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GEOTECHNICAL ENGINEERING SERVICES REPORT

For the

PROPOSED LES SCHWAB TIRE STORE
8920 BARBUR BOULEVARD
PORTLAND, OREGON

Prepared for

LS CONSTRUCTION
P.O. Box 667
Prineville, Oregon 97754

Prepared by

PROFESSIONAL SERVICE INDUSTRIES, INC.
6032 N. Cutter Circle, Suite 480
Portland, Oregon 97217
Telephone (503) 289-1778

PSI REPORT NO. 704-15077-1

May 22, 2001

01-142523-CO

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May 22, 2001

Mr. Brian Hudspeth
LS Construction
P.O. Box 667
Prineville, Oregon 97754

Subject: **Geotechnical Engineering Services Report**
Proposed Les Schwab Tire Store
8920 Barbur Boulevard (Rose Motel Site), Portland, Oregon
PSI Report No. 704-15077-1

Dear Mr. Hudspeth:

Professional Service Industries, Inc. (PSI) is pleased to submit our Geotechnical Engineering Services Report for the above-referenced project. The purpose of these services was to assist you, the architect, and the engineer in designing foundations and pavement, and preparing plans and specifications for construction of the proposed tire store. Our evaluation was completed in general accordance with PSI Proposal No. 704-01-P060, dated May 4, 2001. Written authorization for our services was provided by Mr. Larry McMichael, Construction Manager, by signing our proposal on May 7, 2001. We are enclosing this summary report along with our formal detailed geotechnical engineering services report for your review.

Project Description

We understand the proposed development will include removing seven existing wood frame buildings (the Rose Motel) and then constructing a 12,000 square foot tire store and associated asphalt parking lot. A significant amount of fill placement, on the order of 6 to 10 feet, will be necessary to backfill an existing below grade swimming pool and the basement of the hotel office to achieve final site grades.

The proposed building will have 18 to 20-foot high structural masonry walls and a concrete slab on grade with a finish floor elevation of 431.50 feet. Maximum continuous wall and column loads, as provided by Mr. Wright will be 3.3 kips per lineal foot and 50 kips, respectively. The building will not include service bays that are sometimes included in Les Schwab Tire Stores. Asphalt parking areas are anticipated to be subjected to automobile traffic and approximately one heavy truck and trailer per week according to Mr. Hudspeth. An existing 7-foot high concrete retaining wall at the northeast corner of the site will be replaced with a new retaining wall having a maximum height of approximately 7 feet. Final site grades are anticipated to be within 2 feet of existing grade.

Summary of Results

Eight soil borings (B-1 through B-8) were completed in the project area. Boring B-1 through B-5 were located within or adjacent to the proposed building footprint. Borings B-1, B-2 and B-4 were drilled to depths of 21-1/2 feet below existing grade. Borings B-3 and B-5 were relatively shallow and drilled adjacent to borings B-2 and B-4 to obtain relatively undisturbed Dames and Moore ring samples within the upper bearing soils. Boring B-6, B-7 and B-8 were located within the proposed pavement area and were drilled to depths of 6-1/2 feet below existing grade. It should be noted that due to existing improvements some areas of the proposed building and pavement were not accessible to our drill rig.

The general subsurface profile typically consisted of asphalt pavement underlain by silt and silt with sand that extended to the maximum depths of our borings. The asphalt pavement section consisted of about 2 inches of severely distress asphalt underlain by 1 to 4 inches of base rock. The base rock was underlain by mottled to brown to gray silt and silt with sand. The silt soil was very soft to very stiff. Moisture content values of the samples tested ranged from 18 to 33 percent.

The silt encountered at the northeast end of the site is likely to be fill. Its variable consistency (N-value), color change, organic content, and adjacent topographical features indicate the presence of fill. Additionally, significant settlement was observed throughout the site which may also be associated with fill. Groundwater was not encountered within our borings at the time of the site investigation.

Summary of Recommendations

Based on the results of our soil borings, it is our opinion that the proposed building may be supported on conventional shallow spread footings. We recommend that the footings be designed for a net maximum allowable soil bearing pressure of 1,500 pounds per square foot (psf) when founded on undisturbed, medium stiff silt, or on an engineered structural fill placed on this stratum. Based on what we perceived to be soft fill soils encountered in borings B-2, B-3, B-4 and B-5 (northeast corner of the site), we anticipate that some overexcavation may be required beneath footings. The depth of the fill to be excavated through may be as much as 6-1/2 feet below existing grade, based on boring B-4.

The recommended soil bearing pressure may be increased by 1/3 when considering short-term live loads (i.e. due to wind and seismic). Based on maximum column point loads and continuous wall loads of 50 kips and 3.3 kips per linear foot, respectively, we anticipate maximum total static settlement will not exceed 1 inch, with differential settlement less than ½ inch.

We anticipate that the floor slab will be relatively lightly loaded. As such, the floor slab should be supported by 6 inches of well-graded crushed rock with a maximum particle size of 1-1/2 inches. If soft fill soils are encountered, the crushed rock thickness may be increased to at least 12 inches and be underlain by a geotextile stabilization fabric (Mirafi 500X or equivalent) to achieve compaction. Alternatively, during extended periods of dry weather, the soft soils may be moisture conditioned and recompacted to a firm condition.

The on-site silt soils are considered to be highly sensitive to wet weather and construction traffic. If not protected, these soils will be weakened and will not be appropriate for supporting buildings and pavement. We recommend mitigative measures that would include either placing a geotextile stabilization fabric (Mirafi 500X or equivalent) and at least 18 inches of well graded 1-1/2 inch minus crushed rock (generally, three to six inches of crushed rock is sufficient in foot traffic areas) or stabilizing the subgrade with cement treatment. For preliminary planning purposes, we anticipate that treating the upper 12 inches of soil with 5 to 8 percent Portland cement will provide adequate protection from construction traffic.

General

Please refer to the attached report for a more detailed summary of our analyses and recommendations. If we can provide additional assistance, or observation and testing services during construction, please do not hesitate to contact Troy Hull, P.E. at (503) 978-4707 or toll free at (800) 783-6985.

Respectfully Submitted,
Professional Service Industries, Inc.

REGISTERED PROFESSIONAL ENGINEER 19206PE OREGON JULY 15, 1997 TROY M. HULL

EXPIRES: 6/30 01

REGISTERED PROFESSIONAL ENGINEER 5944 OREGON JULY 14 1967 CHARLES R. LANE

ex 12-31-02

Troy Hull, P.E.
Department Manager

Charles R. Lane, P.E.
Sr. Geotechnical Engineer

TH:th

Attachment: Geotechnical Engineering Services Report

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Geotechnical Engineering Services Report

Proposed Les Schwab Tire Center
8920 Barbur Boulevard (Rose Motel Site)
Portland, Oregon
PSI Report No. 704-15077-1
May 22, 2001

1.0 Introduction

Professional Service Industries, Inc. (PSI) has conducted a geotechnical evaluation for the above-referenced project site in general accordance with the scope of work as outlined in our proposal no. 704-01-P060, dated May 4, 2001. Written authorization for our services was provided by Mr. Larry McMichael, Construction Manager for LS Construction, by signing our proposal on May 7, 2001.

2.0 Proposed Construction

General project information was provided by Mr. Brian Hudspeth and Art Young of LS Construction. Building load information was provided by Geoff Wright of Miller Consulting Engineers. Grading information was provided by Tom Sisul with Sisul Engineering. PSI was provided with an existing site plan (SE2), a proposed site plan, a Grading and Erosion Control Plan (C1), and a foundation plan indicating maximum anticipated wall and column loads.

We understand the proposed development will include removing seven existing wood frame buildings (the Rose Motel) and then constructing a 12,000 square foot tire store and associated asphalt parking lot. A significant amount of fill placement, on the order of 6 to 10 feet, will be necessary to backfill an existing below grade swimming pool and the basement of the motel office to achieve final site grades.

The proposed building will have 18 to 20-foot high structural masonry walls and a concrete slab on grade with a finish floor elevation of 431.50 feet. Maximum continuous wall and column loads, as provided by Mr. Wright will be 3.3 kips per lineal foot and 50 kips, respectively. The building will not include service bays that are sometimes included in Les Schwab Tire Stores.

Asphalt parking areas are anticipated to be subjected to automobile traffic and approximately one heavy truck and trailer per week according to Mr. Hudspeth. An existing 7-foot high concrete retaining wall at the northeast corner of the site will be replaced with a new retaining wall having a maximum height of approximately 7 feet. Final site grades are anticipated to be within 2 feet of existing grade.

3.0 Scope of Work

The purpose of our evaluation was to assess the subsurface soil conditions at the site in order to provide appropriate recommendations for site preparation and foundation and pavement section thickness design. In general, our evaluation included the following authorized scope of work items:

3.1 Historical Aerial Photo Review

PSI obtained copies of aerial photos from Oregon Department of Transportation's Geometronics Department. Photos were reviewed for the following dates:

- May 15, 1952
- February 4, 1964
- March 19, 1974
- April 1, 1984
- June 10, 1991

The photos indicate that the Rose Motel has been in place since at least May 15, 1952. No significant grading work appears to have been conducted on the site since the first photo was taken in 1952. The photos listed above are included in the appendix of this report.

3.2 Subsurface Exploration

In order to ascertain soil conditions at the site, eight Standard Penetration Test (SPT) soil borings (B-1 through B-8) were made using our CME75 truck-mounted, hollow-stem, power auger with an automatic hammer. Soil boring locations are shown on the attached Boring Location Plan, Figure 2. Logs of the borings are also attached.

The Standard Penetration Test is performed by driving a 2-inch, O.D., split-spoon sampler into the undisturbed formation located at the bottom of the advanced auger with repeated blows of a 140-pound, pin-guided, automatic hammer falling a vertical distance of 30 inches. The number of blows required to drive the sampler one-foot is a measure of the soil consistency (cohesive soils) and density (non-cohesive soils).

