GEOTECHNICAL INVESTIGATION FOR
PROPOSED HARRISON HALL
SW HARRISON STREET (ABANDONED SECTION)
BETWEEN 11TH AND 12TH
PORTLAND STATE UNIVERSITY CAMPUS
PORTLAND, OREGON

Prepared For:

Mr. Burt Ewart
Special Projects Architect
Facilities Department
P.O. Box 751
Portland State University
Portland, Oregon 97207

AGI Project No. 30,438.001
July 26, 1994

30,438.001

Mr. Burt Ewart
Special Projects Architect
Facilities Department
P. O. Box 751
Portland State University
Portland, OR 97207

GEOTECHNICAL INVESTIGATION FOR PROPOSED HARRISON HALL
SW HARRISON STREET (ABANDONED SECTION) BETWEEN 11TH AND 12TH
PORTLAND STATE UNIVERSITY CAMPUS; PORTLAND, OREGON

Dear Mr. Ewart:

This report presents the results of a geotechnical investigation for the design of foundations and floor slab for the proposed Harrison Hall building on the Portland State University Campus. The results of field and laboratory studies are summarized along with comments and recommendations for design. The scope of this study was described in our proposal letter of April 29, 1992. Authorization to proceed was received on June 6, 1994.

BACKGROUND INFORMATION

Site Description

The new building will be located on the PSU Campus in a landscaped area that once was occupied by SW Harrison Street. As shown on the Vicinity Map, Figure 1, the site is south and west of the Portland Central Business District and in the west part of the PSU Campus. With respect to other campus structures, the site is one block west of the Millar Library and one block south of the student dormitory structures constructed in the late 1980's. A 4-story brick apartment building, the Birmingham Building, is 60 feet north and west of the planned location for Harrison Hall.

The site ground surface is relatively level at an elevation varying from 176 to 177 feet above mean sea level. This is 4 to 5 feet above the original finished grade of Harrison Street. The fill used to raise the site grade came from the excavation for the Millar Library addition. Ground cover on the site consists of mowed grass. We understand that the only buried utility that remains in the building area (other than the existing landscape irrigation system) is a storm sewer; this line will be removed during building construction.
Project Description

We understand that Harrison Hall will be a single-story structure with precast concrete facing. It will have plan dimensions of 60 by 128 feet and a finished floor level at elevation 172.25 feet, 4 to 5 feet below the existing site grade. The building will house a multi-purpose meeting hall with seating for approximately 400. The project structural engineer, Dirk Looijenga of Van Domelen/Looijenga/McGarrigle/Knau (VLMK), indicates the foundation loads will be 50 kips (maximum) at the columns and 1.5 to 2 kips per foot at the perimeter continuous footings.

Site History

The proposed building footprint is centered on the right-of-way for the former Harrison Street; hence, perimeter building foundations on the north and south sides will be located outside the old street and sidewalk area. Historic maps and photos indicate that two apartment buildings along Harrison Street at the proposed building site were constructed up to the sidewalk edge. One was near the southwest corner of the proposed building and one was along the west portion of the north building line. The highest potential for buried foundations or filled basements would be in these locations.

WORK SCOPE

The scope of work for this study included exploratory borings, laboratory testing and engineering analyses. The geotechnical issues addressed herein for the Harrison Hall project are:

1. The presence, thickness and character of Man-Made FILL and the alternatives to deal with the FILL at footing locations.
2. Bearing capacity for both isolated and continuous footings.
3. Estimated total and differential settlements of building foundations.
4. Floor slab support recommendations.
5. Subsurface drainage recommendations.

FIELD INVESTIGATION

Exploratory Borings

Our scope of work included four exploratory borings, designated B-1 through B-4 and located as shown on the Exploration Location Plan, Figure 2. The test borings were performed on June 17, 1994 with a solid flight auger drilling rig under subcontract to VanDeHey Soil Exploration of Banks,
Oregon. All borings were made to depth of 31.5 feet; the total footage drilled for this investigation was 126 feet.

Final logs of the test borings are presented in Appendix A on Figures A-1 through A-4. These reflect the descriptions of soil units encountered and their relative depths from the ground surface. The SPT resistance values (N-values) and natural moisture contents of the samples are plotted graphically on the right side of the log. Information relative to groundwater is also presented on the Logs of Borings. A detailed description of the exploration work, including field sampling procedures, is also presented in Appendix A.

