December 16, 2022

Mr. Scott Gaudineer
Principal Architect / President
Flewelling & Moody, Inc.
815 Colorado Boulevard, Suite 200
Los Angeles, California 90041

Subject: **SUPPLEMENTAL LETTER REPORT**
**Burbank High School – New Pool**
902 North 3rd Street, Burbank, California
Converse Project No. 97-31-279-01

Dear Mr. Gaudineer:

Converse Consultants has prepared this supplemental letter report for the subject project to update the CBC seismic design parameters and review and confirm geotechnical recommendations as presented in our previous geotechnical reports (see Appendices A, B and C attached). This letter report was prepared in accordance with our proposal dated December 8, 2022. All other geotechnical recommendations presented in the previous geotechnical reports for this project are still valid.

We appreciate the opportunity to be of continued service to Burbank Unified School District and Flewelling & Moody, Inc. If you should have any questions, please do not hesitate to contact us at (626) 930-1200.

Sincerely,

**CONVERSE CONSULTANTS**

Sachini Madanayake, PhD
Senior Staff Professional

REGISTERED PROFESSIONAL ENGINEER
KATHIRAVETPILLAI SIVATHASAN
No 2708
Exp 6-30-24
GEOTECHNICAL
STATE OF CALIFORNIA

Siva K. Sivathasan, PhD, PE, GE, DGE, QSD, F. ASCE
Vice President/Principal Engineer

Attachments: Appendix A, Updated CBC Seismic Design Parameters, Dated December 16, 2022
Appendix B, Foundation Investigation, Dated June 22, 1998
Appendix C, Supplemental Geotechnical Recommendations, Dated September 21, 1998

# Appendix A

CBC Seismic Design Parameters
Dated December 16, 2022

## UPDATED CBC SEISMIC DESIGN PARAMETERS

Seismic parameters based on the 2019 California Building Code are calculated using the United States Geological Survey *U.S. Seismic Design Maps* website application and the site coordinates (34.188172 degrees North Latitude, -118.315193 degrees West Longitude). The seismic parameters are presented below.

**Table No. 1, 2022 CBC Seismic Parameters**

| Seismic Parameters | 2019 CBC |
|---|---|
| Site Class | D |
| Mapped Short period (0.2-sec) Spectral Response Acceleration, $S_S$ | 2.012 g |
| Mapped 1-second Spectral Response Acceleration, $S_1$ | 0.699 g |
| Site Coefficient (from Table 1613A.2.3(1)), Fa | 1.0 |
| Site Coefficient (from Table 1613A.2.3(2)),), Fv | 1.7 |
| MCE 0.2-sec period Spectral Response Acceleration, $S_{MS}$ | 2.012 g |
| MCE 1-second period Spectral Response Acceleration, $S_{M1}$ | 1.188 g |
| Design Spectral Response Acceleration for short period, $S_{DS}$ | 1.342 g |
| Design Spectral Response Acceleration for 1-second period, $S_{D1}$ | 0.792 g |
| Risk Category | II |

# Appendix B

Foundation Investigation
Dated June 22, 1998

# FOUNDATION INVESTIGATION

**Proposed Reconstruction/Modernization**
**Burbank High School**
**902 North 3rd Street**
**Burbank, California**

PREPARED FOR

Burbank Unified School District
330 North Buena Vista
Burbank, California 91505

Converse Project No. 97-31-279-01

June 22, 1998

**Converse Consultants**

**Over 50 Years of Dedication in Geotechnical Engineering and Environmental Sciences**

June 22, 1998

Burbank Unified School District
Planning Development and Facilities
330 North Buena Vista
Burbank, California 91505

Attention: Dr. Ali A. Kiafar

Subject: **FOUNDATION INVESTIGATION**
Proposed Reconstruction/Modernization
Burbank High School
902 North 3rd Street
Burbank, California
Converse Project No. 97-31-279-01

Gentlemen:

We are pleased to present this geotechnical investigation report for the proposed reconstruction/modernization of the Burbank High School in Burbank, California. This report was prepared in accordance with our November 26, 1997 proposal, and the Agreement between Burbank Unified School District and Converse Consultants (Converse) dated April 20, 1998.

Discernable fill soils were encountered in seven of the 23 borings to depths of about one to four feet below existing site grades. Fill materials were encountered to a depth of about 13 feet in boring BH-20 located near the Stough Canyon Channel. Additional fill materials are expected in existing building areas, as backfill adjacent to existing foundations and retaining walls, and above existing buried utility lines. Natural subsurface materials encountered in the borings generally consisted of interlayered sands, silty sands and sandy silts. Groundwater was not encountered in the borings drilled to maximum depths of about 51 feet below existing site grades.

The results of this investigation indicate the site is suitable for support of proposed buildings on spread footings bearing on undisturbed natural soils or properly compacted fill soils as described in this report. Due to the existence of undocumented fill soils, loose surficial soils, and expected disturbance of surficial soils that will result during the demolition and removal of existing structures, we recommend that

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proposed building areas be overexcavated and replaced with properly compacted fill soils for support of floor slabs.

Thank you for this opportunity to be of continued service. If you have any questions or if we can be of additional service, please do not hesitate to contact us.

Respectfully submitted,

CONVERSE CONSULTANTS

Patrick J. Schmidt, GE 2260
Senior Engineer

Dist: 6/Addressee

REGISTERED PROFESSIONAL ENGINEER
PATRICK J. SCHMIDT
No. 2260
Exp. 3/31/02
GEOTECHNICAL
STATE OF CALIFORNIA

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Converse Project No. 97-31-279-01

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## 1.0 INTRODUCTION

This report presents results of a geotechnical investigation performed by Converse Consultants (Converse) for the planned reconstruction/modernization of Burbank High School in Burbank, California. The purposes of this investigation were to determine the nature and engineering properties of the earth materials at this site, and to provide geotechnical recommendations for the design and construction of new buildings. A probabilistic seismic analysis was also performed for this site, and the results are presented in this report.

This report is intended for use by the Burbank Unified School District and its design professionals. Since this report is intended for use by the designer(s), it should be recognized that it is impossible to include all construction details in this report at this phase in the project. Additional consultation may be prudent to interpret these findings for contractors, or possibly refine these recommendations based upon the final design and actual conditions encountered during construction.

## 2.0 PROJECT DESCRIPTION

For the purpose of this report, Glen Oaks Boulevard has been assumed to be in a east-west direction. The project site is bound by Glen Oaks Boulevard to the north, Harvard Road to the east, Third Street to the south and Delaware Road to the west. We understand that all of the existing buildings and other improvements at this school site, with the exception of the administration building (auditorium and northern portion) and the athletic fields in the northeastern portion of the site, will be demolished and removed as part of the planned modernization. Drawing 1, *Location of Borings* (two sheets in pocket), shows the locations of existing structures (with the portion of the administration building that is to remain identified).

New construction at the school site is tentatively planned to consist of a parking structure, gymnasium building and swimming pool, auto-shop, media, classrooms, courtyards, a play field and basketball courts.

The parking structure will be located at the southwestern corner of the site and is tentatively planned to have plan dimensions of about 125 feet north-south by 430 feet east-west. The parking structure area is currently occupied with tennis courts, the existing science building, temporary portable structures, the western portion of the existing home economics building and existing asphalt paved parking and access roadways. We understand that this structure will be two levels in height with roof-top tennis courts. Construction is expected to consist of reinforced and prestressed concrete construction.

The proposed gymnasium and swimming pool will be located in the southern portion of the site between the proposed parking structure and existing administration building. The gymnasium building is tentatively planned to have plan dimensions of 165 feet north-south by 200 feet east-west. The planned swimming pool area will be located east of the gymnasium and is tentatively planned to occupy a plan area of 165 feet north-south by 110 feet east-west. The area of these structures is currently occupied with a portion of the home economics building, library and classroom building, asphalt paved and landscaped areas. The gymnasium building is expected to consist of reinforced masonry construction with a slab-on-grade floor and a steel framed roof.

An auto shop, classrooms and courtyards will be constructed in the eastern portion of the site, east of the existing administration and industrial arts buildings. The auto shop and possibly a parking lot will be constructed in the northeastern portion of the site. The area of these structures extends between Third Avenue and Glen Oaks Boulevard, north of Harvard Road, and is currently occupied with tennis courts and asphalt paving in the southwest, a turf area in the southeast, and asphalt paved parking areas in the north. These buildings will be terraced with the center east-west portion consisting of three floor levels and the northern and southern sections consisting of two floor levels. Construction is expected to consist of masonry bearing walls, concrete slabs-on-grade and wood or steel framed roof structures.

The northern wall of the center three-story portion of the structure will act as a retaining wall.

A unpaved playing field and basketball courts will be constructed along the northern portion of the site between the existing athletic field and the location of the proposed auto shop and possible parking areas. This area is currently occupied with existing gymnasiums and swimming pool, industrial arts building and paved areas.

It is anticipated that earthwork associated with the planned improvements will include cuts and fills on the order of 10 feet or less. Largest grade changes are anticipated in the central, three-story portion of the tiered classroom construction in the middle eastern portion of the site.

It is our understanding that each of the buildings to be removed consist of slab-on-grade construction without basement levels. We also understand that proposed replacement buildings will not have basements. Although the project is still in the early stages of design, we have estimated that maximum wall and column foundation loads will be on the order of 10 kips per foot and 100 kips, respectively, for the proposed structures with the exception of the parking structure. For the parking structure, we have estimated maximum wall and column foundation loads will be on the order of 10 kips per foot and 150-200 kips, respectively. If actual design loads are significantly greater than these assumed loads, our office should be contacted and requested to re-evaluate the recommendations presented herein with respect to actual design loads.

## 3.0 SCOPE OF WORK

The scope of geotechnical services performed for this project included exploratory borings, geotechnical laboratory testing of soil samples, geotechnical engineering analyses, and preparation of this written report. This report did *not* include an evaluation of the potential for soil and/or groundwater contamination at this site. The scope of work for this investigation included the following:

- Field exploration consisted of drilling twenty three exploratory borings to depths ranging from 10 to 51-1/2 feet below the existing ground surface at the locations shown on Drawing 1. Subsurface conditions encountered in the borings were continuously logged and classified in the field by visual/ manual examination in accordance with the Unified Soil Classification System. Field exploration procedures and boring logs are presented in Appendix A, *Field Exploration.*

- Laboratory testing included moisture and density determinations, a compaction curve, percent passing the No. 200 sieve, direct-shear strength, consolidation, R-value, and pH, resistivity, soluble sulfate, and chloride concentration testing. Descriptions of the individual tests and test results are presented in Appendix B, *Laboratory Test Program.*

- Engineering analyses and evaluation of results of the field exploration and laboratory testing were performed to develop design and construction recommendations for the proposed structures. Findings and recommendations are documented in this written report.

- A site-specific seismic analysis was performed for this project. The seismic evaluation for this site included a probabilistic analysis of seismic design parameters, and a discussion of secondary seismic effects, including liquefaction. The results of the seismic analysis are presented in this report.

## 4.0 EXISTING SITE CONDITIONS

Based on the topographic site plan dated April 16, 1998, prepared by Andreasen Engineering, Inc. and reproduced as Drawing 1 in this report, site grades slope downward to the south from an elevation of about 660 feet along Glen Oaks Boulevard, along the north side of the site, to elevations about 637 near the intersection of Delaware Road and Third Street, at the southwest corner of the site and an elevation of about 643 feet near the intersection of Third Street and Harvard Road, at the southeast corner of the site.

As described in the previous section of this report, proposed building sites are currently occupied with existing buildings, asphalt paving, and landscaped areas. Existing retaining walls are located along the north side of the site (north walls of the gymnasium and industrial arts buildings and between these buildings), along the south side of the industrial areas building, along the south side of the existing basketball courts and swimming pool area, along the south sides of the athletic and baseball field areas, and along approximately the eastern half of the southern side of the site. Existing retaining walls are generally on the order of 12 feet or less in height. With the exception of the existing retaining walls along the southern side of the athletic and baseball fields and along the southern side of the side, it is anticipated that the retaining walls will be removed during redevelopment of the site.

An existing 11-foot by 11-foot storm drain box culvert extends in a north to south direction through the site. The storm drain alignment generally extends southward from Walnut Avenue, north of the site, beneath the athletic field, and between the existing science and home economics buildings before exiting the site to the south. The location of the storm drain is shown on Drawing 1 (two sheets). Other buried utilities are expected throughout the site.

## 5.0 GEOLOGIC CONDITIONS

### 5.1 Earth Materials

Asphalt concrete paving varying in thickness from 1½ to 7 inches was encountered at all of the boring locations with the exception of BH-10, BH-11, BH-13 through BH-15, BH-17, and BH-23. Aggregate base was observed beneath the asphaltic concrete only at boring location BH-16. The thickness of the aggregate base was about 3 inches at this location.

Discernable fill soils were encountered in borings BH-3 and BH-12 through BH-14, BH-16, BH-17, BH-22 and BH-23. Fill depths varied from about one to four feet below existing site grades at these boring locations with the exception of boring location BH-20 which encountered about 13 feet of fill. This boring was located near the existing Stough Canyon Channel. Fill soils were not observed in the other borings. Due to past development of the site, additional fill materials are expected in existing building areas, as backfill adjacent to existing foundations, above the existing buried storm drain box culvert and other utility lines and behind existing retaining walls and swimming pool walls. The depth of fill soils behind existing retaining and swimming pool walls are expected to be approximately equal to the height of the walls. Fill depths behind the storm drain box culvert that extends through the site are expected to be on the order of 15 feet or less. In addition, we anticipate that fill soils extend considerable distances behind some of the existing site retaining walls. Fill depths in other areas are generally expected to be on the order of less than two to five feet. Converse is unaware of any fill placement documentation for fill soils encountered in our subsurface exploration for this site.

Native soils encountered in the borings generally consisted of alternating layers of poorly graded sand, silty sand and sandy silts.

Based on the results of subsurface exploration and experience, variations in the continuity and depth of subsurface conditions should be anticipated. Care should be exercised in interpolating or extrapolating subsurface conditions between or beyond boring locations. Fill depths should be expected to vary between borings.

### 5.2 Groundwater Conditions

Burbank High School site is located within the eastern portion of the San Fernando Basin. This basin lies within the watershed of the Upper Los Angeles River Area (ULARA). The alluvial sediments occupying the floor of the San Fernando Basin comprise a substantial network of groundwater aquifers which collectively constitute the San Fernando groundwater basin. Most wells in the San Fernando Basin pump water from high-yielding aquifers in the eastern portion of the basin.

Groundwater was not encountered in the exploratory borings to the maximum depth of exploration (51 feet below ground surface). Review of the *Watermaster Service in* *the Upper Los Angeles River Area, Los Angeles County* report dated May 1997, for the 1995–96 Water Year, Plate 12, indicates the simulated groundwater elevation beneath the site is on the order of 500 feet. This corresponds to depths of 140 to 160 feet below existing site grades. Groundwater levels beneath the site are subject to seasonal and long-term variations and fluctuations resulting from groundwater spreading, recharge and pumping activities.

## 5.3 Faulting and Seismicity

The site is located within the seismically active Los Angeles Basin in southern California. The Los Angeles Basin has experienced 17 moderate-sized (Richter Magnitude 4.8 – 6.7) mainshock/aftershock sequences since 1920 (Earthquake Engineering Research Institute, 1994). More recent seismic activity which affected the Los Angeles Basin includes the magnitude 5.9 Whittier Narrows earthquake of October 1, 1987, the magnitude 5.8 Sierra Madre earthquake of June 28, 1991, the magnitude 6.1 Desert Hot Springs earthquake of April 22, 1992, the magnitude 7.4 Landers and magnitude 6.5 Big Bear earthquakes of June 28, 1992, and the magnitude 6.7 Northridge earthquake of January 17, 1994. These earthquakes have occurred on or near three primary sets of faults:

- northwest-trending, right-lateral strike-slip faults
- east-west trending, primarily reverse-slip faults, and
- northwest-trending blind thrust faults.

Collectively, these three sets of faults define the structural and seismic setting of the Los Angeles Basin.

There are a number of potentially active (documented movement within the last 1,600,000 years) or active (documented movement within the last 11,000 years) (California Division of Mines and Geology [USGS], 1992) regional faults near Burbank. Active faults can further be classified as faults that have a potential for renewed movement within a period of concern to humans (USGS, 1985).

Since the early 1970s, the majority of seismic activity in the Los Angeles Basin has been centered in the northern section of the basin in the general vicinity of the San Fernando Valley (Earthquake Engineering Research Institute, 1994).

The nearest active fault to the project site is the Verdugo Fault, located about 0.5 mile north of the project site. This fault is about 7 miles long and is considered capable of generating a Maximum Credible Moment Magnitude Earthquake of 6.6.

A recently recognized potential seismic source for the Los Angeles Basin is the Elysian Park fold and thrust belt. The Elysian Park Thrust System consists of a series of shallowly north- and northeast-dipping blind thrusts extending from Orange

County through downtown Los Angeles, and westward beneath the Santa Monica Mountains along the Malibu coast. These faults are expressed at the surface as broad uplifted folds (anticlinoriums) instead of fault scarps, hence the term "blind" thrust. The exact surficial limits of this structure are still poorly resolved. This belt is seismically active as evidenced by the 1987 magnitude 5.9 Whittier Narrows earthquake. Based on seismological evidence, the Whittier Narrows earthquake occurred on a "blind" thrust fault at a depth of about 8 miles below the surface (Hauksson and Jones, 1990).

The magnitude 6.7 Northridge earthquake that occurred on January 17, 1994, and the March 20, 1994 magnitude 5.3 aftershock also occurred on a previously unknown and unnamed, southward-dipping "blind" thrust fault. The epicenter of the earthquake occurred approximately one mile south-southwest of Northridge. Subsurface rupture started at about 12 miles below the surface (Earthquake Engineering Research Institute, 1994), and extended to between two and five miles below the surface (Dames & Moore, undated). No surface rupture occurred.

