

#64-F-34

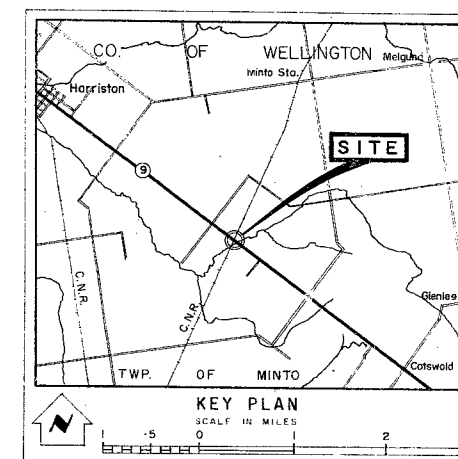
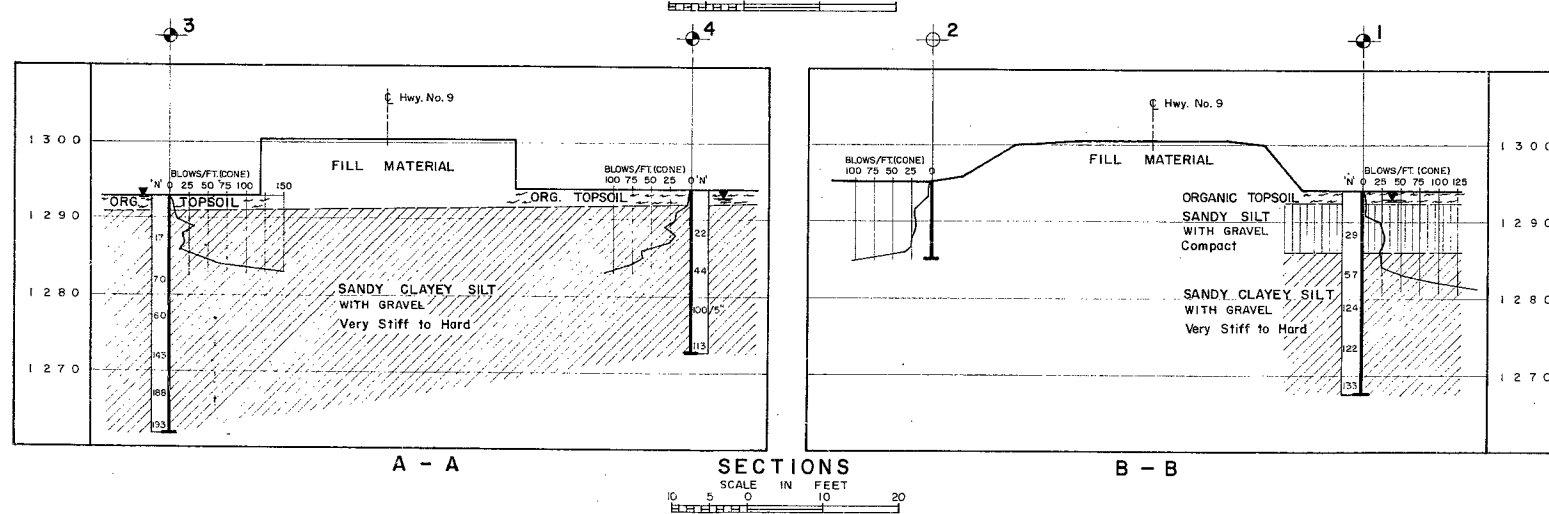
