



ALASKA
Department of Transportation
And Public Facilities

**SUPPLEMENTAL GEOLOGY
FOUNDATION REPORT**


**Seward Hwy MP 18-25
Trail River Bridge No. 610**

Project# STP-031-1(27)


AKSAS# 53919

May 2004


Prepared By:


Peter J. Ondra
Engineering Geologist

Reviewed By:


Terry L. Barber, C.P.G.
Foundation Geologist

Approved By:


David Stanley, C.P.G.
Chief Geologist

INTRODUCTION

Purpose and Scope of Work

After the initial field investigation for the Trail River Bridge No. 610 was completed, the location of Pier 4 was moved approximately 23 ft to the north or up station. At the request of the Design Project Manager, the DOT&PF Statewide Materials Section conducted a foundation investigation at the new location. The work was conducted under the field supervision of Engineering Geologist Peter Ondra using DOT&PF personnel and equipment.

At the time of the investigation this project was being switched from metric to English units. The survey control points are reported in metric units while the Penetrometer and Test Hole logs and elevations are reported in English units.

METHOD OF EXPLORATION

The field investigation at the new Pier 4 location was conducted between March 3 and 11, 2004. A total of three continuous penetrometers (Pen) were driven and five test holes (TH) were drilled. Pen 4K1, 4K2A and TH 4 K1, 4K2A and 4K3 were located by a Central Region Location Section survey crew. Pen 4K2B and TH 4K2B, 4K4 and 4K5 were located by measuring from established survey control points provided by a Central Region Location Section survey crew.

As part of that investigation, Statewide Materials Personnel:

- Drilled test holes with track mounted CME model 75 drills with NW (3 inch I.D. x 3.5 inch O.D.) casing.
- Drove NW casing using a 340 lb CME automatic hammer with a 30 inch free fall.
- Performed standard penetration tests (SPT) about every 5 ft interval using a standard split barrel sampler (1.4 inch I. D. x 2 inch O. D.) driven by a 140 lb CME automatic hammer system that follows AASHTO T-206 (ASTM 1586). The number of blows required to drive the sampler into undisturbed soil for each 6 inch increment was recorded. Refusal for the SPT occurs when the blow counts to drive the sampler reaches 50 blows per 6 inch interval, or 100 blows per one foot interval, or when there is no observed advance of the sampler during application of 10 successive blows of the hammer. The driving may continue to a higher blow count, or be terminated before the driving limit is reached at the discretion of the field geologist.
- Drove penetrometer soundings with a 2.5 inch diameter flush coupled, blunt-tipped steel rod with a 340 pound CME automatic hammer with a 30 inch free fall. Refusal occurs for the friction penetrometer when the blow counts reach 1000 blows per 12 inches.
- Collected rock core samples using NQ size core barrel and wireline drilling methods with water for the circulation medium.

- Photographed the rock core and the site conditions. Selected site photographs and the rock core photographs are included with this report.
- Determined the Point Load Strength Index of representative rock core based on ASTM D 5731-95 testing procedures.
- Determined the Unconfined Compressive Strength of representative rock core based on ASTM D 2938-95 testing procedures.

LABORATORY TESTING

The geologist visually classified soil samples based on the USCS Soil Classification Chart in Appendix A and described the rock core based on the Descriptions of Rock Properties tables in Appendix B. The soil and rock core samples were sealed and transported to the Engineering Geology Section office at Statewide Materials in Anchorage.

The Point Load Strength Index and Unconfined Compressive Strength test results are shown in Appendix C. Untested rock and soil samples are available for inspection upon request at the DOT&PF's Statewide Materials Geology Section office in Anchorage. Field and laboratory testing procedures followed the Alaska DOT&PF Geotechnical Procedures Manual, AASHTO or ASTM procedures.

GENERAL SITE AND SUBSURFACE CONDITIONS

Surface

The new Pier 4 location is on the northern shore of Trail River 23 feet west and downstream of the existing Trail River Bridge. The river's shore is relatively flat and bordered by a steep slope that slopes up about 80 feet to the north and west. The existing highway bridge rises approximately 13 feet above the Pier 4 location.

Subsurface

Pen 4K1 was located on the left side of Pier 4 and Pen 4K2A and Pen 4K2B were located along the right side of Pier 4. The penetrometer rods were deflected along the sloping bedrock surface forcing termination of the holes

TH 4K1 and TH 4K4 were located along the left side of Pier 4. TH 4K2A was located at the centerline of Pier 4. TH 4K2B was located 5 ft right of TH 4K2A and TH 4K3 was located along the right side of Pier 4.

The soil in the test holes consisted of gravel with silt and sand over slightly weathered, moderately hard, very close fractured argillite bedrock. A 12 inch seam of wood was found between 7.0 and 8.0 ft in TH 4K3 and TH 4K5.

Summary of Soil Thickness and Bedrock Depths:

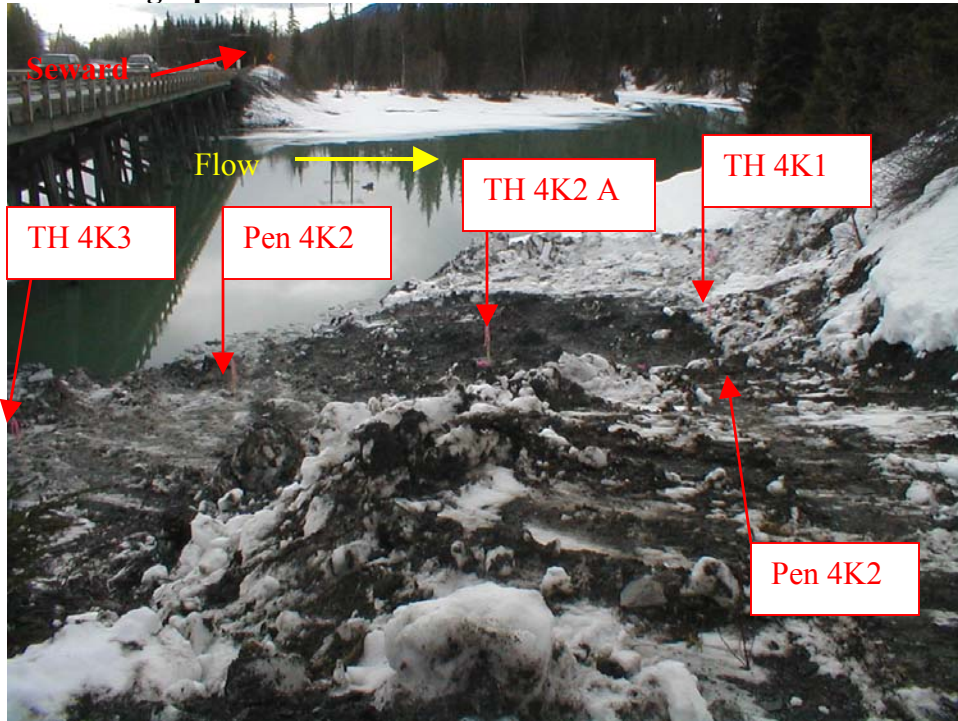
TH/Pen No. (Elevation)	Soil Thickness	Bedrock Depth (Elevation)
Pen 4K1 (462.6 ft)	0 to 6 ± ft	6 ± ft (456.6 ft)
Pen 4K2A (461.0 ft)	0 to 9 ± ft	9 ± ft (452 ft)
Pen 4K2B (461.0 ft)	0 to 7 ± ft	7 ± ft (454 ft)
TH 4K1 (463.2 ft)	1 to 5.5 ft	5.5 ft (457.7 ft)
TH 4K2A (462.0 ft)	0 to 7 ft	7 ft (455 ft)
TH 4K2B (461.8 ft)	0 to 7 ft	7 ft (454.8)
TH 4K3 (463.0 ft)	0 to 15.3 ft	15.3 ft (447.7 ft)
TH 4K4 (462.7 ft)	0 to 6.5 ft	6.5 ft (456.2 ft)
TH 4K5 (462.1 ft)	0 to 13 ft	13 ft (449.1 ft)

Please refer to the Penetrometer and Test Hole logs in Appendix D for a more complete description of the subsurface conditions.

