SECTION 02010
SUBSURFACE EXPLORATION

## PART 1.00 - GENERAL

### 1.01 DESCRIPTION

A. Soil Information

1. Following this sheet is a copy of the soils investigation report for the Pavement Thickness Design For Dike Roadway and the Soils Investigation report for the Grays Harbor Community College Heavy Duty Equipment Building, for Grays Harbor Community College, Aberdeen, Washington, together with the Supplemental Report to the Soils Investigation report for the Grays Harbor Community College Heavy Duty Equipment Building, all as prepared by Western Geotechnical, Inc., and are included herein for Contractor's reference.

2. The Contractor shall make his own deductions and conclusions as to the nature of the materials to be excavated, the difficulties which may arise from subsurface conditions, and of doing any other work affected by the subsurface conditions, and shall accept full responsibility.

3. The Owner does not warrant the correctness of the soil investigation reports or of any interpretation, deduction or conclusion given in the reports relative to subsoil conditions.

REPORT NO. 49

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WESTERN GEOTECHNICAL, INC.
2726-A Black Lake Boulevard, S.W.
Olympia, Washington 98502

(206) 357-4651

# SOILS INVESTIGATION FOR THE GRAYS HARBOR COMMUNITY COLLEGE HEAVY DUTY EQUIPMENT BUILDING

This report represents the results of our subsurface investigation for the new heavy equipment shop at Grays Harbor Community College. It is our understanding that the structure is to be approximately 30' high, of steel frame construction, metal walls and CMU to 8' high.

Our purpose, in the investigation, was to explore the soil conditions on the project site, so that we could develop recommendations for site work and foundation support. Work was authorized, on behalf of the owner, by Mr. Frank Smith, of BJSS Architects.

## SITE CONDITIONS :

### Surface Conditions

The site is lightly wooded with small alders of 6" - 8" diameter, bushes and light grass. Decomposing leaves and other organics are 3" - 5" deep.

### Subsurface Conditions

Subsurface conditions were explored by two test borings, sampled under our supervision, by a truck mounted drill rig. The test borings were logged and blow counts/split spoon samples taken at approximately 5' intervals. The samples were returned to the laboratory for evaluation of their engineering properties for foundation design purposes. The boring logs and the laboratory determinations have been used to develop the recommendations of this report and are included in the appendix.

Generally the top 3" - 5" of the site consists of decomposing leaves and other organic matter. From 4" - 12" deep, the soil consists of a dark brown organic silty sand. From 1' to 8' below grade, the soil consists of a medium dense/wet brown cohesive silt. In the area of boring #3, from 8½' - 11½' below grade, the soil consists of a high plastic blue/brown clay. Generally, from 8' - 12' below grade the soil is a dense/moist silty sand, to 25' below grade. Ath this depth, the soil becomes an extremely dense blue/grey sandstone. The water table varied from 8' - 12' below grade.

CONCLUSIONS AND RECOMMENDATIONS :

All organic top soil, roots, etc. should be removed from the top 12" of the site. Suitable excavated top soil may be stockpiled separately for use in landscaped areas.

To ensure against unacceptable settlement of the building, the following recommendations for footing bearing capacity are submitted :

Overexcavate 10' outside the building perimeter and approximately 8' - 11½' below existing grade, to the brown silty sand material. This will generally be at the water table. Replace the excavated material with structural fill in compacted lifts, in accordance with the Earthwork Criteria section of this report, up to finish floor subgrade. With the footings a minimum of 24" below grade and 18" wide, a maximum allowable bearing capacity of 3,000 psf may be used for design purposes.

FLOOR SLABS :

To ensure a dry concrete, slab-on-grade floor, both a capillary break and a vapor barrier are recommended. A 4" thickness of clean peagravel should be placed beneath the slab floor for a capillary break. A vapor barrier should be placed between the capillary break and the bottom of the slab-on-grade. The integrity of the vapor barrier should be maintained where penetrations exdend through it and laps should be sealed.

SETTLEMENT :

Settlement of concrete footings and slab-on-grade, placed in accordance with our recommendations, are not expected to be significant. A maximum differential settlement of ½" may be expected, with the majority occuring during construction.

EARTHWORK CRITERIA :

Remove all topsoil, sod, roots from the building area. Excavate the wet brown silt to a depth such that the brown silty sand with gravel is exposed (generally 8' - 11½' below existing grade). No excavated

material is recommended for use as structural fill. Replace the excavated material with imported structural fill meeting the criteria for APWA Bank Run Sand and Gravel. If the sitework is performed during the dry season, Class "B" Bank Run may be used. If the sitework is performed during the wet season, Class "A" Bank Run must be used. In either case, Class A Bank Run must be used for the bottom 2' of the fill, due to the water table, In addition, dewatering of the site may be required, due to the water table. All structural fill should be placed in 8" loose lifts and each lift compacted to 95% of ASTM D 1557. If deemed feasible by the engineer, the bottom 2' of structural fill may be placed in a single lift to help bridge the water table.