It should be noted that automatic hammers generally produce lower standard penetration test values than those obtained using a traditional safety hammer. Studies have generally indicated that penetration resistances may vary by a factor of 1.5 to 2 between the two methods. We have considered this drilling and testing methodology in our evaluation of soil strength and compressibility.

Continuous SPT samples were taken for the first 11 feet, and then at 5-foot intervals to the termination depths of borings B-1, B-2 and B-4. Dames and Moore ring samples were taken at the bottom of borings B-3 (5 to 6-1/2 feet) and B-5 (3-1/2 to 5 feet). Continuous SPT sampling was conducted for the entire depth (6-1/2 feet) of borings B-6, B-7 and B-8. Samples were identified in the field, placed in sealed containers, and transported to the laboratory for further classification and testing.

3.3 Field & Laboratory Testing

Selected samples of the subsurface soils encountered were returned to our laboratory for further evaluation to aid in classification of the materials, and to help assess their strength and compressibility characteristics. The laboratory evaluation consisted of visual and textural examinations, moisture content tests, sieve analyses, Atterberg limits, triaxial shear, unit weight, moisture-density relationship (Proctor) and California Bearing Ratio (CBR) tests. Results of the tests are shown on the attached boring logs and laboratory test result summary in the Appendix.

3.4 Engineering Analyses

Engineering analyses and recommendations regarding general foundation design including allowable soil bearing pressures, minimum footing depth requirements, and estimates of foundation settlement are included in this report. In addition, recommendations were developed addressing site preparation, design and construction of asphaltic concrete pavement, placement and compaction of fill materials, and site preparation of the floor slab areas.

The geotechnical recommendations presented in this report are based solely on the available project information, building location, and the subsurface materials described in this report. If any of the noted information is incorrect, please inform us in writing so that we may amend the recommendations presented in this report, if appropriate and if desired by the client. PSI will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

The scope of services did not include a Seismic Site Hazard Investigation in accordance with Section 1804.2.1 of the 1998 State of Oregon Structural Specialty Code, or an environmental evaluation for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air, on or below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for information purposes and do not constitute an environmental evaluation of the soils encountered.

4.0 Surface and Subsurface Features

4.1 Site Description

At the time of our field services, the project site contained the Rose Motel, which has been in place since at least 1952. The Rose Motel includes seven wood frame buildings. One building, the motel office, has a basement. A below grade swimming pool is located west of the motel. The existing,asphaltic concrete pavement is severely distressed. A failing (overturning) concrete retaining wall is located at the northeast corner of the site. The site is bordered by Southwest Barbur Boulevard to the northwest, an approximate 1H to 1V downslope and then Southwest Barbur Court to the northeast, retail buildings to the west and Interstate 5 to the southeast.

Evidence of significant settlement of the existing improvements was observed across the site, likely due to soft fill soils used to level the site during construction of the Rose Motel. Indications of settlement include: sidewalks, steps and door openings that are offset up to 2 or 3 inches, concrete foundation walls with settlement cracks, and "rolling" pavement typical of differential settlement.

4.2 Soils and Geology

Soils within the project area typically consist of silt and sandy silts. This soil unit is typically referred to as the Portland Hills Silt. It is derived from the Pleistocene Age catastrophic flooding of the Columbia and Willamette River basins (lower elevations) and from wind blown deposits (higher elevations). This fine-grained unit may be several tens of feet in thickness, and is underlain by highly weathered and then competent basalt bedrock, most likely derived from the Columbia River Basalt Group.

The general soil profile typically consisted of asphalt pavement underlain by silt and silt with sand that extended to the maximum depths of our borings. The asphalt pavement section consisted of about 2 inches of severely distress asphalt underlain by 1 to 4 inches of base rock. The base rock was underlain by mottled to brown to gray silt and silt with sand. The silt soil was very soft to very stiff. Moisture content values of the samples tested ranged from 18 to 33 percent.

The silt encountered at the northeast end of the site is likely to be fill. It's variable consistency (N-values), color change, organic content, and adjacent topographical features indicate the presence of fill. Additionally, significant settlement was observed throughout the site which may also be associated with fill.

4.3 Groundwater

Groundwater was not encountered in the borings at the time of drilling. We anticipate that the groundwater table may rise during months of peak runoff. Variations in groundwater levels should be expected seasonally, annually, and from location to location.

4.4 Seismic Considerations

The site falls within seismic Zone 3 with a seismic zone factor of 0.3 as classified by the 1998 State of Oregon Structural Specialty Code, an amendment to the Uniform Building Code, 1997 edition. Based on the local geology and the soil conditions encountered, we recommend a soil profile type of S_D with site coefficients of $C_a = 0.36$ and $C_V = 0.54$ (Table 16J, 16Q, and 16R, 1998 State of Oregon Structural Specialty Code). The soil profile type recommendation reflects the estimated average soil properties for the top 100 feet of subsurface profile.

5.0 Conclusions and Recommendations

5.1 Geotechnical Discussion

Based on the results of our field work, laboratory evaluation, and engineering analyses, it is our opinion that site development will be influenced by the presence of soft silt fill soils encountered in borings B-2, B-3, B-4 and B-5 that are anticipated to experience total settlement exceeding 1 inch. The location of the fill soils appears to be located primarily within the proposed parking lot east of the new building. However, fill soils may be encountered in other areas of the development, including the footprint of the proposed building. The depth of the fill soils in our borings was up to about 6-1/2 feet below existing grade. We do not recommend the foundations be supported on the variable density fill soils. We recommend that soft fill soils, if encountered within the building foundation areas, be removed by trenching down to the medium stiff native soil. The width of the overexcavation should be equal to the width of the footing plus one foot. The overexcavation should be backfilled with properly compacted, granular structural fill.

5.2 Site Preparation

In general, we recommend that all structural improvement areas be drained of surface water, and stripped of remnants of old foundations and utilities, surface vegetation, topsoil materials, highly saturated or disturbed soil, and any other deleterious materials encountered at the time of construction. Additional site preparation will depend upon the proposed site grades, weather conditions and building features.

All required structural fill materials placed in the building and pavement areas should be moisture conditioned to within 2 percent of optimum moisture content and compacted by mechanical means to a minimum of 95 percent of the material's maximum dry density as determined in accordance with ASTM D 1557 (Modified Proctor). Fill materials should be placed in layers that, when compacted, do not exceed about 8 inches.

Fills on slopes should be properly benched into the existing soil. Horizontal bench lengths should be at least 4 feet. Compacted fill should extend at least 5 feet laterally beyond the edges of footings.

5.2.1 Site Preparation During Dry Weather Construction

During the dry season, prior to the placement of any fills, all exposed subgrade surfaces should be proofrolled with a fully loaded dump truck. Areas found to be soft or otherwise unsuitable for support of structural loads should be overexcavated and replaced with compacted fill as described above.

The on-site, native silt soil could be considered for re-use as structural fill provided it is free from organic materials and debris. However, the moisture content of the on-site soils tested ranged from 20 to 33 percent. Moisture conditioning and some re-working of the on-site soils in order to facilitate compaction should be anticipated. Should wet weather grading be anticipated, use of the on-site soils as structural fill is not recommended. Selected samples of the materials to be used for structural fill should be submitted to our laboratory in order to evaluate the maximum density, optimum moisture content, and suitability of the soil for use as fill.

5.2.2 Site Preparation During Wet Weather Construction

The on-site silt soils are considered to be highly moisture sensitive. If not protected, the soils will be weakened by construction traffic. We recommend mitigative measures that would include either placing a geotextile stabilization fabric (Mirafi 500X or equivalent) and at least 18 inches of well graded 1-1/2 inch minus crushed rock (generally, three to six inches of crushed rock is sufficient in foot traffic areas) or stabilizing the subgrade with cement treatment. For preliminary planning purposes, we anticipate that treating the upper 12 inches of soil with 5 to 8 percent cement will provide adequate protection from construction traffic.

The on-site, native silt soil is considered to be highly moisture sensitive and thus will not be suitable for use as structural fill during wet weather construction. Additional fill material, if needed, during wet weather construction should consist of an all-weather, clean, granular fill containing less than 5 percent material passing the No. 200 sieve, such as sand, crushed rock, or sand and gravel. During wet weather grading operations, all excavations should be performed using a smooth-bladed, tracked backhoe working from areas where material has yet to be removed or from the already placed structural fill. Subgrade areas should be cleanly cut to firm undisturbed soil.

Proofrolling of excavation bottoms is likely not appropriate during wet weather grading in order to avoid disturbance of moisture-sensitive soils. Should construction take place during wet weather, we recommend that a representative of the geotechnical engineer be present to observe the subgrade in order to evaluate whether additional preparation is indicated.

5.3 Excavations

Excavation and construction operations may expose the on-site soils to inclement weather conditions. The stability of exposed soils may rapidly deteriorate due to precipitation or the action of heavy or repeated construction traffic. Accordingly, foundation and pavement area excavations should be adequately protected from the elements, and from the action of repetitive or heavy construction loadings.

5.3.1 Construction Dewatering

Water seepage in excavations should be anticipated during the wet season of the year. For most of the excavations for this project, pumping from sumps outside the limits of the excavation should control water seepage and surface water ponding.

5.3.2 Excavations/Slopes

Temporary earth slopes may be cut near-vertical to heights of 4 feet. Excavations deeper than 4 feet should be performed in accordance with Department of Labor Occupational Safety and Health Administration (OSHA) guidelines. Permanent slopes shall be no steeper than 2 horizontal to 1 vertical, and shall be adequately protected from erosion. Job site safety is the responsibility of the project contractor and the soil types identified above should be verified by the contractor during construction.

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P. This document was issued to better insure the safety of personnel entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavations, or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and, if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal state regulations.

We are providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations.

