

#67-F-31

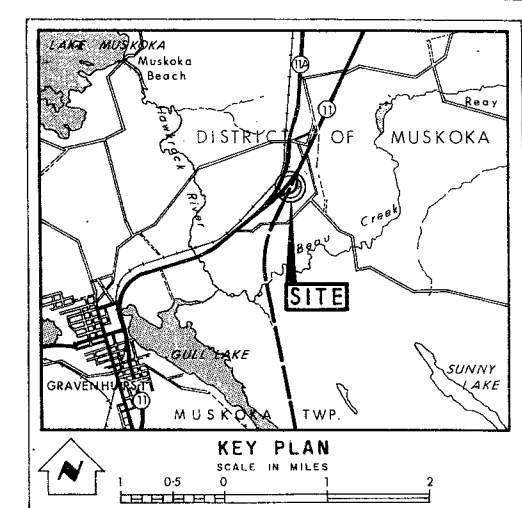
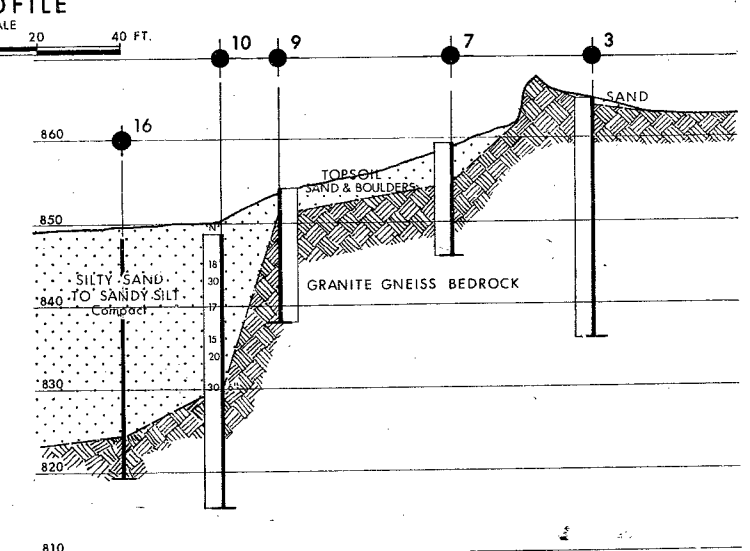
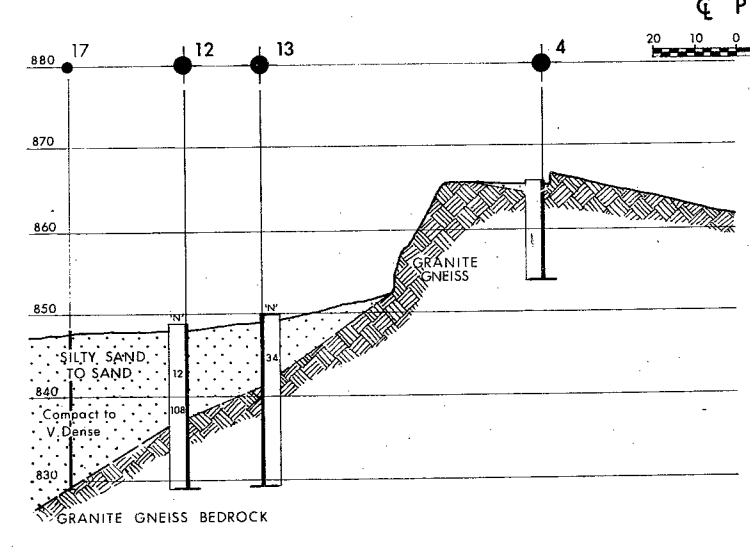
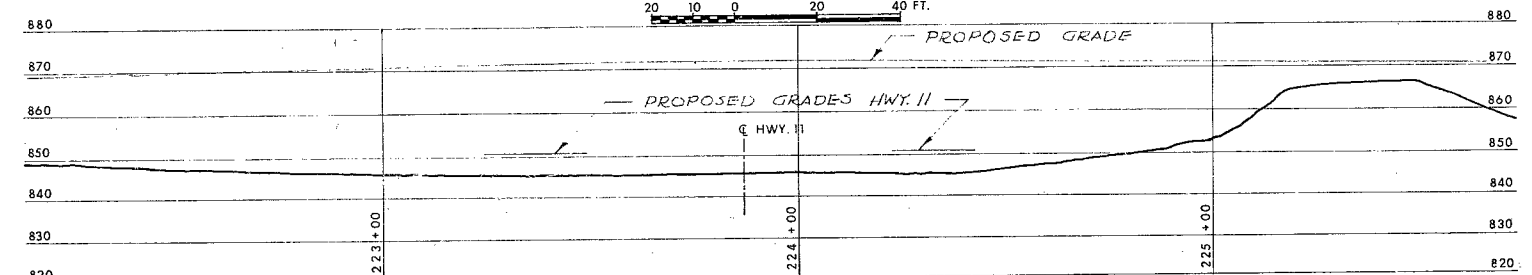
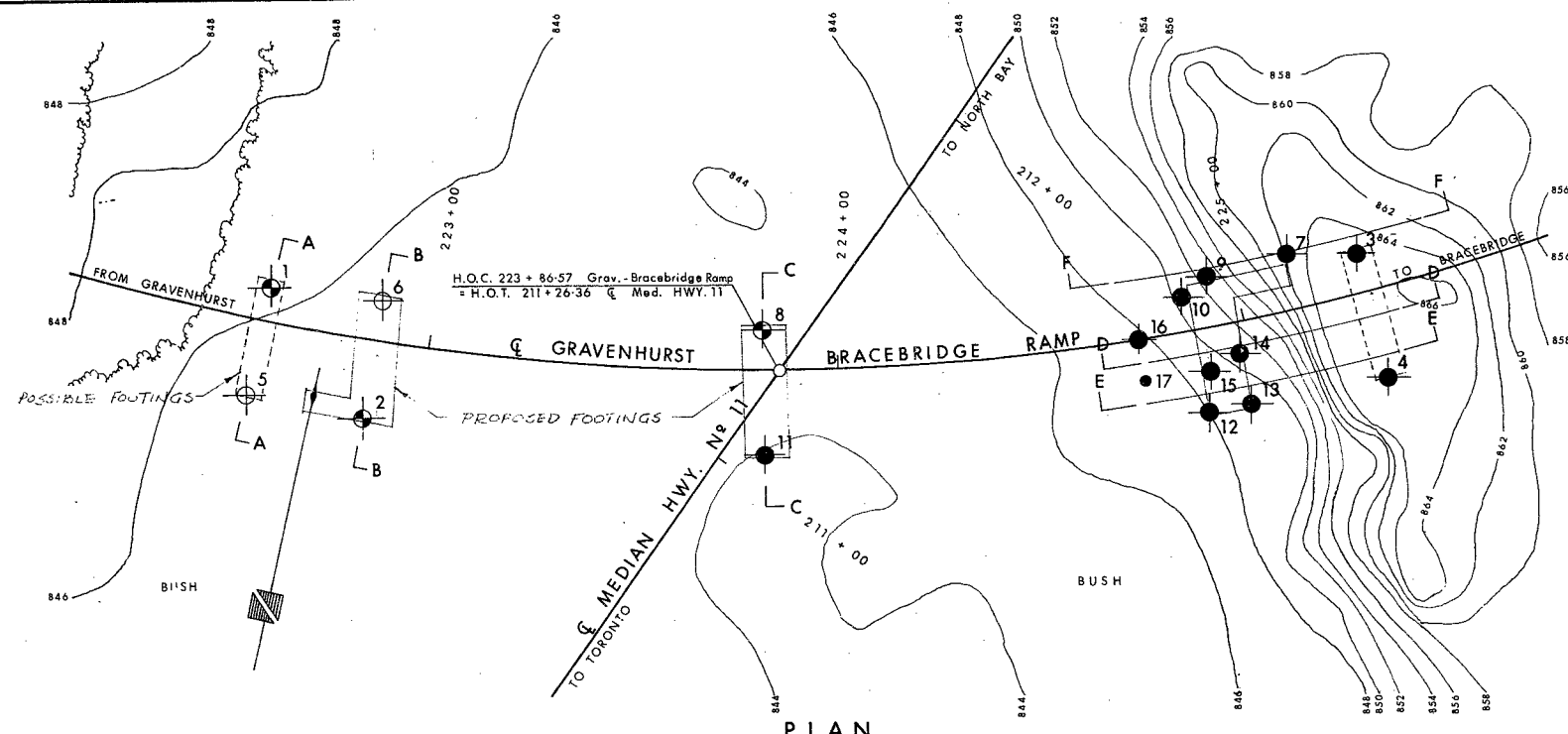
