01-169740-CO

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CITY OF
PORTLAND, OREGON
OFFICE OF PLANNING AND DEVELOPMENT REVIEW
PO Box 8120
Portland, OR 97207-8120

MULTNOMAH COUNTY

STRUCTURAL CHECKSHEET

Application # : 01-169740-000-00-CO

Commercial Building Permit

Review Date : December 12, 2001

To:	APPLICANT	David Keltner Thomas Hacker and Associates Architects 34 NW FIRST AVENUE PORTLAND OR 97209	Work: Home:	503 227-1254 503 227-7818 ext.FAX
From:	Structural Engineer	Amit Kumar	Phone:	503-823-7561
cc:	OWNER	LEWIS & CLARK COLLEGE 0615 SW PALATINE HILL RD PORTLAND, OR 97219-7899		

PROJECT INFORMATION	
Street Address:	0615 SW PALATINE HILL RD
Description of Work:	Demo a portion of existing Albany Quad building at L&C college.

Based on the plans and specifications submitted, the following items appear to be missing or not in conformance with the Oregon Structural Specialty Code and / or other city, state, or federal requirements.

Item #	Location on plans	Code Section	Clarification / Correction Required
1.			Please clarify if the entire building is to remain un-occupied during demolition and construction. If so please clearly state on the plans. If not an occupant safety program would be required for any portion of the building that will remain occupied during demolition and construction. Please call to discuss if this is the case.
2.	A1D.2		Between grids 2 and 3 several openings with key note 24 are noted. These do not appear to have been shown on the structural drawing. Please clarify the note to state that the openings are to be cut between existing joists. Joists are NOT to be cut. Note 24 is not clear in this regard.
3.	A1D.3		It appears that the existing floor was bracing the walls. Please provide a note to state that these walls need to be temporarily braced till permanent bracing is installed as shown on the structural drawings

STRUCTURAL CHECKSHEET

Application # 01-169740-000-00-CO
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INSTRUCTIONS

To respond to this checksheet, come to Document Services (1900 SW Fourth Ave., 2nd floor) and update all four sets of the originally submitted drawings. To update the drawings, you may either replace the original sheets with new sheets, or edit the originally submitted sheets when corrections are of a minor nature and when approved by the Office of Planning and Development Review. (Specific instructions for updating plans are posted in Document Services.)

Please complete the attached Checksheet Response Form and include it with your re-submittal. Notify Document Services Staff that you are submitting corrections for **Structural review**. To ensure that the plan reviewer receives notification, verify that the computer has been updated to show that the corrections were received.

If you have specific questions concerning this Checksheet, please call me at 503-823-7561. To check the status of your project, please call (503) 823-7000 and select option 4. Your Plan Review Status will be faxed to you, so please be ready to provide a fax number. If you don't have a fax number, you may dial (503) 823-7357 to request a Plan Review Status or visit Document Services.

You may receive separate Checksheets from other City agencies that will require separate responses.

Structural Checksheet Response

Permit #: 01-169740-000-00-CO **Date:** ____________________

Customer name and phone number: ____________________________________

Note: *Please number each change in the '#' column. Use as many lines as necessary to describe your changes. Indicate which reviewer's checksheet you are responding to and the item your change addresses. If the item is not in response to a checksheet, write* customer *in the last column.*

#	**Description of changes, revisions, additions, etc.**	Checksheet and item #

(for office use only)

Date: Application #: 01-169740-CO

City of Portland, Bureau of Buildings, 503-823-7310, TDD: 503-823-6868

Multi-Family/Commercial Building Permit Application

Please provide the following information:

Project Address: 0615 SW PALATINE HILL RD 97219	Project Valuation: $175,000
Legal Description: SECTION 27, 1S1E, TL 100	Tax Account #: R99127 0260
Applicant's Name: DAVID KELTNER	☎ Phone #: 503-227-1254
Company Name: THOMAS HACKER AND ASSOCIATES, ARCHITECTS	☎ Fax #: 503-227-7818
Address: 34 NW FIRST AVENUE, PORTLAND, OR 97209	
Contractor's Name: HOFFMAN CONSTRUCTION	☎ Phone #: 503-221-8811
Address: 805 SW BROADWAY #2100, PORTLAND OR 97205	☎ Fax #: 503-221-8934

Which of the following best describes the proposed work?

- ☐ Addition
  How many square feet?______
- ☑ Demolish structure
- ☐ Fire Damage Repair
- ☐ Move a structure
  From what address? ______
- ☐ Alteration
  If change of use or occupancy:
  From use/occupancy______
  To use/occupancy______
  Seismic Upgrade: Yes ___ No ___
- ☐ New Construction
  How many square feet?______
  How many stories?______
  Number of structures______

***Briefly describe the proposed work** (include location):* DEMOLITION OF A PORTION OF EXISTING ALBANY QUAD BUILDING AT LEWIS AND CLARK COLLEGE.

Which of the following best describes the use of the structure(s)? *Check all that are applicable.*

- ☐ Apartments/Condos
- ☐ Assembly
- ☐ Assisted Care Facility
- ☐ Business
- ☐ Education
- ☐ Factory/Industrial
- ☐ Hazardous
- ☐ Hotel
- ☑ Institutional
- ☐ Mercantile
- ☐ Row House (*3 or more*)
- ☑ Storage
- ☐ Miscellaneous (*deck, driveway, fence, retaining wall, tank, tower, site work*)

Existing Structure: AREA TO BE DEMOLISHED:
What is the square footage of the existing structure? ~2,560 SF
How many stories is the existing structure? ONE.

Plumbing Fixtures:
How many new plumbing fixtures? NA

For Dwelling Units:
How many dwelling units are existing? NA
How many dwelling units will be demolished? NA
How many dwelling units will be added? NA

Floodplain:
Is the property in the floodplain?
Yes ___ No ✓

Have any appeals been requested or approved for this project?
Yes ___ No ✓ *If yes, please attach a copy.*

Have any Land Use Reviews been requested or approved for this project?
Yes ___ No ✓ *If yes, please attach a copy.*

H:\Admin\FORMS\Commercial Submittal App.wpd

Commercial, Industrial, and Multi-Family Submittal Request
Commercial Submittal Requirements

Please indicate below the items being submitted for review. *Please refer to the "Summary of Submittal Requirements - Commercial, Industrial and Multi-Family Dwellings" handout for a comprehensive list of requirements. Failure to provide any of the required information at time of submittal will be cause for rejection of your application.* Applications will not be processed or routed for review until all plan review/processing fees have been paid.

Yes	N/A		Office Use Only	Accepted
		Final Plat Approval: Projects involving a land division or new subdivision are required to have final plat		
		Appeals: Have appeals been granted for this project? YES NO If Yes, copies must be attached		
		Phased Permits: Are you requesting phased permitting at time of permit submittal? YES NO		
✓		**Main Permit:** Four (4) complete sets of construction documents (design drawings for phased permits) that include: EROSION CONTROL PLAN		
✓		• **Site Plan:** A 100% complete site plan showing all related improvements		
✓		• **Foundation Plans:** A foundation plan including all dimensions, construction details and references		
		• **Elevations:** Building elevations		
✓		• **Floor Plans:** Floor plans (for phased permits see handout)		
		• **Sections:** Building sections (for phased permits see handout)		
		• ***Mechanical, Electrical & Plumbing drawings:*** (see handout)		
		• ***Specifications:*** Two (2) sets of complete construction specifications (for phased permits see handout)		
		• ***Structural Calculations:*** one (1) set		
		• **Soils Report:** Two (2) sets of soils reports		

If you are also requesting a phased permit at the time of permit submittal, you must also provide

Yes	N/A		Office Use Only	Accepted
		Partial Permit: Four (4) complete sets of construction documents for the scope of the partial permit (usually "Grading/Shoring Only", Structural Only", or "Foundation Only" permits) that include:		
		• **Site Plan:** *A 100% complete site plan showing all related improvements*		
		• **Construction Plans:** *100% construction plans showing all work to be done under partial permit*		
		• **Mechanical, Electrical, Plumbing Drawings:** (see handout)		
		• **Specifications:** Two (2) sets of construction specifications for work to be covered under the partial permit		
		• **Structural Calculations:** One set of complete calculations for the work covered under the partial permit		
		• **Soils Reports:** Two (2) sets of soils reports		

For Official Use Only

Applicant's Signature ____________________ Date ____________

The above referenced submittal has been reviewed for adequacy and is ☐ accepted for submission or ☐ rejected. If it is rejected the reasons indicated above need to be addressed before resubmittal. A copy of this review has been given to the applicant and its contents reviewed with them. ☐

Signature of Reviewer ____________________ Date ____________

Reviewer Comments ____________________

I:\Admin\FORMS\Commercial Submittal Req 7/10/[illegible]

RECEIVED DEC 14 2001 BDS DOCUMENT SERVICES

Structural Checksheet Response

Permit #: 01-169740-000-00-CO **Date:** 12/12/01

Customer name and phone number: DAVID KELTNER 503-22?-1254

Note: *Please number each change in the '#' column. Use as many lines as necessary to describe your changes. Indicate which reviewer's checksheet you are responding to and the item your change addresses. If the item is not in response to a checksheet, write* **customer** *in the last column.*