5.4 Foundation Support

Based on the results of our geotechnical investigation, it is our opinion that the proposed building can be supported on conventional shallow spread footings designed for a maximum allowable soil bearing pressure of up to 1,500 psf, when founded on medium dense, undisturbed silt soil, or on an engineered structural fill placed on this stratum. Based on what we perceived to be soft fill soils encountered in borings B-2, B-3, B-4 and B-5 (northeast corner of the site), we anticipate that some overexcavation may be required beneath footings. The depth of the fill to be excavated through may be as much as 6 feet below existing grade, based on boring B-4. As discussed in Section 5.1, the soft soils should be removed by trenching with a backhoe down to the medium stiff, undisturbed native soil. The width of the overexcavation should be equal to the width of the footing plus one foot. The overexcavation should be backfilled with properly compacted, granular structural fill

The allowable bearing pressure includes a safety factor of 3 and is intended for dead loads and sustained live loads and can be increased by one-third for the total of all loads, including short-term wind or seismic loads. Continuous wall and isolated column footings should be at least 18 and 24 inches in width, respectively. Wall footings should extend to a minimum depth of 18 inches beneath the lowest adjacent exterior grade to provide frost protection. Interior footings can be located at nominal depths compatible with architectural and structural considerations.

Allowable lateral frictional resistance between the base of footings and the subgrade can be expressed as the applied vertical load multiplied by a coefficient of friction of 0.25. In addition, lateral loads may be resisted by an passive earth pressure based on equivalent fluid density of 250 pounds per cubic foot (pcf) on footings poured "neat" against in-situ soils or properly backfilled with granular structural fill, respectively. The passive earth pressure recommendations includes a factor of safety of approximately 1.5, which is appropriate due to the amount of movement required to develop full passive resistance.

We estimate that foundations designed and constructed in accordance with the above recommendations will experience total settlements generally less than 1-inch with differential settlements between columns generally less than ½-inch.

If footings are constructed during wet weather, it may be necessary to protect the foundation excavation bottoms from disturbance during construction activities. In this regard, we recommend that a 3 to 4-inch thickness of crushed rock be placed at the bottom of the footing excavations immediately after the excavation is completed. If footings are constructed during the drier summer months, this crushed rock layer should not be required.

5.5 Floor Slab Support

We anticipate that the floor slab will be relatively lightly loaded. As such, the floor slab should be supported on at least at least 6 inches of well-graded crushed rock (base course) with a maximum particle size not exceeding 1-1/2 inches. Prior to placement of any fill, the floor slab area should be proofrolled with a half-loaded dump truck. The proofroll operation should be observed and documented by a representative of the geotechnical engineer. Where soft soils are encountered, the upper 12 inches of subgrade should be scarified and recompacted. During wet weather construction, recompaction may not be achievable. Instead, a geotextile stabilization fabric (Mirafi 500X or equivalent) and at least 12 inches of crushed rock may be necessary to provide a firm floor slab grade.

Base course material should be moisture conditioned to within 2 percent of optimum moisture content and compacted by mechanical means to a minimum of 95 percent of the material's maximum dry density as determined in accordance with ASTM D 1557 (Modified Proctor). Fill materials should be placed in layers that, when compacted, do not exceed about 8 inches.

The crushed rock should provide a capillary break to limit migration of moisture through the slab. If additional protection against moisture vapor is desired, a vapor retarding membrane may also be incorporated into the design. Factors such as cost, special considerations for construction, and the floor coverings suggest that decisions on the use of vapor retarding membranes be made by the architect and owner.

5.6 Retaining Walls

We understand a 7-foot high retaining wall is planned for the northeast corner of the site. General retaining wall design parameters are provided below. We are available to provide the retaining wall design or to review a design by others to verify our recommendations have been applied appropriately.

Lateral earth pressures on walls, which are not restrained at the top, such as retaining walls, etc., may be calculated on the basis of an equivalent fluid pressure of 40 pcf for level backfill.

Walls that are restrained from yielding at the top may be calculated on the basis of an equivalent fluid pressure of 55 pcf for level backfill. Lateral loads may be resisted by passive pressures acting against footings and by frictional resistance between foundation elements and supporting soils. An equivalent fluid density of 250 pounds per cubic foot (pcf) and a friction factor of 0.25 may be used for design for foundations bearing on and resisted by native soils. The recommended equivalent fluid density includes a factor of safety of 1.5, which is appropriate due to the amount of movement required to develop full passive resistance.

All backfill for retaining walls, foundation walls, etc., should be select granular material (sand and/or sandy gravel). We anticipate that on site material will not be suitable for this purpose and that it will be necessary to import material to the project for structure backfill. All backfill behind walls should be placed in lifts not exceeding 6 inches in loose thickness and compacted to at least 90 percent of the maximum dry density obtainable by the ASTM D-1557 test procedure. Care in the placement of fill behind walls must be taken in order to ensure that undue lateral loads are not placed on the wall.

The recommended lateral pressures do not include the influence of adjacent surcharge loads. Additionally, where groundwater is expected to rise above the bottom of walls, the corresponding hydrostatic pressure must be included in the design. The actual earth pressure on the walls will vary according to material types and backfill materials used and how the backfill is compacted.

5.7 Pavement Section Thickness Recommendations

The following pavement recommendations are presented as preliminary for your consideration. The civil engineer for the project may have more traffic and project design data available than is presently known, and may wish to modify and refine these pavement sections. We will, upon request, be pleased to provide a more detailed pavement design when definite traffic and building plans are available.

Prior to placing the base or leveling course, the subgrade should be proofrolled with a half-loaded dump truck in order to detect areas or pockets of unusually soft material. These areas, if encountered, should be overexcavated and replaced with structural fill.

5.7.1 Asphalt Pavement

Our asphalt pavement section thickness recommendations are based on a recommended California Bearing Ratio (CBR) value of 6 for the firm silt soils based on laboratory testing, and a design life period of 20 years. In order to use a CBR value of 6, it is likely that some pavement areas will require scarification of the upper 12 inches and recompaction to at least 95 percent of the dry density as determined by ASTM D1557. For entrance drives and parking stalls, we assumed traffic will not exceed 10 and 5 equivalent 18-kip single axle loads (ESALs) per day, respectively. If the anticipated traffic exceeds these values, we should be informed so that a specific pavement design can be made for the project, or the design can be modified by the site civil engineer.

A typical asphalt pavement section would be:

Table 1. Typical Asphalt Pavement Section

	Minimum Recommended Thickness	
Material	Entrance Service Roads	Car Parking
Asphalt Pavement (Oregon DOT Class C)	3 inches	2½ inches
Crushed Rock Base (Oregon State Specification)	8 inches	6 inches

Asphalt pavement base course material should consist of a well-graded, 1½-inch or ¾-inch-minus, crushed rock, having less than 5 percent material passing the No. 200 sieve. The base course and asphaltic concrete materials should conform to the requirements set forth in the latest edition of the State of Oregon, Standard Specifications for Highway Construction. Base course material should be moisture conditioned to within 2 percent of optimum moisture content and compacted by mechanical means to a minimum of 95 percent of the material's maximum dry density as determined in accordance with ASTM D 1557 (Modified Proctor). Fill materials should be placed in layers that, when compacted, do not exceed about 8 inches. The asphaltic concrete material should be compacted to at least 92 percent of the material's theoretical maximum density as determined in accordance ASTM D 2041 (Rice Specific Gravity).

5.7.2 Concrete Pavement

We recommend that concrete pavement be designed for a modulus of subgrade reaction of 150 pci. A typical concrete pavement section would be:

Table 2. Typical Concrete Pavement Section

	Thickness	
Material	Entrance Service Roads	Car Parking
Concrete (4,000 psi)	8 inches	4 inches
Leveling Coarse (Sand or All-Weather Base)	2 inches	2 inches

5.8 Drainage Considerations

Any areas of the building which are to be developed below the exterior site grade must be provided with a well-designed, drainage system in order to control hydrostatic pressures against walls, seepage of groundwater through basement walls, etc.

Under no circumstances should surface runoff water be led into foundation drains. Foundation drains should be placed at the base of footings in order to prevent surface and shallow perched water from migrating beneath the footings. Surface run-off from roofs, parking areas, etc., should be tightlined to the storm sewer or other approved disposal areas.

5.9 Construction Monitoring

It is recommended that PSI be retained to examine and identify soil exposures created during project excavations in order to verify that soil conditions are as anticipated. We further recommend that the structural fills be continuously observed and tested by our representative in order to evaluate the thoroughness and uniformity of their compaction. If possible, samples of fill materials should be submitted to our laboratory for evaluation prior to placement of fills on site.

Costs for the recommended observations during construction are beyond the scope of this current consultation. Such future services would be at an additional charge.

6.0 General

Our conclusions and recommendations described in this report are subject to the following general conditions:

6.1 Use of Report

This report is for the exclusive use of the addressee and their representative to use to design the proposed structure described herein and prepare construction documents. The data, analyses, and recommendations may not be appropriate for other structures or purposes. We recommend that parties contemplating other structures or purposes contact us. In the absence of our written approval, we make no representation and assume no responsibility to other parties regarding this report.

6.2 Level of Care

The recommendations contained in this report are based on the available subsurface information obtained by PSI, and design details furnished for the proposed project. If there are any revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the foundation recommendations are required. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the project.

Services performed by the geotechnical engineer for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area. No warranty, expressed or implied, is made.

Respectfully Submitted,

Professional Service Industries, Inc.