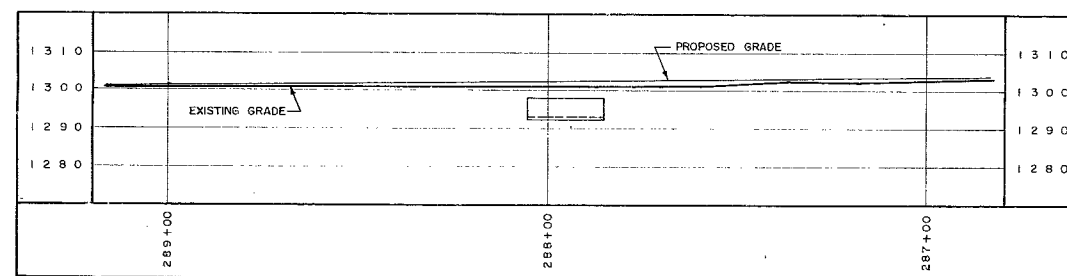
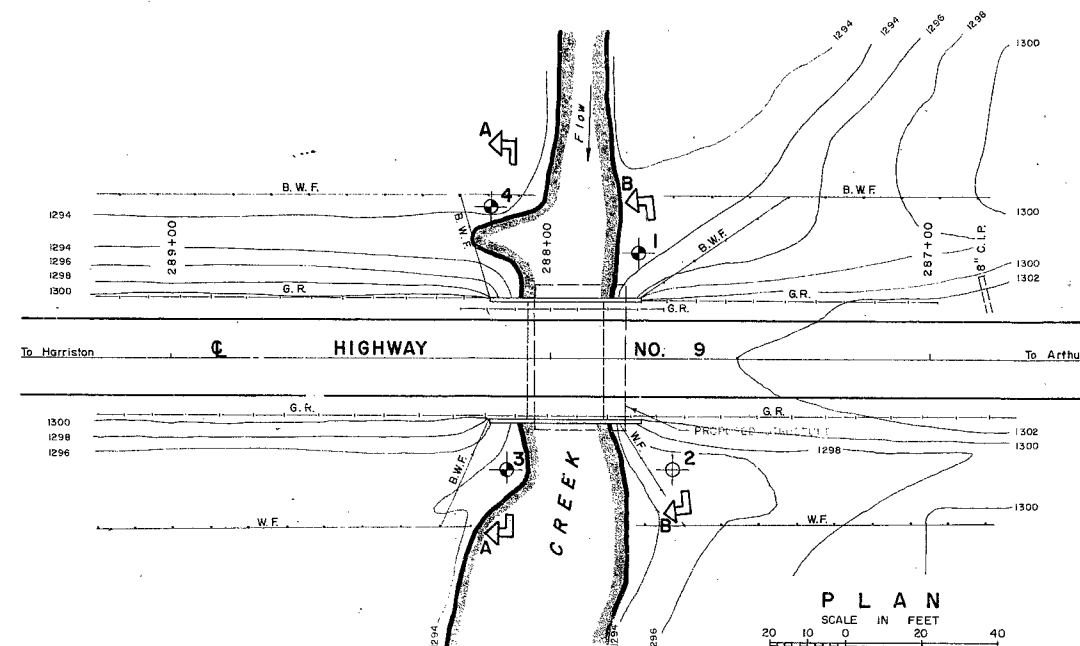
W.P. #248-63