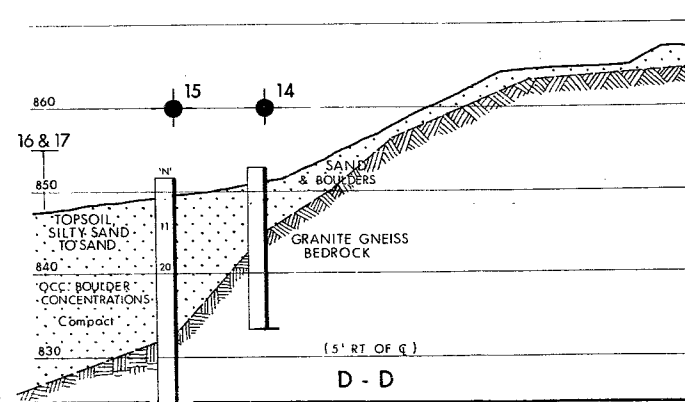
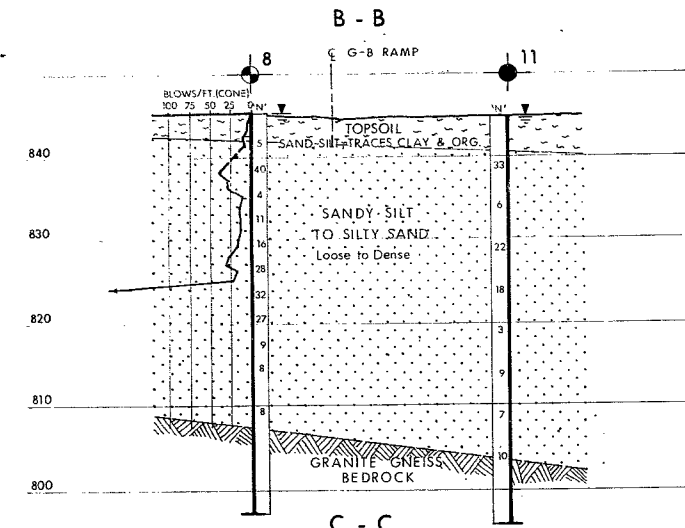
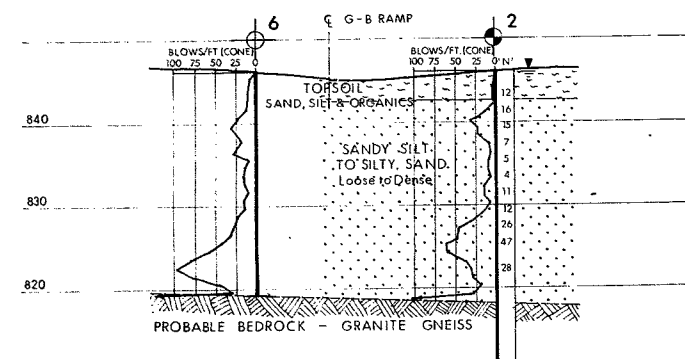
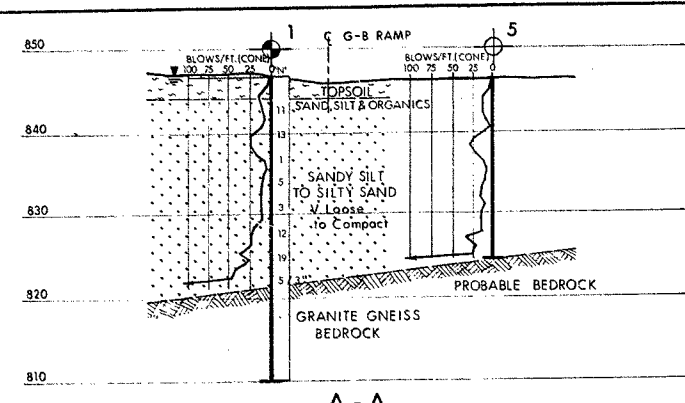
W.P. #247-60-2

