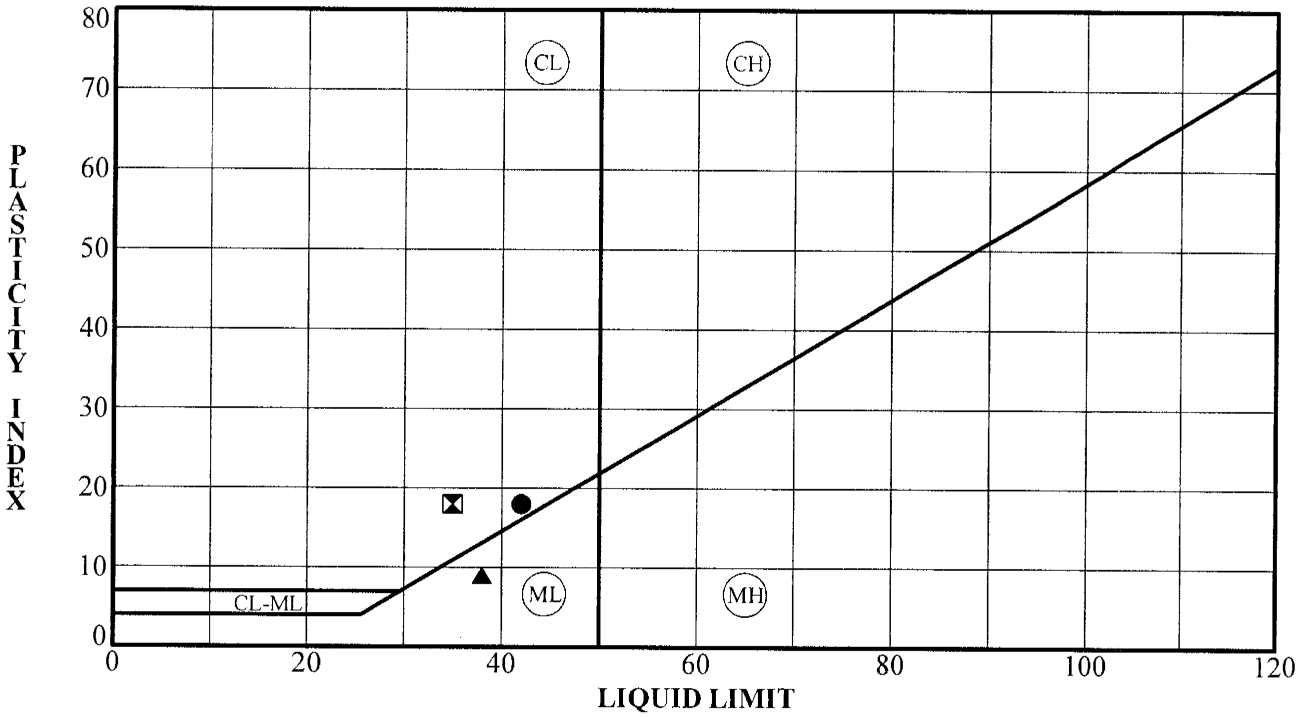
Date: 4/29/2008

Job No.: 204104.10

TABLE A4-32



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-082	22.5	42	18	0.211	28	98	CL
☒	BH-082	42.5	35	18	0.483	26	72	CL
▲	BH-082	67.5	38	9	-0.233	27	96	ML

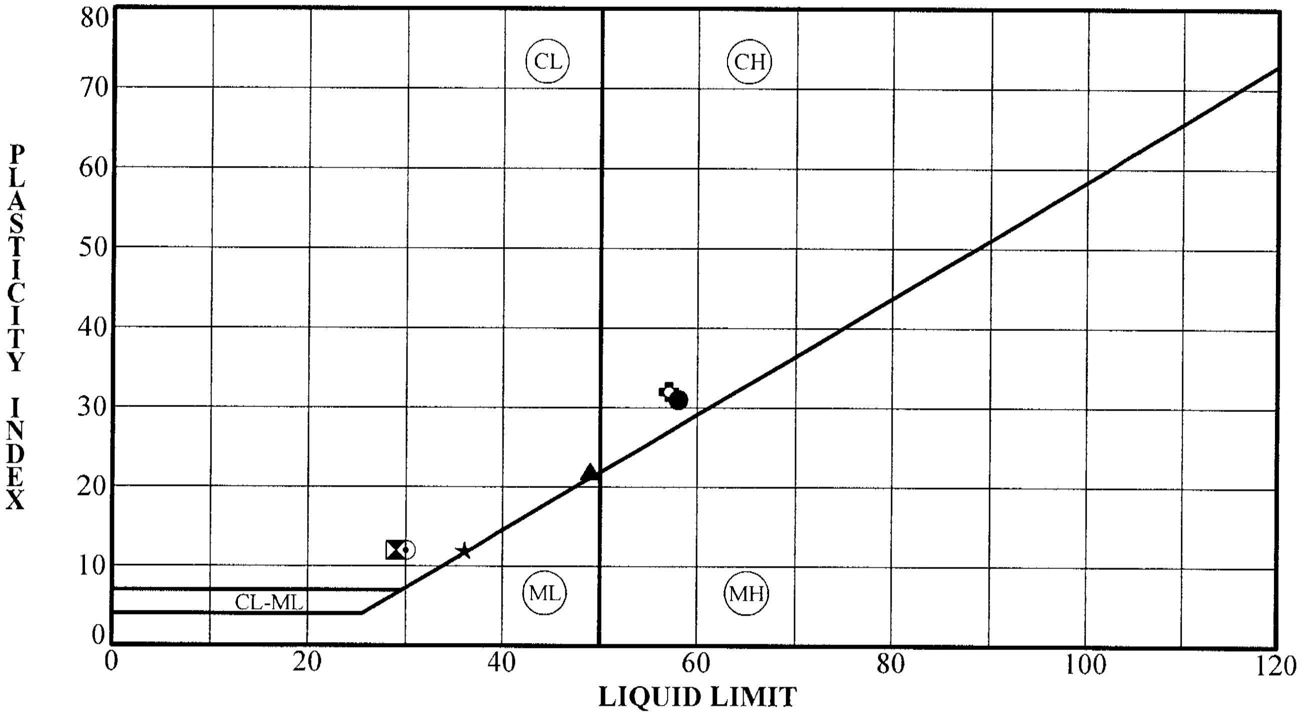
PREP'D BY:
L. Tran
APP'D BY:
F. Wang
DATE:
4/29/08
DWG FILE:

PLASTICITY CHART AND DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

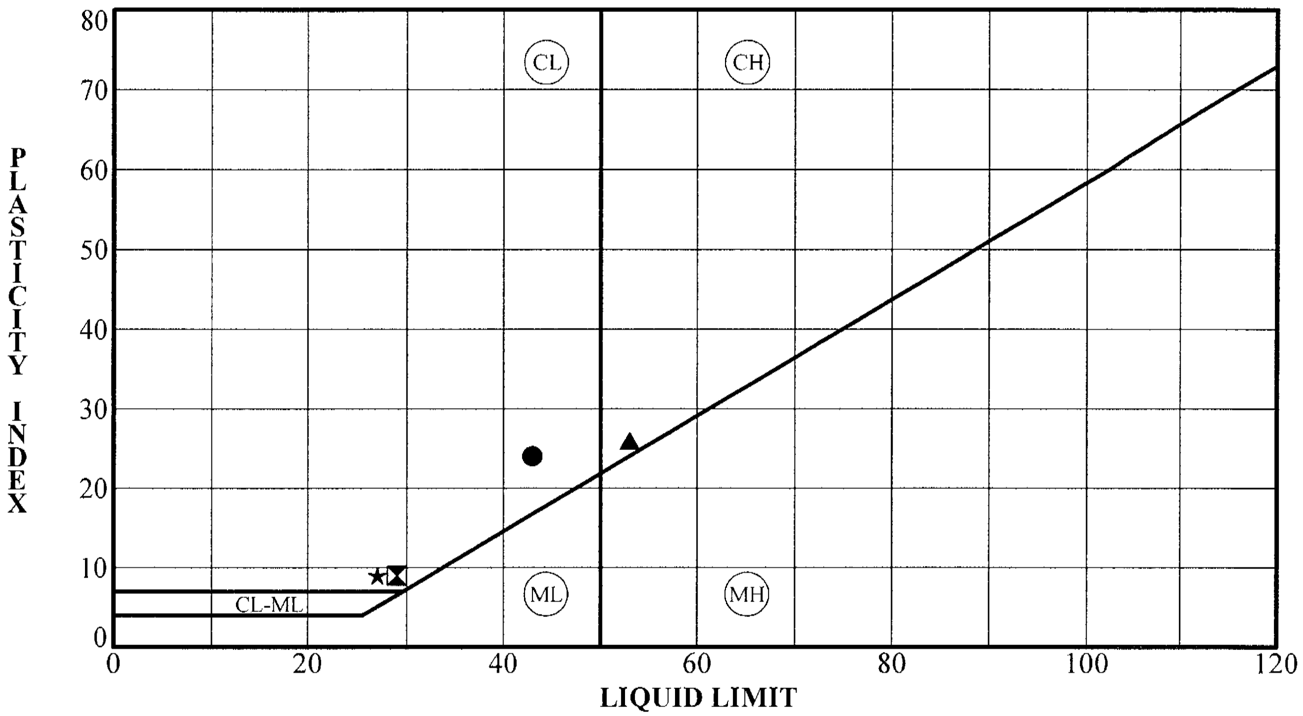
FIGURE
4-1
PROJECT No.
213213

ATTERBERG SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-084	42.5	58	31	0.194	33		CH
☒	BH-084	157.5	29	12	0.150	19		CL
▲	BH-084	167.5	49	22	0.086	29		CL/CH
★	BH-084	177.5	36	12	0.133	26		CL/ML
⊙	BH-084	192.5	30	12	0.225	21		CL
✿	BH-084	207.5	57	32	-0.106	22		CH

PREP'D BY: L. Tran	PLASTICITY CHART AND DATA		FIGURE
APP'D BY: F. Wang			4-2
DATE: 4/29/08	**SILICON VALLEY RAPID TRANSIT PROJECT** **San Jose, California**		PROJECT No.
DWG FILE:			213213



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-085	52.5	43	24	0.188	24		CL
⧗	BH-085	151.5	29	9	0.344	23		CL
▲	BH-085	167.5	53	26	-0.027	26		CH
★	BH-085	192.5	27	9	-0.089	17	60	CL

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APP'D BY: F. Wang
DATE: 4/29/08
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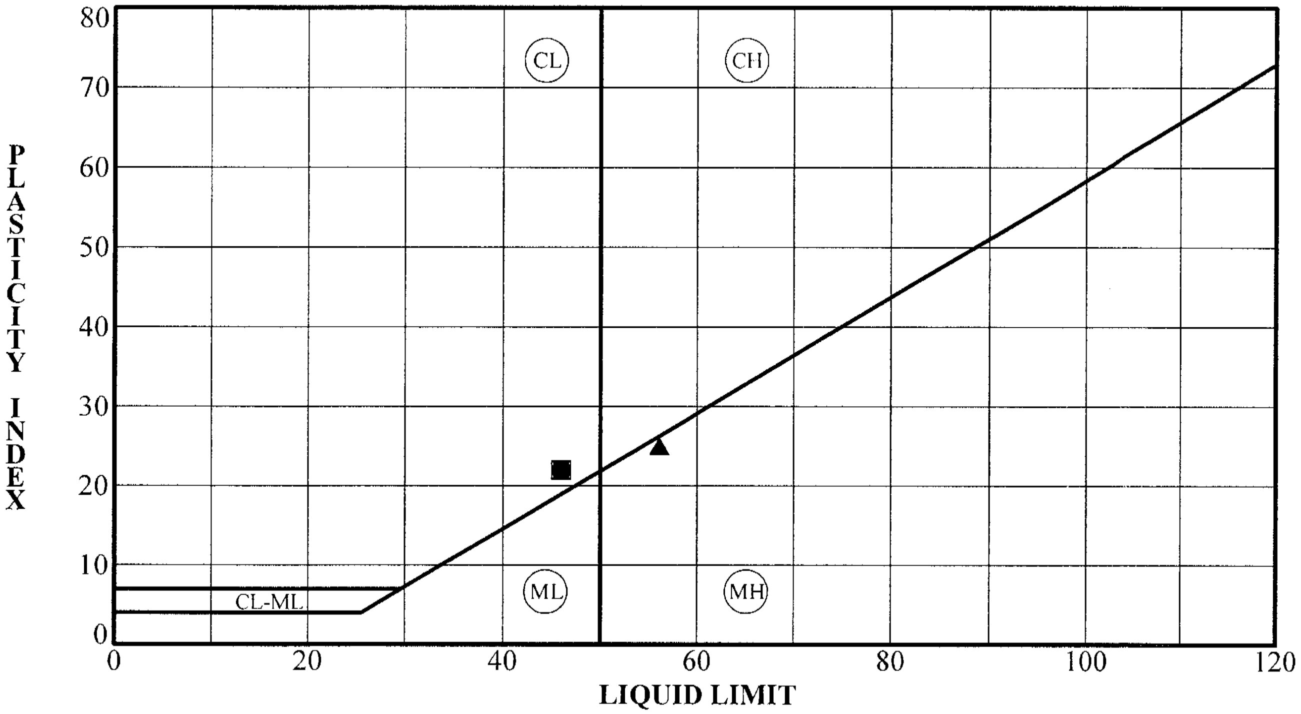
PLASTICITY CHART AND DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-3
PROJECT No.
213213

ATTERBERG SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-087	52.5	46	22	0.227	29		CL
☒	BH-087	62.5	46	22	0.195	28		CL
▲	BH-087	187.5	56	25	0.172	35		MH/CH

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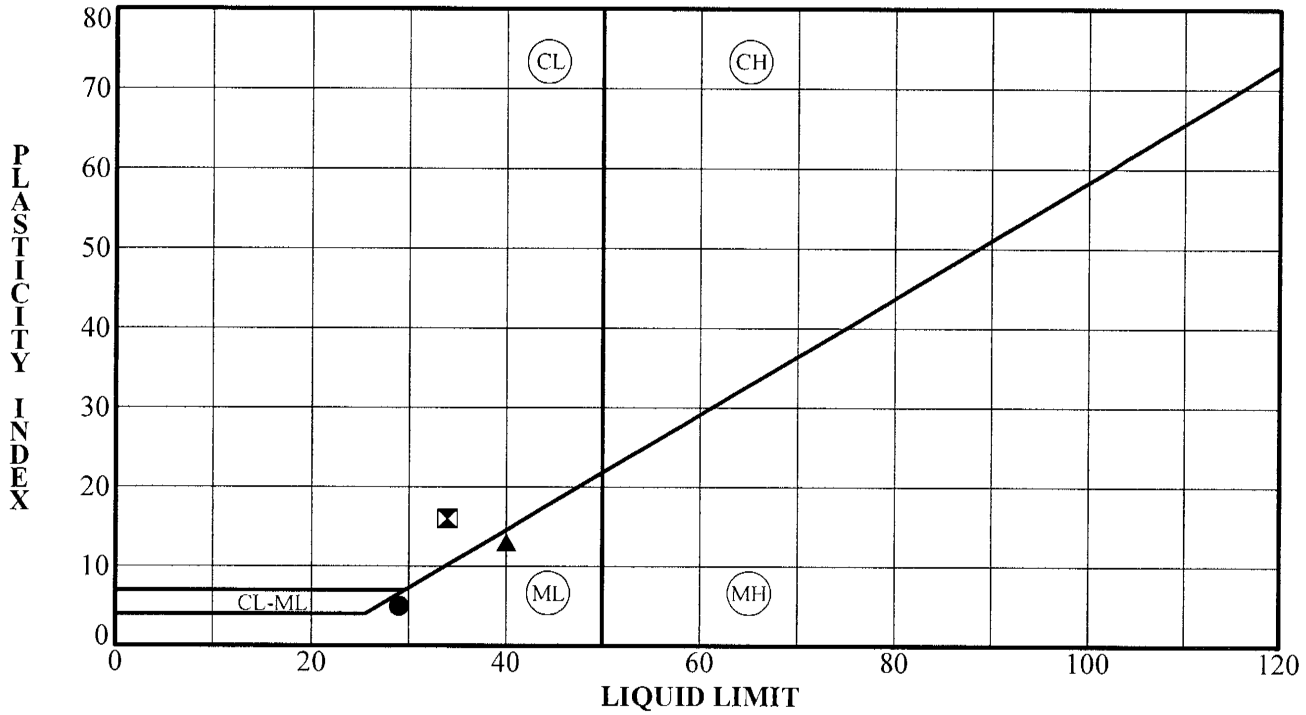
PLASTICITY CHART AND DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-4

PROJECT No.
213213

ATTERBERG SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-088	33.5	29	5			90	ML
☒	BH-088	41.0	34	16	0.463	25		CL
▲	BH-088	68.0	40	13			100	ML
	BH-088	71.0	NP	NP			11	GP-GM

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APP'D BY: F. Wang
DATE: 4/29/08
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PLASTICITY CHART AND DATA

SILICON VALLEY RAPID TRANSIT PROJECT
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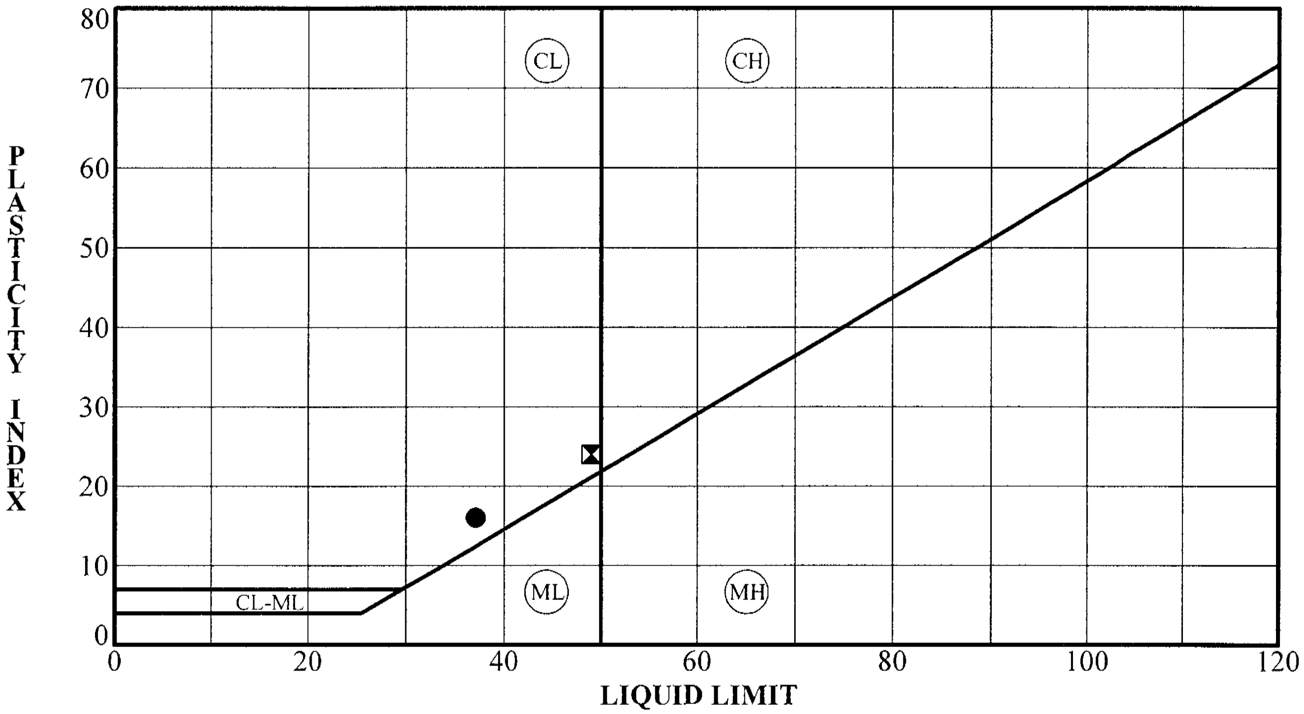
FIGURE
4-5

PROJECT No.
213213

ATTERBERG SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-089	22.5	37	16	0.681	32		CL
⧗	BH-089	191.5	49	24	0.008	25	98	CL

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L. Tran
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F. Wang
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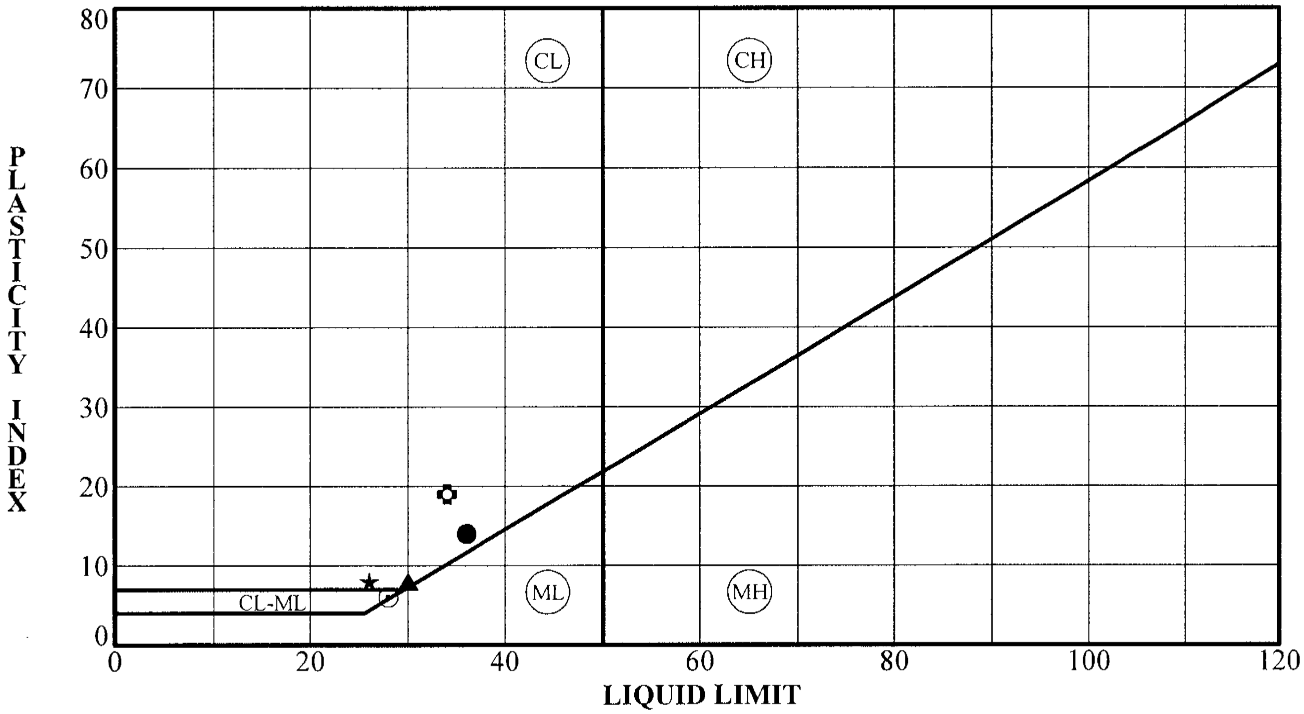
PLASTICITY CHART AND DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-6
PROJECT No
213213



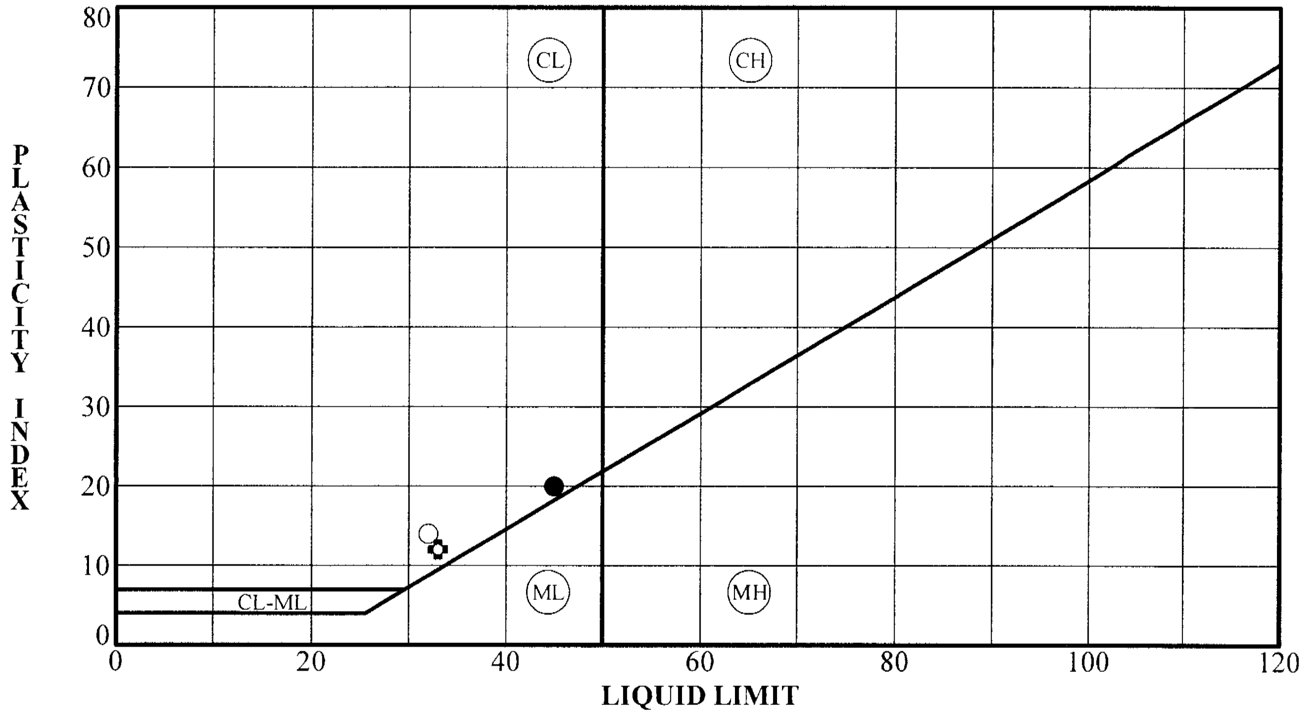
Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-090	29.0	36	14	0.100	23	89	CL
	BH-090	34.0	NP	NP		28	70	ML
▲	BH-090	39.0	30	8	0.725	28	81	CL
★	BH-090	46.5	26	8	0.800	24	70	CL
⊙	BH-090	54.0	28	6	1.233	29	78	CL-ML
✿	BH-090	58.5	34	19	0.353	22	65	CL

PREP'D BY:
L. Tran
APP'D BY:
F. Wang
DATE:
4/29/08
DWG FILE:

PLASTICITY CHART AND DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-7
PROJECT No.
213213



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-091	22.5	45	20	0.650	38		CL
	BH-091	27.5	NP	NP				
	BH-091	29.0	NP	NP		24	37	SM
	BH-091	31.0	NP	NP		24	35	SM
	BH-091	32.5	NP	NP		17	9	SP-SM
✿	BH-091	40.5	33	12			82	CL
○	BH-091	45.5	32	14			75	CL

PREP'D BY: L. Tran
APP'D BY: F. Wang
DATE: 4/29/08
DWG FILE:

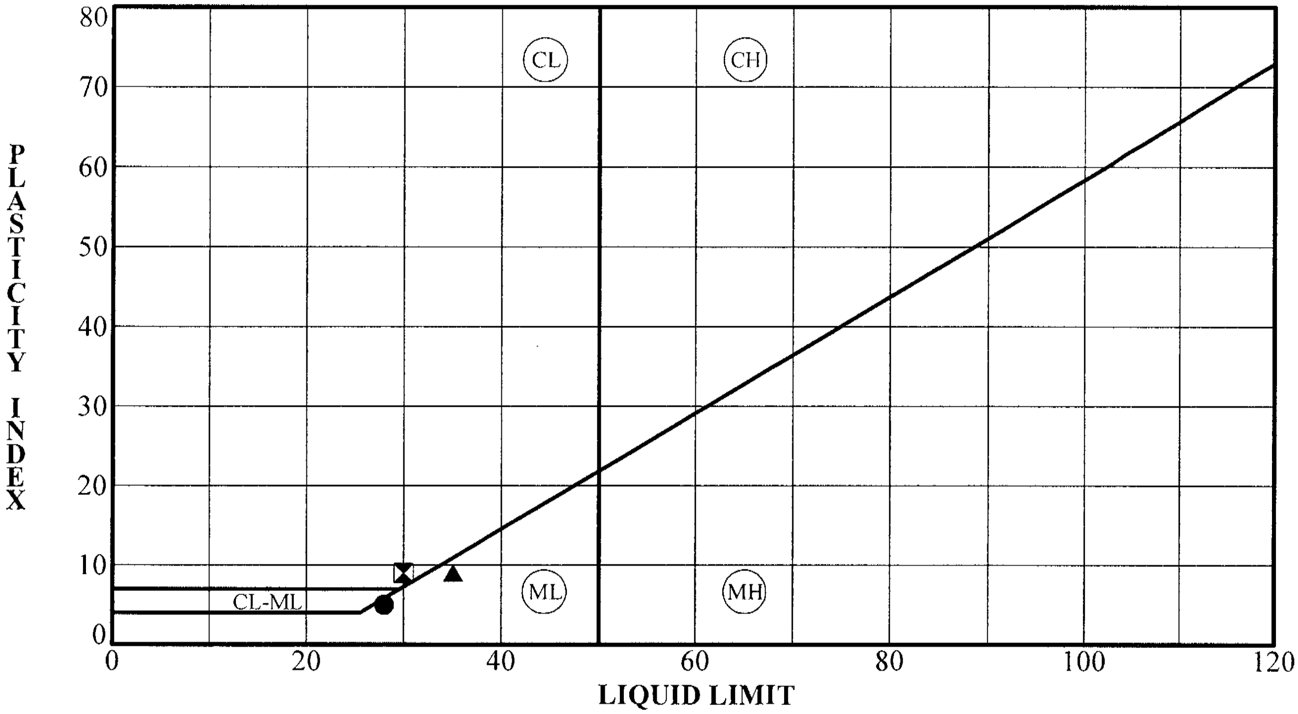
PLASTICITY CHART AND DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-8

PROJECT No.
213213

ATTERBERG SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-093	52.5	28	5	-0.380	21		CL-ML
☒	BH-093	158.5	30	9	0.222	23	83	CL
▲	BH-093	200.0	35	9	0.100	27	75	ML

PREP'D BY
L. Tran
APP'D BY
F. Wang
DATE
4/29/08
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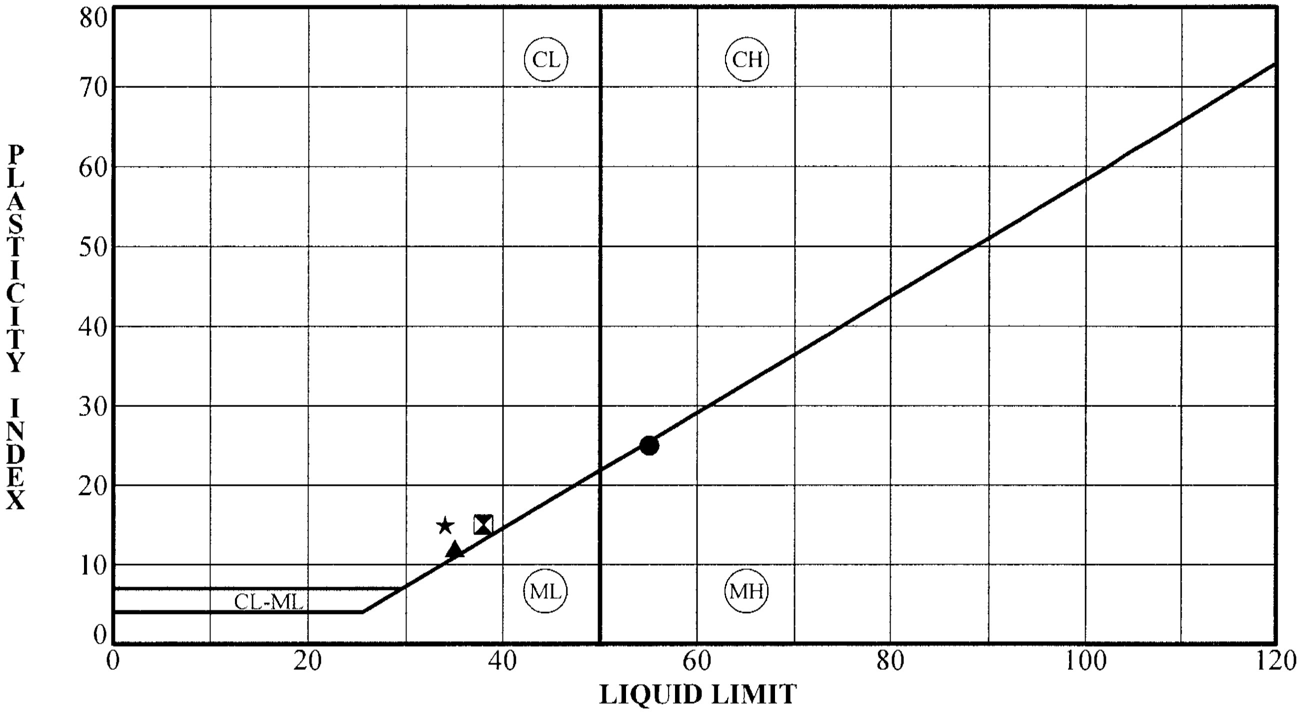
PLASTICITY CHART AND DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-9

PROJECT No.
213213

ATTERBERG SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-095	22.5	55	25	0.396	40		MH/CH
⧗	BH-095	46.5	38	15	0.493	30		CL
▲	BH-095	51.5	35	12	0.258	26		CL
★	BH-095	97.5	34	15	0.400	25		CL

ATTERBERG SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08

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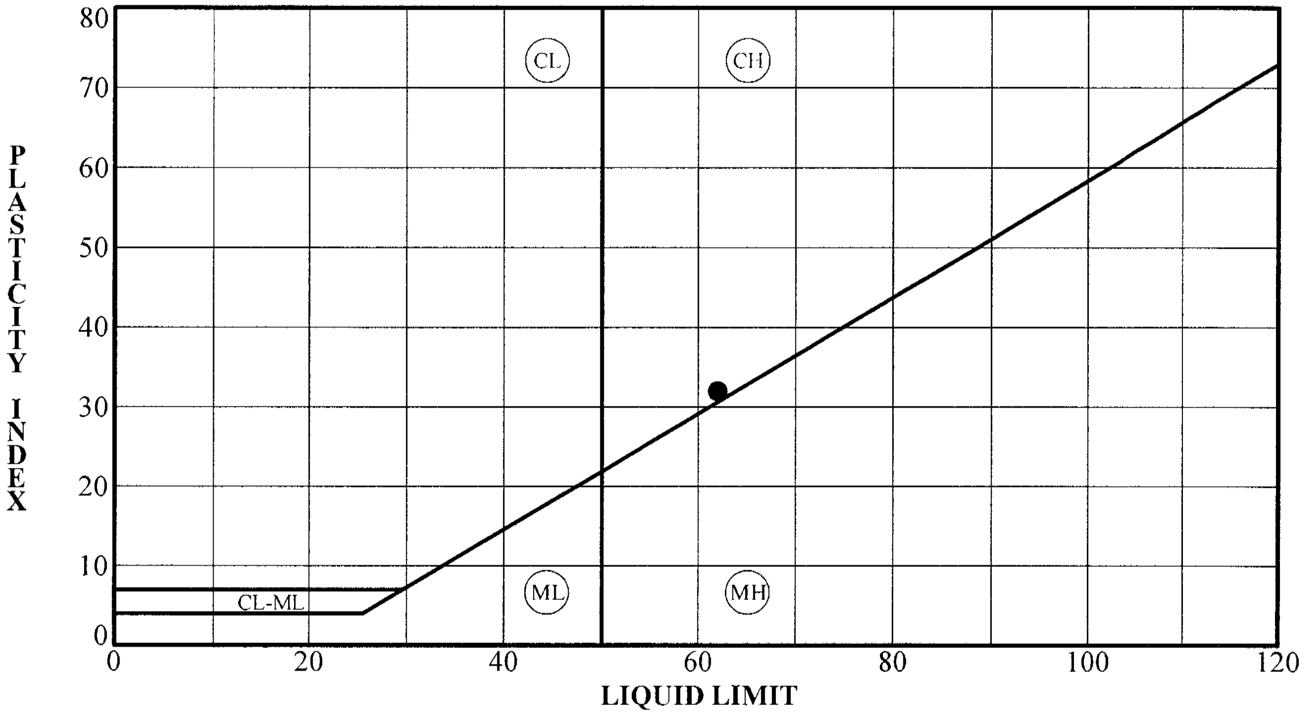
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-10
PROJECT No.
213213



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-097	17.5	62	32	0.391	43	99	CH

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PLASTICITY CHART AND DATA

SILICON VALLEY RAPID TRANSIT PROJECT
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FIGURE
4-11
PROJECT No.
213213

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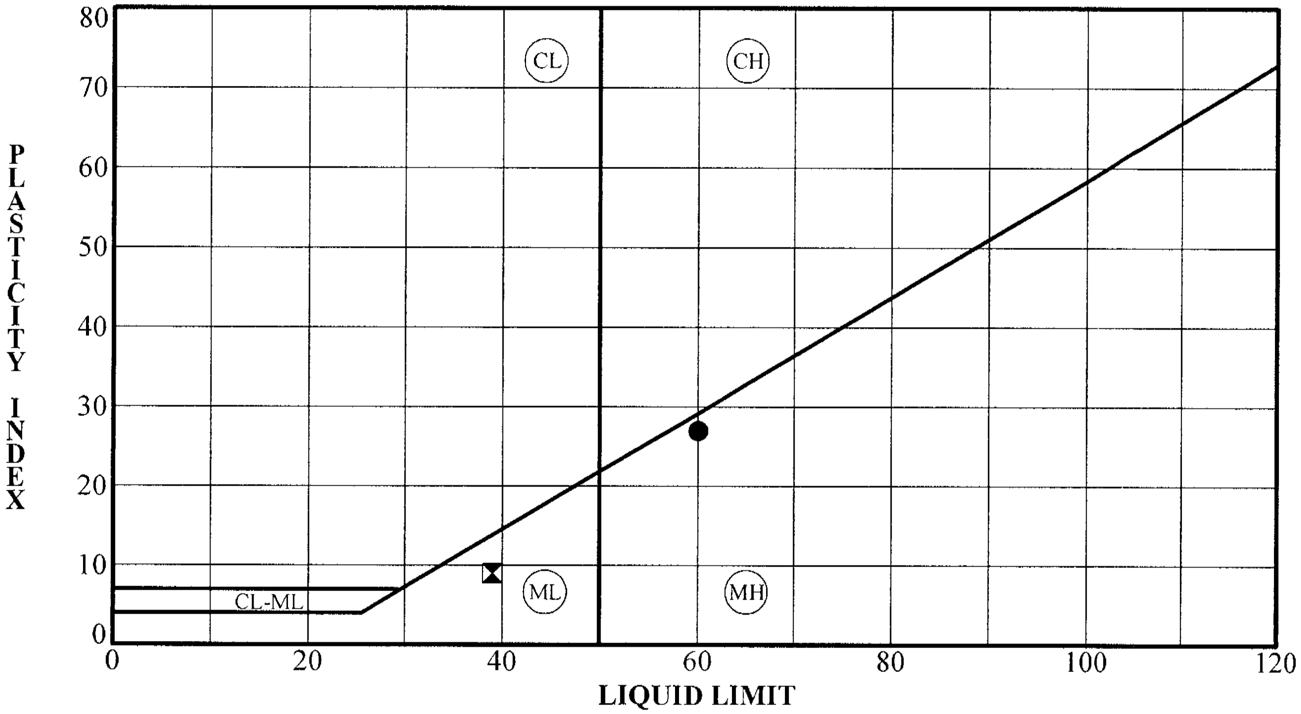

Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-098	11.5	60	27	0.107	36		MH
⧗	BH-098	56.5	39	9	0.422	34		ML

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DATE: 4/29/08
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SILICON VALLEY RAPID TRANSIT PROJECT
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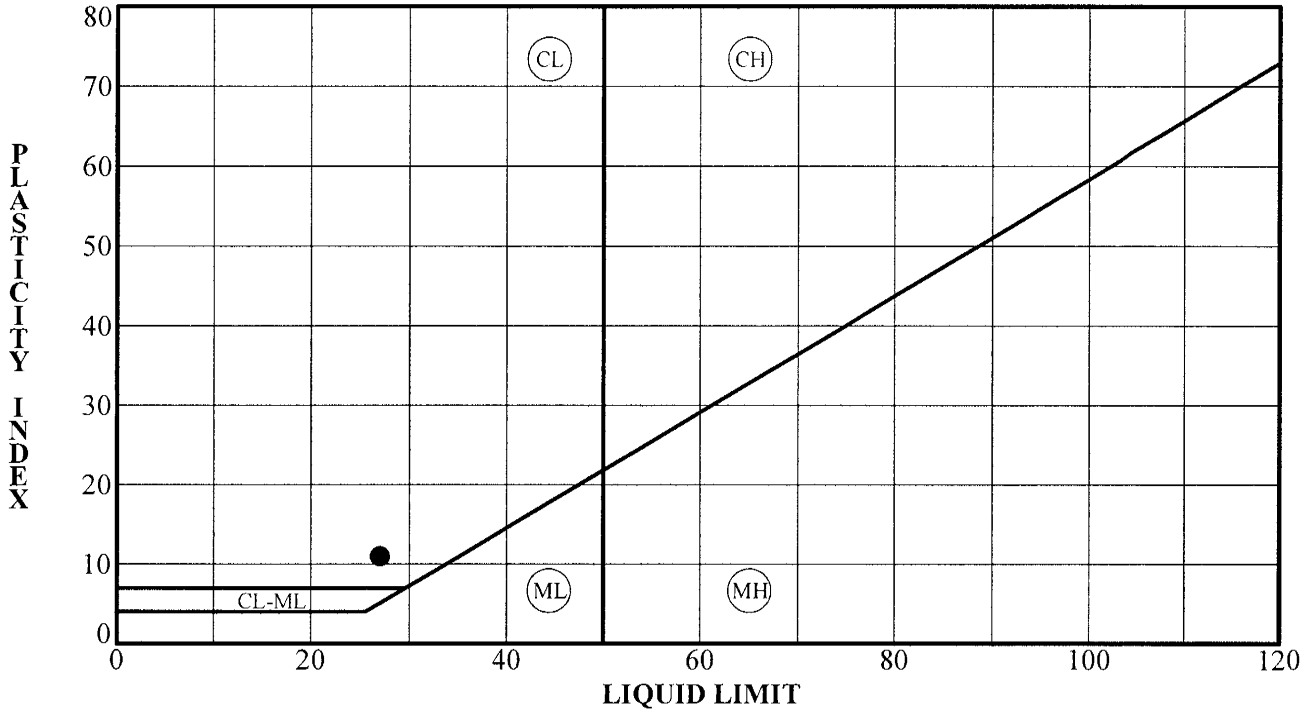
FIGURE
4-12
PROJECT No.
213213



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-099	31.5	27	11	0.982	27	61	CL

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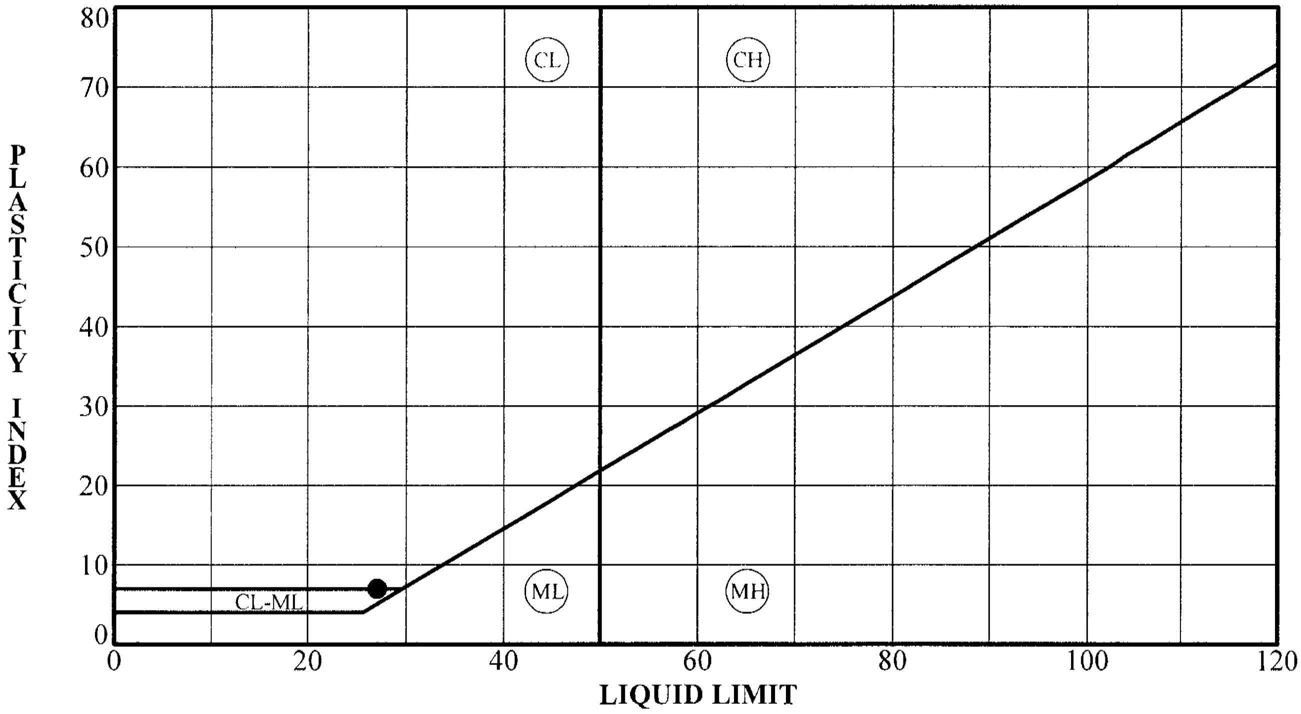
PLASTICITY CHART AND DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-13

PROJECT No.
213213



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-100	27.5	27	7	0.257	22		CL-ML

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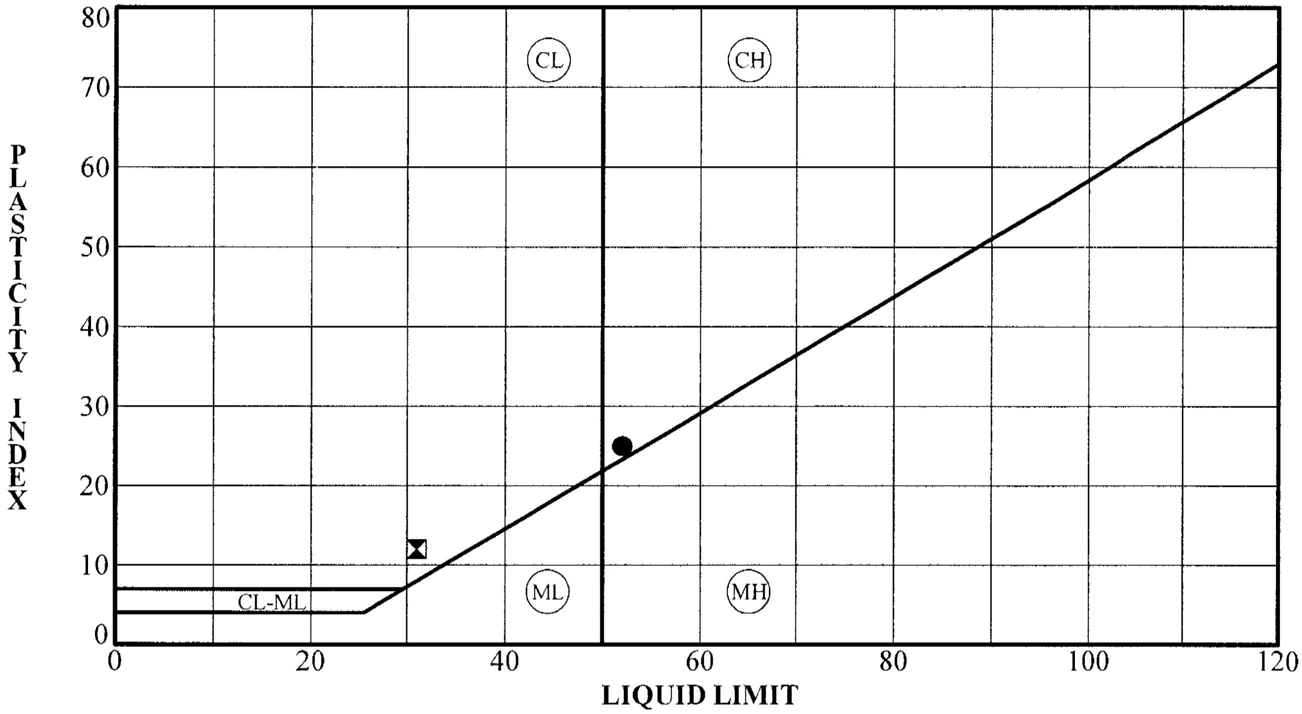
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-14

PROJECT No.
213213



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-101	22.5	52	25	0.560	41		CH
☒	BH-101	37.5	31	12	0.133	21		CL

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SILICON VALLEY RAPID TRANSIT PROJECT
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FIGURE
4-15
PROJECT No.
213213

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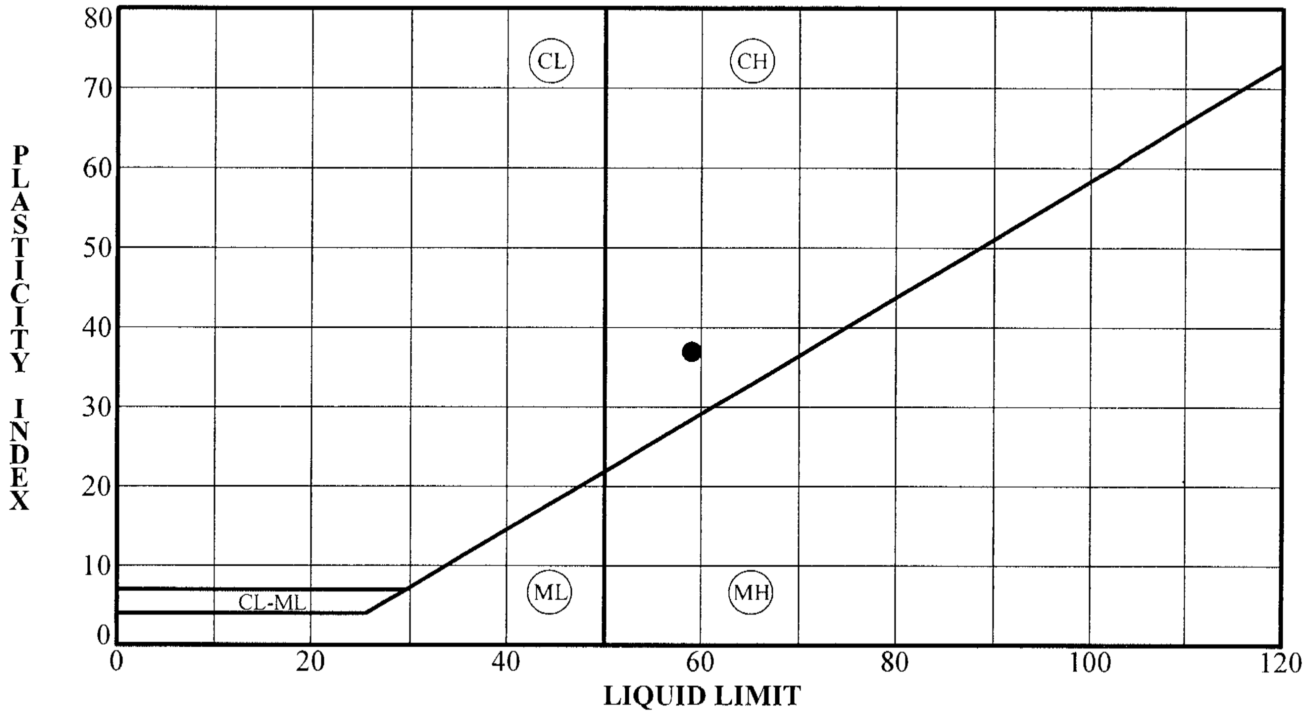

Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-103	32.0	59	37			90	CH
	BH-103	55.0	NP	NP			65	ML
	BH-103	89.0	NP	NP			52	ML

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PLASTICITY CHART AND DATA

SILICON VALLEY RAPID TRANSIT PROJECT
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FIGURE
4-16
PROJECT No.
213213

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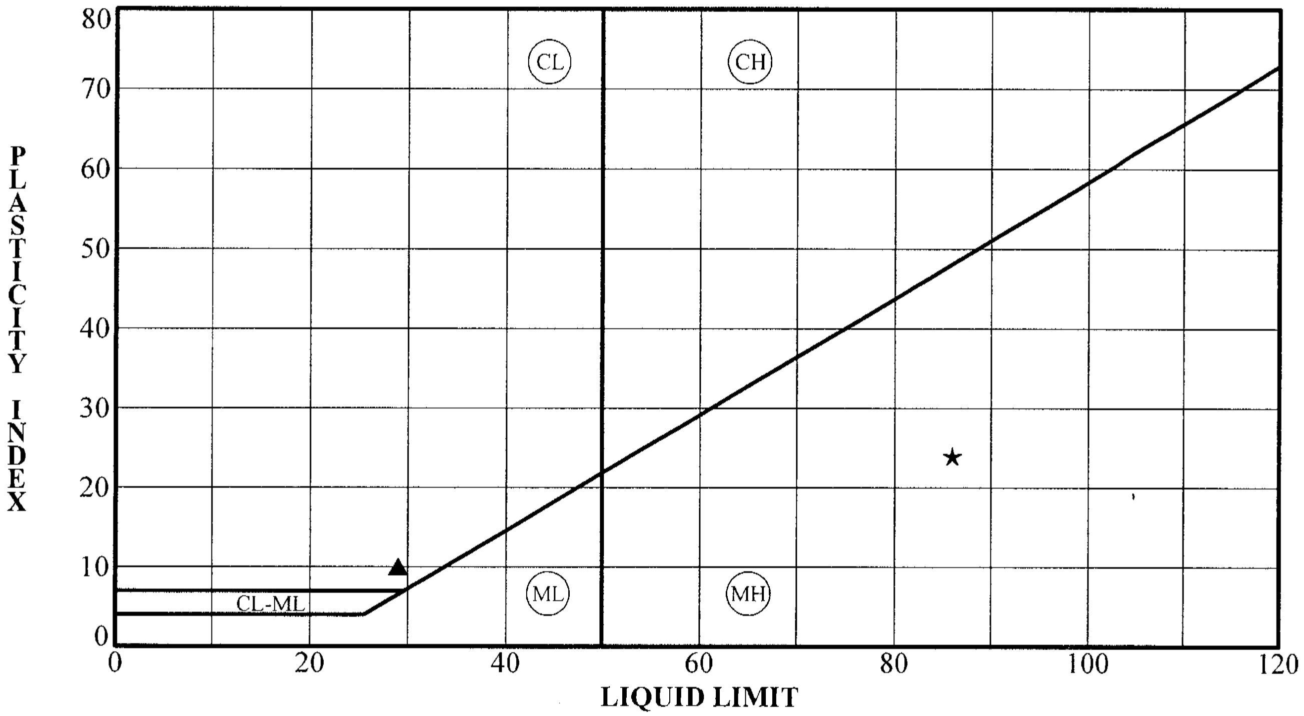

Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
	BH-105	24.0	NP	NP		27	50	SM
	BH-105	27.5	NP	NP		35	34	SM
▲	BH-105	32.5	29	10	1.290	32	45	SC
★	BH-105	39.0	86	24	0.108	65	48	SM/OH

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L. Tran
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F. Wang
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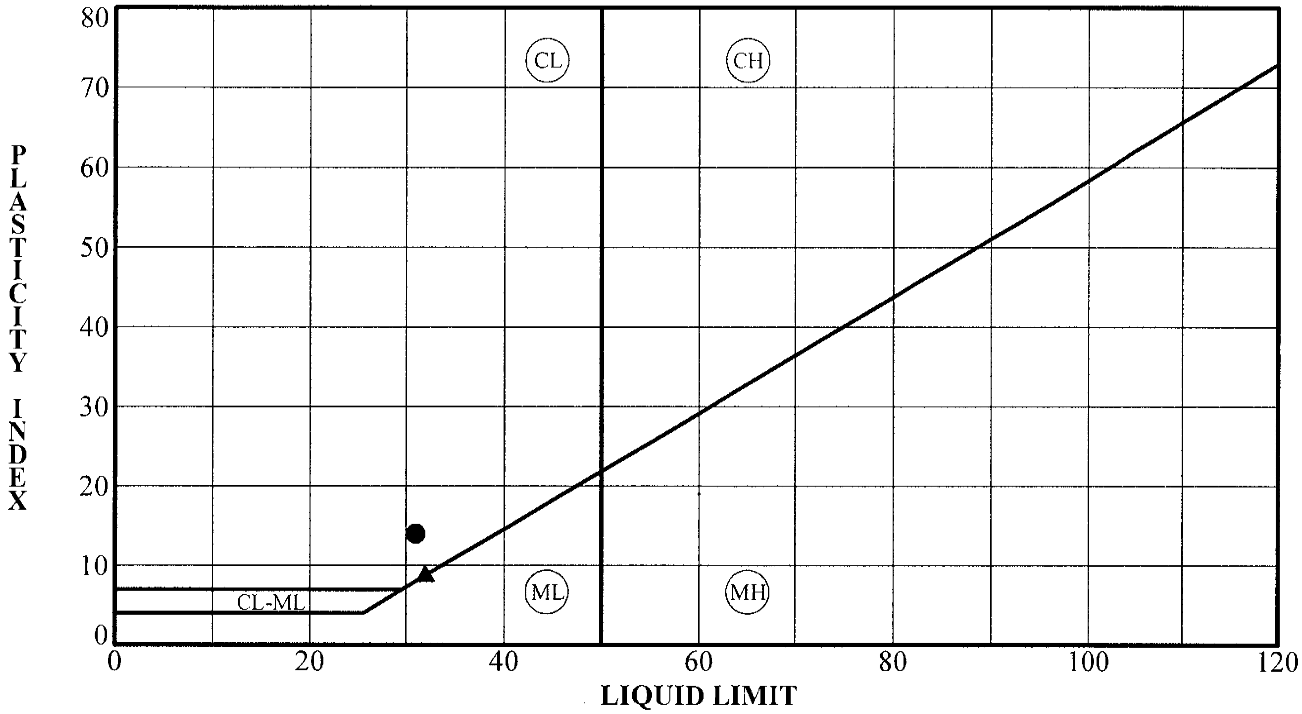
PLASTICITY CHART AND DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-17

PROJECT No.
213213



Key Symbol	Boring No.	Depth (Feet)	Liquid Limit (%)	Plasticity Index (%)	Liquidity Index	Water Content (%)	% Passing #200 Sieve	USCS
●	BH-106	22.5	31	14				CL
	BH-106	68.5	NP	NP			51	ML
▲	BH-106	85.0	32	9				ML

ATTERBERG SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08

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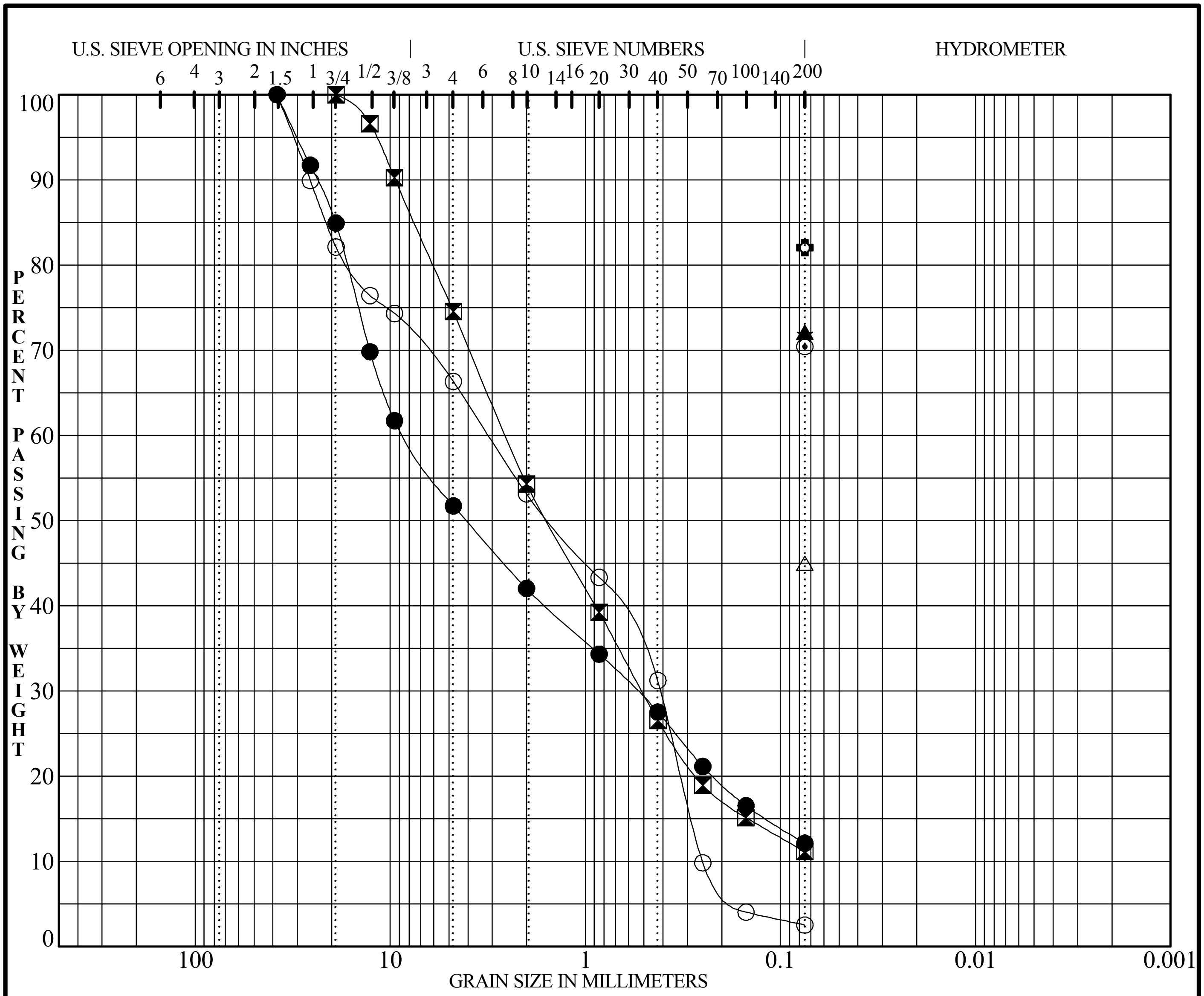
PLASTICITY CHART AND DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-18

PROJECT No.
213213



Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-81	33.8	12	52	Silty GRAVEL with sand (GM)	GM
⧗	BH-81	46.5	11	75	Well-graded SAND with clay and gravel (SW-SC)	SW-SC
▲	BH-81	65.0	72		Sandy Lean CLAY (CL)	CL
★	BH-81	80.0	72		Sandy SILT (ML)	ML
⊙	BH-81	84.5	70		Sandy Lean CLAY (CL)	CL
✣	BH-81	98.7	82		Lean CLAY with sand (CL)	CL
○	BH-81	117.8	3	66	Poorly-graded SAND with gravel (SP)	SP
△	BH-81	125.2	45		Silty SAND (SM)/ Sandy SILT (ML)	SM/ML

PREP'D BY:

APP'D BY:
Y. D. Wang

DATE:
4/29/08

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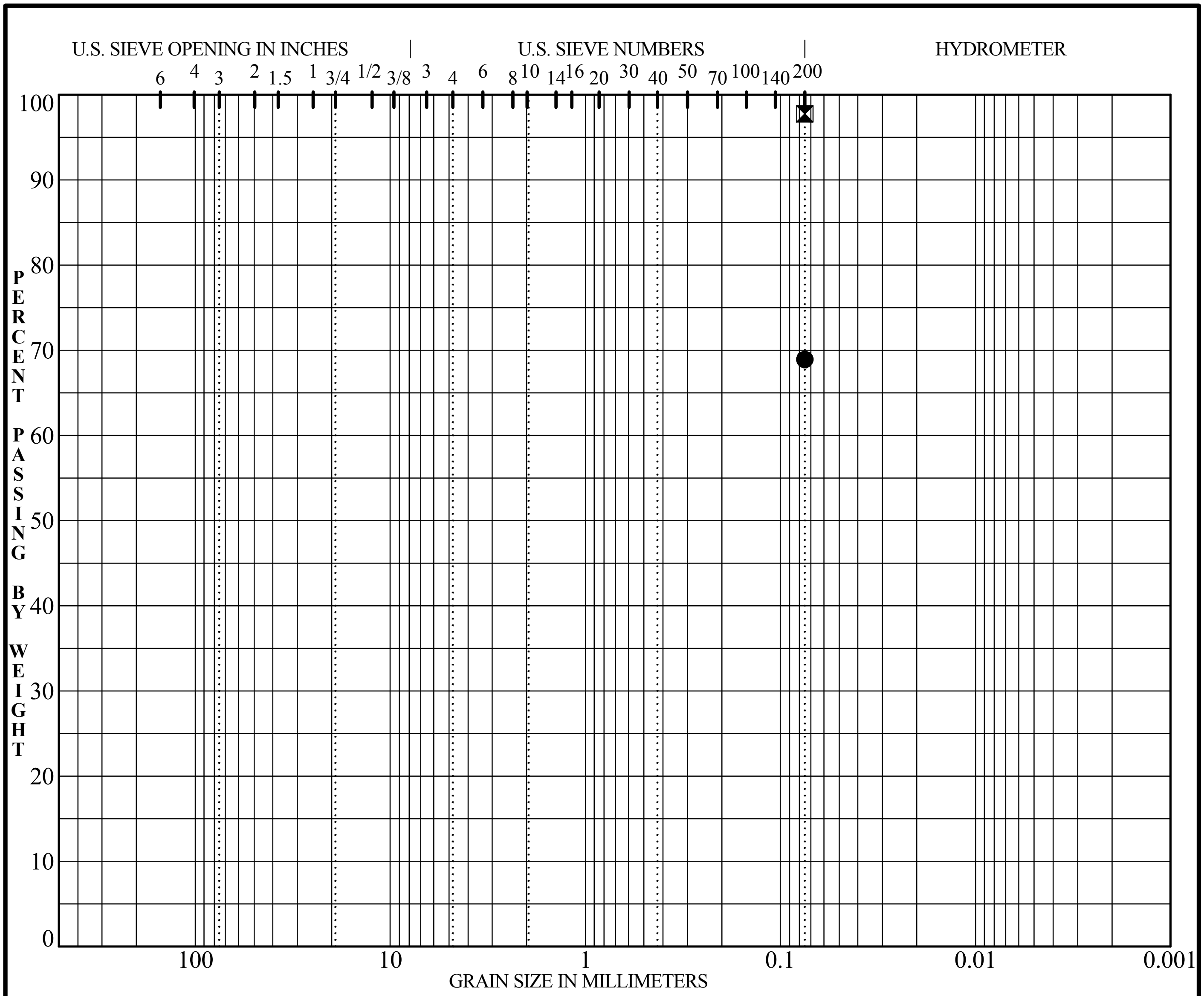
GRADATION TEST DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4- 19a

PROJECT No.
213213

GRADATION_B ALTERNATE SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08



Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-81	130.2	69		Sandy Lean CLAY (CL)	CL
☒	BH-81	141.5	98		Lean CLAY (CL)	CL

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APP'D BY:
Y. D. Wang

DATE:
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SILICON VALLEY RAPID TRANSIT PROJECT
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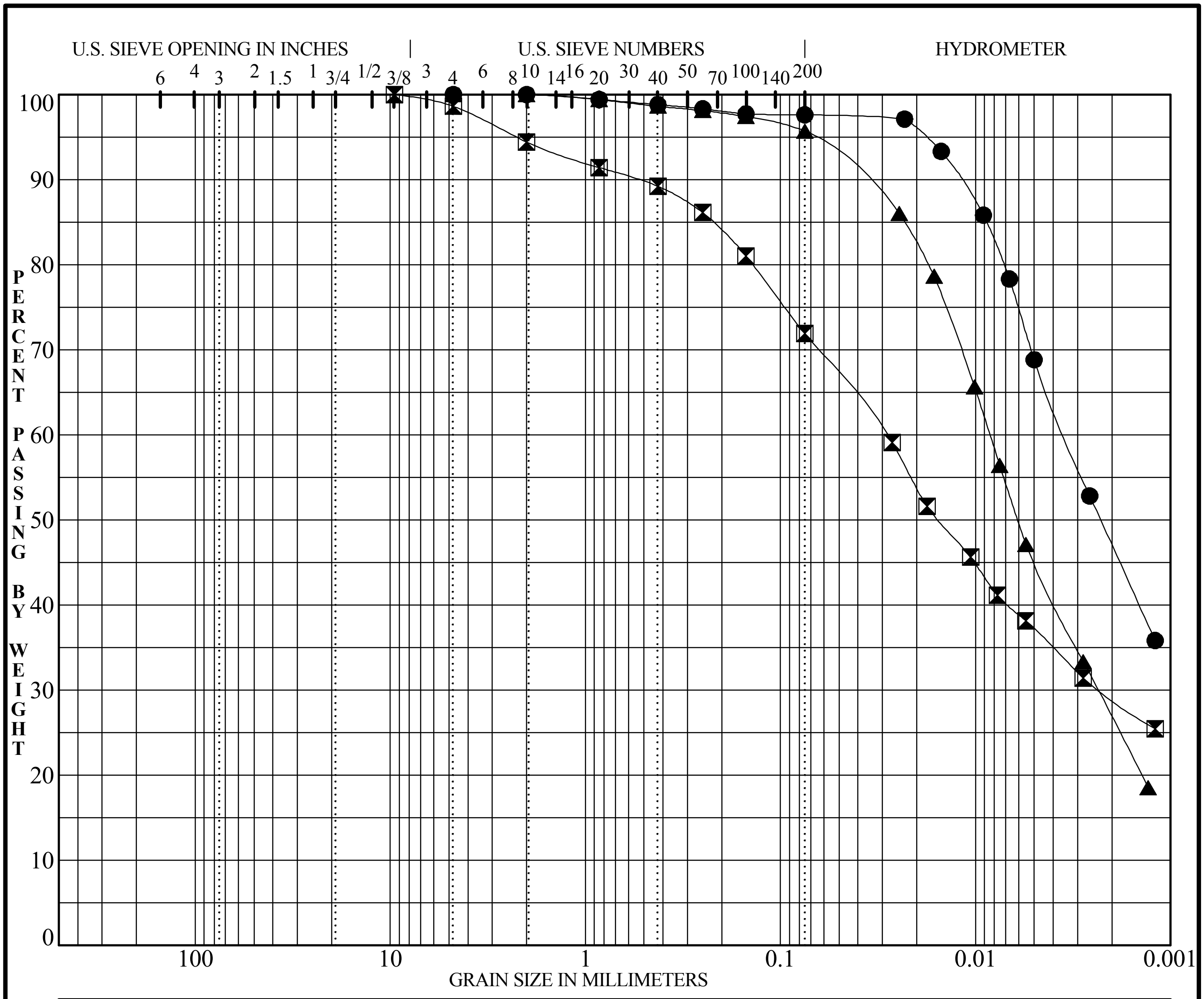
FIGURE
A4-19b

PROJECT No.
213213



Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-82	22.5	98	100	Lean CLAY (CL)	CL
☒	BH-82	42.5	72	99	Lean CLAY with sand (CL)	CL
▲	BH-82	67.5	96	100	SILT (ML)	ML

GRADATION_B SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08

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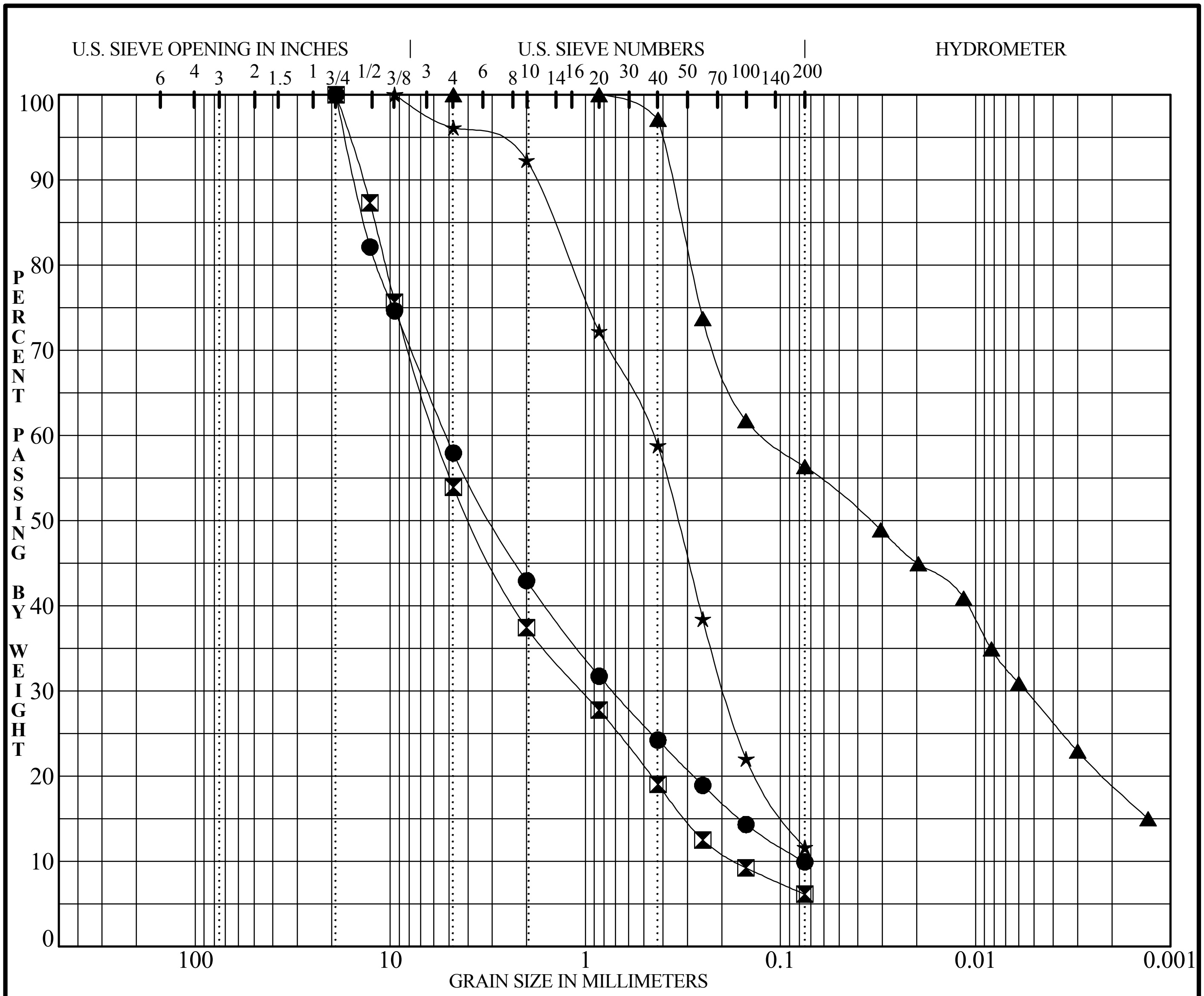
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-20

PROJECT No.
213213



Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-84	82.5	10	58	Well-graded SAND with clay and gravel (SW-SC)	SW-SC
☒	BH-84	111.5	6	54	Well-graded SAND with silt and gravel (SW-SM)	SW-SM
▲	BH-84	131.5	56	100	Sandy Lean CLAY (CL)	CL
★	BH-84	141.0	12	96	Well-graded SAND with silt (SW-SM)	SW-SM

GRADATION_B SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08

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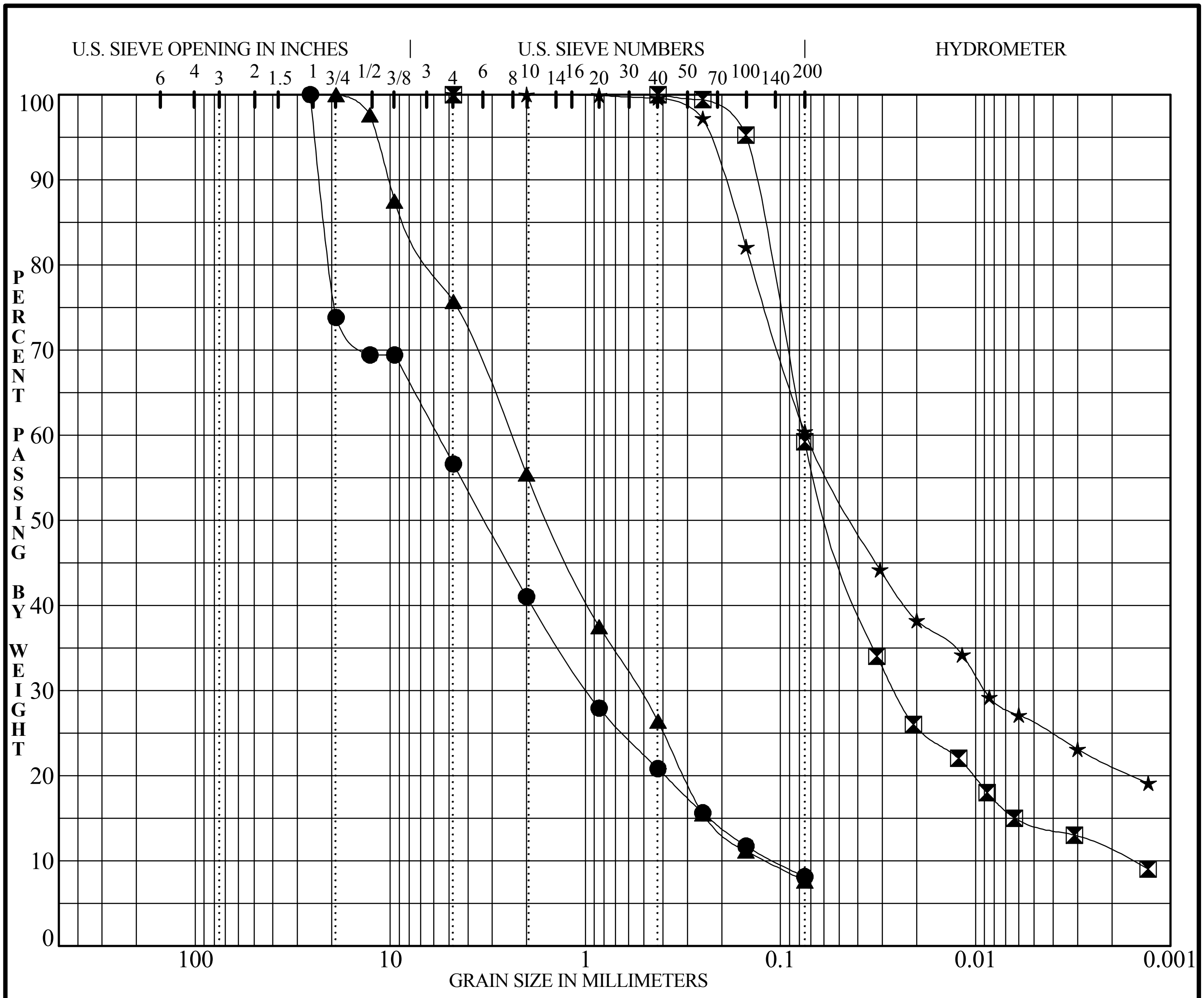
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-21

PROJECT No.
213213



Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-85	86.5	8	57	Well-graded SAND with clay and gravel (SW-SC)	SW-SC
⊠	BH-85	102.5	59	100	Sandy SILT (ML)	ML
▲	BH-85	121.5	8	76	Poorly-graded SAND with clay and gravel (SP-SC)	SP-SC
★	BH-85	192.5	60	100	Sandy Lean CLAY (CL)	CL

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SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-22

PROJECT No.
213213

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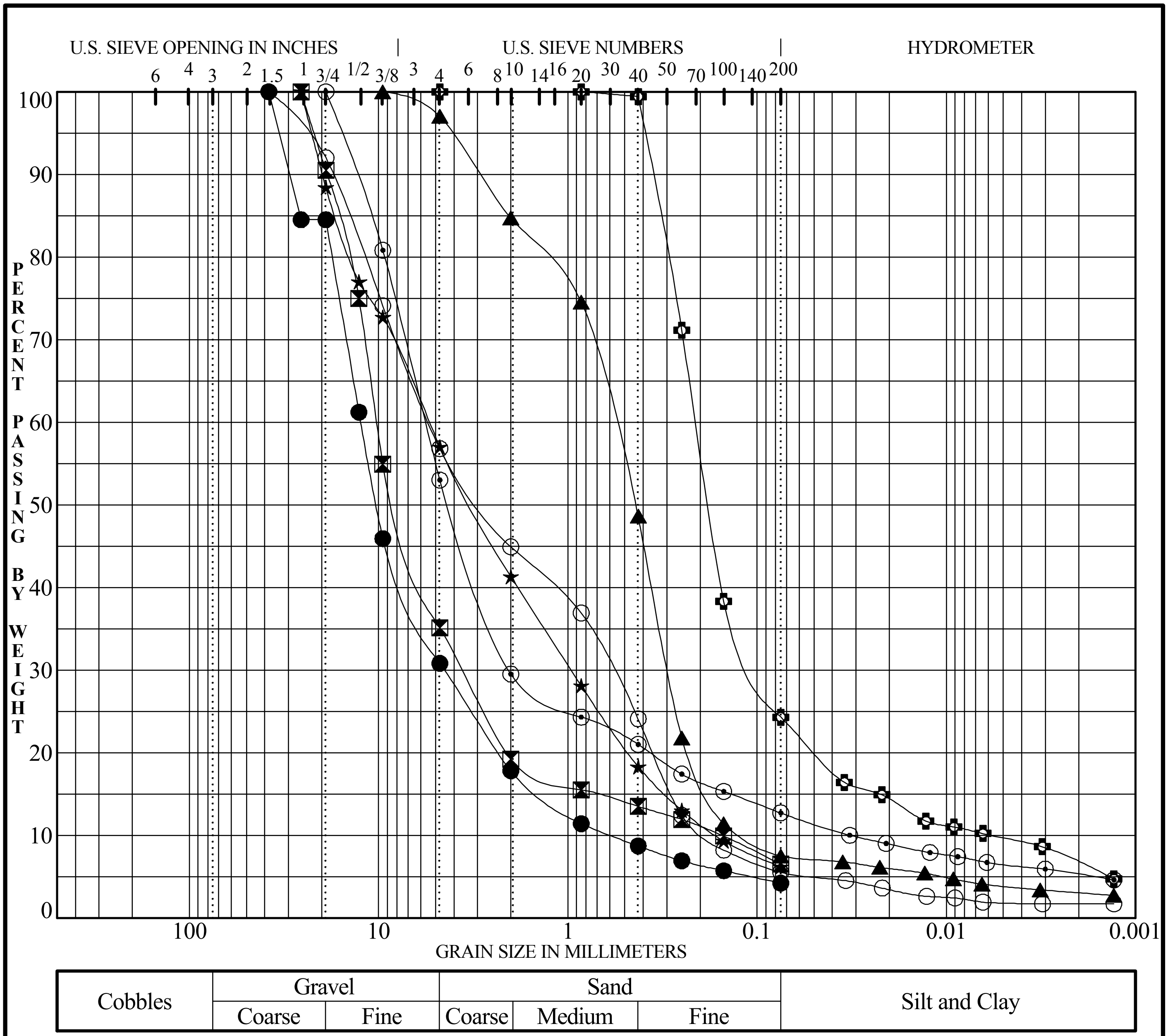

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-87	71.5	4	31	Well-graded GRAVEL (GW)	GW
☒	BH-87	79.0	7	35	Poorly-graded GRAVEL with clay and sand (GP-GC)	GP-GC
▲	BH-87	86.5	8	97	Poorly-graded SAND with silt (SP-SM)	SP-SM
★	BH-87	121.5	6	57	Well-graded SAND with silt and gravel (SW-SM)	SW-SM
⊙	BH-87	137.5	13	53	Clayey GRAVEL with sand (GC)	GC
✚	BH-87	157.5	24	100	Silty SAND (SM)	SM
○	BH-87	181.0	6	57	Poorly-graded SAND with silt and gravel (SP-SM)	SP-SM

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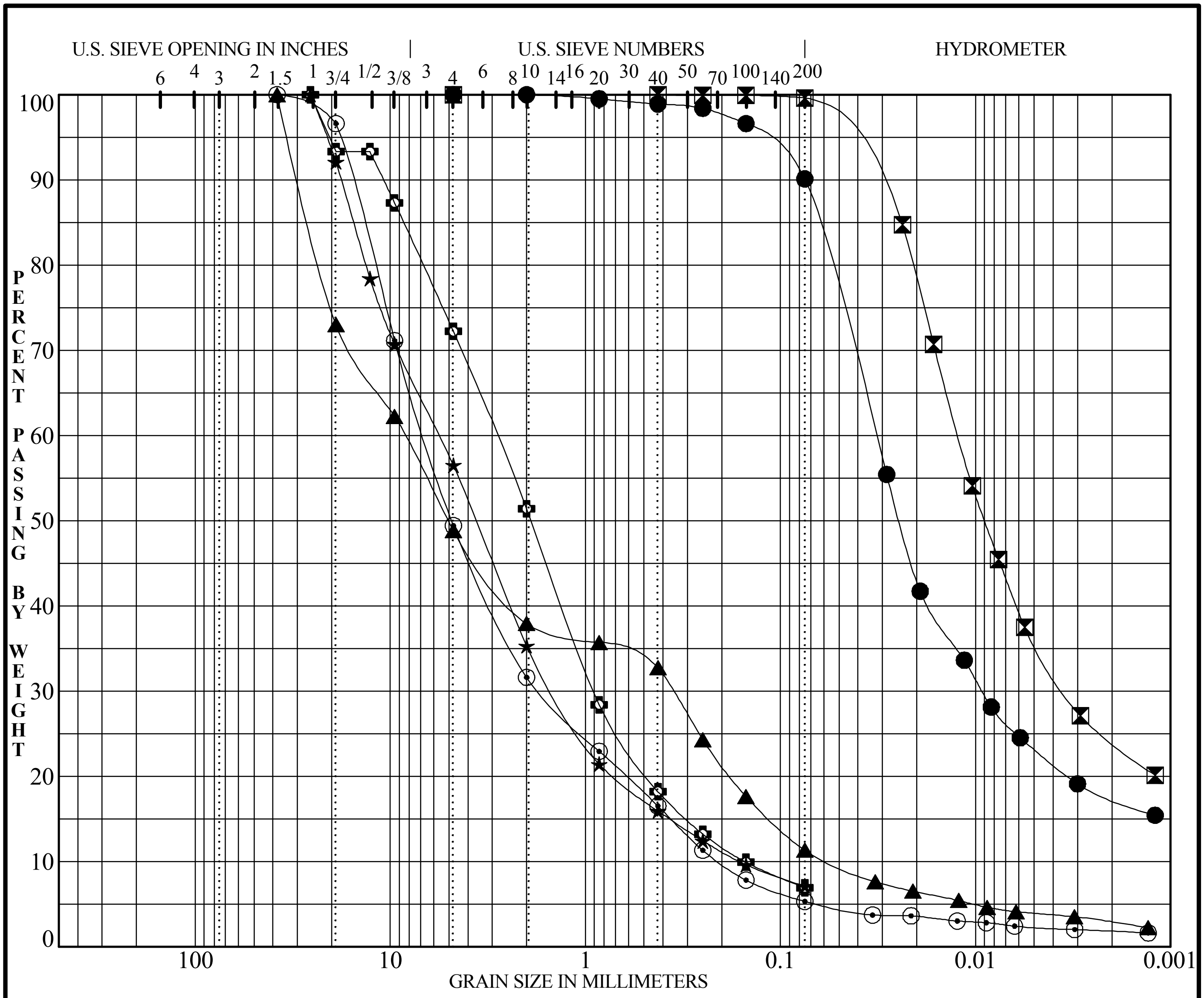
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-23

PROJECT No.
213213



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<tr><td>Coarse</td><td>Fine</td><td>Coarse</td><td>Medium</td><td>Fine</td></tr>
</table>

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-88	33.5	90	100	SILT (ML)	ML
⧗	BH-88	68.0	100	100	SILT (ML)	ML
▲	BH-88	71.0	11	49	Poorly-graded GRAVEL with silt and sand (GP-GM)	GP-GM
★	BH-88	81.5	7	57	Well-graded SAND with silt and gravel (SW-SM)	SW-SM
⊙	BH-88	94.5	5	49	Well-graded GRAVEL with silt and sand (GW-GM)	GW-GM
✚	BH-88	104.0	7	72	Well-graded SAND with silt and gravel (SW-SM)	SW-SM

GRADATION_B SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08

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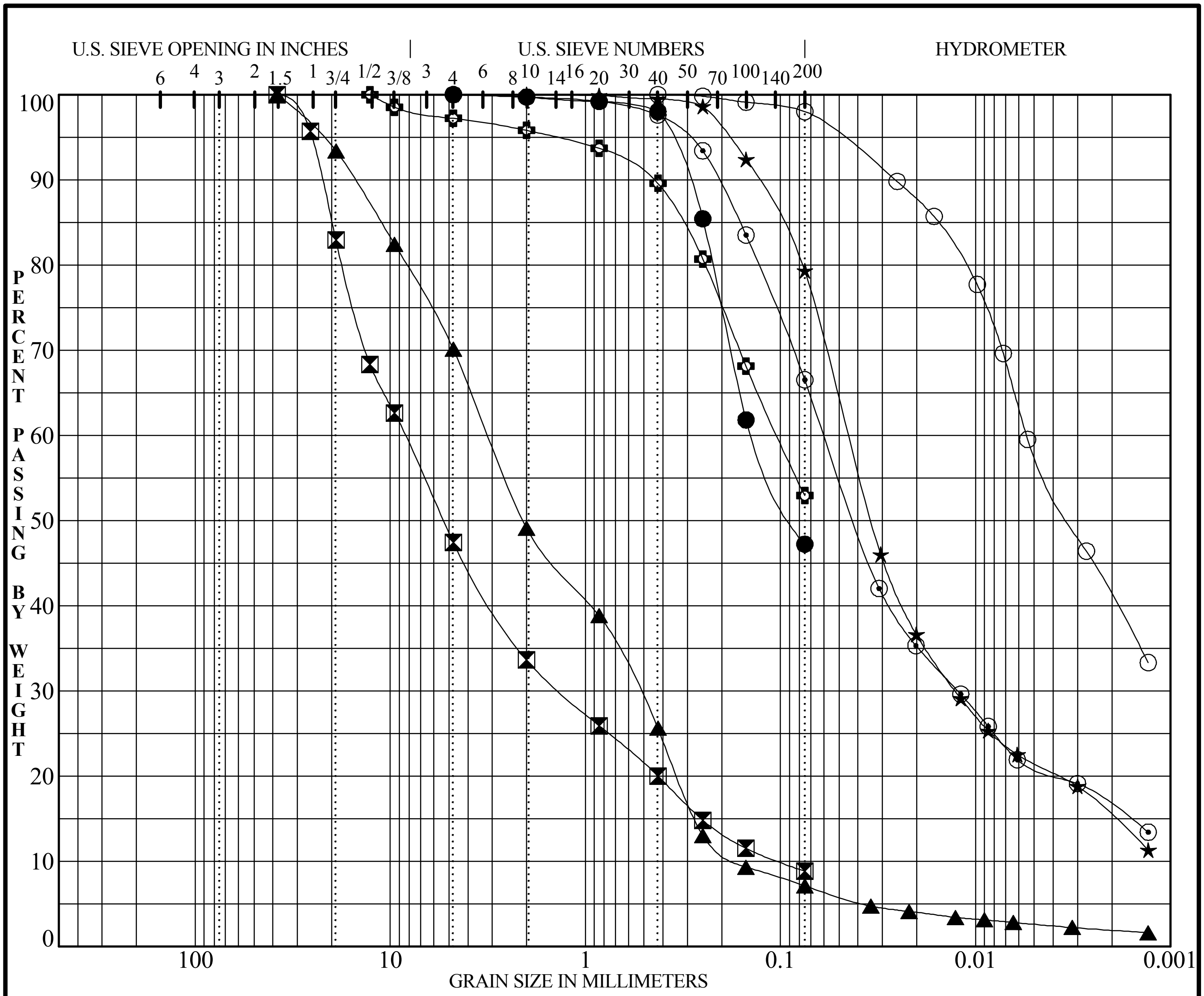
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-24

PROJECT No.
213213



Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-89	41.5	47	100	Silty SAND (SM)	SM
☒	BH-89	51.5	9	47	Well-graded GRAVEL with silt and sand (GW-GM)	GW-GM
▲	BH-89	81.5	7	70	Poorly-graded SAND with silt and gravel (SP-SM)	SP-SM
★	BH-89	147.5	79	100	SILT with sand (ML)	ML
⊙	BH-89	161.5	67	100	Sandy Lean CLAY (CL)	CL
✚	BH-89	172.5	53	97	Sandy SILT (ML)	ML
○	BH-89	191.5	98	100	Lean CLAY (CL)	CL

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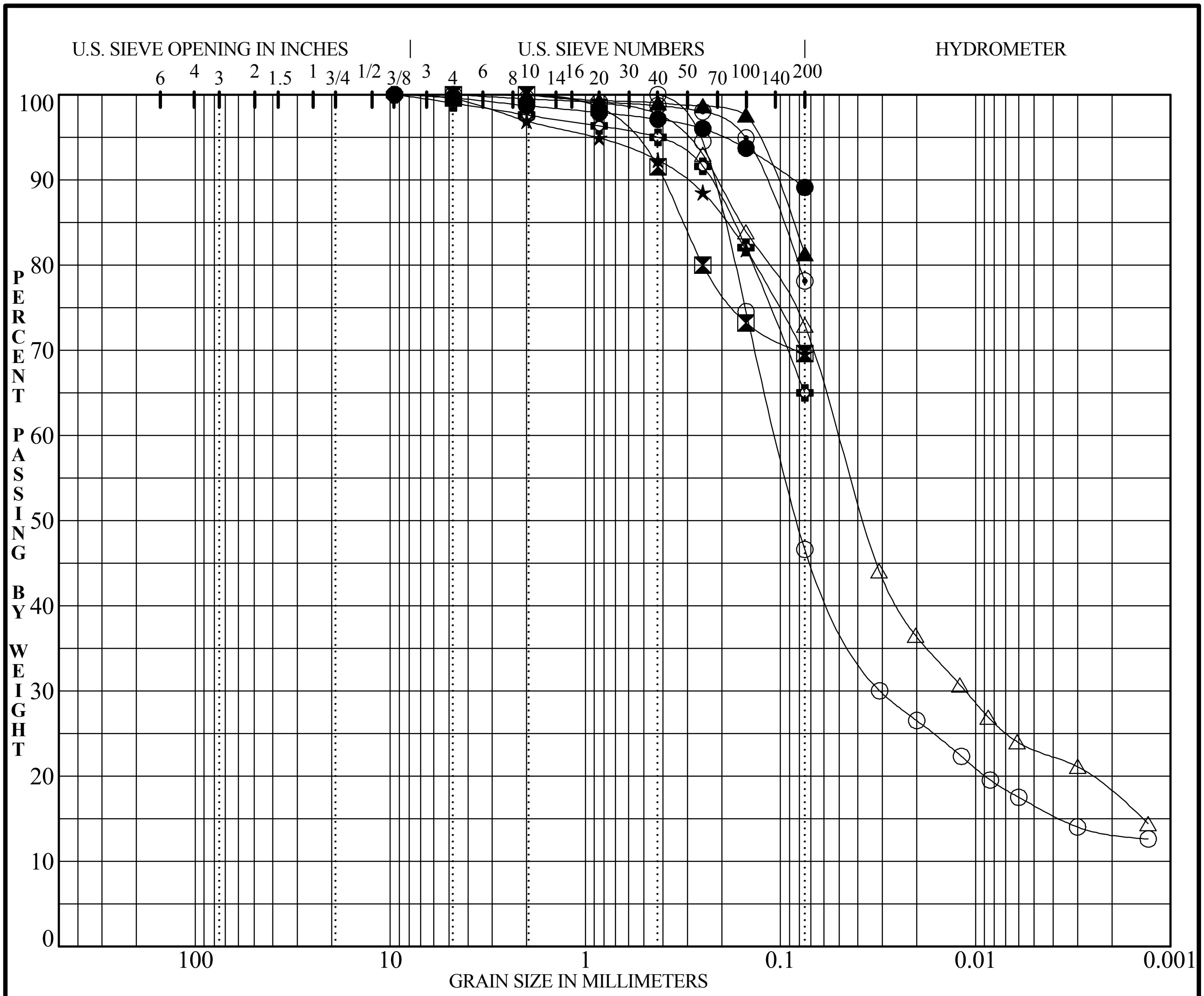
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-25

PROJECT No.
213213



Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-90	29.0	89	100	Lean CLAY (CL)	CL
⧗	BH-90	34.0	70	100	Sandy SILT (ML)	ML
▲	BH-90	39.0	81	100	Lean CLAY with sand (CL)	CL
★	BH-90	46.5	70	100	Lean CLAY with sand (CL)	CL
⊙	BH-90	54.0	78	100	Silty CLAY with sand (CL-ML)	CL-ML
✿	BH-90	58.5	65	99	Sandy Lean CLAY (CL)	CL
○	BH-90	151.5	47	100	Silty SAND (SM)	SM
△	BH-90	162.5	73	100	Lean CLAY with sand (CL)	CL

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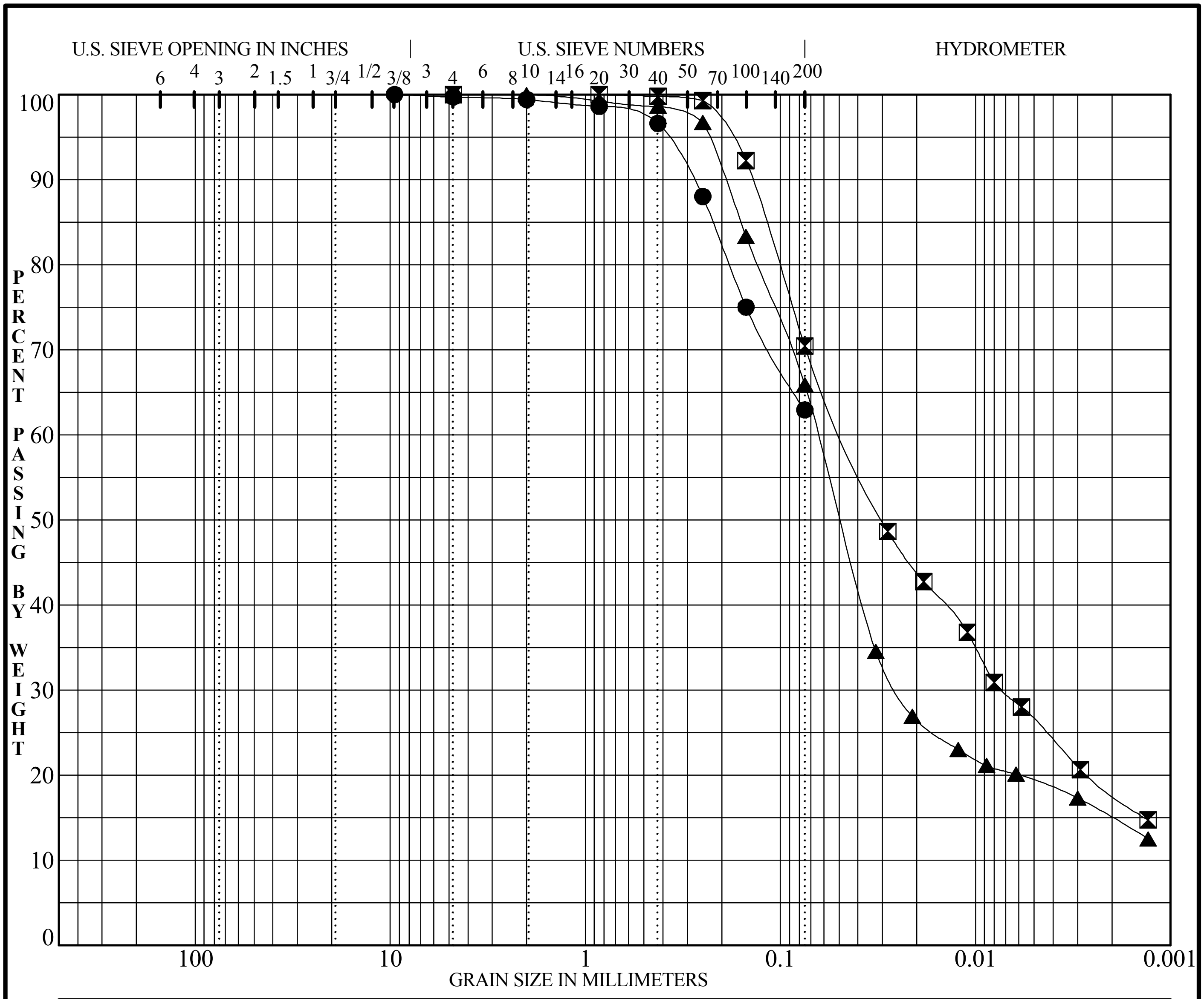
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
A4-26a

PROJECT No.
213213



Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-90	182.5	63	100	Sandy Lean CLAY (CL)	CL
☒	BH-90	186.5	70	100	Sandy Lean CLAY (CL)	CL
▲	BH-90	197.5	66	100	Sandy SILT (ML)	ML

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L. Tran
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F. Wang
DATE:
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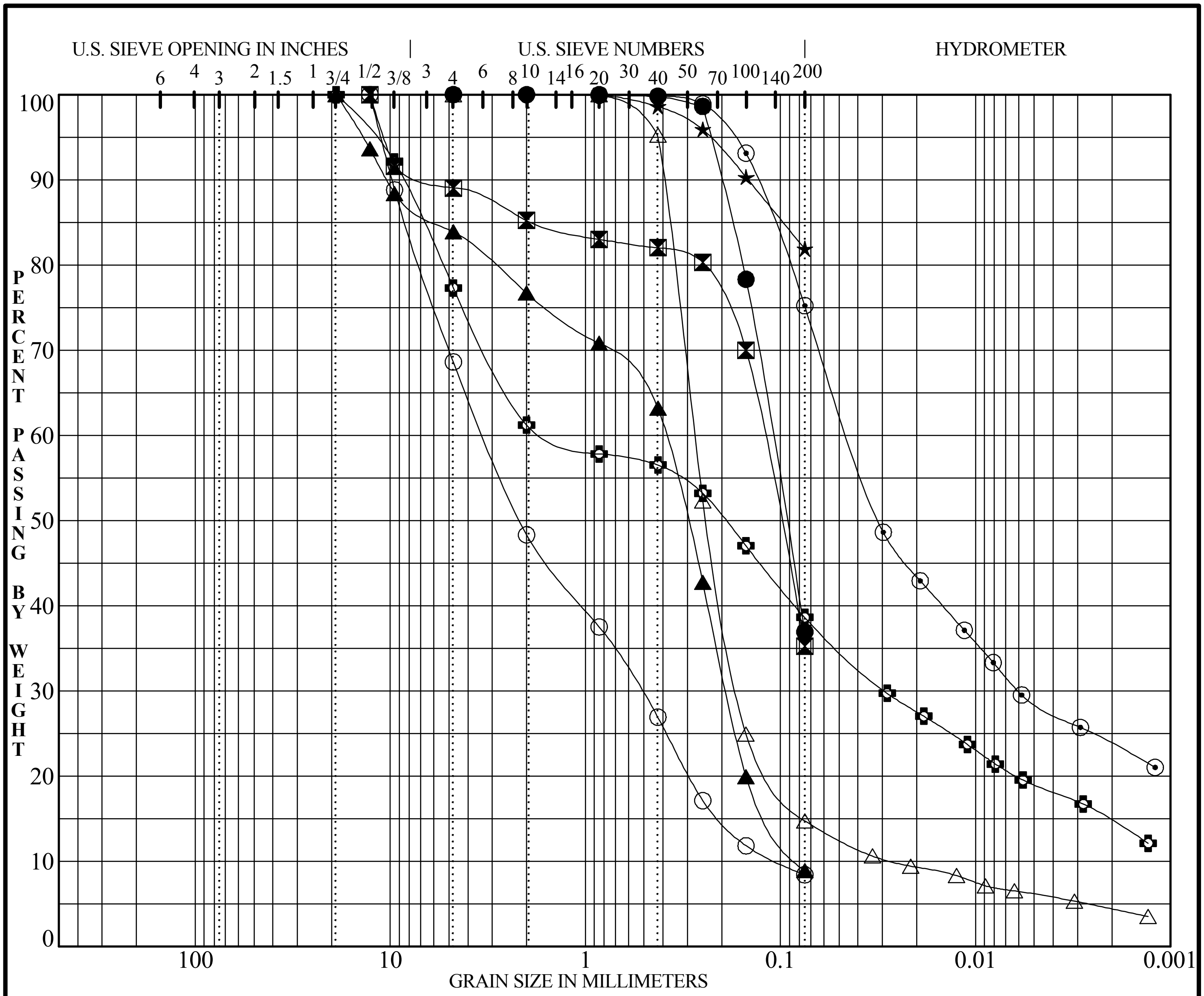
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
A4-26b

