66-F-224C

H. Q. GOLDER & ASSOCIATES LTD.

CONSULTING CIVIL ENGINEERS

H. Q. GOLDER
V. MILLIGAN
L. G. SODEKMAN
J. L. SEYCHUK

2444 BLOOR STREET WEST
TORONTO 9, ONTARIO
763-4103
767-9201

W.P. 191-64

REPORT

TO

DEPARTMENT OF HIGHWAYS, ONTARIO

ON

SOIL CONDITIONS AND FOUNDATIONS

PROPOSED BUTTERMILK FALLS CROSSING

HIGHWAY NO. 35 - LINE G

HALLS LAKE ONTARIO

Distribution:

11 copies - Department of Highways, Ontario, Toronto, Ontario.

2 copies - H. Q. Golder & Associates Ltd., Toronto, Ontario.

June, 1966

66078

TABLE OF CONTENTS

ABSTRACT

The results of an investigation to determine the subsurface conditions at the site of a realigned crossing of Highway 35 over the stream at Buttermilk Falls, north of Carnarvon, Ontario are reported and recommendations are made for the foundation design of the proposed structure.

It was found that the site is underlain by granite gneiss bedrock which is generally in a fairly sound to sound condition, except for the upper 1 to 3 feet which is highly weathered. The bedrock is overlain by about 1 foot of sandy soil. The water level in the stream channel is controlled at elevation 1068 or some 6 to 10 feet below the top of the stream banks by the dam immediately south of the proposed crossing.

It is recommended that the bridge abutments be founded in the fairly sound bedrock, which occurs at a 2 to 4 foot depth. To ensure the stability of the near vertical rock face at the east abutment location, it is recommended that rock fill be dumped in the stream channel adjacent to the face and up to footing level for the length of the footing.

There should be no overall stability problem with the proposed approach embankments some 10 feet high.

INTRODUCTION

H. Q. Golder and Associates Ltd. have been retained by the Department of Highways, Ontario, to carry out a subsurface investigation at the site of a proposed bridge crossing at Buttermilk Falls over the stream leading from Halls Lake to Boshkung Lake, north of Carnarvon, Ontario. The purpose of this investigation was to determine the subsurface conditions at the abutment locations and to make recommendations for the foundation design of the proposed structure.

PROCEDURE

The field work for this investigation was carried out on May 30 and 31, 1966. Two borings were put down and the bedrock was cored in AXT size for some 15 to 20 feet depth, to an elevation equivalent to the existing stream bed. The borings were carried out using a machine drillrig supplied and operated by the F.E. Johnston Drilling Co. Ltd. Two test pits were also hand dug through the shallow overburden. The field work was supervised throughout by a member of our engineering staff.

The location of the borings put down during this investigation is shown on Figure 1. A detailed record of each borehole is presented on the Records of Boreholes following the text of this

report. A section along the centerline of the proposed alignment is given on Figure 1. The Record of Test Pits is given on Figure 2.

The soil and rock samples obtained during the investigation were shipped to our laboratory for detailed examination.

The elevations of the boreholes given in this report are referred to Geodetic datum. The Geodetic bench mark, No. 323S is located on the south face of the west abutment of the old bridge. The elevation of this bench mark is 1070.60.

SITE AND GEOLOGY

The proposed alignment of Highway 35 at the crossing location is about 100 feet north of the existing bridge. An "old bridge" which predates the existing bridge is located immediately north of the present bridge crossing. Immediately north of the old bridge is a small concrete dam, with a timber plank wier which controls the level of Halls Lake at about elevation 1068. The topography of the area is the typically undulating ground surface of the rock uplands of the Haliburton region.

From available geological information, it is known that the area is generally covered by a thin mantle of glacial drift

followed by metamorphic bedrock of Pre-Cambrian Age. The bedrock in this region is principally granite gneiss.

SUBSURFACE CONDITIONS

The detailed stratigraphy encountered in each boring is given on the Records of Boreholes. Following is a summarized account of the inferred subsurface conditions at the site.

The stream banks are covered by about one foot of sandy topsoil, followed by granite gneiss bedrock. The upper few feet of the bedrock is highly weathered and it was possible to drive the casing through this weathered zone. In general the bedrock becomes fairly sound to sound with depth.

Visual examination of the rock outcrops on the stream banks and examination of the rock core, indicate that the granite gneiss bedrock is thinly bedded (generally 3 to 6 inch bed thickness) and that these beds dip gently towards the south. The rock core is banded in colour consisting of light grey, quartz rich, and dark grey, hornblende rich, layers. The bedding planes above the water level in the stream show evidence of weathering. Between a 9 and 19 foot depth in borehole 2, the core recovered is mainly a dark grey, hornblende rich, gneiss. The core recovery was poor in this section and it is considered that much of the dark grey

rock was ground during drilling due to its softened condition possibly as a result of weathering.

