Geotechnical Investigation

New Medical Office Building Complex

Good Samaritan Hospital

Corvallis, Oregon

Prepared for:

FILE COPY

Devco Engineering, Inc.
Corvallis, Oregon

January 29, 1998

Foundation Engineering, Inc.
Professional Geotechnical Services

Lyle Hutchens
Devco Engineering, Inc.
245 NE Conifer, P.O. Box 1211
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January 29, 1998

Medical Office Building Complex
Geotechnical Investigation
Good Samaritan Hospital
Corvallis, Oregon

Project 97100243

Dear Mr. Hutchens:

We have completed the requested geotechnical investigation for the above-referenced project. Our report includes a description of our work, a discussion of site conditions, a summary of laboratory testing, and a discussion of engineering analyses. Recommendations for site preparation, basement/retaining wall design, building drainage, floor slabs, foundation and pavement design and construction are enclosed.

The subsurface conditions typically consist of stiff to very stiff, residual silty clay underlain by weak and weathered siltstone at depths of ±1 to 15 feet below existing grades. Therefore, we conclude that the foundation conditions are suitable to support the proposed buildings on shallow spread footings. We anticipate that the siltstone within the depths of the planned building cuts and underground utility trench excavations (maximum depth of ±15 feet) can be excavated using conventional, heavy earthmoving and excavation equipment.

Ground water levels were measured at depths of ±10 to 20 feet, and may rise to near ground surface levels by late spring. The building drainage recommendations provided in this report should be closely followed to reduce the potential for wall and floor slab wetness.

It has been a pleasure assisting you with this phase of your project. Please do not hesitate to contact us if you have any questions or if you require further assistance.

Sincerely,

FOUNDATION ENGINEERING, INC.

Jonathan N. Guido

Jonathan N. Guido, P.E.
Project Manager

REGISTERED PROFESSIONAL ENGINEER
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JULY 19, 1994
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GEOTECHNICAL INVESTIGATION
NEW MEDICAL OFFICE BUILDING COMPLEX
GOOD SAMARITAN HOSPITAL
CORVALLIS, OREGON

PROJECT DESCRIPTION

Our understanding of the project is based on the 100-scale site plan and other information provided to us by Devco Engineering, Inc. The proposed site development is shown on the site plan (Figure 1). The site consists of a ±15-acre, undeveloped parcel at the northeast corner of the Good Samaritan Hospital property. The planned development will include six separate hillside office buildings and an engineering building, ranging from ±4000 to 12,000 S.F. in plan area. The buildings will be situated along the crest of east and south facing slopes, and will consist of conventional, one or two-level, wood-framed structures with daylight basements and slab-on-grade floors. Basement retaining walls up to ±12 feet in height are expected.

Our geotechnical investigation did not include the proposed Engineering Building shown on Figure 1, and no explorations were advanced within or around the building as part of our current investigation. Additionally, no information has been provided to us regarding this structure. Prior to design, we recommend that a limited geotechnical investigation, possibly including field explorations, be performed to develop foundation design criteria for this building.

The development will also include a ±70,000-square foot paved parking lot, and a ±1100-foot long paved perimeter driveway. Approximately 1500 lineal feet of underground utilities are planned, including sanitary sewer, storm drain and other services.

Site grading will include cuts and fills for buildings, pavements and landscape areas. Maximum excavation depths of ±15 feet are anticipated for building pad and roadway cuts. A maximum fill thickness of ±10 feet is anticipated for the hillside roadway embankments.

Foundation Engineering, Inc. was retained by Devco Engineering, Inc. to provide geotechnical engineering services. The scope of work for this investigation is described in our proposal dated October 27, 1997.

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FIELD EXPLORATION

Test Pits

The initial phase of our field investigation included digging exploratory test pits to examine the shallow subsurface and ground water conditions across the site. We dug 11 exploratory test pits on November 21, 1997, using a John Deere Model 190 trackhoe. The test pits extended to a maximum depth of ±10½ feet. Disturbed soil and rock samples were obtained for office examination and/or possible laboratory testing. The soil profiles were logged and levels of ground water infiltration, where it occurred, were noted. Undrained shear strength measurements were made on the test pit side walls using a Torvane shear device. The soil profile, sampling depths and strength measurements are summarized on the appended test pit logs. Figure 1 shows the approximate locations of the test pits. The subsurface conditions are discussed below.

Boreholes

The second phase of our field investigation included three borings to explore and sample soil, rock and ground water conditions. The boreholes were drilled at the site between December 1 and 3, 1997, using a track-mounted drill rig and both mud-rotary and hollow-stem auger-drilling methods. The boreholes were drilled to a maximum depth of ±35 feet. PVC standpipe piezometers were installed in Boreholes BH-2 and BH-3 to monitor the ground water levels. Sectional details of the piezometers are presented on the appended boring logs.

The boreholes were continually logged during drilling. Disturbed samples were obtained at 2½ to 5-foot intervals using a split-spoon. The Standard Penetration Test (SPT), which is run when the split-spoon is driven, provides an indication of the relative stiffness, or density, of the foundation soils. The final logs (appended) were prepared based on review of the field logs and an examination of the soil and rock samples in our laboratory. The locations of the borings are shown in Figure 1. The subsurface conditions are discussed below.

SITE GEOLOGY

Good Samaritan Hospital is situated on a ridge at the western edge of the Willamette Valley. The site is underlain by siltstone deposits of the Spencer Formation (Eocene age), (Bela, 1979). The Spencer Formation includes massive to thin-bedded sandstone and siltstone. The project development will be supported within the Spencer Formation siltstone or the overlying soil layers.

Regional outcrops indicate that the Spencer Formation is underlain by the Flournoy Formation of the Middle Eocene age. The Flournoy Formation consists of graded beds of well-cemented sandstone. The Flournoy Formation is underlain by Siletz

River Volcanics, composed of pillow lava, basalt flows, and flow breccias, coarse pyroclastics and interbeds of tuffaceous siltstone.

SEISMIC CONSIDERATIONS

Local and Regional Faults

The northeast-trending Corvallis Fault traces across the foothills in northwestern Corvallis, about 1 mile northwest of the project site. Faulting along the Corvallis Fault has been on-going since the Eocene age with the most recent detectable movement occurring before 28,500 years ago (Pleistocene). The length of this fault is increased to over 58 miles (93 km) when combined with the Turner and Waldo Hills Faults west of Salem. Although these faults appear connected along the same northeasterly trend, the potential for simultaneous rupture along the entire length of the compound fault is low (Geomatrix, 1994). There have been three historic earthquakes with intensities of V, III and III-IV located along the Corvallis Fault (Yeats et al, 1991).

The Owl Creek Fault is the closest fault to Corvallis, showing late Pleistocene movement (Yeats et al, 1991). This 9-mile (15 km) long fault is located along a north-south trend ± 2 miles east of Corvallis. Numerous other concealed and inferred faults are located within 10 miles of Corvallis. These included the Bald Hill, Calapooia River, Kings Valley, Lebanon and East Albany Faults. None of these show any evidence of Quaternary movement.

Although no indication of current faulting can be found in the area, hidden and/or deep-seated active faults could remain undetected. Additionally, recent crustal seismic activity cannot always be tied to observable faults (Madin, 1989). In the event of a catastrophic earthquake with a large seismic moment, inactive faults could potentially become reactivated.

Local Seismic History

Crustal earthquakes dominate Oregon's seismic history. Only three of the major events reached $M_L = 6$ with the majority in the $M_L = 4$ to 5 range. Table 1 lists $M_L \geq 3.5$ earthquakes that have occurred within a 50-mile radius of Corvallis over the last 150 years (Johnson et al, 1993).

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Table 1. Historic Earthquakes within 50-mile Radius of Corvallis

Year	Month	Day	Hour	Minute	Latitude	Longitude	Depth (km)	Magnitude
1956	5	18	3	41	45.000	124.000	0.0	3.7
1961	8	19	4	56	44.700	122.500	0.0	4.5
1962	9	5	5	37	44.500	122.900	0.0	3.5
1963	3	7	23	53	44.900	123.500	47.0	4.6
1988	9	14	4	10	43.775	123.494	99.0	5.4
1993	3	25	13	34	45.035	122.607	20.6	5.6
1993	6	8	0	1	45.030	122.597	20.2	3.7

The 1993 Scotts Mills Earthquake, with a $M_L=5.6$ and a local MM intensity of V, is the largest event within 50 miles of Corvallis. Although not listed on the above table, Wong and Bott (1995) and Geomatrix (1994) both record the occurrence of a $M_L=4+$ earthquake with an epicenter less than 10 miles northwest of Corvallis.

Distant strong earthquakes felt in the Corvallis area include the following (MM intensities in parentheses): the 1962 Portland Earthquake (≤IV); the 1949 Olympia, Washington earthquake (VI) and the 1873 Crescent City, California earthquake (V).

Regional Tectonics

Western Oregon is located in an area of potentially high seismic activity. The Juan de Fuca Plate, located off the Oregon coast, is being subducted beneath the North American Plate on which Oregon is located. The eastward-dipping subduction zone generates earthquakes within the descending plate (intraslab), at the inclined interface between the two plates (interface) and within the upper North American Plate (crustal).

Although crustal and intraslab earthquakes have been detected, no great subduction zone event has occurred in Oregon during the 150 years of recorded earthquakes. Recently discovered tsunami inundation deposits, combined with evidence for episodic subsidence along the Oregon and Washington coasts, are thought to have been caused by great seismic events (Peterson, 1993). These $M_W=9.0$ earthquakes appear to rupture along the entire length of the subduction zone. Interface earthquakes have an average return rate of 500 years (Brian Atwater, personal communication) with the last event occurring ±300 years ago (Nelson et al, 1995).