Earthwork, including excavation to bearing material, should be performed under the continuous supervision and inspection of the engineer. A testing laboratory, approved by the engineer, should be retained to ensure compliance with the compaction requirements.

Excavation to subgrade and placement of fill should be suspended during periods of unfavorable weather. No fill is to be placed while the ground is frozen or thawing. When work is stopped by rain, the placement of fill will not resume until the engineer determines that conditions are suitable for compactive effort and that the previously placed fill has not been loosened. The contractor will take appropriate measures, during unfavorable weather, to protect fill already placed and subgrade already exposed. Measures may be required limiting wheeled traffic and/or grading to provide temporary drainage. Due to the water table, pumping and/or ditching may be required to keep the building area dry, until fill placement has been completed. Per the direction of the engineer, the contractor will be responsible for the removal or re-working of fill that has softened to less than the required compaction, or is flexing under loadings.

LIMITS OF LIABILITY :

The engineer is responsible for the conclusions and opinions contained in this report based on the data relating only to the specific project and location discussed herein. In the event conclusions or recommen dations based on this data are made by others, such conclusions and recommendations are not the responsibility of the engineer unless he has been give an opportunity to review them and concurs in such conclusions and recommendations in writing.

The analysis and recommendations submitted in this report are based upon the data obtained from the test pit logs at the locations in dicated on the attached plan. This report does not reflect any variations that may occur between these test pits. The nature and extent of variations between the test pits may not become evident until they appear during the course of construction. If variations then appear, it will be necessary for the recommendations of this report to be reevaluated after performing onsite observations during the excavation period and noting the characteristics of such variations.

This opinion assumes that the contractor will exercise the highest degree of sound construction practices, and that he will adhere to the criteria and procedures set forth in the previous sections.

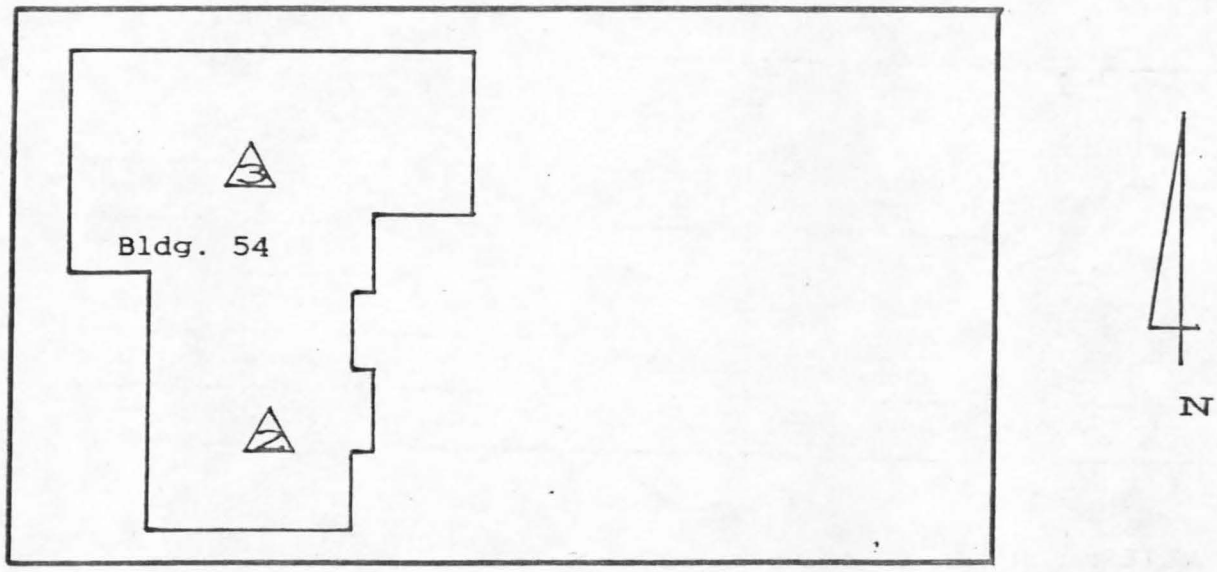
Harold Hasahl, Engineer

10 MAR 87

J.D. Cooke, P.E.

J. D. COOKE
STATE OF WASHINGTON
8928
REGISTERED
PROFESSIONAL ENGINEER

GRAYS HARBOR COLLEGE HEAVY EQUIPMENT SHOP




△ Boring Locations

SCALE: 1" = 50'

