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G.I.-30 SEPT. 1976

GEOCRES No. 31L-4

DIST. 13 REGION _____

W.P. No. _____

CONT. No. _____

W. O. No. 70-11004(R)

STR. SITE No. 43-119

HWY. No. Loc

LOCATION ANABLE Du FOND
RIVER BRIDGE

No. of PAGES - _____

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____

REMARKS: _____

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

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

Attention: Mr. S. McCombie

Date: March 18, 1970

Our File Ref.

In Reply To

MAR 31 1970

Subject:

31L-4

FOUNDATION INVESTIGATION REPORT
For

Amable du Fond River Bridge
Township of Calvin
Lot 21 - Concessions IV & V
District No. 13 (North Bay)
W.J. 70-F-4R -- P.O. No. M138211
SITE 43-119

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.

AGS/MdeF
Attach.

cc: Messrs. B. R. Davis
H. A. Tregaskes
D. W. Farren
C. R. Wilmot
H. McArthur
G. E. French
J. C. McAllister (2)
E. R. Saint
B. A. Singh

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

Foundations Files
Gen. Files

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FOUNDATION INVESTIGATION REPORT
For
Amable du Fond River Bridge
Township of Calvin
Lot 21 - Concessions IV & V
District No. 13 (North Bay)
W.J. 70-F-4R -- P.O. No. M138211

1. INTRODUCTION:

A request for a foundation investigation at the site of the proposed new bridge at the location above, was received from Mr. J. C. McAllister, Regional Bridge Location Supervisor, in a memo dated December 15, 1969.

A field investigation was subsequently carried out by this Section to determine the subsoil conditions existing at the location of the proposed structure. Presented in this report are the results of this investigation, together with recommendations for the future structure foundations.

2. DESCRIPTION OF THE SITE:

The site is located on the Amable du Fond River in the Township of Calvin, Lot 21, Concs. IV and V; it lies some 2 miles west of Hwy. #630 and 5 miles south of Hwy. #17 on a Township road. The immediate area is bush-covered, with the site lying in a gully. Generally the area is hilly and consists of farmland and bush.

The existing bridge is a three-span structure of total length 115 ft., supporting a wooden deck of width 18 ft. Timber trestles have been erected under the deck as additional support.

Geologically the area is in the Precambrian Shield, with bedrock being mainly granite. The overburden has been formed by glacial drifts and spillways, etc.

3. FIELD AND LABORATORY WORK:

A total of 4 boreholes and 3 dynamic cone penetration tests was carried out during the course of the field work. Three of the boreholes were sampled down to the bedrock and cored using an AXT core barrel; the fourth borehole was discontinued when practical refusal was reached.

Boring was achieved by means of a Diamond Drill adapted for soil sampling purposes. Disturbed samples were recovered using a split-spoon sampler which was driven into the soil according to the requirements of the Standard Penetration Test.

The locations and elevations of the boreholes were surveyed in the field by personnel from the Municipal Section, North Bay District, and are shown on Dwg. 70-F-4A which accompanies this report.

All samples were visually identified in the field and then returned to the laboratory where further tests were carried out to determine Atterberg Limits, moisture contents and particle size distribution.

4. SUBSOIL CONDITIONS:

4.1) General:

The subsoil at the site consists of a shallow deposit of silty sand with organics overlying a deposit of silty sand with gravel, this in turn, overlying granite gneiss bedrock.

A shallow stratum of silty clay was found lying between the silty sand with organics layer and the silty sand with gravel layer on the east bank of the river only.

The top six feet of material on the west bank consists of sandy silt.

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

4.2) Sandy Silt:

This was found in Borehole No. 1 only and extended from the surface down to a depth of six feet. One 'N' value gave the value of 5 blows/ft., indicating a loose denseness.

Laboratory tests gave the following results:

Grain Size Distribution: Gravel 0% Sand 37% Silt 60%
Clay 3%

Moisture Content: 25%

4.3) Silty Sand with Organics:

This deposit was found in all boreholes, from ground surface down, in Boreholes #2, 3 and 4, and underlying the sandy silt layer in Borehole #1. Its thickness varied from 4 to 10 feet. 'N' values ranged from 2 blows/ft. to 15 blows/ft., indicating a denseness of very loose to compact, though generally loose.