Seismic Hazards

The following seismic hazards are discussed as to their potential effect to site development:

Liquefaction: The proposed office buildings, pavements and earthworks will be founded in either stiff residual soil or siltstone, which extends to a depth of at least 35½ feet below site grades (maximum depth of our subsurface explorations). The liquefaction potential of these materials is low.

Ground Rupture: Review of available geologic maps, reports and other published information indicates that no active faults are mapped within the limits of the project. Based on this information, it is our opinion that the potential for ground rupture at the site is relatively low.

SITE CONDITIONS

Surface Conditions

The site is bordered by Highway 99W to the east and Samaritan Drive to the west. The northern boundary of the site abuts a large undeveloped, grassy pasture. A wooded parcel and single-family homes are located south of the site. The site limits, topography, the proposed building, and pavement locations are shown on the site plan (Figure 1).

The site is covered with grass, stands of fir and pine trees. An unimproved access road traverses the northwest portion of the property. A stockpile of organic debris (i.e. felled trees, stumps, landscaping and construction materials) is located along the access road in the northern portion of the site. A stockpile of imported soil is located on the slope, next to Borehole BH-1. Underground utilities have been identified within the northwest corner of the site.

The site is located on a southeast-facing slope, which is dissected by a southeast-trending ravine. Ground surface elevations range from ±300 feet at the north-central end of the property, to ±235 feet within the ravine along Highway 99W. Slopes ranging from less than 5:1(H:V) up to 1½:1(H:V) exist across the site. Site drainage consists primarily of sheet flow down to Highway 99W with moderate ponding and infiltration in the center of the site. Concentrated runoff has been observed within the ravine during periods of heavy rainfall.

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Subsurface Conditions

The subsurface profile at the site typically includes ±3 to 6 inches of sod, roots and forest duff. The surficial materials are followed by topsoil and/or residual soil underlain by siltstone. A thin layer of fill was also encountered at the surface in Test Pit TP-11.

The topsoil, where encountered, ranged from ±1 to 5 feet in thickness. The topsoil consists of dark brown, moist to wet, soft to medium stiff, silty clay or clayey silt with some organics and low to moderate plasticity.

The residual soil consists of brown or tan, mottled orange, moist, stiff to very stiff, clayey silt with low plasticity. This soil layer represents bedrock that has decomposed to the consistency of soil. Residual soil was encountered in each of the test pits and borings (with the exception of TP-6 and BH-3) at depths ranging from ±2 to 5 feet. The residual soil is typically ±½ to 15 feet thick.

Siltstone was encountered at depths ranging from ±3½ to 15 feet. The weathering of the rock typically varies with depth and location. In most locations, the upper ±1 to 2 feet the rock is brown to tan, mottled orange, extremely weak (R0) to very weak (R1), and slightly to highly weathered with close to very close jointing. The rock becomes grey, very weak (R1) to weak (R2), and slightly weathered to fresh with close jointing with depth. The siltstone was encountered to the limits of our exploration (±35½ feet).

The terminology used in this report and on the appended test pit and boring logs to describe rock strength, hardness, weathering, and other characteristics, is explained on the "Rock Descriptions" sheet in Appendix A. Please note that terms like "weak" and "soft" have very different meanings when applied to rock classification vs. soil classification. We recommend that the reader carefully review the terminology on the "Rock Descriptions" sheet to develop an understanding of the rock descriptions provided in this report.

Ground Water

Local water well data indicates that the ground water table lies at an elevation of ±El. 225 to El. 300 at Good Samaritan Hospital (Frank, 1974). The sedimentary rocks in the foothills and upland areas in the Corvallis area are recharged by precipitation into perched aquifers located upland. Local water well records show a distinct pattern of recharge, generally starting in late fall and continuing through June. During this period ground water levels tend to rise ±10 and 15 feet from the lowest levels measured in the late summer or fall.

Periodic piezometer readings taken between December 5, 1997, and January 7, 1998, indicate ground water levels of ±10 to 20 feet below existing site grades. Water levels initially fluctuated by ±4 to 10 feet during the first two weeks of monitoring. During the final three weeks of monitoring, water levels stabilized at depths of ±10 and 20 feet (BH-3 and BH-2, respectively), fluctuating less than ±1 foot during this period. Based on local water well fluctuation patterns and measured site ground water levels, we anticipate that ground water levels may rise to near the ground surface by late spring.

The test pits were dug the day after the site experienced heavy rainfall. We observed some surface runoff and rapid ground water infiltration in Test Pits TP-1 through TP-5 at depths of ±4 to 6½ feet below the ground surface. The seepage appeared to be rainfall that does not runoff the poorly-drained site and perches on underlying strata of less pervious soil. Shallow, perched water is usually seasonal in nature and typically disappears by late summer.

LABORATORY TESTING

The laboratory work included natural water content and Atterberg limits tests to classify the foundation soils, determine their homogeneity and estimate their overall engineering properties. Moisture-density and California Bearing Ratio (CBR) tests were performed to establish the compaction characteristics of the subgrade and develop parameters for pavement design. Results of all laboratory testing are appended.

CONCLUSIONS

Based on the results of our subsurface exploration, laboratory testing and analysis, it is our opinion that the planned development is feasible from a geotechnical standpoint, provided the recommendations in this report are incorporated into the project design and carefully implemented during construction. Our principal conclusions regarding geotechnical conditions that may affect the planned development include the following:

- The proposed buildings can be adequately supported on shallow, continuous and spread footing foundations bearing on the stiff, residual soils or the underlying siltstone. The relatively weak, compressible and somewhat organic topsoil is not suitable to support the structures and should be completely removed from building pad areas. Fill supporting proposed building foundations should be based within competent residual soil or siltstone, below the topsoil layer.

- The development plans indicate that the proposed buildings will be based at depths of at least 1½ to 8 feet below existing site grades. The ground water levels are expected to fluctuate seasonally and could be as high as ground surface levels. Therefore, the proposed buildings will require wall and subfloor drainage systems to minimize the potential moisture.

- The highly weathered rock and on-site soils are moisture sensitive and will become soft, weak and practically unworkable during wet weather periods. However, during the dry weather, the inorganic on-site soils should be suitable for use in site earthwork and landscape areas outside of building and wall backfill areas.

- The stiff residual soils and underlying siltstone are relatively strong. However, these materials were excavated with light to moderate effort using a John Deere 190. Therefore, we expect that the site can be graded using conventional earthmoving equipment. We estimate that temporary cut slopes will remain stable at maximum inclinations of up to 1:1(H:V) during dry weather.

ENGINEERING ANALYSIS

We estimated the bearing capacity of conventional (i.e., spread or continuous) footings planned on a minimum of 6 inches of select fill bearing on either stiff residual soil or siltstone. Torvane measurements within the residual soil layer indicated undrained shear strengths ranging from 1000 to 1700 psf. An allowable bearing pressure was calculated using an undrained shear strength of 1250 psf. These calculations suggest an allowable bearing pressure of 2500 psf with a typical factor of safety of 3. The allowable bearing pressure may be increased to 4000 psf for foundations bearing on competent siltstone.

This analysis assumes that the continuous (wall) footings will have a nominal width of 12 inches and will bear on a minimum of 6 inches of compacted, crushed aggregate. In addition, we assumed that crushed aggregate extends a minimum of 12 inches outside the footprint of the footing. Similar assumptions were made for the spread footings. Our settlement analyses indicates that foundations could settle between ±½ and ¾ inch.

We used the *AASHTO '86* computer program, an assumed traffic data and the CBR laboratory test results to determined the required flexible asphalt pavement section for the main parking lot. We assumed the following traffic volume for the proposed main parking lot: 100 automobiles per day; 50 light trucks per day; and 4 moderate weight trucks per day (24-kip maximum axle load). A M_r value of 4500 psi was selected for the analysis based on available correlations with a laboratory-derived CBR value of 3 for the on-site topsoil. The low CBR value represents the relatively poor subgrade conditions anticipated in the main parking area.

Our analysis indicates that the main parking lot should have a minimum flexible pavement section consisting of a nominal 3 inches of asphalt over 10 inches of crushed rock base. This minimum pavement section assumes that the parking lot would be built on a subgrade prepared as recommended herein and that any subgrade areas containing excessively weak, soft or high plasticity soils would be removed and replaced with compacted granular fill as recommended herein.

This minimum pavement section (provided above) assumes that construction will occur during the drier, summer or fall months, after site grading and construction of the buildings. As discussed below, an all-weather pavement subbase layer is recommended if pavement construction occurs during wet weather. Additionally, if heavy construction equipment or truck traffic loads are anticipated across site pavements, the adequacy of the minimum pavement section should be re-evaluated and a thicker pavement section substituted if required.

The on-site soils and bedrock materials are moisture sensitive and will become soft, weak and practically unworkable during wet weather. Therefore, we recommend that pavement construction be done during dry weather. If pavement construction is done during wet weather, pavement areas should be surfaced with a compacted, all-weather, granular base layer. This layer should be at least 18 inches in thickness, depending on the frequency and weight of construction traffic. The layer should be composed of 3 to 4-inch minus, crushed rock or pit-run fill, with less than 5 percent fines. The layer should be constructed on a geotextile fabric, such as Amoco 2002, or equal.

A 20-year design life was assumed for the analysis. However, a nominal 2-inch overlay should be planned at about 12 years. The Asphalt Institute (TAI) recommends overlaying flexible pavements when 60% of the structure life is used. Research has shown that overlaying pavements at that time is more cost-effective than a full-depth repair after the pavement has failed. The pavement should be inspected by an experienced engineer every 2 to 3 years to determine its condition and need for rehabilitation.