HWY. #9 &

MAITLAND

RIVER

TRIBUTARY



LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation. (May 1964)		
NO.	ELEVATION	STATION	OFFSET
1	1294.0	287+77	28' RT.
2	1295.0	287+68	28' LT.
3	1293.0	288+11	29' LT.
4	1294.0	288+16	40' 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

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION

MAITLAND RIVER TRIBUTARY

KING'S HIGHWAY NO. 9 DIST. NO. 3

CO. WELLINGTON

TWP. MINTO LOT 97 CON. 'C' & 'D'

BORE HOLE LOCATIONS & SOIL STRATA

SURV'D W. K.	CHECKED <input checked="" type="checkbox"/>	W.P. NO. 248-63	DATE DRAWN 6/4/64
DRAWN D. M.	CHECKED <input checked="" type="checkbox"/>	JOB NO. 64-F-34	64-F-34 A
DATE 4 JUNE 1964	SITE NO.	PROJECT NO.	
APPROVED <i>A. Thomas</i>	CONT. NO.		

REF. NO. E-4319-1

MEMORANDUM

To: Mr. A. M. Toye,
Bridge Engineer,
Bridge Division.

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

Attention: Mr. S. McCombie

DATE: June 9, 1964

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Hwy. #9 and Maitland River Tributary,
County of Wellington, Twp. of Minto,
Concessions C & D - District No. 3.
W.J. 64-F-34 -- W.P. 248-63

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

We believe that you will find the factual data and recommendations contained therein, adequate for your future design work. Should further information be required, please do not hesitate to contact our Office.

KYL/MdeF

Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan
A. Gater
L. D. Barrett
J. Roy
A. Watt

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

Foundations Office
Gen. Files

TABLE OF CONTENTS

1. INTRODUCTION.
 2. DESCRIPTION OF SITE.
 3. FIELD AND LABORATORY WORK.
 4. SUBSOIL CONDITIONS:
 - 4.1) General.
 - 4.2) Sandy Silt with Gravel - Dense.
 - 4.3) Sandy Clayey Silt with Gravel - Very Stiff to Hard - (Glacial Till).
 5. GROUND WATER CONDITIONS.
 6. DISCUSSION AND RECOMMENDATIONS.
 7. SUMMARY.
 8. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT

For

Hwy. #9 and Maitland River Tributary,
County of Wellington, Twp. of Minto,
Concessions C & D - District No. 3.
W.J. 64-F-34 -- W.P. 248-63

1. INTRODUCTION:

A request to carry out a foundation investigation at Hwy. #9 and Maitland River Tributary, was received from the Bridge Location Engineer, Mr. N. Zoltay, dated April 10, 1964.

It is proposed to erect a new bridge to carry Hwy. #9 over Maitland River Tributary. The site of the proposed bridge is located approx. 3.5 miles east of the Town of Harriston, County of Wellington, Twp. of Minto. At this location the chainage of Hwy. #9 is 287+92.

In order to determine the soil properties and decide on the type of foundation, an investigation was carried out by this Section. Results and the discussion of the field and laboratory investigations, as well as conclusions and recommendations for the future design work, are contained in the following paragraphs of this report.

2. DESCRIPTION OF SITE:

The site of the proposed underpass is located approximately 3.5 miles east of the Town of Harriston. The surrounding area is generally flat terrain.

Physiographically, the site is located in the so-called Dundalk Till Plain.

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

The abutments of the existing bridge which was built in 1920 are sound, but the deck is badly damaged by weather and traffic. From the information gathered at the site it seems that the bridge was constructed on spread footings placed 6 to 7 feet below the creek bed.

The width of the Maitland River Tributary at the proposed crossing is about 15 feet, and the depth of the water, approx. 3'-0" to 4'-0".

3. FIELD AND LABORATORY WORK:

In order to obtain sufficient information on the type and properties of the subsoil, three sampled boreholes and four dynamic cone penetration tests, were carried out at this site.

Split-spoon Samples were taken at various depth intervals. Samples recovered in the split-spoon sampler were used to determine the following physical properties:

1. Natural Moisture Content.
2. Atterberg Limits.
3. Grain Size Distribution.

Results of these laboratory tests are summarized in Appendix I of this report.

cont'd. /3 ...

4. SUBSOIL CONDITIONS:

4.1) General:

The stratigraphy of the soil at the site was found to be generally uniform. A detailed description of various soil types encountered during the investigation, is shown in Appendix I of this report, and is also given in subsequent paragraphs. The estimated stratigraphical profile, shown on Dr. No. 64-F-34A, is based upon this information.

4.2) Sandy Silt with Gravel - Dense:

This layer, which extends for a depth of 8'-0" was found in B.H. #1 only, just below the topsoil.

It may be classified as dense with an average 'N' value of 47 blows/foot.

4.3) Sandy Clayey Silt with Gravel - Very Stiff to Hard - (Glacial Till):

Following the layer of sandy silt with gravel in B.H. #1 and immediately below the topsoil in B.H. #2, 3 and 4 is a stratum of sandy clayey silt with gravel (glacial till). This deposit extends to the maximum depth tested, which was 31.5 ft. in B.H. #3.

The overall stratum is in a very stiff to hard condition with an average 'N' value of 105 blows/foot.