Laboratory tests gave the following results:

Grain Size Distribution: Gravel 0% Sand 81% - 92%
Silt and Clay 8% - 19%

Moisture Content: 26% - 41%

Grain size distribution curves are shown in Fig. #1.

4.4) Silty Sand with some Gravel:

This deposit was found in all boreholes overlying the bedrock, and varied in thickness from 2 - 10 feet.

'N' values ranged from 16 blows/ft. to 50 blows/ft., indicating a denseness of compact to dense, though generally compact.

Laboratory tests gave the following results:

Grain Size Distribution: Gravel 19% - 24% Sand 48% - 50%
Silt 23% - 25% Clay 3% - 8%

Moisture Content: 7% - 22% (mean 10%)

Grain size distribution curves are shown in Fig. #2.

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

4.5) Clayey Silt to Silty Clay:

This deposit was only found in boreholes #3 and 4, on the east bank. The layer is 3 feet thick and lies below the silty sand with organics stratum. Only one Standard Penetration Test was performed in this material, giving a value of 8 blows/ft., hence the consistency is estimated to be firm.

Laboratory tests gave the following results:

Grain Size Distribution:	Gravel 0%	Sand 2%	Silt 64%	Clay 34%
Plastic Limit:	-	15% - 21%		
Liquid Limit:	-	24% - 40%		
Moisture Content:	-	35% - 40%		

4.6) Granite Gneiss Bedrock:

A total of 3 rock cores were taken; these were examined by Mr. K. W. Ingham, D.H.O. Geologist. The following is his report:

"Boreholes 1, 2 and 3 at this site intersect basically the same type of bedrock, that is, a medium grained granite gneiss with minor injections of meta-granite. The rock is relatively unweathered in each hole throughout the section of core examined.

"The most conspicuous bedrock feature is an upper zone displaying extensive horizontal and vertical jointing and fissuring resulting in: 0.5 to 1.0 ft. of rubble at the rock surface underlain by 3.0 to 8.0 ft. of blocky or broken rock. This section is characterized by lower core recovery due to open cracks and fissures. In holes 1, 2 and 3, the corresponding intervals for this zone are: 22.2 to 26.0 ft., 17.3 to 21.5 ft., and 13.8 to 21.3 ft. Below this zone the joints are relatively tight and the rock becomes progressively more massive.

"Bedrock can be assumed to start at 22.2 ft., 17.3 ft. and 13.8 ft., in holes 1, 2 and 3 respectively, with a stable but more open blocky structure in the upper 4 to 6 ft."

5. GROUNDWATER ELEVATIONS:

The water levels in the boreholes at the completion of field operations, were found to be as follows:

B.H. 1	71.5'	B.H. 3	72.6'
B.H. 2	71.4' (ice level)	B.H. 4	not taken

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct a new bridge at this location to replace the existing structure. The new centre line will be located some 25 to 30 feet south of the present centre line and the structure will have a span of 115 feet. The new grade will be the same as, or up to, a maximum of 2 feet higher than the existing grade.

Subsoil at the site consists of from 13 to 22 feet of granular overburden followed by granite gneiss bedrock. A shallow intrusion of clayey silt to silty clay occurs on the east bank of the river. The bedrock contains open cracks and fissures within the top 3 to 8 feet.