LABORATORY TESTING

Classification Testing

All jar samples were visually classified in the laboratory to refine, when necessary, the field soil classification. In addition, natural moisture content tests were made on most samples in accordance with ASTM D2216. The moisture contents are expressed as a percentage of free water lost by evaporation compared to the dry weight of soil. These are presented graphically on the boring logs, Figures A-1 through A-4.

CONSOLIDATION TEST

One consolidation test was performed on a representative sample (Sample S-4, Boring B-3) of the foundation soil. Consolidation testing results in a plot of strain response versus the logarithm of applied normal stress. The load increments are applied to a 1-inch thick specimen and strain readings are taken over the time required for primary consolidation strains to occur. The final plot represents the total strain under each load increment and is used to estimate settlement of soils under structural loads. Final logarithmic plot of stress versus strain for the consolidation test is presented on Figure B-1, Appendix B. An Atterberg limit test was also conducted on Sample S-4, Boring B-3. Test results are presented on Figure B-2.

SUBSURFACE CONDITIONS

Foundation Soil Conditions

The explorations performed for this study encountered relatively uniform subsurface soil conditions across the site. Based on our explorations, the soil conditions may be described in terms of three generalized subsurface units. From the ground surface downward these units are: 1) Man-Made FILL consisting of loose silty SAND and soft to very stiff SILT; 2) Stiff to very stiff SILT; and 3) Medium dense silty fine to very fine SAND. Presented below is a summary of the units encountered; detailed descriptions of the units appear on the boring logs.
Man-Made FILL (Loose to medium dense silty SAND and soft to very stiff SILT): These soils were encountered in all of the exploratory borings from the ground surface to depths of 5 to 7.5 feet. The silty sand was present at the ground surface in all borings to depths of 2.5 to 4.5 feet; abundant grass roots were present in the upper few inches. The silt material below the sand was found to contain some to abundant amounts of concrete, brick and wood debris in small pieces. The thickness of the silt section varied from 2 to 5 feet. Natural water contents ranged from 15 to 35 percent and averaged 20 percent. The average N-value was 15 bpf.

Stiff to very stiff SILT: A brown SILT with traces of fine to very fine sand was present below the FILL soils in all borings. The deposit ranged from 6 to 10 feet thick and extended to maximum depths of 13 to 17 feet. Occasional layers of silty fine to very fine SAND were observed in this deposit. Natural water contents ranged from 9 to 39 percent and averaged 23 percent. N-values ranged from 15 to 22 bpf, averaging 18.5 bpf.

Medium dense silty fine to very fine SAND: Below the SILT deposit to the maximum depth of penetration in all borings (11.5 feet) was silty fine to very fine SAND. The percentage of silt varied considerably but generally decreased with depth. Occasional silt layers were observed in the SAND deposit. Natural water content values were typically in the upper 20's and low 30's but ranged from 14 to 40; the average was 32 percent. The N-values ranged from 9 to 23 bpf and averaged slightly less than 16 bpf.

Groundwater

No free water was observed in the borings during the explorations on June 17, 1994. The regional groundwater table is estimated to be 100 to 150 feet below the surface, based on published regional data.

COMMENTS AND RECOMMENDATIONS

General

The explorations performed for this study encountered relatively uniform subsurface conditions consisting of Man-Made FILL (loose SAND over soft to stiff SILT) overlying stiff to very stiff SILT and then medium dense fine to very fine SAND. The FILL zone was 5 to 7.5 feet thick in the four borings. Thicker areas of fill may exist at utility lines that have been abandoned and where adjacent four and five story apartment house structures existed (west end of site along the proposed north and south building lines). It is not known if all of the apartment house foundations were removed when the structures were demolished or the character of any fill placed within the building footprint. It is anticipated that excavation for the proposed structure to achieve floor and footing subgrade levels will remove most of the Man-Made FILL. However, detailed examination of the excavation bases will be necessary to avoid constructing over localized areas of deeper FILL.

Building loads can be supported on conventional spread footings provided they are constructed on either the native stiff to very stiff SILT or a mat of compacted replacement fill extending down to
native soil. Detailed comments and recommendations for foundations and related project elements are presented in the following sections.

**Spread Footings**

We recommend that spread footings be designed for a maximum allowable soil pressure of 3000 pounds per square foot (psf) when they bear on undisturbed SILT or well-compacted Structural Fill (as defined in a following section) which replaces all Man-Made FILL. All footings should be located at least 18 inches below the lowest adjacent grade for frost protection and bearing/settlement requirements. Minimum foundation dimensions of 18 inches wide for continuous footings and 20 inches square for column footings are recommended.

