Washington State
Department of Transportation

FILE
Memorandum

Date: 30 January 2002

TO: Jerry Weigel/Jugesh Kapur
Bridge and Structures Office
MS 47340

FROM: T. M. Allen/M. A. Frye
Geotechnical Branch
MS 47365

SUBJECT: SR-20, OL-1475
Gulch Bridge 20/265 Replacement
Geotechnical Report

Enclosed is the geotechnical report for the SR 20 Gulch Bridge Replacement project. This report presents the results of our subsurface investigation and geotechnical analyses and recommendations for drilled shaft foundations and retaining walls associated with the subject project.

If you have questions or require further information, please contact Tony Allen at (360) 709-5450 or Mark Frye at (360) 709-5469.

TMA:maf

enclosure

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GEOTECHNICAL REPORT

SR-20 Gulch Bridge 20/265 Replacement

OL-1475, Milepost 93.13 to 93.15

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EXPIRES JULY 1, 2003

January 30, 2002

Washington State Department of Transportation
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1. INTRODUCTION

1.1. GENERAL

This report presents the geotechnical recommendations for replacement of the Gulch Bridge, bridge number 20/265, along SR 20 at approximately milepost (MP) 93.15. A vicinity map of the project site is shown on Figure 1 in Appendix A. This project includes replacing the Gulch Bridge, widening SR 20, drainage work, and construction and removal of a detour. This report provides bridge foundation, retaining wall, and infiltration rate recommendations.

The analyses, conclusions, and recommendations provided in this report are based on the project description, and site conditions existing at the time of our site visits. The exploratory borings are assumed to be representative of the subsurface conditions at locations throughout the site. If during construction, subsurface conditions differ from those described in the explorations, we should be advised immediately so that we may reevaluate our recommendations and provide assistance.

1.2. PROJECT DESCRIPTION

The existing Gulch Bridge was constructed in 1953 and is founded on timber piles. As proposed, the new single span bridge will be constructed using pre-cast concrete girders supported on drilled shafts. The existing bridge consists of two 11-foot lanes and two 2-foot shoulders. This project will widen the existing lanes and shoulders to full standards (two 12-foot lanes with two 8-foot shoulders).

Construction of the new bridge will require a single lane detour to be constructed parallel to and north of the existing structure. The detour will be cut into the slope above the existing bridge and requires retaining walls both above and below the detour. Wall AC will be a permanent wall constructed on the uphill side of the detour. Walls B and D will be temporary retaining walls constructed below the detour. The detour is shown on Figure 2.

Widening of the existing roadway is planned to the south along the alignment. To accomplish this, construction of a retaining wall, Wall 102, to support the approach fill on the west side of the proposed bridge is planned.

Also as part of this project, a portion of the slope downhill from SR 20 and approximately 400 feet west of the Gulch Bridge is marginally stable and has experienced recent shallow landsliding. Retaining Wall 101 will be constructed to help stabilize the slope at this location.

A detention pad is also planned as part of this project. The detention pad will be located on the east side of the proposed structure as shown on Figure 2 in Appendix A.

1.3. PREVIOUS STUDIES

WSDOT has performed two previous geotechnical investigations at this project site. A geotechnical investigation was performed for the design report in 1993. Three bridge-

replacement options were presented in a memorandum dated June 24, 1993. Additional subsurface drilling was performed in May, 1995 as part of a geotechnical investigation to determine the feasibility of replacing the Gulch Bridge with a retaining wall. The results of this study confirmed the feasibility of using retaining walls to replace the Gulch Bridge and were presented in a memorandum dated January 10, 1996.

2. FIELD AND LABORATORY INVESTIGATIONS

2.1. SUBSURFACE INVESTIGATION

In 1993 and 1995, a total of 9 boreholes were drilled at the project site. These holes were concentrated in the vicinity of the existing Gulch Bridge and were use in determining the feasibility of replacing the bridge with a retaining wall system. Several piezometers and slope inclinometers were installed in these boreholes. Boring logs, piezometer readings, and slope inclinometer data are included in Appendices B and C.

For this investigation, 7 additional boreholes were drilled at the site to characterize the subsurface conditions in the vicinity of the proposed retaining walls and the eastern bridge approach. Boreholes SI-1-01 and H-1-01 through H-6-01 were drilled with a skid mounted drill rig using mud rotary drilling techniques. Piezometers were installed in holes H-1-01 and H-2-01. Slope inclinometers were installed in holes SI-1-01, H-3-01, and H-4-01. Detailed field exploration methods and logs of test borings are presented in Appendix B.

2.2. INSTRUMENTATION AND MONITORING

Following installation, data was collected from piezometers and inclinometers installed at the site to assist in interpretation of subsurface conditions and to provide information on depths, rates, and direction of landslide movement. Water levels in standpipe piezometers were measured using an electronic water level indicator. Water level information is provided on individual boring logs in Appendix B.

Deflections in slope inclinometer casings installed at the site were monitored using a Slope Inclinometer Biaxial Probe. This instrument is capable of measuring very small (~0.001 inch) incremental displacements and direction in inclinometer casing. These measurements are then used to determine rates, and depth of subsurface movement with time. Slope inclinometer data is provided in Appendix B. Interpretation of groundwater readings and slope inclinometer data is discussed in Sections 3.3 and 3.4

2.3. LABORATORY TESTING

Laboratory testing was performed on selected soil samples for the purposes of classification and to aid in evaluation of pertinent engineering soil properties. Tests included natural moisture content, sieve analyses, and Atterberg Limit tests. Laboratory test results are attached in Appendix C.

3. PROJECT SUBSURFACE CONDITIONS

3.1. REGIONAL GEOLOGY

Within the vicinity of this project, SR 20 lies on the north side of the Skagit River Valley. Subsurface materials within the project vicinity include a combination of soils from Pleistocene continental glaciation, deposits from alpine glaciation, and post-glacial alluvial sediments. Alpine glaciers had retreated as the most recent continental glacier, referred to as the Vashon Stade, advanced up-valley from both the west and northwest directions sometime between 18,000 and 14,000 years ago (Heller, 1978). In front of the advancing ice, sand and gravel outwash deposits began filling the Skagit Valley. Later, the valley was dammed by the advancing ice, forming a proglacial lake up-valley of the advancing ice, which resulted in the deposition of silt and clay on top of the outwash. The more than mile high thickness of advancing ice overrode these glaciolacustrine and underlying outwash deposits and capped them with till (Armstrong, 1976). The continental ice terminus was approximately located several miles up-valley of this project. For a short period, this glacial dam diverted flow of the Skagit to the south into the Stillaguamish River near Darrington (Vance, 1957). As the glacial ice began to retreat, the dam was breached and westward flow resumed within the Skagit. The advance glacial deposits were rapidly incised, and remnants of the valley fill are preserved in the bench/terrace (located around elevation 800 feet) on both sides of the valley.

Recent landslide mapping by Landau Associates in the project vicinity identified several unstable and potentially unstable slopes. Several active and historically active landslides in the immediate vicinity were identified both above and below SR 20. Two very large post-Vashon landslides were also mapped above the project area.

3.2. SOIL CONDITIONS

Explorations in the project area indicate soils consistent with the geologic mapping. The soils encountered underlying the project site are a complex assemblage of glacial deposits, both Vashon and Pre-Vashon, overlain by material associated with landslide activity. More specifically, we observed three generalized soil units; colluvium (landslide materials), Vashon glaciolacustrine deposits, and Pre-Vashon drift. These soil units are further grouped on the basis of engineering properties and classification. The following soil units are listed in the order of geologic deposition from youngest to oldest.

Unit 1 consists of very loose to medium dense silt and silty sand with some lean clay layers. This unit is considered colluvium derived from landslide activity and erosion from the slopes above the Gulch Bridge. This unit is located at the surface above the bridge and is generally about 10-feet thick.

Unit 2 consists of very stiff to hard lean clay. This unit is considered a Vashon glaciolacustrine deposit and generally overlies the coarser grained silts and sands also associated with the Vashon glaciolacustrine deposits. This unit, together with Units 3 and 4, typically ranges from 30 to 50 feet thick.

Unit 3 consists of medium dense to dense silt and sandy silt and is considered a member of the Vashon glaciolacustrine deposits.

Unit 4 consists of dense to very dense poorly graded sand and silty sand. This unit is considered a member of the Vashon glaciolacustrine deposits.

Unit 5 consists of very dense silty sands and silty gravel. This unit is considered Pre-Vashon Drift and underlies the Vashon glaciolacustrine deposits of Units 2, 3, and 4. This deposit typically extended to the full depth of each of our explorations.

Figures 3, 4, and 5 provide general subsurface profiles for the project site based on our field exploration and laboratory testing program.

3.3. SLOPE STABILITY

There are three potentially unstable slopes within the vicinity of the Gulch Bridge. Approximately 400-ft west of the bridge is a marginally stable slope that has experienced recent shallow surficial sliding. The south side of the western bridge approach fill is also unstable. The slope above the Gulch Bridge appears unstable and shows sign of movement. These three areas are described in further detail, as follows.

Approximately 400 feet west of the Gulch Bridge (SR 20 station 191+00 vicinity) a landslide area was identified by WSDOT Maintenance in 1995. The slide appears to have been a relatively shallow surface slide on the slope below (south) of SR 20. WSDOT maintenance crews have placed concrete barrier across the top of the slide to protect traffic although the slide has not actually encroached onto the lanes or shoulders of SR 20. Widening of SR 20 will require a retaining wall through the top of the slide area. A slope inclinometer installed in hole H-3-01 has shown no sign of movement to date. There is no indication of a deep failure that would impact SR 20.

A slope inclinometer installed in hole H-2-93, near the west abutment of the existing bridge (SR 20 station 194+80 vicinity), has shown approximately 1.5 inches of downslope movement in the top 12 to 15 feet of soil since 1993. This movement appears to only be in the man-made fill and may be the result of poor compaction. The slope inclinometer in hole H-4-01 was installed in the same fill material as H-2-93 and shows a very small amount of movement in the top 3 to 4 feet of soil.

In 1993, inclinometer H-3-93 was installed approximately 170 feet north (upslope) of the Gulch Bridge (SR 20 station 195+30 vicinity). Slope inclinometer data shows 0.75 inches of downslope movement before the inclinometer sheared at a depth of 10 feet in 1996. The slope above the bridge is very uneven with several 3-to 4-foot vertical sections that could be small landslide scarps. Some trees on the slope are bowed, indicating slope movement. Soil borings indicate a 10-foot thick layer of weak silts, silty sands, and silty gravels overlying stiff lean clays.

3.4. GROUNDWATER

Groundwater levels in the project vicinity have been monitored since the initial studies in 1993. In general, the groundwater is approximately 25 below the roadway surface. Piezometer readings

directly above and below the Gulch Bridge indicate that the water surface roughly parallels the ground surface. Within the gulch below the bridge, and in the drainage west of the bridge, the groundwater is at or near the surface. Groundwater levels are anticipated to fluctuate with time of year, rainfall, and other factors.

4. SEISMOLOGICAL CONSIDERATIONS

4.1. TECTONIC SETTING AND SEISMICITY

Tectonic activity in Western Washington is mostly associated with the subduction of the Juan de Fuca Plate under the North American Plate. Within this tectonic environment, three potential seismic sources can be identified. Interplate seismic activity associated directly with the subduction zone between the Juan de Fuca Plate and the North American Plate, Intraplate seismic activity within the Juan de Fuca Plate as it subducts under the North American Plate, and shallow crustal earthquakes within the North American Plate.

Interplate, or subduction zone, earthquakes take place at the boundary of the Juan de Fuca and the North American Plates. Although a subduction zone earthquake has not been recorded off the coast of Washington or Oregon during historic time, geologic evidence suggests that they may occur. The last great earthquake to occur on the interface zone appears to have occurred around 1700. Studies of recurrence suggest that the average recurrence interval is about 450 years with about a 90 percent confidence interval of about 200 years. A magnitude M8 to M9 earthquake is believed possible along the subduction zone, however, the best estimate is M8.3 (USCOE, 1994 and Geomatrix, 1995)

Intraplate earthquakes take place within the subduction Juan de Fuca Plate at depths between 25 to 40 miles. These earthquakes occur inland from the interface earthquakes. Intraplate earthquakes have occurred in the Puget Sound region, with five historical earthquakes having magnitudes greater than 6. The largest earthquakes include the 1949 magnitude 7.1 Olympia earthquake, the 1965 magnitude 6.5 Seattle-Tacoma earthquake, and the 2001 magnitude 6.8 Olympia quake.

The third major type of earthquake is the crustal earthquake, which occurs in the North American Plate, typically at depths between 5 to 15 miles. Several earthquakes, between M4.0 and M5+, have occurred in the Puget Sound area over the past 150 years. The maximum expected magnitude for crustal earthquake varies throughout the state and depends on the thickness of the crust, the length and rate at which seismic strain accumulates on faults.

4.2. DESIGN EARTHQUAKE PARAMETERS

For seismic design, a peak ground acceleration coefficient of 0.2 is recommended, based on the June 1996 US Geological Survey National Seismic Hazards Mapping Project, which is cited in the *Bridge Design Manual*. The recommended acceleration coefficient is based on expected ground motion at the project site that has a 10 percent probability of exceedance in a 50-year period (475-year return period). Design response spectra presented in the AASHTO guide specifications for seismic design of highway bridges are considered appropriate for seismic

design of the Gulch Bridge structure. A Type II Soil Profile response spectrum, with a Site Coefficient of 1.2 is recommended for seismic design.

4.3. SEISMIC HAZARDS

Soil liquefaction is a phenomenon wherein saturated soil deposits temporarily lose strength and behave as a viscous fluid in response to cyclic loading. Soil liquefaction is generally limited to loose, granular soils located below the water table. Test borings indicate site soils located below the water table are dense to very dense, suggesting risk of soil liquefaction is relatively low. Liquefaction induced lateral spreading and settlement are therefore not likely.

5. GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

5.1. GENERAL

The selection of shaft foundations to support the new Gulch Bridge was based on several factors, including the relatively weak soil bearing conditions in the top 20 to 25 feet of soil, area landslide hazards, and bridge loading. Soldier pile retaining walls are recommended for supporting proposed cuts and fills. Walls 101, 102, and A-C will help to increase the factor of safety of marginally stable slopes at these locations.

In addition to bridge foundations and retaining walls, recommendations for approach slabs and the detention pad are discussed herein.

5.2. DRILLED SHAFT FOUNDATIONS

5.2.1. Axial Capacity

We understand design of the new Gulch Bridge will be performed using AASHTO Load and Resistance Factor Design (LRFD) methodology. In accordance with this methodology, we have provided axial capacities for nominal strength (ultimate), service and extreme limit states on charts in Appendix D. Nominal capacities for end bearing and skin friction resistance are provided for several shaft diameters. Axial capacities for the service limit state are based on one inch of shaft settlement. Shaft uplift capacity for the strength and extreme event limit cases can be taken directly from the capacity charts, where the unit uplift resistance is taken as equal to the unit skin friction.

Shaft tip elevations should be determined by the structural engineer, as we anticipate lateral loading will govern shaft length.

Resistance factors for bearing capacity and uplift for service, strength, and extreme event limit states are shown in the following table.

Table 1. Drilled Shaft Resistance Factors

Limit State	Resistance Factor ϕ		
	Skin Friction	End Bearing	Uplift
Strength	0.65	0.50	0.55
Service	1.00	1.00	N/A
Extreme	1.00	1.00	0.75

5.2.2. Lateral Analysis of Drilled Shafts

We understand lateral analysis of drilled shafts will be evaluated using the LPILE computer program (Reese and Wang, 1989). P-y curve soil parameters for both static and dynamic (seismic) loading cases are presented in Appendix D.

5.2.3. Group Reduction Factors

5.2.3.1.Lateral Loads

For shaft groups, we recommend the group reduction factors provided in Tables 3 be used for both lateral loads transverse and longitudinal to the structure, based on shaft diameter D.

Table 3. Group Reduction Factors for Lateral Loading

Shaft Spacing	Transverse Loading Reduction Factor	Longitudinal Loading Reduction Factor
8D	1.0	1.0
6D	0.9	1.0
5D	0.8	1.0
4D	0.65	0.9
3D	0.5	0.8

5.2.4. Abutments

Abutment walls supported on the drilled shafts should be designed using the lateral earth pressure coefficients and soil parameters presented in the following table. Parameters should be applied in accordance with the design methodology presented in the *Bridge Design Manual.*

Table 4. Lateral Earth Pressure Coefficients and Soil Parameters

Parameter	Value
Unit Weight (γ)	130 pcf
Backfill Soil Friction Angle (ϕ_f)	36°
Active Earth Pressure (K_a)	0.26
Seismic Coefficient (ΔK_{ae})	0.08

Per the *Bridge Design Manual*, the lateral earth pressure due to traffic surcharge loading could be calculated using a uniformly distributed load at the ground surface of 250 psf, multiplied by K_a (K_a x 250 psf), or 65 psf.

5.3. RETAINING WALLS

5.3.1. Retaining Walls 101 and 102

As proposed, Walls 101 and 102 will be permanent walls constructed on the south side of SR 20 (see Figure 2 in Appendix A). The walls will be parallel to the roadway and will allow for proposed widening of SR 20. We recommend soldier pile and lagging walls to support the proposed cuts and fills for three reasons: (1) weak soil bearing conditions in the top 20 to 25 feet of soil, (2) soldier piles will improve slope stability, and (3) soldier pile construction methods will work well with the limited work area and site conditions. A 4-foot to 5-foot wide bench should be constructed in front of the walls to facilitate placement of the lagging and to provide future access for inspection and maintenance. This bench should be gently sloped away from the wall so that it will not trap water against the base of the wall.

Retaining Wall 101 will be located from SR 20 station 190+50 to station 191+40. The maximum exposed wall height will be approximately 10 feet. We recommend soldier piles be embedded a minimum of 25 feet below the finished grade in front of the wall to provide an overall stability factor of safety of 1.3.

Retaining Wall 102 will be located from SR 20 station 192+30 to station 194+85. The maximum exposed wall height will be approximately 13 feet. We recommend soldier piles be embedded a minimum of 20 feet below the finished grade in front of the wall to provide an overall stability factor of safety of 1.3.

Earth pressure diagrams for soldier pile wall design are provided in Figures 6 and 7 of Appendix A.

5.3.2. Retaining Wall AC

Retaining Wall AC will extend from D1 station 11+50 to station 14+85, left of centerline. While this wall is being constructed as part of the temporary detour during bridge construction, the wall will remain in place as a permanent wall. As such, this wall is being designed to retain landslide material observed in the upper 10 feet. Supporting this landslide mass will help to protect the bridge and its foundation. To accomplish this, we recommend the soldier piles be embedded a minimum of 40 feet below the finished grade in front of the wall to provide an overall stability factor of safety of 1.3.

For design, we assumed the landslide above the wall is an infinite slope failure. Therefore, we recommend a load of 1.0 kip per square foot be applied to the wall for the exposed height of the wall. The earth pressure diagram shown on Figure 8 of Appendix A should be used for the design of this wall.

After removal of the detour, the ground in front of the retaining wall should be graded in such a way as to direct water away from the face of the wall and away from the bridge abutments. We do not recommend removing any material in front of the wall below the grade of the proposed detour. The original ground line can be restored and the face of the wall completely buried if the Region Design Office chooses.

5.3.3. Temporary Retaining Walls

We understand detour Retaining Walls B and D will be temporary walls and will be removed after construction. Wall types considered feasible and economical include ecology block walls and driven sheet pile walls. Design, construction, and removal of temporary retaining walls are the responsibility of the contractor. The Geotechnical Branch should review any contractor submittals for these walls.

5.4. BRIDGE APPROACH SLABS

The Design Manual Section 1120.03(6) requires all bridges to have approach slabs unless approval for their deletion has been given. For reasons including, but not limited to, the potential for differential settlement between the abutment backfill and the bridge foundation, we consider approach slabs necessary for this project.

5.5. DETENTION PAD

We understand a detention pad will be constructed to the east of the proposed structure in the vicinity of SR 20 station 197+00. We understand the pad will be an excavated area backfilled with quarry spalls and capped with a layer of soil. Runoff will be conveyed to and discharged into the pad with pipes. An overflow wier will be provided. Based on gradation testing of the soils in the vicinity of the proposed pad, we recommend that an infiltration rate of no more than 0.25 inches per hour be used in designing this pad.

We recommend the detention pad be constructed as far away as possible from the bridge foundations and that it not be constructed above any slopes steeper than 2H:1V. We recommend a layer of geotextile be placed above the quarry spalls to prevent the soil from clogging the

quarry spalls. A geotextile that meets the requirements for underground drainage and moderate survivability in accordance with Section 9.33 of the WSDOT *Standard Specifications for Road, Bridge and Municipal Construction* should be used.

6. CONSTRUCTION CONSIDERATIONS

Site soils are predominantly fine grained and are moisture sensitive. In addition, slopes are susceptible to landsliding and surficial erosion. Consequently, we recommend construction be scheduled for the drier summer months, May through September only, to minimize disturbance to slopes caused by heavy equipment. Stormwater runoff needs to be controlled to prevent saturation of the slopes below the roadway.

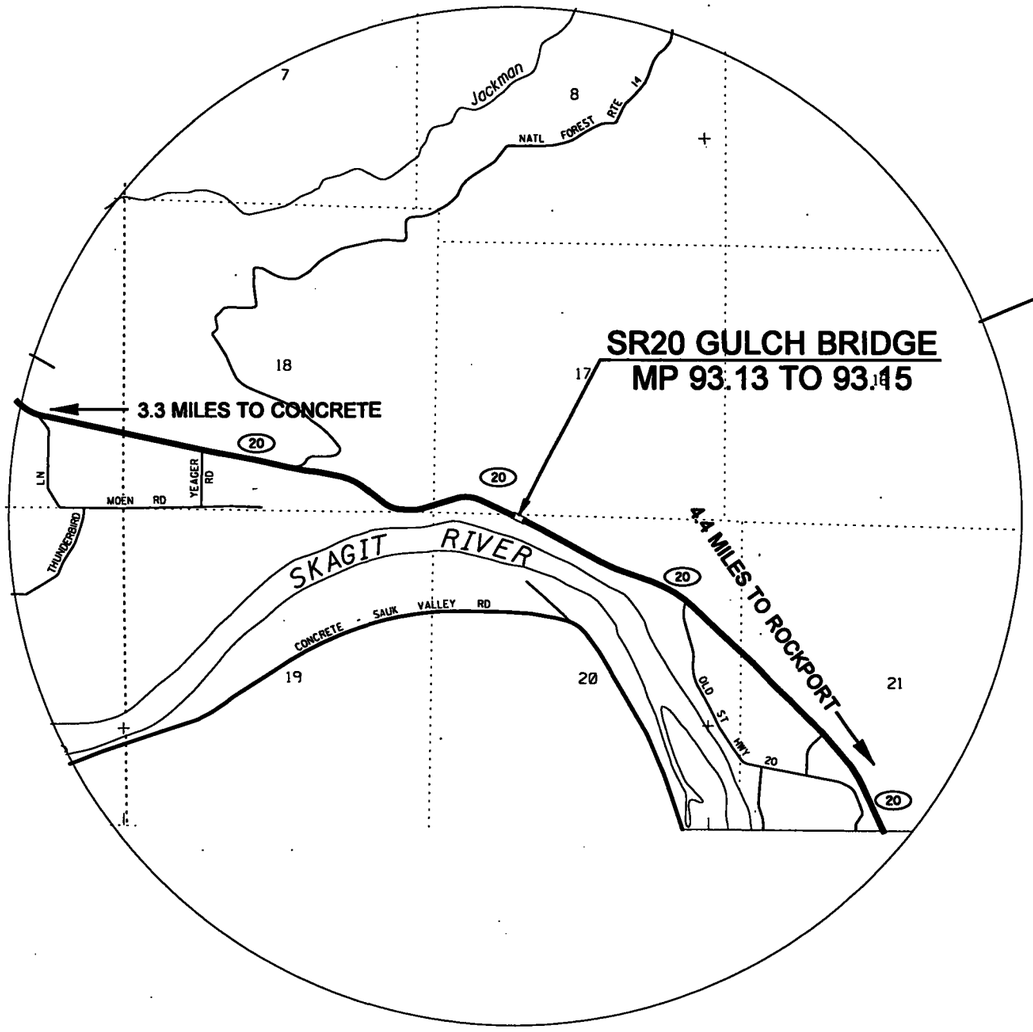
Use of temporary casing should be at the contractor's discretion. Soil sloughing may occur in the fill and colluvium layers (Unit 1) and/or where groundwater is encountered. The contractor should be prepared to handle sloughing using temporary casing and/or slurry or a weighted drilling fluid. Installation of drilled shafts in wet conditions will require cross-hole sonic logging (CSL) testing.

Based on the conditions observed during drilling, we anticipate cobbles and boulders will be encountered during drilled shaft construction.

APPENDIX A

FIGURES

WSDOT



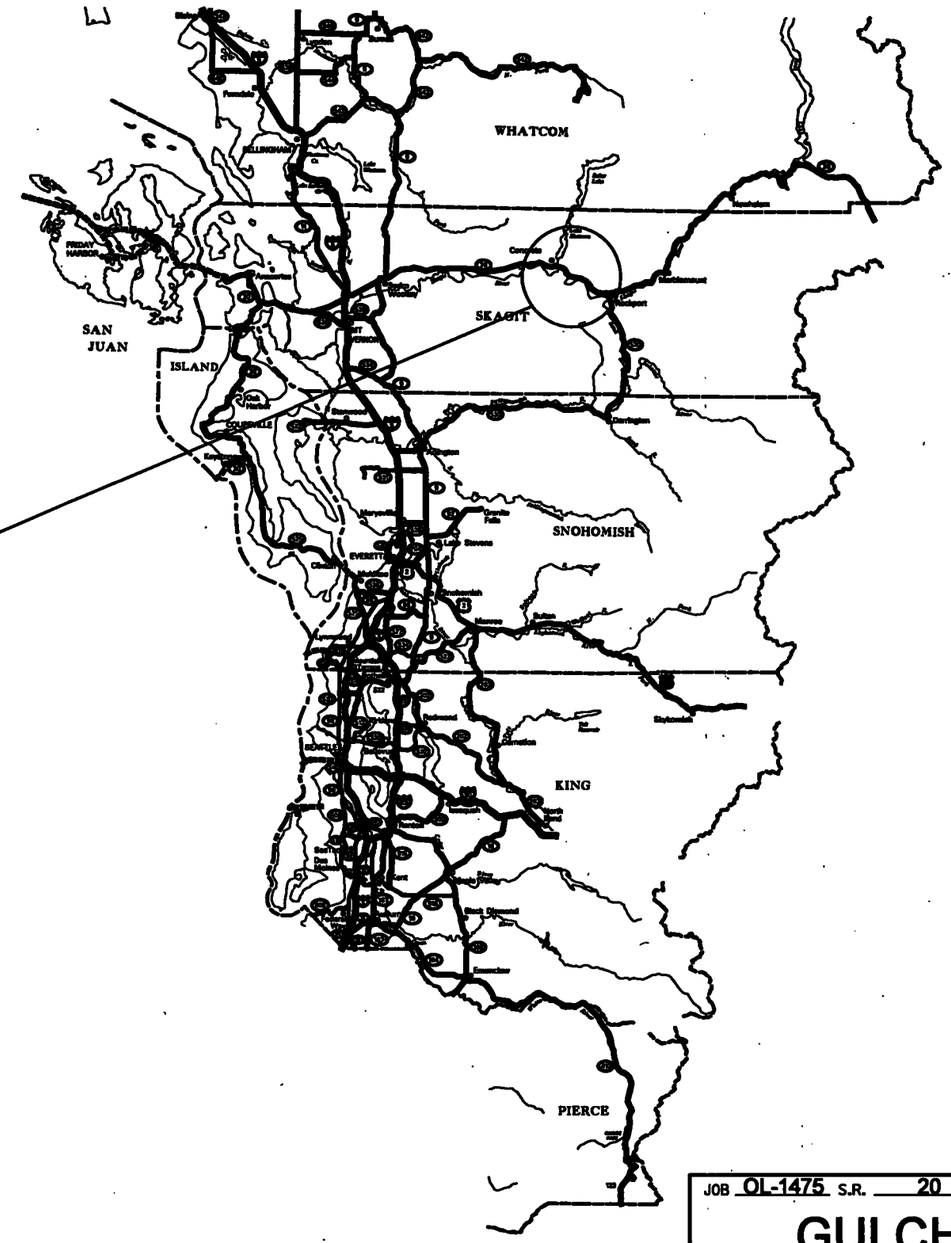


FIGURE 1: GENERAL SITE VICINITY

JOB OL-1475 S.R. 20 C.S.