REGISTERED PROFESSIONAL ENGINEER 18206PE OREGON JULY 15, 1997 TROY M. HULL

EXPIRES: 6/30 01

REGISTERED PROFESSIONAL ENGINEER 5944 OREGON JULY 14 1967 CHARLES R. LANE

exp 12-31-02

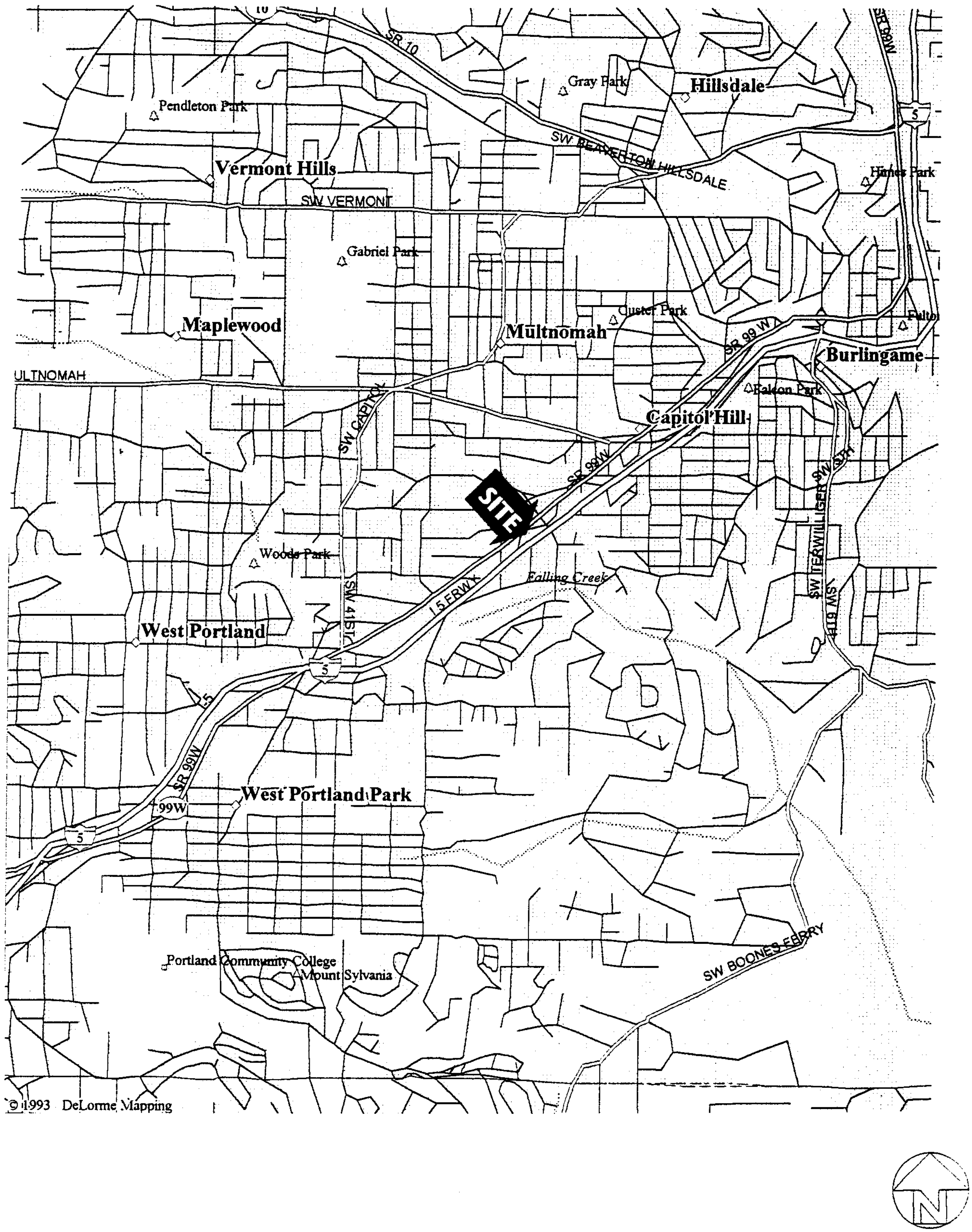
Troy Hull, P.E.
Department Manager

Charles R. Lane, P.E.
Senior Geotechnical Engineer

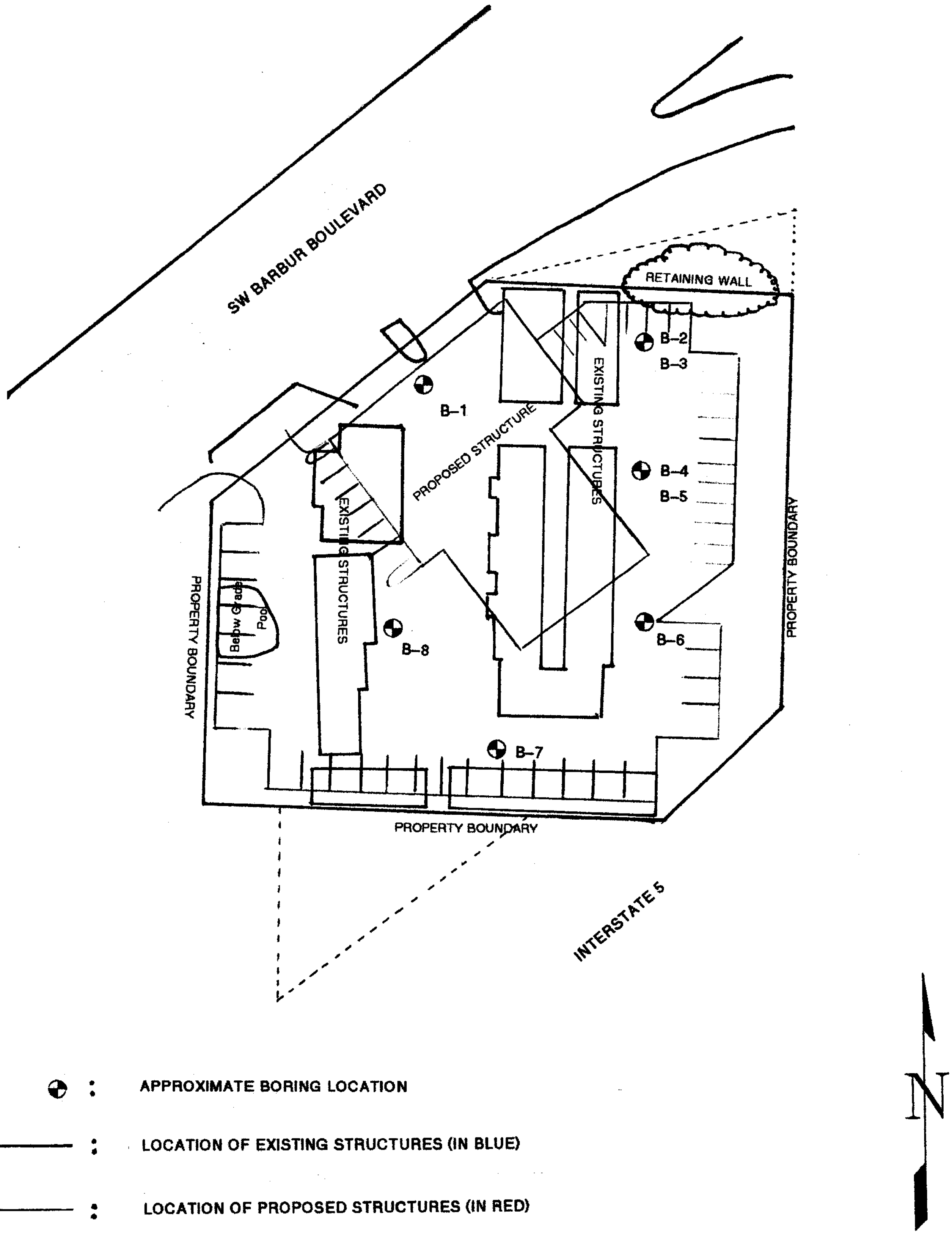
TH:th

s:\groups\704\projects\2001\15077\704-15077-1

APPENDIX



psi	SITE LOCATION MAP PROPOSED LES SCHWAB TIRE CENTER 8920 SW BARBUR BOULEVARD PORTLAND, OREGON	DRAWN BY: A.G. REPORT NO: 704-15077-1 DATE: 05/08/2001 DRAWING: 1



: APPROXIMATE BORING LOCATION

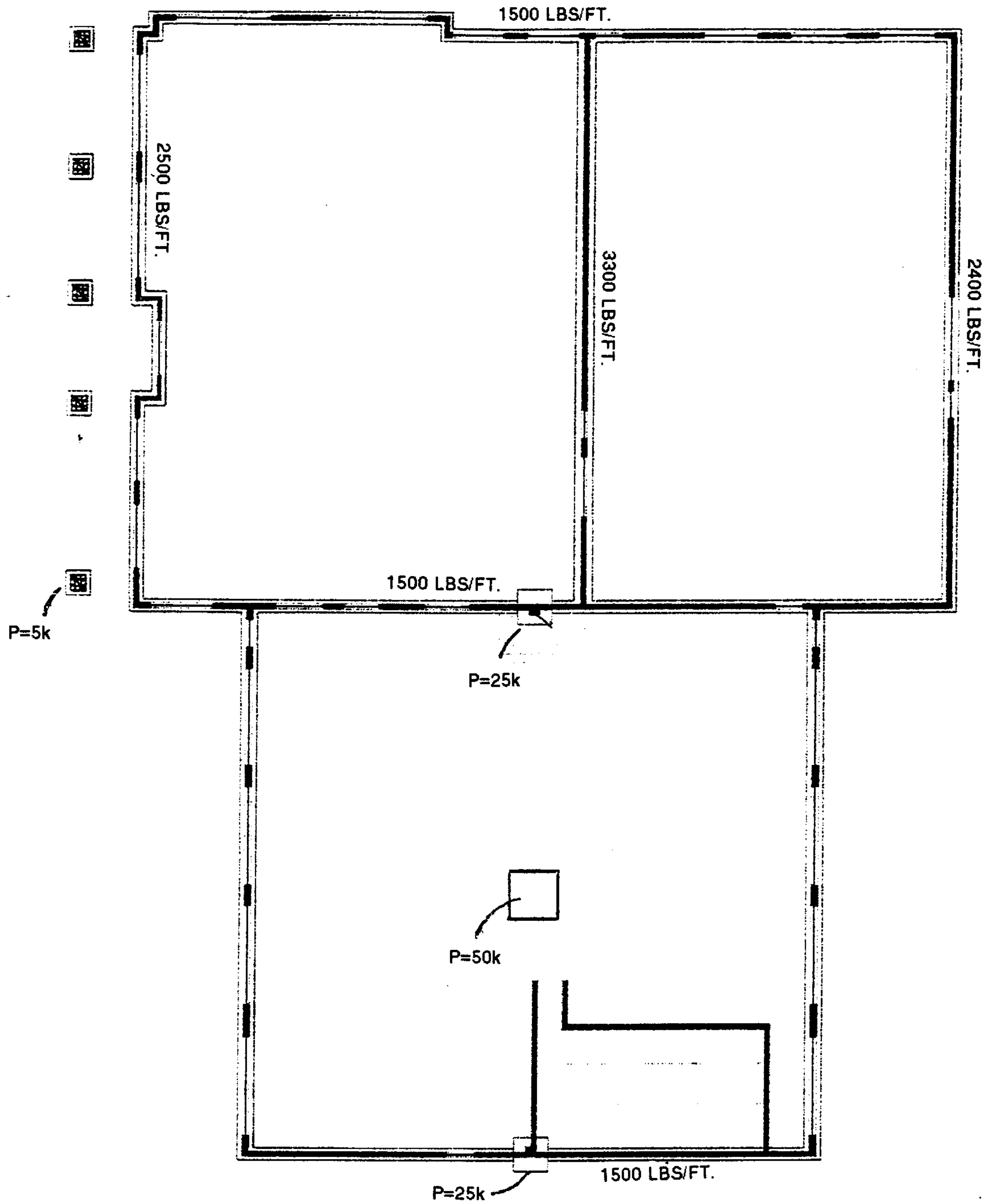
: LOCATION OF EXISTING STRUCTURES (IN BLUE)

