STATE OF ALASKA
DEPARTMENT OF HIGHWAYS
FAIRBANKS DISTRICT MATERIALS SECTION
ENGINEERING GEOLOGY BRANCH

FILE COPY

ENGINEERING GEOLOGY & FOUNDATION REPORT

Foundation Report
Nenana River at Park Boundary
Bridge No. 694
Project No. F-052-2(1)
Interior District

PREPARED BY

Engineering Geology Section

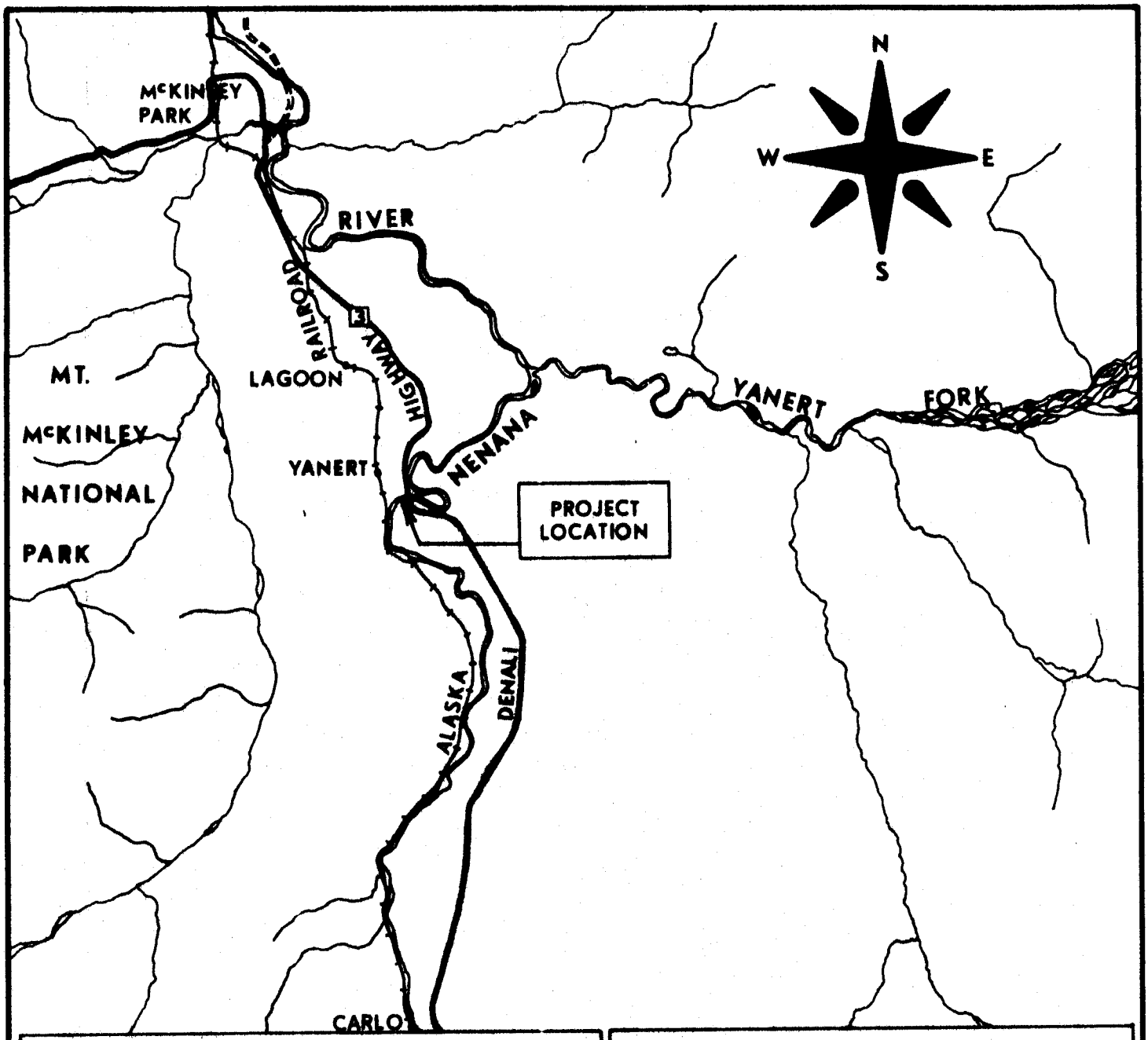
MATERIALS DIVISION

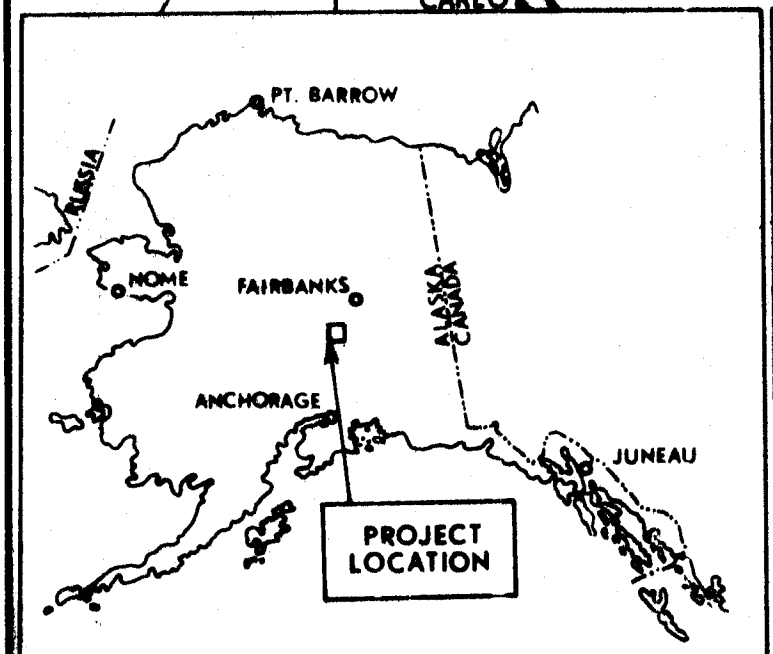
ALASKA DEPARTMENT OF HIGHWAYS

Foundation Report
Nenana River at Park Boundary
Bridge No. 694
Project No. F-052-2(1)
Interior District

Prepared by the
Engineering Geology Section
Alaska Department of Highways
February 1971

Appendix





NENANA RIVER AT PARK BOUNDRY
BRIDGE No. 694
PROJECT No F-052-2(1)

LOCATION MAP

State of Alaska
DEPARTMENT OF HIGHWAYS
ENGINEERING GEOLOGY SECTION
COLLEGE, ALASKA

Scale 1" = 2 miles Date Jan. 1971

Data RPR | Drawn By WL | Approved

I. Introduction

The Alaska Department of Highways proposes the relocation of the Nenana River crossing at the southeast boundary of McKinley Park at Mile 231 on the Anchorage-Fairbanks Highway. The proposed bridge includes two spans of 107 feet and a center span of 140 feet for a total length of approximately 358 feet.

The Engineering Geology Section, Alaska Department of Highways conducted a foundation investigation for the abutments in the summer of 1969 under the supervision of M. E. Grahek. The foundation investigation for the piers was conducted in March 1970 under the supervision of G. E. Utermohle, Jr.

This report describes the methods of investigation and the conditions which existed at the site at the time the investigations were made.

II. Field Studies

Studies conducted at the site consisted of a surface examination and sampling and testing of subsurface materials.

A track-mounted Mobile B-61 rotary drill was used to conduct the subsurface investigation. A total of four borings were accomplished using hollow stem auger or NX casing to prevent caving and water as the circulating medium.

Standard penetration tests were made in all borings. Sampling frequency was determined by the geologist in the field and varied depending on the material encountered. The standard penetration test consisted of driving a standard split tube sampler (1.4 inch I.D. x 2.0 inch O.D.) with a 140 pound hammer having a free fall of 30 inches.