RECOMMENDATIONS

The following recommendations assume that the earthwork will be completed during dry weather. We should be contacted in the event that the work occurs in the winter or late spring so that we can provide additional recommendations for wet weather construction. Compaction of the on-site fine-grained soils will not be practical during the winter or when the subgrade is wet of optimum. Therefore, the stripping may have to be done with a hoe, operating outside of the foundation area, to prevent the subgrade from pumping. A geotextile may also be required to prevent subgrade intrusion into the fill. The contractor may still experience pumping problems in the summer if the surficial soils have not adequately dried. Therefore, we recommend an on-site conference with the contractor prior to the grading work to review site conditions.

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General Earthwork Specifications

1. The building and pavement locations should be cleared of surface and subsurface deleterious matter, including sod, roots, forest duff, brush, trees designated for removal, and associated stumps and roots. Strip

these areas ±6 inches (or as necessary) to remove topsoil containing organic material. The stripped material should be removed from the site or stockpiled for use in landscape areas.

2. Fill supporting proposed building foundations should be based within competent residual soil or siltstone, below the topsoil layer. Fill supporting proposed buildings should consist of select fill compacted in accordance with the recommendations provided below. Outside of proposed building areas, areas to be filled should be scarified to a depth of at least 8 inches and compacted as recommended below. Fill to be placed on slopes steeper than ±5:1 (H:V) should be keyed and benched into the slope face. Keyways should be at least 10 feet wide and embedded into competent topsoil, residual soil or siltstone. Subdrains should be installed at the rear of each keyway in accordance with the recommendations provided below.

3. Subdrains may be recommended for the site based on conditions encountered during site grading and construction. Subdrains should consist of drain rock encapsulated within a suitable non-woven, geotextile filter fabric, such as Amoco 4545, or equivalent. The subdrains should be at least ±2 feet in thickness, extending to the depths determined by an FEI representative in the field during excavation. A 4-inch diameter, perforated PVC[1] pipe should be installed near the base of the subdrainage layer, underlain by a minimum of 3 inches of free-draining material. Subdrains should have a minimum slope of 1 percent to promote positive drainage to suitable discharge points. Subdrain lines should be equipped with clean-out risers for maintenance. The number and locations of subdrains required should be established by an FEI representative based on field conditions observed during site grading and piezometer levels recorded during winter and spring.

4. Temporary cut slopes in the competent topsoil, residual soil or siltstone may be constructed at maximum inclinations of 1:1(H:V) during dry weather. Flatter cut slopes will be required to maintain stability if excavations penetrate weaker topsoil layers, or if construction is done during wet weather. Permanent cuts and fills constructed in accordance with the recommendations in this report should be constructed at maximum slopes of 2:1(H:V). Permanent cuts within weaker topsoil materials should be laid back at slopes of 3:1(H:V) or less.

5. To achieve uniform compaction, we recommend that fill slopes be over-built and subsequently cut back to expose well-compacted fill. Newly constructed slopes should be surfaced with a suitable erosion-control

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[1] All PVC pipe should meet requirements of Schedule PVC 40, or equal.

product immediately after grading to minimize erosion of surface soils. We recommend that surface water runoff not be allowed to flow over earth slopes.

6. The site should be graded to direct surface runoff away from building pads, pavement areas and earthworks, and towards suitable runoff collection and discharge facilities.

7. Select fill as defined in this report should consist of ½ to 1½-inch minus, clean, well-graded, crushed gravel or rock. We should be provided a sample of the intended fill for approval, prior to delivery to the site.

8. Drain rock as defined in this report should consist of a graded, clean, free-draining, durable, crushed or uncrushed rock with a maximum 1½-inch particle size. We should be provided a sample of the intended drain rock for approval, prior to delivery to the site.

9. Granular site fill should consist of sand, gravel or rock, or mixtures of the above, that are free of plastic soil, organic matter or construction debris. We should be provided a sample of the intended fill for approval, prior to delivery to the site.

10. Fine-grained site fill should consist of approved soil that is free of organics, construction debris or expansive clay. Fine-grained soils should not be placed under foundation areas or under settlement-sensitive structures.

11. Compact all fine-grained soils and imported, granular fill in loose lifts not exceeding 12 inches. Thinner lifts may be required if light or hand-operated equipment is used. Compact all fill to a minimum of 95% relative compaction, unless otherwise specified. The maximum dry density of ASTM D 698 should be used as the standard for estimating relative compaction, unless otherwise specified. The moisture content of the fine-grained soil should be adjusted to within ±2% of its optimum value prior to compaction. Efficient compaction of fine-grained soils will typically require the use of a padfoot or kneading roller to achieve the required compaction. Granular fill (sand, rock or gravel) will compact more efficiently with a smooth drum, vibratory roller. Field density tests should be run frequently to confirm adequate compaction.

12. Overexcavate all test pits that extend under the building pad and pavements. Replace the test pit backfill with compacted, select fill.

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Foundation Design and Construction

13. We recommend that building foundations be supported on 6 inches of compacted select fill, placed over stiff, residual soil or siltstone. All continuous wall footings and isolated column footings should be designed using an allowable bearing pressure of 2500 psf for footings bearing on residual soil and 4000 psf for footings bearing on competent siltstone. These values may be increased by one-third for analysis using temporary live (wind and earthquake) loads.

14. Assume that the new buildings could experience long-term, post-construction total and differential settlements of up to ¾ inch. This settlement estimate assumes that the buildings will be supported on either stiff residual soil or siltstone within cut building pads, and that the footings are designed and built as specified herein. We understand that the northernmost proposed building (Building A on Figure 1), will be supported within fill. Fill supporting Building A should be based within competent residual soil or siltstone, below the topsoil layer. Building foundation elements which span from cut to fill areas could experience greater magnitudes of post-construction differential settlement and possible structural distress. We, therefore, recommend that Building A, or any other proposed building, be supported entirely in cut or on fill.

15. Lateral loads can be resisted by a combination of friction between the bottom of footings and the supporting subgrade, and passive resistance acting against the embedded face of the footings. A frictional resistance of 0.35 times the vertical dead load should be used. We recommend using an allowable passive pressure based on an equivalent fluid weight of 300 pcf acting against the embedded footings. The upper ±1 foot of soil should be neglected when calculating passive resistance, unless the adjacent ground surface is confined by a slab or pavement.

16. Provide a minimum width of 12 inches for all continuous wall footings and at least 6 inches of compacted select granular fill under all footings. The fill under the foundation, if not continuous, should extend at least 12 inches beyond the edges of all footings. Provide a minimum footing dimension of 24 feet for all column footings. Place the base of all footings at least 18 inches below the finished grade or paved surface.

17. Design the building using a Seismic Zone Factor, Z, of 0.3, and a Site Coefficient, S_1, of 1.0, in accordance with the provisions of UBC (94). The liquefaction potential of the foundation soils are low due to their stiffness and grain size.

18. Use a modulus of subgrade reaction, k_s, of 175 pci, for floor slab design. Reinforce all floor slabs to reduce cracking and warping. Rebar, instead of wire mesh, is recommended. The use of fiber as the sole method of reinforcement is not recommended.

19. Provide a minimum of 4 inches of compacted, select fill under floor slabs and all other isolated concrete slabs and sidewalks.

20. Provide a suitable vapor barrier under the slab that is compatible with the proposed floor covering and the method of slab curing.

21. Provide suitable footing, wall and subfloor drains in accordance with the recommendations contained herein.

__Site Preparation (Buildings)__

22. The highly weathered and residual soils are very moisture-sensitive and tend to become soft, weak and compressible when exposed to moisture, and often require removal and replacement with granular fill. Therefore, we recommend that the foundation areas under the proposed buildings be prepared during dry weather to reduce the potential for building subgrade disturbance.

23. Since stiff residual soils or competent siltstone are anticipated at the planned basement finish floor elevations, subgrade scarification and compaction is not recommended. Any weak or soft building subgrade areas should be selectively removed and replaced with compacted granular fill in accordance with the recommendations above. Compacted select fill is anticipated at the subgrade level of Building A. The building pad subgrade should be compacted in accordance with the recommendations provided for select fill above.

__Drainage for Buildings__

24. Building floors should be underlain by a drainage blanket at least 18 inches in thickness to intercept and remove ground water flowing into the building area. The drainage blanket should be composed of a 3-inch minus, crushed rock material with less than 3 to 5 percent fines (particles passing the No. 200 Sieve). The drainage blanket should be underlain by a non-woven, filter fabric (Amoco 4545, or equivalent). The drainage blanket should include trench drains at least 12 inches wide and ±24 inches deep, lined with filter fabric and backfilled with crushed rock. The top of the trench backfill should extend to the bottom of the drainage blanket. A 4-inch diameter, slotted or perforated PVC pipe should be placed in the bottom of the trench and bedded in at

least 4 inches of drain rock. The drain pipes should be spaced no further than 20 feet apart.

25. Discharge the subfloor drainage system by gravity flow into the nearest catch basin, manhole or storm drain.

26. To minimize seepage into down-gradient areas, backfill drainage trenches with low-permeability material near the building lines to create a seepage barrier. This backfill section should be at least 3 feet in length and be composed of a suitable compacted silty or clayey soil, or other suitable material. To further reduce seepage, a solid PVC pipe should be used down-gradient of this backfill zone.

27. Provide clean-outs at appropriate locations for future maintenance of the drainage system.

Basement/Retaining Wall Design

28. The cast-in-place concrete basement/retaining walls planned for the buildings should be designed to resist at-rest lateral earth pressures calculated using an equivalent fluid weight of 50 pounds per cubic foot (pcf). Cantilever conditions apply to walls capable of horizontal movements of at least 0.002H at the top of the wall, where H is the height of the wall. If these conditions are satisfied, then a lower active lateral earth pressure condition may be used. We recommend that cantilever walls be designed using an equivalent fluid weight of 35 pcf.