: LOCATION OF PROPOSED STRUCTURES (IN RED)

psi

BORING LOCATION MAP
PROPOSED LES SCHWAB TIRE CENTER
8920 SW BARBUR BOULEVARD
PORTLAND, OREGON

DRAWN BY: A.G.
REPORT NO: 704-15077-1
DATE: 05-08-2001
DRAWING: 2



SOURCE: MILLER CONSULTING ENGINEERS DRAWING

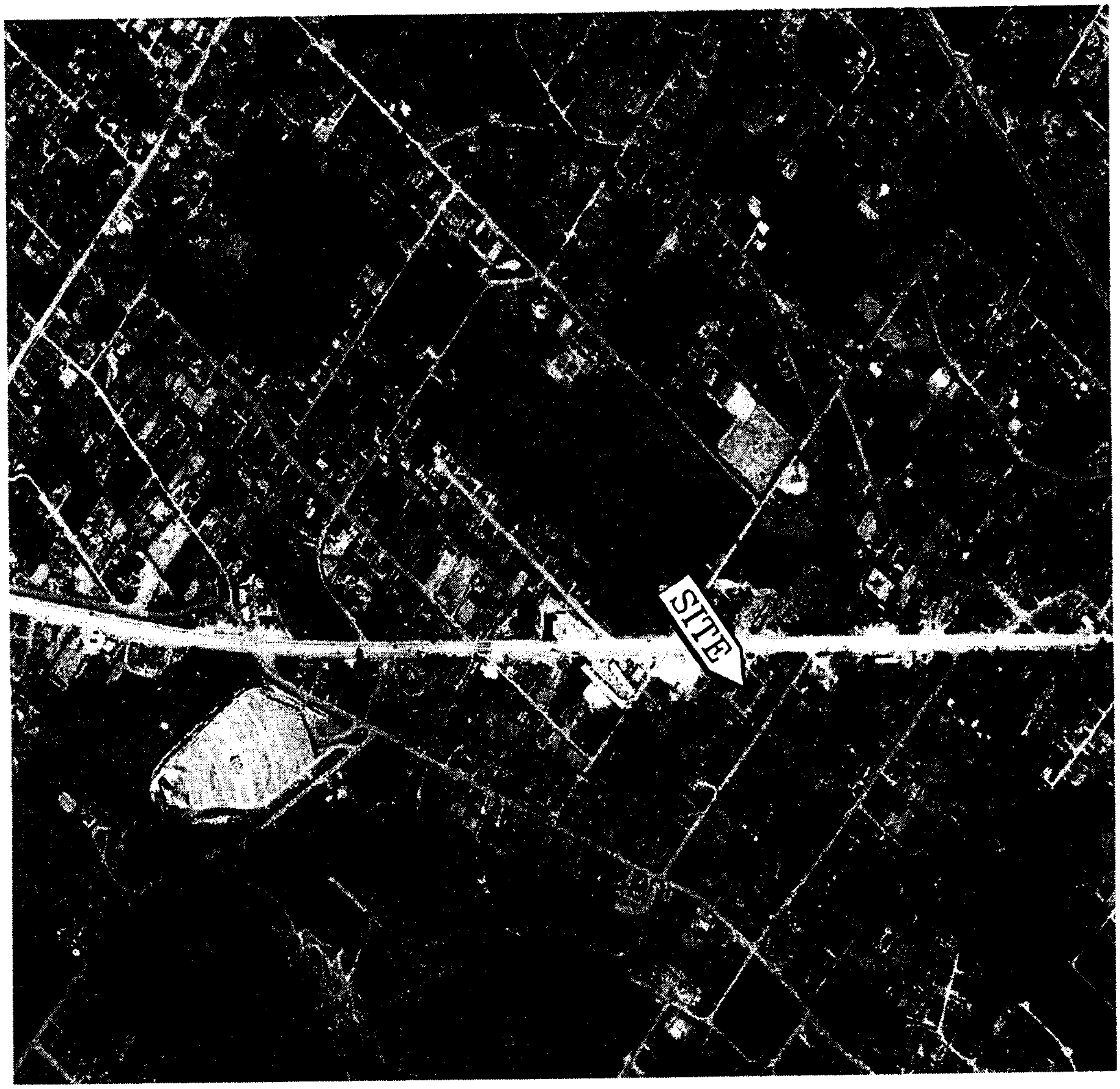
psi

FOUNDATION LOADING PLAN
PROPOSED LES SCHWAB TIRE CENTER
8920 SW BARBUR BOULEVARD
PORTLAND, OREGON

DRAWN BY: A.G.
JOB NO: 704-15077
DATE: 05/22/2001
DRAWING: 3

Proposed Les Schwab Tire Store
8920 Barbur Boulevard, Portland, OR
PSI Report No.: 704-15077-1
May 22, 2001
Photograph 1

Historical Aerial Photograph Log



May 15, 1952

Scource: Oregon Department of Transportation Geometronix Department

Proposed Les Schwab Tire Store
8920 Barbur Boulevard, Portland, OR
PSI Report No.: 704-15077-1
May 22, 2001
Photograph 2

Historical Aerial Photograph Log

February 2, 1964

Scource: Oregon Department of Transportation Geometronix Department

Proposed Les Schwab Tire Store
8920 Barbur Boulevard, Portland, OR
PSI Report No.: 704-15077-1
May 22, 2001
Photograph 3

Historical Aerial Photograph Log

March 19, 1974

Scource: Oregon Department of Transportation Geometronix Department

Proposed Les Schwab Tire Store
8920 Barbur Boulevard, Portland, OR
PSI Report No.: 704-15077-1
May 22, 2001
Photograph 4

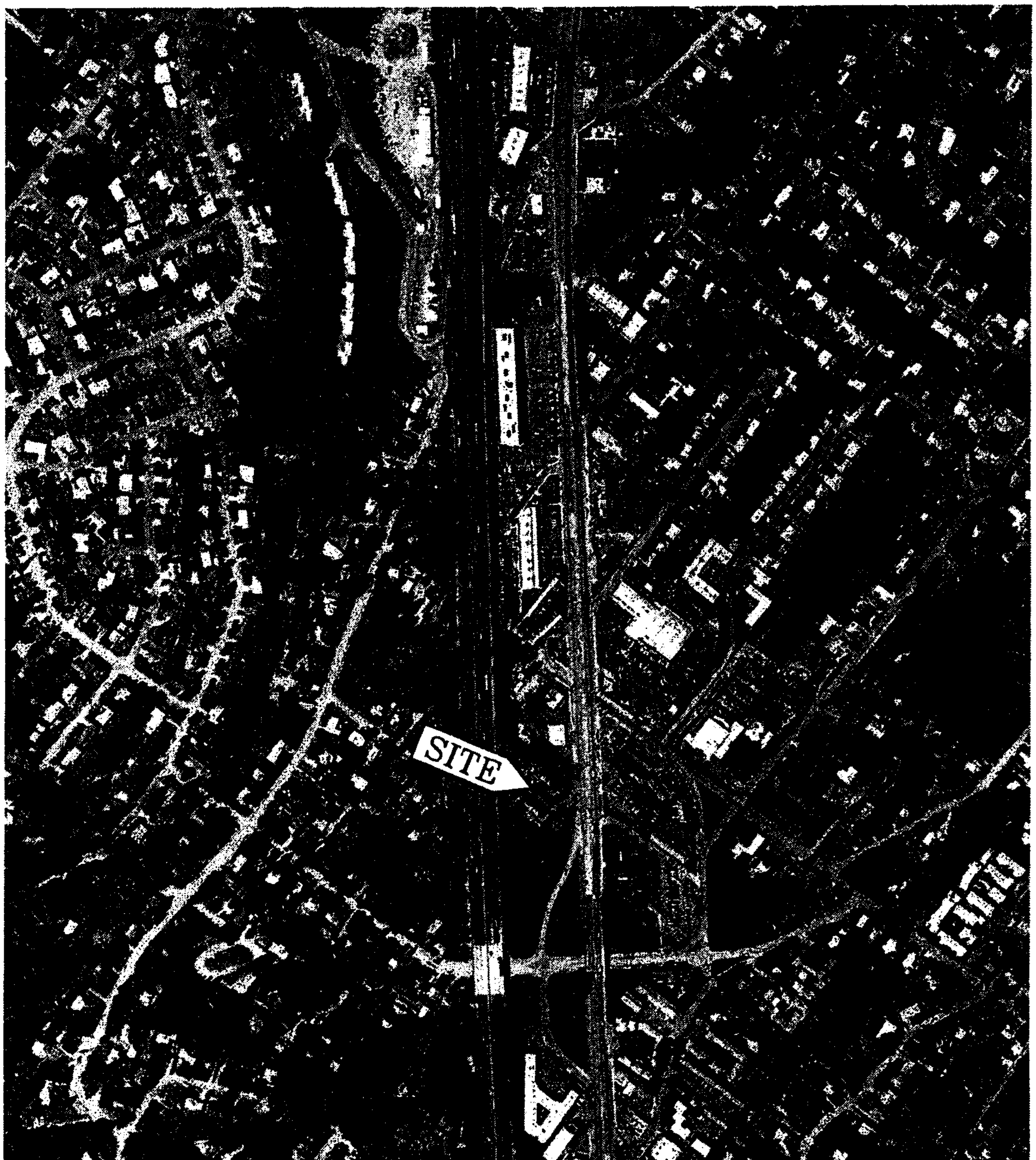
Historical Aerial Photograph Log

April 1, 1984

Scource: Oregon Department of Transportation Geometronix Department

Proposed Les Schwab Tire Store
8920 Barbur Boulevard, Portland, OR
PSI Report No.: 704-15077-1
May 22, 2001
Photograph 5

