

66-F-96

W.P. # 163-65

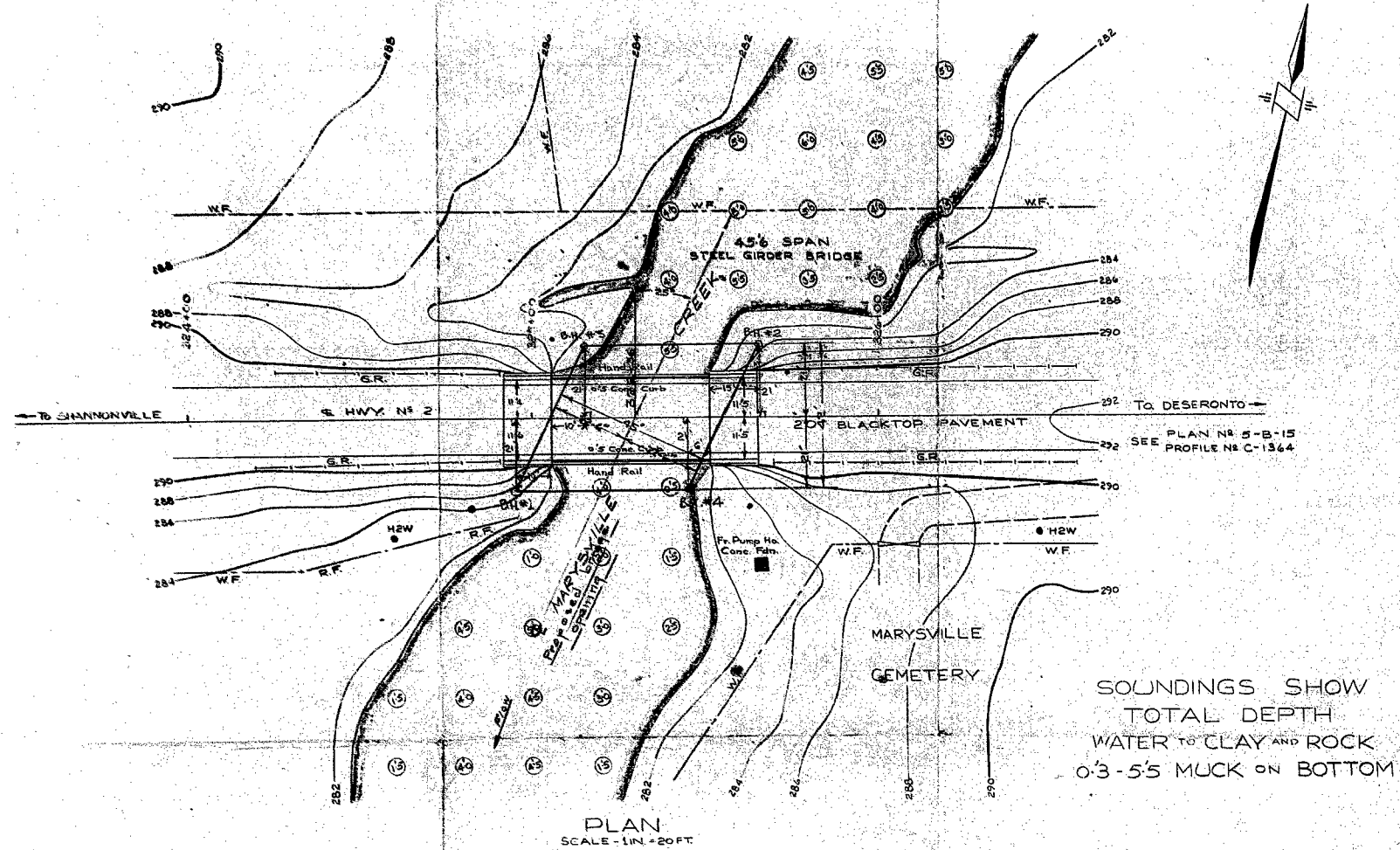
Hwy. # 2

CROSSING

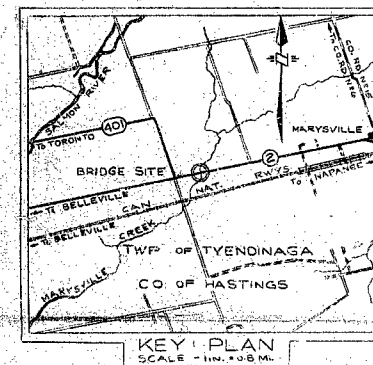
MARYSVILLE

CREEK

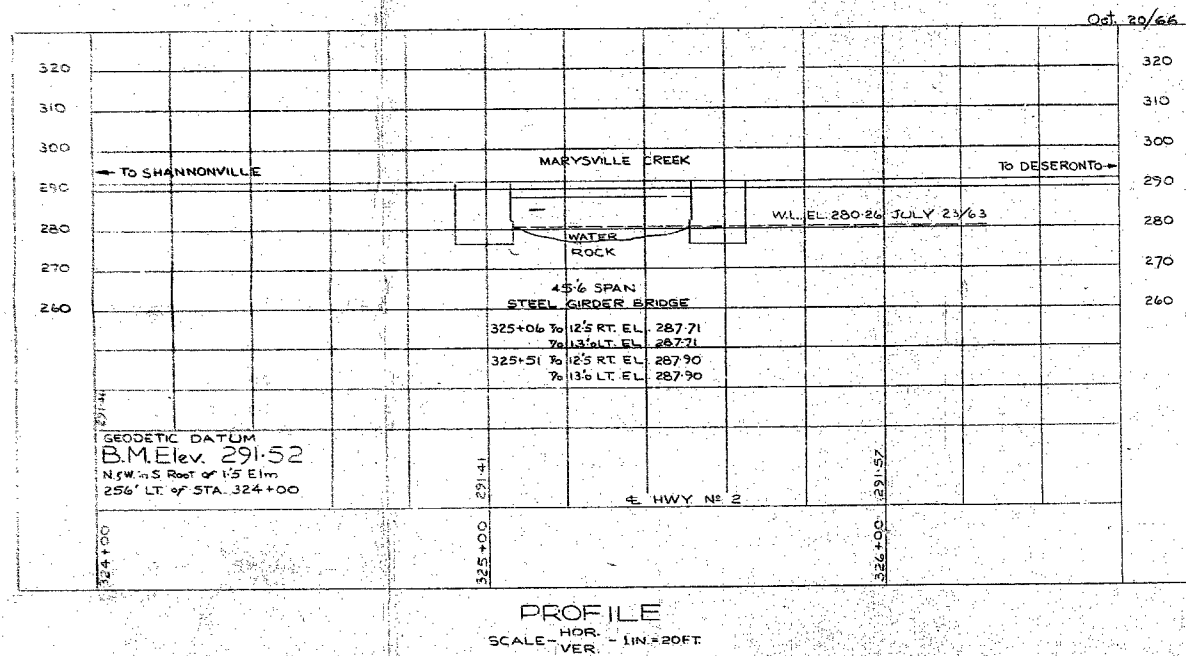
COUNTY of HASTINGS
TOWNSHIP of TYENDINAGA
CONS. 1N. & 1S.
LOT'S 23 & 24



SOUNDINGS SHOW
TOTAL DEPTH
WATER TO CLAY AND ROCK
0.3-5.5 MUCK ON BOTTOM



Sketch showing proposed structure location
as submitted for Foundation Investigation.



WP. # 163-65

DATE	REVISIONS	BY	CHKD.
DEPARTMENT OF HIGHWAYS - ONTARIO			
PLANNING & DESIGN BRANCH			
DISTRICT NO 8			
CROSSING AT MARYSVILLE CREEK			
AND			
THE KING'S HIGHWAY NO 2			
LOTS 23 & 24		CONS 15 & 1N.	
TOWNSHIP OF TYENDINAGA		COUNTY OF HASTINGS	
BRIDGE SITE			
SURVEY BY CHIEF OF PARTY - M.J. SHEEDY SUPERVISOR - G.H. READMAN		APPROVED <i>Director of Public Works Design</i>	
DRAWN BY DRAFTSMAN - G.A. MARTIN SUPERVISOR - G.F. BROWN		SCALE - AS SHOWN DATE OF SURVEY - JULY 1963 DATE OF PLAN - AUG. 1963	
CHECKED BY DRAFTSMAN - R.K. FUJIMARA SUPERVISOR - G.F. BROWN		WORK - 70-5-63-29	
PLAN E-4225-1			

MEMORANDUM

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Division.
Attention: Mr. S. McCombie

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

Date: December 5, 1966

In Reply To: **DEC 14 1966**

Our File Ref.

