69-F-5

W.P. 246-66

H.W.Y. #129, LINE 'D'

PHILLIPS CREEK

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX $= \frac{w - w_p}{I_p}$
I_c	CONSISTENCY INDEX $= \frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX $= \frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE $= \frac{-\Delta e}{(1+e)\Delta \sigma'}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX $= \frac{\Delta e}{\Delta \log_{10} \sigma'}$
T_v	TIME FACTOR $= \frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT — IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION — IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION — IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION — IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3·1416
e	BASE OF NATURAL LOGARITHMS 2·7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ε	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL

RM. 110 — LAB. 3206

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Office,
Admin. Bldg.

Attention: Mr. S. McCombie

From: Foundation Section,
Materials & Testing Office,
Room 107, Lab. Bldg.

Date: June 27, 1969

Our File Ref.

In reply to: JUL - 4 1969

Subject:

FOUNDATION INVESTIGATION REPORT
For
Proposed Crossing at Phillips Creek
& Hwy. #129, Line 'D', Lot 2, Con.I
Twp. of Bridgland, District: Algoma
District #18 (Sault Ste. Marie)
W.J. 69-F-5 -- W.P. 246-66

Attached, we are forwarding to you, our detailed foundation investigation report on the subsoil conditions existing at the above structure site.

We believe that the factual data and recommendations contained therein, will prove adequate for your design requirements. Should additional information be required, please do not hesitate to contact our Office.

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

AGS/EdeF
Attach.
cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
H. W. Hurrell
J. H. Blevins
E. R. Saint
S. B. Davidson
B. A. Singh

Foundations Files
Gen. Files

TABLE OF CONTENTS

FOUNDATION INVESTIGATION REPORT
For
Proposed Crossing at Phillips Creek
& Hwy. #129, Line 'D', Lot 2, Con.I
Twp. of Bridgland, District: Algoma
District #18 (Sault Ste. Marie)
W.J. 69-F-5 -- W.P. 246-66

1. INTRODUCTION:

A request for a foundation investigation at the site of the proposed crossing of Hwy. #129, Line 'D' and Phillips Creek, was received from Mr. F. De Visser, Regional Bridge Location Engineer, in a memo dated January 28, 1969.

A field investigation was subsequently carried out by the Foundation Section to determine the subsoil conditions existing at the site. This report contains the results of this investigation and our recommendations pertaining to the design of the proposed structure foundation and the stability of the proposed embankment.

2. DESCRIPTION OF THE SITE:

The site is located approx. 8 miles north of the junction of Hwy. #17 and Hwy. #129. The proposed crossing is situated in a valley, surrounded by steeply sloping hills.

3. FIELD AND LABORATORY INVESTIGATION PROCEDURES:

A total of five sampled boreholes and nine dynamic cone penetration tests was carried out during the course of the field investigation. Boring was achieved by means of conventional diamond drilling equipment adapted for soil sampling purposes. During the field work, disturbed and 'undisturbed' samples were obtained. 'Undisturbed' samples were recovered using 2-inch I.D. Shelby tubes which were pushed into the soil by hand. Disturbed samples were recovered by means of a standard split-spoon sampler,

..... 2

3. FIELD AND LABORATORY INVESTIGATION PROCEDURES: (cont'd.) ...

and the energy used in driving it, conformed to the requirements of the Standard Penetration Test. Dynamic cone penetration tests were carried out adjacent to each borehole and at four other locations. Driving energy to advance the cone was 350 ft.-lbs. per blow. In-situ vane tests were carried out wherever possible, at elevations 12 inches below the various sample depths. The locations and elevations of all boreholes are shown on the attached Drawing #69-F-5A.

Samples were visually examined and classified at the site as well as in the laboratory. Tests were carried out in the laboratory to determine the following physical properties:

Atterberg Limits
Organic Content
Moisture Content
Undrained Shear Strength
Grain-Size Distribution
Bulk Density
Consolidation Characteristics

The test results are summarized on the Record of Borehole sheets in the Appendix of this report.

4. SOIL TYPES AND SOIL CONDITIONS:

4.1) General:

The subsoil at the site consists of a surficial layer of very soft organic muck, overlying deposits of very soft to soft silty clay, very soft to very stiff clayey silt, followed by compact to very dense silty sand to sandy silt, and in some boreholes, sand and gravel.

The boundaries of the different deposits as determined in the boreholes, are shown on the accompanying Record of Borehole sheets and the estimated stratigraphical profile contained in Dwg. #69-F-5A is based on this information.

..... 3

4. SOIL TYPES AND SOIL CONDITIONS: (cont'd.) ...

4.1) General: (cont'd.) ...

From ground level downward, the various soil types, discussed in detail, are as follows:

4.2) Muck:

This deposit was observed in all boreholes, and extends from ground level to a minimum depth of 2.0 ft. The thickness varies from 2.0 to 4.5 ft. It is possible that the observed thickness may differ to a great extent at other locations. The material in the deposit consists mainly of black-coloured decayed and undecayed organic substances mixed with sand. The consistency may be described as very soft. The organic content was found to be in the order of 39%. The moisture content was found to be as high as 62%.

