

#65-F-62
BARR CREEK
& MILLS RD.
CAMPBELL TWP.

DEPARTMENT OF HIGHWAYS ONTARIO

28-17

MEMORANDUM

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

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

Attn: Mr. K. L. Kleinsteinber,
Mun. Bridge Liaison Engr.

DATE: June 23, 1965

OUR FILE REF.

IN REPLY TO

23-66-176

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Barr Creek and Mills Road, Township
of Campbell, District of Manitoulin
District #17 (Sudbury
W.J. 65-F-62 -- W.P. (N11)
(Municipal Job)

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
feel free to contact our Office.

KYL/MdeF
Attach.

cc: Messrs. K.L. Kleinsteinber (3)

J. P. Howard

T. A. Sharpe (Attn: Mr. R. E. Dawson)

E. R. Saint

Foundations Office
Gen. Files ✓

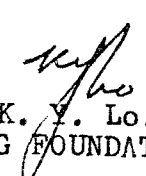

K. Y. Lo,
SUPERVISING FOUNDATION ENGINEER

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FOUNDATION INVESTIGATION REPORT

For

Barr Creek and Mills Road, Township
of Campbell, District of Manitoulin
District #17 (Sudbury)
W.J. 65-F-62 -- W.P. (Nil)

(Municipal Job)

1. INTRODUCTION:

A soils investigation was requested by Mr. R. E. Dawson, Sudbury District Municipal Engineer, at Barr Creek on Mills Road, Manitoulin Island, to determine the subsoil conditions existing at the site. The Foundation Section began the investigation on May 26, 1965.

2. DESCRIPTION OF SITE:

The above site is located about 3 miles east of Poplar and about 13 miles from Gore Bay, in Campbell Township on Manitoulin Island.

The bridge carrying Mills Road over Barr Creek is of wooden construction, 16.5' long x 16.0' wide, in a poor state of repair because the foundations are gradually sinking into the subsoil. The area consists mainly of bush, and farm pasture, with outcrops of rock erratics at the surface. The immediate vicinity of the creek is swampy, apparently flooded each year by the back-up of water from a beaver dam.

cont'd. /2 ...

3. FIELD PROCEDURE:

Two boreholes were drilled, on opposite sides of the bridge, together with a total of six cone penetration tests. A surveyed plan of the area was provided by Mr. R. E. Dawson, and the holes were located on site by the field engineer. Disturbed samples were obtained by means of split-spoon samplers, and a number of undisturbed samples were obtained using Shelby tubes. Several vane tests were carried out. An assumed datum of 100.00' was located 61.0' right of station -1+00, indicated by a nail in the root of a 1.0' Maple stump.

4. SOIL TYPES:

The top 3.0' to 4.5' of soil consists of a sandy fill containing some organic material, below which is a corduroy mat. Below this, to a depth of about 3.5' is a deposit of soft to very soft organic muck. This layer of muck overlies a 3.0' deep layer of very loose grey silt with a high organic content. A deposit of varved clay then occupies a depth of about 17.3', reaching the bedrock of dolomite at a depth of about 29.8' (elevation 63.4'). The bed of the creek is at elevation 92.1' and ground-water level is that of the creek \pm 3".

Generally, the consistency of the subsoil ranges from soft to very soft. A complete set of results for both field and laboratory tests is shown on the enclosed borelog sheets, and the location of boreholes is shown on the attached Drawing #65-F-62A.

cont'd. /3 ...

5. RECOMMENDATIONS:

The 5.0' to 6.0' deep layer of muck beneath the corduroy mat is one of the main reasons for the current instability of the bridge. With regard to a new structure, the choice appears to be governed by financial considerations. It is therefore recommended that a flexible pipe replace the bridge, the size of the pipe being governed by hydrological considerations. The muck should be excavated down to elevation 88.4' and a 1.5' deep brushwood mat laid. On top of the brushwood mat, a granular fill should be placed, and built up to the invert level of the pipe. After the pipe has been positioned the sides should be backfilled with granular material up to the proposed grade level. Since settlement of the pipe is likely to occur, it would be advisable to place it with a 12" camber in the centre.

6. MISCELLANEOUS:

The boring programme was commenced on May 26, 1965 and completed on May 29, by the Canadian Longyear Drilling Company, under the supervision of Mr. Peter McGlone, Project Foundation Engineer. The preparation of this report was carried out by Mr. R. Pratt, and reviewed by Mr. K. G. Selby, Senior Foundation Engineer.

June 1965

APPENDIX 1.

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 65-F-62

LOCATION 57.5' E., 7' N., Barr Creek & Mills Rd.

ORIGINATED BY R.P.

W. P. _____ BORING DATE May 28, 1965.

COMPILED BY R.P.

DATUM 100.0

BOREHOLE TYPE BX Casing.

CHECKED BY K.G.S.

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 65-F-62 LOCATION 113' E., 3.5' N. Barr Creek & Mills Rd ORIGINATED BY R.P.

W.P. _____ BORING DATE May 29, 1965. COMPILED BY R.P.

DATUM 100.0 BOREHOLE TYPE Cone Penetration Only CHECKED BY K.G.S. *AK*

[illegible]

FOUNDATION SECTION

CHECKED BY K.G.S. 

[illegible]

FOUNDATION SECTION

CHECKED BY K.G.S. *W*

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	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT ——— w _p	WATER CONTENT ——— w		
98.8	Groundlevel											
						90						
						80						
						70						
68.0												
30.75	End of cone test					60						

FOUNDATION SECTION

DATUM 100.0 BOREHOLE TYPE Cone Penetration Only

CHECKED BY K.G.S.

[illegible]

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
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

65-F-62

Mr. R. E. Dawson,
District Municipal Engineer,
District #17, Sudbury, Ont.

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

May 4, 1965

Your Memo -- April 22, 1965

Campbell Township Statute Labour Board
Barr Creek Bridge No. 9

We submit herewith, an estimate of a soils investigation for the above job. The total estimated cost is \$1,700.00, including laboratory work and salaries of Departmental personnel involved. The last two items would amount to approximately \$700.00

KYL/MdeF

KYL
K. Y. Lo,
SUPERVISING FOUNDATION ENGR.

cc: Foundations Office ✓
Gen. Files

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

#17, Sudbury

To: Mr. A. Stermac,
Principal Foundation Eng'r.

FROM: Mr. R. E. Dawson,
District Municipal Engineer.

DATE: April 22nd, 1965.

OUR FILE REF.

IN REPLY TO

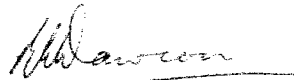
SUBJECT:

Re: Campbell Township Statute Labour Board
Barr Creek Bridge No. 9

The bridge as shown on the enclosed card is becoming a serious problem. This is mainly due to the type of ground in which it is built causing the whole bridge to settle gradually. As it will have to be replaced very soon, we would be obliged if you could advise us on the soil conditions so that a proper design can be made by our Bridge Office.

If you would let us know the estimated cost of an investigation, we will set up a work order to cover this cost.

This is a Statute Labour Board in which investigation by consultants would not be in our interests as far as costs go.



Enc.
R.E.D:T

R. E. Dawson,
District Municipal Engineer.

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

#17, Sudbury

To: Mr. K. Y. Lo,
Supervising Foundation Engr.

FROM: Mr. R. E. Dawson,
District Municipal Engineer.

DATE: May 31st, 1965.

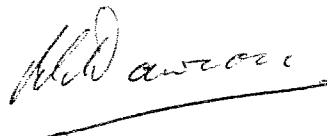
OUR FILE REF.

IN REPLY TO

SUBJECT:

Re: Campbell Township Statute Labour Board
Barr Creek Bridge No. 9

We are sending you to-day, under separate cover, plan and profile of the bridge as requested by your field staff.



RED:T

R. E. Dawson,
District Municipal Engineer.

MEMORANDUM

#17, Sudbury

To: Mr. K. Y. Lo,
Supervising Foundation Engr.

FROM: Mr. R. E. Dawson,
District Municipal Engineer.

821 675-8207

DATE: May 31st, 1965.

Our File Ref.

IN REPLY TO

SUBJECT:

Re: Campbell Township Statute Labour Board
Barr Creek Bridge No. 9

We are sending you to-day, under separate cover, plan and profile of the bridge as requested by your field staff.



RED:T

R. E. Dawson,
District Municipal Engineer.