29. The design at-rest and active lateral earth pressures recommended above assumes a level backfill condition and no surcharge loads. The equivalent fluid pressures presented above should be increased by a factor of 1.5 for retaining walls which have a backslope inclination of 2:1(H:V). Walls with anticipated surcharge loads acting closer than a distance H should be designed to resist a uniform lateral earth pressure equal to approximately one-third of the estimated average surface surcharge.

30. Retaining walls should include a back-drain consisting of a free-draining, select granular layer at least 12 inches in thickness. The granular fill should be separated from the adjacent soil by a non-woven filter fabric such as Amoco 4545 or equal, and meet the material criteria outlined above. The upper foot of backfill should consist of silty or clayey soil to form a barrier against surface water intrusion and drain siltation.

31. A 4-inch diameter PVC perforated collector pipe should be placed at the base of the wall. Discharge the water from the retaining wall drainage system into the nearest catch basin, manhole or storm drain.

32. The backfill materials should be compacted to at least 90 percent of ASTM D 698-91. Only hand-operated equipment should be used within 5 feet behind retaining walls.

33. Waterproof all below-grade portions of the basement walls.

Subgrade Preparation and Pavement Construction

34. Strip the existing ground ±6 inches, or as required to remove roots, sod and forest duff. Dispose of all strippings outside of construction areas.

35. Compact the subgrade to a depth of at least 12 inches. Compaction may not be practical if the soils are too wet of optimum. Therefore, the site work should not be attempted during wet weather and should be delayed until the subgrade soils are sufficiently dry or until weather permits efficient aeration. A geotextile should be placed under any portion of the fill that is to be used as a staging area.

36. Maintain the moisture in the subgrade to prevent excessive drying and cracking. Immediately backfill the prepared subgrade with select fill and compact as specified.

37. Overexcavate and replace any areas of base rock and/or subgrade pumping with compacted, select fill.

38. Use granular site fill to grade the terrain under the new pavement section. The quality of the fill will affect the required thickness of the pavement section. Therefore, a sample of the proposed fill should be provided to us for approval.

39. Compact the granular site fill in loose lifts not exceeding 8 inches.

40. Use select fill as base rock under all pavements and compact as specified. Do not allow loaded trucks or heavy construction equipment on the finished base rock prior to paving.

41. Provide a minimum flexible pavement section of 3 inches of asphalt over 10 inches of select fill, compacted in accordance with the recommendations in this report.

42. Compact the asphalt concrete pavement to a minimum of 91% relative compaction according to the theoretical maximum density calculated from the Rice specific gravity.

43. The on-site soils and bedrock materials are moisture sensitive and will become soft, weak and practically unworkable during wet weather. Therefore, we recommend that pavement construction be done during dry weather. If pavement construction is done during wet weather,

pavement areas should be surfaced with a compacted, all-weather granular base layer. This layer should be at least 18 inches in thickness, depending on the frequency and weight of construction traffic. The layer should be composed of 3 to 4-inch minus, crushed rock or pit-run fill, with less than 5 percent fines. The layer should be constructed on a geotextile fabric, such as Amoco 2002, or equal.

DESIGN REVIEW/CONSTRUCTION OBSERVATION/TESTING

We should be provided the opportunity to review all drawings and specifications that pertain to site preparation, foundation construction and pavements. Site preparation will require field confirmation of exposed subgrade and ground water conditions. Mitigation of any subgrade pumping will also require engineering review and judgment. That judgment should be provided by one of our representatives. Frequent field density tests should be run on all engineered fill, subgrade and base rock. We recommend that we be retained to provide the necessary construction observation and testing.

VARIATION OF SUBSURFACE CONDITIONS, USE OF THIS REPORT AND WARRANTY

The analysis, conclusions and recommendations contained herein are based on the assumption that the soil profiles and the ground water levels encountered in the test pits and borings are representative of overall site conditions. The above recommendations assume that we will have the opportunity to review final drawings and be present during construction to confirm assumed foundation conditions. No changes in the enclosed recommendations should be made without our approval. We will assume no responsibility or liability for any engineering judgment, inspection or testing performed by others.

This report was prepared for the exclusive use of Devco Engineering, Inc. and their design consultants for the New Medical Office Building Complex project at Good Samaritan Hospital in Corvallis, Oregon. Information contained herein should not be used for other sites or for unanticipated construction without our written consent. This report is intended for planning and design purposes. Contractors using this information to estimate construction quantities or costs do so at their own risk. Our services do not include any survey or assessment of potential surface contamination or contamination of the soil or ground water by hazardous or toxic materials. We assume that those services, if needed, have been completed by others.

Our work was done in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

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Appendix A

Figure

Professional
Geotechnical
Services

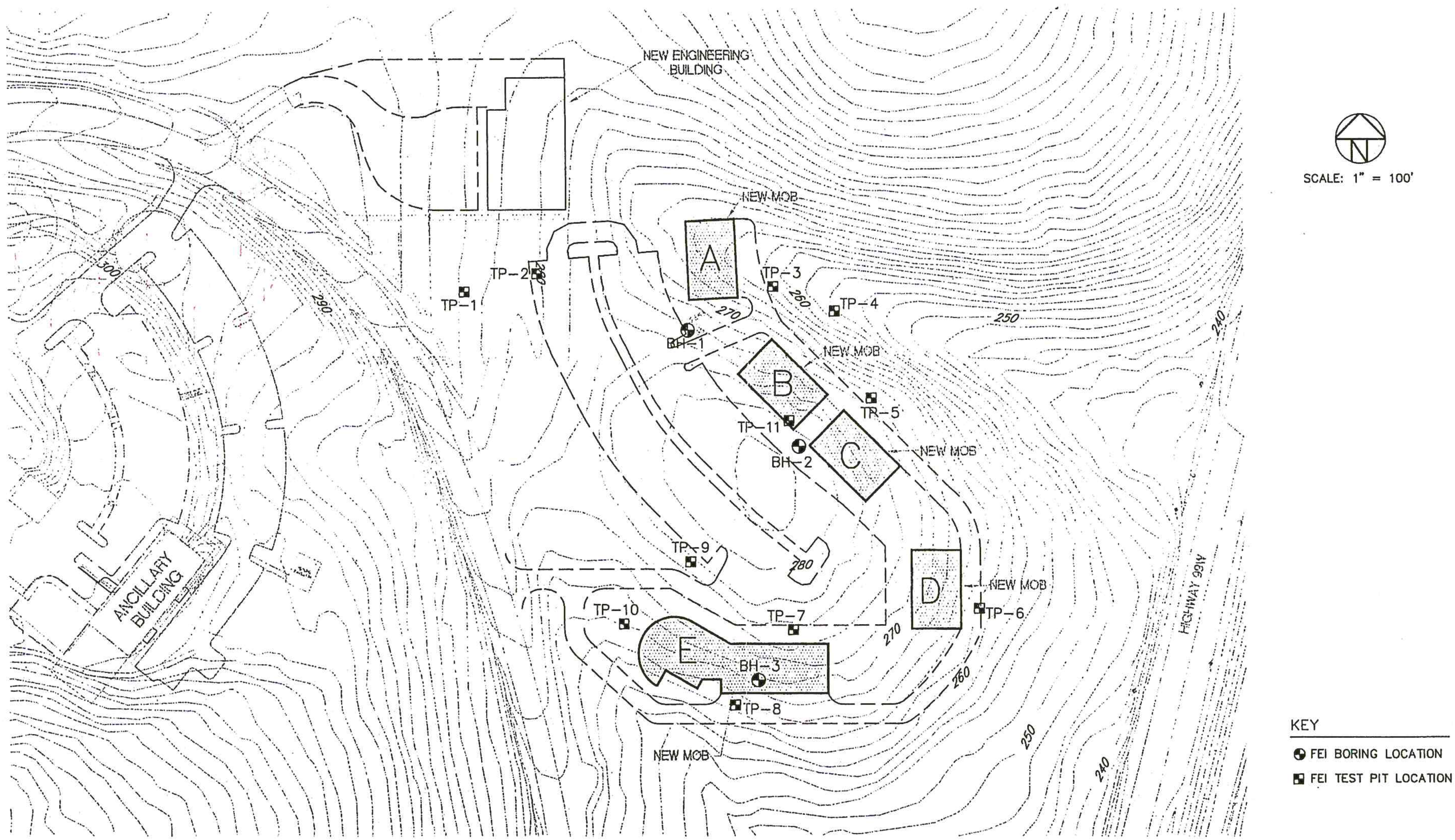
Foundation Engineering, Inc.

Appendix B

Boring and Test Pit Logs

Professional Geotechnical Services

Foundation Engineering, Inc.



NOTES:
1. BASE MAP WITH BORING AND TEST PIT LOCATIONS PROVIDED BY DEVCO ENGINEERING, INC.
2. SEE REPORT FOR A DISCUSSION OF SUBSURFACE CONDITIONS.

FOUNDATION ENGINEERING INC.
PROFESSIONAL GEOTECHNICAL SERVICES
5030 SW PHILOMATH BLVD.
CORVALLIS, OR 97333-1044
BUS. (541) 757-7645 FAX (541) 757-7650

DATE 1/26/98
DWN. MKN
APPR.
REVIS.
PROJECT NO.
97100243

SITE PLAN
NEW MEDICAL OFFICE BUILDING COMPLES
GOOD SAMITARIAN HOSPITAL
CORVALLIS, OREGON

FIGURE NO.
1

ROCK DESCRIPTIONS

Core Log: start depth, end depth, length, recovery, % recovery, unbroken length, RQD.
Rock Description: Strength (hardness), NAME; color, weathering, joint/bedding spacing, joint angles/character/infilling, other, (formation/unit name).
Discontinuity Description: Angle/type/shape/roughness/infilling, description, width.