GULCH BRIDGE 20/265 REPLACEMENT

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 1/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

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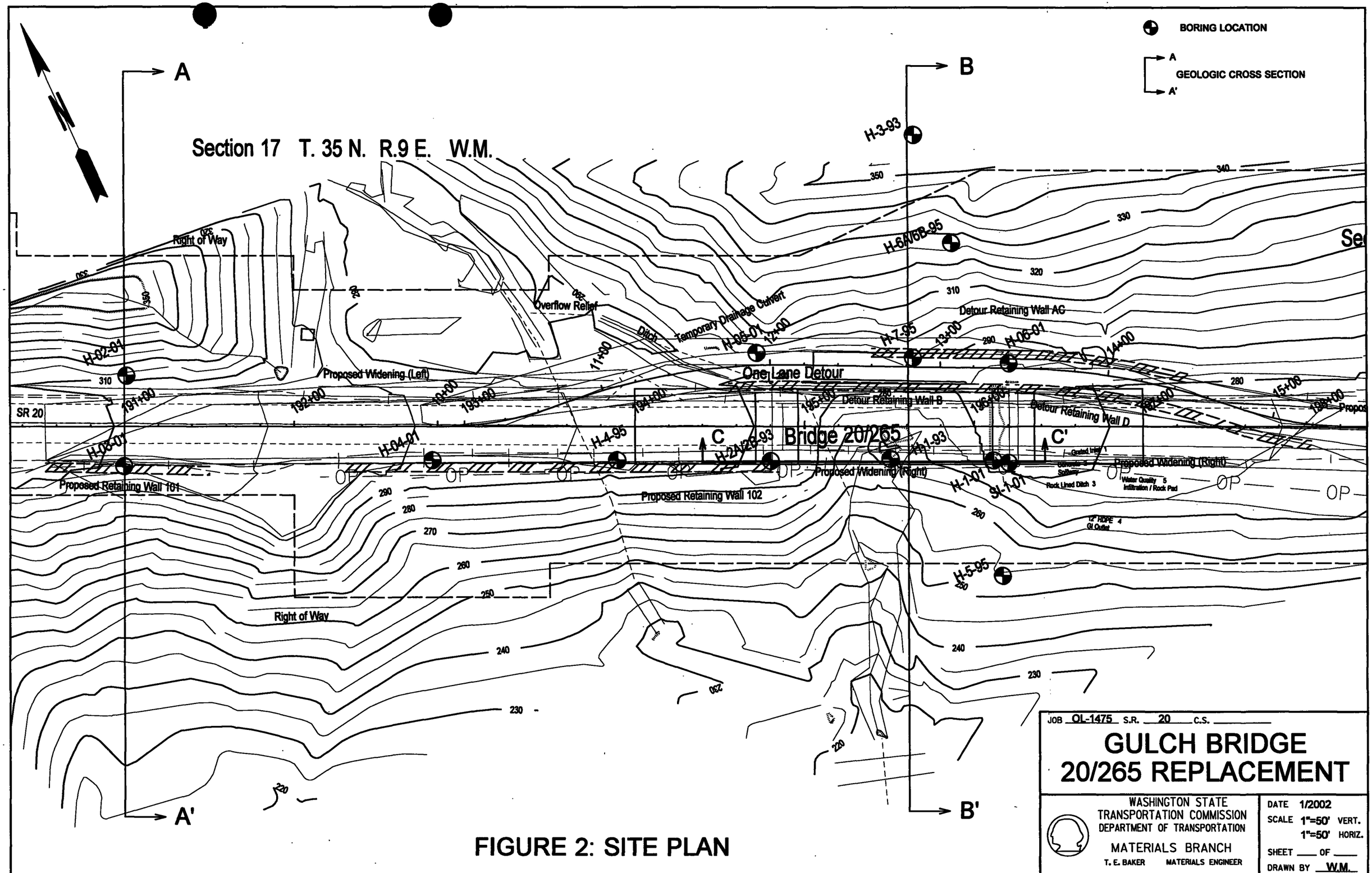

FIGURE 2: SITE PLAN

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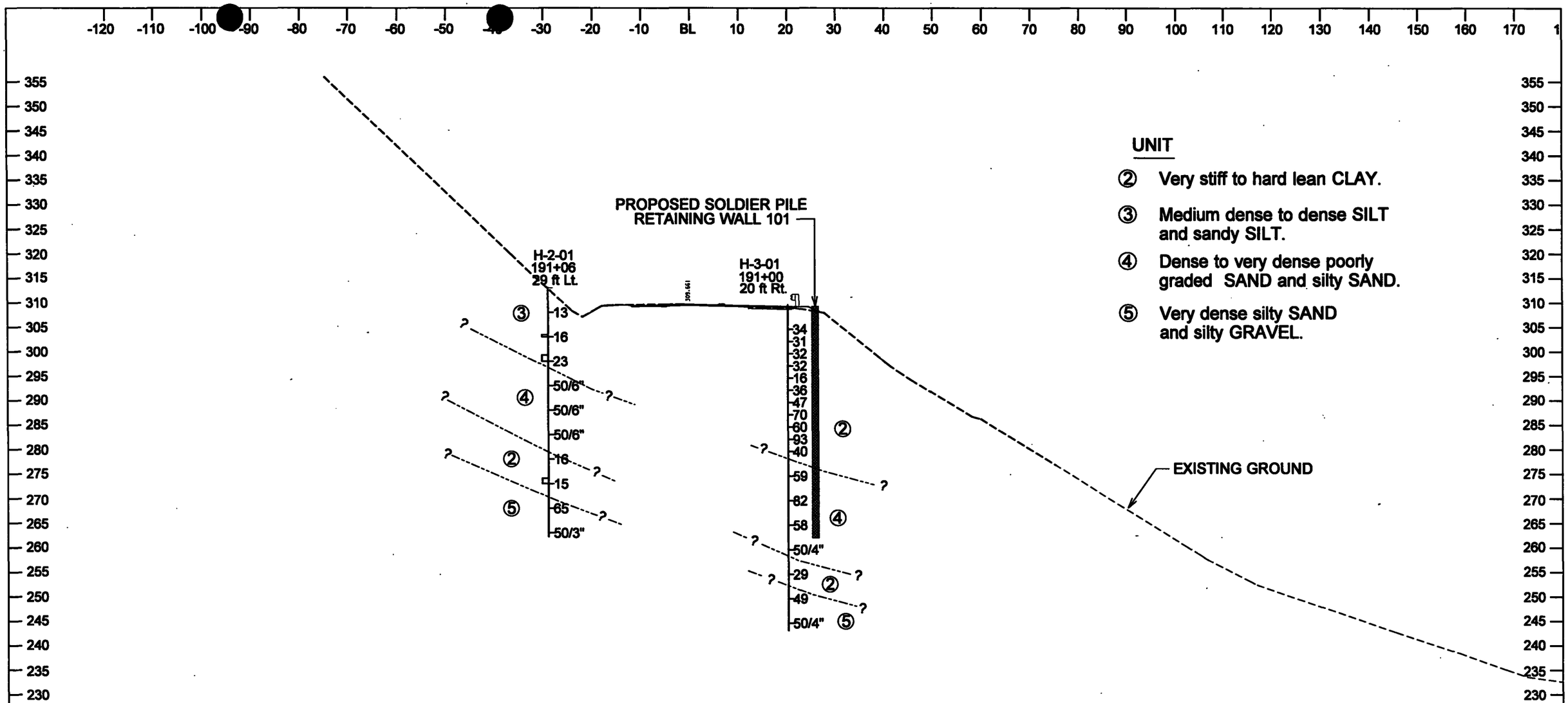

TEST HOLE LEGEND

H-1-98	TEST HOLE NUMBER
110+55	TEST HOLE STATION
26 ft.Rt.	TEST HOLE OFFSET
23	STANDARD PENETROMETER TEST (BLOWS PER FOOT)
	UNDISTURBED SAMPLE
W.L. 8-6-86	WATER LEVEL & DATE
?	INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS
	INDICATES INTACT ROCK
86%	INDICATES CORE SAMPLE TAKEN
	ROCK QUALITY DESIGNATION

191+00

FIGURE 3: A-A' CROSS-SECTION

JOB OL-1475 S.R. 20 C.S. _____ LAYOUT _____

GULCH BRIDGE 20/265 REPLACEMENT

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 1/2002
SCALE 1"=20' VERT. 1"=20' HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

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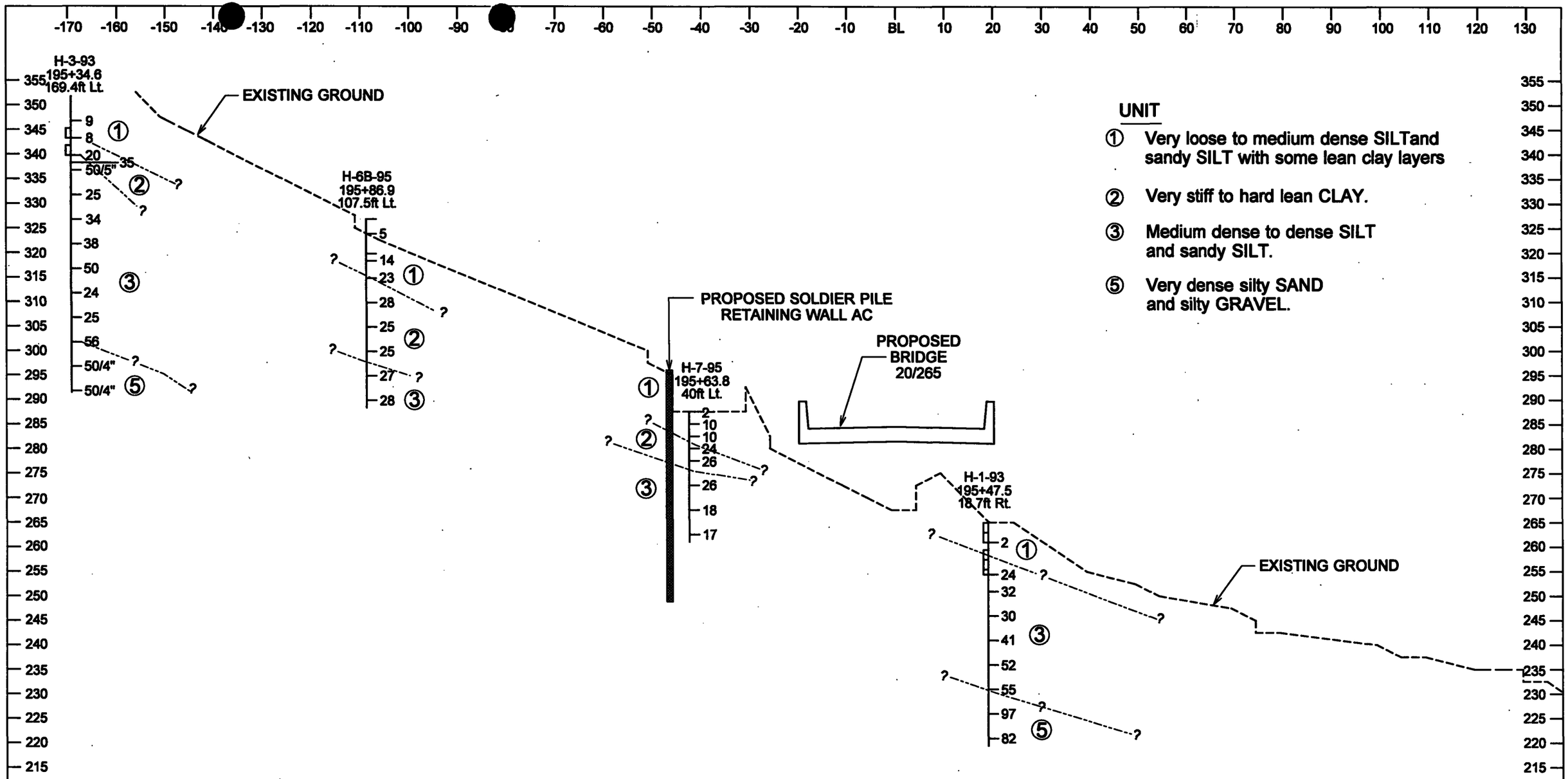

TEST HOLE LEGEND

H-1-98	TEST HOLE NUMBER
110+55	TEST HOLE STATION
26 ft.Rt.	TEST HOLE OFFSET
23	STANDARD PENETROMETER TEST (BLOWS PER FOOT)
	UNDISTURBED SAMPLE
W.L. 8-6-86	WATER LEVEL & DATE
?	INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS
	INDICATES INTACT ROCK
86%	INDICATES CORE SAMPLE TAKEN
	ROCK QUALITY DESIGNATION

195+60

FIGURE 4: B-B' CROSS-SECTION

JOB OL-1475 S.R. 20 C.S. _____ LAYOUT _____

GULCH BRIDGE 20/265 REPLACEMENT

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 1/2002
SCALE 1"=20' VERT.
1"=20' HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

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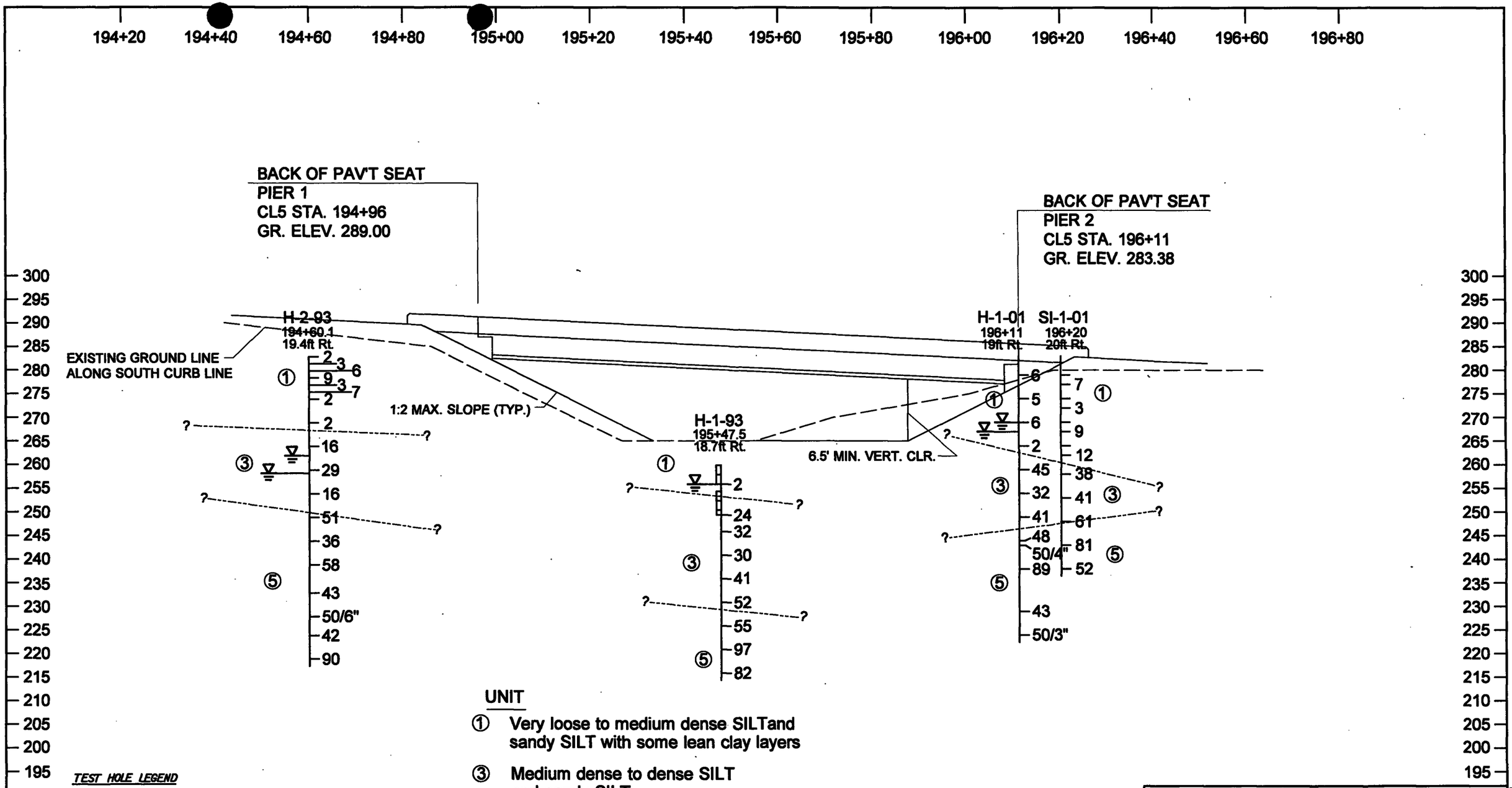


UNIT

① Very loose to medium dense SILTand sandy SILT with some lean clay layers

③ Medium dense to dense SILT and sandy SILT.

⑤ Very dense silty SAND and silty GRAVEL.

TEST HOLE LEGEND

H-1-98 TEST HOLE NUMBER
110+55 TEST HOLE STATION
26 ft.Rt. TEST HOLE OFFSET

23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)
UNDISTURBED SAMPLE
W.L. 8-6-86 WATER LEVEL & DATE
? INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS
INDICATES INTACT ROCK
86% INDICATES CORE SAMPLE TAKEN
ROCK QUALITY DESIGNATION

(NAVD) 88

FIGURE 5: C-C' CROSS-SECTION

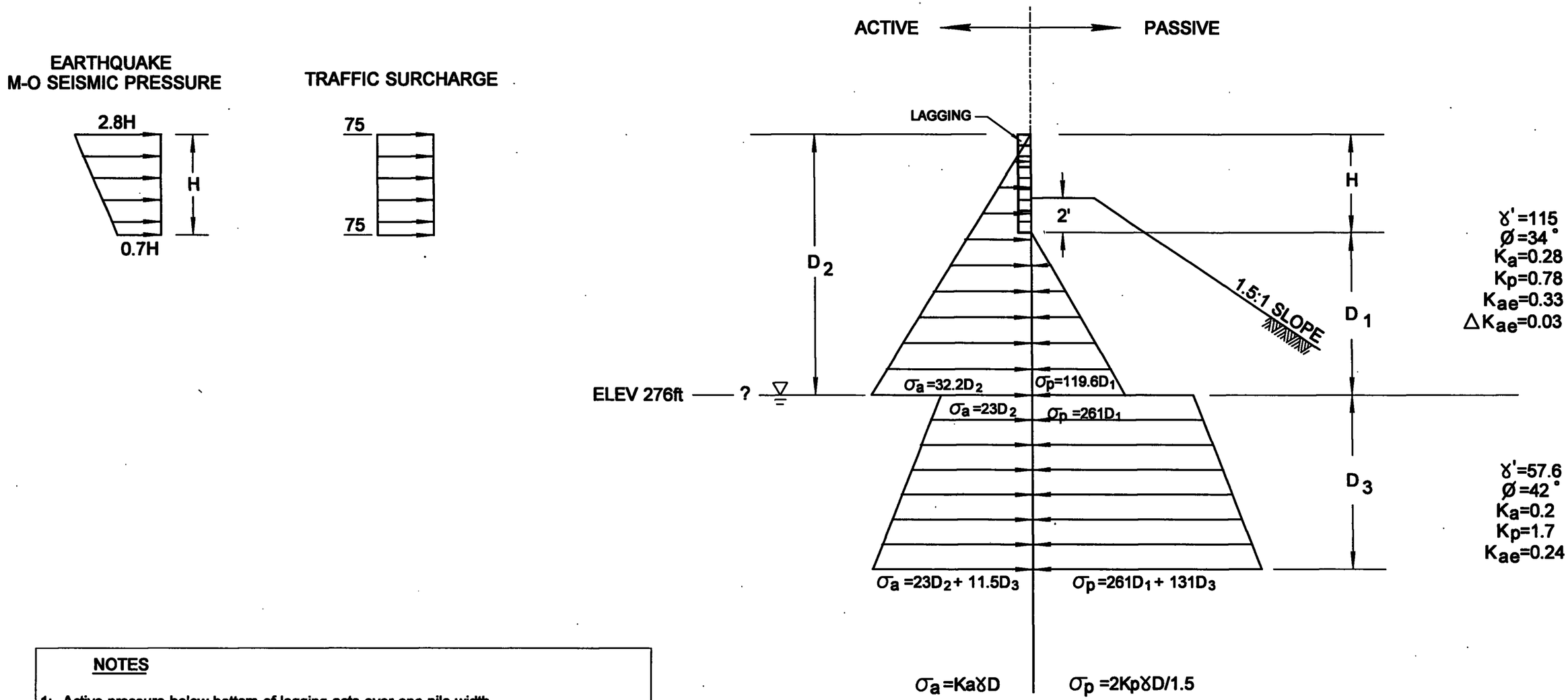
JOB OL-1475 S.R. 20 C.S.

GULCH BRIDGE 20/265 REPLACEMENT

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 1/2002
SCALE 1"=20' VERT. 1"=20' HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\OL1475MAP.DGN 01/30/2002 11:02:03 AM



NOTES

1: Active pressure below bottom of lagging acts over one pile width.

2: The passive pressure shown should be applied over one pile width.

3: σ_p=2KpγD/1.5:The passive pressure assumes the pressure acts over 2 pile widths and includes a factor of safety of 1.5.

4: Ignore passive pressure below finished grade in front of the wall for a distance of 2 feet.

5: All pressures in pounds per square foot (psf).

6: Extend lagging 2 feet below finished grade in front of the wall.

Piles should have a minimum embedment depth of 20 feet (D_1+D_3).

FIGURE 6: EARTH PRESSURE DIAGRAM
RETAINING WALL 101
SR20 STA 190+50 TO 191+40 VICINITY

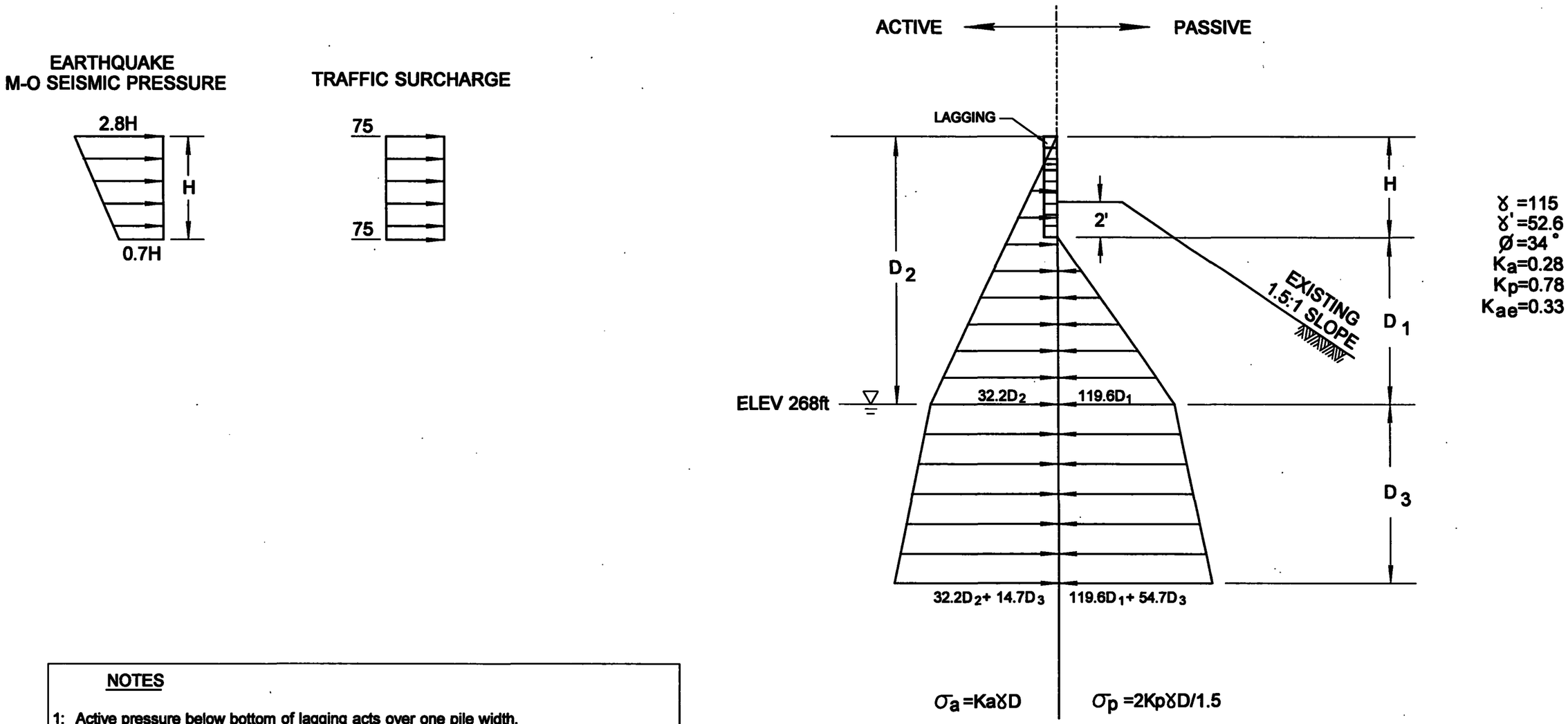
JOB OL-1475 S.R. 20 C.S.

GULCH BRIDGE
20/265 REPLACEMENT

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 1/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\OL1475MAP.DGN 01/30/2002 11:02:45 AM



NOTES

1: Active pressure below bottom of lagging acts over one pile width.

2: The passive pressure shown should be applied over one pile width.

3: σ_p=2KpγD/1.5:The passive pressure assumes the pressure acts over 2 pile widths and includes a factor of safety of 1.5.

4: Ignore passive pressure below finished grade in front of the wall for a distance of 2 feet.

5: All pressures in pounds per square foot (psf).

6: Extend lagging 2 feet below finished grade in front of the wall.

Piles should have a minimum embedment depth of 20 feet (D_1+D_3).

FIGURE 7: EARTH PRESSURE DIAGRAM
RETAINING WALL 102
SR20 STA 192+30 TO 194+85 VICINITY

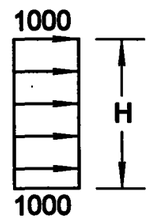
JOB OL-1475 S.R. 20 C.S.

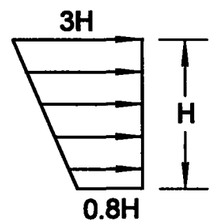
GULCH BRIDGE
20/265 REPLACEMENT

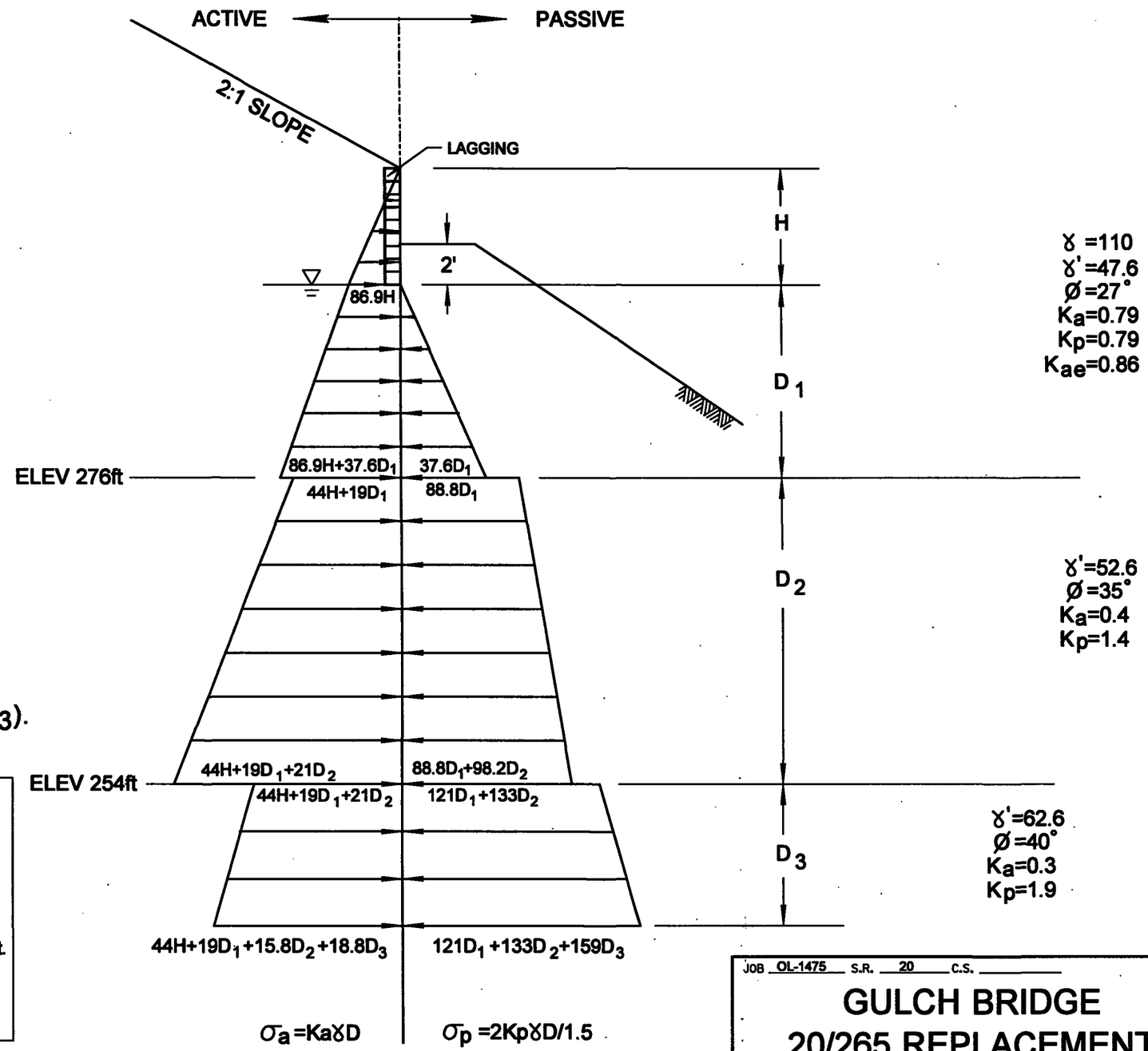
WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 1/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\OL1475MAP.DGN 01/30/2002 11:02:51 AM







Piles should have a minimum embedment depth of 40 feet ($D_1+D_2+D_3$).

NOTES

1: Active pressure below bottom of lagging acts over one pile width.

2: The passive pressure shown should be applied over one pile width.

3: $\sigma_p=2K_p\gamma D/1.5$: The passive pressure assumes the pressure acts over 2 pile widths and includes a factor of safety of 1.5.

4: Ignore passive pressure below finished grade in front of the wall for a distance of 2 feet.

5: All pressures in pounds per square foot (psf).

6: Extend lagging 2 feet below finished grade in front of the wall.

FIGURE 8: EARTH PRESSURE DIAGRAM
RETAINING WALL AC
DETOUR D1 STA 11+50 TO 14+85 VICINITY

JOB OL-1475 S.R. 20 C.S.

GULCH BRIDGE
20/265 REPLACEMENT

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 1/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

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APPENDIX B

FIELD EXPLORATIONS AND FIELD INSTRUMENTATION DATA

FIELD EXPLORATIONS

The field exploration program for this investigation consisted of drilling 7 exploratory borings. The approximate exploration locations are shown on Figure 2. Logs of test borings from the current study, as well as selected logs from previous studies are attached. These logs should be included in the contract documents.

Geotechnical drilling was performed using either a CME 45 skid mounted drill rig. Test holes were advanced to depths up to 70 feet below the ground surface using mud rotary drilling methods. At each location, soil samples were obtained using a SPT (Standard Penetration Test) sampler, in general accordance with ASTM D-1586. SPTs are obtained by driving a 50 mm (2-inch) outside diameter split-spoon sampler 450 mm (18-inches) into the soil with a 63-kg (140-pound) hammer. The number of blows required to achieve each 150 mm (6 inches) of penetration is recorded and the soil's SPT resistance, or N-value, is calculated as the number of blows required to achieve the final 300 mm (12 inches) of penetration. Each drill rig is equipped with an automatic trip hammer to drive the split-spoon sampler. The automatic hammers on these two drill rigs are rated at approximately 70 percent efficiency, as compared to approximately 60 percent for manual hammers.

Select soil samples were then submitted to the OSC Materials Laboratory for laboratory testing.