It is recommended that the new structure be founded on steel H-piles driven to bedrock utilizing the maximum allowable design load for the particular steel section adopted. If a multi-span structure is decided upon, the pier or piers, should consist of a single row of H-piles forming a pile bent. These piles may be encased in concrete to a suitable depth below the river bed for appearance or other purposes. To prevent scouring out and hence loss of lateral support around the piles, it is recommended that suitably sized rip-rap be placed around the bents to a distance about 10 ft. each side and at the ends of each pier bent. As a further precaution, the pier piles should be keyed into the rock. To achieve this, the following procedure may be adopted:

Driving should be carried out by means of a drop hammer. Immediately contact with rock is achieved, driving should be

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

stopped and the pile elevation observed. Driving should then be continued using small heights of drop of the ram (6" - 8"). After the pile has been subjected to a sufficient number of series of twenty blows each, that penetration has ceased (a minimum of five series should be adopted), the fall should be increased to double the height. In this way, the driving should be continued with a stepwise increase in the height of drop until no further penetration is observed. By the great number of blows used in this procedure, it should be possible to chisel the pile into the rock until a satisfactory contact area is achieved. It is recommended that Oslo points be fitted if this procedure is adopted. The points should be made of tempered steel bars of 3" - 4" diameter with the lower end hollow ground. A slice is cut into the web of the H-section and the bar is then welded to the profile. Further information about the points may be obtained from the Norwegian Geotechnical Institute, Publication No. 23, or Geotechnique, Vol. VII, P. 73, 1957. Design loads to be used are dependent on the pile section selected.

As an alternative, the structure piers may be supported on concrete caissons socketed about 4 feet into bedrock. It will be necessary to utilize a permanent steel liner in order to install caissons successfully. Due to the fractured nature of the upper zone of the bedrock, it may, however, be necessary to advance the liners slightly more than the above-mentioned 4 ft. in order to effectively dewater the liners prior to placing concrete within them. This is a possibility which must be considered since the bedrock is fractured down to depths of from 3 to 8 ft. For design purposes, it may be assumed that a safe load of 70 tons per square foot of base area per caisson, will be achieved.

Should pile caps be adopted, these should be at a depth adequate to provide the required frost protection.

No stability problems are anticipated with regard to the approaches, provided 2:1 side slopes are used.

7. MISCELLANEOUS:

The field work was carried out during the period January 17 to 25, 1970, and was supervised by Mr. G. Allen, Project Foundation Engineer.

Equipment used was owned and operated by Canadian Longyear Ltd.

This report was written by Mr. G. Allen and reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

March, 1970

APPENDIX I

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 70-F-4(R)

LOCATION Sta. 6 + 18 31' Lt. E Twp. Rd.

ORIGINATED BY GA

W.P. BORING DATE **January 19, 20, 21 & 22, 1970**

COMPILED BY GA

DATUM  Assumed

BOREHOLE TYPE Washboring, NX & BX Casing

CHECKED BY 

[illegible]

FOUNDATION SECTION

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L			BULK DENSITY γ	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					PLASTIC LIMIT — w_p					WATER CONTENT — w
							20	40	60	80	100	WATER CONTENT %					
							SHEAR STRENGTH P.S.F.										
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE										
71.4	Ice level																
0.0	Riverbed					70											
68.0																	
3.4	Silty sand with organics																
64.4	Compact		1	SS	15												
7.0	Silty sand, some gravel		2	SS	30												
			3	SS	30	60											
	Compact to dense		4	SS	50												
54.1																	
17.3	Granite Bedrock		5	RC	66%	50											
49.9	Weathered																
21.5	Sound		6	RC	100%												
44.9																	
26.5	End of Borehole					40											

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 70-F-4(R) LOCATION Sta. 4 + 44 31.5' Lt. Ø Twp. Rd. ORIGINATED BY GA
W.P. _____ BORING DATE January 23, 1970 COMPILED BY GA
DATUM Assumed BOREHOLE TYPE Washboring, NX & BX Casing CHECKED BY [Signature]

[illegible]

