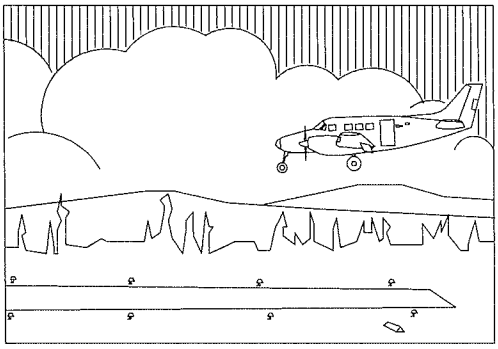
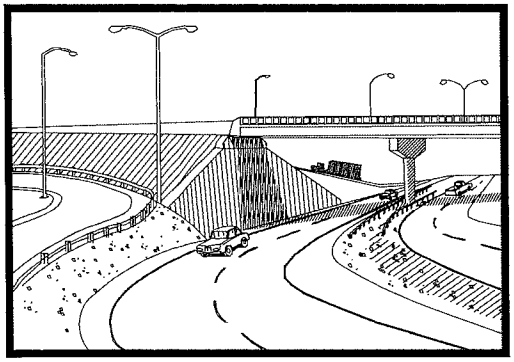
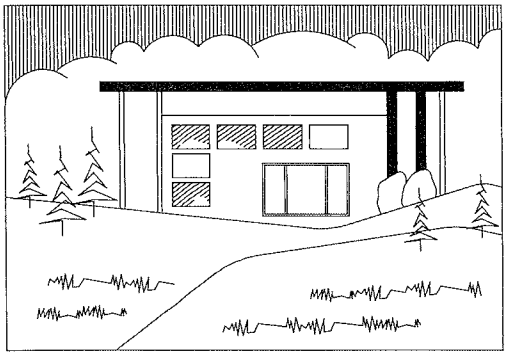
Geotechnical Report

PARKS HIGHWAY MP 237
RILEY CREEK BRIDGE REPLACEMENT

AKSAS: 63763

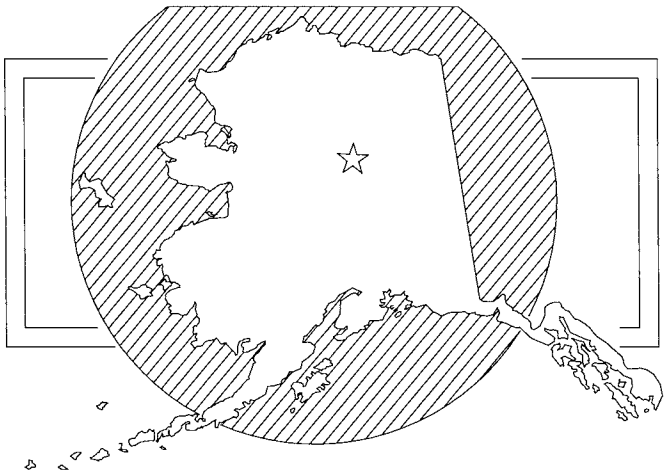






STATE OF ALASKA

Department of Transportation and Public Facilities



NORTHERN REGION

FEBRUARY 2014

GEOTECHNICAL REPORT
PARKS HIGHWAY MP 237
RILEY CREEK BRIDGE REPLACEMENT
PROJECT: 63763
FEDERAL NUMBER IM-BR-0A44(020)
FEBRUARY 2014

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Introduction

At the request of Project Manager Lauren Little, P.E. NRMS (Northern Region Materials Section) personnel conducted geotechnical exploration of: the new alignment for the Riley Creek Bridge replacement, areas with excessive settlement in the south approach to the existing Riley Creek Bridge and Denali Park Road intersection, and abutments for the Riley Creek Bridge replacement where penetration rod data was requested.

Summary

NRMS Personnel conducted geotechnical exploration drilling in the following areas:

South Approach to Riley Creek Bridge (TH13-5110 to TH13-5112)

The Parks Highway shows significant settlement at its approach to the south Riley Creek Bridge Abutment. Test holes were drilled with hollow-stem augers and SPT tests in 5-foot intervals to collect in-situ soil density information for settlement assessment. Test holes in the settled approach intercepted loose to medium dense gravels in the embankment underlain by loose sandy silt and wet sand with silt.

Test holes drilled in the south approach to the existing Riley Creek Bridge (TH13-5109 through 13-5111) intercepted loose silt and/or soft silty clay at the base of the embankment at depths that ranged from 22.5 to 23-feet below the existing finished grade. Loose, well-graded gravels with sand and silt were also observed in the lower portion of the embankment. Consolidation of subgrade soils and loss of lateral confinement at the base of the existing abutment is likely the cause of excessive settlement in this interval. The embankment has eroded away from the north abutment and possibly the south abutment which could have caused settlement.

Denali Park Road/ Parks Highway Intersection (TH13-5108, TH13-5109, and TH13-5127)

Noticeable settlement has occurred at the intersection of Denali Park Road and the Parks Highway. NRMS drilled three hollow-stem auger test holes with SPT tests in 5-foot intervals to collect in-situ soil density information for settlement assessment. Loose silt with sand, sand with silt, and/or silty sand was encountered by test holes under the embankment in the settled areas.

Test holes in high maintenance sections of the Parks Highway at its intersection with Denali Park Road all showed multiple layers of asphalt (3 layers in TH13-5127) or thin asphalt (1-inch in TH13-5109) and very loose silt in subgrade soils. TH13-5109 intercepted very loose thawed silt beneath the initial 3.6-feet of sand in subgrade. TH13-5127 intercepted loose sandy silt and silty clay in subgrade above frozen, (thaw un-stable) sandy silt with stratified ice (VS) in the bottom of the test hole. Thawing of thaw un-stable frozen soils and/or consolidation of loose subgrade silts is likely the cause for excessive maintenance in this area.

Northern Riley Creek Bridge Alignment (TH13-5114 to TH13-5118) and TH13-5126

The northern Riley Creek Bridge Alignment was drilled predominantly with solid stem augers (with the exception of TH13-5115). Test holes from the northern Riley Creek

Alignment drilling intercepted gravels with sand and silt in the embankment and in the subgrade. These materials were difficult to differentiate from each other. In both cases the material contained a large volume of cobbles and boulders.

Southern Riley Creek Bridge Alignment (TH13-5106, TH13-5107 and TH13-5120 to TH13-5124)

The southern Riley Creek Bridge Alignment was drilled with solid stem augers. Test holes from the southern Riley Creek Bridge Alignment intercepted gravels with silt, sand, and abundant cobbles and boulders in the embankment and subgrade. Embankment material and subgrade material was often difficult to differentiate.

Replacement Riley Creek Bridge Abutments

North (TH13-5113)

- The penetration rod test in the north abutment hit refusal (1,000 blows/minute) abruptly at a depth of 57-feet below the ground surface.

South (TH13-5119)

- The penetration rod test in the south abutment hit refusal (1,000 blows/minute) abruptly at a depth of 66-feet below the ground surface.

Physical Setting

Location

The project area is located on the Parks Highway from milepost 237 to approximately 600-feet north of the Denali Park Road/Parks Highway intersection.

Climate

The project area is in a subarctic climate with long, cold winters and short warm summers. Most annual precipitation falls during the summer months. Winter typically lasts from September to May. Average winter temperatures range from -7.8F to 25F, with extreme cold snaps that can reach -40F and warm periods that can reach 40F. Strong temperature inversions are common along the road alignment with temperatures in topographic highs being 10's of degrees warmer than in topographic lows.

Table 1. Monthly climate summary from Denali Park, Alaska. Period of record: 9/1/1949 to 9/30/2012

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	9.2	16.3	24.8	38.8	53.6	64.2	66.3	61.4	50.7	32.4	17.3	11.2	37.2
Average Min. Temperature (F)	-7.8	-4.1	0.4	15.8	29.9	39.7	43.4	39.9	30.6	14.5	0.9	-5.6	16.5
Average Total Precipitation (in.)	0.68	0.60	0.46	0.37	0.80	2.32	3.14	2.57	1.54	0.92	0.83	0.90	15.12
Average Total SnowFall (in.)	10.3	10.2	7.7	5.1	2.9	0.3	0.0	0.0	4.2	12.3	13.1	13.4	79.5
Average Snow Depth (in.)	17	20	21	17	2	0	0	0	1	3	8	13	8

Percent of possible observations for period of record. Max. Temp.: 94.3% Min. Temp.: 94.4% Precipitation: 95% Snowfall: 95% Snow Depth: 93.2%Source: Western Regional Climate Center, www.wrcc.dri.edu

Laboratory data

Soil samples and test hole conditions were logged in the field using the unified soil classification system. Samples were sealed and transported to the Northern Region Materials Laboratory in Fairbanks. Selected samples were tested in accordance with ASTM/AASHTO methods for a determination of any one or a combination of the following properties:

- Classification (particle size distribution)
- Moisture content
- Atterberg Limits
- Organic content

Table 2. List of tests and standard methods offered by the Northern Region Material Laboratory.

Test Method	AASHTO	ASTM
Index Tests		
Gradation	T27	C136
Minus #200 Gradation	T11	C117
Hydrometer	T88	D422
Liquid Limit	T89	D4318
Plastic Limit	T90	D4318
Moisture Content – Aggregate Soil	T255 T265	C566 D2216
Organic Content (Burn)	T267	
Proctor	T180	D1557
USCS Classification	D2487	
Fine Specific Gravity	T100	D854
Coarse Specific Gravity	T85	D127
Quality Tests		
Degradation	T13	
Los Angeles Abrasion	T96	C131
Sodium Soundness	T104	C88
Nordic Abrasion	ATM 312	

Geology/Seismicity

The north end of the project area is located approximately 19 miles north of the main trace of the Denali Fault. The Denali Fault crosses the Parks Highway at MP 238.5.

The Riley Creek Fault runs beneath the north abutment in the existing Riley Creek Bridge. Offset geologic horizons were intercepted by test holes drilled by Alaska Department of Transportation and PF Statewide Foundations personnel, offsets can be seen in draft bore logs but the final report has not been released at this time.

The Denali Fault is a right lateral strike-slip fault that extends from northwestern British Columbia to central Alaska. The Denali Fault was responsible for a magnitude 7.9 earthquake in 2002 that resulted in a 209 mile long surface rupture that crossed several rivers, glaciers, and roads. The Denali Fault is still active with displacement rates that range from 1 to 35mm/year.

Alluvial, fluvial, and glacial deposits above metamorphic, sedimentary, or plutonic bedrock dominate the surficial geology in the project area. The USGS deaggregation calculator indicates that there is a 10 percent probability of the peak horizontal ground acceleration exceeding 27%g in 50 years with a mean return period of 475 years. Currently (as of 2012), this software accesses a 1996 database. As such, it does not factor subsequent events, including the major earthquake on the Denali Fault in 2002.

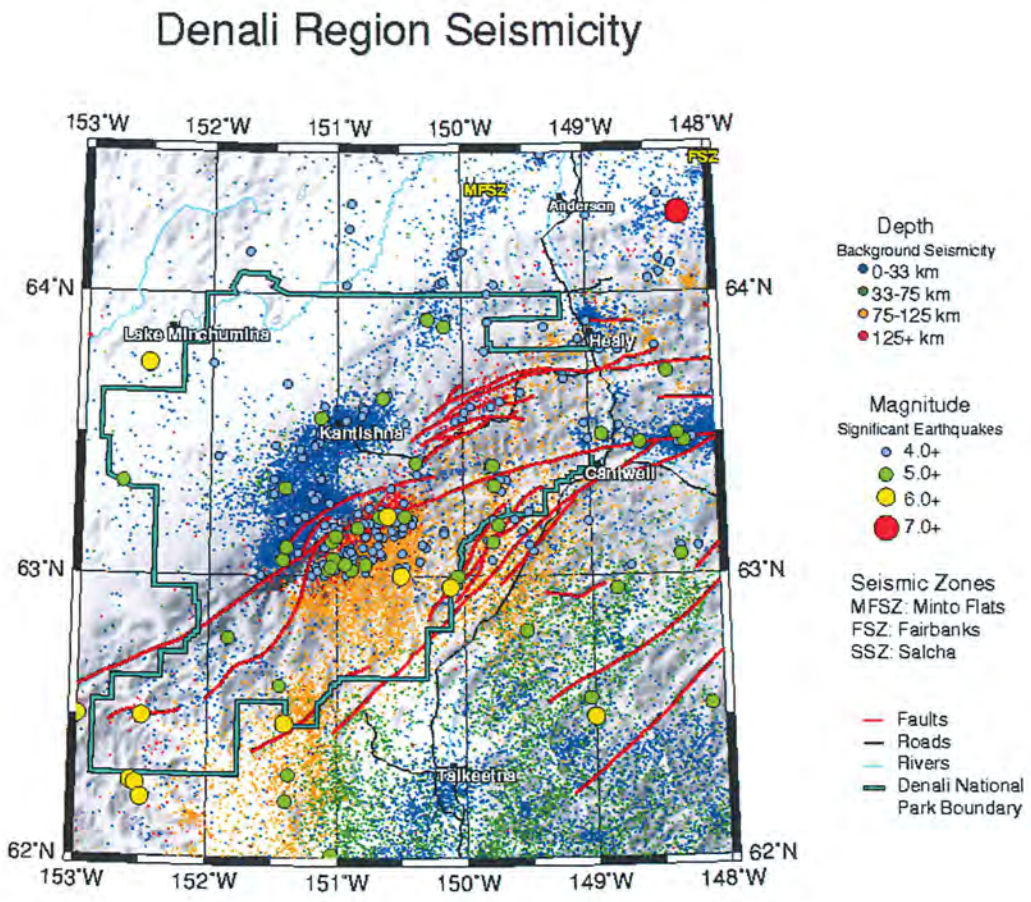


Figure 1. Map of seismicity for interior Alaska. Data displayed is from events that occurred between 1904 and 1-31-2005. Map is available online at http://www.aeic.alaska.edu/maps/interiorseismicitymap.html

Geology

Denali National Park is home to the tallest mountain in North America (Denali or Mount McKinley) which is located in the Alaska Range and has a summit elevation of 20,320 feet. The Denali Fault is located in the Alaska Range approximately 19 miles south of the project area. The Denali fault is North America's largest crustal break with a strike that stretches for 1,300 miles. The Denali Fault is tectonically active with an annual movement of 3/8-inch per year and is responsible for the 2002 earthquake that caused major damage to infrastructure in Alaska including the Parks and Richardson Highways and the Trans-Alaska Pipeline System. Glacial till deposits and alluvial gravels cover the project area and contain little or no permanently frozen soil within the top 30 feet in most places.

Topography

The proposed south alignment and Riley Creek Bridge Replacement runs just east of the existing alignment through a cut in an approximately 50-foot tall (above the alignment) glacial till terrace that tapers out to the north and east as it slopes toward Riley Creek and the Nenana River. Riley Creek marks the topographic low-point in the project area. The northern portion of the proposed alignment runs up a slight hill as the embankment travels up a broad, forested, alluvial terrace.

Permafrost

Generally speaking, permafrost was not encountered while drilling the Riley Creek Bridge abutments, new alignment, or approaches/abutments in the existing Riley Creek Bridge. Test hole TH13-5127 (drilled in the intersection of the Denali Park road and the Parks highway) did intercept frozen soils with 5% visible ice (Vs) at a depth of 12 feet below finished grade in the eastbound turn lane.

Drainage/water table

Riley Creek is a fast moving meandering stream that is typically 50-80 feet wide at the main channel. Riley Creek drains into the Nenana River approximately 600-feet east of the Riley Creek Bridge. Groundwater was only intercepted by the deepest hole in the existing Riley Creek Bridge approach (TH13-5110 intercepted water table 31-feet below finished grade).

Vegetation

Topographic highs are typically thickly covered by a mixture of Black Spruce, Birch, and Alder. Topographic lows are typically covered with thick Black Spruce trees and Alder with tundra. Stream beds are typically lined by Alder Willows and tundra grasses.