All samples recovered were visually classified by the geologist in the field, sealed in jars, and forwarded to the State Materials Laboratory at College, Alaska for further testing.

Recovery of undisturbed samples was not attempted at this site due to the density or granularity of the subsoils.

In addition to the borings, two penetrometer tests were performed near the pier locations. The penetrometer test consisted of driving a 2.5 inch diameter flush-coupled steel rod, with a blunt tip, by means of a 342 pound drop hammer having a free fall of 30 inches.

Graphic logs of all borings and penetrometer tests are shown on the "Log of Test Borings" sheet attached to this report.

III. Laboratory Testing

Samples received at the State Materials Laboratory were visually inspected and those considered to be representative of the strata encountered in the field were tested for determination of the following properties:

1. Particles Size Distribution.
2. Atterberg Limits.
3. AASHO Group Classification.

Selected samples were further examined for determination of:

4. Frost Susceptibility.
5. Natural Moisture Content.

All tests were performed in accordance with methods approved by the Alaska Department of Highways, AASHO, and ASTM. Results of all laboratory tests are contained in the "Summary of Test Data" sheets attached to this report.

IV. Site Conditions

A. Surface

The Nenana River originates at the Nenana Glacier in the Alaska Range and flows westwardly, then northerly to its confluence with the Tanana River at Nenana. The Nenana River is approximately 130 miles long and, at the proposed bridge site, drains an area in excess of 1000 square miles.

The proposed bridge is to be located approximately 500 yards upstream from the existing bridge. At this location, the river flows in a well defined channel 220-230 feet wide. The south bank is moderately inclined and about six feet in height. The ground surface continues to rise to the south at approximately a 14% grade to a height of approximately 20 feet. The north bank is formed by a steep bluff in excess of 60 feet high. At the time of the investigation (March 1970) water depth ranged from 3-5 feet, including up to three feet of ice.

Abutment No. 1 will be located on the south bank of the river. Pier Nos. 2 and 3 will be located in the river channel, and Abutment No. 4 will be located in the face of the steep bluff which forms the north bank of the river.

Between the river banks, the surface material is sand and gravel with cobbles and boulders. Occasional large boulders up to several feet in diameter were noted. Outside the river banks, there is a surface layer of less than one foot of moss and organic material. Vegetation consists of grasses and brush less than three inches in diameter with occasional tress up to one foot in diameter.

B. Subsurface

Results from the field investigations and the laboratory testing indicate the subsoils at this site may be generally described as follows:

The south bank is composed of approximately eight feet of loose to firm silty sand underlain by approximately seventeen feet of very dense river deposited sandy gravel with cobbles and boulders. River deposited sandy gravel with cobbles and boulders is also present in the river bed from 1.5 to 3.5 feet thick. The north bank (bluff) is composed of very dense glacial sandy gravel with cobbles and boulders to a depth of approximately 53 feet (elevation 1871). Underlying both the glacial deposits and the river deposited material is a thick sequence of very dense sediments which have been described (1) as the Cantwell formation of Cretaceous age. In the project area, this formation consists of alternating beds of sand and gravel, silt, and silty clay; all of which are very dense and highly compact, and which may be partially cemented. A few thin beds or stringers of coal were also encountered in the test borings. Drilling at the site was quite difficult, particularly where sandy gravel with cobbles or boulders are noted on the "Log of Test Borings" sheet.

Permafrost was not detected in any of the borings put down at the proposed structure location. A thermocouple installed in Boring No. 2 indicates that no permafrost is present at Abutment No. 4. However, it should be anticipated that permafrost will be encountered in excavation through the bluff in which Abutment No. 4 will be located. Permafrost was encountered at approximately Station 2542+50 at elevation 1841 in a dozer cut made during the subject investigation. Additionally, permafrost was encountered at Station 2543+00 at elevation 1843 in a test pit excavated by Interior District personnel during a centerline soils investigation (2).