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

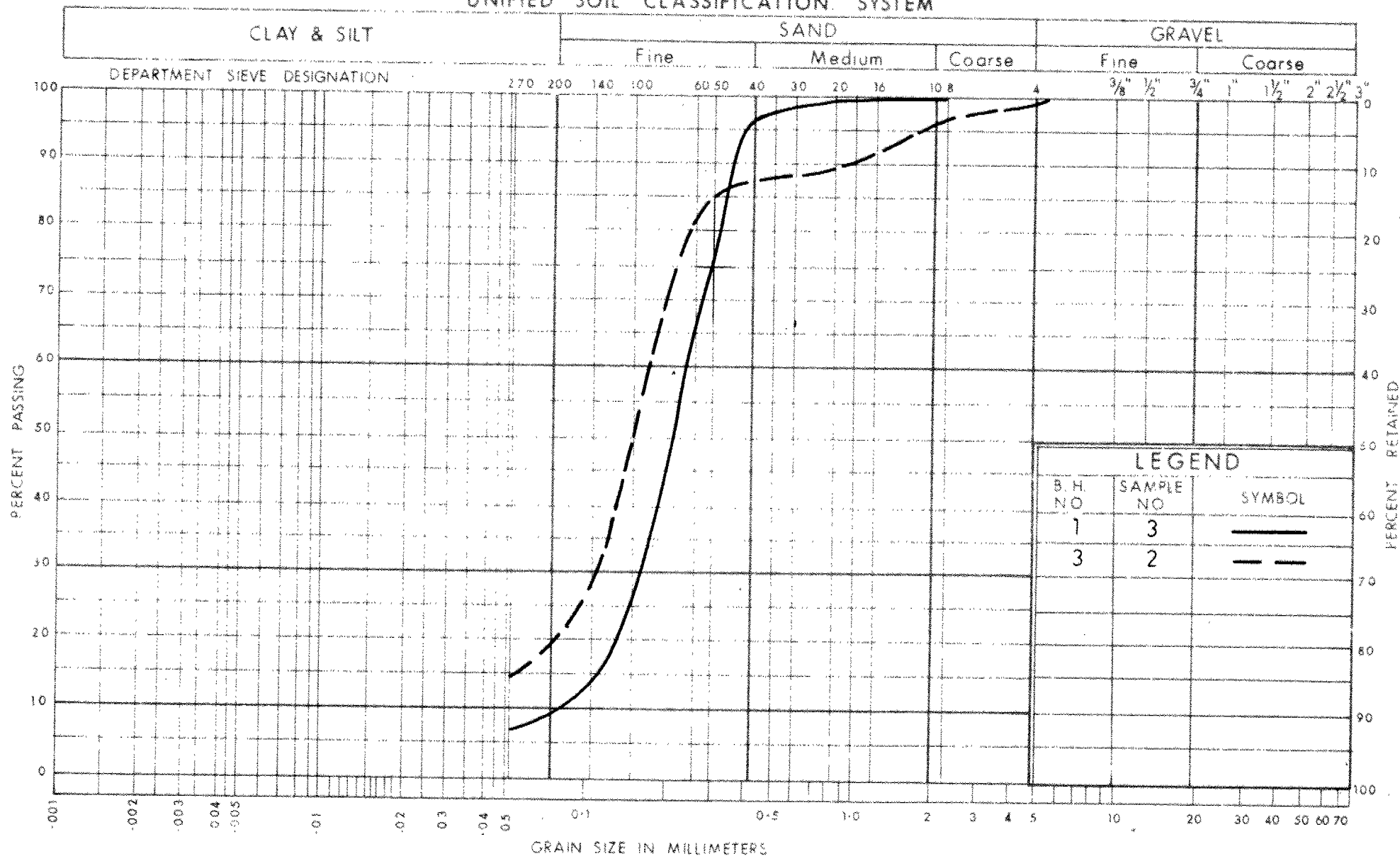
RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 70-F-4(R) LOCATION Sta. 3 + 88 45' Lt. Twp. Rd. ORIGINATED BY GA
 W.P. BORING DATE January 24 & 25, 1970 COMPILED BY GA
 DATUM Assumed BOREHOLE TYPE Washboring, NX Casing CHECKED BY GA

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		20	40	60	80	100	WATER CONTENT % 10 20 30				
75.4	Ground Level						SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE									
0.0	Silty sand with organics		1	SS	6	70										74.0
	Loose		2	SS	2											
65.6			3	SS	2											
9.8	Clayey silt, silty clay. Firm		4	SS	8											
62.9			5	SS	30											
12.5	Silty sand, some gravel. Compact.		6	SS	100/3" 60											
59.6						End of cone test									0 2 64 34	
15.8	End of Borehole															19 50 23 8