Field Identification		UCS psi (MPa)	P.L. Index psi (MPa)	Strength (Hardness)
Indented by thumbnail.	R0	< 100 (0.25-1.0)		Extremely Weak (Extremely Soft)
Crumbles under firm blows with geological hammer, can be peeled by a pocket knife.	R1	100 - 1000 (1.0-5.0)		Very Weak (Very Soft)
Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with geological hammer.	R2	1000 - 4000 (5.0-25)		Weak (Soft)
Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single blow of geological hammer.	R3	4000 - 8000 (25-50)	145-290 (1-2)	Medium Strong (Medium Hard)
Specimen requires more than one blow of geological hammer to fracture it.	R4	8000 - 16000 (50-100)	290-480 (2-4)	Strong (Hard)
Specimen requires many blow of geological hammer to fracture it.	R5	16,000-36,000 (100-250)	480-960 (4-8)	Very Strong (Very Hard)
Specimen can only be chipped with geological hammer.	R6	>36,000 (>250)	>960 (>8)	Extremely Strong (Extremely Hard)

Term	Weathering Field Identification
Fresh	Crystals are bright. Discontinuities may show some minor surface staining. No discoloration in rock fabric.
Slightly Weathered	Rock mass is generally fresh. Discontinuities are stained and may contain clay. Some discoloration in rock fabric.
Moderately Weathered	Significant portions of rock show discoloration and weathering effects. Crystals are dull and show visible chemical alteration. Discontinuities are stained and may contain secondary mineral deposits.
Highly Weathered	Rock can be excavated with geologist's pick. All discontinuities exhibit secondary mineralization. Complete discoloration of rock fabric. Surface of core is friable and usually pitted due to washing out of highly altered minerals by drilling water.
Decomposed	Rock mass is completely decomposed. Original rock "fabric" may be evident. May be reduced to soil with hand pressure.

Spacing meters	Spacing feet	Spacing Term	Bedding/ Foliation
< 0.06	< 2 in.	Very close	Very Thin
0.06 - 0.30	2 in. - 1 ft.	Close	Thin
0.30 - 0.90	1 ft. - 3 ft.	Moderately close	Medium
0.90 - 3.0	3 ft. - 10 ft.	Wide	Thick
>3.0	> 10 ft.	Very Wide	Very Thick (Massive)

Vesicle Term	Volume
Some	3 - 20%
Highly	20 - 50%
Scoria	> 50%

Stratification Term	Description
Lamination	< 1 cm thick beds
Fissile	Preferred break along laminations
Parting	Preferred break direction
Foliation	Metamorphic layering of minerals

Discontinuity Description

Type	Shape	Roughness	Infilling
J - Joint	Pl - Planer	P - Polished	Infilled
F - Fault	C - Curved	Sl - Slikensided	Open
B - Bedding	U - Undulating	Sm - Smooth	Closed
Fo - Foliation	St - Stepped	R - Rough	Healed
S - Shear	Ir - Irregular	VR - Very Rough	Mineralized

SYMBOL KEY
FOR
BORING AND TEST PIT LOGS

DISTINCTION BETWEEN FIELD LOGS AND FINAL LOGS

A field log is prepared for each boring or test pit by our field representative. The log contains information concerning sampling depths, and the presence of various materials such as gravel, cobbles and fill, and observations of ground water. It also contains our interpretation of the soil conditions between samples. The final logs presented in this report represent our interpretation of the contents of the field logs and the results of the laboratory examinations and tests. Our recommendations are based on the contents of the final logs and the information contained therein and not on the field logs.

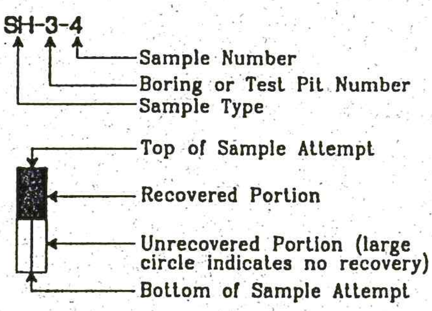
VARIATION OF SOILS BETWEEN TEST PITS AND BORINGS

The final log and related information depict subsurface conditions only at the specific location and on the date indicated. Those using the information contained herein should be aware that soil conditions at other locations or on other dates may differ. Actual foundation or subgrade conditions should be confirmed by us during construction.

TRANSITION BETWEEN SOIL OR ROCK TYPES

The lines designating the interface between soil, fill or rock on the final logs and on subsurface profiles presented in the report are determined by interpolation and are therefore approximate. The transition between the materials may be abrupt or gradual. Only at boring or test pit location s should profiles be considered as reasonably accurate and then abrupt or gradual. Only at boring or test pit locations should profiles by considered as reasonably accurate and then only to the degree implied by the notes thereon.

SAMPLE OR TEST SYMBOLS



SS – Standard Penetration Test Sample (split-spoon)
SH – Thin-walled Shelby Tube Sample
C – Core Sample
CS – Continuous Sample

▲ Standard Penetration Test Resistance equals the number of blows a 140-lb weight falling 30 in. required to drive a standard split-spoon sampler 1 ft. Practical refusal – 50 or more blows per 6 in. of sampler penetration.

● Water Content (%).

UNIFIED SOIL CLASSIFICATION SYMBOLS

G – Gravel	W – Well Graded
S – Sand	P – Poorly Graded
M – Silt	L – Low Plasticity
C – Clay	H – High Plasticity
Pt – Peat	O – Organic

FIELD SHEAR STRENGTH TEST

Shear strength measurements on test pit side walls, blocks of soil or Shelby tube samples are typically made with Torvane or pocket penetrometer devices.

TYPICAL SOIL/ROCK SYMBOLS

 Sand
 Silt
 Clay
 Gravel
 Basalt
 Siltstone

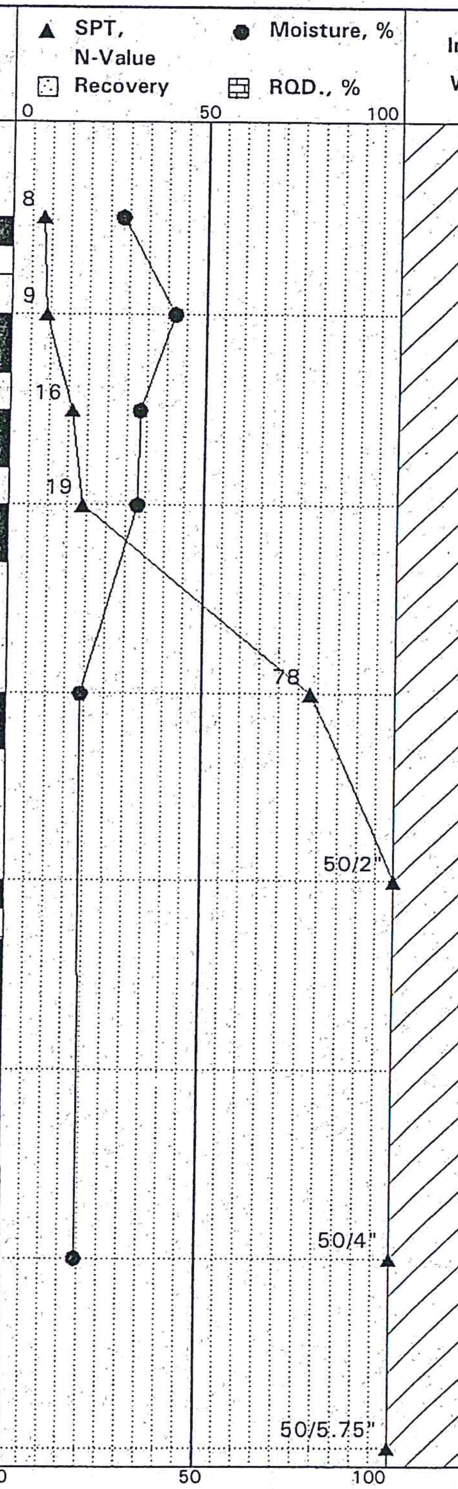
WATER TABLE

 Water Table Location

(1/31/94) Date of Measurement

 Piezometer Tip Location (if used)

Depth Feet	Soil and Rock Description and Comments	Elev. Depth	Samples	Installations/ Water Table
0	Medium stiff SILT; some clay, brown, moist, occasional fine roots (Topsoil).	274.0 / 0.0		Bentonite chips.
3			SS-1-1	
3.5	Stiff, clayey SILT; tan mottled orange, iron-stained relict jointing (Residual soil).	270.5 / 3.5		
5			SS-1-2	
7.5	Soil becomes very stiff below 7.5 feet.		SS-1-3	
10			SS-1-4	
12.5	Extremely weak (R0) to very weak (R1) SILTSTONE; tan mottled orange becoming grey, moderately to slightly weathered (Spencer Formation). Rock contains 6-inch softer lenses between 12.5 to 15 feet. Softer lenses are 1 to 2 inches thick and less common below 15 feet.	261.5 / 12.5		
15			SS-1-5	
20			SS-1-6	
22	Rock becomes weak (R2), fresh and close jointed below 22 feet. Joint surface are open, planar and rough. Rock coring attempted and terminated.			
30			SS-1-7	
35.5	BOTTOM OF BORING	238.5 / 35.5	SS-1-8	



Project No.: 97100243

Surface Elevation: 274 feet (Approx.)