HWY #11

GRAVENHURST

BRACEBRIDGE

RAMP



- LEGEND**
- Bore Hole
 - Cone Penetration Hole
 - Bore & Cone Penetration Hole
 - Water Levels established at time of field investigation, April 1967
 - Probe Hole

NO.	ELEVATION	STATION	OFFSET
1	846.8	222 + 60	7' LT.
2	845.0	222 + 88	20' RT.
3	844.9	225 + 32	10' LT.
4	865.0	225 + 32	21' RT.
5	846.2	222 + 60	20' RT.
6	846.3	222 + 88	9' LT.
7	859.3	225 + 15	14' LT.
8	845.5	223 + 83	10' LT.
9	853.9	224 + 94	12' LT.
10	848.8	224 + 87	9' LT.
11	845.0	223 + 83	21' RT.
12	848.8	224 + 89	20' RT.
13	850.0	224 + 98	20' RT.
14	852.8	224 + 98	7' RT.
15	851.6	224 + 91	10' RT.
16	848.2	224 + 74	C
17	848.1	224 + 74	10' 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.

REVISIONS	DATE	BY	DESCRIPTION
1	15 MAR 68	S.O.	BORE HOLE 16 & PROBE 17 ADDED. SECTIONS D-D, E-E & F-F ADJUSTED.

DEPARTMENT OF HIGHWAYS - C. J. RIO
MATERIALS & TESTING DIVISION - FOUNDATION SECTION

GRAVENHURST-BRACEBRIDGE RAMP

KING'S HIGHWAY NO. 11 - REVISION DIST. NO. 11
DIST. MUSKOKA
TWP. MUSKOKA LOT 13 CON. 5

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D P.P.	CHECKED	W.P. NO. 247-60-2	M.B.T. DRAWING NO.
DRAWN P.G.O.	CHECKED	JOB NO. 67-P-31	67-F-31A
DATE JUNE 8, 1967	SITE NO.	BRIDGE DRAWING NO.	
APPROVED <i>A. J. McCormick</i>	CONT. NO.		

PRINCIPAL FOUNDATION ENGINEER

REF. No. : MCCORMICK & RANKIN LTD.

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

TO: Mr. B. R. Davis,
Bridge Engineer,
Bridge Division,
Admin. Bldg.

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

Attention: Mr. S. McCombie

DATE: June 13, 1967

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For Proposed Crossing At
Proposed Hwy. #11 and Gravenhurst -
Bracebridge Ramp, Lot 13, Con. 5,
Twp: Muskoka -- District: Muskoka
District #11 (Huntsville)
W.J. 67-F-31 -- W.P. 247-60-2

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 feel free to contact our Office.

AGG/McF
Attach.

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
H. McArthur
W. S. Aitken
J. B. Curtis
T. J. Kovich
E. A. Singh

Foundations Files
Gen. Files

A. G. Stermac
A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

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FOUNDATION INVESTIGATION REPORT
For

For Proposed Crossing At
Proposed Hwy. #11 and Gravenhurst -
Bracebridge Ramp, Lot 13, Con. 5,
Twp: Muskoka -- District: Muskoka
District #11 (Huntsville)
W.J. 67-F-31 -- W.P. 247-60-2

1. INTRODUCTION:

A request for a foundation investigation at the site of the proposed crossing at proposed Hwy. #11 and Gravenhurst - Bracebridge Ramp was received from Mr. J. B. Curtis, Regional Bridge Location Engineer, in a memo dated March 31, 1967.

Following this request, a field investigation was carried out by the Foundation Section to determine the subsoil conditions existing at the proposed structure site.