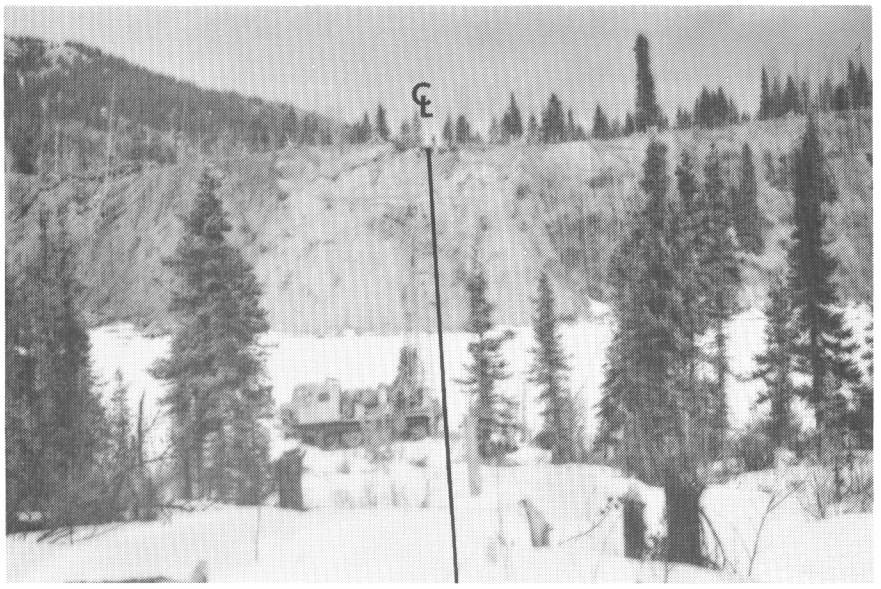
The water table elevation in the borings outside the river channel (Boring Nos. 1 and 2) was within a few feet of the level of the water in the river.

Respectfully submitted,

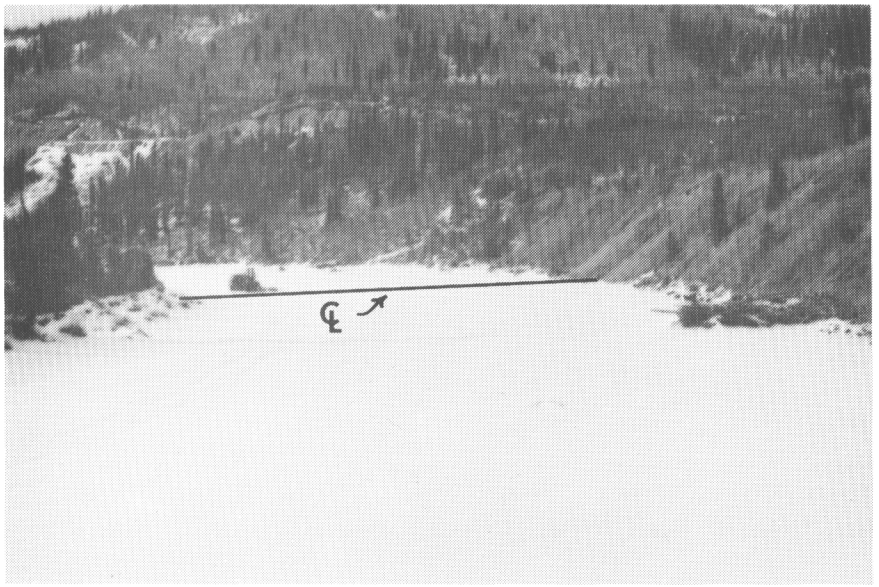
W. H. Slater
Foundation Geologist

(1) Wahrhaftig, Clyde, 1958, Quaternary and Engineering Geology in the Central Part of the Alaska Range: U. S. Geological Survey Professional Paper 293-A.