Date of Boring: December 1, 1997

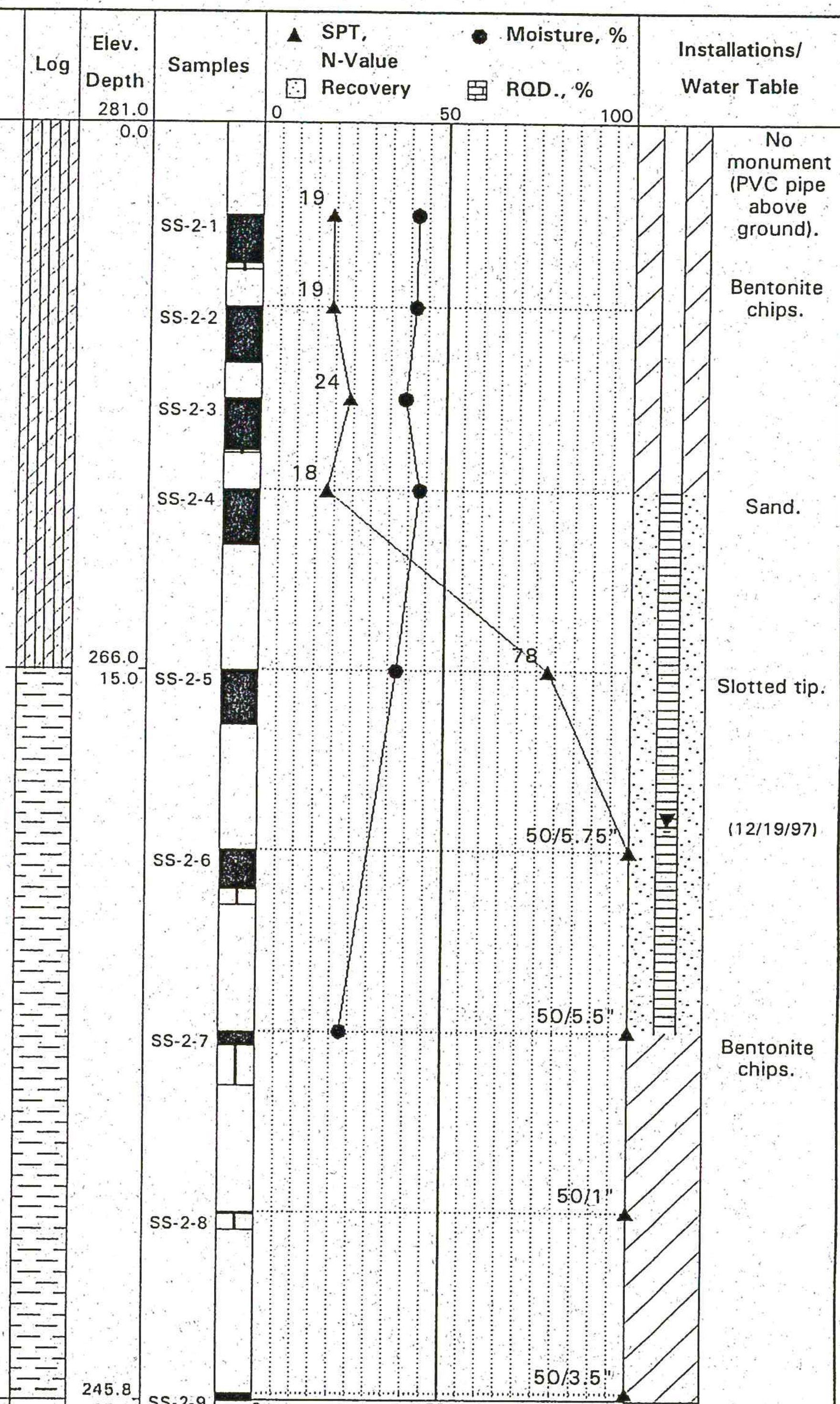
Foundation Engineering, Inc.

Boring Log: BH-1

New Medical Office Building Complex

Corvallis, Oregon

Depth Feet	Soil and Rock Description and Comments
0–15	Very stiff, clayey SILT; some fine sand, tan mottled orange, iron-stained, moist, relict jointing (Residual soil).
12	Stiffer soil conditions encountered below 12 feet.
15	Extremely weak (R0) SILTSTONE; tan mottled orange, moderately to highly weathered (Spencer Formation).
17	Soft zone encountered between 17 and 19 feet.
19	Rock becomes extremely weak (R0) to very weak (R1) and moderately weathered below 19 feet.
25	Rock becomes grey-green and very weak (R1) below 25 feet.
29	Rock becomes weak (R2), grey and fresh below 29 feet. Occasional 1 to 2-inch thick soft lenses encountered.
35	BOTTOM OF BORING Ground water measured at depth of about 19.3 feet below ground on 12/19/97.



Project No.: 97100243

Surface Elevation: 281 feet (Approx.)

Date of Boring: December 2, 1997

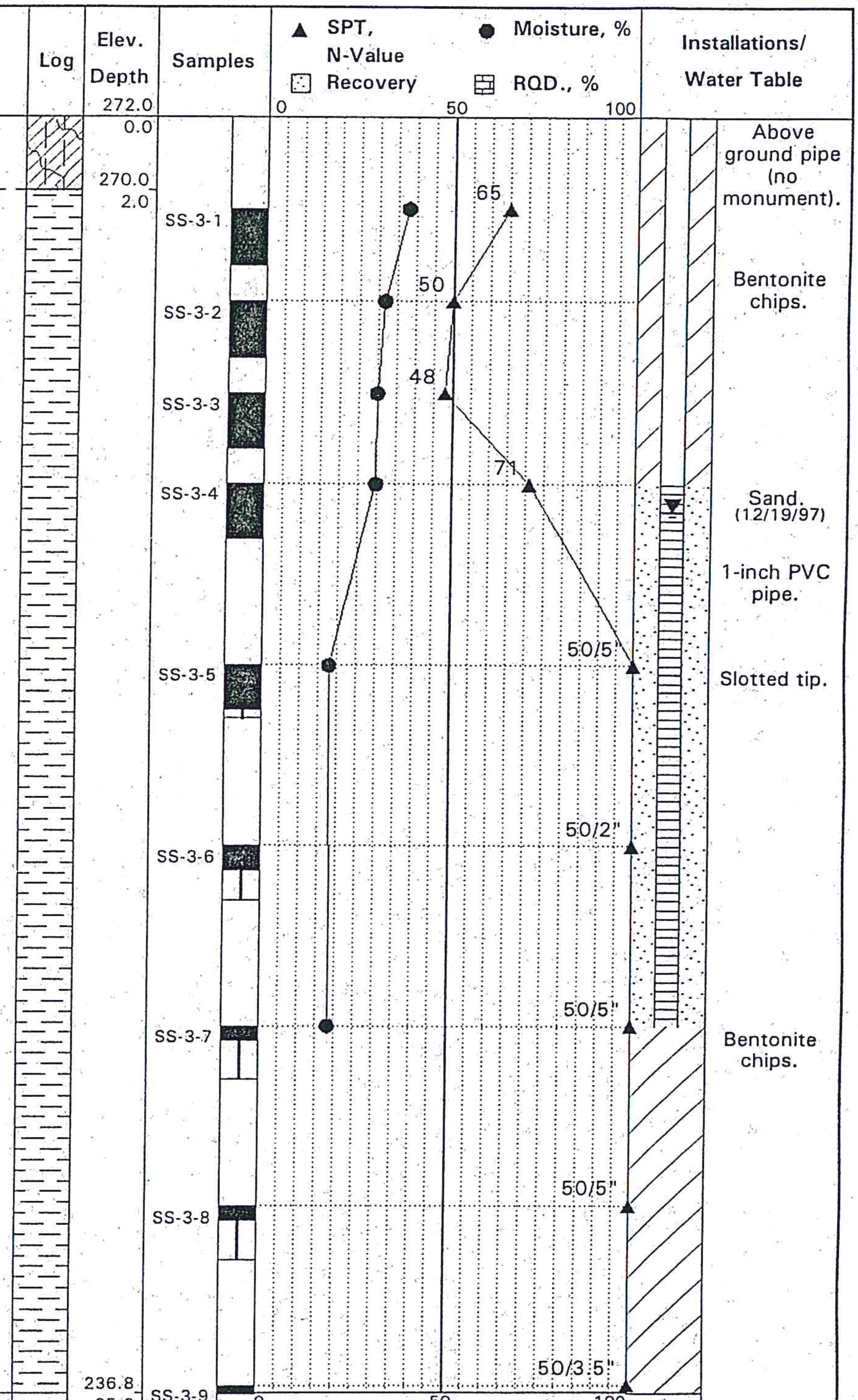
Boring Log: BH-2

New Medical Office Building Complex

Corvallis, Oregon

Foundation Engineering, Inc.

Depth Feet	Soil and Rock Description and Comments	Elev. Depth	Samples
		272.0 / 0.0	
0–2	Medium stiff, silty CLAY with trace fine roots; dark brown, moist, low to medium plasticity (Topsoil).	270.0 / 2.0	
2	Extremely weak (R0) SILTSTONE; brown mottled orange, iron-stained joints, highly weathered (Spencer Formation).		SS-3-1
5	Rock becomes brown mottled grey and orange below 5 feet.		SS-3-2
7.5	Rock becomes grey mottled orange and moderately weathered below 7.5 feet.		SS-3-3
10			SS-3-4
15	Rock becomes extremely weak (R0) to weak (R1), grey and slightly weathered below 15 feet.		SS-3-5
20	Rock become very weak (R1) and fresh below 20 feet.		SS-3-6
25	Rock becomes very weak (R0) to weak (R2) below 25 feet.		SS-3-7
30			SS-3-8
35	BOTTOM OF BORING Ground water measured at depth of about 10.8 feet below ground on 12/19/97.	236.8 / 35.2	SS-3-9



Project No.: 97100243

Surface Elevation: 272 feet (Approx.)

Date of Boring: December 3, 1997

Foundation Engineering, Inc.