PROJECT No.
213213



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<tr><td>Coarse</td><td>Fine</td><td>Coarse</td><td>Medium</td><td>Fine</td></tr>
</table>

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-91	29.0	37	100	Silty SAND (SM)	SM
⧗	BH-91	31.0	35	89	Silty SAND (SM)	SM
▲	BH-91	32.5	9	84	Poorly-graded SAND with silt and gravel (SP-SM)	SP-SM
★	BH-91	40.5	82	100	Lean CLAY (CL)	CL
⊙	BH-91	45.5	75	100	Lean CLAY (CL)	CL
✚	BH-91	142.5	39	77	Clayey SAND with gravel (SC)	SC
○	BH-91	146.0	8	69	Poorly-graded SAND with silt and gravel (SP-SM)	SP-SM
△	BH-91	156.5	15	100	Silty SAND (SM)	SM

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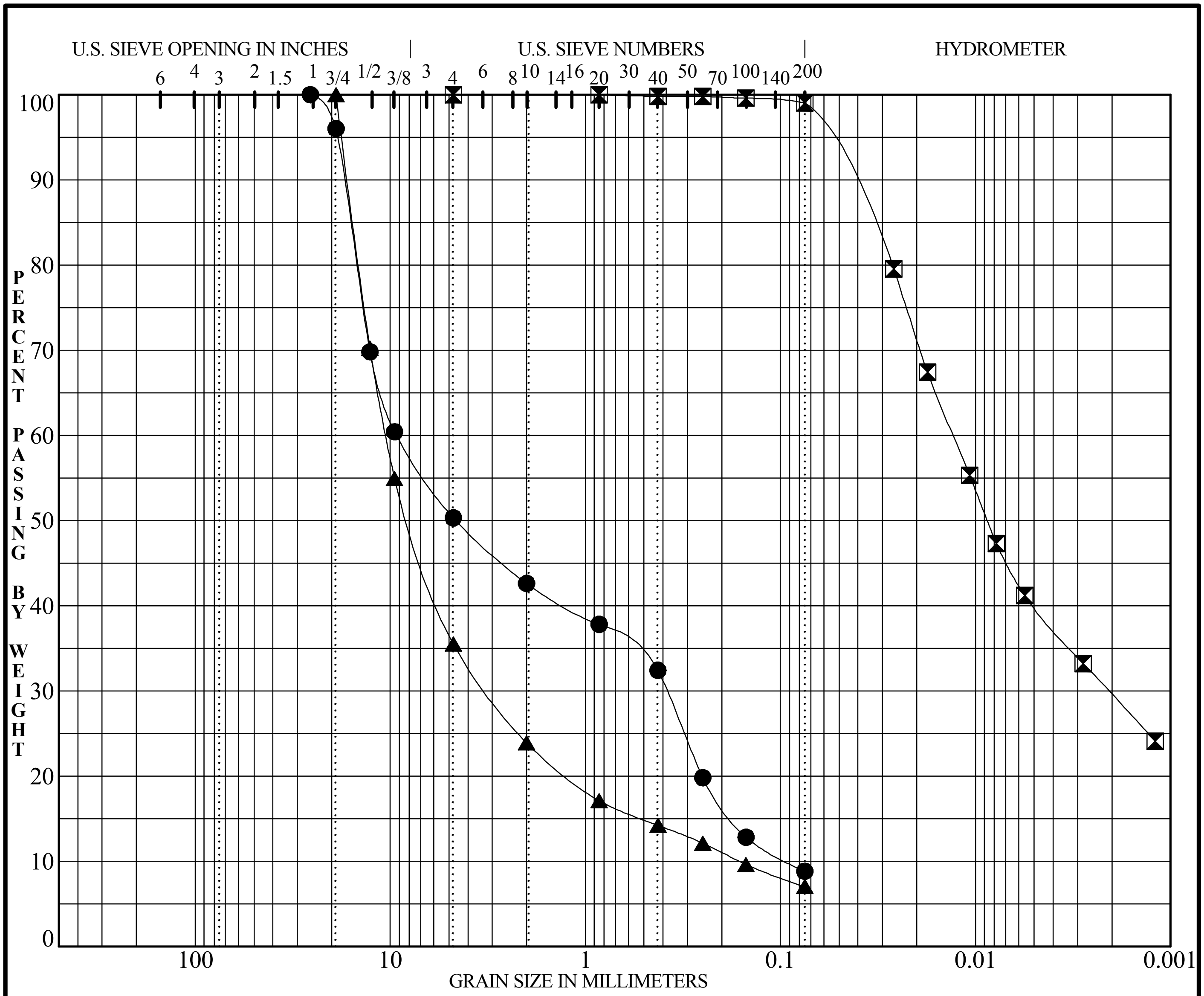
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
A4-27a

PROJECT No.
213213

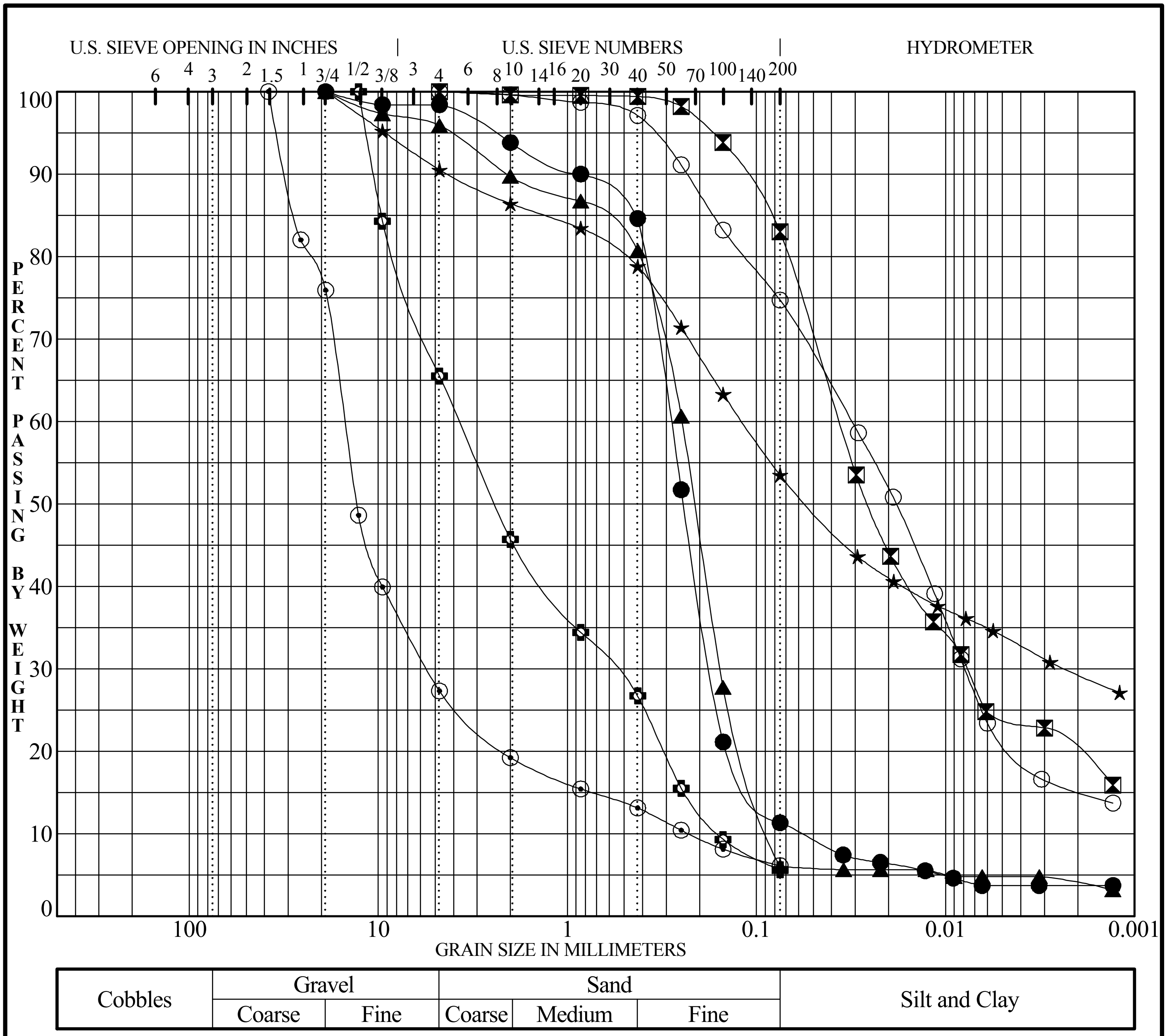


Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-91	176.5	9	50	Poorly-graded GRAVEL with silt and sand (GP-GM)	GP-GM
☒	BH-91	182.5	99	100	Lean CLAY (CL)	CL
▲	BH-91	196.5	7	36	Poorly-graded GRAVEL with clay and sand (GP-GC)	GP-GC

GRADATION_B ALTERNATE SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08

PREP'D BY: L. Tran APP'D BY: F. Wang DATE: 4/29/08 DWG FILE:	GRADATION TEST DATA **SILICON VALLEY RAPID TRANSIT PROJECT** **San Jose, California**	FIGURE **A4-27b** PROJECT No. 213213



Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-93	101.5	11	98	Poorly-graded SAND with silt (SP-SM)	SP-SM
☒	BH-93	158.5	83	100	Lean CLAY with sand (CL)	CL
▲	BH-93	164.7	6	96	Poorly-graded SAND with silt (SP-SM)	SP-SM
★	BH-93	169.7	54	91	Sandy Lean CLAY (CL)	CL
⊙	BH-93	173.2	6	27	Poorly-graded GRAVEL with silt and sand (GP-GM)	GP-GM
✿	BH-93	181.8	6	66	Poorly-graded SAND with silt and gravel (SP-SM)	SP-SM
○	BH-93	200.0	75	100	SILT with sand (ML)	ML

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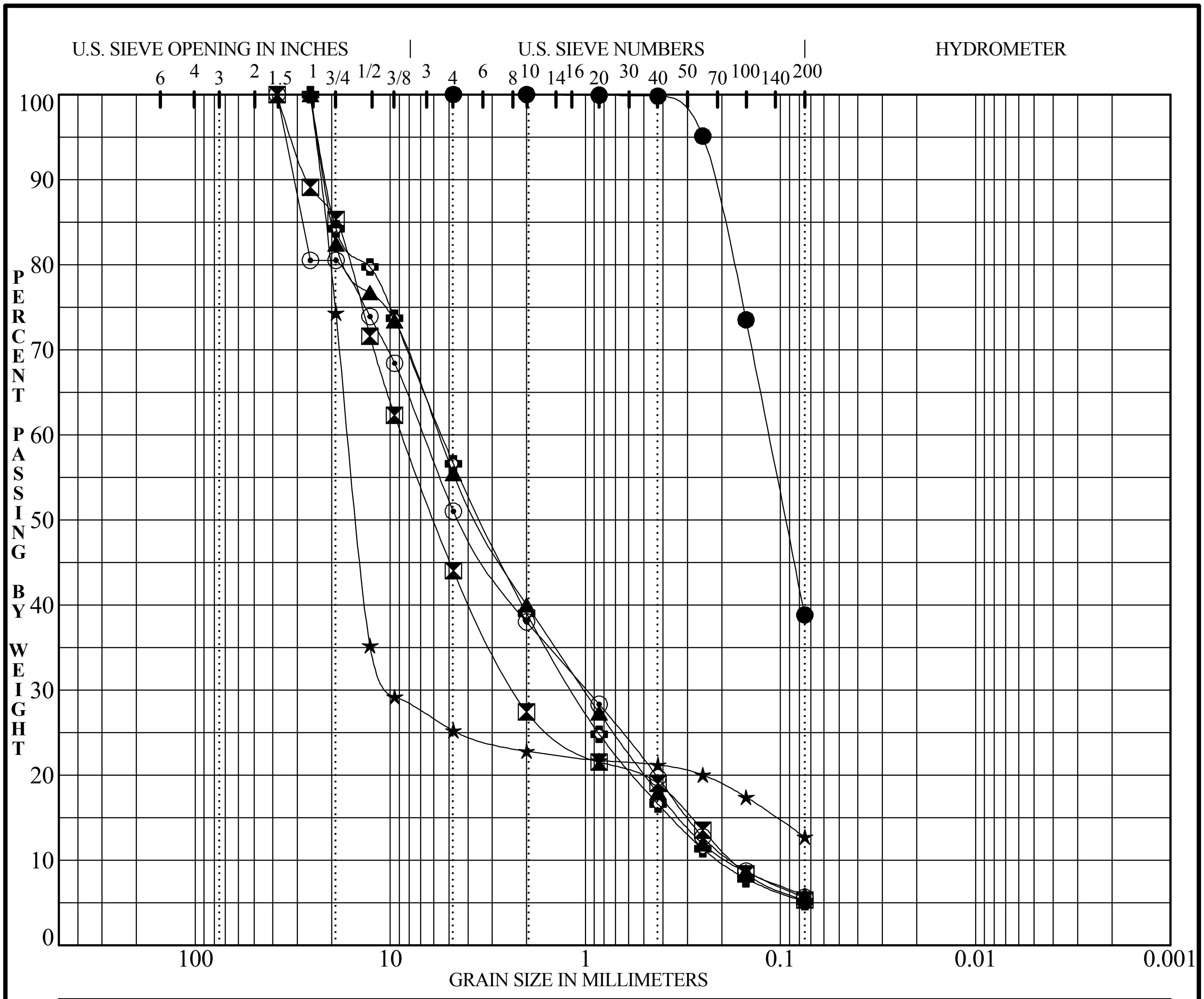
GRADATION TEST DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-28

PROJECT No.
213213



Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-95	32.5	39	100	Silty SAND (SM)	SM
☒	BH-95	39.0	5	44	Poorly-graded GRAVEL with silt and sand (GP-GM)	GP-GM
▲	BH-95	59.0	6	55	Poorly-graded SAND with silt and gravel (SP-SM)	SP-SM
★	BH-95	64.0	13	25	Silty GRAVEL (GM)	GM
⊙	BH-95	69.0	6	51	Poorly-graded GRAVEL with silt and sand (GP-GM)	GP-GM
✤	BH-95	79.0	5	57	Well-graded SAND with silt and gravel (SW-SM)	SW-SM

GRADATION_B SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08

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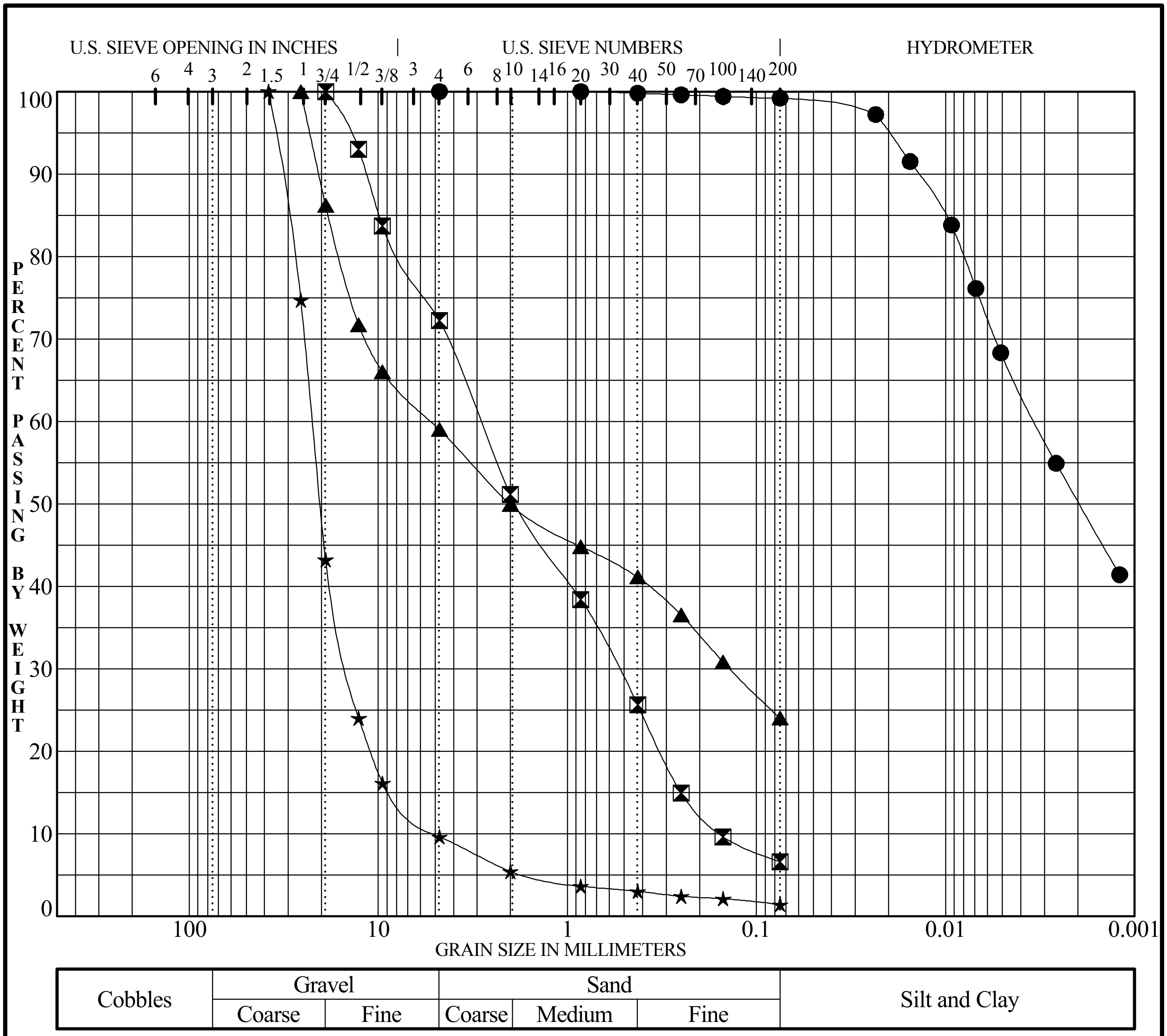
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-29

PROJECT No.
213213



Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-97	17.5	99	100	Fat CLAY (CH)	CH
☒	BH-97	51.5	7	72	Poorly-graded SAND with silt and gravel (SP-SM)	SP-SM
▲	BH-97	71.5	24	59	Clayey GRAVEL with sand (GC)	GC
★	BH-97	86.5	1	10	Well-graded GRAVEL (GW)	GW

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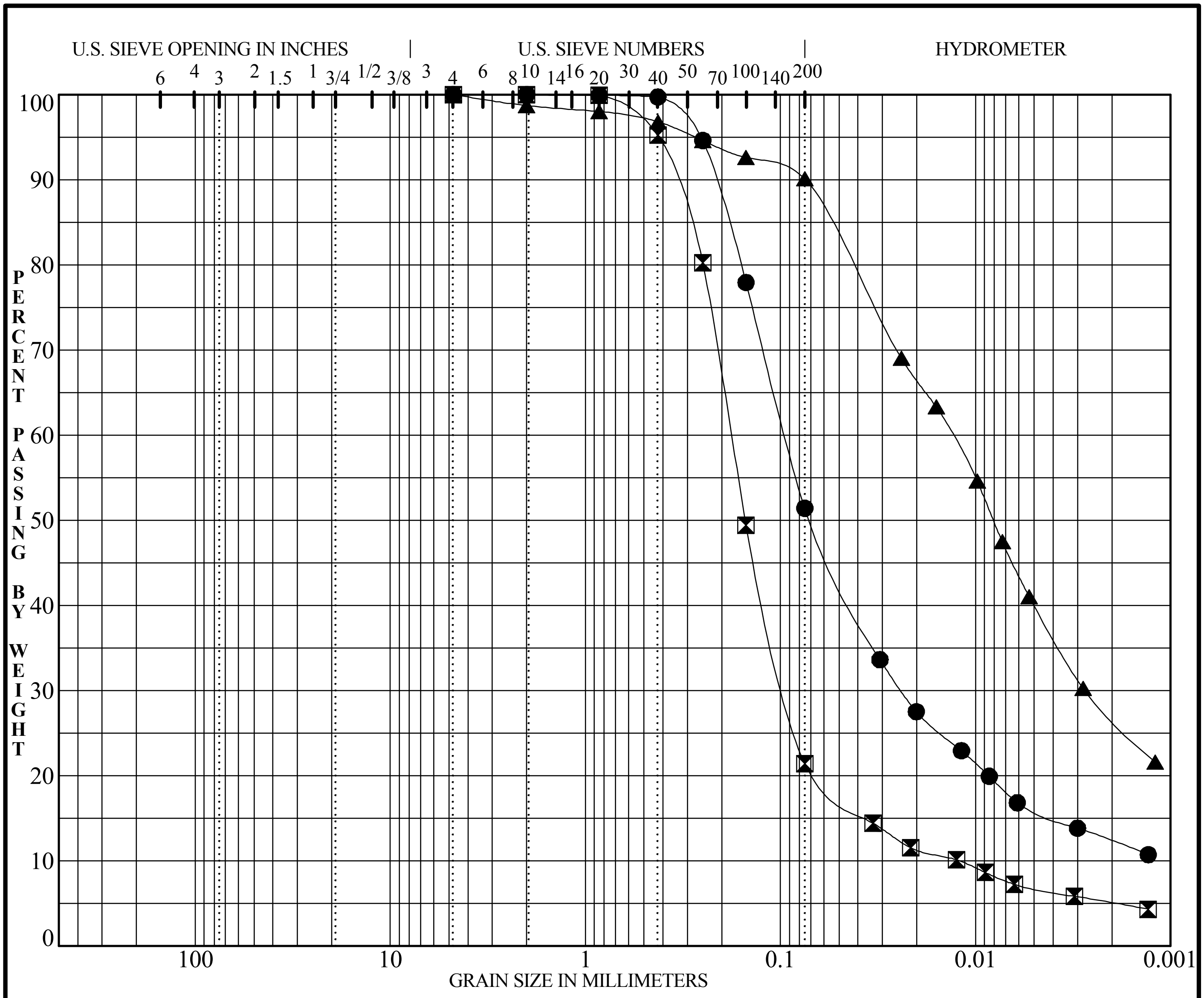
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-30

PROJECT No.
213213



Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-98	37.5	51	100	Sandy SILT (ML)	ML
⧗	BH-98	41.5	21	100	Silty SAND (SM)	SM
▲	BH-98	46.5	90	100	Lean CLAY (CL)	CL

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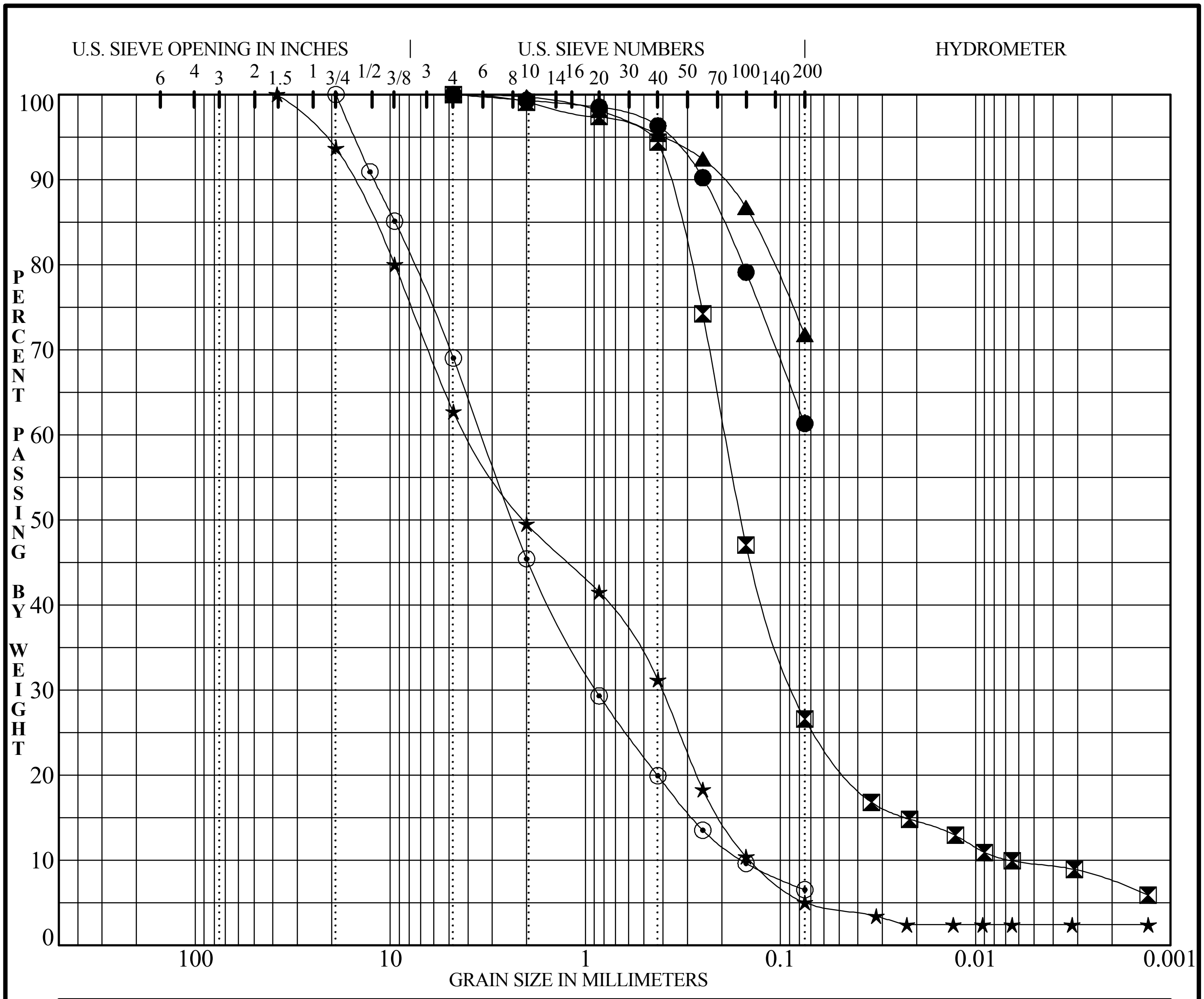
GRADATION TEST DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-31

PROJECT No.
213213



Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-99	31.5	61	100	Sandy Lean CLAY (CL)	CL
⧗	BH-99	47.5	27	100	Silty SAND (SM)	SM
▲	BH-99	57.5	72	100	Sandy Lean CLAY (CL)	CL
★	BH-99	66.5	5	63	Poorly-graded SAND with silt and gravel (SP-SM)	SP-SM
⊙	BH-99	76.5	7	69	Well-graded SAND with silt and gravel (SW-SM)	SW-SM

GRADATION_B SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08

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DWG FILE:

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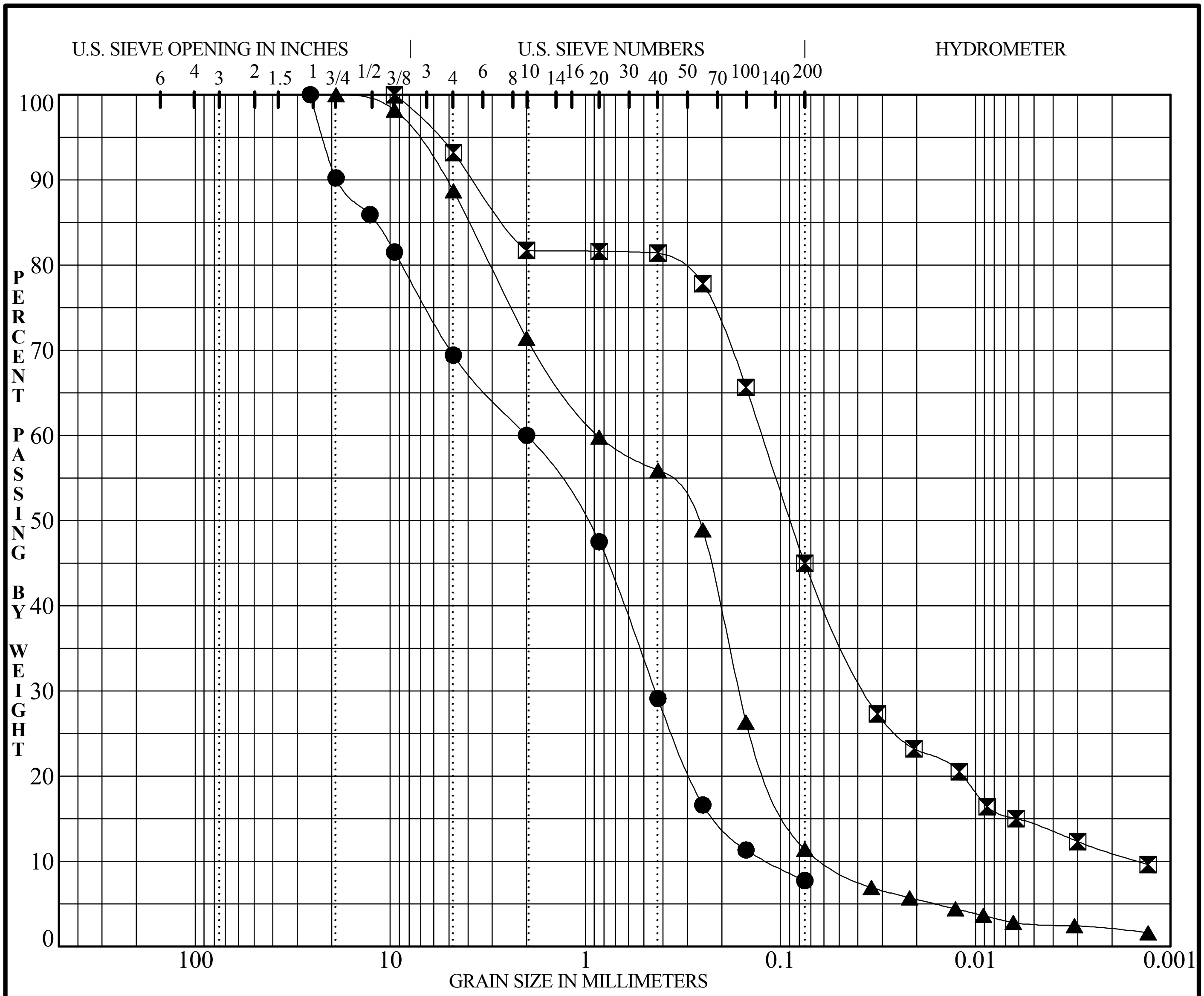
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-32

PROJECT No.
213213



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<tr><td>Coarse</td><td>Fine</td><td>Coarse</td><td>Medium</td><td>Fine</td></tr>
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Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-100	31.5	8	69	Poorly-graded SAND with silt and gravel (SP-SM)	SP-SM
⧗	BH-100	36.5	45	93	Clayey SAND (SC)	SC
▲	BH-100	41.5	11	89	Poorly-graded SAND with silt (SP-SM)	SP-SM

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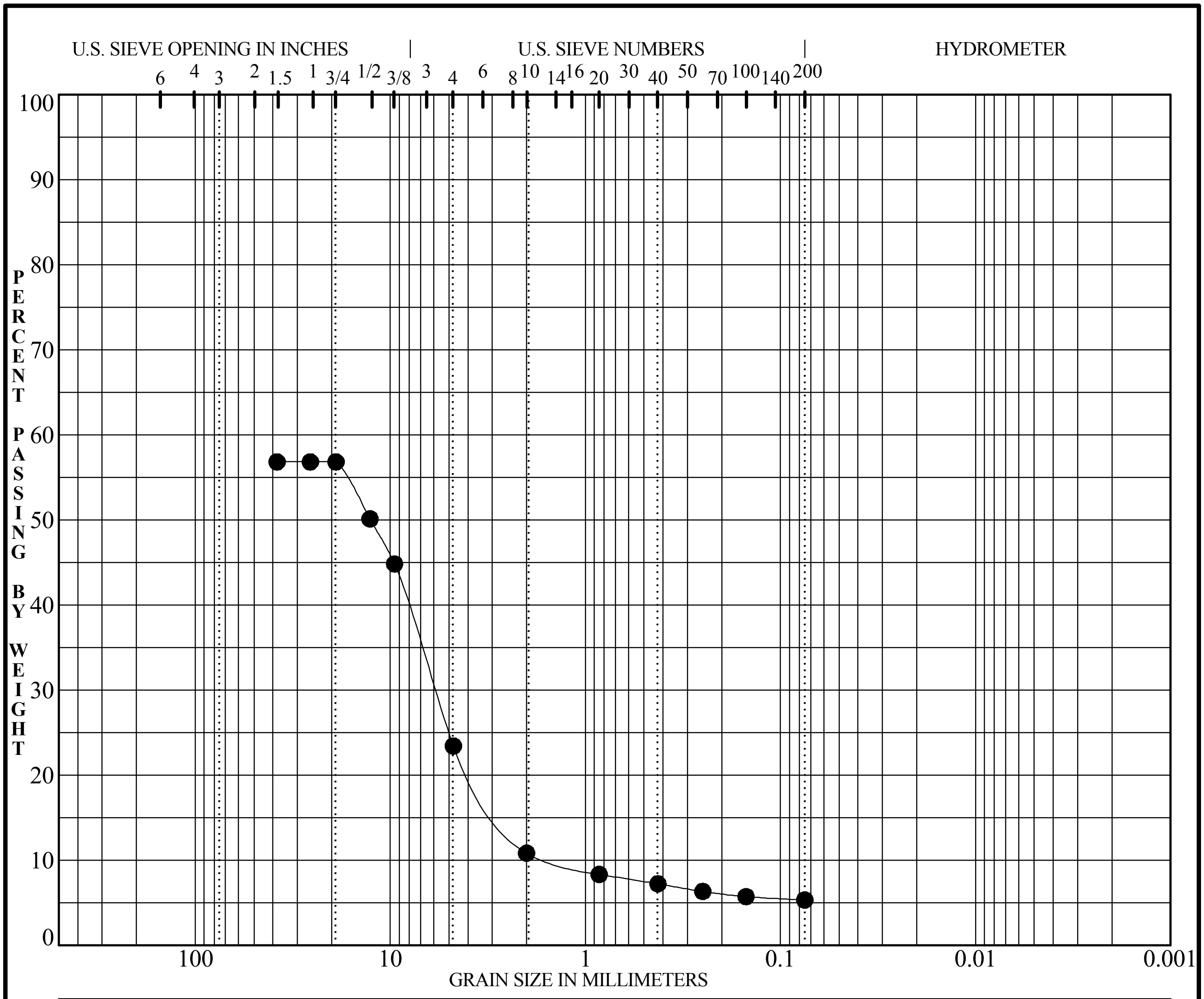
GRADATION TEST DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-33

PROJECT No.
213213



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<tr><td>Coarse</td><td>Fine</td><td>Coarse</td><td>Medium</td><td>Fine</td></tr>
</table>

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-101	6.5	5	23	Poorly-graded GRAVEL with silt and sand (GP-GM)	GP-GM

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GRADATION TEST DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-34

PROJECT No.
213213

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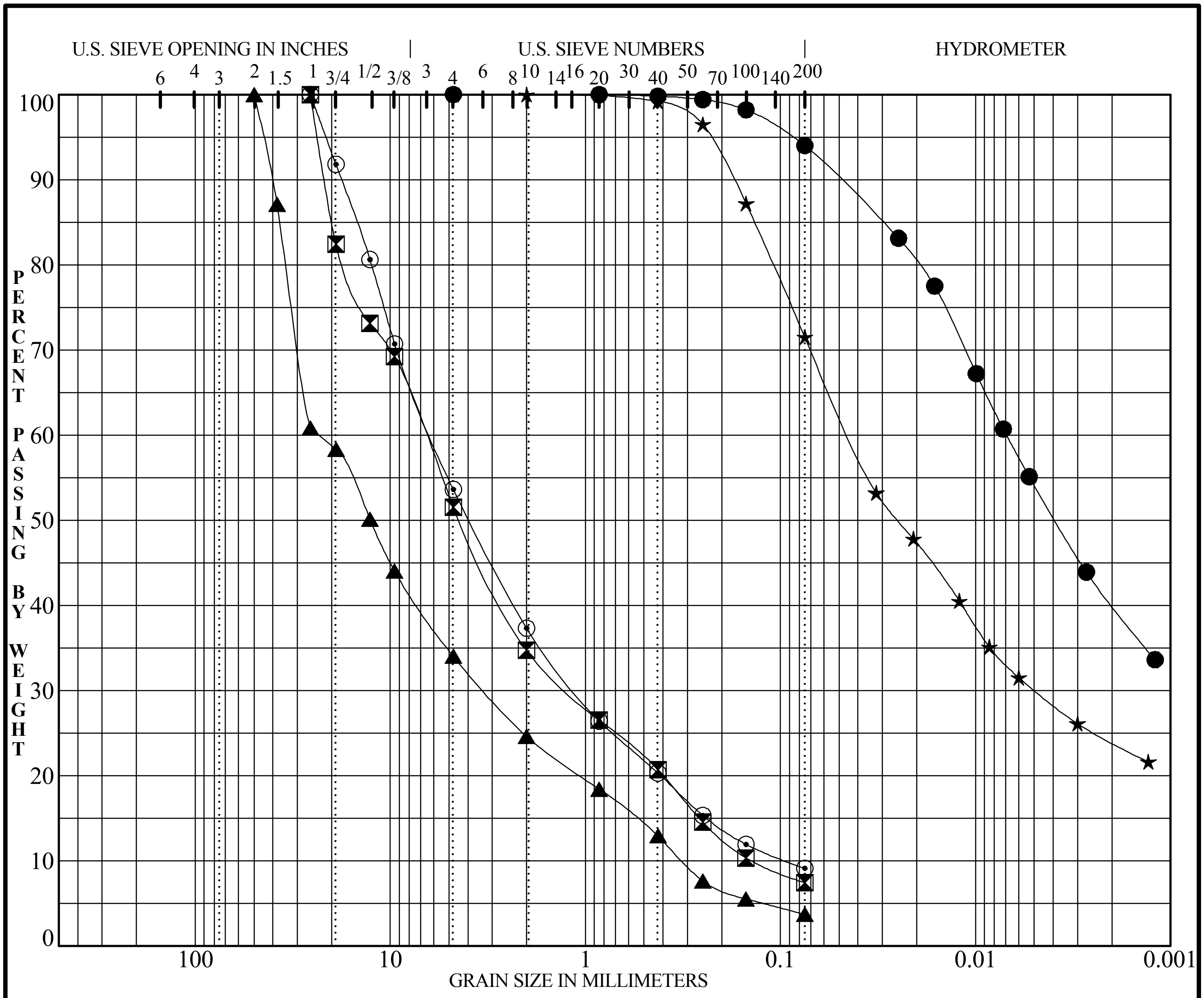

Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-102	27.5	94	100	Lean CLAY (CL)	CL
☒	BH-102	49.0	7	52	Well-graded GRAVEL with silt and sand (GW-GM)	GW-GM
▲	BH-102	60.5	4	34	Well-graded GRAVEL with silt and sand (GW-GM)	GW-GM
★	BH-102	66.5	72	100	SILT (ML)	ML
⊙	BH-102	78.5	9	54	Well-graded GRAVEL with silt and sand (GW-GM)	GW-GM

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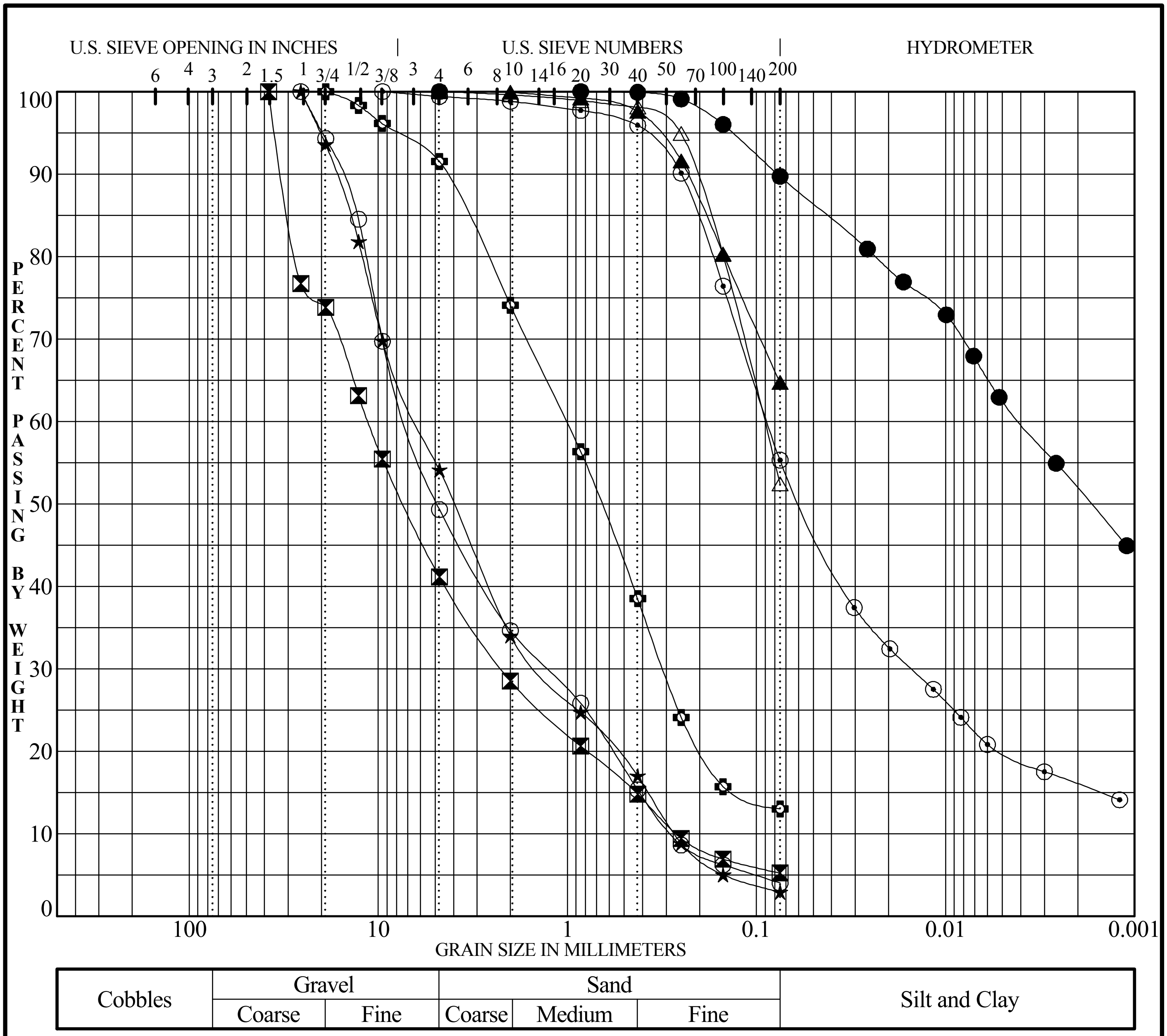
SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-35

PROJECT No.
213213



Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-103	32.0	90	100	Fat CLAY (CH)	CH
⧗	BH-103	47.5	5	41	Well-graded GRAVEL with silt and sand (GW-GM)	GW-GM
▲	BH-103	55.0	65	100	Sandy SILT (ML)	ML
★	BH-103	62.5	3	54	Well-graded SAND with gravel (SW)	SW
⊙	BH-103	72.0	55	99	Sandy SILT (ML)	ML
✤	BH-103	77.5	13	92	Silty SAND (SM)	SM
○	BH-103	84.0	4	49	Poorly-graded GRAVEL with sand (GP)	GP
△	BH-103	89.0	52	100	Sandy SILT (ML)	ML

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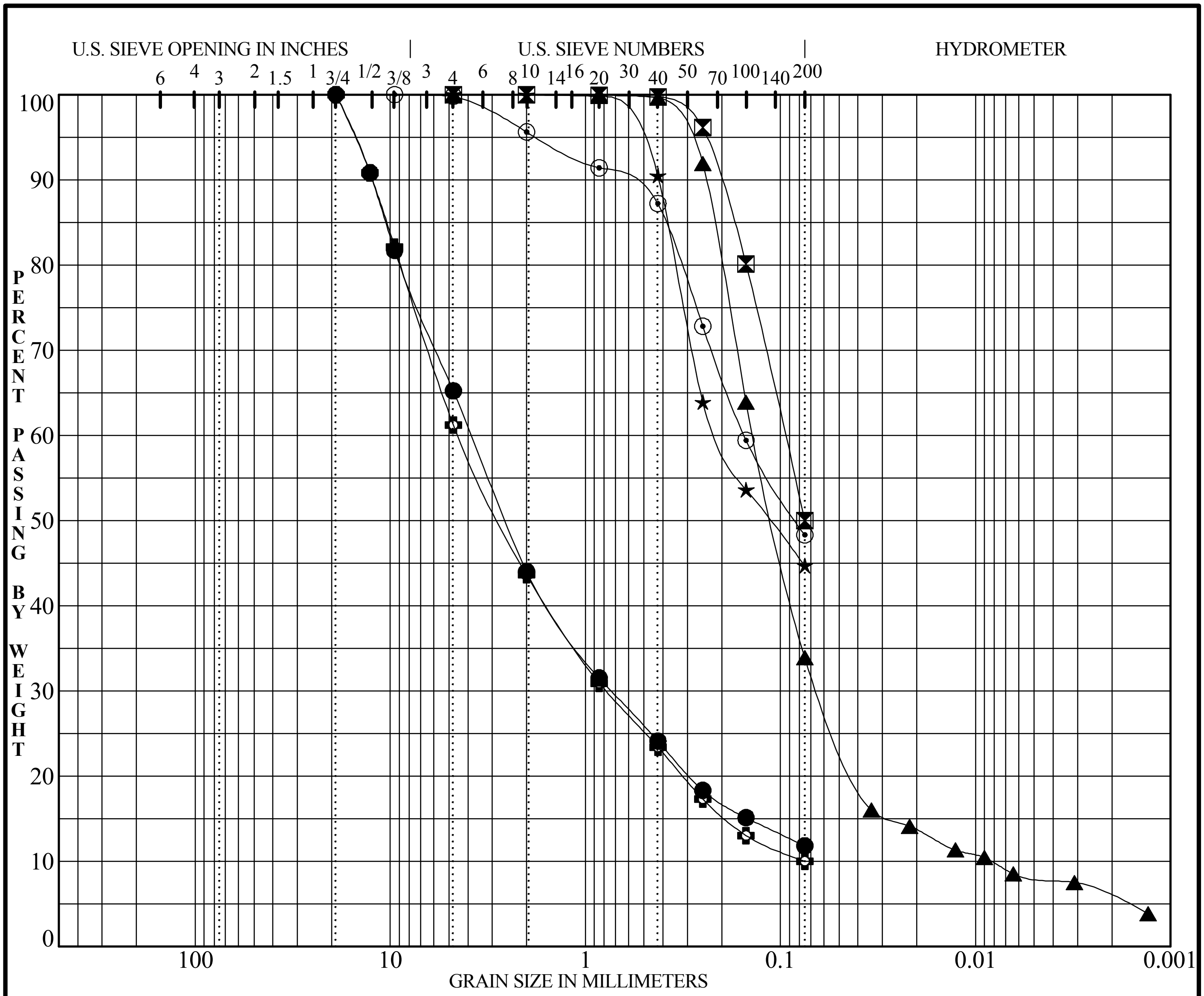
GRADATION TEST DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-36
PROJECT No.
213213

GRADATION_B SVRT_PHASE 2_041808.GPJ SVRT-BART.GDT 4/29/08



Cobbles	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-105	11.5	12	65	Well-graded SAND with silt and gravel (SW-SM)	SW-SM
⧗	BH-105	24.0	50	100	Silty SAND (SM)	SM
▲	BH-105	27.5	34	100	Silty SAND (SM)	SM
★	BH-105	32.5	45	100	Clayey SAND (SC)	SC
⊙	BH-105	39.0	48	100	Silty SAND (SM)/SANDY ORGANIC SILT (OH)	SM/OH
✜	BH-105	41.5	10	61	Well-graded SAND with silt and gravel (SW-SM)	SW-SM

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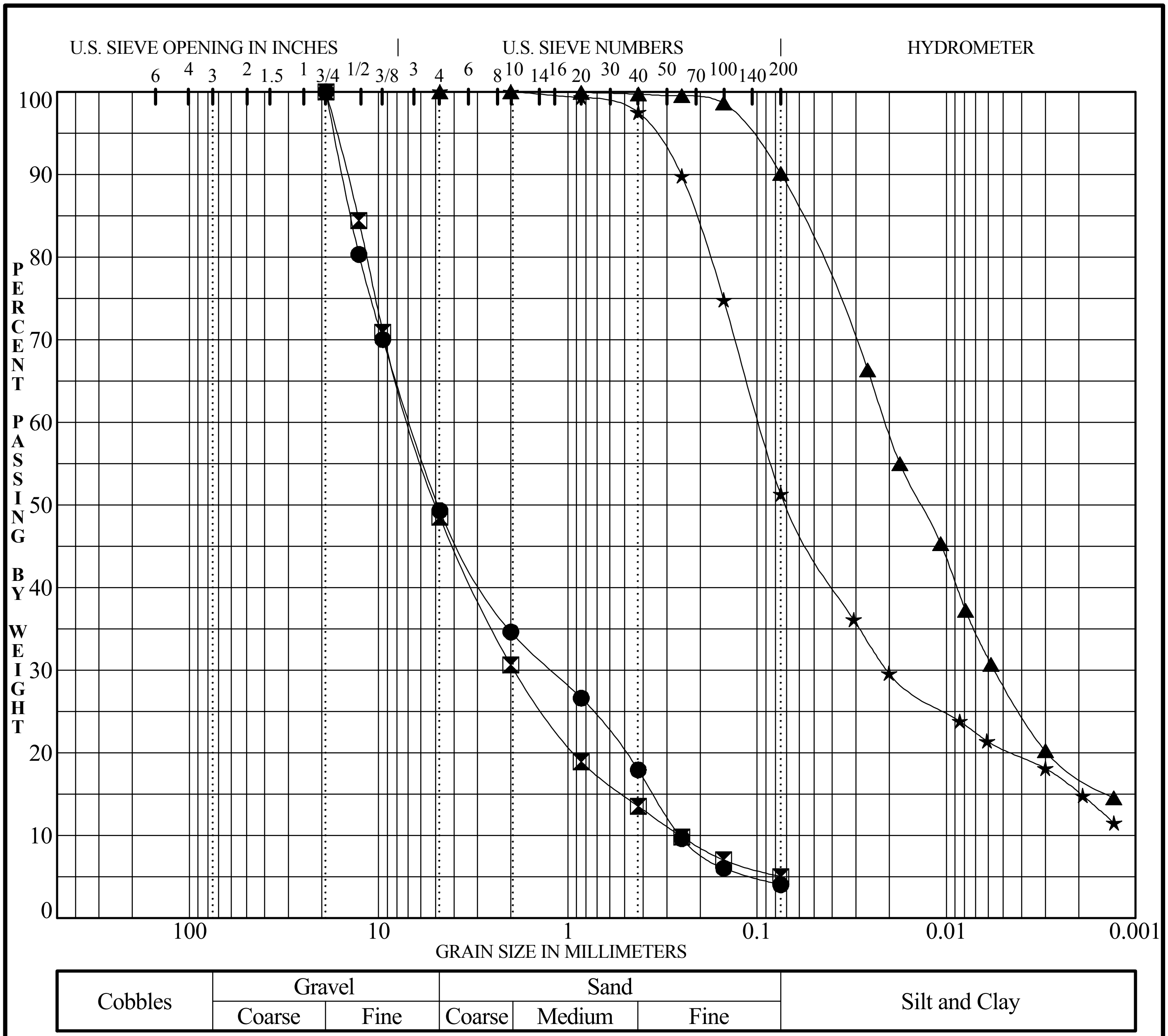
GRADATION TEST DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-37

PROJECT No.
213213



Key Symbol	Boring No.	Depth (Feet)	% Passing No. 200 Sieve	% Passing No. 4 Sieve	Sample Description	USCS
●	BH-106	43.0	4	49	Poorly-graded GRAVEL with sand (GP)	GP
☒	BH-106	49.0	5	49	Well-graded GRAVEL with sand (GW)	GW
▲	BH-106	58.5	90	100	SILT (ML)	ML
★	BH-106	68.5	51	100	Sandy SILT (ML)	ML

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F. Wang
DATE:
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GRADATION TEST DATA

SILICON VALLEY RAPID TRANSIT PROJECT
San Jose, California

FIGURE
4-38

PROJECT No.
213213

Appendix 5: Cyclic Triaxial Test Results

FUGRO WEST, INC.

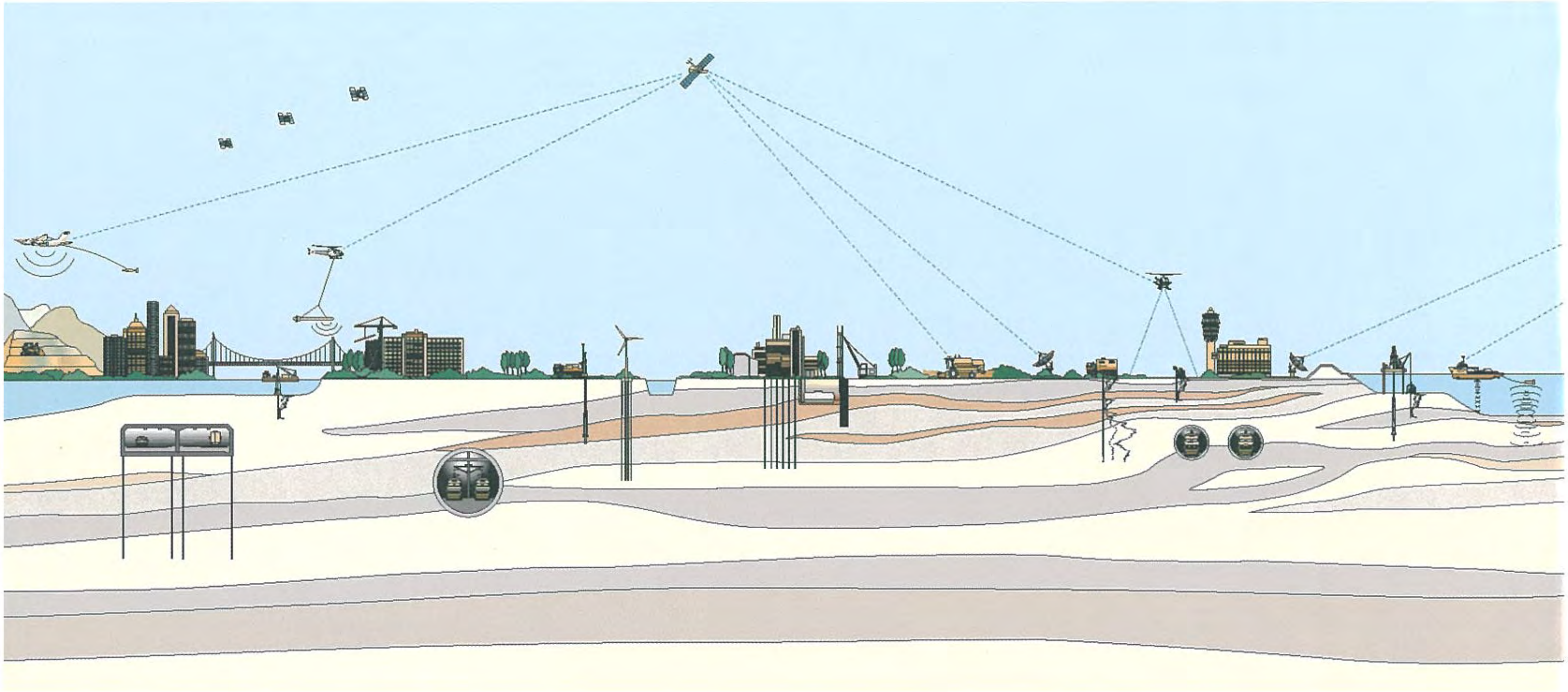
APPENDIX 5
CYCLIC TRIAXIAL STRENGTH TEST RESULTS

GEOTECHNICAL EXPLORATION PROGRAM
CENTRAL AREA GUIDEWAY

SILICON VALLEY RAPID TRANSIT (SVRT) PROJECT
SAN JOSE, CALIFORNIA

Prepared for:
HMM/Bechtel

JANUARY 2008
Fugro Project No. 1637.001



REPORT DOCKET

APPROVAL

This document is approved by the following:

Name	Title	Signature	Issue Date
Michael Paquette, P.E.	Project Engineer	Michael Paquette	1/21/08
Edwin Woo, P.E., G.E.	Principal Engineer	Edwin P. Woo	1/21/08

REVISION HISTORY

Revision	Date	Change	Approval
0	January 21, 2008	Appendix 5 Cyclic Triaxial Strength Test Results.	MP

FUGRO WEST, INC.

1000 Broadway, Suite 440
Oakland, California 94607
Tel: (510) 268-0461
Fax: (510) 268-0545

January 21, 2008
Project No. 1637.001

HMM/Bechtel
3103 North First Street
San Jose, California 95134

Attention: Mr. Thomas Hunt, P.E.

Subject: Appendix 5 – Cyclic Triaxial Test Results,
Central Area Guideway of SVRT Project, San Jose, California

Dear Mr. Hunt:

Fugro is pleased to submit this copy of "Appendix 5 – Cyclic Triaxial Test Results," describing the test equipment, procedures and results for the Central Area Guideway of the SVRT Project in San Jose, California.

We appreciate this opportunity to be of continued service to HMM/Bechtel. Please contact Michael Paquette at (510) 267-4441 if you have any questions regarding the information presented in this appendix.

Sincerely,

FUGRO WEST, INC.

Michael Paquette

Michael Paquette, P.E.
Project Engineer

Edwin P. Woo

Edwin P. Woo, P.E., G.E.
Principal Engineer

MP/EW:rh

Copies Submitted: (PDF) Addressee

CONTENTS

FIGURES

1.0 INTRODUCTION

This appendix presents the results of the Cyclic Triaxial Compression tests conducted by the geotechnical laboratory of Fugro Consultants LP in Houston, Texas, (Fugro Consultants) as a part of the advanced laboratory-testing program for the Central Area Guideway portion of the Silicon Valley Rapid Transit (SVRT) Project.

1.1 PROJECT DESCRIPTION

The Santa Clara Valley Transportation Authority (VTA) intends to construct the SVRT Project in San Jose, California. This will be a 26.2-km (16.3-mile) extension of the Bay Area Rapid Transit (BART) heavy rail rapid transit system from the planned terminus at the end of the Warms Springs Extension in Fremont, to San Jose. The proposed alignment currently includes several new stations and vehicle storage and maintenance facilities. The alignment is composed of two major segments:

1) The “Northern Area” that will be approximately 11.5 miles of at-grade, elevated and cut-and-cover track from Warm Springs to San Jose; and
2) The “Central Area Guideway”, a 5.1-mile-long tunnel, consisting of twin bored tunnels and cut-and-cover structures through downtown San Jose.

As currently planned, the Central Area Guideway includes at-grade and open cut track, cut-and-cover stations, and a cut-and-cover track crossover structure. The cut-and-cover stations and the crossover structures have a cumulative length of approximately 4,970 feet. The remaining 4.14 miles of the alignment will be twin 19.5-foot-diameter tunnels.

This investigation and report cover the 5.1-mile-long Central Area Guideway only.

1.2 GEOTECHNICAL EXPLORATION PROGRAM OVERVIEW

The joint venture of Hatch Mott MacDonald T & T, Inc., and Bechtel Infrastructure Corporation (HMM/Bechtel) is providing engineering design services for the Central Area Guideway of the SVRT Project to the VTA. HMM/Bechtel has subcontracted with a number of companies to conduct the geotechnical field exploration program for the project. HMM/Bechtel’s primary subcontractors for the geotechnical exploration program include: Fugro, Parikh Consultants (Parikh) and Pitcher Drilling Company (Pitcher).

The three companies, Fugro, Parikh, and Pitcher, conducted the majority of the geotechnical field exploration program for the Central Area Guideway of the SVRT Project from October 2004 to March 2005. This supplementary geotechnical field investigation was performed between March 2007 and August 2007. The intent of the field investigation program was to obtain geotechnical data that would aid in the design and construction of the proposed tunnel and cut-and-cover structures.

In general, the geotechnical field investigations explored subsurface conditions along the proposed Central Area Guideway. The explorations were within the vicinity of the proposed Eastern and Western Portals, at the two proposed ventilation structures, and at the proposed stations, including Alum Rock Station, Downtown San Jose Station and Diridon/Arena Station. The geotechnical exploration program included:

- 2004 / 2005 Investigation
    - 76 Rotary Wash Borings (by others); and
    - 146 CPTs (by Fugro).
- 2007 Investigation
    - 18 Rotary Wash Borings (by others); and
    - 22 CPTs (by Fugro).

Figure 3-1 in the main report provides a map of the exploration locations. These locations were selected by HMM/Bechtel based on the following considerations: 1) the requirements of the tunnel designer, 2) the location of existing geotechnical data, 3) reducing impacts on private property, and 4) the avoidance of existing underground and overhead utilities.

The two companies, Parikh and Pitcher, conducted the boring investigation program. The investigation included soil sampling and in-situ testing. Soil sampling consisted of Pitcher Barrel sampling, Shelby tube sampling, SPT sampling and California sampling. The in-situ testing conducted in the borings consisted of field vane shear testing, pressuremeter testing, downhole geophysical logging, and piezometer installation. For further details regarding the boring investigation program and results, please refer to the main report.

1.3 LABORATORY TESTING PROGRAM OVERVIEW

1.3.1 Overview of Consolidated Undrained Cyclic Triaxial Testing Program

Fugro Consultants' geotechnical laboratory conducted the Consolidated Undrained Cyclic Triaxial (CUCTX) laboratory-testing program for the Central Area Guideway of the SVRT Project. This laboratory program was conducted on samples selected by HMM/Bechtel and provided by Parikh from soil borings located along the tunnel segment. This appendix provides a detailed description for the CUCTX tests along with a summary of the interpreted parameters.

The scope of the advanced laboratory-testing program also included the x-raying of assigned soil samples. A discussion of the x-ray testing procedure is provided in Section 2.0 below, with x-ray images attached to this Appendix.

1.3.2 Sample Recovery and Handling

Parikh conducted soil sampling at intervals typically ranging from 5 to 10 feet in accordance with the project specifications. Upon sample recovery, undisturbed portions of the soil sample tubes were sealed and transported to Parikh's lab. For further details regarding sample recovery and handling, refer to the main report. Soil samples assigned for advanced laboratory testing were transported in wooden Shelby tube holders designed to maintain the tubes vertical orientation during transit to Fugro's laboratory in Oakland, California. The samples where then packed in specially fabricated, padded containers designed to minimize disturbance, and maintain an upright (vertical) orientation of the samples during shipping. The samples were shipped to Fugro Consultants' geotechnical laboratory in Houston, Texas, for testing.

2.0 X-RAY TEST PROCEDURES AND RESULTS

2.1 OVERVIEW

Fugro Consultants conducted x-ray tests on soil samples assigned by HMM/Bechtel, in general accordance with ASTM D4452, Standard Test Methods for X-Ray Radiography of Soil Samples. X-ray radiography provides a qualitative measure of the internal structure of the sample's content, as displayed by the varying shades of gray resulting from variations in the soil sample. These varying shades of gray enable one to evaluate items such as the following:

- Sample quality, as noted by signs of voids, drilling wash, separations in the soil caused by gas expansion, unusual changes in bedding planes or layering;
- The presence of inclusions in the sample, such as shells or calcareous nodules; and
- The presence of naturally occurring fissures, bedding planes, voids, layering, gravel, and silts seams.

Results of the x-ray tests are used to help select appropriate and relatively undisturbed soil specimen for the laboratory testing.

2.2 PROCEDURE

In accordance with ASTM D4452, x-rayed soil samples were viewed in a slightly darkened room. Information regarding the tested sample was recorded on the laboratory's tube log sheet. All pertinent project information, including project number, boring, sample, and depth, was recorded on the tube log sheet. Technicians use the x-ray photographs to select the location to cut the tubes to obtain the specimen for advanced testing.

2.3 RESULTS AND LIMITATIONS

The x-ray photographs are attached to this appendix. Interpretation of x-ray photographs involves some degree of uncertainty. The interpretation of the radiographs is dependent upon the quality of the radiograph and the amount of experience the technician has in performing these interpretations.

3.0 CONSOLIDATED UNDRAINED CYCLIC TRIAXIAL TEST PROCEDURES

3.1 INTRODUCTION

The CUCTX tests were conducted in accordance with ASTM D 5311. In the CUCTX test, the sample is prepared and mounted in a triaxial cell similar to a consolidated-undrained triaxial cell. The sample is saturated using backpressure and then isotropically (equal axial and radial stress) consolidated to the assigned stress. The sample is then subjected to a sinusoidal varying axial load. Cyclic load, axial deformation and porewater pressure versus time are recorded.

3.2 CONSOLIDATED UNDRAINED CYCLIC TRIAXIAL TEST STANDARDS AND PROCEDURES

CUCTX tests were performed using an electro-hydraulic closed-loop loading system (MTS-793) manufactured by MTS Systems Corporation and a special control and data acquisition software developed by Fugro for cyclic triaxial testing. The test procedure followed the technical requirements of the ASTM Standard Test Method for Load Controlled Cyclic Triaxial Strength of Soil, Designation D 5311. The procedure for the CUCTX tests typically consists of the following steps:

1. *Cell Preparation*: Using the assigned confining pressure, strength estimates and specimen area, the proper load cell and pressure transducers are selected.

2. *Specimen Preparation:* The selected portions of the tubes were cut into segments with a mechanical hacksaw (18 teeth per inch). A wire saw was used to separate the soil from the surrounding tube in an effort to reduce potential disturbance upon extrusion. In addition, each tube was marked such that all test specimens had the same orientation when sheared. The sample was then extruded from the cut portion of the tube using a hydraulically actuated ram.

   Test specimens were trimmed to an approximate 2-inch diameter by 4¼-inch height. After specimens were trimmed, they were mounted in the triaxial testing apparatus and aligned with the cell base with porous stones at each end. Each specimen had top, bottom and radial drainage boundaries during consolidation. Radial drainage was provided by spirally oriented, ¼ inch wide, Whatman No. 1 filter strips, placed at about ¼-inch spacing.

3. *Back Pressure Saturation*: Specimen saturation was achieved through back pressure by simultaneously increasing the chamber and back pressure. The pressure is applied incrementally to limit the stress applied to the sample.

4. *Consolidation*: The soil specimen is isotropically consolidated to the assigned stress. The samples are typically consolidated to an effective stress approximately equal to the estimated overburden pressure. Specimens were allowed to consolidate at the prescribed stresses for about 24 hours prior to cyclic loading.

5. *Cyclic Loading*: Upon completion of consolidation, a sinusoidal cyclical load was applied to each test specimen at a frequency of 1 hertz (Hz). The specimens were maintained in an undrained (no volume change) state during cyclic loading. The system collected 200 data points per channel (vertical displacement, vertical force, pore pressure, and cell pressure) for each loading cycle, independent of the loading frequency. Fugro's software is capable of ramping the axial force at a given rate, hold the load for a given period, and cycle at a given frequency using the MTS 793 controller.

   Cyclic loading continued until failure occurred or 10% axial strain occurred. Failure could be readily defined if it occurred within the tested cycles; otherwise, failure was defined by data extrapolation. A special Excel worksheet was used to process the raw data files created by the data acquisition and control software.

3.3 CONSOLIDATED UNDRAINED CYCLIC TRIAXIAL TEST RESULTS

During consolidation and loading the necessary data (time, vertical and horizontal forces, shear deformations, pore pressures and transducer excitation voltage) were recorded using an automated data-acquisition system and electronically filed. Specialized Excel worksheets, along with a Visual Basic code (VBA) were used to reduce the data files into engineering units in tabular and graphical format. Figures A5-1 through A5-18 present the CUCTX test results.

Results such as moisture content, initial unit weight, soil type, vertical effective consolidation stress and confinement pressure are summarized in Table A15-1 "Summary of CUCTX Test Results."

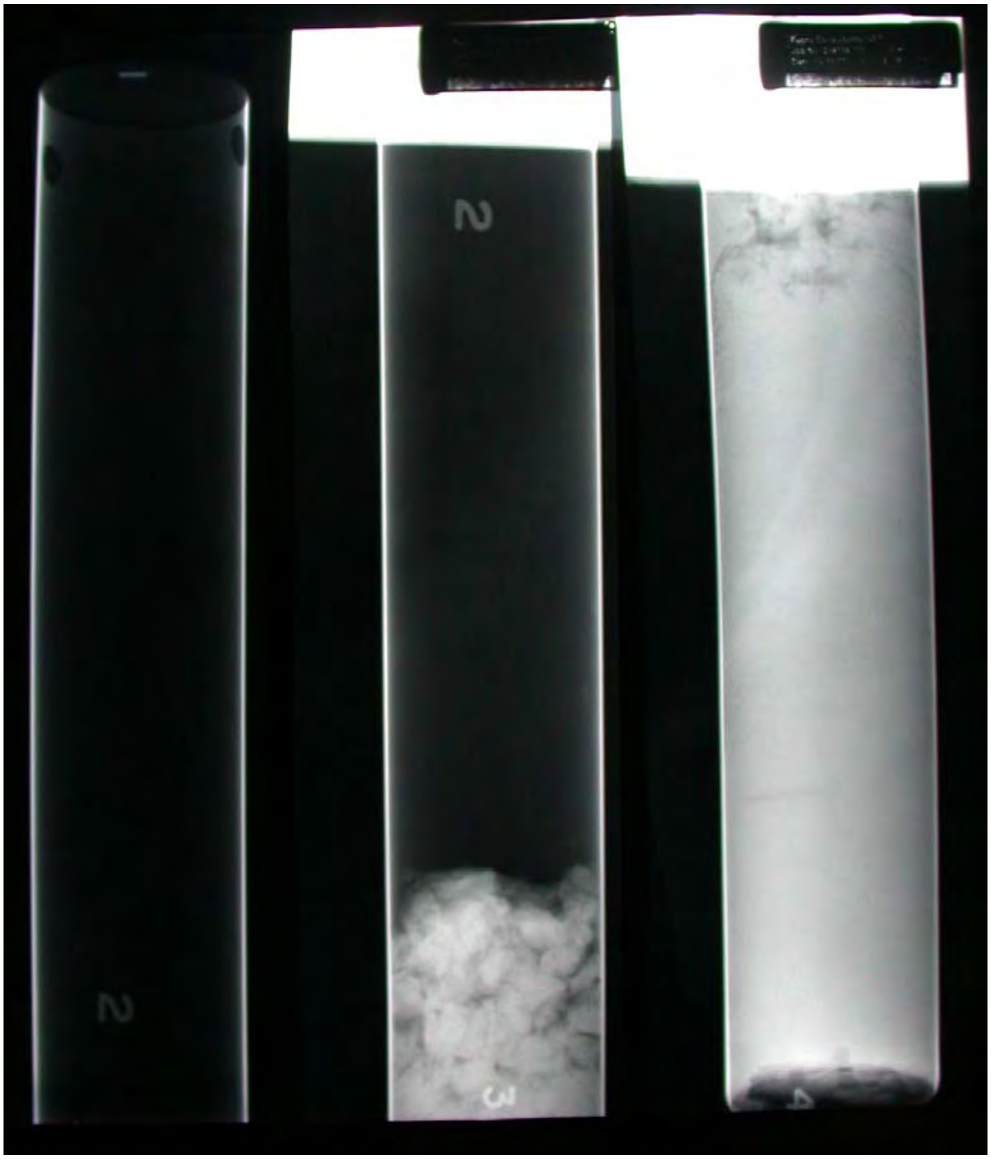
4.0 LIMITATIONS

Our services consist of laboratory testing and data evaluations that are made in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

The test data provided in this appendix are from laboratory testing performed on samples from subsurface explorations by others. The explorations indicate subsurface conditions only at specific locations and times, and only to the depths penetrated. Variations may exist and conditions not observed or described in this report could be encountered during construction. Our laboratory tests results presented in this appendix are based on the standards and procedures indicated herein. HMM/Bechtel provided the laboratory test assignments.

This appendix has been prepared for the exclusive use of HMM/Bechtel and their consultants for specific application to the SVRT project as described herein. In the event that there are any changes in the ownership, nature, design, or location of the proposed project, or if any future additions are planned, the results contained in this appendix should not be considered valid unless: 1) the project changes are reviewed by Fugro, and 2) results presented in this appendix are modified or verified in writing. Reliance on this report by others must be at their risk unless we are consulted on the use or limitations. We cannot be responsible for the impacts of any changes in geotechnical standards, practices, or regulations subsequent to performance of services without our further consultation. We can neither vouch for the accuracy of information supplied by others, nor accept consequences for unconsulted use of segregated portions of this report.

FIGURES

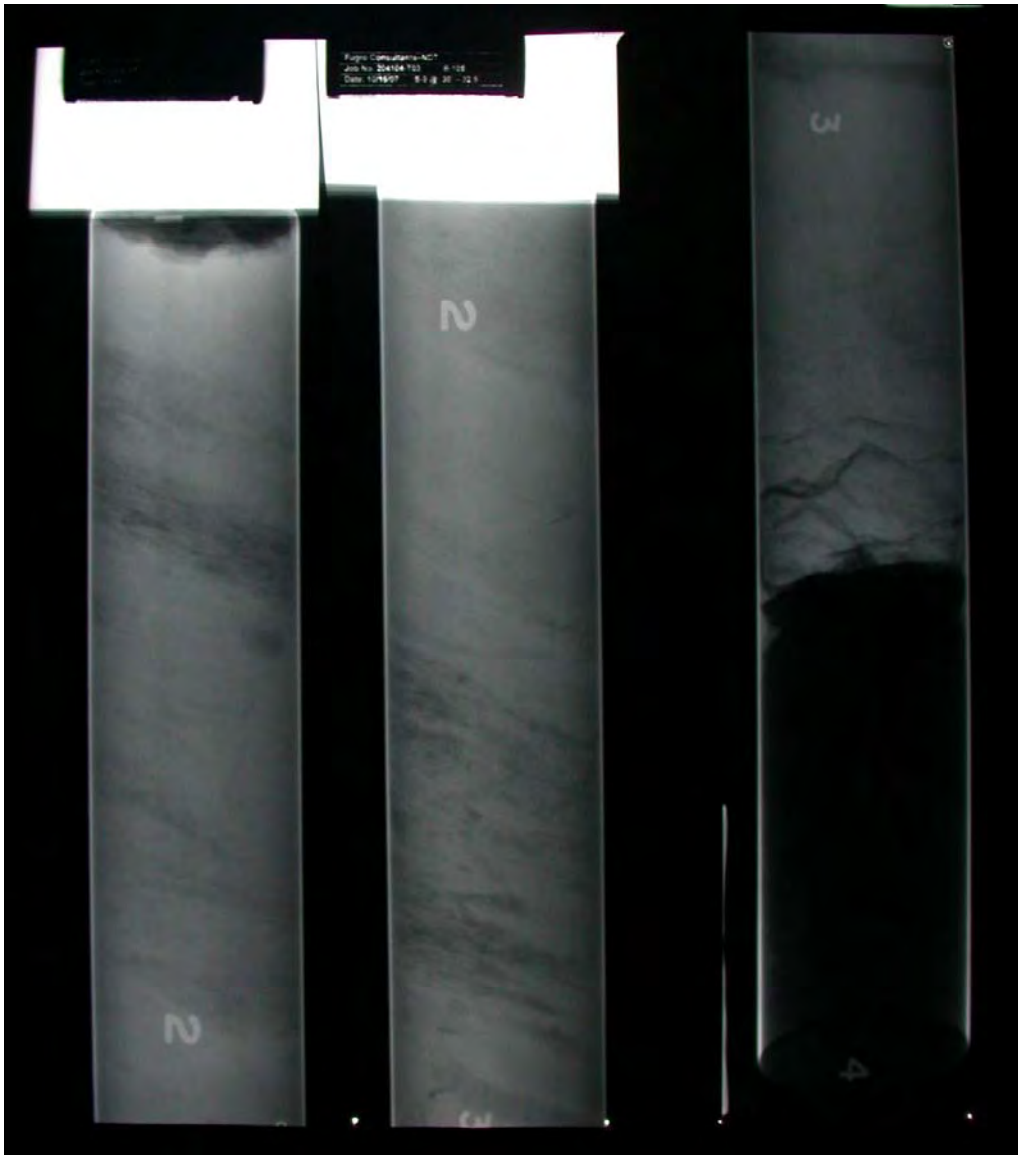


X-Ray of Sample No. 11, Boring B-90

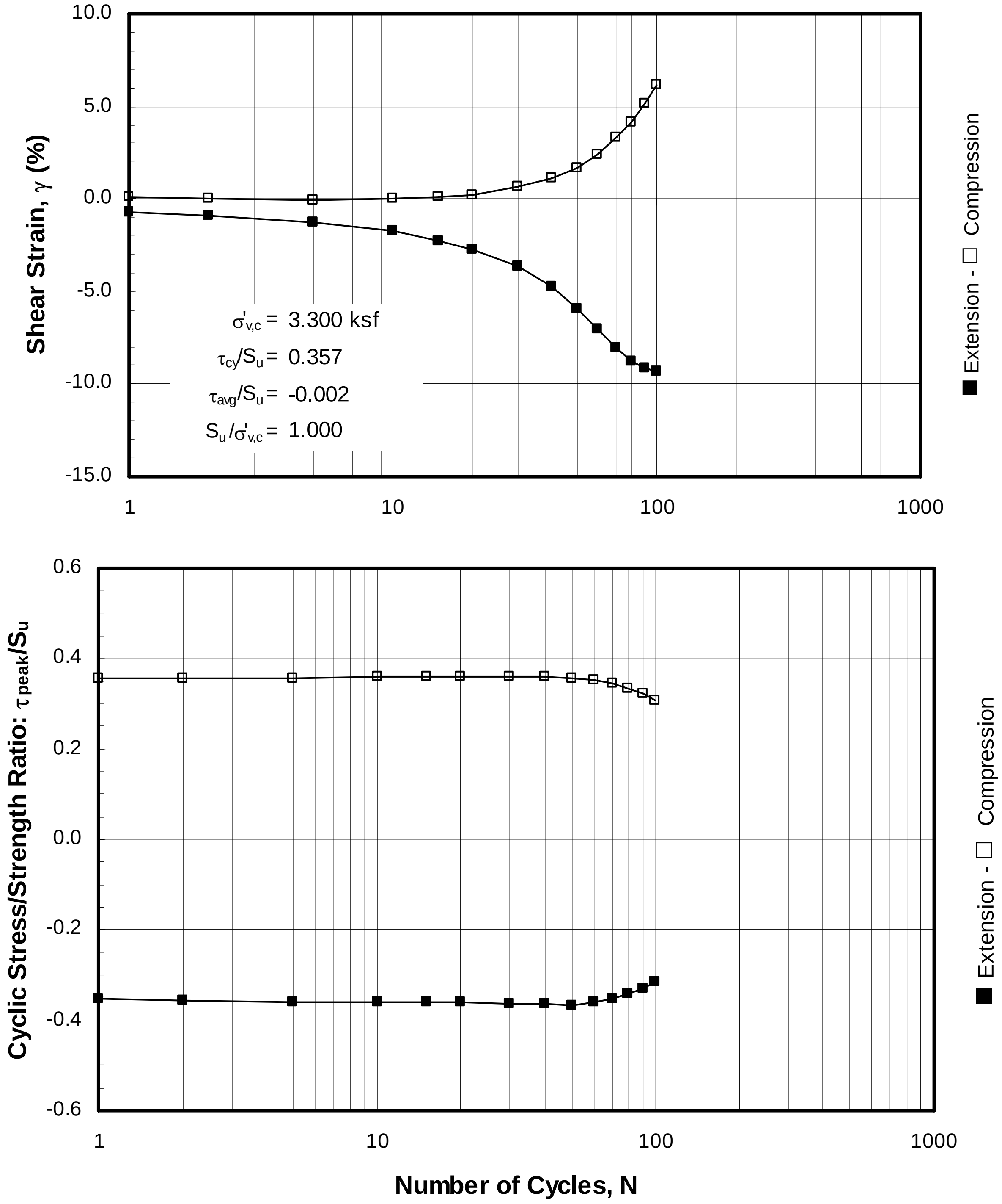
X-Ray of Sample No. 17, Boring B-90

X-Ray of Sample No. 10, Boring B-91

Figure A5-3



X-Ray of Sample No. 19, Boring B-105

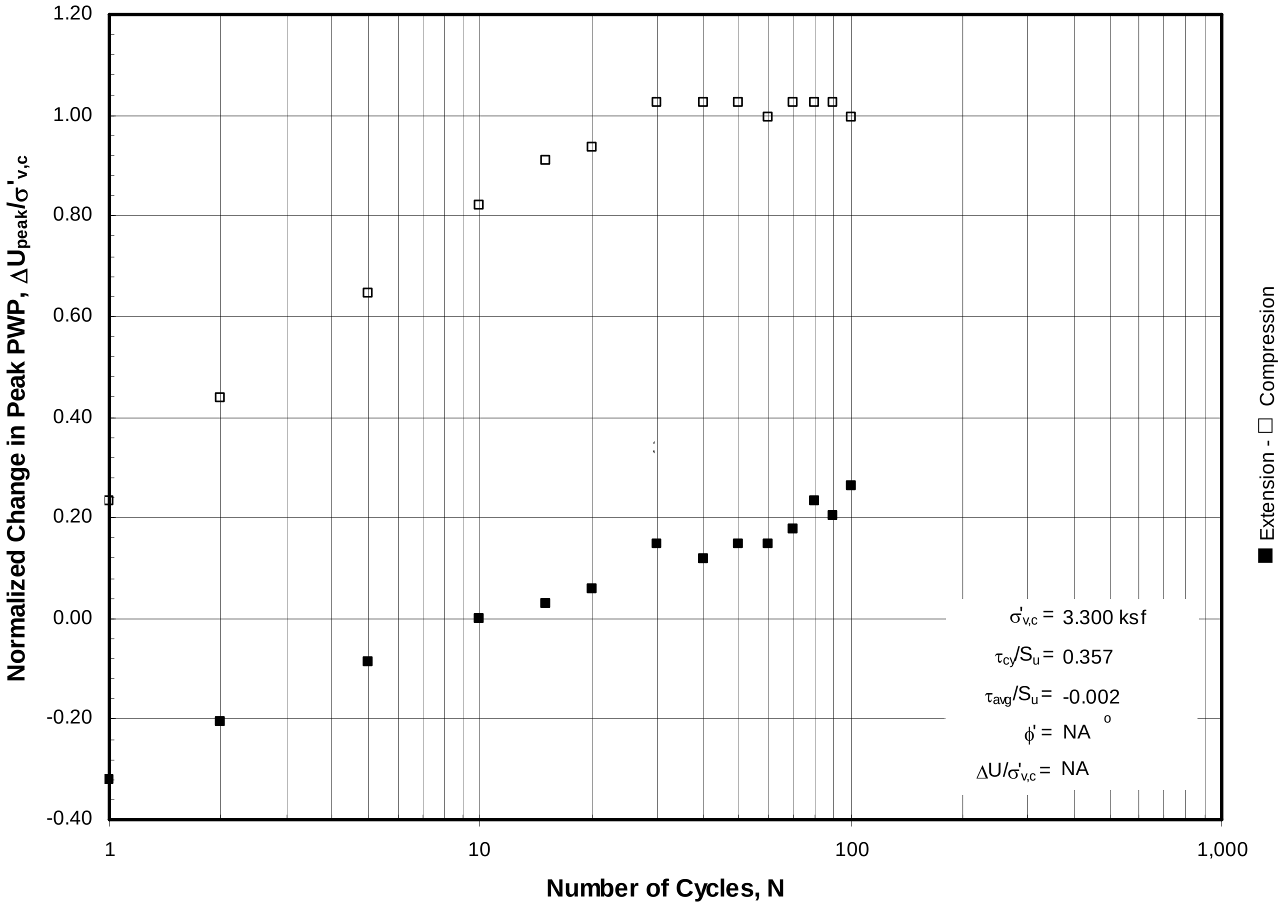


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-11a - Depth: 37.50 ft.

Boring BH-90

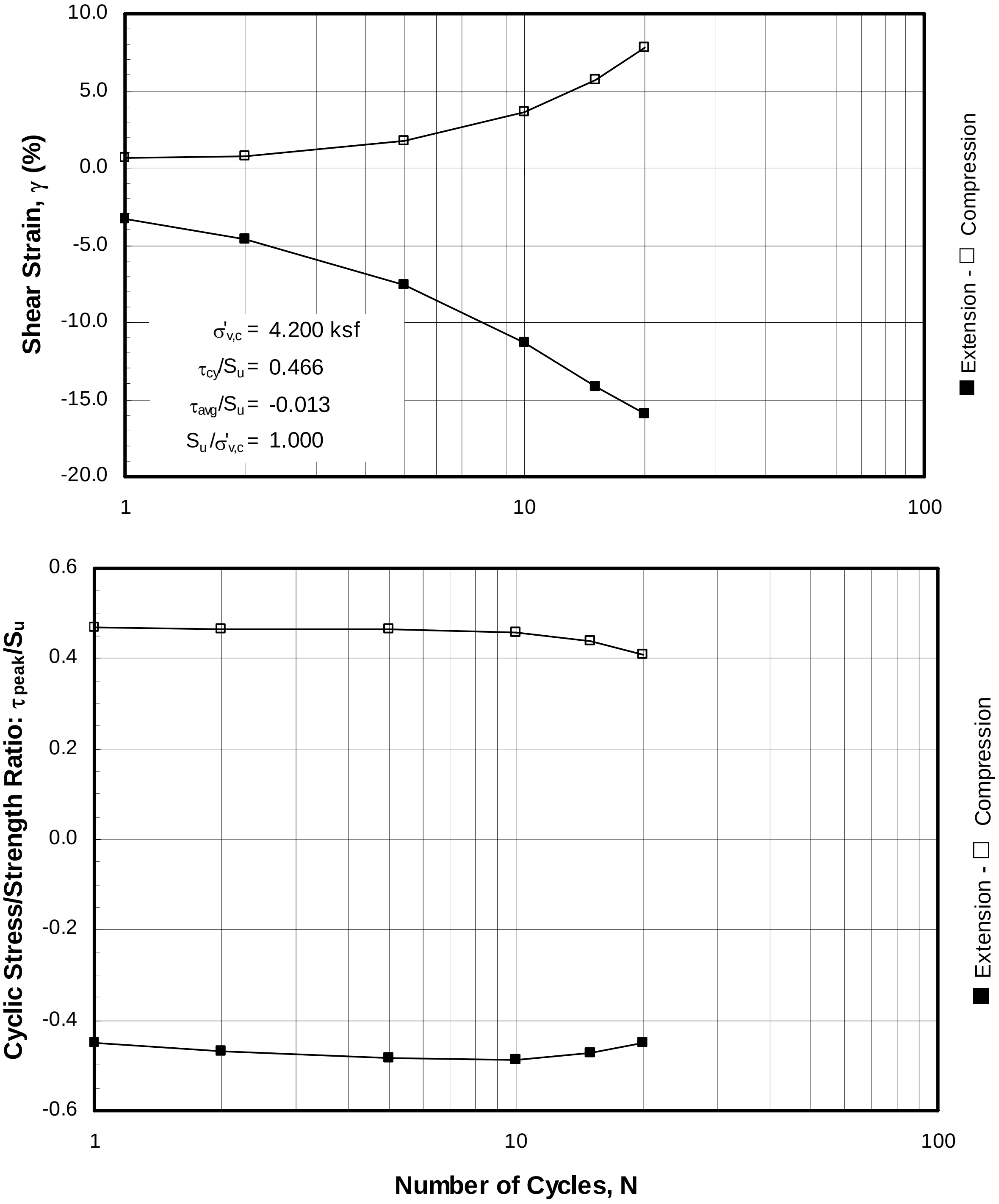


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-11a - Depth: 37.50 ft.

Boring BH-90

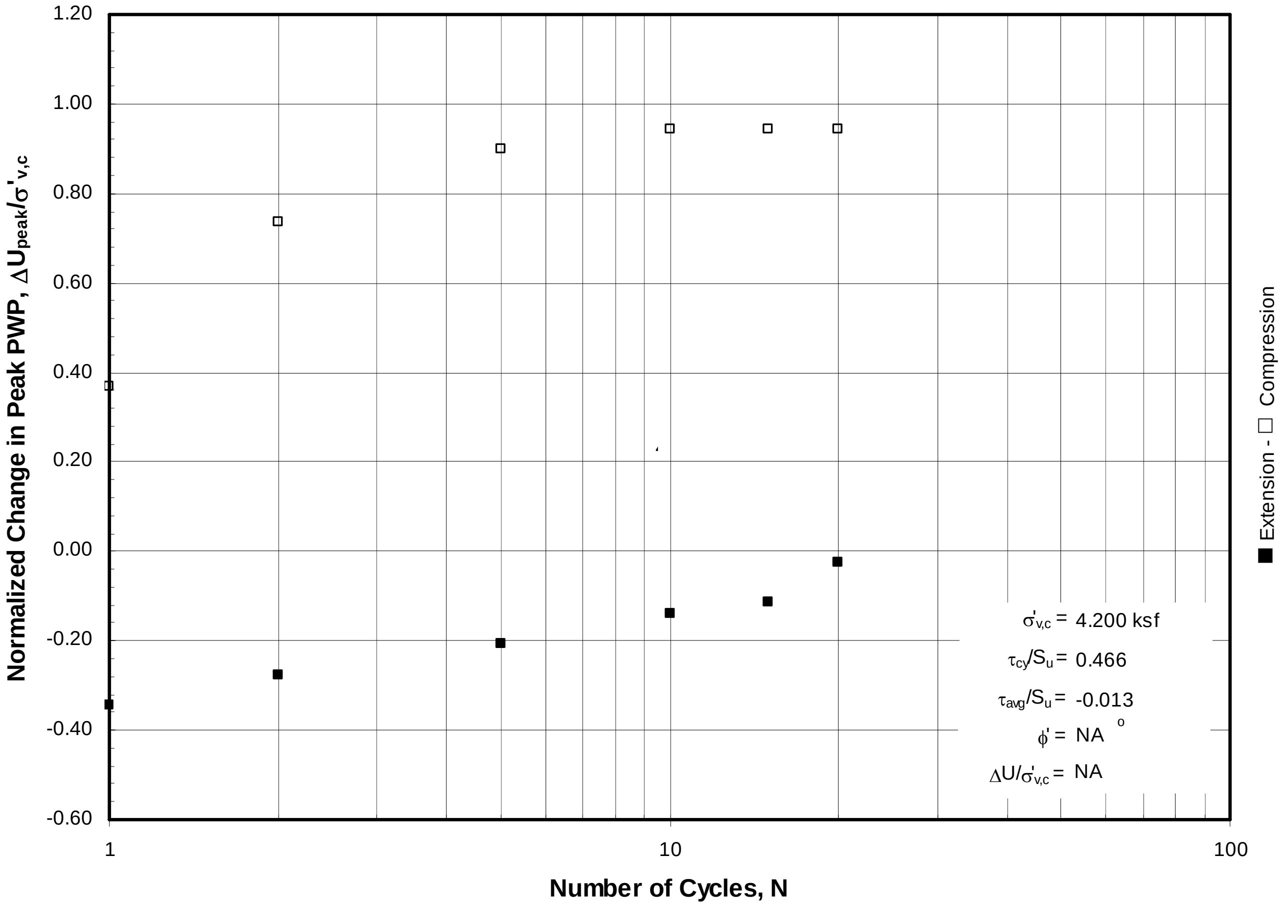


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-17c - Depth: 52.50 ft.

Boring BH-90

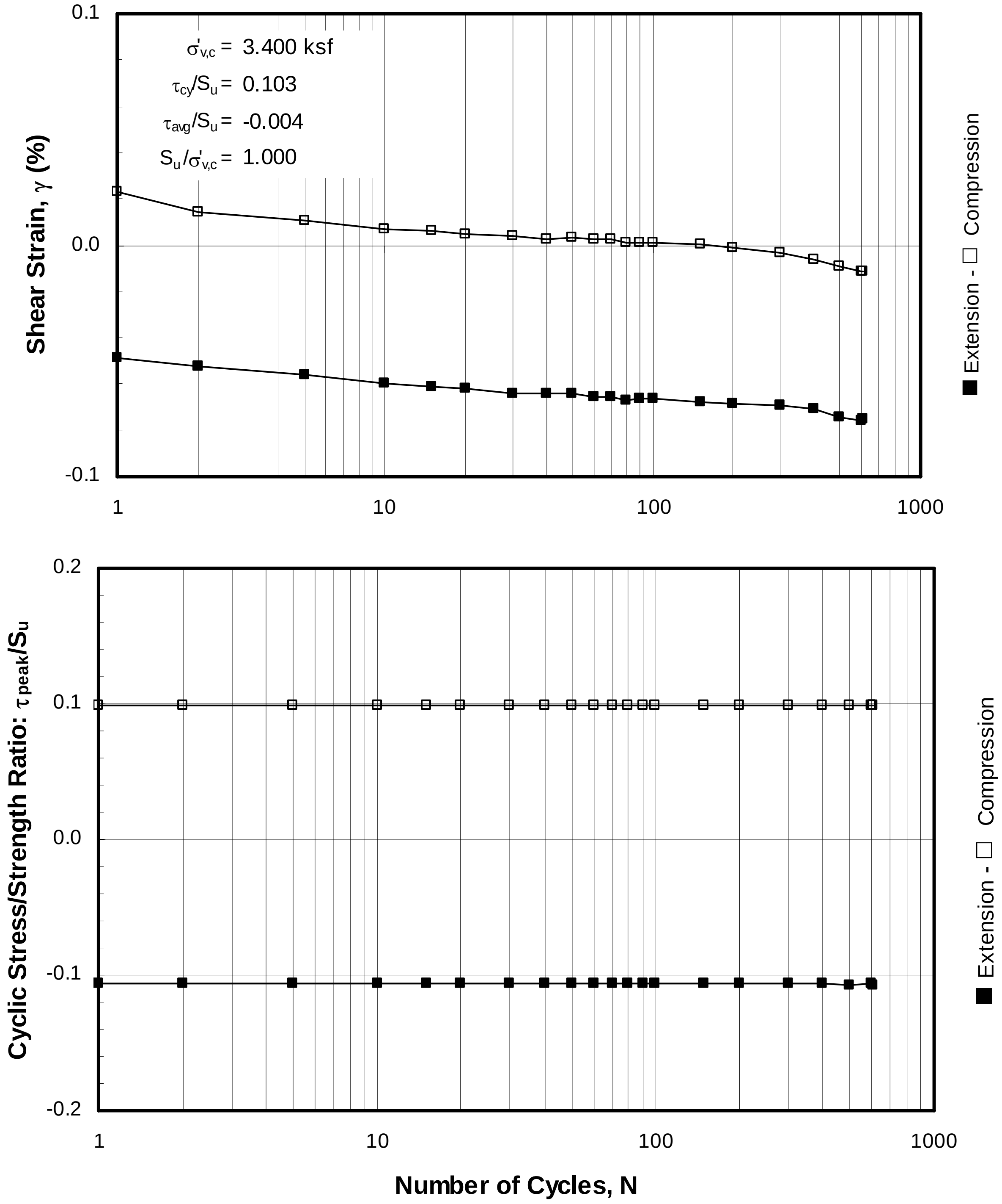


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-17c - Depth: 52.50 ft.

Boring BH-90

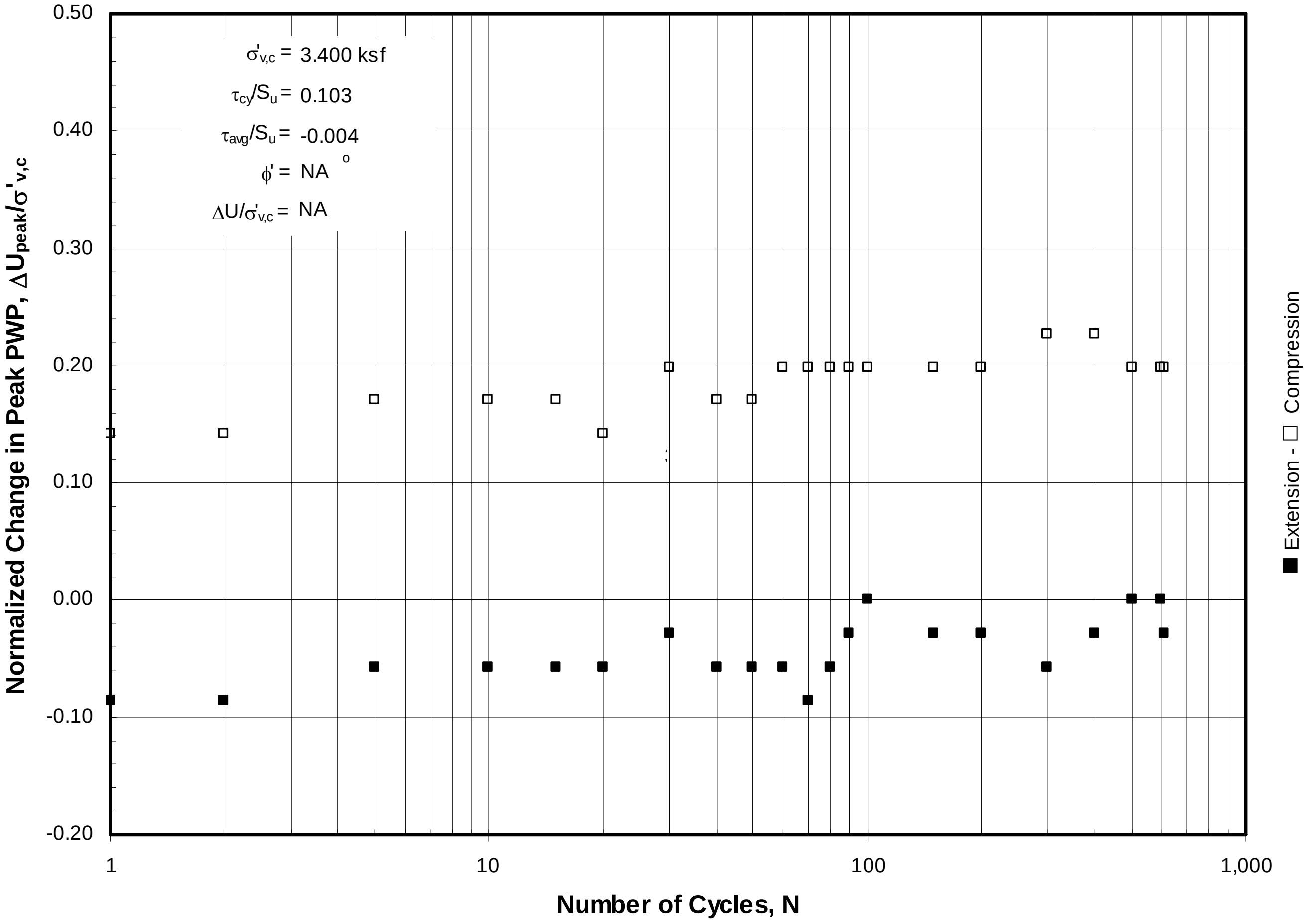


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-10a - Depth: 38.90 ft.