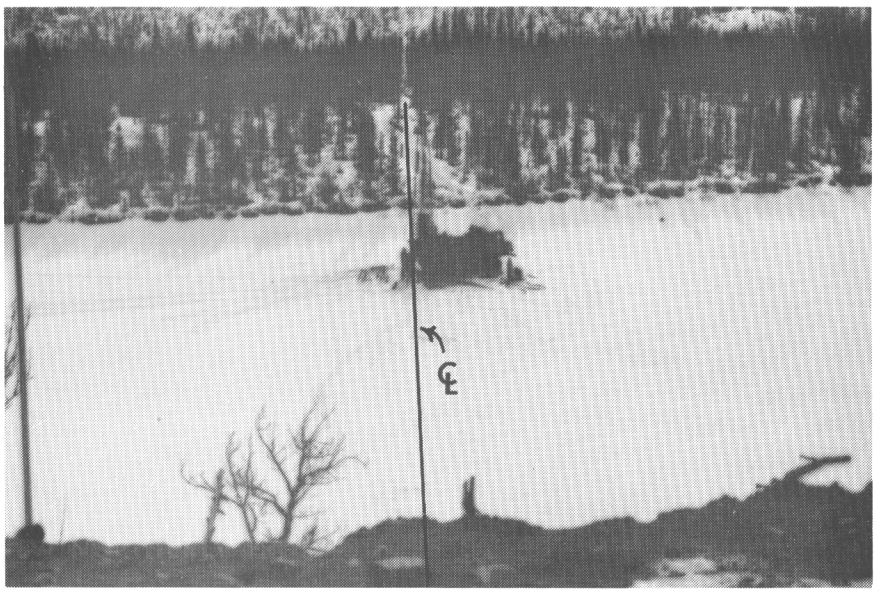
(2) Cantwell to McKinley Park, Bridge Portion - Nenana No. 2, Supplement No. 3, Project No. F-052-2(1): July 16, 1969, Alaska Dept. of Highways Engineering Geology and Soils Report.



VIEW NORTHERLY FROM STA. 2538 + 00



VIEW LOOKING UPSTREAM FROM EXISTING BRIDGE



VIEW SOUTHERLY FROM STA. 2542 + 00

ALASKA DEPARTMENT OF HIGHWAYS
ENGINEERING GEOLOGY SECTION
SUMMARY OF TEST DATA — FOUNDATION SOILS

Project No. F-052-2(1) **Project Name** Nenana River at Park Boundary

Boring	Depth ft.	Laboratory Number	Grading Analysis — % Passing								Atterberg Limits		Nat. Dry Density P.C.F.	Nat. Moist. %	Spec. Gravity	F.S.V. (Corps of Eng.)	AASHO Group Classif.			
			Gravel			Sand		Silt		Clay										
			1"	3/8"	#4	#10	#40	#200	.02	.005	Liquid Limit	Plastic Index								
1	5	69F1218	100	99	98	98	95	41	19.6	11.7	NV	NP			2.71	F-3	A-4(1)			
1	10	1219	100	68	48	33	20	13	7.3	4.9	NV	NP			2.74	F-1	A-1-a			
1	15	1220	100	67	52	36	24	6			NV	NP		11.9			A-1-a			
1	25	1221				100	62	60			26	7		11.5			A-4(5)			
1	35	1222				100	67	37			24	NP		8.6			A-4(0)			
1	40	1223				100	60	39			23	6		7.1			A-4(1)			
1	50	1224				100	99	98			28	8		8.6			A-4(8)			
1	60	1225				100	76	61			24	8		9.1			A-4(5)			
2	5	1226				100	99	77	24.1	13.0	NV	NP			2.74	F-4	A-4(0)			
2	15	1227	90	59	51	41	20	9	5.3	3.3	NV	NP			2.75	F-1	A-1-a			
2	20	1228	91	59	51	40	21	7			NV	NP					A-1-a			
2	35	1229	81	54	42	31	14	6			NV	NP					A-1-a			
2	40	1230	100	76	69	59	45	29			24	8					A-2-4			
2	55	1231		100	98	89	59	28			22	6		10.9			A-2-4			
2	60	1232	100	97	93	88	72	57			32	14		12.4			A-6(7)			

Remarks: All samples taken with 1 3/8" I.D. split-tube drive sampler.

