

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Division.

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

Attention: Mr. S. McCombie

DATE: July 7, 1965

Our File Ref.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Proposed New Structure at Hwy. 69,
(Line P), Moon River Crossing,
District of Muskoka, Twp. of Madora,
District 11 (Huntsville)
W.J. 65-F-43 -- W.P. 173-63

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 design requirements. Should you require additional information, please feel free to contact our Office.

KYL/MdeF
Attach.

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
H. McArthur
E. H. Jones
T. J. Kovich
A. Watt

Foundations Office
Gen. Files

K. Y. Lo.
K. Y. Lo,
SUPERVISING FOUNDATION ENGINEER

FOUNDATION INVESTIGATION REPORT

For

Proposed New Structure at Hwy. 69,
(Line P), Moon River Crossing,
District of Muskoka, Twp. of Madora,
District 11 (Huntsville)
W.J. 65-F-43 -- W.P. 173-63

At the request of Mr. J. McAllister, Bridge Planning Section (memo dated March 4, 1965), a foundation investigation was carried out at Hwy. 69 and Moon River crossing in Bala.

It is proposed to replace the existing structure with a new, wider single-span bridge.

The site is located in the northernmost channel of the three channels that make up the "Bala Falls" in Bala.

Bedrock, identified as "Hornblende Gneiss" is mostly exposed all around. At the specified locations, boreholes were put down and the bedrock was proved by drilling and by extracting AXT core samples. The bedrock profile was established in this manner.

The rock core samples indicated that the bedrock above elevation \pm 733 ft. (elev. 728 ft. in B.H. 5), is generally fissured and fractured and the voids are filled with silty sand. Below this elevation, however, it is sound bedrock.

During the time of the field investigation, the water level in the Moon River was measured at elev. 738.5 ft.

cont'd. /2 ...

If the footings of the new structure are placed on sound bedrock, a safe bearing capacity of 10 t.s.f. can be used. If the footings are placed in the fissured and fractured zone of the bedrock, a safe bearing capacity of 3 t.s.f. is recommended.

The excavations for the foundations of the new structure will necessitate shoring and dewatering operations.

The field work was carried out during May 4 to May 11, 1965, under the supervision of Mr. V. Korlu, Project Foundation Engineer, who also wrote this report. The report was reviewed by Mr. M. Devata, Senior Foundation Engineer.

The field drilling equipment was provided by Dominion Soil Investigation Ltd. of Toronto.

July 1965

APPENDIX I.

FOUNDATION SECTION

CHECKED BY AK

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO		RECORD OF BOREHOLE NO. 2		FOUNDATION SECTION	
MATERIALS & TESTING DIVISION					
JOB <u>65-F-43</u>	LOCATION <u>Hwy 69 & Moon River Bala Sta. 417/01 20' Rt.</u>	ORIGINATED BY <u>V.K.</u>			
W.P. <u>173-63</u>	BORING DATE <u>May 5, 1965.</u>	COMPILED BY <u>V.K.</u>			
DATUM <u>Geodetic</u>	BOREHOLE TYPE <u>AXT Coredrill</u>	CHECKED BY <u>HR</u>			

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT _____	LIQUID LIMIT _____ WL			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F. _____	PLASTIC LIMIT _____ WP	WATER CONTENT _____ W	_____ WL		
738.5	Waterlevel											
0.0	Water											
1'-4"	Sand											
2'-4"	Bedrock											
733.2	(Fissured & Fractured)		1	AXT	90% recovery							
5'-4"	Bedrock											
	(Sound)		2	AXT	100% recovery	730						
726.2			3	AXT	100%							
12.4	End of borehole.				recovery							
						720						
						710						

FOUNDATION SECTION

CHECKED BY AK

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 65-F-43

LOCATION Hwy 69 & Moon River Bala, Sta. 417+16 20' Rt.

ORIGINATED BY V.K.

W. P. 173-63

BORING DATE May 6, 1965.

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE AXT Coredrill

CHECKED BY AK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w _L			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.				PLASTIC LIMIT ——— w _p	WATER CONTENT ——— w	WATER CONTENT %		
738.5	Waterlevel															
0.0	Sand															
2.0	Bedrock				85%											
733.0	(Fissured & Fractured)		1	AXT	recovery											
5.5	Bedrock (Sound)		2	AXT	100% recovery	730										
722.5			3	AXT	100% recovery											
16.0	End of borshole.					720										
						710										

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 5
FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 65-F-43

LOCATION Hwy 69 & Moon River Bala, Sta. 417+26 20' Lt.