This report contains the information resulting from the subsurface exploration, together with our recommendations pertaining to the design of the proposed structure foundations.

2. DESCRIPTION OF THE SITE:

The bridge site is located at the north end of the proposed Gravenhurst By-Pass.

The surrounding area is bush-covered and part of it is swamp.

Large rock outcrops or knobs are very frequently visible.

3. FIELD AND LABORATORY WORK:

The field work consisted of 13 sampled boreholes and five dynamic cone penetration tests. Three of these cone tests

cont'd. /2 ...

3. FIELD AND LABORATORY WORK: (cont'd.) ...

were carried out adjacent to sampled boreholes and two at other locations for the purpose of determining the minimum depth to the bedrock surface.

The locations and elevations of all borings are shown on Dwg. 67-F-31A which forms part of this report.

Boring was achieved by means of conventional diamond drilling equipment. Samples were recovered by a split-spoon sampler, and the number of blows required to drive it was recorded. The energy used in driving it, conformed to the requirements of the Standard Penetration Test. Rock samples were obtained by the use of a BX core barrel.

The samples were visually examined and classified at the site as well as in the laboratory. Tests were carried out on selected samples for classification purposes.

Laboratory and field test results have been summarized on the Record of Borehole sheets and are included in the Appendix of this report.

4. SOIL TYPES AND SOIL CONDITIONS:

4.1) General:

Subsoil at the site consists of an extensive deposit of granular type material, underlain by sound bedrock at the proposed centre pier and west abutment location.

At the location of the east abutment the bedrock was found to be relatively close to the ground surface.

Detailed descriptions of the soil types observed are shown on the borelog sheets contained in the Appendix.

The estimated stratigraphical profile is shown on Dwg. 67-F-31A. The various soil types are described in detail as follows:

cont'd. /3 ...

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

4.2) Sandy Silt to Silty Sand:

This material was observed in all boreholes located in the vicinity of the proposed centre pier and west abutment from ground level downward to the bedrock surface which occurred between El. 822 to El. 803. Reference should be made to the Record of Borehole sheets for the lower boundary elevations.

The extreme upper 3 - 5 ft. of this deposit appears to contain a high percentage of decayed and undecayed organic matter and also, occasional thin layers and pockets of clay.

The chief components of the deposit were found to be sand and silt in varying proportions. Typical grain-size distribution curves are included in the Appendix of this report.

The average natural moisture content is approx. 20%.

The 'N' values ranged from 1 to 47 blows per foot. The relative density may be described as very loose to dense.

4.3) Silty Sand to Sand:

This deposit was found to cover the area at the east abutment location, from ground level to the bedrock surface. Reference should be made to the Record of Borehole sheets for the lower boundary elevation.

The material encountered may be classified as compact to dense silty sand to sand. At some borehole locations, occasional boulder concentrations were discovered.

4.4) Bedrock:

Granite gneiss type of bedrock was encountered in the following boreholes by obtaining BX-size core samples:

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

4.4) Bedrock: (cont'd.) ...

<u>Borehole No.</u>	<u>Elevation (Ft.)</u>
1	821.5
2	818.1
3	862.5
4	863.8
5	-
6	-
7	854.3
8	807.4
9	850.9
10	829.1
11	803.4
12	837.8
13	842.0
14	845.3
15	832.8

The following rock description was given by Mr. K. W. Kingham, Geologist:

"The bedrock exposed at the bridge site at the south end of the Gravenhurst By-Pass (W.P. 247-60-1) is predominantly a medium crystalline, biotite rich, granite gneiss with minor zones of hornblende biotite gneiss and, quartz feldspar gneiss. Alternating zones give the rock a banded appearance. Pegmatite dikes are common, from 0.1 ft. to 1.0 ft. in thickness, striking north-south and dipping to the east at 60°.

There are two main joint systems. A set of vertical joints with a 5 - 15 ft. spacing trends approximately north 30° east at an angle of 45°. The strike of this set makes an angle of approximately 20° with the vertical joints. Occasional irregular joints exist randomly orientated with respect to the major sets. Planes of weakness exist parallel to the lineation

cont'd. /5 ...

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

4.4) Bedrock: (cont'd.) ...

Rock Description by K. W. Ingham, Geologist: (cont'd.) ...

of the rock, which dips in the same direction and at the same angle as the inclined joints. The rock may be expected to fracture along these planes and at the contacts of pegmatite dikes when blasted. Overbreak should be moderate.

The disposition of the joints suggests that the footings be set back a minimum of 10 ft. from the face of the rock cut.

The rock exposed at the location of the east abutment footing at the bridge site at the north end of the Gravenhurst By-Pass (W.P. 247-60-2) is also a banded biotite granite gneiss with perhaps more hornblende than the rock described above. A system of vertical joints similar in spacing and direction is present. The system of inclined joints is similar in strike and spacing to those previously described but here dips at 60° and is again parallel to the lineation of the rock."

5. GROUNDWATER CONDITIONS:

A certain portion of the site investigation was covered with water during the course of the field work.

The water level in boreholes No. 1, 2, 8, and 11, was found to be the same as the ground level elevation.

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct a 3-span structure at the proposed crossing of new Hwy. #11 and Gravenhurst - Bracebridge Ramp.

The maximum height of the contemplated approach fills is in the order of 25 ft. above the existing ground level.

The subsoil at the site was found to consist of a granular type deposit underlain by granite gneiss bedrock. The depth to the bedrock varied from 1 to 42 ft.

cont'd. /6 ...

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

The investigation has revealed that the subsoil at the centre pier and west abutment locations is not suitable for a spread footing type foundation. Therefore, it is recommended that the centre pier and west abutment be supported on H-piles driven to the bedrock. A load of up to 100 tons per pile can be used for 14 BP 73 piles.

The east abutment should be founded on a spread footing placed directly on the bedrock. The rock surface on which the foundation is to be placed should be carefully inspected before placing the concrete and, if any serious cracks are apparent, the excavation should be carried down to a level where the rock is relatively sound. Up to 20 tons per sq. ft. may be used for design purposes.

In the event of blasting operations, the overbreak should be moderate, provided normal blasting techniques are carried out.

Due to the presence of the organic material in the extreme upper portion of the sandy silt to silty sand deposit, it is recommended that all the soft material be removed within the entire construction area prior to placing the fill. The stripping and backfilling should be in accordance with the current D.H.O. Standards.

If the recommendations are followed, no stability problems are anticipated for the approach fills provided with 2:1 standard slopes.

7. SUMMARY:

A foundation investigation at the proposed structure site is reported.

The subsoil at the site was found to consist of a granular type deposit from ground level to the granite gneiss bedrock. The bedrock surface elevation varied erratically from place to place.

cont'd. /7 ...

7. SUMMARY: (cont'd.) ...

It is recommended that the east abutment be founded on a spread footing directly on the bedrock. The rest of the structure should be supported on H-piles driven to the bedrock.

All soft organic material should be removed within the construction area.

No stability problems are anticipated for the proposed approach embankments.

8. MISCELLANEOUS:

The field work was carried out from April 21, 1967 to May 3, 1967. The equipment used was owned and operated by Johnston Drilling Co. Ltd., and Canadian Longyear Ltd.

The field investigation was supervised directly by Mr. P. Payer, Project Foundation Engineer, who also prepared this report.

The report was reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

June 1967

APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 67-F-31

W.P. 247-60-2

DATUM Geodetic

LOCATION Sta. 222 / 88; 20' Rt.

BORING DATE April 25, 1967

BOREHOLE TYPE Washboring - NX Casing

FOUNDATION SECTION

ORIGINATED BY _____ PP

COMPILED BY _____ PP

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		25 50 75 100 125	SHEAR STRENGTH P.S.F.	WP WL ----- WATER CONTENT % 10 20 30		
846.0	GROUND LEVEL										
0.0	Topsoil, sand,silt, some clay & org.		1	SS	12						Sa.26 Si.& Cl.74
	Sandy silt. Loose to Dense		2	SS	16	840					Sa.37 Si.& Cl.63
			3	SS	15						Sa.21 Si.& Cl.79
			4	SS	7						Sa.36 Si.& Cl.64
			5	SS	5						Sa.35 Si.& Cl.65
			6	SS	4						
			7	SS	11	830					
			8	SS	12						
			9	SS	26						
			10	SS	47						
			11	SS	28	820					
818.1											
27.9	Granite Gneiss		12	BX RC	100%						
809.9	Bedrock		13	BX RC	100%						
36.1	End of Borehole					810					

DEPARTMENT OF HIGHWAYS - ONT.

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 67-F-31

LOCATION Sta. 225 / 32; 10' Lt.

ORIGINATED BY PP

W.P. 247-60-2

BORING DATE April 25, 1967

COMPILED BY _____ PP

DATUM Geodetic

BOREHOLE TYPE BX Rock Coring - BX Casing

CHECKED BY AK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W				BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT				SHEAR STRENGTH P.S.F.						WATER CONTENT %
864.9	GROUND LEVEL																
0.0	Sand																
1.4	Granite Gneiss	NNN	1	BX RC	Rec 100%	860											
			2	BX RC	Rec 90%												
			3	BX RC	Rec 100%	850											
			4	BX RC	Rec 100%												
			5	BX RC	Rec 90%	840											
			6	BX RC	Rec 100%												
835.9	Bedrock																
29.0	End of Borehole					830											

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 67-F-31

LOCATION Sta. 225 + 32: 21' Rt.

ORIGINATED BY PP

W.P. 247-60-2

BORING DATE April 26, 1967

COMPILED BY _____ PP

DATUM Geodetic

BOREHOLE TYPE BX Rock Coring

CHECKED BY

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	BLOWS / FOOT	PLASTIC LIMIT ——— WP	WATER CONTENT ——— W		
865.0	GROUND LEVEL											
0.0	Topsoil & sand											
1.2	Granite Gneiss		1	BX RC	Rec 100%	860						
			2	BX RC	Rec 100%							
853.8	Bedrock		3	BX RC	Rec 100%							
11.2	End of Borehole					850						

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 67-F-31

LOCATION Sta. 222 / 60; 20' Rt.

ORIGINATED BY PP

W.P. 217-60-2

BORING DATE April 26, 1967

COMPILED BY _____ PP

DATUM _____ Geodetic

BOREHOLE TYPE Cone Test Only

CHECKED BY AK

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

JOB 67-F-31

LOCATION Sta. 222 / 88; 9' Lt.

ORIGINATED BY _____ PP

W. P. 247-60-2

BORING DATE April 27, 1967

COMPILED BY _____ PP

DATUM _____ Geodetic

BOREHOLE TYPE Cone Test Only

CHECKED BY _____

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W		REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.			
846.3	GROUND LEVEL									
0.0	Probable Sandy silt to silty sand					840				
						830				
						820				
819.2										
27.1	End of Borehole									
						810				

MATERIALS & TESTING DIVISION

FOUNDATION SECTION

DATUM Geodetic BOREHOLE TYPE BX Rock Coring CHECKED BY [Signature]

[illegible]


REPORT ON SOIL EXPLORATION RECORD OF BOREHOLE NO. 8

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

FOUNDATION SECTION

JOB 67-E-31LOCATION Sta. 223 / 83: 10' Lt.ORIGINATED BY PPW.P. 247-60-2BORING DATE April 27 & 28, 1967COMPILED BY PPDATUM GeodeticBOREHOLE TYPE Washboring - NX CasingCHECKED BY HR

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT 25 50 75 100 125					w_p w w_L				
							SHEAR STRENGTH P.S.F.					WATER CONTENT % 10 20 30				
845.5	GROUND LEVEL															
0.0	Topsoil, sand, traces of clay & organics.					840 <										

End of Cone Test

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 67-E-37

LOCATION Sta. 224 / 94; 12' Lt.

ORIGINATED BY PP

W.P. 247-60-1

BORING DATE April 27, 1967

COMPILED BY PP

DATUM _____ Geodetic _____

BOREHOLE TYPE BX Rock Coring

CHECKED BY AK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W				REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.	<div style="text-align: center;"> WP ————— WL WATER CONTENT % </div>				
853.9	GROUND LEVEL											
0.0	Topsoil, sand & boulders.					850						
850.9												
3.0	Granite Gneiss		1	RC	100%							
			2	RC	90%							
			3	RC	95%							
			4	RC	100%							
			5	HX RC	Rec 100%	840						
837.9	Bedrock											
16.0	End of Borehole					830						

CHECKED BY

[illegible]

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 11

FOUNDATION SECTION

JOB 67-F-31

LOCATION Sta. 223 + 83: 21' Rt.

ORIGINATED BY PP

W.P. _____ 247-60-2

BORING DATE May 1, 1967

COMPILED BY _____ PP

DATUM Geodetic

BOREHOLE TYPE Washboring - EX Casing

CHECKED BY AK

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 67-F-31

W.P. 240-60-2

DATUM Geodetic

RECORD OF BOREHOLE NO. 12

LOCATION Sta. 224 / 89; 20' Rt.

BORING DATE May 1, 1967

BOREHOLE TYPE Washboring & BX Rock Coring

FOUNDATION SECTION

ORIGINATED BY PP

COMPILED BY PP

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE						LIQUID LIMIT _____ WL PLASTIC LIMIT _____ WP WATER CONTENT _____ W			BULK DENSITY P.C.F.	REMARKS			
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT						SHEAR STRENGTH P.S.F.					WATER CONTENT %		
																		10 20 30		
848.8	GROUND LEVEL																			
0.0	Silty sand to sand. Compact to V.Dense.	1	SS	12	840														
837.8			2	SS	108															
11.0	Granite Gneiss		3	RC	95%															
			4	RC	100%															
829.5	Bedrock		5	RC	95%		830													
19.3	End of Borehole					820														

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 13

FOUNDATION SECTION

JOB 67-E-31

LOCATION sta. 224 + 98: 20' Rt.

ORIGINATED BY PP

W.P. 247-60-2

BORING DATE May 2, 1967

COMPILED BY PP

DATUM Gaodetic

BOREHOLE TYPE Washboring & BX Rock Coring

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY γ P.C.F.	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					SHEAR STRENGTH P.S.F.					WATER CONTENT % 10 20 30	
850.0	GROUND LEVEL					850												
0.0	Silty sand to sand with boulder concentrations.	1	SS	34	840												
842.0	Dense																	
8.0	Granite Gneiss		2	EX RC	Rec 100%													
			3	EX RC	Rec 100%													
829.0	Bedrock		4	EX RC	Rec 100%	830												
21.0	End of Borehole					820												

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 15

FOUNDATION SECTION

JOB 67-F-31

LOCATION Sta. 224 \pm 91. 10' Rt.

