

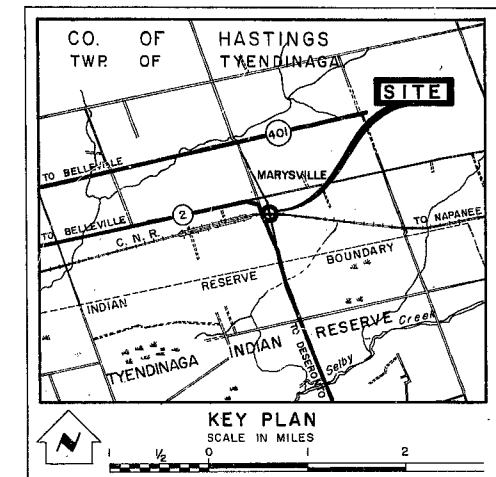
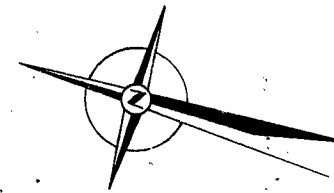
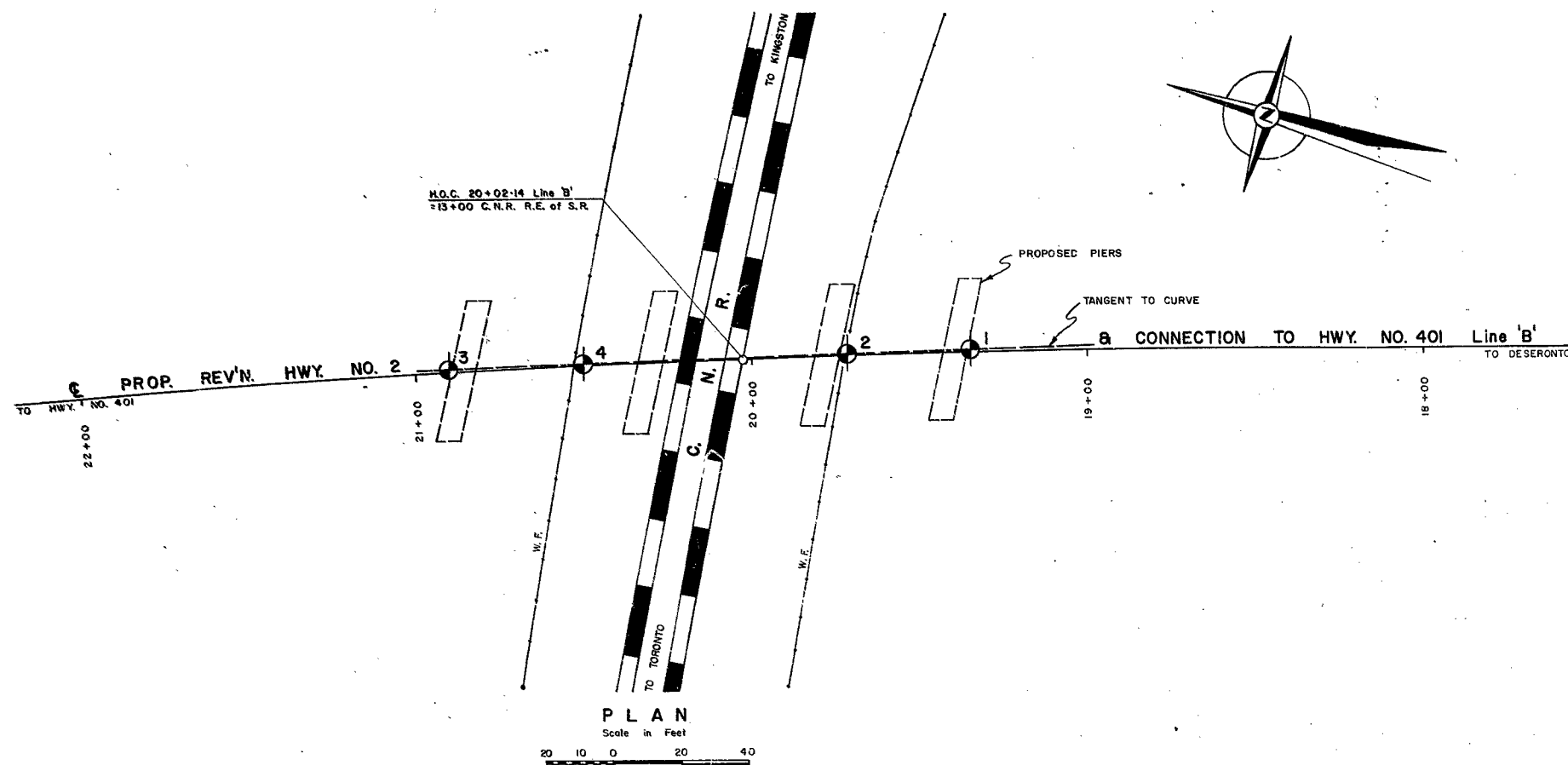
62-F-28