Historical Aerial Photograph Log



June 10, 1991

Scource: Oregon Department of Transportation Geometronix Department

LOG OF TEST BORING NO. B-1

CLIENT: LS Construction
PROJECT: Proposed Les Schwab Tire Store
LOCATION: 8920 Barbur Blvd., Portland, Oregon
PSI PROJECT NUMBER: 704-15077
SURF. ELEV.:

DATE OF EXPLORATION: 5/14/2001
EQUIPMENT: CME 75 Hollow Stem Auger
LOGGED BY: Troy Hull, P.E.
BORING LOCATION: See Boring Location Plan

DEPTH, FT.	SAMPLES	SOIL DESCRIPTION	SYMBOL	U.S.C.S. CLASS	MOISTURE CONTENT(%)	N-VALUE (BLOWS PER FT.)	POCKET PEN(tsf)	% PASSING #200 SIEVE	REMARKS
	SPT 1	**ASPHALTIC PAVEMENT SECTION:** 2 inches of distressed asphalt overlying 1 inch of base rock. **SILT:** mottled yellow-brown, medium to very stiff		ML	30	6			Bulk Sample of cuttings obtained from 0.5 to 5 feet
	SPT 2				31	18		94	
5	SPT 3	becomes brown at 3.5 feet			31	12			
	SPT 4				31	12			
	SPT 5				30	12			
	SPT 6				33	7		96	
10	SPT 7					7			
15	SPT 8	becomes mottled at 15 feet				16			
20	SPT 9					9			
25									
30									
35									
40									

Boring terminated at 21-1/2' below grade. Groundwater was not encountered at time of drilling. Backfilled with granular bentonite on 5/14/01.

Stratification lines and depths shown are approximate. Actual soil conditions encountered during construction may vary from those described above.

N-values shown above have been corrected (original values were multiplied by 1.5) to correspond to the safety hammer.

BL_PTLD 15077.GPJ PSI_CORP.GDT 5/22/01

psi
6032 North Cutter Circle, Suite 480
Portland, Oregon 97217-0126
(800) 783-6985

LOG OF TEST BORING NO. B-2

CLIENT: LS Construction
PROJECT: Proposed Les Schwab Tire Store
LOCATION: 8920 Barbur Blvd., Portland, Oregon
PSI PROJECT NUMBER: 704-15077
SURF. ELEV.:

DATE OF EXPLORATION: 5/14/2001
EQUIPMENT: CME 75 Hollow Stem Auger
LOGGED BY: Troy Hull, P.E.
BORING LOCATION: See Boring Location Plan

DEPTH, FT.	SAMPLES	SOIL DESCRIPTION	SYMBOL	U.S.C.S. CLASS	MOISTURE CONTENT(%)	N-VALUE (BLOWS PER FT.)	POCKET PEN(tsf)	% PASSING #200 SIEVE	REMARKS
	SPT 1	**ASPHALTIC PAVEMENT SECTION:** 2 inches of distressed asphalt overlying 4 inches of base rock.		ML		6		92	
	SPT 2	**SILT:** brown, very soft to medium stiff, moist to wet, probable fill within upper 6-1/2 feet			24	7			
5	SPT 3					3			
	SPT 4				27	3			
	SPT 5				27	6			
	SPT 6				29	6			
10	SPT 7					4			
15	SPT 8				30	9			
20	SPT 9					8			
25									
30									
35									
40									

Boring terminated at 21-1/2' below grade. Groundwater was not encountered at time of drilling. Backfilled with granular bentonite on 5/14/01.

Stratification lines and depths shown are approximate. Actual soil conditions encountered during construction may vary from those described above.

N-values shown above have been corrected (original values were multiplied by 1.5) to correspond to the safety hammer.

BL_PTLD 15077.GPJ PSI_CORP.GDT 5/22/01

psi
6032 North Cutter Circle, Suite 480
Portland, Oregon 97217-0126
(800) 783-6985

LOG OF TEST BORING NO. B-3

CLIENT: LS Construction	DATE OF EXPLORATION: 5/14/2001
PROJECT: Proposed Les Schwab Tire Store	EQUIPMENT: CME 75 Hollow Stem Auger
LOCATION: 8920 Barbur Blvd., Portland, Oregon	LOGGED BY: Troy Hull, P.E.
PSI PROJECT NUMBER: 704-15077	BORING LOCATION: See Boring Location Plan
SURF. ELEV.:	

DEPTH, FT.	SAMPLES	SOIL DESCRIPTION	SYMBOL	U.S.C.S. CLASS	MOISTURE CONTENT(%)	N-VALUE (BLOWS PER FT.)	POCKET PEN(tsf)	% PASSING #200 SIEVE	REMARKS
		ASPHALTIC PAVEMENT SECTION: 2 inches of distressed asphalt overlying 4 inches of base rock.							
		SILT: brown, probable fill		ML					
5	MC 1					9			
		Boring terminated at 6-1/2' below grade. Groundwater was not encountered at time of drilling. Backfilled with granular bentonite on 5/14/01.							
10		Stratification lines and depths shown are approximate. Actual soil conditions encountered during construction may vary from those described above.							
15		N-values shown above have been corrected (original values were multiplied by 1.5) to correspond to the safety hammer.							
20									
25									
30									
35									
40									

BL_PTLD 15077.GPJ PSI_CORP.GDT 5/22/01

psi
6032 North Cutter Circle, Suite 480
Portland, Oregon 97217-0126
(800) 783-6985

LOG OF TEST BORING NO. B-4

CLIENT: LS Construction
PROJECT: Proposed Les Schwab Tire Store
LOCATION: 8920 Barbur Blvd., Portland, Oregon
PSI PROJECT NUMBER: 704-15077
SURF. ELEV.:

DATE OF EXPLORATION: 5/14/2001
EQUIPMENT: CME 75 Hollow Stem Auger
LOGGED BY: Troy Hull, P.E.
BORING LOCATION: See Boring Location Plan

DEPTH, FT.	SAMPLES	SOIL DESCRIPTION	SYMBOL	U.S.C.S. CLASS	MOISTURE CONTENT(%)	N-VALUE (BLOWS PER FT.)	POCKET PEN(tsf)	% PASSING #200 SIEVE	REMARKS
	SPT 1	**ASPHALTIC PAVEMENT SECTION:** 2 inches of distressed asphalt overlying 4 inches of base rock.		ML	27	4			
	SPT 2	**FILL:** silt, very soft to medium stiff, wet, gray, trace organics			31	0		80	
5	SPT 3					9			
	SPT 4				29	4			
	SPT 5	**SILT:** brown, medium stiff to stiff, wet, possible fill		ML		13			
	SPT 6				32	15	2.0		
10	SPT 7					10			
15	SPT 8					6			
20	SPT 9					13	1.0		
25									
30									
35									
40									

Boring terminated at 21.5' below grade. Groundwater was not encountered at time of drilling. Backfilled with granular bentonite on 5/14/01.

Stratification lines and depths shown are approximate. Actual soil conditions encountered during construction may vary from those described above.

N-values shown above have been corrected (original values were multiplied by 1.5) to correspond to the safety hammer.

BL_PTLD 15077.GPJ PSI_CORP.GDT 5/22/01

psi
6032 North Cutter Circle, Suite 480
Portland, Oregon 97217-0126
(800) 783-6985

LOG OF TEST BORING NO. B-5

CLIENT: LS Construction	DATE OF EXPLORATION: 5/14/2001
PROJECT: Proposed Les Schwab Tire Store	EQUIPMENT: CME 75 Hollow Stem Auger
LOCATION: 8920 Barbur Blvd., Portland, Oregon	LOGGED BY: Troy Hull, P.E.
PSI PROJECT NUMBER: 704-15077	BORING LOCATION: See Boring Location Plan
SURF. ELEV.:	

DEPTH, FT.	SAMPLES	SOIL DESCRIPTION	SYMBOL	U.S.C.S. CLASS	MOISTURE CONTENT(%)	N-VALUE (BLOWS PER FT.)	POCKET PEN(tsf)	% PASSING #200 SIEVE	REMARKS
		ASPHALTIC PAVEMENT SECTION: 2 inches of distressed asphalt overlying 4 inches of base rock.							
		FILL: silt gray, trace organics		ML					
5	MC 1				31	10			Wet Density = 107 pcf
10									
15									
20									
25									
30									
35									
40									

Boring terminated at 5' below grade. Groundwater was not encountered at time of drilling. Backfilled with granular bentonite on 5/14/01.

Stratification lines and depths shown are approximate. Actual soil conditions encountered during construction may vary from those described above.

N-values shown above have been corrected (original values were multiplied by 1.5) to correspond to the safety hammer.