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TEST PIT/BORING LOCATIONS

## SOIL CLASSIFICATION SYSTEM

| MAJOR DIVISIONS | | | GROUP SYMBOL | GROUP NAME |
|---|---|---|---|---|
| COARSE GRAINED SOILS<br>MORE THAN 50% RETAINED ON NO. 200 SIEVE | GRAVEL<br>MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | CLEAN GRAVEL | GW | WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL |
| | | | GP | POORLY-GRADED GRAVEL |
| | | GRAVEL WITH FINES | GM | SILTY GRAVEL |
| | | | GC | CLAYEY GRAVEL |
| | SAND<br>MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE | CLEAN SAND | SW | WELL-GRADED SAND, FINE TO COARSE SAND |
| | | | SP | POORLY-GRADED SAND |
| | | SAND WITH FINES | SM | SILTY SAND |
| | | | SC | CLAYEY SAND |
| FINE GRAINED SOILS<br>MORE THAN 50% PASSES NO. 200 SIEVE | SILT AND CLAY<br>LIQUID LIMIT LESS THAN 50 | INORGANIC | ML | SILT |
| | | | CL | CLAY |
| | | ORGANIC | OL | ORGANIC SILT, ORGANIC CLAY |
| | SILT AND CLAY<br>LIQUID LIMIT 50 OR MORE | INORGANIC | MH | SILT OF HIGH PLASTICITY, ELASTIC SILT |
| | | | CH | CLAY OF HIGH PLASTICITY, FAT CLAY |
| | | ORGANIC | OH | ORGANIC CLAY, ORGANIC SILT |
| HIGHLY ORGANIC SOILS | | | PT | PEAT |

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-83.
2. Soil classification using laboratory tests is based on ASTM D2487-83.
3. Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry - Absence of moisture, dusty, dry to the touch

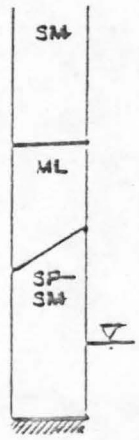
Moist - Damp, but no visible water

Wet - Visible free water or saturated, usually soil is obtained from below water table

## LABORATORY TESTS:

| | |
|---|---|
| AL | Atterberg limits |
| CP | Compaction |
| CS | Consolidation |
| DS | Direct shear |
| GS | Grain-size analysis |
| HA | Hydrometer analysis |
| K | Permeability |
| M | Moisture content |
| MD | Moisture and density |
| SP | Swelling pressure |
| TX | Triaxial compression |
| UC | Unconfined compression |
| SC | Soil Classification (includes AL & GS) |

## SOIL GRAPH:




Soil Group Symbol

Distinct contact between Soil Strata

Gradual Change between Soil Strata

Water Level

Bottom of Boring

## BLOW-COUNT/SAMPLE DATA:

Blows required to drive sampler 12 inches or other indicated distances using 140 pound hammer falling 30 inches.

"P" indicates sampler pushed with weight of hammer or hydraulics of drill rig.

22 — Location of relatively undisturbed sample (Shelby)

12 — Location of disturbed sample

P — Location of sampling attempt with no recovery

10 — Location of sample using Standard Penetration Test procedures (Split Spoon)

| | |
|---|---|
| WESTERN GEOTECHNICAL, INC. | KEY TO BORING LOG SYMBOLS |

BORING NO. 2

| Depth in Feet | Lab Tests | Moisture Content | Blow Count | Samples | Group Symbol | Surface Elevation: existing — Description |
|---|---|---|---|---|---|---|
| 0 | | | | | SM | Dark brown organic silty sand |
| | UC/CS SC/M | 42.6% | 11 | ¥ | ML | Brown silt (wet/medium dense) |
| 5 | | | | | | ∇ |
| 10 | SC/M | 16.9% | 50(3") | ¥ | SM | Brown silty sand (dense/moist) |
| 15 | SC/M | 15.1% | 50(5") | ¥ | SM/SW | Brown slightly silty sand (dense/moist) |
| 20 | SC/M | 22.1% | 50(2") | ¥ | GM/GP | Brown slightly silty gravel (dense/moist) |
| 25 | SC/M | 12.2% | 51(6") | ¥ | GM/GW | Brown slightly silty gravel (dense/moist/refusal) — Blue/grey sandstone |
| 30 | | | | | | |

LOG OF BORING

WESTERN GEOTECHNICAL INC.