Boring BH-91

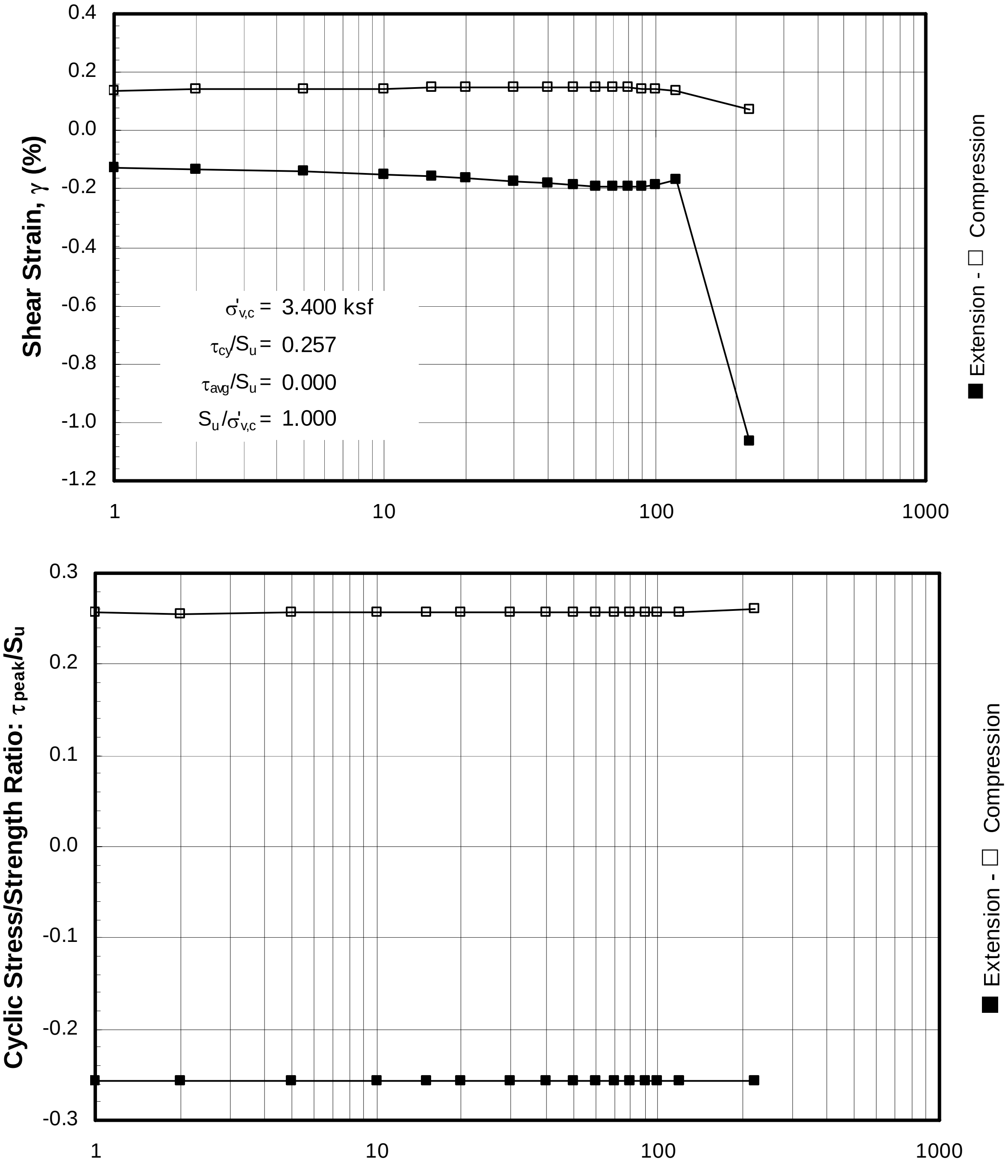


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz
Sample: S-10a - Depth: 38.90 ft.
Boring BH-91

Central Area Guideway of SVRT Project
San Jose, California

Figure A5-7b

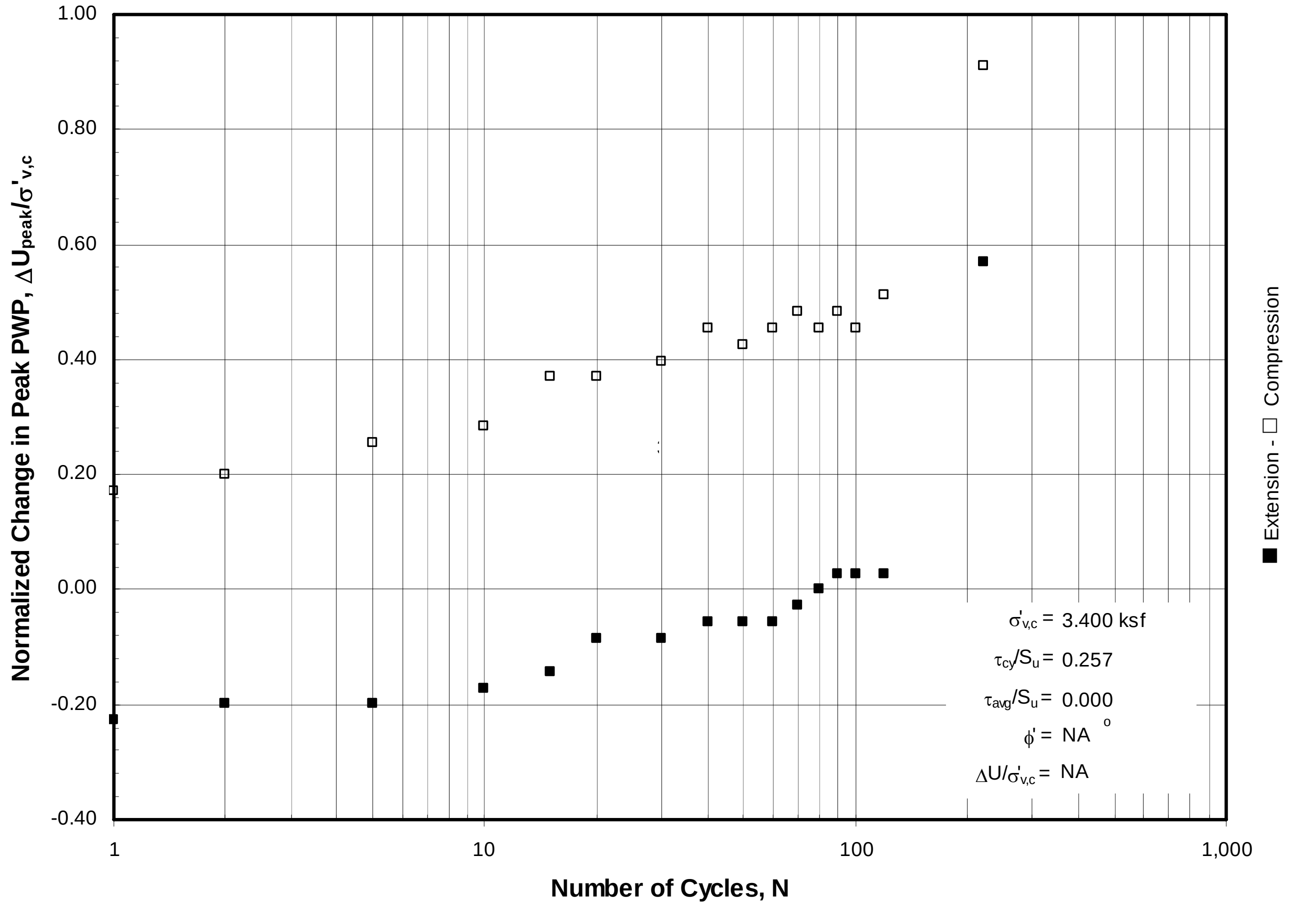


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

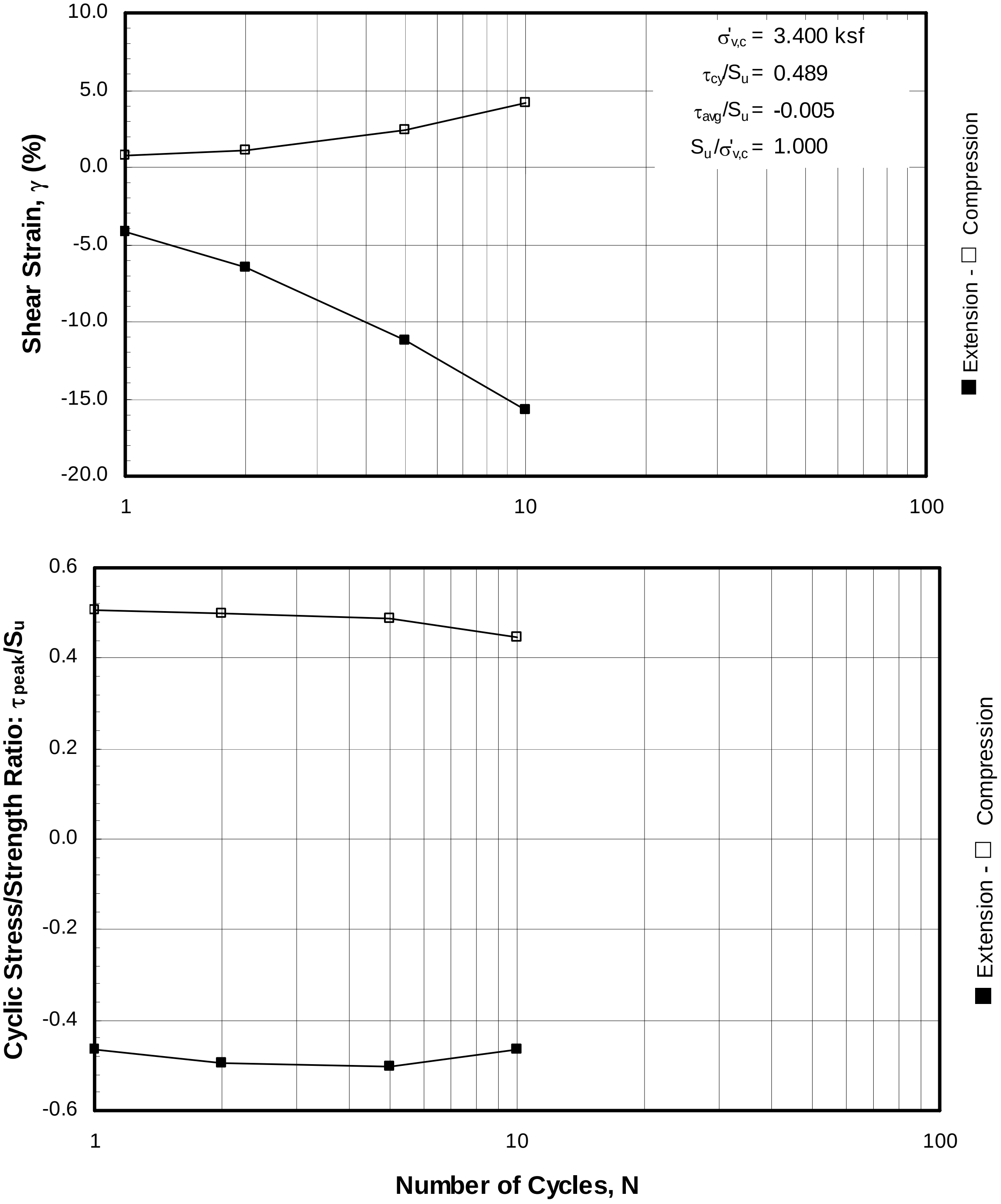
Sample: S-10b - Depth: 38.50 ft.

Boring BH-91



CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz
Sample: S-10b - Depth: 38.50 ft.
Boring BH-91

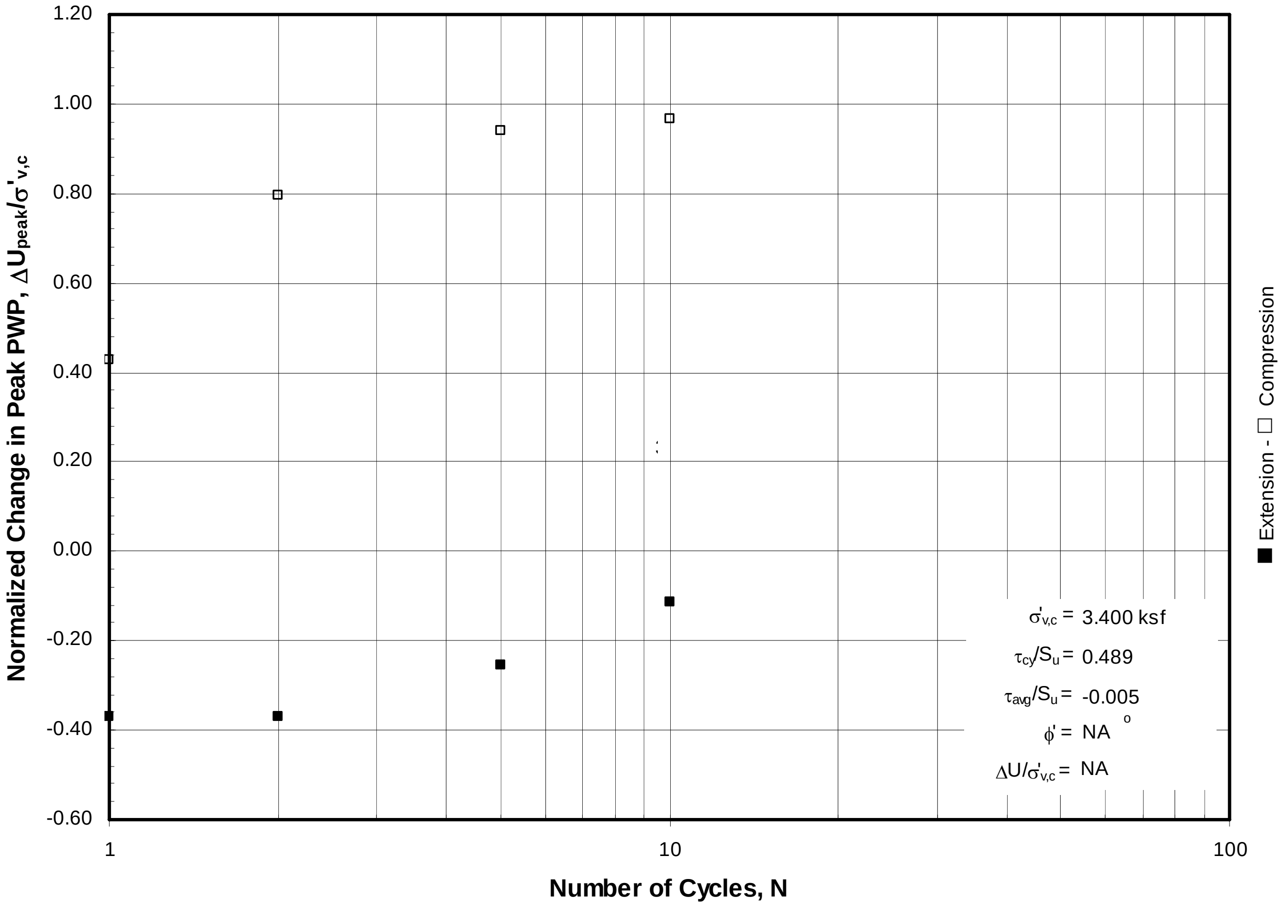


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

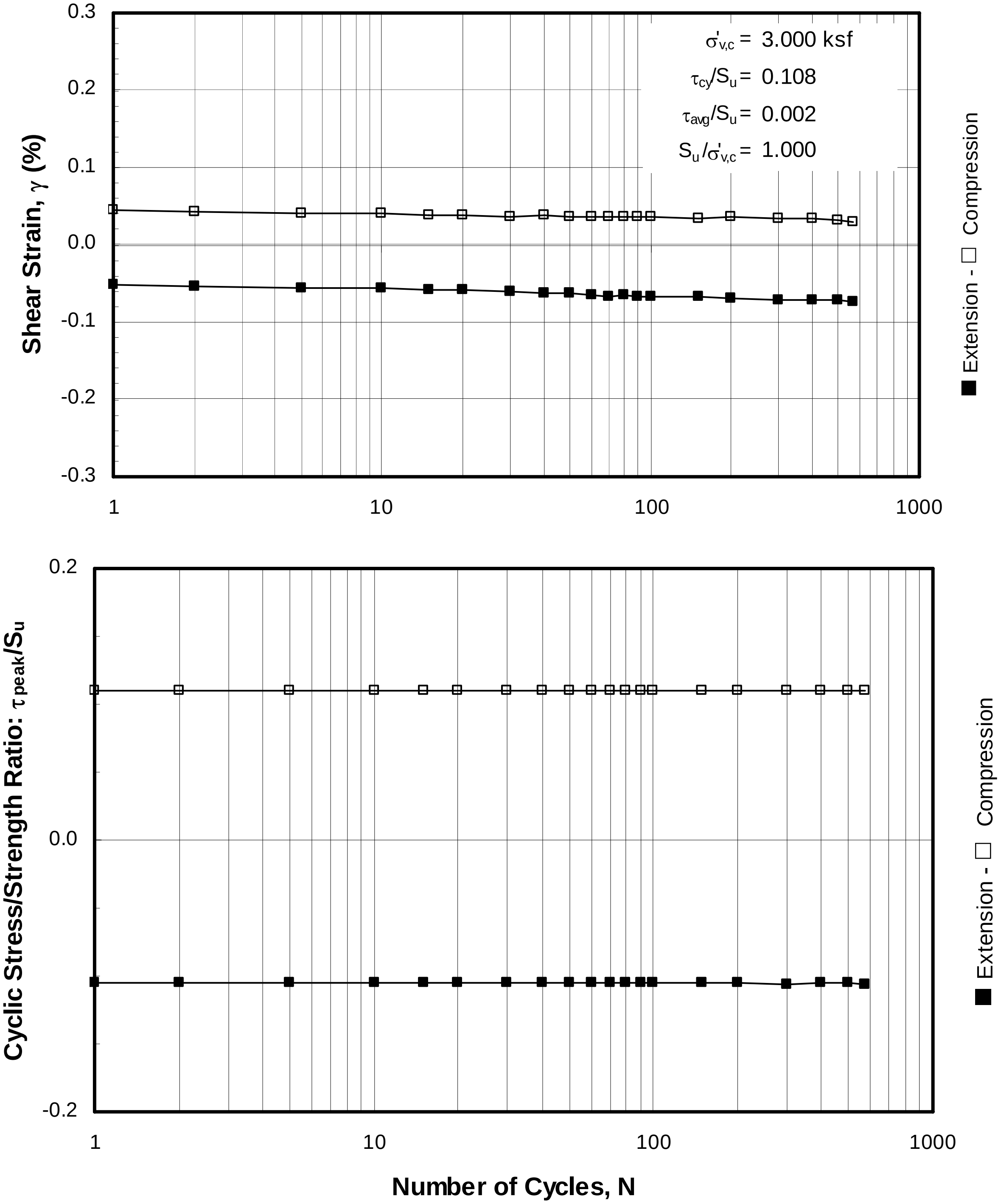
Sample: S-10c - Depth: 38.10 ft.

Boring BH-91



CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz
Sample: S-10c - Depth: 38.10 ft.
Boring BH-91

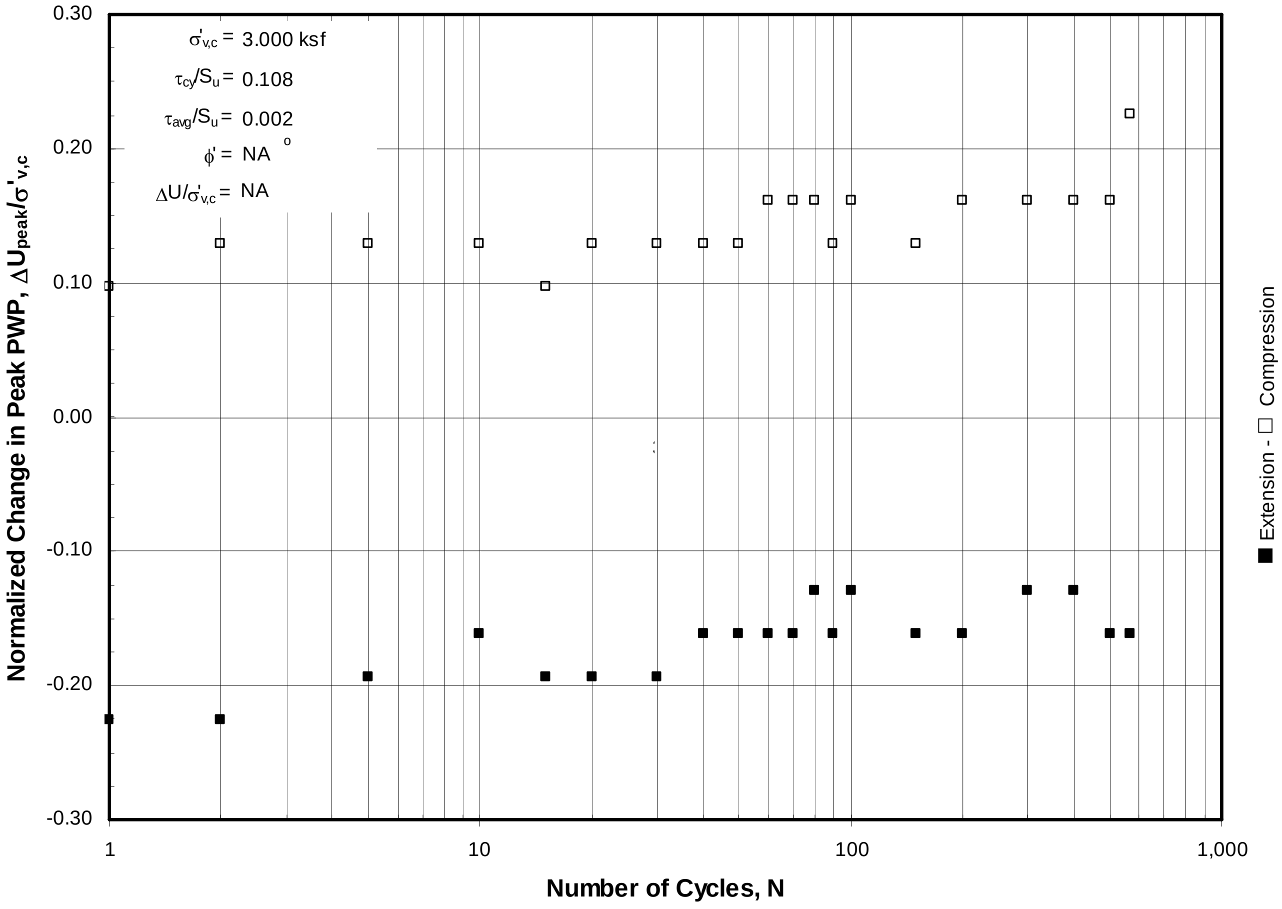


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-9a - Depth: 32.45 ft.

Boring BH-105

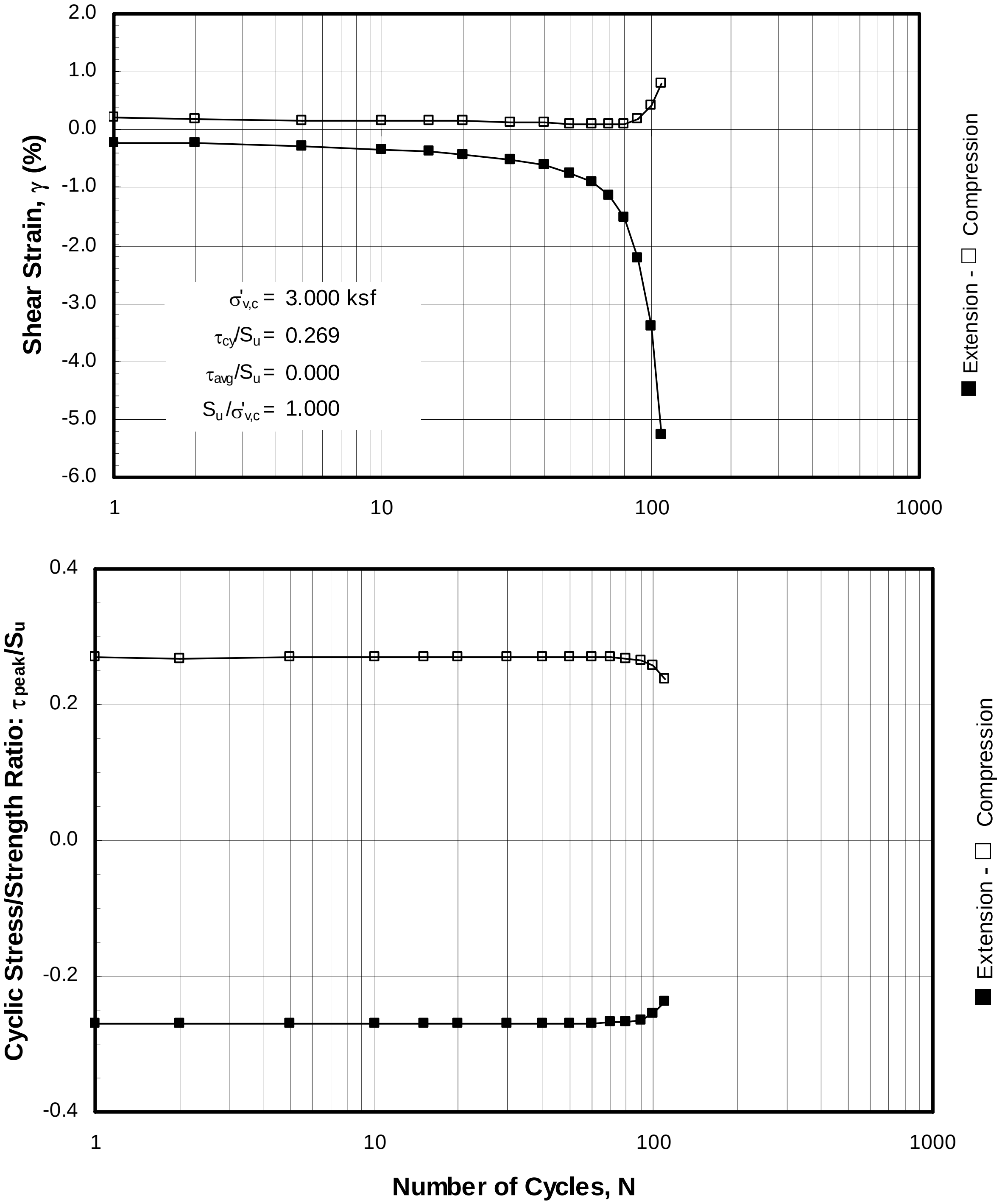


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

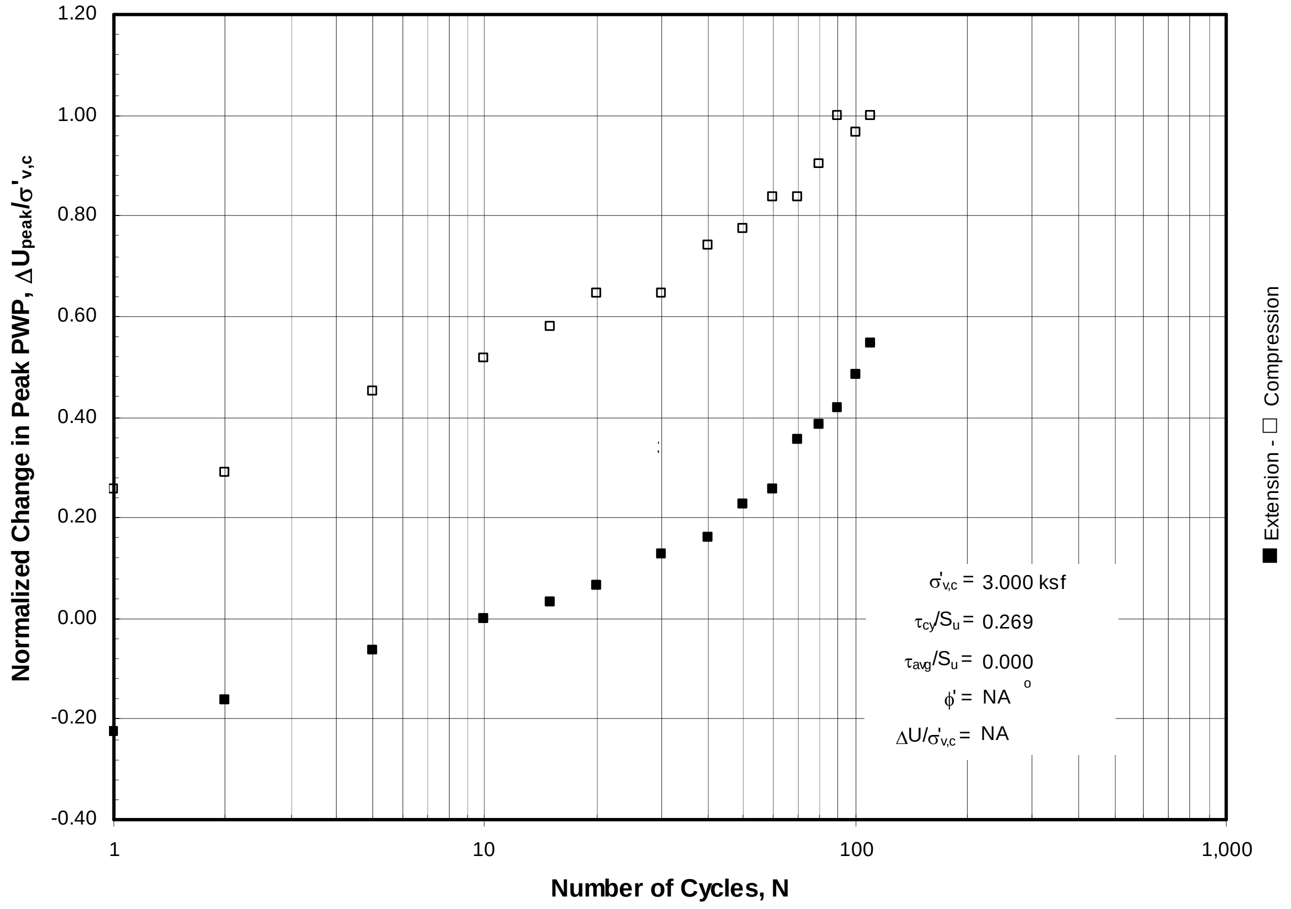
Sample: S-9a - Depth: 32.45 ft.

Boring BH-105



CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz
Sample: S-9b - Depth: 32.05 ft.
Boring BH-105

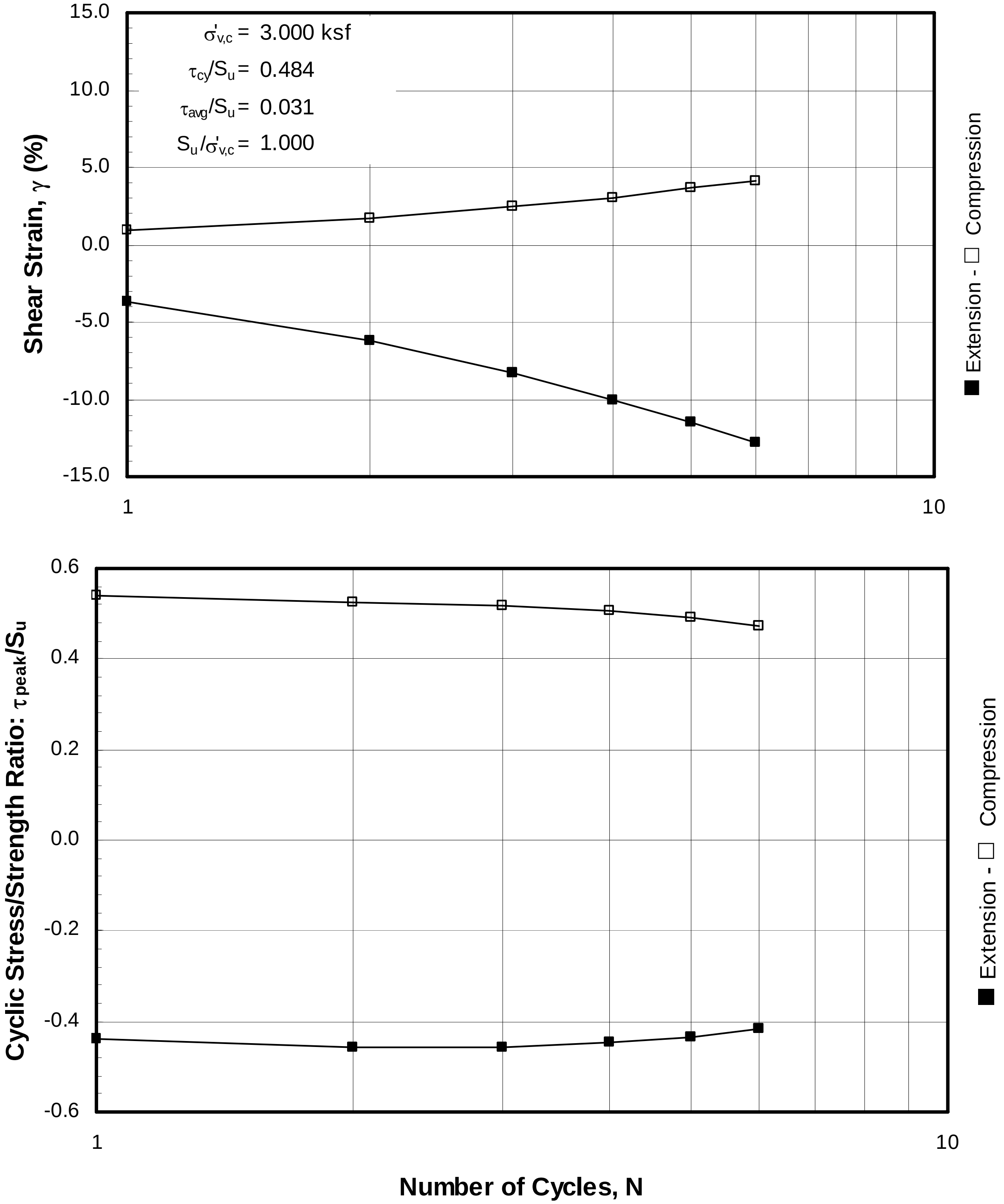


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-9b - Depth: 32.05 ft.

Boring BH-105

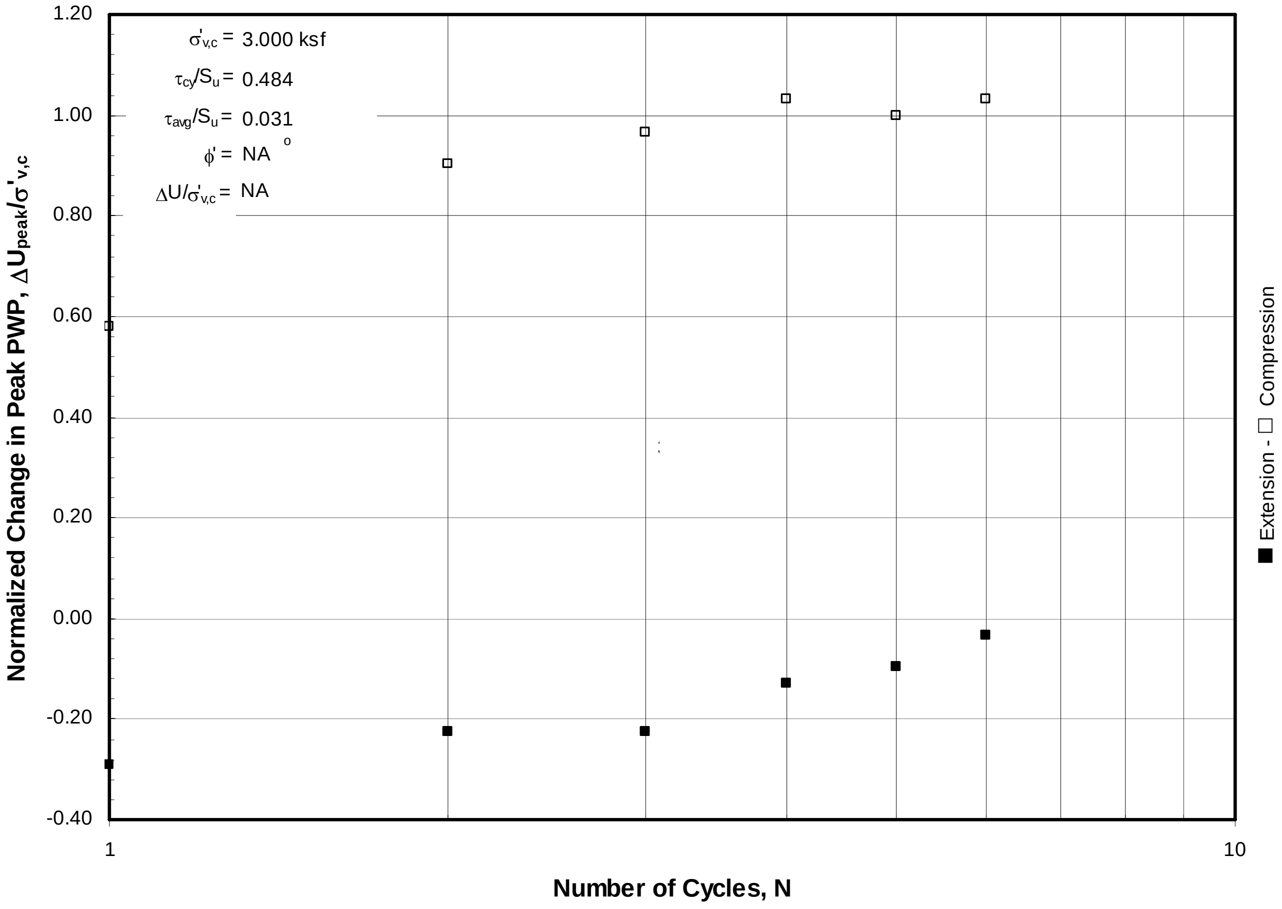


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-9c - Depth: 31.65 ft.

Boring BH-105

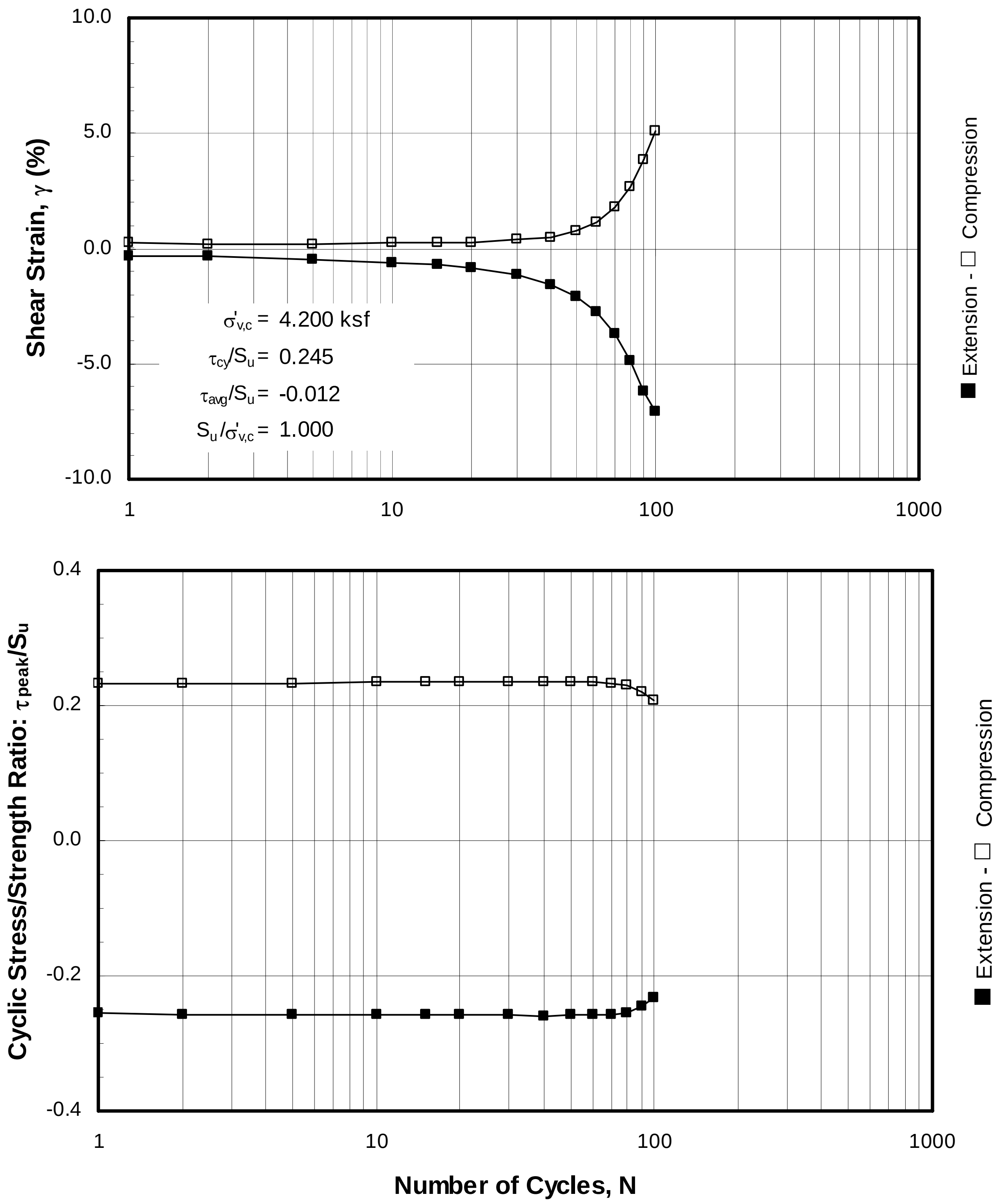


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-9c - Depth: 31.65 ft.

Boring BH-105

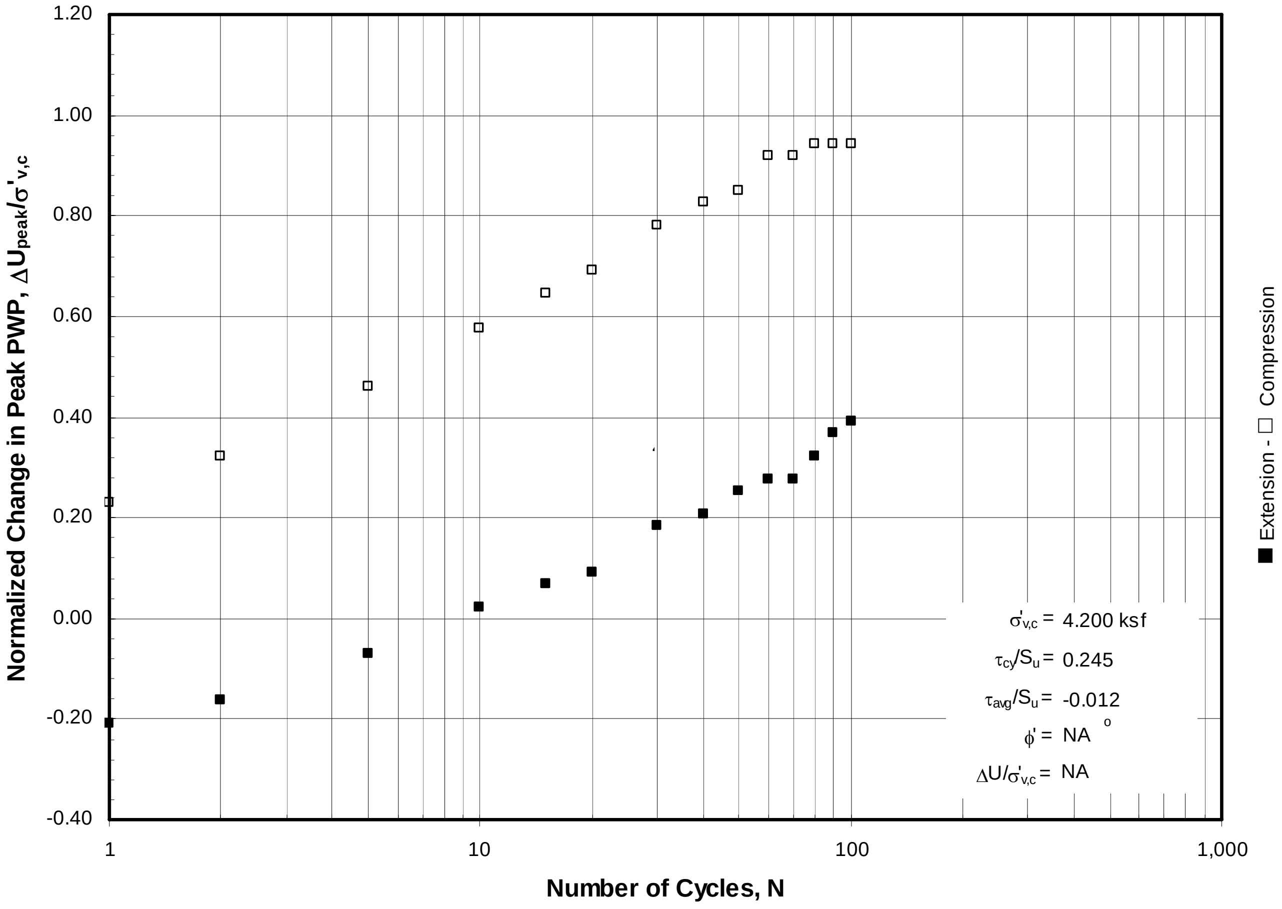


CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-17d - Depth: 52.10 ft.

Boring BH-90



CYCLIC TRIAXIAL STRENGTH TEST: With Undrained Bias Stress

Isotropic Consolidation - OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-17d - Depth: 52.10 ft.

Boring BH-90

Central Area Guideway of SVRT Project
San Jose, California

Figure A5-13b

Date Assigned: 10/22/2007

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX: ASTM D 4318

Project Number: 1637-001
Task Number:
Project Name:
Visual Identification: Lean Clay or Silty clay brown & gray with some sand

Test Spec. from Eng. Property Test:
☒ Yes; ☐ Trimmings; ☒ Spec.
Type Test: CyCU ta=0

Boring No.: BH-90
Sample No.: S-17d
Penetration/Depth (ft): 52.1
Test No.: of

Signs of organic soil behavior: ☐ No; ☐ Yes (spongy PL; signs of oxidation; organic fibers; black color, humus odor)

INITIAL VISUAL USCS GROUP SYMBOL (1):

SPECIMEN PREPARATION			
Wet	✓	Washed on # 40 Sieve	
Dry (Air)		Dry Sieved on # 40 Sieve	
Dry (Oven)		Mechanically Pushed Through # 40 Sieve	✓
Mixed on Glass Plate and Removed Medium Plus Sand Particles			
Mixing water	✓	Distilled;	☐ Demineralized; or other

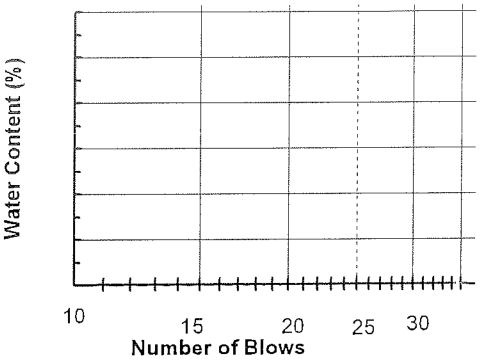
TESTING EQUIPMENT USED		
Plastic Limit:	Hand Rolled	✓
	Between Glass Plates	
	Mechanical Rolling Device	
Liquid Limit:	Manual	✓
Apparatus No. ( )	Mechanical	
Casagrande / ASTM	Metal	
Grooving Tool:	Plastic	✓

AS-RECEIVED WATER CONTENT (OVEN DRIED)

Container No.			
Mass Moist Soil + Container, M1 (g)			
Mass Dry Soil + Container, M2 (g)			Average
Mass Container, M3 (g)			
WATER CONTENT, w_o (%)			

Circle Approximate Max. Grain Size in "Sample": 3" 1-1/2" 3/4" 3/8" 3/8" #4 #10 <#10

Flow Curve



PLASTIC LIMIT

Container No.	3	4		
Mass Moist Soil + Container, M1 (g)	8.81	9.14		
Mass Dry Soil + Container, M2 (g)	7.49	7.76		
Mass Container, M3 (g)	1.27	1.27		Average
WATER CONTENT, w (%)	21.2	21.3		21

LIQUID LIMIT

Container No.	1	2		
Mass Moist Soil + Container, M1 (g)	9.68	10.17		
Mass Dry Soil + Container, M2 (g)	7.67	8.05		
Mass Container, M3 (g)	1.27	1.27		
WATER CONTENT, w (%)	31.4	31.3		
NUMBER OF BLOWS, N	21	22		Average
LIQUID LIMIT, ASTM SINGLE POINT				31

LINEAR REGRESSION ANALYSIS	
w at N = 25 Blows	
Coef. of Determination, r^2	

Recommended range of Blow Count for Multiple Point Method A :
15 to 25, 20 to 30, and 25 to 35.
Recommended range of Blow Count for Single Point Method B:
20 to 30.

w_o or w = ((M1-M2) / (M2-M3)) × 100
LL = Water Content at N=25 blows, from Flow Curve.
LL by Single Point = w × $(N / 25)^{0.121}$
PI = LL - PL
LI = (w_o - PL) / (LL - PL)

NOTES: (1) USCS: Unified Soil Classification System.
(2) Wet = Wet Preparation Method, and Dry = Dry Preparation Method

REMARKS:

SUMMARY

TEST METHOD (2) A ☐ B ✓ Wet ✓ Dry ☐	
AS-RECEIVED WATER CONTENT, w_o (%)	
LIQUID LIMIT, LL	31
PLASTIC LIMIT, PL	21
PLASTICITY INDEX, PI	10
LIQUIDITY INDEX, LI	
PERCENTAGE POINTS ABOVE/BELOW A-LINE	
PLASTICITY CHART CLASSIFICATION	

Prepared By: VLH Date: 1-22-8
Tested By: LR Date: 1-23-08
Dry Masses By: CR 1/24
Calculated By: cy 1·24·08
Spot Checked By: KB 1-24-08
Reviewed By:

207.1 (11/30/07)
HandLimits.xls, Hand 1/21/2008
FUGRO CONSULTANTS, INC.

Date Assigned: 10/22/2007

LAC on Sandy lean Clay

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX: ASTM D 4318

Project Number: 1637-001
Task Number:
Project Name:
Visual Identification: Cl fi Sa dk g W/ few Si pkts

Test Spec. from Eng. Property Test:
☒ Yes; ☐ Trimmings; ☒ Spec.
Type Test: CyCU ta=0

Boring No.: BH-91
Sample No.: S-10a
Penetration/Depth (ft): 38.9
Test No.: of

Signs of organic soil behavior: ☐ No; ☐ Yes (spongy PL; signs of oxidation; organic fibers; black color, humus odor)

INITIAL VISUAL USCS GROUP SYMBOL (1):

SPECIMEN PREPARATION			
Wet	✓	Washed on # 40 Sieve	
Dry (Air)		Dry Sieved on # 40 Sieve	
Dry (Oven)		Mechanically Pushed Through # 40 Sieve	✓
Mixed on Glass Plate and Removed Medium Plus Sand Particles			
Mixing water	✓	Distilled; ☐ Demineralized; or other	

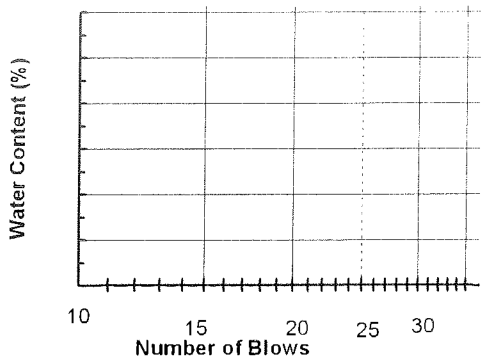
TESTING EQUIPMENT USED		
Plastic Limit:	Hand Rolled	✓
	Between Glass Plates	
	Mechanical Rolling Device	
Liquid Limit:	Manual	✓
Apparatus No. ( )	Mechanical	
Casagrande / ASTM	Metal	
Grooving Tool:	Plastic	✓

AS-RECEIVED WATER CONTENT (OVEN DRIED)

			Average
Container No.			
Mass Moist Soil + Container, M1 (g)			
Mass Dry Soil + Container, M2 (g)			
Mass Container, M3 (g)			
WATER CONTENT, w_o (%)			

Circle Approximate Max. Grain Size in "Sample": 3" 1-1/2" 3/4" 3/8" 3/8" #4 #10 <#10

Flow Curve



PLASTIC LIMIT

				Average
Container No.	19	20		
Mass Moist Soil + Container, M1 (g)	8.12	7.90		
Mass Dry Soil + Container, M2 (g)	6.95	6.85		
Mass Container, M3 (g)	1.32	1.34		
WATER CONTENT, w (%)	19.0	19.0		19

LIQUID LIMIT

					Average
Container No.	17	18			
Mass Moist Soil + Container, M1 (g)	15.20	17.68			
Mass Dry Soil + Container, M2 (g)	12.36	14.24			
Mass Container, M3 (g)	1.32	1.32			
WATER CONTENT, w (%)	26.6	26.6			
NUMBER OF BLOWS, N	23	25			
LIQUID LIMIT, ASTM SINGLE POINT					26

LINEAR REGRESSION ANALYSIS	
w at N = 25 Blows	
Coef. of Determination, r^2	

Recommended range of Blow Count for Multiple Point Method A : 15 to 25, 20 to 30, and 25 to 35.
Recommended range of Blow Count for Single Point Method B: 20 to 30.

w_o or $w = ((M1-M2) / (M2-M3)) \times 100$
LL = Water Content at N=25 blows, from Flow Curve.
LL by Single Point = $w \times (N / 25)^{0.121}$
PI = LL - PL
LI = (w_o - PL) / (LL - PL)

SUMMARY

TEST METHOD (2) A ☐ B ✓ Wet ✓ Dry ☐	
AS-RECEIVED WATER CONTENT, w_o (%)	
LIQUID LIMIT, LL	26
PLASTIC LIMIT, PL	19
PLASTICITY INDEX, PI	7
LIQUIDITY INDEX, LI	
PERCENTAGE POINTS ABOVE/BELOW A-LINE	
PLASTICITY CHART CLASSIFICATION	

NOTES: (1) USCS: Unified Soil Classification System.
(2) Wet = Wet Preparation Method, and Dry = Dry Preparation Method

REMARKS: Maybe NON-Plastic

Checked By: PK 11-15-07
Prepared By: VLH
Date: 11-12-7
Dry Masses By: CR 11/14
Spot Checked By:
Tested By: CR
Date: 11/12
Calculated By: cj 11.14.07
Reviewed By:

207.1 (10/01/07) HandLimits.xls, Hand 10/23/2007 **FUGRO CONSULTANTS, INC.**

Date Assigned: 10/22/2007

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX: ASTM D 4318

Project Number: 1637-001

Task Number:

Project Name:

Test Spec. from Eng. Property Test:
☒ Yes; ☐ Trimmings; ☒ Spec.
Type Test: CyCU ta=0

Boring No.: BH-105

Sample No.: S-9a

Penetration/Depth (ft): 32.45

Test No.: of

Visual Identification: CL DK Grny w/ Si; f; Sa PBS, organics

Signs of organic soil behavior: ☑ No; ☐ Yes (spongy PL; signs of oxidation; organic fibers; black color, humus odor)

INITIAL VISUAL USCS GROUP SYMBOL (1):	

SPECIMEN PREPARATION		
Wet	✓	Washed on # 40 Sieve ☐
Dry (Air)	☐	Dry Sieved on # 40 Sieve ☐
Dry (Oven)	☐	Mechanically Pushed Through # 40 Sieve ✓
Mixed on Glass Plate and Removed Medium Plus Sand Particles ☐		
Mixing water ☐	Distilled; ✓	Demineralized; or other

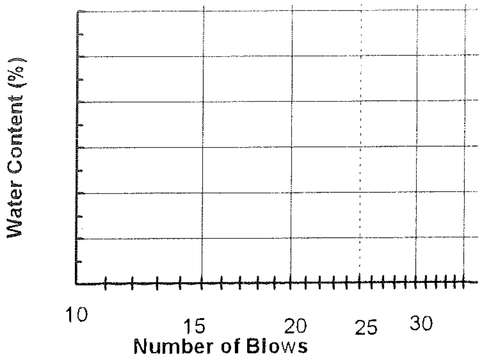
TESTING EQUIPMENT USED		
Plastic Limit:	Hand Rolled	✓
	Between Glass Plates	
	Mechanical Rolling Device	
Liquid Limit:	Manual	✓
Apparatus No. ( )	Mechanical	
Casagrande / ASTM	Metal	
Grooving Tool:	Plastic	✓

AS-RECEIVED WATER CONTENT (OVEN DRIED)

			Average
Container No.			
Mass Moist Soil + Container, M1 (g)			
Mass Dry Soil + Container, M2 (g)			
Mass Container, M3 (g)			
WATER CONTENT, w_o (%)			

Circle Approximate Max. Grain Size in "Sample": 3" 1-1/2" 3/4" 3/8" 3/8" #4 #10 <#10

Flow Curve



PLASTIC LIMIT

				Average
Container No.	11	12		
Mass Moist Soil + Container, M1 (g)	8.24	8.14		
Mass Dry Soil + Container, M2 (g)	7.02	6.95		
Mass Container, M3 (g)	1.27	1.29		
WATER CONTENT, w (%)	21.2	21.0		21

LIQUID LIMIT

					Average
Container No.	9	10			
Mass Moist Soil + Container, M1 (g)	12.01	11.23			
Mass Dry Soil + Container, M2 (g)	8.84	8.29			
Mass Container, M3 (g)	1.28	1.27			
WATER CONTENT, w (%)	41.9	41.9			
NUMBER OF BLOWS, N	26	27			
LIQUID LIMIT, ASTM SINGLE POINT					42

LINEAR REGRESSION ANALYSIS	
w at N = 25 Blows	
Coef. of Determination, r^2	

Recommended range of Blow Count for Multiple Point Method A :
15 to 25, 20 to 30, and 25 to 35.
Recommended range of Blow Count for Single Point Method B:
20 to 30.

w_o or w = ((M1-M2) / (M2-M3)) × 100
LL = Water Content at N=25 blows, from Flow Curve.
LL by Single Point = w × $(N / 25)^{0.121}$
PI = LL - PL
LI = (w_o - PL) / (LL - PL)

SUMMARY

TEST METHOD (2) A ☐ B ✓ Wet ✓ Dry ☐	
AS-RECEIVED WATER CONTENT, w_o (%)	
LIQUID LIMIT, LL	42
PLASTIC LIMIT, PL	21
PLASTICITY INDEX, PI	21
LIQUIDITY INDEX, LI	
PERCENTAGE POINTS ABOVE/BELOW A-LINE	
PLASTICITY CHART CLASSIFICATION	

NOTES: (1) USCS: Unified Soil Classification System.
(2) Wet = Wet Preparation Method, and Dry = Dry Preparation Method

REMARKS:

Checked By: PK 11-8

Prepared By: AC
Date: 11-5-07
Dry Masses By: CR 11/8
Spot Checked By:

Tested By: AC
Date: 11-7-07
Calculated By: CJ 11-8-07
Reviewed By:

Date Assigned: 10/22/2007

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX: ASTM D 4318

Project Number: 1637-001
Task Number:
Project Name:
Visual Identification: Clayey silty sand tan & gray

Test Spec. from Eng. Property Test: ☒ Yes; ☐ Trimmings; ☒ Spec.
Type Test: CyCU ta=0

Boring No.: BH-90
Sample No.: S-11a
Penetration/Depth (ft): 32.5
Test No.: of

Signs of organic soil behavior: ☑ No; ☐ Yes (spongy PL; signs of oxidation; organic fibers; black color, humus odor)

INITIAL VISUAL USCS GROUP SYMBOL (1):

SPECIMEN PREPARATION			
Wet	✓	Washed on # 40 Sieve	
Dry (Air)		Dry Sieved on # 40 Sieve	
Dry (Oven)		Mechanically Pushed Through # 40 Sieve	✓
Mixed on Glass Plate and Removed Medium Plus Sand Particles			
Mixing water	✓ Distilled;	☐ Demineralized; or other	

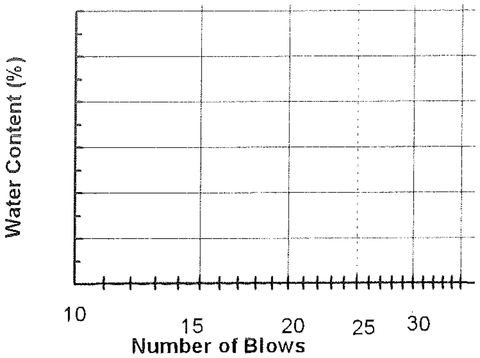
TESTING EQUIPMENT USED		
Plastic Limit:	Hand Rolled	✓
	Between Glass Plates	
	Mechanical Rolling Device	
Liquid Limit:	Manual	✓
Apparatus No. ( )	Mechanical	
Casagrande / ASTM	Metal	
Grooving Tool:	Plastic	✓

AS-RECEIVED WATER CONTENT (OVEN DRIED)

			Average
Container No.			
Mass Moist Soil + Container, M1 (g)			
Mass Dry Soil + Container, M2 (g)			
Mass Container, M3 (g)			
WATER CONTENT, w_o (%)			

Circle Approximate Max. Grain Size in "Sample": 3" 1-1/2" 3/4" 3/8" 3/8" #4 #10 <#10

Flow Curve



PLASTIC LIMIT

				Average
Container No.	31	32		
Mass Moist Soil + Container, M1 (g)	8.27	8.16		
Mass Dry Soil + Container, M2 (g)	7.15	7.02		
Mass Container, M3 (g)	1.26	1.27		
WATER CONTENT, w (%)	19.0	19.8		19

LIQUID LIMIT

					Average
Container No.	29	30			
Mass Moist Soil + Container, M1 (g)	10.17	10.13			
Mass Dry Soil + Container, M2 (g)	8.52	8.49			
Mass Container, M3 (g)	1.27	1.28			
WATER CONTENT, w (%)	22.8	22.7			
NUMBER OF BLOWS, N	22	23			
LIQUID LIMIT, ASTM SINGLE POINT					22

LINEAR REGRESSION ANALYSIS	
w at N = 25 Blows	
Coef. of Determination, r^2	

Recommended range of Blow Count for Multiple Point Method A :
15 to 25, 20 to 30, and 25 to 35.
Recommended range of Blow Count for Single Point Method B:
20 to 30.

w_o or w = ((M1-M2) / (M2-M3)) × 100
LL = Water Content at N=25 blows, from Flow Curve.
LL by Single Point = w × $(N / 25)^{0.121}$
PI = LL - PL
LI = (w_o - PL) / (LL - PL)

NOTES: (1) USCS: Unified Soil Classification System.
(2) Wet = Wet Preparation Method, and Dry = Dry Preparation Method

REMARKS: maybe non-plastic

SUMMARY

TEST METHOD (2) A ☐ B ✓ Wet ✓ Dry ☐	
AS-RECEIVED WATER CONTENT, w_o (%)	
LIQUID LIMIT, LL	22
PLASTIC LIMIT, PL	19
PLASTICITY INDEX, PI	3
LIQUIDITY INDEX, LI	
PERCENTAGE POINTS ABOVE/BELOW A-LINE	
PLASTICITY CHART CLASSIFICATION	

Checked By: KB 1-17-08
Prepared By: VLH Date: 1-14-8
Dry Masses By: CR 1-16
Spot Checked By:
Tested By: AC Date: 1-15-08
Calculated By: CJ 1-16-08
Reviewed By:

PERCENT FINES (ASTM D 1140)

DATE: 1-29-08
REVIEWED BY: KB
DATE: 1-28-08
COMPUTED BY: CJ
DATE: 1/28/08
TESTED BY: RNC

DATE October 22, 2007
PROJECT NAME
PROJECT NO.: 1637-001

Boring No.	Sample No.	Depth (ft)	Visual Identification (Color, Group Name & Symbol)	Initial Dry Mass of Soil (g)	Dry Mass of Soil After Washing & Shaking Over 75 µm Sieve	% Passing 75 µm Sieve
BH-90	S-17d	52'	Lean Clay or ~~silty clay~~ brown & gray w/some sand	30.85	5.80	81.2

REMARKS

DETERMINATION OF PERCENTAGE OF FINES (ASTM D 1140)

DATE 10/22/07
PROJECT NAME CyCU ta=0
PROJECT NO.: 1637-001

Boring No.	Sample No.	Depth (ft)	Material Description	Initial Dry Mass of Soil (g)	Dry Mass of Soil After Washing & Shaking Over 74 μ m Sieve	% Passing 74 μ m Sieve
BH-91	S-10a	38.9	Silty Sand, dark gray w/ clayey sand seam	75.75	40.47	46.6

REMARKS

TESTED BY: TL
DATE: 11/14/07
COMPUTED BY: CJ
DATE: 11.14.07
CHECKED BY: PK
DATE: 11-15-07

DETERMINATION OF PERCENTAGE OF FINES (ASTM D 1140)

DATE: 11-8-07

CHECKED BY: PK

DATE: 11-8-07

COMPUTED BY:

DATE: 11/7/07

TESTED BY:

DATE 10/22/07

PROJECT NAME CyCU ta=0

PROJECT NO.: 1637-001

Boring No.	Sample No.	Depth (ft)	Material Description	Initial Dry Mass of Soil (g)	Dry Mass of Soil After Washing & Shaking Over 74 μ m Sieve	% Passing 74 μ m Sieve
BH-105	S-9a	32.45	Si Sa Dk G	75.68	46.90	38.0

REMARKS

DETERMINATION OF PERCENTAGE OF FINES (ASTM D 1140)

FUGRO

DATE: 1-18-08
CHECKED BY: KB
DATE: 1.17.08
COMPUTED BY:
DATE: [illegible]
TESTED BY:

DATE 10/22/07
PROJECT NAME CyCU ta=0
PROJECT NO.: 1637-001

Boring No.	Sample No.	Depth (ft)	Material Description	Initial Dry Mass of Soil (g)	Dry Mass of Soil After Washing & Shaking Over 74 μ m Sieve	% Passing 74 μ m Sieve
BH-90	S-11a	37.5	Clay Silty Sand, tan & gray	30.97	18.04	41.75

KB
41.8

REMARKS

Appendix 6: Large-Scale Direct Shear Test Results

Prepared for:

Hatch Mott Macdonald
3103 N. 1st St., Building B, Suite 200
San Jose, CA 95134

FINAL REPORT

PARTICLE-SIZE ANALYSIS, RELATIVE DENSITY, AND DIRECT SHEAR TESTING

SILICON VALLEY RAPID TRANSIT PROJECT

Prepared by:

SGI TESTING SERVICES, LLC

4405 International Blvd., Suite B-117
Norcross, GA 30093

Project Number SGI7047

18 January 2008

CAVEAT

The reported results apply only to the materials and test conditions used in the laboratory testing program. The results do not necessarily apply to other materials or test conditions. The test results should not be used in engineering analysis unless the test conditions model the anticipated field conditions. The testing was performed in accordance with general engineering testing standards and requirements. This testing report is submitted for the exclusive use of the client to whom it is addressed.

1. INTRODUCTION

SGI Testing Services, LLC (SGI) conducted a laboratory testing program to evaluate the particle-size distribution, relative density, and internal shear strength of four soil samples for the Silicon Valley Rapid Transit (SVRT) project. The sample preparation procedures and testing conditions used in the testing program were specified by Mr. Abhishek Jain of Hatch Mott Macdonald (HMM) to simulate anticipated field conditions. All of the tests were conducted at SGI located in Norcross, Georgia.

2. TEST MATERIALS

2.1 Soil Samples

Four types of soil materials were used in this testing program. Descriptions of the four materials are given below:

- Soil Sample MW-8A;
- Soil Sample MW-2B;
- Soil Sample MW-4A; and
- Soil Sample MW-6J.

Bulk samples of the four soil materials were provided to SGI by HMM.

2.2 Soil Processing and Index Property Testing

For each type of soil, the received bulk sample was first air-dried, mixed and separated into two portions. One portion of the air-dried soil sample was used for particle-size analysis in accordance with ASTM D 422, *"Particle-Size Analysis of Soils"*. The results of the particle analysis are presented in Appendix A to this report. The other portion of soil sample was sieved by using a 1.25 in. sieve to remove the particles greater than 1.25 in. The remaining soil sample with all the particles passing through 1.25-in sieve, referred to as 1.25-in. minus material, was used for relative density testing in accordance with

ASTM D 4253, *"Maximum Index Density and Unit Weight of Soils Using a Vibratory Table"*, and ASTM D 4254, *"Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density"*. The results of relative density tests for the four 1.25-in. minus materials are presented in Appendix B. The 1.25-in. minus materials of soil samples MW-8A, MW-2B, and MW-6J were subsequently used in direct shear testing.

3. DIRECT SHEAR TEST EQUIPMENT

The direct testing device used in this testing consisted an upper and lower shear box. The upper shear box measured 12 in. by 12 in. in plan and 3 in. in depth. The lower shear box measured 12 in. by 12 in. in plan and 3 in. in depth. Normal stresses were applied to the testing specimen through an air bladder system, and shear loads were applied to the test specimen through an automatically controlled motor system.

4. TEST METHOD AND PROCEDURES

The direct shear tests were performed in accordance with ASTM D 3080, *"Direct Shear Test of Soils under Consolidated Drained Conditions"*. For each direct shear test, the test was set up in accordance with the following procedures and tested under the specific conditions as described below:

- 1.25-in. minus material was moisture-conditioned to approximately the specified moisture content, and compacted by hand tamping in 2 in. thick lifts within the lower and upper shear boxes, to form a 6 in. thick test specimen. The target dry unit weight, corresponding to the specified relative density, was achieved by compacting a pre-determined amount of soil into a fixed volume (12 in. x 12 in. x 6 in.);

- A specific normal stress was applied to top of the test specimen through an air bladder system; and

- After the application of the normal stress, the test specimen was sheared at a constant shear displacement rate of 0.04 in/min. Shearing was continued until a minimum total shear displacement of 2.5 in. was achieved.

5. DIRECT SHEAR TEST RESULTS

Five series of direct shear tests were performed in this testing program. For each test series, the test results are presented on a summary page in Appendix C. The summary page includes:

- Shear force versus displacement figure;
- Shear strength versus normal stress figure; and
- A table that summarizes test conditions, peak shear strength, and large displacement (LD) shear strength at the end of test.

For each test series, the shear strength parameters of friction angle and cohesion were determined based on the best-fit straight line drawn through the test data points on a plot of shear strength versus normal stress, and reported on the summary page. Caution should be exercised in using these shear strength parameters for applications involving normal stresses outside the range of stresses covered by the test series.

6. CLOSURE

The reported test results apply only to the materials and test conditions used in the laboratory testing program. The test results do not necessarily apply to other materials or test conditions. The test results should not be used in engineering analysis unless the test conditions model the anticipated field conditions. The testing was performed in accordance with general engineering testing standards and requirements. This testing report is submitted for the exclusive use of HMM.

APPENDIX A

RESULTS OF PARTICLE SIZE ANALYSIS

SGI Testing Services, LLC

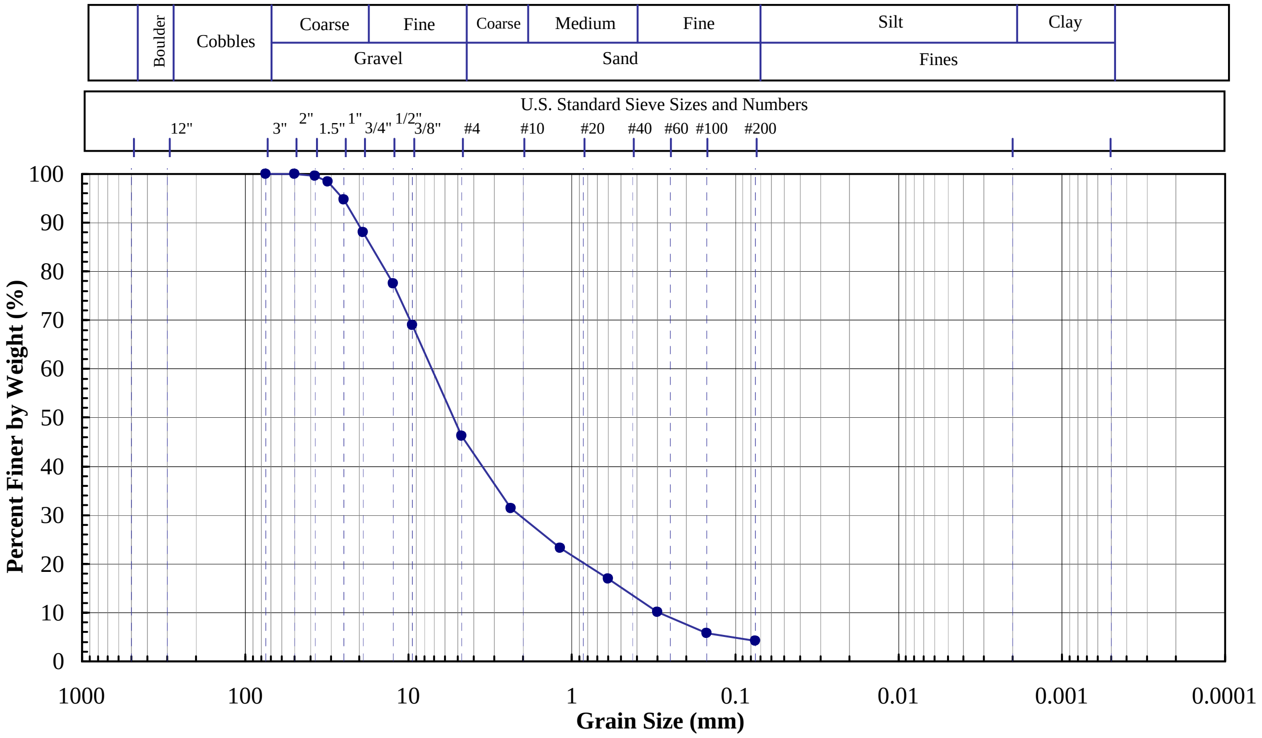
4405 International Blvd., Suite B-117, Norcross, GA 30093
Ph: (770) 931-8222 Fax: (770) 931-8240

Project Name:	SVRT
Project No:	SGI7047
Client Sample ID:	Soil Sample MW-8A
Lab Sample No:	S13087

ASTM D 2216, D 1140, D 422,
C 136, D 4318, D 2487

SOIL INDEX PROPERTIES

Moisture Content, Grain Size, Atterberg Limits, Classification

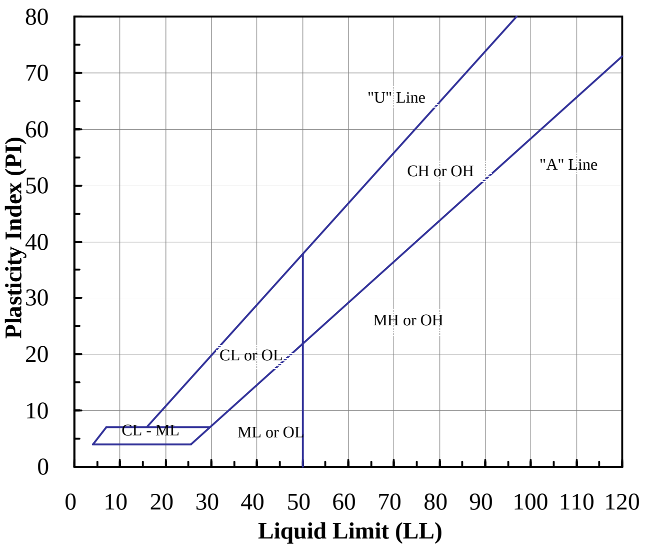


Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	99.6
1.25"	31.25	98.4
1"	25	94.8
3/4"	19	88.0
1/2"	12.5	77.5
3/8"	9.5	69.0
#4	4.75	46.3
#8	2.00	31.4
#16	0.850	23.2
#30	0.425	16.9
#50	0.250	10.1
#100	0.150	5.8
#200	0.075	4.2

Hydrometer Particle Diameter (mm)	% Finer
0.0310	
0.0200	
0.0061	
0.0031	
0.0013	

Gravel (%):	53.7
Sand (%):	42.1
Fines (%):	4.2
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	24.0
Coeff. Curv. (Cc):	2.0



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (%)	PL (%)	PI (-)	
Soil MW-8A	S13087		4.2				GW

Note(s):

SGI Testing Services, LLC

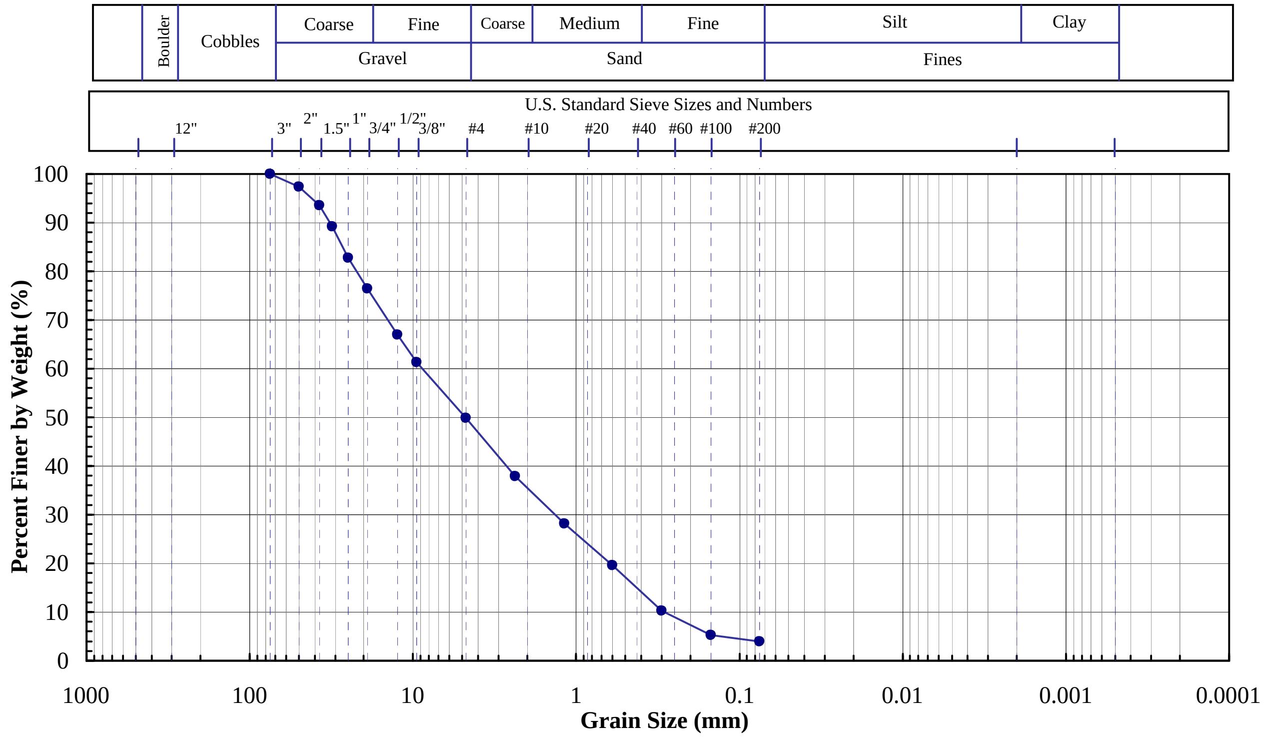
4405 International Blvd., Suite B-117, Norcross, GA 30093
Ph: (770) 931-8222 Fax: (770) 931-8240

Project Name:	SVRT
Project No:	SGI7047
Client Sample ID:	Soil Sample MW-2B
Lab Sample No:	S13088

ASTM D 2216, D 1140, D 422,
C 136, D 4318, D 2487

SOIL INDEX PROPERTIES

Moisture Content, Grain Size, Atterberg Limits, Classification

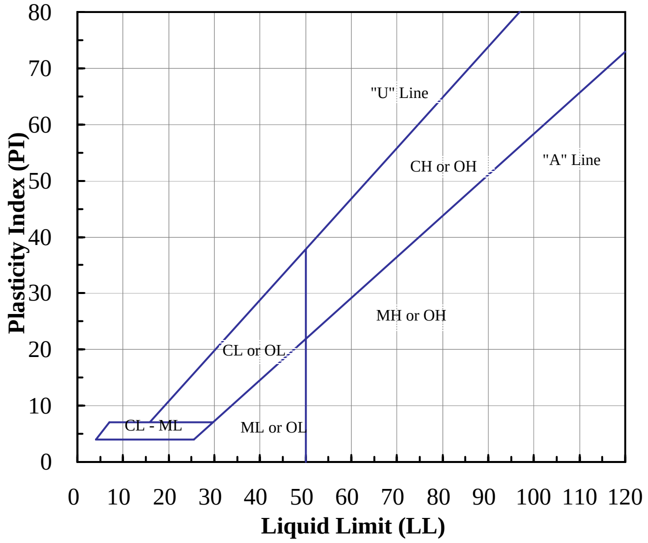


Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	97.4
1.5"	37.5	93.5
1.25"	31.25	89.2
1"	25	82.7
3/4"	19	76.5
1/2"	12.5	67.0
3/8"	9.5	61.3
#4	4.75	49.9
#8	2.00	37.9
#16	0.850	28.1
#30	0.425	19.6
#50	0.250	10.3
#100	0.150	5.3
#200	0.075	4.0

Hydrometer Particle Diameter (mm)	% Finer
0.0310	
0.0200	
0.0061	
0.0031	
0.0013	

Gravel (%):	50.1
Sand (%):	45.9
Fines (%):	4.0
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	31.0
Coeff. Curv. (Cc):	0.7



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits LL (%)	PL (%)	PI (-)	Engineering Classification
Soil MW-2B	S13088		4.0				GP

Note(s):

SGI Testing Services, LLC

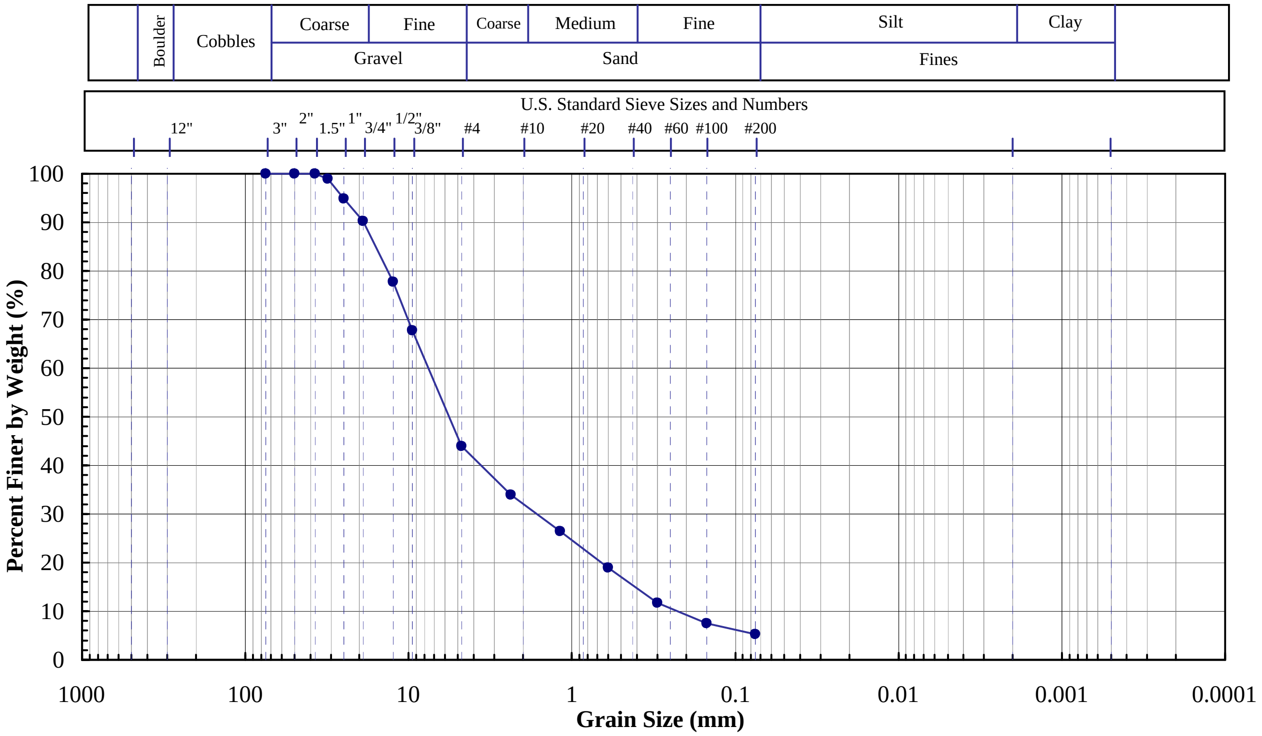
4405 International Blvd., Suite B-117, Norcross, GA 30093
Ph: (770) 931-8222 Fax: (770) 931-8240

Project Name:	SVRT
Project No:	SGI7047
Client Sample ID:	Soil Sample MW-4A
Lab Sample No:	S13089

ASTM D 2216, D 1140, D 422,
C 136, D 4318, D 2487

SOIL INDEX PROPERTIES

Moisture Content, Grain Size, Atterberg Limits, Classification

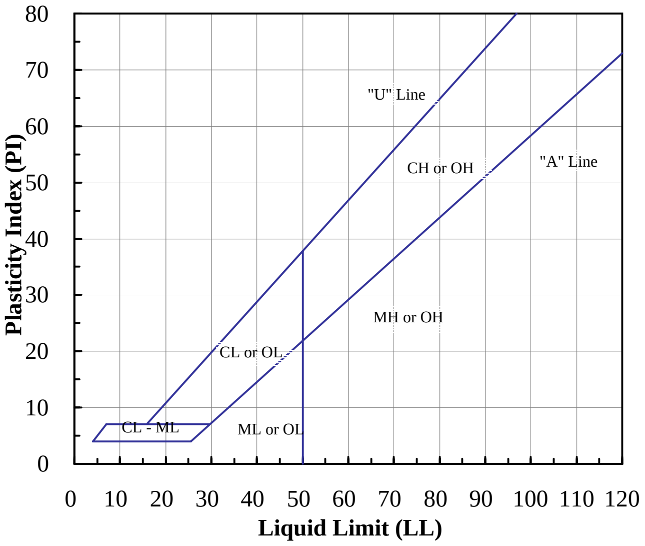


Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	100.0
1.25"	31.25	98.9
1"	25	94.9
3/4"	19	90.2
1/2"	12.5	77.7
3/8"	9.5	67.8
#4	4.75	44.0
#8	2.00	34.0
#16	0.850	26.4
#30	0.425	19.0
#50	0.250	11.7
#100	0.150	7.5
#200	0.075	5.3

Hydrometer Particle Diameter (mm)	% Finer
0.0310	
0.0200	
0.0061	
0.0031	
0.0013	

Gravel (%):	56
Sand (%):	38.7
Fines (%):	5.3
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	34.0
Coeff. Curv. (Cc):	1.7



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (%)	PL (%)	PI (-)	
Soil MW-4A	S13089		5.3				GW-GM

Note(s):

SGI Testing Services, LLC

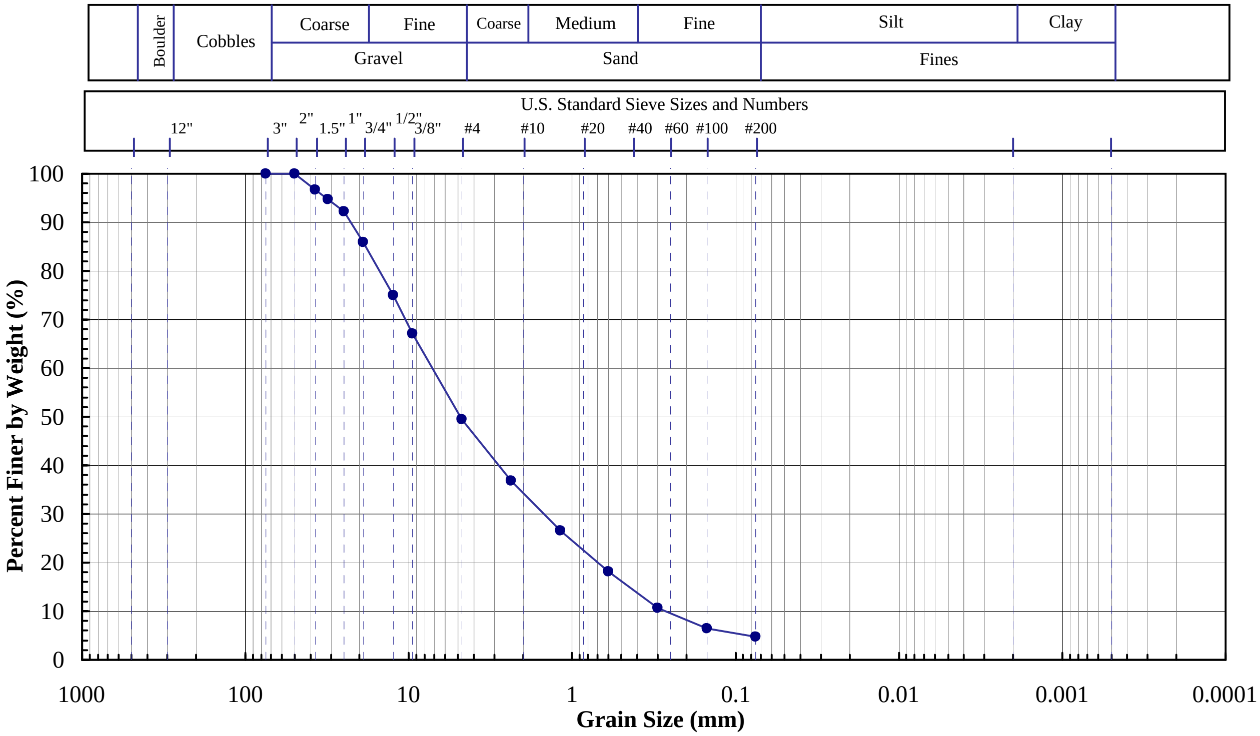
4405 International Blvd., Suite B-117, Norcross, GA 30093
Ph: (770) 931-8222 Fax: (770) 931-8240

Project Name:	SVRT
Project No:	SGI7047
Client Sample ID:	Soil Sample MW-6J
Lab Sample No:	S13090

ASTM D 2216, D 1140, D 422,
C 136, D 4318, D 2487

SOIL INDEX PROPERTIES

Moisture Content, Grain Size, Atterberg Limits, Classification

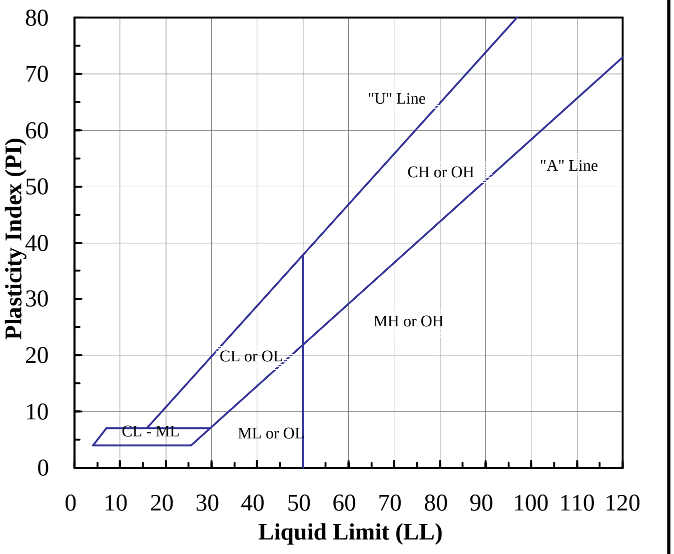


Sieve No.	Size (mm)	% Finer
3"	75	100.0
2"	50	100.0
1.5"	37.5	96.7
1.25"	31.25	94.7
1"	25	92.2
3/4"	19	85.9
1/2"	12.5	75.0
3/8"	9.5	67.1
#4	4.75	49.5
#8	2.00	36.8
#16	0.850	26.6
#30	0.425	18.1
#50	0.250	10.7
#100	0.150	6.5
#200	0.075	4.8

Hydrometer Particle Diameter (mm)	% Finer
0.0310	
0.0200	
0.0061	
0.0031	
0.0013	

Gravel (%):	50.5
Sand (%):	44.7
Fines (%):	4.8
Silt (%):	
Clay (%):	

Coeff. Unif. (Cu):	27.0
Coeff. Curv. (Cc):	1.1



Client Sample ID.	Lab Sample No:	Moisture Content (%)	Fines Content < No. 200 (%)	Atterberg Limits			Engineering Classification
				LL (%)	PL (%)	PI (-)	
Soil MW-6J	S13090		4.8				GW

Note(s):

APPENDIX B

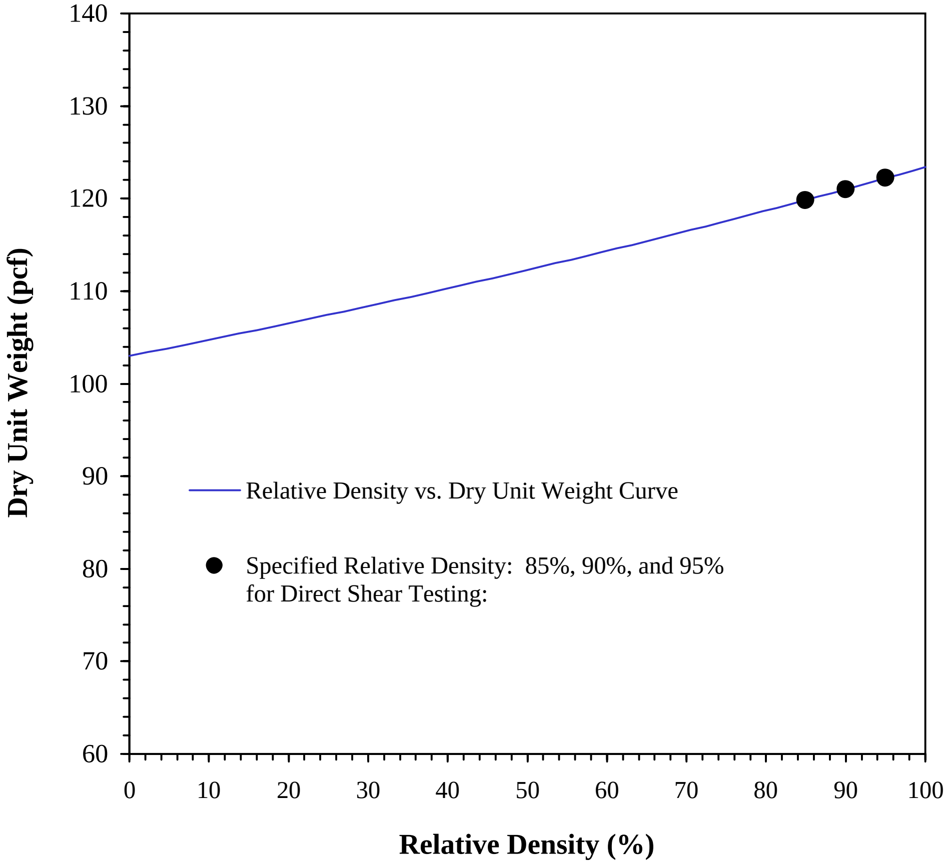
RELATIVE DENSITY TEST RESULTS

HATCH MOTT MACDONALD – SILICON VALLEY RAPID TRANSIT PROJECT

RELATIVE DENSITY (ASTM D 4253/4254)

Soil Sample MW-8A (1.25" Minus Material)

SGI Lab Sample ID: S13087



Test Description	Diameter of Mold (in.)	Height of Mold (in.)	Average Height of Sample (in.)	Volume of Sample (ft^3)	Dry Weight of Sample (g)	Dry Unit Weight (pcf)
Maximum Dry Unit Weight	5.988	6.112	5.47	0.0891	5000	123.4
Minimum Dry Unit Weight	5.998	6.112	6.11	0.100	4675	103.0

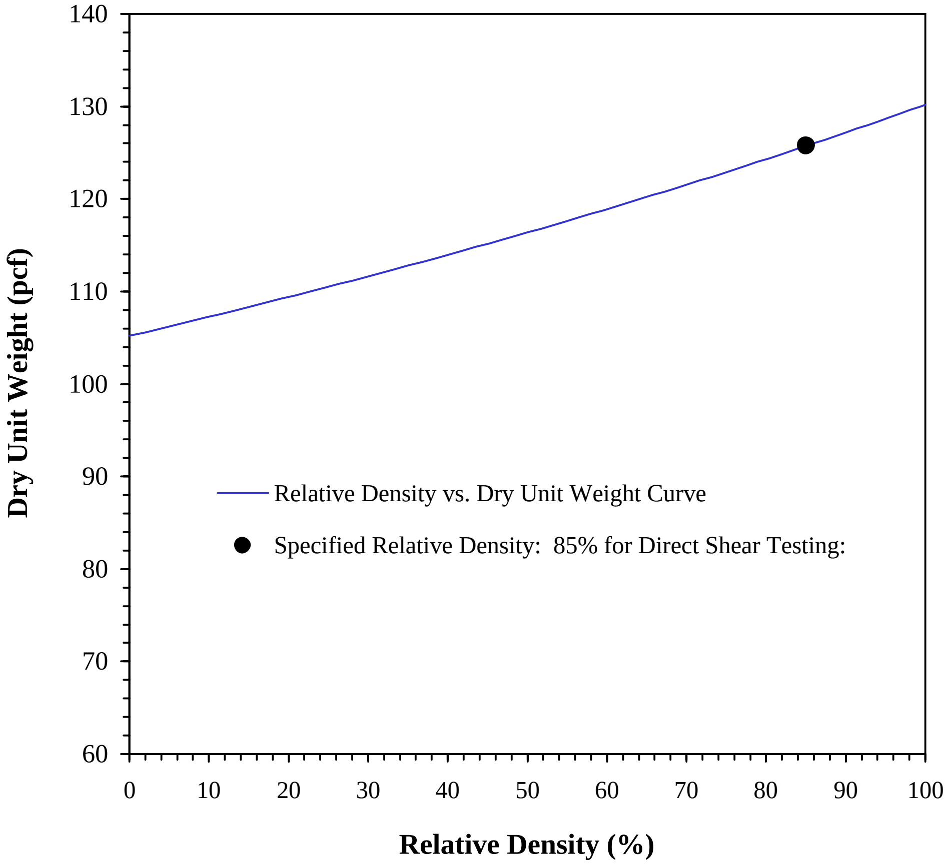
Specified Relative Density (%)	Dry Unit Weight (pcf)
85.0	119.8
90.0	121.0
95.0	122.2

DATE REPORTED:	12/16/2007
FIGURE NO.	B-1
PROJECT NO.	SGI7047
DOCUMENT NO.	
FILE NO.	

SGI TESTING SERVICES, LLC

HATCH MOTT MACDONALD – SILICON VALLEY RAPID TRANSIT PROJECT
RELATIVE DENSITY (ASTM D 4253/4254)

Soil Sample MW-2B(1.25" Minus Material)
SGI Lab Sample ID: S13088



Test Description	Diameter of Mold (in.)	Height of Mold (in.)	Average Height of Sample (in.)	Volume of Sample (ft^3)	Dry Weight of Sample (g)	Dry Unit Weight (pcf)
Maximum Dry Unit Weight	5.988	6.112	5.18	0.0845	5000	130.2
Minimum Dry Unit Weight	5.998	6.112	6.11	0.100	4775	105.2

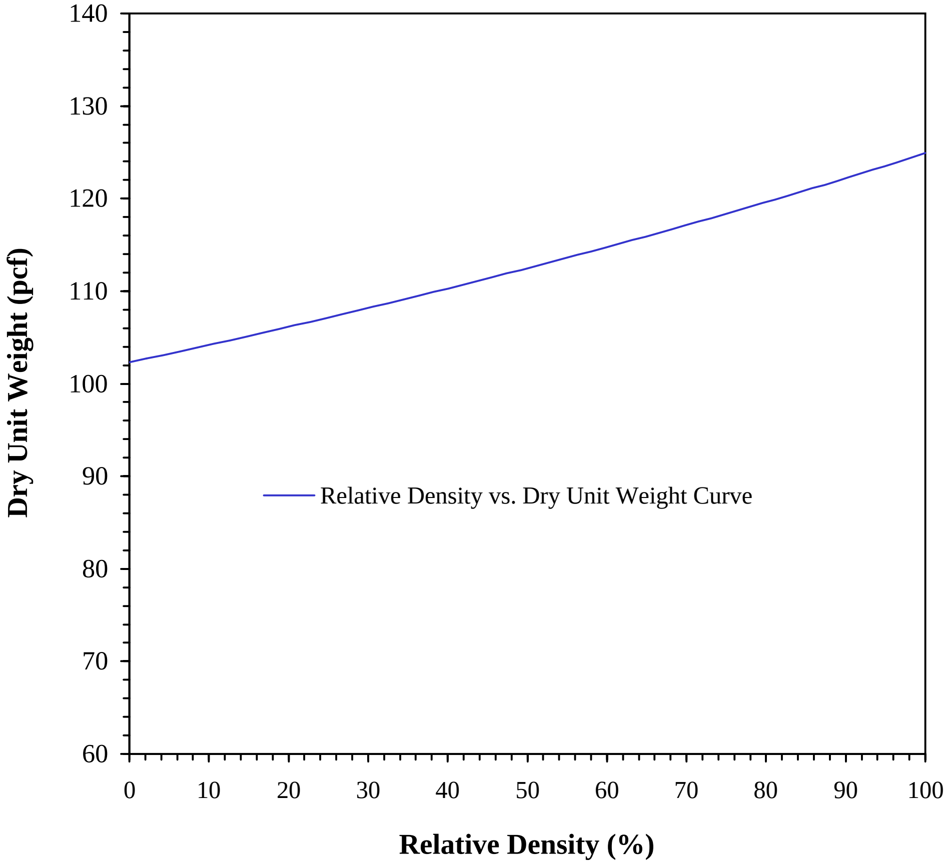
Specified Relative Density (%)	Dry Unit Weight (pcf)
85.0	125.7

DATE REPORTED:	12/16/2007
FIGURE NO.	B-2
PROJECT NO.	SGI7047
DOCUMENT NO.	
FILE NO.	

SGI TESTING SERVICES, LLC

HATCH MOTT MACDONALD – SILICON VALLEY RAPID TRANSIT PROJECT
RELATIVE DENSITY (ASTM D 4253/4254)

Soil Sample MW-4A (1.25" Minus Material)
SGI Lab Sample ID: S13089



Test Description	Diameter of Mold (in.)	Height of Mold (in.)	Average Height of Sample (in.)	Volume of Sample (ft^3)	Dry Weight of Sample (g)	Dry Unit Weight (pcf)
Maximum Dry Unit Weight	5.988	6.112	4.407	0.0718	4077	124.9
Minimum Dry Unit Weight	5.998	6.112	6.11	0.100	4640	102.3

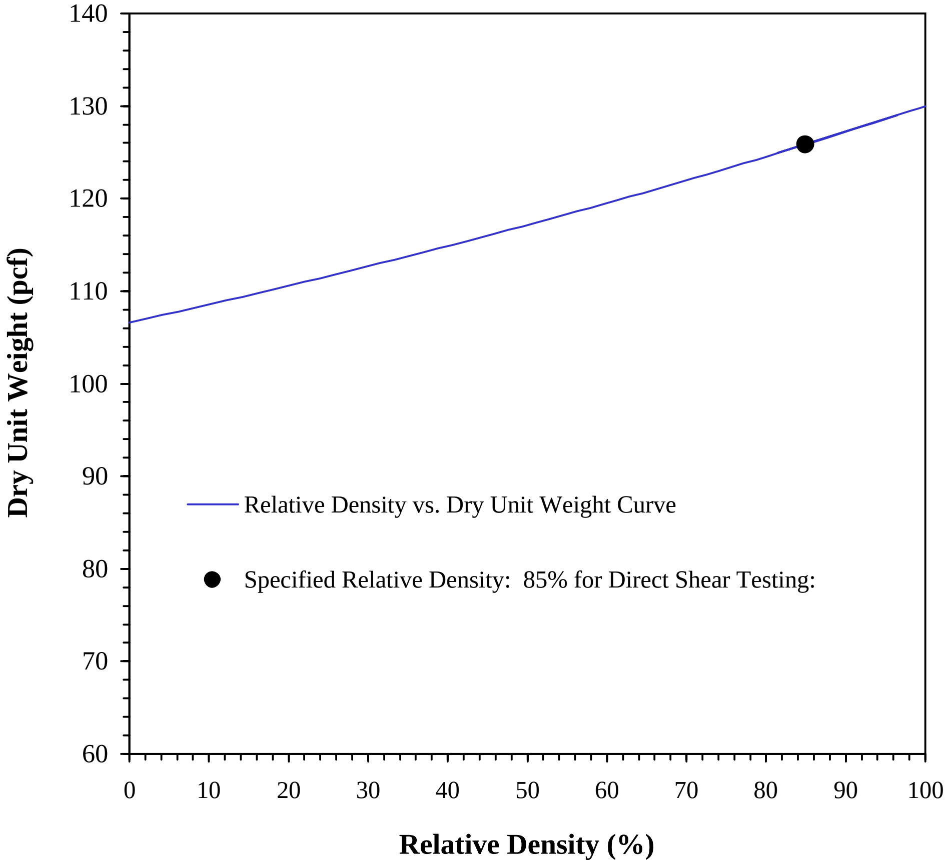
Specified Relative Density (%)	Dry Unit Weight (pcf)

SGI TESTING SERVICES, LLC

DATE REPORTED:	12/16/2007
FIGURE NO.	B-3
PROJECT NO.	SGI7047
DOCUMENT NO.	
FILE NO.	

HATCH MOTT MACDONALD – SILICON VALLEY RAPID TRANSIT PROJECT
RELATIVE DENSITY (ASTM D 4253/4254)

Soil Sample MW-6J (1.25" Minus Material)
SGI Lab Sample ID: S13090



Test Description	Diameter of Mold (in.)	Height of Mold (in.)	Average Height of Sample (in.)	Volume of Sample (ft^3)	Dry Weight of Sample (g)	Dry Unit Weight (pcf)
Maximum Dry Unit Weight	5.988	6.112	5.193	0.0846	5000	130.0
Minimum Dry Unit Weight	5.998	6.112	6.11	0.100	4835	106.6

Specified Relative Density (%)	Dry Unit Weight (pcf)
85.0	125.9

DATE REPORTED:	12/16/2007
FIGURE NO.	B-4
PROJECT NO.	SGI7047
DOCUMENT NO.	
FILE NO.	