ORIGINATED BY V.K.

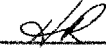
W.P. 173-63



BORING DATE May 6, 1965.

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE AXT Coredrill

CHECKED BY 

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.					<div> <div>WP</div> <div>W</div> <div>WL</div> </div> WATER CONTENT %				
738.5	Waterlevel					730										
0.0	Water															
2.5	Sand															
3.5	Bedrock (Fissured & Fractured)		1	AXT	80% recovery	720										
728.0			2	AXT	70% recovery											
10.5	Bedrock (Sound)		3	AXT	100% recovery											
723.5						710										
15.0	End of borehole.															

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

JOB 65-F-43

LOCATION Hwy 69 & Moon River Bala, Sta. 417+08 20' Lt.

ORIGINATED BY V.K.

W. P. 173-63

BORING DATE May 7, 1965.

COMPILED BY _____ V.K.

DATUM Geodetic

BOREHOLE TYPE AXT Coredrill

CHECKED BY AK

[illegible]

FOUNDATION SECTION

CHECKED BY JK

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 8

FOUNDATION SECTION

JOB 65-F-43

LOCATION Hwy 69 & Moon River Bala, Sta 417+40 30' Lt.

ORIGINATED BY V.K.

W. P. 173-63

BORING DATE May 10, 1965.

COMPILED BY _____ V.K.

DATUM Geodetic

BOREHOLE TYPE AXT Coredrill

CHECKED BY AK

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.	<div style="text-align: center;"> wp w WL </div>					
740.0	Groundlevel					740							
3.8	Boulder		1	AXT	recovery	100%							
4.6	Sand												
4.6	Bedrock (Fissured & Fractured)		2	AXT	95% recovery								
7.6	Bedrock (Sound)		3	AXT	100% recovery	730							
12.6	End of borehole.												
						720							
						710							

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

MEMORANDUM

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

FROM: Bridge Division,
Downsview, Ontario.

DATE: March 4, 1965

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P.173-63, Moon River Bridge
North End of Town of Bala
Hwy. #69, Dist. #11

The above culvert will require a foundation investigation. The attached prints of site plan E 4413-1 show the locations at which bedrock elevations are required. Bedrock is exposed at the downstream side of the existing bridge making spot elevations of the bedrock easy to obtain. Drilling will however be necessary on the upstream side to obtain the required bedrock profiles.

We propose to design a 16' C.R.F. open culvert approximately as shown on the plan.

J. C. McAllister

JCMCA/m
c.c. R. Fitzgibbon
N.D. Smith

J. C. McAllister,
for S. McCombie
Bridge Planning Engineer

65 - F - 43

W.P. 173-63 ; W.J. 65-F-43 Moon Shoar Crossing.

Q.: To prevent sliding a 2 ft key is contemplated. Can this be done in view of the fissured and fractured upper few feet of bedrock?

A.: Yes. Bedrock in the upper few feet is not as sound as the underlying but it is still very good.

Mr. Savata and Ben Glanville inspected the core and confirmed the above.

Message to Bill Hashizume August 16/65

Afternoon

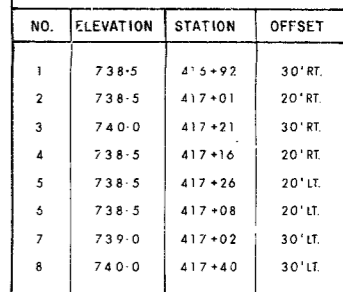
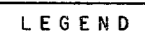
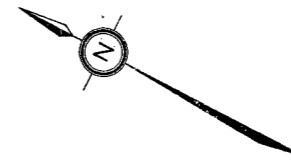
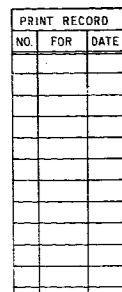
#65-F-43

W.P. #173-63

Hwy. #69

CROSSING

MOON RIVER

[illegible]

MOON RIVER

KING'S HIGHWAY NO. 69 LINE 'P' DIST. NO. 11
DIST. MUSKOKA TOWN OF BALA
TWP. MEDORA LOT _____ CON. _____

BORE HOLE LOCATIONS & SOIL STRATA

SUB'D V. K.	CHECKED	W.P. NO. 173-63	M. & T. DRAWING NO.
DRAWN S. O.	CHECKED <i>HP</i>	JOB NO. 65-F-43	65-F-43 A
DATE 2 JUNE 1965		SITE NO	BRIDGE DRAWING NO.
APPROVED S. O. PRINCE		CONT. NO	

REF. NO. E-4413-1