#	Description of changes, revisions, additions, etc.	Checksheet and item #
1	ADD GENERAL NOTE 'Q' TO SHEET A1D.1 "ENTIRE BUILDING TO REMAIN UNOCCUPIED DURING DEMOLITION AND CONSTRUCTION"	1
2	MODIFY KEY NOTE '24' ON SHEET A1D.2. ADD "... CUT OPENINGS BETWEEN JOISTS. DO NOT CUT JOISTS."	2
3	MODIFY KEY NOTE '28' ON SHEET A1D.3 BY ADDING "PROVIDE TEMPORARY BRACING OF EXTERIOR WALLS UNTIL PERMANENT BRACING IS INSTALLED.	3

(for office use only)

01-169740
CO 11/2/01

GEOTECHNICAL INVESTIGATION
SITE-SPECIFIC SEISMIC HAZARD EVALUATION

ALBANY QUADRANGLE RESTORATION AND EXPANSION LEWIS AND CLARK COLLEGE PORTLAND, OREGON

City of Portland
APPROVED
DEC 26 2001
01-169740 CO
Permit Number

GEOCON
INCORPORATED
GEOTECHNICAL CONSULTANTS

PREPARED FOR

LEWIS AND CLARK COLLEGE
PORTLAND, OREGON

NOVEMBER 2000

GEOCON
NORTHWEST

GEOTECHNICAL CONSULTANTS

Project No. P1059-05-01
November 17, 2000

Mr. Michael Sestric
Lewis and Clark College
0615 SW Palatine Hill Road
Portland, Oregon 97219-7899

Subject: ALBANY QUADRANGLE RESTORATION AND EXPANSION
LEWIS AND CLARK COLLEGE
PORTLAND, OREGON
GEOTECHNICAL INVESTIGATION AND
SITE SPECIFIC SEISMIC HAZARD EVALUATION

Dear Mr. Sestric:

In accordance with our proposal number P00-05-67, dated October 3, 2000, and your authorization, we have performed a geotechnical investigation for the proposed construction of a new addition and renovation to Albany Quadrangle within Lewis and Clark College in Portland, Oregon. The accompanying report presents the findings of the site-specific seismic hazard evaluation, geotechnical investigation and conclusions and recommendations regarding the geotechnical aspects of the proposed development. Based on the results of this investigation, it is our opinion that the proposed project can be developed as proposed, provided the recommendations of this report are followed. The presence of soft clayey silt soils at shallow depths will require mitigation as discussed in this report.

If you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Sincerely,

GEOCON NORTHWEST, INCORPORATED

Bryan Wavra
Geotechnical Engineering Staff

Wesley Spang

Wesley Spang, Ph.D., P.E.
President

REGISTERED PROFESSIONAL
ENGINEER
18281
OREGON
JAN 16, 1995
WESLEY SPANG
EXPIRATION DATE: 6/30/0

BJW:AWS

cc: Mr. Jerome Madden, kpff Consulting Engineers

TABLE OF CONTENTS

GEOTECHNICAL INVESTIGATION

1 PURPOSE AND SCOPE

This report presents the results of the geotechnical investigation for the proposed construction of a new addition and renovation to Albany Quadrangle within Lewis and Clark College in Portland, Oregon, as shown in Figure 1, Site Vicinity. The project will consist of a restoration to Albany Quadrangle and the construction of a two-story addition to the south side of the existing building. The subject site includes Building 14 of Albany Quadrangle and the landscaped area located immediately south of Building 14 and the Computer Services facility. Bodine Hall and Olin Physics and Chemistry Building border the site to the west and east, respectively. A greenhouse is also located within the landscape area which will be removed as part of the project. The purpose of the geotechnical investigation was to evaluate subsurface soil and geologic conditions a 'ie site and, based on the conditions encountered, provide conclusions and recommendations pertaining to the geotechnical aspects of the construction of the proposed expansion. Section 1804 of the Oregon Specialty Structural Code requires that a site-specific seismic hazard evaluation be conducted prior to the design of new structures and facilities classified by ORS 455.447 as essential facilities, hazardous facilities, major structures, or special occupancy structures. Therefore, a site-specific seismic hazard evaluation was performed, and the results are presented herein.

The scope of the investigation consisted of a site reconnaissance, review of published geological literature, two geotechnical borings, two dilatometer soundings, and one cone penetrometer sounding. Past geotechnical reports provided by Lewis and Clark College for sites within the project vicinity were also reviewed during the preparation of this report. A detailed discussion of the field investigation is presented in Section 4. Exploratory logs are presented in Appendix A.

Laboratory tests were performed on selected soil samples obtained during the investigation to evaluate pertinent physical properties. Appendix B presents a summary of the laboratory test results. The results of laboratory moisture content tests are presented on the boring logs located in Appendix A.

The recommendations presented herein are based on an analysis of the data obtained during the investigation, laboratory test results and our experience with similar soil and geologic conditions within the project vicinity. This report has been prepared for the exclusive use of Lewis and Clark College and their agents, for specific application to this project, in accordance with generally accepted geotechnical engineering practice. This report may not contain sufficient information for purposes of other parties or other uses.

2 SITE AND PROJECT DESCRIPTION

The project site is located in Multnomah County, Oregon, in the City of Portland, on the Lewis and Clark College Campus. The approximate location is shown on the Site Vicinity Map, Figure 1. Building 14 of Albany Quadrangle, an operating greenhouse, and landscape areas currently occupy the site. Existing underground improvements may include, but are not limited to, underground tunnels, basements, and utilities.

The proposed Albany Quadrangle Restoration and Expansion project consists of the interior renovation of the existing structures, the demolition of Building 14, the removal of the existing greenhouse, and the construction of a two-story addition. Discussions with the project structural engineers, kpff Consulting Engineers, indicate that the existing north perimeter wall of Building 14 will be retained and used as foundation support for the expansion. The two-story addition is currently proposed to consist of an underground basement in the eastern half of the building's footprint. Column loads are anticipated to be approximately 160 kips for the basement level and 60 kips for the at-grade portion of the building. Based on preliminary site elevations and architectural drawings, it is expected that site grading will consist of maximum cuts and fills on the order of 15 and 5 feet, respectively.

3 SEISMIC SETTING

3.1 Regional Geology

Based on the geologic literature reviewed, the site is mapped in an area of Tertiary Age Basalt of Waverly Heights and associated undifferentiated sedimentary rocks. This unit consists of a sequence of subaerial basaltic lava flows and associated sediments that unconformable underlie flows of the Columbia River Basalt Group. The thickness of the unit is assumed to extend to a considerable depth in the map area. The Basalt of Waverly Heights unit underlies five feet or more of loess deposits of silt.

3.2 Seismic Setting

3.2.1 Earthquake Sources

The seismicity of the Portland area, and hence the potential for ground shaking, is controlled by three separate fault mechanisms. These include the Cascadia Subduction Zone (CSZ), the mid-depth intraplate zone, and relatively shallow crustal zone sources.

The Cascadia Subduction Zone is located offshore and extends from Northern California to British Columbia. Within this zone, the oceanic Juan De Fuca Plate is being subducted beneath the continental North American Plate to the east. The interface between these two plates is located at a depth of approximately 15 to 20 kilometers. The seismicity of the CSZ is subject to several uncertainties, including the maximum earthquake magnitude and the recurrence intervals associated with various magnitude earthquakes. Anecdotal evidence of previous CSZ earthquakes has been observed within coastal marshes along the Oregon coast (Peterson et al. 1993). Sequences of interlayered peat and sands have been interpreted to be the result of large subduction zone earthquakes occurring at intervals on the order of 300 to 500 years, with the most recent event taking place approximately 300 years ago. A recent study by Geomatrix (1995) suggests that the maximum earthquake associated with the CSZ is moment magnitude (M_W) 8 to 9. This is based on an empirical expression relating moment magnitude to the area of fault rupture derived from earthquakes which have occurred within subduction zones in other parts of the world.

The intraplate zone encompasses the portion of the subducting Juan De Fuca Plate located at a depth of approximately 20 to 40 km below Western Oregon. Very low levels of seismicity have been observed within the intraplate zone in Oregon. However, much higher levels of seismicity within this zone have been recorded in Washington and California. Several reasons for this seismic quiescence in Oregon were suggested in the Geomatrix (1995) study and include changes in the direction of subduction between Oregon and British Columbia, as well as the effects of volcanic activity along the Cascade Range. Historical activity associated with the intraplate zone includes the 1949 Olympia (magnitude 7.1) and the 1965 Puget Sound (magnitude 6.5) earthquakes.

The third source of seismicity that can result in ground shaking is near-surface crustal earthquakes that occur within the North American Plate. The historical seismicity of crustal earthquakes in western Oregon is higher than the seismicity associated with the CSZ and the intraplate zone. The 1993 Scotts Mills (magnitude 5.6) and Klamath Falls (magnitude 6.0) were crustal earthquakes. Individual faults or fault zones, which have been mapped by the Oregon Department of Geology and Mineral Industries (1991) and Geomatrix (1995) within the near-vicinity of the site, are indicated on Table 1: Area Faults.

Table 1: Area Faults

Fault System	*Approximate. Distance to Site (miles)*
Oatfield Fault	<1
Portland Hills Fault	1.5
Bolton Fault	4
East Bank Fault	4.5
Grant Butte, Damascus-Tickle Creek Fault Zone	9
Helvetia Fault	11.5
Lacamas Creek Fault	13.5
Sandy River Fault	13.5
Mt. Angel Fault	24.5
Newberg Fault	18
Gales Creek Fault	19

Seismic and geologic parameters such as slip rate, horizontal and vertical offset, rupture length, and geologic age have not been determined for the majority of the above faults. This is primarily due to the lack of surface expressions or exposures of faulting because of urban development and the presence of late Quaternary soil deposits that overlie the faults. The low level of historical seismicity (particularly for earthquakes greater than magnitude 5) and lack of paleo-seismic data results in large uncertainties when evaluating individual crustal fault maximum magnitude earthquakes and recurrence intervals. Thus, it is considered prudent to also evaluate the potential for seismic shaking due to crustal earthquakes on a regional scale. Based on data presented by Geomatrix (1995) and DOGAMI (1991), the seismic exposure at the site from crustal zone sources is represented by an earthquake of magnitude 6.5.