WG 1099

# BORING NO. 3

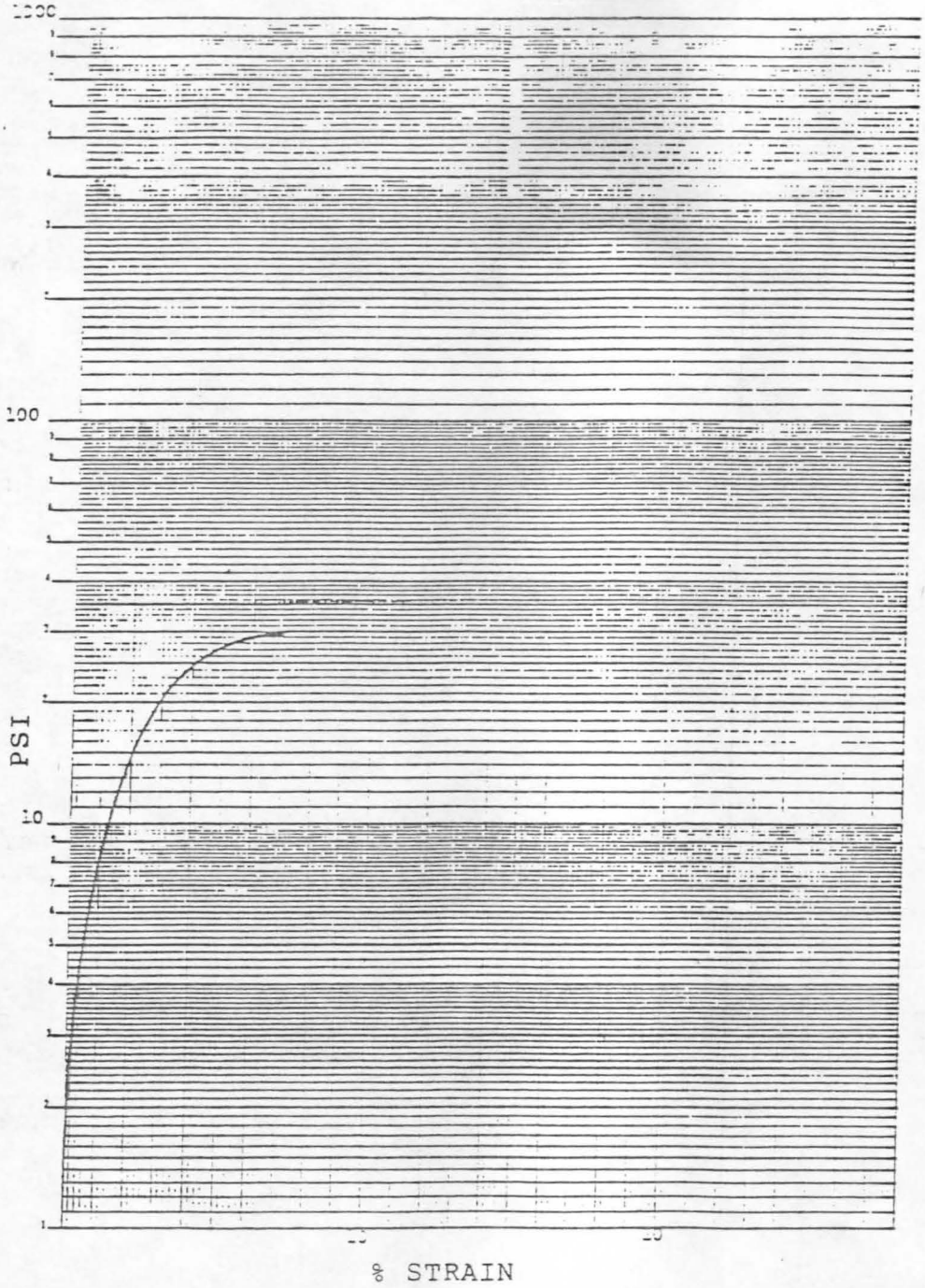
TEST DATA

| DEPTH IN FEET | Lab Tests | Moisture Content | Blow Count | Samples | Group Symbol | Surface Elevation | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 0 | | | | | SM | | existing Dark brown organic silty sand |
| 5 | SC/M | 38.8% | 16 | ¥ | ML | | Grey silt(medium dense/wet) |
| 10 | SC/M | 48.7% | 4 | ¥ | CH | | Mottled blue/brown clay (soft/wet/highly plastic |
| 15 | SC/M | 15.1% | 50 | ¥ | SM | | Brown silty sand (dense/moist) |
| 20 | SC/M | 19.0% | Refusal | ¥ | SM | | Brown silty sand (dense/moist) |
| 25 | SC/M | 15.6% | Refusal | ¥ | | | |
| | | | | | | | Blue sandstone (refusal) |
| 30 | | | Refusal | | | | |

LOG OF BORING

WESTERN GEOTECHNICAL, INC.

WG 1099




| BORING NO. | SAMPLE DEPTH | SOIL CLASSIFICATION | % H2O | DRY DENSITY | UNCONFINED COMPRESSION (PSF) |
|---|---|---|---|---|---|
| TB 2 | 3½'-5' | Brown Silt (ML) | 42.6 | 112.6 (pcf) | 29.642 psi<br>4,262 psf |