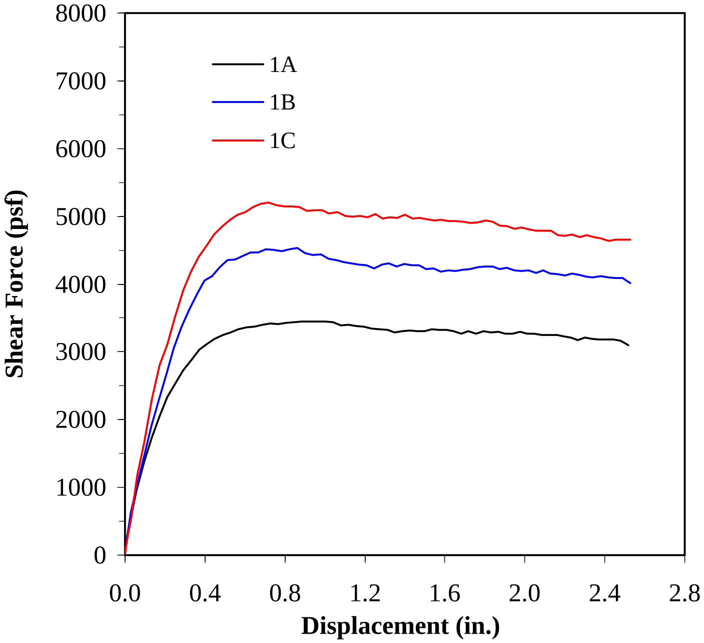
SGI TESTING SERVICES, LLC

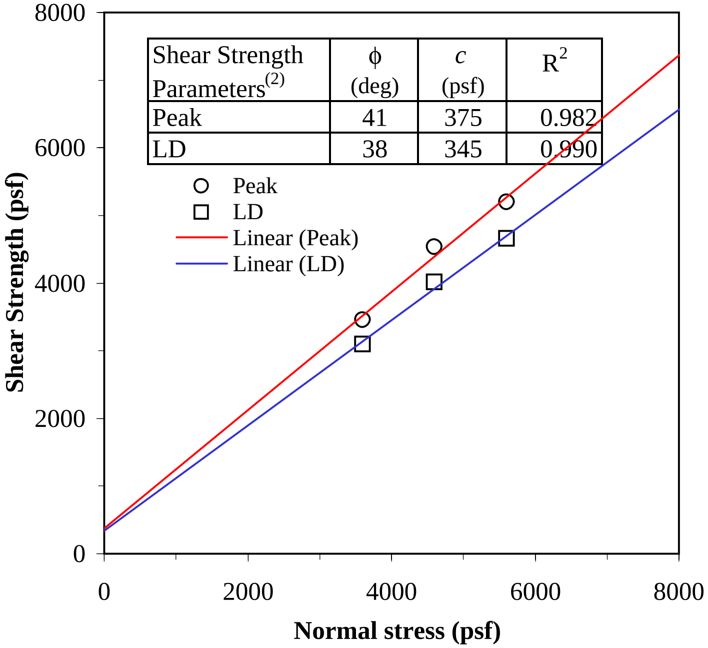
APPENDIX C

DIRECT SHEAR TEST RESULTS

HATCH MOTT MACDONALD – SILICON VALLEY RAPID TRANSIT PROJECT
DIRECT SHEAR TESTING (ASTM D D3080)

Test Series No. 1: Soil sample MW-8A (1.25" minus material) compacted to approximately 85% relative density





Shear Strength Parameters[(2)]	ϕ (deg)	c (psf)	R^2
Peak	41	375	0.982
LD	38	345	0.990

Test	Shear	Normal	Shear	Soaking		Consolidation		Soil # MW-8A			Soil # MW-8A			GCL		Shear Stress		Failure
No.	Box Size	Stress	Rate	Stress	Time	Stress	Time	γ_d	ω_i	ω_f	γ_d	ω_i	ω_f	ω_i	ω_f	τ_P	τ_{LD}	Mode
	(in. x in.)	(psf)	(in./min)	(psf)	(hour)	(psf)	(hour)	(pcf)	(%)	(%)	(pcf)	(%)	(%)	(%)	(%)	(psf)	(psf)	
1A	12 x 12	3600	0.040	-	-	-	-	120.1	9.7	8.9	-	-	-	-	-	3452	3100	(1)
1B	12 x 12	4600	0.040	-	-	-	-	119.5	10.3	8.5	-	-	-	-	-	4532	4015	(1)
1C	12 x 12	5600	0.040	-	-	-	-	120.2	9.6	7.9	-	-	-	-	-	5200	4656	(1)

NOTES:

(1) Sliding (i.e., shear failure) was forced to occur on the plane between the upper and lower shear box.

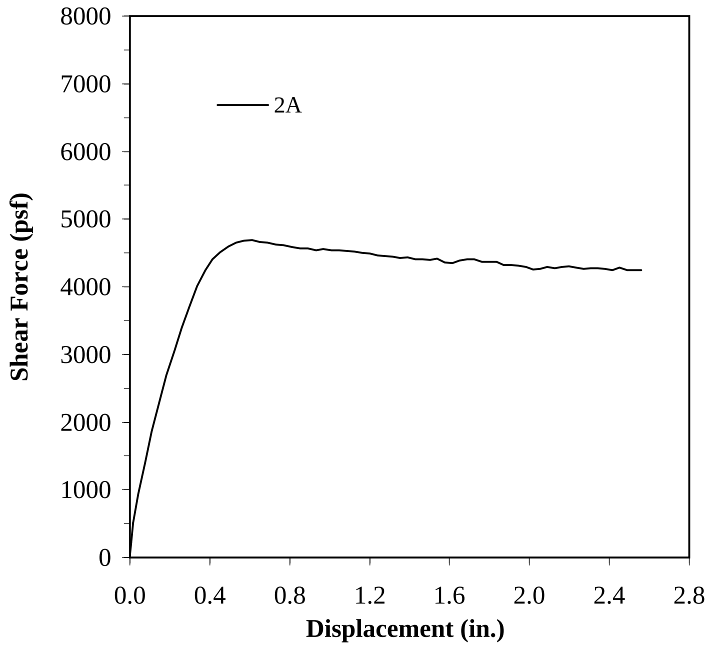
(2) The reported total-stress parameters of friction angle and cohesion were determined from a best-fit line drawn through the test data. Caution should be exercised in using these strength parameters for applications involving normal stresses outside the range of the stresses covered by the test series. The large-displacement (LD) shear strength was calculated using the shear force measured at the end of the test.

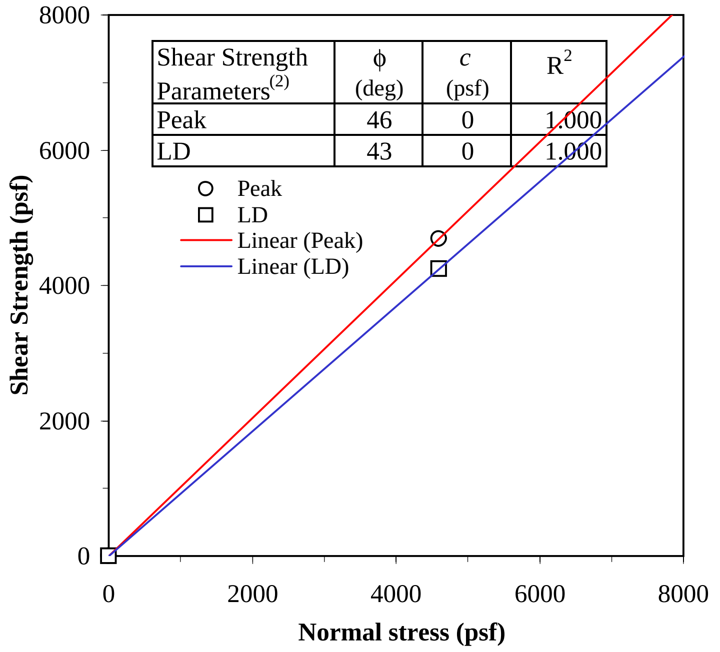
SGI TESTING SERVICES, LLC

DATE OF REPORT:	12/17/2007
FIGURE NO.	C-1
PROJECT NO.	SG7047
DOCUMENT NO.	
FILE NO.	

HATCH MOTT MACDONALD – SILICON VALLEY RAPID TRANSIT PROJECT
DIRECT SHEAR TESTING (ASTM D D3080)

Test Series No. 2: Soil sample MW-8A (1.25" minus material) compacted to approximately 90% relative density





Shear Strength Parameters[(2)]	ϕ (deg)	*c* (psf)	R^2
Peak	46	0	1.000
LD	43	0	1.000

Test	Shear	Normal	Shear	Soaking		Consolidation		Soil # MW-8A			Soil # MW-8A			GCL		Shear Stress		Failure
No.	Box Size	Stress	Rate	Stress	Time	Stress	Time	γ_d	ω_i	ω_f	γ_d	ω_i	ω_f	ω_i	ω_f	τ_P	τ_{LD}	Mode
	(in. x in.)	(psf)	(in./min)	(psf)	(hour)	(psf)	(hour)	(pcf)	(%)	(%)	(pcf)	(%)	(%)	(%)	(%)	(psf)	(psf)	
2A	12 x 12	4600	0.040	-	-	-	-	121.2	9.8	8.6	-	-	-	-	-	4694	4245	(1)

NOTES:

(1) Sliding (i.e., shear failure) was forced to occur on the plane between the upper and lower shear box.

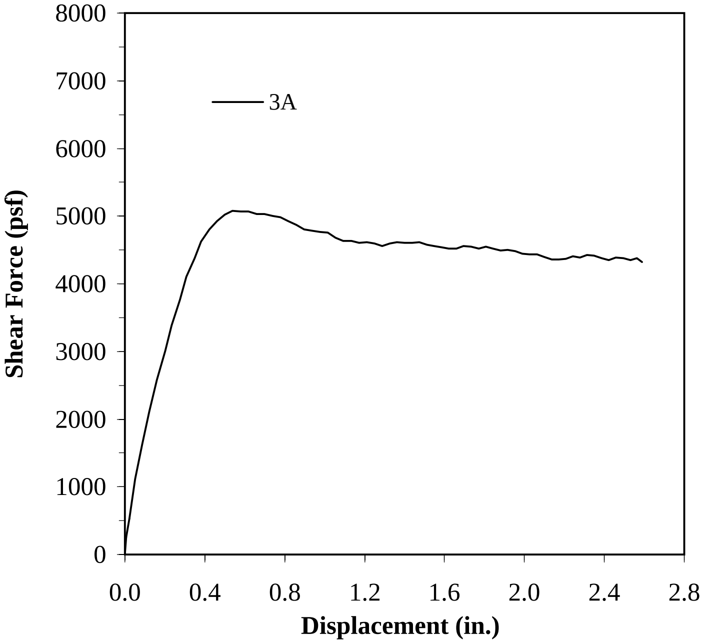
(2) The reported total-stress friction angle was determined by drawing a straight line from origin through the test data point. Caution should be exercised in using the friction angle for applications involving normal stresses other than the test normal stress.

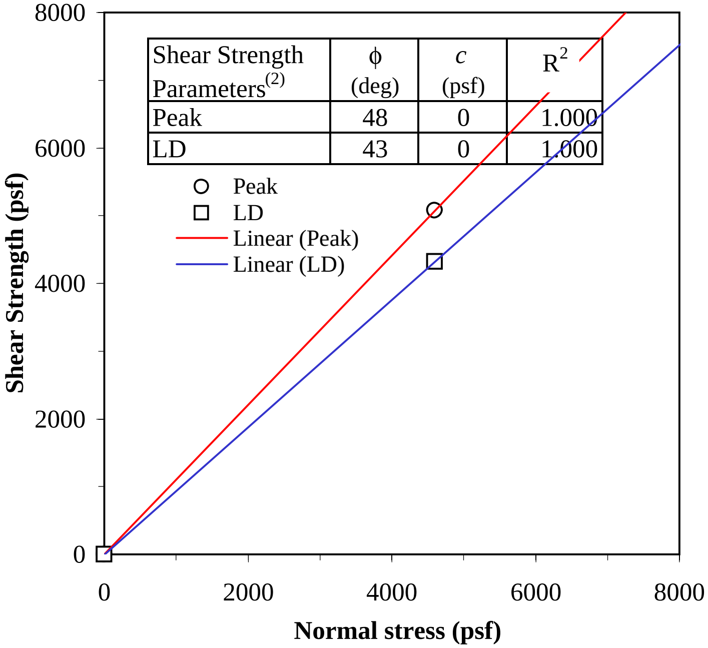
DATE OF REPORT:	12/17/2007
FIGURE NO.	C-2
PROJECT NO.	SG7047
DOCUMENT NO.	
FILE NO.	

SGI TESTING SERVICES, LLC

HATCH MOTT MACDONALD – SILICON VALLEY RAPID TRANSIT PROJECT
DIRECT SHEAR TESTING (ASTM D D3080)

Test Series No. 3: Soil sample MW-8A (1.25" minus material) compacted to approximately 95% relative density





Shear Strength Parameters[(2)]	ϕ (deg)	c (psf)	R^2
Peak	48	0	1.000
LD	43	0	1.000

Test No.	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	Soaking		Consolidation		Soil # MW-8A			Soil # MW-8A			GCL		Shear Stress		Failure Mode
				Stress (psf)	Time (hour)	Stress (psf)	Time (hour)	γ_d (pcf)	ω_i (%)	ω_f (%)	γ_d (pcf)	ω_i (%)	ω_f (%)	ω_i (%)	ω_f (%)	τ_P (psf)	τ_{LD} (psf)	
3A	12 x 12	4600	0.040	-	-	-	-	121.9	10.3	8.8	-	-	-	-	-	5074	4326	(1)

NOTES:

(1) Sliding (i.e., shear failure) was forced to occur on the plane between the upper and lower shear box.

(2) The reported total-stress friction angle was determined by drawing a straight line from origin through the test data point. Caution should be exercised in using the friction angle for applications involving normal stresses other than the test normal stress.

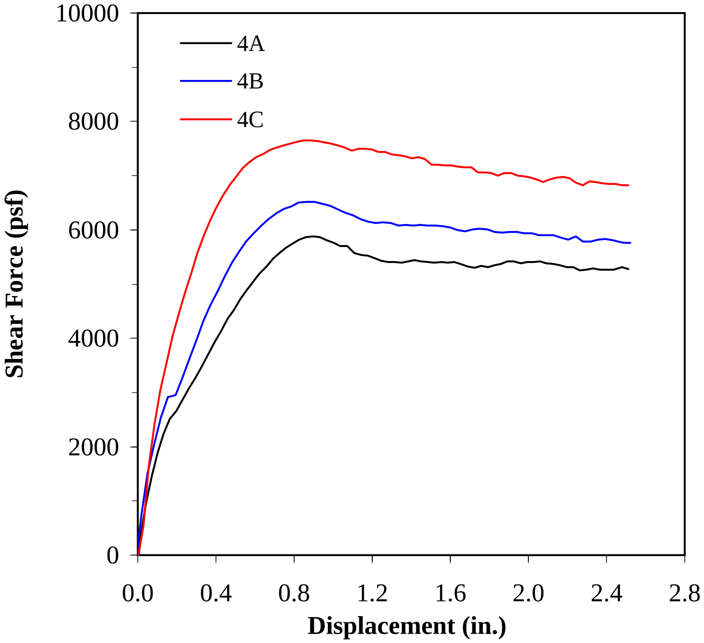
SGI TESTING SERVICES, LLC

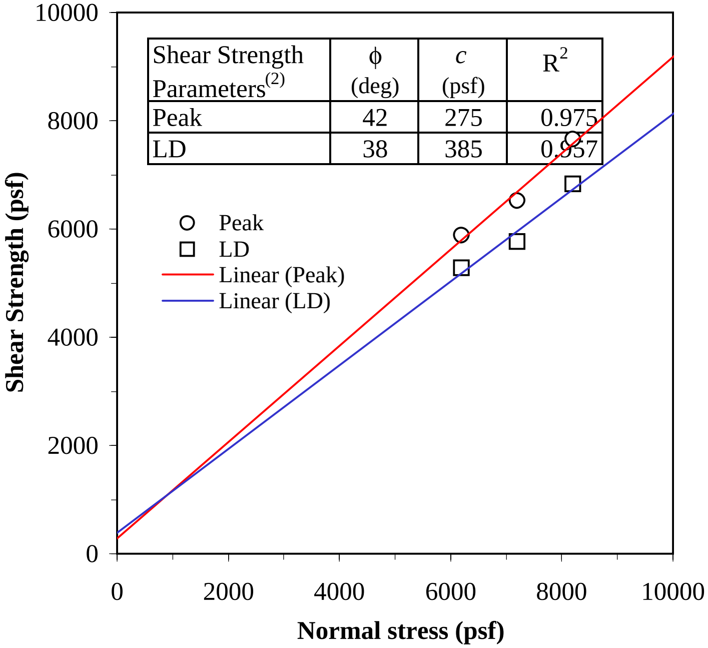
DATE OF REPORT:	12/17/2007
FIGURE NO.	C-3
PROJECT NO.	SG7047
DOCUMENT NO.	
FILE NO.	

S7047-3.ds.xls

HATCH MOTT MACDONALD – SILICON VALLEY RAPID TRANSIT PROJECT
DIRECT SHEAR TESTING (ASTM D D3080)

Test Series No. 4: Soil sample MW-2B (1.25" minus material) compacted to approximately 85% relative density





Shear Strength Parameters(2)	φ (deg)	c (psf)	R^2
Peak	42	275	0.975
LD	38	385	0.957

Test	Shear	Normal	Shear	Soaking		Consolidation		Soil # MW-2B			Soil # MW-2B			GCL		Shear Stress		Failure
No.	Box Size	Stress	Rate	Stress	Time	Stress	Time	γ_d	ω_i	ω_f	γ_d	ω_i	ω_f	ω_i	ω_f	τ_P	τ_{LD}	Mode
	(in. x in.)	(psf)	(in./min)	(psf)	(hour)	(psf)	(hour)	(pcf)	(%)	(%)	(pcf)	(%)	(%)	(%)	(%)	(psf)	(psf)	
4A	12 x 12	6200	0.040	-	-	-	-	125.6	10.1	8.9	-	-	-	-	-	5876	5278	(1)
4B	12 x 12	7200	0.040	-	-	-	-	126.2	9.6	8.2	-	-	-	-	-	6520	5767	(1)
4C	12 x 12	8200	0.040	-	-	-	-	125.4	10.3	7.6	-	-	-	-	-	7656	6826	(1)

NOTES:

(1) Sliding (i.e., shear failure) was forced to occur on the plane between the upper and lower shear box.

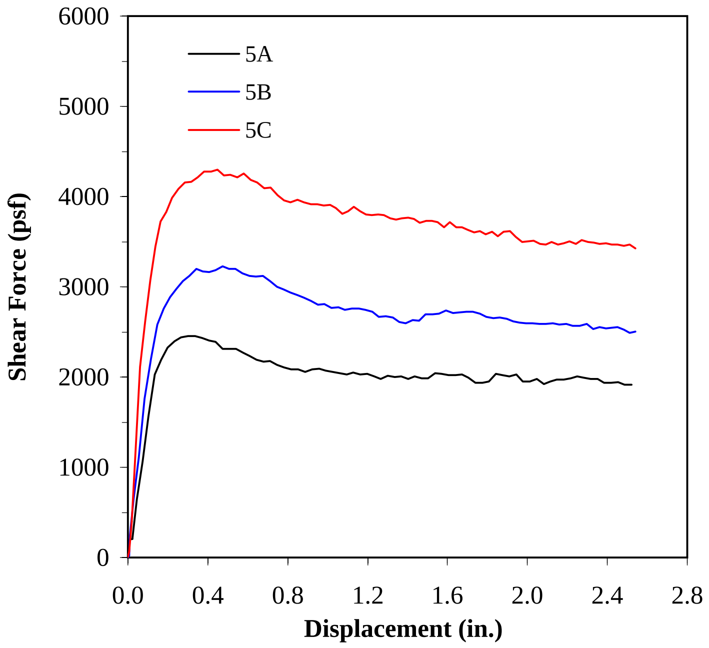
(2) The reported total-stress parameters of friction angle and cohesion were determined from a best-fit line drawn through the test data. Caution should be exercised in using these strength parameters for applications involving normal stresses outside the range of the stresses covered by the test series. The large-displacement (LD) shear strength was calculated using the shear force measured at the end of the test.

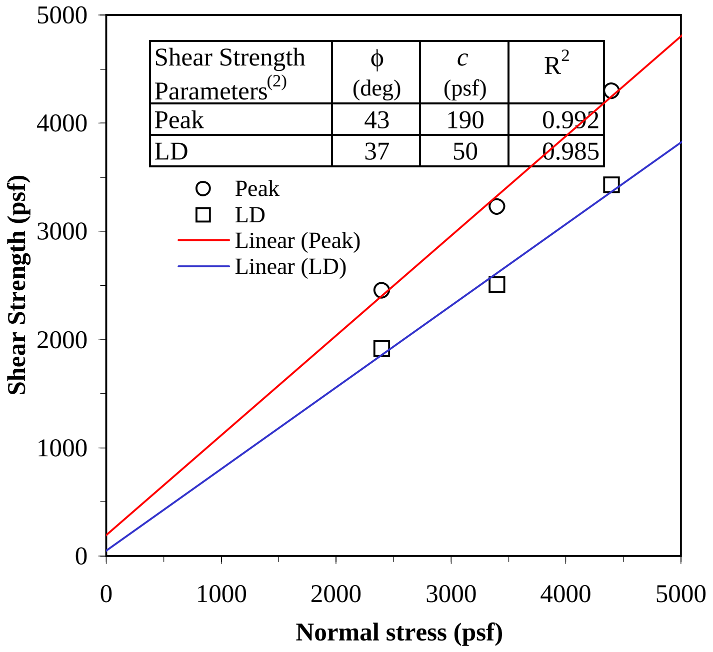
DATE OF REPORT:	12/17/2007
FIGURE NO.	C-4
PROJECT NO.	SG7047
DOCUMENT NO.	
FILE NO.	

SGI TESTING SERVICES, LLC

HATCH MOTT MACDONALD – SILICON VALLEY RAPID TRANSIT PROJECT
DIRECT SHEAR TESTING (ASTM D D3080)

Test Series No. 5: Soil sample MW-6J (1.25" minus material) compacted to approximately 85% relative density





Shear Strength Parameters[(2)]	ϕ (deg)	*c* (psf)	R^2
Peak	43	190	0.992
LD	37	50	0.985

Test No.	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	Soaking		Consolidation		Soil # MW-6J			Soil # MW-6J			GCL		Shear Stress		Failure Mode
				Stress (psf)	Time (hour)	Stress (psf)	Time (hour)	γ_d (pcf)	ω_i (%)	ω_f (%)	γ_d (pcf)	ω_i (%)	ω_f (%)	ω_i (%)	ω_f (%)	τ_P (psf)	τ_{LD} (psf)	
5A	12 x 12	2400	0.040	-	-	-	-	125.2	10.6	8.6	-	-	-	-	-	2454	1916	(1)
5B	12 x 12	3400	0.040	-	-	-	-	125.7	10.2	8.9	-	-	-	-	-	3229	2507	(1)
5C	12 x 12	4400	0.040	-	-	-	-	126.2	9.7	8.1	-	-	-	-	-	4298	3425	(1)

NOTES:

(1) Sliding (i.e., shear failure) was forced to occur on the plane between the upper and lower shear box.

(2) The reported total-stress parameters of friction angle and cohesion were determined from a best-fit line drawn through the test data. Caution should be exercised in using these strength parameters for applications involving normal stresses outside the range of the stresses covered by the test series. The large-displacement (LD) shear strength was calculated using the shear force measured at the end of the test.

DATE OF REPORT:	12/17/2007
FIGURE NO.	C-5
PROJECT NO.	SG7047
DOCUMENT NO.	
FILE NO.	

SGI TESTING SERVICES, LLC

Appendix 7: Sticky Limit Test Results

SHANNON & WILSON, INC.
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ALASKA
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COLORADO
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MISSOURI
OREGON
WASHINGTON

January 18, 2008

Mr. Abhishek Jain
Hatch Mott MacDonald
3103 North First Street
Building B, Suite 200
San Jose, CA 95134

RE: BAY AREA RAPID TRANSIT (BART) EXTENSION STICKY LIMIT TESTING

Dear Mr. Jain:

In response to our telephone conversation on January 16, 2008, I have put together the following letter describing the procedures and methods used to perform the moisture content, liquid limit, plastic limit, and stick limit laboratory tests on samples provided to us by Hatch Mott MacDonald for the BART extension project.

On September 10, 2007, the Shannon & Wilson, Inc. (S&W) Seattle soils testing laboratory received 7 wooden core boxes containing 14 steel tube soil samples and 1 bag soil sample. It is our understanding that the samples were originally obtained by Hatch Mott MacDonald in 2004 and 2005, and that the tube samples were sealed with wax and stored vertically in a temperature-controlled room.

Upon receiving the samples, S&W laboratory personnel extruded the thin-walled tube samples using a hydraulic tube extruder. Following extrusion, the samples were classified in accordance with ASTM International (ASTM) Standard D 2488, "Description and Identification of Soils (Visual-Manual Procedure)." The tube samples were logged along the entire length of the sample by laboratory staff. Along with classifying the soil type, variations in stratigraphy and soil structure were also noted. Water contents were also determined from each sample in accordance with ASTM standard D 2216, "Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass." A specimen was taken from approximately the middle of each tube sample to perform the liquid, plastic, and sticky limit tests.

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TDD: 1•800•833•6388
www.shannonwilson.com

The plastic limit and liquid limit tests were both performed in accordance with ASTM standard 4318, "Liquid Limit, Plastic Limit, and Plasticity Index of Soils." The sticky limit was determined by following the procedure described in K.H. Head's Manual of Soil Laboratory Testing, Volume 1: Soil Classification and testing (1980). A description of the sticky limit procedure is presented below:

> "Use a pat of clay which has been matured at a moisture content within the plastic range, such that it is 'sticky'- that is, the clay sticks to a clean, dry spatula blade. Allow the clay to dry gradually by exposure to the atmosphere, and at intervals draw the tool lightly over the surface of the clay-pat. When the tool no longer picks up any clay, measure the moisture content. Add a little water to the clay so that it becomes sticky again, and repeat the process once or twice more.
> If the measured moisture contents are within reasonable agreement (an overall range of 2%), calculate the average moisture content to the nearest 1% and report it as the sticky limit of the clay."

After completion of testing, a report was generated for each test in accordance with applicable ASTM standards and results were summarized in a table including visual description, water content, plastic limit, liquid limit, and sticky limit. All calculations, data entry, and reports were reviewed by the laboratory technical director.

Please contact me at (206) 632-8020 if you have any questions regarding any of the procedures used in our laboratory.

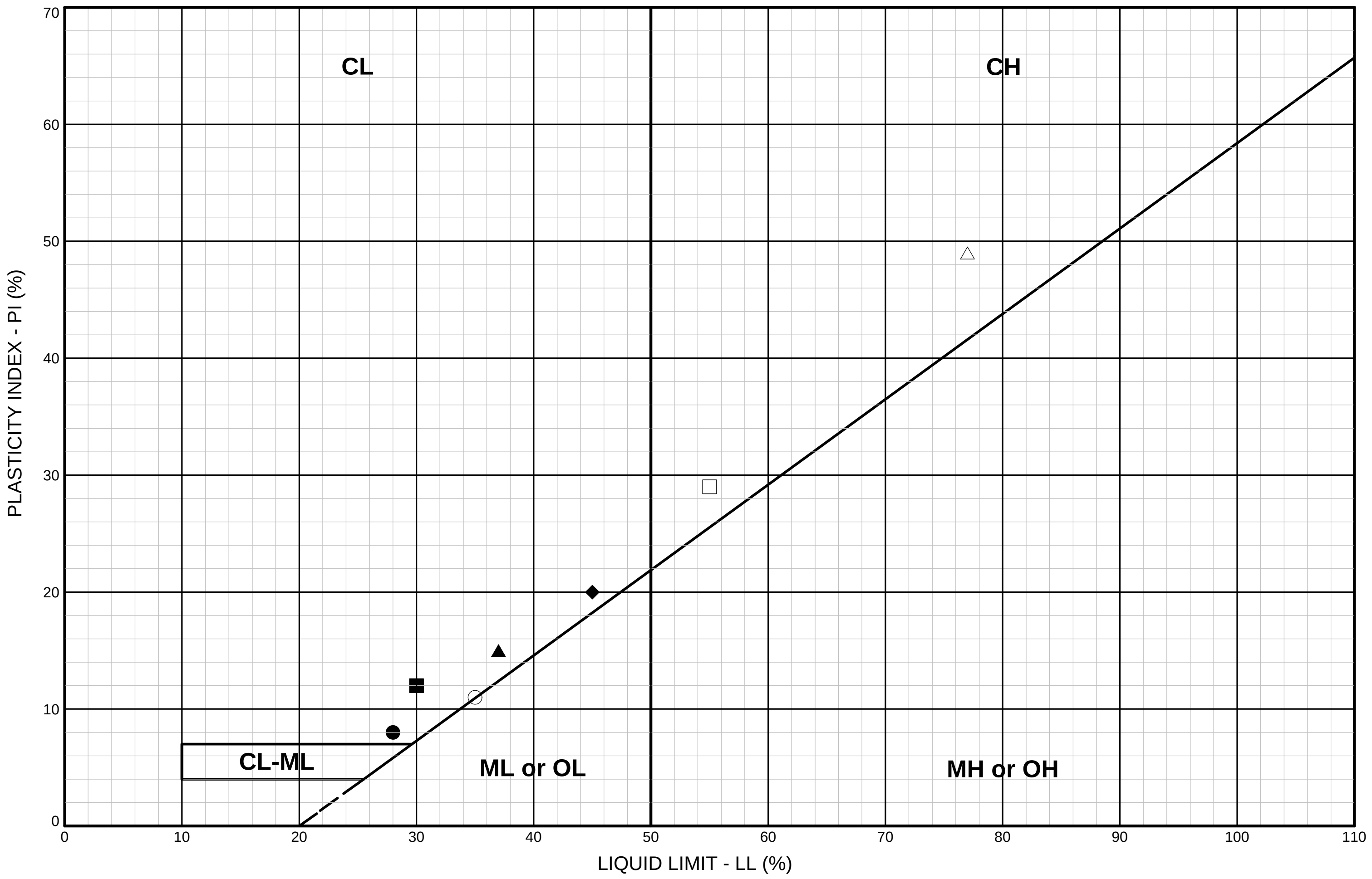
Sincerely,

SHANNON & WILSON, INC.

Andrew Caneday

Andrew Caneday
Seattle Laboratory Technical Director

AJC/ajc



LEGEND

CL: Low plasticity inorganic clays; sandy and silty clays

CH: High plasticity inorganic clays

ML or OL: Inorganic and organic silts and clayey silts of low plasticity

MH or OH: Inorganic and organic silts and clayey silts of high plasticity

CL-ML: Silty clays and clayey silts

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT. W.C. %	PASS. #200, %
● BH-01, S-6	26.0	CL	Gray, slightly sandy, Lean CLAY, trace of fine gravel	28	20	8	27.3	
■ BH-01, S-8	35.3	CL	Gray, slightly fine sandy, Lean CLAY	30	18	12	24.0	
▲ BH-07, S-4	41.5	CL	Gray, Lean CLAY	37	22	15	30.9	
◆ BH-12, S-2	50.0	CL	Gray, Lean CLAY; scattered organics	45	25	20	31.3	
○ BH-16, S-7	85.9	CL	Gray, Lean CLAY	35	24	11	25.4	
□ BH-17, S-2	51.1	CH	Gray, Fat CLAY	55	26	29	31.7	
△ BH-18, S-1	41.2	CH	Gray, Fat CLAY; scattered to abundant organics	77	28	49	44.3	

Silicon Valley Rapid Transit Project
Silicon Valley, California

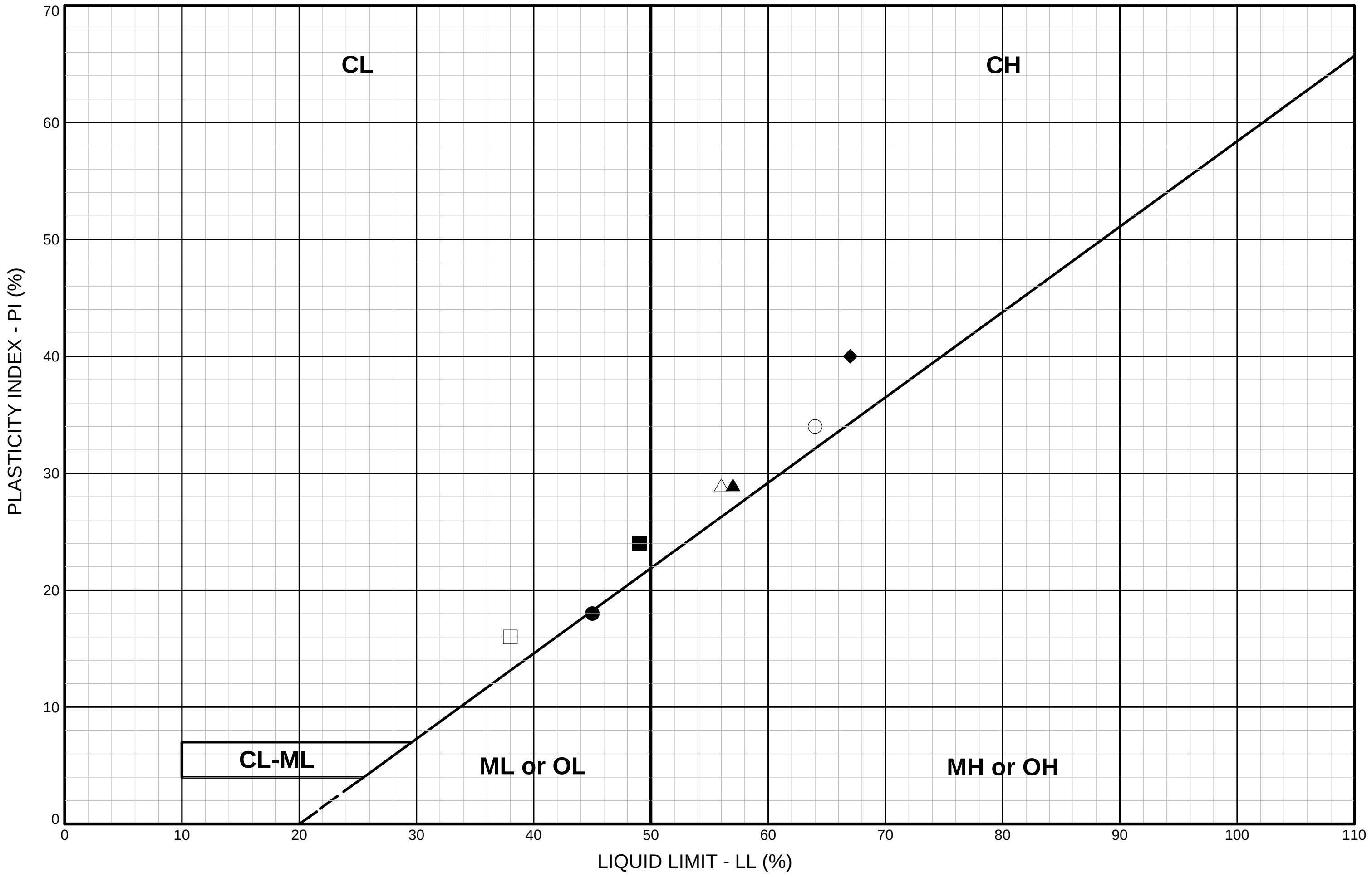
PLASTICITY CHART

October 2007
21-1-08824-030

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. FINAL

FIG. FINAL



LEGEND

CL: Low plasticity inorganic clays; sandy and silty clays

CH: High plasticity inorganic clays

ML or OL: Inorganic and organic silts and clayey silts of low plasticity

MH or OH: Inorganic and organic silts and clayey silts of high plasticity

CL-ML: Silty clays and clayey silts

ATT MAIN 21-08824-030.GPJ SHAN WIL.GDT 10/26/07

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT. W.C. %	PASS. #200, %
● BH-101, S-5	21.0	ML	Gray and brown, clayey SILT; scattered organics	45	27	18	37.0	
■ BH-103, S-7	30.0	CL	Brown, Lean CLAY, trace of sand	49	25	24	31.8	
▲ BH-19, S-3	41.1	CH	Gray, Fat CLAY; scattered organic laminations	57	28	29	37.9	
◆ BH-19, S-4	45.0	CH	Gray, Fat CLAY, trace of sand; scattered organics	67	27	40	32.6	
○ BH-52, S-14	37.6	CH	Gray, Fat CLAY; scattered organic seams	64	30	34	46.2	
□ BH-54, S-8	36.5	CL	Gray, Lean CLAY, trace of sand; scattered organics	38	22	16	34.0	
△ BH-87, S-9	56.0	CH	Gray, Fat CLAY, trace of sand; scattered organics	56	27	29	29.2	

Silicon Valley Rapid Transit Project
Silicon Valley, California

PLASTICITY CHART

October 2007 21-1-08824-030

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FIG. FINAL

FIG. FINAL

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GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
400 NORTH 34TH STREET • SUITE 100
P.O. BOX 300303 • SEATTLE, WASHINGTON 98103
206-632-8020 FAX 206-695-6777

SUMMARY OF LABORATORY TESTING

Silicon Valley Rapid Transit Project
Job No. 213213 EC03

Boring	Sample	Sample Recovery (feet)	Test Depth (feet)	Sample Description	USCS Symbol	Water Content (%)	LL	PL	PI	NP	SL
BH-01	6	25.0-26.7	26.0	Gray, slightly sandy, Lean CLAY, trace of fine gravel	CL	27.3	28	20	8		28
BH-01	8	35.0-37.5	35.3	Gray, slightly fine sandy, Lean CLAY	CL	24.0	30	18	12		28
BH-06	5	37.5-38.5	38.1	Brown, silty, fine to medium SAND, trace of gravel	SM	19.2	-	-	-	NP	
BH-07	4	40.0-41.7	41.5	Gray, Lean CLAY	CL	30.9	37	22	15		39
BH-12	2	50.0-52.2	50.0	Gray, Lean CLAY; scattered organics	CL	31.3	45	25	20		33
BH-16	7	85.0-86.8	85.9	Gray, Lean CLAY	CL	25.4	35	24	11		34
BH-17	2	50.0-51.9	51.1	Gray, Fat CLAY	CH	31.7	55	26	30		38
BH-18	1	40.0-42.5	41.2	Gray, Fat CLAY; scattered to abundant organics	CH	44.3	77	28	49		56
BH-19	3	40.0-42.0	41.1	Gray, Fat CLAY; scattered organic laminations	CH	37.9	57	28	30		49
BH-19	4	45.0-46.1	45.0	Gray, Fat CLAY, trace of sand; scattered organics	CH	32.6	67	27	40		44
BH-52	14	37.0-38.3	37.6	Gray, Fat CLAY; scattered organic seams	CH	46.2	64	30	33		53
BH-54	8	35.0-36.8	36.5	Gray, Lean CLAY, trace of sand; scattered organics	CL	34.0	38	22	16		36
BH-87	9	55.0-57.5	56.0	Gray, Fat CLAY, trace of sand; scattered organics	CH	29.2	56	27	28		45
BH-101	5	20.0-22.1	21.0	Gray and brown, clayey SILT; scattered organics	ML	37.0	45	27	18		37
BH-103	7	Bag Sample	30.0	Brown, Lean CLAY, trace of sand	CL	31.8	49	25	24		36

Notes:

The above results were obtained from samples stored for a period of 2-3 years. Moisture loss or other types of disturbance associated with storing samples for an extended period of time may affect test results.

LL = Liquid Limit
PL= Plastic Limit
PI = Plastic Index
NP = Non plastic
SL = Sticky Limit

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

ALASKA
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OREGON
WASHINGTON

March 10, 2008

Mr. Abhishek Jain
Hatch Mott MacDonald
3103 North First Street
Building B, Suite 200
San Jose, CA 95134

RE: 24965-PO-00011: SILICON VALLEY RAPID TRANSIT PROJECT (213213 EC03), LABORATORY TESTING

Dear Mr. Jain:

This letter presents the results of and describes the procedures and methods that we used to perform moisture content, liquid limit, plastic limit, and stick limit laboratory tests on samples provided to us by Hatch Mott MacDonald for the Silicon Valley Rapid Transit Project (SVRTP).

On February 5, 2008, the Shannon & Wilson, Inc. (S&W) Seattle soils testing laboratory received 17 soil samples. Samples were immediately stored in a humidity-controlled storage area. It is our understanding that the samples were originally obtained by Hatch Mott MacDonald in November 2007.

Upon receiving authorization to begin testing the samples on February 25, 2008, S&W laboratory personnel classified each sample in accordance with ASTM International (ASTM) Standard D 2488, “Description and Identification of Soils (Visual-Manual Procedure).” Water contents were determined from each sample in accordance with ASTM standard D 2216, “Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.” A representative specimen was taken from each sample to perform the liquid, plastic, and sticky limit tests.

The plastic limit and liquid limit tests were both performed in accordance with ASTM standard 4318, “Liquid Limit, Plastic Limit, and Plasticity Index of Soils.” The sticky limit was determined by following the procedure described in K.H. Head’s Manual of Soil Laboratory Testing, Volume 1: Soil Classification and testing (1980). Sticky limit tests were only performed on soils having a Unified Soil Classification System (USCS) symbol of CH. A description of the sticky limit procedure is presented below:

> "Use a pat of clay which has been matured at a moisture content within the plastic range, such that it is 'sticky'- that is, the clay sticks to a clean, dry spatula blade. Allow the clay to dry gradually by exposure to the atmosphere, and at intervals draw the tool lightly over the surface of the clay-pat. When the tool no longer picks up any clay, measure the moisture content. Add a little water to the clay so that it becomes sticky again, and repeat the process once or twice more.
> If the measured moisture contents are within reasonable agreement (an overall range of 2%), calculate the average moisture content to the nearest 1% and report it as the sticky limit of the clay."

After completion of testing, a report was generated for each test in accordance with applicable ASTM standards and results were summarized in a table including visual description, water content, plastic limit, liquid limit, and sticky limit. All calculations, data entry, and reports were reviewed by the laboratory technical director. The table summarizing the results and plots of the limit testing are enclosed.

Please contact me at (206) 632-8020 if you have any questions regarding any of the procedures used in our laboratory.

Sincerely,

SHANNON & WILSON, INC.

Andrew Caneday
Seattle Laboratory Technical Director

AJC/twh:ajc

Enclosures: Summary of Laboratory Testing
Figure 1 – Plasticity Chart (3 sheets)

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SUMMARY OF LABORATORY TESTING

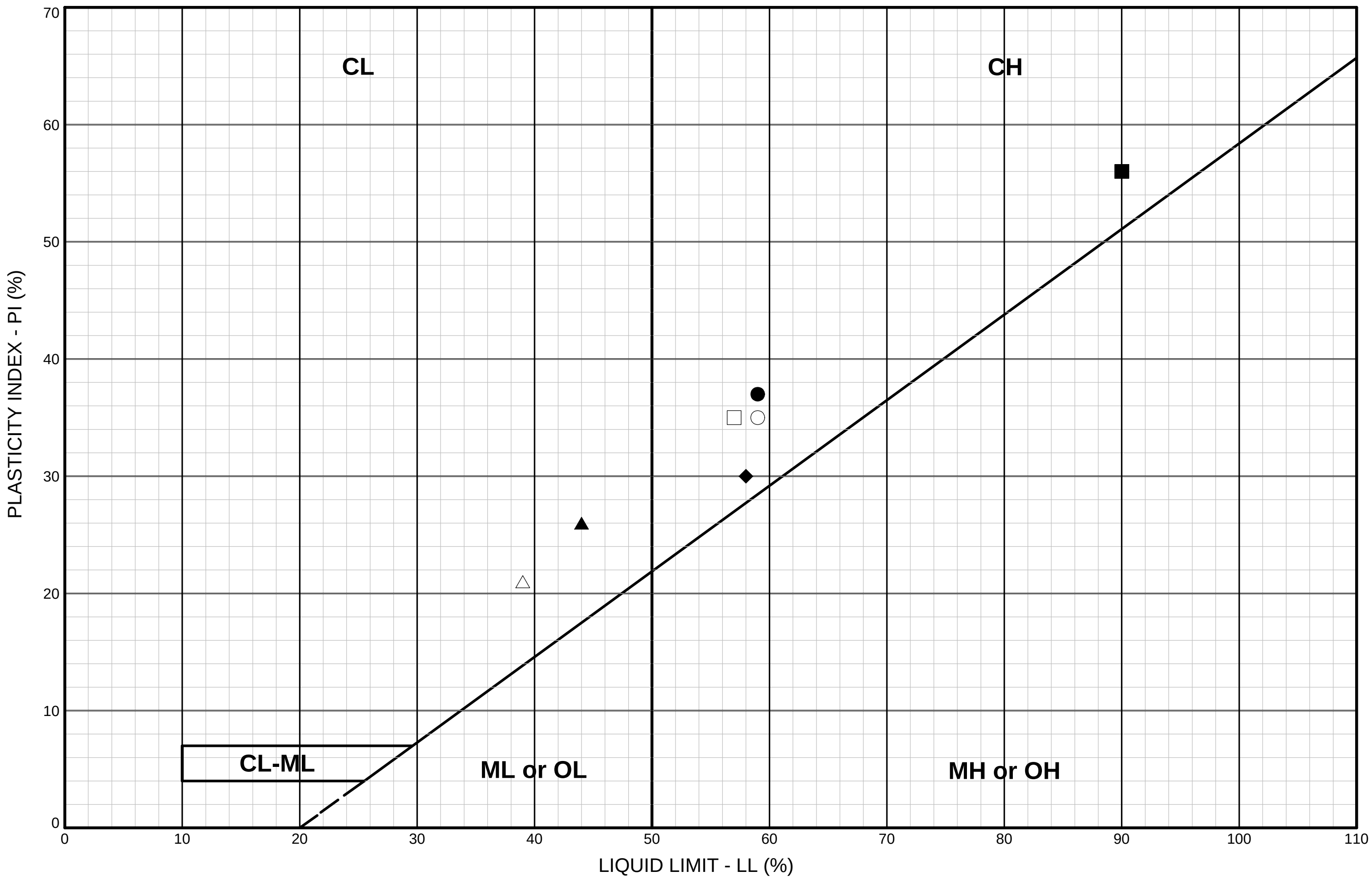
Silicon Valley Rapid Transit Project
Job No. 213213 EC03
Purchase Order No. 24965-PO-00011

Boring	Sample	Test Depth (feet)	Sample Description	USCS Symbol	Water Content (%)	LL	PL	PI	SL
BH-84	26	200	Brown and light brown, Lean CLAY, trace of sand and fine gravel	CL	18.7	44	18	26	-
BH-85	5	42.25	Gray, Fat CLAY; scattered organics	CH	35.5	58	28	30	47
BH-85	26	187.25	Gray, Fat CLAY	CH	28.7	59	24	35	37
BH-85	28	197.25	Gray-brown, Fat CLAY	CH	25.3	57	22	34	38
BH-90	6	22.5	Gray, fine sandy, Lean CLAY	CL	24.7	39	18	21	-
BH-90	13	40	Gray, Fat CLAY	CH	44.9	72	32	40	47
BH-92	8A	130	Gray, Lean CLAY	CL	20.4	43	19	24	-
BH-99	1	2	Gray, slightly sandy, Fat CLAY, trace of fine gravel	CH	26.8	66	24	42	36
BH-99	5	20	Gray, Lean CLAY, trace of fine to medium sand	CL	24.6	34	15	18	-
BH-100	1	2	Dark brown, Fat CLAY; abundant organics	CH	29.2	59	22	38	38
BH-100	2	7.25	Gray-brown, Fat CLAY	CH	48.1	90	34	56	55
MW-3C	-	46.5	Gray, Fat CLAY	CH	31.6	59	27	32	47
MW-3C	-	61.5	Gray, Fat CLAY	CH	28.7	57	25	32	42
MW-3D	-	39	Gray, Fat CLAY	CH	29.1	57	27	30	43
MW-3D	-	53	Gray, Fat CLAY	CH	28.3	59	27	32	43
PZ-6J	-	30	Dark gray-brown, Fat CLAY	CH	36.0	68	32	36	46
PZ-6K	-	33.5	Light brown, Fat CLAY, trace of fine sand	CH	28.9	54	20	35	34

LL = Liquid Limit
PL= Plastic Limit
PI = Plastic Index
SL = Sticky Limit

trace= <5% constituent
slightly= 5-12% constituent
lower case= +12% constituent
ALL CAPS= Major constituent

- Sticky Limit Test not performed on CL soils



LEGEND

CL: Low plasticity inorganic clays; sandy and silty clays

CH: High plasticity inorganic clays

ML or OL: Inorganic and organic silts and clayey silts of low plasticity

MH or OH: Inorganic and organic silts and clayey silts of high plasticity

CL-ML: Silty clays and clayey silts

NOTES

AD	Sample air dried before testing
ND	Sample not air dried

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT. W.C. %	PASS. #200,%	TEST BY	CKD BY	SMPL PREP.
● BH-100, S-1	2.0	CH	Dark brown, Fat CLAY; abundant organics	59	22	37	29.2		AKV	AJC	ND
■ BH-100, S-2	7.3	CH	Gray-brown, Fat CLAY	90	34	56	48.1		AKV	AJC	ND
▲ BH-84	200.0	CL	Brown and light brown, Lean CLAY, trace of sand and fine gravel	44	18	26	18.7		AJC	AJC	ND
◆ BH-85, S-5	42.3	CH	Gray, Fat CLAY; scattered organics	58	28	30	35.5		AKV	AJC	ND
○ BH-85, S-26	187.3	CH	Gray, Fat CLAY	59	24	35	28.7		AKV	AJC	ND
□ BH-85, S-28	197.3	CH	Gray-brown, Fat CLAY	57	22	35	25.3		AKV	AJC	ND
△ BH-90, S-6	22.5	CL	Gray, fine sandy, Lean CLAY	39	18	21	24.7		JFL	AJC	ND

Silicon Valley Rapid Transit Project
California

PLASTICITY CHART

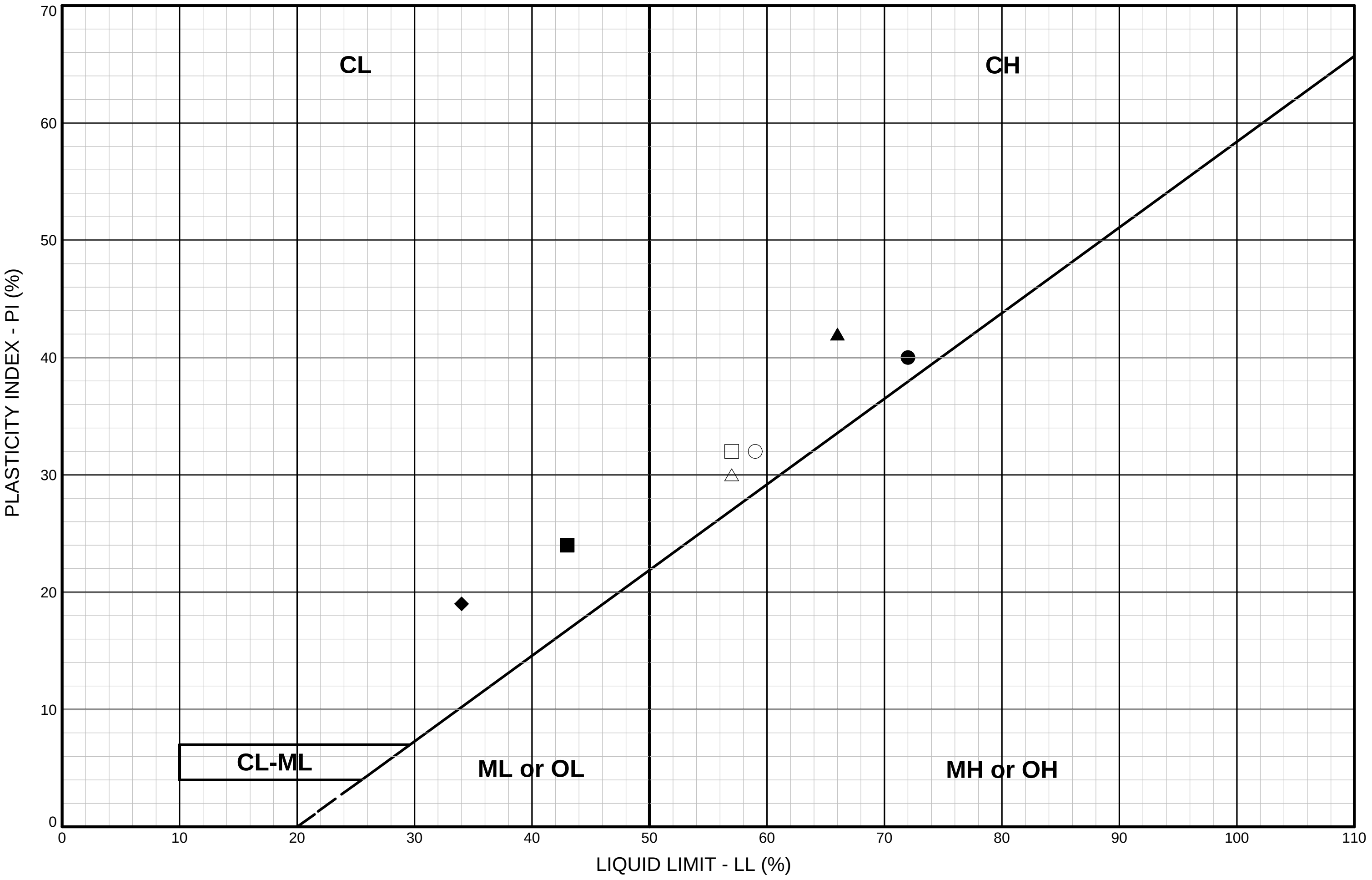
March 2008 213213 EC03

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 1
Sheet 1 of 3

FIG. 1

AASHTO ATT MAIN 21-08824-033.GPJ SHAN WIL.GDT 3/10/08



LEGEND

CL: Low plasticity inorganic clays; sandy and silty clays

CH: High plasticity inorganic clays

ML or OL: Inorganic and organic silts and clayey silts of low plasticity

MH or OH: Inorganic and organic silts and clayey silts of high plasticity

CL-ML: Silty clays and clayey silts

NOTES

AD	Sample air dried before testing
ND	Sample not air dried

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT. W.C. %	PASS. #200,%	TEST BY	CKD BY	SMPL PREP.
● BH-90	40.0	CH	Gray, Fat CLAY	72	32	40	44.9		AJC	AJC	ND
■ BH-92, 8A	130.0	CL	Gray, Lean CLAY	43	19	24	20.4		AKV	AJC	ND
▲ BH-99, S-1	2.0	CH	Gray, slightly sandy, Fat CLAY, trace of fine gravel	66	24	42	26.8		JFL	AJC	ND
◆ BH-99, S-5	20.0	CL	Gray, Lean CLAY, trace of fine to medium sand	34	15	19	24.6		AKV	AJC	ND
○ MW-3C	46.5	CH	Gray, Fat CLAY	59	27	32	31.6		OTH	AJC	ND
□ MW-3C	61.5	CH	Gray, Fat CLAY	57	25	32	28.7		OTH	AJC	ND
△ MW-3D	39.0	CH	Gray, Fat CLAY	57	27	30	29.1		AKV	AJC	ND

Silicon Valley Rapid Transit Project
California

PLASTICITY CHART

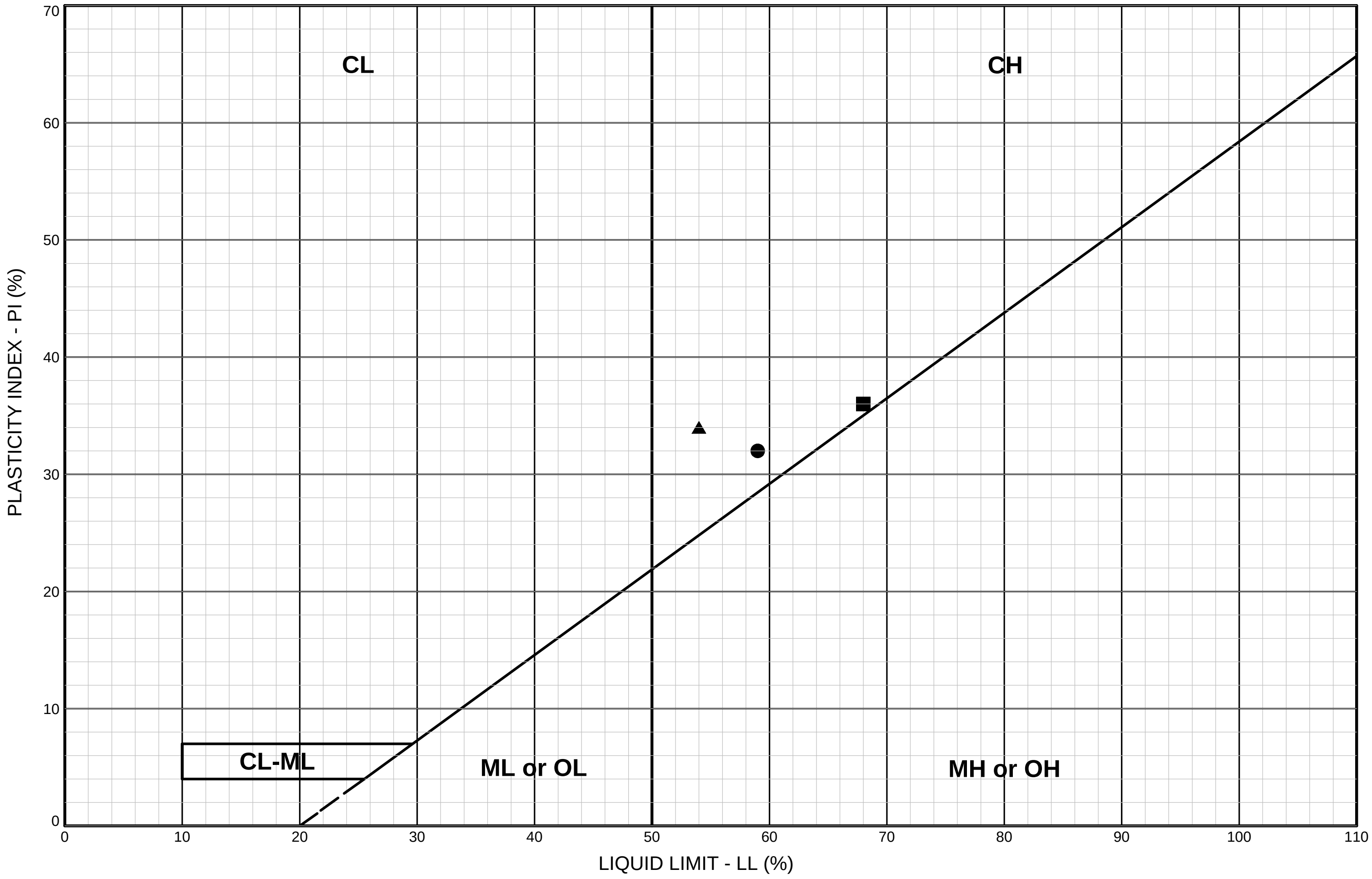
March 2008 213213 EC03

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 1
Sheet 2 of 3

FIG. 1

AASHTO_ATT_MAIN 21-08824-033.GPJ SHAN_WIL.GDT 3/10/08



LEGEND

CL: Low plasticity inorganic clays; sandy and silty clays

CH: High plasticity inorganic clays

ML or OL: Inorganic and organic silts and clayey silts of low plasticity

MH or OH: Inorganic and organic silts and clayey silts of high plasticity

CL-ML: Silty clays and clayey silts

NOTES

AD Sample air dried before testing
ND Sample not air dried

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT. W.C. %	PASS. #200,%	TEST BY	CKD BY	SMPL PREP.
● MW-3D	53.0	CH	Gray, Fat CLAY	59	27	32	28.3		AKV	AJC	ND
■ PZ-6J	30.0	CH	Dark gray-brown, Fat CLAY	68	32	36	36.0		JFL	AJC	ND
▲ PZ-6K	33.5	CH	Light brown, Fat CLAY, trace of fine sand	54	20	34	28.9		AKV	AJC	ND
											ND
											ND
											ND
											ND

Silicon Valley Rapid Transit Project
California

PLASTICITY CHART

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FIG. 1
Sheet 3 of 3

AASHTO_ATT_MAIN 21-08824-033.GPJ SHAN_WIL.GDT 3/10/08

FIG. 1

Appendix 8: Direct Shear Test Results

COOPER TESTING LABORATORY

937 Commercial Street
Palo Alto, California 94303
T: 650.213.8436 F: 650.213.8437
http://www.coopertestinglabs.com

Mr. Abhishek Jain, E.I.T.
Geotechnical Professional
Hatch Mott Macdonald

Re: SVRT Testing Program description

The following is a brief description of the testing program undertaken by Cooper Testing Labs for the SVRT project under your guidance.

1. Introduction

Cooper Testing Laboratories, Inc. (Cooper) conducted a laboratory testing program consisting of particle-size distribution, relative density, and direct shear tests for Silicon Valley Rapid Transit (SVRT) project. The tests were performed in general accordance with American Society of Testing and Materials (ASTM) standards. This memorandum describes the tests performed, and presents the test results.

2. Testing Program

Three (3) bulk soil samples, labeled as MW-2D, MW-6K and MW-4A, were provided to Cooper by the client. Cooper performed the following tests on these samples.

Particle-size Distribution

On each sample, Cooper performed particle-size distribution in accordance with ASTM D 422, "*Particle-Size Analysis of soils*". The particle-size distribution graphs for each specimen are shown on 'Particle Size Distribution Test Report'.

Relative Density Tests

The tests were performed in accordance with ASTM D 4253, "*Maximum Index Density and Unit Weight of Soils Using a Vibratory Table*", and ASTM D 4254, "*Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density*". The maximum density tests were performed on wet samples using an electro-magnetic vertically vibrating table (Method 1A), except for sample MW-6K that was run dry due to the high fines content. The minimum density tests were performed by either the soil-filled tube method (Method B) or the graduated cylinder method (Method C). The samples were reused for direct shear testing due to scarcity of samples provided.

The sample MW-6K contained 27 % (more than 15 %) particles passing the no. 200 sieve. ASTM recommends using a 'modified-proctor' procedure (ASTM D 1557) for such soils, however, this procedure could not be used due to scarcity of soil samples provided.

The results of maximum and minimum index density tests are provided on 'Minimum & Maximum Index unit Weight' reports for each sample.

Direct Shear Tests

Three direct shear envelopes were developed for each of the samples. Each envelope was based on material being compacted to one of three relative densities (60%, 80%, and 95%). The tests were performed in accordance with ASTM D 3080, "*Direct Shear Test of Soils Under Consolidated Drained Conditions*". The client provided the normal pressures and relative densities. The samples were moisture conditioned and remolded by tamping in 1" layers according to the remolding targets. These remolding targets were calculated using the results of maximum and minimum relative density tests, and the target relative densities provided. The test results are presented on 'Direct Shear' test reports for each soil sample at a specific relative density. Each report includes plots of 1) shear stress vs. normal stress, 2) change in specimen height vs. deformation, and 3) shear stress vs. deformation. The spreadsheets of raw data have also been provided to the client. The shear strength parameters of friction angle and cohesion were determined based on the best-fit straight line drawn through the test data points on a plot of shear strength vs. normal stress. The report format allows the client to reinterpret the raw data using their engineering judgment.

3. Direct Shear Test Limitations

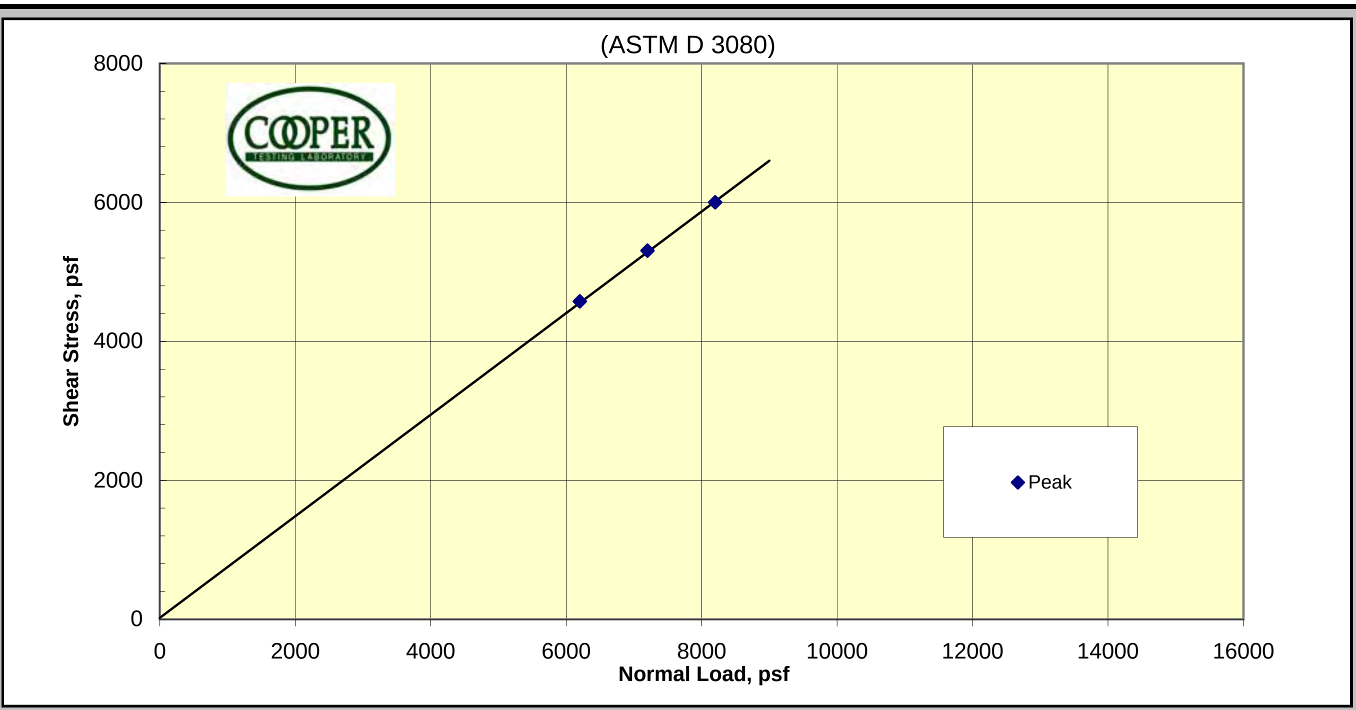
In general, direct shear tests can be problematic. In this test, the sample is forced to fail along a narrow predefined plane. Any gravel in this plane can cause strange behavior and higher shear loads to be observed during the test. Likewise, any variations in density that occur in this predefined shear plane can have a significant impact on the measured strength of any given point. It is also not uncommon for the top cap to tip during a test. This can affect both the shear load and the measured change in height of the sample. These problems can begin to overshadow differences due to the normal loads if the grouping of the normal loads is too tight

Please let me know if there are any questions,

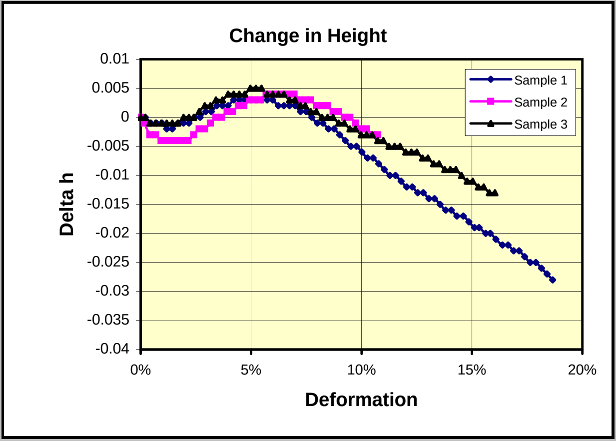
Best regards,

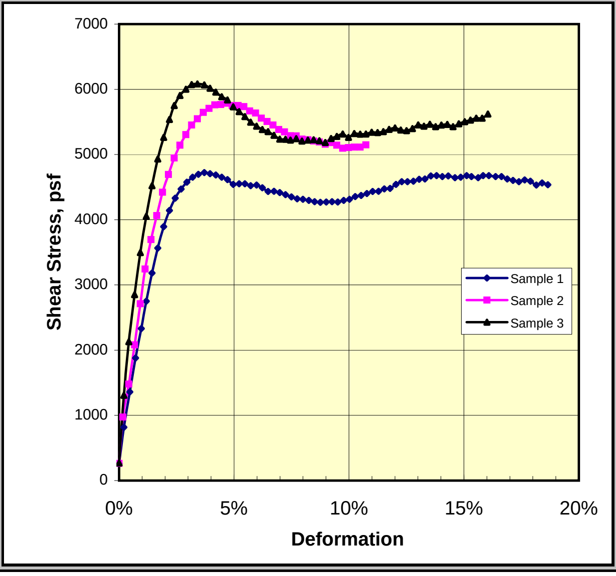
Peter Jacke
Vice President
Cooper testing Labs

Direct Shear



P. Phi (degrees)	36.2	Ult. phi (degrees)	
P. Cohesion (psf)	20	Ult.Cohesion (psf)	





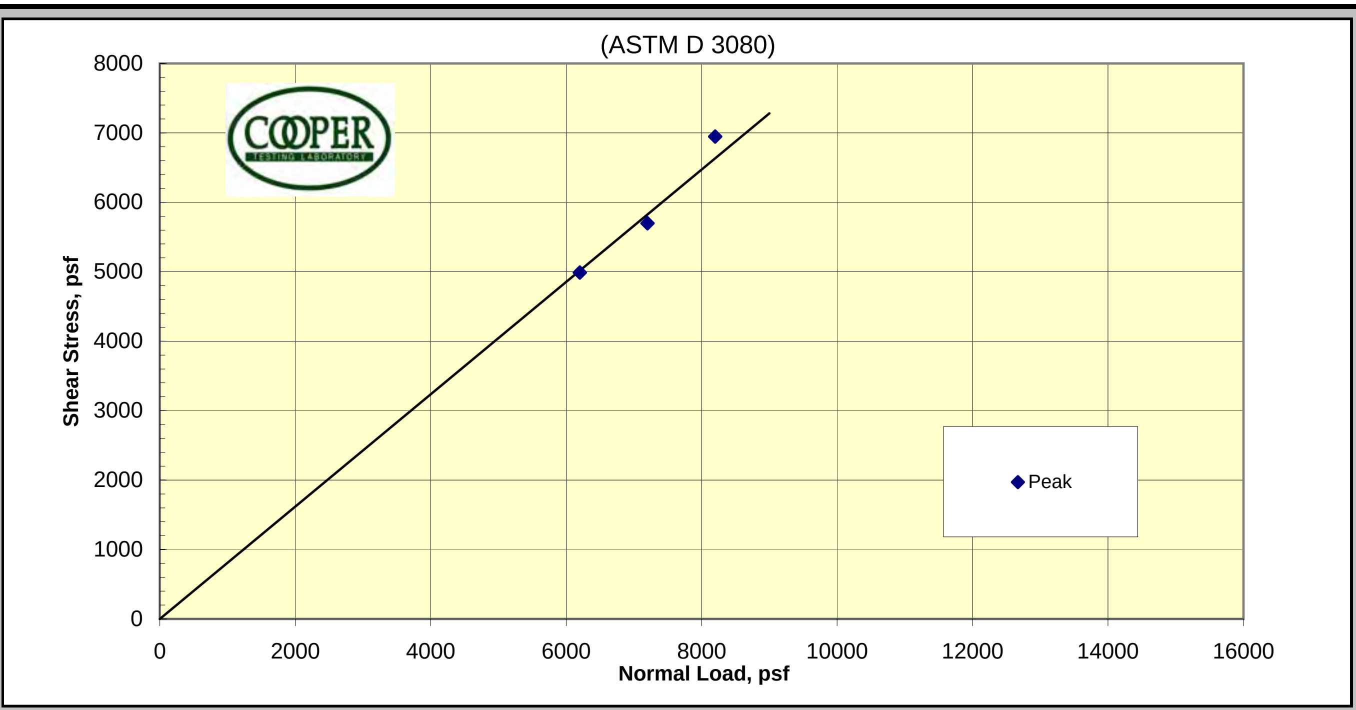
	Sample Data: Initial			
Initial	**1**	**2**	**3**	**4**
Moisture	14.5%	14.5%	14.5%	
Dry Density, pcf	118.1	118.0	117.9	
Void Ratio	0.4539	0.4550	0.4550	
Saturation	87.8%	87.7%	87.7%	
Diameter, in.	2.38	2.375	2.375	
Height, in.	1.01	1.01	1.01	
	Sample Data: At Test			
Moisture	14.8%	14.3%	14.3%	
Dry Density, pcf	121.1	122.2	121.6	
Void Ratio	0.4173	0.4140	0.4111	
Saturation	97.4%	99.7%	95.6%	
Diameter, in.	2.375	2.375	2.375	
Height, in.	0.98	0.98	0.97	
Normal Stress, psf	6200	7200	8200	
Shear Stress, psf	4577	5305	6000	
Deformation	3%	3%	3%	
Ultimate Stress, psf	0	0	0	
Rate in/min.	0.002	0.002	0.002	

CTL #	659-001	**Date:**	12/5/2007	
Client:	HMM			
Project Name:	SVRT			
Project Number:	213213		**Reduced by:**	MD
Sample #	**Boring**	**Sample**	**Depth, ft.**	
1	MW-2D		105-108	
2	MW-2D		105-108	
3	MW-2D		105-108	
4				

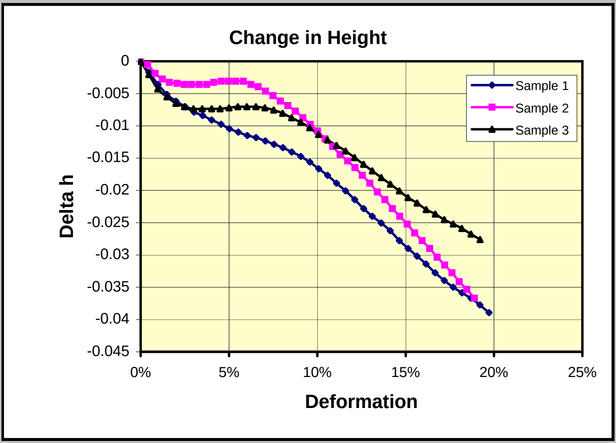
	Visual Soil Classification
1	Brown well graded SAND with Silt & Gravel
2	Brown well graded SAND with Silt & Gravel
3	Brown well graded SAND with Silt & Gravel
4	

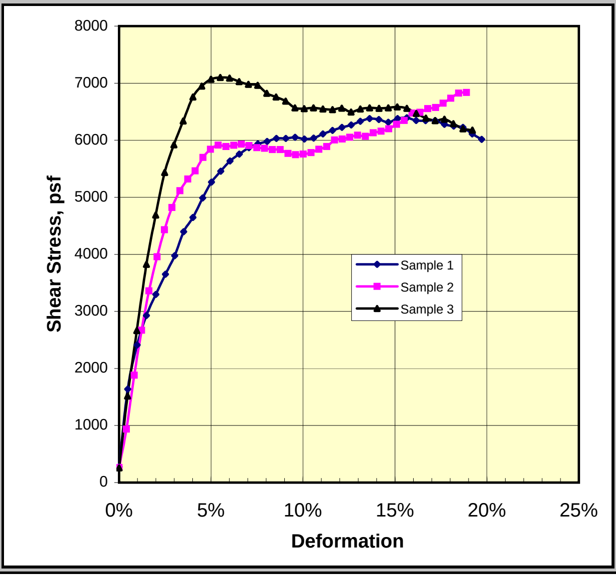
Remarks: Remolding target = 80% Relative density (120.3 pcf dry)

Direct Shear



P. Phi (degrees)	**39.0**	**Ult. phi (degrees)**	
P. Cohesion (psf)	**0**	**Ult.Cohesion (psf)**	





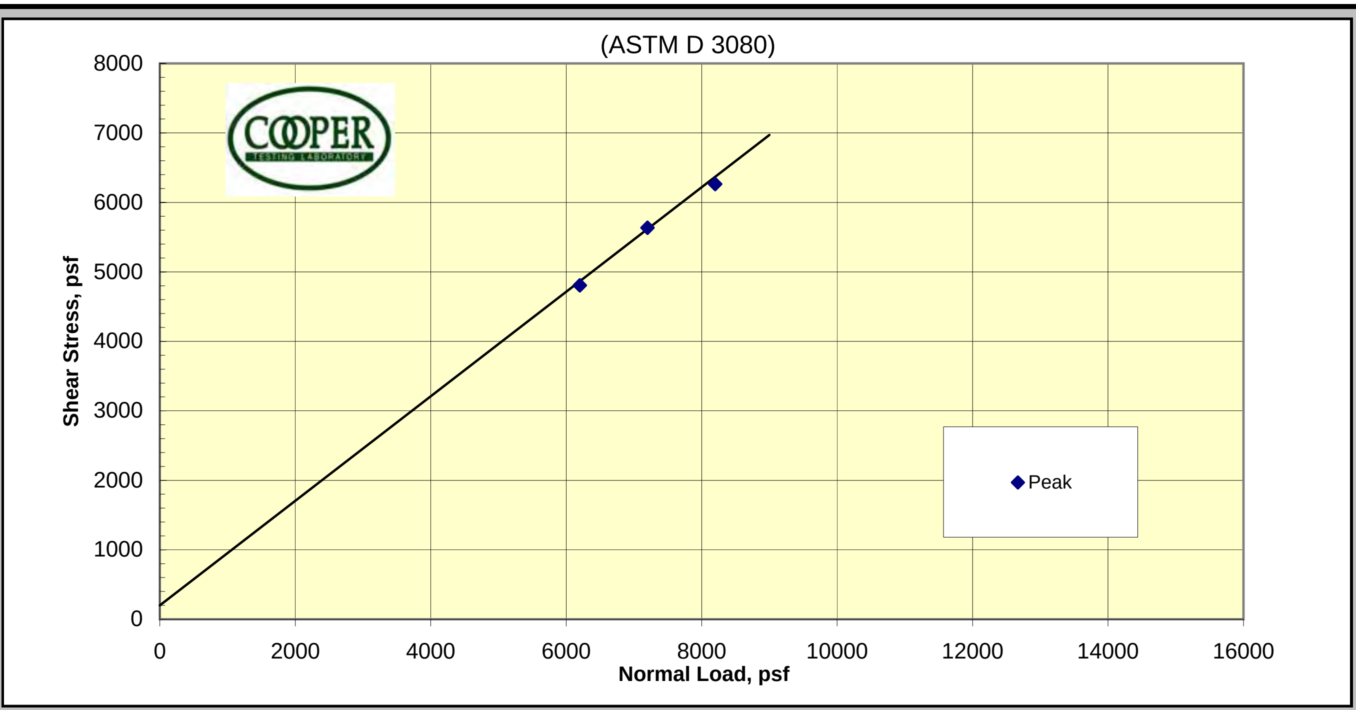
	Sample Data: Initial			
Initial	**1**	**2**	**3**	**4**
Moisture	14.5%	14.5%	14.5%	
Dry Density, pcf	116.5	116.7	116.6	
Void Ratio	0.4734	0.4712	0.4712	
Saturation	84.0%	84.7%	84.7%	
Diameter, in.	2.38	2.375	2.375	
Height, in.	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture	14.6%	14.8%	14.1%	
Dry Density, pcf	119.7	120.1	120.2	
Void Ratio	0.4345	0.4300	0.4277	
Saturation	92.5%	94.7%	90.5%	
Diameter, in.	2.375	2.375	2.375	
Height, in.	0.97	0.97	0.97	
Normal Stress, psf	6200	7200	8200	
Shear Stress, psf	4988	5699	6947	
Deformation	5%	5%	5%	
Ultimate Stress, psf	0	0	0	
Rate in/min.	0.002	0.002	0.002	

CTL #	659-001	**Date:**	11/18/2007	
Client:	HMM			
Project Name:	SVRT			
Project Number:	213213		**Reduced by:**	MD
Sample #	**Boring**	**Sample**	**Depth, ft.**	
1	MW-2D		105-108	
2	MW-2D		105-108	
3	MW-2D		105-108	
4				

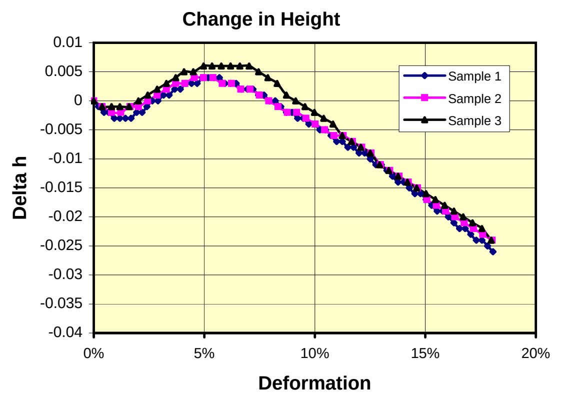
	Visual Soil Classification
1	Brown Well Graded SAND with Silt & Gravel
2	Brown Well Graded SAND with Silt & Gravel
3	Brown Well Graded SAND with Silt & Gravel
4	

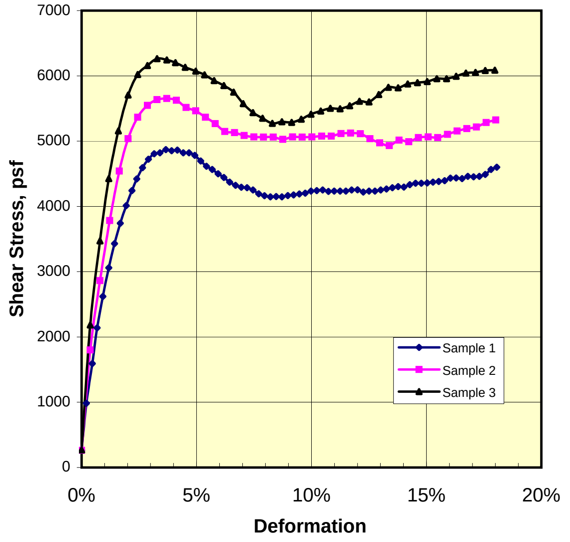
Remarks: Remolding target = 65% Relative density (117.3 pcf dry)

Direct Shear



P. Phi (degrees)	**37.0**	**Ult. phi (degrees)**	
P. Cohesion (psf)	**200**	**Ult.Cohesion (psf)**	





	Sample Data: Initial			
Initial	**1**	**2**	**3**	**4**
Moisture	14.5%	14.5%	14.5%	
Dry Density, pcf	120.6	120.7	119.6	
Void Ratio	0.4240	0.4220	0.4347	
Saturation	94.4%	94.2%	91.9%	
Diameter, in.	2.38	2.375	2.375	
Height, in.	1.01	1.01	1.02	
	Sample Data: At Test			
Moisture	13.8%	14.2%	14.1%	
Dry Density, pcf	123.5	122.9	123.6	
Void Ratio	0.3899	0.3972	0.3883	
Saturation	97.1%	98.6%	99.9%	
Diameter, in.	2.375	2.375	2.375	
Height, in.	0.99	0.99	0.99	
Normal Stress, psf	6200	7200	8200	
Shear Stress, psf	4807	5636	6264	
Deformation	Peak	Peak	Peak	
Ultimate Stress, psf	0	0	0	
Rate in/min.	0.002	0.002	0.002	

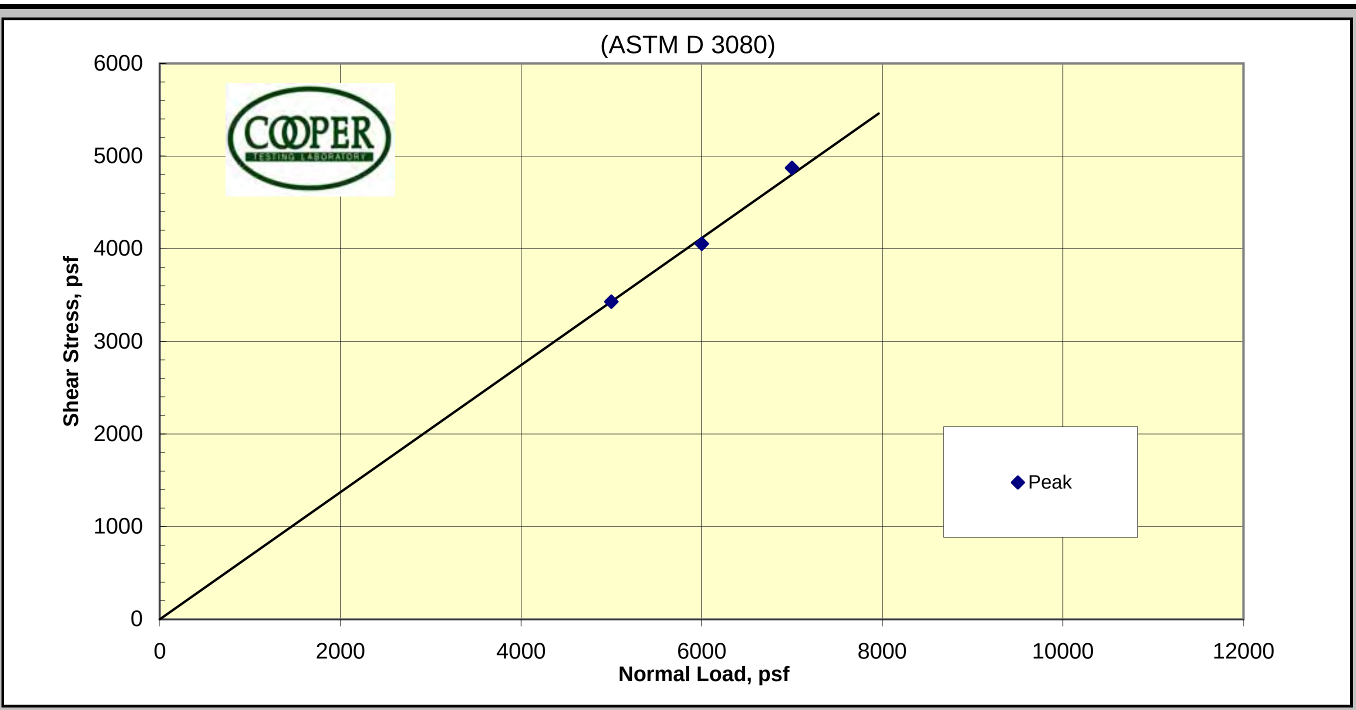
CTL #	659-001	**Date:**	12/3/2007
Client:	HMM		
Project Name:	SVRT		
Project Number:	213213	**Reduced by:**	MD

Sample #	**Boring**	**Sample**	**Depth, ft.**
1	MW-2D		105-108
2	MW-2D		105-108
3	MW-2D		105-108
4			

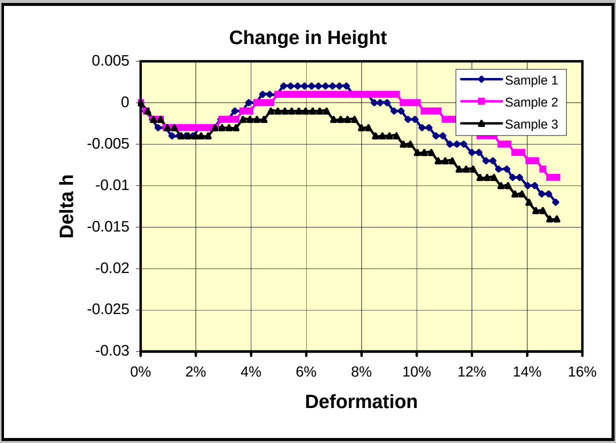
	Visual Soil Classification
1	Brown well graded SAND with Silt & Gravel
2	Brown well graded SAND with Silt & Gravel
3	Brown well graded SAND with Silt & Gravel
4	

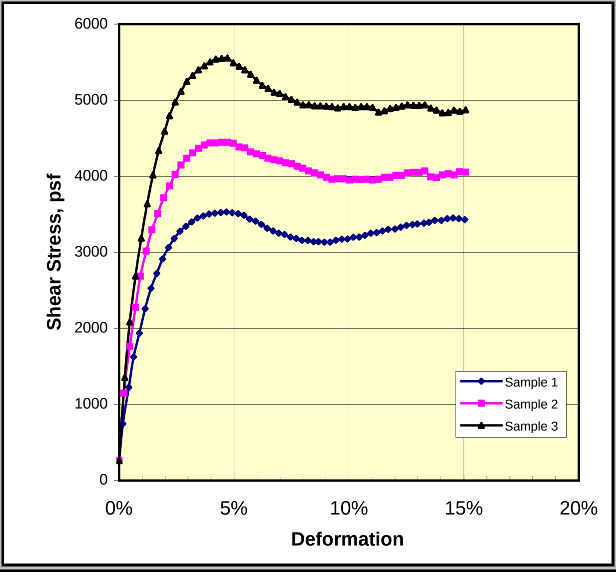
Remarks: Target density = 95% Relative density (123.5 pcf dry)

Direct Shear



P. Phi (degrees)	34.4	Ult. phi (degrees)	
P. Cohesion (psf)	0	Ult.Cohesion (psf)	





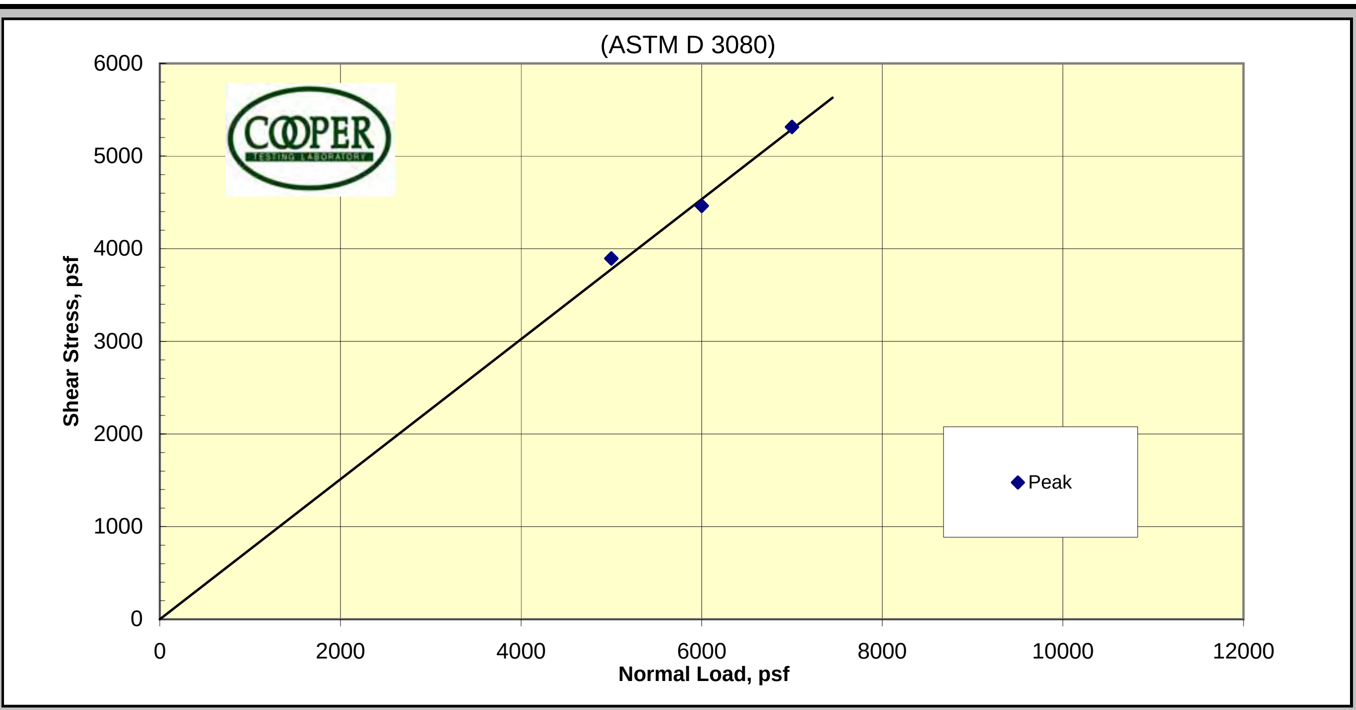
	Sample Data: Initial			
Initial	**1**	**2**	**3**	**4**
Moisture	15.7%	15.7%	15.7%	
Dry Density, pcf	106.0	106.3	106.2	
Void Ratio	0.6192	0.6152	0.6152	
Saturation	69.9%	70.2%	70.2%	
Diameter, in.	2.38	2.375	2.375	
Height, in.	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture	17.3%	17.7%	18.0%	
Dry Density, pcf	108.1	108.7	108.5	
Void Ratio	0.5874	0.5792	0.5810	
Saturation	80.9%	84.1%	85.0%	
Diameter, in.	2.375	2.375	2.375	
Height, in.	0.98	0.98	0.98	
Normal Stress, psf	5000	6000	7000	
Shear Stress, psf	3429	4053	4872	
Deformation	15%	15%	15%	
Ultimate Stress, psf	0	0	0	
Rate in/min.	0.002	0.002	0.002	

CTL #	659-001	**Date:**	11/29/2007	
Client:	HMM			
Project Name:	SVRT			
Project Number:	213213		**Reduced by:**	MD
Sample #	**Boring**	**Sample**	**Depth, ft.**	
1	MW-4A		84-85	
2	MW-4A		84-85	
3	MW-4A		84-85	
4				

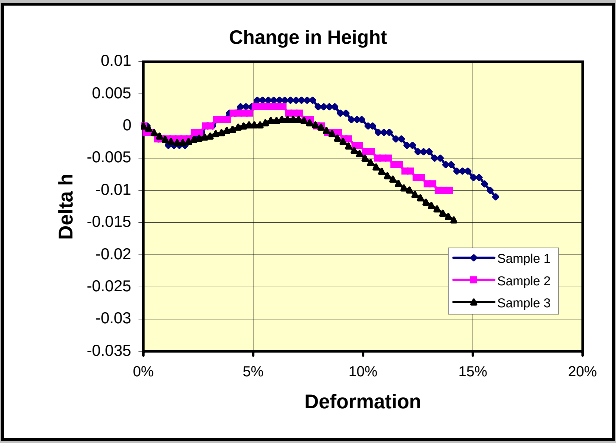
	Visual Soil Classification
1	Brown poorly Graded SAND with Silt
2	Brown poorly Graded SAND with Silt
3	Brown poorly Graded SAND with Silt
4	

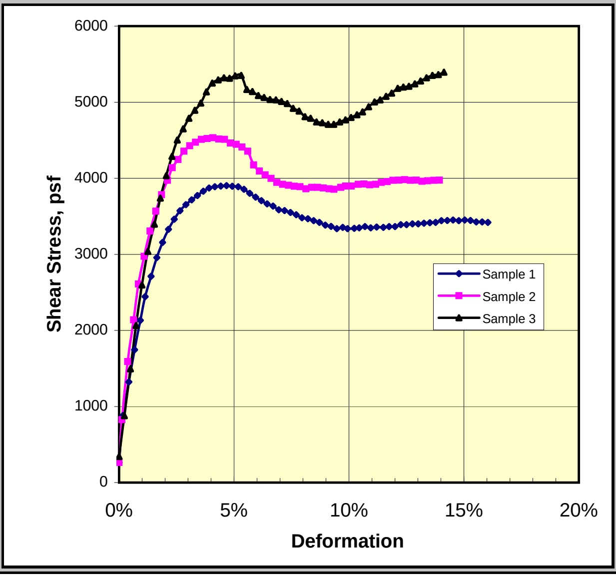
Remarks: Remolding target = 80% relative density (106.9pcf dry)

Direct Shear



P. Phi (degrees)	**37.1**	**Ult. phi (degrees)**	
P. Cohesion (psf)	**0**	**Ult.Cohesion (psf)**	





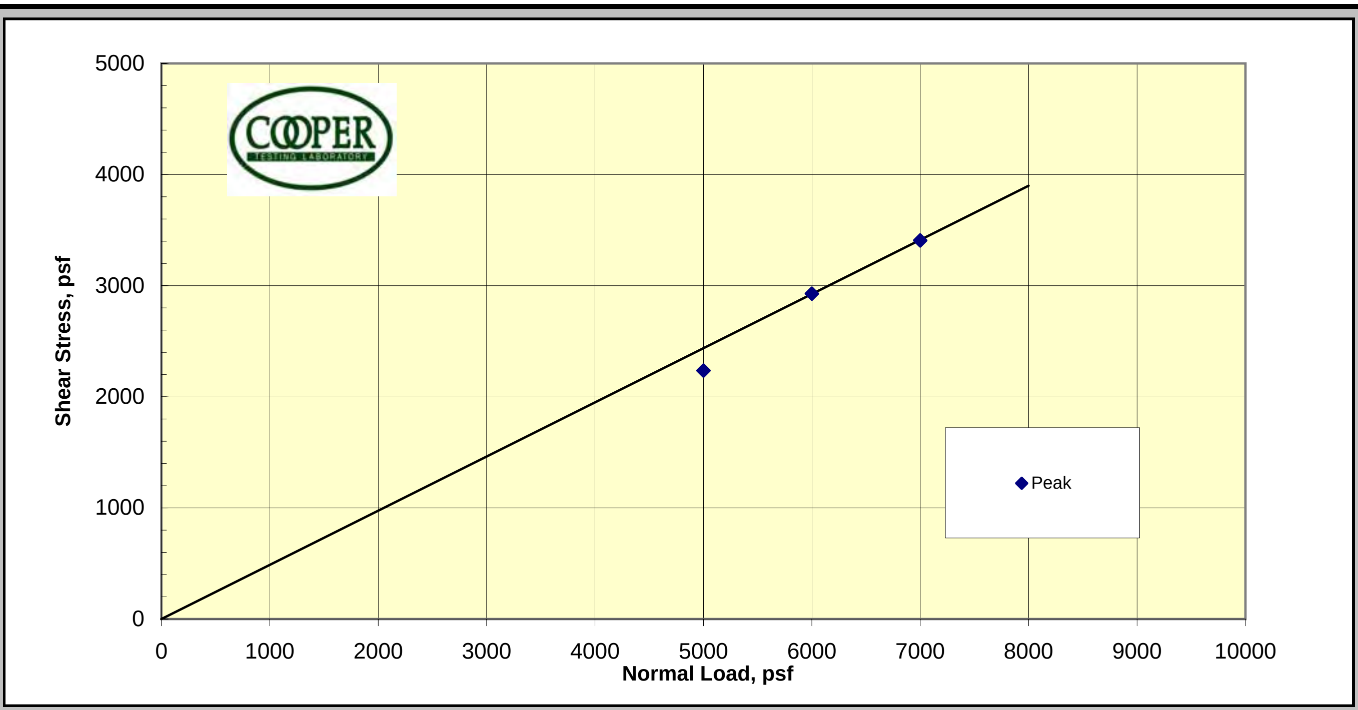
	Sample Data: Initial			
Initial	**1**	**2**	**3**	**4**
Moisture	15.7%	15.7%	15.7%	
Dry Density, pcf	109.0	108.9	108.8	
Void Ratio	0.5745	0.5770	0.5770	
Saturation	75.1%	74.9%	74.9%	
Diameter, in.	2.38	2.375	2.375	
Height, in.	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture	16.6%	15.4%	16.2%	
Dry Density, pcf	111.3	111.9	112.0	
Void Ratio	0.5419	0.5337	0.5322	
Saturation	84.4%	79.4%	83.7%	
Diameter, in.	2.375	2.375	2.375	
Height, in.	0.98	0.97	0.97	
Normal Stress, psf	5000	6000	7000	
Shear Stress, psf	3894	4463	5315	
Deformation	5%	5%	5%	
Ultimate Stress, psf	0	0	0	
Rate in/min.	0.002	0.002	0.002	

CTL #	659-001		**Date:**	12/4/2007
Client:	HMM			
Project Name:	SVRT			
Project Number:	213213		**Reduced by:**	MD
Sample #	**Boring**	**Sample**	**Depth, ft.**	
1	MW-4A		84-85	
2	MW-4A		84-85	
3	MW-4A		84-85	
4				

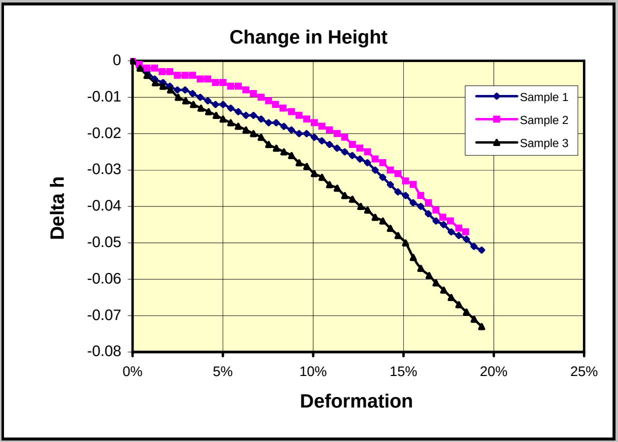
	Visual Soil Classification
1	Brown poorly graded SAND with Silt
2	Brown poorly graded SAND with Silt
3	Brown poorly graded SAND with Silt
4	

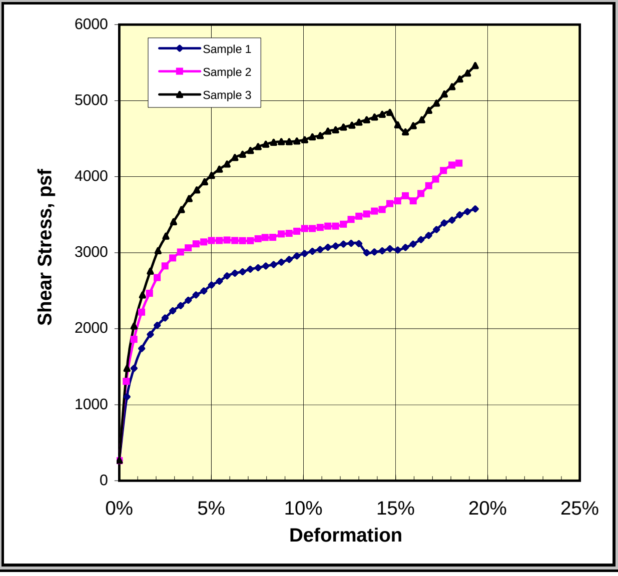
Remarks: Remolding target = 95% relative density (110pcf dry)

Direct Shear



P. Phi (degrees)	**26.0**	**Ult. phi (degrees)**	
P. Cohesion (psf)	**0**	**Ult.Cohesion (psf)**	

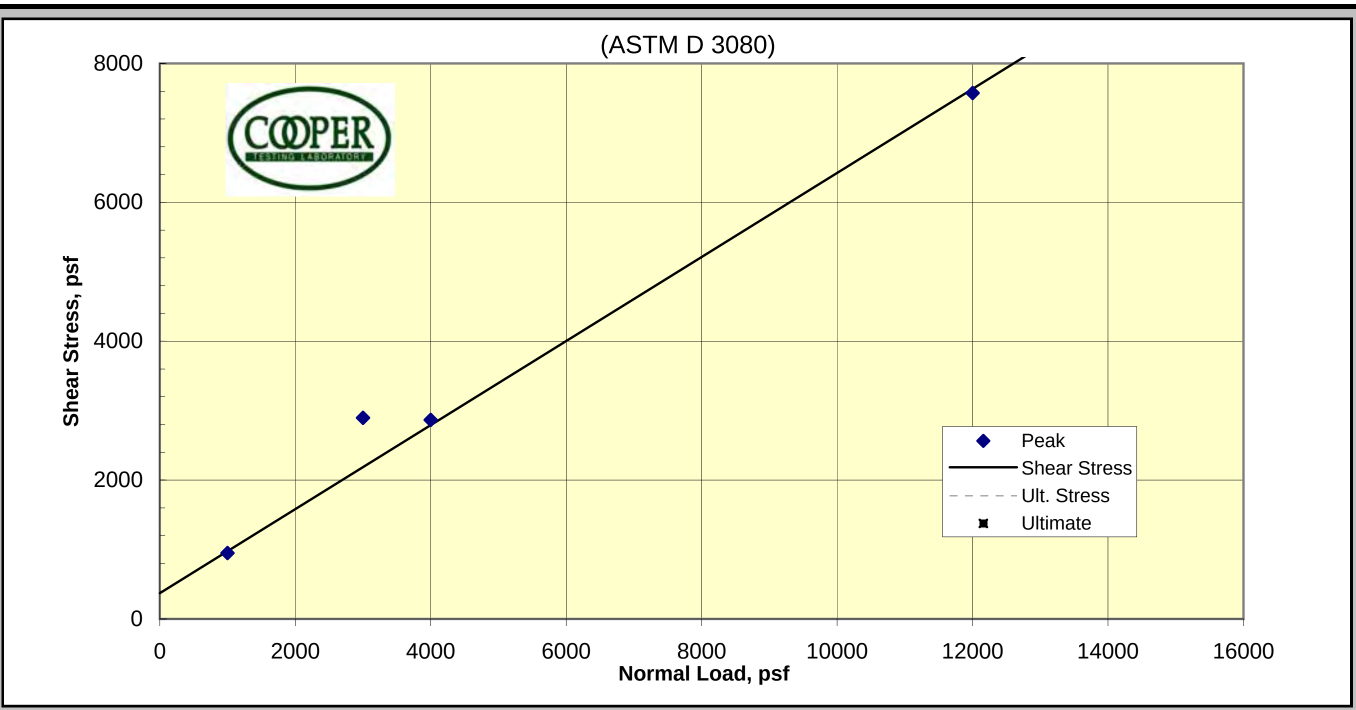




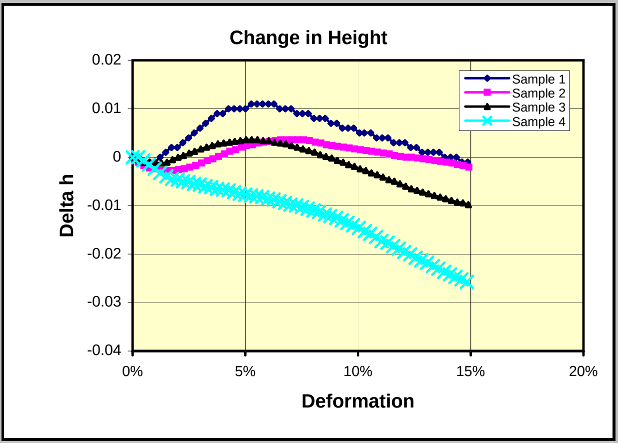
	Sample Data: Initial			
Initial	**1**	**2**	**3**	**4**
Moisture	15.7%	15.7%	15.8%	
Dry Density, pcf	105.0	105.0	105.0	
Void Ratio	0.6343	0.6351	0.6351	
Saturation	68.1%	68.1%	68.4%	
Diameter, in.	2.38	2.375	2.375	
Height, in.	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture	17.8%	18.5%	18.6%	
Dry Density, pcf	107.4	107.5	107.5	
Void Ratio	0.5987	0.5975	0.5963	
Saturation	81.9%	85.2%	85.7%	
Diameter, in.	2.3754	2.375	2.375	
Height, in.	0.98	0.98	0.98	
Normal Stress, psf	5000	6000	7000	
Shear Stress, psf	2236	2929	3406	
Deformation	3%	3%	3%	
Ultimate Stress, psf	0	0	0	
Rate in/min.	0.002	0.002	0.002	
CTL #	659-001	**Date:**	11/19/2007	
Client:	HMM			
Project Name:	SVRT			
Project Number:	213213		**Reduced by:**	MD
Sample #	**Boring**	**Sample**	**Depth, ft.**	
1	MW-4A	95%	84-85	
2	MW-4A	95%	84-85	
3	MW-4A	95%	84-85	
4				
	Visual Soil Classification			
1	Brown Poorly Graded SAND with Silt			
2	Brown Poorly Graded SAND with Silt			
3	Brown Poorly Graded SAND with Silt			
4				