4.3) Silty Clay:

This stratum underlies the surficial muck deposit in all boreholes. The lower boundary was found to be at El. 729.

The material in the deposit is predominantly a mixture of clay and silt with traces of sand. In B.H. #8, layers of silt and clayey silt were encountered within this deposit.

Physical properties of the material as determined from field and laboratory tests, are as follows:

Natural Moisture Content	(%)	45	to 55
Liquid Limit	(%)	42	to 53
Plastic Limit	(%)	22	to 32
Bulk Density	(PCF)	103	to 121

The shear strength of the material was found to vary from 250 to 500 PSF. The consistency may be described as very soft to soft.

.... 4

4. SOIL TYPES AND SOIL CONDITIONS: (cont'd.) ...

4.4) Clayey Silt:

This deposit was observed in all boreholes immediately below the silty clay zone. The lower boundary was found to be between El. 704 and El. 723.

The material was found to consist of clayey silt with occasional layers of sand, silt, and clay, and also some fine gravel.

Field and laboratory tests indicated that the shear strength of the material increases with depth, being in the order of 400 PSF, in the extreme upper zone, and over 1000 PSF at the bottom. For design purposes, an average value of 600 PSF may be used. The consistency of the overall stratum may be described as soft to stiff.

In general, the natural moisture content was found to exceed the liquid limit.

Physical properties of the material in the deposit are summarized as follows:

Natural Moisture Content (%)	15	to	35
Liquid Limit (%)	22	to	34
Plastic Limit (%)	15	to	22
Bulk Density (PCF)	120	to	131
Unconfined Shear Strength (PSF)	400	to	1350
Field Vane Test (PSF)	350	to	1850

Typical grain-size distribution curves are shown on Figure 1 of the Appendix.

..... 5

4. SOIL TYPES AND SOIL CONDITIONS: (cont'd.) ...

4.5) Sandy Silt to Silty Sand:

This zone was found to underlie the clayey silt material at all borehole locations. The observed thickness was about 10 ft.

The material consists of sand and silt in varying proportions, and also contains traces of gravel. The moisture content ranges from 10 to 19%. The 'N' values obtained from standard penetration tests ranged from 14 to over 100 blows per foot, which indicates the relative density of the stratum to vary from compact to very dense.

Results of mechanical analyses are summarized in the accompanying Record of Borehole sheets.

4.6) Sand and Gravel:

A very dense sand and gravel stratum was encountered in B.H.'s #2 and #3 at El. 701 and El. 713, respectively. The lower boundary was not determined, since the borings were terminated in this layer.

5. DISCUSSION AND RECOMMENDATIONS:

It is proposed to build a new structure at the crossing of Phillips Creek and Hwy. #129, Line 'D'. The proposed profile grade will be about 16 ft. above the existing creek bed.

As can be seen from the previous paragraphs of this report, the subsoil consists of very soft organic muck deposits, overlying very soft to soft silty clay and very soft to very stiff clayey silt, overlying compact to very dense silty sand to sandy silt. The depth of the soft deposits ranges from 6 to 11 ft.

To ensure stability of the proposed embankments, it is necessary to excavate all the soft material down to approx. El. 730.0 and replace it with suitable granular material. If organic soil is found below this depth, it must also be removed.

..... 6

5. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

The width of this excavation should extend for at least the full width of the proposed embankment, toe to toe, as per Fig. 2, and should continue across the stream bed. The length of the excavation should extend from Sta. 215+00 - 216+80. Outside of these limits, the excavation and backfill should be as per D.H.O. Standard DD-406.

Stability analyses, which have been carried out in terms of total stresses, indicated that the proposed 16-ft. high embankments constructed with standard 2:1 slopes, will be stable, provided the foregoing recommendations are carried out. The underlying soft to very stiff stratum will settle due to the load imposed by the weight of embankment fill. It is estimated that the magnitude of this settlement will be in the order of 12 to 18 inches.

The proposed two 11-ft. diameter round C.I.P. culverts may be installed as shown on the Bridge Site Plan E-4565-1, ensuring that a granular pad of minimum thickness 12 inches, is provided under the pipes.

