RAIL CONSTRUCTION CORPORATION

METRO RAIL PROJECT

Geotechnical Design Summary Report
for Construction Contract B-281

Hollywood/Vine Station

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1.0 Introduction

The Geotechnical Design Summary Report (GDSR) describes the subsurface conditions anticipated in the Contract Unit B-281 area and the influence that geologic conditions have had upon the design. In addition, the GDSR is intended to assist prospective bidders in evaluating the requirements for excavating and supporting the ground, and in establishing a geotechnical baseline that will serve as the basis for identification of differing site conditions in Contract Unit B-281 area.

The GDSR is incorporated into the construction Contract Documents and is binding upon both the Commission and the Contractor. It contains a description of the anticipated subsurface conditions at the project site, the anticipated ground behavior, and the impact these conditions may have on construction methods which are likely to be considered by the Contractor. In addition, requirements for needed protection and/or monitoring of existing structures, utilities and facilities adjacent to Contract Unit B-281 are presented.

The GDSR provides a brief description of the subsurface investigation, an interpretation of the data obtained, and the manner in which that information was incorporated into design. It includes a definition and discussion of geologic features of engineering and construction significance.

In the event of apparent conflicts, discrepancies, or inconsistencies with any other interpretation of geotechnical data made available to the Contractor, the GDSR shall take precedence in reconciliation of the conflict.

2.0 Project Description

2.1 General Information

Contract Unit B-281 includes construction of the Hollywood/Vine Station which consists of a cut-and-cover multi-level reinforced concrete station structure, and an adjoining cut-and-cover cross over structure. The contract will also include the removal of existing tunnel initial support system (installed by others under Contract Unit B-251) within the limits of the Hollywood/Vine Station. The scope of this contract also includes connecting existing tunnels to the station structure at both ends. Contract Unit B-281 extends from Station AR 549 + 92* to Station AR 558 + 81. The Hollywood/Vine Station is located within The Hollywood Boulevard right-of-way between about 166 feet east of the centerline of El Centro Avenue and about 292 feet west of the centerline of Argyle Avenue. The location of this contract, with respect to the Metro Red Line project, is shown in Figure 2-1.

This report is based on the current plan that the Contractor of Contract Unit B-251 will excavate the twin tunnels and install the required initial tunnel support system within the limits of the Hollywood/Vine Station prior to the completion of station structure excavation. If the B-251 twin tunnels are not excavated by the time the B-281 excavation starts, the Contractor of Contract Unit B-281 is restricted to excavating the station and installing necessary support system only to a depth of 30 feet or more above the top of the rail. After the tunnel excavation and initial tunnel support operations are completed, the B-281 Contractor can proceed with the station excavation to the final elevation.

**In this report, only the station number for AR track is given. Within the Hollywood/Vine Station limits, the station number for AL track is same as that for AR track.*

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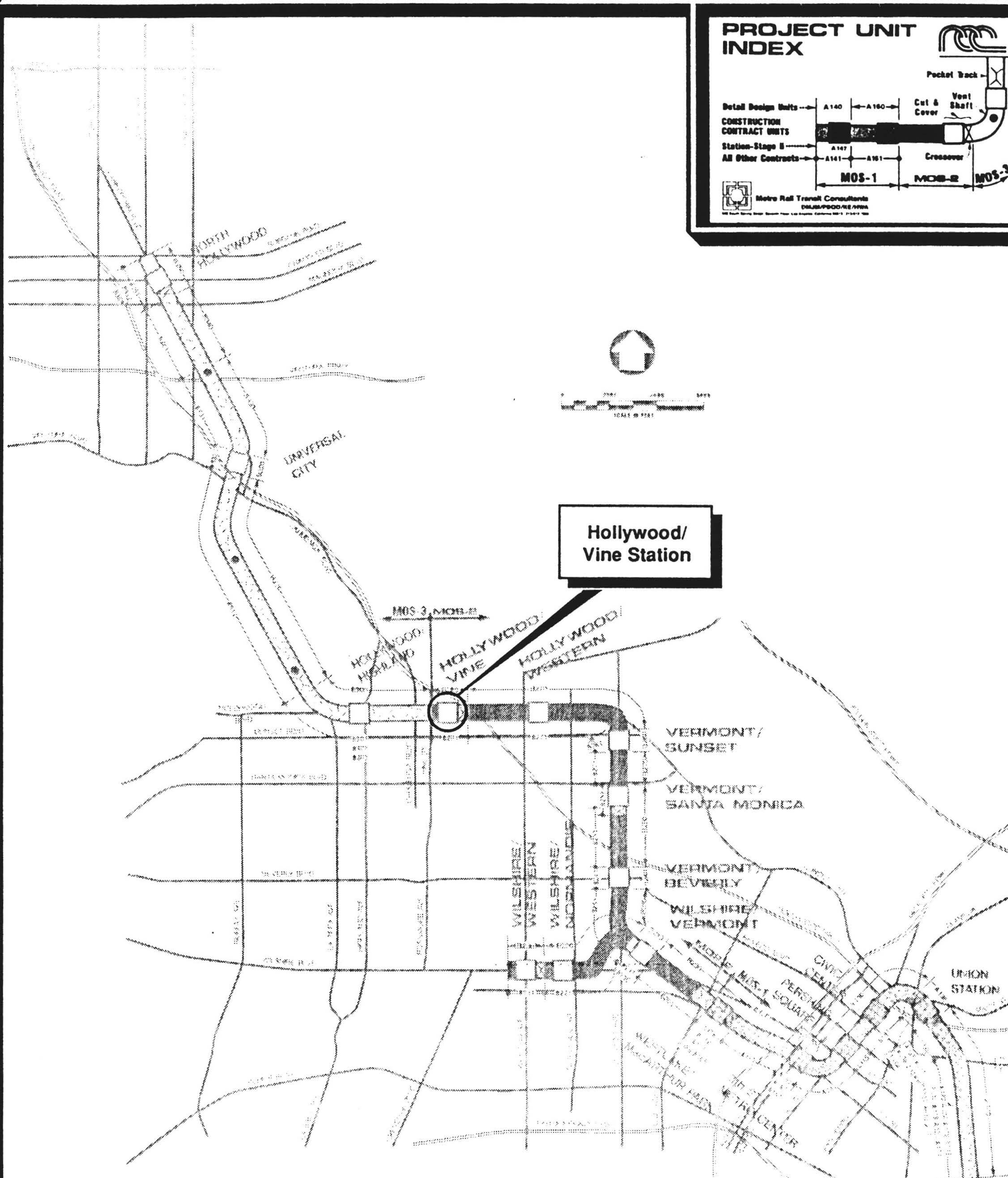

KEY PLAN

FIGURE 2–1

2.2 Existing Ground and Station Profiles

Ground surface and station profiles for Contract Unit B-281 are shown on Contract Drawings. In the station area, the existing paved ground surface slopes westerly from approximate Elevation 379** feet at the eastern end of the station (Station AR 549 + 92) to a topographically low of approximate Elevation 374 feet at approximate Station AR 554 + 40 and then gently slopes westerly to approximate Elevation 375 at the western end of the station (Station AR 558 + 81). The top of the rail and station invert both slope up from east to west at a gradient of +0.3 percent. The top of the rail is at Elevation 315.78 feet at the eastern end of the station (Station AR 549 + 92) and slopes up grade to the western end (Station AR 558 + 81) at Elevation 318.45 feet. The station invert ranges from approximate Elevation 308 feet at the eastern end to approximate Elevation 311 feet at the western end.

2.3 Geology and Borings

2.3.1 Available Geotechnical Investigations

Geotechnical investigations in the general vicinity of Contract Unit B-281 were first conducted in 1988 by The Earth Technology Corporation (TETC) under a Limited Preliminary Engineering (LPE) program for the Minimum Operable Segment 2 (MOS-2); which consisted of one boring and its subsequent conversion to a monitoring well at LPE-14 (approximate Station AR 560 + 73), approximately 192 feet west of the western end of the Hollywood/Vine Station (Reference 3.1 in Section 3.0). Subsequently, more detailed geotechnical investigations were conducted by TETC in 1989 (References 3.2 and 3.3). The borings of the geotechnical investigations were located to be as close as possible to the contract area. The penetration depth was selected to be about 20 feet to 40 feet below the planned station inverts at the time of the geotechnical investigations. The field work for the borings

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***Elevations refer to Los Angeles City Engineer's Datum - 1975 Adjustment* was completed by TETC in May 1989. Since then, the vertical alignments for the station have been revised, generally about 3 to 5 feet lower than those planned at the time of 1989 field investigation. Within the Contract B-281 limits, the 1989 geotechnical investigation consisted of four borings (PII-85, -86, -88 and -89), one piezometer (Monitoring Well PII-86), wireline electric logging, geotechnical laboratory testing and preliminary chemical testing. A supplementary geotechnical investigation for Contract Unit B-281 was performed in 1992 (Reference 3.4). The supplementary geotechnical investigation consisted of six borings (HV-1 through HV-6), one piezometer (Monitoring Well HV-2), pressuremeter tests in Borings HV-5 and HV-6, and geotechnical laboratory testing. In association with the environmental assessment, a deep Boring (EV-35A) was drilled in the contract area to a depth of about 55 feet below the planned station invert to provide additional geotechnical information. Locations and penetrations of these borings and piezometers are summarized in Table 2-1. The geotechnical borings are shown in the profiles included in the Contract Drawings.

An additional monitoring well (EV-37) was also installed in association with the environmental assessment in the contract area. Details of this monitoring well are documented in one report (Reference 3.6) and are included in Table 2-1.

The detailed boring logs and the results of TETC's geotechnical investigations have been documented in geotechnical reports referenced in Section 3.0.

2.3.2 Geologic Profiles

Locations and logs of geotechnical borings and monitoring wells and general geologic profiles in the vicinity of Contract Unit B-281 are provided in Contract Drawings. The geologic profiles are based on interpretations of boring data and engineering interpretation between borings to visually aid in a general understanding of subsurface conditions and to illustrate the variability of subsurface conditions. These interpolated

TABLE 2-1. SUMMARY OF GEOTECHNICAL BORING AND GROUNDWATER LEVEL DATA

BORING NO. (1)	APPROX. STA. ALONG CENTER LINE OF AR TRACK	APPROX. OFFSET FROM CENTER LINE OF AR TRACK (2) (feet)	APPROX. GROUND SURFACE ELEV. (3) (feet)	PENETRATION DEPTH (feet)	GROUNDWATER LEVEL DATA (4)					
					DATE	APPROX. DEPTH (feet)	APPROX. ELEV. (feet)	DATE	APPROX. DEPTH (feet)	APPROX. ELEV. (feet)
HV-2	551+03	10 RT.	378	92.5				4/92	64	314
HV-1	551+15	24 LT.	378	90.5						
HV-3	551+95	36 LT.	377	90.8						
EV-35A	552+18	5 LT.	375	120.5						
PII-85	552+67	25 LT.	376	81.0						
PII-86	553+89	39 RT.	375	91.0	12/91	67	308	4/92	67	308
HV-4	555+02	15 RT.	374	91.5						
PII-88	555+25	25 LT.	374	101.0						
EV-37	556+58	222 LT.	369	85.0	7/91	69	300	4/92	69	300
HV-5	557+00	11 RT.	373	86.5						
HV-6	557+09	47 LT.	372	86.0						
PII-89	557+92	25 LT.	373	101.0						

NOTES:

(1) PII series of borings and monitoring wells were drilled in 1989 for the Phase II (PII) program.
HV series of borings and monitoring wells were drilled in 1992 for the Supplementary Geotechnical Investigation 5.
EV series of borings and monitoring wells were drilled in 1990 and 1991 for Environmental Assessment (EV).

(2) LT. = Left; RT. = Right.

(3) Elevations refer to Los Angeles City Engineer's Datum - 1975 adjustment.

(4) Groundwater level data obtained at time of initial development of monitoring well and in April 1992 (most recent readings) are presented.

profiles are utilized to predict ground behavior on the basis of laboratory testing, field observations and testing in the project vicinity. More detailed boring data are presented in Contract Drawings and Sources of Information listed in Section 3.0. Description of the geologic setting, geotechnical data and subsurface conditions is provided in Section 4.0 (Geologic Setting and Subsurface Conditions) and Section 5.0 (Geologic Features of Engineering and Construction Significance).

3.0 Sources of Information

The following sources of information were used in developing this report:

3.1 The Earth Technology Corporation, "Geotechnical Investigation Report, Limited Preliminary Engineering Program, (LPE) MOS-2 Alignment," 1988.

3.2 The Earth Technology Corporation, "Geotechnical Report - Hollywood/Vine Station and Adjacent Tunnel Segments," May 1990.

3.3 The Earth Technology Corporation, "Summary of Subsurface Conditions, Metro Rail Project," May 1990.

3.4 The Earth Technology Corporation, "Supplementary Geotechnical Report, Investigation 5, Hollywood/Vine Station, Metro Red Line," April 1992.

3.5 The Earth Technology Corporation, "Stage I Environmental Site Assessment, Vermont/Hollywood Segment, Metro Rail Phase II," July 1990.

3.6 The Earth Technology Corporation, "Stage II Environmental Assessment, Hollywood Boulevard Segment," December 1991.

3.7 The Earth Technology Corporation, "Results of Groundwater Quality Analyses, Vermont/Hollywood Segment, MOS-2 Metro Red Line", June 1991.

3.8 The Earth Technology Corporation, "Groundwater Characterization, Vermont/Hollywood Segment, Metro Red Line," April 1992.

4.0 Geologic Setting and Subsurface Conditions

4.1 Geologic Setting

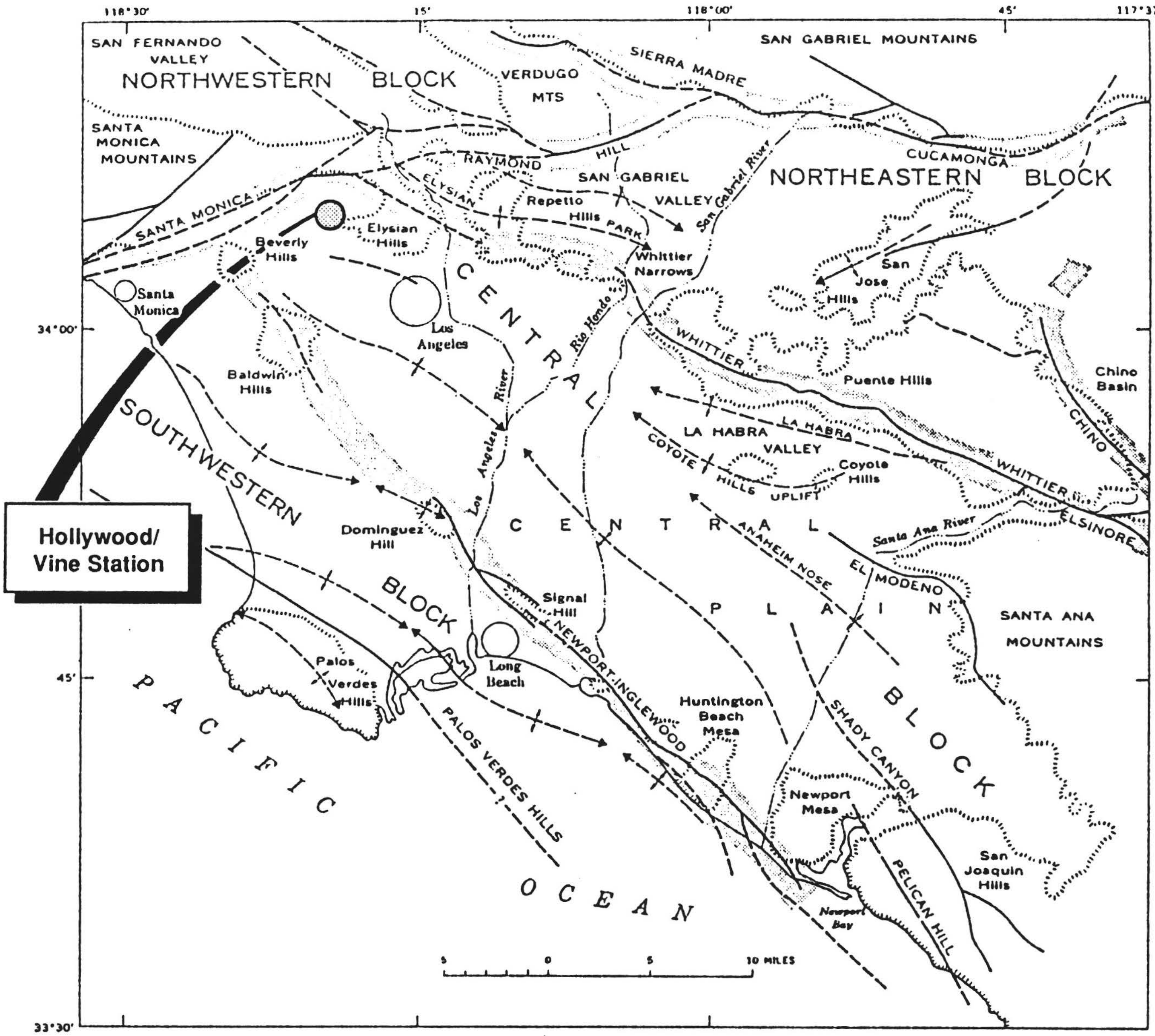
4.1.1 Regional Setting

The Hollywood/Vine Station is located within the Los Angeles Basin, whose boundaries are based on tectonic or structural blocks. As shown in Figure 4-1, the basin can be further subdivided into four structural blocks including the Northwestern Block, the Northeastern Block, the Central Block, and the Southwestern Block. The Contract Unit B-281 is located in the Central Block, near the boundary between the Central Block and the Northwestern Block. The Central Block is bounded on the north by the Santa Monica-Raymond Hill Fault zone, on the northeast and east by the Whittier-Elsinore Fault zone, and on the west-southwest by the Newport-Inglewood Fault zone (Figure 4-1). The Northwestern Block of the Los Angeles Basin is bounded on the south by the Santa Monica-Raymond Hill Fault zone, on the east by the Sierra Madre Fault zone, on the north by the Santa Susana-Oak Ridge and San Gabriel Fault zone and on the west by the Pacific Ocean (Figure 4-1).

4.1.2 Stratigraphy and Geologic Units

The Central Block of the Los Angeles Basin in the general vicinity of Contract Unit B-281 is underlain by a relatively deep structural depression which has been infilled with a sequence of geologic units. Geologic units encountered within the depth range of station excavation in the general vicinity of Contract Unit B-281 are described in order of deposition, as follows:

- Old Alluvium (Units A3 and A4). These Pleistocene age sediments consist of granular alluvium (Unit A3) deposited in relatively "swift" water environments, and fine-grained alluvium (Unit A4) deposited in



EXPLANATION

WHITTIER	Anticline	Syncline	
Fault or fault zone *Dashed where approximately located; queried where doubtful*	Anticline *Dashed where approximately located*	Syncline *Dashed where approximately located*	Boundary of structural block

GEOLOGIC SETTING

FIGURE 4-1

relatively "quiet" water environments. The granular Old Alluvium consists primarily of medium-dense to very dense clean sand, silty sand, clayey sand (with fines content less than 35 percent), sandy silt, gravelly sand, sandy gravel, and gravel. The fine-grained Old Alluvium consists primarily of stiff to hard clay, silty clay, sandy clay, silt, clayey silt, and clayey sand (with fines content of 35 percent or more).

- Young Alluvium (Units A1 and A2). These Holocene-age sediments consist of granular alluvium (Unit A1) deposited in relatively "swift" water environments, and fine-grained alluvium (Unit A2) deposited in relatively "quiet" water environments. The granular Young Alluvium consists predominantly of loose to dense clean sand, silty sand, clayey sand (with fines content less than 35 percent), gravelly sand, sandy gravel, and gravel, with a potential local presence of cobbles and boulders. The fine-grained Young Alluvium consists of medium to hard clay, silty clay, silt, clayey silt, sandy clay, and clayey sand (with fines content of 35 percent or more) with a local presence of traces of gravel.

Detailed subsurface and groundwater conditions encountered in the Contract Unit B-281 area are discussed in Sections 4.2 and 4.3.

4.2 Site Geologic Conditions

Within the Contract B-281 area, the subsurface stratigraphy below the existing roadway pavement and shallow fill consists of Young Alluvium (Units A1 and A2) overlying Old Alluvium (Units A3 and A4). The contact between Young Alluvium and Old Alluvium is difficult to delineate since the criteria for distinction are subtle. The delineation shown in the geologic profiles in Contract Drawings was based on color, density, consistency (as determined by the standard penetration test (SPT) blowcounts, the presence or absence of cementation, higher plasticity clays or coarse gravel, and on engineering judgement.

Based on available boring data, the Young Alluvium within the station area varies from about 48 feet to about 60 feet thick. This geologic unit is composed of about 90 percent of granular Young Alluvium (Unit A1) interspersed with about 10 percent of fine-grained Young Alluvium (Unit A2). Granular Old Alluvium consists predominantly of medium dense to dense silty sand, sandy silt, clayey sand (with fines content less than 35 percent), sand and gravelly sand. Available data from the 11 borings within the station area indicate that the equivalent SPT*** blowcounts of the granular Young Alluvium range from two to more than the cutoff value of 100 blows per foot. Low SPT values within Unit A1 of less than 10 blows per foot are localized and generally located less than 15 feet below ground surface. Fine-grained Young Alluvium within the station area consists predominantly of medium to hard silty clay, clay, clayey silt and clayey sand (with significant plastic clay and fines content of 35 percent or more). Available SPT data within the station area indicate that the equivalent SPT blowcounts of the fine-grained Young Alluvium range from about five to 76 with an average value of about 28. Again, the soils within Unit A2 with low blowcounts of less than 10 blows per foot are localized and generally located less than 15 feet below ground surface. The wide variety and variation in soil types and the interspersed natures of both Young Alluvium units are indicative that Young Alluvium is heterogenous and nonuniform. Histograms of equivalent SPT blowcounts for Young Alluvium within the station area are shown in Figure 4-2.

Old Alluvium is also heterogeneous and nonuniform in nature. Within the exploration depth of the borings in the station area, the Old Alluvium consists of about 80 percent of granular Old Alluvium (Unit A3) interspersed with about 20 percent of fine-grained Old Alluvium (Unit A4). Granular Old Alluvium consists predominantly of dense to very dense sand, silty sand, clayey sand (with fines content less than 35 percent) with zones of gravel and gravelly sand. Available SPT data within the station area indicate that the equivalent SPT

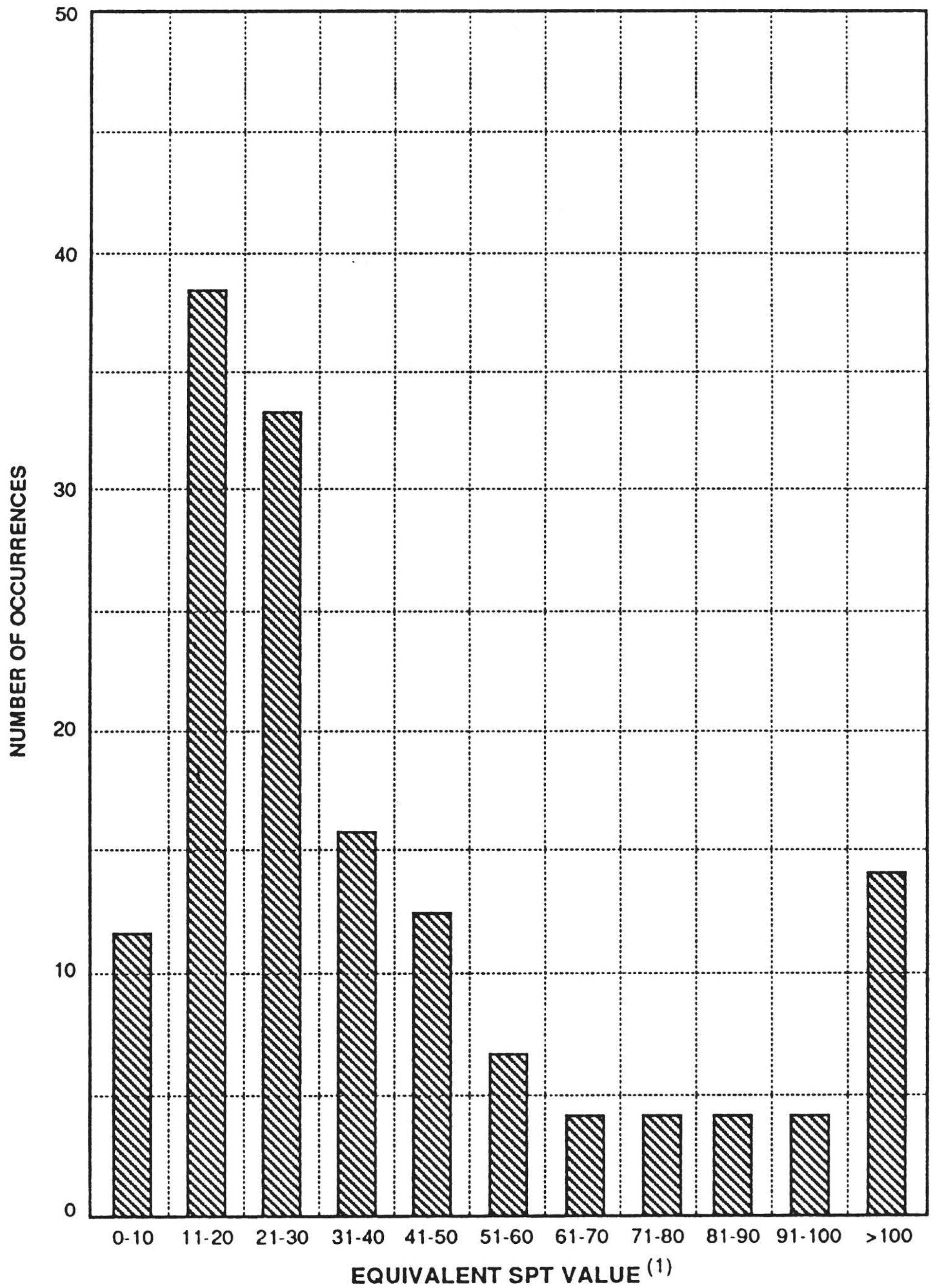
***_Refer to Table 4-1 for the definition of equivalent SPT used in this report._

TABLE 4-1. PROCEDURE USED TO COMPUTE THE EQUIVALENT SPT VALUE

During the geotechnical investigation, a standard penetration test (SPT) split-spoon sampler was driven into the soil by a 140-pound hammer dropping 30 inches in free fall. The number of blows required to drive the split-spoon sampler a distance of 12 inches after an initial penetration of 6 inches is referred to as the SPT value. In addition to the SPT sampler, a California drive sampler was used. This was driven with hammers of different weight and fall than the SPT hammer. In order to compare the SPT values on a uniform basis, the drive sampler blowcount was corrected to the SPT value. In this GDSR the SPT values and corrected SPT values are designated as the "Equivalent SPT Value." Methodology used in computing the equivalent SPT value is obtained by one of the following cases, whichever is applicable:

P_1	=	Penetration for first 6" or less
N_1	=	Number of blows for first 6" or less penetration (SPT)
N_1^1	=	Number of blows for first 6" or less penetration (Drive) corrected for hammer weight and fall
P_2	=	Penetration from 6" to 12"
N_2	=	Number of blows for 6" to 12" penetration (SPT)
N_2^1	=	Number of blows for 6" to 12" penetration (Drive) corrected for hammer weight and fall
P_3	=	Penetration from 12" to 18" (SPT)
N_3	=	Number of blows for 12" to 18" penetration (SPT)
EN	=	Equivalent SPT value

SPT Sampler	Drive Sampler
Case a: $P_1 + P_2 + P_3 = 18''$ $EN = N_2 + N_3$	Case a: $P_1 + P_2 = 12''$ $EN = N_1^1 + N_2^1$
Case b: $P_3 < 6''$ $EN = N_2 + \frac{N_3}{P_3} \times 6$	Case b: $P_2 < 6''$ $EN = N_1^1 + \frac{N_2^1}{P_2} \times 6$
Case c: $P_2 < 6''$ $EN = \frac{N_2}{P_2} \times 12$	Case c: $P_1 < 6''$ $EN = \frac{N_1^1}{P_1} \times 12$
Case d: $P_1 < 6''$ $EN = \frac{N_1}{P_1} \times 12$	



NOTE: (1) For definition of equivalent SPT value refer to Table 4-1.

HISTOGRAMS OF EQUIVALENT SPT VALUES IN YOUNG ALLUVIUM IN CONTRACT UNIT B-281

FIGURE 4-2

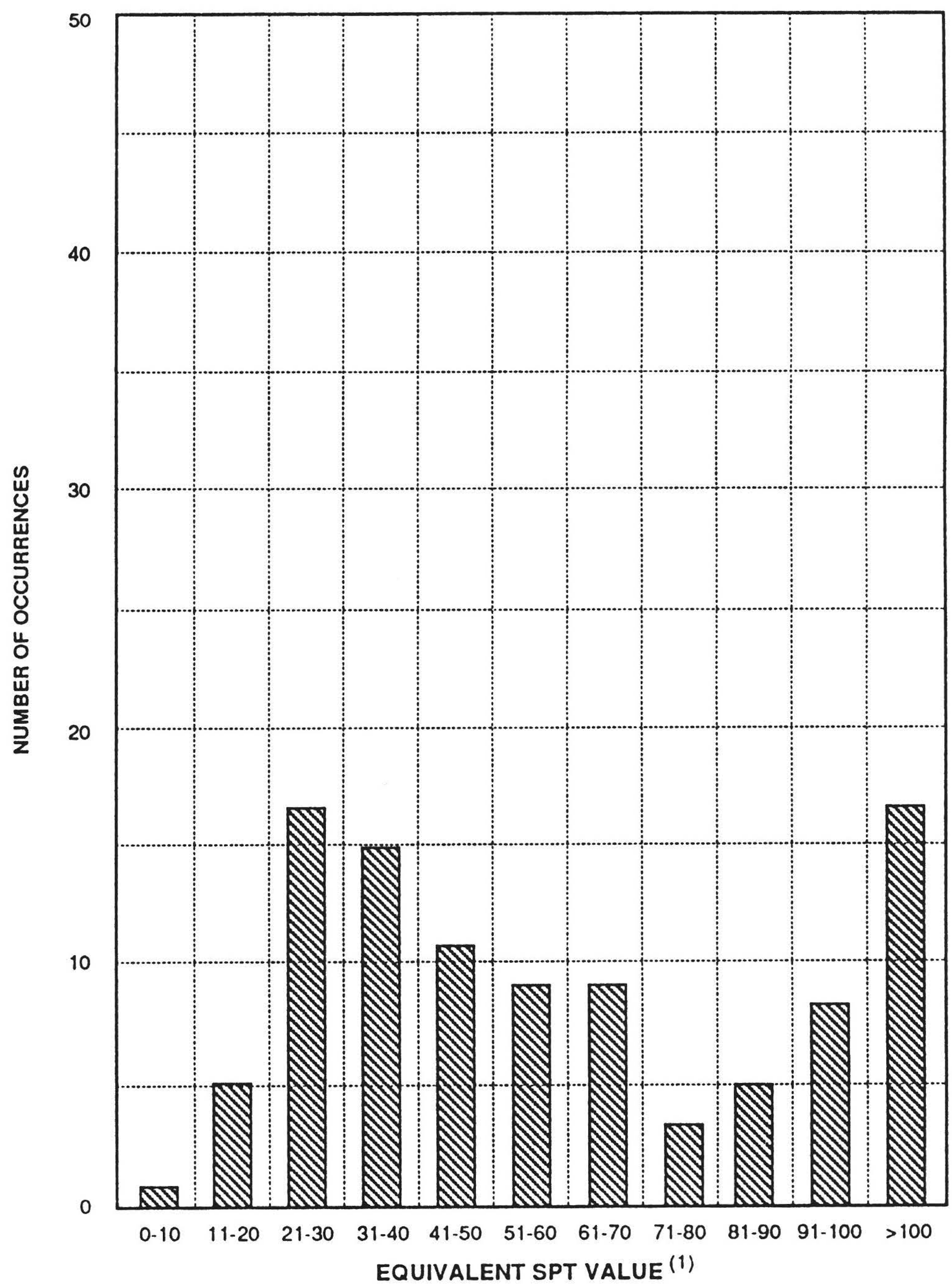
blowcounts of the granular Old Alluvium range from 7 to more than the cutoff value of 100 blows per foot. Fine-grained Old Alluvium in the station area consists predominantly of very stiff to hard silty clay, clayey silt, and clayey sand (with significant plastic clay and fines content of 35 percent or more). The equivalent SPT blowcounts for the fine-grained Old Alluvium range from 18 to more than the cutoff value of 100 blows per foot. Histograms of equivalent SPT blowcounts for the Old Alluvium for all borings within the station area are shown in Figure 4-3.

4.3 Groundwater Conditions

Groundwater levels in the station area were monitored at three monitoring wells/piezometer locations (PII-86, EV-37 and HV-2). Groundwater level readings were taken periodically. The first and most recent readings are provided in Table 2-1. These data together with available groundwater reading data from adjacent tunnels (Reference 3.2) indicate that the groundwater table is within the Old Alluvium. In general, the present groundwater levels are at or below the planned station excavation bottom approximately west of Monitoring Well PII-86 (approximate Station AR 553 + 89) while the groundwater levels are up to about 6 feet above the planned station excavation bottom, east of Monitoring Well PII-86. Available data also indicate that the groundwater table appears to gently slope down westerly at an approximate gradient of about 1 percent. Due to seasonal groundwater level variations in the area, there is a possibility that the groundwater may rise to an elevation a few feet above the current levels.

4.4 Engineering Properties of the Subsurface Materials

The general geologic profiles showing subsurface materials and distributions along Contract Unit B-281 are shown in the Contract Drawings. Details of engineering properties of subsurface materials based on the results of field and laboratory tests for Contract Unit B-281 have been provided in a geotechnical report (References 3.2 and 3.4).



NOTE: (1) For definition of equivalent SPT value refer to Table 4-1.

HISTOGRAMS OF EQUIVALENT SPT VALUES IN OLD ALLUVIUM IN CONTRACT UNIT B-281

FIGURE 4-3

Available field and laboratory test data with respect to soil type, geologic unit, penetration resistance in terms of equivalent SPT blowcount, moisture content, dry density, grain size distribution, Atterberg limits, and permeability of the subsurface materials are summarized in Table A-1 (Appendix A).

Laboratory tests for engineering properties of the shallow surficial fill (which has little or no effect on the Contract B-281 construction) were not performed. Tables 4-2 and 4-3 summarize equivalent SPT, moisture content, dry density, percent fines, index properties, and permeability test data for the Young Alluvium and Old Alluvium, respectively. Two series of tabulation are presented in these tables. Series A tables summarize the available data from the borings within the station area, while series B tables summarize the available data from the borings within the station area (References 3.2 and 3.4) and available soil borings in similar soil conditions from adjacent tunnel segments (from approximate Station AR 507 + 35 to AR 549 + 92 and from approximate Station AR 558 + 81 to AR 589 + 24). These tables are presented to demonstrate the potential range and variation of the engineering properties of the Young Alluvium and Old Alluvium.

Available direct shear test data for Young and Old Alluvium within the station area is limited. Therefore, to demonstrate the potential range and variation, available direct shear test data for Young and Old Alluvium within the station area and adjacent tunnel segments (in similar soil conditions) are summarized in Figures 4-4 and 4-5, respectively. Similarly, results of consolidated undrained triaxial compression tests with pore pressure measurements (CIU) on samples of granular Old Alluvium within the station area and adjacent tunnel segments are summarized in Figure 4-6. The approximate ranges of strength parameters of the alluvium units as determined by the direct shear and CIU tests are as follows:

TABLE 4-2A. SUMMARY OF GEOTECHNICAL ENGINEERING PROPERTIES OF YOUNG ALLUVIUM WITHIN THE HOLLYWOOD/VINE STATION BASED ON AVAILABLE TEST DATA

	Equivalent SPT Value[1]	Moisture Content (%)	Dry Density (pcf)	Percent Fines[2]	Atterberg Limits		Coefficient of Permeability (10E-07 cm/sec)
					Liquid Limit	Plasticity Index	
No. of Tests	154	34	31	52	14	14	NA
Minimum	2	8	101	1	26	9	NA
Maximum	>100	17	128	43	37	25	NA
Mean	NA[3]	12	117	20	29	15	NA
Standard Deviation	NA	2	6	11	4	5	NA

TABLE 4-2B. SUMMARY OF GEOTECHNICAL ENGINEERING PROPERTIES OF YOUNG ALLUVIUM WITHIN THE HOLLYWOOD/VINE STATION AND ADJACENT TUNNEL SEGMENTS BASED ON AVAILABLE TEST DATA

	Equivalent SPT Value[1]	Moisture Content (%)	Dry Density (pcf)	Percent Fines[2]	Atterberg Limits		Coefficient of Permeability (10E-07 cm/sec)
					Liquid Limit	Plasticity lindex	
No. of Tests	485	131	128	128	43	43	3
Minimum	2	5	94	1	22	7	0.35
Maximum	>100	29	129	74	54	32	2100
Mean	NA[3]	15	109	27	34	17	NA
Standard Deviation	NA	5	9	16	7	6	NA

NOTES:

(1) For definition of equivalent SPT value refer to Table 4-1.

(2) Fines refer to percentage of soil by weight passing through No. 200 sieve.

(3) NA = not applicable.

TABLE 4-3A. SUMMARY OF GEOTECHNICAL ENGINEERING PROPERTIES OF OLD ALLUVIUM WITHIN THE HOLLYWOOD/VINE STATION BASED ON AVAILABLE TEST DATA

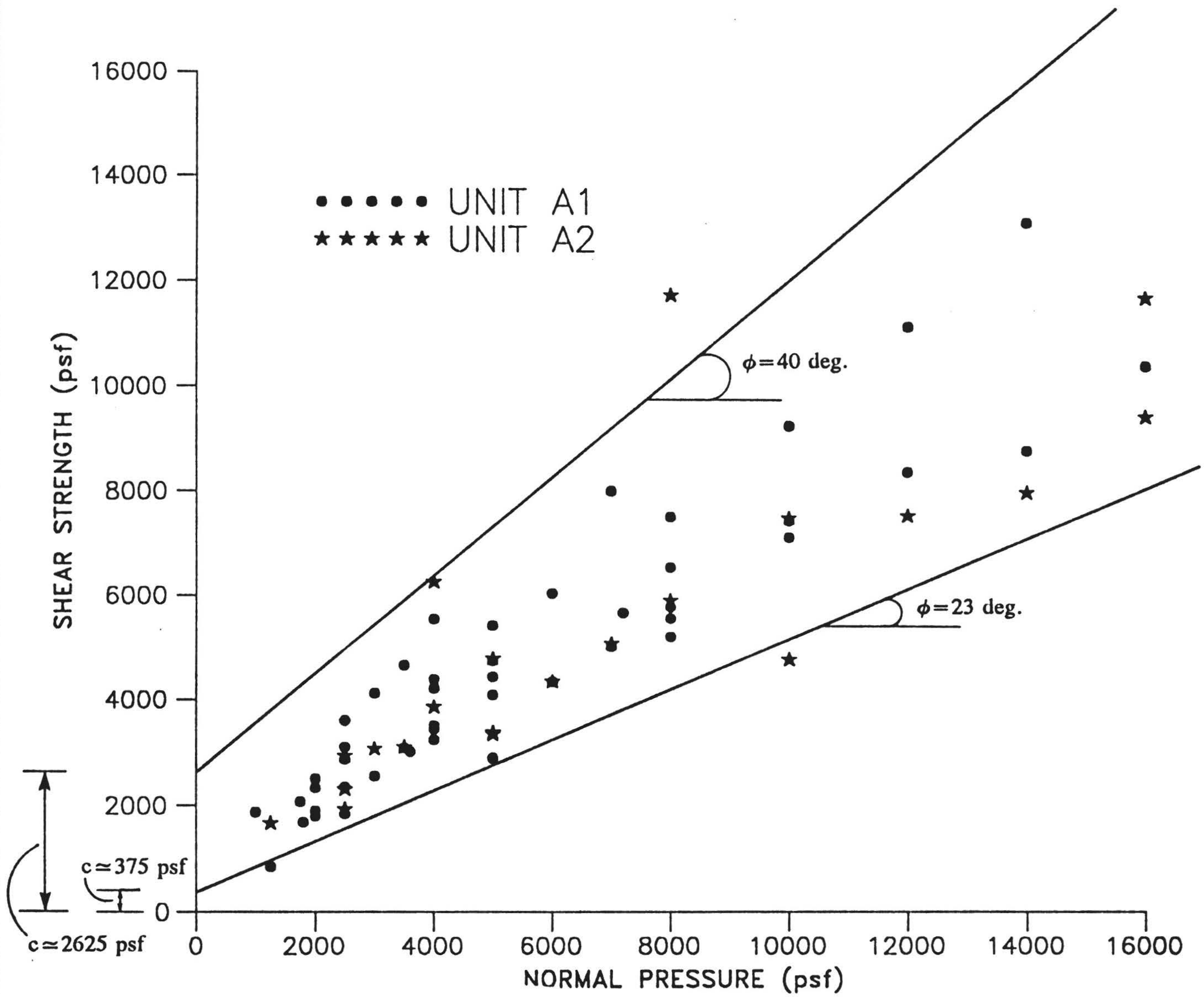
	Equivalent SPT Value[1]	Moisture Content (%)	Dry Density (pcf)	Percent Fines[2]	Atterberg Limits		Coefficient of Permeability (10E-07 cm/sec)
					Liquid Limit	Plasticity Index	
No. of Tests	100	26	24	27	14	14	3
Minimum	7	11	104	6	18	8	18.2
Maximum	>100	23	126	74	45	29	365
Mean	NA[3]	16	115	27	32	17	228
Standard Deviation	NA	3	7	16	7	6	151

TABLE 4-3B. SUMMARY OF GEOTECHNICAL ENGINEERING PROPERTIES OF OLD ALLUVIUM WITHIN THE HOLLYWOOD/VINE STATION AND ADJACENT TUNNEL SEGMENTS BASED ON AVAILABLE TEST DATA

	Equivalent SPT Value[1]	Moisture Content (%)	Dry Density (pcf)	Percent Fines[2]	Atterberg Limits		Coefficient of Permeability (10E-07 cm/sec)
					Liquid Limit	Plasticity Index	
No. of Tests	406	106	101	108	46	46	4
Minimum	7	7	92	5	18	7	18.2
Maximum	>100	30	128	74	50	31	2200
Mean	NA[3]	18	111	32	35	18	720
Standard Deviation	NA	5	8	18	7	6	864

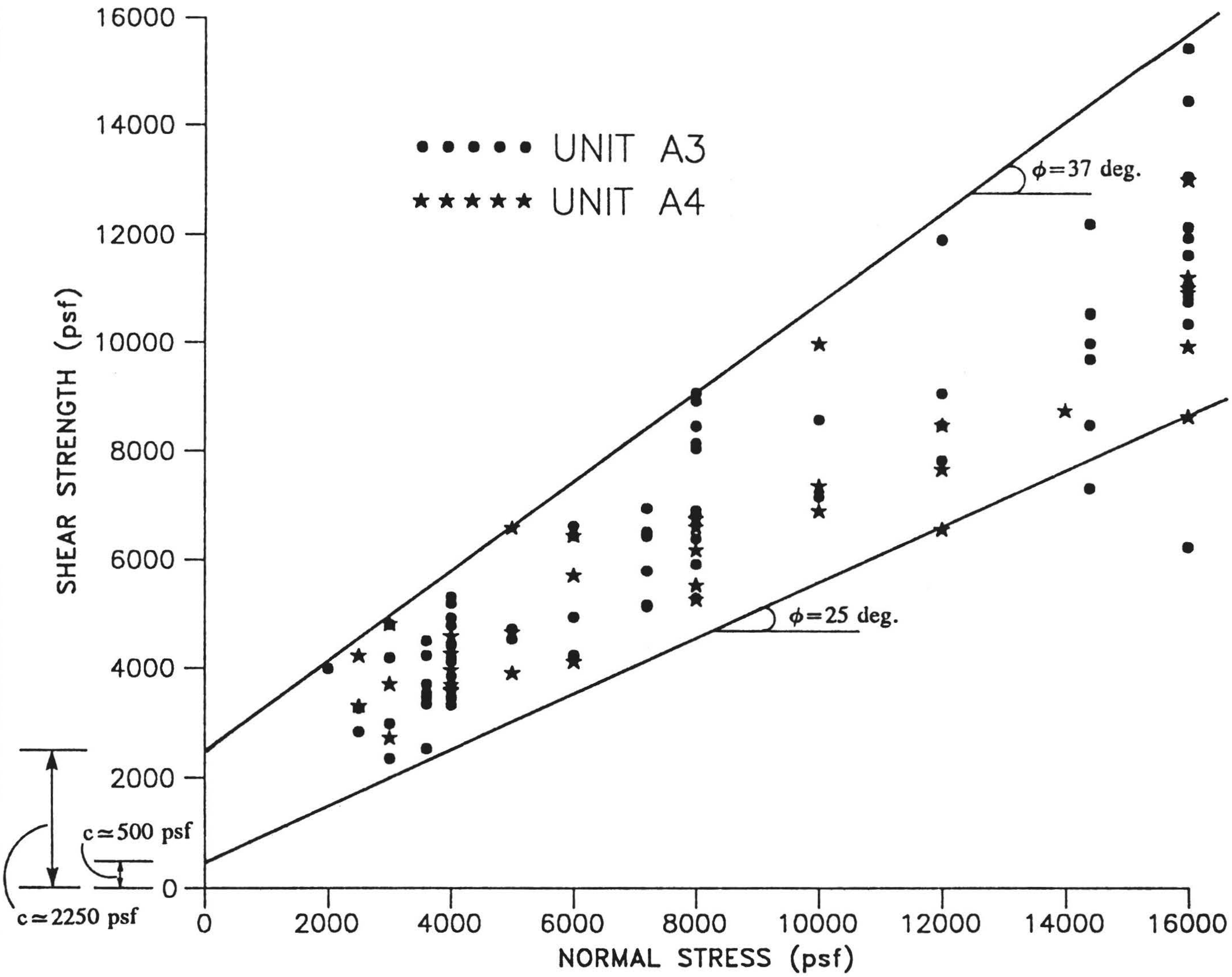
NOTES:

(1) For definition of equivalent SPT value refer to Table 4-1.
(2) Fines refer to percentage of soil by weight passing through No. 200 sieve.
(3) NA = not applicable.



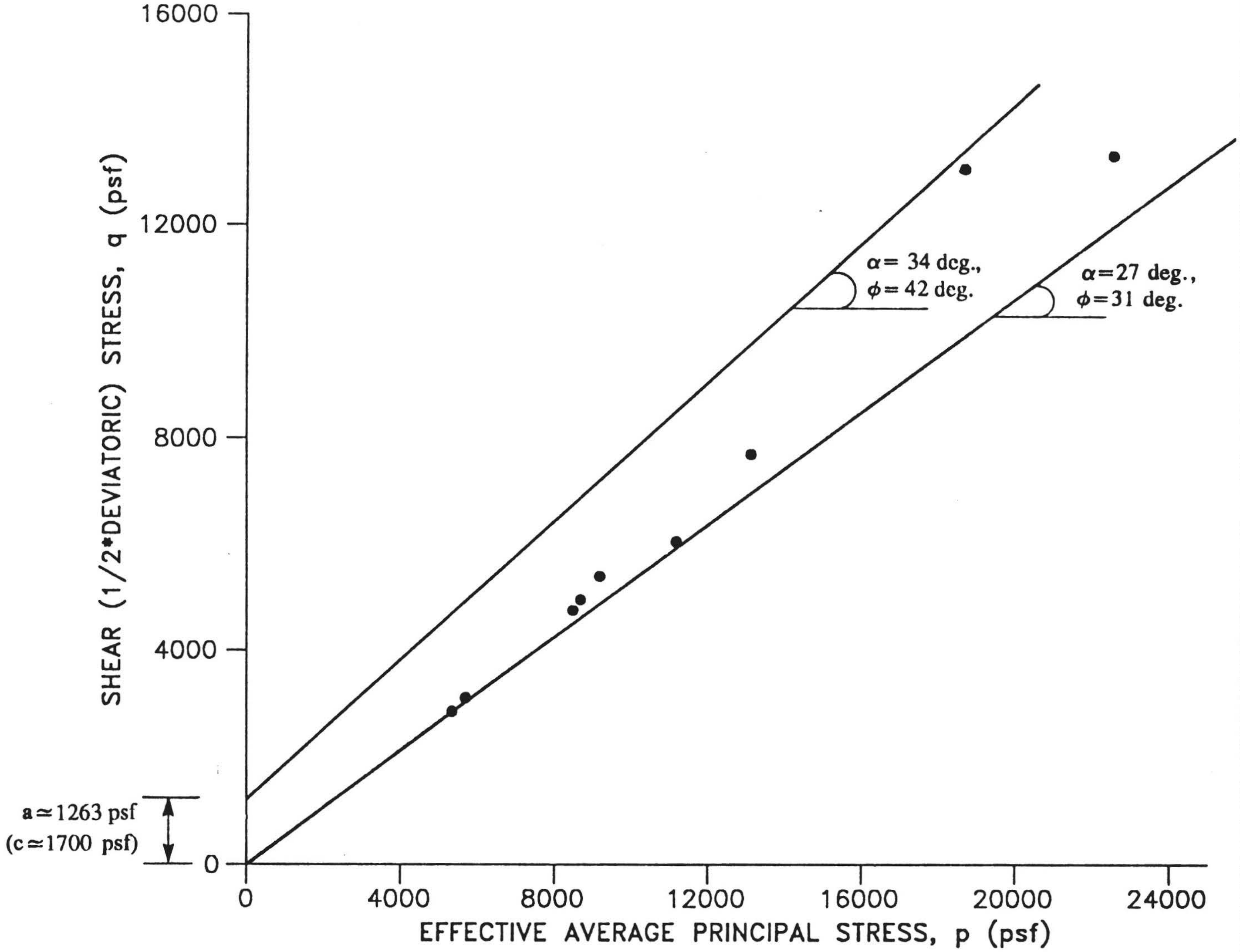
RESULTS OF DIRECT SHEAR TESTS ON YOUNG ALLUVIUM WITHIN THE HOLLYWOOD/VINE STATION AND ADJACENT TUNNEL SEGMENTS

FIGURE 4-4



RESULTS OF DIRECT SHEAR TESTS ON OLD ALLUVIUM WITHIN THE HOLLYWOOD/VINE STATION AND ADJACENT TUNNEL SEGMENTS

FIGURE 4-5



Explanation

$p=(\sigma_1'+\sigma_3')/2$

$q=(\sigma_1'-\sigma_3')/2$

$\phi=\arcsin(\tan\alpha)$

$c=a/\cos\phi$

RESULTS OF CIU TESTS ON GRANULAR OLD ALLUVIUM WITHIN THE HOLLYWOOD/VINE STATION AND ADJACENT TUNNEL SEGMENTS

FIGURE 4-6

Unit	Direct Shear Tests		CIU Tests	
	Friction Angle (degrees), ϕ	Cohesion (psf), c	Effective Friction Angle (degrees), ϕ'	Effective Cohesion (psf), c'
Young Alluvium	23-40	375-2,625	-	-
Old Alluvium	25-37	500-2,250	-	-
Granular Old Alluvium	-	-	31-42	0-1,700

Direct shear tests were performed on drive samples while CIU tests were performed on Pitcher (thin-walled tube) samples (Appendix A, Tables A-2 and A-3).

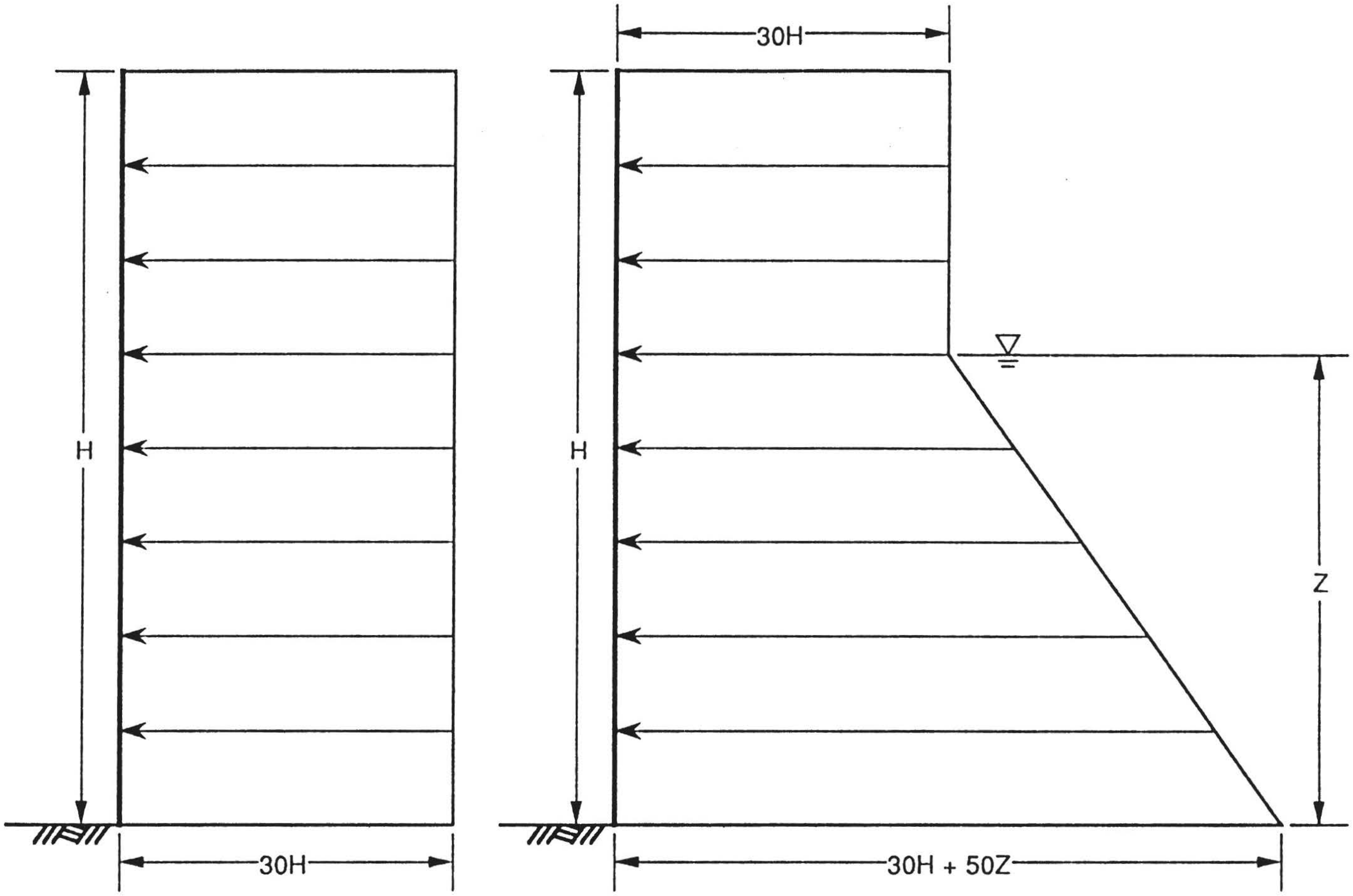
Table 4-4 summarizes Young's Modulus values of Young Alluvium and Old Alluvium based on the results of pressuremeter tests performed as part of a supplementary geotechnical investigation (see Reference 3.4) in Borings HV-5 (approximate Station AR 557 + 00) and HV-6 (approximate Station AR 557 + 09). Anticipated ranges of Young's Modulus for these alluvial soils based on engineering correlation (Reference 3.2) and the pressuremeter test results are also shown in Table 4-4. The stiffness characteristics of the Young and Old Alluvium will have significant effects on the magnitude and distribution of induced lateral load on any shoring system which uses internal bracing or combined internal bracing with external tiebacks.

4.5 Lateral Earth Pressures and Stability Consideration

4.5.1 Lateral Pressures Criteria

Based on the available subsurface conditions and engineering properties of the subsurface materials, design lateral pressures for the multiple braced excavation support systems above the bottom of excavation due to subsurface materials and groundwater are established and shown in Figure 4-7. These diagrams are intended to be used for sizing of the support members.

It should be noted that the design lateral pressures shown in Figure 4-7 are applicable to flexible wall systems to support the station excavation until permanent rigid wall systems are installed. Magnitudes and distribution of lateral pressures on permanent rigid wall systems are specified in the geotechnical report (Reference 3.2).



(A) Dewatered

(B) Not Dewatered

Notes:

1. H and Z in Feet
2. Lateral Pressure in psf

DESIGN LATERAL PRESSURES FOR EXCAVATION SUPPORT ABOVE BOTTOM OF EXCAVATION IN YOUNG AND OLD ALLUVIUM

FIGURE 4-7

TABLE 4-4. RANGES OF YOUNG'S MODULUS FOR ALLUVIUM

Soil Type	Young's Modulus (ksf)	
	Based on Pressuremeter[1] Test Results	Anticipated Range
Granular Young Alluvium (Unit A1)	100 to 150	50 to 1000
Fine-grained Young Alluvium (Unit A2)	135 to 380	50 to 750
Granular Old Alluvium (Unit A3)	DNA[2]	100 to 2000
Fine-grained Old Alluvium (Unit A4)	560 to 1025	100 to 2000

NOTES:

(1) Performed in Borings HV-5 (approximate Station AR 557+00) and HV-6 (approximate Station 557+09).
(2) DNA=data not available.

4.5.2 Stability Consideration

A factor of safety of 1.5 or more is required for the overall stability of the excavation and temporary support system. Based on the SPT data and the results of laboratory tests on the alluvium samples from this station and adjacent areas, the recommended shear strength parameters are as follows:

Young Alluvium:	$c = 600$ psf; $\phi = 26°$
Old Alluvium:	$c = 600$ psf; $\phi = 28°$

4.6 Gassy Conditions

During geotechnical field work (References 3.1, 3.2 and 3.4) the background and headspace Organic Vapor Analyzer (OVA) readings of every soil sample and triple-meter monitoring on samples with high OVA readings were performed. Headspace OVA readings range from 0 to 21 ppm with a majority of the readings at less than 10 ppm above the corresponding background readings. During the Stage II environmental assessment (Reference 3.6) Flame Ionization Detector (FID) and Photo Ionization Detector (PID) readings were obtained. Within the station area most of the FID readings are less than 10 ppm above the corresponding background readings, except some localized FID readings up to 22 ppm above the background in Boring EV-35 (approximate Station AR 552 + 18). The PID readings in Boring EV-35 registered zero, whereas in Boring EV-38 (approximate Station AR 556 + 78) the PID reading ranged from 14 to 49 ppm above the corresponding background readings. Sulfur odors were occasionally noticed during drilling and sampling of borings during the field work.

The potential accumulation of methane and other gases within oil fields in the Los Angeles Basin is well known, as evidenced by the fire explosion within the Salt Lake Oil Field at West Third Street in 1984. The known closest boundaries of the Salt Lake and Western Avenue Oil Fields are about 8,000 and 9,000 feet from the Contract Unit B-281, respectively. Oil fields are known sources of methane and H_2S. Thus, the possibility of high methane and H_2S concentrations in the station area cannot be eliminated. The Contract Unit B-281 has been classified as "potentially gassy" by the California Department of Industrial Relations, Division of Occupational Safety and Health Administration (CAL/OSHA). Therefore, the contractor will comply with the applicable provisions in accordance with Specification Section 01545, Worksite Safety Requirements. These safety measures are required to avoid any possible harmful accumulation of H_2S and hydrocarbon gases in the excavation during the construction period.

4.7 Chemical Contamination in Subsurface Materials and Groundwater

4.7.1 Overview

Stage I and II environmental assessments and groundwater quality assessments of the Hollywood Boulevard Segment were performed and the results of this work are presented in References 3.5 through 3.8. Anticipated contamination in soil and groundwater in the Contract Unit B-281 area, inferred from these studies, is discussed in Sections 4.7.2 and 4.7.3, respectively.

4.7.2 Contamination in Soil

4.7.2.1 Crude Oil

During drilling of Boring EV-37 (Station AR 556 + 58), field instruments indicated high Total Petroleum Hydrocarbon (TPH) concentrations in soil samples from 5 feet and 30 feet below ground surface. This observation indicates the possibility of pockets of heavy hydrocarbons related to natural crude oil. There is a possibility that the soil within the station boundaries may be contaminated with isolated pockets of naturally occurring crude oil and related gases since the station area is located about 8,000 feet from the Salt Lake and Western Oil Fields. If soil contaminated with crude oil is found within the station excavation, it must be treated as a California-regulated hazardous waste based on the level of contamination.

4.7.2.2 TPH (Total Petroleum Hydrocarbons) and BTEX (Benzene, Toluene, Ethylbenzene and Xylenes)

Available data indicate that localized zones of soil within the station area are contaminated with measurable concentrations of TPH and BTEX. For purposes of this GDSR, and in the absence of other contaminants, soil containing contaminants with concentrations less than those listed below are assumed to be "clean."

Chemical	Contamination Concentration Limit
TPH	100 mg/kg
Benzene	1.0 μg/kg
Toluene	100 μg/kg
Ethylbenzene	680 μg/kg
Xylenes	1750 μg/kg

Based on the above criteria, the extent of TPH or BTEX contaminated soils is expected to be localized and minimal.

4.7.3 Contamination in Groundwater

Xylenes and ethylbenzene were detected below the corresponding California Maximum Contaminant Levels (MCLs) or guidelines for drinking water in a groundwater sample from Monitoring Well PII-86 (approximate Station 553+89) within the Contract Unit B-281 area. In addition, Total Recoverable Petroleum Hydrocarbon (TRPH) and oil and grease were detected in groundwater samples from Monitoring Well PII-86 at concentrations above the generally accepted guideline of 0.1 mg/L. Thus, localized groundwater contamination of TRPH and oil and grease is anticipated in the Contract Unit B-281 area.

Benzene and total petroleum hydrocarbons (TPH) were detected above the MCL for benzene and the generally accepted guideline for TPH in a groundwater sample from Monitoring Well LPE-14 (approximate Station AR 560 + 73), approximately 192 feet west of the western end of the Hollywood/Vine Station.

No dewatering prior to station excavation is anticipated. However, localized and a small amount of groundwater seeping into the excavation should be anticipated. Effluent discharge will be required to meet all the applicable standards, conditions and requirements imposed by the City of Los Angeles Sanitation District and RWQCB.

5.0 Geologic Features of Engineering and Construction Significance

5.1 General

Subsurface conditions in the Contract B-281 area are described in Section 4.0. In general, station excavation and construction will encounter thin roadway pavement, shallow fill (up to 5 feet thick), and about 60 to 67 feet of heterogeneous and nonuniform Young and Old Alluvium. As described in Section 4.0, groundwater table in the contract area is within the Old Alluvium. This section provides a description of potential geologic subsurface features which may significantly affect the construction of Contract B-281.

5.2 Difficult Excavation Conditions

Station excavation in this contract will encounter a number of conditions during excavation. These conditions are summarized as follows:

- Local presence of granular Young and Old Alluvium with little or no fines (i.e., fines content less than 12 percent), which may readily run and ravel.

- Local presence of soft to medium stiff fine-grained and loose granular alluvial soils which may have a tendency to slowly slough or ravel if support is not applied timely.

- Although not encountered in the borings in the Contract Unit B-281 area, abandoned rail and/or rail ties may exist within the station excavation limits (railway remains were encountered at various locations along Hollywood Boulevard).

- High water table in portions of station excavation which may affect soldier pile drill hole stability and excavation stability.

5.3 Fault Crossings

No known active or inactive faults cross or project toward the station area.

5.4 Oil and Gas Fields and Undocumented Oil Wells

As described in Section 4.5, the known closest boundaries of the Salt Lake and Western Avenue Oil Fields are about 8,000 and 9,000 feet from the station area, respectively. In addition to being the likely sources of gassy conditions (Section 4.5), these oil fields may also be potential soil and groundwater contamination sources due to the presence of residual petroleum (oil and tar).

6.0 Man-made Features of Engineering and Construction Significance

6.1 Building Protection Criteria

To estimate potential damage to the structures adjacent to the station area, the following factors were considered:

- Structure and utility type
- Horizontal and vertical position of the structures and their foundations relative to station excavation
- Estimated magnitude of angular distortion at the ground surface
- Type of ground
- Depth of excavation.

Alternative methodologies exist for evaluating the influence of settlement on existing buildings. For the purpose of this GDSR, limiting angular distortion of buildings is given in Table 6-1. A review of Table 6-1 indicates that bearing wall structures and plaster partitions are first cracked at an angular distortion of approximately 1/300. To provide ample warning and control of ground movement due to station excavation and dewatering, the maximum allowable sustained angular distortion induced by station excavation will be limited to one-half this amount, i.e., 1/600. The maximum absolute settlement of a column or footing will be limited to 1 inch. To prevent these sustained movements and distortions which may be deleterious, a value of 1/900 angular distortion and an absolute settlement of a column or footing of 1/2 inch have been established as the points at which defensive measures, including modifications to excavation methods and techniques, may be required.

TABLE 6-1. LIMITING ANGULAR DISTORTION

Category of Potential Damage	Angular Distortion
Danger to machinery sensitive to settlement	1/750
Danger to frames with diagonals	1/600
Safe limit for no cracking of buildings	1/500
First cracking of panel walls	1/300
Difficulties with overhead cranes	1/300
Tilting of high rigid buildings becomes visible	1/250
Considerable cracking of panel and brick walls	1/150
Danger of structural damage to general buildings	1/150
Safe limit for flexible brick walls, $L/H^{(1)} > 4^{(2)}$	1/150

Notes: (1) L = Length; H = Height
(2) Safe limits include a factor of safety

6.2 Building Structures

Most of the structures along the project site and within 100 feet of either sides of the station excavation, are up to 4-story wood frame or concrete masonry units, except for the 100-to 125-foot high Pantages Theater and a 13-story office building at the northwest corner of the Hollywood Boulevard/Vine Avenue intersection. The planned excavation for Contract Unit B-281 is not expected to have an adverse effect on adjacent structures and no pre-construction building protection is specified.

6.3 Impact of Construction

Station excavation may cause some ground settlement or angular distortion at ground surface within 60 feet to 70 feet of station outline. It is the Contractor's responsibility to carry out the excavation with adequate and timely placement of a suitable support system to ensure that the adjacent structures are not damaged due to station construction.

6.4 Walk of Fame

The sidewalks on both sides of the Hollywood/Vine Station are portions of the Walk of Fame which consists of decorative sidewalks with inset stars in terrazzo in recognition of entertainment industry stars. Protection of the Walk of Fame from damage is of paramount importance and is the responsibility of the Contractor. The best protection of these sidewalks will be either removal for protection during construction or exercising good station excavation/shoring practice to minimize ground loss. Any damage that does occur should be repaired to its original condition.

6.5 Assessment of Damages

To establish actual damage resulting from station construction, the Commission will conduct a preconstruction survey of all private and public structures. The results of the preconstruction survey will form the baseline condition of the existing building structures and public utilities.

6.6 Monitoring Criteria

To monitor settlement of the structures located on both sides of the station, building and ground settlement reference points will be installed and ground and structural movements will be recorded by the Commission as specified in specification Section 01056, Geotechnical Instrumentation, Cut-and-Cover.

6.7 Protection

No preconstruction structure protection is specified. If geotechnical instrumentation indicates that settlement and ground distortion are having a damaging effect on adjacent structures, the Commission will direct the Contractor to take any mitigative measures deemed necessary.

6.8 Restoration

Should architectural damage be incurred by any building near the station excavation because of station construction, the building will be repaired and restored to its preconstruction condition by the Contractor. The preconstruction survey before station construction will be used to determine the extent of any damages incurred during station construction.

6.9 Summary and Conclusions

Information gained from the subsurface exploration and experience on other Metro Rail projects indicate that ground settlements and angular distortions will generally be small, if proper construction techniques are followed. Both careful excavation control and the monitoring of settlements at buildings near the station are needed to control and evaluate ground movements and minimize damage. During construction, it is important to closely coordinate the results of the monitoring of existing adjacent structures (done by the Commission) so that appropriate treatment measures can be immediately implemented.

7.0 Selection and Design of Ground Support

7.1 Definition

Initial and final ground support systems are required for the construction of Contract Unit B-281. The initial support system is required to support and retain the station excavation until the final support system has been installed and gained sufficient strength to sustain the required long-term loadings for the permanent support for the station structures. The required loads encompass all the long-term loadings to which the structure will be exposed over its lifetime, including earth pressure, hydrostatic pressure, earthquake and other imposed loadings. The initial support system is designed by the Contractor based on his analysis of the ground conditions, his chosen method of excavation and construction techniques, and his schedule. Initial support sheeting elements are generally left in place. Final support structure is designed by the Engineer.

Design criteria for excavation support systems are detailed in the Contract Documents.

7.2 Initial Support

Excavation for this contract will generally consist of one large excavation and several smaller adjacent excavations. The station and crossover excavation will be approximately 60 feet wide and 895 feet long with depth ranging from approximately 65 feet to 72 feet. If the B-251 twin tunnels in the station area are not excavated by the time the Contractor for B-281 starts the station excavation operations, the initial station excavation is limited to 30 feet above the top of the rail to allow B-251 tunnel construction by others to proceed unimpeded.

Selection, design, installation and maintenance of an appropriate initial support system will be the responsibility of the Contractor and subject to review and approval by the Commission or its designee.

Because of the deep excavation, internal bracing (struts and wales), or external tiebacks with sheeting system of soldier piles and timber lagging or interlocking steel sheeting, will be required for lateral support. Soldier piles and timber lagging are a relatively inexpensive choice of support, but will require control of ground losses during installation and control and restriction of soil migration through the lagging afterwards. In lieu of timber lagging, precast reinforced concrete lagging will also be permitted. Preloading of struts and/or pre-stressing of tiebacks, to minimize support wall deformation is required as specified in the Contract Documents. If a shoring system which combines external tiebacks and internal bracing on struts and wales is selected for support of excavation, the support design must account for the variation in stiffness and deflection characteristics of the support elements which may induce substantially different loads. The Contractor is cautioned to adhere to the criteria given for the design and installation of excavation support system.

Driving of an interlocking steel sheeting system or soldier piles is not considered for this project. The use of conventional impact driving of soldier piles and steel sheeting is not permitted. The soldier piles in the site area shall be installed in predrilled holes as specified. Slurry or casing will be required in the predrilled holes to minimize caving and maintain hole stability. The use of slurry wall construction for support of excavation in lieu of conventionally supported soldier piles and timber lagging does not appear to be practical. Hard drilling and drill chatter were observed during the drilling of the borings in the gravel layers. This indicates difficult or time consuming drilling of the holes for the soldier piles. The gravel layers are of substantial thickness and may be encountered at any depth. Gravels and sands, when exposed to even small hydraulic gradients become unstable causing caving and large inflow of ground into the drill holes. Backfill quantities around installed soldier piles may greatly exceed the theoretical volume and pose a problem later during the station excavation by intruding into the designated structure limits.

The simplest and most economical method of supporting a deep excavation, given the subsurface conditions, future use, and construction requirements, would be the use of conventionally supported excavation with a braced sheeting system of soldier piles and timber lagging provided groundwater is controlled where needed, especially east of approximate Station AR 553 + 89 (monitoring well PII-86).

The other smaller excavations required for entrance ways, shafts and emergency exits can be excavated using similar methods.

7.3 Final Support

The final support system is an integral part of the station structure and will consist of a reinforced cast-in-place concrete box, as indicated on the Contract Drawings. A properly installed High Density Polyethylene (HDPE) membrane is required to prevent methane gas and hydrocarbon penetration into the structure.

8.0 Anticipated Ground Behavior and Construction Difficulties

8.1 Excavation and Drilling Methods

The station excavation will be made predominantly in the Young Alluvium and Old Alluvium. The base of the excavation will be in Old Alluvium. No boulders are likely to be encountered in the base of the excavation. The Young and Old Alluvium may be excavated with conventional earth-moving equipment. The alluvial soils may have a tendency to slake and ravel if subjected to changes in moisture conditions and may run or flow when they are exposed to adverse hydraulic gradients or are below water table. Thus, timely application of initial ground support is important. The clayey and silty soils may be locally soft and sticky and the granular soils may be locally loose in the upper 5 feet to 15 feet of excavation. This may make excavation and spoil handling equipment travel difficult at times.

Soldier piles for a temporary support system will be installed in predrilled holes. Hard drilling may be encountered due to a local presence of gravel. Drilling could be accomplished with conventional equipment. A conventional pile drilling rig with sufficient weight should not have unusual difficulty in drilling the holes for the soldier piles. Hole instability is to be anticipated where and when the granular (cohesionless) alluvial soils are encountered (granular Young and Old Alluvium is predominant in the station area) both above and below the water table. Caving and later large overruns in backfilling quantities may occur when such adverse conditions are encountered. Casing or slurry will be required in those instances. Appropriate drilling equipment and casings should be available at the job site for rapid use.

8.2 Anticipated Ground Behavior

Ground behavior during excavation in Young Alluvium and Old Alluvium depends on the density and fines content of granular soils and the stiffness of fine-grained soils and the hydrologic conditions. In general, these materials should stand long enough to place lagging at practical intervals except locally where clean and relatively clean granular alluvial soils are encountered which may locally run and ravel readily. Fined-grained alluvial soil will also have a tendency to ravel locally if lagging is not applied in a timely manner. Local areas of unsupported medium stiff to stiff fine-grained soils may tend to migrate into the excavations. Presence of hydraulic gradients towards the excavation, especially in the east end, tends to decrease stability and may drastically alter drill hole stability. Once excavation is supported, migration of fine-grained soils through the lagging, by raveling or water transport, should be prevented.

It is important that field personnel must recognize subtle material changes as the excavation is made, and promptly adjust their production rates and lagging installation intervals and shoring needs in order to control the ground and minimize ground losses accordingly. Maximum vertical distances between bracing are given in the Contract Documents.

8.3 Construction Sequencing

Construction sequencing will be selected by the Contractor, based on his excavation support system design and earth-moving methods. The excavation must be carried out in an orderly fashion that includes adequate and timely placement of lateral bracing to prevent ground movements in the excavation and at the ground surface.

8.4 Groundwater Seepage and Inflow

As described in Section 4.3, the measured groundwater table in the station area is about 6 feet above the bottom of station excavation at the east end of the station. This groundwater table slopes down westerly at a gradient of about one percent and below the bottom of excavation west of approximate Station AR 553 + 89 (Boring PII-86). No dewatering prior to the construction is considered necessary. Considering the moist nature of the subsurface soil above groundwater and potential seasonal fluctuations of groundwater levels, there will be localized groundwater inflows into the excavation opening. These inflows will have to be collected and pumped out of the excavation using ditches (drains) and sumps during mass excavation. Below the water table the granular non-cohesive soils tend to be unstable during soldier pile drilling and placement.

8.5 Potential Effects on Adjacent Facilities

The excavation support system will be designed and constructed using the criteria indicated in the Structural Standard Drawing Nos. SS-002, SS-003, and SS-004, and Specification Section 02160 - Excavation Support Systems. Potential impact of station construction on adjacent facilities and the associated responsibility of the Contractor are described in Section 6.0.

9.0 Geotechnical Instrumentation and Monitoring

The following types of geotechnical instrumentation are indicated in the Contract Documents:

- Ground Surface Settlement Reference Points
- Building Settlement Reference Points
- Inclinometer Casings
- Observation Wells
- Load Instrumentation Zones.

The Contractor will furnish, install, and maintain all geotechnical instruments for cut-and-cover structures in accordance with Specification 01056, Geotechnical Instrumentation, Cut-and-Cover. The Commission will monitor the instruments. The purpose of the instrumentation is to detect movements of the ground, structure, and groundwater fluctuation during construction; and the influence of such observation on the support of the excavation system, building structures, utilities, and facilities.

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GEOTECHNICAL
STATE OF CALIFORNIA

APPENDIX A

SUMMARY OF GEOTECHNICAL FIELD AND LABORATORY TEST DATA

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SUMMARY OF GEOTECHNICAL FIELD AND LABORATORY TEST DATA

The geotechnical field and laboratory test data from the borings within the Hollywood/Vine Station limits are presented in Table A-1.

Available laboratory direct shear and triaxial compression test data for Young and Old Alluvium within the station area is limited. Therefore, to demonstrate the potential range and variation of the shear strength properties of Young and Old Alluvium, all the available shear strength data for the subsurface materials within the Hollywood/Vine Station area and adjacent tunnel segments (in similar soil conditions) are used in summarizing the engineering properties of the subsurface materials in Section 4.4. These data are summarized in Table A-2 (direct shear test results) and Table A-3 (triaxial compression test results).

TABLE A-1. SUMMARY OF GEOTECHNICAL FIELD AND LABORATORY TEST DATA WITHIN THE HOLLYWOOD/VINE STATION LIMITS (1 OF 7)

BORING NO. (1)	STATION	DEPTH (feet)	SOIL TYPE (2)	GEO. UNIT (3)	EQ. SPT VALUE (4)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	GRAIN SIZE			ATTERBERG LIMITS (6)		k (7) (x 10E-07) (cm/sec)
								GRAVEL (%)	SAND (%)	FINES (5) (%)	LL	PI	
HV-2	551+03	5.0	SM	A1	16								
		10.0	SM	A1	14								
		11.5	SM	A1	27								
		12.5	SM	A1	15								
		14.0	SM	A1	20								
		15.0	SM	A1	15								
		16.5	SM	A1	22	11	122						
		17.5	SM	A1	25			2	71	27			
		19.0	SM	A1	42								
		20.5	SM	A1	25								
		22.0	SM	A1	62	9	113						
		23.0	SM	A1	23			25	62	13			
		25.0	SP-SM	A1	22								
		26.0	SP-SM	A1	42			18	72	10			
		27.5	SP-SM	A1	37								
		28.5	SC	A2	19			10	47	43	32	17	
		30.0	SC	A2	27								
		31.0	SM	A1	33								
		32.0	SM	A1	43								
		33.5	SM	A1	83	9	128						
		34.5	SM	A1	55								
		36.0	SM	A1	99			8	73	19			
		37.0	SP-SM	A1	44			22	68	10			
		39.0	SP-SM	A1	79	12	109	2	87	11			
		44.5	SP-SM	A1	>100			41	50	9			
		50.0	GP	A1	99								
		52.5	SM	A1	>100			7	75	18			
		58.5	SC	A3	44								
		60.0	SC	A3	67								
		61.0	SC	A3	24								
		65.0	SC/SM	A4	45								
		70.0	SC/SM	A4	>100								
		79.0	SC	A3	69	17	113						
		85.0	CL	A4	45			0	26	74	40	20	
		92.0	SM	A3	99								
HV-1	551+15	5.0	SM/ML	A1									
		10.6	SC	A1	45	11	117						
		11.6	SC	A1	12								
		12.9	SM	A1	33								
		13.9	SC	A1	15								
		15.4	SM	A1	42								

TABLE A-1. SUMMARY OF GEOTECHNICAL FIELD AND LABORATORY TEST DATA
WITHIN THE HOLLYWOOD/VINE STATION LIMITS (2 OF 7)

BORING NO. (1)	STATION	DEPTH (feet)	SOIL TYPE (2)	GEO. UNIT (3)	EQ. SPT VALUE (4)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	GRAIN SIZE GRAVEL (%)	GRAIN SIZE SAND (%)	GRAIN SIZE FINES (5) (%)	ATTERBERG LIMITS (6) LL	ATTERBERG LIMITS (6) PI	k (7) (x 10E-07) (cm/sec)
		16.4	SC	A1	12								
		17.8	SC	A1	47								
		19.3	SM	A1	26			3	76	21			
		21.0	SP-SM	A1	>100	15	108	0	75	5			
		22.3	SM	A1	34								
		24.0	SM	A1	>100								
		24.7	SM/SC	A1	11								
		26.2	SC/SM	A1	42	12	119						
		27.2	SM	A1	16								
		28.7	SC	A1	36								
		30.0	SC	A1	9								
		31.1	SC	A1	21								
		32.7	SC	A1	22								
		34.2	SC	A1	66								
		35.2	SC	A1	24								
		36.8	SC	A1	81			16	68	16			
		37.8	SC	A1	55								
		39.4	SC	A1	>100								
		55.5	SM	A3	>100			3	83	14			
		60.5	SC/CL	A3	52	14	120						
		65.5	SC/SM	A3	>100								
		70.9	SM	A3	>100								
		75.9	CL	A4	39								
		77.4	CL	A4	20						40	20	
		81.5	SC	A3	97								
		85.5	SM	A3	39			1	80	19			
		90.0	SM	A3	>100								
HV-3	551+95	5.1	SM	A1	10								
		10.1	SC	A1	37								
		11.2	SC	A1	16								
		13.1	SM	A1	77	10	120						
		14.1	SM	A1	27			12	75	13			
		15.6	SM	A1	>100								
		16.5	SC	A1	8								
		18.1	SC	A1	91								
		19.2	SC	A1	16					30			
		20.8	SM	A1	92								
		23.0	SM	A1	24			3	78	19			
		24.8	GP	A1	>100								
		25.6	GP	A1	15								
		27.1	SC	A2	29					37			

TABLE A-1. SUMMARY OF GEOTECHNICAL FIELD AND LABORATORY TEST DATA WITHIN THE HOLLYWOOD/VINE STATION LIMITS (3 OF 7)

BORING NO. (1)	STATION	DEPTH (feet)	SOIL TYPE (2)	GEO. UNIT (3)	EQ. SPT VALUE (4)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	GRAIN SIZE GRAVEL (%)	GRAIN SIZE SAND (%)	GRAIN SIZE FINES (5) (%)	ATTERBERG LIMITS (6) LL	ATTERBERG LIMITS (6) PI	k (7) (x 10E-07) (cm/sec)
		28.6	SC	A2	54	11	120						
		29.6	SC	A2	19								
		31.2	SC	A2	34								
		32.6	SC	A2	20								
		34.2	SM	A1	25								
		35.8	SC	A2	76	13	119			36			
		36.8	SC	A2	37								
		38.5	SM	A1	74	10	125			24			
		43.8	SP-SM	A1	67			19	69	12			
		50.5	SC	A3	64	12	123			29			
		55.8	SC	A3	7					30			
		60.8	SM	A3	>100	12	122			27			
		64.5	SC	A3	12								
		70.2	SC	A3	82								
		75.9	CL	A4	21								
		80.8	SP-SM	A3	>100								
		86.0	CL	A4	37								
		89.9	SM	A3	>100								
EV-35A	552+18	2.0	SM	A1									
		5.0	SC	A1									
		13.0	SC	A1									
		20.0	SC	A1									
		30.0	SC	A4									
		40.0	SC	A4									
		50.0	SC	A4									
		60.0	SC	A4									
		70.0	SC	A3	57			8	81	11	28	10	
		80.0	SC	A3	21	17	111						
		90.0	SC	A3	74			9	63	28			
		100.0	SC/CL	A4	22								
		110.0	SM	A3	>100			4	81	15	25	11	
		120.0	SP	A3	>100	17	107						
PII-85	552+67	1.8		FILL									
		5.0	SM	A1	7								
		10.0	SC	A2	9	8	122	32	51	17			
		15.0	SM	A1	34			16	67	17			
		20.0	SC	A2	18	13	114						
		25.0	SM	A1	36								
		30.0	SC	A3	26	11	126						
		35.0	SC	A3	32								
		40.0	SC	A3	40	11	122	10	66	24			

TABLE A-1. SUMMARY OF GEOTECHNICAL FIELD AND LABORATORY TEST DATA WITHIN THE HOLLYWOOD/VINE STATION LIMITS (4 OF 7)

BORING NO. (1)	STATION	DEPTH (feet)	SOIL TYPE (2)	GEO. UNIT (3)	EQ. SPT VALUE (4)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	GRAIN SIZE GRAVEL (%)	GRAIN SIZE SAND (%)	GRAIN SIZE FINES (5) (%)	ATTERBERG LIMITS (6) LL	ATTERBERG LIMITS (6) PI	k (7) (x 10E-07) (cm/sec)
		45.0	SM	A3	39								
		50.0	SM	A3	19	16				34			
		55.0	SM	A3									
		60.0	SM	A3	28	11							
		65.0	SC	A4	56								
		70.0	SC	A4	48	14	118						
		75.0	SC	A4	100								
		80.0	SC	A4	39	19	109						18.20
PII-86	553+89	2.5		FILL									
		5.0	SM	A1	2								
		10.0	SM	A1	13								
		15.0	SM	A1	7								
		20.0	SC	A1	22						27	14	
		25.0	SM	A1	20								
		30.0	SC	A3	17								
		35.0	SM	A3	27								
		40.0	SM	A3	52	17	104			13			
		45.0	SM	A3	>100								
		50.0	SM	A3	61					29			
		55.0	SC	A3	54								
		60.0	SM	A3	22	14	119						
		65.0	SM	A3	44								
		70.0	SM	A3	35								
		75.0	SM	A3	>100								
		80.0	SC	A3	28								
		85.0	SM	A3	>100								
		89.7	SM	A3	66								
HV-4	555+02	5.0	CL	A2	4								
		10.0	CL	A2	25								
		11.5	SM	A1	13	12	109						
		12.5	SM	A1	9								
		14.0	SM	A1	33								
		16.0	SM	A1	44								
		17.0	SC	A1	22								
		18.3	SC	A1	15								
		19.8	SM	A1	30	13	116						
		20.9	SM	A1	33								
		22.4	SM	A1	26								
		23.4	SM	A1	17			3	71	26			
		24.9	SM	A1	38	12	115	2	83	15			
		26.0	CL	A2	26								

TABLE A-1. SUMMARY OF GEOTECHNICAL FIELD AND LABORATORY TEST DATA WITHIN THE HOLLYWOOD/VINE STATION LIMITS (5 OF 7)

BORING NO. (1)	STATION	DEPTH (feet)	SOIL TYPE (2)	GEO. UNIT (3)	EQ. SPT VALUE (4)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	GRAIN SIZE GRAVEL (%)	GRAIN SIZE SAND (%)	GRAIN SIZE FINES (5) (%)	ATTERBERG LIMITS (6) LL	ATTERBERG LIMITS (6) PI	k (7) (x 10E-07) (cm/sec)
		27.5	SM	A1	19								
		28.5	CL	A2	12								
		30.0	CL	A2	23								
		31.0	CL	A2	20								
		32.6	SP	A1	45	14	118						
		33.9	SM	A1	20					20			
		35.7	SP-SM	A1	89	16	114	0	94	6			
		37.7	SM	A1	55			9	78	13			
		39.2	SP-SM	A1	53	11	116	2	88	10			
		40.5	SM	A1	>100			10	73	17			
		45.5	CL	A2	>100								
		50.0	SP-SM	A3	>100			30	60	10			
		55.0	CL	A4	37	15	118						
		60.0	ML/SM	A3	53								
		65.0	ML/SM	A3	38								
		67.0	SC	A3	41								
		70.0	SC	A3	30								
		75.0	SC	A3	29								
		80.0	SM/SC	A3	75			5	60	35			
		85.0	SM	A3	46	15	118	1	80	19			
		90.0	SM	A3	67			1	72	27			
PII-88	555+25	1.8		FILL									
		5.0	ML	A2	5								
		10.0	SP-SM	A1	11					11			
		15.0	SM	A1	20								
		20.0	SM	A1	13								
		25.0	SC	A1	22								
		30.0	SC	A1	25								
		35.0	SC	A1	53					19			
		40.0	SP-SM	A1	60					9			
		43.0	SP-SM	A1	48					10			
		46.0	SM	A1	>100			34	51	15			
		50.0	SM	A3	98								
		55.0	SC	A4	25					40			
		60.0	GP-GM	A3	51			48	43	9			
		65.0	ML	A4	29								
		70.0	SM	A3	38	19	110	0	69	31			365.00
		75.0	SC	A3	30					32	25	13	
		80.0	SM	A3	53	15	120						
		85.0	SM	A3	63			0	80	20			
		90.0	SC	A3	32	14	120						

TABLE A-1. SUMMARY OF GEOTECHNICAL FIELD AND LABORATORY TEST DATA WITHIN THE HOLLYWOOD/VINE STATION LIMITS (6 OF 7)

BORING NO. (1)	STATION	DEPTH (feet)	SOIL TYPE (2)	GEO. UNIT (3)	EQ. SPT VALUE (4)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	GRAIN SIZE GRAVEL (%)	GRAIN SIZE SAND (%)	GRAIN SIZE FINES (5) (%)	ATTERBERG LIMITS (6) LL	ATTERBERG LIMITS (6) PI	k (7) (x 10E-07) (cm/sec)
		95.0	SC	A3	96						18	8	
		99.8	SC-SM	A3	>100					13			
HV-5	557+00	5.0	SP-SM	A1	25								
		10.0	SP-SM	A1	21			2	87	11			
		11.8	SC	A1	19								
		12.8	SP-SM	A1	10								
		21.8	SM	A1	34	16	120						
		25.5	SM	A1	29								
		31.0	SC	A1	35	14	118						
		32.0	SC	A1	22					43	37	25	
		37.0	SC	A2	22	12	114			27	26	9	
		38.0	SC	A2	30								
		39.5	SC	A1	30	11	110			15	27	13	
		44.5	SC	A1	36					34	28	14	
		49.0	SC	A1	44	10	124						
		54.0	SC	A4	47						27	15	
		58.0	SC	A4	33								
		63.5	CL	A4	47						31	20	
		67.5	SC	A4	18								
		73.0	CL	A4	24						29	13	
		79.0	SC	A4	25	22	107				30	12	
		85.0	SC	A4	90								
HV-6	557+09	5.2	SP	A1	31								
		10.4	SC	A1	11			19	67	14	28	13	
		12.2	SC	A1	33								
		13.2	SC	A1	18			19	61	20			
		17.5	SC	A1	>100								
		20.4	SC	A1	43	14	118	1	70	29	27	12	
		25.3	SC	A2	34	13	118	3	62	35	28	12	
		26.4	SC	A2	14			1	59	40	26	14	
		31.8	SC	A2	26	17	118	17	48	35	35	19	
		33.1	SC	A2	19			9	52	39	36	24	
		38.6	SC	A2	37	14	118	6	56	38	26	11	
		43.8	SP-SM	A1	>100	10		25	67	8			
		48.3	SP-SM	A1	>100	17		6	86	8			
		61.0	CL	A4	99	15	119	1	49	50	42	28	
		66.5	CL	A4	67			0	28	72	45	29	
		71.6	SC	A3	63	23	107	0	69	31	30	14	
		76.0	SM	A3	>100								
		78.3			>100								
		80.3	SM	A3	>100								

TABLE A-1. SUMMARY OF GEOTECHNICAL FIELD AND LABORATORY TEST DATA WITHIN THE HOLLYWOOD/VINE STATION LIMITS (7 OF 7)

BORING NO. (1)	STATION	DEPTH (feet)	SOIL TYPE (2)	GEO. UNIT (3)	EQ. SPT VALUE (4)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	GRAIN SIZE			ATTERBERG LIMITS (6)		k (7) (x 10E-07) (cm/sec)
								GRAVEL (%)	SAND (%)	FINES (5) (%)	LL	PI	
		85.0	SC	A3	46	19	110						
PII-89	557+92	2.5		FILL									
		5.0	SM	A1	10								
		10.0	SP	A1	32	12	123	45	54	1			
		15.0	SM	A1	14								
		20.0	SM	A1	16								
		25.0	SC	A1	12						27	14	
		30.0	SC	A1	19	17	108			37			
		35.0	SC	A1	24								
		40.0	SP-SM	A1	67	11	101	15	80	5			
		45.0	SM	A1	>100								
		50.0	SP-SM	A1	87	11		32	62	6			
		52.0	SC	A3	>100								
		55.0	SC	A3	30								
		60.0	SC	A3	57								
		65.0	SC	A3	75						34	20	
		70.0	SC	A3	44	22	106						
		75.0	SC	A3	36								
		82.0	SM	A3	91								
		85.0	SM	A3	88								
		90.0	SP-SM	A3	87	21	105			6			300.00
		95.0	SM	A3	88								
		100.0	SC	A3	35	15	119						

NOTES:

(1) PII series of borings and monitoring wells were drilled in 1989 for the Phase II (PII) program.
HV series of borings were drilled in 1992 for the Supplementary Geotechnical Investigation 5.
EV series of borings were drilled in 1991 for the Stage II Environmental Assessment (EV).

(2) Soil type is as per Unified Soil Classification System.

(3) Geologic Units:
A1= Granular Young Alluvium
A2= Fine-grained Young Alluvium
A3= Granular Old Alluvium
A4= Fine-grained Old Alluvium

(4) For definition of equivalent SPT value, refer to Table 4-1 in Section 4.0.

(5) Fines refer to percentage of soil by weight passing through No. 200 sieve.

(6) LL= Liquid Limit; PI= Plasticity Index

(7) k = Coefficient of Permeability in 10E-07 cm/sec.

TABLE A-2. SUMMARY OF DIRECT SHEAR TEST RESULTS WITHIN THE HOLLYWOOD/VINE STATION AND ADJACENT TUNNEL SEGMENTS (1 of 5)

BORING NO. (1)	SAMPLE (2) NO.	DEPTH (feet)	SOIL TYPE (3)	GEOLOGIC UNIT (4)	APPLIED NORMAL STRESS (psf)	SHEAR STRESS PEAK (psf)	SHEAR STRESS RESIDUAL (psf)	ESTIMATED STRENGTH PARAMETERS COHESION (psf)	ESTIMATED STRENGTH PARAMETERS FRICTION ANGLE (degree)
PII-73	D-9	40.0	SC	A4	2500	3290	2630	1940	28
					5000	4660	4150		
					10000	7360	7110		
PII-74	D-10	50.0	SM	A3	3000	2964	2640	895	34
					6000	4937	4910		
					12000	9071	8936		
PII-74	D-12	60.0	SM	A3	3600	4493	3726	1610	36
					7200	6434	6074		
					14400	12194	11865		
PII-76	D-10	40.0	SC	A3	2500	2824	2291	1595	30
					5000	4719	4126		
					10000	7168	7168		
PII-76	D-14	60.0	SP-SM	A3	3600	3694	3178	1679	32
					7200	6512	5948		
					14400	10535	10535		
PII-77	D-14	70.0	SC	A4	4000	4586	3637	2280	29
					8000	6605	5624		
					16000	11217	10704		
LPE-12	D-8	45.0	SC	A4	2500	4214	2698	2500	37
					5000	6577	5440		
					10000	9966	9766		
LPE-12	D-12	65.0	SM	A3	4000	5305	4300	3000	32
					8000	8455	7405		
					16000	13034	12059		
PII-81	D-17	85.0	SM	A3	4000	4780	2095	1550	39
					8000	9063	8171		
					16000	14448	12695		
PII-83	D-11	55.0	SM	A3	3000	4178	2883	1540	41
					6000	6619	6291		
					12000	11895	10980		
PII-83	D-15	75.0	SM	A3	4000	4414	3773	765	43
					8000	8140	6950		
					16000	15434	14276		
LPE-13	D-5A	35.0	SM	A3	2000	3983	2586	2000	33
					4000	5183	4039		
					8000	8916	8191		
LPE-13	D-10	65.0	SC/CL	A4	4000	4258	3642	2200	29
					8000	6765	6111		
					16000	10933	10836		

TABLE A-2. SUMMARY OF DIRECT SHEAR TEST RESULTS WITHIN THE HOLLYWOOD/VINE STATION AND ADJACENT TUNNEL SEGMENTS (2 of 5)

BORING NO. (1)	SAMPLE (2) NO.	DEPTH (feet)	SOIL TYPE (3)	GEOLOGIC UNIT (4)	APPLIED NORMAL STRESS (psf)	SHEAR STRESS PEAK (psf)	SHEAR STRESS RESIDUAL (psf)	ESTIMATED STRENGTH PARAMETERS COHESION (psf)	ESTIMATED STRENGTH PARAMETERS FRICTION ANGLE (degree)
PII-84	D-16	80.0	SC	A3	4000	3444	3162	820	34
					8000	6387	6027		
					16000	11631	11474		
PII-84	D-18	90.0	SM-SC	A3	4000	4120	3701	1605	33
					8000	6909	6397		
					16000	11939	11611		
PII-86	D-10	40.0	SM	A3	2500	3256	2755	1240	36
					5000	4540	4023		
					10000	8578	7655		
PII-86	D-14	60.0	SM	A3	3600	3338	3135	1530	27
					7200	5135	5015		
					14400	7330	611		
PII-88	D-17	80.0	SM	A3	4000	4920	3648	1750	38
					8000	8054	6774		
					16000	13063	12174		
PII-89	D-8	30.0	SC	A1	1800	1680	1510	360	36
					3600	3016	3016		
					7200	5659	5659		
PII-89	D-18	70.0	SC	A3	4000	3679	3162	2070	22
					8000	5291	4743		
					16000	6246	4884		
LPE-14	D-3	20.0	SM	A1	1000	1873	1516	1000	38
					2000	2497	2297		
					4000	4214	4192		
LPE-14	D-7	40.0	SC	A2	2500	2926	2813	1600	31
					5000	4777	4648		
					10000	7463	7444		
LPE-14	D-10	55.0	SP-SM	A1	3500	4656	3100	2200	39
					7000	7988	6696		
					14000	13080	11772		
LPE-14	D-13	65.5	SC	A2	4000	6243	4281	4440	24
					8000	11705	8472		
					16000	11660	11482		
LPE-14	D-15	75.0	ML	A2	4000	3857	3723	1830	27
					8000	5886			
					16000	9405			
PII-91	D-11	50.0	SP-SM	A1	3000	4118	3662	1000	40
					6000	6027	5012		
					12000	11106	10888		

TABLE A-2. SUMMARY OF DIRECT SHEAR TEST RESULTS WITHIN THE HOLLYWOOD/VINE STATION AND ADJACENT TUNNEL SEGMENTS (3 of 5)

BORING NO. (1)	SAMPLE (2) NO.	DEPTH (feet)	SOIL TYPE (3)	GEOLOGIC UNIT (4)	APPLIED NORMAL STRESS (psf)	SHEAR STRESS		ESTIMATED STRENGTH PARAMETERS	
						PEAK (psf)	RESIDUAL (psf)	COHESION (psf)	FRICTION ANGLE (degree)
PII-92	D-18	80.0	SC	A3	4000	3851	3585	1000	35
					8000	6653	6653		
					16000	10363	10363		
PII-93	D-9	45.0	SM	A1	2500	2344	2119	700	34
					5000	4092	7271		
					10000	7414	7271		
PII-94	D-13	60.0	SM	A3	3600	2520	2442	560	33
					7200	5792	5761		
					14400	9705	9611		
PII-94	D-15	70.0	GP-GM	A3	4000	3596	3384	975	35
					8000	6825	6371		
					16000	12140	12016		
VH-1	D-7	60.0	SM	A1	4000	3500		1239	28
					8000	5200			
					14000	8750			
VH-1	D-9	70.0	CL	A4	5000	3900		1233	29
					10000	6900			
					14000	8750			
PII-95	D-11	50.0	SM	A1	3000	2552	2301	550	33
					6000	4336	4180		
					12000	8343	8328		
PII-96	D-7	35.0	SM	A1	2000	1894	1675	730	31
					4000	3240	2943		
					8000	5557	5354		
PII-96	D-17	85.0	SC/CL	A4	4000	3679	3225	1830	25
					8000	5526	5213		
					16000	9936	7827		
PII-97	D-14	50.0	CL	A2	3000	3061	2619	1475	27
					6000	4340	3967		
					12000	7512	5534		
LPE-15	D-7	35.0	SM	A1	2000	2332	2134	1250	34
					4000	5536			
					8000	6530			
LPE-15	D-9	45.0	SM	A1	2500	3601	3488	1790	36
					5000	5412	5053		
LPE-15	D-11	55.0	CL	A2	3500	3099	3054	1600	25
					7000	5061	4994		
					14000	7959	7937		

TABLE A-2. SUMMARY OF DIRECT SHEAR TEST RESULTS WITHIN THE HOLLYWOOD/VINE STATION AND ADJACENT TUNNEL SEGMENTS (4 of 5)

BORING NO. (1)	SAMPLE (2) NO.	DEPTH (feet)	SOIL TYPE (3)	GEOLOGIC UNIT (4)	APPLIED NORMAL STRESS (psf)	SHEAR STRESS		ESTIMATED STRENGTH PARAMETERS	
						PEAK (psf)	RESIDUAL (psf)	COHESION (psf)	FRICTION ANGLE (degree)
PII-98	D-16	70.0	SM	A1	4000	4384	3574	1200	38
					8000	7495	6202		
					16000	10376	9334		
PII-98	D-18	80.0	ML	A4	4000	3953	3499	820	37
					8000	6751	6351		
					16000	13008	12899		
PII-99	D-14	60.0	SM	A3	3600	3444	2943	1033	32
					7200	5166	5166		
					14400	9988	9988		
PII-100	D-9	40.0	ML	A2	2500	1926	1818	520	29
					5000	3338	3311		
					10000	4761	4761		
PII-100	D-11	50.0	ML	A4	3000	2705	2153	1485	23
					6000	4112	3750		
					12000	6563	6563		
PII-101	D-11	50.0	ML/SM	A4/A3	3000	4799	2732	3200	29
					6000	6439	4491		
					12000	8478	7629		
PII-101	D-13	60.0	SM	A3	3600	4227	3162	1500	37
					7200	6951	6795		
					14400	10551	10176		
PII-101	D-15	70.0	ML	A4	4000	3569	3037	1880	23
					8000	5260	4665		
					16000	8642	8642		
PII-101	D-19	90.0	ML	A4	4000	3601	3131	1175	32
					8000	6168	5949		
					16000	11021	11021		
PII-102	D-4	20.0	CL	A2	1250	1665	1530	1127	24
					2500	2300	2124		
					5000	3376	3259		
PII-102	D-7	31.0	SM	A1	2000	1802	1737	635	33
					4000	3436	3436		
					8000	5773	5773		
PII-102	D-9	40.0	SP-SM	A1	2500	2868	2375	1450	29
					5000	4437	4437		
					10000	7099	6909		
PII-102	D-11	50.0	CL	A4	3000	3695	2787	1720	33
					6000	5699	4947		
					12000	7671	7483		

TABLE A-2. SUMMARY OF DIRECT SHEAR TEST RESULTS WITHIN THE HOLLYWOOD/VINE STATION AND ADJACENT TUNNEL SEGMENTS (5 of 5)

BORING NO. (1)	SAMPLE (2) NO.	DEPTH (feet)	SOIL TYPE (3)	GEOLOGIC UNIT (4)	APPLIED NORMAL STRESS (psf)	SHEAR STRESS		ESTIMATED STRENGTH PARAMETERS	
						PEAK (psf)	RESIDUAL (psf)	COHESION (psf)	FRICTION ANGLE (degree)
PII-102	D-13	60.0	SM	A3	3600	3538	3256	1240	32
					7200	5793	5479		
					14400	8485	8391		
PII-103	D-4	20.0	SM	A1	1250	844	844	324	28
					2500	1840	1840		
					5000	2889	2889		
PII-103	D-6	30.0	SM	A1	1750	2067	1369	1107	29
					3500	3084	2408		
					7000	5005	4788		
PII-103	D-9	40.0	ML	A1	2500	3095	2240	845	40
					5000	4734	3982		
					10000	9225	4469		
PII-103	D-11	50.0	SM	A3	3000	2343	2072	539	31
					6000	4231	3885		
					12000	7835	7477		
PII-103	D-15	70.0	SM	A3	4000	4195	3381	1500	33
					8000	6825	6074		
					16000	10864	10676		
PII-103	D-17	80.0	SC	A3	4000	3319	3068	893	32
					8000	5917	5886		
					16000	10770	10738		

NOTES:

(1) PII series of borings and monitoring wells were drilled in 1989 for the Phase II (PII) program.
LPE series of borings and monitoring wells were drilled in 1988 for the Limited Preliminary Engineering (LPE) program.
Boring VH-1 was drilled in 1991 for the Supplementary Geotechnical Investigation 1.

(2) D= Drive samples.

(3) Soil type is as per Unified Soil Classification System.

(4) Geologic Units:
- A1= Granular young alluvium
- A2= Fine-grained young alluvium
- A3= Granular old alluvium
- A4= Fine-grained old alluvium

TABLE A-3. SUMMARY OF TRIAXIAL COMPRESSION TEST RESULTS WITHIN THE HOLLYWOOD/VINE STATION AND ADJACENT TUNNEL SEGMENTS

BORING NO. (1)	SAMPLE (2) NO.	DEPTH (feet)	GEOLOGIC UNIT (3)	INITIAL CONFINING PRESSURE (ksf)	BACK PRESSURE (ksf)	PEAK DEVIATORIC STRESS (ksf)	PORE PRESSURE AT PEAK DEVIATORIC STRESS (ksf)	RESIDUAL DEVIATORIC STRESS (ksf)	PORE PRESSURE AT RESIDUAL DEVIATORIC STRESS (ksf)
PII-68	P-11	55	A3	2.8	8.8	10.8	-1.00	10.8	-1.0
				5.6	8.8	9.5	1.85	9.5	1.85
PII-75	P-10	50	A4	2.6	8.8	4.0	1.42	4.0	1.42
				5.2	8.8	5.3	3.10	5.3	3.10
PII-81	P-14	70	A3	3.3	8.8	9.9	-0.45	9.9	-0.45
				6.7	8.8	12.1	1.55	12.1	1.55
PII-82	P-11	55	A3	2.8	8.8	5.7	0.30	5.7	0.30
				5.6	8.8	6.2	3.00	6.2	3.00
PII-96	P-13	65	A1	3.2	8.8	26.1	-2.48	26.1	-2.48
				6.3	8.8	26.6	-3.00	25.4	-3.0
PII-83	P-12	60	A3	2.9	8.8	6.6	0.80	6.6	0.80
				5.9	8.8	11.4	1.50	11.4	1.50
				8.9	8.8	15.4	3.45	15.4	3.45

NOTES:

(1) PII series of borings and monitoring wells were drilled in 1989 for the Phase II (PII) program.

(2) P= Thin-wall tube (Pitcher) samples.

(3) Geologic Unit:

A1=Granular young alluvium

A3=Granular old alluvium

A4=Fine-grained old alluvium