Subject:

FOUNDATION INVESTIGATION REPORT
For
Proposed New Structure at Crossing
of Marysville Creek and Hwy. #2,
County of Hastings
District #8 (Kingston)
W.J. 66-F-96 -- W.P. 163-65

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

AGS/MdeF
Attach.

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

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
S. J. Markiewicz
E. A. Cash
G. Scott
J. E. Gruspier
A. Watt

Foundations Office ✓
Gen. Files

TABLE OF CONTENTS

1. INTRODUCTION.
 2. DESCRIPTION OF SITE.
 3. FIELD WORK.
 4. LABORATORY TESTING.
 5. SUBSOIL CONDITIONS:
 - 5.1) General.
 - 5.2) Fill Material.
 - 5.3) Clayey Silt.
 - 5.4) Bedrock.
 6. GROUNDWATER.
 7. DISCUSSION AND RECOMMENDATIONS.
 8. MISCELLANEOUS.
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FOUNDATION INVESTIGATION REPORT
For
Proposed New Structure at Crossing
of Marysville Creek and Hwy. #2,
County of Hastings
District #8 (Kingston)
W.J. 66-F-96 -- W.P. 163-65

1. INTRODUCTION:

The Foundation Section was requested to carry out an investigation at the above site. The request was contained in a memorandum dated October 19, 1966, from Mr. G. Scott, Regional Bridge Location Engineer.

An investigation was subsequently carried out to determine the subsoil conditions at the site.

2. DESCRIPTION OF SITE:

The crossing of Marysville Creek and Hwy. #2 is situated about 5 miles east of Shannonville. The area is flat-to-undulating with bedrock visible in many places. Physiographically, this region is referred to as the 'Napanee Plain.' This is an area of limestone from which the glacier stripped most of the overburden. Grazing is the most important land use. A church and cemetery are located at the south-east corner of the crossing. At present, a narrow, single-span steel girder bridge serves as a crossing.

3. FIELD WORK:

Using conventional diamond drilling equipment adapted for soil sampling purposes, four boreholes along with two dynamic cone penetration tests were carried out at the site. A 140-lb. hammer imparting an energy of 350 ft.-lbs. per blow was used for the dynamic cone penetration tests.

cont'd. /2 ...

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

In cohesive materials, 2-inch I.D. Shelby tube samples were obtained by manually pushing the tubes into the soil. Otherwise, samples of granular materials were obtained by driving a 2-inch O.D. split-spoon sampler according to the specifications of the Standard Penetration Test. All split-spoon samples were visually examined in the field.

The locations and elevations at all four borings were surveyed by personnel from Kingston Region Engineering Surveys Section, and are shown on Drawing #66-F-96A, together with the estimated stratigraphical profile. This drawing is included in the Appendix of the report.

Bedrock was proven for five feet in two borings by obtaining AXT size rock core samples. In the other two boreholes bedrock was assumed to be at the level at which the borehole casing met refusal while being driven by means of a 140-lb. hammer.

4. LABORATORY TESTING:

Samples were subjected to a careful visual inspection in the laboratory. Laboratory tests were then conducted on selected representative samples to determine:

- 1) Atterberg Limits.
- 2) Natural moisture content.
- 3) Grain-size distribution.
- 4) Undrained shear strength.
- 5) Bulk densities.

The results of the above tests, the field test results, locations and elevations of the boreholes, have been summarized and are presented in Appendix I of this report.

cont'd. /3 ...

5. SUBSOIL CONDITIONS:

5.1) General:

Subsoil conditions over the site area were found to be generally uniform. Subsoil at the site consists of fill material at borehole #2, followed by a stratum of clayey silt with some gravel. Above the limestone bedrock, gravel was encountered. The boundaries between the different deposits are shown on the borelog sheets in Appendix I of this report.

5.2) Fill Material:

This fill material was met in borehole #2 since this hole was drilled through the highway fill. The material consists of sandy gravel with traces of clayey silt. 'N' values obtained from Standard Penetration tests ranged from 2 to 15 blows per foot, indicating a very loose to compact relative density. A mechanical analysis test gave the following grain-size distribution: gravel 28%, sand 29%, silt 31%, clay 12%. The natural moisture content is in the order of 13%.

5.3) Clayey Silt:

This deposit appeared in all four boreholes. It varied from 6 feet in B.H. #3 to 13 feet in B.H. #2. This layer consisted mainly of clayey silt with some gravel and stones. 'N' values ranged from 3 to 24 blows per foot, indicating a consistency from soft to very stiff. Physical properties as determined in the laboratory, were as follows:

W _L	--	13.2% - 44.6%
W _p	--	9.8% - 31.7%
W	--	12.0% - 50.0%

Grain-size distribution tests on samples from the overall deposit gave the following average results: Gravel 5%, sand 40%, silt 35%, clay 20%.

cont'd. /L ...

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

5.3) Clayey Silt: (cont'd.) ...

One undrained shear strength test on one sample gave a strength of 2425 p.s.f. and a bulk density of 131 p.c.f.

5.4) Bedrock:

Bedrock was proven for 5 feet in 2 of the 4 boreholes. The recovery was very good, showing the bedrock to be sound limestone. The elevation of the bedrock on the west bank differed by about 8 ft. from that on the east bank.

6. GROUNDWATER:

The elevation of the groundwater ranged from elev. 281.5 to 282.

7. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct a new bridge at this site to replace the existing structure. No significant change of profile grade is contemplated, and the new centre-line will be coincident with the present centre-line. The length of the new structure will be about 50 feet, and the maximum height of the approach is about 15 feet above the river bed.

The investigation has shown that sound bedrock is located between elev. 266 and elev. 267 on the east bank of the river, and between elev. 274 and elev. 277 on the west side. It is recommended that the new structure be supported on spread footings founded on sound bedrock, keyed in about 12 inches. During construction, some variations in rock elevation may be discovered and it may be necessary to excavate to a slightly lower elevation than that interpolated between borings. In such a case, provision for mass concrete should be made. The footings may be designed assuming a safe pressure of up to 20 tons/sq.ft.

No stability problems are anticipated.

cont'd. /5 ...

8. MISCELLANEOUS:

Equipment was owned and operated by George Wimpey & Sons Ltd. of Toronto.

The field work, performed during November 7 to 17, 1966, together with the preparation of this report, was undertaken by Mr. A. M. Seppala, Project Foundation Engineer. The investigation was carried out under the general supervision of Mr. K. G. Selby, Supervising Foundation, who also reviewed this report.

December 1966

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-96

LOCATION Sta. 325+74 on Hwy. #2 & O/S 13' Lt.

ORIGINATED BY A.M.S.

W. P. 163-65

BORING DATE November 15, 16 & 17, 1966

COMPILED BY A.M.S.

DATUM Geodetic

BOREHOLE TYPE EX Casing

CHECKED BY _____

RECORD OF BOREHOLE NO.2

FOUNDATION SECTION

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.		WATER CONTENT % 20 40 60			
290.7	GROUND LEVEL					290					Y	Gr. 28%, SA 29% Si. 31%, Cl. 12% W.L. ELEV. 281.7 Gr. 3% Sa. 31% Si. 38% Cl. 28%
0	(Fill) Sandy gravel with a trace of clayey silt. Loose to compact.		1	SS	6							
			2	SS	2							
280.7			3	SS	15	280						
10.0	Clayey silt to silty clay with some gravel		4	SS	11							
			5	SS	19							
	Stiff to very stiff		6	SS	17	270						
267.4			7	SS	16							
23.3	Probable Bedrock											

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 66-F-96 LOCATION Sta. 325+06 on Hwy. #2 & O/S 23' Lt. ORIGINATED BY A.M.S.
W.P. 163-55 BORING DATE November 9 & 10, 1966 COMPILED BY A.M.S.
DATUM Geodetic BOREHOLE TYPE BX Casing & Axt. Rock Core CHECKED BY 4/2

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— W _L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					PLASTIC LIMIT ——— W _P				
							20	40	60	80	100	WATER CONTENT ——— W				
							SHEAR STRENGTH P.S.F.					W _P ——— W ——— W _L				
												WATER CONTENT %				
												20 40 60				
283.1	GROUND LEVEL					280										
0	Clayey silt with gravel. Trace of organics. Firm		1	SS	5											Gr. 4% Sa. 22% Si. 29% Cl. 45%
276.6																
6.5	Limestone Bedrock Sound		2	RC	Axt. Rec. 85%											
271.6																
11.5	End of Borehole															

Gr. 4%
Sa. 22%
Si. 29%
Cl. 45%

FOUNDATION SECTION

ORIGINATED BY A M S

COMPILED BY A.M.S.

CHECKED BY

REMARKS

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_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

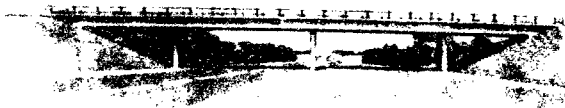
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

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



66-F-96

DEPARTMENT OF HIGHWAYS
Bridge Section, Postal Bag 4000, Kingston, Ontario.

October 19, 1966.

Mr. A. Stermac,
Principal Foundation Engineer,
Laboratory Building, DOWNSVIEW.

W.P. #163-65, Marysville Creek, Hwy. #2,
Site #11-211, District #8, Kingston

We are sending herewith two prints of bridge site plan #E-4225-1 on which we have marked in red the proposed location of the above structure.

The bridge site is readily accessible from Highway #2.

Please make the necessary arrangements for foundation soils investigation: we will be pleased to have your report in due course.


J. A. Fisher

For: G. Scott,

REGIONAL BRIDGE LOCATION ENGINEER.

JAF/GS/lm

515
120
395

Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division,
Admin. Bldg.

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

February 23, 1967

Marysville Creek Bridge --
W.P. 163-65 -- W.J. 66-P-96
Hwy. #2 -- District #9 (Kingston)
Bridge Plan Drawing D-6133-1.

We have reviewed the preliminary plan for the above mentioned structure. The designer appears to have complied with the recommendations contained in our Foundation Report.

KGS/MieF

cc: Messrs. S. McCombie
G. Scott

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

Foundations Files
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DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Engineer,
Administration Building,
DOWNSVIEW, Ontario.

FROM: Mr. G. Scott,
Regional Bridge Location Engineer,
KINGSTON, Ontario.

DATE: February 22, 1967

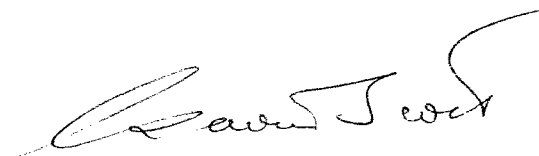
OUR FILE REF.

IN REPLY TO

SUBJECT:

W.P. 163-65, Site 11-211, Marysville Creek
Bridge, Highway #2, District #8

Herewith please find print of Preliminary Plan
D-6133-1. May we have such comments as you wish to
make.



G. Scott
REGIONAL BRIDGE LOCATION ENG.

GS/h1

Enc.

Department of Highways Ontario

Copy for the information of
Mr. A. Stermac, Principal Foundation Engineer,
Room 107, Lab. Building

Mr. G. Scott,
Regional Bridge Location Engineer,
Kingston Regional Office

Bridge Division,
Downsview, Ontario

February 17, 1967

Marysville Creek Bridge
1.9 Miles W. of Marysville
W.P. 163-65, Site 11-211
Highway 2, District No. 8

Attached herewith are prints of the Preliminary Bridge
Plan Drawing D-6133-1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$54,870.
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. Grabski,
Bridge Design Engineer

Attach.

c.c. S. McCombie
F. Stermac
A. Forrest
L. Cross