The geometry and location of the "blind" thrust structures such as the Elysian Park fold and thrust belt is very theoretical and is based on review of oil-well data, seismic data, and detailed structural analyses. Since these structures are buried and confined to relatively deep depths, they are not considered to be a hazard in terms of surface fault rupture. However, they can generate moderate to strong ground shaking and substantial damage, as evidenced by the Northridge earthquake.

The San Andreas fault is the most prominent structural feature in California. It extends a length of about 620 miles from Point Arena in northern California to the east side of the Salton Sea where it is concealed by alluvium. This fault zone has sustained several great earthquakes, including the 1857 magnitude 8.0 Fort Tejon earthquake and the 1906 magnitude 8.0 San Francisco earthquake. The 1857 earthquake is estimated to have ruptured the surface a distance of 190 miles from Cholame to south of Wrightwood (Sieh, 1978).

The San Andreas fault system is divided into regional segments. Each segment of the San Andreas fault south of Parkfield, California, is thought capable of large or great earthquakes. The central segment of the San Andreas fault is located about 30 miles northeast of the project site. Fault segments of the San Andreas rupture separately or with adjoining segments at different times, leading to a range of possible magnitudes in each earthquake. The best estimates for the San Andreas earthquakes are from magnitude 6.8 to 8.0, depending on how many segments rupture together in an event.

## 6.0 DESIGN RECOMMENDATIONS

### 6.1 General

Proposed buildings may be supported on conventional spread footings bearing solely on undisturbed natural soils or properly compacted fill soils. Undocumented fill soils encountered in the borings and expected in other areas of the site, as previously discussed, and loose surficial natural soils are *not* considered suitable for support of proposed buildings.

In the subsections below, design recommendations for seismicity, earthwork, foundations, slabs-on-grade, pavements, and corrosion and chemical attack resistance are provided. Construction considerations, such as temporary excavations, are discussed in the construction considerations section, presented later in this report.

### 6.2 Seismicity

Seismic design parameters are provided based upon both simplified Uniform Building Code (UBC) methods and for site-specific seismic analyses in the following subsections.

6.2.1 Uniform Building Code Parameters: This site is not within a currently designated Alquist-Priolo Earthquake Fault Zone. However, strong ground shaking due to seismic activity is anticipated at the site. The closest known fault is the Verdugo located less than 1 mile northeast of the site. The site is within UBC Seismic Zone 4 with a Z factor of 0.4, as is the case for most of Southern California. A site coefficient of 1.2 ($S_2$) should be used, as shown in Table 16-J of the 1994 UBC for seismic design. Also, normalized response spectra for "medium dense to dense soils (soil type 2)" can be used as shown on Figure 16-3 of the 1994 UBC.

6.2.2 Site-Specific Ground Motion Parameters: In addition to choosing appropriate conventional UBC seismic design parameters, a site-specific probabilistic seismic evaluation was performed using uniform hazard techniques. Two earthquakes were selected to represent a reasonable range of earthquake energy levels for design of the school buildings. Definitions of these different design levels, here referred to as the Upper Bound Earthquake (UBE) and Maximum Probable Earthquake (MPE), and the selected faults and earthquake magnitudes are discussed below:

- Upper Bound Earthquake (UBE): The term "Upper Bound Earthquake" (UBE) is used to describe potential large magnitude seismic events on regional faults. The UBE is defined as an event with 10 percent probability of exceedance in 100 years.

- Maximum Probable Earthquake (MPE): This is defined as the earthquake resulting in a site-specific ground motion with a 10 percent probability of being exceeded in 50 years. This is the minimum ground motion representation based on the 1994 UBC.

An analysis was performed for the site using the computer program "FRISKSP" developed by Thomas F. Blake. Output for FRISKSP is presented on Figure 6.2.1, "Probability of Exceedence versus Acceleration." Uniform Hazard Techniques were used in the analyses. Ground accelerations are based upon the Boore, Joyner and Fumal (1993) attenuation relationships for random mean horizontal ground accelerations, for type "C" soils. Based upon this analysis, Table 6.2.2, "Possible Design Earthquakes and Horizontal Ground Motion Parameters," was developed; which briefly summarizes the possible design level earthquakes and important characteristics of the anticipated horizontal site-specific ground motion.

TABLE 6.2.2

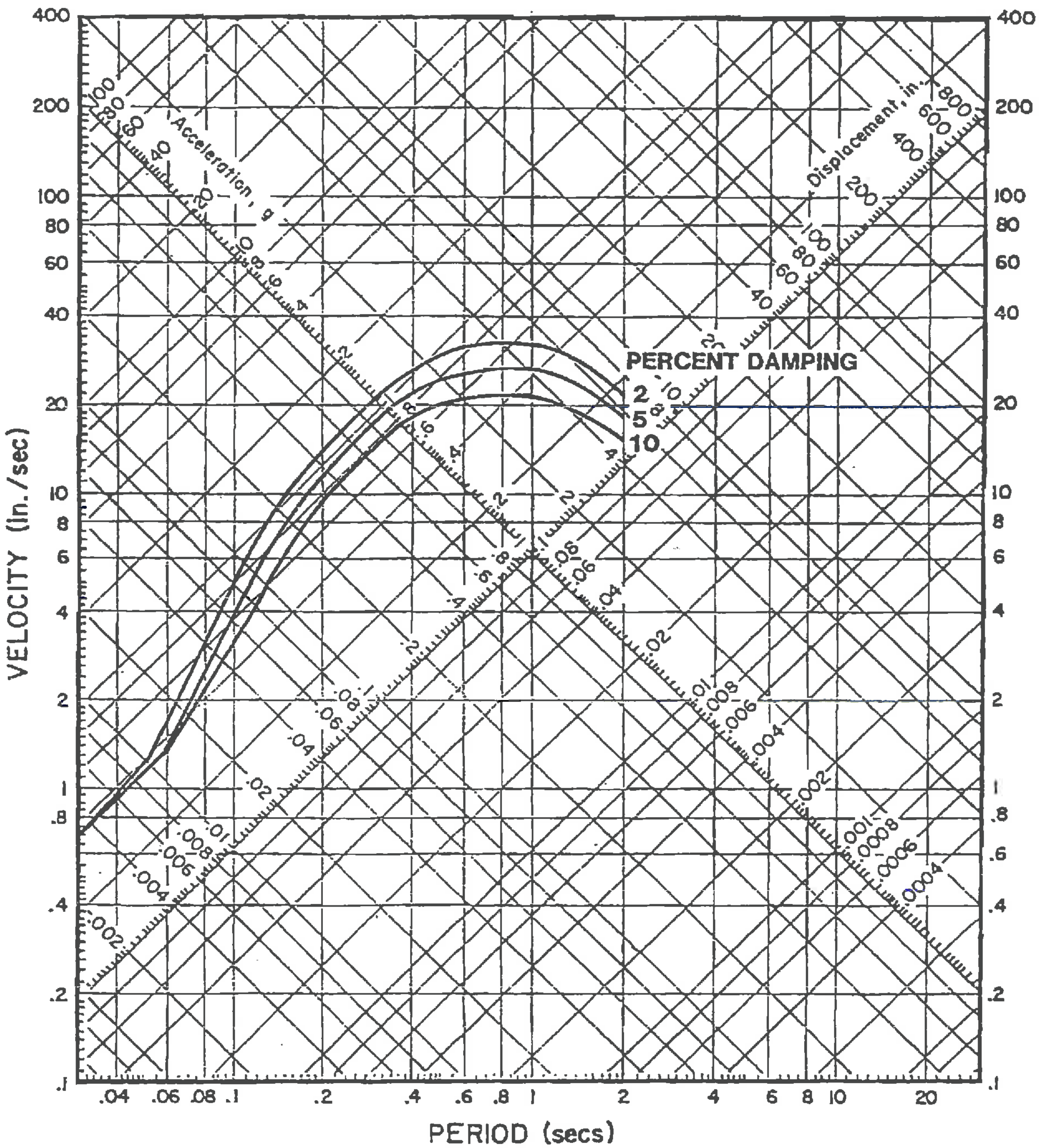
POSSIBLE DESIGN EARTHQUAKES AND HORIZONTAL GROUND MOTION PARAMETERS

| Earthquake Parameters | Maximum Probable (MPE) | Upper Bound (UBE) |
|---|---|---|
| Maximum Peak Horizontal Ground Acceleration (g) | 0.39 | 0.43 |
| Duration of Strong Ground Shaking (seconds)[1] | 20-26 | 20-26 |

1 Based on Bolt et al. (1977) "bracketed" duration (acceleration >0.05g: frequency >2Hz)

6.2.3 Site-Specific Response Spectra: Horizontal ground motion elastic response spectra are presented in tripartite form on Figure 6.2.2, "Uniform Hazardous Response Spectra." This horizontal ground motion spectra represent the maximum response amplitude of a linear elastic single-degree-of-freedom system with equivalent viscous damping of 2 percent, 5 percent, and 10 percent of critical damping. Spectra were drawn using the FRISKSP program for 5 percent damping. Response spectra curves for 2 percent and 10 percent damping were derived from the 5 percent damping curve using spectral amplification factors developed by Newmark and Hall (1982).

The Uniform Building Code (UBC, 1994 Edition) allows a reduction down to two-thirds for the vertical acceleration relative to the horizontal acceleration (Section 1629.2.5). In general, for both near-field and far-field ground motions, the vertical motions have about 40 percent to 60 percent higher frequency than the horizontal motions. It should also be noted that maximum vertical and horizontal accelerations seldom occur simultaneously. It is recommended that the vertical motion elastic response spectra for the possible design level ground motions be based on the following modifications of the




UNIFORM HAZARD RESPONSE SPECTRA
MAXIMUM PROBABLE EVENT
10% PROBABILITY OF EXCEEDANCE IN 50 YEARS
475 YEAR RETURN PERIOD

BURBANK HIGH SCHOOL

UNIFORM HAZARD RESPONSE SPECTRA - MPE EVENT

Converse Consultants West

Project No. 97-31-279-01

Figure No. 6.2.2

horizontal ground motion elastic response spectra illustrated on Figures 6.2.1 and 6.2.2.

- decrease the acceleration amplitudes by 33 percent (multiply the ordinates by 0.67).
- decrease the periods by 33 percent (multiply the abscissas by 0.67).

6.2.4 Secondary Seismic Effects: In addition to ground shaking, secondary effects of seismic activity on a project site may include surface fault rupture, soil liquefaction, differential settlement of structures, ground lurching, land-sliding, lateral spreading, earthquake-induced flooding, seiches, and tsunamis. Results of a site-specific evaluation of each of the above secondary effects are explained below:

- *Surface Fault Rupture*: The project site is not located within a currently designated State of California Earthquake Fault Zone. Based on review of existing geologic information, no major surface fault crosses through or extends towards the site. The potential for surface rupture resulting from the movement of nearby major faults is not known with certainty but is considered low.

- *Liquefaction*: Liquefaction is defined as the phenomenon in which a soil mass, because of the rapid development of excess pore pressures, suffers a substantial reduction in its shear strength to a constant value and deforms continuously until the imposed shear stresses become equal to the residual shear strength. During earthquakes, excess pore pressure develops in saturated soil deposits as a result of induced cyclic shear stresses, resulting in liquefaction. Research has shown that soils having the greatest susceptibility to liquefaction appear to be fine, silty sands and clean sands. Standard penetration Test (SPT) blow counts indicate that sands and gravels below a depth of 15 to 20 feet are dense to very dense. In addition, the results of our subsurface exploration indicate that the depth to groundwater at the project site is more than 51 feet.

  Review of the CDMG Reconnaissance Seismic Hazard Map for the Burbank Quadrangle, dated February 1996, Open-File Report 96-01J, indicates the school is not located in an area that may contain liquefiable materials. Based on these findings, the project site is considered to have a low susceptibly to liquefaction.

- *Landslides*: Seismically induced landslides and other slope failures are common occurrences during or soon after earthquakes. The project site slops gently to the south. In the absence of significant ground slopes, the potential for seismically induced landslides to affect the proposed site is considered to be nil.

- *Lateral Spreading*: Seismically induced lateral spreading involves primarily lateral movement of earth materials due to ground shaking. It differs from slope failure in that complete ground failure involving large movement does not occur due to the relatively smaller gradient of the initial ground surface. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. The topography at the project site and in the immediate vicinity of the site is relatively flat. Under these circumstances, the potential for lateral spreading at the subject site is considered very low.

- *Differential Settlement Due to Seismic Shaking*: The potential for significant differential settlement due to seismic shaking exists for medium- or coarse-grained sands. Based on field sampling blow counts, it is our opinion that the potential for significant differential settlement due to seismic shaking is low.

- *Tsunamis*: Tsunamis are tidal waves generated in large bodies of water by fault displacement or major ground movement. Based on the location of the site, tsunamis do not pose a hazard to this site.

- *Seiches*: Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No enclosed bodies of water that can experience seiches during an earthquake are present in the vicinity of the proposed project site.

- *Earthquake-Induced Flooding*: This is flooding caused by failure of dams or other water-retaining structures as a result of earthquakes. The potential of earthquake-induced flooding is considered to be very low.

### 6.3 Earthwork

Earthwork is expected to consist of backfill of excavations resulting from the removal of existing foundations, retaining walls, swimming pool walls and other below grade obstructions, over-excavation of existing fill soils from building areas, placement of compacted fill soils within proposed building areas, utility trench backfill, and subgrade preparation for slabs and pavements. Earthwork recommendations are presented in Appendix C, *Recommended Earthwork Specifications,* and also in the following subsections.

6.3.1 Removals: Prior to the start of construction, the existing structures to be removed should be demolished and completely removed from the site. All subsurface structures and foundation remnants and swimming pool walls and foundations should be removed. Any loose, disturbed, or otherwise unsuitable materials should be excavated. Demolition activities should not disturb adjacent utilities, buildings, and structures to remain. Existing utilities should be removed and adequately capped at the project boundary line, or salvaged/ rerouted as designed. Dust control may be required.

6.3.2 Over-Excavation: Existing fill soils should be overexcavated from all building areas and replaced with compacted fill. Depths of over-excavation are typically anticipated to be on the order of 2 to 4 feet. If new building foundations are to be supported on compacted fill, the depth of over-excavation should be increased as necessary to provide a minimum fill thickness of two feet or one-half the footing width, whichever is greater, beneath new foundations. Over-excavation depths may have to be greater in some areas, such as in the vicinity of Stough Canyon Channel, to completely remove existing fill soils. Removal excavations should extend horizontally five feet beyond the plan dimensions of the buildings.

6.3.3 Subgrade Preparation and Compaction: All exposed subgrade soil surfaces, including over-excavation bottom surfaces and subgrade surfaces below proposed slabs and pavements, should be observed by a Converse representative prior to placement of fill or placement of slabs and pavements. If soft, yielding, or unsuitable soils are exposed at the subgrade surface, then the unsuitable soils should be removed and replaced with properly compacted fill soils. For subgrade soil surfaces that are suitable for fill placement or placement of slabs and pavements, the exposed soils should be scarified to a depth of 6 to 8 inches, moisture-conditioned at 0 to 3 percent above optimum moisture, and then compacted to 90 percent of the ASTM D1557-91 laboratory maximum density to a minimum depth of 6 inches below the surface grade. Subgrade soils should be kept moist until floor slabs are poured.

6.3.4 Fill Compaction: All fill and backfill soils should be placed in lifts not exceeding eight inches in thickness, moisture-conditioned at 0 to 3 percent above optimum moisture, and compacted to 90 percent of the ASTM D1557-91 laboratory maximum density. All fill and backfill should be placed and compacted under observation and testing performed by Converse.

6.3.5 Fill Materials: Fill soils should consist of imported non-expansive soils or site soils free of organics, cobbles, boulders, rubble, or rock larger than three inches in largest dimension. Any imported soils should be granular and non-expansive, with an EI less than 20. Import soils should be evaluated and possibly tested by Converse if the materials are questionable.

Grading operations during the wet season may require provisions for drying of the soil prior to compaction. If the project necessitates fill placement and compaction in wet conditions, we could provide alternatives for drying the soil. Conversely, additional moisture may be required during the dry months. Water trucks should be available in sufficient number to provide adequate water during compaction.

6.3.6 Site Grading: A grading plan was not available for review at the time of writing this report. However, final grades should slope at 1 to 2 percent away from structures to prevent ponding and to reduce percolation of water into foundation soils.

## 6.4 Foundations

6.4.1 Vertical Capacity: Conventional spread footings founded on undisturbed natural soils or properly compacted fill soils may be used to support proposed structures. For support of building foundations on compacted fill, foundation areas should be overexcavated to provide a minimum fill thickness of two feet or one-half the footing width, whichever is greater, beneath foundations. Footings for the proposed buildings should be founded at least 18 inches below lowest adjacent final grade. Continuous footings should have a minimum width of 18 inches, and isolated spread footings should have a minimum width of 24 inches. Footings may be designed for a net allowable vertical bearing pressure of 3,000 pounds-per-square-foot (psf) for dead-plus-live loads. This allowable bearing pressure may be increased by 500 pounds per square foot for each additional foot of footing width beyond the minimum specified widths for continuous and spread footings, to a maximum of 5,000 psf. New footings located adjacent to existing footings should be founded at depths equal to the existing footings to avoid excess surcharge loading or undercutting of adjacent existing footings.

The anticipated settlement of a square footing founded on properly compacted fill soil is estimated to less than 1-inch for a column load of 200 kips. Differential settlements are expected to be less than one-half of estimated total settlements.

6.4.2 Lateral Capacity: Resistance to lateral loads can be provided by friction acting at the base of the foundations and by passive earth pressure. A coefficient-of-friction of 0.35 may be assumed with the dead-load forces. An allowable passive lateral earth pressure of 300 psf per foot of depth, up to a maximum of 3,000 psf, may be used for sides of footings poured against properly compacted fill soils.

6.4.3 Dynamic Increases: Bearing values indicated above are for total dead-load and frequently applied live loads. The above vertical bearing may be increased by 33 percent for short durations of loading which will include the effect of wind or seismic forces. The allowable passive pressure may be increased by 33 percent for lateral loading due to wind or seismic forces.