The water level in the open holes coincided with that of the stream water level, that is, at about elevation 1067.

DISCUSSION

General

It is understood that a one span bridge some 85 feet in length is planned for the Buttermilk Falls crossing. The abutment locations will be on the stream banks at the locations shown on Figure 1.

Foundations

This investigation has disclosed that the proposed abutment locations are underlain by fairly sound granite gneiss bedrock at a shallow depth. At the west abutment location, borehole 1 encountered fairly sound bedrock at and below a 2 foot depth (elevation 1072). At the east abutment, the fairly sound bedrock is below elevation 1073 in test pit No. 2. For design of footings founded at or below the above elevations, an allowable bearing value of 10 tons/sq.ft. may be used. Under this allowable bearing pressure the resulting settlement should be negligible. For excavations carried

out above elevation 1068, which is the water level controlled by the dam, there would be no unwatering problem.

The west bank of the stream is at a slope of about 1½ horizontal to 1 vertical and as such is considered to be stable. The east bank is near vertical for a height in excess of 15 feet. There is some irregularity in the rock face crest which suggests that portions of this face have fallen away in the past. To provide stability it is recommended that rock fill, which will be available during road construction in this area, be dumped at the base of this rock face to form a stable slope up to at least the underside of the proposed footing level. The estimated stable angle for rock fill in the stream is about 1½ horizontal to 1 vertical. As the current through the channel area above the dam is minor, this rock fill slope should not form a serious constriction of the stream channel.

In the computation of sliding resistance between a rough concrete footing base and the granite gneiss bedrock, a coefficient of friction of 0.5 may be used in design.

It is recommended that free-draining and non-frost-susceptible granular backfill be provided behind the bridge abutments. This granular backfill should extend horizontally from the back face

of the abutment walls a minimum distance of 5 feet. Provision for drainage from this material should be made. With full effective drainage behind the walls it is recommended that a coefficient of earth pressure at rest, Ko = 0.4, and a total unit weight, γ, of 135 lb/cu.ft. be used for the compacted granular backfill in design of the walls. If some movement of the top of the abutment "retaining" walls can be accommodated an active earth pressure coefficient, Ka = 0.3, may be used.

Approach Embankments

The approach embankments as planned are less than 10 feet in height. After stripping of topsoil and any other organic material, the embankments can be constructed directly on inorganic subsoil or bedrock using 2 horizontal to 1 vertical side slopes, provided that suitable fill properly compacted in place is used in the embankment.

F. J. Heffernan, P.Eng.

REGISTERED PROFESSIONAL ENGINEER
F. J. HEFFERNAN
PROVINCE OF ONTARIO

J. L. Seychuk, P.Eng.

FJH:hdg
66078
June 14, 1966.

GOLDER & ASSOCIATES

LIST OF ABBREVIATIONS

The abbreviations commonly employed on each "Record of Borehole," on the figures and in the text of the report, are as follows:

I. SAMPLE TYPES

AS auger sample
CS chunk sample
DO drive open
DS Denison type sample
FS foil sample
RC rock core
ST slotted tube
TO thin-walled, open
TP thin-walled, piston
WS wash sample

II. PENETRATION RESISTANCES

Dynamic Penetration Resistance: The number of blows by a 140-pound hammer dropped 30 inches required to drive a 2-inch diameter, 60 degree cone one foot, where the cone is attached to 'A' size drill rods and casing is not used.

Standard Penetration Resistance, *N*: The number of blows by a 140-pound hammer dropped 30 inches required to drive a 2-inch drive open sampler one foot.

WH sampler advanced by static weight—weight, hammer

PH sampler advanced by pressure—pressure, hydraulic

PM sampler advanced by pressure—pressure, manual

III. SOIL DESCRIPTION

(a) *Cohesionless Soils*

Relative Density	*N, blows/ft.*
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) *Cohesive Soils*

Consistency	c_u, *lb./sq. ft.*
Very soft	Less than 250
Soft	250 to 500
Firm	500 to 1,000
Stiff	1,000 to 2,000
Very stiff	2,000 to 4,000
Hard	over 4,000

IV. SOIL TESTS

C consolidation test
H hydrometer analysis
M sieve analysis
MH combined analysis, sieve and hydrometer[1]
Q undrained triaxial[2]
R consolidated undrained triaxial[2]
S drained triaxial
U unconfined compression
V field vane test

NOTES:

[1]Combined analyses when 5 to 95 per cent of the material passes the No. 200 sieve.