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-1-01

PROJECT Gulch Bridge Replacement Sheet 1 of 3

Gulch Bridge (20/265) MP 93.15 Inspector Dan Reed

Station SR 20 196 + 11 Offset 19 ft. Rt. Equipment CME 45 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing Easting Casing HW/HQ

Ground Elevation 283.0 (86.26 m) Start Date August 8, 2001 Completion Date August 10, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1			2 3 3 (6)		D-1		Sandy Elastic SILT with gravel and trace of organics, medium stiff, brown, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
10	2, 3			3 3 2 (5)		D-2	GS MC	SM, MC=22% Silty SAND, loose, brown, wet, Homogeneous, no HCl reaction, with clay lenses Length Recovered 1.5 ft, Length Retained 1.5 ft		
15	4, 5			3 3 3 (6)		D-3	GS MC PI	08/08/2001 CL, MC=33%, PI=9 Lean CLAY with sand, medium stiff, brown, moist, Stratified, no HCl reaction, with sand lenses Length Recovered 1.5 ft, Length Retained 1.5 ft 08/09/2001		
20	6			1 1		D-4		Sandy Elastic SILT with gravel, very soft, brown, wet, Homogeneous, no HCl reaction		

SOIL OL1475 GULCH BRIDGE REPLACEMENT.GPJ SOIL.GDT 1/22/02 09:57:55 A1

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-1-01

PROJECT Gulch Bridge Replacement Sheet 2 of 3

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 (2)				Length Recovered 1.5 ft, Length Retained 1.0 ft		
	7									
25				18 20 25 (45)		D-5		Sandy Elastic SILT with gravel, hard, brown, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
	8									
	9			9 15 17 (32)		D-6		Lean CLAY, hard, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
30										
	10									
35				12 18 23 (41)		D-7	GS MC	ML, MC=18% Sandy SILT, very dense, dark gray, moist, Homogeneous, no HCl reaction, w/rock fragments Length Recovered 1.5 ft, Length Retained 1.5 ft		
	11									
	12			18 13 35 (48)		D-8	GS MC	ML, MC=30% SILT, hard, dark gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
40				49 50/4" (50/4")		D-9	GS MC	SM, MC=11% Silty SAND with gravel, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	13									
45										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-1-01

PROJECT Gulch Bridge Replacement Sheet 3 of 3

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14			23 39 50 (89)		D-10		Silty GRAVEL with sand and trace of organics, angular, very dense, gray, wet, Stratified, no HCl reaction, material change at 50' silt w/sand lenses Length Recovered 1.5 ft, Length Retained 1.5 ft		
50	15									
	16									
55	17			15 18 25 (43)		D-11	GS MC	SM, MC=28% Silty SAND, hard, gray, wet, Homogeneous, no HCl reaction, w/rock fragments Length Recovered 1.5 ft, Length Retained 1.5 ft		
60	18			50/3 (50/3")		D-12	GS MC	GM, MC=11% Silty GRAVEL with sand, angular, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.0 ft, Length Retained 0.0 ft		
65	19							End of test hole boring at 60.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
70	20									
	21									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. SI-1-01

PROJECT Gulch Bridge Replacement Sheet 1 of 3

Gulch Bridge (20/265) MP 93.15 Inspector Dan Reed

Station SR 20 196 + 20 Offset 20 ft. Rt. Equipment CME 45 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing Easting Casing HW/HQ

Ground Elevation 283.0 (86.26 m) Start Date August 13, 2001 Completion Date August 16, 2001

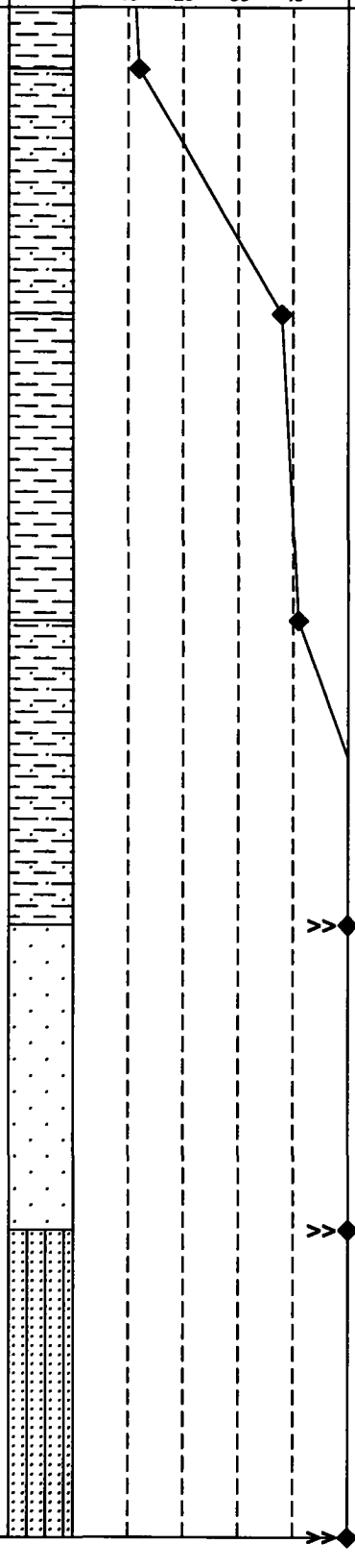
Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
						S-1		Sandy Lean CLAY, medium stiff, brown, moist, Homogeneous, no HCl reaction Length Recovered 1.8 ft, Length Retained 1.8 ft		
5	1									
	2			3 3 4 (7)		D-2	GS MC PI	CL, MC=26%, PI=14 Lean CLAY with sand, medium stiff, brown, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
						S-3		Sandy Lean CLAY, soft, brown, moist, Homogeneous, no HCl reaction Length Recovered 1.4 ft, Length Retained 1.4 ft		
10	3			4 1 2 (3)		D-4		Sandy Lean CLAY, soft, brown, moist, Homogeneous, no HCl reaction Length Recovered 0.5 ft, Length Retained 0.5 ft		
	4									
						S-5		Sandy Fat CLAY, stiff, brown, moist, Homogeneous, no HCl reaction Length Recovered 1.4 ft, Length Retained 1.4 ft		
15	5			3 4 5 (9)		D-6		Sandy Fat CLAY, stiff, brown, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
						S-7		Sandy Fat CLAY with gravel, w/trace of organics, stiff, brown, moist, Homogeneous, no HCl reaction		
20	6									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. SI-1-01

PROJECT Gulch Bridge Replacement Sheet 2 of 3



Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
						Length Recovered 1.4 ft, Length Retained 1.4 ft		
		3 5 7 (12)		D-8	GS MC PI	CL, MC=30%, PI=12 Lean CLAY with sand, stiff, brown, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
25	7	11 17 21 (38)		D-9		Sandy Fat CLAY, hard, brown, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
30	8 9	15 18 23 (41)		D-10		Sandy Lean CLAY, hard, gray, moist, Laminated,Fissured, no HCl reaction, w/sand lenses Length Recovered 1.5 ft, Length Retained 1.5 ft		
35	10 11	>>18 22 39 (61)		D-11		SILT with sand with trace of organics, very dense, gray, moist, Stratified, no HCl reaction, w/sand lenses Length Recovered 1.5 ft, Length Retained 1.5 ft		
40	12 13	>>20 31 50/4" (81)		D-12	GS MC	SM, MC=14% Silty SAND, very dense, gray, moist, Stratified, no HCl reaction, material change at 40' Length Recovered 1.5 ft, Length Retained 1.5 ft		
45		>>						

SOIL OL1475 GULCH BRIDGE REPLACEMENT.GPJ SOIL.GDT 1/22/02 09:59:21 A1

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. SI-1-01

PROJECT Gulch Bridge Replacement Sheet 3 of 3

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14			15 22 30 (52)		D-13		Silty GRAVEL, angular, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
50	15							End of test hole boring at 46.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
55	16									
60	17									
65	18									
70	19									
	20									
	21									

SOIL OL1475 GULCH BRIDGE REPLACEMENT.GPJ SOIL.GDT 1/22/02 09:59:21 A1

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-2-01

PROJECT Gulch Bridge Replacement Sheet 1 of 3

Gulch Bridge (20/265) MP 93.15 Inspector Dan Reed

Station SR 20 191+06 Offset 29 ft. Lt. Equipment CME 45 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing Easting Casing hq

Ground Elevation 310.0 (94.49 m) Start Date October 3, 2001 Completion Date October 3, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1			5 6 7 (13)		D-1		No Recovery Sandy elastic SILT, medium dense, brown, moist, stratified, sand lenses Length Recovered 1.5 ft, Length Retained 1.5 ft		
10	2			7 7 9 (16)		U-2 D-3	GS MC	No Recovery SM, MC=27% Silty SAND, medium dense, brown, moist, stratified, sand lenses Length Recovered 1.0 ft, Length Retained 1.0 ft		
15	3			5 10 13 (23)		U-4 D-5		10/03/2001 Elastic SILT with sand, medium dense, brown, moist, Disrupted, sand lenses Length Recovered 1.5 ft, Length Retained 1.5 ft 10/03/2001		
20	4									
	5									
	6									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-2-01

PROJECT Gulch Bridge Replacement Sheet 2 of 3

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				20 50/6 (50/6")		U-6 D-7		No Recovery Well graded SAND with gravel, very dense, brown, wet, Homogeneous Length Recovered 1.0 ft, Length Retained 1.0 ft Cobbles at 22'		
25	7			39 50/6 (50/6")		D-8		Well graded SAND with gravel, very dense, brown, wet, Homogeneous Length Recovered 1.0 ft, Length Retained 1.0 ft		
30	8			35 50/6 (50/6")		D-9		Well graded SAND with gravel, very dense, brown, wet, Homogeneous Length Recovered 1.0 ft, Length Retained 1.0 ft		
35	9			5 7 9 (16)		D-10		SILT with sand, medium dense, brown, wet, Homogeneous Length Recovered 1.5 ft, Length Retained 1.5 ft		
40	10			6 7 8 (15)		U-11 D-12	GS MC	Elastic SILT with sand, medium dense, gray, wet, Disrupted Length Recovered 0.3 ft, Length Retained 0.3 ft ML, MC=31% SILT, medium dense, gray, wet, Disrupted Length Recovered 1.5 ft, Length Retained 1.5 ft		
45	11									
	12									
	13									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-2-01

PROJECT Gulch Bridge Replacement Sheet 3 of 3

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14			17 33 32 (65)		D-13		Sandy Elastic SILT, very dense, gray, wet, Homogeneous, rock fragments Length Recovered 1.5 ft, Length Retained 1.5 ft		
	15									
50				35 50/3 (50/3")		D-14		Silty GRAVEL, angular, very dense, gray, moist, Homogeneous, rock fragments Length Recovered 0.8 ft, Length Retained 0.8 ft		
	16							End of test hole boring at 50.8 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
55	17									
	18									
60	19									
65	20									
	21									
70										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-3-01

PROJECT Gulch Bridge Replacement Sheet 1 of 3

Gulch Bridge (20/265) MP 93.15 Inspector Dan Reed

Station SR 20 191 + 00 Offset 20 ft. Rt. Equipment CME 45 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing Easting Casing HQ

Ground Elevation 309.0 (94.18 m) Start Date September 25, 2001 Completion Date September 27, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1			17 19 15 (34)		D-1		Lean CLAY with sand, hard, light brown, moist, Homogeneous Length Recovered 1.5 ft, Length Retained 1.5 ft		
	2			19 21 19 (31)		D-2	GS MC PI	CL, MC=26%, PI=10 Lean CLAY, hard, light brown, moist, Homogeneous Length Recovered 1.5 ft, Length Retained 1.5 ft		
10	3			12 17 15 (32)		D-3		Fat CLAY with sand, hard, light brown, moist, Homogeneous Length Recovered 1.5 ft, Length Retained 1.5 ft		
	4			14 15 17 (32)		D-4		Lean CLAY with sand, hard, gray, moist, Homogeneous Length Recovered 1.5 ft, Length Retained 1.5 ft		
15	5			8 9 7 (16)		D-5		Silty SAND with silt lenses, medium dense, gray, wet, Laminated,Fissured Length Recovered 1.5 ft, Length Retained 1.5 ft		
				17 19 17 (36)		D-6		Lean CLAY with sand, hard, gray, moist, Homogeneous Length Recovered 1.5 ft, Length Retained 1.5 ft		
20	6									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-3-01

PROJECT Gulch Bridge Replacement Sheet 2 of 3

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				15 20 27 (47)		D-7		Lean CLAY with gravel, hard, gray, moist, Homogeneous Length Recovered 1.5 ft, Length Retained 1.5 ft		
	7		>>	17 30 40 (70)		D-8	GS MC PI	CL, MC=18%, PI=8 Lean CLAY with gravel, very hard, gray, moist, Homogeneous Length Recovered 1.5 ft, Length Retained 1.5 ft		
25	8		>>	15 20 40 (60)		D-9		Lean CLAY with gravel, very hard, gray, moist, Homogeneous Length Recovered 1.5 ft, Length Retained 1.5 ft		
	9		>>	29 48 45 (93)		D-10		Lean CLAY with gravel, very hard, gray, moist, Homogeneous Length Recovered 1.5 ft, Length Retained 1.5 ft		
30	10			10 19 21 (40)		D-11		Lean CLAY with gravel, hard, gray, moist, Stratified, material change to brown poorly graded sand at 30.7' Length Recovered 1.5 ft, Length Retained 1.5 ft	▽ 09/25/2001	
35	11		>>	16 28 31 (59)		D-12		Poorly graded SAND, very dense, brown, moist, Stratified, fine and coarse sand Length Recovered 1.5 ft, Length Retained 1.5 ft		
40	12 13		>>	21 42 40 (82)		D-13		Well graded SAND, very dense, brown, moist, Stratified, fine and coarse sand Length Recovered 1.5 ft, Length Retained 1.5 ft		
45			>>							

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-3-01

PROJECT Gulch Bridge Replacement Sheet 3 of 3

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14			19 24 34 (58)		D-14		Well graded SAND, w/ silt lenses, very dense, brown, moist, Stratified, fine and coarse sand Length Recovered 1.5 ft, Length Retained 1.5 ft		
	15									
50				49 50/4 (50/4")		D-15		Well graded SAND, very dense, brown, moist, Stratified, fine and coarse sand Length Recovered 1.5 ft, Length Retained 1.5 ft		
	16									
55				9 14 15 (29)		D-16		SILT, very dense, gray, moist, Homogeneous, color change brown to gray at 55.4' Length Recovered 1.5 ft, Length Retained 1.5 ft		
	17									
	18									
60				16 22 27 (49)		D-17		Sandy Elastic SILT with gravel, dense, gray, moist, Homogeneous Length Recovered 1.5 ft, Length Retained 1.5 ft		
	19									
65				40 50/4 (50/4")		D-18		Sandy Elastic SILT with gravel, very dense, gray, moist, Homogeneous Length Recovered 0.9 ft, Length Retained 0.9 ft		
	20									
								End of test hole boring at 66.5 ft below ground elevation.		
	21							This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
70										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-4-01

PROJECT Gulch Bridge Replacement Sheet 1 of 4

Gulch Bridge (20/265) MP 93.15 Inspector Dan Reed

Station SR 20 192 + 80 Offset 22 ft. Rt. Equipment CME 45 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing Easting Casing HW/HQ

Ground Elevation 296.0 (90.22 m) Start Date October 10, 2001 Completion Date October 10, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1			2 3 2 (5)		D-1		Well graded GRAVEL with sand, angular, loose, brown, wet, Homogeneous. Length Recovered 1.0 ft, Length Retained 1.0 ft		
	2			3 2 3 (5)		D-2		Well graded GRAVEL with sand, angular, loose, brown, wet, Homogeneous. Length Recovered 1.5 ft, Length Retained 1.5 ft		
10	3					U-3		No Recovery		
	4			1 3 3 (6)		D-4		SILT with sand, loose, gray, wet, Homogeneous. Length Recovered 1.5 ft, Length Retained 1.5 ft		
15	5			2 3 3 (6)		D-5	GS MC	ML, MC=18% SILT with sand, loose, gray, wet, Homogeneous. Length Recovered 1.0 ft, Length Retained 1.0 ft		
	6					U-6 A B C		Lean CLAY with sand, soft, gray, wet, Homogeneous. Length Recovered 1.5 ft, Length Retained 1.5 ft		
20										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-4-01

PROJECT Gulch Bridge Replacement Sheet 2 of 4

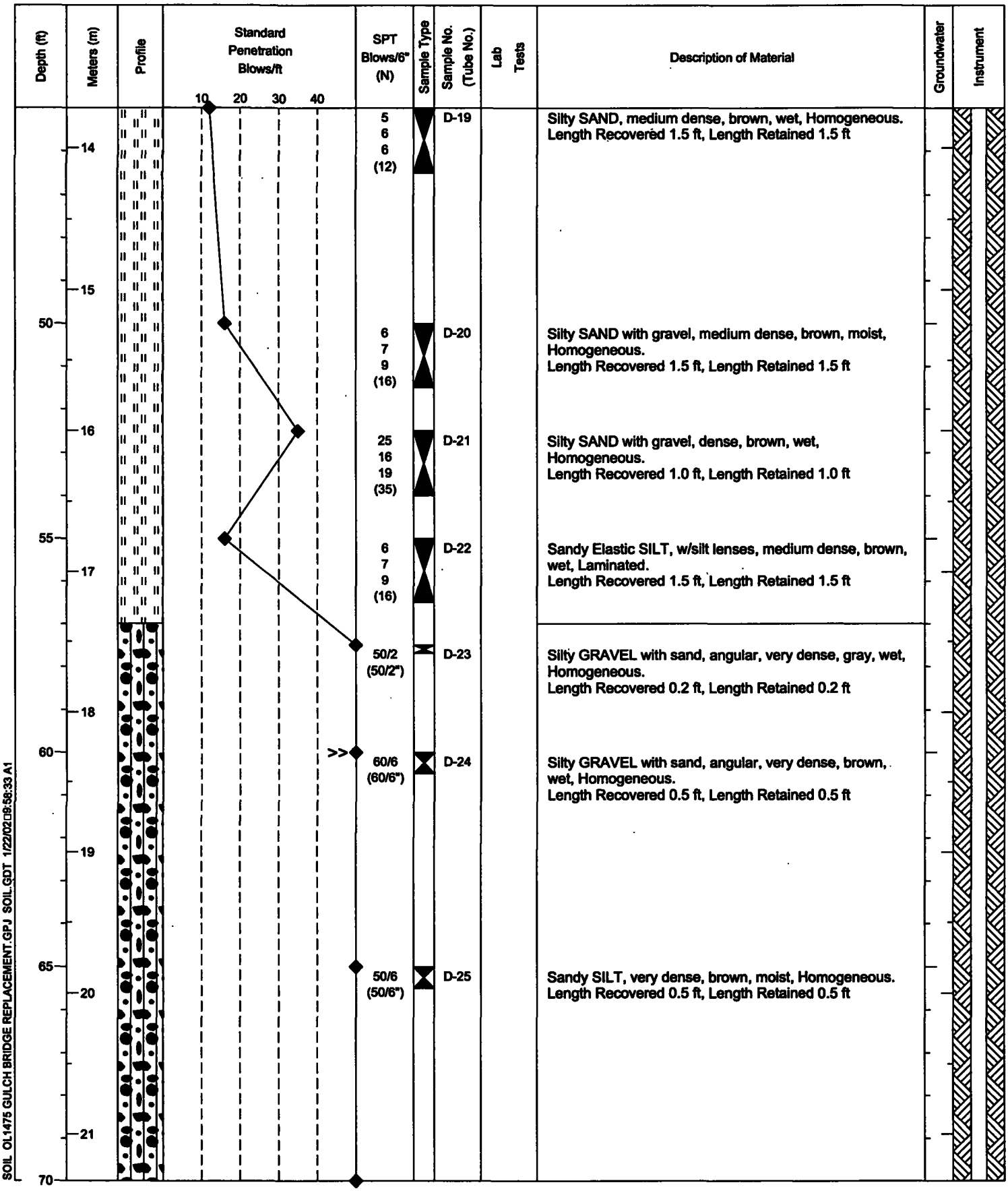
Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				2 2 2 (4)		D-7		Lean CLAY with sand, soft, gray, wet, Homogeneous. Length Recovered 1.0 ft, Length Retained 1.0 ft		
	7			1 2 3 (5)		D-8		Lean CLAY with sand, medium stiff, gray, wet, Homogeneous. Length Recovered 1.0 ft, Length Retained 1.0 ft		
						U-9 A B C		Lean CLAY with sand, medium stiff, gray, wet, Homogeneous. Length Recovered 1.0 ft, Length Retained 1.0 ft		
25	8			2 6 8 (14)		D-10	GS MC PI	CL, MC=26%, PI=13 Lean CLAY, stiff, gray, wet, Laminated. Length Recovered 1.5 ft, Length Retained 1.5 ft		
				3 4 7 (11)		D-11		Lean CLAY with sand, stiff, gray, wet, Homogeneous. Length Recovered 1.5 ft, Length Retained 1.5 ft		
30	9			2 3 2 (5)		D-12		Lean CLAY with sand, w/wood debris, medium stiff, gray, moist, Disrupted. Length Recovered 1.5 ft, Length Retained 1.5 ft		
						U-13 A B		Lean CLAY with sand, medium stiff, gray, moist, Disrupted. Length Recovered 1.0 ft, Length Retained 1.0 ft		
	10			1 4 4 (8)		D-14		Lean CLAY with sand, medium stiff, gray, moist, Disrupted. Length Recovered 1.5 ft, Length Retained 1.5 ft	▽ 10/10/2001	
35	11			2 4 6 (10)		D-15		Lean CLAY with sand, stiff, gray, wet, Disrupted. Length Recovered 1.5 ft, Length Retained 1.5 ft		
				5 5 7 (12)		D-16		SILT with sand, w/wood debris, dense, brown, moist, Disrupted. Length Recovered 1.5 ft, Length Retained 1.5 ft		
40	12			6 6 6 (12)		D-17		Clayey GRAVEL with sand, angular, medium dense, brown, wet, Homogeneous. Length Recovered 1.0 ft, Length Retained 1.0 ft		
	13			2 2 2 (4)		D-18	GS MC	SM, MC=24% Silty SAND with gravel, soft, brown, wet, Homogeneous. Length Recovered 1.5 ft, Length Retained 1.5 ft		
45										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-4-01

PROJECT Gulch Bridge Replacement Sheet 3 of 4



Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-4-01

PROJECT Gulch Bridge Replacement Sheet 4 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				50/6 (50/6")		D-26		Sandy SILT with gravel, very dense, brown, moist, Homogeneous. Length Recovered 0.5 ft, Length Retained 0.5 ft		
	22							End of test hole boring at 70.5 ft below ground elevation.		
								This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
75	23									
	24									
80										
	25									
85	26									
	27									
90										
	28									
95										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-5-01

PROJECT Gulch Bridge Replacement Sheet 1 of 2

Gulch Bridge (20/265) MP 93.15 Inspector Dan Reed

Station DL 11+90 Offset 10 ft. Lt. Equipment CME 45 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing Easting Casing hq

Ground Elevation 291.0 (88.70 m) Start Date October 5, 2001 Completion Date October 5, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
						C-1		No Recovery		
5	1, 2			RQD 68% FF 2		C-2		Elastic SILT, gray, moist, Homogeneous., see core recovery Length Recovered 4.0 ft, Length Retained 4.0 ft		
10	3, 4			RQD 100% FF 0		C-3		Clayey SAND, gray, moist, Homogeneous. Length Recovered 5.0 ft, Length Retained 5.0 ft	▽ 10/05/2001	
15	5, 6			RQD 95% FF 2		C-4		Clayey SAND, gray, moist, Homogeneous. Length Recovered 4.8 ft, Length Retained 4.8 ft		
20										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-5-01

PROJECT Gulch Bridge Replacement Sheet 2 of 2

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				RQD 26% FF 2		C-5		Clayey SAND with gravel, gray, wet, Stratified., 20.0 ft to 21.3 ft sandy fat clay with gravel 21.3 ft to25.0 ft poorly graded sand as indicted by drilling and drill cuttings in fluid return Length Recovered 1.4 ft, Length Retained 1.4 ft		
25	7									
	8									
30	9		>>	16 29 50/3 (79/9")		D-6		Silty SAND, very dense, brown/gray, moist, Stratified., 30.0 ft to 30.5 ft well graded brown sand 30.5 ft to 31.3 ft gray silty sand see sample bags a and b Length Recovered 1.0 ft, Length Retained 1.0 ft		
	10							End of test hole boring at 31.3 ft below ground elevation.		
								This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
35	11									
40	12									
	13									
45										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-6-01

PROJECT Gulch Bridge Replacement Sheet 1 of 2

Gulch Bridge (20/265) MP 93.15 Inspector Dan Reed

Station DL 13 + 40 Offset 10 ft. Lt. Equipment CME 45 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing Easting Casing HQ/HW

Ground Elevation 285.0 (86.87 m) Start Date October 5, 2001 Completion Date October 5, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1									
5	2									
10	3			16 21 17 (38)		D-1		SILT with sand, dense, gray, moist, Disrupted., see core recovery 5.0-10.0' Length Recovered 1.5 ft, Length Retained 1.5 ft		
10	4									
15	5			5 7 12 (19)		D-2		M, M.C.=32% SILT with sand, medium dense, gray, moist, Homogeneous., see core recovery 10.0-15.0' Length Recovered 1.5 ft, Length Retained 1.5 ft	10/05/2001	
20	6									

SOIL OL1475 GULCH BRIDGE REPLACEMENT.GPJ SOIL.GDT 1/22/02 9:58:57 A1

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-6-01

PROJECT Gulch Bridge Replacement Sheet 2 of 2

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				8 15 17 (32)		D-3		SILT with sand and gravel, hard, gray, moist, Homogeneous., see core recovery 15.0-20.0' Length Recovered 1.5 ft, Length Retained 1.5 ft		
	7									
25				5 8 25 (33)		D-4		SILT with sand and gravel, hard, gray, wet, Homogeneous., see core recovery 20.0-25.0' Length Recovered 1.5 ft, Length Retained 1.5 ft		
	8									
	9									
30			>>	7 40 50 (90)		D-5		Well graded SAND with gravel, w/silt lenses, very dense, gray, moist, Homogeneous., see core recovery 25.0-30.0' Length Recovered 1.5 ft, Length Retained 1.5 ft		
	10							End of test hole boring at 31.5 ft below ground elevation.		
								This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
35										
	11									
	12									
40										
	13									
45										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-1-93

PROJECT Gulch Bridge Replacement Sheet 1 of 3

Gulch Bridge (20/265) MP 93.15 Inspector

Station SR 20 195+47.5 Offset 18.7 ft. Rt. Equipment

Latitude Longitude Method Wet Rotary

Northing Easting Casing HW X 36'/HQ X 44'

Ground Elevation 259.9 (79.22 m) Start Date Completion Date May 5, 1993

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				A		U-1		Sandy SILT, with organics, wood fiber and a foul odor, soft, gray, moist. Retained 0.3 ft.		
						U-2		No recovery.		
	1			1 1 1 (2)		D-3	GS MC PI	GM-GC, M.C. = 27.8%, PI = 5.8 Sandy, silty, clayey GRAVEL, soft, gray and brown, wet. Retained 0.7 ft.	6/7/93	
5				A		U-4		Sandy, slightly clayey SILT, soft, gray, wet. Retained 0.3 ft.		
	2			A B C D E F		U-5	GS MC	ML, M.C. = 28.0% Gravelly, sandy SILT, soft, brown, olive gray at bottom, wet. Retained 2.0 ft.		
10	3			A B		U-6		Slightly gravelly, clayey SILT, soft, gray, wet. Retained 0.7 ft.		
				5 12 12 (24)		D-7		Sandy GRAVEL (Till like material), medium dense, grey green, dry to moist. Retained 1.0 ft.		
	4									
15				5 14 18 (32)		D-8		Sandy SILT (14.0' to 17.75' b.g.e.) with transition to sandy GRAVEL, dense, gray green, dry. Retained 1.2 ft.		
	5									
20	6			11 12		D-9		Silty, sandy GRAVEL (19.0' to 19.2' b.g.e.) with transition to very stiff, grey green, dry SILT, dense, grey green, dry.		

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-1-93

PROJECT Gulch Bridge Replacement Sheet 2 of 3

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				18 (30)				Retained 1.0 ft.		
	7									
25				11 17 24 (41)		D-10		SILT with interbedded layers of silty, sandy GRAVEL, hard, gray green, moist. Retained 1.2 ft.		
	8									
			>>	21 27 25 (52)		D-11		Silty, sandy GRAVEL, very dense, gray green, moist. Retained 1.0 ft.		
30	9									
	10									
			>>	13 24 31 (55)		D-12		Silty, sandy GRAVEL, very dense, gray green, moist. Retained 1.2 ft.		
35	11									
	12		>>	25 47 50/4"		D-13		Silty, sandy GRAVEL, very dense, gray green, moist. Retained 0.8 ft.		
40	13									
			>>	28 40		D-14		Silty, sandy GRAVEL, very dense, gray green, moist. Retained 0.8 ft.		
45										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-1-93

PROJECT Gulch Bridge Replacement Sheet 3 of 3

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				42 (82)						
	14							End of test hole boring at 45.5 ft. below ground elevation.		
								Installed piezometer to 44.0 ft. below ground elevation.		
	15									
50								Water Table Elevation: Recorded 6-7-93		
	16							This is a Summary Log of the Test Hole Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
55										
	17									
	18									
60										
	19									
65										
	20									
	21									
70										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-2-93

PROJECT Gulch Bridge Replacement Sheet 1 of 4

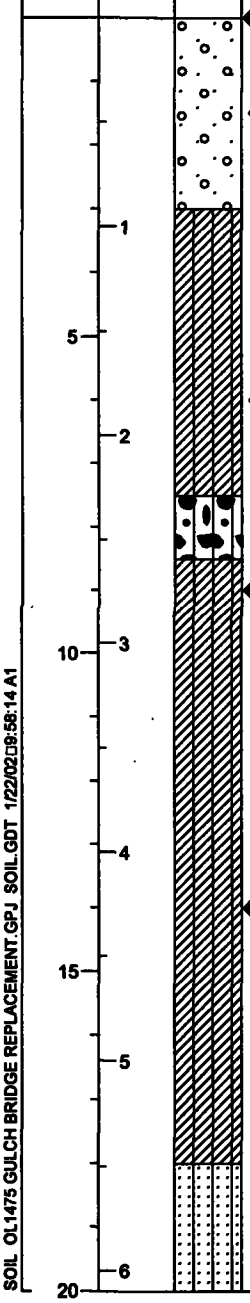
Gulch Bridge (20/265) MP 93.15 Inspector

Station SR 20 194+60.1 Offset 19.4 ft. Rt. Equipment

Latitude Longitude Method Wet Rotary

Northing Easting Casing HW

Ground Elevation 282.8 (86.20 m) Start Date Completion Date April 14, 1993



Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
		3 1 1 (2)		D-1		Gravelly SAND (Fill), very loose, olive brown, moist. Retained 0.7 ft.		
		1 1 2 (3)		D-2		Slightly silty, slightly gravelly, fine SAND (Fill), very loose, brown, moist. Retained 1.0 ft.		
	1	2 2 4 (6)		D-3		Slightly sandy, slightly gravelly, clayey SILT with a trace of organics, medium stiff, gray brown, moist. Retained 0.8 ft.		
5		4 4 5 (9)		D-4		Sandy CLAY with a trace of organics, stiff, gray brown, dry. Retained 1.0 ft.		
	2	1 1 2 (3)		D-5	GS MC PI	CL, M.C. = 25.3%, PI = 11.2 Sandy CLAY with a trace of organics, soft, light olive brown, moist. Retained 1.0 ft.		
		3 3 4 (7)		D-6		Silty, sandy GRAVEL, loose, brown, moist. Retained 0.8 ft.		
10	3	1 1 1 (2)		D-7		Gravelly SILT, soft, brown, moist. Retained 0.3 ft.		
	4							
15		1 1 1 (2)		D-8	GS MC PI	CL, M.C. = 25.4%, PI = 11.6 Sandy CLAY, soft, light olive brown, moist. Retained 1.0 ft.		
	5							
	6	3 6		D-9		Silty, SAND with interbedded layers of silt, medium dense, brown and gray, moist.		
20								

SOIL OL1475 GULCH BRIDGE REPLACEMENT.GPJ SOIL.GDT 1/22/02 09:58:14 A1

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-2-93

PROJECT Gulch Bridge Replacement Sheet 2 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				10 (16)				Retained 1.3 ft.	4/14/93	
	7									
25				11 13 16 (29)		D-10		Silty, SAND, with 2 inches of silt at the bottom of sample, dense, gray to brown, dry. Retained 1.5 ft.	6/7/93	
	8							Small layer of gravels.		
30	9			4 8 8 (16)		D-11	GS MC PI	ML-CL, M.C. = 29.1%, PI = 4.8 Sandy, silty CLAY, very stiff, dark gray, moist. Retained 1.3 ft.		
	10									
35			>>	14 20 31 (51)		D-12		Silty, gravelly, SAND, very dense, greenish gray, dry. Retained 1.2 ft.		
	11									
40	12			17 15 21 (36)		D-13		Silty, gravelly, SAND, dense, greenish gray, dry. Retained 1.3 ft.		
	13									
45			>>	19 20		D-14		Silty, gravelly, SAND, very dense, greenish gray, dry. Retained 1.2 ft.		