W.P. # 272-61

Hwy. # 2 Rev. E

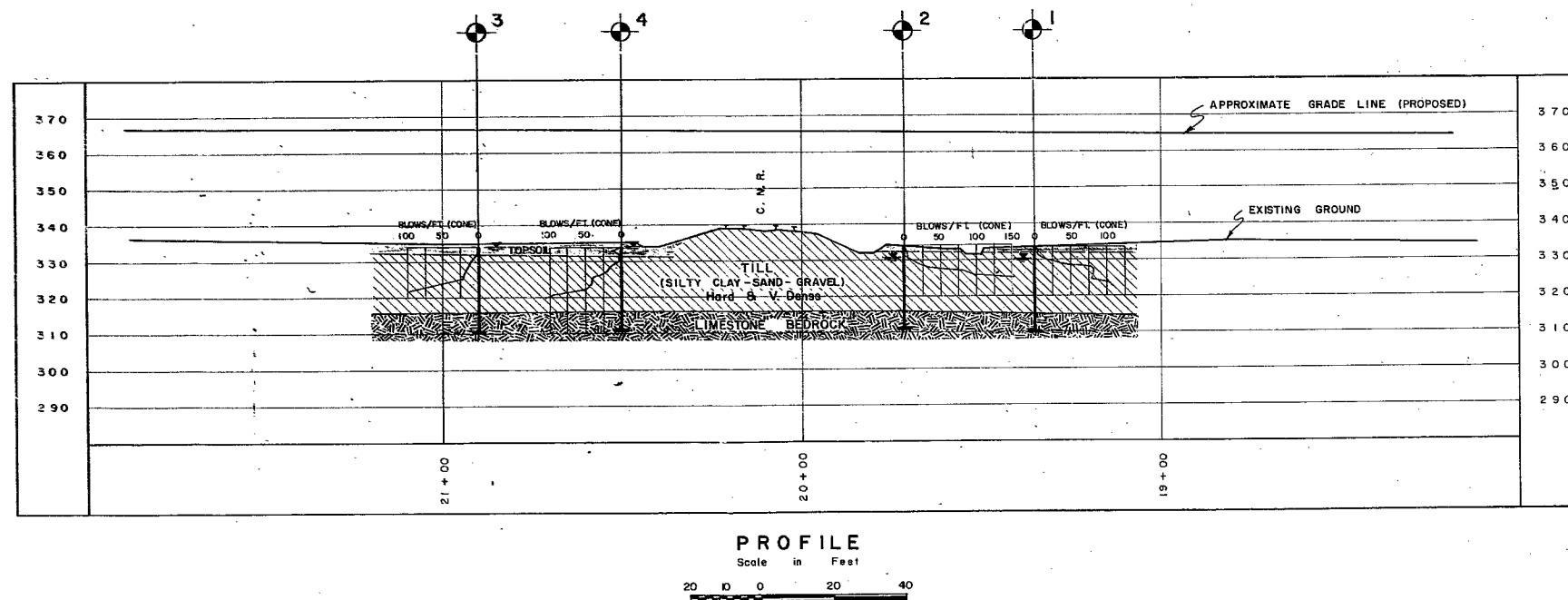
C.N.R. OVERHEAD

MARYSVILLE



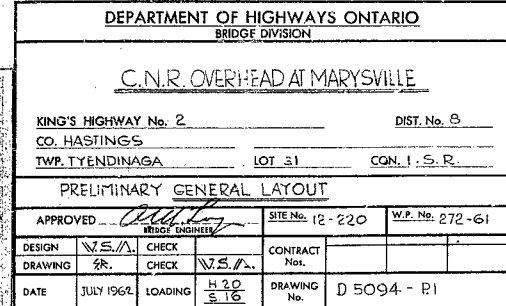
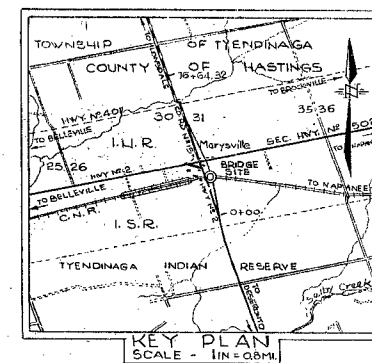
LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation		
NO.	ELEVATION	STATION	OFFSET
1	333.0	19+35	E OF TANGENT TO CURVE.
2	334.0	19+71	"
3	334.0	20+90	"
4	334.0	20+50	"

- 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.



REF. NO. E-4053-1

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION		
CANADIAN NATIONAL RAILWAY AND HIGHWAY NO. 2 REVISION LINE 'B' CONNECTION TO HIGHWAY NO. 401 AT MARYSVILLE		
ORIGINATED B. GHADIALI	DISTRICT NO. 8	DATE 4 APRIL 1962
DRAWN D. MUMFORD	W.P. NO. 272-61	JOB NO. 62-F-28
CHECKED <i>LR</i>	CONTRACT NO.	DRAWING NO.
APPROVED <i>K.H. 8/4</i>		62-F-28A



Mr. A. M. Tove,
Bridge Engineer.
Materials & Research Division,

May 17, 1962.

D.H.C. FOUNDATION INVESTIGATION
REPORT.
W.J. 62-F-28. -- W.P. 272-61.

(Foundation Section)

Attention: Mr. S. McCombie.

Re: Proposed overhead at C.N.R. Crossing
and Hwy. #2 (Line 'B'), in Marysville,
Township of Tyendinaga, District #8.

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

We believe you will find the factual data and
recommendations contained therein, adequate for your future