ORIGINATED BY PP

W. P. _____ 247-60-2

BORING DATE May 3, 1967

COMPILED BY _____ PP

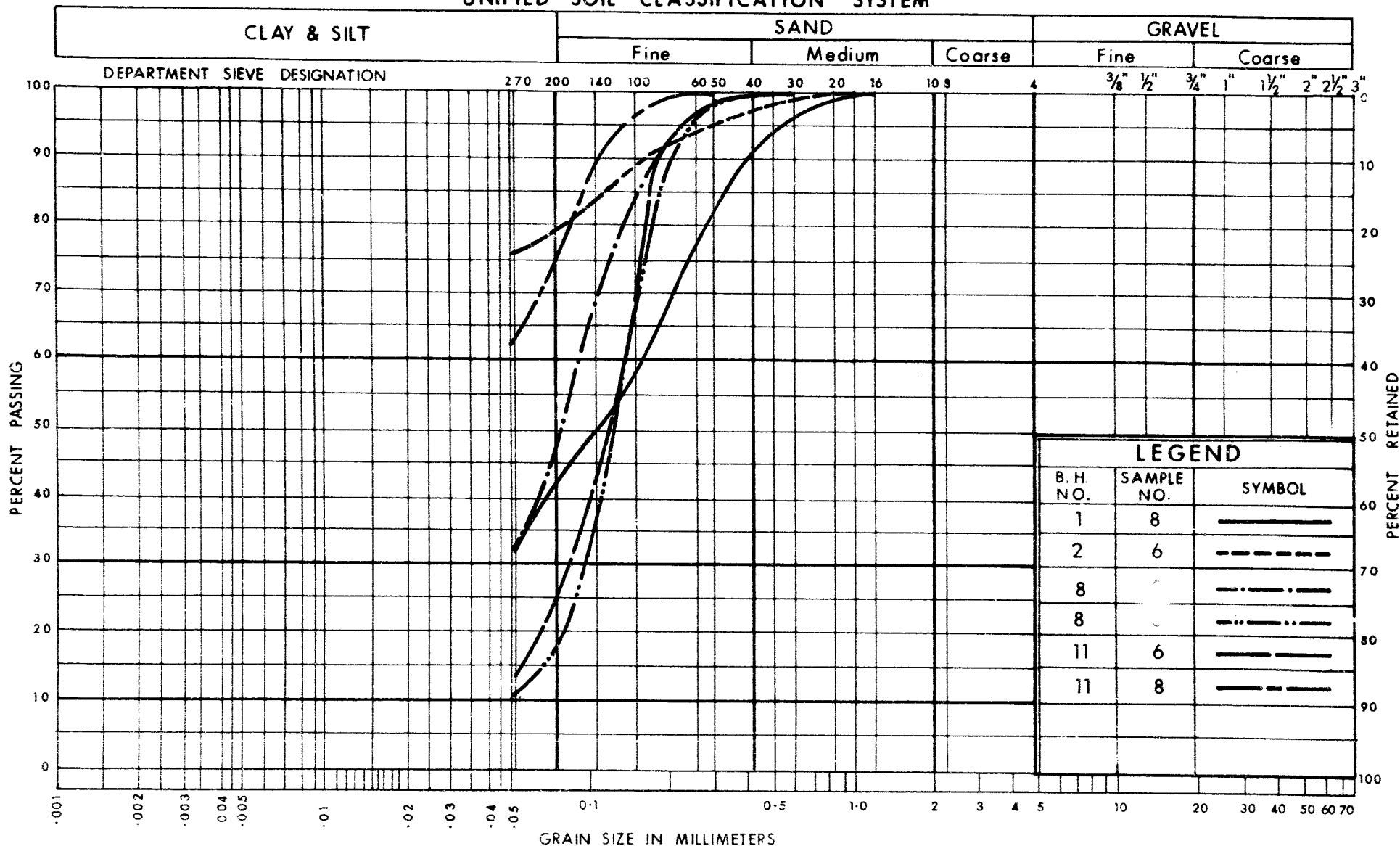
DATUM Geodetic

BOREHOLE TYPE BX Rock Coring

CHECKED BY [Signature]

[illegible]

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

ONTARIO

GRAIN SIZE DISTRIBUTION

W.P. No. 247 - 60 - 2

JOB No. 67 - F - 31

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

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

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
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
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 (YOUNG'S 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_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
β	ANGLE OF SLOPE TO HORIZONTAL

MEMORANDUM

To: Mr. K. Selby,
Foundation Section.

From: K. W. Ingham,
Geologist.

Date: June 1st, 1967

Our File Ref.

In Reply To

SUBJECT:

Re: Proposed structures on Gravenhurst By-pass
section of Highway #11

The bedrock exposed at the bridge site at the south end of the Gravenhurst By-pass is predominantly a medium crystalline, biotite rich, granite gneiss with minor zones of hornblende biotite gneiss and, quartz feldspar gneiss. Alternating zones give the rock a banded appearance. Pegmatite dikes are common, from 0.1 ft. to 1.0 ft. in thickness, striking north south and dipping to the east at 60° .

There are two main joint systems. A set of vertical joints with a 5 - 15 ft. spacing trends approximately northeast southwest, i.e., more or less parallel to the rock-cut in the vicinity of the proposed abutment footings. A set of inclined joints are spaced 3 - 8 ft. apart dipping approximately north 30° east at an angle of 45° . The strike of this set makes an angle of approximately 20° with the vertical joints. Occasional irregular joints exist randomly orientated with respect to the major sets.

Planes of weakness exist parallel to the lineation of the rock, which dips in the same direction and at the same angle as the inclined joints. The rock may be expected to fracture along these planes and at the contacts of pegmatite dikes when blasted. Over-break should be moderate.

The disposition of the joints suggests that the footings be set back a minimum of 10 ft. from the face of the rock cut.

The rock exposed at the location of the east abutment footing at the bridge site at the north end of the Gravenhurst By-pass is also a banded biotite granite gneiss with perhaps more hornblende than the rock described above. A system of vertical joints similar in spacing and direction is present. The system of inclined joints is similar in strike and spacing to those previously described but here dips at 60° and is again parallel to the lineation of the rock.

K. W. Ingham
K. W. Ingham,
Geologist.

KWI/jm

MEMORANDUM

To: Mr. A. G. Stermac,
Principal Foundation Engineer,
Materials & Testing Division,
Lab. Build., Downsview.

FROM: Bridge Planning Section,
Northern Region.

DATE: March 31, 1967.

Received Apr. 3/67.

IN REPLY TO

Our File Ref.

SUBJECT: North Interchange of the Gravenhurst By-Pass,
Highway 11, District 11, Huntsville, W.P. 247-60-2.