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-2-93

PROJECT Gulch Bridge Replacement Sheet 3 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				38 (58)						
	14							6-7-93		
	15									
50				15 21 22 (43)		D-15	GS MC	SM, M.C. = 10.8% Silty, gravelly SAND, dense, very dark gray, moist. Retained 1.2 ft.		
	16							Cobbles and boulders.		
55				38 50/6 (50/6")		D-16		Silty, sandy GRAVEL, very dense, greenish gray, dry. Retained 0.7 ft.		
	17									
	18			7 10 32 (42)		D-17		Silty, sandy GRAVEL, dense, greenish gray, dry. Retained 0.7 ft.		
60								Cobbles and boulders.		
	19									
			>>	20 43 47 (90)		D-18		Silty, sandy GRAVEL, very dense, greenish gray, dry. Retained 0.5 ft.		
65	20							End of test hole boring at 65.5 feet below ground elevation.		
								Installed slope inclinometer to 64.0 ft. below ground elevation.		
	21									
70										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-2-93

PROJECT Gulch Bridge Replacement Sheet 4 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
								This is a Summary Log of the Test Hole Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	22									
75	23									
	24									
80										
	25									
85	26									
	27									
90										
	28									
95										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-2A-93

PROJECT Gulch Bridge Replacement Sheet 1 of 1

Gulch Bridge (20/265) MP 93.15 Inspector

Station SR 20 194+66.8 Offset 18.9 ft. Rt. Equipment

Latitude Longitude Method Wet Rotary

Northing Easting Casing HQ X 40'

Ground Elevation 286.0 (87.17 m) Start Date Completion Date April 28, 1993

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	1			A B C		U-1		Sandy, gravelly SILT, tan, dry. Recovered 1.0 ft.		
5				A B C		U-2	GS MC PI	CL, M.C. = 23.9%, PI = 14.0 Gravelly, sandy CLAY, olive, moist. Recovered 1.0 ft.		
	2					U-3		Sandy, gravelly SILT, tan, dry. No recovery.		
10	3									
	4			A B C D		U-4	GS MC PI	CL, M.C. = 27.7%, PI = 12.2 Gravelly, sandy CLAY, mottled, light olive brown, and grey, moist. Recovered 1.3 ft.		
15	5							End of test hole boring at 16.0 ft.		
								Water Table Elevation: Not determined.		
								This is a Summary Log of the Test Hole Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
20	6									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-3-93

PROJECT Gulch Bridge Replacement Sheet 1 of 3

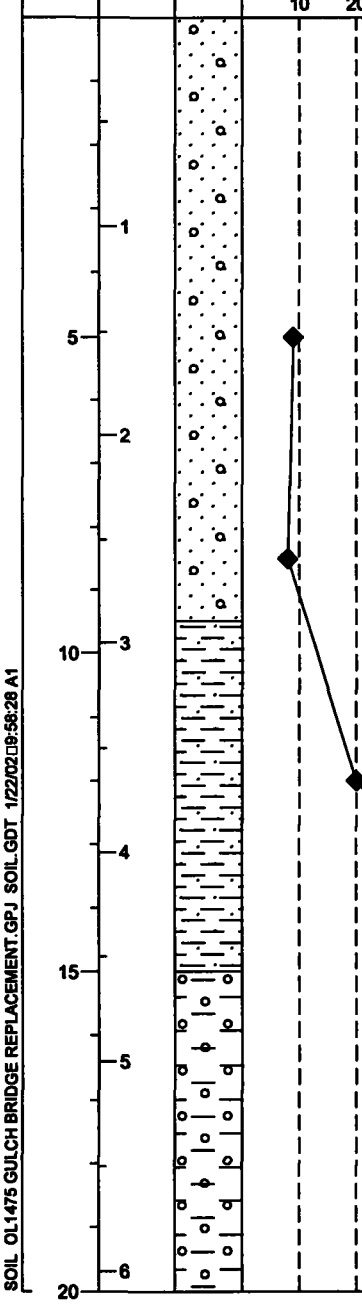
Gulch Bridge (20/265) MP 93.15 Inspector

Station SR 20 195+34.6 Offset 169.4 ft. Lt. Equipment

Latitude Longitude Method Wet Rotary

Northing Easting Casing HW X 60'

Ground Elevation 351.7 (107.20 m) Start Date Completion Date May 12, 1993



SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				Material from 0 ft. to 5.0 ft. below ground elevation is fill. Test hole was made over logging access road. Fill is side cast material from road cut: Gravelly SAND.		
				6-7-93	▽	
3 3 6 (9)		D-1		Gravelly, fine to coarse SAND with organics, loose, brown, wet. Retained 0.8 ft.		
		U-2		No recovery.		
3 2 6 (8)		D-3		SAND (8.5' to 9.0' b.g.e.), dense, brown, moist with transition to SILT, medium stiff, brown, dry. Retained 1.0 ft.		
A B C D E		U-4	GS MC PI	CL, M.C. = 19.0%, PI = 11.15 Gravelly, sandy CLAY, olive grey, moist. Recovered 1.7 ft.		
4 7 13 (20)		D-5	GS MC PI	CL, M.C. = 31.1%, PI = 20.3 Gravelly, sandy CLAY, very stiff, dark gray wet. Retained 1.5 ft.		
8 13 22 (35)		D-6		Gravelly, sandy CLAY hard, gray, dry. Retained 1.5 ft.		
50/5" (50/5")		D-7		No recovery. Drilling on a boulder?		

SOIL OL1475 GULCH BRIDGE REPLACEMENT.GPJ SOIL.GDT 1/22/02 09:58:28 A1

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-3-93

PROJECT Gulch Bridge Replacement Sheet 2 of 3

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				8 10 15		D-8		Very stiff. No recovery.		
25	7			6 15 19 (34)		D-9	GS MC	SP-SM, M.C. = 29.4% Gravelly, silty, SAND, dense, olive grey, moist. Retained 0.8 ft.		
30	8 9			9 17 21 (38)		D-10		Silty, SAND with silt lenses, dense, tan, moist. Retained 1.5 ft.		
35	10 11			11 20 30 (50)		D-11		Gravelly, silty, SAND, very dense, grey, moist. Retained 1.3 ft.		
40	12			6 9 15 (24)		D-12	GS MC	ML, M.C. = 29.4% Sandy SILT, very stiff, dark grey, moist. Retained 1.5 ft.		
45	13									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-3-93

PROJECT Gulch Bridge Replacement Sheet 3 of 3

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14			5 11 14 (25)		D-13		Gravelly, silty, SAND with a trace of organics, dense, grey, moist. Retained 1.5 ft.		
	15									
50			>>	16 26 30 (56)		D-14	GS MC	SM, M.C. = 17.7% Gravelly, silty, SAND (Till-like material), very dense, dark grey. Retained 1.3 ft.		
	16									
55				50/4" (50/4")		D-15		Gravelly, silty, SAND, very dense, grey green, dry. Retained 0.3 ft.		
	17									
	18									
60				50/4" (50/4")		D-16		Gravelly, silty, SAND, very dense, grey green, dry. Retained 0.2 ft.		
								End of test hole boring at 60.3 ft. below ground elevation.		
	19									
								Installed slope inclinometer to 60.0 ft. below ground elevation.		
65								This is a summary Log of the Test Hole Boring. Soil/Rock descriptions are derived from visual field identifications and laboratoroy test data.		
	20									
	21									
70										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-4-95

PROJECT Gulch Bridge Replacement Sheet 1 of 4

Gulch Bridge (20/265) MP 93.15 Inspector

Station SR 20 193+83.9 Offset 19.9 ft. Rt. Equipment

Latitude Longitude Method Wet Rotary

Northing Easting Casing

Ground Elevation 284.8 (86.81 m) Start Date February 11, 1995 Completion Date February 11, 1995

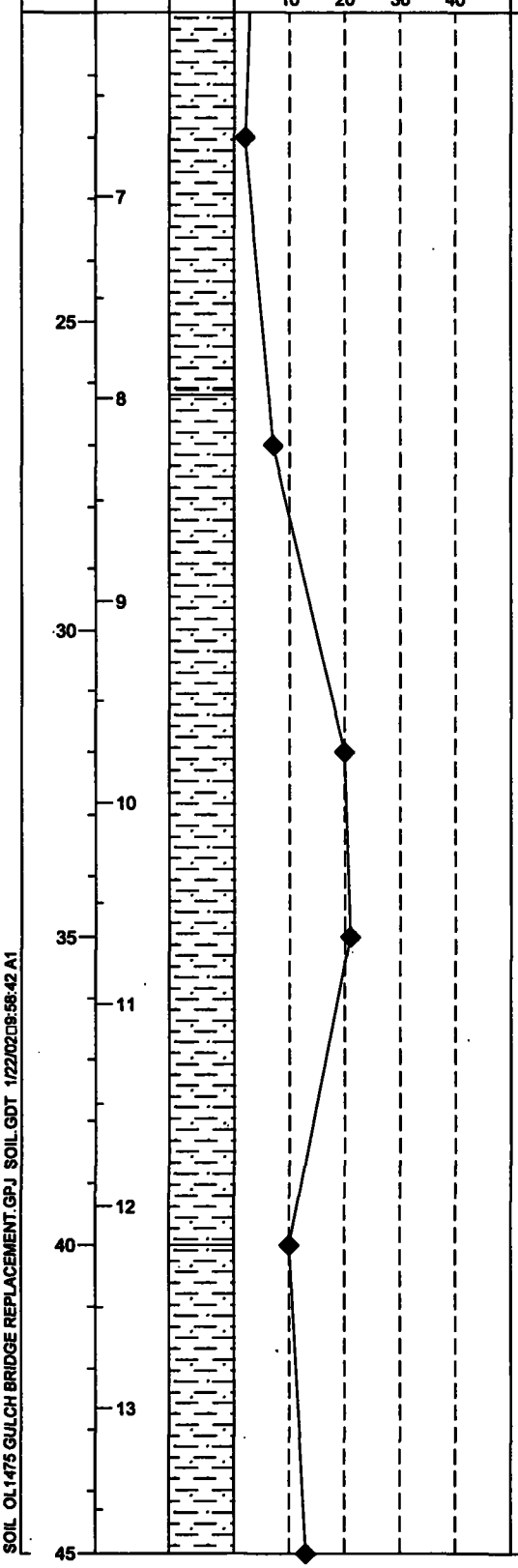
Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1, 2			5 4 5 (9)		D-1		GRAVEL with sand, loose, gray, wet. Retained 0.3 ft.		
10	3, 4			1 1 1 (2)		D-2	GS MC PI	ML, M.C.=30% SILT with decayed wood, very soft, gray, wet. Retained 1.0 ft.		
15	5			1 2 3 (5)		D-3	GS MC PI	CL, M.C.=25%, PI=15 LEAN CLAY with decayed wood, loose, gray, wet. Retained 1.0 ft.		
20	6									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-4-95

PROJECT Gulch Bridge Replacement Sheet 2 of 4



Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				S-4	GS MC PI CU	ML, M.C.=25%, PI=4 SILT with sand, brown, wet. Retained 1.0 ft.		
		1 1 1 (2)		D-5		Silty SAND with clay, very loose, brown, wet. Retained 1.0 ft.		
25	7			S-6	GS MC PI CN	ML, M.C.=28%, PI=11 SILT with sand and gravel, subrounded, brown, wet. Retained 1.2 ft.		
	8	2 3 4 (7)		D-7		LEAN CLAY with sand and gravel, subrounded, medium stiff, gray, wet. Retained 1.0 ft.		
30	9			S-8		Silty SAND with clay and gravel, subrounded, brown, wet. Retained 1.9 ft.		
	10	7 9 11 (20)		D-9	GS MC PI	CL, M.C.=21%, PI=11 LEAN CLAY with sand and gravel, subrounded, very stiff, brown, wet. Retained 1.0 ft.		
35	11	8 9 12 (21)		D-10		LEAN CLAY with sand and gravel, subrounded, very stiff, brown, wet. Retained 1.0 ft.		
40	12	4 5 5 (10)		D-11	GS MC PI	ML, M.C.=42% Sandy SILT with wood fragments and gravel, subrounded, stiff, gray, wet. Retained 1.0 ft.		
45	13							

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-4-95

PROJECT Gulch Bridge Replacement Sheet 3 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14			5 6 7 (13)		D-12		LEAN CLAY with sand and gravel, subrounded, stiff, gray, wet. Retained 1.0 ft.		
	15									
50				5 9 9 (18)		D-13		LEAN CLAY with sand, very stiff, gray, wet. Retained 1.0 ft.		
	16									
55				6 8 10 (18)		D-14		LEAN CLAY with sand, very stiff, gray, wet. Retained 1.0 ft.		
	17									
	18									
60			>>	13 21 50/5"		D-15		Silty GRAVEL with sand, very dense, gray, wet. Retained 1.0 ft.		
	19									
65			>>	15 25 50/4"		D-16	GS MC	GM, M.C.=13% Silty GRAVEL with sand, very dense, gray, wet. Retained 1.0 ft.		
	20									
	21									
70										

SOIL OL1475 GULCH BRIDGE REPLACEMENT.GPJ SOIL.GDT 1/22/02 09:58:42 A1

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-4-95

PROJECT Gulch Bridge Replacement Sheet 4 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				25 50/6 (50/6")		D-17		Silty GRAVEL with sand, very dense, gray, wet. Retained 0.8 ft.		
	22							End of test hole boring at 71.0 ft. below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
75	23									
	24									
80										
	25									
85	26									
	27									
90										
	28									
95										

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. H-5-95

PROJECT Gulch Bridge Replacement — Job No. OL-1475

Gulch Bridge (20/265) MP 93.15 — S.R. 20

Station SR 20 196+09.4 — Offset 75.4 ft. Rt. — C.S. 2942

Equipment — Casing — Ground El 246.3 (75.07 m)

Method of Boring Wet Rotary

Start Date February 9, 1995 — Completion Date February 9, 1995 — Sheet 1 of 2

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
						S-1	GS MC PI UU	CL, M.C.=20%, PI=17 LEAN CLAY with sand, organic material, gray, moist. Retained 1.2 ft.		
	1			2 3 4 (7)		D-2	GS MC PI	CL, M.C.=25%, PI=12 LEAN CLAY with sand, gravel and fibrous organic material, medium stiff, gray, wet. Retained 1.5 ft.		
5										
	2					S-3	GS MC PI UU	CL, M.C.=23%, PI=8 Sandy LEAN CLAY with wood and gravel, brown, wet. Retained 2.0 ft.		
				2 3 4 (7)		D-4	GS MC PI	CL-ML, M.C.=26%, PI=7 Sandy, silty CLAY, medium stiff, gray, wet. Retained 1.5 ft.		
10	3									
						S-5	GS MC PI UU	CL-ML, M.C.=28%, PI=7 Silty CLAY with sand, gray, wet. Retained 1.5 ft.		
	4			5 8 5 (13)		D-6		Sandy LEAN CLAY with gravel, subrounded, stiff, gray, wet. Retained 1.5 ft.		
15										
	5					S-7		No recovery.		
				9 6 6 (12)		D-8	GS MC PI	CL, M.C.=25%, PI=8 Sandy LEAN CLAY with gravel, subrounded, stiff, gray, wet. Retained 1.0 ft.		
20	6									

LOG OF TEST BORING

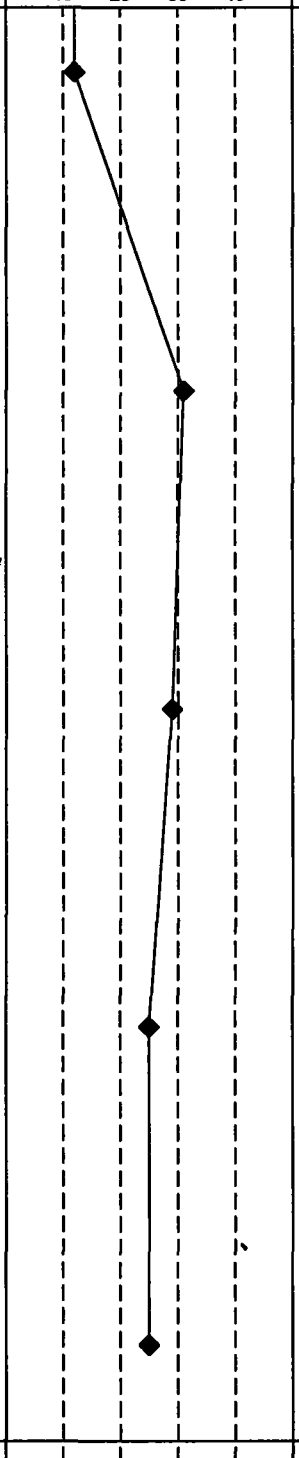
Washington State Department of Transportation

HOLE No. H-5-95

Sheet 2 of 2

PROJECT Gulch Bridge Replacement

Job No. OL-1475



Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				2 5 7 (12)		D-9		Sandy LEAN CLAY with gravel, subrounded, stiff, gray, wet. Retained 1.0 ft.		
	7									
25										
	8			6 15 16 (31)		D-10		Sandy SILT with gravel, subrounded, hard, gray, wet. Retained 1.0 ft.		
	9									
30										
				5 9 20 (29)		D-11	GS MC	ML, M.C.=23% Sandy SILT, very stiff, gray, wet. Retained 1.5 ft.		
	10									
35										
	11			10 10 15 (25)		D-12		Sandy SILT with gravel, subrounded, very stiff, gray, wet. Retained 1.2 ft.		
	12									
40										
				11 12 13 (25)		D-13		Sandy SILT with gravel, subrounded, very stiff, brown, wet. Retained 1.0 ft.		
	13							End of test hole boring at 42.5 ft. below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
45										

SOIL OL1475 GULCH BRIDGE REPLACEMENT.GPJ SOIL.GDT 1/29/02 09:57:26 A1

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. H-6A-95

PROJECT Gulch Bridge Replacement — Job No. OL-1475

Gulch Bridge (20/265) MP 93.15 — S.R. 20

Station SR 20 195+60.9 — Offset 92.7 ft. Lt. — C.S. 2942

Equipment — Casing 45 degree angle hole — Ground El 316.3 (96.41 m)

Method of Boring Wet Rotary

Start Date February 3, 1995 — Completion Date February 3, 1995 — Sheet 1 of 2

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
						C-1		Silty SAND with roots and wood, brown, wet, residual soil. Recovered 31%		
	1									
5						C-2		COBBLES with silty sand, brown, wet, residual soil. Recovered 10%		
	2									
10	3					C-3	GS AL	CH FAT CLAY, brown/gray. Recovered 100%, No Fractures		
	4									
15						C-4	GS AL	CL LEAN CLAY with SAND, gray, moist. Recovered 67%, No Fractures		
	5									
	6									
20										

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. H-6A-95

Sheet 2 of 2

PROJECT Gulch Bridge Replacement

Job No. OL-1475

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
						C-5	GS AL	CL LEAN CLAY, gray, moist. Recovered 76%, FPF=0		
	7									
25						C-6		LEAN CLAY, subrounded, gray, moist. Recovered 50%, FPF=1		
	8									
	9									
30								End of test hole boring 30.0 ft. below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	10									
35										
	11									
	12									
40										
	13									
45										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-6B-95

PROJECT Gulch Bridge Replacement Sheet 1 of 2

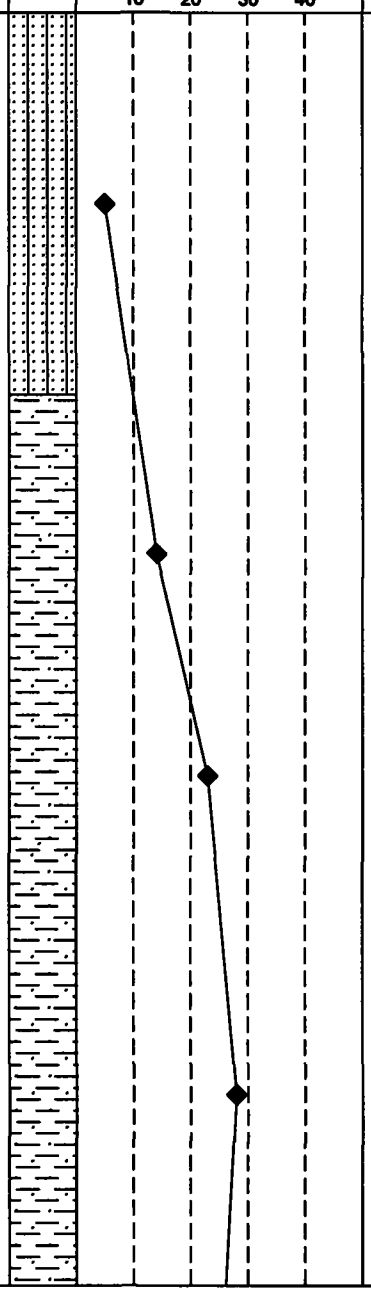
Gulch Bridge (20/265) MP 93.15 Inspector

Station SR 20 195+86.9 Offset 107.5 ft. Lt. Equipment

Latitude Longitude Method Wet Rotary

Northing Easting Casing

Ground Elevation 316.3 (96.41 m) Start Date February 3, 1995 Completion Date February 3, 1995



Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				S-1		Silty SAND with wood, brown, wet, residual soil. Retained 0.8 ft,		
	1	2 2 3 (5)		D-2		Silty SAND with roots and wood, loose, brown, wet, residual soil. Retained 0.3 ft.		
5								
	2			S-3	GS MC PI UU	CL, M.C.=31%, PI=23 LEAN CLAY, brown, wet, residual soil. Retained 1.6 ft.		
		13 9 5 (14)		D-4	GS MC PI	CH, M.C.=26%, PI=25 Sandy FAT CLAY, stiff, brown, wet, residual soil. Retained 1.0 ft.		
10	3							
		7 10 13 (23)		D-5		Sandy LEAN CLAY, very stiff, gray, moist, residual soil. Retained 1.0 ft.		
	4							
15								
	5	7 15 13 (28)		D-6	GS MC PI	CL, M.C.=17%, PI=7 Sandy LEAN CLAY with gravel, subrounded, very stiff, gray, moist, residual soil. Retained 1.5 ft.		
	6							
20								

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-6B-95

PROJECT Gulch Bridge Replacement Sheet 2 of 2

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				6 10 15 (25)		D-7		Sandy LEAN CLAY, very stiff, gray, moist, residual soil. Retained 1.5 ft.		
25	7									
	8			12 12 13 (25)		D-8		Sandy LEAN CLAY, very stiff, gray, moist, residual soil. Retained 1.5 ft.		
30	9									
	10			12 14 13 (27)		D-9		Sandy LEAN CLAY, very stiff, gray, moist, residual soil. Retained 1.5 ft.		
35	11									
				13 13 15 (28)		D-10		Sandy LEAN CLAY, very stiff, gray, moist, residual soil. Retained 1.5 ft.		
	12							End of test hole boring at 38.5 ft. below ground elevation.		
40								This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	13									
45										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-7-95

PROJECT Gulch Bridge Replacement Sheet 1 of 2

Gulch Bridge (20/265) MP 93.15 Inspector

Station SR 20 195+80.0 Offset 40 ft. Lt. Equipment

Latitude Longitude Method Tripod/Washbore

Northing Easting Casing 3" X 10'

Ground Elevation 291.7 (88.91 m) Start Date May 25, 1995 Completion Date May 25, 1995

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				0 1 1 (2)		D-1		Clayey SAND with gravel and organics, brown, moist, soft. Retained 0.5 ft.		
	1			3 7 3 (10)		D-2	GS MC PI	SC, M.C.=14%, PI=9 Clayey SAND with gravel and organics, brown, moist, soft. Retained 1.0 ft.		
5	2			4 4 6 (10)		D-3		SILT with sand, clay, gravel, and organics, brown, moist, soft. No recovery.		
				7 10 14 (24)		D-4	GS MC PI	CL, M.C.=26%, PI=12 LEAN CLAY, gray, moist, very stiff. Retained 0.7 ft.	▽	
10	3			7 11 15 (26)		D-5		LEAN CLAY, gray, moist, very stiff. Retained 1.0 ft.		
15	4			6 10 16 (26)		D-6		SILT, gray, moist, very stiff. Retained 0.5 ft.		
20	5									
	6									

SOIL OL1475 GULCH BRIDGE REPLACEMENT.GPJ SOIL.GDT 1/22/02 10:23:46 A1

Washington State Department of Transportation

LOG OF TEST BORING

Job No. OL-1475 SR 20 HOLE No. H-7-95

PROJECT Gulch Bridge Replacement Sheet 2 of 2

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				6 9 9 (18)		D-7	GS MC PI	ML, M.C.=23%, PI=NP SILT, stiff, gray, moist. Retained 1.0 ft.		
	7									
25				5 8 9 (17)		D-8		SILT, stiff, gray, moist. Retained 1.0 ft.		
	8									
								End of test hole boring at 26.5 ft. below ground elevation.		
								This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	9									
30										
	10									
35										
	11									
	12									
40										
	13									
45										

PIEZOMETER DATA

OL-1475
SR 20 GULCH CREEK BRIDGE

H1A-93 (DEPTH =44.0')

DATE	W.T. BGE	CHANGE	COMMENT
6/7/1993	4.05		
6/16/1993	3.8	0.25	
8/5/1993	3.6	0.2	
8/30/1993	3.75	-0.15	
12/6/1993	2.8	0.95	
4/20/1994	1.9	0.9	
8/29/1994	3.45	-1.55	
2/1/1995	1.8	1.65	
4/5/1995	2.8	-1	
5/17/1995	2.9	-0.1	
9/18/1995	3.9	-1	
4/15/1996	2.45	1.45	
8/19/1996	3.45	-1	
1/29/1997	2.5	0.95	
1/21/1998	2.1	0.4	
4/21/1998	2.4	-0.3	
8/23/2001	3.4	-1	
10/28/2001	3.1	0.3	
11/23/2001	2.3	0.8	
12/22/2001	2.1	0.2	

H2A-93 (DEPTH = 40.3')

DATE	W.T. BGE	CHANGE	COMMENT
6/7/1993	24.75		
6/16/1993	24.5	0.25	
8/5/1993	24.3	0.2	
8/30/1993	24.3	0	
12/6/1993	23.4	0.9	
4/20/1994	22.95	0.45	
8/29/1994	24.15	-1.2	
2/1/1995	22.8	1.35	
4/5/1995	23.15	-0.35	
5/17/1995	23.45	-0.3	
9/18/1995	24.3	-0.85	
4/15/1996	22.9	1.4	
8/19/1996	23.75	-0.85	
1/29/1997	22.7	1.05	
1/21/1998	22.55	0.15	
4/21/1998	22.8	-0.25	
8/23/2001	23.8	-1	
10/28/2001	23.9	-0.1	
11/23/2001	23.3	0.6	
12/22/2001	23.2	0.1	

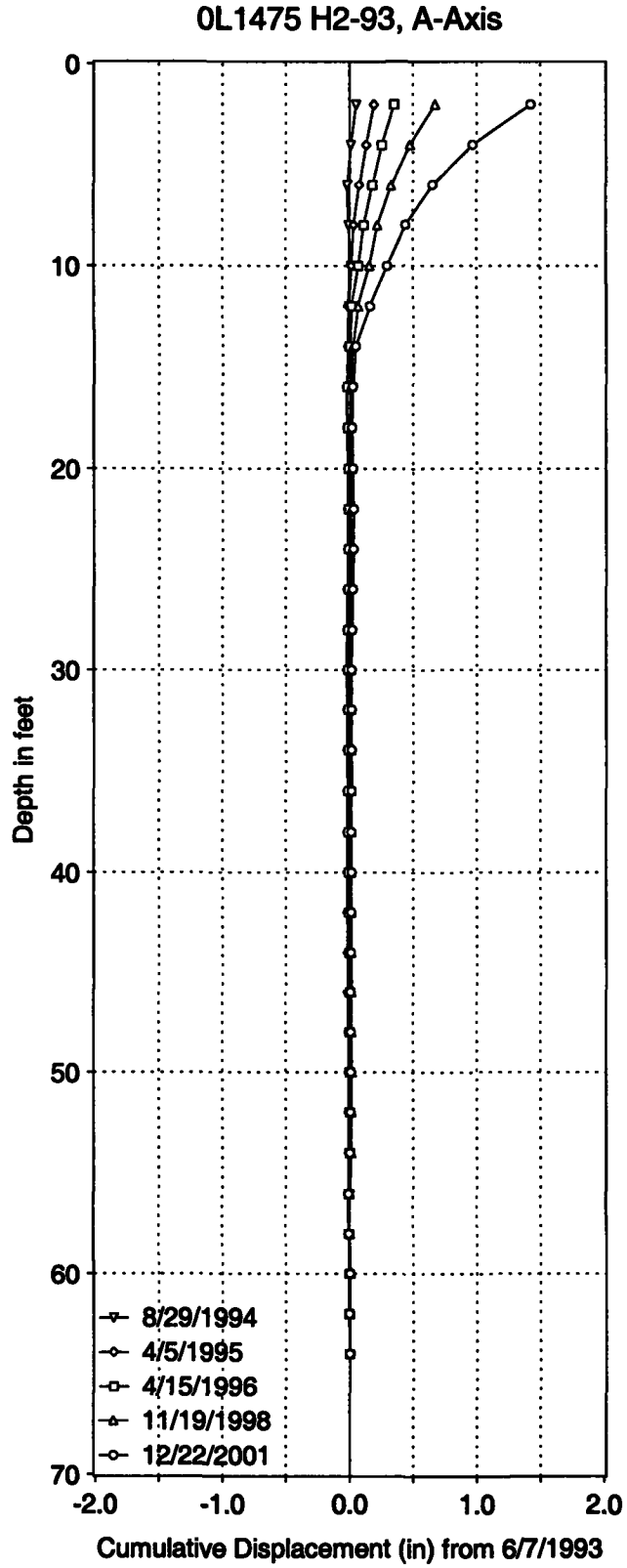
H1-01 (DEPTH = 40.2')

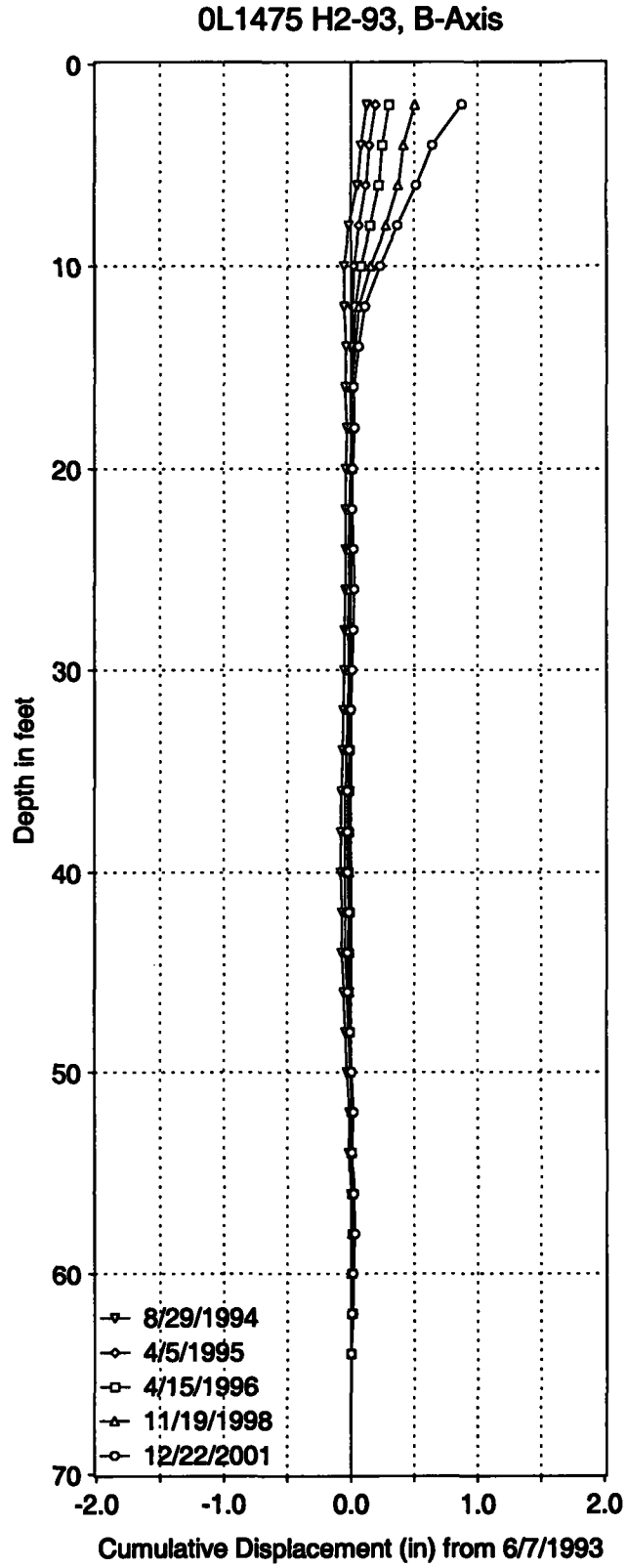
DATE	W.T. BGE	CHANGE	COMMENT
8/23/2001	15.3		
10/28/2001	14.2	1.1	
11/23/2001	13.4	0.8	
12/22/2001	13.8	-0.4	

H2-01 (DEPTH = 44.5')

DATE	W.T. BGE	CHANGE	COMMENT
10/28/2001	31.2		
11/23/2001	28.5	2.7	
12/22/2001	28.3	0.2	

SLOPE INCLINOMETER DATA





WSDOT Materials Lab Geotech Section Olympia, WA	OL-1475 SR 20 Gulch Cr. Bridge H-2-93 A+ = N156 deg.