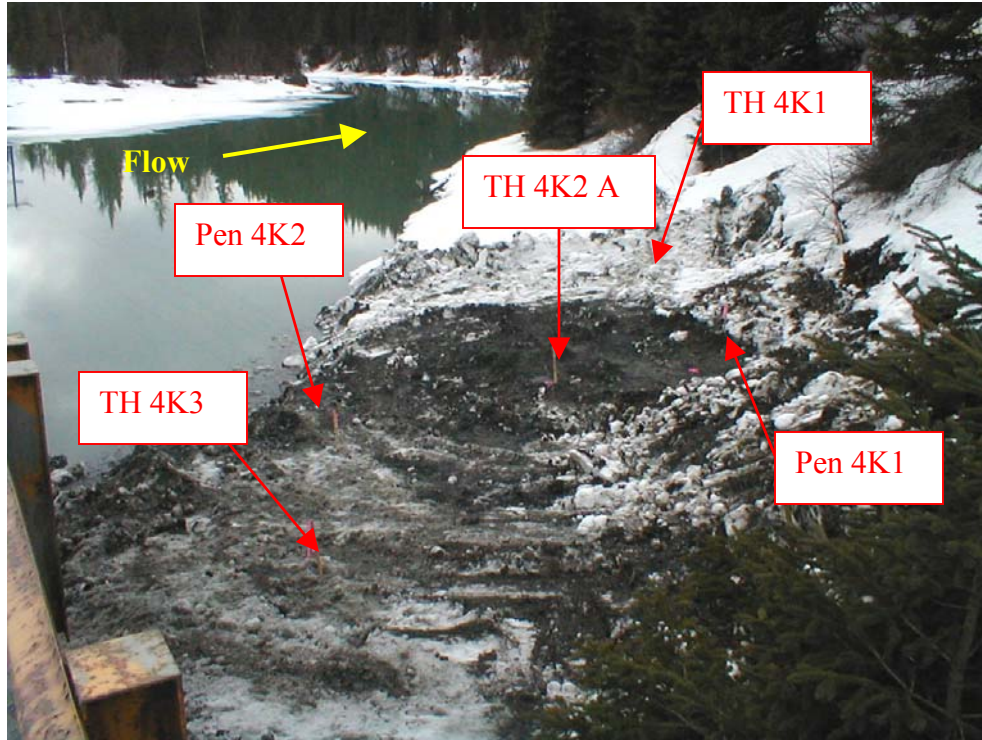
Surface Water and Groundwater

The surface and groundwater levels at the site will fluctuate seasonally due to rainfall, snowmelt, and the water level in Trail Lake. At the time of drilling the groundwater level was observed between 2.5 and 3.5 feet in depth (elev 459.2 and 460.7 ft).

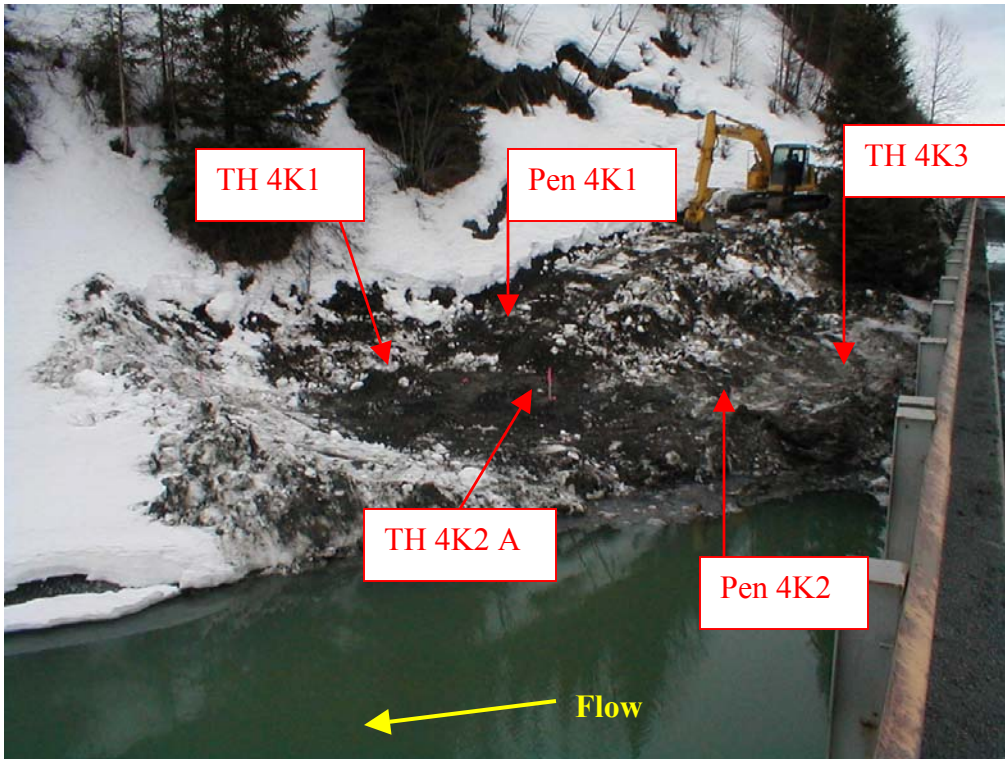
Site Photographs



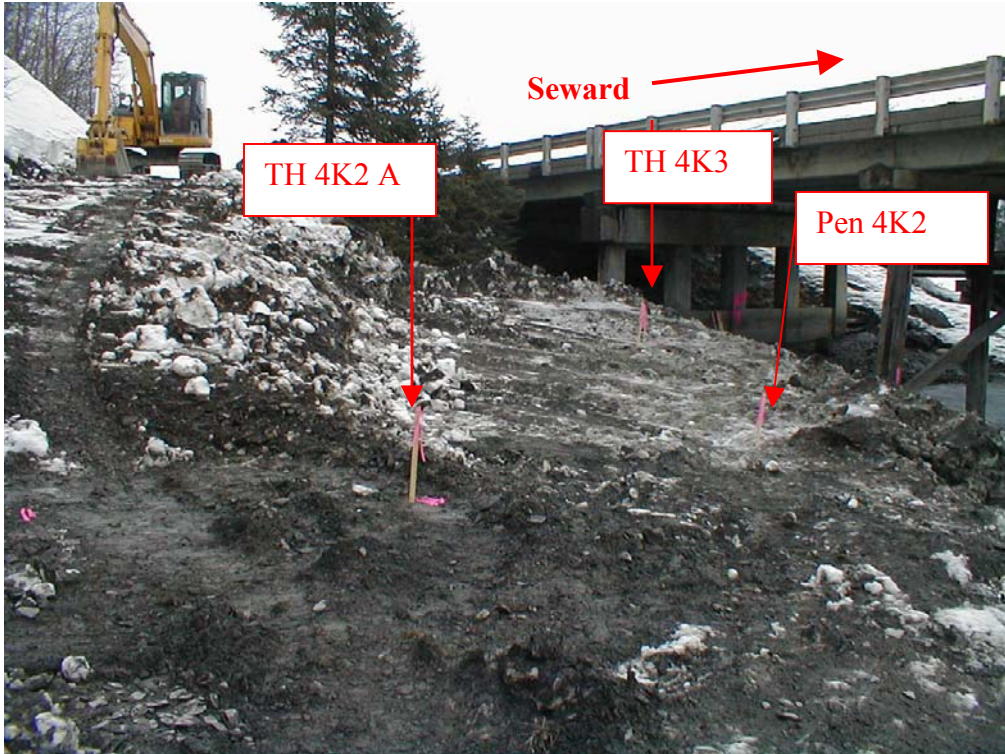
Looking south at the new Pier 4 location.



Looking southwest at the new Pier 4 location.



Looking north at the new Pier 4 location.



Looking northeast at the new Pier 4 location.