3.2.2 Historical Seismicity

The historical seismicity of the site and the vicinity was determined based upon the review of the September 1993 and November 1995 issues of Oregon Geology, Bureau of

Reclamation Scoggins Dam Seismic Study, and on the analysis of the 150 year Oregon earthquake catalog, DOGAMI Open-File Report O-94-4. OFR O-94-4 is a database of 15,000 Oregon earthquakes that occurred between 1833 and October 25, 1993. In order to establish an estimated Richter Magnitude for those seismic events that do not have such a recording, the Gutenberg and Richter, 1965 relationship, M = (2/3) MMI +1, was applied to those earthquakes that only had a Modified Mercalli Intensity (MMI). The MMI scale is a means of estimating the size of an earthquake using human observations and reactions to the earthquake. The MMI scale ranges from I to XII, with XII representing the highest intensity. A search of the database was conducted to determine the number and estimated magnitude of earthquakes that have taken place within 50 kilometers of the site. The information derived from the Oregon earthquake catalog indicates that eight M5.0 to M5.7 earthquakes occurred within the search zone.

4 SUBSURFACE EXPLORATION AND CONDITIONS

4.1 Site Exploration

The subsurface soil conditions within the site were determined based on the literature review, field exploration and laboratory testing. The field exploration was completed on October 11 and 20, 2000 and consisted of two exploratory borings, two dilatometer soundings, and one cone penetrometer sounding. The explorations were completed in the approximate locations shown in Figure 2, Site Plan.

4.1.1 Cone Penetration Test

The cone penetration test is an in situ testing technique that provides an effective method of delineating subsurface stratigraphy in areas of clays, silts, sands and fine gravel. The testing equipment consists of a 35.6-mm diameter cone equipped with a load cell, friction sleeve, strain gages, porous stone, and geophone. As the cone is hydraulically pushed at a rate of 2 cm/sec, an electronic data acquisition system records tip resistance, sleeve friction, and pore pressure at 0.1-meter intervals. This technique provides a nearly continuous profile of the subsurface conditions encountered. Additionally, at selected depths, the advancement of the cone can be suspended and pore water dissipation rates can be measured. Shear waves can be generated at the ground surface and the travel time for the wave to reach the geophone located within the cone are recorded. Data from the CPT is used in foundation design and liquefaction analyses. The ratio of the sleeve friction to the tip resistance (the friction ratio) provides soil classification information.

At this site the CPT sounding was advanced to approximately 32 feet below the ground surface (bgs). The cone tip resistance and sleeve friction readings were recorded every four inches along the length of the sounding. A shear wave was generated at the ground surface at one-meter intervals within the sounding, and the travel time for the wave to reach the cone tip was recorded. A shear wave velocity profile was developed for the site and is provided in Appendix A.

4.1.2 Dilatometer Test

The dilatometer test provides a rational, cost-effective method to determine engineering parameters for the design of earthworks and structural foundations. It is particularly useful in silts and sands that can be difficult to sample or test by other methods. The DMT is performed in situ by pushing a blade-shaped instrument into the soil. The blade is equipped with an expandable membrane on one side that is pressurized until the membrane moves horizontally into the surrounding soil. Readings of the pressure required to move the membrane to a point that is flush with the blade (A – pressure) and to a point 1.1 mm into the surrounding soil (B – pressure) are recorded. The pressure is subsequently released and, in permeable soils below the groundwater table, a pressure reading is recorded as the membrane returns to the flush position (C – pressure). In addition, the thrust required to advance the blade to the desired test depth is recorded. The test sequence is performed at 0.2-meter (eight-inch) intervals to obtain a comprehensive soil profile. A material index (I_D), a horizontal stress index (K_D) and a dilatometer modulus (E_D) are obtained directly from the dilatometer data.

Marchetti (1980) developed a soil classification system based on the material index. According to this system, soils with I_D values less than 0.35 are classified as clay. Soils classified as sand have an I_D value greater than 3.3. Material index values between 0.35 – 3.3 indicate silty clay to silty sand soils.

Empirical relationships between the horizontal stress index and the coefficient of lateral earth pressure (K_o) have been developed by Lunne et al. (1990) for clays and by Schmertmann (1983) for uncemented sands. While Lunne's method makes use of dilatometer data exclusively, Schmertmann utilizes both DMT and cone penetration data to estimate K_o.

Since the DMT is strained controlled, the measured difference between the B-pressure and A-pressure readings (corrected for membrane stiffness) and cavity expansion theory, can be used to directly measure the soil stiffness. Assuming a Poisson's ratio, the dilatometer modulus is correlated to shear modulus, Young's modulus and constrained modulus.

The dilatometer soundings completed at this site were advanced to depths ranging from approximately 29 to 31.5 feet below the ground surface. A member of Geocon Northwest's engineering staff recorded thrust and pressure readings every eight inches along the length of each sounding. Logs of the dilatometer soundings performed at this site are provided in Appendix A at the end of this report.

4.1.3 Borings

Two borings were advanced to a depth of approximately 36.5 feet bgs. The borings were completed with a trailer-mounted drill rig equipped with solid stem auger. A member of Geocon Northwest's geotechnical engineering staff logged the subsurface conditions encountered within each boring. Standard penetration tests (SPT) were performed at regular intervals by driving a 2-inch outside diameter split spoon sampler 18 inches into the bottom of the boring, in general accordance with ASTM D1586. The number of blows to drive the sampler the last 12 of the 18 inches are reported on the boring logs located in Appendix A at the end of this report. Disturbed bag samples were obtained from SPT testing. Service providers subcontracted by Geocon Northwest completed the borings.

Exploration logs describing the subsurface conditions encountered within the borings are presented in Appendix A at the end of this report.

4.2 Subsurface Conditions

The subsurface explorations were widely spaced across the site and it is possible that some local variations and possible unanticipated subsurface conditions exist. Based on the conditions observed during the reconnaissance and field exploration, the subsurface conditions, in general, consisted of the following:

TOPSOIL – A layer of organic topsoil, approximately six to twelve inches thick, was encountered in the borings. The topsoil was overlain by a thin surface layer of angular pea gravel associated with a pedestrian path in boring B-1 and was covered with landscape bark in boring B-2.

SILT - Brown clayey silt to silty clay with fine-grained sand was encountered below the topsoil to depths ranging from 27 to 30 feet bgs. The deposit is medium-stiff to stiff and moist to wet to approximately ten feet bgs and becomes very soft and saturated for the remainder of the layer. The soft layer of silt was evidenced by low SPT blow counts, low cone tip resistance values, low dilatometer modulus values, and high moisture contents.

RESIDUAL SOIL - Very stiff to hard, gray silty clay with occasional fragments of highly weathered rock was encountered below the Silt to the maximum depth explored.

GROUNDWATER – Groundwater was measured at a depth of approximately 31 feet in boring B-2. Due to the presence of saturated soils above this depth, perched groundwater should be anticipated to approach the ground surface during prolonged periods of rain. The layer of soft silt had high moisture contents and may require dewatering of excavations that extend into the soft silt layer. Typical locations for perched groundwater may be within interbedded sand and silt layers, near landscaping areas and within existing utility trenches, or where there are variations in soil permeability.

Subsurface conditions encountered during the field investigation appear to be consistent with geologic conditions mapped within the region.

5 SEISMIC HAZARD EVALUATION

The primary geologic hazards associated with earthquakes are liquefaction, settlement, lateral spreading, fault rupture, landsliding, ground shaking, ground motion amplification, and seiche/tsunami. For many of these potential hazards, the subsurface conditions and topography of a site will dictate how a site will likely perform during a seismic event. Liquefaction typically takes place in loose, saturated sand and silt. Seismically induced settlement generally occurs in loose granular soil. Lateral spreading is a form of slope failure that occurs in liquefiable sediments adjacent to an open-face (e.g. riverbank). Seismically induced landsliding generally takes place in over-steepened slopes that are at or near static equilibrium prior to the earthquake event. The level of ground shaking at a given site will depend on the magnitude of the seismic event and the distance from the source. Typically the level of ground shaking will attenuate as it propagates away from the source. However, depending on the earthquake motion characteristics and the subsurface conditions at the site, the level of ground shaking can be increased due to amplification. Seiche and tsunami hazards are seismically induced waves in lakes or inland bodies of water and oceans, respectively.

5.1 Ground Shaking

In their recent study, Geomatrix (1995) estimated peak bedrock horizontal accelerations in the Portland Metropolitan area of 0.20g, 0.27g, and 0.37g for return periods of 500, 1000, and 2500 years, respectively. The analyses were based on a total mean hazard comprised of crustal and subduction zone sources. The majority of these bedrock accelerations were attributed to crustal earthquake sources

Based on the subsurface conditions encountered during the field investigation, it is recommended that the following 1997 Uniform Building Code (UBC) seismic factors and coefficients given in Table 2 be used for seismic design.