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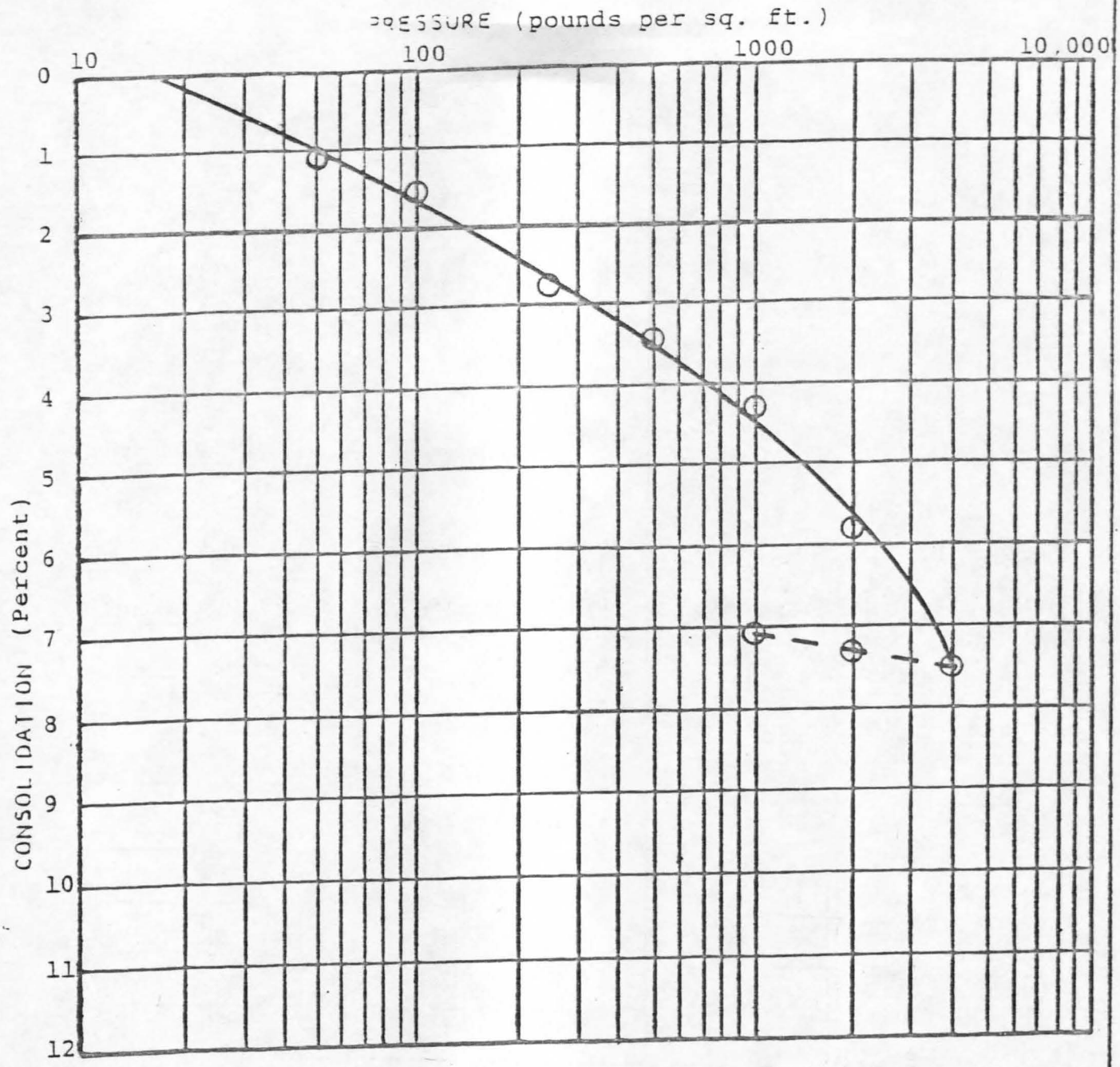
UNCONFINED COMPRESSIVE STRENGTH

WG 1099




| KEY | BORING NUMBER | SAMPLE DEPTH (FT) | SOIL CLASSIFICATION | MOISTURE CONTENT | DRY DENSITY (LBS/FT³) |
|---|---|---|---|---|---|
| ○ | TB2 | 3½-5' | Brown silt (ML) | 42.6% | 112.6 |

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CONSOLIDATION TEST RESULTS

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# PARTICLE SIZE ANALYSIS
## AASHTO T 88