Rock Core Photographs



Supplemental: Seward Highway MP 18-25
Trail River Bridge No. 610
Project No. STP-031-1(27)/53919



Supplemental: Seward Highway MP 18-25
Trail River Bridge No. 610
Project No. STP-031-1(27)/53919



Supplemental: Seward Highway MP 18-25
Trail River Bridge No. 610
Project No. STP-031-1(27)/53919



Supplemental: Seward Highway MP 18-25
Trail River Bridge No. 610
Project No. STP-031-1(27)/53919

APPENDIX A

USCS SOIL CLASSIFICATION CHART

UNIFIED SOIL CLASSIFICATION CHART (ASTM 2488)

MAJOR DIVISIONS			GROUP SYMBOLS *	TYPICAL NAMES	
COARSE GRAINED SOILS	More than half of material is <u>larger</u> than No. 200 sieve size	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size	CLEAN GRAVELS	GW	Well graded gravels, gravel-sand mixtures, little or no fines
			GRAVELS WITH FINES	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
			CLEAN SANDS	GM	Silty gravels, poorly graded gravel-sand-silt mixtures
			SANDS WITH FINES	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
		SANDS More than half of coarse fraction is smaller than No. 4 sieve size	CLEAN SANDS	SW	Well graded sands, gravelly sands, little or no fines
			SANDS WITH FINES	SP	Poorly graded sands, gravelly sands, little or no fines
			SANDS WITH FINES	SM	Silty sands, sand-silt mixtures
			SANDS WITH FINES	SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS	More than half of material is <u>smaller</u> than No. 200 sieve size	SILTS AND CLAYS Liquid limit less than 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silt-clays of low plasticity	
		SILTS AND CLAYS Liquid limit greater than 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity	
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils	
<p>* Boundary classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example, GW-GC, for well graded gravel-sand mixture with clay binder.</p>					

APPENDIX B

DESCRIPTION OF ROCK PROPERTIES

Description of Rock Properties¹

Classification of Rock Materials Strengths (ISRM, 1977)

GRADE	DESCRIPTION ²	FIELD IDENTIFICATION	APPROXIMATE RANGE OF COMPRESSIVE STRENGTH	
			Mpa	p.s.i.
R6	Extremely Strong Rock	Specimen can only be chipped with geological hammer	>250	>36,000
R5	Very Strong Rock	Specimen requires many blows of geological hammer to fracture it.	100-250	15,000-36,000
R4	Strong Rock	Specimen requires more than one blow with a geological hammer to fracture it.	50-100	7,000-15,000
R3	Medium Weak Rock	Cannot be scraped with a pocket knife; specimen can be fractured with a single firm blow of geological hammer.	25-50	3,500-7,000
R2	Weak Rock	Can be peeled with a pocket knife; shallow indentations made by firm blow with point of geological hammer.	5-25	725-3,500
R1	Very Weak Rock	Crumbles under firm blows with point of geological hammer; can be peeled with pocket knife.	1-5	150-725
R0	Extremely Weak Rock	Indented by thumbnail.	0.25-1	35-150
S6 ³	Hard Clay	Indented with difficulty with thumbnail.	>0.5	>70
S5	Very Stiff Clay	Readily indented by thumbnail.	0.25-0.5	35-70
S4	Stiff Clay	Readily indented by thumb, but penetrated only with great difficulty.	0.1-0.25	15-35
S3	Firm Clay	Can be penetrated several inches by thumb with moderate effort.	0.05-0.1	7-15
S2	Soft Clay	Easily penetrated several inches by thumb.	0.025-0.05	4-7
S1	Very Soft Clay	Easily penetrated several inches by fist.	<0.025	<4

¹ From Tables 2-2, 2-3, and 2-4 in the Alaska Department of Transportation & Public Facilities Alaska Field Rock Classification and Structure Mapping Guide, October 2003.

² Note: Hardness for engineering geology descriptions of rocks should not be confused with Moh's hardness scale of minerals.

³ The soil material strengths may refer to infillings in discontinuities.

Weathering and Alteration Grades (ISRM 1977)

GRADE	TERM	DESCRIPTION
I	Fresh	No visible sign of rock material weathering; perhaps slight discoloration on major discontinuity surfaces.
II	Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
III	Moderately weathered	Less than half the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
IV	Highly weathered	More than half the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present as a discontinuous framework or as corestones.
V	Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
VI	Residual Soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

Aperture Description

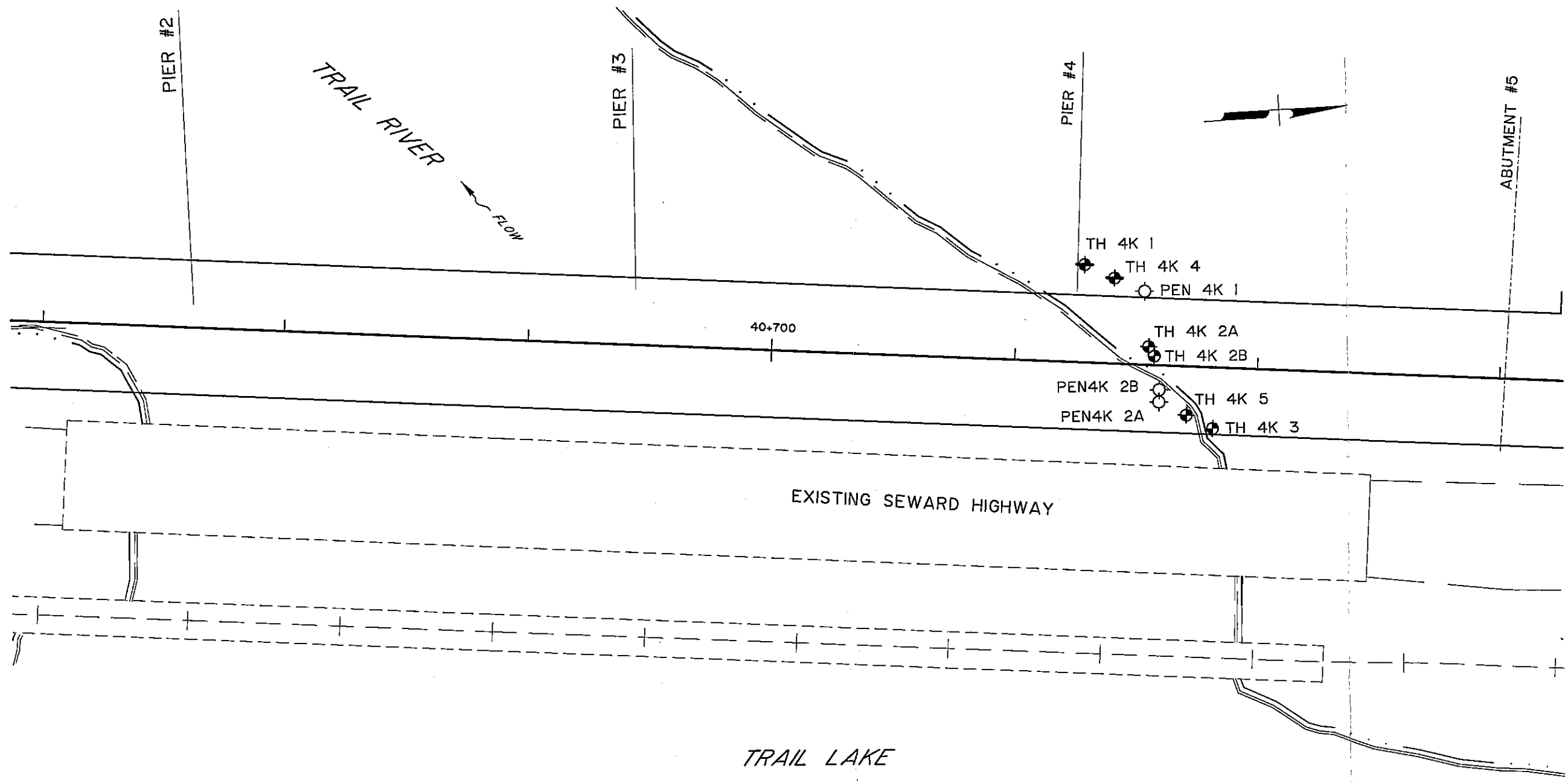
APERTURE (inches/feet)	DESCRIPTION	CATEGORY
<0.004 in	Very tight	Closed
0.004 – 0.01 in	Tight	Closed
0.01 – 0.02 in	Partly open	Closed
0.02 – 0.1 in	Open	Gapped
0.1 – 0.4 in	Moderately wide	Gapped
0.4 – 2.5 in	Wide	Gapped
2.5 – 4.0 in	Very wide	Open
4.0 in – 3 ft	Extremely wide	Open
> 3 ft	Cavernous	Open

APPENDIX C

TEST HOLE AND PENTROMETER LOCATIONS AND LOGS

GENERAL NOTES:

- HORIZONTAL AND VERTICAL GEOMETRY WITH TOPOGRAPHIC DATA FURNISHED BY USING A CLOTH TAPE, SWING TIES FROM SURVEY STAKES PROVIDED BY THE DEPARTMENT OF TRANSPORTATION, CENTRAL REGION, LOCATION SECTION.
- TEST HOLE AND CONTINUOUS PENETROMETER LOCATIONS ARE APPROXIMATE.