BL_PTLD 15077.GPJ PSI_CORP.GDT 5/22/01

psi
6032 North Cutter Circle, Suite 480
Portland, Oregon 97217-0126
(800) 783-6985

LOG OF TEST BORING NO. B-6

CLIENT: LS Construction	DATE OF EXPLORATION: 5/14/2001
PROJECT: Proposed Les Schwab Tire Store	EQUIPMENT: CME 75 Hollow Stem Auger
LOCATION: 8920 Barbur Blvd., Portland, Oregon	LOGGED BY: Troy Hull, P.E.
PSI PROJECT NUMBER: 704-15077	BORING LOCATION: See Boring Location Plan
SURF. ELEV.:	

DEPTH, FT.	SAMPLES	SOIL DESCRIPTION	SYMBOL	U.S.C.S. CLASS	MOISTURE CONTENT(%)	N-VALUE (BLOWS PER FT.)	POCKET PEN(tsf)	% PASSING #200 SIEVE	REMARKS
	SPT 1	**ASPHALTIC PAVEMENT SECTION:** 2 inches of distressed asphalt overlying 4 inches of base rock.		ML	20	15			
	SPT 2	**SILT:** mottled yellow-brown to brown, medium stiff to very stiff, moist			24	18			
5	SPT 3				24	16			
	SPT 4					6			
10		Boring terminated at 6-1/2' below grade. Groundwater was not encountered at time of drilling. Backfilled with granular bentonite on 5/14/01.							
15		Stratification lines and depths shown are approximate. Actual soil conditions encountered during construction may vary from those described above.							
		N-values shown above have been corrected (original values were multiplied by 1.5) to correspond to the safety hammer.							
20									
25									
30									
35									
40									

BL PTLD 15077.GPJ PSI CORP.GDT 5/22/01

psi
6032 North Cutter Circle, Suite 480
Portland, Oregon 97217-0126
(800) 783-6985

LOG OF TEST BORING NO. B-7

CLIENT: LS Construction
PROJECT: Proposed Les Schwab Tire Store
LOCATION: 8920 Barbur Blvd., Portland, Oregon
PSI PROJECT NUMBER: 704-15077
SURF. ELEV.:

DATE OF EXPLORATION: 5/14/2001
EQUIPMENT: CME 75 Hollow Stem Auger
LOGGED BY: Troy Hull, P.E.
BORING LOCATION: See Boring Location Plan

DEPTH, FT.	SAMPLES	SOIL DESCRIPTION	SYMBOL	U.S.C.S. CLASS	MOISTURE CONTENT(%)	N-VALUE (BLOWS PER FT.)	POCKET PEN(tsf)	% PASSING #200 SIEVE	REMARKS
	SPT 1	**ASPHALTIC PAVEMENT SECTION:** 2 inches of distressed asphaltic overlying 4 inches of base rock.		ML	28	10			
	SPT 2	**SILT:** mottled yellow-brown to brown, medium to very stiff, wet			28	21			
5	SPT 3					15			
	SPT 4					13			
10									
15									
20									
25									
30									
35									
40									

Boring terminated at 6-1/2' below grade. Groundwater was not encountered at time of drilling. Backfilled with granular bentonite on 5/14/01.

Stratification lines and depths shown are approximate. Actual soil conditions encountered during construction may vary from those described above.

N-values shown above have been corrected (original values were multiplied by 1.5) to correspond to the safety hammer.

BL_PTLD 15077.GPJ PSI_CORP.GDT 5/22/01

psi
6032 North Cutter Circle, Suite 480
Portland, Oregon 97217-0126
(800) 783-6985

LOG OF TEST BORING NO. B-8

CLIENT: LS Construction
PROJECT: Proposed Les Schwab Tire Store
LOCATION: 8920 Barbur Blvd., Portland, Oregon
PSI PROJECT NUMBER: 704-15077
SURF. ELEV.:

DATE OF EXPLORATION: 5/14/2001
EQUIPMENT: CME 75 Hollow Stem Auger
LOGGED BY: Troy Hull, P.E.
BORING LOCATION: See Boring Location Plan

DEPTH, FT.	SAMPLES	SOIL DESCRIPTION	SYMBOL	U.S.C.S. CLASS	MOISTURE CONTENT(%)	N-VALUE (BLOWS PER FT.)	POCKET PEN(tsf)	% PASSING #200 SIEVE	REMARKS
	SPT 1	**ASPHALTIC PAVEMENT SECTION:** 2 inches of distressed asphalt overlying 1 inch of base rock. **SILT:** mottled yellow-brown to brown, medium stiff, moist to wet		ML	25	7			
	SPT 2					9			
	SPT 3				18	7			
5	SPT 4				28	6			
10									
15									
20									
25									
30									
35									
40									

Boring terminated at 6-1/2' below grade. Groundwater was not encountered at time of drilling. Backfilled with granular bentonite on 5/14/01.

Stratification lines and depths shown are approximate. Actual soil conditions encountered during construction may vary from those described above.

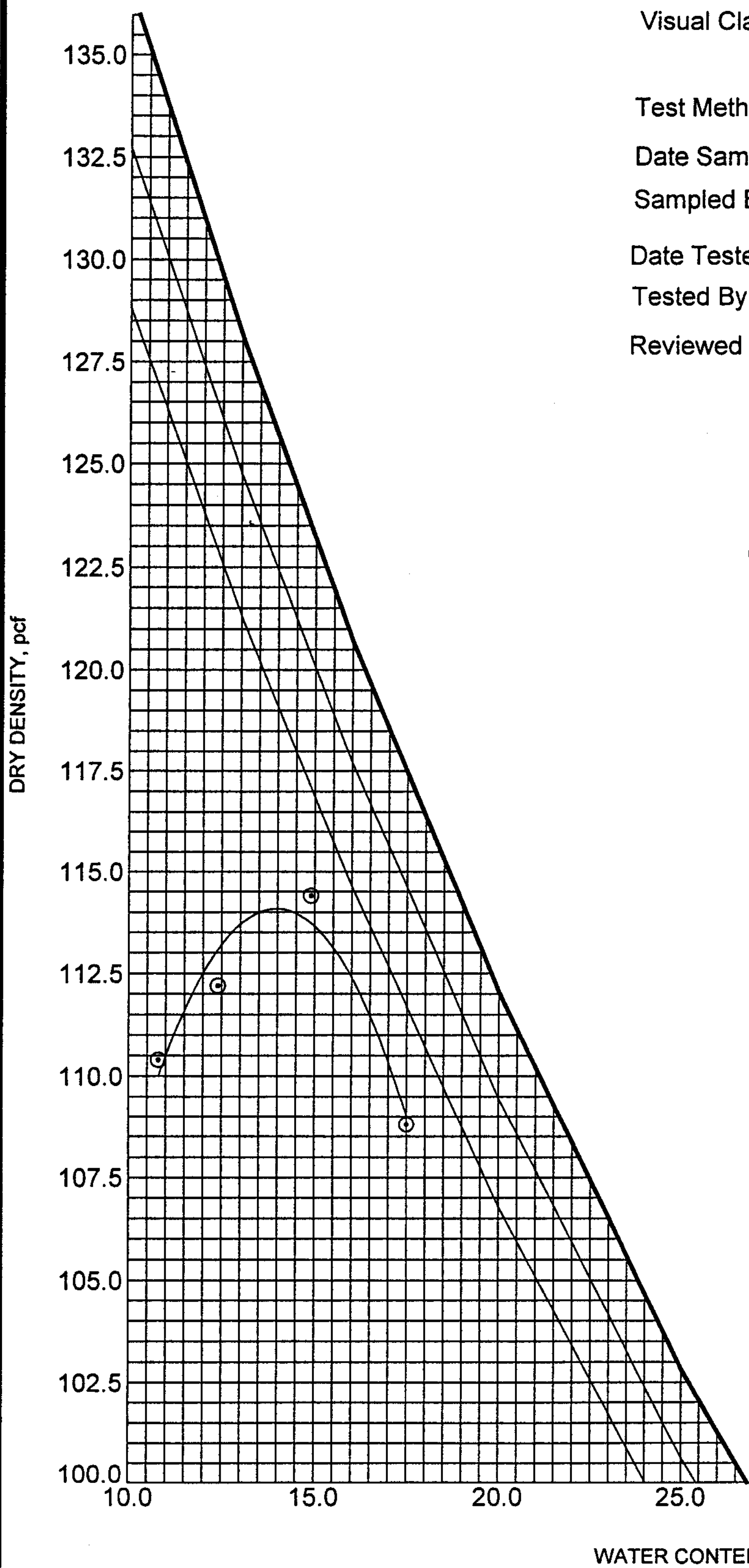
N-values shown above have been corrected (original values were multiplied by 1.5) to correspond to the safety hammer.

BL_PTLD 15077.GPJ PSI_CORP.GDT 5/22/01

psi
6032 North Cutter Circle, Suite 480
Portland, Oregon 97217-0126
(800) 783-6985

Source of Material	B-2 0.5' - 5' Cuttings
Visual Classification	SILT
Test Method	ASTM D1557-91 Method C
Date Sampled	5/15/01
Sampled By:	Troy Hull, P.E.
Date Tested	5/16/01
Tested By:	Mike Ober
Reviewed by:	

Troy Hull, P.E., Department Manager



TEST RESULTS

Maximum Dry Density	114.5	PCF
Optimum Water Content	14.5	%
Calculated Oversize Correction (If Applicable)		
Corrected Maximum Dry Density		PCF
Corrected Optimum Moisture Content		%

Sample was corrected for % retained on the sieve.
Atterberg Limits not determined.