CLIENT BJSS Architects

DATE SAMPLED 2-12-87

PROJECT Grays Harbor College Shop

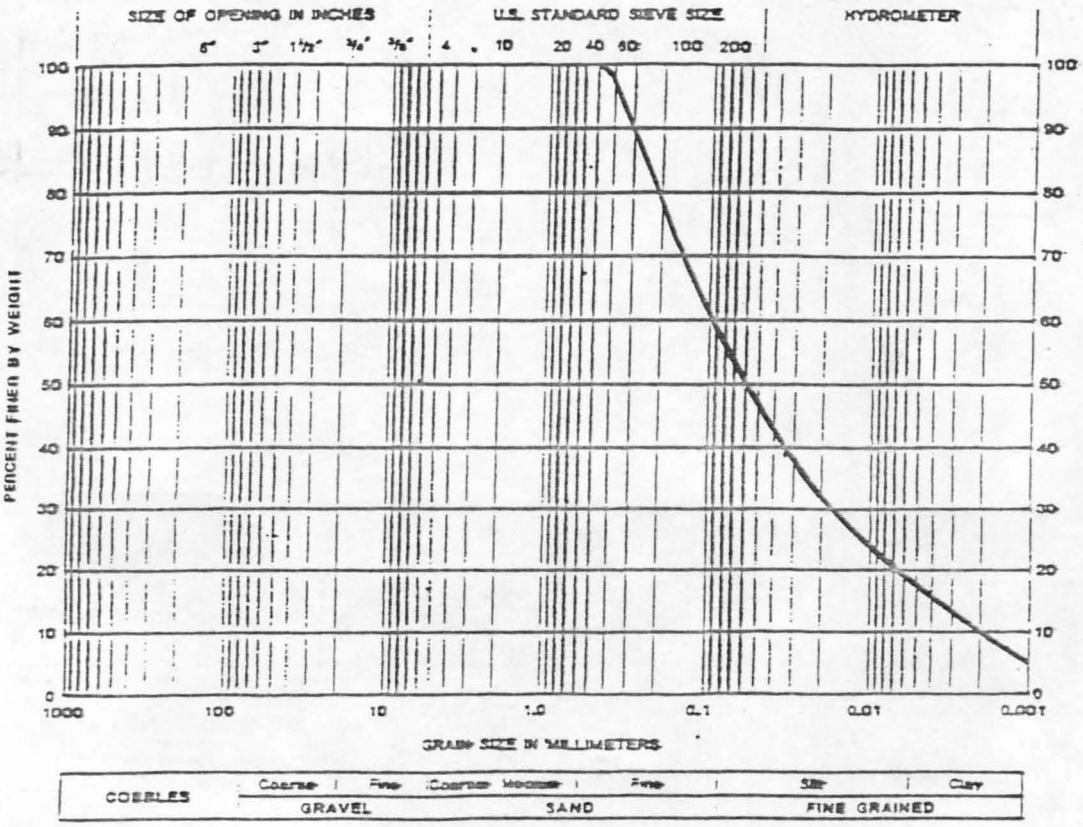
PROJECT NO. WG 1099

LOCATION SAMPLED TP 2

DEPTH 3½'-5'

| GRAIN SIZE | % PASSING |
|---|---|
| 1" | |
| #4 | |
| #10 | 100 |
| #40 | 99 |
| #200 | 54 |
| 0.02mm | 32 |
| 0.002mm | 10 |
| 0.001mm | 6 |

| | |
|---|---|
| LARGE PARTICLES | 0% |
| COARSE SAND | 1% |
| FINE SAND | 45% |
| SILT | 44% |
| CLAY | 10% |
| COLLOIDS | 6% |



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# SOIL CLASSIFICATIONS

| BORING # | TB2 | TB2 | TB2 | TB2 | TB2 |
|---|---|---|---|---|---|
| DEPTH | 3½'-5' | 8½'-10' | 13½'-15' | 18½'-20' | 23½'-24' |
| 1½" | | | | 100 | 100 |
| 1" | | 100 | 100 | | |
| #4 | | 55.0 | 58.5 | 47.6 | 45.8 |
| #8 | 100 | 45.8 | 41.3 | 39.4 | 42.3 |
| #16 | 99.9 | 39.8 | 31.9 | 33.9 | 38.7 |
| #40 | 99.0 | 32.5 | 21.3 | 23.5 | 31.6 |
| #100 | 77.2 | 23.9 | 11.3 | 11.3 | 20.3 |
| #200 | 53.6 | 16.6 | 8.3 | 7.3 | 16.1 |
| Liquid limit | 34 | 36 | 33 | 33 | 36 |
| Plastic limit | 30 | NP | NP | NP | NP |
| Plasticity index | 4 | NP | NP | NP | NP |
| % $H_2O$ | 42.6 | 16.9 | 15.1 | 22.1 | 12.2 |
| Soil class. | ML | SM | SM-SW | GM-GP | GM |
| Description | Brown silt | Brown silty sand | Brown slightly silty sand | Brown slightly silty gravel | Brown silty gravel |

PROJECT : Grays Harbor Community College - Heavy Equipment Shop

PROJECT NO. : WG-1099

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## SOIL CLASSIFICATIONS

| BORING # | TB# | TB3 | TB3 | TB3 | TB3 |
|---|---|---|---|---|---|
| DEPTH | 3½'-5' | 8½'-10' | 13½'-15' | 18½'-20' | 23½'-25' |
| 3/4" | | | 100 | 100 | 100 |
| #4 | | | 59.5 | 61.9 | 64.4 |
| #8 | 100 | | 49.2 | 52.8 | 53.0 |
| #16 | 99.4 | 100 | 43.2 | 48.3 | 45.2 |
| #40 | 98.5 | 98.6 | 35.6 | 39.3 | 35.3 |
| #100 | 96.7 | 92.9 | 22.9 | 20.0 | 21.8 |
| #200 | 82.0 | 82.9 | 16.3 | 12.3 | 16.6 |
| Liquid limit | 30 | 71 | 36 | 34 | 36 |
| Plastic limit | NP | 26 | NP | NP | NP |
| Plasticity index | NP | 45 | NP | NP | NP |
| % $H_2O$ | 38.8 | 48.7 | 15.1 | 19.0 | 15.6 |
| Soil class. | ML | CH | SM | SM | SM |
| Description | Grey silt | Brown/ blue highly plastic clay | Brown silty sand | Brown silty sand | Brown silty sand |

PROJECT : Grays Harbor Community College - Heavy Equipment Shop

PROJECT NO. : WG - 1099

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# SUPPLEMENTAL REPORT TO THE SOILS INVESTIGATION FOR THE GRAYS HARBOR COMMUNITY COLLEGE HEAVY EQUIPMENT BUILDING (PILING)

This report represents supplemental data, for the new heavy equipment shop at Grays Harbor Community College. This report is an addition to our original report of March 10, 1987.