LEGEND

- TESTHOLE
- PENETROMETER
- TESTPIT



TEST HOLE LOGS AND LOCATIONS
SEWARD HIGHWAY
MP 18 TO MP 25
TRAIL RIVER
GENERAL LAYOUT

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

BRIDGE NO: 610
DRAWING NO: 1

DWG NAME: C:\MATERIALS\BASE-SEWARD\PIER\PIER4.DWG DATE: 4/22/04 VIEW: TRAIL_PIER4

SUMMARY OF TEST HOLES					
TEST HOLE DESIGNATION	STATION	OFFSET	NORTHING	EASTING	SOURCE
TH 4K 1	40+725.5	8.0 m LT.	46265.9640	16368.7582	SURVEY
TH 4K 4	40+728.0	7.0 m LT.	46268.4±	16370.0±	SWING TIES
PEN 4K 1	40+730.5	6.0 m LT.	46270.7402	16371.2258	SURVEY
TH 4K 2A	40+731.0	1.5 m LT.	46270.7938	16375.7740	SURVEY
TH 4K 2B	40+732.0	ϕ	46271.2±	16376.6±	SWING TIES
PEN 4K 2B	40+732.0	2.0 m RT.	46271.4±	16379.4±	SWING TIES
PEN 4K 2A	40+732.0	3.0 m RT.	46271.3489	16380.3503	SURVEY
TH 4K 5	40+734.3	4.0 m RT.	46273.5±	16381.6±	SWING TIES
TH 4K 3	40+736.5	5.0 m RT.	46275.6160	16382.7881	SURVEY

THESE STATION AND OFFSETS ARE BASED ON DESIGN CENTERLINE 8/1/03.



STATE OF ALASKA DOT&PF
 Statewide Materials
 Geology Section

PENETROMETER LOG

HOLE # Pen 4K1

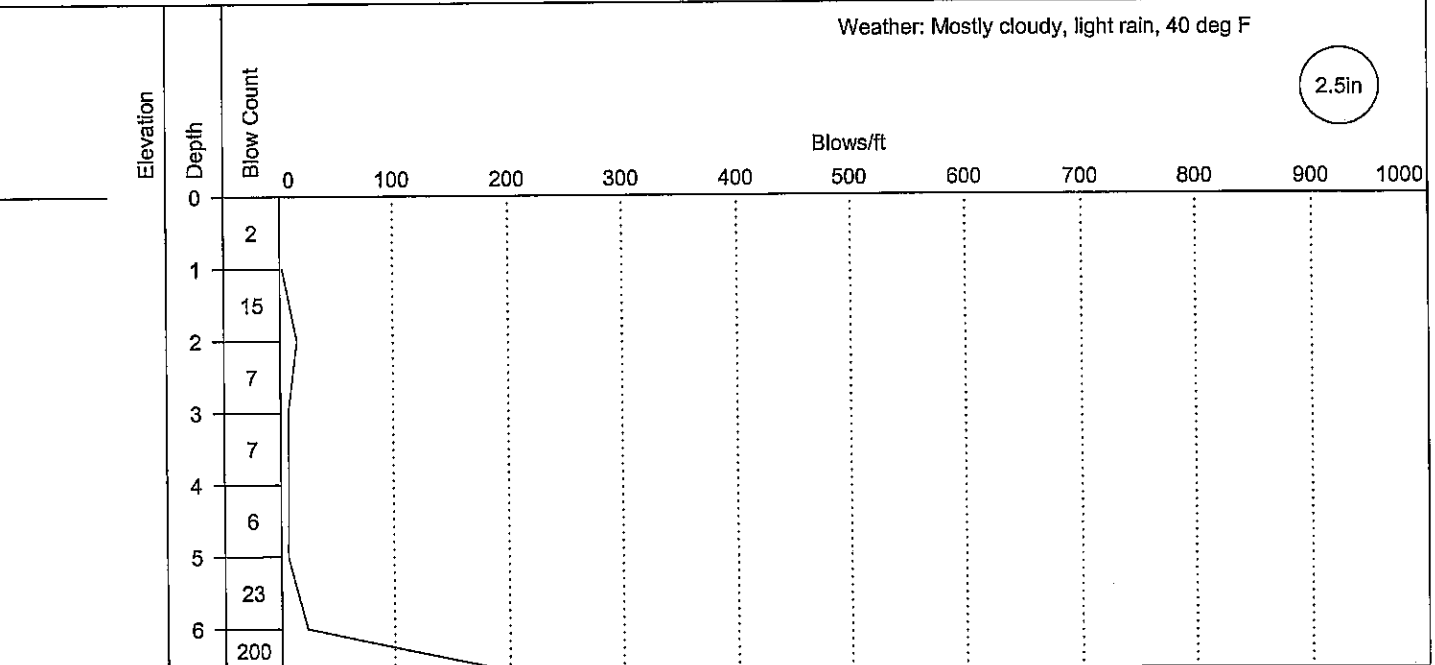
PROJECT NUMBER: 53919
 PROJECT: Seward Hwy MP 18-25, Trail River Bridge
 NORTHING: 46270.7402, EASTING: 16371.2258

Station / Location: 40+730.5
 Offset: 6.0 m Lt. (19.7 ft)
 Elevation: 462.6 ft

Equipment Type: CME 850
 Drilling Method: Penetrometer
 Field Crew: W. Mitchell, G. Hamrick

Total Depth: 6.6 feet
 Date: 3/3/2004 - 3/3/2004
 Geologist: P. Ondra

Weather: Mostly cloudy, light rain, 40 deg F



Bottom of Penetrometer Test at: 6.6 feet
 Notes: Pen rod started deflecting below 6 ft.
 200 blows for 7" below 6.0 ft



STATE OF ALASKA DOT&PF
 Statewide Materials
 Geology Section

PENETROMETER LOG

HOLE # Pen 4K2 A

PROJECT NUMBER: 53919
 PROJECT: Seward Hwy MP 18-25, Trail River Bridge
 NORTHING: 46271.3489, EASTING: 16380.3503

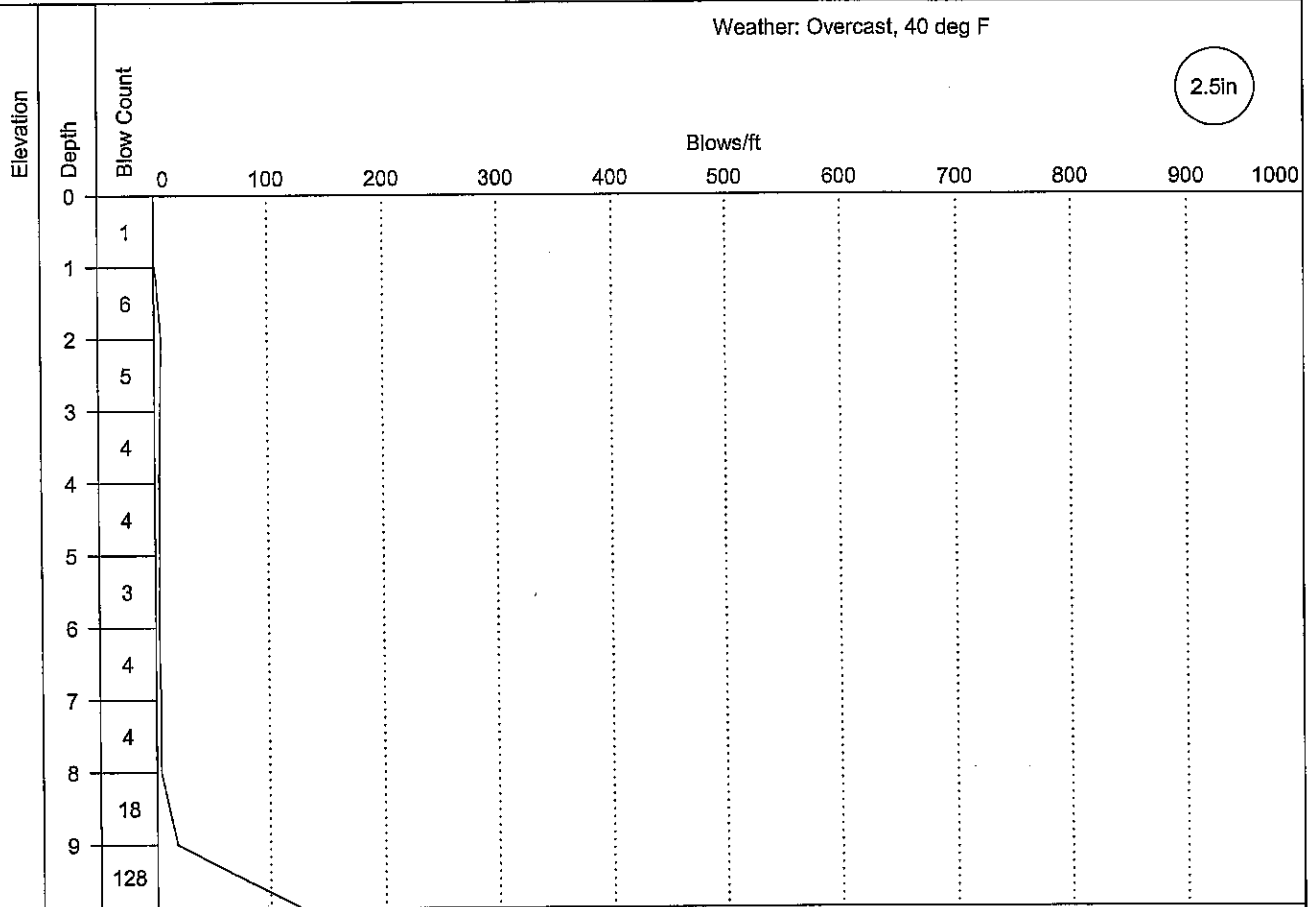
Station / Location: 40+732.0
 Offset: 3.0 m Rt. (9.8 ft)
 Elevation: 461.0 ft