Table 2: 1997 UBC Seismic Design Recommendations

Seismic Variable	*Recommended Value*
Soil profile type	S_D
Seismic zone factor, Z	0.30
Seismic coefficient, C_a	0.36
Seismic coefficient, C_v	0.54

5.2 Fault Displacement and Subsidence

The site lies within approximately one mile of the Catfield Fault, an individual fault of the Portland Hills Fault Zone. However, identified faults have not been mapped within the boundaries of the site or within adjacent properties. Individual faults of the Portland Hills Fault Zone do not appear to be present within the project site. Evidence was not encountered during the field investigation to suggest the presence of faults within the property (i.e., no significant offset of the underlying weathered rock or the more recent silt deposit was encountered).

The potential for fault displacement and associated ground subsidence at the site is considered remote.

5.3 Slope Instability

Earthquake induced landslides generally occur on steep slopes composed of weak soil or bedrock. Among the factors that influence seismically induced landsliding include earthquake intensity and duration, topographic relief, ground water, and soil or bedrock type. Earthquakes can also reactivate existing landslides. Based on the topography and field observations, the site is estimated to have a negligible earthquake induced slope instability hazard.

5.4 Liquefaction

Liquefaction can cause aerial and differential settlement, lateral spreading, loss of bearing capacity, and sudden loss in soil strength. Soils prone to liquefaction are typically loose, saturated sands and, to a lesser degree, silt. When ground shaking commences, the loose, saturated, soils tend to contract which results in the generation of excess pore water pressures. The degree of excess pore water pressure generation is largely a function of the magnitude and duration of the ground shaking, as well as the density of the soil. Liquefiable soils are generally young alluvial deposits and can be found along waterways such as the Willamette River.

The soils at the Albany Quadrangle site were evaluated for liquefaction potential in accordance with the procedures presented in NCEER, 1997. The liquefaction resistance of the soils was assessed using methods based on the percentage of fine-grained material, SPT blow counts, and cone penetrometer (CPT) data obtained at the site. The seismically induced shear stresses at the site were assessed through the use of a simplified empirical procedure. Based on the results of these analyses, the likelihood of liquefaction at this site is considered low.

5.5 Lateral Spreading

Lateral spreading is a liquefaction related seismic hazard that may adversely impact some sites. Areas subject to lateral spreading are underlain by liquefiable sediments and are sites that slope or are flat sites adjacent to an open face. Based on the relatively flat topographic features at the site, the characteristics of subsurface conditions, and the absence of identified liquefiable material, it is estimated that the site has negligible potential for lateral spreading.

5.6 Seiche and Tsunami Inundation

There is not a potential for seiche- and tsunami-related damage at the site due to the distance of the site from waterways, lakes, and coastal areas.

6 LABORATORY TESTING

Laboratory testing was performed on selected soil samples to evaluate moisture content, grain size distribution, and plasticity. Visual soil classification was performed both in the field and laboratory, in general accordance with the Unified Soil Classification System. Moisture content determinations (ASTM D2216) were performed on soil samples to aid in classifying the soil. Grain size analyses were performed on selected samples using procedures ASTM D1140 and ASTM D422. The plasticity index was determined in general accordance with ASTM D4318. Moisture contents are indicated on the boring logs and are located in Appendix A of this report. Other laboratory test results for this project are summarized in Appendix B.

7 DISCUSSION

An important geotechnical aspect of the Albany Quadrangle Renovation and Expansion project is the presence of a very soft silt layer that is located at a depth of approximately ten feet bgs and is estimated to vary from 12 to 15 feet in thickness. The ground surface generally slopes north to south and ranges from elevation 406 feet at Building 14 down to elevation 398 feet at the south-bordering sidewalk. Adjacent to Building 14 it is estimated that the soft silt layer is present at elevation 396 feet and generally slopes with the surface profile as shown in Figure 3.

Based on the architectural plans at the time of the preparation of this report, the proposed finished basement floor is elevation 394 feet. Preliminary discussions between project structural engineer, kpff Consulting Engineers, and Geocon Northwest have resulted in a design basement mat footing thickness of two-feet that will be underlain by approximately 12 inches of crushed rock. It is estimated that the basement excavation will extend down to elevation 391 feet. Therefore, the excavation will extend as much as five feet into the soft silt and could result in unstable conditions if the site excavation is not properly sloped or shored. It should be noted that utility trenches greater than approximately five feet deep experienced sloughing and caving of the walls during the Watzek Library Expansion to the south of the site. Other foundation options include spread footings for the at-grade portion of the building or pile foundations.

Slope stability analyses were conducted to assess the stability of the slopes during the basement excavation. Factors of safety of 1.1 and 1.5 were calculated for excavation slopes of 1.5H:1V and 2H:1V, respectively. However, due to the close proximity of existing structures and underground utilities to the location of the proposed excavation, adequate sloping may not be feasible. Shoring systems such as sheetpile walls, soldier pile and lagging walls, or auger cast pile walls may be required.

Additional geotechnical concerns associated with the current architectural scheme include the location of an underground tunnel beneath the northeast corner of the proposed addition and the excavation adjacent to and beneath the southwest corner of the south classroom of the Computer Services facility. The proposed tunnel may have to be relocated depending on its expected dimensions and depth, and the footing beneath the classroom may require underpinning.

It is anticipated that the design of the excavation plan will be based primarily on cost information and constructibility issues as provided by project general contractor, Hoffman Construction. Geocon Northwest should be contacted to provide future geotechnical analyses as project plans are finalized.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 General

8.1.1 It is our opinion that the proposed project is geotechnically feasible, provided the recommendations of this report are followed.

8.1.2 Moisture contents of near-surface soils were wet of optimum at the time of the investigation. Recommendations for both dry- and wet-weather construction in moisture-sensitive soils are provided. However, dry weather construction at this site is recommended. Topsoil stripping and removal of existing underground improvements will be required prior to construction. Due to the existing irrigated landscaped areas at the site, it is anticipated that wet weather construction techniques will be required regardless of the time of year.

8.1.3 Due to the sensitive nature of the underlying soft silt layer, all soil should be statically compacted to reduce the potential for subgrade disturbance.

8.1.4 Evidence for the potential of foundation level groundwater was encountered within the borings during the field investigation. Recommendations regarding drainage and vapor retarders are provided in subsequent sections of this report.

8.2 Site Preparation

8.2.1 Prior to beginning construction, the areas of the site to receive fill, footings, structural improvements or pavement should be stripped of concrete, asphalt, vegetation, topsoil, non-engineered fill, previous subsurface improvements, debris, and otherwise unsuitable material, down to firm native soil. Stripping depths of approximately 6 to 12 inches may be anticipated in the landscaped areas within the proposed building footprint. Excavations made to remove previous subsurface improvements should be backfilled with structural fill per Section 8.4 of this report.

8.2.2 Recommendations for both dry weather and wet weather construction are provided in the following sections. However, due to the moisture sensitive near surface soils, it is recommended that the site be prepared during dry weather.

8.2.3 Dry Weather Construction

Subgrades in pavement and structural areas that have been disturbed during stripping or cutting operations should be scarified to a depth of at least eight-inches. The scarified soil should be moisture conditioned as necessary to achieve the proper moisture content, then compacted to at least 92% of the maximum dry density as determined by ASTM D-1557. Even during dry weather it is possible that some areas of the subgrade will become soft or may "pump," particularly in poorly drained areas. Soft or wet areas that cannot be effectively dried and compacted should be prepared in accordance with Section 8.2.4.

8.2.4 Wet Weather Construction

During wet weather, or when adequate moisture control is not possible, it may be necessary to install a granular working blanket to support construction equipment and to provide a firm base on which to place subsequent fills and pavements. Commonly, the working blanket consists of a bank run gravel or pit run quarry rock (six to eight inch maximum size with no more that 5% by weight passing a No. 200 sieve). A member of Geocon Northwest's engineering staff should be contacted to evaluate the suitability of the material before installation.

The working blanket should be installed on a stripped subgrade in a single lift with trucks end-dumping off an advancing pad of granular fill. It should be possible to strip most of the site with careful operation of track-mounted equipment. However, during prolonged wet weather, or in particularly wet locations, operation of this type of equipment may cause excessive subgrade disturbance. In some areas, final stripping and/or cutting may need to be accomplished with a smooth-bucket trackhoe, or similar equipment, working from an advancing pad of granular fill. After installation, the working blanket should be compacted by a minimum of four complete passes with a moderately heavy static steel drum or grid roller. It is recommended that Geocon Northwest be retained to observe granular working blanket installation and compaction.

The working blanket must provide a firm base for subsequent fill installation and compaction. Past experience indicates that about 18 inches of working pad in normally required. This assumes that the material is placed on a relatively undisturbed subgrade prepared in accordance with the preceding recommendations. Areas used as haul routes for heavy construction equipment may require a work pad thickness of two feet or more.

8.2.5 In particularly soft areas, a heavy-grade, non woven, non-degradable filter fabric installed on the subgrade may reduce the thickness of working blanket required.

8.2.6 Construction practices can affect the amount of work pad necessary. By using tracked equipment and special haul roads, the work pad area can be minimized. The routing of dump trucks ana rubber tired equipment across the site can require extensive areas and thicknesses of work pad. Normally, the design, installation and maintenance of a work pad are the responsibility of the contractor.