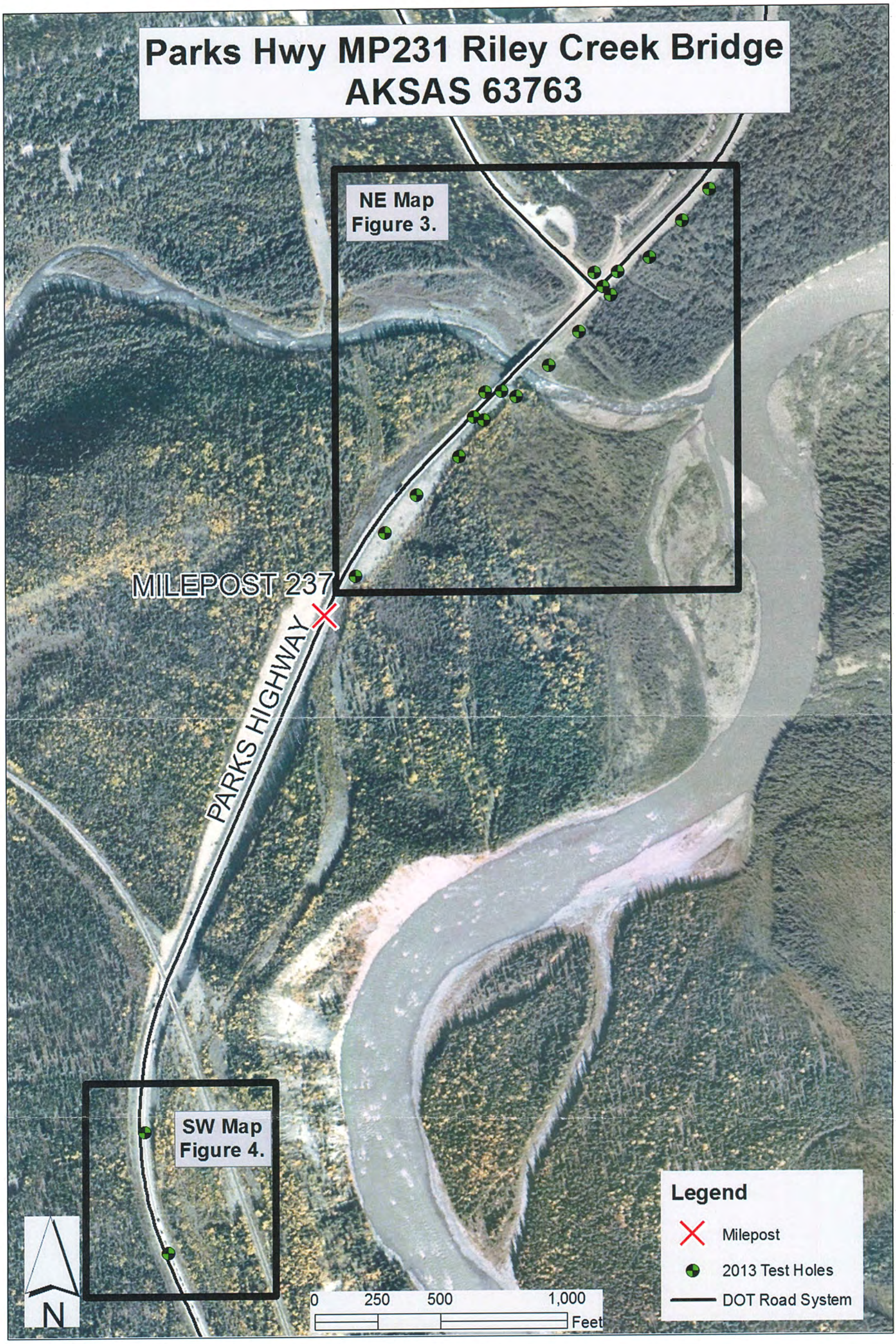


Figure 2. Map of project area.

Figure 3. Detailed map of NE drill pattern.

Figure 4. Map of SW drill pattern.

Field Investigation

NRMS personnel drilled 21 test holes to depths between 14-and 31.5-feet. Drilling was completed between 11-4-13 and 11-22-13. Field personnel included: Engineering Geologist G. Speeter and Drillers S. Parker, G. Nelson, P. Lanigan, and M. Sousa. Test holes were drilled with either a track mounted CME-850 drill rig or truck mounted CME-55 drill rig and 6.5-inch hollow stem or 6-inch solid stem augers. Penetration tests were conducted in 5-foot intervals in all hollow stem auger test holes utilizing 2–inch (ID) 2.5 –inch (OD) California-Modified Style Split-Barrel samplers and a 340-pound auto-hammer. Penetration rod tests were conducted in each abutment for the replacement bridge. Hollow stem augers were used to investigate settling soils in the embankment and subgrade in the approach to the existing Riley Creek Bridge on the south side, settlement near the intersection with the Parks Highway and Denali Park Road, and sporadically through the new alignment. Solid stem augers were used to investigate subsurface conditions along the new alignment. Samples were collected from auger cuttings and split-barrel samplers and submitted to the NRMS Materials Laboratory for gradation analyses, moisture content, and organic content analysis.

Site and Subsurface Conditions

South Approach to Riley Creek Bridge (TH13-5110 to TH13-5112)

The Parks Highway shows significant settlement at its approach to the south Riley Creek Bridge Abutment. Test holes were drilled with hollow-stem augers and SPT tests in 5-foot intervals to collect in-situ soil density information for settlement assessment. Test holes in the settled approach intercepted the following generalized soil profile:

- 1 to 2-feet of asphalt, usually in 2 layers;
- 21 to 27-feet of loose to medium-dense poorly-or well-graded gravel with sand, silt, cobbles, and boulders;
- At least 7 to 7.5-feet of loose sandy silt;
- Underlain by wet, medium dense, poorly-graded sand with silt.

TH13-5110 was the deepest test hole and the only test hole to intercept a water table. TH13-5110 intercepted ground water 31-feet below finished grade.

No frozen soil was encountered while drilling the south approach to the Riley Creek Bridge.

Abundant cobbles and boulders made drilling difficult. Blow counts from SPT tests were likely inflated due to cobble interference with samplers.

Laboratory data

Laboratory analyses of samples collected from drilling in the south approach of the existing Riley Creek Bridge are summarized below:

- One of 4 samples collected for gradation in the embankment met standard highways materials gradation standards for Selected Materials Type A.
- Two of 4 samples collected for gradation in the embankment met standard highways materials gradation standards for Selected Materials Type B.

- One of 4 samples collected for gradation in the embankment met standard highways materials gradation standards for Selected Materials Type C.

Table 3. Laboratory data from drilling in the south approach to the existing Riley Creek Bridge. (Number of determinations is listed in parenthesis)

Site	% Gravel (+#4)	% Sand (-#4, +#200)	% Fines (-#200)	USCS Classification	LA Abrasion	Degradation	%Moisture	Organic	Max density / %Opt. moisture	Liquid Limit / Plastic Index
RCB South Approach	Fill/Glacial Till/Alluvium									
	41-65 (5)	20.8-44.7 (5)	4.8-11.3 (5)	GW, GP-GM (1),(1)	-	-	3.1-5.5 (5)	0.8-3.5 (10)	-	NV/NP (5)
	Deeper silt and sand deposits									
	0-1 (3)	0-12.3 (3)	86.7-94 (3)	-	-	-	19.6-22.5 (3)	1.8-2.3 (3)	-	19-23/NP-5 (3)

Denali Park Road/ Parks Highway Intersection (TH13-5108, TH13-5109, and TH13-5127)

Noticeable settlement has occurred at the intersection of Denali Park Road and the Parks Highway. NRMS drilled three hollow-stem auger test holes with SPT tests in 5-foot intervals to collect in-situ soil density information for settlement assessment. TH13-5108 was drilled where settlement appeared to be at an end to provide basis for comparison. TH13-5109 and TH13-5127 were drilled where settlement was most obvious. These test holes intercepted the following generalized soil profiles:

TH13-5108

- 0.3-foot thick asphalt layer;
- 1.2-feet of crushed poorly-graded gravel with sand and silt (fill)
- 7.5-feet of dense well-graded gravel with sand, silt, cobbles and boulders (fill?)
- 5-feet of loose to medium dense well-graded gravel with sand, silt, cobbles, and boulders.

TH13-5109 and TH13-5127

- 0.1 to 1.5-feet of asphalt (3-layers in TH13-5127);
- 0 to 11.9-feet dense well-graded gravel with sand, silt, and cobbles (fill);
- 8.5 to 11-feet of loose silt with sand, sandy silty, poorly-graded sand with silt, or silty sand;
- 0 to 2-feet of soft to stiff silty clay;
- 0 to 4 feet of sandy silt.

Only TH13-5127 (drilled in the lowest area) intercepted clay and frozen soil.

TH13-5127 intercepted frozen soil with 5% visible Vs (thaw unstable ice) from 12 to 16 feet below finished grade.

Laboratory data

Laboratory analyses of samples collected from drilling in the Denali Park Road Intersection are summarized below:

- Three of 3 samples collected for gradation in the embankment met standard highways materials gradation standards for Selected Materials Type B.

Table 4. Laboratory data from drilling in the Denali Park Road intersection. (Number of determinations is listed in parenthesis)

Site	% Gravel (+#4)	% Sand (-#4, +#200)	% Fines (-#200)	USCS Classification	LA Abrasion	Degradation	%Moisture	Organic	Max density / %Opt. moisture	Liquid Limit / Plastic Index
Denali Park Road Intersection	Fill/Glacial Till/Alluvium									
	34-50 (5)	40.4-51.3 (5)	6.3-14.1 (5)	GW-GM, SM (1), (1)	-	-	1.2-13.1 (5)	1.2-1.7 (5)	-	NV/NP (5)
	Deeper silt and sand deposits									
	0 (3)	4.8-1.8 (3)	95.2-98.2 (3)	-	-	-	19.0-27.2 (3)	1.2-2.0 (3)	-	19-NV/NP (3)

Northern Riley Creek Bridge Alignment (TH13-5114 to TH13-5118 and TH13-5126)

The northern Riley Creek Bridge Alignment was drilled predominantly with solid stem augers (with the exception of TH13-5115 which was drilled with hollow stem because it was located adjacent the Denali Park Road intersection). Test holes from the northern Riley Creek Bridge Alignment intercepted the following generalized soil profile:

- 0 to 1-foot thick lichen/organic mat;
- 3 to 9.5-feet of loose well-or poorly-graded gravels with sand, silt, cobbles, and boulders. Up to 50% cobbles in this interval;
- 1 to 3.5-feet of loose poorly-graded sand with silt;
- Underlain by (in most test holes) cobbles and boulders with silt and gravel or poorly-or well-graded gravel with sand silt, cobbles and boulders.
- Underlain by (only TH13-5114 drilled deep enough to intercept this soil) stiff silty clay with sand.

The deepest test hole, TH13-5114, intercepted silty clay at 17-feet. The majority of other test holes were cut short due to refusal/broken steel complications from hard cobbles and boulders. It is possible that this clay layer is present beneath the other test holes as well.

TH13-5114 intercepted 0.5-feet of seasonal frost (Nbn) just below the surface.

Laboratory data

Laboratory analyses of samples collected from drilling in the northern Riley Creek Bridge Alignment are summarized below:

- One of 10 samples collected for gradation in the embankment met standard highways materials gradation standards for Selected Materials Type A.
- Five of 10 samples collected for gradation in the embankment met standard highways materials gradation standards for Selected Materials Type B.
- Four of 10 samples collected for gradation in the embankment met standard highways materials gradation standards for Selected Materials Type C.

Table 5. Laboratory data from drilling in the northern Riley Creek Bridge Alignment. (Number of determinations is listed in parenthesis)

Site	% Gravel (+#4)	% Sand (-#4, +#200)	% Fines (-#200)	USCS Classification	LA Abrasion	Degradation	%Moisture	Organic	Max density / %Opt. moisture	Liquid Limit / Plastic Index
Northern Alignment	Fill/Glacial Till/Alluvium									
	25-80 (10)	16.4-59.9 (10)	3.6-16.6 (10)	GP-GM, SP-SM, GW, GW-GM (3), (1), (1), (2)	-	-	2.6-3.7 (4)	1.2-2.0 (4)	-	NV/NP (9)
	Deeper silt and sand deposits									
	5 (1)	14.2 (1)	80.8 (1)	-	-	-	23.2 (1)	3.2 (1)	-	19-NV/NP (1)

Southern Riley Creek Bridge Alignment (TH13-5106, TH13-5107 and TH13-5120 to TH13-5124)

The northern Riley Creek Bridge Alignment was drilled with solid stem augers. Test holes from the southern Riley Creek Bridge Alignment intercepted the following generalized soil profile:

- 0 to 0.3-feet of asphalt;
- 0 to 1.75-feet poorly-graded gravel with silt, and sand or silty sand with gravel. Crushed material found only in test holes with asphalt;
- Underlain by poorly-or well-graded gravel with silt, cobbles and boulders. This layer has an intermediate layer of silty sand with gravel in some cases that was never observed to be greater than 2-feet thick.

Seasonal frost was observed in TH13-5120, TH13-5121, TH13-5122, and TH13-5124. The seasonal frost layers observed did not extend to depths greater than 1-foot below the ground surface and were composed of Nbn.

Laboratory data

Laboratory analyses of samples collected from drilling in the southern Riley Creek Bridge Alignment are summarized below:

- Six of 8 samples collected for gradation in the embankment met standard highways materials gradation standards for Selected Materials Type A.
- Two of 8 samples collected for gradation in the embankment met standard highways materials gradation standards for Selected Materials Type B.

Table 6. Laboratory data from drilling in the southern Riley Creek Bridge Alignment. (Number of determinations is listed in parenthesis)

Site	% Gravel (+#4)	% Sand (-#4, +#200)	% Fines (-#200)	USCS Classification	LA Abrasion	Degradation	%Moisture	Organic	Max density / %Opt. moisture	Liquid Limit / Plastic Index
Southern Alignment	Fill/Glacial Till/Alluvium									
	57-87 (9)	10.5-37.5 (9)	2.5-6.5 (9)	GW, GW-GM, GP, GP-GM (3), (2), (2), (2)	-	-	1.7-2.0 (2)	0.8 (2)	-	NV/NP (9)

Replacement Riley Creek Bridge Abutments

North (TH13-5113)

- The penetration rod test in the north abutment hit refusal (1,000 blows/minute) abruptly at a depth of 57-feet below the ground surface.

South (TH13-5119)

- The penetration rod test in the north abutment hit refusal (1,000 blows/minute) abruptly at a depth of 66-feet below the ground surface.

Expected Physical Site Conditions

- Expect to find frozen ground, either seasonal or perennially frozen, anywhere at the site, at any time of the year.
- Boulders and/or cobbles should be anticipated in the glacial and fluvial deposits.
- Expect water table elevations to fluctuate from than those shown in this report. The water table generally fluctuates with changing river levels and precipitation.

Comments and Recommendations

- Test holes in high maintenance section of the Parks Highway at its intersection with Denali Park Road all showed multiple layers of asphalt (3 layers in TH13-5127) or thin asphalt (1-inch in TH13-5109) and very loose silt in subgrade soils. TH13-5109

intercepted very loose thawed silt beneath the initial 3.6-feet of sand in subgrade. TH13-5127 intercepted loose sandy silt and silty clay in subgrade above frozen, thaw un-stable sandy silt in the bottom of the test hole. Thawing of thaw un-stable frozen soils and/or consolidation of loose subgrade silts is likely the cause for excessive maintenance in this area.

- Test holes drilled in the south approach to the existing Riley Creek Bridge (TH13-5110 through 13-5112) intercepted loose silt and/or soft silty clay at the base of the embankment at depths that ranged from 22.5 to 23-feet below the existing finished grade. Loose well-graded gravels with sand and silt were also observed in the lower portion of the embankment. Consolidation of subgrade soils and loss of lateral confinement at the base of the existing abutment is likely the cause of excessive settlement in this interval. The embankment has eroded away from the north abutment and possibly the south abutment which could have caused settlement.
- As noted in the Geology section of this report, Riley Creek Bridge is approximately 19-miles south of the Denali Fault which is an active fault that shows approximately 3/8-ich of slip per year and is the source of the 2002 earthquake that was responsible for major damage to infrastructure throughout Alaska. The Riley Creek Fault also runs through the project area and, based on previous drill logs and surface geomorphology, appears to run directly beneath the north abutment in the existing Riley Creek Bridge. The project's close proximity to the major active Denali Fault and smaller but probably at least Holocene active Riley Creek Fault merits careful design consideration. At minimum, designers should keep the bridge on one side of the Riley Creek Fault if budget and geometric constraints allow.
- Fill material placed in the Parks Highway Embankment is very similar to the native soil the embankment sits on. There appeared to be a slight density contrast between the in-situ density of the embankment fill (higher density) and the native material (looser). In many cases this distinction was evidenced only by drill reaction. It was very difficult to accurately pinpoint the native/fill transition in most of the test holes drilled in this project area.