Remarks: Due to the angularity of the material the strength envelope is non linear and increases as the confining stress increases,causing a negative cohesion. Note the stress-strain curves continue to increase at high strain, as the material interlocks. Remolding target = 65% relative density (103.9pcf dry)

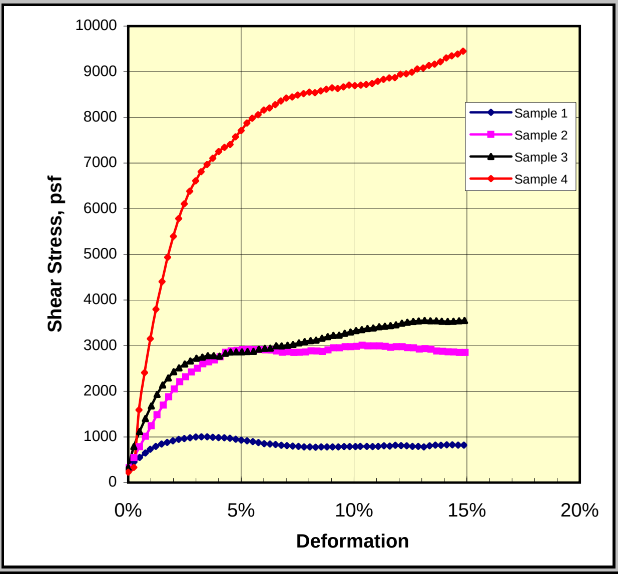
Direct Shear



P. Phi (degrees)	**31.2**	**Ult. phi (degrees)**	
P. Cohesion (psf)	**370**	**Ult.Cohesion (psf)**	



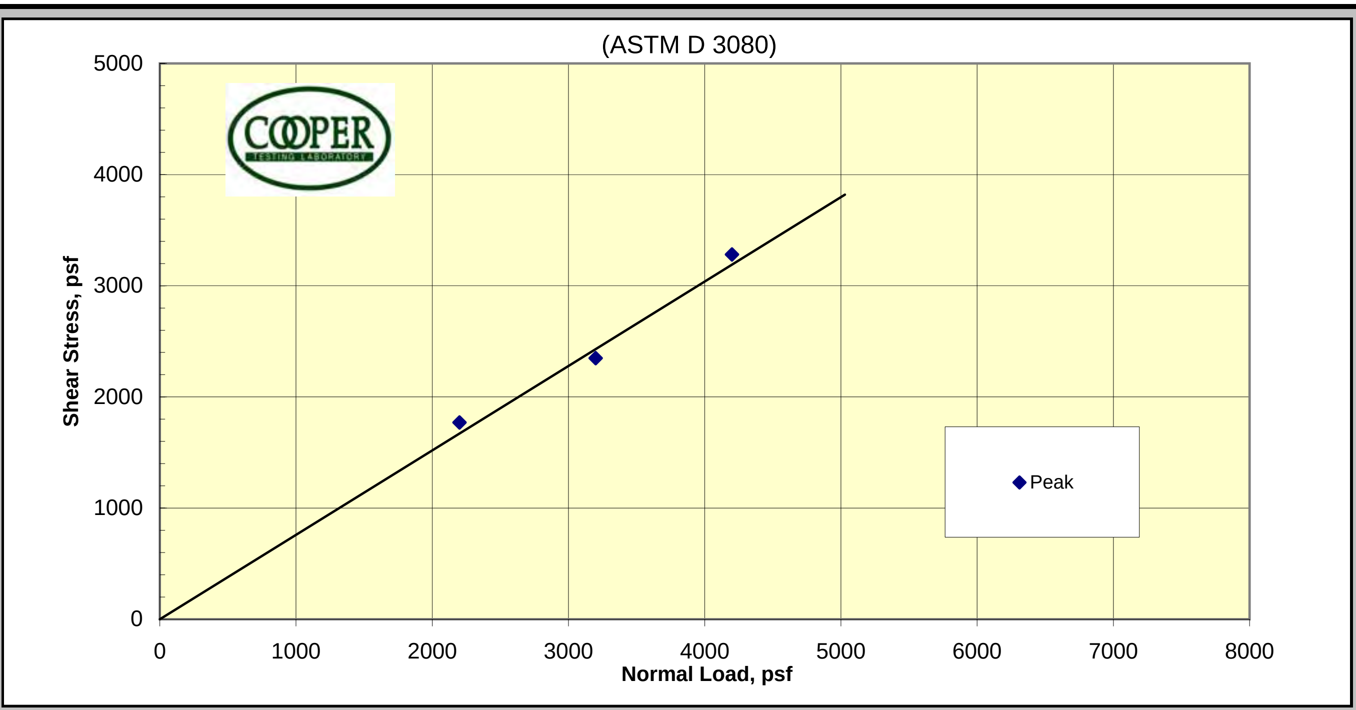
	Sample Data: Initial			
Initial	**1**	**2**	**3**	**4**
Moisture	15.0%	15.0%	15.0%	15.0%
Dry Density, pcf	104.0	104.0	103.7	103.6
Void Ratio	0.681	0.680	0.680	0.680
Saturation	61.5%	61.6%	61.6%	61.6%
Diameter, in.	2.38	2.38	2.38	2.38
Height, in.	1.00	1.00	1.00	1.00
	Sample Data: At Test			
Moisture	17.2%	17.1%	17.1%	17.1%
Dry Density, pcf	104.4	106.0	105.8	106.8
Void Ratio	0.674	0.649	0.647	0.630
Saturation	71.5%	73.8%	73.7%	75.7%
Diameter, in.	2.375	2.375	2.375	2.375
Height, in.	1.00	0.98	0.98	0.97
Normal Stress, psf	1000	3000	4000	12000
Shear Stress, psf	949	2897	2865	7574
Deformation	5%	5%	5%	5%
Ultimate Stress, psf	0	0	0	0
Rate in/min.	0.002	0.002	0.002	0.002



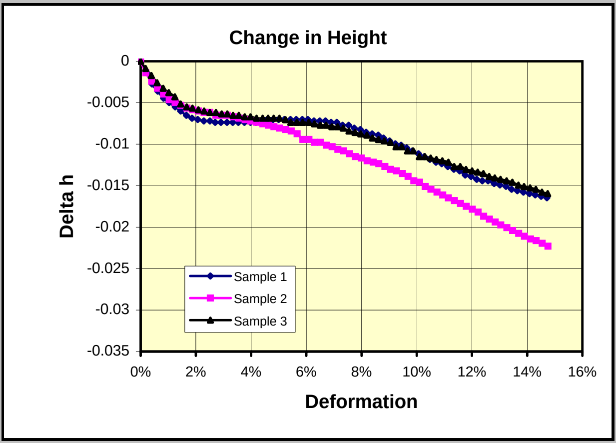
CTL #	659-003	**Date:**	7/26/2007	
Client:	HMM			
Project Name:	SVRT			
Project Number:			**Reduced by:**	MD
Sample #	**Boring**	**Sample**	**Depth, ft.**	
1	MW4A		84-85	
2	MW4A		84-85	
3	MW4A		84-85	
4				
	Visual Soil Classification			
1	Brown poorly Graded SAND with Silt			
2	Brown poorly Graded SAND with Silt			
3	Brown poorly Graded SAND with Silt			
4	Brown poorly Graded SAND with Silt			

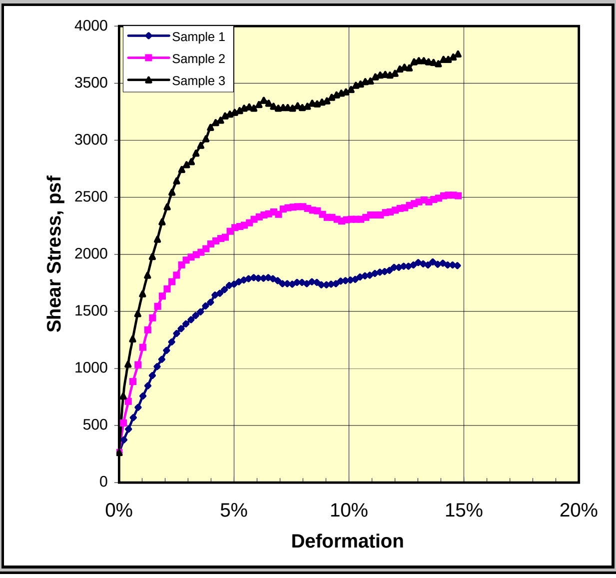
Remarks: Sample remolded to 105pcf @ 15%

Direct Shear



P. Phi (degrees)	37.2	Ult. phi (degrees)	
P. Cohesion (psf)	0	Ult.Cohesion (psf)	





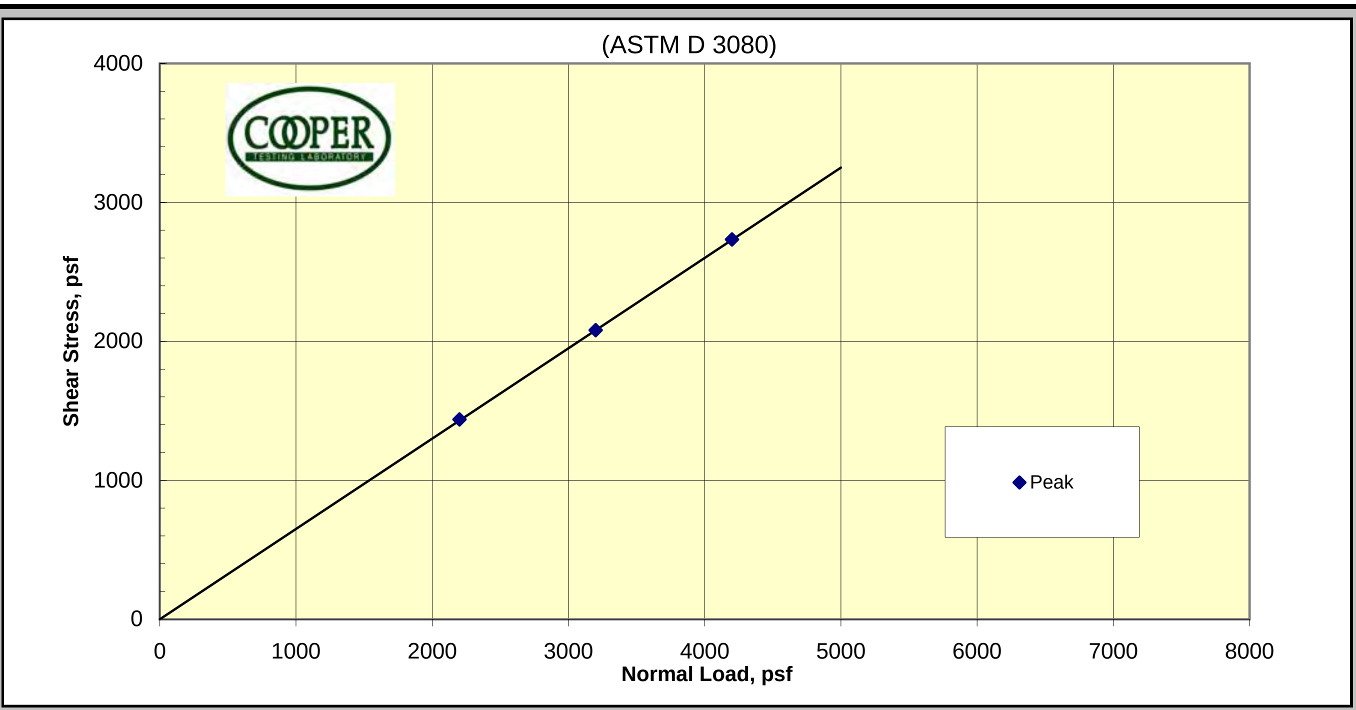
	Sample Data: Initial			
Initial	**1**	**2**	**3**	**4**
Moisture	15.3%	15.3%	15.3%	
Dry Density, pcf	101.5	101.4	101.4	
Void Ratio	0.6919	0.6933	0.6933	
Saturation	60.6%	60.6%	60.6%	
Diameter, in.	2.38	2.375	2.375	
Height, in.	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture	20.8%	20.7%	22.2%	
Dry Density, pcf	103.0	103.6	103.5	
Void Ratio	0.6667	0.6567	0.6595	
Saturation	85.6%	86.7%	92.7%	
Diameter, in.	2.375	2.375	2.375	
Height, in.	0.99	0.98	0.98	
Normal Stress, psf	2200	3200	4200	
Shear Stress, psf	1770	2349	3281	
Deformation	7%	7%	7%	
Ultimate Stress, psf	0	0	0	
Rate in/min.	0.001	0.001	0.001	

CTL #	659-001	**Date:**	11/30/2007	
Client:	HMM			
Project Name:	SVRT			
Project Number:	213213		**Reduced by:**	MD
Sample #	**Boring**	**Sample**	**Depth, ft.**	
1	MW-6K		37-38.5	
2	MW-6K		37-38.5	
3	MW-6K		37-38.5	
4				

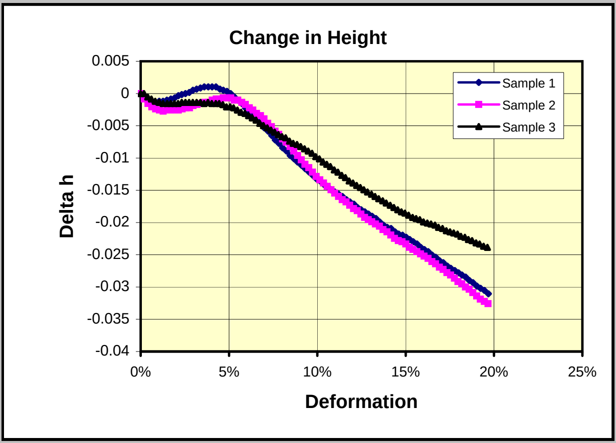
	Visual Soil Classification
1	Brown Silty SAND
2	Brown Silty SAND
3	Brown Silty SAND
4	

Remarks: Remolding target = 65% relative density(101.7pcf dry)

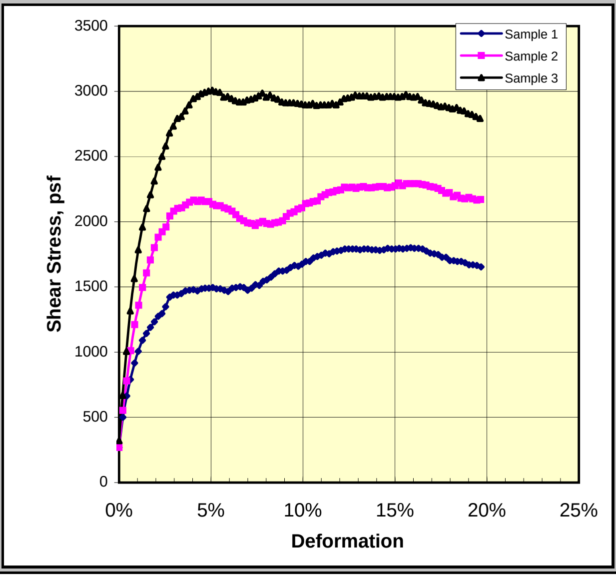
Direct Shear



P. Phi (degrees)	**33.0**	**Ult. phi (degrees)**	
P. Cohesion (psf)	**0**	**Ult.Cohesion (psf)**	



	Sample Data: Initial			
Initial	**1**	**2**	**3**	**4**
Moisture	15.3%	15.3%	15.3%	
Dry Density, pcf	104.7	104.7	104.7	
Void Ratio	0.6391	0.6404	0.6404	
Saturation	65.7%	65.6%	65.6%	
Diameter, in.	2.38	2.375	2.375	
Height, in.	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture	15.6%	15.8%	19.3%	
Dry Density, pcf	109.4	109.6	106.7	
Void Ratio	0.6168	0.6129	0.6098	
Saturation	85.3%	86.3%	87.5%	
Diameter, in.	2.375	2.375	2.375	
Height, in.	0.99	0.98	0.98	
Normal Stress, psf	2200	3200	4200	
Shear Stress, psf	1438	2081	2734	
Deformation	3%	3%	3%	
Ultimate Stress, psf	0	0	0	
Rate in/min.	0.001	0.001	0.001	

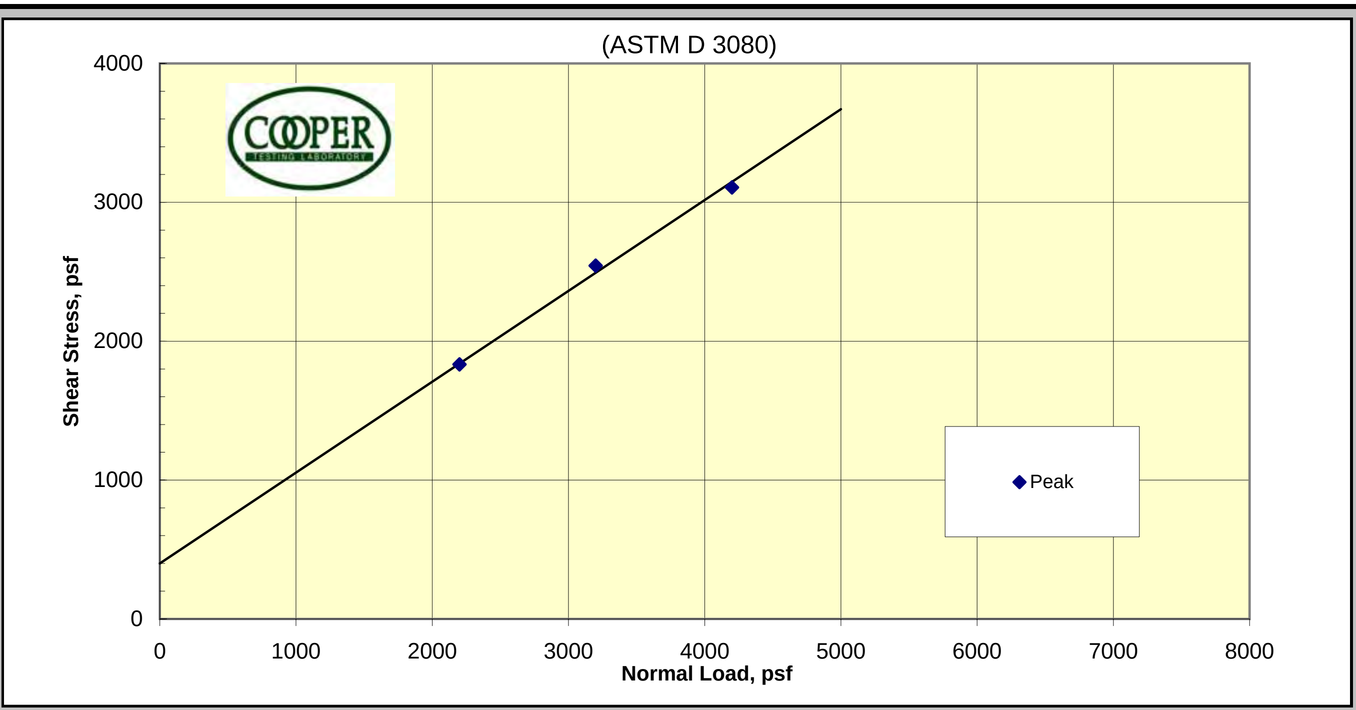


CTL #	659-001	**Date:**	11/9/2007	
Client:	HMM			
Project Name:	SVRT			
Project Number:	213213		**Reduced by:**	MD
Sample #	**Boring**	**Sample**	**Depth, ft.**	
1	MW-6K		37-38.5	
2	MW-6K		37-38.5	
3	MW-6K		37-38.5	
4				

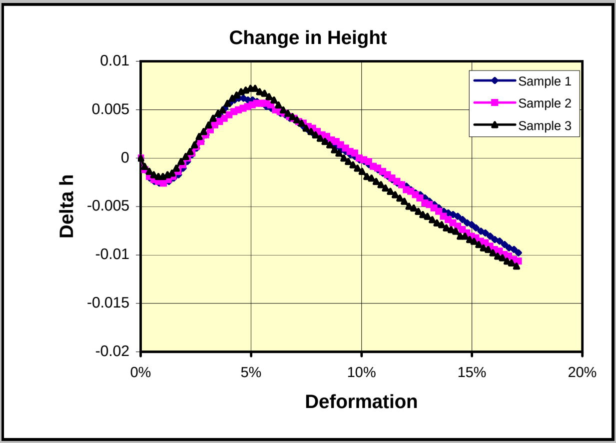
	Visual Soil Classification
1	Brown Silty SAND
2	Brown Silty SAND
3	Brown Silty SAND
4	

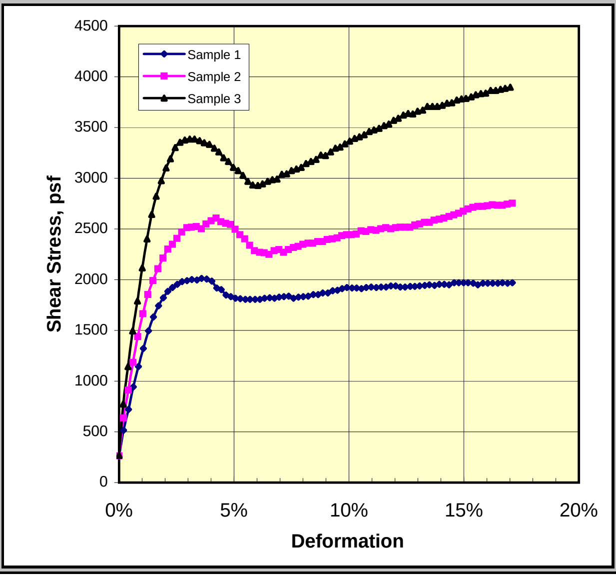
Remarks: Remolding target = 80% relative density (105.3pcf dry)

Direct Shear



P. Phi (degrees)	33.2	Ult. phi (degrees)	
P. Cohesion (psf)	400	Ult.Cohesion (psf)	





	Sample Data: Initial			
Initial	**1**	**2**	**3**	**4**
Moisture	15.3%	15.3%	15.3%	
Dry Density, pcf	108.8	108.7	108.7	
Void Ratio	0.5782	0.5794	0.5794	
Saturation	72.9%	72.8%	72.8%	
Diameter, in.	2.38	2.375	2.375	
Height, in.	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture	17.9%	17.7%	16.7%	
Dry Density, pcf	110.7	110.6	111.7	
Void Ratio	0.5503	0.5529	0.5366	
Saturation	89.7%	88.1%	85.5%	
Diameter, in.	2.375	2.375	2.375	
Height, in.	0.98	0.98	0.97	
Normal Stress, psf	2200	3200	4200	
Shear Stress, psf	1833	2544	3108	
Deformation	5%	5%	5%	
Ultimate Stress, psf	0	0	0	
Rate in/min.	0.001	0.001	0.001	

CTL #	659-001	**Date:**	12/6/2007	
Client:	HMM			
Project Name:	SVRT			
Project Number:	213213		**Reduced by:**	MD
Sample #	**Boring**	**Sample**	**Depth, ft.**	
1	MW-6K		37-38.5	
2	MW-6K		37-38.5	
3	MW-6K		37-38.5	
4				

	Visual Soil Classification
1	Brown Silty SAND
2	Brown Silty SAND
3	Brown Silty SAND
4	

Remarks: Remolding target = 95% relative density (109.2pcf dry)

Minimum & Maximum Index Unit Weight
ASTM D4254 & ASTM D4253

CTL Job No.: 659-001
Client: HMM/Bechtel Joint Venture
Project Name: SVRT Project
Project No:

Boring: MW - 4A
Sample:
Depth (ft.): 84-85

Date: 10/29/2007
Tested : PJ
Checked: DC

Visual Description: Brown Poorly Graded SAND w/ Silt

INDEX UNIT WEIGHT TEST RESULTS

Minimum Index Unit Wt., pcf	**92.7**
Maximum Index Unit Wt., pcf	**111.1**

GRADATION TEST RESULTS

Gradation As Received			
Sieve #	**Wt. Retained**	**% Retained**	**% Finer**
3"	0.0	0.0	100.0
1 1/2"	0.0	0.0	100.0
3/4"	0.0	0.0	100.0
1/2"	0.0	0.0	100.0
3/8"	0.2	1.0	99.0
#4	0.5	2.9	97.1

Testing Remarks

Minimum Index Unit Weight:

Test Method used: Method B
Size of mold used (ft^3): 0.1
Remarks: Soil-filled Tube

Maximum Index Unit Weight:

Test Method used: Method 1B
Size of mold used (ft^3): 0.1
Remarks: Run using oven-dried material.

Minimum & Maximum Index Unit Weight
ASTM D4254 & ASTM D4253

CTL Job No.: 659-001
Client: HMM/Bechtel Joint Venture
Project Name: SVRT Project
Project No:

Boring: MW - 6K
Sample:
Depth (ft.): 37-38.5

Date: 11/2/2007
Tested : PJ
Checked: DC

Visual Description: Brown Silty SAND

INDEX UNIT WEIGHT TEST RESULTS

Minimum Index Unit Wt., pcf	**88.4**
Maximum Index Unit Wt., pcf	**110.6**

GRADATION TEST RESULTS

Gradation As Received			
Sieve #	**Wt. Retained**	**% Retained**	**% Finer**
3"	0.0	-	-
1 1/2"	0.0	-	-
3/4"	0.0	-	-
1/2"	0.0	-	-
3/8"	0.0	0.0	100.0
#4	0.0	-	-

Testing Remarks

Minimum Index Unit Weight:

Test Method used: Method C
Size of mold used (ft^3): Cylinder
Remarks:

Maximum Index Unit Weight:

Test Method used: Method 1B
Size of mold used (ft^3): 0.1
Remarks: Not enough sample to run multiple trials

Minimum & Maximum Index Unit Weight
ASTM D4254 & ASTM D4253

CTL Job No.: 659-001
Client: HMM/Bechtel Joint Venture
Project Name: SVRT Project
Project No:

Boring: MW - 2D
Sample:
Depth (ft.): 105-108

Date: 10/29/2007
Tested : PJ
Checked: DC

Visual Description: Brown Well-Graded SAND w/ Silt & Gravel

INDEX UNIT WEIGHT TEST RESULTS

Minimum Index Unit Wt., pcf	**105.8**
Maximum Index Unit Wt., pcf	**124.6**

GRADATION TEST RESULTS

Gradation As Received			
Sieve #	**Wt. Retained**	**% Retained**	**% Finer**
3"	0.0	0.0	100.0
1 1/2"	0.0	0.0	100.0
3/4"	0.0	0.2	99.8
1/2"	-	-	-
3/8"	0.9	4.6	95.4
#4	2.8	15.1	84.9

Testing Remarks

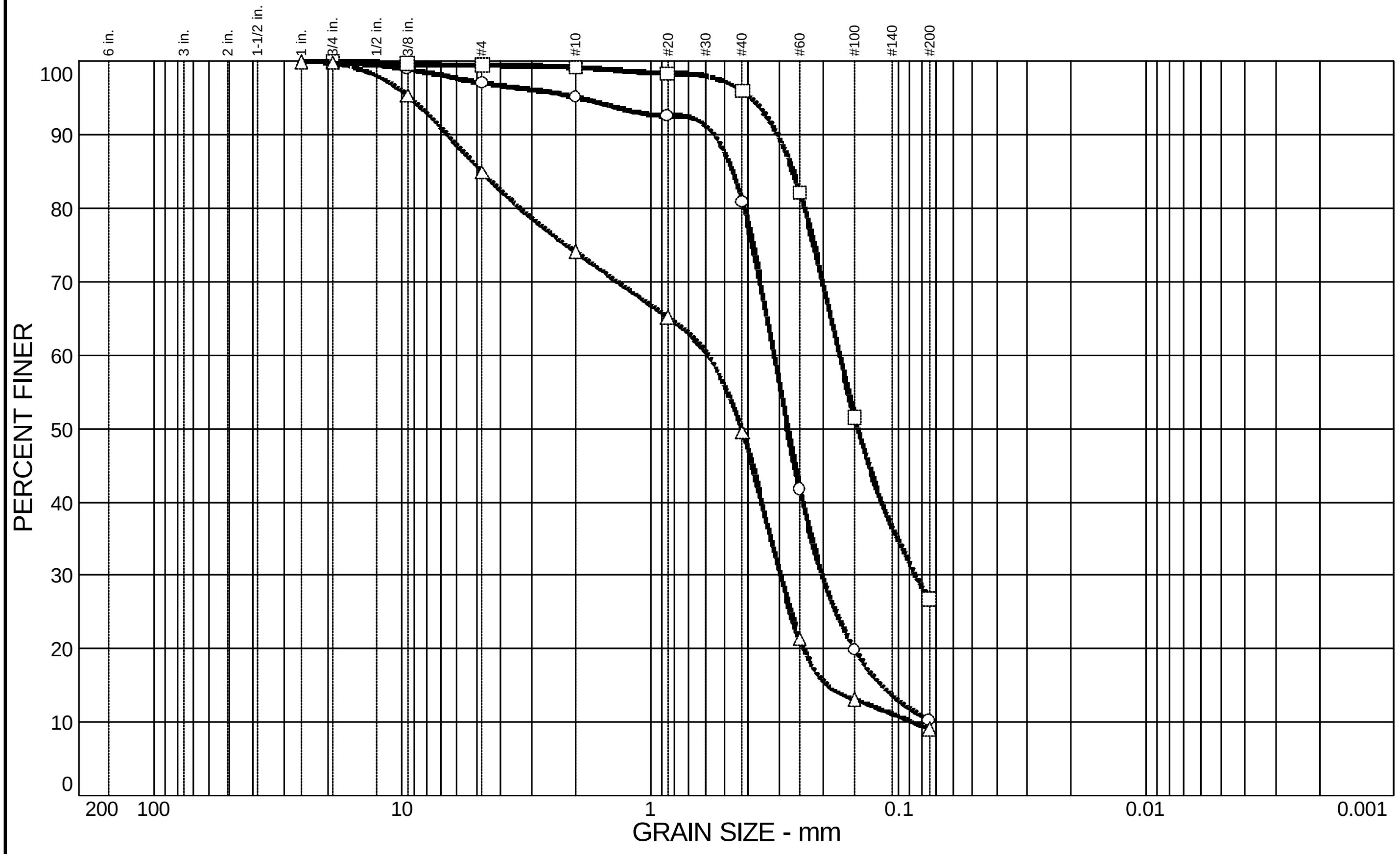
Minimum Index Unit Weight:

Test Method used: Method B
Size of mold used (ft^3): 0.1
Remarks: Soil-filled Tube

Maximum Index Unit Weight:

Test Method used: Method 1B
Size of mold used (ft^3): 0.1
Remarks: Run using oven-dried soil. Some Dust/Fines lost during compaction. Not enough sample to run multiple trials

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		2.9	86.8	10.3					
□		0.5	72.7	26.8					
△		15.1	75.8	9.1					

SIEVE inches size	PERCENT FINER ○	□	△
1			100.0
3/4	100.0	100.0	99.8
3/8	99.0	99.7	95.4
	GRAIN SIZE		
D_{60}	0.318	0.173	0.587
D_{30}	0.203	0.0848	0.299
D_{10}			0.0870
	COEFFICIENTS		
C_c			1.76
C_u			6.75

SIEVE number size	PERCENT FINER ○	□	△
#4	97.1	99.5	84.9
#10	95.2	99.2	74.1
#20	92.6	98.4	65.2
#40	80.8	96.0	49.5
#60	41.7	82.2	21.3
#100	19.9	51.5	13.1
#200	10.3	26.8	9.1

SOIL DESCRIPTION

○ Brown Poorly Graded SAND w/ Silt

□ Brown Silty SAND

△ Brown Well-Graded SAND w/ Silt & Gravel

REMARKS:

○

□

△

○ Source: MW-4A Elev./Depth: 84-85'

□ Source: MW-6K Elev./Depth: 37-38.5'

△ Source: MW-2D Elev./Depth: 105-108'

COOPER TESTING LABORATORY

Client: Hatch Mott Macdonald (HMM)

Project: SVRT Project - 213213

Project No.: 659-001 Figure

Appendix 9: Consolidation and Cyclic Shear Test Results

Memorandum

Date: November 1, 2007

To: Peter Chiu, Project Engineer
Praad Geotechnical

From: Jonathan Stewart, Ph.D., P.E. and Eric Yee
UCLA Civil & Environmental Engineering Department

RE: Draft report on results of cyclic simple shear (CSS) laboratory testing for SVRT project

Overview and Test Procedures

Suites of cyclic simple shear tests have been completed on three samples: BH-101 at 35 ft depth, BH-89 at 20 ft depth, and BH-85 at 50 ft depth. All of the samples were obtained using Shelby tubes. We do not know the date of sampling.

The procedure and equipment that was used in our testing program is summarized below:

1. Samples tubes were cut around their perimeter with a band saw.
2. A wire saw was used to cut the soil in the sample tube. By this process, a slice of the sample tube with soil approximately 4-6 cm in height was obtained.
3. Appropriate measurements were made to evaluate the water content and density of the soil in the cut section of sample tube.
4. As discussed further below, samples were soaked while still inside the cut Shelby tube section to increase saturation levels. This soaking took place for 24 to 48 hours. During the soaking phase the specimens were under the in situ vertical stresses corresponding to the sample depths (σ_v = 2,200 psf for BH101-35, 2,400 psf for BH89-20, and 3700 psf for BH85-50 ft).
5. Soils specimens were extracted from the cut section of Shelby tube by pushing them out with a static force acting on a plate just slightly smaller than the inside diameter of the tube. Specimens were then carefully trimmed by hand to a diameter of 7.1 cm.
6. A wire-reinforced membrane was carefully placed around the specimen, which was then positioned for placement in the simple shear apparatus. The purpose of the wire-reinforced membrane is to minimize lateral extension of the samples.
7. A vertical load was applied to the specimen matching the in situ vertical stress from the location of the sample depth. Those vertical stresses are indicated in Item (4) above.
8. Prescribed strain histories were applied to the specimens. Measured responses include horizontal displacements (used in the control algorithm), vertical load (which

remains constant), vertical displacement, and horizontal loads. Results are typically presented as shear stress versus shear strain and vertical strain versus shear strain.

All shear testing was performed using the Digitally Controlled Simple Shear (DCSS) device in the geotechnical laboratory at UCLA. Details on the physical characteristics and capabilities of the device are given in Duku et al. (2007).

Saturation of Specimens

Our understanding is that these samples have been handled previously by another laboratory. Some drying of sample BH101 was evident from saturation levels measured on specimens retrieved from the bottom of the sample tube that ranged from 78-92%. Saturations were much higher for the other specimens (BH89 and BH85).

Because field saturations are expected to be unity, we soaked the specimens for times ranging from 24 to 48 hours to increase saturation levels prior to simple shear testing. The need for this soaking had not been anticipated when the testing program was first discussed. The use of this soaking phase is a major factor in the relatively long time frame involved in completing the tests. The configuration under which the specimens were given access to water is depicted in Figure 1.

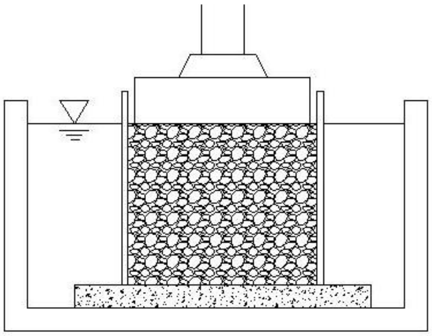


Figure 1. Configuration of specimen during soaking phase

As shown in Figure 1, during the soaking phase the soil specimen is within a cut section of the Shelby tube. It sits upon a pre-saturated porous stone and has an aluminum top cap with a diameter nearly matching the inside diameter of the Shelby tube. A vertical seating load is placed on the top cap matching the in situ vertical stress at the sample depth. The soaking was generally effective in raising the saturation for BH101, with little effect for the other samples.

Format of Results

Results of the simple shear tests are presented in three figures per sample. The results are presented in the following order: BH101-35 (Figures 2-4), BH89-20 (Figures 5-7), and BH85-50 (Figures 8-10). For each sample, CSS tests were performed on three specimens under the following conditions: monotonic fast test with $\dot{\gamma} = 1\%/\text{sec}$, monotonic slow test with $\dot{\gamma} = 1\%/20$ min (0.0008%/sec), and cyclic test with strain rate of $\dot{\gamma} = 1\%/\text{sec}$ and full stress-strain cycles at strain amplitudes of approximately γ=0.05%, 0.10%, 0.15%, 0.2%, 0.3%, 0.5%, 1%, and 1.7%. One cycle was performed at each of those strain levels, followed by monotonic shear to the next strain level.

The first figure for each sample (Figures 2, 5, and 8) summarizes the monotonic test results and cyclic backbone curves. Those results are interpreted in the section below title: “Evaluation of Backbone Curve Results.” The second figure for each sample (Figures 3, 6, and 9) shows the stress-strain cyclic loops obtained in the fast cyclic tests. The third figure for each sample (Figures 4, 7, and 10) shows shear moduli and damping values inferred from the cyclic loops. Also shown in the damping plots are estimates of damping versus shear strain calculated using the model of Darendeli (2001). An interpretation of the shear moduli and damping values is presented in the section below titled: “Interpretation of Shear Modulus and Damping Results.”

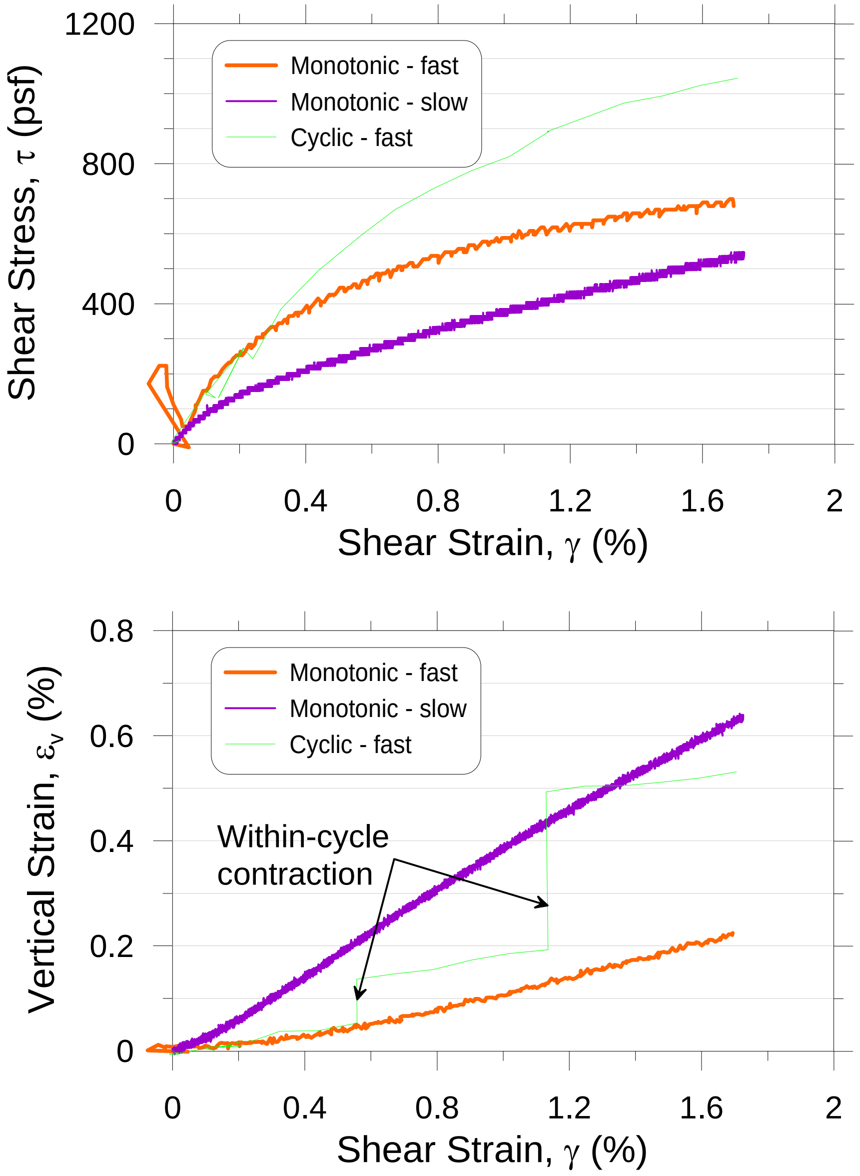


Figure 2. Variation of shear stress and vertical strain with shear strain for fast and slow monotonic CSS tests on specimens from sample BH101-35 ft

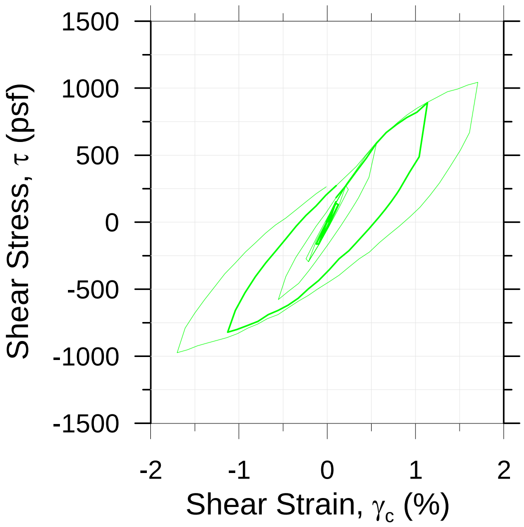


Figure 3. Cyclic stress-strain hysteresis curves for specimen from Sample BH-101-35ft.

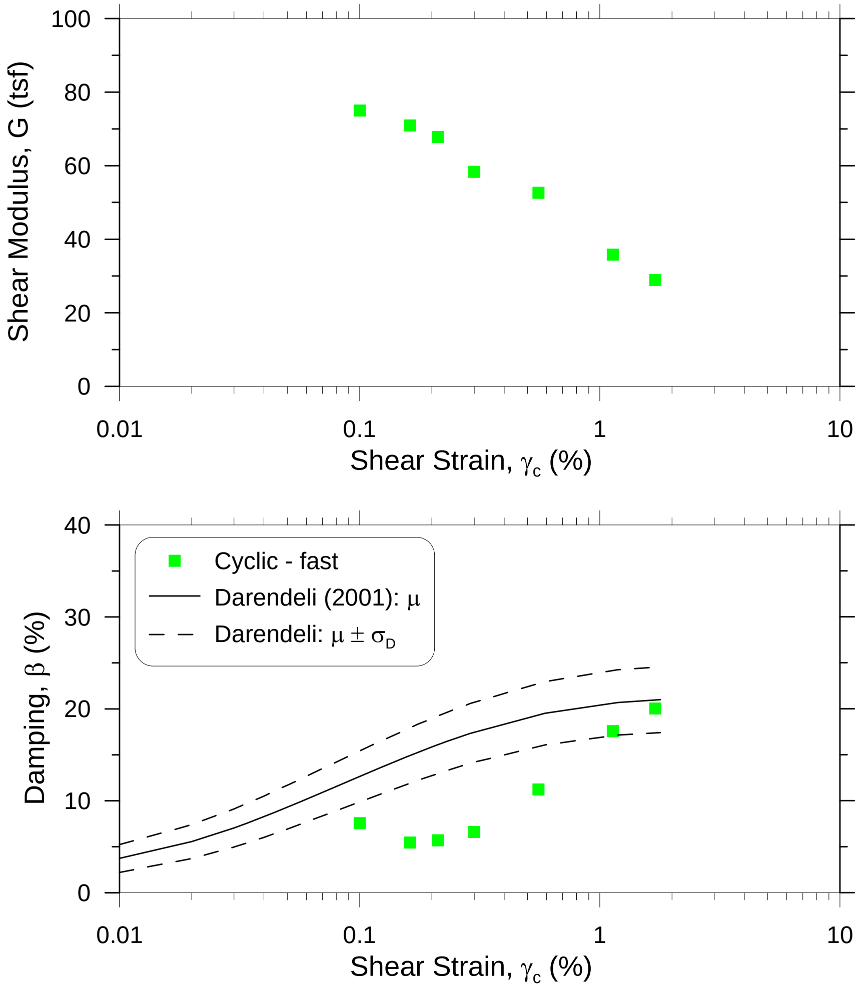


Figure 4. Shear modulus and damping ratio versus shear strain. Sample BH-101-35ft. Darendeli model prediction is for σ_v = 2,200 psf, PI=12, and OCR=2

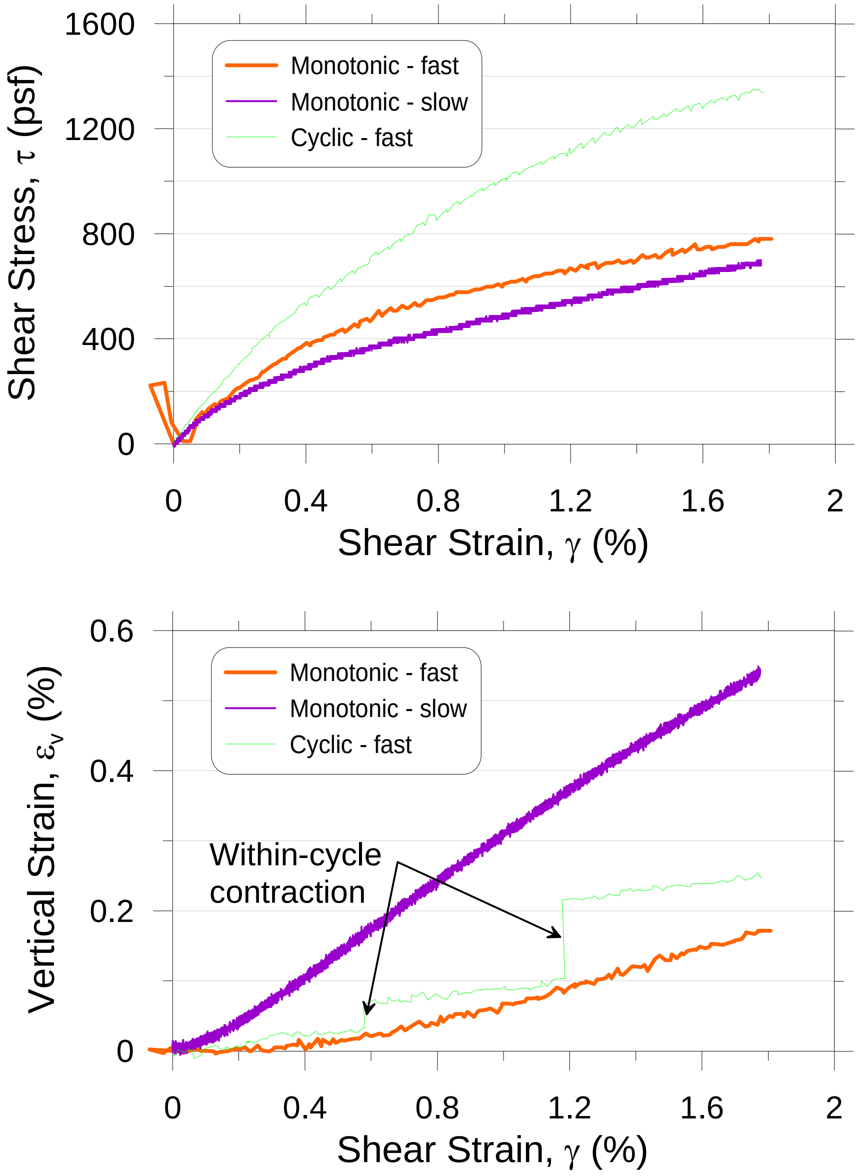


Figure 5. Variation of shear stress and vertical strain with shear strain for fast and slow monotonic CSS tests and fast cyclic test on specimens from sample BH89-20 ft

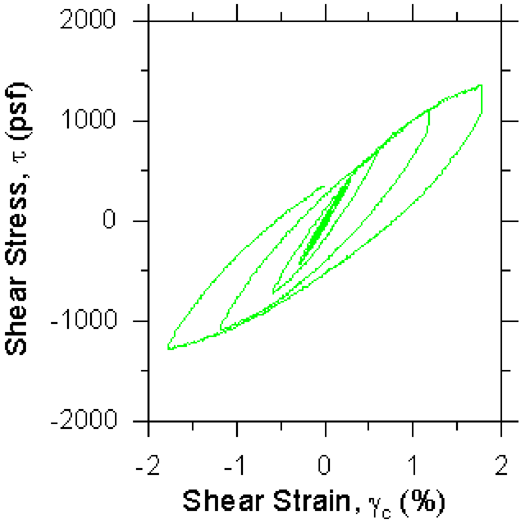


Figure 6. Cyclic stress-strain hysteresis curves for specimen from Sample BH-89, 20ft.

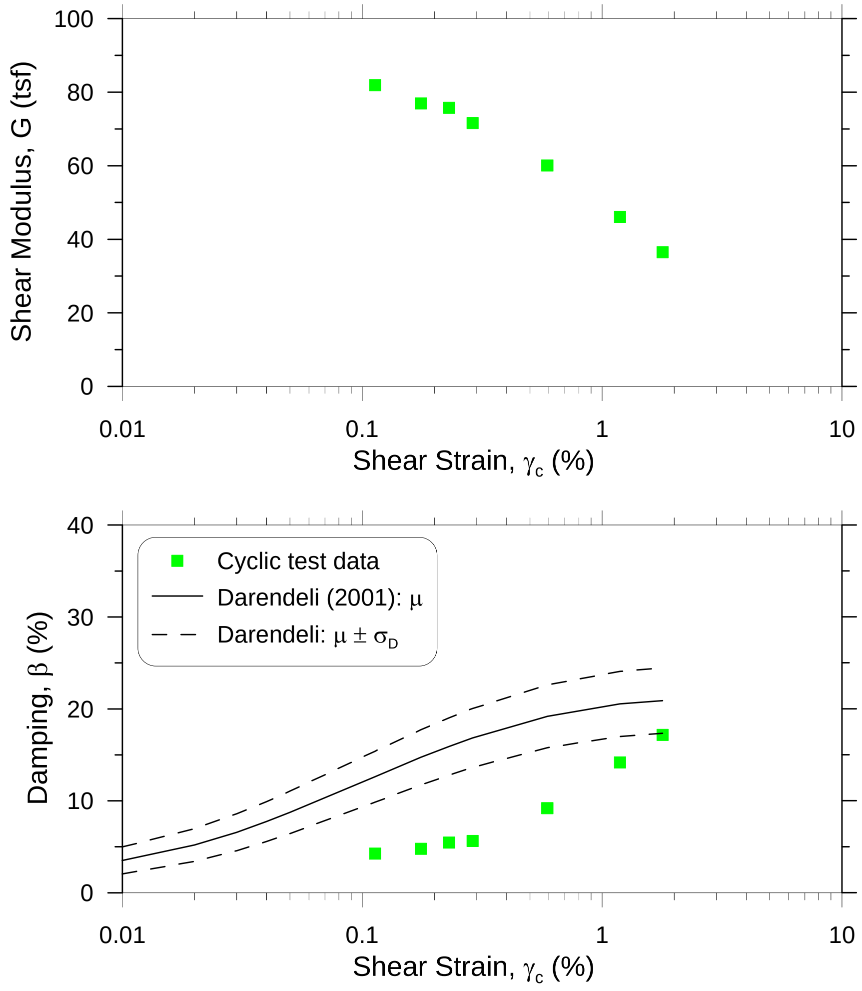


Figure 7. Shear modulus and damping ratio versus shear strain. Sample BH-89, 20ft. Darendeli model prediction is for σ_v = 2,400 psf, PI=16, and OCR=2

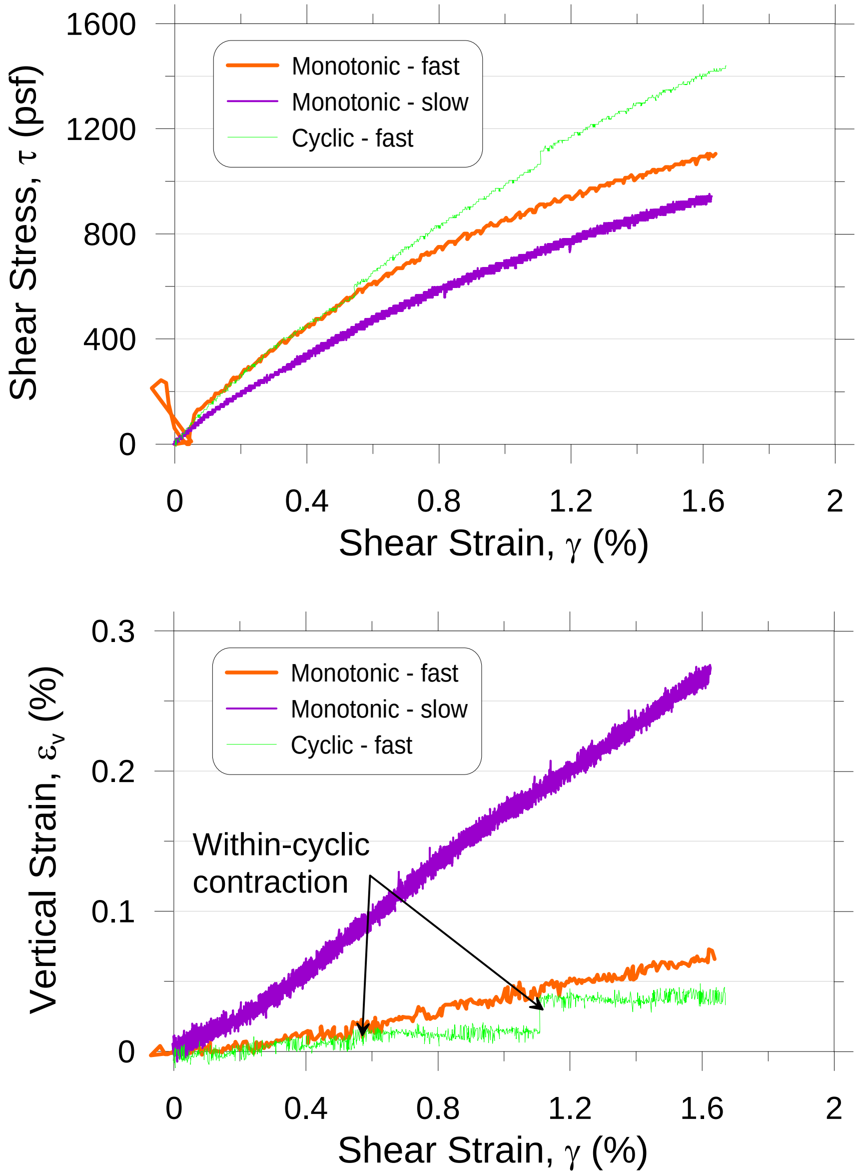


Figure 8. Variation of shear stress and vertical strain with shear strain for fast and slow monotonic CSS tests and fast cyclic test on specimens from sample BH85-50 ft

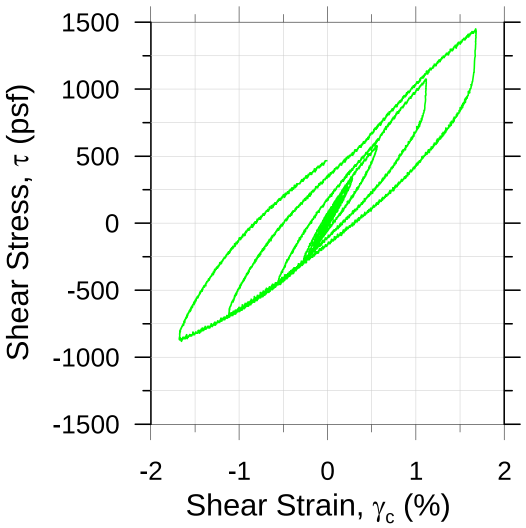


Figure 9. Cyclic stress-strain hysteresis curves for specimen from Sample BH-85, 50ft.

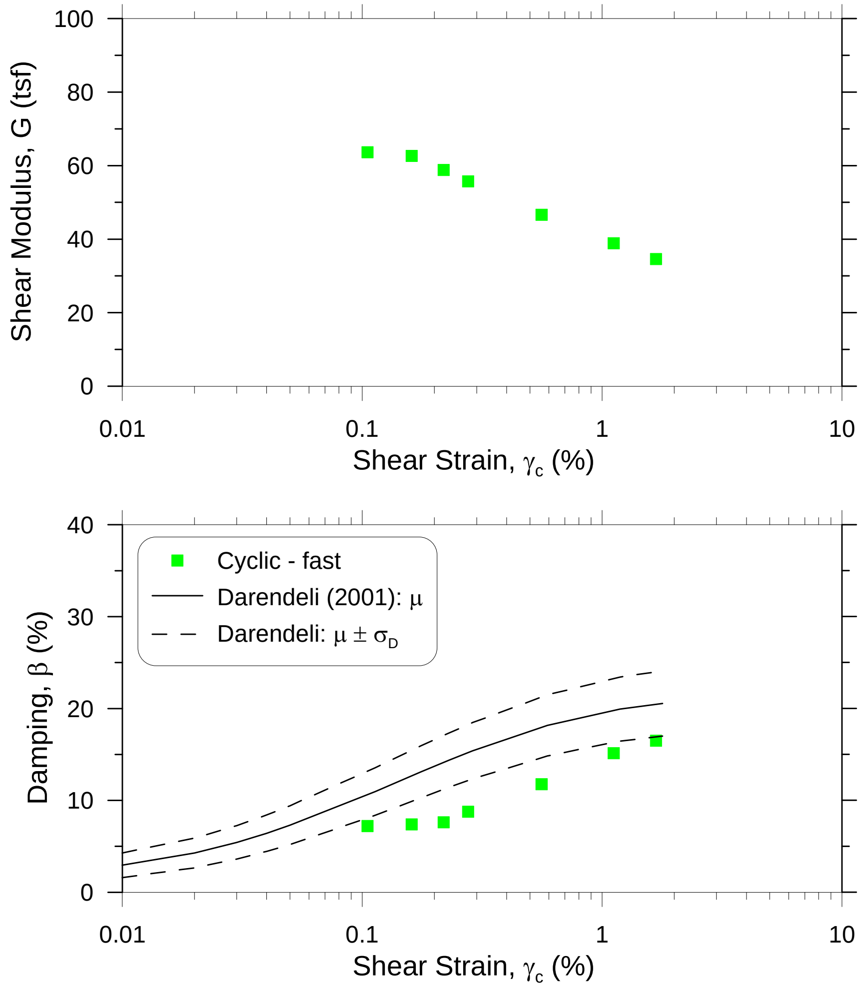


Figure 10. Shear modulus and damping ratio versus shear strain. Sample BH-85-50ft. Darendeli model prediction is for σ_v = 3,700 psf, PI=24, and OCR=2

Evaluation of Backbone Curve Results

One important point of comparison with respect to the backbone curves are differences between the slow and fast monotonic tests. Comparing shear stresses for shear strains of approximately 0.2, 0.5, 1.0, and 1.5%, the rate effects are found to be as indicated below:

- BH101: range of 35 to 92%, average 65%
- BH89: range of 18 to 28%, average 24%
- BH85: range of 18 to 37%, average 28%

For each specimen, testing was performed to a maximum strain of approximately 1.7% due to control difficulties that were encountered for larger strains. Although we did not reach a peak strength for the specimens, it is likely reasonable to take the rate effect for these samples as the values given above since at γ=1.7% we are well beyond the maximum strain anticipated for the SVRT project.

The fast cyclic test produces larger stresses than the fast monotonic tests, which may be due to strain hardening resulting from within-cycle specimen contraction, as shown in the bottom half of Figures 2, 5, and 8. Volumetric contraction of unsaturated soils subjected to cyclic loading, such as depicted in the bottom frame of the figures, is a well-known phenomenon (e.g., Whang et al., 2004).

The differences between the monotonic-fast and cyclic-fast results lead us to believe that separate specimens should be used to evaluate damping ratios and rate effects on shear strength. That is, if the fast monotonic test were omitted, the effect of strain rate could not be isolated from the effect of within-cycle contraction in comparing the monotonic-slow and cyclic-fast tests.

Interpretation of Shear Modulus and Damping Results

Figures 4, 7, and 10 show secant shear moduli and damping ratios calculated from the stress-strain loops. The results at small strains (≤ 0.2%) for BH85 (Figure 10) have relatively high uncertainty due to a controller error that led to a relatively small number of data points being recorded to define the cyclic loops.

There are two points that should be made in connection with the shear moduli reported in these figures.

1. The moduli do not extend to the very small strains that would typically be associated with the maximum shear modulus, G_{max}. The lowest strain for which moduli are reported is γ=0.1%. Values of G_{max} should generally be taken from strain cycles at amplitudes of approximately γ=10^{-4}%.The DCSS device is not well configured for very

small-strain testing, as would be required to evaluate a laboratory value of G_{max}. Alternative devices, such as described by Doroudian and Vucetic (1995) could be employed for such testing.

2. Allowing for typical levels of modulus reduction associated with the minimum tested strain level of 0.1% ($G/G_{max} \approx 0.5$ at γ=0.1%), the inferred values of maximum shear modulus (denoted here $G_{max\text{-}inf}$) are approximately 150 tsf for BH101, 170 tsf (BH89) and 130 tsf (BH85). Based on the in situ measurement of shear wave velocity (Vs = 640 ft/s, 580 ft/s, and 760 ft/s for the respective samples), the "field" values of G_{max} = 700 tsf, 570 tsf, and 990 tsf, respectively. Hence, the ratios of laboratory-to-field G_{max} are approximately 0.21, 0.30, and 0.13. This offset between laboratory and field estimates of G_{max} is well established in the literature. For example, Hueze et al. (2003) found the laboratory/field G_{max} ratios for three sites to typically be in the range of 0.1-0.5 for Pitcher barrel sample depths retrieved from 2-90 m depth. These offsets between laboratory and field moduli result from sample disturbance, possible lack of full K_0 lateral pressures for samples tested at the in situ vertical stress, and different strain rates in the laboratory and field tests.

As a result of the above points, the shear moduli reported in Figure 4, 7, and 10 are not expected to be representative of field conditions. They could be used to construct a modulus reduction (G/G_{max}) curve following appropriate extrapolation to G_{max} if that is desired. Additional testing could also be undertaken to measure G_{max} in the laboratory (this was not part of our scope).

In the lower part of Figures 4, 7, and 10, the damping data are compared to the predictions of the Darendeli (2001) model. The Darendeli model was used with the parameters given in the respective captions. The comparisons show that the Darendeli model predicts higher levels of damping than demonstrated by the data. It is possible that the reduced damping is related to suction effects increasing the inter-particle stresses beyond those represented by the seating load. That is, damping is known to decrease with confining pressure for granular and low-plasticity soils (e.g., Seed et al., 1986; Darendeli, 2001), so additional confinement from suction could decrease damping levels relative to what would have been measured in a fully saturated specimen.

References

Darendeli, M. (2001). "Development of a new family of normalized modulus reduction and material damping curves." Ph.D. Dissertation, Dept. of Civil Engrg., Univ. of Texas, Austin.

Doroudian, M. and M. Vucetic (1995). "A direct simple shear device for measuring small strain behavior," Geotech. Testing Journal, ASTM, 18 (1), 69-85.

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Heuze, F., R. Archuleta, F. Bonilla, S. Day, M. Doroudian, A. Elgamal, S. Gonzales, M. Hoehler, T. Lai, D. Lavallee, B. Lawrence, P.-C. Liu, A. Martin, L. Matesic, B. Minster, R. Mellors, D. Oglesby, S. Park, M. Riemer, J. Steidl, F. Vernon, M. Vucetic, J. Wagoner, and Z. Yang (2003). “Estimating site-specific strong earthquake motions,” Soil Dynamics and Earthquake Engineering, 24 (3), 199-223.

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Seed, H.B., R.T. Wong, I.M. Idriss, and K. Tokimatsu (1986). “Moduli and damping factors for dynamic analysis of cohesionless soils,” Journal of Geotechnical Engineering, 112 (11), 1016-1032.

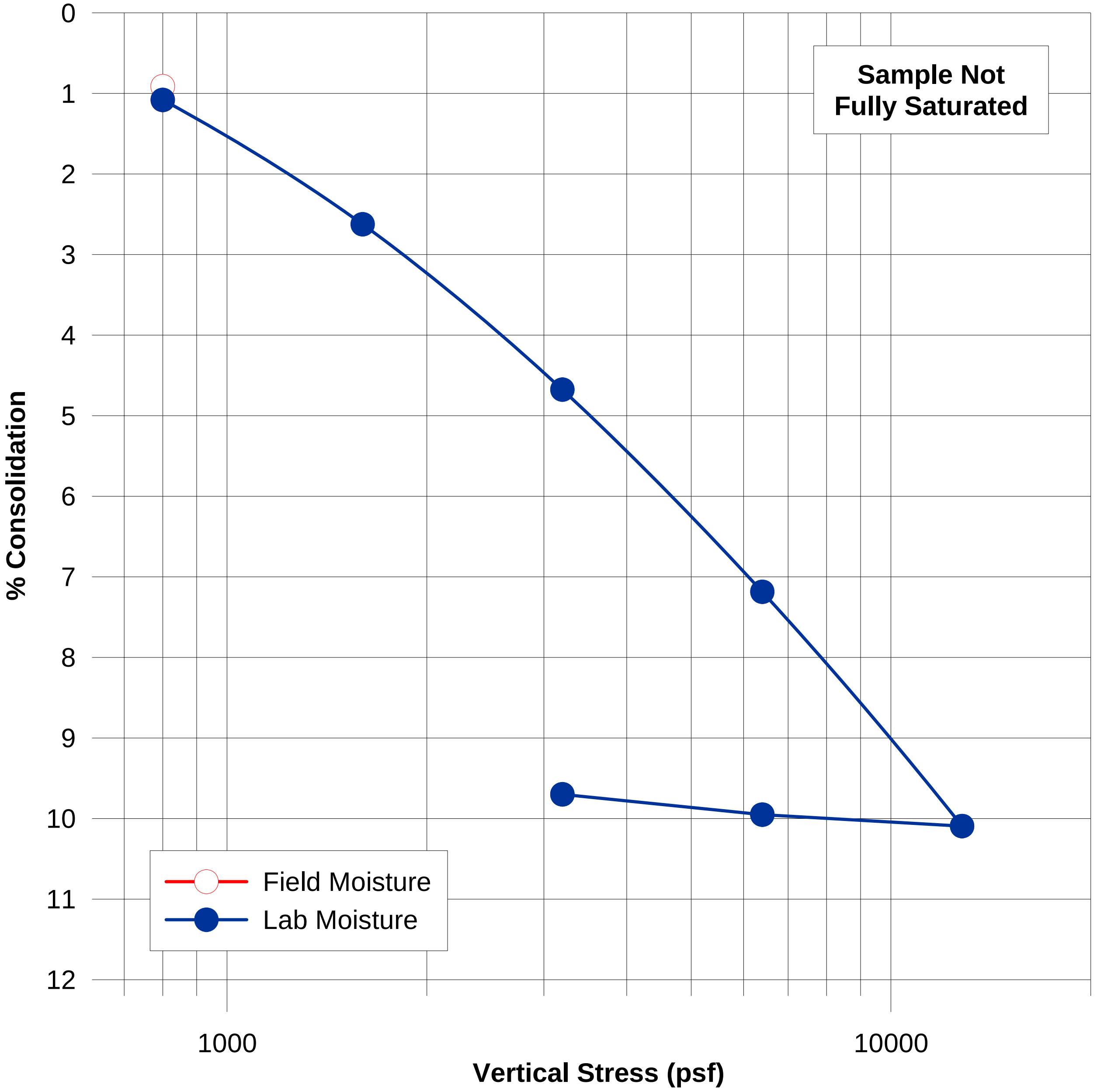
SVRT LABORATORY TESTS

September – October 2007

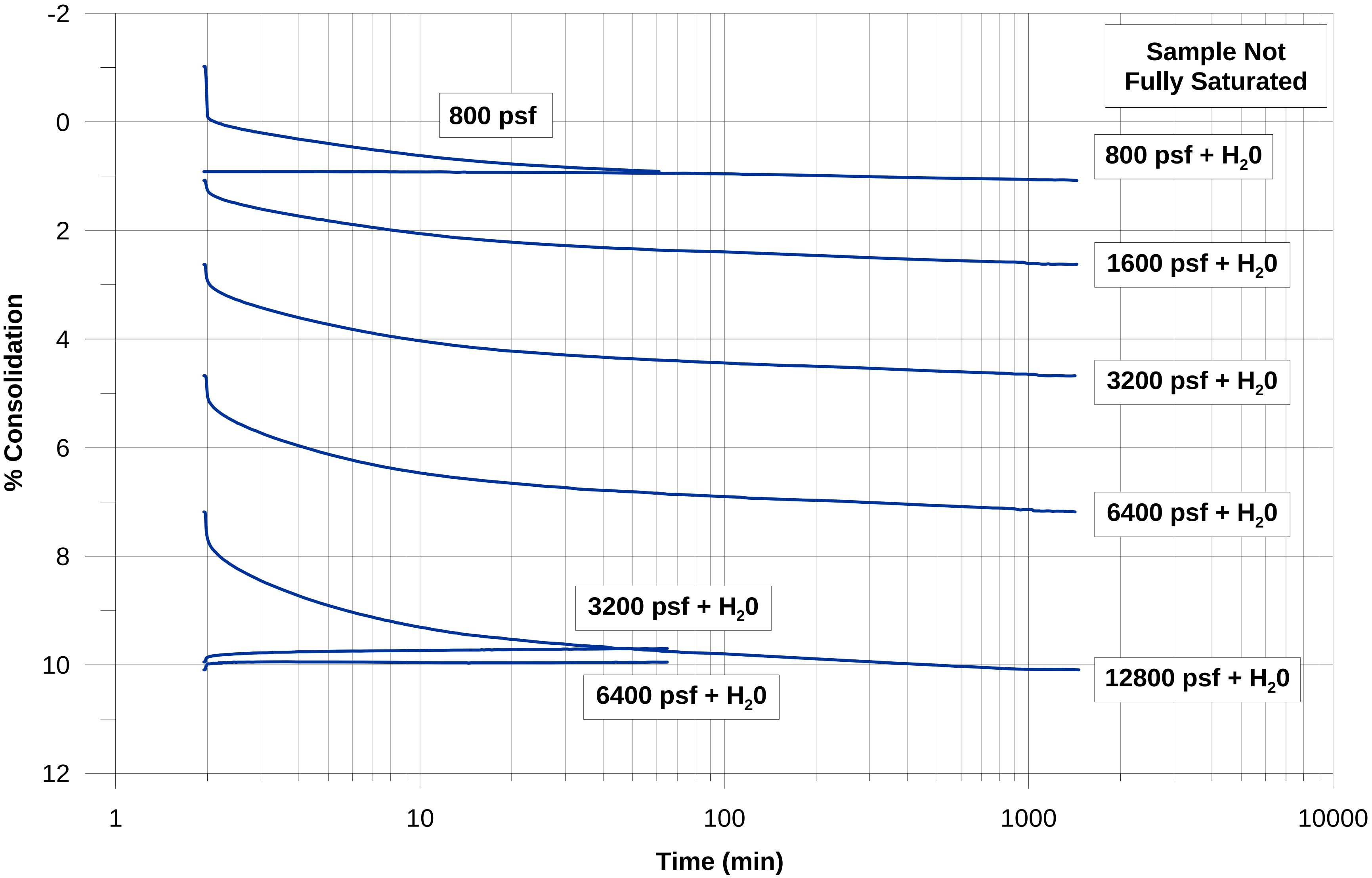
Consolidation and Atterberg Limits:

- **BH-89 at 20 ft**
- **BH-101 at 35 ft**
- **BH-85 at 50 ft**
- **BH-87 at 106 ft**
- **BH-90 at 110 ft**

SVRT 05-108-C
BH-89 @ 20'

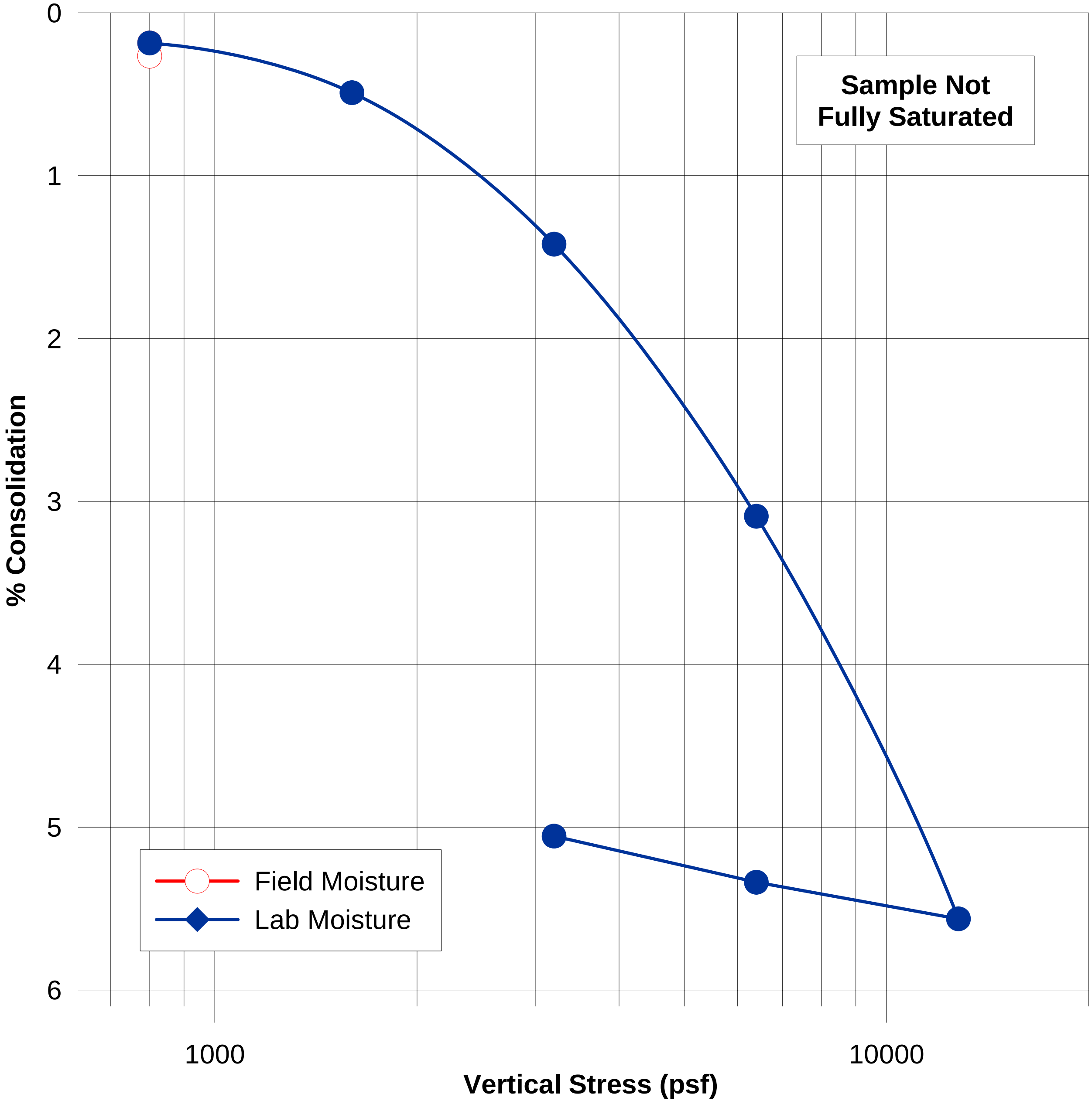


SVRT 05-108-C
BH-89 @ 20'



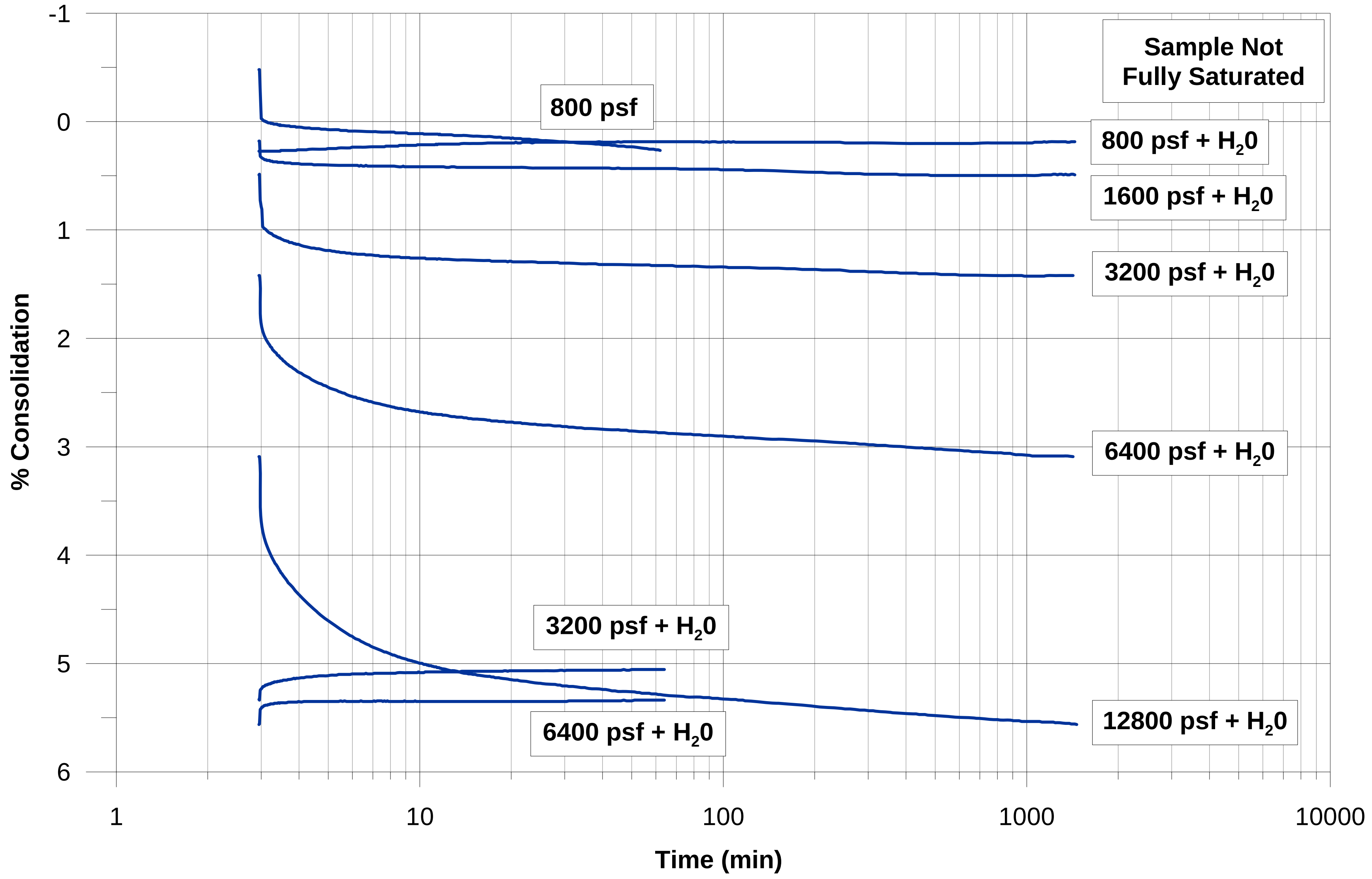
Praad Geotechnical, Inc.
Sept – Oct 2007

SVRT 05-108-C
BH-101 @ 35'



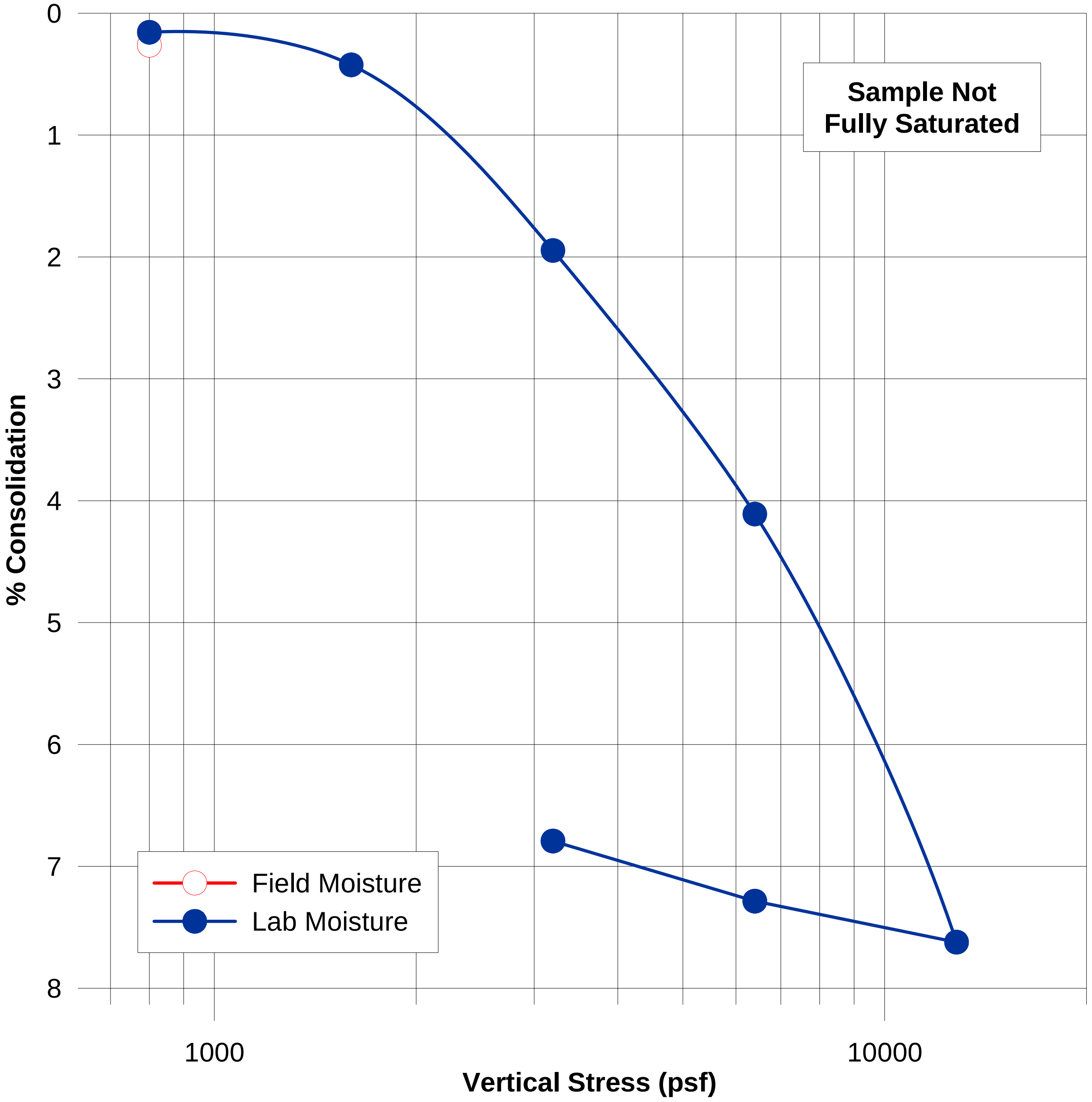
Praad Geotechnical, Inc.
Sept – Oct 2007

SVRT 05-108-C
BH-101 @ 35'



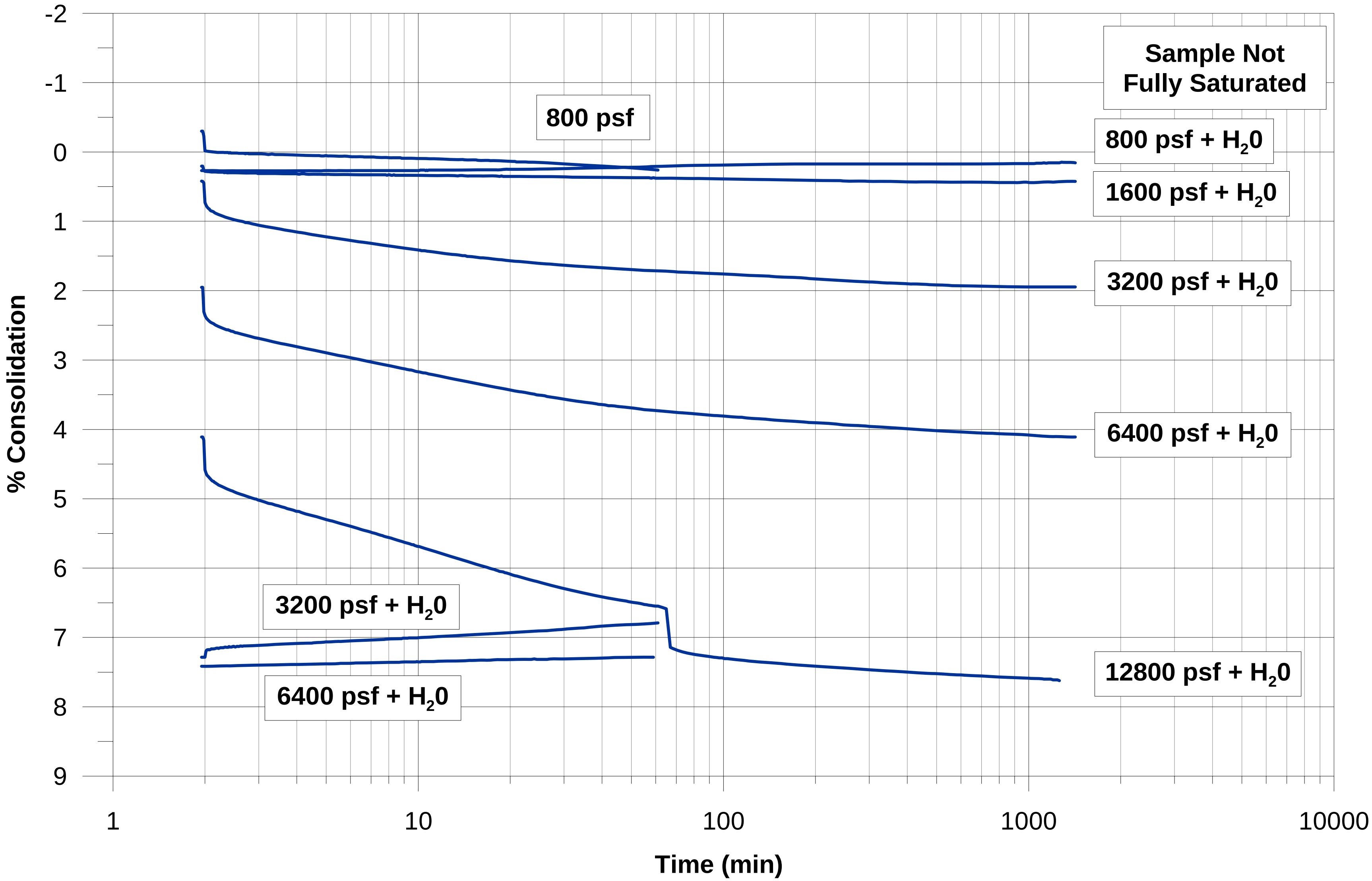
Praad Geotechnical, Inc.
Sept – Oct 2007

SVRT 05-108-C
BH-85 @ 50' - Test 1



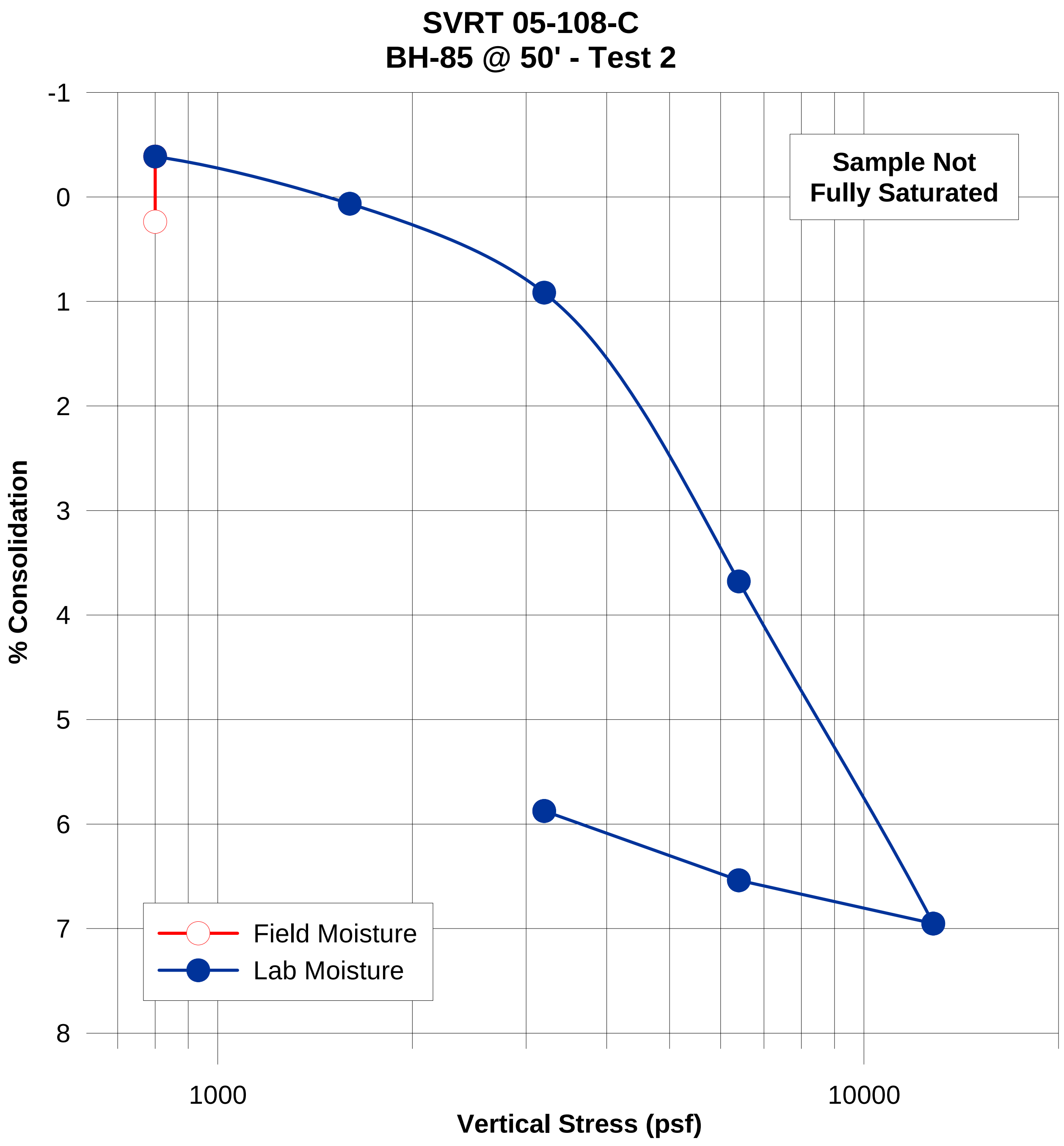
Note: Carbon stained pores observed in sample

SVRT 05-108-C
BH-85 @ 50' Test 1



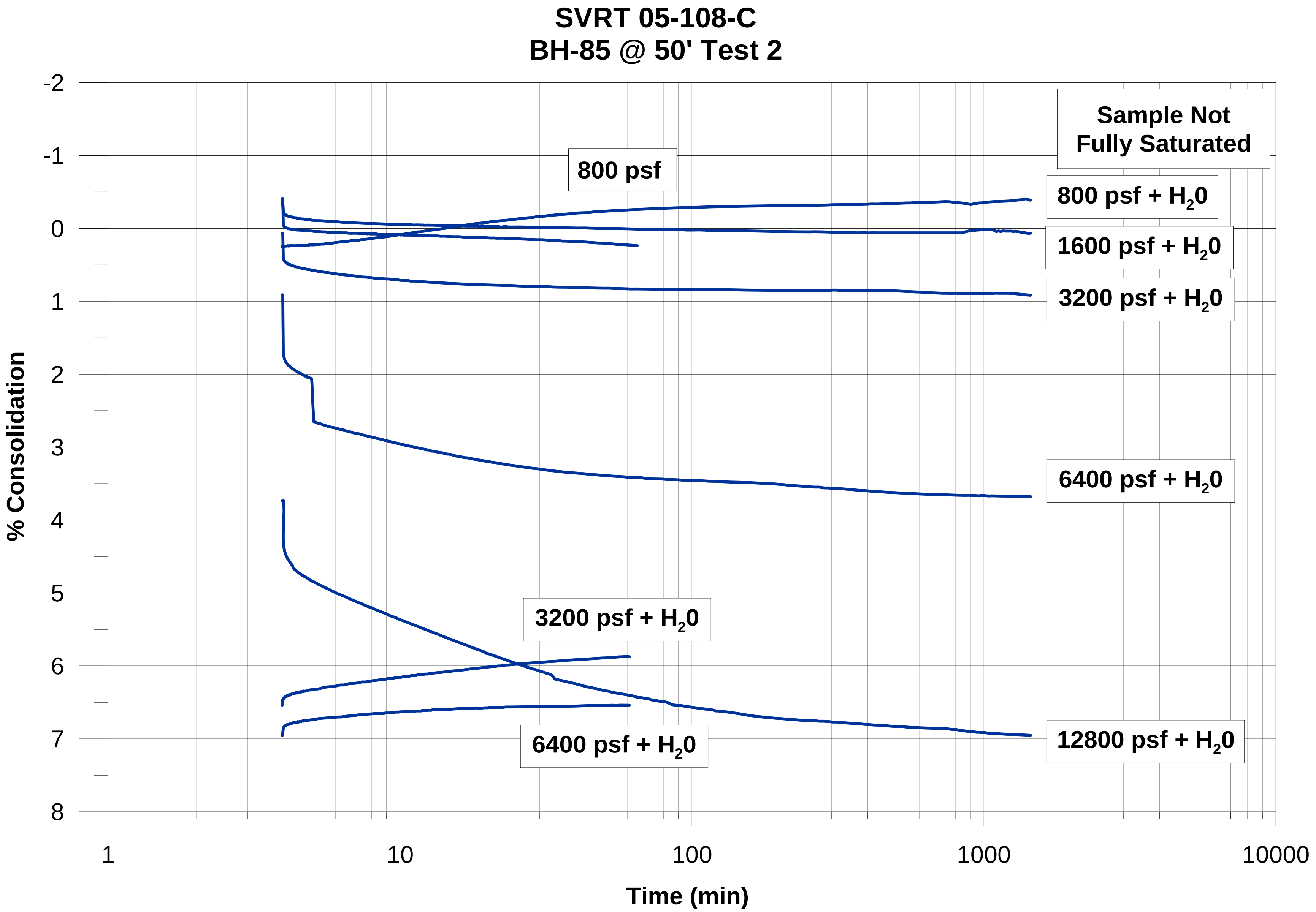
Note: Carbon stained pores observed in sample

Praad Geotechnical, Inc.
Sept – Oct 2007



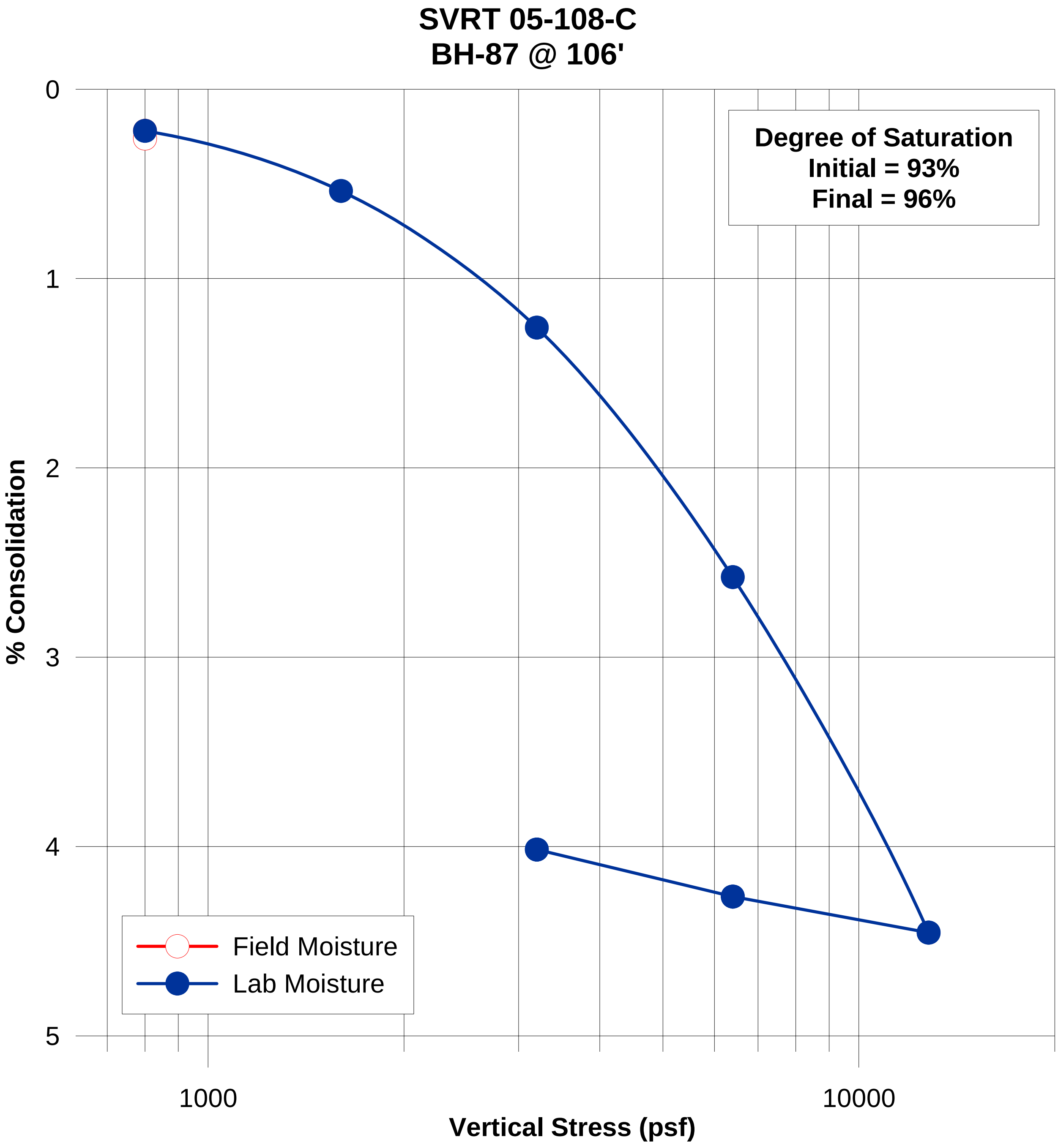
Note: Carbon stained pores observed in sample

Praad Geotechnical, Inc.
Sept – Oct 2007



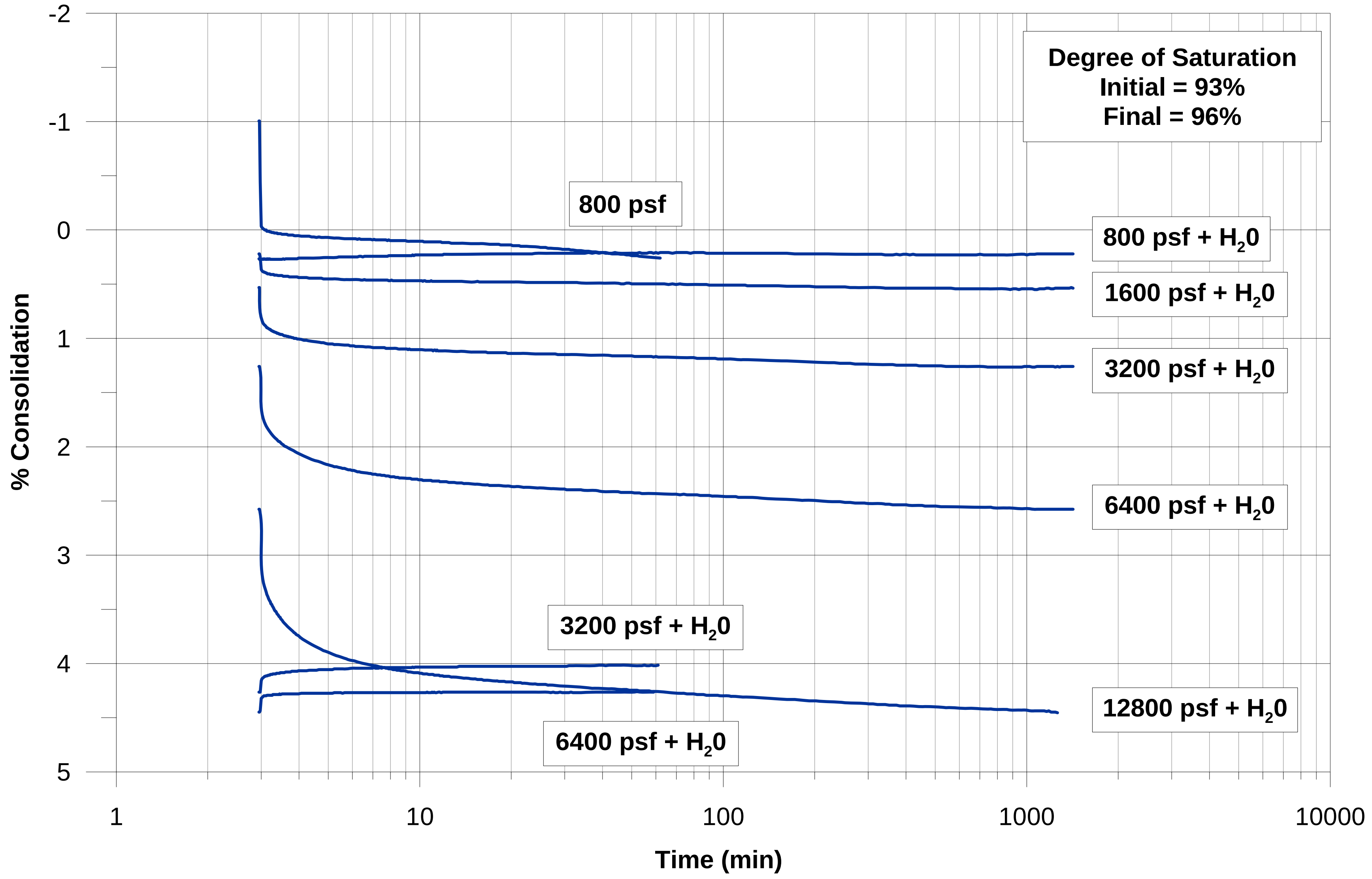
Note: Carbon stained pores observed in sample

Praad Geotechnical, Inc.
Sept – Oct 2007



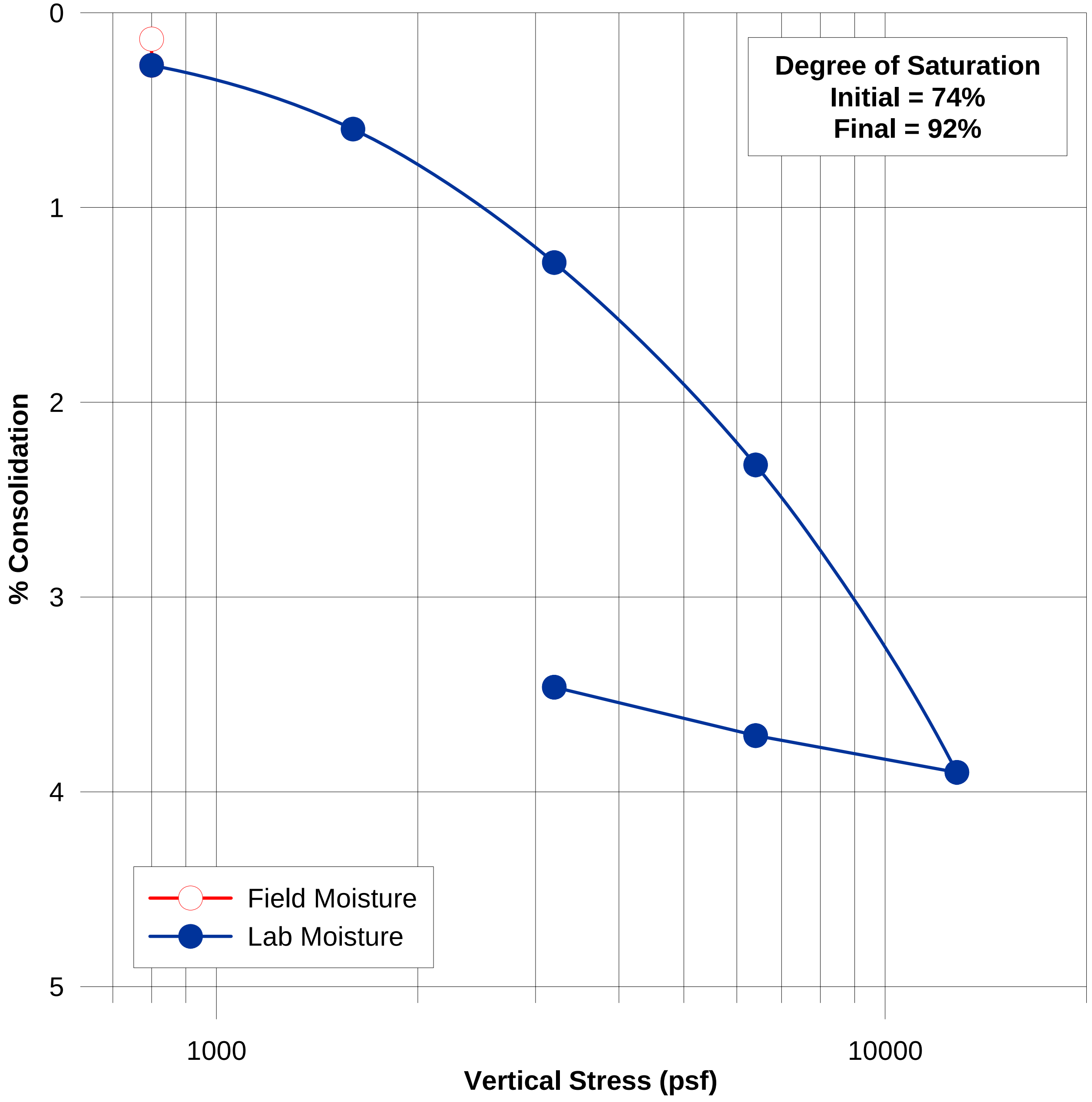
Praad Geotechnical, Inc.
Sept – Oct 2007

SVRT 05-108-C
BH-87 @ 106'

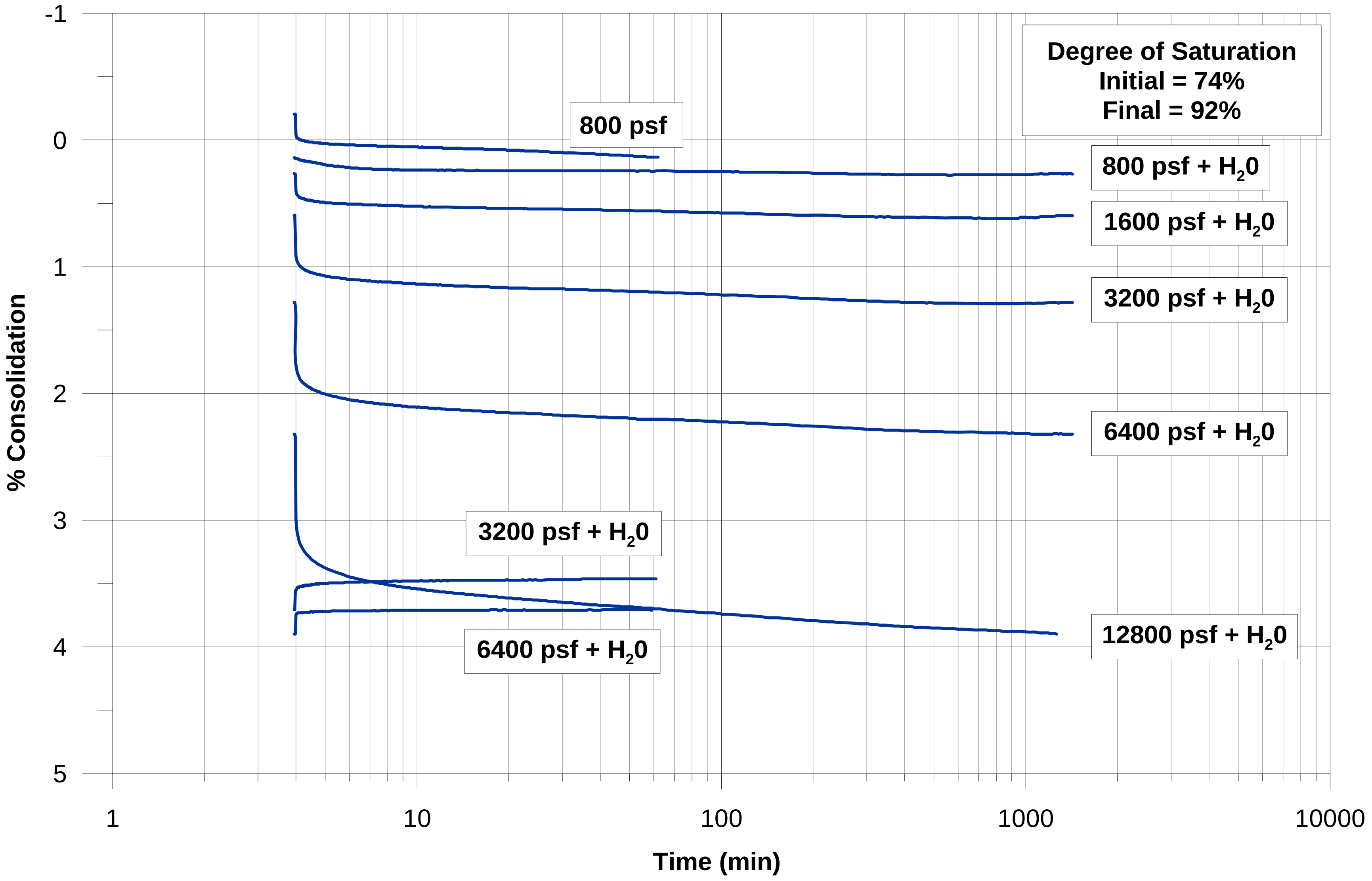


Praad Geotechnical, Inc.
Sept – Oct 2007

SVRT 05-108-C
BH-90 @ 110'



SVRT 05-108-C
BH-90 @ 110'



Praad Geotechnical, Inc.
Sept – Oct 2007

SVRT 05-108-C

Maximum Past Pressure, σ'_p, Summary

Sample	σ'_p, psf
BH-89 @ 20 ft	-
BH-101 @ 35 ft	~ 3,700
BH-85 @ 50 ft (1)	~ 3,200
BH-85 @ 50 ft (2)	~ 3,800
BH-87 @ 106 ft	-
BH-90 @ 110 ft	-

Atterberg Limit Summary

Sample	PRAAD			Parikh Lab
	Liquid Limit, LL	Plastic Limit, PL	Plastic Index, PI	Plastic Index, PI
BH-89 @ 20 ft	29	19	10	16
BH-101 @ 35 ft	29	20	9	12
BH-85 @ 50 ft	49	24	25	24
BH-87 @ 106 ft	36	25	11	-
BH-90 @ 110 ft	28	22	6	-

Appendix 10: Dissolved Gas Sampling and Analysis Report

Locus
TECHNOLOGIES

16 September 2008

Mr. Thomas Hunt
SVRT Project
3103 North First Street
Hynix Building B, 2nd Floor
San Jose CA 95134-1927

RE: *Report on Dissolved Gas Sampling and Analysis*
Locus Project No. 28006-0012

Dear Mr. Hunt:

Locus Technologies (Locus) recently completed sampling and analysis of 30 groundwater wells as requested by the HMM/Bechtel Silicon Valley Rapid Transit Project (SVRT) under Subcontract 24965-AE-029. This report documents the sampling and analyses, including field observations, laboratory results, and review of quality control information.