Boring Log: BH-3

New Medical Office Building Complex

Corvallis, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
	1-							3 inches of sod followed by medium stiff, silty CLAY with some small roots; dark brown, moist, medium plasticity, friable (Topsoil).
	2-	S-1-1				0.4		Stiff, clayey SILT; brown, moist, low to medium plasticity (Residual soil).
	3-	S-1-2				0.7		
	4-							
	5-							
Rapid seepage noted at about 5.7 feet. Rock excavated relatively easy with trackhoe.	6-							Extremely weak (R0) SILTSTONE; grey, stained red and black, slightly to moderately weathered, very close jointed (Spencer Formation).
	7-							
	8-	S-1-3						
	9-							BOTTOM OF TEST PIT
	10–							
	11-							

Project No.: 97100243

Surface Elevation: 284 feet (Approx.)

Date of Test Pit: November 21, 1997

Test Pit Log: TP -1

New Medical Office Building Complex

Corvallis, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
	1-							3 inches of sod and roots followed by medium stiff, silty CLAY with some small roots; dark brown, moist, low to medium plasticity (Topsoil).
	2-					0.6		Stiff, clayey SILT; brown, moist, low to medium plasticity (Residual soil).
	3-							
	4-							
	5-							
Rapid seepage noted at about 6 feet.	6-							Color grades to brown-grey, mottled, below about 6 feet.
	7-	S-2-1						
	8-							
	9-							BOTTOM OF TEST PIT
	10–							
	11-							

Project No.: 97100243

Surface Elevation: 280 feet (Approx.)

Date of Test Pit: November 21, 1997

Test Pit Log: TP -2

New Medical Office Building Complex

Corvallis, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Caving in upper 6 feet of test pit.								4 inches of sod followed by soft, silty CLAY with small roots; dark brown, wet, low to medium plasticity, friable (Topsoil).
	1-	S-3-1						
	2-							
	3-	S-3-2				0.7		Stiff, clayey SILT; brown, moist, low to medium plasticity (Residual soil).
	4-							Stiff, clayey SILT with trace charcoal; brown-grey, mottled, moist, low plasticity (Residual soil).
	5-							
Rapid surface runoff. Seepage noted at about 6 feet.	6-							
	7-	S-3-3						
	8-							
Rock excavated relatively easily with trackhoe.	9-	S-3-4						Extremely weak (R0) to very weak (R1) SILTSTONE; grey mottled brown, moderately to slightly weathered, very close to close jointed (Spencer Formation).
	10–							BOTTOM OF TEST PIT
	11-							

Project No.: 97100243

Surface Elevation: 262 feet (Approx.)

Date of Test Pit: November 21, 1997

Test Pit Log: TP -3

New Medical Office Building Complex

Corvallis, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Caving in the upper 6 feet of test pit.								4 inches of sod followed by soft, silty CLAY with small roots; dark brown, wet, low plasticity, friable (Topsoil).
	1-							Stiff, clayey SILT; brown, moist, low to medium plasticity (Residual soil).
	2-							
	3-							Stiff, clayey SILT; brown-grey, moist, low plasticity (Residual soil).
Rapid surface runoff. Seepage noted at 4 feet.	4-							
	5-							
	6-	S-4-1				0.6		
	7-							
	8-							
	9-							Stiff, clayey SILT with some charcoal and highly weathered rock fragments; grey-brown, mottled, moist, low plasticity (Residual soil).
	10–	S-4-2						BOTTOM OF TEST PIT
	11-							

Project No.: 97100243

Surface Elevation: 256 feet (Approx.)

Date of Test Pit: November 21, 1997

Test Pit Log: TP -4

New Medical Office Building Complex

Corvallis, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Caving in upper 5 to 6 feet.	1-							4 inches of sod followed by soft, clayey SILT with some small roots; dark brown, moist, low to medium plasticity, friable (Topsoil).
	2-	S-5-1				0.3		
Some surface runoff in upper 3 feet.	3-	S-5-2						Stiff, clayey SILT; brown, moist, low to medium plasticity (Residual soil).
	4-					0.6		
	5-							
Seepage noted at 6.5 feet.	6-							Stiff, clayey SILT with trace charcoal; red-brown mottled grey, damp, low to medium plasticity (Residual soil).
	7-							
	8-							
	9-							
	10-	S-5-3						
	11-							BOTTOM OF TEST PIT

Project No.: 97100243

Surface Elevation: 270 feet (Approx.)

Date of Test Pit: November 21, 1997

Test Pit Log: TP -5

New Medical Office Building Complex

Corvallis, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
	1-					0.35		6 inches of sod followed by medium stiff, silty CLAY; brown, moist, low to medium plasticity, friable (Topsoil).
	2-							Grades to stiff and non-friable below about 2 feet.
	3-	S-6-1				0.6		
	4-							
	5-							Extremely weak (R0) to weak (R1) SILTSTONE; grey stained brown and black, moderately weathered, very close to close jointed (Spencer Formation).
	6-	S-6-2						
Rock excavated relatively easily with a trackhoe.	7-	S-6-3						Grades to slightly weathered below about 7 feet.
No ground water infiltration noted.	8-							
	9-							BOTTOM OF TEST PIT
	10-							
	11-							

Project No.: 97100243

Surface Elevation: 262 feet (Approx.)

Date of Test Pit: November 21, 1997

Test Pit Log: TP -6

New Medical Office Building Complex

Corvallis, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
								3 inches of sod followed by medium stiff, silty CLAY with trace small roots; dark brown, moist, low to medium plasticity (Topsoil).
	1-	S-7-1-				0.38		
	2-	S-7-2						Extremely weak (R0) to weak (R1) SILTSTONE; brown mottled grey and black, highly weathered (upper 9 inches) to moderately weathered, very close jointed (Spencer Formation).
	3-							
	4-							
	5-							
	6-							Becomes fresh, close jointed and color grades to tan mottled brown and black below about 6 feet.
Rock excavated with moderate effort using a trackhoe.	7-	S-7-3						
No ground water infiltration noted.	8-							
	9-							BOTTOM OF TEST PIT
	10-							
	11-							

Project No.: 97100243

Surface Elevation: 274 feet (Approx.)

Date of Test Pit: November 21, 1997

Test Pit Log: TP -7

New Medical Office Building Complex

Corvallis, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
								3 inches of sod followed by medium stiff, clayey SILT with some small roots; brown, moist, low to medium plasticity (Topsoil).
	1-	S-8-1				0.5		
	2-							Extremely weak (R0) SILTSTONE; tan mottled brown and black, slightly to moderately weathered, very close to close jointed (Spencer Formation).
	3-	S-8-2						
	4-	S-8-3						
	5-							Becomes very weak (R1) and slightly weathered below 5 feet.
	6-							
Moderate to hard digging below bout 7 feet.	7-							
No ground water infiltration noted.	8-	S-8-4						
	9-							BOTTOM OF TEST PIT
	10-							
	11-							

Project No.: 97100243

Surface Elevation: 265 feet (Approx.)

Date of Test Pit: November 21, 1997

Test Pit Log: TP -8

New Medical Office Building Complex

Corvallis, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
	1-							4 inches of sod followed by medium stiff, silty CLAY with some small roots; dark brown, moist, low to medium plasticity (Topsoil).
	2-	S-9-1				0.4		
	3-	S-9-2 S-9-3				0.6		Stiff, clayey SILT; grey mottled brown, moist, low plasticity, becomes very stiff below 3 feet (Residual soil).
	4-							Very weak (R1) SILTSTONE; tan mottled brown, slightly weathered, very close jointed, joints are iron-stained (Spencer Formation).
Moderate digging effort required below about 5 feet.	5-							
No ground water infiltration noted.	6-	S-9-4						Becomes weak (R2) below 5.5 feet. BOTTOM OF TEST PIT
	7-							
	8-							
	9-							
	10-							
	11-							

Project No.: 97100243

Surface Elevation: 275 feet (Approx.)

Date of Test Pit: November 21, 1997

Test Pit Log: TP -9

New Medical Office Building Complex

Corvallis, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
	1-	S-10-1						3 inches of sod followed by medium stiff, clayey SILT; dark brown, moist, low to medium plasticity (Topsoil).
	2-					0.35		
	3-	S-10-2				0.6		Stiff, clayey SILT; brown, moist, low plasticity (Residual soil). Color grades to brown mottled grey and becomes very stiff below 3.5 feet.
	4-							
	5-							
No ground water infiltration noted.	6-							Extremely weak (R0) to very weak (R1) SILTSTONE; grey-brown, mottled, iron-stained, decomposed to moderately weathered (Spencer Formation). BOTTOM OF TEST PIT
	7-							
	8-							
	9-							
	10-							
	11-							

Project No.: 97100243

Surface Elevation: 268 feet (Approx.)

Date of Test Pit: November 21, 1997

Test Pit Log: TP-10

New Medical Office Building Complex

Corvallis, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
	1-							Loose, silty GRAVEL; brown mottled grey, moist, fine to medium, rounded gravels. Some residual soil (Fill).
	2-							Medium stiff, clayey SILT with some roots; dark brown moist, low plasticity, becomes stiff below about 3 feet (Topsoil).
	3-	S-11-1 S-11-2				0.35		
	4-					0.6		
	5-							Stiff, clayey SILT; grey-brown, mottled, moist, low plasticity, some fragments of highly weathered rock (Residual soil).
	6-							
	7-							Very weak (R1) SILTSTONE; grey stained brown, very close to close joints (Spencer Formation).
	8-							
	9-							
No ground water infiltration noted.	10-							BOTTOM OF TEST PIT
	11-							

Project No.: 97100243

Surface Elevation: 280 feet (Approx.)

Date of Test Pit: November 21, 1997

Test Pit Log: TP-11

New Medical Office Building Complex

Corvallis, Oregon

Appendix C

Laboratory Test Results

Professional Geotechnical Services

Foundation Engineering, Inc.