design work. If further information is required, please feel
free to contact our office.

AGS/MdeF
Attach.

cc: Messrs. A. M. Tove (2)
H. A. Tregaskes
H. D. McMillan
J. Ford
E. A. Cash
J. E. Gruspier
T. J. Kovich
J. Roy
B. E. Saint
F. Norman
A. Watt
Foundations Office
Gen. Files.

AGS
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

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 3. DESCRIPTION OF FIELD AND LABORATORY WORK.
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 - 4.2) Clay, Silt, Sand & Gravel (Glacial Till).
 - 4.3) Bedrock.
 5. GROUND WATER CONDITIONS.
 6. DISCUSSION AND RECOMMENDATIONS.
 7. CONCLUSIONS.
 8. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION

For

Proposed Overhead at C.N.R. Crossing
and Hwy. #2 (Line 'B'), in Marysville,
Township of Tyendinaga, District #8.

W.J. 62-F-28 -- W.P. 272-61.

1. INTRODUCTION:

A foundation investigation for the proposed structure over the C.N.R. in Marysville, was requested by the Bridge Location Engineer in a memo dated March 15, 1962. An investigation was carried out at the site of this proposed structure on March 21, 1962.

This report contains the field and laboratory findings, together with the recommendations for the foundations for the proposed structure.

2. DESCRIPTION OF SITE AND GEOLOGY:

The site is located about 250 feet east of the existing level crossing of Hwy. 2 and the C.N.R. at Marysville, Ontario. This level crossing is provided with wig-wag signals. Two tracks of the C.N.R. run in east-west directions on an elevated track-bed. The area on either side of the tracks is generally flat. Part of it is under cultivation and was submerged with water at the time of the investigation, due to the melting of snow. Due to the cohesive nature of the topsoil, the drainage conditions are poor. On either side of the tracks, shallow ditches are intercepted to carry surface run-off. Wire fences run parallel to the tracks on either side of the railroad property line. High-tension utility

cont'd. /2 ...

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

wires run parallel to the tracks on the south side, and approximately 15 feet above it.

Geologically, the site is located in the region known as the "Wapaneet Plain". It is a flat to undulating plain of limestone from which the glaciers have stripped most of the overburden. Whilst the soil is only a few inches deep over much of the region, some deeper glacial till deposits occur in the stream valleys and towards the north where this region borders on the limestone moraines.

3. DESCRIPTION OF FIELD AND LABORATORY WORK:

Field work consisted of four sampled boreholes with dynamic cone penetration tests adjacent to each borehole. The locations of the boreholes were chosen from Plan E-4053-1, provided by the Bridge Office.

The exploration programme was carried out by a standard core drill machine adapted for soil sampling. A conventional wash boring procedure was followed. Samples were recovered at required depths by means of a 2-inch O.D. split spoon sampler. The dimension of this spoon sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test. Rock samples were obtained by the use of an AXT core barrel

Samples were visually examined and identified in the field before transportation to the laboratory. Tests were carried out in the laboratory on a few selected samples for the determination of Atterberg limits, moisture content and grain size distribution.

cont'd. /3 ...

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

Laboratory and field test results have been summarized and are included in this report in Appendix I. Drawing No. 62-F-28A shows the borehole locations, their respective elevations and the estimated subsoil stratigraphy.

4. GUESOIL CONDITIONS:

4.1) General:

The investigation has shown the general stratification of the subsoil to be regular. Below a thin layer of topsoil, there is a layer of glacial till overlying bedrock.

4.2) Clay, Silt, Sand and Gravel (Glacial Till):

This deposit was encountered in all the borings to approximate elevation 316.0. It consists of a heterogeneous mixture of clay, silt, sand, and gravel in varied proportions. The thickness of the layer was found to be 16.8' in boring 1, 16.3' in borings 2 and 3, and 15.2' in boring 4. The material is fairly cohesive in the upper part of the layer, but becomes progressively less cohesive with depth. The bottom 10' is essentially granular in nature. 'N' values are generally in excess of 50 blows per foot, indicating the relative density of the deposit to be very dense. The material is desiccated from the upper surface down to a depth of about 8.0' and in consequence, has a brown colour. Below this depth, the colour is brownish grey.

cont'd. /4 ...

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

4.2) Clay, Silt, Sand and Gravel (Glacial Till): (Cont'd.) ...

The results of five grain size distribution curves show on the average, the following particle size contents:- 50% silt, 21% clay, and 30% sand and gravel. The average moisture content is about 10%.

4.3) Bedrock:

Below the above-mentioned layer of glacial till, limestone bedrock was encountered in the all the boreholes. It contains occasional thin grey shale bands. The elevations at which the bedrock was encountered, are as given below:

<u>Borehole No.</u>	<u>Elevation</u>
1	314.8'
2	316.2'
3	315.7'
4	316.3'

5. GROUND WATER CONDITIONS:

Measurements and observations carried out during the boring and sampling operations, indicate that the ground water level in boring 1 was at elev. 329.7 and in boring 2 at elev. 331.0. The elevation of the water level in a drainage ditch nearby, was also at elev. 329.7 ft. Ground surface in the vicinity of borings 3 and 4, was submerged under four to six inches of water due to the melting of snow. An artesian water condition was observed in boreholes 1 and 2. In borehole 1, it was encountered around elevation 320.3' and the elevation to which the water rose in the casing was 333.5'. In borehole 2, the elevations were 318.0 and 336.5', respectively.

cont'd. /5 ...

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct an overhead to carry revised Line 'E' of Hwy. 2 over the C.N.R. tracks in Marysville. The site is located in Lot 31, Con. I, in the County of Hastings.

In the preceding paragraphs, subsoil conditions and properties are described in detail. The soil stratification can be considered as uniform over the site area. The strength and compressibility characteristics of the upper till layer, are such, that it is competent to support spread footings for the proposed structure. Spread footings 6 to 8 feet wide, founded at least 5 feet below the ground level (Elev. 328' or lower), to allow for adequate frost protection, can support a net safe load of 3.0 T.S.F. If it is desired to place the abutment footings in the fill, a pile-supported foundation will be required. 12 BP 74 steel H-piles, driven to bedrock contact, should support a safe load of 70 tons per pile.

No dewatering problems are anticipated, as the upper subsoil layer is relatively impermeable.

No slope stability problems should be encountered for any embankments with the standard two horizontal to one vertical slopes, either during or after construction.

7. CONCLUSIONS:

Subsoil at the site consists of about 16 feet of glacial till overlying limestone bedrock.

Water level was found to be near the ground surface of the site. Artesian pressure conditions were encountered in borings 1 and 2, around elevations 320 feet and lower, about 13.0' below ground level.

cont'd. /6 ...

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

Subsoil conditions are such that spread footing support can be obtained. Footings founded at elevation 328 feet or lower, can support a safe load of 3 T.S.F. If it is desired to support abutments on piles, within the approach fills, end-bearing steel H-piles 12 BP 74, driven to bedrock contact, can support a safe load of 70 tons per pile.

No dewatering problems are anticipated.


No slope stability problems should arise with the standard 2:1 slopes for the approach fills.

8. MISCELLANEOUS:

The field work, performed during the period from March 21, 1962 to March 26, 1962, together with the preparation of this report, was undertaken by Mr. B. M. Ghadiali. The investigation was carried out under the general supervision of Mr. K. G. Selby, who reviewed this report.

Equipment was owned and operated by Johnston Drilling Co. of Ottawa.

May 1962.


K. Y. Lo,
SUPERVISING FOUNDATION ENGINEER

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 _u	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Q _{cu}	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q _d	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_e	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_s	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

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 62-F-28

LOCATION C.N.R. Crossing & Hwy. 2 (Line B), Marysville

ORIGINATED BY B.M.G.

W. P. 272-61


BORING DATE March 21, 1962.

COMPILED BY B.K.

DATUM 3331

BOREHOLE TYPE Washboring (BX Casing)

CHECKED BY

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— *L		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	BLOWS / FOOT	PLASTIC LIMIT ——— *P	WATER CONTENT ——— *W		
						20	40	60		
							SHEAR STRENGTH P.S.F.		WATER CONTENT %	
									20 ——— 40 ——— 60	
333'										
0-0"	Topsoil									
1'-6"	 Silty clay-sand and fine gravel. (Till) Hard brown to Br. grey.		1	S.S.	42					Gr. water level El. 329.7
			2	S.S.	95					
			3	S.S.	77					
320.2	Artesian Pr.									Artesian Head to El. 333.5
12.8			4	S.S.	>100					
314.7										
18.3	Bedrock. (Limestone)									
			5	R.C.	-					
309.7										
23.3	End of borehole.									

FOUNDATION SECTION

LOCATION C.N.R. Crossing & Hwy. 2 (Line B), Marysville

ORIGINATED BY B.M.G.

BORING DATE March 22, 1962.

COMPILED BY B.K.

BOREHOLE TYPE Washboring (BX Casing)

CHECKED BY _____ H.S.

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ———— W _L PLASTIC LIMIT ———— W _P WATER CONTENT ———— W	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE BLOWS / FOOT	SHEAR STRENGTH P.S.F.	W _P ———— W ———— W _L WATER CONTENT % 20 40 60	P C F	
334'							
0'-0"	Topsoil						
1.5'							
331' 330	Clayey silt-sand and gravel. (Up to 1" size) (Till) Hard, brown to Br. grey.		1 S.S. 45		OH		Ground water level El. 331
			2 S.S. 80				
318' 316.0	Artesian Pr.		3 S.S. >100		O		
316.2' 17.8	Bedrock. (Limestone)		4 R.C. -				Artesian Head to El. 336.5
211'							
23.0'	End of borehole						

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 62-F-28

LOCATION C.N.R. Crossing and Hwy. 2 (Line B), Marysville

ORIGINATED BY B.M.G.

W. P. 272-61

BORING DATE March 23, 1962.

COMPILED BY B.K.

DATUM 334'

SOREHOLE TYPE Washboring (BX Casing).

CHECKED BY _____ H.S.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— % PLASTIC LIMIT ——— % WATER CONTENT ——— %			BULK DENSITY P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT	BLOWS / FOOT 20 40 60 80 100					WATER CONTENT % 20 40 60				
334'															
0'-0"	Topsoil														
2.0'	Silty clay- sand and fine gravel. (Till) V. stiff to hard brown to Br. grey.		1	S.S.	22										
			2	S.S.	56										
			3	S.S.	63										
			4	S.S.	81										
18.3	Bedrock. (Limestone)		5	R.C.	-										
23.3	End of borehole.														

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & RESEARCH DIVISION			RECORD OF BOREHOLE NO. 4				FOUNDATION SECTION		
JOB 62-F-28		LOCATION C.N.R. Crossing and Hwy. 2 (Line B), Marysville			ORIGINATED BY B.M.G.				
W.P. 272-61		BORING DATE March 26, 1962.			COMPILED BY B.K.				
DATUM 334'		BOREHOLE TYPE Washboring (BX Casing).			CHECKED BY H.S.				

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W WP ——— W ——— WL WATER CONTENT % 20 40 60	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE					
334'	0'-0"							
	Topsoil							
331.5	2.5							
	Sand-gravel and silty clay. (Till)	1	S.S. 25					
	Compact to V. dense brown to Br. grey.	2	S.S. 53					
		3	S.S. >100					
316.3	17.7							
	Bedrock. (Limestone)	4	R.C. -					
311.3	22.7							
	End of borehole.							

MEMORANDUM

To:

Mr. A. G. Stermac,
Principal Foundation Engr.,
Room 107, Lab. Bldg.

FROM:

W. Melinyshyn,
for J. Keen,
Sr. Bridge Project Engr.

Att.: Mr. K. Y. Lo

DATE:

October 23, 1962.

OUR FILE REF.

IN REPLY TO

SUBJECT:

C.N.R. Overhead at Marysville,
W.P. 272-61, Hwy. #2 Dist. #8.

62-5-28

In reference to the soils report at the above proposed bridge site it was recommended to use 12 BP 74 piles (design load 70 tons) supporting the abutments on fill.

We have employed 12 BP 53 piles with reinforced pile tips driven to bedrock at a design load of 65 tons. It is felt that these piles are sufficient for this load and also adequate to penetrate the dense till.

If you are not in agreement with the proposed alteration we would appreciate an early reply.

W. Melinyshyn

WM:go

W. Melinyshyn,
for J. Keen,
Sr. Bridge Project Engineer.

No Comment

K. Y. Lo

MEMORANDUM

TO: Mr. A. G. Stermac,
Principal Foundations Engineer,
D.H.O., Room 107, Lab. Bldg.,
DOWNSVIEW, Ont.

FROM: J. B. Curtis,
Bridge Location Engineer

DATE: July 20, 1962.

OUR FILE REF.

IN REPLY TO


SUBJECT: W.P. 272-61 - Bridge Site No. 12-220
Hwy. 2 and 41 - C.N.R. O'head at Marysville
District #8

Enclosed find one copy of the preliminary plan for the structure proposed at the above location.

Spread footings have been placed at elevation 329.0 rather than the 328.0 as recommended in your report. Fill from the railway tracks, however, appear to provide sufficient frost protection.

All other recommendations in your report appear to have been followed.

JBC/bm


J. B. Curtis,
Bridge Location Engineer.

c.c. N.D. Smith