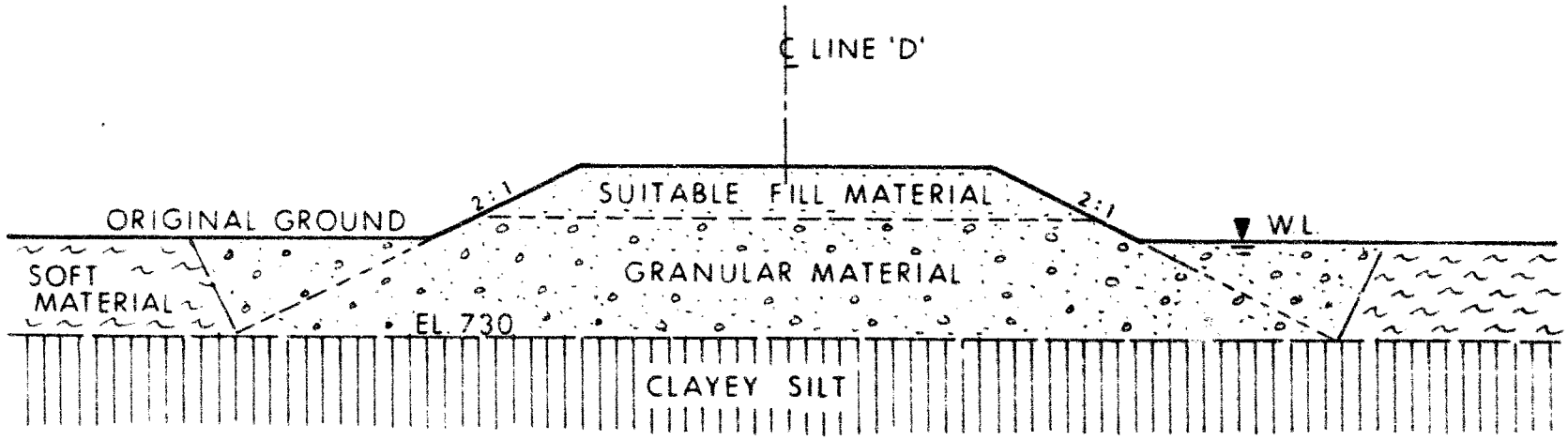
As an alternative, a new bridge structure may be built. The abutments of the bridge should be supported on end-bearing piles driven to approximate El. 705.0. The maximum allowable load for the particular pile used may be assumed for design purposes. In the case of 12 BP @ 53 steel H-piles, this load would be 70 tons per pile.

6. MISCELLANEOUS:

The field work was carried out during the period February 11 to February 17, 1969. Equipment used was owned and operated by Dominion Soil Investigation Ltd.

The supervision of the field work, together with the preparation of this report, was carried out by Mr. P. Payer, Project Foundation Engineer. The report was reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

June 1969.



TYPICAL SECTION THROUGH EMBANKMENT
SHOWING SUBEXCAVATION OF SOFT MATERIAL
BETWEEN STA. 215+00 & STA. 216+80

FIG. 2

69-F-5

APPENDIX I

FORM OB-MT-126 (REV 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 69-F-5 LOCATION Sta. 215 + 98 48' Rt. ORIGINATED BY PP
W.P 246-66 BORING DATE February 11 & 12, 1969 COMPILED BY PP
DATUM Geodetic BOREHOLE TYPE Washbore - NX Casing CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
742.3	Water Level				
0.0					
739.3	Ground Level				
3.0	Muck. Very soft.				
737.3			1	SS	1
5.0	Muck and sand.				
734.8	Very soft.				
7.5	Silty Clay				
729.3	Very soft to soft		2	SS	2
13.0			3	SS	3
	Clayey silt with occasional layers of clay, silt and sand, and some gravel.		4	TW	PH
			5	SS	22
	Soft to firm		6	SS	4
			7	SS	14
704.3					
38.0	Sandy silt		8	SS	21
698.5	Compact to very dense				
43.8	End of Borehole				

ELEV SCALE: 740, 730, 720, 710, 700

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT: 25 50 75 100 125

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
500 1000 1500 2000 2500

Refusal

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_p
WATER CONTENT —— w
w_p w w_L
WATER CONTENT % 20 40 60

BULK DENSITY γ P.C.F.	REMARKS GR SA SI CL
	0 1 (99)
127	0 8 85 7
	16 16 67 1
	2 9 88 1
	6 41 52 1

FORM OB-MT-126 (REV 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 69-F-5 LOCATION Sta. 215 + 98 o/s 3' ~~Lt.~~ Rt. ORIGINATED BY PP
W.P. 240-66 BORING DATE February 12 and 13, 1969 COMPILED BY PP
DATUM Geodetic BOREHOLE TYPE Washbore - NX Casing CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV SCALE
742.3	Water (Ice) Level					
0.0	Water					
736.8	Ground Level					
5.5	Muck - Very soft		1	SS	-	
733.3	Silty clay		2	TW	PM	
9.0	Very soft to soft					
730.3			3	TW	PM	730
12.0			4	TW	PM	
	Clayey silt with occasional layers of silt, clay & sand.		5	TW	PM	
			6	TW	PM	720
			7	TW	PM	
	Soft to stiff		8	TW	PM	
711.8						
30.5	Silty sand with traces of gravel.		9A	SS	14	710
			10	SS	35	
	Compact to very dense					
701.3			11	SS	74/10"	
41.0	Sand & Gravel		12	RC	-	700
697.3	Very dense					
45.0	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT: 25 50 75 100 125

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
500 1000 1500 2000 2500

+s=7.0
+s=2.5
+s=9.0
+s=4.5
+s=4.7
+s=5.6
+s=3.8
+s=4.6
Refusal

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w

WATER CONTENT % 20 40 60

BULK DENSITY γ P.C.F.	REMARKS GR SA SI CL
	0 8 37 55
103	0 3 53 44
120	
120	
120	0 5 82 13
128	
126	
128	0 5 86 9
	15 64 20 1
	1 31 59 9