8.3 Proof Rolling

8.3.1 Regardless of which method of subgrade preparation is used (i.e., wet weather or dry weather), it is recommended that, prior to on-grade slab construction, the subgrade or granular working blanket be proof-rolled with a fully-loaded 10- to 12-yard dump truck. Areas of the subgrade that pump, weave, or appear soft or muddy should be scarified, dried and compacted, or overexcavated and backfilled with structural granular fill per Section 8.4. If a significant length of time passes between fill placement and commencement of construction operations, or if significant traffic has been routed over these areas, the subgrade should be similarly proof-rolled before slab construction. It is recommended that a member of our geotechnical engineering staff observe the proof-roll operation.

8.4 Fills

8.4.1 Structural fills should be constructed on a subgrade that has been prepared in accordance with the recommendations in Section 8.2 of this report. Structural fills should be installed in horizontal lifts not exceeding approximately eight inches in thickness and should be compacted to at least 92% of the maximum dry density fo. the native silt soils or for imported granular material. Compaction should be referenced to ASTM D-1557 (Modified Proctor). The compaction criteria may be reduced to 85% in landscape, planter, or other non-structural areas.

8.4.2 During dry weather when moisture control is possible, structural fills may consist of native material, free of topsoil, debris and organic matter, which can be compacted to the preceding specifications. However, if excess moisture causes the fill to pump or weave, those areas should be scarified and allowed to dry. The soil should then be recompacted, or removed and backfilled with compacted granular fill as discussed in Section 8.2 of this report.

8.4.3 The native, non-organic silt would generally be acceptable for structural fills if properly moisture conditioned. Near-surface moisture contents at the time of the field investigation ranged from approximately 24.5% to 31.9%. Based on past experience, optimum moisture content for the near-surface silty soils is approximately 15% at a maximum dry density of approximately 105 pcf.

8.4.4 During wet-weather grading operations, Geocon Northwest recommends that fills consist of well-graded granular soils (sand or sand and gravel) that do not contain more than 5% material by weight passing the No. 200 sieve. In addition, it is usually desirable to limit this material to a maximum six inches in diameter for future ease in the installation of utilities.

8.5 Cut and Fill Slopes

8.5.1 Cut slopes less than eight feet in height should be sloped no steeper than 2H:1V. These values assume that the slopes will be protected from erosion and that significant drainage will not occur over the face of the slope. They further assume that no loads will be imposed within a horizontal distance of one-half of the slope height measured from the top of the slope face. Cut slopes should be constructed with a smooth bucket excavator to minimize subgrade disturbance. Slope drainage may be required if springs, seeps, or groundwater are encountered. Cut slopes greater than eight feet should be designed on an individual basis.

8.5.2 If fills are placed in areas where ground slopes exceed 5H:1V, the fills should be keyed and benched into existing native, undisturbed non-organic soil. Fill slopes should be obtained by placing and compacting material beyond the design slope and then excavated back to the desired grade or by other means that will result in a dense, compacted sloped face. Filled slopes should not be graded steeper than 2H:1V. The face of the fill slope should be protected from erosion by applying vegetation or other approved erosion control material as soon as practicable after construction. Fill compaction should be as stated in Section 8.4. Subdrains are recommended in the lower portions of the slope fill. If slopes higher than ten feet above the original grade are proposed, Geocon Northwest should be contacted to evaluate slope stability conditions.

8.5.3 As previously mentioned in Section 7 of this report, it is anticipated that the area required to properly slope the proposed excavation is not adequate without encroaching upon existing structures and utilities. Geocon Northwest should be consulted for subsequent shoring analyses as the project plans are finalized.

8.6 Surface and Subsurface Drainage

8.6.1 During site contouring, positive surface drainage should be maintained away from foundation and pavement areas. Additional drainage or dewatering provisions may be necessary if soft spots, springs, or seeps are encountered in subgrades. Where possible, surface runoff should be routed independently to a storm water collection system. Surface water should not be allowed to enter subsurface drainage systems.

8.6.2 It is anticipated that the finished grade of the proposed addition will be at or below the existing grade. Subsurface drainage systems are recommended for those locations of the addition that will have finished grade more than one foot below the existing grade. An underslab drainage system should be constructed with a minimum 8-inch thick layer of granular fill (less than 5% by weight passing the No. 200 sieve). It is recommended that the underslab drainage system consist of 4-

inch diameter PVC perforated pipe placed within the granular fill at 10 to 15-foot centers beneath the building footprint. The PVC pipe should be wrapped with a geotextile filter fabric. The underslab drainage system should be constructed to drain by gravity. Figure 4 presents a cross-section of the underslab drainage system.

8.6.3 Drainage systems should be sloped to drain by gravity to a storm sewer or other positive outlet.

8.6.4 Drainage and dewatering systems are typically designed and constructed by the contractor. Failure to install necessary subsurface drainage provisions may result in premature foundation or pavement failure.

8.7 Foundations

8.7.1 Mat foundation support for proposed structures may be obtained from the near-surface non-organic silt soil or from structural fill installed in accordance with our recommendations.

8.7.2 The mat foundation should extend at least 18 inches below the lowest adjacent pad grade. A mat foundation that is founded on firm native soils or engineered fill may be designed for an allowable soil bearing pressure of 800 pounds per square foot (psf).

8.7.3 Due to the presence of the soft silt layer at or near the base of the mat foundation, the subgrade should be overexcavated at least 12 inches and covered with a non-woven geotextile fabric. The fabric should have the minimum properties as shown in Table 3. The overexcavation should then be backfilled with granular fill (less than 5% by weight passing the No. 200 sieve) and statically compacted to at least 92% of the maximum dry density as determined by ASTM D1557.

Table 3: Minimum Non-woven Geotextile Fabric Properties

Property	*Minimum Value*
Puncture Resistance (ASTM D3787)	110 lbs
Mullen Burst Strength (ASTM D3786)	425 psi
Trapezoidal Tear Strength (ASTM D4533-85)	65 lbs

8.7.4 Spread and wall footings may be utilized for those portions of the building that are located at or above existing grade. It is recommended that the footings have a minimum width of 18 inches and a minimum depth of embedment below finish subgrade of 18 inches. An allowable soil bearing pressure of 1,500 psf is recommended for spread and wall foundations.

8.7.5 The allowable bearing pressure given above in Paragraph 8.7.2 and 8.7.4 may be increased by one-third for short term transient loading, such as wind or seismic forces.

8.7.6 Lateral loads may be resisted by sliding friction and passive pressures. A base friction of 40% of the vertical load may be used against sliding. An equivalent fluid weight of 275 pcf may be used to evaluate passive resistance to lateral loads.

8.7.7 Foundation settlements for the loading conditions expected for this project are estimated to be less than one inch, with not more than one-half inch occurring as differential settlement.

8.7.8 Geocon Northwest recommends that foundation drains be installed at or below the elevation of perimeter of the foundation to intercept potential subsurface water that may migrate under the building area.

8.7.9 It is understood that pile foundations may also be considered for building support. Preliminary pile capacities are presented to assist in evaluating the feasibility of pile foundations. It is recommended that steel pipe piles or H piles be driven to refusal within the underlying basalt rock to obtain an allowable axial capacity of 100 tons. Results of the current field investigation and review of previous geotechnical reports prepared in the near vicinity suggest that pile foundations will need to extend to depths of approximately 40 to 50 feet below existing grade. Pile foundations having a minimum diameter of 10 inches may be designed for an allowable uplift capacity of 20 tons per pile. Geocon Northwest should be contacted to provide additional recommendations if pile foundations will be used.

8.8 Concrete Slabs-on-Grade

8.8.1 Subgrades in floor slab areas outside the mat foundation should be prepared in accordance with Section 8.2 of this report. Floor slab areas should be proof-rolled with a fully loaded 10- to 12- yard dump truck to detect areas that pump, weave, or appear soft or muddy. When detected these areas should be overexcavated and stabilized with compacted granular fill.

8.8.2 A minimum six-inch thick layer of compacted ¾-inch minus material should be installed over the prepared subgrade to provide a capillary barrier and to minimize subgrade disturbance during construction. The crushed rock or gravel material should be poorly-graded, angular, and contain no more than 5% by weight passing the No. 200 Sieve.

8.8.3 A modulus of subgrade reaction of 100 pci is recommended for design.

8.8.4 The fine-grained near-surface soils at the site have high natural moisture contents and low permeability. These characteristics indicate that high ground moisture may develop under floor slabs during the life of the project. The difference in moisture content between the air in the subgrade soil and the air in the finished building may cause water vapor to travel upward. The resulting water vapor pressure will force migration of moisture through the slab. This migration can result in the loosening of flooring materials attached with mastic, the warping of wood flooring, and in extreme cases, mildewing of carpets and building contents. To retard the migration of moisture through the floor slab, Geocon Northwest recommends installing a vapor retarding membrane below the crushed rock under-slab section where moisture-sensitive floor coverings are installed. A 10-mil polyethylene retarder should be placed on the subgrade soil prepared per Section 7.2 of this report. A minimum 6-inch under-slab section of crushed rock should be placed above the vapor retarder and below the floor slab. Alternatively, a 6 mil polyethylene retarder may be used in conjunction with a thin layer of sand placed between the membrane and overlying crushed rock section to protect the barrier from punctures during construction.

8.9 Retaining Walls

8.9.1 The relatively weak underlying soil conditions require that any proposed retaining structures be evaluated on an individual basis. Geocon Northwest should be consulted to conduct analyses and give recommendations regarding bearing capacity, global stability, lateral earth pressures, drainage, and backfill for retaining structures when project plans become finalized.