## 6.5 Slabs-on-Grade

Slabs-on-grade should be placed on properly compacted subgrade soils as described in Section 6.3.3. Prior to placing concrete, the exposed subgrade should be scarified to at least 6 to 8 inches, moisture-conditioned, and then compacted to 90 percent of the ASTM D1557-91 laboratory maximum density. Subgrade soils should be kept moist until slabs are ready to be poured.

Slabs-on-grade should have a minimum thickness of four inches for support of nominal ground-floor live loads. The thickness of more-heavily loaded slabs will be dependent upon the anticipated loads and should be designed by a structural engineer. Slabs should be reinforced with at least No. 3 reinforcing bars spaced 30 inches on-center in two perpendicular directions. A coefficient of vertical subgrade reaction of 150 pounds-per-cubic-inch (pci) may be used for design of heavily loaded concrete slabs-on-grade. Care should be taken to avoid slab curling if slabs are poured in hot weather. Slabs should be designed and constructed as promulgated by the Portland Cement Association (PCA). Prior to the slab pour, all utility trenches should be properly backfilled and compacted.

In areas where a moisture-sensitive floor covering (such as vinyl tile or carpet) is used, slabs should be protected by at least a six-mil-thick polyethylene vapor barrier between the slab and compacted subgrade. Where a vapor barrier is used, it should be protected with two inches of sand placed above and below the barrier, to reduce the potential for punctures and to aid concrete curing. Polyethylene sheets should be overlapped a minimum of six inches, and should be taped or otherwise sealed.

## 6.6 Retaining Walls

Cantilevered retaining walls which are able to deflect at least 0.001 radian can be designed using an active equivalent fluid pressure of 35 pounds-per-cubic-foot (pcf). Braced walls which are restrained against deflection and rotation can be designed using an active equivalent fluid pressure of 50 pounds-per-cubic-foot (pcf). Design earth pressures are based upon the assumption that walls retain level backfill for a distance behind the wall greater than or equal to the wall height, for walls no taller than 15 feet.

Surcharge pressures should be added to the above earth pressures for surcharges within a horizontal distance less than or equal to the wall height. A surcharge coefficient of 28 percent and 44 percent of any uniform vertical surcharge should be added as a horizontal wall pressure for cantilever and braced walls, respectively.

Design recommendations presented above are based on the assumption that retaining walls will retain either onsite soils or imported non-expansive soils that have been properly compacted. All wall backfill should be compacted to at least 90 percent of the ASTM D1557-91 laboratory maximum density. Backfill operations should be performed as specified in Appendix C. Over-compaction and use of large equipment adjacent to the walls should be avoided. Care should be taken not to damage retaining walls during the backfill operations. Concrete should attain the design (28-day) strength prior to placement of large quantities of backfill. Final surface grades should be sloped at a gradient such that surface water drain away from the structures.

The above pressures assume that sufficient drainage will be provided behind walls to reduce the potential for hydrostatic pressure build-up from surface and subsurface water infiltration. Drainage may be provided by a 12-inch-wide zone of Class 2 Permeable Material (State of California Department of Transportation Standard Specifications Section 68), or open-graded gravel. The permeable material or open-graded gravel should extend from the base of the wall to within 1½ feet of the surface. The upper 1½ feet of the backfill should consist of compacted native soil. Open-graded gravel should be separated from the native soil by a non-woven geotextile filter fabric such as Mirafi 140N or equivalent.

Drainage outlet may be provided by either weep holes spaced at 6 feet on-center along the base of retaining walls, or a 4-inch-diameter perforated drain pipe provided along the base of the wall leading to a suitable discharge point. If weep holes are used, these holes should have an open area of at least 4 square inches (½-inch-wide gap in masonry block). A filter fabric or coarse gravel should be placed behind the weep hole to prevent piping of fine sands and silts. Alternatively, a 4-inch-diameter perforated drain pipe may be placed at the bottom of the retaining wall. This pipe should be placed with perforations down and surrounded with a Class 2 Caltrans *permeable* material (gravel) specified under Caltrans Standard Specification 68-1.025. Drain pipes should flow by gravity to a suitable outlet. To resist crushing the pipe, the drain pipe should be PVC Schedule 40 as a minimum.

### 6.7 Pavements

Existing fill soils within two feet of proposed pavement subgrade elevations should be overexcavated and replaced with new properly compacted fill soils. The upper 6 to 8 inches of all pavement subgrade soils should be scarified, moisture-conditioned, and properly compacted. Exposed subgrade soils should be compacted to a minimum of 90 percent of the ASTM D1557-91 laboratory maximum density to 0 or 3 percent above optimum moisture content to a minimum depth of 6 inches.

Minimum asphalt pavement sections presented below in Table 6.1, *Asphalt Pavement Sections,* are based on recommended Traffic Index (TI) values of 4.0 and 6.0, and a subgrade R-value of 58 which was determined for a bulk sample from the site. Additional R-value testing of pavement soils should be performed following the completion of site grading.

TABLE 6.1

ASPHALT PAVEMENT SECTIONS

| Traffic Index (TI) | Minimum Asphalt Thickness (inches) | Minimum Aggregate Base Thickness (inches) |
|---|---|---|
| 4.0 (auto parking) | 2.5 | 4 |
| 6.0 (light truck traffic) | 3.5 | 4 |

Aggregate base should be compacted to at least 95 percent of the ASTM D1557-91 laboratory maximum density. Base materials should conform with Sections 200-2.2 or 200-2.4 of the *Standard Specifications for Public Works Construction* (Green-book), 1997 Edition. To reduce the potential for premature pavement distress, it is important that final pavement grade be designed such that ponding on or adjacent to the pavements is avoided. Pavement runoff should be directed to a suitable non-erosion drainage device. Landscape irrigation should *not* be allowed to flow into pavement subgrades.

Where asphalt pavements meet concrete or existing pavements, the concrete and/or asphalt should be sprayed with an SS-1 or CSS-1 emulsion. Proper asphalt compaction next to concrete pavements, curbs and existing pavements is important to provide a relatively impermeable contact between the two materials.

A coefficient of vertical subgrade reaction of 150 pounds-per-cubic-inch (pci) may be used for design of concrete pavements. Concrete pavements should be designed and constructed in accordance with the Portland Cement Association "Thickness Design for Concrete Highway and Street Pavements" or other appropriate procedure.

## 6.8 Corrosivity and Chemical Attack

Minimum electrical resistivity, pH, soluble chloride and soluble sulfate test results obtained from two bulk soil samples recovered at the site are presented in Appendix B. Sulfate was not detected in either of the two samples collected from the site. Therefore, conventional Type I or II portland cement may be used. A low chloride content (11 ppm) and near-neutral pH's were measured for each of the samples. Saturated minimum resistivities of 11,500 and 12,500 ohms-centimeters were also measured. These values would indicate a low to moderate corrosivity potential for ferrous metals in contact with these soils. Therefore, conventional corrosion mitigation measures are considered appropriate for these potentially corrosive soils, including the following:

- All steel and wire concrete reinforcement should have at least three inches of concrete cover where cast against soil, unformed.

- Below-grade ferrous metals should be given a high-quality protective coating, such as 18-mil plastic tape, extruded polyethylene, coal-tar enamel, or portland cement mortar.

- Below-grade metals should be electrically insulated (isolated) from above-grade metals, by means of dielectric fittings in ferrous utilities and/or exposed metal structures breaking grade.

## 7.0 CONSTRUCTION CONSIDERATIONS

### 7.1 Temporary Excavations

Temporary slopes may be used during excavations. Where space is limited due to adjacent facilities and buried utilities to be salvaged and protected, shoring may be required. Recommendations for shoring design are provided in the following section of this report.

Temporary sloped excavations may be used where plan dimensions for excavations and slopes are not constrained by adjacent utilities and structures. Based upon the soils encountered in the borings, it is our opinion that sloped temporary excavations may be cut according to the slope ratios presented in the following table:

TABLE 7.1
TEMPORARY EXCAVATION SLOPES

| Maximum Depth of Cut (feet) | Maximum Slope Ratio (horizontal:vertical) |
|---|---|
| 0 – 3 | vertical |
| 3 – 5 | ½:1 |
| 5 – 10 | 1:1 |

In areas where existing retaining wall, swimming pool backfill or deep utility trench backfill is encountered, slopes may have to be flattened. Slope ratios given above are assumed to be uniform from top to toe of slope. Surfaces exposed in sloped excavations should be kept moist but not saturated to retard ravelling and sloughing during construction. Adequate provisions should be made to protect slopes from erosion during periods of rainfall. Surcharge loads should not be permitted within a horizontal distance equal to the depth of the cut from the top of slopes. Cuts in loose fill may have to be less steep than tabulated above. Workers entering excavations should be protected from possible caving and ravelling soils.

### 7.2 Temporary Shoring

Temporary shoring may be required for support of construction excavations. Shoring heights on the order of 15 feet or less are anticipated for the project. A soldier-pile shoring system may be used to maintain temporary support of vertical walled excavations. A soldier-pile system will most likely require lagging to control caving and sloughing in the excavation between soldier piles. Shoring design must consider the support of adjacent underground utilities and/or structures, and should consider the effects of shoring deflection on supported improvements.

Temporary cantilever shoring should be designed to resist a lateral earth pressure equivalent to a fluid density of 30 pounds-per-cubic-foot (pcf). That is to say, a triangular pressure distribution should be used, which increases by 30 psf per foot of depth below level ground. This equivalent fluid pressure is valid only for level ground, and cantilever shoring elements with exposed heights no greater than 15 feet.

Surcharge pressures should be added to the above earth pressures for surcharges within a distance from the top of the shoring less than or equal to the shoring height. A surcharge coefficient of 28 percent of any uniform vertical surcharge should be added as a horizontal shoring pressure for cantilever shoring.

Lateral resistance for soldier piles may be assumed to be provided by passive pressure below the bottom of excavations. The allowable passive pressure for soldier piles spaced at least 2 diameters on center may be taken as 600 psf on the pile per foot of depth, measured below the bottom of excavation. Closer spaced soldier piles should be designed using a passive resistance of 300 psf. The allowable maximum passive resistance should not exceed 9,000 psf.

Caving soils may be encountered between the piles. To limit local sloughing, caving soils can be supported by lagging or guniting. All lumber to be left in the ground should be treated in accordance with Section 204-2 of the "Standard Specifications for Public Works Construction" (1991 Edition, Green Book).

It is recommended that Converse review plans and specifications for proposed shoring and that a Converse representative observe installation of shoring. A licensed surveyor should be retained to establish monuments on shoring and the surrounding ground prior to excavation. Such monuments should be monitored for horizontal and vertical movement during construction. Results of the monitoring program should be provided immediately to the project Structural (shoring) Engineer and Converse for review and evaluation. Adjacent structures should be photo-documented prior to construction.

## 7.3 Geotechnical Services During Construction

This report has been prepared to aid in the evaluation of the proposed site improvements and to assist architects and engineers in design of the proposed structures. It is recommended that this office be provided an opportunity to review final design drawings and specifications to determine if the recommendations of this report have been properly implemented.

Foundation recommendations in this report are based on the assumption that all structural foundations will be placed on undisturbed natural soils or properly compacted fill soils. All foundation excavations should be observed by Converse prior to placement of steel and concrete, to verify that foundation elements are founded on satisfactory materials and that excavations are free of loose and disturbed soils. All structural fill and backfill should be placed and compacted during observation and testing by Converse.

## 8.0 CLOSURE

The findings and recommendations of this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice for Southern California at this time. We make no other warranty, either express or implied. Conclusions and recommendations presented in this report are based on results of this field and laboratory investigation, combined with an interpolation and extrapolation of subsurface conditions between and beyond boring locations. If conditions encountered during construction appear to be different form those assumed in this report, this office should be notified immediately.

# REFERENCES

## REFERENCES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# APPENDIX A

## FIELD EXPLORATION

## APPENDIX A

## FIELD EXPLORATION

Field exploration included a site reconnaissance and subsurface drilling. During the site reconnaissance, surface conditions were noted, and the locations of the test borings were determined. Borings were approximately located using existing features as a guide. Elevations at the boring locations were approximated based upon ground elevation data shown on a topographic site plan dated April 14, 1998, prepared by Andreasen Engineering, Inc, and reproduced as Drawing 1 (two sheets in pocket) in this report.

Test borings were advanced using a truck-mounted, 8-inch-diameter, hollow-stem auger drilling rig equipped for soil sampling. Soils were continuously logged and classified in the field by visual/manual examination, in accordance with the Unified Soil Classification System. Field descriptions have been modified, where appropriate, to reflect laboratory test results.

Relatively undisturbed samples of the subsurface soils were obtained at frequent intervals in the borings using a drive sampler (2.4-inch inside diameter, 3-inch outside diameter) lined with sample rings. The steel sampler was driven into the bottom of the borehole with successive 30-inch drops of a 140-pound drive weight. An automatic ("safety") hammer was used. Blows required to drive the sampler one foot are shown on the boring logs in the "blows/foot" column. Samples were retained in brass rings (2.4 inches in diameter, 1.0 inch in height) and carefully sealed in waterproof plastic containers for shipment to the Converse geotechnical laboratory. Standard Penetration Tests (SPT) were also performed at various intervals in the borings in general accordance with the ASTM D1586-84 Standard Test Method. Blow counts given for the last two 6-inch increments are indicated on the boring logs, which is the SPT "N"-value, in parentheses. Bulk samples were also obtained.

Logs of the borings are presented on Drawings A-1 through A-23, which also include descriptions of the soils encountered, pertinent field data, and supplemental laboratory results. Drawing A-24, *Exploration Log Key,* describes the various symbols and nomenclature shown on the logs.

# Log of Boring No. BH-1

Date Drilled: 4/17/98 Logged by: DA Checked by: PJS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 658 feet Depth to Water: none encountered

**SUMMARY OF SUBSURFACE CONDITIONS**

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | 1.5 inches of ASPHALT PAVEMENT | | | | | | |
| | | SILTY SAND (SM); fine, some gravel, brown | | | | | | |
| | | | | | 12 | 3 | 108 | |
| 5 | | slightly more silty | | | (9) | | | |
| 10 | | gravelly | | | 50/6" | | | |

End of boring at 10.5 feet
No groundwater encountered
Boring backfilled with soil cuttings and tamped
Surface cold patched with asphaltic concrete

Converse Consultants

Project No. 97-31-279-01

Drawing No. A-1

# Log of Boring No. BH-2

Date Drilled: 4/17/98 Logged by: DA Checked by: PJS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 646 feet Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES DRIVE | SAMPLES BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | 2.5 inches of ASPHALT PAVEMENT | | | | | | |
| | | SILTY SAND (SM); fine to medium, gravelly, brown | | | | | | |
| | | | | | (15) | | | |
| 5 | | more silty, some coarse sand, less gravelly | | | 14 | 9 | 113 | |
| 10 | | mostly fine sand, trace of gravel | | | (7) | | | |
| 15 | | less silty, fine to medium sand | | | 16 | 6 | 115 | |
| | | POORLY GRADED SAND (SP); fine to medium, some coarse, slightly gravelly, light brown | | | | | | |
| 20 | | | | | (17) | | | |
| | | End of boring at 21.5 feet<br>No groundwater encountered<br>Boring backfilled with soil cuttings and tamped<br>Surface cold patched with asphaltic concrete | | | | | | |

# Log of Boring No. BH-3

Date Drilled: 4/14/98 Logged by: DA Checked by: PJS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 659 feet Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | 3 inches of **ASPHALT PAVEMENT** | | | | | | |
| | | **FILL: SILTY SAND (SM);** fine to medium, some coarse sand and gravel, dark brown | | | (12) | | | |
| | | **SILTY SAND (SM);** fine to coarse, some clay, brown | | | | | | |
| 5 | | **POORLY GRADED SAND (SP);** fine to coarse, gravelly, brown | | | 42 | | | |
| | | | | | 25 | 4 | 119 | |
| 10 | | **SILTY SAND (SM);** fine to medium, some coarse sand and gravel, brown | | | (28) | | | |

End of boring at 11.5 feet
No groundwater encountered
Boring backfilled with soil cuttings and tamped
Surface cold patched with asphaltic concrete

Converse Consultants

Project No. 97-31-279-01

Drawing No. A-3

# Log of Boring No. BH-4

Date Drilled: 4/14/98 Logged by: DA Checked by: PJS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 660 feet Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES DRIVE | SAMPLES BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | 5 inches of **ASPHALT PAVEMENT** | | | | | | |
| | | **SILTY SAND (SM);** fine to medium, trace gravel, brown | | | | | | |
| | | | ■ | | 20 | 7 | 114 | |
| 5 | | | □ | | (6) | | | |
| | | slightly less silty | | | | | | |
| 10 | | mostly fine sand, more silty | ■ | | 14 | 9 | 117 | |
| 15 | | | □ | | (7) | | | |
| | | less silty | | | | | | |
| 20 | | **POORLY GRADED SAND (SP);** fine to medium, gravelly, brown | ■ | | 45 | 3 | 108 | |

End of boring at 21 feet
No groundwater encountered
Boring backfilled with soil cuttings and tamped
Surface cold patched with asphaltic concrete

Converse Consultants

Project No. 97-31-279-01

Drawing No. A-4

# Log of Boring No. BH-5

Date Drilled: 4/14/98　　Logged by: DA　　Checked by: PJS

Equipment: 8" Hollow Stem Auger　　Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 659 feet　　Depth to Water: none encountered

**SUMMARY OF SUBSURFACE CONDITIONS**

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

| DEPTH (ft) | DESCRIPTION | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|
| 0 | 7 inches of ASPHALT PAVEMENT | | | | | | |
| | SILTY SAND (SM); mostly fine, brown | | X | | | | |
| | | X | X | (3) | | | |
| 5 | less silty, trace of fine gravel | X | | 8 | 9 | 106 | |
| 10 | slightly more silty | X | | (10) | | | |
| 15 | less silty, some medium grains, occasional gravel | X | | 35 | 3 | 114 | |
| | POORLY GRADED SAND (SP); fine to medium, gravelly, trace silt, light brown to tan | | | | | | |
| 20 | | X | | (25) | | | |