Our purpose, in this supplemental report, is to provide recommendations for piling foundations. The owner, Grays Harbor Community College, has elected to use piling, rather than a structural fill section. The additional work was authorized by Mr. Frank Smith, of BJSS Architects.

## CONCLUSIONS AND RECOMMENDATIONS :

### Pile Type

We recommend creosote treated timber piling meeting State of Washington Standard Specifications for Road, Bridge and Municipal Construction, edition of 1984.

### Pile Bearing and Uplift

The specified timber piling may be driven to 20 to 25 tons bearing capacity, based on the Engineering News Formula. The maximum uplift capacity (resistance to tension) is estimated to be 10 tons.

### Lateral Bearing Capacity of Soil

The lateral bearing capacity of the soil, from 1' to 8' below grade, is 150 psf per foot of depth.

Pile Lengths

Piling embedded lengths are estimated at 11' to 15' for 20 tons bearing and 13' - 17' for 25 tons bearing.

TEST PILES :

Three test piles are recommended to determine the required length of production piling. Test piles should be at least 25' in length and driven by the same hammer proposed for production piling. The test piles will be driven to a minimum of 25 tons bearing, as determined by the Engineering News Formula. Blow counts will be taken for each 1' increment of embedment. It is recommended that the test piles be placed at three locations; the Southend of the building, the Center of the building and the Northend of the building. The test piles may be used as permanent piling. Care should be taken not to overdrive the piling (in excess of 30 tons bearing) to avoid splitting and/or brooming of the piles. We recommend that a representative of our firm be present during the driving of the test piling, so as to accurately record the resulting data and assess the materials and equipment used.

LIMITS OF LIABILITY :

The engineer is responsible for the conclusions and opinions contained in this report based on the data relating only to the specific project and location discussed herein. In the event conclusions or recommendations based on this data are made by others, such conclusions and recommendations are not the responsibility of the engineer unless he has been given an opportunity to review them and concurs in such conclusions and recommendations in writing.

The analysis and recommendations submitted in this report are based upon the data obtained from the test pit logs at the locations indicated on the attached plan. This report does not reflect any variations that may occur between these test pits. The nature and extent of variations between the test pits may not become evident until they appear during the course of construction. If variations then appear, it will be necessary for the recommendations of this report to be re-evaluated after performing on-site observations during the excavation period and noting the characteristics of such variations.

This opinion assumes that the contractor will exercise the highest degree of sound construction practices, and that he will adhere to the criteria and procedures set forth in the previous sections.

PREPARED BY :

J. Ross, Materials Engineer

REVIEWED BY : 18 JUN 87

J.D. Cooke, P.E.

J. D. COOKE
STATE OF WASHINGTON
8928
REGISTERED
PROFESSIONAL ENGINEER

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# CALIFORNIA BEARING RATIO TEST

CLIENT Grays Harbor Community College PROJECT Dike Roadway

DATE SAMPLED 4-2-87 REPORT NO.

SAMPLE LOCATION Center of Dike @ 6" - 22" below grade

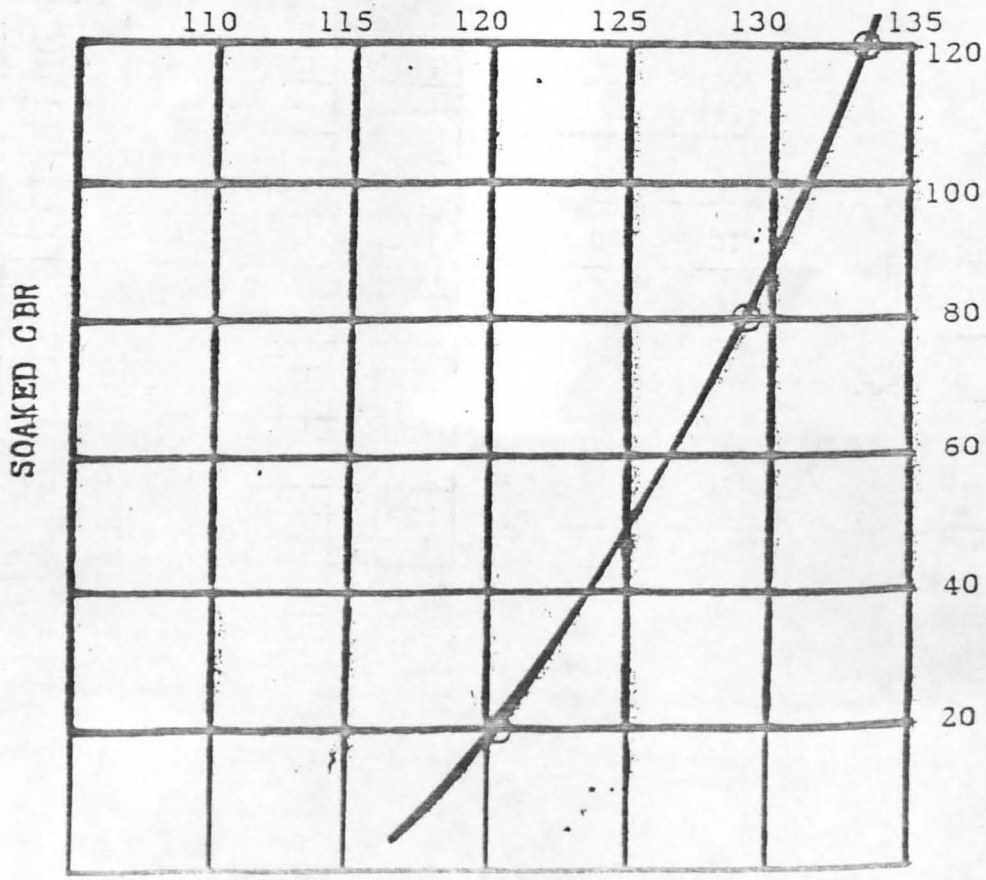
TEST SPECS. AASHTO T 180 / T 193 PROJECT NO. WG 1099

## TEST DATA

| BLOWS (per layer) | % $H_2O$ | DRY DENSITY | SWELL (% of length) | CBR |
|---|---|---|---|---|
| 10 | 10.6 | 120.5 | 0.000 | 20 |
| 30 | " | 128.9 | " | 80 |
| 65 | " | 133.1 | " | 120 |

## DESIGN DATA

DESIGN CBR 15 % DRY DENSITY 118.4 @ % MAX. 90%



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# MAXIMUM DENSITY-OPTIMUM MOISTURE DETERMINATION

Client: Grays Harbor Community College Date Sampled: 4-2-87

Project: Dike Roadway

Contractor: NA

Project No.: WG 1099 Report No: Test No.: P-1

FIELD DATA:

Source of Material: Native

Location Sampled: Dike Roadway

LABORATORY DATA:

Maximum Density Dry: 131.5 P.C.F.

Optimum Moisture: 10.4 %

Soil Type & Color: Brown silty sand w/ gravel

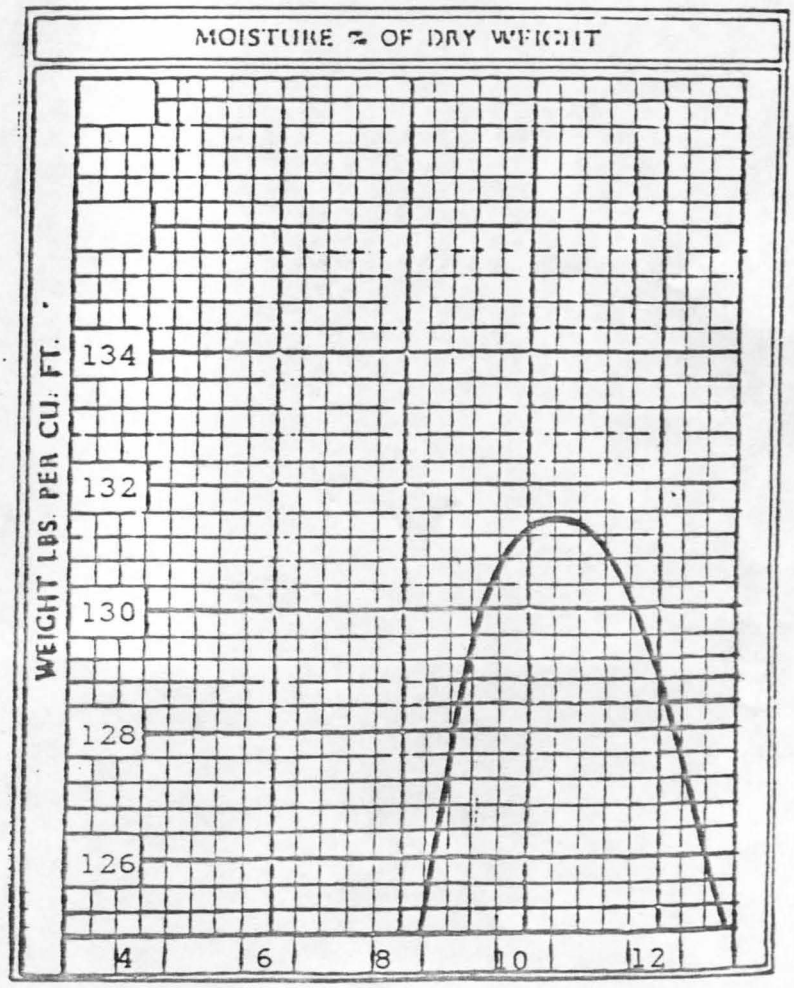
Test Specifications: AASHTO T 180

Cylinder: 6 "

Hammer: 10 lbs.

Drops: 18 "

Layers: 5

Blows/Layer: 56

Technician: D. Mayor/K.Ellis