8.9.2 Basement walls should be designed for an equivalent fluid weight of 45 pcf for level backfill and 60 pcf for a backfill slope of 2H:1V. The basement walls should be provided with drainage to reduce lateral pressures that may accumulate behind the wall. Wall drains, consisting of 4-inch diameter PVC perforated pipe, should be positioned near the base of the wall/mat footing and should be protected by a filter fabric to prevent internal soil erosion and potential clogging.

8.9.3 Backfill used behind the basement walls should consist of free-draining granular material. Open-graded crushed rock with less than 5% by weight passing the No. 200 sieve is recommended for wall backfill. Backfill placed within five feet of the wall should be compacted with lightweight hand-operated equipment. Wall backfill should be compacted to 90% relative compaction per ASTM 1557.

8.10 Utility Excavations

8.10.1 Based on the subsurface explorations, difficult excavation characteristics are not anticipated. However, based on past construction projects in the site vicinity, trench caving and sloughing was observed in trench excavations as shallow as five feet.

8.10.2 Excavations deeper than four feet, or those that encounter groundwater, should be sloped or shored in conformance with OSHA regulations. Shoring systems are typically contractor designed.

8.10.3 It is possible that perched or static groundwater could be within the top five feet of the ground surface. Therefore, excavation dewatering may be necessary if substantial flow of groundwater is encountered. Dewatering systems are typically designed and installed by the contractor.

8.11 Pavement Design

8.11.1 Near surface soil samples were evaluated to determine pavement design parameters. A CBR of 3 at 95% compaction and a resilient modulus of 4,500 were used for pavement design.

8.11.2 Alternate pavement designs for both asphalt and portland cement concrete (pcc) are presented in Tables 4 and 5. Pavement designs have been prepared in accordance with accepted AASHTO design methods. A range of pavement designs for various traffic conditions is provided in the tables. The designs assume that the top eight inches of pavement subgrade will be compacted to 95% ASTM D-1557. Specifications for pavement and base course should conform to current Oregon State Department of Transportation specifications. Additionally, the base rock should contain no more than 5% by weight passing a No. 200 Sieve, and the asphaltic concrete should be compacted to a minimum of 91% of ASTM D2041.

Table 4: Asphalt Concrete Pavement Design

Approximate Number of Trucks per Day (each way)	*Approximate Number of 18 Kip Design Axle Load (1000)*	*Asphalt Concrete Thickness (inches)*	*Crushed Rock Base Thickness (inches)*
Auto Parking	10	2.5	8
5	22	3.0	8
10	44	3.0	10
15	66	3.5	10
25	110	4.0	10
50	220	4.0	12
100	440	4.5	12
150	660	5.0	13

Table 5: Portland Cement Concrete Paveme Design

Approximate Number of Trucks per Day (each way)	*Approximate Number of 18 Kip Design Axle Load (1000)*	*P.C.C. Thickness (inches)*	*Crushed Rock Base Thickness (inches)*
25	110	6.0	6
50	220	7.0	6
100	440	8.0	6
150	660	8.5	6
200	880	8.5	6
250	1100	9.0	6

Pavement sections were designed using AASHTO design methods, with an assumed reliability level (R) of 90%. Terminal serviceability of 2.0 for asphaltic concrete, and 2.5 for portland cement concrete were assumed. The 18 kip design axle loads are estimated from the number of trucks per day using State of Oregon typical axle distributions for truck traffic and AASHTO load equivalency factors, and assuming a 20 year design life. The concrete designs were based on a modulus of rupture equal to 550 psi, and a compressive strength of 4000 psi. The concrete sections assume plain jointed or jointed reinforced sections with no load transfer devices at the shoulder.

8.11.3 If possible, construction traffic should be limited to unpaved and untreated roadways, or specially constructed haul roads. If this is not possible, the pavement design should include an allowance for construction traffic.

9 FUTURE GEOTECHNICAL SERVICES

The analyses, conclusions and recommendations contained in this report are based on site conditions as they presently exist, and on the assumption that the subsurface investigation locations are representative of the subsurface conditions throughout the site. It is the nature of geotechnical work for soil conditions to vary from the conditions encountered during a normally acceptable geotechnical investigation. While some variations may appear slight, their impact on the performance of structures and other improvements can be significant. Therefore, it is recommended that Geocon Northwest be retained to observe portions of this project relating to geotechnical engineering, including site preparation, grading, compaction, foundation construction and other soils related aspects of construction. This will allow correlation of observations and findings to actual soil conditions encountered during construction and evaluation of construction conformance to the recommendations put forth in this report.

A copy of the plans and specifications should be forwarded to Geocon Northwest so that they may be evaluated for specific conceptual, design, or construction details that may affect the validity of the recommendations of this report. The review of the plans and specifications will also provide the opportunity for Geocon Northwest to evaluate whether the recommendations of this report have been appropriately interpreted.

10 LIMITATIONS

Unanticipated soil conditions are commonly encountered during construction and cannot always be determined by a normally acceptable subsurface exploration program. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Northwest should be notified so that supplemental recommendations can be given.

This report is issued with the understanding that the owner, or his agents, will ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans.

The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review should such changes occur.

If you have any questions regarding this report, or if you desire further information, please contact the undersigned at (503) 626-9889.

GEOCON NORTHWEST, INC.

Bryan Wavra

Bryan Wavra
Engineering Staff

Wesley Spang

Wesley Spang, Ph.D., P.E.
President

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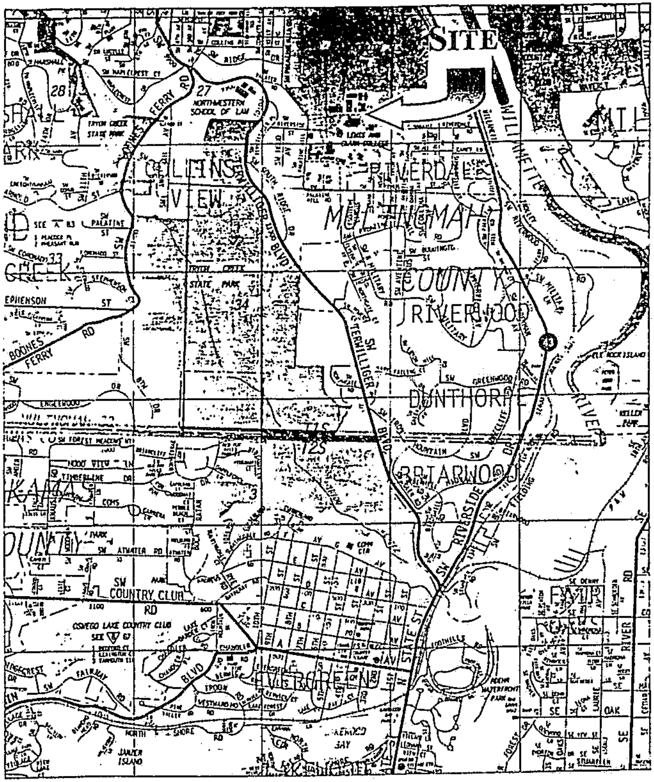

SOURCE: 2000 THOMAS BROTHERS MAP
PORTLAND METROPOLITAN AREA

N
NO SCALE

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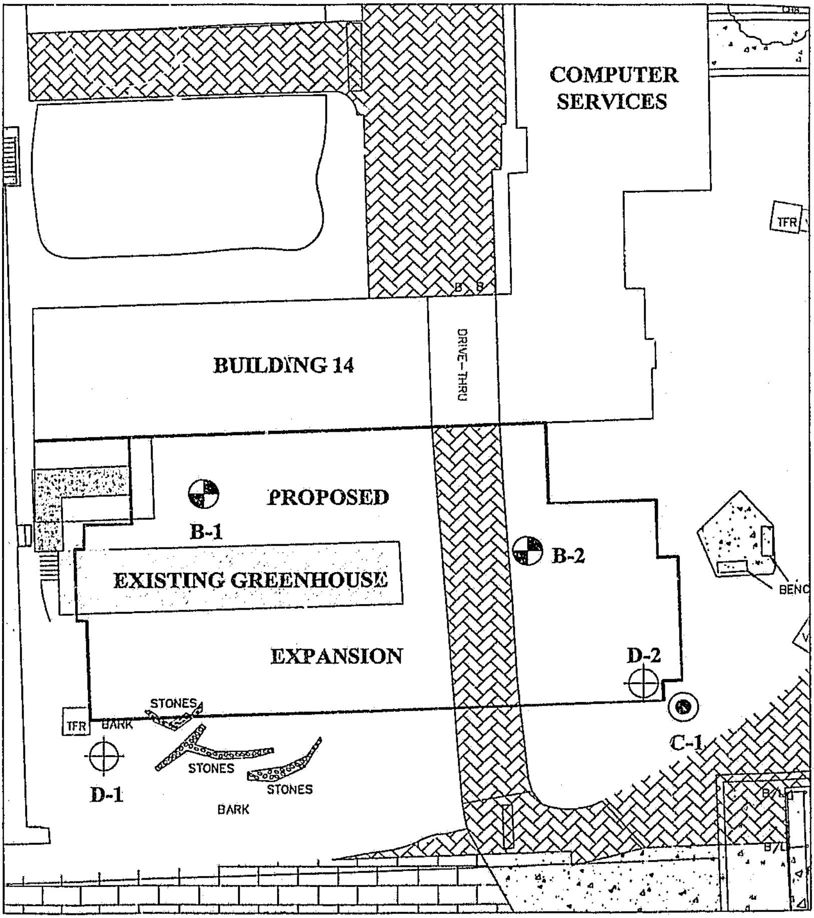
HD / RSS		DSK / D000D