References

Alaska Department of Transportation and Public Facilities. 2003, Alaska Field Rock Classification and Structural Mapping Guide: State of Alaska, ADOT&PF Geotechnical Procedures Manual, 31 p.

Eberhart-Phillips, Donna, et al. "The 2002 Denali fault earthquake, Alaska: A large magnitude, slip-partitioned event." *Science* 300.5622 (2003): 1113-1118.

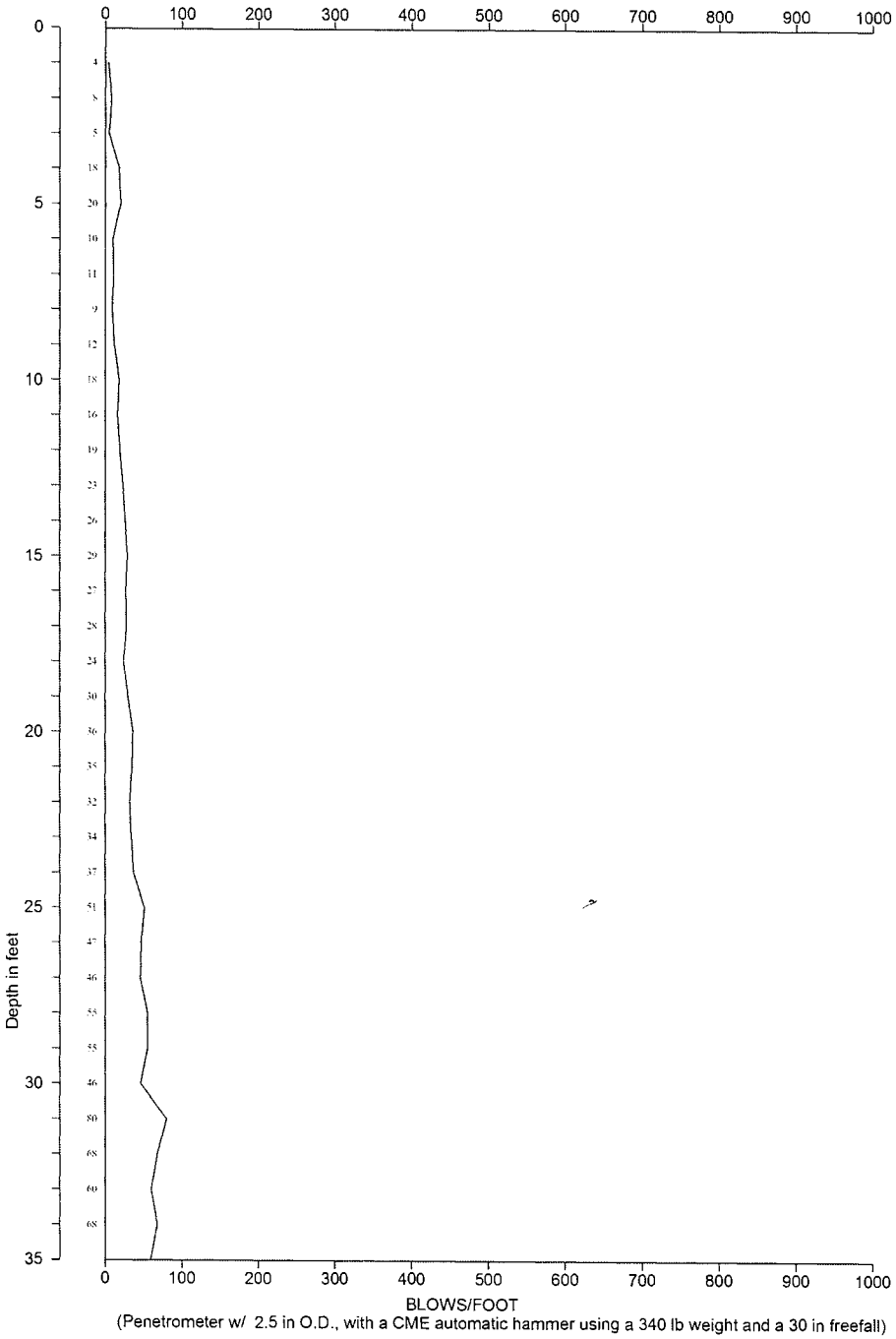
Matmon, Ari, et al. "Denali fault slip rates and Holocene–late Pleistocene kinematics of central Alaska." *Geology* 34.8 (2006): 645-648.

Appendix A-Test Hole Logs

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
PENETROMETER REPORT

PENETROMETER 13-5113
Elevation:
Date: 11/10/13
Lat / Long: 63.727624N / -148.887385W

PROJECT NAME:
AKSAS NUMBER: 63763
SAMPLED BY: G. SPEETER
STATION / OFFSET: 2859+35 / 25R



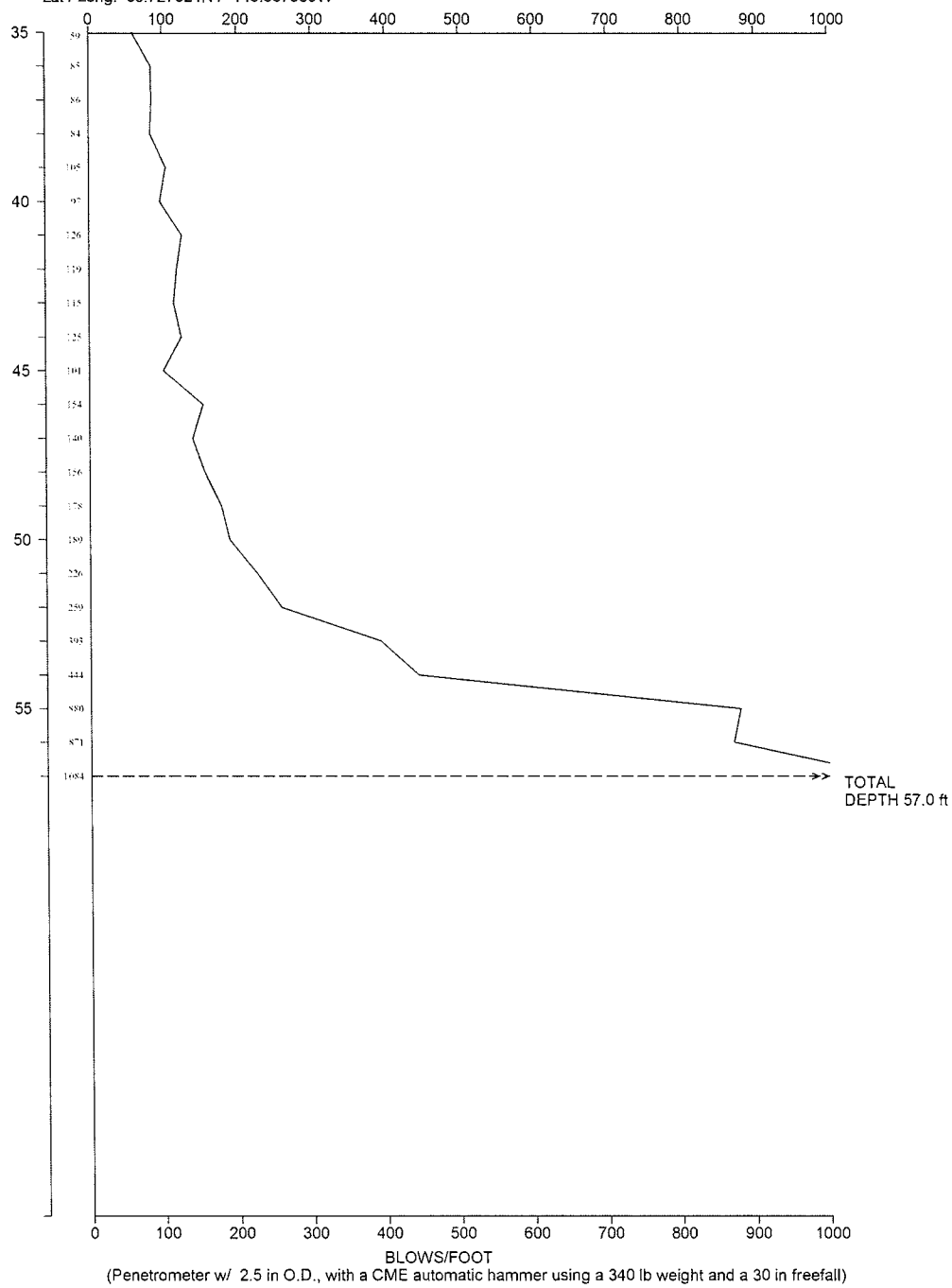
(Penetrometer w/ 2.5 in O.D., with a CME automatic hammer using a 340 lb weight and a 30 in freefall)

NOTES:
BODR=Based on drill reaction

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
PENETROMETER REPORT

PENETROMETER 13-5113
Elevation:
Date: 11/10/13
Lat / Long: 63.727624N / -148.887385W

PROJECT NAME:
AKSAS NUMBER: 63763
SAMPLED BY: G. SPEETER
STATION / OFFSET: 2859+35 / 25R



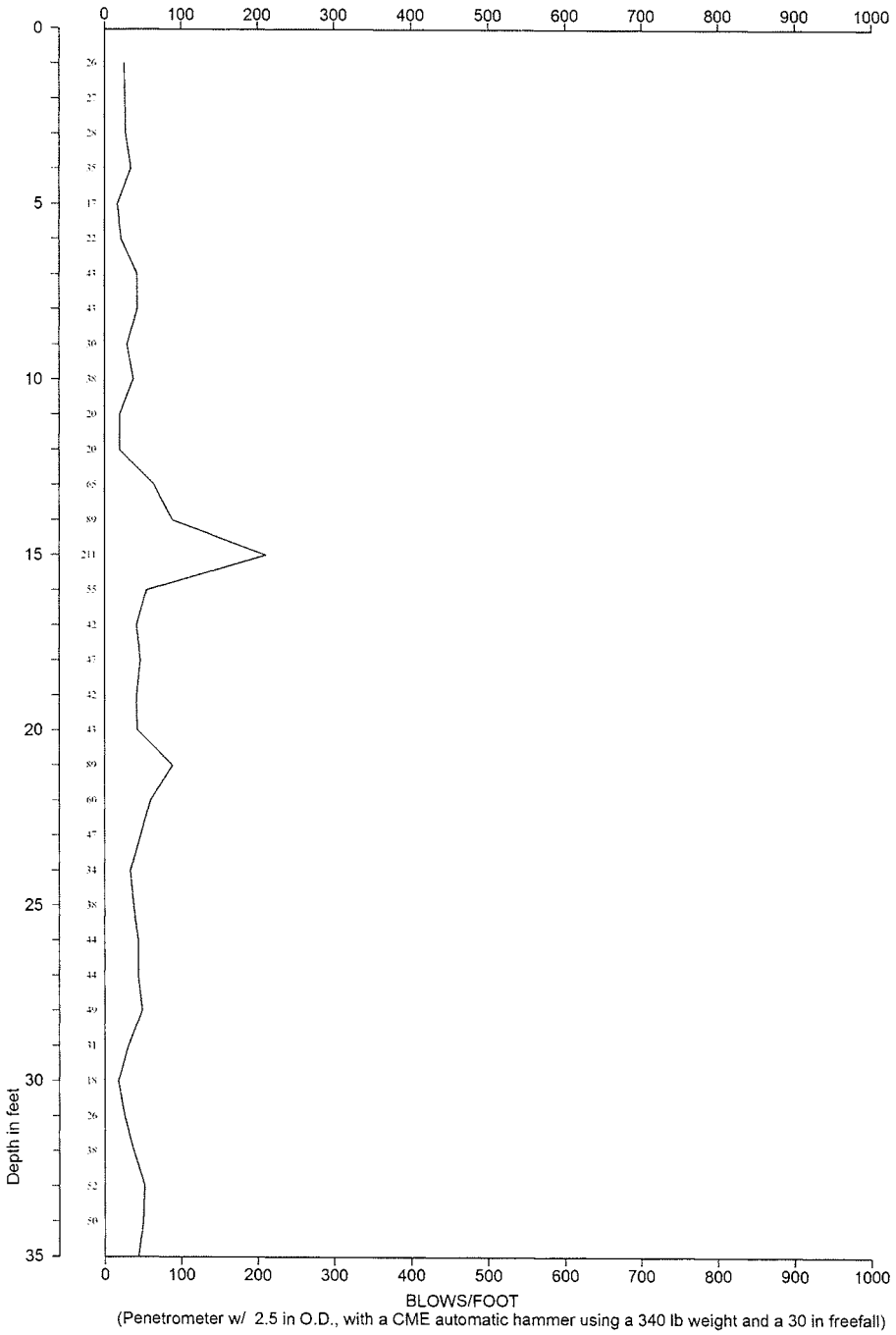
(Penetrometer w/ 2.5 in O.D., with a CME automatic hammer using a 340 lb weight and a 30 in freefall)

NOTES:
BODR=Based on drill reaction

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
PENETROMETER REPORT

PENETROMETER 13-5119
Elevation:
Date: 11/15/13
Lat / Long: 63.72727N / -148.88815W

PROJECT NAME:
AKSAS NUMBER: 63763
SAMPLED BY: G. SPEETER
STATION / OFFSET: 2857+72 / 25R



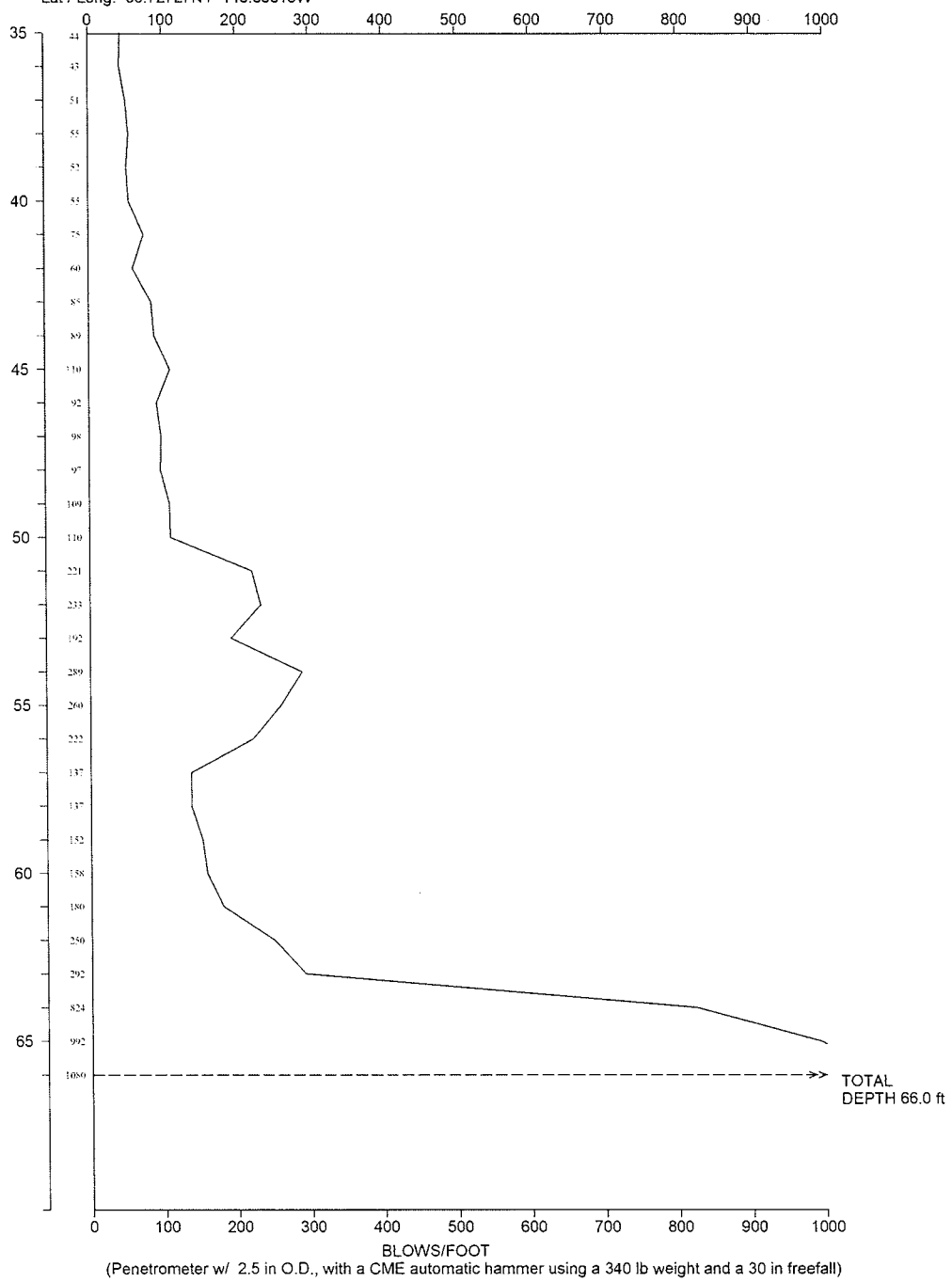
BLOWS/FOOT
(Penetrometer w/ 2.5 in O.D., with a CME automatic hammer using a 340 lb weight and a 30 in freefall)