End of boring at 21 feet
No groundwater encountered
Boring backfilled with soil cuttings and tamped
Surface cold patched with asphaltic concrete

Converse Consultants

Project No. 97-31-279-01　　Drawing No. A-5

# Log of Boring No. BH-6

Date Drilled: 4/14/98 | Logged by: DA | Checked by: PJS

Equipment: 8" Hollow Stem Auger | Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 655 feet | Depth to Water: none encountered

**SUMMARY OF SUBSURFACE CONDITIONS**

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

| DEPTH (ft) | DESCRIPTION | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|
| 0 | 4 inches of ASPHALT PAVEMENT | | | | | | |
| | SILTY SAND (SM); fine to medium, occasional coarse sand and gravel, brown | | | | | | |
| | | ■ | | 7 | 8 | 103 | ds |
| 5 | more silty | □ | | (13) | | | |
| 10 | less silty, trace of gravel | ■ | | 19 | 6 | 113 | c |
| 15 | POORLY GRADED SAND (SP); fine to medium, slightly gravelly, light brown to tan | □ | | (19) | | | |
| 20 | fine to coarse, more gravelly | ■ | | 40 | 3 | 116 | |
| 25 | SILTY SAND (SM); fine, brown | □ | | (9) | | | |
| | POORLY GRADED SAND (SP); fine to medium, gravelly, light brown to tan | | | | | | |
| 30 | End of boring at 31 feet | ■ | | 50/11" | 4 | 117 | |

No groundwater encountered

Boring backfilled with soil cuttings and tamped

Surface cold patched with asphaltic concrete

*c = Consolidation Test (see Appendix B)

ds = Direct Shear Test (see Appendix B)

Converse Consultants

Project No. 97-31-279-01

Drawing No. A-6

# Log of Boring No. BH-7

Date Drilled: 4/14/98   Logged by: DA   Checked by: PJS

Equipment: 8" Hollow Stem Auger   Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 648 feet   Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES DRIVE | SAMPLES BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | 3 inches of **ASPHALT PAVEMENT** | | | | | | |
| | | SILTY SAND (SM); fine to medium, trace coarse sand and gravel, brown | | | (7) | | | |
| 5 | | slightly more silty | | | 14 | 7 | 114 | |
| 10 | | less silty | | | (8) | | | |
| | | POORLY GRADED SAND (SP); fine to medium, slightly gravelly, light brown to tan | | | | | | |
| 15 | | | | | 50 | 3 | 117 | |
| | | SILTY SAND (SM); fine, brown | | | | | | |
| 20 | | | | | (12) | | | |
| | | End of boring at 21.5 feet<br>No groundwater encountered<br>Boring backfilled with soil cuttings and tamped<br>Surface cold patched with asphaltic concrete | | | | | | |

Converse Consultants

Project No. 97-31-279-01   Drawing No. A-7

# Log of Boring No. BH-8

Date Drilled: 4/14/98 Logged by: DA Checked by: PJS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 650 feet Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES DRIVE | SAMPLES BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | 2.5 inches of ASPHALT PAVEMENT | | | | | | |
| | | SILTY SAND (SM); fine to medium, trace of coarse sand and gravel, brown | | | | | | |
| | | | | | 13 | 4 | 110 | c max |
| 5 | | less silty | | | (4) | | | |
| 10 | | more silty, mostly fine | | | 14 | 9 | 120 | |
| 15 | | less silty, fine to medium | | | (12) | | | |
| | | POORLY GRADED SAND (SP); fine to medium, some gravel, light brown to tan | | | | | | |
| 20 | | mostly medium sand | | | 28 | 3 | 106 | |
| 25 | | SILTY SAND (SM); fine to medium, some gravel, brown | | | (20) | | | |
| | | POORLY GRADED SAND (SP); fine to medium, slightly gravelly, light brown | | | | | | |
| 30 | | | | | 50/ 11" | 4 | 116 | |

# Log of Boring No. BH-8

Date Drilled: 4/14/98 | Logged by: DA | Checked by: PJS

Equipment: 8" Hollow Stem Auger | Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 650 feet | Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES DRIVE | SAMPLES BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | **POORLY GRADED SAND (SP)** (continued)<br>some coarse grains, trace silt | | | (40) | | | |
| 40 | | fine to coarse, less gravelly | | | 46 | 3 | 118 | |
| 45 | | more gravelly, drilling refusal at 47 feet | | | (56) | | | |

Drilled to refusal at 47 feet
No groundwater encountered
Boring backfilled with soil cuttings and tamped
Surface cold patched with asphaltic concrete

*c = Consolidation Test (see Appendix B)
max = Compaction Test (see Appendix B)

# Log of Boring No. BH-9

Date Drilled: 4/14/98 Logged by: DA Checked by: PJS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 649 feet Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES DRIVE | SAMPLES BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | 3 inches of ASPHALT PAVEMENT | | | | | | |
| | | SILTY SAND (SM); mostly fine, brown | | | (9) | | | |
| 5 | | less silty, occasional gravel | | | 17 | 8 | 103 | c |
| | | POORLY GRADED SAND (SP); fine to medium, slightly gravelly, light brown to tan | | | | | | |
| 10 | | | | | (33) | | | |
| | | SILTY SAND (SM); fine, trace gravel, brown | | | | | | |
| 15 | | | | | 49 | 7 | 113 | |
| 20 | | POORLY GRADED SAND (SP); fine to coarse, some gravel, light brown | | | (35) | | | |
| | | SILTY SAND (SM); mostly fine, trace of fine gravel, brown | | | | | | |
| 25 | | | | | 24 | 8 | 114 | |
| 30 | | slightly more silty, fine to medium, occasional gravel | | | | | | |
| | | End of boring at 31.5 feet | | | (32) | | | |
| | | No groundwater encountered<br>Boring backfilled with soil cuttings and tamped<br>Surface cold patched with asphaltic concrete<br>*c = Consolidation Test (see Appendix B) | | | | | | |

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Drawing No. A-9

# Log of Boring No. BH-10

Date Drilled: 4/15/98 | Logged by: DA | Checked by: PJS

Equipment: 8" Hollow Stem Auger | Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 645 feet | Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | SILTY SAND (SM); fine, brown | | | | | | |
| | | | | | (8) | | | |
| 5 | | less silty, fine to medium, trace gravel | | | 28 | 6 | 114 | |
| 10 | | more silty, mostly fine | | | (10) | | | |
| | | End of boring at 11.5 feet<br>No groundwater encountered<br>Boring backfilled with soil cuttings and tamped | | | | | | |

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Drawing No. A-10

# Log of Boring No. BH-11

Date Drilled: 4/15/98 Logged by: DA Checked by: PJS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 644 feet Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | SILTY SAND (SM); fine, brown | | | | | | |
| | | | ■ | | 10 | 13 | 111 | |
| 5 | | POORLY GRADED SAND (SP); fine to medium, trace gravel, light brown | | | | | | |
| | | | □ | | (8) | | | |
| | | SILTY SAND (SM); mostly fine, brown | | | | | | |
| 10 | | | ■ | | 11 | 8 | 111 | |
| 15 | | slightly less silty, trace of gravel | □ | | (9) | | | |
| 20 | | | ■ | | 22 | 5 | 102 | |
| | | POORLT GRADED SAND (SP); fine to coarse, some gravel, light brown | | | | | | |
| | | SILTY SAND (SM); fine to medium, occasional gravel, clay seams, brown | | | | | | |
| 25 | | | □ | | (7) | | | |
| 30 | | more silty, slightly gravelly | ■ | | 42 | 11 | 125 | |
| | | End of boring at 31 feet<br>No groundwater encountered<br>Boring backfilled with soil cuttings and tamped | | | | | | |

# Log of Boring No. BH-12

Date Drilled: 4/14/98 Logged by: DA Checked by: PJS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 643 feet Depth to Water: none encountered

**SUMMARY OF SUBSURFACE CONDITIONS**

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

| DEPTH (ft) | SUMMARY OF SUBSURFACE CONDITIONS | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|
| 0 | 3 inches of ASPHALT PAVEMENT | | | | | | |
| | FILL: SILTY SAND (SM); fine to medium, brown | ■ | | 10 | 7 | 113 | |
| 5 | SILTY SAND (SM); mostly fine, trace gravel, brown | □ | | (4) | | | |
| 10 | POORLY GRADED SAND (SP); fine to coarse, some gravel, light brown | ■ | | 38 | 3 | 105 | |
| 15 | SILTY SAND (SM); fine to medium, some gravel, brown | □ | | (17) | | | |
| 20 | POORLY GRADED SAND (SP); fine to coarse, slightly gravelly, light brown | ■ | | 31 | 3 | 108 | |
| 25 | fine to medium, less gravelly, trace silt | □ | | (23) | | | |
| 30 | mostly medium grain | ■ | | 41 | 5 | 113 | |
| | End of boring at 31 feet<br>No groundwater encountered<br>Boring backfilled with soil cuttings and tamped<br>Surface cold patched with asphaltic concrete | | | | | | |

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Drawing No. A-12

# Log of Boring No. BH-13

Date Drilled: 4/15/98 Logged by: DA Checked by: PJS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 643 feet Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES DRIVE | SAMPLES BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | FILL: SILTY SAND (SM); fine to medium, occasional gravel, brown | | | | | | |
| | | SILTY SAND (SM); fine, brown | ■ | | 19 | 8 | 109 | |
| 5 | | | □ | | (3) | | | |
| 10 | | trace gravel | ■ | | 10 | 11 | 117 | |
| 15 | | slightly more silty | □ | | (9) | | | |
| | | POORLY GRADED SAND (SP); fine to coarse, gravelly, light brown to tan | | | | | | |
| 20 | | | ■ | | 39 | 3 | 107 | |
| 25 | | fine to medium, less gravelly, tan | | | | | | |
| | | SILTY SAND (SM); mostly fine, brown | □ | | (11) | | | |
| | | POORLY GRADED SAND (SP); fine to coarse, some gravel, light brown | | | | | | |
| 30 | | | ■ | | 48 | | | |
| | | End of boring at 31 feet<br>No groundwater encountered<br>Boring backfilled with soil cuttings and tamped | | | | | | |

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Drawing No. A-13

# Log of Boring No. BH-14

Date Drilled: 4/15/98 Logged by: DA Checked by: PJS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 642 feet Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | FILL: SILTY SAND (SM); fine to medium, trace gravel, brown | | | | | | |
| | | | | | (7) | 4 | 106 | |
| | | SILTY SAND (SM); fine, brown | | | | | | |
| 5 | | | | | 12 | 9 | 115 | |
| 10 | | less silty, fine to medium, occasional gravel | | | (5) | | | |
| 15 | | | | | 9 | 9 | 114 | |
| 20 | | POORLY GRADED SAND (SP); fine to medium, trace silt, light brown | | | (17) | | | |
| | | SILTY SAND (SM); fine to medium, trace of coarse sand and gravel, brown | | | | | | |
| 25 | | | | | 33 | 9 | 117 | |
| 30 | | less silty, slightly gravelly | | | (23) | | | |
| | | End of boring at 31.5 feet<br>No groundwater encountered<br>Boring backfilled with soil cuttings and tamped | | | | | | |

# Log of Boring No. BH-15

Date Drilled: 4/15/98 Logged by: DA Checked by: PJS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 635 feet Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | SILTY SAND (SM); fine to coarse, brown | | | | | | |
| | | | | | (3) | | | |
| 5 | | slightly less silty, mostly fine, trace gravel | | | 6 | 7 | 103 | c |
| 10 | | more silty | | | (6) | | | |
| 15 | | occasional gravel up to 3 inches diameter | | | 33 | 8 | 110 | |
| 20 | | mostly fine, trace of medium grains | | | (7) | | | |
| 25 | | less silty, fine to medium | | | 43 | 9 | 122 | |
| | | POORLY GRADED SAND (SP); fine to medium, trace silt, occasional gravel, light brown | | | | | | |
| 30 | | | | | (25) | | | |
| | | End of boring at 31.5 feet<br>No groundwater encountered<br>Boring backfilled with soil cuttings and tamped<br>*c = Consolidation Test (see Appendix B) | | | | | | |

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Drawing No. A-15

# Log of Boring No. BH-16

Date Drilled: 4/15/98 | Logged by: DA | Checked by: PJS

Equipment: 8" Hollow Stem Auger | Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 637 feet | Depth to Water: none encountered

**SUMMARY OF SUBSURFACE CONDITIONS**

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

| DEPTH (ft) | DESCRIPTION | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|
| 0 | 2.5 inches of ASPHALT PAVEMENT over 3 inches of BASE | | | | | | |
| | FILL: SILTY SAND (SM); fine to medium, gravelly, brown | ■ | | 17 | 2 | Disturbed | |
| | SILTY SAND (SM); fine, brown | | | | | | |
| 5 | | □ | | (5) | | | |
| 10 | slightly less silty, occasional gravel | ■ | | 18 | 5 | 101 | c |
| 15 | more silty, mostly fine | □ | | (28) | | | |
| | POORLY GRADED SAND (SP); fine to medium, trace gravel, light brown to tan | | | | | | |
| 20 | | ■ | | 25 | 3 | 109 | |
| | SILTY SAND (SM); mostly fine, brown | | | | | | |
| 25 | | □ | | (28) | | | |
| 30 | more silty, fine to coarse, trace gravel | ■ | | 38 | | | |
| | POORLY GRADED SAND (SP); fine to medium, trace silt, light brown | | | | | | |

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Drawing No. A-16a

# Log of Boring No. BH-16

Date Drilled: 4/15/98 | Logged by: DA | Checked by: PJS

Equipment: 8" Hollow Stem Auger | Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 637 feet | Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES DRIVE | SAMPLES BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | POORLY GRADED SAND (SP); (continued) | | | (27) | | | |
| 40 | | some coarse grains, slightly gravelly, tan | | | 50/ 10" | | | |
| 45 | | fine to coarse, some gravel | | | (39) | | | |
| 50 | | slightly silty, gravelly, light brown | | | 50/9" | | | |

End of boring at approximately 51 feet
No groundwater encountered
Boring backfilled with soil cuttings and tamped
Surface cold patched with asphaltic concrete

*c = Consolidation Test (see Appendix B)

# Log of Boring No. BH-17

Date Drilled: 4/17/98 Logged by: DA Checked by: PJS

Equipment: 8" Hollow Stem Auger Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 635 feet Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES DRIVE | SAMPLES BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | FILL: SILTY SAND (SM); fine, dark brown | | | | | | |
| | | POORLY GRADED SAND (SP); fine to medium, slightly gravelly, light brown to tan | | | | | | |
| | | | ■ | | 15 | 3 | 110 | |
| 5 | | less gravelly | □ | | (21) | | | |
| 10 | | | □ | | 35 | | | |
| | | SILTY SAND (SM); fine, brown | | | | | | |
| 15 | | | □ | | (6) | | | |
| | | POORLY GRADED SAND (SP); fine to medium, slightly gravelly, light brown to tan | | | | | | |
| 20 | | | ■ | | 35 | | | |
| | | SILTY SAND (SM); mostly fine, brown | | | | | | |
| 25 | | | □ | | (27) | | | |
| 30 | | slightly less silty, fine to medium, occasional gravel | ■ | | 36 | | | |
| | | End of boring at 31 feet<br>No groundwater encountered<br>Boring backfilled with soil cuttings and tamped | | | | | | |

# Log of Boring No. BH-18

Date Drilled: 4/16/98 | Logged by: DA | Checked by: PJS

Equipment: 8" Hollow Stem Auger | Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 640 feet | Depth to Water: none encountered

**SUMMARY OF SUBSURFACE CONDITIONS**

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

| DEPTH (ft) | SUMMARY OF SUBSURFACE CONDITIONS | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|
| 0 | 2 inches of ASPHALT PAVEMENT | | | | | | |
| | SILTY SAND (SM); fine to medium, trace gravel, brown | | | | | | |
| 3 | | X | | 8 | 7 | 110 | c,ds |
| 5 | mostly fine | | | | | | |
| 6 | | X | | (16) | | | |
| 8 | POORLY GRADED SAND (SP); fine to coarse, slightly gravelly, light brown to tan | | | | | | |
| 10 | | X | | 20 | 2 | 103 | |
| 12 | SILTY SAND (SM); fine, trace gravel, brown | | | | | | |
| 15 | | X | | (10) | | | |
| 20 | less silty, fine to medium | X | | 13 | | | |
| 23 | POORLY GRADED SAND (SP); fine to medium, trace gravel, light brown | | | | | | |
| 25 | | X | | (21) | | | |
| 28 | SILTY SAND (SM); fine to medium, slightly gravelly, brown | | | | | | |
| 30 | | X | | 36 | | | |

End of boring at 31 feet
No groundwater encountered
Boring backfilled with soil cuttings and tamped
Surface cold patched with asphaltic concrete
*c = Consolidation Test (see Appendix B)
ds = Direct Shear Test (see Appendix B)

# Log of Boring No. BH-19

Date Drilled: 4/16/98 | Logged by: DA | Checked by: PJS

Equipment: 8" Hollow Stem Auger | Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 640 feet | Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | 4 inches of ASPHALT PAVEMENT | | | | | | |
| | | SILTY SAND (SM); fine, brown | | | | | | |
| | | | | | (8) | | | |
| 5 | | less silty, fine to medium | | | 11 | 5 | 105 | |
| 10 | | slightly gravelly | | | (23) | | | |
| 15 | | more silty, trace gravel | | | 14 | 8 | 118 | |
| | | POORLY GRADED SAND (SP); fine to medium, occasional gravel, light brown to tan | | | | | | |
| 20 | | | | | (15) | | | |
| 25 | | trace of silt, some gravel | | | 49 | 6 | 120 | |
| | | SILTY SAND (SM); mostly fine, brown | | | | | | |
| 30 | | | | | (19) | | | |
| | | End of boring at 31.5 feet<br>No groundwater encountered<br>Boring backfilled with soil cuttings and tamped<br>Surface cold patched with asphaltic concrete | | | | | | |