[2]Undrained triaxial tests in which pore pressures are measured are shown as $\bar{Q}$ or $\bar{R}$.

LIST OF SYMBOLS

I. GENERAL

$\pi = 3.1416$

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

II. STRESS AND STRAIN

u	pore pressure
σ	normal stress
σ'	normal effective stress ($\bar{\sigma}$ is also used)
τ	shear stress
ϵ	linear strain
ϵ_{xy}	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

III. SOIL PROPERTIES

(a) *Unit weight*

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_s	specific gravity of solid particles $G_s = \gamma_s/\gamma_w$
e	void ratio
n	porosity
w	water content
S_r	degree of saturation

(b) *Consistency*

w_L	liquid limit
w_P	plastic limit
I_P	plasticity index
w_S	shrinkage limit
I_L	liquidity index $= (w - w_P)/I_P$
I_C	consistency index $= (w_L - w)/I_P$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
D_r	relative density $= (e_{max} - e)/(e_{max} - e_{min})$

(c) *Permeability*

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

(d) *Consolidation (one-dimensional)*

m_v	coefficient of volume change $= -\Delta e/(1+e)\Delta\sigma'$
C_c	compression index $= -\Delta e/\Delta \log_{10} \sigma'$
c_v	coefficient of consolidation
T_v	time factor $= c_v t/d^2$ (d, drainage path)
U	degree of consolidation

(e) *Shear strength*

τ_f	shear strength	
c'	effective cohesion intercept	in terms of effective stress $\tau_f = c' + \sigma' \tan \phi'$
ϕ'	effective angle of shearing resistance, or friction	
c_u	apparent cohesion*	in terms of total stress $\tau_f = c_u + \sigma \tan \phi_u$
ϕ_u	apparent angle of shearing resistance, or friction	
μ	coefficient of friction	
S_t	sensitivity	

*For the case of a saturated cohesive soil, $\phi_u = 0$ and the undrained shear strength $\tau_f = c_u$ is taken as half the undrained compressive strength.

PROJECT No. 66078

RECORD OF BOREHOLE 1

LOCATION See Figure 1 BORING DATE MAY 30, 1966 DATUM GEODETIC

BOREHOLE TYPE WASH BORING BOREHOLE DIAMETER BX, AX CASING

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES PEN. TEST HAMMER WEIGHT — LB. DROP INCHES

ELEVN. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/FT.	ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FT. / SHEAR STRENGTH C_u, LB./SQ.FT.	COEFFICIENT OF PERMEABILITY k, CM./SEC. / WATER CONTENT, PERCENT W_P W W_L	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
1073.8 / 0.0	GROUND LEVEL.					1075				
0.0 / 1.1	LOOSE DARK GREY TOPSOIL.		1	2" D.O.	14					
1.1 / 2.1	HIGHLY WEATHERED DARK GREY BEDROCK.		2	4" D.O. / AX SA	100/0"					
2.1	FAIRLY SOUND LIGHT AND DARK GREY BANDED GRANITE GNEISS BEDROCK.		3	AX RC	1	1070	PERCENT CORE RECOVERY: 100			W.L. IN OPEN HOLE AT ELEV. 1067.6 MAY 31, 1966.
1066.3 / 7.5			4	AX RC	1	1065	95			
	SOUND LIGHT AND DARK GREY BANDED GRANITE GNEISS BEDROCK, BEDDING PLANES AT 1" TO 6" SPACING DIPPING AT 10° TO 15°.		5	—	1	1060	100			
			6	—	1		100			
1056.1 / 17.7	END OF HOLE.					1055				

15-5 / 10 Percent axial strain at failure

VERTICAL SCALE
1 INCH TO 5'-0"

GOLDER & ASSOCIATES

DRAWN M.W.
CHECKED J.J.N.