FORM OB-MT-126 (REV 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 69-F-5 LOCATION Sta. 216 + 11 o/s 44' Lt. ORIGINATED BY PP
W.P. 246-66 BORING DATE February 14, 1969 COMPILED BY PP
DATUM Geodetic BOREHOLE TYPE Washbore - NX Casing CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
742.3	Water (Ice) Level				
0.0	Water				
737.3	Ground Level				
5.0	Muck - very soft				
734.3					
8.0	Silty clay		1	TW	PM
729.3	Soft				
13.0	Clayey silt with occ. layers of clay, silt and gravel.		2	TW	PM
723.3	Soft to Firm.				
19.0	Silty sand, traces of gravel.		3	TW	PM
			4	SS	21
			5	SS	26
713.3	Compact to very dense				
29.0	Sand & gravel		6	SS	74/6"
710.1	Very dense				
32.2	End of Borehole				

ELEV SCALE: 740, 730, 720, 710, 700

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT: 25 50 75 100 125

SHEAR STRENGTH P.S.F
○ UNCONFINED ◆ FIELD VANE
● QUICK TRIAXIAL × LAB VANE
500 1000 1500 2000 2500

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_p
WATER CONTENT —— w
WATER CONTENT %: 20 40 60

BULK DENSITY γ PCF	REMARKS GR. SA. SI. CL.
106	0 1 58 41
127	
	0 58 38 4
	7 20 72 1

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

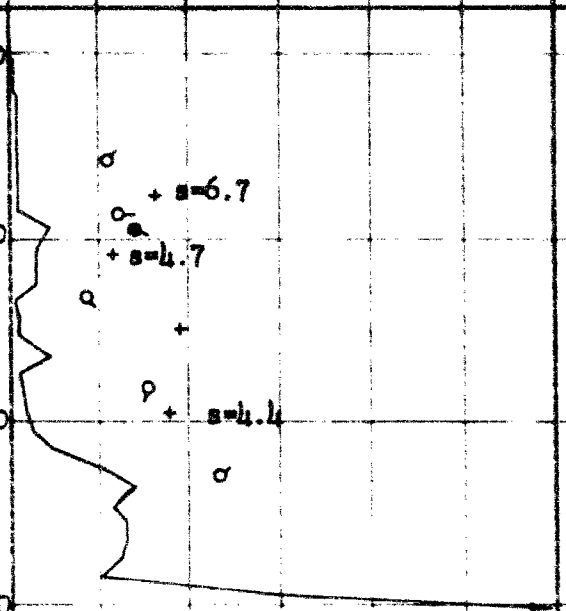
RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 69-F-5 LOCATION Sta. 215 + ~~49~~ 59 o/s 34' Lt. ORIGINATED BY PP
W.P. 246-66 BORING DATE February 14 and 15, 1969 COMPILED BY PP
DATUM Geodetic BOREHOLE TYPE Washbore - NX Casing CHECKED BY

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
742.3	Water (Ice) Level					
0.0	Water					
739.8	Ground Level					
2.5	Muck - very soft					
737.3			1	TW	PM	
5.0	Silty clay					
732.3	Very soft to soft		2	TW	PM	
10.0			3	TW	PM	
	Clayey silt with occ. layers of silt and sand.		4	TW	PM	
			5	TW	PM	
	Soft to firm					
715.3			6	TW	PM	
27.0	Sandy silt, traces of gravel.					
709.8	Dense to very dense.		7	SS	135	
32.5	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT: 25 50 75 100 125
SHEAR STRENGTH P.S.F. — ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE: 500 1000 1500 2000 2500



LIQUID LIMIT — w_L
PLASTIC LIMIT — w_P
WATER CONTENT — w
WATER CONTENT %: 20 40 60

BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL.
108	0 7 56 37
125	
129	
129	
131	2 15 82 1
	3 30 63 4

FORM 08-MT-126 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 5

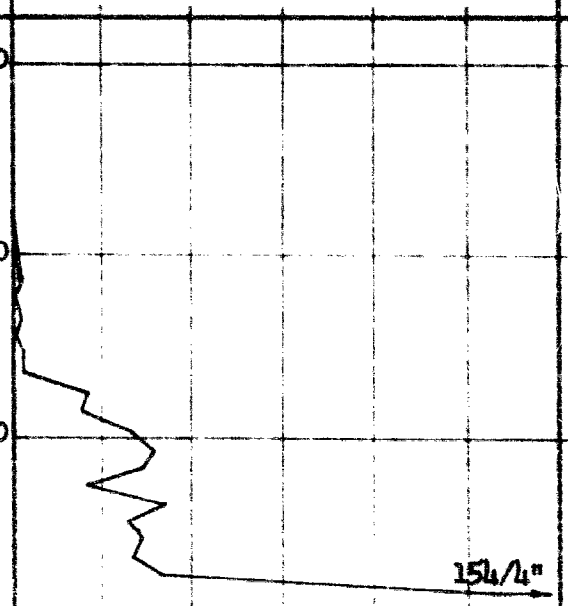
FOUNDATION SECTION

JOB 69-F-5 LOCATION Sta. 215 + 10 56' Lt. ORIGINATED BY PP
W.P. 246-66 BORING DATE Feb. 15, 1969 COMPILED BY HR
DATUM Geodetic BOREHOLE TYPE Cone Penetration Test CHECKED BY

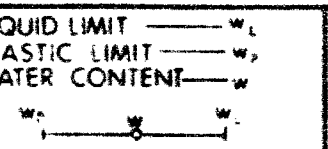
ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/FOOT	ELEV. SCALE
742.3	Ice Level					
0.0	Water					
711.0						
31.3	End of Cone Test					

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 25 50 75 100 125

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE



LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w



WATER CONTENT %

BULK DENSITY γ P.C.F

REMARKS

GR. SA. SI. CL.