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

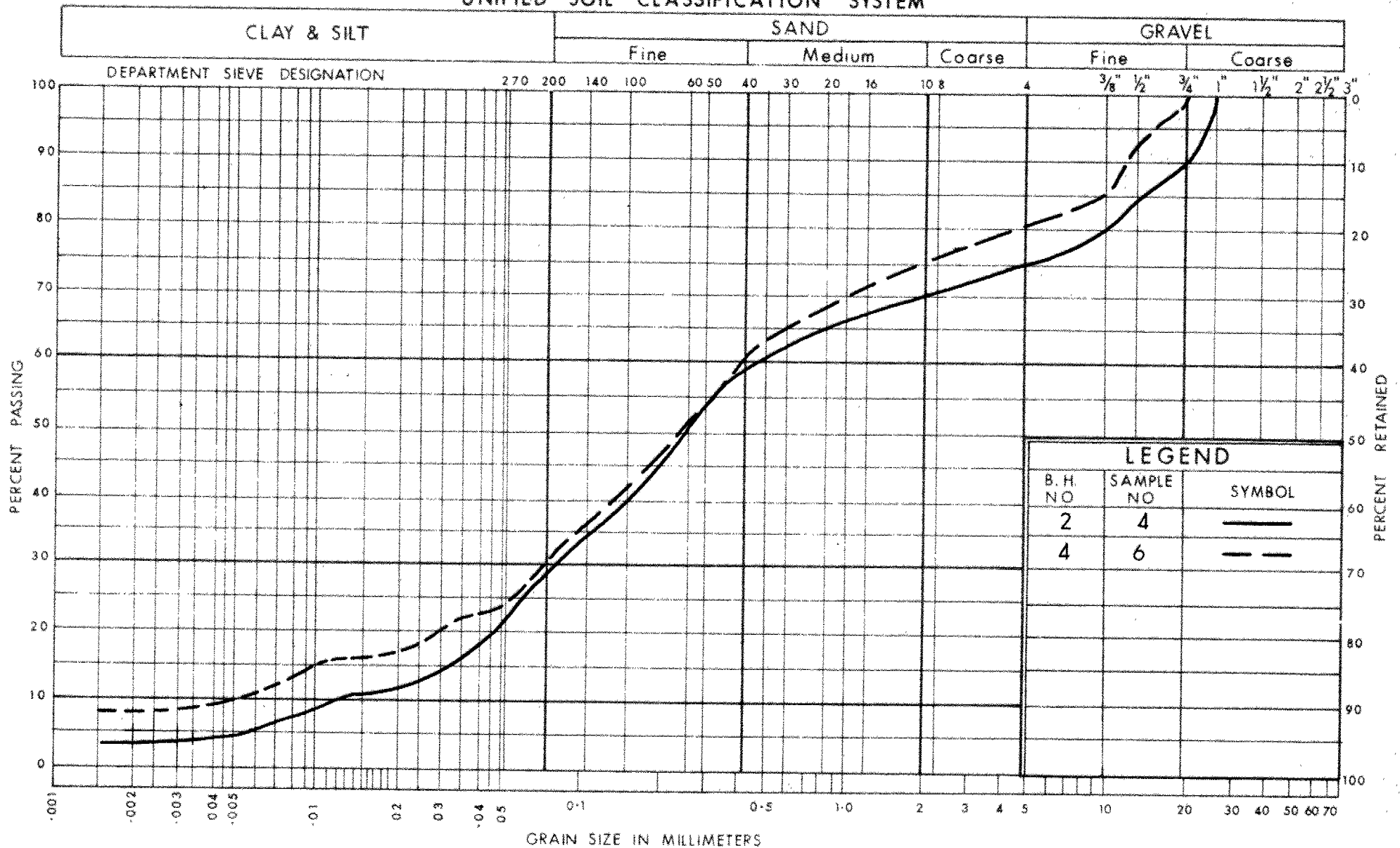
GRAIN SIZE DISTRIBUTION SILTY SAND WITH ORGANICS

W.P. No.