NOTES:
BODR=Based on drill reaction

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
PENETROMETER REPORT

PENETROMETER 13-5119
Elevation:
Date: 11/15/13
Lat / Long: 63.72727N / -148.88815W

PROJECT NAME:
AKSAS NUMBER: 63763
SAMPLED BY: G. SPEETER
STATION / OFFSET: 2857+72 / 25R



(Penetrometer w/ 2.5 in O.D., with a CME automatic hammer using a 340 lb weight and a 30 in freefall)

NOTES:
BODR=Based on drill reaction

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5106
Project Number	AKSAS 63763	Total Depth	21 feet
Field Geologist	G. SPEETER	Material Site	S. Riley Creek Alignment	Dates Drilled	11/4/2013 - 11/4/2013
Field Crew	P. Lanigan S. Parker	Equipment Type		Station, Offset	2824+14, 15R
		Weather		Latitude, Longitude	N63.71915°, W148.89648°
TH Finalized By	G. SPEETER	Vegetation		Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
S. Riley Creek Alignment

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	13-5946						Bk ASPHALT (fill) 2-inch
	2									Bn Poorly-graded GRAVEL w/ Silt & Sand (fill) dry to moist, crushed
	4									Bn Well-graded GRAVEL w/ Sand (fill?) w/ Cobbles and Boulders dry to moist, dense BODR
	6									Bn Well-graded GRAVEL w/ Sand (fill?) w/ Cobbles and Boulders dry to moist, loose BODR
	9									SAMPLE 13-5946 (6.0-9.5): GW, 3.8% -200, NM 1.7%, ORG 0.8%, NV, NP
	10									Bn Poorly-graded SAND w/ Gravel dry to moist
	11									Bn Well-graded GRAVEL w/ Sand w/ Cobbles and Boulders dry to moist, med-dense BODR
	21									BOH

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR AKDOT PRECON USCS 06 28 07.GDT 4/8/14

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5107
Project Number	AKSAS 63763	Total Depth	17 feet
Field Geologist	G. SPEETER	Material Site	S. Riley Creek Alignment	Dates Drilled	11/4/2013 - 11/4/2013
Field Crew	P. Lanigan S. Parker	Equipment Type		Station, Offset	1819+14, 8R
		Weather		Latitude, Longitude	N63.71785°, W148.89578°
TH Finalized By	G. SPEETER	Vegetation		Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

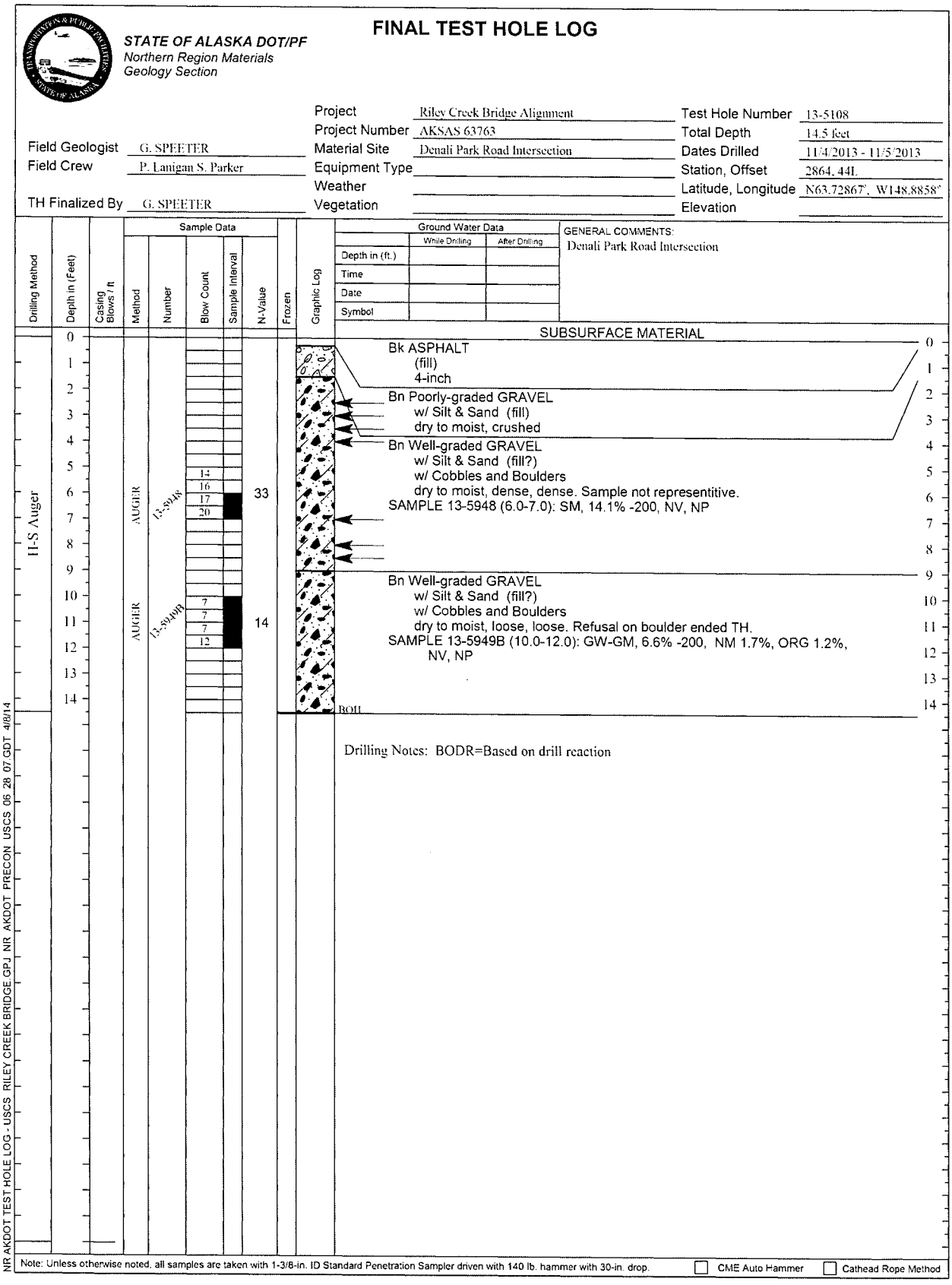
GENERAL COMMENTS:
S. Riley Creek Alignment

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Bk ASPHALT (fill) 3-inch
	1									
	2									Bn Poorly-graded GRAVEL w/ Silt & Sand (fill) dry to moist, crushed
	3									
	4									Bn Well-graded GRAVEL w/ Silt & Sand (fill?) w/ Cobbles and Boulders dry to moist, dense BODR
	5									
	6									
	7		AUGER	13-5947						Bn Well-graded GRAVEL w/ Silt & Sand (fill?) w/ Cobbles and Boulders dry to moist, loose BODR
	8									
	9									SAMPLE 13-5947 (5.0-10.0): GW-GM, 5.5% -200, NV, NP
	10									
	11									
	12									
	13									
	14									
	15									
	16									
	17									BOH

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 4/8/14



FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5108
Project Number	AKSAS 63763	Total Depth	14.5 feet
Material Site	Denali Park Road Intersection	Dates Drilled	11/4/2013 - 11/5/2013
Equipment Type		Station, Offset	2864, 44L
Weather		Latitude, Longitude	N63.72867°, W148.8858°
Vegetation		Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Lanigan S. Parker		
TH Finalized By	G. SPEETER		

Ground Water Data

	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Denali Park Road Intersection

Depth (ft)	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
0								Bk ASPHALT (fill) 4-inch
1								
2								Bn Poorly-graded GRAVEL w/ Silt & Sand (fill) dry to moist, crushed
3								
4								Bn Well-graded GRAVEL w/ Silt & Sand (fill?) w/ Cobbles and Boulders dry to moist, dense, dense. Sample not representitive.
5								
6	AUGER	13-5948	14 16 17 20		33			SAMPLE 13-5948 (6.0-7.0): SM, 14.1% -200, NV, NP
7								
8								
9								
10								Bn Well-graded GRAVEL w/ Silt & Sand (fill?) w/ Cobbles and Boulders dry to moist, loose, loose. Refusal on boulder ended TH.
11	AUGER	13-5949B	7 7 7 12		14			SAMPLE 13-5949B (10.0-12.0): GW-GM, 6.6% -200, NM 1.7%, ORG 1.2%, NV, NP
12								
13								
14								BOH

Drilling Method: H-S Auger

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR AKDOT PRECON USCS 06 28 07.GDT 4/8/14

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5109
Project Number	AKSAS 63763	Total Depth	22 feet
Material Site	Denali Park Road Intersection	Dates Drilled	11/7/2013 - 11/7/2013
Equipment Type		Station, Offset	2863+8, 48L
Weather		Latitude, Longitude	N63.72851°, W148.88615°
Vegetation		Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Lanigan S. Parker		
TH Finalized By	G. SPEETER		

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Denali Park Road Intersection

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log
11-S Auger	0–22		AUGER	13-5949A					
			SPT	13-5950	5, 11, 11, 13		22		
					8, 9, 5, 4		14		
			SPT	13-5982	1, 2, 2, 3		4		
			SPT	13-5983	1, 2, 3, 2		5		

SUBSURFACE MATERIAL

0 Bk ASPHALT
(fill)
1-inch

Bn Well-graded GRAVEL
w/ Silt & Sand (fill?)
w/ Cobbles and Boulders
dry to moist, medium dense, dense BODR
SAMPLE 13-5949A (0.5-3.0): GW-GM, 8.6% -200, NM 2.2%, ORG 1.3%, NV, NP
SAMPLE 13-5950 (5.0-7.0): GW-GM, 6.3% -200, NM 2.4%, ORG 1.6%, NV, NP

11 Bn Poorly-graded SAND
w/ Silt
moist to wet, loose, fine grained.

14 Gy SILT
w/ Sand
wet, very loose
SAMPLE 13-5982 (15.0-17.0): ML, 98.2% -200, NM 27.2%, ORG 2.0%, NV, NP

19 Gy SILT
w/ Sand
wet, very loose, less sand
SAMPLE 13-5983 (20.0-22.0): ML, 95.2% -200, NM 23.2%, ORG 2.1%, LL 24, PI 3

22 BOH

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR_AKDOT_PRECON_USCS 06 28 07.GDT 4/8/14

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5110
Project Number	AKSAS 63763	Total Depth	31.5 feet
Field Geologist	G. SPEETER	Material Site	Riley Creek Bridge Approach	Dates Drilled	11/8/2013 - 11/8/2013
Field Crew	P. Lanigan S. Parker	Equipment Type		Station, Offset	2857+37, 40L
		Weather		Latitude, Longitude	N63.72733°, W148.88851°
TH Finalized By	G. SPEETER	Vegetation		Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)	31.0	
Time		
Date		
Symbol	▼	

GENERAL COMMENTS:
Riley Creek Bridge Approach

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
	0									Bk ASPHALT (fill) 4-inch
	1									
	2									Bk ASPHALT (fill) Old. Softer.
	3									
	4									Bn Well-graded GRAVEL w/ Sand (fill?) w/ Cobbles and Boulders dry to moist, medium dense, dense BODR
	5		SPT		3, 5, 9, 7		14			
	6									
	7									SAMPLE 13-5985 (6.5-11.0): GW, 4.8% -200, NM 3.1%, ORG 0.8%, NV, NP
	8									
	9		AUGER	13-5985						
	10				6, 5, 5, 3		10			
	11									
	12									
	13									
	14									SAMPLE 13-5986 (14.0-16.0): GP-GM, 7.2% -200, NM 3.4%, ORG 1.6%, NV, NP
	15		AUGER	13-5986	9, 7, 8, 13		15			
	16									
	17									
	18									
	19									
	20		SPT		8, 9, 9, 9		18			
	21									
	22									
	23									Gy Silty CLAY moist, soft, 4.9C
	24									SAMPLE 13-5988 (24.0-26.0): CL-ML, 94.1% -200, NM 21.5%, ORG 2.0%, LL 23, PI 5
	25		SPT	13-5988	1, 3, 4, 4		7			
	26									
	27									
	28									
	29									SAMPLE 13-5989 (29.0-31.0):
	30		SPT	13-5989	1, 6, 7, 8		13			Bn Poorly-graded SAND w/ Silt wet, medium dense
S-S Auger	31								BOH	

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR AKDOT PRECON USCS 06 28 07.GDT 4/8/14

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5111
Project Number	AKSAS 63763	Total Depth	30 feet
Field Geologist	G. SPEETER	Material Site	Riley Creek Bridge Approach	Dates Drilled	11/8/2013 - 11/9/2013
Field Crew	P. Lanigan S. Parker	Equipment Type		Station, Offset	2856+94, 80L
		Weather		Latitude, Longitude	N63.72731°, W148.88891°
TH Finalized By	G. SPEETER	Vegetation		Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Riley Creek Bridge Approach

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
	0									Bk ASPHALT (fill) 6-inch
	1									
	2									Bk ASPHALT (fill) Old. Softer.
	3									
	4				10					Bn Well-graded GRAVEL w/ Silt & Sand (fill?) w/ Cobbles and Boulders dry to moist, medium dense, dense BODR
	5		SPT	13-5990	18		38			
	6				20					SAMPLE 13-5990 (5.0-6.0): NM 2.8%, ORG 1.0%
	7				23					
	8									
	9				9					SAMPLE 13-5991 (9.0-11.0): NM 1.9%
	10		SPT	13-5991	11		18			
	11				7					
	12				8					
	13									
	14				14					SAMPLE 13-5992 (14.0-16.0): GW-GM, 8.8% -200, NM 4.2%, ORG 1.6%, NV, NP
	15		SPT	13-5992	17		32			
	16				15					
	17				14					
	18									
	19									
	20									
	21									
	22									
	23									Gy Sandy SILT (fill?) moist, loose, 4.9C
	24				1					
	25		SPT	13-5993	3		7			SAMPLE 13-5993 (24.0-26.0): ML, 86.7% -200, NM 22.5%, ORG 2.3%, LL 23, PI 3
	26				4					
	27				4					
	28									
	29				1					SAMPLE 13-5994 (28.0-30.0): ML, 89.2% -200, NM 19.6%, ORG 1.8%, LL 19, NP
	30		SPT	13-5994	2		6			
					4					
					6					BOH

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

11-S Auger

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR AKDOT PRECON USCS 06 28 07.GDT 4/8/14

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5112
Project Number	AKSAS 63763	Total Depth	26 feet
Field Geologist	G. SPEETER	Material Site	Riley Creek Bridge Approach	Dates Drilled	11/9/2013 - 11/9/2013
Field Crew	P. Lanigan S. Parker	Equipment Type		Station, Offset	2855+91, 45L
		Weather		Latitude, Longitude	N63.72704°, W148.88917°
TH Finalized By	G. SPEETER	Vegetation		Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Riley Creek Bridge Approach

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log
11-S Auger	0–26		AUGER	13-5995	7				
			AUGER	13-5997	X				
			SPT	13-5996	6, 9, 10, 4		19		
			SPT	13-5998	6, 13, 13, 14		26		
			SPT	13-5999	5, 8, 13, 15		21		

SUBSURFACE MATERIAL

Bk ASPHALT
(fill)
6-inch

Bn Poorly-graded GRAVEL
w/ Silt & Sand (fill?)
w/ Cobbles and Boulders
dry to moist, dense BODR
SAMPLE 13-5997 (2.0-9.0): GP-GM, 7.2% -200, NV, NP
SAMPLE 13-5995 (4.0-4.5): NM 3.5%, ORG 1.0%

SAMPLE 13-5996 (9.0-11.0): NM 2.3%, ORG 1.1%

Bn Well-graded GRAVEL
w/ Silt & Sand (fill?)
w/ Cobbles and Boulders
dry to moist, loose BODR. 13-5999 gradation not representative.
SAMPLE 13-5998 (14.0-16.0): NM 2.3%, ORG 1.5%