Grain size distribution curves indicated that this stratum is composed of 21% gravel, 21% sand, and the rest of 58% is formed by silt and clay. Liquid limits for this stratum vary from 13.2% to 25.3%, while plastic limits range from 10.1% to 17.2%. The average moisture content in this stratum was found

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

4.3) Sandy Clayey Silt with Gravel - Very Stiff to Hard -
(Glacial Till):

to be 10%, ranging from 6.7% to 20.1%. Plasticity charts for all borings are given in Appendix I of this report.

5. GROUND WATER CONDITIONS:

The ground water level at the time of the investigation was found to be at El. 1293.0 which corresponded with the water level elevation of the creek. It may be assumed that the water level will vary with the seasons of the year. No artesian water conditions were encountered.

6. DISCUSSION AND RECOMMENDATIONS:

The investigation has revealed that the subsoil conditions at the site are such that adequate support for spread footing type foundations can be obtained at relatively shallow depths. It is therefore recommended that the abutment footings be founded about 5 feet below the creek bed at approx. El. 1284.0. A net allowable pressure of 3 tons/sq.ft. may be assumed for design purposes. The exact depth of the footings will be dependent on hydrological considerations and should therefore be determined by the Hydrology Section.

The subsoil being basically of a granular nature, and the ground water table being relatively high, dewatering during construction may present a problem. If sheet piling is used for this purpose, these should be driven to a depth below the footing

cont'd. /5 ...

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

bottom equal to the height of water above it. Footing bases should be formed on a granular pad, or a suitable concrete working slab.

7. SUMMARY:

The stratification of subsoil at the site is relatively uniform and consists of topsoil, underlain by dense sandy silt with gravel (in B.H. #1) and by very stiff to hard sandy clayey silt with gravel (glacial till). The investigation has revealed that adequate support for spread footing type foundations can be obtained at relatively shallow depths. An allowable net pressure of 3 tons/sq.ft. is recommended for footings placed about 5 ft. below the creek bed at approx. El. 1284.0. Exact footing depth will be subject to hydrological considerations. Footing bases should be formed on a granular pad, or a suitable concrete working slab. A dewatering scheme will be necessary; recommendations contained in the body of the report should be followed.

8. MISCELLANEOUS:

The field work, performed during the period from May 5 to May 8, 1964, together with the preparation of this report, was undertaken by Mr. W. W. Kulmatickas, Project Foundation Engineer. The investigation was carried out under the general supervision of Mr. K. G. Selby, Senior Foundation Engineer, who reviewed this report.

