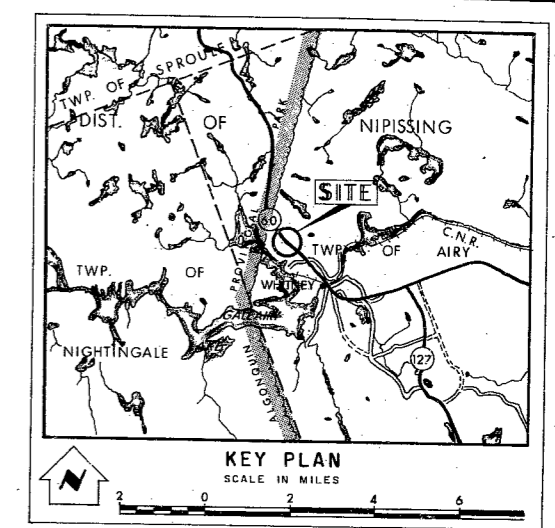
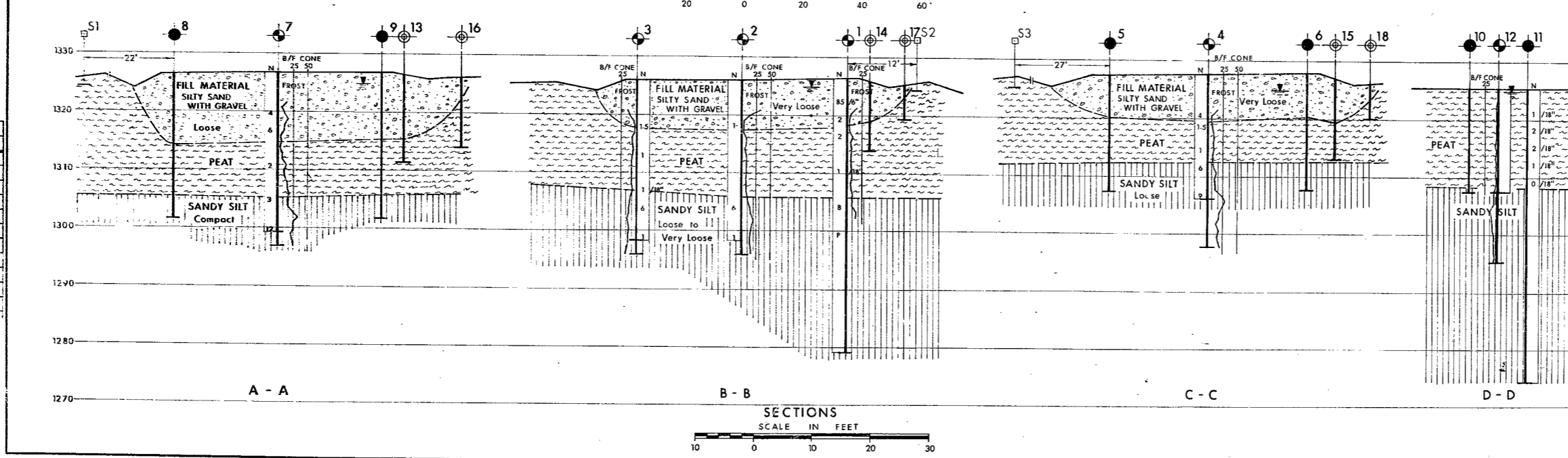
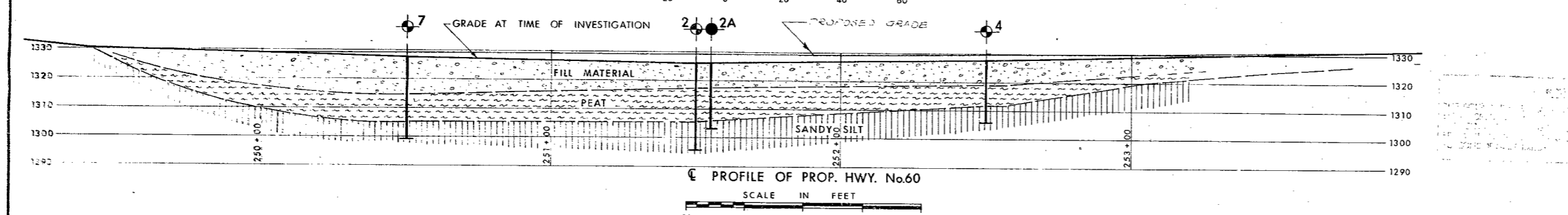
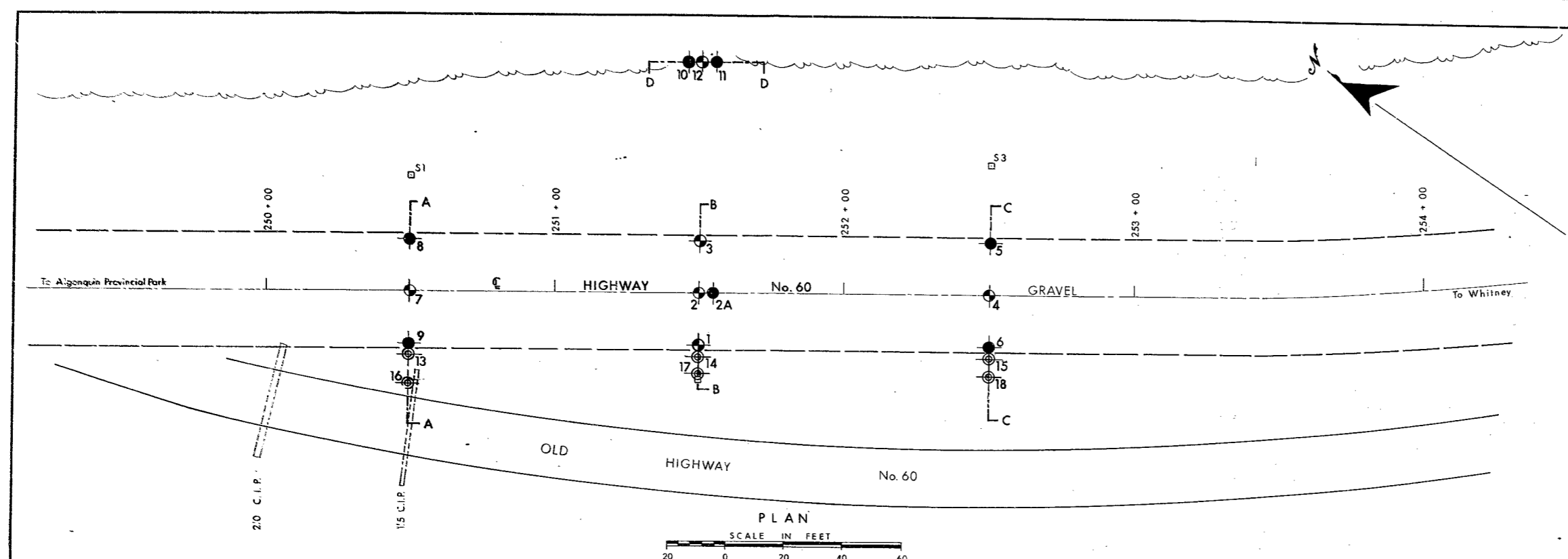