SAMPLE 13-5999 (19.0-21.0): SP-SM, 11.3% -200, NM 5.5%, ORG 1.7%, NV, NP

Bedd

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR_AKDOT_PRECON USCS 06 28 07.GDT 4/8/14

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5114
Project Number	AKSAS 63763	Total Depth	22 feet
Field Geologist	G. SPEETER	Material Site	N. Riley Creek Alignment	Dates Drilled	11/11/2013 - 11/11/2013
Field Crew	P. Lanigan S. Parker	Equipment Type		Station, Offset	2861+13, 13R
		Weather		Latitude, Longitude	N63.728°, W148.88668°
TH Finalized By	G. SPEETER	Vegetation		Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

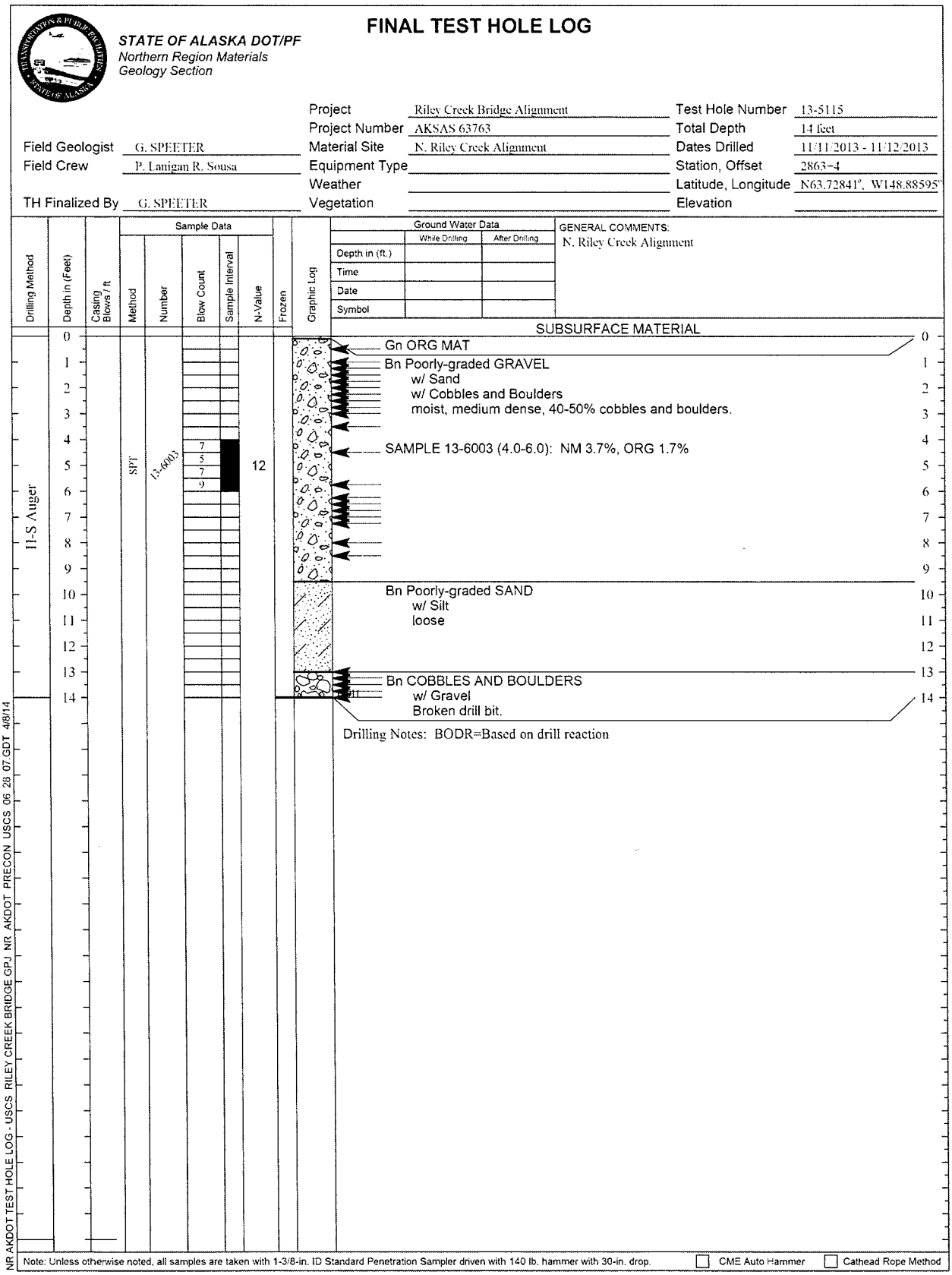
GENERAL COMMENTS:
N. Riley Creek Alignment

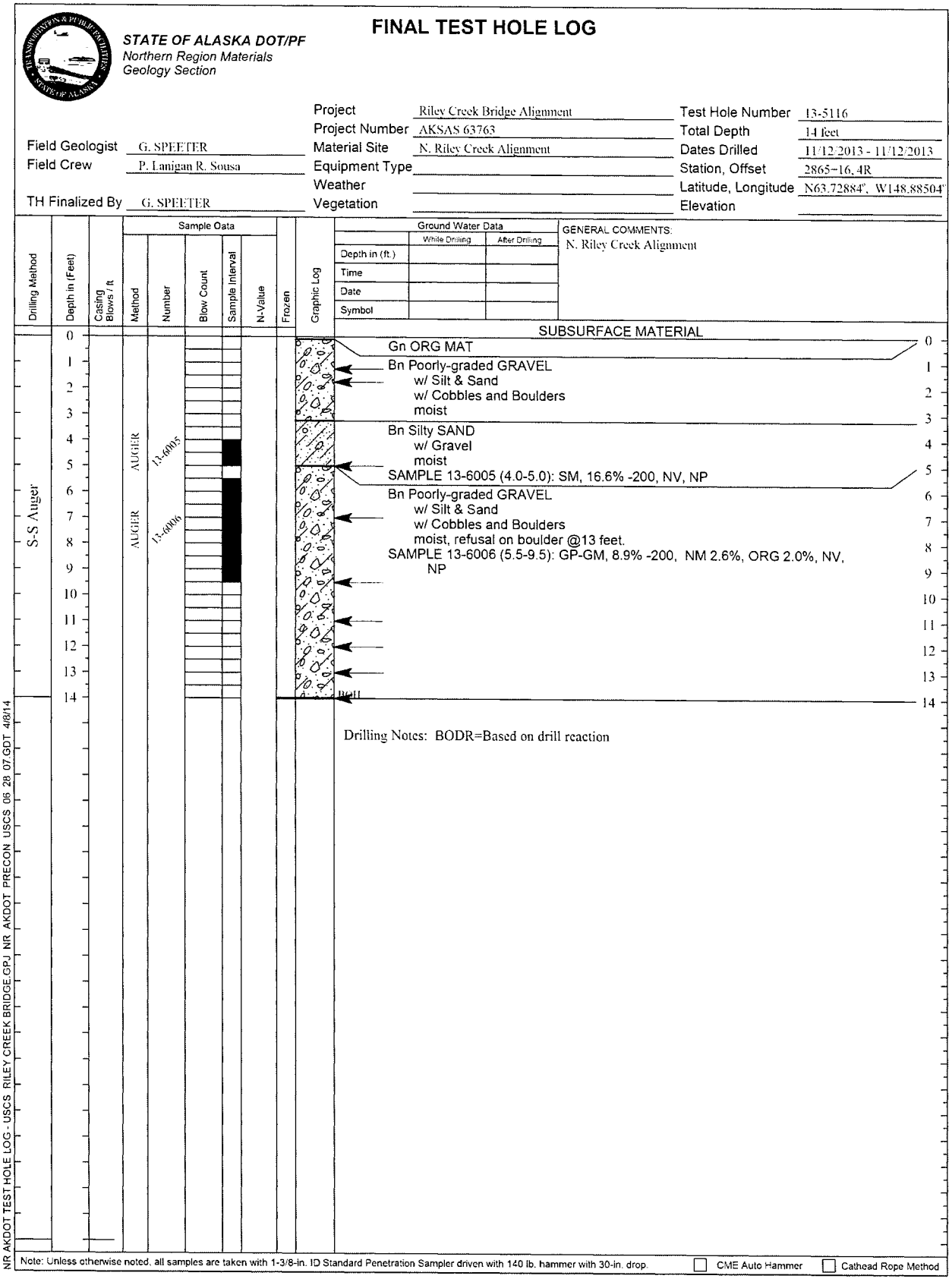
Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Bn Well-graded GRAVEL w/ Silt & Sand (fill?) w/ Cobbles and Boulders moist, Dense BODR
	1									
	2									
	3									
	4									SAMPLE 13-6001 (4.0-10.0): GW-GM, 6% -200, NV, NP
	5									
	6		AUGER	13-6001						
	7									
	8									
	9									Bn Poorly-graded SAND w/ Gravel (fill?) w/ Cobbles lose BODR
	10									
	11									
	12									Bn Well-graded GRAVEL w/ Silt & Sand w/ Cobbles and Boulders moist, lose BODR
	13									
	14									
	15									
	16									
	17									Gy SILT w/ Sand wet, Hard BODR. Plastic?
	18		AUGER	13-6002						
	19									SAMPLE 13-6002 (17.0-20.0): ML, 80.8% -200, NM 23.2%, ORG 3.2%, NV, NP
	20									
	21									
	22									BOH

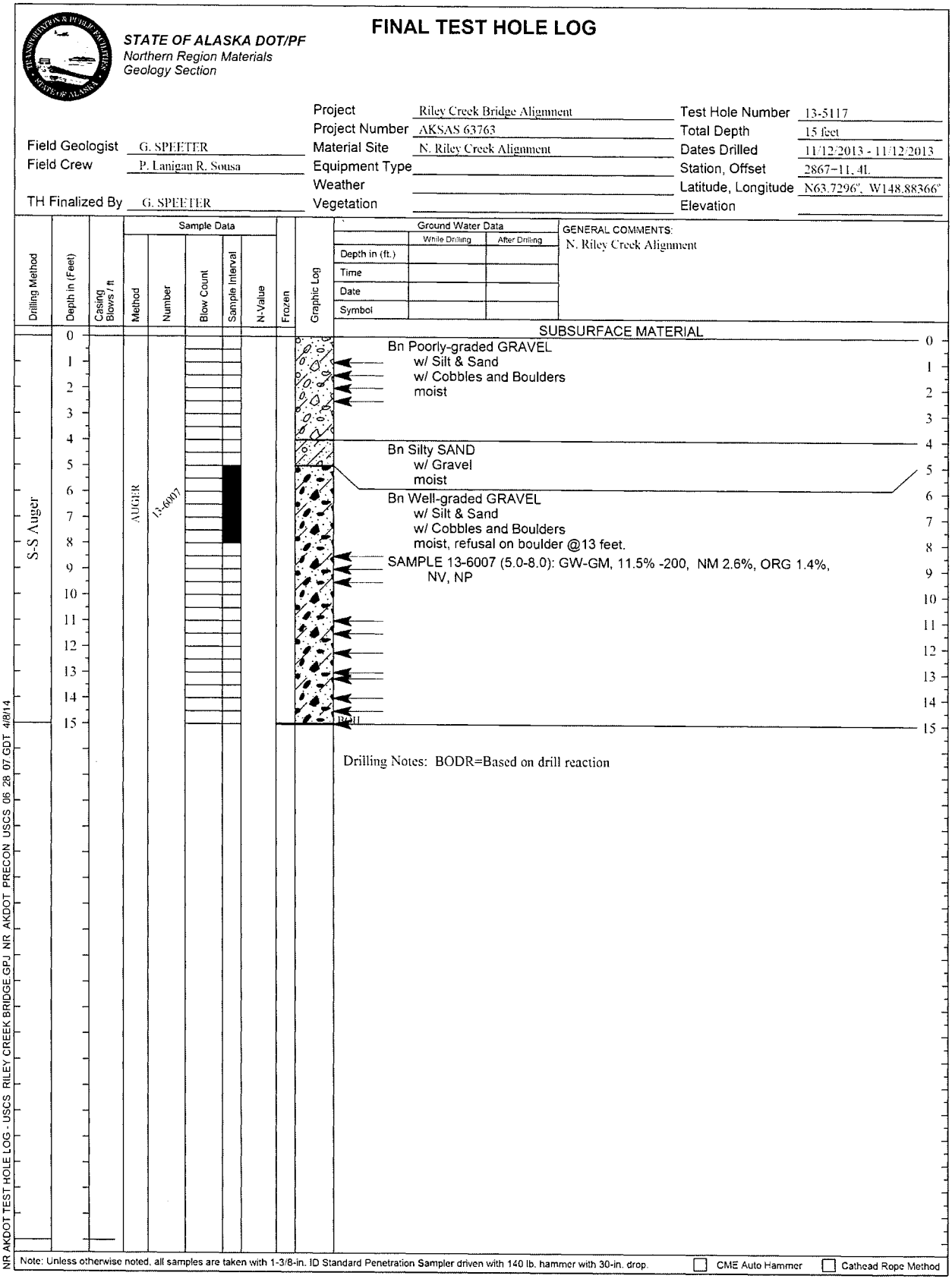
Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 4/8/14


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project: Riley Creek Bridge Alignment
Project Number: AKSAS 63763
Material Site: N. Riley Creek Alignment
Equipment Type:
Weather:
Vegetation:
Test Hole Number: 13-5115
Total Depth: 14 feet
Dates Drilled: 11/11/2013 - 11/12/2013
Station, Offset: 2863+4
Latitude, Longitude: N63.72841°, W148.88595°
Elevation:
Field Geologist: G. SPEETER
Field Crew: P. Lanigan R. Sousa
TH Finalized By: G. SPEETER
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS:
N. Riley Creek Alignment
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
Gn ORG MAT
Bn Poorly-graded GRAVEL
w/ Sand
w/ Cobbles and Boulders
moist, medium dense, 40-50% cobbles and boulders.
SAMPLE 13-6003 (4.0-6.0): NM 3.7%, ORG 1.7%
SPT
13-6003
7
5
7
9
12
H-S Auger
Bn Poorly-graded SAND
w/ Silt
loose
Bn COBBLES AND BOULDERS
w/ Gravel
Broken drill bit.
Drilling Notes: BODR=Based on drill reaction
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 4/8/14


STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
FINAL TEST HOLE LOG
Project Riley Creek Bridge Alignment
Project Number AKSAS 63763
Material Site N. Riley Creek Alignment
Equipment Type
Weather
Vegetation
Test Hole Number 13-5116
Total Depth 14 feet
Dates Drilled 11/12/2013 - 11/12/2013
Station, Offset 2865+16, 4R
Latitude, Longitude N63.72884°, W148.88504°
Elevation
Field Geologist G. SPEETER
Field Crew P. Lanigan R. Sousa
TH Finalized By G. SPEETER
Sample Data
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS:
N. Riley Creek Alignment
Drilling Method
Depth in (Feet)
Casing Blows / ft
Method
Number
Blow Count
Sample Interval
N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
13-6005
AUGER
13-6006
Gn ORG MAT
Bn Poorly-graded GRAVEL
w/ Silt & Sand
w/ Cobbles and Boulders
moist
Bn Silty SAND
w/ Gravel
moist
SAMPLE 13-6005 (4.0-5.0): SM, 16.6% -200, NV, NP
Bn Poorly-graded GRAVEL
w/ Silt & Sand
w/ Cobbles and Boulders
moist, refusal on boulder @13 feet.
SAMPLE 13-6006 (5.5-9.5): GP-GM, 8.9% -200, NM 2.6%, ORG 2.0%, NV, NP
Drilling Notes: BODR=Based on drill reaction
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR AKDOT PRECON USCS 06 28 07.GDT 4/8/14



FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5117
Project Number	AKSAS 63763	Total Depth	15 feet
Material Site	N. Riley Creek Alignment	Dates Drilled	11/12/2013 - 11/12/2013
Equipment Type		Station, Offset	2867+11, 4L
Weather		Latitude, Longitude	N63.7296°, W148.88366°
Vegetation		Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Lanigan R. Sousa		
TH Finalized By	G. SPEETER		

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
N. Riley Creek Alignment

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log
S-S Auger	0–15		AUGER	13-6007					

SUBSURFACE MATERIAL

0 – Bn Poorly-graded GRAVEL
w/ Silt & Sand
w/ Cobbles and Boulders
moist

4 – Bn Silty SAND
w/ Gravel
moist

5 – Bn Well-graded GRAVEL
w/ Silt & Sand
w/ Cobbles and Boulders
moist, refusal on boulder @13 feet.