Equipment Type: CME 850
 Drilling Method: Penetrometer
 Field Crew: W. Mitchell, G. Hamrick

Total Depth: 9.9 feet
 Date: 3/3/2004 - 3/3/2004
 Geologist: P. Ondra

Weather: Overcast, 40 deg F

2.5in



Bottom of Penetrometer Test at: 9.9 feet
 Notes: Pen rod deflecting below 9 ft.
 128 blows for 11" below 9.0 ft



STATE OF ALASKA DOT&PF
 Statewide Materials
 Geology Section

PENETROMETER LOG

HOLE # Pen 4K2 B

PROJECT NUMBER: 53919
PROJECT: Seward Hwy MP 18-25, Trail River Bridge
NORTHING: 46271.4, **EASTING:** 16379.4

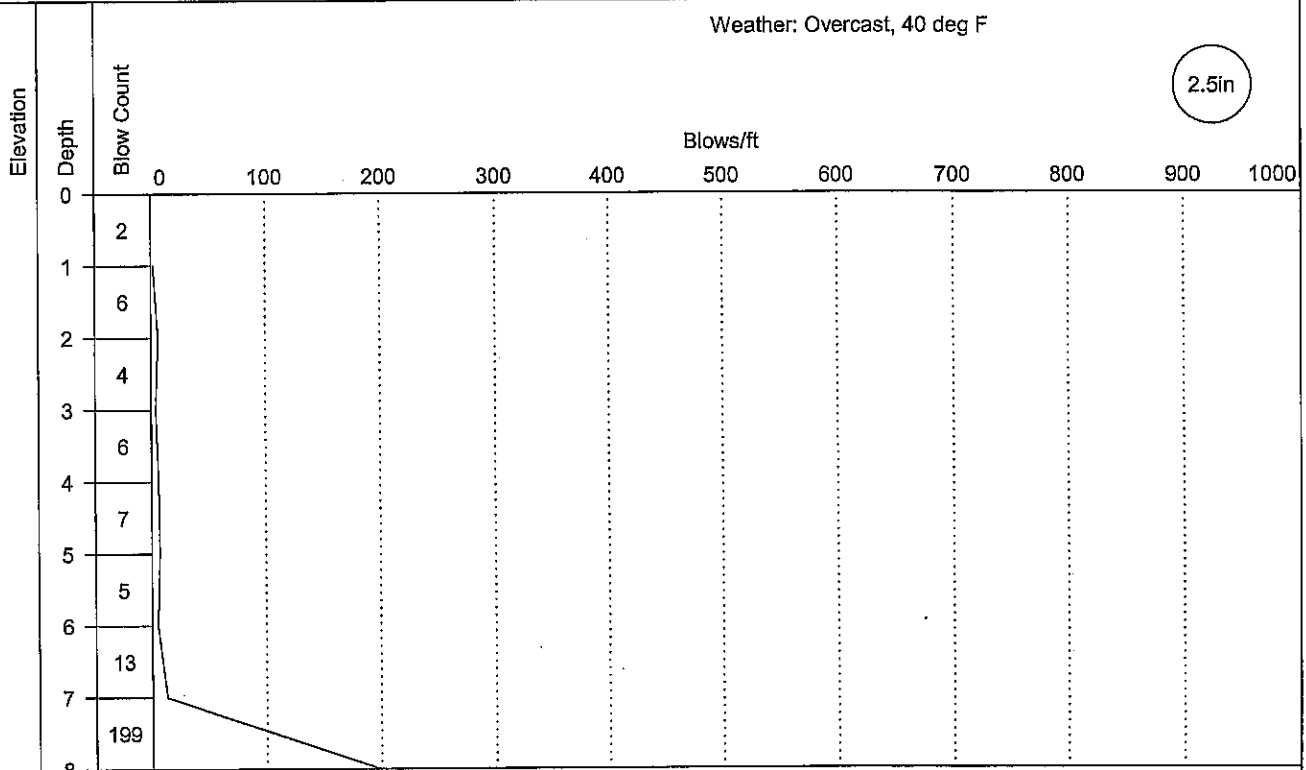
Station / Location: 40+732.0
Offset: 2.0 m Rt. (6.6 ft)
Elevation: 461.0 ft

Equipment Type: CME 850
Drilling Method: Penetrometer
Field Crew: W. Mitchell, G. Hamrick

Total Depth: 8.0 feet
Date: 3/3/2004 - 3/3/2004
Geologist: P. Ondra

Weather: Overcast, 40 deg F

2.5in



Bottom of Penetrometer Test at: 8 feet
 Notes: Pen rod deflecting at 7 ft.



STATE OF ALASKA DOT&PF
Statewide Materials
Geology Section

LOG OF TEST HOLE

HOLE # TH 4K2 A

PROJECT NUMBER: 53919
PROJECT: Seward Hwy MP 18-25, Trail River Bridge
NORTHING: 46270.7938, EASTING: 16375.774

Station / Location: 40+731.0
Offset: 1.5 m Lt. (5.0 ft)
Elevation: 462.0 ft

Equipment Type: CME 850
Drilling Method: Casing Size NW
Field Crew: W. Mitchell, G. Hamrick

Total Depth: 28.0 feet
Date: 3/5/2004 - 3/9/2004
Geologist: P. Ondra

Depth (Feet)	Sample Data					USCS Classification	Frozen Zone	Soil Graphic	Ground Water Data		Weather: Partly cloudy, 28 deg F
	Sample Type	Number	Blow Count	Sample Recovery	Casing Blows				Depth in (ft.)	Time	
0					20	GW-GM		3		SUBSURFACE MATERIAL	
0.1					20			14:30			
1					9			3/9/04			
2					9			▼			
3											
4					7						
5	SPT	FS 610-4K2-1	6		7						
6			6								
7			8		12						
8			10		40						
9	SPT		50/3"		42						
10											
11	CORE										
12											
13											
14											
15	CORE										
16											
17											
18											
19											
20											

C:\USCS FOUNDATION LOG OF TEST HOLE PIER 4.GPJ 2004\TEMPLATE.GDT 4/16/04



STATE OF ALASKA DOT&PF
 Statewide Materials
 Geology Section

LOG OF TEST HOLE

HOLE # TH 4K2 A

PROJECT NUMBER: 53919
 PROJECT: Seward Hwy MP 18-25, Trail River Bridge
 NORTHING: 46270.7938, EASTING: 16375.774

Station / Location: 40+731.0
 Offset: 1.5 m Lt. (5.0 ft)
 Elevation: 462.0 ft

Equipment Type: CME 850
 Drilling Method: Casing Size NW
 Field Crew: W. Mitchell, G. Hamrick

Total Depth: 28.0 feet
 Date: 3/5/2004 - 3/9/2004
 Geologist: P. Ondra

Depth (Feet)	Sample Data						USCS Classification	Frozen Zone	Soil Graphic	Ground Water Data			Weather: Partly cloudy, 28 deg F
	Sample Type	Number	Blow Count	Sample Recovery	Casing Blows	Depth in (ft.)				Time	Date	Symbol	
20										3	14:30	3/9/04	
21	CORE												
22													
23													
24													
25													
26	CORE												
27													
28													

Run 4: 23.0' to 28.0', No Recovery

BOH
28

Notes:
 NQ core barrel
 Rock jammed in outer barrel below 18 ft, no recovery in inner barrel.