SITE : 0L1475
INSTALLATION : H2-93
DESCRIPTION : GULCH CREEK BRIDGE

CURRENT SURVEY : 12/22/2001 10:58:00 AM
Probe Serial No : 1

INITIAL SURVEY : 6/7/1993 11:40:00 AM
Probe Serial No : 1

DATE PRINTED : 12/23/2001 5:42:28 AM

Data Reduction in Digi units for A Axis:

Depth (ft)	Initial A0	Initial A180	Initial Incr. Dev. (Diff)	Current A0	Current A180	Current Incr. Dev. (Diff)	Incr. Disp. (Change)	Cum. Disp. (in)
2	465	-460	925	825	-861	1686	761	1.4436
4	469	-463	932	709	-742	1451	519	0.9870
6	414	-410	824	574	-611	1185	361	0.6756
8	349	-343	692	447	-485	932	240	0.4590
10	298	-294	592	394	-430	824	232	0.3150
12	263	-260	523	335	-376	711	188	0.1758
14	239	-231	470	233	-271	504	34	0.0630
16	233	-226	459	218	-253	471	12	0.0426
18	248	-244	492	223	-259	482	-10	0.0354
20	285	-278	563	260	-297	557	-6	0.0414
22	403	-400	803	384	-421	805	2	0.0450
24	366	-360	726	349	-385	734	8	0.0438
26	304	-299	603	287	-326	613	10	0.0390
28	265	-263	528	251	-287	538	10	0.0330
30	248	-243	491	230	-264	494	3	0.0270
32	260	-256	516	239	-276	515	-1	0.0252
34	308	-308	616	291	-324	615	-1	0.0258
36	297	-293	590	279	-314	593	3	0.0264
38	279	-274	553	261	-296	557	4	0.0246
40	254	-247	501	234	-271	505	4	0.0222
42	202	-197	399	185	-220	405	6	0.0198
44	204	-198	402	183	-220	403	1	0.0162
46	166	-162	328	143	-183	326	-2	0.0156
48	176	-173	349	156	-195	351	2	0.0168
50	146	-139	285	127	-163	290	5	0.0156
52	129	-123	252	114	-147	261	9	0.0126
54	85	-78	163	69	-108	177	14	0.0072
56	11	-5	16	-13	-26	13	-3	-0.0012
58	70	-66	136	46	-84	130	-6	0.0006
60	100	-98	198	86	-119	205	7	0.0042
62	55	-48	103	33	-70	103	0	0.0000
64	0	0	0	0	0	0	0	0.0000

SITE : 0L1475
INSTALLATION : H2-93
DESCRIPTION : GULCH CREEK BRIDGE

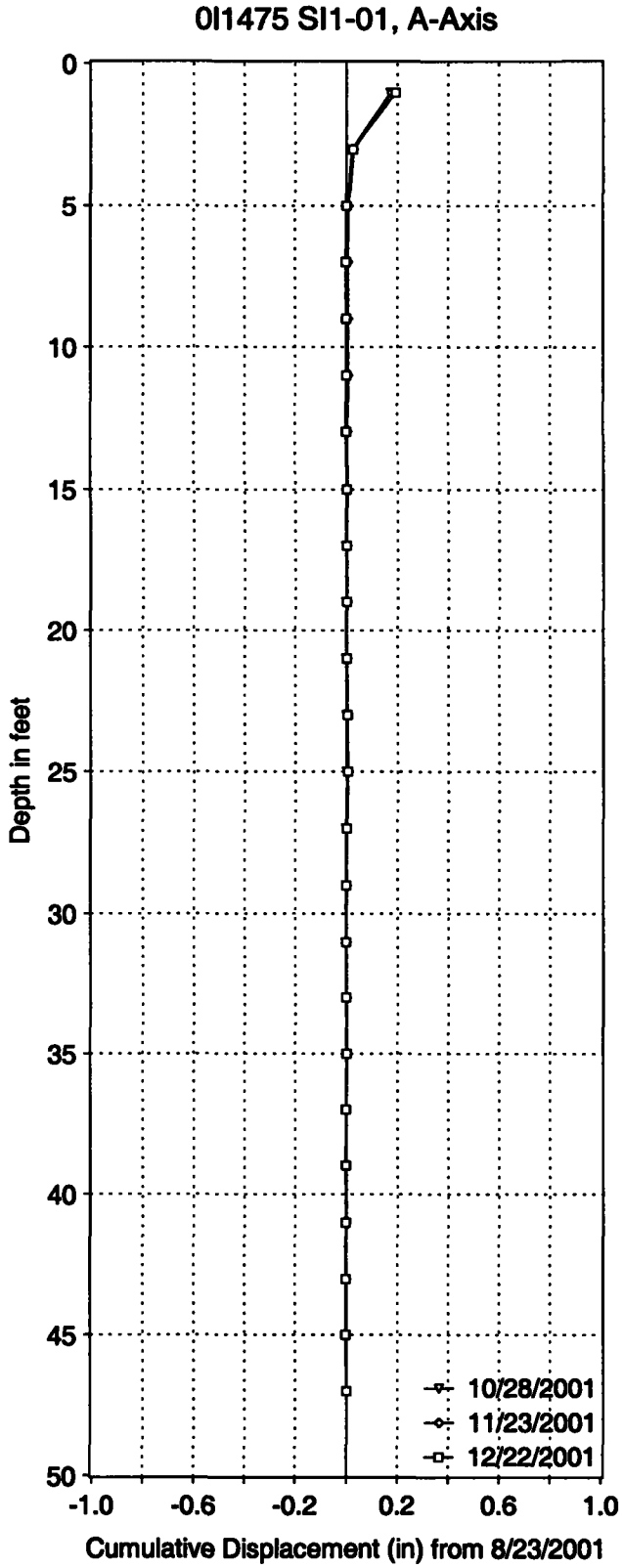
CURRENT SURVEY : 12/22/2001 10:58:00 AM
Probe Serial No : 1

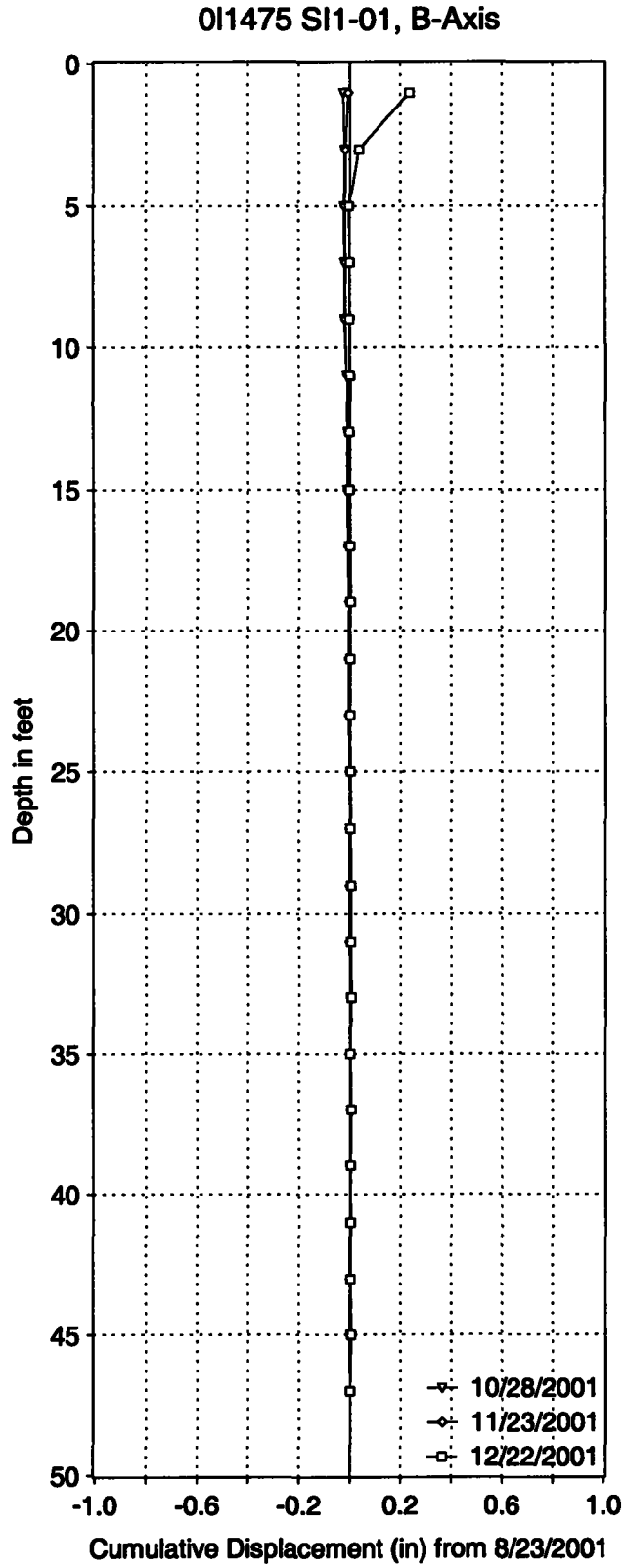
INITIAL SURVEY : 6/7/1993 11:40:00 AM
Probe Serial No : 1

DATE PRINTED : 12/23/2001 5:42:28 AM

Data Reduction in Digi units for B Axis:

Depth (ft)	Initial B0	Initial B180	Initial Incr. Dev. (Diff)	Current B0	Current B180	Current Incr. Dev. (Diff)	Incr. Disp. (Change)	Cum. Disp. (in)
2	-433	381	-814	-210	214	-424	390	0.8952
4	-441	405	-846	-314	323	-637	209	0.6612
6	-430	402	-832	-278	308	-586	246	0.5358
8	-414	366	-780	-260	281	-541	239	0.3882
10	-405	370	-775	-283	293	-576	199	0.2448
12	-466	421	-887	-397	407	-804	83	0.1254
14	-490	447	-937	-429	445	-874	63	0.0756
16	-463	417	-880	-431	458	-889	-9	0.0378
18	-481	443	-924	-446	449	-895	29	0.0432
20	-399	353	-752	-362	381	-743	9	0.0258
22	-447	400	-847	-425	440	-865	-18	0.0204
24	-465	431	-896	-454	454	-908	-12	0.0312
26	-483	431	-914	-439	462	-901	13	0.0384
28	-480	430	-910	-439	455	-894	16	0.0306
30	-467	415	-882	-419	440	-859	23	0.0210
32	-454	411	-865	-414	426	-840	25	0.0072
34	-447	411	-858	-414	429	-843	15	-0.0078
36	-409	362	-771	-371	397	-768	3	-0.0168
38	-404	353	-757	-369	387	-756	1	-0.0186
40	-401	363	-764	-379	400	-779	-15	-0.0192
42	-423	380	-803	-386	397	-783	20	-0.0102
44	-422	370	-792	-395	405	-800	-8	-0.0222
46	-446	405	-851	-434	443	-877	-26	-0.0174
48	-490	458	-948	-477	492	-969	-21	-0.0018
50	-534	505	-1039	-519	544	-1063	-24	0.0108
52	-561	515	-1076	-517	537	-1054	22	0.0252
54	-552	511	-1063	-542	543	-1085	-22	0.0120
56	-630	593	-1223	-615	623	-1238	-15	0.0252
58	-695	646	-1341	-649	662	-1311	30	0.0342
60	-694	647	-1341	-654	670	-1324	17	0.0162
62	-646	634	-1280	-635	635	-1270	10	0.0060
64	0	0	0	0	0	0	0	0.0000





WSDOT Materials Lab Geotech Section Olympia, WA	OL-1475 SR 20 Gulch Cr. Bridge H1-01 A+ = N254 deg.

SITE : 0I1475
INSTALLATION : SI1-01
DESCRIPTION : SR 20 GULCH CR. BRIDGE

CURRENT SURVEY : 12/22/2001 9:46:44 AM
Probe Serial No :

INITIAL SURVEY : 8/23/2001 10:22:42 AM
Probe Serial No :

DATE PRINTED : 12/23/2001 5:42:59 AM

Data Reduction in Digi units for A Axis:

Depth (ft)	Initial A0	Initial A180	Initial Incr. Dev. (Diff)	Current A0	Current A180	Current Incr. Dev. (Diff)	Incr. Disp. (Change)	Cum. Disp. (in)
2	62	-141	203	218	-266	484	281	0.1932
4	161	-195	356	179	-215	394	38	0.0246
6	142	-173	315	142	-179	321	6	0.0018
8	110	-139	249	106	-141	247	-2	-0.0018
10	158	-191	349	155	-193	348	-1	-0.0006
12	207	-239	446	205	-239	444	-2	0.0000
14	200	-231	431	199	-233	432	1	0.0012
16	143	-175	318	141	-176	317	-1	0.0006
18	90	-119	209	89	-121	210	1	0.0012
20	87	-118	205	83	-119	202	-3	0.0006
22	115	-146	261	111	-147	258	-3	0.0024
24	128	-159	287	124	-161	285	-2	0.0042
26	116	-150	266	118	-154	272	6	0.0054
28	150	-181	331	150	-184	334	3	0.0018
30	130	-162	292	129	-166	295	3	0.0000
32	150	-182	332	148	-184	332	0	-0.0018
34	182	-215	397	177	-214	391	-6	-0.0018
36	246	-278	524	246	-284	530	6	0.0018
38	181	-215	396	180	-217	397	1	-0.0018
40	123	-157	280	122	-159	281	1	-0.0024
42	70	-104	174	67	-105	172	-2	-0.0030
44	93	-126	219	93	-129	222	3	-0.0018
46	-57	27	-84	-63	27	-90	-6	-0.0036
48	0	0	0	0	0	0	0	0.0000

SITE : 0I1475
INSTALLATION : SI1-01
DESCRIPTION : SR 20 GULCH CR. BRIDGE

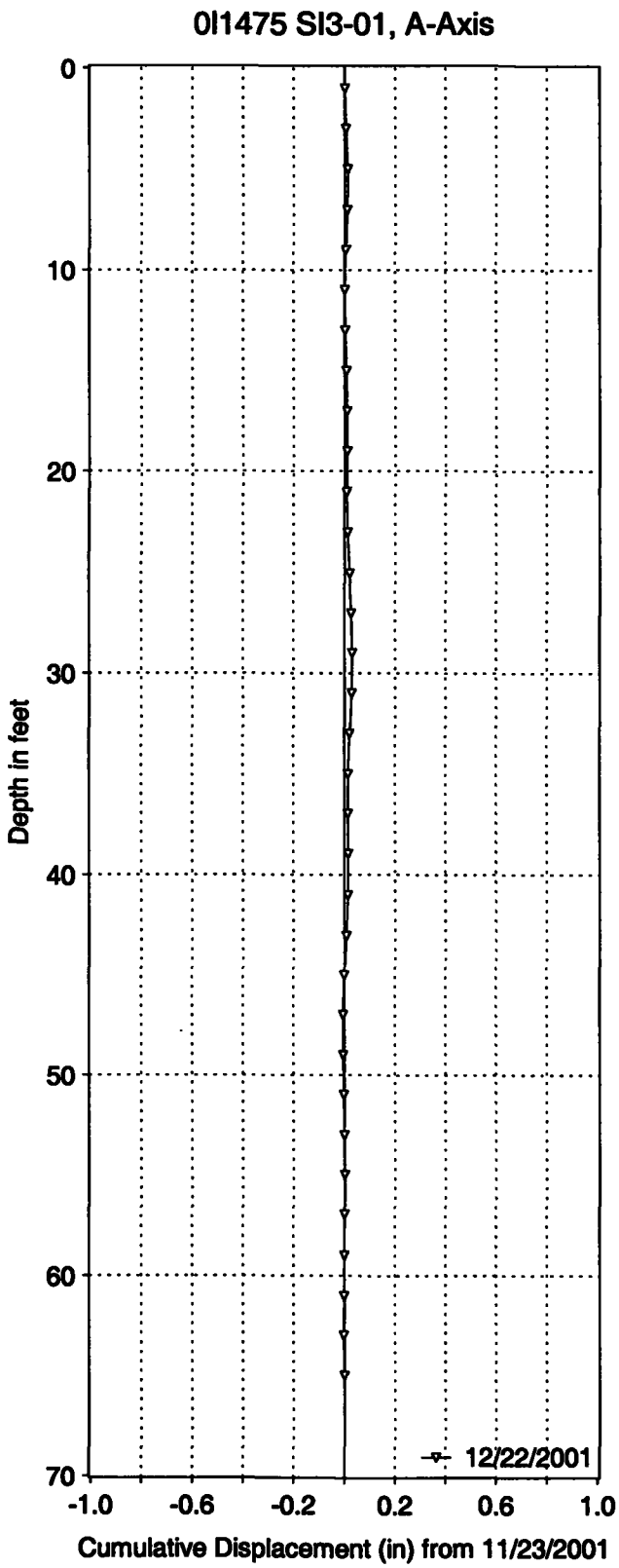
CURRENT SURVEY : 12/22/2001 9:46:44 AM
Probe Serial No :

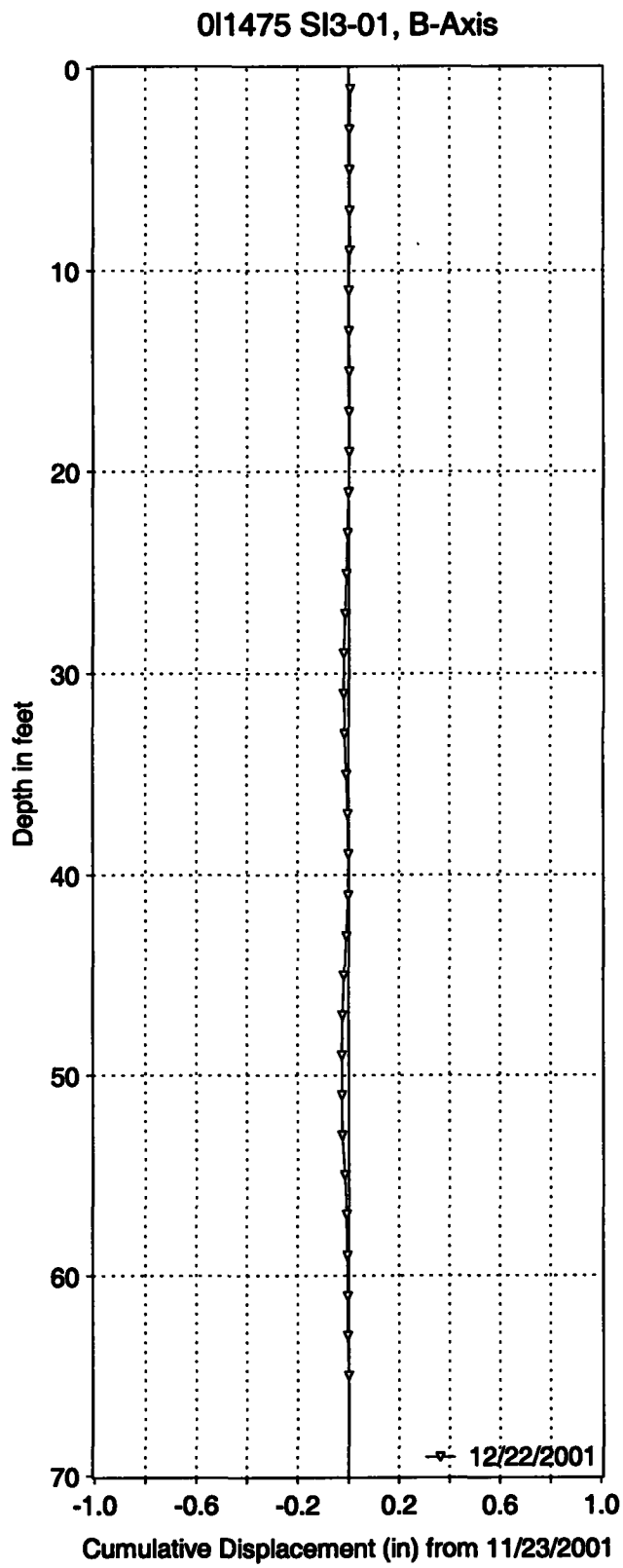
INITIAL SURVEY : 8/23/2001 10:22:42 AM
Probe Serial No :

DATE PRINTED : 12/23/2001 5:42:59 AM

Data Reduction in Digi units for B Axis:

Depth (ft)	Initial B0	Initial B180	Initial Incr. Dev. (Diff)	Current B0	Current B180	Current Incr. Dev. (Diff)	Incr. Disp. (Change)	Cum. Disp. (in)
2	-869	882	-1751	-730	686	-1416	335	0.2766
4	-676	679	-1355	-650	639	-1289	66	0.0756
6	-601	601	-1202	-604	599	-1203	-1	0.0360
8	-518	535	-1053	-522	525	-1047	6	0.0366
10	-510	525	-1035	-511	523	-1034	1	0.0330
12	-500	512	-1012	-499	507	-1006	6	0.0324
14	-465	477	-942	-465	473	-938	4	0.0288
16	-407	417	-824	-409	417	-826	-2	0.0264
18	-366	385	-751	-368	383	-751	0	0.0276
20	-365	384	-749	-366	379	-745	4	0.0276
22	-374	390	-764	-375	385	-760	4	0.0252
24	-375	390	-765	-377	386	-763	2	0.0228
26	-399	402	-801	-398	403	-801	0	0.0216
28	-415	415	-830	-414	417	-831	-1	0.0216
30	-366	363	-729	-361	362	-723	6	0.0222
32	-350	357	-707	-353	353	-706	1	0.0186
34	-378	377	-755	-377	370	-747	8	0.0180
36	-410	410	-820	-411	414	-825	-5	0.0132
38	-347	349	-696	-344	342	-686	10	0.0162
40	-369	369	-738	-369	365	-734	4	0.0102
42	-391	393	-784	-393	390	-783	1	0.0078
44	-385	381	-766	-385	381	-766	0	0.0072
46	-315	309	-624	-311	301	-612	12	0.0072
48	0	0	0	0	0	0	0	0.0000





WSDOT **Materials Lab** **Geotech Section** **Olympia, WA**	OL-1475 SR 20 Gulch Cr. Bridge H3-01 A+ = N202 deg.

SITE : 0I1475
INSTALLATION : SI3-01
DESCRIPTION : SR 20 GULCH CR. BRIDGE

CURRENT SURVEY : 12/22/2001 10:07:09 AM
Probe Serial No : .