SAMPLE 13-6007 (5.0-8.0): GW-GM, 11.5% -200, NM 2.6%, ORG 1.4%, NV, NP

15 – BOH

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR AKDOT PRECON USCS 06 28 07.GDT 4/8/14

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5118
Project Number	AKSAS 63763	Total Depth	16 feet
Field Geologist	G. SPEETER	Material Site	N. Riley Creek Alignment	Dates Drilled	11/13/2013 - 11/13/2013
Field Crew	P. Lanigan R. Sousa	Equipment Type		Station, Offset	2868+74, 5R
		Weather		Latitude, Longitude	N63.72925°, W148.88428°
TH Finalized By	G. SPEETER	Vegetation		Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
N. Riley Creek Alignment

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Gn ORG MAT
	1		AUGER	13-6008						Bn Poorly-graded GRAVEL w/ Silt & Sand w/ Cobbles and Boulders moist
	2									
	3									
	4									SAMPLE 13-6008 (1.0-6.5): GP-GM, 9.6% -200, NM 2.8%, ORG 1.2%, NV, NP
	5									
	6									
	7									Bn Silty SAND w/ Gravel moist
	8									
	9									
	10									Bn Well-graded GRAVEL w/ Silt & Sand w/ Cobbles and Boulders moist
	11									
	12									
	13									
	14									
	15									
	16									Well

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR_AKDOT_PRECON USCS 06 28 07.GDT 4/8/14

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5120
Project Number	AKSAS 63763	Total Depth	16.5 feet
Field Geologist	G. SPEETER	Material Site	S. Riley Creek Alignment	Dates Drilled	11/16/2013 - 11/16/2013
Field Crew	P. Lanigan R. Sousa	Equipment Type		Station, Offset	2856+1, 13L
		Weather		Latitude, Longitude	N63.72701°, W148.88891°
TH Finalized By	G. SPEETER	Vegetation		Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
S. Riley Creek Alignment

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
	0–6									Bn Well-graded GRAVEL w/ Silt & Sand (fill) w/ Cobbles and Boulders moist, Dense BODR
	7–16									Bn Well-graded GRAVEL w/ Silt & Sand (fill?) w/ Cobbles and Boulders moist, Loose BODR. Broken auger. BOH

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR AKDOT PRECON USCS 06 28 07.GDT 4/8/14

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment			Test Hole Number	13-5121
Project Number	AKSAS 63763			Total Depth	15 feet
Field Geologist	G. SPEETER	Material Site	S. Riley Creek Alignment	Dates Drilled	11/17/2013 - 11/17/2013
Field Crew	P. Lanigan R. Sousa	Equipment Type		Station, Offset	2854+43, 18R
		Weather		Latitude, Longitude	N63.7266°, W148.8895°
TH Finalized By	G. SPEETER	Vegetation		Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
S. Riley Creek Alignment

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log
S-S Auger	0–15		AUGER	13-6009					

SUBSURFACE MATERIAL

0 – Bn Poorly-graded GRAVEL
w/ Silt & Sand
w/ Cobbles and Boulders
moist

3 – Bn Silty SAND
w/ Gravel
moist

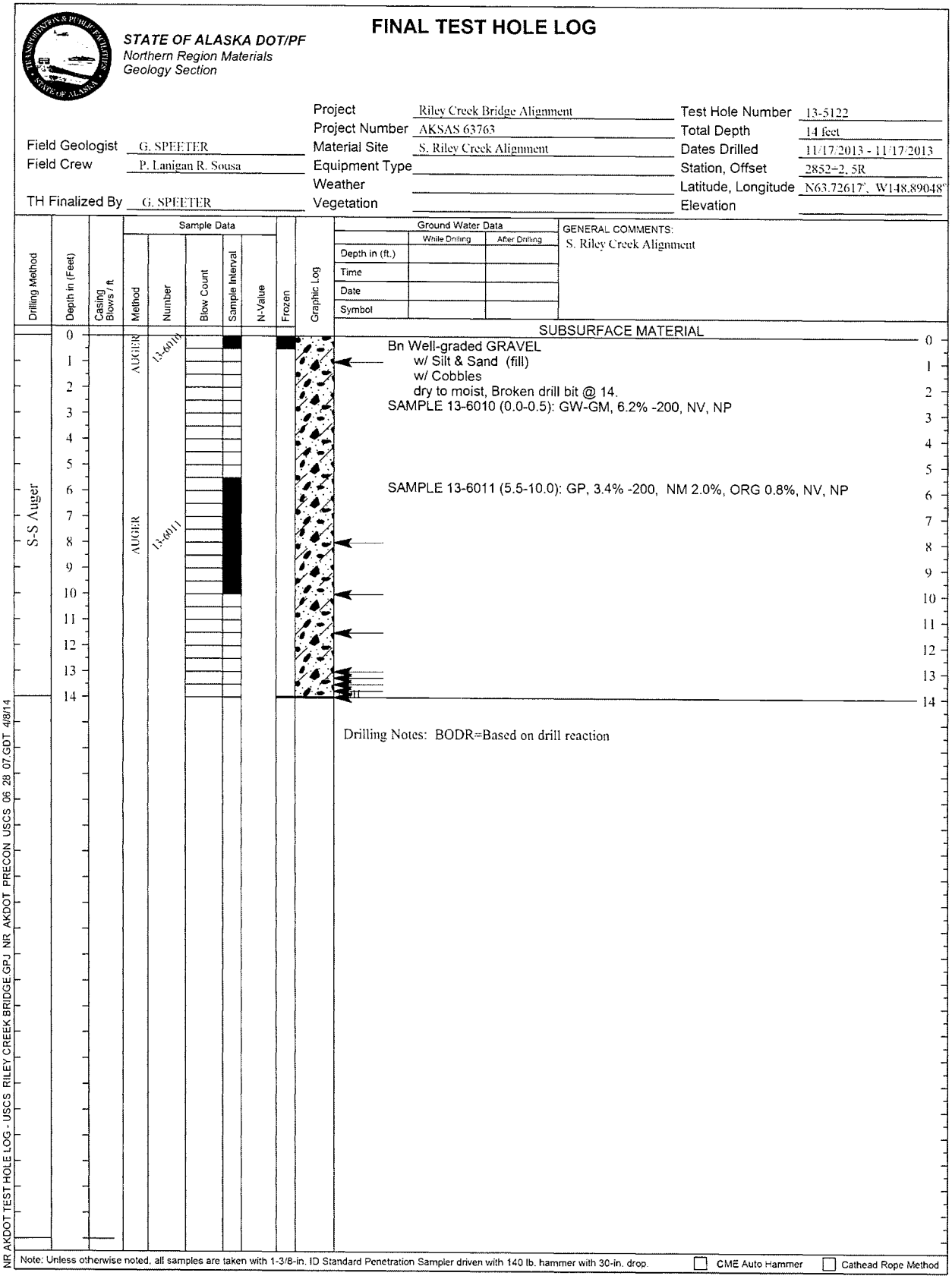
5 – Bn Poorly-graded GRAVEL
w/ Silt & Sand
w/ Cobbles and Boulders
moist
SAMPLE 13-6009 (5.0-9.0): GP-GM, 6.5% -200, NV, NP

15 – BOH

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 4/8/14


STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
FINAL TEST HOLE LOG
Project Riley Creek Bridge Alignment
Project Number AKSAS 63763
Material Site S. Riley Creek Alignment
Equipment Type
Weather
Vegetation
Test Hole Number 13-5122
Total Depth 14 feet
Dates Drilled 11/17/2013 - 11/17/2013
Station, Offset 2852+2, 5R
Latitude, Longitude N63.72617°, W148.89048°
Elevation
Field Geologist G. SPEETER
Field Crew P. Lanigan R. Sousa
TH Finalized By G. SPEETER
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS:
S. Riley Creek Alignment
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
N-Value
Frozen
Graphic Log
S-S Auger
AUGER
13-6010
AUGER
13-6011
SUBSURFACE MATERIAL
Bn Well-graded GRAVEL
w/ Silt & Sand (fill)
w/ Cobbles
dry to moist, Broken drill bit @ 14.
SAMPLE 13-6010 (0.0-0.5): GW-GM, 6.2% -200, NV, NP
SAMPLE 13-6011 (5.5-10.0): GP, 3.4% -200, NM 2.0%, ORG 0.8%, NV, NP
Drilling Notes: BODR=Based on drill reaction
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR_AKDOT_PRECON_USCS_06_28_07.GDT 4/8/14

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

FINAL TEST HOLE LOG

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5123
Project Number	AKSAS 63763	Total Depth	20 feet
Material Site	S. Riley Creek Alignment	Dates Drilled	11/17/2013 - 11/17/2013
Equipment Type		Station, Offset	2850+2, 10R
Weather		Latitude, Longitude	N63.72574°, W148.89123°
Vegetation		Elevation	
Field Geologist	G. SPEETER		
Field Crew	P. Lanigan R. Sousa		
TH Finalized By	G. SPEETER		

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

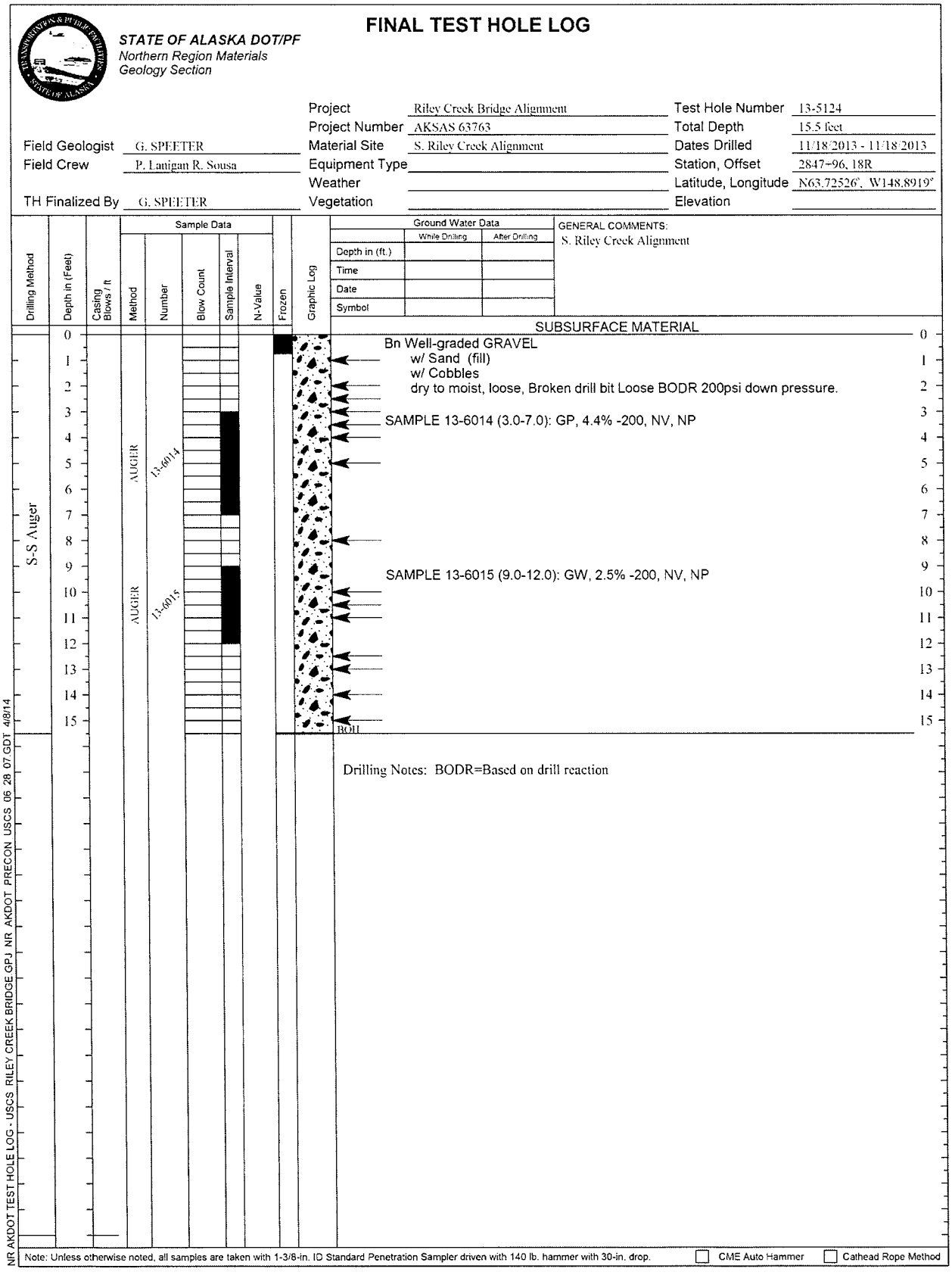
GENERAL COMMENTS:
S. Riley Creek Alignment

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0		AUGER	13-6012						Bn Well-graded GRAVEL
	1									w/ Silt & Sand (fill)
	2									w/ Cobbles
	3									dry to moist, Estimate 30% cobbles. Mixed cuttings starting at 16.
	4									SAMPLE 13-6012 (1.5-5.5): GP-GM, 5.3% -200, NV, NP
	5									
	6									SAMPLE 13-6013 (5.5-10.5): GW, 4.2% -200, NV, NP
	7		AUGER	13-6013						
	8									
	9									
	10									
	11									
	12									
	13									
	14									
	15									
	16									
	17									
	18									
	19									
	20									BOH

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR AKDOT PRECON USCS 06 28 07.GDT 4/8/14


FINAL TEST HOLE LOG
STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section
Project Riley Creek Bridge Alignment
Project Number AKSAS 63763
Material Site S. Riley Creek Alignment
Equipment Type
Weather
Vegetation
Test Hole Number 13-5124
Total Depth 15.5 feet
Dates Drilled 11/18/2013 - 11/18/2013
Station, Offset 2847+96, 18R
Latitude, Longitude N63.72526°, W148.8919°
Elevation
Field Geologist G. SPEETER
Field Crew P. Lanigan R. Sousa
TH Finalized By G. SPEETER
Ground Water Data
While Drilling
After Drilling
Depth in (ft.)
Time
Date
Symbol
GENERAL COMMENTS:
S. Riley Creek Alignment
Drilling Method
Depth in (Feet)
Casing Blows / ft
Sample Data
Method
Number
Blow Count
Sample Interval
N-Value
Frozen
Graphic Log
SUBSURFACE MATERIAL
S-S Auger
AUGER
13-6014
AUGER
13-6015
Bn Well-graded GRAVEL
w/ Sand (fill)
w/ Cobbles
dry to moist, loose, Broken drill bit Loose BODR 200psi down pressure.
SAMPLE 13-6014 (3.0-7.0): GP, 4.4% -200, NV, NP
SAMPLE 13-6015 (9.0-12.0): GW, 2.5% -200, NV, NP
BOH
Drilling Notes: BODR=Based on drill reaction
Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop.
CME Auto Hammer
Cathead Rope Method
NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR AKDOT PRECON USCS 06 28 07.GDT 4/8/14

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5126
Project Number	AKSAS 63763	Total Depth	16 feet
Field Geologist	G. SPEETER	Material Site	S. Riley Creek Alignment	Dates Drilled	11/21/2013 - 11/21/2013
Field Crew	P. Lanigan R. Sousa	Equipment Type		Station, Offset	2873+2, 10R
		Weather		Latitude, Longitude	N63.73067°, W148.88262°
TH Finalized By	G. SPEETER	Vegetation		Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
S. Riley Creek Alignment

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL
S-S Auger	0									Bk ASPHALT (fill) 2-inch
	1									
	2		AUGER	13-6022						Bn Silty SAND w/ Gravel (fill) moist, Crushed
	3									
	4									Bn Poorly-graded GRAVEL w/ Silt & Sand (fill) w/ Cobbles moist
	5									
	6									SAMPLE 13-6022 (1.5-5.0): SM, 15.1% -200, NV, NP
	7		AUGER	13-6023						SAMPLE 13-6023 (5.5-9.0): GP-GM, 7.7% -200, NV, NP
	8									
	9									
	10									Bn Poorly-graded SAND w/ Silt moist
	11		AUGER	13-6024						
	12									SAMPLE 13-6024 (10.0-12.0): SP-SM, 9.4% -200, NV, NP
	13									Bn Well-graded GRAVEL w/ Sand w/ Cobbles moist
	14		AUGER	13-6025						
	15									SAMPLE 13-6025 (13.0-16.0): GW, 3.6% -200, NV, NP
	16									BOH

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR_AKDOT PRECON USCS 06 28 07.GDT 4/8/14