C:\USCS FOUNDATION LOG OF TEST HOLE PIER 4.GPJ 2004TEMPLATE.GDT 4/16/04



STATE OF ALASKA DOT&PF
 Statewide Materials
 Geology Section

LOG OF TEST HOLE

HOLE # TH 4K2 B

PROJECT NUMBER: 53919
 PROJECT: Seward Hwy MP 18-25, Trail River Bridge
 NORTHING: 46271.2, EASTING: 16376.6

Station / Location: 40+732
 Offset: C/L
 Elevation: 461.8 ft

Equipment Type: CME 850
 Drilling Method: Casing Size NW
 Field Crew: W. Mitchell, G. Hamrick

Total Depth: 49.0 feet
 Date: 3/9/2004 - 3/10/2004
 Geologist: P. Ondra

Depth (Feet)	Sample Data					USCS Classification	Frozen Zone	Soil Graphic	Ground Water Data		Weather: Heavy snow, wind, 30 deg F
	Sample Type	Number	Blow Count	Sample Recovery	Casing Blows				Depth in (ft.)	Time	
									Date	Symbol	
0					25	GW-GM		3	15:00		
1					18						
2					11						
3					9						
4					10						
5					24						
6					84						
7					88						
8					117						
9											
10											
11											
12	CORE										
13											
14											
15											
16	CORE										
17											
18											
19											
20											

C USCS FOUNDATION LOG OF TEST HOLE PIER 4.GPJ 2004TEMPLATE.GDT 4/16/04



STATE OF ALASKA DOT&PF
 Statewide Materials
 Geology Section

LOG OF TEST HOLE

HOLE # TH 4K2 B

PROJECT NUMBER: 53919
 PROJECT: Seward Hwy MP 18-25, Trail River Bridge
 NORTHING: 46271.2, EASTING: 16376.6

Station / Location: 40+732
 Offset: C/L
 Elevation: 461.8 ft

Equipment Type: CME 850
 Drilling Method: Casing Size NW
 Field Crew: W. Mitchell, G. Hamrick

Total Depth: 49.0 feet
 Date: 3/9/2004 - 3/10/2004
 Geologist: P. Ondra

Depth (Feet)	Sample Data						USCS Classification	Frozen Zone	Soil Graphic	Ground Water Data			Weather: Heavy snow, wind, 30 deg F
	Sample Type	Number	Blow Count	Sample Recovery	Casing Blows	Depth In (ft.)				Time	Date		
										Symbol			
20									SUBSURFACE MATERIAL			20.0	
21	CORE								(cont.) more fractured than previous, numerous fractures 1/4" to 3" apart			21	
22												22	
23												23	
24									Run 4: 24.0' to 26.5', 87% Recovery Longest Pc: 3", RQD=0			24	
25	CORE											25	
26												26	
27	CORE								Run 5: 26.5' to 29.0', 100% Recovery Longest Pc: 2", RQD=0 very fractured			27.0	
28												28	
29									Run 6: 29.0' to 32.5', 86% Recovery Longest Pc: 6", RQD=17			29	
30	CORE								very fractured, broken up 29.0' to 30.5'			30.0	
31												31	
32												32	
33	CORE								Run 7: 32.5' to 34', 89% Recovery Longest Pc: 5", RQD=28			33	
34									Run 8: 34.0' to 37.0', 83% Recovery Longest Pc: 2", RQD=0			34	
35	CORE								contains calcite seams to 1/4" thick			35.0	
36									very fractured, broken up below 35.5'			35.5	
37												36	
38	CORE								Run 9: 37.0' to 39.0', 100% Recovery Longest Pc: 4", RQD=17 very fractured, broken up 37.5' to 38.0' very close fractures 38.0' to 40.0'			37.5	
39												38.0	
40									Run 10: 39.0' to 44.0', 105% Recovery Longest Pc: 26", RQD=76			39	
												40	

C:\USCS FOUNDATION LOG OF TEST HOLE PIER 4.GPJ 2004TEMPLATE.GDT 4/16/04

CME Auto Hammer Cathead Rope Method 140 lb. hammer with 30 in. drop 300 lb. hammer with 30 in. drop



STATE OF ALASKA DOT&PF
 Statewide Materials
 Geology Section

LOG OF TEST HOLE

HOLE # TH 4K2 B

PROJECT NUMBER: 53919
 PROJECT: Seward Hwy MP 18-25, Trail River Bridge
 NORTHING: 46271.2, EASTING: 16376.6

Station / Location: 40+732
 Offset: C/L
 Elevation: 461.8 ft

Equipment Type: CME 850
 Drilling Method: Casing Size NW
 Field Crew: W. Mitchell, G. Hamrick

Total Depth: 49.0 feet
 Date: 3/9/2004 - 3/10/2004
 Geologist: P. Ondra

Depth (Feet)	Sample Data					USCS Classification	Frozen Zone	Soil Graphic	Ground Water Data		Weather: Heavy snow, wind, 30 deg F
	Sample Type	Number	Blow Count	Sample Recovery	Casing Blows				Depth in (ft.)		
40									3		SUBSURFACE MATERIAL
41								15:00			
42								3/10/04			
43								▼			
44	CORE										(cont.) close to moderately close fractures below 40.0' 3 fractures from 40.0' to 44.0'
45											Run 11: 44.0' to 49.0', 102% Recovery Longest Pc: 33", RQD 90
46	CORE										1 fracture from 44.0' to 46.5'
47											4 fractures from 46.5' to 49.0'
48											
49								BOH 49			Notes: NQ core barrel

C USCS FOUNDATION LOG OF TEST HOLE PIER 4.GPJ 2004TEMPLATE.GDT 4/16/04



STATE OF ALASKA DOT&PF
 Statewide Materials
 Geology Section

LOG OF TEST HOLE

HOLE # TH 4K3

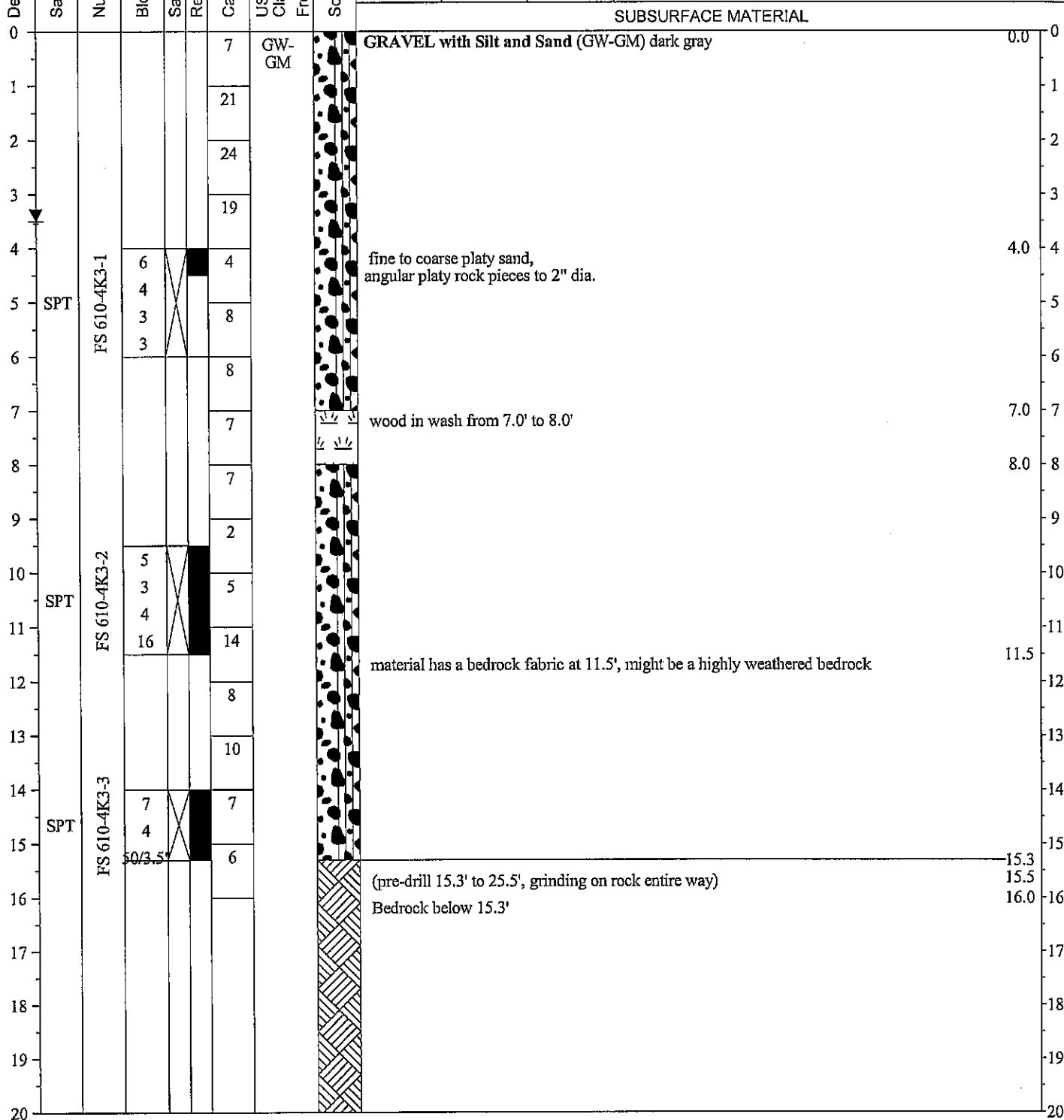
PROJECT NUMBER: 53919
 PROJECT: Seward Hwy MP 18-25, Trail River Bridge
 NORTHING: 46275.616, EASTING: 16382.7881