#66-F-20

CONT. #57-157  
HWY #60  
WHITNEY

SWAMP

INVESTIGATION



LEGEND			
	Bore Hole		
	Power Auger Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation, Feb. 1966		
	Settlement Plate		

NO.	ELEVATION	STATION	OFFSET
1	1326.5	251+50	18' RT.
2	1326.0	251+50	18' LT.
3	1326.0	251+50	18' LT.
4	1327.8	252+50	17' RT.
5	1327.5	252+50	17' RT.
6	1328.0	252+50	17' RT.
7	1326.8	250+50	18' LT.
8	1326.5	250+50	18' LT.
9	1326.8	250+50	18' LT.
10	1325.6	251+45	80' LT.
11	1325.6	251+55	80' LT.
12	1325.6	251+50	80' LT.
24	1326.0	251+54	80' LT.
51	1324.52	250+50	40' LT.
52	1324.58	251+50	30' RT.
53	1325.02	252+50	44' LT.
13	1326.6	250+50	22' RT.
14	1325.8	251+50	22' RT.
15	1327.0	252+50	22' RT.
16	1326.1	250+50	32' RT.
17	1325.3	251+50	28' RT.
18	1326.1	252+50	28' RT.

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & TESTING DIVISION - FOUNDATION SECTION			
SWAMP INVESTIGATION			
STA. 250+50, STA. 251+50, STA. 252+50			
KING'S HIGHWAY NO. 60		DIST. NO. 10	
60. DIST. OF NIPISSING			
TWP. OF AIRY		LOT 5	CON. VIII
BORE HOLE LOCATIONS & SOIL STRATA			
SUBM'D. R.M.	CHECKED	W.P. NO.	M.B.T. DRAWING NO.
DRAWN G.H.	CHECKED	JOB NO. 66-F-20	66-F-20A
DATE 18 APRIL 1966	SITE NO.	BRIDGE DRAWING NO.	
APPROVED	CONT. NO.		

## DEPARTMENT OF HIGHWAYS ONTARIO

## MEMORANDUM

23-65-157.

To: Mr. J. E. Callaghan,  
District Engineer,  
District #10 (Bancroft).

FROM: Foundation Section,  
Materials & Testing Div.,  
Room 107, Lab. Bldg.

DATE: July 15, 1966

JUL 21 1966

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Hwy. 60 over a Swampy Area,  
Approx. 3 Miles West of Whitney  
District #10 (Bancroft)

W.J. 66-F-20 -- Cont. 65-157

Attached, we are forwarding to you, our detailed foundation investigation report for the above mentioned project where Hwy. 60 crosses a swampy area.

We believe that the factual data, together with our conclusions, will be adequate for your present requirements.

Should additional information be required, please do not hesitate to contact our Office.

AGS/Eden  
Attach.

cc: Messrs. J. E. Callaghan (2)

H. A. Tregaskes

D. W. Farren

R. S. Pillar

J. E. Gruspier

Foundations Office (2)

Gen. Files ✓

107  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGINEER

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3. FIELD INVESTIGATION PROCEDURE.
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  - 5.2) Fill Material (Silty Sand with Gravel).
  - 5.3) Peat.
  - 5.4) Sandy Silt.
6. CONCLUSIONS.
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b) Standard Penetration Tests.
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b) Bulk Densities.

# FOUNDATION INVESTIGATION REPORT

For

Hwy. 60 over a Swampy Area,  
Approx. 3 Miles West of Whitney  
District #10 (Bancroft)

W.J. 66-F-20 -- Cont. 65-157

---

## 1. INTRODUCTION:

Following verbal discussions between Mr. A. G. Stermac, Principal Foundation Engineer, and Mr. J. Callaghan, District Engineer, Bancroft, it was decided that the Foundation Section should carry out a field investigation including some instrumentation at the site of a swamp crossing on Hwy. 60, approximately three miles west of Whitney.

An investigation was subsequently carried out by this Section during the period February 6 to Feb. 15, 1966. This period coincided with the latter phases of a staged construction which was actually started some time previously in October 1965, based on the recommendations of Mr. J. E. Gruspier, Regional Materials Engineer.

The purpose of our investigation was to observe the performance of fill material placed in stages over a swampy section of the highway. The various aspects of the investigation which received detailed study were: settlement of the fill, consolidation, displacement and deformation of the underlying organic subsoil layers.

## 2. DESCRIPTION OF SITE:

The site is located in northern Ontario, about 3 miles west of the town of Whitney, near the eastern entrance of Algonquin Park. The terrain is generally hilly, with the hills and valleys being formed by undulating bedrock. Generally, these valleys are partially filled with sands and silts, but occasionally peat and muskeg overlie the granular materials. The actual site

cont'd. /2 ...

2. DESCRIPTION OF SITE: (cont'd.) ...

is located at one such area. At this location, the road crosses at right angles, a 20-ft. deep and 400-ft. wide valley, containing a deposit of organic peat.

Physiographically, the area is part of the Pre-Cambrian Shield also known as the "Canadian Shield." The bedrock is generally a granite biotite gneiss. This rock as mentioned above, has been extensively folded. It has partially broken down due to weathering and erosion, to form the sands and silts which fill the valleys.

3. FIELD INVESTIGATION PROCEDURE:

Twelve sampled boreholes and six dynamic cone penetration tests were carried out during the course of the field investigation. The work was carried out in the field by means of a conventional diamond drill adapted for soil sampling purposes. Thin-walled Shelby tube samplers were pushed manually into the soils, wherever possible, in order to recover undisturbed samples, while disturbed samples were obtained by means of a split-spoon. In addition, in-situ vane tests were conducted in the field to determine the shear strength of cohesive materials. Standard and dynamic penetration tests were performed using a driving energy of 350 ft.-lbs.

The main objective of the foundation investigation can be summarized as follows:

- 1) To establish the existing subsoil stratigraphy.
- 2) To determine the original extent and physical properties of the subsoil, and to compare these with the present conditions (after placing the fill).
- 3) To measure any vertical settlements.

cont'd. /3 ...