We recommend that all excavations for foundations be accomplished with a straight-edged bucket to preclude disturbance to bearing surfaces by bucket teeth. Following excavation, the bearing surfaces should be thoroughly cleaned of loosened or disturbed soil, using hand methods, if necessary. The cleaned bearing surfaces should be observed by the Engineer to verify suitable subgrade soils. Lowering the footings to bear on competent material (stiff to very stiff SILT) will be required in those areas where FILL is found below the planned footing grade. Alternatively, the unsuitable material could be overexcavated and replaced with compacted structural fill. A detail with general recommendations for overexcavation and replacement beneath footings is presented on Figure 3.

For footings founded as recommended above, we estimate that the settlement of isolated column footings (50 kip maximum load) will be on the order of 1/2-inch. The estimated settlement of continuous footings with a maximum load of 2 kips per foot is also on the order of 1/2-inch. This assumes that the footing subgrades are protected from disturbance with a 2 to 3 inch working pad of granular material (clean sand or fine crushed gravel, i.e., maximum size 3/4 inch). The granular material should contain less than 5 percent silt or clay and should be compacted with a vibratory compactor prior to placing reinforcing steel. Footing settlements will occur rapidly, probably within a few days after the loads are applied.

**Floor Slabs**

For typical office/classroom floor loads of less than 100 psf, slab-on-grade floor systems may be founded over a 6-inch zone of compacted crushed rock. A 3/4 inch minus crushed rock with a maximum fines content of 2 percent is recommended for the floor base rock material. The 6-inch base rock thickness assumes that no existing Man-Made FILL is present and the subgrade consists entirely of either undisturbed native soil with uniform characteristics or the upper 9 inches is compacted to a minimum of 92 percent of the modified Proctor maximum density (ASTM 1557) and does not yield under wheel loads. For these conditions, a modulus of subgrade reaction of 100 pounds per cubic inch (pci) is recommended for floor design.

If it is necessary to construct floor slabs during wet weather, when moisture control and compaction of the SILT subgrade is not possible, approximately 6 inches of crushed rock will be required in addition to the thicknesses noted above. In this case, the excavation should be made with a straight-edged bucket as recommended for footings.
To protect against the remote possibility of damp floors, a vapor barrier should be considered between the floor slab and base rock layer.

**Drainage**

We recommend that a continuous footing drain be placed around the perimeter of the building and behind any basement/retaining walls for positive subsurface drainage. A recommended perimeter footing drain detail is presented on Figure 4. Connect drains to the storm system. Provide positive surface grades away from the building.

**Retaining Walls**

The project may involve retaining walls in the landscape area. For free-standing walls, designed to deflect at the top, we recommend that lateral equivalent fluid pressures of 35 pounds per cubic foot (pcf) be used for design. For rigid walls, restrained from top deflection, an equivalent fluid pressure of 50 pcf is recommended. Both recommendations assume that the wall backfill will be fully drained, typically granular and no other surcharge effects exist. If cohesive soils will be used for backfill, hydrostatic pressures will be accommodated, the backfill is sloping, and/or surcharge effects from surface loads exist, the lateral pressures will be higher.

**Structural Fill Material**

Unless otherwise discussed in this report (floor slab base rock, for example) Structural fill (i.e., fill placed below footings, floor slabs, pavements, sidewalks, etc.) may consist of on-site, non-organic soils or select, imported granular material as described below. However, the near-surface Man-Made FILL and SILT soils contain a high percentage of fines (particles passing the #200 sieve) such that they will not be compactible to structural fill specifications during periods of wet weather.

Imported structural fill may consist of any non-organic material whose maximum particle size does not exceed 2 inches and which can be compacted to the minimum requirements shown below. We recommend granular materials such as silty sand, sand, reject rock, or crushed rock that are readily compacted to structural fill specifications be used. Import materials should be approved by the engineer prior to its use onsite. For wet weather construction imported structural fill material should consist of free-draining (generally less than 5% passing the No. 200 sieve) granular material (sand, gravelly sand, sandy gravel, or well-graded gravel), free of organics, debris, or other deleterious matter and whose maximum particle size does not exceed 2 inches. The material may be derived from naturally occurring geologic deposits or from crushing operations on bedrock or larger gravel/cobbles/boulders. All particles of the fill should be sound, durable, and unweathered and be capable of withstanding compaction, as specified, and construction traffic without crushing, fracturing, or otherwise altering the original gradation.