SITE VICINITY
ALBANY QUADRANGLE RENOVATION/EXPANSION
LEWIS & CLARK COLLEGE
PORTLAND, OREGON

11/8/2000	P1059-05-01	FIG. 1



APPROXIMATE LOCATION OF EXPLORATIONS

- BORING
- DILATOMETER
- CONE PENETROMETER

N

SITE PLAN

ALBANY QUADRANGLE RENOVATION/EXPANSION
LEWIS AND CLARK COLLEGE
PORTLAND, OREGON

11/8/2000	P1059-05-01	FIGURE 2

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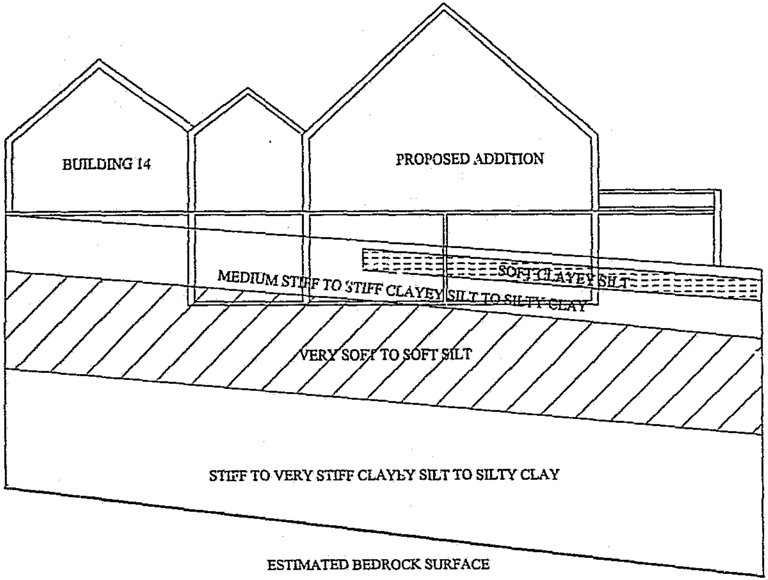

APPROXIMATE SCALE: 1"=16'

SUBSURFACE PROFILE

ALBANY QUADRANGLE EXPANSION AND RENOVATION

11/8/2000 | P1059-05-01 | FIGURE 3

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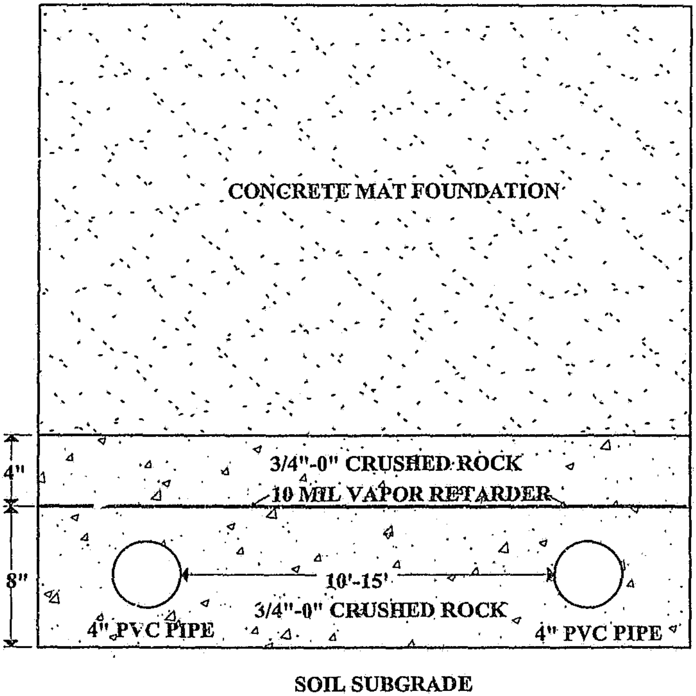

NOT TO SCALE

UNDERSLAB DRAINAGE SYSTEM

ALBANY QUADRANGLE
EXPANSION AND RENOVATION

11/8/2000 | P1059-05-01 | FIGURE 4

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APPENDIX A

FIELD INVESTIGATION

The field exploration was completed on October 11 and 20, 2000 and consisted of two exploratory borings, two dilatometer soundings, and one cone penetrometer sounding.

The borings were drilled with a trailor mounted drill rig equipped with a solid stem auger. Standard penetration tests (SPT) were conducted at regular intervals within the borings. Disturbed bag samples were collected with a split spoon sampler and returned to the laboratory for further testing. Subsurface conditions encountered were logged by a member of Geocon Northwest's geotechnical staff.

Cone penetration tests were advanced in the locations shown in Figure 2. Data was recorded every four inches along the length of the soundings. Shear waves were introduced at the ground surface at one-meter intervals. A shear wave velocity profile is provided in the following pages.

The dilatometer sounding was assisted by services subcontracted by Geocon Northwest. A member of Geocon Northwest's geotechnical engineering staff recorded dilatometer readings every eight inches along the sounding.

Subsurface logs of the conditions encountered are presented in the following pages. Both solid and dashed contact lines indicated on the logs are inferred from soil samples and drilling characteristics and should be considered approximate.

PROJECT NO. P1059-05-01

BORING B 1

ELEV. (MSL.) 405 ft DATE COMPLETED 10/20/00

EQUIPMENT TRLR MT. HOL. STEM

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			Angular pea gravel underlain by approximately 6" topsoil			
3	B1-1			5		25.5
4			Medium stiff to stiff, moist to wet, rust/gray/brown, Clayey SILT to Silty CLAY with trace of fine-grained sand			
5.5	B1-2	ML/CL		9		27.6
8	B1-3			15		30.9
10	B1-4			3		34.0
11			Very soft to soft, saturated, brown, Clayey SILT with trace of fine-grained sand			
13	B1-5			2		33.0
15	B1-6	ML		2		34.4
18	B1-7			2		34.7
20	B1-8			4		30.9
23	B1-9	ML	Medium stiff to stiff, saturated, greenish-gray, Clayey SILT with trace of fine-grained sand	5		28.1
25	B1-10			8		32.2
28		CL				

Figure A-1, Log of Boring-B 1

AOE

SAMPLE SYMBOLS
☐ ... SAMPLING UNSUCCESSFUL ◨ ... STANDARD PENETRATION TEST ■ ... DRIVE SAMPLE (UNDISTURBED)
⊠ ... DISTURBED OR BAG SAMPLE ◩ ... CHUNK SAMPLE ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. P1059-05-01

BORING B 1

ELEV. (MSL.) 405 ft DATE COMPLETED 10/20/00

EQUIPMENT TRLR MT. HOL. STEM

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B1-11					18		24.8
32				CL	Very stiff, saturated, greenish-gray, Silty CLAY with trace of highly weathered basalt			
34								
36	B1-12					19		24.1
					BORING TERMINATED AT 36.5 FEET GROUNDWATER WAS NOT MEASURED			

Figure A-2, Log of Boring-B 1

AQE

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. P1059-05-01

BORING B 2

ELEV. (MSL.) 403 ft DATE COMPLETED 10/20/00

EQUIPMENT TRLR MT. HOL. STEM

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			Landscape bark underlain by approximately 12" TOPSOIL			
2	B2-1	CL/ML	Soft, moist to wet, rust/brown, Silty CLAY to Clayey SILT with trace of fine-grained sand	4		24.5
4	B2-2			3		22.3
6			-Trace of organics			
8	B2-3	ML	Medium stiff to stiff, moist to wet, rust/light gray, Clayey SILT with a trace of fine-grained sand	8		31.6
10	B2-4		-Color change to brown	10		29.1
12	B2-5			5		31.9
14	B2-6	ML	Very soft to soft, saturated, brown, Clayey SILT with trace of fine-grained sand	2		35.3
16						
18	B2-7			3		31.8
20	B2-8			3		31.8
22	B2-9			3		32.6
24						
26	B2-10			3		30.1
28	B2-11			6		31.1

Figure A-3, Log of Boring-B 2

AQE

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. P1059-05-01

BORING B 2

ELEV. (MSL.) 403 ft DATE COMPLETED 10/20/00

EQUIPMENT TRLR MT. HOL. STEM

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B2-12		▼	CL	Medium stiff, saturated, gray, Silty CLAY	6		31.7
32								
34								
36	B2-13				Hard, saturated, gray to dark gray, Silty CLAY with highly weathered basalt	30		20.3

BORING TERMINATED AT 36.5 FEET

Figure A-4, Log of Boring-B 2

AQE

SAMPLE SYMBOLS		
☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
⊠ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Albany Quadrangle Expansion/Renovation

Operator: W.MCC / A.MEE
Sounding: SND181
Cone Used: 442 TC

CPT Date/Time: 10-11-00 12:05
Location: CPT-1 LEWIS&CLK
Job Number: LEWIS & CLARK