INITIAL SURVEY : 11/23/2001 10:47:53 AM
Probe Serial No :

DATE PRINTED : 12/23/2001 5:44:29 AM

Data Reduction in Digi units for A Axis:

Depth (ft)	Initial A0	Initial A180	Initial Incr. Dev. (Diff)	Current A0	Current A180	Current Incr. Dev. (Diff)	Incr. Disp. (Change)	Cum. Disp. (in)
2	127	-158	285	122	-156	278	-7	-0.0360
4	-62	28	-90	-70	35	-105	-15	-0.0318
6	-124	85	-209	-121	86	-207	2	-0.0228
8	-71	31	-102	-66	29	-95	7	-0.0240
10	-34	-5	-29	-31	-5	-26	3	-0.0282
12	18	-57	75	17	-54	71	-4	-0.0300
14	62	-102	164	59	-96	155	-9	-0.0276
16	65	-105	170	64	-100	164	-6	-0.0222
18	49	-85	134	49	-83	132	-2	-0.0186
20	59	-95	154	59	-94	153	-1	-0.0174
22	54	-94	148	52	-89	141	-7	-0.0168
24	33	-71	104	26	-63	89	-15	-0.0126
26	-14	-27	13	-19	-18	-1	-14	-0.0036
28	-38	-1	-37	-41	5	-46	-9	0.0048
30	-29	-12	-17	-25	-11	-14	3	0.0102
32	-27	-15	-12	-20	-18	-2	10	0.0084
34	-74	33	-107	-67	31	-98	9	0.0024
36	-128	89	-217	-127	91	-218	-1	-0.0030
38	-85	46	-131	-86	48	-134	-3	-0.0024
40	-55	17	-72	-54	18	-72	0	-0.0006
42	-42	2	-44	-37	0	-37	7	-0.0006
44	-13	-29	16	-5	-32	27	11	-0.0048
46	38	-79	117	43	-81	124	7	-0.0114
48	14	-53	67	14	-51	65	-2	-0.0156
50	-23	-16	-7	-26	-12	-14	-7	-0.0144
52	-73	31	-104	-74	36	-110	-6	-0.0102
54	-87	46	-133	-88	50	-138	-5	-0.0066
56	-115	77	-192	-115	79	-194	-2	-0.0036
58	-87	50	-137	-87	49	-136	1	-0.0024
60	-3	-34	31	-3	-34	31	0	-0.0030
62	43	-81	124	43	-81	124	0	-0.0030
64	75	-114	189	74	-110	184	-5	-0.0030
66	0	0	0	0	0	0	0	0.0000

SITE : 0I1475
INSTALLATION : SI3-01
DESCRIPTION : SR 20 GULCH CR. BRIDGE

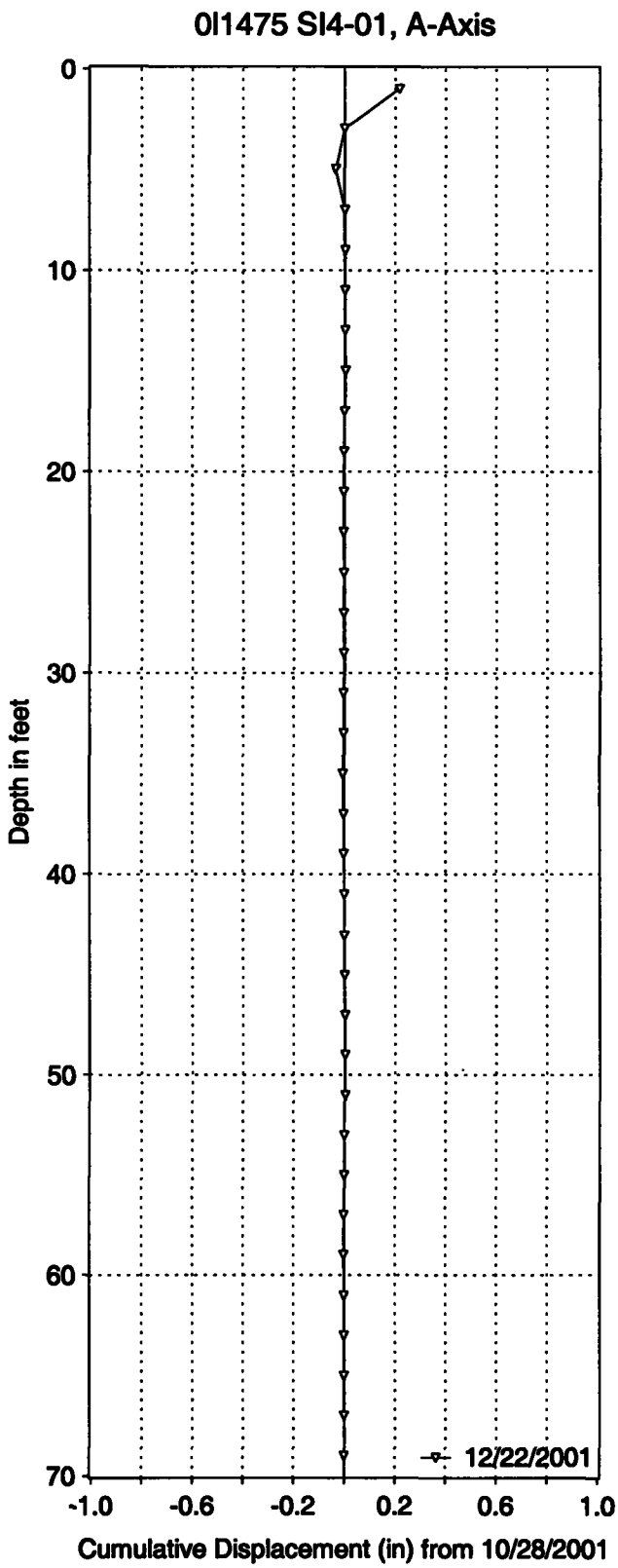
CURRENT SURVEY : 12/22/2001 10:07:09 AM
Probe Serial No :

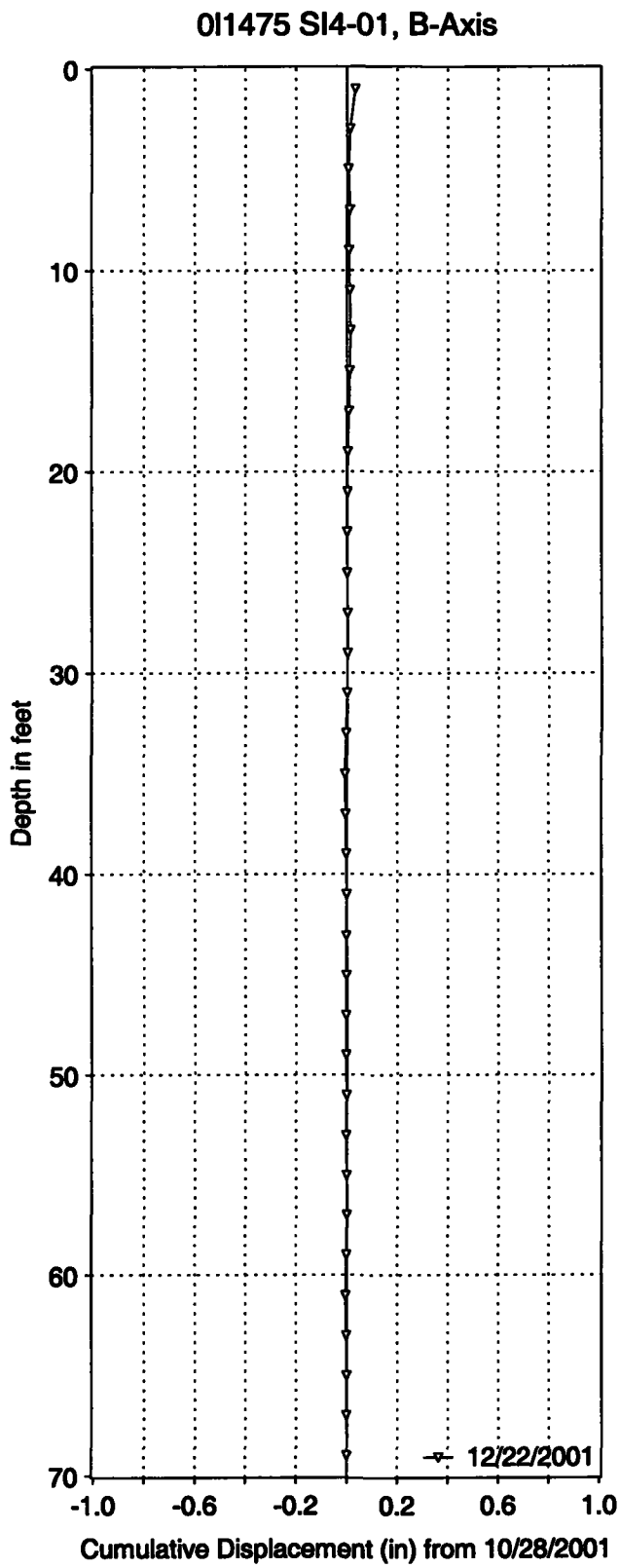
INITIAL SURVEY : 11/23/2001 10:47:53 AM
Probe Serial No :

DATE PRINTED : 12/23/2001 5:44:29 AM

Data Reduction in Digi units for B Axis:

Depth (ft)	Initial B0	Initial B180	Initial Incr. Dev. (Diff)	Current B0	Current B180	Current Incr. Dev. (Diff)	Incr. Disp. (Change)	Cum. Disp. (in)
2	384	-381	765	387	-384	771	6	0.0072
4	321	-319	640	323	-317	640	0	0.0036
6	300	-291	591	302	-290	592	1	0.0036
8	261	-255	516	259	-255	514	-2	0.0030
10	235	-229	464	238	-229	467	3	0.0042
12	218	-210	428	219	-210	429	1	0.0024
14	209	-209	418	211	-205	416	-2	0.0018
16	242	-241	483	246	-238	484	1	0.0030
18	277	-275	552	278	-275	553	1	0.0024
20	307	-302	609	307	-303	610	1	0.0018
22	334	-329	663	336	-334	670	7	0.0012
24	315	-322	637	319	-326	645	8	-0.0030
26	306	-304	610	314	-307	621	11	-0.0078
28	302	-301	603	307	-306	613	10	-0.0144
30	305	-304	609	307	-299	606	-3	-0.0204
32	328	-329	657	324	-325	649	-8	-0.0186
34	336	-341	677	332	-336	668	-9	-0.0138
36	286	-284	570	281	-281	562	-8	-0.0084
38	241	-241	482	238	-240	478	-4	-0.0036
40	169	-172	341	171	-172	343	2	-0.0012
42	103	-106	209	111	-109	220	11	-0.0024
44	116	-119	235	123	-126	249	14	-0.0090
46	185	-181	366	191	-185	376	10	-0.0174
48	200	-197	397	201	-201	402	5	-0.0234
50	205	-201	406	205	-201	406	0	-0.0264
52	223	-220	443	222	-218	440	-3	-0.0264
54	234	-237	471	225	-230	455	-16	-0.0246
56	231	-228	459	223	-222	445	-14	-0.0150
58	219	-218	437	216	-218	434	-3	-0.0066
60	279	-273	552	276	-274	550	-2	-0.0048
62	314	-309	623	311	-312	623	0	-0.0036
64	321	-325	646	317	-323	640	-6	-0.0036
66	0	0	0	0	0	0	0	0.0000





WSDOT **Materials Lab** **Geotech Section** **Olympia, WA**	OL-1475 SR 20 Gulch Cr. Bridge H4-01 A+ = N180 deg.

SITE : 0I1475
INSTALLATION : SI4-01
DESCRIPTION : SR 20 GULCH CR. BRIDGE

CURRENT SURVEY : 12/22/2001 10:31:48 AM
Probe Serial No :

INITIAL SURVEY : 10/28/2001 10:31:34 AM
Probe Serial No :

DATE PRINTED : 12/23/2001 6:04:25 AM

Data Reduction in Digi units for A Axis:

Depth (ft)	Initial A0	Initial A180	Initial Incr. Dev. (Diff)	Current A0	Current A180	Current Incr. Dev. (Diff)	Incr. Disp. (Change)	Cum. Disp. (in)
2	546	-579	1125	728	-759	1487	362	0.2478
4	177	-214	391	208	-243	451	60	0.0306
6	1	-38	39	-28	-7	-21	-60	-0.0054
8	27	-64	91	27	-63	90	-1	0.0306
10	24	-61	85	26	-63	89	4	0.0312
12	85	-122	207	86	-121	207	0	0.0288
14	81	-118	199	82	-118	200	1	0.0288
16	41	-78	119	45	-79	124	5	0.0282
18	42	-79	121	45	-81	126	5	0.0252
20	75	-114	189	78	-115	193	4	0.0222
22	101	-138	239	103	-139	242	3	0.0198
24	122	-158	280	122	-158	280	0	0.0180
26	125	-163	288	127	-164	291	3	0.0180
28	137	-173	310	138	-174	312	2	0.0162
30	111	-149	260	113	-148	261	1	0.0150
32	116	-153	269	118	-153	271	2	0.0144
34	49	-87	136	51	-88	139	3	0.0132
36	17	-53	70	17	-52	69	-1	0.0114
38	64	-102	166	65	-101	166	0	0.0120
40	81	-121	202	81	-119	200	-2	0.0120
42	81	-116	197	82	-117	199	2	0.0132
44	73	-110	183	73	-108	181	-2	0.0120
46	-1	-36	35	1	-34	35	0	0.0132
48	-109	71	-180	-106	73	-179	1	0.0132
50	-206	170	-376	-204	169	-373	3	0.0126
52	-301	265	-566	-299	262	-561	5	0.0108
54	-336	299	-635	-334	298	-632	3	0.0078
56	-277	239	-516	-275	239	-514	2	0.0060
58	-290	251	-541	-287	251	-538	3	0.0048
60	-323	287	-610	-322	288	-610	0	0.0030
62	-350	313	-663	-348	313	-661	2	0.0030
64	-387	348	-735	-385	349	-734	1	0.0018
66	-409	371	-780	-407	371	-778	2	0.0012
68	-394	355	-749	-394	355	-749	0	0.0000
70	0	0	0	0	0	0	0	0.0000

SITE : 0I1475
INSTALLATION : SI4-01
DESCRIPTION : SR 20 GULCH CR. BRIDGE

CURRENT SURVEY : 12/22/2001 10:31:48 AM
Probe Serial No :

INITIAL SURVEY : 10/28/2001 10:31:34 AM
Probe Serial No :

DATE PRINTED : 12/23/2001 6:04:25 AM

Data Reduction in Digi units for B Axis:

Depth (ft)	Initial B0	Initial B180	Initial Incr. Dev. (Diff)	Current B0	Current B180	Current Incr. Dev. (Diff)	Incr. Disp. (Change)	Cum. Disp. (in)
2	-346	344	-690	-328	323	-651	39	0.1158
4	-442	446	-888	-433	438	-871	17	0.0924
6	-478	481	-959	-482	483	-965	-6	0.0822
8	-501	497	-998	-497	493	-990	8	0.0858
10	-539	540	-1079	-539	540	-1079	0	0.0810
12	-526	526	-1052	-525	527	-1052	0	0.0810
14	-537	533	-1070	-530	530	-1060	10	0.0810
16	-562	562	-1124	-557	559	-1116	8	0.0750
18	-544	542	-1086	-539	537	-1076	10	0.0702
20	-523	523	-1046	-520	521	-1041	5	0.0642
22	-567	567	-1134	-563	563	-1126	8	0.0612
24	-623	624	-1247	-622	621	-1243	4	0.0564
26	-574	578	-1152	-572	577	-1149	3	0.0540
28	-426	428	-854	-424	427	-851	3	0.0522
30	-382	385	-767	-378	381	-759	8	0.0504
32	-394	396	-790	-390	391	-781	9	0.0456
34	-515	516	-1031	-513	509	-1022	9	0.0402
36	-567	569	-1136	-566	569	-1135	1	0.0348
38	-483	484	-967	-481	485	-966	1	0.0342
40	-499	499	-998	-497	499	-996	2	0.0336
42	-544	547	-1091	-543	543	-1086	5	0.0324
44	-538	541	-1079	-536	539	-1075	4	0.0294
46	-489	488	-977	-484	486	-970	7	0.0270
48	-421	423	-844	-417	423	-840	4	0.0228
50	-360	362	-722	-357	363	-720	2	0.0204
52	-409	401	-810	-406	400	-806	4	0.0192
54	-490	487	-977	-486	490	-976	1	0.0168
56	-527	525	-1052	-524	523	-1047	5	0.0162
58	-666	667	-1333	-664	665	-1329	4	0.0132
60	-679	684	-1363	-675	679	-1354	9	0.0108
62	-612	622	-1234	-610	623	-1233	1	0.0054
64	-618	622	-1240	-617	621	-1238	2	0.0048
66	-659	659	-1318	-655	657	-1312	6	0.0036
68	-706	706	-1412	-706	706	-1412	0	0.0000
70	0	0	0	0	0	0	0	0.0000

APPENDIX C

LABORATORY TESTING

LABORATORY TESTING

Laboratory testing was performed on selected samples from the field exploration program. Testing included performing moisture content, grain size analyses and Atterberg Limits. The tests were done in general accordance with AASHTO T-88, T-89, and T-90 guide specifications, respectively. After the testing was complete, the samples were classified in general accordance with the Unified Soil Classification System (USCS).

Job No. **OL-1475** Date **October 17, 2001**

Hole No. **H-1-01** Sheet **1** of **2**

Project **Gulch Bridge Replacement**

Laboratory Summary

Washington State Department of Transportation

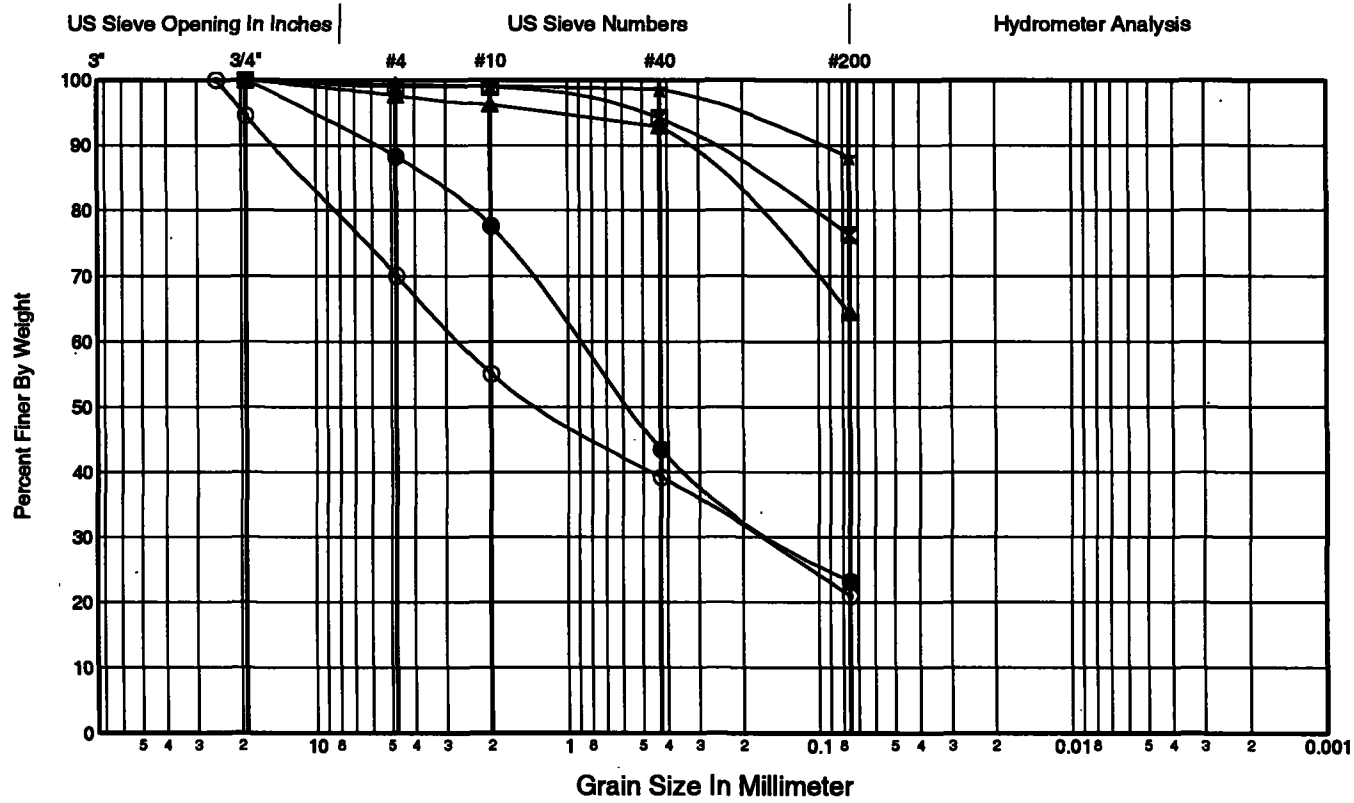
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	9.0	2.74	D-2	SM	See Boring Log	SILTY SAND	22	NP	NP	NP
⊠	14.0	4.27	D-3	CL	See Boring Log	LEAN CLAY with SAND	33	31	22	9
▲	34.0	10.36	D-7	ML	See Boring Log	SANDY SILT	18	NP	NP	NP
★	39.0	11.89	D-8	ML	See Boring Log	SILT	30	NP	NP	NP
⊙	40.0	12.19	D-9	SM	See Boring Log	SILTY SAND with GRAVEL	11	NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	11.7	65.1	23.2		
⊠	1.0	22.7	76.3		
▲	2.4	33.1	64.5		
★	0.6	11.2	88.2		
⊙	29.9	49.1	21.0		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.90	0.57	0.13		
⊠					
▲					
★					
⊙	2.65	1.22	0.18		



Job No. **OL-1475** Date **October 17, 2001**

Hole No. **H-1-01** Sheet **2** of **2**

Project **Gulch Bridge Replacement**

Laboratory Summary

Washington State Department of Transportation

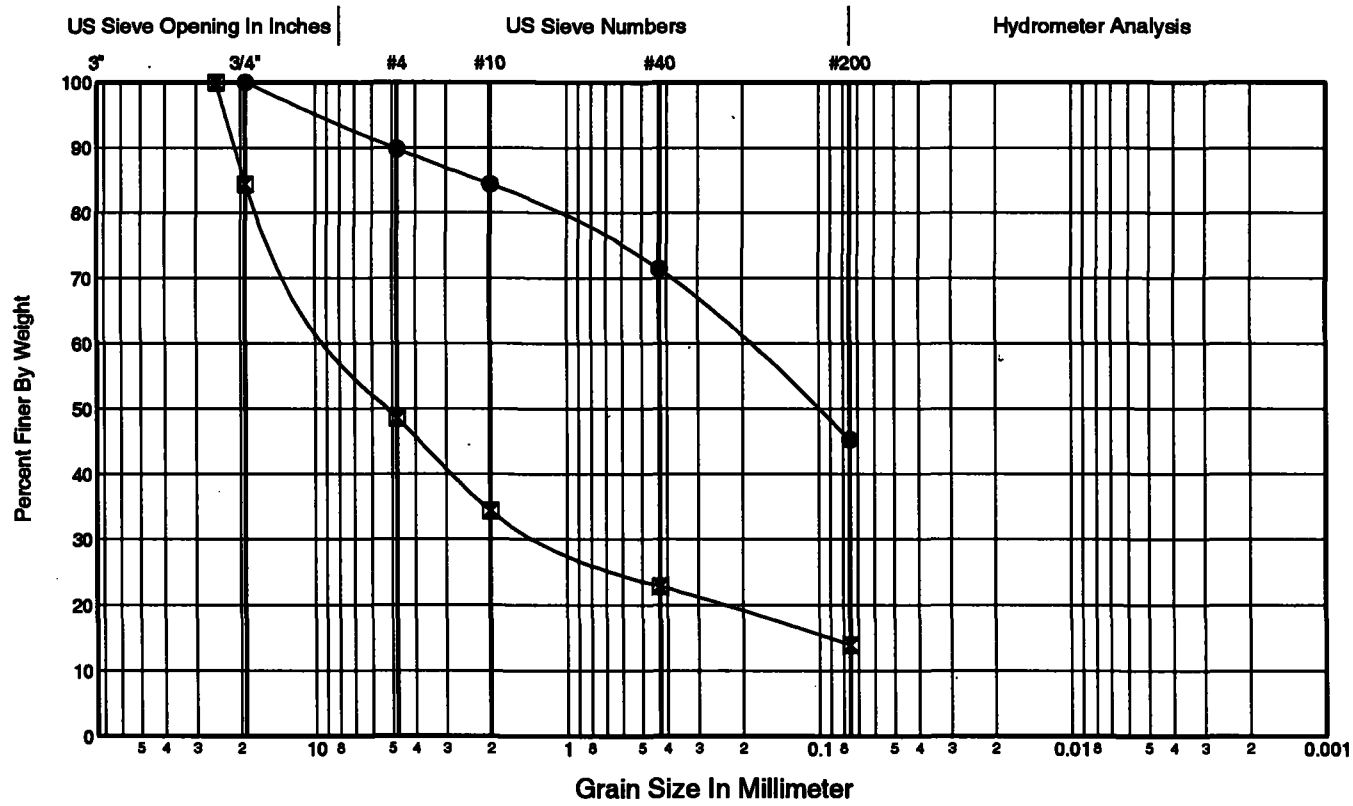
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	54.0	16.46	D-11	SM	See Boring Log	SILTY SAND	28	NP	NP	NP
⊠	59.0	17.98	D-12	GM	See Boring Log	SILTY GRAVEL with SAND	11	NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	10.2	44.5	45.3		
⊠	51.5	34.6	13.9		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.20	0.10			
⊠	7.40	5.03	1.12	0.24	



Job No. **OL-1475** Date **October 17, 2001**

Hole No. **SI-1-01** Sheet **1** of **1**

Project **Gulch Bridge Replacement**

Laboratory Summary

Washington State Department of Transportation

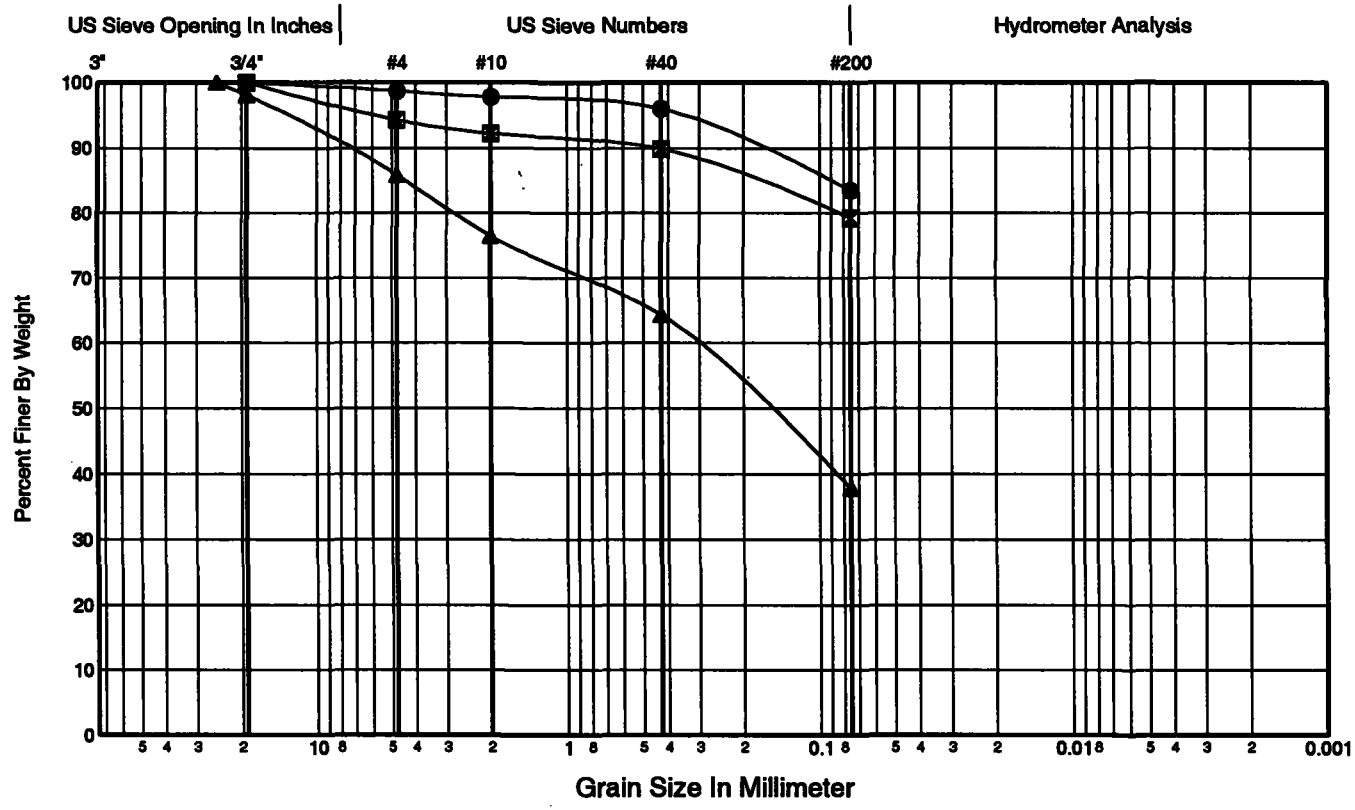
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	6.0	1.83	D-2	CL	See Boring Log	LEAN CLAY with SAND	26	39	25	14
⊠	21.0	6.40	D-8	CL	See Boring Log	LEAN CLAY with SAND	30	35	23	12
▲	40.0	12.19	D-12	SM	See Boring Log	SILTY SAND	14	NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	1.3	15.2	83.5		
⊠	5.7	15.0	79.3		
▲	14.2	48.0	37.8		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲	0.32	0.17			



Job No. **OL-1475** Date **October 30, 2001**

Hole No. **H-2-01** Sheet **1** of **1**

Project **Gulch Bridge Replacement**

Laboratory Summary

Washington State Department of Transportation

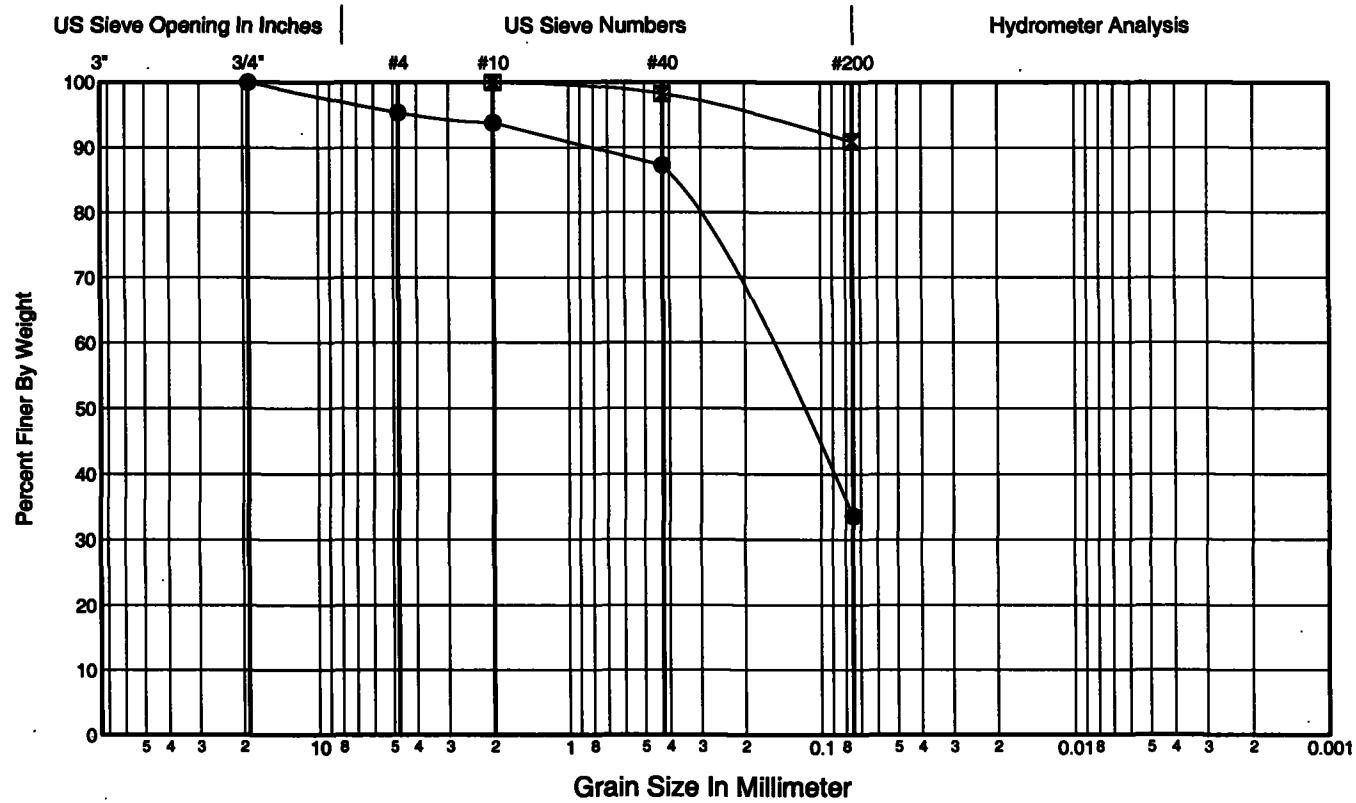
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	10.0	3.05	D-3	SM	See Boring Log	SILTY SAND	27	NP	NP	NP
⊠	40.3	12.28	D-12	ML	See Boring Log	SILT	31	NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	4.7	61.7	33.6		
⊠	0.0	9.1	90.9		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.18	0.13			
⊠					