**Structural Fill-compaction**

Structural fill should be spread in maximum 9-inch loose lifts for compaction by heavy, self-propelled or tractor-towed compactors and maximum 6-inch loose lifts for light, manually-guided compactors. Each lift should be thoroughly compacted to the required criterion with equipment
suitable to the soil types being compacted. We recommend that the structural fill attain minimum relative compactions based on ASTM D1557 (AASHTO T180), modified Proctor as noted below. Prior to compacting each lift, the fill should be properly moisture conditioned by the uniform addition of water or by drying, as required, to achieve a moisture content which is within ±2 percent of the optimum moisture content as determined by ASTM D1557 (AASHTO T180). All fill surfaces should be firm and may deflect only slightly beneath rubber-tired construction equipment. Fills which rut, pump, or weave should be considered to possess excess moisture and are not acceptable. These should be removed and replaced with fill material of proper moisture content or moisture-conditioned as specified herein.

<table>
<thead>
<tr>
<th>Application</th>
<th>ASTM D1557 Minimum Relative Compaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beneath Foundations</td>
<td>95%</td>
</tr>
<tr>
<td>Beneath Floor Slabs</td>
<td>92%</td>
</tr>
<tr>
<td>Beneath Sidewalks and Pavements</td>
<td></td>
</tr>
<tr>
<td>Within 3 ft. of grade (1)</td>
<td>95%</td>
</tr>
<tr>
<td>Below 3 ft. of grade</td>
<td>92%</td>
</tr>
<tr>
<td>Retaining or Basement Wall Backfill</td>
<td>90%</td>
</tr>
<tr>
<td>Interior Footing Backfill</td>
<td>95%</td>
</tr>
<tr>
<td>Utility Trench Backfill</td>
<td></td>
</tr>
<tr>
<td>a. Upper 3 ft. beneath pavements,</td>
<td>95%</td>
</tr>
<tr>
<td>slabs or structures</td>
<td></td>
</tr>
<tr>
<td>b. Below 3 ft. beneath pavements,</td>
<td>92%</td>
</tr>
<tr>
<td>slabs or within 15 feet of structures</td>
<td></td>
</tr>
<tr>
<td>c. In landscaped areas above pipe</td>
<td>88%</td>
</tr>
<tr>
<td>zone</td>
<td></td>
</tr>
<tr>
<td>Random Site or Landscaping Fill</td>
<td>85%</td>
</tr>
</tbody>
</table>

Notes:

1. Use lightweight, manually guided compactors within 3 feet of all embedded walls.
2. Where conflicts occur between values, the higher percentage shall govern.
3. Imported material should be reviewed by the geotechnical engineer prior to delivery on site.

SEISMIC CONSIDERATIONS

A seismic evaluation of the structure should use Soil Profile Type "S_2" in Table No. 23-J of the Uniform Building Code. A site factor of 1.2 should be used for determining the minimum seismic design forces using the static lateral force design procedure, or the corresponding normalized response spectra from Figure 23-3 with Soil Type 2 could be selected for the dynamic lateral force procedure.
With respect to liquefaction potential during a seismic event, there is no potential for this to occur since the water table is 100 to 150 feet below the ground surface and perched water conditions are not anticipated.

GENERAL NOTES

This report was prepared solely for the Owner and Engineer for the design of the project. We encourage its review by bidders and/or the Contractor as it relates to factual data only (logs of borings and laboratory data). The opinions and recommendations contained within the report are not intended to be nor should they be construed to represent a warranty of subsurface conditions but are forwarded to assist in the planning and design process.

If, during construction, unexpected subsurface conditions are encountered within excavations, we should be notified at once so that we may review such conditions and revise our recommendations, if necessary. We request that we be retained to review the excavation and replacement filling for conformance to our recommendations.

We would be pleased to provide additional input, as necessary, during the design process and to provide on-site observations during construction. Please feel free to contact us for this work as well as for any questions you might have regarding this report.

Sincerely,

AGI Technologies

[Signature]

Robert J. Strazer, P.E.
Principal Engineer

[Signature]

Patrick B. Kelly, P.E.
Staff Consultant

PBK/RJS:

Attachments: Figures 1 through 4
Appendices A and B

[Signature]

Expires 1/96