Summary of Sampling Activities

Locus collected groundwater samples from 12 Phase 1 groundwater wells specified by SVRT on 21-22 May 2008. Field activity logs, water sampling logs, and chain of custody records for this event are included in Attachment A. Field quality control samples collected during this round included a duplicate (sample ID 4767 collected from well MW-2F), a rinseate blank (sample ID 4769 collected after sampling TW-6A), and two travel blanks (sample IDs 4768 and "Trip Bl"). Samples collected during this event were shipped to Bioremediation Consulting Inc (BCI) in Watertown, MA and Gusmer Enterprises, Inc (Gusmer) in Napa, CA.

On 22-23 July 2008, Locus collected groundwater samples from 18 Phase 2 groundwater wells specified by SVRT. Field activity logs, water sampling logs, and chain of custody records for this event are included in Attachment B. Field quality control samples collected during this round included two duplicates (sample ID 4783 collected from well MW-2G and sample ID 4785 collected from well MW-6D), two rinseate blanks (sample ID 4784 collected after sampling MW-3C and sample ID 4786 collected after sampling ST-11), and a travel blank (sample ID "Trip Bl"). Samples collected during this event were shipped to BCI in Watertown, MA.

All samples were collected using low-flow purge methods in accordance with EPA Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers (2002). As required for the sample analysis, all samples were collected in bottles with zero headspace. Small bubbles were noted in some sample bottles prior to shipping, but these bubbles are attributed to dissolved gas accumulation.

Laboratory Analysis

Phase 1 groundwater samples were analyzed for methane, ethane, ethanethiol, argon, nitrogen, carbon monoxide, carbon dioxide, ammonia-nitrogen, sulfide, oxygen, hydrogen, and hydrogen sulfide. The complete analytical reports from BCI and Gusmer are presented in Attachment C.

After review of the Phase I results, Phase 2 samples were analyzed for a limited list of dissolved gases including methane, nitrogen, carbon dioxide, and sulfide. The complete analytical reports from BCI are presented in Attachment D.

Quality Control Review

The duplicate samples for Phase I showed acceptable replicability, with the only significant percent differences occurring near the reporting limit for ethane (0.2 μg/L in MW-2F and 0.3 μg/L in 4767) and ammonia (<0.02 mg/L in MW-2F and 0.03 mg/L in 4767). Duplicate analyses were also performed in the laboratory on samples MW-3Dr and TW-2B. These duplicates also showed similar results. Some blank samples collected during Phase I showed low detections of methane, nitrogen, and carbon dioxide. However, the concentrations of these gases in the blank samples were much lower than those detected in the well samples. Therefore, these detections do not have any impact on the results. Hydrogen and oxygen were also detected in the blank samples. However, since both of these gases are inherent in every water sample, these results do not invalidate any of the sample results.

For the Phase 2 samples, the two duplicate pairs showed similar results for all analytes except sulfide, which had 57percent difference in the MW-2G duplicate and 70 percent difference in the MW-6D duplicate. Laboratory duplicate analyses performed on samples MW-4A and ST-8 showed similar results, but these samples were not analyzed for sulfide. Concentrations of methane and nitrogen were detected in the rinseate blanks and travel blanks. Most methane concentrations in the groundwater samples were higher than the concentrations in the blanks, indicating no significant quality control issue. However, nitrogen results in the groundwater samples were similar to concentrations found in the blank samples, which indicates that the nitrogen results should be considered with data qualifiers. A low carbon dioxide concentration was also detected in one of the blanks, but at a much lower concentration than detected in any of the groundwater samples. Sulfide was not detected in any of the blank samples.

Should you have questions, please do not hesitate to call.

Sincerely,

J. Wesley Hawthorne, P.E., P.G.
Senior Project Manager

JWH/mmm

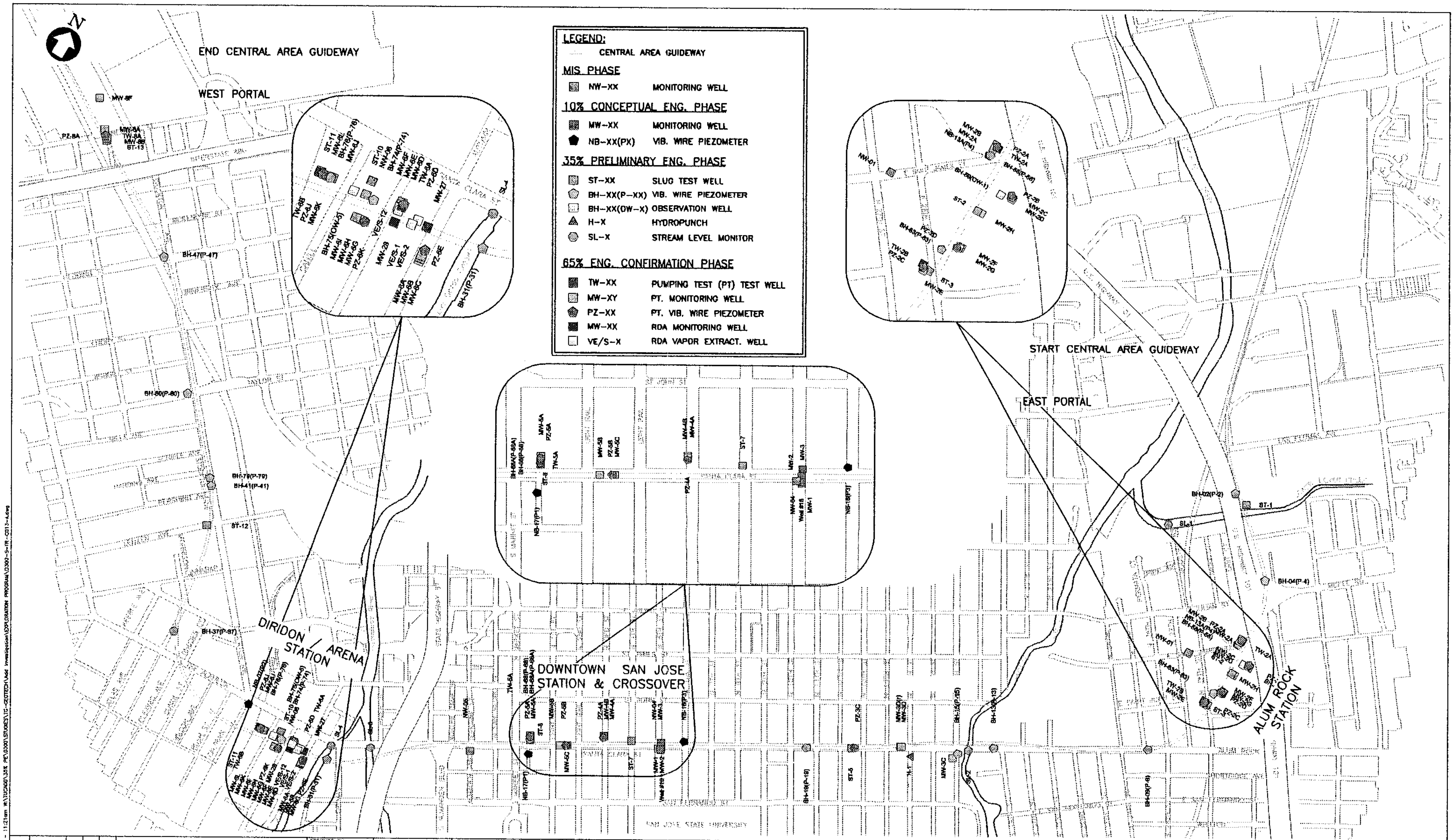
WELLS SELECTED FOR DISSOLVED GAS SAMPLING

Well Number	Well Screen (ft bgs)		Hydrogeologic Unit	Well Casing Diameter (inches)	Gas Sampling Priority = 1	Gas Sampling Priority = 2
	Top	Bottom				
East Portal to Alum Rock Station						
ST-1	67.5	72.5	Upper Aquifer ?	4		2
Alum Rock Station						
TW-2B	108	128		10	1	
MW-2C	98	108		2		2
MW-2E	110	120		2	1	
MW-2F	115	125		2	1	
MW-2G	63	73		2		2
ST-2	77.5	87.5	Upper Aquifer	4		2
ST-3	59.5	79.5	Upper Aquifer	4	1	
NW-01	70	80	Upper Aquifer	6		2
Alum Rock Station to Crossover						
MW-3C	68	78		2		2
MW-3D(r)	60	70		2	1	
ST-5	55	65	Upper Aquifer	4	1	
MW-1	64	74	Upper Aquifer	2		2
Crossover & Downtown San Jose Station						
TW-5A	78	93		10	1	
MW-4A	80	90		2		2
MW-5A	115	125		2	1	
MW-5B	73	97		2		2
ST-7	67.5	72.5	Upper Aquifer	4		2
ST-8	76.25	86.25	Upper Aquifer	4		2
Downtown San Jose Station to Diridon/Arena Station						
NW-05	80	90	Upper Aquifer	6		2
Diridon/Arena Station						
TW-6A	72	87		10	1	
TW-6B	106	116		10	1	
MW-6D	76	86		2		2
MW-6J	103	113		2	1	
ST-10	68	73	Upper Aquifer	4		2
ST-11	79.5	84.5	Upper Aquifer	4		2
NW-06	90	100	Upper Aquifer	6		2
Diridon/Arena Station to West Portal						
ST-12	64.5	69	Upper Aquifer	4		2
West Portal						
TW-8A	55	75		10	1	
ST-13	21	31	Channel in Confining Layer	4		2
Total				51	12	18

Gas sampling priority:

1 - Gas detected during drilling/sampling/pumping/slug testing at this location and depth. Require sampling.

2 - Gas not previously detected, but well screen is similar to tunnelling depth (e.g., 60 to 100 ft bgs). Recommend sampling.



0	20080408				IN PROGRESS	
REV	DATE	BY	SUB	APP	DESCRIPTION	

DESIGNED BY T HUNT
DRAWN BY M WHITE
CHECKED BY
IN CHARGE
DATE

HMM / BECHTEL
A Joint Venture of Hatch Mott MacDonald T&T, Inc. and Bechtel Infrastructure Corp.

SUBMITTED ____________ APPROVED ____________

VTA Silicon Valley Rapid Transit Corridor
BART to Milpitas San Jose Santa Clara

SILICON VALLEY RAPID TRANSIT PROJECT
CENTRAL AREA GUIDEWAY
HYDROGEOLOGY REPORT
WELL AND PIEZOMETER LOCATION MAP
FIGURE 4-1

CADD FILENAME D300-S-TR-C013-A.dwg
SIZE D
SCALE 1"=600'
CONTRACT NO. D300
REV. 0
AREA CODE TR
SHEET NO. C013
PAGE NO.

ATTACHMENT A

Field Log, Water Sampling Log, and Chain of Custody Forms

Phase 1 Sampling

WELL SAMPLING SUMMARY
PHASE 1 GROUNDWATER SAMPLING

Well	Sample Date	Sample Time	Purge Duration (min)	Purge Volume (gal)	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)	Oxidation-Reduction Potential	Conductivity (µS)
TW-6B	21-May	7:20	10	1	17.6	7.04	4.98	52.2	386.9	721
MW-6J	21-May	8:35	25	2.5	18.7	6.96	4.45	47.6	393.2	698
ST-3	21-May	9:40	20	2	19.9	7.04	4.01	47.2	381.1	1160
MW-3Dr	21-May	10:50	15	1.5	24.8	7.25	2.98	34.4	358.9	1010
ST-5	21-May	12:05	15	1.5	24.6	7.21	2.62	30.2	358.9	1060
TW-6A	21-May	13:10	20	2	25.5	6.61	1.37	17.2	244.7	792
MW-2F	21-May	14:20	25	2.5	23.4	7.23	2.92	34.4	171.2	1407
TW-2B	21-May	15:15	20	2	21.1	7.39	2.58	30.2	52.3	1337
MW-2E	21-May	15:55	15	1.5	21.3	7.37	2.8	29.4	130.7	1397
TW-5A	22-May	8:45	25	2.5	18.5	7.11	1.81	19.7	172.2	1042
MW-5A	22-May	9:50	25	2.5	19.2	7.50	1.74	20.6	65.3	546
TW-8A	22-May	10:40	20	2	20.9	7.17	1.97	20.8	66.2	714

LOCUS TECHNOLOGIES

DAILY FIELD ACTIVITY LOG

Project Name: Santa Clara VTA

Field Activity: Well Sampling

Weather: Clear/Sunny

Project No.: 28006-08-0001

Date: 5-21-08

Logged by: H. Castro Jr.

Page: 1 of 2

TIME	DAILY ACTIVITIES AND EVENTS
0600	Prepped & loaded truck for low flow sampling.
0700	Arrived onsite at TW-6B. Set up equipment for purge. Met with Tom Hunt from VTA.
0725	Sampled TW-6B.
0800	AT MW-6J, Set up equipment for low flow purge.
0840	Sampled MW-6J.
0900	AT ST-3. Met with Officer Bryan & Traffic control Inc for traffic control. Set up equipment for low flow purge.
0945	Sampled ST-3.
1005	AT MW-3D(r). Set up traffic control.
1025	Set up equipment for low flow purge.
1055	Sampled MW-3D(r).
1120	AT ST-5. Set up traffic control.
1140	Set up equipment for low flow purge.
1210	Sampled ST-5. Traffic control Inc. & Officer Bryan left site.

Comments/Remarks:

LOCUS
TECHNOLOGIES

DAILY FIELD ACTIVITY LOG

roject Name: Santa Clara UTA
ield Activity: Well Sampling
Veather: Clear/Sunny

Project No.: 28006-08-0001
Date: 5-21-08
Logged by: A. Castro Jr.
Page: 2 of 2

TIME	DAILY ACTIVITIES AND EVENTS
1240	AT TW-6A, Set up equipment for low flow purge.
1315	Sampled TW-6A. (RB TAKEN 4769)
1345	AT MW-2F. Set up equipment for low flow purge.
1425	Sampled MW-2F. (DUP TAKEN 4767)
1445	AT TW-2B. Set up equipment for low flow purge.
1520	Sampled TW-2B.
1530	AT MW-2E, Set up equipment for low flow purge.
1600	Sampled MW-2E.
5/22/08	
0800	Arrived onsite. AT TW-5A. Set up equipment for purge.
0850	Sampled TW-5A.
0915	AT MW-5A. Set up equipment for purge.
0955	Sampled MW-5A.
1010	AT TW-8A. Set up equipment for purge.
1045	Sampled TW-8A.
1120	Left purge water onsite just SE of TW-8A w/ pending analysis label.
1135	Left site for office.

omments/Remarks:

LOCUS TECHNOLOGIES WATER SAMPLING LOG

SITE: S.C. VTA
WELL\SAMPLE DESIGNATION TW-6B
DATE 5-21-08
SAMPLE SOURCE A
PROJECT# 28006-08-0001
AMBIENT CONDITIONS Clear & Sunny
SAMPLER H.CASTRO/ T.Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD
CONTINUOUS PUMPER YES NO
PUMP CYCLING YES NO
pH meter
METER READING
FLOW RATE

WATER LEVEL INFORMATION

MEASURING POINT TOC
INSTRUMENT USED SJ-1

W.L. BEFORE PURGE TIME
W.L. AFTER PURGE TIME
W.L. FOR 80% RECOVERY
W.L. TIME OF SAMPLE DATE TIME

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD E

PURGE DEVICE I D. Low flow pump
WELL DEPTH 116'
DIAMETER 10"
#CASING VOLUMES (PROTOCOL)
SCREENED INTERVAL ------
PUMP SETTING
PURGE VOLUME CALCULATION
TIME PURGE BEGINS
ACTUAL AMOUNT PURGED
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	DO
720	17.6°	721	7.04	Slightly brown/no odor	386.9	52.2% 4.98mg/L

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD D

APPROXIMATE DEPTH OF GRAB N/A
SAMPLING DEVICE ID Tubing
SAMPLING TIME 725
DATE 5-21-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
		(See bottle list)				

DECONTAMINATION INFORMATION

PURGE DEVICE ID HOSE REEL
SAMPLING DEVICE ID
PREVIOUSLY USED IN WELL
PREVIOUSLY USED IN WELL
SITE
SITE
DECON METHOD/STEAM TIME
DECON METHOD/STEAM TIME
RINSEATE SAMPLE YES NO I.D.
RINSEATE SAMPLE YES NO ID

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK X YES NO ID 4768 QA/QC SPIKE YES X NO ID ------
DUPLICATE YES X NO ID — FIELD BLANK YES X NO ID ---- INTER-LAB SPLIT YES X NO ID ---

NOTES

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION MW-6J
SAMPLE SOURCE A
AMBIENT CONDITIONS Clear & Sunny
SITE: S.C. VTA
DATE 5-21-08
PROJECT# 28006-08-0001
SAMPLER H.CASTRO/ T.Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD
CONTINUOUS PUMPER YES NO
PUMP CYCLING YES NO
pH meter
METER READING
FLOW RATE

WATER LEVEL INFORMATION

MEASURING POINT TOC
INSTRUMENT USED: SJ-1

W.L. BEFORE PURGE
TIME
W.L. AFTER PURGE
TIME
W.L. FOR 80% RECOVERY
W.L. TIME OF SAMPLE
DATE
TIME

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD E

PURGE DEVICE I.D. Low flow pump
WELL DEPTH 113'
DIAMETER 2"
#CASING VOLUMES (PROTOCOL)
SCREENED INTERVAL -----
PUMP SETTING
PURGE VOLUME CALCULATION
TIME PURGE BEGINS
ACTUAL AMOUNT PURGED
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	DO
835	18.7°c	698	6.96	brown/no odor	393.2	47.6% 4.45mg/L

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD D

APPROXIMATE DEPTH OF GRAB N/A
SAMPLING DEVICE ID Tubing
SAMPLING TIME 840
DATE 5-21-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
(SEE BOTTLE LIST)						

DECONTAMINATION INFORMATION

PURGE DEVICE ID
HOSE REEL
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLE YES NO ID
SAMPLING DEVICE ID
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLE YES NO ID

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK X YES NO ID 4768 QA/QC SPIKE YES X NO ID -----
DUPLICATE YES X NO ID — FIELD BLANK YES X NO ID ---- INTER-LAB SPLIT YES X NO ID ----

NOTES

LOCUS TECHNOLOGIES WATER SAMPLING LOG

SITE: S.C. VTA

WELL\SAMPLE DESIGNATION ST-3

DATE 5-21-08

SAMPLE SOURCE A

PROJECT# 28006-08-0001

AMBIENT CONDITIONS Clear & Sunny

SAMPLER H.CASTRO/ T.Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD: ____ CONTINUOUS PUMPER ____ YES ____ NO ____ pH meter ____ FLOW RATE ____

PUMP CYCLING ____ YES ____ NO ____ METER READING ____

WATER LEVEL INFORMATION

MEASURING POINT TOC INSTRUMENT USED: SJ-1

W.L. BEFORE PURGE ____ TIME ____ W.L. AFTER PURGE ____ TIME ____

W.L. FOR 80% RECOVERY ____ W.L. TIME OF SAMPLE ____ DATE ____ TIME ____

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD E

PURGE DEVICE I.D. Low flow pump

WELL DEPTH 79.5'

DIAMETER 4"

#CASING VOLUMES (PROTOCOL) ____

SCREENED INTERVAL -----

PUMP SETTING ____

PURGE VOLUME CALCULATION ____

TIME PURGE BEGINS ____

ACTUAL AMOUNT PURGED ____

pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	DO
940	19.9c	1160	7.04	clear/no odor	381.1	47.2% 4.01mg/L

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD D

APPROXIMATE DEPTH OF GRAB N/A

SAMPLING DEVICE ID Tubing

SAMPLING TIME 945

DATE 5-21-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
			(See bottle list)			

DECONTAMINATION INFORMATION

PURGE DEVICE ID ____ HOSE REEL ____ SAMPLING DEVICE ID ____

PREVIOUSLY USED IN WELL ____ PREVIOUSLY USED IN WELL ____

SITE ____ SITE ____

DECON METHOD/STEAM TIME ____ DECON METHOD/STEAM TIME ____

RINSEATE SAMPLE ____ YES ____ NO ____ ID ____ RINSEATE SAMPLE ____ YES ____ NO ____ ID ____

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK X YES ____ NO ID 4768 QA/QC SPIKE ____ YES X NO ID -----

DUPLICATE ____ YES X NO ID ---- FIELD BLANK ____ YES X NO ID ---- INTER-LAB SPLIT ____ YES X NO ID ---

NOTES

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION MW-3D(r)
SAMPLE SOURCE A
AMBIENT CONDITIONS Clear & Sunny
SITE: S.C. VTA
DATE 5-21-08
PROJECT# 2B006-08-0001
SAMPLER H.CASTRO/ T.Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD: CONTINUOUS PUMPER YES NO
PUMP CYCLING YES NO
pH meter
METER READING
FLOW RATE

WATER LEVEL INFORMATION

MEASURING POINT TOC
INSTRUMENT USED SJ-1

W.L BEFORE PURGE TIME W.L AFTER PURGE TIME
W.L FOR 80% RECOVERY W.L TIME OF SAMPLE DATE TIME

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD E

PURGE DEVICE I.D. Low flow pump
WELL DEPTH 70'
DIAMETER 2"
#CASING VOLUMES (PROTOCOL)
SCREENED INTERVAL -----
PUMP SETTING
PURGE VOLUME CALCULATION
TIME PURGE BEGINS
ACTUAL AMOUNT PURGED
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	DO
1050	24.8c	1010	7.25	cloudy/no odor	358.9	34.4% 2.98mg/L

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD D

SAMPLING DEVICE ID Tubing
SAMPLING TIME 1055
APPROXIMATE DEPTH OF GRAB N/A
DATE 5-21-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
		(See bottle list)				

DECONTAMINATION INFORMATION

PURGE DEVICE ID HOSE REEL
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLE YES NO ID

SAMPLING DEVICE ID
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLES YES NO ID

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK X YES NO ID 4768 QA/QC SPIKE YES X NO ID -----
DUPLICATE YES X NO ID — FIELD BLANK YES X NO ID ---- INTER-LAB SPLIT YES X NO ID ----

NOTES

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION ST-5
SAMPLE SOURCE A
AMBIENT CONDITIONS Clear & Sunny

SITE: S.C. VTA
DATE 5-21-08
PROJECT# 28006-08-0001
SAMPLER H.CASTRO/ T.Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD
CONTINUOUS PUMPER YES NO
PUMP CYCLING YES NO
pH meter
METER READING
FLOW RATE

WATER LEVEL INFORMATION

MEASURING POINT TOC
INSTRUMENT USED SJ-1

W.L. BEFORE PURGE TIME
W.L. AFTER PURGE TIME
W.L. FOR 80% RECOVERY
W.L. TIME OF SAMPLE DATE TIME

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD E

PURGE DEVICE I.D. Low flow pump
WELL DEPTH 65'
DIAMETER 4"
#CASING VOLUMES (PROTOCOL)
SCREENED INTERVAL ------
PUMP SETTING
PURGE VOLUME CALCULATION
TIME PURGE BEGINS
ACTUAL AMOUNT PURGED
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	DO
1205	24.6°	1060	7.21	Clear/no odor	358.9	30.2% 2.62 mg/L

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD D

APPROXIMATE DEPTH OF GRAB N/A
SAMPLING DEVICE ID Tubing
SAMPLING TIME 1210
DATE 5-21-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
		(See bottle list)				

DECONTAMINATION INFORMATION

PURGE DEVICE ID HOSE REEL
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLE YES NO ID

SAMPLING DEVICE ID
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLE YES NO ID

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK X YES NO ID 4768 QA/QC SPIKE YES X NO ID -----
DUPLICATE YES X NO ID — FIELD BLANK YES X NO ID --- INTER-LAB SPLIT YES X NO ID ---

NOTES

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION TW-6A
SAMPLE SOURCE A
AMBIENT CONDITIONS Clear & Sunny
SITE: S.C. VTA
DATE 5-21-08
PROJECT# 28006-08-0001
SAMPLER H.CASTRO/ T.Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD
CONTINUOUS PUMPER YES NO
PUMP CYCLING YES NO
pH meter
METER READING
FLOW RATE

WATER LEVEL INFORMATION

MEASURING POINT TOC
INSTRUMENT USED SJ-1

W.L BEFORE PURGE TIME
W.L AFTER PURGE TIME
W.L FOR 80% RECOVERY
W.L TIME OF SAMPLE DATE TIME

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD E

PURGE DEVICE I.D Low flow pump
WELL DEPTH 87'
DIAMETER 10"
#CASING VOLUMES (PROTOCOL)
SCREENED INTERVAL ------
PUMP SETTING
PURGE VOLUME CALCULATION
TIME PURGE BEGINS
ACTUAL AMOUNT PURGED
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	DO
1310	25.5c	792	6.61	silty brwn/slight odor	244.7	17.2% 1.37mg/L

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD D

SAMPLING DEVICE ID Tubing
SAMPLING TIME 1315
APPROXIMATE DEPTH OF GRAB N/A
DATE 5-21-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
(See bottle list)						

DECONTAMINATION INFORMATION

PURGE DEVICE ID
HOSE REEL
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLE YES NO ID
SAMPLING DEVICE ID
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLE YES NO ID

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK X YES NO ID 4768 QA/QC SPIKE YES X NO ID ------
DUPLICATE YES X NO ID — Rinse BLANK X YES NO ID 4769 INTER-LAB SPLIT YES X NO ID ---

NOTES

(RB TAKEN)

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION MW-2F

SAMPLE SOURCE A

AMBIENT CONDITIONS Clear & Sunny

SITE: S.C. VTA

DATE 5-21-08

PROJECT# 28006-08-0001

SAMPLER H.CASTRO/ T.Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD

CONTINUOUS PUMPER YES NO

PUMP CYCLING YES NO

pH meter

METER READING

FLOW RATE

WATER LEVEL INFORMATION

MEASURING POINT TOC

INSTRUMENT USED SJ-1

W.L BEFORE PURGE TIME W.L AFTER PURGE TIME

W.L FOR 80% RECOVERY W.L TIME OF SAMPLE DATE TIME

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD E

PURGE DEVICE I.D. Low flow pump

WELL DEPTH 120'

DIAMETER 2"

#CASING VOLUMES (PROTOCOL)

SCREENED INTERVAL ------

PUMP SETTING

PURGE VOLUME CALCULATION

TIME PURGE BEGINS

ACTUAL AMOUNT PURGED

pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	DO
1420	23.4c	1407	7.23	clear/no odor	171.2	34.4% 2.92 mg/L

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD D

APPROXIMATE DEPTH OF GRAB N/A

SAMPLING DEVICE ID Tubing

SAMPLING TIME 1425

DATE 5-21-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
			(See bottle list)			

DECONTAMINATION INFORMATION

PURGE DEVICE ID HOSE REEL

PREVIOUSLY USED IN WELL

SITE

DECON METHOD/STEAM TIME

RINSEATE SAMPLE YES NO ID

SAMPLING DEVICE ID

PREVIOUSLY USED IN WELL

SITE

DECON METHOD/STEAM TIME

RINSEATE SAMPLE YES NO ID

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK X YES __ NO ID 4768 QA/QC SPIKE __ YES X NO ID ------

DUPLICATE X YES __ NO ID 4767 FIELD BLANK __ YES X NO ID ---- INTER-LAB SPLIT __ YES X NO ID ---

NOTES

(DUP TAKEN)

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION TW-2B

SAMPLE SOURCE A

AMBIENT CONDITIONS Clear & Sunny

SITE: S.C. VTA

DATE 5-21-08

PROJECT# 28006-08-0001

SAMPLER H.CASTRO/ T.Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:

CONTINUOUS PUMPER YES NO

PUMP CYCLING YES NO

pH meter

METER READING

FLOW RATE

WATER LEVEL INFORMATION

MEASURING POINT TOC

INSTRUMENT USED SJ-1

W.L BEFORE PURGE TIME

W.L AFTER PURGE TIME

W.L FOR 80% RECOVERY

W.L TIME OF SAMPLE DATE TIME

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD E

PURGE DEVICE I.D Low flow pump

WELL DEPTH 128'

DIAMETER 10"

#CASING VOLUMES (PROTOCOL)

SCREENED INTERVAL ------

PUMP SETTING

PURGE VOLUME CALCULATION

TIME PURGE BEGINS

ACTUAL AMOUNT PURGED

pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	DO
1515	21.1c	1337	7.39	slightly brwn/no odor	52.3	30.2% 2.58mg/L

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD D

SAMPLING DEVICE ID Tubing

SAMPLING TIME 1520

APPROXIMATE DEPTH OF GRAB N/A

DATE 5-21-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
			(See bottle list)			

DECONTAMINATION INFORMATION

PURGE DEVICE ID HOSE REEL

PREVIOUSLY USED IN WELL

SITE

DECON METHOD/STEAM TIME

RINSEATE SAMPLE YES NO ID

SAMPLING DEVICE ID

PREVIOUSLY USED IN WELL

SITE

DECON METHOD/STEAM TIME

RINSEATE SAMPLE YES NO ID

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK X YES __ NO ID 4768 QA/QC SPIKE __ YES X NO ID ------

DUPLICATE __ YES X NO ID — FIELD BLANK __ YES X NO ID ---- INTER-LAB SPLIT __ YES X NO ID ---

NOTES

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION MW-2E
SAMPLE SOURCE A
AMBIENT CONDITIONS Clear & Sunny

SITE: S.C. VTA
DATE 5-21-08
PROJECT# 28006-08-0001
SAMPLER H.CASTRO/ T.Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:
CONTINUOUS PUMPER YES NO
PUMP CYCLING YES NO
pH meter
METER READING
FLOW RATE

WATER LEVEL INFORMATION

MEASURING POINT TOC
INSTRUMENT USED SJ-1

W.L. BEFORE PURGE TIME W.L. AFTER PURGE TIME
W.L. FOR 80% RECOVERY W.L. TIME OF SAMPLE DATE TIME

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD E

PURGE DEVICE I.D. Low flow pump
WELL DEPTH 120'
DIAMETER 2"
#CASING VOLUMES (PROTOCOL)
SCREENED INTERVAL ------
PUMP SETTING
PURGE VOLUME CALCULATION
TIME PURGE BEGINS
ACTUAL AMOUNT PURGED
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	DO
1555	21.3°c	1397	7.37	Cloudy/no odor	150.7	29.4% 2.80mg/L

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD D

SAMPLING DEVICE ID Tubing
SAMPLING TIME 1600
APPROXIMATE DEPTH OF GRAB N/A
DATE 5-21-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
			(See bottle list)			

DECONTAMINATION INFORMATION

PURGE DEVICE ID HOSE REEL
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLE YES NO ID

SAMPLING DEVICE ID
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLE YES NO ID

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK X YES NO ID 4768 QA/QC SPIKE YES X NO ID ------
DUPLICATE YES X NO ID ------ FIELD BLANK YES X NO ID ---- INTER-LAB SPLIT YES X NO ID ---

NOTES

LOCUS TECHNOLOGIES WATER SAMPLING LOG

SITE: S.C. VTA
WELL\SAMPLE DESIGNATION TW-5A
DATE 5-22-08
SAMPLE SOURCE A
PROJECT# 28006-08-0001
AMBIENT CONDITIONS Clear & Sunny
SAMPLER H.CASTRO/ T.Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD
CONTINUOUS PUMPER YES NO
PUMP CYCLING YES NO
pH meter METER READING
FLOW RATE

WATER LEVEL INFORMATION

MEASURING POINT TOC
INSTRUMENT USED SJ-1

W.L BEFORE PURGE TIME
W.L AFTER PURGE TIME
W.L FOR 80% RECOVERY
W.L TIME OF SAMPLE DATE TIME

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD E

PURGE DEVICE I.D. Low flow pump
WELL DEPTH 95'
DIAMETER 10"
#CASING VOLUMES (PROTOCOL)
SCREENED INTERVAL ------
PUMP SETTING
PURGE VOLUME CALCULATION
TIME PURGE BEGINS
ACTUAL AMOUNT PURGED
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	DO
845	18.5°c	1042	7.11	cloudy brwn/no odor	172.2	19.7% 1.81mg/L

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD D

APPROXIMATE DEPTH OF GRAB N/A
SAMPLING DEVICE ID Tubing
SAMPLING TIME 850
DATE 5-22-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
			(See bottle list)			

DECONTAMINATION INFORMATION

PURGE DEVICE ID
HOSE REEL
SAMPLING DEVICE ID
PREVIOUSLY USED IN WELL
PREVIOUSLY USED IN WELL
SITE
SITE
DECON METHOD/STEAM TIME
DECON METHOD/STEAM TIME
RINSEATE SAMPLE YES NO ID
RINSEATE SAMPLE YES NO ID

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK X YES ___NO ID 4768 QA/QC SPIKE ___YES X NO ID -----
DUPLICATE ___YES X NO ID — FIELD BLANK ___YES X NO ID ---- INTER-LAB SPLIT ___YES X NO ID ---

NOTES

LOCUS TECHNOLOGIES WATER SAMPLING LOG

SITE: S.C. VTA

WELL\SAMPLE DESIGNATION MW-5A

DATE 5-22-08

SAMPLE SOURCE A

PROJECT# 28006-08-0001

AMBIENT CONDITIONS Clear & Sunny

SAMPLER H.CASTRO/ T.Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD: CONTINUOUS PUMPER YES NO pH meter FLOW RATE

PUMP CYCLING YES NO METER READING

WATER LEVEL INFORMATION MEASURING POINT TOC INSTRUMENT USED SJ-1

W.L. BEFORE PURGE TIME W.L. AFTER PURGE TIME

W.L. FOR 80% RECOVERY W.L. TIME OF SAMPLE DATE TIME

MONITORING WELL PURGE INFORMATION MONITORING WELL PURGE METHOD E

PURGE DEVICE I.D. Low flow pump

WELL DEPTH 125'

DIAMETER 2"

#CASING VOLUMES (PROTOCOL)

SCREENED INTERVAL -----

PUMP SETTING

PURGE VOLUME CALCULATION

TIME PURGE BEGINS

ACTUAL AMOUNT PURGED

pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	DO
950	19.2°c	546	7.50	clear/no odor	65.3	20.6% 1.74mg/L

WATER SAMPLING INFORMATION MONITORING WELL SAMPLE METHOD D

APPROXIMATE DEPTH OF GRAB N/A

SAMPLING DEVICE ID Tubing

SAMPLING TIME 955

DATE 5-22-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
		(See bottle list)				

DECONTAMINATION INFORMATION

PURGE DEVICE ID HOSE REEL 1 SAMPLING DEVICE ID

PREVIOUSLY USED IN WELL PREVIOUSLY USED IN WELL

SITE SITE

DECON METHOD/STEAM TIME DECON METHOD/STEAM TIME

RINSEATE SAMPLE YES NO ID RINSEATE SAMPLE YES NO ID

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK X YES ___ NO ID 4768 QA/QC SPIKE ___ YES X NO ID -----

DUPLICATE ___ YES ✓ NO ID — FIELD BLANK ___ YES X NO ID ---- INTER-LAB SPLIT ___ YES X NO ID ---

NOTES

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION TW-8A
SAMPLE SOURCE A
AMBIENT CONDITIONS Clear & Sunny

SITE: S.C. VTA
DATE 5-22-08
PROJECT# 28006-08-0001
SAMPLER H.CASTRO/ T.Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE / CONTINUOUS PUMPER YES NO pH meter FLOW RATE
METHOD PUMP CYCLING YES NO METER READING

WATER LEVEL INFORMATION MEASURING POINT TOC INSTRUMENT USED SJ-1

W.L. BEFORE PURGE TIME W.L. AFTER PURGE TIME
W.L. FOR 80% RECOVERY W.L. TIME OF SAMPLE DATE TIME

MONITORING WELL PURGE INFORMATION MONITORING WELL PURGE METHOD E

PURGE DEVICE I.D. Low flow pump
WELL DEPTH 75'
DIAMETER 10"
#CASING VOLUMES (PROTOCOL)
SCREENED INTERVAL -----
PUMP SETTING
PURGE VOLUME CALCULATION
TIME PURGE BEGINS
ACTUAL AMOUNT PURGED
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	DO
1040	20.9°c	714	7.17	clear/no odor	66.2	20.8% 1.97 mg/L

WATER SAMPLING INFORMATION MONITORING WELL SAMPLE METHOD D

APPROXIMATE DEPTH OF GRAB N/A
SAMPLING DEVICE ID Tubing
SAMPLING TIME 1045
DATE 5-22-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
		(See bottle list)				

DECONTAMINATION INFORMATION

PURGE DEVICE ID HOSE REEL SAMPLING DEVICE ID
PREVIOUSLY USED IN WELL PREVIOUSLY USED IN WELL
SITE SITE
DECON METHOD/STEAM TIME DECON METHOD/STEAM TIME
RINSEATE SAMPLE YES NO I.D. RINSEATE SAMPLE YES NO ID

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK X YES NO ID 4768 QA/QC SPIKE YES X NO ID ------
DUPLICATE YES X NO ID — FIELD BLANK YES X NO ID ---- INTER-LAB SPLIT YES X NO ID ----

NOTES

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Fax (707)255-2019

Date: ____________

File Code (Office Use): ________

Have you submitted samples to us in the past? ____ yes
✓ no

IF YES, (**) MARKED INFORMATION **MUST** BE FILLED OUT FOR SAMPLES TO BE PROCESSED
IF NO, PLEASE FILL OUT THIS FORM COMPLETELY

ANALYSIS REQUEST FORM

PLEASE LABEL EACH SUBMITTED SAMPLE WITH YOUR WINERY NAME, A SAMPLE NAME AND THE SUBMISSION DATE

PLEASE FILL OUT THE REQUIRED INFORMATION ON BOTH SIDES OF THIS FORM AND SEND OR BRING WITH YOUR SAMPLES

MINIMUM ANALYSIS CHARGE $25 00

****Account Name** (*Responsible Party*) Locus Technologies

****Name** (person requesting analysis) J. Wesley Hawthorne

Address: 299 Fairchild Drive

City, State and Zip: Mountain View, CA 94043

****Daytime Phone** (650) 960-1640 ****Fax** (650) 960-0739

****E-mail** hawthornew@locustec.com

Credit Card # ______________ exp date __________

Name on Card ______________ Signature __________

****Send Results to** (if different from above): same as above

****Please send results by:** ☐ fax ☒ e-mail ☐ mail only (Sorry, results may not be reported by telephone.)
A copy of the written results for your files will be sent by mail with your invoice

Are these samples involved in a legal dispute between two parties? no

Please check all that apply:

☐ I am not sure which test to run (please write a note or call our lab staff to discuss the sample)
☒ Do only the tests I select
☐ Other

Comments:

ANALYSIS REQUEST FORM

Please write the corresponding letter of the analysis you would like performed after the sample name in the table below
Please refer to our Web Page or Catalog for instructions on preparing and sending samples and amount of sample required

**Sample Name		Letter(s) of Requested Analyses	
1. TW-2B	11 TW-5A	O	O
2. MW-2E	12. MW-5A		
3. MW-2F	13. TW-6A		
4. ST-3	14. TW-6B		
5. TW-8A	15. MW-6		
6. MW-3D(v)			
7. ST-5			
8. 4767			
9. 4768			
10. 4769		↓	↓

Sample Type(s):

☐ uncrushed grapes

☐ juice

☐ fermenting

☐ refrigerated

☐ wine in cellar

☐ bottled wine

☒ water

ANALYSIS PANELS FOR COMMERCIAL WINEMAKERS

	Panel Name	*Sample Size Needed*
AA	**Juice Panel** Brix, TA, pH, YAN (NOPA and Ammonia), Nutrient Recommendation ($68.00)	125 mL
BB	**Basic Wine Chemistry** Alcohol, VA, TA, pH, Free and Total SO_2 ($70.00)	250 mL
CC	**Monitoring Malolactic Fermentation** pH, Malic acid, Detailed Micro Exam ($40.00)	125 mL
DD	**Comprehensive Wine Panel** Alcohol. VA. TA. pH, F/T SO_2, Malic Acid. G/F. Basic Sensory Evaluation. Detailed Micro Exam ($140.00)	375 mL
EE	**Cellar Maintenance Panel** VA, pH, Malic acid, F/T SO_2, SO_2 Recommendation ($55.00)	125 mL
FF	**Stuck/Sluggish Fermentation Panel** Alcohol, VA, pH, G/F, Detailed Micro Exam, Yeast Viability ($85.00)	375 mL
GG	**Problematic MLF Panel** Alcohol, VA, pH, F/T SO_2, Malic acid, Detailed Micro Exam ($90.00)	125 mL
HH	**Comprehensive Microbiology Panel** VA. pH. F/T SO_2. Detailed Sensory. Detailed Micro Exam. Direct culture for yeast, mold and bacteria ($115.00)	375 mL
II	**Sediment/Haze ID** pH, F/T SO_2, Detailed Micro Exam. Detailed Sensory Evaluation. Direct culture for Yeast, Mold and Bacteria ($100.00) [White wine analysis includes: Cold and Heat (Protein) Stability ($125.00)]	750 mL Un-opened
JJ	**Pre-Bottling Panel** Alcohol, VA. TA. pH. F/T SO_2. Malic Acid, G/F. Detailed Micro Exam. Direct Culture for Spoilage Organisms ($140.00) [White wine analysis includes: Cold and Heat (Protein) Stability ($162.50)]	375 mL
KK	**Post-Bottling Panel** Alcohol. pH. F/T SO_2. Membrane culture for Sterility ($80.00)	750 mL Un-opened

CHEMICAL TESTS

50mL min - no headspace

A	Alcohol (NIR)	O	Free and Total SO2	X	Brix Refractometer
V	Volatile Acidity	R	SO2 Recommendation* pH, F/T SO2 are required	D	Brix Hydrometer
T	Total Acidity	M	Malic Acid (Enzymatic)	K	Potassium
P	pH	Z	Residual Sugar (Enzymatic)	B	Bentonite Fining Trials (5 trial levels included)
F	Free SO2	C	Cold Stability (Freeze/Thaw)	Y	YAN (NOPA, NH_4)
S	Total SO2	H	Heat (Protein Stability)		

SENSORY EVALUATIONS & ADJUSTMENTS

Sensory Evaluations:

SB Basic

Sulfide Treatment:

FA SRM (no charge)
FB Detection only
FC Detection AND treatment

Adjustment Trials:

TA Acidification
TD De-Acidification

MICROBIOLOGICAL TESTS

Direct Culture

MM Yeast, Mold & Bacteria
MY Yeast & Mold
MB Bacteria only
MD Dekkera/Brettanomyces
MR Red Wine Spoilage

Membrane Culture

MC Yeast, Mold & Bacteria
MP Yeast & Mold
MQ Bacteria only

Microscopic Examination

ME Detailed Micro exam

Other:

MV Yeast Viability
ML Yeast Cell Count

Bioremediation Consulting Inc
39 Clarendon Street Watertown MA 02472
phone 617-923-0976 fax 617-923-0959
e-mail MFindlay@bciLabs com

CHAIN OF CUSTODY RECORD

Project Name: Locus wells
PO 30-12342
Sampling Location: SCVTA
Sampled by: Hank Castro

Contact: John Hawthorne hawthornej@locustec.com
pH: 650-960-1640 fax: 650-960-0739

Instructions: Fill containers completely. No air bubble.

each set: *2* voas, HCl-preserved: methane, ethane, ethanethiol 5021A
2 voas, no preservative: Argon, O_2, CO, CO_2, N_2 → 5021A
1 voa, no preservative: dissolved sulfide → HACH 8131
1 voa, no preservative: NH_3-N — HACH 8155
1 160-ml serum bottle: H_2 analyses
2 4-oz jars: dissolved O_2

RETURN CRIMPER & PLIERS TO BCI

Well Number	Date	VOA Vials HCl-preserved	rcv	VOA Vials No Preserv	rcv	160 ml SB (contain Argon)	rcv	4 oz jars for D.O.	rcv
TW-5A	5/21/08	2		4		1		2	
MW-5A		2		4		1		2	
TW-6A		2		4		1		2	
TW-6B		2		4		1		2	
MW-6J	↓	2		4		1		2	
trip blanks									
Return crimper to BCI									

SHIP TO: Bioremediation Consulting Inc (phone 617-923-0976)
39 Clarendon St Watertown MA 02472

Shipping Conditions:

ICE NECESSARY; however,
No Loose Ice – bag ice in leak-proof bags
Do not allow ice to contact groundwater samples

Fed Ex Priority Overnite **NO** Saturday Delivery

Call or fax BCI at time of shipping and report the tracking number

Relinquished by Thomas Murphy date 5/21/08

Received by ____________ date ____________

Bioremediation Consulting Inc
39 Clarendon Street Watertown MA 02472
phone 617-923-0976 fax 617-923-0959
e-mail MFindlay@bciLabs com

CHAIN OF CUSTODY RECORD

Project Name: Locus wells
PO 30-12342
Sampling Location: SCVTA

Sampled by: HANK CASTRO

Contact: John Hawthorne hawthornej@locustec.com
pH: 650-960-1640 fax: 650-960-0739

Instructions: Fill containers completely. No air bubble.
each set: *2* voas, HCl-preserved: methane, ethane, ethanethiol
2 voas, no preservative: Argon, O_2, CO, CO_2, N_2
1 voa, no preservative: dissolved sulfide
1 voa, no preservative: NH_3-N
1 160-ml serum bottle: H_2 analyses
2 4-oz jars: dissolved O_2

RETURN CRIMPER & PLIERS TO BCI

Well Number	Date	VOA Vials HCl-preserved	rcv	VOA Vials No Preserv	rcv	160 ml SB (contain Argon)	rcv	4 oz jars for D.O.	rcv
TW-2B	5/21/08	2		4		1		2	
MW-2E	5/21/08	2		4		1		2	
MW-2F	5/21/08	2		4		1		2	
ST-3	5/21/08	2		4		1		2	
TW-8A	5/21/08	2		4		1		2	
trip blanks		1		2					
Return crimper to BCI									

SHIP TO: Bioremediation Consulting Inc (phone 617-923-0976)
39 Clarendon St Watertown MA 02472

Shipping Conditions:

ICE NECESSARY; however,
No Loose Ice – bag ice in leak-proof bags
Do not allow ice to contact groundwater samples

Fed Ex Priority Overnite. **NO** Saturday Delivery

Call or fax BCI at time of shipping and report the tracking number

Relinquished by date 5/21/08

Received by date

Bioremediation Consulting Inc
39 Clarendon Street Watertown MA 02472
phone 617-923-0976 fax 617-923-0959
e-mail. MFindlay@bciLabs com

CHAIN OF CUSTODY RECORD

Project Name: Locus wells Sampling Location: SCVTA
PO 30-12342
Sampled by: Hank casino

Contact: John Hawthorne hawthornej@locustec.com
pH: 650-960-1640 fax: 650-960-0739

Instructions: Fill containers completely. No air bubble.
each set: *2* voas, HCl-preserved: methane, ethane, ethanethiol
2 voas, no preservative: Argon, O_2, CO, CO_2, N_2
1 voa, no preservative: dissolved sulfide
1 voa, no preservative: NH_3-N
1 160-ml serum bottle: H_2 analyses
2 4-oz jars: dissolved O_2
RETURN CRIMPER & PLIERS TO BCI

Well Number	Date	VOA Vials HCl-preserved	rcv	VOA Vials No Preserv	rcv	160 ml SB (contain Argon)	rcv	4 oz jars for D.O.	rcv
MW-3D(r)	5/21/08	2		4		1		2	
ST-5		2		4		1		2	
4767		2		4		1		2	
4768		2		4		1		2	
4769	↓	2		4		1		2	
trip blanks									
Return crimper to BCI									

SHIP TO: Bioremediation Consulting Inc (phone 617-923-0976)
39 Clarendon St Watertown MA 02472

Shipping Conditions:
ICE NECESSARY; however,
No Loose Ice – bag ice in leak-proof bags
Do not allow ice to contact groundwater samples

Fed Ex Priority Overnite. **NO** Saturday Delivery

Call or fax BCI at time of shipping and report the tracking number

Relinquished by ______________ date 5/21/08

Received by ______________ date ______________

ATTACHMENT B

Field Log, Water Sampling Log, and Chain of Custody Forms

Phase 2 Sampling

WELL SAMPLING SUMMARY
PHASE 2 GROUNDWATER SAMPLING

Well	Sample Date	Sample Time	Purge Duration (min)	Purge Volume (mL)	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)	Oxidation-Reduction Potential	Conductivity (µS)	Turbidity (NTU)
ST-7	22-Jul	11:40	14	1900	23.8	7.31	1.10	13.1	113.9	916	13.7
MW-5B	22-Jul	12:10	10	4500	24.5	7.01	1.09	13.1	89.7	1200	75.6
NW-05	22-Jul	12:40	8	3900	26.3	7.68	1.44	18.4	84.3	282	2378.4
ST-12	22-Jul	13:45	10	6000	25.3	6.02	1.75	21.0	169	608	96.5
MW-1	22-Jul	14:35	12	4000	29.3	6.86	1.63	21.6	81.4	230	179.2
MW-3C	22-Jul	15:05	10	4500	27.9	7.25	1.23	16.2	34.9	977	254.1
MW-2G	22-Jul	15:50	14	3800	32.0	7.29	0.70	9.8	122.4	2308	1897.1
MW-6D	23-Jul	7:20	15	3800	20.2	6.19	3.13	34.7	141.7	417	180.3
ST-11	23-Jul	7:56	16	6300	20.0	7.08	1.75	19.5	121.6	594	7.4
ST-10	23-Jul	8:30	11	4800	21.1	7.18	1.17	13.4	95.8	601	1.8
MW-4A	23-Jul	9:10	14	1900	24.2	11.49	1.18	14.0	140.4	1299	93.2
NW-06	23-Jul	10:07	17	4400	23.1	7.77	0.98	11.3	80.1	538	58.6
ST-8	23-Jul	10:45	10	4500	21.8	7.30	0.92	10.7	147.3	1106	37.5
ST-1	23-Jul	11:55	20	2500	24.6	7.19	0.77	9.4	48.4	2873	10.3
NW-01	23-Jul	12:57	9	4500	27.3	7.51	0.83	10.7	67.1	638	341.8
MW-2C	23-Jul	13:43	14	1900	26.8	12.03	1.19	15.1	90.3	5988	39.4
ST-2	23-Jul	14:15	13	5100	26.5	8.50	0.65	8.2	64.7	608	50.7
ST-13	23-Jul	15:00	6	3300	25.6	7.08	2.10	25.6	122.8	1162	70.3

LOCUS TECHNOLOGIES

DAILY FIELD ACTIVITY LOG

1

Project Name: Santa Clara VTA

Field Activity: Well Sampling

Weather: clear

Project No.: 28006-08-0002

Date: 7-22-08

Logged by: H. Castro Jr.

Page: 1 of 3

TIME	DAILY ACTIVITIES AND EVENTS
	7-22-08
0610	Prepped & loaded truck for Micro Purge sampling.
0705	Arrived onsite at ST-8. Setup equipment for Purge.
0750	Could not get water to come up purge line. Called
	equipco to let them know.
	Equipco is sending out new equipment powered by
	CO_2.
1055	Equipco arrived with CO_2 equipment, exchanged equipment.
1115	AT ST-7. Met with officer Bryan & TCI for traffic
	control. Set up equipment.
1140	Sampled ST-7.
1150	AT MW-5B. Setup traffic control & purge equipment.
1210	Sampled MW-5B.
1225	AT NW-05. Setup traffic control & purge equipment.
1240	Sampled NW-05.
1320	AT ST-12. Setup traffic control & purge equipment.
1345	Sampled ST-12. TCI & officer Bryan left site.
1415	AT MW-1. Setup purge equip.
1435	Sampled MW-1.
1450	AT MW-3C. Setup purge equip.
1505	Sampled MW-3C.

Comments/Remarks:

LOCUS TECHNOLOGIES

DAILY FIELD ACTIVITY LOG

Project Name: Santa Clara VTA
Field Activity: Well Sampling
Weather: clear

Project No.: 28006-08-0002
Date: 7-2223-08
Logged by: H. C[illegible] Jr
Page: 2 of 3

TIME	DAILY ACTIVITIES AND EVENTS
1530	AT MW 2G. Setup purge equip.
1550	Sampled MW-2G.
	7-23-08
0700	AT MW-6D. Setup purge equip.
0720	Sampled MW-6D.
0735	AT ST-11. Setup purge equip.
0756	Sampled ST-11.
0815	AT ST-10. Setup purge equip.
0830	Sampled ST-10.
0850	AT MW-4A. Setup purge equip.
0910	Sampled MW-4A
0945	AT NW-06. Setup purge equip.
1007	Sampled NW-06.
1025	AT ST-8. Setup purge equip.
1045	Sampled ST-8
1125	AT ST-1. Setup purge equip.
1155	Sampled ST-1.
1240	AT NW-01. Setup purge equip.
1257	Sampled NW-01

Comments/Remarks:

LOCUS TECHNOLOGIES

DAILY FIELD ACTIVITY LOG

Project Name: Santa Clara VTA
Field Activity: Well Sampling
Weather: clear

Project No.: 28006-08-0002
Date: 7-23-08
Logged by: H. Castat
Page: 3 of 3

TIME	DAILY ACTIVITIES AND EVENTS
1322	AT MW-2C. Setup purge equip.
1343	Sampled MW-2C.
1400	AT ST-2. Setup purge equip.
1415	Sampled ST-2.
1440	AT ST-13. Setup purge equip.
1500	Sampled ST-13.
1525	Left purge water onsite east of ST-13 against wall w/ analysis label filled out.
1540	Left site for M.V. office.

Comments/Remarks:

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION ST-7
SAMPLE SOURCE A
AMBIENT CONDITIONS clear

SITE: S.C. VTA
DATE 7-22-08
PROJECT# 28006-08-0002
SAMPLER H. Castro/T. Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:____
CONTINUOUS PUMPER ____YES____NO
PUMP CYCLING____YES____NO
pH meter:____
FLOW RATE:____
METER READING____

WATER LEVEL INFORMATION

MEASURING POINT____
INSTRUMENT USED____

W.L. BEFORE PURGE 15.31 TIME____
W.L. ~~AFTER~~ During PURGE 15.31
TIME____
W.L. FOR 80% RECOVERY____
W.L. TIME OF SAMPLE____
DATE____
TIME____

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD____

PURGE DEVICE I.D. Low flow pump
WELL DEPTH____
SCREENED INTERVAL____
PURGE VOLUME CALCULATION____
TIME PURGE BEGINS 1126
DIAMETER 4"
PUMP SETTING 70'
ACTUAL AMOUNT PURGED 1900 ML
CPM ~~#CASING VOLUMES (PROTOCOL)~~ ~~B~~ 1
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1137	23.8	916	7.30	Cloudy / no odor	113.8	13.7
1138	23.8	916	7.31	" " " "	113.9	13.7
1139	23.9	918	7.31	" " "	113.9	13.6

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B

SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 1140
APPROXIMATE DEPTH OF GRAB —
DATE 7-22-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO2, N2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID____HOSE REEL____
PREVIOUSLY USED IN WELL____
SITE____
DECON METHOD/STEAM TIME____
RINSEATE SAMPLE____YES____NO I.D.____

SAMPLING DEVICE ID____HOSE REEL____
PREVIOUSLY USED IN WELL____
SITE____
DECON METHOD/STEAM TIME____
RINSEATE SAMPLE____YES____NO ID____

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK____YES X NO ID —
QA/QC SPIKE____YES X NO ID —
DUPLICATE____YES X NO ID —
FIELD BLANK____YES X NO ID —
INTER-LAB SPLIT____YES X NO ID —

NOTES

DO% = 13.1
DO mg = 1.10

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION MW-5B
SAMPLE SOURCE A
AMBIENT CONDITIONS clear
SITE: S.C. VTA
DATE 7-22-08
PROJECT# 28006-08-0002
SAMPLER H. Castro/T. Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:
CONTINUOUS PUMPER ___YES___NO
PUMP CYCLING ___YES___NO
pH meter:
FLOW RATE:
METER READING

WATER LEVEL INFORMATION

MEASURING POINT
INSTRUMENT USED

W.L. BEFORE PURGE 23.06 TIME
W.L. ~~AFTER~~ During PURGE 23.06 TIME
W.L. FOR 80% RECOVERY
W.L. TIME OF SAMPLE
DATE
TIME

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD

PURGE DEVICE I.D Low flow pump
WELL DEPTH
DIAMETER 2"
~~#CASING VOLUMES (PROTOCOL)~~ CPM 3
SCREENED INTERVAL
PUMP SETTING 90'
PURGE VOLUME CALCULATION
TIME PURGE BEGINS 1200
ACTUAL AMOUNT PURGED 4500ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1207	24.5	1200	7.00	clear/noodor	89.7	75.7
1208	24.5	1200	7.01	" " "	89.7	75.6
1209	24.5	1200	7.01	" " "	89.6	75.5

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B

SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 1210
APPROXIMATE DEPTH OF GRAB —
DATE 7-22-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO2, N2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID
HOSE REEL
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLE ___YES___NO I D

SAMPLING DEVICE ID
HOSE REEL
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLE ___YES___NO ID

ξ

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK ___YES X NO ID —
QA/QC SPIKE ___YES X NO ID —
DUPLICATE ___YES X NO ID —
FIELD BLANK ___YES X NO ID —
INTER-LAB SPLIT ___YES X NO ID —

NOTES

DO% = 13.1
DOMg = 1.09

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION NW-05
SAMPLE SOURCE A
AMBIENT CONDITIONS clear
SITE: S.C. VTA
DATE 7-22-08
PROJECT# 28006-08-0002
SAMPLER H. Castro/T. Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:____
CONTINUOUS PUMPER ____YES____NO
PUMP CYCLING ____YES____NO
pH meter:____
FLOW RATE:____
METER READING____

WATER LEVEL INFORMATION

MEASURING POINT____
INSTRUMENT USED____

W.L. BEFORE PURGE 21.31 TIME____
W.L. ~~AFTER~~ During PURGE 21.36
TIME____
W.L. FOR 80% RECOVERY____
W.L. TIME OF SAMPLE____
DATE____
TIME____

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD____

PURGE DEVICE I.D Low flow pump
WELL DEPTH____
DIAMETER 6"
~~#CASING VOLUMES (PROTOCOL)~~ CPM 3
SCREENED INTERVAL____
PUMP SETTING 85'
PURGE VOLUME CALCULATION____
TIME PURGE BEGINS 1232
ACTUAL AMOUNT PURGED 3900ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1241	26.2	280	7.68	Silty/Slight odor	84.2	2376.8
1242	26.3	282	7.68	" " "	84.3	2378.6
1243	26.3	282	7.68	" " "	84.3	2378.4

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B

SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 1240
APPROXIMATE DEPTH OF GRAB —
DATE 7-22-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO_2, N_2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID____
HOSE REEL____
SAMPLING DEVICE ID____
HOSE REEL____
PREVIOUSLY USED IN WELL____
PREVIOUSLY USED IN WELL____
SITE____
SITE____
DECON METHOD/STEAM TIME____
DECON METHOD/STEAM TIME____
RINSEATE SAMPLE____YES____NO I D____
RINSEATE SAMPLE____YES____NO ID____

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK____YES X NO ID —
QA/QC SPIKE____YES X NO ID —
DUPLICATE____YES X NO ID —
FIELD BLANK____YES X NO ID —
INTER-LAB SPLIT____YES X NO ID —

NOTES

DO% = 18.4
DO mg = 1.44

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION ST-12
SAMPLE SOURCE A
AMBIENT CONDITIONS clear
SITE: S.C. VTA
DATE 7-22-08
PROJECT# 28006-08-0002
SAMPLER H. Castro/T. Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:
CONTINUOUS PUMPER ____ YES ____ NO
PUMP CYCLING ____ YES ____ NO
pH meter:
METER READING
FLOW RATE:

WATER LEVEL INFORMATION

MEASURING POINT
INSTRUMENT USED

W.L. BEFORE PURGE 19.90 TIME
W.L. ~~AFTER~~ During PURGE 19.90
TIME
W.L. FOR 80% RECOVERY
W.L. TIME OF SAMPLE
DATE
TIME

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD

PURGE DEVICE I.D. Low flow pump
WELL DEPTH
DIAMETER 4"
~~#CASING VOLUMES (PROTOCOL)~~ CPM 4
SCREENED INTERVAL
PUMP SETTING 66'
PURGE VOLUME CALCULATION
TIME PURGE BEGINS 1335
ACTUAL AMOUNT PURGED 6000 mL
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1342	25.2	609	6.00	cloudy/no odor	169.0	96.4
1343	25.3	608	6.02	" " "	169.0	96.5
1344	25.3	608	6.02	" " "	169.1	96.5

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B

SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 1345
APPROXIMATE DEPTH OF GRAB —
DATE 7-22-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO2, N2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID ____ HOSE REEL ____
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLE ____ YES ____ NO I D

SAMPLING DEVICE ID ____ HOSE REEL ____
PREVIOUSLY USED IN WELL
SITE
DECON METHOD/STEAM TIME
RINSEATE SAMPLE ____ YES ____ NO ID

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK ____ YES X NO ID —
QA/QC SPIKE ____ YES X NO ID —
DUPLICATE ____ YES X NO ID —
FIELD BLANK ____ YES X NO ID —
INTER-LAB SPLIT ____ YES X NO ID —

NOTES

DO% = 21.0
DO mg = 1.75

LOCUS TECHNOLOGIES WATER SAMPLING LOG

SITE: S.C. VTA
DATE 7-22-08
PROJECT# 28006-08-0002
SAMPLER H. Castro/T. Murphy

WELL\SAMPLE DESIGNATION MW-1
SAMPLE SOURCE A
AMBIENT CONDITIONS clear

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:____
CONTINUOUS PUMPER ____YES____NO
PUMP CYCLING ____YES____NO
pH meter:____
METER READING____
FLOW RATE:____

WATER LEVEL INFORMATION

MEASURING POINT____
INSTRUMENT USED____

W.L. BEFORE PURGE 12.77 TIME____
W.L. ~~AFTER~~ During PURGE 12.98
TIME____
W.L. FOR 80% RECOVERY____
W.L. TIME OF SAMPLE____
DATE____
TIME____

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD____

PURGE DEVICE I.D Low flow pump
WELL DEPTH____
DIAMETER 2"
~~#CASING VOLUMES (PROTOCOL)~~ CPM 2
SCREENED INTERVAL____
PUMP SETTING 60'
PURGE VOLUME CALCULATION____
TIME PURGE BEGINS 1423
ACTUAL AMOUNT PURGED____
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1433	29.3	230	6.86	cloudy/no odor	81.4	179.2
1433	29.3	230	6.86	" " "	81.4	179.1
1434	29.3	231	6.86	" " "	81.4	179.3

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD R

APPROXIMATE DEPTH OF GRAB —
SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 1435
DATE 7-22-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO_2, N_2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID____HOSE REEL____
PREVIOUSLY USED IN WELL____
SITE____
DECON METHOD/STEAM TIME____
RINSEATE SAMPLE____YES____NO I D____

SAMPLING DEVICE ID____HOSE REEL____
PREVIOUSLY USED IN WELL____
SITE____
DECON METHOD/STEAM TIME____
RINSEATE SAMPLE____YES____NO ID____

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK____YES X NO ID —
QA/QC SPIKE____YES X NO ID —
DUPLICATE____YES X NO ID —
FIELD BLANK____YES / NO ID —
INTER-LAB SPLIT____YES X NO ID —

NOTES

DO % = 21.6
DO mg = 1.63

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION MW-3~~0~~C
SAMPLE SOURCE A
AMBIENT CONDITIONS clear
SITE: S.C. VTA
DATE 7-22-08
PROJECT# 28006-08-0002
SAMPLER H. Castro/T. Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:____
CONTINUOUS PUMPER ____ YES ____ NO
PUMP CYCLING ____ YES ____ NO
pH meter:____
METER READING ____
FLOW RATE: ____

WATER LEVEL INFORMATION

MEASURING POINT ____
INSTRUMENT USED ____

W.L. BEFORE PURGE 20.47 TIME ____
W.L. ~~AFTER~~ During PURGE 20.47
TIME ____
W.L. FOR 80% RECOVERY ____
W.L. TIME OF SAMPLE ____
DATE ____
TIME ____

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD ____

PURGE DEVICE I.D. Low flow pump
WELL DEPTH ____
DIAMETER 2"
~~#CASING VOLUMES (PROTOCOL)~~ CPM 3
SCREENED INTERVAL ____
PUMP SETTING 73'
PURGE VOLUME CALCULATION ____
TIME PURGE BEGINS 1455
ACTUAL AMOUNT PURGED 4500ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1502	27.9	976	7.24	cloudy/no odor	34.8	253.8
1503	27.9	977	7.25	" " " "	34.9	254.1
1504	27.9	977	7.25	" " "	34.9	254.1

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B

SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 1505
APPROXIMATE DEPTH OF GRAB —
DATE 7-22-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO_2, N_2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID ____ HOSE REEL ____
PREVIOUSLY USED IN WELL ____
SITE ____
DECON METHOD/STEAM TIME ____
RINSEATE SAMPLE ____ YES ____ NO ID ____

SAMPLING DEVICE ID ____ HOSE REEL ____
PREVIOUSLY USED IN WELL ____
SITE ____
DECON METHOD/STEAM TIME ____
RINSEATE SAMPLE ____ YES ____ NO ID ____

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK ____ YES X NO ID —
QA/QC SPIKE ____ YES X NO ID —
DUPLICATE ____ YES X NO ID —
~~FIELD~~ Rinse BLANK X YES 4784 NO ID ____
INTER-LAB SPLIT ____ YES X NO ID —

NOTES

DO% = 16.2
DOmg = 1.23

LOCUS TECHNOLOGIES WATER SAMPLING LOG

SITE: S. C. VTA
WELL\SAMPLE DESIGNATION MW-2G
DATE 7-22-08
SAMPLE SOURCE A
PROJECT# 28006-08-0002
AMBIENT CONDITIONS clear
SAMPLER H. Castro/T. Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:____
CONTINUOUS PUMPER ____YES____NO
PUMP CYCLING ____YES____NO
pH meter:____
FLOW RATE:____
METER READING ____

WATER LEVEL INFORMATION

MEASURING POINT____ INSTRUMENT USED____

W.L. BEFORE PURGE 20.21 TIME____
W.L. ~~AFTER~~ During PURGE 20.32 TIME____
W.L. FOR 80% RECOVERY____
W.L. TIME OF SAMPLE____ DATE____ TIME____

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD____

PURGE DEVICE I.D. Low flow pump
WELL DEPTH____
DIAMETER 2"
~~#CASING VOLUMES (PROTOCOL)~~ CPM 2
SCREENED INTERVAL____
PUMP SETTING 70'
PURGE VOLUME CALCULATION____
TIME PURGE BEGINS 1536
ACTUAL AMOUNT PURGED 3800ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1552	31.9	2309	7.30	silty / slight odor	-122.6	1896.4
1553	32.0	2308	7.29	" " "	-122.4	1897.1
1554	32.0	2308	7.29	" " "	-122.4	1897.2

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B

APPROXIMATE DEPTH OF GRAB —
SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 1550
DATE 7-22-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO_2, N_2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID____ HOSE REEL____
PREVIOUSLY USED IN WELL____
SITE____
DECON METHOD/STEAM TIME____
RINSEATE SAMPLE____YES____NO ID____

SAMPLING DEVICE ID____ HOSE REEL____
PREVIOUSLY USED IN WELL____
SITE____
DECON METHOD/STEAM TIME____
RINSEATE SAMPLE____YES____NO ID____

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK____YES X NO ID — QA/QC SPIKE____YES X NO ID —
DUPLICATE X YES____NO ID 4783 FIELD BLANK____YES X NO ID — INTER-LAB SPLIT____YES X NO ID —

NOTES

DO % = 9.8
DO mg = 0.70 mg

LOCUS TECHNOLOGIES WATER SAMPLING LOG

SITE: S.C. VTA
WELL\SAMPLE DESIGNATION MW-6D
DATE 7-23-08
SAMPLE SOURCE A
PROJECT# 28006-08-0002
AMBIENT CONDITIONS clear
SAMPLER H. Castro/T. Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:______
CONTINUOUS PUMPER ____YES____NO
PUMP CYCLING ____YES____NO
pH meter:______
METER READING ______
FLOW RATE: ______

WATER LEVEL INFORMATION

MEASURING POINT ______ INSTRUMENT USED ______

W.L. BEFORE PURGE 21.12 TIME______ W.L. ~~AFTER~~ During PURGE 21.17 TIME______
W.L. FOR 80% RECOVERY______ W.L. TIME OF SAMPLE______ DATE______ TIME______

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD ______

PURGE DEVICE I.D Low flow pump
WELL DEPTH______
DIAMETER 2"
~~#CASING VOLUMES (PROTOCOL)~~ CPM ≅2
SCREENED INTERVAL______
PUMP SETTING 75'
PURGE VOLUME CALCULATION______
TIME PURGE BEGINS 705
ACTUAL AMOUNT PURGED 3800ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
716	20.2	417	6.19	clear/no odor	141.7	180.2
717	20.2	417	6.19	" " "	141.7	180.3
718	20.2	417	6.20	" " "	141.7	180.3

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B

APPROXIMATE DEPTH OF GRAB —
SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 720
DATE 7-23-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO_2, N_2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID______ HOSE REEL______
PREVIOUSLY USED IN WELL______
SITE______
DECON METHOD/STEAM TIME______
RINSEATE SAMPLE____YES____NO ID______

SAMPLING DEVICE ID______ HOSE REEL______
PREVIOUSLY USED IN WELL______
SITE______
DECON METHOD/STEAM TIME______
RINSEATE SAMPLE____YES____NO ID______

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK YES [✓ NO] ID — QA/QC SPIKE YES [✓ NO] ID —
DUPLICATE [✓ YES] NO ID 4785 FIELD BLANK YES [✓ NO] ID — INTER-LAB SPLIT YES [✓ NO] ID —

NOTES

DO % = 34.7
(DUP TAKEN) DO Mg = 3.13

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION ST-11

SAMPLE SOURCE A

AMBIENT CONDITIONS clear

SITE: S.C. VTA

DATE 7-23-08

PROJECT# 28006-08-0002

SAMPLER H. Castro/T. Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD: ____

CONTINUOUS PUMPER ___ YES ___ NO

PUMP CYCLING ___ YES ___ NO

pH meter: ____ FLOW RATE: ____

METER READING ____

WATER LEVEL INFORMATION

MEASURING POINT ____ INSTRUMENT USED ____

W.L. BEFORE PURGE 24.50 TIME ____

W.L. ~~AFTER~~ During PURGE 24.50 TIME ____

W.L. FOR 80% RECOVERY ____

W.L. TIME OF SAMPLE ____ DATE ____ TIME ____

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD ____

PURGE DEVICE I.D. Low flow pump

WELL DEPTH ____

DIAMETER 4"

#~~CASING VOLUMES (PROTOCOL)~~ CPM 3

SCREENED INTERVAL ____

PUMP SETTING 82'

PURGE VOLUME CALCULATION ____

TIME PURGE BEGINS 740

ACTUAL AMOUNT PURGED 6300ML

pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
752	20.0	593	7.08	clear/no odor	121.4	7.4
753	20.1	594	7.08	" " "	121.6	7.4
754	20.0	594	7.08	" " "	121.6	7.5

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B

APPROXIMATE DEPTH OF GRAB —

SAMPLING DEVICE ID 1/4" Tubing

SAMPLING TIME 756

DATE 7-23-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO2, N2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID ____ HOSE REEL ____

PREVIOUSLY USED IN WELL ____

SITE ____

DECON METHOD/STEAM TIME ____

RINSEATE SAMPLE ___ YES ___ NO ID ____

SAMPLING DEVICE ID ____ HOSE REEL ____

PREVIOUSLY USED IN WELL ____

SITE ____

DECON METHOD/STEAM TIME ____

RINSEATE SAMPLE ___ YES ___ NO ID ____

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK ___ YES X NO ID — QA/QC SPIKE ___ YES X NO ID —

DUPLICATE ~~E~~ YES X NO ID — ~~FIELD~~ BLANK X YES ___ NO ID 4786 INTER-LAB SPLIT ___ YES X NO ID —

NOTES

Rinse (RB TAKEN)

DO% = 19.5

DO mg = 1.75

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION ST-10
SAMPLE SOURCE A
AMBIENT CONDITIONS clear

SITE: S.C. VTA
DATE 7-23-08
PROJECT# 28006-08-0002
SAMPLER H. Castro/T. Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD: ____
CONTINUOUS PUMPER ____ YES ____ NO
PUMP CYCLING ____ YES ____ NO
pH meter: ____
FLOW RATE: ____
METER READING ____

WATER LEVEL INFORMATION

MEASURING POINT ____
INSTRUMENT USED ____

W.L. BEFORE PURGE 23.06 TIME ____
W.L. ~~AFTER~~ During PURGE 23.06
TIME ____
W.L. FOR 80% RECOVERY ____
W.L. TIME OF SAMPLE ____ DATE ____ TIME ____

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD ____

PURGE DEVICE I.D. Low flow pump
WELL DEPTH ____
DIAMETER 4"
~~#CASING VOLUMES (PROTOCOL)~~ CPM 3
SCREENED INTERVAL ____
PUMP SETTING 70'
PURGE VOLUME CALCULATION ____
TIME PURGE BEGINS 819
ACTUAL AMOUNT PURGED 4800ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
827	21.1	600	7.18	Clear/no odor	95.7	1.8
828	21.1	601	7.18	" " "	95.8	1.8
829	21.1	601	7.19	" " "	95.8	1.8

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B

SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 830
APPROXIMATE DEPTH OF GRAB —
DATE 7-23-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO_2, N_2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID ____ HOSE REEL ____
PREVIOUSLY USED IN WELL ____
SITE ____
DECON METHOD/STEAM TIME ____
RINSEATE SAMPLE ____ YES ____ NO I D ____

SAMPLING DEVICE ID ____ HOSE REEL ____
PREVIOUSLY USED IN WELL ____
SITE ____
DECON METHOD/STEAM TIME ____
RINSEATE SAMPLE ____ YES ____ NO ID ____

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK ____ YES X NO ID —
QA/QC SPIKE ____ YES X NO ID —
DUPLICATE ____ YES X NO ID —
FIELD BLANK ____ YES X NO ID —
INTER-LAB SPLIT ____ YES X NO ID —

NOTES

DO% = 13.4
DOMg = 1.17

LOCUS TECHNOLOGIES WATER SAMPLING LOG

SITE: S.C. VTA
DATE 7-23-08
WELL\SAMPLE DESIGNATION MW-4A
PROJECT# 28006-08-0002
SAMPLE SOURCE A
AMBIENT CONDITIONS clear
SAMPLER H. Castro/T. Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:____
CONTINUOUS PUMPER ____YES____NO
PUMP CYCLING ____YES ____NO
pH meter:____
FLOW RATE: ____
METER READING ____

WATER LEVEL INFORMATION

MEASURING POINT____
INSTRUMENT USED____

W.L. BEFORE PURGE 13.61 TIME____
W.L. ~~AFTER~~ During PURGE 16.68
TIME____
W.L. FOR 80% RECOVERY____
W.L. TIME OF SAMPLE____
DATE____
TIME____

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD____

PURGE DEVICE I.D Low flow pump
WELL DEPTH____
DIAMETER 2"
~~#CASING VOLUMES (PROTOCOL)~~ CPM #1
SCREENED INTERVAL____
PUMP SETTING 70'
PURGE VOLUME CALCULATION____
TIME PURGE BEGINS 856
ACTUAL AMOUNT PURGED 1900 ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
907	24.2	1298	11.49	cloudy/slight odor	140.4	93.1
908	24.2	1299	11.49	" " "	140.4	93.2
909	24.2	1299	11.49	" " "	140.3	93.4

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B

APPROXIMATE DEPTH OF GRAB —
SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 910
DATE 7-23-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO_2, N_2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID____ HOSE REEL____
SAMPLING DEVICE ID____ HOSE REEL____
PREVIOUSLY USED IN WELL____
PREVIOUSLY USED IN WELL____
SITE____
SITE____
DECON METHOD/STEAM TIME____
DECON METHOD/STEAM TIME____
RINSEATE SAMPLE____YES____NO I D____
RINSEATE SAMPLE____YES____NO ID____

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK____YES X NO ID —
QA/QC SPIKE____YES X NO ID —
DUPLICATE____YES X NO ID —
FIELD BLANK____YES X NO ID —
INTER-LAB SPLIT____YES X NO ID —

NOTES

DO% = 14.0
DOmg = 1.18

LOCUS TECHNOLOGIES WATER SAMPLING LOG

SITE: S.C. VTA
DATE 7-23-08
PROJECT# 28006-08-0002
SAMPLER H. Castro/T. Murphy
WELL\SAMPLE DESIGNATION NW-06
SAMPLE SOURCE A
AMBIENT CONDITIONS clear

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD: ______
CONTINUOUS PUMPER ____ YES ____ NO
PUMP CYCLING ____ YES ____ NO
pH meter: ______
FLOW RATE: ______
METER READING ______

WATER LEVEL INFORMATION

MEASURING POINT ______
INSTRUMENT USED ______

W.L. BEFORE PURGE 22.24 TIME ______
W.L. ~~AFTER~~ During PURGE 22.24
TIME ______
W.L. FOR 80% RECOVERY ______
W.L. TIME OF SAMPLE ______
DATE ______
TIME ______

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD ______

PURGE DEVICE I.D. Low flow pump
WELL DEPTH ______
DIAMETER 6"
~~#CASING VOLUMES (PROTOCOL)~~ CPM 2
SCREENED INTERVAL ______
PUMP SETTING 90'
PURGE VOLUME CALCULATION ______
TIME PURGE BEGINS 950
ACTUAL AMOUNT PURGED 4400 ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1004	23.0	538	7.77	clear/no odor	80.1	58.6
1005	23.1	538	7.77	〃 〃 〃	80.1	58.7
1006	23.1	539	7.78	〃 〃 〃	80.1	58.6

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B
APPROXIMATE DEPTH OF GRAB —
SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 1007
DATE 7-23-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO_2, N_2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID ______ HOSE REEL ______
PREVIOUSLY USED IN WELL ______
SITE ______
DECON METHOD/STEAM TIME ______
RINSEATE SAMPLE ____ YES ____ NO I D ______

SAMPLING DEVICE ID ______ HOSE REEL ______
PREVIOUSLY USED IN WELL ______
SITE ______
DECON METHOD/STEAM TIME ______
RINSEATE SAMPLE ____ YES ____ NO ID ______

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK ____ YES X NO ID —
QA/QC SPIKE ____ YES X NO ID —
DUPLICATE ____ YES X NO ID —
FIELD BLANK ____ YES X NO ID —
INTER-LAB SPLIT ____ YES X NO ID —

NOTES

DO% = 11.3
DO Mg = 0.98

LOCUS TECHNOLOGIES WATER SAMPLING LOG

SITE: S.C. VTA
WELL\SAMPLE DESIGNATION ST-8
DATE 7-23-08
SAMPLE SOURCE A
PROJECT# 28006-08-0002
AMBIENT CONDITIONS clear
SAMPLER H. Castro/T. Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:______
CONTINUOUS PUMPER ____YES____NO
PUMP CYCLING____YES____NO
pH meter:______
METER READING ______
FLOW RATE: ______

WATER LEVEL INFORMATION

MEASURING POINT______ INSTRUMENT USED______

W.L. BEFORE PURGE 23.60 TIME______ W.L. During ~~AFTER~~ PURGE 23.71 TIME______
W.L. FOR 80% RECOVERY______ W.L. TIME OF SAMPLE______ DATE______ TIME______

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD______

PURGE DEVICE I.D. Low flow pump
WELL DEPTH______
DIAMETER 4"
CPM ~~#CASING VOLUMES (PROTOCOL)~~ 3
SCREENED INTERVAL______
PUMP SETTING 80'
PURGE VOLUME CALCULATION______
TIME PURGE BEGINS 1035
ACTUAL AMOUNT PURGED 4500 ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1042	21.8	1106	7.29	clear/no odor	147.2	37.5
1043	21.8	1107	7.30	" " "	147.3	37.5
1044	21.8	1106	7.30	" " "	147.3	37.6

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B

APPROXIMATE DEPTH OF GRAB —
SAMPLING DEVICE ID 1/4" Tubing SAMPLING TIME 1045 DATE 7-23-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO2, N2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID______HOSE REEL______ SAMPLING DEVICE ID______HOSE REEL______
PREVIOUSLY USED IN WELL______ PREVIOUSLY USED IN WELL______
SITE______ SITE______
DECON METHOD/STEAM TIME______ DECON METHOD/STEAM TIME______
RINSEATE SAMPLE____YES____NO ID______ RINSEATE SAMPLE____YES____NO ID______

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK____YES X NO ID — QA/QC SPIKE____YES X NO ID —
DUPLICATE____YES X NO ID — FIELD BLANK____YES X NO ID — INTER-LAB SPLIT____YES X NO ID —

NOTES

DO% = 10.7
DOMg = 0.92

LOCUS TECHNOLOGIES WATER SAMPLING LOG

SITE: S.C. VTA
DATE 7-23-08
PROJECT# 28006-08-0002
SAMPLER H. Castro/T. Murphy
WELL\SAMPLE DESIGNATION ST-1
SAMPLE SOURCE A
AMBIENT CONDITIONS clear

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD: ____
CONTINUOUS PUMPER ____ YES ____ NO
PUMP CYCLING ____ YES ____ NO
pH meter: ____
FLOW RATE: ____
METER READING ____

WATER LEVEL INFORMATION

MEASURING POINT ____
INSTRUMENT USED ____
W.L. BEFORE PURGE 4.77 TIME ____
W.L. ~~AFTER~~ During PURGE 4.98 TIME ____
W.L. FOR 80% RECOVERY ____
W.L. TIME OF SAMPLE ____ DATE ____ TIME ____

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD ____
PURGE DEVICE I.D. Low flow pump
WELL DEPTH ____
DIAMETER 4"
~~#CASING VOLUMES (PROTOCOL)~~ CPM ~~3~~1
SCREENED INTERVAL ____
PUMP SETTING 70'
PURGE VOLUME CALCULATION ____
TIME PURGE BEGINS 1135
ACTUAL AMOUNT PURGED 2500 ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1152	24.5	2871	7.18	clear/no odor	48.4	10.3
1153	24.6	2873	7.19	" " "	48.4	10.3
1154	24.6	2874	7.19	" " "	48.4	10.5

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B
APPROXIMATE DEPTH OF GRAB —
SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 1155
DATE 7-23-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO_2, N_2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID ____ HOSE REEL ____
PREVIOUSLY USED IN WELL ____
SITE ____
DECON METHOD/STEAM TIME ____
RINSEATE SAMPLE ____ YES ____ NO I D ____

SAMPLING DEVICE ID ____ HOSE REEL ____
PREVIOUSLY USED IN WELL ____
SITE ____
DECON METHOD/STEAM TIME ____
RINSEATE SAMPLE ____ YES ____ NO ID ____

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK ____ YES [✓ NO] ID —
QA/QC SPIKE ____ YES [✓ NO] ID —
DUPLICATE ____ YES [✓ NO] ID —
FIELD BLANK ____ YES [✓ NO] ID —
INTER-LAB SPLIT ____ YES [✓ NO] ID —

NOTES

DO% = 9.4
DOMg = 0.77

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION NW-01
SAMPLE SOURCE A
AMBIENT CONDITIONS clear
SITE: S.C. VTA
DATE 7-23-08
PROJECT# 28006-08-0002
SAMPLER H. Castro/T. Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD: ____
CONTINUOUS PUMPER ____ YES ____ NO
PUMP CYCLING ____ YES ____ NO
pH meter: ____
METER READING ____
FLOW RATE: ____

WATER LEVEL INFORMATION

MEASURING POINT ____
INSTRUMENT USED ____
W.L. BEFORE PURGE 19.11 TIME ____
W.L. ~~AFTER~~ During PURGE 19.11
TIME ____
W.L. FOR 80% RECOVERY ____
W.L. TIME OF SAMPLE ____ DATE ____ TIME ____

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD ____
PURGE DEVICE I.D Low flow pump
WELL DEPTH ____
SCREENED INTERVAL ____
DIAMETER 6"
PUMP SETTING 75'
~~#CASING VOLUMES (PROTOCOL)~~ CPM 3
PURGE VOLUME CALCULATION ____
TIME PURGE BEGINS 1248
ACTUAL AMOUNT PURGED 4500ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1253	27.2	637	7.50	cloudy / slight odor	67.1	341.6
1254	27.3	638	7.52	" " "	67.1	341.8
1255	27.4	638	7.51	" " "	67.3	341.8

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD IS
APPROXIMATE DEPTH OF GRAB —
SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 1257
DATE 7-23-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO_2, N_2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID ____ HOSE REEL ____
PREVIOUSLY USED IN WELL ____
SITE ____
DECON METHOD/STEAM TIME ____
RINSEATE SAMPLE ____ YES ____ NO I D ____
SAMPLING DEVICE ID ____ HOSE REEL ____
PREVIOUSLY USED IN WELL ____
SITE ____
DECON METHOD/STEAM TIME ____
RINSEATE SAMPLE ____ YES ____ NO ID ____

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK ____ YES [✓ NO] ID —
QA/QC SPIKE ____ YES [✓ NO] ID —
DUPLICATE ____ YES [✓ NO] ID —
FIELD BLANK ____ YES [✓ NO] ID —
INTER-LAB SPLIT ____ YES [✓ NO] ID —

NOTES

DO % = 10.7
DO mg = 0.81

LOCUS TECHNOLOGIES WATER SAMPLING LOG

SITE: S.C. VTA
DATE 7-23-08
PROJECT# 28006-08-0002
SAMPLER H. Castro/T. Murphy

WELL\SAMPLE DESIGNATION MW-2C
SAMPLE SOURCE A
AMBIENT CONDITIONS clear

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:
CONTINUOUS PUMPER ____ YES ____ NO
PUMP CYCLING ____ YES ____ NO
pH meter: ________ FLOW RATE: ________
METER READING ________

WATER LEVEL INFORMATION

MEASURING POINT ________ INSTRUMENT USED ________

W.L. BEFORE PURGE 16.36 TIME ________
W.L. ~~AFTER~~ During PURGE 16.55 TIME ________
W.L. FOR 80% RECOVERY ________
W.L. TIME OF SAMPLE ________ DATE ________ TIME ________

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD ________

PURGE DEVICE I.D. Low flow pump
WELL DEPTH ________
DIAMETER 2"
~~#CASING VOLUMES (PROTOCOL)~~ CPM #1
SCREENED INTERVAL ________
PUMP SETTING 98'
PURGE VOLUME CALCULATION ________
TIME PURGE BEGINS 1339
ACTUAL AMOUNT PURGED 1900 ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1340	26.8	5988	12.04	Cloudy/Slight odor	90.1	38.0
1341	26.8	5987	12.03	" " "	90.3	39.4
1342	26.7	5988	12.03	" " "	90.4	39.7

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD ________

APPROXIMATE DEPTH OF GRAB —
SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 1343
DATE 7-23-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO_2, N_2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID ________ HOSE REEL ________
PREVIOUSLY USED IN WELL ________
SITE ________
DECON METHOD/STEAM TIME ________
RINSEATE SAMPLE ____ YES ____ NO I D ________

SAMPLING DEVICE ID ________ HOSE REEL ________
PREVIOUSLY USED IN WELL ________
SITE ________
DECON METHOD/STEAM TIME ________
RINSEATE SAMPLE ____ YES ____ NO ID ________

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK ____ YES X NO ID —
QA/QC SPIKE ____ YES X NO ID —
DUPLICATE ____ YES ____ NO ID ________
FIELD BLANK ____ YES ____ NO ID ________
INTER-LAB SPLIT ____ YES X NO ID —

NOTES

DO% = 15.1
DO mg = 1.19

LOCUS TECHNOLOGIES WATER SAMPLING LOG

SITE: S.C. VTA
DATE 7-23-08
PROJECT# 28006-08-0002
SAMPLER H. Castro/T. Murphy

WELL\SAMPLE DESIGNATION ST-2
SAMPLE SOURCE A
AMBIENT CONDITIONS clear

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD: ____
CONTINUOUS PUMPER ____ YES ____ NO
PUMP CYCLING ____ YES ____ NO
pH meter: ____
FLOW RATE: ____
METER READING ____

WATER LEVEL INFORMATION

MEASURING POINT ____
INSTRUMENT USED ____

W.L. BEFORE PURGE 17.48 TIME ____
W.L. ~~AFTER~~ During PURGE 17.52
TIME ____
W.L. FOR 80% RECOVERY ____
W.L. TIME OF SAMPLE ____ DATE ____ TIME ____

MONITORING WELL PURGE INFORMATION

MONITORING WELL PURGE METHOD ____

PURGE DEVICE I.D. Low flow pump
WELL DEPTH ____
DIAMETER 4"
~~#CASING VOLUMES (PROTOCOL)~~ CPM 4
SCREENED INTERVAL ____
PUMP SETTING 80'
PURGE VOLUME CALCULATION ____
TIME PURGE BEGINS 1402
ACTUAL AMOUNT PURGED 5100 ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1412	26.4	608	8.49	cloudy/no odor	64.6	50.8
1413	26.5	608	8.50	" " " "	64.7	50.7
1414	26.5	608	8.50	" " " "	64.7	50.7

WATER SAMPLING INFORMATION

MONITORING WELL SAMPLE METHOD B

APPROXIMATE DEPTH OF GRAB —
SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 1415
DATE 7-23-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO2, N2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID ____ HOSE REEL ____
PREVIOUSLY USED IN WELL ____
SITE ____
DECON METHOD/STEAM TIME ____
RINSEATE SAMPLE ____ YES ____ NO ID ____

SAMPLING DEVICE ID ____ HOSE REEL ____
PREVIOUSLY USED IN WELL ____
SITE ____
DECON METHOD/STEAM TIME ____
RINSEATE SAMPLE ____ YES ____ NO ID ____

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK ____ YES X NO ID —
QA/QC SPIKE ____ YES X NO ID —
DUPLICATE ____ YES X NO ID —
FIELD BLANK ____ YES X NO ID —
INTER-LAB SPLIT ____ YES X NO ID —

NOTES

DO % = 8.2
DO Mg = 0.65

LOCUS TECHNOLOGIES WATER SAMPLING LOG

WELL\SAMPLE DESIGNATION ST-13
SAMPLE SOURCE A
AMBIENT CONDITIONS clear
SITE: S.C. VTA
DATE 7-23-08
PROJECT# 28006-08-0002
SAMPLER H. Castro/T. Murphy

GRAB SAMPLE INFORMATION (use notes section for meter reading, flow rate, vol. purged etc.)