ALASKA DEPARTMENT OF HIGHWAYS
ENGINEERING GEOLOGY SECTION
SUMMARY OF TEST DATA — FOUNDATION SOILS

Project No. F-052-2(1) Project Name Nenana River at Park Boundary

Boring	Depth ft.	Laboratory Number	Grading Analysis — % Passing								Atterberg Limits		Nat. Dry Density P.C.F.	Nat. Moist. %	Spec. Gravity	F.S.V. (Corps of Eng.)	AASHO Group Classif.			
			Gravel			Sand		Silt		Clay										
			1"	3/8"	#4	#10	#40	#200	.02	.005	Liquid Limit	Plastic Index								
3	8	70F159	100	89	82	64	51	41	27.9	16.3	25	7			2.64	F-3	A-4(0)			
3	12.5	160	100	88	72	60	50	37	22.8	14.0	23	8			2.69	F-4	A-4(0)			
3	25	148				100	87	70	43.6	25.5	22	7		9.2	2.76	F-4	A-4(2)			
3	30	149				100	99	91	55.8	32.1	28	8		9.3	2.69	F-4	A-4(6)			
3	50	161				100	97	93	73.0	47.5	19	2			2.73	F-4	A-4(0)			
4	7.5	155	100	98	96	90	84	75	65.4	42.8	33	15			2.65	F-3	A-6(11)			
4	12.5	156	100	96	92	78	75	45	37.4	26.1	24	9			2.64	F-4	A-4(1)			
4	35	157		100	100	98	92	66	38.2	14.8	17	NP			2.71	F-4	A-4(3)			
4	45	158				100	84	77	51.1	29.9	29	12			2.70	F-4	A-6(7)			

Remarks: All samples taken with 1 3/8" I.D. split-tube drive sampler.

THERMOCOUPLE READINGS

Project Name Nenana River @ Park Boundary Bridge No. 694 Project No. F-052-2(1)

Thermocouple Location No. Boring No. 2

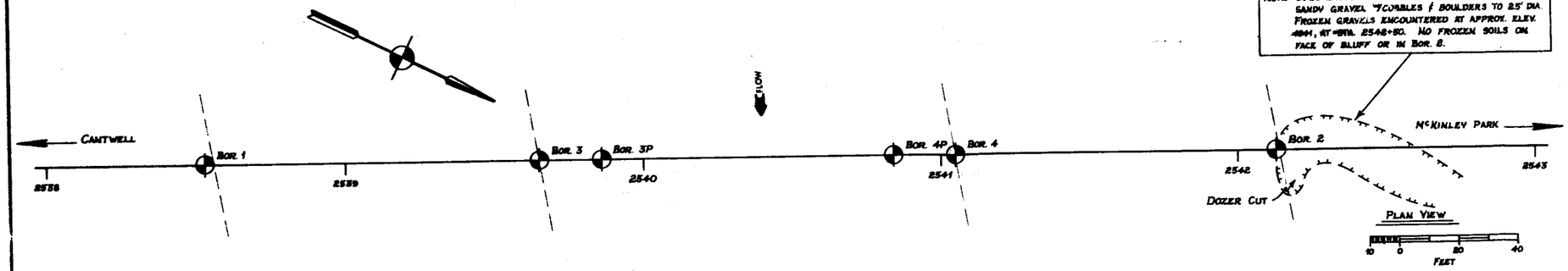
Depth of Thermocouple in Ft.	Date of Readings: 9/5/69	10/23/69	3/17/70		
	Temperature in Degrees Fahrenheit				
0	46.1	33.2	31.1		
5	38.0	39.2	35.0		
10	34.8	38.2	35.9		
15	34.8	37.5	36.6		
20	34.5	36.8	37.8		
25	33.4	34.8	38.5		
30	33.4	33.9	38.5		
40	33.4	33.9	37.5		
50	33.4	33.6	38.0		
60	33.4	33.4	38.0		

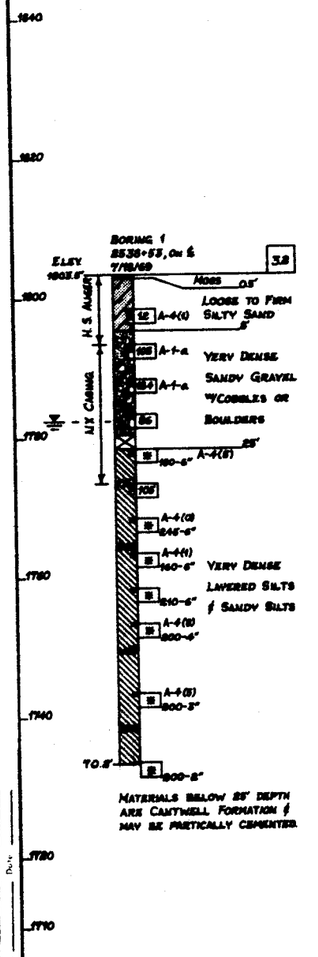
Thermocouple Location No.

Depth of Thermocouple in Ft.	Date of Readings				
	Temperature in Degrees Fahrenheit				

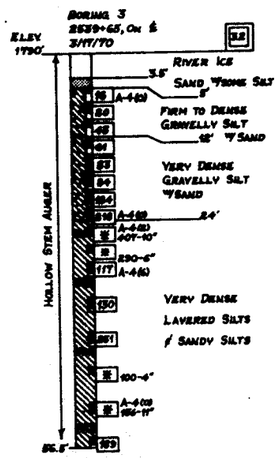
STATE	PROJECT DESIGNATION	YEAR	SHEET NO	TOTAL SHEETS
ALASKA	F-052-2(1)	1971	1	1

NOTE: SOILS ENCOUNTERED IN DOZER CUT CONSISTED OF SANDY GRAVEL W/COBBLES & BOULDERS TO 2.5' DIA. FROZEN GRAVELS ENCOUNTERED AT APPROX. ELEV. 1804, AT ~STA. 2548+50. NO FROZEN SOILS ON FACE OF BLUFF OR IN BOR. 2.

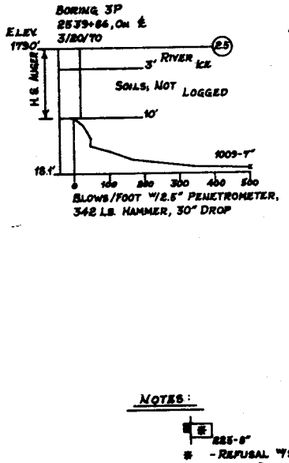




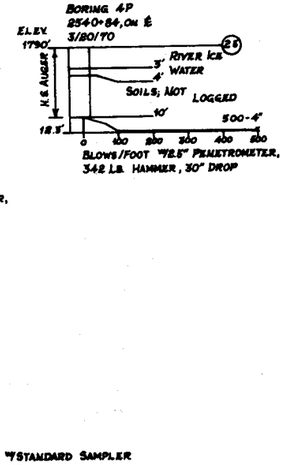
MATERIALS BELOW 25' DEPTH ARE CANTWELL FORMATION & MAY BE PRETICALLY CEMENTED.



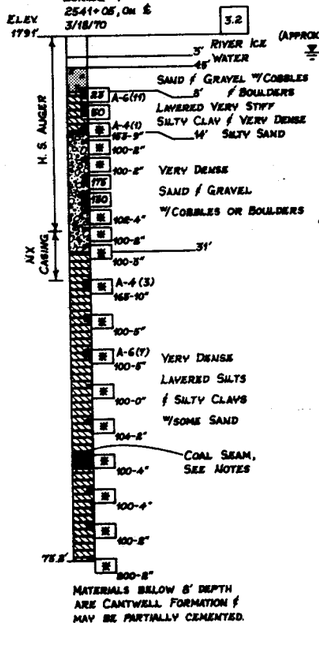
MATERIALS BELOW 5' DEPTH ARE CANTWELL FORMATION & MAY BE PARTIALLY CEMENTED.