JOB No. 70 - F - 4 (R)

FIG. 1

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION
SILTY SAND WITH SOME GRAVEL

W.P. No.

JOB No. 70 - F - 4 (R)

FIG. 2

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
$\bar{\sigma}$	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

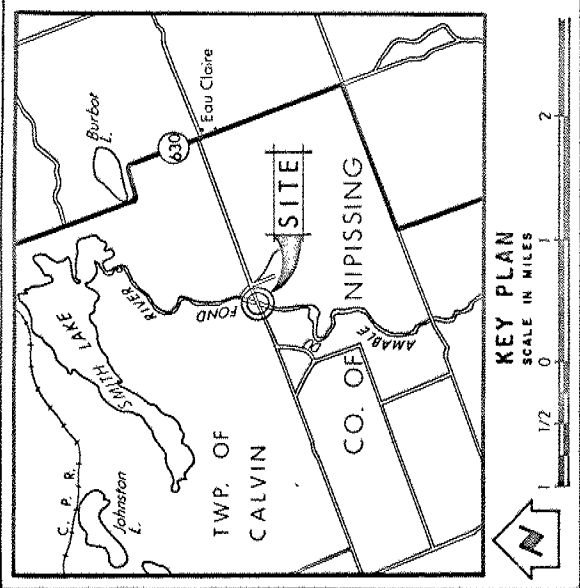
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

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



LEGEND		
	Bore Hole	
	Cone Penetration Hole	
	Bore & Cone Penetration Hole	
	Water Levels established at time of field investigation, JAN., 1970	
	Estimated Water Level	
NO.	ELEVATION	STATION
1	76.0	6 + 18
2	71.4	5 + 10
3	73.4	4 + 44
4	75.4	3 + 88
		31' LT.
		33' LT.
		31.5' LT.
		45' LT.

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

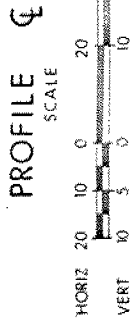
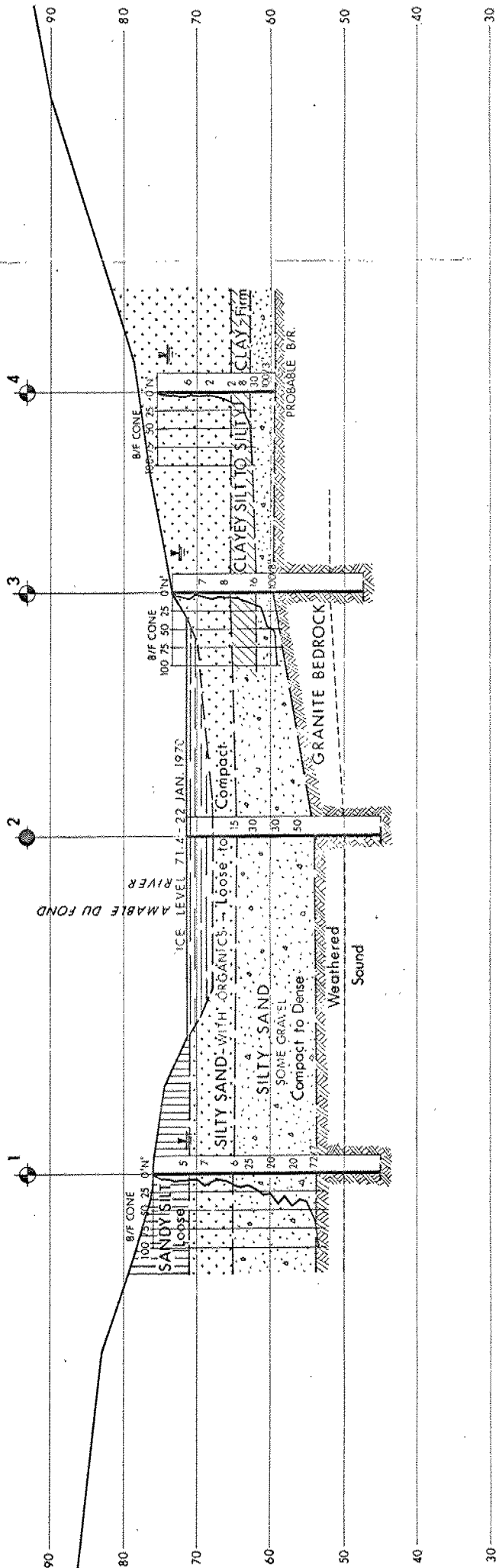
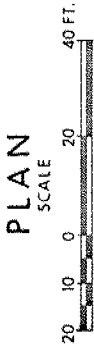
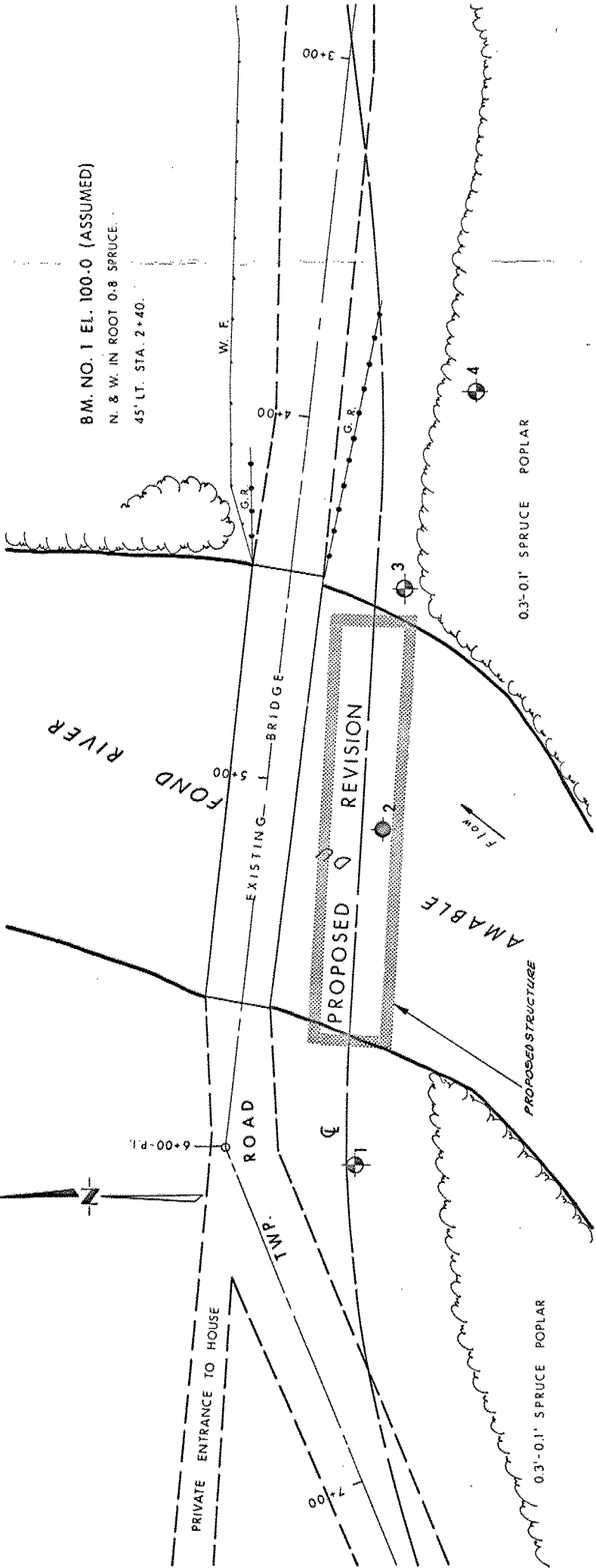
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE - FOUNDATION SECTION

AMABLE DU FOND RIVER

KING'S-HIGHWAY-NO. 100-0 (ASSUMED) DIST. NO. 9
400 DIST. NIPISSING
TWP. CALVIN LOT 21 CON. IV & V

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD. G.A.	CHECKED	W.P. NO.	M.B.T. DRAWING NO.
DRAWN E.D.	CHECKED	JOB NO. 70-F-4 (R)	70-F-4A
DATE	MAR 20, 1970	SITE NO.	BRIDGE DRAWING NO.
APPROVED	<i>[Signature]</i>	CONT. NO.	