FINAL TEST HOLE LOG

STATE OF ALASKA DOT/PF
Northern Region Materials
Geology Section

Project	Riley Creek Bridge Alignment	Test Hole Number	13-5127
Project Number	AKSAS 63763	Total Depth	16 feet
Field Geologist	G. SPEETER	Material Site	Denali Park Road Intersection	Dates Drilled	11/22/2013 - 11/22/2013
Field Crew	P. Lanigan R. Sousa	Equipment Type		Station, Offset	2863+23, 109L
		Weather		Latitude, Longitude	N63.72865°, W148.88637°
TH Finalized By	G. SPEETER	Vegetation		Elevation	

Ground Water Data	While Drilling	After Drilling
Depth in (ft.)		
Time		
Date		
Symbol		

GENERAL COMMENTS:
Denali Park Road Intersection

Drilling Method	Depth in (Feet)	Casing Blows / ft	Sample Data: Method	Number	Blow Count	Sample Interval	N-Value	Frozen	Graphic Log	SUBSURFACE MATERIAL	Depth in (Feet)
	0										0
	1									Bk ASPHALT (fill) 6-inch	1
	2		AUGER	13-6026						Bk ASPHALT (fill) older layer 6-inch	2
	3										3
	4				2					Bk-Bn ASPHALT (fill) chip seal	4
	5		SPT	13-6027A	13		18				5
	6				5					Bn Silty SAND w/ Gravel (fill?) dry to moist, medium dense	6
	7				8					SAMPLE 13-6026 (1.5-3.5): SM, 12.7% -200, NV, NP	7
	8										8
	9									Bn Silty SAND moist, medium dense	9
	10		SPT	13-6027B	2		5			SAMPLE 13-6027A (5.0-6.0): NM 13.1%, ORG 1.7%	10
	11				3					Bn Sandy SILT moist, loose	11
	12				4					SAMPLE 13-6027B (9.0-11.0): ML, 95.2% -200, NM 22.0%, ORG 1.9%, LL 19, NP	12
	13									Gy Silty CLAY moist, firm	13
	14				4						14
	15		SPT	13-6028	9		17			Gy Sandy SILT moist, Vs, 5% visible Vs.	15
	16				8					SAMPLE 13-6028 (14.0-16.0): ML, 96.7% -200, NM 24.4%, ORG 1.2%, NV, NP	16
					5					BOH	

Drilling Notes: BODR=Based on drill reaction

Note: Unless otherwise noted, all samples are taken with 1-3/8-in. ID Standard Penetration Sampler driven with 140 lb. hammer with 30-in. drop. ☐ CME Auto Hammer ☐ Cathead Rope Method

NR AKDOT TEST HOLE LOG - USCS RILEY CREEK BRIDGE.GPJ NR AKDOT PRECON USCS 06 28 07.GDT 4/8/14

Appendix B- Lab Data

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME:	Riley Creek Bridge Alignment
PROJECT NUMBER:	
AKSAS NUMBER:	63763
SAMPLED BY:	G. Speeter
MATERIAL SOURCE:	Riley Creek Bridge

TEST HOLE NUMBER		13-5106	13-5107	13-5108	13-5109	13-5108	13-5109	13-5109
DEPTH (feet)		6.0-9.5	5.0-10.0	6.0-7.0	0.5-3.0	10.0-12.0	5.0-7.0	15.0-17.0
LATITUDE		2824+14	1819+14	2864	2863+8	2864	2863+8	2863+8
LONGITUDE		15R	8R	44L	48L	44L	48L	48L
LAB NUMBER		**13-5946**	**13-5947**	**13-5948**	**13-5949A**	**13-5949B**	**13-5950**	**13-5982**
DATE SAMPLED		4-Nov-13	4-Nov-13	4-Nov-13	7-Nov-13	4-Nov-13	7-Nov-13	7-Nov-13
% Passing	**3"**							
	2"	98						
	1.5"	94	99					
Gravel	**1.0"**	78	88	93	91		81	
	0.75"	67	78	87	84		75	
	0.5"	54	64	83	73	65	65	
	0.375"	46	57	71	66	61	60	
	#4	32	43	64	50	47	48	
	#8	21	31		38			
	#10	20	29		36			
	#16	14	23	42	28	27	26	
	#30	10	16		20			
Sand	**#40**	8	13		17			
	#50	7	10		15			
	#60	7	9		14			100
	#80	6	8		12			99
	#100	5	7	19	11	9	9	99
Silt/Clay	**#200**	3.8	5.5	14.1	8.6	6.6	6.3	98.2
Hydro	**0.02**							
	0.005							
	0.002							
	0.001							
LIQUID LIMIT		NV	NV	NV	NV	NV	NV	NV
PLASTIC INDEX		NP	NP	NP	NP	NP	NP	NP
USCS CLASSIFICATION		GW	GW-GM		GW-GM			
USCS SOIL DESCRIPTION		(WGGr w/Sa)	(WGGr w/Si&Sa)	(WGGr w/SiCl&Sa)	(WGGr w/SiCl&Sa)	(WGGr w/SiCl&Sa)	(WGGr w/SiCl&Sa)	(Si w/Sa)
NATURAL MOISTURE		1.7			2.2	1.7	2.4	27.2
ORGANICS		0.8			1.3	1.2	1.6	2.0
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS								

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Riley Creek Bridge Alignment
PROJECT NUMBER:
AKSAS NUMBER: 63763
SAMPLED BY: G. Speeter
MATERIAL SOURCE: Riley Creek Bridge

TEST HOLE NUMBER		13-5109	13-5110	13-5110	13-5110	13-5111	13-5111	13-5111
DEPTH (feet)		20.0-22.0	6.5-11.0	14.0-16.0	24.0-26.0	5.0-6.0	9.0-11.0	24.0-26.0
LATITUDE		2863+8	2857+37	2857+37	2857+37	2856+94	2856+94	2856+94
LONGITUDE		48L	40L	40L	40L	80L	80L	80L
LAB NUMBER		**13-5983**	**13-5985**	**13-5986**	**13-5988**	**13-5990**	**13-5991**	**13-5993**
DATE SAMPLED		7-Nov-13	8-Nov-13	8-Nov-13	8-Nov-13	8-Nov-13	8-Nov-13	8-Nov-13
% Passing	**3"**							
	2"							
	1.5"		96	90				
Gravel	**1.0"**		89	73				
	0.75"		78	66				
	0.5"		63	60				99
	0.375"		54	56				99
	#4		35	46				99
	#8		24					99
	#10		22					99
	#16	100	16	32				98
	#30	99	12					98
Sand	**#40**	98	10					98
	#50	98	8					98
	#60	97	8					98
	#80	97	7					98
	#100	97	6	11				98
Silt/Clay	**#200**	95.2	4.8	7.2	94.1			86.7
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT		24	NV	NV	23			23
PLASTIC INDEX		3	NP	NP	5			3
USCS CLASSIFICATION			GW					
USCS SOIL DESCRIPTION		(Si w/Sa)	(WGGr w/Sa)	(WGGr w/Sa)	(SiCl)	(WGGr w/Si&Sa)	(WGGr w/Si&Sa)	(Si)
NATURAL MOISTURE		23.2	3.1	3.4	21.5	2.8	1.9	22.5
ORGANICS		2.1	0.8	1.6	2.0	1.0		2.3
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS		sl Org[1]						sl Org[1]

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: WG = Well-graded; PG = Poorly-graded; E = Elastic; L = Lean; F = Fat

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Riley Creek Bridge Alignment
PROJECT NUMBER:
AKSAS NUMBER: 63763
SAMPLED BY: G. Speeter
MATERIAL SOURCE: Riley Creek Bridge

TEST HOLE NUMBER		13-5111	13-5112	13-5112	13-5112	13-5112	13-5114	13-5114
DEPTH (feet)		28.0-30.0	4.0-4.5	9.0-11.0	14.0-16.0	19.0-21.0	4.0-10.0	17.0-20.0
LATITUDE		2856+94	2855+91	2855+91	2855+91	2855+91	2861+13	2861+13
LONGITUDE		80L	45L	45L	45L	45L	13R	13R
LAB NUMBER		**13-5994**	**13-5995**	**13-5996**	**13-5998**	**13-5999**	**13-6001**	**13-6002**
DATE SAMPLED		8-Nov-13	9-Nov-13	9-Nov-13	9-Nov-13	9-Nov-13	11-Nov-13	11-Nov-13
% Passing	**3"**							
	2"						94	
	1.5"						90	
Gravel	**1.0"**					91	79	
	0.75"					89	71	
	0.5"					77	59	
	0.375"					71	50	97
	#4					56	35	95
	#8						27	
	#10						25	
	#16					31	19	90
	#30						13	
Sand	**#40**						11	
	#50						10	
	#60						9	
	#80	100					8	
	#100	99				14	8	83
Silt/Clay	**#200**	89.2				11.3	6.0	80.8
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT		19				NV	NV	NV
PLASTIC INDEX		NP				NP	NP	NP
USCS CLASSIFICATION							GW-GM	
USCS SOIL DESCRIPTION		(Si)	(PGGr w/Si&Sa)	(PGGr w/Si&Sa)	(WGGr w/SiCl&Sa)	(WGGr w/SiCl&Sa)	(WGGr w/Si&Sa)	(Si)
NATURAL MOISTURE		19.6	3.5	2.3	2.3	5.5		23.2
ORGANICS		1.8	1.0	1.1	1.5	1.7		3.2
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS								sl Org[1]

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

USCS Soil Description Abbreviations: W = Well-graded; P = Poorly-graded; E = Elastic; L = Lean; F = Fat

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Riley Creek Bridge Alignment
PROJECT NUMBER: 63763
AKSAS NUMBER:
SAMPLED BY: G. Speeter
MATERIAL SOURCE: Riley Creek Bridge

TEST HOLE NUMBER		13-5115	13-5116	13-5116	13-5117	13-5118	13-5121	13-5122
DEPTH (feet)		4.0-6.0	4.0-5.0	5.5-9.5	5.0-8.0	1.0-6.5	5.0-9.0	0.0-0.5
LATITUDE		2863+4	2865+16	2865+16	2867+11	2868+74	2854+43	2852+2
LONGITUDE		W148.88595°	4R	4R	4L	5R	18R	5R
LAB NUMBER		**13-6003**	**13-6005**	**13-6006**	**13-6007**	**13-6008**	**13-6009**	**13-6010**
DATE SAMPLED		11-Nov-13	12-Nov-13	12-Nov-13	12-Nov-13	13-Nov-13	17-Nov-13	17-Nov-13
% Passing	**3"**							
	2"					95		
	1.5"			97		90		
Gravel	**1.0"**			89	92	84	90	86
	0.75"			84	83	78	79	75
	0.5"		96	73	68	67	54	61
	0.375"		93	64	60	57	41	52
	#4		84	46	46	39	19	37
	#8			33	38	30	14	27
	#10			31	36	28	13	26
	#16		71	26	31	24	12	20
	#30			22	26	19	12	13
Sand	**#40**			19	23	17	11	11
	#50			17	20	15	11	10
	#60			15	19	15	10	9
	#80			13	16	13	10	8
	#100		26	12	15	12	9	8
Silt/Clay	**#200**		16.6	8.9	11.5	9.6	6.5	6.2
Hydro	**0.02**							
	0.005							
	0.002							
	0.001							
LIQUID LIMIT			NV	NV	NV	NV	NV	NV
PLASTIC INDEX			NP	NP	NP	NP	NP	NP
USCS CLASSIFICATION				GP-GM	GW-GM	GP-GM	GP-GM	GW-GM
USCS SOIL DESCRIPTION		(PGGr w/Sa)	(SiSa)	(PGGr w/Si&Sa)		(PGGr w/Si&Sa)	(PGGr w/Si&Sa)	(WGGr w/Si&Sa)
NATURAL MOISTURE		3.7		2.6	2.6	2.8		
ORGANICS		1.7		2.0	1.4	1.2		
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS								

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

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STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME:	Riley Creek Bridge Alignment
PROJECT NUMBER:	
AKSAS NUMBER:	63763
SAMPLED BY:	G. Speeter
MATERIAL SOURCE:	Riley Creek Bridge

TEST HOLE NUMBER		13-5122	13-5123	13-5123	13-5124	13-5124	13-5126	13-5126
DEPTH (feet)		5.5-10.0	1.5-5.5	5.5-10.5	3.0-7.0	9.0-12.0	1.5-5.0	5.5-9.0
LATITUDE		2852+2	2850+2	2850+2	2847+96	2847+96	2873+2	2873+2
LONGITUDE		5R	10R	10R	18R	18R	10R	10R
LAB NUMBER		**13-6011**	**13-6012**	**13-6013**	**13-6014**	**13-6015**	**13-6022**	**13-6023**
DATE SAMPLED		17-Nov-13	17-Nov-13	17-Nov-13	18-Nov-13	18-Nov-13	21-Nov-13	21-Nov-13
% Passing	**3"**			88				
	2"	88	71	81	96	89		93
	1.5"	82	68	78	89	82		88
Gravel	**1.0"**	70	55	66	77	67	96	83
	0.75"	59	46	59	66	54	95	75
	0.5"	42	36	48	51	34	91	61
	0.375"	33	31	42	42	25	88	53
	#4	21	23	30	25	13	75	37
	#8	14	18	23	18	8	59	28
	#10	13	17	22	16	8	56	27
	#16	10	14	16	13	6	44	22
	#30	7	11	11	10	5	34	17
Sand	**#40**	6	9	9	8	4	29	15
	#50	5	8	7	7	4	25	13
	#60	5	8	7	7	4	23	12
	#80	5	7	6	6	3	20	11
	#100	4	7	6	6	3	19	10
Silt/Clay	**#200**	3.4	5.3	4.2	4.4	2.5	15.1	7.7
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT		NV	NV	NV	NV	NV	NV	NV
PLASTIC INDEX		NP	NP	NP	NP	NP	NP	NP
USCS CLASSIFICATION		GP	GP-GM	GW	GP	GW	SM	GP-GM
USCS SOIL DESCRIPTION		(WGGr w/Si&Sa)	(WGGr w/Si&Sa)	(WGGr w/Si&Sa)	(WGGr w/Sa)	(WGGr w/Sa)	(PGGr w/Si&Sa)	(PGGr w/Si&Sa)
NATURAL MOISTURE		2.0						
ORGANICS		0.8						
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS								

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

(Soil descriptions shown in parentheses are based on field determinations.)

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STATE OF ALASKA DEPARTMENT OF TRANSPORTATION
NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME:	Riley Creek Bridge Alignment
PROJECT NUMBER:	
AKSAS NUMBER:	63763
SAMPLED BY:	G. Speeter
MATERIAL SOURCE:	Riley Creek Bridge

TEST HOLE NUMBER		13-5126	13-5126	13-5127	13-5127	13-5127	13-5127	
DEPTH (feet)		10.0-12.0	13.0-16.0	1.5-3.5	5.0-6.0	9.0-11.0	14.0-16.0	
LATITUDE		2873+2	2873+2	2863+23	2863+23	2863+23	2863+23	
LONGITUDE		10R	10R	109L	109L	109L	109L	
LAB NUMBER		**13-6024**	**13-6025**	**13-6026**	**13-6027A**	**13-6027B**	**13-6028**	
DATE SAMPLED		21-Nov-13	21-Nov-13	22-Nov-13	22-Nov-13	22-Nov-13	22-Nov-13	
% Passing	**3"**							
	2"		94					
	1.5"		85					
Gravel	**1.0"**	95	72	99				
	0.75"	92	59	95				
	0.5"	85	42	89				
	0.375"	79	34	82				
	#4	60	20	66				
	#8	42	14	52				
	#10	40	13	50				
	#16	30	10	40				
	#30	21	8	30				
Sand	**#40**	18	7	26				
	#50	16	6	23				
	#60	15	5	21				
	#80	13	5	19				
	#100	12	5	17		100		
Silt/Clay	**#200**	9.4	3.6	12.7		95.2	96.7	
	0.02							
Hydro	**0.005**							
	0.002							
	0.001							
LIQUID LIMIT		NV	NV	NV		19	NV	
PLASTIC INDEX		NP	NP	NP		NP	NP	
USCS CLASSIFICATION		SP-SM	GW	SM				
USCS SOIL DESCRIPTION		(PGSa w/Si)	(WGGr w/Sa)	(SiSa)	(SiSa)	(SaSi)	(SaSi)	
NATURAL MOISTURE					13.1	22.0	24.4	
ORGANICS					1.7	1.9	1.2	
SP. GR. (FINE)								
SP. GR. (COARSE)								
MAX. DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRAD. FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
NORDIC ABRASION								
REMARKS								

GENERAL COMMENTS

Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

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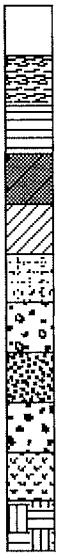
Appendix C- Symbols and Definitions

SYMBOLS AND DEFINITIONS

BASIC MATERIAL SYMBOLS



ASPHALT

PEAT

CLAY (Cl)

ICE

SILT (Si)

POORLY GRADED SAND (Sa)

POORLY GRADED GRAVEL (Gr)

WELL GRADED SAND

WELL GRADED GRAVEL

BEDROCK (Bx), soft(Type)

BEDROCK (Bx), hard(Type)

SOFT OR HARD BEDROCK BASED ON DRILLING RATE

NOTE

MAIN COMPONENT (UPPER CASE ... SOLID LINES)
MINOR COMPONENT (Title Case ... DASHED LINES OR SPARSER PATTERN)

USCS SIZE DEFINITIONS

BOULDERS (Boulders)	12"+
COBBLES (Cobbles)	3" TO 12"
GRAVEL	#4 TO 3"
ANGULAR FRAGMENTS	#10 +
SAND	#200 TO #4
SILT	#200 TO 0.005 mm
CLAY	MINUS 0.005 mm

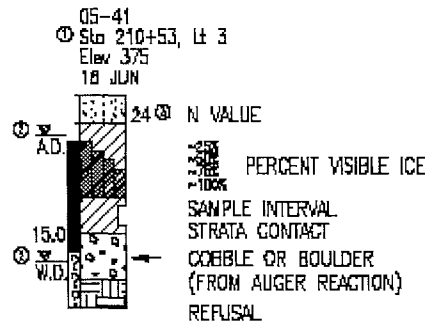
TEST RESULTS

_._%-200	= % PASSING #200 SIEVE
NM _._%	= NATURAL MOISTURE
ORG _._%	= ORGANIC CONTENT
SSc _	= SODIUM SULFATE LOSS(coarse)
SSf _	= SODIUM SULFATE LOSS(fine)
LA _	= LOS ANGELES ABRASION
DEG _	= DEGRADATION
LL _	= LIQUID LIMIT (NV = no value)
PI _	= PLASTIC INDEX (NP = non-plastic)

MISC.

Tr	= TRACE
sl	= SLIGHTLY
hi	= HIGHLY
w/_	= WITH UNSPECIFIED AMOUNT
Xtls	= CRYSTALS
TH	= TEST HOLE
TT	= TEST TRENCH
TP	= TEST PIT

TYPICAL LOG



① Station value may also be on centerline e.g. Sta 210+53, CL or lat-long format e.g. N64.56789°, W145.67890°
② W.D.= WHILE DRILLING, A.D.= AFTER DRILLING
③ "N VALUE" INDICATES STANDARD PENETRATION TEST (1.4" I.D., 2.0" O.D. SAMPLER DRIVEN WITH 140 LB. HAMMER, 30" FREE FALL) AND IS SUM OF 2nd AND 3rd 6" OF PENETRATION.

PLAN VIEW SYMBOLS

POWER AUGER TEST HOLE (TH)
HAND AUGER TEST HOLE (TH)
EXPOSED MATERIAL
PROBE
HAND DUG TEST PIT (TP)
DOZER/BACKHOE TEST TRENCH (TT)
BODY OF WATER
FLOW DIRECTION
WASTE BERM
BANK
SWAMP
TREELINE

SOIL DENSITY/CONSISTENCY DESCRIPTORS

NON-COHESIVE		COHESIVE	
RELATIVE DENSITY	BLOWS/FOOT (N) VALUE	CONSISTENCY	BLOWS/FOOT (N) VALUE
VERY LOOSE	< 4	VERY SOFT	< 2
LOOSE	5-10	SOFT	2-4
MEDIUM DENSE	11-30	FIRM	5-8
DENSE	31-50	STIFF	9-15
VERY DENSE	> 50	VERY STIFF	16-30
		HARD	> 30

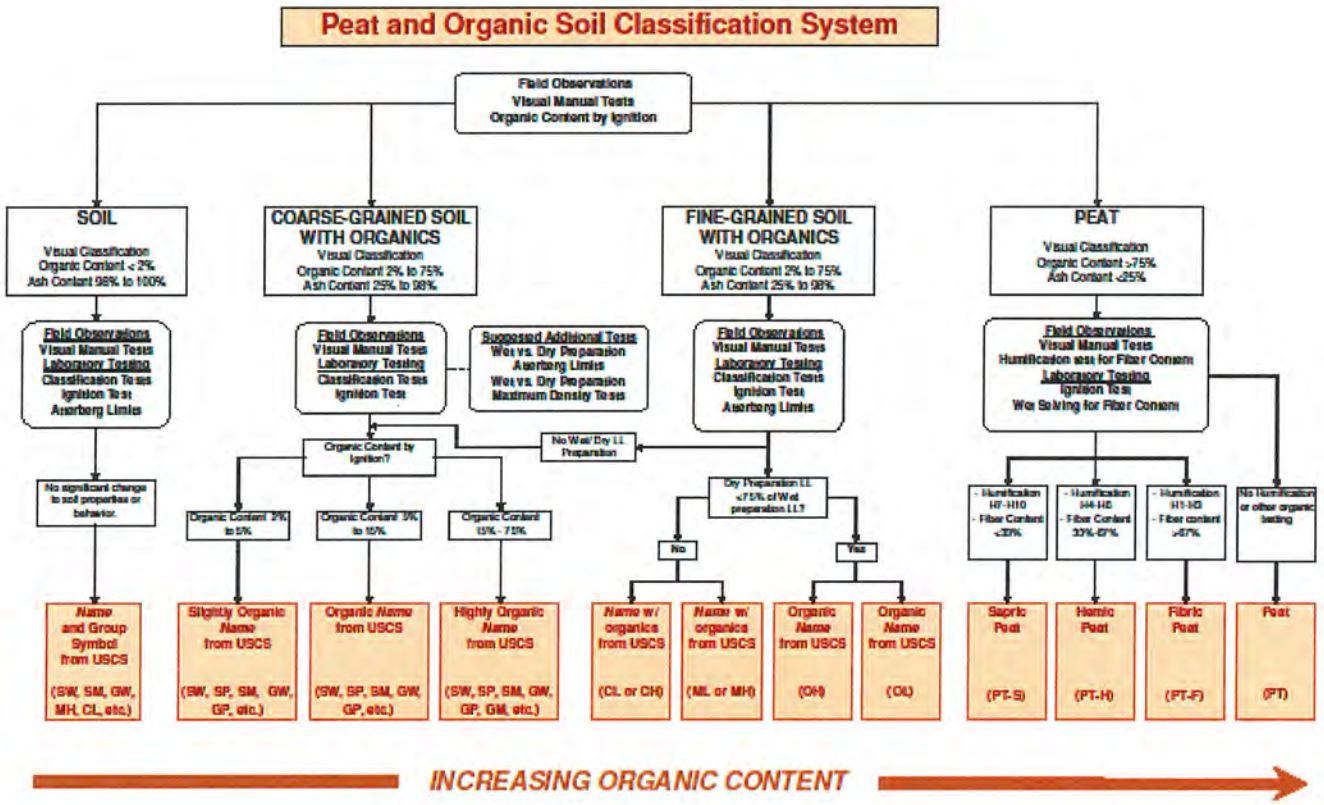
COLOR

Bk = BLACK	Gy = GRAY	Tn = TAN
Bl = BLUE	Or = ORANGE	Wh = WHITE
Bn = BROWN	Rd = RED	Yw = YELLOW
Gn = GREEN		

MOISTURE

dry	= < OPTIMUM*	DUSTY, DRY TO THE TOUCH
moist	~ OPTIMUM*	DAMP, NO VISIBLE WATER
wet	= > OPTIMUM*	VISIBLE FREE WATER

* OPTIMUM MOISTURE FOR MAXIMUM DENSITY


Peat and Organic Soil Classification System
Field Observations
Visual Manual Tests
Organic Content by Ignition
SOIL
Visual Classification
Organic Content < 2%
Ash Content 98% to 100%
COARSE-GRAINED SOIL WITH ORGANICS
Visual Classification
Organic Content 2% to 75%
Ash Content 25% to 98%
FINE-GRAINED SOIL WITH ORGANICS
Visual Classification
Organic Content 2% to 75%
Ash Content 25% to 98%
PEAT
Visual Classification
Organic Content >75%
Ash Content <25%
Field Observations
Visual Manual Tests
Laboratory Testing
Classification Tests
Ignition Test
Atterberg Limits
Field Observations
Visual Manual Tests
Laboratory Testing
Classification Tests
Ignition Test
Suggested Additional Tests
Wet vs. Dry Preparation
Atterberg Limits
Wet vs. Dry Preparation
Maximum Density Tests
Field Observations
Visual Manual Tests
Laboratory Testing
Classification Tests
Ignition Test
Atterberg Limits
Field Observations
Visual Manual Tests
Humification test for Fiber Content
Laboratory Testing
Ignition Test
Wet Sieving for Fiber Content
Organic Content by Ignition?
No Wet/ Dry LL Preparation
Dry Preparation LL <75% of Wet preparation LL?
No significant change to soil properties or behavior.
Organic Content 2% to 5%
Organic Content 5% to 15%
Organic Content 15% - 75%
No
Yes
- Humification H7-H10 - Fiber Content <33%
- Humification H4-H6 - Fiber Content 33%-67%
- Humification H1-H3 - Fiber content >67%
No Humification or other organic testing
Name and Group Symbol from USCS
(SW, SM, GW, MH, CL, etc.)
Slightly Organic Name from USCS
(SW, SP, SM, GW, GP, etc.)
Organic Name from USCS
(SW, SP, SM, GW, GP, etc.)
Highly Organic Name from USCS
(SW, SP, SM, GW, GP, GM, etc.)
Name w/ organics from USCS
(CL or CH)
Name w/ organics from USCS
(ML or MH)
Organic Name from USCS
(OH)
Organic Name from USCS
(OL)
Sapric Peat
(PT-S)
Hemic Peat
(PT-H)
Fibric Peat
(PT-F)
Peat
(PT)
INCREASING ORGANIC CONTENT

DESCRIPTION AND CLASSIFICATION OF FROZEN SOILS

Part I Description of Soil Physical (Independent of Frozen State)	Major Group		Sub-Group		Field Identification (6)	Pertinent Properties of Frozen Materials which may be measured by physical tests to supplement field identification. (7)	Guide for Construction on Soils Subject to Freezing and Thawing	
	Description (2)	Designation (3)	Description (4)	Designation (5)			Thaw Characteristics (8)	Criteria (9)
Part II Description of Frozen Soil	Segregated ice is not visible by eye (b)	N	Poorly Bonded or Friable	Nf	Identify by visual examination. To determine presence of excess ice, use procedure under note (c) below and hand magnifying lens as necessary. For soils not fully saturated, estimate degree of ice saturation: Medium, Low. Note presence of crystals, or of ice coatings around larger particles.	In-Place Temperature Density and Void Ratio a) In Frozen State b) After Thawing in Place Water Content (Total H_2O, including ice) a) Average b) Distribution Strength a) Compressive b) Tensile c) Shear d) Adfreeze Elastic Properties Plastic Properties Thermal Properties Ice Crystal Structure (using optional instruments.) a) Orientation of Axes b) Crystal size c) Crystal shape d) Pattern of Arrangement	Usually Thaw-Stable	The potential intensity of ice segregation in a soil is dependent to a large degree on its void sizes and may be expressed as an empirical function of grain size as follows: Most inorganic soils containing 3 percent or more of grains finer than 0.02 mm in diameter by weight are frost-susceptible. Gravels, well-graded sands and silty sands, especially those approaching the theoretical maximum density curve, which contain 1.5 to 3 percent finer than 0.02 mm by weight without being frost-susceptible. However, their tendency to occur interbedded with other soils usually makes it impractical to consider them separately. Soils classed as frost-susceptible under the above criteria are likely to develop significant ice segregation and frost heave if frozen at normal rates with free water readily available. Soils so frozen will fall into the thaw-unstable category. However, they may also be classed as thaw-stable if frozen with insufficient water to permit ice segregation. Soils classed as non-frost-susceptible ("NFS) under the above criteria usually occur without significant ice segregation and are not exact and may be inadequate for some structure applications; exceptions may also result from minor soil variations. In permafrost areas, ice wedges, pockets, veins, or other ice bodies may be found whose mode of origin is different from that described above. Such ice may be the result of long-time surface expansion and contraction phenomena or may be glacial or other ice which has been buried under a protective earth cover.
			Segregated ice visible by eye (ice 1 inch or less in thickness) (b)	V	Individual ice crystals or inclusions	Vx	For ice phase, record the following as applicable: Location Size Orientation Shape Thickness Spacing Pattern of arrangement Length Hardness) per part III Below Structure) Color) Estimate volume of visible segregated ice present as percent of total sample volume.		Usually Thaw-Unstable	
					Ice coatings on particles	Vc				
					Random or irregularly oriented ice formations	Vr				
					Stratified or distinctly oriented ice formations	Vs				
Part III Description of Substantial Ice Strata	Ice (Greater than 1 inch in thickness)	Ice	Ice with soil inclusions	Ice + Soil Type	Designate material as ICE (d) and use descriptive terms as follows, usually one item from each group, as applicable:	Same as Part II above, as applicable, with special emphasis on Ice Crystal Structure		
			Ice without soil inclusions	Ice	Hardness: Hard (firm, not indicrystals); Soft Structure: Clear; Cloudy; Porous; Candled; Granular; Stratified Color: e.g.: Colorless; Gray; Blue Admixtures: eg.: Contains Thin Silt Inclusions			

DEFINITIONS:

Ice Coatings on Particles are discernible layers of ice found on or below the larger soil particles in a frozen soil mass. They are sometimes associated with hoarfrost crystals, which have grown into voids produced by the freezing action.

Ice Crystal is a very small individual ice particle visible in the face of a soil mass. Crystals may be present alone or in a combination with other ice formations.

Clear Ice is transparent and contains only a moderate number of air bubbles (e)

Cloudy Ice is translucent, but essentially sound and non-pervious.

Porous Ice contains numerous voids, usually interconnected and usually resulting from melting at air bubbles or along crystal interfaces from presence of salt or other materials in the water, or from the freezing of saturated snow. Though porous, the mass retains its structural unity.

Candled Ice is ice which has rotted or otherwise formed into long columnar crystals, very loosely bonded together.

Granular Ice is composed of coarse, more or less equidimensional, ice crystals weakly bonded together.

Ice Lenses are lenticular ice formations in soil occurring essentially parallel to each other, generally normal to the direction of heat loss and commonly in repeated layers.

Ice Segregation is the growth of ice as distinct lenses, layers, veins and masses in soils, commonly but not always oriented normal to direction of heat loss.

Well-bonded signifies that the soil particles are strongly held together by the ice and that the frozen soil possesses relatively high resistance to chipping or breaking.

Poorly-bonded signifies that the soil particles are weakly held together by the ice and that the frozen soil consequently has poor resistance to chipping or breaking.

Friable denotes a condition in which material is easily broken up under light to moderate pressure.

Thaw-Stable frozen soils do not, on thawing, show loss of strength below normal, long-time thawed values nor produce detrimental settlement.

Thaw-Unstable frozen soils show on thawing, significant loss of strength below normal, long-time thawed values and/or significant settlement, as a direct result of the melting of the excess ice in the soil.

Modified from: Linell, K. A. and Kaplar, C. W., 1966, *Description and Classification of Frozen Soils*, Proc. International Conference on Permafrost (1963), Lafayette, IN, U.S. National Academy of Sciences, Publ. 1287, pp 481–487.

NOTES:

(a) When rock is encountered, standard rock classification terminology should be used.

(b) Frozen soils in the N group may on close examination indicate presence of ice within the voids of the material by crystalline reflections or by a sheen on fractured or trimmed surfaces. However, the impression to the unaided eye is that none of the frozen water occupies space in excess of the original voids in the soil. The opposite is true of frozen soils in the V group.

(c) When visual methods may be inadequate, a simple field test to aid evaluation of volume of excess ice can be made by placing some frozen soil in a small jar, allowing it to melt and observing the quantity of supernatant water as a percent of total volume.

(d) Where special forms of ice, such as hoarfrost, can be distinguished, more explicit description should be given.

(e) Observer should be careful to avoid being misled by surface scratches or frost coating on the ice.