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 6

FOUNDATION SECTION

JOB 69-F-5 LOCATION Sta. 215 + 20 16' Lt. ORIGINATED BY PP
W.P. 246-66 BORING DATE February 15, 1969 COMPILED BY HR
DATUM Geodetic BOREHOLE TYPE Cone Penetration Test CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/FOOT	ELEV. SCALE
742.5	Ice Level					
0.0						740
						730
						720
						710
705.5						
36.8	End of Cone Test					700

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT
25 50 75 100 125

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE

150/10"

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_p
WATER CONTENT —— w

w_p — w — w_L

WATER CONTENT %

BULK DENSITY γ P.C.F.

REMARKS

GR. SA. SI. CL.

FORM OB-MT-126 (REV 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 7

FOUNDATION SECTION

JOB 69-F-5 LOCATION Sta. 215 + 69 ℄ ORIGINATED BY PP
W P 246-66 BORING DATE February 15, 1969 COMPILED BY HR
DATUM Geodetic BOREHOLE TYPE Cone Penetration Test CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV SCALE
742.8	Ground Level					
0.0						740
						730
						720
						710
706.5						
36.3	End of Cone Test					700

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT
25 50 75 100 125

SHEAR STRENGTH P.S.F
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

150/4"

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT %

BULK DENSITY γ P C F

REMARKS
GR. SA. SI. CL.

FORM 08-MT-126 (REV 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 8

FOUNDATION SECTION

JOB 69-F-5 LOCATION Sta. 216 + 50 o/s 7' Lt. ORIGINATED BY PP
W P 246-66 BORING DATE February 15, 16, 1969 COMPILED BY PP
DATUM Geodetic BOREHOLE TYPE Washbore - NX Casing CHECKED BY

ELEV / DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
743.3	Ground Level				
741.3	Muck & sand. Very soft				
2.0	Silty clay with layers of silt & clayey silt		1	TW	PM
			2	TW	PM
			3	TW	PM
730.3	Very soft to firm				
13.0	Clayey silt with occ. layers of sand, silt & clay.		4	TW	PM
723.3	Firm				
20.0	Silty sand with gravel and traces of clay.		5	TW	PM
			6	SS	26
712.3	Compact to very dense		7	SS	116
31.0	End of Borehole				

ELEV. SCALE: 740, 730, 720, 710

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
25 50 75 100 125

SHEAR STRENGTH P.S.F.
○ UNCONFINED ⊕ FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
500 1000 1500 2000 2500