ATTERBERG LIMITS

LL	PL	PI
%	%	%

Curves of 100% Saturation for Specific Gravity Equal to:

Lab No.: 01-0184

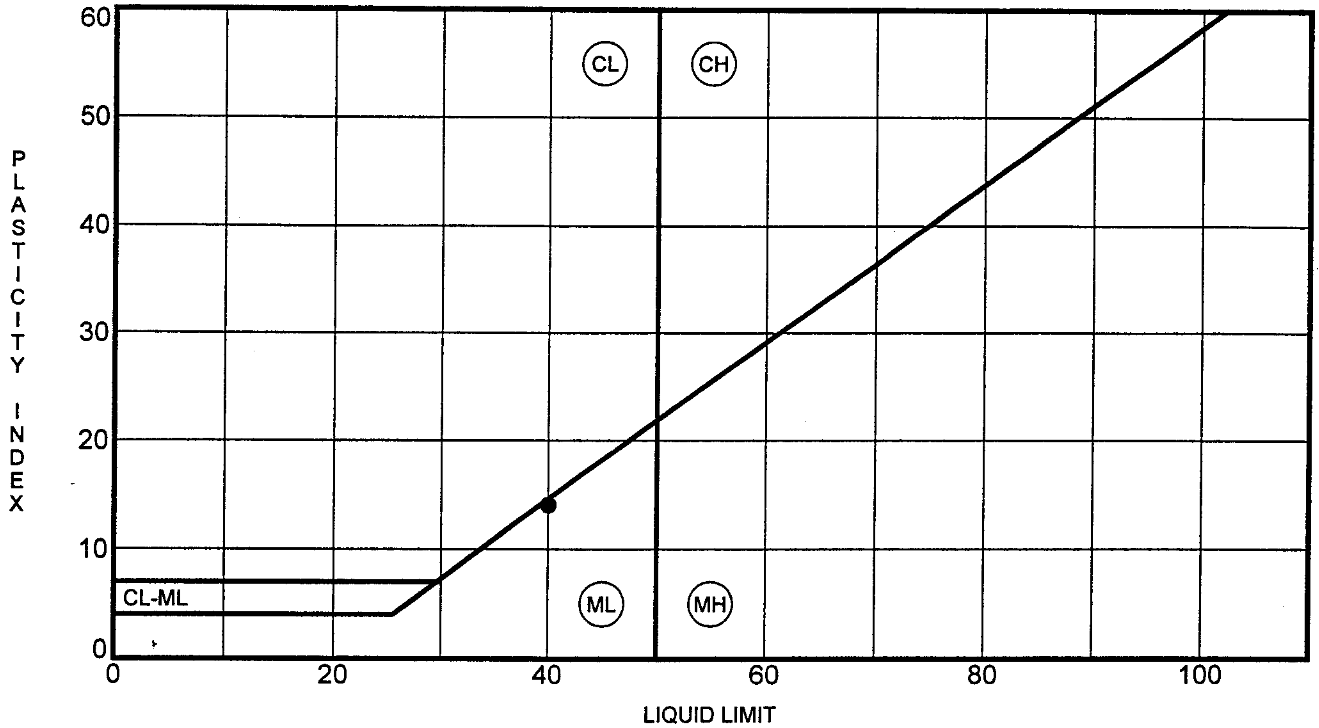
US COMPACTION SAND 15077.GPJ PSI CORP.GDT 5/21/01

psi

Engineering Consulting Testing
6032 N. Cutter Circle Suite #480, Portland, Oregon 97217
Phone (503) 289-1778 Fax (503) 289-1918

MOISTURE-DENSITY RELATIONSHIP

Client: LS Construction
Project Name: Proposed Les Schwab Tire Store
Project Location: 8920 Barbur Blvd., Portland, Oregon
Report Number: 704-15077



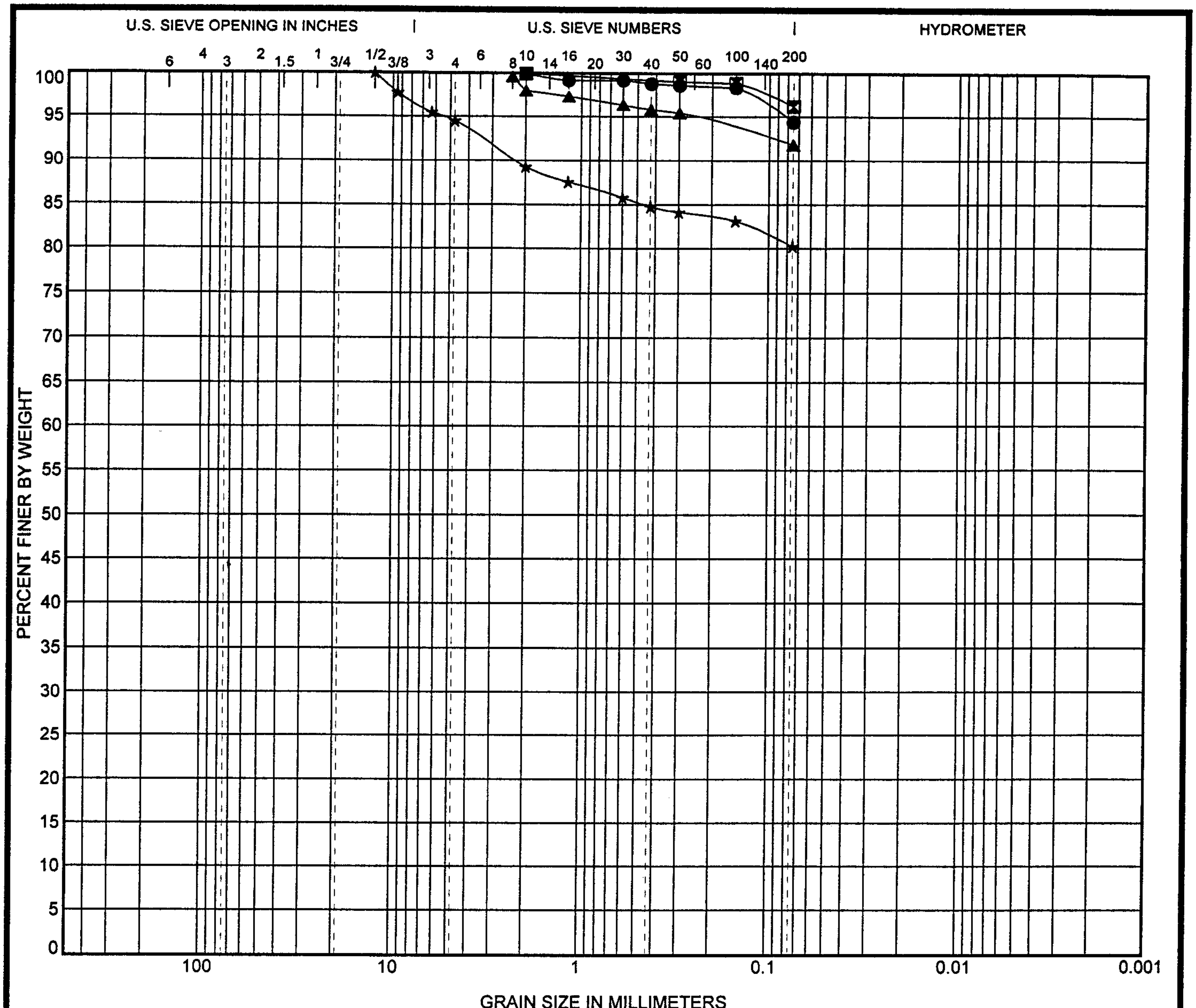
	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-1**	**at 2.0'**	**40**	**26**	**14**	**94**	**SILT(ML)**

US ATTERBERG LIMITS 15077.GPJ PSI CORP.GDT 5/21/01

psi
Engineering Consulting Testing
6032 N. Cutter Circle Suite #480, Portland, Oregon 97217
Phone (503) 289-1778 Fax (503) 289-1918

ATTERBERG LIMITS RESULTS

Client: LS Construction
Project Name: Proposed Les Schwab Tire Store
Project Location: 8920 Barbur Blvd., Portland, Oregon
Report Number: 704-15077



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● B-1	at 2.0'	SILT(ML)	40	26	14		
⊠ B-1	at 8.0'	SILT(ML)					
▲ B-2	at 0.5'	SILT(ML)					
★ B-4	at 2.0'	SILT WITH SAND(ML)					

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-1	at 2.0'	2				0.0	5.5	94.4	
⊠ B-1	at 8.0'	2				0.0	3.8	96.2	
▲ B-2	at 0.5'	2.36				0.0	7.8	91.8	
★ B-4	at 2.0'	12.5				5.5	14.3	80.2	

psi
Engineering Consulting Testing
6032 N. Cutter Circle Suite #480, Portland, Oregon 97217
Phone (503) 289-1778 Fax (503) 289-1918

GRAIN SIZE DISTRIBUTION

Client: LS Construction
Project Name: Proposed Les Schwab Tire Store
Project Location: 8920 Barbur Blvd., Portland, Oregon
Report Number: 704-15077

US GRAIN SIZE 15077.GPJ PSI CORP.GDT 5/21/01

CALIFORNIA BEARING RATIO (CBR) TEST REPORT

Sample: B-2, cuttings 0.5 to 5'

CBR VALUE	HAMMER BLOWS	DRY DENSITY (PCF)
6.7	25	109
6.7	56	111

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classificaton System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split-spoon.

Qu: Unconfined compressive strength, TSF.

Qp: Penetrometer value, unconfined compressive strength, TSF.

Mc: Water content, %.

LL: Liquid limit, %.

PI: Plasticity index, %.

δd: Natural dry density, PCF.

▼: Apparent groundwater level at time noted after completion of boring.

DRILLING AND SAMPLING SYMBOLS

SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
AU: Auger Sample.
DB: Diamond Bit.
CB: Carbide Bit.
WS: Washed Sample.

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

TERM (NON-COHESIVE SOILS)	STANDARD PENETRATION RESISTANCE
Very Loose	0-4
Loose	4-10
Medium	10-30
Dense	30-50
Very Dense	Over 50

TERM (COHESIVE SOILS)	Qu - (TSF)
Very Soft	0 - 0.25
Soft	0.25 - 0.50
Firm (Medium)	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

PARTICLE SIZE

Boulders	8 in.+	Coarse Sand	5mm-0.6mm	Silt	0.074mm-0.005mm
Cobbles	8 in.-3 in.	Medium Sand	0.6mm-0.2mm	Clay	-0.005mm
Gravel	3 in.-5mm	Fine Sand	0.2mm-0.074mm		

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

psi