GRAB SAMPLE METHOD:____
CONTINUOUS PUMPER ____YES____NO
PUMP CYCLING____YES____NO
pH meter:____
METER READING____
FLOW RATE:____

WATER LEVEL INFORMATION **MEASURING POINT**____ **INSTRUMENT USED**____

W.L. BEFORE PURGE 13.76 TIME____
W.L. ~~AFTER~~ During PURGE 13.76
TIME____
W.L. FOR 80% RECOVERY____
W.L. TIME OF SAMPLE____
DATE____
TIME____

MONITORING WELL PURGE INFORMATION **MONITORING WELL PURGE METHOD**____

PURGE DEVICE I.D. Low flow pump
WELL DEPTH____
DIAMETER 4"
#~~CASING VOLUMES (PROTOCOL)~~ CPM 3
SCREENED INTERVAL____
PUMP SETTING 26'
PURGE VOLUME CALCULATION____
TIME PURGE BEGINS 1454
ACTUAL AMOUNT PURGED 3300 ML
pH INSTRUMENT Low flow cell

TIME	TEMP.	COND.	pH	PURGE WATER APPEARANCE/ODOR	ORP	TURBIDITY
1457	25.5	1161	7.09	cloudy/slight odor	122.6	70.1
1458	25.6	1162	7.08	" " "	122.8	70.4
1459	25.6	1163	7.08	" " "	122.8	70.3

WATER SAMPLING INFORMATION **MONITORING WELL SAMPLE METHOD**____

APPROXIMATE DEPTH OF GRAB —
SAMPLING DEVICE ID 1/4" Tubing
SAMPLING TIME 1500
DATE 7-23-08

BOTTLE TYPE	NO.	VOLUME	ANALYSIS	LAB	PRESERVATION	FILTRATION
VOA	2	40ML	Methane	BCI	HCl	None
VOA	2	40ML	CO_2, N_2	BCI	None	None
VOA	1	40ML	Dissolved Sulfide	BCI	None	None

DECONTAMINATION INFORMATION

PURGE DEVICE ID____
HOSE REEL____
SAMPLING DEVICE ID____
HOSE REEL____
PREVIOUSLY USED IN WELL____
PREVIOUSLY USED IN WELL____
SITE____
SITE____
DECON METHOD/STEAM TIME____
DECON METHOD/STEAM TIME____
RINSEATE SAMPLE____YES____NO I.D____
RINSEATE SAMPLE____YES____NO ID____

QA/QC INFORMATION

IN SAMPLE SHIPMENT: TRAVEL BLANK____YES [✓ NO] ID —
QA/QC SPIKE____YES [✓ NO] ID —
DUPLICATE____YES [✓ NO] ID —
FIELD BLANK____YES [✓ NO] ID —
INTER-LAB SPLIT____YES [✓ NO] ID —

NOTES

DO% = 25.6
DO Mg = 2.10

Bioremediation Consulting Inc
39 Clarendon Street Watertown MA 02472
phone 617-923-0976 fax 617-923-0959
e-mail MFindlay@bciLabs com

CHAIN OF CUSTODY RECORD

Project Name: Locus wells Sampling Location: SC VTA
PO 30-12362
Sampled by: H. Costa / T. Murphy

Contact: John Hawthorne hawthornej@locustec com
pH: 650-960-1640 fax: 650-960-0739

Instructions: Fill containers completely. No air bubble.
each set: *2* voas. HCl-preserved: methane
2 voas. no preservative: CO_2, N_2
1 voa. no preservative: dissolved sulfide

Well Number	Date	VOA Vials HCl-preserved	rcv	VOA Vials No Preserv	rcv
MW-6D	7/23	2		3	
ST-11	7/23	2		3	
ST-10	7/23	2		3	
MW-4	7/23	2		3	
NW-6	7/23	2		3	
ST-8	7/23	2		3	
ST-1	7/23	2		3	
NW-01	7/23	2		3	
MW-2C	7/23	2		3	
trip blanks	7/23				

SHIP TO: Bioremediation Consulting Inc (phone 617-923-0976)
39 Clarendon St Watertown MA 02472

Shipping Conditions:
ICE NECESSARY; however,
No Loose Ice – bag ice in leak-proof bags
Do not allow ice to contact groundwater samples

Fed Ex Priority Overnite. **NO** Saturday Delivery

Call or fax BCI at time of shipping and report the tracking number

Relinquished by date 7-23-08

Received by __________ date ________

Bioremediation Consulting Inc
39 Clarendon Street Watertown MA 02472
phone 617-923-0976 fax 617-923-0959
e-mail MFindlay@bciLabs com

CHAIN OF CUSTODY RECORD

Project Name: Locus wells PO 30-12362 Sampling Location: SC VTA

Sampled by: H. Castro/K. Murphy

Contact: John Hawthorne hawthornej@locustec com
pH: 650-960-1640 fax: 650-960-0739

Instructions: Fill containers completely. No air bubble.
each set: *2* voas. HCl-preserved: methane
2 voas. no preservative: CO_2, N_2
1 voa. no preservative: dissolved sulfide

Well Number	Date	VOA Vials HCl-preserved	rcv	VOA Vials No Preserv	rcv
ST-7	7/22	2		3	
MW-5B	7/22	2		3	
NW-05	7/22	2		3	
ST-12	7/22	2		3	
MW-1	7/22	2		3	
MW-3C	7/22	2		3	
MW-2G	7/22	2		3	
4783	7/22	2		3	
4784	7/22	2		3	
trip blanks					

SHIP TO: Bioremediation Consulting Inc (phone 617-923-0976)
39 Clarendon St Watertown MA 02472

Shipping Conditions:

ICE NECESSARY: however,
No Loose Ice – bag ice in leak-proof bags
Do not allow ice to contact groundwater samples

Fed Ex Priority Overnite. **NO** Saturday Delivery

Call or fax BCI at time of shipping and report the tracking number

Relinquished by ______________ date 72308

Received by ______________ date ______________

Bioremediation Consulting Inc
39 Clarendon Street Watertown MA 02472
phone 617-923-0976 fax 617-923-0959
e-mail MFindlay@bciLabs com

CHAIN OF CUSTODY RECORD

Project Name: Locus wells PO 30-12362 Sampling Location: SCVTA

Sampled by: H. Castro / T. Murphy

Contact: John Hawthorne hawthornej@locustec.com
pH: 650-960-1640 fax: 650-960-0739

Instructions: Fill containers completely. No air bubble.
each set: *2* voas, HCl-preserved: methane
2 voas. no preservative: CO_2. N_2
1 voa. no preservative: dissolved sulfide

Well Number	Date	VOA Vials HCl-preserved	rcv	VOA Vials No Preserv	rcv
ST-2	7/23	2		3	
ST-13	7/23	2		3	
4785	7/23	2		3	
4786	7/23	2		3	
		2		3	
		2		3	
		2		3	
		2		3	
trip blanks					

SHIP TO: Bioremediation Consulting Inc (phone 617-923-0976)
39 Clarendon St Watertown MA 02472

Shipping Conditions:
ICE NECESSARY: however,
No Loose Ice – bag ice in leak-proof bags
Do not allow ice to contact groundwater samples

Fed Ex Priority Overnite. **NO** Saturday Delivery

Call or fax BCI at time of shipping and report the tracking number

Relinquished by date 7-23-08

Received by date

ATTACHMENT C

Laboratory Reports

Phase 1 Sampling

Analytical Results

Groundwater Samples from SCVTA Site

15 wells Sampled 5/21/08
Received 5/23/08
Analyzed 5/23/08 through 5/29/08

5/30/08

Prepared for:

John Hawthorne
hawthornej@locustec.com 650-960-1640
Locus Technologies
299 Fairchild Drive
Mountain View CA 94043

Prepared by
Bioremediation Consulting Inc
39 Clarendon St, Watertown MA 02472
ph 617-923-0976 fx -0959 bioremediation@bciLabs.com

Groundwater Samples from SCVTA Site

15 wells Sampled 5/21/08 Received 5/23/08 Analyzed 5/23/08 through 5/29

Prepared for John Hawthorne, Locus Technologies

5/30/08

Dissolved Gasses by Gas Chromatography. Dissolved gasses were analyzed by according to EPA Method 5021A. Vials (40 ml), without preservative, were prepared for analysis by replacing 5 ml of groundwater with 5 cc Helium, using a double needle procedure through the septum, then shaken for 20 minutes to allow volatilization of gasses into the headspace. Headspace samples of 100 µL were removed by syringe and injected directly into an HP 5890 gas chromatograph.

Argon, N_2, O_2, and CO_2 were detected by Thermal Conductivity Detector.
Methane, ethane, and ethanethiol were detected by Flame Ionization Detector.

Standards were prepared and analyzed in the same manner as samples. Compounds were identified by retention time, and quantitation was conducted using ChemStation software.

Dissolved Argon was calculated by subtracting the field O_2 readings from the combined Argon/O_2 peak on the gas chromatograph.

Dissolved O_2 by chemical test. Two samples, in 4 oz jars, were analyzed for dissolved O_2 according to Hach 8166.

Sulfide and Ammonia. VOA vials for the analysis of sulfide and ammonia were placed upright to allow sediment to settle prior to removing sub-samples for analysis. Sulfide was measured by Hach method 8131, NH_3-N by Hach method 8155. Measurements were made using a Hach Spectrophotometer. Samples were not diluted for analysis.

H_2 from Aqueous Samples. Serum bottles, 160 ml, provided pre-filled with H_2-free gas, were filled with ground water during field sampling and sealed with Teflon-coated gray rubber septa affixed with crimped caps. At BCI, using a two-needle procedure, 10 ml of water were removed while adding 10 cc of Argon, then the bottle was shaken for 20 min to allow H_2 to transfer to the headspace. A headspace sample of 5cc was removed from the 160 ml serum bottle (while injecting 5 cc degassed water) and injected directly into the H_2 Analyzer. A response factor for H_2 was obtained by analyzing a 5 ppm H_2 gas standard. The H_2 concentration originally in the ground water was calculated from the measured headspace concentration assuming a Henry's constant of 50.3. A lab blank was subtracted from the sample results prior to entering in data table.

Sample ID			4767	4768	4769	MW-2E	MW-2F	MW-3D-(r)	MW-3D-(r)-dup	MW-5A	MW-6J
Date Sampled			5/21/2008	5/21/2008	5/21/2008	5/21/2008	5/21/2008	5/21/2008	5/21/2008	5/22/2008	5/21/2008
Date Received			5/23/2008	5/23/2008	5/23/2008	5/23/2008	5/23/2008	5/23/2008	5/23/2008	5/23/2008	5/23/2008
Dissolved Gas, water matrix,											
Headspace GC, EPA meth 5021A											
Date Analyzed			5/23/2008	5/27/2008	5/27/2008	5/23/2008	5/23/2008	5/23/2008	5/28/2008	5/27/2008	5/27/2008
Analyst	Det. Lim.	Units	t.s.	i.a.	i.a.	t.s.	t.s.	t.s.	i.a.	i.a.	i.a.
Methane	0.2	µg/L	4.4	0.2	0.2	2.9	4.6	98	107	9.2	16
Ethane	0.2	µg/L	0.3	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 0.2	0.2	< 0.2
Ethanethiol	0.07	mg/L	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07
Argon	2	mg/L	< 2	< 2	< 2	< 2	< 2	2	1.6 J	< 2	< 2
Nitrogen	7	mg/L	34	15	15	33	36	34	28	25	24
Carbon monoxide	0.5	mg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carbon dioxide	0.2	mg/L	16	0.4	0.4	17	17	20	20	8	20
Chemical Tests											
Dates Analyzed											
Analysts			i.a./c.m	i.a./c.m	i.a./c.m	i.a./c.m	i.a./c.m	i.a./c.m		i.a./c.m	i.a./c.m
NH3-N Hach 8155	0.02	mg/L	0.03	< 0.02	< 0.02	< 0.02	< 0.02	0.06		0.10	0.02
sulfide Hach 8131	0.003	mg/L	0.004	< 0.003	< 0.003	0.007	0.005	0.008		0.003	0.010
Dissolved O2 Hach 8166		mg/L	n.a.	8.3	9.8	n.a.	n.a.	n.a.		n.a.	n.a.
Dissolved H2, water matrix											
Reduction gas analyzer											
Date Analyzed			5/23/2008	5/23/2008	5/23/2008	5/23/2008	5/23/2008	5/23/2008		5/23/2008	5/23/2008
Analyst			t.s.	t.s.	t.s.	t.s.	t.s.	t.s.		t.s.	t.s.
Sample Dilution	Det. Lim.		1	1	1	1	1	1		1	1
Sample Result	0.3	nM	1.6	4.9	2.8	1.1	0.9	0.4		1.0	0.5
Field DO			2.92	n.a.	n.a.	2.8	2.92	2.98		1.74	4.45

Sample ID			ST-3	ST-5	TW-2B	TW-2B-dup	TW-5A	TW-6A	TW-6B	TW-8A	Trip Bl
Date Sampled			5/21/2008	5/21/2008	5/21/2008	5/21/2008	5/22/2008	5/21/2008	5/21/2008	5/22/2008	prep 5/15
Date Received			5/23/2008	5/23/2008	5/23/2008	5/23/2008	5/23/2008	5/23/2008	5/23/2008	5/23/2008	5/23/2008
Dissolved Gas, water matrix,											
Headspace GC, EPA meth 5021A											
Date Analyzed			5/23/2008	5/23/2008	5/23/2008	5/27/2008	5/27/2008	5/27/2008	5/27/2008	5/23/2008	5/28/2008
Analyst	Det. Lim.	Units	t.s.	t.s.	t.s.	i.a.	i.a.	i.a.	i.a.	t.s.	i.a.
Methane	0.2	µg/L	6.9	6.1	75	70	0.5	95	0.5	31	0.6
Ethane	0.2	µg/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.2	< 0.2	< 0.2	< 0.2
Ethanethiol	0.07	mg/L	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07	< .07
Argon	2	mg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	n.a.
Nitrogen	7	mg/L	33	32	33	29	34	24	24	33	21
Carbon monoxide	0.5	mg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Carbon dioxide	0.2	mg/L	23	21	16	15	32	49	20	17	< 0.5
Chemical Tests											
Dates Analyzed											
Analysts			i.a./c.m	i.a./c.m	i.a./c.m		i.a./c.m	i.a./c.m	i.a./c.m	i.a./c.m	i.a./c.m
NH3-N Hach 8155	0.02	mg/L	< 0.02	0.08	0.03		0.10	0.04	0.52	0.03	
sulfide Hach 8131	0.003	mg/L	0.007	< 0.003	0.014		0.005	0.005	< 0.003	0.009	n.a.
Dissolved O2 Hach 8166		mg/L	n.a.	n.a.	n.a.		n.a.	n.a.	n.a.	n.a.	
Dissolved H2, water matrix											
Reduction gas analyzer											
Date Analyzed			5/23/2008	5/23/2008	5/23/2008		5/23/2008	5/23/2008	5/23/2008	5/23/2008	
Analyst			t.s.	t.s.	t.s.		t.s.	t.s.	t.s.	t.s.	
Sample Dilution	Det. Lim.		1	1	1		1	1	1	1	
Sample Result	0.3	nM	1.3	< 2	0.8		0.9	0.8	1.2	0.7	
Field DO			4.01	2.62	2.58		1.81	1.37	4.98	1.97	

Bioremediation Consulting Inc
39 Clarendon Street Watertown MA 02472
phone 617-923-0976 fax 617-923-0959
e-mail MFindlay@bciLabs com

CHAIN OF CUSTODY RECORD

Project Name: Locus wells
PO 30-12342
Sampling Location: SCVTA

Sampled by: HANK CASTRO

Contact: John Hawthorne hawthornej@locustec.com
pH: 650-960-1640 fax: 650-960-0739

Instructions: Fill containers completely. No air bubble.
each set: *2* voas, HCl-preserved: methane, ethane, ethanethiol
2 voas, no preservative: Argon, O_2, CO, CO_2, N_2
1 voa, no preservative: dissolved sulfide
1 voa, no preservative: NH_3-N
1 160-ml serum bottle: H_2 analyses
2 4-oz jars: dissolved O_2
RETURN CRIMPER & PLIERS TO BCI

Well Number	Date	VOA Vials HCl-preserved	rcv	VOA Vials No Preserv	rcv	160 ml SB (contain Argon)	rcv	4 oz jars for D.O.	rcv
TW-2B	5/21/08	2	✓✓	4 ✓	✓✓✓✓	1	✓	2	✓✓
MW-2E	5/21/08	2	✓✓	4 ✓	✓✓✓✓	1	✓	2	✓✓
MW-2F	5/21/08	2	✓✓	4 ✓	✓✓✓✓	1	✓	2	✓✓
ST-3	5/21/08	2	✓✓	4 ✓	✓✓✓✓	1	✓	2	✓✓
TW-8A	5/21/08	2	✓✓	4 ✓	✓✓✓✓	1	✓	2	✓✓
trip blanks		1	✓	2	✓✓				
Return crimper to BCI									

SHIP TO: Bioremediation Consulting Inc (phone 617-923-0976)
39 Clarendon St Watertown MA 02472

Shipping Conditions:

ICE NECESSARY; however,

No Loose Ice – bag ice in leak-proof bags

Do not allow ice to contact groundwater samples

Fed Ex Priority Overnite NO Saturday Delivery

Call or fax BCI at time of shipping and report the tracking number

Relinquished by date 5/21/08

Received by date 5/23/08

mediation Consulting Inc
larendon Street Watertown MA 02472
one 617-923-0976 fax 617-923-0959
mail: MFindlay@bciLabs com

CHAIN OF CUSTODY RECORD

Project Name: Locus wells Sampling Location: SCVTA
PO 30-12342
Sampled by: Hank Cusaw

Contact: John Hawthorne hawthornej@locustec com
pH: 650-960-1640 fax: 650-960-0739

Instructions: Fill containers completely No air bubble
each set: *2* voas, HCl-preserved: methane, ethane, ethanethiol 50-1A
2 voas, no preservative: Argon, O_2, CO, CO_2, N_2 → 5021A
1 voa, no preservative: dissolved sulfide → HACH 8131
1 voa, no preservative: NH_3-N → HACH 8155
1 160-ml serum bottle: H_2 analyses
2 4-oz jars: dissolved O_2

RETURN CRIMPER & PLIERS TO BCI

Well Number	Date	VOA Vials HCl-preserved	rcv	VOA Vials No Preserv	rcv	160 ml SB (contain Argon)	rcv	4 oz jars for D O	rcv
TW-5A	5/21/08	2	✓✓	4 ✓✓✓✓		1	✓	2	✓✓
MW-5A		2	✓✓	4 ✓✓✓✓		1	✓	2	✓✓
TW-6A		2	✓✓	4 ✓✓✓✓		1	✓	2	✓✓
TW-6B		2	✓✓	4 ✓✓✓✓		1	✓	2	✓✓
MW-6J	↓	2	✓✓	4 ✓✓✓✓		1	✓	2	✓✓
trip blanks									
Return crimper to BCI									

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Shipping Conditions:
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Do not allow ice to contact groundwater samples

Fed Ex Priority Overnite **NO** Saturday Delivery

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Received by date 5/23/08

Bioremediation Consulting Inc
39 Clarendon Street Watertown MA 02472
phone 617-923-0976 fax 617-923-0959
e-mail MFindlay@bciLabs com

CHAIN OF CUSTODY RECORD

Project Name: Locus wells
PO 30-12342
Sampling Location: SCVTA

Sampled by: Hank Casmo

Contact: John Hawthorne hawthornej@locustec.com
pH: 650-960-1640 fax: 650-960-0739

Instructions: Fill containers completely. No air bubble.

each set: *2* voas, HCl-preserved: methane, ethane, ethanethiol
2 voas, no preservative: Argon, O_2, CO, CO_2, N_2
1 voa, no preservative: dissolved sulfide
1 voa, no preservative: NH_3-N
1 160-ml serum bottle: H_2 analyses
2 4-oz jars: dissolved O_2

RETURN CRIMPER & PLIERS TO BCI

Well Number	Date	VOA Vials HCl-preserved	rcv	VOA Vials No Preserv	rcv	160 ml SB (contain Argon)	rcv	4 oz jars for D.O.	rcv
MW-3D(r)	5/21/08	2	✓✓	4	✓✓✓✓	1	✓	2	✓✓
ST-5	↓	2	✓✓	4	✓✓✓✓	1	✓	2	✓✓
4767		2	✓✓	4	✓✓✓✓	1	✓	2	✓✓
4768		2	✓✓	4	✓✓✓✓	1	✓	2	✓✓
4769		2	✓✓	4	✓✓✓✓	1	✓	2	✓✓
trip blanks									
Return crimper to BCI									

SHIP TO: Bioremediation Consulting Inc (phone 617-923-0976)
39 Clarendon St Watertown MA 02472

Shipping Conditions:

ICE NECESSARY; however,

No Loose Ice – bag ice in leak-proof bags
Do not allow ice to contact groundwater samples

Fed Ex Priority Overnite. **NO** Saturday Delivery

Call or fax BCI at time of shipping and report the tracking number

Relinquished by date 5/21/08

Received by date 5/23/08

Gusmer Enterprises, Inc.

Locus Technologies
J. Wesley Hawthorne
299 Fairchild Drive
Mountain View, CA 94043

Phone: 1 650 960 1640
Fax: 1 650 960 0739
Email: hawthornej@locustec.com

Account Name:
File name: LOC 8143

ANALYSIS REPORT

Date Submitted: 5/23/08

Report Date: 5/27/08

Sample	Test	Result
TW-2B	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm
MW-2E	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm
MW-2F	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm
ST-3	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm
TW-8A	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm
MW-3D(r)	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm
ST-5	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm
4767	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm
4768	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm
4769	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm

Results apply to samples as received.

TW-5A	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm
MW-5A	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm
TW-6A	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm
TW-6B	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm
MW-6J	Free SO2 (Skalar)	< 5 ppm
	Total SO2 (Skalar)	< 5 ppm

Signed: David A. Jeff

David A. Jeffrey, Enologist

Results apply to samples as received.

ATTACHMENT D

Laboratory Reports

Phase 2 Sampling

Analytical Results

Groundwater Samples from SCVTA Site

Sampled 7/22 & 7/23/08
Received 7/24/08
Analyzed 7/24/08 through 7/29/08

7/31/08

Prepared for:

John Hawthorne
hawthornej@locustec.com 650-960-1640
Locus Technologies
299 Fairchild Drive
Mountain View CA 94043

Prepared by
Bioremediation Consulting Inc
39 Clarendon St, Watertown MA 02472
ph 617-923-0976 fx -0959 bioremediation@bciLabs.com

Groundwater Samples from SCVTA Site

Sampled 7/22 & 7/23/'08 Received 7/24/'08 Analyzed 7/24 through 7/29/'08

Prepared for John Hawthorne, Locus Technologies

7/31/'08

Dissolved Gasses by Gas Chromatography. Dissolved gasses were analyzed by according to EPA Method 5021A. For the analysis of N_2 and CO_2, vials (40 ml) without preservative were prepared for analysis by replacing 5 ml of groundwater with 5 cc Helium, using a double needle procedure through the septum, then shaken for 20 minutes to allow volatilization of gasses into the headspace. For the analysis of methane, vials with HCl as preservative were prepared for analysis in the same manner. Headspace samples of 100 µL were removed by syringe and injected directly into an HP 5890 gas chromatograph.

N_2 and CO_2 were detected by Thermal Conductivity Detector.
Methane was detected by Flame Ionization Detector.

Standards were prepared and analyzed in the same manner as samples. Compounds were identified by retention time, and quantitation was conducted using ChemStation software.

Sulfide. VOA vials, unpreserved, were placed upright to allow sediment to settle prior to removing sub-samples for analysis. Samples were analyzed within one day of recepit by BCI. Sulfide was measured by Hach method 8131 and measurements were made using a Hach Spectrophotometer.

Sample ID			**4783**	**4784**	**4785**	**4786**	**MW-1**	**MW-5B**	**MW-6D**
Date Sampled			7/22/2008	7/22/2008	7/23/2008	7/23/2008	7/22/2008	7/22/2008	7/23/2008
Date Received			7/24/2008	7/24/2008	7/24/2008	7/24/2008	7/24/2008	7/24/2008	7/24/2008
Dissolved Gas, water matrix,									
Headspace GC, EPA meth 5021A									
Date Analyzed			7/28/2008	7/25/2008	7/25/2008	7/29/2008	7/24/2008	7/24/2008	7/25/2008
Analyst	Det. Lim.	Units	t.s.	t.s.	t.s.	t.s.	t.s.	t.s.	t.s.
Methane	0.2	µg/L	35	0.7	1.8	1.0	0.5	0.9	1.9
Nitrogen	7	**mg/L**	27	15	22	18	17	28	21
Carbon dioxide	0.2	**mg/L**	23	< 0.2	66	< 0.2	1.5	37	72
Chemical Test									
Dates Analyzed			7/24/2008	7/25/2008	7/25/2008	7/24/2008	7/24/2008	7/24/2008	7/25/2008
Analysts			i.a.	i.a.	i.a.	i.a.	i.a.	i.a.	i.a.
sulfide Hach 8131	0.01	**mg/L**	0.012	< 0.01	0.017	< 0.01	0.019	< 0.01	0.010
Sample ID			**MW-2C**	**MW-2G**	**MW-3C**	**MW-4A**	**MW-4A lab dup**	**ST-1**	**ST-2**
Date Sampled			7/23/2008	7/22/2008	7/22/2008	7/23/2008	7/23/2008	7/23/2008	7/23/2008
Date Received			7/24/2008	7/24/2008	7/24/2008	7/24/2008	7/24/2008	7/24/2008	7/24/2008
Dissolved Gas, water matrix,									
Headspace GC, EPA meth 5021A									
Date Analyzed			7/29/2008	7/28/2008	7/24/2008	7/25/2008	7/25/2008	7/29/2008	7/29/2008
Analyst	Det. Lim.	Units	t.s.	t.s.	t.s.	t.s.	t.s.	t.s.	t.s.
Methane	0.2	µg/L	7.7	39	9.9	8.3	8.2	2.0	31
Nitrogen	7	**mg/L**	32	26	35	24	24	28	22
Carbon dioxide	0.2	**mg/L**	< 0.2	24	22	< 0.2	< 0.2	38	3.7
Chemical Test									
Dates Analyzed			7/24/2008	7/24/2008	7/24/2008	7/25/2008		7/25/2008	7/24/2008
Analysts			i.a.	i.a.	i.a.	i.a.		i.a.	i.a.
sulfide Hach 8131	0.01	mg/L	< 0.01	0.028	< 0.01	0.033		< 0.01	0.017

Sample ID			**NW-01**	**NW-05**	**NW-6**	**ST-10**	**ST-11**	**ST-12**	**ST-13**	**Trip Bl**
Date Sampled			7/23/2008	7/22/2008	7/23/2008	7/23/2008	7/23/2008	7/22/2008	7/23/2008	prep 7/16
Date Received			7/24/2008	7/24/2008	7/24/2008	7/24/2008	7/24/2008	7/24/2008	7/24/2008	7/24/2008
Dissolved Gas, water matrix,										
Headspace GC, EPA meth 5021A										
Date Analyzed			7/29/2008	7/24/2008	7/29/2008	7/25/2008	7/25/2008	7/24/2008	7/29/2008	7/29/2008
Analyst	Det. Lim.	Units	t.s.	t.s.	t.s.	t.s.	t.s.	t.s.	t.s.	t.s.
Methane	0.2	µg/L	2.0	2.1	2.1	0.1	0.4	1.0	1.0	0.4
Nitrogen	7	**mg/L**	35	20	26	27	27	23	27	29
Carbon dioxide	0.2	**mg/L**	11	2.7	12	17	17	110	56	0.7
Chemical Test										
Dates Analyzed			7/25/2008	7/24 & 7/25	7/25/2008	7/25/2008	7/25/2008	7/24/2008	7/24/2008	7/25/2008
Analysts			i.a.	i.a.	i.a.	i.a.	i.a.	i.a.	i.a.	i.a.
sulfide Hach 8131	0.01	**mg/L**	0.025	< 0.11 (1)	0.011	< 0.01	< 0.01	< 0.01	0.015	< 0.01

(1) interference from turbidity;
Hach turbidity interference correction
procedure unsuccessful

Sample ID			**ST-7**	**ST-8**	**ST-8 lab dup**
Date Sampled			7/22/2008	7/23/2008	7/23/2008
Date Received			7/24/2008	7/24/2008	7/24/2008
Dissolved Gas, water matrix,					
Headspace GC, EPA meth 5021A					
Date Analyzed			7/24/2008	7/28/2008	7/28/2008
Analyst	Det. Lim.	Units	t.s.	t.s.	t.s.
Methane	0.2	µg/L	1.5	1.7	1.3
Nitrogen	7	**mg/L**	31	37	37
Carbon dioxide	0.2	**mg/L**	29	31	31
Chemical Test					
Dates Analyzed			7/24/2008	7/25/2008	
Analysts			i.a.	i.a.	
sulfide Hach 8131	0.01	mg/L	< 0.01	< 0.01	

ioremediation Consulting Inc
39 Clarendon Street Watertown MA 02472
phone 617-923-0976 fax 617-923-0959
e-mail: MFindlay@bciLabs com

CHAIN OF CUSTODY RECORD

Project Name: Locus wells Sampling Location: SCVTA
PO 30-12362

Sampled by: H. Castro/K. Murphy

Contact: John Hawthorne hawthornej@locustec.com
pH: 650-960-1640 fax: 650-960-0739

Instructions: Fill containers completely. No air bubble.
each set: *2* voas, HCl-preserved: methane
2 voas, no preservative: CO_2, N_2
1 voa, no preservative: dissolved sulfide

Well Number	Date	VOA Vials HCl-preserved	rcv	VOA Vials No Preserv	rcv
ST-7	7/22	2	2	3	3
MW-5B	7/22	2	2	3	3
NW-05	7/22	2	2	3	3
ST-12	7/22	2	2	3	3
MW-1	7/22	2	2	3	3
MW-3C	7/22	2	2	3	3
MW-2G	7/22	2	2	3	3
4783	7/22	2	2	3	3
4784	7/22	2	2	3	3
trip blanks		2	2	2	2

SHIP TO: Bioremediation Consulting Inc (phone 617-923-0976)
39 Clarendon St Watertown MA 02472

Shipping Conditions:
ICE NECESSARY; however,
No Loose Ice – bag ice in leak-proof bags
Do not allow ice to contact groundwater samples

Fed Ex Priority Overnite. **NO** Saturday Delivery

Call or fax BCI at time of shipping and report the tracking number

Relinquished by date 7-23-08
Received by Tim Snyder date 7/24/08

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39 Clarendon Street Watertown MA 02472
phone 617-923-0976 fax 617-923-0959
e-mail MFindlay@bciLabs com

CHAIN OF CUSTODY RECORD

Project Name: Locus wells
PO 30-12362 Sampling Location: SCVTA

Sampled by: H. Costa / T. Murphy

Contact: John Hawthorne hawthornej@locustec com
pH: 650-960-1640 fax: 650-960-0739

Instructions: Fill containers completely. No air bubble.
each set: *2* voas, HCl-preserved: methane
2 voas, no preservative: CO_2, N_2
1 voa, no preservative: dissolved sulfide

Well Number	Date	VOA Vials HCl-preserved	rcv	VOA Vials No Preserv	rcv	
MW-6D	7/23	2	2	3	3	+2 +3 (X4)
ST-11	7/23	2	2	3	3	
ST-10	7/23	2	2	3	3	
MW-4	7/23	2	2	3	3	MW4A (X5)
NW-6	7/23	2	2	3	3	
ST-8	7/23	2	2	3	3	
ST-1	7/23	2	2	3	3	
NW-01	7/23	2	2	3	3	
MW-2C	7/23	2	2	3	3	
trip blanks	7/23					

SHIP TO: Bioremediation Consulting Inc (phone 617-923-0976)
39 Clarendon St Watertown MA 02472

Shipping Conditions:
ICE NECESSARY: however,
No Loose Ice – bag ice in leak-proof bags
Do not allow ice to contact groundwater samples

Fed Ex Priority Overnite. **NO** Saturday Delivery

Call or fax BCI at time of shipping and report the tracking number

Relinquished by ________ date 7-23-08
Received by ________ date 7-24-08

remediation Consulting Inc
9 Clarendon Street Watertown MA 02472
phone 617-923-0976 fax 617-923-0959
e-mail MFindlay@bciLabs.com

CHAIN OF CUSTODY RECORD

Project Name: Locus wells Sampling Location: SCVTA
PO 30-12362

Sampled by: H. Costo/T. Murphy

Contact: John Hawthorne hawthornej@locustec.com
pH: 650-960-1640 fax: 650-960-0739

Instructions: Fill containers completely. No air bubble.
each set: *2* voas, HCl-preserved: methane
2 voas, no preservative: CO_2, N_2
1 voa, no preservative: dissolved sulfide

Well Number	Date	VOA Vials HCl-preserved	rcv	VOA Vials No Preserv	rcv
ST-2	7/23	2	2	3	3
ST-13	7/23	2	2	3	3
4785	7/23	2	0	3	0
4786	7/23	2	2	3	3
		2		3	
		2		3	
		2		3	
		2		3	
trip blanks					

dup of MW6D-194

SHIP TO: Bioremediation Consulting Inc (phone 617-923-0976)
39 Clarendon St Watertown MA 02472

Shipping Conditions:
ICE NECESSARY: however,
No Loose Ice – bag ice in leak-proof bags
Do not allow ice to contact groundwater samples

Fed Ex Priority Overnite. **NO** Saturday Delivery

Call or fax BCI at time of shipping and report the tracking number

Relinquished by date 7-23-08
Received by date 7-24-08

Appendix 11: Soil Abrasion Test Results

SINTEF

SINTEF Building and Infrastructure
Rock and Soil Mechanics

Address: NO-7465 Trondheim, NORWAY

Location: R. Birkelands vei 3
Telephone: +47 73 59 46 00
Fax: +47 73 59 47 78

Location: Høgskoleringen 7a
Telephone: +47 73 59 46 00
Fax: +47 73 59 53 40

Enterprise No: NO 948 007 029 MVA

TEST REPORT

CLIENT(S)

HMM/Bechtel
SVRT Project
Hynix Building
3331 North First Street (Bldg. A)
San Jose, CA 95134
USA

CLIENTS REF

Dinesh C. Mathur/Abhishek Jain

SAMPLE MATERIAL

Four soil samples

SCOPE OF WORK

SAT - Soil Abrasion Testing, Atterbergs Limits

REPORT/JOURNAL NO.	CLASSIFICATION	PERSON RESPONSIBLE (NAME, SIGN.)	
08043 IG	Confidential	Pål Drevland Jakobsen	
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3C0097.00	02.10.08	Filip Dahl	15

DETERMINATION OF ABRASIVITY PROPERTIES OF FOUR SOIL SAMPLES FROM THE SILICON VALLEY RAPID TRANSPORT (SVRT) PROJECT

SINTEF Building and Infrastructure, Rock and Soil Mechanics received four samples, consisting of soil, from the Client on August 11, 2008.

The samples were analysed by use of the Soil Abrasion Test (SAT) in order to determine abrasivity properties. The testing was performed in accordance with Nilsen, B., Dahl, F., Holzhäuser, J. and Raleigh, P. (2007): "New test methodology for estimating the abrasiveness of soils for TBM tunnelling", RETC Proceedings, 104 - 116.

One of the samples was additionally analysed according to the Norwegian Standards NS 8001 and NS 8003 in order to determine Atterbergs Limits.

The laboratory testing was conducted during the period from August 12 to September 9, 2008.

CONTENT

TABLE OF SAMPLES OF SOIL RECEIVED FOR TESTING
(Given by the Client)

Sample No.	Boring Number (Sample I.D.)	Soil type	Depth Interval (ft)
1	BH-12/S-6	CL	55 – 57.5
2	BH-31/S-4	SC	53.5 – 56
3	MW-61	SP-SM	69 – 70
4	MW-8B	GW	25.5 – 28

TEST RESULTS

Basis SAT: "New test methodology for estimating the abrasiveness of soils for TBM tunnelling", RETC 2007 Proceedings, 104 - 116.

Basis Atterbergs Limits: NS 8001 and NS 8003

Sample No. (given by the Client)	1	2	3	4
Sample ID. (given by the Client)	BH-12/S-6	BH-31/S-4	MW-61	MW-8B
Soil Abrasion Test				
SAT Test 1	1	22	21	18
SAT Test 2	0	24	25	20
SAT Test 3	-	-	23	16
SAT (Mean)	**0.5**	**23.0**	**23.0**	**18.0**
Percentage of the total sample < 4.0 mm after preparation	100.0 %	92.6 %	99.1 %	91.1 %
Percentage of the total sample < 1.0 mm after preparation	100.0 %	81.7 %	84.7 %	51.9 %
Atterbergs Limits				
w_l	**63.9 %**	-	-	-
w_p	**30.1 %**	-	-	-
Ip	**33.8 %**	-	-	-

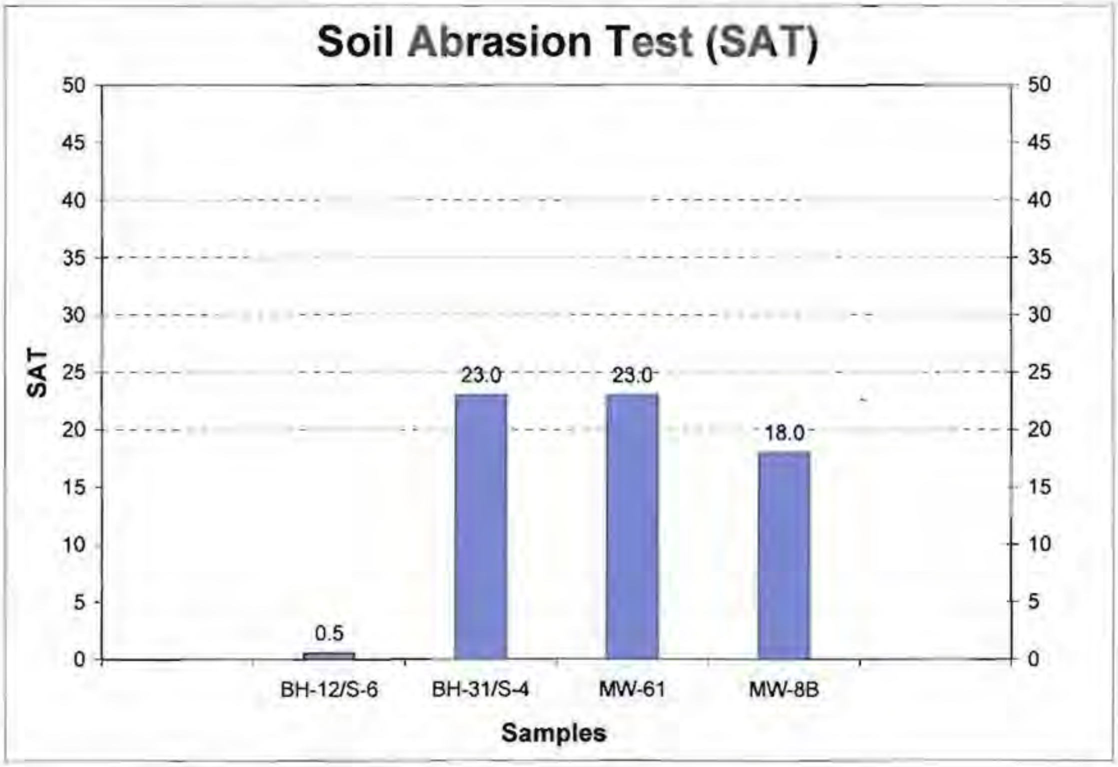


Figure 1. The SAT results presented as bar graph.

METHODOLOGY AND TEST PROCEDURE FOR THE SOIL ABRASION TEST (SAT)

The abrasivity of the received soil samples was tested by use of the Soil Abrasion Test (SAT). The Soil Abrasion Test is a further development of the existing Abrasion Value (AV) and Abrasion Value Cutter Steel (AVS) tests for rock. Compared to the AVS test, only one detail has been changed: instead of crushed rock powder <1 mm, a sieved soil sample with grain size < 4 mm is used in the SAT test. The initial SAT tests were performed with an upper grain size limit of 1 mm (Nilsen et al. 2006a to c), but this has now by a modification of the original test pieces, as shown in Figure 2 and 3, been increased to 4 mm (Nilsen et al. RETC 2007).

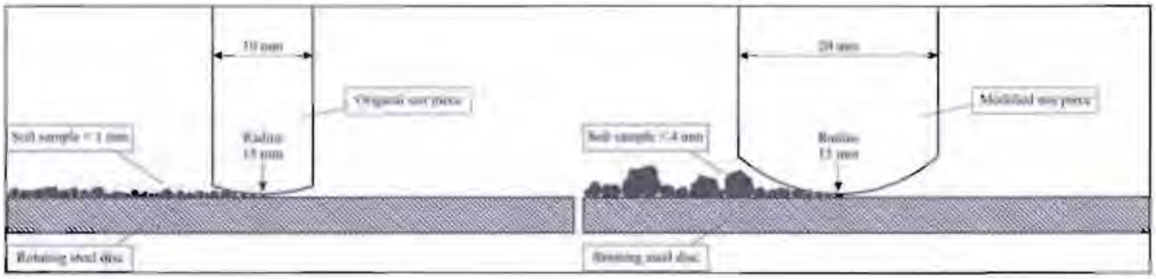


Figure 2. The original (left) and modified (right) SAT test pieces.

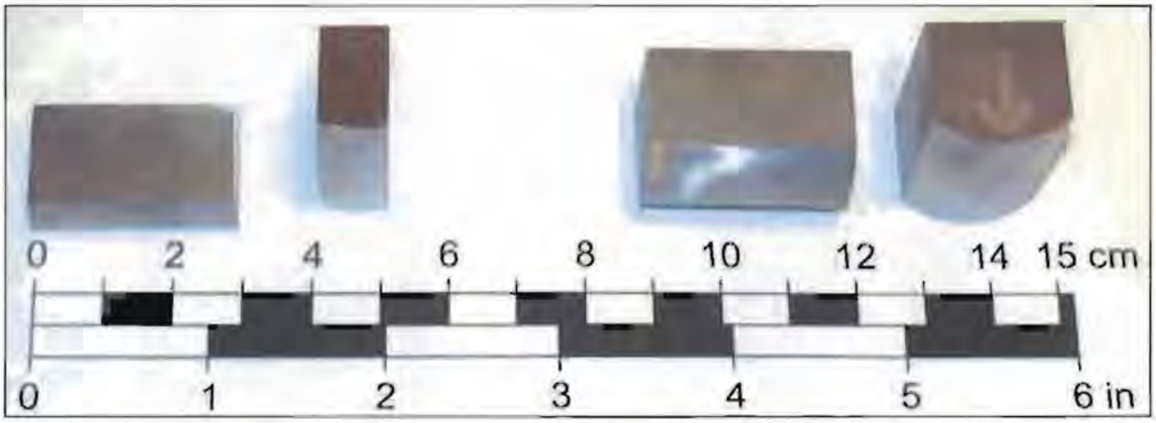


Figure 3. Photo showing two original AVS (to the left) and two modified SAT test pieces (to the right).

Preparation of soil samples

To enable comparison with previous test results and to take advantage of the extensive NTNU database, it is considered important to follow the standardized NTNU abrasion test procedures as closely as possible. The following preparation of soil samples is therefore recommended:

In order to reduce or avoid changes of the original properties, soil samples should be dried gently in a ventilated oven at 30° C for 2 - 3 days.

The following techniques should be used after drying in order to disintegrate and separate the particles for the abrasion powder:

1. Disintegration with a soft hammer (plastic head).
2. Sieving with steel balls as gentle milling/disintegration aid. The sample material is sieved on 4.0 mm and 1.0 mm sieves. 20 small steel balls with individual weight 14 g and diameter 15 mm are added to each sieve.
3. Crushing by use of jaw crushers (type and opening depending on the size of the lumps): Initial disintegration of samples which contains very hard lumps of cohesive material after drying. Crushing of intact grains should be avoided.

The disintegrated material should be sieved on 1 mm and 4 mm in order to verify the grain size distribution after preparation. SAT testing of the sieved fraction < 4.0 mm is then carried out according to the same procedures as for AVS testing (*see pages 8 - 9*) and the SAT value is calculated as the mean value of the measured weight loss in mg (to be accepted, the results of 2 - 4 parallel tests should not deviate by more than 5 units).

SAT testing in progress is illustrated in Figure 5 and examples of the appearance of test pieces after completed tests are shown in Figure 6.

Figure 4. Overview photo showing the general layout of the SAT rig.

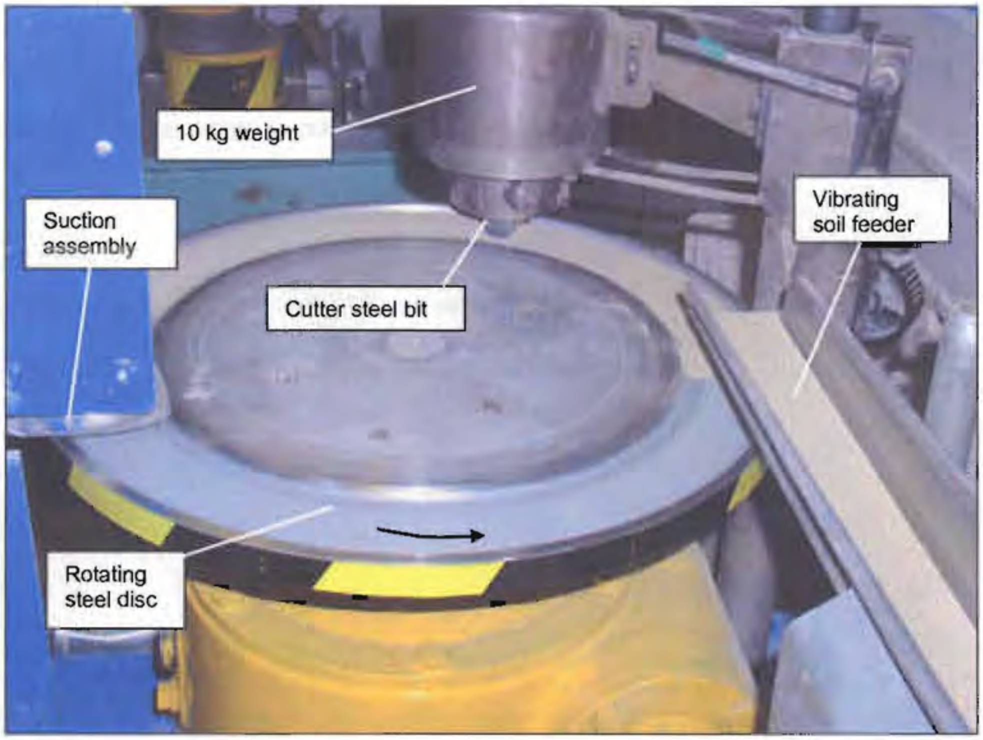


Figure 5. Close up photo taken during testing. The test piece which is clamped under the 10 kg weight is running on sample material supplied to the rotating disc by the vibrating feeder.

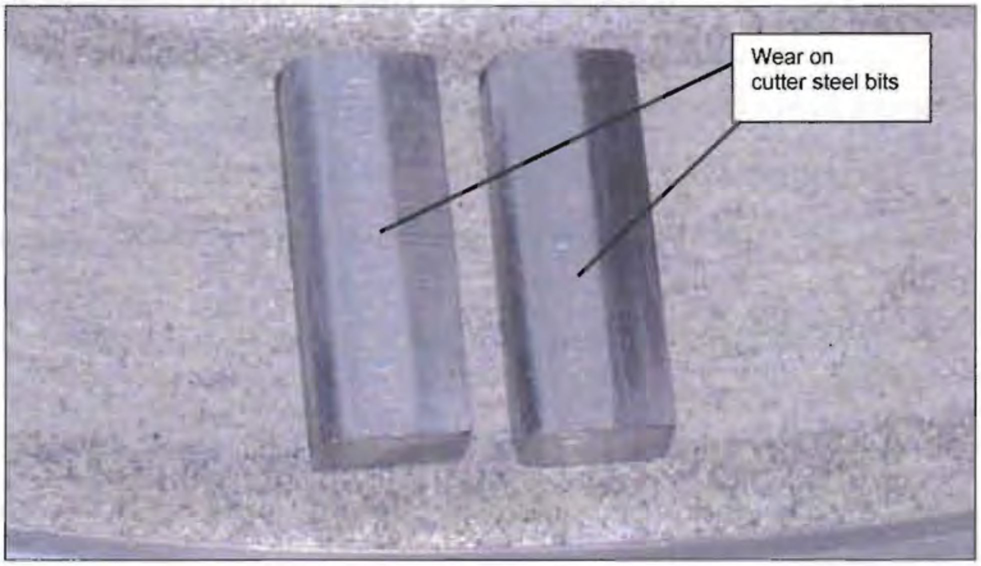


Figure 6. Abrasion of test pieces (L = 30 mm) after Soil Abrasion Test (SAT) (minimum 2 test runs per soil sample).

Test procedures for determination of Abrasion Value (AV), Abrasion Value Cutter Steel (AVS) and Soil Abrasion Test (SAT)

An outline of the principle for the Abrasion tests and specification of measurements for the test bits are given in Figure 7 and Figure 1 (modified SAT test pieces).

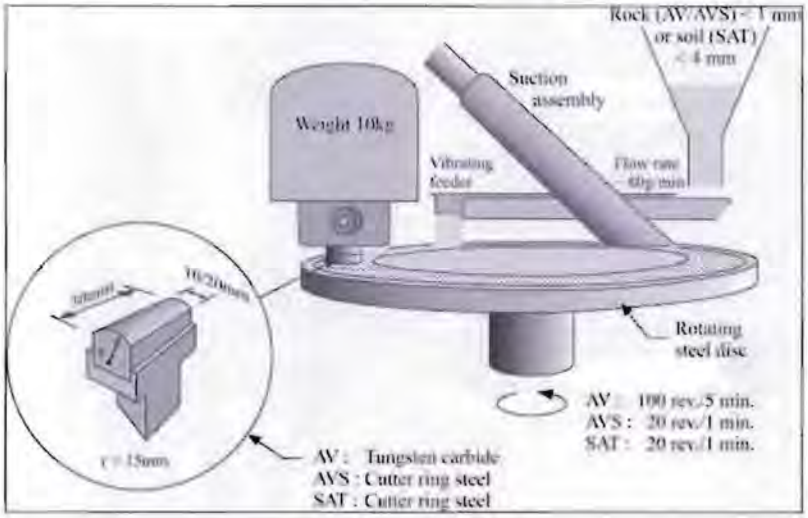


Figure 7. Abrasion Value, Abrasion Value Cutter Steel and Soil Abrasion tests.

Abrasion Value (AV)

Prepare 2 - 4 numbered tungsten carbide test pieces by grinding them to the specified dimensions.

Note:
Grinding of the test surface is a critical step and extra care is important in order to avoid overheating.

Visually examine the test surface and make sure that it is smooth and straight after grinding.

Polish the edges of the test surface by a hone and ensure that the test bit is absolutely clean and dry before weighing.

Weigh the test piece separately to the nearest 0.001g and note the number of the test piece and corresponding weight.

Secure a test piece to the weight and place it gently on the steel disc (*see Figure 5*).

Verify that the test surface is horizontally aligned with the steel disc, and if necessary, adjust the clamping of the test piece and the suspension of the weight.

Start the test and run it for 5 minutes, i.e. 100 revolutions. Verify whether the amount of abrasion powder fed onto the steel disc is sufficient or excessive. Adjust the vibrating feeder in order to avoid steel against steel abrasion or a pile of powder in front of the test piece. Make sure that the test piece runs in the middle of the track and that a single point of it does not bear directly against the steel disc.

Loosen the test piece from the weight and rinse and dry thoroughly before weighing.

Note the weight and calculate the weight loss in mg.

Run 2 - 4 parallel tests. The results shall not deviate by more than 5 units.

The Abrasion Value (AV) is calculated as the mean value of the measured weight loss in milligrams after 5 minutes testing time, i.e. 100 revolutions.

Abrasion Value Cutter Steel (AVS) and Soil Abrasion Test (SAT)

Prepare 2 - 4 numbered cutter ring test pieces by grinding them to the specified dimensions.

Follow the steps given for Abrasion Value (AV), apart from the testing time.

Note:
The testing time for the Abrasion Value Cutter Steel (AVS) and Soil Abrasion Test (SAT) are 1 min, i.e. 20 revolutions.

The Abrasion Value Cutter Steel (AVS) and Soil Abrasion Test (SAT) are calculated as the mean value of the measured weight loss in milligrams after 1 minute testing time, i.e. 20 revolutions.

References

Nilsen, B., Dahl, F., Holzhäuser, J., Raleigh, P. (2006a): Abrasivity of soils in TBM tunnelling. Tunnels & Tunnelling International, March 2006, 36 - 38.

Nilsen, B., Dahl, F., Holzhäuser, J., Raleigh, P. (2006b): Abrasivity testing for rock and soils. Tunnels & Tunnelling International, April 2006, 47 - 49.

Nilsen, B., Dahl, F., Holzhäuser, J., Raleigh, P. (2006c): SAT: NTNU's new soil abrasion test. Tunnels & Tunnelling International, May 2006, 43 - 45.

Nilsen, B., Dahl, F., Holzhäuser, J., Raleigh, P. (2007): New test methodology for estimating the abrasiveness of soils for TBM tunneling. RETC 2007 Proceedings, 104 - 116.

COMMENTS AND REMARKS ON SAT TESTING AND TEST RESULTS

The percentages of sample material < 1.0 mm and < 4.0 mm which are given in the tables on page 4 are subsequent to preparation according to the given procedures.

All samples were tested on the sieved portion < 4.0 mm by use of modified SAT pieces. These samples have all an original portion of particles < 4.0 mm which constitutes higher than 90 % of the total sample volume. The SAT values for these samples can hence be regarded as very representative.

There is currently no available classification for SAT values. The SAT is however based on the AVS test and the classification (*see Table 1.*) based on the so far 1747 recorded test results from this test are useful also for describing/evaluating the abrasiveness of soils.

Category	Cumulative %	AVS
Extremely low	0-5%	<1
Very low	5-15%	2-3
Low	15-35%	4-12
Medium	35-65%	13-25
High	65-85%	26-35
Very high	85-95%	36-44
Extremely high	95-100%	>44

Table 1. Classification of AVS for rock samples.

A summary of soil samples tested by use of AVS and SAT per April 2008 is shown in Figure 8.

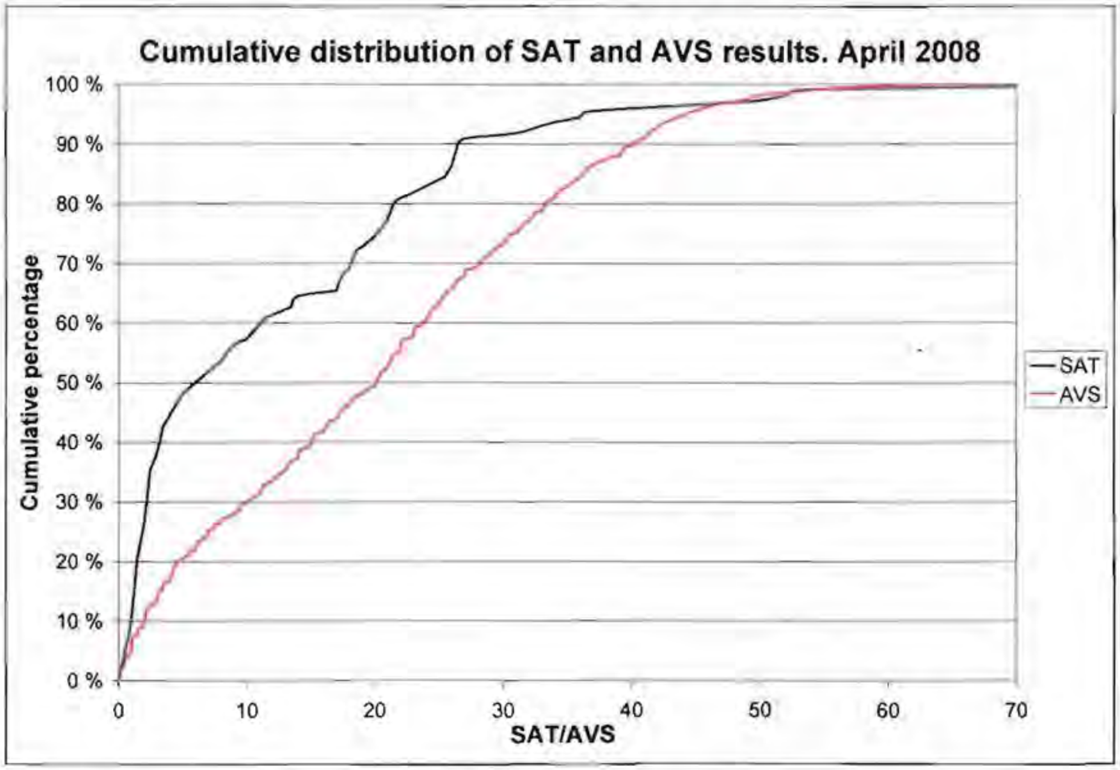


Figure 8. Cumulative distribution of AVS and SAT results. The distribution curves are based on the results from 1747 AVS and 115 SAT tests recorded so far in our database.

Tunnelling in soil is quite different from TBM hard rock excavation, and it is therefore not possible to use the SAT results directly for estimation of wear of cutter tools. There is however evidently similarities concerning cutter tool abrasion, and useful indications of the abrasiveness of soil samples could be obtained by comparing the results with the results for rock. The SAT is therefore believed to represent a great potential for describing/evaluating the abrasiveness of soils.

Based on rock testing, the content of quartz and other hard minerals like garnet and epidote have a major impact on the abrasion on the test pieces, but grain shape and grain binding may also contribute substantially.

In Table 2, AVS results for some sedimentary rocks tested at SINTEF are shown, illustrating that there is a considerable difference in AVS values between the softest (i.e. limestone) and hardest (i.e. quartzite) rocks. As also shown, the AVS value may differ significantly within one type of rock.

Rock type	**Number of samples**	**AVS**
Limestone	17	0.2 – 1.4
Shale	17	0.4 – 10
Siltstone	4	0.4 – 44
Sandstone	36	0.4 – 52
Quartzite	20	17 – 63

Table 2. AVS values for some sedimentary rock samples tested at SINTEF

For quality control, calibration of the test apparatus is performed at regular intervals (normally every 9 -12 months) by use of reference samples from three different rock types.

Rock type	**AVS category**	**AVS test results*) Calibration**	**Acceptance range for AVS calibration**
Quartzite (Metamorphic sandstone) 98% quartz	Extremely high	58	55 – 60
Trondhjemite (Tonalite) 25% quartz, 30% alkali feldspar, 15% plagioclase, 19% mica	Very high	37	35 – 40
Limestone (Jura limestone) 99% carbonate (calcite)	Extremely low	0.5	0 – 1

*) *Mean value of 4 separate tests*

Table 3. The most recent calibration performed by use of reference samples.

"Steel against steel" testing (running the test without abrasion powder) show no measurable abrasion on the test pieces.

PHOTOGRAPHS OF THE SAMPLES PRIOR TO PREPARATION

Sample No. 1, BH-12/S-6. SAT powder was prepared by use of soft hammer and sieving with steel balls. Of the total sample volume, 100.0 % was < 1.0 mm after preparation.

Sample No. 2, BH-31/S-4. SAT powder was prepared by sieving with steel balls. Of the total sample volume, 92.6 % was < 4 mm and 81.7 % was < 1.0 mm after preparation.

Sample No. 3, MW-61. SAT powder was by prepared by sieving with steel balls. Of the total sample volume, 99.1 % was < 4 mm and 84.7 % was < 1.0 mm after preparation.

Sample No. 4, MW-8B. SAT powder was prepared by sieving with steel balls. Of the total sample volume, 91.1 % was < 4 mm and 51.9 % was < 1.0 mm after preparation.

Soil Abrasion Test

(SAT: NTNU's new soil abrasion test,
Tunnels & Tunnelling International,
May 2006, 43-45)

The University of Texas at Austin

Geotechnical Engineering Center
Department of Civil, Architectural and Environmental Engineering

Project name	Silicon Valley Rapid Transit Project
project No.	ADM 329
UT reference	2008_HMM/Bechtel_001_01
Test Date	09/08/2008
Tested by	Seung Han Kim

Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder, 20 mm test piece
Boring number	MW-8B
Sample top depth	25.5 ft
USCS soil type	GP-GM

Result of Soil Abrasion Test (2 cm test piece, passing 4 mm sieve)

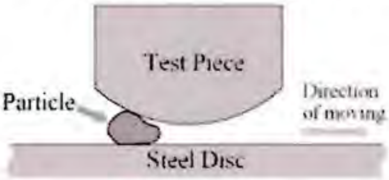
Portion No.	1		2	
Sample description	Soil fraction less than 4 mm without gravel size particles		Soil fraction less than 4 mm with gravel size particles crushed to less than 4 mm	
Test No.	A	B	A	B
Test piece weight loss (mg)	6	4	4	5
AVS	5		4.5	

Photographs of the sample

Portion No. 1	Portion No. 2
	

Note:
Refer to the next page to have the result of SAT using 1 cm test pieces and samples crushed to less than 1 mm.

Observed problem during the test when using 2 cm test piece.



Larger particles stuck between the rotating steel disc and the test piece. Smaller particles passed beneath the test piece without making contact with the test piece, leading an underestimation of the AVS. This happened several times during the 60 second test period and lasted about 2~10 seconds. To mitigate the risk of having influenced abrasion value, another set of test results, obtained using 1 cm test pieces and soils passing 1mm sieve, are provided below

Result of Soil Abrasion Test (1 cm test piece, passing 1 mm sieve)

Portion No.	1		2	
Sample description	Soil fraction less than 1 mm without gravel size particles		Soil fraction less than 1 mm with gravel size particles crushed to less than 1 mm	
Test No.	A	8	A	B
Test piece weight loss (mg)	11	14	17	20
AVS	12.5		18.5	

Photographs of the sample

Portion No. 1	Portion No. 2
	

Parikh Consultant's Inc.

Job #: 204104.T03 Project Engineer: DAVID

Project: SVRT- BART TO SAN JOSE

Location: SAN JOSE Date: 7/25/08

To: DAVID

From: PRAV DAYAH

Attached are the final results of the laboratory test acquired.

Signed By:

Q C Checked By:
Lab Supervisor

Samples:

BH-12/S-6
BH-31/S-4
MW-6I
MW-86

PLEASE NOTE: Lab not responsible for missing data after 48 hours from the above date:

SVRT - TUNNEL SEGMENT

LABORATORY TEST ASSIGNMENT FORM

Boring Number:

Project Name: SVRT - Bart to San Jose
Project Number: 213213
Assigned By: AJ

Date Assigned: 07/17/2008
Date in: Date Out:
Tested By:

Reference No.:
Page: 1 of 1

Sample Number	Boring Number	Sample type	Soil Type	Depth Interval (ft)	U.C., Moisture Content, Dry Density	Moisture Content, Dry Density	Moisture Content	Plasticity Index	Sieve Analysis: 2"-#200	Sieve Analysis: #4-#200	Sieve Analysis: #200	Hydrometer	pH	Sulfate	Calcium Carbonate	Laboratory Vane Shear	1-D Consolidation	1-D Consolidation (CRS)	UU Triaxial Compression	CU Triaxial Compression	CD Triaxial Compression	Ko CU Triaxial Compression	X-Ray Radiography	Static Simple Shear	Cyclic Simple Shear	Strain-Controlled Cyclic Simple Shear	Resonant Column	Extrusion	Visual Classification Test	Special Instructions and/ or Comments
1	BH-12/S-6	SH	CL	55 - 57.5			⊗																					⊗	⊗	
2	BH-31/S-4	SH	SC	55 - 57.5			⊗																					⊗	⊗	Sieve Analysis performed during 35% PE phase
3	MW-6I	Bucket	SP-SM	69 - 70.5					⊗																				⊗	
4	MW-8B	Bucket	GW	25.5 - 28					⊗																				⊗	

8 HRS.

MOISTURE / DENSITY

Project #: 104104.703 Lab # G623 Tested By: PRW Page #: 1/1

Project Name: SVRT - BART to SJ. Date Tested: 7/13/08

					Sieve		Sieve	
Boring #	BH-12/S-6		BH-31/S-4		MW-6I		MW-8I	
Sample #	1		2					
Depth	55-57½		55-57½		69-70½		25.5-28	
Ht of Sample								
Tare #	G64		G41					
Gross Wet Wt.	378.2		396.7					
Gross Dry Wt.	305.6		356.8					
Tare Wt.	84.9		85.0					
Wt. of Water	72.6		39.9					
Net dry Wt.	220.7		271.8					
% Moisture	32.9		14.7					
Dry Density								
Wet Density								
Pocket Pen	2.25							
$\phi = 2.416"$ $f = 0.831$ $\gamma d = \frac{Wds (g) \times f}{L (in)}$ $\gamma d = \frac{4.8493 \times Wds(g)}{(\phi)^2 (in) \times L (in)}$ $\gamma d = pcf \times 0.1572 = KN/m\text{-}cub$	TOP TO BOTTOM LENGTH 27" - TOTAL WET WT. 5233.5 gm MOIST, HARD FAT CLAY. GRAY.		TOTAL LENGTH 21" TOTAL WET WT 4113.6 gm MOIST, LOOSE SILTY SAND WITH SOME GRAVEL, BROWN					

PARIKH CONSULTANTS, INC.

04/06/00

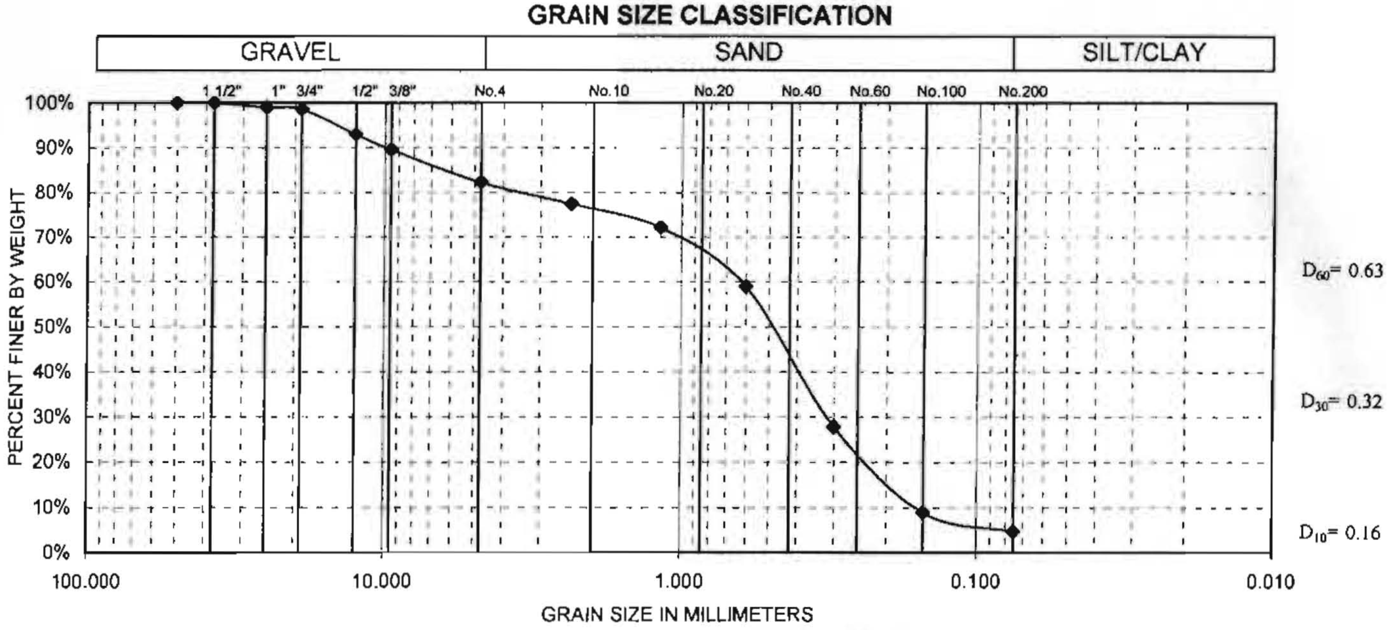
3.5/1

SIEVE ANALYSIS

ASTM C117 & C136, D422 or CAL 202

Project Name:	SVRT - BART To San Jose	Lab #	G623	Project #:	204104.T03
Sample #:	MW-6I Depth: 69'	Tested By::	PD	Date Tested:	7/25/08

U.S. Standard Seive	Weight Retained Cumulative/ Individual	Tare:	Percent RETAINED Cumulative	Percent PASSING Cumulative	Percent PASSING Cumulative		
2-in. (50-mm)			0.0%	100.0%			
1 1/2-in. (37.5-mm)	0.0		0.0%	100.0%		Dry Wt + Tare	100.0
1-in. (25.0-mm)	1.0		1.0%	99.0%		Tare Wt	0.0
3/4-in. (19.0-mm)	1.4		1.4%	98.6%		Dry Wt of Soil	100.0
1/2-in. (12.5-mm)	7.0		7.0%	93.0%			
3/8-in. (9.5-mm)	10.5		10.5%	89.5%			
No. 4 (4.75-mm)	17.8		17.8%	82.2%		**Gravel**	**17.8%**
No. 8 (2.36mm)	22.6		22.6%	77.4%			
No.16 (1.18 - µm)	27.9		27.9%	72.1%		**Sand**	**77.5%**
No.30 (600 - µm)	41.1		41.1%	58.9%			
No.50 (300 - µm)	72.2		72.2%	27.8%		**Fines**	**4.7%**
No.100 (150 - µm)	91.1		91.1%	8.9%			
No.200 (75 - µm)	95.3		95.3%	4.7%	**Dry Wt + #4**		**1,009 gm**
Wash - #200 + Pan			0.0%	100.0%	**Dry Wt - #4**		**4,642 gm**
TOTAL	100.0				**Total Dry Wt**		**5,651 gm**



SAMPLE NO.	DEPTH	U.S.C.	CLASSIFICATION	Cu	Cc
MW-6I	69'	SP	POORLY-GRADED SAND WITH GRAVEL	4.06	1.00

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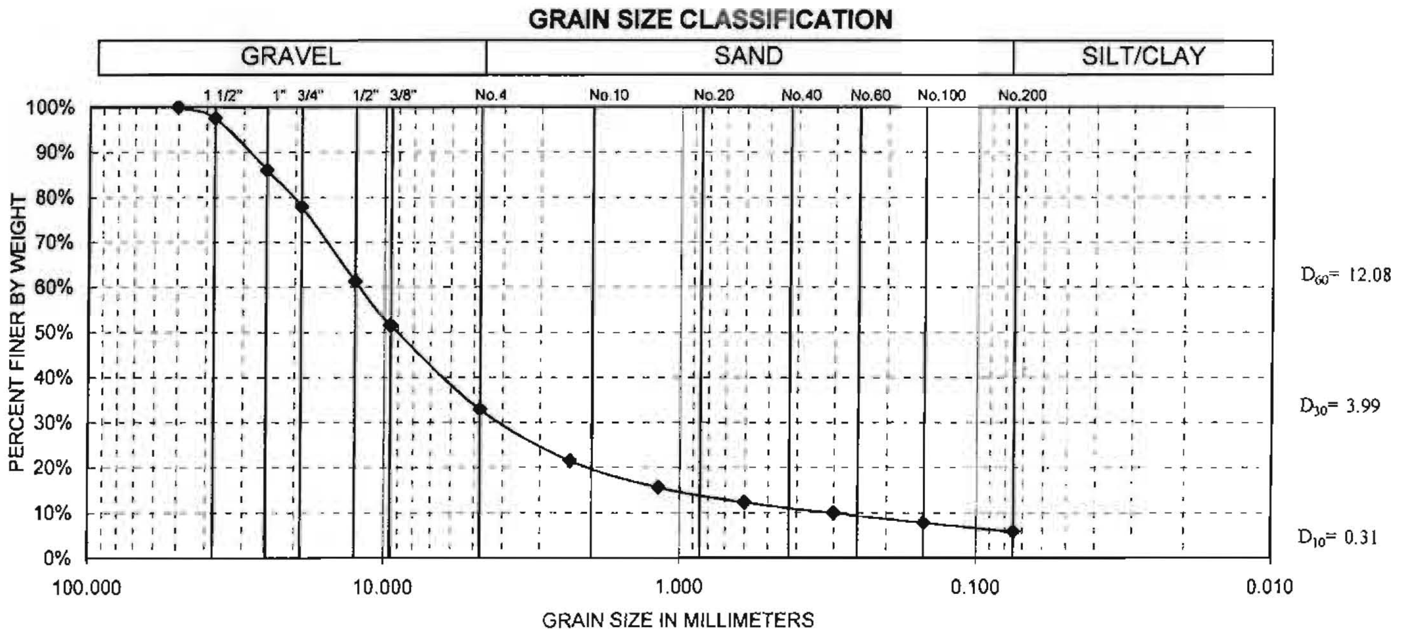
SIEVE ANALYSIS

ASTM C117 & C136, D422 or CAL 202

Project Name:	SVRT - BART To San Jose	Lab #	G623	Project #:	204104.T03
Sample #:	MW-8B Depth: 25.5'	Tested By::	PD	Date Tested:	7/25/08

U.S. Standard Seive	Weight Retained Cumulative/ Individual	Tare:	Percent RETAINED Cumulative	Percent PASSING Cumulative	Percent PASSING Cumulative		
2-in. (50-mm)			0.0%	100.0%			
1 1/2-in. (37.5-mm)	2.5		2.5%	97.5%		Dry Wt + Tare	100.0
1-in. (25.0-mm)	14.0		14.0%	86.0%		Tare Wt	0.0
3/4-in. (19.0-mm)	22.2		22.2%	77.8%		Dry Wt of Soil	100.0
1/2-in. (12.5-mm)	38.8		38.8%	61.2%			
3/8-in. (9.5-mm)	48.5		48.5%	51.5%			
No. 4 (4.75-mm)	67.2		67.2%	32.8%		**Gravel**	**67.2%**
No. 8 (2.36mm)	78.5		78.5%	21.5%			
No.16 (1.18 - µm)	84.4		84.4%	15.6%		**Sand**	**27.0%**
No.30 (600 - µm)	87.7		87.7%	12.3%			
No.50 (300 - µm)	90.1		90.1%	9.9%		**Fines**	**5.8%**
No.100 (150 - µm)	92.2		92.2%	7.8%			
No.200 (75 - µm)	94.2		94.2%	5.8%	**Dry Wt + #4**		**16,517 gm**
Wash - #200 + Pan			0.0%	100.0%	**Dry Wt - #4**		**8,050 gm**
TOTAL	100.0				**Total Dry Wt**		**24,567 gm**



SAMPLE NO.	DEPTH	U.S.C.	CLASSIFICATION	Cu	Cc
MW-8B	25.5'	GP-GM	POORLY-GRADED GRAVEL WITH SILT AND SAND	39.13	4.28

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Appendix 12: Mineralogy Test Results

CAMET Research, Inc. www.camet-lab.com X-Ray Analysis for Industry and Research

Anil Dean, PE, GE
Hatch Mott MacDonald
3825 Hopyard Road, Suite 240
Pleasanton, CA 94588

July 7, 2008

RE: Soil Mineralogy Testing - SVRT Project
P.O. No.: 24965-PO-00012
Report No.: 60060108

It was requested to test a total of eleven (11) soils for abrasivity by mineralogical and petrographic evaluations. The soil samples received were labeled and classified as follows:

Silicon Valley Rapid Transit Project

S.	Boring	Depth	Sample	Soil Type
1	BH-20	57.2	S-12	GW-GC
2	BH-21	56.5	S-8	GW-GC
3	BH-26	56.7	S-8	SP-SC
4	BH-28	67.7	S-11	CL
5	BH-31	61.2	S-5	GP-GM
6	BH-46	50.9	S-18A	ML/CL
7	BH-78	26	S-6	GW-GC
8	MW-6I	69		SP w/ gravel
9	MW-2G	70.5		SW-SM
10	MW-8B	25.5		GW-GM w/ sand
11	MW-8B	39		SP-SM

Below are the specific test assignments requested for each soil sample:

S. No.	XRD	Sieve/Hyd	XRF	Clay ID	Petrography	Durability
1	1	1	1			
2	1	1	1			
3	1	1	1		1	
4	1		1	1		
5	1	1	1		1	
6	1		1	1		
7	1	1	1		1	
8	1	1	1		1	1
9	1	1	1		1	1
10	1	1	1		1	1
11	1	1	1		1	1

TEST PROCEDURES [a]

XRD (X-ray powder diffraction analysis) was performed on a horizontal Rigaku powder diffractometer using CuKα radiation with a diffracted beam monochromator. The specifics of the XRD techniques used are described in the RESULTS section of this report.

Sieve/Hydrometer tests were performed in accordance with ASTM D422-07.

XRF (wavelength dispersive X-ray fluorescence analysis) was performed using methods outlined in "The Practical Guide for Preparation of Specimens for X-ray Fluoerescence and X-ray Diffraction Analysis" .

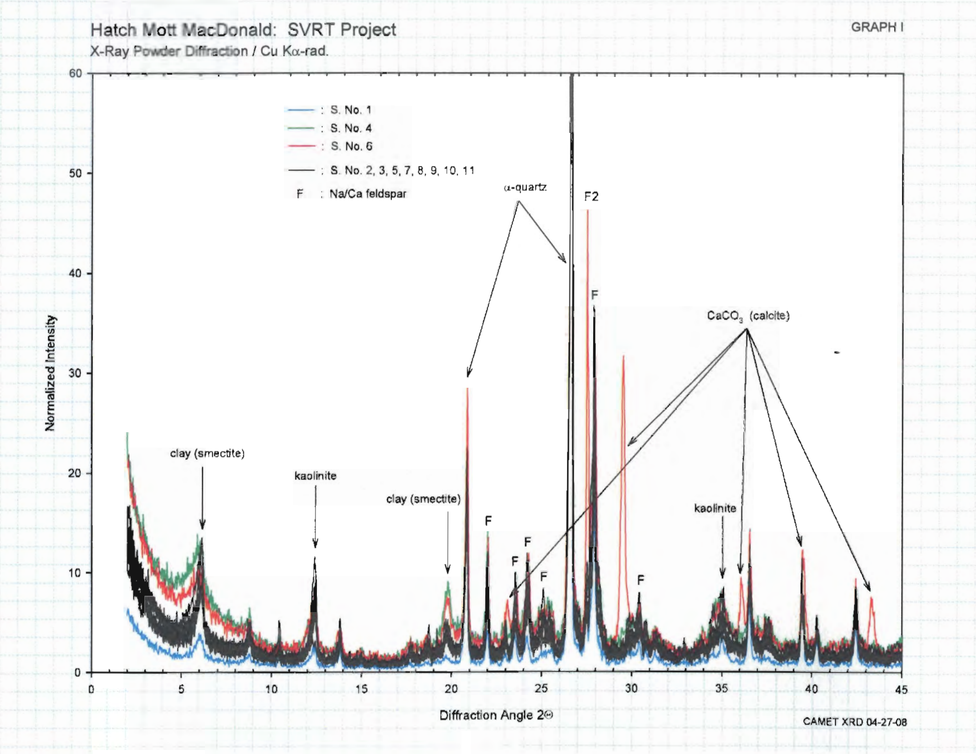
Clay ID was determined by the method described in Reference 3.

Petrography was performed in accordance with ASTM C295.

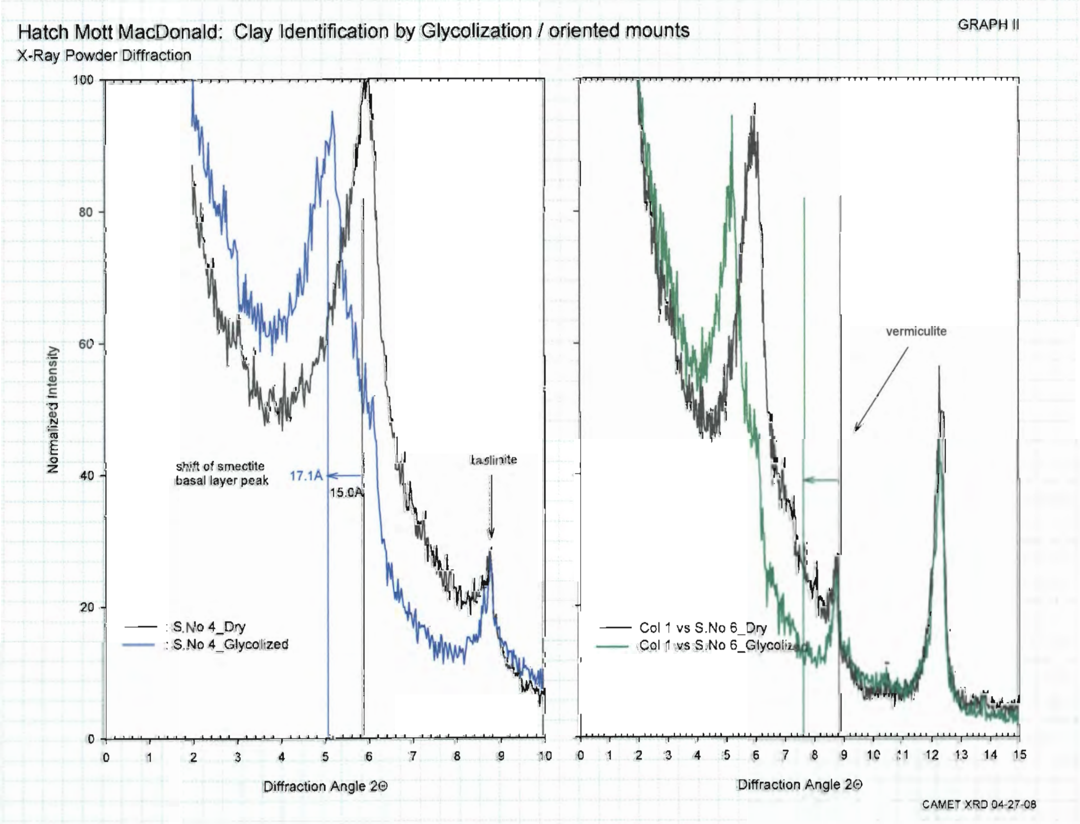
Durability was performed in accordance with accordance with ASTM D3744

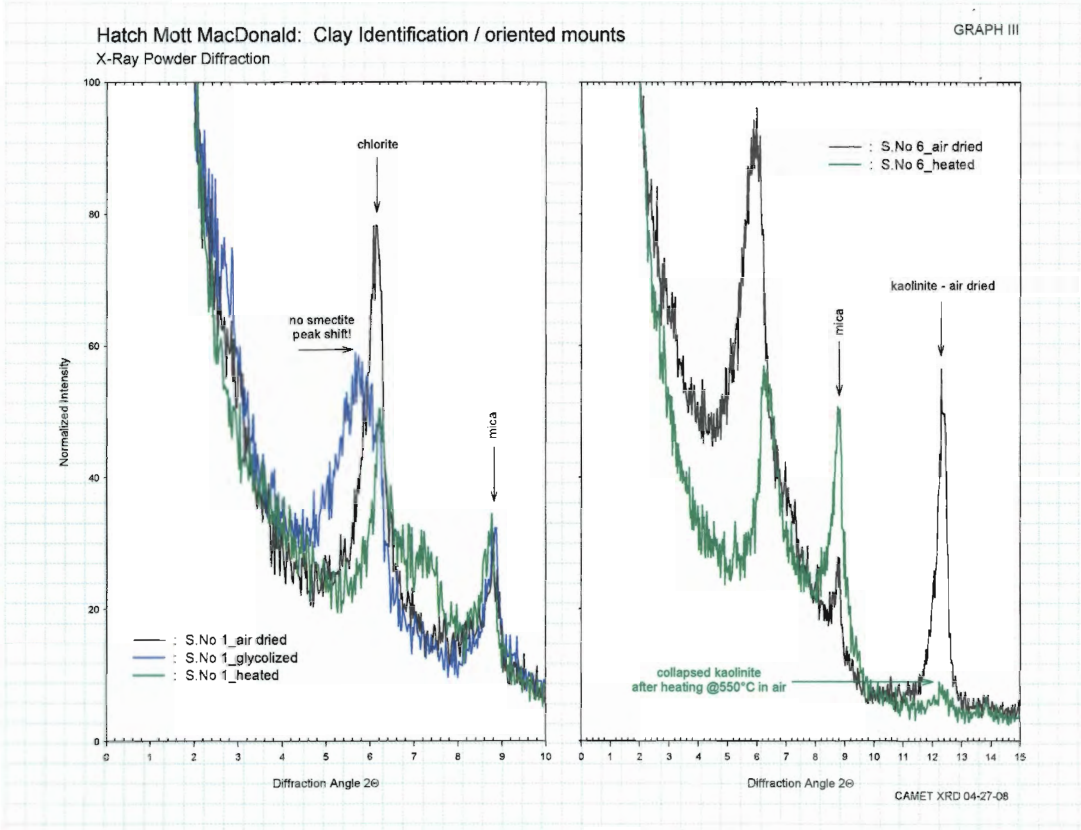
RESULTS

XRD and Clay ID

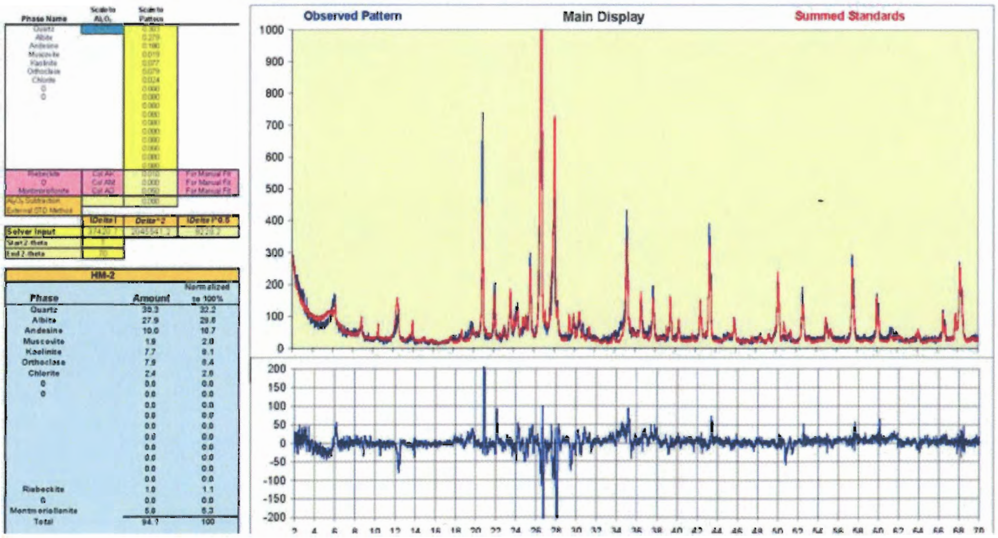


X-ray powder diffraction patterns were produced from fractions passing through a 325 mesh sieve (<45µm) of each homogenized soil. GRAPH I shows all the XRD patterns combined which were obtained from each of the 11 soils. Except for soil No. 6, all materials exhibit very similar concentrations of the rock forming minerals quartz, feldspar, expansive clay (smectite) and non-expansive clay (kaolinite, mica). Only soil No. 6 shows a considerable amount of calcite ($CaCO_3$) in addition to these minerals. With respect to expansive clay content, the eleven soils appear to fall into three distinctive groups: soil No.1, soil No. 4 & 6 and the remaining soils No. 2, 3 ,5,7,8,9,10 and 11. The presence of expansive clay was confirmed in soils No. 4 and 6 (GRAPH II) by ethylene glycol treatment while the presence of kaolinite was found in soil No. 6 by heat treatment in air (GRAPH III).





The actual mineral concentrations of the three soil groups were obtained by least squares analysis of the full diffraction pattern (FULLPAT) of soils No. 1, 2 and 6.



HM-2		
Phase	Amount	Normalized to 100%
Quartz	30.3	32.2
Albite	27.9	29.6
Andesine	10.0	10.7
Muscovite	1.9	2.0
Kaolinite	7.7	8.1
Orthoclase	7.9	8.4
Chlorite	2.4	2.6
0	0.0	0.0
0	0.0	0.0
	0.0	0.0
	0.0	0.0
	0.0	0.0
	0.0	0.0
	0.0	0.0
	0.0	0.0
	0.0	0.0
	0.0	0.0
Riebeckite	1.0	1.1
0	0.0	0.0
Montmorillonite	5.8	6.3
Total	94.7	100

Determination of mineral content of soil No. 2 by full pattern analysis (FULLPAT)

The table below lists the approximate(!) mineral concentrations for the three soil groups. The actual concentrations within each group can be expected to vary from the values listed in the table.

Mineral	Hardness	Soil No. 1	Soil No. 2, 3, 5, 7, 8, 9, 10, 11	Soil No. 4, 6
	(Mohs)	wt%	wt%	wt%
Quartz	7	51.0	32.0	24.0
Albite	6-6.5	21.0	30.0	22.0
Andesine	5-6	10.0	10.5	13.0
Orthoclase	6-6.5	8.5	8.5	12.0
Riebeckite	5	1.0	1.0	
Calcite	3-4			6*
Clay mineral:				
Muscovite	2.5-3	1.0	2.0	1.0
Kaolinite	2-2.5	5.5	8.0	11.0
Chlorite	1-2	1.5	3.0	3.0
Montmorillonite	1-2	--	5.0	8.0
Total Clay content		10	18	23

Nonexpansive clays: muscovite kaolinite chlorite
Expansive clay (smectite): montmorillonite
Feldspars: Albite, Andesine, Orthoclase
* no $CaCO_3$ content in soil No. 4

WDXRF

The material received was dried at 60°C to remove excess water, pulverized in a SPEX ball-type mill to pass a 150µm sieve (No.100) and subsequently homogenized and dried at 110°C to constant weight (oven dry weight). Approximately three grams of material were placed in a porcelain crucible and calcined at 950°C in a muffle furnace. Samples 4 and 6 (clays) showed an elevated weight loss when compared to the other samples. It should be noted that XRD could identify calcium carbonate ($CaCO_3$) in sample 6. When heated in air at 900° $CaCO_3$ starts to decompose to calcium oxide CaO and carbon dioxide gas CO_2.

Prior to the fusion process, the mass loss associated with the calcination is reported as loss on ignition (LOI) and accounts in general for free moisture (a), combined water/organics (b) and CO_2/organics (c). The materials calcined were mixed with a lithium borate flux and fused to beads at 1000°C in a muffle furnace. The glass beads were ground and polished to produce a flat surface for the X-ray analysis. Elemental data sets were collected on a Siemens SRS200 wavelength dispersive XRF spectrometer for which instrument calibration was established with USGS and Estonia reference rocks .

The table below lists the elemental composition (expressed in oxide) of the homogenized fraction of each soil:

Analyte	**Soil No.**										
	1 wt%	**2** wt%	**3** wt%	**4** wt%	**5** wt%	**6** wt%	**7** wt%	**8** wt%	**9** wt%	**10** wt%	**11** wt%
SiO_2	76.47	67.19	68.74	62.13	66.51	61.84	67.36	68.82	71.63	65.61	71.89
Al_2O_3	10.54	12.60	11.74	15.23	12.72	12.49	13.91	12.39	12.76	13.74	13.33
Fe_2O_3	4.19	5.52	5.62	6.06	5.60	5.83	6.04	5.68	5.84	6.19	4.24
CaO	2.05	2.27	1.99	1.82	2.66	2.69	2.59	2.06	2.22	2.88	1.68
MgO	1.95	2.67	2.54	2.82	2.67	2.62	2.88	2.92	2.72	2.86	1.89
Na_2O	2.56	2.77	2.72	2.48	3.34	3.59	4.48	3.17	2.61	3.66	2.87
K_2O	1.66	1.79	1.49	2.44	1.64	1.64	1.54	1.69	1.45	1.74	2.39
TiO_2	0.45	0.59	0.60	0.78	0.59	0.59	0.70	0.59	0.65	0.64	0.52
P_2O_5	0.11	0.15	0.15	0.14	0.16	0.16	0.17	0.17	0.18	0.14	0.15
LOI	2.51	3.31	3.36	5.02	3.25	7.68	2.69	2.99	3.76	2.27	2.58
Total	102.48	98.86	98.96	98.92	99.13	99.14	102.37	100.49	103.83	99.73	101.55

It should be noted that the higher LOI in Sample 6 is consistent with the presence of calcium carbonate that was found in that sample only by XRD

L Keller

Ludwig Keller, Ph.D.
CAMET RESEARCH, INC.

[a] XRD measurements were carried out by CAMET Research, Inc.

Sieve/Hydrometer tests were carried out by Pacific Materials Laboratory, 35S La Patera Ln, Goleta, CA 93117

Tel. 805.964.6901)

XRF measurements were carried out by Chemistry of Concrete, 6409 Camino Vista #E, Goleta, CA 93117 Tel. 805.965.9844

Clay ID measurements were carried out by CAMET Research, Inc.

Petrographic analysis was carried out by Analytical Consulting Group, Inc, 1746F Victoria Ave., Ventura, CA 93003 Tel 805.642.8180

Durability tests were carried out by Twining Laboratories of Southern California, 2883 East Spring Street, Long Beach, CA Tel 562.426.3355

[1] Buhrke, VE, Jenkins R, Smith DK, A Practical Guide for the Preparation of Specimens for X-ray Fluorescence and X-ray Diffraction Analysis, Chapter 3, Whole Rock Analysis, Wiley-VCH, 1998.

[2] Chipera, S.J. and Bish, D.L., *"FULLPAT: a full pattern quantitative analysis program for X-ray powder diffraction using measured and calculated patterns"*, J. Appl. Cryst. 35, 744-749 2002

[3] T. Kiipli, R.A. Batchelor, R.M. Rousseau, et al., *"Seven Sedimentary Rock Reference Samples from Estonia"*, Oil Shale, 2000,Vol. 17, No. 3, p. 215-223

Pacific Materials Laboratory of Santa Barbara, Inc.

35-A South La Patera Lane
P.O. Box 96
Goleta, CA 93116
Ph: (805) 964-6901

Santa Ynez
Ph: (805) 688-7587

FAX No: (805) 964-6239
E-mail: pml@pml.sbcoxmail.com

April 18, 2008
Lab No: 79546-2
File No: 08-12785-2

Chemistry of Concrete
Attn: Michael Neff, SM PE
6409 Camino Vista #E
Goleta, CA 93117

SUBJECT: Sieve and Hydrometer Tests (ASTM D422)
Soil Samples Delivered to PML
SVRT project

Dear Mr. Neff:

In accordance with the request of Thomas Holzheu, sieve and hydrometer tests (ASTM D422) were performed per your chain of custody on eleven (11) soil samples delivered to this laboratory on April 4, 2008.

It should be noted; all of the samples containing material larger than the No. 10 sieve did not have enough material to meet the minimum quantity specified in ASTM D422 section 5.1.1 based on the nominal diameter of largest particles. The results of the testing is shown graphically in Appendix A.

If you have any questions concerning this matter, please do not hesitate to call. Thank you for the opportunity of providing this service.

Respectfully submitted,

PACIFIC MATERIALS LABORATORY, INC.

R Pike

Ronald J. Pike, C. E. 42788

RJP:kfb

APPENDIX A

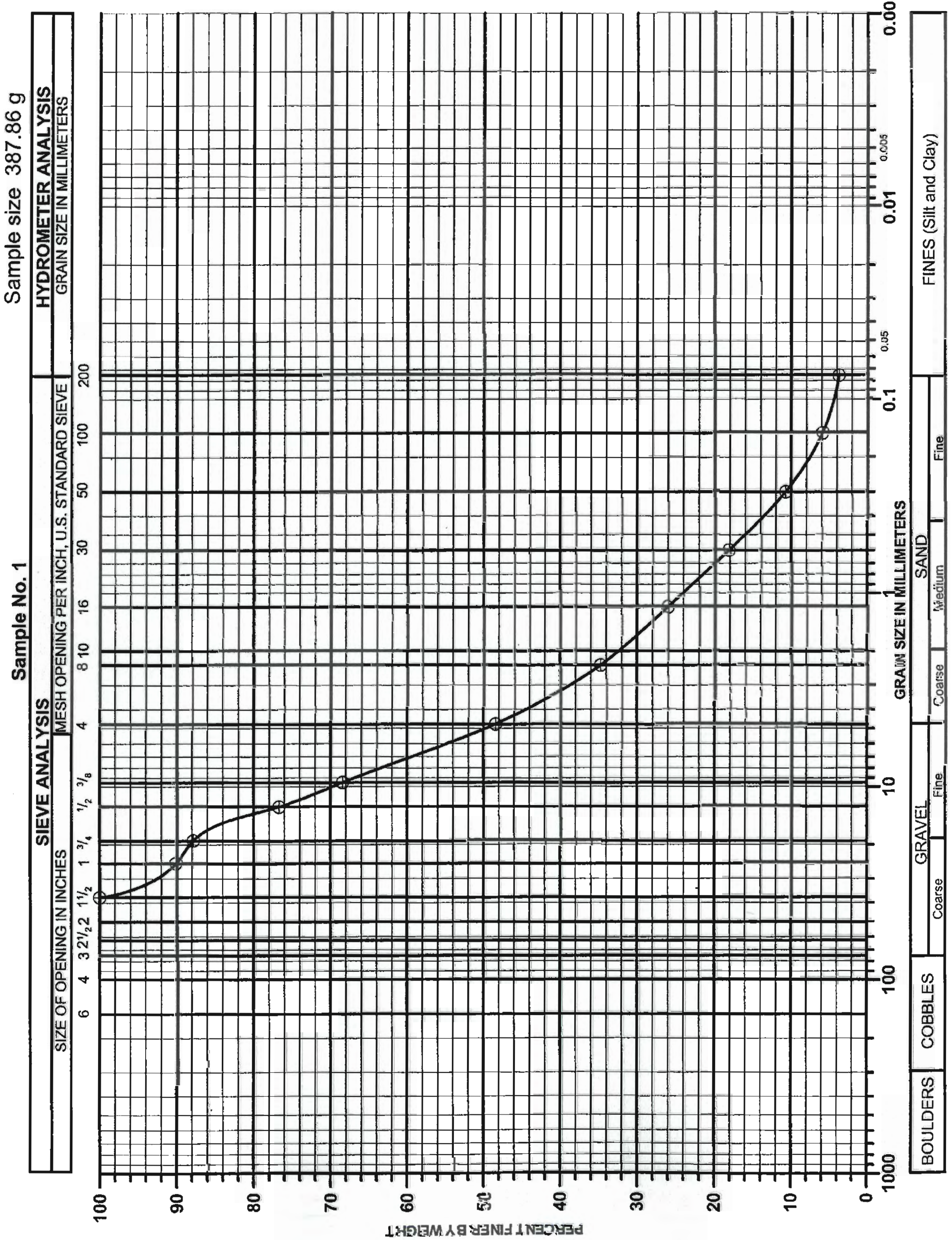
LABORATORY TESTS

April 18, 2008

Lab No: 79546-2

File No: 08-12785-2

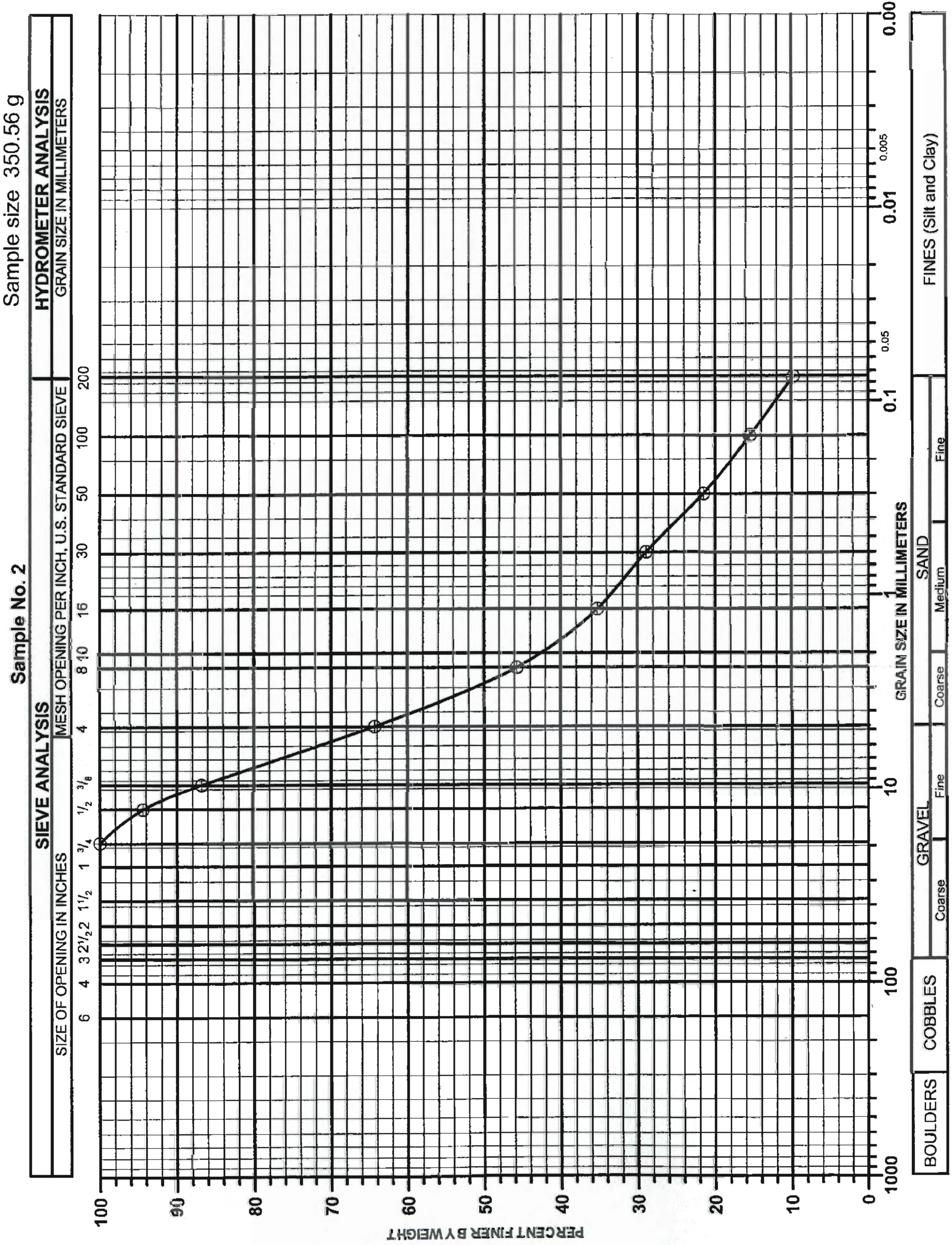
Pacific Materials Laboratory of Santa Barbara, Inc.