+s=4.0
+s=10.6
+s=9.1
Refusal

LIQUID LIMIT w_L
PLASTIC LIMIT w_P
WATER CONTENT w
WATER CONTENT %
20 40 60

BULK DENSITY γ P.C.F	REMARKS GR SA SI CL
121	
106	
	0 11 65 24
127	
	20 44 33 3

FORM 08-MT-426 (REV 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

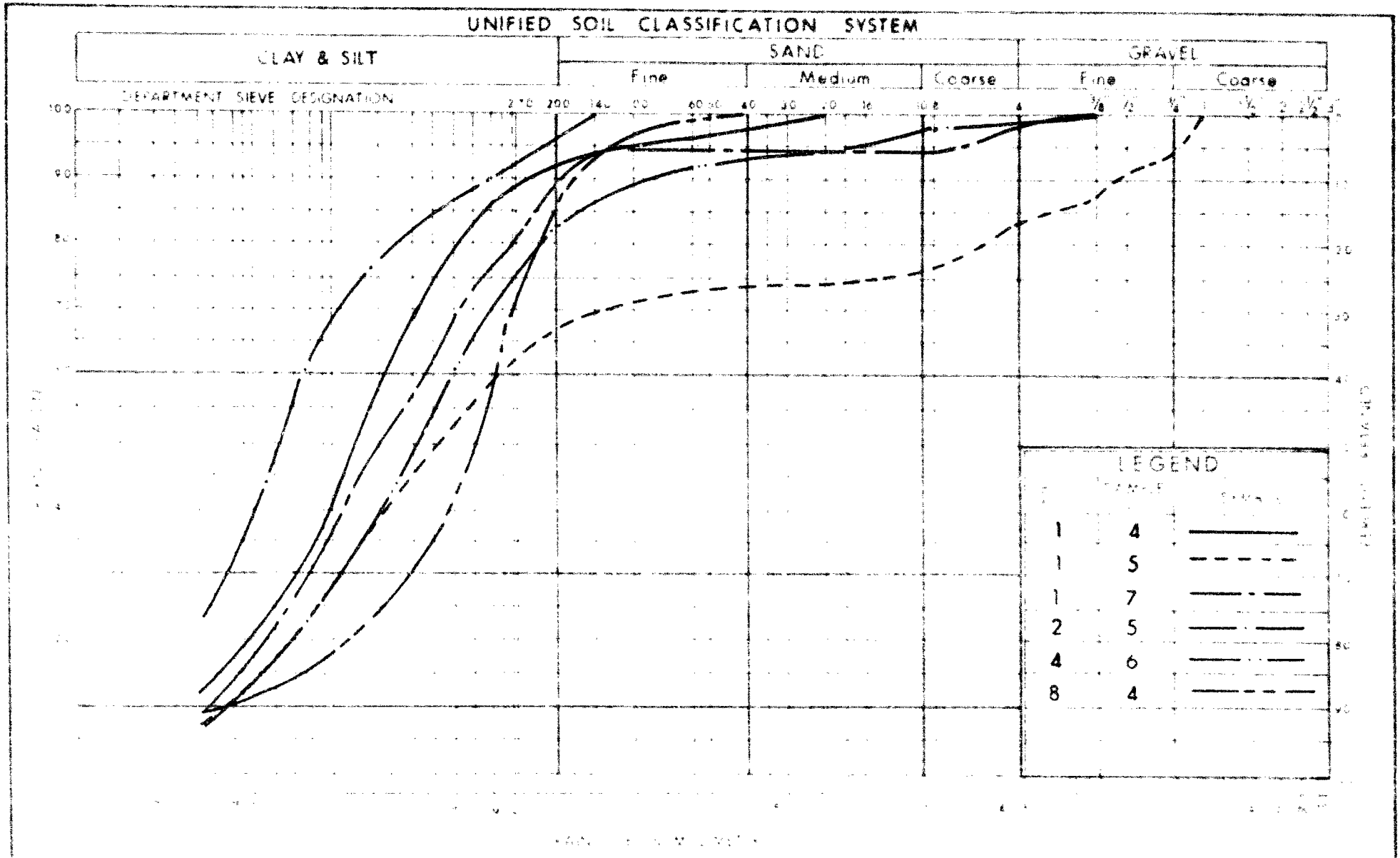
RECORD OF BOREHOLE No. 9

FOUNDATION SECTION

JOB 69-F-5 LOCATION Sta. 217 + 00 5' Rt. ORIGINATED BY PP
W P 240-66 BORING DATE February 16, 1969 COMPILED BY HR
DATUM Geodetic BOREHOLE TYPE Cone Penetration Test CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 25 50 75 100 125	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w — WATER CONTENT %	BULK DENSITY γ P.C.F	REMARKS GR. SA. SI. CL.
743.3	Ground Level						SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE			
0.0										
							150/9"			
722.6										
20.7	End of Cone Test									

FORM DS M1 - 12
REV APR 1965



GRAIN SIZE DISTRIBUTION

CLAYEY SILT

246 - 66

69 - F - 5

FIG. 1

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

CONSISTENCY	'N' BLOWS/FT.	c LB./SQ.FT.	DENSENESS	'N' BLOWS/FT.
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

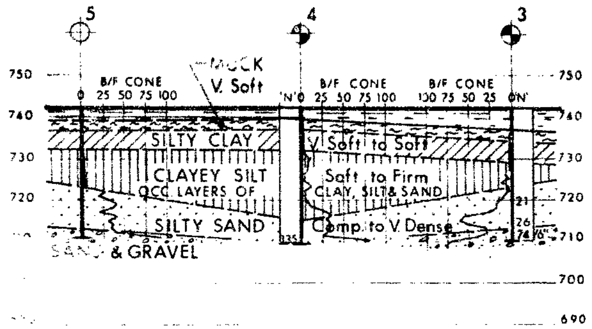
S S	SPLIT SPOON	T W	THINWALL OPEN
W S	WASHED SAMPLE	T P	THINWALL PISTON
S B	SCRAPER BUCKET SAMPLE	O S	OESTERBERG SAMPLE
A S	AUGER SAMPLE	F S	FOIL SAMPLE
C S	CHUNK SAMPLE	R C	ROCK CORE
S T	SLOTTED TUBE SAMPLE		