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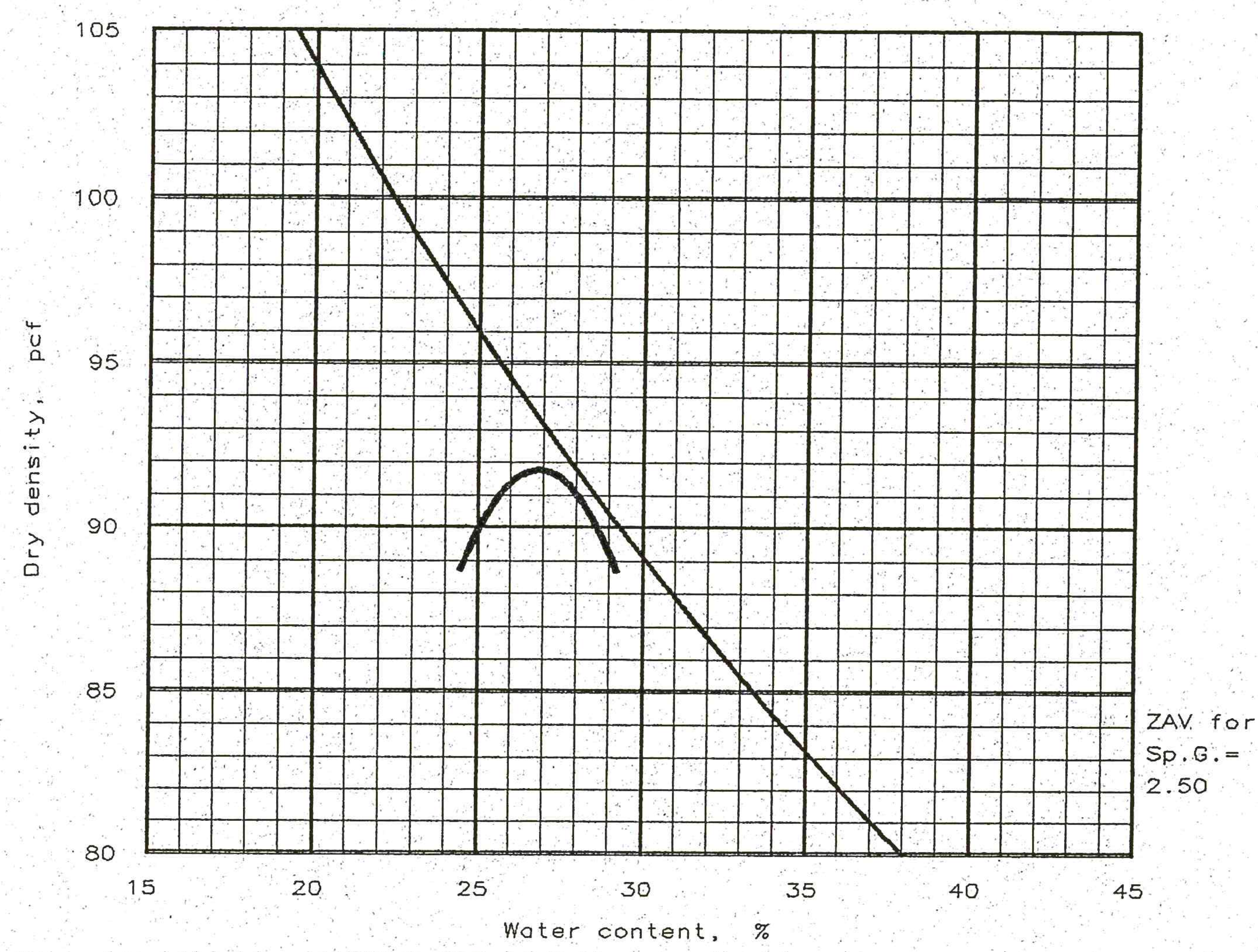
Medical Office Building Complex
Good Samaritan Hospital
Project 97100243

Table 1. Natural Water Content and Atterberg Limits

Sample Number	Sample Depth (feet)	Natural Water Content (percent)	LL	PL	PI	USCS Classification
S-1-1	2.0	28.7				
S-1-2	3.5	31.5				
S-2-1	7.5	29.2				
S-3-2	3.5	27.9				
S-4-1	6.5	23.4				
S-4-2	10.0	30.7				
S-5-1	2.0	33.4	41	14	27	ML
S-5-3	10.0	27.8				
S-6-1	3.0	23.8	32	11	21	CL
S-7-1	1.5	31.1				
S-8-1	1.5	27.8				
S-9-1	2.0	30.4				
S-10-1	1.5	24.5				
S-11-2	3.0	28.4				

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-91 Method A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
---	---	---	27.9 %	---	---	---	0 %	--- %

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 92.0 pcf Optimum moisture = 27.0 %	Brown silt.

Project No.: 97100243

Project: M.O.B. Complex, G.S.H.

Location: Corvallis, Oregon

Date: 12-03-1997

Remarks:

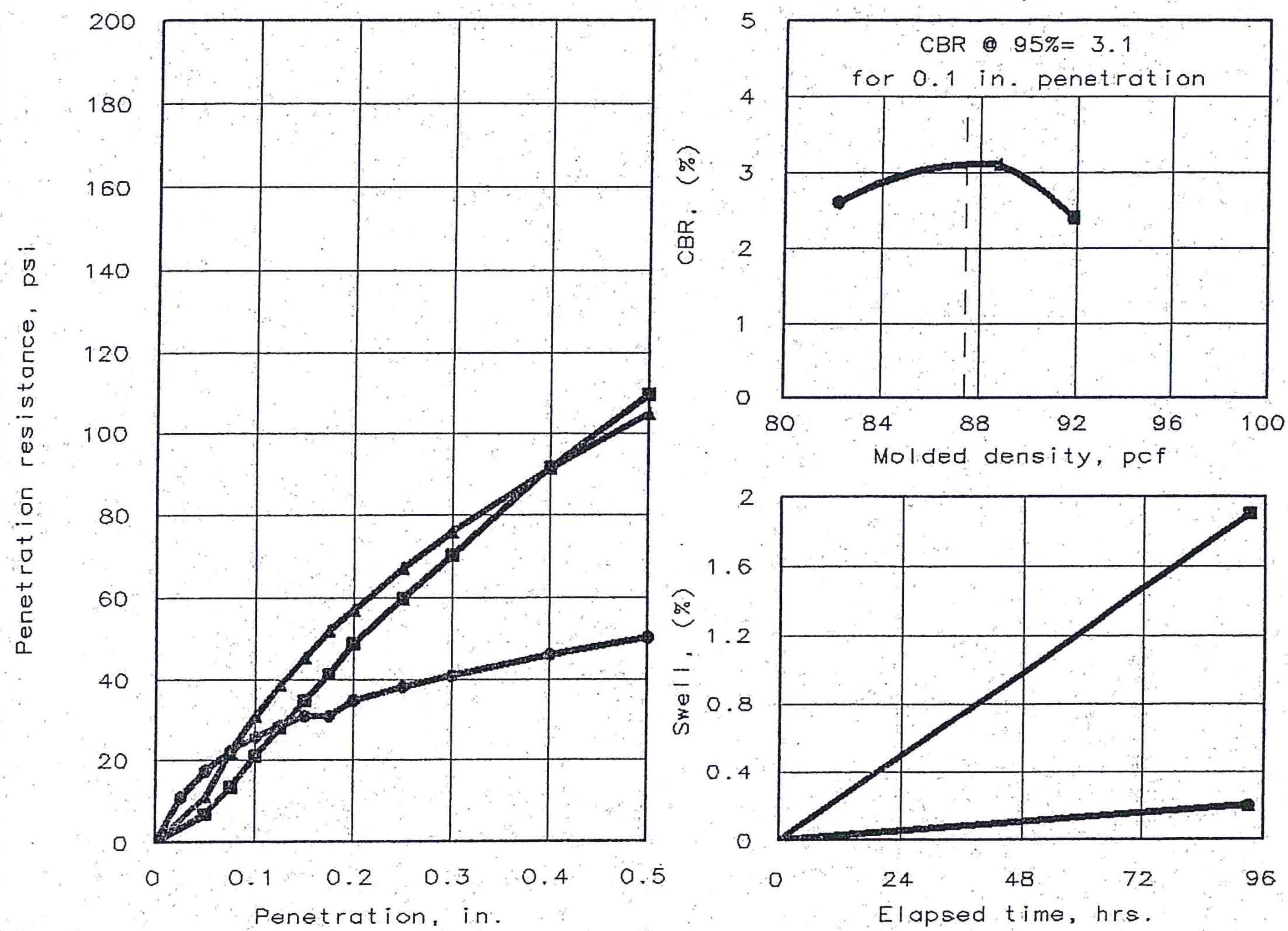
Sample: S-10-1

MOISTURE-DENSITY RELATIONSHIP TEST

Foundation Engineering, Inc.

Fig. No. 1a

BEARING RATIO TEST REPORT



	Molded			Soaked			CBR, (%)		Lin.	Pen.	Swell
	Dens.	% max	moist	Dens.	% max	moist	0.1"	0.2"	Cor.	Sur.	%
1 ●	82.2	89.3	26.9%	82.0	89.1	32.7%	2.6	2.3	0	20	0.2
2 ▲	88.8	96.5	26.9%	88.6	96.3	29.6%	3.1	3.8	0	20	0.2
3 ■	91.9	99.9	26.9%	90.2	98.0	28.3%	2.4	3.4	0.010	20	1.9

MATERIAL DESCRIPTION	USCS	Max. dens.	Opt. w.c.	LL	PI
Brown silt.	---	92.0	27.9	---	---

Project No: 97100243
Project: M.O.B. Complex, G.S.H
Location: Corvallis, Oregon

Date: 12-14-1997

Test Descr./Remarks:

Sample: S-10-1

APPROVED
JUL 16 2007
DEVELOPMENT SERVICES
CITY OF CORVALLIS

BEARING RATIO TEST REPORT
Foundation Engineering, Inc.

Fig. No. 1b