Station / Location: 40+736.5
 Offset: 5.0 m Rt. (16.4 ft)
 Elevation: 463.0 ft

Equipment Type: CME 850
 Drilling Method: Casing Size NW
 Field Crew: W. Mitchell, G. Hamrick

Total Depth: 25.5 feet
 Date: 3/4/2004 - 3/4/2004
 Geologist: P. Ondra

Depth (Feet)	Sample Data					USCS Classification Frozen Zone	Soil Graphic	Ground Water Data		Weather: Heavy snow, 35 deg F
	Sample Type	Number	Blow Count	Sample Recovery	Casing Blows			Depth In (ft.)	3.5	
								Time	14:15	
								Date	3/4/04	
								Symbol	▼	



C:\USCS FOUNDATION LOG OF TEST HOLE_PIER 4.GPJ_2004TEMPLATE.GDT 4/16/04



STATE OF ALASKA DOT&PF
 Statewide Materials
 Geology Section

LOG OF TEST HOLE

HOLE # TH 4K3

PROJECT NUMBER: 53919
PROJECT: Seward Hwy MP 18-25, Trail River Bridge
NORTHING: 46275.616, **EASTING:** 16382.7881

Station / Location: 40+736.5
Offset: 5.0 m Rt. (16.4 ft)
Elevation: 463.0 ft

Equipment Type: CME 850
Drilling Method: Casing Size NW
Field Crew: W. Mitchell, G. Hamrick

Total Depth: 25.5 feet
Date: 3/4/2004 - 3/4/2004
Geologist: P. Ondra

Depth (Feet)	Sample Data						USCS Classification Frozen Zone	Soil Graphic	Ground Water Data			Weather: Heavy snow, 35 deg F	
	Sample Type	Number	Blow Count	Sample Recovery	Casing Blows	Depth in (ft.)			Time	Date	Symbol		
20									3.5	14:15	3/4/04		
21													
22													
23													
24													
25													
SUBSURFACE MATERIAL													
(cont.)													
								BOH 25.5	Notes:				

C:\USCS FOUNDATION LOG OF TEST HOLE PIER 4.GPJ 2004TEMPLATE.GDT 4/16/04



STATE OF ALASKA DOT&PF
 Statewide Materials
 Geology Section

LOG OF TEST HOLE

HOLE # TH 4K4

PROJECT NUMBER: 53919
 PROJECT: Seward Hwy MP 18-25, Trail River Bridge
 NORTHING: 46268.4, EASTING: 16370

Station / Location: 40+728
 Offset: 7.0 m Lt. (23.0 ft)
 Elevation: 462.7 ft

Equipment Type: CME 850
 Drilling Method: Casing Size NW
 Field Crew: W. Mitchell, G. Hamrick

Total Depth: 34.0 feet
 Date: 3/11/2004 - 3/11/2004
 Geologist: P. Ondra

Depth (Feet)	Sample Data						USCS Classification	Frozen Zone	Soil Graphic	Ground Water Data			Weather: Partly cloudy, 28 deg F
	Sample Type	Number	Blow Count	Sample Recovery	Casing Blows	Depth in (ft.)				Time	Date	Symbol	
	0					16				GW-GM			
1					20								
2					13								
3					13								
4					11								
5					16								
6					55								
7					78								
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													

C USCS FOUNDATION LOG OF TEST HOLE PIER 4.GPJ 2004TEMPLATE.GDT 4/16/04



STATE OF ALASKA DOT&PF
 Statewide Materials
 Geology Section

LOG OF TEST HOLE

HOLE # TH 4K4

PROJECT NUMBER: 53919
 PROJECT: Seward Hwy MP 18-25, Trail River Bridge
 NORTHING: 46268.4, EASTING: 16370

Station / Location: 40+728
 Offset: 7.0 m Lt. (23.0 ft)
 Elevation: 462.7 ft

Equipment Type: CME 850
 Drilling Method: Casing Size NW
 Field Crew: W. Mitchell, G. Hamrick

Total Depth: 34.0 feet
 Date: 3/11/2004 - 3/11/2004
 Geologist: P. Ondra

Depth (Feet)	Sample Data						USCS Classification Frozen Zone	Soil Graphic	Ground Water Data			Weather: Partly cloudy, 28 deg F
	Sample Type	Number	Blow Count	Sample Recovery	Casing Blows	Depth in (ft.)			3.5			
						Time			11:30			
						Date			3/11/04			
						Symbol			▼			
SUBSURFACE MATERIAL												
20							(cont.)				20.0	
							fracture at 20.0'				20	
21	CORE						fracture at 21.0'				21.0	
							fracture at 22.0'				22.0	
22							fracture at 22.5'				22.5	
							fracture at 23.4'				23	
23							fracture at 23.4'				23.4	
							Run 4: 24.0' to 29.0', 100% Recovery Longest Pc: 18", RQD=85				24	
24							fracture at 25.0', 2 fractures at 25.7'				24	
							2 fractures at 26.3'				25.0	
25	CORE						fractures at 28.0', 28.6'				25	
							many calcite seams to 1/4" thick				26	
26							Run 5: 29.0' to 34.0', 100% Recovery Longest Pc: 45", RQD=100				26.3	
							fracture at 30.0'				27	
27	CORE						intact core from 30.0' to 34.0'				27	
											28.0	
28											28.5	
											29	
29											29	
											30.0	
30											30	
											31	
31											31	
											32	
32											32	
											33	
33											33	
											34	
34							BOH 34			Notes: NQ core barrel	34.0	

C:\USCS FOUNDATION LOG OF TEST HOLE PIER 4.GPJ 2004TEMPLATE.GDT 4/16/04



STATE OF ALASKA DOT&PF
 Statewide Materials
 Geology Section

LOG OF TEST HOLE

HOLE # TH 4K5

PROJECT NUMBER: 53919
 PROJECT: Seward Hwy MP 18-25, Trail River Bridge
 NORTHING: 46273.5, EASTING: 16381.6

Station / Location: 40+734.3
 Offset: 4.0 m Rt. (13.1 ft)
 Elevation: 462.1 ft

Equipment Type: CME 850
 Drilling Method: Casing Size NW
 Field Crew: W. Mitchell, G. Hamrick

Total Depth: 18.0 feet
 Date: 3/11/2004 - 3/11/2004
 Geologist: P. Ondra

Depth (Feet)	Sample Data					USCS Classification	Frozen Zone	Soil Graphic	Ground Water Data		Weather: Overcast, snow, 33 deg F	
	Sample Type	Number	Blow Count	Sample Recovery	Casing Blows				Depth in (ft.)	Time		
0					2	GW-GM			3			
1					12				14:15			
2					14				3/11/04			
3					12				▼			
4					7							
5	SPT	FS 610-4K5-1	5		4							
6			2		5							
7			3									
8			2									
9					14							
10	SPT	FS 610-4K5-2	8		12							
11			8		12							
12			7		12							
13			7		12							
14					35							
15												
16												
17												
18												

SUBSURFACE MATERIAL

GRAVEL with Silt and Sand (GW-GM) dark gray

fine to coarse platy sand, angular platy rock pieces to 1" dia.