3. FIELD INVESTIGATION PROCEDURE: (cont'd.) ...

In order to achieve these objectives, the following field programme was carried out. Boreholes 1 to 9 inclusive, were drilled at centre-line, 18 ft. Lt. and 18 ft. Rt. at each of the three sections, Sta. 250+50, Sta. 251+50, and Sta. 252+50, to determine the existing conditions. Three boreholes (No's. 10, 11 and 12), were drilled some 80 ft. Lt. of centre-line, Sta. 251+50, the purpose of these being to provide information about the soil prior to the placing of any fill material. It is here (assumed that soil conditions were generally uniform over the whole of the swampy area), that settlement plates were installed at three locations: Sta. 250+50 (40 ft. Lt.), Sta. 251+50 (30 ft. Rt.), and Sta. 252+50 (44 ft. Lt.).

The exact locations and elevations of the boreholes and settlement plates were surveyed by a Department of Highways' survey crew from Bancroft District, and are shown on Dwg. 66-F-20A, which accompanies this report.

Dwg. 66-F-20B is included in the Appendix, and shows comparisons of certain field tests carried out during the investigation in B.H.'s 1 - 9 and B.H.'s 10 - 12. These field tests are: 1) in-situ vane tests; 2) Standard Penetration tests.

4. LABORATORY WORK:

All soil samples were subjected to a careful visual inspection in the laboratory prior to any testing being carried out. Following this inspection, representative samples were selected and tests were carried out to define certain physical properties, primarily for identification and classification purposes. These tests were as follows:

- 1) Atterberg Limits
- 2) Grain-size Distribution
- 3) Bulk Densities
- 4) Undrained Shear Strengths
- 5) Moisture Contents
- 6) Organic Contents

cont'd. /4 ...

4. LABORATORY WORK: (cont'd.) ...

The purpose of the investigation included the determination of the effects of the fill material on the adjacent soil strata. Tests were therefore carried out on samples recovered from boreholes located some distance away from the influence of the fill. For these purposes of comparison, samples were selected and tested to define:

- i) Moisture Contents
- ii) Undrained Shear Strengths
- iii) Bulk Densities

The results of all laboratory testing are summarized on the record of borelog sheets contained in the Appendix of the report. In addition, the following drawings are included in the report in order to show a comparison of soil properties at the different locations (i.e., below the fill and some distance away from the fill):

- Dwg. 66-F-20B - Undrained Shear Strengths comparison
- Dwg. 66-F-20C - Comparison of Moisture Contents and Bulk Densities.

5. SUBSOIL CONDITIONS:

5.1) General:

A subsoil investigation was carried out by the Regional Materials and Testing Division of the Department, during July 1962. The purpose of this investigation was to provide information for the design and construction of Hwy. 62 in this area. This investigation revealed that the site is generally covered by 16 to 20 ft. of a soft organic deposit (peat), followed by a granular deposit of silty sand and sandy silt.

Subsequently, during the progress of construction, as requested by the District, a detailed subsoil investigation was carried out by this Section during the period of Feb. 7 - 15, 1966. Subsoil conditions revealed by our foundation investigation,

5. SUBSOIL CONDITIONS: (cont'd.) ...

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

generally confirmed the findings of the Regional Materials and Testing Division, with the exception that embankment fill consisting of silty sand with gravel, has been placed on the peat to form a so-called "floating roadbed." This embankment, however, has been settling due to its own weight so that at the time of the second investigation, the top of the roadbed was approximately level with the surrounding peat, although some 8 to 10 ft. of material had already been placed.

A detailed description of the soil types encountered are shown on the attached borelog sheets. The estimated stratigraphical profile on Dwg. 66-F-20A, is based upon this information. A description of the various deposits follows:

5.2) Fill Material (Silty Sand with Gravel):

This material forms the existing roadbed and consists of silty sand with gravel. Due to settlement and displacement of the underlying peat deposit, the thickness of the roadbed ranged from 7 to 12 ft. Generally speaking, the base of the roadbed is parallel with the surface and the variation in depth is in the longitudinal rather than the transverse direction. Standard Penetration test results gave 'N' values ranging from 1 to 6 blows/ft., indicating a very loose to loose relative density. Average moisture content was found to be 15%.

5.3) Peat:

Except for the portion where it has been displaced and/or compressed by the fill, this deposit covers the entire site area. The layer extends downward from ground surface, or directly from below the roadbed. The original thickness of the peat deposit as revealed by borings 10, 11 and 12, was in the order of 17 ft. Under the roadbed the thickness ranges from 6 to 12 ft. The material within the deposit consists of fibrous organic peat, dark brown to black in colour. The actual organic content as determined

cont'd. /6 ...

5. SUBSOIL CONDITIONS: (cont'd.) ...

5.3) Peat: (cont'd.) ...

from chemical tests, was found to range from 56% to 96%.

A comparison of physical properties of the peat deposit under the roadbed and at the location some distance away from the roadbed, is given below:

	<u>Under the Roadbed</u>	<u>Away from the Roadbed</u>
Moisture Contents	434% - 800%	729% - 869%
Field Vanes	1120 p.s.f. - 200 p.s.f.	480 p.s.f. - 120 p.s.f.
Undrained Shear Strengths	445 p.s.f. - 90 p.s.f.	160 p.s.f. - 96 p.s.f.
'N' Values	2 blows/ft. - 1 blow/18"	2 blow/18" - 1 blow/18"

From these results, it can be seen that the undrained shear strength of the organic deposit in the remaining upper 3 to 4 ft. has undergone a considerable increase in strength. This is evident, not only from strength results, but also from moisture content results.

5.4) Sandy Silt:

This deposit was found to directly underlie the peat. The maximum depth of penetration into the stratum was 34 ft. in borehole #11. At this depth the rods began bouncing hard, indicating the presence of either bedrock or boulders. Standard Penetration test (N) values in the deposit varied at random, ranging from 1 blow/ft. to 12 blows/ft., indicating a relative density of very loose to compact, with the majority of the values in the very loose to loose range.

6. CONCLUSIONS:

The success of any highway construction method can be judged only by the subsequent performance of the road over an extended period of time. In the case of this particular swamp

cont'd. /7 ...

6. CONCLUSIONS: (cont'd.) ...

crossing, the method used was one of stage construction in which the rate of placement of fill was determined by the rate and amount of settlement taking place. The present investigation and instrumentation carried out, indicates a certain increase in strength and, therefore, load bearing capacity of a portion of the underlying compressible layers. Definite conclusions cannot, however, be drawn at this stage since the roadbed has not even been completed to the final grade. As a continuing and necessary part of this investigation, settlement readings must be taken at regular intervals for a sufficient period of time after the highway is completed to establish that the rate of settlement is sufficiently small to be tolerable from a maintenance point of view.