P H SAMPLE ADVANCED HYDRAULICALLY

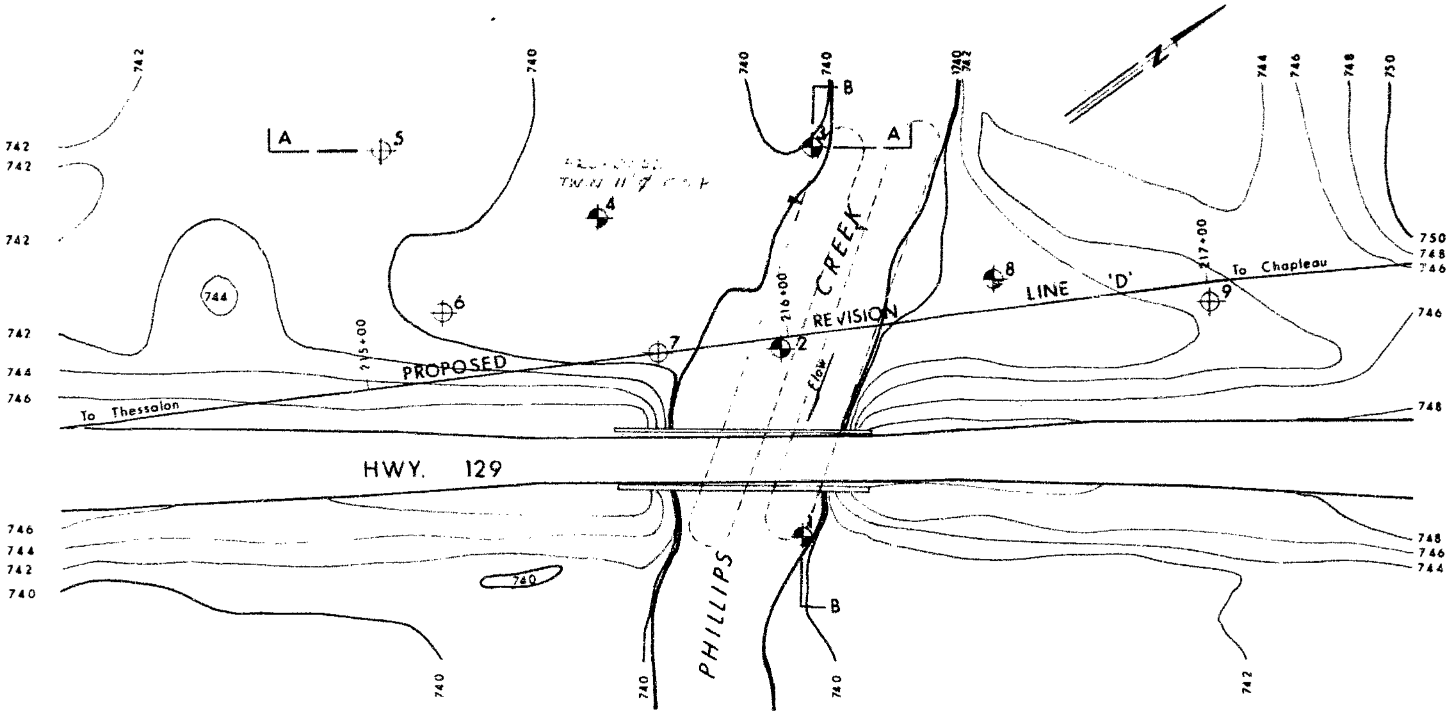
P M SAMPLE ADVANCED MANUALLY

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F V	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY



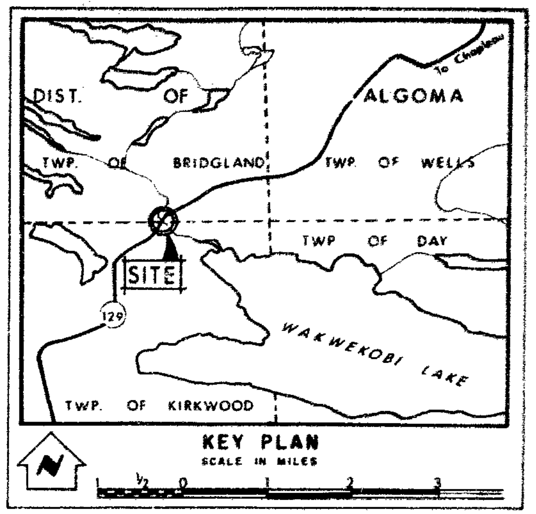
SECTION A - A



PLAN

SCALE

20 10 0 20 40 60 FT



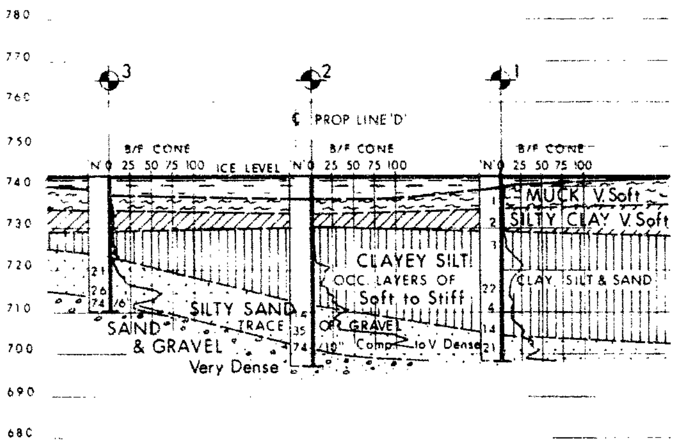
LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation. Feb. 1969

NO.	ELEVATION	STATION	OFFSET
1	742.3	215+98	48' RT
2	742.3	215+98	3' RT
3	742.3	216+11	44' LT.
4	742.3	215+59	34' LT
5	742.3	215+10	56' LT.
6	742.3	215+20	16' LT
7	742.8	215+69	℄
8	743.3	216+50	7' LT
9	743.3	217+00	5 RT