June 1964

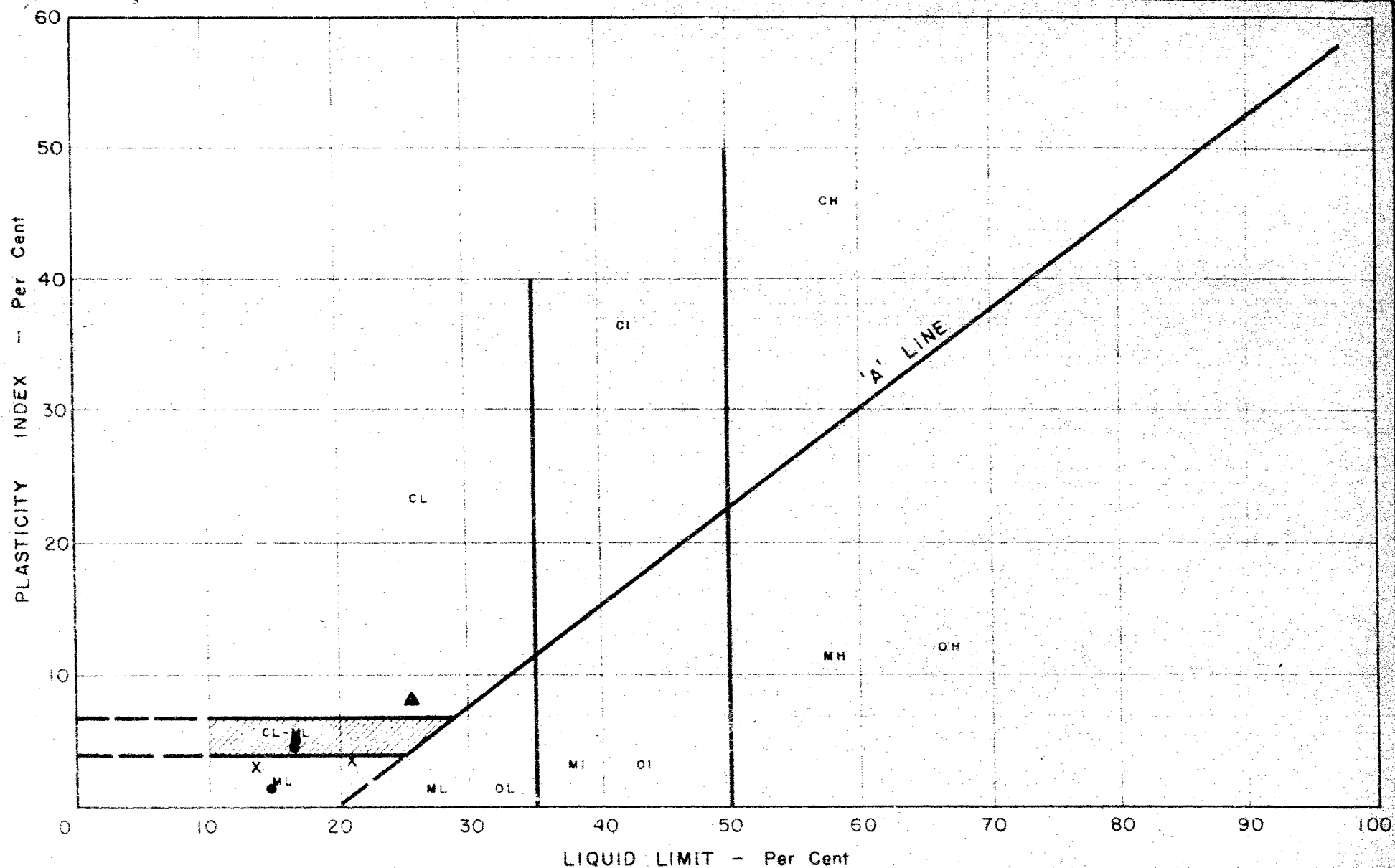
APPENDIX I.

ELEV. / DEPTH		DESCRIPTION		STRAT. PLT.	SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 25 50 75 100 125 SHEAR STRENGTH P.S.F.	LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W _c W _c — W _L WATER CONTENT % 10 20 30	BULK DENSITY P.C.F.	REMARKS
NUMBER	TYPE	BLOWS / FOOT									
1294	Groundlevel										
292.5	Black org. topsoil										
1.5	Sandy silt with gravel.						1290				
1286	Compact.	1	SS	29							
8.0	Sandy, clayey silt with gravel.	2	SS	57							
	Very stiff to hard.	3	SS	124			1280				
		4	SS	122							
							1270				
1267.5		5	SS	133							
26.5	End of borehole.						1260				

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE	LIQUID LIMIT		BULK DENSITY	REMARKS
ELEV. / DEPTH	DESCRIPTION	NUMBER	TYPE		BLOWS / FOOT	W _P	W _L		
1295	Groundlevel				25 50 75 100 125				
0.0	Penetration Test Only.				SHEAR STRENGTH P & S				
1285									
10.0	End of Penetration.								
				1290					
				1280					
				1270					

CHECKED BY **K.G.S.**

Observed in casing.



NOTES

- - B.H. NO. 1
- X - B.H. NO. 3
- ▲ - B.H. NO. 4

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION
PLASTICITY CHART

Job No. 64 - F - 34

W.P. No. 248 - 63

Location MAITLAND RIVER TRIBUTARY & HIGHWAY NO. 9

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
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

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Engineer,
Lab. Building.

FROM: Bridge Division,
Downsview, Ontario.

DATE: April 10, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT: Br. Site #36-368,
W.P. 248-63,
Maitland River Tributary,
Hwy. # 9 District # 3.

We are sending to you herewith two prints of Bridge Site Plan E-4319-1 on which we have marked in red the proposed location of the above structure.