Wood in wash from 7.0' to 8.0'

material as bedrock fabric at 11.0', might be a soft, highly weathered bedrock

(casing started to bend at 13.0', pre-drill 13.0' to 15.0')

Bedrock at 13.0'

(tried core run at 15.0', casing bent too much)

(pre-drill 15.0' to 18.0', in rock entire way)

Notes:

C.USCS FOUNDATION LOG OF TEST HOLE_PIER 4.GPJ_2004TEMPLATE.GDT 4/21/04

APPENDIX D

SUMMARY OF ROCK TEST DATA

Rock Strength Testing

We performed strength testing on rock cores using point load testing and uniaxial compressive strength testing. The quick and relatively inexpensive point load test results yield a "strength index" which may be used to estimate compressive strength. Typically, a few of the expensive uniaxial compression tests are performed and many more of the point load tests are performed. The two types of results are used together to estimate compressive strength of rock at the site. For these test results, the values of the ratio between uniaxial compressive strength and point load strength index are not within the typical range of values. We suggest using the uniaxial compressive strength test results for estimation of compressive strength of the rock at this site. We also recommend careful consideration of the strength results along with the rock characteristics, most notably the bedding/foliation planes.

Summary of Point Load Test Method

The point load strength test is used as an index test for strength classification of rock materials. The test is performed by subjecting a rock specimen to an increasingly concentrated load until failure occurs by splitting the specimen in tension. The concentrated load is applied through coaxial, truncated conical platens. The failure load is used to calculate the point load strength index and to estimate the uniaxial compressive strength.¹

Summary of Unconfined Compressive Strength Test Method

Unconfined compressive strength of rock is used in many design formulas and is sometimes used as an index property to select the appropriate excavation technique. A rock core sample is cut to length and the ends are machined flat. The specimen is placed in a loading frame. Axial load is continuously increased on the specimen until peak load and failure occur. The strength of rock cores measured in the laboratory usually does not accurately reflect large-scale in situ properties because the latter are strongly influenced by joints, faults, inhomogeneities, weakness planes and other factors. Therefore, laboratory values for intact specimens must be employed with proper judgment in engineering applications.²

¹ Standard Test Method for Determination of the Point Load Strength Index of Rock. ASTM Designation: D 5731 – 95.

² Standard Test Method for Unconfined Compressive Strength of Intact Rock Core Specimens. ASTM Designation: D 2938 – 95.

Point Load Test

IP-031-1(27)53919 Job Name: Seward Hwy MP 18-25 Job Location: Trail River Bridge No. 610, Pier 4, Test Hole 4K2b and 4K4
 NOTE: Fracture pattern in core relatively random, therefore judged to be // to a fracture

Tested by: Pete Ondra Date Sampled: 3/10/2004 Date Tested: 3/22/2004

BORING NO.	DEPTH (ft)	TEST TYPE	ORIENTATION	W (mm)	D or h (in)	D or h (mm)	D ² (mm ²)	Load P (lbf)	LOAD P (N)	Is (Mpa)	Size Corr. Factor F	Is(50)	Uniaxial Comp. Strength (psi)	Is(50) //	Is(50) ⊥
Core Type NQ															
4K2b	15.1'	D	//	-	1.76	44.7	1998.4	515.0	2290.8	1.15	0.951	1.09	0	-	-
4K2b	16.9'	D	//	-	1.76	44.7	1998.4	1110.0	4937.5	2.47	0.951	2.35	0	-	-
4K2b	20.4'	D	//	-	1.76	44.7	1998.4	80.0	355.9	0.18	0.951	0.17	0	-	-
4K2b	38.9'	D	//	-	1.76	44.7	1998.4	670.0	2980.3	1.49	0.951	1.42	0	-	-
4K2b	41.5'	D	//	-	1.76	44.7	1998.4	480.0	2135.1	1.07	0.951	1.02	0	-	-
4K4	10.3'	D	//	-	1.76	44.7	1998.4	1600.0	7117.2	3.56	0.951	3.39	0	-	-
4K4	13.5'	D	//	-	1.76	44.7	1998.4	1400.0	6227.5	3.12	0.951	2.96	0	-	-
4K4	19.5'	D	//	-	1.76	44.7	1998.4	1700.0	7562.0	3.78	0.951	3.60	0	-	-
4K4	23.0'	D	//	-	1.76	44.7	1998.4	710.0	3158.2	1.58	0.951	1.50	0	-	-
4K4	28.2'	D	//	-	1.76	44.7	1998.4	1200.0	5337.9	2.67	0.951	2.54	0	-	-

Mean Is (50)	
Mean Is(50) //	1.99
Is (50)	

D = diametral
 a = axial
 b = block
 |= irregular lump test
 | = perpendicular
 // = parallel to planes of weakness.
 Mpa = mega pascal
 Is = Uncorrected Point Load Strength Index
 Is(50) = Size Correction Factor

* Mean Is(50) = two highest and lowest values deleted and sum / total values allowed.

Rock Strength Test Results Summary

Job Name: Seward Hwy MP 18-25
Site Location: Trail River Bridge No. 610 - Pier 4
Proj. Number: STP-031-1(27) / 53919
Date Sampled: 3/10/2004
Date Tested: 4/13/2004

Boring No.	Depth (Ft.)	Lab No.	Sample		Load Rate (lbs./min.)	Temp	Max Load (lbs.)	Uniaxial Comp. Strength (psi)	Uniaxial Comp. Strength (Mpa)	Is(50) Point Load Strength Index (Mpa)	Ratio of Uniaxial Strength to Point Load	
			Lgth (in.)	Diam. (in.)								Area (in.)
4K2B	14.2-14.8 ^A	04A-0184	4.31	1.77	2.45	500	3424.5	1400	9.65 ^A	1.09 ^A	9 ^A	
4K2B	15.1 ^A									2.35 ^B	1 ^B	
4K2B	16.9 ^B											
4K2B	17.2-17.6 ^B	04A-0185	4.16	1.77	2.45	500	1082.5	440	3.03 ^B	0.17 ^B	18 ^B	
4K2B	20.4 ^B									1.42 ^C	7 ^C	
4K2B	38.9 ^C											
4K2B	40.5-41.2 ^C	04A-0186	4.19	1.77	2.46	500	3688.0	1500	10.34 ^C	1.02 ^C	10 ^C	
4K2B	41.5 ^C											
4K4	10.3 ^D									3.39 ^D	4 ^D	
4K4	13.8-14.5 ^D	04A-0182	4.49	1.77	2.45	500	5050.5	2060	14.2 ^D	2.96 ^D	5 ^D	
4K4	13.5 ^D									3.6 ^E	1 ^E /5 ^F	
4K4	19.5 ^E											
4K4	19.9-20.8 ^E	04A-0183*	4.23	1.77	2.46	500	1828.0	740	5.1 ^E			
4K4	19.9-20.8 ^F	04A-0183*	4.13	1.77	2.46	500	6931.5	2820	19.44 ^F			
4K4	23 ^{E/F}									1.5 ^{E/F}	3 ^E /13 ^F	
4K4	28.2 ^{E/F}									2.54 ^{E/F}	2 ^E /8 ^F	
Average							1493	10	2	Average ratio without high and low Is(50)		

* 2 tests from same sample

Typically, compressive strengths are 20-25 times the point load strength index, but the value may range between 15-50 times the point load strength index, especially for anisotropic rocks. Ref.: Wyllie, Duncan C., "Foundations On Rock," 2nd ed., 1999. For this group of tests on rock cores from the Pier 4 test holes, the average ratio between compressive strength and the point load strength index for samples at comparative depths (A,B etc.) was about 5. Since these results are outside the typical range of values we suggest using the uniaxial compressive strength test results to estimate the compressive strength of the rock at the site. We also recommend careful consideration of the strength results along with the rock characteristics, most notably the bedding/foliation planes.

Compressive Strength Test Sample Photos



Compressive Strength Test 04A-0184, Boring No. TH 4K2B, Depth 14.2 - 14.8 ft



Compressive Strength Test 04A-0185, Boring No. TH 4K2B, Depth 17.2 - 17.6 ft



Compressive Strength Test 04A-0186, Boring No. TH 4K2B, Depth 40.5 - 41.2 ft



Compressive Strength Test 04A-0182, Boring No. TH 4K4, Depth 13.8 - 14.5 ft



Compressive Strength Test 04A-0183, Boring No. TH 4K4, Depth 19.9 - 20.8 ft, Test 1



Compressive Strength Test 04A-0183, Boring No. TH 4K4, Depth 19.9 - 20.8 ft, Test 2