— NOTE —

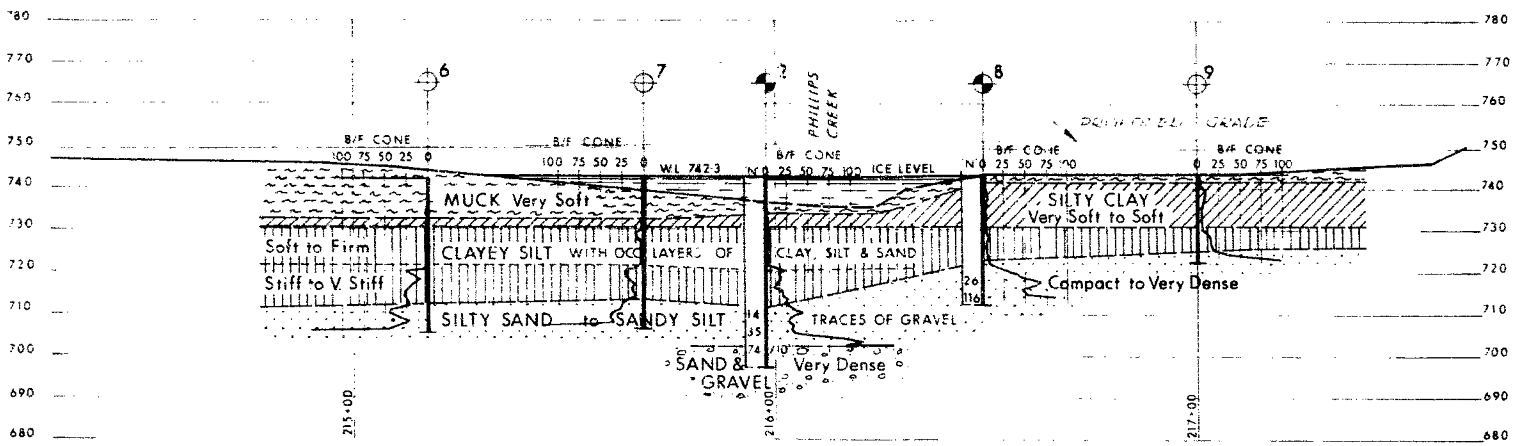
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.



SECTION B - B

SCALE

20 10 0 20 40 60 FT



℄ PROFILE LINE 'D'

SCALE

20 10 0 20 40 60 FT.

PRINT RECORD		
NO	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION - FOUNDATION SECTION

PHILLIPS CREEK

KING'S HIGHWAY NO. 129 LINE 'D' DIST NO. 18

DIST. OF ALGOMA

TWP. BRIDGLAND LOT 2 CON. 1

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D P.P.	CHECKED	W.P. NO. 246-66	M.&T. DRAWING NO. 69-F-5A
DRAWN A.N.	CHECKED	JOB NO. 69-F-5	
DATE 27 MAY 1969		SITE NO	BRIDGE DRAWING NO.
APPROVED [signature] PRINCIPAL FOUNDATION ENGINEER		CONT. NO.	

REF. NO. E-4565-1

cc: Foundations Files (Rm. 110)

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. J. H. Blevins,
District Engineer,
District #18,
SAULT STE. MARIE, ONT.

Attention: Mr. H. Potts,
Construction Engineer

Our File Ref.

From: Foundation Section,
Materials & Testing Office,
Room 107, Lab. Bldg.

Date: July 18, 1969

In reply to

Subject: Re: Phillips Creek (Stewart Creek) - Site 38S-199,
Hwy. 129 -- District #18 (Sault Ste. Marie)
W.P. 246-66 - Contract 69-108 - W.J. 69-F-5

We have recently reviewed the Contract Drawings for the above mentioned project. We note that the recommendations given in our memo dated March 19, 1969, to Mr. B. R. Davis, Bridge Engineer, relating to excavation of soft material, have not been followed. We have discussed this matter with the Regional Road Design Office and apparently there has been some misinterpretation - (see Teletype - June 25th - H. McArthur to A. G. Stermac). In any event, the Region has suggested that the District take the necessary steps to ensure that our recommendations are followed correctly. These you will find in Report 69-F-5, a copy of which has already been sent to you.

If we can be of any further assistance in this matter, please contact this Office.

K. G. Selby

KGS/MdeP

K. G. Selby,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

cc: Messrs. B. R. Davis
H. A. Tregaskes
D. W. Farren
H. W. Hurrell
S. B. Davidson
F. Norman

Foundations Files
Gen. Files

1969 JUN 25 PM 3:26

MX NBAR JUNE 25/69 3:01 PM

DOWN 6 A G STERMAC PRINCIPAL FOUNDATION ENG

ATTN K SELBY

CC

SAUL 1 J H BLEVINS DIST ENG

FTWR 1 F NORMAN MATERIALS AND TESTING

RE: PHILLIPS CREEK, HWY. 129, DISTRICT NO. 13

FURTHER TO OUR TELEPHONE CONVERSATION, THE CONTRACT WAS PREPARED ACCORDING TO SOILS REPORT. TO INCREASE MUSKEG EXCAVATION SHOULD NOT PRESENT A PROBLEM OTHER THAN OVERRUN ON EQUIPMENT RENTAL AND BACKFILL QUANTITIES. WE WOULD THEREFORE SUGGEST THAT YOU ADVISE THE DISTRICT AND REGIONAL SOILS OF YOUR RECOMMENDATIONS TO ENSURE PROPER CONSTRUCTION PROCEDURES.

J G VANDEKAA FOR H MCARTHUR REG RD DES ENG

LS

TELETYPE TELETYPE