Please make the necessary arrangements for a Foundation Soils Investigation. We will be pleased to have your report in due course.



NZ/kd
c.c. S. McCombie
G. Scott
N.D. Smith
W. Kinnear
R. Fitzgibbon

N. Zoltay,
for G. Scott,
Bridge Location Engineer.

MAY 4 PM 1 33 5
14 23'

T
E
L
F

STF DOWN 3 MAY 4/4 1.30P VR

L D BARRETT DIST ENGR

ATTN R J OBRIEN MTCE ENGR

FOUNDATION SECTION WILL COMMENCE FIELD WORK FOR PROPOSED
NEW BRIDGE HWY 9 AND MAITLAN RIVER TRIBUTAY W P 248-63
TUESDAY MAY 5TH 1964

K G SELBY SR FOUNDATION ENGR

FOR A G STERMAC PRIN FOUND ENGR

G

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

Bill McFARLANE

AUGUST 14, 1964

Q: 4 24 FT SPAN X 40 FT WIDE
BOX CULVERT IS CONTEMPLATED
WHAT ABOUT DEWATERING?

A: IT IS FELT THAT IF THE CREEK
IS DIVERTED EXCAVATION COULD
BE KEPT DRY BY PUMPING
IF SOME BOILING OCCURS
IT SHOULD NOT BE CRITICAL
BECAUSE OF THE NATURE
OF THE STRUCTURE.
A GRANULAR BLANKET SHOULD
BE PLACED PRIOR TO
POURING OF CONCRETE

AG EYERHAC

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Bldg.

FROM: Bridge Division,
Downsview, Ontario.

DATE: September 18, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 248-63
Bridge Site 36-368
Maitland River Structure
Highway 9 District 3

64-F-34

We are sending to you herewith two prints of Preliminary Plan D 5523-P of the above structure.

Would you please let us have your written comments.

L. Zoltay

NZ/es

N. Zoltay,
for G. Scott,
Regional Bridge Location Engineer.

cc. S. McCombie
cc. G. Scott
cc. N. D. Smith
cc. R. Fitzgibbon

No comments

*W.C.
10/1/64*

*Phoned G. Scott
12/2/64*

Mr. G. Scott,
Regional Bridge Location Eng.,
Bridge Planning Section,
Admin. Bldg.

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

October 27, 1964.

Attention: Mr. N. Zoltany

This is a correction of the memo sent to you on
October 15, 1964.

Subject reads: (1) W.P. 240-64 Br. Site #25-7
Credit River Br. Widening Hwy #136

(2) W.P. 248-63 Br. site #36-368
Hwy #9 District #3.

It should read: (1) W.P. 420-64 Br. Site #25-7
Credit River Br. Widening Hwy #136

(2) W.P. 248-63 Br. site #36-368
Maitland River Structure
Hwy #9 District #3.

YS/PB

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

Mr. G. Scott,
Regional Bridge Location Eng.,
Bridge Planning Section,
Admin. Bldg.

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

October 15, 1964.

Attention: Mr. H. Zoltany

- 410-64
- (1) W.P. ~~248-63~~ Br. site #25-7 64-F-42
Credit River Br. Widening Hwy #136
- (2) W.P. 248-63 Br. site #36-368
Maitland River Structure
Hwy. #9 District #3. 64-F-42

We have reviewed the preliminary plans for the above
proposed structures. The designer appears to have conformed with
the recommendations contained in our foundation reports.

K. Selby
K. Selby
per:

KS/PB

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

Mr. G. Scott,
Regional Bridge Location Eng.,
Bridge Planning Section,
Admin. Bldg.

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

October 15, 1964.

Attention: Mr. M. Zoltany

- 420-64
- (1) W.P. ~~258-63~~ Br. site #25-7 64-F-42
Credit River Br. Widening Hwy #136
- (2) W.P. 248-63 Br. site #36-368
Maitland River Structure
Hwy. #9 District #3. 64-F-42

We have reviewed the preliminary plans for the above
proposed structures. The designer appears to have conformed with
the recommendations contained in our foundation reports.

K. Selby
K. Selby
per:

KS/PB

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER