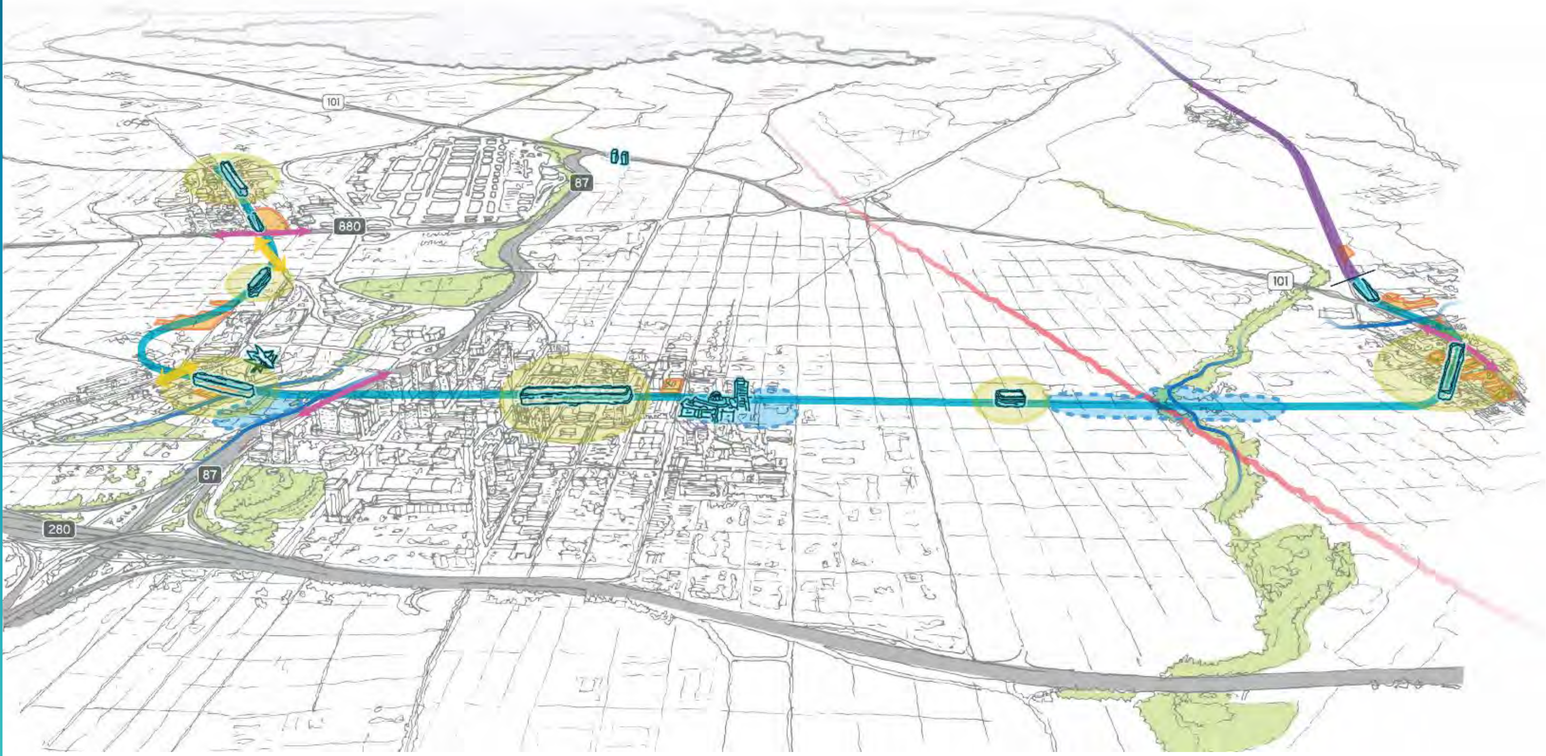
VTA's BART Silicon Valley Phase II Extension Project

General Engineering Consulting Services



Geotechnical Data Report Volume II

Rev. 0
February 2021

MMW TEAM
MOTT MACDONALD
WONG ENGINEERING

Revision History

Revision	Date	Revision details	Revised by
Rev. 0	February 2021	Issued Final	JA

This report was prepared under my direct supervision.

Martin J Walker, Geotechnical Discipline Lead
Mott MacDonald/PGH Wong Joint Venture

Contents – Volume II

List of Tables

1 Introduction

This Geotechnical Data Report (GDR) provides data collected from several sources and under several contracts. It is presented by Santa Clara Valley Transportation Authority (VTA) for use by design-build contractors in the BART Silicon Valley Phase II Extension (BSVII) project in San Jose, Santa Clara County, California.

This report constitutes Volume II of the GDR. The report collates various Geotechnical Reports produced by URS Corporation, ENGEO Incorporated, and HMM/Bechtel Joint Venture (HMM/Bechtel) during the period 2003 to 2010 for BSVII (formerly Silicon Valley Rapid Transit Project).

2 Limitations

VTA has included the reports in Volume II of the GDR solely to provide factual information. Some reports included in this volume contain opinions, design values, or interpretive statements regarding the data compiled for previous procurement approaches which differ significantly from the current procurement method. All interpretations, conclusions, or recommendations within these reports were not prepared for this project and may not be relied upon for any purpose in connection with this procurement or any project resulting therefrom.

The user of these data acknowledges that MMW makes no representation or warranty, express or implied, as to their correctness, accuracy, or quality of any data or opinions contained in the reports prepared by engineers other than MMW included with Volume II of the GDR.

It should be noted, certain design elements may require further environmental analysis under CEQA and/or NEPA, which, to the extent required, would be completed prior to approval by VTA of any contract that includes any such design elements.

3 Available Data and Information

Table 3-1 summarises the reports included in Volume II of the GDR. Each document report title has been linked to a respective cover page bookmark.

Table 3-1. Reports Included in Volume II of the GDR

Report Title	Date	Originator	Location
Geotechnical Exploration Findings and Recommendations Report. Volume II: Tunnel and Underground Stations Segment - 10% Conceptual Engineering (P0501-PW-08-0852)	10/10/2003	URS Corporation	SVRT Alignment
SVRT Project-Tunnel Segment Geotechnical Data Report Volume I Of VI (P0503-D300-RPT-GEO-002, Rev. 0)	9/23/2005	HMM/Bechtel	Along tunnel alignment based on April 2005 PE (S1 Track)
SVRT Project-Tunnel Segment Geotechnical Data Report Volume II Of VI (P0503-D300-RPT-GEO-002, Rev. 0)	9/23/2005	HMM/Bechtel	Along tunnel alignment based on April 2005 PE (S1 Track)
SVRT Project-Tunnel Segment Geotechnical Data Report Volume III Of VI (P0503-D300-RPT-GEO-002, Rev. 0)	9/23/2005	HMM/Bechtel	Along tunnel alignment based on April 2005 PE (S1 Track)
SVRT Project-Tunnel Segment Geotechnical Data Report Volume IV Of VI (P0503-D300-RPT-GEO-002, Rev. 0)	9/23/2005	HMM/Bechtel	Along tunnel alignment based on April 2005 PE (S1 Track)
SVRT Project-Tunnel Segment Geotechnical Data Report Volume V Of VI (P0503-D300-RPT-GEO-002, Rev. 0)	9/23/2005	HMM/Bechtel	Along tunnel alignment based on April 2005 PE (S1 Track)
SVRT Project-Tunnel Segment Geotechnical Data Report Volume VI Of VI (P0503-D300-RPT-GEO-002, Rev. 0)	9/23/2005	HMM/Bechtel	Along tunnel alignment based on April 2005 PE (S1 Track)
Geotechnical Report – Yards & Shops Segment (P0504-D400-RPT-DE-008, Rev.0)	5/24/2006	ENGEO	Newhall Yard Maintenance Facility, Santa Clara, CA
Geotechnical Report Supplement - Western Area Guideway Yard & Shops (P0504-D400-PRT-DE-008, Rev.1)	8/29/2008	ENGEO	West Portal to Santa Clara Station
Central Area Guideway GDR - Phase Two 65% Engineering Design Investigation (P0503-D300-RPT-GEO-004, Rev. 1)	12/16/2008	HMM/Bechtel	Along tunnel alignment based on April 2005 PE (SI Track).
Central Area Guideway Coyote Creek Geotechnical Investigation Report (P0503-D300-RPT-DE070, Rev.0)	1/21/2010	HMM/Bechtel	Santa Clara Street Bridge over Coyote Creek in San Jose, CA

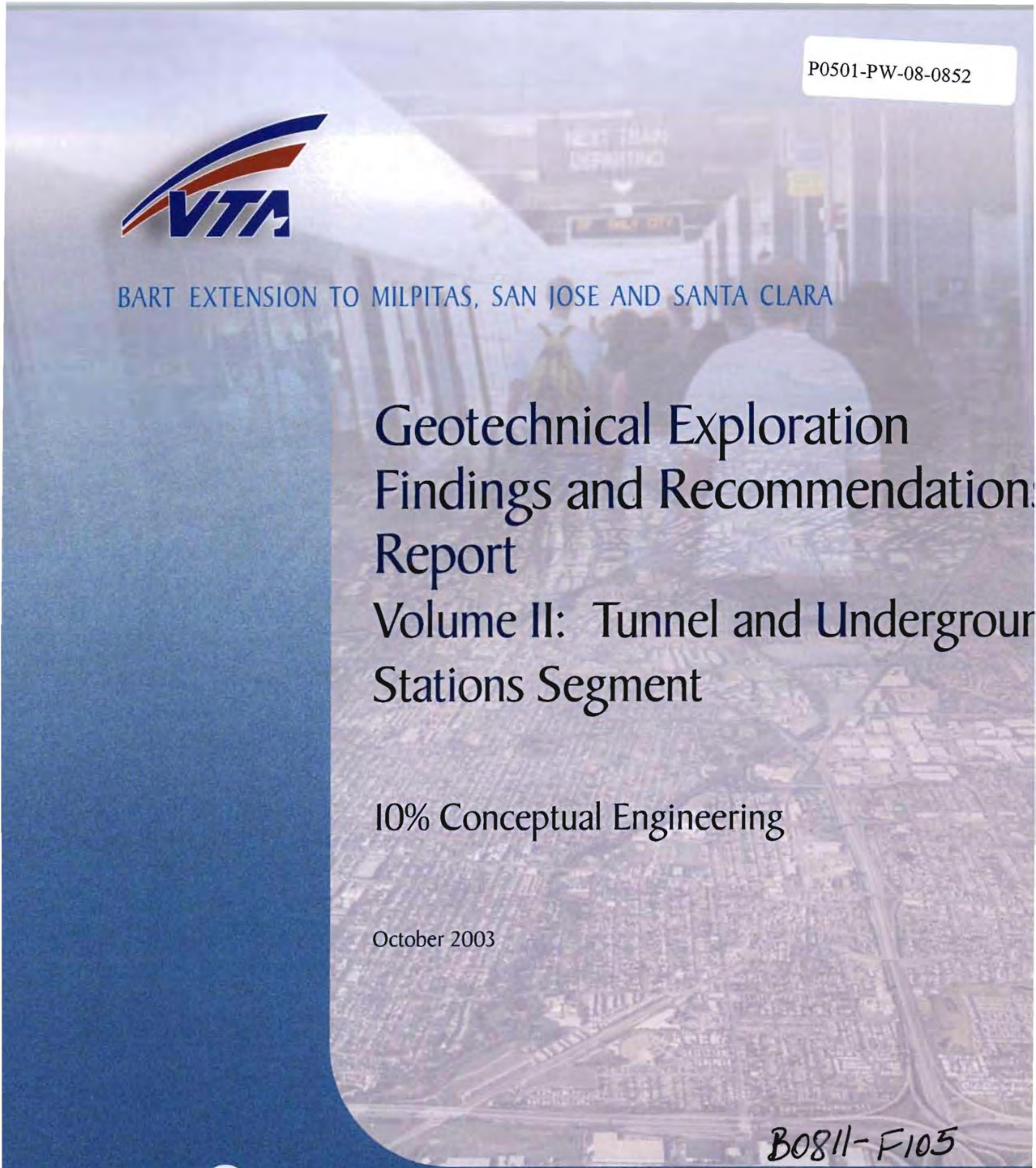
Appendix F

10% Conceptual Engineering (URS 2003)
35% Preliminary Engineering Vol I (HMM/Bechtel 2005)
35% Preliminary Engineering Vol II (HMM/Bechtel 2005)
35% Preliminary Engineering Vol III (HMM/Bechtel 2005)
35% Preliminary Engineering Vol IV (HMM/Bechtel 2005)
35% Preliminary Engineering Vol V (HMM/Bechtel 2005)
35% Preliminary Engineering Vol VI (HMM/Bechtel 2005)
Geotechnical Report – Yards and Shops Segment (ENGEO 2006)
Geotechnical Report – Yards and Shops Supplement (ENGEO 2008)
65% Engineering Design Investigation (HMM/Bechtel 2008)
Coyote Creek GI Report (HMM/Bechtel 2010)

Geotechnical Exploration Findings and Recommendations Report Volume II: Tunnel and Underground Stations Segment

(P0501-PW-08-0852)

P0501-PW-08-0852



BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

Geotechnical Exploration Findings and Recommendation Report

Volume II: Tunnel and Undergrou Stations Segment

10% Conceptual Engineering

October 2003

B0811-F105

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY

695 RIVER OAKS PARKWAY • SAN JOSE, CALIFORNIA 95134-1907

SANTA CLARA VALLEY TRANSPORTATION AUTHORITY (VTA)

BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

10% CONCEPTUAL ENGINEERING

DRAFT

Geotechnical Exploration Findings and Recommendations Report

Volume II: Tunnel and Underground Stations Segment

Prepared by URS Corporation
for Earth Tech, Inc.

October 2003

URS

October 10, 2003
Project 28649330

Mr. David Minister, Vice President
Transit and Railroad Group
Earth Tech, Inc.
2101 Webster Street, Suite 1000
Oakland, CA 94612-3060

Subject: Geotechnical Data Report
10% Conceptual Engineering
Tunnel and Underground Stations – Segments BSJ3 and BSJ4
Silicon Valley Rapid Transit Project
BART Extension to Milpitas, San Jose and Santa Clara Alternative
Santa Clara County, California

Dear Mr. Minister:

We are pleased to submit this Draft Geotechnical Data Report for the Silicon Valley Rapid Transit Project in Santa Clara County, California. More specifically, this draft report is for the BART Extension to Milpitas, San Jose and Santa Clara Alternative utilizing the UPRR's former Milpitas Corridor right-of-way and a subsurface alignment under Santa Clara Street in downtown San Jose. Conceptual geotechnical engineering opinions and recommendations regarding at-grade track and retained cut (U-wall) track in Segments BSJ1, BSJ2 and BSJ5 are presented in a separate companion report, dated October 10, 2003.

The accompanying draft report presents the results of our subsurface exploration along the tunnel alignment and at proposed underground station locations for the Silicon Valley Rapid Transit Project, consisting of 21 borings, 5 cone penetration tests (CPTs), 7 observation wells, 8 piezometers, and 5 insitu field vane shear tests, plus laboratory test results of samples obtained from the new borings.

The purpose of this report is to present new (2001, 2002 and 2003) and previous geotechnical data and subsurface conditions along the tunnel alignment and at the following four underground stations:

- Alum Rock Station
- Civic Plaza/San Jose State University Station
- Market Street Station
- Diridon/Arena Station

In addition to presenting the results of our subsurface exploration program, we provide preliminary opinions and recommendations regarding feasible methods of bored tunnel and underground station construction, including a detailed discussion of groundwater issues based on observations of dewatering activities at the new San Jose Civic Center

URS Corporation
55 South Market Street, Suite 1500
San Jose, CA 95113
Tel: 408.297.9585
Fax: 408.297.6962

excavation. Furthermore, in this report, we describe the results of our liquefaction potential analysis. The opinions and conclusions have been based upon the results of widely spaced explorations, laboratory testing, and limited engineering analyses we conducted as part of our scope, as well as engineering judgment and local experience.

In this report, we refer to URS' report dated January 11, 2002 entitled "Preliminary Geotechnical Exploration Report, Silicon Valley Rapid Transit Corridor, Alternative 11 – BART on UPRR Alignment, Alameda County and Santa Clara County, California" (Project Number 95-00112023.00). That report presented our opinions regarding the geology, faulting and seismicity for the entire alignment from Warm Springs to the Santa Clara Station.

Preliminary design considerations were to be evaluated and presented in our technical memorandum for Task 25.2, Tunnel Engineering, of the 10% Conceptual Engineering phase of the project. Work on Task 25.2 has been suspended, as directed by Earth Tech.

Preliminary design considerations were to be evaluated and presented in our technical memorandum for Task 25.3, Underground Station Engineering, of the 10% Conceptual Engineering phase of the project. Work on Task 25.3 also has been suspended, as directed by Earth Tech.

In developing URS' preliminary opinions and conclusions, URS used the most current 10% Conceptual Engineering drawings and cross sections provided by Earth Tech dated April 28, 2003.

Messrs. Stephen Huang, Michael Larson, and Thomas Pennington performed the geotechnical analyses and assisted in the preparation of this report. Mr. William Bischoff, Principal Geotechnical Engineer, provided peer review for the geotechnical aspects of the project. This peer review was in accordance with the URS Corporation Quality Control Plan. The undersigned provided management oversight of all aspects of our professional services and the preparation of this report.

We are pleased to have been of service to Earth Tech and the Santa Clara Valley Transportation Authority (VTA) on this significant project. If any questions should arise, please contact our office.

Sincerely,

Paul J Boddie

Paul J. Boddie, G.E. 00152
Project Manager

Enclosures

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.1 GENERAL

This Geotechnical Data Report presents the results of recent subsurface exploration performed between October 2002 and July 2003 to further study the subsurface conditions along Segments 3 and 4 of the BART Extension to Milpitas, San Jose and Santa Clara project. Segments 3 and 4 are located in downtown San Jose, California. These explorations supplement the findings of our January 11, 2002 "Preliminary Geotechnical Exploration Report." For convenience, we have included an updated discussion of the geologic and seismic setting. More specifically, we provided further clarification regarding the proximity of the alignment to active and inactive faults for inclusion in the Administrative Draft EIS/EIR. The results of previous subsurface investigations that are in close proximity to the corridor are also included. The limits of Segments 3 and 4 are summarized in the table below. Note that on the most current 10% Conceptual Engineering Plans dated April 28, 2003, Segments 3 and 4 are referred to as BSJ3 and BSJ4, respectively. The two different Segment designations are referenced throughout the text of this report and are considered interchangeable.

Segment	Station Limits (feet)		Length (feet)	Location	
	Begin	End		City	County
BSJ3	560+00	643+62	8,362	San Jose	Santa Clara
BSJ4	643+62	825+00	18,138^{1,2}	San Jose	Santa Clara

Note: 1. At Station 648+50, S1 648+50 BK = S1 641+65.665 AHD
2. Actual Distance = 18,822.335

The entire BART Extension Project alignment is presented in Figure 1, BART Extension Alignment and Segments, whereas the limits of Segments 3 and 4, as well as location of the proposed tunnel alignment and underground stations are presented in Figures 2 and 3. The locations of BART Extension Project field explorations located along Segments 3 and 4 are presented in Figure 4, Exploration Location Plan – Segments 3 and 4. BART Extension Project field explorations are presented again with existing explorations in greater detail on Figures 5 through 7, Site and Field Exploration Location Plan. Figure 8 also presents the locations of monitoring wells installed near the Civic Plaza/SJSU Station. A generalized soil profile and logs of borings along the tunnel alignment are presented in Figures 9 through 12. Plan and Profile Sheets 38 through 57, i.e. Drawings C138 through C157, provided by Earth Tech, are presented in Appendix A as a reference. Cross Section Sheets 17 through 26, i.e. Drawings C190 through C199, are also included in Appendix A. A detailed description of the main features planned along Segments 3 and 4 is presented in the following section.

It should be noted that the BART Extension Project tunnel alignment through downtown San Jose includes a majority of Segments 3 and 4, as demarcated in Figure 1, BART Extension Alignment and Segments. A separate Geotechnical Memorandum entitled "Silicon Valley Rapid Transit Corridor, At-Grade Track and Retained Cut (U-Wall) Track, Segment BSJ1, Fremont and Milpitas, California, Segment BSJ2, San Jose, California, and Segment BSJ5, San Jose and Santa Clara, California" dated August 15, 2003, presents results of our subsurface explorations along Segments BSJ1, BSJ2, and BSJ5.

1.2 PROJECT DESCRIPTION

Presently, there are several design options for the BART Extension Project tunnel alignment through downtown San Jose. For the Alum Rock Alignment, two (2) design alternatives are under consideration and are presented on Figure 2. The alternatives are: (1) US101/Diagonal Option, which consists of above grade track until the alignment crosses Lower Silver Creek, whereupon the tracks transition to below grade track (subway), and (2) Railroad/28th Street Option, which consists of the at-grade track transitioning to below grade track north of Las Plumas Avenue and continuing below Lower Silver Creek and US101. For the Crossover Track, two (2) design alternatives are under consideration and are presented on Figure 3. The alternatives are: (1) West of Civic Plaza/SJSU Option, and (2) West of Market Street Station Option. For the Diridon/Arena Alignment, two (2) design alternatives are under consideration and presented on Figure 3. The alternatives are: (1) North Option which consists of the tunnel alignment following immediately south of W. Santa Clara Street after passing under State Route 87 and proceeding under the Caltrain Yard, and (2) South Option which consists of the tunnel alignment veering slightly southward as it passes under State Route 87 and continuing under the existing Diridon Station.

It should be noted the following discussion is based on the most current 10% Conceptual Engineering Plans dated April 28, 2003, provided by Earth Tech. On these plans, the Railroad/28th Street Option is presented for the Alum Rock Alignment, the West of Civic Plaza/SJSU Option is presented for the Crossover Track, and the North Option is presented for the Diridon/Arena Alignment.

We have summarized major structures in Segments BSJ3 and BSJ4 in the following table.

Summary of Structures in Segments BSJ3 and BSJ4

Structure	Approximate Station Limits (feet)		Approximate Length (feet)	Comments	At Grade Track	Subway
	From	To				
Mabury Road Crossing Retained Fill	560+00	568+85	885	Continued from Station 549+50 (Segment 2)		
HWY 101 Crossing - Single Track Bridge	568+85	572+25	340	New bridge on SE side of existing railroad bridge		
Lower Silver Creek Crossing	580+40	581+55	115	New	X	
Subway Portal	584+00	589+90	590	Retained Cut		
Cut and Cover Subway	589+90	596+00	610	-		X
Traction Power Substation Site #7	596+00	597+25	125	North end of Alum Rock Station		X
Alum Rock Station	596+00	605+50	950	Underground Station		X
Bored Tunnel	605+50	677+20[1]	7854[2]	-		X

Summary of Structures in Segments BSJ3 and BSJ4

Structure	Approximate Station Limits (feet)		Approximate Length (feet)	Comments	At Grade Track	Subway
	From	To				
Civic Plaza/SJSU Station	677+20	686+70	950	Underground Station		X
Traction Power Substation Site #8	685+47	686+62	115	Southwest end of Civic Plaza/SJSU Station		X
Cut and Cover Crossover Box	686+70	693+60	690	-		X
Bored Tunnel	693+60	697+95	435	-		X
Market Street Station	697+95	707+45	950	Underground Station		X
Bored Tunnel	707+45	731+35	2390	-		X
Diridon/Arena Station	731+35	740+85	950	Underground Station		X
Traction Power Substation Site #9	739+92	740+85	93	West end of Diridon/Arena Station		X
Bored Tunnel	740+85	811+50	7065	-		X
Cut and Cover Subway	811+50	822+40	1090	-		X
Subway Portal	822+40	825+00	1090	Retained Cut		X

Notes: 1. At Station 648+50, S1 648+50 BK = S1 641+65.665 AHD
2. Actual distance

1.2.1 Tunnel Alignment and Profile

According to the most current 10% Conceptual Engineering Plans (dated April 28, 2003), the proposed BART Extension Project follows the Union Pacific Railroad (UPRR) right-of-way to Alum Rock Station (Railroad/28th Street Option). At Station 584+00, the alignment transitions from at-grade to underground by means of a 600-foot long retained cut. At Station 590+00, the alignment continues below-grade via cut and cover subway leading to the north end of Alum Rock Station. At the south end of Alum Rock Station, alignment continues below-grade by means of bored twin tunnels. From Alum Rock Station, the tunnel alignment turns west in a wide loop beneath commercial and residential properties and proceeds under Santa Clara Street near 19th Street at approximately Station 647+50. The tunnel alignment continues under Santa Clara Street to Civic Plaza/San Jose State University (SJSU) near 7th Street at approximately Station 677+20. At the west end of the Civic Plaza/SJSU at Station 686+70, a cut and cover crossover track extends to Station 693+60. After the crossover track, the bored tunnels continue from Station 693+60 to Market Street Station near 1st Street at approximately Station 698+00. After the Market Street Station, the bored tunnels continue under State Route 87 and enter Diridon/Arena Station near Autumn Street at approximately Station 731+40. Upon exiting the station, the bored tunnels proceed north at approximately Station 740+85 after crossing under the existing UPRR/Caltrain tracks. Here, the tunnel alignment continues under residential and industrial properties and follows Stockton Avenue until it crosses under the UPRR/Caltrain tracks between Emory and Hedding Streets. At Station 811+50, the bored tunnels transition to a cut and cover subway as the tunnel alignment climbs and continues north. At Station 822+40, a 660-foot long retained cut is planned as the alignment transitions to at-grade track.

Where the alignment transitions from at-grade to underground Station 590+00, the ground cover above the subway portal is approximately 6 feet and the tunnels slope down at the grade of 3.5% until they enter the Alum Rock Station at Station 596+00. As the tunnels exit Alum Rock Station at approximately Station 605+50, the groundcover above the tunnels is approximately 31 feet as they slope down at a grade of 0.561%. Where the horizontal alignment merges in Santa Clara Street at approximately Station 648+00, the tunnels pass under Coyote Creek. Here the crown of the tunnels are approximately 33 feet beneath the bottom of the creek and 65 feet below existing ground surface. At Station 643+86, the tunnels climb at a grade of 0.3% to Civic Plaza/SJSU Station where it enters at Station 677+20 with ground cover of approximately 38 feet. Continuing to climb at this grade, the tunnels exit the Civic Plaza/SJSU Station in a 690 feet long cut and cover crossover box (West of Civic Plaza/SJSU Option). At Station 693+60, the tunnels continue until they enter Market Street Station at Station 697+95 with a ground cover of approximately 41 feet. After Market Street Station, the tunnels descend at a grade of 0.36% at Station 715+00, where they cross under Almaden Blvd with a ground cover of approximately 41 feet. The tunnels continue to climb at a grade of 0.30% as they pass below State Route 87. Before the tunnels arrive at Diridon/Arena Station (North Option), they pass under Guadalupe River and Los Gatos Creek with approximately 25 feet of ground cover between the crown of the tunnels and the bottom of the waterways. Ground cover between the crown of the tunnels and existing ground surface varies between 41 and 46 feet. After leaving Diridon/Arena Station at Station 740+85, the grade of the tunnels varies between 0.3% upslope to 0.3% downslope. At Station 811+50 near McKendrie Street, the tunnels transition to a cut and cover subway and climb at a grade of 1.995% until Station 822+40 where the alignment continues above grade.

As discussed previously, there are several design options planned for the tunnel alignment and two design options for the crossover track. Details regarding these alternatives were not available in the 10% Conceptual Engineering Plans dated April 28, 2003. However, Figures 2 and 3 show approximate locations of design alternatives.

~~1.2.1~~1.2.2 Underground Stations

Four underground stations are proposed along the underground segments of the SVRTC alignment in downtown San Jose. They include: (1) Alum Rock, (2) Civic Plaza/San Jose State University, (3) Market Street, and (4) Diridon/Arena Station. Based on the 10% Conceptual Engineering Plans (dated April 28, 2003), each of the cut and cover stations will be approximately 950 feet long. Each station will have a concourse level above the boarding platform level, with the concourse typically 25 feet below existing ground surface. The anticipated depths of the excavations for the four stations are as follows: (1) Alum Rock – 50 feet (Elevation +38 feet), (2) Civic Plaza/SJSU – 61 feet (Elevation +21), (3) Market Street – 64 feet (Elevation +24), (4) Diridon/Arena – 63 feet (Elevation +25).

A crossover structure is also planned between the Civic Plaza/SJSU and Market Street Station. The cut and cover crossover box will be approximately 690 feet long with an anticipated excavation depth of about 60 feet.

The Alum Rock and Diridon/Arena Station will be constructed in generally open areas with ample room for cut and cover construction while having minimum impacts to traffic, adjacent buildings, and local businesses. However, the Civic Plaza/SJSU Station, Market Street Station, and crossover box will be constructed in an urban setting within a few feet of many existing buildings, including a number of high rise structures.

Traction Power Substation Site #7, 8 and 9 are planned as part of Alum Rock, Civic Plaza/SJSU and Diridon/Arena Station, respectively. Length of substations ranges from about 93 to 125 feet.

1.3 PROJECT SCOPE

This phase of the geotechnical investigation is based on the scope of services developed for the 10% Conceptual Engineering for the Build Alternative – BART of the Silicon Valley Rapid Transit Corridor project. The objectives were to expand the subsurface exploration program to better understand the subsurface conditions along the project alignment, especially at proposed underground station and structure locations, and to provide geotechnical input for "Type Selection" design.

Specifically, the scope of work for the downtown underground segments included the following:

- Perform additional exploratory borings and cone penetration tests (CPT) at the 4 underground stations and along tunnel segments between stations including:
    - Lower Silver Creek to Seventh Street
    - Fourth Street to First Street
    - Almaden Avenue Street to Autumn Street
    - Caltrain tracks crossing south of Santa Clara Street
    - The Alameda to Interstate 880
- Install vibrating wire piezometers to supplement the existing single standpipe piezometer at each proposed underground station location. The purpose of the piezometers is to evaluate the distribution of porewater pressure in clay layers above and below gravel layers, for use in temporary shoring and permanent station wall design.
- Perform seismic cone penetration tests as part of the proposed CPTs, to estimate shear wave velocities for underground station locations.
- Perform laboratory testing, including special testing to develop geotechnical parameters for underground station constitutive models. Tests on high quality, relatively undisturbed samples included constant rate of strain consolidation, k_O consolidated undrained direct simple shear and unconsolidated triaxial compression.

- Evaluate liquefaction potential based on site-specific field and exploratory data. Where liquefaction appeared likely, evaluate the potential consequences (e.g., differential settlement along tunnel or buoyancy effects).
- Coordinate with Harris, Miller, Miller, & Hanson, Inc. during down-hole vibration testing performed in four of URS' geotechnical exploration boreholes.

The following report sections summarize our preliminary findings and conclusions.

1.4 TUNNEL ENGINEERING

Preliminary design considerations were to be evaluated and presented in our technical memorandum for Task 25.2, Tunnel Engineering, of the 10% Conceptual Engineering phase of the project. Work on Task 25.2 has been suspended, as directed by Earth Tech.

1.5 UNDERGROUND STATION ENGINEERING

Preliminary design considerations were to be evaluated and presented in our technical memorandum for Task 25.3, Underground Station Engineering, of the 10% Conceptual Engineering phase of the project. Work on Task 25.3 also has been suspended, as directed by Earth Tech.

2.1 BACKGROUND

A discussion of the geologic and seismic setting of the entire corridor was presented in Section 2 of our January 11, 2002 Preliminary Geotechnical Exploration Report. For convenience, that discussion is repeated below. The discussion of Fault Rupture (Section 2.4.1) has been modified to clarify that there are no known active faults crossing the BART Extension Project alignment.

2.2 GEOLOGY

The BART Extension Project is located in the Santa Clara Valley, which extends southeastward from San Francisco Bay and is one of many northwest-trending valleys separated by intervening ranges within the Coast Ranges geomorphic province of northern California. The valleys and ranges of the Coast Ranges geomorphic province are generally parallel to major strike-slip faults and fold axes. The Santa Clara Valley is an alluvial basin located between the Santa Cruz Mountains to the southwest and the Diablo Range to the northeast. The Santa Clara Valley lies between the active San Andreas fault to the west, and the Hayward and Calaveras faults to the east. The valley is covered by alluvial fan, levee, and active stream channel deposits with marine estuary deposits along the Bay margins. These unconsolidated deposits cover Tertiary through Cretaceous age (144 to 1.8 million years old) bedrock. Regional geologic mapping has been performed by Dibblee (1972a and 1972b) and by Helley *et al.* (1979). Geologic mapping information for the greater San Francisco Bay area has been compiled and summarized by Wagner *et al.* (1990). Knudsen *et al.* (2000) have more recently mapped Quaternary age (less than 1.8 million years old) deposits in the nine county San Franciscan Bay region (Figure 13).

The entire BART Extension Project line lies on alluvial deposits that are underlain, at depths much greater than will be encountered during construction of the project, by Tertiary age (65 to 1.8 million years old) and upper Cretaceous age (about 78 to 65 million years old) marine sedimentary rocks and Cretaceous age (144 to 65 million years old) Franciscan Complex bedrock (Wagner *et al.*, 1990). These older rocks appear at the surface in the ranges southwest and northeast of the BART Extension Project.

The alluvium has been described as Holocene age (less than 10,000 years old) alluvial fan deposits, fine-grained Holocene alluvial fan deposits, and Holocene alluvial fan levee deposits (Figure 13, modified from Knudsen *et al.*, 2000). These alluvial fan deposits consist of sand, gravel, silt, and clay that were deposited by streams emanating from mountain canyons onto alluvial valley floors or alluvial plains. Fine-grained alluvial fan deposits occur on the flatter distal portions of fans and consist primarily of silt and clay-rich sediments with interbedded lobes of coarser sand and occasional gravel. The Holocene alluvial fan levee deposits have formed naturally where streams have overtopped their banks and deposited sand, silt, and clay adjacent to the channel.

Near the north end of the BART Extension Project alignment, these alluvial fan deposits grade into Holocene alluvial fan-estuarine complex deposits and Holocene Bay Mud (Knudsen *et al.*, 2000). The Holocene alluvial fan-estuarine complex deposits form where the distal zone of the fan and basin environments transition to the estuarine environment at the edge of San Francisco Bay between the Guadalupe River and Coyote Creek. These deposits are transitional from sand, silt, and clay of the alluvial environment to Bay Mud, which can be distinguished from fine grained alluvial sediment by its high water content and often high organic content.

Artificial fill may be present over any of these Holocene age deposits along the BART Extension Project alignment.

2.3 FAULTING AND SEISMICITY

2.3.1 Seismotectonic Setting

The BART Extension Project is located within one of the most seismically active regions in the world, situated within the San Andreas fault system, which marks the tectonic boundary between the Pacific and North American plates. Motion across the plate boundary is accommodated on a number of faults (Figures 14 and 15). As stated above, the BART Extension Project is located within the Santa Clara Valley between the Santa Cruz Mountains to the southwest and the Diablo Range to the northeast. The Santa Clara Valley is located between the active San Andreas fault to the west, and the Hayward and Calaveras faults to the east. Each of these faults has produced damaging earthquakes during historic time. The valley margins are marked by belts of active thrust faults; the Foothills fault system to the southwest and the East Valley thrusts (Southeast Extension of the Hayward fault) to the northeast.

The California Division of Mines and Geology has produced maps showing Alquist-Priolo Earthquake Fault Zones along faults with known Holocene activity. The closest faults to the project corridor along which Alquist-Priolo Earthquake Fault Zones have been mapped are the Hayward fault and farther to the west, the San Andreas fault (CDMG, 1982a, b, and c).

Seismogenic faults within 100 km of the corridor are described in the following sections. Each fault is characterized in terms of its closest distance to the corridor route, type of faulting, maximum magnitude, and slip rate. To estimate the maximum shaking that might occur at the project area in a future earthquake, estimates of the ground motion parameter, peak horizontal ground acceleration (PGA), were made using four empirical attenuation relationships and the maximum earthquakes listed in Table 1. Ground motions were only calculated for the faults that will have the greatest impact on the BART Extension Project, *i.e.*, those faults that are the most active (greatest slip rates), closest to the Corridor route, and that are capable of generating the largest earthquakes. The median (50th percentile) peak horizontal acceleration potentially generated by the maximum earthquake for each seismic source is tabulated in Tables 1 through 3. Ground motions have been calculated for soil conditions, as encountered along the majority of the corridor route. We also calculated the 84^{th} percentile peak ground acceleration for soil conditions (Tables 4 through 6). For several faults, we have estimated maximum magnitudes based on potential rupture lengths using the empirical relationships developed by Wells and Coppersmith (1994). The maximum magnitudes for the other faults were adopted from the Working Group on Northern California Earthquake

Potential (WGNCEP, 1996) and Working Group on California Earthquake Probabilities (WGCEP, 1999).

2.3.1.1 Hayward Fault

The Hayward fault is the closest active fault to the BART Extension Project. This fault extends for 100 km from the area of Mount Misery, east of San Jose, to Point Pinole on San Pablo Bay. Systematic right-lateral geomorphic offsets and creep offset of cultural features have been well documented along the entire length of the fault (Lienkaemper, 1992). The last major earthquake on the Hayward fault, in October 1868, occurred along the southern segment of the fault. This approximate Richter magnitude 7 event caused toppling of buildings in Hayward and other localities within about 5 km of the fault.

WGCEP (1999) considers the Hayward-Rodgers Creek fault system the most likely source of the next moment magnitude (M_w) 6.7 or larger earthquake in the Bay Area, with a 32 percent probability in the time period 2000 to 2030. Rupture of the Hayward fault would generate a maximum credible earthquake (MCE) of M_w 7.1.

2.3.1.2 Hayward Southeast Extension

The northeastern margin of Santa Clara Valley, including Evergreen Valley, is marked by a northeast-dipping sequence of thrusts that are part of the East Bay Hills structural domain (Aydin, 1984). This sequence of southwest-verging, reverse faults is located in the restraining left-step between the Calaveras and Hayward faults. Like the Foothill thrust belt on the western side of Santa Clara Valley, this series of reverse and reverse-oblique faults marks the margin of a region of rapid late Cenozoic uplift. No large, historical earthquakes have been conclusively attributed to the thrust faults along the eastern Santa Clara Valley margin (Oppenheimer *et al.*, 1990). The recent activity of many of these faults is inconclusive, and in some cases it is unclear whether the mapped trace is of tectonic or landslide origin. The range front along the northeastern side of Santa Clara Valley is modified by many large-scale slope failures. WGNCEP (1996) assigns a MCE of M_w 6.4 with a recurrence interval of 220 years for the Hayward Southeast Extension.

2.3.1.3 Rodgers Creek Fault

As indicated previously, the Hayward fault runs into San Pablo Bay at Point Pinole. The northern continuation of this fault system is the Rodgers Creek fault. The two faults are separated by a 5-km-wide right step beneath San Pablo Bay. The Rodgers Creek fault is 44 km long and has a similar geomorphic expression to the Hayward. Paleoseismic investigations by Schwartz *et al.* (1992) revealed three events in 925 to 1,000 years. This gives a preferred recurrence of 230 years for a maximum earthquake of M_w 7.1. The calculated slip rate for the Rodgers Creek fault is 8.4 ±2 mm/yr.

As stated above, the Working Group for California Earthquake Probabilities (1999) considers the Hayward-Rodgers Creek fault system the most likely source of the next M_w 6.7 or larger earthquake in the Bay Area, with a 32 percent probability of occurring in the time period 2000 to 2030.

2.3.1.4 Calaveras Fault

This fault is a main component of the San Andreas system, branching off the main San Andreas fault south of Hollister, and extending northwards for approximately 120 km to die out in the area of Danville. The predominant sense of motion on the Calaveras fault is right lateral strike-slip. The Calaveras fault has generated a number of moderate-size earthquakes in historic time, including the 1979 M_L 5.9 Coyote Lake and 1984 M_L 6.2 Morgan Hill events.

The long-term slip rate and contemporary creep rate for the southern Calaveras fault are approximately 15 ± 3 mm/yr (WGCEP, 1999), while the northern Calaveras fault has a creep rate of approximately 6 mm/yr (Prescott and Lisowski 1983) and a long-term geologic slip rate of 6 ± 1 mm/yr (Simpson *et al.* 1999). WGCEP (1999) suggests that rupture of the entire Calaveras fault would generate a MCE of M_w 7.2.

2.3.1.5 Sargent Fault

The 56-km-long Sargent fault zone is a northwest-striking, northeast-verging, reverse-oblique fault zone that intersects the San Andreas fault to the north near Lake Elsman, and the Calaveras fault to the south beneath the southern Santa Clara Valley near Hollister. The fault exhibits a prominent component of right-lateral slip, as shown by geomorphic offsets and fault plane slickensides exposed near Loma Prieta (Bryant *et al.*, 1981). Prescott and Burford (1976) measured 3 ± 1 mm/yr creep along the southern third of the Sargent fault. Like several of the faults in the Foothills thrust belt, the Sargent fault experienced triggered slip during the 1989 M_w 6.9 Loma Prieta earthquake (Aydin *et al.*, 1992). From a trenching investigation along the southern part of the fault, Nolan *et al.* (1995) calculated a preliminary slip rate of only 0.6 mm/yr, and a recurrence interval of 1,200 years for the southernmost part of the fault; however, these estimates are based on poorly constrained data. Based on its proximity to the San Andreas fault, WGNCEP (1996) did not consider the northern two-thirds of the Sargent fault to be an independent seismic source. The Sargent fault is capable of generating a MCE of M_w 6.8.

~~2.3.1.7~~2.3.1.6 Foothills Thrust Belt

The southwestern margin of the Santa Clara Valley is bounded by the rugged, young southern Santa Cruz Mountains. Late Cenozoic uplift of the mountains has occurred, in part, along a series of northwest-striking reverse faults bordering the northeastern margin of the range front. Bounded by the main trace of the San Andreas fault to the west, this sequence of southwest-dipping thrusts, associated with a restraining left bend in the San Andreas fault, has been responsible for the uplift of the Santa Cruz Mountains (Bürgmann *et al.*, 1994). These faults offset the Pliocene and Pleistocene Santa Clara Formation, and locally offset and deform overlying Quaternary sediments and geomorphic surfaces along the southwestern margin of the Santa Clara Valley (Fenton and Hitchcock, 2001). The up-dip projection of the blind Loma Prieta fault, which is interpreted to have been the source of the 1989 M_w 6.9 Loma Prieta earthquake (Bürgmann *et al.*, 1994), coincides with the Foothill thrust belt. Historical records indicate that a magnitude 6.5 earthquake in 1865 may have occurred on a fault east of the

San Andreas fault, possibly along the northeastern flank of the Santa Cruz Mountains (Toppozada and Borchardt, 1998).

The faults of the Foothill thrust belt are considered active and capable of generating large-magnitude earthquakes. The MCE for faults within the Foothill fault system is M_w 6.8. Fault slip rates are considered to be in the range 0.2 to 0.8 mm/yr, with 0.5 mm/yr being the preferred estimate.

2.3.1.7 San Andreas Fault

The San Andreas fault extends from the Gulf of California, Mexico, to Point Delgada on the Mendocino Coast in northern California, a total distance of 1,200 km. The right-lateral strike-slip San Andreas fault accommodates the majority of the motion between the Pacific and North American plates. This is the largest active fault in California and is responsible for the largest known earthquake in northern California, the 1906 M_w 7.9 San Francisco earthquake (Wallace, 1990). The 1906 earthquake resulted from rupture of the fault from San Juan Bautista north to Point Delgada, a distance of approximately 470 km. The average amount of slip on the fault during this earthquake was 5.1 m in the area to the north of the Golden Gate, and 2.5 m in the Santa Cruz Mountains (WGNCEP, 1996).

Based on differences in geomorphic expression, fault geometry, paleoseismic chronology, slip rate, seismicity, and historic fault ruptures, the San Andreas fault is divided into a number of fault segments. In the San Francisco Bay Area, these segments include the Santa Cruz Mountains, possible source of the 1989 M_w 7.1 Loma Prieta earthquake; the Peninsula segment; and the North Coast segment. All three segments ruptured during the 1906 M_w 7.9 San Francisco earthquake.

Fault activity is expressed in terms of slip rate, as determined by paleoseismic trenching studies, e.g., Hall *et al.* (1999). South of the Golden Gate, the fault slip rate is 17 ± 4 mm/yr (Hall *et al.* 1999). WGCEP (1999) assigns a recurrence interval of 361 years to a M_w 7.9 1906-type event on the San Andreas fault, with a 21 percent probability of a M_w 6.7 or larger earthquake on the San Andreas in Northern California in the time period 2000 to 2030.

2.3.1.8 San Gregorio Fault

This northwest-striking fault is the principal active fault west of the San Andreas fault in the coastal region of central California. The fault extends from just offshore of Point Sur, northward to Bolinas Lagoon, where it merges with the North Coast segment of the San Andreas. The majority of the fault is located offshore, with only two short sections, at Seal Cove and Moss Beach, occurring on land. Because of the limited onshore extent of the fault, the fault is relatively poorly understood. Jennings (1994) shows the fault as two distinct segments, separated by a prominent step in Monterey Bay. Simpson *et al.* (1997) carried out one of the few paleoseismic investigations along the fault. They demonstrated late Holocene right-lateral movement on the Seal Cove section of the fault. The most recent surface faulting event on the fault occurred sometime after A.D. 1270 to A.D. 1400, but prior to 1775 (Simpson *et al.*, 1997). Estimates of slip along the San Gregorio fault are highly variable. Simpson *et al.* (1997) give a range of 4 to 10 mm/yr, while WGCEP (1999) assigned a slip rate of 7 ± 3 mm/yr to the northern San Gregorio fault and 3 ± 2 mm/yr to the southern part of the fault. WGCEP (1999) assigns a maximum credible earthquake (MCE) of M_w 7.5 for an earthquake rupturing the entire length of the San Gregorio fault.

2.3.1.9 Monterey Bay-Tularcitos Fault

The Monterey Bay-Tularcitos fault is a zone of strike-slip faulting comprising the Monterey Bay, Navy and Tularcitos faults. The Monterey Bay fault zone is a diffuse zone of en echelon faults extending from an apparent junction with the San Gregorio fault in the northwestern part of Monterey Bay, southeast to merger with the Navy-Tularcitos fault zone between Sand City and Marina (Greene *et al.*, 1973). The Monterey Bay fault zone is associated with diffuse seismicity, and seismic reflection profiling in the area of Monterey Canyon shows that the fault may displace Holocene deposits. The slip rate for the Monterey Bay fault zone is approximately 0.5 ± 0.4 mm/yr. WGNCEP (1996) assigned an effective recurrence of 2,600 years for a MCE of M_w 7.1 on this fault.

2.3.1.10 Concord-Green Valley Fault

The Concord fault, and its continuation on the northern side of Suisun Bay, the Green Valley fault, is a northwest-striking right-lateral strike-slip fault of the San Andreas system. Both the Concord and Green Valley faults exhibit aseismic creep. Galehouse (1992) measured a creep rate of 3 to 6 mm/yr. Relatively few paleoseismic data exist for either fault. Wills *et al.* (1994) showed 30 to 60 m of right-lateral offset has occurred across the Concord fault during the Holocene (the last 10,000 years). Snyder *et al.* (1994) estimate a slip rate range of 2.6 to 10.8 mm/yr. WGCEP (1999) has assigned a slip rate of 4 ± 2 mm/yr for the Concord and 5 ± 2 mm/yr for the Green Valley fault. WGCEP (1999) assigns a MCE of M_w 6.8 for an earthquake rupturing the entire length of the Concord-Green Valley fault system.

2.3.1.11 West Napa Fault

This fault is a north-northwest-striking right-lateral strike-slip fault comprising a series of *en echelon* fault strands along the western side of the Napa Valley, from south of Napa to Yountville, a distance of approximately 25 km. The fault is characterized by well-defined active fault features including tonal lineaments, fault scarps in Holocene deposits, closed depressions, and right-laterally offset drainages. Very little contemporary seismicity is associated with this fault (Wong, 1990). To date, no independent paleoseismic data exist for the West Napa fault. Current estimates of 1 mm/yr for the slip rate and 700 years for the recurrence interval are based upon "regional strain book-keeping" (WGNCEP, 1996). Rupture of the entire West Napa fault would generate a MCE of M_w 6.5.

2.3.1.12 Greenville Fault

This fault is a north-northwest- to northwest-striking strike-slip fault of the San Andreas system in the northern Diablo Range. The fault extends from Bear Valley to just north of Livermore Valley. Evidence for right-lateral displacement on the Greenville fault includes right-laterally offset drainages and sidehill benches, and right-lateral surface offsets observed along traces of the fault following the January 1980 Livermore earthquake sequence (Hart, 1981). WGCEP (1999) assigned a maximum earthquake of M_w 7.2 and a minimum slip rate of 2 mm/yr to the Greenville fault. The recurrence interval is estimated to be on the order of 550 years.

2.3.1.13 Ortigalita Fault

This fault is a 66-km-long, north-northwest-striking, right-lateral strike-slip fault located in the southern Diablo Range, approximately 70 km to the west-northwest of the Bay Street pipeline. The fault extends from Panoche to southeast of Mount Stakes. The fault consists of two distinct geometric segments, separated by a 3.1-mile-wide (5-km-wide) right-step across San Luis Reservoir. Much of the fault is delineated by persistent microseismicity. The fault is marked by geomorphic indicators of recent strike-slip faulting including deflected drainages, shutter ridges, sidehill benches, and vegetation 4lineaments (Anderson *et al.*, 1982). Paleoseismic trenching investigations have estimated a slip rate of 1.0 ± 0.5 mm/yr. The MCE for the Ortigalita fault is M_w 6.9, with an effective recurrence of 1,100 years (WGNCEP, 1996).

2.3.1.14 Coast Range-Sierran Block Boundary (CRSB)

The CRSB is a complex zone of thrust faulting that marks the boundary between the Coast Range block and the Sierran basement rocks that are concealed beneath the Great Valley sedimentary rocks of the Sacramento and San Joaquin valleys. The basal detachment within the CRSB is a low-angle, west-dipping thrust accommodating eastward thrusting of the Coast Range block over the Sierran block. Above this detachment is a complex array of west-dipping thrusts and east-dipping back-thrusts. The CRSB was the probable source of the two M_w 6¼ to 6½ 1892 Winters earthquakes and the 1983 M_w 6.5 Coalinga earthquake (Wong *et al.*, 1988). Based on differences in geomorphic expression and fault geometry, Wakabayashi and Smith (1994) divided the CRSB into a number of segments. WGNCEP (1996) has since modified this segmentation model, using the rupture geometry of the 1983 Coalinga earthquake as a "characteristic" event. Fault activity is expressed in terms of slip rate as determined by Wakabayashi and Smith (1994) and refined by WGNCEP (1996). The preferred geologic slip rate is 1.5 mm/yr. The segments of the CRSB closest to the Rapid Transit Corridor are capable of generating a MCE of M_w 6.6 to 6.7 (WGNCEP, 1996).

2.3.1.15 Sacramento Delta Faults

Recent investigations in the Delta region have revealed a number of Quaternary active thrust faults beneath a series of right-stepping *en echelon* anticlines to the north of Mount Diablo (Unruh and Hector, 1999). These faults include the Roe Island thrust, Potrero Hills thrust fault, Pittsburg-Kirby Hills fault, and the Midland fault.

The Roe Island thrust underlies the asymmetric Roe Island anticline in Suisun Bay. The northeast-dipping thrust fault is considered capable of generating a MCE of M_w 5.5 to M_w 6.0 (Unruh, 1999). Slip-rate estimates range from 0.3 to 0.7 mm/yr.

The Potrero Hills thrust fault underlies the north-tilted Potrero Hills anticline, located just south of Fairfield. Unruh and Hector (1999) consider this fault capable of generating a MCE of M_w 6. Estimates of fault slip-rate range from 0.1 to 0.6 mm/yr.

The Pittsburg-Kirby Hills fault (PKHF) is a right-lateral tear fault that bounds the eastern margin of a series of folds and thrusts in the Grizzly Bay-Van Sickle Island area (Unruh *et al.* 1997). The PKHF is highlighted by a linear alignment of microseismicity, which is unusual in that it occurs at depths of 20 to 25 km (Wong *et al.*, 1988). Unruh and Hector (1999) assign a MCE of M_w 6.3 to the PKHF. Estimates for the slip rate of the PKHF range from 0.3 to 0.7 mm/yr.

The Midland fault is a west-dipping fault located along the eastern margin of the Montezuma Hills. From the offset of known Cenozoic reflectors, the Midland fault is estimated to have a slip rate of 0.1 to 0.6 mm/yr. The MCE for the Midland fault is considered to be M_w 6.3 ± 0.3.

2.3.1.16 Mount Diablo Thrust Fault

This thrust fault is a northeast-dipping, southwest propagating thrust fault beneath the Mount Diablo anticline. Unruh and Sawyer (1995) proposed that slip on the northern Greenville fault appears to die out northward because the fault steps to the northwest (left) across Mount Diablo to join with the right-lateral Concord fault. This model argues that the Mount Diablo anticline is a contractional left-stepover between the Greenville and Concord faults. Unruh and Sawyer (1995) specifically proposed that Mount Diablo is an asymmetric, southwest-vergent fault-propagation fold underlain by a northeast-dipping blind thrust fault that links the northern Greenville fault to the Concord fault.

Considering the likely fault geometry, an average slip rate for the Mount Diablo thrust would be approximately 4.1 ± 1.4 mm/yr. The likely geometry of this blind thrust fault indicates that it is capable of generating a maximum credible earthquake of M_w 6¾.

2.3.1.17 Los Medanos Thrust

This thrust is interpreted by Unruh and Hector (1999) to underlie the asymmetric, southwest-tilted Los Medanos and Concord anticlines. Based on an estimate of potential fault rupture area from the length of the overlying folds and the down-dip width from structural cross sections, Unruh *et al.* (1997) estimated a maximum earthquake magnitude of M_w 6 for the Los Medanos thrust fault. However, due to uncertainties on the fault geometry and the interaction of the fault with neighboring faults, namely the Roe Island thrust to the northwest and the Pittsburg-Kirby Hills fault to the east, the MCE for the Los Medanos thrust ranges from M_w 5¾ to M_w 6¼. Estimates for the slip rate on the Los Medanos thrust range from 0.3 to 0.7 mm/yr.

2.3.1.18 East Bay Thrust Domains

The East Bay Hills is a region of youthful, elevated topography between the Hayward and Calaveras faults. Late Cenozoic crustal shortening across this region is shown by folded Miocene and Pliocene rocks, and the presence of discrete thrust faults that repeat parts of the Neogene stratigraphy. Geomatrix Consultants (1998) have documented evidence for late Pleistocene and possibly Holocene surface faulting on secondary structures related to the Franklin fault near Walnut Creek. Wakabayashi and Sawyer (1998) have also obtained paleoseismic evidence for late Pleistocene to Holocene surface rupture on the Miller Creek fault. Based on the elevated topography, late Cenozoic folding, and paleoseismic evidence for surface-rupturing earthquakes, the Thrust Faults Subgroup of the 1999 Working Group on California Earthquake Probabilities (unpublished memo) concluded that active thrust-related seismic sources exist within the East Bay hills. However, given the limited amount of paleoseismic information, rather than characterize individual faults, the Thrust Fault Subgroup defined a series of areal source zones, rather than try to characterize discrete fault sources. These zones are:

- The Western East Bay Hills domain bounded by the Hayward fault to the west and the Moraga-Miller Creek-Palomares faults to the east. This domain contains the active Miller Creek thrust fault (Wakabayashi and Sawyer, 1998). This elongate zone is considered capable of generating a MCE of M_w 6. The slip rate, considered to be comparable to measured uplift rates in this area (Kelson and Simpson, 1996), is approximately 1.0 mm/yr.
- The southern East Bay Hills domain is roughly a triangular region bounded to the west by the Western East Bay Hills domain, by the northern Calaveras fault to the east, and by the Bollinger thrust fault to the north and northeast. The maximum length of thrust faults in this domain is about 15 km. This domain is considered capable of generating earthquakes of M_w 6¼ to 6½. Slip rates, calculated from measured uplift rates and assuming slip on thrust faults that dip 30° to 45°, are in the range 0.1 to 1.0 mm/yr, with 0.3 mm/yr representing the best-estimate value.
- The northern East Bay Hills domain is the region that lies north of the Bollinger thrust fault and west of the western domain. This domain contains the Pinole, Southampton, and Franklin faults. Geomatrix Consultants (1998) assigned a MCE of M_w 6¾ to the Franklin fault. The Thrust Fault Subgroup assigned a MCE of M_w 6¼ to 6¾ to the northern domain. The slip rate for this domain is 1.0 to 4.0 mm/yr. The higher value assumes that slip from the northern Calaveras fault is transferred through this region (Aydin, 1982).

2.3.1.19 Quien Sabe Fault

The 22-km-long Quien Sabe fault is a right-lateral strike-slip fault located to the east of Tres Pinos. WGNCEP (1996) considers this fault capable of generating a MCE of M_w 6.4.

2.4 GEOLOGIC AND SEISMIC IMPACTS

The potential geologic and seismic impacts on the BART Extension Project include fault rupture, strong ground shaking, liquefaction, lateral spreading, and settlement. Landsliding, seismically-induced or otherwise, is not anticipated to have a potential impact on the project due to the relatively flat topography along the corridor. The distance of the project from San Francisco Bay and the shallow depth of the south end of the Bay makes the potential for seismically-induced inundation from a tsunami or seiche nil. There are no known or mapped active or Quaternary volcanoes in the vicinity of the project site (Jennings, 1994). Accordingly, the potential for volcanic hazards at the site is nil.

2.4.1 Fault Rupture

As shown on Figure 15, there are no known active faults crossing the BART Extension Project project alignment; thus the potential for ground rupture due to faulting is considered very low. The Silver Creek fault is classified as pre-Holocene by the California Geological Survey (CGS), is shown as an early Quaternary fault on the CDMG (now the CGS) Recency of Faulting map sheet for the San Francisco – San Jose Quadrangle by Wagner, D.L., *et. al.* (1990) and is not an Alquist Priolo zoned fault. The City of San Jose Fault Hazard map (1983) does show the Silver Creek fault as a Special Studies Zone on the San Jose East quadrangle. A recent study by William Lettis & Associates completed by Hitchcock, C.S. and Brankman, C.M., (July 2002) for the USGS included a cut slope exposure completed during construction of a golf course near the intersection of Silver Creek Valley Road and Stonyford Circle. The cut was made across the Silver Creek fault where bedrock is exposed at the surface, south of where the fault is crossed by the BART alignment. The trench revealed that the fault did displace a colluvial wedge, however age dating of the colluvium was not well-constrained and no definitive conclusion that the Silver Creek fault is a Holocene fault could be made. At the BART crossing location the fault is buried by several hundred feet of alluvium and the possibility of a fault rupture occurring that could impact the proposed project is considered to be very low. However, as discussed below in more detail, active faults are located to the northeast and southwest, and surface fault rupture is possible to the north of this project alignment near the existing Fremont BART station.

The proposed BART Warm Springs Extension, located immediately north of the BART Extension Project, crosses the Hayward fault at two locations. The two crossings, just south of the existing Fremont BART station and at the intersection of Washington Boulevard and Osgood Road have a high potential for experiencing fault rupture during the life of that project. In addition to potential fault rupture, this section of the Hayward fault is actively creeping (*i.e.*, continuous, aseismic slip). In the area of the Fremont BART station crossing, the creep rate is 5.3 to 5.5 mm/yr. Adjacent to the Washington/Osgood intersection, the creep rate has been measured at 8.9 mm/yr over a 47-year period.

Based on empirical relationships between fault length and fault displacement (Wells and Coppersmith, 1994), and assuming a fault rupture length of 70 km (Lienkaemper and Galehouse, 1997), the potential displacement at each of these sites along the Warm Springs Extension is 1.6 m for average displacement and 3.2 m for maximum displacement. The width of the zone over which this displacement is likely to occur is 4.2 to 26.5 m (Lienkaemper and Galehouse, 1997; Fenton, 2000).

2.4.2 Strong Ground Shaking

Ground motions were calculated at three sites: at the proposed stations at Warm Springs, Montague/Capitol, and Santa Clara. Deep soil conditions were assumed at each site. Both median and 84th percentile peak ground acceleration (PGA) ground motions were calculated (Tables 1 to 6). Ground motions are quoted in percentage of g, the acceleration under the force of gravity ($g=9.8\ m/s^2$).

At Warm Springs a M_w 7.1 earthquake on Hayward fault at a distance of 1 km would generate the greatest ground motions. Median PGA is 0.55 g, while 84th percentile ground motion is 0.85 g.

At Montague/Capitol, the Southeast extension of the Hayward fault with a MCE of M_w 6.4, located 1.3 km east of the site, would generate median PGA of 0.55 g. The 84th percentile value is 0.92 g.

At Santa Clara the highest ground motions are generated by a M_w 6.8 earthquake on the Foothills thrust belt, located 7.5 km west-southwest of the site. The median and 84th percentile PGAs are 0.43 g and 0.68 g, respectively.

The proximity of the project site to a number of active faults capable of generating large magnitude earthquakes means that strong ground shaking will probably be the major geologic hazard at the site. Strong ground shaking may directly cause damage to BART Extension Project structures and may also cause liquefaction and related secondary seismic hazards such as lateral spreading, ground lurching, cracking, warping, and settlement.

2.4.3 Liquefaction

Liquefaction is a process that occurs under certain conditions, when saturated, granular soils are subjected to prolonged shaking during an earthquake. The material experiences a rapid loss of shear strength due to increased pore pressure and decreased effective stress, resulting in fluid-like behavior. Liquefaction can result in catastrophic ground failure, if soils lose bearing capacity. Lateral spreading, ground lurching, cracking, warping, and settlement can also result from liquefaction. Loose, clean, fine sands and silts that are relatively free of clay most commonly experience liquefaction.

A review of recent published data (Knudsen *et al.*, 2000) indicates that about a quarter of the BART Extension Project is within areas of high to very high liquefaction susceptibility, about half of the corridor is within areas of moderate susceptibility, and about a quarter is within areas of low susceptibility (Figure 16). Subsurface exploration along the corridor alignment will enable the identification of areas where these effects may occur.

A more detailed discussion of liquefaction potential along Segments BSJ-3 and BSJ-4 is presented in Section 5 of this report, based on the updated geotechnical data obtained during our recent exploration.

2.4.4 Lateral Spreading and Lurching

Lateral spreading is the movement of unconsolidated earth materials following liquefaction and occurs on horizontal to gentle slopes (and embankments) that have little or no lateral support. Lurching is the abrupt, seismically-induced movement of weak, unconsolidated earth materials, most commonly adjacent to "open faces" of unsupported excavations or stream channels. Lateral spreading and lurching are often associated with ground cracking and ground settlement. Subsurface exploration along the corridor alignment will be enable the identification of areas where these effects may occur.

Based on updated geotechnical data obtained during our recent exploration, a detailed discussion of lateral spreading and lurching along Segments 3 and 4 is presented in Section 5 of this report.

2.4.5 Flooding

A review of the Santa Clara Valley Water District flood control maps (1992) indicates that a major portion of the corridor is located within the 1% flood limits (100-year flood). FEMA flood hazard maps also show that a major portion of the corridor lies within the Special Flood Hazard Area. According to these maps, flooding occurs along Coyote Creek, Guadalupe River, Penitencia Creek, Upper Penitencia Creek, Lower Penitencia Creek, Lower Silver Creek, and Wrigley Ford Creek. Therefore, the flood hazard along a major portion of the corridor is moderate to high.

The northernmost portion of the BART Extension Project within Alameda County does not lie within areas that are expected to be inundated by the 100-year flood (FEMA, 2000).

2.5 CONCLUSIONS

The results of this geologic hazards evaluation of the proposed BART Extension Project indicate that there are no geologic hazards that would preclude the proposed project. There are no known active faults crossing the corridor or that are in sufficiently close proximity to the alignment, thus the potential for ground rupture due to faulting is considered to be very low. However, like all of the Bay Area, the project is located in a region of potentially high seismic activity and thus may experience the effects of strong ground shaking. These effects may include liquefaction, lateral spreading and lurching. Section 5.3 presents our evaluation of the potential for these secondary seismic effects, based on our site-specific exploratory findings.

Based upon our findings, we have concluded that construction of the rapid transit facility is feasible along the proposed alignment, from an engineering geology viewpoint. The potential for inundation by flooding from the nearby Guadalupe River, Coyote Creek, and other local creeks will also need to be considered and addressed during final design of the project.

In this section, a discussion of explorations along the tunnel alignment and at underground station locations is presented. The approximate station number for all explorations, including previous and new (2001, 2002, and 2003) BART Extension Project explorations is presented in Table 7.

3.1 PREVIOUS SUBSURFACE INVESTIGATIONS

We reviewed the following 11 reports that provided geotechnical information along the tunnel alignment and at underground stations.

Boring Index	Consultant / Agency	Consultant / Agency Project Number	Project Date	Project Name
100W-n	Applied Soil Mechanics, Inc.	A5-1699-J1	May, 1985	Geotechnical Investigation, 100 West Santa Clara Office Building and Parking Garage, San Jose
150W-n	Applied Soil Mechanics, Inc.	A6-1669-J3	Oct, 1986	Review of Proposed Dewatering Program, 150 West Santa Clara Office Building, San Jose
150W-n	Applied Soil Mechanics, Inc.	A6-1669-J3	Nov, 1986	Shoring Deflection Analysis, 150 West Santa Clara Office Building, San Jose
AT-n	Lee and Praszker	L-810	Sept, 1985	Geotechnical Investigation, Almaden Tower, San Jose
CC-n/ CPT-n	URS Corporation	95-00112001.00	Jul, 2001	Geotechnical Investigation, New San Jose Civic Center, San Jose
IPP-n	Woodward-Clyde Consultants	983002NA	May, 1998	South Bay Water Recycling Program, Geotechnical Investigation Infill Pipelines Project, San Jose
LSO-n	Caltrans, Project Development	04-112724	Aug, 1989	Project Plans for Construction on State Highway in Santa Clara County in San Jose, From Route 82 to Coleman Avenue Overcrossing
MC-n	Peter Kaldveer and Associates	K480-4	Sept, 1977	Geotechnical Investigation for Radiology and Laboratory Building, San Jose Hospital and Health Center, San Jose
OPUS-n	Kleinfelder, Inc.	10-3007-42	Mar, 1998	Geotechnical Investigation Report, Multi-Story Office Building, West Santa Clara Street and Almaden Avenue, San Jose
SJA-n	Woodward-Clyde Consultants	8815020-R	Apr, 1989	Geotechnical Engineering Study, San Jose Multipurpose Arena, San Jose
TSP-n	Parikh Consultants, Inc. / Woodward-Clyde Consultants	95117.10	Dec, 1995	Geotechnical Engineering Investigation, Draft Report, South Bay Water Recycling Project-Phase 1, Twelfth Street Pipeline, San Jose

The assigned boring numbers are shown in the first left-hand column in the above table. Locations, logs and laboratory results of these previous borings were attached as reference in our report entitled "Preliminary Geotechnical Exploration Report, Silicon Valley Rapid Transit Corridor, Alternative 11 -BART on UPRR Alignment, Alameda County and Santa Clara County, California," and dated January 11, 2002. Logs of pertinent explorations (borings and CPTs) are presented in Appendix B.

3.2 SUBSURFACE EXPLORATION PROGRAM FOR THE BART EXTENSION PROJECT

3.2.1 2001 Field Exploration

To characterize subsurface conditions at the four underground stations, 4 exploratory borings (numbered NB-01, NB-04, NB-05 and NB-06) and 4 observation wells (numbered NW-01, NW-04, NW-05, and NW-06), were completed in August 2001 during the MIS phase of this project. Approximate locations of the borings and wells are presented on Figures 4 through 7. Logs of borings and laboratory results were presented in our January 2002 Preliminary Geotechnical Report. For convenience, the logs and laboratory results are included in Appendix C and Appendix D, respectively of this report. A summary of the groundwater level readings from the 2001 observation wells is presented in Table 8.

Downhole vibration monitoring tests were performed by Harris, Miller, Miller, & Hanson, Inc. (HMMH) in 3 borings (NB-01, NB-04 and NB-06) at selected depth intervals. Results and interpretation of these tests were presented in a separate report issued by HMMH.

3.2.2 2002 / 2003 Field Exploration

To further characterize subsurface conditions along the tunnel alignment and at the four underground stations, seventeen (17) exploratory borings, five (5) cone penetration tests (CPTs), five (5) in situ performed between November 2002 and July 2003 during the Conceptual Engineering phase of the project. Approximate locations of the exploratory borings, CPTs, and observation wells are presented on Figures 4 through 8. Logs of the borings, CPTs, and observation wells are presented in Appendix C.

Insitu field vane shear tests were performed in Borings NB-07, NB-13A, NB-16, NB-17 and NB-19 at each of the four underground station locations. Appendix E provides a detailed discussion of the field vane shear test apparatus, the test procedure and the results. Appendix F describes seismic cone tests performed at the underground station locations. Graphical plots of shear wave velocity vs. elevation are presented.

Vibrating wire piezometers were installed in four of the exploratory borings (NB-07, NB-13A, NB-16, and NB-17) to measure discrete changes in soil porewater pressures. The piezometers were installed tandem in each of the four Borings NB-07, NB-13A, NB-16 and NB-17 and were located between Elevation 16 to 21 feet and Elevation 39 to 46 feet. A summary of pertinent piezometer information and a summary of readings taken to date is presented in Table 9.

Three observation wells (MW-1, MW-2, and MW-3) were installed in March 2003 near the San Jose Civic Center construction site. The wells extend to a depth of 74 to 84 feet below ground surface and were intended to provide further insight regarding temporary dewatering of excavations along the downtown portion of the alignment. Figure 8 presents the approximate locations of these wells in relation to the existing San Jose Civic Center Excavation and proposed Civic Plaza/SJSU Station. Logs and construction details of the observation wells are presented in Appendix C. A summary of the monitoring results is presented in Table 10. A more comprehensive evaluation of the dewatering operations at the Civic Center site will be discussed in Section 5 of this report.

Downhole vibration monitoring tests were performed by HMMH in four borings (NB-02, NB-03, NB-3A and NB-08) at selected depth intervals; the depth intervals where the tests were performed are noted on the appropriate logs of borings in Appendix C.

A discussion of the subsurface conditions and geotechnical characteristics of the major strata encountered along the underground (tunnel) alignment was presented previously in our January 2002 Preliminary Geotechnical Exploration Report. An update of the subsurface conditions is presented below, based on data from the recent field exploration and laboratory testing program.

4.1 GENERALIZED SOIL PROFILES

Figures 9 through 12 present the tunnel profile and logs of borings and CPT soundings along the tunnel alignment and at underground stations. In addition, we have developed generalized subsurface soil profiles at the four underground station locations. On these figures, soil index properties are summarized graphically for each underground station; included are plots of undrained shear strength (Su), moisture content, dry density and sampler penetration resistance (blows/foot) versus elevation. The subsurface conditions along the tunnel alignment and at each of the four underground stations are discussed below. Detailed descriptions of the subsurface stratigraphy are presented on the appropriate boring logs included in Appendix C.

4.1.1 Subsurface Conditions along Tunnel Alignment

Based on the information from previous investigations and the current SVRTC investigation and laboratory testing program, the subsurface conditions along the underground (tunnel) alignment are described below.

4.1.1.1 Station 590+00 to 647+00

The subsurface soils in the eastern end (near the planned Alum Rock Station) of the tunnel consist of alternating layers of medium to very stiff lean clay and fat clay to a depth of about 60 feet below ground surface (bgs); occasionally, layers of soft clays were encountered in the upper 30 feet or so. Below these layers are granular layers consisting of very dense well graded sand and clayey sand to a depth of about 90 feet bgs. Occurring below the granular layers is a layer of stiff to very stiff lean clay to maximum boring depth of 120 feet bgs.

4.1.1.2 Station 647+00 to 731+35

Along Santa Clara Street, varying thickness of pavement and fill sections were encountered. Below the fill/pavement section, native soils are predominately lean clays with occasional fat clays extending to depths of about 50 feet to 70 feet bgs. These clay deposits are generally medium to very stiff and occasionally soft just below groundwater level. Granular interbeds consisting of loose to medium dense well graded sand and silty sand about 1 to 4 feet thick were encountered in most borings at depths ranging from 10 feet to 35 feet bgs. Occurring directly below the lean clay deposits are predominately granular layers which extend to the maximum boring depth of 121½ feet. These granular deposits are generally dense to very dense silty sand, well graded sand, clayey sand, poorly graded sand, silty gravel and poorly graded gravel; at a few locations these deposits are medium dense. Within these granular layers are occasional interbeds of stiff to very stiff lean clay.

4.1.1.3 Station 731+35 to 757+00

As the tunnel alignment progresses along The Alameda, pavement sections of varying thickness were encountered overlying fill. Native soil conditions are predominately lean clays and silty clays with some fat clays and silts to depths of about 65 to 90 feet; they are generally medium to stiff and occasionally soft or very stiff in consistency. Within the upper 65 to 90 feet, numerous granular interbeds of silty sand, clayey sand, well graded sand, gravelly sand, well graded gravel and clayey gravel were encountered ranging in thickness from 4 to 13 feet. These granular deposits are medium dense to very dense. Below depths of about 65 to 90 feet, the predominant soils are dense to very dense silty sand, clayey sand, well graded sand, poorly graded sand, gravelly sand, and sandy gravel.

4.1.1.4 Station 757+00 to 822+40

Along Stockton Avenue from Julian Street to I880, below the pavement section, borings encountered native soils consisting of predominately medium to stiff silty clay to depths of about 25 to 40 feet. Occasionally these clay layers are soft. Within the silty clay deposits, interbeds of loose to medium dense silty sand and clayey sand occurred; interbed thickness ranged from 3 to 10 feet. These granular deposits are quite variable in relative density, ranging from medium dense to very dense. Below depths of about 25 to 40 feet, granular deposits were generally encountered consisting of medium dense to very dense silty sand, clayey sand and well-graded gravel. Within the granular deposits, interbeds of stiff to very stiff silty clay were encountered.

4.1.1.5 Summary

Based on the current profile of the tunnel alignment, we expect the eastern portion of the tunnel (east of the Market Street Station) will encounter predominately fine grained silts and clays of medium to stiff consistency, with occasional soft deposits. From Market Street Station and proceeding westward, some granular deposits of sand and gravel to silty sand and clayey sand interbedded in fine grained silts and clays are expected. The majority of the tunnel invert will be below groundwater, with a maximum hydrostatic head of about 55 feet.

~~3.2.6~~4.1.2 Subsurface Conditions at Alum Rock Station

According to Cross Section Sheet 19 (Drawing Number C192) in Appendix A, the anticipated maximum depth of excavation for the Alum Rock Station is approximately 50 feet below existing grade (Elevation +38 feet). Considering a full concourse above the boarding platform level, we estimate the roof of the station will be about 3 feet below existing grade (Elevation +85 feet). Subsurface conditions within the excavation generally consist of lean, lean to fat, and fat, medium to stiff clays, with a thick sand layer extending from approximately 63 to 95 feet below existing grade (Elevation +29 to –3 feet).

Also presented on Figure 9 are undrained shear strengths obtained with field vane shear and CPT soundings advanced at the Alum Rock Station. Based on the laboratory and insitu test results, we estimate the material above the anticipated excavation subgrade at Alum Rock Station has undrained shear strengths in the range of 1,000 to 1,500 pounds per square foot (psf). The underlying sand is dense with equivalent standard penetration test (SPT) N-values typically in excess of 30 blows/foot. The sand layer is underlain by another layer of stiff to very stiff clay exhibiting shear strengths of about 2,000 psf. Plots of index properties for the Alum Rock Station are summarized on Figure 9.

As part of the 2001 exploration program, one deep observation well (NW-01) was installed in Boring NB-01 to monitor the piezometric head in the sand layer between depths of 70 and 80 feet (Elevation +22 to +12 feet). As shown on Table 8, measurements indicate the piezometric head in the sand layer varies between 6 to 12 feet below existing grade (Elevation +74 to +80 feet).

In our 2002/2003 exploration program, two vibrating wire piezometers were installed in Boring NB-13A at depths of 40 and 70 feet (Elevation +46 to +16 feet) to monitor pore pressure changes, and to provide data for the evaluation of hydraulic stability at the anticipated underground station excavation subgrade. As shown in Table 9, the measured piezometric head in the piezometers varied between Elevation +77 to +72 feet (approximately 11 to 14 feet below existing grade); these pore pressures are consistent with the piezometric level measured in NW-01 (Elevation +74 to +80 feet).

The excavation for the station is anticipated to leave a relatively thin clay "cap" above the sand. Therefore, the subgrade will be subject to significant hydrostatic pressures. A key concern is the potential for uplift of the excavation bottom because the weight of the clay cap would be insufficient to resist the uplift pressures.

~~3.2.7~~4.1.3 Subsurface Conditions at Civic Plaza/San Jose State University Station

The anticipated maximum depth of excavation for the Civic Plaza/San Jose State University Station is approximately 61 feet below existing grade (Elevation +20 feet), as shown on Cross Section Sheet 22 (Drawing Number C195) in Appendix A. Considering a full concourse above the boarding platform level, the roof of the station will be about 13 feet below existing grade (Elevation +69 feet). Subsurface conditions within the excavation generally consist of interbedded layers and lenses of clays and sand. Extending from existing grade to approximately 53 to 61 feet (Elevation +28 to +20 feet), the subsurface soils consist predominantly of medium stiff to very stiff, lean, lean to fat, and fat clay. The clay is underlain by dense to very dense sand and gravel with lenses and pockets of silt. The sand and gravel layer is approximately 30 to 40 feet thick and extends to about 92 to 101 feet below existing grade (Elevation –11 to –20 feet). Below the sand and gravel layer is a very stiff to hard clay layer, extending to the terminal depth of the borings (121½ feet below existing grade).

Presented on Figure 10 are undrained shear strengths obtained with the field vane shear and CPT soundings at the Civic Plaza/SJSU Station. The undrained shear strengths of the clays vary from 750 to more than 2,000 psf. The sand and gravel layer was typically dense to very dense with equivalent standard penetration test (SPT) N-values in excess of 40 blows/foot. Plots of index properties for the Civic Plaza/SJSU Station are summarized on Figure 10.

As part of the 2001 exploration program, one observation well (NW-04) was installed in Boring NB-04 to monitor piezometric head in the sand layers between depths of 70 and 80 feet (Elevation +18 and +8 feet). As shown on Table 8, measurements indicate the piezometric head in the sand and gravel at about 14 feet below existing grade (Elevation +74 feet).

As part of our 2002/2003 investigation, two vibrating wire piezometers were installed in Boring NB-16 at depths of 42 and 60 feet (Elevation +31 and +21 feet) to monitor the pore pressures changes. As shown on Table 9, the measure piezometric head in both piezometers varies between Elevation +72 to +66 feet (approximately 9 to 15 feet below existing grade).

Since the planned excavation subgrade will likely extend into the sand and gravel layer, significant hydrostatic pressures should be anticipated at the subgrade level and control of groundwater will be critical during excavation.

~~3.2.8~~4.1.4 Subsurface Conditions at the Market Street Station

The anticipated maximum depth of excavation for the Market Street Station is approximately 64 feet below existing grade (Elevation +24 feet), as shown on Cross Section Sheet 23 (Drawing Number C196) in Appendix A. Considering a full concourse above the boarding platform level, the roof of the station will be about 17 feet below existing grade (Elevation +71 feet). From existing grade to a depth of about 71 to 80 feet (Elevation +18 to +9 feet) subsurface conditions consist predominately of medium to stiff lean, lean to fat, and fat clays with interbedded dense to very dense sands. Extending from about 71 to 99 feet below existing grade (Elevation +18 to –10 feet) is a very dense gravel layer with some hard to stiff clay seams.

Presented on Figure 11 are undrained shear strengths obtained with the field vane shear and CPT soundings at the Market Street Station. Undrained shear strengths of the clays generally vary from 900 to more than 2,000 psf. The deep gravel layer was typically very dense with equivalent standard penetration test (SPT) N-values in excess of 50 blows/feet. Plots of index properties for the Market Street Station are summarized on Figure 11.

As part of the 2001 exploration program, one observation well (NW-05) was installed in Boring NB-05 to monitor piezometric head in the sand layer between depths of 80 and 90 feet below existing grade (Elevation +10 and +0 feet). As shown on Table 8, measurements indicate the piezometric head in the sand and gravel layer varies between 19 and 22 feet below existing grade (Elevation +71 to +68 feet).

As part of our 2002/2003 investigation, two vibrating wire piezometers were installed in Boring NB-17 at depths of 45 and 70 feet (Elevation +44 and +19 feet) to monitor pore pressure changes. As shown in Table 9, the measured piezometric head in both piezometers varies between Elevation +65 and +63 feet (approximately 24 and 26 feet below existing grade).

It is anticipated that the bottom of the station excavation will be at Elevation +66 feet, approximately 10 feet above the highly permeable sand/gravel layer. Consequently, the excavation subgrade will be subjected to high hydrostatic pressure.

~~3.2.9~~4.1.5 Subsurface Conditions at Diridon/Arena Station

The anticipated maximum depth of excavation for the Diridon/Arena Station is approximately 63 feet below existing grade (Elevation +25 feet), as shown on Cross Section Sheet 24 (Drawing Number C197) in Appendix A. Considering a full concourse above the boarding platform level, the roof of the station will be about 16 feet below existing grade (Elevation +72 feet). Subsurface conditions within the anticipated excavation consist of medium to stiff lean, lean to fat, and fat clays, with interbedded lenses of sand and gravel extending from existing grade to a depth of 68 to 108 feet (Elevation +6 to +2 feet). From about 68 to 110 feet below existing grade (Elevation +20 to –22 feet), a very dense gravel layer underlies portions of the upper clay layers. Underlying the gravel layer from about 90 to 108 feet below existing grade (Elevation –2 to –20 feet) is a very stiff silt and clay seam (Boring NB-07) which, in turn, is underlain by a very dense sand from 98 to 121 feet below existing grade (Elevation -10 to –33 feet).

Figure 11 presents undrained shear strengths obtained with the field vane shear and CPT soundings at the Diridon/Arena Station. The data shown that the clays extending to a depth of about 18 feet below existing grade (Elevation +70 feet) are generally stiff to very stiff with strengths ranging between 900 and 2,000 psf. Below Elevation +70 feet, the clay layers are medium stiff to stiff with undrained shear strengths ranging between 900 and 1,700 psf. The deep sand and gravel layers are typically very dense with standard penetration test (SPT) N-values in excess of 50 blows/foot. Plots of index properties for the Diridon/Arena Station are summarized in Figure 11.

As part of our 2001 exploration program, one observation well (NW-06) was installed in Boring NB-06 to monitor piezometric head in the deep sand layer between depths of 90 and 100 feet below existing grade (Elevation –1 and –11 feet). As shown on Table 8, measurements indicate the piezometric head in the deep sand layer at Elevation +73 feet.

As part of our 2002/2003 investigation, two vibrating wire piezometers were installed in Boring NB-07 at depths of 40 and 65 feet (Elevation +44 and +119 feet) to monitor pore pressure changes. As shown in Table 9, the measured piezometric head in both piezometers varies between Elevation +70 to +65 feet (approximately 14 and 19 feet below existing grade).

It is anticipated portions of the excavation subgrade will be about 13 feet above the highly permeable gravel layer (located at about Elevation +16 to -6 feet in Boring NB-07). Since the piezometric head in the gravel layer was observed to be as high as Elevation +70 feet, we expect the station excavation subgrade to be subject to significant hydrostatic pressure.

Presented below is a discussion of conceptual geotechnical opinions and conclusions for the Bored Tunnels, Underground Stations, Groundwater Issues, and Liquefaction. It should be noted that the following discussion is based on widely spaced explorations.

5.1 BORED TUNNELS

A detailed discussion regarding recommended Tunneling Methods, Construction Scheduling, Cost Estimates, Settlement Impacts, and Contractual Considerations, is presented in our technical memorandum entitled "BART Extension to San Jose – Bored Tunnels, Silicon Valley Rapid Transit Corridor, Downtown San Jose, California", dated April 9, 2002. The conceptual information presented below is consistent with our April 9, 2002 report.

5.1.1 Tunneling Methods

Given the relatively soft alluvial soils and high groundwater table anticipated to be encountered along the tunnel alignment, it is our opinion that a pressurized face Tunnel Boring Machine (TBM) would be most appropriate for construction of the twin single-track tunnels. Pressurization of the excavated face ahead of the TBM can be accomplished by means of compressed air, pressurized slurry, or pressurized muck.

Typically, compressed air requires a specialized workforce and stringent safety requirements that are difficult to meet and can have significant impact on the cost of construction. The Slurry Shield and Earth Pressure Balance (EPB) Machine are possible alternatives that are more appropriate. Of the two TBM types, the EPB Machine is considered to be the most likely to be chosen for the ground conditions to be encountered along the tunnel alignment.

EPB Machines consist of a full face rotating excavator (cutter head) with a pressurized muck chamber that provides support for the tunnel face. As the TBM advances, the chamber is filled with the excavated soils which are mixed into a toothpaste-like plasticized muck. As a result of forward jacking of the TBM, the muck becomes pressurized and thus provides support for the excavated face. A screw conveyor then removes the excess material from the chamber for transport away from the TBM.

Traditionally, EPB Machines have been most effective in fine grained materials that are readily plasticized. Where sand and gravel lenses are encountered, newly developed polymer foams are available to readily plasticize these materials and assist with maintaining a chamber pressure close to the in situ water and earth pressure in the ground. Given the proximity of the tunnel alignment to existing structures, maintaining the proper chamber pressure will be of prime importance when controlling groundwater inflows, preventing excessive face loss, and controlling subsequent settlements at the ground surface.

5.1.2 Tunnel Lining

As the EPB Machine advances, watertight segmental-lining rings are erected in the tail shield of the TBM. The lining typically consists of precast concrete segments with synthetic rubber gaskets, which are bolted together during erection. This type of lining system is a one-pass operation, requiring no additional permanent lining. This minimizes the excavated tunnel diameter, and saves construction time that would otherwise be needed for a separate lining operation.

5.1.3 Construction Considerations

As shown on Plan and Profile Sheet 50 (Drawing Number C150) in Appendix A, there is an existing retaining wall supported on drilled concrete piers that intersects the proposed tunnel alignment at Station 722+70. According to design documents obtained by URS, the retaining wall was constructed recently as part of the Guadalupe River Project - Contract 3B by the U.S. Army Corps of Engineers. The drilled concrete piers are 5 feet in diameter at 8-foot centerline to centerline spacings, post-tensioned, and extend to Elevation +25. Clear spacing between piers is 3 feet.

The presently proposed top of rail for the bored tunnels at the location of the retaining wall is at approximately Elevation +28. Therefore, the proposed alignment will have to be adjusted, so that the bored tunnels avoid the existing piers. In lieu of changing the horizontal alignment it would be necessary to deepen the tunnel profile in order to clear the existing concrete piles. In this case, the retaining wall may have to be underpinned.

5.2 UNDERGROUND STATIONS

A detailed discussion regarding impacts of the underground station excavations, as well as conceptual level recommendations regarding excavation and shoring methodology at each station, is presented in our report entitled "Conceptual Engineering Recommendations for Cut-and-Cover Construction of Subway Stations: Silicon Valley Rapid Transit Corridor – BART Extension to San Jose," dated April 9, 2002. The information presented below is consistent with our April 9, 2002 report.

5.2.1 Excavation Support

The design of the excavation support systems for the four underground stations must consider several impacts associated with excavation activities, including the need for temporary bracing of excavations, control of groundwater, control of ground deformations, and associated impacts on adjacent buildings, utilities, pavements, and underground structures. Several different excavation support systems have been considered: (1) conventional soldier piles and lagging, (2) tangent pile walls, (3) in situ mixed soil-cement walls with steel soldier piles, (4) steel sheet pile walls, (5) slurry walls, and (6) soil-nailed walls.

As discussed in our April 9, 2002 report on cut-and-cover construction, we recommend the aforementioned alternatives be evaluated in greater detail during subsequent phases of the project. Further evaluation should include (1) additional explorations to assist in developing detailed subsurface profiles and geotechnical parameters for design, (2) numerical analyses to verify design of shoring system, (3) detailed structural design of the shoring and bracing system, and (4) detailed evaluation of groundwater conditions at each station.

5.2.2 Control of Groundwater During Station Excavation

Based on a review of groundwater conditions encountered during our exploration program, including an evaluation of dewatering activities at the existing San Jose Civic Center excavation, we have developed preliminary opinions regarding groundwater control during construction of the four underground stations. This work was performed in accordance with Task 31.5, Install Observation Wells at Civic Plaza.

5.2.2.1 San Jose Civic Center Dewatering

The dewatering system currently in operation at the new San Jose Civic Center construction site has provided valuable insight into the effectiveness of a dewatering system that might be used during underground station construction. As shown on Figure 8, the current Civic Center excavation is immediately adjacent to the proposed Civic Plaza/SJSU Station. The Civic Center excavation is approximately 650 by 340 feet in plan dimension and extends to about Elevation +66 feet. Based on a review of design documents for the temporary dewatering system, 34 wells surround the excavation perimeter at about 50 to 60-foot typical spacings. Each well extends to a depth of about 70 feet (approximate depth of the deep, permeable sand stratum beneath the Civic Center site). Since ground surface at the wells is about Elevation +80 feet, each well extends to about Elevation +10 feet, or about 56 feet below bottom of Civic Center excavation. Each well contains a 2-HP, 70-gallon per minute pump.

The drawdown produced by the dewatering system was evaluated by installing three (3) monitoring wells, MW-1, MW-2, and MW-3, at 13, 54, and 94 feet offsets, respectively, on a perpendicular line from Dewatering Well #18 at the northern edge of the Civic Center excavation. The monitoring wells extended to depths of 74 to 84 feet below existing ground surface (approximate depth of the deep, permeable sand stratum). A summary of readings from the monitoring wells and Dewatering Well #18 is presented in Table 10. In December 2002, the flow from the temporary dewatering system was estimated to range from about 1,700 to 2,500 gallons per minute. It is understood that pumping from the temporary dewatering system began in October 2002 and remains in operation at the time of this report.

The initial piezometric head in the deep sand stratum prior to pumping was about Elevation +68 to +69 feet. After several months of pumping from the deep sand stratum, the piezometric surface in the dewatering wells immediately adjacent to the excavation was about Elevation +61 to +62 feet. Therefore, we concluded the drawdown produced by the temporary dewatering system was approximately 6 to 8 feet.

5.2.2.2 *Opinions and Preliminary Recommendations*

Currently, the planned subgrade levels for the four underground station excavations vary in depth between 55 and 67 feet below existing ground surface, and the groundwater level at the four stations varies between 6 and 26 feet below existing ground surface. Therefore, it is estimated that dewatering of the proposed excavations will typically require depressing the groundwater table 40 to 50 feet.

Given the significant amount of drawdown required and relatively high permeability of the deep sand/gravel stratum, dewatering the excavations will require significant effort and could be quite expensive, especially if the groundwater requires special treatment before disposal. It is estimated that the required pumping rate could be several thousand gallons per minute. Although the data from the Civic Center monitoring wells suggest that the radius of influence is relatively small, it is our opinion that with multiple high capacity dewatering wells required to lower the groundwater 40 to 50 feet, the effective stress of the soil will increase at least 2,500 to 3,000 psf. This could result in significant settlements at the ground surface as a result of consolidation of clays due to the increase in effective stress, thus resulting in potentially undesirable differential settlement of adjacent structures, utilities, and pavements.

It should be noted that during our construction observations at the Civic Center, the dewatering system malfunctioned on at least one occasion causing significant disruption and delay of construction activities within the excavation. Although a malfunction or failure of the dewatering system may appear to be a minor detail when considering construction alternatives at this phase of the BART Extension Project, it is important that a feasibility analysis include consideration for malfunction or failure of the dewatering systems. Unless a reliable back-up system is in place, i.e. extra stand-by power generators, pumps, and 24-hour monitoring of dewatering system, failure or malfunction of the dewatering system can have a significant impact on the schedule and cost of station construction.

One alternative to avoid potential complications caused by dewatering of the excavations is to construct cutoff walls extending into impervious clay below the pervious sand/gravel strata, creating a seepage barrier between the excavation subgrade and the water bearing aquifer. Based on subsurface conditions encountered during our recent investigation, it is anticipated that depths of the cutoff walls at each of the four stations might extend to depths of about 100 to 120 feet below existing ground surface. However, these depths assume that a deep continuous impermeable clay stratum of sufficient thickness is present beneath the footprint of each station. Where the impermeable clay stratum is of insufficient thickness to resist hydrostatic uplift pressures, consideration would need to be given to deepening the cutoff walls or utilizing a pre-installed jet-grouted slab at the excavation subgrade level. A jet-grouted slab would provide resistance to excessive uplift pressures, while also serving as a lateral restraint to inward movement of the excavation walls at the base.

In addition to a cutoff wall system, sumping and/or dewatering shafts with submersible pumps will be required within the excavation to predrain permeable sand and gravel layers as the excavation proceeds to subgrade level. Consideration might also be given to installing relief wells in the deep permeable sand and gravel stratum below the impervious clay stratum as a means of relieving hydrostatic pressure and improving overall stability of the excavation. However, it should be noted this will require pumping of the water collected from the relief wells.

In order to determine the feasibility of cutoff walls as a method of controlling ground water during station excavation, it is recommended that additional dewatering analyses be performed at each station, as well as additional explorations to determine the thickness and lateral extent of the deep impermeable clay stratum.

~~4.1~~5.3 LIQUEFACTION POTENTIAL

Soil liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under cyclic shear stresses associated with earthquake shaking. Three conditions are required for liquefaction to occur: (1) a cohesionless soil of loose to medium dense relative density; (2) a saturated condition; and (3) rapid, large strain cyclic loading normally induced by earthquake ground shaking.

Liquefaction can result in catastrophic ground failure, if soils lose bearing capacity. Lateral spreading, ground lurching, cracking, warping, and settlement can also result from liquefaction. Loose, clean, fine sands and silts that are relatively free of clay most commonly experience liquefaction.

Based on a review of recent published information (Knudsen *et. al.*, 2000), as shown on Figure 16, Segments BSJ3 and BSJ4 are within an area of moderate to high liquefaction susceptibility. Since our January 2002 Preliminary Geotechnical Exploration Report was issued, we have completed Borings NB-02, NB-03, NB-03A, NB-07, NB-08, NB-13 through NB-21, NB-24, and CPTs NC-09, and NC-11 through NC-13.

5.3.1 Soils in the Upper 70 feet

In our borings and CPTs along the alignment, we encountered generally medium to very stiff lean clays and fat clays in the upper 70 feet; within these clayey deposits are occasional granular interbeds that generally range in relative density from medium dense to dense. The clay deposits are not considered to be susceptible to liquefaction. Where granular layers were encountered in the explorations, we analyzed the potential for liquefaction using median peak ground acceleration (PGA) of 0.55g and a M_W of 7.1 on the Southeast extension of the Hayward fault. A semi-empirical method was used to compare shear stresses induced by earthquakes (CSR) with those required to cause liquefaction (CRR). Results of our analysis are summarized in the table below.

Boring / CPT Number	Depth Intervals of Potentially Liquefiable Layer (feet) (i.e. CRR/CSR < 1)	Estimated Liquefaction Induced Settlement (inches)
NB-02	29 to 32	0.6
NB-04	60.5 to 63	0.3
NB-07	19.5 to 22	0.3
NB-08	35 to 40	0.5
NB-15	55 to 61	0.6
NB-17	36 to 39.5 63 to 66	1.0
NB-24	21.5 to 29 38 to 42 69 to 70	1.6
NC-09	Several less than 6-inch thick layers at 11 feet and from 20 to 24 feet	1.5
NC-11	Less than 6-inch thick layers at 22, 26 and 32 feet	1
NC-12	29 to 30, 32 to 38, and 51 to 52	2.5
NC-13	Less than 6-inch thick layers at 21, 31 to 33 and 45 feet	1

Results of analyses for Borings NB-01, NB-03, NB-05, NB-06, NB-13, NB-14, NB-16, and NB-18 through NB-21, indicate low potential for liquefaction; i.e. the ratio of CRR/CSR is greater than 1. The semi-empirical liquefaction analysis for all the pertinent borings and CPTs are presented graphically on Figures 17 through 38.

5.3.2 Soils below 70 feet

In general, granular deposits encountered below depths greater than 70 feet are dense to very dense and are considered to have low potential for liquefaction. Clay deposits encountered below a depth of 70 feet are not considered to be susceptible to liquefaction.

~~4.1.1~~5.3.3 Liquefaction Induced Potential Settlement

As shown in the summary table above, depths of the potentially liquefiable granular interbeds range from 19 to 70 feet bgs. We also estimated the post-liquefaction ground settlement in the areas of these borings and CPTs; the estimates are also presented in the summary table above. Considering (1) that the soils, which overlie the potentially liquefiable materials, are predominantly medium to very stiff cohesive materials and (2) that the potentially liquefiable materials are above the proposed tunnel crown except at Borings NB-04, NB-15, NB-17, NB-24 and NC-12, we expect that the consequences of liquefaction in these areas probably would be limited to post-liquefaction settlement of the ground surface. Therefore, in general, we anticipate the impact of liquefaction on the tunnel alignment would be negligible. However, at four locations (NB-04, NB-15, NB-17, NB-24, and NC-12) some liquefaction of granular layers below tunnel invert is anticipated. Based on our analysis, we estimate the tunnel or station at these four locations could undergo settlements of about ½ to 1½ inches, should a strong earthquake occur. In addition, lateral loads on station walls will increase due to adjacent liquefaction of granular soils. These effects should be further evaluated during final design. Therefore, we recommend that additional borings and/or CPTs be advanced in localized areas near NB-04 and NB-15 (Civic Plaza/SJSU Station), NB-17 and NC-12 (Market Street Station), and NB-24 (Newhall Yard Tunnel Portal) during the next phase of design.

~~4.1.2~~5.3.4 Potential for Lateral Spreading and Lurching

Lateral spreading is the movement of unconsolidated earth materials following liquefaction and occurs on horizontal to gentle slopes (and embankments) that have little or no lateral support. Lurching is the abrupt, seismically induced movement of weak, unconsolidated earth materials, most commonly adjacent to "open faces" of unsupported excavations or stream channels. Lateral spreading and lurching are often associated with ground cracking and ground settlement.

We evaluated the potential for liquefaction at locations where the alignment crosses below Coyote Creek, Guadalupe River and Los Gatos Creek. Based on this analysis, the potential for liquefaction, lateral spreading and lurching at Coyote Creek appears to be low. However, our analysis at Guadalupe River and Los Gatos Creek suggests there is potential for liquefaction, mostly within the upper 20 feet of the soil profile. Therefore, it is conceivable lurching or lateral spreading of the channel banks could occur. However, the crown of the tunnel extends about 30 feet below channel bottom at these locations. Therefore, it is unlikely lurching or lateral spreading will impact the tunnel.

This report is preliminary in nature; the data and opinions presented herein are for conceptual design purposes and should be reviewed during final design of the project. The opinions regarding subsurface conditions presented herein are based on twenty-one borings and five CPTs located at widely spaced intervals and upon engineering correlations developed from existing topography, laboratory and subsurface data. They are also based on our local experience and engineering judgment. The opinions presented in this report are based on the assumption that the subsurface conditions do not deviate substantially from those encountered in or extrapolated from the CPTs and borings presented in this report. The elevations shown on the boring logs and CPT printouts are based upon the topography shown on the profiles in Appendix A.

Before proceeding with final design of the proposed project, a design level geotechnical interpretation report should be prepared. The final report should include detailed recommendations for structure foundations, lateral support, and other pertinent tunneling and underground station design considerations.

An investigation for subsurface environmental contamination was beyond the scope of our services.

The opinions and recommendations presented in this report were developed with the standard of care commonly used as state of the practice in the profession. No other warranties are included, either expressed or implied, as to the professional advice included in this report.

Anderson, L.W., LaForge, R. and Anders, M.H., 1982, Seismotectonic study of the San Luis Area, Eastern Diablo Range, California for San Luis Dam, O'Neill Dam, Los Banos Detention Dam, and Little Panoche Detention Dam, San Luis Unit, Central Valley Project, U.S. Bureau of Reclamation, Seismotectonic Report 82-2, 89 p.

Aydin, A., 1982, The East Bay Hills, a compressional domain resulting from interaction between the Calaveras and Hayward-Rodgers Creek faults, in Proceedings, Conference on Earthquake Hazards in the Eastern San Francisco Bay Area, Hart, E.W., Hirschfeld, S.E. and Schulz, S.S. (eds.), California Division of Mines and Geology, Special Publication 62, p. 11-22.

Aydin, A. and Page, B.M., 1984, Diverse Pliocene-Quaternary tectonics in a transform environment, San Francisco Bay region, California, Geological Society of America Bulletin, v. 95, p. 1,303-1,317.

Aydin, A., Johnson, A.M. and Fleming, R.W., 1992, Right-lateral-reverse surface rupture along the San Andreas and Sargent faults associated with the October 17, 1989, Loma Prieta, California, earthquake, Geology, v. 20, p. 1,063-1,067.

Bryant, W.A., Smith, D.P. and Hart, E.W., 1981, Sargent, San Andreas and Calaveras fault zone - evidence for recency in the Watsonville East, Chittenden and San Felipe quadrangles, California, California Division of Mines and Geology, Open-File Report 81-7, 3 map sheets, scale 1:24,000.

Bürgmann, R., Arrowsmith, R. and Dumitru, T., 1994, Rise and fall of the southern Santa Cruz Mountains, California, from fission tracks, geomorphology, and geodesy, Journal of Geophysical Research, v. 99B, p. 20, 181-20, 202.

California Division of Mines and Geology, 1982a, Alquist Priolo Earthquake Fault Zone map of the Milpitas quadrangle, scale 1: 24,000.

California Division of Mines and Geology, 1982b, Alquist Priolo Earthquake Fault Zone map of the San Jose East quadrangle, scale 1: 24,000.

California Division of Mines and Geology, 1982c, Alquist Priolo Earthquake Fault Zone map of the Mindego Hill quadrangle, scale 1: 24,000.

City of San Jose Fault Hazard map, 1983, San Jose East quadrangle, scale 1:24,000..

Dibblee, T.W., Jr., 1972a, Preliminary geologic map of the Milpitas quadrangle, Alameda and Santa Clara Counties, California, U.S. Geological Survey, Open-File Report 72-91, scale 1: 24,000.

Dibblee, T.W., Jr., 1972b, Preliminary geologic map of the San Jose East quadrangle, Alameda and Santa Clara Counties, California, U.S. Geological Survey, Open-File Report 72-92, scale 1: 24,000.

Federal Emergency Management Agency (FEMA), 2000, Flood insurance rate map, City of Fremont, Alameda County, California, Panels 33, 46, and 48.

Fenton, C.H., 2000, Quantifying surface faulting hazards for lifelines crossing the Hayward and Calaveras faults, California, <u>in</u> Sixth International Conference on Seismic Zonation (6ICSZ), Palm Springs, Earthquake Engineering Research Institute, v. p. in press.

Fenton, C.H. and Hitchcock, C.S., 2001, Recent geomorphic and paleoseismic investigations of thrust faults in Santa Clara Valley, California, in Engineering Geology Practice in Northern California, Ferriz, H. (ed.) California Division of Mines and Geology, p. 71-89.

Galehouse, J., 1992, Creep rates and creep characteristics of eastern San Francisco Bay Area faults: 1979-1992, in Proceedings of the Second Conference on Earthquake

Hazards in the Eastern San Francisco Bay Area, Borchardt, G., Hirschfeld, S.E., Lienkaemper, J.J., McClellan, P., Williams, P.L. and Wong, I.G. (eds.), California Department of Conservation, Division of Mines and Geology, p. 45-53.

Geomatrix Consultants, 1998, Final Report, Walnut Creek Water Treatment Plant Expansion Seismic Study - Phase II, Report prepared for East Bay Municipal Utility District, Seismic Improvement Program, 1330 Broadway, Suite 800, Oakland, California 94612, 57 p.

Greene, H.G., Lee, W.H.K., McCulloch, D.S. and Brabb, E.E., 1973, Faults and earthquakes in the Monterey Bay region, U.S. Geological Survey, Miscellaneous Field Series Map MF-518.

Hall, N.T., Wright, R.H. and Clahan, K.B., 1999, Paleoseismic studies of the San Francisco Peninsula segment of the San Andreas fault zone near Woodside, California, Journal of Geophysical Research, v. 104, p. 23, 215-223, 236.

Hart, E.W., 1981, Greenville fault, California Division of Mines and Geology, Fault Evaluation Report 117, 27 p.

Helley, E.J., Lajoi, K.R., Spangle, W.E., and Blair, M.L., 1979, Flatland deposits of the San Francisco Bay region, California; their geology and engineering properties, and their importance to comprehensive planning, U.S. Geological Survey Professional Paper 943, 88 p.

Hitchcock, C.S. and Brankman, C.M, 2002, Final Technical Report, Assessment of late Quaternary deformation, eastern Santa Clara Valley, San Francisco Bay region, prepared for U.S. Geological Survey National Earthquake Hazards Reduction Program, Award no. 01HQGR0034, July.

Jennings, C.W., 1994, Fault activity map of California and adjacent areas, California Division of Mines and Geology, California Geologic Data Map Series, Map No. 6, 1:750,000 scale 1: 750,000.

Knudsen, K.L., Sowers, J.M., Witter, R.C., Wentworth, C.M., and Helley, E.J., 2000, Preliminary Maps of Quaternary Deposits and Liquefaction Susceptibility, Nine-County San Francisco Bay Region, California: A Digital Database, U.S. Geological Survey, Open-File Report 00-444, scale 1: 275,000.

Kelson, K.I. and Simpson, G.D., 1996, Late Quaternary deformation of the southern East Bay Hills, Alameda County, CA, in Toward Assessing the Seismic Risk Associated With Blind Faults, San Francisco Bay Region, Jayko, A.S. and Lewis, S.D. (eds.), U.S. Geological Survey Open-File Report 96-267, p. 110-118.

Lienkaemper, J.J., 1992, Map of recently active traces of the Hayward fault, Alameda and Contra Costa counties, California, U.S. Geological Survey, Miscellaneous Field Studies Map, scale 1: 24,000.

Lienkaemper, J.J. and Galehouse, J.S., 1997, Revised long-term creep rates on the Hayward fault, Alameda and Contra Costa Counties, California, U.S. Geological Survey, Open-File Report 97-690, 18 p.

Nolan, J.M., Zinn, E.N. and Weber, G.E., 1995, Paleoseismic study of the southern Sargent fault, Santa Clara and San Benito Counties, California, U.S. Geological Survey, NEHRP Final technical Report Award No. 1434-94-G-2466, 23 p.

Oppenheimer, D.H., Bakun, W.H. and Lindh, A.G., 1990, Slip partitioning of the Calaveras fault, California, and prospects for future earthquakes, Journal of Geophysical Research, v. 95, p. 84838498.

Prescott, W.H. and Burford, R.O., 1976, Slip on the Sargent fault, Bulletin of the Seismological Society of America, v. 66, p. 1,013-1,016.

Prescott, W.H. and Lisowski, M., 1983, Strain accumulation along the San Andreas fault system east of San Francisco Bay, California, Tectonophysics, v. 97, p. 41-56.

Santa Clara Valley Water District, 1992, Maps of flood control facilities and limits of 1% flooding: prepared by the Predesign Division and Drafting Section of the Flood Control Unit.

Schwartz, D.P., Pantosti, D., Hecker, S., Okomura, K., Budding, K.E. and Powers, T., 1992, Late Holocene behavior and seismogenic potential of the Rodgers Creek fault zone, Sonoma County, California, in Proceedings of the Second Conference on Earthquake Hazards in the Eastern San Francisco Bay Area, Borchardt, G., Hirschfeld, S.E., Lienkaemper, J.J., McClellan, P., Williams, P.L. and Wong, I.G. (eds.), California Department of Conservation, Division of Mines and Geology, p. 393-398.

Simpson, G.D., Thompson, S.C., Noller, J.S. and Lettis, W.R., 1997, The northern San Gregorio fault zone: Evidence of the timing of late Holocene earthquakes near Seal Cove, California, Bulletin of the Seismological Society of America, v. 87, p. 1,158-1,170.

Simpson, G.D., Baldwin, J.N., Kelson, K.I. and Lettis, W.R., 1999, Late Holocene slip rate and earthquake history for the northern Calaveras fault at Welch Creek, eastern San Francisco Bay Area, California, Bulletin of the Seismological Society of America, v. 89, p. 1,250-1,263.

Snyder, D.L., Borchardt, G. and Wills, C.J., 1994, Initial paleoseismic study of the Concord fault, California, EOS, Transactions of the American Geophysical Union, Supplement, v. 75, p. 684.

Toppozada, T.R. and Borchardt, G., 1998, Re-evaluation of the 1836 "Hayward fault" and 1838 San Andreas fault earthquakes, Bulletin of the Seismological Society of America, v. 88, p. 140-159.

Unruh, J.R. and Hector, S.T., 1999, Subsurface characterization of the Potrero-Ryer Island thrust system, western Sacramento-San Joaquin Delta, northern California, William Lettis and Associates, Inc., Final Technical Report, U.S. Geological Survey, National Earthquake hazards Reduction Program Award No. 1434-HQ-96-GR-02724, 32 p.

Unruh, J.R. and Sawyer, T.L., 1995, Late Cenozoic growth of the Mount Diablo fold-and-thrust belt, central Contra Costa County, California, and implications for transpressional deformation of the northern Diablo Range, Bulletin of the American Association of Petroleum Geologists, v. 79, p.

Unruh, J.R., Hector, S.T., Williams, P.L. and Rector, J.W., 1997, Transpressional tectonics of the western Sacramento-San Joaquin delta, eastern San Francisco Bay region, California, EOS, Transactions of the American Geophysical Union, Supplement, v. 78, p. F631. Wallace, R.E., 1990, The San Andreas Fault System, California, U.S. Geological Survey, Professional Paper 1515, 283 p.

Wakabayashi, J. and Sawyer, T.L., 1998, Paleoseismic investigation of the Miller Creek fault, eastern San Francisco Bay Area, California, Final Technical Report, U.S. Geological Survey National Earthquake Hazards Reduction Program Award No. 1434-HQ-96-GR-02724, 17 p.

Wakabayashi, J. and Smith, D.L., 1994, Evaluation of recurrence intervals, characteristic earthquakes and slip-rates associated with thrusting along the Coast Range-Central Valley geomorphic boundary, Bulletin of the Seismological Society of America, v. 84, p. 1960-1970.

Wagner, D.L., Bortugno, E.J., and McJunkin, R.D., 1990, Geologic map of the San Francisco-San Jose quadrangle: California Division of Mines and Geology Regional Geologic Map No. 5A, scale 1: 250,000.

Wallace, R.E., 1990, The San Andreas Fault System, California, U.S. Geological Survey, Professional Paper 1515, 283 p.

Wells, D.L. and Coppersmith, K.J., 1994, New empirical relationships among magnitude, rupture length, rupture width, rupture area, and surface displacement, Bulletin of the Seismological Society of America, v. 84, p. 974-1002.

Wills, C.J., Snyder, D.L. and Borchardt, G., 1994, Preliminary results of paleoseismic studies of the Concord fault at Galindo Creek, Concord, California, in Proceedings of the Workshop on Paleoseismology, 18-22 September 1994, Marshall, California, Prentice, C.S., Schwartz, D.P. and Yeats, R.S. (eds.), U.S. Geological Survey Open-File Report 94-568, p. 200-201.

Wong, I.G., 1990, Seismotectonics of the Coast Ranges in the vicinity of Lake Berryessa, northern California, Bulletin of the Seismological Society of America, v. 80, p. 935-950.

Wong, I.G., Ely, R.W. and Kollmann, A.C., 1988, Contemporary seismicity and tectonics of the Northern and Central Coast Ranges-Sierran Block Boundary zone, California, Journal of Geophysical Research, v. 93, p. 7,813-7,833.

Working Group on Northern California Earthquake Potential, 1996, Database of potential sources for earthquakes larger than magnitude 6 in northern California, U.S. Geological Survey, Open-File Report 96-705, 53 p.

Working Group on California Earthquake Probabilities, 1999, Earthquake probabilities in the San Francisco Bay region: 2000 to 2030 - A summary of findings, U.S. Geological Survey, Open-File Report 99-517, 38 p.

Tables

Table 1: MEDIAN (50th PERCENTILE) PEAK HORIZONTAL ACCELERATIONS ON SOIL AT WARMS SPRINGS

Seismic Source	Maximum Magnitude (M_w)	Fault Style[1]	Distances			Peak Ground Acceleration (g)				
			Horizontal Distance[2] (km)	Seismogenic Distance[3] (km)	Rupture Distance[4] (km)	Abrahamson & Silva (1997)	Boore *et al.* (1997)	Sadigh *et al.* (1997)	Campbell (1997)	Average
Hayward	7.1	SS	1.0	2.2	1.0	0.54	0.59	0.55	0.51	**0.55**
Hayward SE Extention	6.4	OR	6.3	8.5	6.3	0.35	0.34	0.42	0.44	**0.39**
Calaveras	7.2	SS	8.3	8.5	8.3	0.35	0.40	0.37	0.44	**0.39**
Sargent	6.8	OR	41.3	43.3	41.3	0.12	0.12	0.12	0.09	**0.11**
Foothills Thrusts	6.8	R	20.5	22.6	20.5	0.21	0.21	0.23	0.21	**0.22**
San Andreas (1906)	7.9	SS	28.5	28.6	28.5	0.19	0.25	0.23	0.30	**0.24**
San Andreas (Santa Cruz Mtns.)	7.2	SS	28.5	28.6	28.5	0.15	0.18	0.17	0.20	**0.17**
San Gregorio	7.5	SS	43.5	43.5	43.5	0.12	0.15	0.13	0.16	**0.14**
Concord-Green Valley	6.8	SS	30.0	30.1	30.0	0.12	0.14	0.13	0.14	**0.13**
Greenville	7.2	SS	46.0	46.0	46.0	0.10	0.12	0.11	0.12	**0.11**
Ortigalita	6.9	SS	63.5	63.5	63.5	0.07	0.08	0.06	0.06	**0.07**

[1] R - reverse or thrust fault; SS - strike-slip fault; OR – Oblique Reverse.

[2] Horizontal distance is defined as the shortest distance from the site to the vertical projection of the fault rupture on the earth's surface.

[3] M_w and seismogenic distance used by Campbell (1997). This is the shortest distance from the site to the zone of seismogenic rupture. Top of this zone is at a depth of 2 km.

[4] M_w and rupture distance used by Abrahamson and Silva (1997) and Sadigh *et al.* (1997). Rupture distance is the shortest distance from the site to the surface rupture.

Table 2: MEDIAN (50th PERCENTILE) PEAK HORIZONTAL ACCELERATIONS ON SOIL AT MONTAGUE/CAPITOL

Seismic Source	Maximum Magnitude (M_w)	Fault Style[1]	Distances			Peak Ground Acceleration (g)				
			Horizontal Distance[2] (km)	Seismogenic Distance[3] (km)	Rupture Distance[4] (km)	Abrahamson & Silva (1997)	Boore *et al.* (1997)	Sadigh *et al.* (1997)	Campbell (1997)	Average
Hayward	7.1	SS	4.3	4.7	4.3	0.46	0.50	0.45	0.48	**0.47**
Hayward SE Extention	6.4	OR	1.3	3.8	1.3	0.49	0.47	0.63	0.65	**0.55**
Calaveras	7.2	SS	8.3	8.5	8.3	0.35	0.40	0.37	0.44	**0.39**
Sargent	6.8	OR	33.5	35.6	33.5	0.14	0.14	0.15	0.12	**0.14**
Foothills Thrusts	6.8	R	16.0	18.1	16.0	0.25	0.25	0.29	0.27	**0.26**
San Andreas (1906)	7.9	SS	25.0	25.1	25.0	0.21	0.28	0.26	0.33	**0.27**
San Andreas (Santa Cruz Mtns.)	7.2	SS	25.0	25.1	25.0	0.17	0.19	0.19	0.22	**0.19**
San Gregorio	7.5	SS	45.0	45.0	45.0	0.12	0.14	0.13	0.15	**0.13**
Concord-Green Valley	6.8	SS	31.3	31.4	31.3	0.12	0.13	0.12	0.13	**0.13**
Greenville	7.2	SS	53.0	53.0	53.0	0.09	0.11	0.09	0.10	**0.10**
Ortigalita	6.9	SS	57.5	57.5	57.5	0.07	0.09	0.07	0.07	**0.07**

[1] R - reverse or thrust fault; SS - strike-slip fault; OR – Oblique Reverse.

[2] Horizontal distance is defined as the shortest distance from the site to the vertical projection of the fault rupture on the earth's surface.

[3] M_w and seismogenic distance used by Campbell (1997). This is the shortest distance from the site to the zone of seismogenic rupture. Top of this zone is at a depth of 2 km.

[4] M_w and rupture distance used by Abrahamson and Silva (1997) and Sadigh *et al.* (1997). Rupture distance is the shortest distance from the site to the surface rupture.

Table 4: 84th PERCENTILE PEAK HORIZONTAL ACCELERATIONS ON SOIL AT WARM SPRINGS

Seismic Source	Maximum Magnitude (M_w)	Fault Style[1]	Distances			Peak Ground Acceleration (g)				
			Horizontal Distance[2] (km)	Seismogenic Distance[3] (km)	Rupture Distance[4] (km)	Abrahamson & Silva (1997)	Boore *et al.* (1997)	Sadigh *et al.* (1997)	Campbell (1997)	Average
Hayward	7.1	SS	1.0	2.2	1.0	0.82	1.00	0.82	0.76	**0.85**
Hayward SE Extention	6.4	OR	6.3	8.5	6.3	0.58	0.58	0.69	0.69	**0.64**
Calaveras	7.2	SS	8.3	8.5	8.3	0.52	0.67	0.55	0.65	**0.60**
Sargent	6.8	OR	41.3	43.3	41.3	0.18	0.21	0.18	0.14	**0.18**
Foothills Thrusts	6.8	R	20.5	22.6	20.5	0.33	0.35	0.36	0.32	**0.34**
San Andreas (1906)	7.9	SS	28.5	28.6	28.5	0.26	0.43	0.35	0.45	**0.37**
San Andreas (Santa Cruz Mtns.)	7.2	SS	28.5	28.6	28.5	0.22	0.29	0.25	0.29	**0.27**
San Gregorio	7.5	SS	43.5	43.5	43.5	0.17	0.25	0.20	0.23	**0.21**
Concord-Green Valley	6.8	SS	30.0	30.1	30.0	0.20	0.23	0.20	0.21	**0.21**
Greenville	7.2	SS	46.0	46.0	46.0	0.15	0.20	0.16	0.17	**0.17**
Ortigalita	6.9	SS	63.5	63.5	63.5	0.11	0.14	0.09	0.09	**0.11**

---

[1] R - reverse or thrust fault; SS - strike-slip fault; OR – Oblique Reverse.

[2] Horizontal distance is defined as the shortest distance from the site to the vertical projection of the fault rupture on the earth's surface.

[3] M_w and seismogenic distance used by Campbell (1997). This is the shortest distance from the site to the zone of seismogenic rupture. Top of this zone is at a depth of 2 km.

[4] M_w and rupture distance used by Abrahamson and Silva (1997) and Sadigh *et al.* (1997). Rupture distance is the shortest distance from the site to the surface rupture.

Table 5: 84th PERCENTILE PEAK HORIZONTAL ACCELERATIONS ON SOIL AT MONTAGUE/CAPITOL

Seismic Source	Maximum Magnitude (M_w)	Fault Style[1]	Distances			Peak Ground Acceleration (g)				
			Horizontal Distance[2] (km)	Seismogenic Distance[3] (km)	Rupture Distance[4] (km)	Abrahamson & Silva (1997)	Boore *et al.* (1997)	Sadigh *et al.* (1997)	Campbell (1997)	Average
Hayward	7.1	SS	4.3	4.7	4.3	0.69	0.84	0.67	0.72	**0.73**
Hayward SE Extention	6.4	OR	1.3	3.8	1.3	0.82	0.78	1.04	1.02	**0.92**
Calaveras	7.2	SS	8.3	8.5	8.3	0.52	0.67	0.55	0.65	**0.60**
Sargent	6.8	OR	33.5	35.6	33.5	0.22	0.24	0.23	0.19	**0.22**
Foothills Thrusts	6.8	R	16.0	18.1	16.0	0.40	0.42	0.44	0.41	**0.42**
San Andreas (1906)	7.9	SS	25.0	25.1	25.0	0.28	0.47	0.38	0.49	**0.41**
San Andreas (Santa Cruz Mtns.)	7.2	SS	25.0	25.1	25.0	0.25	0.32	0.28	0.33	**0.30**
San Gregorio	7.5	SS	45.0	45.0	45.0	0.17	0.24	0.19	0.22	**0.21**
Concord-Green Valley	6.8	SS	31.3	31.4	31.3	0.19	0.22	0.19	0.20	**0.20**
Greenville	7.2	SS	53.0	53.0	53.0	0.14	0.18	0.13	0.14	**0.15**
Ortigalita	6.9	SS	57.5	57.5	57.5	0.11	0.15	0.10	0.10	**0.12**

[1] R - reverse or thrust fault; SS - strike-slip fault; OR – Oblique Reverse.

[2] Horizontal distance is defined as the shortest distance from the site to the vertical projection of the fault rupture on the earth's surface.

[3] M_w and seismogenic distance used by Campbell (1997). This is the shortest distance from the site to the zone of seismogenic rupture. Top of this zone is at a depth of 2 km.

[4] M_w and rupture distance used by Abrahamson and Silva (1997) and Sadigh *et al.* (1997). Rupture distance is the shortest distance from the site to the surface rupture.

Table 6: 84th PERCENTILE PEAK HORIZONTAL ACCELERATIONS ON SOIL AT SANTA CLARA

Seismic Source	Maximum Magnitude (M_w)	Fault Style[1]	Distances			Peak Ground Acceleration (g)				
			Horizontal Distance[2] (km)	Seismogenic Distance[3] (km)	Rupture Distance[4] (km)	Abrahamson & Silva (1997)	Boore *et al.* (1997)	Sadigh *et al.* (1997)	Campbell (1997)	Average
Hayward	7.1	SS	13.8	13.9	13.8	0.38	0.47	0.41	0.50	**0.44**
Hayward SE Extention	6.4	OR	8.0	10.2	8.0	0.51	0.52	0.61	0.60	**0.56**
Calaveras	7.2	SS	14.5	14.6	14.5	0.37	0.48	0.41	0.51	**0.44**
Sargent	6.8	OR	23.8	25.8	23.8	0.29	0.31	0.32	0.28	**0.30**
Foothills Thrusts	6.8	R	7.5	9.7	7.5	0.67	0.66	0.69	0.69	**0.68**
San Andreas (1906)	7.9	SS	17.5	17.6	17.5	0.36	0.61	0.47	0.60	**0.51**
San Andreas (Santa Cruz Mtns.)	7.2	SS	17.5	17.6	17.5	0.32	0.42	0.37	0.45	**0.39**
San Gregorio	7.5	SS	40.0	40.0	40.0	0.18	0.27	0.22	0.25	**0.23**
Concord-Green Valley	6.8	SS	37.5	37.6	37.5	0.16	0.19	0.16	0.16	**0.17**
Greenville	7.2	SS	63.5	63.5	63.5	0.12	0.16	0.11	0.12	**0.13**
Ortigalita	6.9	SS	57.5	57.5	57.5	0.11	0.15	0.10	0.10	**0.12**

[1] R - reverse or thrust fault; SS - strike-slip fault; OR – Oblique Reverse.

[2] Horizontal distance is defined as the shortest distance from the site to the vertical projection of the fault rupture on the earth's surface.

[3] M_w and seismogenic distance used by Campbell (1997). This is the shortest distance from the site to the zone of seismogenic rupture. Top of this zone is at a depth of 2 km.

[4] M_w and rupture distance used by Abrahamson and Silva (1997) and Sadigh *et al.* (1997). Rupture distance is the shortest distance from the site to the surface rupture.

TABLE 7

SUMMARY OF BORING AND CPT LOCATIONS IN SEGMENTS BSJ3 AND BSJ4					
SEGMENT	STATION LIMITS (feet)		BORING / CPT NUMBER	APPROXIMATE BORING / CPT STATION (feet)	COMMENTS
	BEGIN	END			
BSJ3	560+00	637+00	NB-12	580+20	
			NB-13A	593+60	Alum Rock Station
			NB-13	594+30	Alum Rock Station
			NB-01/NW-01	595+00	Alum Rock Station
			NB-14	603+80	Alum Rock Station
			NC-11	604+40	Alum Rock Station
			NB-02	614+00	
BSJ4	637+00	825+00	MC-3	647+60	
			MC-1	648+40	
			TSP-9	659+00	
			TSP-8	659+00	
			NB-15	676+80	Civic Plaza/SJSU Station
			NB-16	680+00	Civic Plaza/SJSU Station
			CC-9	681+00	Civic Plaza/SJSU Station
			CPT-6	681+00	Civic Plaza/SJSU Station
			CPT-8	682+50	Civic Plaza/SJSU Station
			NB-04/NW-04	683+00	Civic Plaza/SJSU Station
			MW-1	683+00	Civic Plaza/SJSU Station
			MW-2	683+00	Civic Plaza/SJSU Station
			MW-3	683+00	Civic Plaza/SJSU Station
			CC-8	684+00	Civic Plaza/SJSU Station
			CPT-5	685+50	Civic Plaza/SJSU Station
			CC-1	687+00	Civic Plaza/SJSU Station
			NC-12	700+40	Market Street Station
			NB-17	700+80	Market Street Station
			NB-18	702+50	Market Street Station
			NB-19	705+20	Market Street Station
			100W-1	705+40	Market Street Station
			NB-20	706+00	Market Street Station
			150W-6	707+50	Market Street Station
			150W-5	708+40	Market Street Station
			NB-05/NW-05	708+80	Market Street Station
			AT-1	709+30	Market Street Station
			OPUS-5	709+30	Market Street Station
			OPUS-4	710+40	Market Street Station
			OPUS-4A	710+40	Market Street Station
			AT-4	711+20	Market Street Station
			NC-09	725+90	
			SJA-1	727+40	
			SJA-2	730+60	
			SJA-6	734+00	Diridon/Arena Station
			NB-06/NW-06	734+40	Diridon/Arena Station
			NB-21	735+80	Diridon/Arena Station
			SJA-8	736+80	Diridon/Arena Station
			NB-07	740+20	Diridon/Arena Station
			NC-13	740+80	Diridon/Arena Station
			NB-08	758+20	
			NC-10	789+00	
			LSO-6	819+00	
			LSO-3	820+00	
			LSO-9	820+40	
			LSO-4	821+40	
			LSO-1	822+20	
			NB-24	822+80	
			LSO-5	823+40	

TABLE 8: 2001 OBSERVATION WELLS DATA SUMMARY

Silicon Valley Rapid Transit Corridor
San Jose, California
Job No. 28648793.02513

	NW-01	NW-04	NW-05	NW-06
Surface Elevation (ft)	92.0	88.0	90.0	90.0
Screen Depth (ft)	70.0 to 80.0	70.0 to 80.0	80.0 to 90.0	90.0 to 100.0
Date Installed	10/17/01	09/05/01	10/17/01	09/06/01

Read Date	**Water Depth (feet below ground surface)**			
10/16/01	-	13.8	-	-
10/17/01	18.5	-	-	20.2
11/08/01	-	13.6	21.6	20.2
01/07/02	16.4	-	20.5	19.5
04/14/03	11.7	N/A*	18.7	16.9
	Water Level Elevation (feet)			
10/16/01	-	74.2	-	-
10/17/01	73.5	-	-	69.8
11/08/01	-	74.4	68.4	69.8
01/07/02	75.6	-	69.5	70.5
04/14/03	80.3	N/A*	71.3	73.1

* Note: Well destroyed at Civic Center site

TABLE 9: 2002 VIBRATING WIRE PIEZOMETERS
DATA SUMMARY

Silicon Valley Rapid Transit Corridor
San Jose, California
Job No. 28648793.002513

	NB-17		NB-07		NB-16		NB-13A	
	P1-1	P1-2	P2-1	P2-2	P3-1	P3-2	P4-1	P4-2
SURFACE ELEV.	88.5	88.5	84	84	81	81	86	86
PIEZO. DEPTH (ft)	45	70	40	65	42	60	40	70
PIEZO. ELEV. (ft)	43.5	18.5	44	19	39	21	46	16
INSTALL. DATE	11/13/02	11/13/02	11/15/02	11/15/02	11/22/02	11/22/02	11/25/02	11/25/02

READ DATE	READ TIME	Reading (psi)							
11/13/02	16:10	9.88	19.92	--	--	--	--	--	--
11/15/02	16:00	--	--	9.98	20.48	--	--	--	--
11/22/02	16:00	--	--	--	--	14.45	19.69	--	--
11/25/02	4:30	--	--	--	--	--	--	12.87	25.74
12/9/02	16:20	8.42	19.11	9.49	20.06	11.56	19.96	12.68	24.2
12/20/02	16:00	8.58	19.48	10.16	20.5	12.07	20.25	13.26	24.4
1/16/03	12:00	8.94	19.73	10.75	21.08	12.27	19.99	13.49	25.15
1/24/03	1:00	8.99	19.9	10.8	21.23	12.13	20.13	13.51	25.18
2/13/03	7:30	9	19.97	10.83	21.38	12.62	20.51	13.25	25.11
3/3/03	11:00	9.28	20.32	11.05	21.78	13.5	21.29	13.51	25.5

READ DATE	READ TIME	Reading (feet of head)							
11/13/02	16:10	22.8	46	--	--	--	--	--	--
11/15/02	16:00	--	--	23	47.3	--	--	--	--
11/22/02	16:00	--	--	--	--	33.3	45.4	--	--
11/25/02	4:30	--	--	--	--	--	--	29.7	59.4
12/9/02	16:20	19.4	44.1	21.9	46.3	26.7	46.1	29.3	55.8
12/20/02	16:00	19.8	45	23.4	47.3	27.9	46.7	30.6	56.3
1/16/03	12:00	20.6	45.5	24.8	48.6	28.3	46.1	31.1	58
1/24/03	1:00	20.7	45.9	24.9	49	28	46.5	31.2	58.1
2/13/03	7:30	20.8	46.1	25	49.3	29.1	47.3	30.6	57.9
3/3/03	11:00	21.4	46.9	25.5	50.3	31.2	49.1	31.2	58.8

READ DATE	READ TIME	Reading (pressure head elevation in feet)							
11/13/02	16:10	66.3	64.5	--	--	--	--	--	--
11/15/02	16:00	--	--	67	66.3	--	--	--	--
11/22/02	16:00	--	--	--	--	72.3	66.4	--	--
11/25/02	4:30	--	--	--	--	--	--	75.7	75.4
12/9/02	16:20	62.9	62.6	65.9	65.3	65.7	67.1	75.3	71.8
12/20/02	16:00	63.3	63.5	67.4	66.3	66.9	67.7	76.6	72.3
1/16/03	12:00	64.1	64	68.8	67.6	67.3	67.1	77.1	74
1/24/03	1:00	64.2	64.4	68.9	68	67	67.5	77.2	74.1
2/13/03	7:30	64.3	64.6	69	68.3	68.1	68.3	76.6	73.9
3/3/03	11:00	64.9	65.4	69.5	69.3	70.2	70.1	77.2	74.8

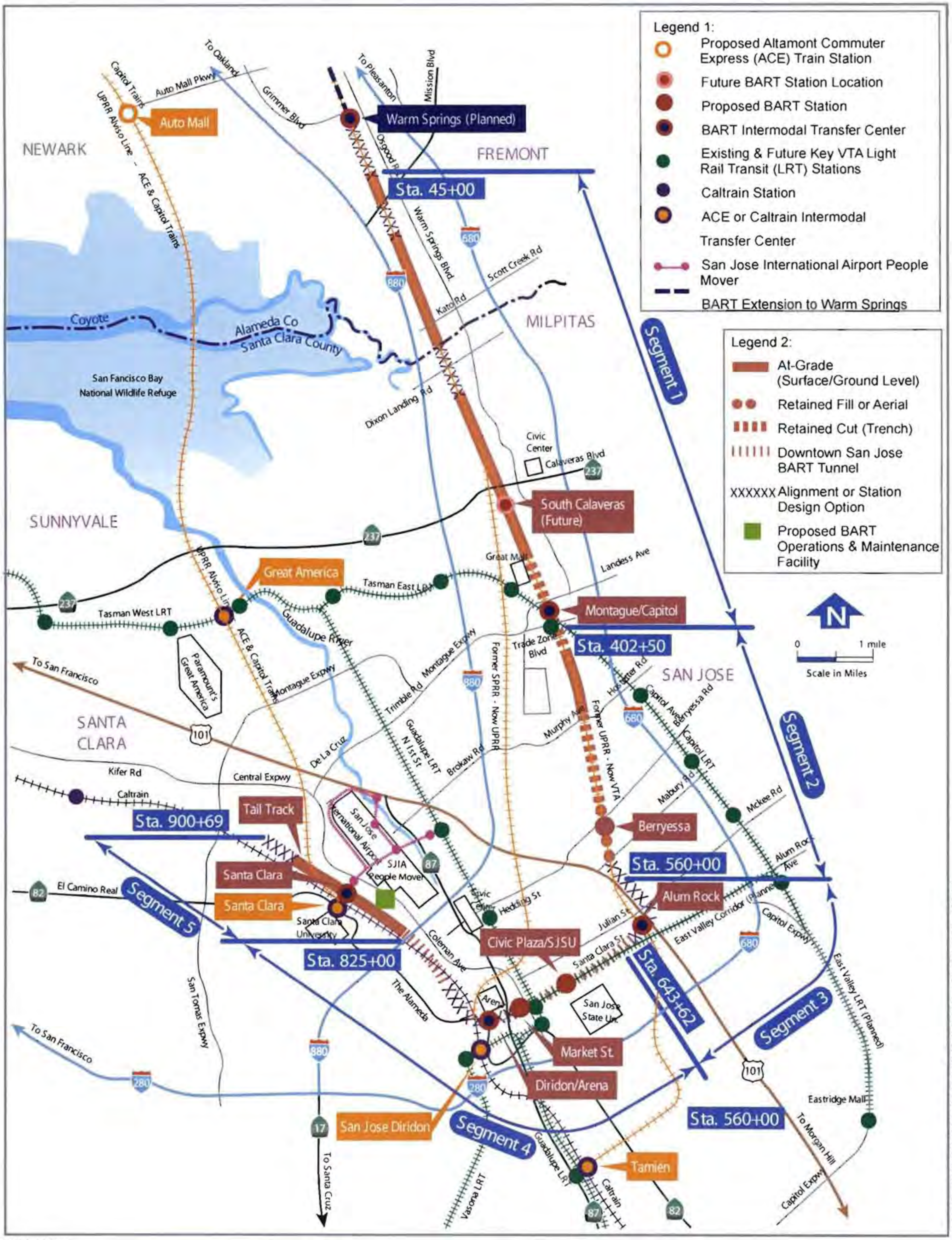
TABLE 10: 2003 CIVIC PLAZA STATION OBSERVATION WELLS DATA SUMMARY

Silicon Valley Rapid Transit Corridor
San Jose, California
Job No. 28648793.02513

	WELL # 18	MW-1	MW-2	MW-3
Surface Elevation (ft)	80.0	80.0	80.0	80.0
Screen Depth (ft)	N/A	64.0 to 74.0	60.0 to 80.0	74.0 to 84.0
Date Installed	N/A	03/01/03	03/01/03	03/02/03

READ DATE	Water Depth (feet below ground surface)			
03/03/03	38.0	12.3	12.2	12.3
03/0803	38.4	12.0	13.3	12.2
04/14/03	40.3	14.7	12.2	11.3
	Water Level Elevation (feet)			
03/03/03	42	67.7	67.8	67.7
03/0803	41.6	68	66.7	67.8
04/14/03	39.7	65.3	67.8	68.7

Figures



J01-025 Fig1 5/29/03

X:\Major_Project\BART_SJ\95-0011\2023.00\Geotech_Reports\TM's\EIR Figures\LRS Figs\Segments 1 to 5\Fig 1.ai

Figure 1: BART Extension Alignment and Segments

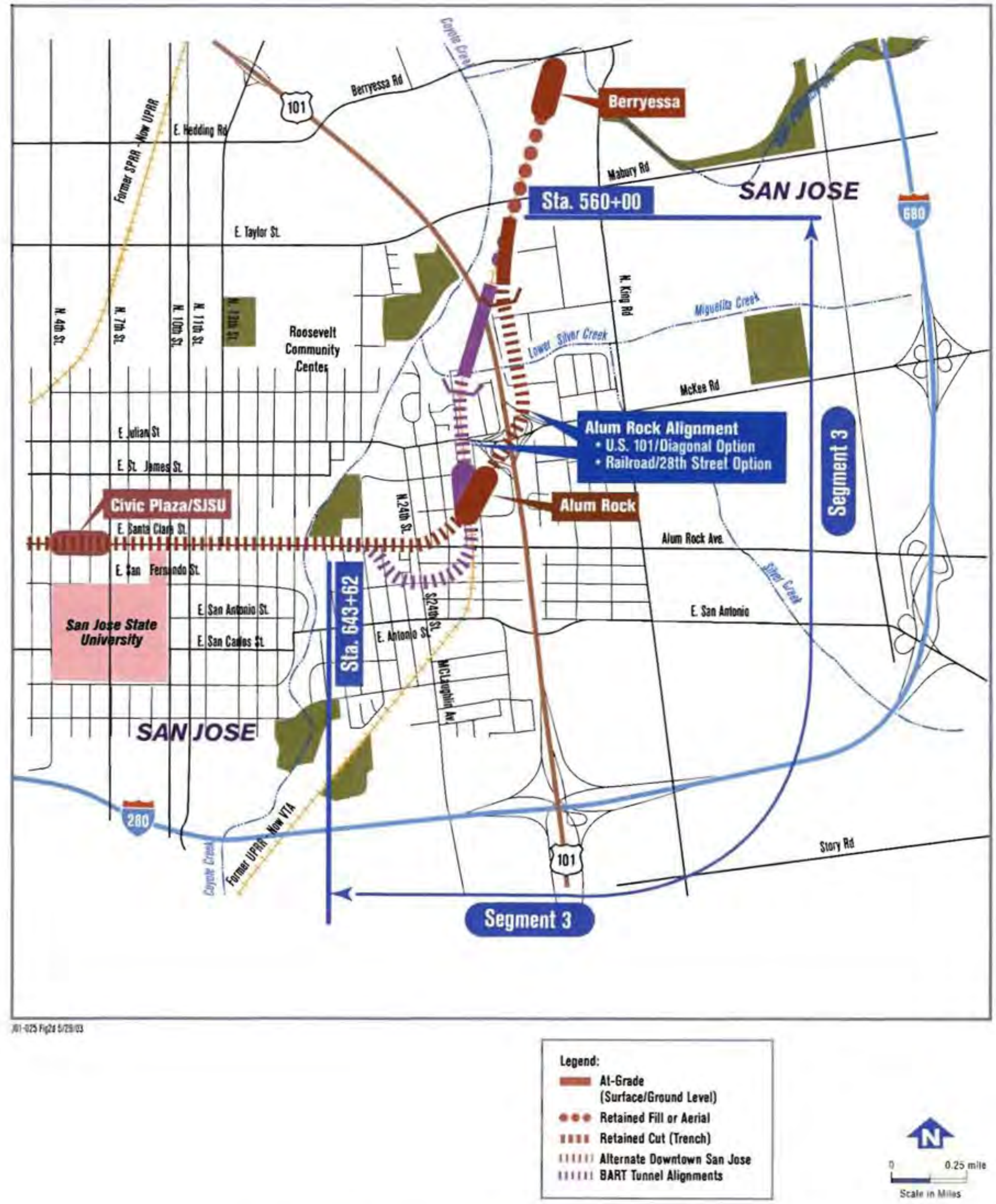


Figure 2: Segment 3 from Mabury Road to 19th Streets

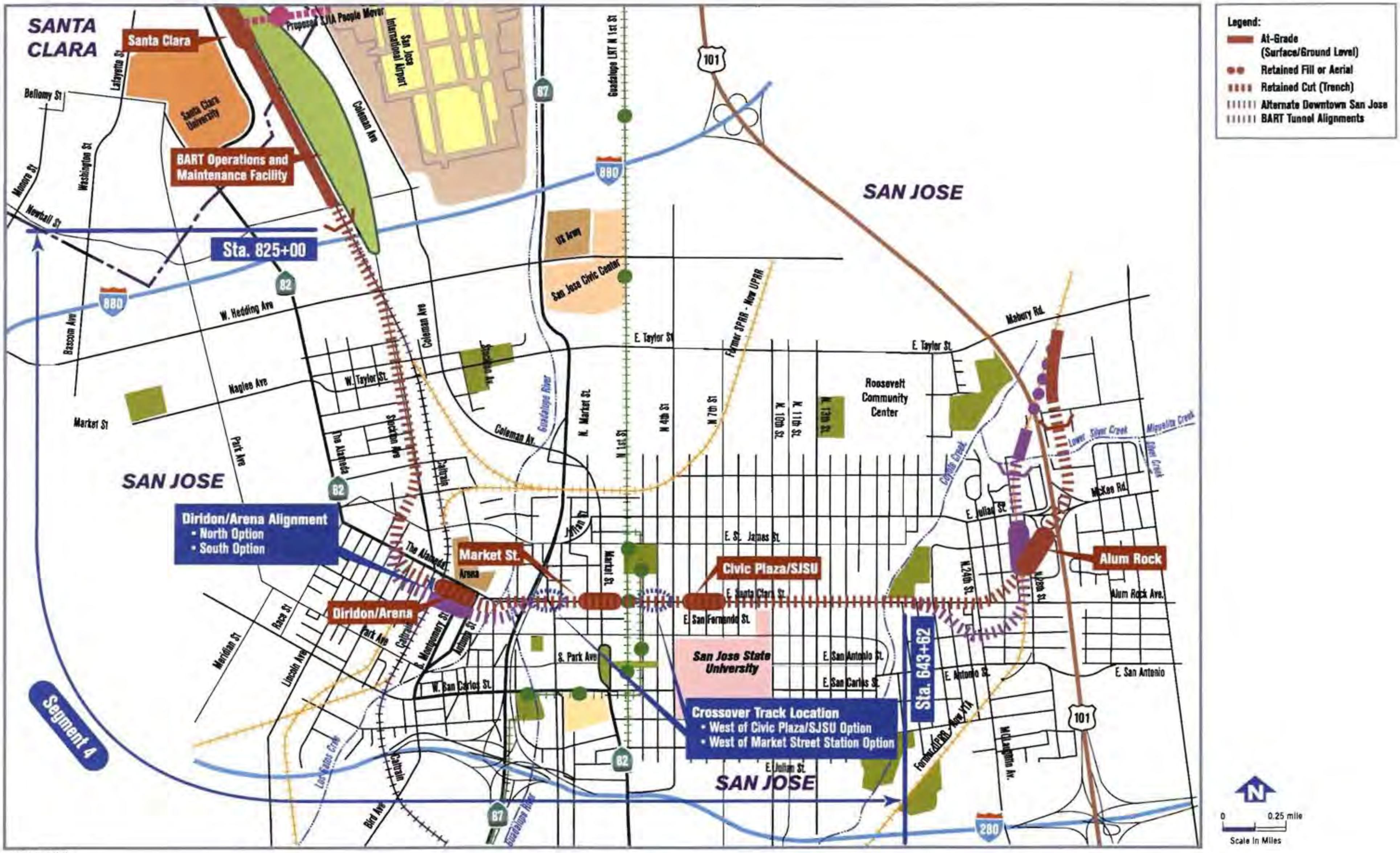
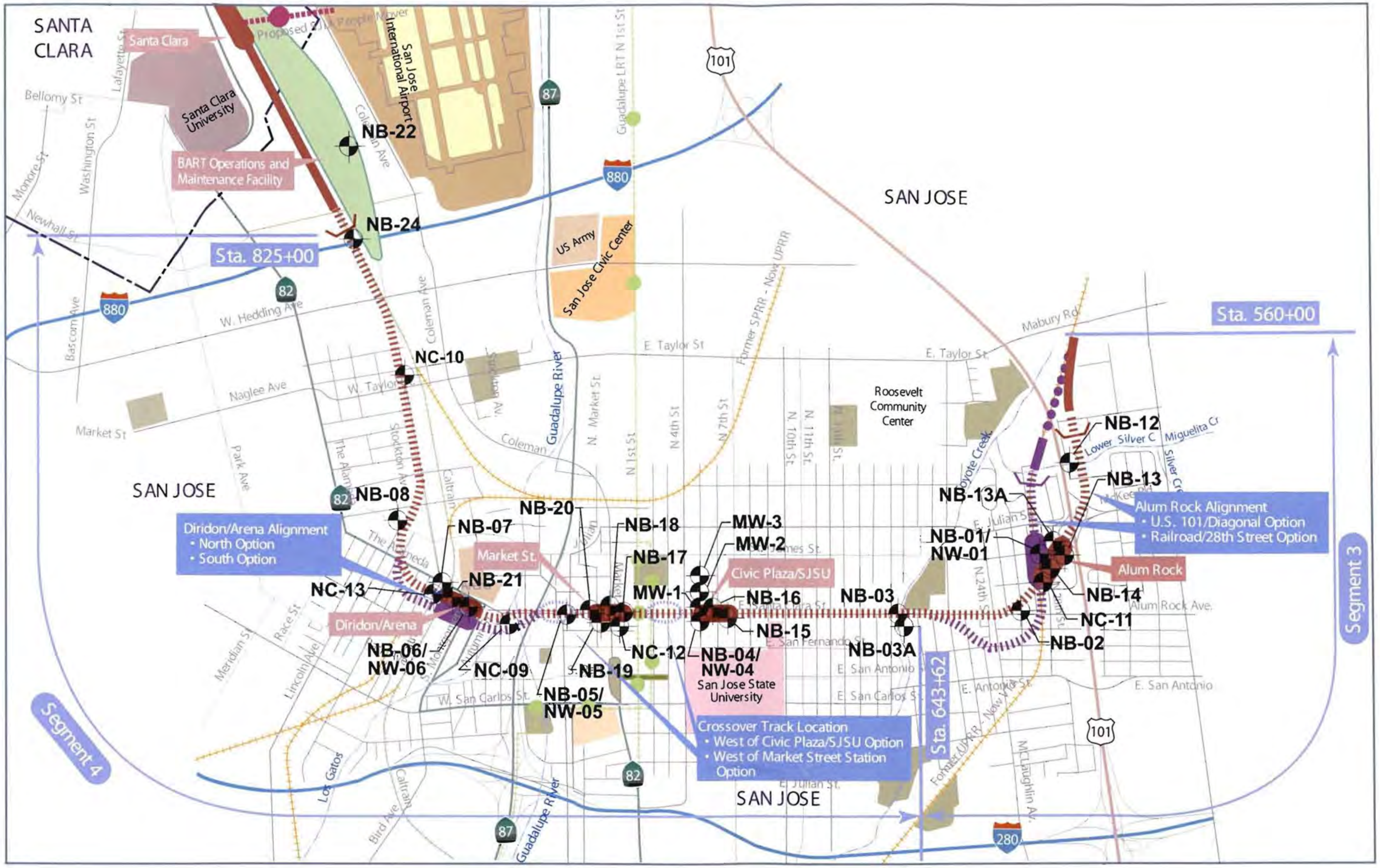


Figure 3: Segment 4 from 19th Streets to I-880



NOT TO SCALE

Legend:
- 🟥 At-Grade (Surface/Ground Level)
- ●●● Retained Fill or Aerial
- ▮▮▮▮▮ Retained Cut (Trench)
- ▮▮▮▮▮ Alternate Downtown San Jose
- ▮▮▮▮▮ BART Tunnel Alignments
- ⊕ SVRTC Exploration Location

SOURCE:

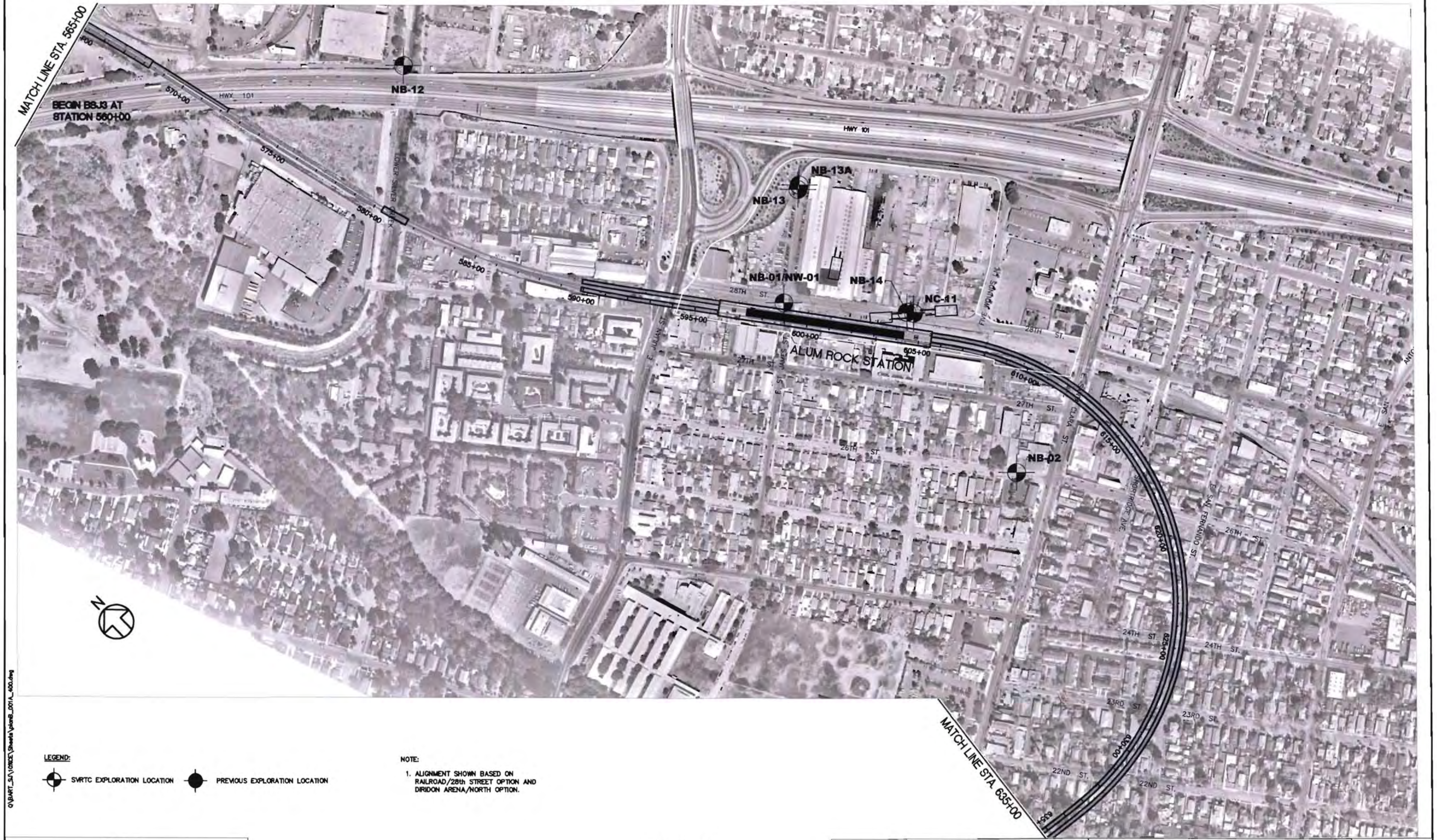
Earth Tech, Inc. June 20, 2003

Project No. 28649330

Silicon Valley Rapid Transit Corridor

Exploration Location Plan
Segments 3 and 4

Figure
4



Q:\BART_SJ\10%CE\Sheets\planB_001A_400.dwg

LEGEND:

- ⊕ SVRTC EXPLORATION LOCATION
- ● PREVIOUS EXPLORATION LOCATION

NOTE:

1. ALIGNMENT SHOWN BASED ON RAILROAD/28th STREET OPTION AND DIRIDON ARENA/NORTH OPTION.

GRAPHIC SCALE

200' 0' 200' 400'

SOURCE
10% Conceptual Engineering Drowings Dated April 28, 2003 By Earth Tech, Inc.

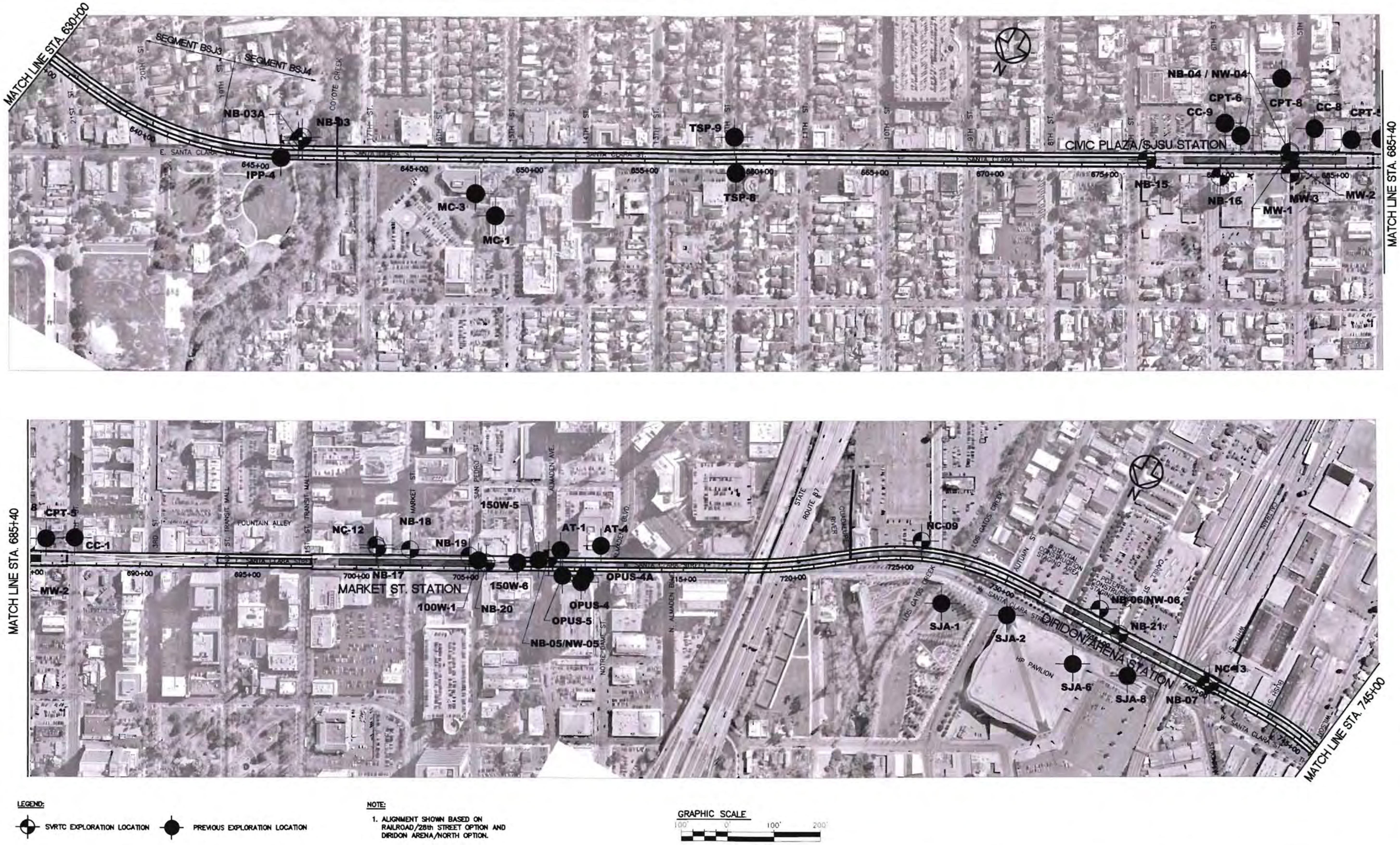
URS

Project No. 28648793

Silicon Valley Rapid Transit Corridor

SITE AND FIELD EXPLORATION LOCATION PLAN

Figure 5



NOTE:

1. ALIGNMENT SHOWN BASED ON RAILROAD/28th STREET OPTION AND DIRIDON ARENA/NORTH OPTION.

Q:\BART_SJ\(OBCE)\Sheets\plan8_002A_400.dwg

SOURCE

10% Conceptual Engineering Drawings
Dated April 28, 2003 By Earth Tech, Inc.

URS

Project No. 28648793

Silicon Valley Rapid Transit Corridor

SITE AND FIELD EXPLORATION LOCATION PLAN

Figure 6

Q:\BART_SJ\10802E\Sheets\planB_003_400.dwg

SOURCE

10% Conceptual Engineering Drawings
Dated April 28, 2003 By Earth Tech, Inc.

LEGEND:

⊕ SVRTC EXPLORATION LOCATION

● PREVIOUS EXPLORATION LOCATION

NOTE:

1. ALIGNMENT SHOWN BASED ON RAILROAD/28th STREET OPTION AND DIRIDON ARENA/NORTH OPTION.

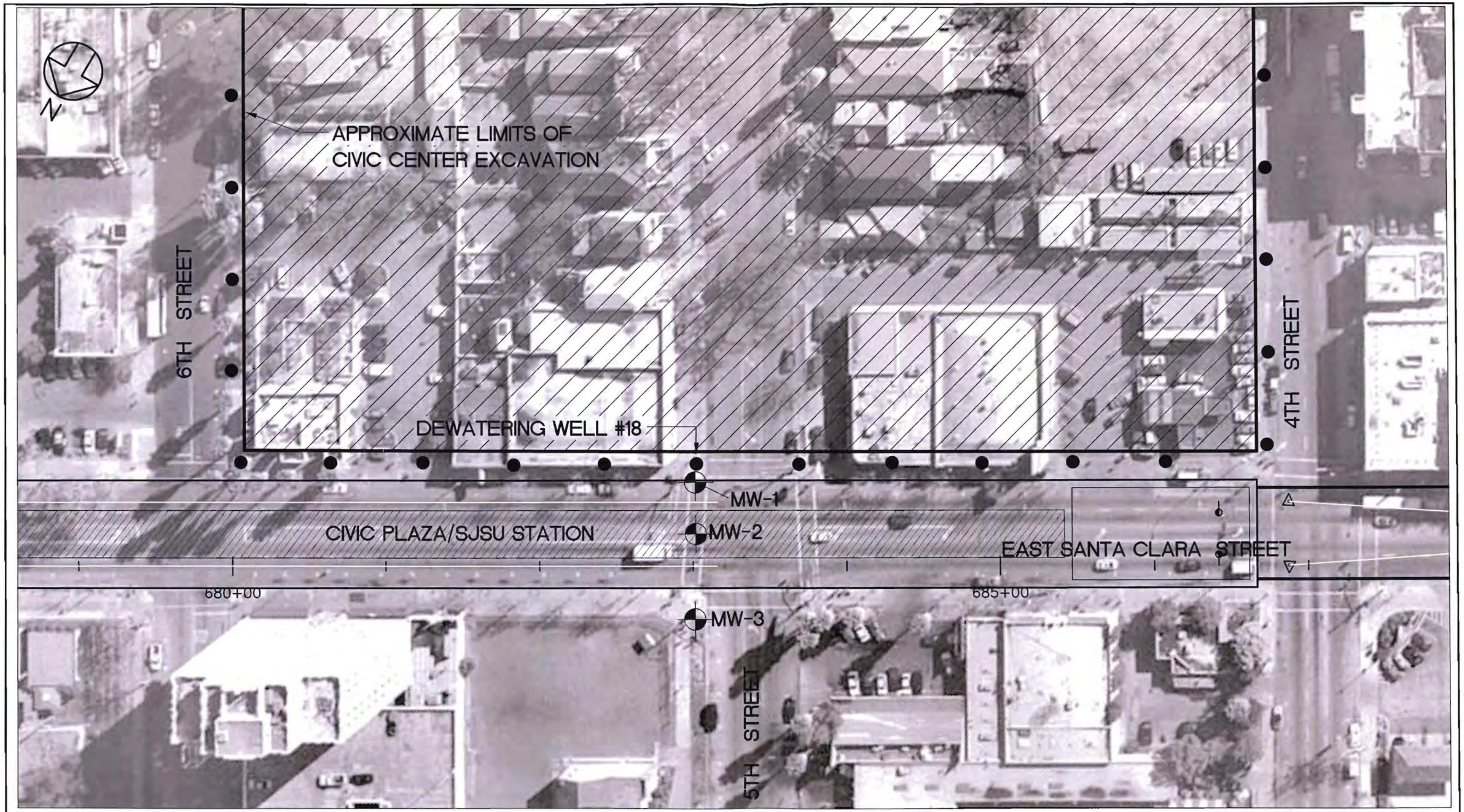
URS

Project No. 28648793

Silicon Valley Rapid Transit Corridor

SITE AND FIELD EXPLORATION LOCATION PLAN

Figure 7



GRAPHIC SCALE
30' 0' 30' 60'

Q:\BART_SJ\URSplans\Mwells\Dewater_plan1.dwg

⊕ SVRTC Exploration Location

● Dewatering Well (by others)

SOURCE:
10% Conceptual Engineering Drawings
Dated April 20, 2003 By Earth Tech, Inc.

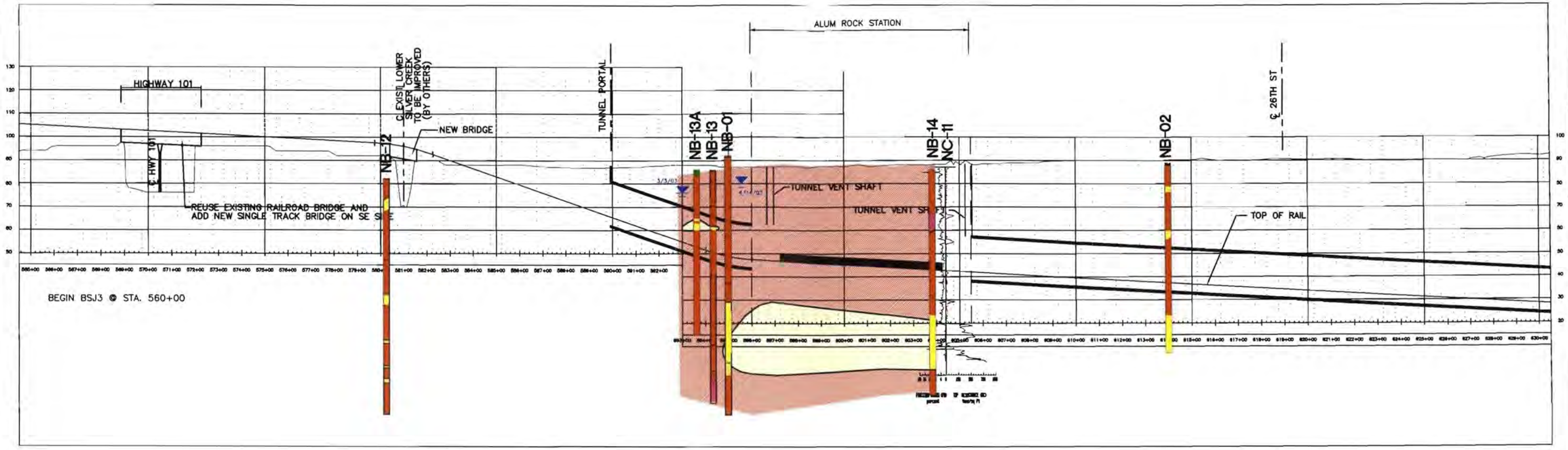
URS

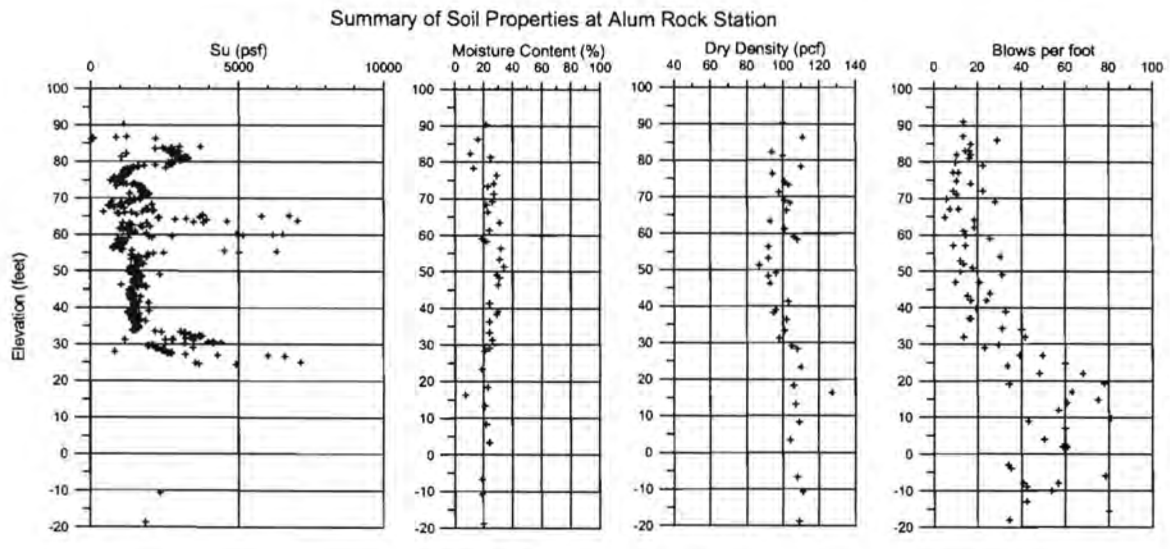
Project No. 28648793

Silicon Valley Rapid Transit Corridor

MONITORING WELL LOCATION PLAN
Civic Plaza/SJSU Station

Figure
8

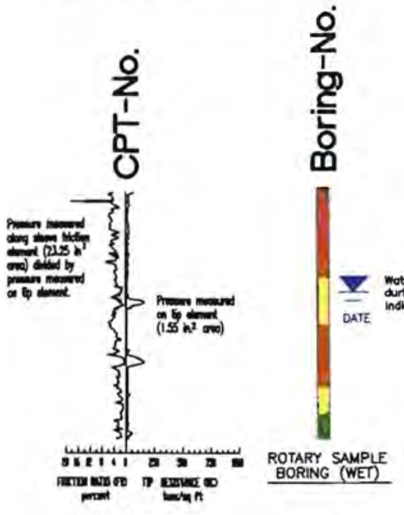



Summary of Soil Properties at Alum Rock Station

Includes data from the following Borings and CPTs:

NB-01 NB-02 NB-13 NB-13A NB-14 NC-11

LEGEND OF BORING AND CPT OPERATIONS



ELECTRONIC CONE PENETROMETER TEST

Cone Penetrometer dimensions and testing procedures are in accordance with ASTM standard D 3441-86, or as noted.

LEGEND OF SOIL TYPES

1. FINE-GRAINED SOILS (CL, ML, CH) 🟥
2. GRANULAR SOILS
   - A. SANDS (SP, SW, SC, SM) 🟨
   - B. GRAVELS (GP, GW, GC, GW) 🟩

Notes:

1) Tunnel Profile based on Alum Rock Railroad/28th Street Option and Diridon Arena North Option.
2) Figures ⑤ through ⑦ show locations of exploratory borings and CPT's in plan view.
3) The idealized soil profile has been constructed by direct interpolation between borings and CPTs advanced at varying spacings. Soil Profile shown is for schematic illustration purposes only, and should not be construed to represent the actual conditions in the field. Note some borings and CPTs have been projected onto section.

Q:\bart_SJ\URSplans\profiles\RevA\Pro-SVRT001_1.dwg

SOURCE
10% Conceptual Engineering Drawings Dated April 28, 2003 By Earth Tech, Inc.

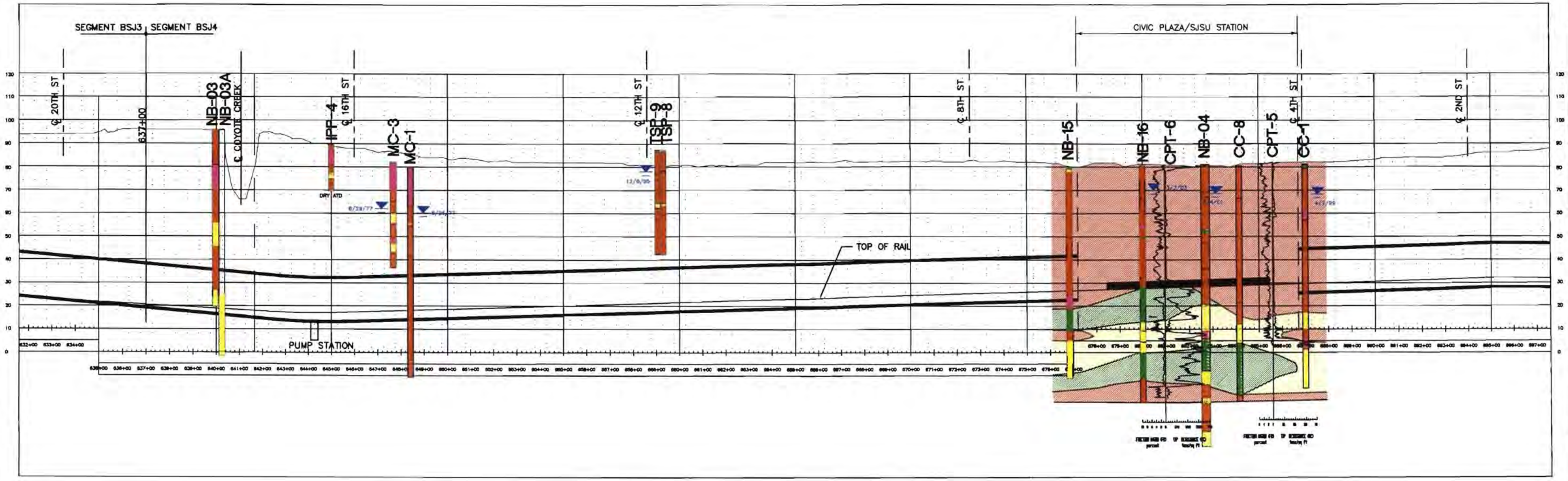
URS

Project No. 28648793

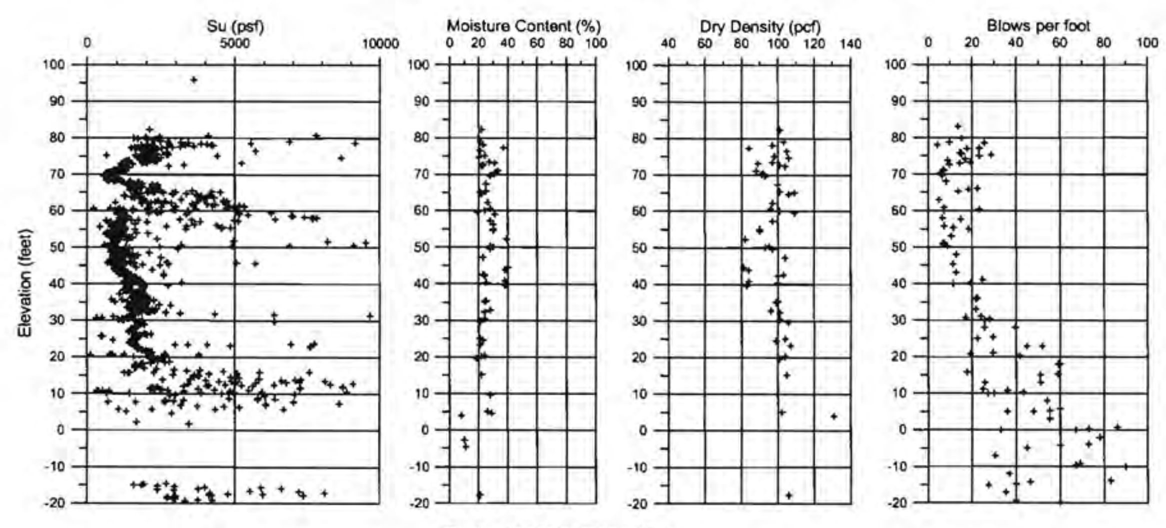
Silicon Valley Rapid Transit Corridor

TUNNEL GENERALIZED PROFILE AND LOGS OF BORINGS

Figure 9



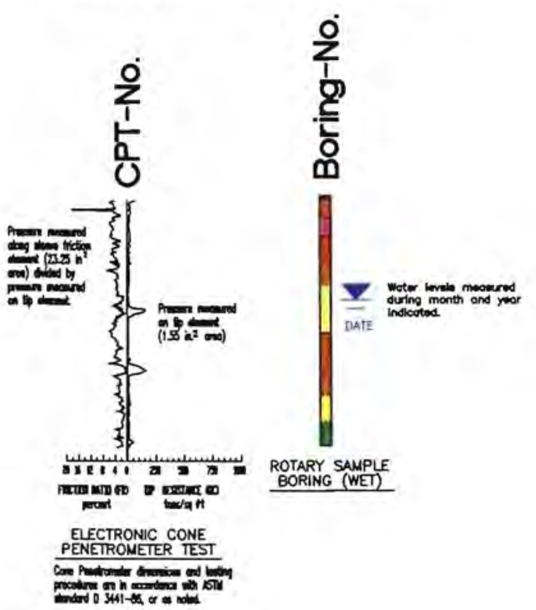
Summary of Soil Index Properties at Civic Plaza/SJSU Station



Data from the following borings and CPTs.

CC-1	CC-9	NB-15	CPT-5
CC-8	NB-04	NB-16	CPT-6

LEGEND OF BORING AND CPT OPERATIONS



ELECTRONIC CONE PENETROMETER TEST

Cone Penetrometer dimensions and testing procedures are in accordance with ASTM standard D 3441-86, or as noted.

ROTARY SAMPLE BORING (WET)

LEGEND OF SOIL TYPES

1. FINE-GRAINED SOILS (CL, ML, CH)
   🟥
2. GRANULAR SOILS
   - A. SANDS (SP, SW, SC, SM)
     🟨
   - B. GRAVELS (GP, GW, GC, GW)
     🟩

Notes:

1) Tunnel Profile based on Alum Rock Railroad/28th Street Option and Diridon/Arena North Option.

2) Figures ⑤ through ⑦ show locations of exploratory borings and CPT's in plan view.

3) The idealized soil profile has been constructed by direct interpolation between borings and CPTs advanced at varying spacings. Soil Profile shown is for schematic illustration purposes only, and should not be construed to represent the actual conditions in the field. Note some borings and CPTs have been projected onto section.

q:\bart_SJ\10%CE\Sheets\Pro-SVRT002_2.dwg

SOURCE

10% Conceptual Engineering Drawings
Dated April 28, 2003 By Earth Tech, Inc.

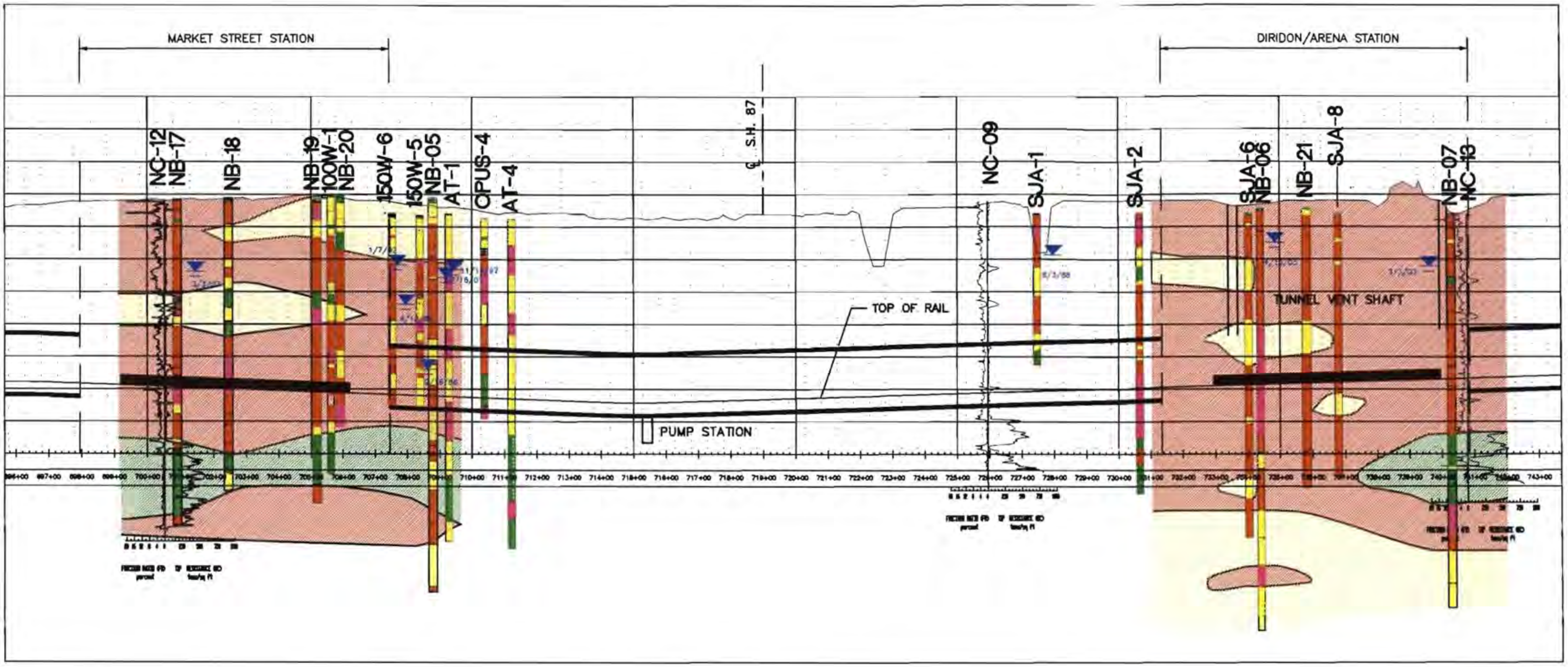
URS

Project No. 28648793

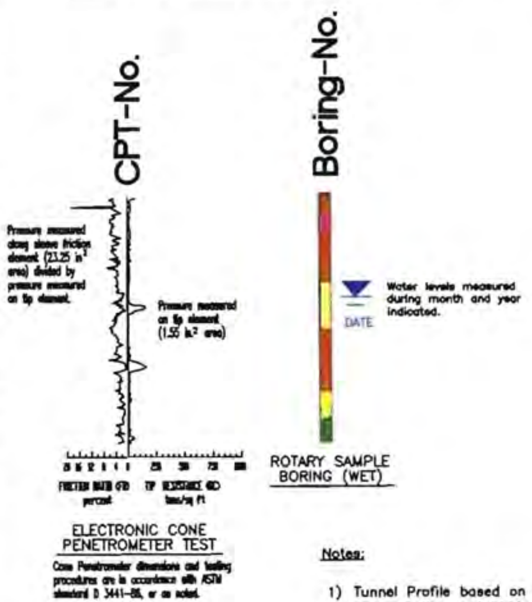
Silicon Valley Rapid Transit Corridor

TUNNEL GENERALIZED PROFILE AND LOGS OF BORINGS

Figure 10



LEGEND OF BORING AND CPT OPERATIONS



ELECTRONIC CONE PENETROMETER TEST

Cone Penetrometer dimensions and testing procedures are in accordance with ASTM standard D 3441-86, or as noted.

ROTARY SAMPLE BORING (WET)

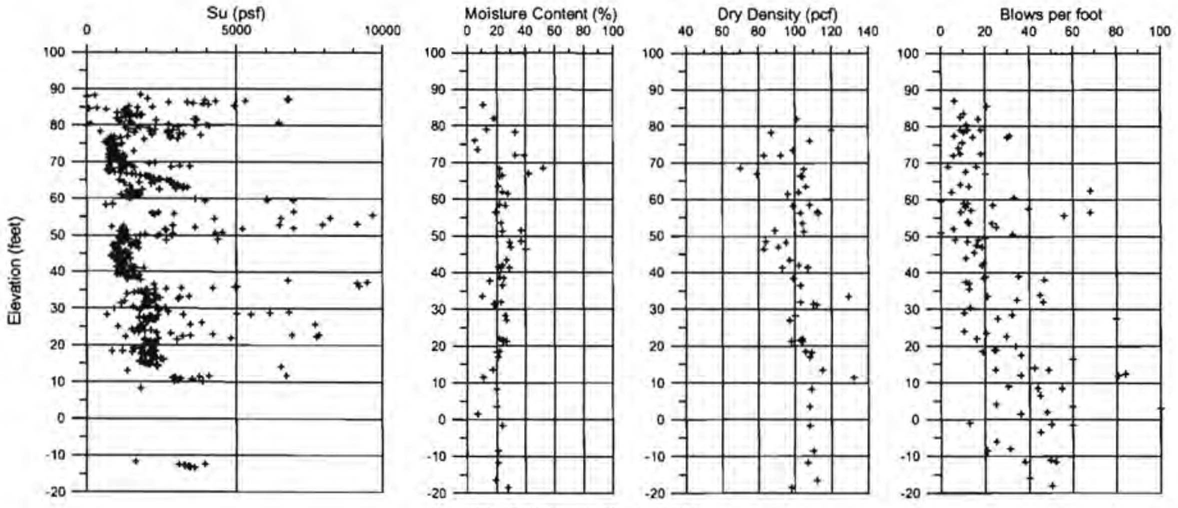
LEGEND OF SOIL TYPES

1. FINE-GRAINED SOILS (CL, ML, CH)
   🟥
2. GRANULAR SOILS
   - A. SANDS (SP, SW, SC, SM)
     🟨
   - B. GRAVELS (GP, GW, GC, GW)
     🟩

Notes:

1) Tunnel Profile based on Alum Rock Railroad/28th Street Option and Diridon/Arena North Option.
2) Figures ⑤ through ⑦ show locations of exploratory borings and CPT's in plan view.
3) The idealized soil profile has been constructed by direct interpolation between borings and CPTs advanced at varying spacings. Soil Profile shown is for schematic illustration purposes only, and should not be construed to represent the actual conditions in the field. Note some borings and CPTs have been projected onto section.

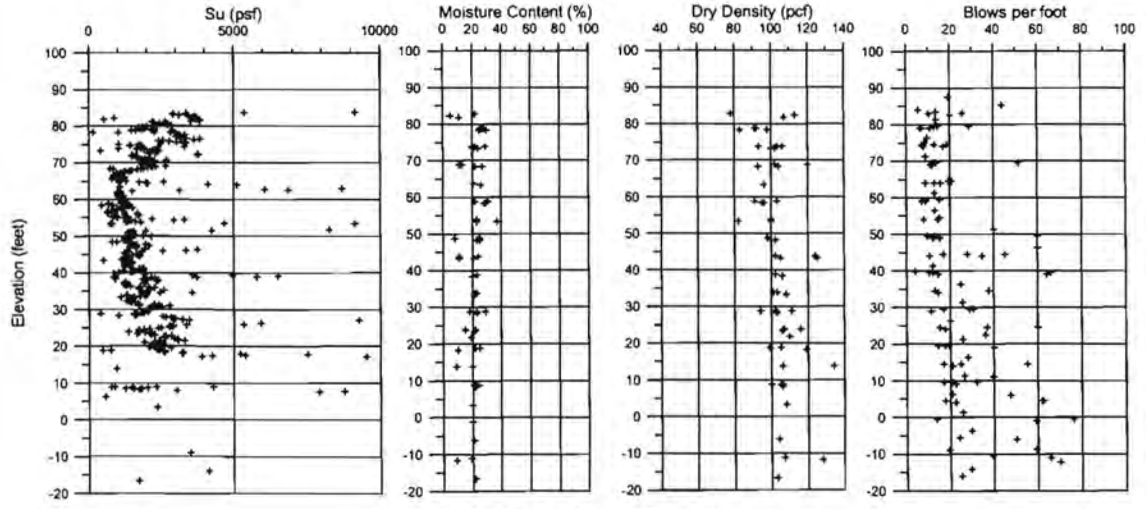
Summary of Soil Index Properties at Market Street Station



Data from the following borings and CPTs:

100W-1
150W-5
150W-6
AT-1
AT-4
NB-05
NB-17
NB-18
NB-19
NB-20
OPUS-4
OPUS-5
NC-12

Summary of Soil Index Properties at Diridon/Arena Station



Data from the following borings and CPTs:

NB-06
NB-07
NB-21
NC-09
NC-13
SJA-1
SJA-2
SJA-6
SJA-8

Q:\bart_SJ\10%CE\Sheets\Pro-SVRT003_3.dwg

SOURCE

10% Conceptual Engineering Drawings
Dated April 28, 2003 By Earth Tech, Inc.

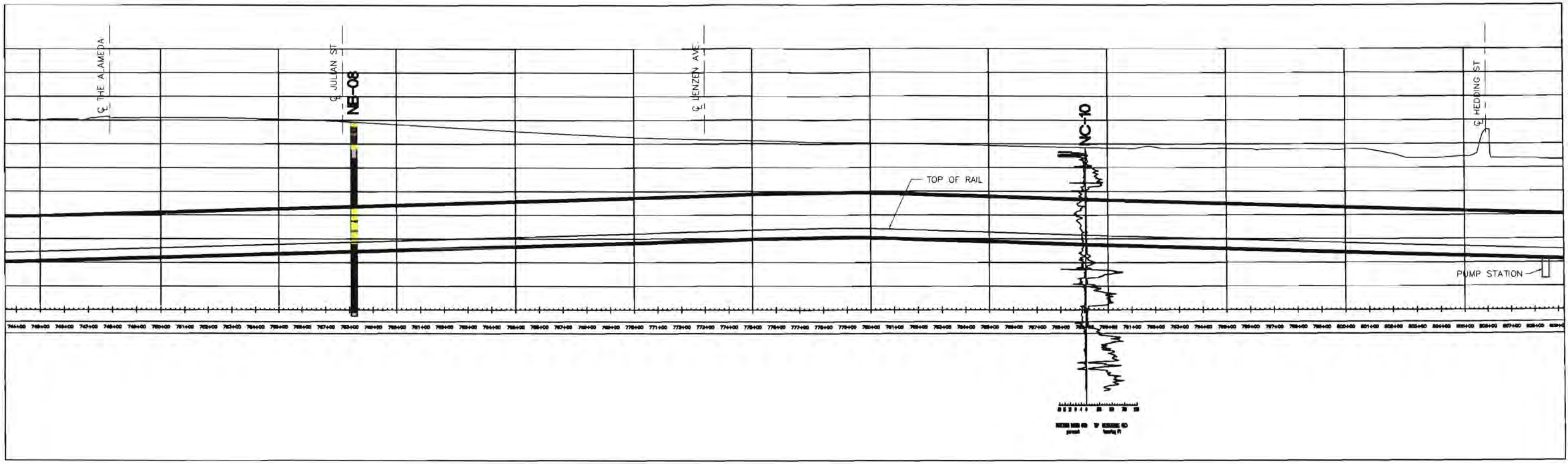
URS

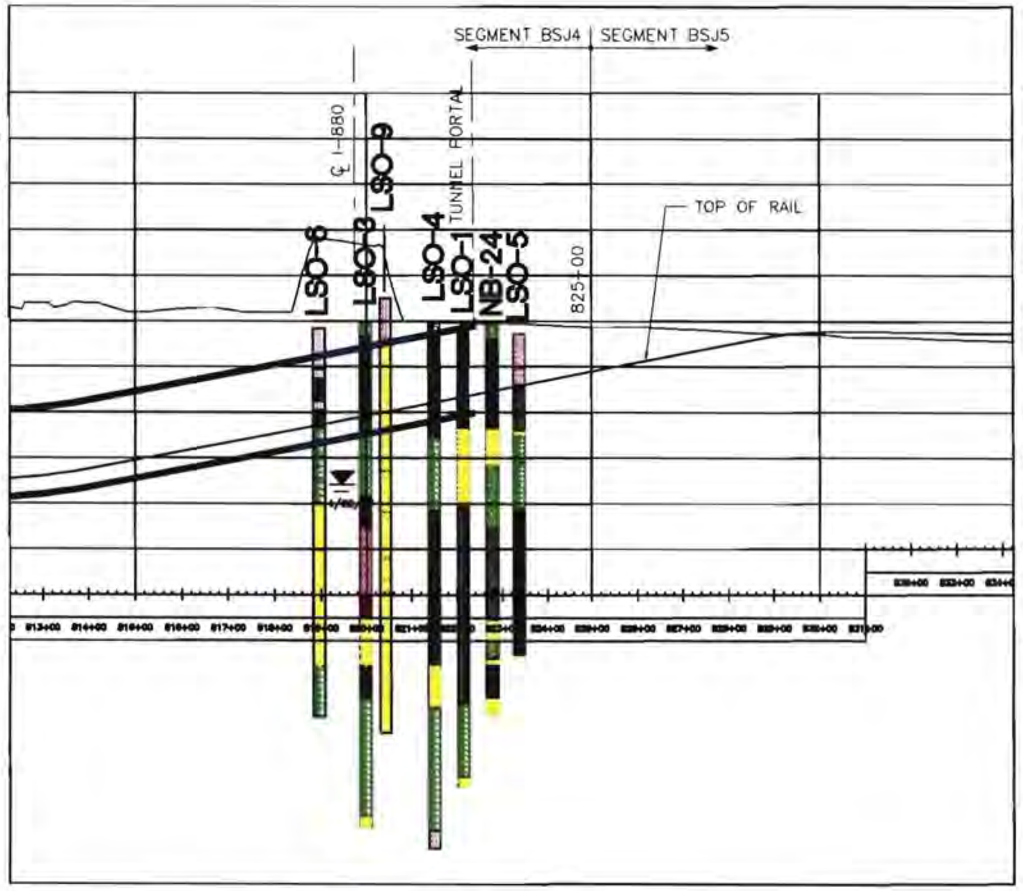
Project No. 28648793

Silicon Valley Rapid Transit Corridor

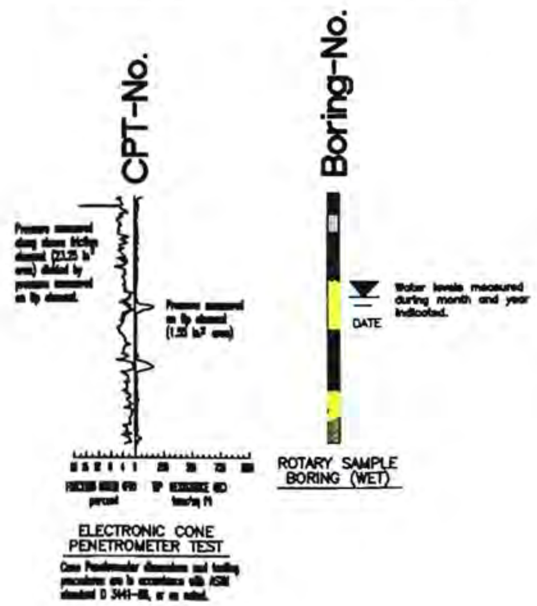
TUNNEL GENERALIZED PROFILE AND LOGS OF BORINGS

Figure 11





LEGEND OF BORING AND CPT OPERATIONS



LEGEND OF SOIL TYPES

1. FINE-GRAINED SOILS (CL, ML, CH)

   ▨

2. GRANULAR SOILS

   A. SANDS (SP, SW, SC, SM)

   ⬛

   B. GRAVELS (GP, GW, GC, GW)

   🟩

Notes:

1) Tunnel Profile based on Alum Rock Railroad/28th Street Option and Diridon/Arena North Option.

2) Figures ⑤ through ⑦ show locations of exploratory borings and CPT's in plan view.

3) The idealized soil profile has been constructed by direct interpolation between borings and CPTs advanced at varying spacings. Soil Profile shown is for schematic illustration purposes only, and should not be construed to represent the actual conditions in the field. Note some borings and CPTs have been projected onto section.

Q:\bart_SJ\10%CE\Sheets\Pro-SVRT004_4.dwg

SOURCE

10% Conceptual Engineering Drawings
Dated April 28, 2003 By Earth Tech, Inc.

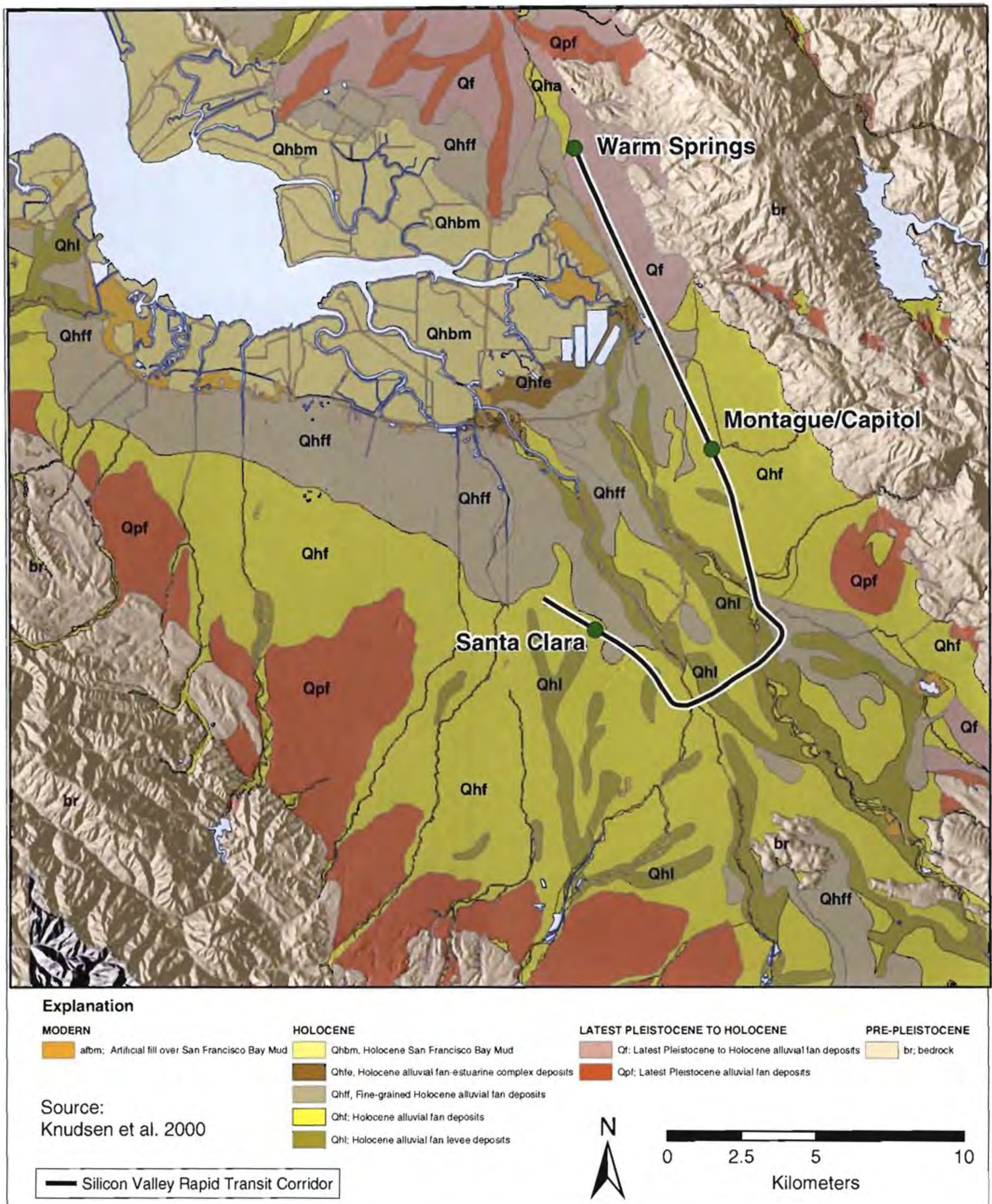
URS

Project No. 28648793

Silicon Valley Rapid Transit Corridor

TUNNEL GENERALIZED PROFILE AND LOGS OF BORINGS

Figure 12



Source:
Knudsen et al. 2000

URS

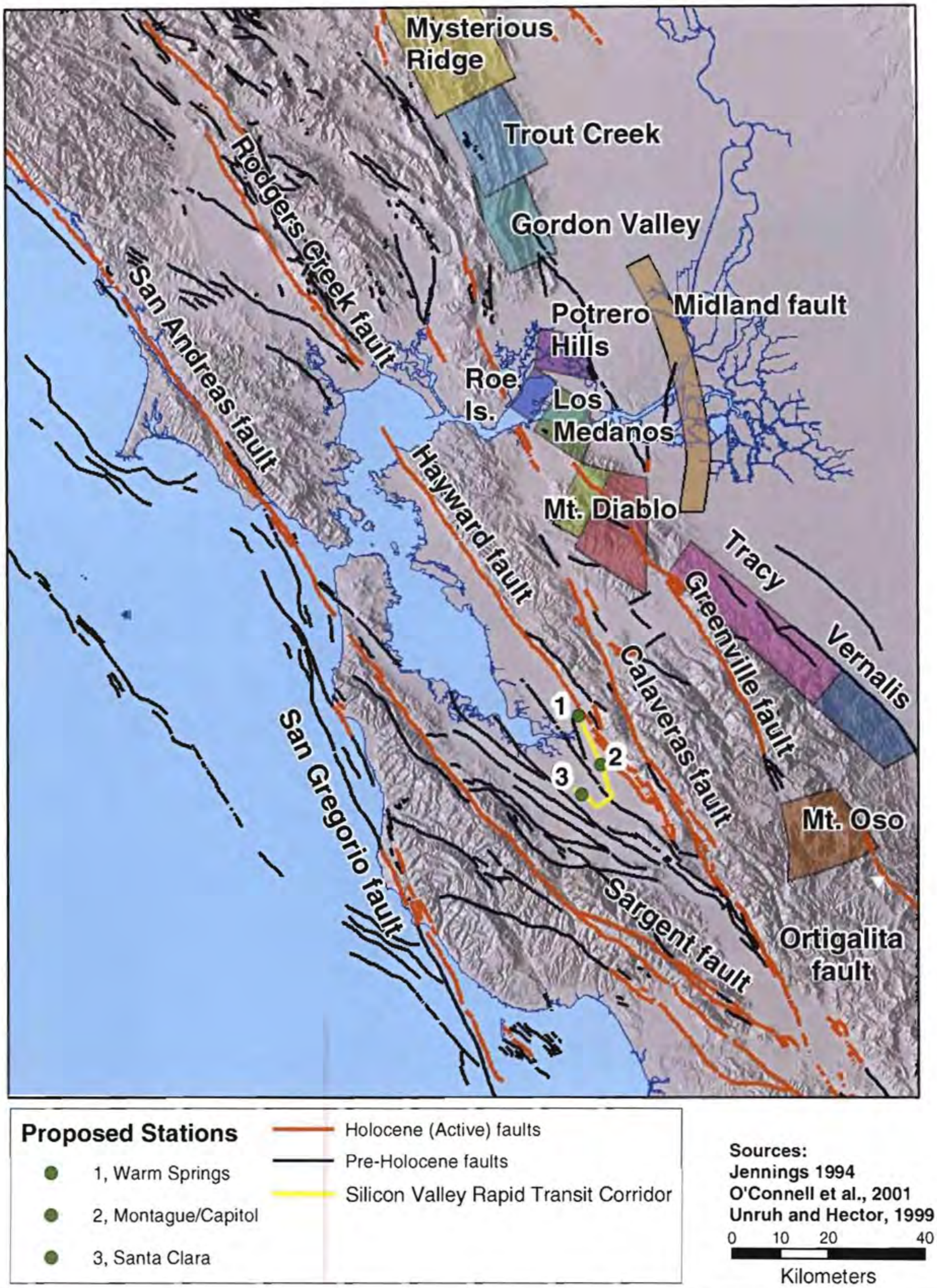
Project No. 28648793

Silicon Valley
Rapid Tansit Corridor

Quaternary Deposits Map

Figure
13

URS Corporation L:\Projects\BART_Warm_Springs_Extension_29648793\MXD\Draft\F_13 Quaternary Deposits Map.mxd Name: dhwrigh0



Sources:
Jennings 1994
O'Connell et al., 2001
Unruh and Hector, 1999

URS

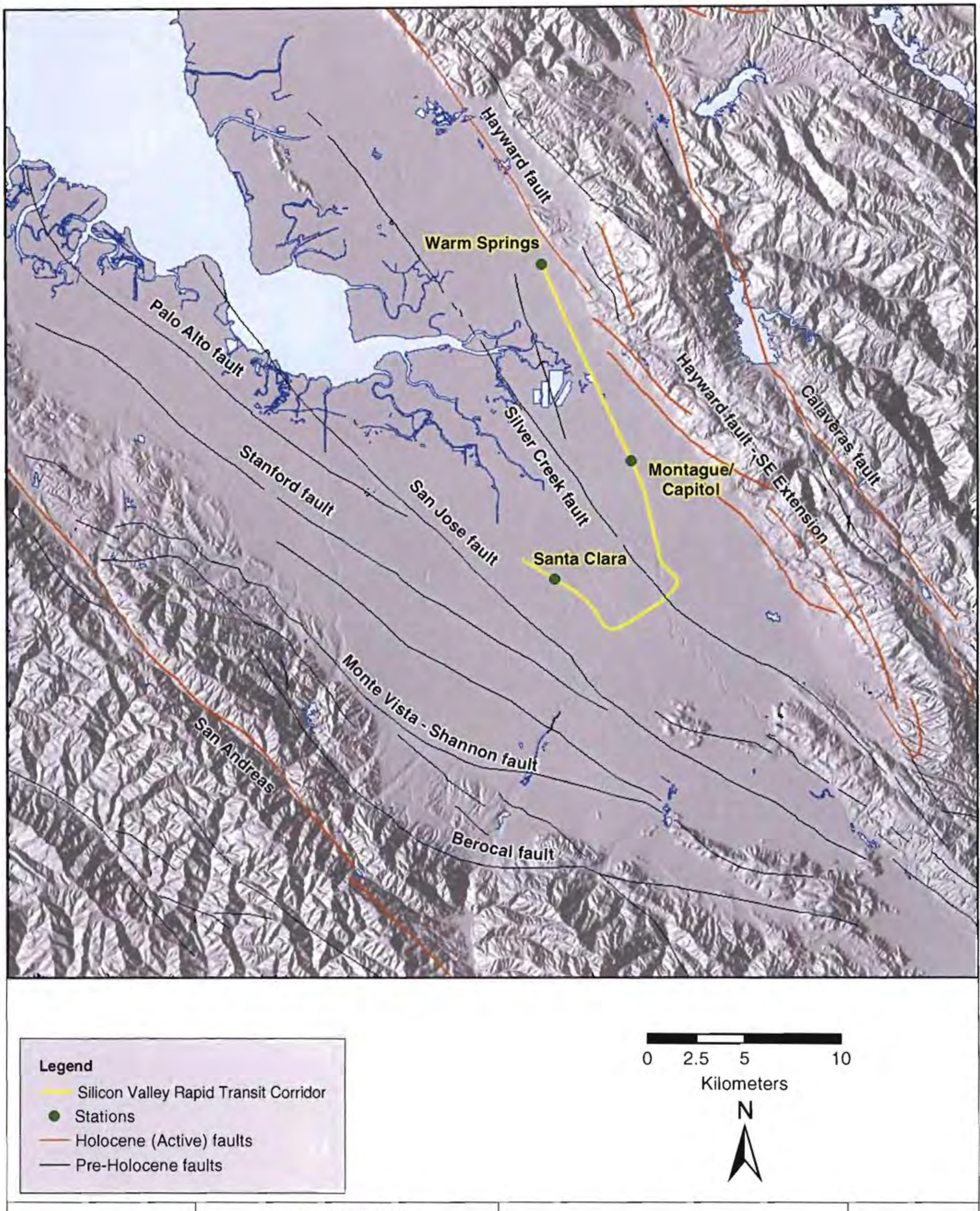
Project No. 29648793

Silicon Valley
Rapid Tansit Corridor

Regional Active Faults

Figure 14

URS Corporation L:\Projects\BART_Warm_Springs_Extension_29648793\MXD\Draft\F_14 Regional Active faults.mxd Name: dhwrigh0



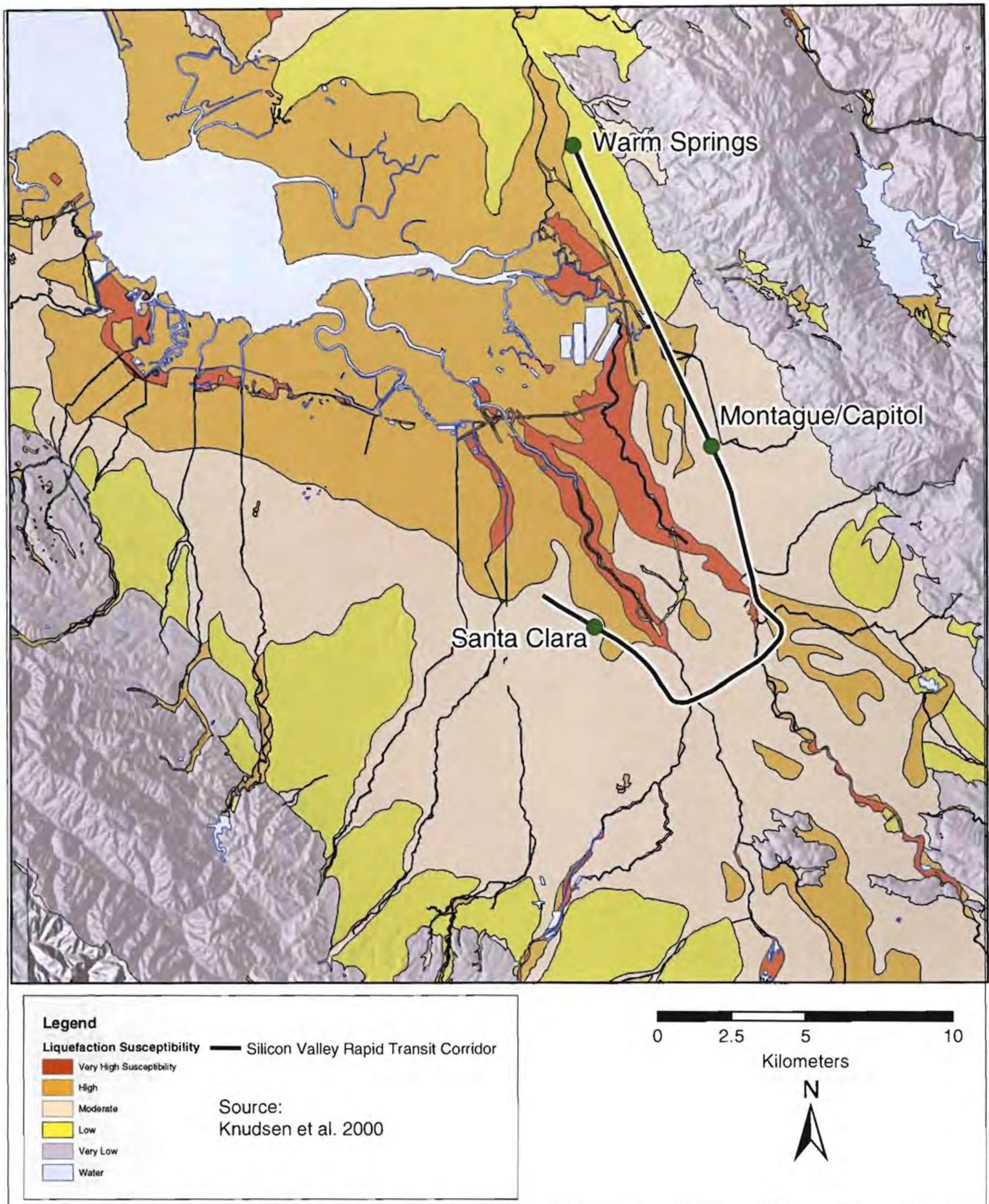
Project No. 29648793

Silicon Valley
Rapid Tansit Corridor

Local Active Faults

Figure
15

URS Corporation L:\Projects\BART_Warm_Springs_Extension_29648793\MXD\Draft\F_15 Local Active Faults.mxd Name: dhwrigh0



Source:
Knudsen et al. 2000

URS	Project No. 29648793 Silicon Valley Rapid Tansit Corridor	**Liquefaction Susceptibility Map**	**Figure 16**

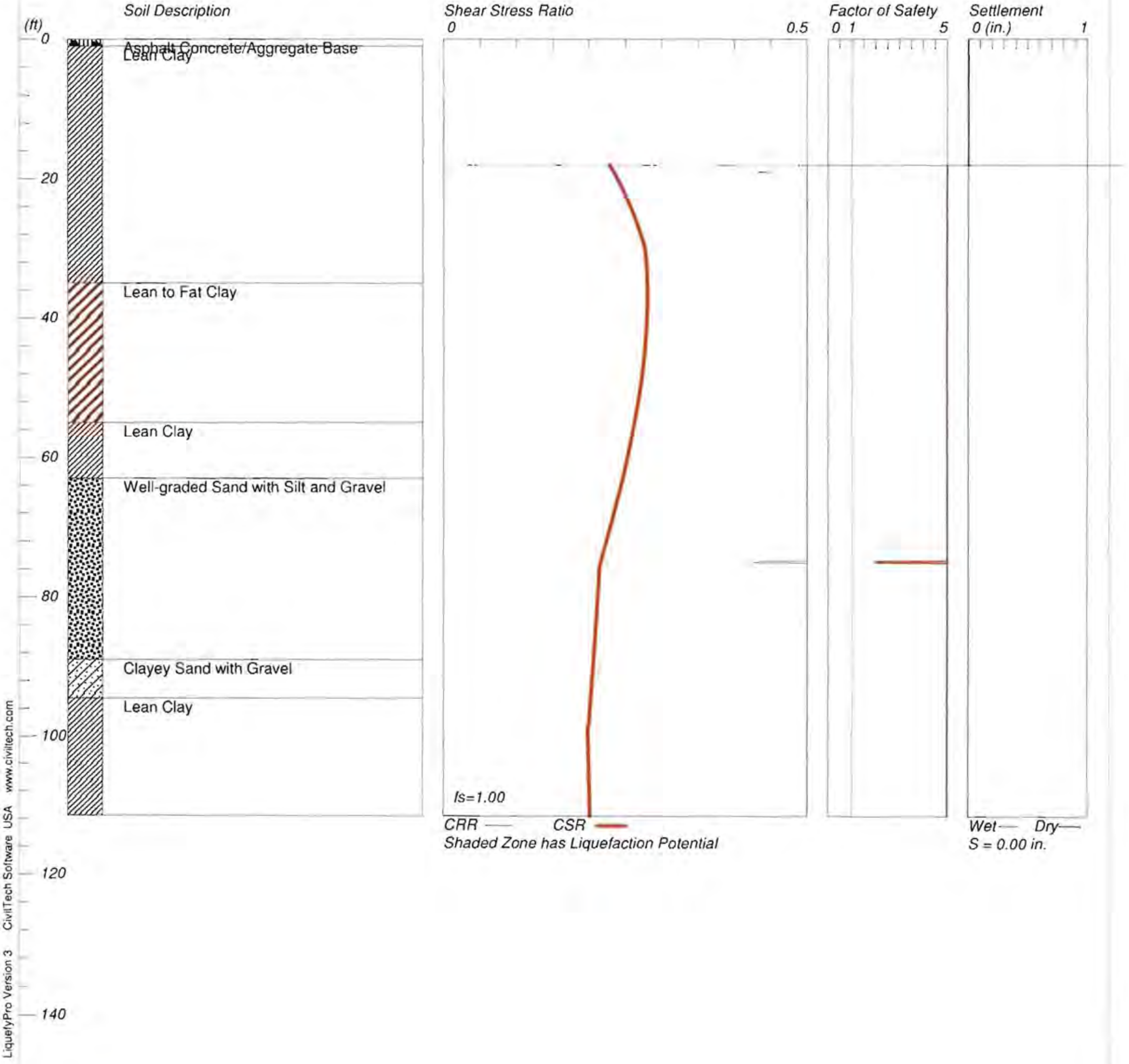
URS Corporation L:\Projects\BART_ Warm_Springs_Extension_29648793\MXD\Draft\F_16 Liquefaction Susceptibility Map.mxd Name: dhwrigh0

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-01 Water Depth=18 ft Surface Elev.=92

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

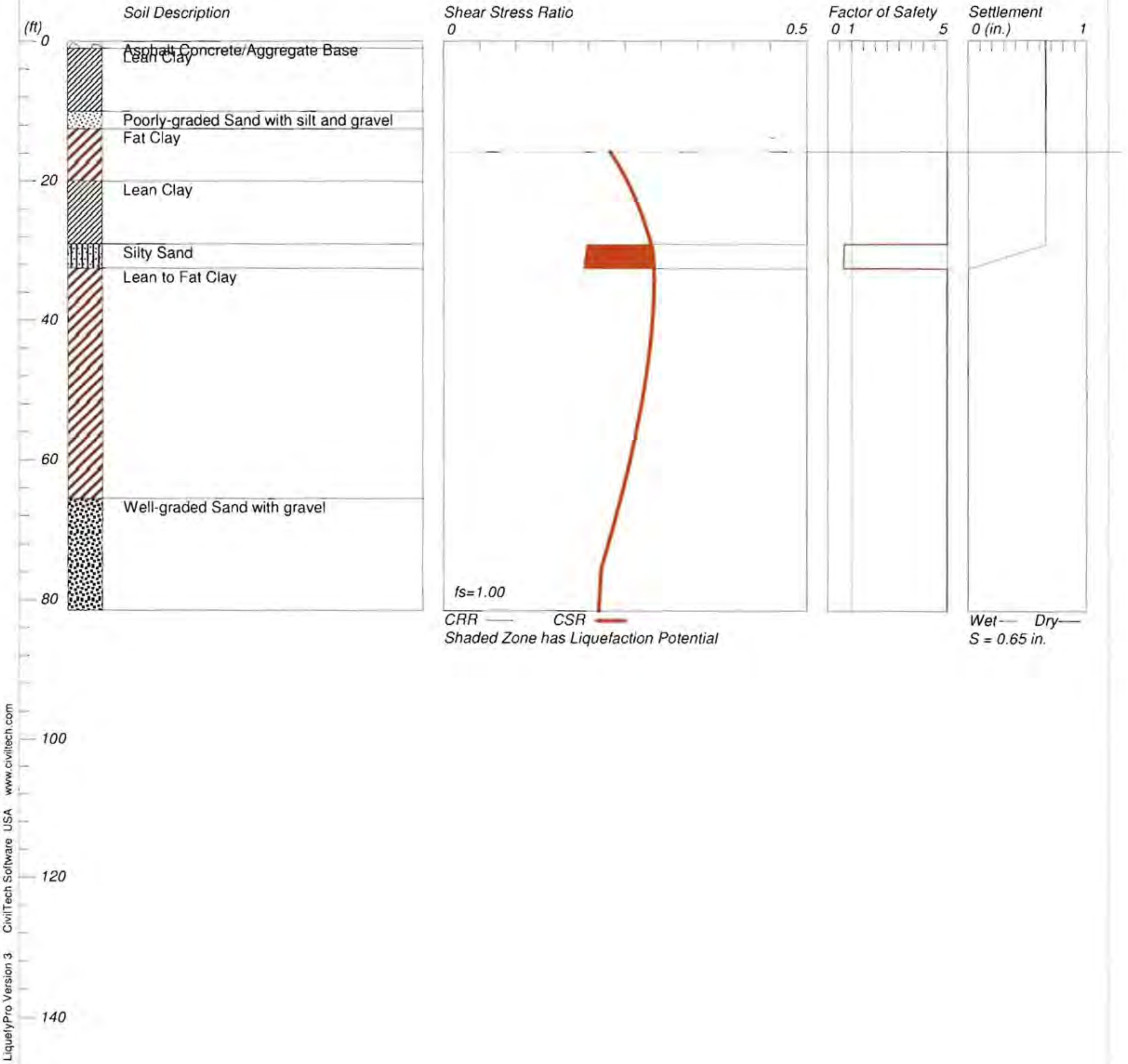
Figure 17

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-02 Water Depth=15.8 ft Surface Elev.=89.8

Magnitude=6.4
Acceleration=0.55g



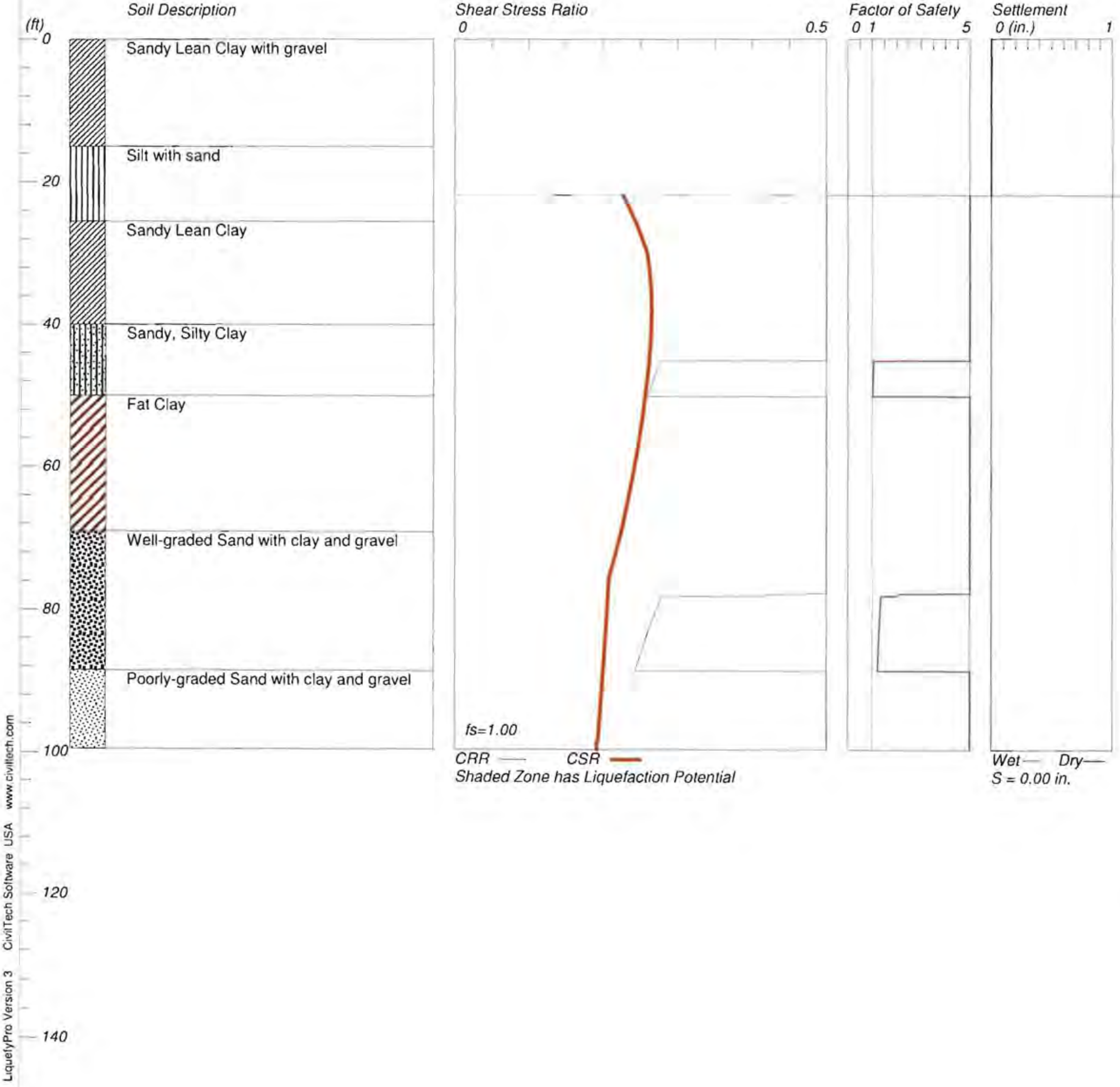
Median (50th percentile) PGA

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-03 Water Depth=21.8 ft Surface Elev.=95.8

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

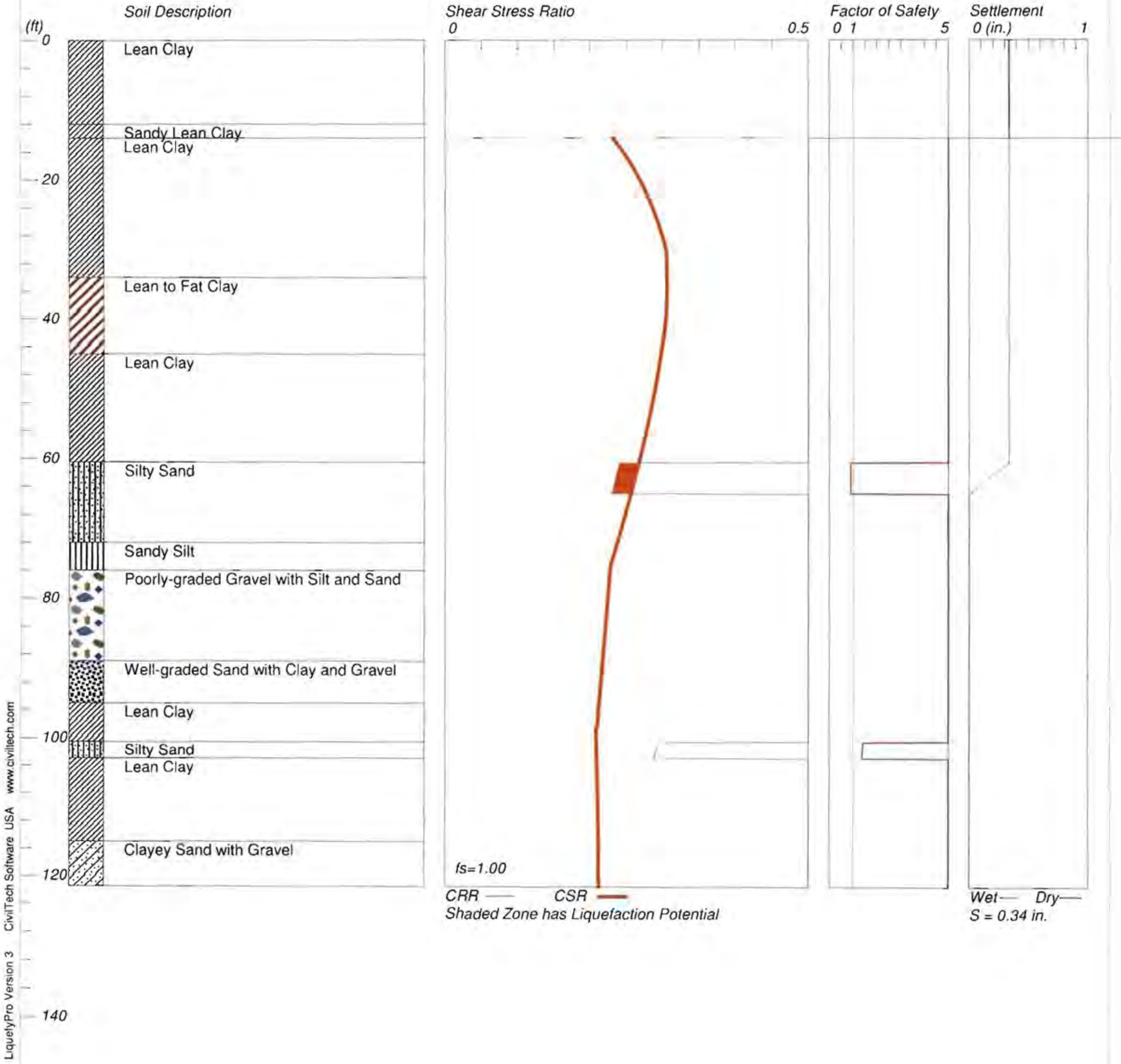
Figure 19

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-04   Water Depth=14 ft   Surface Elev.=88

Magnitude=6.4
Acceleration=0.55g



URS

Median (50th percentile) PGA

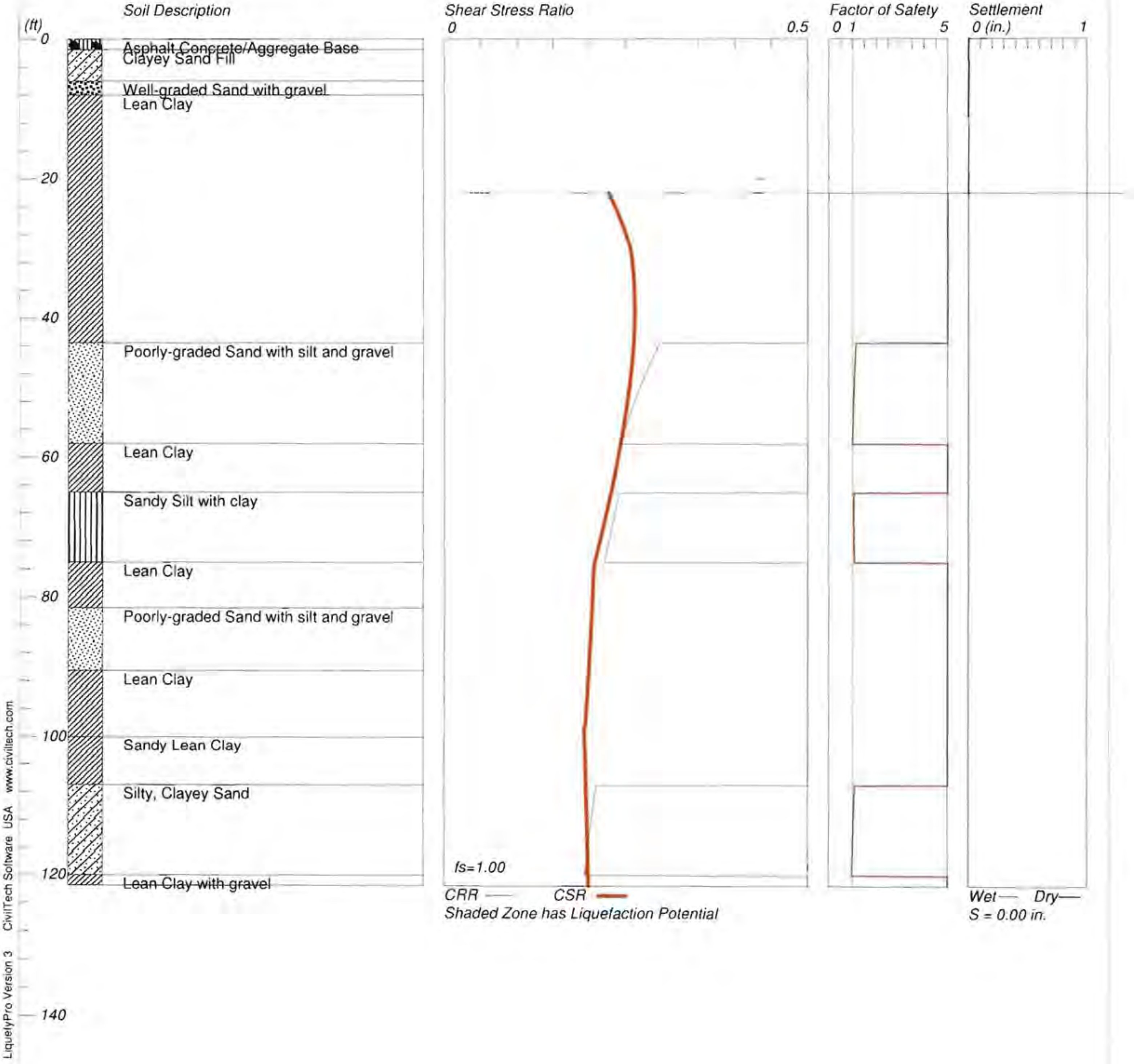
Figure 20

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-05 Water Depth=22 ft Surface Elev.=89

Magnitude=6.4
Acceleration=0.55g



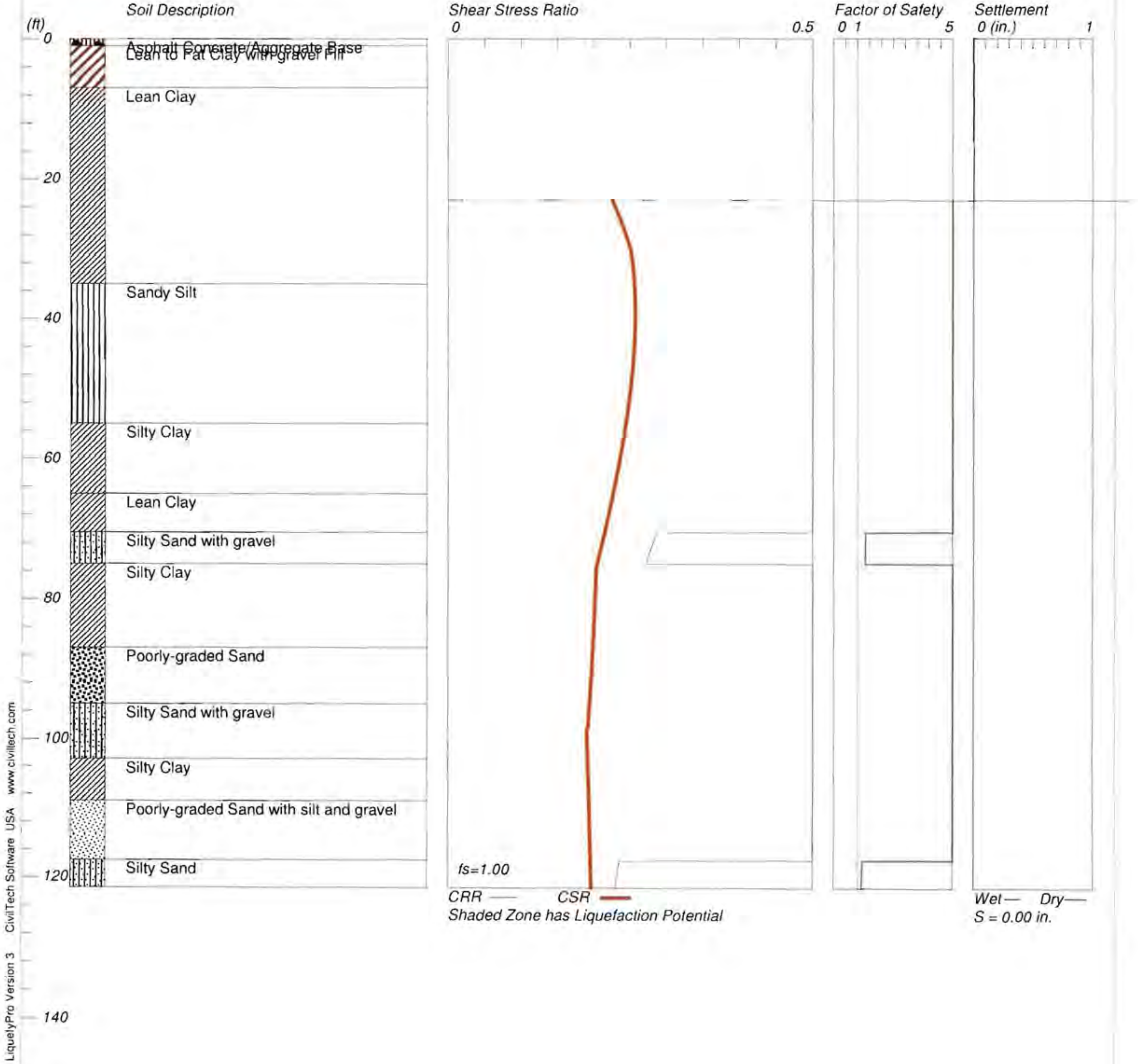
Median (50th percentile) PGA

Figure 21

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-06 Water Depth=23 ft Surface Elev.=89 ***Magnitude=6.4***
Acceleration=0.55g



Median (50th percentile) PGA

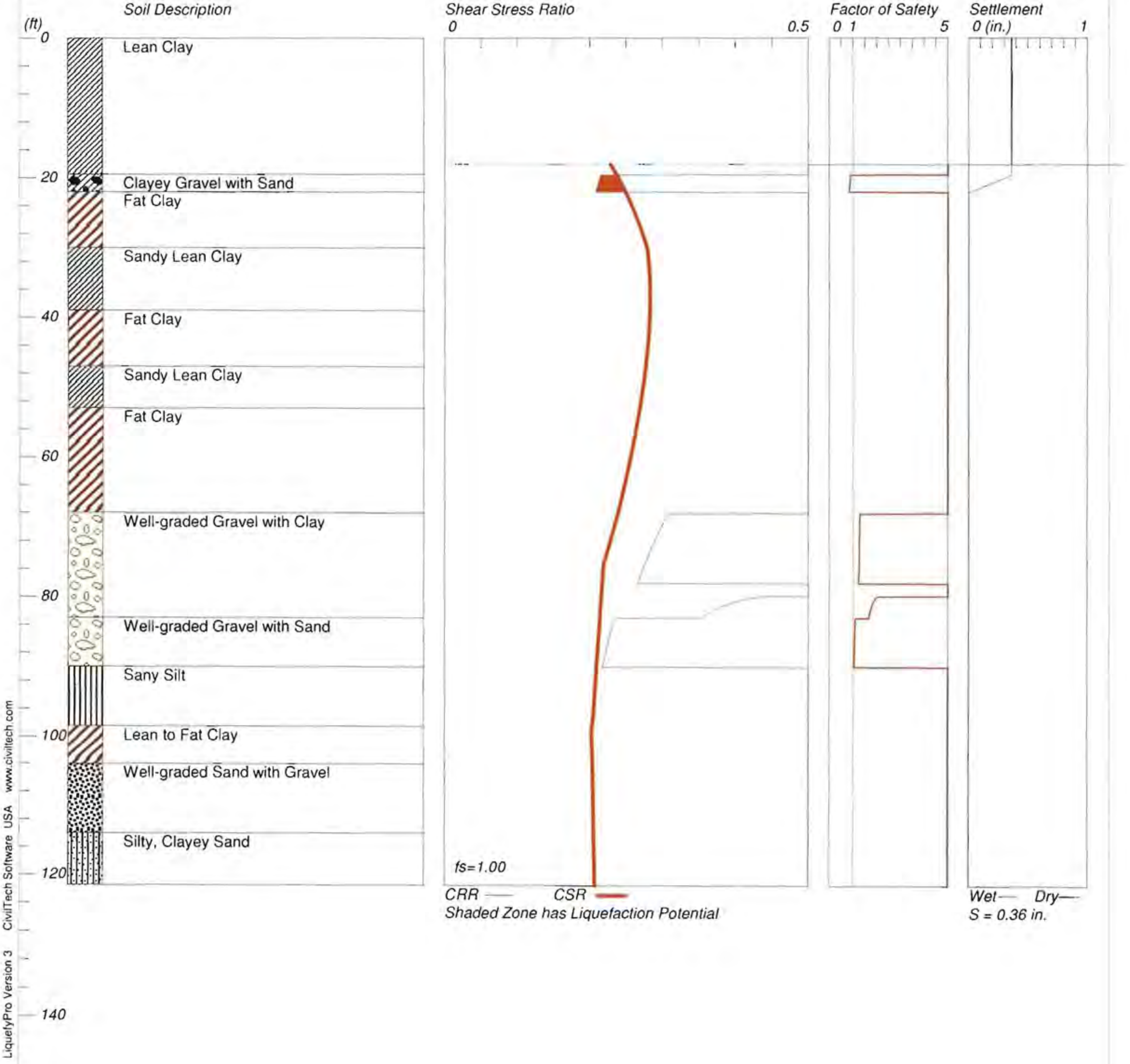
Figure 22

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-07 Water Depth=18 ft Surface Elev.=84

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

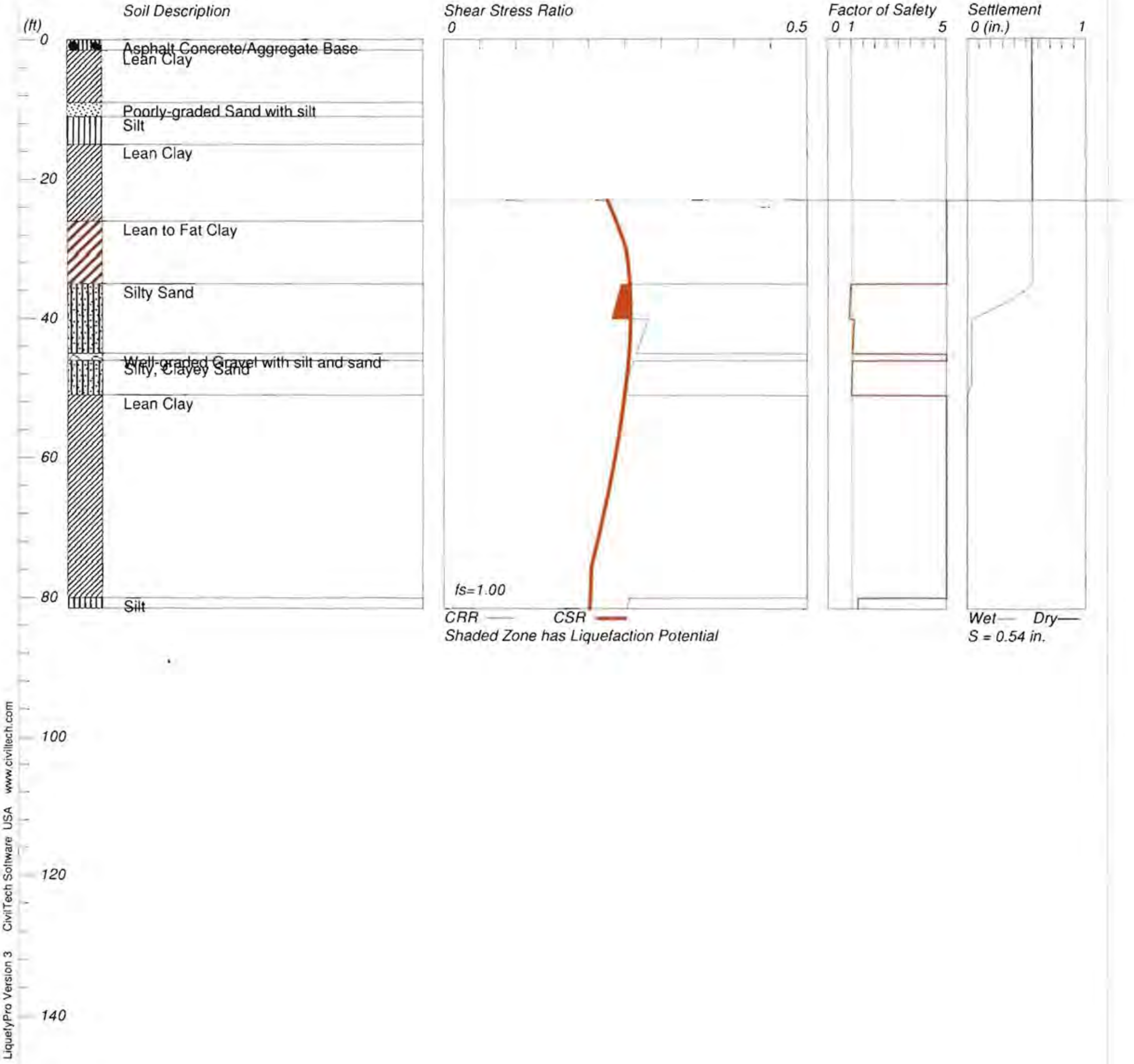
Figure 23

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-08 Water Depth=23 ft Surface Elev.=89

Magnitude=6.4
Acceleration=0.55g



URS

Median (50th percentile) PGA

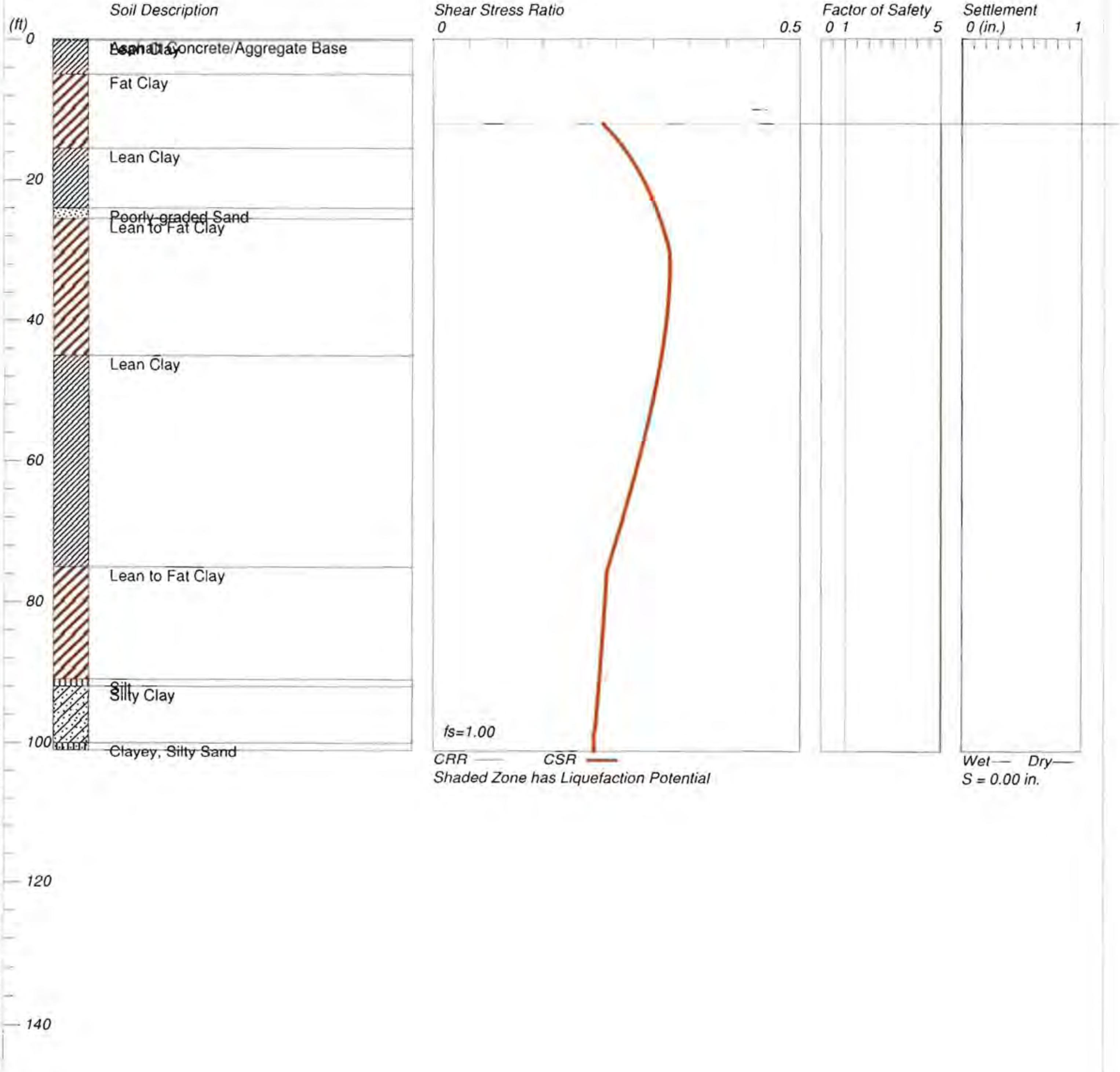
Figure 24

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-13 Water Depth=12 ft Surface Elev.=86

Magnitude=6.4
Acceleration=0.55g



LiquefyPro Version 3 CivilTech Software USA www.civiltech.com

URS

Median (50th percentile) PGA

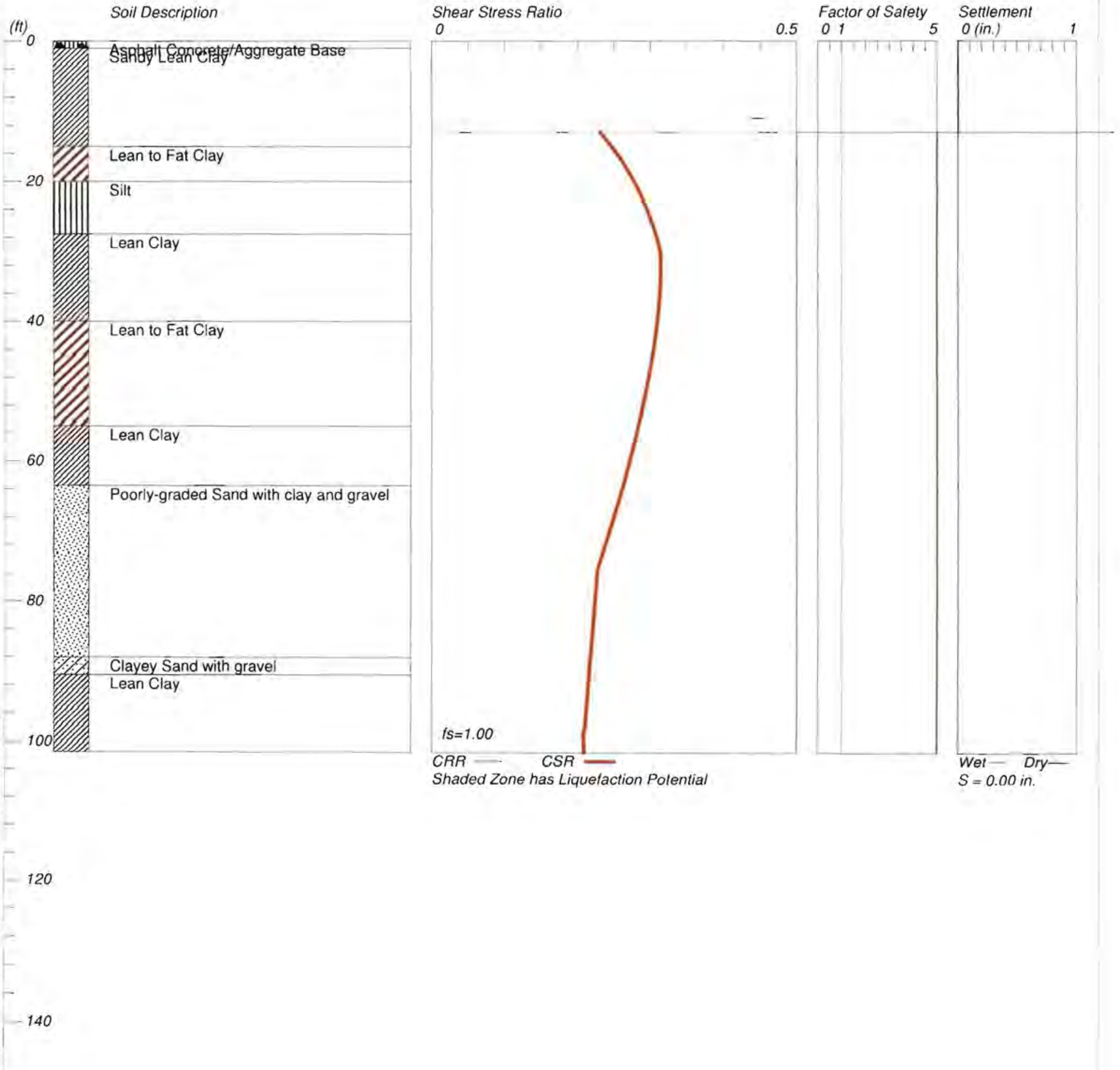
Figure 25

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-14 Water Depth=13 ft Surface Elev.=87

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

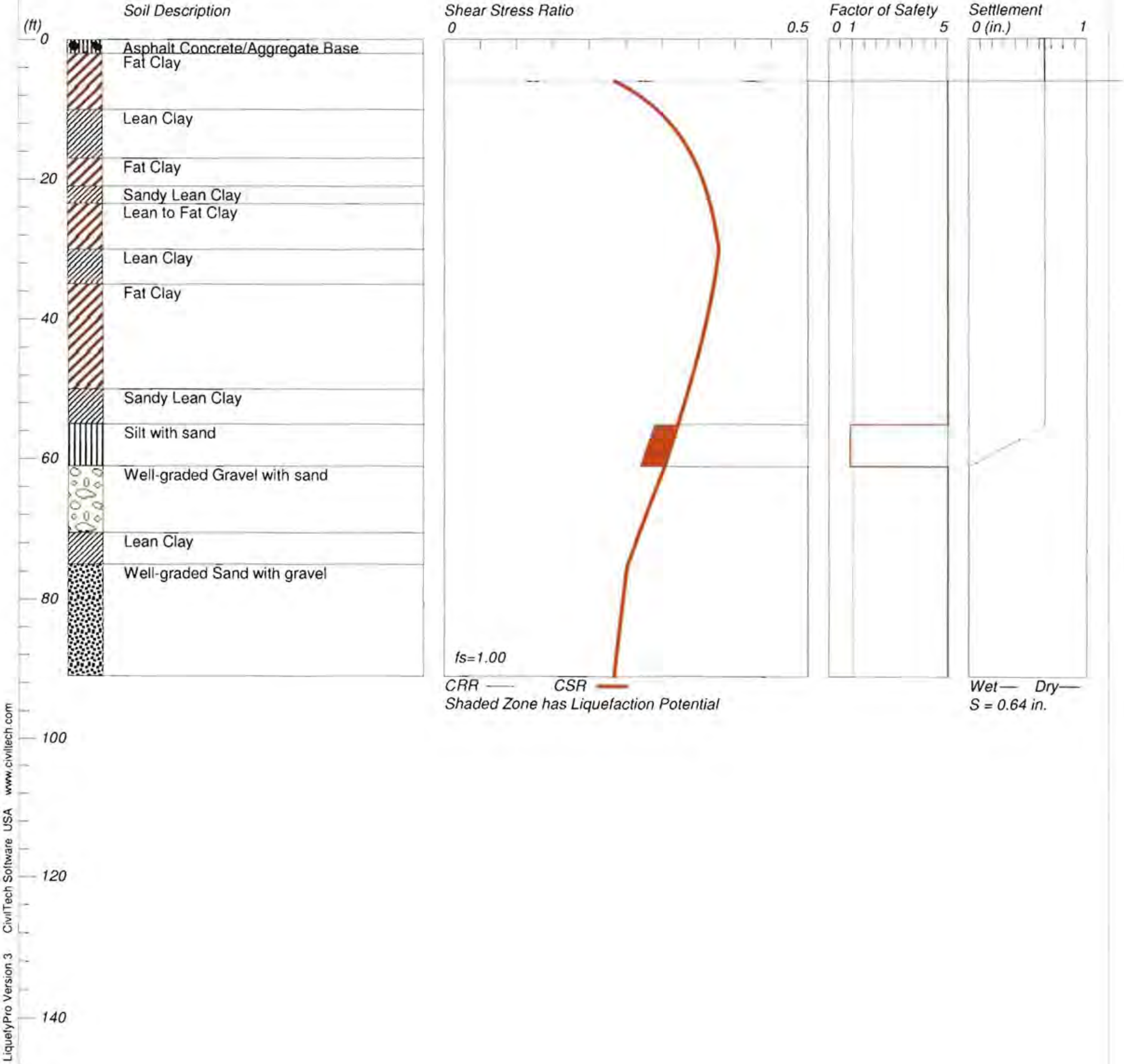
Figure 26

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-15 Water Depth=6 ft Surface Elev.=80

Magnitude=6.4
Acceleration=0.55g



LiquefyPro Version 3 CivilTech Software USA www.civiltech.com

URS

Median (50th percentile) PGA

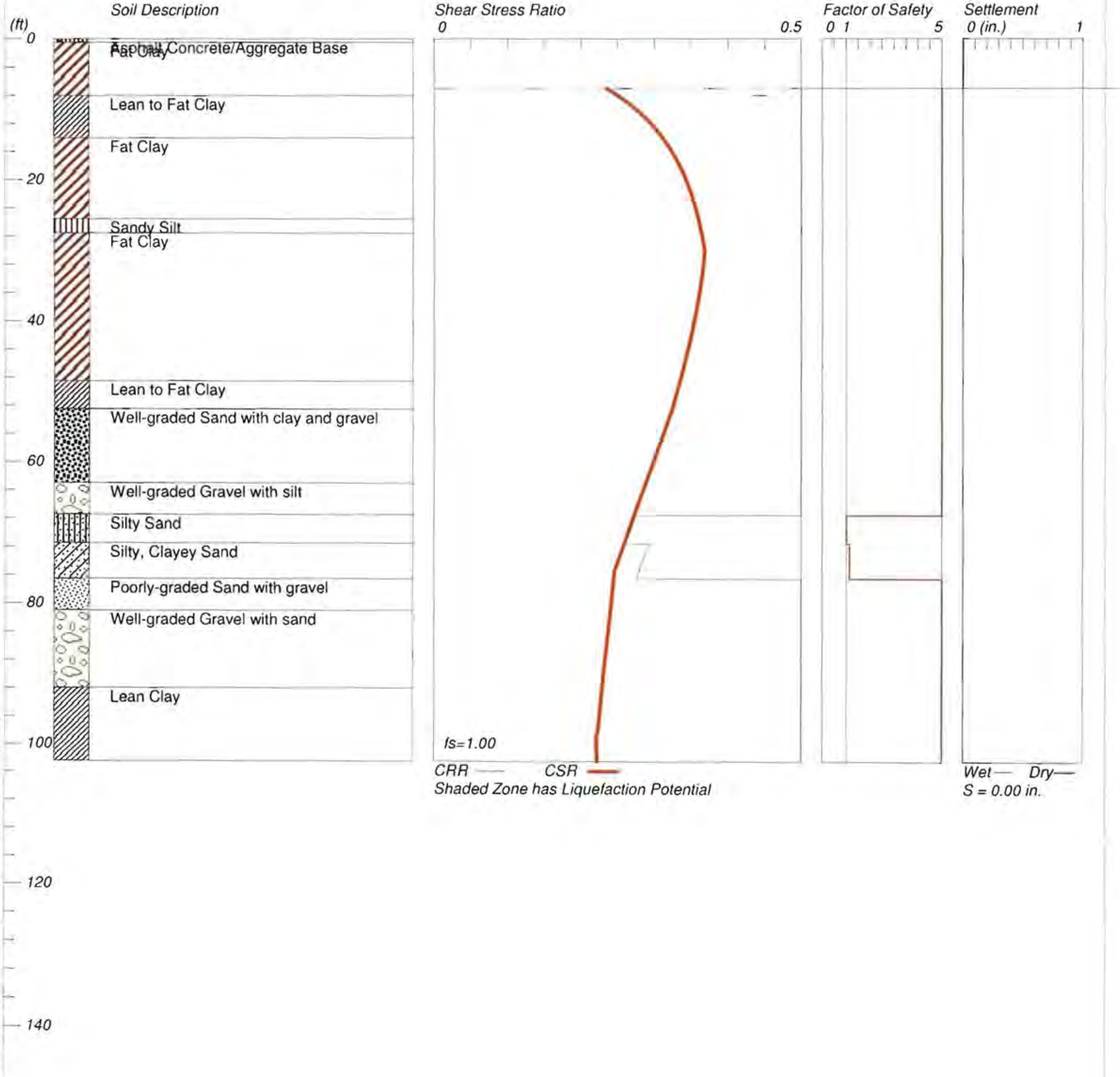
Figure 27

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-16 Water Depth=7 ft Surface Elev.=81

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

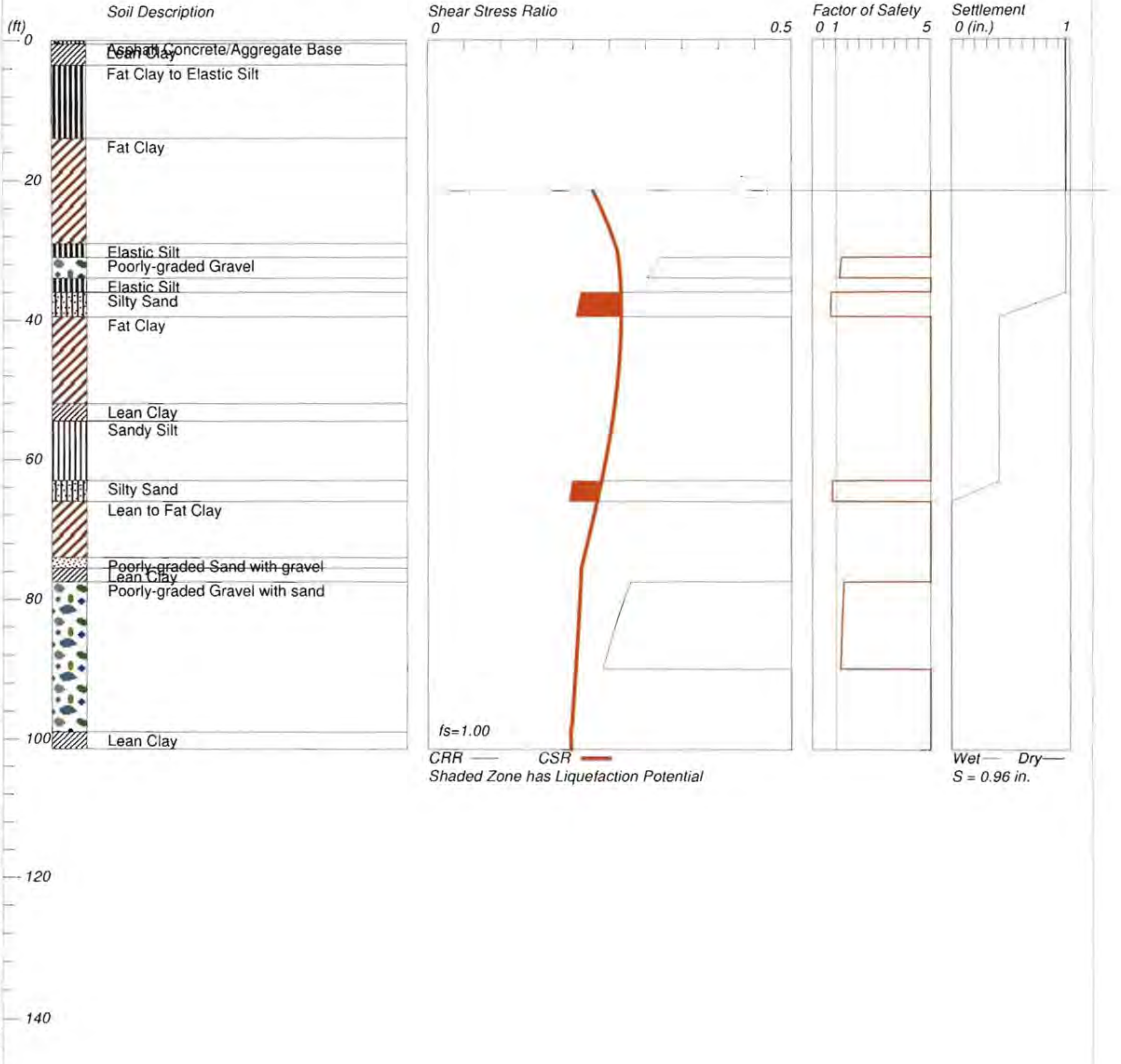
Figure 28

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-17 Water Depth=21.5 ft Surface Elev.=88.5

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

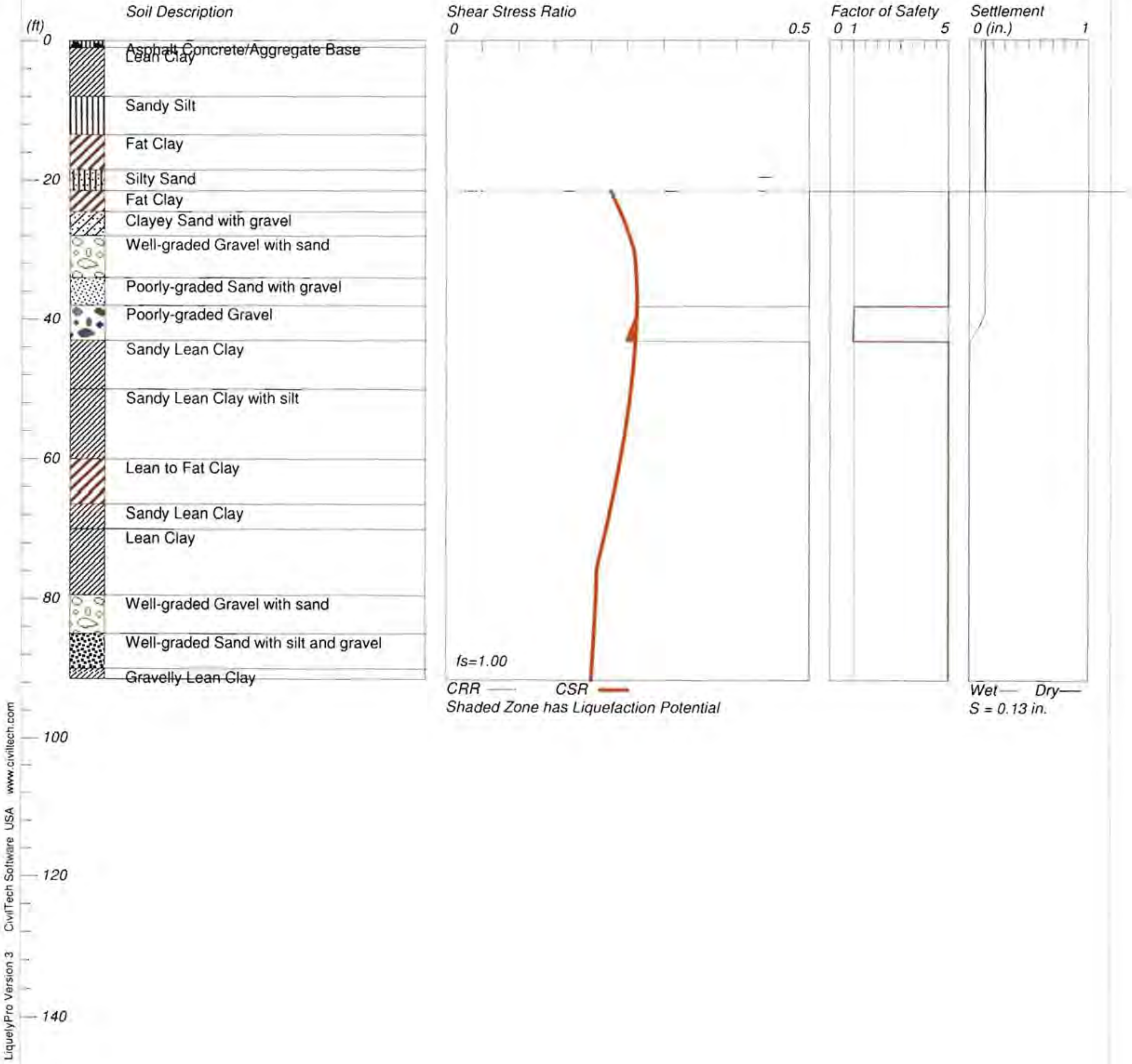
Figure 29

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-18   Water Depth=21.5 ft   Surface Elev.=88.5

Magnitude=6.4
Acceleration=0.55g



URS

Median (50th percentile) PGA

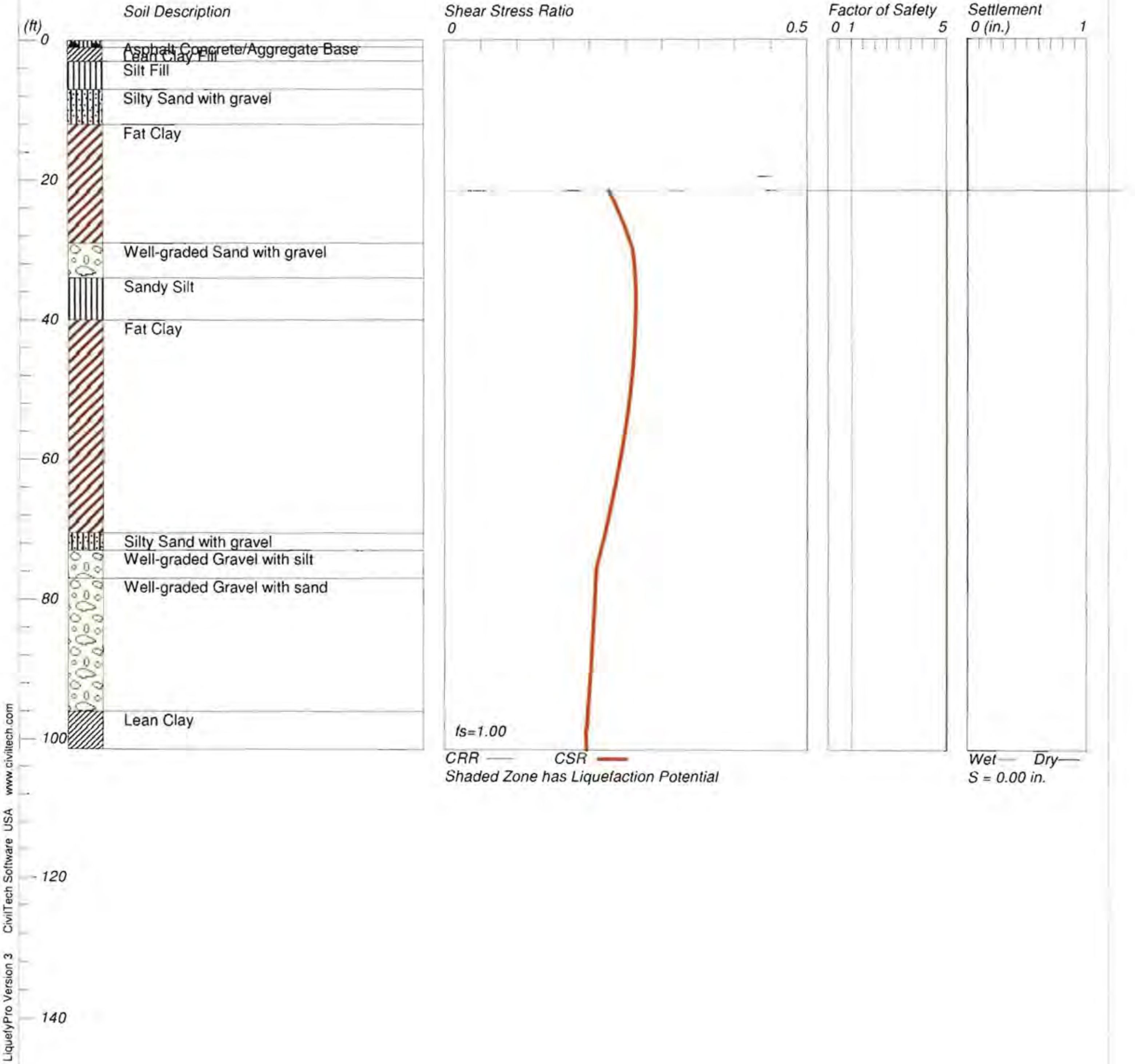
Figure 30

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-19 Water Depth=21.5 ft Surface Elev.=88.5

Magnitude=6.4
Acceleration=0.55g



URS

Median (50th percentile) PGA

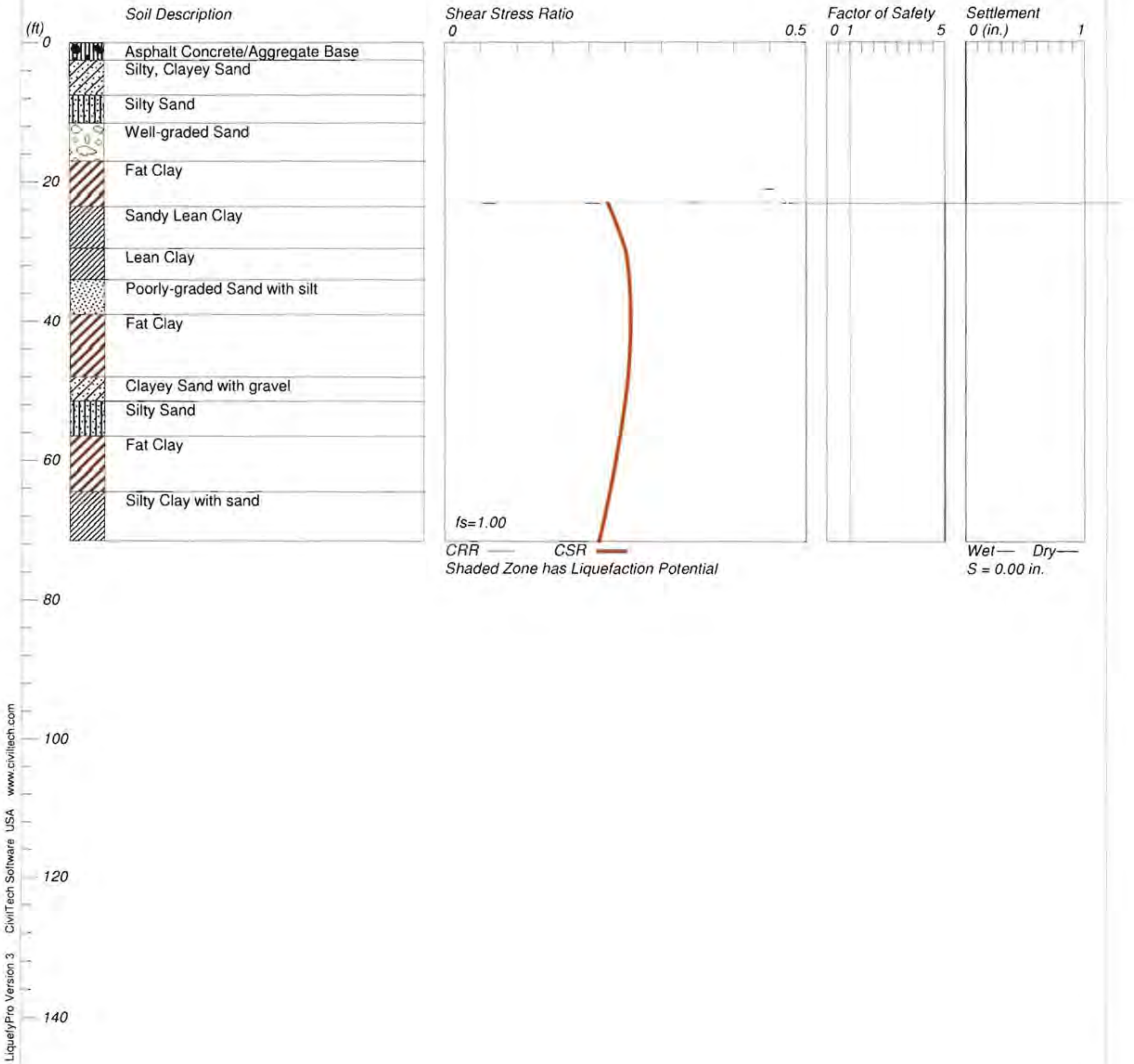
Figure 31

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-20 Water Depth=23 ft Surface Elev.=90

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

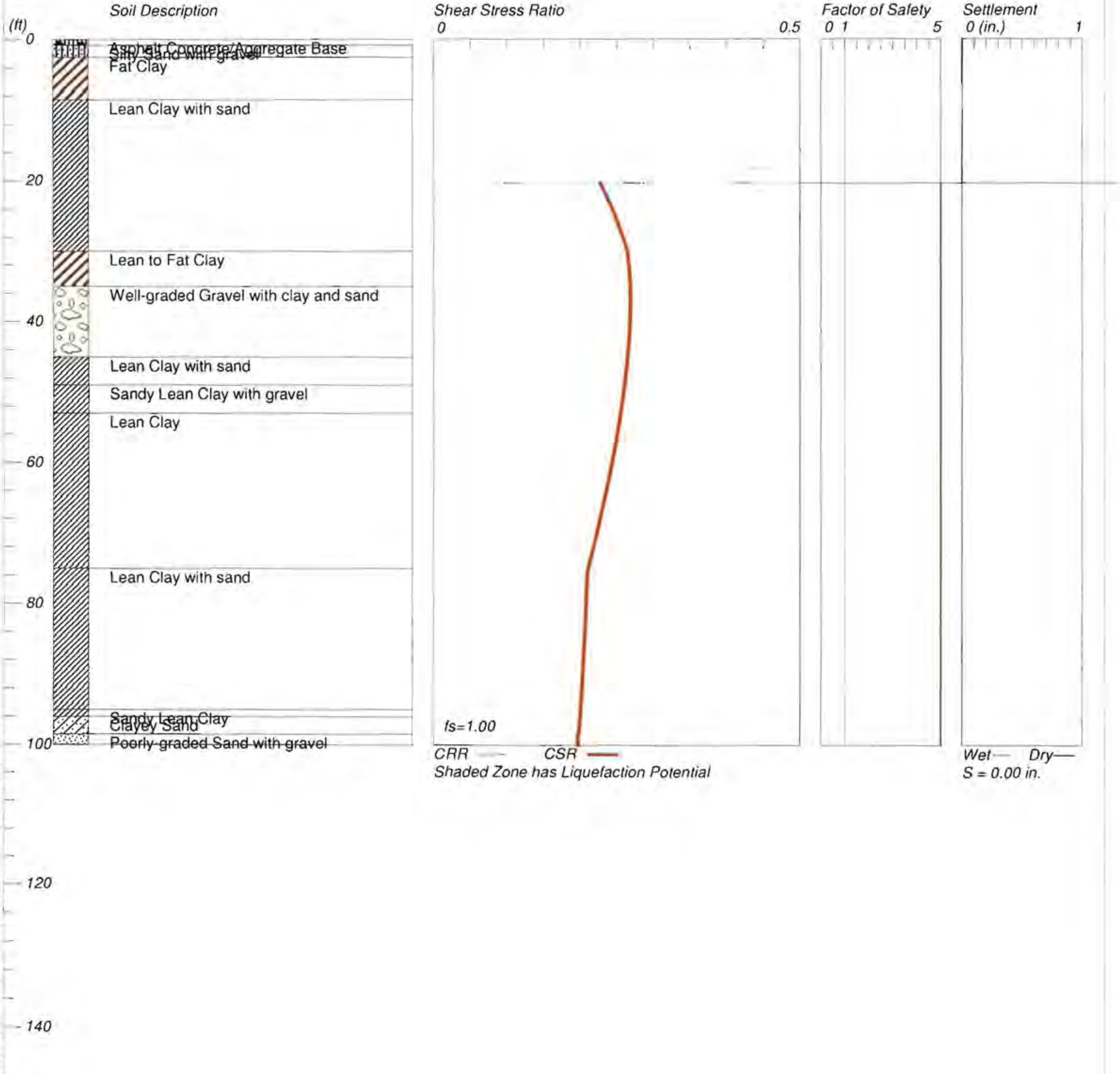
Figure 32

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-21 Water Depth=20.3 ft Surface Elev.=86.3

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

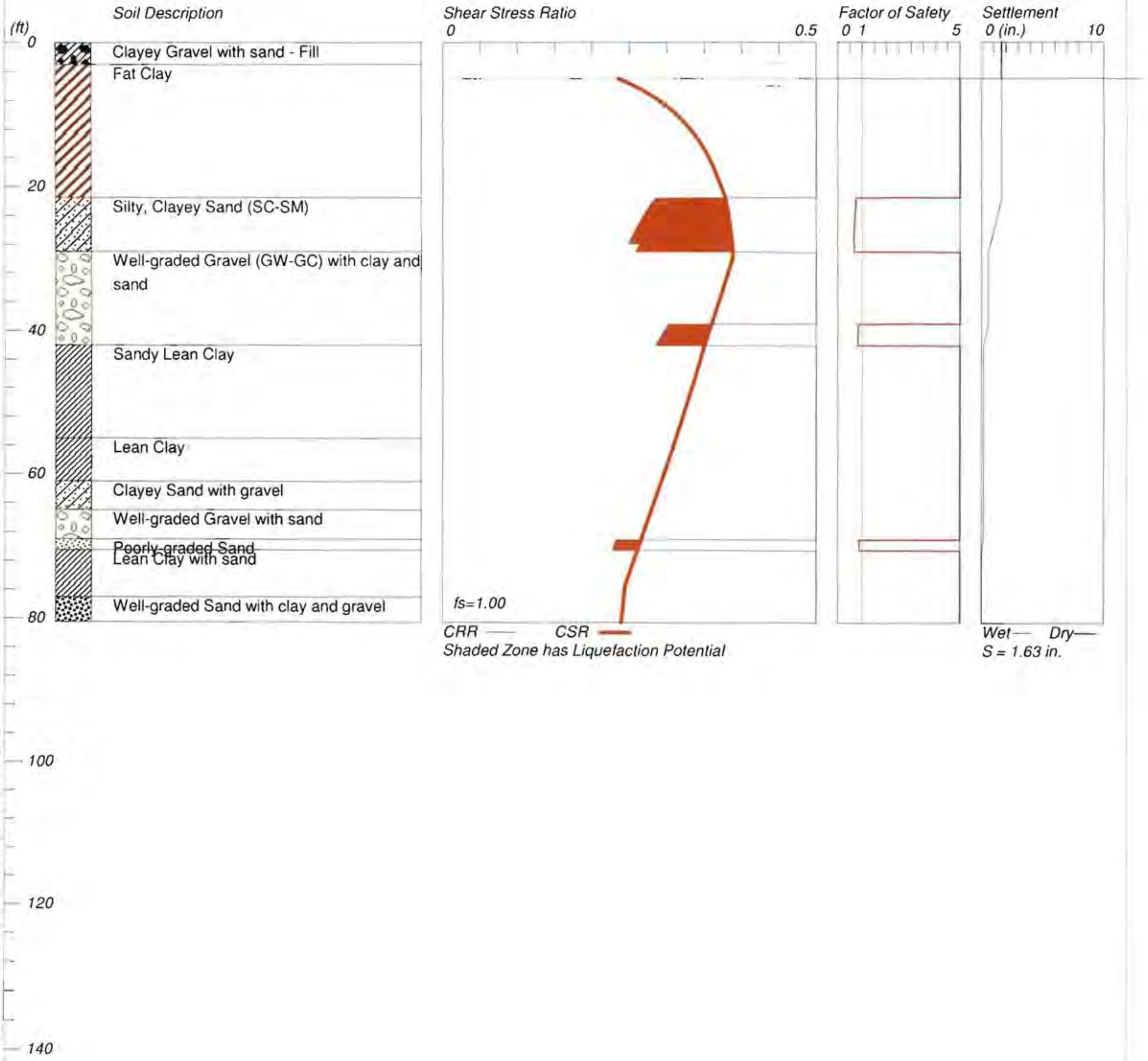
Figure 33

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-24 Water Depth=5 ft Surface Elev.=69.5

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

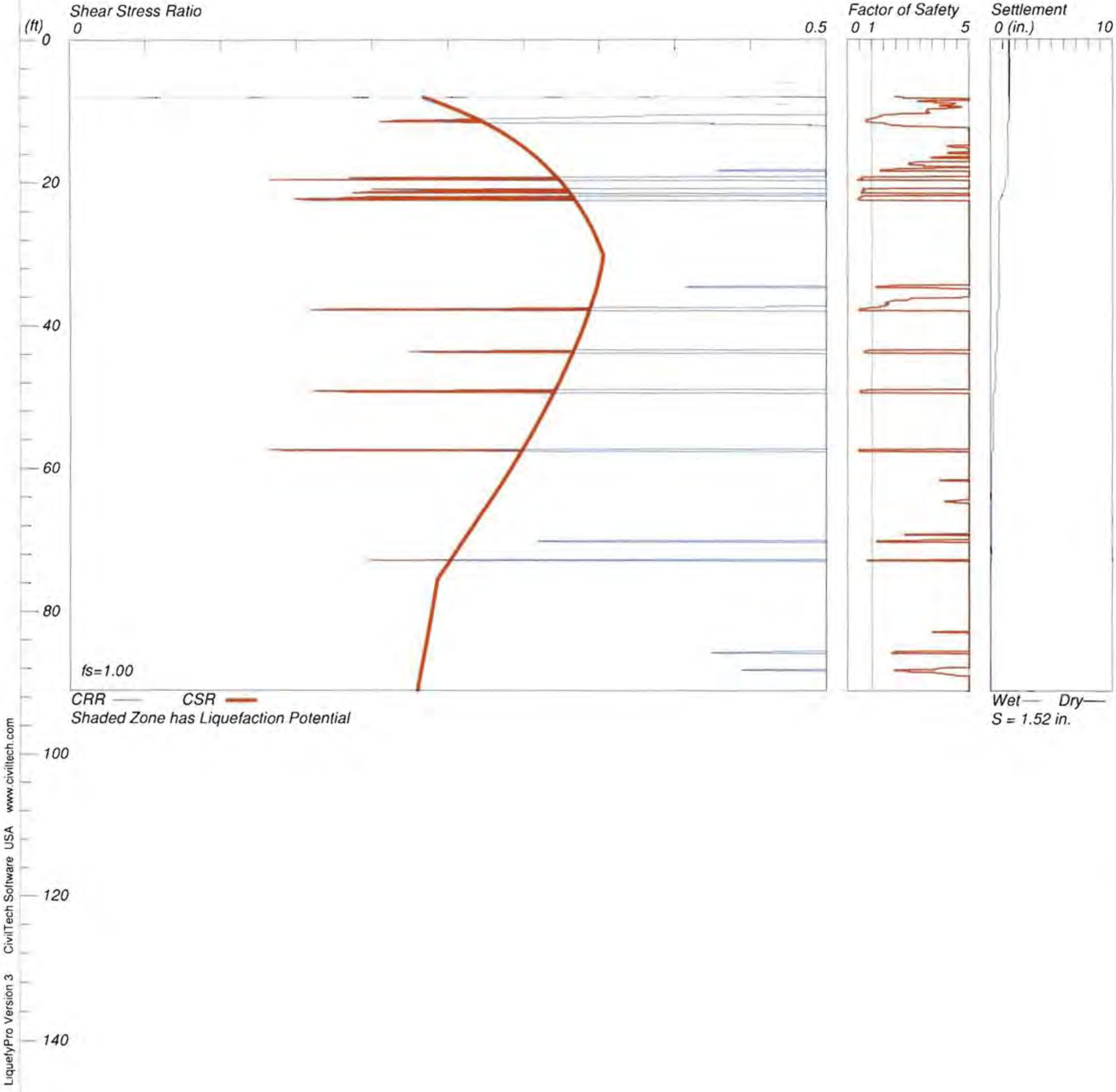
Figure 34

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NC-09 Water Depth=8 ft Surface Elev.=87.8

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

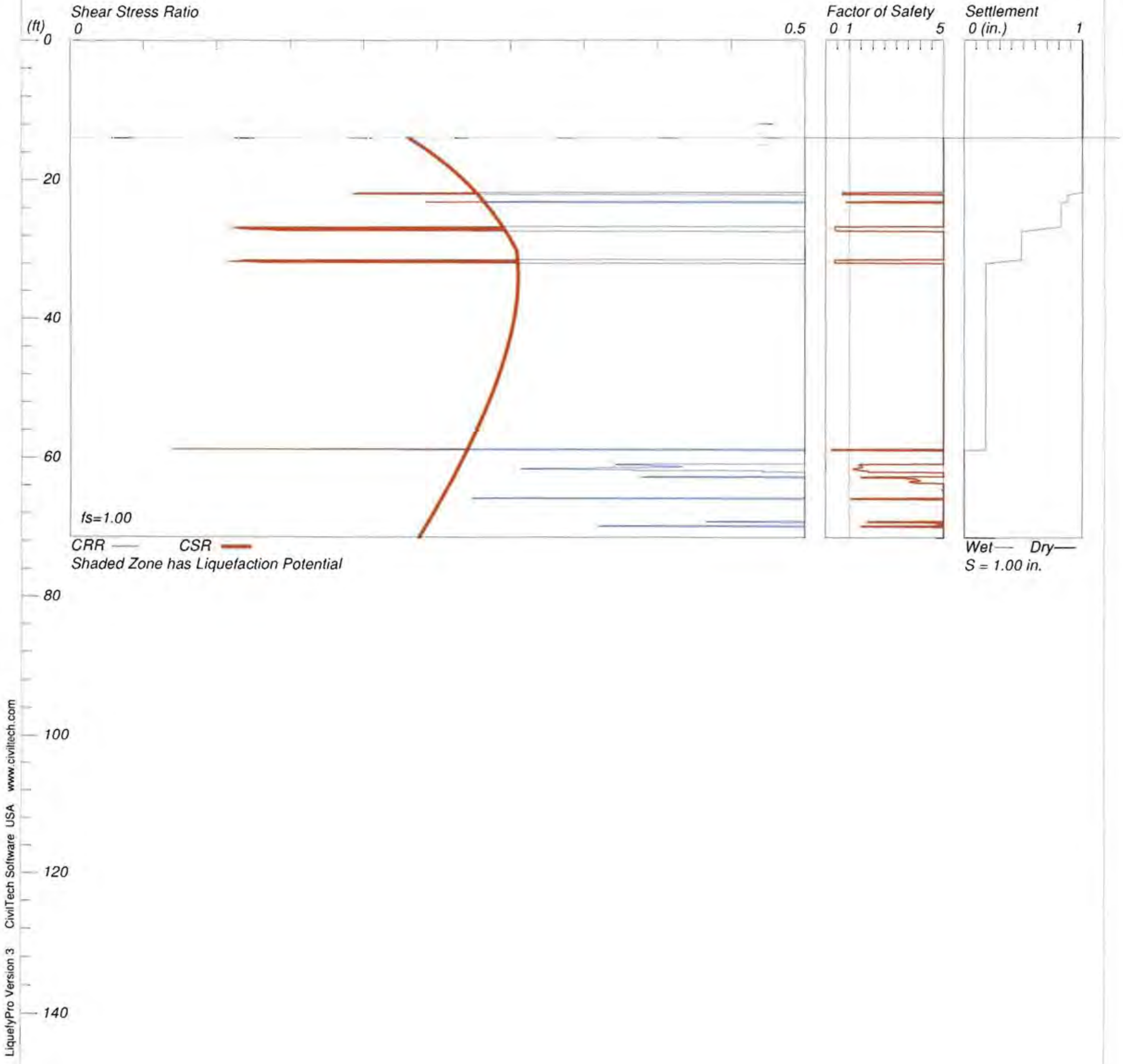
Figure 35

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NC-11   Water Depth=14 ft   Surface Elev.=88.0

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

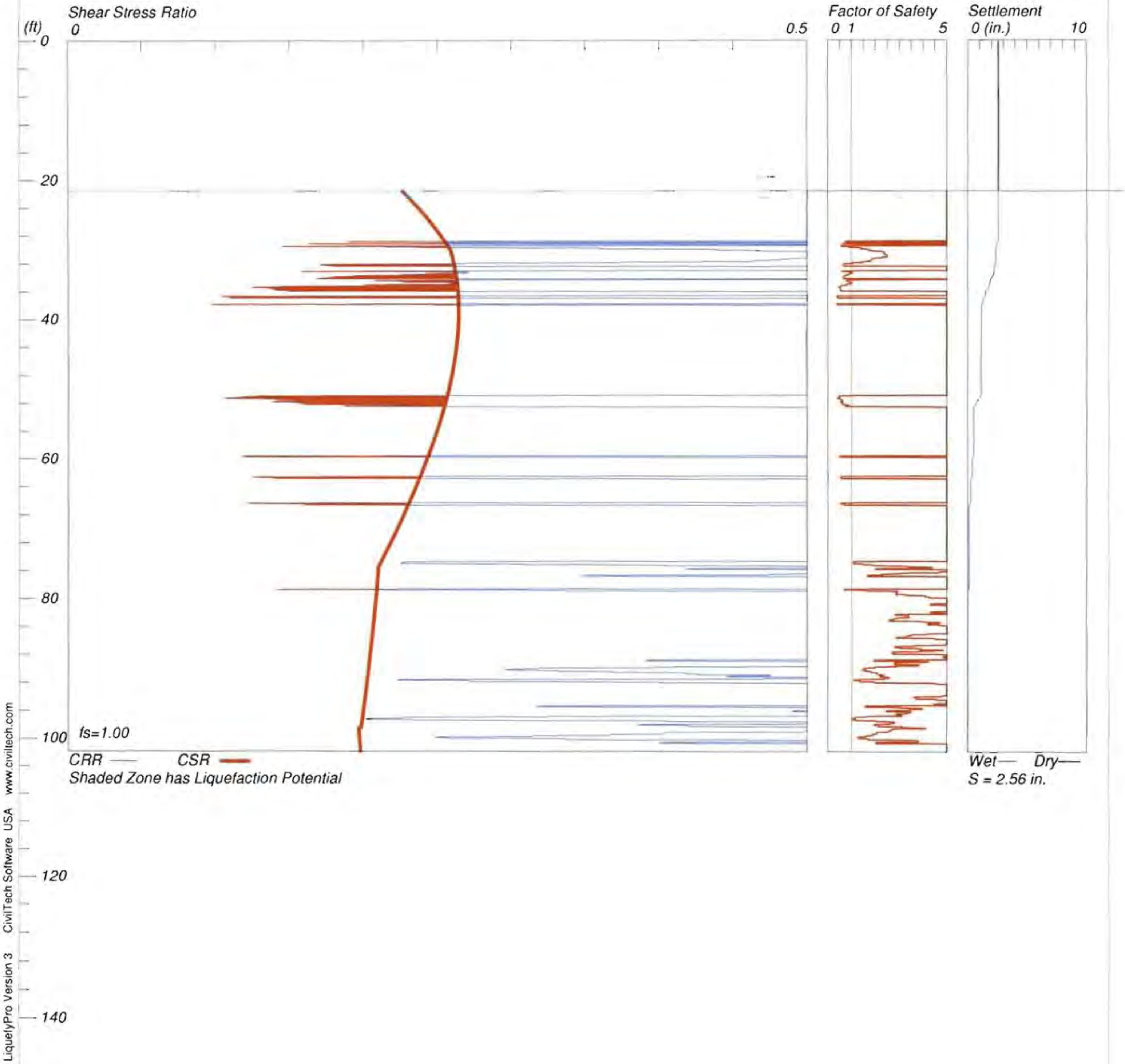
Figure 36

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NC-12   Water Depth=21.5 ft   Surface Elev.=88.5

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

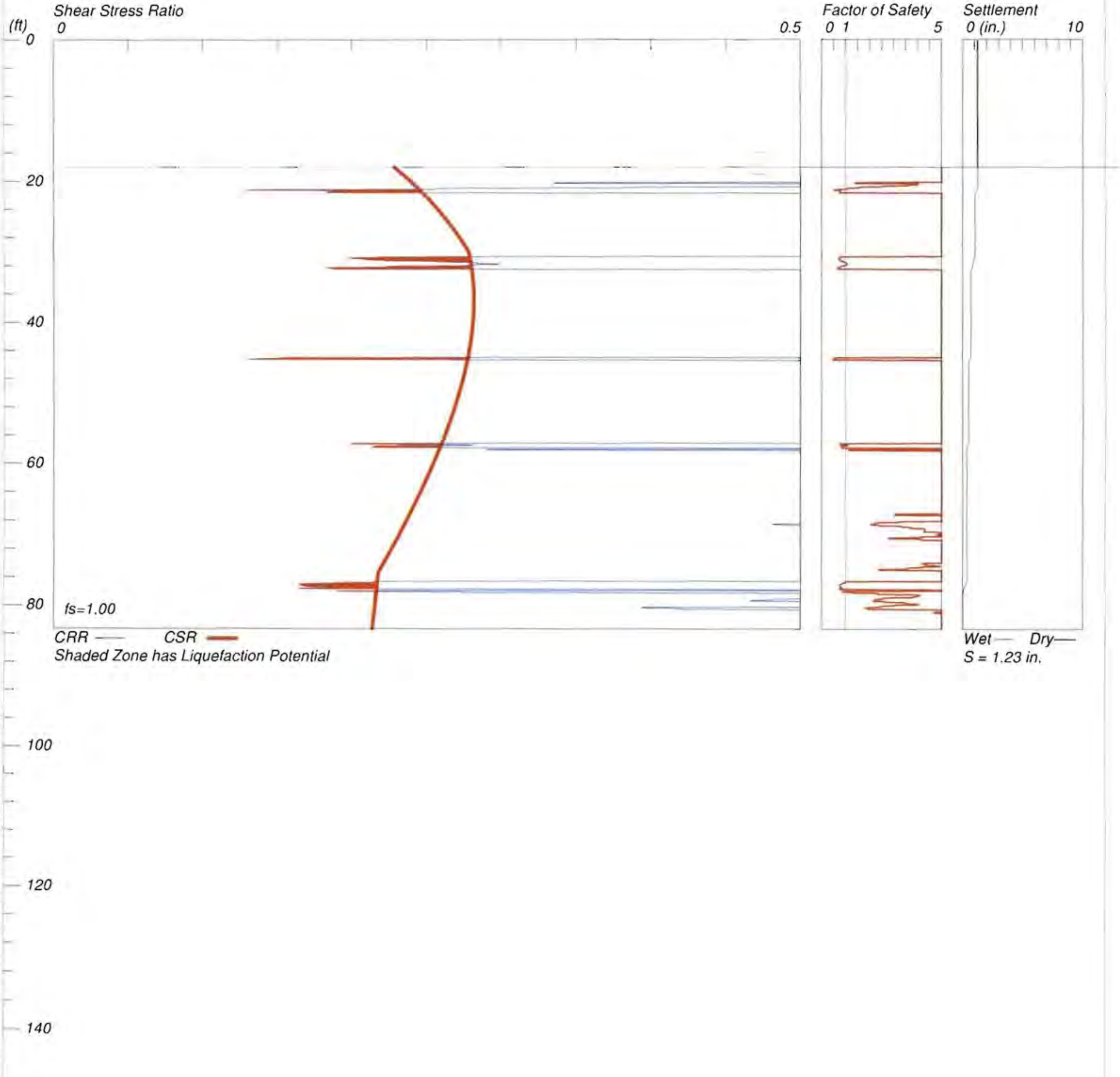
Figure 37

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NC-13 Water Depth=18 ft Surface Elev.=84

Magnitude=6.4
Acceleration=0.55g

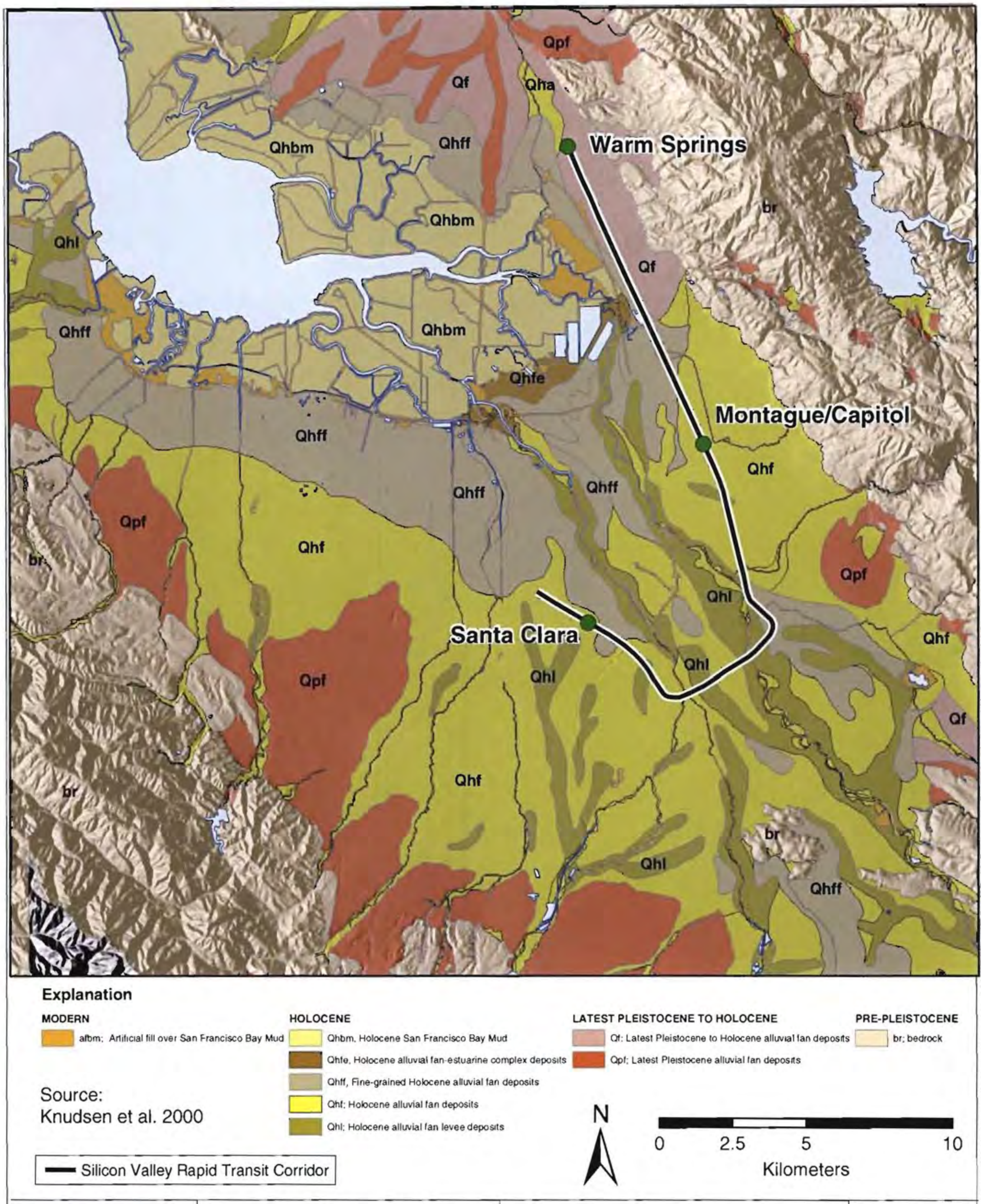


LiquefyPro Version 3 CivilTech Software USA www.civiltech.com

URS

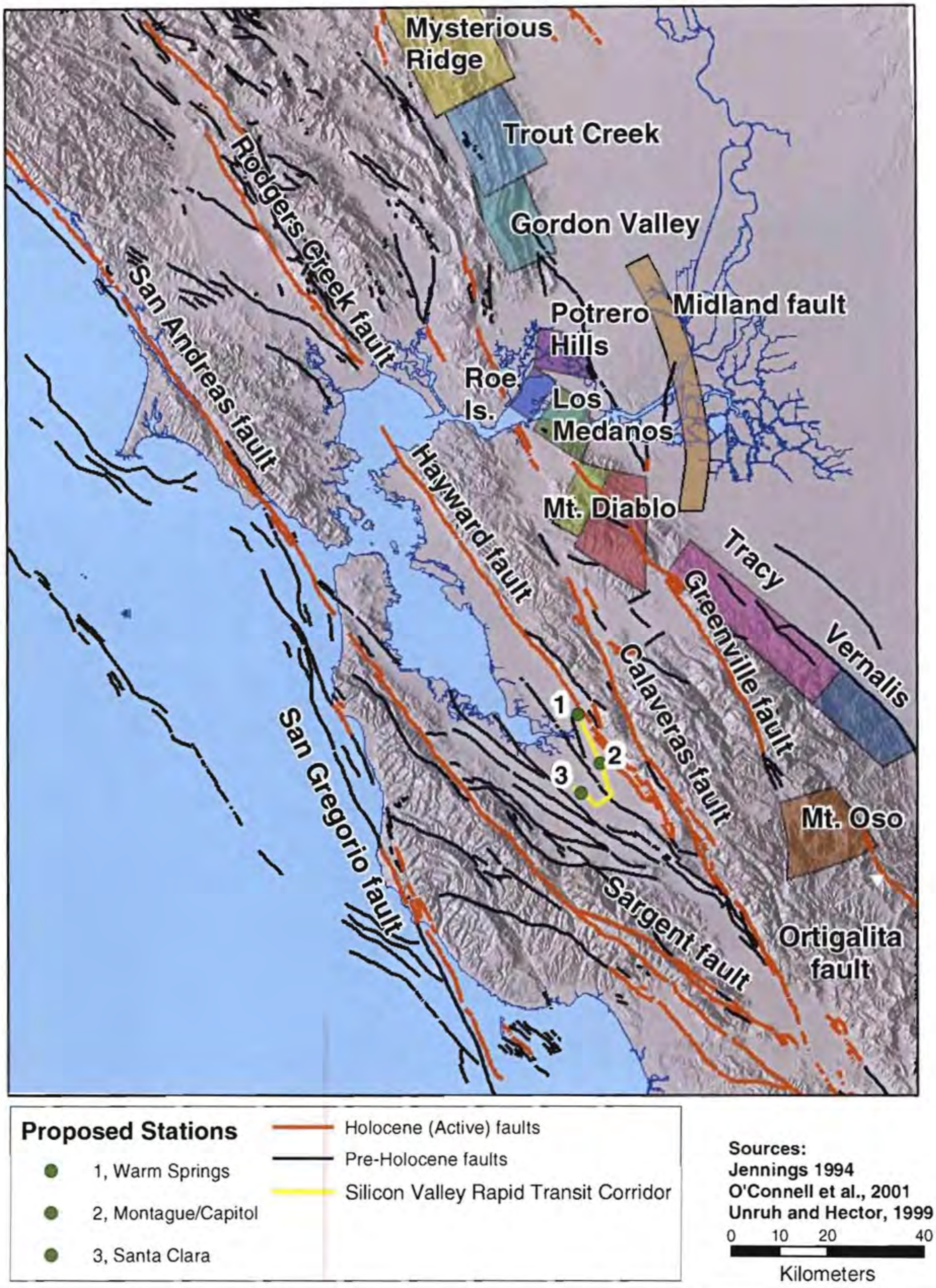
Median (50th percentile) PGA

Figure 38



URS	Project No. 28648793 Silicon Valley Rapid Tansit Corridor	**Quaternary Deposits Map**	**Figure 13**

URS Corporation L:\Projects\BART_Warm_Springs_Extension_29648793\MXD\Draft\F_13 Quaternary Deposits Map.mxd Name: dhwright0



Sources:
Jennings 1994
O'Connell et al., 2001
Unruh and Hector, 1999

URS

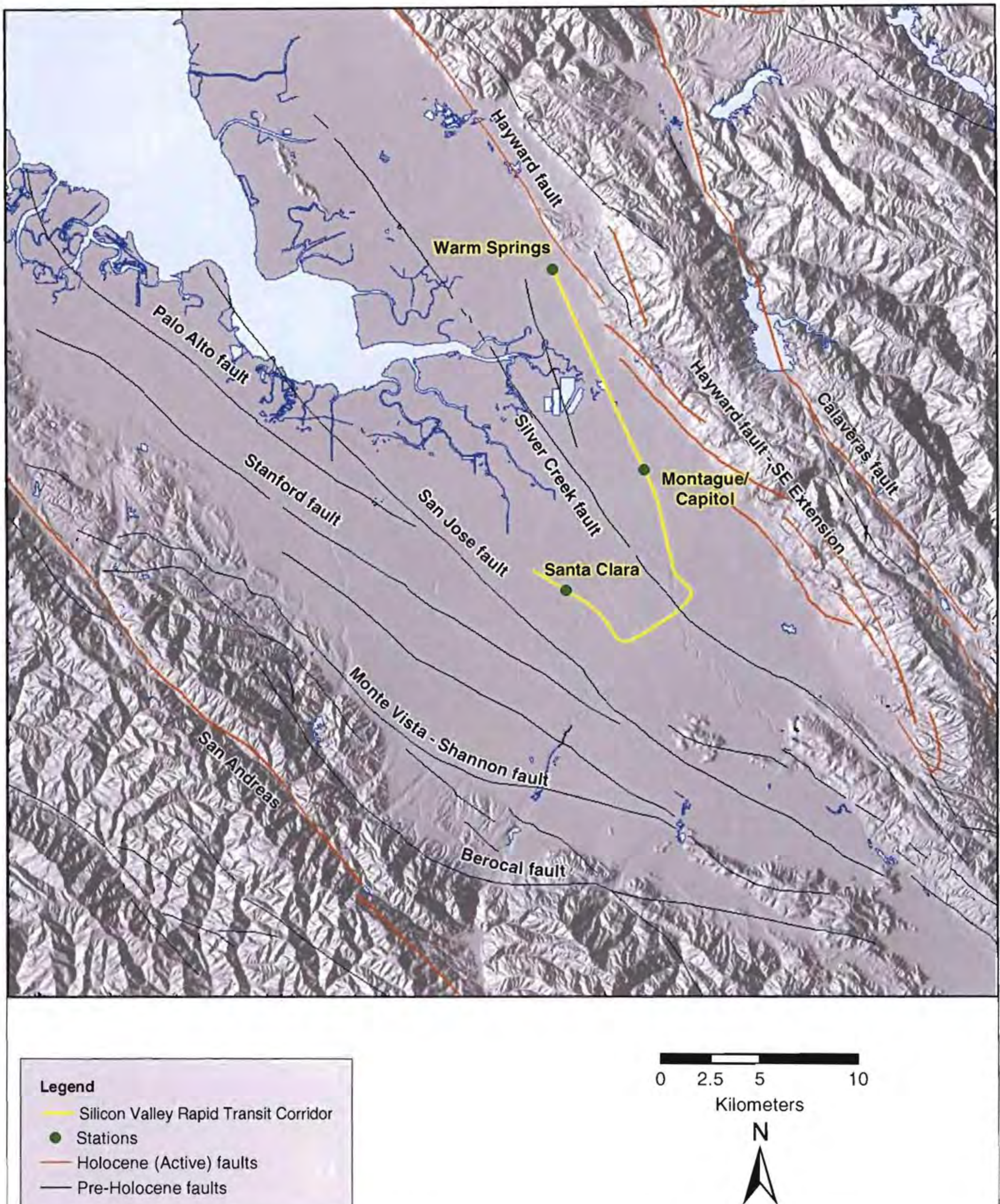
Project No. 29648793

Silicon Valley
Rapid Tansit Corridor

Regional Active Faults

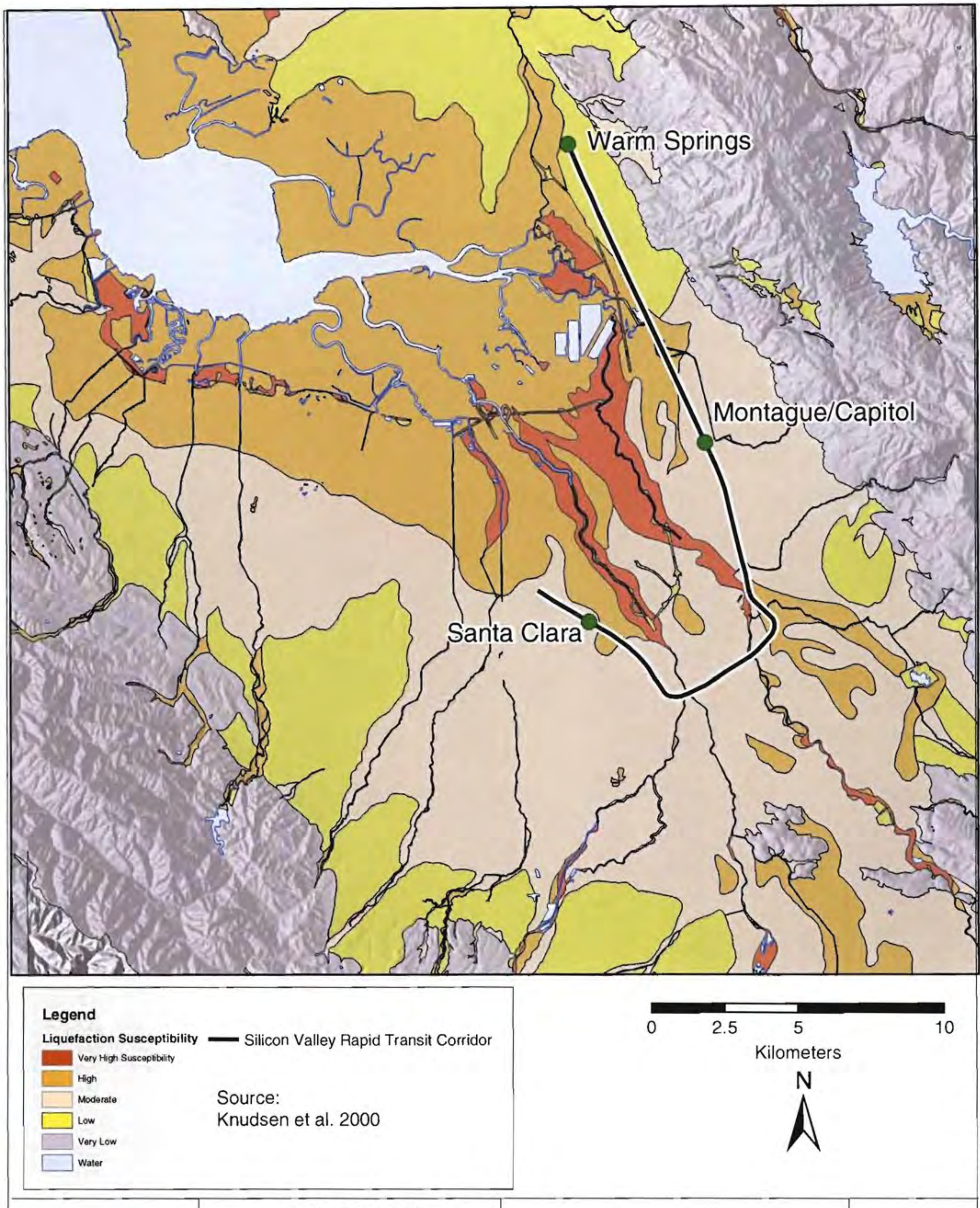
Figure
14

URS Corporation L:\Projects\BART_Warm_Springs_Extension_29648793\MXD\Draft\F_14 Regional Active faults.mxd Name: dhwrigh0



URS	Project No. 29648793		
	Silicon Valley Rapid Tansit Corridor	Local Active Faults	Figure 15

URS Corporation L:\Projects\BART_Warm_Springs_Extension_29648793\MXD\Draft\F_15 Local Active Faults.mxd Name: dhwrigh0



Source:
Knudsen et al. 2000

URS

Project No. 29648793

Silicon Valley
Rapid Tansit Corridor

Liquefaction Susceptibility Map

Figure 16

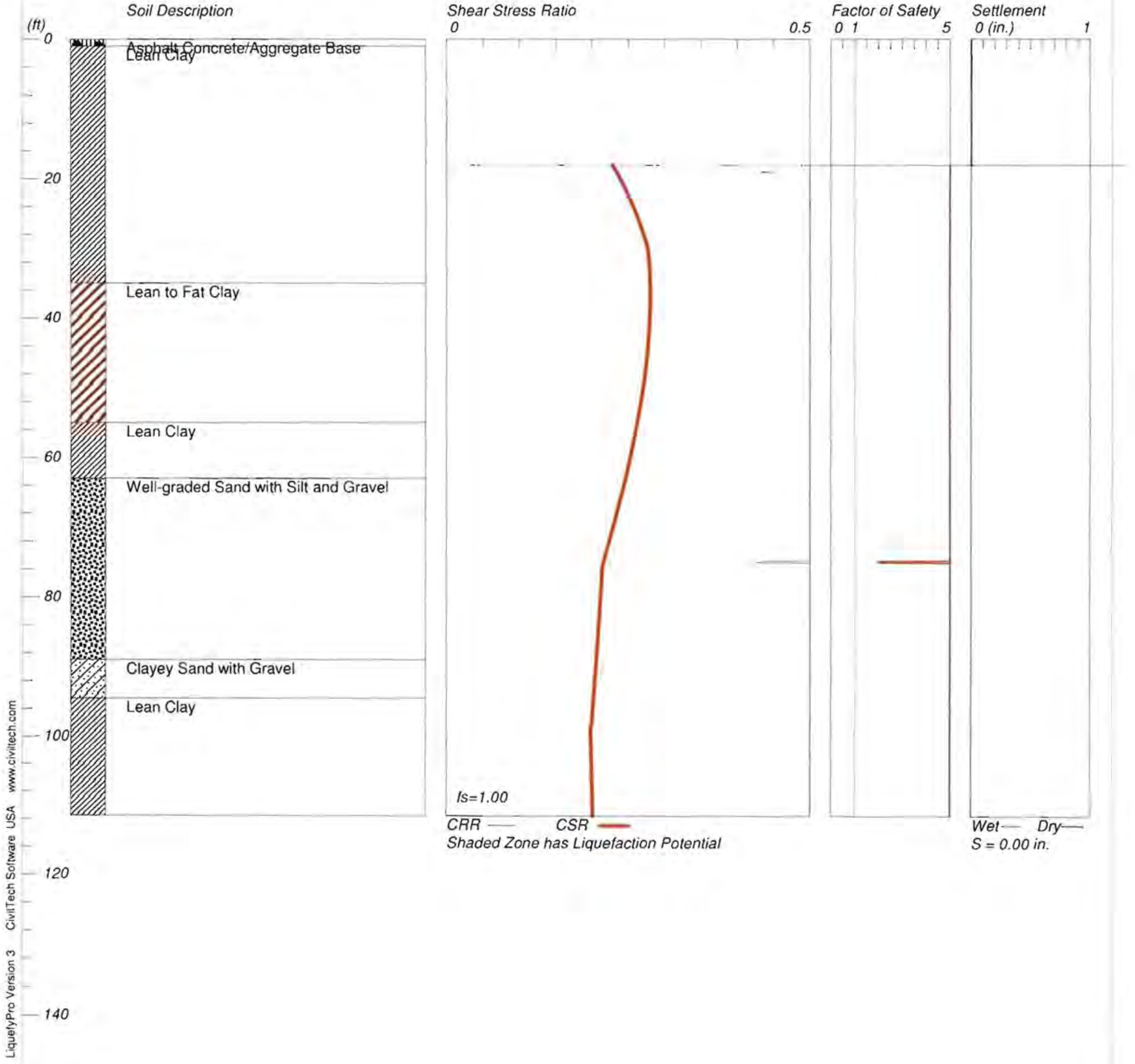
URS Corporation L:\Projects\BART_Warm_Springs_Extension_29648793\MXD\Draft\F_16 Liquefaction Susceptibility Map.mxd Name: dhwrigh0

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-01 Water Depth=18 ft Surface Elev.=92

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

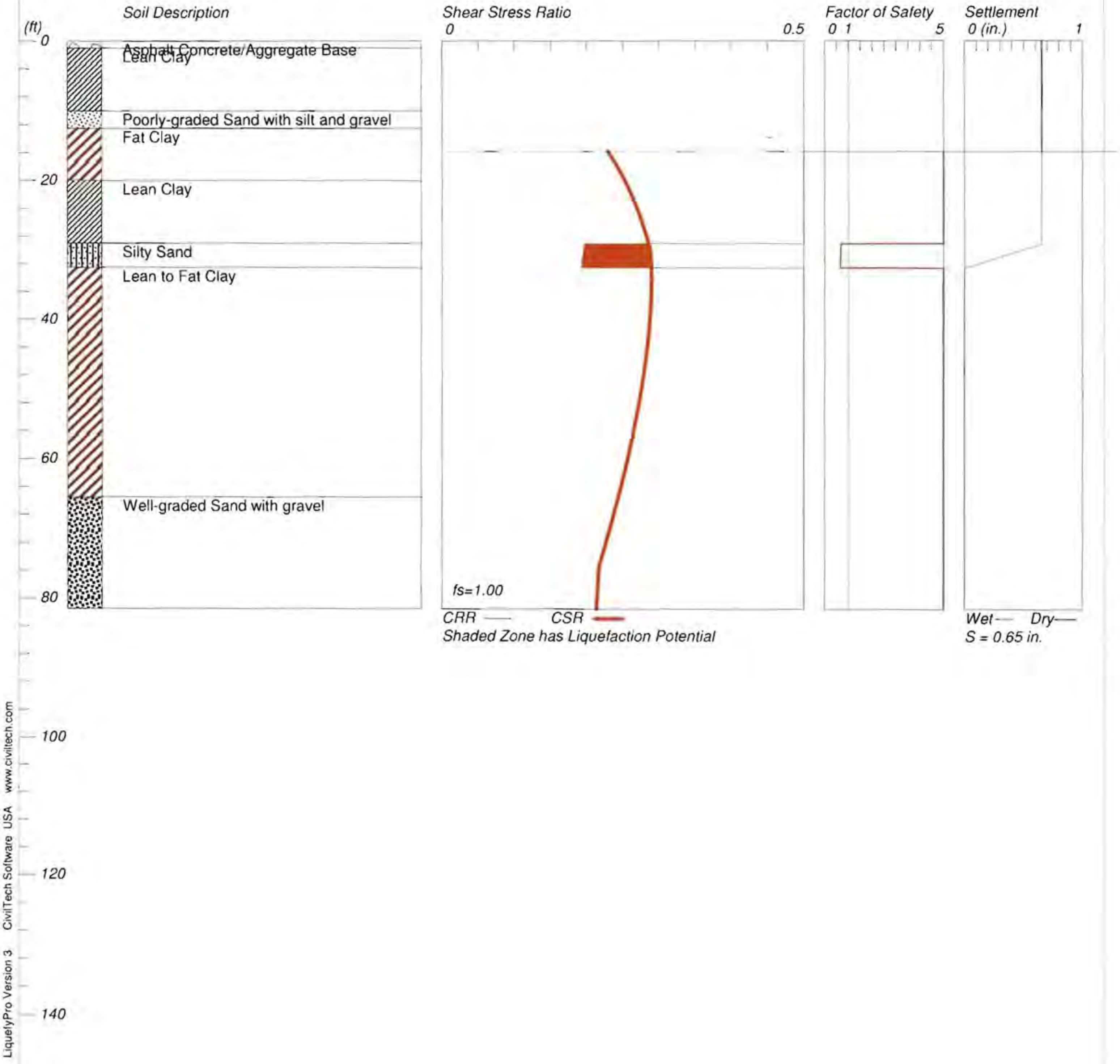
Figure 17

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-02 Water Depth=15.8 ft Surface Elev.=89.8

Magnitude=6.4
Acceleration=0.55g



URS

Median (50th percentile) PGA

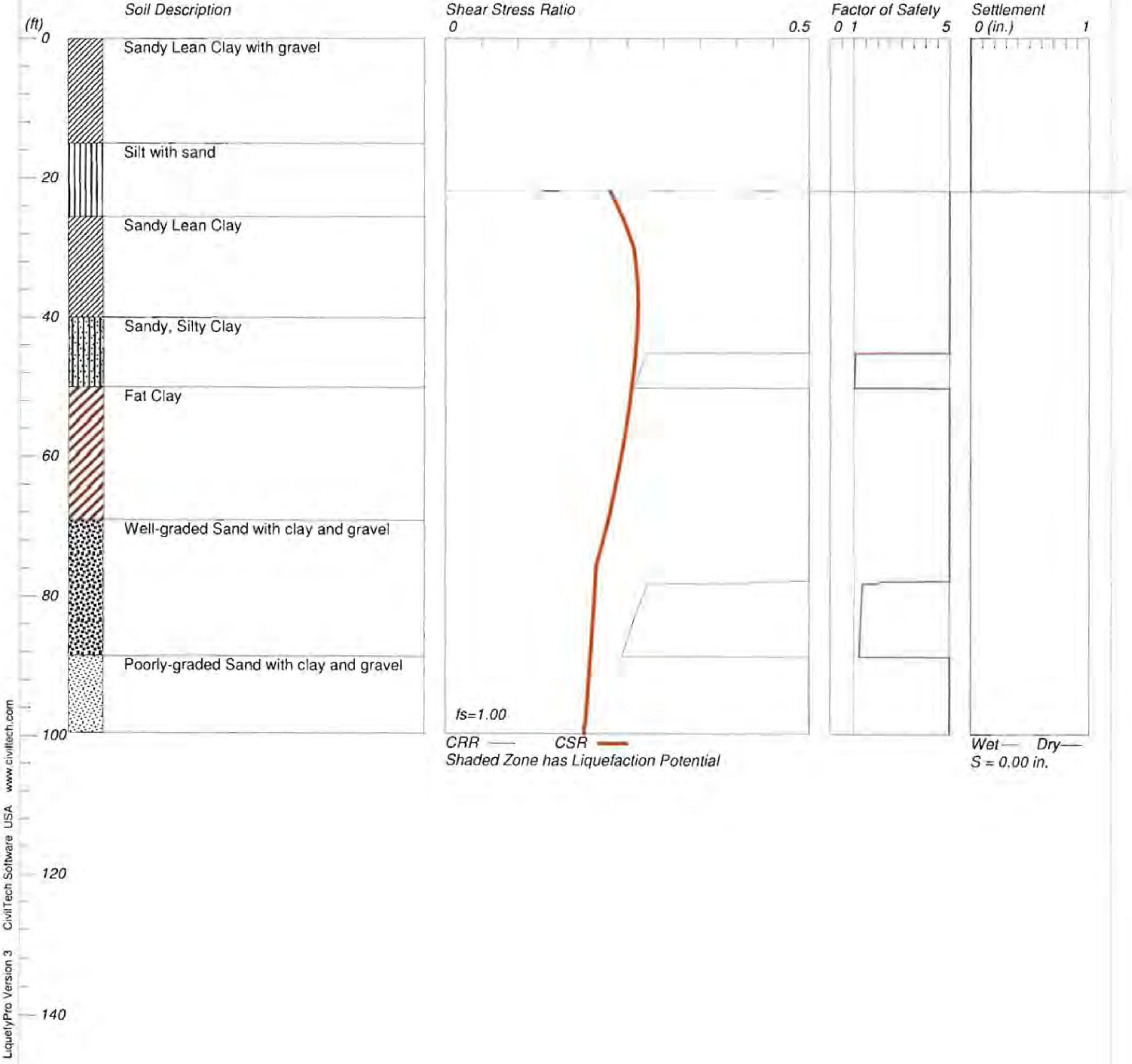
Figure 18

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-03 Water Depth=21.8 ft Surface Elev.=95.8

Magnitude=6.4
Acceleration=0.55g



URS

Median (50th percentile) PGA

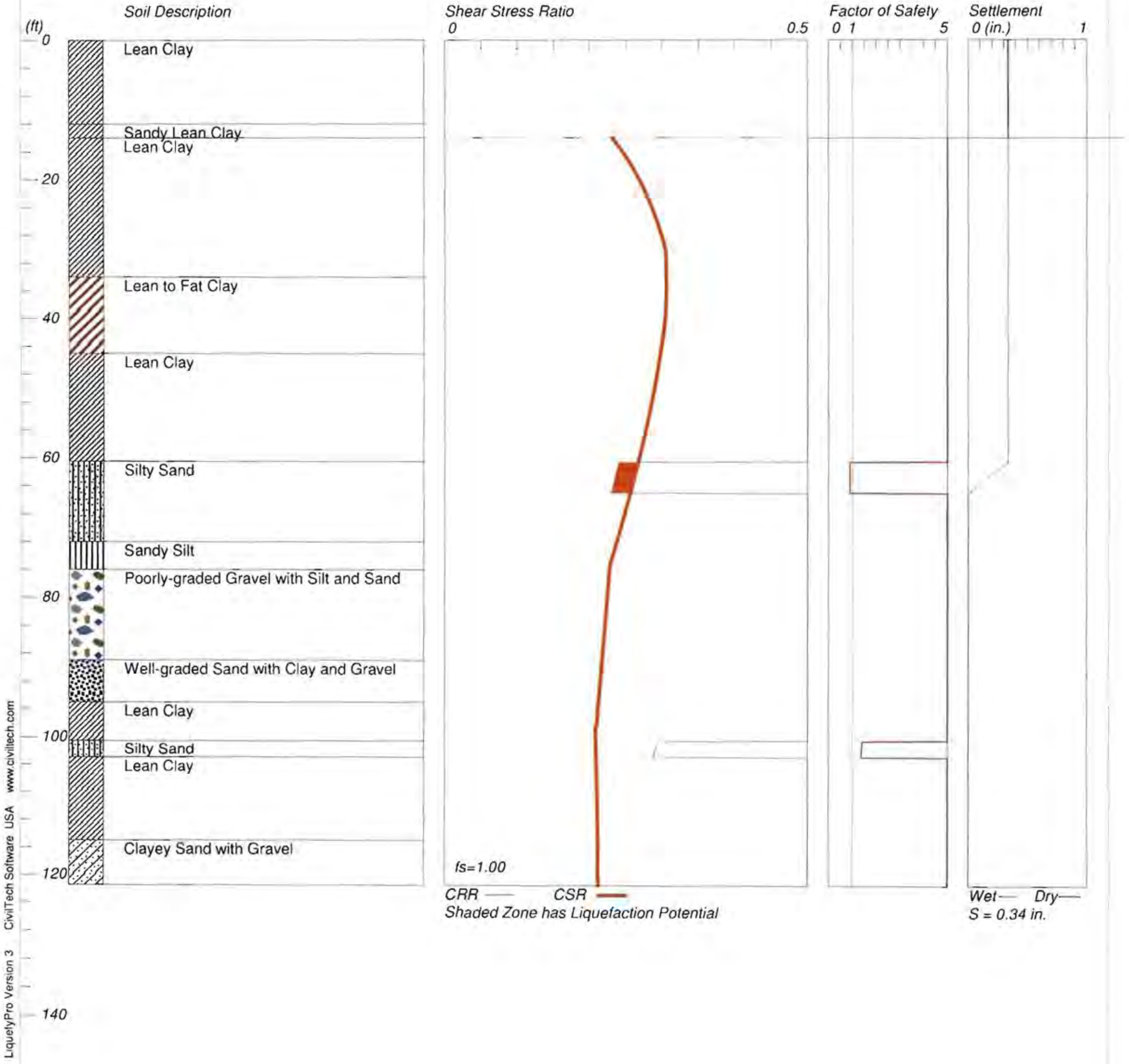
Figure 19

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-04 Water Depth=14 ft Surface Elev.=88

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

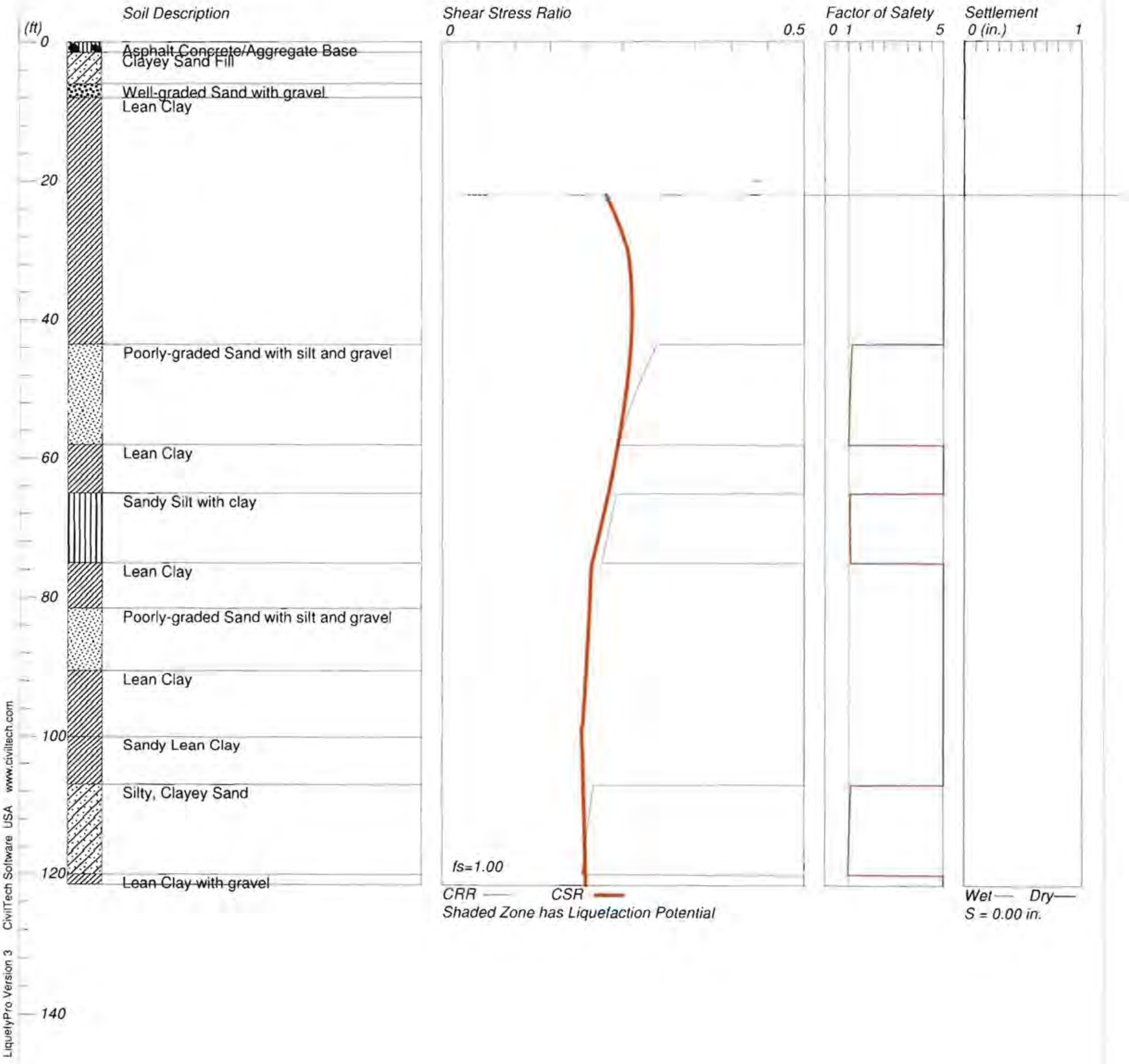
Figure 20

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-05 Water Depth=22 ft Surface Elev.=89

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

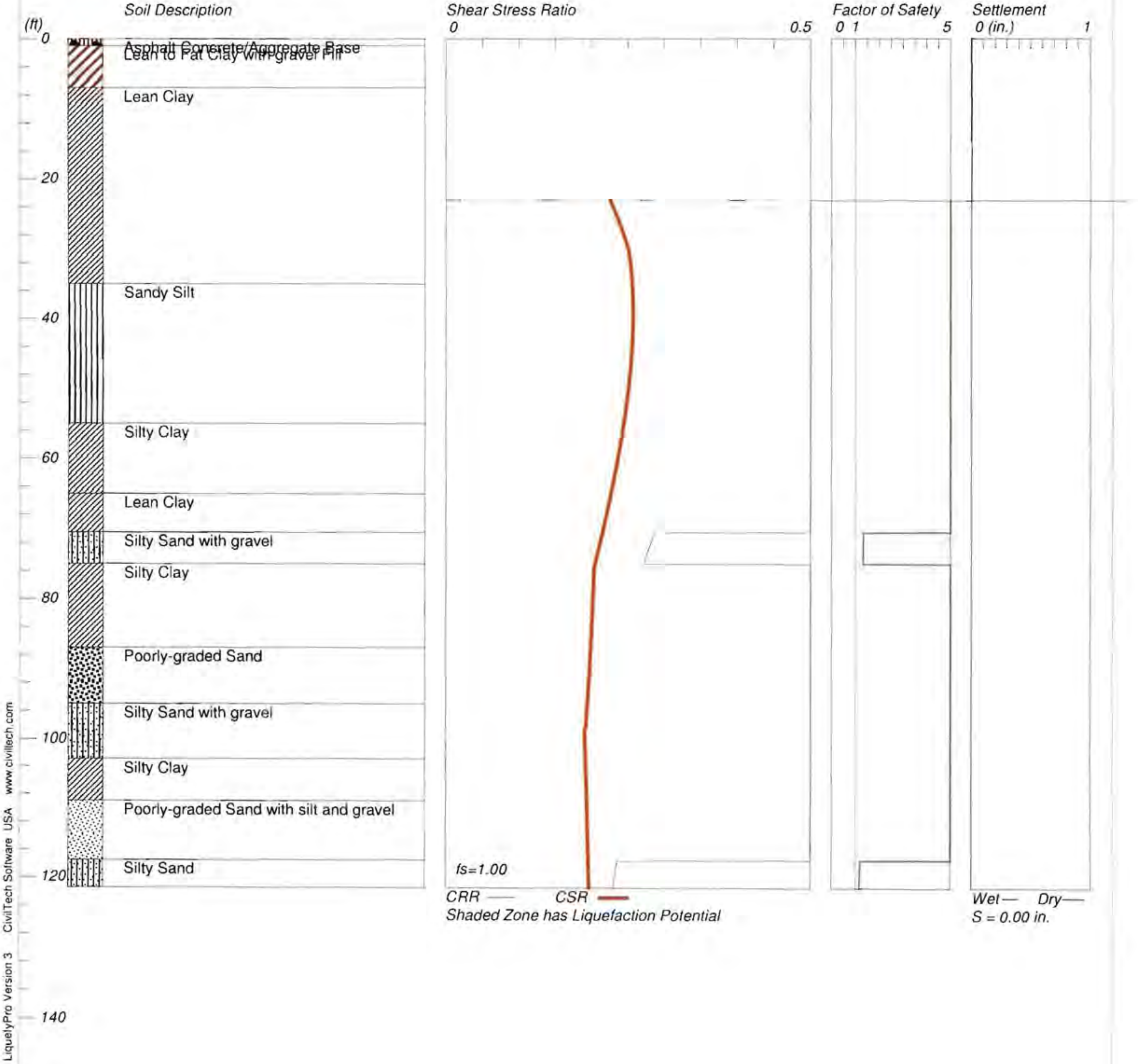
Figure 21

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-06 Water Depth=23 ft Surface Elev.=89

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

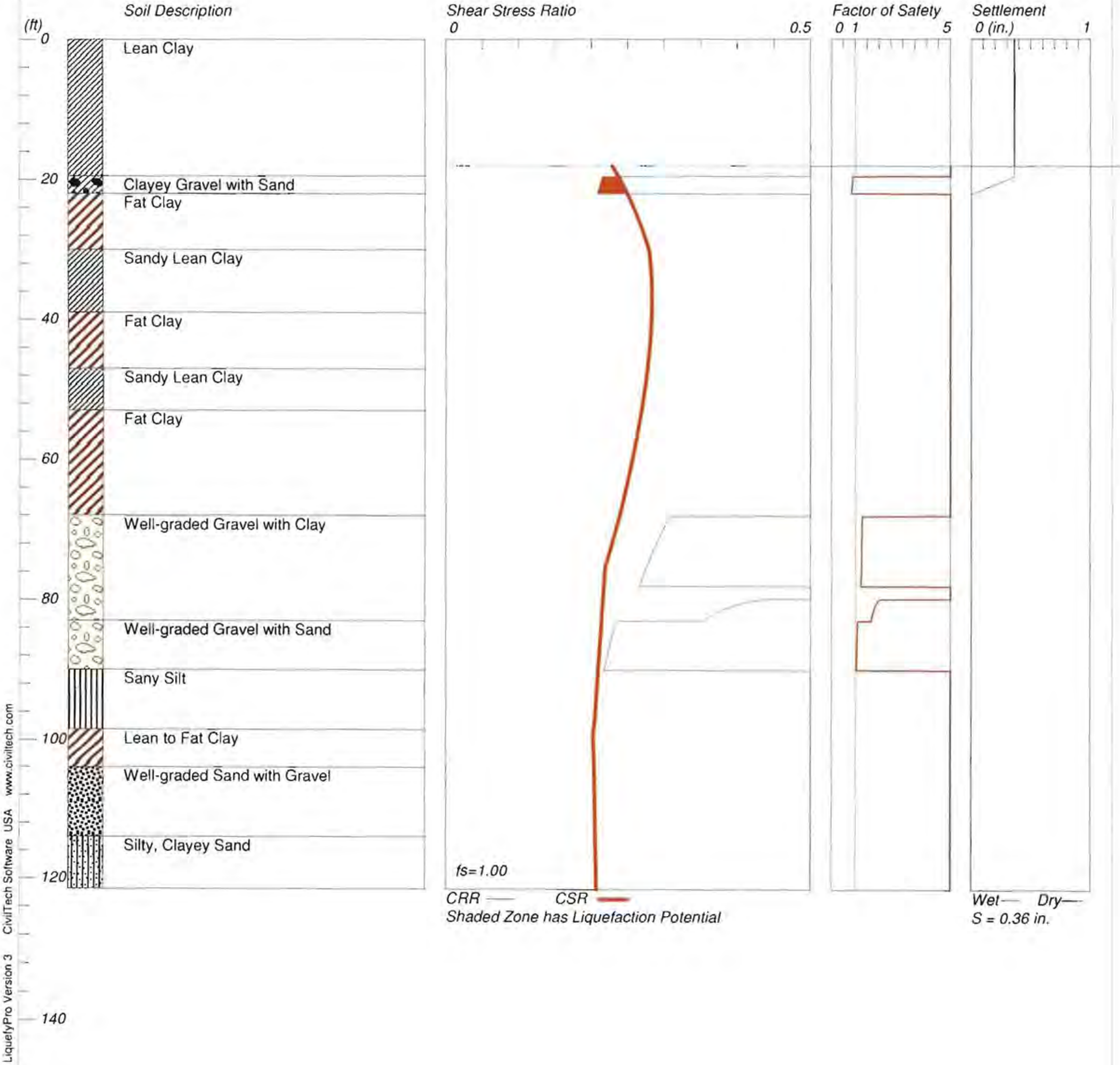
Figure 22

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-07   Water Depth=18 ft   Surface Elev.=84

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

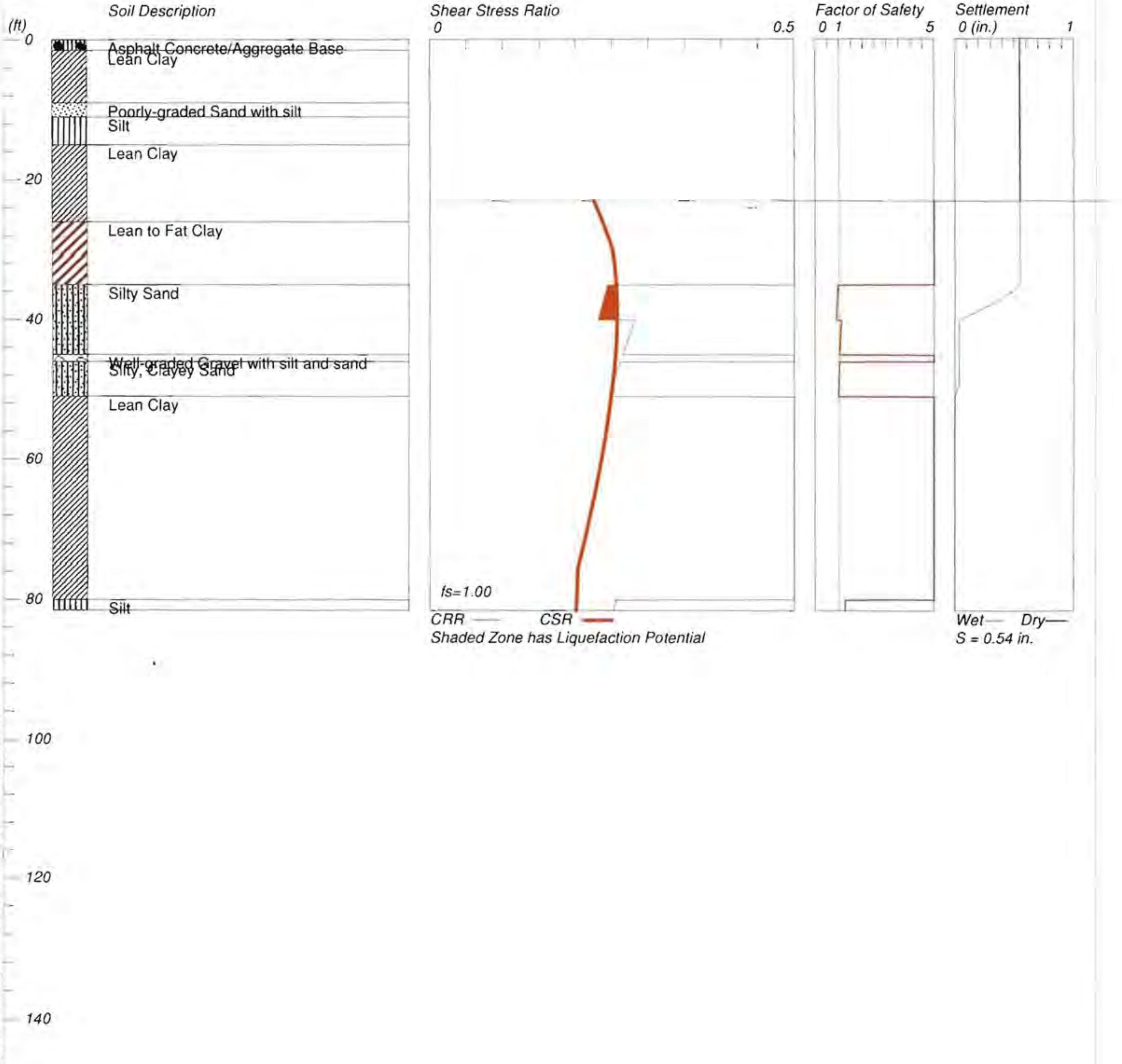
Figure 23

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-08 Water Depth=23 ft Surface Elev.=89

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

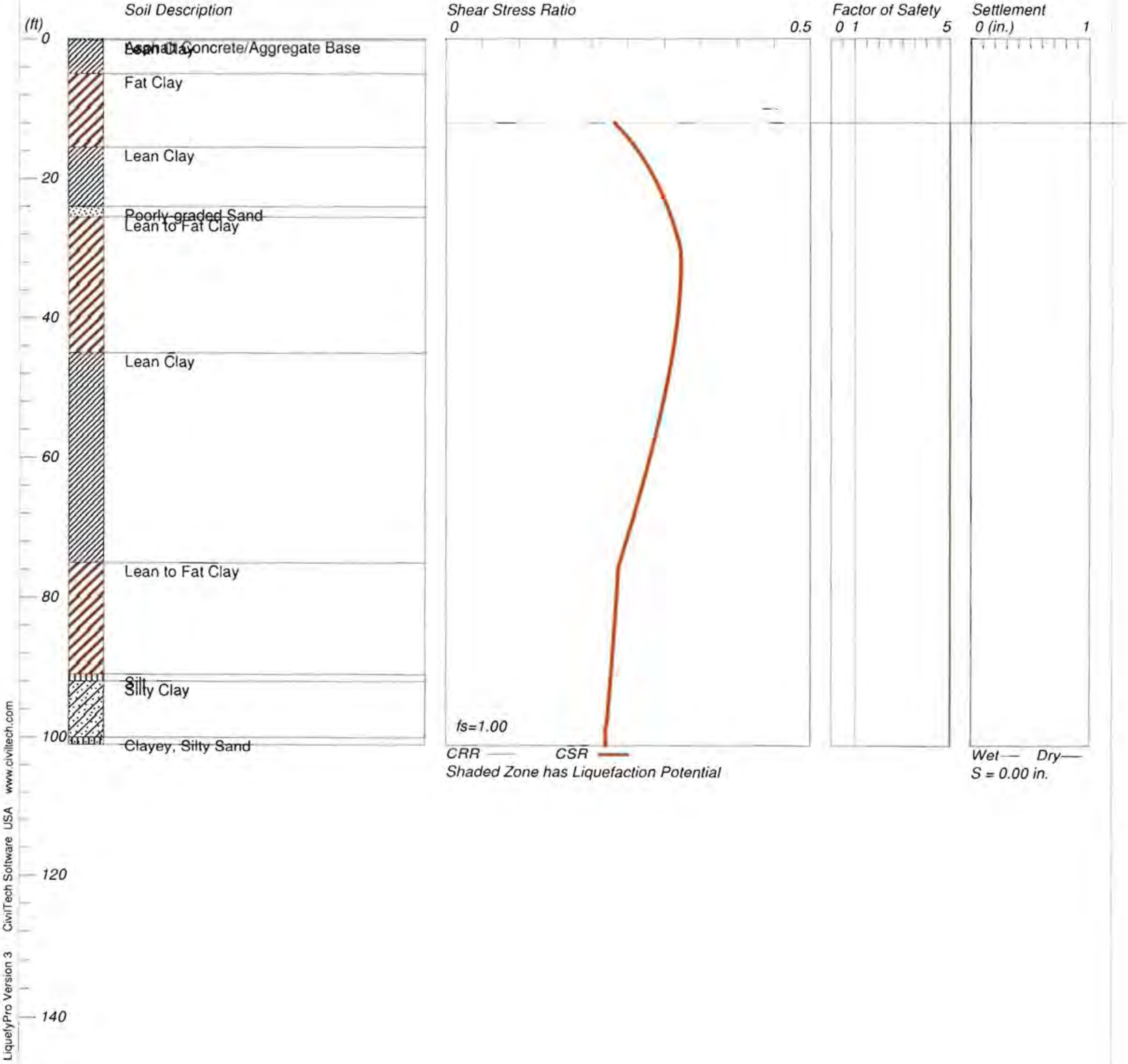
Figure 24

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-13 Water Depth=12 ft Surface Elev.=86

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

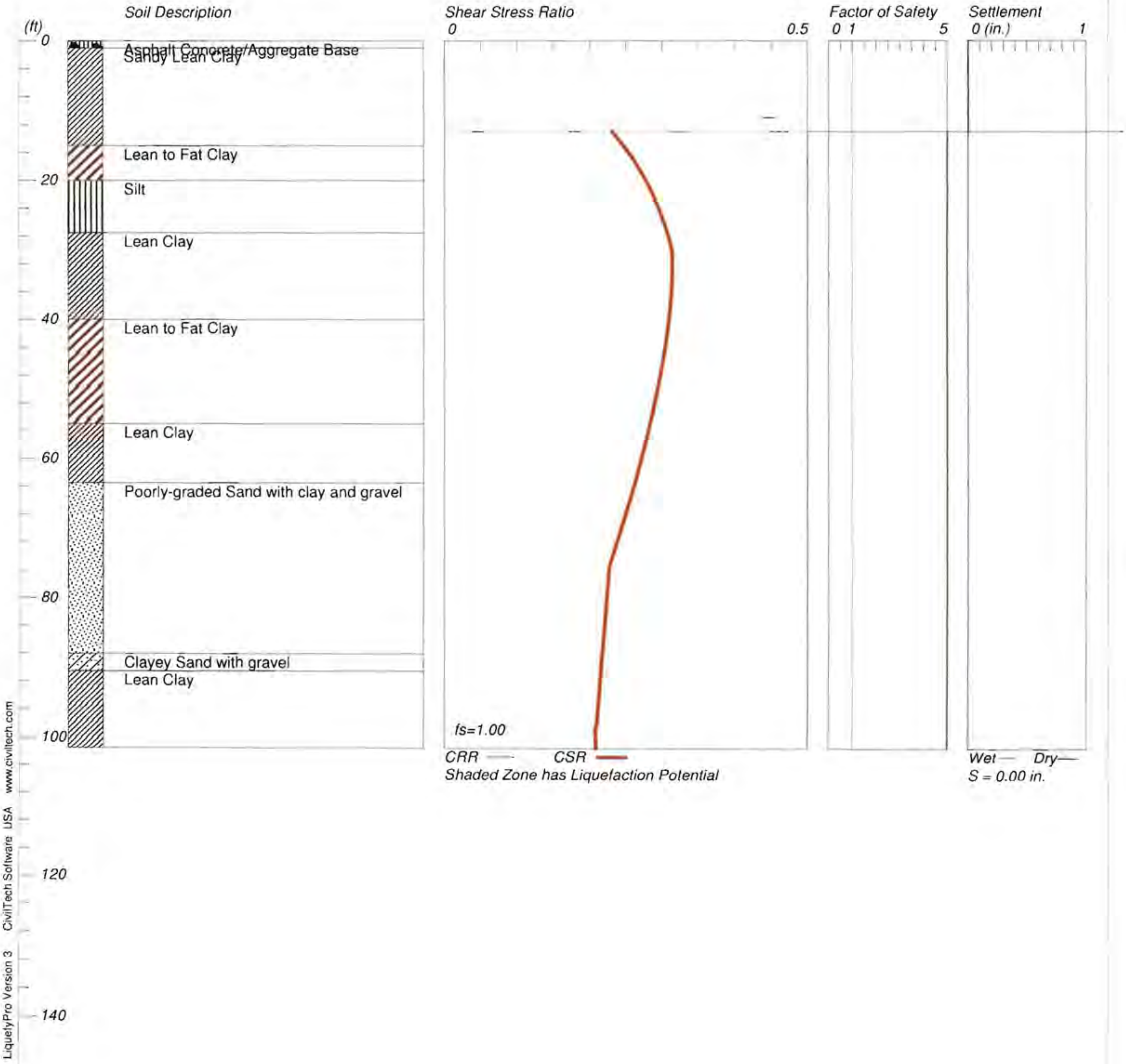
Figure 25

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-14 Water Depth=13 ft Surface Elev.=87

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

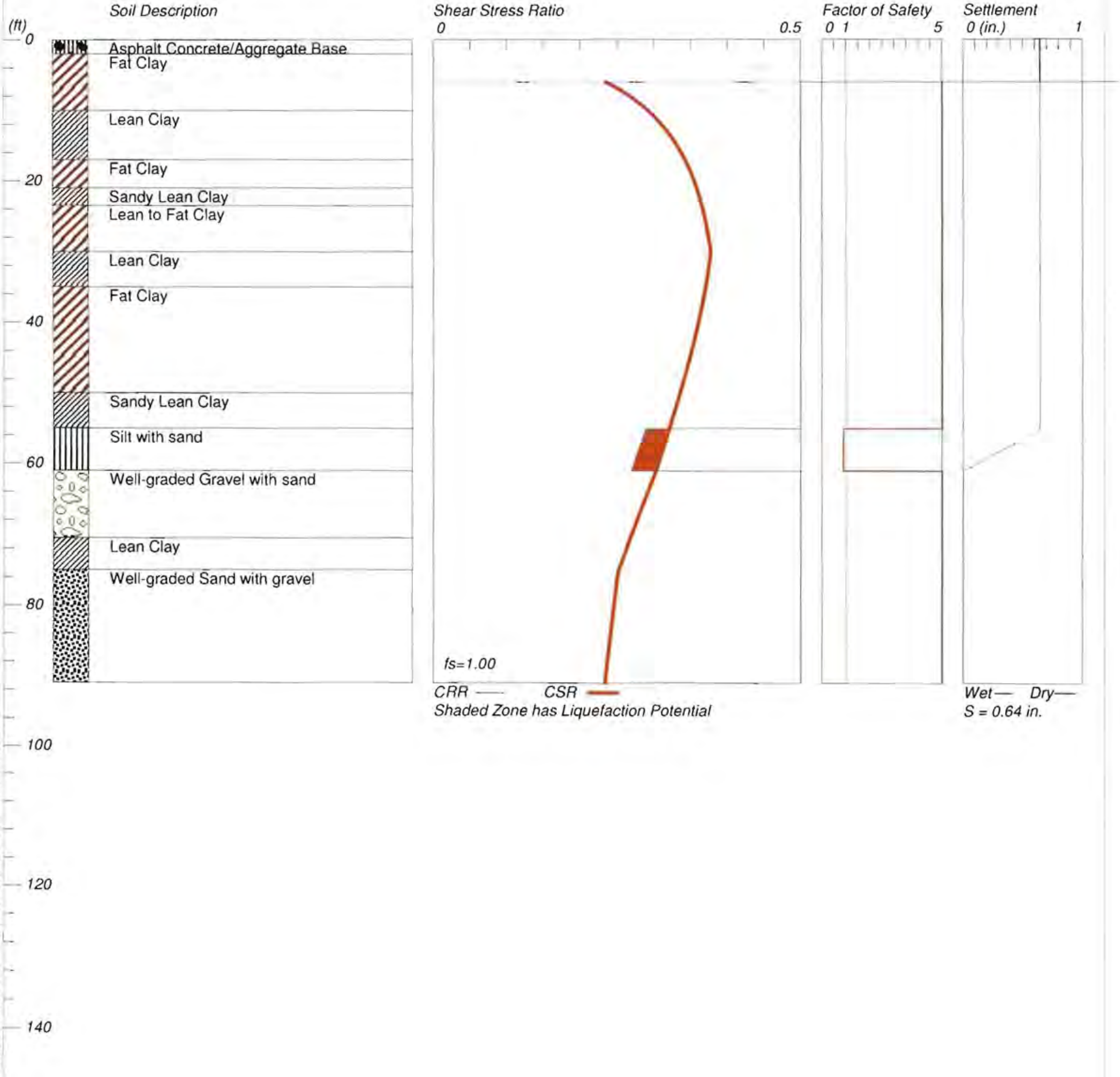
Figure 26

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-15 Water Depth=6 ft Surface Elev.=80

Magnitude=6.4
Acceleration=0.55g



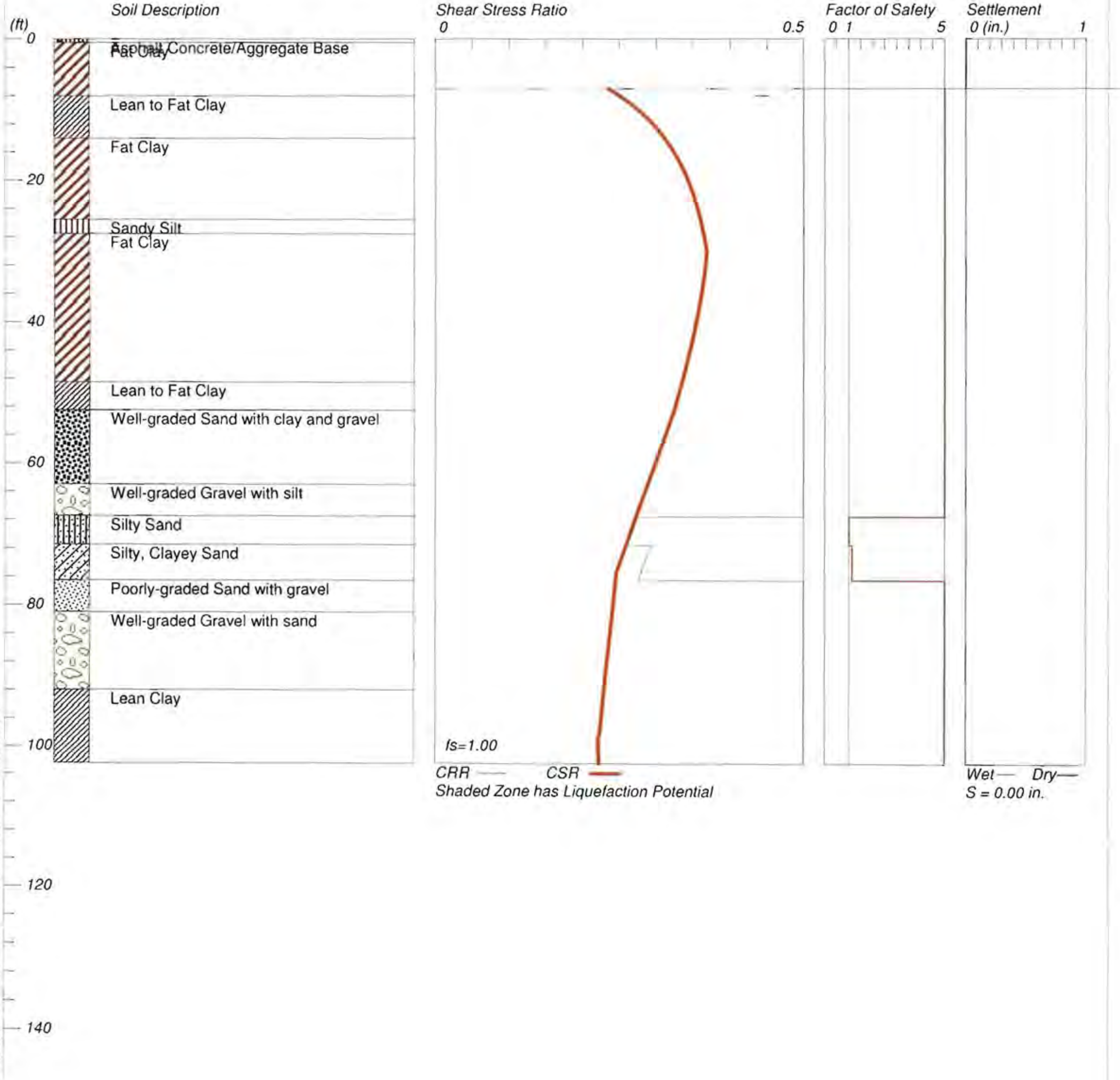
Median (50th percentile) PGA

Figure 27

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-16 ***Water Depth=7 ft*** ***Surface Elev.=81*** ***Magnitude=6.4***
Acceleration=0.55g



Median (50th percentile) PGA

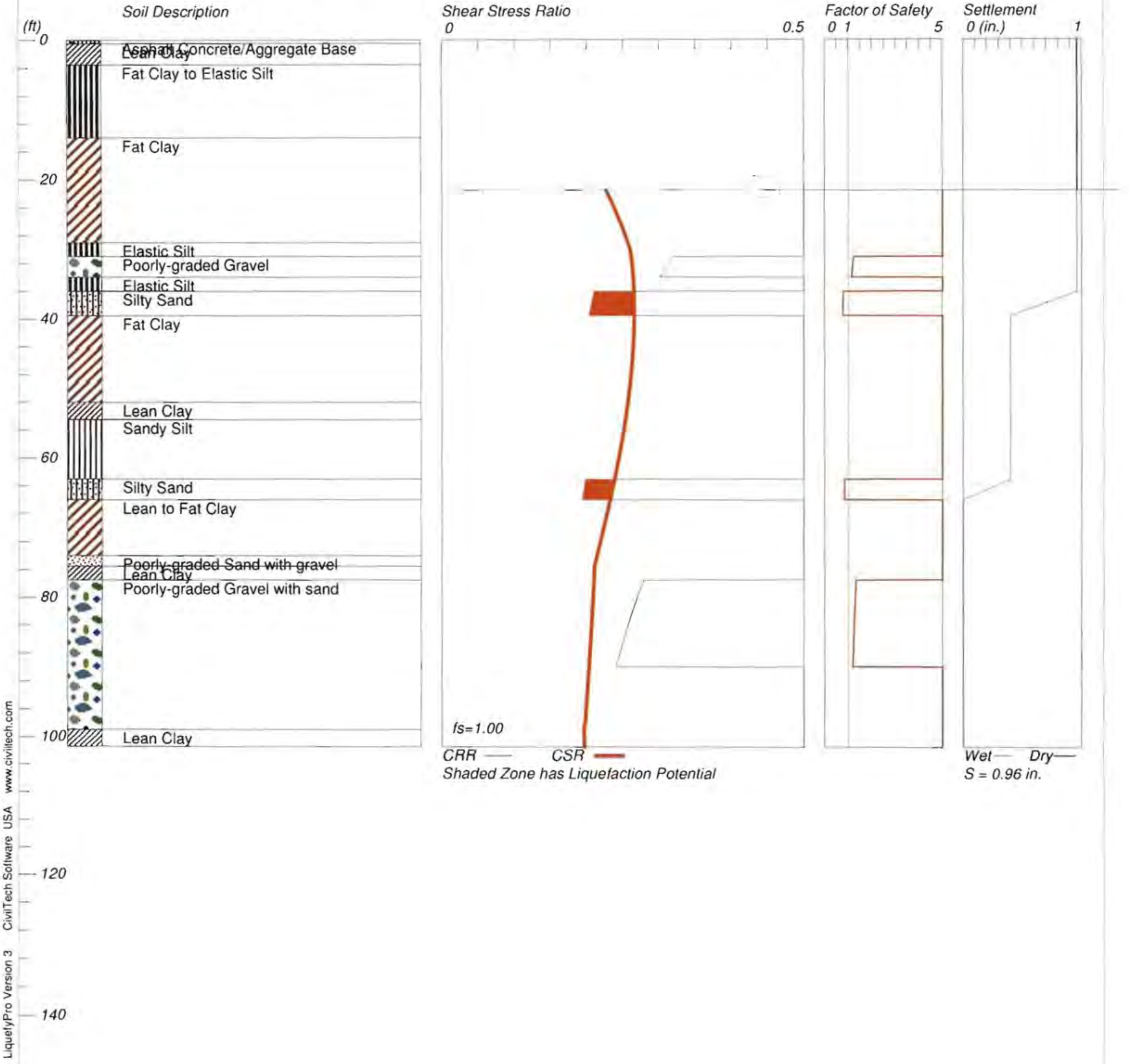
Figure 28

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-17 Water Depth=21.5 ft Surface Elev.=88.5

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

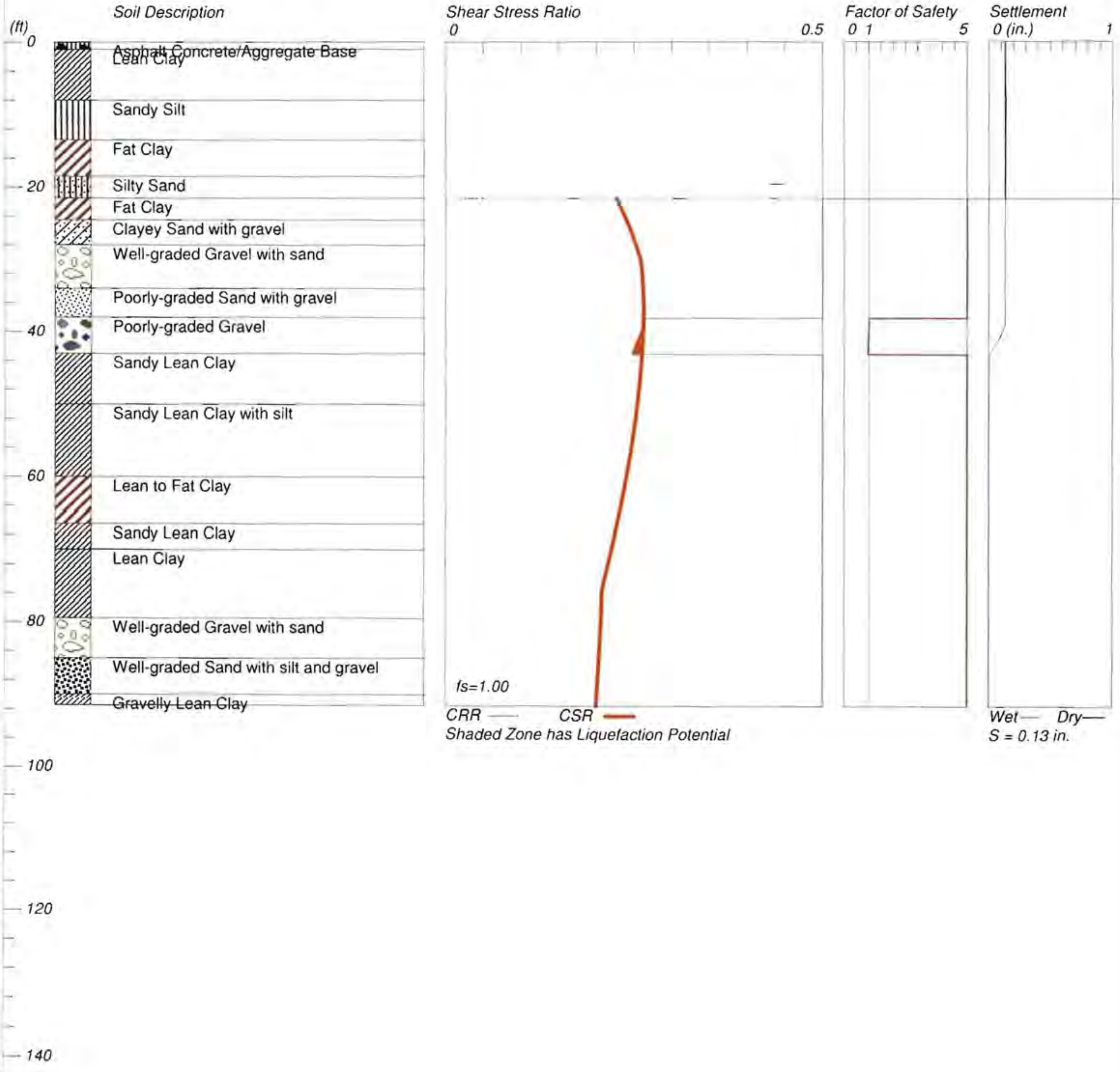
Figure 29

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-18 Water Depth=21.5 ft Surface Elev.=88.5

Magnitude=6.4
Acceleration=0.55g



LiquefyPro Version 3 CivilTech Software USA www.civiltech.com

Median (50th percentile) PGA

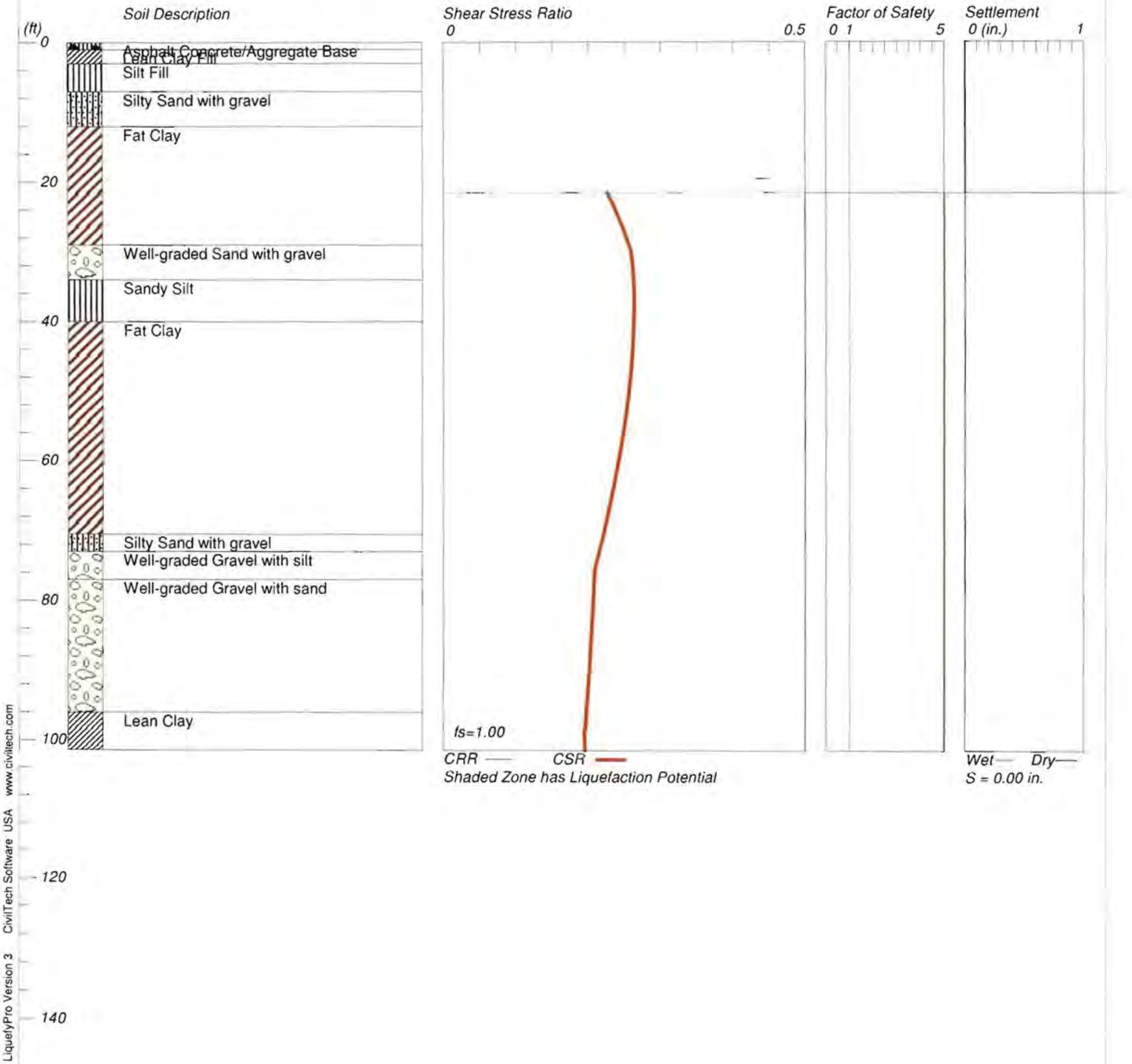
Figure 30

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-19 Water Depth=21.5 ft Surface Elev.=88.5

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

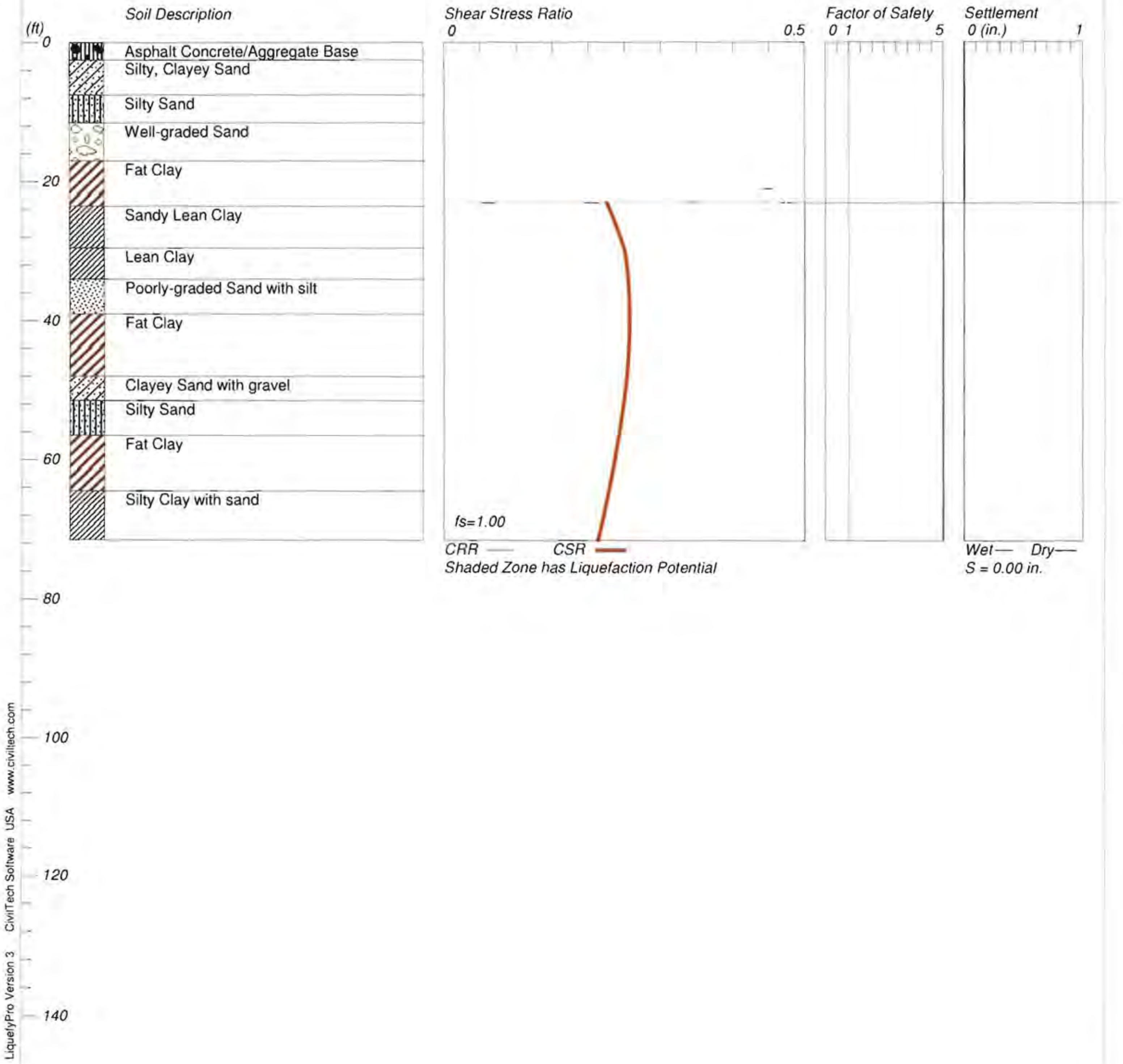
Figure 31

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-20 Water Depth=23 ft Surface Elev.=90

Magnitude=6.4
Acceleration=0.55g



URS

Median (50th percentile) PGA

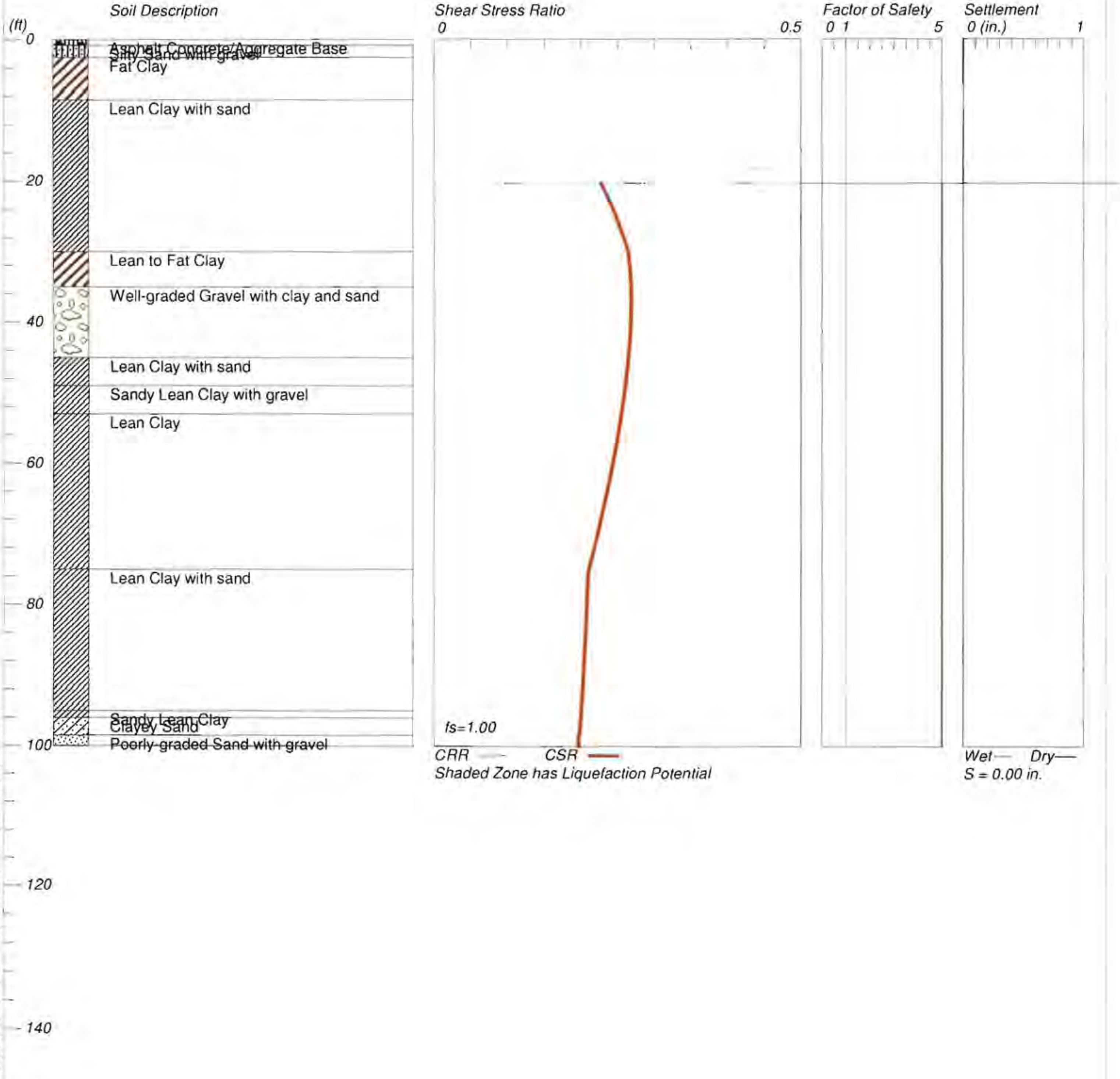
Figure 32

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-21 Water Depth=20.3 ft Surface Elev.=86.3

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

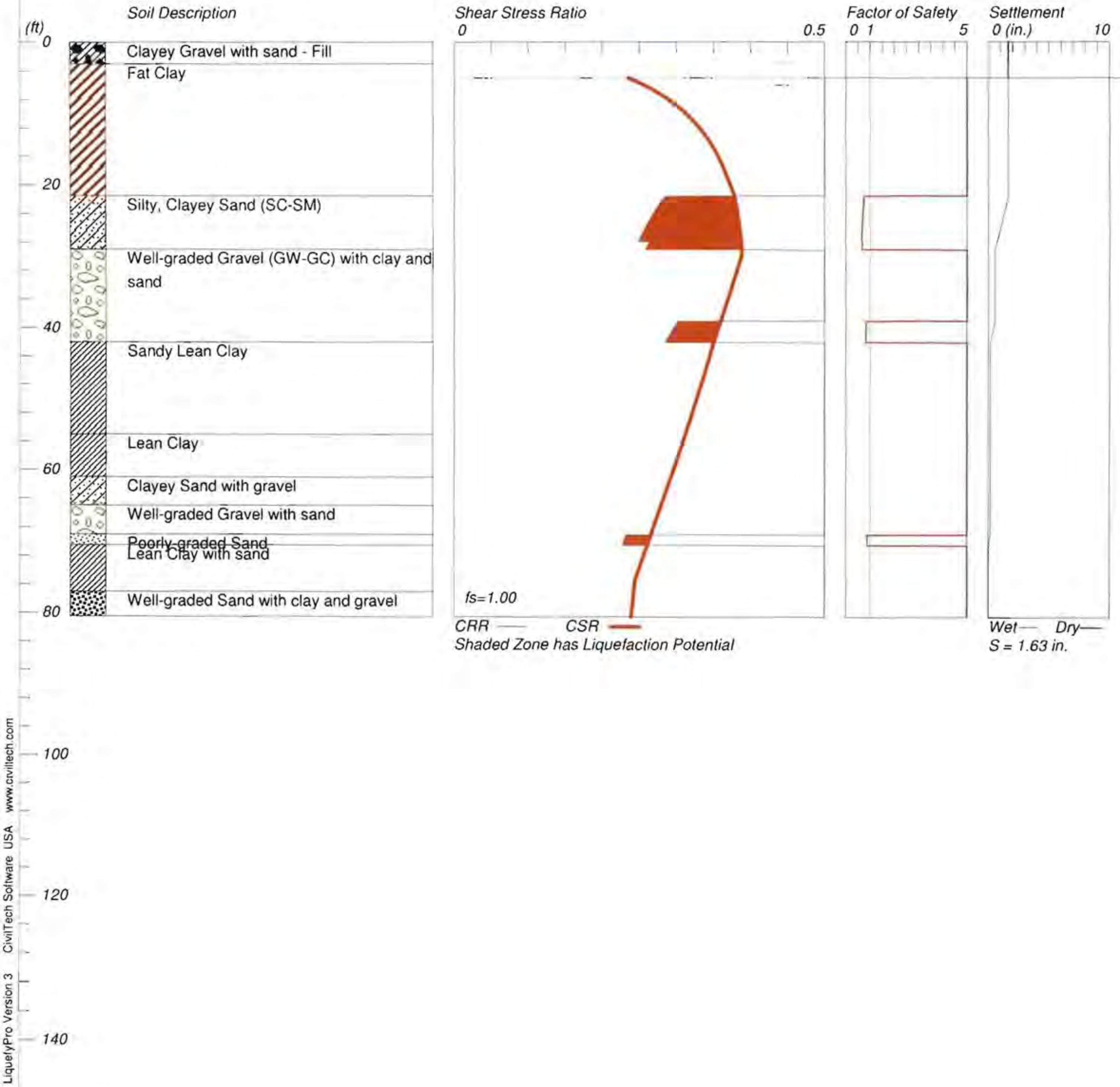
Figure 33

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NB-24 Water Depth=5 ft Surface Elev.=69.5

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

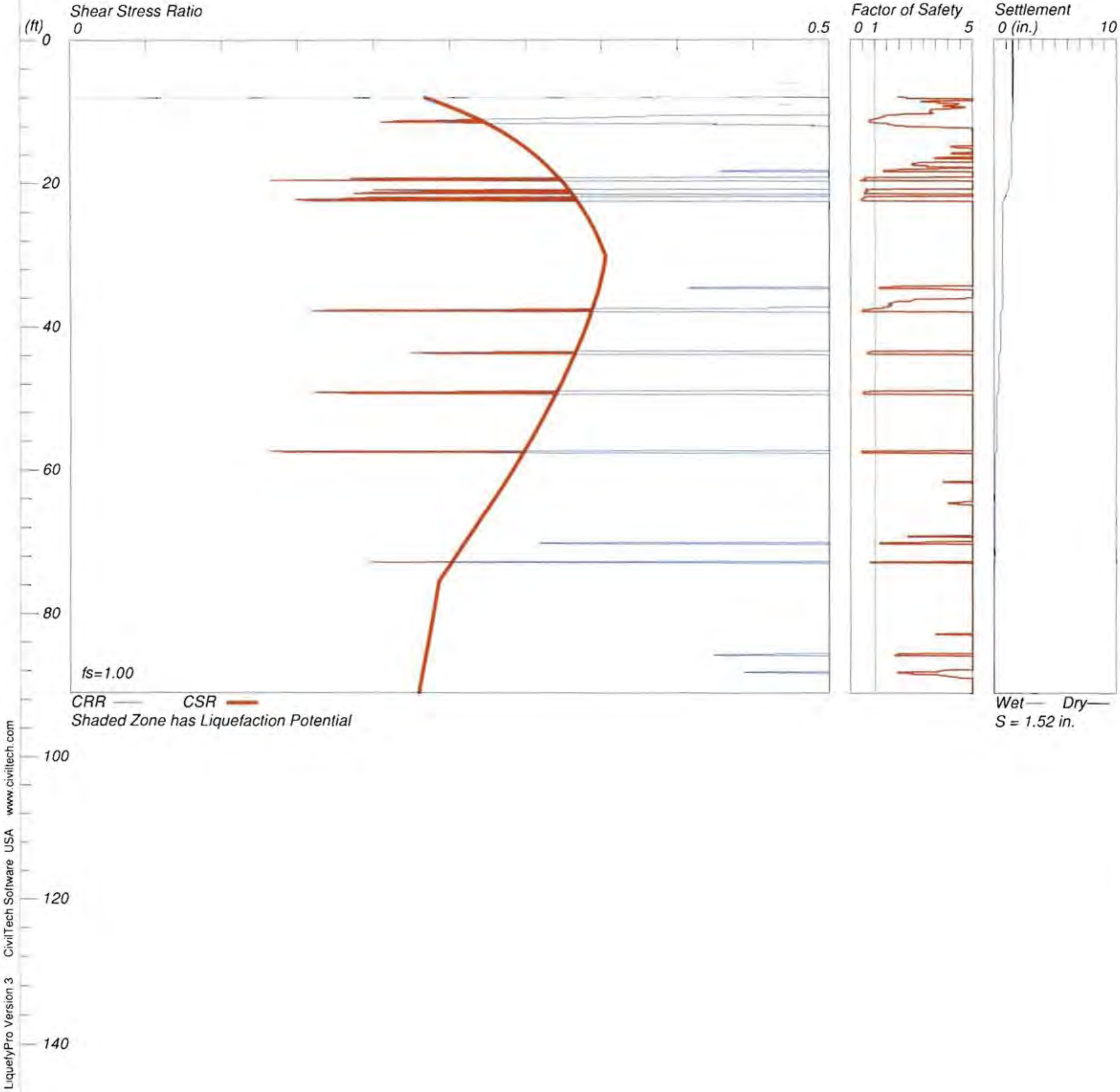
Figure 34

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NC-09 Water Depth=8 ft Surface Elev.=87.8

Magnitude=6.4
Acceleration=0.55g



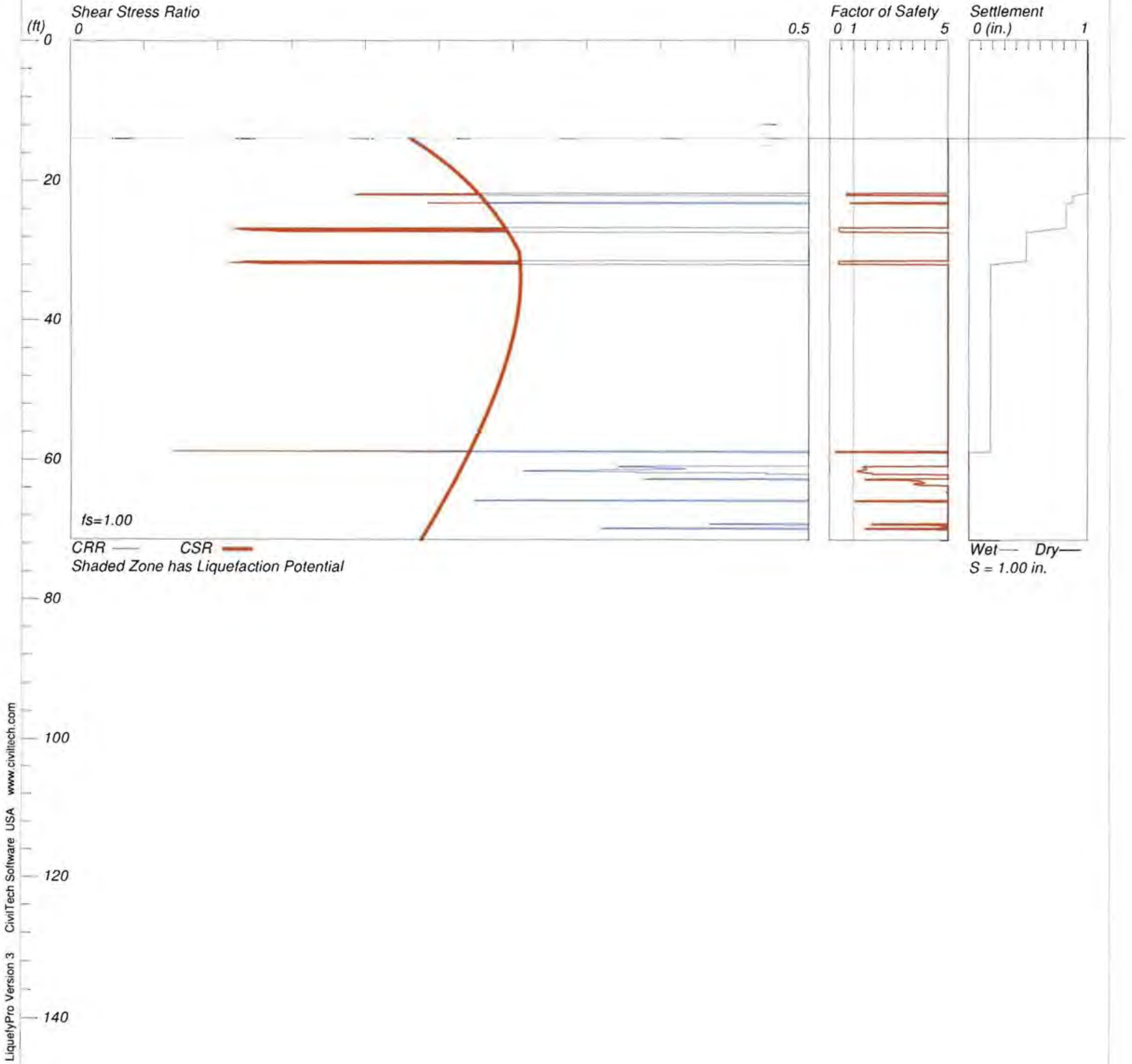
Median (50th percentile) PGA

Figure 35

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NC-11 Water Depth=14 ft Surface Elev.=88.0 Magnitude=6.4 Acceleration=0.55g



URS

Median (50th percentile) PGA

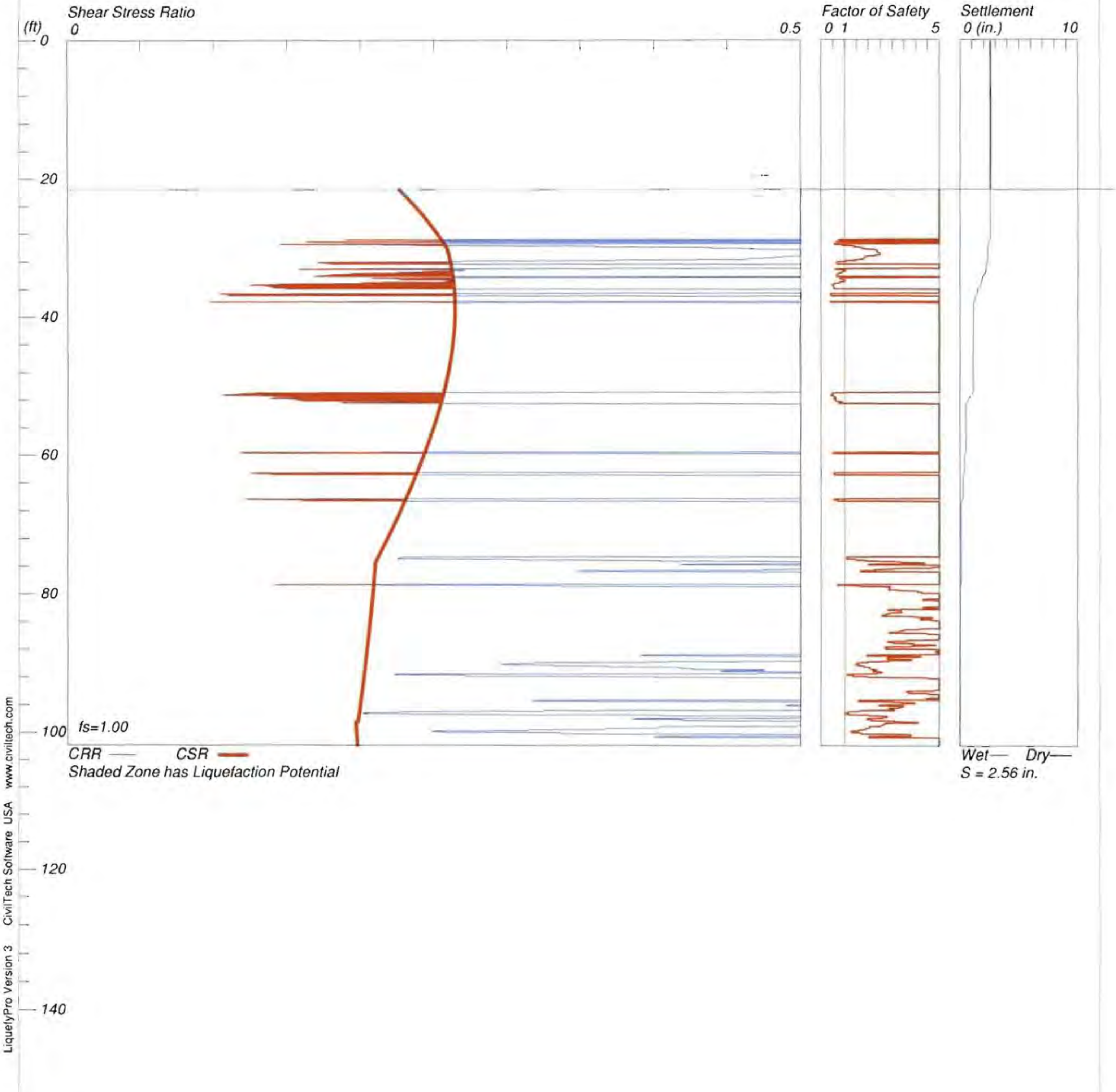
Figure 36

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NC-12   Water Depth=21.5 ft   Surface Elev.=88.5

Magnitude=6.4
Acceleration=0.55g



Median (50th percentile) PGA

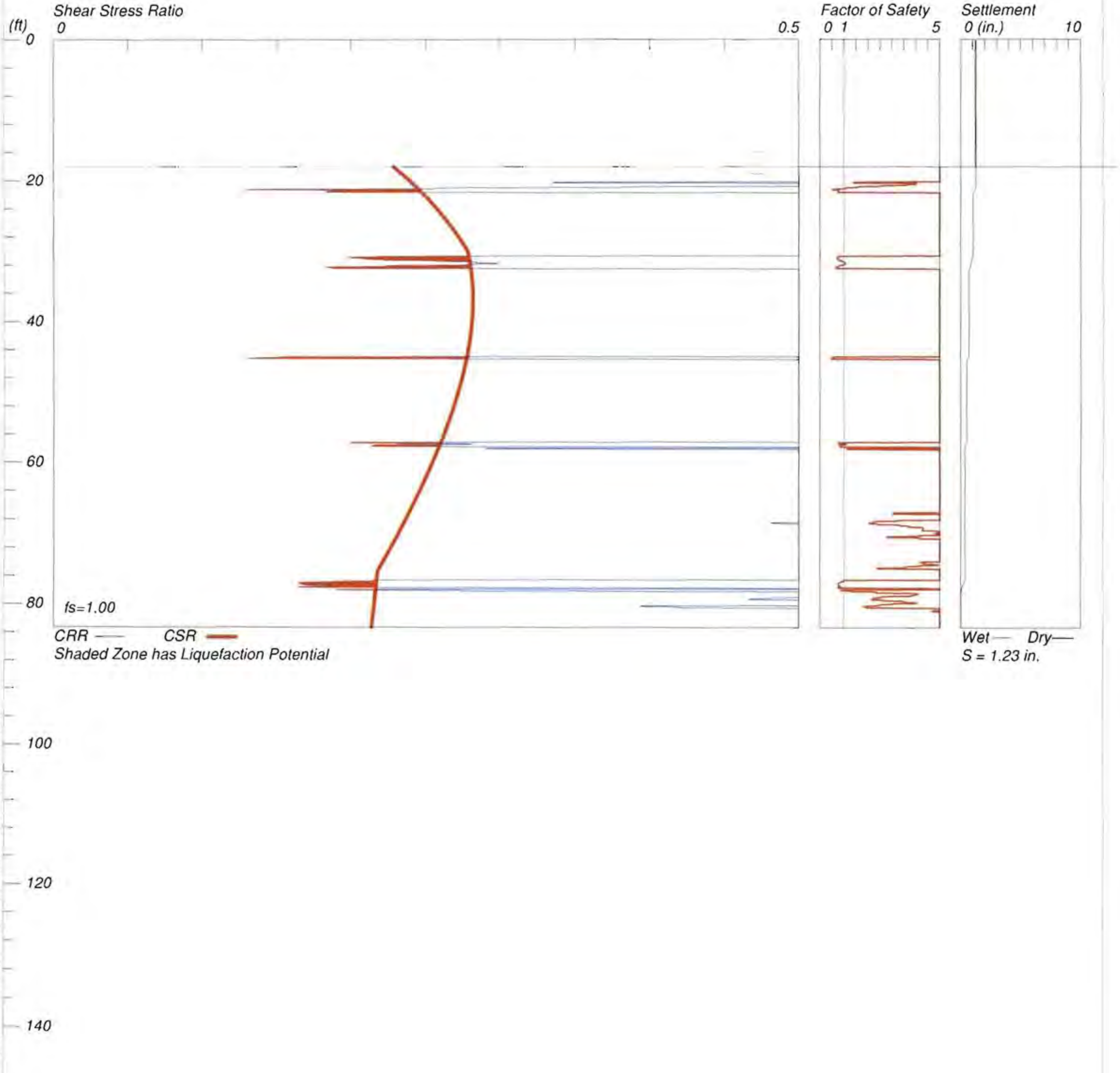
Figure 37

LIQUEFACTION ANALYSIS

Silicon Valley Rapid Transit Corridor

Hole No.=NC-13 Water Depth=18 ft Surface Elev.=84

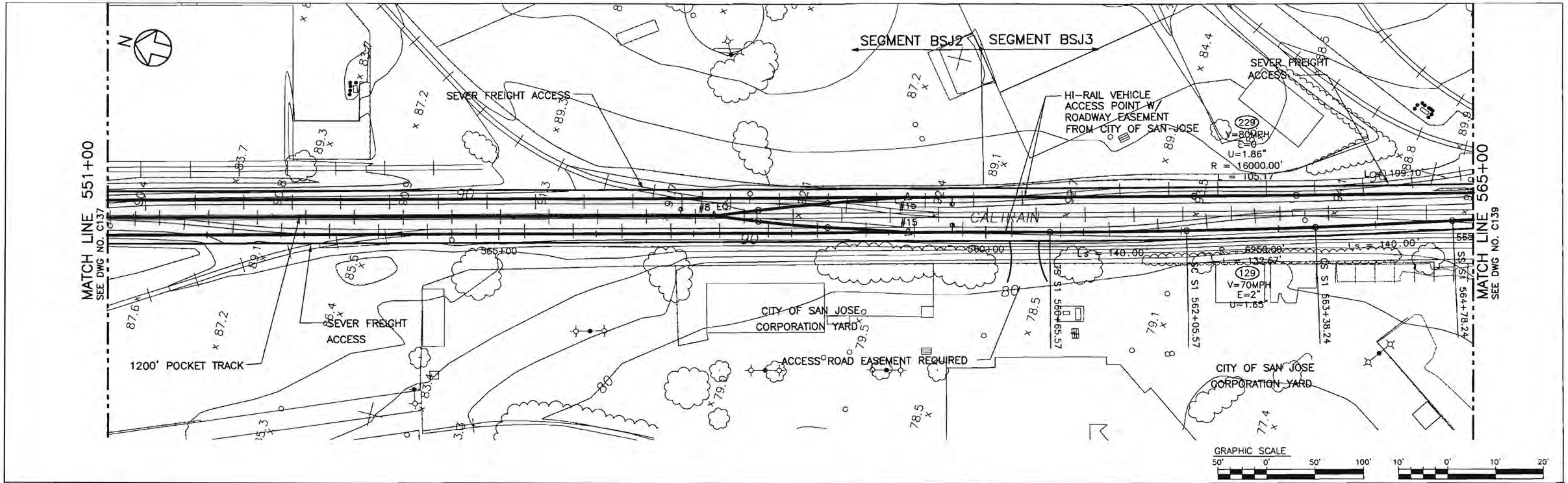
Magnitude=6.4
Acceleration=0.55g

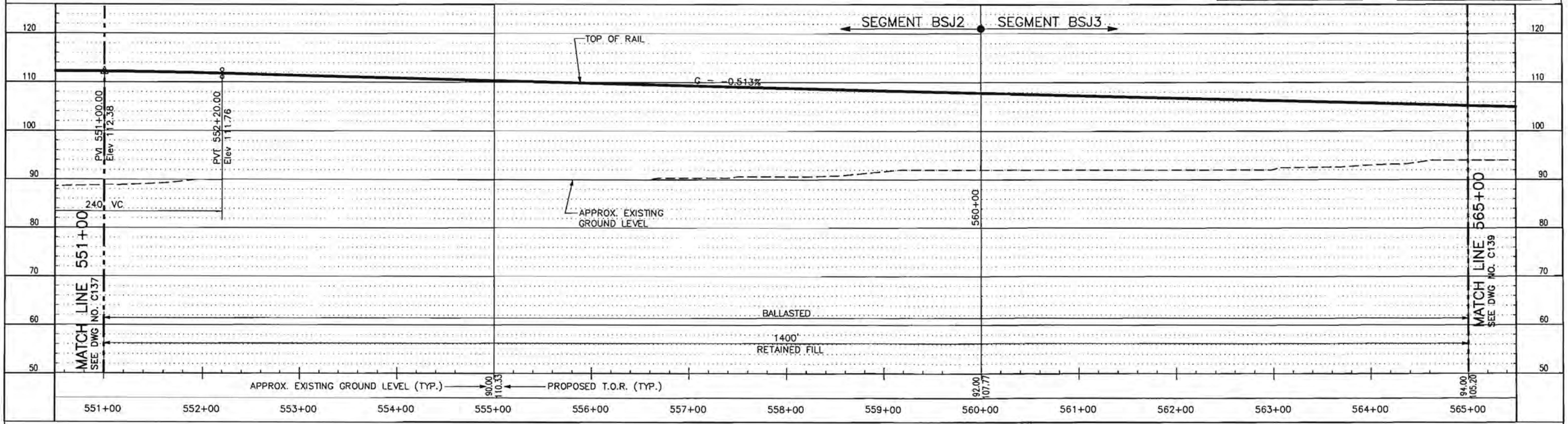


URS

Median (50th percentile) PGA

Figure 38





REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY T. LUNA
DRAWN BY V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

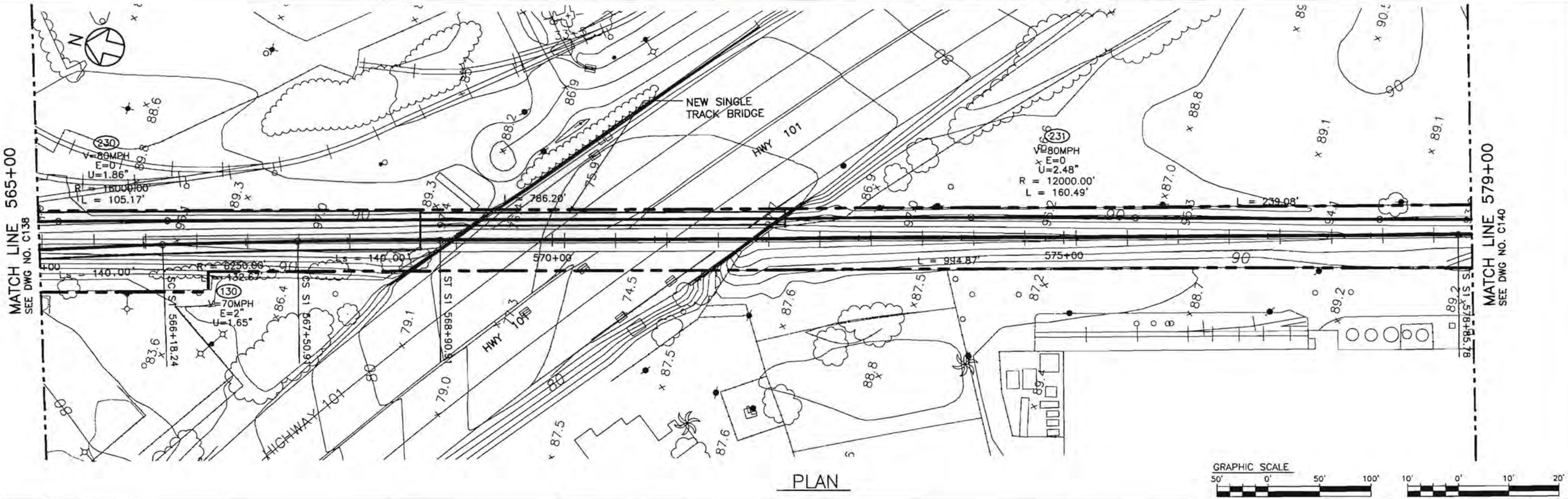
SANTA CLARA
Valley Transportation Authority

BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

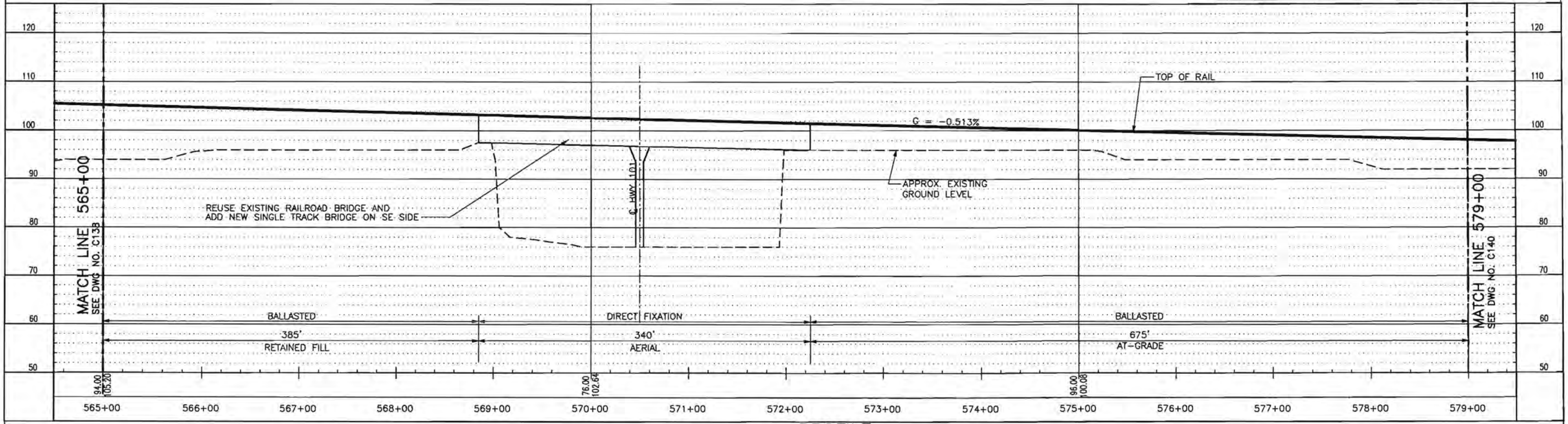
LAND, TRACKWORK AND SYSTEMS PLAN AND PROFILE

SHEET 38

CADD DATE 11AP03
SCALE: 1"=50'H; 1"=10'V
CADD FILE NO. BSJ2C138.DWG
DWG No: C138
REV 0
PAGE No.



PLAN



PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
T. LUNA
DRAWN BY
V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

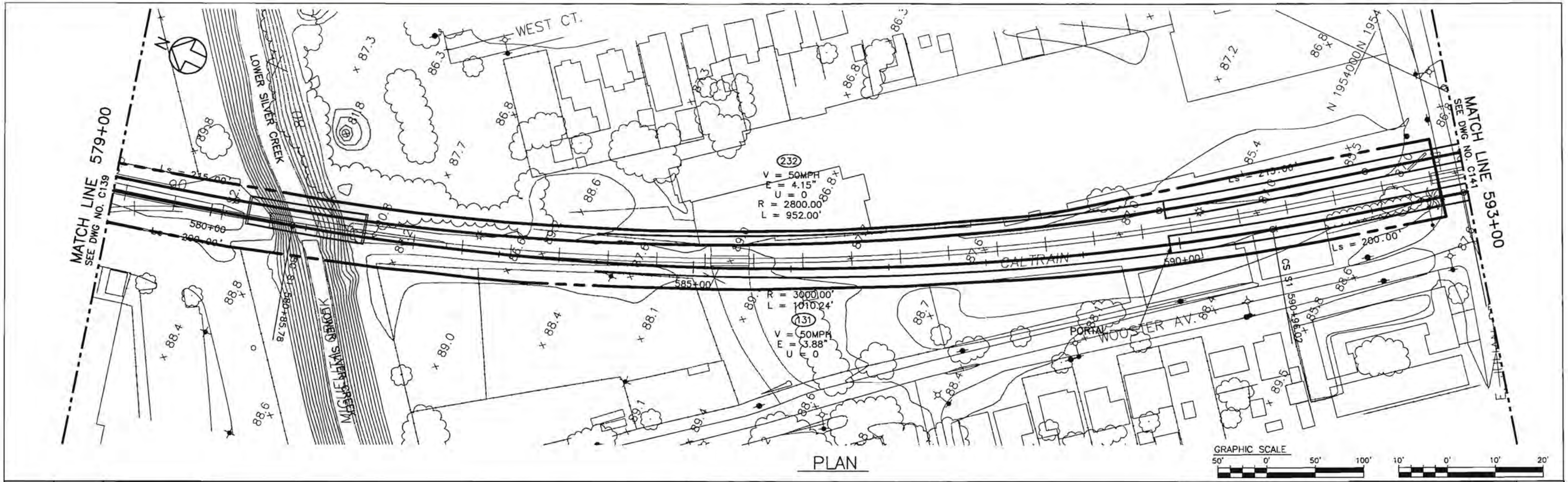
VTA SANTA CLARA Valley Transportation Authority

BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

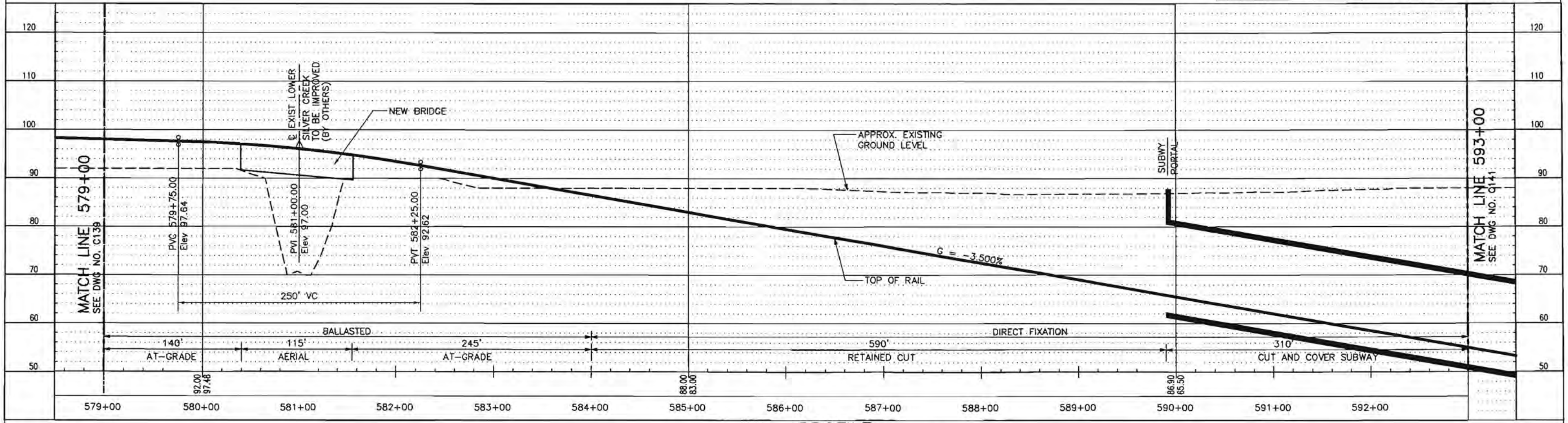
LINE, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

SHEET 39

CADD DATE 11AP03
SCALE: 1"=50'H; 1"=10'V
CADD FILE NO. BSJ3139.DWG
DWG No: C139
REV 0
PAGE No.



PLAN



PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
T. LUNA
DRAWN BY
V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

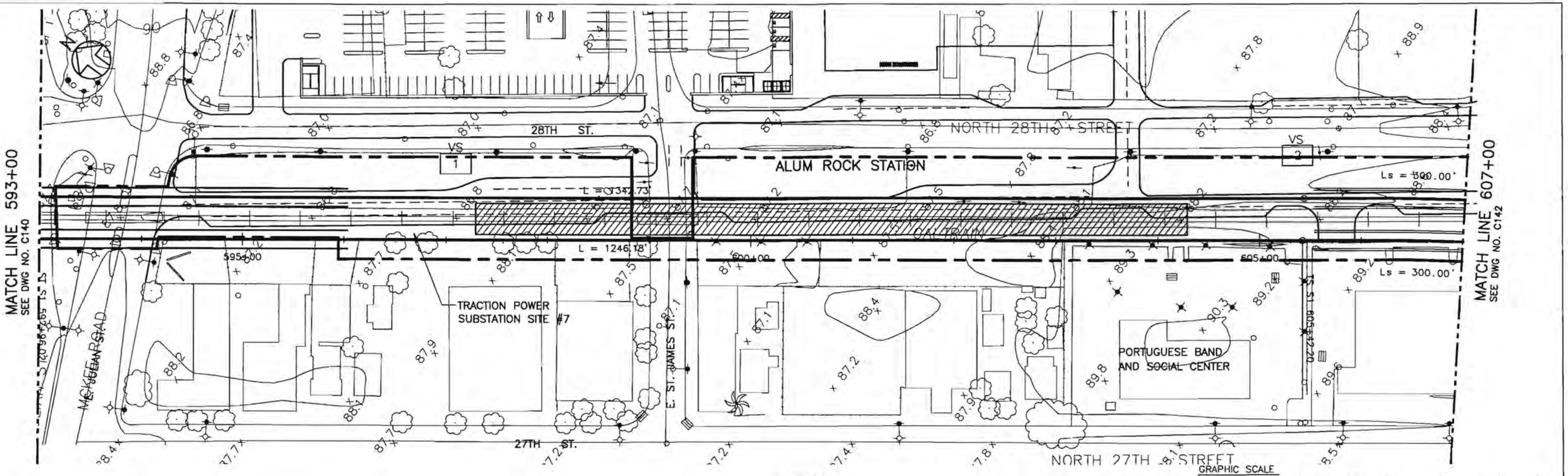
VTA SANTA CLARA Valley Transportation Authority

BART EXTENSION TO MILPITAS,
SAN JOSE AND SANTA CLARA

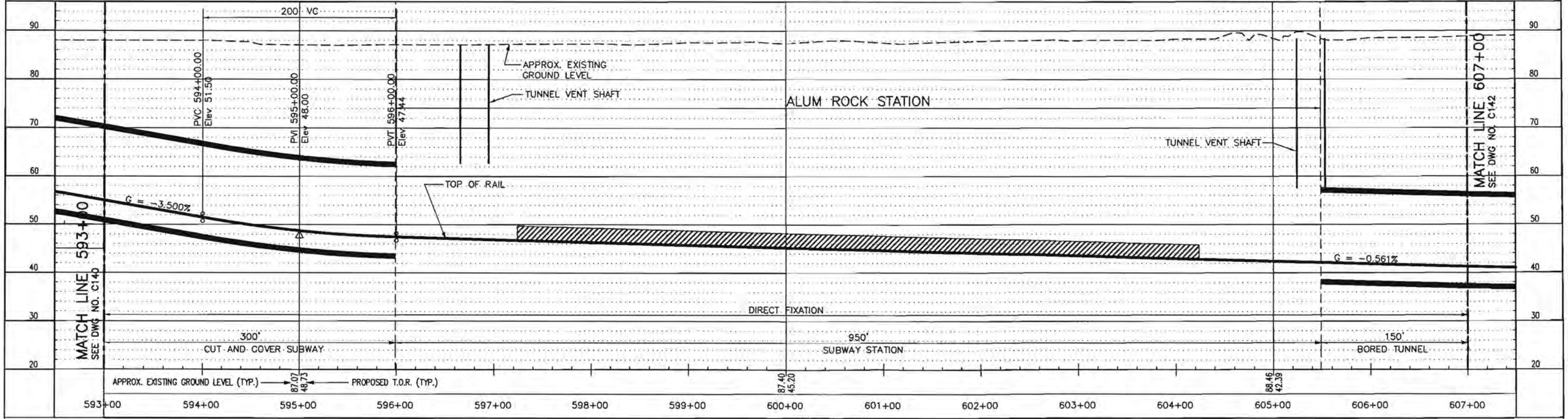
LAND, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

SHEET 40

CADD DATE 07AP03
SCALE: 1"=50'H; 1"=10'V
CADD FILE NO. BSJ3C140.DWG
DWG No: C140
REV 0
PAGE No.



PLAN



PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY T. LUNA
DRAWN BY V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

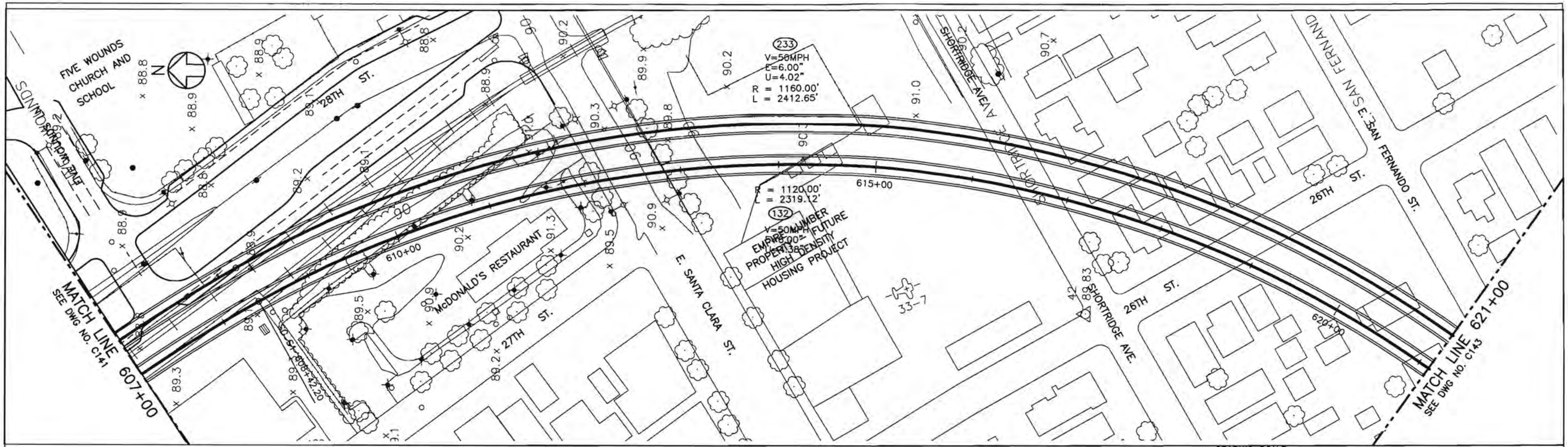
SANTA CLARA
Valley Transportation Authority

**BART EXTENSION TO MILPITAS,
SAN JOSE AND SANTA CLARA**

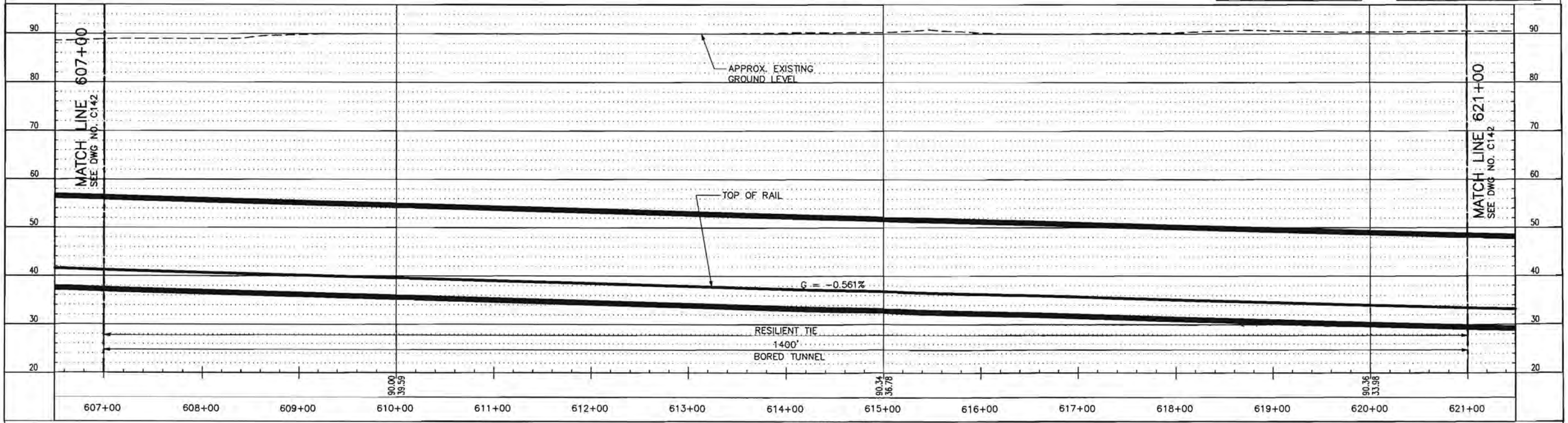
LAND, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

SHEET 41

CADD DATE: 11AP03
SCALE: 1"=50'H; 1"=10'V
CADD FILE NO. BSJ3C141.DWG
DWG No: C141
REV: 0
PAGE No.



PLAN



PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY T. LUNA
DRAWN BY V. FELIX
CHECKED BY
APPROVED BY
DATE

E A R T H T E C H
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

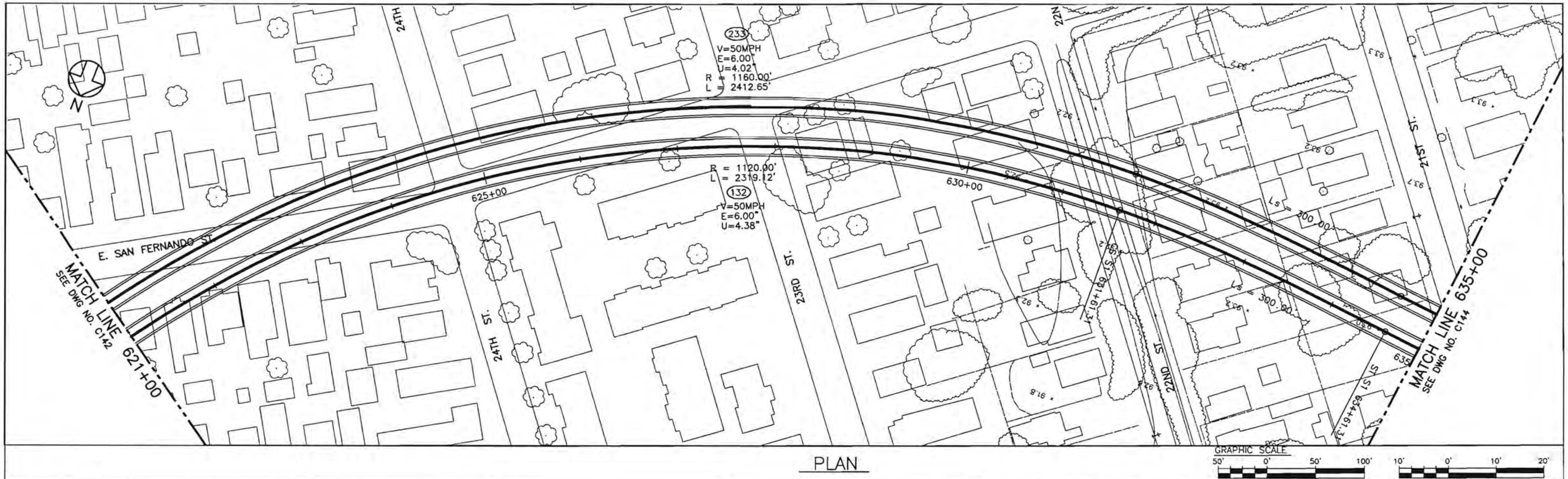
VTA SANTA CLARA Valley Transportation Authority

BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

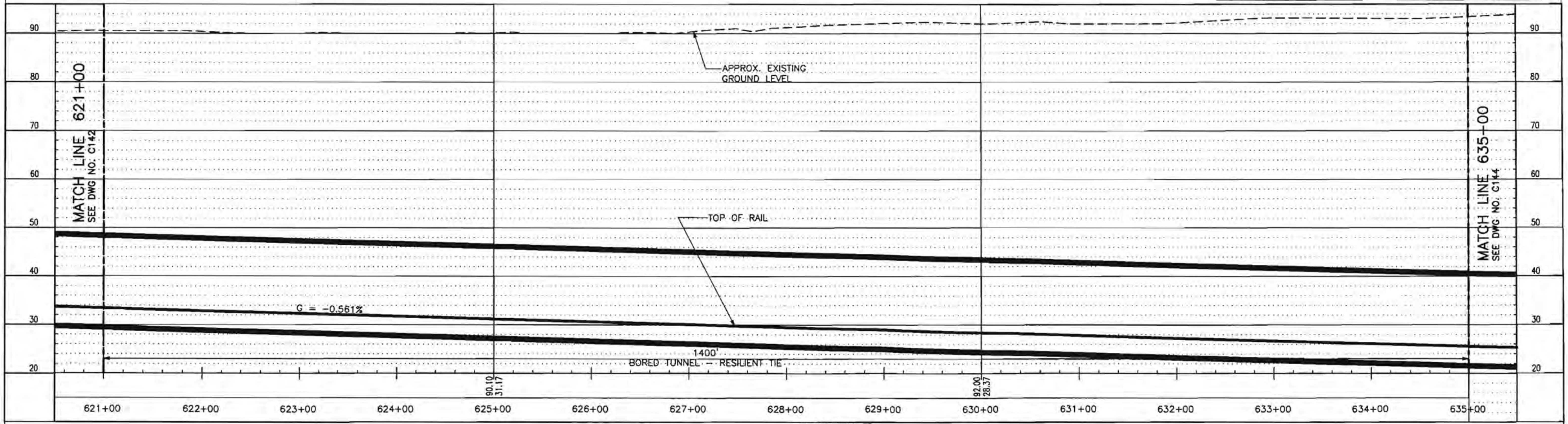
LINE, TRACKWORK AND SYSTEMS PLAN AND PROFILE

SHEET 42

CADD DATE 11AP03
SCALE: 1"=50'H; 1"=10'V
CADD FILE NO. BSJ3C142.DWG
DWG No: C142
REV 0
PAGE No.



PLAN



PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY T. LUNA
DRAWN BY V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

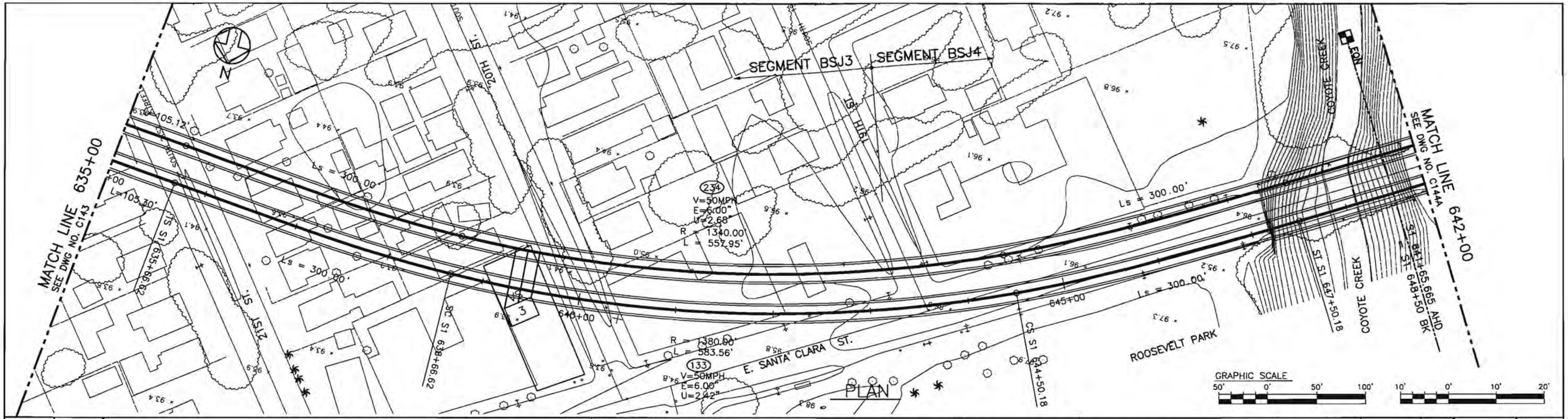
SANTA CLARA
Valley Transportation Authority

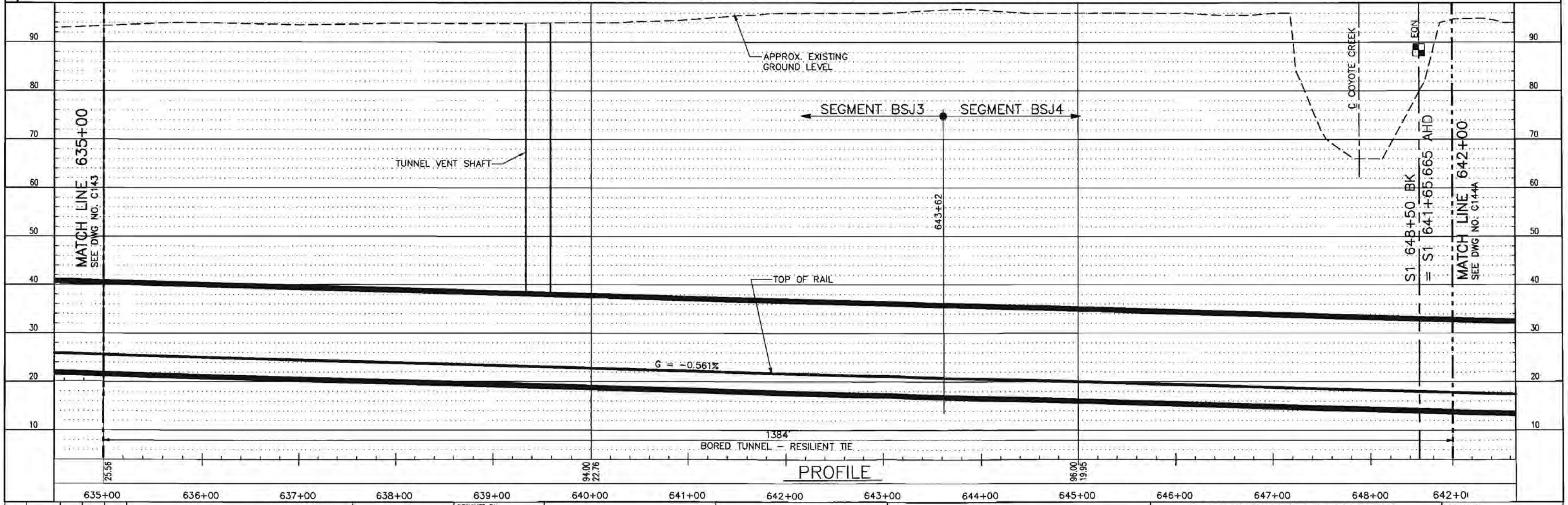
BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

LINE, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

SHEET 43

CADD DATE 11AP03
SCALE: 1"=50'H; 1"=10'V
CADD FILE NO. BSJ3C143.DWG
DWG No: C143
REV 0
PAGE No.





REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
T. LUNA

DRAWN BY
V. FELIX

CHECKED BY

APPROVED BY

DATE

E A R T H T E C H
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

SANTA CLARA
Valley Transportation Authority

**BART EXTENSION TO MILPITAS,
SAN JOSE AND SANTA CLARA**

LINE, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

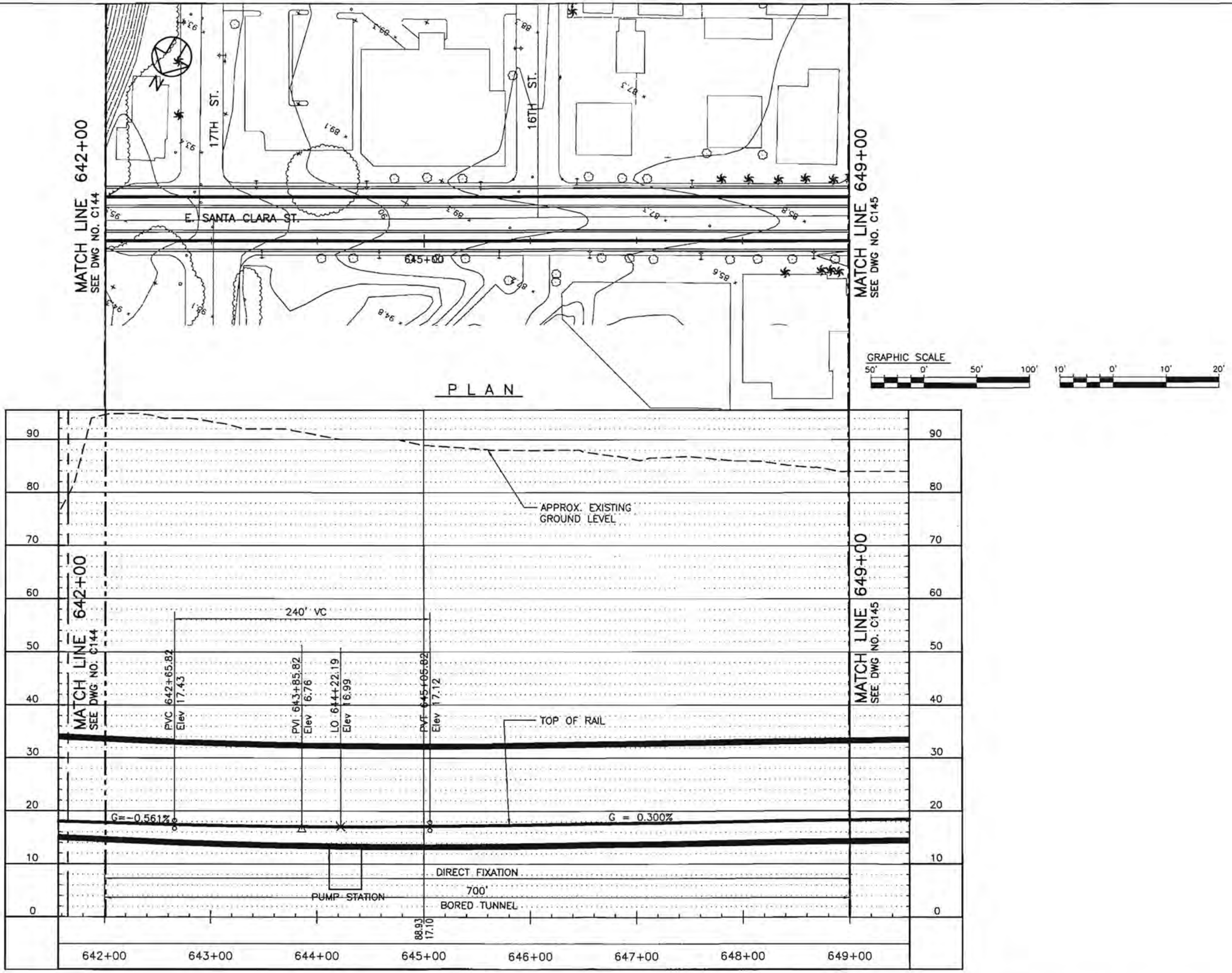
SHEET 44

CADD DATE
11AP03

SCALE:
1"=50'H; 1"=10'V

CADD FILE NO.
BSJ3C144.DWG

DWG No: C144
REV 0
PAGE No.



PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
T. LUNA
DRAWN BY
V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

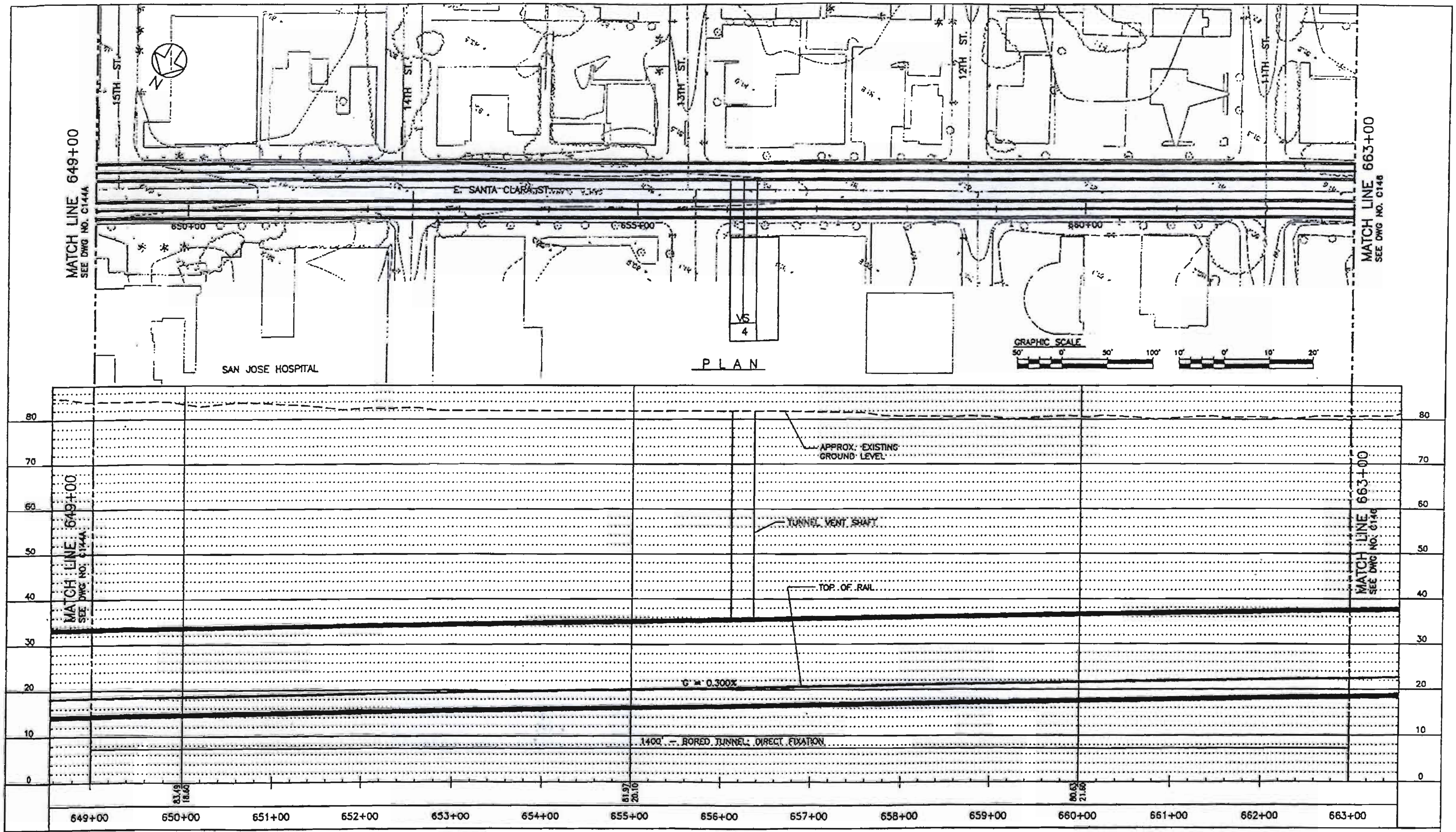
SANTA CLARA
Valley Transportation Authority

BART EXTENSION TO MILPITAS,
SAN JOSE AND SANTA CLARA

LINE, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

SHEET 44A

CADD DATE 11AP03
SCALE: 1"=50'H; 1"=10'V
CADD FILE NO. BSJ3C144A.DWG
DWG No: C144A
REV 0
PAGE No.



REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
T. LUNA
DRAWN BY
V. FELIX
CHECKED BY

APPROVED BY

DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

SANTA CLARA Valley Transportation Authority

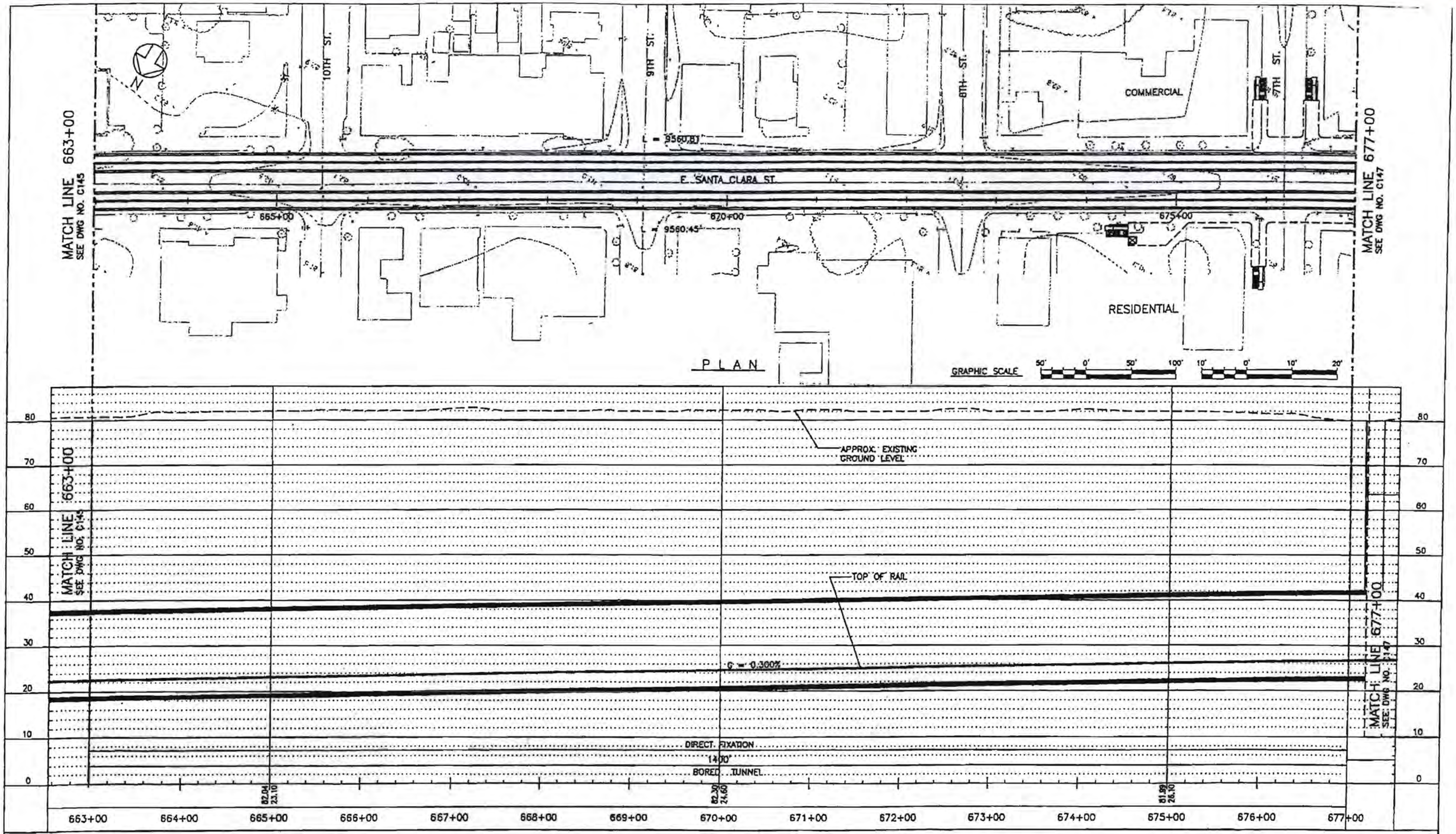
BART EXTENSION TO MILPITAS,
SAN JOSE AND SANTA CLARA

LINE, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

SHEET 45

CADD DATE
11AP03
SCALE:
1"=50'H; 1"=10'V
CADD FILE NO.
BSJ3C145.DWG
DWG No.
C145
REV
0
PAGE No.

H:\56648-BART\0S7\Drawings\ET-DWGS\CIVIL\BSJ\C145.dwg, 04/16/2003 12:29:22 PM, TLuna



PROFILE

REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
T. LUNA
DRAWN BY
V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

VTA SANTA CLARA Valley Transportation Authority

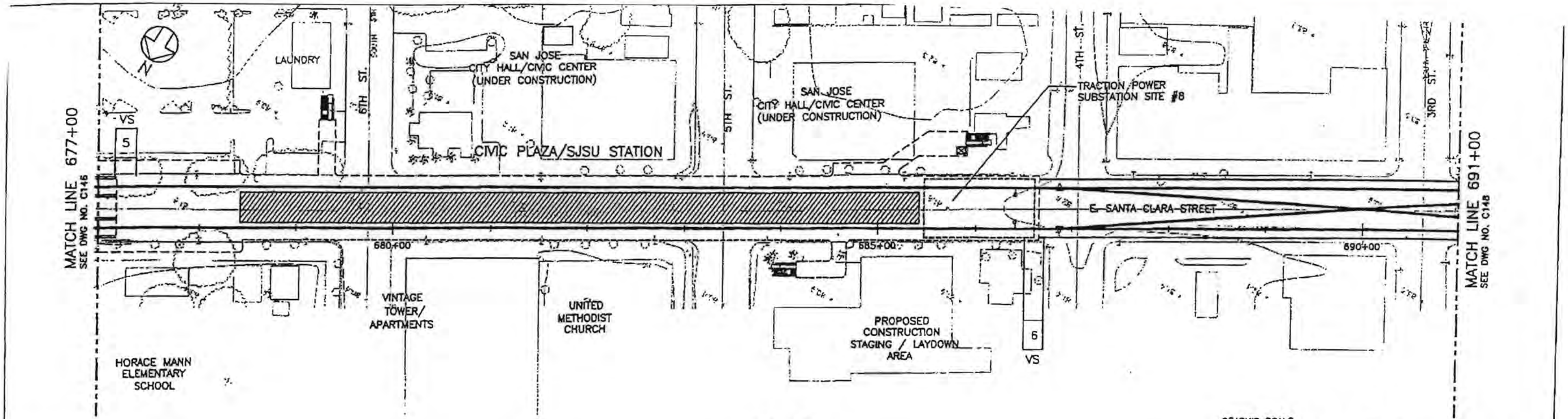
BART EXTENSION TO MILPITAS,
SAN JOSE AND SANTA CLARA

LINE, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

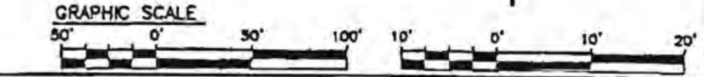
SHEET 46

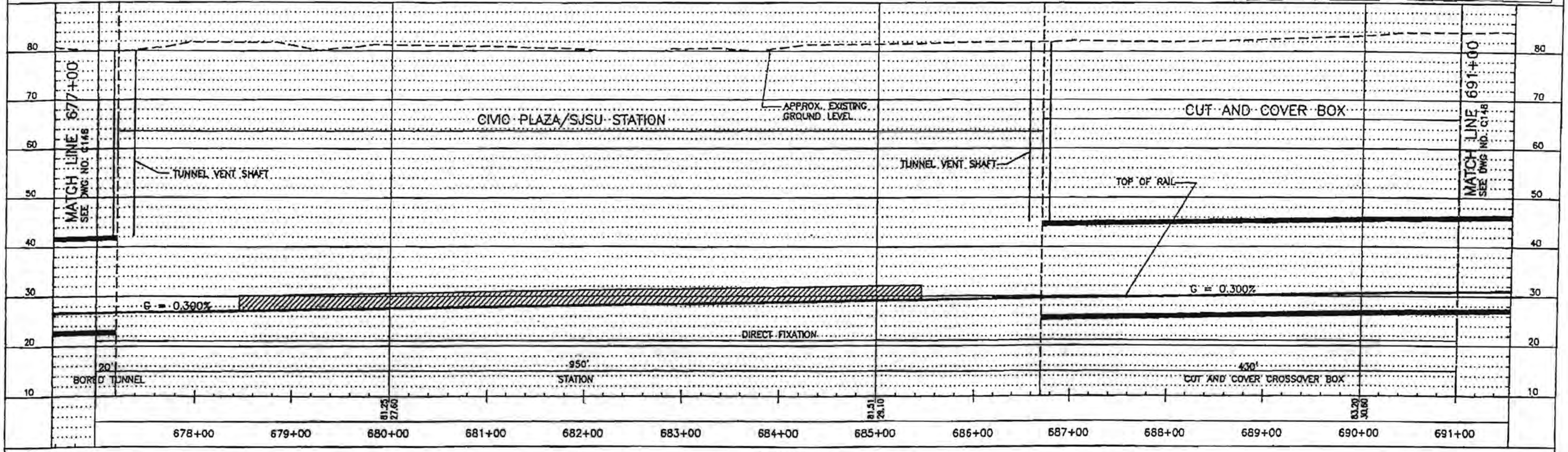
CADD DATE 11AP03
SCALE 1"=50'H; 1"=10'V
CADD FILE NO. BSJ4C146.DWG
DWG No. C146
REV 0
PAGE No.

\56648-BARTtoSJ\Drawings\ET-DWGS\CIVIL\BSJ4C146.dwg, 04/16/2003 12:29:41 PM, TLuna



PLAN





PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
T. LUNA
DRAWN BY
V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

SANTA CLARA
Valley Transportation Authority

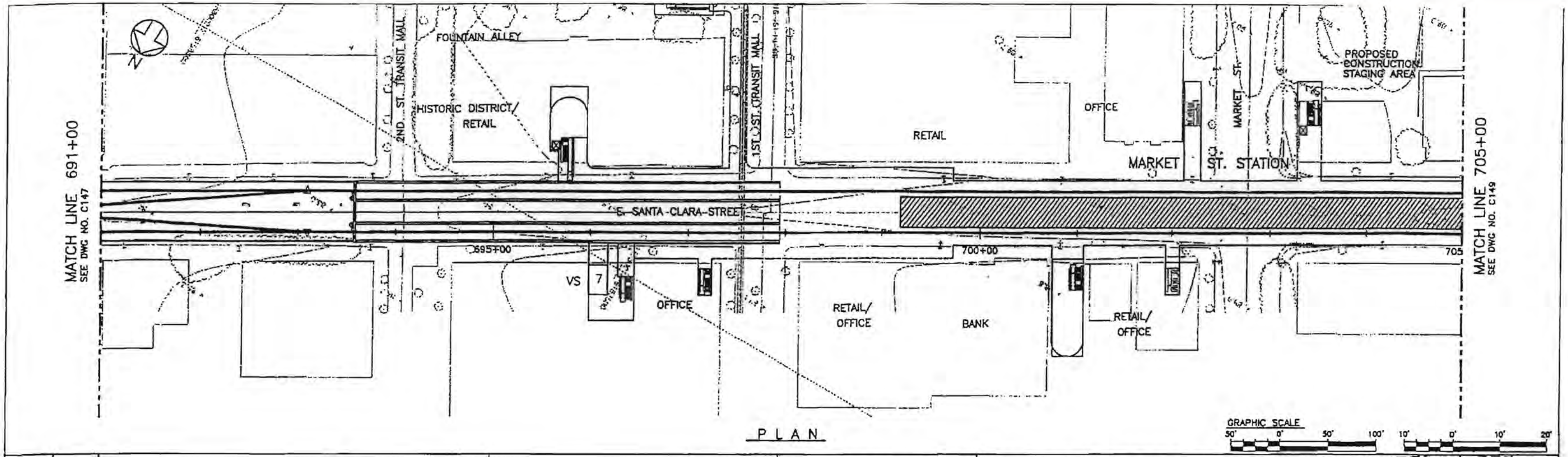
BART EXTENSION TO MILPITAS,
SAN JOSE AND SANTA CLARA

LAND, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

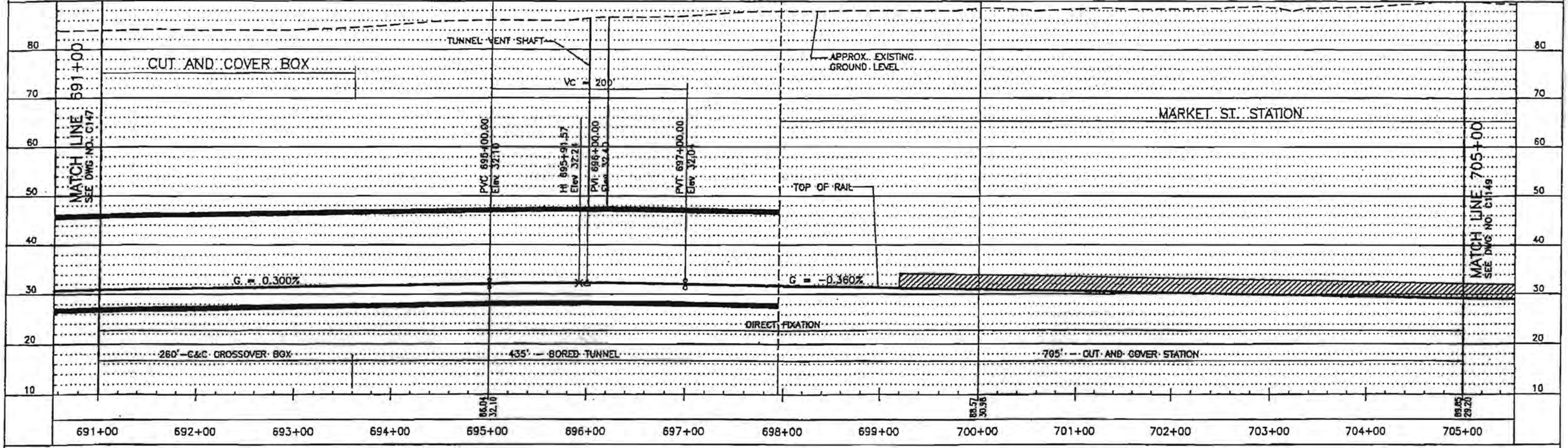
SHEET 47

CADD DATE 11AP03
SCALE: 1"=50'H; 1"=10'V
CADD FILE NO. BSJ4C147.DWG
DWG No. C147
REV 0
PAGE No.

M:\56648-BARTtoSJ\Drawings\ET-DWGS\CIVIL\BSJ4C147.dwg, 04/16/2003 12:30:00 PM, l Luna



PLAN



PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
T. LUNA
DRAWN BY
V. FELIX
CHECKED BY

APPROVED BY

DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

VTA SANTA CLARA Valley Transportation Authority

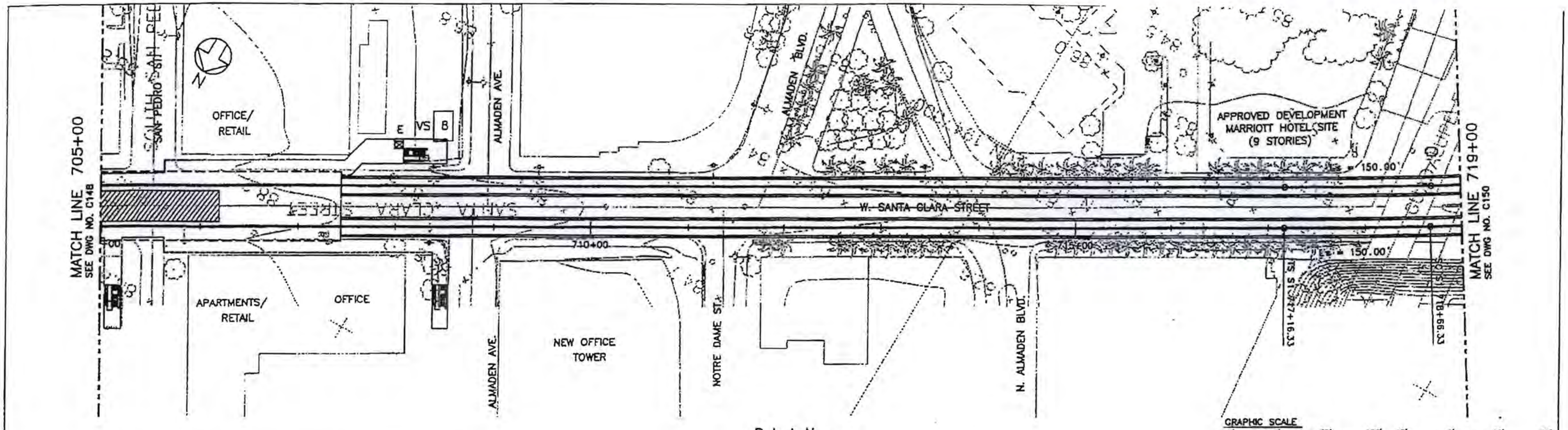
BART EXTENSION TO MILPITAS,
SAN JOSE AND SANTA CLARA

LAND, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

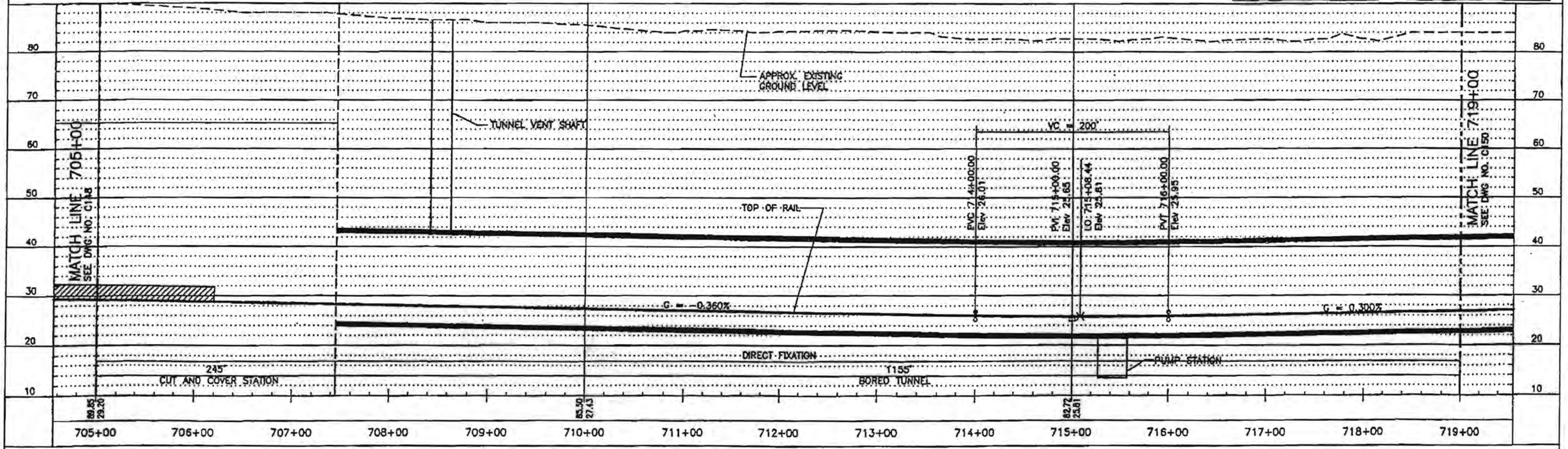
SHEET 48

CADD DATE 11AP03
SCALE 1"=50'H; 1"=10'V
CADD FILE NO. BSJ4C148.DWG
DWG No. C148
REV 0
PAGE No.

M:\56618-BARTtoSJ\Drawings\ET-DWGS\CIVIL\BSJ4C148.dwg, 04/16/2003 12:30:15 PM, TLuna



PLAN



PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY T. LUNA
DRAWN BY V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A TYCO INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

VTA SANTA CLARA Valley Transportation Authority

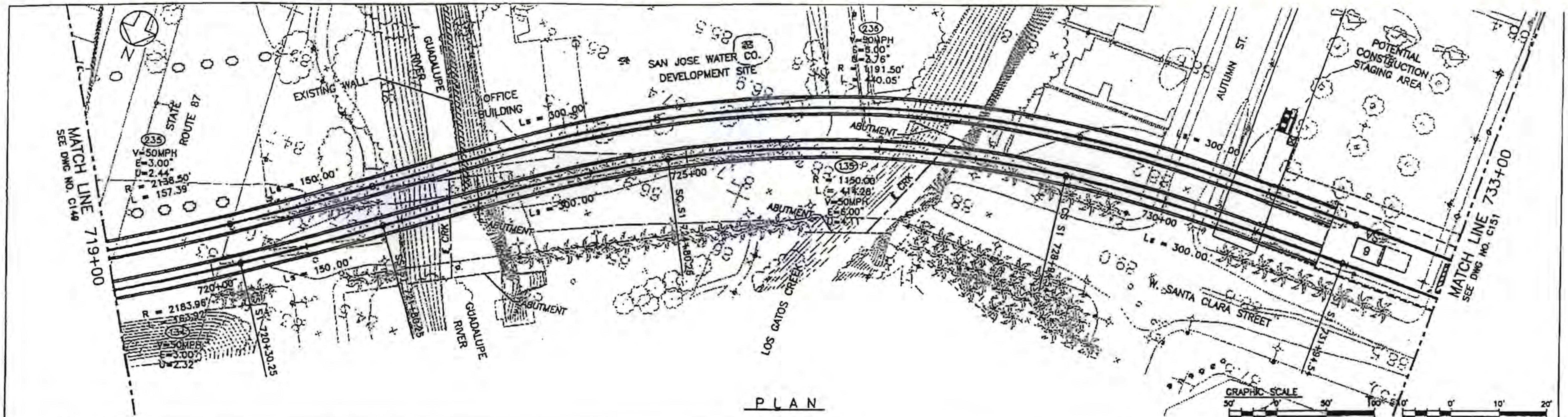
BART EXTENSION TO MILPITAS,
SAN JOSE AND SANTA CLARA

LINE, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

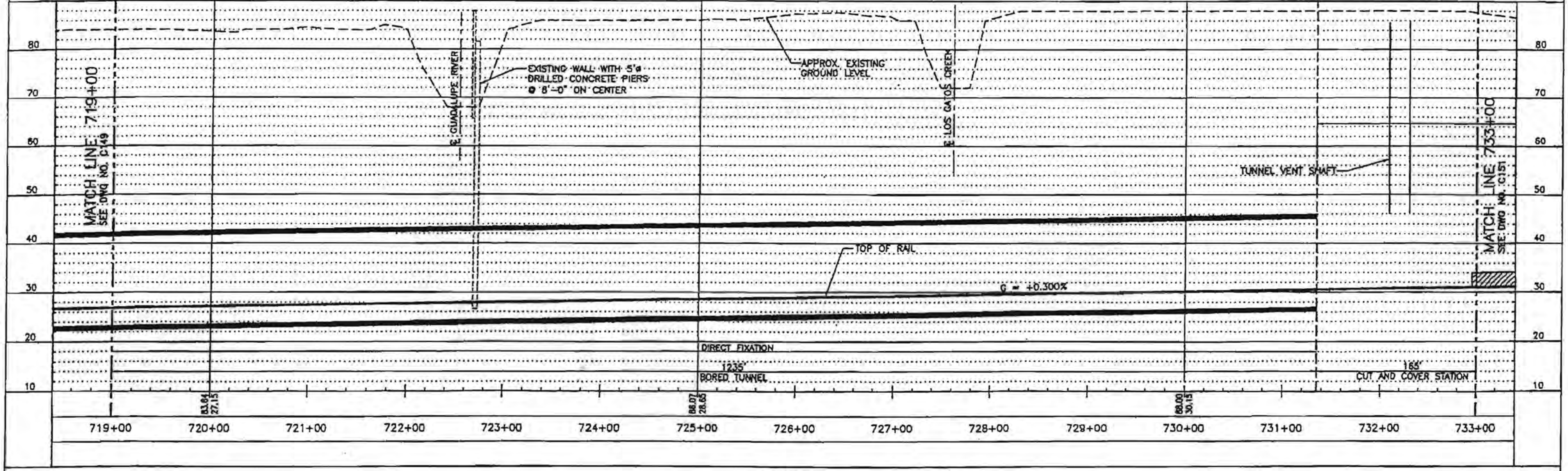
SHEET 49

CADD DATE 11AP03
SCALE: 1"=50'H; 1"=10'V
CADD FILE NO. BSJ4C149.DWG
DWG No. C149
REV 0
PAGE No.

I:\55648-BARTtoSJ\Drawings\ET-DWGS\CIVIL\BSJ4C149.dwg, 04/16/2003 12:30:32 PM, TLuna



PLAN



PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
T. LUNA
DRAWN BY
V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

SANTA CLARA
Valley Transportation Authority

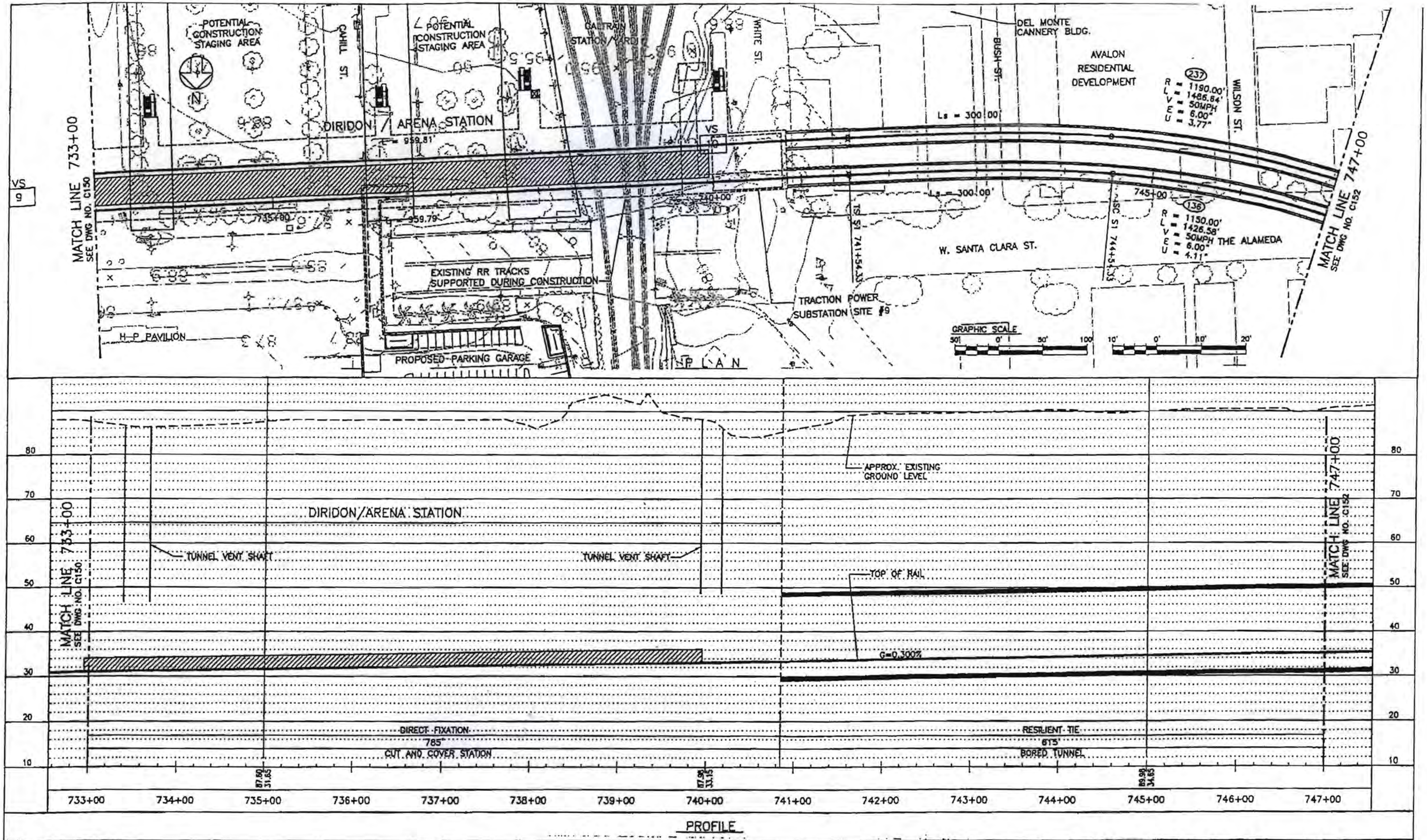
BART EXTENSION TO MILPITAS,
SAN JOSE AND SANTA CLARA

LINE, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

SHEET 50

CADD DATE 07AP03
SCALE 1"=50'H; 1"=10'V
CADD FILE NO. BSJ4C150.DWG
DWG No. C150
REV 0
PAGE No.

M:\56648-BARTtoSJ\Drawings\ET-DWGS\CIVIL\BSJ4C150.dwg, 04/16/2003 12:30:53 PM, TLuna



56640-BART\c63\Drawings\ET-DWGS\CIVIL\BSJ4C151.dwg, 04/16/2003 12:31:11 PM, TLuna

DESIGNED BY
T. LUNA
DRAWN BY
V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A TYCO INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

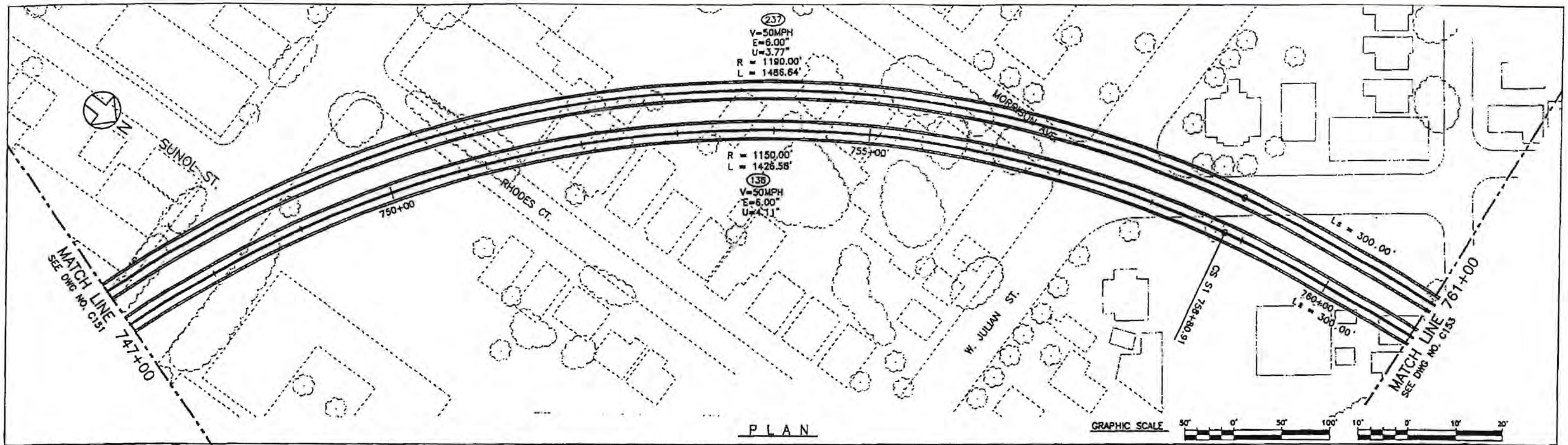
SANTA CLARA
Valley Transportation Authority

BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

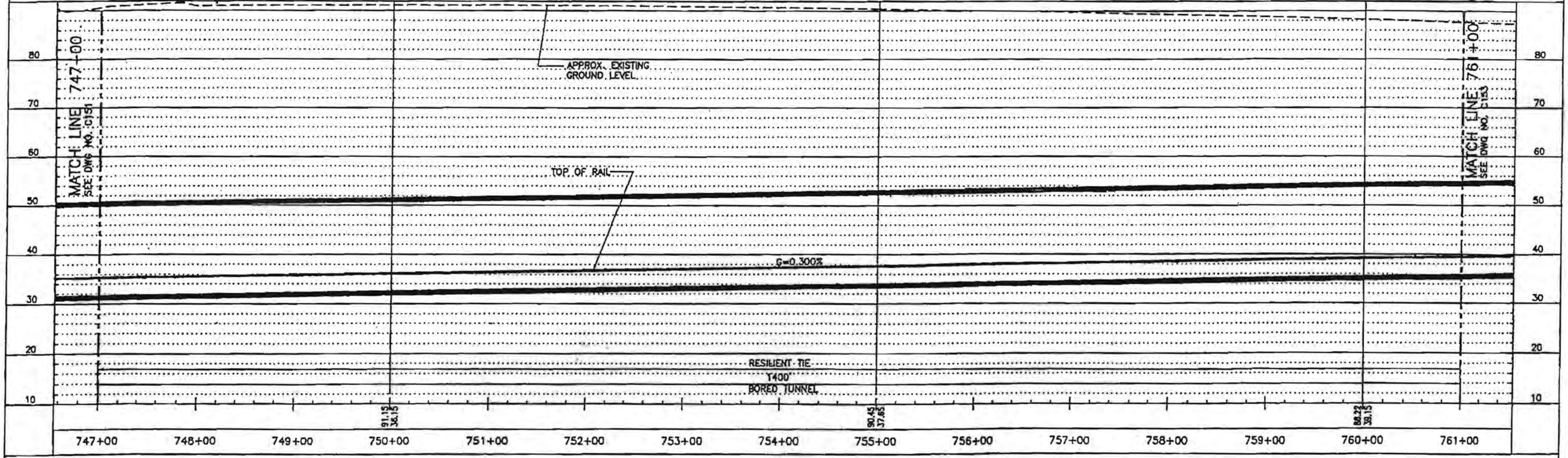
LINE, TRACKWORK AND SYSTEMS PLAN AND PROFILE

SHEET 51

CADD DATE	08AP03
SCALE	1"=50'H; 1"=10'V
CADD FILE NO.	BSJ4C151.DWG
DWG No.	C151
REV	0
PAGE No.	



PLAN



PROFILE

DESIGNED BY
T. LUNA
DRAWN BY
V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

VTA SANTA CLARA Valley Transportation Authority

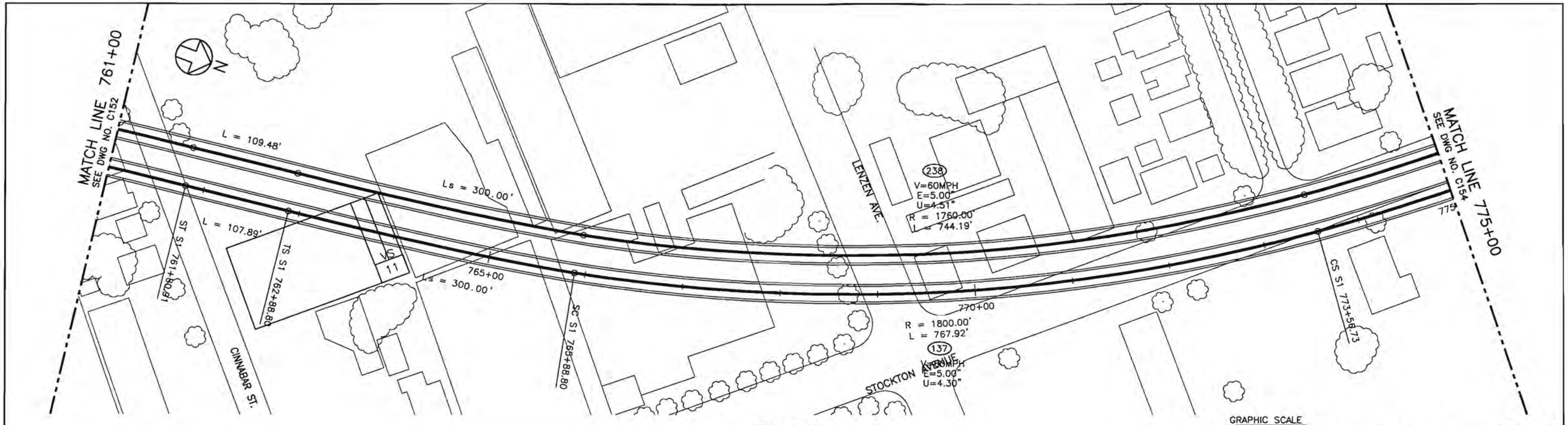
BART EXTENSION TO MILPITAS,
SAN JOSE AND SANTA CLARA

LINE, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

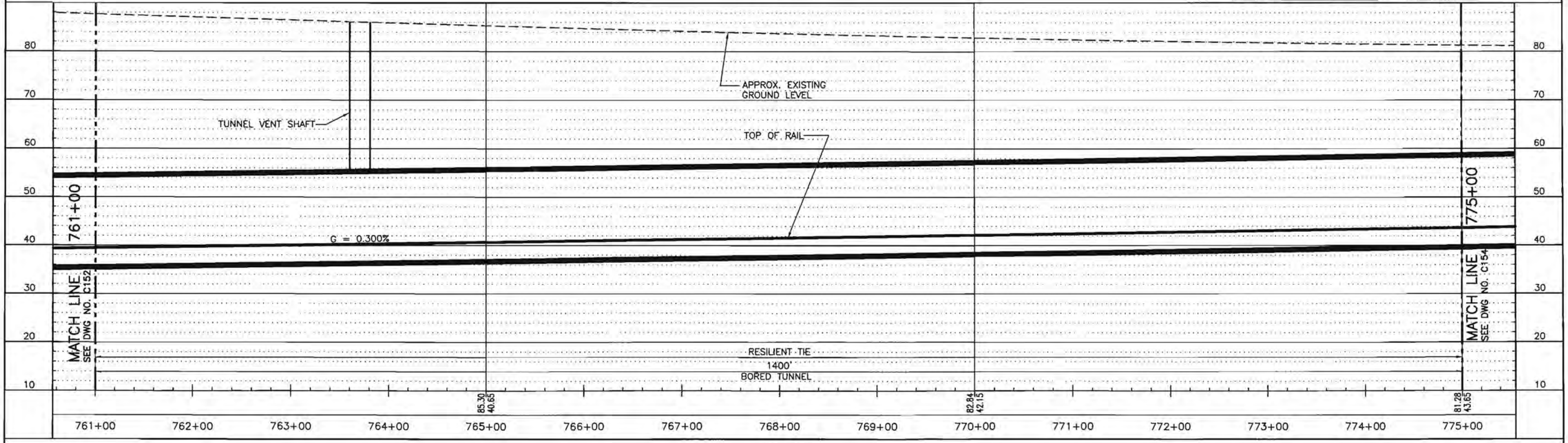
SHEET 52

CADD DATE 11AP03
SCALE 1"=50'H; 1"=10'V
CADD FILE NO. BSJ4C152.DWG
DWG No. C152
REV 0
PAGE No.

56648-BART(oeS7)\Drawings\ET-DWGS\CIVIL\BSJ4C152.dwg, 04/18/2003 12:31:28 PM, TLuna



PLAN



PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY T. LUNA
DRAWN BY V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

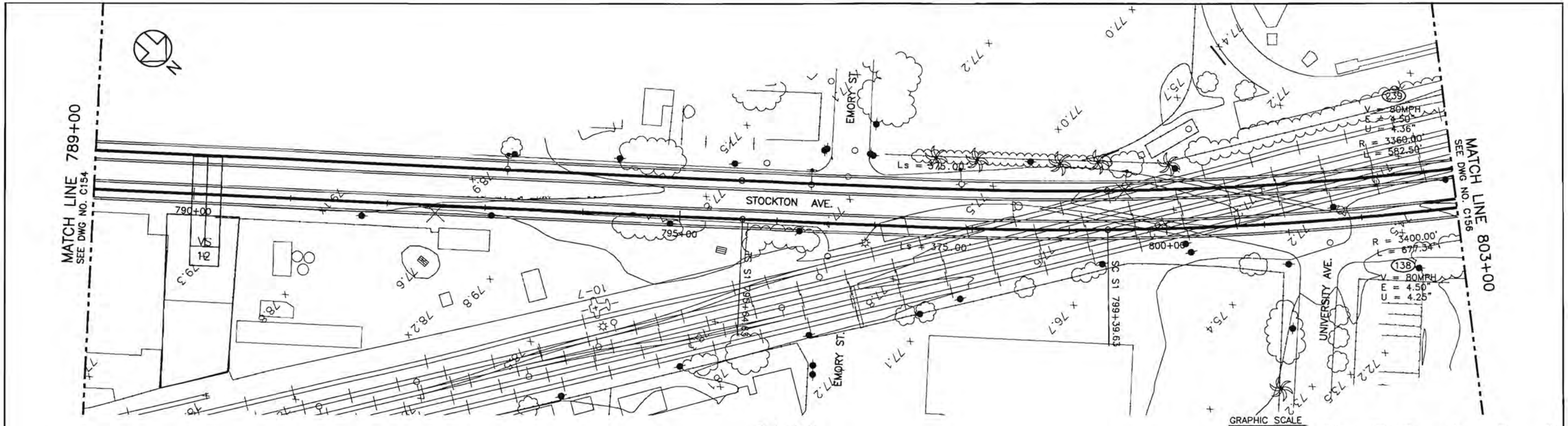
SANTA CLARA
Valley Transportation Authority

**BART EXTENSION TO MILPITAS,
SAN JOSE AND SANTA CLARA**

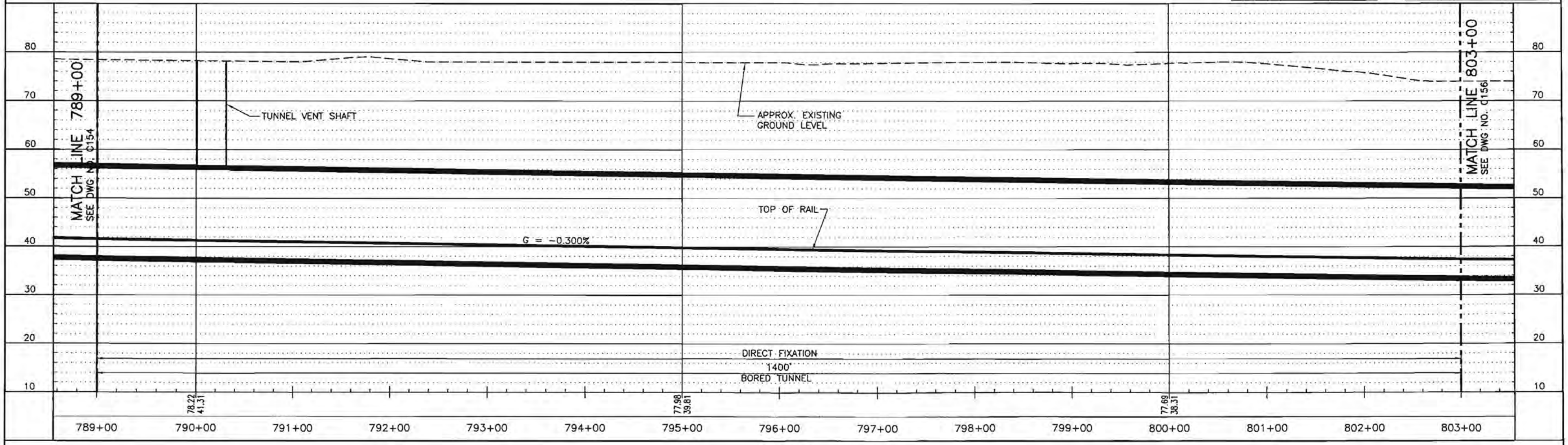
LINE, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

SHEET 53

CADD DATE 31MR03
SCALE: 1"=50'H; 1"=10'V
CADD FILE NO. BSJ4C153.DWG
DWG No: C153
REV 0
PAGE No.



PLAN



PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY T. LUNA
DRAWN BY V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

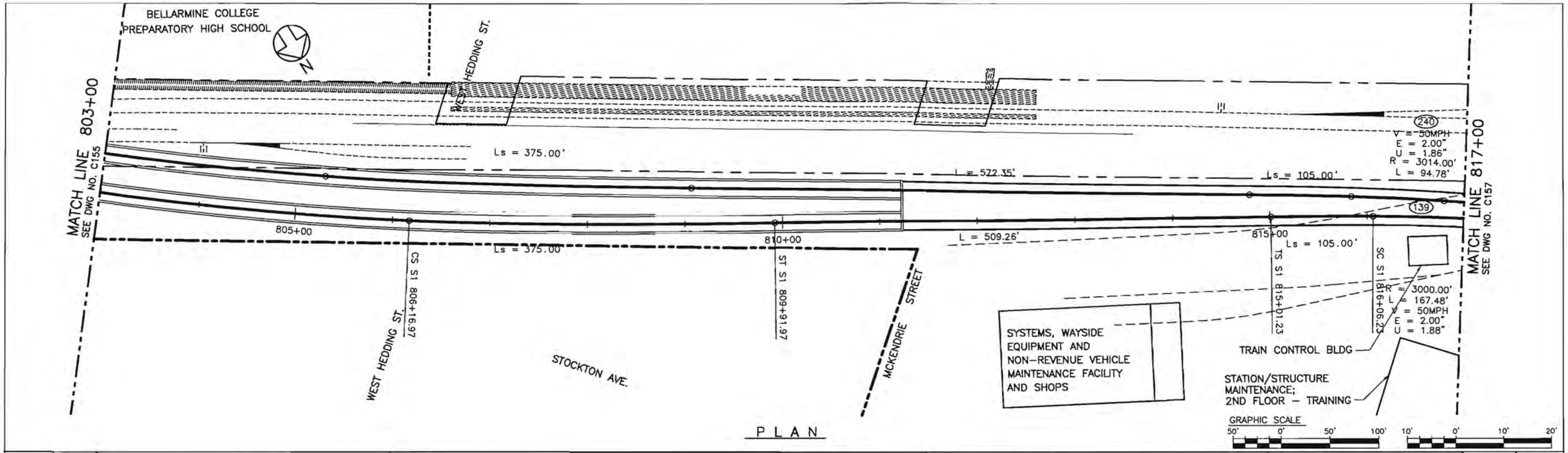
SANTA CLARA
Valley Transportation Authority

BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

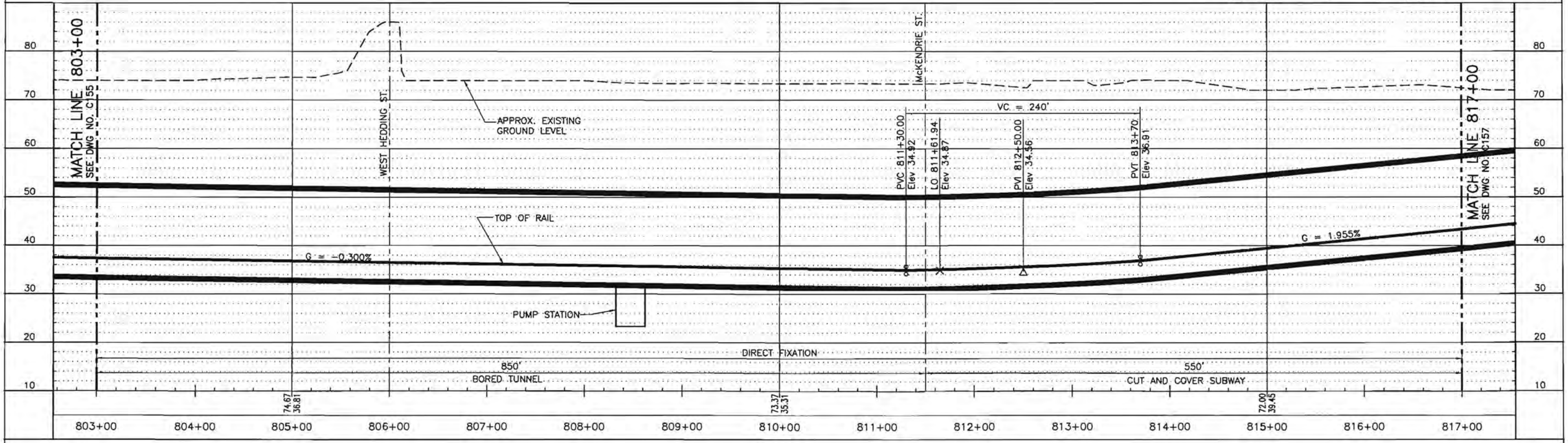
LINE, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

SHEET 55

CADD DATE 11AP03
SCALE: 1"=50'H; 1"=10'V
CADD FILE NO. BSJ4C155.DWG
DWG No: C155
REV 0
PAGE No.



PLAN



PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY T. LUNA
DRAWN BY V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

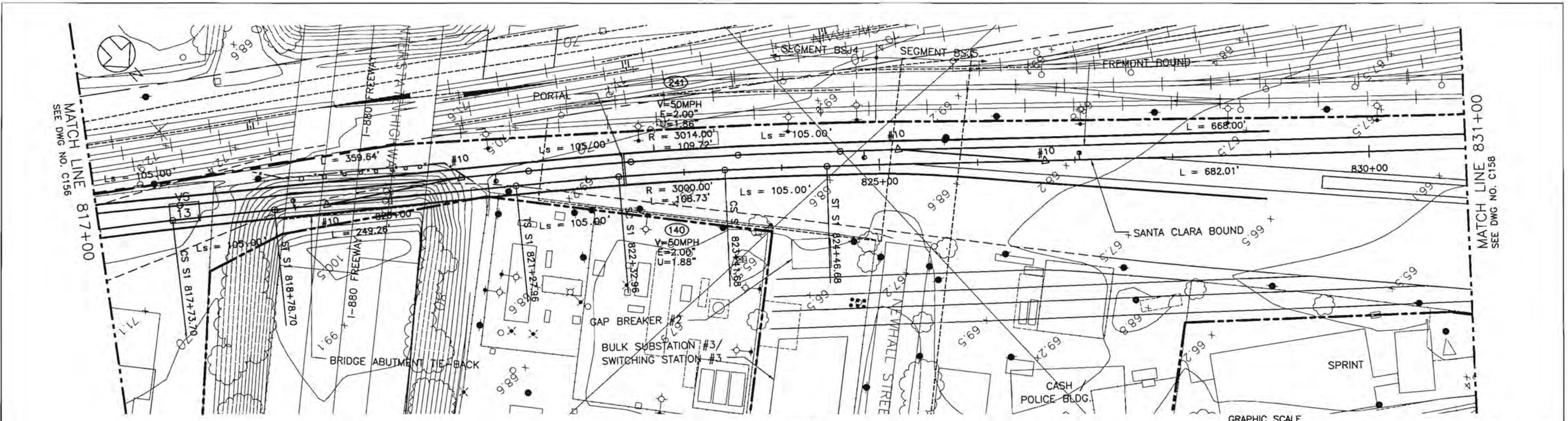
SANTA CLARA
Valley Transportation Authority

BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

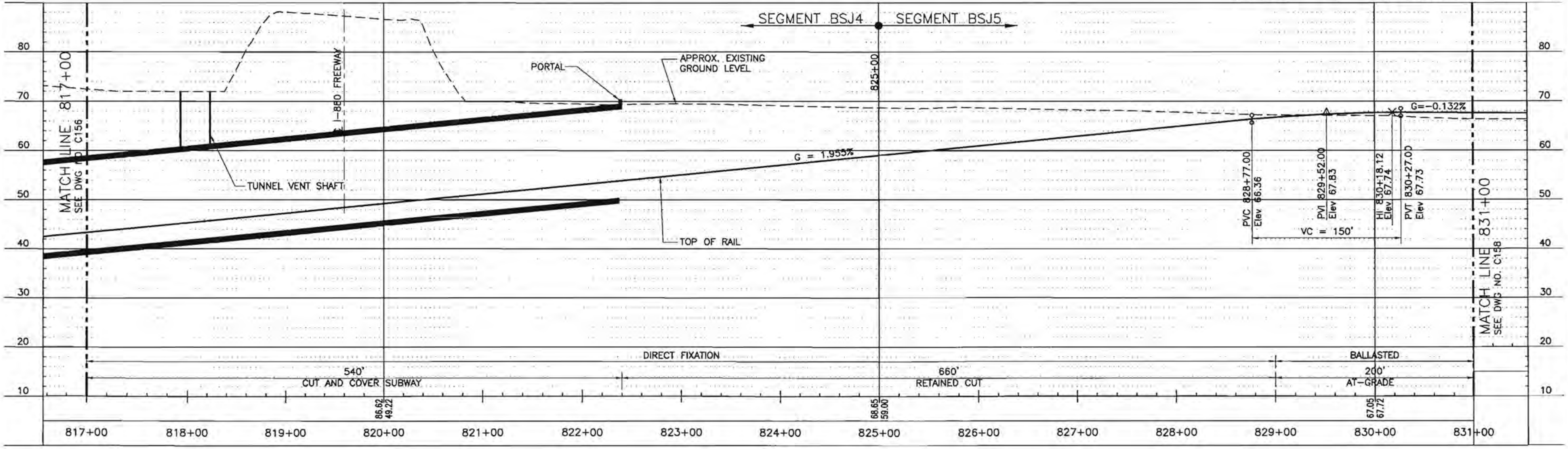
LINE, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

SHEET 56

CADD DATE 11AP03
SCALE: 1"=50'H; 1"=10'V
CADD FILE NO. BSJ4C156.DWG
DWG No: C156
REV 0
PAGE No.



PLAN



PROFILE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
T. LUNA
DRAWN BY
V. FELIX
CHECKED BY
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

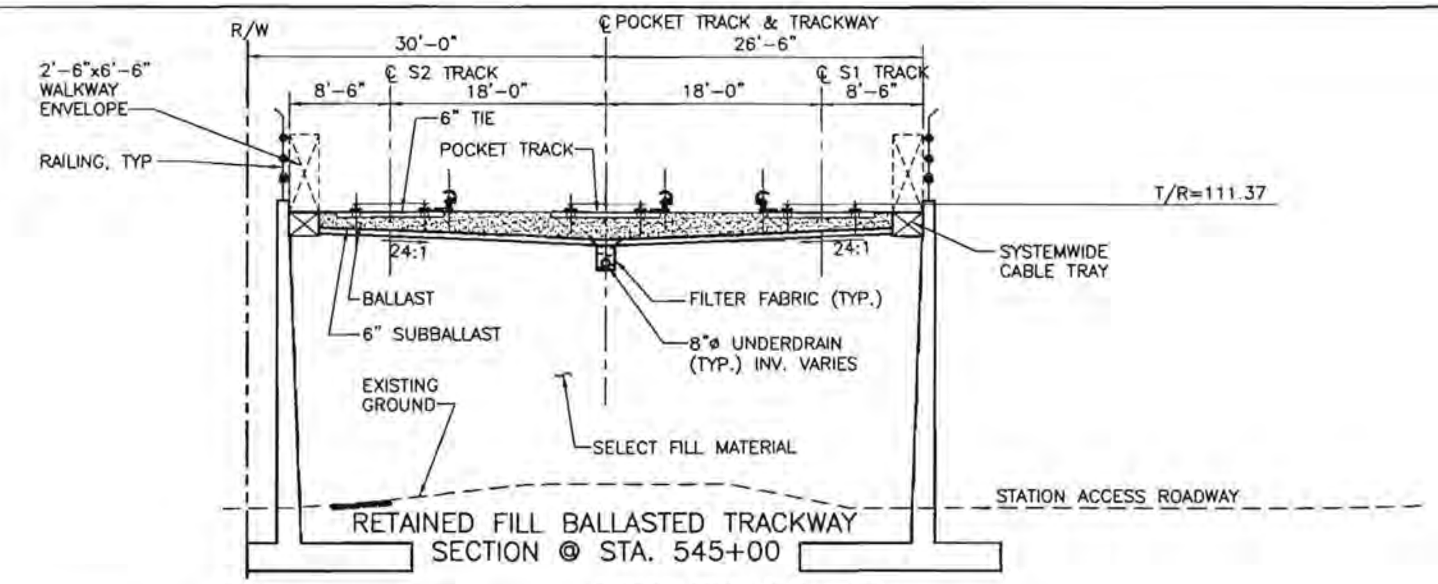
SANTA CLARA
Valley Transportation Authority

BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

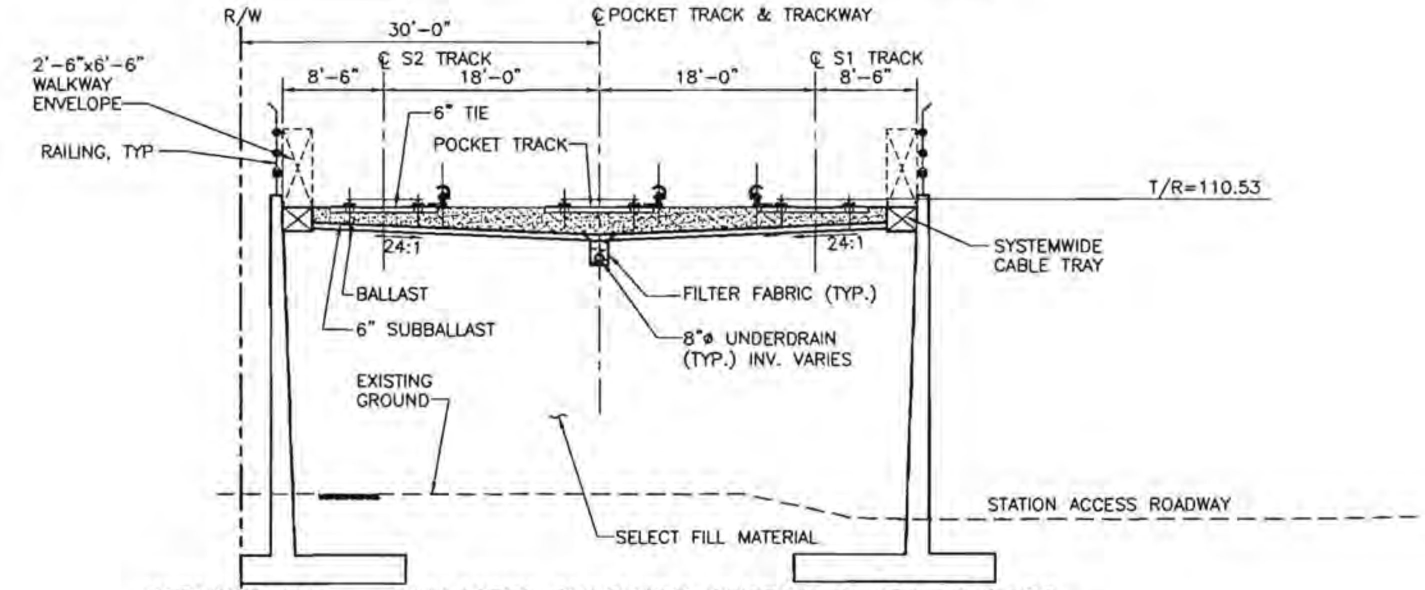
LINE, TRACKWORK AND SYSTEMS
PLAN AND PROFILE

SHEET 57

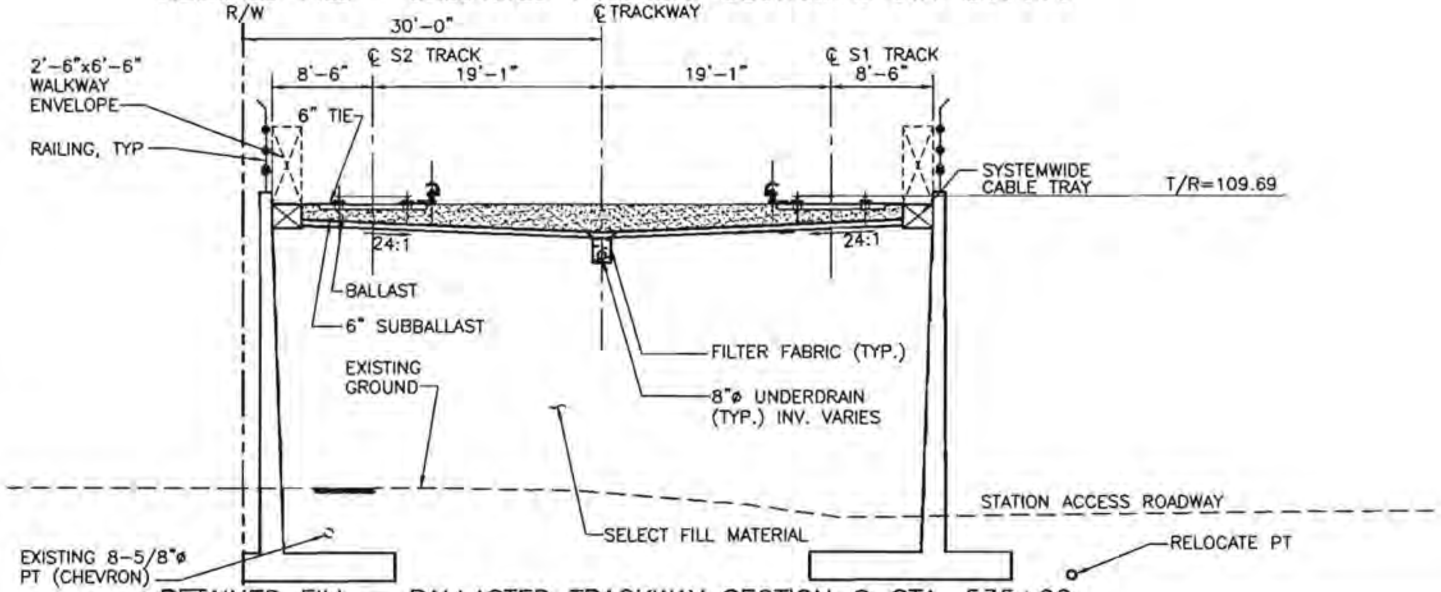
CADD DATE: 11AP03
SCALE: 1"=50'H; 1"=10'V
CADD FILE NO. BSJ4C157.DWG
DWG No: C157
REV: 0
PAGE No.



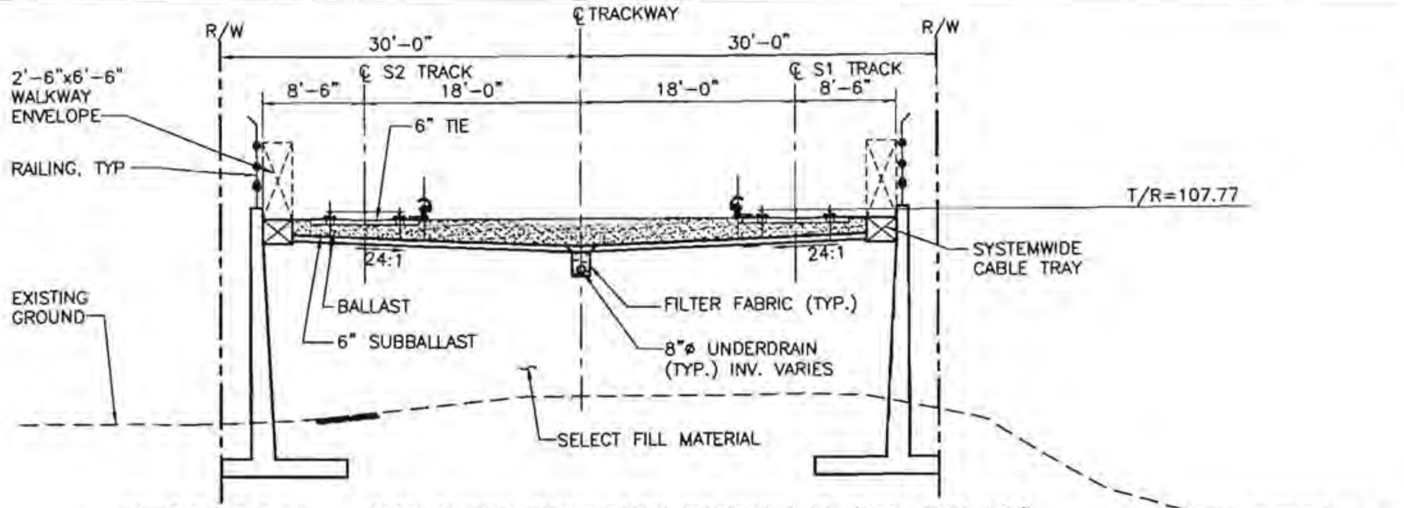
RETAINED FILL BALLASTED TRACKWAY SECTION @ STA. 545+00



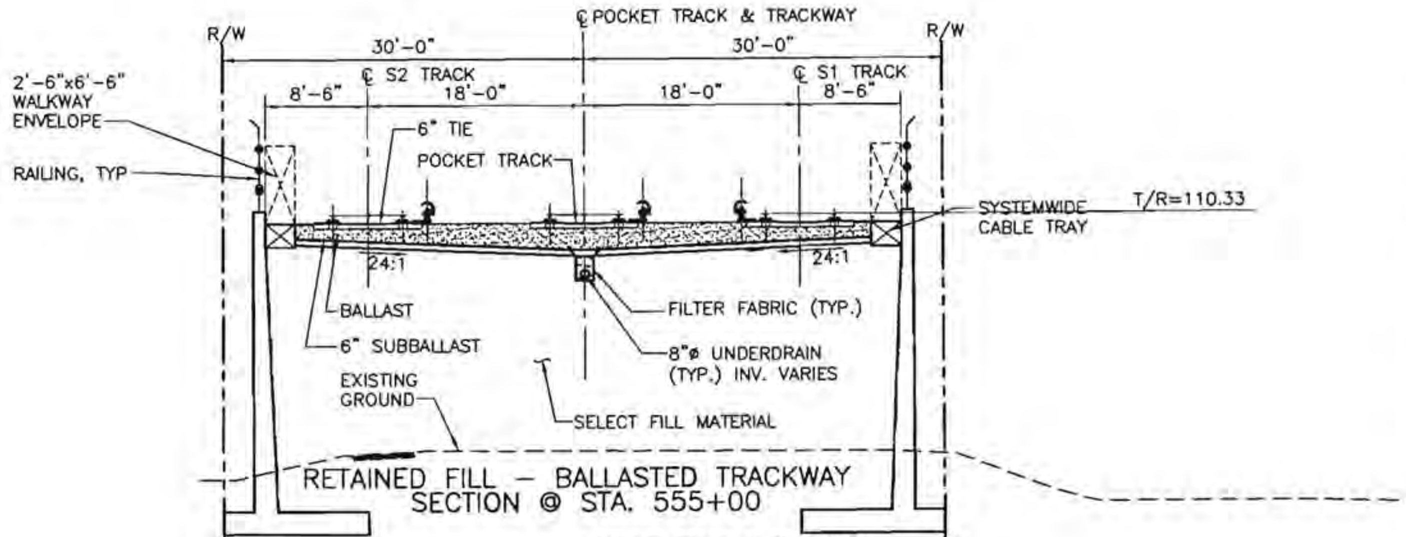
RETAINED FILL – BALLASTED TRACKWAY SECTION @ STA. 540+00



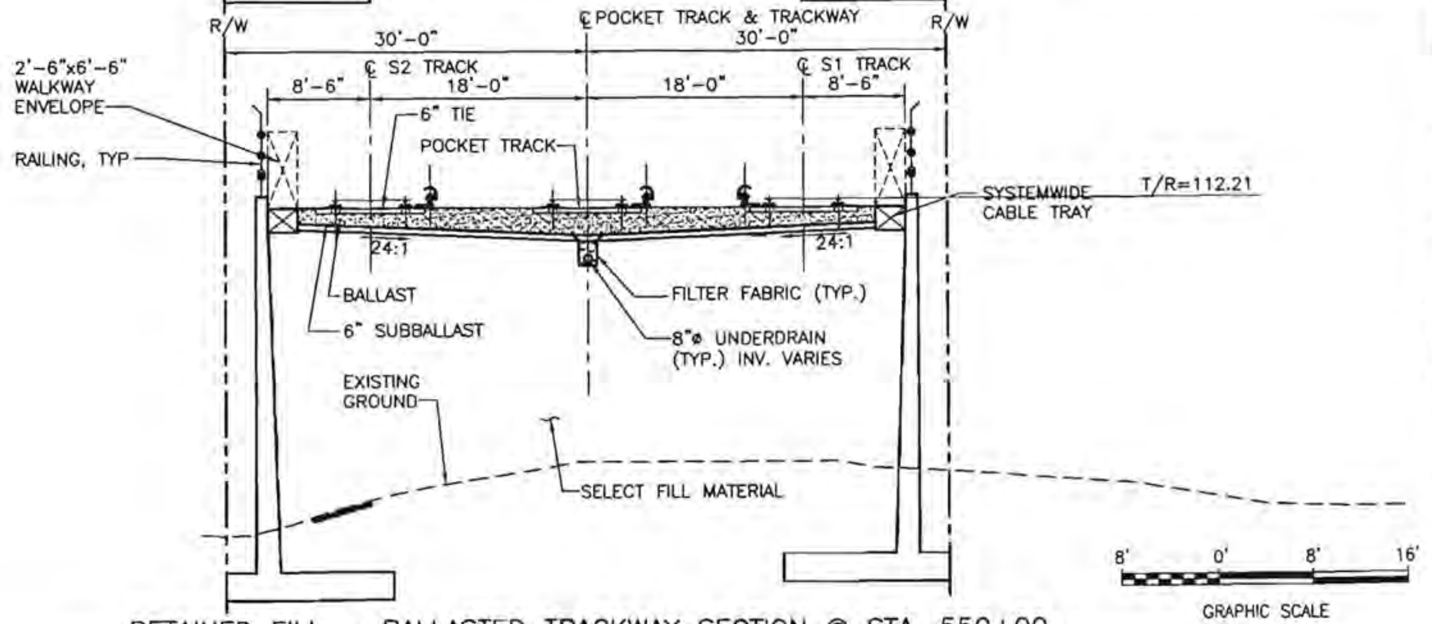
RETAINED FILL – BALLASTED TRACKWAY SECTION @ STA. 535+00



RETAINED FILL – BALLASTED TRACKWAY SECTION @ STA. 560+00



RETAINED FILL – BALLASTED TRACKWAY SECTION @ STA. 555+00



RETAINED FILL – BALLASTED TRACKWAY SECTION @ STA. 550+00

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
B. LEVERIZA
DRAWN BY
V. FELIX
CHECKED BY
J. MAHER
APPROVED BY

DATE

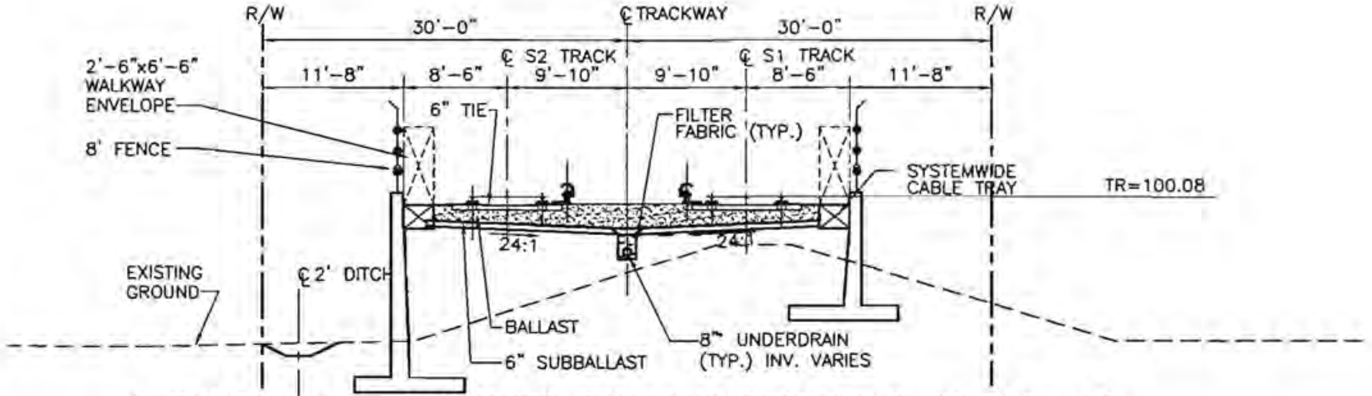
EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

VTA SANTA CLARA Valley Transportation Authority

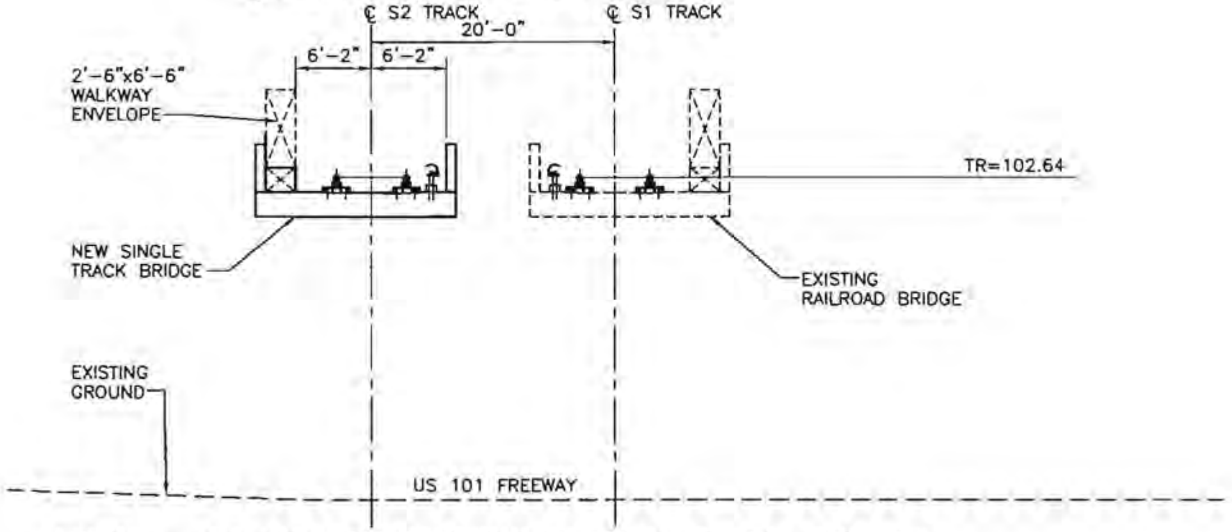
BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

LINE, TRACKWORK AND SYSTEMS
CROSS SECTIONS
STATION 535+00 TO 560+00
SHEET 17

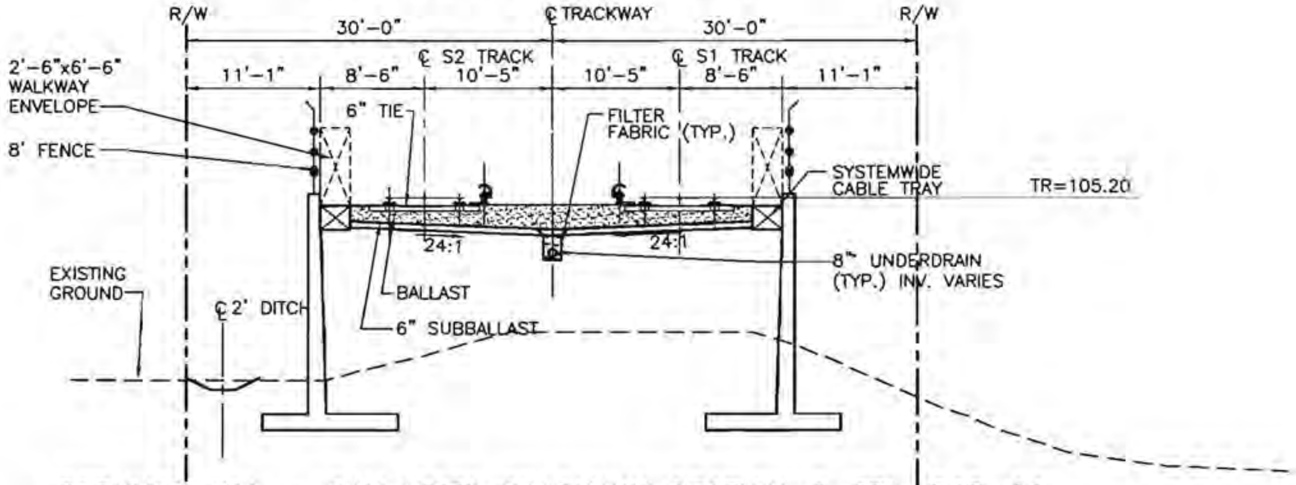
CADD DATE 30MR03
SCALE: 1/8"=1'-0"
CADD FILE NO. BSJ1C190.DWG
DWG No. C190
REV 0
PAGE No.



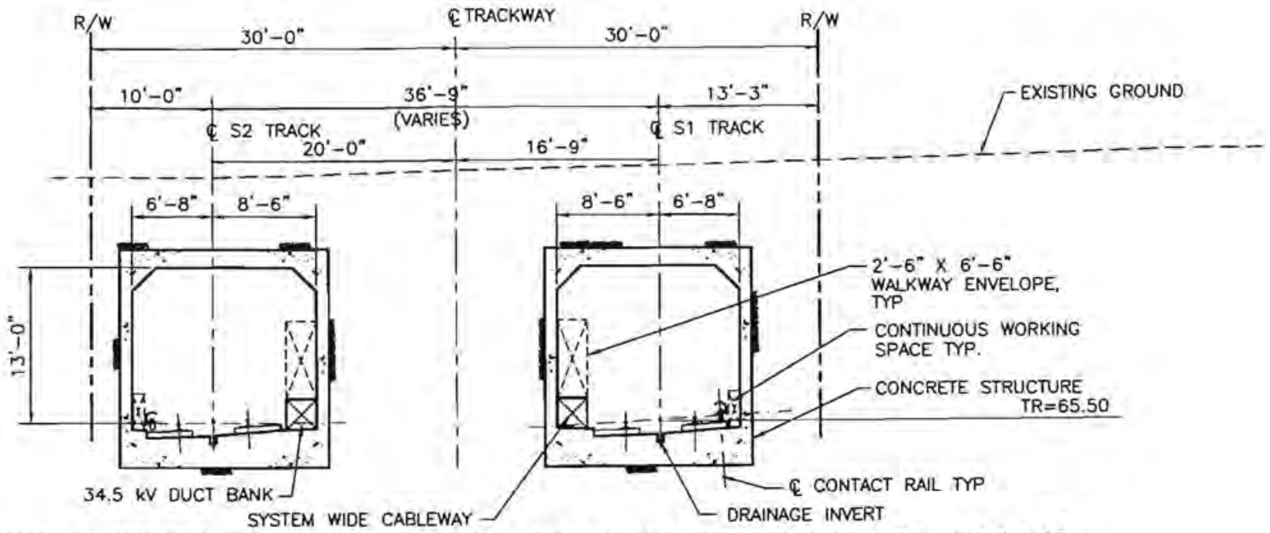
RETAINED FILL – BALLASTED TRACKWAY SECTION @ STA. 575+00
(RAILROAD / 28TH ST. OPTION)



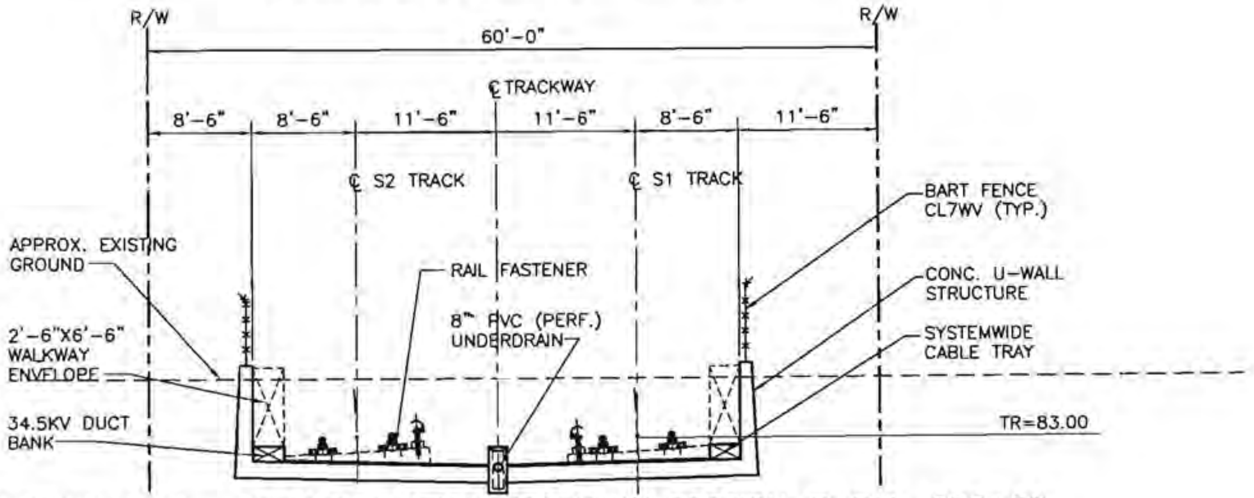
AERIAL – BALLASTED TRACKWAY SECTION @ STA. 570+00
(RAILROAD / 28TH ST. OPTION)



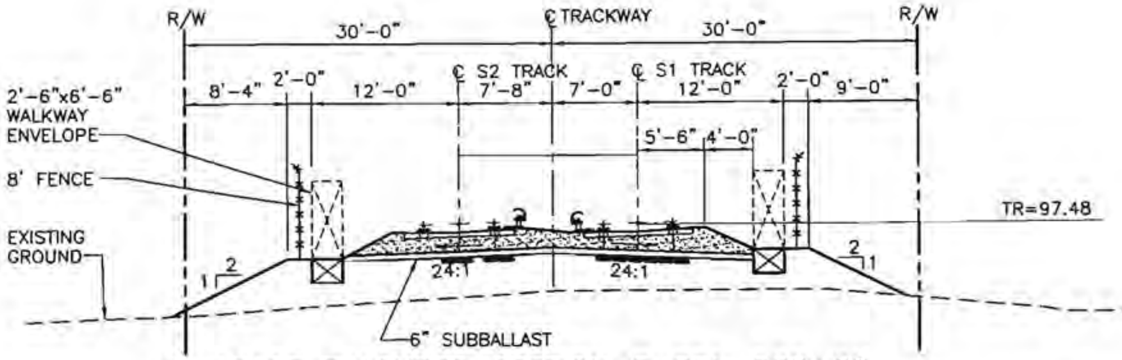
RETAINED FILL – BALLASTED TRACKWAY SECTION @ STA. 565+00
(RAILROAD / 28TH ST. OPTION)



CUT & COVER – DIRECT FIXATION TRACKWAY SECTION @ STA. 590+00
(RAILROAD / 28TH ST. OPTION)



RETAINED CUT – DIRECT FIXATION TRACKWAY SECTION @ STA. 585+00
(RAILROAD / 28TH ST. OPTION)



AT-GRADE TRACKBED SECTION @ STA. 580+00
(RAILROAD / 28TH ST. OPTION)

8' 0' 8' 16'
GRAPHIC SCALE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
B. LEVERIZA
DRAWN BY
V. FELIX
CHECKED BY
J. MAHER
APPROVED BY

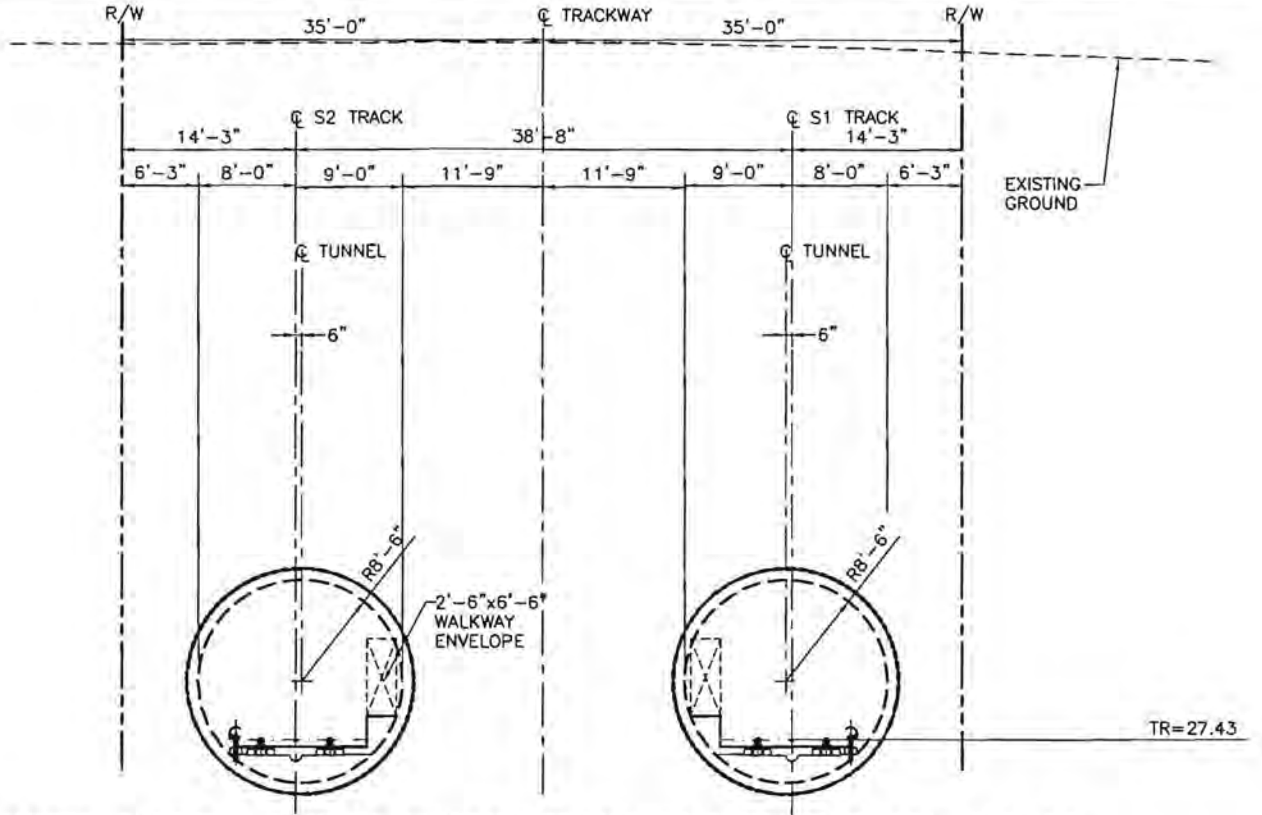
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

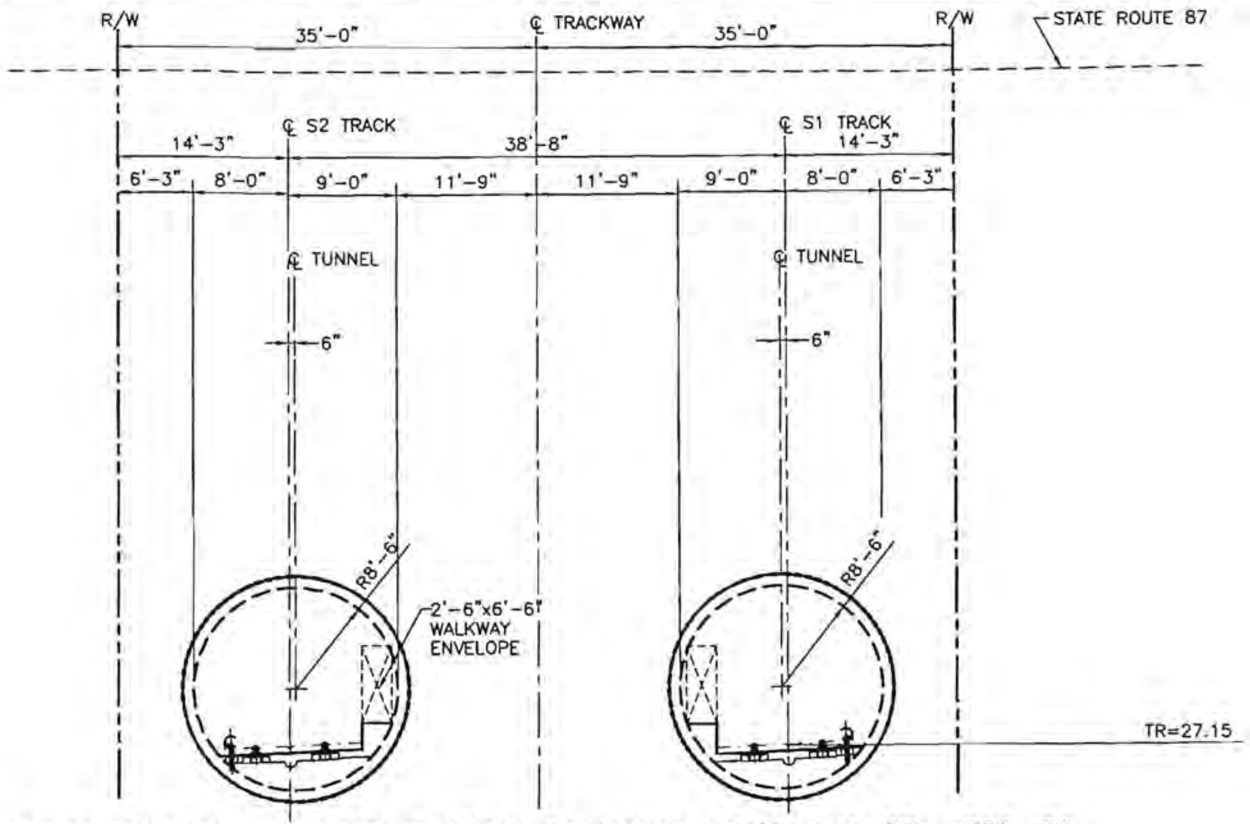
VTA SANTA CLARA Valley Transportation Authority

BART EXTENSION TO MILPITAS,
SAN JOSE AND SANTA CLARA
LINE, TRACKWORK AND SYSTEMS
CROSS SECTIONS
STATION 565+00 TO 590+00
SHEET 18

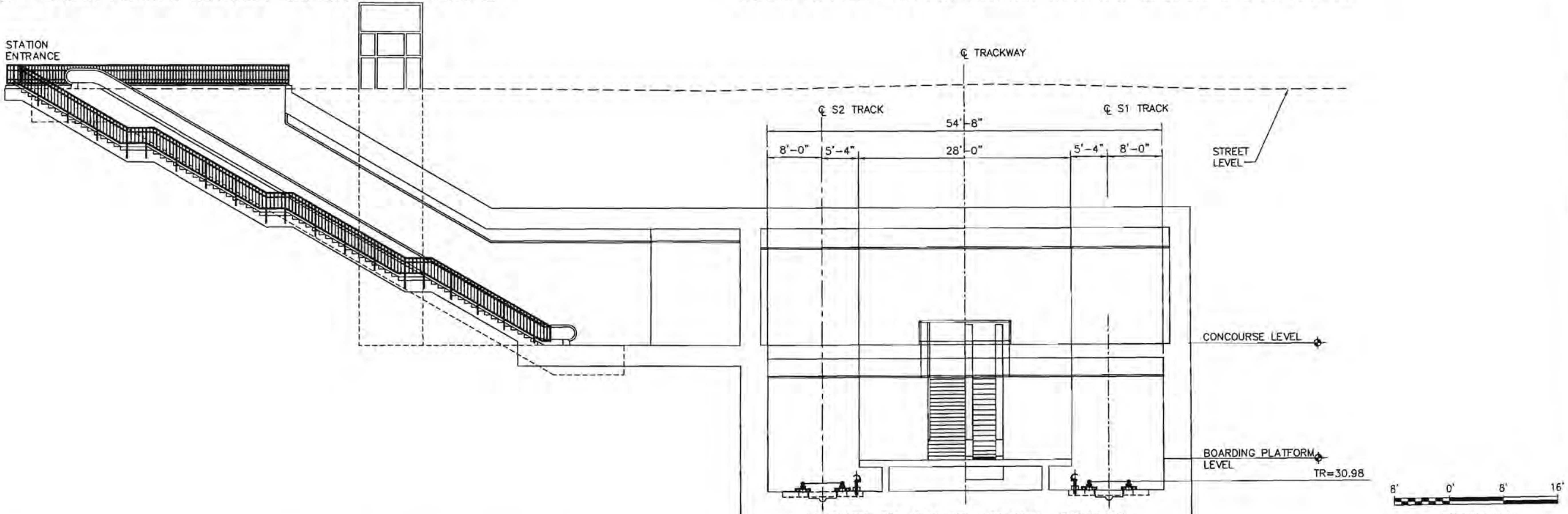
CADD DATE 30MR03
SCALE: 1/8"=1'-0"
CADD FILE NO. BSJ1C191.DWG
DWG No: C191
REV 0
PAGE No.



BORED TUNNEL – DIRECT FIXATION TRACKWAY SECTION @ STA. 710+00



BORED TUNNEL – DIRECT FIXATION TRACKWAY SECTION @ STA. 720+00



MARKET ST. STATION @ STA. 700+00

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY B. LEVERIZA
DRAWN BY V. FELIX
CHECKED BY J. MAHER
APPROVED BY
DATE

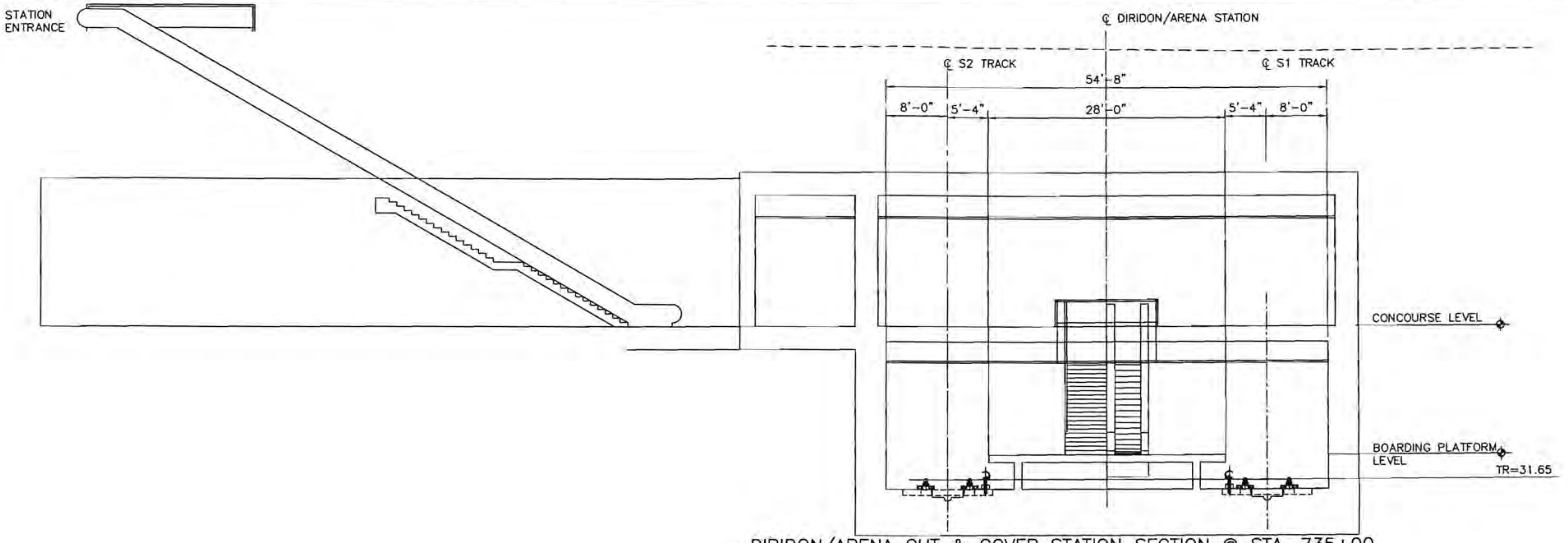
EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

SANTA CLARA Valley Transportation Authority

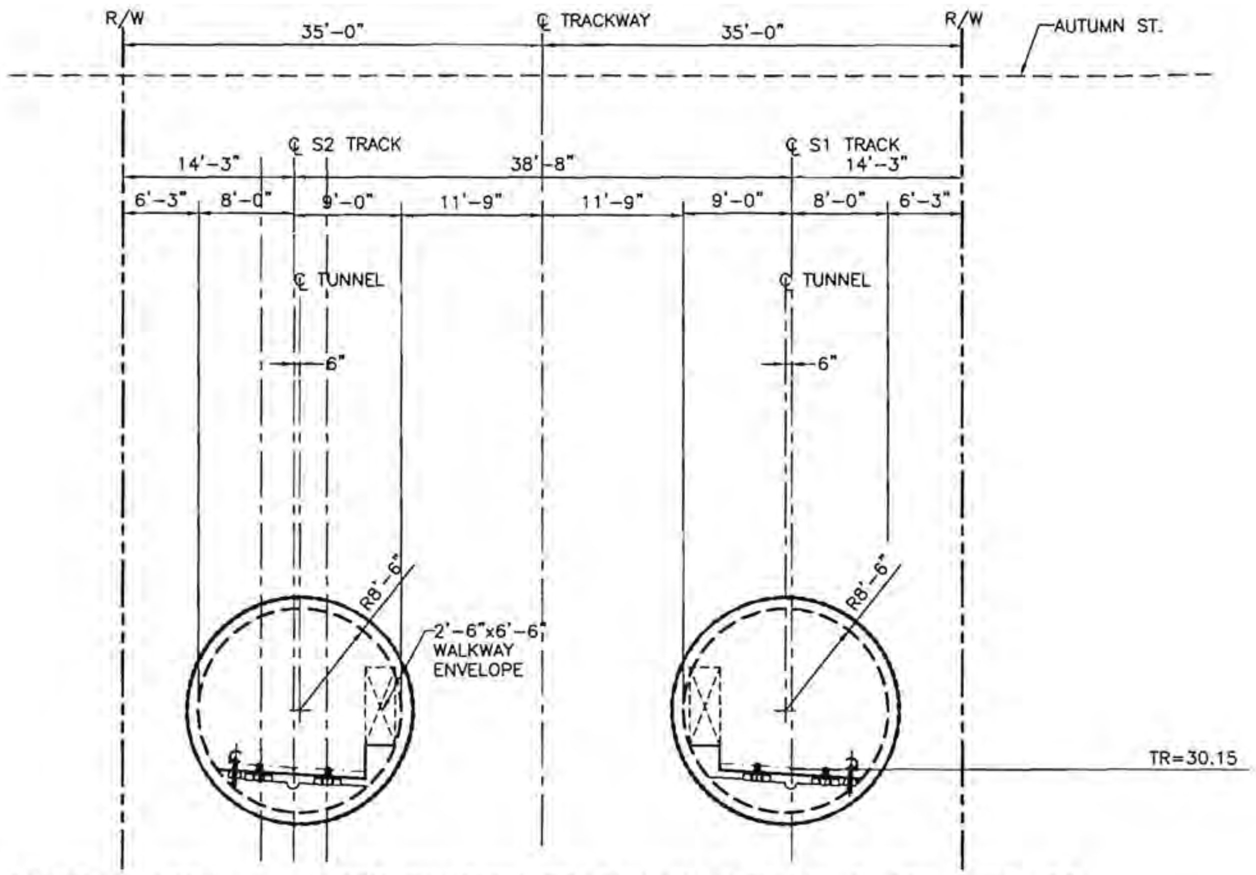
BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

LINE, TRACKWORK AND SYSTEMS
CROSS SECTIONS
STATION 700+00 TO 720+00
SHEET 23

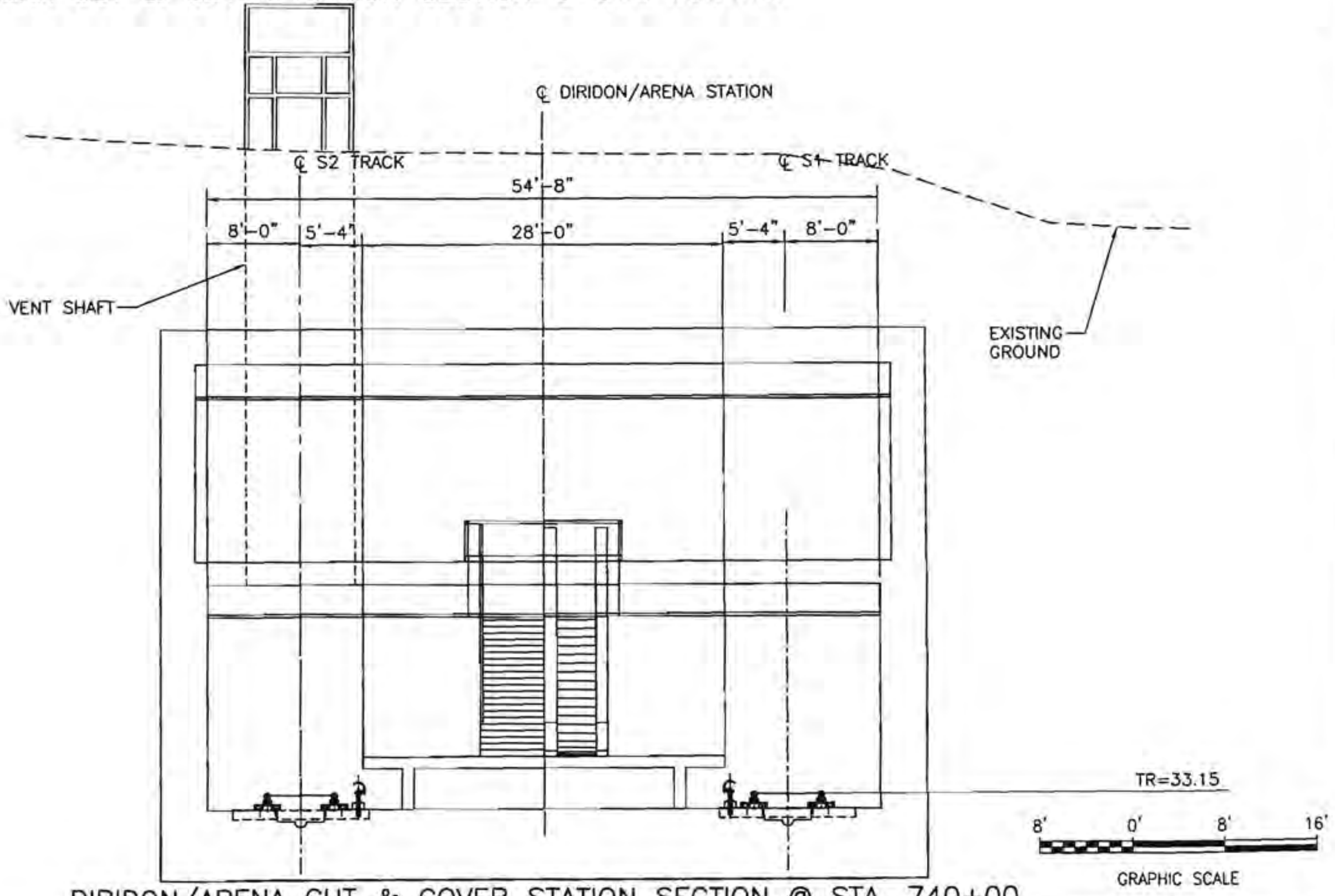
CADD DATE 30MR03
SCALE: 1/8"=1'–0"
CADD FILE NO. BSJ1C196.DWG
DWG No: C196
REV 0
PAGE No.



DIRIDON/ARENA CUT & COVER STATION SECTION @ STA. 735+00



BORED TUNNEL – DIRECT FIXATION TRACKWAY SECTION @ STA. 730+00



DIRIDON/ARENA CUT & COVER STATION SECTION @ STA. 740+00

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
B. LEVERIZA
DRAWN BY
V. FELIX
CHECKED BY
J. MAHER
APPROVED BY
DATE

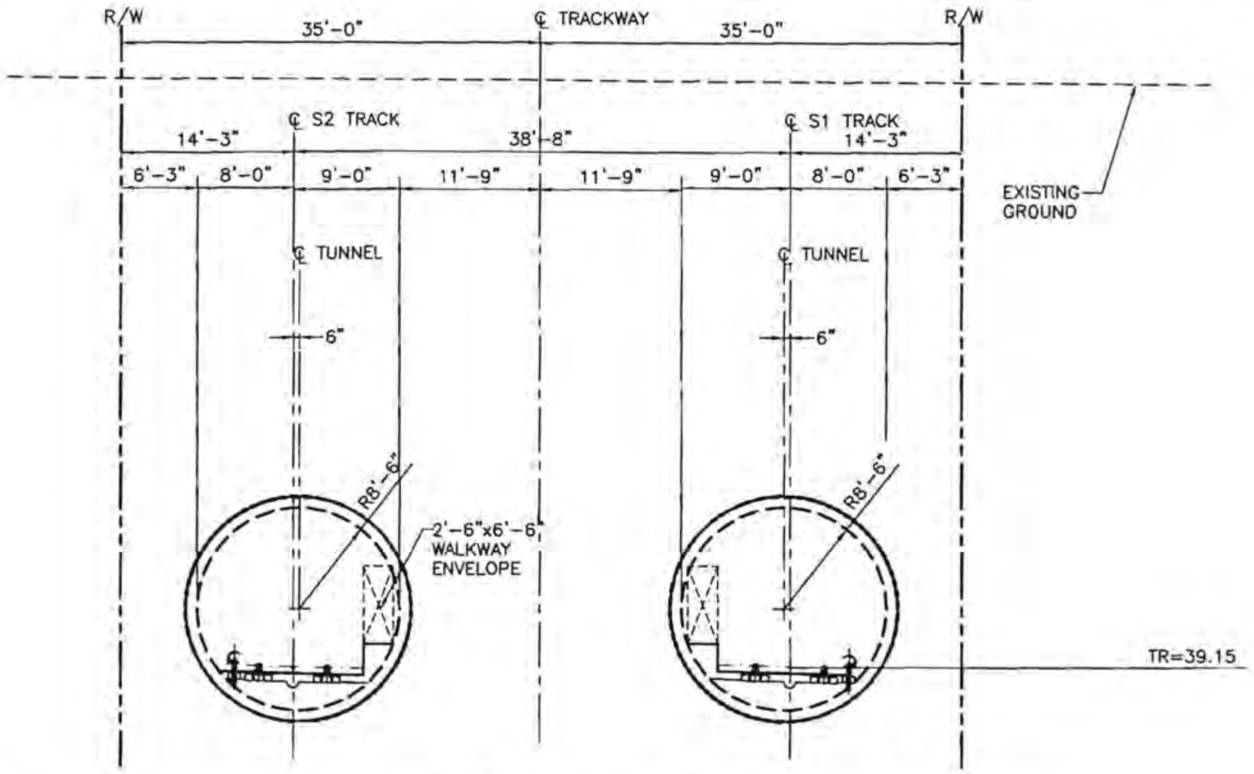
EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

VTA SANTA CLARA Valley Transportation Authority

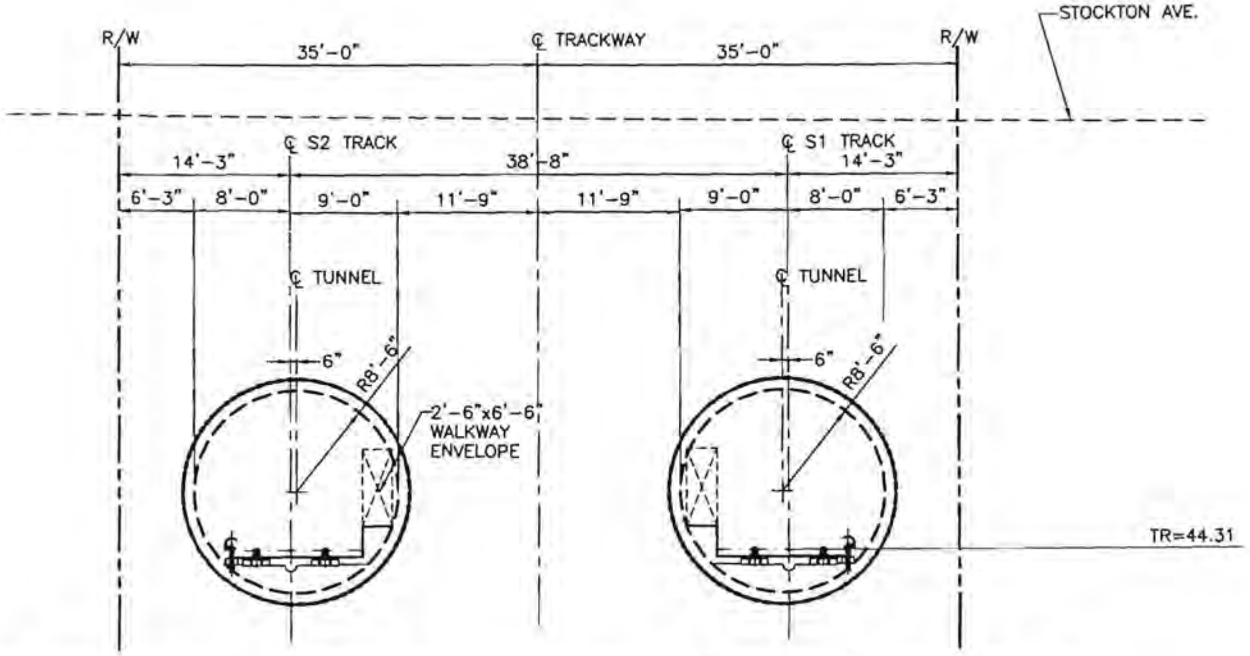
BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

LINE, TRACKWORK AND SYSTEMS
CROSS SECTIONS
STATION 730+00 TO 740+00
SHEET 24

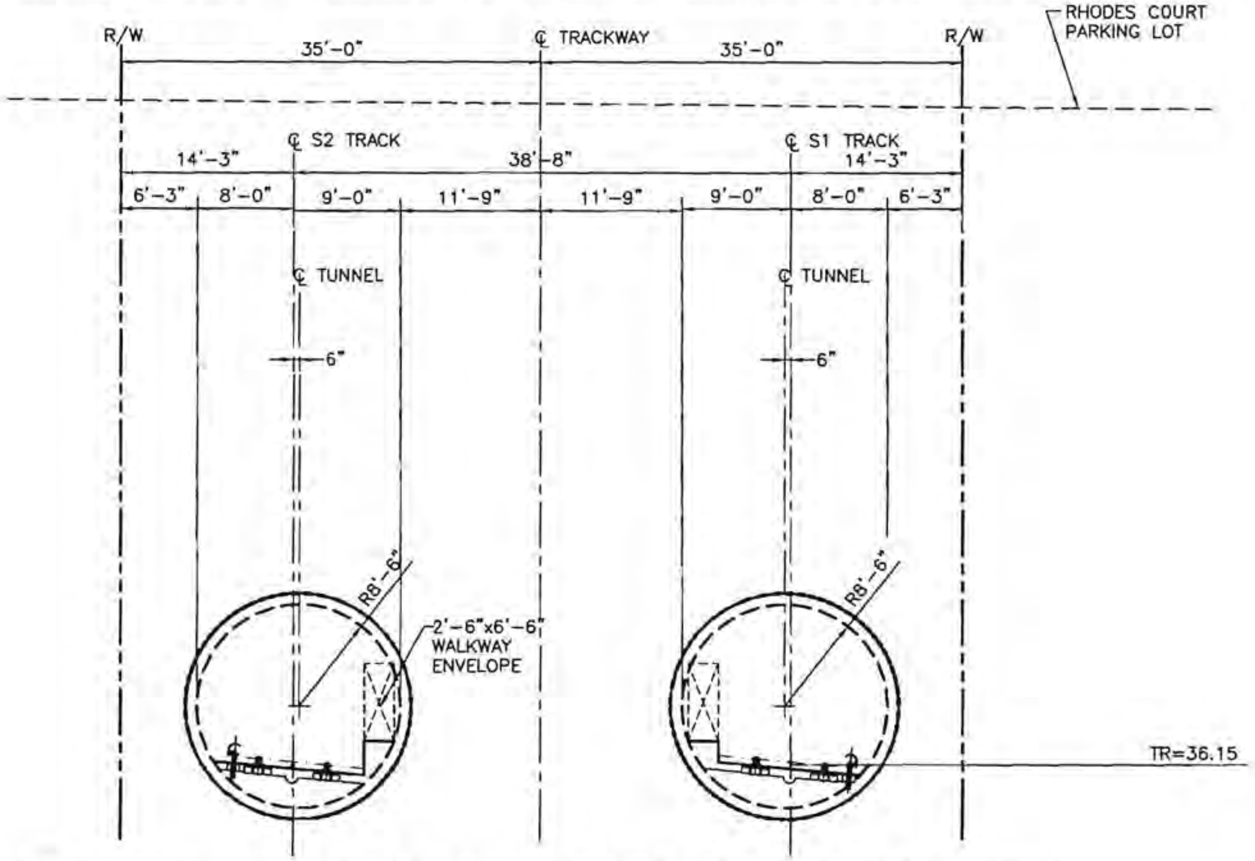
CADD DATE 30MR03
SCALE: 1/8"=1'-0"
CADD FILE NO. BSJ1C197.DWG
DWG No: C197
REV 0
PAGE No.



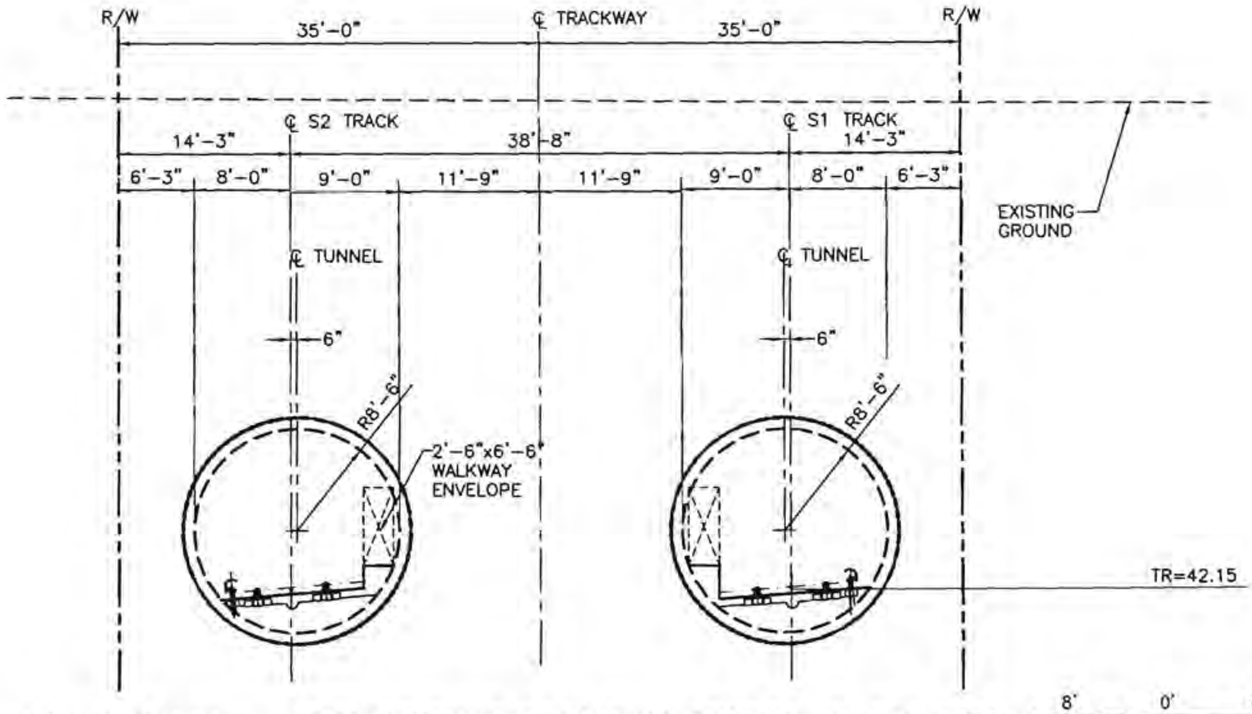
BORED TUNNEL – RESILIENT TIE TRACKWAY SECTION @ STA. 760+00



BORED TUNNEL – DIRECT FIXATION TRACKWAY SECTION @ STA. 780+00



BORED TUNNEL – RESILIENT TIE TRACKWAY SECTION @ STA. 750+00



BORED TUNNEL – RESILIENT TIE TRACKWAY SECTION @ STA. 770+00

GRAPHIC SCALE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
B. LEVERIZA
DRAWN BY
V. FELIX
CHECKED BY
J. MAHER
APPROVED BY
DATE

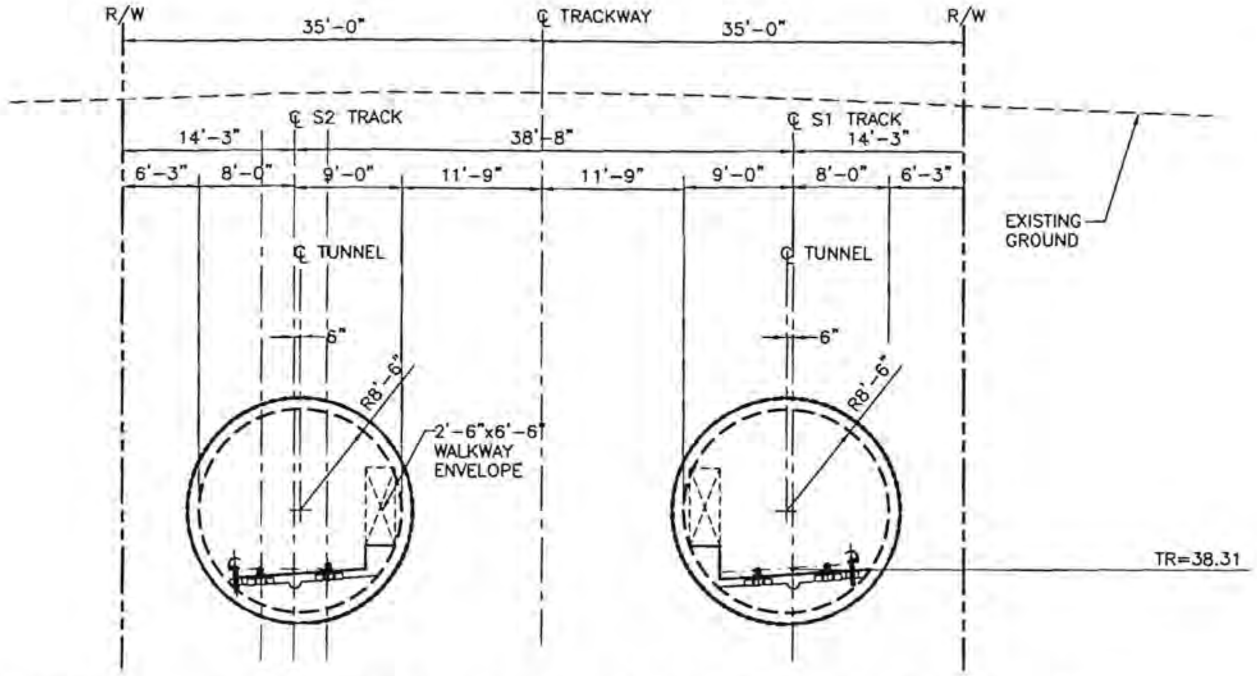
EARTH TECH
A tyco INTERNATIONAL LTD COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

SANTA CLARA Valley Transportation Authority

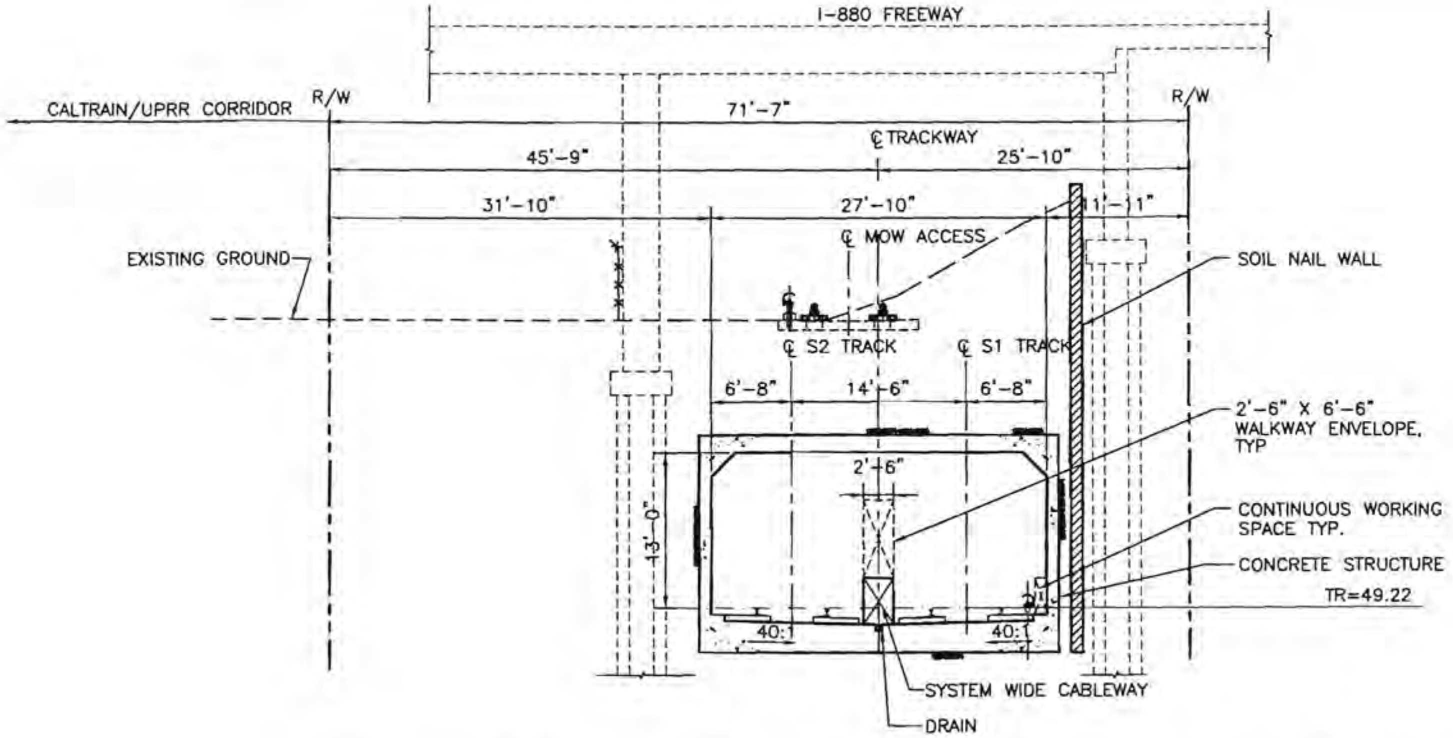
BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

LINE, TRACKWORK AND SYSTEMS
CROSS SECTIONS
STATION 750+00 TO 780+00
SHEET 25

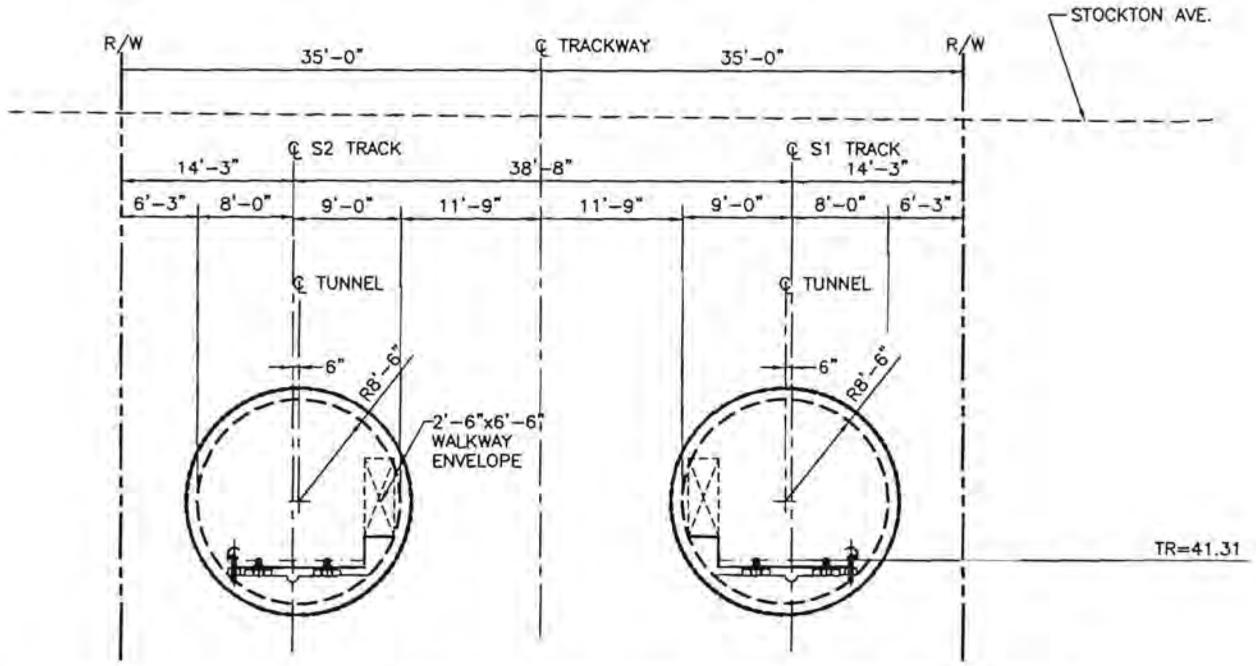
CADD DATE 30MR03
SCALE: 1/8"=1'-0"
CADD FILE NO. BSJ1C198.DWG
DWG No: C198
REV 0
PAGE No.



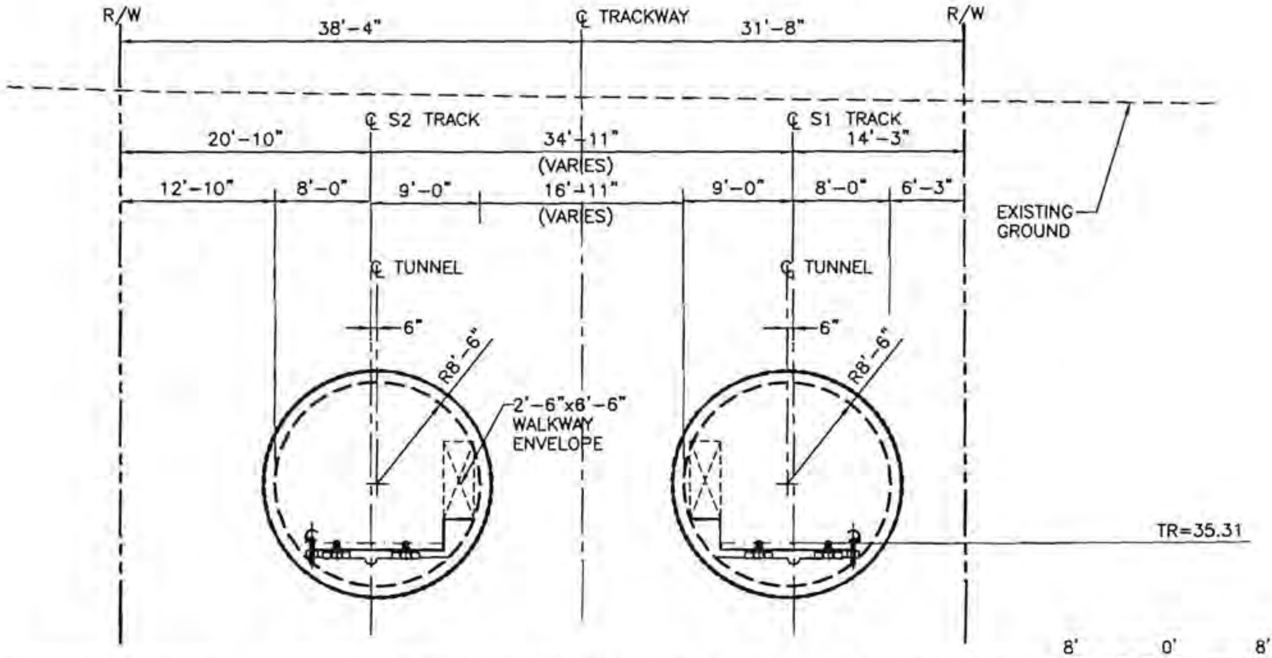
BORED TUNNEL – DIRECT FIXATION TRACKWAY SECTION @ STA. 800+00



CUT & COVER TUNNEL – DIRECT FIXATION TRACKWAY SECTION @ STA. 820+00



BORED TUNNEL – DIRECT FIXATION TRACKWAY SECTION @ STA. 790+00



BORED TUNNEL – DIRECT FIXATION TRACKWAY SECTION @ STA. 810+00

8' 0' 8' 16'
GRAPHIC SCALE

REV.	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY B. LEVERIZA
DRAWN BY V. FELIX
CHECKED BY J. MAHER
APPROVED BY
DATE

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
2101 Webster St., Suite 1000
Oakland, CA 94612
Phone: (510) 419-6000
Fax: (510) 419-5355

SANTA CLARA Valley Transportation Authority

BART EXTENSION TO MILPITAS, SAN JOSE AND SANTA CLARA

LINE, TRACKWORK AND SYSTEMS
CROSS SECTIONS
STATION 790+00 TO 820+00
SHEET 26

CADD DATE: 30MR03
SCALE: 1/8"=1'-0"
CADD FILE NO.: BSJ1C199.DWG
DWG No: C199
REV: 0
PAGE No.:

Appendix B

We reviewed the following 11 reports that provided geotechnical information along Segments BSJ-3 and BSJ-4. Logs from the following explorations are presented in Figures B-1 through B-28.

Boring Index	Consultants	Consultants' Project Number	Project Date	Project Name
100W-n	Applied Soil Mechanics, Inc.	A5-1699-J1	May, 1985	Geotechnical Investigation, 100 West Santa Clara Office Building and Parking Garage, San Jose
150W-n	Applied Soil Mechanics, Inc.	A6-1669-J3	Oct, 1986	Review of Proposed Dewatering Program, 150 West Santa Clara Office Building, San Jose
150W-n	Applied Soil Mechanics, Inc.	A6-1669-J3	Nov, 1986	Shoring Deflection Analysis, 150 West Santa Clara Office Building, San Jose
AT-n	Lee and Praszker	L-810	Sept, 1985	Geotechnical Investigation, Almaden Tower, San Jose
CC-n/ CPT-n	URS Corporation	95-00112001.00	Jul, 2001	Geotechnical Investigation, New San Jose Civic Center, San Jose
IPP-n	Woodward-Clyde Consultants	983002NA	May, 1998	South Bay Water Recycling Program, Geotechnical Investigation Infill Pipelines Project, San Jose
LSO-n	Caltrans, Project Development	04-112724	Aug, 1989	Project Plans for Construction on State Highway in Santa Clara County in San Jose, From Route 82 to Coleman Avenue Overcrossing
MC-n	Peter Kaldveer and Associates	K480-4	Sept, 1977	Geotechnical Investigation for Radiology and Laboratory Building, San Jose Hospital and Health Center, San Jose
OPUS-n	Kleinfelder, Inc.	10-3007-42	Mar, 1998	Geotechnical Investigation Report, Multi-Story Office Building, West Santa Clara Street and Almaden Avenue, San Jose
SJA-n	Woodward-Clyde Consultants	8815020-R	Apr, 1989	Geotechnical Engineering Study, San Jose Multipurpose Arena, San Jose
TSP-n	Woodward-Clyde Consultants / Parikh Consultants, Inc.	95117.10	Dec, 1995	Geotechnical Engineering Investigation, Draft Report, South Bay Water Recycling Project-Phase 1, Twelfth Street Pipeline, San Jose

The assigned boring numbers are shown in the first left-hand column in the above table. Locations, logs and laboratory results of these existing borings were attached as reference in our report entitled "Preliminary Geotechnical Engineering Report, Silicon Valley Rapid Transit Corridor, Alternative 11 -BART on UPRR Alignment, Alameda County and Santa Clara County, California," and dated January 11, 2002.

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring 100W-1

Date Drilled: 5/14/85
Type of Boring:
Hammer/drop: 140lb/30in *=375lb

Remarks: DATA FROM A5-1699-J1 - Applied Soil Mechanics - 100 West Santa Clara

Surface Elevation: 0 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					3 inches Asphalt Concrete over 6 inches Aggregate Base				
					Clayey SAND (SC) FILL Brown, very silty, slightly moist, medium dense Rock and brick fragments FILL				
5									
	1 ☒	11*			**Silty SAND (SM)** Light gray brown, fine, some clay binder, damp, medium dense Grading to fine to medium sand	18	101		
10					**Gravelly SAND (GW)**				
	2 ☐	6			**Silty SAND (SM)** Brown, streaked with silt, damp, loose				
					Sandy SILT (CL) Gray, with clay, locally very silty clay, very moist, medium stiff				
15									
	3 ☒	11*	1.1-1.4		**Silty CLAY (CL)** Gray brown, very silty, very moist, stiff Becoming dark gray in color, locally very silty to sandy	39	83		
20									
	4 ☒	14*	1.0		**Silty CLAY (CH)** Black, very moist, stiff Becoming dark gray in color	42	79		
					Sandy CLAY (CL) Gray, with fine gravel, moist, stiff, slightly calcareous				
25									
	5 ☒	21*				24	102		
					Clayey SAND (SC) Gray brown, loose				
	6 ☒	16*							
30					**Silty SAND (SM)** Gray, very silty, interbedded with coarse sand, medium dense				
					Sandy GRAVEL (GW) Gray, with some binder, dense				
	7 ☐	68							
35	8 ☐	23			**Silty SAND (SW)** Gray, medium dense Occasional streak of sandy silt				
40					**Silty CLAY (CH)** Gray, moist, stiff				
	9 ☒	20*	1.0-1.2		Becoming mottled with greenish gray, slightly calcareous	30	91		
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring 100W-1 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	10	24*	1.0- 1.8			24	102		
50					**Sandy SILT (ML)** Light gray, interbedded with sand, trace of clay binder				
	11	14*	1.0		**Silty CLAY (CL) with sand** Gray, very silty, moist, stiff				
					Silty SAND (SM) Gray, trace of clay, interbedded with sandy silt				
55					**Sandy CLAY (CL)** Orange brown and gray, moist, very stiff, calcareous				
	12	43*	2.7- 3.7			23	103		
					Silty CLAY (CL) with sand Gray, very silty, fine sand, moist, stiff				
60	13	32*	1.3- 1.6			27	97		
					BREAK IN LOG				
65	14	37*	1.6- 2.2			22	104		
70	15	45*			**Silty SAND (SM)** Gray brown and orange brown, variable clay binder, dense	21	108		
					Sandy GRAVEL (GW) Yellow brown, very dense				
75	16	84							
					Decreasing heavy gravels				
80									
					Increasing gravels				
					Increasing gravels				
85	17	100+							
					BOTTOM OF BORING AT 86 FEET				
90									
95									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring 150W-5

Date Drilled: 9/16/86
Type of Boring:
Hammer/drop: 140lb/30in *=375lb

Remarks: DATA FROM A5-1699-J3 - Applied Soil Mechanics - 150 West Santa Clara

Surface Elevation: 83 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					6 inches Cement over 6 inches Aggregate Base				
					Clayey SAND with gravel and brick fragments - FILL Dark gray brown, moist, stiff FILL				
5	1	31*			**Silty SAND (SM)** Light brown, very silty, fine, with some clay binder, damp, medium dense Becoming clean, streaked with silt				
10	2	18*			**SAND (SP)** Gray, coarse, loose to medium dense				
					Silty SAND (SM) Brown, streaked with clay/silt, some minor organics, damp, medium dense				
	3				**CLAY / SILT (CL)** Brown, very moist, medium stiff				
15					**Silty CLAY (CL)** Light gray, very silty, very moist Becoming dark gray, stiff				
20	4				**Silty CLAY (CH)** Black, moist, stiff				
					Sandy CLAY (CL) Blue gray, moist, stiff				
25	5	11*			**Silty CLAY (CL)** Gray brown, moist, stiff				
					Silty SAND (SM) Brown, very silty, streaked with sandy silt, loose				
					Clayey SAND (SC) Dark gray brown, streaked with sandy clay, moist, stiff				
30	6	25*			**Gravelly SAND (SW)** Gray, coarse, medium dense				
					Clayey SAND (SC) Gray and brown, moist, medium dense				
35					**Sandy CLAY/SILT (CL)** Gray, very moist, medium stiff to stiff				
	7	8 14			**Silty SAND (SM)** Gray, streaked with silt, wet, medium dense				
40	8				**Silty CLAY (CH)** Gray, moist, stiff				
					Sandy CLAY (CL) Greenish gray, slightly calcareous, moist, stiff				
45									

Project: SV RAPID TRANSIT CORRIDOR | **Log of Boring 150W-5** Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
				▨	▼				
				▩	**Gravelly SAND (SW)** Brown, medium dense				
				▨	**Sandy CLAY (CL)** Orange brown and gray, moist, stiff				
50				▩	**Gravelly SAND (SW)** Brown, dense				
55				▩					
	9	80		▩	◄ Hole caved to 56 feet				
60					BOTTOM OF BORING AT 60 FEET				
65									
70									
75									
80									
85									
90									
95									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring 150W-6

Date Drilled: 9/12/86
Type of Boring:
Hammer/drop: 140lb/30in *=375lb

Remarks: DATA FROM A5-1699-J3 - Applied Soil Mechanics - 150 West Santa Clara
Surface Elevation: 84 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					2 inches Asphalt Concrete over 6 inches Concrete over 6 inches Aggregate Base				
					Clayey SAND with gravels and brick fragments - FILL Dark brown, moist, stiff FILL				
5	1	18*			**Silty SAND (SM)** Yellow brown, with binder				
					SAND (SW) with gravel Brown, damp, loose to medium dense				
					Sandy SILT (ML) Brown, damp				
10					**Silty SAND (SM)** Brown, damp, medium dense Decreasing binder				
15					**Sandy SILT (ML)** Brown, moist, loose				
	2				**Silty CLAY (CL)** Light gray and brown, very silty, moist, medium stiff to stiff				
					Sandy SILT (CL) Brown, with clay, very moist, medium stiff				
20					**Silty CLAY (CH)** Black, moist, stiff				
					Sandy CLAY (CL) Greenish gray to dark gray, moist, stiff Becoming light gray, calcareous				
25					**Sandy SILT (CL)** Brown, moist, stiff				
	3	9*			**Sandy CLAY (CL)** Gray and greenish gray, moist, stiff, slightly calcareous ▼				
30					**Sandy CLAY/SILT (CL)** Brown and gray, moist, medium stiff				
35	4	20			**Silty SAND (SM)** Gray, wet, medium dense Locally very silty				
40					**Silty CLAY (CH)** Gray, very silty, very moist, medium stiff				
	5								
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring 150W-6 Continued

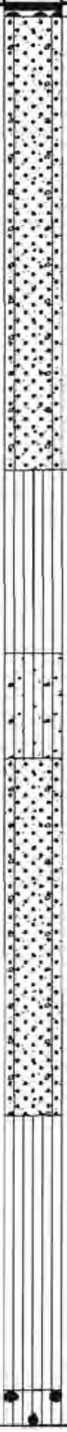
Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					Silty CLAY (CL) Light gray and greenish gray, calcareous, occasional large rock				
					Sandy SILT (CL) Gray, wet				
					Silty CLAY (CL) Gray, very silty, moist, stiff				
50					**Silty SAND (SM)** Gray, with clay binder, medium dense				
55					**Sandy CLAY/SILT (CL)** Gray and brown, very moist, stiff				
	6				**Silty CLAY (CH)** Gray, moist, stiff				
60					BOTTOM OF BORING AT 60 FEET				
65									
70									
75									
80									
85									
90									
95									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring AT-1

Date Drilled: 9/3/85
Type of Boring:
Hammer/drop:

Remarks: DATA FROM L-810 - Lee & Praszker - Almaden Tower
Surface Elevation: 84 x feet (approx.)



Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
				2 inches Asphalt Concrete over 3 inches Base Rock				
				SAND (SM) Brown, very silty, fine, medium dense				
5	⧓	11*			13	120		
10	⧓	10*			7	99		
15	⧓	4*		**SAND/SILT (SM-ML)** Grayish brown and black, slightly clayey, silty, fine, medium dense sand, sandy stiff silt	52	70		
20	⧓	11*			21	106		
25	⧓	13*			22	108		
30	⧓	15*			23	104		
35	⧓	8*			37	84		
40	⧓	14*			27	97		
				Gravelly at 44 feet				
45								

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	⧓	25*			**SAND (SM)** Brown, silty, fine, dense	25	99		
50	⧓	56*			Grading with 1 inch gravel 50 to 58 feet	10	129		
55									
					SILT (ML) Gray, slightly clayey, medium stiff				
60	⧓	13*							
65	⧓	30*				22	106		
70	⧓	53*			**SAND (SM)** Tan and gray brown, silty, fine to medium grained, dense	17	115		
75									
80	⧓	31*				20	108		
					GRAVEL (GP) Up to 2 inch size in brown silt matrix				
85									
90	⧓	31*							
95									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring AT-1 Continued

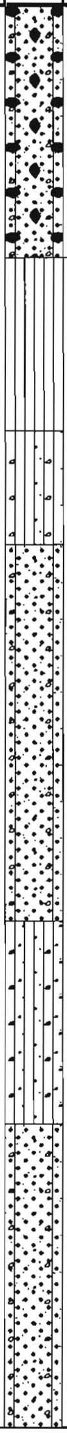
Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
				▨	**SAND (SM)** Brown, silty, fine, dense				
100	⧗	50/ 6"*		▨		19	112		
					BOTTOM OF BORING AT 101 FEET				
105									
110									
115									
120									
125									
130									
135									
140									
145									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring AT-4

Date Drilled: 10/22/85
Type of Boring:
Hammer/drop:

Remarks: DATA FROM L-810 - Lee & Praszker - Almaden Tower
Surface Elevation: 82 x feet (approx.)



Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					SAND (SM) Brown, clean to slightly silty, fine to medium grained, medium dense, with small gravel less than 1/2 inch size				
5	⧗	18*				5	108		
					SAND/Sandy SILT (SM-ML) Grayish brown and black, silty, fine, medium dense				
10	⧗	7*				33	92		
15	⧗	25*				24	103		
20	⧗	6*				28	96		
25	⧗	17*				19	112		
30	⧗	7*				37	89		
35	⧗	23*				40	83		
40	⧗	23*				21	107		
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring AT-4 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	⊠	16*				24	103		
50	⊠	58*				18	110		
					SAND (SP-SM) Gray brown, slightly silty, fine, medium dense				
55									
60	⊠	20*				25	103		
65									
					SAND and GRAVEL (GP-GM) Brown, slightly silty, very dense				
70	⊠	101*				11	132		
75									
80	⊠	50/ 5"*				7			
85									
					SAND/Sandy SILT (SM-ML) Gray brown, silty, fine, medium dense, with small gravel up to 1/4 inch in size				
90	⊠	39*				21	110		
					SAND and GRAVEL (GM) Gray brown, silty, dense				
95									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring AT-4 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
100	☒	63*			Grading very silty with less gravel at 101 feet	28	98		
					BOTTOM OF BORING AT 101-1/2 FEET				
105									
110									
115									
120									
125									
130									
135									
140									
145									

1/14/04 JGLOGPP 8790E.GPJ

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring CC-1

Date Drilled: 4/7/99
Type of Boring: 4-7/8-in Rotary Wash
Hammer/drop: 140lb/30in

Remarks: DATA FROM 95-00112001.00 - New San Jose Civic Center
Surface Elevation: 81.1 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					6 inches Asphalt Concrete over 18 inches Gravelly FILL / Baserock Dry, light brown, silty FILL				
	1	32			**Lean CLAY (CL)** Very stiff, moist, dark brown				
5	2	29			Light brown	21	105	5720	
	3	19			Wet, brown				PID= 88ppm
	4	21			Medium	27	97	1410	
	5	12							
10	6	9			Soft to medium, wet, dark grayish brown	33	88	1310	FROM W-1:
	7	8			∇	31	92	670	LL=38 PI=15 PID= 0ppm
					Lean to fat CLAY (CL/CH) Stiff, wet, dark greenish gray				
15	8	28				25	101	2500	
20	9	250 psi			**Silty SAND (SM) to Sandy silty CLAY (CL-ML)** Medium dense, wet, dark brown, fine sand	28	96	220	
					Calcareous nodules	31			+#4=10% -#200=57%
	10	15	0.3		**Lean CLAY (CL)** Medium, wet, dark greenish gray				
25						30			
30	11	9			Soft	28	95	680	
35	12	0 300 psi			Stiff, Lean CLAY (CL) (Continued)...				
						38	84	2190	
40	13	31			Dark gray	25	100	3200	
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring CC-1 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	14	28			Greenish gray with red iron oxide staining	25	100	1980	
50	15	30			Medium	24	101	1170	
55									
60	16	37			Stiff, decrease in red iron oxide staining, becoming sandy (very fine sand) in tip of sampler	24	104	2190	
					Well-graded SAND (SW) with gravel Medium dense, wet, greenish gray				
65									
70	17	25	0.8		**Gravelly lean CLAY (CL) with sand** Medium to stiff, wet, greenish gray **Gravelly lean CLAY (CL) with sand (Continued)...**	28			#200 WASH: +#4=26% -#200=58%
75	18	300 psi			**Sandy Silt (ML)** Medium dense, wet, light brown	29			+#4=0 -#200=66%
80					**Well-graded SAND (SW-SM) with silt and gravel** Very dense, wet, fine to coarse sand, trace to some fine gravel to 3/4 inches				
85	19	73				11			+#4=47% -#200=6%
90					Increase in gravel content				
95									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring CC-1 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	20	83		▨					
					BOTTOM OF BORING AT 96-1/2 FEET				
100									
105									
110									
115									
120									
125									
130									
135									
140									
145									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring CC-8

Date Drilled: 2/23/01
Type of Boring: 4-7/8-in Rotary Wash
Hammer/drop: 140lb/30in

Remarks: DATA FROM 95-00112001.00 - New San Jose Civic Center
Surface Elevation: 80.8 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					2-1/2 inches Asphalt Concrete over 3 inches Aggregate Base				
	1	19			**Lean CLAY (CL)** Very stiff, moist, brown	21	103	6870	
					Light brown, with sand				
5									
	2	18				24	98	4390	
	3	11				31	89	5230	Enviromental sample Mud up
10									
	4	8				31	91	1050	
					Medium, brown, trace sand and gravel				
					Lean CLAY (CL) Very stiff, wet, dark brown				
15									
	5	23				21	109	4500	Environmental sample
20									
	6	9			Medium, light brown	24	101	1530	
25									
	7	9			Soft, brown with red and gray mottling, black at 26 feet	30	90	980	
30									
	8	8			Medium, dark gray to black	30	93	1020	
35					**Lean CLAY (CL) (Continued)...**				
	9	125 psi							No recovery
	10	200 psi				23	103	2600	
40						38	84		
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring CC-8 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	11	27			**Fat CLAY (CH)** Medium, wet, blue gray	24	99	1370	
50	12	21			Some sand				
55	13	150 psi				21	104	1610	
						21	107	2980	
					Sandy lean CLAY (CL) Medium, wet, gray				
60	14	24				22	104	1560	-#200=66%
65	15	22			Stiff	22	105	2900	
					Silty SAND (SM) with gravel Dense, wet, light brown				
70	16	45							
75	17	50 4"			**Silty SAND (SM) with gravel (Continued)...** Very dense				
					Poorly graded GRAVEL (GP) with sand Very dense, wet, brown				
80	18	86							
85	19	50/4"							
90	20	69							
95									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring CC-8 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	21	58		●					
100	22	40	2.5	▨	**Lean CLAY (CL) with sand** Very stiff, wet, light brownish gray				
					BOTTOM OF BORING AT 101-1/2 FEET				
105									
110									
115									
120									
125									
130									
135									
140									
145									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring CC-9

Date Drilled: 2/22/01
Type of Boring: 4-7/8-in Rotary Wash
Hammer/drop: 140lb/30in

Remarks: DATA FROM 95-00112001.00 - New San Jose Civic Center
Surface Elevation: 80.3 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					12 inches Asphalt Concrete				
					Lean CLAY (CL) Stiff, moist, gray and brown mottled				
	1	12				23	97	3320	
5	2	36			Hard	20	106	8670	
	3	24			Stiff	23	101	3270	Environmental sample, mud up
10	4	7			Soft, gray	28	93	780	
15	5	17			Stiff	22	106	2880	
20	6	29			With brown mottling	19	109	2490	
25	7	14				30	90	1050	
					Clayey SAND (SC) Medium dense, wet, brown				
					Lean CLAY (CL) Stiff, wet, gray, occasional Poorly graded Sand (SP-SM) with silt lenses				
30	8	11				28	97	3070	Fluid loss in sand lenses
					No lenses of sand				
35					**Fat CLAY (CH)** Medium, wet, dark gray				
	9	14				40	81	1650	
40	10	24			Stiff	38	83	2730	
45									

Project: SV RAPID TRANSIT CORRIDOR

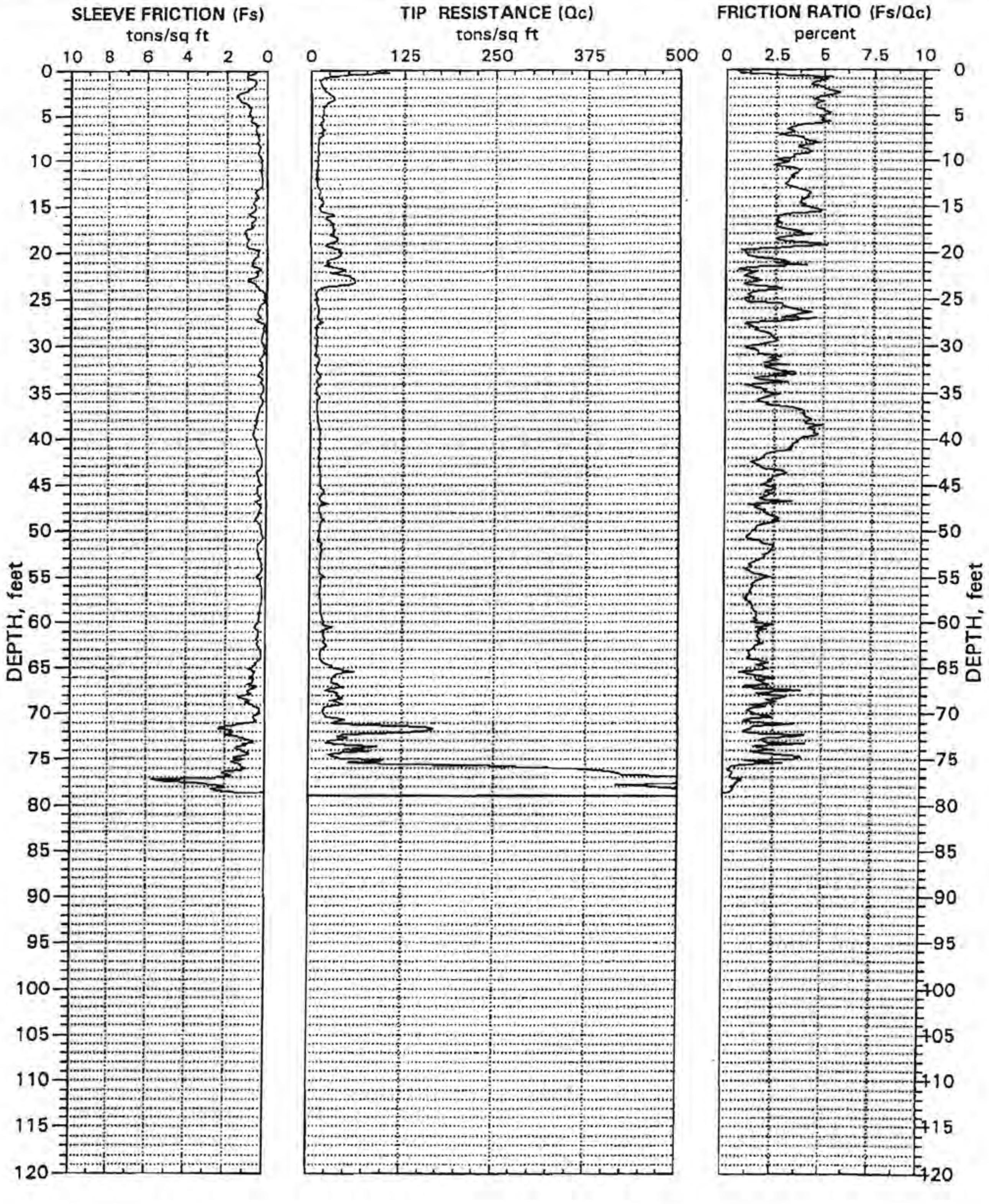
Log of Boring CC-9 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	11	150 psi			**Lean CLAY (CL)** Medium, wet, gray and brown mottled	28	96	1980	LL=37 PI=17
50	12	35			Very stiff, brown	21	106	6370	
55	13	37			**Sandy lean CLAY (CL)** Soft, wet, gray and brown mottled, some Clayey Sand seams	23	99	870	
60	14	52			**Silty SAND (SM)** Dense, wet, brown	18	101		
					With gravel				
65	15	59			Very dense				
					Less gravel				
70	16	54			Dense				
75	17	69			**Silty SAND (SM) Continued** **Lean CLAY (CL)** Medium, wet, brown	26	102	1330	
					Silty GRAVEL (GM) Very dense, wet, brown	8	131		
80	18	73							
85	19	75/ 8"							
90	20	67							Fluid loss
95									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring CC-9 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	21	50/ 6"		●					
				▨	**Lean CLAY (CL) with sand** Stiff, wet, gray				
100					**Silty SAND (SM)** Very dense, wet, brown				
	22	50/5"							
					BOTTOM OF BORING AT 101-1/2 FEET				
105									
110									
115									
120									
125									
130									
135									
140									
145									



Date: 2/12/01

Surface Elevation: 81.20 feet

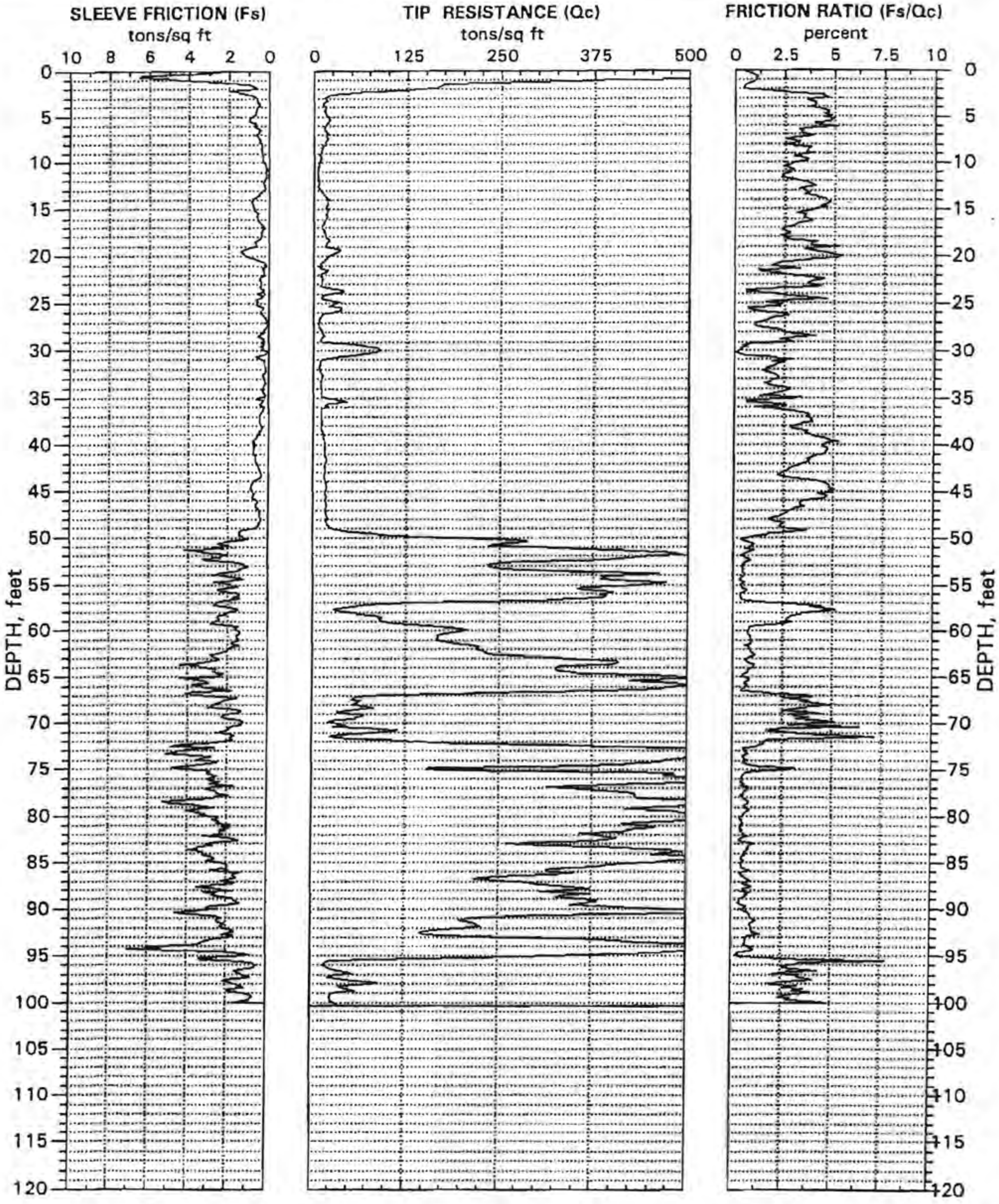
Remarks: DATA FROM 95-00112001.00 - New San Jose Civic Center

SV RAPID TRANSIT CORRIDOR

Project Number: 28648793.02513	CONE PENETRATION TEST SOUNDING NUMBER: CPT-5	Fig. B-9 Page 1 of 1

4/29/03 CONES 8790E

URS



Date: 2/14/01

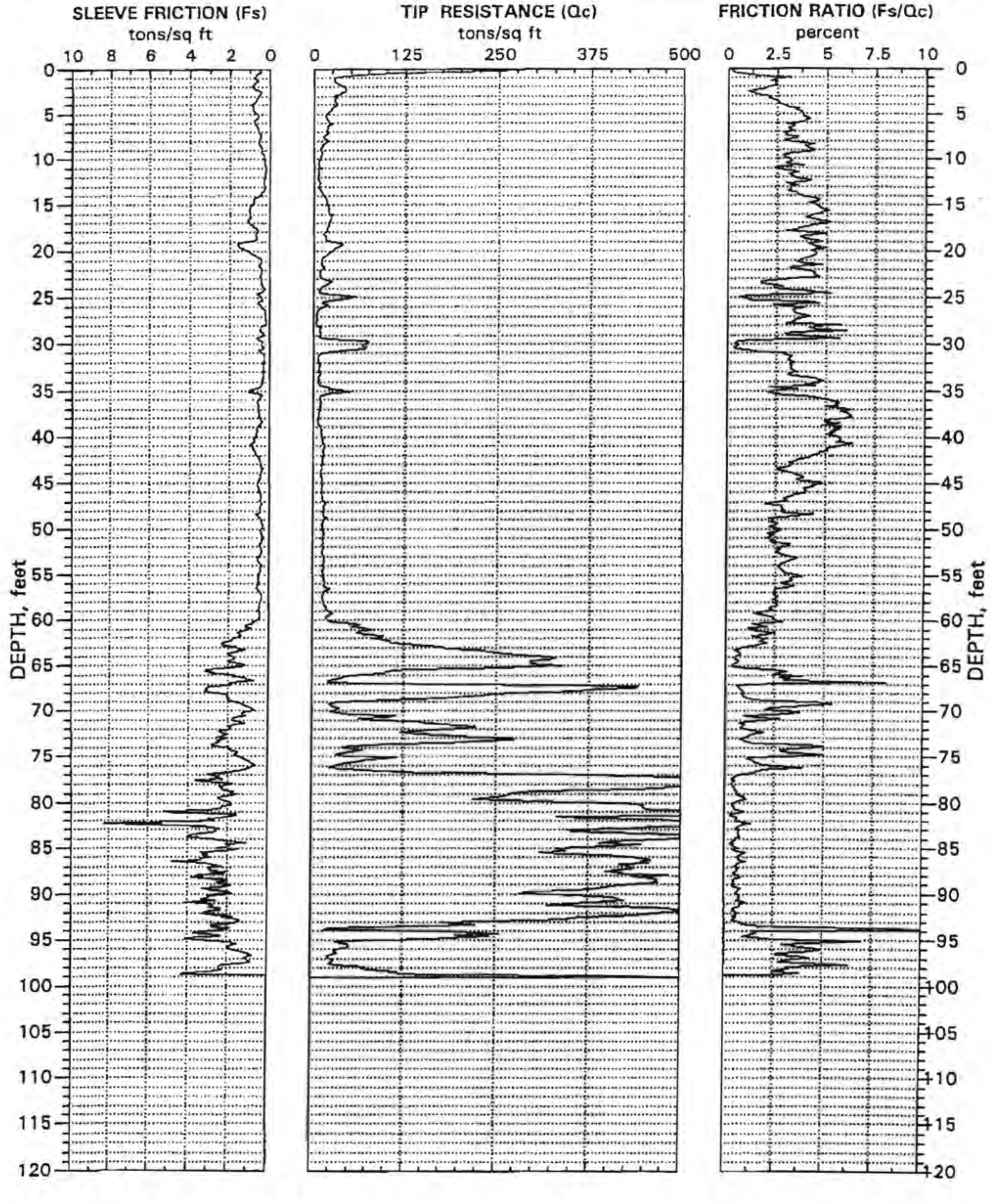
Surface Elevation: 81.00 feet

Remarks: DATA FROM 95-00112001.00 - New San Jose Civc Center

SV RAPID TRANSIT CORRIDOR

Project Number: 28648793.02513	**CONE PENETRATION TEST** **SOUNDING NUMBER: CPT-6**	**Fig. B-10** **Page 1 of 1**

4/29/03 CONS3 8790E



Date: 2/14/01

Surface Elevation: 82.00 feet

Remarks: DATA FROM 95-00112001.00 - New San Jose Civic Center

SV RAPID TRANSIT CORRIDOR

Project Number: 28648793.02513	CONE PENETRATION TEST SOUNDING NUMBER: CPT-8	Fig. B-11 Page 1 of 1

4/29/03 CONES 87908

URS

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring IPP-4

Date Drilled: 2/4/98
Type of Boring: 8 inch Hollow Stem Auger
Hammer/drop: 140lb/30in

Remarks: DATA FROM 983002NA - Infill Pipeline Projects
Surface Elevation: 94 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	1	9	2.0	▨	**Lean CLAY (CL)** Stiff to medium, moist, dark brown, with some grass roots to 1 foot in depth	23	99	1130	
	2	5	<0.5	▨	**Silty CLAY (CL-ML)** Very soft, moist, dark brown	23	96	490	
5	3	6	<0.5	▨	With light gray stains	23	101	290	LL=23 PI=4
	4	13	0.5	▨	Soft	21	102	520	
	5	13	0.5	▨		22	102	430	
	6	9	0.5	▨	**Lean CLAY (CL)** Soft, moist, dark brown with dark gray stains	25	97	220	
10	7	12	0.5	▨		29	92	440	
	8	17		░	**Silty SAND (SM)** Medium dense, moist, gray brown				
	9	34		░	**Well-graded SAND (SW-SC) with clay and gravel** Medium dense, moist, grayish brown	5	120		+#4=40% -#200=5%
15	10	14	1.5- 1.7	▨	**Lean CLAY (CL)** Stiff, moist, dark reddish brown, reddish brown with black mottles and gray stains below 16 feet, silty sand lens at 15-1/2 feet	12	119		
	11	12	0.7- 1.0	▨	Silty sand lens Medium Silty sand lens	24	99	400	
20					BOTTOM OF BORING AT 20 FEET Boring dry ATD				
25									
30									
35									
40									
45									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring LSO-1

Date Drilled: 4/12/88
Type of Boring: Rotary Wash (wet)
Hammer/drop: 140lb/30in

Remarks: DATA FROM Caltrans - Bridge 37-129 - Laurel Street Overhead (replace)

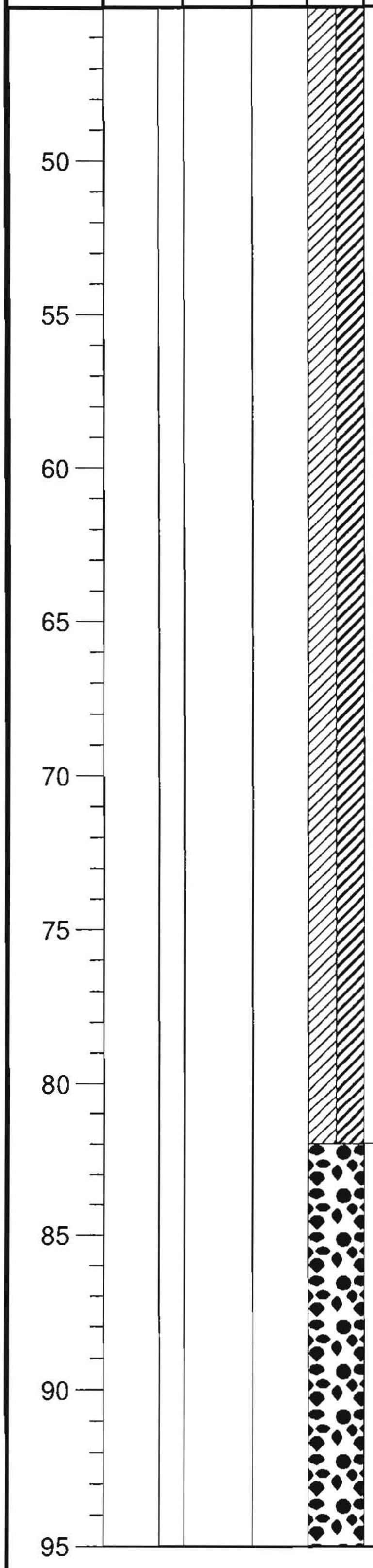
Surface Elevation: 68.3 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
				▨	**SILTY CLAY to CLAY**				
5				▨					
10				▨					
15				▨					
20				▨					
				●	**SANDY GRAVEL**				
25				●					
30				●					
35				●					
				▨	**SILTY CLAY to CLAY** Gray				
40				▨					
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring LSO-1 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks



GRAVEL

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring LSO-1 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					SAND and GRAVEL lenses				
100					BOTTOM OF BORING AT 100 FEET				
105									
110									
115									
120									
125									
130									
135									
140									
145									

1/14/04 JGLOGPP 8790E.GPJ

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring LSO-3

Date Drilled: 4/20/88
Type of Boring: Rotary Wash (wet)
Hammer/drop: 140lb/30in

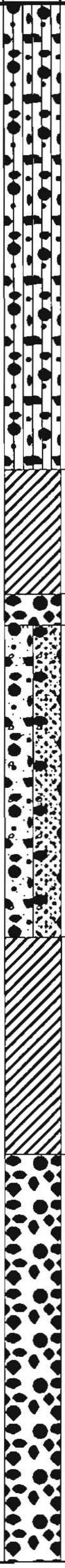
Remarks: DATA FROM Caltrans - Bridge 37-129 - Laurel Street Overhead (replace)

Surface Elevation: 69.5 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
				●	**GRAVEL**				
				▨	**CLAY**				
5				▨					
10				▨					
15				▨					
20				▨					
25				●	**GRAVEL**				
30				●					
35				●					
				▨	**CLAY**				
40				▨					
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring LSO-3 Continued



Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					SILT and GRAVEL				
50									
55									
60					**CLAY**				
					GRAVEL				
65					**SAND and GRAVEL**				
70									
75					**CLAY**				
80									
					GRAVEL				
85									
90									
95									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring LSO-3 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
100				●					
105				●					
				▨	**SAND**				
110					BOTTOM OF BORING AT 110 FEET				
115									
120									
125									
130									
135									
140									
145									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring LSO-4

Date Drilled: 4/21/88
Type of Boring: Rotary Wash (wet)
Hammer/drop: 140lb/30in

Remarks: DATA FROM Caltrans - Bridge 37-129 - Laurel Street Overhead (replace)
Surface Elevation: 69.7 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					GRAVEL				
					CLAY				
5									
10									
15									
20									
25					**GRAVEL**				
30									
35									
40									
					CLAY Blue				
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring LSO-4 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
50				▨					
55				▨					
60				▨					
65				▨					
70				▨					
75				⁘	**SILT and SAND**				
80				⁘					
				●	**GRAVEL**				
85				●					
90				●					
95									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring LSO-4 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
100									
105									
110									
					SANDY SILT				
115					BOTTOM OF BORING AT 115 FEET				
120									
125									
130									
135									
140									
145									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring LSO-5

Date Drilled: 3/25/87
Type of Boring:
Hammer/drop:

Remarks: DATA FROM Caltrans - Bridge 37-129 - Laurel Street Overhead (replace)

Surface Elevation: 67.7 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
				●	**CLAYEY SILT with GRAVEL** Slightly compact, gray with brown mottles				
5	▯	17		●					
				●	**CLAYEY SILT with GRAVEL, ORGANICS** Slightly compact, light brown with rust mottles				
10	▯	16		●					
				▨	**CLAY with GRAVEL, ORGANICS** Stiff, black with rust mottles				
				▨	**SILTY CLAY with GRAVEL** Soft, light brown with rust mottles				
15	▯	9		▨					
20	▯	8		▨					
				⁘	**SILTY SAND with GRAVEL** Stiff, greenish brown, fine to coarse sand				
				●	**SANDY GRAVEL** Dense, brown with rust mottles				
25	▯	60		●					
				●	**SANDY GRAVEL** Very dense, brown with rust mottles				
30	▯	>100		●					
35	▯	81		●					
				▨	**CLAY with ORGANICS** Stiff, blue gray				
40	▯	10		▨					
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring LSO-5 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
		13		▨					
				▨	**CLAY with ORGANICS** Very stiff, blue gray				
50		22		▨					
55				▨	**CLAY with ORGANICS** Stiff, blue gray				
60		14		▨					
65				▨					
70					BOTTOM OF BORING AT 70 FEET				
75									
80									
85									
90									
95									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring LSO-6

Date Drilled: 4/22/87
Type of Boring: Rotary Wash (wet)
Hammer/drop: 140lb/30in

Remarks: DATA FROM Caltrans - Bridge 37-129 - Laurel Street Overhead (replace)
Surface Elevation: 68.3 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
				▥	**CLAYEY SILT** Slightly compact, gray with yellow mottles, damp				
5	▯	18							
				▥	**SILT** Slightly compact, brown with rust mottles, damp				
10	▯	10							
				▨	**CLAY** Stiff, black, damp				
15	▯	12							
				▥	**CLAYEY SILT** Slightly compact, brown with rust mottles, damp				
				▨	**CLAY** Stiff, black, with roots and rare gravel, damp				
20	▯	10							
				●	**SANDY GRAVEL** Dense, brown, damp				
25	▯	61							
				●	**SANDY GRAVEL** Very dense, brown, damp				
30	▯	80							
				●	**SANDY GRAVEL** Compact, brown, damp ▼				
35	▯	36							
				⁘	**SILTY SAND** Slightly compact, light brown with some rust mottles, fine sand, moist				
40	▯	15							
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring LSO-6 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
50	I	16			**SAND with SILT, GRAVEL, scattered ORGANICS and interbedded CLAYEY SILT and SILT layers** Slightly compact, blue gray, fine to coarse sand				
55									
60									
65									
70									
75	I	35			**SANDY GRAVEL** Dense, orange, moist				
80									
85					BOTTOM OF BORING AT 85 FEET				
90									
95									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring LSO-9

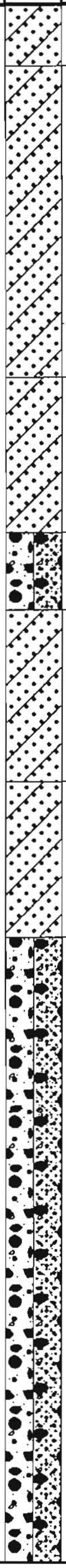
Date Drilled: 11/6/55
Type of Boring: Rotary Wash (wet)
Hammer/drop: 140lb/30in

Remarks: DATA FROM Caltrans - Bridge 37-129 - Laurel Street Overhead
Surface Elevation: 75 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					SANDY SILT Slightly compact, dark gray				
5									
					CLAYEY SAND Slightly compact, fine				
10									
15									
					Compact, gray				
20	▯	21							
					SAND and GRAVEL Dense				
25									
30					Very dense				
35									
					CLAYEY SAND Slightly compact, gray, fine to medium				
40	▯	17							
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring LSO-9 Continued



Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
				CLAYEY SAND Slightly compact, blue gray, fine				
50								
55								
				CLAYEY SAND Compact, tan, fine to medium				
60								
				SAND and GRAVEL Dense, coarse				
				CLAYEY SAND Loose to slightly compact, buff, fine				
65	▯	6						
70				**CLAYEY SAND** Slightly compact to compact, tan and red brown, medium				
75				**SAND and GRAVEL** Dense				
80								
85								
				Very dense				
90								
95								

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring LSO-9 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					BOTTOM OF BORING AT 95 FEET				
100									
105									
110									
115									
120									
125									
130									
135									
140									
145									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring MC-1

Date Drilled: 8/26/77
Type of Boring: 8 inch Hollow Stem Auger
Hammer/drop: unknown

Remarks: DATA FROM K480-4 - Peter Kaldveer and Associates - Radiology and Laboratory Building
Surface Elevation: 80 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
		12			**Clayey SILT (ML) FILL** Firm, brown, with some gravel FILL				
					Clayey, sandy SILT (ML) Stiff, brown				
5		14				14	109	4740	Su=2370 psf
10		13				15			-#200=55%
					Clayey SILT (ML) with gravel Very stiff, brown				
15		17				19	85	1430	Su=720 psf
					Silty CLAY (CL/CH) Firm, mottled brown-gray				
20		7			∇	24			
25		10			5 inch lens of sand at 24-1/2 feet	25			-#200=75%
					Silty, sandy CLAY (CL) Stiff, gray				
30		11			Gray-green	25			-#200=82%
35		12				23			
					Silty CLAY (CL/CH) Stiff, blue-gray, some organics				
40		12				36			
45		450							

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring MC-1 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
		500 psi				34	89	4780	Su=2390 psf
50									
55		425 psi						3500	Su=1300 psf
60									
65		750 psi			Very stiff	26	97	7880	Su=3940 psf
70									
75		20			Tan, grading very sandy 74 to 74-1/2 feet	27			
80									
					Silty CLAY (CL) with sand Very stiff, mottled light gray-brown, fine grained sand				
85		26				24			
90					**Silty SAND (SP-SM)** Dense, tan	26			
					BOTTOM OF BORING AT 90-1/2 FEET				
95									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring MC-3

Date Drilled: 8/29/77
Type of Boring: 8 inch Hollow Stem Auger
Hammer/drop: unknown

Remarks: DATA FROM K480-4 - Peter Kaldveer and Associates - Radiology and Laboratory Building
Surface Elevation: 82 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					1 inches Asphalt Concrete over 3 inches Aggregate Base				
					Clayey SILT (CL-ML) with sand Stiff, brown, fine grained sand				
		14				12			
		19				12	104	1740	LL=26 PI=7 -#200=76% Su=870 psf
5									
		12				9			
10					Tan, grading with some gravel				
					Silty CLAY (CL) Stiff, brown				
		8				22			-#200=92%
15									
					Silty CLAY (CL/CH) Stiff, mottled gray-brown				
		12			∇	26			
20									
					Silty SAND (SM) Loose, gray-brown, fine to medium grained				
		6							
25									
					Clayey, sandy SILT (ML) Stiff, tan				
		300 psi			**Silty CLAY (CL)** Stiff, mottled gray-brown	25	98	650	-#200=75% Su=320 psf
		15				27			
30									
		400 600 psi				26			PI=9 LL=30 -#200=87%
					Grading very silty (CL-ML)				
35					**Silty SAND (SM)** Medium dense, gray, fine grained				
									-#200=16%
		10			**Silty CLAY (CL) with sand** Firm, blue-gray	27			
40									
		400 psi				32			-#200=73%
					Stiff				
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring MC-3 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					BOTTOM OF BORING AT 45-1/2 FEET				
50									
55									
60									
65									
70									
75									
80									
85									
90									
95									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring OPUS-4

Date Drilled: 11/18/97
Type of Boring: Rotary Wash
Hammer/drop: 140lb/30in

Remarks: DATA FROM Kleinfelder - 10-3007-42 - Opus Building
Surface Elevation: 82 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					Approximately 4 inches Asphalt Concrete				
					GRAVELLY CLAYEY SAND (SC) FILL Reddish brown, medium dense, coarse gravel, fine to coarse grained sand, dry to moist				
5					**GRAVEL (GP) FILL** Gray, fine gravel, dry, (PEA GRAVEL)				
					GRAVELLY CLAYEY SAND (SC) FILL Reddish brown, fine to coarse sand, fine gravel, concrete debris, moist				
10					**CONCRETE**				
					SANDY CLAY (CL) FILL Black, low plasticity, coarse sand, trace fine gravel, wood and concrete debris, roots, rebar, moist Tile at 14-1/2 feet FILL				
15		14	1.5						
					CLAYEY SILT (ML) Mottled gray and yellow brown, stiff, low plasticity, moist	22	104		
					SANDY CLAYEY SILT (ML) Light gray, loose to medium dense, fine grained sand, trace coarse gravel, moist				
20		9							
25		11	1.0		Grading less silty				
					SILTY SAND/SANDY SILT (SM/ML) Light gray, loose, soft to medium, low plasticity, fine to medium grained sand, interbedded, with some clay, wet	20	103		
30		5				24	105		
					SILTY CLAY (CL) Gray, medium, low plasticity, moist				
35		8	1.0						
40		11	1.0		Trace fine sand	23	107		
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring OPUS-4 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
50		47			**SANDY GRAVEL (GW) WITH SILT** Mottled, dense, fine to coarse grained sand, fine to coarse gravel, wet				
55									
60		10	1.5		**CLAYEY SILT (ML)** Gray, medium, low plasticity, moist	24	104		
					BOTTOM OF BORING AT 61-1/2 FEET				
65									
70									
75									
80									
85									
90									
95									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring OPUS-4A

Date Drilled: 11/18/97
Type of Boring: Rotary Wash
Hammer/drop: 140lb/30in

Remarks: DATA FROM Kleinfelder - 10-3007-42 - Opus Building

Surface Elevation: 82 feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					Approximately 4 inches Asphalt Concrete				
					GRAVELLY CLAYEY SAND (SC) FILL Reddish brown, medium dense, fine to coarse sand, coarse gravel, concrete debris, moist				
5					**GRAVEL (GP) FILL** Gray, fine gravel, dry, (PEA GRAVEL)				
					GRAVELLY SANDY CLAY (CL) FILL Reddish brown, low plasticity, coarse gravel, fine to coarse sand, moist				
10					**GRAVEL (SP) FILL** Gray, fine gravel, dry (PEA GRAVEL) Concrete debris, rebar and wood. Void between 8 and 9 feet				
					BOTTOM OF BORING AT 12 FEET				
15									
20									
25									
30									
35									
40									
45									

1/14/04 JGLOGPP 8790E.GPJ

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring OPUS-5

Date Drilled: 11/13/97
Type of Boring: Rotary Wash
Hammer/drop: 140lb/30in

Remarks: DATA FROM Kleinfelder - 10-3007-42 - Opus Building
Surface Elevation: 82 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					2 inches Asphalt Concrete over 4 inches Aggregate Base				
					CLAYEY SAND (SC) FILL Mottled brown, medium dense, fine to coarse sand, dry to moist				
5					Concrete, rebar and brick debris				
					Plastic debris				
10					FILL				
					SANDY CLAY (CL) Brown, soft, low plasticity, fine sand, moist				
	▨	3	<0.5		**SILTY CLAY (CL)** Mottled yellow brown and gray, soft to medium stiff, low plasticity, moist				
15									
20					Color changes to dark brown ∇				
	▨	6	<0.5						
					CLAYEY SILT (ML) Gray, medium, low plasticity, moist to wet				
					SAND (SP) WITH CLAY Gray, medium dense, fine to medium grained sand, wet				
25	▨	16	>4.5			20	113		
30	▨	9			Trace gravel				-#200=35%
35					Grading more silty				
					SILTY CLAY/CLAYEY SILT (CL/ML) Mottled reddish brown and gray, medium, low plasticity, moist				
40	▨	16	1.5			29	93	2000	
					SANDY GRAVEL (GP) Mottled, medium dense, fine to coarse grained				
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring OPUS-5 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					sand and gravel, wet				
					SANDY CLAYEY SILT (ML) Yellow brown, stiff, low plasticity, fine sand, moist				
50	▨	26	4.0			19	112		
55					Grading more clayey				
60	▨	14	1.0			27	98		
					BOTTOM OF BORING AT 61-1/2 FEET				
65									
70									
75									
80									
85									
90									
95									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring SJA-1

Date Drilled: 8/3/88
Type of Boring: 4-7/8inch Rotary Wash
Hammer/drop: 140lb/30in (*=335lb)

Remarks: DATA FROM 8815020R - San Jose Multipurpose Arena
Surface Elevation: 84 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	1	13		**1-1/2 inches Asphalt Concrete over 5 inches Rock Base** **GRAVELLY CLAY (CL) FILL** Poorly compacted, damp, brown, with gravel to 2 inch particle size, and trace of broken glass, brick and wood FILL				
5	2	7		**CLAYEY SILT (ML)** Soft, wet, dark brown, slightly sandy	30	83	280	
10	3	21		**SILTY CLAY (CH)** Very stiff, moist, very dark gray to black With light gray mottling ▽	21	102	4830	
15	4	14		**SANDY CLAY (CL)** Stiff, light brown gray and orange mottled, with interbedded lenses of Silty to Clayey Sand (SC-SM)	27	93	1670	
20	5	16		**SILTY SAND (SM)** Medium dense, brown With alternating lenses of Silty Clay (CL), stiff, brown				-#200=31%
25	6	11		**SILTY CLAY (CL/CH)** Medium, dark gray	28	95	880	
30	7	10		Dark gray and olive green brown mottled	37	82	1620	
35	8	19		**SILTY CLAY (CL)** Medium to stiff, brown-gray and orange mottled, with fine sand	25	100	1900	
40	9	43		**GRAVELLY SAND (SW-SM)** Medium dense, brown, with gravel to 3/4 inch particle size, slightly clayey Silty Sand (SM) Grading to Sandy Gravel (GW-GM)	11	125		
45								

Project: 28649330.02520

URS

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring SJA-1 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	10	64		▨					+#4=53% -#200=8%
					BOTTOM OF BORING AT 46-1/2 FEET				
50									
55									
60									
65									
70									
75									
80									
85									
90									
95									

1/14/04 JGLOGPP 8790E.GPJ

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring SJA-2

Date Drilled: 8/2/88
Type of Boring: 4-7/8inch Rotary Wash
Hammer/drop: 140lb/30in (*=335lb)

Remarks: DATA FROM 8815020R - San Jose Multipurpose Arena
Surface Elevation: 84.5 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	1	17		**1-1/2 inches Asphalt Concrete** **SILTY CLAY (CL) FILL** Poorly compacted, moist, dark gray brown, with scattered gravel and brick fragments FILL	22	78		
				SANDY CLAYEY SILT (ML) Soft, wet, dark brown				
5	2	16		**SILTY CLAY (CL-ML)** Stiff, moist, brown, with lenses of Silty Sand (SM)	28	92	2930	
10	3	23		**SANDY CLAY (CL)** Stiff, moist, light brown-gray with orange and dark brown mottling, grades to medium dense Clayey Sand (SC) below 11 feet	20	106		
15	4	64		**SILTY SAND (SM)** Dense, moist to wet, dark gray with scattered gravel Grading to Sandy Gravel (GW-GM) with strong gasoline odor	11	120		+#4=33% -#200=21%
20	5	26		Grading to Gravelly Sand with Silt (SW-SM), medium dense				+#4=25% -#200=9%
				SILTY CLAY (CL/CH) Stiff, wet, dark gray				
25	6				29	96	2730	
	7	16						
30				**SILTY CLAY (CL)** Stiff, moist, gray, slightly sandy, with some organic matter ∇				
35	8	12			25	98	2410	
				Increasing sand content, with olive-green brown mottling				
40	9	21		Clayey Sand (SC)	24	102		
45								

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring SJA-2 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	10	13			Clayey Sand (SC) More plastic (CL-CH), medium	23	102	1720	
50	11	16			Less plastic (CL-ML), stiff, blue-gray and olive brown mottled	23	103	2600	
55	12	21			Clayey Silt (ML), dark gray	23	102	3100	
60	13	19			Gray and light gray mottled	22	107	2690	
65	14	18			With lenses of sandy Silt (ML) With coarse pebbly sand	22	105	1500	
70	15	69			**GRAVELLY SAND to SANDY GRAVEL (SW-SM/GW-GM)** Dense, tan, with silt	9	134		+#4=43% -#200=9%
					SANDY CLAY (CL) Medium, tan and orange mottled				
75	16	26				24	100	1530	
					Increasing sand content				
					GRAVELLY SAND to SANDY GRAVEL (SW-SM/GW-GM) Very dense, brown, with silt				
80	17	78							+#4=43% -#200=10%
85	18	17							
					BOTTOM OF BORING AT 86-1/2 FEET				
90									
95									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring SJA-6

Date Drilled: 11/16/88
Type of Boring: 4-7/8inch Rotary Wash
Hammer/drop: 140lb/30in (*=335lb)

Remarks: DATA FROM 8815020R - San Jose Multipurpose Arena
Surface Elevation: 84.5 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					1 inch Asphalt Concrete over 11 inches Aggregate Base				
	1	32*			**SILTY CLAY (CL) FILL** Brown to green-gray, with gravel up to 1 inch, with brick fragments Becomes Silty sand (SM) FILL	5	113		LL=27 PI=8
5	2	36*			**SILTY CLAY (CH)** Very stiff, moist, dark gray	26	91	5810	
					SILTY CLAY (CL) Stiff, moist, mottled green-gray and brown				
10	3	16*				22	103	3570	LL=36 PI=17
15	4	17*			**CLAYEY SAND (SC)** Medium dense, moist, green-gray, medium to fine grained, with strong gasoline odor With gravel	13	102		
20	5	24				21			+#4=0% -#200=13%
25	6	11*			**SILTY CLAY (CL)** Stiff, moist, brown	31	91	1345	LL=42 PI=18
30	7								
					With some gravel				
					GRAVELLY SAND (SW-SC) Very dense, moist, green-gray, well graded, coarse to fine grained, with clay				
35	8	50/ 5"				8			
40	9	58 /6"				11	124		+#4=26% -#200=8%
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring SJA-6 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	10	66							
					SAND CLAY (CL) Stiff, moist, green-gray				
50	11	47*				23	101		+#4=0% -#200=67%
55	12	36*				29	94	790	
60	13	46*							
	14	45*			**INTERBEDDED LAYERS OF SILTY SAND (SM) AND SILTY CLAY (CL)** DEnse, moist, green-gray	19	110		
65	15	22			**SILTY CLAY (CL)** Medium to stiff, moist, mottled green-gray and brown	25	99	930	LL=35 PI=15
70	16	31*			With trace of sand				
75	17	40*			Becomes mottled brown and light brown	22	106	2955	
80	18	77*			**SAND (SW-SM)** Very dense, moist, mottled light and dark brown, fine to coarse-grained, with silt; with occasional gravel (up to 3/4 inch)				
85	19	76				20			+#4=12% -#200=12%
					SILTY CLAY (CL) Stiff, moist, green-gray				
90	20	30				21	104		
95									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring SJA-6 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	21 ▨	49*		▨	Becomes brown, with fine sand	19	107		
100					BOTTOM OF BORING AT 100 FEET				
105									
110									
115									
120									
125									
130									
135									
140									
145									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring SJA-8

Date Drilled: 11/17/88
Type of Boring: 4-7/8inch Rotary Wash
Hammer/drop: 140lb/30in (*=335lb)

Remarks: DATA FROM 8815020R - San Jose Multipurpose Arena
Surface Elevation: 84.5 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					6 inches Asphalt Concrete over 3 inches Aggregate Base				
	1	25*			**SILTY CLAY (CH) FILL** Poorly compacted, moist, black FILL	11	107	1035	LL=39 PI=18
					SANDY CLAY (CL) Medium, moist, mottled green-gray and brown				
5	2	18*			**SILTY CLAY (CH)** Stiff, moist, dark gray with light gray mottling	27	91	3230	LL=44 PI=23
					SILTY CLAY (CL) Medium, moist, light gray, lens of sand and gravel below 8 feet				
10	3	9*			**SILTY CLAY (CL)** Stiff, moist, mottled green-gray and brown	29	93	2040	
15	4	12			Lens of sand				
20	5								
25	6	19*			Becomes green-gray	22	103	2180	
30	7	19*			Becomes mottled green-gray and brown	23	100	2550	LL=48 PI=27
35	8	16*			With some lenses of silty sand				
40	9	35*			Sandy Clay				
45									

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring SJA-8 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
	10	15*		▨	Becomes green-gray, with fine sand				
50	11	16*		▨		22	103	2645	
55	12	38*		▨	**CLAYEY SAND (SC)** Dense to very dense, moist, green-gray	18	111		+#4=0% -#200=43%
60	13	50/ 4"		▨		15	116		+#4=3% -#200=22%
				▨	**SILTY CLAY (CL)** Medium, moist, mottled green-gray and brown				
65	14	24*		▨					
70	15	21*		▨		20	106	1855	
75	16	21*		▨		21	105	1750	
80	17	22*		▨	Becomes green-gray				
					BOTTOM OF BORING AT 81-1/2 FEET				
85									
90									
95									

1/14/04 JGLOGPP 8790E.GPJ

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring TSP-8

Date Drilled: 11/18/95
Type of Boring: Rotary Wash
Hammer/drop: 140lb/30in

Remarks: DATA FROM 95117.10 - Parikh Consultants, Inc. - 12th Street Pipeline
Surface Elevation: 0 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					6 inches Asphalt Concrete over 3 inches Aggregate Base				
	1	14	3.0		**Lean CLAY (CL)** Stiff to very stiff, moist, brown, trace medium sand	20	97	3130	
5	2	20	2.8			25	96		
10					**Lean CLAY (CL)** Medium, wet, gray				
	3	5							No recovery
	4	11				31	90		
15	5	16							No recovery
	6	15	2.5			25	100	1660	Boring dry to 15 feet, began rotary wash
20					**Lean CLAY (CL)** Stiff, wet, brown, with sand				
	7	8				19			
	8	7			**Silty SAND (SM)** Loose, wet, fine to medium, gray	29			
25					**Lean CLAY (CL)** Medium to stiff, wet, brown, with sand				LL=32 PI=11
					Fat CLAY (CH) Medium, wet, mottled brown-gray				
30	9	12	0.8			32	87	1000	
35	10	20	1.0		Stiff	35	85	2130	
40	11	20	1.5			36	83	2700	
45	12	23	2.0			36	86		

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring TSP-8 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					BOTTOM OF BORING AT 45 FEET Boring dry ATD				
50									
55									
60									
65									
70									
75									
80									
85									
90									
95									

Project: SV RAPID TRANSIT CORRIDOR
Location: Santa Clara County, CA

Log of Boring TSP-9

Date Drilled: 10/31/95
Type of Boring: Rotary Wash
Hammer/drop: 140lb/30in

Remarks: DATA FROM 95117.10 - Parikh Consultants, Inc. - 12th Street Pipeline
Surface Elevation: 0 x feet (approx.)

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					9 inches Asphalt Concrete				
	1	13	2.0		**Lean CLAY (CL)** Very stiff, moist, brown	20	98		
					Becomes stiff				
5	2	16	1.8			29	93	2300	
					▼ 12/6/95				
10	3	9	0.5		**Lean CLAY (CL) with sand** Loose, wet, brown	27	93	430	
					Lean CLAY (CL) Medium, wet, gray				
15	4	10	0.5			22	105	1200	LL=46 PI=23 +#4=0% -#200=50%
					▽				
					Lean CLAY (CL) Medium, wet, brown, with sand				
20	5	8				19			
					Silty SAND (SM)				
25	6	8			**Lean CLAY (CL)** Medium, wet, brown	29			
30	7	9	0.8		**Fat CLAY (CH)** Medium, wet, mottled brown gray	35	84	1160	
35	8	11	0.5			41	79	1070	
40	9	11	1.0			55	67		
45	10	24	2.0		Stiff	33	89		

Project: SV RAPID TRANSIT CORRIDOR

Log of Boring TSP-9 Continued

Depth, feet	Samples	Blows/ft	Pocket Pen. (tsf)	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, pcf	Unconfined Compressive Strength, psf	Other Tests/ Remarks
					BOTTOM OF BORING AT 45 FEET				
50									
55									
60									
65									
70									
75									
80									
85									
90									
95									

Appendix C

Appendix C

This appendix summarizes the drilling and sampling techniques used to perform the Geotechnical Investigation for the underground portion (Segments BSJ-3 and BSJ-4) of the Silicon Valley Rapid Transit Corridor (SVRTC) in San Jose, California. The objective of this investigation was to collect geotechnical data necessary to define and characterize the subsurface conditions along the underground segment of the SVRTC alignment.

The geotechnical field investigation consisted of a total of twenty (21) geotechnical borings, seven (7) observation wells, five (5) cone penetration tests (CPT's), eight (8) vibrating wire piezometers, and three (3) seismic cone tests, extending to depths between 71.0 feet and 121.5 feet below the existing ground surface. Pertinent information for each exploration is presented in Tables C-1 through C-3. The explorations were performed between September 5, 2001 and July 30, 2003 by Pitcher Drilling Company of East Palo Alto, California (rotary wash borings, observations wells, and piezometers), and VBI In-Situ Testing, Inc. of West Sacramento, California (CPT's and seismic cones).

Downhole vibration monitoring tests were also performed at select exploratory locations, as noted in Table C-1. Depths of the vibration monitoring tests are also shown on the respective boring logs. The vibration monitoring tests were performed by representatives of Harris Miller Miller & Hanson, Inc. of Sacramento, California. Results and interpretation of these results are outside of the scope of our work and have been issued in a separate report.

Location of Explorations and Exploration Program

The exploration locations were chosen to investigate the subsurface conditions along the underground segments of the SVRTC alignment, and to obtain sufficient subsurface information to determine construction feasibility of the tunnel, underground stations, and associated structures, as well as provide preliminary geotechnical design recommendations.

While meeting these objectives, the locations also had to be chosen to avoid underground utilities and subsurface obstructions. Layouts of the proposed explorations were performed by representatives of URS, and were checked for conflict with underground utilities by contacting Underground Service Alert (USA) Network. USA in turn alerted the various municipalities and utility companies that a subsurface investigation was to be conducted near their utilities. In addition, the exploration locations were independently checked by a utility locating subcontractor retained by URS to ensure marked locations were in fact clear of utilities.

After underground utility clearance, URS obtained permits from the City of San Jose, Santa Clara Valley Water District, San Jose Water Company, and Union Pacific Railroad, and coordinated with appropriate personnel to accommodate the required inspection during and following exploration at each location.

Rotary Wash Borings (NB-01 through NB-08, NB-12 through NB-22, and NB-24)

Rotary wash borings were drilled to provide the necessary information to evaluate the subsurface stratigraphy along the alignment and to allow acquisition of high-quality soil samples for laboratory testing. Four (4) borings (NB-01, NB-13, NB-13A and NB-14) were performed at the Alum Rock Station, three (3) borings (NB-04, NB-15 and NB-16) were performed at the Civic Plaza/SJSU Station, five (5) borings (NB-05, NB-17, NB-18, NB19 and NB-20) were performed at the Market Street Station, three (3) borings (NB-06, NB-07 and NB-21) were performed at the Diridon/Arena Station, and five (5) borings (NB-02, NB-03, NB-03A, NB-09, NB-12, and NB-24) were performed at various locations along the tunnel alignment. These borings were drilled and sampled at the locations indicated on the Exploration Location Plan, Figure 4. The depth of the borings varied from 71.0 feet to 121.5 feet below existing ground surface, as shown on Table C-1. A truck-mounted rotary wash type drill rig (Failing) was used to drill the boreholes. The drilling was performed by Pitcher Drilling Company of East Palo Alto, California, under the supervision of a URS engineer who maintained a record of all field activities, classified the soils encountered using the Unified Soil Classification System (USCS), and maintained continuous logs of the borings. Logs of the borings based on field classification and subsequent laboratory testing are presented in Figures C-3 through C-23 in this appendix. Logs of boreholes drilled for vane shear testing are also included in this appendix. Details about vane shear tests are presented in Appendix D. A key to the soil classification and test data on the logs is given in Figures C-1 and C-2.

The drilling operation proceeded very carefully, with particular attention to potential interference with utilities or other buried structures. During drilling, both disturbed and undisturbed samples were obtained for identification and laboratory testing. Soil samples were generally obtained at 5-foot intervals and at changes in strata. Where fill was encountered, samples were mainly obtained using the Dames & Moore Type U Sampler and Modified California sampler. High quality undisturbed samples of soft to very stiff alluvial clays and silts were obtained with the Shelby Tube, Dames & Moore Piston, and Osterberg Piston samplers. The Dames & Moore Type U Sampler, Modified California Sampler, and Standard Split Spoon Sampler were typically used where sand and gravel layers were encountered.

A detailed description of the types of samplers used during our investigation is presented in the following paragraphs. In general, the choice of sampler type was based on the soil conditions encountered and the sample quality required for laboratory testing.

- **Dames & Moore U-Sampler:** The U-Sampler was used in both granular and cohesive deposits to obtain relatively undisturbed samples. This ring-lined barrel sampler, with a nominal 2½-inch inner diameter and 3¼-inch outer diameter, is in substantial compliance with ASTM D-3550. In this investigation, the same hammer used for the SPT test was used to drive the U-Sampler: a 140 pound hammer falling 30 inches. The blowcount recorded on the boring logs adjacent to the sample depth is the number of blows required to drive the sampler for the final 12 inches of an 18-inch drive.
- **Dames & Moore Piston Sampler (P):** The Dames & Moore Piston Sampler was used to obtain relatively undisturbed samples of the alluvial clays and silts. The Piston Sampler hydraulically pushes a 2½-inch diameter, 18-inch long brass thin-walled tube into the soil below the bottom of the borehole. A stationary piston is maintained at the top of the soil as the tube is driven downward which reduces potential for sample disturbance.

- **Shelby Tube Sampler (ST):** The Shelby Tube Sampler was used to obtain relatively undisturbed samples of the alluvial clays and silts. The Shelby Tube Sampler hydraulically pushes a 3-inch diameter, 36-inch long mild steel thin-walled tube into the soil below the base of the borehole.
- **Osterberg Piston Sampler (O):** The Osterberg Piston Sampler was used to obtain relatively undisturbed samples of alluvial clays and silts. The Osterberg PistonSampler operates similarly to the Dames & Moore Piston Sampler, except that it uses a 3-inch diameter, 36-inch long mild steel thin-walled tube.
- **Modified California Sampler (MC):** The Modified California Sampler was used to obtain relatively undisturbed samples of the alluvial clays and silts. This sampler consists of a ring-lined barrel sampler with a nominal 2-inch inside diameter and 2½-inch outside diameter. In this investigation, the same hammer used for the SPT test was used to drive the U-Sampler: a 140 pound hammer falling 30 inches. The blowcount recorded on the boring logs adjacent to the sample depth is the number of blows required to drive the sampler for the final 12 inches of an 18-inch drive.
- **Standard Split Spoon Sampler (SPT):** The Standard Spit Spoon Sampler was used to obtain disturbed samples of sand and gravel layers. The sampler consists of a split barrel sampler with a nominal 1½-inch inside diameter and a 2-inch outside diameter. The standard penetration resistance of the soil is reflected by the number of blows required to drive the sampler 18 inches into the soil with a 140-pound hammer falling 30 inches. The blowcount recorded on the boring logs adjacent to the sample depth is the number of blows required to drive the sampler for the final 12 inches of an 18-inch drive.

One of the objectives of the field investigation was to obtain high-quality undisturbed samples for laboratory testing. Every effort was made to minimize sample disturbance during sample handling and transportation. After careful withdrawal from the ground, the sample was placed upright and the ends of the sample were cleaned of disturbed soil. If possible, Pocket Penetrometer or Torvane Tests (on cohesive soils only) were performed on the bottom end of the tube or ring samples. The ring samples were first placed in a plastic bag and then in a plastic container, capped, and transported in a padded box. Both ends of the tube samples were sealed, then covered with plastic caps, taped, and the tubes were carefully transported to the URS laboratory in San Jose.

Observation Wells (NW-1, NW-4, NW-5, NW-6, MW-1, MW-2 and MW-3)

As part of the initial phase of our investigation (2001), four (4) observation wells (NW-1, NW-4, NW-5 and NW-6) were installed at each of the underground station locations. Locations of the wells are presented in Figures 5 through 8 in the main text of this report. The depths of the wells varied from 80.0 feet to 100.0 feet below existing ground surface, as shown in Table C-2. A truck-mounted rotary wash type drill rig (Failing) was used to drill the wells. The drilling and installation of the wells was carried out by Pitcher Drilling Company of East Palo Alto, California, under the supervision of a URS engineer who maintained records of all field activities. A summary of water level measurements is presented in Table C-4. Logs of the wells are presented in Figures C-24 through C-27.

Additional observation wells were installed (March 2003) at the Civic Plaza/SJSU Station to evaluate on-going dewatering operations adjacent to the San Jose Civic Center construction site. A total of three (3) observation wells (MW-1, MW-2 and MW-3) were installed at the locations indicated on Figure 8, Monitoring Well Location Plan - Civic Plaza/SJSU Station, in the main text of this report.. The depth of the wells varied from 74.0 feet to 84.0 feet below existing ground surface, as shown in Table C-2. A truck-mounted rotary wash type drill rig (Failing) was used to drill the wells. The drilling and installation of the wells was carried out by Pitcher Drilling Company of East Palo Alto, California, under the supervision of a URS engineer who maintained records of all field activities, classified the soils encountered using the Unified Soil Classification System (USCS), and maintained continuous logs of the wells. A summary of water level measurements is presented in Table C-5. Logs of the wells are presented in Figures C-28 through C-30.

Vibrating Wire Piezometers

A total of eight (8) vibrating wire piezometers were installed at each of the underground stations. A vibrating wire piezometer is a sealed, electronic water-pressure-measurement instrument that is connected by a multi-wire signal cable to the ground surface through a grouted borehole. The instrument is read using a specialized readout box attached to the instrument wires at the ground surface. These instruments were installed to measure small changes in soil pore water pressure.

A nest of two piezometers was installed in each of borings NB-07, NB-13A, NB-16, and NB-17. Piezometer elevations varied between 16 to 21 feet, and 39 to 46 feet. A summary of pertinent information regarding the piezometers is presented in Table C-6. Installation details are also presented on the respective boring logs in Figures C-10, C-14, C-17, and C-18.

The vibrating wire piezometers used for this project were manufactured by Slope Indicator of Mukilteo, Washington. Prior to installation, factory calibrations of all piezometers were checked by representatives of Robert Y. Chew Geotechnical, Inc.

The vibrating wire piezometers were installed at the required depth by the following procedures: The filter stones were saturated on-site to eliminate any trapped air and were put onto the piezometer tips in a bucket of water just prior to the installation of the piezometers into the borehole. Once the piezometers were placed at the required depth, a 2-foot high clean #4 sand pack was placed around the piezometer and filter stones. Bentonite pellets were then used to backfill the remainder of the boring above the sand pocket.

Readings have been taken on average once every two or three weeks. Table C-6 presents a summary of those readings.

Cone Penetration Tests (NC-9, NC-10, NC-11, NC-12 and NC-13)

Supplementary to our exploratory borings and observation wells, five (5) cone penetration tests (CPT's) were performed at locations along the alignment as indicated on the Site and Exploration Location Plan, Figures 5 through 7. The depth of the CPT's varied from 78.2 feet to 88.5 feet below existing ground surface, as shown on Table C-3. The CPT's were carried out by Virgil Baker Insitu Testing (VBI) of West Sacramento, California, under the supervision of a URS engineer. Logs of the CPT's are presented in Figures C-31 through C-35 and computer plots of the reduced CPT data received from VBI are presented in Figures C-36 through C-40.

Seismic cone tests were also performed in three (3) of the five (5) CPT's described above. Results of these tests, as well as results from existing nearby seismic cones, are presented in Appendix F.

Disposal of Cuttings

All drill cuttings and fluids generated during drilling of rotary wash borings and observation wells were collected in 55-gallon drums and collected by Integrated Waste Management, of San Jose, California for disposal in accordance with applicable local, state, and federal regulations.

TABLE C-1
SUMMARY OF ROTARY WASH BORINGS

Boring No.	Location	Approx. Ground Surface Elevation (ft)	Total Drilling Depth (ft)	Date Drilled	Comments
NB-01	Alum Rock Station	+92.0	111.5	9/7/01	-
NB-02	Tunnel	+89.9	81.5	9/5/02	Downhole Vibration Monitoring
NB-03	Tunnel	+95.8	76.0	10/28/02	Downhole Vibration Monitoring
NB-03A	Tunnel	+95.8	99.5	10/29/02	Downhole Vibration Monitoring
NB-04	Civic Plaza/SJSU Station	+81.0	81.0	9/4/01	Downhole Vibration Monitoring
NB-05	Market Street Station	+89.0	121.5	10/15/01 – 10/16/01	-
NB-06	Diridon/Arena Station	+89.0	121.5	9/5/01	Downhole Vibration Monitoring
NB-07	Diridon/Arena Station	+84.0	121.5	11/14/02 – 11/15/02	Vibrating Wire Piezometers, Field Vane Shear Tests
NB-08	Tunnel	+89.0	81.5	9/6/02	Downhole Vibration Monitoring
NB-12	Tunnel	+82.2	101.5	9/25/02	-
NB-13	Alum Rock Station	+86.0	101.0	11/17/02 – 11/18/02	-
NB-13A	Alum Rock Station	+86.0	71.0	11/24/02 – 11/25/02	Vibrating Wire Piezometers, Field Vane Shear Tests
NB-14	Alum Rock Station	+87.0	101.5	10/31/02	-
NB-15	Civic Plaza/SJSU Station	+80.0	91.0	11/6/02	-
NB-16	Civic Plaza/SJSU Station	+81.0	102.5	11/21/02 – 11/22/02	Vibrating Wire Piezometers, Field Vane Shear Tests
NB-17	Market Street Station	+88.5	101.5	11/12/02 – 11/12/02	Vibrating Wire Piezometers, Field Vane Shear Tests
NB-18	Market Street Station	+88.5	91.5	11/5/02	-
NB-19	Market Street Station	+88.5	101.5	11/18/02 – 11/20/02	Field Vane Shear Tests
NB-20	Market Street Station	+90.0	71.5	11/3/02 – 11/4/02	-
NB-21	Diridon/Arena Station	+86.3	100.0	11/1/02	-
NB-24	Tunnel	+69.5	80.5	7/30/03	-

TABLE C-2 SUMMARY OF MONITORING WELLS					
Boring No.	**Location**	**Approx. Ground Surface Elevation (ft)**	**Total Drilling Depth (ft)**	**Date Drilled**	**Comments**
NW-01	Alum Rock Station	+92.0	80.0	10/17/01	-
NW-04	Civic Plaza/SJSU Station	+88.0	80.0	9/5/01	-
NW-05	Market Street Station	+90.0	90.0	10/17/01	-
NW-06	Diridon/Arena Station	+90.0	100.0	9/6/01	-
MW-1	Civic Plaza/SJSU Station	+80.0	76.5	3/1/03 – 3/2/03	City Hall Excavation Dewatering
MW-2	Civic Plaza/SJSU Station	+80.0	81.5	3/1/03	City Hall Excavation Dewatering
MW-3	Civic Plaza/SJSU Station	+80.0	84.5	3/2/03	City Hall Excavation Dewatering

TABLE C-3
SUMMARY OF CONE PENETRATION TESTS

Boring No.	Location	Approx. Ground Surface Elevation (ft)	Total Drilling Depth (ft)	Date Drilled	Comments
NC-09	Tunnel	+87.8	91.0	10/31/02	-
NC-10	Tunnel	+88.2	101.1	10/31/02	-
NC-11	Alum Rock Station	+87.0	71.4	10/29/02	Seismic Cone
NC-12	Market Street Station	+88.5	101.9	11/4/02	Seismic Cone
NC-13	Diridon/Arena Station	+84.0	83.3	11/1/03	Seismic Cone

TABLE C-4: 2001 OBSERVATION WELLS DATA SUMMARY

Silicon Valley Rapid Transit Corridor
San Jose, California
Job No. 28648793.02513

	NW-01	NW-04	NW-05	NW-06
Surface Elevation (ft)	92.0	88.0	90.0	90.0
Screen Depth (ft)	70.0 to 80.0	70.0 to 80.0	80.0 to 90.0	90.0 to 100.0
Date Installed	10/17/01	09/05/01	10/17/01	09/06/01

Read Date	**Water Depth (feet below ground surface)**			
10/16/01	-	13.8	-	-
10/17/01	18.5	-	-	20.2
11/08/01	-	13.6	21.6	20.2
01/07/02	16.4	-	20.5	19.5
04/14/03	11.7	N/A*	18.7	16.9
	Water Level Elevation (feet)			
10/16/01	-	74.2	-	-
10/17/01	73.5	-	-	69.8
11/08/01	-	74.4	68.4	69.8
01/07/02	75.6	-	69.5	70.5
04/14/03	80.3	N/A*	71.3	73.1

* Note: Well destroyed at Civic Center site

TABLE C-5: 2003 CIVIC PLAZA STATION OBSERVATION WELLS DATA SUMMARY

Silicon Valley Rapid Transit Corridor
San Jose, California
Job No. 28648793.02513

	WELL # 18	MW-1	MW-2	MW-3
Surface Elevation (ft)	80.0	80.0	80.0	80.0
Screen Depth (ft)	N/A	64.0 to 74.0	60.0 to 80.0	74.0 to 84.0
Date Installed	N/A	03/01/03	03/01/03	03/02/03

READ DATE	Water Depth (feet below ground surface)			
03/03/03	38.0	12.3	12.2	12.3
03/0803	38.4	12.0	13.3	12.2
04/14/03	40.3	14.7	12.2	11.3
	Water Level Elevation (feet)			
03/03/03	42	67.7	67.8	67.7
03/0803	41.6	68	66.7	67.8
04/14/03	39.7	65.3	67.8	68.7

TABLE C-6: 2002 VIBRATING WIRE PIEZOMETERS
DATA SUMMARY

Silicon Valley Rapid Transit Corridor
San Jose, California
Job No. 28648793.002513

	NB-17		NB-07		NB-16		NB-13A	
	P1-1	P1-2	P2-1	P2-2	P3-1	P3-2	P4-1	P4-2
SURFACE ELEV.	88.5	88.5	84	84	81	81	86	86
PIEZO. DEPTH (ft)	45	70	40	65	42	60	40	70
PIEZO. ELEV. (ft)	43.5	18.5	44	19	39	21	46	16
INSTALL. DATE	11/13/02	11/13/02	11/15/02	11/15/02	11/22/02	11/22/02	11/25/02	11/25/02

READ DATE	READ TIME	Reading (psi)							
11/13/02	16:10	9.88	19.92	--	--	--	--	--	--
11/15/02	16:00	--	--	9.98	20.48	--	--	--	--
11/22/02	16:00	--	--	--	--	14.45	19.69	--	--
11/25/02	4:30	--	--	--	--	--	--	12.87	25.74
12/9/02	16:20	8.42	19.11	9.49	20.06	11.56	19.96	12.68	24.2
12/20/02	16:00	8.58	19.48	10.16	20.5	12.07	20.25	13.26	24.4
1/16/03	12:00	8.94	19.73	10.75	21.08	12.27	19.99	13.49	25.15
1/24/03	1:00	8.99	19.9	10.8	21.23	12.13	20.13	13.51	25.18
2/13/03	7:30	9	19.97	10.83	21.38	12.62	20.51	13.25	25.11
3/3/03	11:00	9.28	20.32	11.05	21.78	13.5	21.29	13.51	25.5

READ DATE	READ TIME	Reading (feet of head)							
11/13/02	16:10	22.8	46	--	--	--	--	--	--
11/15/02	16:00	--	--	23	47.3	--	--	--	--
11/22/02	16:00	--	--	--	--	33.3	45.4	--	--
11/25/02	4:30	--	--	--	--	--	--	29.7	59.4
12/9/02	16:20	19.4	44.1	21.9	46.3	26.7	46.1	29.3	55.8
12/20/02	16:00	19.8	45	23.4	47.3	27.9	46.7	30.6	56.3
1/16/03	12:00	20.6	45.5	24.8	48.6	28.3	46.1	31.1	58
1/24/03	1:00	20.7	45.9	24.9	49	28	46.5	31.2	58.1
2/13/03	7:30	20.8	46.1	25	49.3	29.1	47.3	30.6	57.9
3/3/03	11:00	21.4	46.9	25.5	50.3	31.2	49.1	31.2	58.8

READ DATE	READ TIME	Reading (pressure head elevation in feet)							
11/13/02	16:10	66.3	64.5	--	--	--	--	--	--
11/15/02	16:00	--	--	67	66.3	--	--	--	--
11/22/02	16:00	--	--	--	--	72.3	66.4	--	--
11/25/02	4:30	--	--	--	--	--	--	75.7	75.4
12/9/02	16:20	62.9	62.6	65.9	65.3	65.7	67.1	75.3	71.8
12/20/02	16:00	63.3	63.5	67.4	66.3	66.9	67.7	76.6	72.3
1/16/03	12:00	64.1	64	68.8	67.6	67.3	67.1	77.1	74
1/24/03	1:00	64.2	64.4	68.9	68	67	67.5	77.2	74.1
2/13/03	7:30	64.3	64.6	69	68.3	68.1	68.3	76.6	73.9
3/3/03	11:00	64.9	65.4	69.5	69.3	70.2	70.1	77.2	74.8

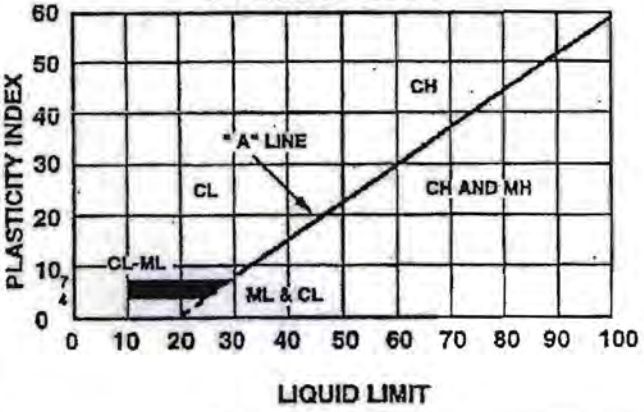
ROTARY WASH BORINGS

SAMPLE CLASSIFICATION CHART

UNIFIED SOIL CLASSIFICATION SCHEME

MAJOR DIVISIONS		SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOIL (More than 1/2 of soil >no. 200 sieve size)	**GRAVELS** (More than 1/2 of coarse fraction > no. 4 sieve size)	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
		GP	Poorly graded gravel or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	SAND (More than 1/2 of coarse fraction < no. 4 sieve size)	SW	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOIL (More than 1/2 of soil <no. 200 sieve size)	**SILTS & CLAYS** Liquid Limit < 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey, fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS Liquid Limit > 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

PLASTICITY CHART



GRAIN SIZE CLASSIFICATION

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size In Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL coarse (c) fine (f)	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND coarse (c) medium (m) fine (f)	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

MOISTURE CONTENT

DRY	-No sign of water and soil dry to touch
MOIST	-Signs of water and soil is relatively dry to touch
WET	-Signs of water and soil definitely wet to touch; granular soil exhibits some free water when densified

SOIL CONSISTENCY/RELATIVE DENSITY

SILT, SAND AND GRAVEL	BLOWS/FT	SILT OR CLAY	UNCONFINED COMPRESSIVE STRENGTH (psf)	THUMB PENETRATION
Very loose	<4	Very Soft	< 500	Very easily - inches
Loose	5-10	Soft	500 - 1000	Easily - inches
Medium Dense	11-30	Medium (firm)	1000 - 2000	Moderate effort - inches
Dense	31-50	Stiff	2000 - 4000	Indented easily
Very Dense	>50	Very Stiff	4000 - 8000	Indented by nail
		Hard	> 8000	Difficult by nail

CLASSIFICATION MODIFIERS

TRACE	0 - 12%
SOME	12 - 30%

± MODIFIERS

URS

Figure C-1

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION:
GROUND SURFACE ELEVATION (ft):
TOP OF WELL CASING ELEVATION (ft):
DRILLING AGENCY
DRILLER
DATE STARTED:
DATE FINISHED:
DRILLING EQUIPMENT
COMPLETION DEPTHS BORING: 25.0 (ft) WELL: (ft)
DRILLING METHOD
DRILL BIT
SAMPLING METHOD
SIZE AND TYPE OF CASING
NUMBER OF SAMPLES DIST: UNDIST:
TYPE OF PERFORATION FROM TO
WATER DEPTH (ft) FIRST: 15.5 ∇ COMPL.: 17.2 ▼ 24 hr.: ▼
SIZE AND TYPE OF PACK FROM TO
LOGGED BY
CHECKED BY

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1:			No. 3:		
	No. 2:			No. 4:		

LOG OF LEGEND

(Sheet 1 of 1)

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
				POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
		Arrow denotes bottom of fill layer FILL														
		2 inch inside diameter Modified California sample														
5		2 inch outside diameter Standard Split Spoon sample (Standard Penetration Test)						5								
		3 inch outside diameter Shelby tube sample														
10		DM U-Sampler						10				30				
		DM Piston Sampler										250 psi				
		Osterberg Sampler										50/ 5"				
15							∇	15								
		Groundwater level at time of drilling					▼									
		Groundwater at a time after drilling (as specified)														
20		**KEY TO TESTS**						20								
		LL= Liquid Limit (%) PI= Plasticity Index (%) NOTE: PI= LL - (Plastic Limit [%]) +#4= Percentage of material retained on #4 sieve -#200= Percentage of material passing #200 sieve														LL=42 PI=21 +#4=13% -#200=10%
25								25								
30								30								
35								35								

URS

PROJECT NO. 28649330.02520

Fig: C-2

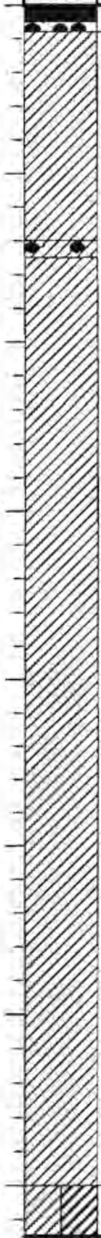
SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: 28th Street and East Saint James, San Jose
GROUND SURFACE ELEVATION (ft): 92.00 (approx)
TOP OF WELL CASING ELEVATION (ft): N/A
DRILLING AGENCY: Pitcher Drilling Company
DRILLER:
DATE STARTED: 9/7/01
DATE FINISHED: 9/7/01
DRILLING EQUIPMENT:
COMPLETION DEPTHS: BORING: 111.5 (ft) WELL: N/A (ft)
DRILLING METHOD: Rotary Wash
DRILL BIT: 4-7/8 inch
SAMPLING METHOD: Modified California, SPT
SIZE AND TYPE OF CASING: N/A
NUMBER OF SAMPLES: DIST: UNDIST:
TYPE OF PERFORATION: N/A FROM N/A TO N/A
WATER DEPTH (ft): FIRST: N/A ∇ COMPL.: N/A ▼ 24 hr.: N/A ∇
SIZE AND TYPE OF PACK: N/A FROM N/A TO N/A
LOGGED BY: C.Rambo
CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-01

(Sheet 1 of 3)



DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
		6 Inches Asphalt Concrete over 4 inches Aggregate Base														
		Lean CLAY (CL) Very stiff to medium, moist, brown	90						1	▨		17	22	100	2270	
5								5	2	▨		17	16	111	4390	
		With sand and gravel	85													
10								10	3	▨		13	25	100	2100	
			80													
15								15	4	▨		14	29	94	2340	
			75													
20								20	5	▨		11	27	98	2630	
		Gray with brown mottling	70													
25								25	6	▨		14	23	102	860	
		Soft	65													
30								30	7	▨		23	24	101	4360	
		Very stiff	60													
35		**Lean to fat CLAY (CL/CH)** Stiff to medium, moist, gray						35	8	▨		11	32	92	1510	

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-01

Continued- Sheet 2 of 3

				FIELD TESTS					SAMPLES				INDEX PROPERTIES			
DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
			55													
40								40	9	▨		17	34	87	3020	
			50													
45								45	10	▨		12	30	93	2040	
			45													
50								50	11	▨		21	24	103	3920	
			40													
55		**Lean CLAY (CL)** Stiff, moist, gray brown						55	12	▨		20	24	102	3700	
			35													
60								60	13	▨		17	26	98	2310	
		Gray with olive brown mottling														
			30													
		Well-graded SAND (SW-SM) with silt and gravel Very dense, moist, brown														
65								65	14	▨		62				
			25													
70								70	15	▯		48				
			20													
75								75	16	▨		79	7	127		+#4=32% -#200=8%
			15													
80								80	17	▯		57				
			10													

1/14/04 BART1 8790E.GPJ

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-01
Continued- Sheet 3 of 3

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
85								85								
			5													
		Silty SAND (SM) - lense														
		Clayey SAND (SC) with gravel Very dense, moist, brown														
90								90	18			59				+#4=37% -#200=13% -5micr=6%
			0													
95		**Lean CLAY (CL)** Very stiff to stiff, moist, gray and brown mottled						95								
			-5													
100								100	19			51				No recovery
			-10													
									20			67	19	111	4700	
105								105								
			-15													
110								110	21			43	20	109	3730	
		BOTTOM OF BORING AT 111-1/2 FEET	-20													
115								115								
			-25													
120								120								
			-30													
125								125								
			-35													
130								130								
			-40													

URS

PROJECT NO. 28649330.02520

Fig: C-3

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: NE Corner 26th and Santa Clara, San Jose
GROUND SURFACE ELEVATION (ft): 89.80 (approx)
TOP OF WELL CASING ELEVATION (ft): N/A
DRILLING AGENCY Pitcher Drilling Company
DRILLER R.Medina
DATE STARTED: 9/5/02
DATE FINISHED: 9/5/02
DRILLING EQUIPMENT
COMPLETION DEPTHS BORING: 81.5 (ft) WELL: N/A (ft)
DRILLING METHOD Rotary Wash
DRILL BIT 4-7/8 inch
SAMPLING METHOD Modified California, SPT
SIZE AND TYPE OF CASING N/A
NUMBER OF SAMPLES DIST: UNDIST:
TYPE OF PERFORATION N/A FROM N/A TO N/A
WATER DEPTH (ft) FIRST: N/A ∇ COMPL.: N/A ▼ 24 hr.: N/A ∇
SIZE AND TYPE OF PACK N/A FROM N/A TO N/A
LOGGED BY T.Pennington
CHECKED BY S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-02

(Sheet 1 of 2)

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
	6 inches Asphalt Concrete over 6 inches Aggregate Base														
	Lean CLAY (CL) Very stiff, moist, brown, trace gravel														
5		85					5	1	▨		21				
															Dry to 6.5', began rotary wash
	Increase in sand														
10	**Poorly graded SAND (SP-SM) with silt and gravel** Medium dense, moist, brown	80					10	2	▨		12				
	Fat CLAY (CH) Stiff, moist, light brownish gray														
15		75					15	3	▨		13	27	101	2950	
20	**Lean CLAY (CL)** Medium, moist, brown	70					20	4	▨		7	26	101	1420	
25		65					25	5	▨		6				
	Dark brownish gray, fine sand														
30	**Silty SAND (SM)** Medium dense, moist, gray, fine sand	60					30	6	▨		18	20 19	100 106		+#4=0 -#200=27%
	Lean to fat CLAY (CL/CH) Stiff to very stiff, moist, light greenish gray														
35		55					35								Vibration Test 35'

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-02
Continued- Sheet 2 of 2

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
									7			15				
40			50					40	8			15	29	96	4670	LL=49 PI=23
45			45					45								Vibration Test 45'
									9			19				
50			40					50	10			24	30	96	3940	
55			35					55								Vibration Test 55'
		Dark greenish gray							11			39				
60			30					60								
		Gray and brown mottled							12			37	24	105	6920	
65			25					65								
		Well-graded SAND (SW) with gravel Very dense, moist, brown							13			50/4"				
70			20					70								Vibration Test 70' +#4=40% -#200=8%
									14			78	8			
		Clay seam at 72 feet														
75			15					75	15			75				
80			10					80	16			81				
		BOTTOM OF BORING AT 81-1/2 FEET														

URS

PROJECT NO. 28649330.02520

Fig: C-4

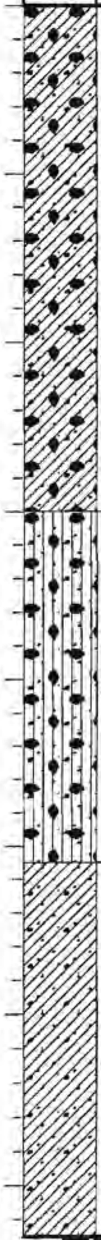
SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: Santa Clara Street at Coyote Creek, San Jose		GROUND SURFACE ELEVATION (ft): 95.80 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY: Pitcher Drilling Company	DRILLER: R.J.	DATE STARTED: 10/28/02 DATE FINISHED: 10/28/02	
DRILLING EQUIPMENT		COMPLETION DEPTHS	BORING: 76.0 (ft) WELL: N/A (ft)
DRILLING METHOD: Rotary Wash	DRILL BIT: 4-7/8 inch	SAMPLING METHOD	Modified California, SPT, Shelby Tube
SIZE AND TYPE OF CASING: N/A		NUMBER OF SAMPLES	DIST: UNDIST:
TYPE OF PERFORATION: N/A	FROM N/A TO N/A	WATER DEPTH (ft)	FIRST: N/A COMPL.: N/A 24 hr.: N/A
SIZE AND TYPE OF PACK: N/A	FROM N/A TO N/A	LOGGED BY: T.Pennington	CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-03

(Sheet 1 of 2)



DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	FIELD TESTS: POCKET TV (psf)	FIELD TESTS: VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY (%)	SAMPLES: BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	INDEX PROPERTIES: DRY DENSITY (pcf)	INDEX PROPERTIES: UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
	Sandy lean CLAY (CL) with gravel Medium, moist, dark brown	95													
5		90					5	1			14				Began rotary wash at 5'
10	Soft, increase in sand and gravel	85					10	2			3				
15	**Sandy SILT (ML) with gravel** Medium, moist, brown	80					15	3			8	23	92		
20	Increase in sand - possible (SP-SM) seam	75					20	4			6	23	89		+#4=0% -#200=82% -5micr=15% Non-plastic Lost circulation at 20'
25	**Sandy lean CLAY (CL)** Stiff to very stiff, moist, gray and brown mottled, with silt, trace gravel	70					25	5			19				
30	Increase in silt	65					30	6			26	27	99	1850	Losing circulation - installed casing to 22' Still losing circulation - Installed casing to 35'
35		60					35	7			35	21	109	4910	

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-03
Continued- Sheet 2 of 2

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
40		**Sandy, silty CLAY (CL-ML)** Stiff, moist, dark gray	55					40	8			11	27	99		+#4=0% -#200=58%
45			50					45	9			23	29			+#4=0 -#200=65%
50		**Fat CLAY (CH)** Stiff, moist, gray to dark gray	45					50	10			21				
55			40					55	11			36	34	91	3430	LL=62 PI=34
60			35					60	12			250 100 psi				
65		Very stiff, light gray with some brown mottling	30					65	13			39	32	91	4630	Vibration test - 66'
70		**Clayey SAND (SC) with gravel** Very dense, moist, brown	25					70	14			50+	8	133		+#4=42% -#200=14%
		Increase in gravel														Lost circulation - stopped drilling
75			20					75								
		BOTTOM OF BORING AT 76 FEET														
80			15					80								

URS

PROJECT NO. 28649330.02520

Fig: C-5

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: Santa Clara Street at Coyote Creek, San Jose		GROUND SURFACE ELEVATION (ft): 95.80 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY: Pitcher Drilling Company	DRILLER: R.J.	DATE STARTED: 10/29/02 DATE FINISHED: 10/29/02	
DRILLING EQUIPMENT		COMPLETION DEPTHS: BORING: 99.5 (ft) WELL: N/A (ft)	
DRILLING METHOD: Rotary Wash	DRILL BIT: 4-7/8 inch	SAMPLING METHOD: SPT	
SIZE AND TYPE OF CASING: N/A		NUMBER OF SAMPLES: DIST: UNDIST:	
TYPE OF PERFORATION: N/A	FROM N/A TO N/A	WATER DEPTH (ft): FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: N/A ▼	
SIZE AND TYPE OF PACK: N/A	FROM N/A TO N/A	LOGGED BY: T.Pennington	CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-03A

(Sheet 1 of 3)

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
		Clay and Silt with occasional Sand lenses													
			95												
		(No samples taken until 72 feet)													
5								5							
			90												
10								10							
			85												
															Began Rotary Wash
15								15							
			80												
20								20							
			75												
25								25							
			70												
30								30							
			65												
35								35							
			60												

URS

PROJECT NO. 28649330.02520

Fig: C-6

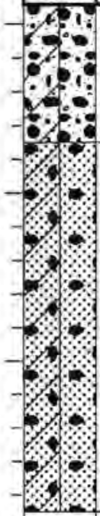
SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-03A
Continued- Sheet 2 of 3

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
40								40								
			-55													
45								45								
			-50													
50								50								
			-45													
55								55								
			-40													
60								60								
			-35													
65								65								
			-30													Vibration test - 66'
70								70								
		Well-graded SAND (SW-SC) with clay and gravel Very dense, moist, brown	-25													
									1			50+	8			+#4=32% -#200=7%
75								75								
			-20													Vibration test - 76'
									2			45				
80								80								
			-15													

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-03A
Continued- Sheet 3 of 3



DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
85		10					85								Vibration test - 86'
	Poorly graded SAND (SP-sc) with clay and gravel Very dense, moist, gray brown							3			50+ /6"				
90		5					90								Losing circulation
								4			17/2"	10			+#4=43% -#200=9%
95		0					95								
								5			27/3"				
100	BOTTOM OF BORING AT 99-1/2 FEET	-5					100								
105		-10					105								
110		-15					110								
115		-20					115								
120		-25					120								
125		-30					125								
130		-35					130								

URS

PROJECT NO. 28649330.02520

Fig: C-6

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: 5th Street and Santa Clara Street		GROUND SURFACE ELEVATION (ft): 81.00 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY: Pitcher Drilling Company	DRILLER	DATE STARTED: 9/4/01 DATE FINISHED: 9/4/01	
DRILLING EQUIPMENT		COMPLETION DEPTHS	BORING: 121.5 (ft) WELL: N/A (ft)
DRILLING METHOD: Rotary Wash	DRILL BIT 4-7/8 inch	SAMPLING METHOD	Modified California, SPT, Shelby Tube
SIZE AND TYPE OF CASING: N/A		NUMBER OF SAMPLES	DIST: UNDIST:
TYPE OF PERFORATION: N/A	FROM N/A TO N/A	WATER DEPTH (ft)	FIRST: N/A COMPL.: N/A 24 hr.: N/A
SIZE AND TYPE OF PACK: N/A	FROM N/A TO N/A	LOGGED BY: L.G/C.R.	CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-04

(Sheet 1 of 3)

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
	▨	**Lean CLAY (CL)** Stiff to medium, moist, brown	80													
5	▨		75					5	1	▧		17	22	101	2110	
10	▨		70					10	2	▧		5	37	84	1490	
	▨	**Sandy lean CLAY (CL)** Wet, gray														
15	▨	**Lean CLAY (CL)** Stiff to medium, moist, gray	65					15	3	▧		18	22	104	2760	
20	▨	Brown with gray mottling	60					20	4	▧		10	25	100	1710	
25	▨	Soft, wet, gray brown	55					25	5	▧		6	26	97	960	
	●	Gravel														
30	▨		50					30	6	▧		8	28	97	640	
35	▨	**Lean to fat CLAY (CL/CH)** Stiff, moist, gray	45					35	7	▧		13	39	82	2370	

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-04
Continued- Sheet 2 of 3

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
40		40					8			16	23	104	2500	
45	**Lean CLAY (CL)** Stiff, moist, gray with green mottling	35					9			16	24	100	2590	
50		30					10			160 psi				
55		25					11			27	24	101	2100	
60	**Silty SAND (SM)** Dense, moist, brown and green mottling	20					12			32				
65	Very dense	15					13			52				+#4=2% -#200=20%
70	Gray, with fine gravel	10					14			74				
	Sandy SILT (ML) Medium, moist, brown with gray mottling													
75	**Silty SAND (SM)** Dense, moist, brown	5					15			64				
	Poorly graded GRAVEL (GP-GM) with silt and sand Very dense, moist, brown													
80	Gray	0					16			54				

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-04
Continued- Sheet 3 of 3

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
				POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
85			-5					85	17	▨		69				
90		**Well-graded SAND (SW-SC) with clay and gravel** Very dense, moist, olive green	-10					90	18	☐		78	10			+#4=39% -#200=10%
95		**Lean CLAY (CL)** Very stiff, moist, gray with brown mottling	-15					95	19	▨		38				
100		**Silty SAND (SM)** Dense, moist, gray with brown mottling	-20					100	20	▨		46				
		Lean CLAY (CL) Very stiff to stiff, moist, gray														
105			-25					105	21	▨		44	21	106	4120	
110			-30					110	22	▨		30	22	104	2450	
115		**Clayey SAND (SC) with gravel** Very dense, dark gray, brown below 118 feet	-35					115	23	▨		50/ 4.5"	9	128		+#4=36% -#200=15%
120			-40					120	24	☐		50/ 5.5"				
		BOTTOM OF BORING AT 121-1/2 FEET														
125			-45					125								
130			-50					130								

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: Santa Clara Street and Almaden Avenue		GROUND SURFACE ELEVATION (ft): 89.00 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY: Pitcher Drilling Company	DRILLER	DATE STARTED: 10/15/01 DATE FINISHED: 10/16/01	
DRILLING EQUIPMENT		COMPLETION DEPTHS	BORING: 121.5 (ft) WELL: N/A (ft)
DRILLING METHOD: Rotary Wash	DRILL BIT 4-7/8 inch	SAMPLING METHOD	Modified California, SPT, Shelby Tube
SIZE AND TYPE OF CASING: N/A		NUMBER OF SAMPLES	DIST: UNDIST:
TYPE OF PERFORATION: N/A	FROM N/A TO N/A	WATER DEPTH (ft)	FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: N/A
SIZE AND TYPE OF PACK: N/A	FROM N/A TO N/A	LOGGED BY: C.Rambo	CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-05

(Sheet 1 of 3)

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
	4 inches Asphalt Concrete over 4 inches Portland Cement Concrete over 10 inches Aggregate Base														
	Clayey SAND (SC) FILL Medium dense, moist, light brown														
								1	☒			11			
		85													
5							5								
	Well-graded SAND (SW) with gravel - FILL FILL														
	Lean CLAY (CL) Medium, very moist, brown with orange to red brown mottling	80													
10							10								
	Soft							2	▨		15	33	87	910	
		75													
15	**Lean CLAY (CL)** Medium, moist, gray						15								
	Lean CLAY (CL) Stiff, moist, dark gray	70													
20							20								
								3	▨		20	22	105	2180	
	With brown mottling, sand lense at 24-1/2 feet	65													
25	**Lean CLAY (CL)** Medium, dark gray. With Poorly graded Sand (SP-SM) with silt lenses, medium dense, gray						25								
		60													
30							30								
								4	▨		15	26	99	1280	
		55													
35							35								

URS

PROJECT NO. 28649330.02520

Fig: C-8

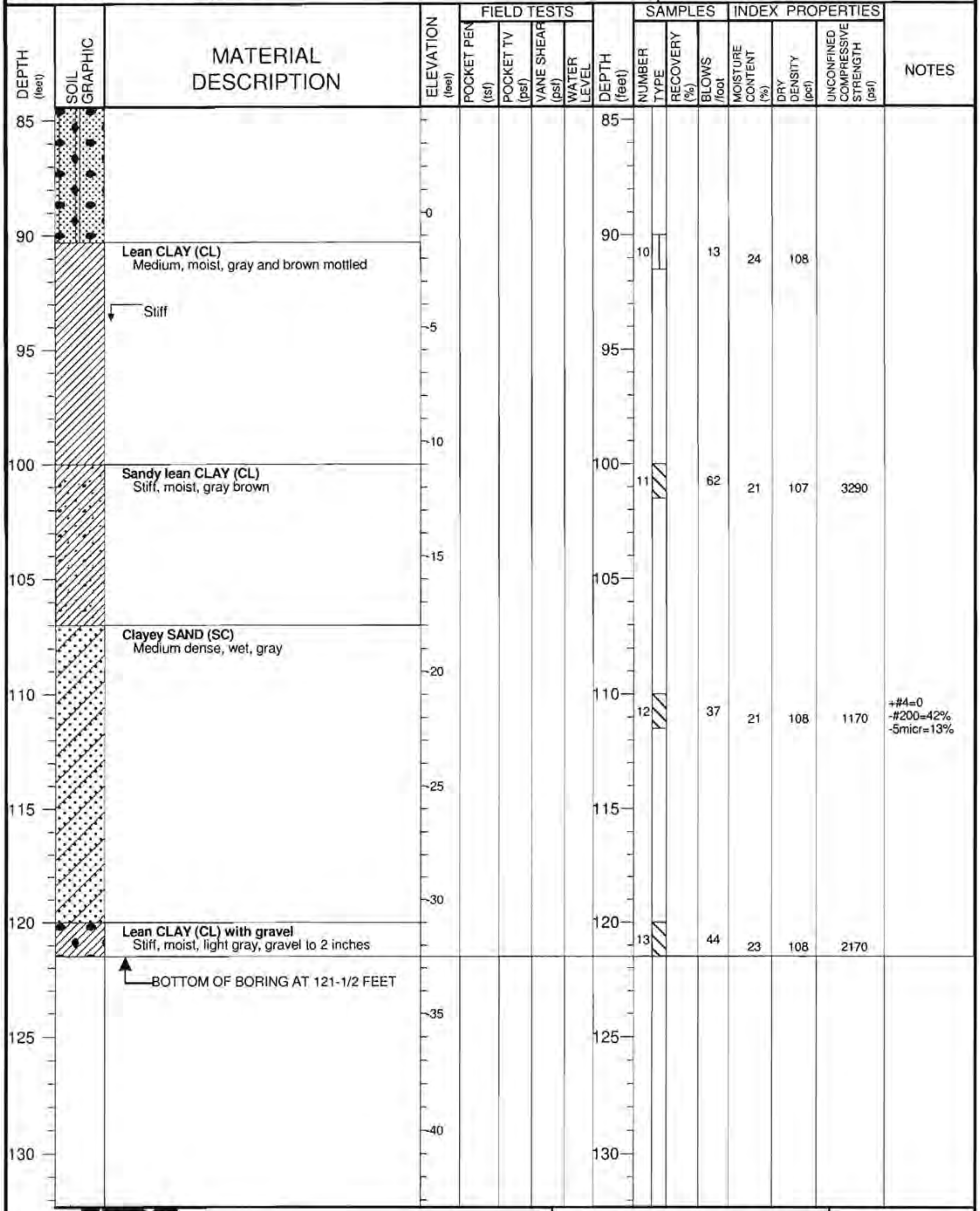
SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-05
Continued- Sheet 2 of 3

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
				POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
			50													
40								40								
		▼ Stiff, with brown mottling							5	▨		21	29	95	3300	
		Poorly graded SAND (SP-SM) with silt and gravel Medium dense to dense	45													
45								45								
			40													
50								50								
		Lean CLAY (CL) Stiff, moist, gray and brown mottled							6	☐		35	22			
		Poorly graded SAND (SP-SM) with silt and gravel Dense, moist, gray, fine gravel											15			+#4=21% -#200=8%
			35													
55								55								
		Lean CLAY (CL) Medium, moist, gray	30													
60								60								
									7	▨		13	26	100	1350	
			25													
65		**Silty SAND (SM)** Medium dense, wet, olive green						65								
			20													
70								70								
									8	▨		31	20	109	1700	+#4=7% -#200=48% -5micr=17%
			15													
75		**Sandy lean CLAY (CL)** Brown						75								
		Lean CLAY (CL) Gray														
			10													
		Poorly graded SAND (SP) Dark gray, trace silt														
80		**Lean CLAY (CL)** Stiff, moist, gray and brown mottled						80	9	▨		38	20	109	3630	
		Poorly graded SAND (SP-SM) with silt and gravel Dense to medium dense, dark gray, some fluid loss, gravel to 3/4 inch														
			5													

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-05
Continued- Sheet 3 of 3



DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
90	**Lean CLAY (CL)** Medium, moist, gray and brown mottled Stiff						10			13	24	108		
100	**Sandy lean CLAY (CL)** Stiff, moist, gray brown						11			62	21	107	3290	
107	**Clayey SAND (SC)** Medium dense, wet, gray						12			37	21	108	1170	+#4=0 -#200=42% -5micr=13%
120	**Lean CLAY (CL) with gravel** Stiff, moist, light gray, gravel to 2 inches						13			44	23	108	2170	

BOTTOM OF BORING AT 121-1/2 FEET

URS

PROJECT NO. 28649330.02520

Fig: C-8

1/14/04 BART1 8790E.GPJ

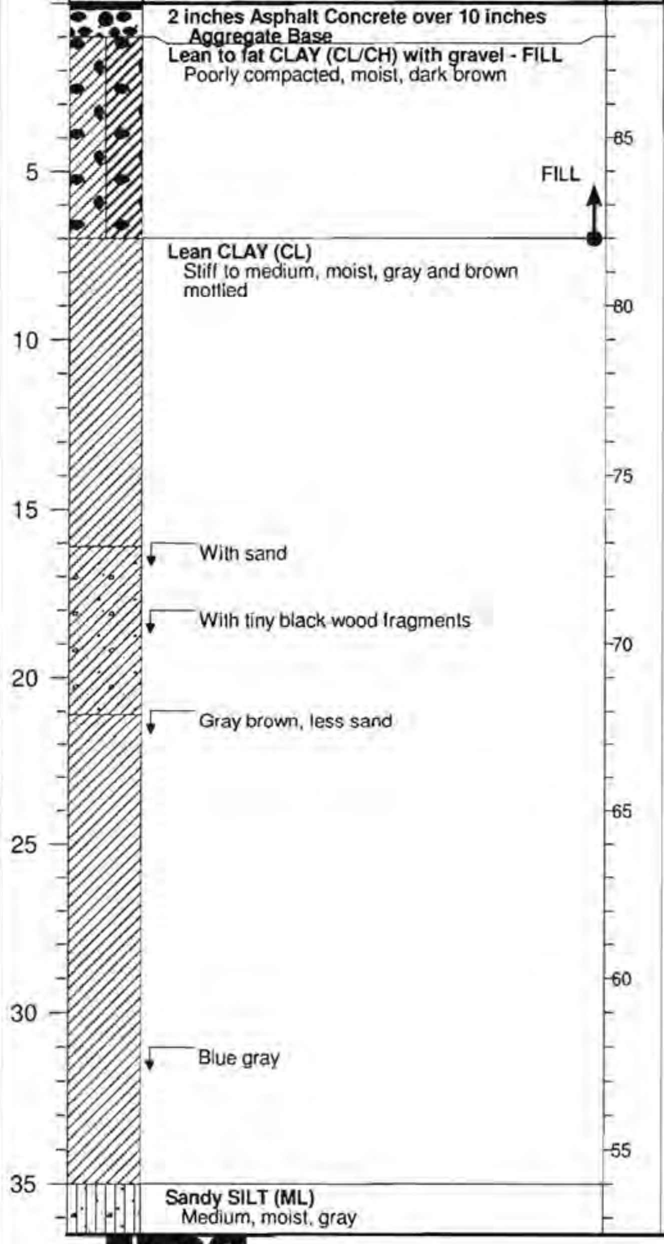
SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: Santa Clara Street and Cahill Street		GROUND SURFACE ELEVATION (ft): 89.00 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY: Pitcher Drilling Company	DRILLER	DATE STARTED: 9/5/01 DATE FINISHED: 9/5/01	
DRILLING EQUIPMENT		COMPLETION DEPTHS: BORING: 121.5 (ft) WELL: N/A (ft)	
DRILLING METHOD: Rotary Wash	DRILL BIT 4-7/8 inch	SAMPLING METHOD: Modified California	
SIZE AND TYPE OF CASING: N/A		NUMBER OF SAMPLES: DIST: UNDIST:	
TYPE OF PERFORATION: N/A	FROM N/A TO N/A	WATER DEPTH (ft): FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: N/A ▽	
SIZE AND TYPE OF PACK: N/A	FROM N/A TO N/A	LOGGED BY: C.Rambo	CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-06

(Sheet 1 of 3)



MATERIAL DESCRIPTION

2 inches Asphalt Concrete over 10 inches Aggregate Base

Lean to fat CLAY (CL/CH) with gravel - FILL
Poorly compacted, moist, dark brown

Lean CLAY (CL)
Stiff to medium, moist, gray and brown mottled

With sand

With tiny black wood fragments

Gray brown, less sand

Blue gray

Sandy SILT (ML)
Medium, moist, gray

SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
1	▨		24				
2	▨		7				
3	▨		8	25	98	2030	
4	▨		10	24	100	800	
5	▨		15	22	104	1460	
6	▨		11	26	96	2140	
7	▨		9	28	95	1660	
8	▨		18	16	105	1460	Non-plastic

FIELD TESTS: POCKET PEN (tsf) | POCKET TV (psf) | VANE SHEAR (psf) | WATER LEVEL

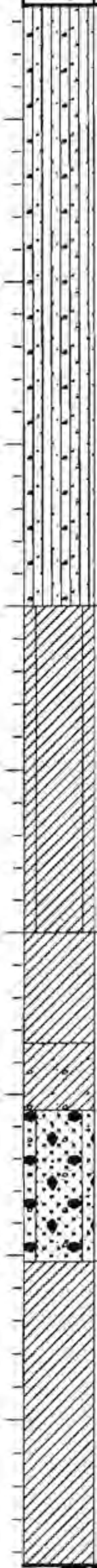
URS

PROJECT NO. 28649330.02520

Fig: C-9

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-06
Continued- Sheet 2 of 3



DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
											23	100		
		50												
40							9	▧		15	23	102	1600	+#4=0 -#200=72% -5micr=22%
		45												
45							10	▧		13	20 21	102 105	990	+#4=0% -#200=58%
		40												
50														
	Gray with brown mottling						11	▧		18	19 20	104 106	1810	+#4=0 -#200=70%
		35												
55	**Silty CLAY (CL-ML)** Stiff, moist, gray						12	▧		18	21	108	2180	
		30												
60							13	▧		14	23	103	2040	
		25												
65	**Lean CLAY (CL)** Stiff, moist, brown with gray mottling						14	▧		22	21	106	3300	
	With sand	20												
70	**Silty SAND (SM) with gravel** Very dense, moist, brown						15	▧		50	10	119		+#4=27% -#200=13%
		15												
75	**Silty CLAY (CL-ML)** Very stiff to stiff, moist, dark gray to gray, trace gravel						16	▯		21				
		10												
80							17	▧		28	22	106	3590	
		5												

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-06
Continued- Sheet 3 of 3

				FIELD TESTS					SAMPLES				INDEX PROPERTIES			
DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
85								85	18			28	20	108	4710	
		Poorly graded SAND (SP) Very dense, moist, dark brown, trace gravel and silt	0													
90								90	19			59	12			+#4=1% -#200=4#
		With gravel	-5													
95		**Silty SAND (SM) with gravel** Very dense, dark gray brown						95	20			50/6"				
			-10													
100								100	21			82	9	128		+#4=32% -#200=13% -5micr=5%
		Silty CLAY (CL-ML) Stiff, moist, gray and brown mottled	-15													
105								105	22			31	22	103	3420	
		Poorly graded SAND (SP-SM) with silt and gravel Very dense, moist, brown	-20													
110								110	23			81				
			-25													
115								115	24			50/5"				
		Silty SAND (SM) Very dense, moist, brown	-30													
120								120	25			49	19	101		+#4=0 -#200=27%
		BOTTOM OF BORING AT 121-1/2 FEET	-35													
125								125								
			-40													
130								130								

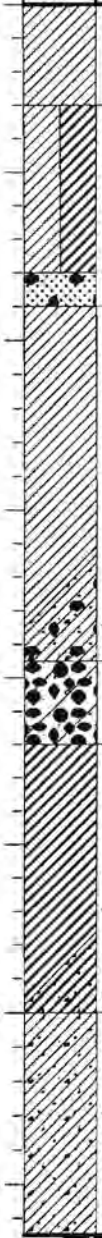
SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: White Street and The Alameda, San Jose		GROUND SURFACE ELEVATION (ft): 84.00 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY: Pitcher Drilling Company	DRILLER: R.Medina	DATE STARTED: 11/14/02 DATE FINISHED: 11/15/02	
DRILLING EQUIPMENT		COMPLETION DEPTHS: BORING: 121.5 (ft) WELL: N/A (ft)	
DRILLING METHOD: Rotary Wash	DRILL BIT 4-7/8 inch	SAMPLING METHOD: DM U-Sampler, DM Piston, Shelby Tube	
SIZE AND TYPE OF CASING: N/A		NUMBER OF SAMPLES: DIST: UNDIST:	
TYPE OF PERFORATION: N/A	FROM N/A TO N/A	WATER DEPTH (ft): FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: N/A ▽	
SIZE AND TYPE OF PACK: #3 Sand (see graphic)	FROM N/A TO N/A	LOGGED BY: E.Ntambakwa	CHECKED BY: S.Huang

TYPE OF SEAL	FR	TO	TYPE	FR	TO
No. 1: Bentonite Chips	65.5'	121.5'	No. 3: Bentonite Chips	31.5'	38.5'
No. 2: Bentonite Chips	40.5'	63.5'	No. 4: Cement Grout	0	31.5'

LOG OF BORING NB-07

(Sheet 1 of 3)



DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	FIELD TESTS: POCKET TV (psf)	FIELD TESTS: VANE SHEAR (psf)	FIELD TESTS: WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY (%)	SAMPLES: BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	INDEX PROPERTIES: DRY DENSITY (pcf)	INDEX PROPERTIES: UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
	Lean CLAY (CL) Moist to slightly moist, grayish-brown, trace fine sand														
	Lean to fat CLAY (CL/CH) Medium, moist, gray with brown mottling, trace sand	80													
5							5								
				1820				1		100	18				Dry to 6', began rotary wash
	Sand and gravel pocket														
	Lean CLAY (CL) Stiff, moist, gray with brown mottling	75													
10				1020			10	2		100	14				
					1499				FV						
		70			>1912				FV						
15					>1840		15		FV		100 150 psi				
								3		94		20	110		LL=26 PI=11 UU Test
	Sand/gravel in cuttings			1040											
		65													
20	**Clayey GRAVEL (GC) with sand** Dense, moist, gray and brown						20	4		100	26				
	Fat CLAY (CH) Stiff, gray														
		60													
25					1353		25		FV						
					1499				FV						
	Light olive gray with some brown mottling, trace fine sand				1210				FV						
					1714				FV						
	Grades sandy	55			1332				FV						
30	**Sandy lean CLAY (CL)** Medium, gray and brown, with gray fine sand pockets						30	5		100	24				
	Grading more clayey														
		50						6		67	250 psi				Too sandy for PTV
35							35								

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-07
Continued- Sheet 2 of 3

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
			POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
	Less sandy in cuttings							7	▨	61	250 psi				
	Sandy in sample	45													
40	**Fat CLAY (CH)** Stiff, moist, light olive gray, trace fine sand						40								
				1170				8	▨	33	180 psi	27	97		UU Test Vibrating Wire Piezometer P2-1 installed a 40'
		40			>1934				FM						
45	Increase in stiffness						45								
					>1890				EM						Unable to push vane to 48'
	Sandy lean CLAY (CL) Moist, gray, with cemented sand pockets														
		35						9	▨	56	250 psi				
50							50								
	Grades less sandy, more plastic (CL/CH)														
	Fat CLAY (CH) Stiff, light gray, trace carbonate stains	30		1750				10	▨	67	350 psi	26	99		UU Test
55							55								
	Grades with brown mottling														
		25		1700				11	▨	72	200 psi				
60	Grades grayish-brown with reddish brown mottling						60								
		20		1900				12	▨	67	350 psi	23	105		UU Test LL=32 PI=14
65							65								Vibrating Wire Piezometer P2-2 installed a 65'
	Well-graded GRAVEL (GW-GC) with clay Very dense, moist, brown to reddish-brown, with clay pockets	15						13	∪	35	50/5"				
70							70								
	Clay seam from 74 to 74.3 feet	10						14	∪	78	66	13			+#4=35% -#200=28%
75							75								
	Poorly graded Sand (SP) seam, very dense, moist, medium sand	5						15	∪	11	79				Driller reported sand seam was approximately 8 to 10" thick
80							80								
	Well-graded GRAVEL (GW) with sand Very dense, moist, brown	0						16	∪	67	50/5"				

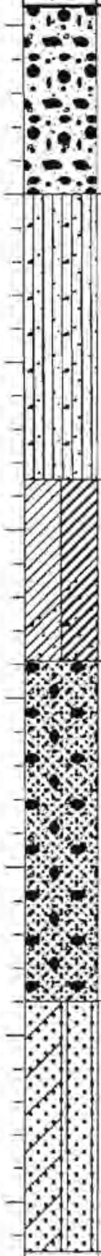
URS

PROJECT NO. 28649330.02520

Fig: C-10

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-07
Continued- Sheet 3 of 3



DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
85							85								
		-5						17	U	64	50/5"				
90	**Sandy SILT (ML)** Very stiff, moist, dark gray, fine sand, trace fine gravel						90								
		-10		3500				18	U	61	32	22	103		+#4=3% -#200=65% -5micr=17% Non-plastic
95							95								
	Lean to fat CLAY (CL/CH) Very stiff to hard, moist, dark gray, trace sand	-15		4125				19	U	72	49				
100							100								
	Becoming sandy, brown							20		0	400 psi				No recovery
	Well-graded SAND (SW) with gravel Very dense, moist, reddish-brown	-20													
105							105	21	U	100	50/5"				
		-25													
110							110	22	U	36	50/5"				
	Silty, clayey SAND (SC-SM) Dense to very dense, moist, dark gray, with thin silty clay lenses	-30													
115							115	23	U	67	39	20	111		+#4=3% -#200=48% -5micr=18% Non-plastic
		-35													
120				3630			120	24	U	89	65				
	BOTTOM OF BORING AT 121-1/2 FEET														
		-40													
125							125								
		-45													
130							130								

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: NW Corner West Julian and Morrison Avenue		GROUND SURFACE ELEVATION (ft): 89.00 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY Pitcher Drilling Company	DRILLER R.Medina	DATE STARTED: 9/6/02 DATE FINISHED: 9/6/02	
DRILLING EQUIPMENT		COMPLETION DEPTHS BORING: 81.5 (ft) WELL: N/A (ft)	
DRILLING METHOD Rotary Wash	DRILL BIT 4-7/8 inch	SAMPLING METHOD Modified California, SPT, Shelby Tube	
SIZE AND TYPE OF CASING N/A		NUMBER OF SAMPLES DIST: UNDIST:	
TYPE OF PERFORATION N/A	FROM N/A TO N/A	WATER DEPTH (ft) FIRST: N/A ∇ COMPL.: N/A ▼ 24 hr.: N/A	
SIZE AND TYPE OF PACK N/A	FROM N/A TO N/A	LOGGED BY T.Pennington	CHECKED BY S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-08

(Sheet 1 of 2)

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
		6 inches Asphalt Concrete														
		Silty SAND (SM) with gravel - FILL	FILL													
		Lean CLAY (CL) with gravel Moist, dark gray														
		Sandy, silty CLAY (CL-ML) with gravel Moist, light gray	85													
5		**Sandy lean CLAY (CL)** Very stiff, moist, gray and brown mottled						5	1			24				Dry to 5', began rotary wash
10		**Poorly graded SAND (SP-SM) with silt** Loose, moist, gray and brown mottled, fine sand	80					10	2			11				
		SILT (ML) Stiff, moist, gray and brown mottled	75													
15		**Lean CLAY (CL)** Stiff, moist, gray and brown mottled						15	3			11	32	89		
20			70					20	4			15	31	93	2850	
25			65					25	5			15	35	90	2150	LL=51 PI=28
30		**Lean to fat CLAY (CL/CH)** Stiff, moist, dark greenish gray	60					30	6			50 100 psi				
35		**Silty SAND (SM)** Medium dense, moist, brown, trace gravel	55					35	7			24	21	104		+#4=0%

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-08
Continued- Sheet 2 of 2

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				SAMPLES				INDEX PROPERTIES			NOTES
			POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
														-#200=34%
		50												
40							8	☐		23				No recovery
	Clay seam													
	Increase in gravel													
		45												
45	**Well-graded GRAVEL (GW-GM) with silt and sand** Very dense, wet, gray brown						9	☐		50/5"				Vibration Test 46'
	Silty, clayey SAND (SC-SM) Medium dense, moist, gray and brown mottled, trace gravel													
		40												
50			3.5				10	▨		23	26	101	3120	
	Lean CLAY (CL) Stiff, moist, light brownish gray, trace gravel													
		35												
55							11	▨		31				
														Vibration Test 57'
		30												
60	Medium, light greenish gray, fine sand						12	▨		18	24	102	1410	
		25												
65							13	▨		15	25	104	1600	
														Vibration Test 67'
		20												
70	Stiff, gray, increase in sand						14	▨		30	22	107	2750	
		15												
75							15	▨		32				
														Vibration Test 77'
		10												
80	**SILT (ML)** Very stiff, moist, yellowish brown to light brown, trace clay						16	▨		38				
	BOTTOM OF BORING AT 81-1/2 FEET													
		5												

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: 101 and Marburg, San Jose

GROUND SURFACE ELEVATION (ft): 82.20 (approx)
TOP OF WELL CASING ELEVATION (ft): N/A

DRILLING AGENCY: Pitcher Drilling Company
DRILLER: R.J.

DATE STARTED: 9/25/02
DATE FINISHED: 9/25/02

DRILLING EQUIPMENT:

COMPLETION DEPTHS: BORING: 101.5 (ft) WELL: N/A (ft)

DRILLING METHOD: Rotary Wash
DRILL BIT: 4-7/8 inch

SAMPLING METHOD: Modified California, Shelby Tube

SIZE AND TYPE OF CASING: N/A

NUMBER OF SAMPLES: DIST: UNDIST:

TYPE OF PERFORATION: N/A FROM N/A TO N/A

WATER DEPTH (ft): FIRST: N/A COMPL.: N/A 24 hr.: N/A

SIZE AND TYPE OF PACK: N/A FROM N/A TO N/A

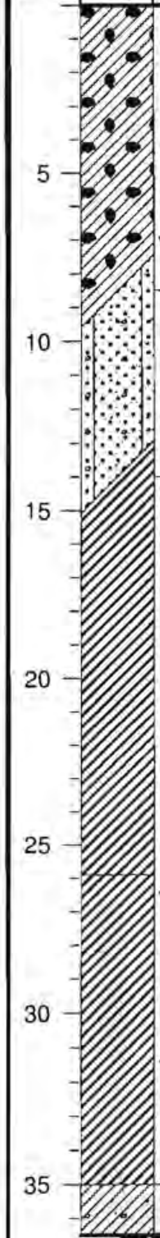
LOGGED BY: C.Rambo
CHECKED BY: S.Huang

TYPE OF SEAL:

TYPE	FR	TO	TYPE	FR	TO
No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-12

(Sheet 1 of 3)



MATERIAL DESCRIPTION

Lean CLAY (CL) with gravel - FILL
Very stiff, moist, gray brown, asphalt concrete debris

With roots

FILL

Silty SAND (SM)
Medium dense, moist, gray and brown mottled

Fat CLAY (CH)
Very stiff, moist, gray and brown mottled

Stiff, with sand

Less sand

Lean CLAY (CL) with sand
Medium, moist, dark greenish gray

ELEVATION (feet): 80, 75, 70, 65, 60, 55, 50

DEPTH (feet)	NUMBER	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
	1	23				
5	2	23				Began rotary wash at 6.5'
10	3	18				
15	4	22	29	98	4320	LL=54 PI=28
20	5	19				
25	6	15	28	98	2040	
30	7	17				
35	8	13	20	113	1180	

FIELD TESTS: POCKET PEN (tsf) | POCKET TV (psf) | VANE SHEAR (psf) | WATER LEVEL

SAMPLES: NUMBER | TYPE | RECOVERY (%) | BLOWS /foot

URS

PROJECT NO. 28649330.02520

Fig: C-12

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-12
Continued- Sheet 2 of 3

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	FIELD TESTS: POCKET TV (psf)	FIELD TESTS: VANE SHEAR (psf)	FIELD TESTS: WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY (%)	SAMPLES: BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	INDEX PROPERTIES: DRY DENSITY (pcf)	INDEX PROPERTIES: UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
			45													
40								40	9			26				
		Trace gravel														
			40													
45								45	10			26	23	104	1590	
		Less sand														
			35													
50		**Silty, clayey SAND (SC-SM) with gravel** Very dense, moist, dark greenish gray						50	11			77	10	136		+#4=34% -#200=16%
			30													
55		**Lean CLAY (CL)** Very stiff, moist, light greenish gray						55	12			29	21	109	4240	
			25													
60								60	13			100 200 psi				
			20													
65		With fine sand						65	14			25				
			15													
70		**Poorly graded SAND (SP-SM) with silt** Medium dense, moist, gray						70	15			26				
		Lean CLAY (CL) Very stiff, moist, gray and brown mottled														
			10													
75								75	16			53	21	107	6390	
			5													
80		**Silty SAND (SM)** Very dense, moist, brown						80	17			49				
		Lean CLAY (CL) Stiff, moist, gray														
			0													

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-12
Continued- Sheet 3 of 3

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
85							85	18	▨		31				
	Silty, clayey SAND (SC-SM) Medium dense, moist, dark greenish gray	-5													
	Lean CLAY (CL) Very stiff to hard, moist, gray and brown mottled, trace fine sand														
90							90	19	▨		44				
		-10													
95							95	20	▨		44				
	Light brown														
		-15													
100							100	21	▨		34				
	BOTTOM OF BORING AT 101-1/2 FEET	-20													
105							105								
		-25													
110							110								
		-30													
115							115								
		-35													
120							120								
		-40													
125							125								
		-45													
130							130								
		-50													

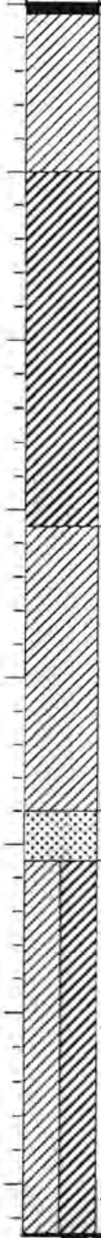
SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: North 30th St and East St. James, San Jose		GROUND SURFACE ELEVATION (ft): 86.00 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY Pitcher Drilling Company	DRILLER R.Medina	DATE STARTED: 11/17/02 DATE FINISHED: 11/18/02	
DRILLING EQUIPMENT		COMPLETION DEPTHS BORING: 101.0 (ft) WELL: N/A (ft)	
DRILLING METHOD Rotary Wash	DRILL BIT 4-7/8 inch	SAMPLING METHOD DM U-Sampler, DM Piston	
SIZE AND TYPE OF CASING N/A		NUMBER OF SAMPLES DIST: UNDIST:	
TYPE OF PERFORATION N/A	FROM N/A TO N/A	WATER DEPTH (ft) FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: N/A ▽	
SIZE AND TYPE OF PACK N/A	FROM N/A TO N/A	LOGGED BY T.Pennington	CHECKED BY S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-13

(Sheet 1 of 3)



DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
			POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
	2 Inches Asphalt Concrete														
	Lean CLAY (CL) Stiff, moist, brown, trace fine gravel	85													
								1		89	18				
5	**Fat CLAY (CH)** Stiff, moist, dark brown	80		1680			5	2		78	20				
10		75		1550			10	3		61	150 psi				
15	**Lean CLAY (CL)** Medium, moist, brown, trace fine sand	70					15	4		67	13				
20		65		990			20	5		78	200 psi	19	113		UU Test
	Poorly graded SAND (SP) Medium dense, moist, brown														
25	**Lean to fat CLAY (CL/CH)** Stiff, moist, gray brown	60		1530			25	6		56	17				
30	Grades dark gray	55		1520			30	7		78	225 psi	35	99		UU Test
35	Grades gray brown	50		1600			35	8		100	22				

URS

PROJECT NO. 28649330.02520

Fig: C-13

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-13
Continued- Sheet 2 of 3

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
				POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
40			45		1840			40	9		83	275 psi				
45		**Lean CLAY (CL)** Very stiff, moist, gray, trace fine gravel	40		3500			45	10		78	275 psi				
50			35		3125			50	11		78	350 psi	23	104		UU Test LL=35 PI=16
55		Grades brown and gray mottled	30		3180			55	12		89	250 psi				
60			25		3220			60	13		78	325 psi				
65			20		2880			65	14		83	300 psi	22	106		UU Test
70			15		2950			70	15		78	300 psi				
75		**Lean to fat CLAY (CL/CH)** Very stiff, moist, gray brown, trace fine to coarse gravel	10		3830			75	16		78	350 psi	27	99		UU Test
80			5		3950			80	17		78	375 psi				

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-13
Continued- Sheet 3 of 3

			FIELD TESTS					SAMPLES				INDEX PROPERTIES			
DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
85							85								
		0		3780				18		78	400 psi	30	96		UU Test LL=55 PI=28
90							90								
	SILT (ML) Very stiff, moist, gray and brown mottled, trace fine sand	-5						19		100	44				
	Silty CLAY (CL-ML) Very stiff, moist, dark gray, with silt lenses														
95							95								
		-10		2630				20		89	53				
100	**Clayey, silty SAND (SC-SM)** Very dense, moist, dark gray, fine sand						100	21		100	50/4"				
	BOTTOM OF BORING AT 101 FEET	-15													
105							105								
		-20													
110							110								
		-25													
115							115								
		-30													
120							120								
		-35													
125							125								
		-40													
130							130								
		-45													

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: North 30th St and East St. James, San Jose

GROUND SURFACE ELEVATION (ft): 86.00 (approx)
TOP OF WELL CASING ELEVATION (ft): N/A

DRILLING AGENCY Pitcher Drilling Company

DRILLER R.Medina

DATE STARTED: 11/24/02
DATE FINISHED: 11/25/02

DRILLING EQUIPMENT

COMPLETION DEPTHS BORING: 71.0 (ft) WELL: N/A (ft)

DRILLING METHOD Rotary Wash

DRILL BIT 4-7/8 inch

SAMPLING METHOD N/A

SIZE AND TYPE OF CASING N/A

NUMBER OF SAMPLES DIST: UNDIST:

TYPE OF PERFORATION N/A

FROM N/A TO N/A

WATER DEPTH (ft) FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: N/A ▽

SIZE AND TYPE OF PACK #3 Sand (see diagram)

FROM AS TO NOTED

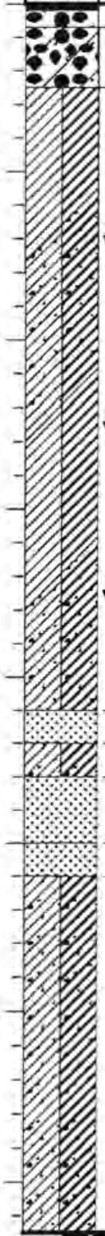
LOGGED BY E.Ntambakwa

CHECKED BY S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: Bentonite Chips	40.5'	68.5'	No. 3: Cement Grout	0	32'
	No. 2: Bentonite Chips	32'	38.5'	No. 4: N/A	N/A	N/A

LOG OF BORING NB-13A

(Sheet 1 of 2)



				FIELD TESTS					SAMPLES				INDEX PROPERTIES			
DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
		Asphaltic Concrete over 6 inches brown Gravel with sand (Baserock) **Clayey GRAVEL (GC) with sand - FILL** Moist, yellowish brown FILL	85													
		Lean to fat CLAY (CL/CH) Very stiff, gray, medium to high plasticity														
5						1649		5	1	FV						
			80													
		Grades sandy				>1934			2	FV						
						>1934			3	FV						
10								10								
			75			1520			4	FV						
		Grades with no sand														
						1868			5	FV						
15						1890		15	6	FV						
			70													
		Grades sandy				1190			7	FV						
						952			8	FV						
20								20								
		Sand pocket 21 to 22 feet	65			>1934			9	FV						Unable to advance vane past 21'
		Sand pocket 23 to 25 feet														
25		Sand pocket 25 to 26 feet						25								
			60													
						1846			10	FV						
30								30								
			55			1353			11	FV						
						1425			12	FV						
35						>1934		35	13	FV						
			50													

URS

PROJECT NO. 28649330.02520

Fig: C-14

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-13A
Continued- Sheet 2 of 2

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
				POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
	▨					>1934			14	FM						
						1649			15	FM						
40								40								Vibrating Wire Piezometer P4-1 installed a 40'
						1478			16	FM						
			45													
						>1934			17	FM						
						>1934			18	FM						
45								45								
			40													
						>1934			19	FM						
						>1934			20	FM						
50								50								
			35													
55								55								
			30													
60								60								
			25													
65								65								
			20													
																Vibrating Wire Piezometer P4-2 installed a 70'
70								70								
		BOTTOM OF BORING AT 71 FEET	15													
75								75								
			10													
80								80								
			5													

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: North 28th St., San Jose		GROUND SURFACE ELEVATION (ft): 87.00 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY: Pitcher Drilling Company	DRILLER: R.J.	DATE STARTED: 10/31/02 DATE FINISHED: 10/31/02	
DRILLING EQUIPMENT		COMPLETION DEPTHS	BORING: 101.5 (ft) WELL: N/A (ft)
DRILLING METHOD: Rotary Wash	DRILL BIT: 4-7/8 inch	SAMPLING METHOD	Modified California, SPT, Shelby Tube
SIZE AND TYPE OF CASING: N/A		NUMBER OF SAMPLES	DIST: UNDIST:
TYPE OF PERFORATION: N/A	FROM N/A TO N/A	WATER DEPTH (ft)	FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: N/A ▼
SIZE AND TYPE OF PACK: N/A	FROM N/A TO N/A	LOGGED BY: C.Rambo	CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-14

(Sheet 1 of 3)

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
		6 inches Asphalt Concrete over 4 inches Asphalt Concrete														
		Sandy lean CLAY (CL) Stiff, moist, gray-brown	85						1			36				
5								5	2			21	16	115	7570	Began rotary wash
		Less gravel	80													
10		Gray and brown mottled						10	3			11	26	99	2370	
		With sand lens	75													
15		**Lean to fat CLAY (CL/CH)** Very stiff, moist, gray and brown mottled						15	4			28	27	98	5240	LL=52 PI=27
			70													
20		**SILT (ML)** Medium to stiff, moist, gray and brown mottled						20	5			9				+#4=0 -#200=90% -5micr=28%
			65													
25								25	7			100 200 psi				
			60													
		Lean CLAY (CL) Stiff, moist, gray brown														
30								30	8			18				
			55													
35		Grades gray						35	9			17				

URS

PROJECT NO. 28649330.02520

Fig: C-15

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-14
Continued- Sheet 2 of 3

DEPTH (feet)	MATERIAL DESCRIPTION
40	**Lean to fat CLAY (CL/CH)** Stiff, moist, gray with some olive gray mottling
50	Increase in plasticity
55	**Lean CLAY (CL)** Stiff, moist, gray and light brown mottled, trace fine sand
60	Grades sandy, brown
63.5	**Poorly graded SAND (SP-SC) with clay and gravel** Very dense, moist, brown

ELEVATION (feet): 50, 45, 40, 35, 30, 25, 20, 15, 10, 5

FIELD TESTS: POCKET PEN (tsf) | POCKET TV (psf) | VANE SHEAR (psf) | WATER LEVEL

DEPTH (feet)	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
40	10	▨		26	32	97	2930	LL=57 PI=30
45	11	▨		30				
50	12	▨		21				
55	13	▨		52	21	106	5920	
60	14	▨		49				
65	15	▯		68				Slight fluid loss
70	16	▨		50/5"	4			+#4=43% -#200=8%
75	17	▯		50/ 5.5"				
80	18	▯		60				

URS

PROJECT NO. 28649330.02520

Fig: C-15

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-14
Continued- Sheet 3 of 3

				FIELD TESTS					SAMPLES				INDEX PROPERTIES			
DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
85		Reddish brown clay pockets						85	19	▨		76				
			0													
		Clayey SAND (SC) with gravel Dense, moist, dark gray														
90								90	20	▯		34				
		Lean CLAY (CL) Very stiff, moist, gray and brown mottled	-5													
95				4.0				95	21	▨		71				
			-10													
100								100	22	▨		53				
		BOTTOM OF BORING AT 101-1/2 FEET	-15													
105								105								
			-20													
110								110								
			-25													
115								115								
			-30													
120								120								
			-35													
125								125								
			-40													
130								130								
			-45													

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: 7th St. and Santa Clara St., San Jose

GROUND SURFACE ELEVATION (ft): 80.00 (approx)
TOP OF WELL CASING ELEVATION (ft): N/A

DRILLING AGENCY: Pitcher Drilling Company
DRILLER: R.J.

DATE STARTED: 11/6/02
DATE FINISHED: 11/6/02

DRILLING EQUIPMENT:

COMPLETION DEPTHS: BORING: 91.0 (ft) WELL: N/A (ft)

DRILLING METHOD: Rotary Wash
DRILL BIT: 4-7/8 inch

SAMPLING METHOD: Mod. CA, SPT, Shelby Tube, DM Piston

SIZE AND TYPE OF CASING: N/A

NUMBER OF SAMPLES: DIST: UNDIST:

TYPE OF PERFORATION: N/A FROM N/A TO N/A

WATER DEPTH (ft): FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: N/A ▼

SIZE AND TYPE OF PACK: N/A FROM N/A TO N/A

LOGGED BY: T.Pennington
CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-15

(Sheet 1 of 3)

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	FIELD TESTS: POCKET TV (psf)	FIELD TESTS: VANE SHEAR (psf)	FIELD TESTS: WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY (%)	SAMPLES: BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	INDEX PROPERTIES: DRY DENSITY (pcf)	INDEX PROPERTIES: UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
		6 inches Asphalt Concrete over 6 inches Aggregate Base	80													
		Silty, clayey SAND (SC) with gravel Dry, dark brown														
		Fat CLAY (CH) Stiff, moist, gray brown														
									1		89	22				
5		Trace gravel	75	3.0				5	2		89	29	21	101	5940	Began rotary wash at 5'
10		**Lean CLAY (CL)** Stiff, moist, light brownish gray	70		1433			10	3		78	150 psi	34	88		CRSC Test
15			65					15	4		87	150 250 psi				
		Fat CLAY (CH) Very stiff, moist, dark greenish gray														
20			60					20	5		78	9				
		Sandy lean CLAY (CL) Medium to stiff, moist, gray, fine to medium sand														
		Lean to fat CLAY (CL/CH) Very stiff, moist, gray and brown mottled with reddish brown staining														
25			55	2.5				25	6		67	23				
30		**Lean CLAY (CL)** Medium, moist, dark greenish gray	50		890			30	7		90	150 250 psi	35 35 37	87 87 85		DSS Test CRSC Test
35		**Fat CLAY (CH)** Medium to stiff, moist, dark greenish gray	45		933			35	8		83	150 psi	37	84		CRSC Test

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-15
Continued- Sheet 2 of 3

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
40			40	1.0				40	9		100	14				
45			35					45	10		87	150 300 psi				
		Fat CLAY (CH) Very stiff to hard, moist, dark gray														
50		**Sandy lean CLAY (CL)** Very stiff, moist, dark greenish gray	30	2.75				50	11		100	32				
55		**SILT (ML) with sand** Stiff, moist, dark gray, fine sand	25	2.25				55	12		100	28				
60			20					60	13		67	150 300 psi				Pushed tube 12"
		Well-graded GRAVEL (GW) with sand Very dense, moist, brown, medium to coarse sand														
65			15					65	14		56	51				
70		**Lean CLAY (CL)** Very stiff, moist, greenish gray, trace fine sand	10	2.5				70	15		56	34				
75		**Well-graded SAND (SW) with gravel** Very dense, moist, brown, fine gravel	5					75	16		0	50/5"				No recovery
80			0					80	17		18	50/ 4.5"				

URS

PROJECT NO. 28649330.02520

Fig: C-16

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-15
Continued- Sheet 3 of 3

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
				POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
85			-5					85								
90			-10					90	18		18	50/5"				
		BOTTOM OF BORING AT 91 FEET														
95			-15					95								
100			-20					100								
105			-25					105								
110			-30					110								
115			-35					115								
120			-40					120								
125			-45					125								
130			-50					130								

URS

PROJECT NO. 28649330.02520

Fig: C-16

1/14/04 BART1 8790E.GPJ

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: 6th St. and Santa Clara St., San Jose		GROUND SURFACE ELEVATION (ft): 81.00 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY Pitcher Drilling Company	DRILLER R.Medina	DATE STARTED: 11/21/02 DATE FINISHED: 11/22/02	
DRILLING EQUIPMENT		COMPLETION DEPTHS BORING: 102.5 (ft) WELL: N/A (ft)	
DRILLING METHOD Rotary Wash	DRILL BIT 4-7/8 inch	SAMPLING METHOD DM U-Sampler, DM Piston, Shelby Tube	
SIZE AND TYPE OF CASING N/A		NUMBER OF SAMPLES DIST: UNDIST:	
TYPE OF PERFORATION N/A	FROM N/A TO N/A	WATER DEPTH (ft) FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: N/A ▽	
SIZE AND TYPE OF PACK #3 Sand (see graphic)	FROM N/A TO N/A	LOGGED BY E.N./T.P.	CHECKED BY S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: Bentonite Chips	60.5'	102.5'	No. 3: Bentonite Chips	32.5'	40.5'
	No. 2: Bentonite Chips	42.5'	58.5'	No. 4: Cement Grout	0	32.5'

LOG OF BORING NB-16

(Sheet 1 of 3)

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
	6 inches Asphaltic Concrete													
	Fat CLAY (CH) Very stiff, slightly moist to moist, gray	80												
5					>1934			FV						
		75												
					1499			FV						Set casing to 6', began rotary wash
	Lean to fat CLAY (CL/CH) Stiff, brown, trace fine sand				1070			FV						
10		70			1110			FV						
					795			FV						
15	**Fat CLAY (CH)** Very stiff, gray, trace sand				>1934			FV						
		65			1562			FV						
	Grades sandy				>1934			FV						
20	**Fat CLAY (CH)** Very stiff, moist, brown, trace fine gravel	60		2550			1		72	375 psi	19	111		CRSC Test LL=21 PI=6 Very difficult advancing vane housing to 21'
25	**Sandy SILT (ML)** Medium, brownish-gray	55					2		56	250 psi				
	Fat CLAY (CH) Stiff to very stiff, gray													
30					1552			FV						
	Gravel lens	50												Unable to advance vane from 31'
					1912			FV						
35		45			1150			FV						

URS

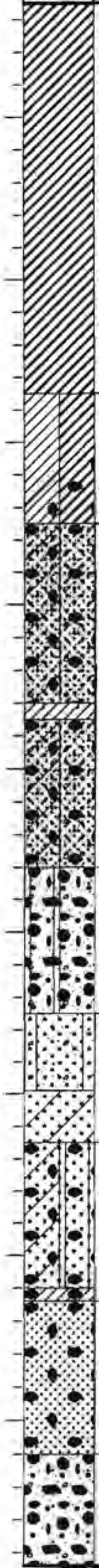
PROJECT NO. 28649330.02520

Fig: C-17

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-16

Continued- Sheet 2 of 3



DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
					972				FM						
40					1714		40		FM						
		-40													
					>1934				FM						Vibrating Wire Piezometer P3-1 installed a 42' Unable to advance vane to 48' UU Test CRSC Test
					>1934				FM						
45							45								
		-35			>1934				FM						
	Lean to fat CLAY (CL/CH) Very stiff, moist, brown, trace sand, medium to high plasticity			2100				3	▧	72		24 22	100 106		
50							50								
	Grades with gravel	-30													
	Well-graded SAND (SW-SC) with clay and gravel Very dense, moist, brown and gray							4	∪	67	66	12	118		+#4=20% -#200=10%
55							55								
		-25													
	Clay pocket and fine to medium sand in sample							5	∪	56	50/ 4"	28			+#4=0% -#200=57%
60							60								Vibrating Wire Piezometer P3-2 installed a 60'
		-20													
	Well-graded GRAVEL (GW-GM) with silt and sand Very dense, moist, brown, medium to coarse sand							6	∪	67	50/ 3"				
65							65								
		-15													
	Silty SAND (SM) Dense, moist, gray, trace gravel, with dark brown clay pockets							7	∪	11	43				3" cobble stuck in sampler shoe. Gravel slough prevented piston from advancing
70	Becoming clayey at 70 feet						70	8	▧	10					
		-10													
	Silty, clayey SAND (SC-SM) with gravel Very dense, moist, gray brown with reddish brown staining							9	∪	50	50				
75							75								
	Light brown clay seam with gravel from 76 to 76.4 feet	-5													
	Poorly graded SAND (SP) with gravel Very dense, moist, brown, fine and coarse gravel							10	∪	73	50/ 5"				
80							80								
		0													
	Well-graded GRAVEL (GW) with sand Very dense, moist, brown, medium to coarse sand							11	∪	52	50/ 5.5"				

1/14/04 BART1 8790E.GPJ

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-16
Continued- Sheet 3 of 3

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
				POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
85								85								
			-5													
									12		60	50/ 4"				
90								90								
			-10													
									13		38	50/ 2"				
		Lean CLAY (CL) Hard, moist, greenish gray, trace fine sand														
95								95								
			-15													
					3600				14		100	46				
100								100								
		Light brown	-20									200				
					4150				15		100	400 psi				Pushed tube 18"
		BOTTOM OF BORING AT 102-1/2 FEET														
105								105								
			-25													
110								110								
			-30													
115								115								
			-35													
120								120								
			-40													
125								125								
			-45													
130								130								
			-50													

PROJECT NO. 28649330.02520

Fig: C-17

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: Lightson Alley and Santa Clara St., San Jose		GROUND SURFACE ELEVATION (ft): 88.50 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY Pitcher Drilling Company	DRILLER R.Medina	DATE STARTED: 11/12/02 DATE FINISHED: 11/12/02	
DRILLING EQUIPMENT		COMPLETION DEPTHS BORING: 101.5 (ft) WELL: N/A (ft)	
DRILLING METHOD Rotary Wash	DRILL BIT 4-7/8 inch	SAMPLING METHOD DM U-Sampler	
SIZE AND TYPE OF CASING N/A		NUMBER OF SAMPLES DIST: UNDIST:	
TYPE OF PERFORATION N/A	FROM N/A TO N/A	WATER DEPTH (ft) FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: N/A	
SIZE AND TYPE OF PACK #3 Sand (see graphic)	FROM N/A TO N/A	LOGGED BY E.Ntambakwa	CHECKED BY S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: Bentonite Chips	70.5'	101.5'	No. 3: Bentonite Chips	34'	43.5'
	No. 2: Bentonite Chips	45.5'	68.5'	No. 4: Cement Grout	0	34'

LOG OF BORING NB-17

(Sheet 1 of 3)

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
				POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
		**Asphaltic Concrete**														
		Lean CLAY (CL) FILL Grayish brown, traces of fine sand and fine gravel, some red brick fragments FILL														
			85													
		Fat CLAY to Elastic SILT (CH/MH) Medium to stiff, brown, slightly moist														
5								5		FM						
						1692										
		Gravel and sand from 6 to 7 feet														
																Unable to advance vane housing at 6'
			80													
						1271				FM						
10						1415		10		FM						
						1605				FM						
						913				FM						
			75													
						1190				FM						
15		**Fat CLAY (CH)** Stiff, olive gray						15								
						1021				FM						
						1231				FM						
			70													
20						1353		20		FM						
		Grades gray with reddish brown mottling														
		Fat CLAY (CH) Stiff to very stiff, gray and dark gray, trace sand				>1934				FM						
			65													
						>1934				FM						
		Grades sandy, greenish-gray with dark green mottling														
25								25								
		Reddish-brown mottling			1450				1	U	100	21				
			60													
30		**Elastic SILT (MH)** Medium to stiff, moist, gray, high plasticity						30								
					880				2	U	100	39				
		Well-graded GRAVEL (GW-GM) with silt and sand Gray and olive gray, fine sand, trace clay, clay pocket from 33 to 34 feet														+#4=48% -#200=6%
			55													
35		**Elastic SILT (MH)** Medium to stiff, gray, trace very fine sand						35								
									3	U	100	21				

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-17
Continued- Sheet 2 of 3

			FIELD TESTS				SAMPLES				INDEX PROPERTIES			
DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
	Silty SAND (SM) Medium dense, gray, trace to some clay													+#4=0 -#200=31%
		50												
40	**Fat CLAY (CH)** Stiff, gray													
					1499			FM						
	Fat CLAY (CH) with sand Stiff to very stiff, olive gray	45												
					>1934			FM						
45														Vibrating Wire Piezometer P1-1 installed a 45'
					>1934			FM						
		40			1912			FM						
50					>1934			FM						
					>1934			FM						
	Lean CLAY (CL) Stiff, moist, brown with green mottling													
		35		1350			4		100	21				
55	**Sandy SILT (ML)** Stiff, brown with brownish red mottling, occasional clay pockets. Grades clayey, gray color below 56-1/2 feet													
	Grades with less clay at 58-1/2 feet	30		1560			5		100	22	25 20	100 104		+#4=0 -#200=57% -5micr=16% Non-plastic
60														
	Silty SAND (SM) Medium dense, gray, trace to some clay pockets, fine sand	25												
65														
	Lean to fat CLAY (CL/CH) Stiff, gray with some brown mottling, trace organics (no organic odor)			1300			6		100	34	29	97		+#4=0 -#200=42%
		20												
70														
	Brown mottling			1530			7		100	31				Vibrating Wire Piezometer P1-2 installed a 70'
		15												
75	**Poorly graded SAND (SP) with gravel** Very dense, brown, very fine sand, trace clay													
	Lean CLAY (CL) Stiff, brown and gray			1370			8		100	41				
	Poorly graded GRAVEL (GP) with sand Very dense, brown, trace clay	10												
80							9		50	73	10	132		
		5												

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-17
Continued- Sheet 3 of 3

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
				POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
85								85								Borehole caving in during drilling, lost circulation (mixed very thick drilling mud)
			0													
90								90	10		0	50/3"				No recovery
			-5													
95								95								
			-10													
		Lean CLAY (CL) Hard, light gray, trace carbonate nodules														
100								100	11		100	63				
		BOTTOM OF BORING AT 101-1/2 FEET														
			-15													
105								105								
			-20													
110								110								
			-25													
115								115								
			-30													
120								120								
			-35													
125								125								
			-40													
130								130								

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: Market St. and Santa Clara St., San Jose		GROUND SURFACE ELEVATION (ft): 88.50 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY Pitcher Drilling Company	DRILLER R.J.	DATE STARTED: 11/5/02 DATE FINISHED: 11/5/02	
DRILLING EQUIPMENT		COMPLETION DEPTHS BORING: 91.5 (ft) WELL: N/A (ft)	
DRILLING METHOD Rotary Wash	DRILL BIT 4-7/8 inch	SAMPLING METHOD Mod. CA, SPT, ST, DM U-Sampler	
SIZE AND TYPE OF CASING N/A		NUMBER OF SAMPLES DIST: UNDIST:	
TYPE OF PERFORATION N/A	FROM N/A TO N/A	WATER DEPTH (ft) FIRST: N/A COMPL.: N/A 24 hr.: N/A	
SIZE AND TYPE OF PACK N/A	FROM N/A TO N/A	LOGGED BY T.Pennington	CHECKED BY S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-18

(Sheet 1 of 3)

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
		8 inches Asphalt Concrete over 6 inches Aggregate Base														
		Lean CLAY (CL) Very stiff, dry, dark brown, trace fine sand														
			85	>4.5					1		56	26				
5								5								
		Grades sandy, brown														
		Sandy SILT (ML) Stiff, moist, brown, fine to medium sand	80						2		100	19	13	97		+#4=0 -#200=57%
10								10								
			75						3		100	16				
		Fat CLAY (CH) Stiff, moist, brown and gray mottled														
15								15								
		Silty SAND (SM) Medium dense, moist, gray	70						4		58	150 300 psi	37	82		CRSC Test
20								20								
		Fat CLAY (CH) Stiff, moist, dark gray, trace gravel														
			65						5		90	150 200 psi	30 31	88 85		DSS Test CRSC Test
25		**Clayey SAND (SC) with gravel** Moist, gray, medium to fine sand, fine gravel						25								
		Well-graded GRAVEL (GW) with sand Very dense, moist, dark gray, fine to coarse sand and gravel	60						6		50	50/ 5.5"	12	122		
30								30								
			55						7		100	56				
35		**Poorly graded GRAVEL (GP-GM) with silt and sand** Very dense, moist, greenish gray						35								+#4=51% -#200=8%

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-18
Continued- Sheet 2 of 3

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
	Poorly graded GRAVEL (GP) Dense, moist, dark gray, coarse gravel	50						8		100	54				+#4=90% -#200=2%
40							40								
	Sandy lean CLAY (CL) Stiff, moist, gray	45						9		0	15				No recovery
45							45								
				1040				10		70	150 psi				
		40													
50	**Sandy SILT (ML)** Stiff, moist, light brown, trace coarse gravel, fine sand						50	11		100	32	26 25	97		+#4=0 -#200=56% +#4=3% -#200=63% -5micr=24% LL=32 PI=13
		35													
55	Medium, some clay						55	12		100	21				
		30													
60	**Lean to fat CLAY (CL/CH)** Very stiff, moist, light greenish gray and light brown mottled		2.5				60	13		56	40				
		25													
65							65	14		70	150 300 psi				
	Sandy lean CLAY (CL) with gravel Moist, brown gray mottled, fine sand														
		20													
70	**Lean CLAY (CL)** Stiff, moist, dark greenish gray, trace gravel			1200			70	15		87					
		15													
75	Increase in gravel						75	16		100	81				
	Lean CLAY (CL) with sand Very stiff, moist, dark greenish gray														
		10													
80	**Well-graded GRAVEL (GW) with sand** Very dense, moist, brown						80	17		91	50/ 5.5"				
		5													

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-18
Continued- Sheet 3 of 3

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
				POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
85		**Well-graded GRAVEL (GW) with sand** Very dense, moist, reddish brown						85	18		18	50/5"				+#4=68% -#200=3%
			0													
90		**Gravelly lean CLAY (CL)** Hard, moist, reddish brown						90	19		100	51				
		BOTTOM OF BORING AT 90-1/2 FEET														
			-5													
95								95								
			-10													
100								100								
			-15													
105								105								
			-20													
110								110								
			-25													
115								115								
			-30													
120								120								
			-35													
125								125								
			-40													
130								130								

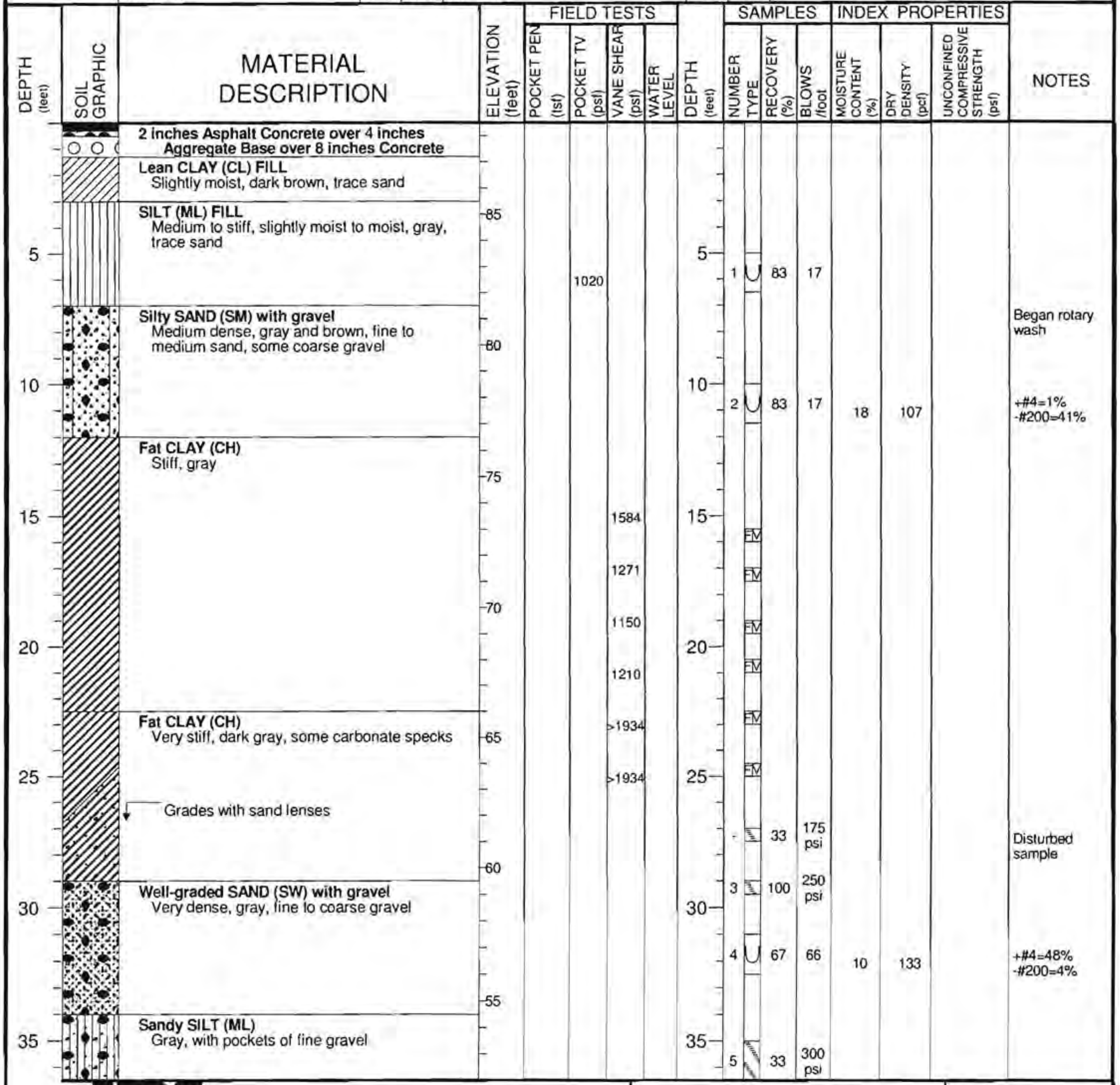
SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: San Pedro St. and Santa Clara St., San Jose
GROUND SURFACE ELEVATION (ft): 88.50 (approx)
TOP OF WELL CASING ELEVATION (ft): N/A
DRILLING AGENCY: Pitcher Drilling Company
DRILLER: R.Medina
DATE STARTED: 11/18/02
DATE FINISHED: 11/20/02
DRILLING EQUIPMENT:
COMPLETION DEPTHS: BORING: 101.5 (ft) WELL: N/A (ft)
DRILLING METHOD: Rotary Wash
DRILL BIT: 4-7/8 inch
SAMPLING METHOD: DM U-Sampler, DM Piston, Osterberg
SIZE AND TYPE OF CASING: N/A
NUMBER OF SAMPLES: DIST: UNDIST:
TYPE OF PERFORATION: N/A FROM N/A TO N/A
WATER DEPTH (ft): FIRST: N/A COMPL.: N/A 24 hr.: N/A
SIZE AND TYPE OF PACK: N/A FROM N/A TO N/A
LOGGED BY: E.N./T.P.
CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-19

(Sheet 1 of 3)



DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
	2 inches Asphalt Concrete over 4 inches Aggregate Base over 8 inches Concrete														
	Lean CLAY (CL) FILL Slightly moist, dark brown, trace sand														
	SILT (ML) FILL Medium to stiff, slightly moist to moist, gray, trace sand	85													
5							5	1		83	17				
				1020											
	Silty SAND (SM) with gravel Medium dense, gray and brown, fine to medium sand, some coarse gravel														Began rotary wash
		80													
10							10	2		83	17	18	107		+#4=1% -#200=41%
	Fat CLAY (CH) Stiff, gray														
		75													
15					1584		15		FM						
					1271				FM						
		70			1150				FM						
20					1210		20		FM						
	Fat CLAY (CH) Very stiff, dark gray, some carbonate specks	65			>1934				FM						
25					>1934		25		FM						
	Grades with sand lenses														
								-		33	175 psi				Disturbed sample
		60													
	Well-graded SAND (SW) with gravel Very dense, gray, fine to coarse gravel							3		100	250 psi				
30							30								
								4		67	66	10	133		+#4=48% -#200=4%
		55													
35	**Sandy SILT (ML)** Gray, with pockets of fine gravel						35	5		33	300 psi				

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-19
Continued- Sheet 2 of 3

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
			50													
40		**Fat CLAY (CH)** Stiff, gray			1660			40	6		100	20				
			45		1740				7		72	300 psi				
45		Grades silty, trace sand						45								
			40		1500				8		56	250 psi	23	102		CRSC Test
50		**Fat CLAY (CH)** Very stiff, brown, with carbonate/calcite nodules	35		2250			50	9		100	400 psi				
55		**Fat CLAY (CH)** Stiff, gray	30		1150			55	10		94	100 psi	32 23	91 104		UU Test CRSC Test
60		Very stiff	25		2050			60	11		83	275 psi				
65		Some brown color in sample	20		3000			65	12		100	300 psi	21 22	107 105		UU Test CRSC Test
70		**Silty SAND (SM) with gravel** Very dense, moist, gray brown, fine sand						70	13		100	50/3"	20	110		+#4=1% -#200=27%
		Well-graded GRAVEL (GW-GM) with silt and sand Very dense, moist, gray brown	15													
75		**Well-graded GRAVEL (GW) with sand** Very dense, moist, brown	10					75	14		73	50/5"	12	121		
80			5					80	15		0	50/4"				No recovery

URS

PROJECT NO. 28649330.02520

Fig: C-20

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-19
Continued- Sheet 3 of 3

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
85	●							85								Driller noticed softer drilling at 85'
	●								16		64	50/5"				
	●		0													
90	●							90								
	●								17		30	50/4"				
	●		-5													
95	●							95								
	▨	**Lean CLAY (CL)** Hard, moist, light gray brown, trace fine sand, trace gravel														
	▨								18		0	35				No recovery
	▨		-10													
100	▨							100								
	▨								19		94	87				
		BOTTOM OF BORING AT 101-1/2 FEET														
			-15													
105								105								
			-20													
110								110								
			-25													
115								115								
			-30													
120								120								
			-35													
125								125								
			-40													
130								130								

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: San Pedro St. and Santa Clara St., San Jose		GROUND SURFACE ELEVATION (ft): 90.00 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY: Pitcher Drilling Company	DRILLER R.J.	DATE STARTED: 11/3/02 DATE FINISHED: 11/4/02	
DRILLING EQUIPMENT		COMPLETION DEPTHS	BORING: 71.5 (ft) WELL: N/A (ft)
DRILLING METHOD: Rotary Wash	DRILL BIT 4-7/8 inch	SAMPLING METHOD	DM U-Sampler & Piston, ST, Osterberg, SPT
SIZE AND TYPE OF CASING: N/A		NUMBER OF SAMPLES	DIST: UNDIST:
TYPE OF PERFORATION: N/A	FROM N/A TO N/A	WATER DEPTH (ft)	FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: N/A ▼
SIZE AND TYPE OF PACK: N/A	FROM N/A TO N/A	LOGGED BY: T.Pennington	CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-20

(Sheet 1 of 2)

				FIELD TESTS					SAMPLES				INDEX PROPERTIES			
DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
		3 inches Asphalt Concrete over 27 inches dry, brown Aggregate Base (FILL)	90													
		Silty, clayey SAND (SC-SM) Loose, dry, dark brown, fine sand, trace fine gravel							1		100	10	13	86		Began rotary wash at 3'
5			85					5								
		Silty SAND (SM) Medium dense, moist, brown, fine to medium sand							2		100	28	6	101		+#4=0% -#200=24%
10			80					10								
		Well-graded SAND (SW) Medium dense, moist							3		100	50	8	116		+#4=14% -#200=3%
15			75					15								
		Fat CLAY (CH) Medium, moist, olive gray			730				4		87	150 200 psi	42 41	79 81		CRSC Test UU Test LL=52 PI=24
20			70					20								
					740				5		83	125 psi				
25		**Sandy lean CLAY (CL)** Stiff, moist, greenish gray with brownish yellow mottling, trace fine gravel	65					25								
					1100				6		80	200 psi				Sample was sliding out of tube
30		**Lean CLAY (CL)** Stiff, moist, olive gray	60		1150			30	7		89	100 psi	31	92		CRSC Test
35		**Poorly graded SAND (SP-SM) with silt** Moist, dark gray, fine to medium sand	55					35	8		90	150 225 psi				+#4=0 -#200=44%

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-20
Continued- Sheet 2 of 2

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				SAMPLES				INDEX PROPERTIES			NOTES
			POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psi)	WATER LEVEL	NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
							9		100		27	98		
40	**Fat CLAY (CH)** Stiff, moist, olive gray	50		1310					0	150 psi				No recovery - sample slid in the hole - cuttings indicate olive gray Fat Clay
				1420			10		92	225 psi	35	111		CRSC Test
45		45												
	Clayey SAND (SC) with gravel Dense, olive gray, fine to medium						11		100	150 300 psi				Unable to push tube past 48.5'
50	Grades more gravel at 50 feet	40												
	Silty SAND (SM) Dense, moist, olive gray, fine sand, trace clay						12		94	78	27	95		+#4=5% -#200=14%
55		35												
	Fat CLAY (CH) Stiff, moist, greenish to yellowish gray			1270			13		100	200 250 psi	32 31 28 32	92 92 97 91		DSS Test CRSC Test UU Test LL=43 PI=19 Unable to push tube past 59'
60		30												
									0	150 200 psi				No recovery. Cuttings indicate greenish Fat Clay
65	**Silty CLAY (CL-ML) with sand** Stiff, dark greenish gray, with fine sand	25		1050			14		95	250 psi	23	105		UU Test
	Grades with brownish yellow mottling													
70		20					15		100	56				
	BOTTOM OF BORING AT 71-1/2 FEET													
75		15												
80		10												

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: Cahill St. and Santa Clara St., San Jose

GROUND SURFACE ELEVATION (ft): 86.30 (approx)

TOP OF WELL CASING ELEVATION (ft): N/A

DRILLING AGENCY: Pitcher Drilling Company

DRILLER: R.J.

DATE STARTED: 11/1/02

DATE FINISHED: 11/1/02

DRILLING EQUIPMENT:

COMPLETION DEPTHS: BORING: 100.0 (ft) WELL: N/A (ft)

DRILLING METHOD: Rotary Wash

DRILL BIT: 4-7/8 inch

SAMPLING METHOD: Modified California, SPT, Shelby Tube

SIZE AND TYPE OF CASING: N/A

NUMBER OF SAMPLES: DIST: UNDIST:

TYPE OF PERFORATION: N/A FROM N/A TO N/A

WATER DEPTH (ft): FIRST: N/A COMPL.: N/A 24 hr.: N/A

SIZE AND TYPE OF PACK: N/A FROM N/A TO N/A

LOGGED BY: C.Rambo

CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-21

(Sheet 1 of 3)

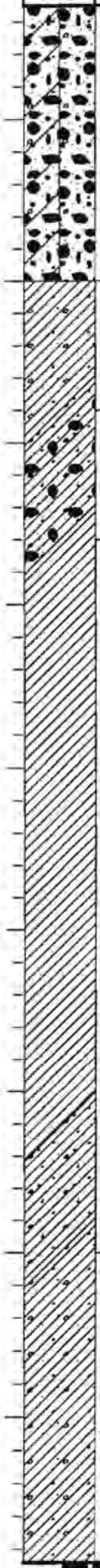
DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
				POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
		6 inches Asphalt Concrete over 3 inches Aggregate Base														
		Silty SAND (SM) with gravel Very dense, moist, dark gray, subbase? FILL	85						1			50/ 5.5"				
		Fat CLAY (CH) Stiff, moist, black														
5			80	2.5				5	2			17				Began rotary wash at 6.5'
		Lean CLAY (CL) with sand Stiff, moist, light gray with light brown mottling, fine sand														
10			75	2.5				10	3			12				
15			70					15	4			11				
20			65					20	5			150 psi				
25		Dark brown with gray mottling	60					25	6			16	23	103	2200	
30		**Lean to fat CLAY (CL/CH)** Stiff, moist, brown with gray mottling, medium to high plasticity	55	2.25				30	7				38	83	3160	
35		**Well-graded GRAVEL (GW-GC) with clay and sand**	50					35	8			50/6"				

URS

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-21
Continued- Sheet 2 of 3

SOIL GRAPHIC



DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
			POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
	Very dense, moist, brown														
40		45					40	9			50/4"	10			+#4=47% -#200=8%
45	**Lean CLAY (CL) with sand** Medium to stiff, moist, greenish gray, medium to fine sand	40					45	10			15				No recovery
								11			5				
50	**Sandy lean CLAY (CL) with gravel** Very stiff, moist, greenish gray	35					50	12			31				
55	**Lean CLAY (CL)** Very stiff, moist, greenish gray, black root traces, trace fine sand	30					55	13			32				
60		25	>4.5				60	14			25				
65	With brown mottling	20					65	15			32				
70	Grades sandy	15					70	16			35				
75	**Lean CLAY (CL) with sand** Very stiff, moist, dark greenish gray, fine sand	10					75	17			33	22	105	2360	
80	Increase in sand	5	4.0				80	18			26				

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-21
Continued- Sheet 3 of 3

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
85	Light greenish gray	0					85	19			32				
90	Dark greenish gray	-5	3.0				90	20			37	22	104	3850	
95	**Sandy lean CLAY (CL)** Hard, moist, gray and brown mottled, increase in sand content with depth	-10					95	21			74				
	Clayey SAND (SC) Very dense, moist, reddish brown														
	Poorly graded SAND (SP) with gravel Very dense, brown							22			70				
100	BOTTOM OF BORING AT 100 FEET	-15					100								
105		-20					105								
110		-25					110								
115		-30					115								
120		-35					120								
125		-40					125								
130		-45					130								

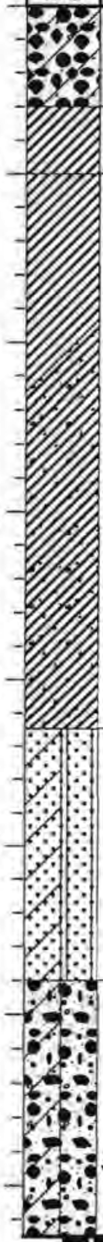
SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: Newhall Yard, Santa Clara		GROUND SURFACE ELEVATION (ft): 69.50 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY: Pitcher Drilling Company	DRILLER: Roger	DATE STARTED: 7/30/03 DATE FINISHED: 7/30/03	
DRILLING EQUIPMENT		COMPLETION DEPTHS	BORING: 80.5 (ft) WELL: N/A (ft)
DRILLING METHOD: Rotary Wash	DRILL BIT: 4-7/8 inch	SAMPLING METHOD: Modified California, SPT	
SIZE AND TYPE OF CASING: N/A		NUMBER OF SAMPLES	DIST: UNDIST:
TYPE OF PERFORATION: N/A	FROM N/A TO N/A	WATER DEPTH (ft)	FIRST: N/A ∇ COMPL.: N/A ▼ 24 hr.: N/A ∇
SIZE AND TYPE OF PACK: N/A	FROM N/A TO N/A	LOGGED BY: T.Pennington	CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: N/A	N/A	N/A	No. 3: N/A	N/A	N/A
	No. 2: N/A	N/A	N/A	No. 4: N/A	N/A	N/A

LOG OF BORING NB-24

(Sheet 1 of 2)



DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
	Clayey GRAVEL (GC) with sand - FILL Dry, brown	FILL													
	Fat CLAY (CH) Very stiff, moist, dark gray, strong carbon odor	65													
5	**Fat CLAY (CH)** Stiff, moist, brown and gray mottled						5	1	▨	45	12				Began rotary wash
10	Dark gray and brown, becoming sandy	60					10	2	▨	78	11	29	92	3110	
15	Gray and brown, with occasional silty seams	55					15	3	▨	72	6				
20		50					20	4	▨	94	5	36	83	1990	LL=57 PI=31
	Silty, clayey SAND (SC-SM) Dense, moist, brown and gray, trace fine gravel														
25		45					25	5	▯	89	19	20			+#4=8% -#200=15%
30	**Well-graded GRAVEL (GW-GC) with clay and sand** Very dense, moist, brown and gray	40					30	6	▯	94	36				
															Slight fluid loss
35	Increase in sand	35					35	7	▯	56	45				

URS

PROJECT NO. 28649330.02520

Fig: C-8

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF BORING NB-24
Continued- Sheet 2 of 2

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	ELEVATION (feet)	FIELD TESTS: POCKET PEN (tsf)	POCKET TV (psf)	VANE SHEAR (psf)	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
40			30					40	8	▨	100	46	9	128		+#4=51% -#200=7%
		Sandy lean CLAY (CL) Medium to stiff, moist, gray, fine to medium sand, trace fine gravel														
45			25					45	9	▨	100	6	19	109	670	LL=25 PI=9
		Decrease in sand content														
50			20					50	10	▨	67	14				
55			15					55	11	▨	100	19				
		Lean CLAY (CL) Stiff, moist, gray and brown mottled, trace fine gravel														
		Red brown and olive gray mottled, sandy														
60			10					60	12	▨	83	35	17	114	2840	
		Clayey SAND (SC) with gravel Very dense, moist, brown														
65			5					65	13	☐	89	71				
		Well-graded GRAVEL (GW) with sand Very dense, moist, brown														
		Poorly graded SAND (SP) Medium dense, wet, dark brown, trace fine gravel														
70			0					70	14	☐	89	25				
		Well-graded GRAVEL (GW) with sand Very dense, brown, approximately 2 inches thick														
		Lean CLAY (CL) with sand Stiff, moist, brown and olive gray mottled, trace fine gravel														
75			-5					75	15	▨	78	26	23	104	3490	
		Well-graded SAND (SW-SC) with clay and gravel Very dense, moist, brown														
80			-10					80	16	☐	89	61	11			+#4=39% -#200=8%
		BOTTOM OF BORING AT 80-1/2 FEET Boring dry ATD														

URS

PROJECT NO. 28649330.02520

Fig: C-8

OBSERVATION WELLS

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

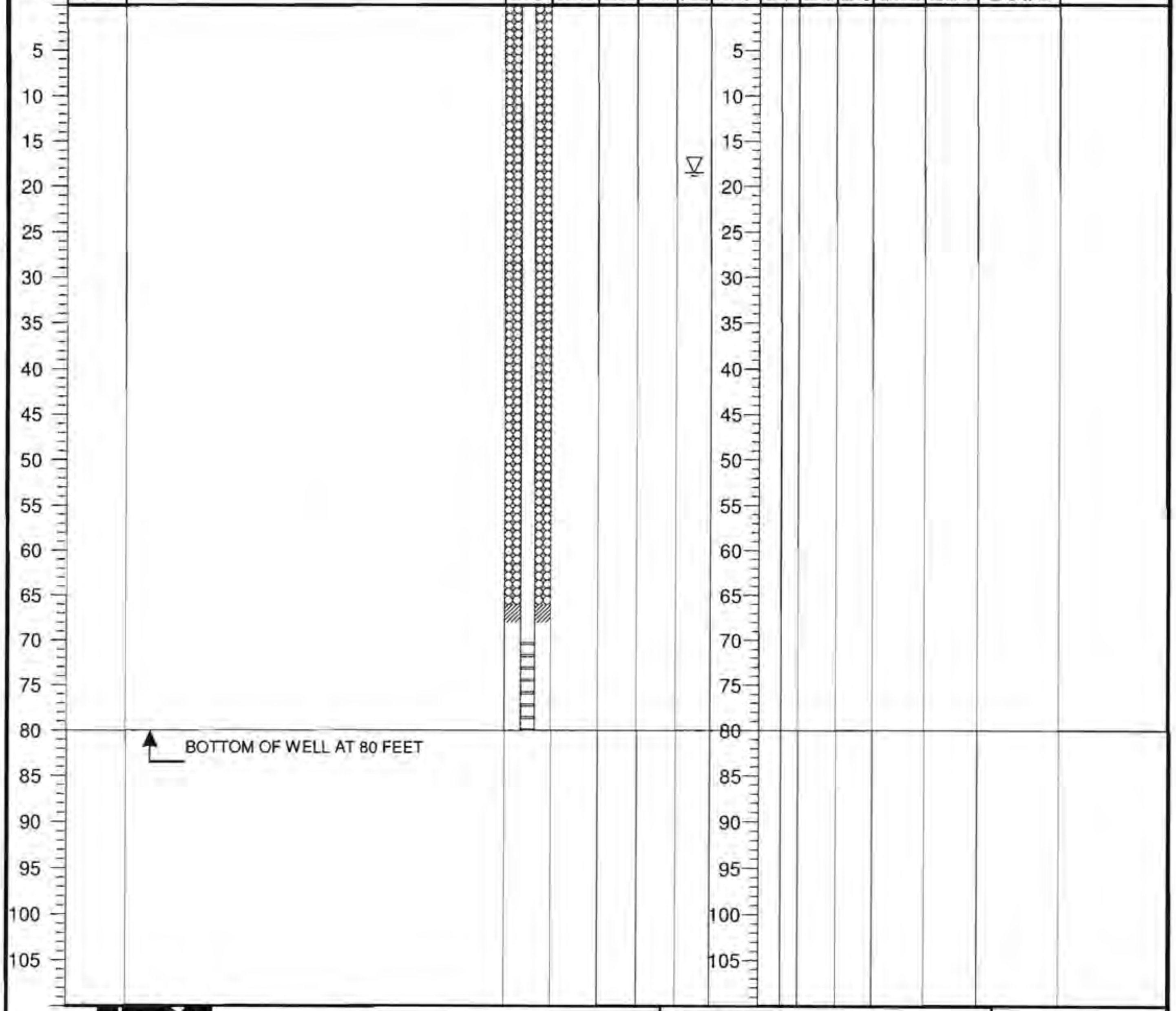
BORING LOCATION:			GROUND SURFACE ELEVATION (ft): 92.00 (approx) TOP OF WELL CASING ELEVATION (ft): N/A
DRILLING AGENCY	Pitcher Drilling Co.	DRILLER Roger	DATE STARTED: 10/17/01 DATE FINISHED: 10/17/01
DRILLING EQUIPMENT			COMPLETION DEPTHS BORING: 80.0 (ft) WELL: 80.0 (ft)
DRILLING METHOD	Rotary Wash	DRILL BIT 6-inch	SAMPLING METHOD
SIZE AND TYPE OF CASING	6-inch Diameter		NUMBER OF SAMPLES DIST: 0 UNDIST: 0
TYPE OF PERFORATION	0.020" slotted SCH 40 PVC	FROM 70' TO 80'	WATER DEPTH (ft) FIRST: 18.5 ∇ COMPL.: N/A ▼ 24 hr.: N/A ∇
SIZE AND TYPE OF PACK	#3 Lonestar Sand	FROM 68' TO 80'	LOGGED BY C.Rambo CHECKED BY M.Larson

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: Bentonite Pellets	66'	68'	No. 3: N/A	N/A	N/A
	No. 2: Cement Grout	0	66'	No. 4: N/A	N/A	N/A

LOG OF WELL NW-01

(Sheet 1 of 1)

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	WELL GRAPHIC	FIELD TESTS				DEPTH (feet)	SAMPLES			INDEX PROPERTIES			NOTES
				POCKET PEN (tsf)	POCKET TV (psf)	PID Reading (airspace),ppm	WATER LEVEL		NUMBER TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	



BOTTOM OF WELL AT 80 FEET

URS

PROJECT NO. 28649330.02520

Fig: C-24

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: 5th and Santa Clara Streets

GROUND SURFACE ELEVATION (ft): 88.00 (approx)
TOP OF WELL CASING ELEVATION (ft): N/A

DRILLING AGENCY: Pitcher Drilling Co.
DRILLER:

DATE STARTED: 9/5/01
DATE FINISHED: 9/5/01

DRILLING EQUIPMENT:

COMPLETION DEPTHS: BORING: 80.0 (ft) WELL: 80.0 (ft)

DRILLING METHOD: Rotary Wash
DRILL BIT: 6-inch

SAMPLING METHOD:

SIZE AND TYPE OF CASING: 6-inch Diameter

NUMBER OF SAMPLES: DIST: 0 UNDIST: 0

TYPE OF PERFORATION: 0.020" slotted SCH 40 PVC FROM 70' TO 80'

WATER DEPTH (ft): FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: 13.83 ▽

SIZE AND TYPE OF PACK: #3 Lonestar Sand FROM 68' TO 80'

LOGGED BY: C.Rambo
CHECKED BY: M.Larson

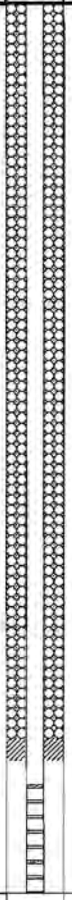
TYPE OF SEAL

TYPE	FR	TO	TYPE	FR	TO
No. 1: Bentonite Pellets	66'	68'	No. 3: N/A	N/A	N/A
No. 2: Cement Grout	0	66'	No. 4: N/A	N/A	N/A

LOG OF WELL NW-04

(Sheet 1 of 1)

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	WELL GRAPHIC	FIELD TESTS: POCKET PEN (tsf)	POCKET TV (psf)	PID Reading (airspace),ppm	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
15							▽	15							Water level on 10/16/01
80		BOTTOM OF WELL AT 80 FEET						80							



URS

PROJECT NO. 28649330.02520

Fig: C-25

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION:

GROUND SURFACE ELEVATION (ft): 90.00 (approx)
TOP OF WELL CASING ELEVATION (ft): N/A

DRILLING AGENCY: Pitcher Drilling Co. | DRILLER: Roger

DATE STARTED: 10/17/01
DATE FINISHED: 10/17/01

DRILLING EQUIPMENT:

COMPLETION DEPTHS: BORING: 90.0 (ft) WELL: 90.0 (ft)

DRILLING METHOD: Rotary Wash | DRILL BIT: 6-inch

SAMPLING METHOD:

SIZE AND TYPE OF CASING: 6-inch Diameter

NUMBER OF SAMPLES: DIST: 0 UNDIST: 0

TYPE OF PERFORATION: 0.020" slotted SCH 40 PVC | FROM 80' TO 90'

WATER DEPTH (ft): FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: N/A ▽

SIZE AND TYPE OF PACK: #3 Lonestar Sand | FROM 78' TO 90'

LOGGED BY: C.Rambo | CHECKED BY: M.Larson

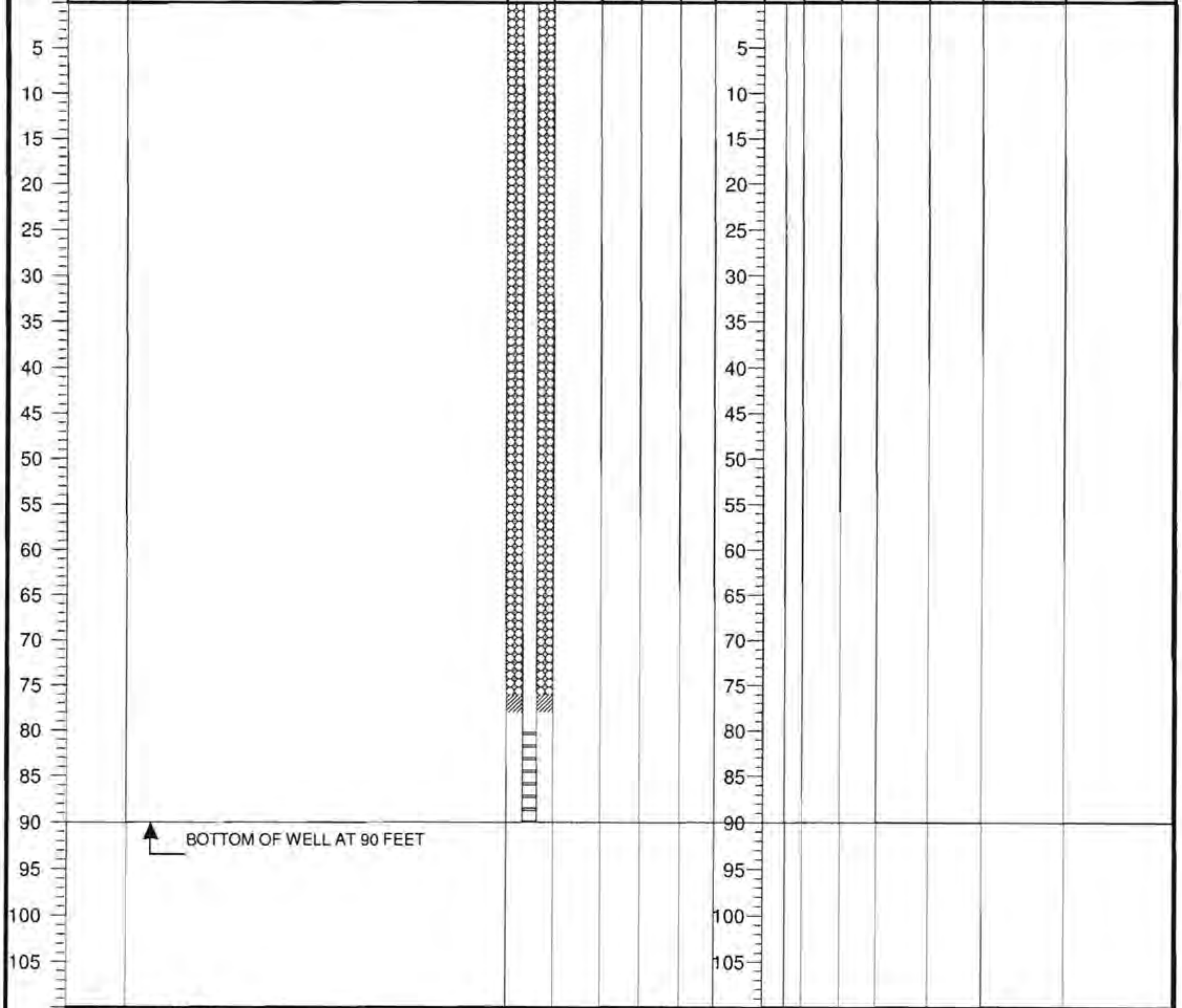
TYPE OF SEAL:

TYPE	FR	TO	TYPE	FR	TO
No. 1: Bentonite Pellets	76'	78'	No. 3: N/A	N/A	N/A
No. 2: Cement Grout	0	76'	No. 4: N/A	N/A	N/A

LOG OF WELL NW-05

(Sheet 1 of 1)

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	WELL GRAPHIC	FIELD TESTS: POCKET PEN (tsf)	FIELD TESTS: POCKET TV (psf)	FIELD TESTS: PID Reading (airspace),ppm	FIELD TESTS: WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER TYPE	SAMPLES: RECOVERY (%)	SAMPLES: BLOWS /foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	INDEX PROPERTIES: DRY DENSITY (pcf)	INDEX PROPERTIES: UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES



BOTTOM OF WELL AT 90 FEET

URS

PROJECT NO. 28649330.02520

Fig: C-26

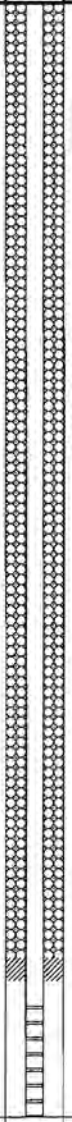
SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: Train Station		GROUND SURFACE ELEVATION (ft): 90.00 (approx) TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY Pitcher Drilling Co.	DRILLER	DATE STARTED: 9/6/01 DATE FINISHED: 9/6/01	
DRILLING EQUIPMENT		COMPLETION DEPTHS BORING: 100.0 (ft) WELL: 100.0 (ft)	
DRILLING METHOD Rotary Wash	DRILL BIT 6-inch	SAMPLING METHOD	
SIZE AND TYPE OF CASING 6-inch Diameter		NUMBER OF SAMPLES DIST: 0 UNDIST: 0	
TYPE OF PERFORATION 0.020" slotted SCH 40 PVC	FROM 90' TO 100'	WATER DEPTH (ft) FIRST: N/A ▽ COMPL.: N/A ▼ 24 hr.: 20.5	
SIZE AND TYPE OF PACK #3 Lonestar Sand	FROM 88' TO 100'	LOGGED BY C.Rambo	CHECKED BY M.Larson

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: Bentonite Pellets	86'	88'	No. 3: N/A	N/A	N/A
	No. 2: Cement Grout	0	86'	No. 4: N/A	N/A	N/A

LOG OF WELL NW-06

(Sheet 1 of 1)



DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	WELL GRAPHIC	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	PID Reading (airspace),ppm	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
5								5							
10								10							
15								15							
20							▼	20							Water level 20.20' on 10/17/01
25								25							
30								30							
35								35							
40								40							
45								45							
50								50							
55								55							
60								60							
65								65							
70								70							
75								75							
80								80							
85								85							
90								90							
95								95							
100		BOTTOM OF WELL AT 100 FEET						100							
105								105							

URS

PROJECT NO. 28649330.02520

Fig: C-27

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: 5th Street and Santa Clara Street		GROUND SURFACE ELEVATION (ft): 80.00 approx TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY Pitcher	DRILLER R.Medina	DATE STARTED: 3/1/03 DATE FINISHED: 3/2/03	
DRILLING EQUIPMENT Failing 1500		COMPLETION DEPTHS BORING: 76.5 (ft) WELL: 74.0 (ft)	
DRILLING METHOD Rotary Wash	DRILL BIT 5-7/8"	SAMPLING METHOD SPT	
SIZE AND TYPE OF CASING 2 inch SCH 40 PVC		NUMBER OF SAMPLES DIST: 1 UNDIST:	
TYPE OF PERFORATION 0.020" PVC	FROM 64' TO 74'	WATER DEPTH (ft) FIRST: N/A ▽ COMPL.: 12.3 ▼ 24 hr.: 12.0 ▽	
SIZE AND TYPE OF PACK #3 Monterey Sand	FROM 60' TO 74'	LOGGED BY T.Pennington	CHECKED BY S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: Bentonite Chips	58'	60'	No. 3: N/A	N/A	N/A
	No. 2: Cement Grout	0	58'	No. 4: N/A	N/A	N/A

LOG OF WELL MW-1

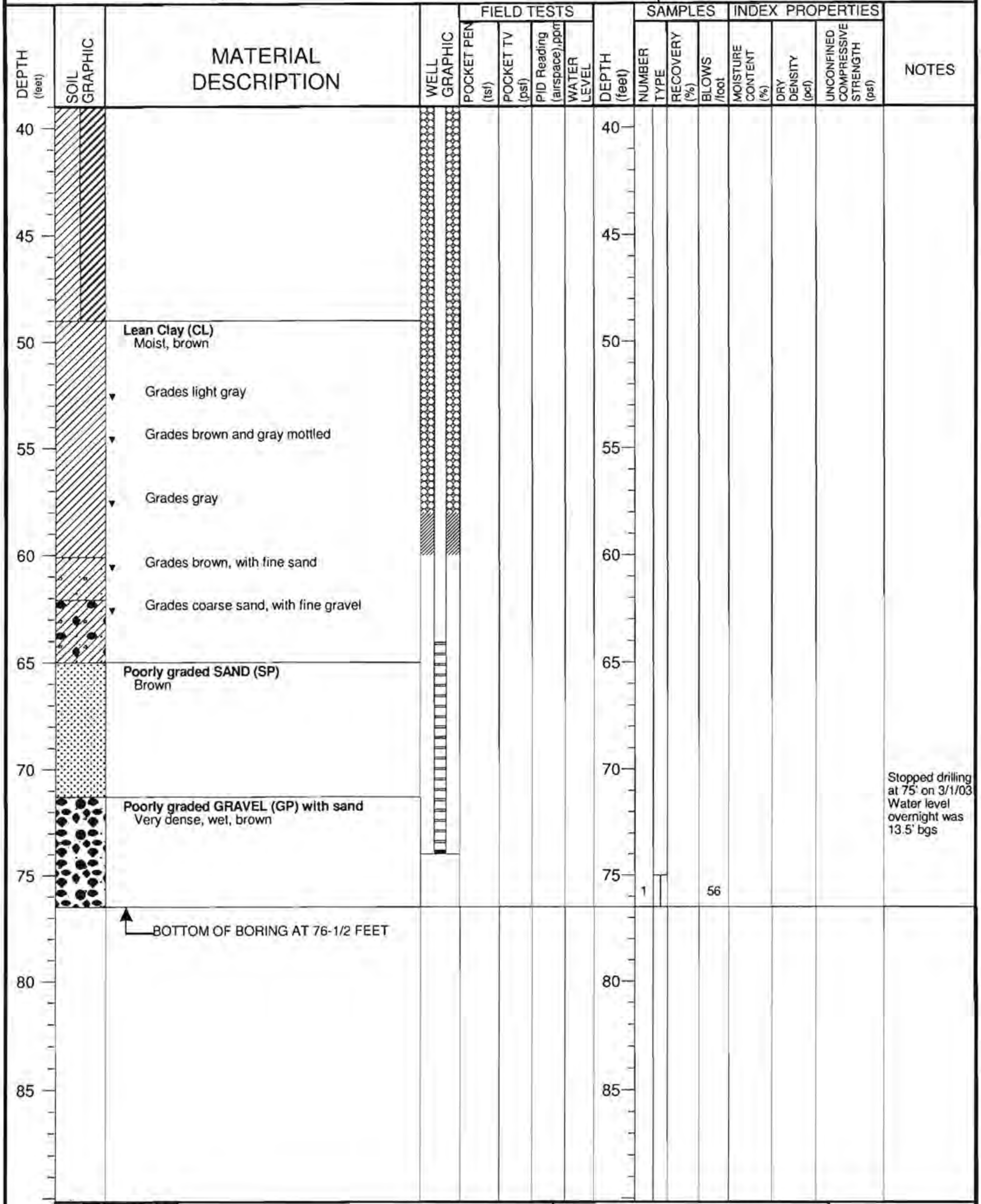
(Sheet 1 of 2)

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	WELL GRAPHIC	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	PID Reading (airspace),ppm	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
		4 inch Concrete Sidewalk													
		Lean CLAY (CL) Moist, olive gray													
		▼ Grades brown													Set casing at 6', began rotary wash
5								5							
		▼ Grades olive gray													
10								10							
							▼								
		Lean to fat CLAY (CL/CH) Moist, gray, medium to high plasticity													
15								15							
		Lean CLAY (CL) Brown and gray mottled													
20								20							
25								25							
		▼ Grades dark gray													
30		**Poorly graded GRAVEL (GP)** Dark gray						30							
		Lean to fat CLAY (CL/CH) Moist, dark gray, medium to high plasticity													
35								35							

URS	PROJECT NO. 28649330.02520	Fig: C-28

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF WELL MW-1
Continued- Sheet 2 of 2



Lean Clay (CL)
Moist, brown

Grades light gray

Grades brown and gray mottled

Grades gray

Grades brown, with fine sand

Grades coarse sand, with fine gravel

Poorly graded SAND (SP)
Brown

Poorly graded GRAVEL (GP) with sand
Very dense, wet, brown

BOTTOM OF BORING AT 76-1/2 FEET

Stopped drilling at 75' on 3/1/03. Water level overnight was 13.5' bgs

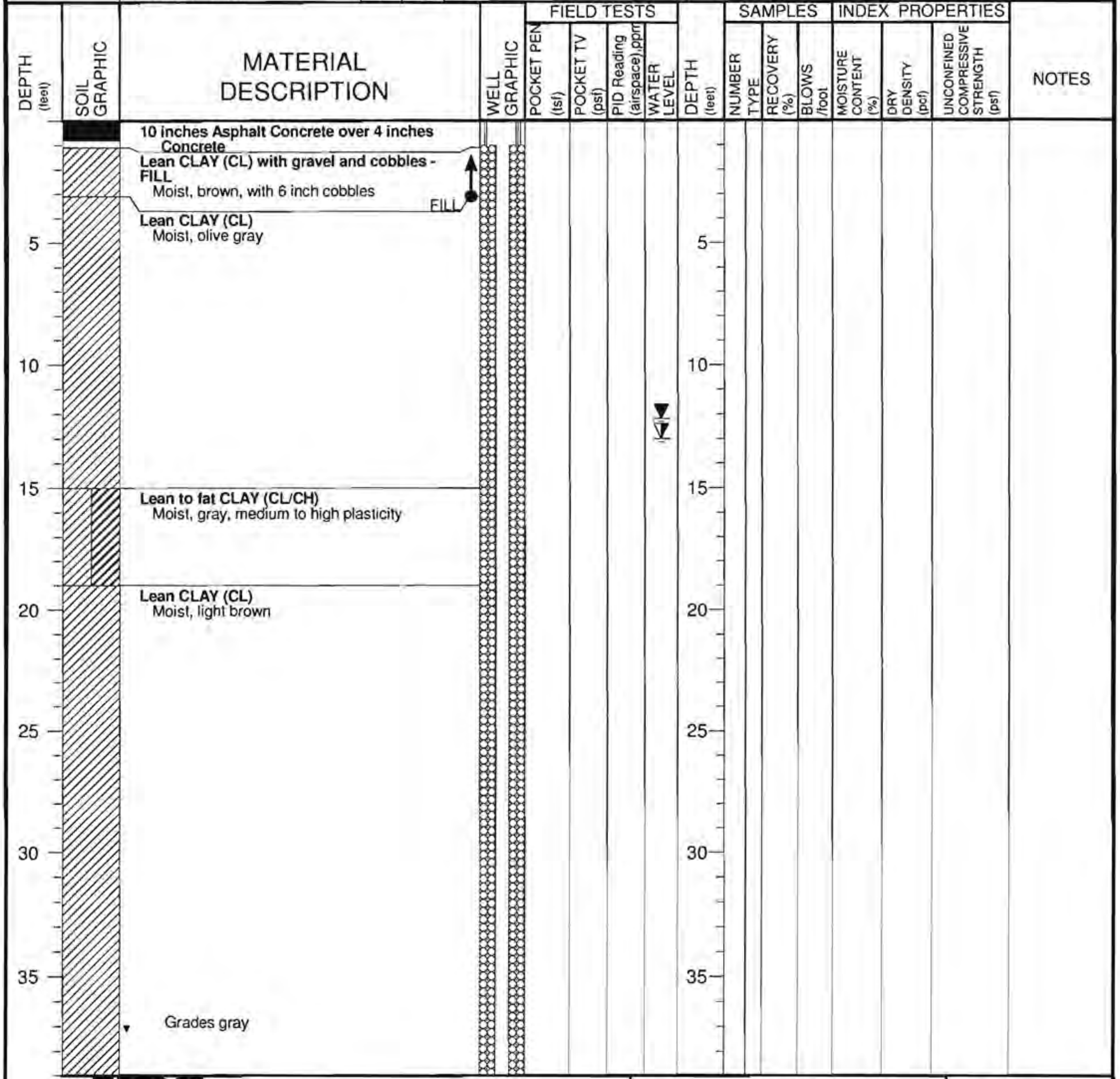
SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: 5th Street and Santa Clara Street		GROUND SURFACE ELEVATION (ft): 80.00 approx TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY: Pitcher	DRILLER: R.Medina	DATE STARTED: 3/1/03 DATE FINISHED: 3/1/03	
DRILLING EQUIPMENT: Failing 1500		COMPLETION DEPTHS: BORING: 81.5 (ft) WELL: 80.0 (ft)	
DRILLING METHOD: Rotary Wash	DRILL BIT: 5-7/8"	SAMPLING METHOD: SPT	
SIZE AND TYPE OF CASING: 2 inch SCH 40 PVC		NUMBER OF SAMPLES: DIST: 1 UNDIST:	
TYPE OF PERFORATION: 0.020" PVC	FROM 60' TO 80'	WATER DEPTH (ft): FIRST: N/A ∇ COMPL.: 12.2 ▼ 24 hr.: 13.0 ∇	
SIZE AND TYPE OF PACK: #3 Monterey Sand	FROM 58' TO 80'	LOGGED BY: C.Rambo	CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: Bentonite Chips	56'	58'	No. 3: N/A	N/A	N/A
	No. 2: Cement Grout	0	56'	No. 4: N/A	N/A	N/A

LOG OF WELL MW-2

(Sheet 1 of 2)



10 inches Asphalt Concrete over 4 inches Concrete

Lean CLAY (CL) with gravel and cobbles - FILL
Moist, brown, with 6 inch cobbles

Lean CLAY (CL)
Moist, olive gray

Lean to fat CLAY (CL/CH)
Moist, gray, medium to high plasticity

Lean CLAY (CL)
Moist, light brown

Grades gray

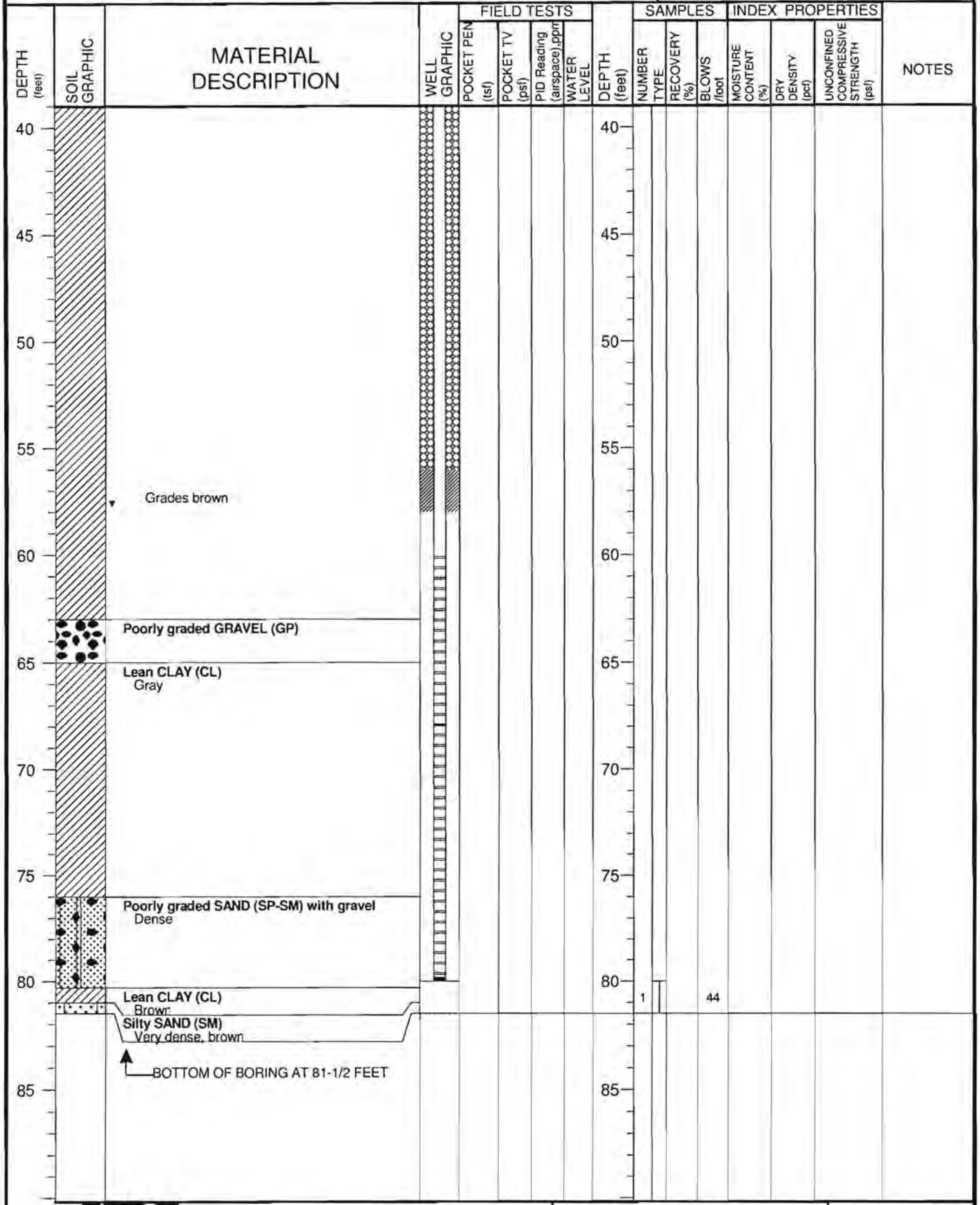
URS

PROJECT NO. 28649330.02520	Fig: C-29

SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF WELL MW-2

Continued- Sheet 2 of 2



Grades brown

Poorly graded GRAVEL (GP)

Lean CLAY (CL)
Gray

Poorly graded SAND (SP-SM) with gravel
Dense

Lean CLAY (CL)
Brown

Silty SAND (SM)
Very dense, brown

BOTTOM OF BORING AT 81-1/2 FEET

SV RAPID TRANSIT CORRIDOR; Santa Clara County, CA

BORING LOCATION: 5th Street and Santa Clara Street		GROUND SURFACE ELEVATION (ft): 80.00 approx TOP OF WELL CASING ELEVATION (ft): N/A	
DRILLING AGENCY: Pitcher	DRILLER: R.Medina	DATE STARTED: 3/2/03 DATE FINISHED: 3/2/03	
DRILLING EQUIPMENT: Failing 1500		COMPLETION DEPTHS	BORING: 84.5 (ft) WELL: 84.0 (ft)
DRILLING METHOD: Rotary Wash	DRILL BIT: 5-7/8"	SAMPLING METHOD: SPT	
SIZE AND TYPE OF CASING: 2 inch SCH 40 PVC		NUMBER OF SAMPLES	DIST: 1 UNDIST:
TYPE OF PERFORATION: 0.020" PVC	FROM 74' TO 84'	WATER DEPTH (ft)	FIRST: N/A ▽ COMPL.: 12.3 ▼ 24 hr.: 12.2
SIZE AND TYPE OF PACK: #3 Monterey Sand	FROM 69' TO 84'	LOGGED BY: T.Pennington	CHECKED BY: S.Huang

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1: Bentonite Chips	67'	69'	No. 3: N/A	N/A	N/A
	No. 2: Cement Grout	0	67'	No. 4: N/A	N/A	N/A

LOG OF WELL MW-3

(Sheet 1 of 2)

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	WELL GRAPHIC	FIELD TESTS				DEPTH (feet)	SAMPLES				INDEX PROPERTIES			NOTES
				POCKET PEN (tsf)	POCKET TV (psf)	PID Reading (airspace),ppm	WATER LEVEL		NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	
	▨	**Lean CLAY (CL)** Moist, dark brown														
	▨	▼ Grades brown														
5	▨							5								Set casing at 6', began rotary wash
10	▨							10								
	▨						▼									
	▨	▼ Grades with fine sand														
15	▨							15								
	▨	▼ Grades gray, trace fine sand														Driller noted several thin sand seams from 17' to 29'
20	▨							20								
25	▨							25								
30	▨							30								
35	▨							35								

URS

PROJECT NO. 28649330.02520

Fig: C-30

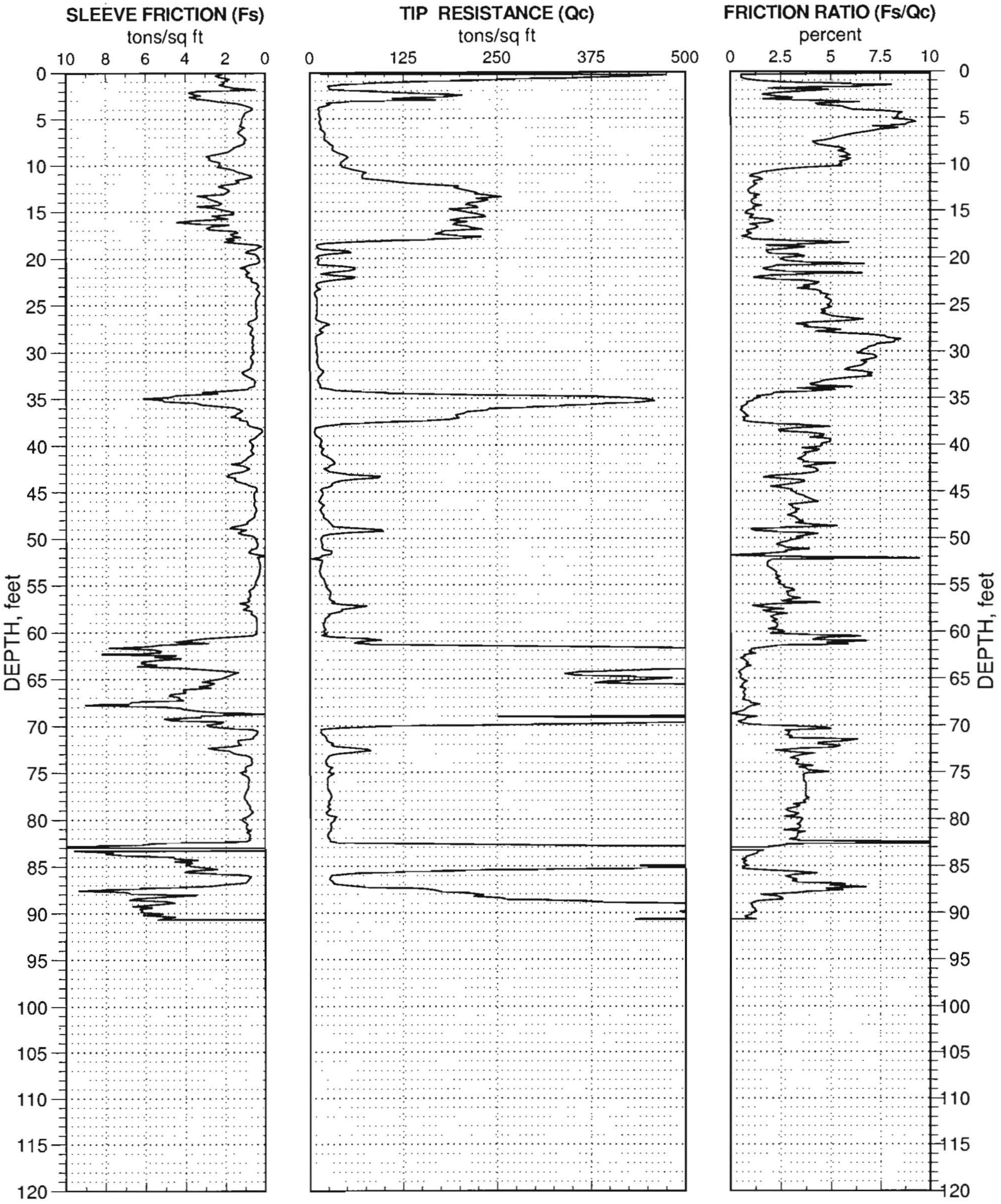
SV RAPID TRANSIT CORRIDOR
Santa Clara County, CA

LOG OF WELL MW-3
Continued- Sheet 2 of 2

DEPTH (feet)	SOIL GRAPHIC	MATERIAL DESCRIPTION	WELL GRAPHIC	FIELD TESTS POCKET PEN (tsf)	POCKET TV (psf)	PID Reading (airspace),ppm	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	TYPE	RECOVERY (%)	BLOWS /foot	INDEX PROPERTIES MOISTURE CONTENT (%)	DRY DENSITY (pcf)	UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
40								40								
45								45								
		Lean CLAY (CL) Moist, brown and gray mottled														
50								50								
		▼ Grades gray														
		▼ Grades brown and gray mottled														
55								55								
60								60								
		▼ Grades sandy														
		▼ Grades less sand														
65		▼ Grades sandy						65								
		▼ Grades gray, less sand														
70								70								
		Well-graded SAND (SW) with gravel Brown, fine to coarse gravel, some clay pockets														
75								75								
																Hole caved to 77' while sampling, driller noticed fluid loss when redrilling to 84-1/2'
80								80								
									1			52				
85		BOTTOM OF BORING AT 84-1/2 FEET						85								

URS

CONE PENETRATION TESTS



Date: 10/31/02

Surface Elevation: 87.80 feet

Remarks:

SV RAPID TRANSIT CORRIDOR

Project Number: 28649330.02520

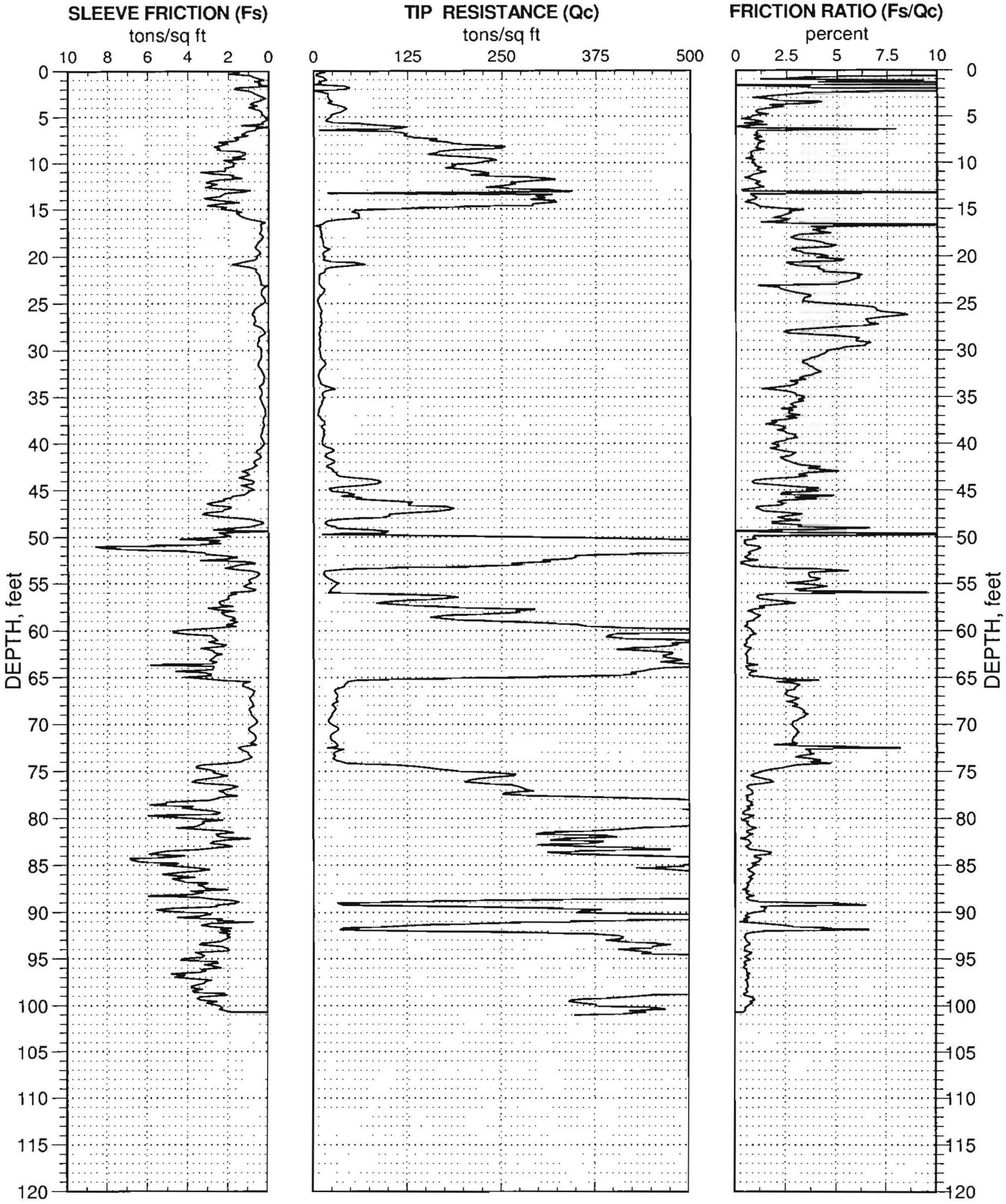
CONE PENETRATION TEST
SOUNDING NUMBER: NC-09

Fig. C-31

Page 1 of 1

1/14/04 CONE8 8790E.GPJ

URS



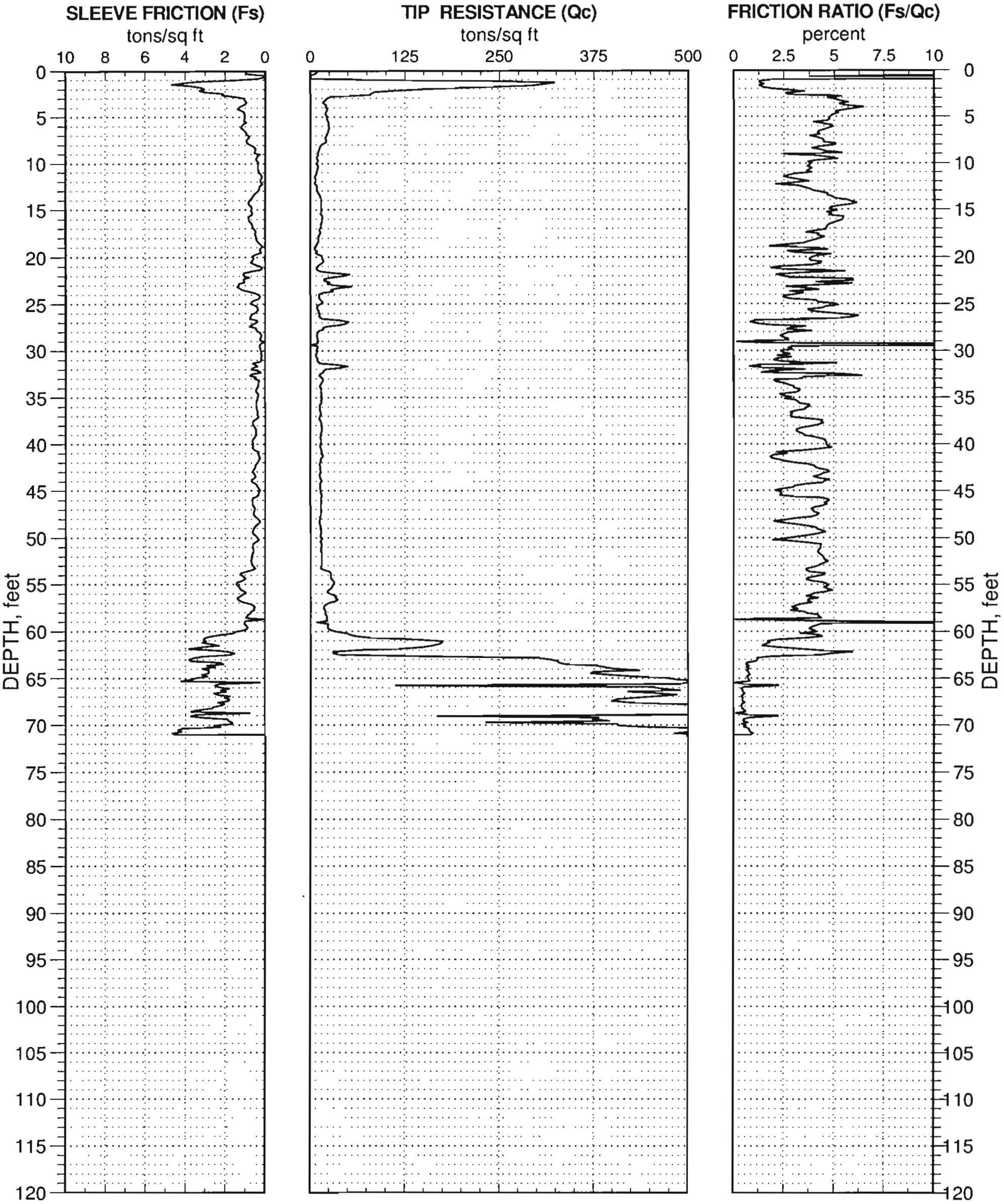
Date: 10/31/02

Surface Elevation: 78.20 feet

Remarks:

SV RAPID TRANSIT CORRIDOR

Project Number: 28649330.02520	**CONE PENETRATION TEST** **SOUNDING NUMBER: NC-10**	**Fig. C-32** **Page 1 of 1**



Date: 10/29/02

Surface Elevation: 87.00 feet

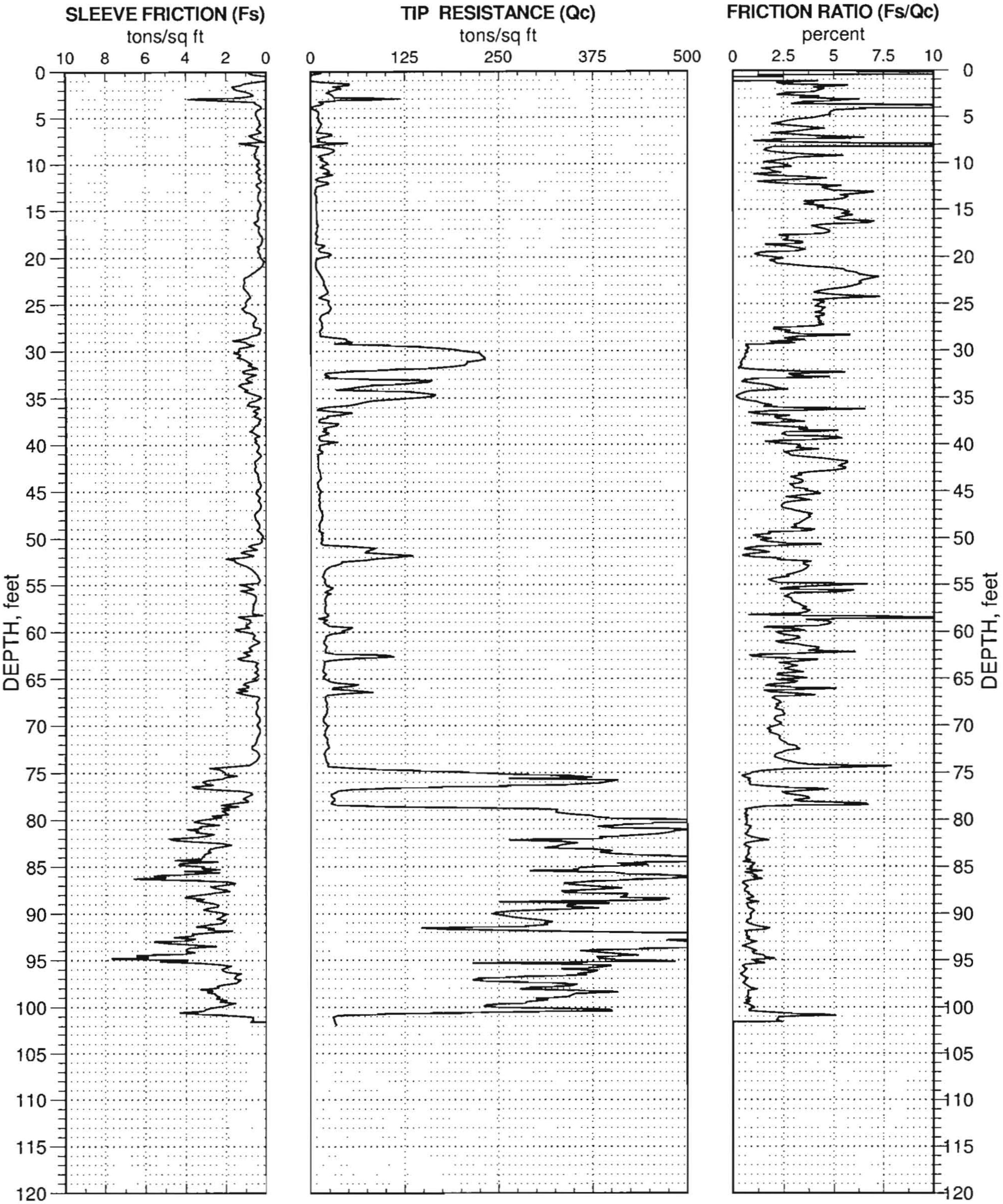
Remarks:

SV RAPID TRANSIT CORRIDOR

Project Number: 28649330.02520	**CONE PENETRATION TEST** **SOUNDING NUMBER: NC-11**	**Fig. C-33** **Page 1 of 1**

1/14/04 CONE8 8790E.GPJ

URS



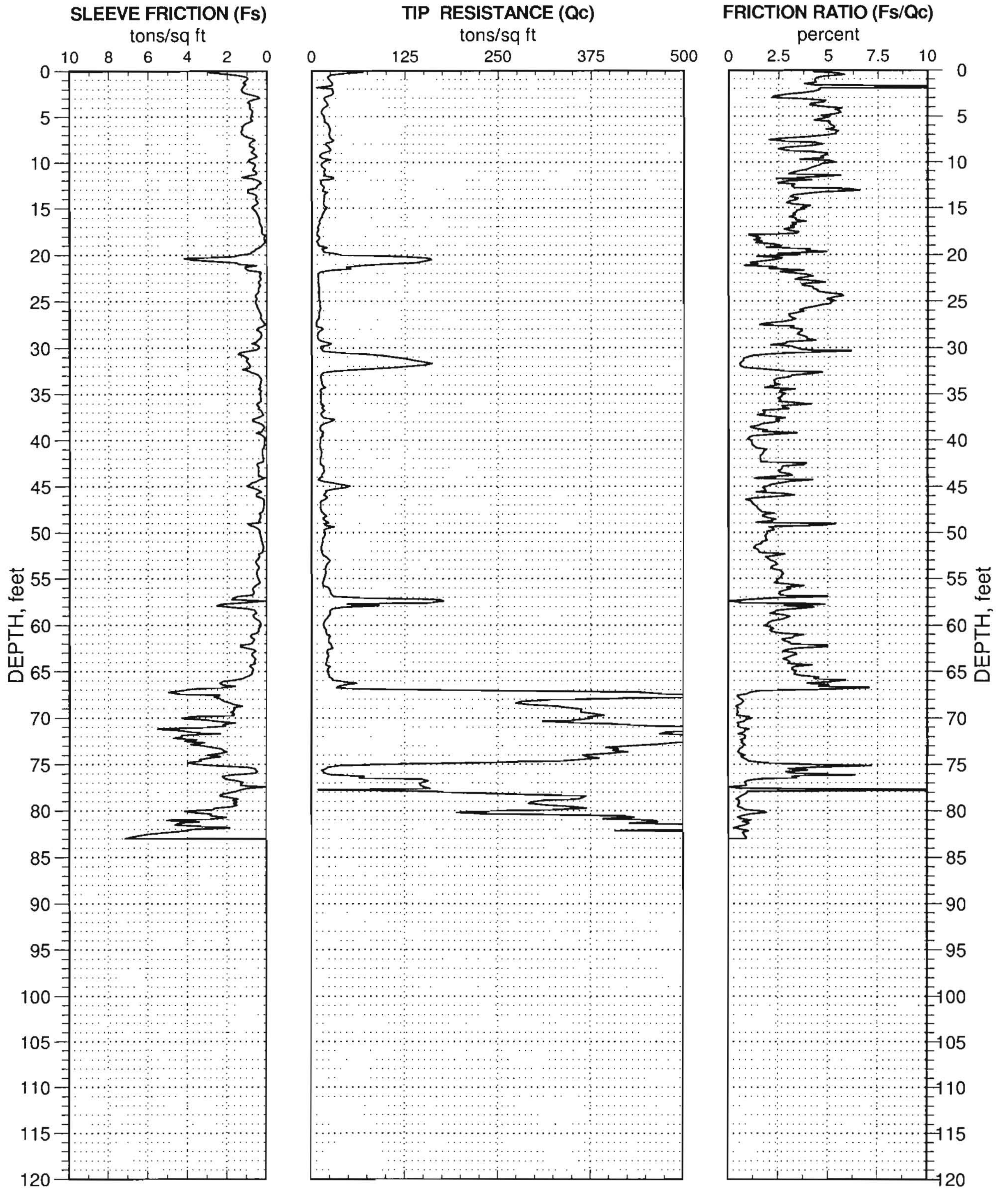
Date: 11/4/02

Surface Elevation: 88.50 feet

Remarks:

SV RAPID TRANSIT CORRIDOR

Project Number: 28649330.02520	**CONE PENETRATION TEST SOUNDING NUMBER: NC-12**	**Fig. C-34** **Page 1 of 1**



Date: 11/1/02

Surface Elevation: 84.00 feet

Remarks:

SV RAPID TRANSIT CORRIDOR

Project Number: 28649330.02520

CONE PENETRATION TEST
SOUNDING NUMBER: NC-13

Fig. C-35

Page 1 of 1

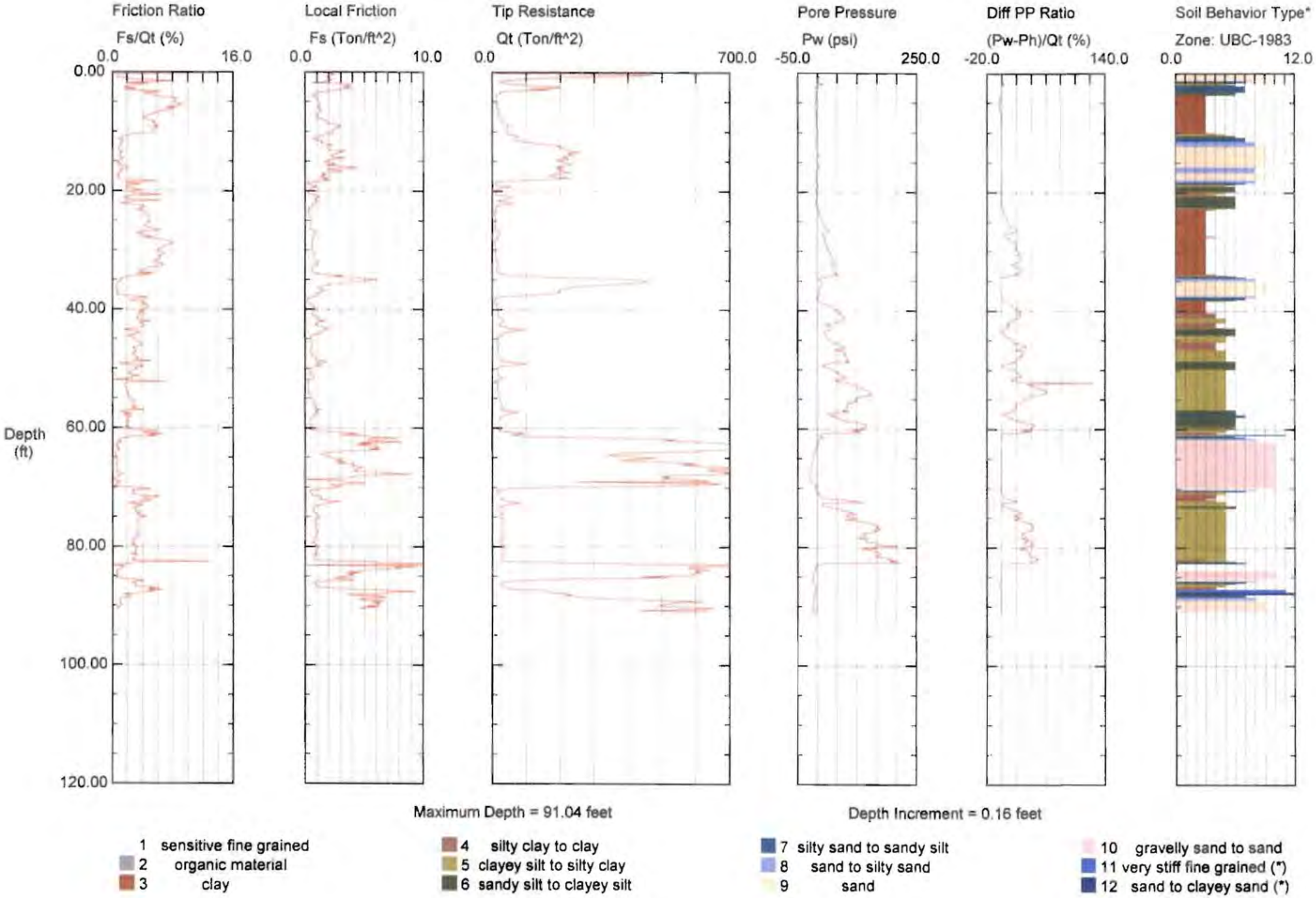
1/14/04 CONE8 8790E.GPJ

URS

VBI In-Situ Testing

Operator: MIKE JONES
Sounding: 02W392
Cone Used: HO738TC-U2

CPT Date/Time: 10-31-02 12:08
Location: NC-09
Job Number: 28648790



Maximum Depth = 91.04 feet

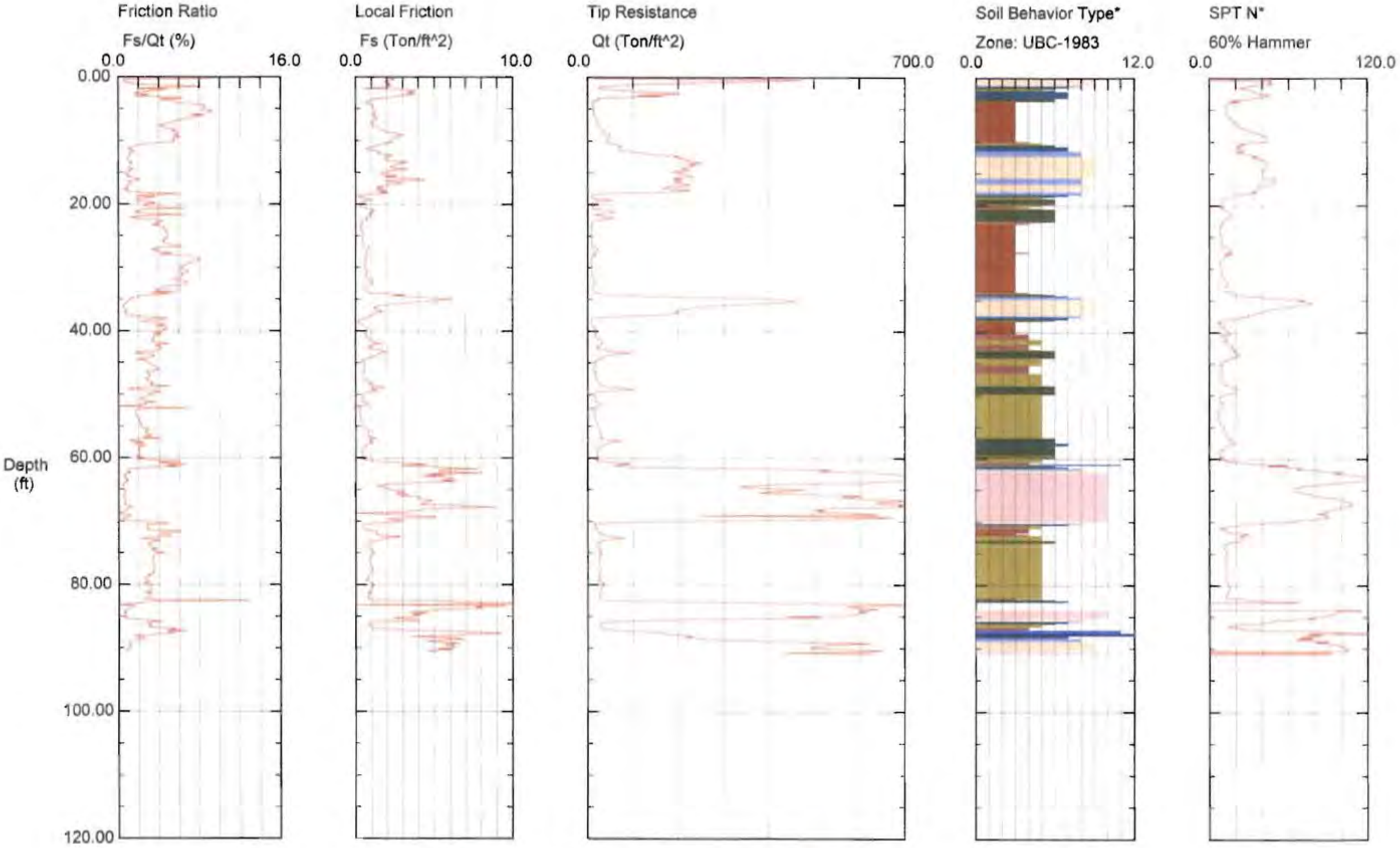
Depth Increment = 0.16 feet

Figure C-36, 1 of 3

VBI In-Situ Testing

Operator: MIKE JONES
Sounding: 02W392
Cone Used: HO738TC-U2

CPT Date/Time: 10-31-02 12:08
Location: NC-09
Job Number: 28648790



Maximum Depth = 91.04 feet

Depth Increment = 0.16 feet

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

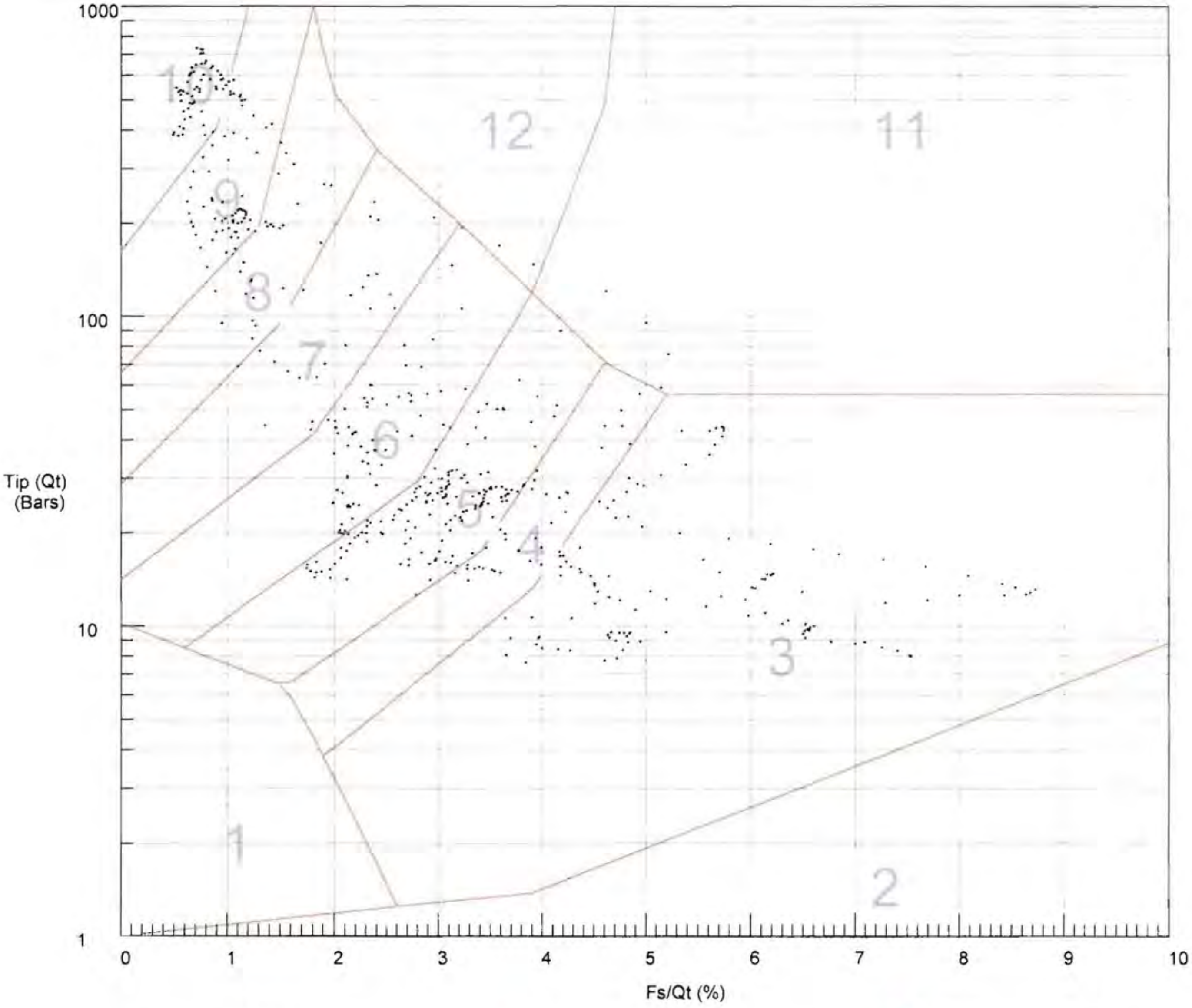
Figure C-36, 2 of 3

VBI In-Situ Testing

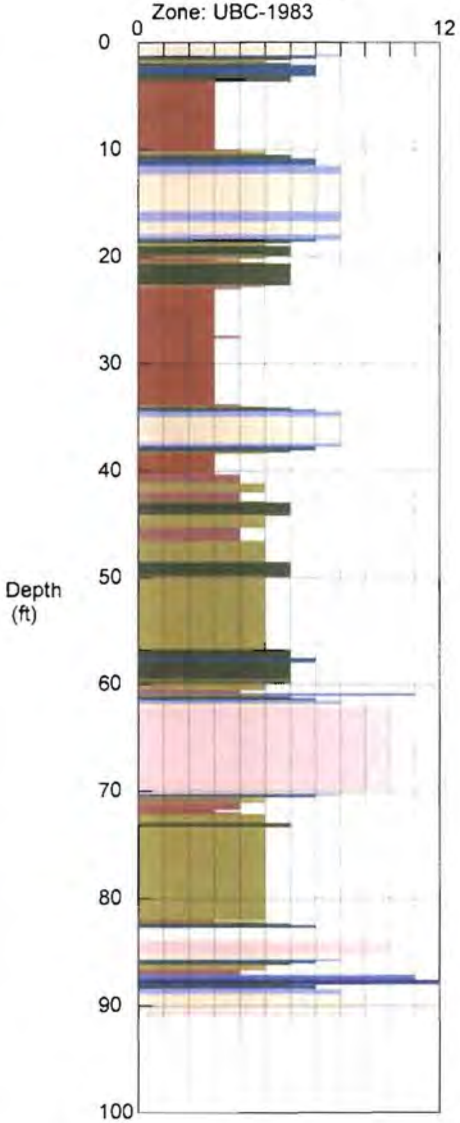
Operator: MIKE JONES
Sounding: 02W392
Cone Used: HO738TC-U2

CPT Date/Time: 10-31-02 12:08
Location: NC-09
Job Number: 28648790

Classification Data:
Robertson and Campanella UBC-1983



Soil Behavior Type*
Zone: UBC-1983



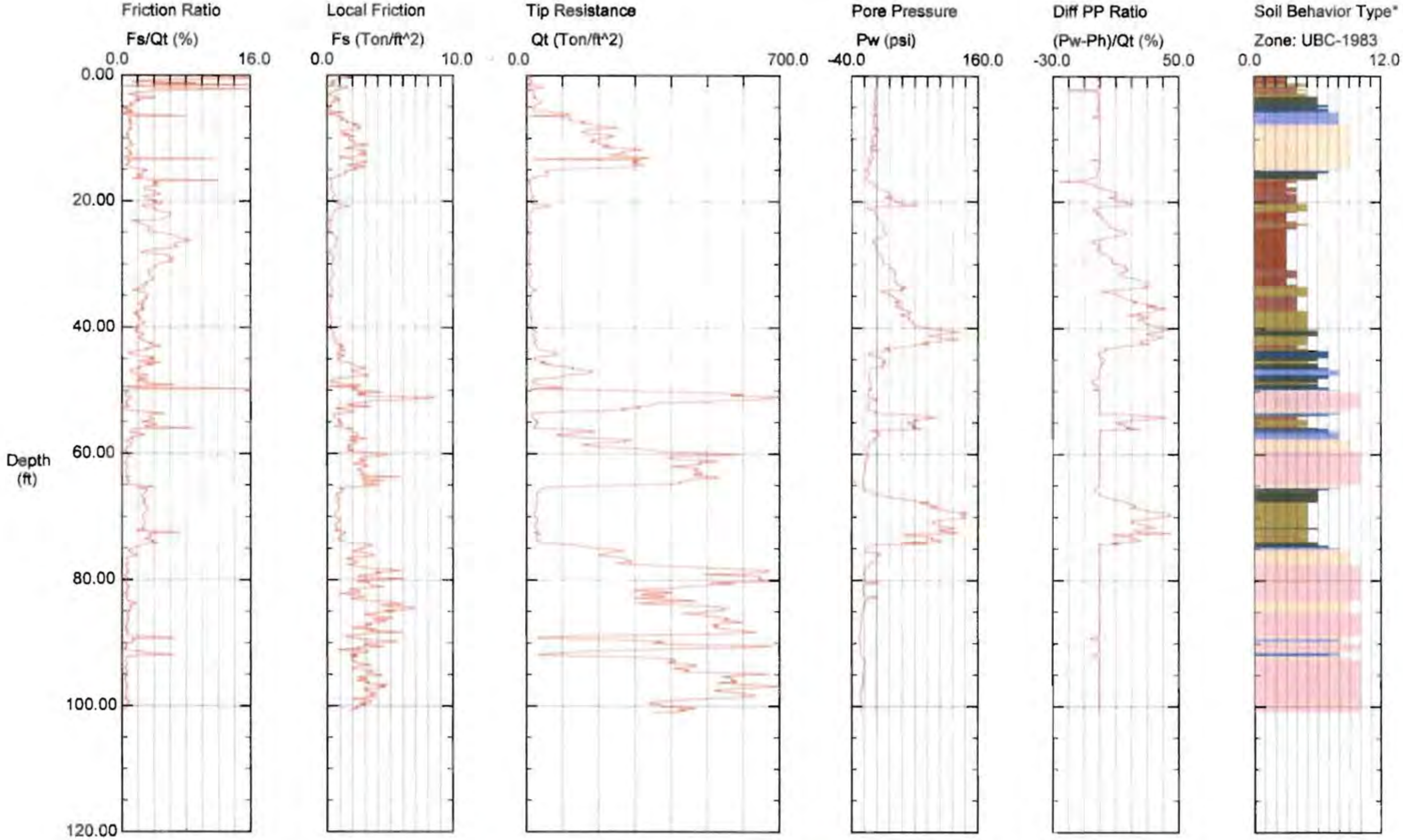
- 1 sensitive fine grained
- ■ 2 organic material
- ■ 3 clay
- ■ 4 silty clay to clay
- ■ 5 clayey silt to silty clay
- ■ 6 sandy silt to clayey silt
- ■ 7 silty sand to sandy silt
- ■ 8 sand to silty sand
- 9 sand
- ■ 10 gravelly sand to sand
- ■ 11 very stiff fine grained (*)
- ■ 12 sand to clayey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

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

VBI In-Situ Testing

Operator: MIKE JONES
Sounding: 02W391
Cone Used: HO738TC-U2

CPT Date/Time: 10-31-02 09:37
Location: NC-10
Job Number: 28648790



Maximum Depth = 101.05 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
■ 2 organic material
■ 3 clay

■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt

■ 7 silty sand to sandy silt
■ 8 sand to silty sand
■ 9 sand

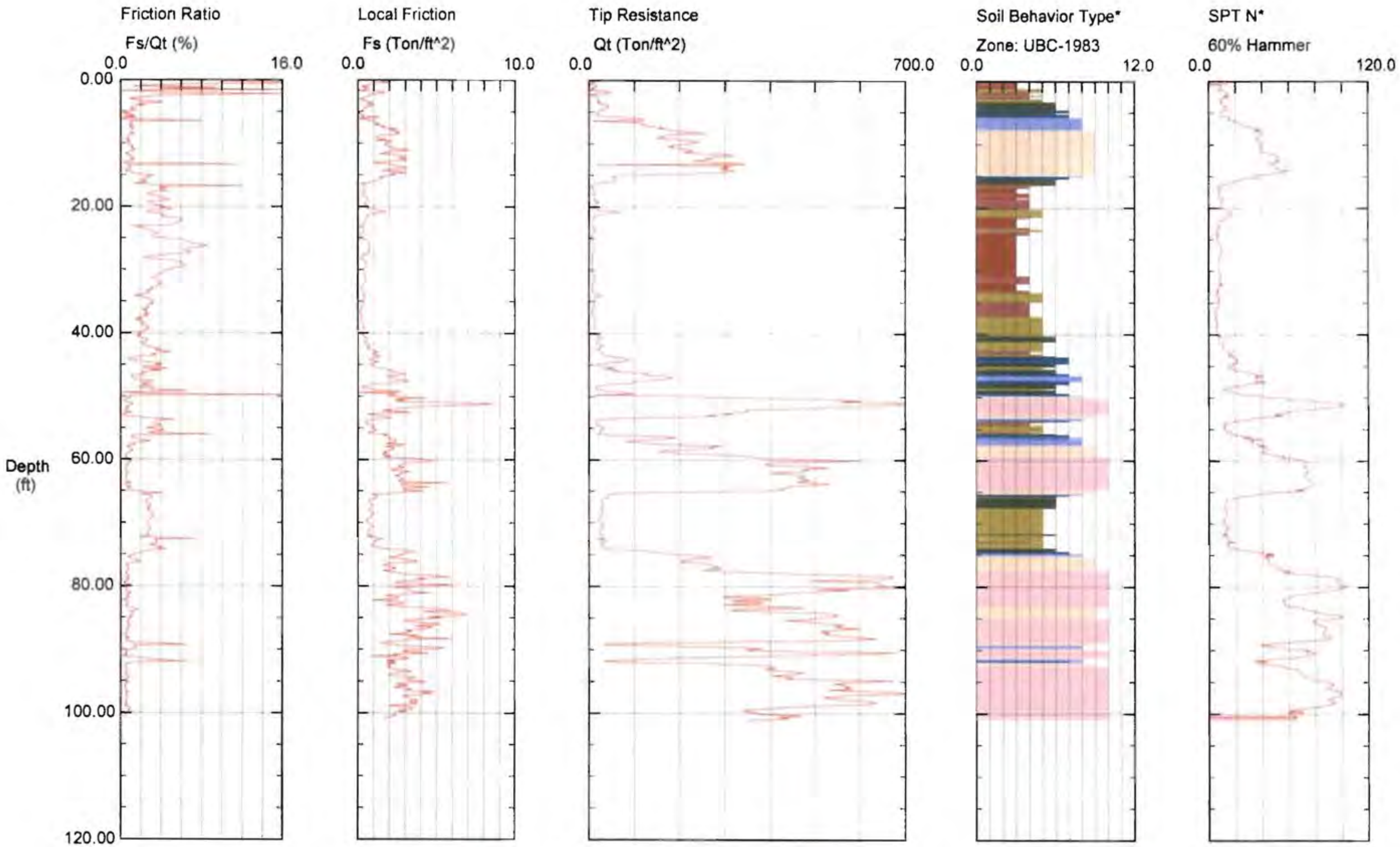
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

Figure C-37, 1 of 3

VBI In-Situ Testing

Operator: MIKE JONES
Sounding: 02W391
Cone Used: HO738TC-U2

CPT Date/Time: 10-31-02 09:37
Location: NC-10
Job Number: 28648790



Maximum Depth = 101.05 feet

Depth Increment = 0.16 feet

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

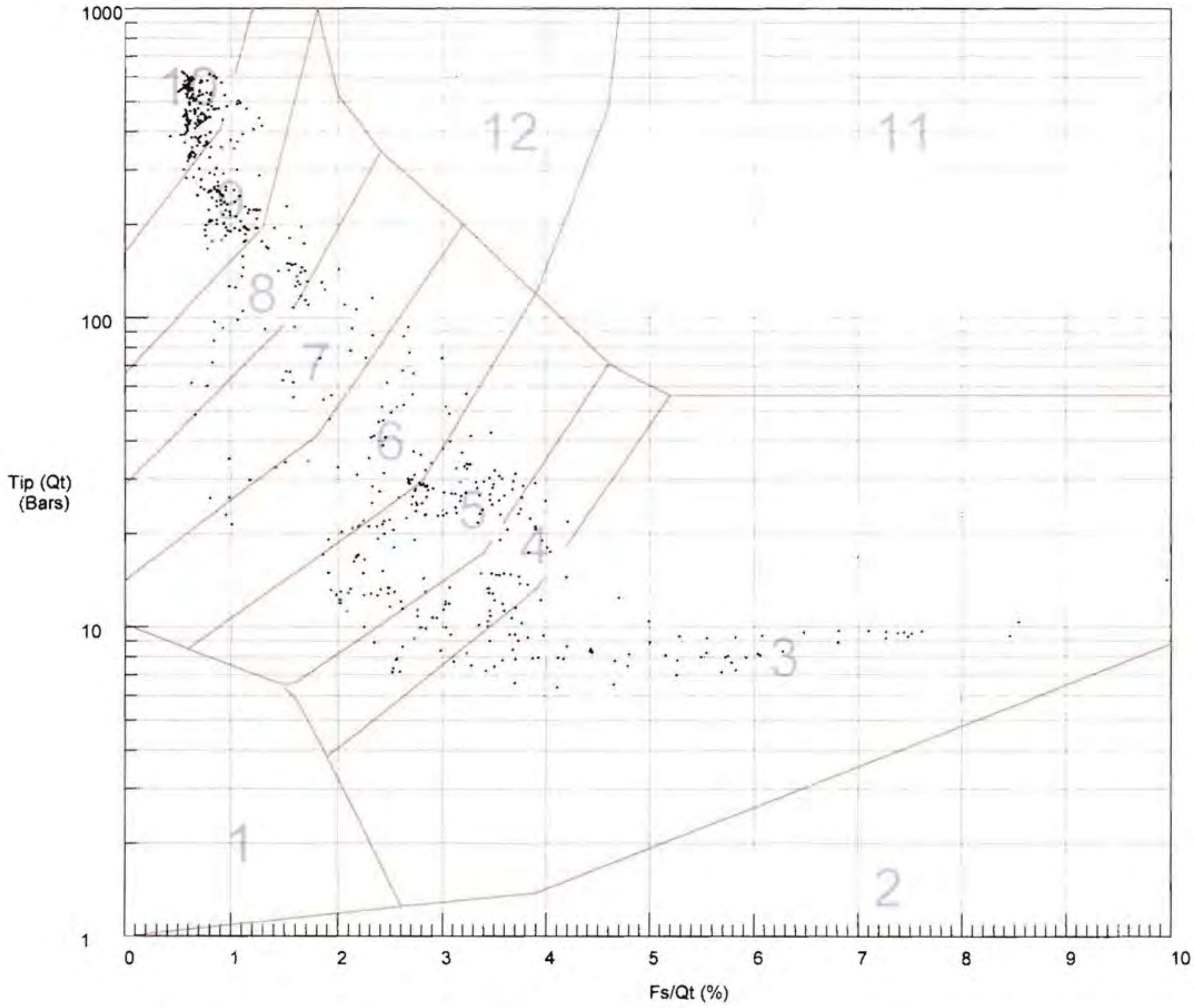
Figure C-37, 2 of 3

VBI In-Situ Testing

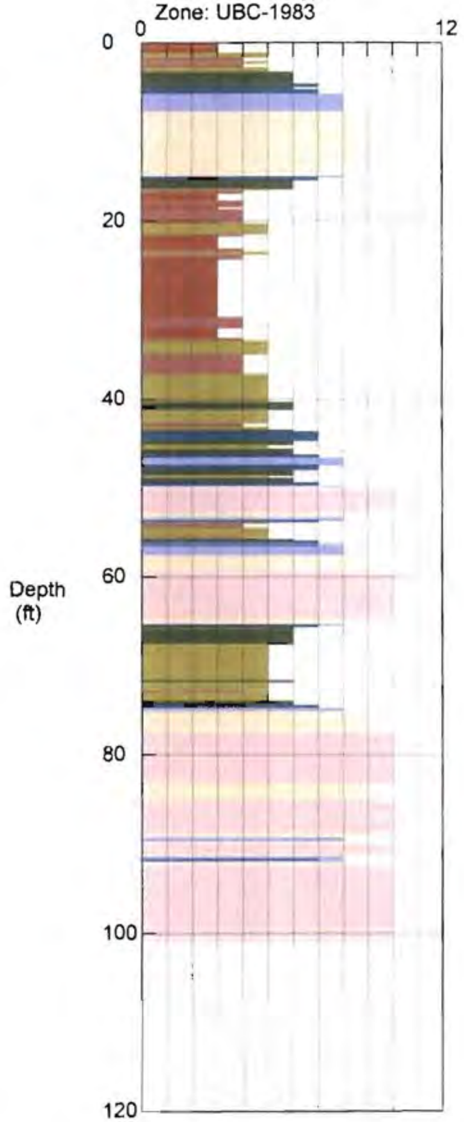
Operator: MIKE JONES
Sounding: 02W391
Cone Used: HO738TC-U2

CPT Date/Time: 10-31-02 09:37
Location: NC-10
Job Number: 28648790

Classification Data:
Robertson and Campanella UBC-1983



Soil Behavior Type*
Zone: UBC-1983

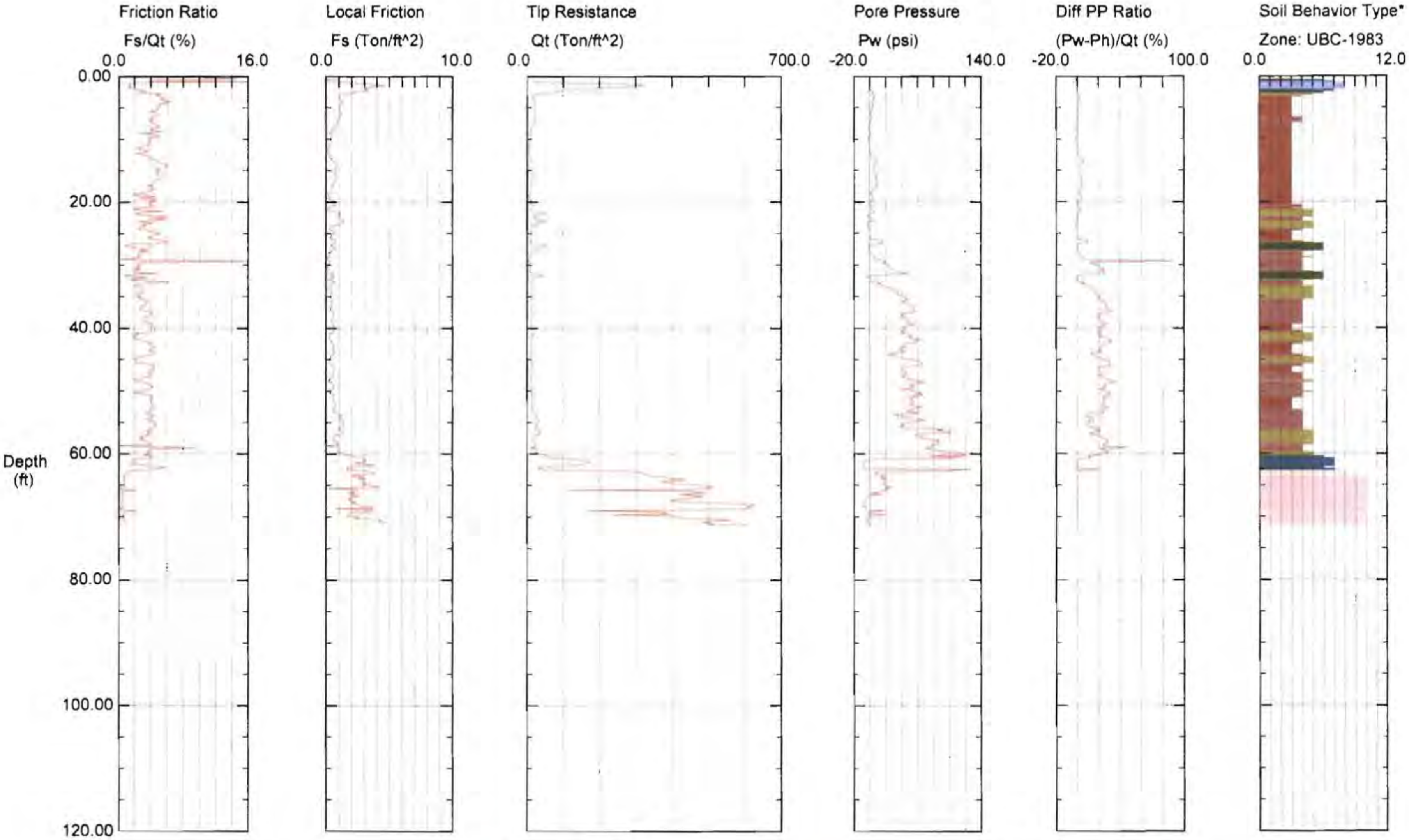


- 1 sensitive fine grained
- ■ 2 organic material
- ■ 3 clay
- ■ 4 silty clay to clay
- ■ 5 clayey silt to silty clay
- ■ 6 sandy silt to clayey silt
- ■ 7 silty sand to sandy silt
- ■ 8 sand to silty sand
- 9 sand
- ■ 10 gravelly sand to sand
- ■ 11 very stiff fine grained (*)
- ■ 12 sand to clayey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

VBI In-Situ Testing

Operator: MIKE JONES
Sounding: 02W387
Cone Used: HO818TC-U2

CPT Date/Time: 10-29-02 14:13
Location: NC-11
Job Number: 28648790



Maximum Depth = 71.36 feet

Depth Increment = 0.16 feet

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

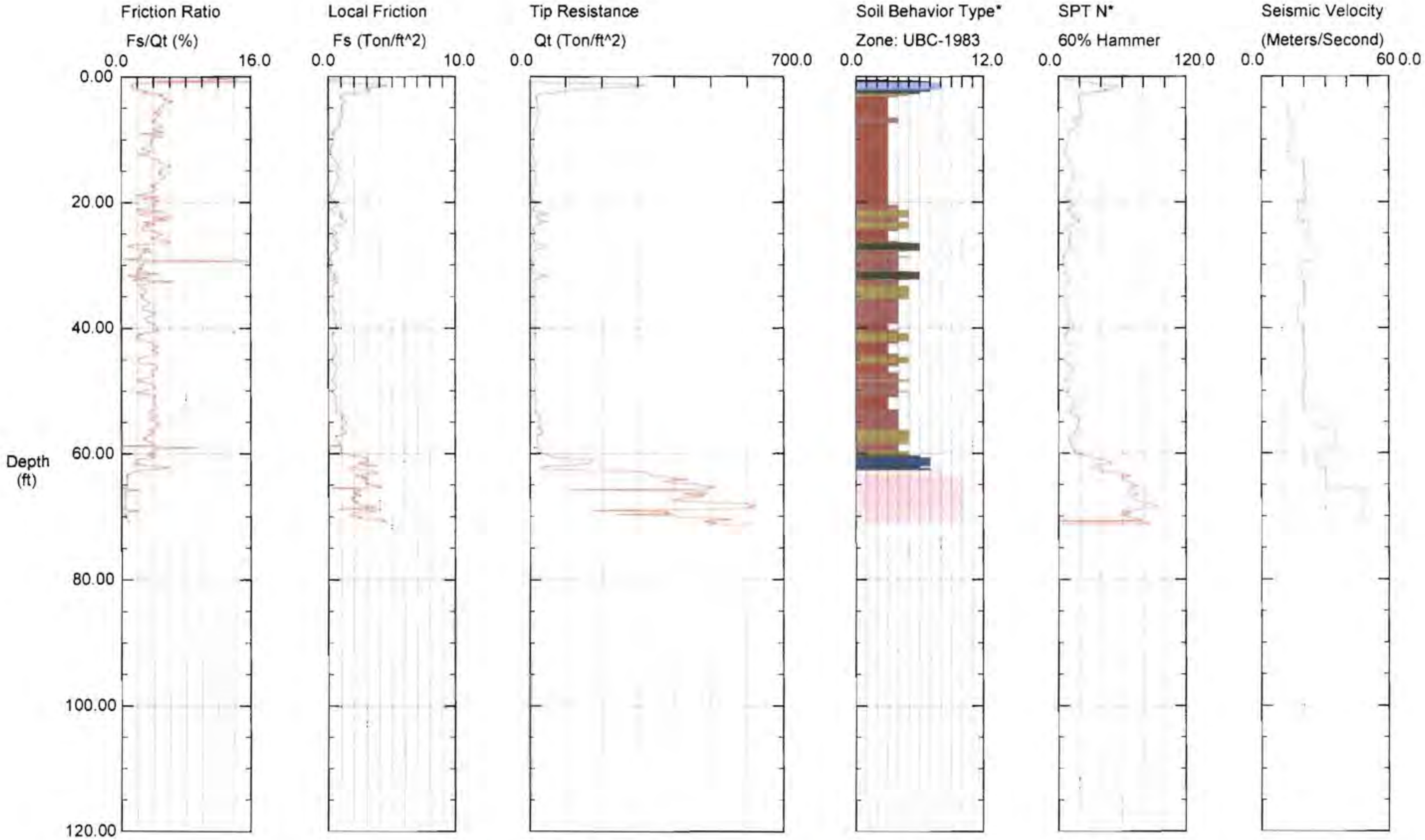
Figure C-38, 1 of 3

il behavior type and SPT based on data from UBC-1983

VBI In-Situ Testing

Operator: MIKE JONES
Sounding: 02W387
Cone Used: HO818TC-U2

CPT Date/Time: 10-29-02 14:13
Location: NC-11
Job Number: 28648790



Maximum Depth = 71.36 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
■ 2 organic material
■ 3 clay

■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt

■ 7 silty sand to sandy silt
■ 8 sand to silty sand
9 sand

■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

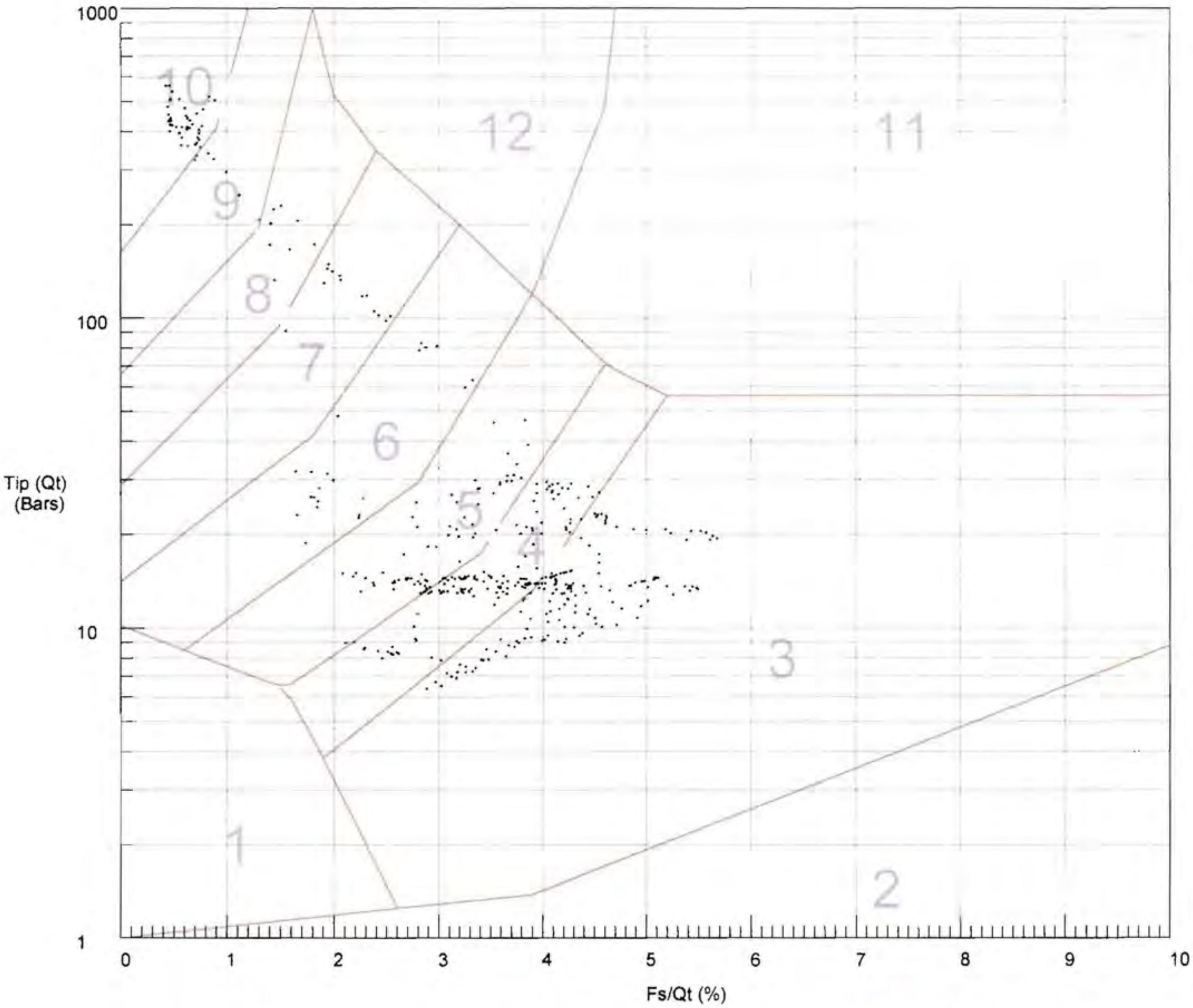
Figure C-38, 2 of 3

VBI In-Situ Testing

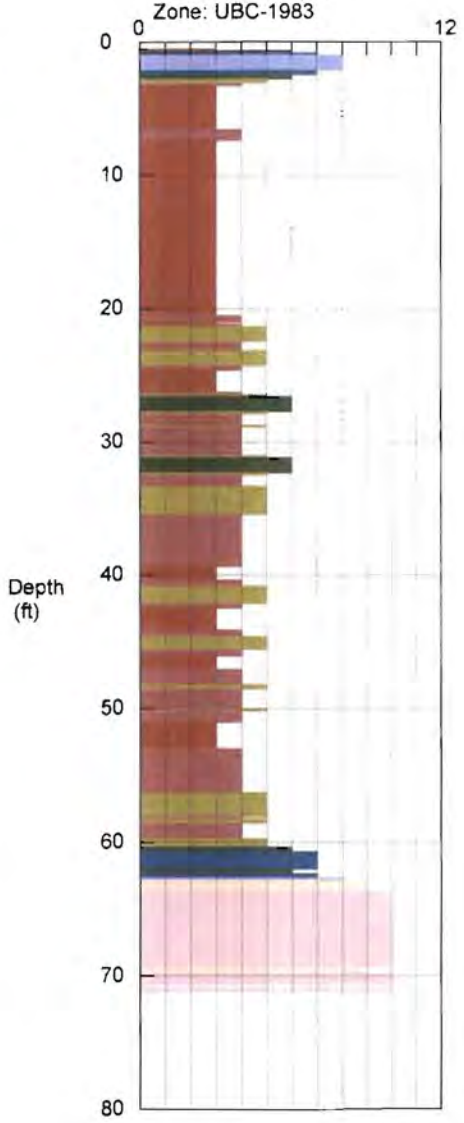
Operator: MIKE JONES
Sounding: 02W387
Cone Used: HO818TC-U2

CPT Date/Time: 10-29-02 14:13
Location: NC-11
Job Number: 28648790

Classification Data:
Robertson and Campanella UBC-1983



Soil Behavior Type*
Zone: UBC-1983



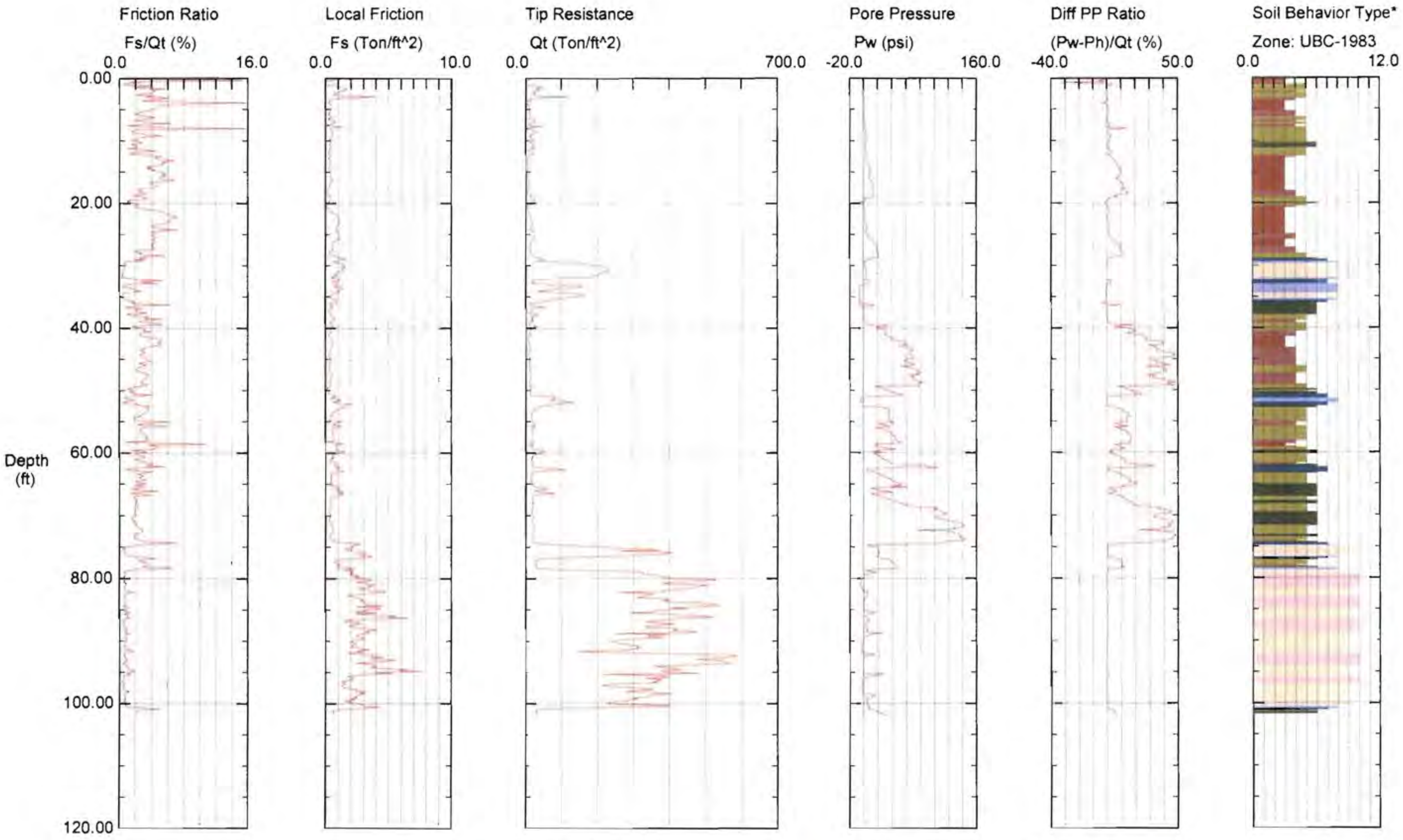
1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

il behavior type and SPT based on data from UBC-1983

VBI In-Situ Testing

Operator: MIKE JONES
Sounding: 02W395
Cone Used: HO818TC-U2

CPT Date/Time: 11-04-02 09:35
Location: NC-12
Job Number: 28648790



Maximum Depth = 101.87 feet

Depth Increment = 0.16 feet

1 sensitive fine grained
🟪 2 organic material
🟥 3 clay
🟫 4 silty clay to clay
🟨 5 clayey silt to silty clay
⬛ 6 sandy silt to clayey silt
🟦 7 silty sand to sandy silt
🟦 8 sand to silty sand
9 sand
⬜ 10 gravelly sand to sand
🟪 11 very stiff fine grained (*)
🟦 12 sand to clayey sand (*)

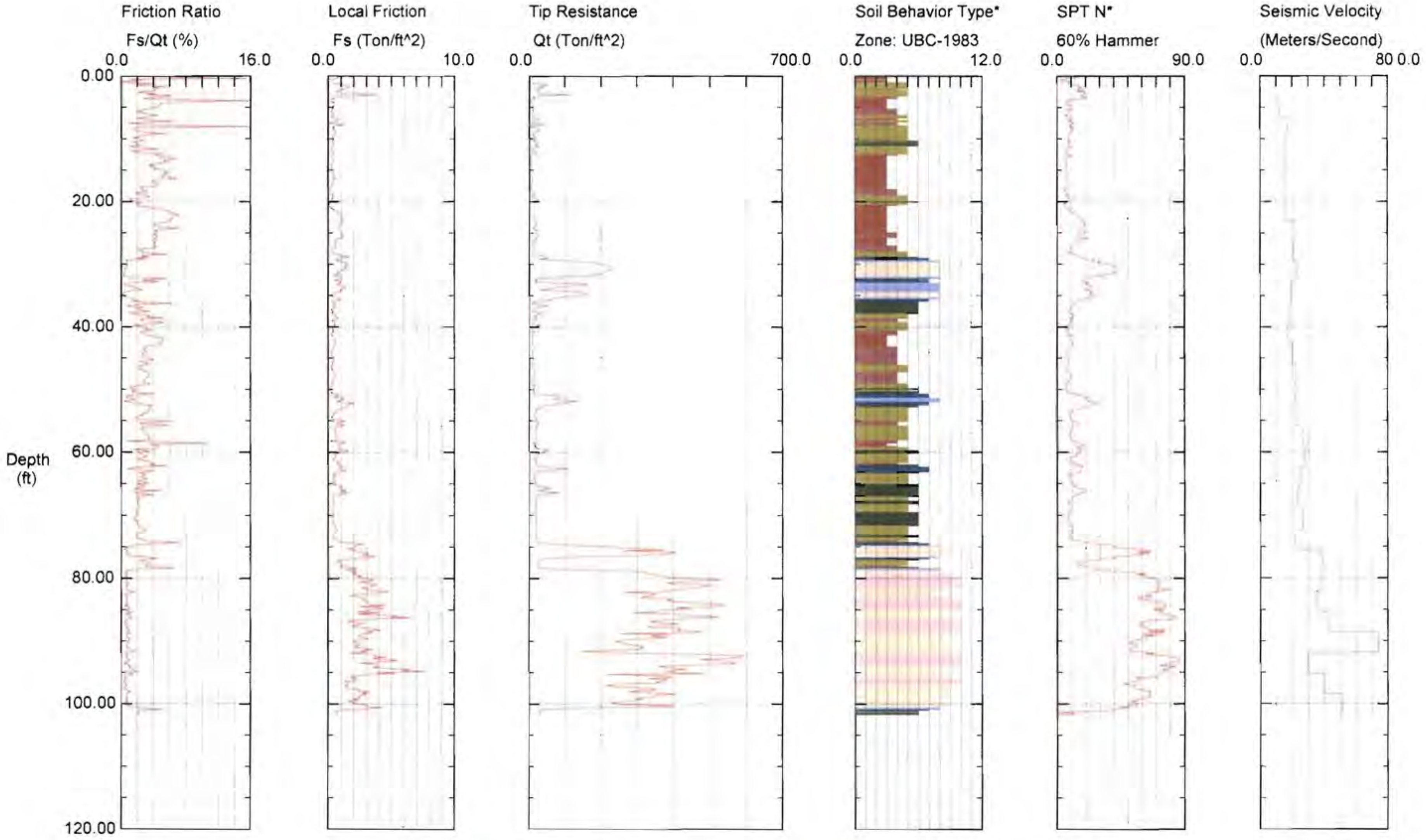
Figure C-39, 1 of 3

il behavior type and SPT based on data from UBC-1983

VBI In-Situ Testing

Operator: MIKE JONES
Sounding: 02W395
Cone Used: HO818TC-U2

CPT Date/Time: 11-04-02 09:35
Location: NC-12
Job Number: 28648790



Maximum Depth = 101.87 feet

Depth Increment = 0.16 feet

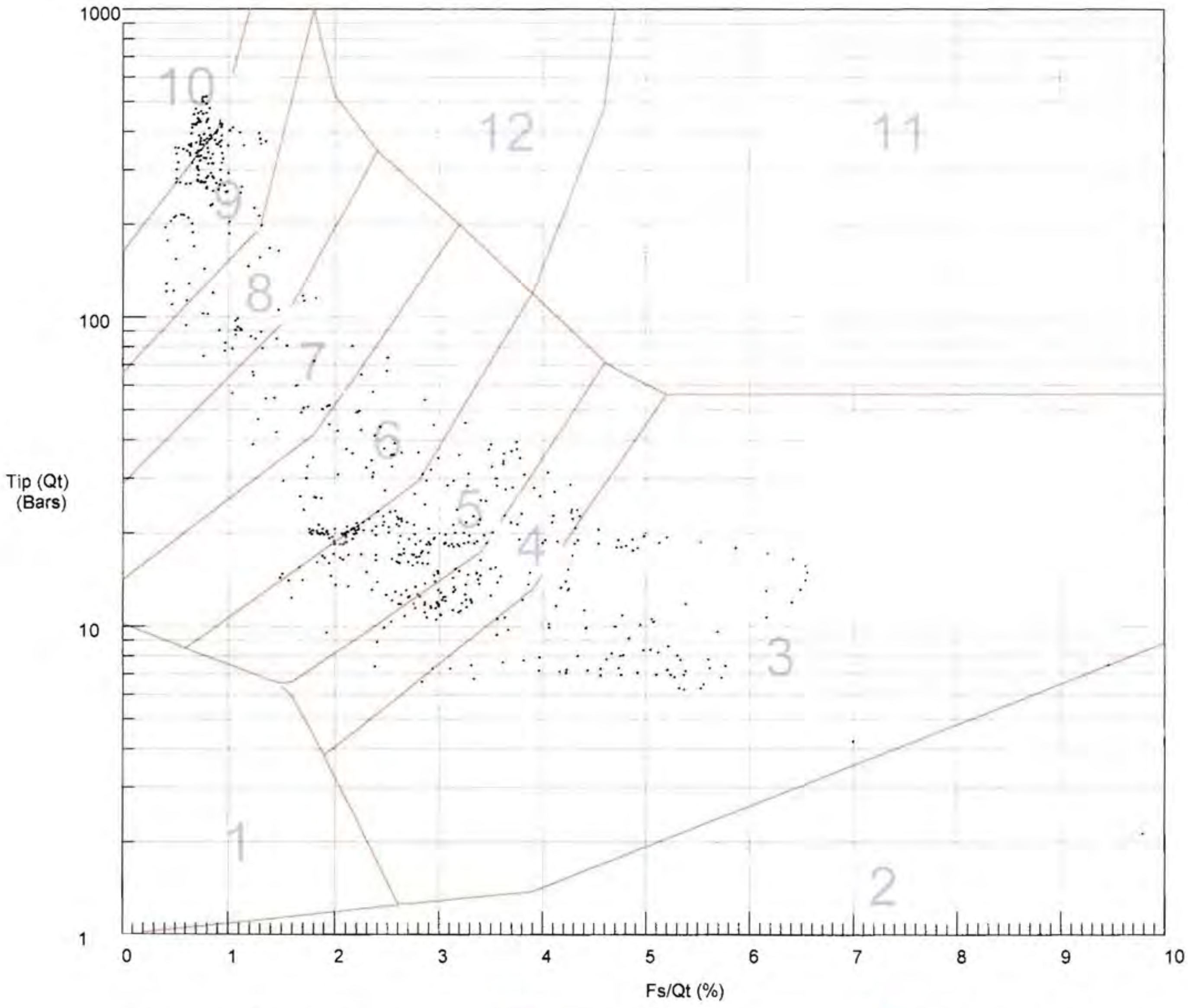
1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

VBI In-Situ Testing

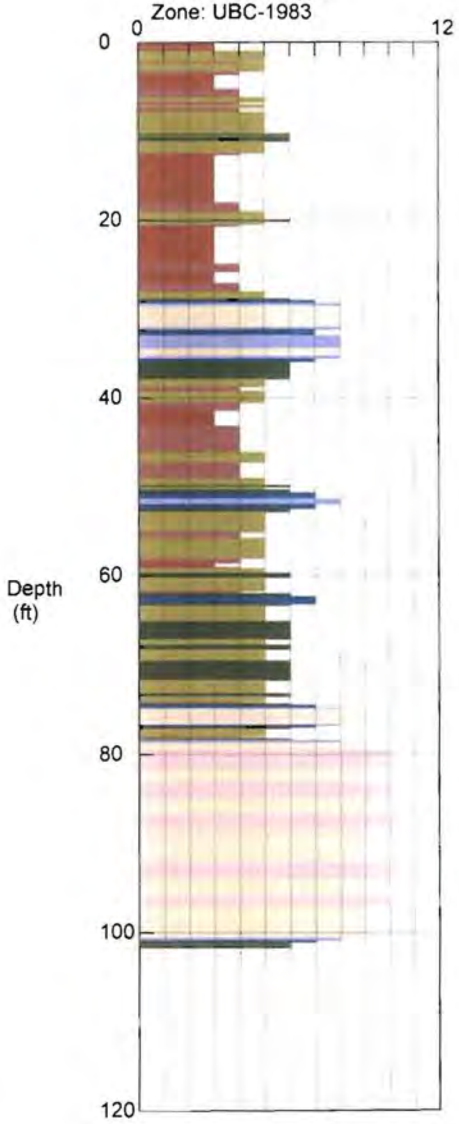
Operator: MIKE JONES
Sounding: 02W395
Cone Used: HO818TC-U2

CPT Date/Time: 11-04-02 09:35
Location: NC-12
Job Number: 28648790

Classification Data:
Robertson and Campanella UBC-1983



Soil Behavior Type*
Zone: UBC-1983



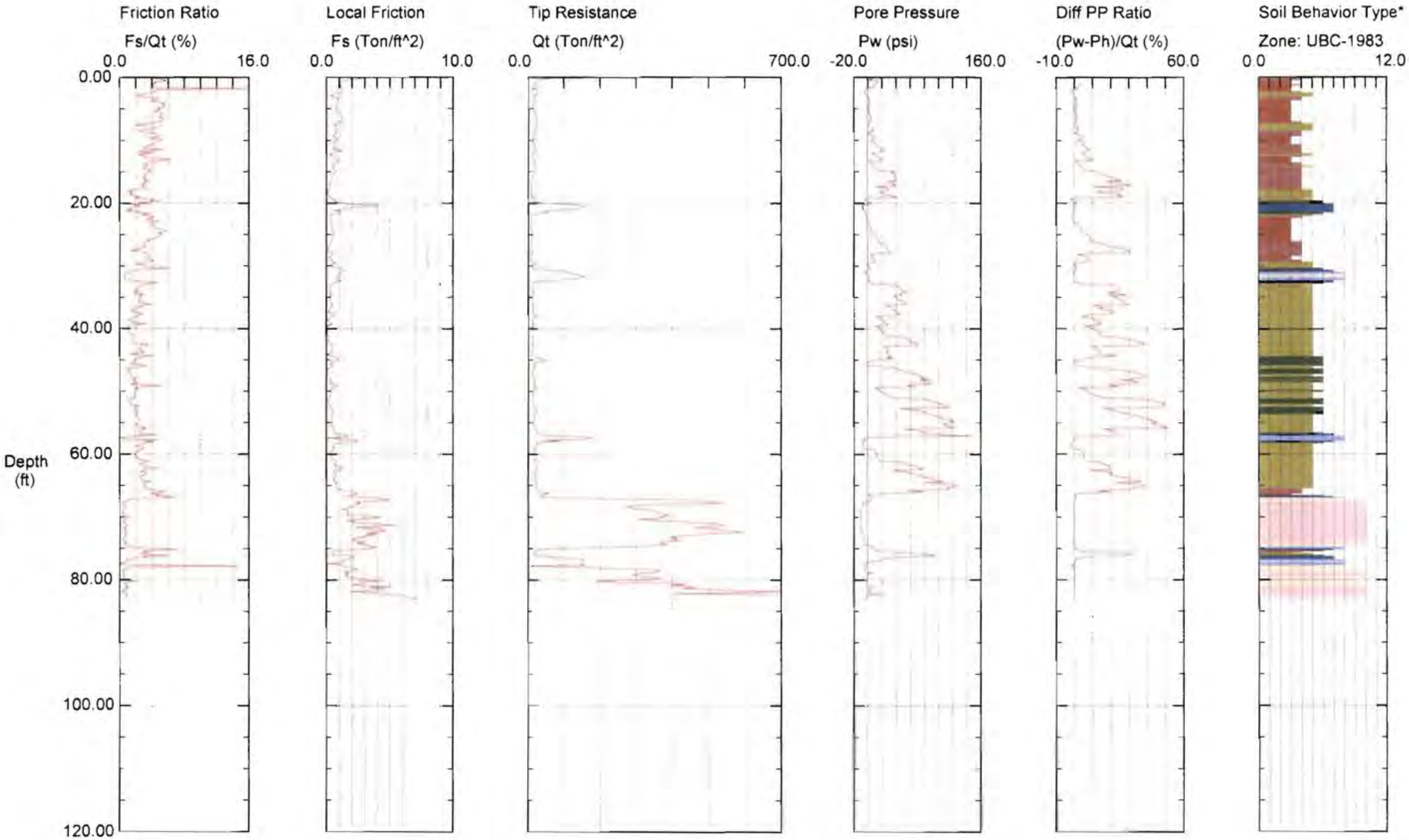
1 sensitive fine grained
■ 2 organic material
■ 3 clay
■ 4 silty clay to clay
■ 5 clayey silt to silty clay
■ 6 sandy silt to clayey silt
■ 7 silty sand to sandy silt
■ 8 sand to silty sand
9 sand
■ 10 gravelly sand to sand
■ 11 very stiff fine grained (*)
■ 12 sand to clayey sand (*)

il behavior type and SPT based on data from UBC-1983

VBI In-Situ Testing

Operator: MIKE JONES
Sounding: 02W393
Cone Used: HO818TC-U2

CPT Date/Time: 11-01-02 08:44
Location: NC-13
Job Number: 28648790



Maximum Depth = 83.33 feet

Depth Increment = 0.16 feet

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

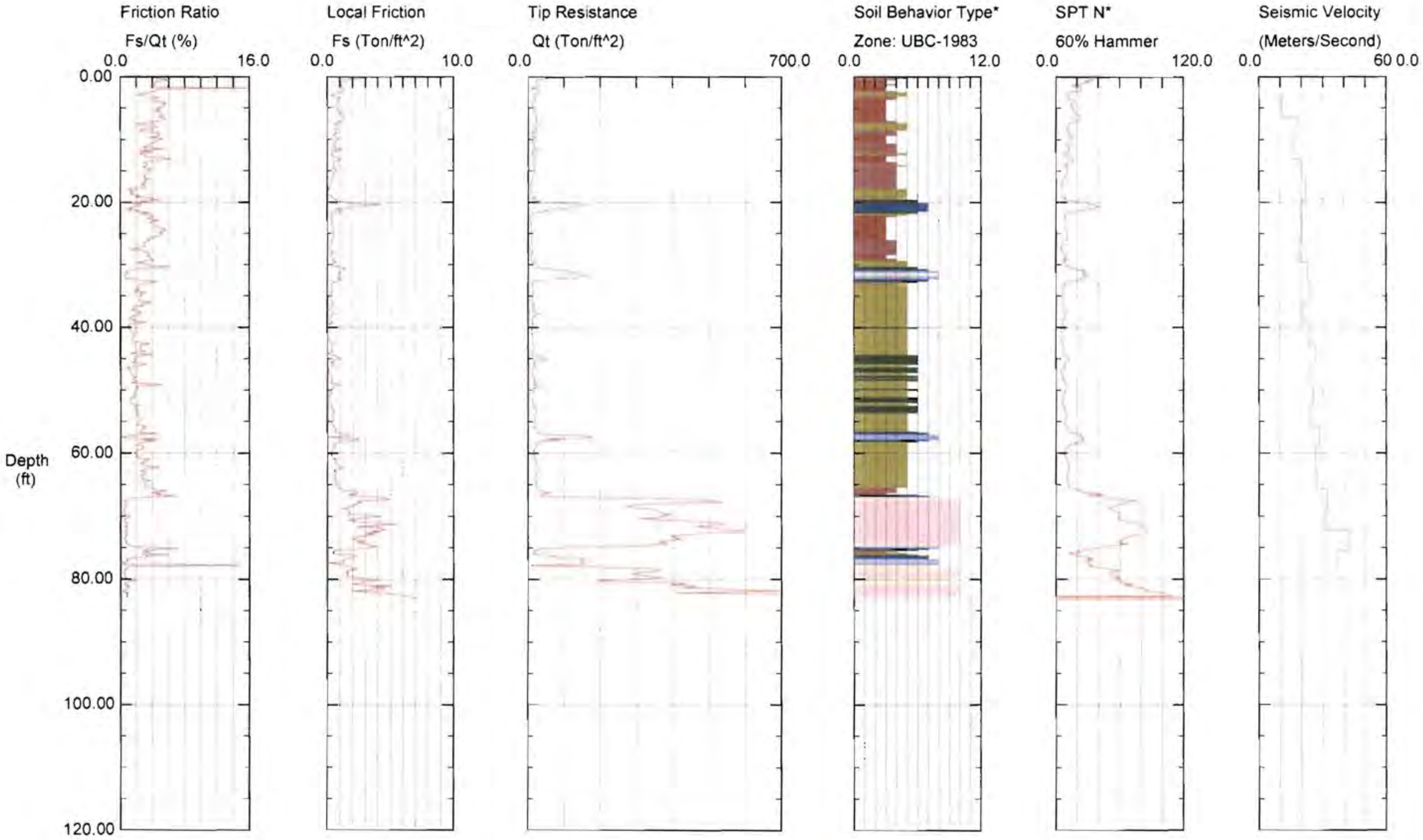
Figure C-40, 1 of 3

il behavior type and SPT based on data from UBC-1983

VBI In-Situ Testing

Operator: MIKE JONES
Sounding: 02W393
Cone Used: HO818TC-U2

CPT Date/Time: 11-01-02 08:44
Location: NC-13
Job Number: 28648790



Maximum Depth = 83.33 feet

Depth Increment = 0.16 feet

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

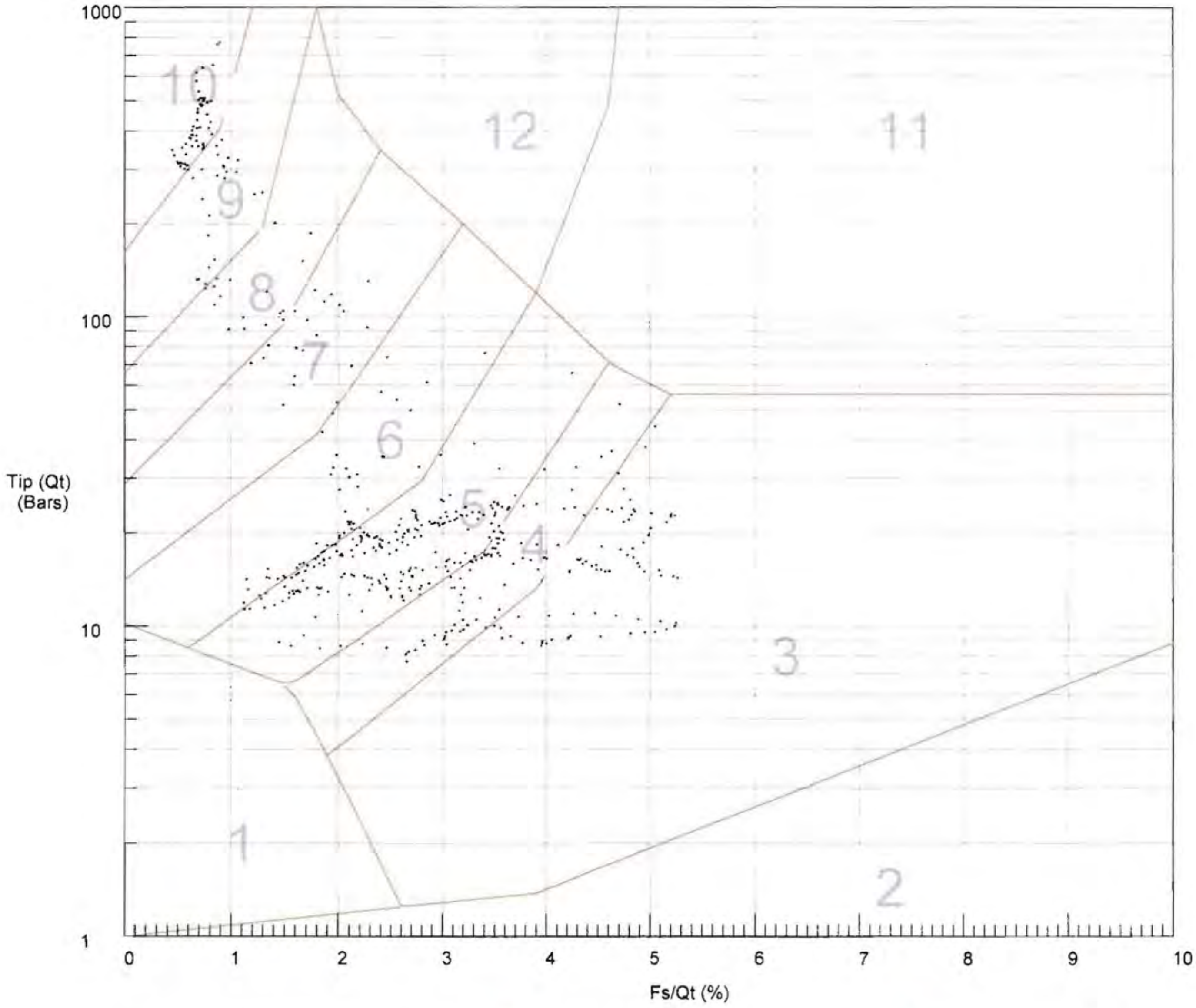
Figure C-40, 2 of 3

VBI In-Situ Testing

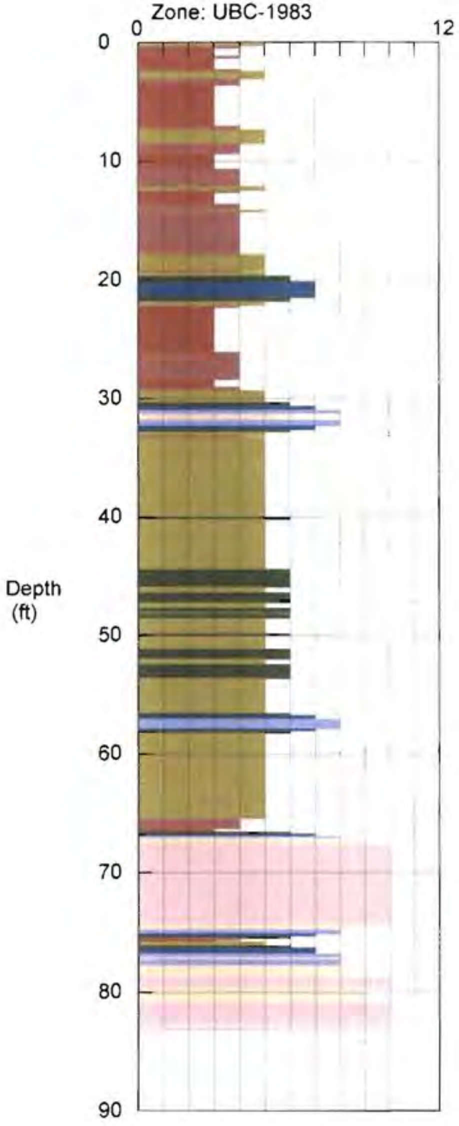
Operator: MIKE JONES
Sounding: 02W393
Cone Used: HO818TC-U2

CPT Date/Time: 11-01-02 08:44
Location: NC-13
Job Number: 28648790

Classification Data:
Robertson and Campanella UBC-1983



Soil Behavior Type*
Zone: UBC-1983



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

Appendix D

A laboratory testing program was carried out to determine the index and engineering properties of the major subsurface strata encountered at the site. The laboratory testing program included conventional tests to confirm the existing information on the engineering characteristics of the major strata and to refine some of the engineering parameters where it was deemed appropriate. These tests were performed at the Massachusetts Institute of Technology (MIT) Laboratories in Massachusetts, at the Signet Testing Laboratories in Hayward, California, a subsidiary of URS Corporation, and also at the URS Laboratory in San Jose, California.

This appendix briefly describes the testing program and procedures for the different types of tests, then presents detailed test results.

Index Tests

Index tests were performed on both cohesive and cohesionless soil samples to aid in soil classification and in correlation with other engineering parameters. Index tests included Atterberg Limits, gradation analyses, moisture content and density determinations. Atterberg Limits tests were performed in accordance with the ASTM D 4318 Standard. Gradation analyses were performed in accordance with the ASTM D 422 Standard. The moisture content tests were performed in accordance with the ASTM D 2216 Standard. Total and dry density tests were carried out following the procedure in the ASTM D 2937 Standard.

Table D-1 presents results of the index tests. Table D-2 presents results of the Atterberg Limits Tests. In addition, the measured moisture content, total densities, Liquid Limit, Plasticity Index, and percentages of gravel and fines are indicated on the Logs of Borings (Figures C-3 through C-23) adjacent to the appropriate sample depth.

A plasticity chart showing graphically the results of the Atterberg Limits tests is presented on Figures D-1 and D-2. Grain size distribution curves are presented graphically on Figures D-3 through D-16.

Unconfined Compression Tests

Unconfined compression tests were performed on select cohesive soil samples to assist in determining shear strength parameters. Table D-3 presents results of the unconfined compression tests. These tests were performed in accordance with ASTM D 2166 Standard. The results of these tests are also indicated on the Logs of Borings (Figures C-3 through C-23) adjacent to the appropriate sample depth.

Constant Rate of Strain Tests

Eleven (11) constant rate of strain tests (CRS) were performed on select undisturbed samples of alluvial clays to evaluate their compressibility characteristics and past geologic history.

CRS tests were performed following procedures outlined by ASTM D 4186. Table D-4 presents the results of the CRS tests.

The maximum past pressure values (σ'_p), were estimated using the Casagrande construction and the end-of-primary-consolidation compression curve. The overconsolidation ratio (*OCR*) was then computed from an estimated maximum past pressure (σ'_p) and the calculated in-situ vertical effective stress (σ'_{vo}) at the depth from which the sample was taken using the following expression:

$OCR = (\sigma'_p)/(\sigma'_{vo})$

The compression curves (vertical strain at the end of load increment versus the log effective stress and coefficient of vertical consolidation versus the log of effective stress) are presented in Figures D-17 through D-31.

The compressibility parameters, Compression Ratio (CR), Swelling Ratio (SR), and Recompression Ratio (RR) were also computed from the end-of-primary-consolidation compression curves and are also tabulated on Tables D-4. The compression ratio, CR, is the slope of the compression curve (when plotted versus log stress) in the virgin compression zone. The recompression ratio, RR, is the slope during the reloading portion of the test and the swelling ratio, SR, is the slope of the unloading portion of the compression curve.

Unconsolidated Undrained Compression Tests

Sixteen (16) Unconsolidated Undrained Triaxial Compression Tests (UUTXC) were performed on select undisturbed samples to evaluate their undrained shear strengths. The tests were performed in accordance with the procedures in the ASTM D 2850 Standard.

Results of the UUTXC tests are presented in Figures D-32 through D-47 and summarized on Table D-5.

K_o-Consolidated Undrained Direct Simple Shear Tests

Six (6) K_o-Consolidated Undrained Direct Simple Shear Tests (CK_oUDSS) were performed on undisturbed samples of stiff Fat Clay to evaluate their shear strength characteristics. Samples were consolidated at a constant rate of strain and results of these consolidation tests are presented in Figures D-52 through D-57. Compressibility parameters are also presented on Table D-4. Results of the Direct Simple Shear Test are presented in Figures D-48 through D-51 and the results are summarized on Table D-6.

Three of the six tests presented in Table D-6 were performed on nearly normally consolidated samples (OCR = 1.13 to 1.22), and the other three tests on overconsolidated samples (OCR = 2.22 to 4.60). A 3-inch tube sample of stiff Fat Clay was used to perform the CK_oUDSS tests. The tests were performed in accordance with the procedures in the ASTM D 6528 Standard.

TABLE D-1
SUMMARY OF INDEX TESTS

Boring	Depth (ft)	Material	Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit (%)	Plasticity Index (%)	Percent Fines (%)	Coefficient of Curvature (C_z)	Coefficient of Uniformity (C_u)	Effective Grain Size (in)
NB-01	1	Lean CLAY (CL)	22.5	123.0						
NB-01	5	Lean CLAY (CL)	15.8	128.6						
NB-01	10	Lean CLAY (CL)	24.7	124.4						
NB-01	15	Lean CLAY (CL)	29.5	122.0						
NB-01	20	Lean CLAY (CL)	26.5	123.4						
NB-01	25	Lean CLAY (CL)	23.5	126.5						
NB-01	30	Lean CLAY (CL)	24.3	125.6						
NB-01	35	Lean to fat CLAY (CL/CH)	31.6	121.1						
NB-01	40	Lean to fat CLAY (CL/CH)	34.5	117.2						
NB-01	45	Lean to fat CLAY (CL/CH)	29.9	121.1						
NB-01	50	Lean to fat CLAY (CL/CH)	23.9	127.2						
NB-01	55	Lean CLAY (CL)	23.7	126.7						
NB-01	60	Lean CLAY (CL)	26.5	123.8						
NB-01	75	Well-graded SAND (SW-SM) with silt and gravel	7.1	136.2			8	1.01	31.57	0.106
NB-01	90	Clayey SAND (SC) with gravel					13			0.030
NB-01	102	Lean CLAY (CL)	19.0	131.9						
NB-01	110	Lean CLAY (CL)	20.0	130.5						
NB-02	15	Fat CLAY (CH)	26.7	127.4						
NB-02	20	Lean CLAY (CL)	25.9	126.9						
NB-02	30	Silty SAND (SM)	20.3	120.4						
NB-02	30	Silty SAND (SM)	18.7	126.3			27			
NB-02	40	Lean to fat CLAY (CL/CH)	29.2	123.8	49	23				
NB-02	50	Lean to fat CLAY (CL/CH)	29.7	124.7						
NB-02	60	Lean to fat CLAY (CL/CH)	24.2	130.1						
NB-02	70	Well-graded SAND (SW) with gravel	7.9				8	1.16	39.90	0.119

TABLE D-1
SUMMARY OF INDEX TESTS

Boring	Depth (ft)	Material	Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit (%)	Plasticity Index (%)	Percent Fines (%)	Coefficient of Curvature (C_z)	Coefficient of Uniformity (C_u)	Effective Grain Size (in)
NB-03	15	Sandy lean CLAY (CL) with gravel	22.8	112.8						
NB-03	20	Sandy SILT (ML) with gravel	23.0	109.5			82			
NB-03	30	Sandy lean CLAY (CL)	26.8	125.6						
NB-03	35	Sandy lean CLAY (CL)	20.8	131.3						
NB-03	40	Sandy, silty CLAY (CL-ML)	27.0	125.1			58			
NB-03	45	Sandy, silty CLAY (CL-ML)	29.3				65			
NB-03	55	Fat CLAY (CH)	34.5	121.8	62	34				
NB-03	65	Fat CLAY (CH)	32.5	120.6						
NB-03	70	Clayey SAND (SC) with gravel	8.3	144.1			14			
NB-03A	72	Well-graded SAND (SW-SC) with clay and gravel	7.8				7	1.89	24.26	0.150
NB-03A	93	Poorly graded SAND (SP-SC) with clay and gravel	9.9				9	4.10	55.50	0.095
NB-04	5	Lean CLAY (CL)	21.8	123.5						
NB-04	10	Lean CLAY (CL)	36.8	115.6						
NB-04	15	Lean CLAY (CL)	21.9	127.2						
NB-04	20	Lean CLAY (CL)	24.8	124.5						
NB-04	25	Lean CLAY (CL)	26.0	122.8						
NB-04	30	Lean CLAY (CL)	28.3	124.3						
NB-04	35	Lean to fat CLAY (CL/CH)	39.0	113.6						
NB-04	40	Lean to fat CLAY (CL/CH)	23.2	127.6						
NB-04	45	Lean CLAY (CL)	23.9	124.3						
NB-04	55	Lean CLAY (CL)	23.9	124.7						
NB-04	65	Silty SAND (SM)					20			
NB-04	90	Well-graded SAND (SW-SC) with clay and gravel	9.7				10	2.46	60.62	0.075
NB-04	105	Lean CLAY (CL)	20.7	128.1						

TABLE D-1
SUMMARY OF INDEX TESTS

Boring	Depth (ft)	Material	Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit (%)	Plasticity Index (%)	Percent Fines (%)	Coefficient of Curvature (C_z)	Coefficient of Uniformity (C_u)	Effective Grain Size (in)
NB-04	105	Lean CLAY (CL)	21.9	126.6						
NB-04	115	Clayey SAND (SC) with gravel	9.3	139.7			15			
NB-05	2	Clayey SAND (SC) FILL	11.2							
NB-05	10	Lean CLAY (CL)	33.1	116.3						
NB-05	20	Lean CLAY (CL)	22.1	128.2						
NB-05	30	Lean CLAY (CL)	26.4	125.4						
NB-05	40	Lean CLAY (CL)	28.7	122.0						
NB-05	50	Poorly graded SAND (SP-SM) with silt and gravel	22.2							
NB-05	50	Poorly graded SAND (SP-SM) with silt and gravel	15.1				8	0.91	12.78	0.099
NB-05	60	Lean CLAY (CL)	26.0	125.6						
NB-05	70	Silty SAND (SM)	19.9	131.0			48			
NB-05	80	Lean CLAY (CL)	19.8	130.4						
NB-05	90	Lean CLAY (CL)	23.9	133.4						
NB-05	100	Sandy lean CLAY (CL)	21.4	129.9						
NB-05	110	Clayey SAND (SC)	21.1	130.2			42			0.001
NB-05	120	Lean CLAY (CL) with gravel	23.3	133.5						
NB-06	10	Lean CLAY (CL)	25.3	123.2						
NB-06	15	Lean CLAY (CL)	24.3	124.0						
NB-06	20	Lean CLAY (CL)	21.7	126.6						
NB-06	25	Lean CLAY (CL)	26.3	121.7						
NB-06	30	Lean CLAY (CL)	27.7	121.2						
NB-06	35	Sandy SILT (ML)	15.9	121.8						
NB-06	35	Sandy SILT (ML)	23.3	123.7						
NB-06	40	Sandy SILT (ML)	22.9	125.0			72			
NB-06	45	Sandy SILT (ML)	20.0	122.8			58			
NB-06	45	Sandy SILT (ML)	21.0	127.3						
NB-06	50	Sandy SILT (ML)	18.8	123.0			70			
NB-06	50	Sandy SILT (ML)	20.3	127.7						
NB-06	55	Silty CLAY (CL-ML)	20.8	130.4						

TABLE D-1
SUMMARY OF INDEX TESTS

Boring	Depth (ft)	Material	Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit (%)	Plasticity Index (%)	Percent Fines (%)	Coefficient of Curvature (C_z)	Coefficient of Uniformity (C_u)	Effective Grain Size (in)
NB-06	60	Silty CLAY (CL-ML)	23.0	127.1						
NB-06	65	Lean CLAY (CL)	20.7	128.5						
NB-06	70	Silty SAND (SM) with gravel	10.2	131.5			13			
NB-06	80	Silty CLAY (CL-ML)	21.6	128.7						
NB-06	85	Silty CLAY (CL-ML)	20.0	129.9						
NB-06	90	Poorly graded SAND (SP)	11.9				4	1.27	3.79	0.110
NB-06	100	Silty SAND (SM) with gravel	9.3	140.2			13			0.030
NB-06	105	Silty CLAY (CL-ML)	22.0	125.6						
NB-06	120	Silty SAND (SM)	19.5	120.9			27			
NB-07	15	Lean CLAY (CL)	20.0	131.6	26	11				
NB-07	40	Lean CLAY (CL)	26.5	123.1						
NB-07	53	Lean CLAY (CL)	26.2	124.9						
NB-07	63	Fat CLAY (CH)	23.0	129.4	32	14				
NB-07	73	Well-graded GRAVEL (GW-GC) with clay	12.6				28			
NB-07	93	Sandy SILT (ML)	21.7	125.6			65			
NB-07	115	Silty, clayey SAND (SC-SM)	20.3	133.3			48			
NB-08	15	Lean CLAY (CL)	32.2	117.5						
NB-08	20	Lean CLAY (CL)	31.3	122.0						
NB-08	25	Lean CLAY (CL)	35.3	121.3	51	28				
NB-08	35	Silty SAND (SM)	21.2	126.6			34			
NB-08	50	Silty, clayey SAND (SC-SM)	25.7	127.5						
NB-08	60	Lean CLAY (CL)	23.7	125.9						
NB-08	65	Lean CLAY (CL)	24.6	129.3						
NB-08	70	Lean CLAY (CL)	21.8	130.2						
NB-12	15	Fat CLAY (CH)	28.9	126.0	54	28				
NB-12	25	Fat CLAY (CH)	28.3	126.1						
NB-12	35	Lean CLAY (CL) with sand	20.1	136.2						
NB-12	45	Lean CLAY (CL) with	22.9	127.8						

TABLE D-1
SUMMARY OF INDEX TESTS

Boring	Depth (ft)	Material	Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit (%)	Plasticity Index (%)	Percent Fines (%)	Coefficient of Curvature (C_z)	Coefficient of Uniformity (C_u)	Effective Grain Size (in)
		sand								
NB-12	50	Silty, clayey SAND (SC-SM) with gravel	9.7	149.0			16			
NB-12	55	Lean CLAY (CL)	20.8	131.1						
NB-12	75	Lean CLAY (CL)	21.5	129.9						
NB-13	20	Lean CLAY (CL)	18.7	133.7						
NB-13	30	Lean to fat CLAY (CL/CH)	34.8	133.7						
NB-13	50	Lean CLAY (CL)	23.1	127.7	35	16				
NB-13	65	Lean CLAY (CL)	21.6	128.4						
NB-13	75	Lean to fat CLAY (CL/CH)	27.3	125.8						
NB-13	85	Lean to fat CLAY (CL/CH)	30.4	125.6	55	28				
NB-14	5	Sandy lean CLAY (CL)	16.0	133.9						
NB-14	10	Sandy lean CLAY (CL)	25.9	124.5						
NB-14	15	Lean to fat CLAY (CL/CH)	26.7	124.2	52	27				
NB-14	20	SILT (ML)					90			
NB-14	40	Lean to fat CLAY (CL/CH)	32.1	127.6	57	30				
NB-14	55	Lean CLAY (CL)	21.5	128.8						
NB-14	70	Poorly graded SAND (SP-SC) with clay and gravel	3.6				8	0.91	46.29	0.119
NB-15	5	Fat CLAY (CH)	21.2	121.9						
NB-15	10	Lean CLAY (CL)	33.9	117.6						
NB-15	30	Lean CLAY (CL)	35.0	117.0						
NB-15	30	Lean CLAY (CL)	35.2	118.1						
NB-15	30	Lean CLAY (CL)	37.3	116.2						
NB-15	35	Fat CLAY (CH)	37.3	115.2						
NB-16	20	Fat CLAY (CH)	18.8	131.4	21	6				
NB-16	48	Lean to fat CLAY (CL/CH)	24.4	123.9						
NB-16	48	Lean to fat CLAY	21.7	128.4						

TABLE D-1
SUMMARY OF INDEX TESTS

Boring	Depth (ft)	Material	Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit (%)	Plasticity Index (%)	Percent Fines (%)	Coefficient of Curvature (C_z)	Coefficient of Uniformity (C_u)	Effective Grain Size (in)
		(CL/CH)								
NB-16	53	Well-graded SAND (SW-SC) with clay and gravel	12.4	133.0			10	1.24	24.98	0.075
NB-16	58	Well-graded SAND (SW-SC) with clay and gravel	27.7				57			
NB-17	30	Well-graded GRAVEL (GW-GM) with silt and sand					6	1.30	49.43	0.122
NB-17	58	Sandy SILT (ML)	25.0	125.0						
NB-17	58	Sandy SILT (ML)	20.3	124.9			57			0.001
NB-17	65	Silty SAND (SM)	28.7	124.6			42			
NB-17	80	Poorly graded GRAVEL (GP) with sand	10.2	145.6						
NB-18	8	Sandy SILT (ML)	13.4	110.3			57			
NB-18	18	Fat CLAY (CH)	36.6	112.5						
NB-18	23	Fat CLAY (CH)	30.4	114.1						
NB-18	23	Fat CLAY (CH)	30.9	111.8						
NB-18	28	Well-graded GRAVEL (GW) with sand	11.8	136.5						
NB-18	33	Poorly graded GRAVEL (GP-GM) with silt and sand					8	0.76	70.23	0.117
NB-18	38	Poorly graded GRAVEL (GP)					2	1.40	3.08	4.750
NB-18	50	Sandy SILT (ML)					56			
NB-18	50	Sandy SILT (ML)	26.4	122.1			63			
NB-18	50	Sandy SILT (ML)	25.0		32	13				
NB-18	85	Well-graded GRAVEL (GW) with sand					3	2.18	6.83	1.131
NB-19	5	SILT (ML) FILL								
NB-19	10	Silty SAND (SM) with gravel	17.7	125.6			41			
NB-19	31	Well-graded SAND (SW) with gravel	9.9	145.9			4	1.09	33.04	0.196
NB-19	47	Fat CLAY (CH)	23.2	125.9						

TABLE D-1
SUMMARY OF INDEX TESTS

Boring	Depth (ft)	Material	Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit (%)	Plasticity Index (%)	Percent Fines (%)	Coefficient of Curvature (C_z)	Coefficient of Uniformity (C_u)	Effective Grain Size (in)
NB-19	57	Fat CLAY (CH)	31.6	120.2						
NB-19	57	Fat CLAY (CH)	23.0	127.9						
NB-19	67	Fat CLAY (CH)	20.8	129.8						
NB-19	67	Fat CLAY (CH)	22.0	128.2						
NB-19	72	Silty SAND (SM) with gravel	20.2	132.0			27			
NB-19	77	Well-graded GRAVEL (GW) with sand	11.8	135.6						
NB-20	3	Silty, clayey SAND (SC-SM)	13.3	97.8						
NB-20	8	Silty SAND (SM)	6.4	107.8			24			
NB-20	13	Well-graded SAND (SW)	8.4	125.5			3	0.96	6.49	0.281
NB-20	17	Fat CLAY (CH)	40.6	114.1	52	24				
NB-20	17	Fat CLAY (CH)	41.6	112.5						
NB-20	21	Fat CLAY (CH)	34.6	117.2						
NB-20	29	Fat CLAY (CH)	30.6	119.5						
NB-20	34	Poorly graded SAND (SP-SM) with silt	26.9	124.5			44			
NB-20	38	Fat CLAY (CH)	27.0	124.5						
NB-20	42	Fat CLAY (CH)	35.9	115.4						
NB-20	52	Silty SAND (SM)	27.4	120.5			14			
NB-20	57	Fat CLAY (CH)	31.5	119.4	43	19				
NB-20	57	Fat CLAY (CH)	28.0	123.7						
NB-20	57	Fat CLAY (CH)	31.6	120.7						
NB-20	57	Fat CLAY (CH)	31.3	120.6						
NB-20	65	Silty CLAY (CL-ML)	23.1	129.4						
NB-21	25	Lean CLAY (CL) with sand	23.2	126.7						
NB-21	30	Lean to fat CLAY (CL/CH)	38.2	115.0						
NB-21	35	Well-graded GRAVEL (GW-GC) with clay and sand	10.2				8	0.94	53.08	0.119
NB-21	75	Lean CLAY (CL)	22.0	127.7						
NB-21	90	Lean CLAY (CL) w/sand	21.9	127.2						

TABLE D-1
SUMMARY OF INDEX TESTS

Boring	Depth (ft)	Material	Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit (%)	Plasticity Index (%)	Percent Fines (%)	Coefficient of Curvature (C_z)	Coefficient of Uniformity (C_u)	Effective Grain Size (in)
NB-24	10	Fat CLAY (CH)	29.2	118.9						
NB-24	20	Fat CLAY (CH)	36.0	113.1	57	31				
NB-24	25	Silty, clayey SAND (SC-SM	20.2				15			
NB-24	40	Well-graded GRAVEL (GW-GC) with clay and sand	9.4	140.4			7	2.15	38.28	0.178
NB-24	45	Sandy Lean CLAY (CL)	19.2	129.7	25	8				
NB-24	60	Lean CLAY (CL)	17.1	133.3						
NB-24	75	Lean CLAY (CL) with sand	22.9	128.1						
NB-24	80	Well-graded SAND (SW-SC) with clay and gravel	10.6				8	1.22	38.08	0.119

TABLE D-2
SUMMARY OF ATTERBERG LIMITS TESTS

Boring	Depth (ft)	Material	Liquid Limit (%)	Plasticity Limit (%)	Plasticity Index (%)
NB-02	40	Lean to fat CLAY (CL/CH)	49	26	23
NB-03	55	Fat CLAY (CH)	62	28	34
NB-07	15	Lean CLAY (CL)	26	15	11
NB-07	63	Fat CLAY (CH)	32	18	14
NB-08	25	Lean CLAY (CL)	51	24	27
NB-12	15	Fat CLAY (CH)	54	27	27
NB-13	50	Lean CLAY (CL)	35	19	16
NB-13	85	Lean to fat CLAY (CL/CH)	55	27	28
NB-14	15	Lean to fat CLAY (CL/CH)	52	25	27
NB-14	40	Lean to fat CLAY (CL/CH)	57	27	30
NB-16	20	Fat CLAY (CH)	21	15	6
NB-18	50	Sandy SILT (ML)	32	19	13
NB-20	17	Fat CLAY (CH)	52	28	24
NB-20	57	Fat CLAY (CH)	43	24	19
NB-24	20	Fat CLAY (CH)	57	26	31
NB-24	45	Lean CLAY (CL)	25	17	8

TABLE D-3
SUMMARY OF UNCONFINED COMPRESSION TESTS

Boring	Depth (ft)	Material	Unconfined Compressive Strength (psf)
NB-01	1	Lean CLAY (CL)	2270
NB-01	5	Lean CLAY (CL)	4390
NB-01	10	Lean CLAY (CL)	2100
NB-01	15	Lean CLAY (CL)	2340
NB-01	20	Lean CLAY (CL)	2630
NB-01	25	Lean CLAY (CL)	860
NB-01	30	Lean CLAY (CL)	4360
NB-01	35	Lean to fat CLAY (CL/CH)	1510
NB-01	40	Lean to fat CLAY (CL/CH)	3020
NB-01	45	Lean to fat CLAY (CL/CH)	2040
NB-01	50	Lean to fat CLAY (CL/CH)	3920
NB-01	55	Lean CLAY (CL)	3700
NB-01	60	Lean CLAY (CL)	2310
NB-01	95	Lean CLAY (CL)	
NB-01	102	Lean CLAY (CL)	4700
NB-01	110	Lean CLAY (CL)	3730
NB-02	15	Fat CLAY (CH)	2950
NB-02	20	Lean CLAY (CL)	1420
NB-02	40	Lean to fat CLAY (CL/CH)	4670
NB-02	50	Lean to fat CLAY (CL/CH)	3940
NB-02	60	Lean to fat CLAY (CL/CH)	6920
NB-03	30	Sandy lean CLAY (CL)	1850
NB-03	35	Sandy lean CLAY (CL)	4910
NB-03	55	Fat CLAY (CH)	3430
NB-03	65	Fat CLAY (CH)	4630
NB-04	5	Lean CLAY (CL)	2110
NB-04	10	Lean CLAY (CL)	1490
NB-04	15	Lean CLAY (CL)	2760
NB-04	20	Lean CLAY (CL)	1710
NB-04	25	Lean CLAY (CL)	960
NB-04	30	Lean CLAY (CL)	640
NB-04	35	Lean to fat CLAY (CL/CH)	2370
NB-04	40	Lean to fat CLAY (CL/CH)	2500
NB-04	45	Lean CLAY (CL)	2590
NB-04	55	Lean CLAY (CL)	2100
NB-04	105	Lean CLAY (CL)	4120
NB-04	110	Lean CLAY (CL)	2450

TABLE D-3
SUMMARY OF UNCONFINED COMPRESSION TESTS

Boring	Depth (ft)	Material	Unconfined Compressive Strength (psf)
NB-05	10	Lean CLAY (CL)	910
NB-05	20	Lean CLAY (CL)	2180
NB-05	30	Lean CLAY (CL)	1280
NB-05	40	Lean CLAY (CL)	3300
NB-05	60	Lean CLAY (CL)	1350
NB-05	70	Silty SAND (SM)	1700
NB-05	80	Lean CLAY (CL)	3630
NB-05	100	Lean CLAY (CL)	3290
NB-05	110	Clayey SAND (SC)	1170
NB-05	120	Lean CLAY (CL) with gravel	2170
NB-06	10	Lean CLAY (CL)	2030
NB-06	15	Lean CLAY (CL)	800
NB-06	20	Lean CLAY (CL)	1460
NB-06	25	Lean CLAY (CL)	2140
NB-06	30	Lean CLAY (CL)	1660
NB-06	35	Sandy SILT (ML)	1460
NB-06	40	Sandy SILT (ML)	1600
NB-06	45	Sandy SILT (ML)	990
NB-06	50	Sandy SILT (ML)	1810
NB-06	55	Silty CLAY (CL-ML)	2180
NB-06	60	Silty CLAY (CL-ML)	2040
NB-06	65	Lean CLAY (CL)	3300
NB-06	80	Silty CLAY (CL-ML)	3590
NB-06	85	Silty CLAY (CL-ML)	4710
NB-06	105	Silty CLAY (CL-ML)	3420
NB-08	20	Lean CLAY (CL)	2850
NB-08	25	Lean CLAY (CL)	2150
NB-08	50	Silty, clayey SAND (SC-SM)	3120
NB-08	60	Lean CLAY (CL)	1410
NB-08	65	Lean CLAY (CL)	1600
NB-08	70	Lean CLAY (CL)	2750
NB-12	15	Fat CLAY (CH)	4320
NB-12	26	Fat CLAY (CH)	2040
NB-12	35	Lean CLAY (CL) with sand	1180
NB-12	45	Lean CLAY (CL) with sand	1590
NB-12	55	Lean CLAY (CL)	4240
NB-12	75	Lean CLAY (CL)	6390
NB-14	5	Sandy lean CLAY (CL)	7570
NB-14	10	Sandy lean CLAY (CL)	2370
NB-14	15	Lean to fat CLAY (CL/CH)	5240
NB-14	40	Lean to fat CLAY	2930

TABLE D-3
SUMMARY OF UNCONFINED COMPRESSION TESTS

Boring	Depth (ft)	Material	Unconfined Compressive Strength (psf)
		(CL/CH)	
NB-14	55	Lean CLAY (CL)	5920
NB-15	5	Fat CLAY (CH)	5940
NB-21	25	Fat CLAY (CH)	2200
NB-21	30	Lean to fat CLAY (CL/CH)	3160
NB-21	75	Lean CLAY (CL) with sand	2360
NB-21	90	Lean CLAY (CL) with sand	3850
NB-24	10	Fat CLAY (CH)	3110
NB-24	20	Fat CLAY (CH)	1990
NB-24	45	Sandy Lean CLAY (CL)	670
NB-24	60	Lean CLAY (CL)	2840
NB-24	75	Lean CLAY (CL) with sand	3490

TABLE D-4
SUMMARY OF CONSTANT RATE OF STRAIN AND DIRECT SIMPLE SHEAR CONSOLIDATION TESTS

Boring	Depth (ft)	Test Number	Soil Unit	Initial Moisture Content (%)	Initial Total Unit Weight (pcf)	Liquid Limit (%)	Plastic Limit (%)	PI (%)	In-Situ Effective Vertical Stress (psf)	Maximum Past Pressure (psf)	OCR	CR	RR	SR
NB-15	10	CRS 539	Alluvial clays, silts & sandy clay	33.88	117.6	-	-	-	1200	5565	4.64	0.148	0.026	0.019
	30	CRS 535	Alluvial clays, silts & sandy clay	34.95	117.0	53	26	27	2536	5530	2.18	0.169	0.032	0.036
	30	DSS 607	Alluvial clays, silts & sandy clay	35.24	118.1	53	26	27	2536	4301	1.70	0.169	0.034	-
	30	DSS 611	Alluvial clays, silts & sandy clay	37.32	116.2	53	26	27	2536	4710	1.86	0.162	0.047	-
	35	CRS 541	Alluvial clays, silts & sandy clay	37.32	115.2	-	-	-	2857	5632	1.97	0.161	0.030	0.017
NB-16	20	CRS 519	Alluvial clays, silts & sandy clay	18.84	131.4	21	15	6	2001	9012	4.50	0.087	0.017	0.007
	48	CRS 523	Alluvial clays, silts & sandy clay	21.70	128.4	-	-	-	3499	11469	3.28	0.108	0.020	0.012
NB-18	18	CRS 547	Alluvial clays, silts & sandy clay	36.64	112.5	-	-	-	2160	5734	2.65	0.175	0.025	-
	23	CRS 549	Alluvial clays, silts & sandy clay	30.38	114.1	31	18	13	3000	3379	1.13	0.148	0.057	0.025
	23	DSS 612	Alluvial clays, silts & sandy clay	30.92	111.8	31	18	13	3000	3482	1.16	0.176	0.039	-
	23	DSS 613	Alluvial clays, silts & sandy clay	-	-	31	18	13	3000	3584	1.19	0.180	0.043	-
NB-19	47	CRS 526	Alluvial clays, silts & sandy clay	23.20	125.9	-	-	-	4254	9010	2.12	0.100	0.035	0.008
	57	CRS 518	Alluvial clays, silts & sandy clay	23.04	127.9	-	-	-	4824	12903	2.67	0.094	0.024	0.005
	67	CRS 520	Alluvial clays, silts & sandy clay	20.77	129.8	-	-	-	5394	10035	1.86	0.107	0.030	0.009
NB-20	17	CRS 521	Alluvial clays, silts & sandy clay	40.59	114.1	52	28	24	2160	2867	1.33	0.158	0.049	0.019
	21	CRS 543	Alluvial clays, silts & sandy clay	34.64	117.2	-	-	-	2520	9032	3.58	0.141	0.058	0.020

TABLE D-4

SUMMARY OF CONSTANT RATE OF STRAIN AND DIRECT SIMPLE SHEAR CONSOLIDATION TESTS

Boring	Depth (ft)	Test Number	Soil Unit	Initial Moisture Content (%)	Initial Total Unit Weight (pcf)	Liquid Limit (%)	Plastic Limit (%)	PI (%)	In-Situ Effective Vertical Stress (psf)	Maximum Past Pressure (psf)	OCR	CR	RR	SR
NB-20	29	CRS 538	Alluvial clays, silts & sandy clay	30.56	119.5	-	-	-	3358	6554	1.95	0.122	0.044	0.008
	42	CRS 527	Alluvial clays, silts & sandy clay	35.94	115.4	-	-	-	4125	7535	1.83	0.170	0.050	0.039
	57	CRS 524	Alluvial clays, silts & sandy clay	31.49	119.4	43	24	19	5010	9845	1.97	0.118	0.033	0.008
	57	DSS 604	Alluvial clays, silts & sandy clay	31.62	120.7	43	24	19	5067	9626	1.90	0.136	0.030	-
	57	DSS 605	Alluvial clays, silts & sandy clay	31.29	120.6	43	24	19	5067	9831	1.94	0.138	0.029	-

Notes: (1) PI Plasticity Index - (2) CR Compression Ratio - (3) SR Swelling Ratio - (4) RR Recompression Ratio - (5) OCR Over Consolidation Ratio

TABLE D-5
SUMMARY OF ISOTROPICALLY UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TESTS

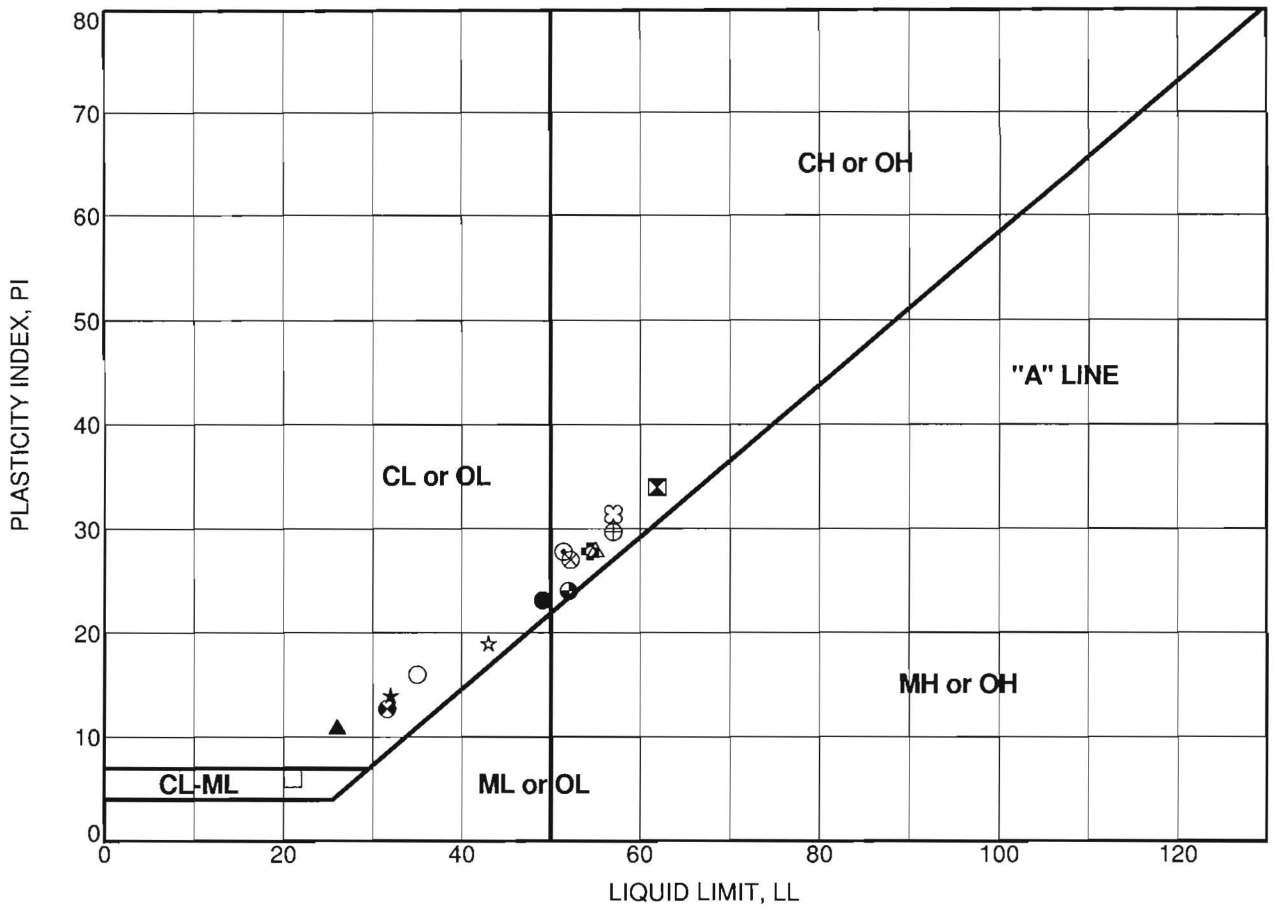
Boring	Depth (ft)	Soil Unit	Moisture Content (%)	Total Unit Weight (pcf)	Confining Pressure (psf)	Shear Strength (psf)
NB-07	15	Alluvial clays, silts, and sandy silts	20.0	131.6	4,000	833
NB-07	40	Alluvial clays, silts, and sandy silts	26.5	123.1	9,500	654
NB-07	53	Alluvial clays, silts, and sandy silts	26.2	124.9	13,000	2,323
NB-07	63	Alluvial clays, silts, and sandy silts	23.0	129.4	15,000	2,251
NB-13	20	Alluvial clays, silts, and sandy silts	18.7	133.7	5,000	1,282
NB-13	30	Alluvial clays, silts, and sandy silts	34.8	118.0	7,500	925
NB-13	50	Alluvial clays, silts, and sandy silts	23.1	127.7	12,000	1,524
NB-13	65	Alluvial clays, silts, and sandy silts	21.6	128.4	16,000	2,126
NB-13	75	Alluvial clays, silts, and sandy silts	27.3	125.8	18,000	1,822
NB-13	85	Alluvial clays, silts, and sandy silts	30.4	125.6	20,500	3,383
NB-16	48	Alluvial clays, silts, and sandy silts	24.4	123.9	11,500	1,780
NB-19	57	Alluvial clays, silts, and sandy silts	31.6	120.2	14,000	1,486
NB-19	67	Alluvial clays, silts, and sandy silts	22.0	128.2	16,000	2,673
NB-20	17	Alluvial clays, silts, and sandy silts	41.6	112.5	2,200	692
NB-20	57	Alluvial clays, silts, and sandy silts	28.0	123.7	14,000	2,276
NB-20	65	Alluvial clays, silts, and sandy silts	23.1	129.4	16,000	2,319

TABLE D-6
SUMMARY OF DIRECT SIMPLE SHEAR TESTS

Boring	Sample No.	Depth (ft)	Test Number	Soil Unit	Initial Moisture Content (%)	Initial Total Unit Weight (pcf)	Liquid Limit (%)	Plastic Limit (%)	Liquidity Index (%)	σ'_{vc} (tsf)	OCR	S_u/σ'_{vc}
NB-15	S-7	30	DSS 607	Alluvial clays, silts & sandy clay	35.24	118.1	53	26	0.34	9.22	1.22	0.1964
			DSS 611	Alluvial clays, silts & sandy clay	37.32	116.2	53	26	0.42	1.56	4.60	0.7317
NB-18	S-5	23	DSS 612	Alluvial clays, silts & sandy clay	30.92	111.8	31	18	0.99	5.35	1.13	0.2383
			DSS 613	Alluvial clays, silts & sandy clay	-	-	31	18	-	2.68	2.22	0.4367
NB-20	S-13	57	DSS 604	Alluvial clays, silts & sandy clay	31.62	120.7	43	24	0.40	16.36	1.16	0.2457
			DSS 605	Alluvial clays, silts & sandy clay	31.29	120.6	43	24	0.38	8.19	2.38	0.4263

Notes: (1) OCR Over Consolidation Ratio

ATTERBERG LIMITS TESTS

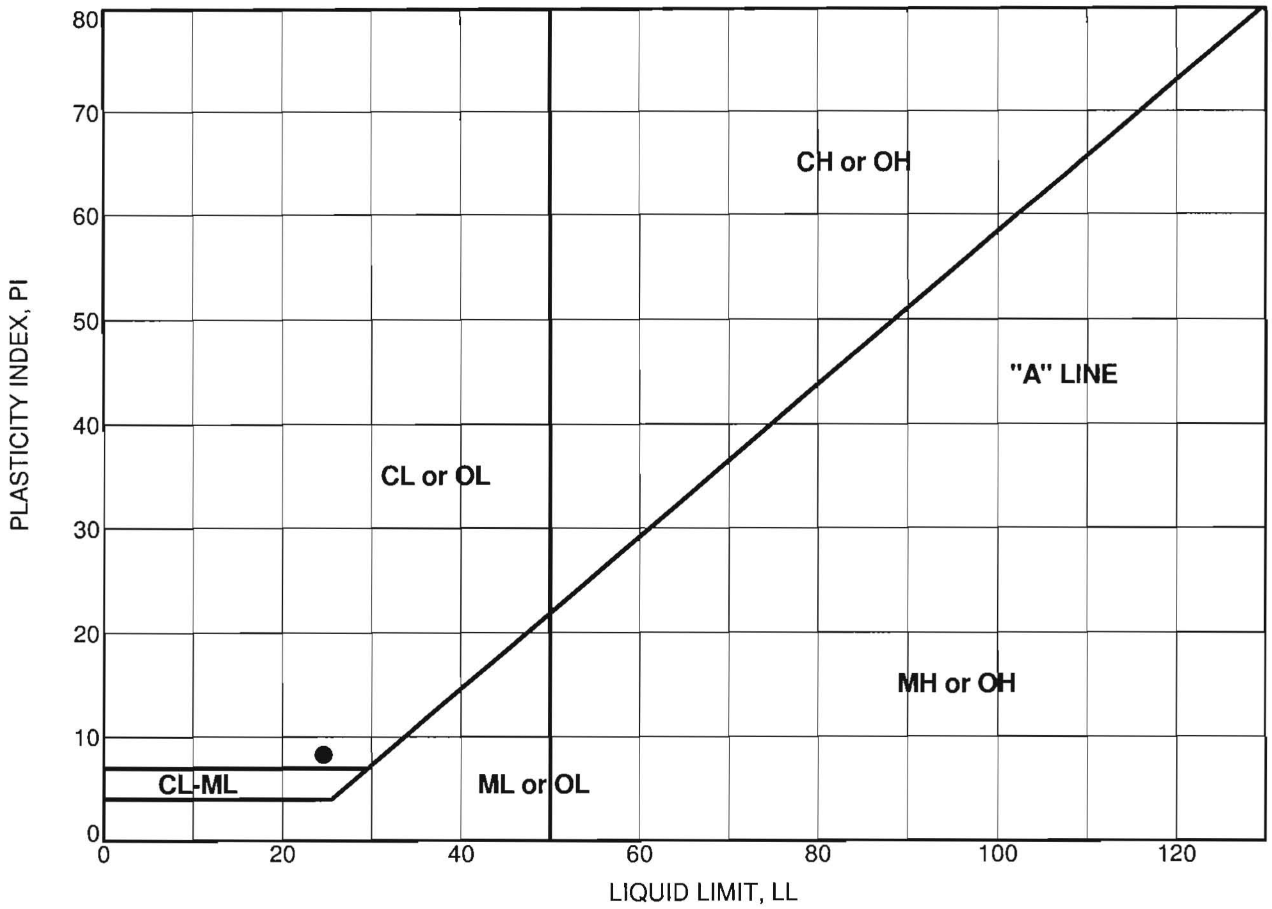


Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
NB-02	8	41	●	29	49	26	23	Lean to fat CLAY (CL/CH)
NB-03	11	56	⧗	34	62	28	34	Fat CLAY (CH)
NB-07	3	16	▲		26	15	11	Sandy lean CLAY (CL)
NB-07	12	64	★		32	18	14	Lean CLAY (CL)
NB-08	5	26	⊙	35	51	24	27	Lean to fat CLAY (CL/CH)
NB-12	11	16	✪	29	54	27	27	Fat CLAY (CH)
NB-13	11	51	○	23	35	19	16	Lean CLAY (CL)
NB-13	18	86	△		55	27	28	Fat CLAY (CH)
NB-14	4	16	⊗	27	52	25	27	Fat CLAY (CH)
NB-14	10	41	⊕	32	57	27	30	Fat CLAY (CH)
NB-16	1	21	□		21	15	6	Silty, clayey SAND (SC-SM)
NB-18	11	51	◍	25	32	19	13	Sandy lean CLAY (CL)
NB-20	4	18	◔		52	28	24	Fat CLAY (CH)
NB-20	13	58	☆	28	43	24	19	Lean CLAY (CL)
NB-24	4	20	✤	36	57	26	31	Fat CLAY (CH)

Project: SV RAPID TRANSIT CORRIDOR
Project Number: 28649330.02520

PLASTICITY CHART

Figure D-1



Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
NB-24	9	45	●	19	25	16	9	Sandy lean CLAY (CL)

Project: SV RAPID TRANSIT CORRIDOR
Project Number: 28649330.02520

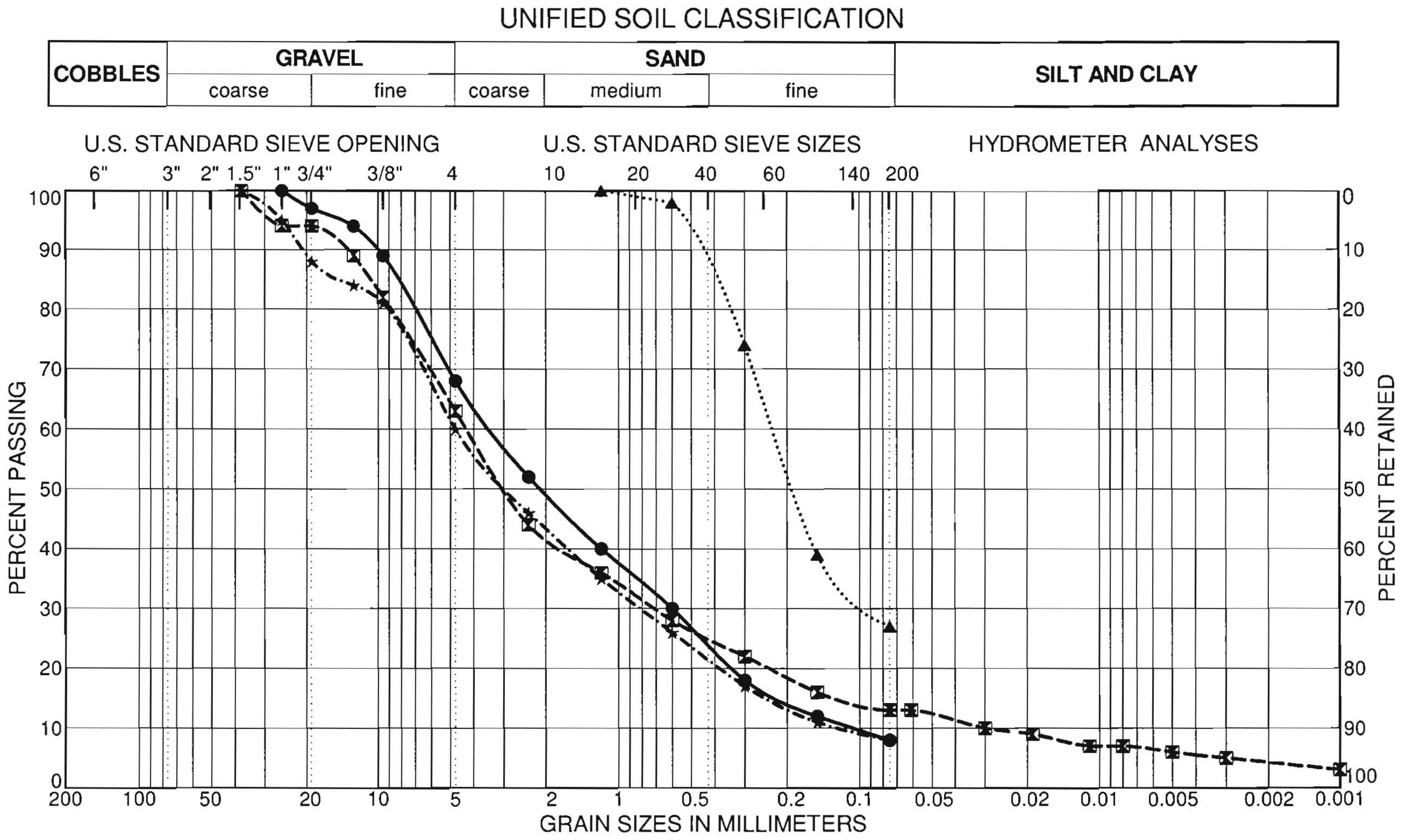
PLASTICITY CHART

Figure D-2

GRADATION ANALYSES

Project : SV RAPID TRANSIT CORRIDOR
Project No. 28649330.02520

1/14/04 JSIEVE 8790E.GPJ



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-01	16	76	●			Well-graded SAND (SW-SM) with silt and gravel
NB-01	18	91	☒			Clayey SAND (SC) with gravel
NB-02	6	31	▲			Silty SAND (SM)
NB-02	14	71	★			Well-graded SAND (SW-SM) with silt and gravel

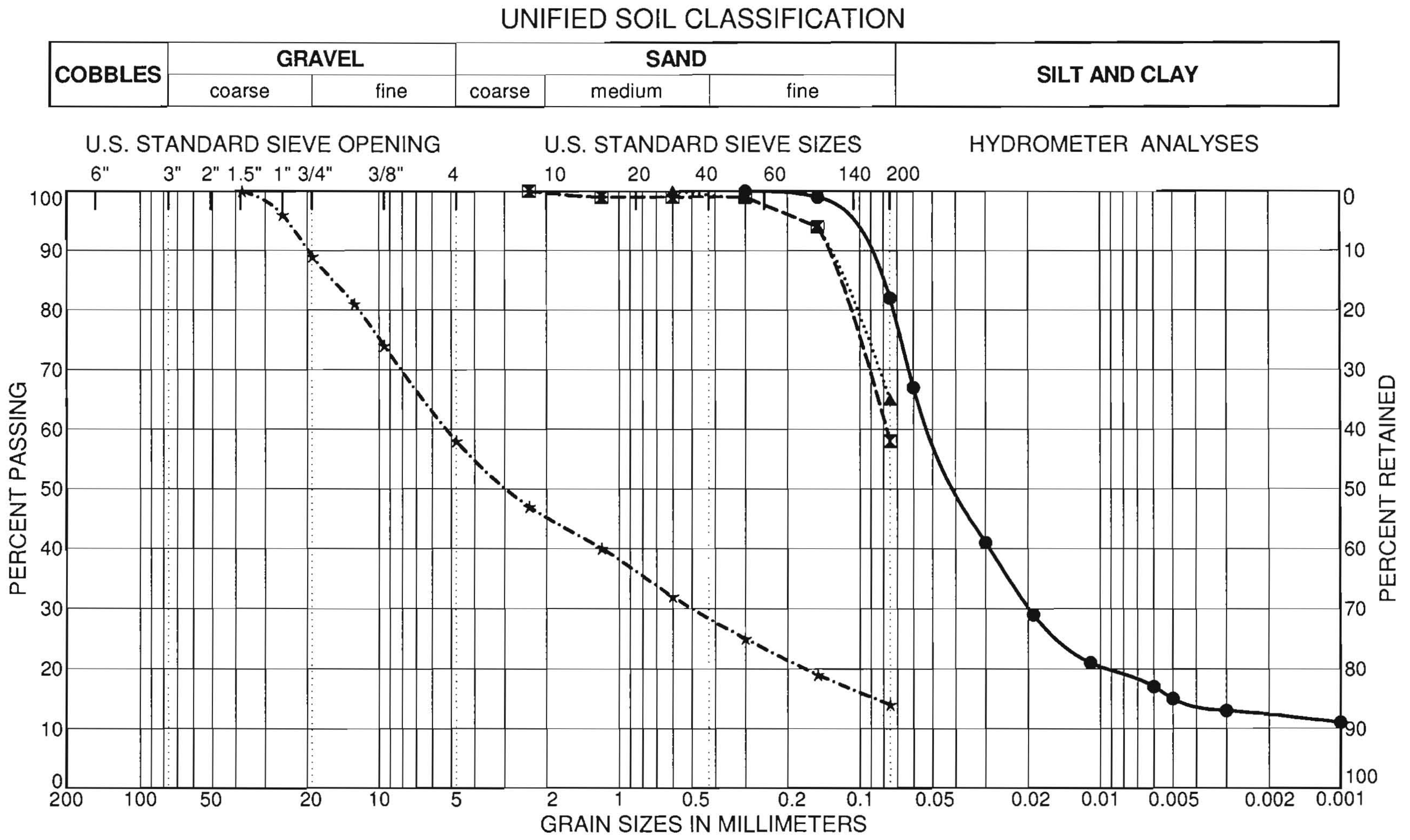
GRAIN SIZE DISTRIBUTION CURVES

Fig. D-3

URS

Project : SV RAPID TRANSIT CORRIDOR
Project No. 28649330.02520

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-03	4	21	●			SILT (ML) with sand
NB-03	8	41	☒			Sandy, silty CLAY (CL-ML)
NB-03	9	46	▲			Sandy, silty CLAY (CL-ML)
NB-03	14	71	★			Clayey SAND (SC) with gravel

Fig. D-4

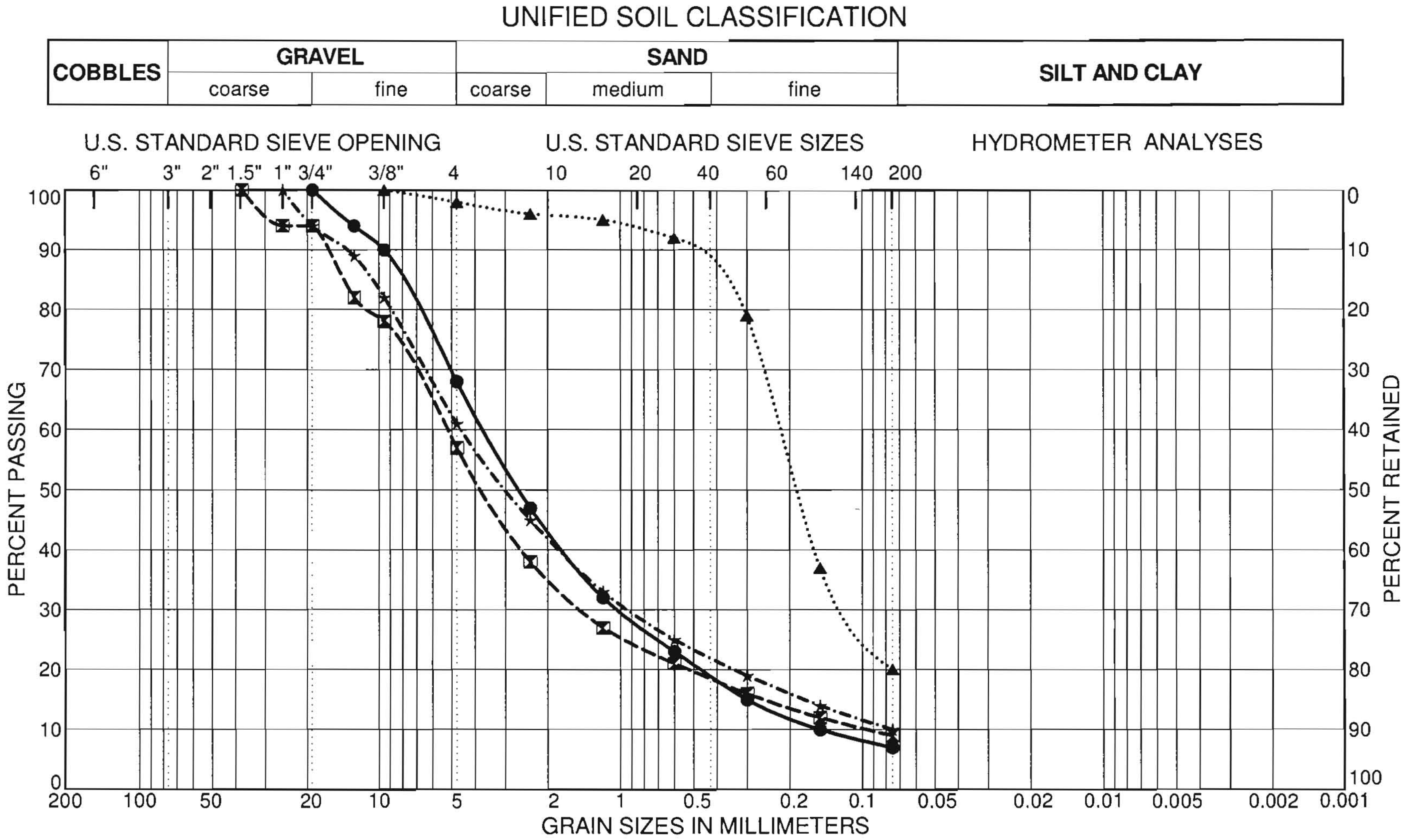
URS

Project : SV RAPID TRANSIT CORRIDOR

Project No. 28649330.02520

1/14/04 JSIEVE 8790E.GPJ

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-03A	1	73	●			Well-graded SAND (SW-SC) with clay and gravel
NB-03A	4	94	☒			Poorly graded SAND (SP-SC) with clay and gravel
NB-04	13	66	▲			Silty SAND (SM)
NB-04	18	91	★			Well-graded SAND (SW-SC) with clay and gravel

Fig. D-5

URS

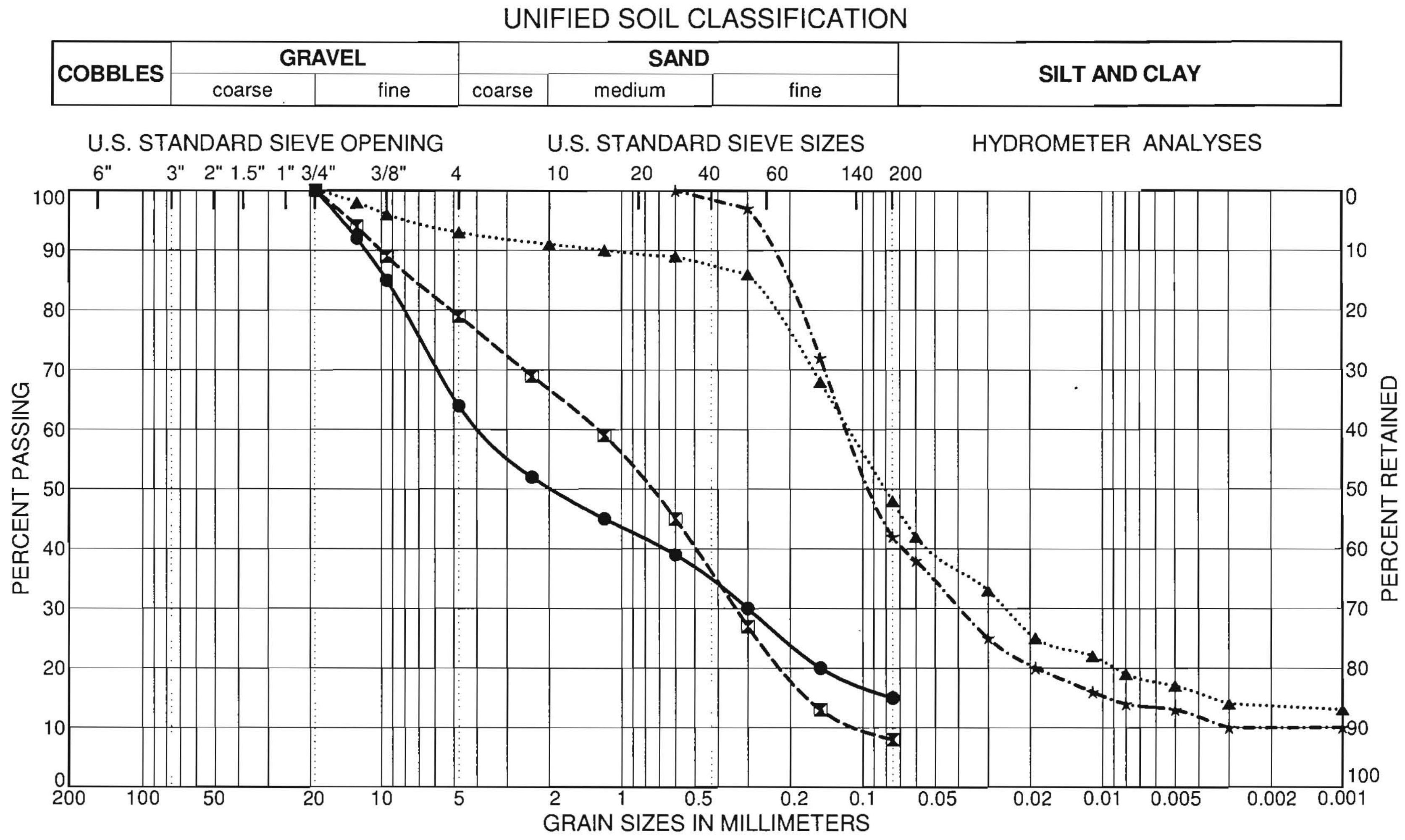
Project : SV RAPID TRANSIT CORRIDOR
Project No. 28649330.02520

1/14/04 JSIEVE 8790E.GPJ

GRAIN SIZE DISTRIBUTION CURVES

Fig. D-6

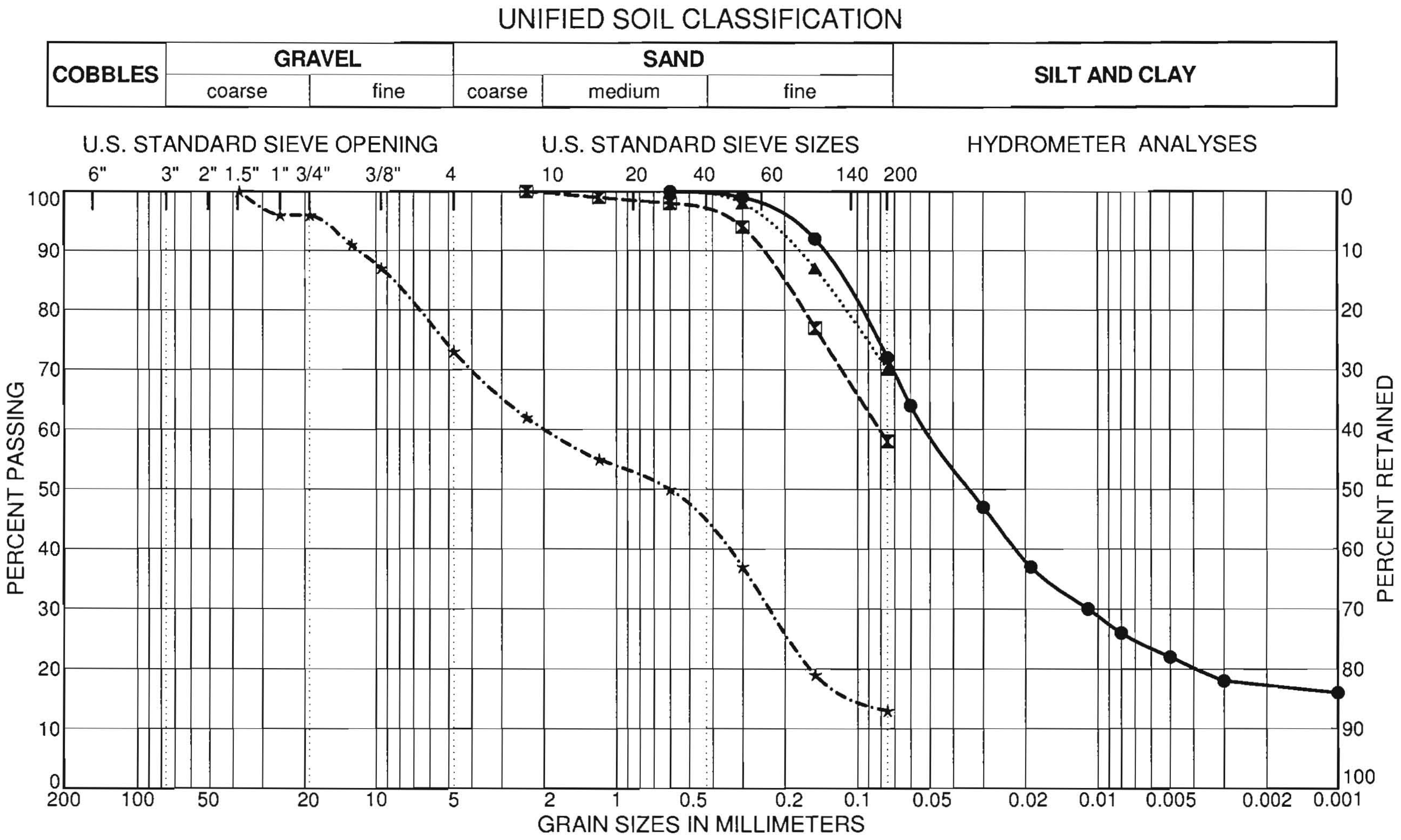
URS



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-04	23	116	●			Clayey SAND (SC) with gravel
NB-05	6	51	☒			Poorly graded SAND (SP-SM) with silt and gravel
NB-05	8	71	▲			Silty SAND (SM)
NB-05	12	111	★			Clayey SAND (SC)

Project : SV RAPID TRANSIT CORRIDOR
Project No. 28649330.02520

1/14/04 JSIEVE 8790E.GPJ

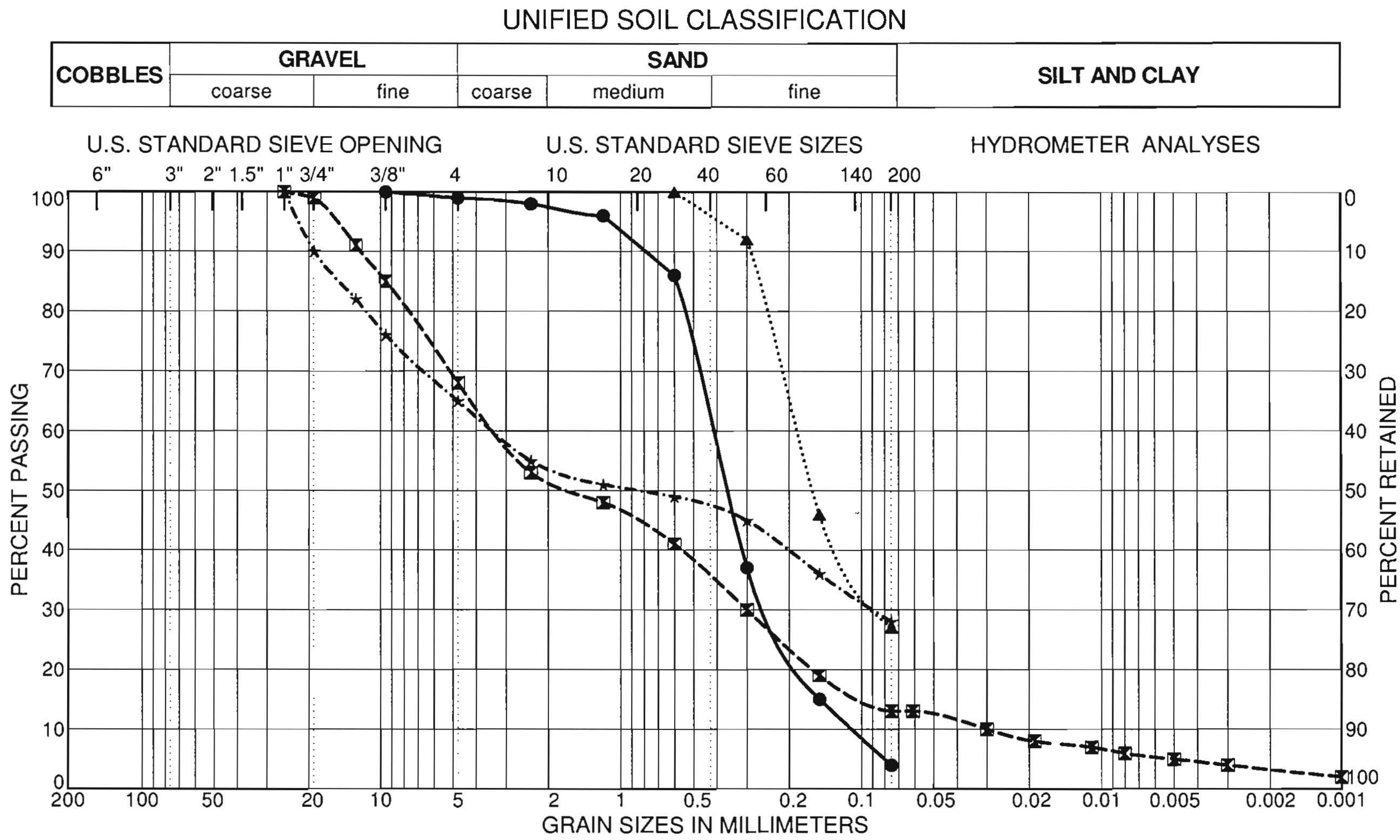


Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-06	9	41	●			Silty CLAY (CL-ML) with sand
NB-06	10	46	☒			Sandy lean CLAY (CL)
NB-06	11	51	▲			Lean CLAY (CL) with sand
NB-06	15	71	★			Silty SAND (SM) with gravel

GRAIN SIZE DISTRIBUTION CURVES

Fig. D-7

URS



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-06	19	91	●			Poorly graded SAND (SP)
NB-06	21	101	☒			Silty SAND (SM) with gravel
NB-06	25	121	▲			Silty SAND (SM)
NB-07	14	74	★			Clayey SAND (SC) with gravel

Project : SV RAPID TRANSIT CORRIDOR

Project No. 28649330.02520

GRAIN SIZE DISTRIBUTION CURVES

Fig. D-8

URS

1/14/04 JSIEVE 8790E.GPJ

1/14/04 J:SIEVE 8790E.GPJ

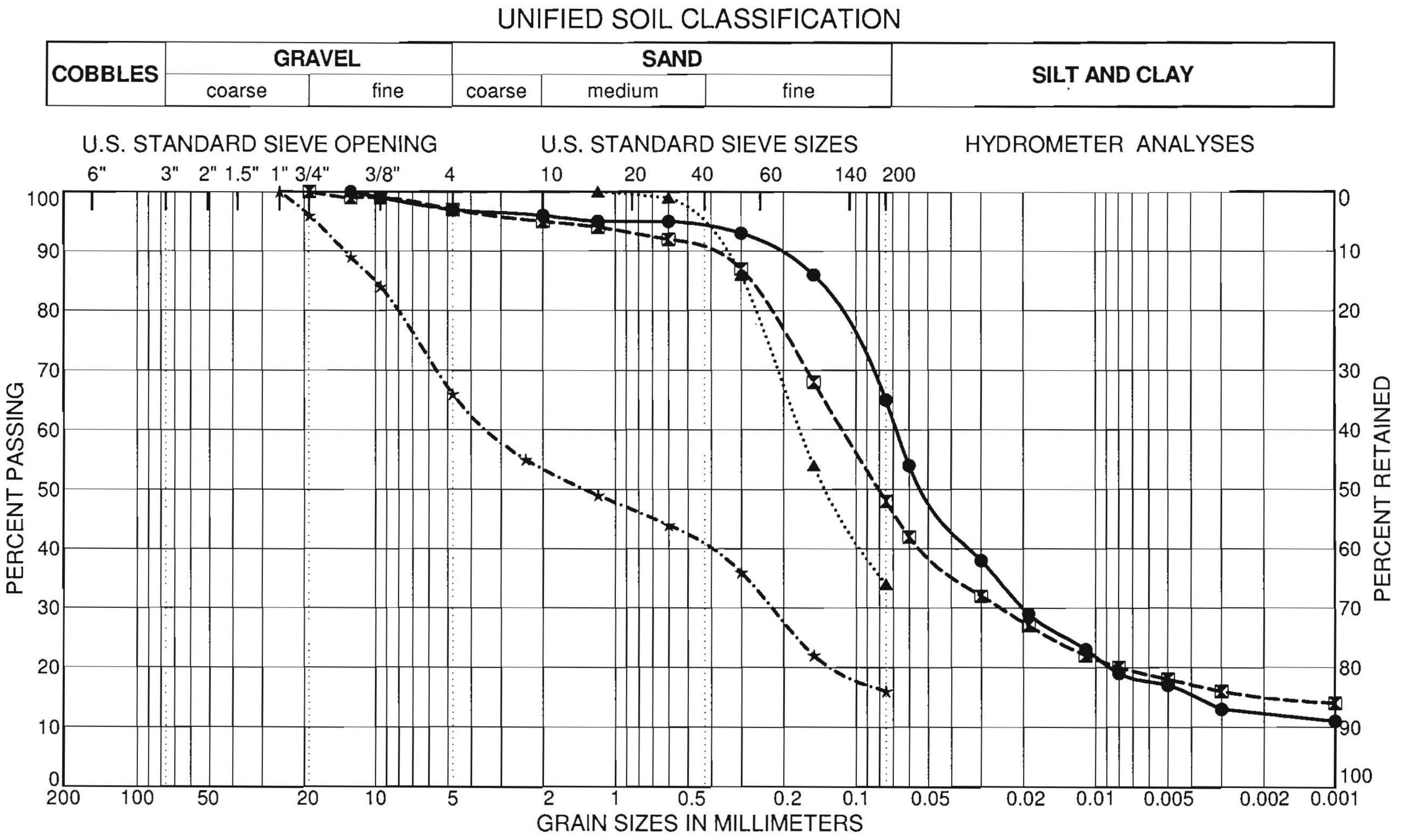
Project : SV RAPID TRANSIT CORRIDOR

Project No. 28649330.02520

GRAIN SIZE DISTRIBUTION CURVES

Fig. D-9

URS

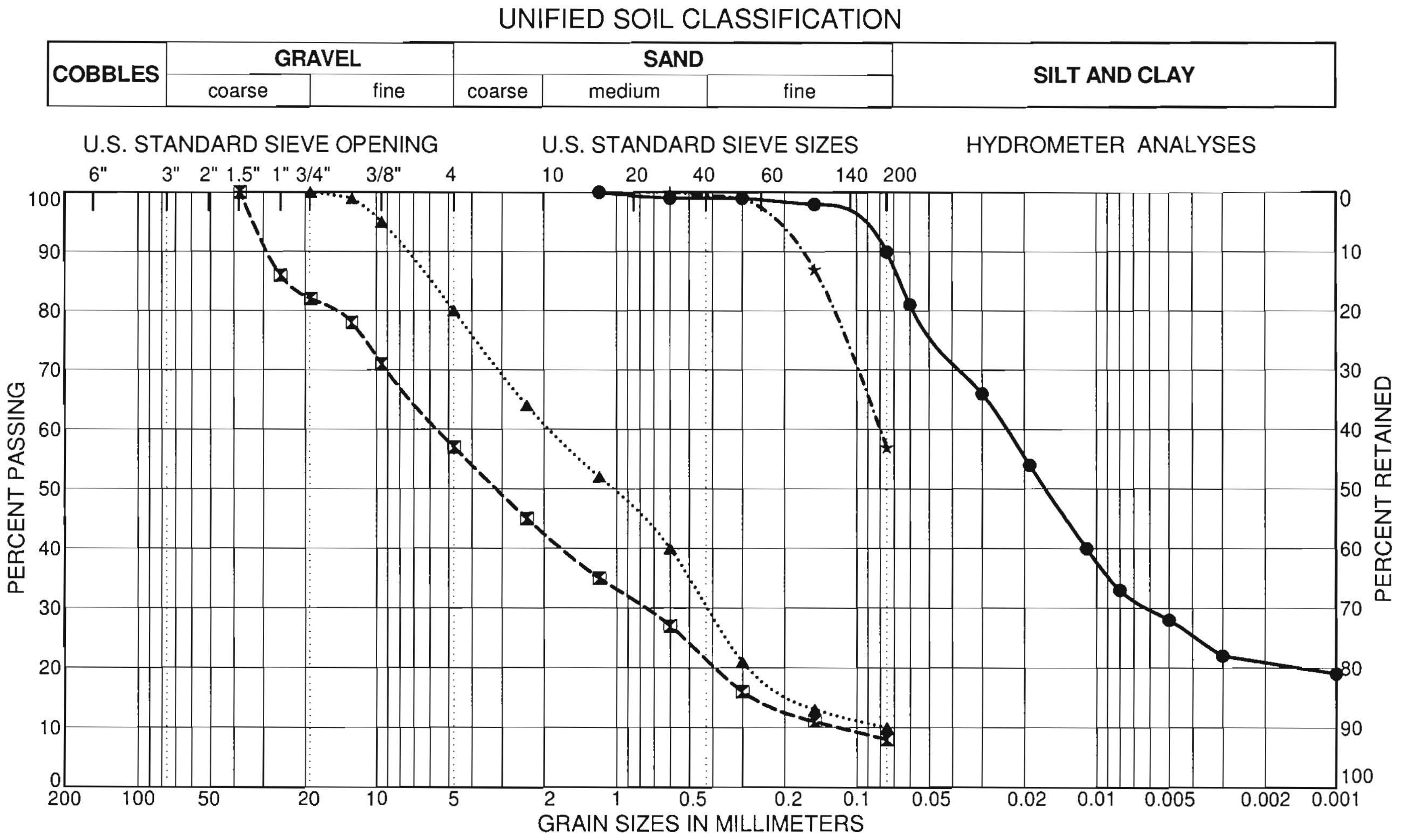


Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-07	18	94	●			Sandy SILT (ML)
NB-07	23B	116	☒			Silty SAND (SM)
NB-08	7	36	▲			Silty SAND (SM)
NB-12	11	51	★			Silty, clayey SAND (SC-SM)

Project : SV RAPID TRANSIT CORRIDOR
Project No. 28649330.02520

1/14/04 JSIEVE 8790E.GPJ

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-14	5	21	●			Lean CLAY (CL)
NB-14	16	71	⊠			Poorly graded SAND (SP-SC) with clay and gravel
NB-16	4B	54	▲			Well-graded SAND (SW-SC) with clay and gravel
NB-16	5A	59	★			Sandy SILT (ML)

URS

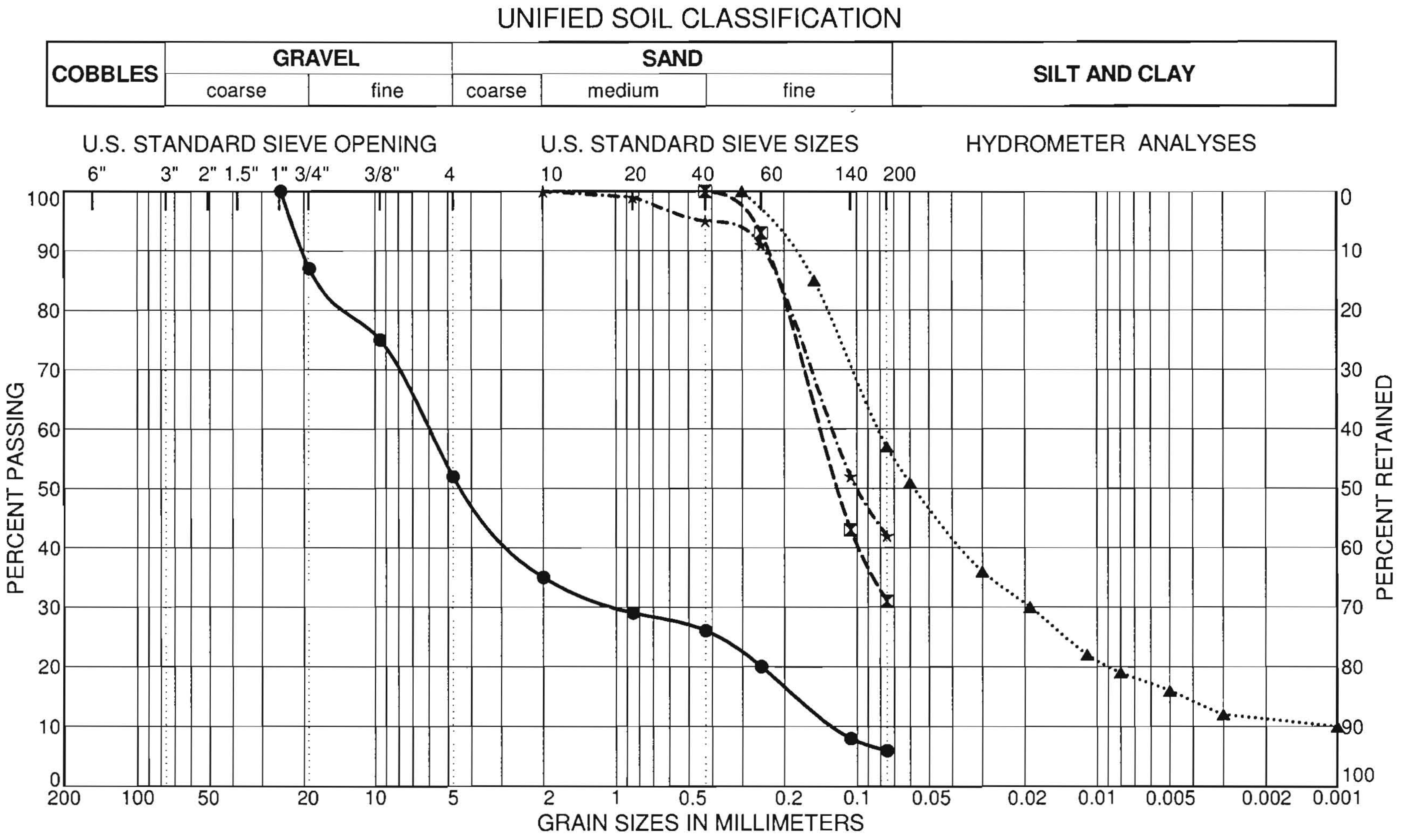
Fig. D-10

Project : SV RAPID TRANSIT CORRIDOR
Project No. 28649330.02520

1/14/04 JSIEVE 8790E.GPJ

GRAIN SIZE DISTRIBUTION CURVES

Fig. D-11

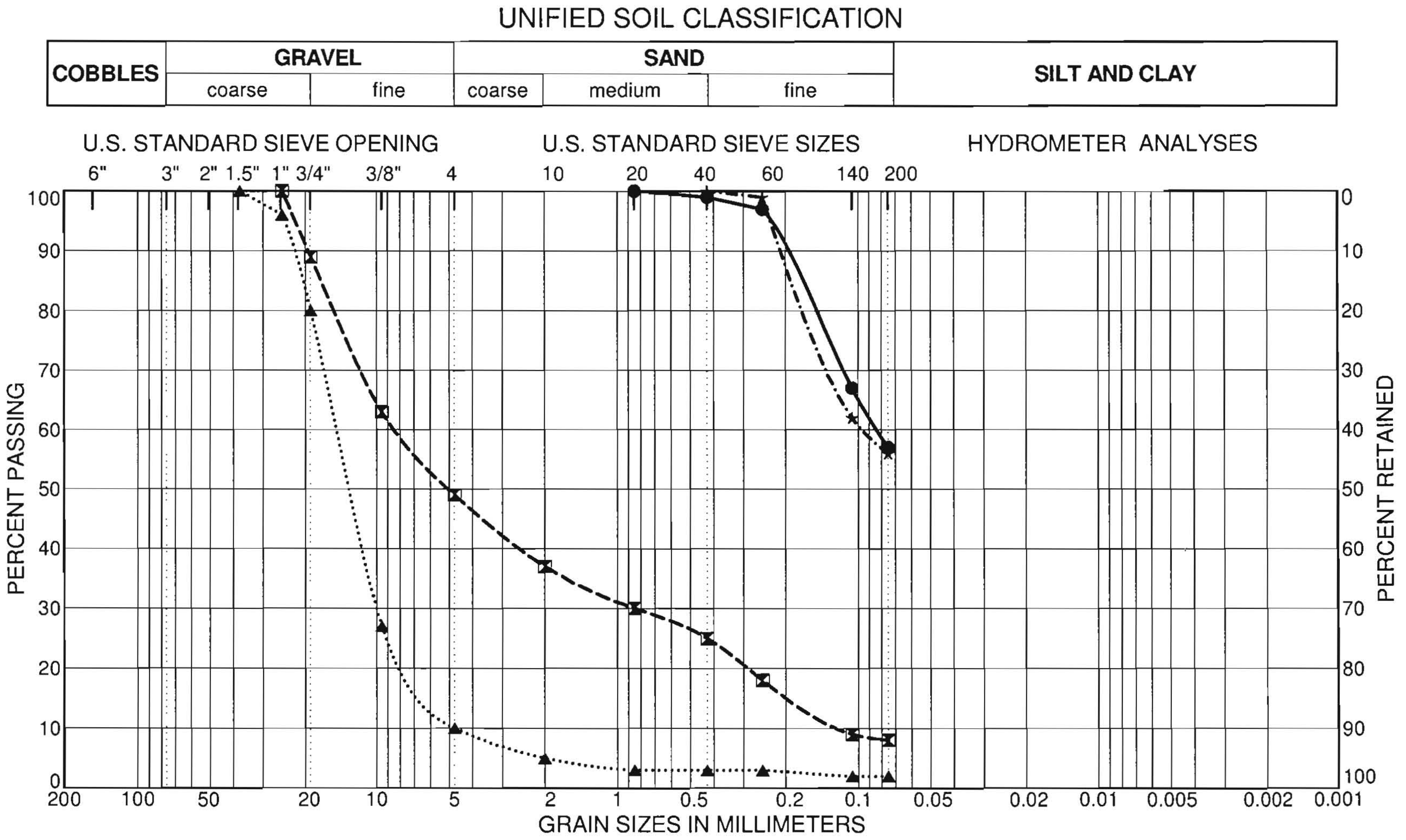


Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-17	2C	31	●			Well-graded GRAVEL (GW-GM) with silt and sand
NB-17	3C	36	☒			Silty SAND (SM)
NB-17	5C	59	▲			Sandy SILT (ML)
NB-17	6A	65	★			Silty SAND (SM)

URS

Project : SV RAPID TRANSIT CORRIDOR
Project No. 28649330.02520

1/14/04 JSIEVE 8790E.GPJ



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-18	2B	8	●			Sandy SILT (ML)
NB-18	7B	34	⊠			Poorly graded GRAVEL (GP-GM) with silt and sand
NB-18	8	38	▲			Poorly graded GRAVEL (GP)
NB-18	11B	50	★			Sandy SILT (ML)

GRAIN SIZE DISTRIBUTION CURVES

Fig. D-12

URS

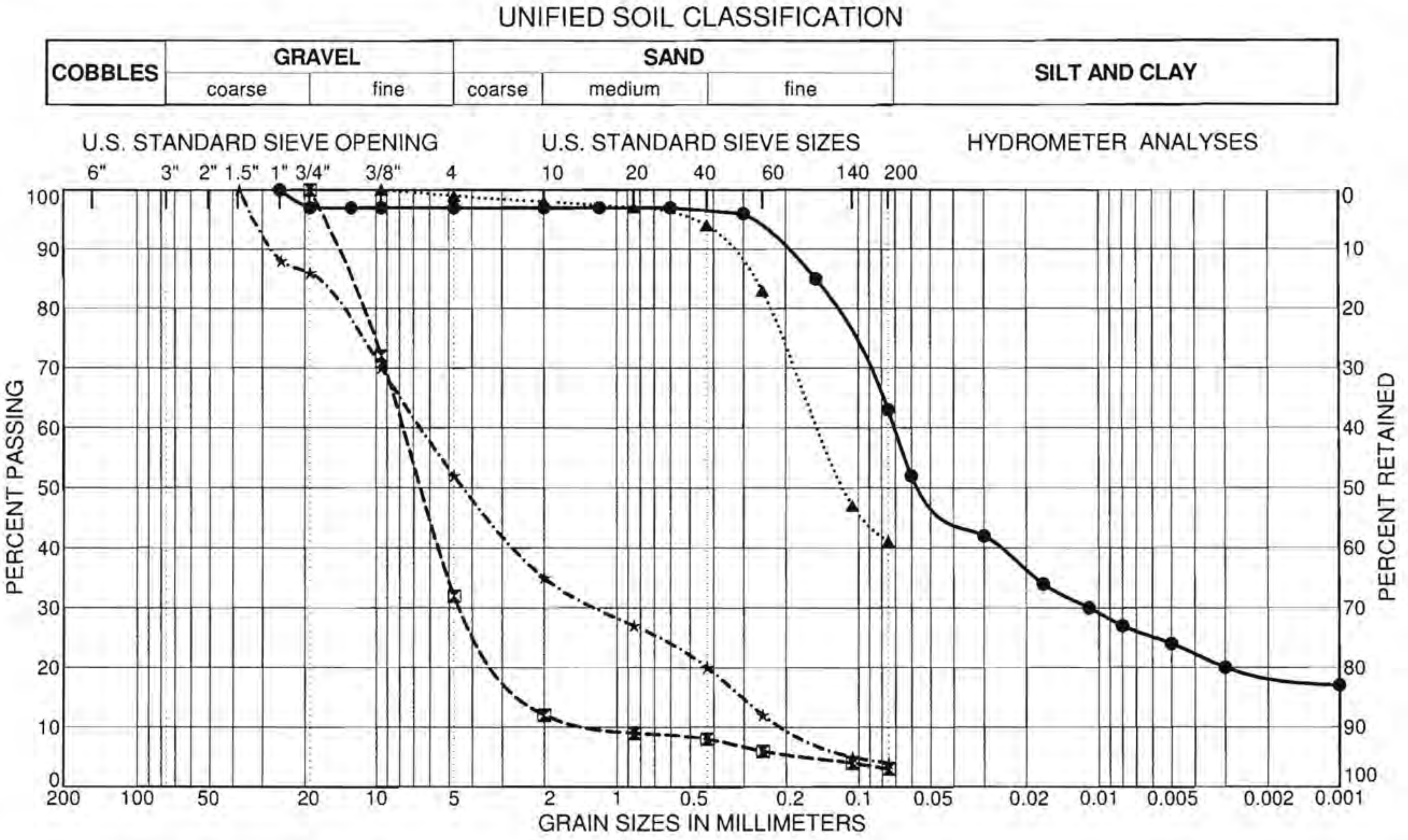
Project : SV RAPID TRANSIT CORRIDOR
Project No. 28649330.02520

1/14/04 JSIEVE 8790E.GPJ

GRAIN SIZE DISTRIBUTION CURVES

Fig. D-13

URS

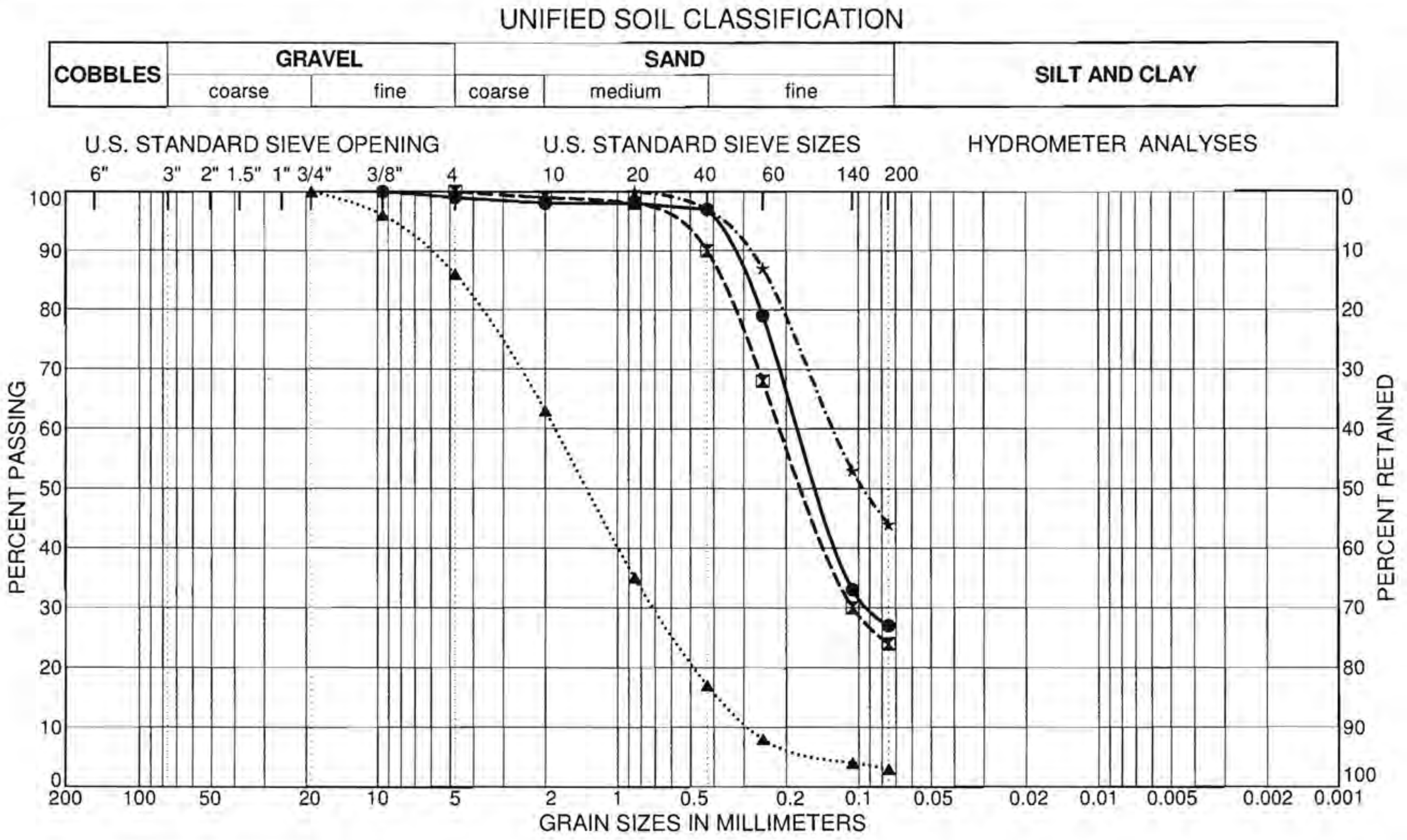


Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-18	11	51	●			Sandy lean CLAY (CL)
NB-18	18	85	☒			Well-graded GRAVEL (GW) with sand
NB-19	2A	10	▲			Silty SAND (SM)
NB-19	4A	31	★			Well-graded SAND (SW) with gravel

GRAIN SIZE DISTRIBUTION CURVES

Project : SV RAPID TRANSIT CORRIDOR
Project No. 28649330.02520

1/14/04 JSIEVE 8790E.GPJ



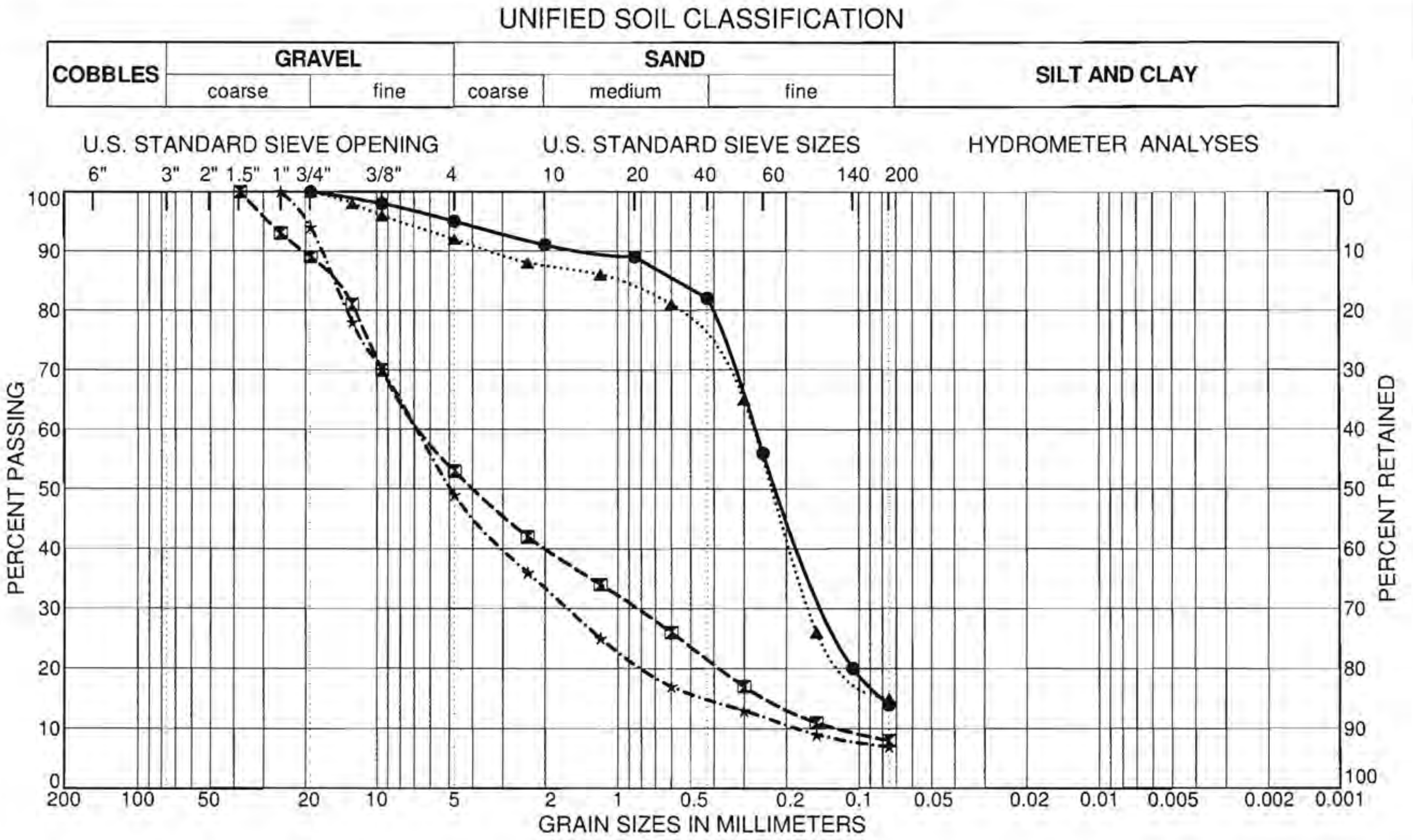
Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-19	13A	72	●			Silty SAND (SM)
NB-20	2B	8	⊠			Silty SAND (SM)
NB-20	3B	13	▲			Well-graded SAND (SW)
NB-20	8	34	★			Silty SAND (SM)

Fig. D-14

URS

Project : SV RAPID TRANSIT CORRIDOR
Project No. 28649330.02520

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-20	12A	52	●			Silty SAND (SM)
NB-21	9	41	⊠			Well-graded GRAVEL (GW-GC) with clay and sand
NB-24	5	25	▲			Silty, clayey SAND (SC-SM)
NB-24	8	40	★			Well-graded GRAVEL (GW-GC) with clay and sand

Fig. D-15

URS

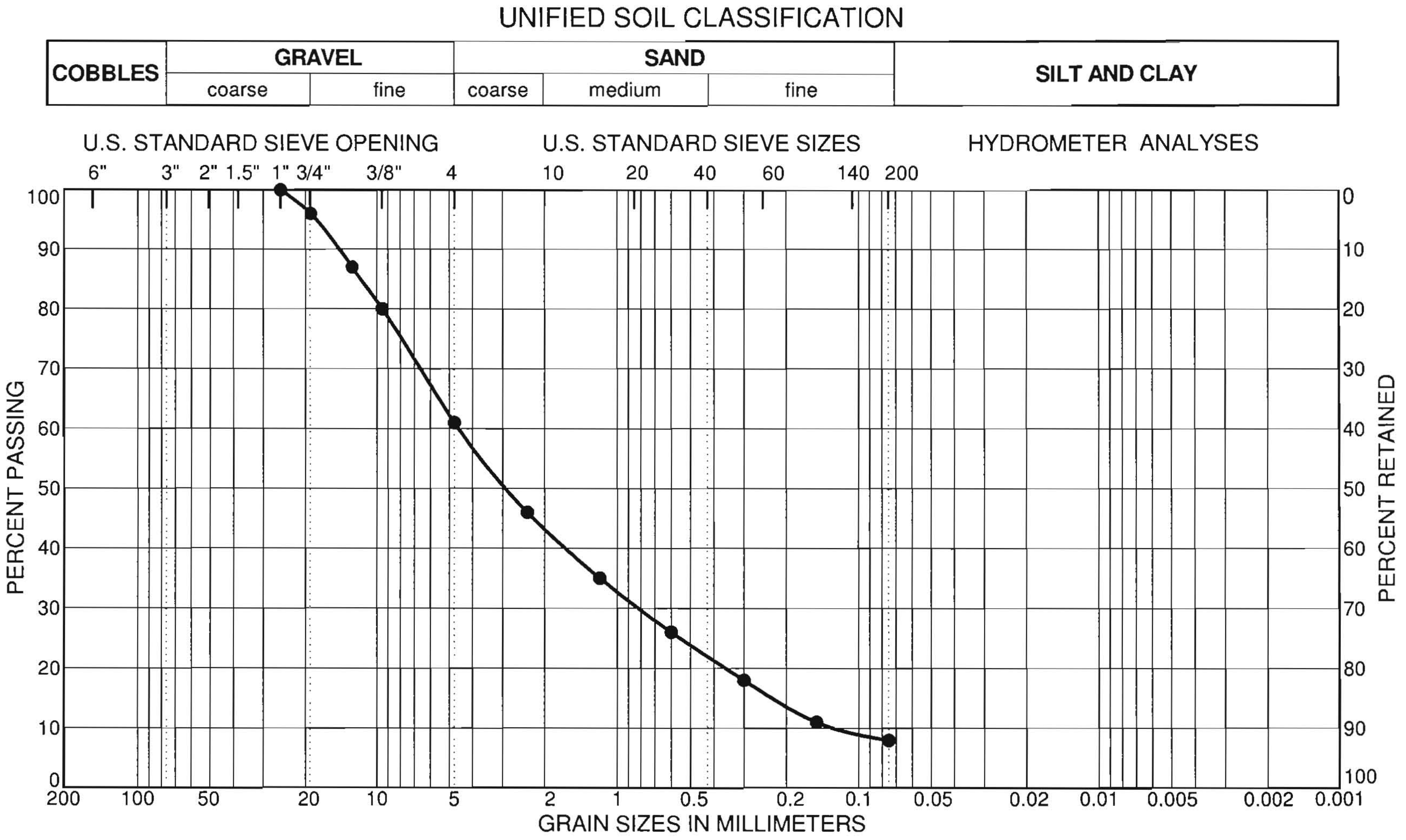
1/14/04 JSIEVE 8790E.GPJ

Project : SV RAPID TRANSIT CORRIDOR

Project No. 28649330.02520

1/14/04 JSIEVE 8790E.GPJ

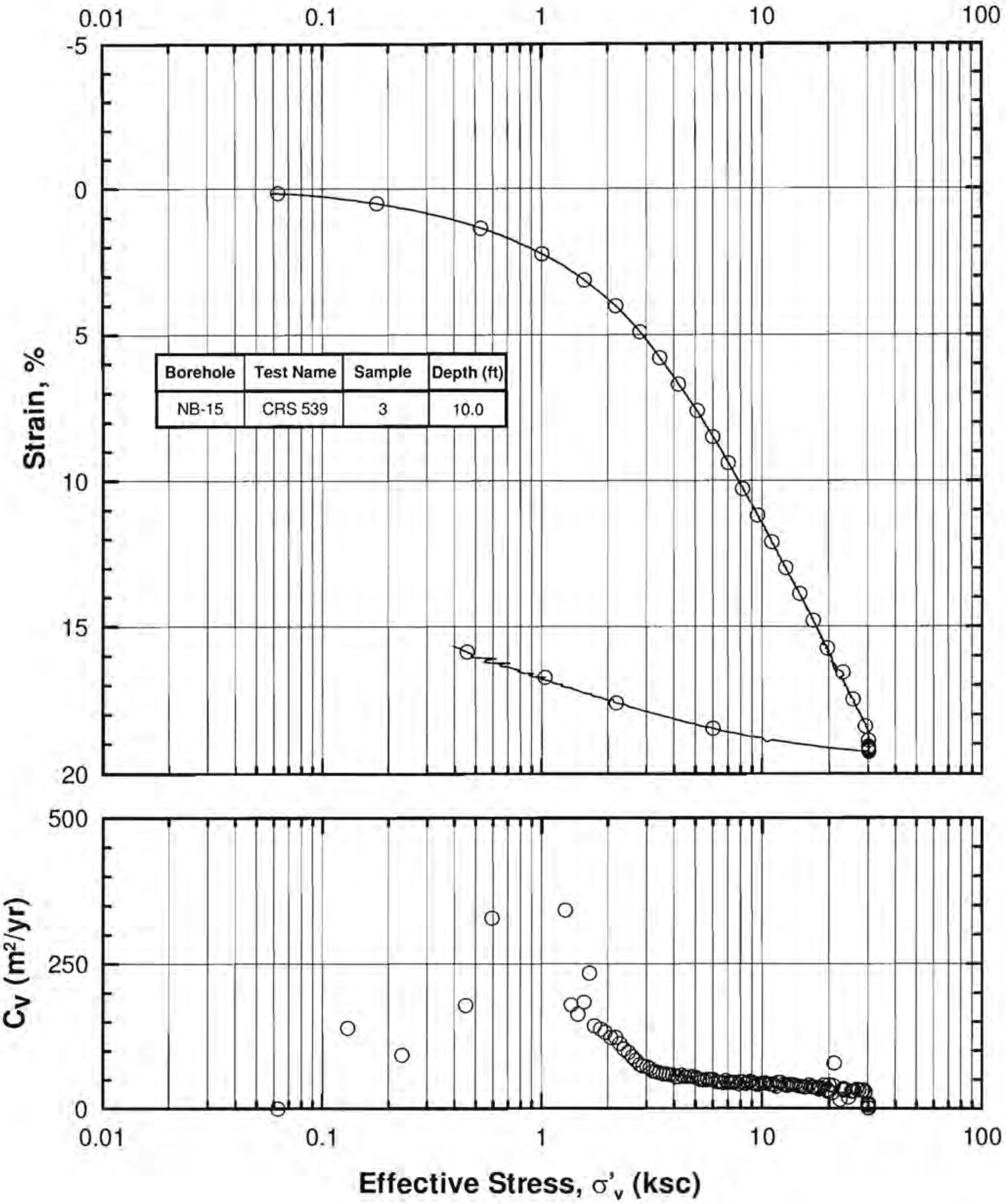
GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Classification
NB-24	16	80	●			Well-graded SAND (SW-SC) with clay and gravel

Fig. D-16

CONSTANT RATE OF STRAIN CONSOLIDATION TESTS



Borehole	Test Name	Sample	Depth (ft)
NB-15	CRS 539	3	10.0

COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

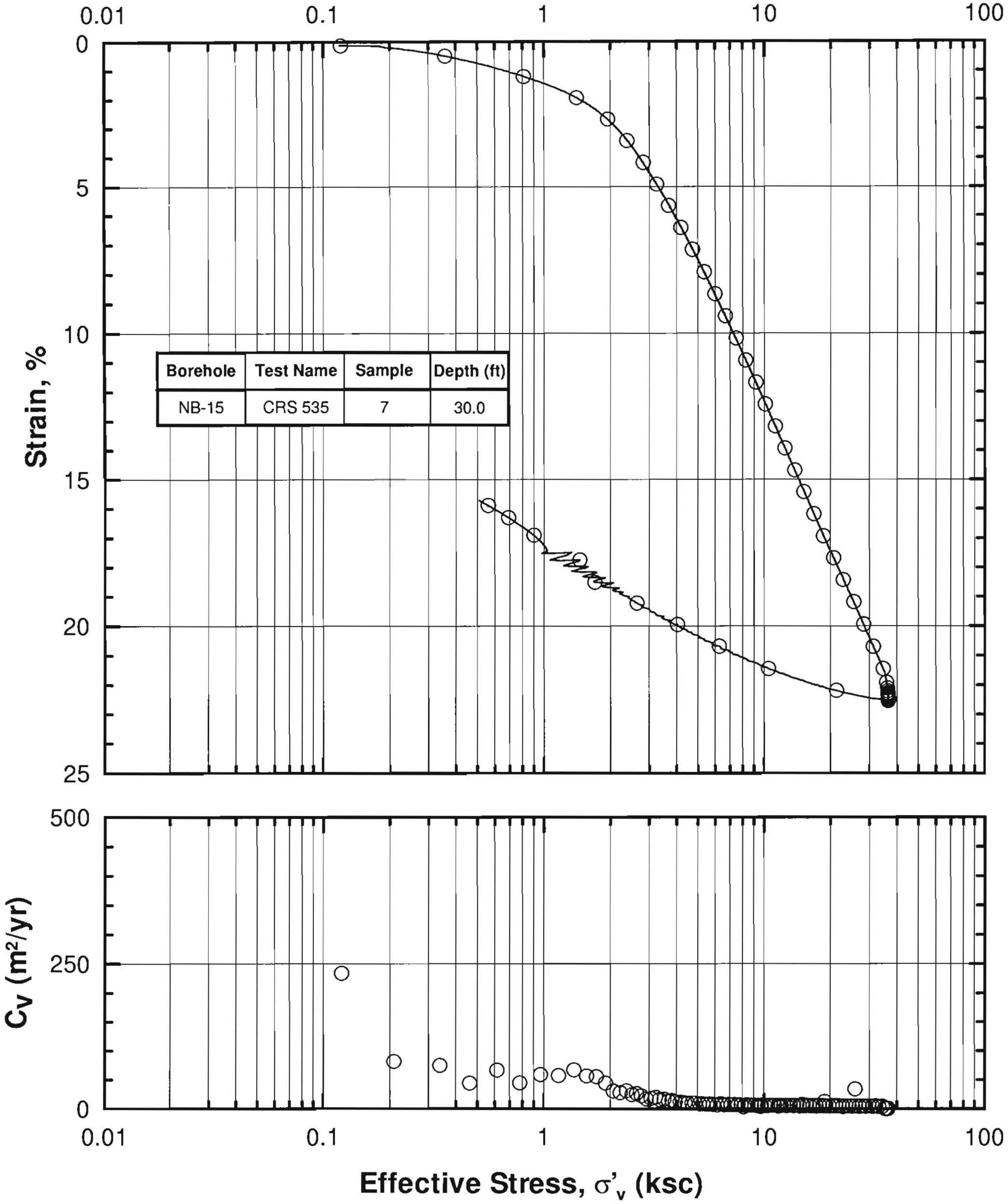
April 2003
28648793

San Jose, California

FIGURE D-17

URS

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 539.grf



Borehole	Test Name	Sample	Depth (ft)
NB-15	CRS 535	7	30.0

COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

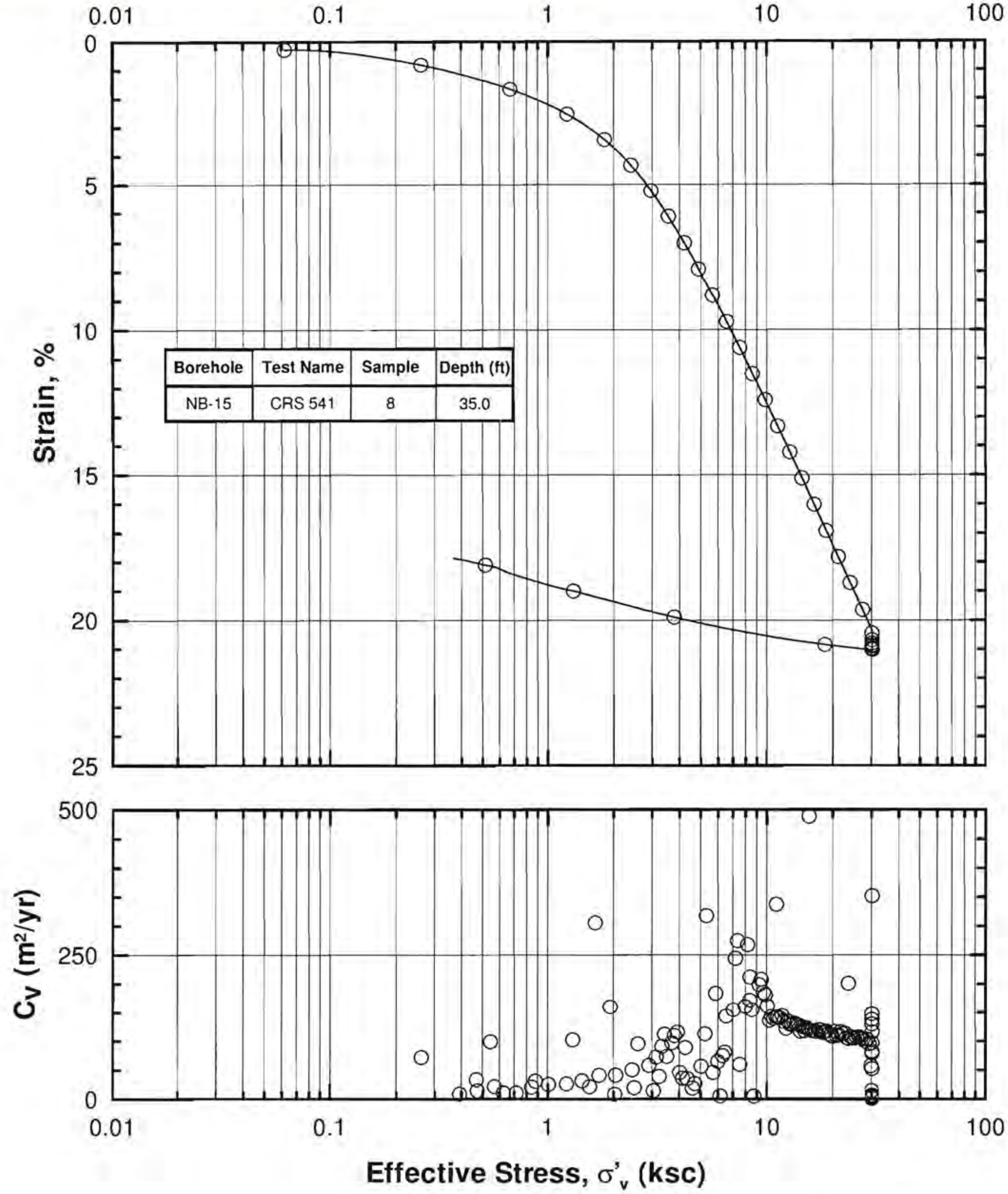
April 2003
28648793

San Jose, California

URS

FIGURE D-18

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 535.grf



Borehole	Test Name	Sample	Depth (ft)
NB-15	CRS 541	8	35.0

COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

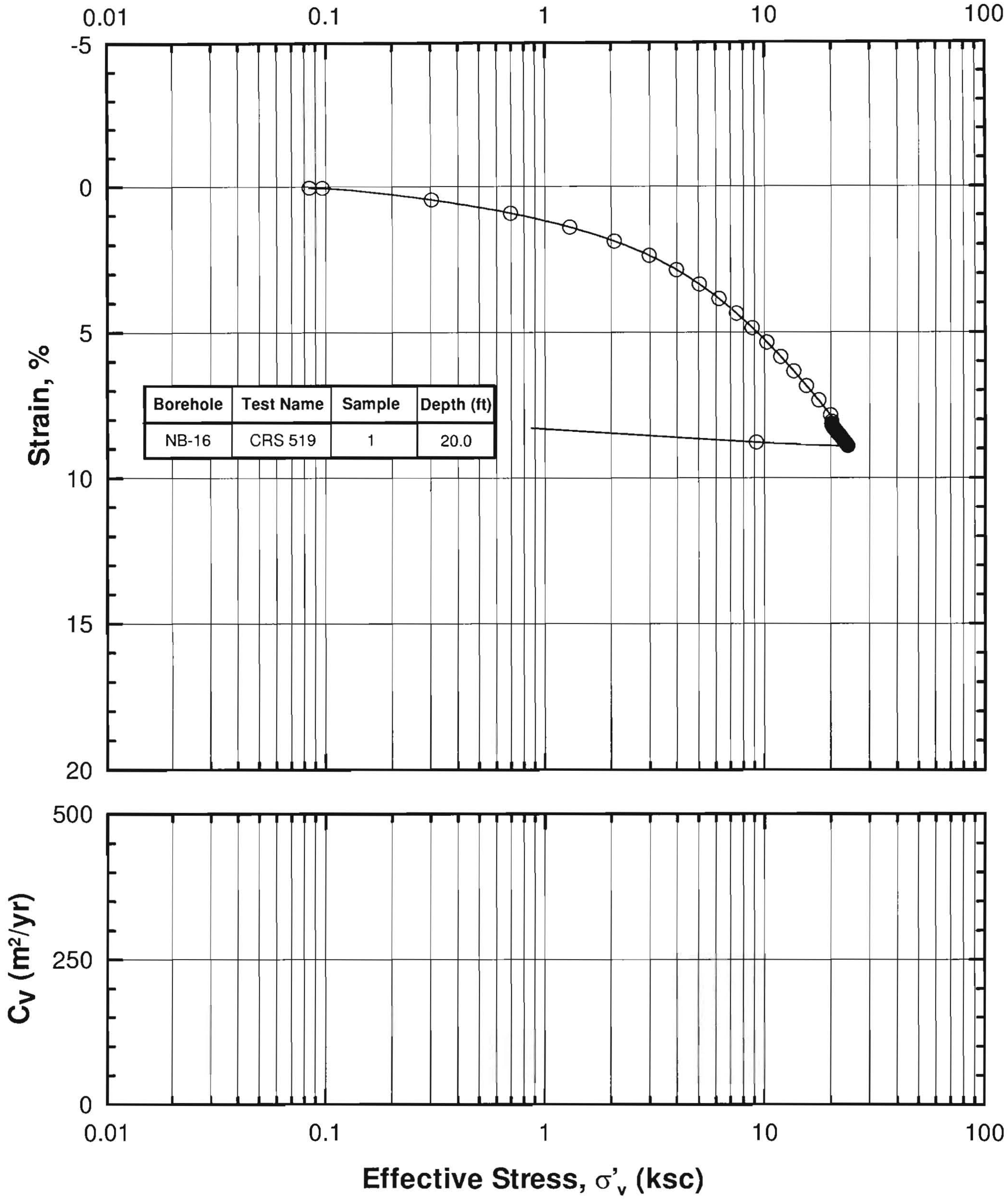
April 2003
28648793

San Jose, California

URS

FIGURE D-19

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 541.grf



COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

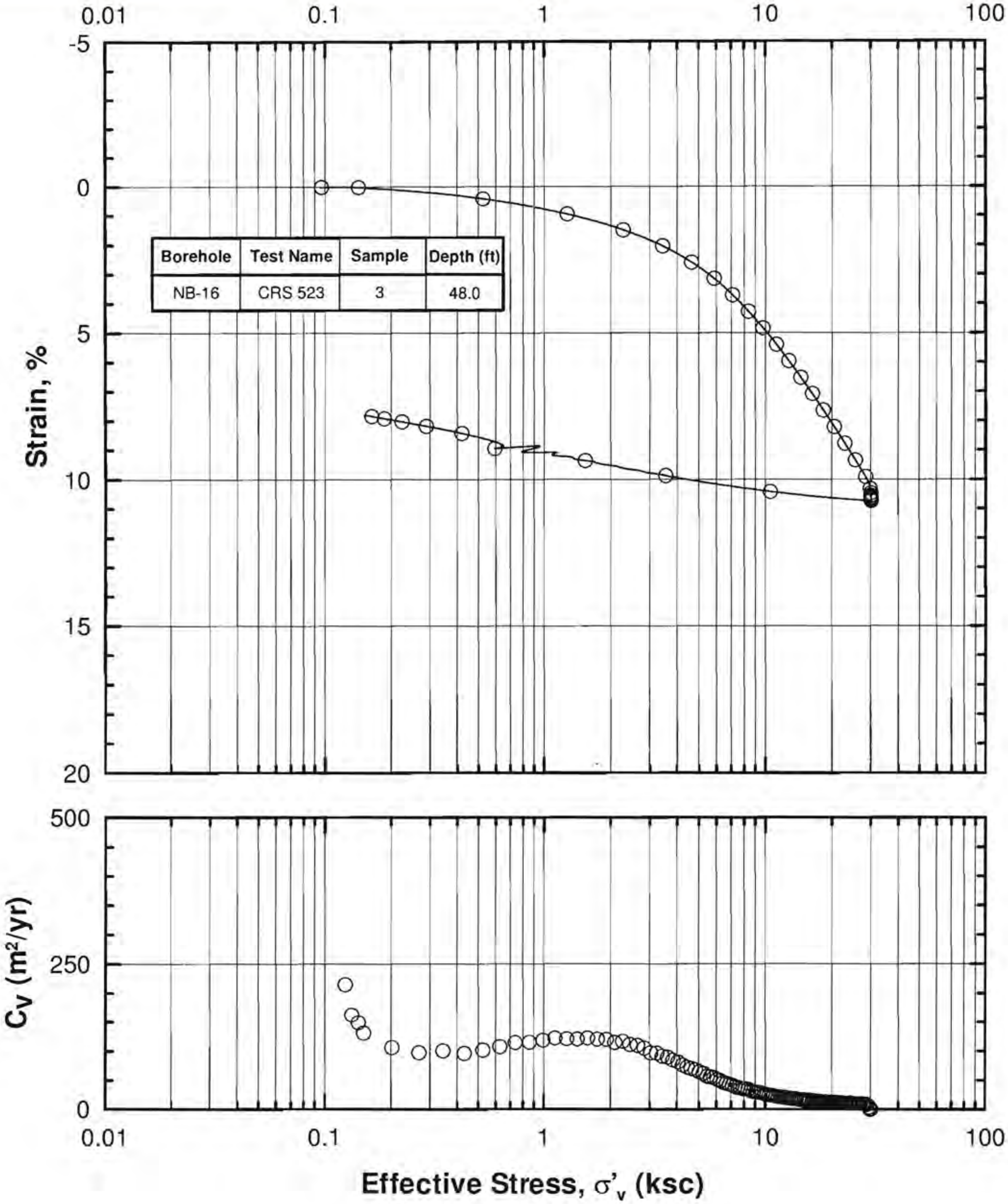
April 2003
28648793

San Jose, California

URS

FIGURE D-20

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 519.grf



Borehole	Test Name	Sample	Depth (ft)
NB-16	CRS 523	3	48.0

COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

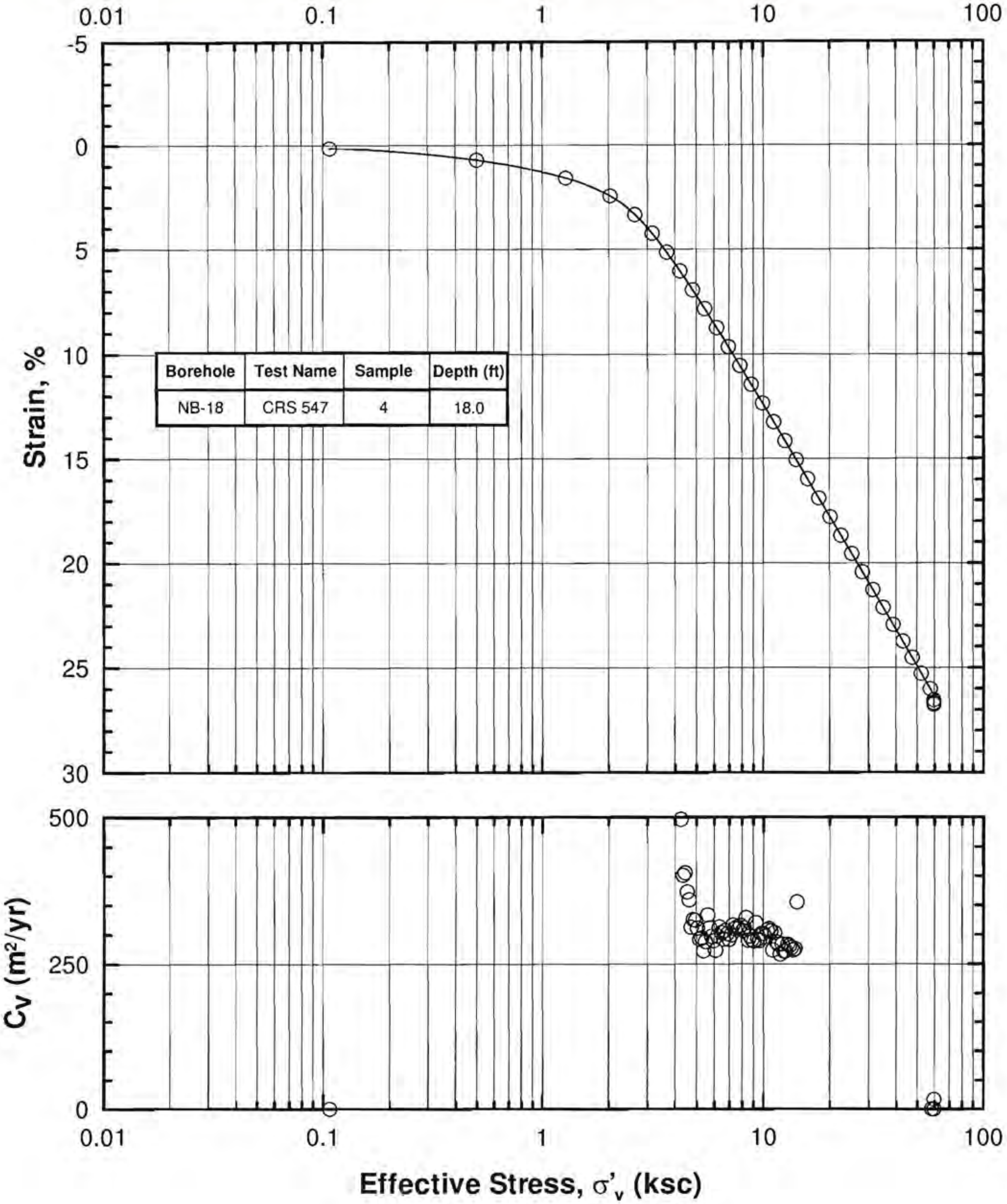
April 2003
28648793

San Jose, California

URS

FIGURE D-21

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 523.grf



Borehole	Test Name	Sample	Depth (ft)
NB-18	CRS 547	4	18.0

COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

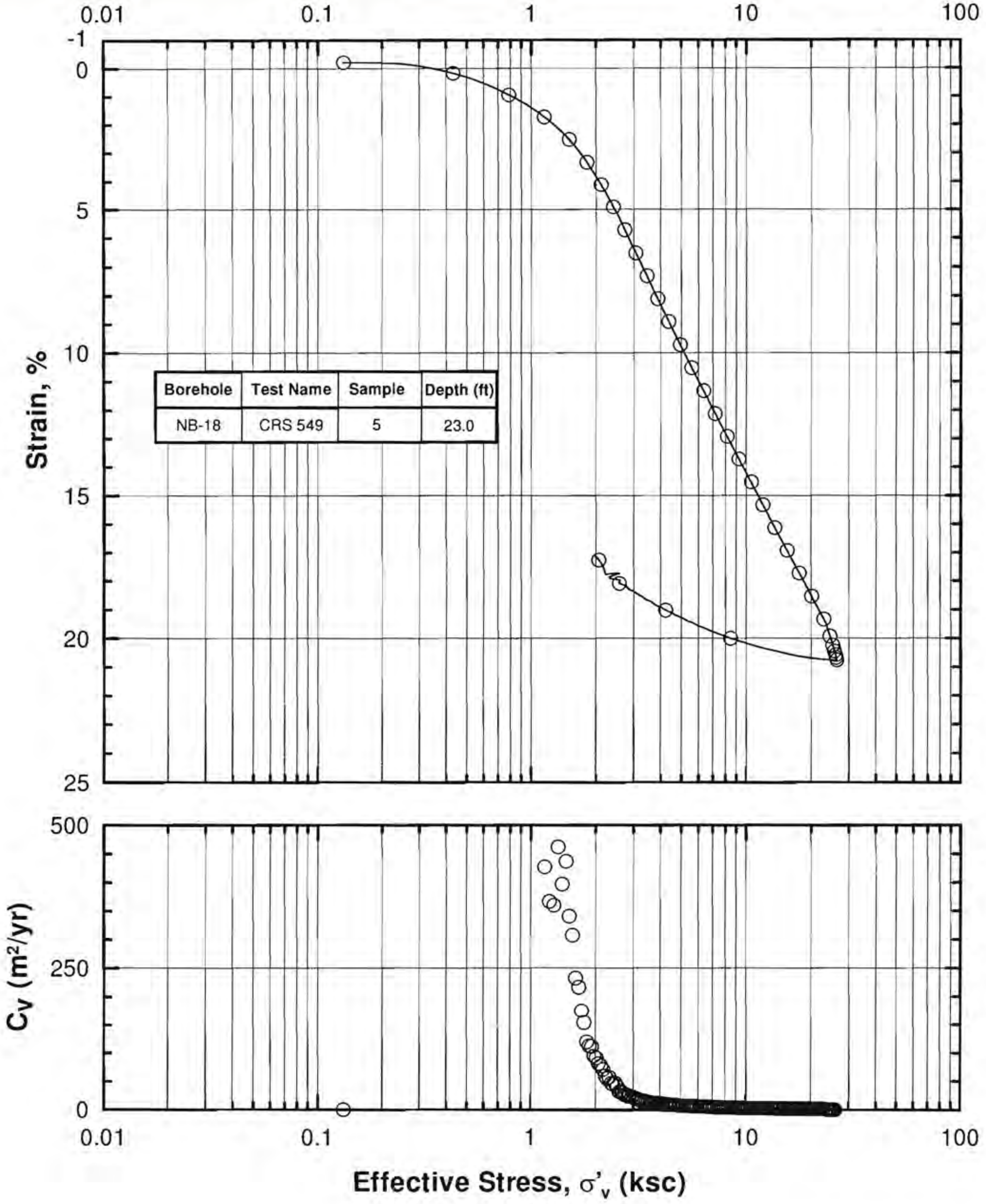
April 2003
28648793

San Jose, California

URS

FIGURE D-22

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 547.grf



Borehole	Test Name	Sample	Depth (ft)
NB-18	CRS 549	5	23.0

COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

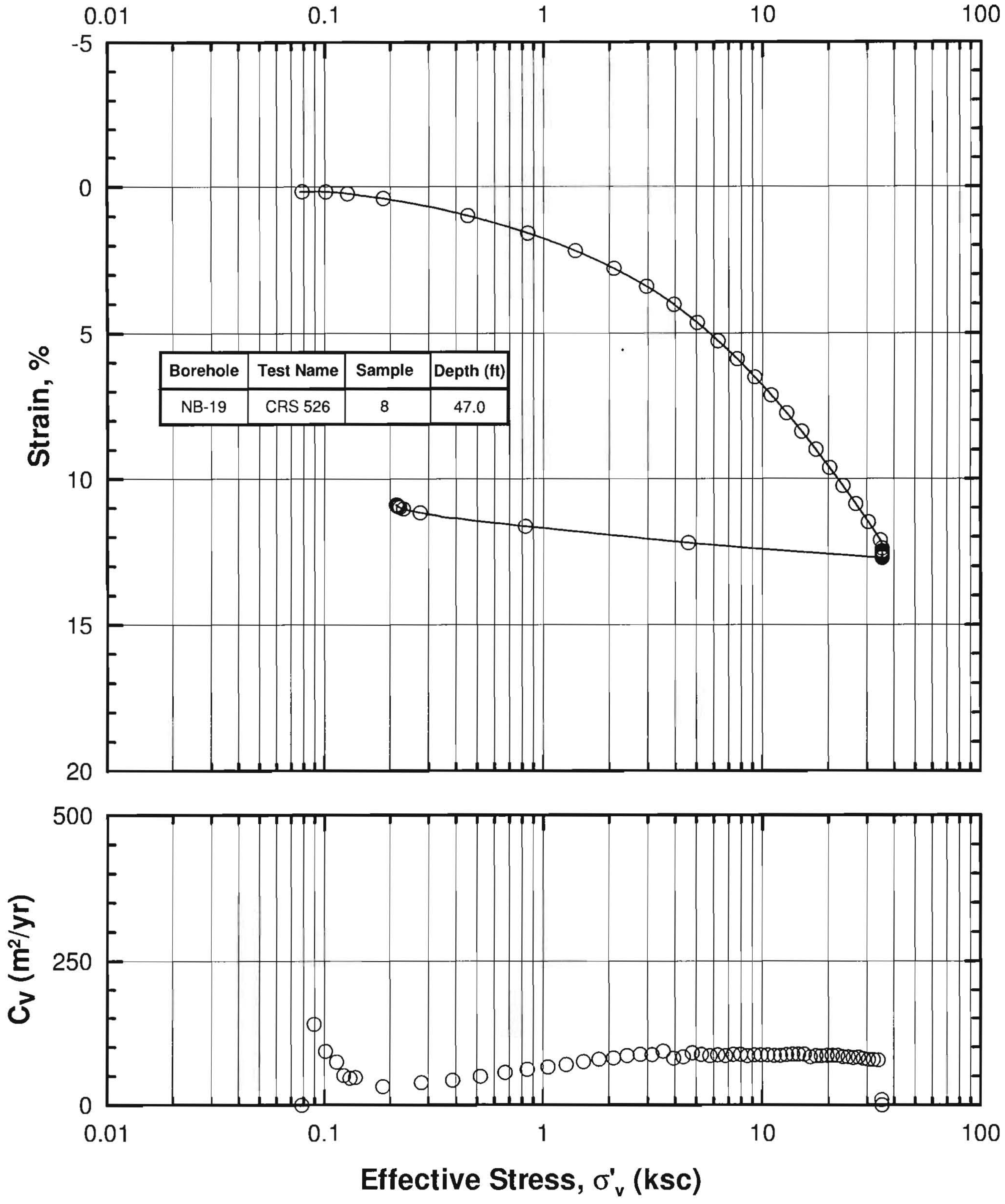
April 2003
28648793

San Jose, California

URS

FIGURE D-23

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 549.grf



Borehole	Test Name	Sample	Depth (ft)
NB-19	CRS 526	8	47.0

COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

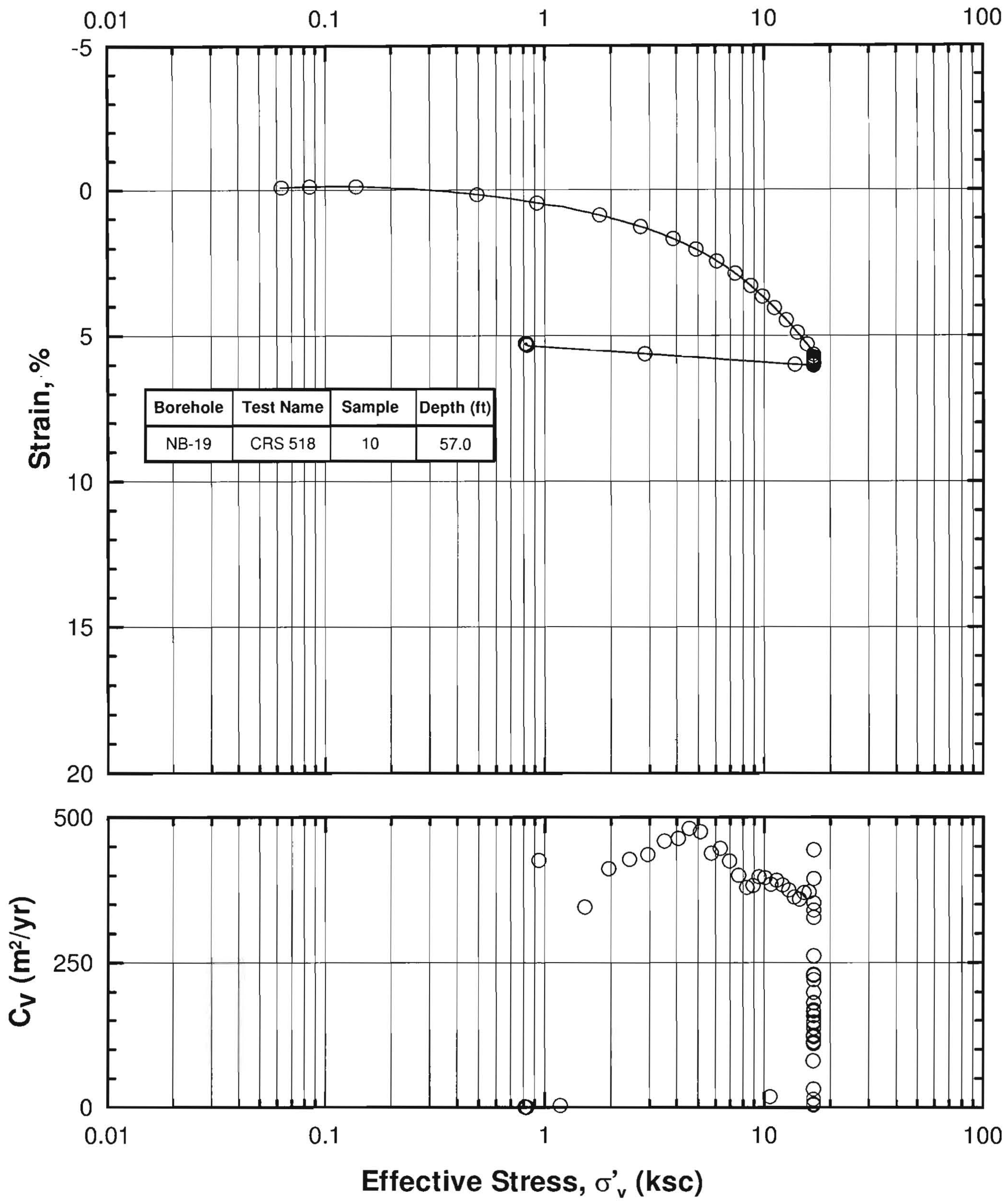
April 2003
28648793

San Jose, California

URS

FIGURE D-24

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 526.grf



Borehole	Test Name	Sample	Depth (ft)
NB-19	CRS 518	10	57.0

COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

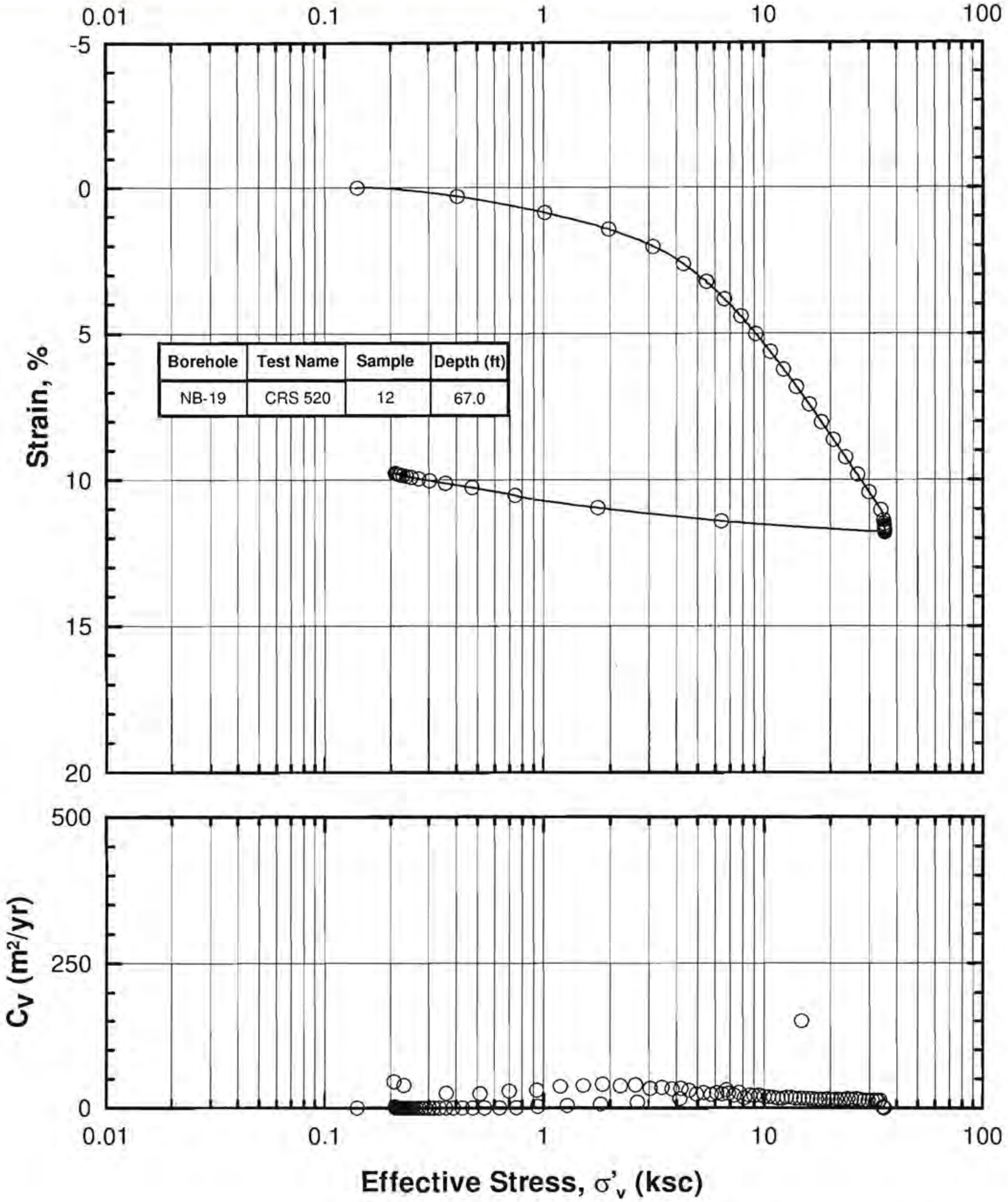
April 2003
28648793

San Jose, California

URS

FIGURE D-25

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 518.grf



Borehole	Test Name	Sample	Depth (ft)
NB-19	CRS 520	12	67.0

COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

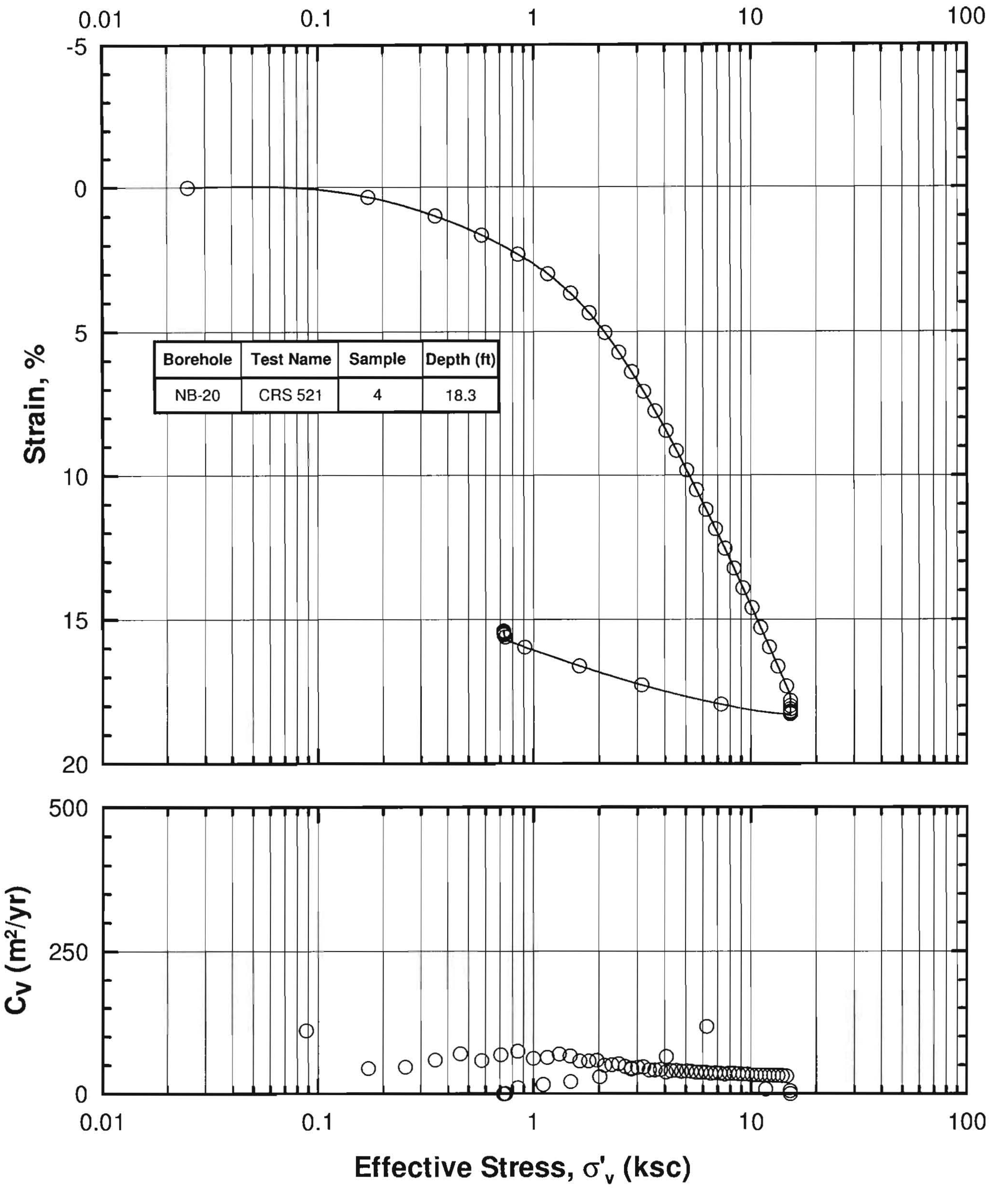
Silicon Valley Rapid Transit Corridor

April 2003
28648793

San Jose, California

URS

FIGURE D-26



Borehole	Test Name	Sample	Depth (ft)
NB-20	CRS 521	4	18.3

COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

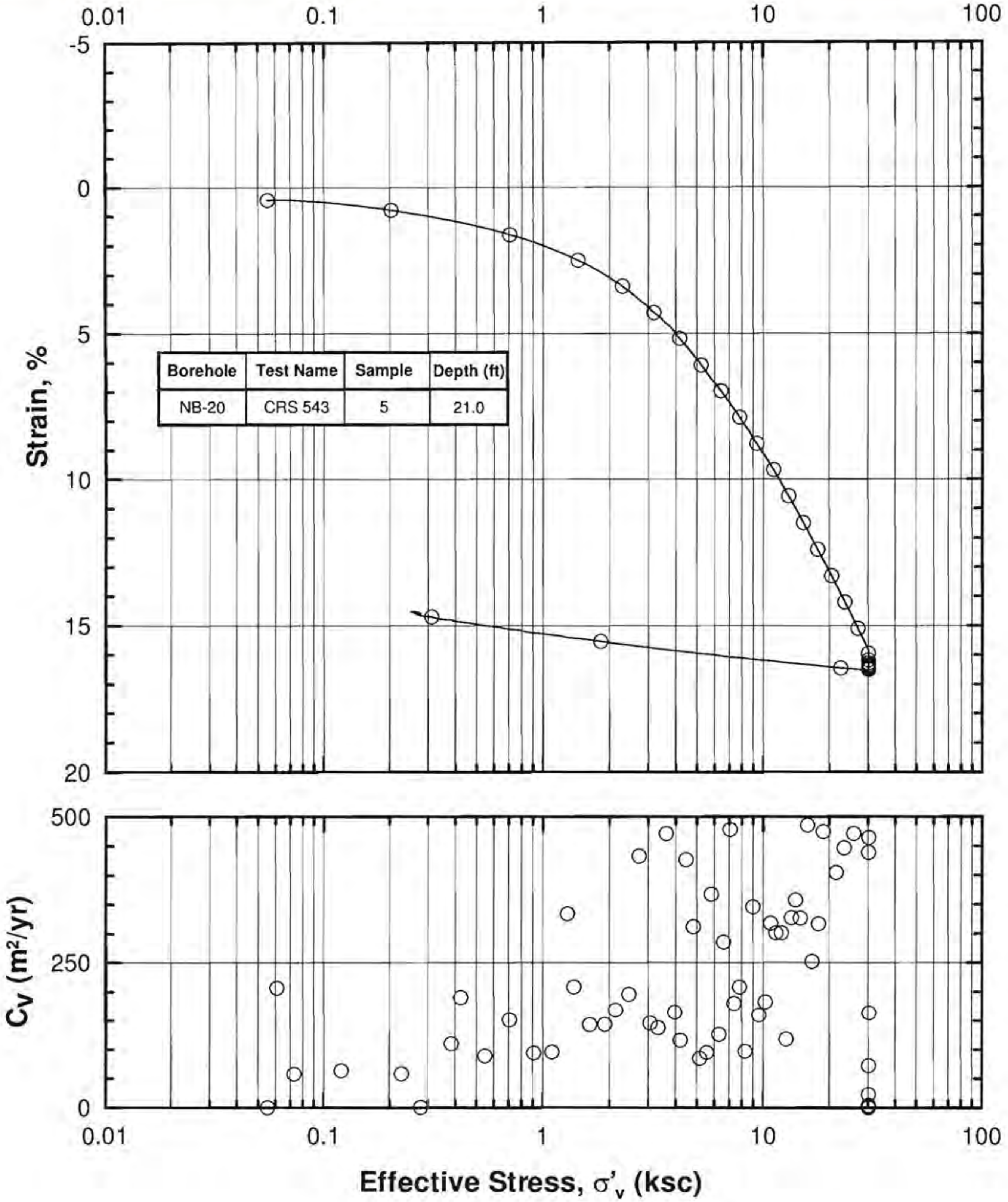
April 2003
28648793

San Jose, California

URS

FIGURE D-27

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 521.grf



COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

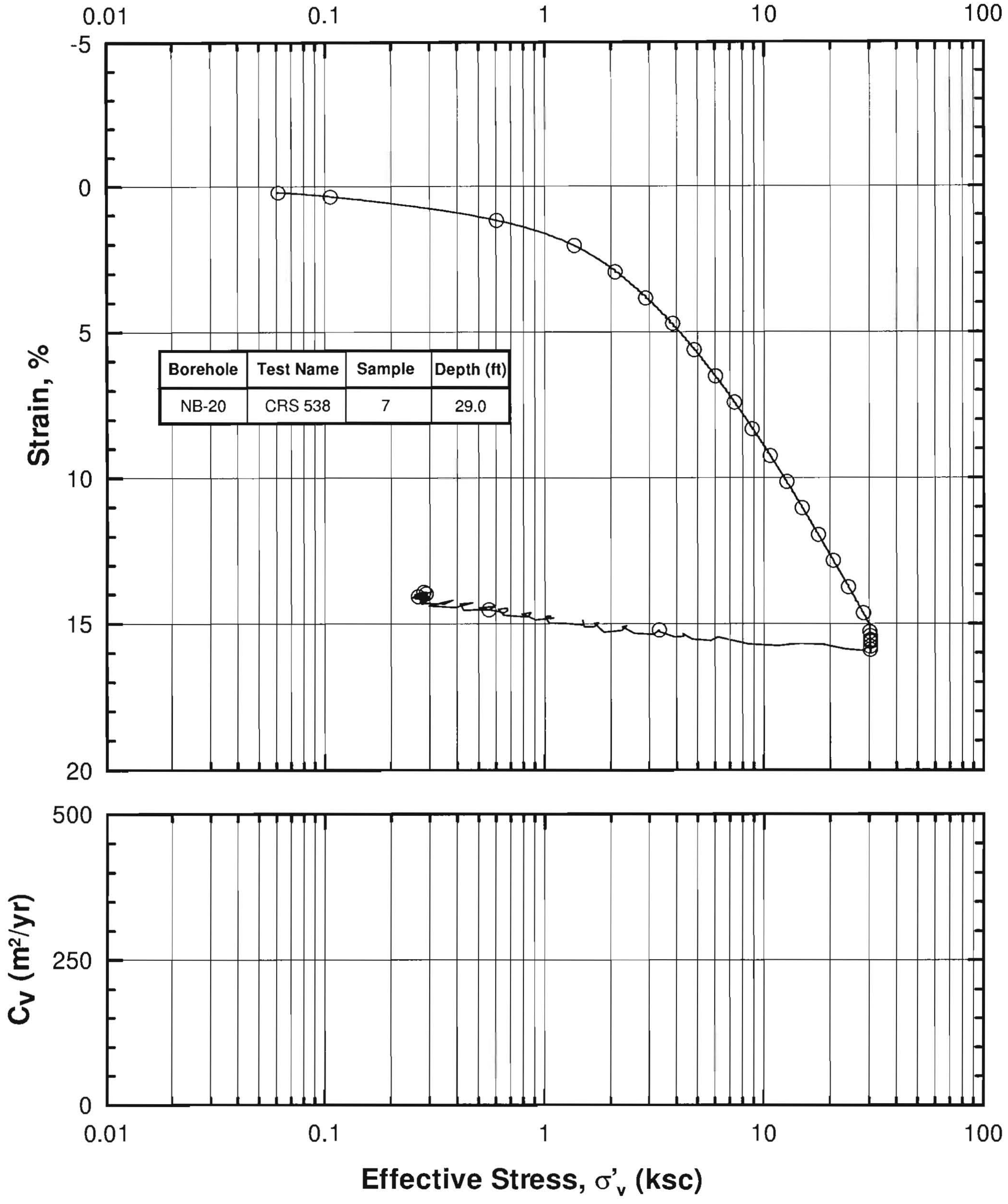
April 2003
28648793

San Jose, California

URS

FIGURE D-28

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 543.grf



Borehole	Test Name	Sample	Depth (ft)
NB-20	CRS 538	7	29.0

COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

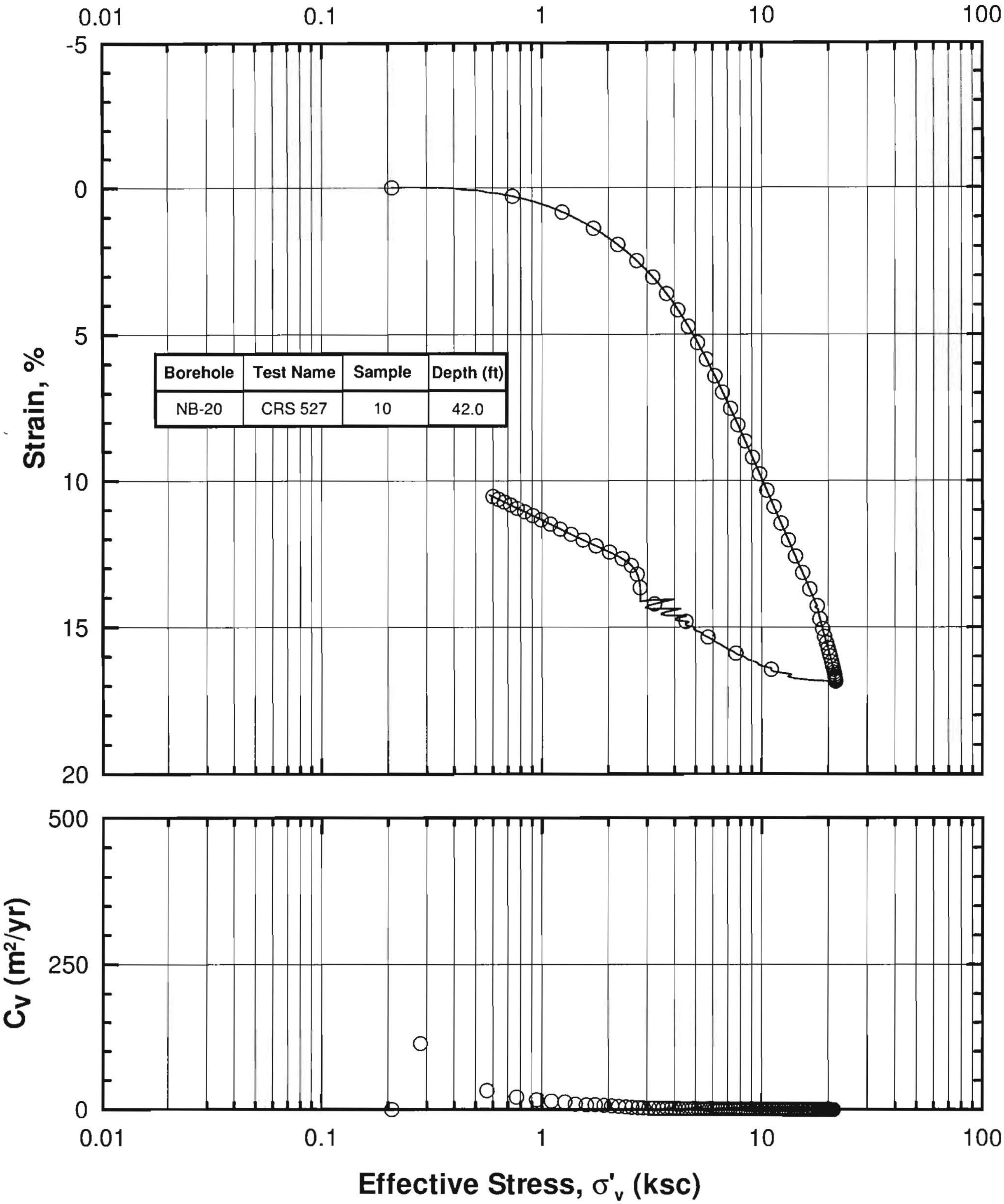
April 2003
28648793

San Jose, California

URS

FIGURE D-29

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 538.grf



Borehole	Test Name	Sample	Depth (ft)
NB-20	CRS 527	10	42.0

COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

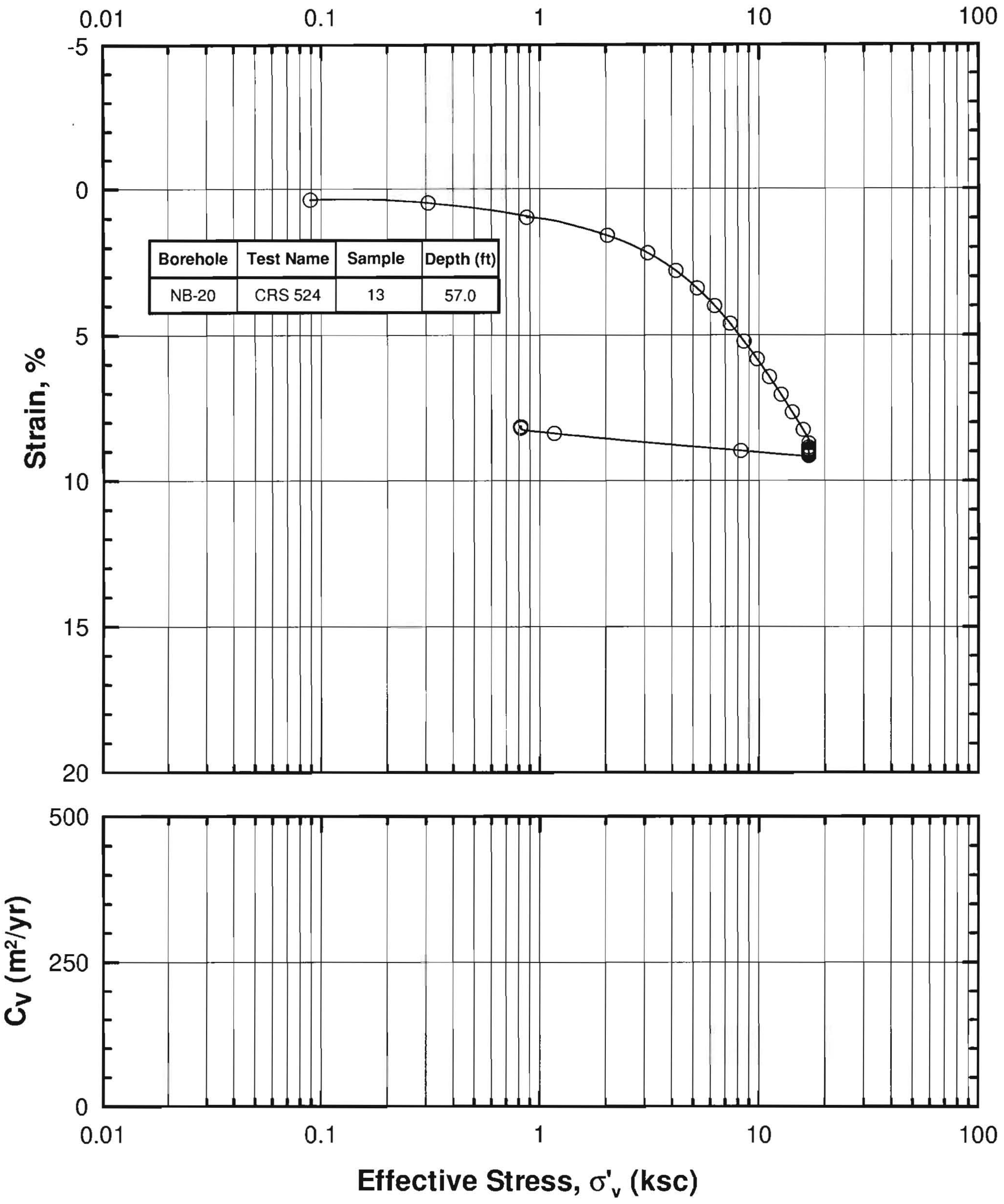
April 2003
28648793

San Jose, California

URS

FIGURE D-30

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 527.grf



Borehole	Test Name	Sample	Depth (ft)
NB-20	CRS 524	13	57.0

COMPRESSION CURVE FROM CONSTANT RATE OF STRAIN CONSOLIDATION TEST

Silicon Valley Rapid Transit Corridor

April 2003
28648793

San Jose, California

URS

FIGURE D-31

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\CRSC Tests\Grapher Files\CRSC 524.grf

UNCONSOLIDATED UNDRAINED COMPRESSION TESTS

UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

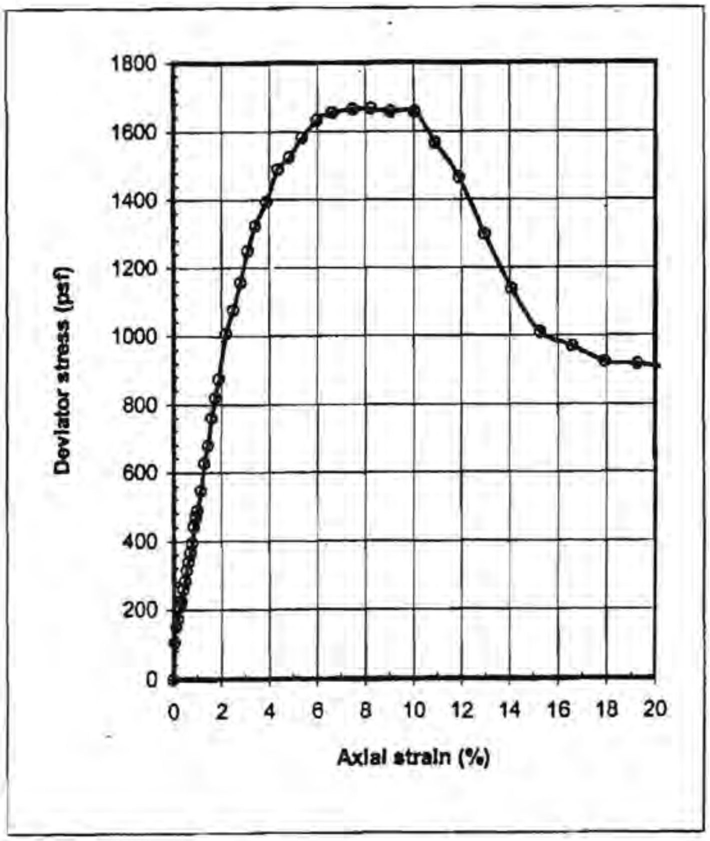
Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-07
Sample # : 3
Depth (ft) : 15
Date tested : 12/14/02
Soil : Dark brown sandy silt

Specimen:

Total wt. =	1353.3	gms
Ht. =	6.000	in
Ave dia. =	2.882	in
Area =	6.526	sq.in
Volume =	641.7	c.c.
Shearing rate =	0.04	inch/min
Shearing rate =	0.67	%/min
Gs (assumed) =	2.70	

Test Report:

Void ratio =	0.537	
Ht/Dia ratio =	2.08	
Moisture =	20.0	%
Total density =	131.6	pcf
Dry density =	109.6	pcf
Saturation =	100.8	%
Chamber pressure =	4000	psf
Max. deviator stress =	1666	psf
Strain @ failure =	8.26	%



Data Reduction:

Dial factor = 1.0 In/unit
Load factor = 1.0 lb/unit

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.000	-0.1	0.00	0.0
0.003	4.7	0.06	105.2
0.008	6.8	0.13	152.0
0.012	7.7	0.20	172.5
0.016	9.4	0.27	208.9
0.020	10.0	0.34	223.0
0.025	11.7	0.41	259.1
0.029	12.8	0.49	282.8
0.034	14.2	0.56	313.8
0.038	15.3	0.64	338.5
0.042	16.6	0.71	366.3
0.047	17.9	0.78	394.2
0.051	20.1	0.85	442.6
0.056	21.4	0.93	470.3
0.060	22.2	1.00	487.9
0.069	25.0	1.15	546.6
0.078	28.7	1.30	627.0
0.087	31.1	1.45	678.3
0.096	34.9	1.60	760.5
0.105	37.7	1.75	819.2
0.114	40.3	1.90	874.9
0.132	46.6	2.20	1007.2
0.151	49.9	2.51	1076.4
0.169	53.8	2.81	1155.8
0.187	58.3	3.12	1249.5
0.206	61.9	3.43	1322.2
0.234	65.6	3.90	1392.7
0.262	70.5	4.37	1489.2
0.290	72.5	4.83	1524.1
0.323	75.6	5.38	1581.1
0.360	78.6	6.00	1632.0
0.399	80.2	6.65	1653.8
0.449	81.4	7.49	1662.9
0.495	82.2	8.26	1665.7
0.544	82.5	9.06	1657.2
0.602	83.3	10.04	1656.2
0.656	79.6	10.93	1566.2
0.715	75.2	11.91	1464.7
0.778	67.4	12.96	1297.4
0.846	59.8	14.10	1134.9
0.917	53.9	15.29	1009.4
0.995	52.5	16.58	968.6
1.076	50.8	17.93	922.3
1.157	51.3	19.28	915.6
1.232	51.3	20.54	901.2
1.275	50.7	21.24	882.8
1.276	50.2	21.27	874.5
1.292	40.4	21.54	700.9

Signet Testing Labs

UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-07
Sample # : 8
Depth (ft) : 40
Date tested : 12/14/02
Soil : Dark gray silty clay

Specimen:

Total wt. =	870.5	gms
Ht. =	5.900	in
Ave dia. =	2.410	in
Area =	4.564	sq.in
Volume =	441.2	c.c.
Shearing rate =	0.06	inch/min
Shearing rate =	1	%/min
Gs (assumed) =	2.70	

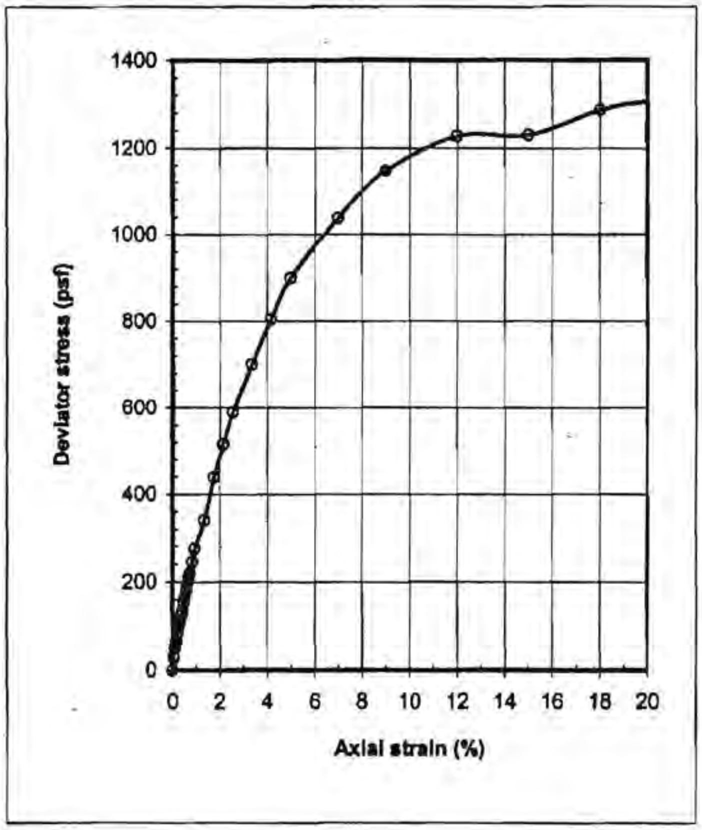
Test Report:

Void ratio =	0.731	
Ht/Dia ratio =	2.45	
Moisture =	26.5	%
Total density =	123.1	pcf
Dry density =	97.3	pcf
Saturation =	97.9	%
Chamber pressure =	9500	psf
Max. deviator stress =	1307	psf
Strain @ failure =	20.01	%

Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.003	27.9	0.00	0.0
0.006	28.9	0.05	29.5
0.009	29.5	0.11	50.3
0.012	30.0	0.15	63.8
0.015	30.6	0.21	83.9
0.018	31.0	0.26	95.9
0.021	31.4	0.31	109.4
0.025	31.9	0.37	123.9
0.028	32.2	0.42	134.1
0.031	32.8	0.47	152.6
0.033	33.2	0.51	165.6
0.037	33.6	0.57	178.4
0.040	34.2	0.62	196.0
0.043	34.6	0.68	208.2
0.046	34.9	0.73	219.0
0.052	35.8	0.83	245.1
0.058	36.7	0.93	274.6
0.083	38.9	1.36	339.9
0.107	42.1	1.77	438.4
0.130	44.6	2.16	514.8
0.155	47.1	2.57	588.8
0.202	50.9	3.37	700.2
0.249	54.5	4.17	804.1
0.297	57.9	4.99	899.2
0.415	63.3	6.99	1038.0
0.534	67.8	9.00	1146.2
0.711	72.1	12.01	1227.7
0.889	73.8	15.01	1229.8
1.066	77.7	18.02	1287.3
1.184	79.7	20.01	1306.9



UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-07
Sample # : 10
Depth (ft) : 53
Date tested : 12/14/02
Soil : Gray silty clay

Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

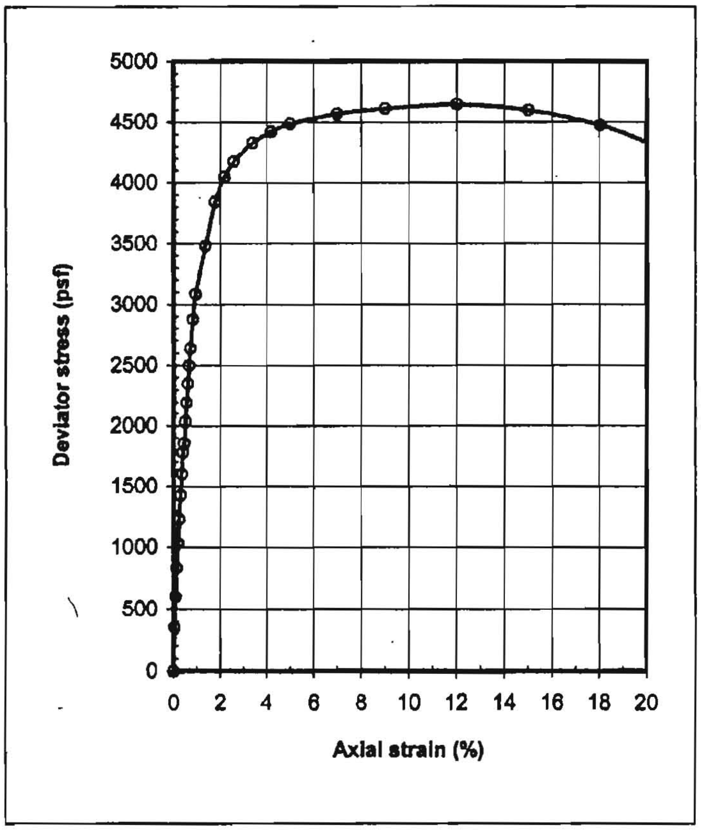
Specimen:

Total wt. = 884.5 gms
Ht. = 5.910 in
Ave dia. = 2.410 in
Area = 4.564 sq.in
Volume = 442.0 c.c.
Shearing rate = 0.06 inch/min
Shearing rate = 1 %/min
Gs (assumed) = 2.70

Test Report:

Void ratio = 0.703
Ht/Dia ratio = 2.45
Moisture = 26.2 %
Total density = 124.9 pcf
Dry density = 98.9 pcf
Saturation = 100.7 %
Chamber pressure = 13000 psf
Max. deviator stress = 4645 psf
Strain @ failure = 12.03 %

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.003	24.6	0.00	0.0
0.006	35.7	0.05	351.0
0.009	43.7	0.10	602.0
0.012	51.1	0.15	833.0
0.015	57.4	0.21	1032.6
0.018	63.8	0.26	1231.5
0.021	69.9	0.31	1425.5
0.025	75.4	0.37	1597.9
0.027	81.3	0.41	1779.9
0.030	83.7	0.47	1855.7
0.034	89.4	0.52	2032.4
0.037	94.6	0.57	2195.5
0.040	99.6	0.63	2351.5
0.043	104.3	0.68	2498.7
0.046	108.8	0.73	2636.9
0.052	116.4	0.83	2873.5
0.058	123.3	0.94	3083.3
0.084	136.4	1.37	3480.2
0.108	148.5	1.77	3840.2
0.132	155.7	2.18	4045.2
0.156	160.5	2.58	4176.2
0.203	166.5	3.39	4326.5
0.251	170.9	4.20	4422.7
0.299	174.3	5.01	4487.1
0.417	180.3	7.01	4567.2
0.536	185.2	9.02	4611.1
0.714	191.9	12.03	4644.9
0.892	196.0	15.04	4594.5
1.070	197.6	18.05	4473.9
1.187	196.2	20.04	4328.7



UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-07
Sample # : 12
Depth (ft) : 64
Date tested : 12/13/02
Soil : Olive brown silty clay

Specimen:

Total wt. = 883.8 gms
Ht. = 5.700 in
Ave dia. = 2.410 in
Area = 4.564 sq.in
Volume = 426.3 c.c.
Shearing rate = 0.06 inch/min
Shearing rate = 1 %/min
Gs (assumed) = 2.70

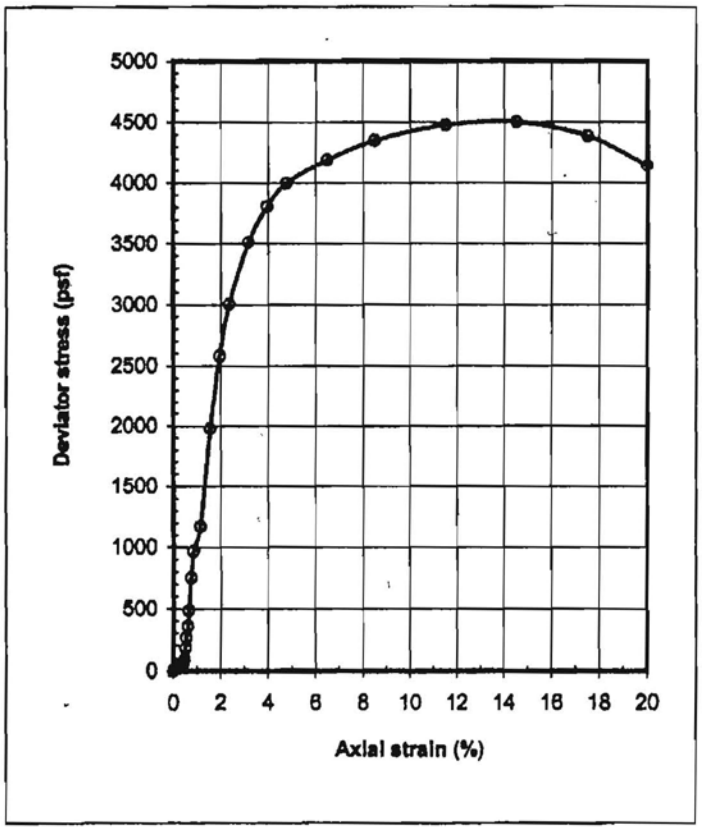
Test Report:

Void ratio = 0.602
Ht/Dia ratio = 2.37
Moisture = 23.0 %
Total density = 129.4 pcf
Dry density = 105.2 pcf
Saturation = 103.3 %
Chamber pressure = 15000 psf
Max. deviator stress = 4501 psf
Strain @ failure = 14.52 %

Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.003	-19.8	0.00	0.0
0.006	-19.0	0.05	23.3
0.008	-18.7	0.10	34.1
0.012	-18.9	0.15	27.9
0.012	-18.8	0.16	30.1
0.015	-19.0	0.21	25.5
0.018	-18.7	0.26	34.6
0.021	-18.5	0.32	40.0
0.023	-18.5	0.36	39.5
0.026	-18.0	0.41	55.2
0.029	-16.9	0.47	90.4
0.033	-14.0	0.52	181.2
0.035	-11.3	0.56	265.7
0.038	-8.4	0.62	355.2
0.041	-4.3	0.66	484.3
0.046	4.2	0.76	751.8
0.052	11.1	0.86	967.0
0.069	17.8	1.17	1172.5
0.092	44.0	1.57	1979.8
0.115	63.6	1.97	2578.3
0.138	77.8	2.37	3004.5
0.184	95.1	3.17	3509.7
0.229	105.8	3.97	3805.8
0.275	113.2	4.78	3994.9
0.373	122.2	6.49	4189.2
0.487	130.9	8.50	4350.3
0.659	140.6	11.51	4476.6
0.831	147.1	14.52	4501.5
1.001	148.7	17.52	4384.7
1.143	144.2	20.00	4139.0



Signet Testing Labs

Figure D-35

UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-13
Sample # : 5
Depth (ft) : 20
Date tested : 12/14/02
Soil : Brown sandy clay with silt

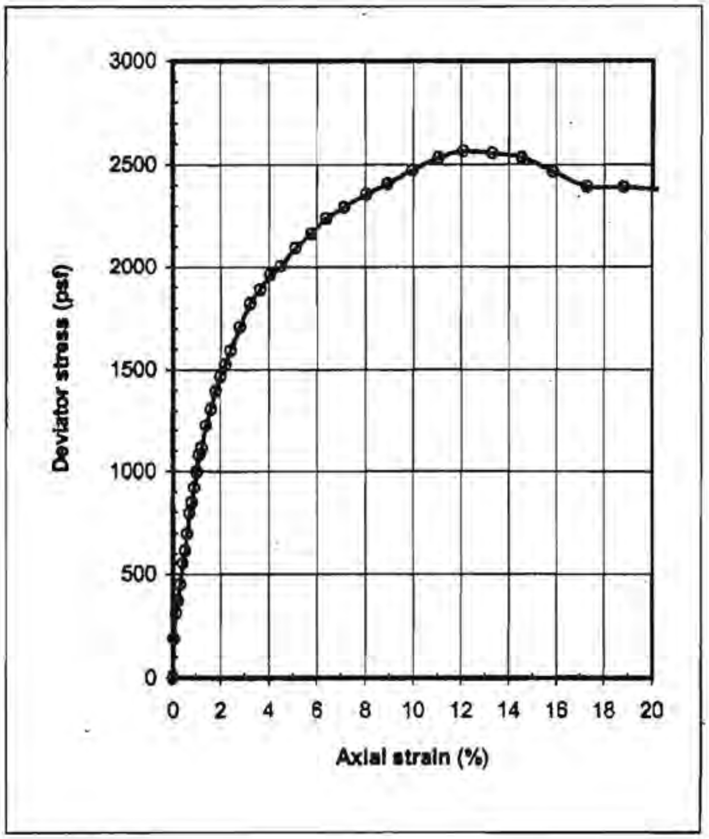
Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 884.8 gms
Ht. = 5.520 in
Ave dia. = 2.410 in
Area = 4.564 sq.in
Volume = 412.8 c.c.
Shearing rate = 0.05 inch/min
Shearing rate = 0.91 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 0.495
Ht/Dia ratio = 2.29
Moisture = 18.7 %
Total density = 133.7 pcf
Dry density = 112.7 pcf
Saturation = 101.9 %
Chamber pressure = 5000 psf
Max. deviator stress = 2563 psf
Strain @ failure = 12.09 %

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.000	-0.2	0.00	0.0
0.000	0.0	0.00	6.8
0.003	5.9	0.05	190.3
0.008	9.7	0.14	311.4
0.013	11.6	0.23	370.5
0.018	14.2	0.33	451.0
0.024	17.5	0.43	555.0
0.029	19.5	0.52	616.6
0.034	22.1	0.62	698.9
0.040	25.3	0.72	796.5
0.045	26.9	0.82	848.6
0.051	29.4	0.92	922.9
0.056	31.7	1.02	995.6
0.062	34.4	1.12	1079.9
0.067	35.6	1.22	1113.7
0.078	39.2	1.41	1224.9
0.089	41.9	1.61	1307.3
0.100	44.9	1.82	1395.2
0.112	47.3	2.02	1466.3
0.123	49.2	2.22	1522.6
0.134	51.5	2.43	1591.7
0.156	55.5	2.83	1707.3
0.179	59.4	3.24	1819.8
0.202	61.9	3.66	1887.7
0.225	64.6	4.08	1961.5
0.248	66.3	4.50	2002.0
0.283	69.8	5.13	2083.4
0.319	72.5	5.77	2161.5
0.354	75.5	6.40	2235.5
0.395	78.0	7.15	2291.5
0.445	81.0	8.06	2353.6
0.493	83.5	8.93	2405.5
0.551	86.9	9.98	2472.5
0.611	90.1	11.07	2532.8
0.668	92.2	12.09	2563.1
0.735	93.2	13.32	2552.4
0.803	93.8	14.54	2533.8
0.876	92.7	15.87	2465.1
0.955	91.5	17.29	2392.4
1.039	93.2	18.81	2391.2
1.130	94.6	20.46	2378.3
1.224	96.6	22.17	2377.0
1.255	82.7	22.73	2020.9



Signet Testing Labs

Figure D-38

UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

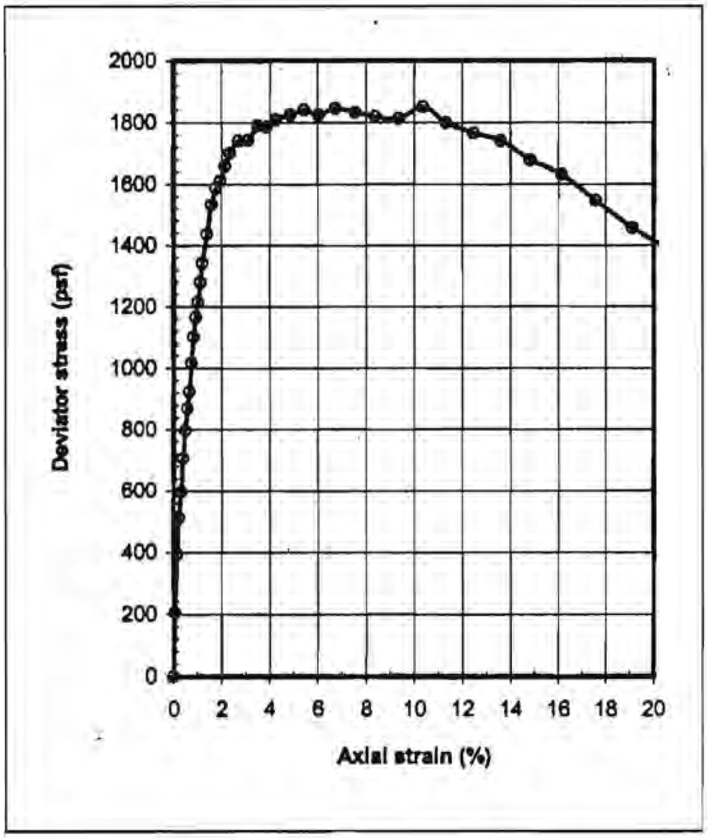
Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-13
Sample # : 7
Depth (ft) : 30
Date tested : 12/14/02
Soil : Dark gray silty clay

Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:	Total wt. =	848.5	gms
	Ht. =	5.950	in
	Ave dia. =	2.420	in
	Area =	4.601	sq.in
	Volume =	448.7	c.c.
	Shearing rate =	0.05	inch/min
	Shearing rate =	0.84	%/min
	Gs (assumed) =	2.70	

Test Report:	Void ratio =	0.925	
	Ht/Dia ratio =	2.46	
	Moisture =	34.8	%
	Total density =	118.0	pcf
	Dry density =	87.5	pcf
	Saturation =	101.7	%
	Chamber pressure =	7500	psf
	Max. deviator stress =	1849	psf
	Strain @ failure =	10.39	%



Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.000	0.1	0.00	0.0
0.004	6.6	0.06	205.4
0.009	12.7	0.15	394.1
0.014	16.5	0.24	512.6
0.019	19.2	0.33	596.7
0.024	22.7	0.41	706.1
0.030	25.7	0.51	796.5
0.035	28.1	0.59	871.3
0.040	29.8	0.68	924.9
0.046	32.8	0.77	1016.3
0.051	35.6	0.86	1102.8
0.056	37.7	0.95	1166.7
0.062	39.3	1.04	1214.3
0.067	41.4	1.13	1279.1
0.073	43.5	1.23	1341.3
0.084	46.7	1.41	1436.9
0.095	49.8	1.60	1532.6
0.106	51.7	1.78	1587.5
0.117	52.6	1.97	1611.2
0.128	54.3	2.16	1658.9
0.140	55.7	2.35	1700.7
0.162	57.3	2.73	1741.4
0.185	57.6	3.11	1743.4
0.208	59.4	3.50	1790.1
0.231	59.5	3.88	1786.3
0.254	60.5	4.28	1809.8
0.290	61.4	4.87	1824.7
0.324	62.3	5.45	1840.6
0.359	62.2	6.03	1825.7
0.400	63.3	6.73	1845.2
0.450	63.4	7.56	1832.2
0.499	63.5	8.39	1819.4
0.557	63.9	9.37	1811.4
0.618	66.0	10.39	1849.4
0.675	64.9	11.34	1799.4
0.742	64.5	12.47	1765.3
0.810	64.5	13.61	1741.5
0.883	63.1	14.83	1678.4
0.961	62.2	16.14	1630.7
1.046	60.0	17.57	1545.1
1.137	57.6	19.11	1455.3
1.232	55.7	20.71	1379.4
1.303	52.6	21.90	1283.3
1.316	45.5	22.12	1107.2

UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-13
Sample # : 11
Depth (ft) : 51
Date tested : 12/13/02
Soil : Dark gray silty clay with sand

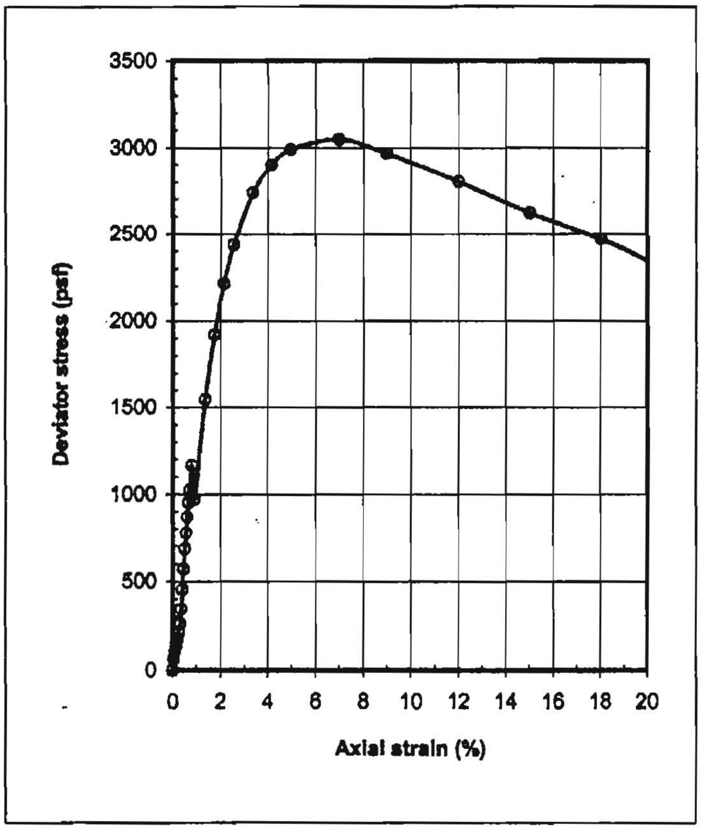
Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 887.7 gms
Ht. = 5.800 in
Ave dia. = 2.410 in
Area = 4.564 sq.in
Volume = 433.7 c.c.
Shearing rate = 0.06 inch/min
Shearing rate = 1 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 0.624
Ht/Dia ratio = 2.41
Moisture = 23.1 %
Total density = 127.7 pcf
Dry density = 103.7 pcf
Saturation = 100.0 %
Chamber pressure = 12000 psf
Max. deviator stress = 3048 psf
Strain @ failure = 6.99 %

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.003	22.7	0.00	0.0
0.006	24.7	0.05	62.8
0.009	26.0	0.11	105.5
0.012	27.1	0.15	137.6
0.015	28.2	0.21	174.2
0.018	29.5	0.26	212.6
0.021	31.0	0.30	261.4
0.024	33.6	0.36	342.5
0.026	37.2	0.40	454.2
0.030	40.8	0.46	570.1
0.032	44.5	0.50	685.0
0.036	47.4	0.56	774.5
0.039	50.4	0.62	868.1
0.041	53.0	0.66	949.8
0.045	55.4	0.72	1024.1
0.050	59.9	0.82	1163.8
0.056	53.7	0.92	970.1
0.082	72.4	1.36	1545.9
0.105	84.6	1.76	1920.1
0.128	94.4	2.16	2214.7
0.152	102.0	2.56	2438.2
0.198	112.5	3.36	2738.8
0.245	118.5	4.16	2898.1
0.291	122.4	4.97	2989.5
0.409	126.5	6.99	3047.6
0.525	126.0	9.00	2965.7
0.699	123.6	12.01	2800.8
0.874	120.4	15.02	2620.7
1.049	118.2	18.03	2469.2
1.164	115.6	20.01	2344.2



Signet Testing Labs

Figure D–38

UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-13
Sample # : 14
Depth (ft) : 65
Date tested : 12/14/02
Soil : Dark gray silty clay

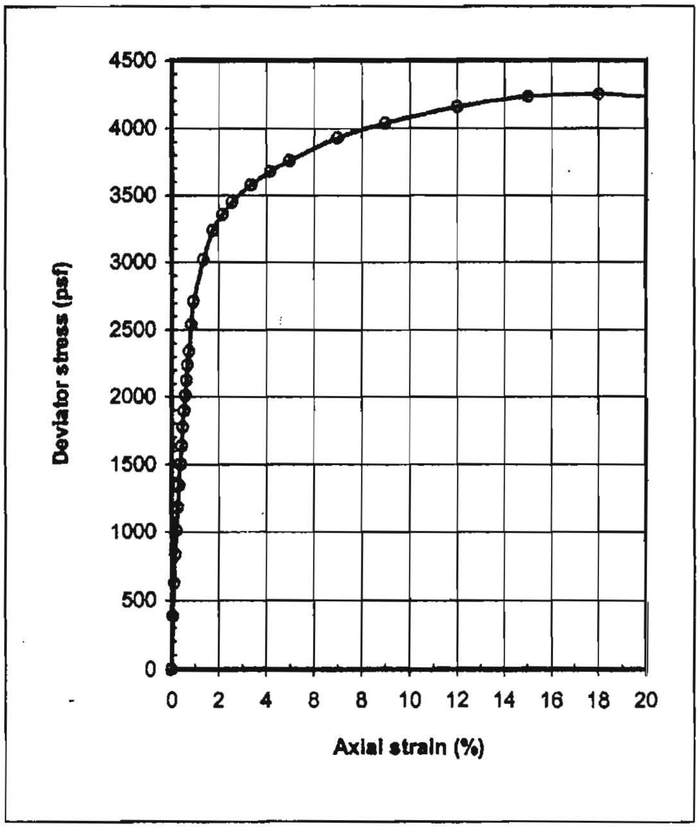
Specimen:
Total wt. = 920.9 gms
Ht. = 5.910 in
Ave dia. = 2.425 in
Area = 4.620 sq.in
Volume = 447.5 c.c.
Shearing rate = 0.06 inch/min
Shearing rate = 1 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 0.595
Ht/Dia ratio = 2.44
Moisture = 21.6 %
Total density = 128.4 pcf
Dry density = 105.6 pcf
Saturation = 98.0 %
Chamber pressure = 16000 psf
Max. deviator stress = 4251 psf
Strain @ failure = 18.03 %

Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.003	29.5	0.00	0.0
0.006	41.8	0.05	383.2
0.009	49.6	0.10	626.5
0.012	56.2	0.15	832.0
0.015	82.0	0.21	1010.6
0.018	67.6	0.26	1184.7
0.021	72.8	0.31	1345.9
0.024	77.8	0.37	1499.9
0.028	82.3	0.42	1637.3
0.030	86.7	0.46	1773.4
0.034	90.6	0.52	1895.6
0.037	94.3	0.57	2007.7
0.040	98.2	0.63	2127.1
0.042	101.8	0.67	2238.9
0.046	105.1	0.72	2339.9
0.052	111.6	0.83	2536.1
0.058	117.3	0.94	2711.9
0.083	127.7	1.36	3017.7
0.107	135.3	1.76	3238.6
0.131	139.5	2.17	3355.3
0.154	143.1	2.56	3448.6
0.202	148.2	3.37	3576.1
0.249	152.6	4.17	3676.8
0.297	156.5	4.98	3761.2
0.416	165.0	7.00	3928.5
0.535	171.8	9.00	4034.8
0.713	181.1	12.01	4156.4
0.891	189.3	15.02	4231.3
1.068	195.9	18.03	4250.8
1.186	199.1	20.02	4226.7



Signet Testing Labs

Figure D-39

UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-13
Sample # : 16
Depth (ft) : 75
Date tested : 12/14/02
Soil : Olive gray silty clay

Specimen:
Total wt. = 835.8 gms
Ht. = 5.530 in
Ave dia. = 2.413 in
Area = 4.576 sq.in
Volume = 414.7 c.c.
Shearing rate = 0.06 inch/min
Shearing rate = 1 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 0.705
Ht/Dia ratio = 2.29
Moisture = 27.3 %
Total density = 125.8 pcf
Dry density = 98.8 pcf
Saturation = 104.4 %
Chamber pressure = 18000 psf
Max. deviator stress = 3643 psf
Strain @ failure = 19.99 %

Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.003	59.4	0.00	0.0
0.006	65.0	0.05	177.6
0.008	68.0	0.10	270.0
0.011	71.3	0.16	375.0
0.014	74.1	0.21	462.0
0.017	76.8	0.26	546.3
0.020	79.7	0.31	638.7
0.022	82.1	0.36	712.7
0.025	84.7	0.41	795.4
0.028	87.5	0.46	882.2
0.031	89.9	0.51	954.9
0.034	92.1	0.56	1024.4
0.036	94.5	0.61	1099.6
0.039	96.9	0.66	1173.7
0.042	99.0	0.71	1238.2
0.047	103.2	0.81	1368.5
0.053	107.3	0.91	1493.5
0.067	111.1	1.17	1610.1
0.089	123.6	1.55	1988.8
0.111	132.2	1.97	2246.1
0.134	139.0	2.37	2447.6
0.178	147.7	3.18	2692.8
0.223	154.3	3.98	2867.9
0.268	159.3	4.79	2992.8
0.362	166.7	6.50	3156.9
0.474	175.3	8.52	3337.7
0.640	184.9	11.53	3495.7
0.807	192.2	14.55	3571.9
0.973	198.6	17.55	3613.5
1.108	204.1	19.99	3642.8

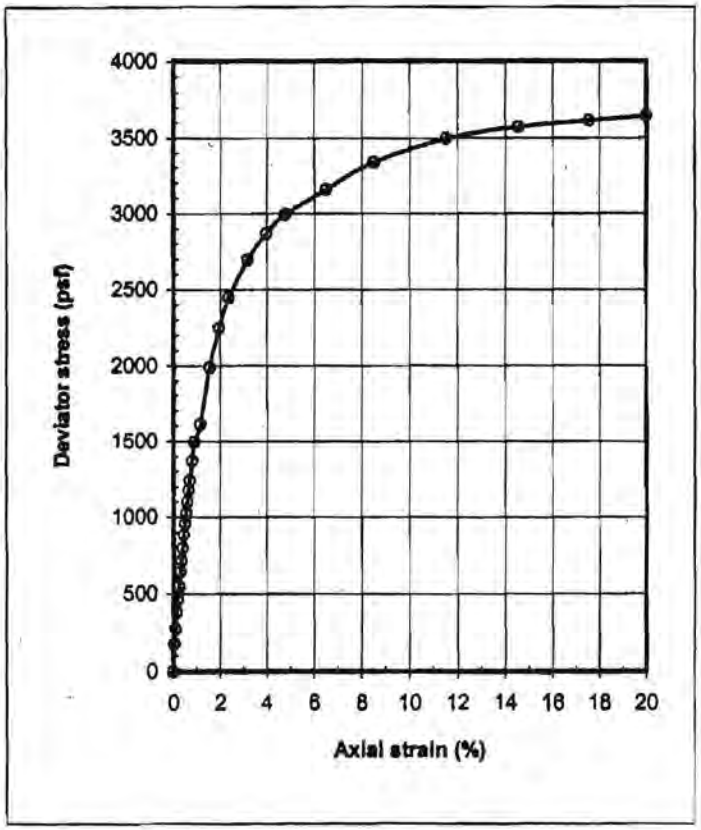


Figure D-40

UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-13
Sample # : 18
Depth (ft) : 86
Date tested : 12/13/02
Soil : Dark gray silty clay

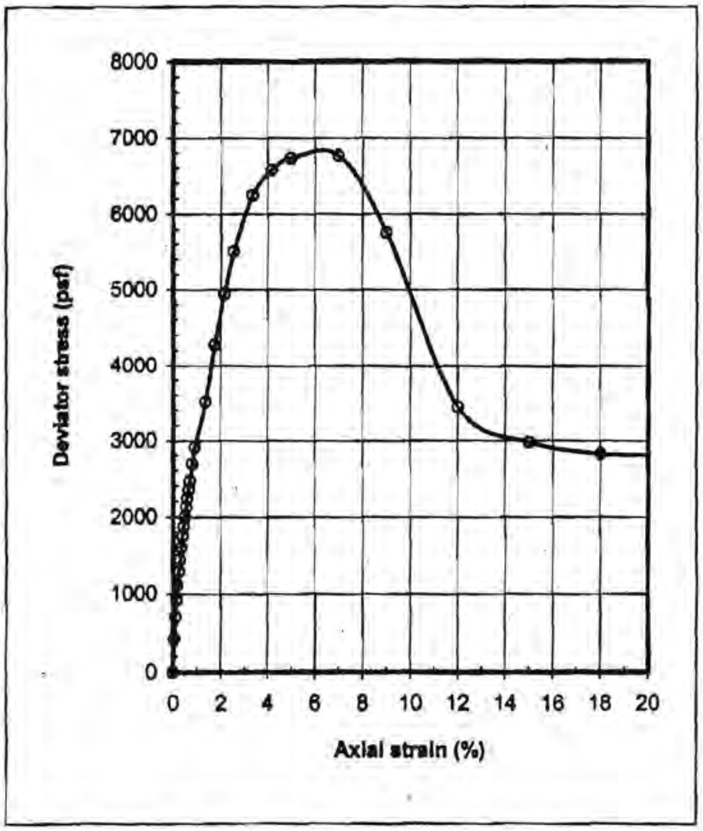
Specimen:
Total wt. = 906.4 gms
Ht. = 6.000 in
Ave dia. = 2.414 in
Area = 4.579 sq.in
Volume = 450.2 c.c.
Shearing rate = 0.06 inch/min
Shearing rate = 1 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 0.749
Ht/Dia ratio = 2.49
Moisture = 30.4 %
Total density = 125.6 pcf
Dry density = 96.3 pcf
Saturation = 109.6 %
Chamber pressure = 20500 psf
Max. deviator stress = 6766 psf
Strain @ failure = 7.00 %

Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.003	38.8	0.00	0.0
0.006	52.0	0.05	415.4
0.009	61.1	0.10	700.9
0.012	68.0	0.15	918.2
0.015	74.2	0.20	1111.4
0.018	79.8	0.25	1285.8
0.022	84.8	0.31	1443.3
0.025	89.7	0.36	1597.2
0.027	94.5	0.40	1745.1
0.031	98.8	0.46	1880.0
0.033	102.7	0.50	1999.4
0.037	106.7	0.56	2124.4
0.040	110.3	0.61	2235.4
0.043	114.0	0.66	2350.8
0.046	117.6	0.72	2462.9
0.052	125.0	0.82	2688.9
0.058	132.1	0.92	2908.1
0.085	151.7	1.36	3502.1
0.109	176.9	1.76	4268.1
0.133	199.4	2.16	4943.0
0.157	218.3	2.56	5502.3
0.205	244.2	3.36	6242.5
0.253	257.0	4.17	6577.9
0.302	263.9	4.98	6727.4
0.423	270.1	7.00	6766.3
0.544	239.8	9.01	5751.4
0.724	163.0	12.02	3438.4
0.905	150.2	15.03	2979.0
1.086	148.3	18.04	2823.8
1.205	150.7	20.02	2815.2



Signet Testing Labs

Figure D-41

UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

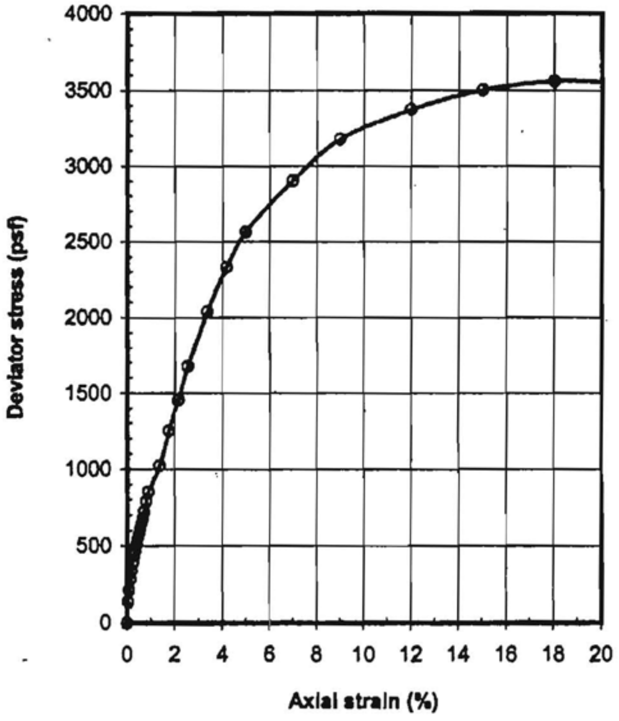
Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-16
Sample # : 3
Depth (ft) : 48
Date tested : 12/14/02
Soil : Brown silty clay

Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 795.4 gms
Ht. = 5.290 in
Ave dia. = 2.425 in
Area = 4.620 sq.in
Volume = 400.5 c.c.
Shearing rate = 0.05 inch/min
Shearing rate = 1 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 0.692
Ht/Dia ratio = 2.18
Moisture = 24.4 %
Total density = 123.9 pcf
Dry density = 99.6 pcf
Saturation = 95.4 %
Chamber pressure = 11500 psf
Max. deviator stress = 3559 psf
Strain @ failure = 18.03 %



Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.003	22.5	0.00	0.0
0.005	26.8	0.05	136.3
0.008	29.2	0.10	210.4
0.011	31.5	0.15	281.3
0.013	33.2	0.21	335.7
0.016	35.0	0.26	390.7
0.019	36.4	0.30	434.2
0.021	37.5	0.36	467.1
0.024	38.8	0.41	507.0
0.027	40.1	0.45	546.1
0.030	41.0	0.51	574.0
0.032	42.2	0.56	611.8
0.035	43.2	0.61	641.7
0.038	44.2	0.66	673.6
0.040	45.6	0.72	717.3
0.046	47.9	0.82	786.5
0.051	50.0	0.91	851.0
0.075	55.6	1.36	1020.2
0.096	63.2	1.76	1248.8
0.117	70.1	2.16	1454.2
0.138	77.6	2.56	1674.2
0.181	90.1	3.37	2036.8
0.223	100.5	4.17	2329.6
0.266	109.0	4.99	2562.8
0.373	122.5	6.99	2901.1
0.479	134.3	9.00	3173.2
0.638	145.5	12.01	3375.1
0.797	154.7	15.02	3502.1
0.956	161.8	18.03	3559.0
1.061	165.0	20.01	3553.1

Signet Testing Labs

UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-19
Sample # : 10
Depth (ft) : 57
Date tested : 12/14/02
Soil : Gray brown silty clay

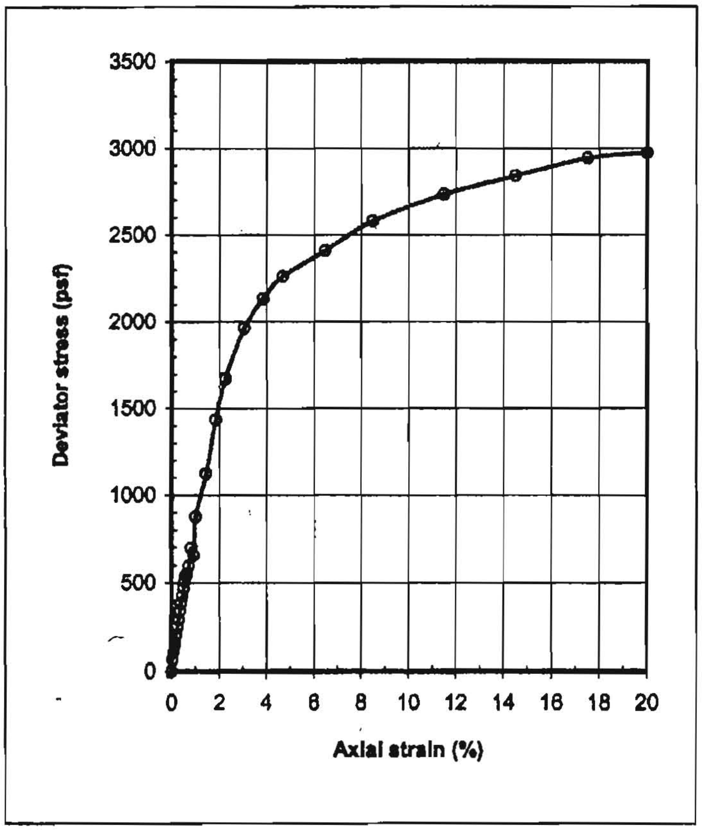
Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 1234.5 gms
Ht. = 6.000 in
Ave dia. = 2.880 in
Area = 6.517 sq.in
Volume = 640.8 c.c.
Shearing rate = 0.06 inch/min
Shearing rate = 1 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 0.845
Ht/Dia ratio = 2.08
Moisture = 31.6 %
Total density = 120.2 pcf
Dry density = 91.3 pcf
Saturation = 101.1 %
Chamber pressure = 14000 psf
Max. deviator stress = 2972 psf
Strain @ failure = 20.00 %

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.003	33.4	0.00	0.0
0.006	36.3	0.05	63.8
0.009	38.3	0.11	107.3
0.012	40.4	0.15	153.7
0.015	42.6	0.21	203.0
0.018	44.6	0.26	245.7
0.022	46.6	0.31	289.2
0.025	48.8	0.37	338.4
0.027	51.0	0.41	385.6
0.031	52.8	0.46	426.3
0.034	54.8	0.52	470.2
0.036	56.8	0.56	512.3
0.040	58.2	0.62	544.7
0.043	58.4	0.67	546.8
0.046	60.5	0.72	594.3
0.053	65.2	0.83	696.3
0.059	63.5	0.93	657.5
0.064	73.5	1.03	875.7
0.090	85.0	1.46	1122.8
0.115	99.7	1.86	1436.2
0.138	111.0	2.26	1675.0
0.187	125.1	3.07	1963.0
0.235	133.9	3.87	2134.7
0.284	140.7	4.68	2260.1
0.392	150.0	6.48	2408.0
0.512	161.0	8.49	2579.2
0.693	173.2	11.50	2732.5
0.874	183.7	14.51	2837.4
1.054	194.9	17.52	2942.4
1.203	201.6	20.00	2971.8



UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-19
Sample # : 12
Depth (ft) : 67
Date tested : 12/14/02
Soil : Dark gray silty clay

Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 896.3 gms
Ht. = 5.810 in
Ave dia. = 2.415 in
Area = 4.582 sq.in
Volume = 436.3 c.c.
Shearing rate = 0.06 inch/min
Shearing rate = 1 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 0.603
Ht/Dia ratio = 2.41
Moisture = 22.0 %
Total density = 128.2 pcf
Dry density = 105.1 pcf
Saturation = 98.4 %
Chamber pressure = 16000 psf
Max. deviator stress = 5345 psf
Strain @ failure = 19.96 %

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.003	28.9	0.00	0.0
0.006	34.9	0.05	188.1
0.008	38.8	0.10	312.1
0.012	42.1	0.15	415.1
0.015	45.5	0.21	519.9
0.018	48.1	0.26	602.4
0.020	50.7	0.30	684.8
0.024	53.2	0.36	760.2
0.027	55.5	0.41	832.7
0.030	57.5	0.46	896.4
0.032	60.0	0.51	972.9
0.035	62.1	0.56	1039.4
0.039	64.4	0.62	1108.5
0.041	66.4	0.66	1172.9
0.044	68.1	0.71	1223.5
0.050	71.9	0.82	1342.5
0.056	75.7	0.92	1458.8
0.062	79.4	1.03	1570.7
0.087	89.1	1.45	1864.4
0.111	101.0	1.86	2223.6
0.134	111.4	2.27	2535.6
0.181	128.9	3.08	3045.3
0.229	143.1	3.88	3449.7
0.276	154.0	4.69	3746.3
0.381	170.6	6.51	4163.7
0.497	186.8	8.51	4541.0
0.672	204.7	11.52	4888.2
0.847	219.5	14.53	5119.2
1.021	231.4	17.53	5247.4
1.162	241.4	19.96	5344.9

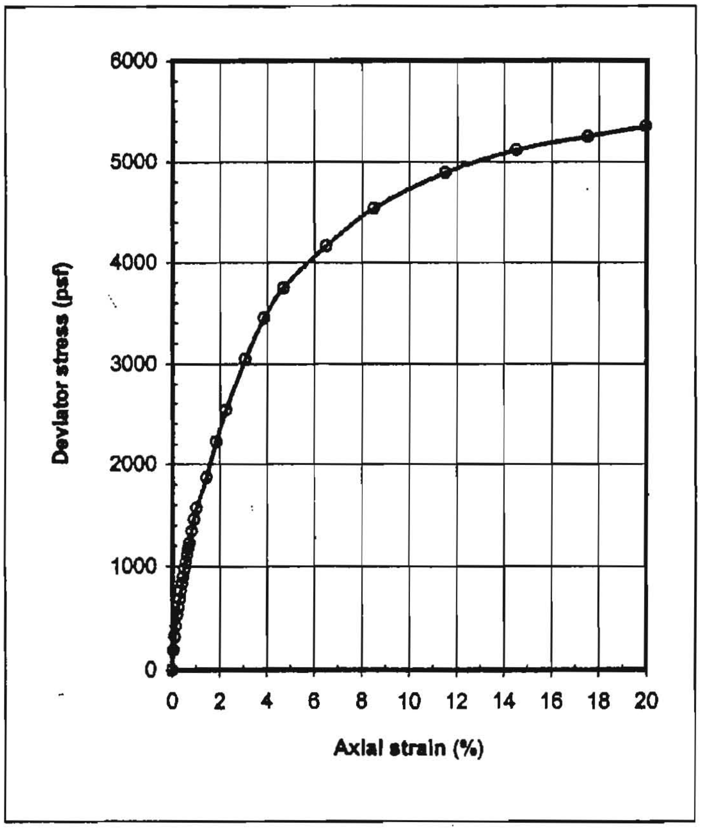


Figure D-44

UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-20
Sample # : 4
Depth (ft) : 17
Date tested : 12/13/02
Soil : Dark gray silty clay

Data Reduction:

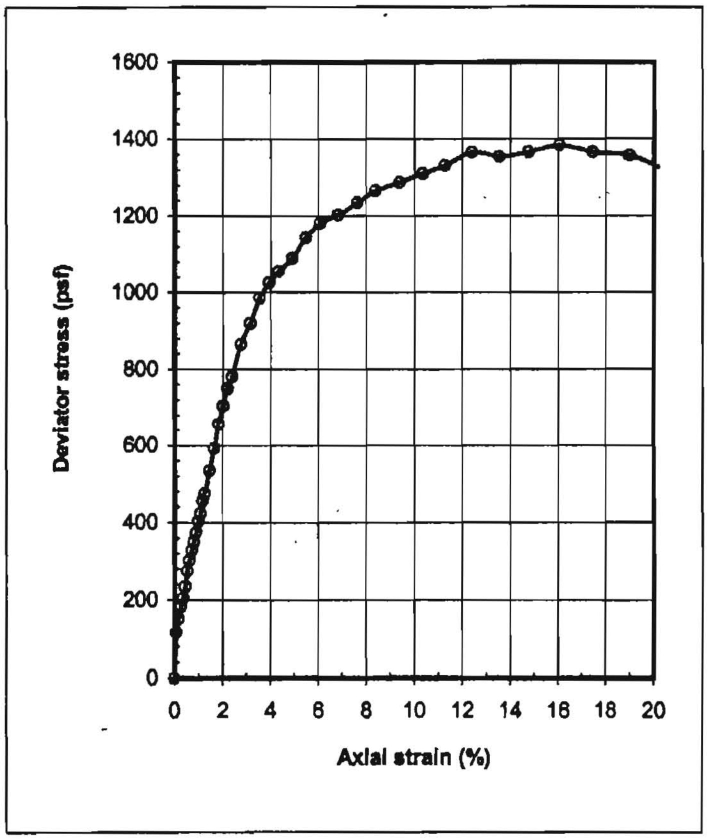
Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:

Specimen:	Total wt. =	1151.5	gms
	Ht. =	6.000	in
	Ave dia. =	2.875	in
	Area =	6.494	sq.in
	Volume =	638.5	c.c.
	Shearing rate =	0.05	inch/min
	Shearing rate =	0.83	%/min
	Gs (assumed) =	2.70	

Test Report:

Void ratio = 1.120
Ht/Dia ratio = 2.09
Moisture = 41.6 %
Total density = 112.5 pcf
Dry density = 79.5 pcf
Saturation = 100.3 %
Chamber pressure = 2200 psf
Max. deviator stress = 1383 psf
Strain @ failure = 16.06 %



Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.000	-0.1	0.00	0.0
0.004	5.1	0.07	116.9
0.010	6.7	0.17	150.8
0.015	8.1	0.26	182.5
0.021	9.1	0.35	204.3
0.026	10.5	0.44	234.7
0.032	12.3	0.53	275.0
0.037	13.6	0.62	302.3
0.043	14.8	0.71	328.6
0.048	15.8	0.81	350.7
0.054	16.9	0.90	374.6
0.060	18.2	0.99	403.5
0.065	19.1	1.09	422.7
0.071	20.6	1.18	455.0
0.076	21.5	1.26	474.7
0.087	24.3	1.46	534.2
0.099	27.0	1.65	592.8
0.110	30.0	1.84	655.4
0.121	32.3	2.02	704.8
0.133	34.4	2.21	749.7
0.144	35.9	2.41	779.6
0.167	39.9	2.79	863.8
0.190	42.7	3.17	918.9
0.213	45.9	3.55	984.8
0.237	48.0	3.95	1024.7
0.260	49.6	4.33	1054.4
0.295	51.5	4.91	1088.6
0.330	54.4	5.49	1142.9
0.365	56.5	6.08	1179.9
0.409	58.0	6.82	1201.2
0.458	60.1	7.63	1234.0
0.504	62.2	8.39	1265.8
0.564	63.9	9.40	1287.0
0.622	65.6	10.37	1309.6
0.677	67.5	11.29	1330.1
0.745	70.1	12.42	1364.3
0.813	70.5	13.55	1353.6
0.886	72.1	14.77	1365.0
0.964	74.1	16.06	1382.7
1.049	74.5	17.48	1365.0
1.139	75.4	18.99	1356.6
1.226	74.8	20.44	1322.5
1.275	76.1	21.24	1331.6
1.286	66.6	21.44	1161.9

Signet Testing Labs

UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-20
Sample # : 13
Depth (ft) : 57
Date tested : 12/13/02
Soil : Gray brown silty clay

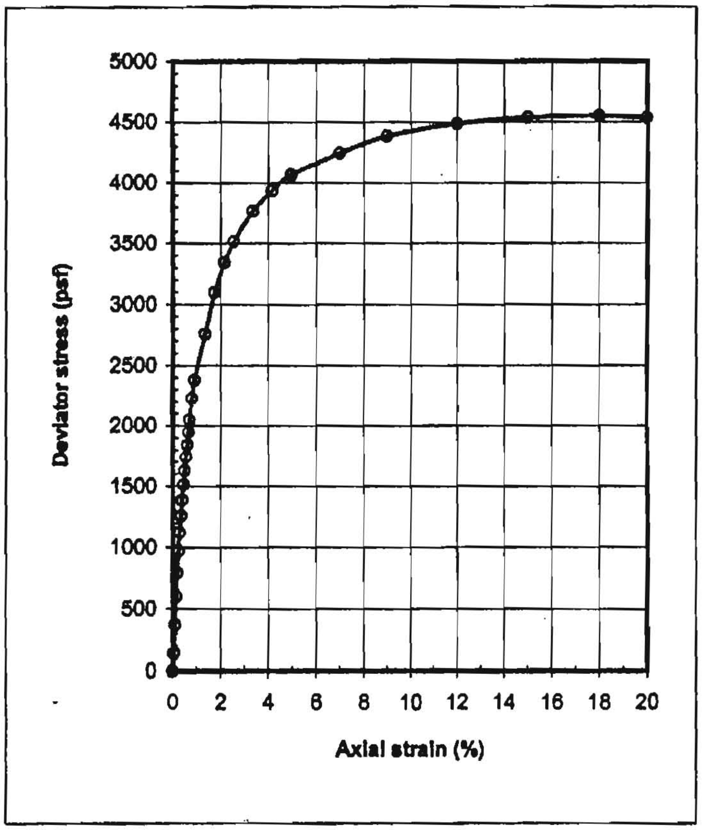
Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:	Total wt. =	1261.6	gms
	Ht. =	6.000	in
	Ave dia. =	2.870	in
	Area =	6.472	sq.in
	Volume =	636.3	c.c.
	Shearing rate =	0.06	inch/min
	Shearing rate =	1	%/min
	Gs (assumed) =	2.70	

Test Report:	Void ratio =	0.743	
	Ht/Dia ratio =	2.09	
	Moisture =	28.0	%
	Total density =	123.7	pcf
	Dry density =	96.7	pcf
	Saturation =	101.7	%
	Chamber pressure =	14000	psf
	Max. deviator stress =	4552	psf
	Strain @ failure =	18.01	%

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.003	28.7	0.00	0.0
0.006	35.1	0.05	140.9
0.009	45.3	0.10	369.1
0.012	55.9	0.15	604.1
0.015	64.6	0.20	796.5
0.018	72.5	0.25	971.5
0.021	79.3	0.30	1122.9
0.024	85.6	0.35	1259.9
0.027	91.3	0.40	1387.8
0.030	97.0	0.45	1512.2
0.033	102.2	0.50	1627.7
0.036	107.5	0.56	1744.0
0.040	112.1	0.61	1843.2
0.043	116.7	0.66	1944.6
0.045	121.4	0.71	2048.4
0.051	129.6	0.81	2227.1
0.058	136.7	0.92	2380.1
0.085	154.3	1.36	2755.3
0.109	170.5	1.76	3099.4
0.133	182.3	2.16	3342.7
0.157	190.9	2.57	3515.0
0.205	204.0	3.37	3768.7
0.253	213.2	4.17	3934.0
0.301	220.9	4.97	4062.8
0.423	233.9	6.99	4246.3
0.543	245.3	9.00	4385.4
0.723	257.8	12.00	4485.4
0.904	268.7	15.01	4538.9
1.084	278.2	18.01	4551.7
1.202	283.3	19.98	4532.6



UNCONSOLIDATED UNDRAINED COMPRESSION TEST - ASTM D2850

Client : URS
Project : Silicon Valley Rapid Transit Corridor, San Jose, CA
Job # : 28648790.02512
Boring # NB-20
Sample # : 14
Depth (ft) : 65
Date tested : 12/14/02
Soil : Dark gray silty clay

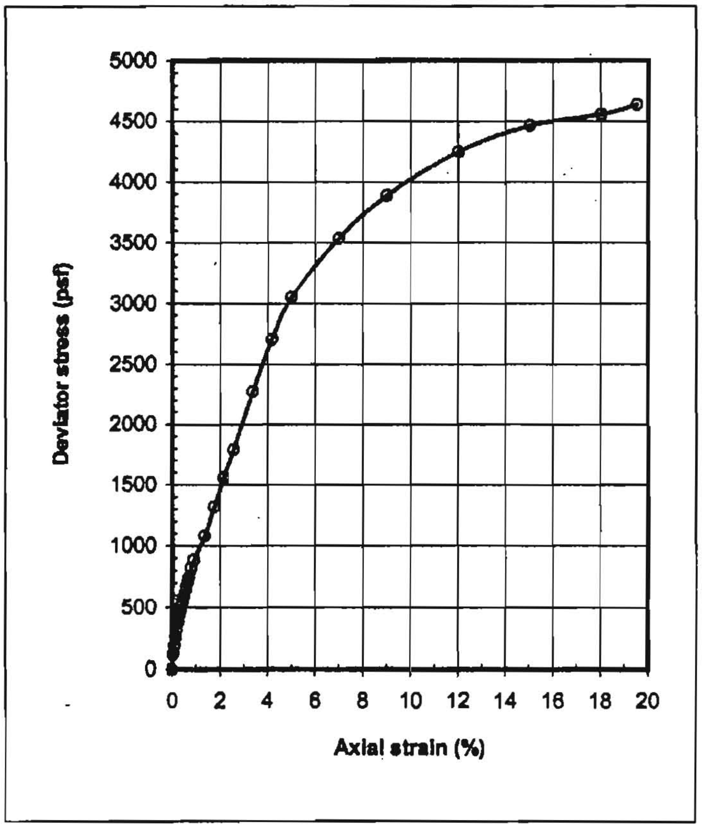
Data Reduction:

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 1319.6 gms
Ht. = 6.000 in
Ave dia. = 2.870 in
Area = 6.472 sq.in
Volume = 636.3 c.c.
Shearing rate = 0.06 inch/min
Shearing rate = 1 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 0.602
Ht/Dia ratio = 2.09
Moisture = 23.1 %
Total density = 129.4 pcf
Dry density = 105.2 pcf
Saturation = 103.4 %
Chamber pressure = 16000 psf
Max. deviator stress = 4638 psf
Strain @ failure = 19.55 %

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
0.003	43.3	0.00	0.0
0.006	48.8	0.05	122.2
0.009	51.9	0.11	189.9
0.012	54.9	0.15	257.8
0.015	57.7	0.21	318.4
0.018	60.2	0.26	375.5
0.021	62.6	0.30	426.8
0.024	64.6	0.36	472.7
0.028	66.5	0.41	513.1
0.030	68.3	0.45	552.4
0.033	70.1	0.51	593.1
0.037	71.8	0.56	630.2
0.039	73.5	0.60	667.2
0.043	75.3	0.66	707.4
0.046	77.1	0.71	745.8
0.051	80.4	0.81	818.1
0.058	83.5	0.92	885.8
0.085	92.5	1.37	1080.0
0.109	103.8	1.77	1321.2
0.133	114.8	2.18	1555.5
0.158	125.9	2.58	1789.4
0.206	149.1	3.39	2274.4
0.254	170.1	4.19	2702.6
0.303	187.7	5.00	3050.9
0.423	214.2	7.01	3536.0
0.544	235.4	9.01	3888.6
0.724	260.5	12.02	4250.2
0.905	279.4	15.03	4463.8
1.085	293.3	18.04	4559.1
1.176	302.4	19.55	4638.0

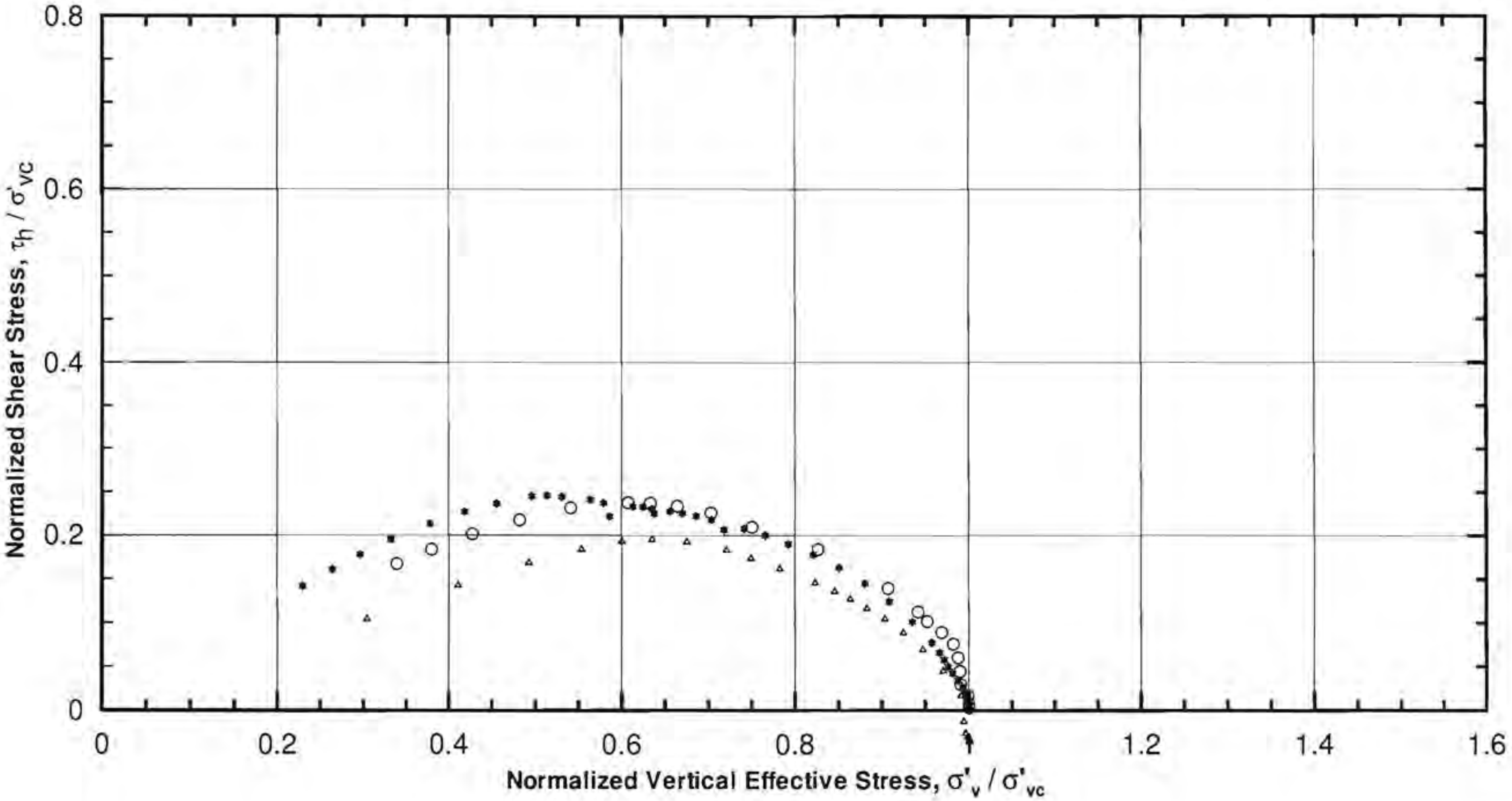


Signet Testing Labs

Figure D-47

K_O-CONSOLIDATED UNDRAINED DIRECT SIMPLE SHEAR TESTS

Test No.	Symbol	Boring No.	Sample No.	Depth Ft.	Elev. Ft.	ω_n (%) ω_f (%)	ω_L ω_P	Liquid Index L.I.	σ'_{vc} tsf	OCR	γ_t pcf	Su/σ_{vc}'
DSS607	△	NB - 15	S - 7	30.0 - 32.5	50.0 - 47.5	35.24 --	53 26	0.34	9.22	1.22	118.05	0.1964
DSS604	✱	NB - 20	S - 13	57.0 - 59.0	33.0 - 31.0	31.62 --	43 24	0.40	16.36	1.16	120.74	0.2457
DSS612	○	NB - 18	S - 5	23.0 - 25.5	65.5 - 63.0	30.92 --	31 18	0.99	5.35	1.13	111.81	0.2383



Normalized Effective Stress Paths From CK_0UDSS Tests On Normally Consolidated Samples of Stiff Fat Clay

Silicon Valley Rapid Transit Corridor

May 2003
28648793

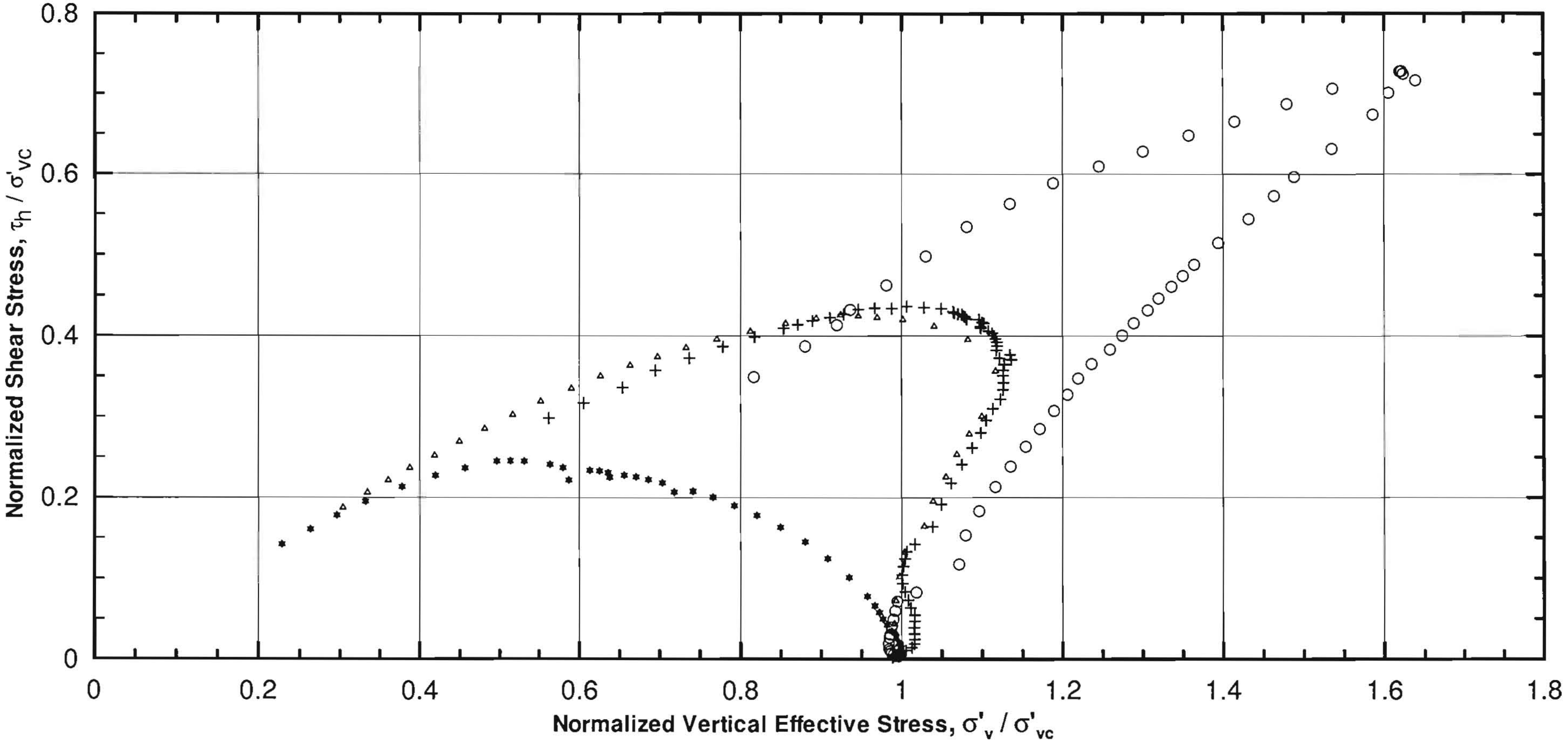
San Jose, California

URS

FIGURE D-48

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\DSS Tests\Grapher Files\StressPaths_norm.grf

Test No.	Symbol	Boring No.	Sample No.	Depth Ft.	Elev. Ft.	ω_n (%) ω_f (%)	ω_L ω_P	Liquid Index L.I.	σ'_{vc} tsf	OCR	γ_t pcf	Su/σ_{vc}'
DSS604	✱	NB - 20	S - 13	57.0 - 59.0	33.0 - 31.0	31.62 --	43 24	0.40	16.36	1.16	120.74	0.2457
DSS605	△	NB - 20	S - 13	57.0 - 59.0	33.0 - 31.0	31.29 --	43 24	0.38	8.19	2.38	120.56	0.4263
DSS611	○	NB - 15	S - 7	30.0 - 32.5	50.0 - 47.5	37.32 --	53 26	0.42	1.56	4.60	116.18	0.7317
DSS613	✚	NB - 18	S - 5	23.0 - 25.5	65.5 - 63.0	-- --	31 18	--	2.68	2.22	--	0.4367



Normalized Effective Stress Paths From CK$_o$UDSS Tests On Normally And Overconsolidated Samples of Stiff Fat Clay

Silicon Valley Rapid Transit Corridor

May 2003
28648793

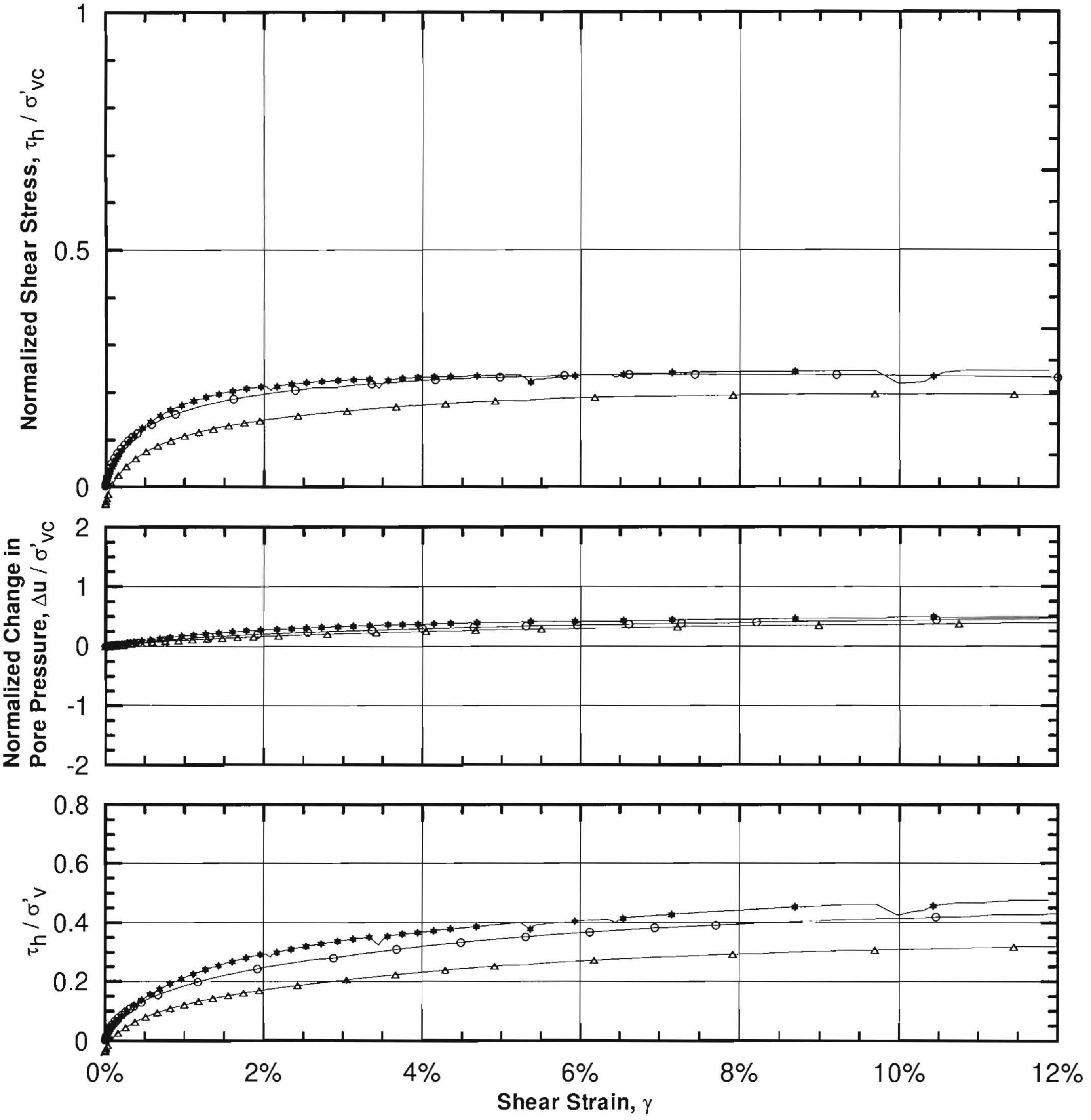
San Jose, California

URS

FIGURE D-49

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tests\DSS Tests\Grapher Files\StressPaths_over.grf

Test No.	Symbol	Boring No.	Sample No.	Depth Ft.	Elev. Ft.	ω_n (%) ω_f (%)	ω_L ω_P	Liquid Index L.I.	σ'_{vc} tsf	OCR	γ_t pcf	Su/σ_{vc}'
DSS607	△	NB - 15	S - 7	30.0 - 32.5	50.0 - 47.5	35.24 --	53 26	0.34	9.22	1.22	118.05	0.1964
DSS604	✱	NB - 20	S - 13	57.0 - 59.0	33.0 - 31.0	31.62 --	43 24	0.40	16.36	1.16	120.74	0.2457
DSS612	○	NB - 18	S - 5	23.0 - 25.5	65.5 - 63.0	30.92 --	31 18	0.99	5.35	1.13	111.81	0.2383



Normalized Stress - Strain Relations From CK_0UDSS Tests
Normally Consolidated Samples of Stiff Fat Clay

Silicon Valley Rapid Transit Corridor

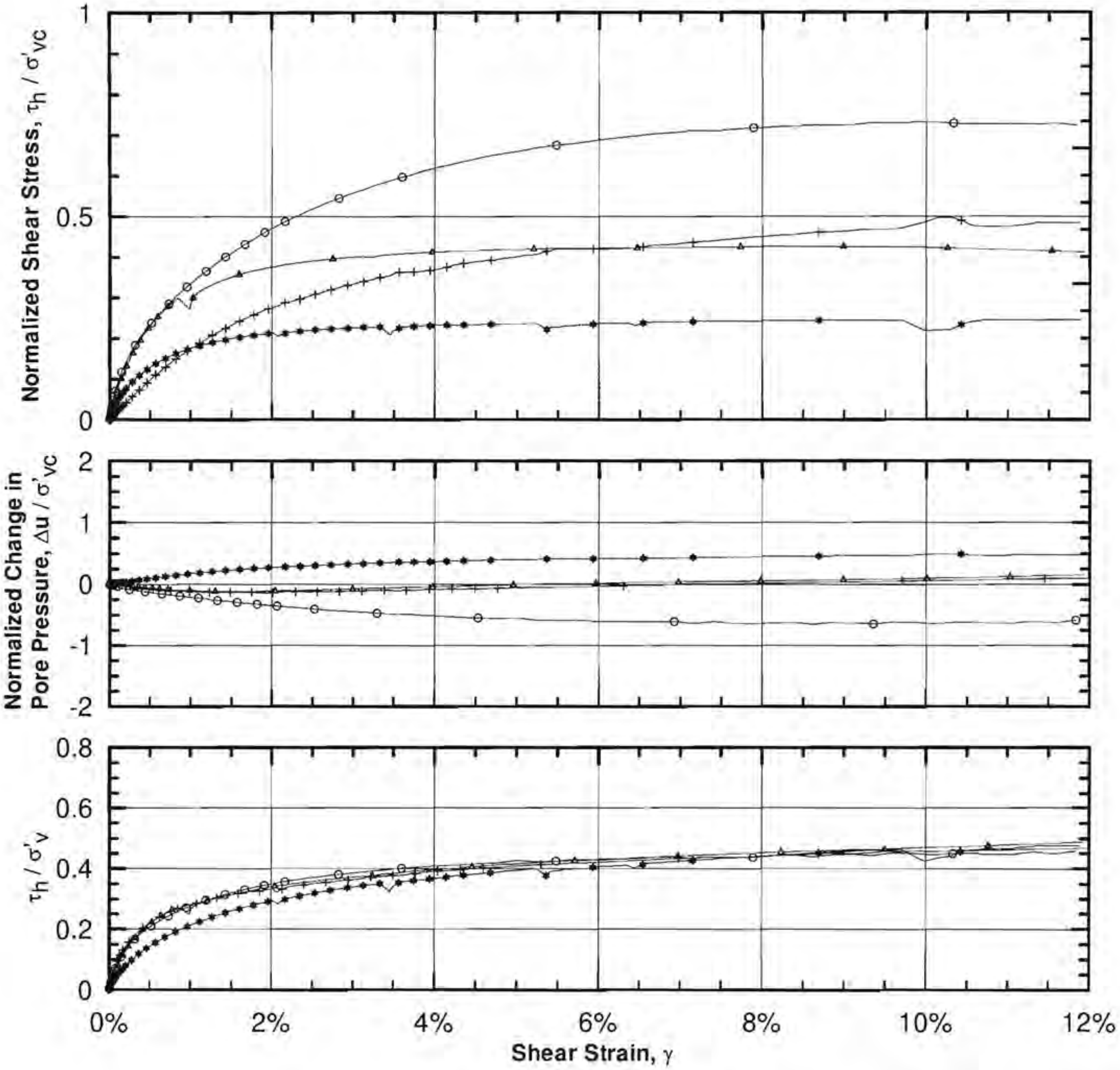
May 2003
28648793

San Jose, California

URS

FIGURE D-50

Test No.	Symbol	Boring No.	Sample No.	Depth Ft.	Elev. Ft.	ω_n (%) ω_f (%)	ω_L ω_P	Liquid Index L.I.	σ'_{vc} tsf	OCR	γ_t pcf	Su/σ_{vc}'
DSS604	✱	NB - 20	S - 13	57.0 - 59.0	33.0 - 31.0	31.62 --	43 24	0.40	16.36	1.16	120.74	0.2457
DSS605	△	NB - 20	S - 13	57.0 - 59.0	33.0 - 31.0	31.29 --	43 24	0.38	8.19	2.38	120.56	0.4263
DSS611	○	NB - 15	S - 7	30.0 - 32.5	50.0 - 47.5	37.32 --	53 26	0.42	1.56	4.60	116.18	0.7317
DSS613	+	NB - 18	S - 5	23.0 - 25.5	65.5 - 63.0	-- --	31 18	--	2.68	2.22	--	0.4367



Normalized Stress - Strain Relations From CK_0UDSS Tests
Normally And Overconsolidated Samples of Stiff Fat Clay

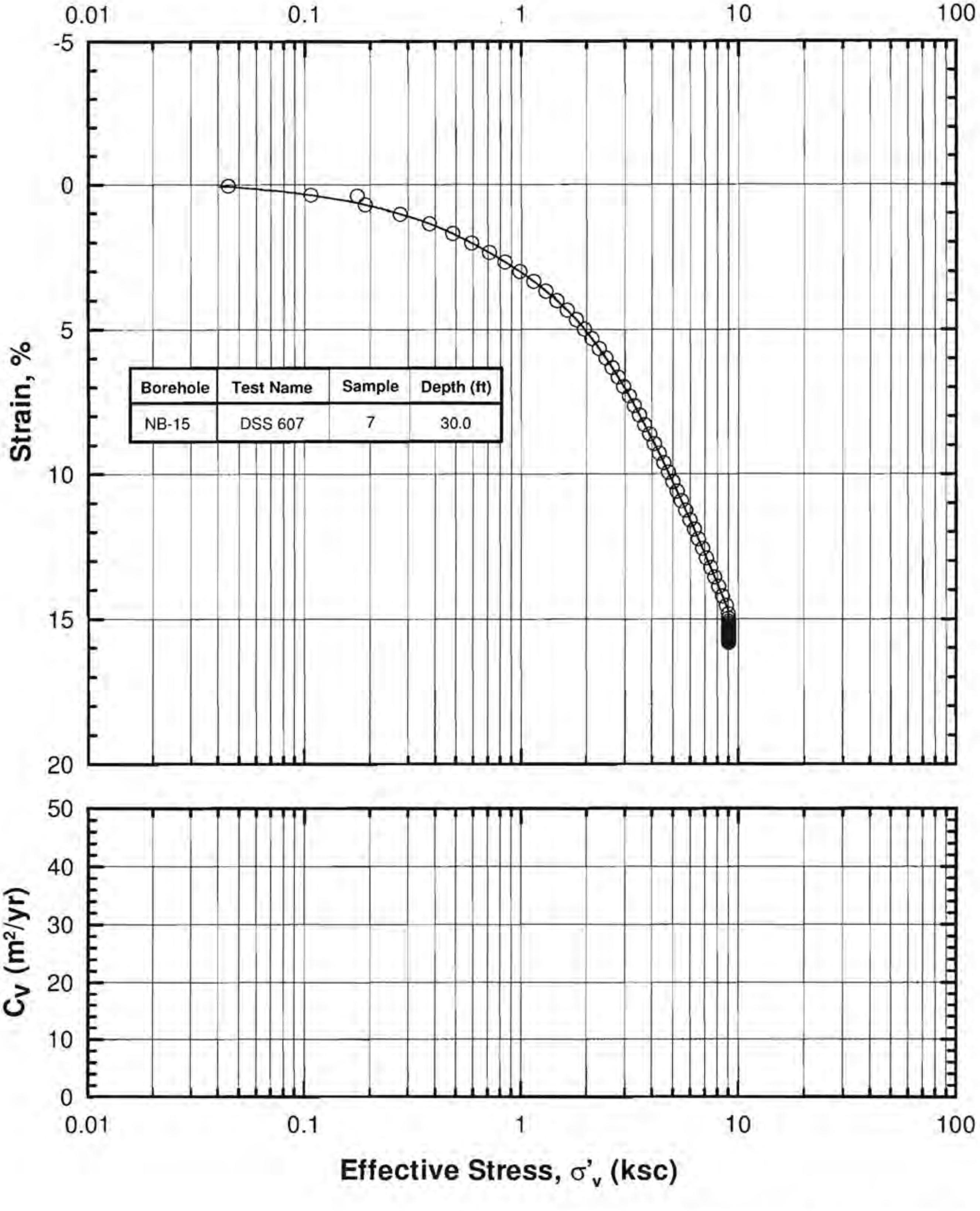
Silicon Valley Rapid Transit Corridor

May 2003
28648793

San Jose, California

URS

FIGURE D-51



COMPRESSION CURVE FROM K_o CONSOLIDATED UNDRAINED DIRECT SIMPLE SHEAR TEST

Silicon Valley Rapid Transit Corridor

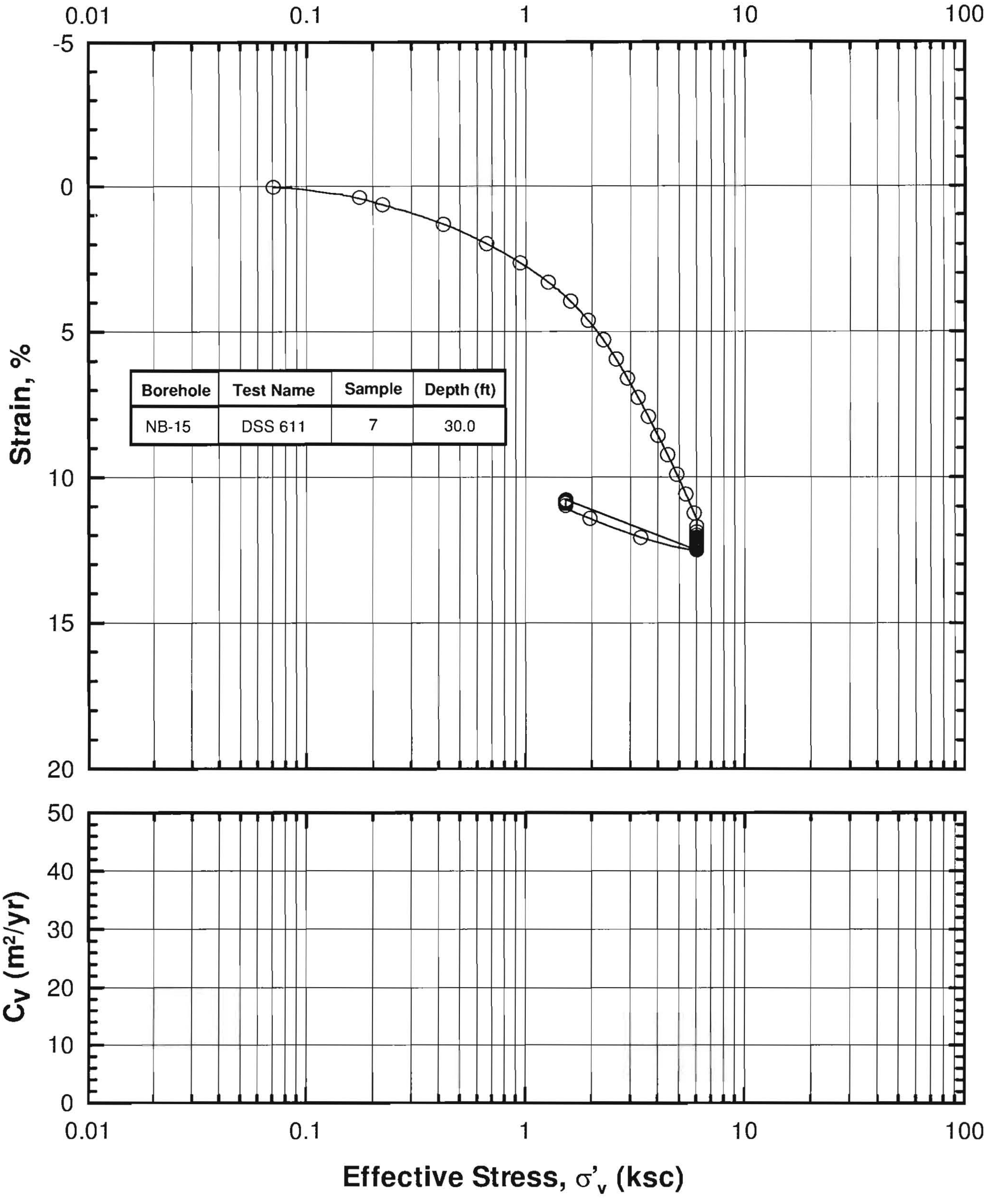
April 2003
28648793

San Jose, California

URS

FIGURE D-52

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tets\DSS Tests\Grapher Files\DSS 607.grf



COMPRESSION CURVE FROM K_o CONSOLIDATED UNDRAINED DIRECT SIMPLE SHEAR TEST

Silicon Valley Rapid Transit Corridor

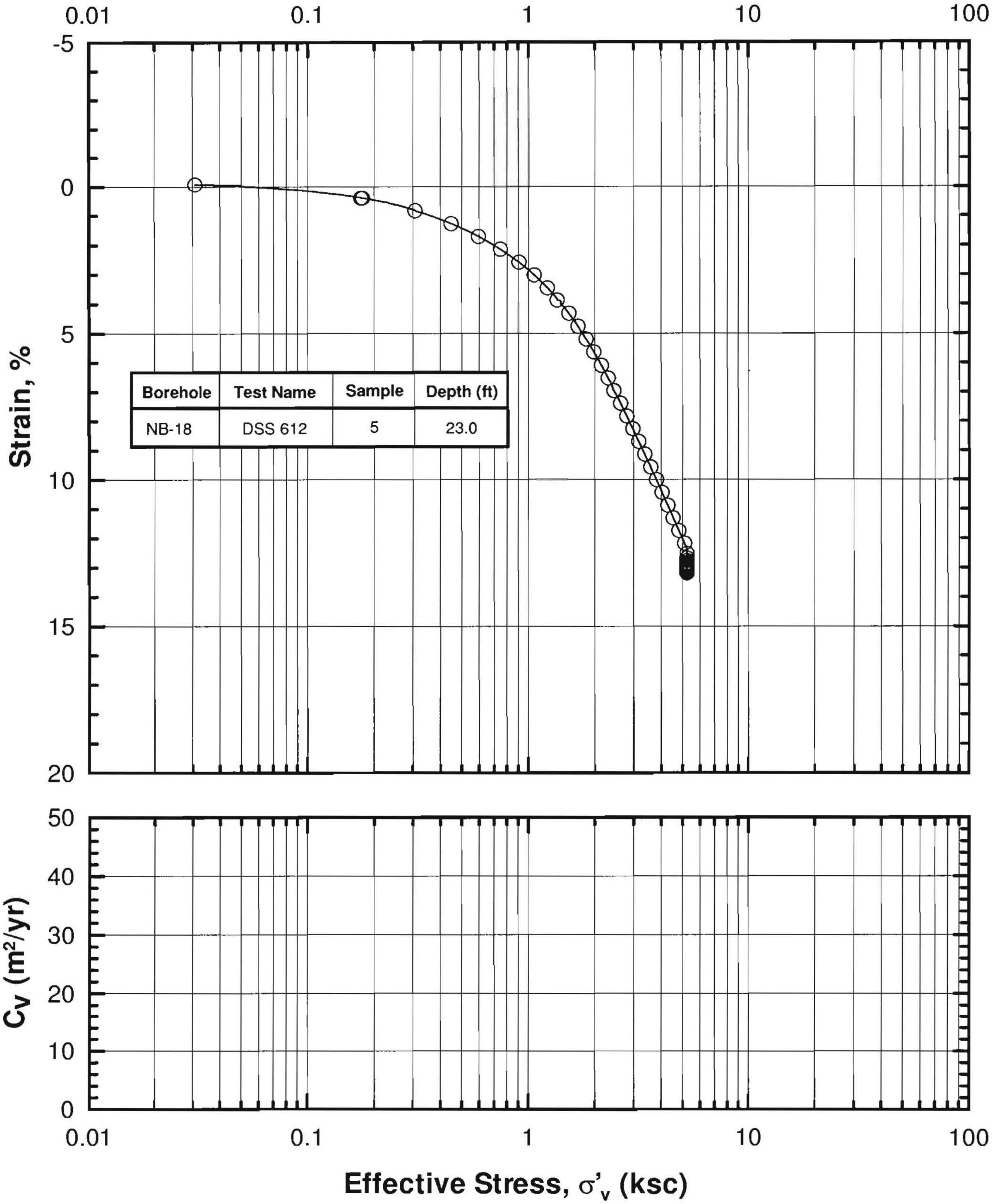
April 2003
28648793

San Jose, California

URS

FIGURE D-53

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tets\DSS Tests\Grapher Files\DSS 611.grf



Borehole	Test Name	Sample	Depth (ft)
NB-18	DSS 612	5	23.0

COMPRESSION CURVE FROM K_o CONSOLIDATED UNDRAINED DIRECT SIMPLE SHEAR TEST

Silicon Valley Rapid Transit Corridor

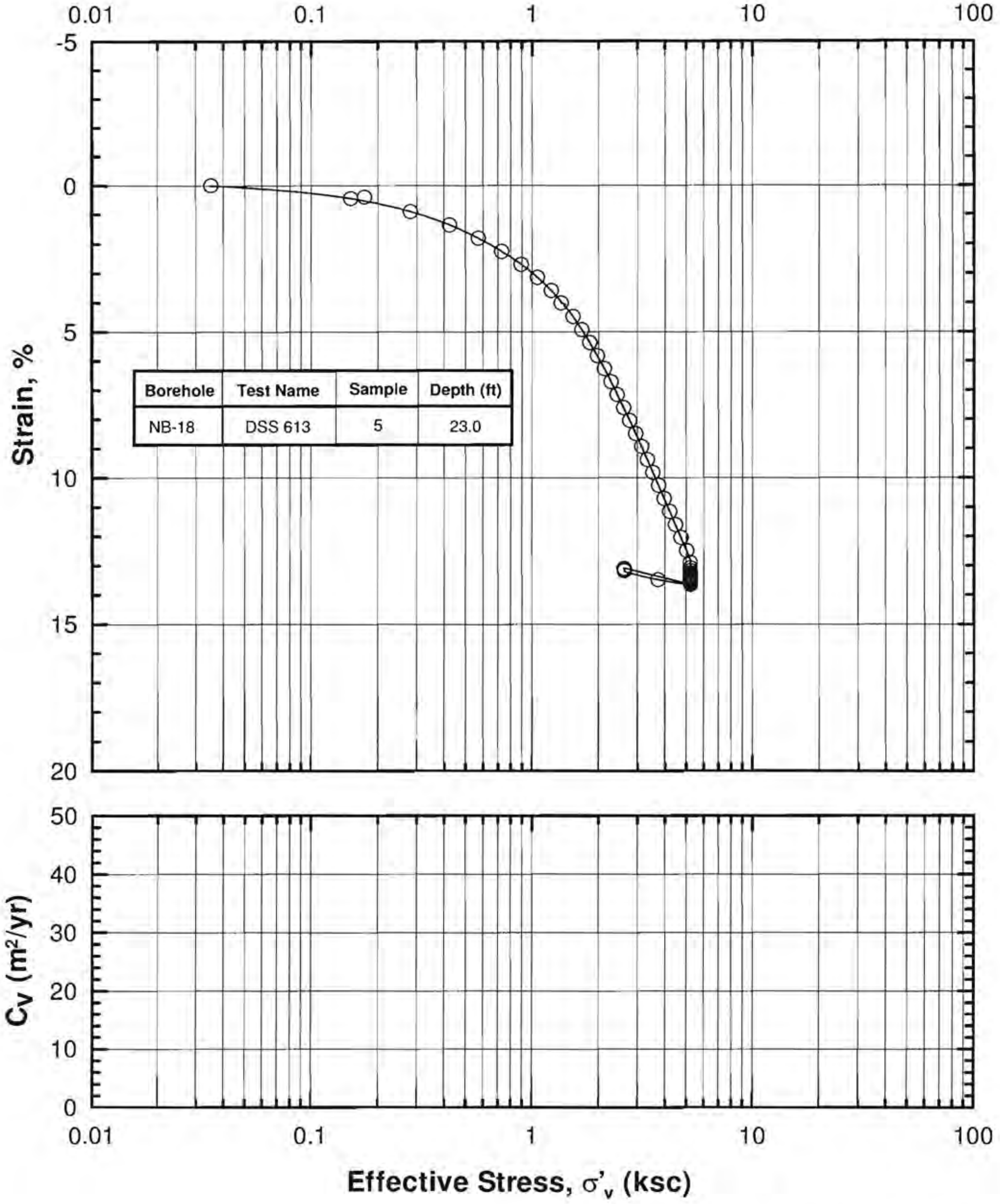
April 2003
28648793

San Jose, California

URS

FIGURE D-54

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tets\DSS Tests\Grapher Files\DSS 612.grf



Borehole	Test Name	Sample	Depth (ft)
NB-18	DSS 613	5	23.0

COMPRESSION CURVE FROM K_o CONSOLIDATED UNDRAINED DIRECT SIMPLE SHEAR TEST

Silicon Valley Rapid Transit Corridor

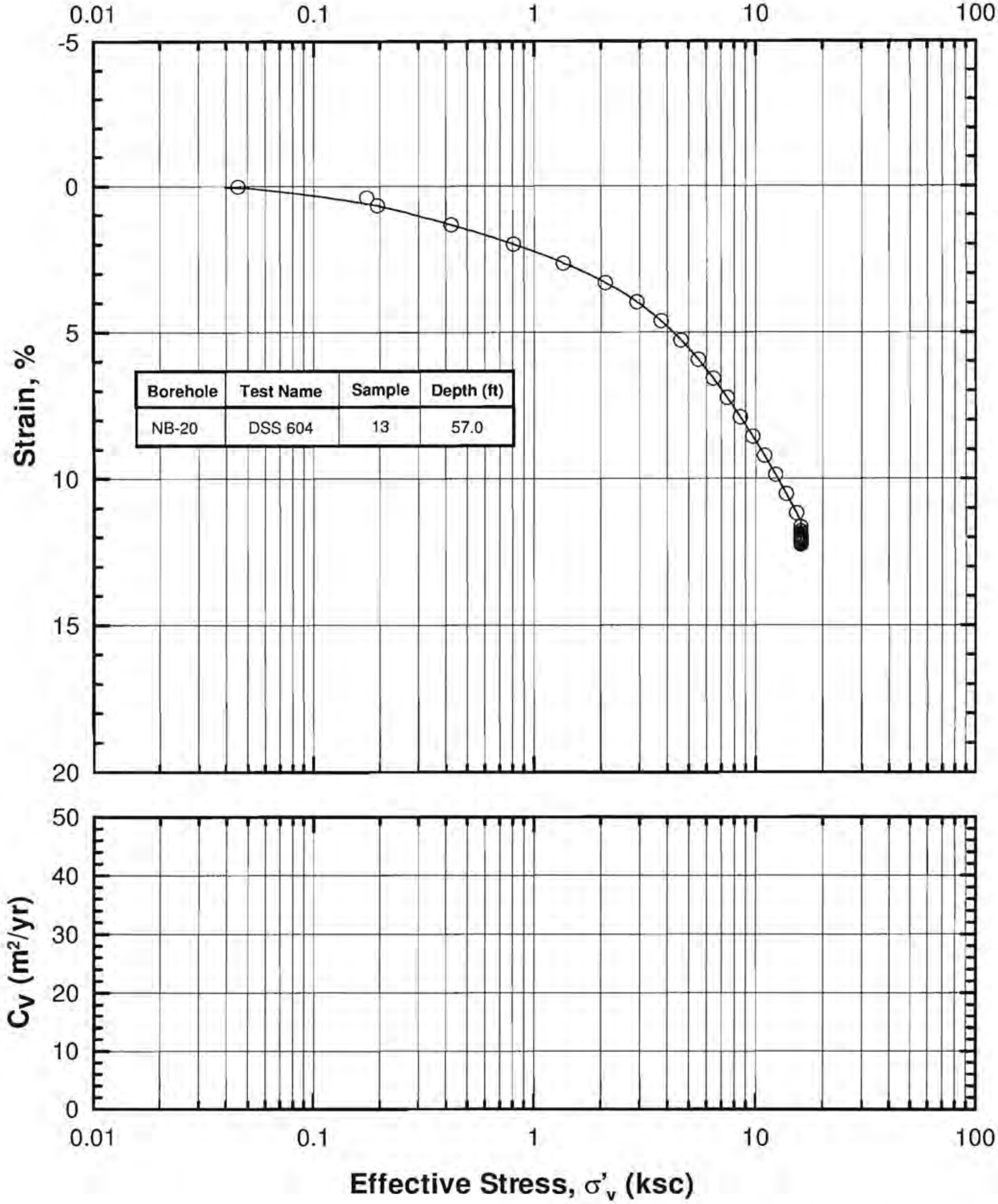
April 2003
28648793

San Jose, California

URS

FIGURE D-55

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tets\DSS Tests\Grapher Files\DSS 613.grf



Borehole	Test Name	Sample	Depth (ft)
NB-20	DSS 604	13	57.0

COMPRESSION CURVE FROM K_o CONSOLIDATED UNDRAINED DIRECT SIMPLE SHEAR TEST

Silicon Valley Rapid Transit Corridor

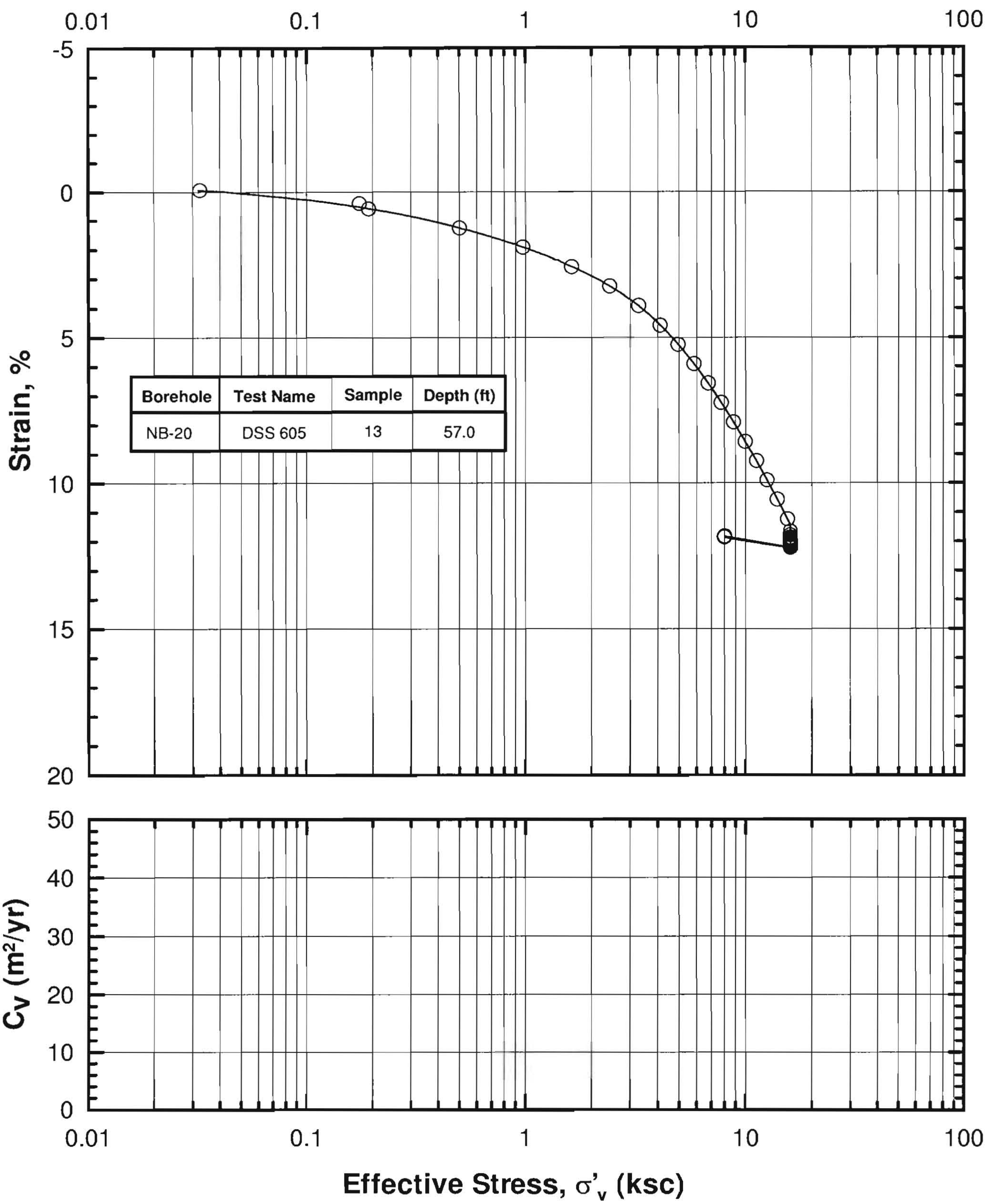
April 2003
28648793

San Jose, California

URS

FIGURE D-56

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tets\DSS Tests\Grapher Files\DSS 604.grf



Borehole	Test Name	Sample	Depth (ft)
NB-20	DSS 605	13	57.0

COMPRESSION CURVE FROM K_o CONSOLIDATED UNDRAINED DIRECT SIMPLE SHEAR TEST

Silicon Valley Rapid Transit Corridor

April 2003
28648793

San Jose, California

URS

FIGURE D-57

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Lab Tets\DSS Tests\Grapher Files\DSS 605.grf

Appendix E

Field vane shear tests were conducted using a Geonor H-10 Vane Borer Instrument. The vane borer instrument consists of: 1) the vane borer and 2) the vane instrument. The main part of the vane borer is the vane which is welded to a steel rod that is housed in a protection tube. The tube protects the vane rod from adhering to the clay soils during rotation of the vane. To reduce friction in the system, the space between the rod and the protection tube is filled with grease under pressure and a thrust ball-bearing is placed between the coupling piece and the protection tube. As the vane borer is advanced in depths, the vane is withdrawn into a protection shoe and locked in place by a retaining spring that is pressed into the locking sleeve groove. With a blow on the extension rod, the vane is unlocked at the depth where measurement is desired. The vane instrument is used to generate and measure the torque required to shear the clay.

The vane used in the field measurements for the SVRTC project was 55mm in diameter with 110 mm in blade length. The test procedure is generally consistent with ASTM D-2573-72. Since the Geonor H-10 instrument is calibrated periodically under the maintenance guidelines of the manufacturer, the manufacturer's calibration sheets were used to convert the readout units to engineering units. This supersedes the manual calculations outlined in ASTM D-2573-72.

Logs of the four (4) field vane soundings are presented in Appendix C, Figures C-10, C-14, C-17, C-18, and C-19. A summary of pertinent information of the field vane shear soundings is provided in Table E-1. Individual field vane results are tabulated on Table E-2. The values of undrained shear strengths included in Table E-2 are uncorrected (field) values. The soil sensitivity (S_t) is defined as the ratio of the in-situ undisturbed shear strength divided by the remolded shear strength.

Plots of the uncorrected vane shear strengths versus elevation are presented in Figures E-1 to E-5 at the end of this appendix.

TABLE E-1
SUMMARY OF FIELD VANE SHEAR TESTS

Field Vane Sounding No.	Ground Surface Elevation (feet)	Total Depth (feet)	Date Drilled	Comments
NB-07	84.0	121.5	11/14/02 - 11/15/02	Vane shear to max. depth of 46.0 feet with intermittent sampling. Continued sampling to completion depth.
NB-13A	86.0	71.0	11/24/02 – 11/25/02	Vane shear to max. depth of 49.0 feet. No sampling.
NB-16	81.0	102.5	11/21/02 - 11/22/02	Vane shear to max. depth of46.0 feet with intermittent sampling. Continued sampling to completion depth.
NB-17	88.5	101.5	11/11/02 - 11/12/02	Vane shear to max. depth of 52.0 feet with intermittent sampling. Continued sampling to completion depth.
NB-19	88.5	101.5	11/19/02 – 11/20/02	Vane shear to max. depth of 25.0 feet with sampling from 0 to 10.0 feet and from 27.5 feet to completion depth.

TABLE E-2
SUMMARY OF FIELD VANE SHEAR TEST DATA

Vane Sounding No.	Test No.	Depth below Ground Surface (ft)	Soil Unit	Undisturbed Strength (psf)	Remolded Strength (psf)	Sensitivity (S_t)
NB-07	1	12.5	Alluvial Clays, Silts & Sandy Clays	1499	-	-
	2	14.0	Alluvial Clays, Silts & Sandy Clays	> 1912	-	-
	3	15.0	Alluvial Clays, Silts & Sandy Clays	> 1849	-	-
	4	25.0	Alluvial Clays, Silts & Sandy Clays	1353	-	-
	5	26.0	Alluvial Clays, Silts & Sandy Clays	1499	-	-
	6	27.0	Alluvial Clays, Silts & Sandy Clays	1210	-	-
	7	28.0	Alluvial Clays, Silts & Sandy Clays	1714	-	-
	8	29.0	Alluvial Clays, Silts & Sandy Clays	1332	-	-
	9	44.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	10	46.0	Alluvial Clays, Silts & Sandy Clays	> 1890	-	-
NB-13	1	5.0	Alluvial Clays, Silts & Sandy Clays	1649	-	-
	2	7.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	3	9.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	4	11.0	Alluvial Clays, Silts & Sandy Clays	1520	-	-
	5	13.0	Alluvial Clays, Silts & Sandy Clays	1868	-	-
	6	15.0	Alluvial Clays, Silts & Sandy Clays	1890	-	-
	7	17.0	Alluvial Clays, Silts & Sandy Clays	1190	-	-
	8	19.0	Alluvial Clays, Silts & Sandy Clays	952	-	-
	9	21.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-

TABLE E-2
SUMMARY OF FIELD VANE SHEAR TEST DATA

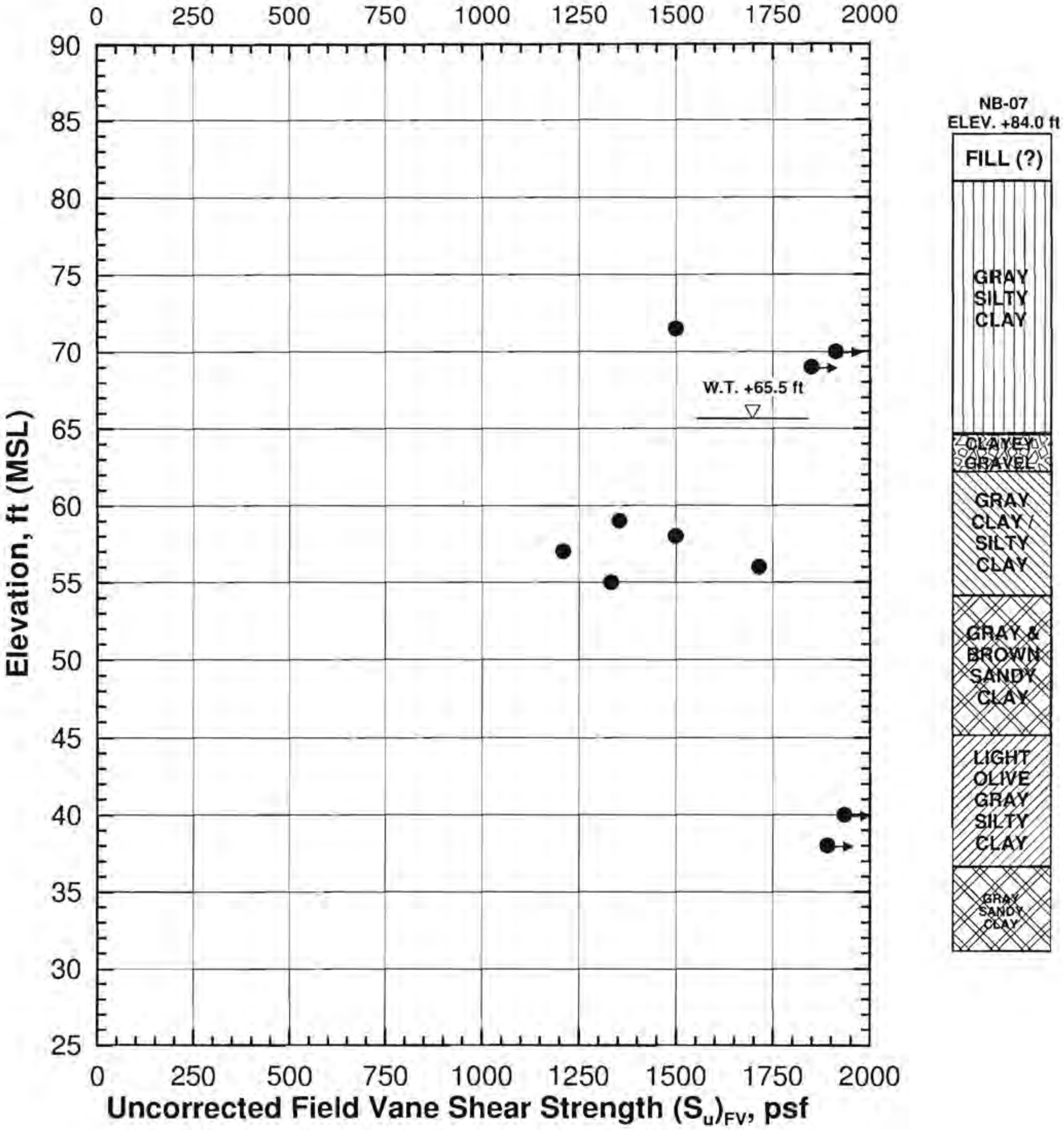
Vane Sounding No.	Test No.	Depth below Ground Surface (ft)	Soil Unit	Undisturbed Strength (psf)	Remolded Strength (psf)	Sensitivity (S_t)
NB-13 (cont'd)	10	29.0	Alluvial Clays, Silts & Sandy Clays	1846	-	-
	11	31.0	Alluvial Clays, Silts & Sandy Clays	1353	-	-
	12	33.0	Alluvial Clays, Silts & Sandy Clays	1425	-	-
	13	35.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	14	37.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	15	39.0	Alluvial Clays, Silts & Sandy Clays	1649	-	-
	16	41.0	Alluvial Clays, Silts & Sandy Clays	1478	-	-
	17	43.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	18	45.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	19	47.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	20	49.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
NB-16	1	5.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	2	7.0	Alluvial Clays, Silts & Sandy Clays	1499	-	-
	3	9.0	Alluvial Clays, Silts & Sandy Clays	1070	-	-
	4	11.0	Alluvial Clays, Silts & Sandy Clays	1110	-	-
	5	13.0	Alluvial Clays, Silts & Sandy Clays	795	-	-
	6	15.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	7	17.0	Alluvial Clays, Silts & Sandy Clays	1562	-	-
	8	19.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-

TABLE E-2
SUMMARY OF FIELD VANE SHEAR TEST DATA

Vane Sounding No.	Test No.	Depth below Ground Surface (ft)	Soil Unit	Undisturbed Strength (psf)	Remolded Strength (psf)	Sensitivity (S_t)
NB-16 (cont'd)	9	30.0	Alluvial Clays, Silts & Sandy Clays	1552	-	-
	10	34.0	Alluvial Clays, Silts & Sandy Clays	1912	-	-
	11	36.0	Alluvial Clays, Silts & Sandy Clays	1150	-	-
	12	38.0	Alluvial Clays, Silts & Sandy Clays	972	-	-
	13	40.0	Alluvial Clays, Silts & Sandy Clays	1714	-	-
	14	42.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	15	44.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	16	46.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
NB-17	1	6.0	Alluvial Clays, Silts & Sandy Clays	1692	-	-
	2	9.0	Alluvial Clays, Silts & Sandy Clays	1271	-	-
	3	10.0	Alluvial Clays, Silts & Sandy Clays	1415	-	-
	4	11.0	Alluvial Clays, Silts & Sandy Clays	1605	-	-
	5	12.0	Alluvial Clays, Silts & Sandy Clays	913	172	5.3
	6	14.0	Alluvial Clays, Silts & Sandy Clays	1190	-	-
	7	16.0	Alluvial Clays, Silts & Sandy Clays	1021	-	-
	8	18.0	Alluvial Clays, Silts & Sandy Clays	1231	-	-
	9	20.0	Alluvial Clays, Silts & Sandy Clays	1353	-	-
	10	22.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	11	24.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	12	42.0	Alluvial Clays, Silts & Sandy Clays	1499	-	-

TABLE E-2
SUMMARY OF FIELD VANE SHEAR TEST DATA

Vane Sounding No.	Test No.	Depth below Ground Surface (ft)	Soil Unit	Undisturbed Strength (psf)	Remolded Strength (psf)	Sensitivity (S_t)
NB-17 (cont'd)	13	44.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	14	46.0	Alluvial Clays, Silts & Sandy Clays	>1934	-	-
	15	48.0	Alluvial Clays, Silts & Sandy Clays	1912	-	-
NB-19	1	15.0	Alluvial Clays, Silts & Sandy Clays	1584	-	-
	2	17.0	Alluvial Clays, Silts & Sandy Clays	1271	-	-
	3	19.0	Alluvial Clays, Silts & Sandy Clays	1150	-	-
	4	21.0	Alluvial Clays, Silts & Sandy Clays	1210	-	-
	5	23.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-
	6	25.0	Alluvial Clays, Silts & Sandy Clays	> 1934	-	-



FIELD VANE DATA NB-07 AT THE DIRIDON/ARENA STATION

Silicon Valley Rapit Transit Corridor

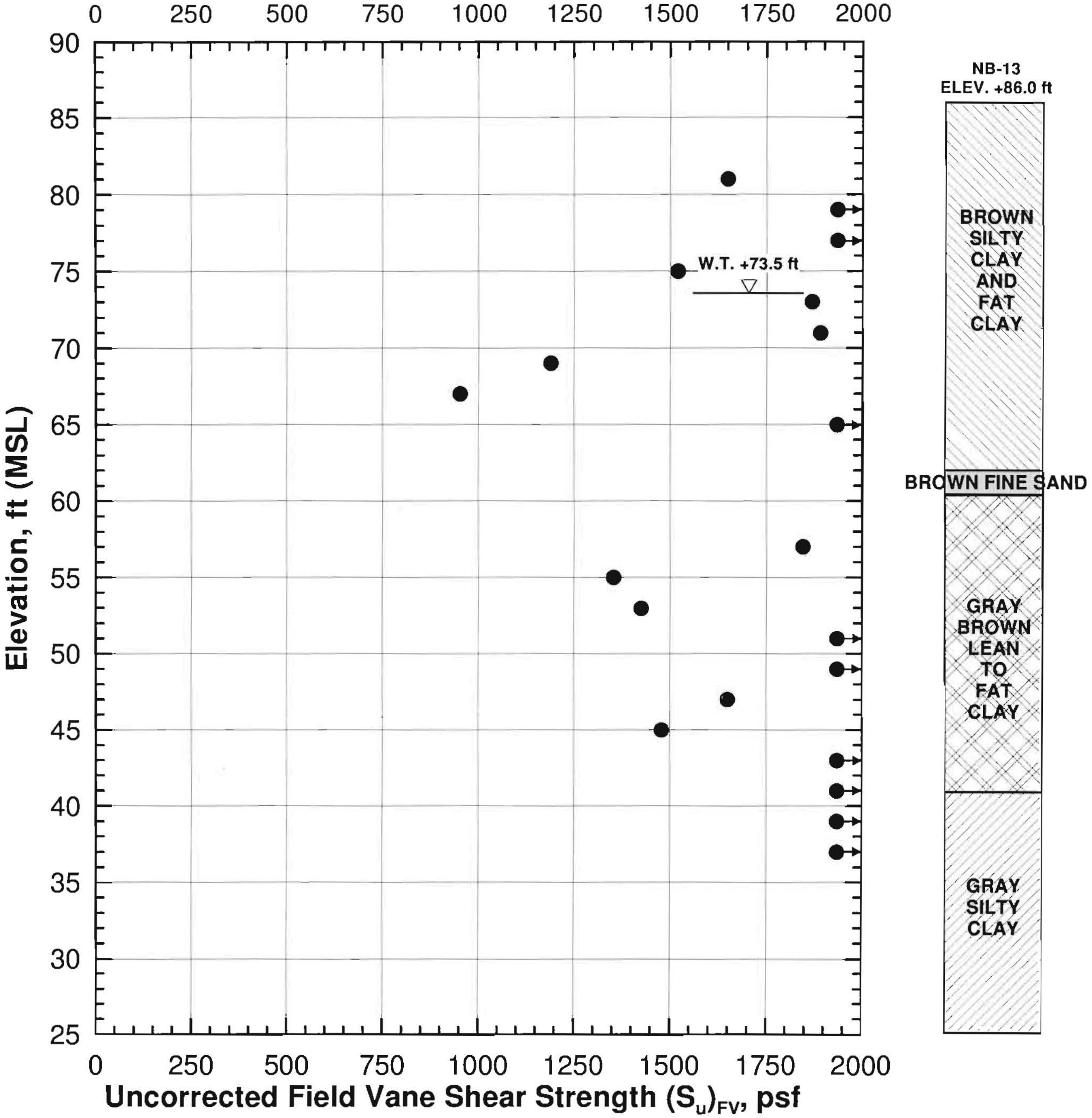
April 2003
28648793

San Jose, California

URS

FIGURE E-1

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Field Vane\Grapher Files\FV NB-07.grf



FIELD VANE DATA NB-13A AT THE ALUM ROCK STATION STATION

Silicon Valley Rapit Transit Corridor

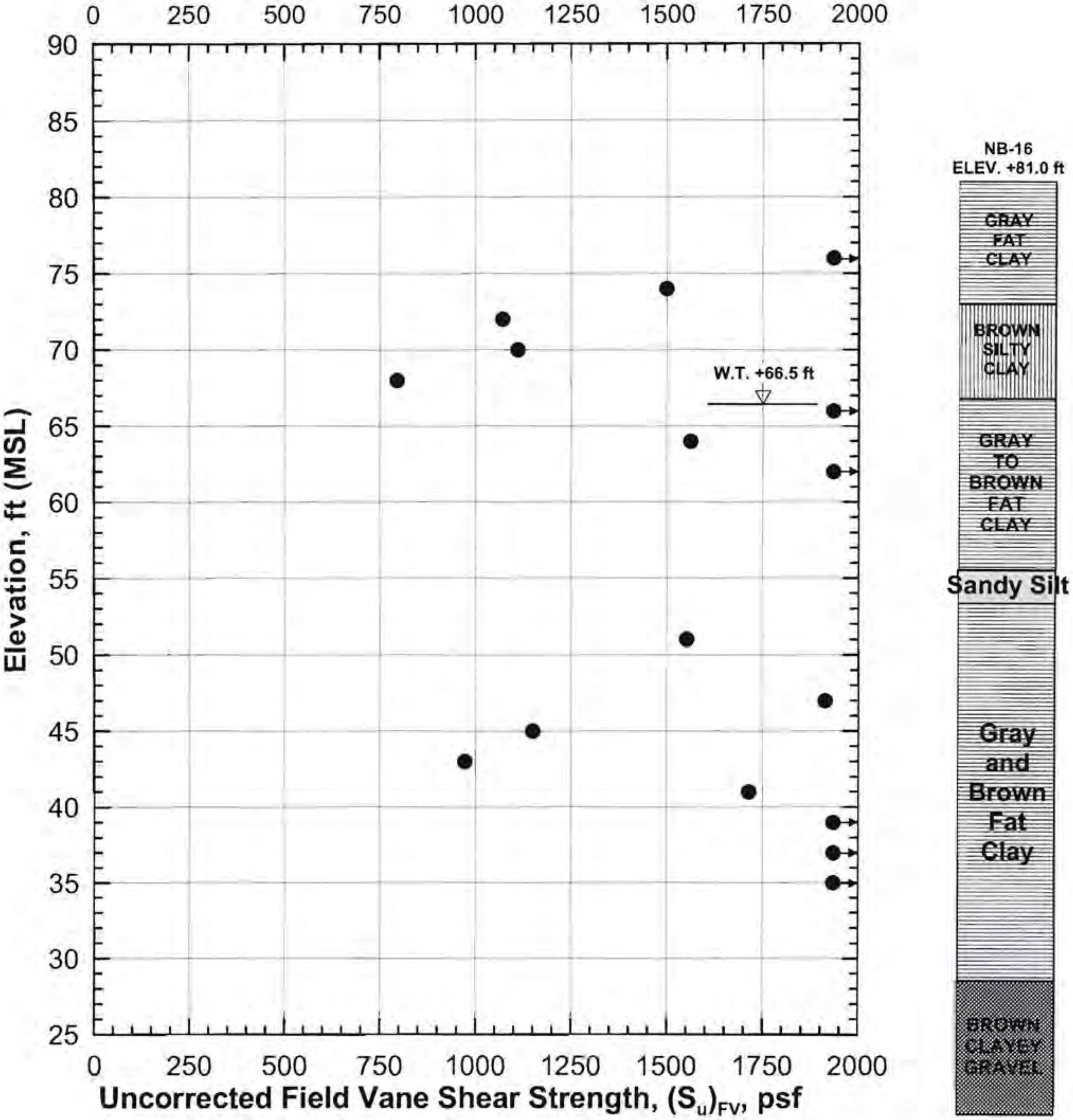
April 2003
28648793

San Jose, California

URS

FIGURE E-2

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Field Vane\Grapher Files\FV NB-13A.grf



FIELD VANE DATA NB-16 AT THE CIVIC PLAZA/SJSU STATION

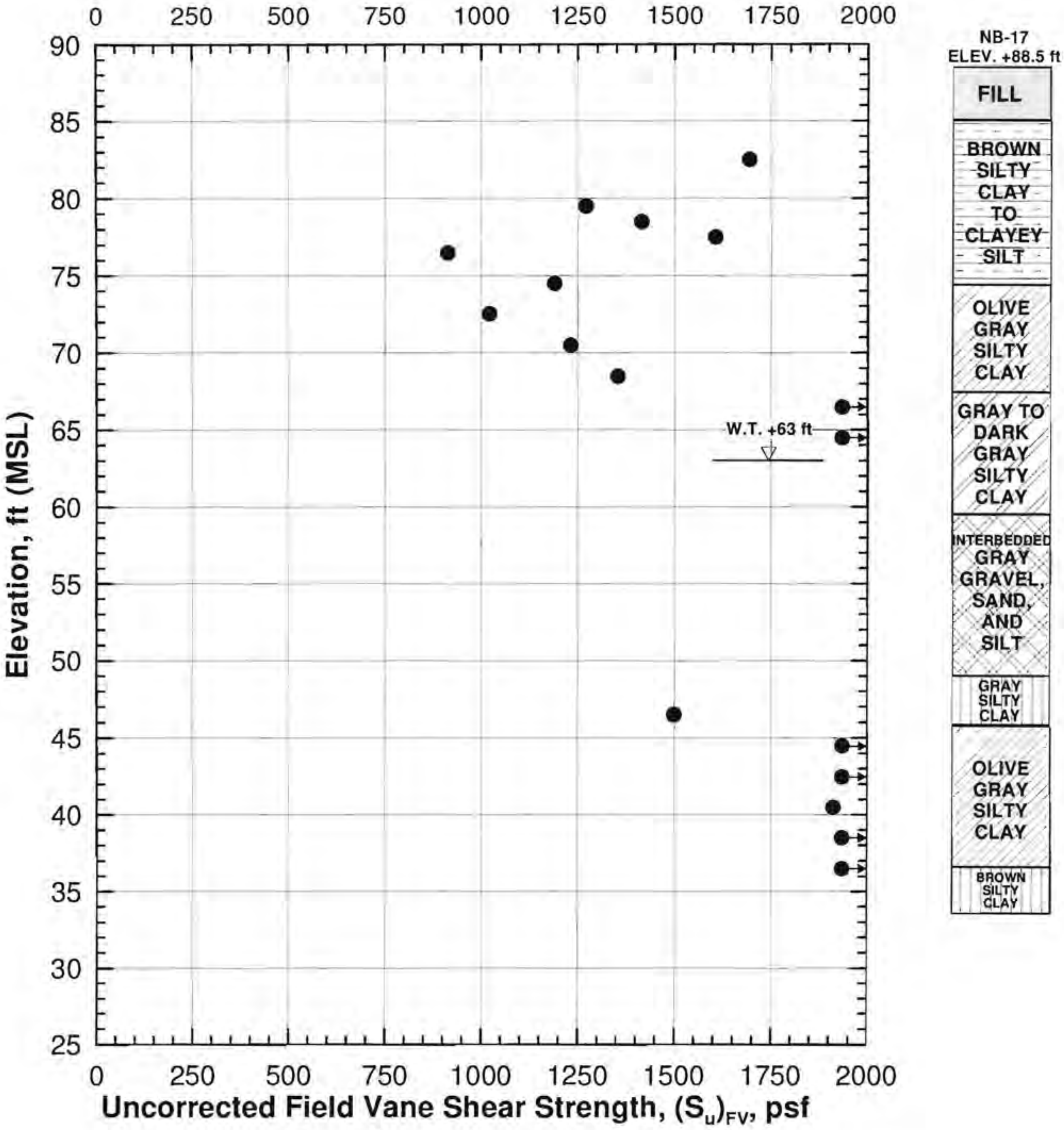
Silicon Valley Rapit Transit Corridor

April 2003
28648793

San Jose, California

URS

FIGURE E-3



FIELD VANE DATA NB-17 AT THE MARKET STREET STATION

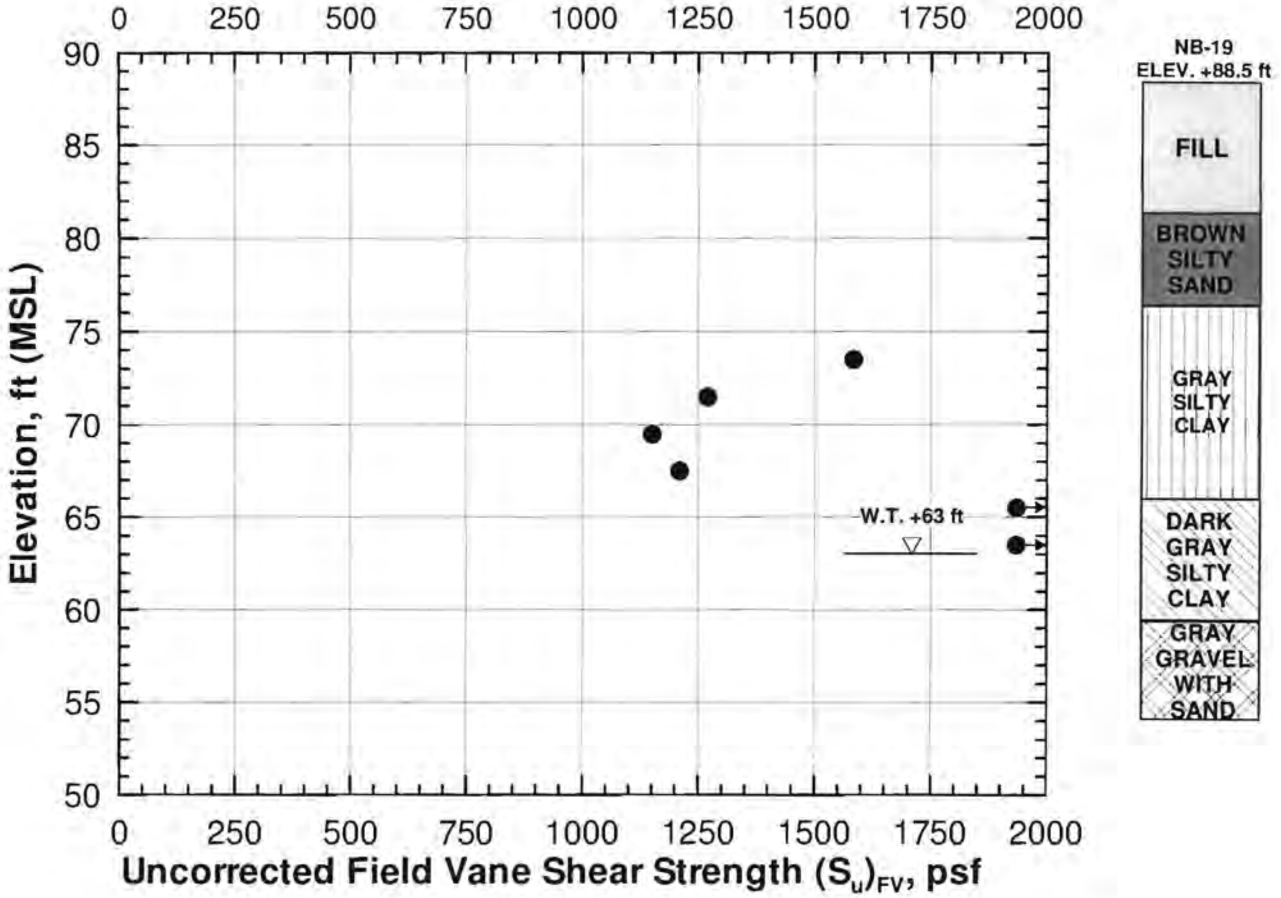
Silicon Valley Rapit Transit Corridor

April 2003
28648793

San Jose, California

FIGURE E-4

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Field Vane\Grapher Files\FV NB-17.grf



FIELD VANE DATA NB-19 AT THE MARKET STREET STATION

Silicon Valley Rapit Transit Corridor

April 2003
28648793

San Jose, California

URS

FIGURE E-5

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Field Vane\Grapher Files\FV NB-19.grf

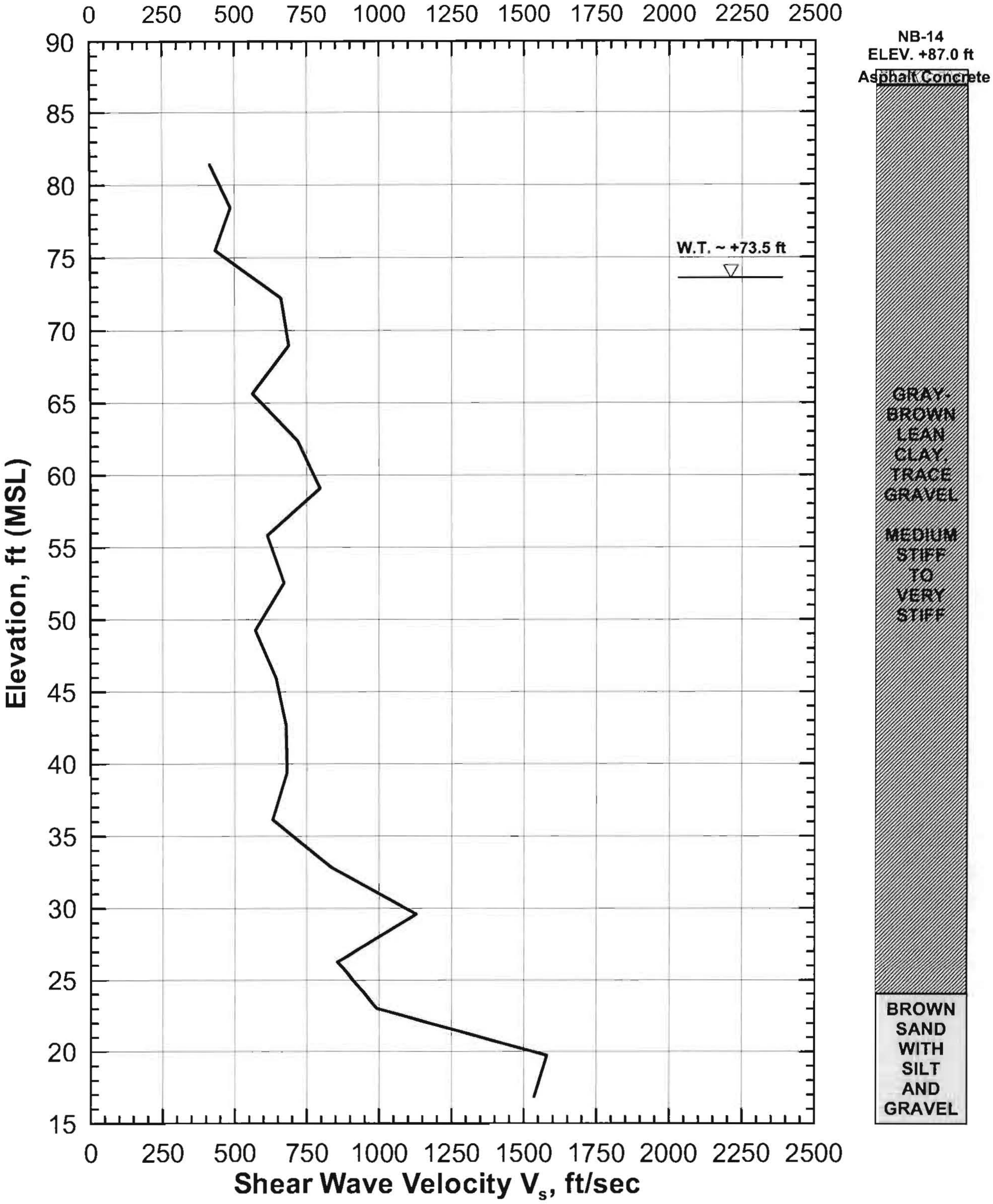
Appendix F

The seismic cone tests consist of a piezocone unit inserted into the ground and seismic source at the ground surface. As the piezocone is inserted into the ground it is stopped at intervals of approximately 1 meter. During the pause in penetration, a s shear wave is generated at the ground surface by hitting a steel plate pressed against the ground by the weight of the CPT vehicle. The shear wave is generated by hitting the plate horizontally and the time required for the shear wave to reach the siesmomoeter in the piezocone is recorded. The seismic test date is then analyzed to create a profile of seismic velocities along the entire depth of the CPT.

Seismic cone penetration tests were performed at CPT locations at the underground station locations; specifically, NC-22 at the Alum Rock Station, NC-12 at the Market Street Station, and NC-13 at the Diridon/Arena Station. Shear wave velocity profiles from each test are presented in Figures F-1 through F-3.

The seismic cone tests were performed by Virgil Baker Insitu Testing (VBI) of West Sacramento, California under supervision of a URS engineer.

Seismic cone data from an existing CPT located near the Civic Plaza/San Jose State University Station (CPT-8) is also included in this Appendix. The shear wave velocity profile at CPT-8 is presented in Figure F-4.



SHEAR WAVE VELOCITY DATA FROM NC-11 AT THE ALUM ROCK STATION

Silicon Valley Rapit Transit Corridor

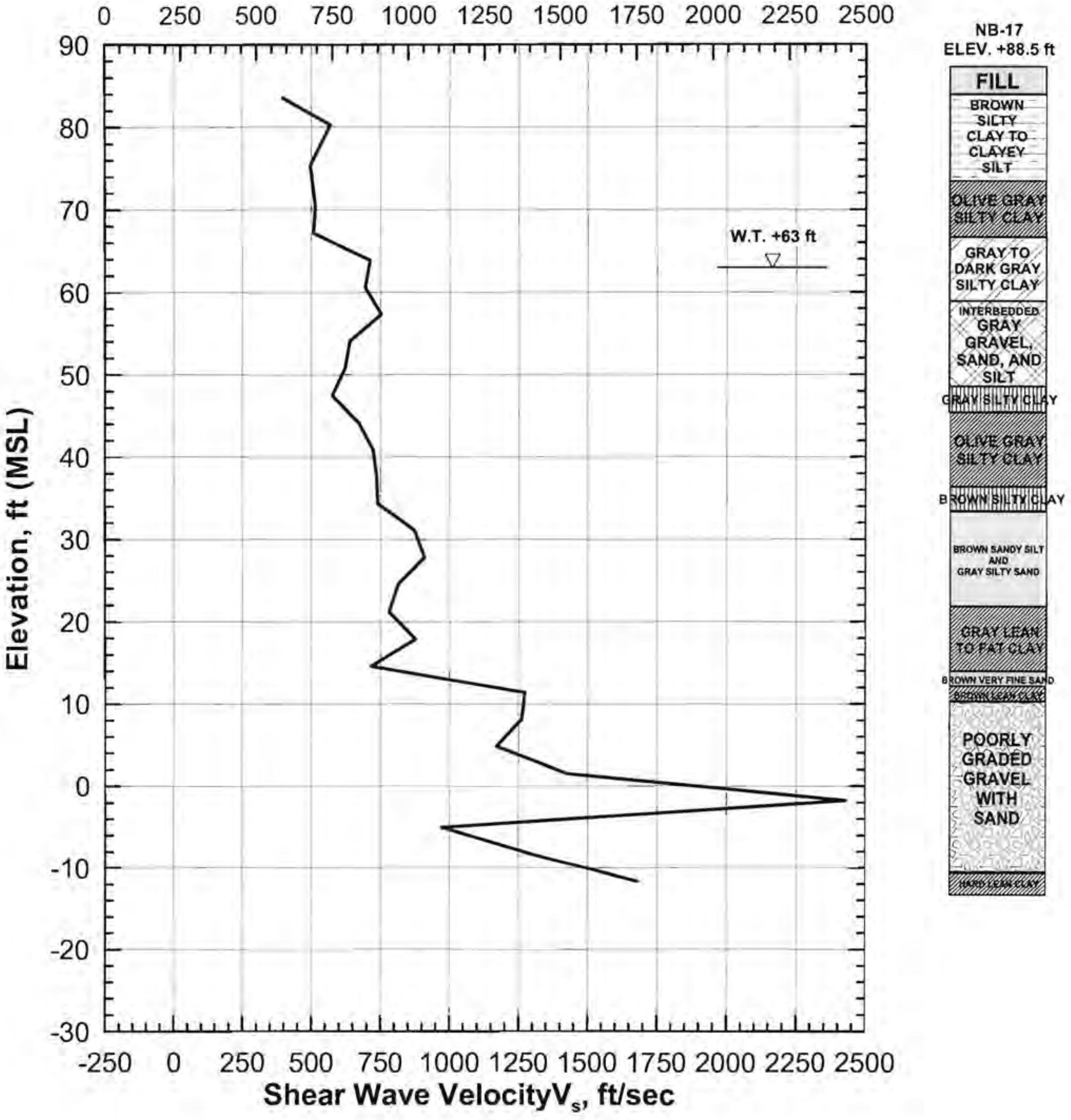
April 2003
28648793

San Jose, California

URS

FIGURE F-1

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Seismic Cones\Grapher files\NC-11.grf



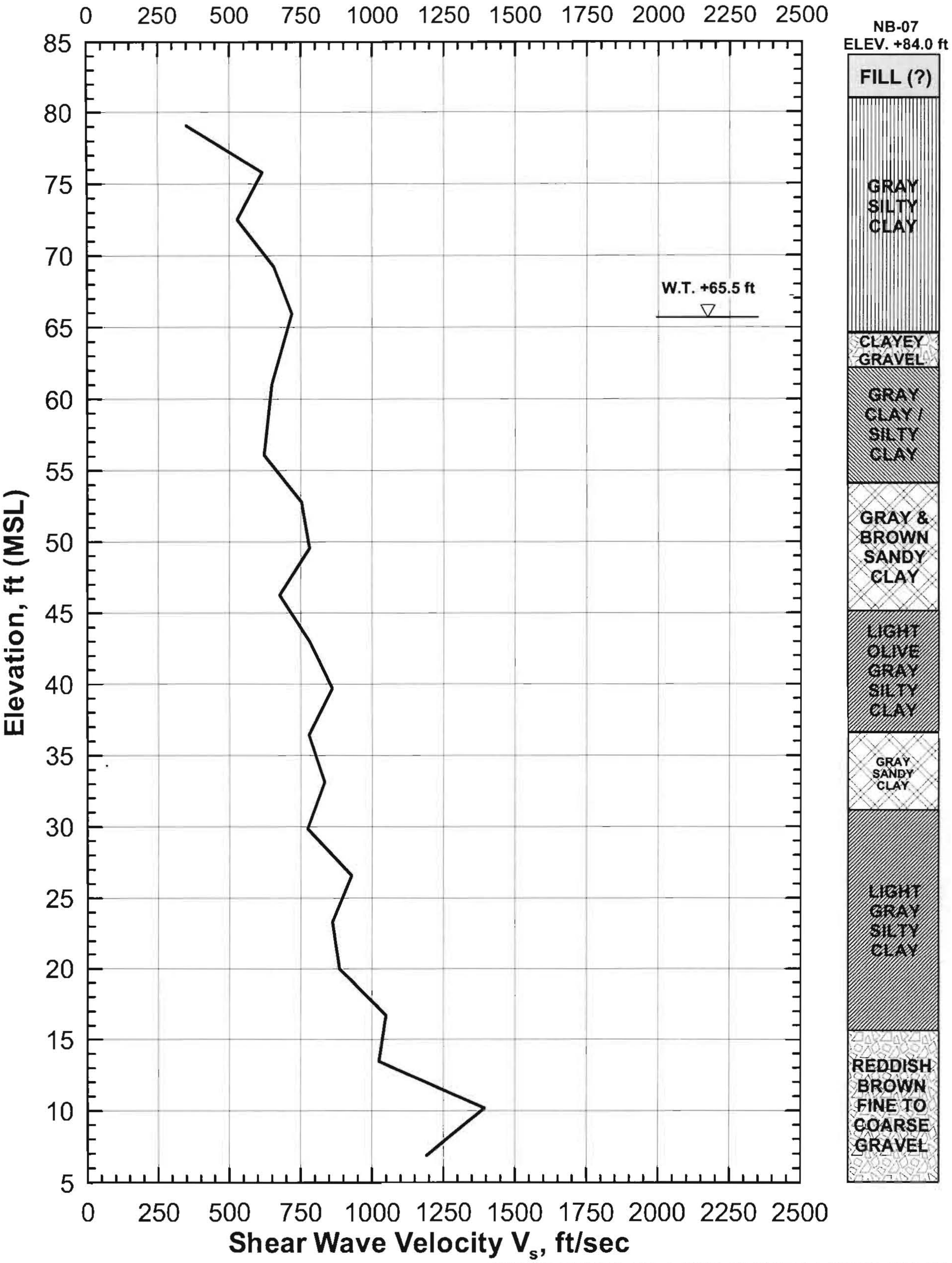
SHEAR WAVE VELOCITY DATA FROM NC-12 AT THE MARKET STREET STATION

Silicon Valley Rapit Transit Corridor

April 2003
28648793

San Jose, California

FIGURE F-2



SHEAR WAVE VELOCITY DATA FROM NC-13 AT THE DIRIDON/ARENA STATION

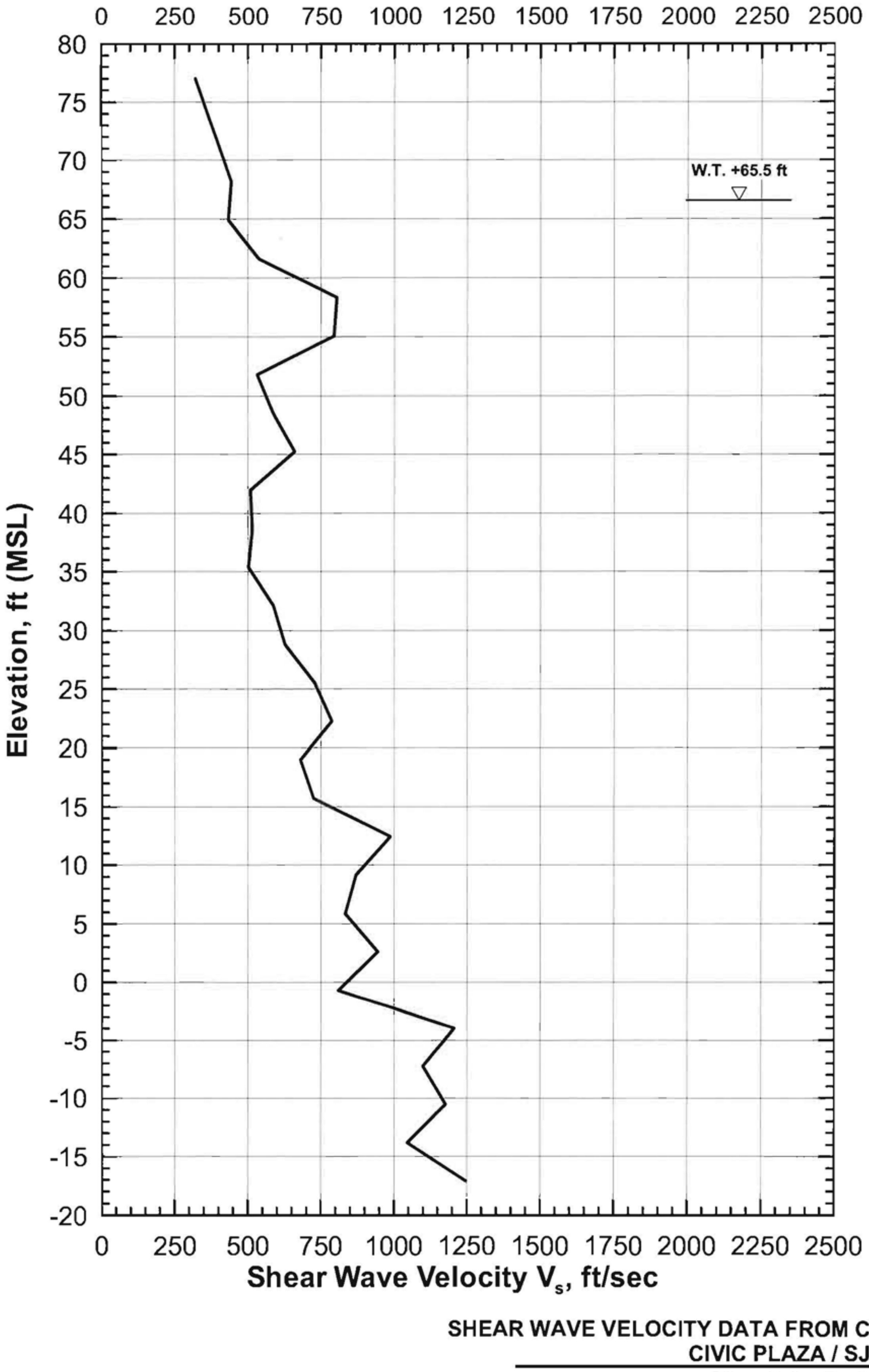
Silicon Valley Rapit Transit Corridor

April 2003
28648793

San Jose, California

URS

FIGURE F-3



SHEAR WAVE VELOCITY DATA FROM CPT-8 AT THE CIVIC PLAZA / SJSU STATION

Silicon Valley Rapit Transit Corridor

April 2003
28648793

San Jose, California

URS

FIGURE F-4

X:\Major_Project\BART_SJ\Analysis\SVRTC - SF (Makram) Files\Seismic Cones\Grapher files\CPT-8.grf