Enclosed find two preliminary prints of the site plan for the above noted crossing marked up to indicate the probable and possible footing locations for the proposed crossing. Would you kindly arrange to have a foundation investigation carried out at this site. I have indicated the probable footing locations in dark red while I have hatched in the possible footing locations. If the sub-soil is sufficiently irregular that one would not be able to predict with reasonable accuracy the material that might be found in the possible footing locations additional borings might be taken to ensure that an investigation would not have to be carried out in the event that a different type of structure than is anticipated were used.

The lines have been run in the field and it is expected that there will be little difficulty in laying out the footing locations with the survey stakes available at the site. If, however, you feel there is insufficient stakes etc., we will be glad to arrange to have the lines run again. I recently was at the site, however, and it is expected that once the snow recedes a little more, the standard stakes will be visible at this time. Some of the stakes are visible by means of large marker stakes sticking well above the snow. Accommodation is available in the town of Gravenhurst.

The site will be reasonably accessible through approximately 150' of moderately dense bush from Highway 11. It will be necessary to cut a wire highway fence to get to the site with your machine.

If we can be of any assistance, please don't hesitate to contact us.


J. B. CURTIS
REGIONAL BRIDGE LOCATION ENGINEER

JBC/et

Enclosure: 2

cc: Mr. R. Forrest,
Mr. A. Crowley.

APR 19/67

JUNE 14/67

401 & Keele St.
Downsview, Ontario

June 19, 1967

Johnston Drilling Co. Ltd.
377 Danster Ave.
Toronto, Ontario

Dear Sirs:

This is to confirm our request of April 14, 1967 for the supply of a Diamond Drill together with all necessary equipment, as specified under the terms of our Contract Agreement, at Gravenhurst, Ontario.

This project bears Job Numbers 67-F-30 and 67-F-31.

Yours truly,

K. L. Selby

KS:mt

K. Selby
Supervising Foundation Engineer
for A. G. Sternac
Principal Foundation Engineer

401 E. Keele St.
Downsview, Ontario

June 19, 1967

Canadian Longyear Limited
35 Brydon Drive
Rexdale, Ontario

Dear Sirs:

This is to confirm our request of April 14, 1967 for the supply of a Diamond Drill together with all necessary equipment, as specified under the terms of our Contract Agreement, at Gravenhurst, Ontario.

This project bears Job Number 67-8-31.

Yours truly,

Respect

A. G. Selby
A. Selby
Supervising Foundation Engineer
for A. G. Stereac
Principal Foundation Engineer

Department of Highways Ontario

Copy for the information of
Mr. A. Stermac,
Principal Foundation Engineer

Mr. J.B. Curtis,
Reg. Bridge Location Engineer,
North Bay Regional Office

Bridge Division,
Downsview, Ontario

September 15, 1967

North Interchange of the
Gravenhurst By-Pass
W.P. 247-60-2, Site 42-142
Highway 11, District No. 11

Attached herewith are prints of the Preliminary Bridge Plan
Drawing D-6292-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$145,000.
This cost includes tender, materials, engineering and sundry
construction.

Any comments or revisions you may have should be submitted
within three weeks.

CSG:rd

C.S. Grebski,
Bridge Design Engineer

Attach.

c.c. S. McCombie
A. Stermac
W. Wigle
R. Forrest
E. Cross

No Comments
D Kateshew
Sept 18th 1967

No Comments: Oct 12th 1967

W.L. Sully

401 & Keele Street
Downsview, Ontario

February 8, 1968

Canadian Longyear Limited
35 Dryden Drive
Bendale, Ontario

Dear Sirs:

This is to confirm our request of February 1, 1968 for the supply of a Diamond Drill together with all necessary equipment, as specified under the terms of our Contract Agreement, at Gravenhurst, Ontario on February 7, 1968 @ 10.30 a.m.

These projects bear Job Numbers 66-F-12 and 67-F-31.

Yours truly,

MD:mt

M. Devata
M. Devata
Supervising Foundation Engineer
For: A. G. Sternac
Principal Foundation Engineer

cc: H. Jennings
Foundation Files / 1 / 2
General Files

Mr. B. D. Davis,
Bridge Engineer,
Bridge Division,
Admin. Bldg.

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

attention: Mr. S. MacCoshie

March 25, 1968

-- ADDITIONAL BORINGS --

For

Proposed structure at the Crossing of
New Hwy. #11 and Cravenhurst-Bracebridge Ramp
Lot 13, Conc. 5, Township of Muskoka
District #11 (Munroville)
M.J. 67-F-31 -- W.P. 247-60-2

Further to your request, we have carried out two
boreholes to establish the bedrock elevations at the above
mentioned structure location. These boreholes (B.H.'s #16
and #17) have now been completed, and the revised Drawing
No. M.J. 67-F-31a, enclosed herewith, should be included
with our original Foundation Investigation Report.

The locations and elevations of B.H.'s #16 and #17,
together with bedrock elevations, are as follows:

<u>B.H. No.</u>	<u>Location:</u>	<u>Ground Elev.</u>	<u>Bedrock Elev.</u>
16	224-74.67 Centre-Line	848.20	824.40
17	224-74.97 C/O 10' Rt.	848.10	829.10

If you have further queries regarding this project,
please contact our Office.

LD/ 667

Attach.

cc: Messrs. B. D. Davis (2)
R. A. Tregaskes
D. A. Farren
H. McArthur
W. C. Aitken
J. B. Curtis
A. J. Kovich
R. B. Singh

Foundations Files
Gen. Files

M. Devata

M. Devata,
SUPERVISING FOUNDATION ENGR.
Per:
A. C. Storzac,
PRINCIPAL FOUNDATION ENGR.