Job No. **OL-1475** Date **October 31, 2001**

Hole No. **H-3-01** Sheet **1** of **1**

Project **Gulch Bridge Replacement**

Laboratory Summary

Washington State Department of Transportation

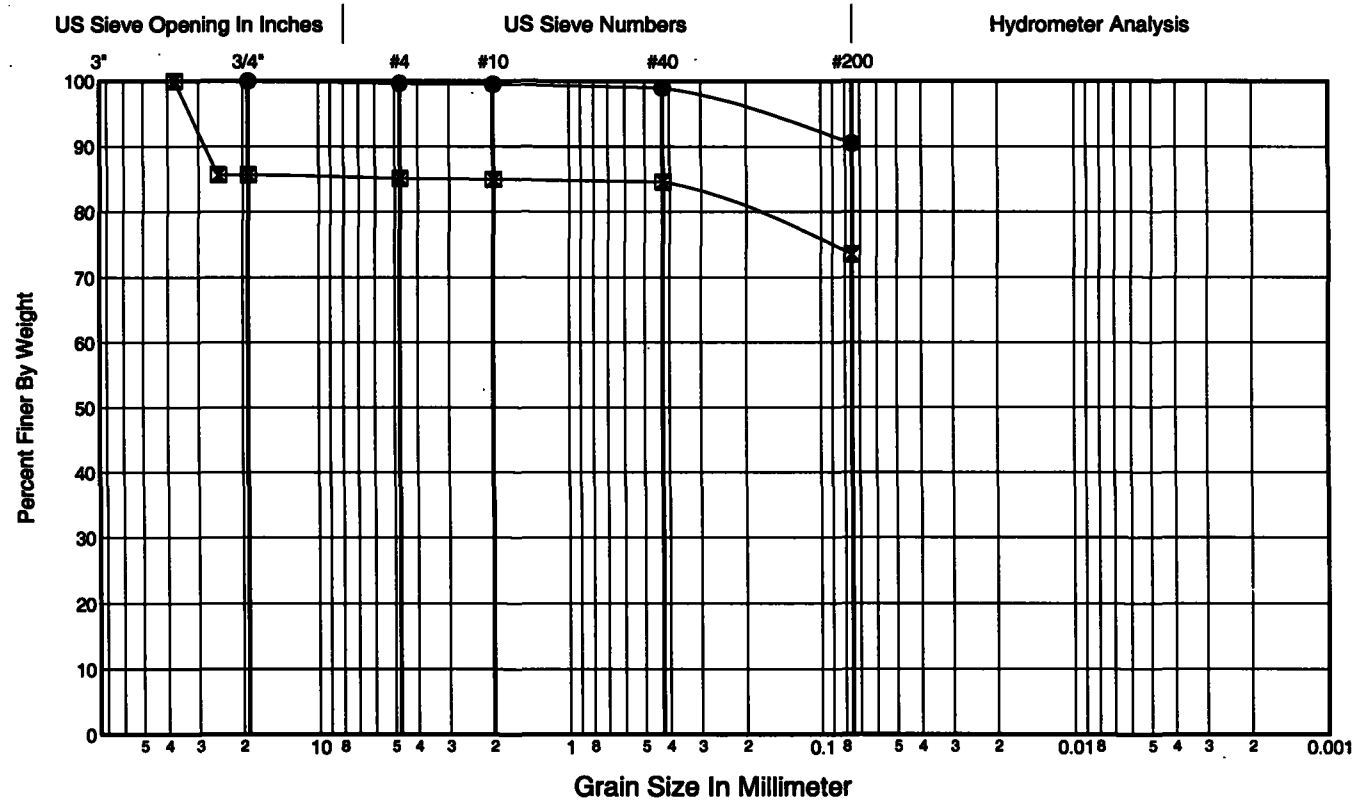
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	7.5	2.29	D-2	CL	See Boring Log	LEAN CLAY	26	32	22	10
⊠	22.5	6.86	D-8	CL	See Boring Log	LEAN CLAY with GRAVEL	18	29	21	8

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.3	9.2	90.5		
⊠	14.9	11.6	73.6		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					



Job No. **OL-1475** Date **January 14, 2002**

Hole No. **H-4-01** Sheet **1** of **1**

Project **Gulch Bridge Replacement**

Laboratory Summary

Washington State Department of Transportation

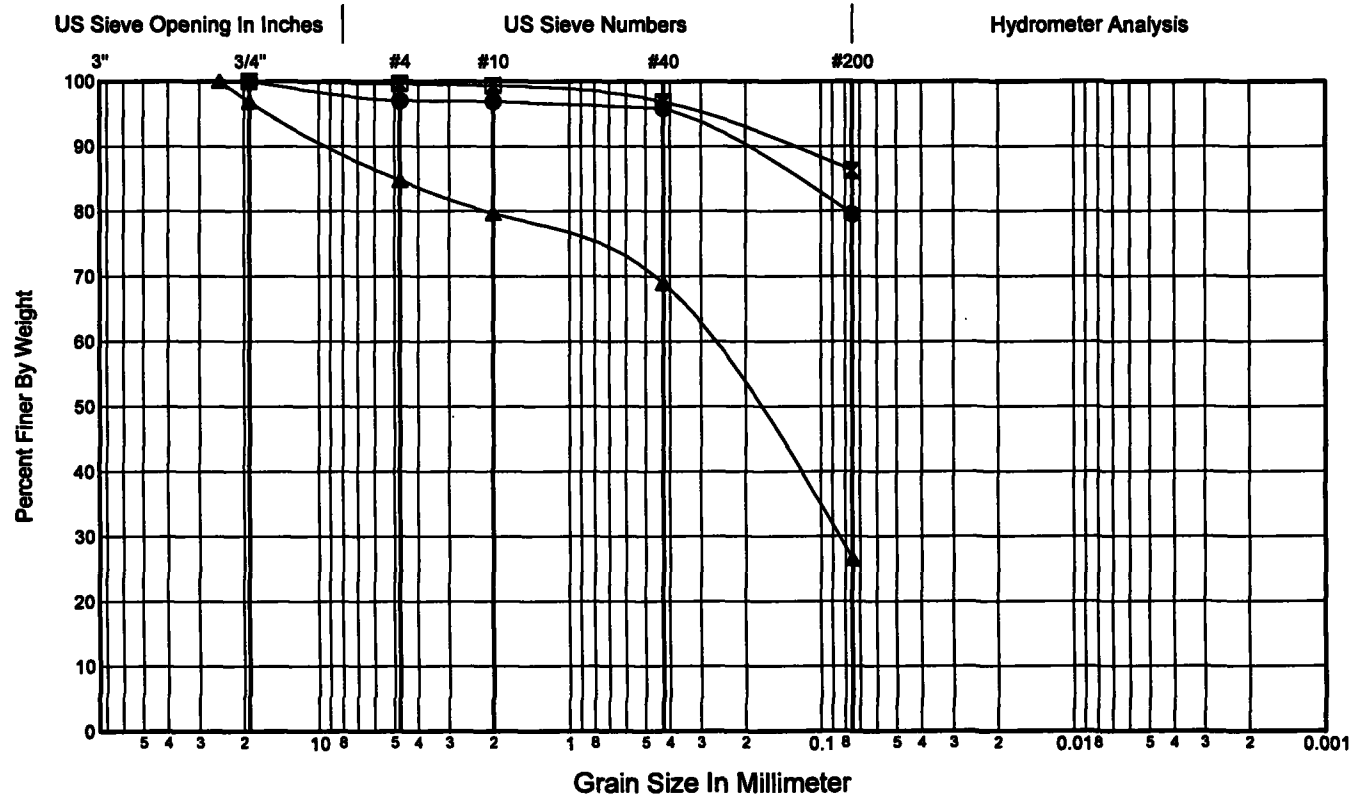
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	15.0	4.57	D-5	ML	See Boring Log	SILT with SAND	18	NP	NP	NP
⊠	25.0	7.62	D-10	CL	See Boring Log	LEAN CLAY	26	36	23	13
▲	42.5	12.95	D-18	SM	See Boring Log	SILTY SAND with GRAVEL	24	NP	NP	NP

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	3.0	17.4	79.5		
⊠	0.4	13.4	86.3		
▲	15.2	58.3	26.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲	0.29	0.20	0.09		



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **OL-1475** Date **November 8, 2001**

Hole No. **H-5-01** Sheet **1** of **1**

Project **Gulch Bridge Replacement**

Laboratory Summary

Washington State Department of Transportation

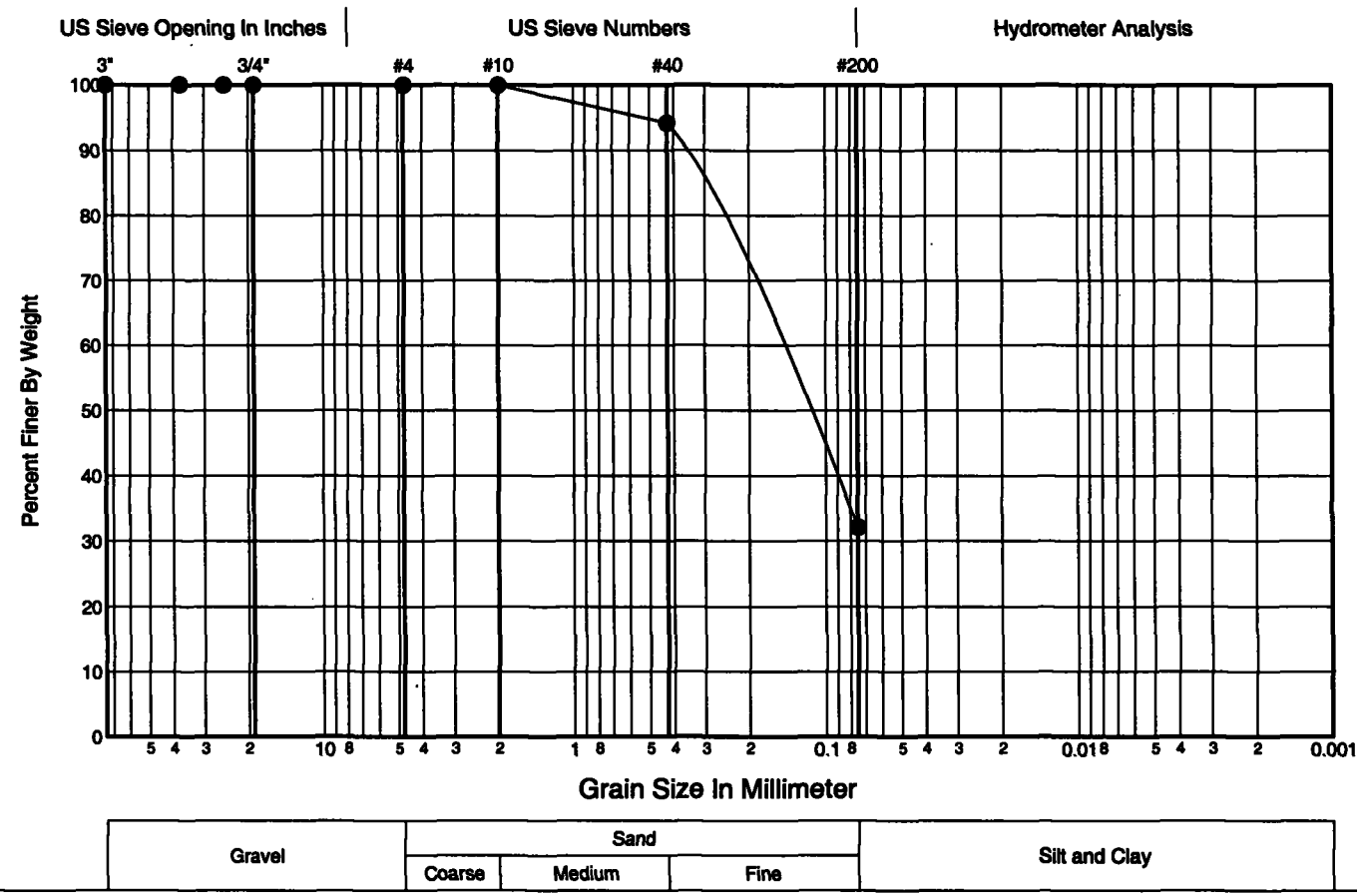
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	15.0	4.57	C-3	SC	See Boring Log	CLAYEY SAND	34	68	30	38

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	67.9	32.1		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.16	0.12			



Job No. **OL-1475** Date **November 6, 2001**

Hole No. **H-6-01** Sheet **1** of **1**

Project **Gulch Bridge Replacement**

Laboratory Summary

Washington State Department of Transportation

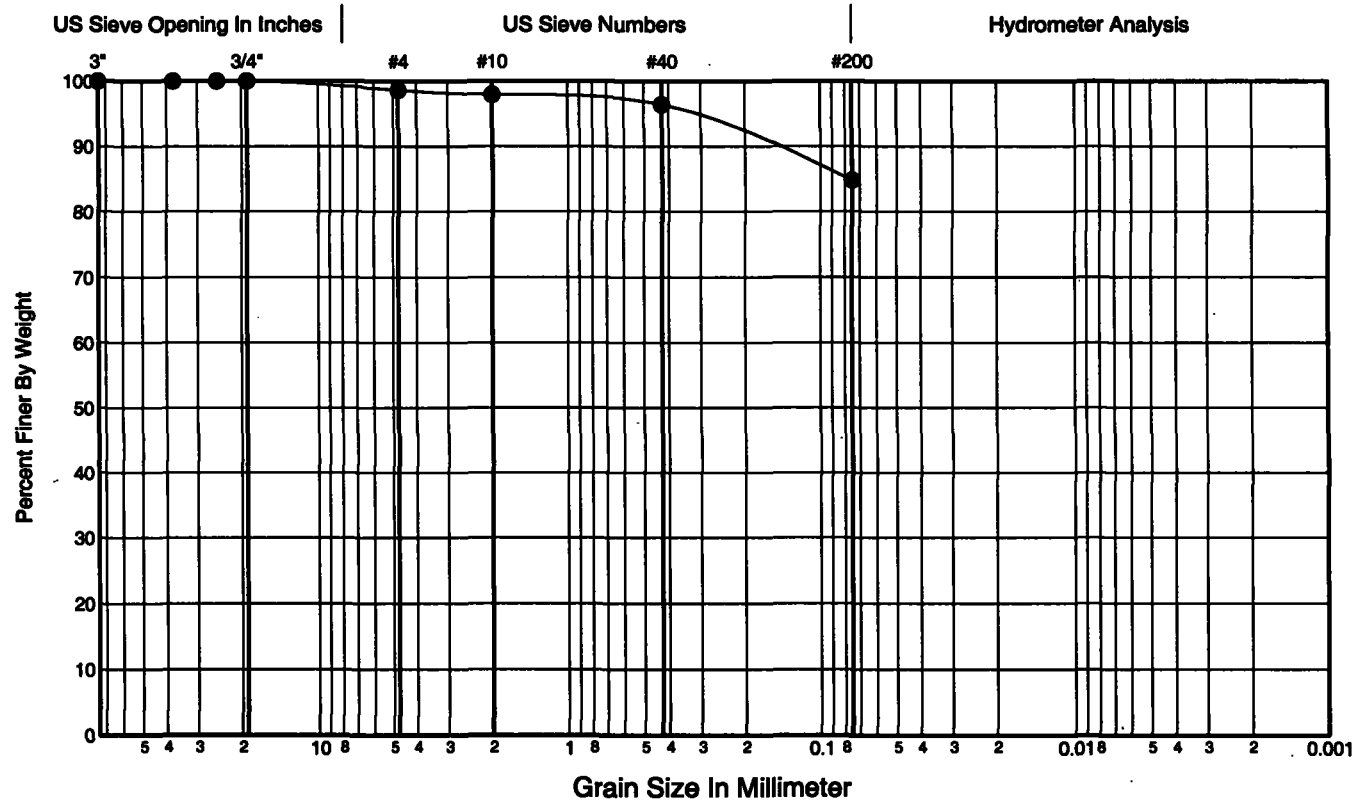
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	15.0	4.57	D-5	ML	See Boring Log	SILT with SAND	32	34	24	10

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	1.4	13.8	84.8		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					



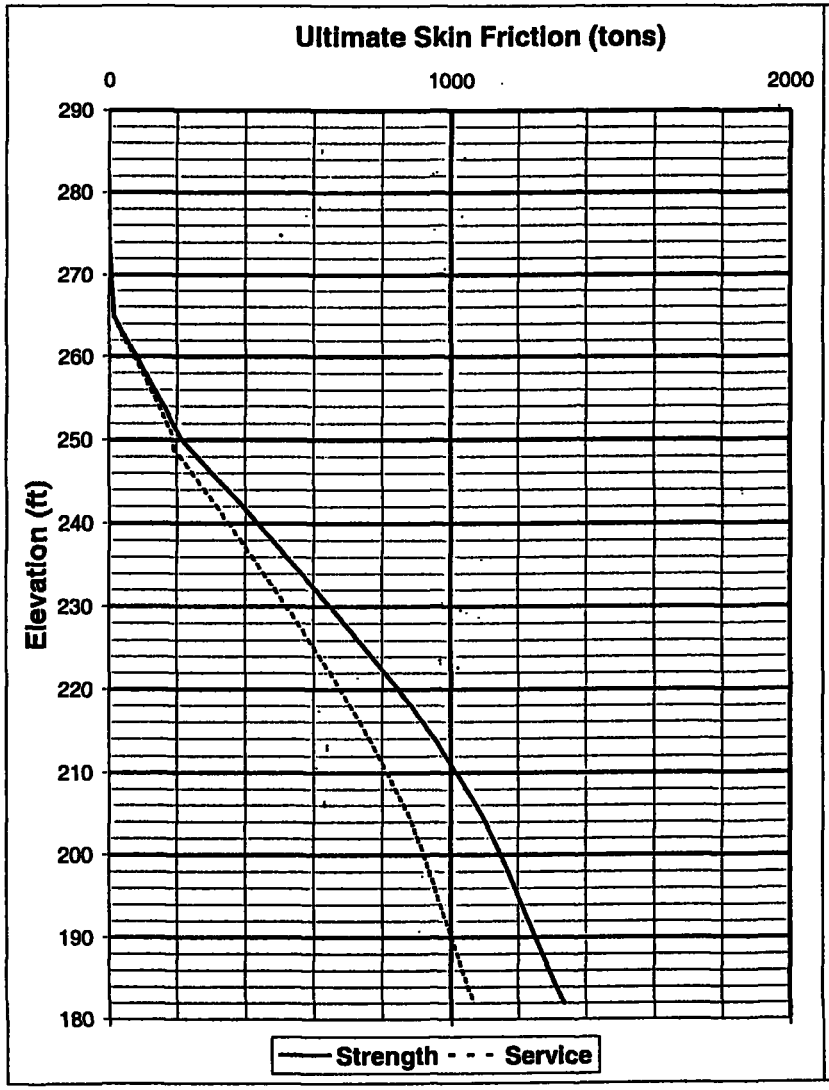
APPENDIX D

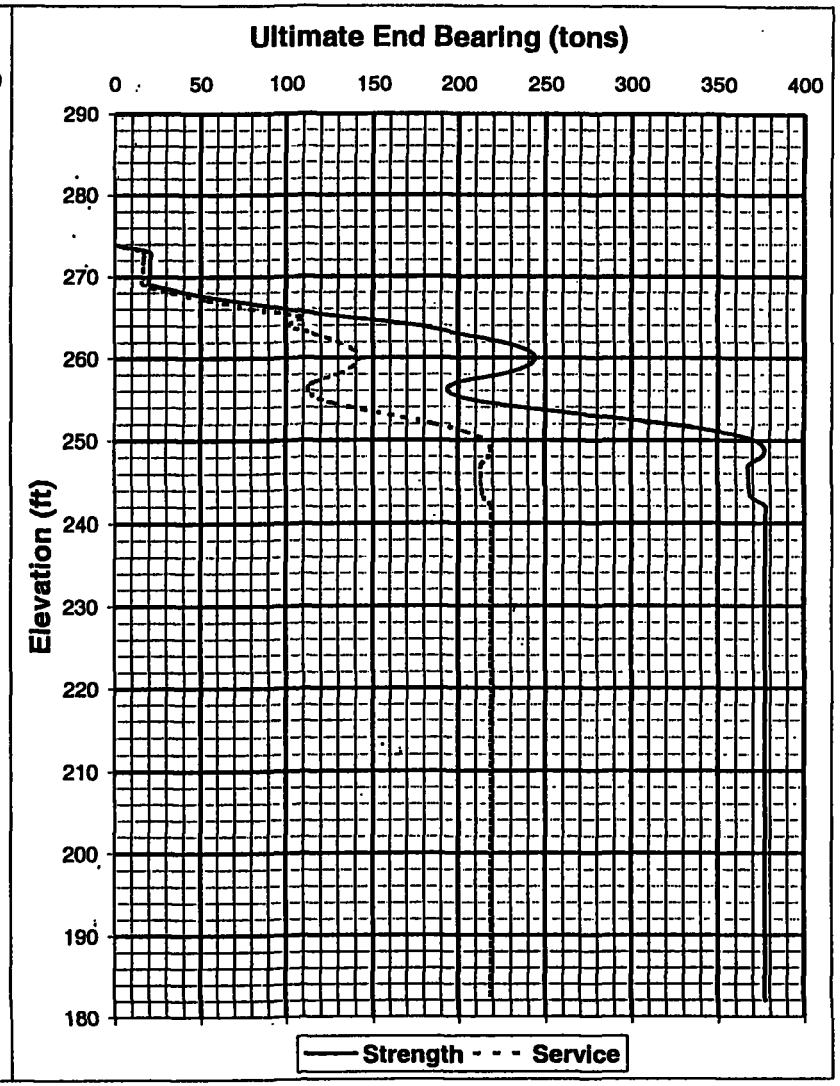
SHAFT CAPACITY CURVES AND P-Y INPUT PARAMETERS

SR20

Gulch Bridge 20/265 Replacement

Pier: 1
Shaft Diameter: 4 ft.

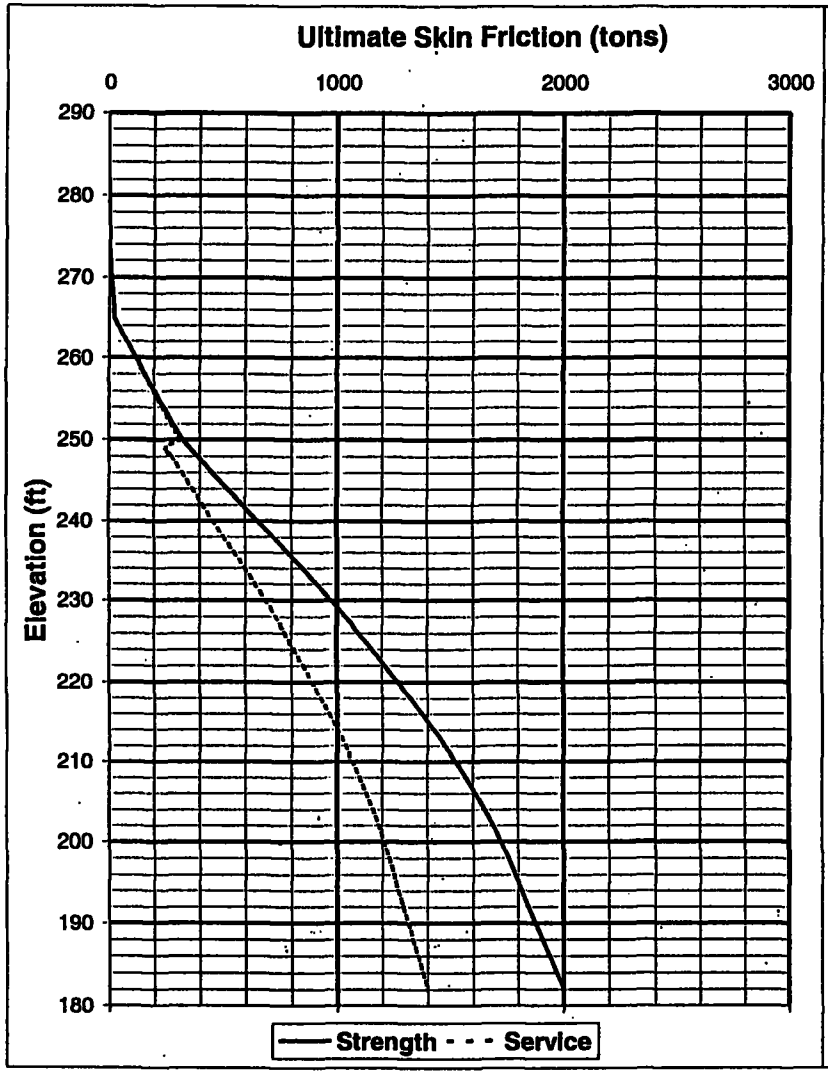


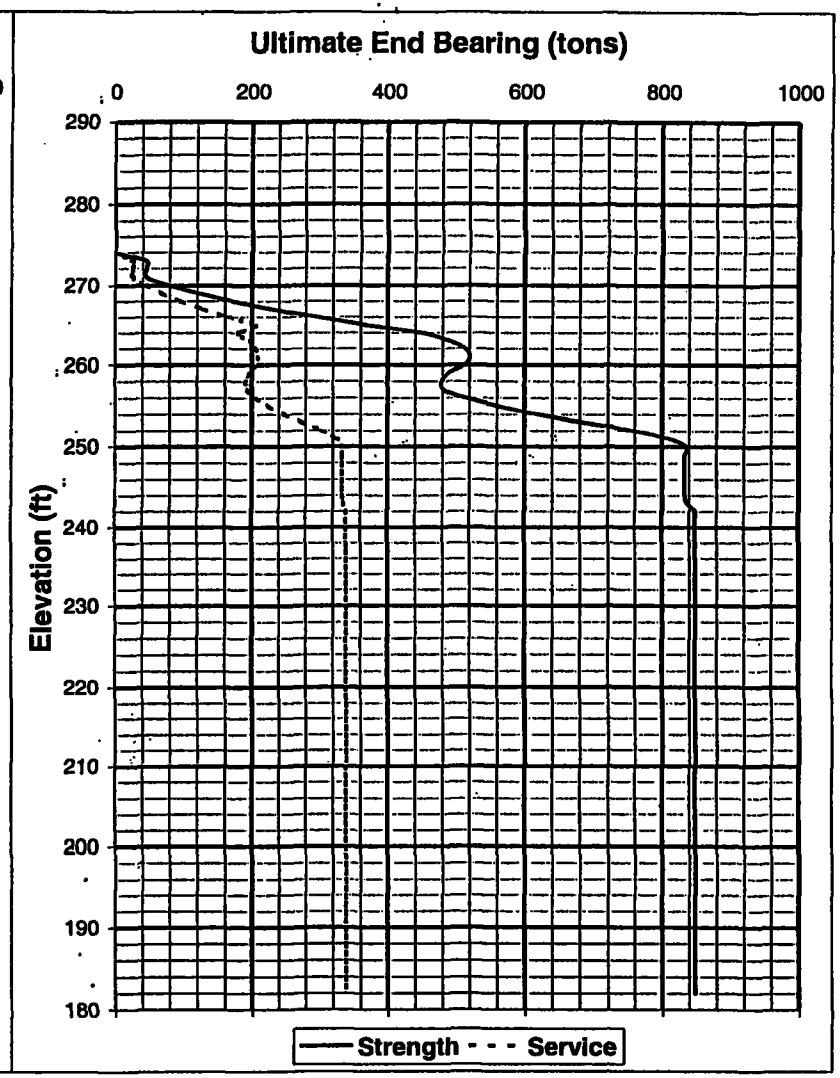


SR20

Gulch Bridge 20/265 Replacement

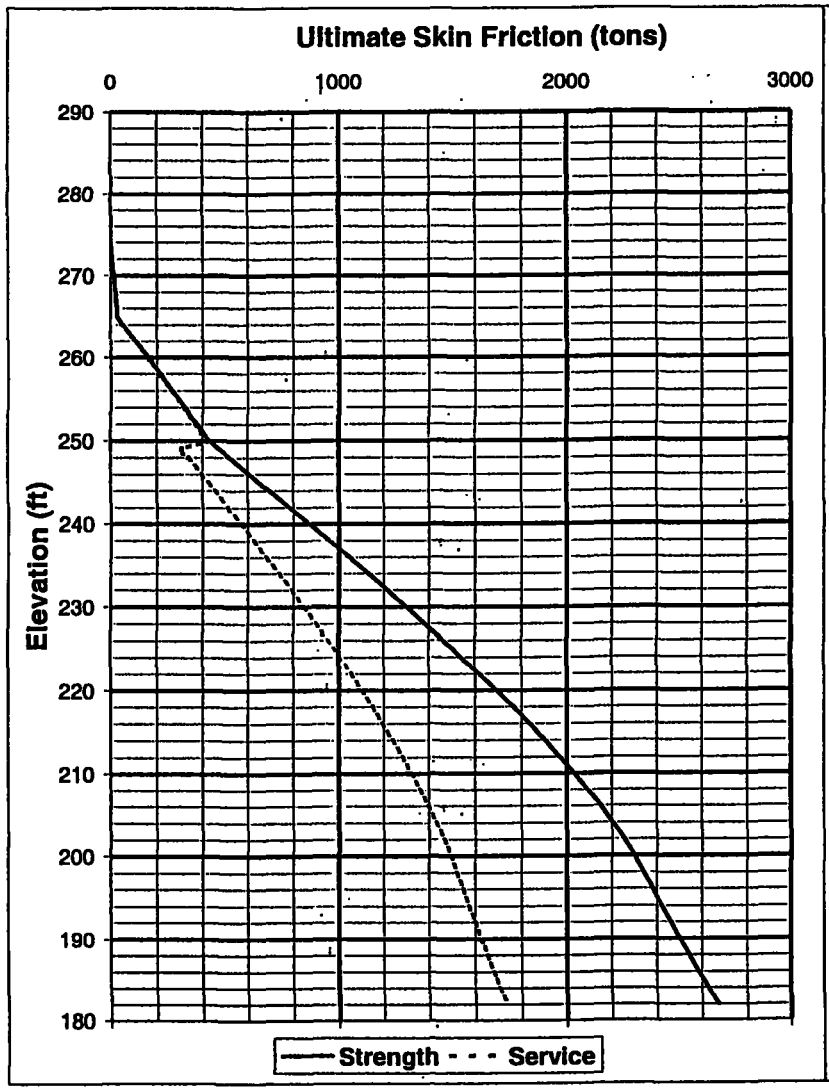
Pier: 1
Shaft Diameter: 6 ft.

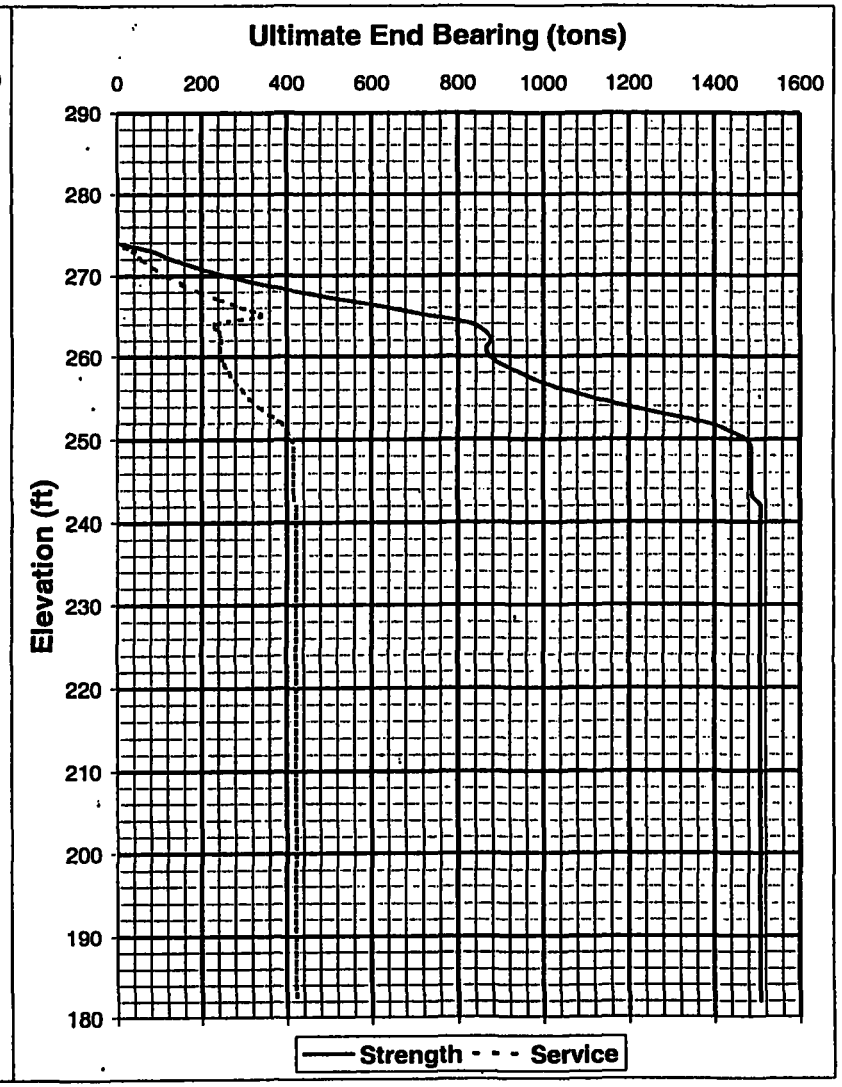




SR20
Gulch Bridge 20/265 Replacement

Pier: 1
Shaft Diameter: 8 ft.