MEMORANDUM

To: Mr. K. Selby,
Supervisor,
Foundation Engineers.

FROM: K. Ingham

ATTENTION:

DATE: January 30, 1970.

OUR FILE REF.

IN REPLY TO

SUBJECT: Foundation Investigation 70-F-4,
Amable du Fond River.

Boreholes 1, 2 and 3 at this site intersect basically the same type of bedrock, that is, a medium grained granite gneiss with minor infections of meta-granite. The rock is relatively unweathered in each hole throughout the section of core examined.

The most conspicuous bedrock feature is an upper zone displaying extensive horizontal and vertical jointing and fissuring resulting in 0.5 to 1.0 ft. of rubble at the rock surface underlain by 3.0 to 8.0 ft. of blocky or broken rock. This section is characterized by lower core recovery due to open cracks and fissures. In holes 1, 2 and 3, the corresponding intervals for this zone are; 22.2 to 26.0 ft., 17.3 to 21.5 ft., and 13.8 to 21.3 ft. Below this zone the joints are relatively tight and the rock becomes progressively more massive.

Bedrock can be assumed to start at 22.2 ft., 17.3 ft. and 13.8 ft., in holes 1, 2 and 3 respectively, with a stable but more open blocky structure in the upper 4 to 6 ft.



Ken Ingham,
GEOLOGIST

KI:NR

Mr. K. Selby,
Supervisor,
Foundation Engineers.

K. Ingham


January 30, 1970.

Foundation Investigation 70-F-4,
Assable du Fond River.

Boreholes 1, 2 and 3 at this site intersect basically the same type of bedrock, that is, a medium grained granite gneiss with minor inclusions of meta-granite. The rock is relatively unweathered in each hole throughout the section of core examined.

The most conspicuous bedrock feature is an upper zone displaying extensive horizontal and vertical jointing and fissuring resulting in 0.5 to 1.0 ft. of rubble at the rock surface underlain by 3.0 to 5.0 ft. of blocky or broken rock. This section is characterized by lower core recovery due to open cracks and fissures. In holes 1, 2 and 3, the corresponding intervals for this zone are; 22.2 to 26.0 ft., 17.3 to 21.5 ft., and 13.8 to 21.3 ft. Below this zone the joints are relatively tight and the rock becomes progressively more massive.

Bedrock can be assumed to start at 22.2 ft., 17.3 ft. and 13.8 ft., in holes 1, 2 and 3 respectively, with a stable but more open blocky structure in the upper 4 to 6 ft.



Ken Ingham,
GEOLOGIST

KI:NR

MEMORANDUM

Telephone: 248-3097

TO: Mr. A. Stermac,
Principal Foundation Engineer,
Room 107,
Lab. Building.

FROM: W.S. Melinyshyn,
Bridge Office,
Central Region.

ATTENTION: Mr. M. Devata.

DATE: January 5th, 1970.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 131-65-02, Site 10-112,
14 Mile Creek Structure,
1.1 MI. South of Hwy. 5,
Hwy. 25N^W District 4.

Further to our memo of November 25th, 1969 we would like to point out, that, although a 24' x 12' box culvert was shown as the proposed structure, your investigation should encompass recommendations on other types of structures - for example multiplate arch - which might suit the site.

JFW/cew

J.F. Walshe
J.F. Walshe,
BRIDGE LOCATION SUPERVISOR,
for:
W.S. Melinyshyn,
REG. BRIDGE PLANNING ENGINEER.