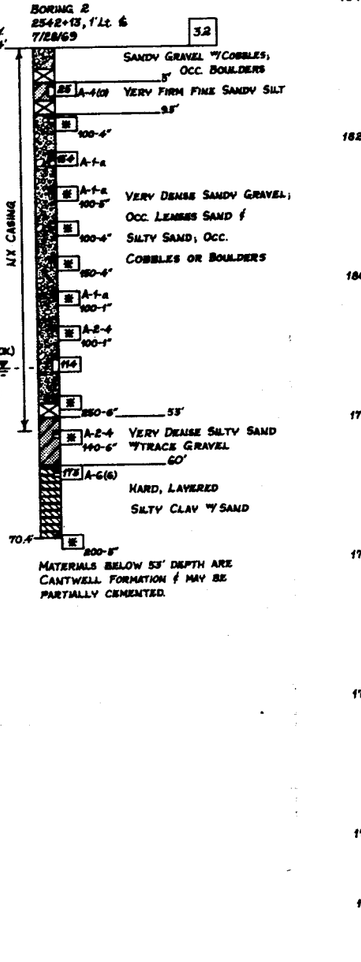
BLOWS/FOOT W/2.5" PENETROMETER, 342 LB. HAMMER, 30" DROP



BLOWS/FOOT W/2.5" PENETROMETER, 342 LB. HAMMER, 30" DROP



MATERIALS BELOW 8' DEPTH ARE CANTWELL FORMATION & MAY BE PARTIALLY CEMENTED.



MATERIALS BELOW 53' DEPTH ARE CANTWELL FORMATION & MAY BE PARTIALLY CEMENTED.

NOTES:

225-8"
8 - REFUSAL W/STANDARD SAMPLER
225 - BLOW COUNT
8" - PENETRATION

OCCASIONAL THIN COAL STRINGERS AND SCATTERED COAL FRAGMENTS WERE NOTED IN BORINGS 1, 3, & 4.

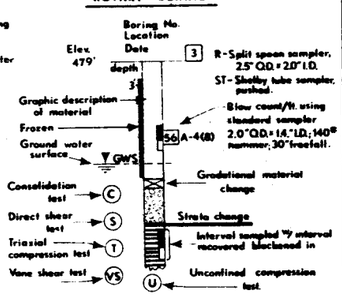
MATERIAL SYMBOLS

- Organics, Organic Silt
- Cobbles and Boulders
- Sandy Gravel
- Gravelly Sand
- Gravel
- Sand
- Clay
- Silt
- Clayey Silt
- Sandy Silt
- Gravelly Silt
- Silty Clay
- Silty Sand
- Silty Gravel

BORING SYMBOLS

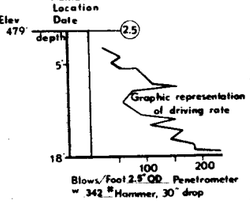
- Plan of any boring
- Flush penetrometer
- Bull nose penetrometer
- Rotary boring
- Auger boring
- Diamond core boring
- Test pit
- Probe

ROTARY BORING



R - Split spoon sampler, 2.5" O.D. x 2.0" I.D.
ST - Shelby tube sampler, pushed.
Blow count/ft. using standard sampler 2.0" O.D. x 1.4" I.D.; 140# hammer, 30" freefall.

PENETROMETER TEST



RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

According to Standard Test Penetration

GRANULAR		COHESIVE	
Blows/ft.	Rel. Density	Blows/ft.	Consistency
0 - 4	very loose	0 - 1	very soft
5 - 10	loose	2 - 4	soft
11 - 20	firm	5 8	firm
21 - 30	very firm	9 15	stiff
31 - 50	dense	15 - 30	very stiff
Over 50	very dense	Over 30	hard

LOG OF TEST BORINGS

Nenana @ Park Boundary

State of Alaska

DEPARTMENT OF HIGHWAYS

Juneau, Alaska

Date Jan. 1971

Approved WJA

Bridge no. 694

Drawing no

Designed By
Drawn By
Checked By
Traced By
Date