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Drawing No. A-19

# Log of Boring No. BH-20

Date Drilled: 4/16/98 | Logged by: DA | Checked by: PJS

Equipment: 8" Hollow Stem Auger | Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 642 feet | Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | 3 inches of **ASPHALT PAVEMENT** | | | | | | |
| | | FILL: POORLY GRADED SAND (SP); fine to medium, some gravel, interlayered silty sand, light brown | ■ | | 12 | 4 | 101 | c |
| 5 | | occasional gravel | □ | | (8) | | | |
| 10 | | gravelly | □ | | 42 | | | |
| | | ? - - - - ? - - - - ? | | | | | | |
| | | SILTY SAND (SM); fine, brown | | | | | | |
| 15 | | | □ | | (6) | | | |
| | | POORLY GRADED SAND (SP); fine to medium, gravelly, light brown | | | | | | |
| 20 | | | □ | | 50/4" | | | |
| 25 | | less gravelly, some coarse grains | □ | | (57) | | | |
| | | SILTY SAND (SM); fine to medium, some gravel, brown | | | | | | |
| 30 | | | ■ | | 46 | | | |
| | | End of boring at 31 feet<br>No groundwater encountered<br>Boring backfilled with soil cuttings and tamped<br>Surface cold patched with asphaltic concrete | | | | | | |

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Drawing No. A-20

# Log of Boring No. BH-21

Date Drilled: 4/16/98 | Logged by: DA | Checked by: PJS

Equipment: 8" Hollow Stem Auger | Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 644 feet | Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES DRIVE | SAMPLES BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | 4 inches of ASPHALT PAVEMENT | | | | | | |
| | | SILTY SAND (SM); fine to medium, trace gravel, brown | | | (6) | | | |
| 5 | | less silty, occasional gravel | | | 15 | | | |
| 10 | | more silty, mostly fine, interbedded sandy silt | | | (8) | | | |
| 15 | | fine, trace fine gravel | | | 17 | 10 | 118 | |
| 20 | | slightly less silty | | | (6) | | | |
| 25 | | fine to medium | | | 39 | 10 | 121 | |
| 30 | | less silty | | | (23) | | | |
| | | POORLY GRADED SAND (SP); fine to coarse, trace gravel, light brown | | | | | | |

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Drawing No. A-21a

# Log of Boring No. BH-21

Date Drilled: 4/16/98 | Logged by: DA | Checked by: PJS

Equipment: 8" Hollow Stem Auger | Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 644 feet | Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES DRIVE | SAMPLES BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| | | POORLY GRADED SAND (SP); (continued)<br>slightly gravelly | | | 38 | | | |
| 40 | | increasing gravel, scattered cobbles | | | 50/1" | | | |
| 45 | | | | | 50/4" | | | |
| 50 | | fine to medium, less gravelly, tan | | | (47) | | | |
| | | End of boring at 51.5 feet<br>No groundwater encountered<br>Boring backfilled with soil cuttings and tamped<br>Surface cold patched with asphaltic concrete | | | | | | |

Converse Consultants

Project No. 97-31-279-01

Drawing No. A-21b

# Log of Boring No. BH-22

Date Drilled: 4/16/98 | Logged by: DA | Checked by: PJS

Equipment: 8" Hollow Stem Auger | Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 645 feet | Depth to Water: none encountered

**SUMMARY OF SUBSURFACE CONDITIONS**

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

| DEPTH (ft) | DESCRIPTION | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|
| 0 | 3 inches of ASPHALT PAVEMENT | | | | | | |
| | FILL: SILTY SAND (SM); fine to medium, gravelly, scattered rocks and cobbles, tan | ■ | | 50/ 10" | | | |
| 5 | SILTY SAND (SM); fine, brown | □ | | (10) | | | |
| 10 | POORLY GRADED SAND (SP); fine to medium, gravelly, tan | □ | | 50/8" | | | |
| 15 | SILTY SAND (SM); mostly fine, brown | □ | | (17) | | | |
| 20 | less silty, fine to medium, light brown | ■ | | 25 | | | |
| 25 | gravelly | □ | | (52) | | | |
| 30 | POORLY GRADED SAND (SP); fine to coarse, gravelly, tan | | | 50/2" | | | |

End of boring at 30.2 feet
No groundwater encountered
Boring backfilled with soil cuttings and tamped
Surface cold patched with asphaltic concrete

Converse Consultants

Project No. 97-31-279-01

Drawing No. A-22

# Log of Boring No. BH-23

Date Drilled: 4/16/98 | Logged by: DA | Checked by: PJS

Equipment: 8" Hollow Stem Auger | Driving Weight and Drop: 140 pounds/30 inches

Ground Surface Elevation: 636 feet | Depth to Water: none encountered

| DEPTH (ft) | GRAPHIC LOG | SUMMARY OF SUBSURFACE CONDITIONS<br>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered. | SAMPLES: DRIVE | SAMPLES: BULK | BLOWS/FOOT | MOISTURE (%) | DRY UNIT WT. (pcf) | OTHER* |
|---|---|---|---|---|---|---|---|---|
| 0 | | SILTY SAND (SM); fine to medium, trace gravel, brown | | | | | | |
| | | | | | (10) | | | |
| 5 | | more silty | | | 12 | 10 | 113 | c |
| 10 | | mostly fine | | | (7) | | | |
| 15 | | less silty, fine to medium, occasional gravel | | | 19 | 9 | 121 | |
| | | POORLY GRADED SAND (SP); fine to medium, slightly gravelly, trace silt, light brown | | | | | | |
| 20 | | | | | (18) | | | |
| 25 | | slightly silty, more gravelly | | | 39 | 7 | 114 | |
| 30 | | fine to coarse, light brown to tan | | | (64) | | | |
| | | End of boring at 31.5 feet<br>No groundwater encountered<br>Boring backfilled with soil cuttings and tamped<br>*c = Consolidation Test (see Appendix B) | | | | | | |

Converse Consultants

Project No. 97-31-279-01

Drawing No. A-23

| MAJOR DIVISIONS | | | SYMBOLS | TYPICAL NAMES |
|---|---|---|---|---|
| COARSE GRAINED SOILS More than half is larger than No. 200 sieve | GRAVELS More than half coarse fraction is larger than No. 4 sieve | Clean gravels with little or no fines | GW | Well graded gravels, gravel–sand mixtures |
| | | | GP | Poorly graded gravels, gravel–sand mixtures |
| | | Gravels with over 12% fines | GM | Silty gravels, poorly graded gravel–sand silt mixtures |
| | | | GC | Clayey gravels, poorly graded gravel–sand–clay mixtures |
| | SANDS More than half coarse fraction is smaller than No. 4 sieve | Clean sands with little or no fines | SW | Well graded sands, gravelly sands |
| | | | SP | Poorly graded sands, gravelly sands |
| | | Sands with over 12% fines | SM | Silty sands, poorly graded sand–silt mixtures |
| | | | SC | Clayey sands, poorly graded sand–clay mixtures |
| FINE GRAINED SOILS Half is smaller than No. 200 sieve | SILTS AND CLAYS Liquid limit less than 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 clays and organic silty clays of low plasticity |
| | SILTS AND CLAYS Liquid limit greater than 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 |

## SAMPLE TYPE

**STANDARD PENETRATION TEST,** Split barrel sampler in accordance with ASTM D 1586-84 Standard Test method

**DRIVE SAMPLE,** 2.42-inch inside diameter driven with 140-pound weight, 30-inch drop (ASTM D 3550-84)

**BULK SAMPLE,** loose cuttings from exploration

## TEST TYPE

(Results shown in Appendix B)

| TEST TYPE | OTHER |
|---|---|
| **CLASSIFICATION** | |
| Plasticity | pi |
| Grain Size Analysis | ma |
| Sand Equivalent | SE |
| Specific Gravity | sg |
| Expansion Index | EI |
| Compaction Curve | max |
| % passing the #200 sieve | f |
| **STRENGTH** | |
| Pocket Penetrometer | p |
| Direct Shear | ds |
| Unconfined Compression | uc |
| Triaxial Compression | tx |
| R-value | R |
| **CONSOLIDATION** | c |
| Collapse | col |

# EXPLORATION LOG KEY

Converse Consultants

Project No. 97-31-279-01

Drawing No. A-24

# APPENDIX B

## LABORATORY TEST PROGRAM

# APPENDIX B

## LABORATORY TEST PROGRAM

Laboratory tests were conducted in the Converse Consultants (Converse) geotechnical laboratory on representative soil samples for the purpose of evaluating the physical properties and engineering characteristics of the sampled materials. A summary of the various laboratory tests conducted is presented below.

### In-Situ Moisture Content and Dry Density

Data obtained from these tests performed on relatively undisturbed ring samples obtained from the field, were used to aid in the classification and correlation of the earth materials and to provide qualitative information regarding soil strength and compressibility. The percent of moisture as a function of dry weight, and the encountered dry density in units of pounds-per-cubic-foot (pcf) are provided in the right-hand columns on the exploration logs.

### Laboratory Maximum Density and Optimum Moisture Test

A representative bulk sample was tested in the laboratory to determine the laboratory maximum density and optimum moisture relationship. Testing was performed in general accordance with the ASTM D1557-91 Standard Test Method. The laboratory maximum density and optimum moisture curve is plotted on Drawing B-1, *Compaction Test.*

### Direct Shear Tests

Direct shear tests were performed using relatively undisturbed ring samples. Specimens were soaked prior to shearing. Individual specimens were prepared and different vertical normal stresses were applied. Samples were sheared at a constant rate of strain. Based upon the range of normal loads applied, the shear strength envelope was determined. Results of the tests are presented on Drawings B-2 and B-3, *Direct Shear Test.*

### Consolidation Tests

Consolidation tests were performed on relatively undisturbed ring samples. These tests were performed to evaluate the compressibility and moisture sensitivity of site soils under load. This test involved loading specimens into a consolidometer which contained porous stones top and bottom to accommodate vertical drainage during testing. Normal vertical axial loads were applied through the porous stones, and the resulting deflections were recorded at various time periods. Normal loads were applied at a constant load-increment ratio, successive loads being generally twice the preceding load. Samples were tested at field and submerged moisture contents. Test results are shown on Drawings B-4 through B-11, *Consolidation Test.*

R-value

A bulk sample of the encountered subgrade soils was tested for Resistance (R) value in accordance with State of California Standard Method 301 (ASTM D2844-89). Results of this test are used for pavement evaluation. Test results are listed below:

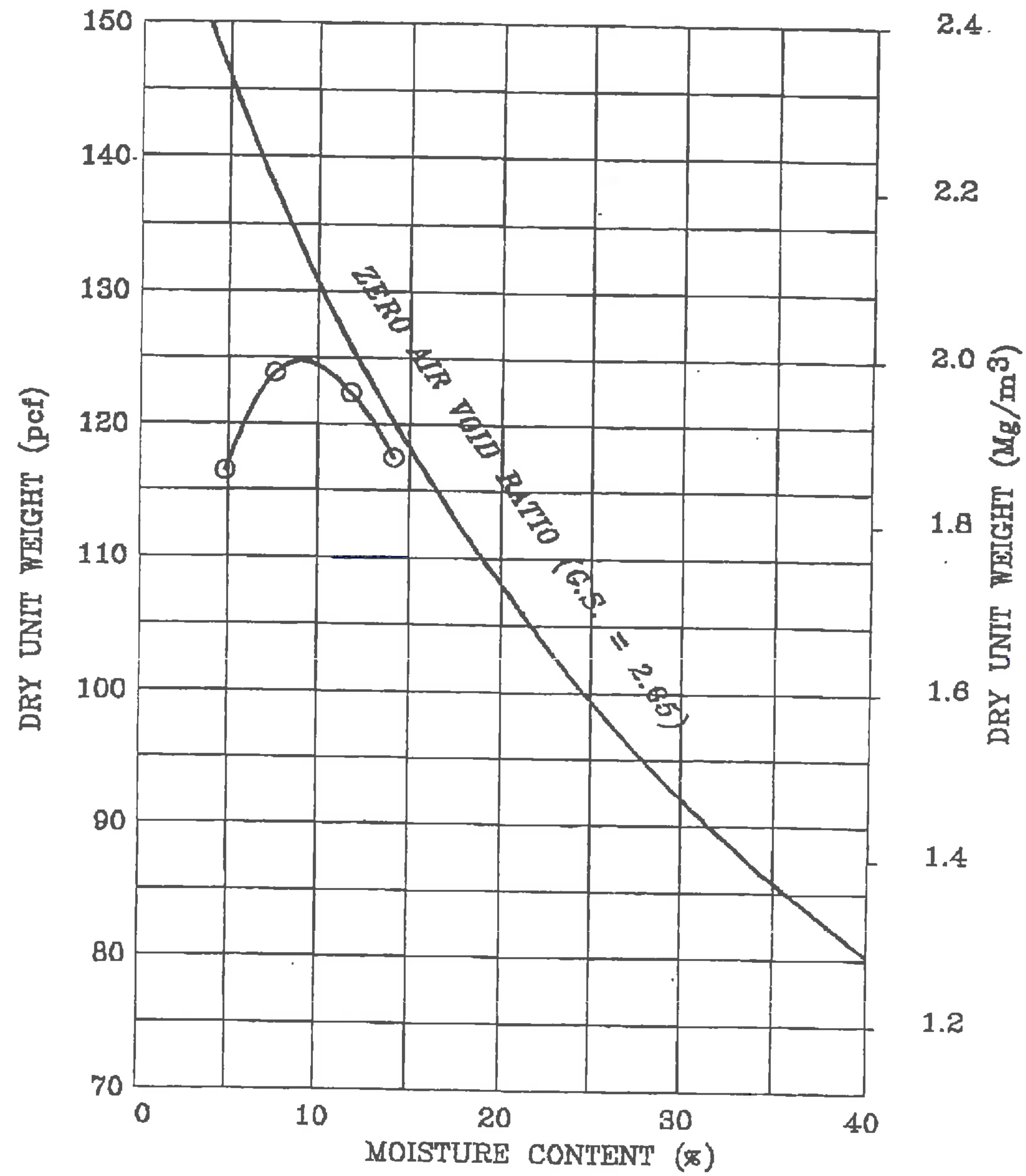
| Boring Number | Sample Depth (feet) | Soil Description | "R" Value by Exudation Pressure |
|---|---|---|---|
| BH-23 | 0 - 5 | Silty Sand (SM) | 58 |

Soil Corrosivity

Resistivity, pH, soluble sulfate and chloride concentrations were determined for a bulk soil sample to evaluate the corrosion potential of common construction materials in contact with site soils. These tests were performed by M. J. Schiff and Associates Inc. Test results are enclosed at the end of this appendix on their letterhead.

Sample Storage

Samples presently stored in the Converse laboratory will be discarded 30 days after the date of this report, unless this office receives a specific request to retain samples for a longer period.




| SYMBOL | SAMPLE LOCATION | DEPTH* (ft) (m) | DESCRIPTION | TEST METHOD | OPTIMUM MOISTURE (%) | MAXIMUM DRY DENSITY ** (pcf) | (Mg/m3) |
|---|---|---|---|---|---|---|---|
| O | BH-8 | 1 – 5 | SILTY SAND (SM) | ASTM D-1557 | 9.0 | 124.8 | 2.0 |

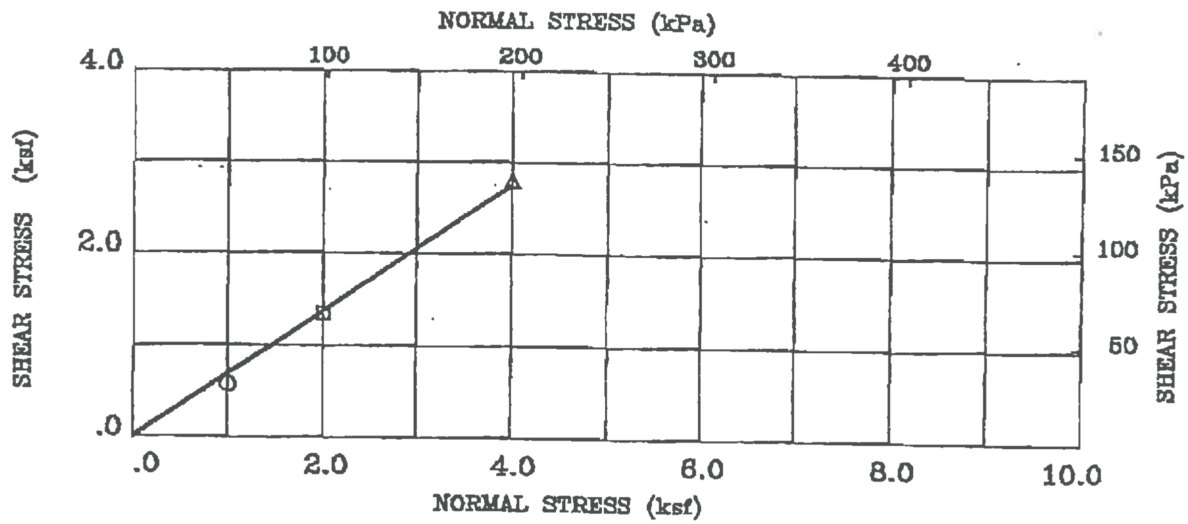
* 1 ft = 0.3048 m
** 1 pcf = 0.016 $Mg/m^3$

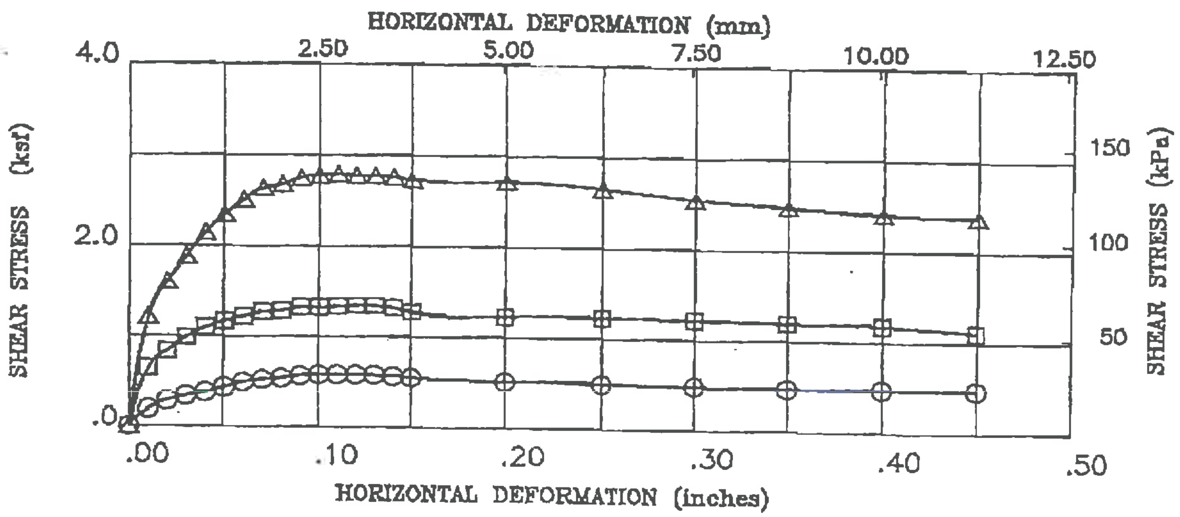
## COMPACTION TEST

Converse Consultants

Project No. 97-31-279-01

Drawing No. B-1




EXPLORATION : BH-6 DEPTH (ft) (m)* : 2 - 3

DESCRIPTION : SILTY SAND (SM)

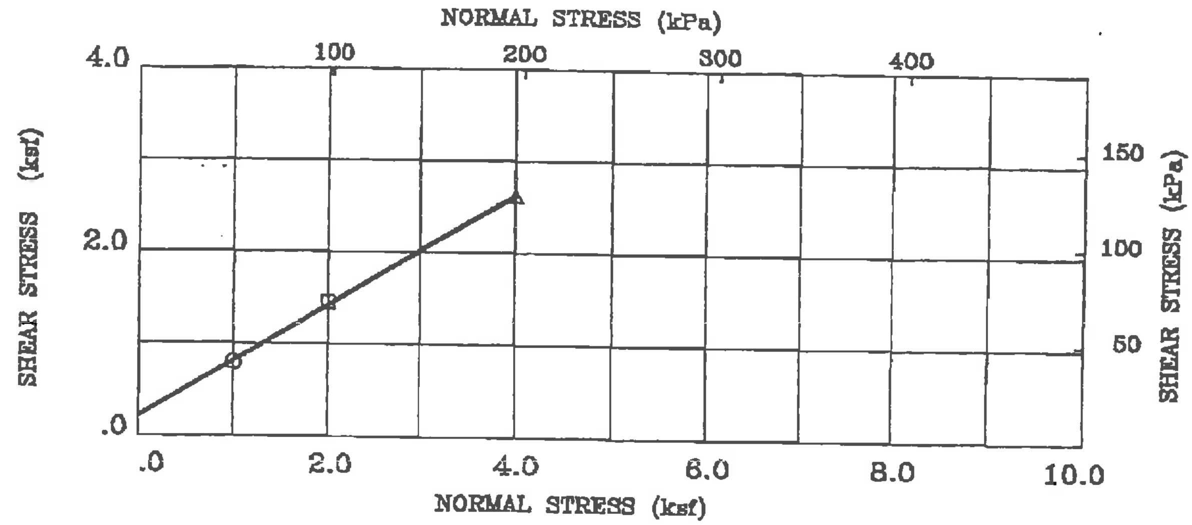
STRENGTH INTERCEPT (C) : .000 , .000 (ksf),(kPa) ** (PEAK STRENGTH)

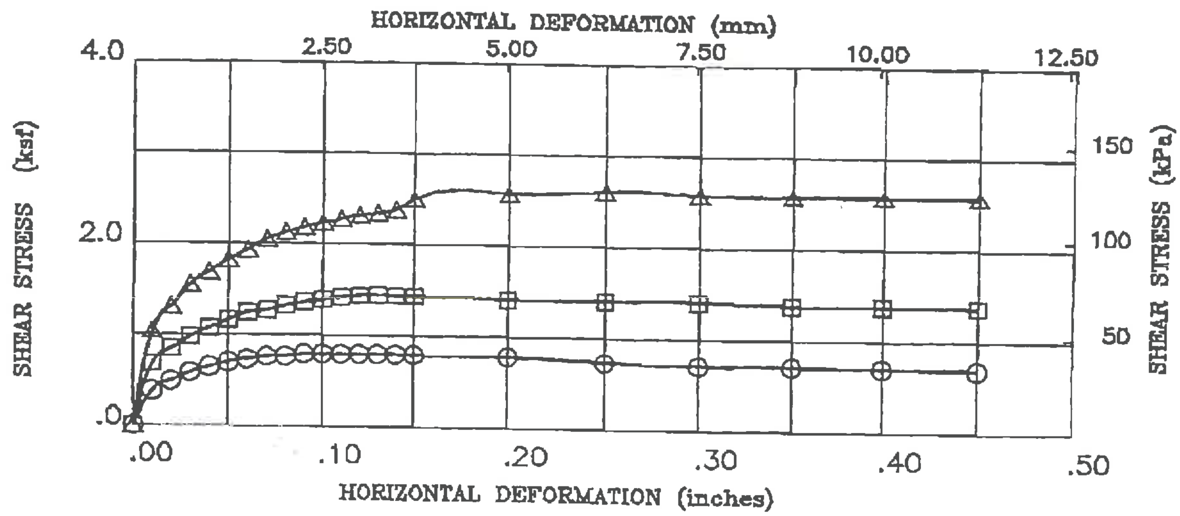
FRICTION ANGLE (PHI) : 34.5 DEGREES

| SYMBOL | SOAKED MOISTURE CONTENT (%) | DRY DENSITY (pcf) | DRY DENSITY (Mg/m³)*** | VOID RATIO | NORMAL STRESS (ksf) | NORMAL STRESS (kPa)** | PEAK SHEAR (ksf) | PEAK SHEAR (kPa)** | RESIDUAL SHEAR (ksf) | RESIDUAL SHEAR (kPa)** |
|---|---|---|---|---|---|---|---|---|---|---|
| ○ | 16.9 | 103.4 | 1.65 | .630 | 1.00 | 47.8 | .58 | 27.6 | .47 | 22.5 |
| □ | 18.2 | 102.6 | 1.64 | .642 | 2.00 | 95.7 | 1.35 | 64.5 | 1.11 | 53.3 |
| △ | 19.6 | 100.3 | 1.60 | .680 | 4.00 | 191.4 | 2.80 | 133.8 | 2.39 | 114.6 |

* 1 ft = 0.3048 m ** 1 ksf = 47.85 kPa *** 1 pcf = 0.016 Mg/m³

# DIRECT SHEAR TEST




EXPLORATION : BH-18 DEPTH (ft) (m)* : 2 - 3
DESCRIPTION : SILTY SAND (SM)
STRENGTH INTERCEPT (C) : .217 , 10.388 (ksf),(kPa) **
FRICTION ANGLE (PHI) : 31.0 DEGREES (PEAK STRENGTH)

| SYMBOL | SOAKED MOISTURE CONTENT (%) | DRY DENSITY (pcf) | (Mg/m³)*** | VOID RATIO | NORMAL STRESS (ksf) | (kPa)** | PEAK SHEAR (ksf) | (kPa)** | RESIDUAL SHEAR (ksf) | (kPa)** |
|---|---|---|---|---|---|---|---|---|---|---|
| ○ | 18.2 | 108.7 | 1.74 | .549 | 1.00 | 47.8 | .80 | 38.2 | .69 | 33.0 |
| □ | 18.4 | 107.8 | 1.72 | .564 | 2.00 | 95.7 | 1.45 | 69.4 | 1.37 | 65.8 |
| △ | 17.3 | 106.3 | 1.70 | .584 | 4.00 | 191.4 | 2.61 | 125.1 | 2.57 | 123.1 |

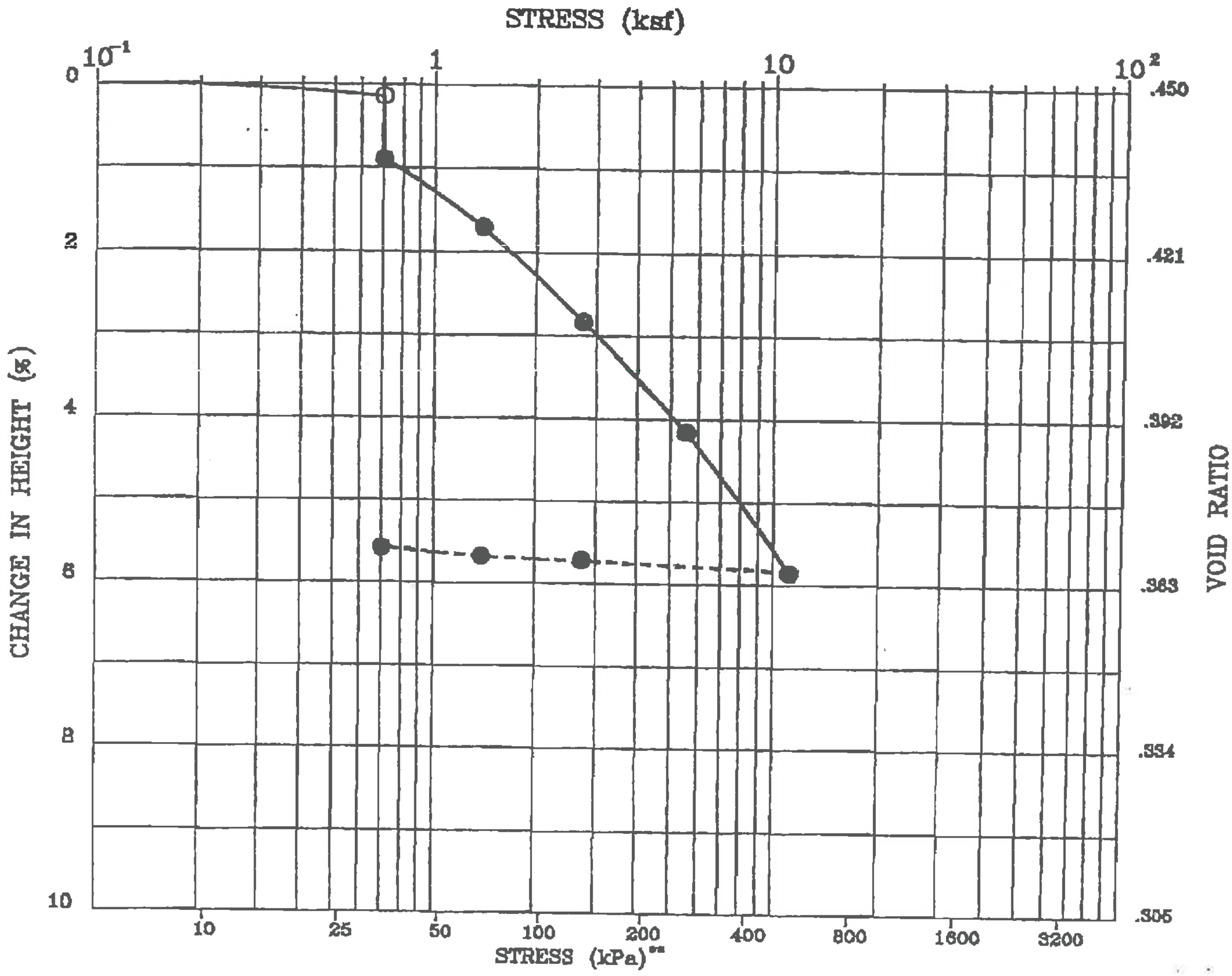
* 1 ft = 0.3048 m ** 1 ksf = 47.85 kPa *** 1 pcf = 0.016 Mg/m³

# DIRECT SHEAR TEST

Converse Consultants

Project No. 97-31-279-01

Drawing No. B-3




EXPLORATION : BH-6
DEPTH (ft) (m):* 10 – 11

DESCRIPTION : SILTY SAND (SM)

| | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | ($Mg/m^3$)*** | PERCENT SATURATION | VOID RATIO |
|---|---|---|---|---|---|
| INITIAL | 6.0 | 112.8 | 1.80 | 35 | .450 |
| FINAL | 14.0 | 119.5 | 1.91 | 100 | .369 |

* 1 ft = 0.3048 m ** 1 ksf = 47.85 kPa *** 1 pcf = 0.016 $Mg/m^3$

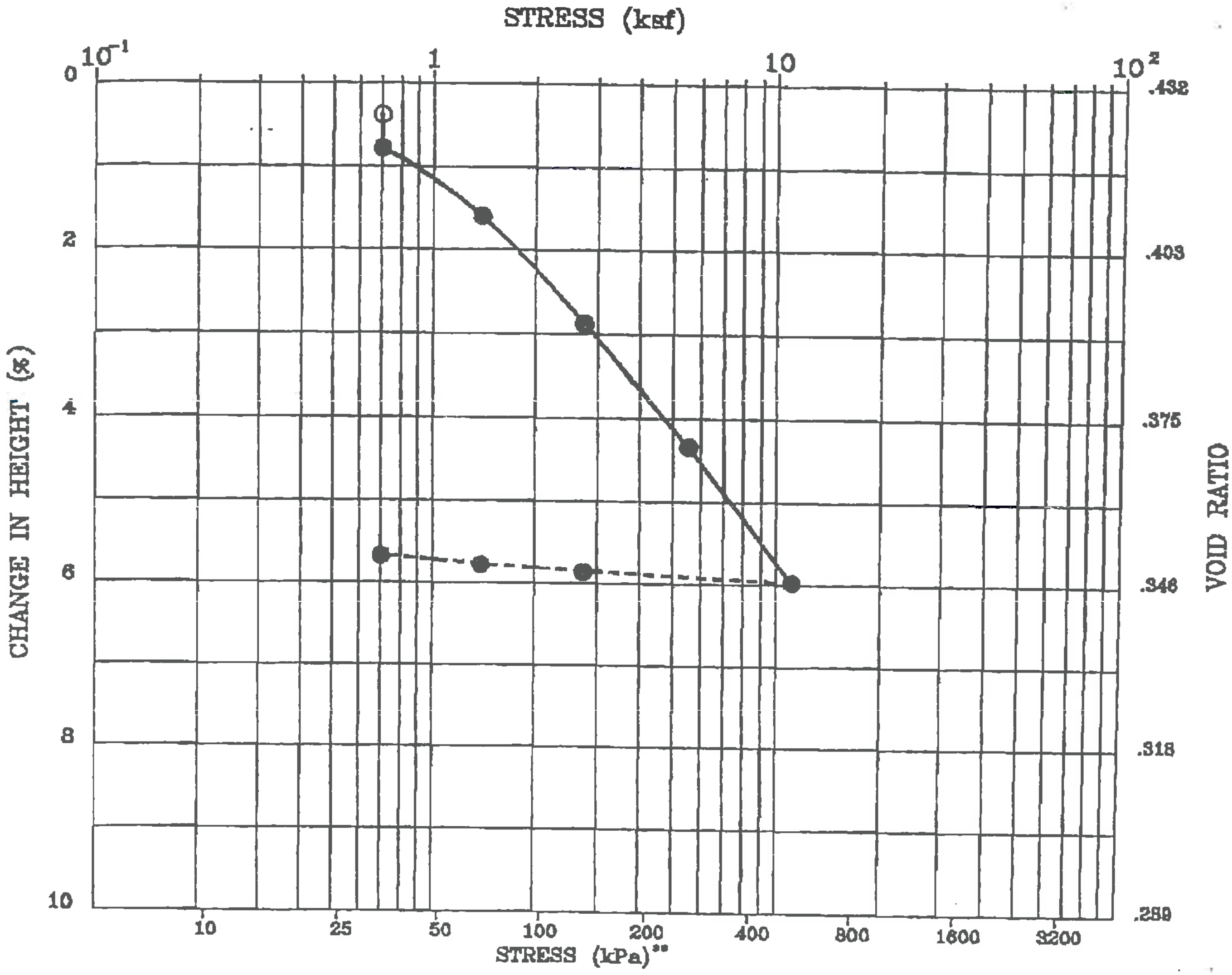
Note: Solid circles indicate readings after addition of water

# CONSOLIDATION TEST

Converse Consultants

Project No. 97–31–279–01

Drawing No. B-4




EXPLORATION : BH-8

DEPTH (ft) (m):* 2 - 3

DESCRIPTION : SILTY SAND (SM)

| | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | (Mg/m³)*** | PERCENT SATURATION | VOID RATIO |
|---|---|---|---|---|---|
| INITIAL | 3.8 | 110.2 | 1.76 | 22 | .432 |
| FINAL | 13.8 | 116.8 | 1.87 | 100 | .350 |

* 1 ft = 0.3048 m  ** 1 ksf = 47.85 kPa  *** 1 pcf = 0.016 Mg/m³

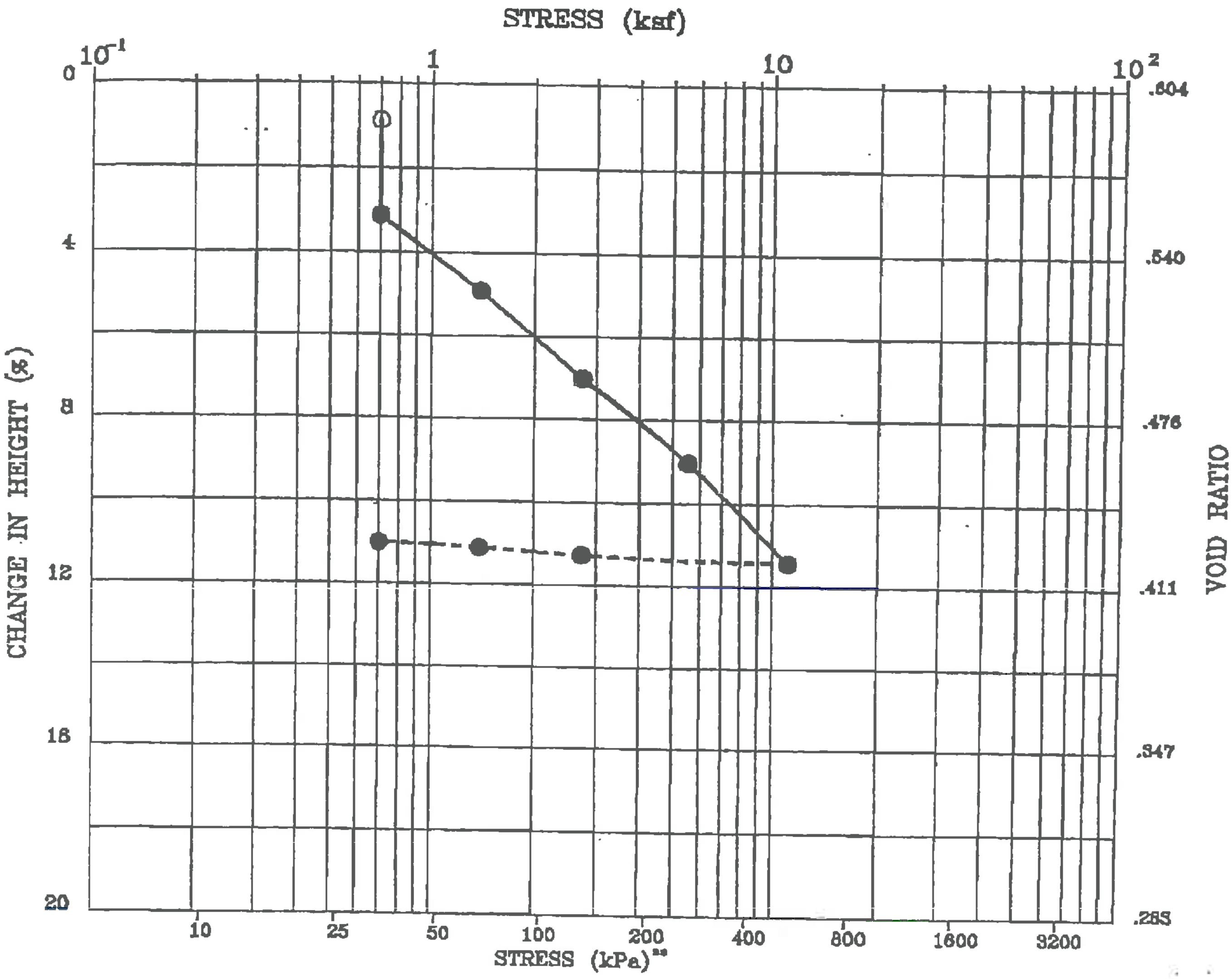
Note: Solid circles indicate readings after addition of water

# CONSOLIDATION TEST

Converse Consultants

Project No. 97-31-279-01

Drawing No. B-5




EXPLORATION : BH-9
DEPTH (ft) (m):* 5 - 6

DESCRIPTION : SILTY SAND (SM)

| | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | (Mg/m³)*** | PERCENT SATURATION | VOID RATIO |
|---|---|---|---|---|---|
| INITIAL | 7.5 | 102.5 | 1.64 | 33 | .604 |
| FINAL | 16.2 | 115.1 | 1.84 | 100 | .427 |

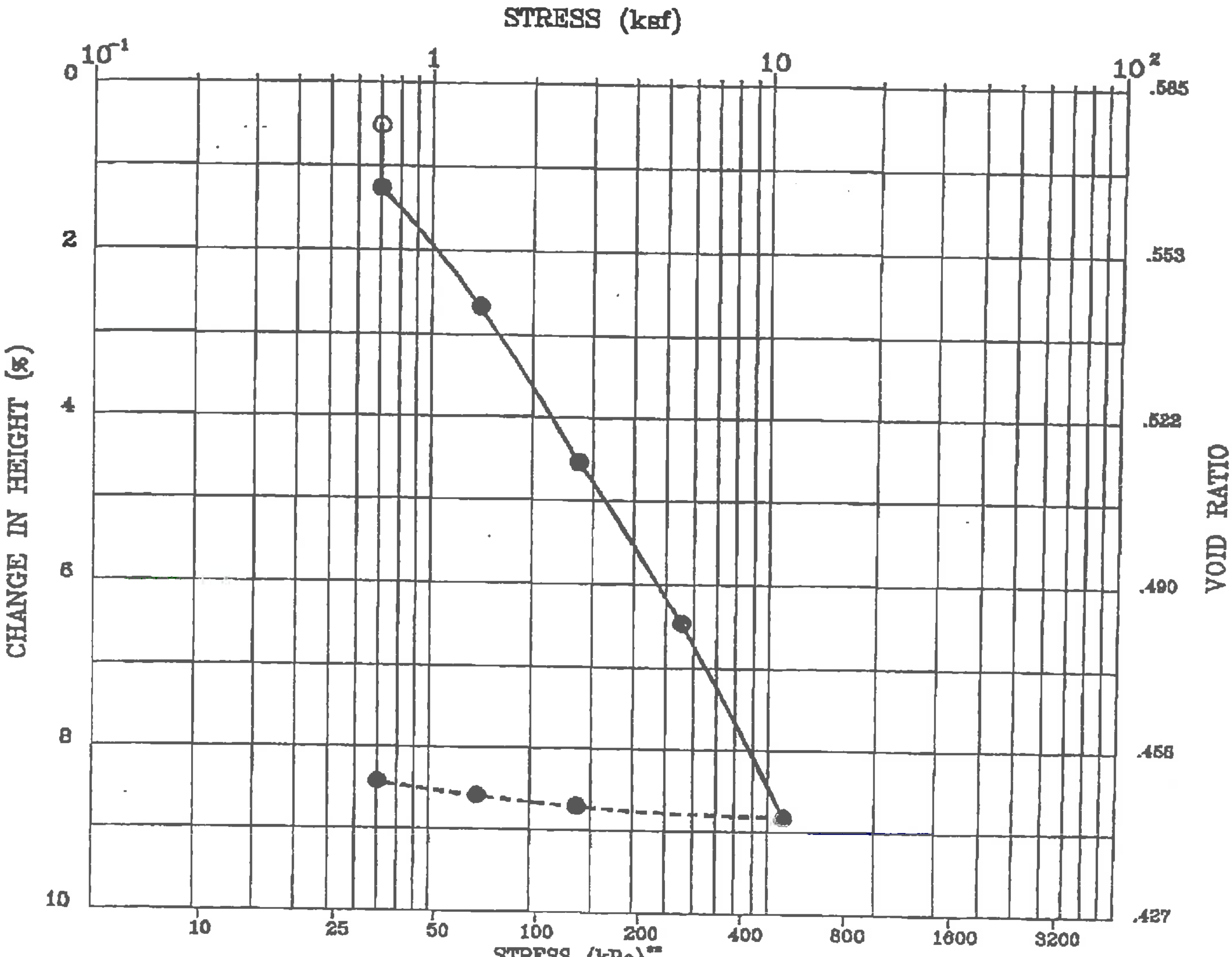
* 1 ft = 0.3048 m ** 1 ksf = 47.85 kPa *** 1 pcf = 0.016 Mg/m³
Note: Solid circles indicate readings after addition of water

## CONSOLIDATION TEST

Converse Consultants

Project No. 97-31-279-01

Drawing No. B-6




EXPLORATION : BH-15
DEPTH (ft) (m):* 5 - 6

DESCRIPTION : SILTY SAND (SM)

| | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | (Mg/m³)*** | PERCENT SATURATION | VOID RATIO |
|---|---|---|---|---|---|
| INITIAL | 7.2 | 102.9 | 1.65 | 32 | .585 |
| FINAL | 17.3 | 112.3 | 1.80 | 100 | .452 |

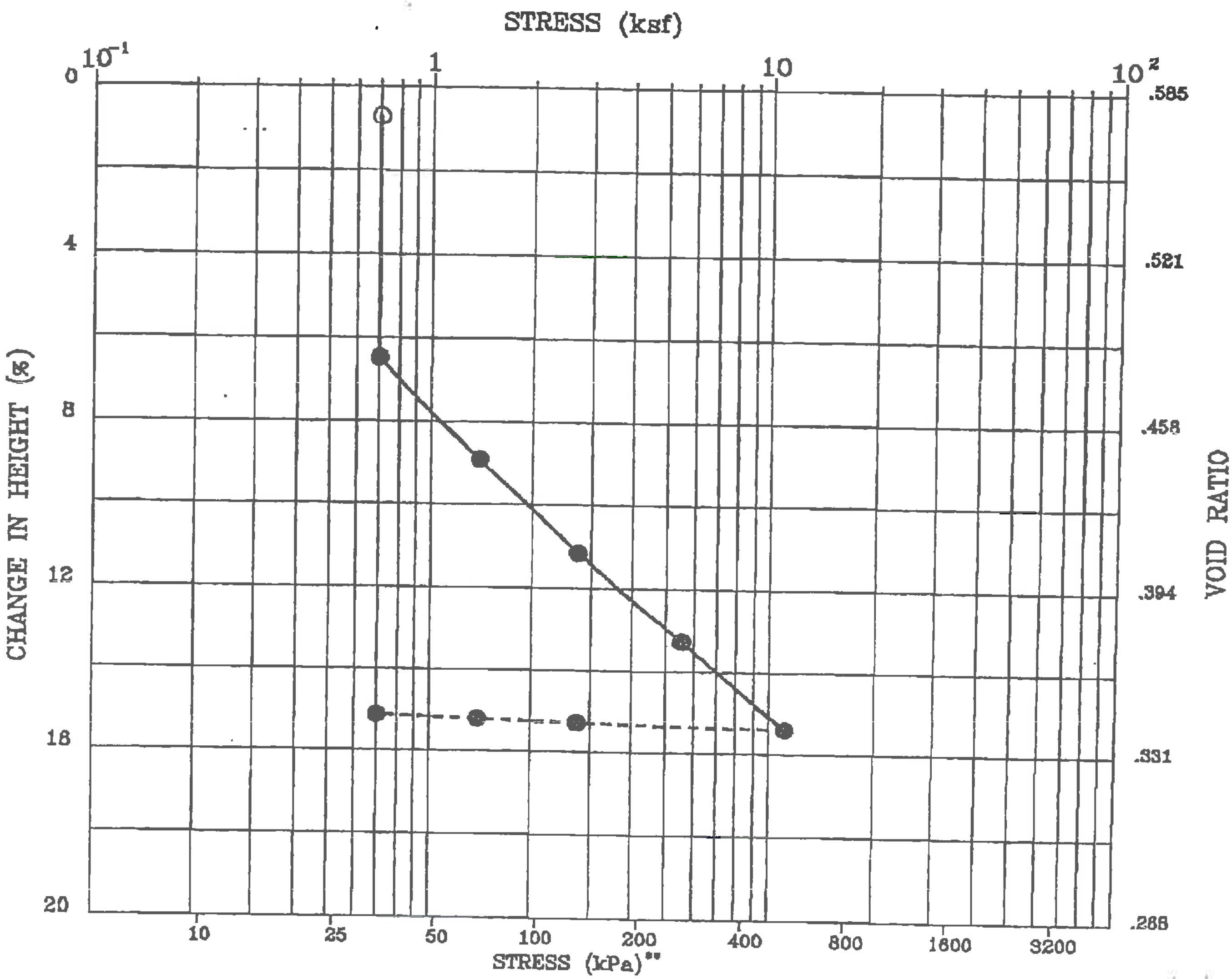
* 1 ft = 0.3048 m ** 1 ksf = 47.85 kPa *** 1 pcf = 0.016 Mg/m³
Note: Solid circles indicate readings after addition of water

## CONSOLIDATION TEST

Converse Consultants

Project No. 97-31-279-01

Drawing No. B-7




EXPLORATION : BH-16

DEPTH (ft) (m):* 10 - 11

DESCRIPTION : SILTY SAND (SM)

| | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | (Mg/m³)*** | PERCENT SATURATION | VOID RATIO |
|---|---|---|---|---|---|
| INITIAL | 5.3 | 100.5 | 1.61 | 23 | .585 |
| FINAL | 13.4 | 118.3 | 1.89 | 100 | .345 |

* 1 ft = 0.3048 m ** 1 ksf = 47.85 kPa *** 1 pcf = 0.016 Mg/m³

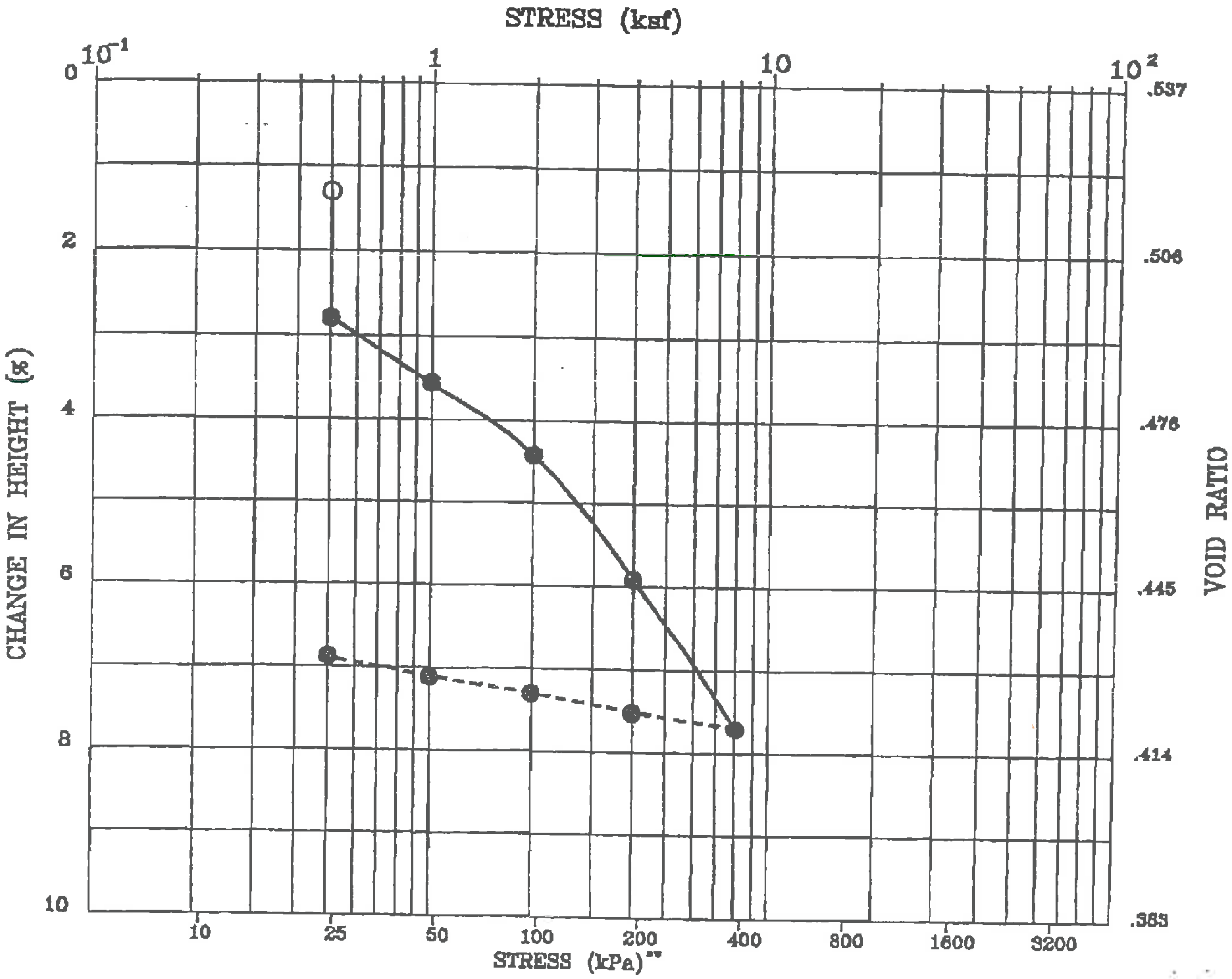
Note: Solid circles indicate readings after addition of water

# CONSOLIDATION TEST

Converse Consultants

Project No. 97-31-279-01

Drawing No. B-8




EXPLORATION : BH-18

DEPTH (ft) (m):* 2 - 3

DESCRIPTION : SILTY SAND (SM)

| | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | (Mg/m³)*** | PERCENT SATURATION | VOID RATIO |
|---|---|---|---|---|---|
| INITIAL | 6.8 | 109.7 | 1.75 | 34 | .537 |
| FINAL | 15.9 | 117.9 | 1.89 | 100 | .430 |

* 1 ft = 0.3048 m ** 1 ksf = 47.85 kPa *** 1 pcf = 0.016 Mg/m³

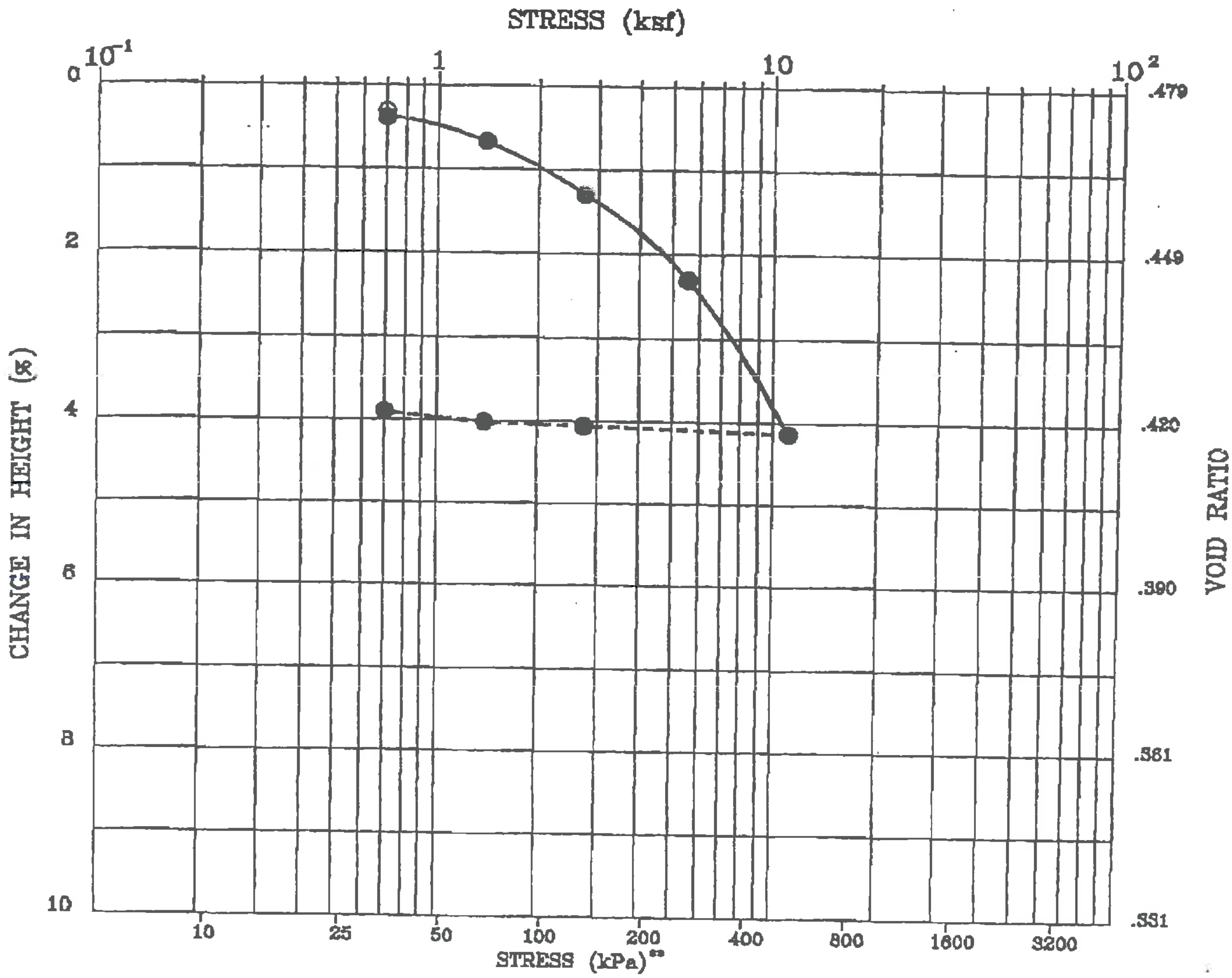
Note: Solid circles indicate readings after addition of water

# CONSOLIDATION TEST

Converse Consultants

Project No. 97-31-279-01

Drawing No. B-9




EXPLORATION : BH-20
DEPTH (ft) (m):* 2 - 3

DESCRIPTION : FILL: POORLY GRADED SAND (SP)

| | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | (Mg/m³)*** | PERCENT SATURATION | VOID RATIO |
|---|---|---|---|---|---|
| INITIAL | 4.0 | 100.5 | 1.61 | 20 | .479 |
| FINAL | 17.6 | 104.5 | 1.67 | 100 | .421 |

* 1 ft = 0.3048 m  ** 1 ksf = 47.85 kPa  *** 1 pcf = 0.016 Mg/m³

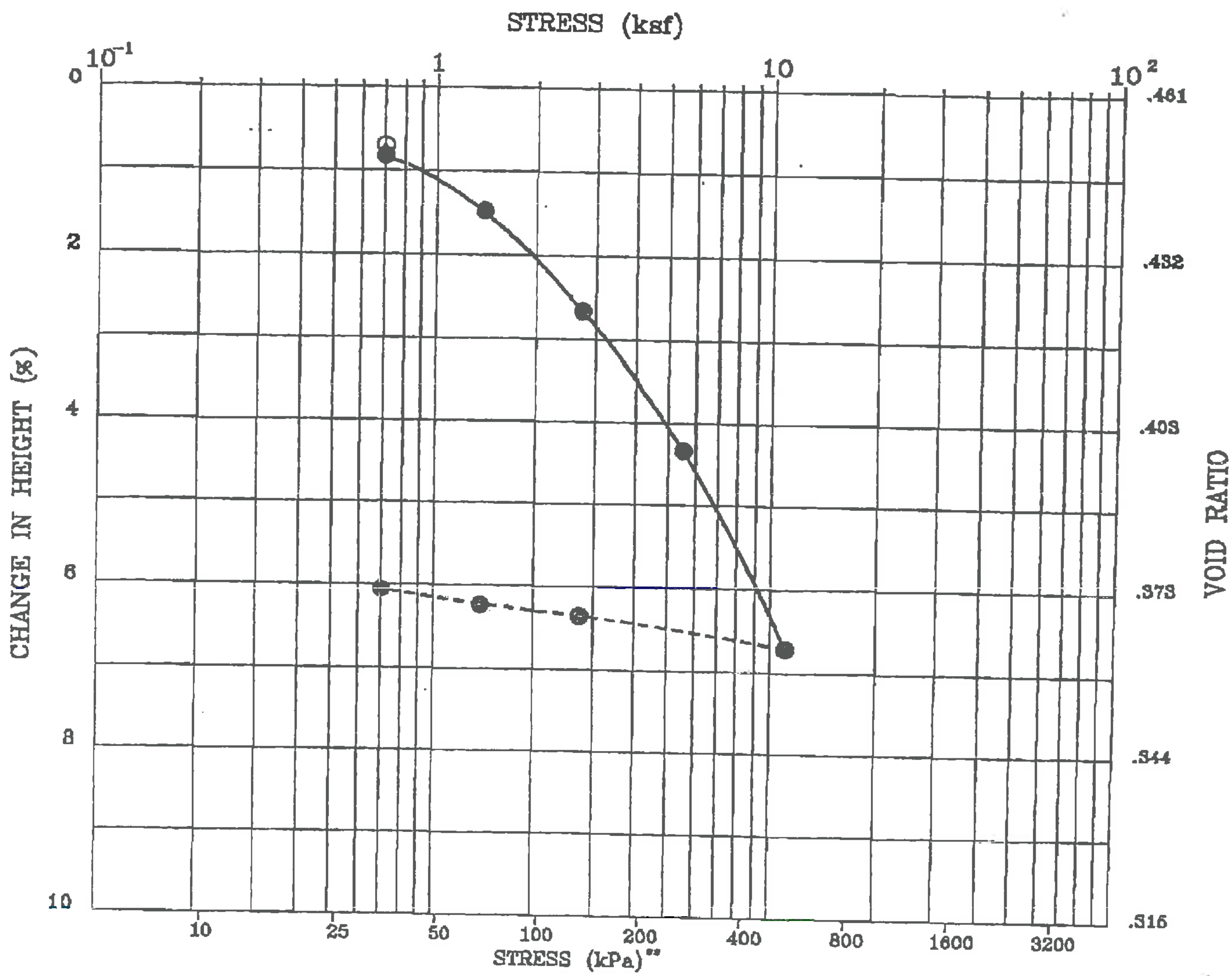
Note: Solid circles indicate readings after addition of water

## CONSOLIDATION TEST

Converse Consultants

Project No. 97-31-279-01

Drawing No. B-10




EXPLORATION : BH-23
DEPTH (ft) (m):* 5 - 6

DESCRIPTION : SILTY SAND (SM)

| | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | (Mg/m³)*** | PERCENT SATURATION | VOID RATIO |
|---|---|---|---|---|---|
| INITIAL | 9.8 | 112.9 | 1.81 | 56 | .461 |
| FINAL | 14.1 | 120.2 | 1.92 | 100 | .372 |

* 1 ft = 0.3048 m ** 1 ksf = 47.85 kPa *** 1 pcf = 0.016 $Mg/m^3$

Note: Solid circles indicate readings after addition of water

# CONSOLIDATION TEST

Converse Consultants

Project No. 97-31-279-01

Drawing No. B-11

*M.J. SCHIFF & ASSOCIATES, INC.*
*1291 N. Indian Hill Boulevard*
*Claremont, California 91711-3897*
*TEL (909) 626-0967/ FAX (909) 621-1419*
*E-mail: mjsa@mjs-a.com http://www.mjs-a.com*

# TRANSMITTAL LETTER

**DATE:** May 5, 1998

**ATTENTION:** Mr. Patrick Schmidt

**To:** CONVERSE CONSULTANTS
222 E. Huntington Drive, Suite 211-A
Monrovia, California 91016-3500

**SUBJECT:** Laboratory Test Data
Burbank High School
Burbank, CA
Your #97-31-279-01, MJS&A #98003-15

**COMMENTS:** Enclosed are the results for the subject project.

Robert A. Pannell

M. J. Schiff & Associates, Inc.
*Consulting Corrosion Engineers - Since 1959*

1291 N. Indian Hill Boulevard
Claremont, CA 91711-3897
Phone 909.626.0967

## Table 1 - Laboratory Tests on Soil Samples

*Burbank High School, Burbank, CA*
*Your #97-31-279-01, MJS&A #98003-15*
*24-Apr-98*

| Sample ID | | | BH-8 @ 1' - 5' | BH-23 B-1 @ 0 - 5' |
|---|---|---|---|---|
| **Soil Type** | | | silty sand | silty sand |
| **Resistivity** | | **Units** | | |
| as-received | | ohm-cm | 26,000 | 24,000 |
| saturated | | ohm-cm | 12,500 | 11,500 |
| **pH** | | | 7.0 | 6.9 |
| **Electrical Conductivity** | | mS/cm | 0.04 | 0.04 |
| **Chemical Analyses** | | | | |
| **Cations** | | | | |
| calcium | $Ca^{2+}$ | mg/kg | 28 | 16 |
| magnesium | $Mg^{2+}$ | mg/kg | 7 | 10 |
| sodium | $Na^{1+}$ | mg/kg | ND | 2 |
| **Anions** | | | | |
| carbonate | $CO_3^{2-}$ | mg/kg | ND | ND |
| bicarbonate | $HCO_3^{1-}$ | mg/kg | 98 | 85 |
| chloride | $Cl^{1-}$ | mg/kg | 11 | 11 |
| sulfate | $SO_4^{2-}$ | mg/kg | ND | ND |
| **Other Tests** | | | | |
| sulfide | $S^{2-}$ | qual | na | na |
| Redox | | mv | na | na |
| ammonium | $NH_4^{1+}$ | mg/kg | na | na |
| nitrate | $NO_3^{1-}$ | mg/kg | na | na |

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

# APPENDIX C

## RECOMMENDED EARTHWORK SPECIFICATIONS

## APPENDIX C

## RECOMMENDED EARTHWORK SPECIFICATIONS

The following specifications are recommended to provide a basis for quality control during the placement of compacted backfill.

1. Areas that are to receive compacted fill shall be observed by Converse Consultants (Converse) prior to placement of fill.

2. Fill and backfill shall be placed in controlled layers (lifts), the thickness of which is compatible with the type of compaction equipment used. The thickness of the compacted fill layer shall be adjusted to obtain proper compaction with the equipment used, and generally should not exceed the maximum allowable thickness of eight inches. Each layer shall be compacted to a minimum of 90 percent of the ASTM D1557-91 laboratory maximum density at 0 to 3 percent above optimum moisture. Pavement base shall be compacted to at least 95 percent of the ASTM D1557-91 laboratory maximum density. Density testing shall be performed by Converse to verify compaction. The contractor shall provide safe access and level areas for testing.

3. Fill soils shall consist of site soils and/or imported soils essentially cleaned of contaminants, organics, rubble, and deleterious material, and shall be approved by Converse. Rocks larger than three inches in diameter shall not be used unless sufficiently broken down. All imported soil shall be granular and non-expansive, with an Expansion Index (EI) less than 20. Converse shall evaluate and/or test import material for conformance with the specifications prior to delivery to the site. The contractor shall notify Converse at least two working days prior to importing material to the site.

4. Converse shall observe placement of compacted fill and conduct in-place field density tests on compacted fill to check for adequate moisture content and the required relative compaction. Where less than the specified relative compaction is indicated, additional compactive effort shall be applied and the soil moisture-conditioned as necessary until adequate relative compaction is attained.

# Appendix C

Supplemental Geotechnical Recommendations
Dated September 21, 1998

**Converse Consultants**

**Over 50 Years of Dedication in Geotechnical Engineering and Environmental Sciences**

September 21, 1998

Burbank Unified School District
Planning Development and Facilities
330 North Buena Vista
Burbank, California 91505

Attention: Dr. Ali A. Kiafar
Assistant Superintendent

Subject: **SUPPLEMENTAL GEOTECHNICAL RECOMMENDATIONS**
Proposed Reconstruction/Modernization
Burbank High School
902 North 3rd Street
Burbank, California
Converse Project No. 97-31-279-01

Gentlemen:

The purpose of this letter is to provide the additional information requested in Mr. Michael Maurizio's August 25, 1998 fax. This fax included a letter from the project architect and project structural engineer. In addition, we have included "Near Source Factors" in accordance with the 1997 Uniform Building Code. Recommendations presented herein are intended to supplement geotechnical recommendations for the project presented in our report titled, "Geotechnical Investigation, Proposed Reconstruction/Modernization, Burbank High School, 902 North 3rd Street, Burbank, California," dated June 22, 1998.

Seismic Earth Pressure

Evaluation of dynamic seismic lateral earth pressure was performed using the Maximum Probable Earthquake horizontal ground acceleration of 0.39g presented in our referenced report. A dynamic equivalent fluid pressure of 35 pcf has been calculated for a wall backfill material with an internal friction angle of 30 degrees. This pressure should be applied as an inverted triangular pressure distribution with the base of the triangle at the top of the wall and the tip of the triangle at the wall base. Ploessel and Slosson (1974) suggest that seismic design of structures can be based on a "Repeatable High Ground Acceleration." They found the "Repeatable High Ground Acceleration" to average about 65 percent of the maximum ground acceleration for sites located within 20 miles of the epicenter of California earthquakes.

Use of 65 percent of the MPE ground acceleration results in an inverted dynamic equivalent fluid pressure of about 23 pcf. In our opinion, use of a seismic earth pressure of 23 pcf is sufficient for the project.

Effect of weather during construction

The only anticipated effect of weather during construction is periods of heavy rainfall. As stated in our referenced report, if grading operations are performed during the wet season provisions for drying of the soil prior to compaction may be required. Drying of the soils could be accomplished by mixing wet soils with dryer materials. Alternatively if weather conditions allow, spreading and turning the materials to allow for wind or sunshine to help in the drying process could be performed. Conversely, additional moisture may be required during the dry months. Water trucks should be available in sufficient number to provide adequate water during compaction.

If earthwork is performed during the rainy season, site grades should be maintained at all times to prevent ponding and to reduce percolation of water into foundation soils. Run-off should be directed to a suitable discharge point. In addition, run-off from upslope areas should be diverted around the construction site. Operation of construction equipment in areas that have become excessively wet could result in rutting and disturbance of subgrade or foundation soils.

Analysis and recommendations regarding excavation, grading and new foundation construction adjacent to existing structures and foundations

As stated in our referenced report, new footings located adjacent to existing footings should be founded at depths equal to the existing footings to avoid surcharge loading or undercutting of adjacent existing footings. If the project design necessitates excavation or grading adjacent to existing structures that extends below the foundation level of the adjacent structure, it may be necessary to underpin existing foundations. The need for underpinning will be a function of the depth to which the planned excavation or grading will extend below the existing foundation level, the horizontal distance between existing foundations and the excavation or grading, and possibly the length of the planned excavation or grading.

In general, existing footings should be underpinned in areas where excavations or grading will lower the adjacent ground surface below an imaginary plane that extends downward from the base on existing foundations at a 1-1/2 to 1 (horizontal to vertical) inclination. For cases where this condition will occur, existing foundations should be underpinned to lower the bearing surface of the existing footings below an imaginary plane that extends upward from the base on the adjacent excavation or proposed graded ground surface elevation at a 1-1/2 to 1 (horizontal to vertical) inclination. Underpinning of foundations should be performed prior to lowering of the adjacent ground surface.

Verification that the report satisfies the requirements of the 1995 California Building Code for public school buildings, in addition to the requirements of the Division of State Architects (DSA) Office of Regulation Services.

Our referenced report has been prepared to comply with the 1995 California Building Code for public school buildings and the requirements of the Division of State Architects. The report is not intended to comply with the requirements of the California Division of Mines and Geology.

1997 Uniform Building Code Near Source Factors

The computer program UBCSEIS was used in the determination of the 1997 Uniform Building Code Near Source Factors for the site. The following table presents a summary of data for the nearest Type A, Type B and Type C Faults.

| Seismic Source Type (Table 16U) | Fault | Minimum Distance to Site (km) | Maximum Moment Magnitude | Slip Rate (mm/yr) | Seismic Coefficient | |
|---|---|---|---|---|---|---|
| | | | | | $N_a$ (Table 16Q) | $N_v$ (Table 16R) |
| A | San Andreas | 44.4 | 7.4 | 1.0 | 1.0 | 1.0 |
| B | Verdugo | 1.7 | 6.7 | 0.5 | 1.3 | 1.6 |
| C | Hollywood | 4.9 | 6.4 | 1.-0 | 1.0 | 1.0 |

Based on the data presented in the above table, seismic source factors $N_a$ = 1.3 and $N_v$ = 1.6 are appropriate for seismic design.

## CLOSURE

Recommendations in this letter were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in Los Angeles County at this time. We make no other warranty, either express or implied.

Thank you for the opportunity to be of continued service to you. If we may be of additional service or if you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,

CONVERSE CONSULTANTS

Patrick J. Schmidt, GE 2260
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
PATRICK J. SCHMIDT
No. 2260
Exp. 3/31/02
GEOTECHNICAL
STATE OF CALIFORNIA

Dist: 2/Addressee
2/Burbank Unified School District
Attn: Mr. Michael Maurizio