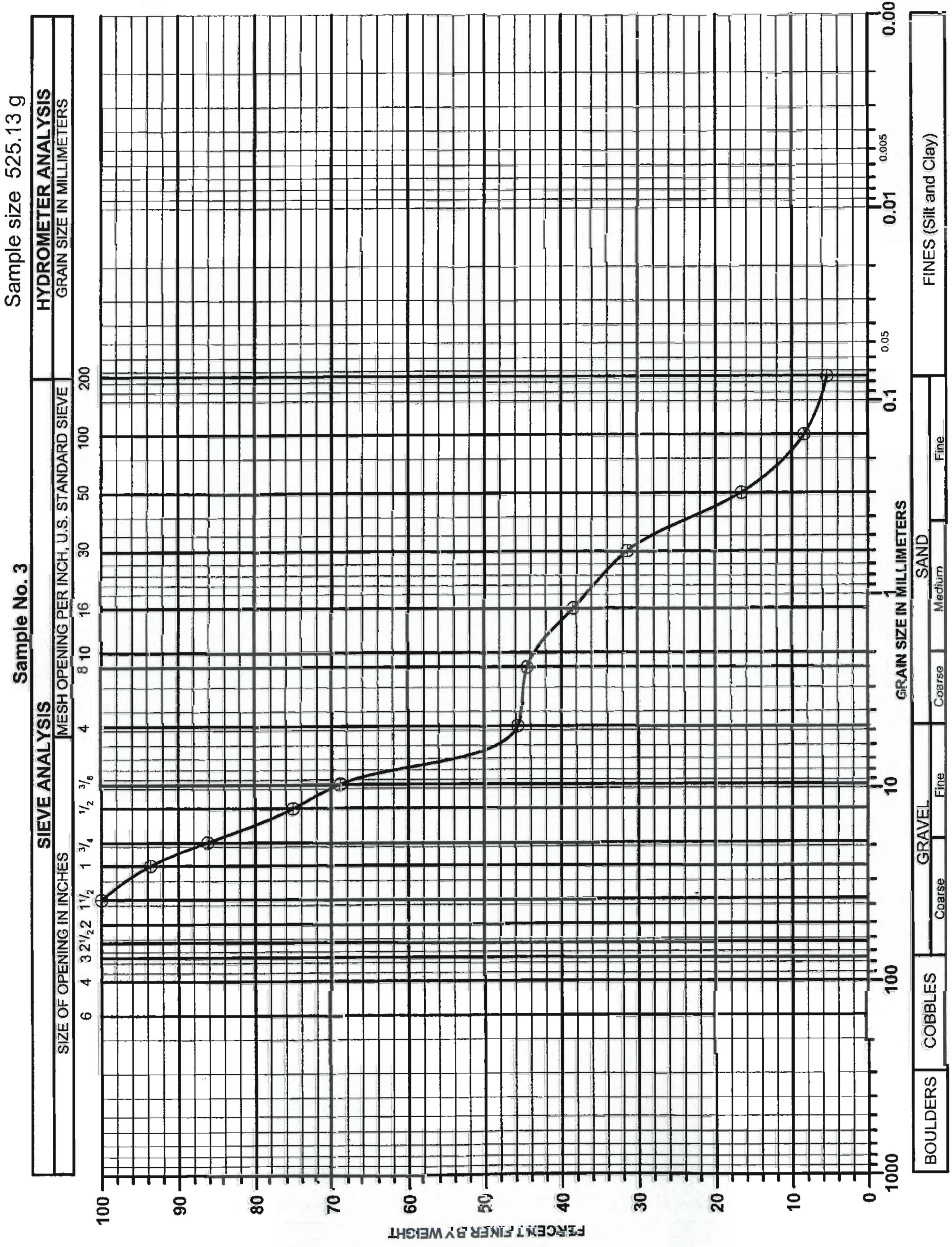


Pacific Materials Laboratory

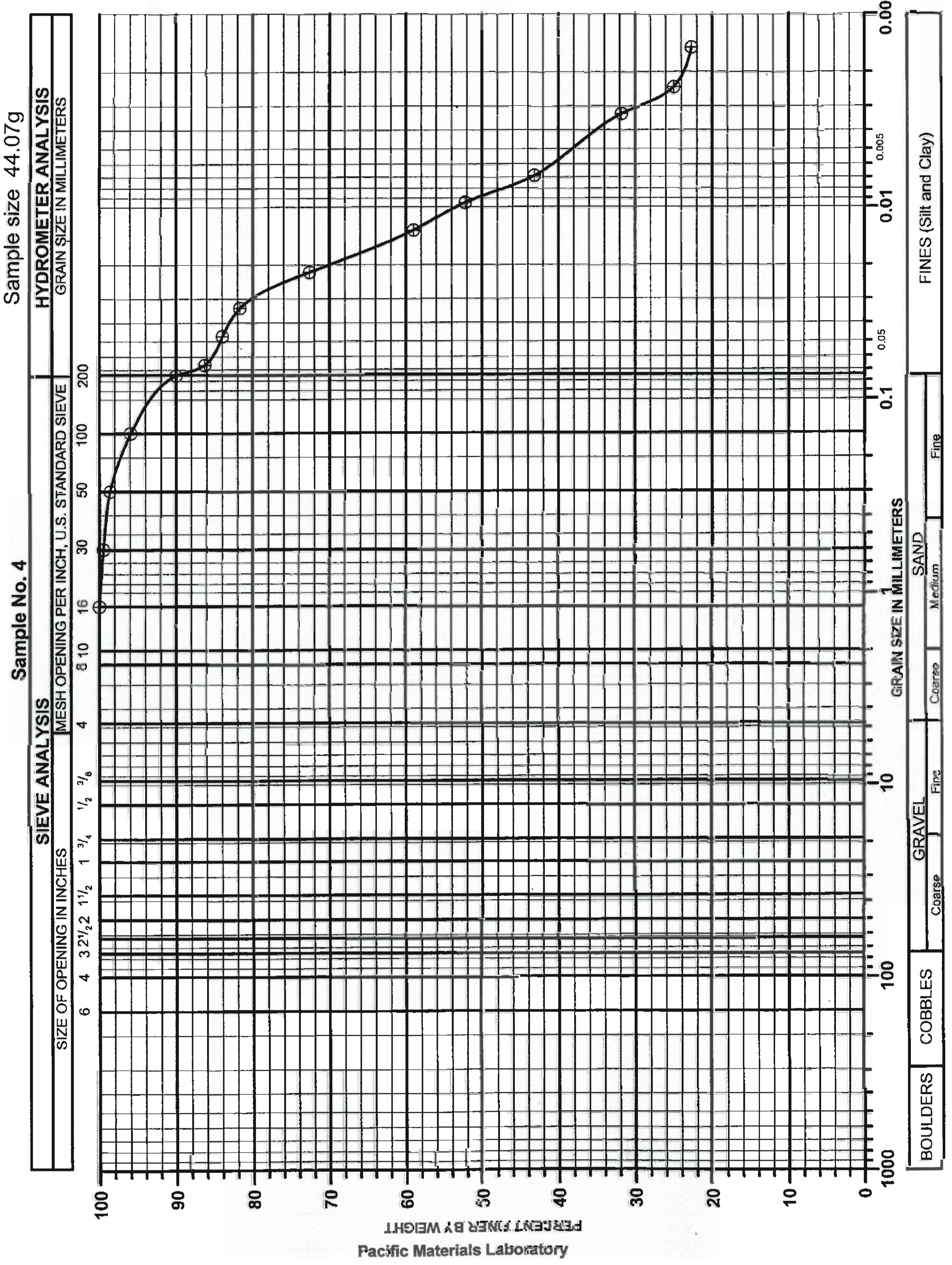
Sample No. 2

Sample size 350.56 g



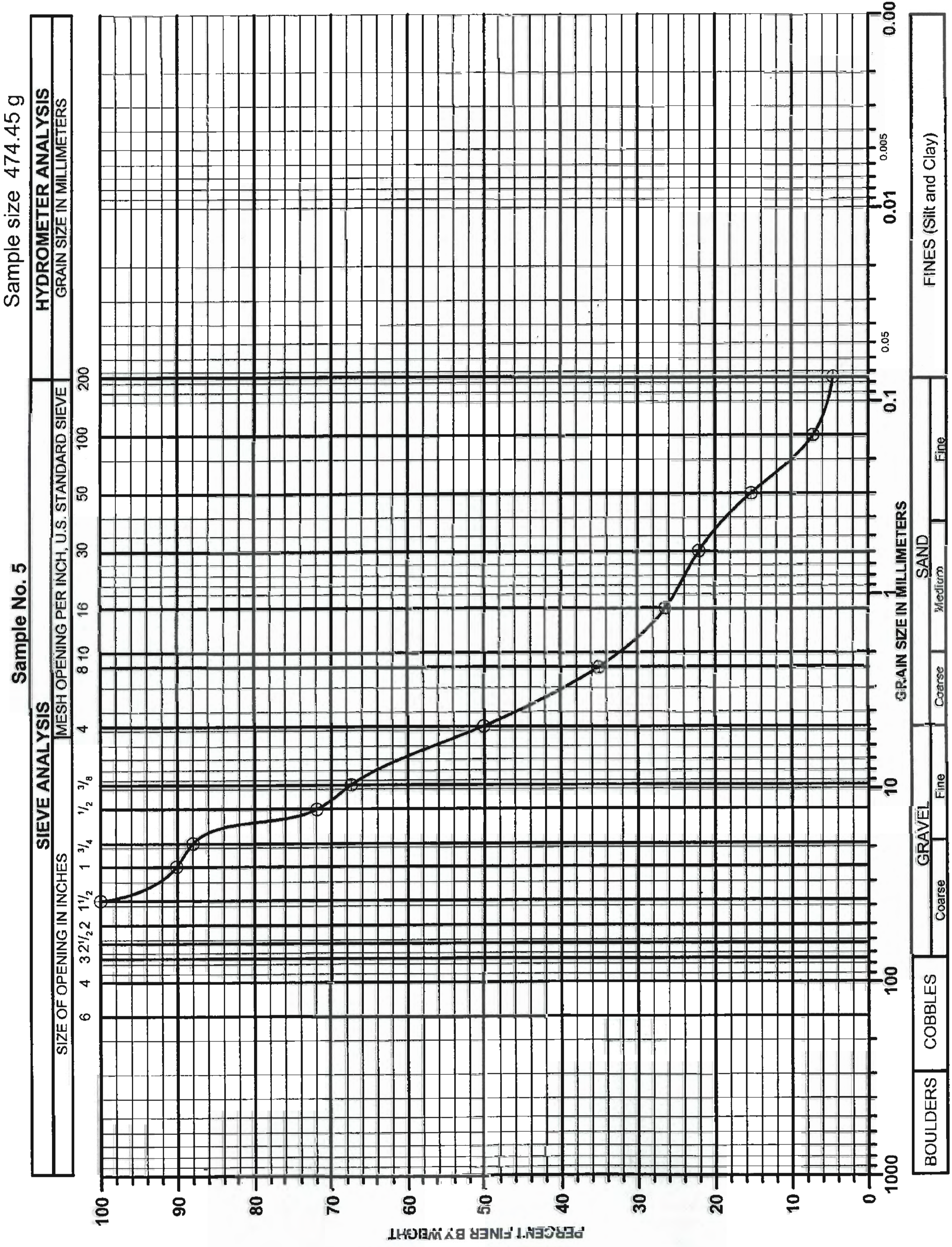


Pacific Materials Laboratory

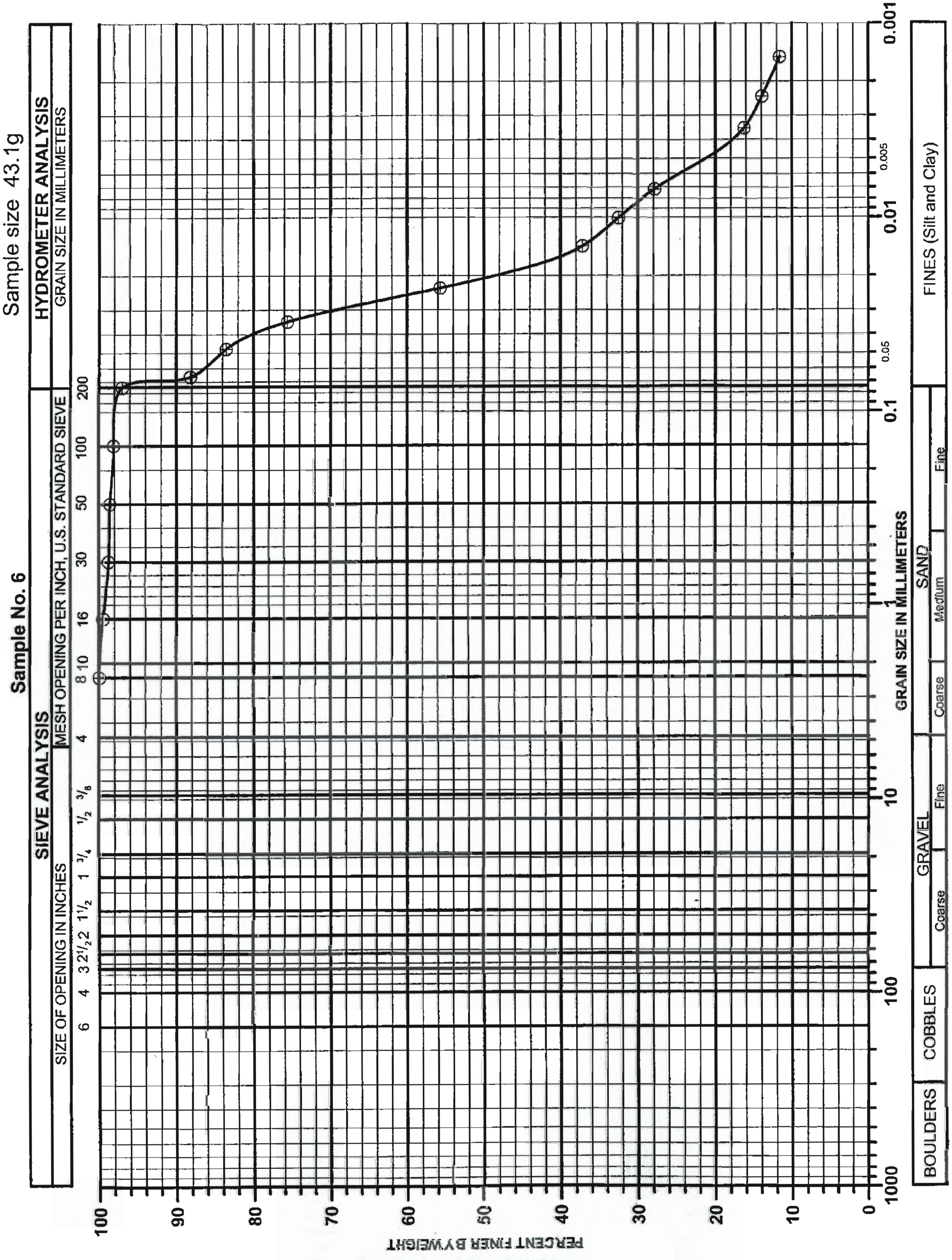


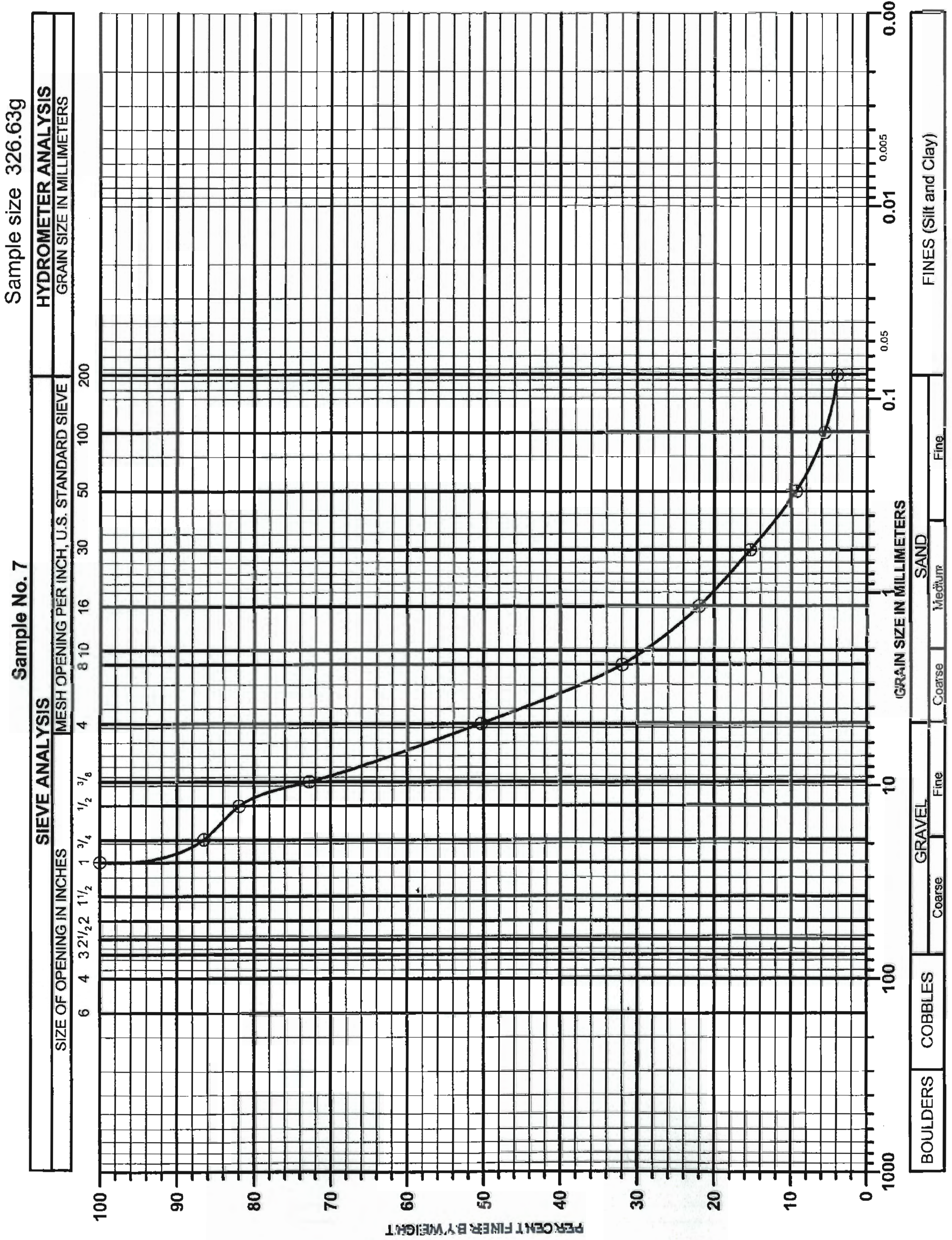
Sample No. 4

Sample size 44.07g

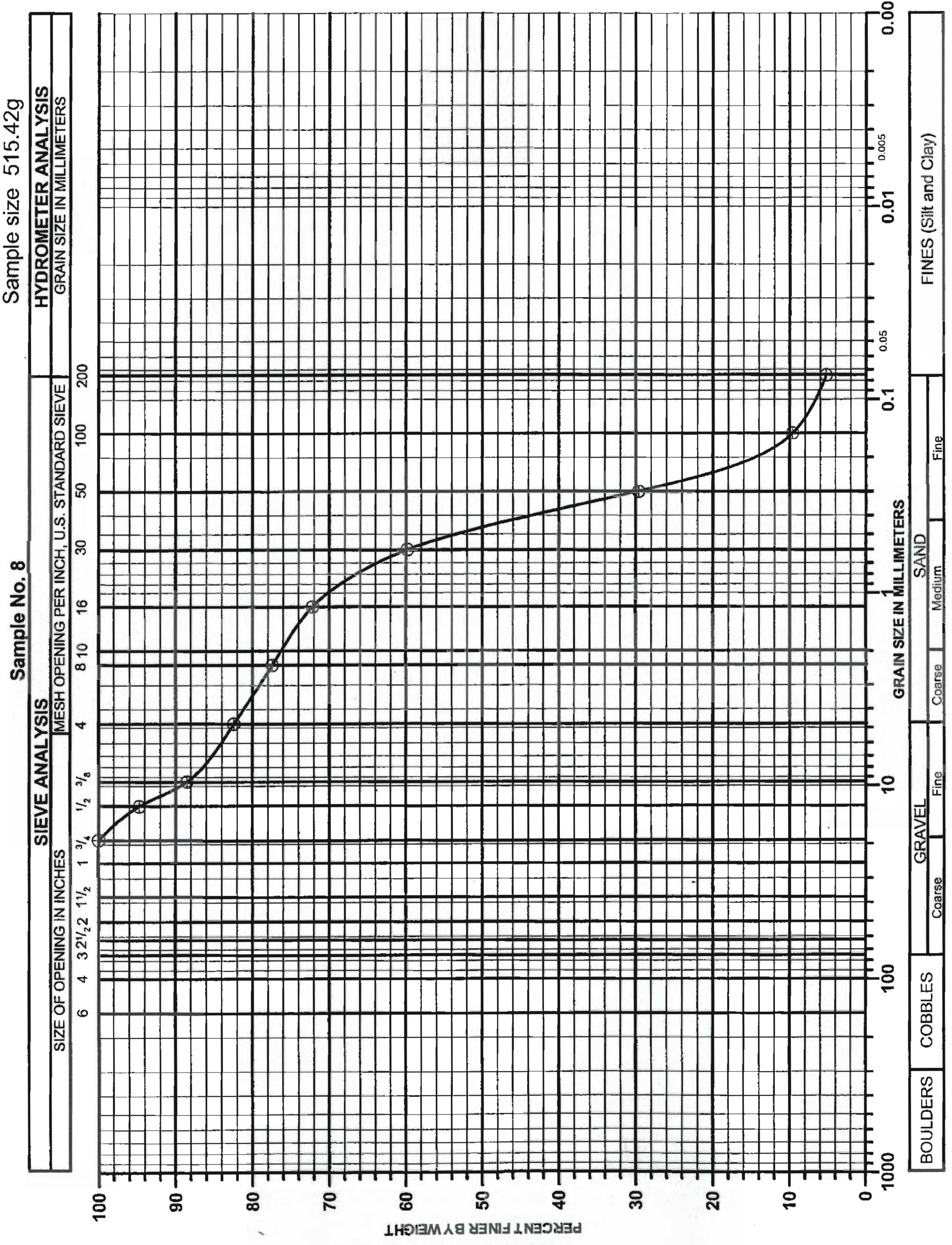


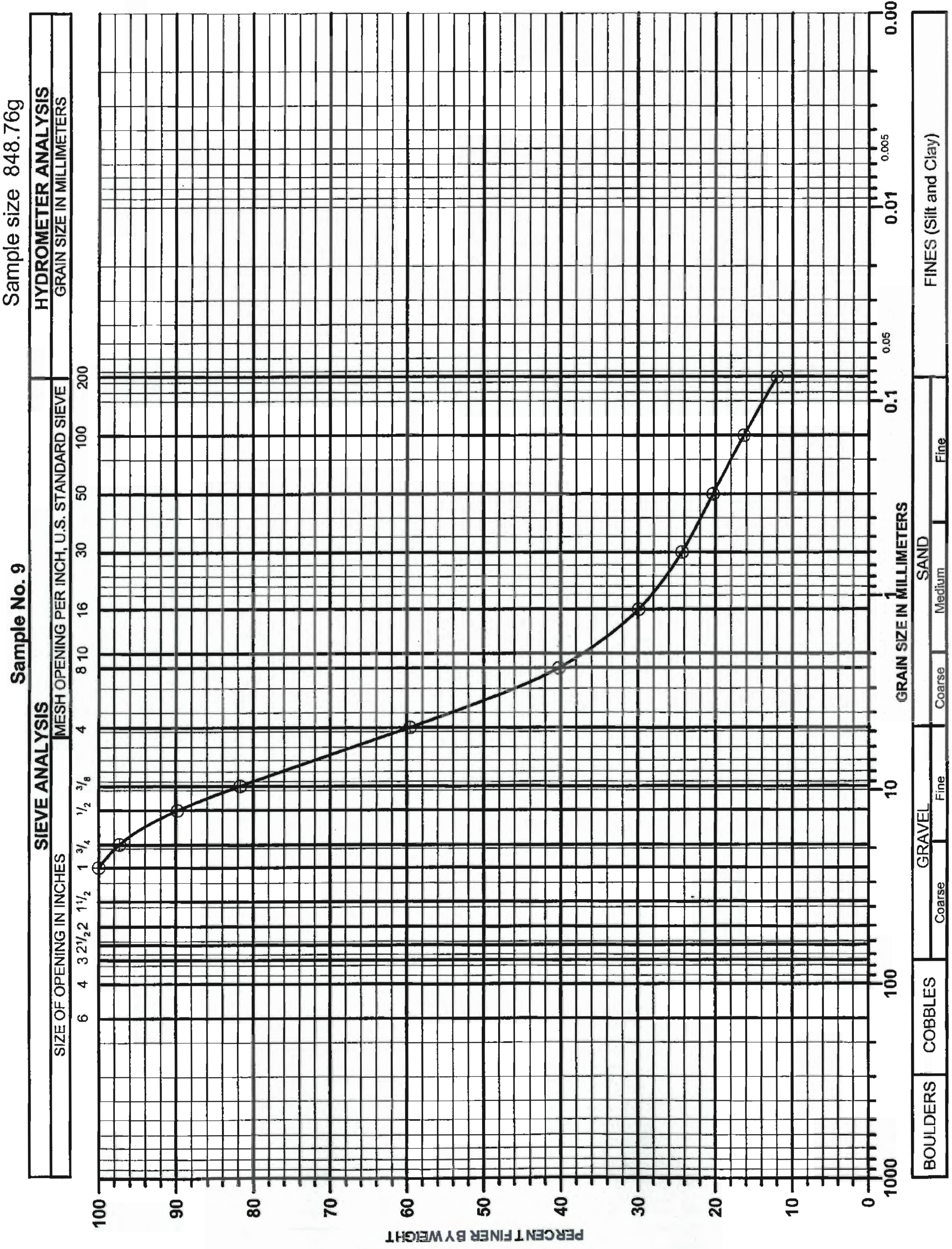
Pacific Materials Laboratory


Sample No. 6
Sample size 43.1g
SIEVE ANALYSIS
SIZE OF OPENING IN INCHES
6 4 3 2½ 2 1½ 1 ¾ ½ ⅜
MESH OPENING PER INCH, U.S. STANDARD SIEVE
4 8 10 16 30 50 100 200
HYDROMETER ANALYSIS
GRAIN SIZE IN MILLIMETERS
PERCENT FINER BY WEIGHT
100
90
80
70
60
50
40
30
20
10
0
GRAIN SIZE IN MILLIMETERS
1000
100
10
1
0.1
0.05
0.01
0.005
0.001
BOULDERS
COBBLES
GRAVEL
Coarse
Fine
SAND
Coarse
Medium
Fine
FINES (Silt and Clay)

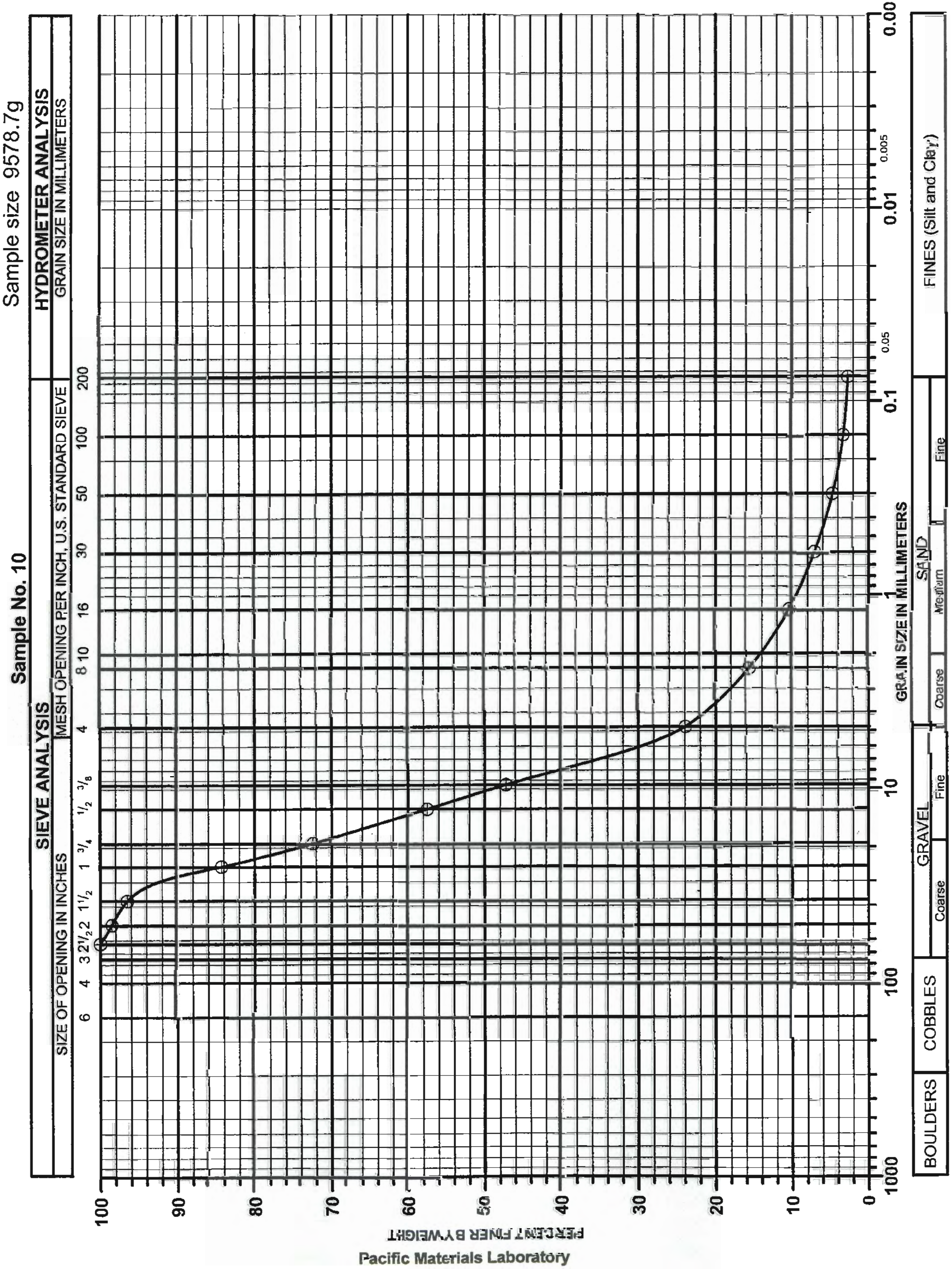


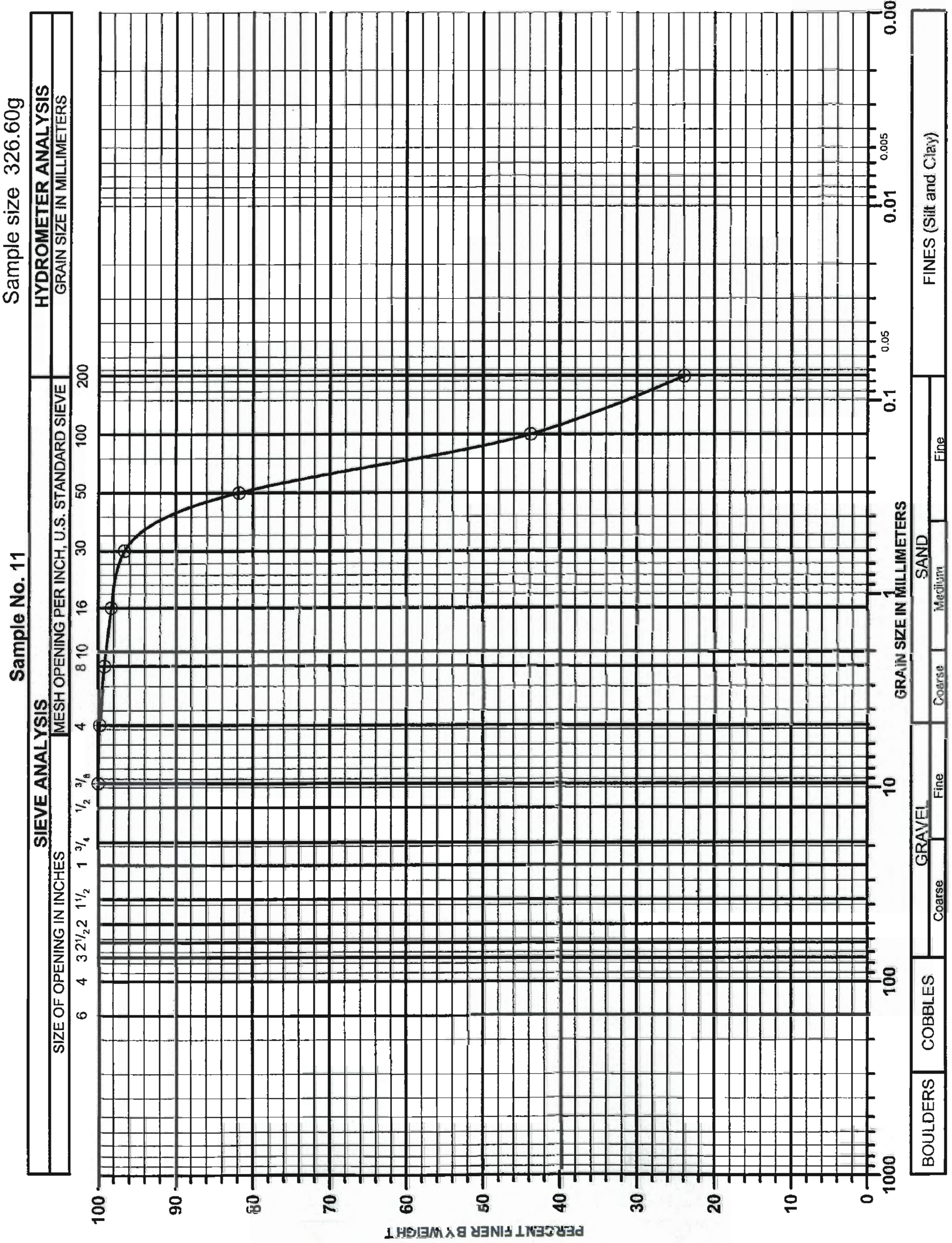
Pacific Materials Laboratory


Sample No. 8
Sample size 515.42g
SIEVE ANALYSIS
HYDROMETER ANALYSIS
SIZE OF OPENING IN INCHES
6
4
3
2½
2
1½
1
¾
½
⅜
MESH OPENING PER INCH, U.S. STANDARD SIEVE
4
8
10
16
30
50
100
200
GRAIN SIZE IN MILLIMETERS
PERCENT FINER BY WEIGHT
100
90
80
70
60
50
40
30
20
10
0
GRAIN SIZE IN MILLIMETERS
1000
100
10
1
0.1
0.05
0.01
0.005
0.001
BOULDERS
COBBLES
GRAVEL
Coarse
Fine
SAND
Coarse
Medium
Fine
FINES (Silt and Clay)



Pacific Materials Laboratory


Sample No. 10
Sample size 9578.7g



Pacific Materials Laboratory

Analytical Consulting Group, Inc.

June 25, 2008

ACG Lab No. P0804-555

CAMET Research, Inc.
6409 Camino Vista
Goleta, CA 93117
Attn: Dr. Ludwig Keller

Subject: ASTM C-295 Petrographic Examination of Soil Sample, SVRT Project

One sample of sandy gravel, identified as SVRT Sample 3: **BH-26 @ 56.7 ft**, was submitted to Analytical Consulting Group, Inc. (ACG) for petrographic examination. The purpose of the examination was to determine the lithological composition of the sample. The sample identification and the USCS classification assigned by the client is listed in the attached table.

The sample was sieved into fractions retained on the $^{3}/_{8}$-in, #4, #8, #16, #30, #50, #100, #200, and passing #200 sieves. Each fraction (except the +$^{3}/_{8}$-in) was further split to yield approximately 100 particles for analysis.

The examination was conducted in accordance with ASTM C-295. The examination was performed using a stereobinocular microscope at 5x to 40x magnification. The finest sand fractions and some crushed grains from coarser fractions were examined immersed in refractive index liquid, using the polarized-light microscope at up to 400x magnification. The enclosed table and charts present the lithologic data for the samples, given as percent by particle count (approximate weight percent) for each size fraction except for the +$^{3}/_{8}$″. The composition of the +$^{3}/_{8}$″ sample was determined by weighing each type of rock due to the range of particle sizes. A weighted average is calculated for the sample using the fraction weights determined by the sieve analysis. The sample data is presented in the attached table and chart. The analytical sensitivity for this method is approximately 0.1% for the weighted average of the sample.

The sample is composed primarily of fine-grained sandstones, siltstones, and mineral grains (principally quartz and feldspar) derived from the rocks. Volcanic and plutonic rocks are also present. Lithic clasts dominate in the larger size fractions and discrete mineral grains in the finer fractions.

Sandstones make up about 45% of the sample. The sandstones range from greywacke to quartz wacke, with lithic to arkosic types dominating. The sandstones are well cemented and some have probably undergone some metamorphism. The matrix consists of clay, mica, and/or chlorite, with variable amounts of iron oxide. No carbonates are present. Thin quartz veins are frequent in the greywackes. The sandstone particles are tan, grey, green, or reddish in color, generally equant, and rounded to subangular, with a few angular crushed particles.

Dark grey siltstone and shale constitute about 7% of the sample. These rocks consist primarily of silt-sized quartz and feldspar grains with clay, mica, and/or chlorite. Some of these rocks are transitional to slate or schist. Thin quartz veins are frequent. The siltstone/shale particles are typically rounded to subrounded and equant to elongated in shape. About ⅔ of the siltstone and shale particles are flat.

Other rock types present in the coarser fractions include volcanic (21%) and plutonic (11%) rocks. The volcanic rocks include a variety of holocrystalline intermediate to siliceous rocks and a few basalts. The groundmass of these rocks generally consists of microgranular quartz and feldspar or chert. Most of the volcanic rocks are metamorphosed to varying degrees, with some grading into quartz schist. The plutonic rocks in this sample are mostly medium-grained granitic rocks.

The proportion of free mineral grains increases with decreasing grain size. Mineral grains in the fine fractions consist primarily of quartz and feldspar, with small amounts of mafic minerals. Some fine-grained rock fragments, mostly siltstone/shale and metavolcanic rocks, persist into the finer fractions.

The sandstones in the #4+ fractions are generally fresh, sound, hard, and tough. Most grains require a light hammer blow (with a 3-lb hammer on a steel anvil) to break. Two percent of the sandstone particles in the #8 fraction were weathered. The weathered sandstone is much less tough but generally not friable. The sandstone particles in the finer fractions are less tough and can be crushed with forceps. The sandstones break down to a mixture of hard grains, mostly quartz, and soft clay/mica matrix.

The siltstone/shale particles are fresh, sound, moderately hard, and moderately tough (can be crushed by a very light tap from the hammer). Grains with quartz veins are hard and quite tough. The volcanic and granitic rocks are generally very hard and tough.

The observations and conclusions given above are ACG's professional opinions based on laboratory observation of the samples as submitted and on information supplied by the client. Extension of these observations or conclusions to the product represented by the samples is the responsibility of the user. No warranty, express or implied, is made or intended in connection with the above investigation, or by the furnishing of this report, or by any other oral or written statement.

We appreciate the opportunity to be of service to you. If you have any questions, please call us at (805) 642-8180.

Respectfully submitted,
Analytical Consulting Group, Inc.

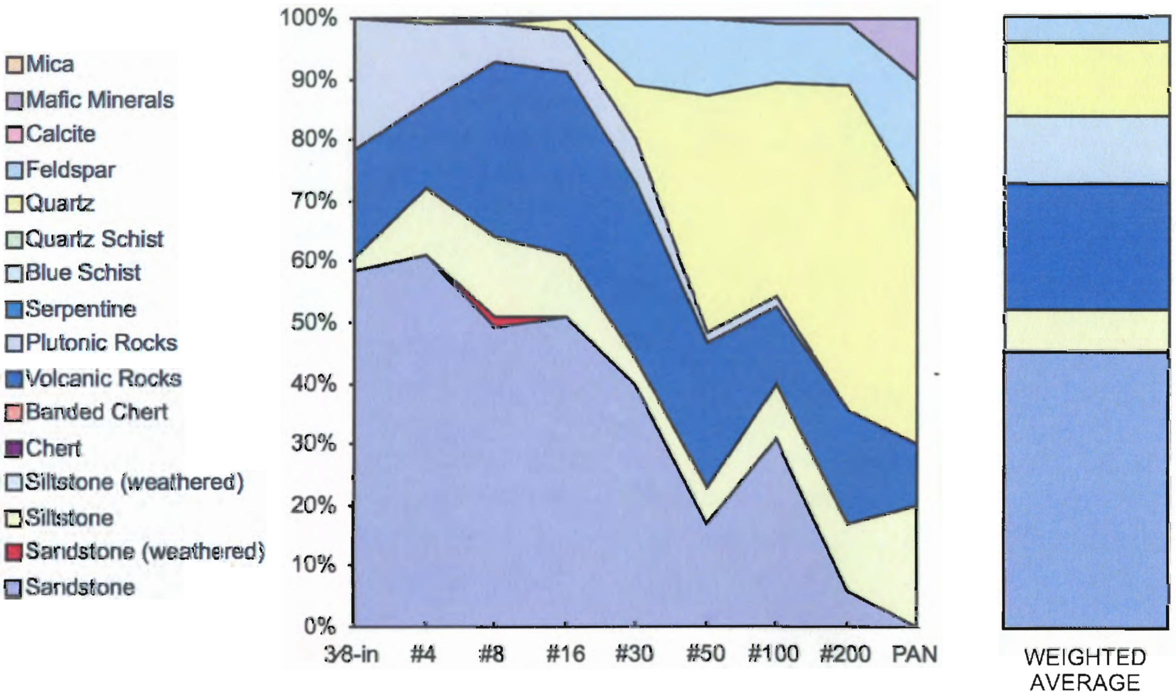
Michael R. Tiffany, Petrographer
Analytical Consulting Group, Inc.
Professional Geologist No. 6750

REGISTERED GEOLOGIST
MICHAEL R. TIFFANY
No. 6750
GEOLOGIST
STATE OF CALIFORNIA

ASTM C-295 Petrographic Analysis
SVRT Sample 3: BH-26 @ 56.7 ft
SP-SC

Rock/Mineral Type	**Size Fraction**									**Weighted Average**
	$^3/_8$-in	#4	#8	#16	#30	#50	#100	#200	PAN	
Sandstone	58.5%	61.0%	49.0%	51.0%	40.0%	16.8%	31.1%	5.9%		45.0%
Sandstone^W			2.0%							0.2%
Siltstone	2.0%	11.0%	13.0%	10.0%	4.0%	5.9%	8.7%	10.9%	20.0%	6.7%
Volcanic Rocks	17.7%	14.0%	29.0%	30.0%	29.0%	23.8%	12.6%	18.8%	10.0%	20.5%
Plutonic Rocks	21.8%	13.0%	6.0%	7.0%	7.0%	2.0%	1.9%		0.0%	11.0%
Quartz		1.0%	0.0%	2.0%	9.0%	38.6%	35.0%	53.5%	40.0%	12.2%
Feldspar			1.0%		11.0%	12.9%	9.7%	9.9%	20.0%	4.2%
Mafic Minerals							1.0%	1.0%	10.0%	0.1%
Weight Fraction	32.2%	14.7%	10.2%	7.0%	6.8%	16.2%	9.7%	3.1%	0.1%	

^{W} = weathered



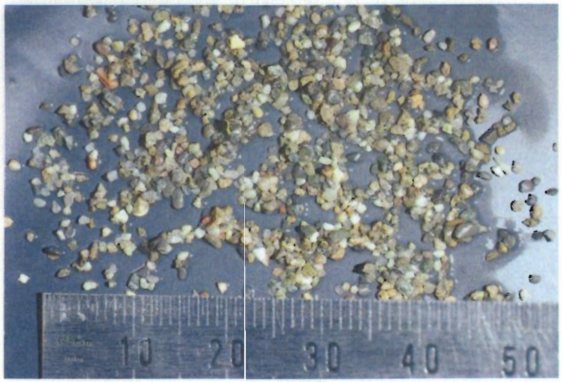
SVRT Sample 3: BH-26 @ 56.7 ft

+3/8″

#4

#8

#16



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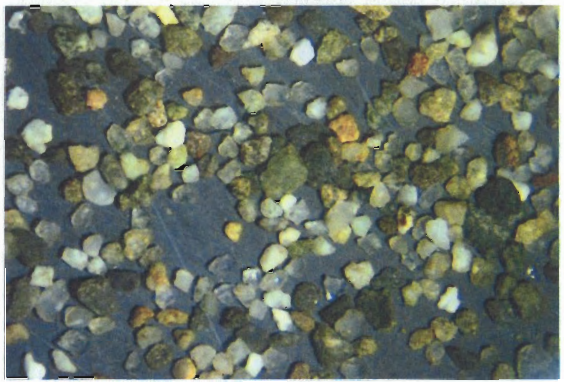

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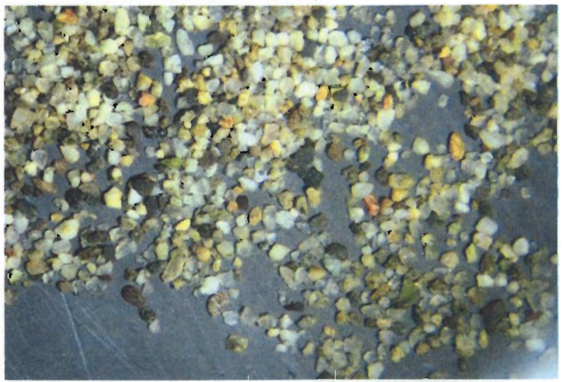

#100

Analytical Consulting Group, Inc.

June 26, 2008

ACG Lab No. P0804-555

CAMET Research, Inc.
6409 Camino Vista
Goleta, CA 93117
Attn: Dr. Ludwig Keller

Subject: ASTM C-295 Petrographic Examination of Soil Sample, SVRT Project

One sample of sandy gravel, identified as SVRT Sample 5: **BH-31 @ 61.2 ft**, was submitted to Analytical Consulting Group, Inc. (ACG) for petrographic examination. The purpose of the examination was to determine the lithological composition of the sample. The sample identification and the USCS classification assigned by the client is listed in the attached table.

The sample was sieved into fractions retained on the $^{3}/_{8}$-in, #4, #8, #16, #30, #50, #100, #200, and passing #200 sieves. Each fraction (except the +$^{3}/_{8}$-in) was further split to yield approximately 100 particles for analysis.

The examination was conducted in accordance with ASTM C-295. The examination was performed using a stereobinocular microscope at 5x to 40x magnification. The finest sand fractions and some crushed grains from coarser fractions were examined immersed in refractive index liquid, using the polarized-light microscope at up to 400x magnification. The enclosed table and charts present the lithologic data for the samples, given as percent by particle count (approximate weight percent) for each size fraction. A weighted average is calculated for the sample using the fraction weights determined by the sieve analysis. The sample data is presented in the attached table and chart. The analytical sensitivity for this method is approximately 0.1% for the weighted average of the sample.

In general, the sample is composed primarily of fine-grained sandstones, siltstones, and mineral grains (quartz and feldspar) derived from the rocks. Lithic clasts dominate in the larger size fractions and discrete mineral grains in the finer fractions.

Sandstones make up about 52% of the sample. The sandstones range from greywacke to quartz wacke, with lithic to arkosic types dominating. The sandstones are well cemented and some have probably undergone some metamorphism. The matrix consists of clay, mica, and/or chlorite, with variable amounts of iron oxide. No carbonates are present. Thin quartz veins are frequent in the greywackes. The sandstone particles are tan, grey, green, or reddish in color, generally equant, and rounded to subangular, with a few angular crushed particles.

Dark grey siltstone and shale constitute about 7% of the sample. These rocks consist primarily of silt-sized or smaller quartz grains with clay, mica, and/or chlorite. Some of these rocks are transitional to slate or schist. Thin quartz veins are frequent. The siltstone/shale particles are typically rounded to subrounded and equant to elongated in shape. About $^{2}/_{3}$ of the siltstone and shale particles are flat.

Other rock types present in the coarser fractions include volcanic and plutonic rocks. The volcanic rocks include a variety of holocrystalline intermediate to siliceous rocks and a few basalts. The groundmass of these rocks generally consists of microgranular quartz and feldspar or chert. Most of the volcanic rocks are metamorphosed to varying degrees, with some grading into quartz schist. The plutonic rocks consist primarily of a variety of granitic rocks and some diabase.

The proportion of free mineral grains increases with decreasing grain size. Mineral grains in the fine fractions consist primarily of quartz and feldspar, with trace amounts of amphibole, chlorite, biotite, epidote, and iron oxides. Some fine-grained rock fragments, mostly siltstone/shale and metavolcanic rocks, persist into the finer fractions.

The sandstones in the #4+ fractions are generally fresh, sound, hard, and tough. Most grains require a light hammer blow (with a 3-lb hammer on a steel anvil) to break. The sandstone particles in the finer fractions are less tough and can be crushed with forceps. The sandstones break down to a mixture of hard grains, mostly quartz, and soft clay/mica matrix.

The siltstone/shale particles are fresh, sound, moderately hard, and moderately tough (can be crushed by a very light tap from the hammer) to moderately soft (crush easily with forceps). Grains with quartz veins are hard and quite tough. The volcanic and plutonic rocks are generally very hard and tough.

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We appreciate the opportunity to be of service to you. If you have any questions, please call us at (805) 642-8180.

Respectfully submitted,
Analytical Consulting Group, Inc.

Michael R. Tiffany, Petrographer
Analytical Consulting Group, Inc.
Professional Geologist No. 6750

REGISTERED GEOLOGIST
MICHAEL R. TIFFANY
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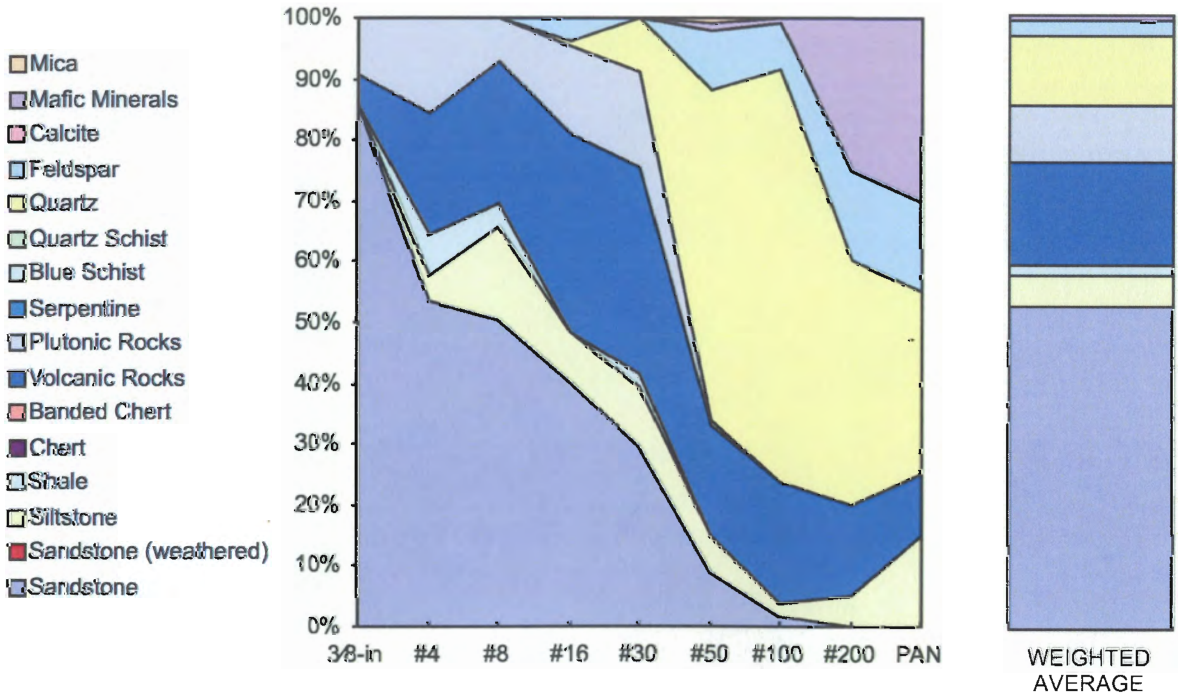
GEOLOGIST
STATE OF CALIFORNIA

ASTM C-295 Petrographic Analysis
SVRT Sample 5: BH-31 @ 61.2 ft
GP-GM

Rock/Mineral Type	Size Fraction									Weighted Average
	⅜-in	#4	#8	#16	#30	#50	#100	#200	PAN	
Sandstone	85.7%	53.5%	50.5%	40.4%	29.7%	9.0%	1.9%			52.4%
Siltstone		4.0%	15.2%	7.7%	9.9%	6.0%	1.9%	5.0%	15.0%	4.9%
Shale		6.9%	4.0%		2.0%					2.0%
Volcanic Rocks	4.8%	19.8%	23.2%	32.7%	33.7%	18.0%	20.0%	15.0%	10.0%	16.8%
Plutonic Rocks	9.5%	15.8%	7.1%	14.4%	15.8%	1.0%				9.3%
Quartz				1.0%	8.9%	54.0%	67.6%	40.0%	30.0%	11.6%
Feldspar				3.8%		10.0%	7.6%	15.0%	15.0%	2.2%
Mafic Minerals						1.0%	1.0%	25.0%	30.0%	0.9%
Mica						1.0%				0.1%
Weight Fraction	34.0%	18.1%	15.1%	9.4%	4.4%	7.1%	9.0%	2.7%	0.2%	



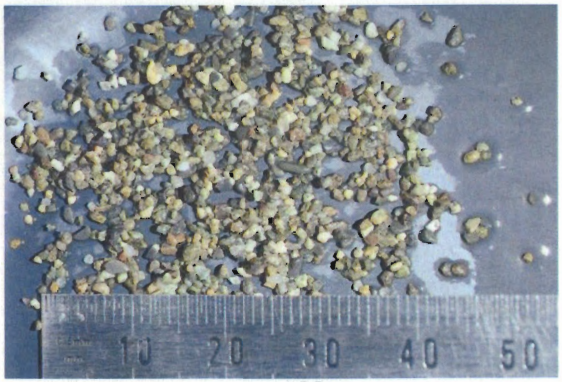
SVRT Sample 5: BH-31 @ 61.2 ft

3/8″

#4

#8

#16



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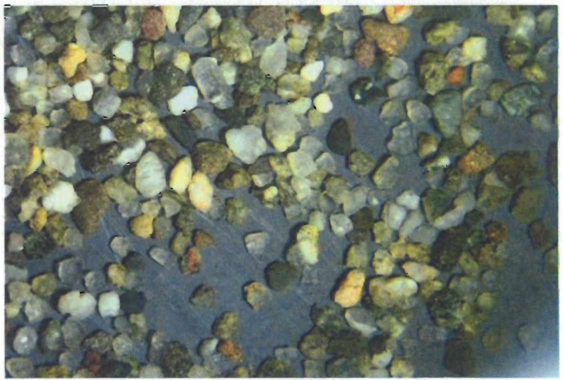

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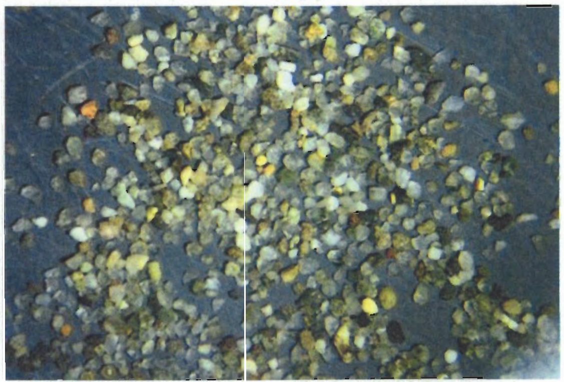

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Analytical Consulting Group, Inc.

June 30, 2008

ACG Lab No. P0804-555

CAMET Research, Inc.
6409 Camino Vista
Goleta, CA 93117
Attn: Dr. Ludwig Keller

Subject: ASTM C-295 Petrographic Examination of Soil Sample, SVRT Project

One sample of soil, identified as SVRT Sample 7: **BH-78 @ 26 ft**, was submitted to Analytical Consulting Group, Inc. (ACG) for petrographic examination. The purpose of the examination was to determine the lithological composition of the sample. The sample identification and the USCS classification assigned by the client is given in the attached table.

The sample was sieved into fractions retained on the ⅜-in, #4, #8, #16, #30, #50, #100, #200, and passing #200 sieves. Each fraction (except the +⅜-in) was further split to yield approximately 100 particles for analysis.

The examination was conducted in accordance with ASTM C-295 using a stereobinocular microscope at 5x to 40x magnification. The finest sand fractions and some crushed grains from coarser fractions were examined immersed in refractive index liquid, using the polarized-light microscope at up to 400x magnification. The enclosed table and charts present the lithologic data for the samples, given as percent by particle count (approximate weight percent) for each size fraction. The composition of the +⅜″ sample was determined by weighing each type of rock rather than particle count. A weighted average is calculated for the sample using the fraction weights determined by the sieve analysis. The sample data is presented in the attached table and chart. The analytical sensitivity for this method is approximately 0.1% for the weighted average of the sample.

In general, the sample is composed primarily of fine-grained sandstones, siltstones, and mineral grains (quartz and feldspar) derived from the rocks. Lithic clasts dominate in the larger size fractions and discrete mineral grains in the finer fractions.

Sandstones make up about 65% of the sample. The sandstones range from greywacke to quartz wacke, with lithic to arkosic types dominating. The sandstones are well cemented and some have probably undergone some metamorphism. The matrix consists of clay, mica, and/or chlorite, with variable amounts of iron oxide. No carbonates are present. Thin quartz veins are frequent in the greywackes. The sandstone particles are tan, grey, green, or reddish in color, generally equant, and rounded to subangular, with a few angular crushed particles. A few weathered sandstone particles are present in the coarsest fractions.

Dark grey siltstone and shale constitute about 12% of the sample. These rocks consist primarily of silt-sized quartz grains with clay, mica, and/or chlorite. Some of these rocks are transitional to slate or schist. Thin quartz veins are frequent. The siltstone/shale particles are typically rounded to subrounded and equant to elongated in shape. About $\frac{2}{3}$ of the siltstone and shale particles are flat.

Minor rock types present in the coarser fractions include volcanic rocks, granitic rocks, and diabase. The granitic rocks and diabase are grouped as plutonic rocks. The volcanic rocks include a variety of holocrystalline intermediate to siliceous rocks. The groundmass of these rocks generally consists of microgranular quartz and feldspar or chert. Most of the volcanic rocks are metamorphosed to varying degrees, with some grading into quartz schist.

The proportion of free mineral grains increases with decreasing grain size. Mineral grains in the fine fractions consist primarily of quartz and feldspar, with trace amounts of amphibole, chlorite, biotite, epidote, and iron oxides. Some fine-grained rock fragments, mostly siltstone/shale and metavolcanic rocks, persist into the finer fractions.

The sandstones in the #4+ fractions are generally fresh, sound, hard, and tough. Most grains require a light hammer blow (with a 3-lb hammer on a steel anvil) to break. Some samples have small quantities of weathered sandstone in the coarse fractions. The weathered sandstone is much less tough but generally not friable. The sandstone particles in the finer fractions are less tough and can be crushed with forceps. The sandstones break down to a mixture of hard grains, mostly quartz, and soft clay/mica matrix material.

The siltstone/shale particles are fresh, sound, moderately hard, and moderately tough (can be crushed by a very light tap from the hammer). Grains with quartz veins are hard and quite tough. The volcanic and plutonic rocks are generally very hard and tough.

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We appreciate the opportunity to be of service to you. If you have any questions, please call us at (805) 642-8180.

Respectfully submitted,
Analytical Consulting Group, Inc.

Michael R. Tiffany, Petrographer
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REGISTERED GEOLOGIST
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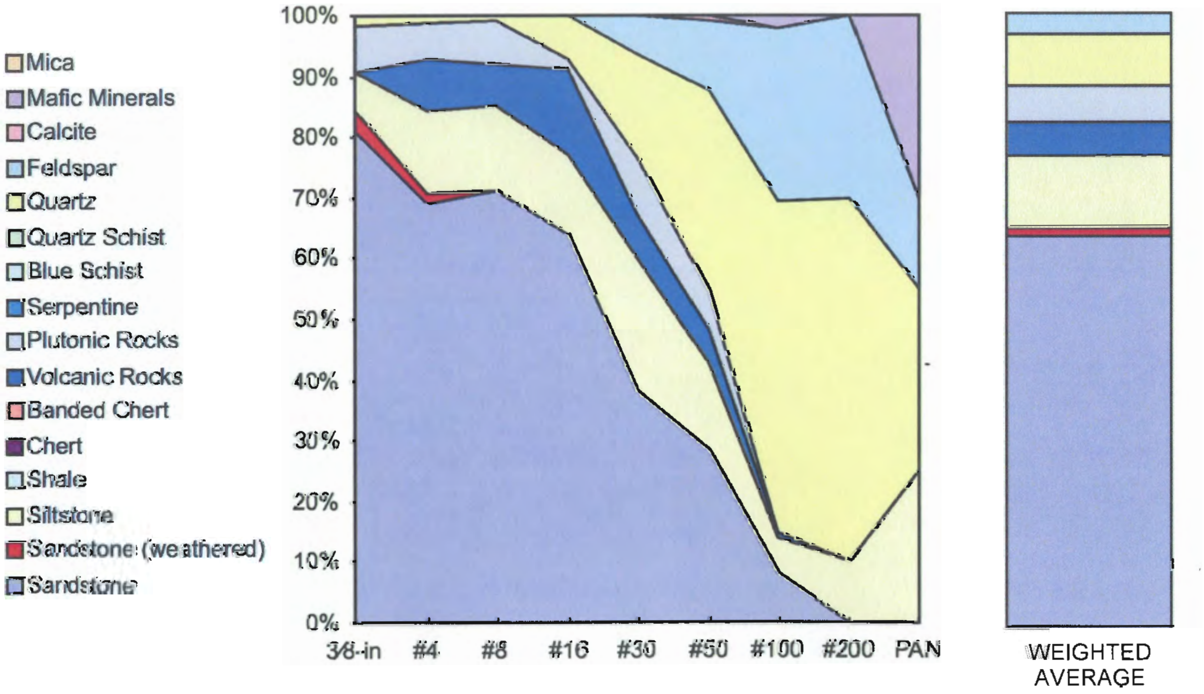
STATE OF CALIFORNIA

ASTM C-295 Petrographic Analysis
SVRT Sample 7: BH-78 @ 26 ft
GW-GC

Rock/Mineral Type	Size Fraction									Weighted Average
	3/8-in	#4	#8	#16	#30	#50	#100	#200	PAN	
Sandstone	81.1%	69.0%	71.0%	64.0%	38.0%	28.6%	7.9%			63.6%
Sandstone^W	3.1%	1.9%								1.3%
Siltstone	6.5%	13.5%	14.0%	13.0%	22.2%	14.3%	5.9%	10.0%	25.0%	11.8%
Volcanic Rocks		8.4%	7.0%	14.0%	7.4%	5.4%	1.0%			5.6%
Plutonic Rocks	7.7%	5.8%	7.0%	2.0%	9.3%	6.3%				6.0%
Quartz	1.6%	1.3%	1.0%	7.0%	16.7%	33.0%	54.5%	60.0%	30.0%	8.4%
Feldspar					6.5%	11.6%	28.7%	30.0%	15.0%	3.0%
Calcite						0.9%				0.1%
Mafic Minerals							2.0%		30.0%	0.1%
Weight Fraction	28.9%	23.4%	17.2%	10.9%	6.6%	6.8%	4.1%	1.8%	0.2%	

^{W} = weathered



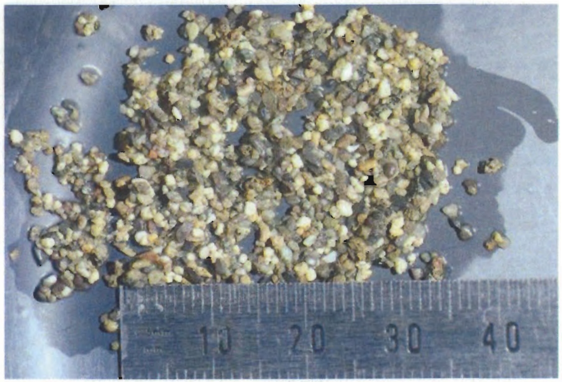
SVRT Sample 7: BH-78 @ 25 ft

3/8″

#4

#8

#16



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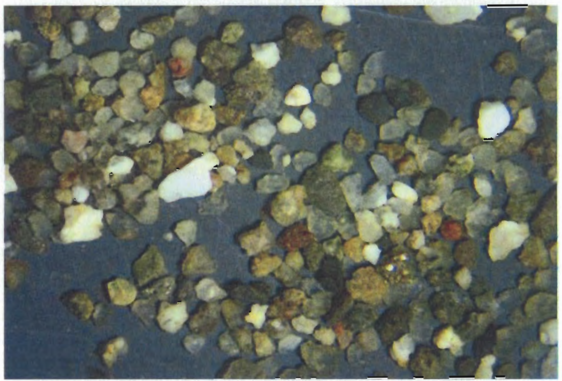

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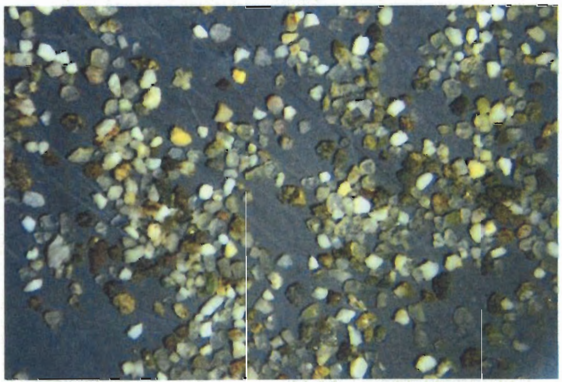

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Analytical Consulting Group, Inc.

June 2, 2008

ACG Lab No. P0804-555

CAMET Research, Inc.
6409 Camino Vista
Goleta, CA 93117
Attn: Dr. Ludwig Keller

Subject: ASTM C-295 Petrographic Examination of Soil Sample, SVRT Project

One sample of soil, identified as SVRT Sample 8: **MW-6I @ 69 ft**, was submitted to Analytical Consulting Group, Inc. (ACG) for petrographic examination. The purpose of the examination was to determine the lithological composition of the sample. The sample identification and the USCS classification assigned by the client is listed in the attached table.

The sample was sieved into fractions retained on the $^{3}/_{8}$-in, #4, #8, #16, #30, #50, #100, #200, and passing #200 sieves. Each fraction (except the +$^{3}/_{8}$-in) was further split to yield approximately 100 particles for analysis. The +$^{3}/_{8}$-in sample consisted of just 17 particles.

The examinations were conducted in accordance with ASTM C-295. The examinations were performed using a stereobinocular microscope at 5x to 40x magnification. The finest sand fractions and some crushed grains from coarser fractions were examined immersed in refractive index liquid, using the polarized-light microscope at up to 400x magnification. Selected grains were thin-sectioned and examined with the polarized-light microscope to assist in rock identification. The enclosed table and charts present the lithologic data for the samples, given as percent by particle count (approximate weight percent) for each size fraction. The composition of the +$^{3}/_{8}$" sample was determined by weight rather than particle count. A weighted average is calculated for the sample using the fraction weights determined by the sieve analysis. The sample data is presented in the attached table and chart. The analytical sensitivity for this method is approximately 0.1% for the weighted average of the sample.

In general, the sample is composed primarily of fine-grained sandstones, volcanic rocks, and mineral grains (quartz and feldspar) derived from the rocks. Lithic clasts dominate in the larger size fractions and discrete mineral grains in the finer fractions.

Volcanic rocks constitute about 25% of the sample. The volcanic rocks include a variety of holocrystalline intermediate to siliceous rocks and a few basalts. The groundmass of these rocks generally consists of microgranular quartz and feldspar or chert. Most of the volcanic rocks are metamorphosed to varying degrees, with some grading into quartz schist.

Sandstones make up about 17% of the sample. The sandstones range from greywacke to quartz wacke, with lithic to arkosic types dominating. The sandstones are well cemented and some have probably undergone some metamorphism. The matrix consists of clay, mica, and/or chlorite, with variable amounts of iron oxide. No carbonates are present. Thin quartz veins are frequent in the greywackes. The sandstone particles are tan, grey, green, or reddish in color, generally equant, and rounded to subangular, with a few angular crushed particles.

Dark grey siltstone and shale constitute about 14% of the sample. These rocks consist primarily of silt-sized quartz grains with clay, mica, and/or chlorite. Some of these rocks are transitional to slate or schist. Thin quartz veins are frequent. The siltstone/shale particles are typically rounded to subrounded and equant to elongated in shape. About ⅔ of the siltstone and shale particles are flat. A few weathered siltstone particles are present.

Other rock types present in the coarser fractions include granitic rocks, gabbro, and diabase. These rocks are grouped as plutonic rocks.

The proportion of free mineral grains increases with decreasing grain size. Mineral grains in the fine fractions consist primarily of quartz, with smaller amounts of feldspar, amphibole, chlorite, biotite, epidote, and iron oxides. Some fine-grained rock fragments, mostly siltstone and metavolcanic rocks, persist into the finer fractions.

The sandstones in the #4+ fractions are generally fresh, sound, hard, and tough. Most grains require a light hammer blow (with a 3-lb hammer on a steel anvil) to break. The sandstone particles in the finer fractions are less tough and can be crushed with forceps. The sandstones break down to a mixture of hard grains, mostly quartz, and soft clay/mica matrix.

The siltstone/shale particles are fresh, sound, moderately hard, and moderately tough (can be crushed by a very light tap from the hammer). Grains with quartz veins are hard and quite tough. The volcanic rocks and plutonic rocks are generally very hard and tough. Small quantities of weathered siltstone are present in the coarse fractions. These particles are generally soft to friable.

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We appreciate the opportunity to be of service to you. If you have any questions, please call us at (805) 642-8180.

Respectfully submitted,
Analytical Consulting Group, Inc.

Michael R. Tiffany, Petrographer
Analytical Consulting Group, Inc.
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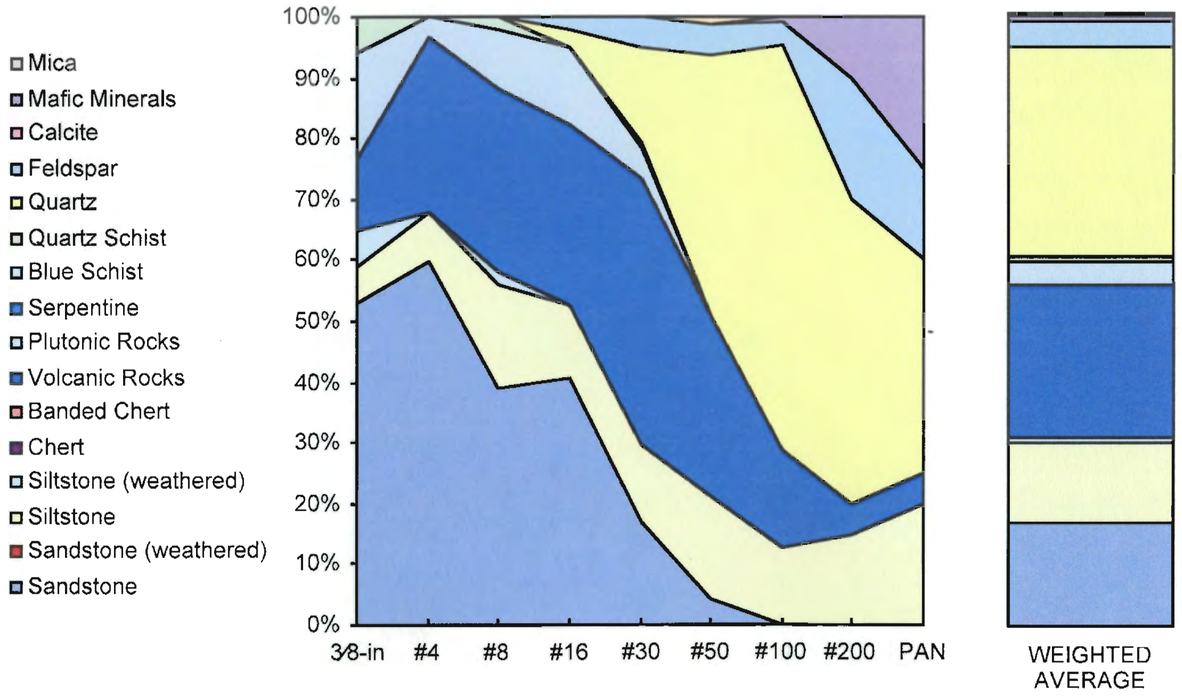
REGISTERED GEOLOGIST
MICHAEL R. TIFFANY
No. 6750
GEOLOGIST
STATE OF CALIFORNIA

ASTM C-295 Petrographic Analysis
SVRT Sample 8: MW-61 @ 69 ft
SP with gravel

Rock/Mineral Type	**Size Fraction**									**Weighted Average**
	⅜-in	#4	#8	#16	#30	#50	#100	#200	PAN	
Sandstone	52.9%	59.7%	39.0%	40.6%	16.8%	4.3%				16.9%
Siltstone	5.9%	8.1%	17.0%	11.9%	12.9%	17.0%	12.5%	15.0%	20.0%	13.2%
Siltstone^W	5.9%		2.0%							0.8%
Volcanic Rocks	11.8%	29.0%	30.0%	29.7%	43.6%	29.8%	16.3%	5.0%	5.0%	24.8%
Plutonic Rocks	17.6%	3.2%	10.0%	12.9%	5.0%					3.8%
Quartz Schist	5.9%		2.0%		1.0%					0.9%
Quartz				3.0%	15.8%	42.6%	66.3%	50.0%	35.0%	34.2%
Feldspar				2.0%	5.0%	5.3%	3.8%	20.0%	15.0%	4.3%
Mafic Minerals							1.0%	10.0%	25.0%	0.7%
Mica						1.1%				0.4%
Weight Fraction	12.7%	6.8%	3.1%	3.6%	12.1%	33.3%	23.6%	4.7%	0.2%	

^{W} = weathered



Sample 8: MW-6I @ 69 ft

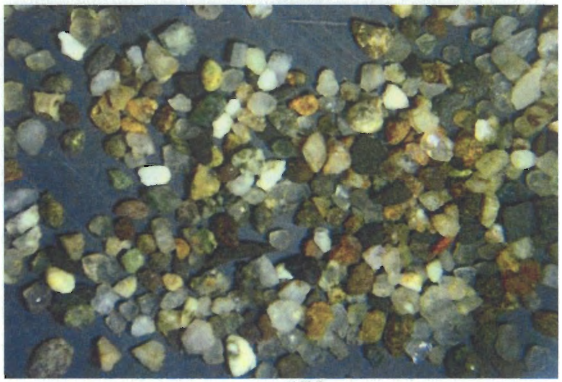
3/8″

#4

#8

#16

#30



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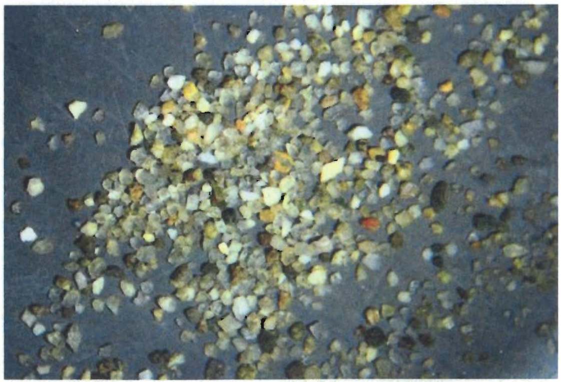

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Analytical Consulting Group, Inc.

June 3, 2008

ACG Lab No. P0804-555

CAMET Research, Inc.
6409 Camino Vista
Goleta, CA 93117
Attn: Dr. Ludwig Keller

Subject: ASTM C-295 Petrographic Examination of Soil Sample, SVRT Project

One sample of soil, identified as SVRT Sample 9: **MW-2G @ 70.5 ft**, was submitted to Analytical Consulting Group, Inc. (ACG) for petrographic examination. The purpose of the examination was to determine the lithological composition of the sample. The sample identification and the USCS classification assigned by the client is listed in the attached table.

The sample was sieved into fractions retained on the $\frac{3}{8}$-in, #4, #8, #16, #30, #50, #100, #200, and passing #200 sieves. Each fraction (except the $+\frac{3}{8}$-in) was further split to yield approximately 100 particles for analysis.

The examinations were conducted in accordance with ASTM C-295. The examinations were performed using a stereobinocular microscope at 5x to 40x magnification. The finest sand fractions and some crushed grains from coarser fractions were examined immersed in refractive index liquid, using the polarized-light microscope at up to 400x magnification. The enclosed table and charts present the lithologic data for the samples, given as percent by particle count (approximate weight percent) for each size fraction. A weighted average is calculated for the sample using the fraction weights determined by the sieve analysis. The sample data is presented in the attached table and chart. The analytical sensitivity for this method is approximately 0.1% for the weighted average of the sample.

This sample is composed primarily of fine-grained sandstones, chert, and mineral grains (quartz and feldspar) derived from coarser rocks. Lithic clasts dominate in the larger size fractions and discrete mineral grains in the finer fractions.

Sandstones make up about 56% of the sample. The sandstones range from greywacke to quartz wacke, with lithic to arkosic types dominating. The sandstones are well cemented and some have probably undergone some metamorphism. The matrix consists of clay, mica, and/or chlorite, with variable amounts of iron oxide. No carbonates are present. Thin quartz veins are frequent in the greywackes. The sandstone particles are tan, grey, green, or reddish in color, generally equant, and rounded to subangular, with a few angular crushed particles.

Chert makes up about 15% of the sample. The cherts consist of microgranular quartz and chalcedony and are mostly red, green, or tan in color. About ¼ of the cherts are banded, with thin lamellae of different grain sizes.

Volcanic rocks make up about 9% of the sample. The volcanic rocks include a variety of holocrystalline intermediate to siliceous rocks. The groundmass of these rocks generally consists of microgranular quartz and feldspar or chert. Most of the volcanic rocks are metamorphosed to varying degrees, with some grading into quartz schist.

Granitic rocks and diabase are grouped as plutonic rocks. The plutonic rocks make up about 5% of the sample. The plutonic rocks are variable but are generally medium-grained rocks consisting of feldspar with quartz and/or mafic minerals.

Dark grey siltstone and shale constitute about 2% of the sample. These rocks consist primarily of silt-sized quartz grains with clay, mica, and/or chlorite. Some of these rocks are transitional to slate or schist. Thin quartz veins are frequent. The siltstone/shale particles are typically rounded to subrounded and equant to elongated in shape. About ⅔ of the siltstone and shale particles are flat.

The proportion of free mineral grains increases with decreasing grain size. Mineral grains in the fine fractions consist primarily of quartz and feldspar, with trace amounts of amphibole, chlorite, biotite, epidote, and iron oxides. Some fine-grained rock fragments, mostly siltstone/shale, chert, and metavolcanic rocks, persist into the finer fractions.

The sandstones in the #4+ fractions are generally fresh, sound, hard, and tough. Most grains require a light hammer blow (with a 3-lb hammer on a steel anvil) to break. Some samples have small quantities of weathered sandstone in the coarse fractions.The sandstone particles in the finer fractions are less tough and can be crushed with forceps. The sandstones break down to a mixture of hard grains, mostly quartz, and soft clay/mica matrix.

The siltstone/shale particles are fresh, sound, moderately hard, and moderately tough (can be crushed by a very light tap from the hammer). Grains with quartz veins are hard and quite tough. The cherts are very hard and extremely tough, requiring a heavy hammer blow to break them. The volcanic rocks, and plutonic rocks are generally very hard and tough.

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Respectfully submitted,
Analytical Consulting Group, Inc.

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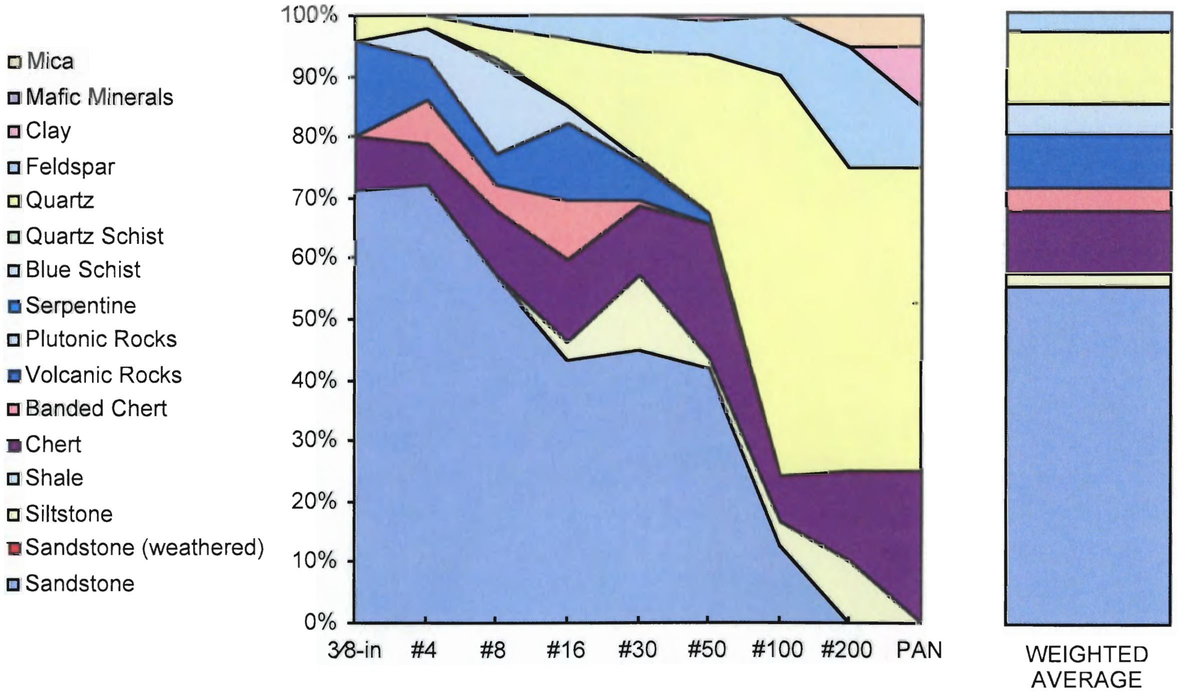
STATE OF CALIFORNIA

ASTM C-295 Petrographic Analysis
SVRT Sample 9: MW-2G @ 70.5 ft
SW-SM

Rock/Mineral Type	**Size Fraction**									**Weighted Average**
	$^3/_8$-in	#4	#8	#16	#30	#50	#100	#200	PAN	
Sandstone	71.1%	72.0%	57.0%	43.1%	45.0%	42.2%	12.6%			55.8%
Siltstone				2.9%	12.2%	1.8%	3.9%	10.0%		1.8%
Chert	8.9%	7.0%	11.0%	13.7%	11.5%	22.0%	7.8%	15.0%	25.0%	10.5%
Banded Chert		7.0%	4.0%	9.8%	0.8%					3.9%
Volcanic Rocks	15.6%	7.0%	5.0%	12.7%	6.1%	1.8%				8.9%
Plutonic Rocks		5.0%	15.0%	2.9%	0.8%					4.8%
Quartz Schist			1.0%							0.2%
Quartz	4.4%	2.0%	5.0%	10.8%	17.6%	26.6%	66.0%	50.0%	50.0%	11.7%
Feldspar			2.0%	3.9%	6.1%	5.5%	9.7%	20.0%	10.0%	2.9%
Clay									10.0%	0.0%
Mica								5.0%	5%	0.2%
Weight Fraction	20.9%	26.0%	20.5%	12.2%	6.0%	4.8%	4.9%	4.6%	0.1%	

^{W} = weathered



Sample 9: MW-2G @ 70.5

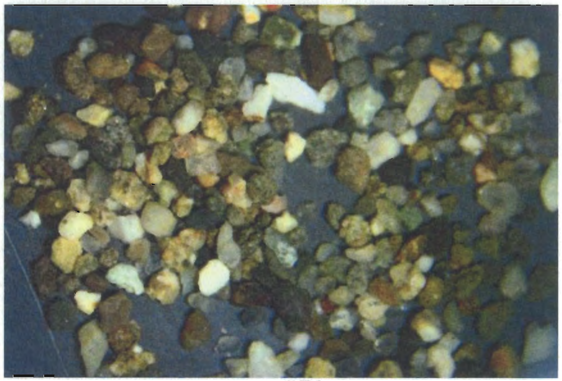
3/8"

#4

#8

#16

#30



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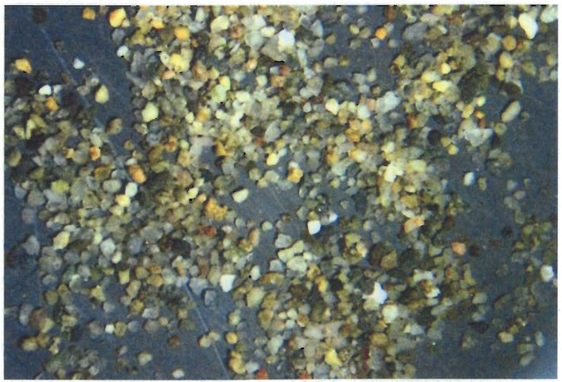


#100

Analytical Consulting Group, Inc.

June 3, 2008

ACG Lab No. P0804-555

CAMET Research, Inc.
6409 Camino Vista
Goleta, CA 93117
Attn: Dr. Ludwig Keller

Subject: ASTM C-295 Petrographic Examination of Soil Sample, SVRT Project

One sample of soil, identified as SVRT Sample 10: **MW-8B @ 25.5 ft**, was submitted to Analytical Consulting Group, Inc. (ACG) for petrographic examination. The purpose of the examination was to determine the lithological composition of the sample. The sample identification and the USCS classification assigned by the client is listed in the attached table.

The sample was sieved into fractions retained on the $\frac{3}{8}$-in, #4, #8, #16, #30, #50, #100, #200, and passing #200 sieves. Each fraction (except the +$\frac{3}{8}$-in) was further split to yield approximately 100 particles for analysis.

The examinations were conducted in accordance with ASTM C-295. The examinations were performed using a stereobinocular microscope at 5x to 40x magnification. The finest sand fractions and some crushed grains from coarser fractions were examined immersed in refractive index liquid, using the polarized-light microscope at up to 400x magnification. Selected grains were thin-sectioned and examined with the polarized-light microscope to assist in rock identification. The enclosed table and charts present the lithologic data for the samples, given as percent by particle count (approximate weight percent) for each size fraction. The composition of the +$\frac{3}{8}$″ sample was determined by weight. A weighted average is calculated for the sample using the fraction weights determined by the sieve analysis. The sample data is presented in the attached table and chart. The analytical sensitivity for this method is approximately 0.1% for the weighted average of the sample.

In general, the sample is composed primarily of fine-grained sandstones, siltstones, volcanic rocks, and mineral grains (quartz and feldspar) derived from coarser rocks. Lithic clasts dominate in the larger size fractions and discrete mineral grains in the finer fractions.

Sandstones make up about 55% of the sample. The sandstones range from greywacke to quartz wacke, with lithic to arkosic types dominating. The sandstones are well cemented and some have probably undergone some metamorphism. The matrix consists of clay, mica, and/or chlorite, with variable amounts of iron oxide. No carbonates are present. Thin quartz veins are frequent in the greywackes. The sandstone particles are tan, grey, green, or reddish in color, generally equant, and rounded to subangular, with a few angular crushed particles.

Volcanic rocks constitute about 21% of the sample. The volcanic rocks include a variety of holocrystalline intermediate to siliceous rocks. The groundmass of these rocks generally consists of microgranular quartz and feldspar or chert. Most of the volcanic rocks are metamorphosed to varying degrees, with some grading into quartz schist.

Dark grey siltstone and shale constitute about 9% of the sample. These rocks consist primarily of silt-sized quartz grains with clay, mica, and/or chlorite. Some of these rocks are transitional to slate or schist. Thin quartz veins are frequent. The siltstone/shale particles are typically rounded to subrounded and equant to elongated in shape. About $\frac{2}{3}$ of the siltstone and shale particles are flat.

Minor constituents include granitic rocks, diabase, chert, blueschist, and serpentine. The granitic rocks and diabase are grouped as plutonic rocks. The two serpentine particles found were partially serpentinized peridotite or greenstone, harder than pure serpentine.

The proportion of free mineral grains increases with decreasing grain size. Mineral grains in the fine fractions consist primarily of quartz and feldspar, with trace amounts of amphibole, chlorite, biotite, epidote, and iron oxides. Some fine-grained rock fragments, mostly siltstone/shale, chert, and metavolcanic rocks, persist into the finer fractions.

The sandstones in the #4+ fractions are generally fresh, sound, hard, and tough. Most grains require a light hammer blow (with a 3-lb hammer on a steel anvil) to break. The sandstone particles in the finer fractions are less tough and can be crushed with forceps. The sandstones break down to a mixture of hard grains, mostly quartz, and soft clay/mica matrix.

The siltstone/shale particles are fresh, sound, moderately hard, and moderately tough (can be crushed by a very light tap from the hammer). Grains with quartz veins are hard and quite tough. The chert, volcanic rocks, and plutonic rocks are generally very hard and tough.

The observations and conclusions given above are ACG's professional opinions based on laboratory observation of the samples as submitted and on information supplied by the client. Extension of these observations or conclusions to the product represented by the samples is the responsibility of the user. No warranty, express or implied, is made or intended in connection with the above investigation, or by the furnishing of this report, or by any other oral or written statement.

We appreciate the opportunity to be of service to you. If you have any questions, please call us at (805) 642-8180.

Respectfully submitted,
Analytical Consulting Group, Inc.

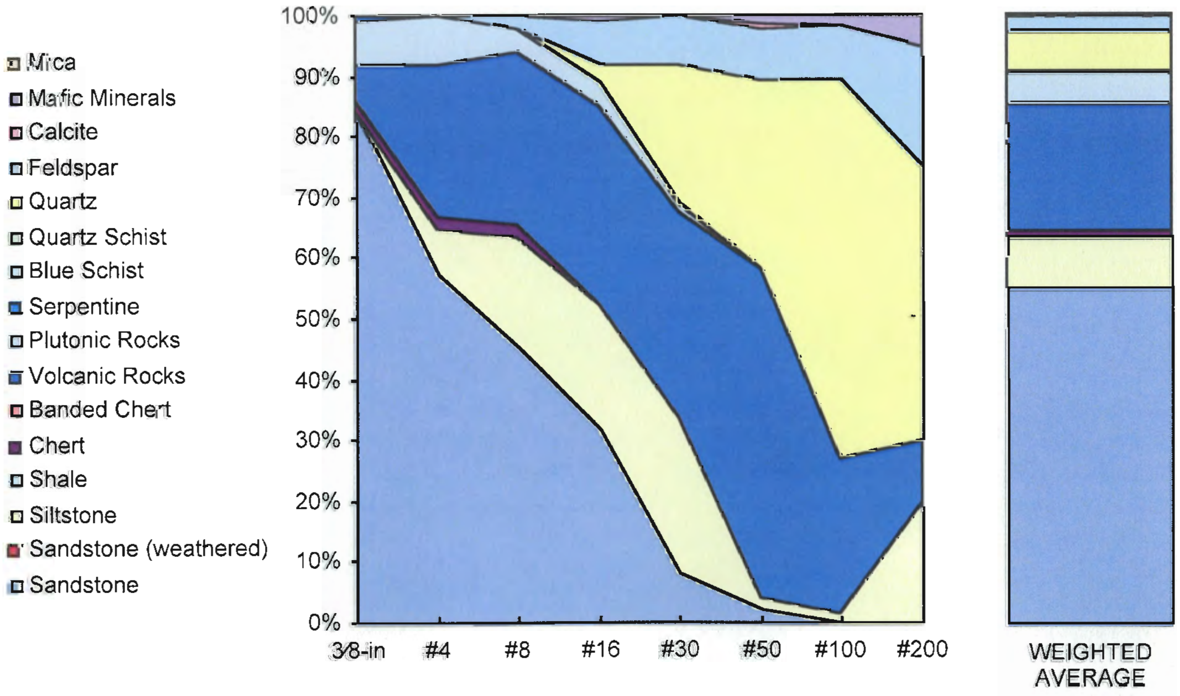
Michael R. Tiffany, Petrographer
Analytical Consulting Group, Inc.
Professional Geologist No. 6750

REGISTERED GEOLOGIST
MICHAEL R. TIFFANY
No. 6750
STATE OF CALIFORNIA

ASTM C-295 Petrographic Analysis
SVRT Sample 10: MW-8B @ 25.5 ft
GW-GM with sand

Rock/Mineral Type	Size Fraction									Weighted Average
	⅜-in	#4	#8	#16	#30	#50	#100	#200	PAN	
Sandstone	84.3%	57.0%	45.5%	31.7%	8.0%	2.2%				54.7%
Siltstone		8.0%	18.2%	20.8%	26.0%	2.2%	1.7%	20.0%		8.6%
Chert	1.6%	2.0%	2.0%							1.3%
Volcanic Rocks	6.0%	25.0%	28.3%	32.7%	34.0%	54.8%	25.2%	10.0%		20.5%
Plutonic Rocks	7.3%	8.0%	4.0%	4.0%	1.0%					5.3%
Serpentine	0.5%									0.2%
Blueschist	0.2%									0.1%
Quartz				3.0%	23.0%	31.2%	62.6%	45.0%		6.2%
Feldspar			2.0%	6.9%	8.0%	8.6%	8.7%	20.0%		2.7%
Mafic Minerals				1.0%		1.1%	1.7%	5.0%		0.3%
Weight Fraction	41.6%	14.5%	15.8%	11.3%	6.5%	5.6%	3.2%	1.5%	0.0%	

^{W} = weathered



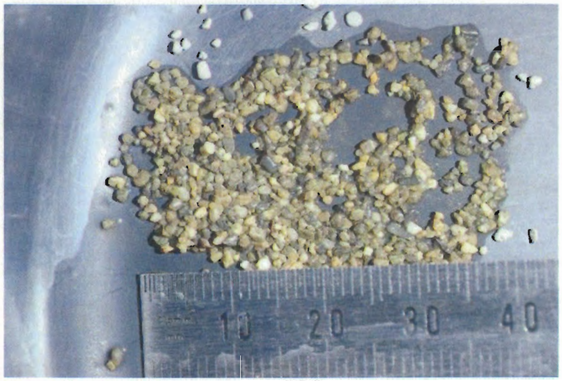
Sample 10: MW-8B @ 25.5′

3/8″+

#4

#8

#16



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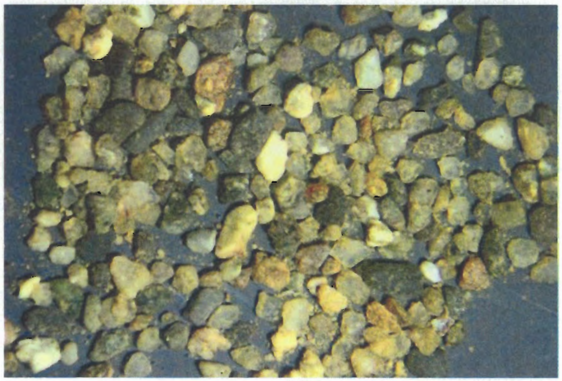

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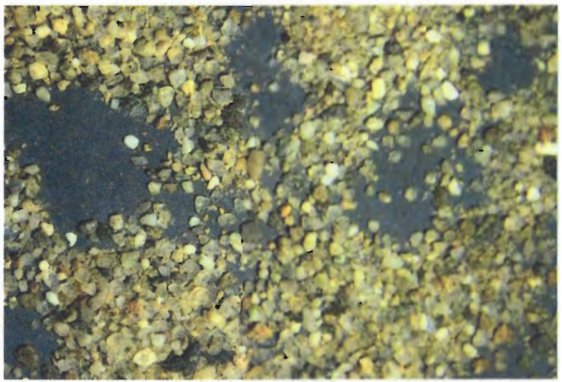

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Analytical Consulting Group, Inc.

June 3, 2008

ACG Lab No. P0804-555

CAMET Research, Inc.
6409 Camino Vista
Goleta, CA 93117
Attn: Dr. Ludwig Keller

Subject: ASTM C-295 Petrographic Examination of Soil Sample, SVRT Project

One sample of soil, identified as SVRT Sample 11: **MW-8B @ 39 ft**, was submitted to Analytical Consulting Group, Inc. (ACG) for petrographic examination. The purpose of the examination was to determine the lithological composition of the sample. The sample identification and the USCS classification assigned by the client is listed in the attached table.

The sample was sieved into fractions retained on the #4, #8, #16, #30, #50, #100, #200, and passing #200 sieves. Each fraction (except the #4 and #8) was further split to yield approximately 100 particles for analysis.

The examinations were conducted in accordance with ASTM C-295. The examinations were performed using a stereobinocular microscope at 5x to 40x magnification. The finest sand fractions and some crushed grains from coarser fractions were examined immersed in refractive index liquid, using the polarized-light microscope at up to 400x magnification. The enclosed table and charts present the lithologic data for the samples, given as percent by particle count (approximate weight percent) for each size fraction. A weighted average is calculated for the sample using the fraction weights determined by the sieve analysis. The sample data is presented in the attached table and chart. The analytical sensitivity for this method is approximately 0.1% for the weighted average of the sample.

This sample is composed primarily of quartz grains, with smaller quantities of rock fragments and other mineral grains. Lithic clasts dominate in the larger size fractions and discrete mineral grains in the finer fractions. Because of the fineness of the material in this sample (SP-SM), quartz comprises about 59% of the sample.

Sandstones make up about 14% of the sample. The sandstones range from greywacke to quartz wacke, with lithic to arkosic types dominating. The sandstones are well cemented and some have probably undergone some metamorphism. The matrix consists of clay, mica, and/or chlorite, with variable amounts of iron oxide. No carbonates are present. Thin quartz veins are frequent in the greywackes. The sandstone particles are tan, grey, green, or reddish in color, generally equant, and rounded to subangular, with a few angular crushed particles. A few weathered sandstone particles are present.

Dark grey siltstone and shale constitute about 12% of the sample. These rocks consist primarily of silt-sized quartz grains with clay, mica, and/or chlorite. Some of these rocks are transitional to slate or schist. Thin quartz veins are frequent. The siltstone/shale particles are typically rounded to subrounded and equant to elongated in shape. About $\frac{2}{3}$ of the siltstone and shale particles are flat.

Minor lithic constituents include chert, volcanic rocks, and granitic (plutonic) rocks. The proportion of free mineral grains increases with decreasing grain size. Mineral grains in the finer fractions consist primarily of quartz and feldspar, with trace amounts of biotite, amphibole, chlorite, epidote, and iron oxides. Some fine-grained fragments of siltstone and chert persist into the finer fractions.

The sandstones in the #4+ fractions are generally fresh, sound, hard, and moderately tough. The sandstone particles can be crushed with forceps. Very small quantities of weathered sandstone are present. The weathered sandstone is much less tough but generally not friable. The sandstones break down to a mixture of hard grains, mostly quartz, and soft clay/mica matrix.

The siltstone/shale particles are fresh, sound, moderately hard, and moderately tough (can be crushed by a very light tap from the hammer). Grains with quartz veins are hard and quite tough. The chert, volcanic rocks, and plutonic rocks are generally very hard and tough.

The observations and conclusions given above are ACG's professional opinions based on laboratory observation of the samples as submitted and on information supplied by the client. Extension of these observations or conclusions to the product represented by the samples is the responsibility of the user. No warranty, express or implied, is made or intended in connection with the above investigation, or by the furnishing of this report, or by any other oral or written statement.

We appreciate the opportunity to be of service to you. If you have any questions, please call us at (805) 642-8180.

Respectfully submitted,
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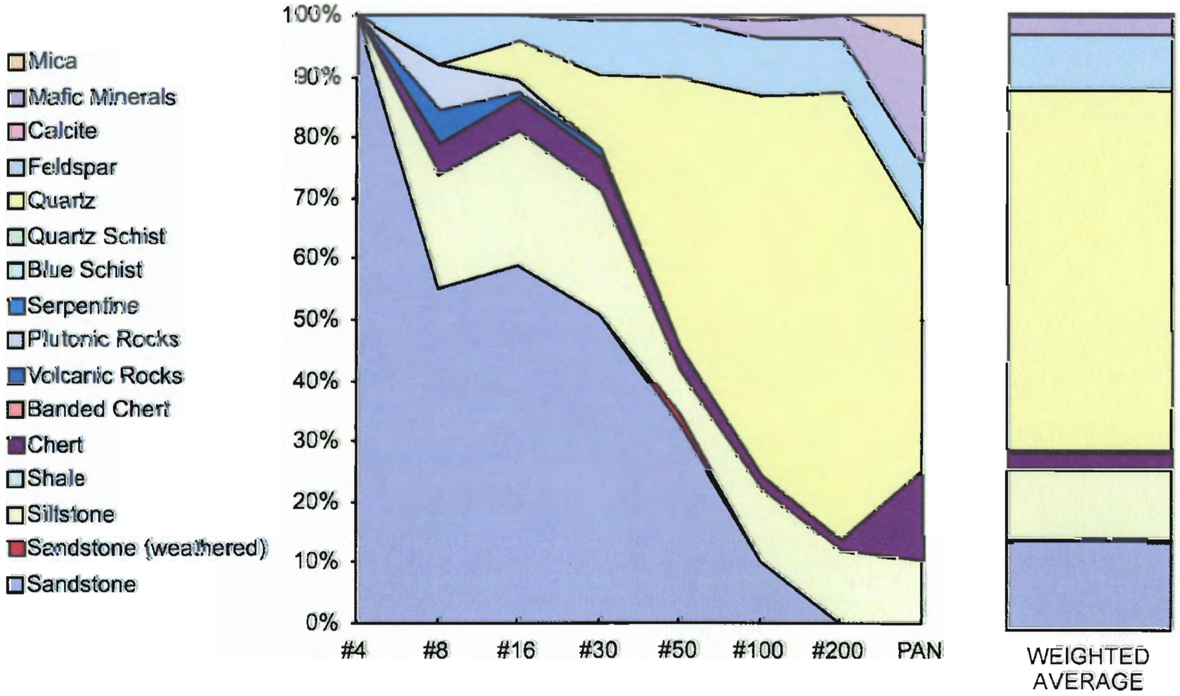
Michael R. Tiffany, Petrographer
Analytical Consulting Group, Inc.
Professional Geologist No. 6750

REGISTERED GEOLOGIST
MICHAEL R. TIFFANY
No. 6750
STATE OF CALIFORNIA

ASTM C-295 Petrographic Analysis
SVRT Sample 11: MW-8B @ 39 ft
SP-SM

Rock/Mineral Type	Size Fraction									Weighted Average
	$^{3}/_{8}$-in	#4	#8	#16	#30	#50	#100	#200	PAN	
Sandstone		100.0%	55.3%	58.9%	51.0%	32.4%	10.2%			14.0%
Sandstone^{W}						1.9%				0.3%
Siltstone			18.4%	22.1%	20.2%	7.4%	12.0%	11.9%	10.0%	11.5%
Chert			5.3%	5.3%	5.8%	3.7%	1.9%	1.8%	15.0%	2.4%
Volcanic Rocks			5.3%	1.1%	1.0%					0.1%
Plutonic Rocks			7.9%	2.1%						0.1%
Quartz				6.3%	12.5%	44.4%	63.0%	73.4%	40.0%	59.2%
Feldspar			7.9%	4.2%	8.7%	9.3%	9.3%	9.2%	10.0%	9.1%
Mafic Minerals					1.0%	0.9%	2.8%	3.7%	20.0%	2.7%
Mica							0.9%		5.0%	0.5%
Weight Fraction	0.0%	0.5%	1.1%	1.5%	2.2%	17.5%	51.5%	25.0%	0.8%	

^{W} = weathered

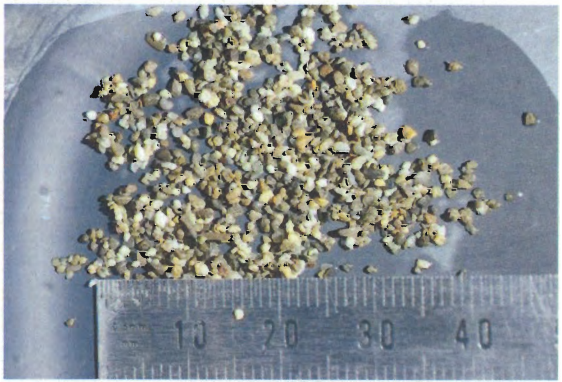


Sample 11: MW-8B @ 39′

#4

#8

#16



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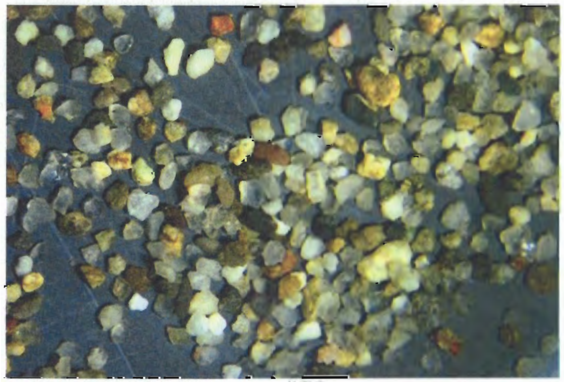

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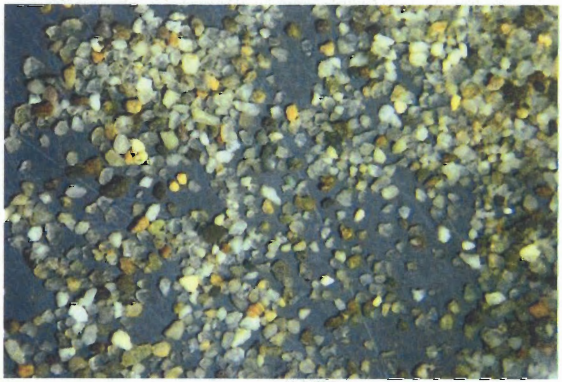

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TWINING
LABORATORIES
OF SOUTHERN CALIFORNIA

Durability Index (Fine)

ASTM D3744/ CAL T229

Project Name: Hatch-Mott-mcdonald 8
Project No. : 080333.3
Client: Chemistry of Concrete
Sampled By: Client
Date Sampled: 4/18/08
Sample Location: N/A
USCS Description: SP
Material Description: pourly graded Sand w/gravel

Tested By : JN
Input By: 5-2-08
Date Tested:
Checked By:
Sample No.: 1
Lab No.: 97916

Trial No.	Soak Time	End Soak Time	Start Sedimentation Time	Sedimentation Time	Clay Reading	Sand Reading	D.I. (%)
1	60	60	38:45	13:45	83	43	52
2							
REMARKS:						TOTAL =	52
						AVG. =	52
						DI=	52

DI = Sand Reading/ Clay Reading*100

TWINING
LABORATORIES
OF SOUTHERN CALIFORNIA

Durability Index (Fine)

ASTM D3744/ CAL T229

Project Name: Hatch-Mott-medonald 9

Project No. : 0803333

Client: Chomistry of concrete

Sampled By: Client

Date Sampled: 4/18/08

Sample Location: N/A

USCS Description: SW-SM

Material Description:

Tested By : JN

Input By: 5-2-08

Date Tested:

Checked By:

Sample No.: 2

Lab No.: 97917

Trial No.	Soak Time	End Soak Time	Start Sedimentation Time	Sedimentation Time	Clay Reading	Sand Reading	D.I. (%)
1	60	50	38:45	18:45	90	38	43
2							

REMARKS:

TOTAL =	43
AVG. =	43
DI=	43

DI = Sand Reading/ Clay Reading*100

TWINING
LABORATORIES
OF SOUTHERN CALIFORNIA

Durability Index (Fine)

ASTM D3744/ CAL T229

Project Name: Hatch-Mott-Mcdonald 10
Project No. : 080833.3
Client: Chemistry of concrete
Sampled By: Client
Date Sampled: 4/18/08
Sample Location: N/A
USCS Description: GW-GM
Material Description:

Tested By : JN
Input By: 5-2-08
Date Tested:
Checked By:
Sample No.: 3
Lab No.: 97918

Trial No.	Soak Time	End Soak Time	Start Sedimentation Time	Sedimentation Time	Clay Reading	Sand Reading	D.I. (%)
1	60	50	33:45	18:00	72	41	57
2							57
REMARKS:						TOTAL =	
						AVG. =	57
						DI=	57

DI = Sand Reading/ Clay Reading*100

TWINING
LABORATORIES
OF SOUTHERN CALIFORNIA

Durability Index (Fine)

ASTM D3744/ CAL T229

Project Name: Hatch-Mott-Mcdonald
Project No.: 080833.3
Client: Chemistry of Concrete
Sampled By: client
Date Sampled: 4/18/08
Sample Location: N/A
USCS Description: SP-SM
Material Description:

Tested By: JR
Input By: 5-2-08
Date Tested:
Checked By:
Sample No.: 4
Lab No.: 97919

Trial No.	Soak Time	End Soak Time	Start Sedimentation Time	Sedimentation Time	Clay Reading	Sand Reading	D.I. (%)
1	60	50	38:45	18:45	105	42	40
2							
REMARKS:						TOTAL =	40
						AVG. =	40
						DI=	40

DI = Sand Reading/ Clay Reading*100