7. MISCELLANEOUS:

The field work, performed during the period February 7 to 16, 1966, was undertaken by Mr. R. Magi, Project Foundation Engineer, under the general supervision of Mr. M. Devata, Supervising Foundation Engineer.

Equipment used was owned and operated by Johnston Drilling Co. Ltd., Ottawa.

The report was prepared by Mr. M. Devata, with the assistance of Mr. R. Magi.

July 1966

APPENDIX I

## 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 :-

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
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

Q <sub>u</sub>	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V	FIELD VANE
Q <sub>cu</sub>	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q <sub>d</sub>	DRAINED TRIAXIAL	S	SENSITIVITY

## ABBREVIATIONS USED IN THIS REPORT

### SOIL PROPERTIES

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	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
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION
	INTERCEPT
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_t$	SENSITIVITY

### GENERAL

$\pi$	= 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
$\sigma$	NORMAL STRESS
$\sigma'$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

### EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	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
$\beta$	ANGLE OF SLOPE TO HORIZONTAL

# RECORD OF BOREHOLE NO. 1

## FOUNDATION SECTION

## MATERIALS & TESTING DIVISION

JOB 66-F-20

LOCATION: Sta. 251+50, 18' Rt. of C

ORIGINATED BY R.M.

W.P. \_\_\_\_\_ BORING DATE Feb. 7 & 8, 1966.

COMPILED BY        A.B.

DATUM Geodetic

BOREHOLE TYPE Washboring, NX Casing.

CHECKED BY M.D. *OK*

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

JOB 66-F-20

LOCATION Sta. 251+50 E

RECORD OF BOREHOLE NO. 2

**FOUNDATION SECTION**

W. P.

BORING DATE Feb. 9, 1966.

ORIGINATED BY R.M.

DATUM Geodetic

BOREHOLE TYPE Washboring, NX Casing.

COMPILED BY A.B.

CHECKED BY M.D. *[Signature]*

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 2A

FOUNDATION SECTION

JOB 66-F-20

LOCATION Sta. 251/55 E

ORIGINATED BY R.H.

W.P. \_\_\_\_\_

BORING DATE Feb. 9, 1966.

COMPILED BY A.B.

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Casing.

CHECKED BY M.D. *AK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT — WP	WATER CONTENT — W		
1326.0	Groundlevel											
1317.5	Fill Material (Silty sand with gravel)					1320						
8.5	Peat		1	SS	2/18							
			2	SS	2							
			3	SS	1/18	1310						
1306.5			4	SS	1/18							
19.5	End of borehole.					1300						



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 66-F-20

LOCATION Sta. 252/50 E

ORIGINATED BY B.M.

W.P. \_\_\_\_\_

BORING DATE Feb. 11, 1966.

COMPILED BY A.B.

DATUM Geodetic

BOREHOLE TYPE Washboring, NX Casing.

CHECKED BY M.D. *HL*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT		PLASTIC LIMIT — WP			
							10	20	30	40		
							SHEAR STRENGTH P.S.F.		WP — W — WL			
							+ - Field Vane					
							o - Unconf. Comp.					
							200 400 600 800 1000		200 400 600			
1327.8	Groundlevel											
	Fill Material (Silty sand with gravel)											
1319.8	Very loose.		1	SS	4	1320						
8.0	Peat		2	SS	2/18							
			3	TW	P							
			4	SS	1							
1312.8			5	SS	6							
15.0	Sandy silt.					1310						
1306.3	Loose		6	SS	9							
21.5	End of borehole.											
						1300						
						1290						
									</			

20  
5-φ 5 Percent strain at failure.  
10

Org. Cont.  
94.7%

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 5

### FOUNDATION SECTION

JOB 66-F-20

LOCATION Sta. 252/50, 17' Lt. of C

ORIGINATED BY R.M.

W. P.

BORING DATE Feb. 12, 1966.

COMPILED BY A.B.

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Casing.

CHECKED BY:            M.D.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT _____	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W				BULK DENSITY  P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.						
1327.5	Groundlevel												
1320.3	Fill Material (Silty sand with gravel)					1320							
7.2	Peat												
1312.5													
15.0	Sandy silt.					1310							
1307.5													
20.0	End of borehole.					1300							

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

JOB 66-F-20

LOCATION Sta. 252+50, 17' Rt. of E

ORIGINATED BY R.M.

W. P.

BORING DATE Feb. 12, 1966.

COMPILED BY A.B.

DATUM Geodetic

BOREHOLE TYPE Washboring, BX Casing.

CHECKED BY           M.D.          

## RECORD OF BOREHOLE NO. 6

### FOUNDATION SECTION

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT _____	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W				BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.	 Wp      w      Wl WATER CONTENT %					
1328.0	Groundlevel												
	Fill Material (Silty sand with gravel)					1320							
1320.6	7.4 Peat												
1312.8						1310							
15.2	Sandy silt.												
1308.0													
20.0	End of borehole.					1300							

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 7

FOUNDATION SECTION

JOB 66-F-20LOCATION Sta. 250/50 EORIGINATED BY R.M.W.P. \_\_\_\_\_ BORING DATE Feb. 12-14, 1966COMPILED BY A.B.DATUM GeodeticBOREHOLE TYPE Washboring, NX Casing.CHECKED BY M.D. *HL*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 10 20 30 SHEAR STRENGTH P.S.F. + - Field Vane o - Unconf. Comp. 200 400 600 800 1000	LIQUID LIMIT _____ WL PLASTIC LIMIT _____ WP WATER CONTENT _____ w wp o WL WATER CONTENT % 200 400 600	BULK DENSITY P.C.F. 61.5	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT					
1326.8	Groundlevel									
	Fill Material (Silty sand with gravel)		1	SS	4	1320				
			2	SS	6					
1314.8	(Loose)		3	TW	P					
12.0	Peat		4	SS	2	1310				
			5	TW	P					
1305.3			6	SS	3					
21.5	Sandy silt.									
1309.3	Compact.		7	SS	12	1300				
27.5	End of borehole.									

20  
15-5 Percent strain at failure.  
10



CHECKED BY                      M.D.

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

**MATERIALS & TESTING DIVISION**

RECORD OF BOREHOLE NO. 10

## FOUNDATION SECTION

JOB 66-F-20 LOCATION Sta. 251+45, 80' Lt. of E ORIGINATED BY R.M.  
W.P.  BORING DATE Feb. 15, 1966. COMPILED BY A.B.  
DATUM Geodetic BOREHOLE TYPE Washboring, BX Casing. CHECKED BY M.D. *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F. O - Unconf. Comp.					WATER CONTENT %					
						200	400	600	800	1000							
1325.6	Groundlevel																
	Peat	~	1	TW	P	1320	0								o	Org. Cont.	
		~	2	TW	P												90.5%
		~	3	TW	P												
		~	4	TW	P												
1308.6		~	5	TW	P	1310	0									18.8%	
17.0	Sandy silt.																
18.0	End of borehole.																
						1300											
						1290											
							20 15 10	5 Percent strain at failure.									

## RECORD OF BOREHOLE NO. 11 &amp; 12

FOUNDATION SECTION

## MATERIALS &amp; TESTING DIVISION

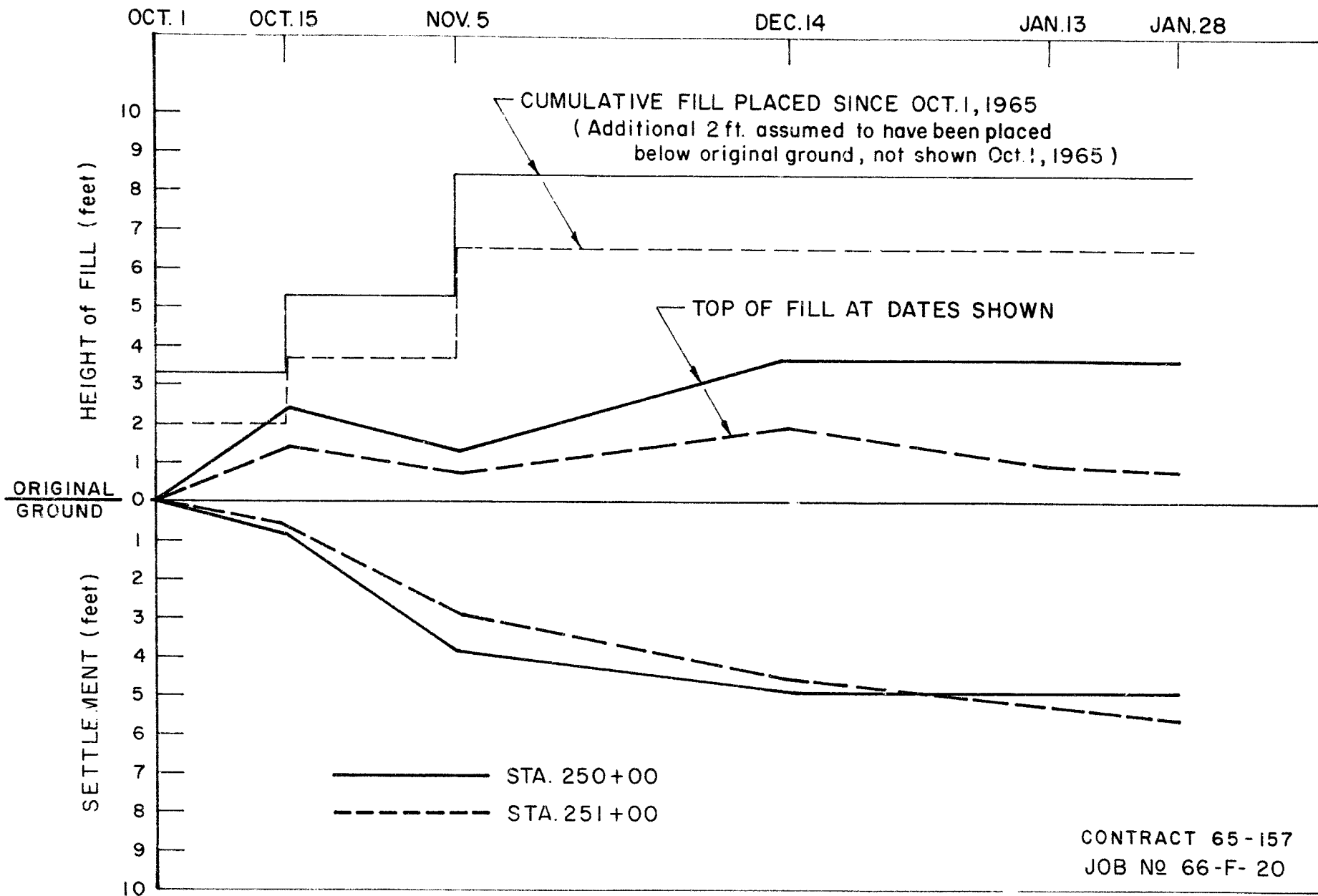
JOB 66-F-20LOCATION Sta. 251+55, 80' Lt. of EORIGINATED BY R.M.

W.P. \_\_\_\_\_

BORING DATE Feb. 15, 1966.COMPILED BY A.B.DATUM GeodeticBOREHOLE TYPE Washboring, BX Casing.CHECKED BY M.D. *MR*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT _____ WL		BULK DENSITY X P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	10 20 30	PLASTIC LIMIT _____ WP	WATER CONTENT _____ W		
1325.6	Groundlevel											
0.0	Peat		1	SS	1/18	1320		+5				
			2	SS	2/18			+5				
			3	SS	2/18			+3				
			4	SS	1/18			+2				
1300.6			5	SS	0	1310		+3				
17.0	Silt with traces of sand.											
						1300						
						1290						
						1280						
1274.6												
51.0	End of borehole. Rods Bouncing!					1270						

B.H. #12 was the field vane hole, put down  
some 5 ft. from B.H. #11.





ONTARIO

DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

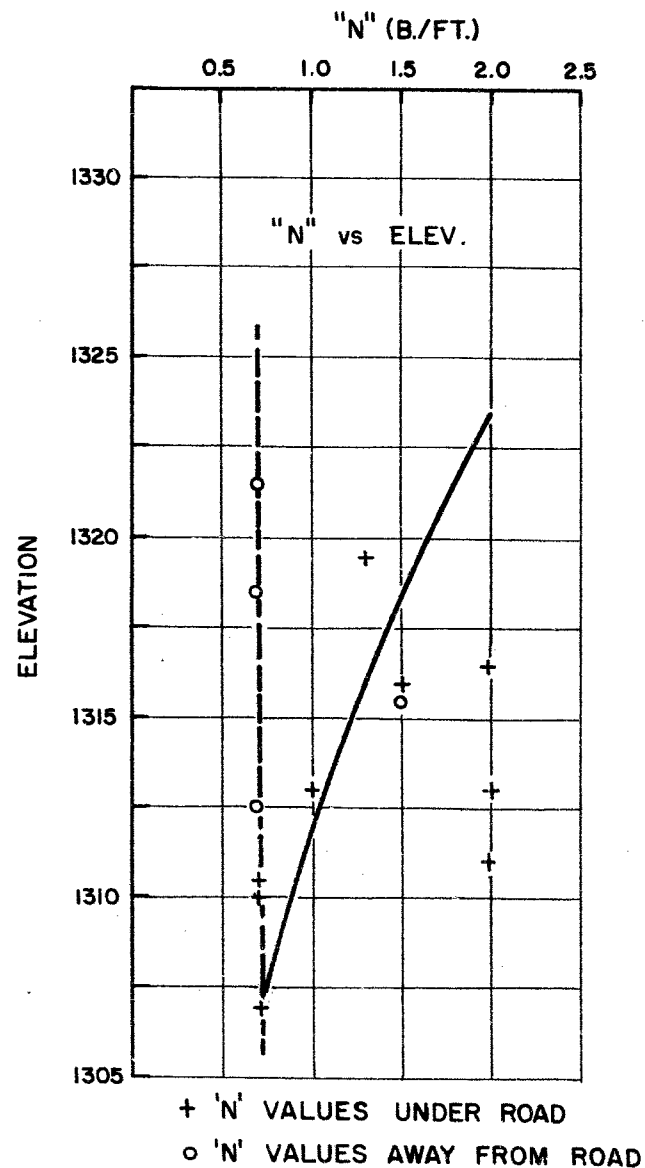
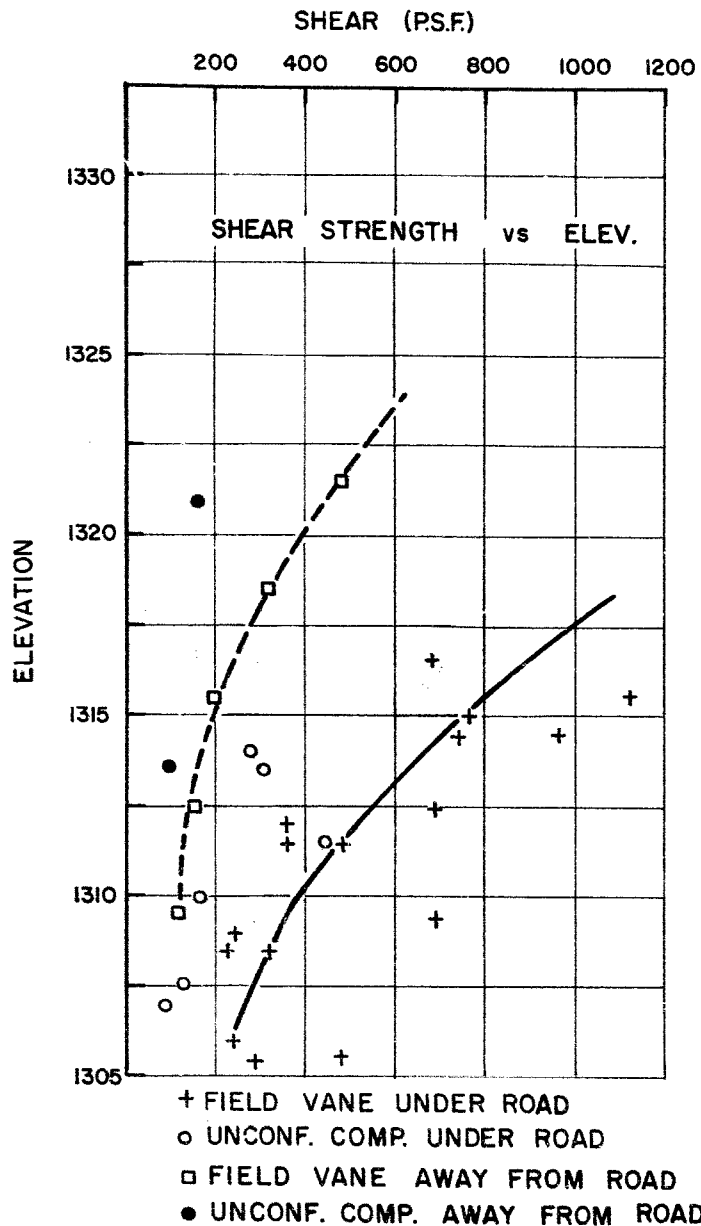
DATE JULY 13, 1966

APPROVED

*W. L. Mac*

DRAWING NO.

66-F-20-B

STRENGTH TEST RESULTS  
FOR PEAT DEPOSIT



ONTARIO

 DEPARTMENT OF HIGHWAYS  
 MATERIALS and  
 TESTING  
 DIVISION

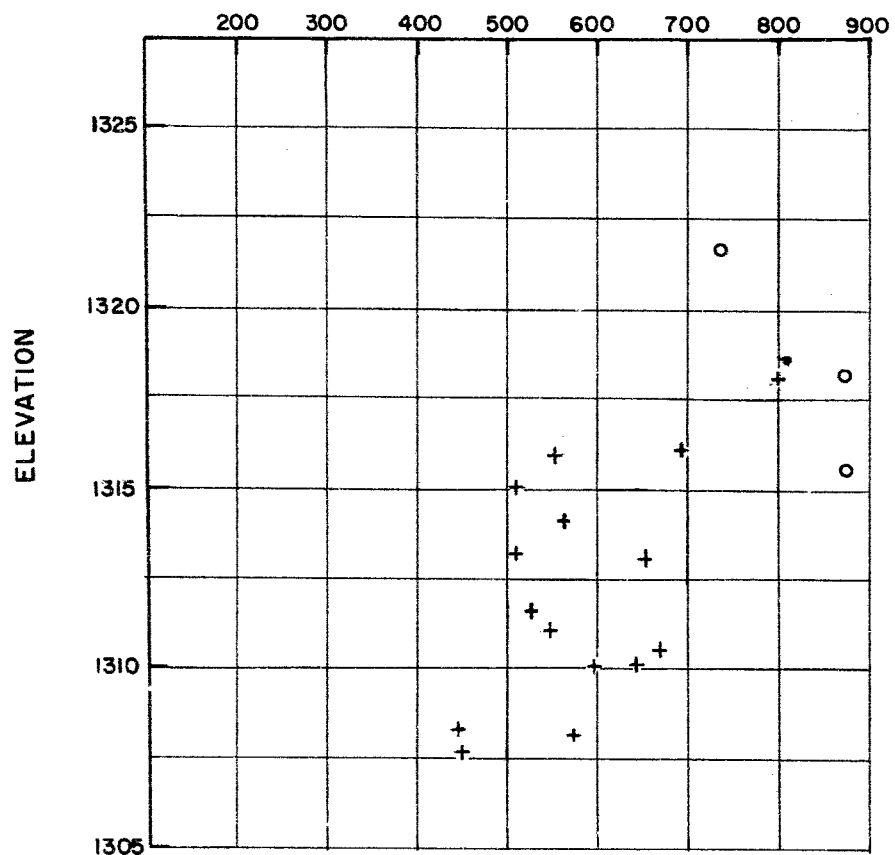
DATE JULY 13, 1966

APPROVED

DRAWING NO. 66-F-20-C

 MOISTURE CONTENT AND BULK DENSITY  
 OF PEAT DEPOSIT

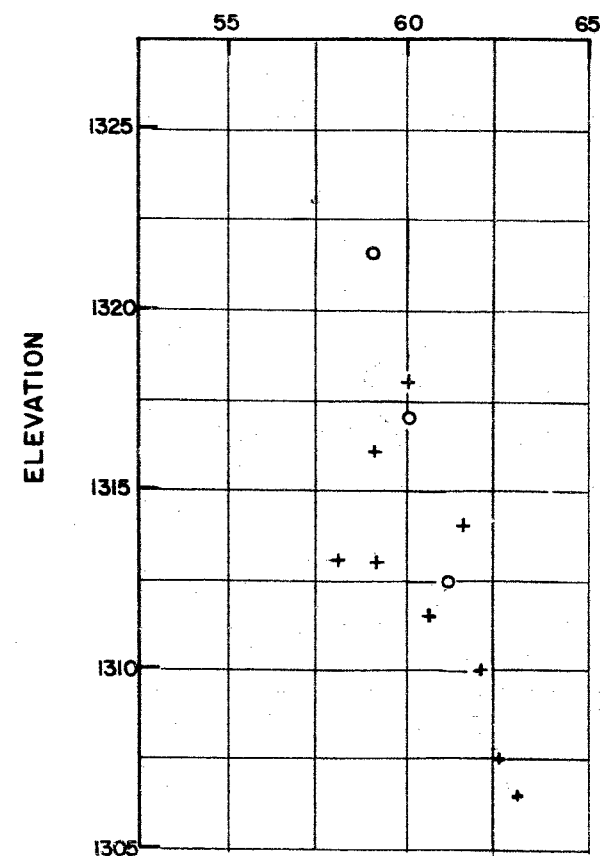
MOISTURE CONTENT (%)



+ MOISTURE CONTENT OF PEAT UNDER INFLUENCE OF THE ROAD

o MOISTURE CONTENT OF PEAT AWAY FROM ROAD

BULK DENSITY (P.C.F.)



+ DENSITY OF PEAT UNDER INFLUENCE OF THE ROAD

o DENSITY OF PEAT AWAY FROM ROAD

Mr. A. Stormac

District #10-Rancroft.

February 16th, 1966.

Report On Muskeg Swamp Station 249/50 - 254/00,  
Contract No. 65-157,  
Highway #60 - Whitney.

On October 11th, 1965, the contractor began placing the estimated 4,300 cubic yards of earth fill required over the muskeg swamp Station 249/50 - 254/00.

The fill kept settling as fast as it was brought to subgrade (profile grade minus 18") and thus was not completed until October 14th, 1965 and actually required 6,600 cubic yards. At that time operations were suspended pending completion of the rock cuts at either end of the swamp.

By November 5th, 1965, this fill had settled approximately 1.2 feet from subgrade elevation (profile grade minus 18").

On December 13th, 1965, granular operations were begun which, due to settlement, could not be completed and since no progress could be made had to be suspended on December 14th, 1965. The traffic was rerouted onto the new grade and although there had been 2,400 tons of granular placed the fill was still 1.5 feet below profile grade.

On December 20th, 1965, due possibly to slight frost action there appeared to be no further settlement and granular operations were resumed.

On December 21st, 1965, the fill was completed to profile grade and although the original estimated quantity of granular ("A" Plus "B") required was 2,000 tons there had been a total of 4,500 tons placed.

By January 25th, 1966, there had been no additional work done on the fill but a profile taken at that time showed a settlement from profile grade of approximately 3 feet which, due probably to frost action following the extremely cold weather, has remained unchanged to date.

(continue.....)


February 16th, 1966.

Report On Muskeg Swamp Station 249/50 - 254/00,  
Contract No. 65-157,  
Highway #60 - Whitney.

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The estimated depth of fill placed to date is approximately 8 - 10 feet and consists of 2 - 3 feet of granular over sandy type earth and the existing grade is approximately 1.0 feet above the level of the swamp.



  
John E. Maxwell

C. to Mr. J.E. Callaghan  
Mr. A. Stermac ✓  
Mr. J. Gruspier  
Mr. B. McKay

66-F-20

To.

MR. F. L. DELTEA  
 CONSTR. SUPERVISOR  
 DEPT. OF HWYS,  
 BANCROFT ONT.

FROM

W. B. WIGGINS  
 CONT. 68-187  
 WHITNEY ONT.  
MAY 30 1966.

RE: SWAMP INVESTIGATION

STATION 250+50 TO 252+50

As you know, a maximum of 3.0 feet of Granular "B" was recently placed through this swamp area. Settlement plates <sup>were placed</sup> on the existing new grade prior to placing the "B" and elevations established for the plates at that time. Shots were taken on the plates at various times during the placing of the material to determine if settlement was occurring. Following is a record of the elevation changes, showing the amount of material that had been placed at the time the shots were taken.

MAY 16 1966 - Prior to placing granular

250+50 - plate elev. 1325.84

251+50 - " " 1325.29

252+50 - " " 1327.07

MAY 16 1966 - After 1.5' of granular placed.

251+50 - plate elev. 1325.17

MAY 16 1966 After 2.0 of granular placed.

250+50 - plate elev. 1325.75

251+50 - " " 1325.20

252+50 - " " 1327.01

THIS STATION NOW AT  
PROFILE GRADE.

MAY 17 1966 After 2.5' of granular placed

251+50 - plate elev 1325.08

MAY 18 1966 After 3.0' of granular placed - a.m.

250+50 - plate elev. 1325.70

THIS STATION NOW AT  
PROFILE GRADE.

251+50 - " " 1324.92

THIS STATION NOW  
APPROX. .50 BELOW GED.

252+50 - " " 1326.99

NO MAT'L PLACED  
AT THIS STATION.

MAY 18 1966 No more mat'l placed - shots taken P.M.

250+50 - plate elev 1325.63

251+50 - " " 1324.74

252+50 - " " 1326.96

MAY 20, 1966 - 2 days after placing material

250+50 -	plate elev	1325.43
251+50 -	" "	1324.51
252+50 -	" "	1326.86

---

MAY 25 1966 - 7 days after placing material

250+50 -	plate elev	1325.09
251+50 -	" "	1324.23
252+50 -	" "	1326.81

---

MAY 27 1966 - 9 days after placing material

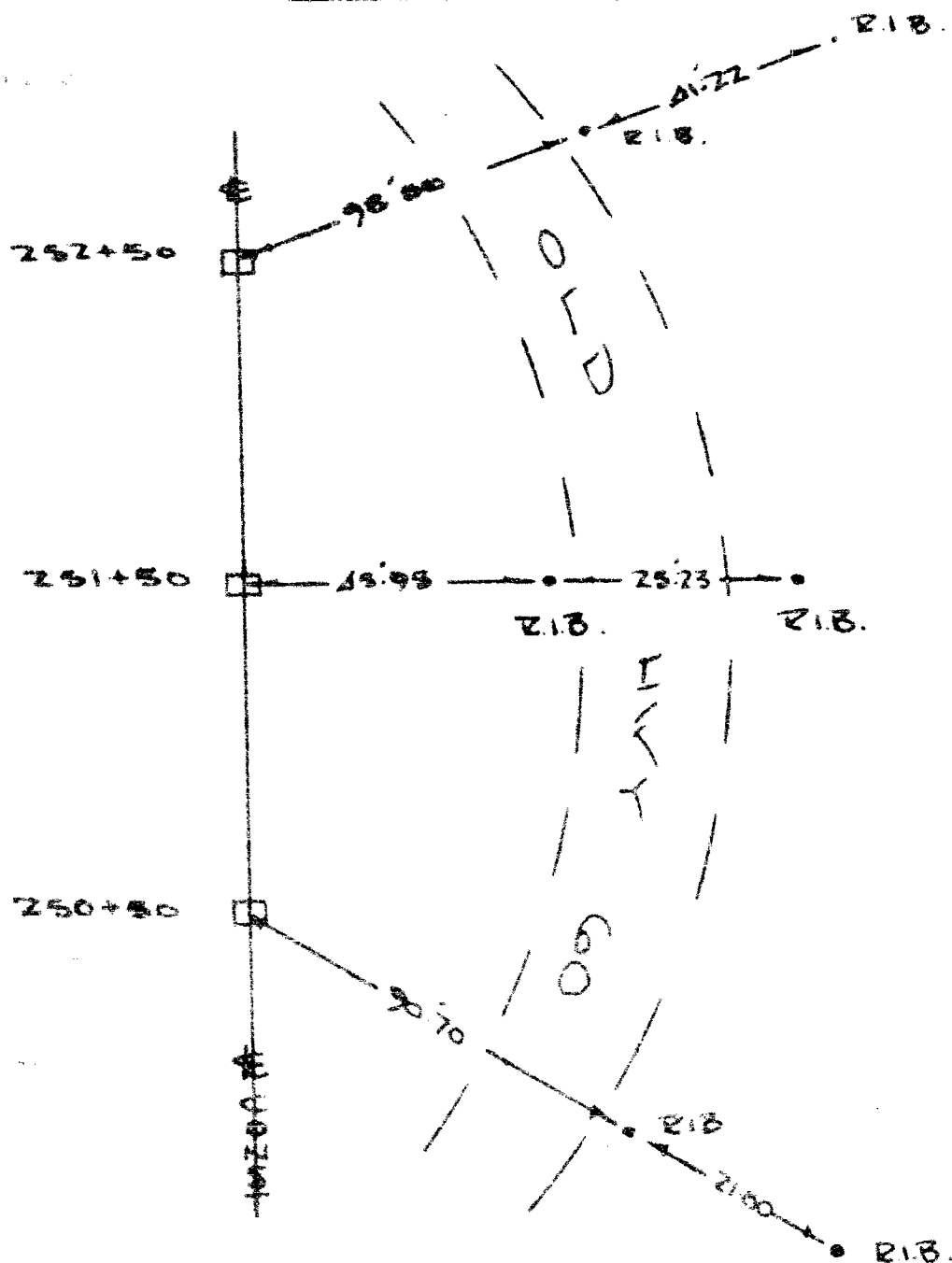
250+50 -	plate elev.	1325.07
251+50 -	" "	1324.07
252+50 -	" "	1326.62

---

Would you please advise me if further study of this area is required by our survey crews.

Yours Truly,  
W.B. Vicens

# SKETCH SHOWING LOCATION OF SETTLEMENT PLATES.



DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. Stermac,  
Principal Foundation Engineer,  
M.&T. Division, Downsview.

FROM: M.&T. Division, Kingston.

DATE: June 30, 1966. 66 F 20

OUR FILE REF.

IN REPLY TO

SUBJECT: Re: Hwy. 60. Contract 65-157. Whitney.

Attached are the borings carried out at the site of the muskeg area as requested by your office.

As mentioned to Mr. Devatta in a phone conversation this morning an additional foot approximately of granular material was placed about a week and a half ago to bring the grade to profile grade prior to the contractor completing the contract and leaving the job site. We have received no settlement readings from the District for some time now and it will likely be necessary to contact the District when the settlement readings are required.

JEG:cdr

*J. E. Gruspier*  
J. E. Gruspier  
Regional Materials Engineer

*March 31.*

66F-20A

LOG OF BORINGS

Contract 65-157

Hwy. 127 W'ly 9.8 Mi.

Hwy. 60

POWER AND LIGHT

Station 250+50

22' (Rt.) 3.5' Above Water

0 - 14'  
14' - 15'

G.B.C. 'B'  
Muck

1326.6

Station 251+50

22' (Rt.) +3' Above Water

0 - 7'  
7' - 12'

G.B.C. 'B'  
Muck

1325.8

Station 252+50

22' (Rt.) +3½' Above Water

0 - 7½'  
7½' - 14'

G.B.C. 'B'  
Muck

1327.0

Station 252+50

55' (Rt.)

0 - 4"  
4" - 48"  
48" - 96"  
96" - 10'

Mulch  
Si. F. Grav. Sty.  
Wet Gr. Sa. Si. Till Grav.  
Muck

Station 251+50

50' (Rt.)

0 - 8"  
8" - 72"  
72" - 96"

Mulch  
Moist. Rd. Sa. Si. Till Grav. Sty.  
Muck

Station 250+50

47' (Rt.)

0 - 3"  
3" - 72"  
72" - 96"

Mulch  
Sat. Gr. Si. F. Grav. Sty. Cbl.  
Muck

Station 250+50

32' (Rt.)

0 - 36"  
36" - 60"

Si. F. Grav. 1326.1  
Muck

Station 251+50

28' (Rt.)

0 - 24"  
24" - 72"

Si. F. Grav. Sty. 1325.3  
Muck

Station 252+50

28' (Rt.)

0 - 30"  
30" - 72"

Si. F. Grav. 1326.1  
Muck

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.

:cdr  
June 30/66