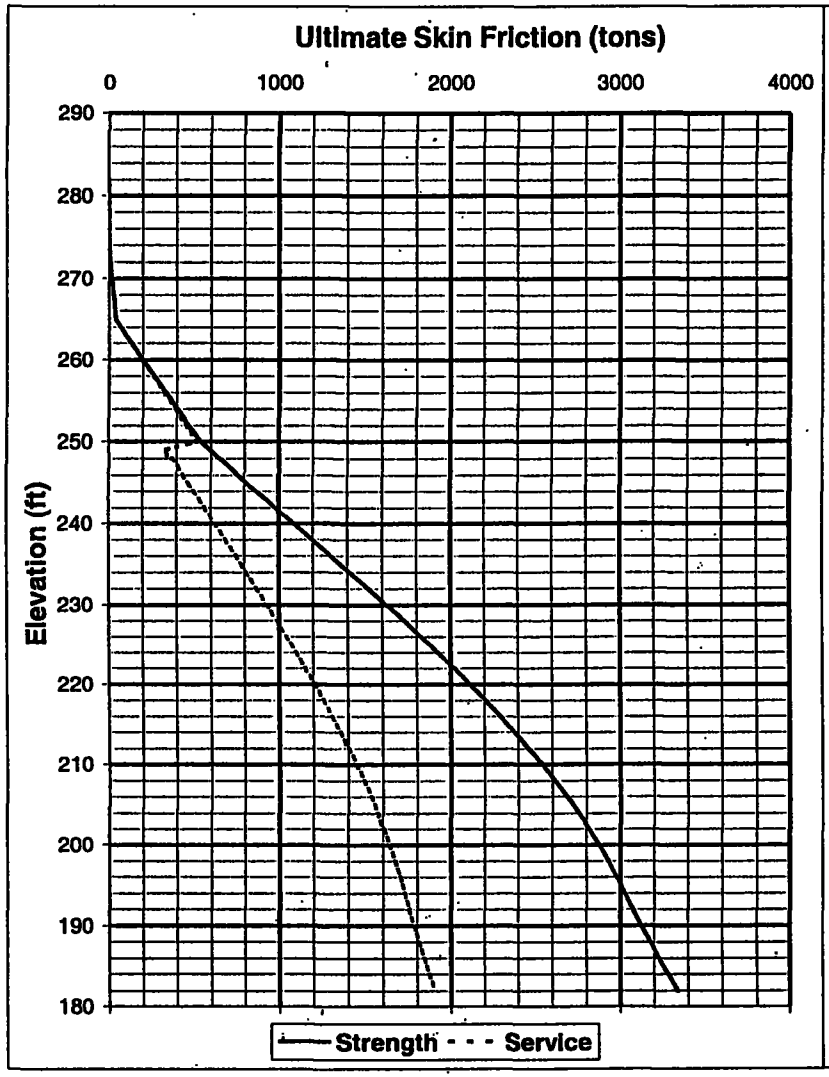


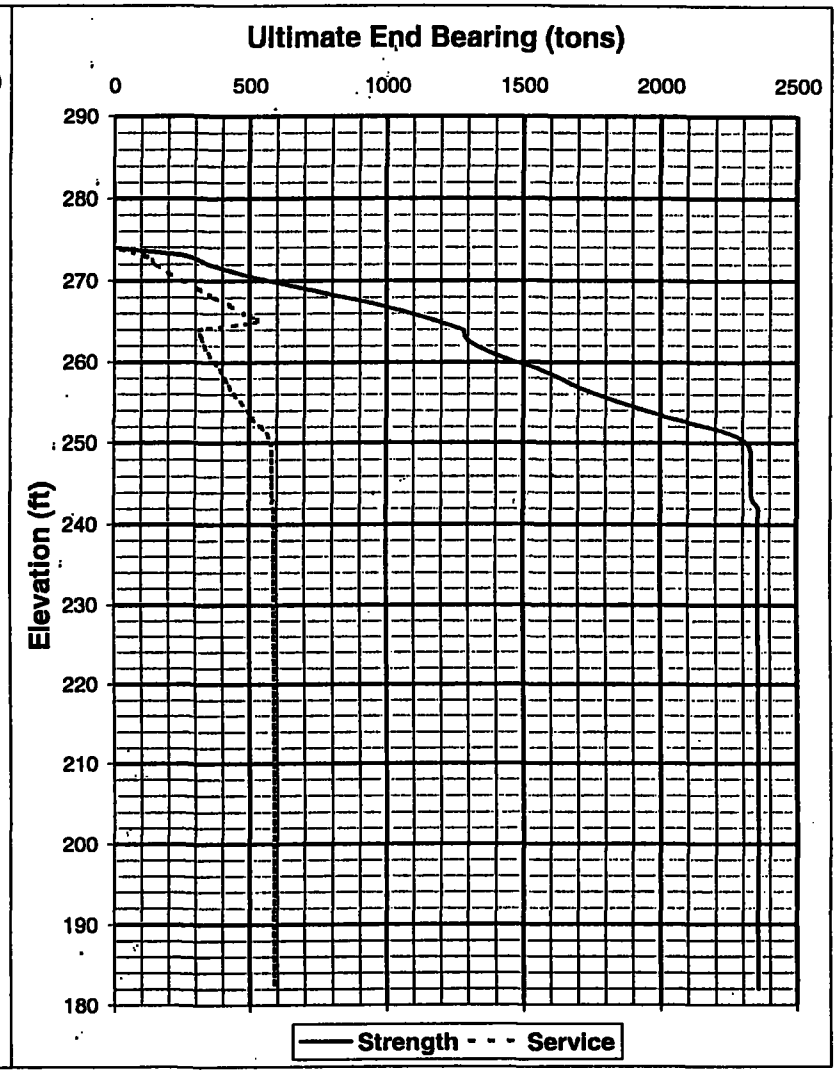


SR20

Gulch Bridge 20/265 Replacement

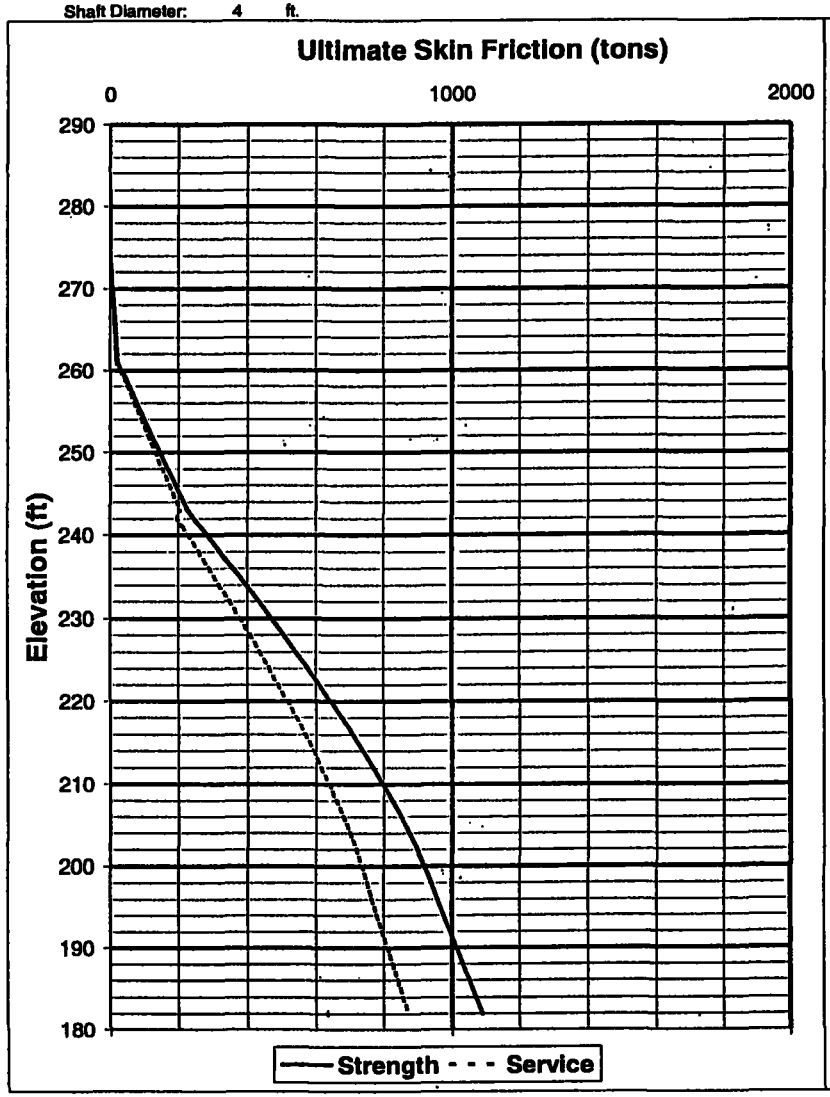
Pier: 1
Shaft Diameter: 10 ft.

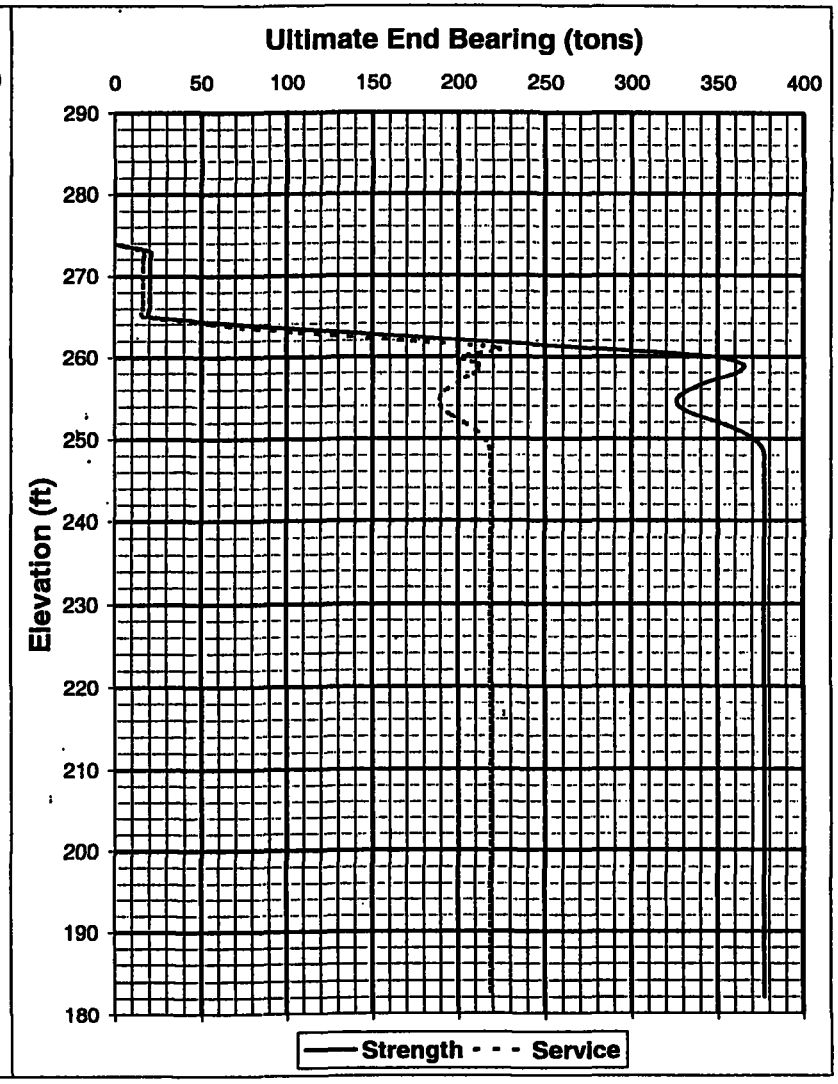




SR20
Gulch Bridge 20/265 Replacement

Pier: 2
Shaft Diameter: 4 ft.

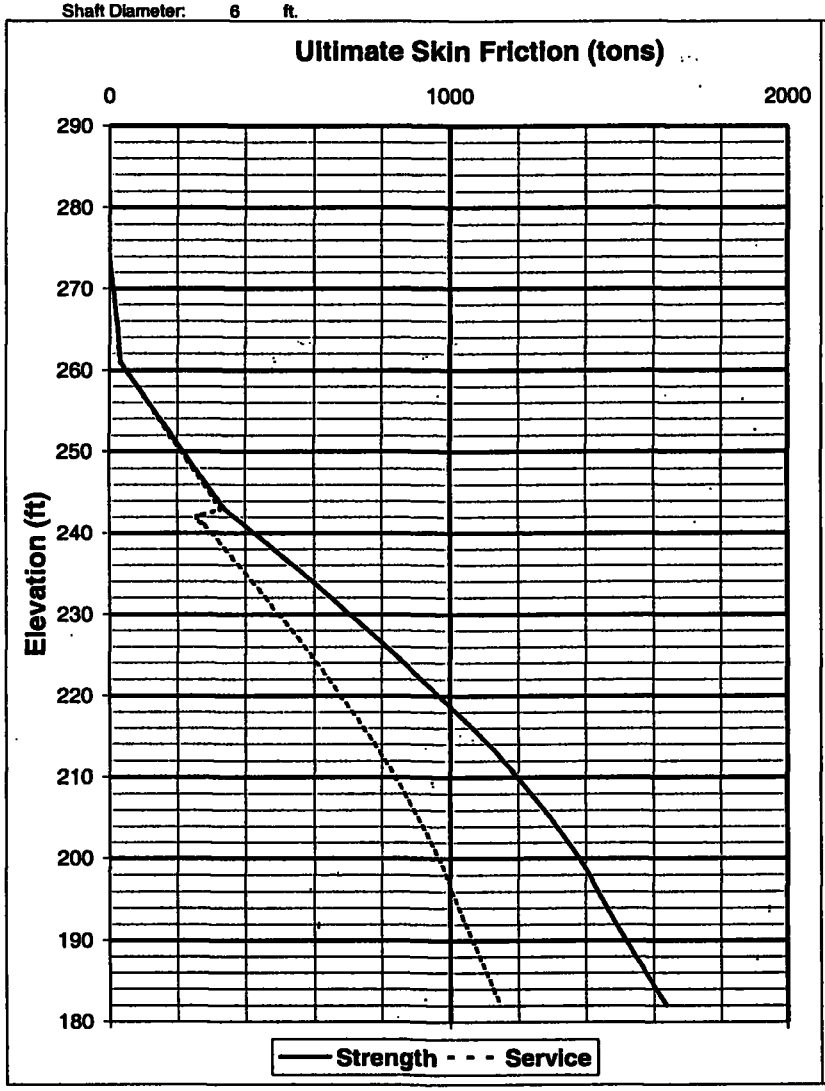


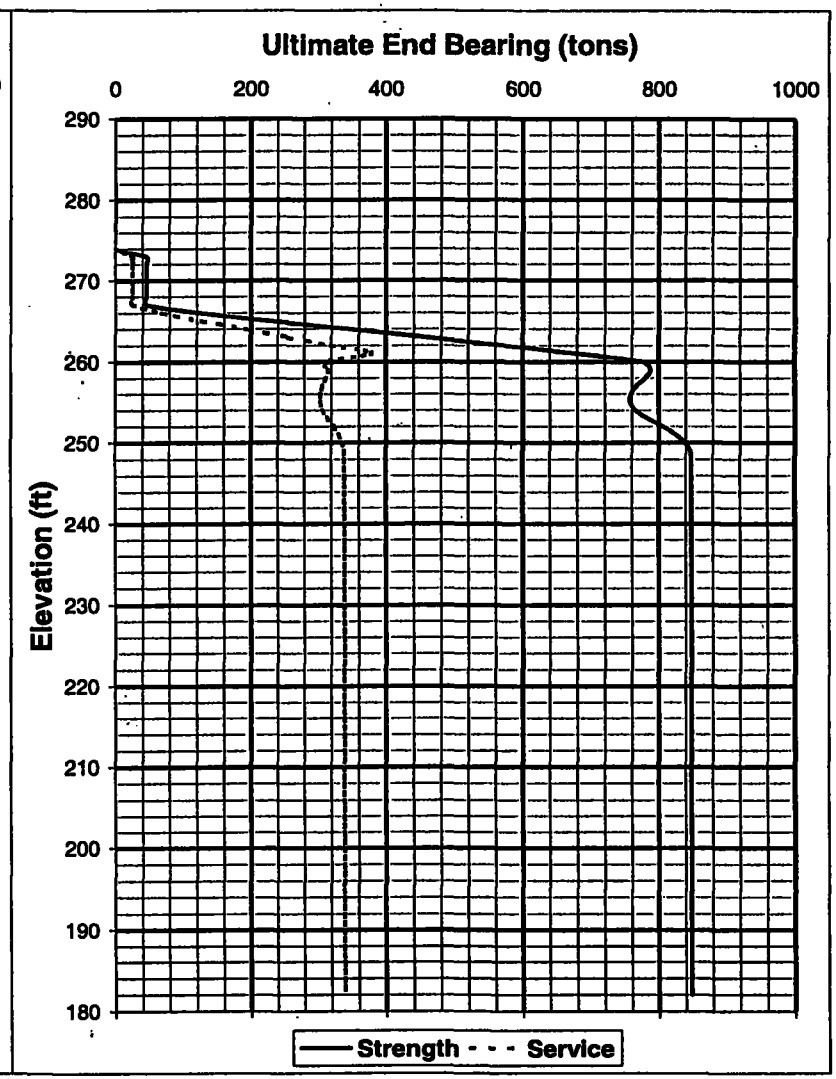


SR20

Gulch Bridge 20/265 Replacement

Pier: 2
Shaft Diameter: 6 ft.

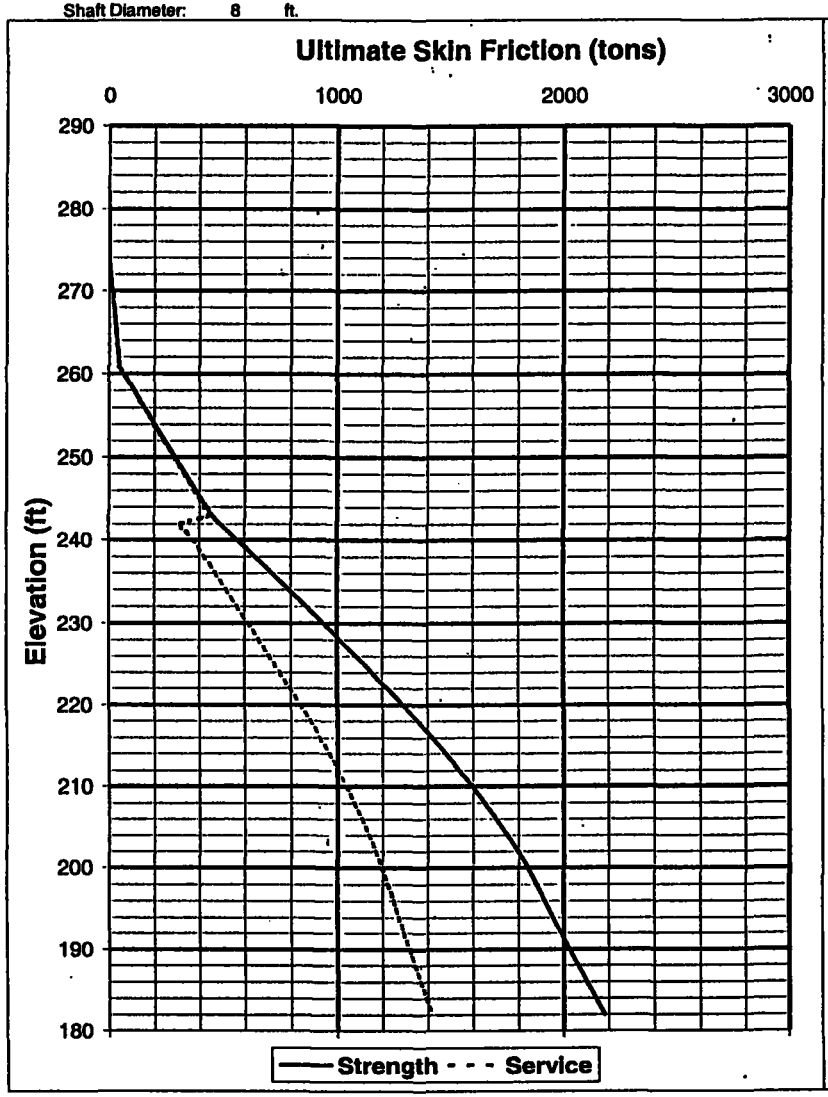


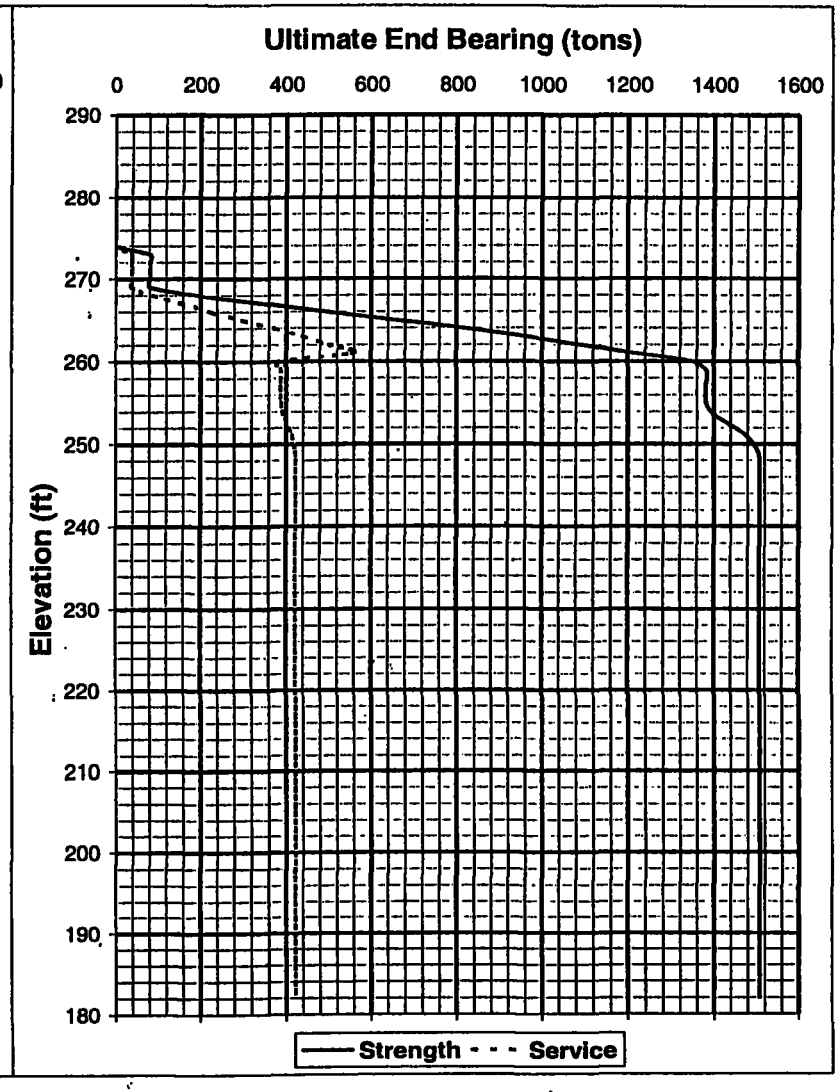


SR20

Gulch Bridge 20/265 Replacement

Pier: 2
Shaft Diameter: 8 ft.

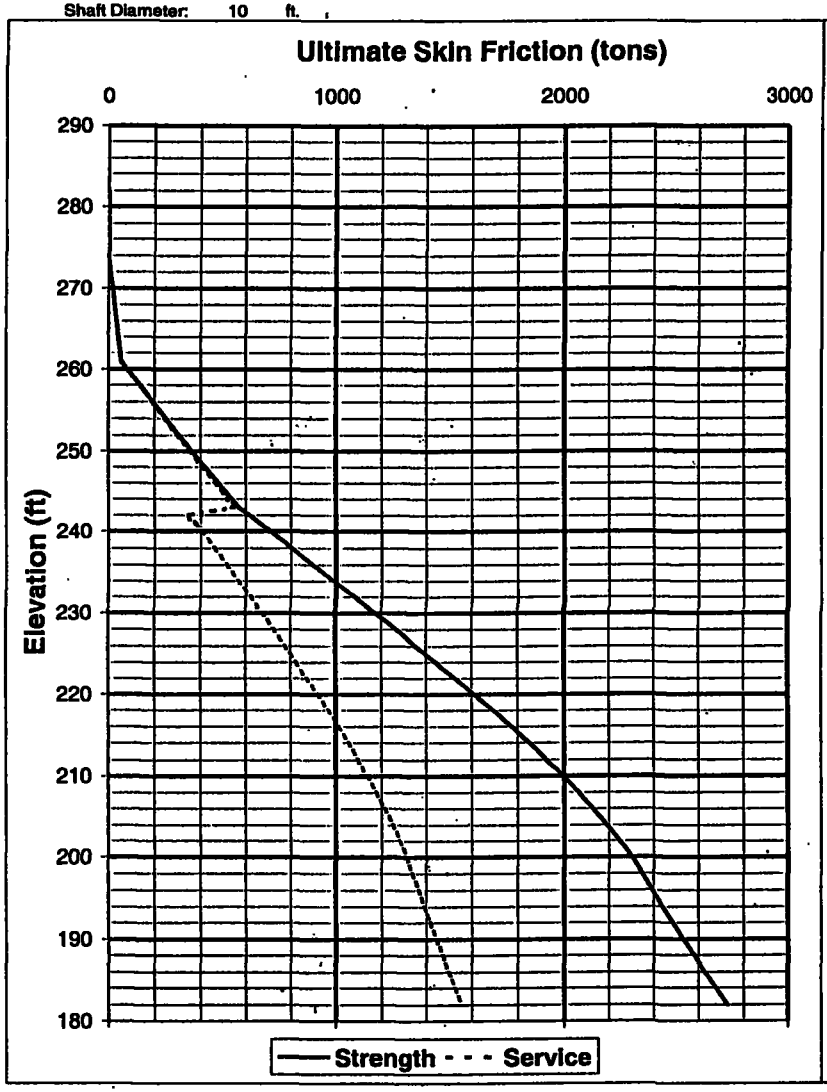


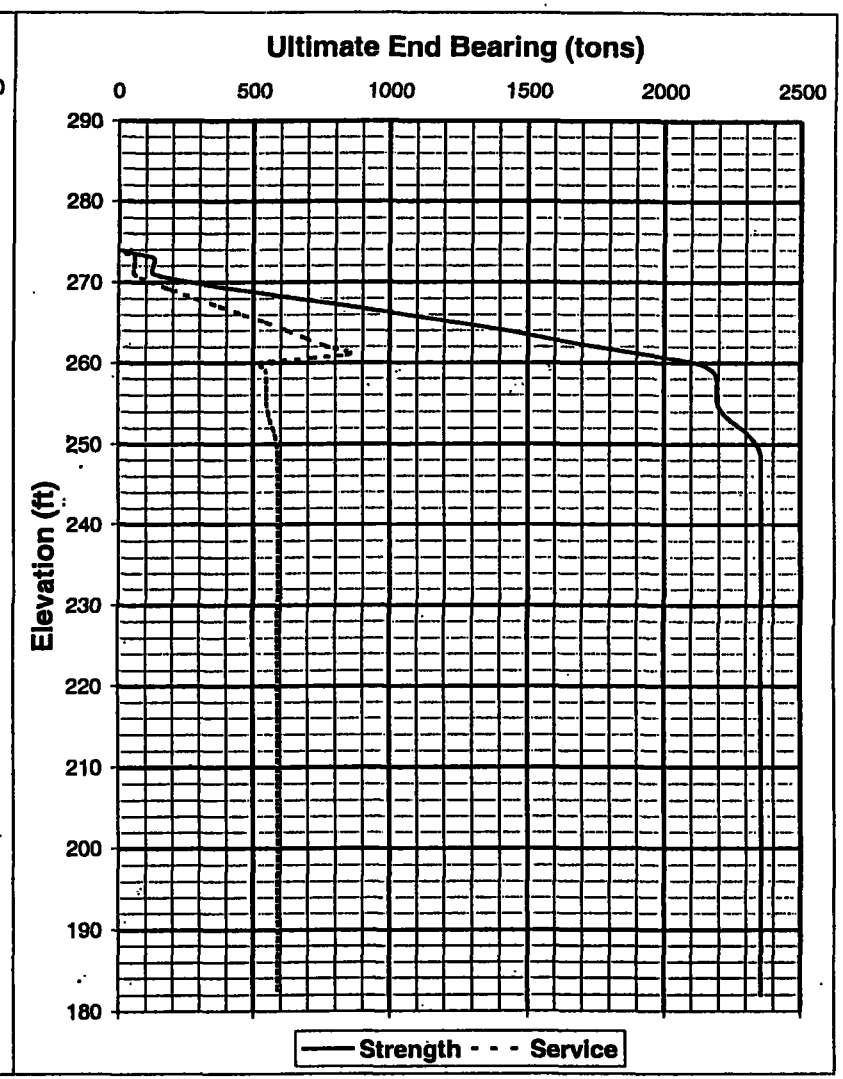


SR20

Gulch Bridge 20/265 Replacement

Pier: 2
Shaft Diameter: 10 ft.





SR20
Gulch Bridge 20/265 Replacement

P-Y Curve Soil Data

Pier 1

Soil Layer	Bottom of Layer Elevation	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight (pcf)	Cohesion (pcf)	Axial Strain ε_{50}	ϕ	Modulus of Subgrade Reaction (pci)
1	265	CLAY	1	110	500	2%	0	
2	260	SAND	4	115	0		33	90
3	249	SAND	4	52.6	0		35	80
4	182	SAND	4	57.6	0		40	140

Pier 2

Soil Layer	Bottom of Layer Elevation	Soil Type	Soil Profile Type (KSOIL)	Effective Unit Weight (pcf)	Cohesion (pcf)	Axial Strain ε_{50}	ϕ	Modulus of Subgrade Reaction (pci)
1	268	CLAY	1	110	500	2%	0	
2	260	CLAY	1	47.6	500	2%	0	
3	243	SAND	4	52.6	0		40	140
4	182	SAND	4	57.6	0		40	140