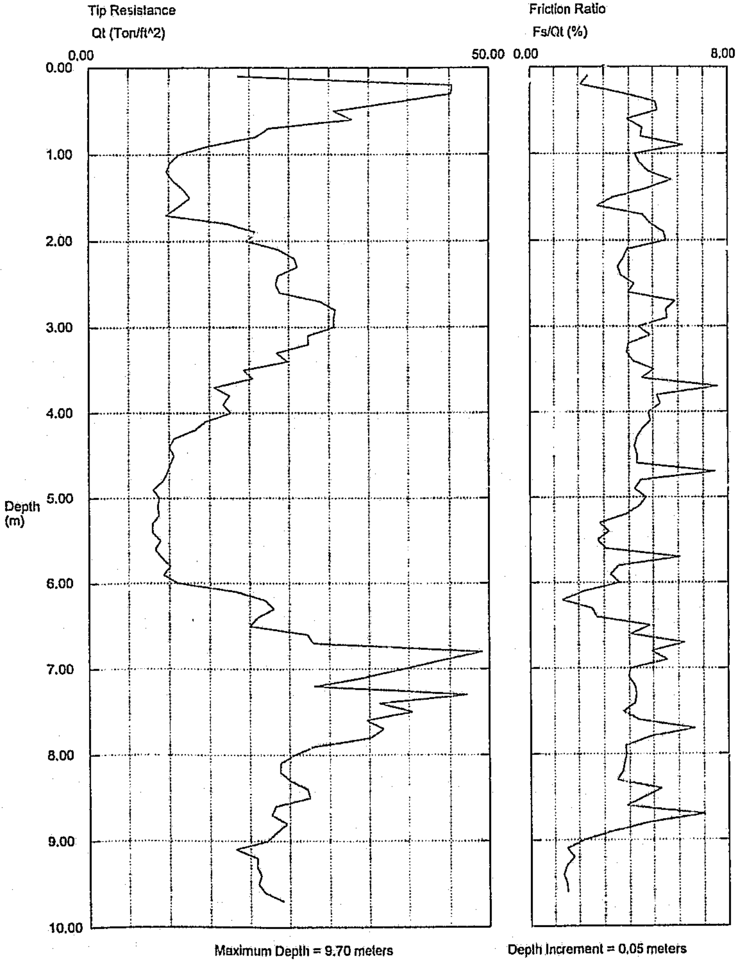

Figure A-5

Albany Quadrangle Expansion/Renovation
Shear Wave Velocity Profile

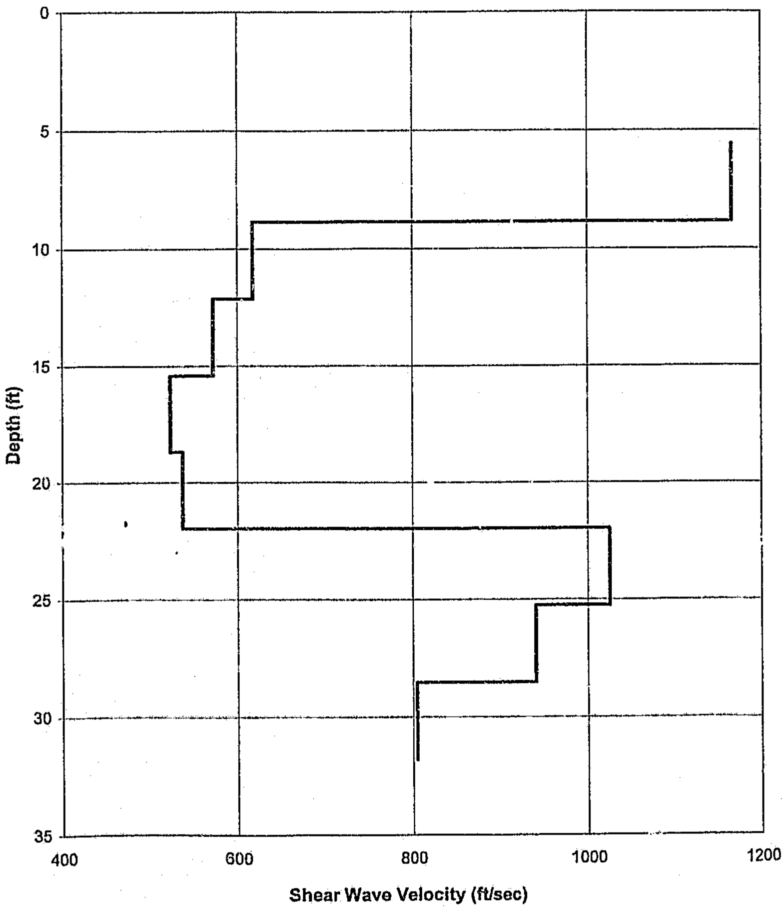

Figure A-6

Albany Quadrangle Expansion/Renovation
Dilatometer Sounding #1

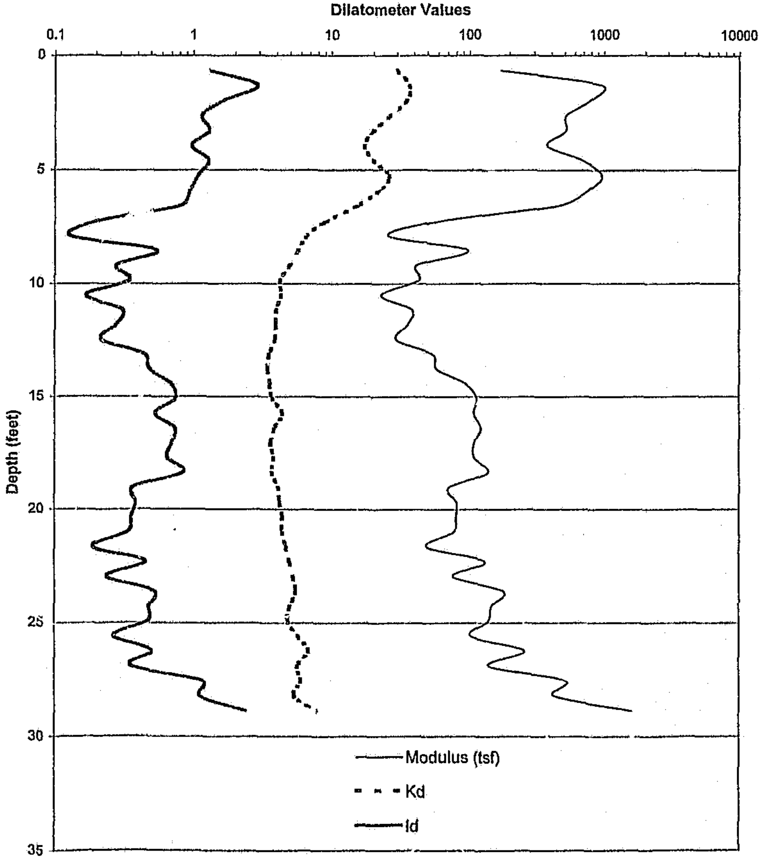

Figure A-7

Albany Quadrangle Expansion/Renovation
Dilatometer Sounding #2

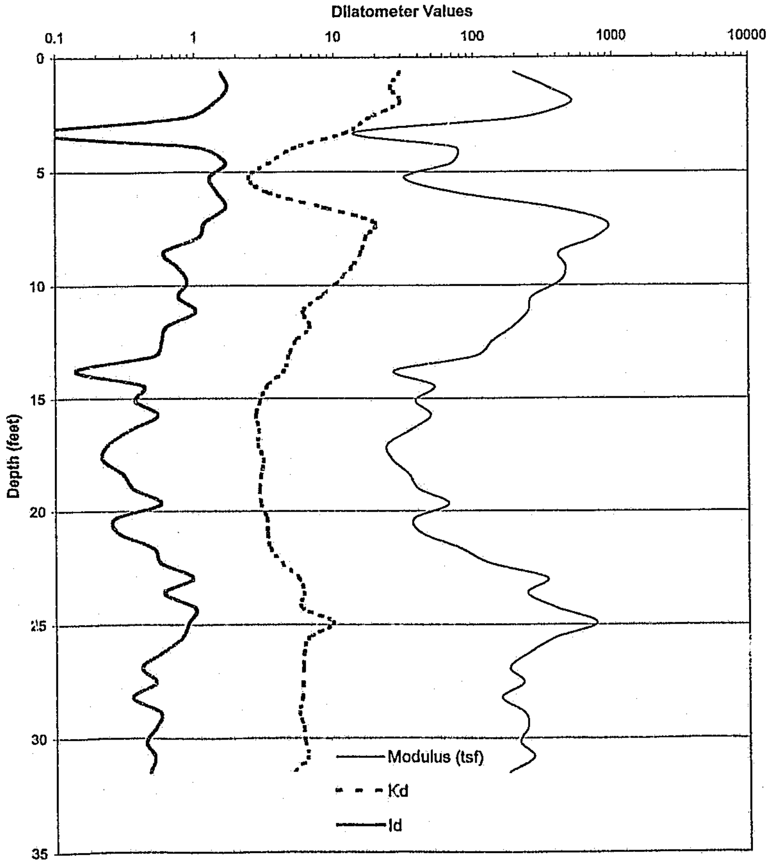

Figure A-8

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected soil samples were tested for their in situ moisture content and grain size distribution. Moisture contents are indicated on the boring logs in Appendix A. The results of the grain size distribution laboratory tests performed are summarized in tabular form on the following tables.

TABLE B-1
SUMMARY OF PARTICLE DISTRIBUTION RESULTS
ASTM D421 and D422

Sample Number	*Depth (ft)*	*% Gravel*	*% Sand*	*% Silt*	*% Clay*	*USCS Classification*
B1-5	12.5-14.0	0.0	16.8	65.9	17.3	ML

TABLE B-2
SUMMARY OF PLASTICITY INDEX TEST RESULTS
ASTM D4318

Sample Number	*Depth (ft)*	*Liquid Limit*	*Plastic Limit*	*Plasticity Index*	*USCS Classification*
B2-7	17.5-19.0	28	27	1	ML