PROJECT No. 66078

RECORD OF BOREHOLE 2

LOCATION See Figure 1 BORING DATE MAY 31, 1966 DATUM GEODETIC

BOREHOLE TYPE WASH BORING BOREHOLE DIAMETER BX, AX CASING

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

ELEVN. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	TYPE	BLOWS/FT.	ELEVATION SCALE
1077.8 / 0.0	GROUND LEVEL. LOOSE BROWN SANDY TOPSOIL.		1	8" D.O.	15	1080
1.0	HIGHLY WEATHERED DARK GREY BEDROCK.		2	"	100/0	
1074.0 / 3.8	FAIRLY SOUND PINK AND DARK GREY BANDED GRANITE GNEISS BEDROCK.		3	AXT RC	-	1075
1068.3 / 9.5	WEATHERED DARK GREY GRANITE GNEISS BEDROCK.		4	"	-	1070
			5	"	-	1065
1058.8 / 19.0	SOUND DARK GREY AND PINK BANDED GRANITE GNEISS BEDROCK.		6	"	-	1060
1053.7 / 24.1	END OF HOLE					1055
						1050

DYNAMIC PENETRATION RESISTANCE BLOWS/FT. ----------

SHEAR STRENGTH C_u, LB./SQ.FT.

PERCENT CORE RECOVERY: 70, 87, 84, 95

COEFFICIENT OF PERMEABILITY k, CM./SEC.

WATER CONTENT, PERCENT W_P W W_L

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

W.L. IN OPEN HOLE AT ELEV. 1067.9 2 HRS. AFTER DRILLING

ε_{15} = 5 / 10 Percent axial strain at failure

VERTICAL SCALE 1 INCH TO 5'-0"

GOLDER & ASSOCIATES

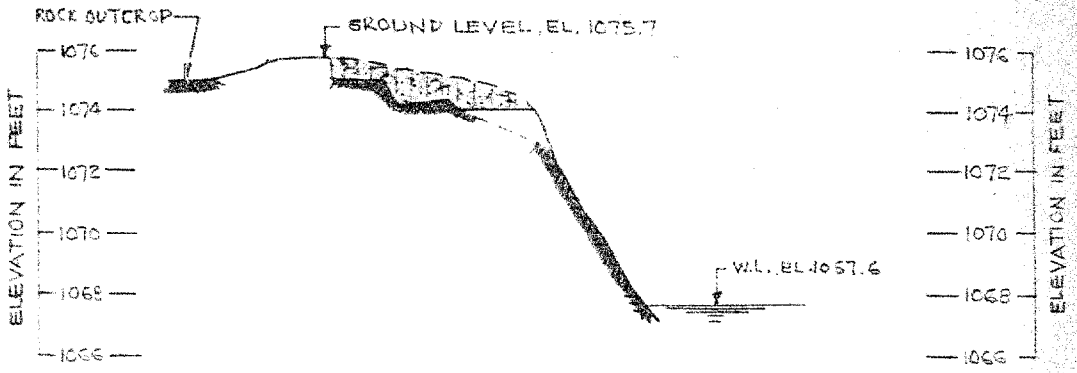
DRAWN ... CHECKED ...

PROJECT No. 66078

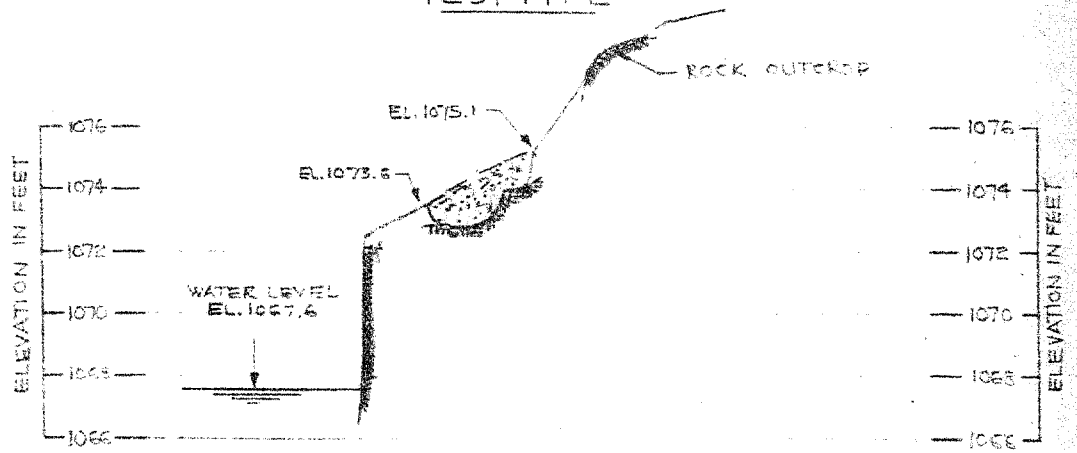
RECORD OF TEST PITS

FIGURE 2

TEST PIT 1



TEST PIT 2



STRATIGRAPHY

LOOSE DARK BROWN SANDY **TOPSOIL**

HIGHLY WEATHERED DARK GREY GRANITE GNEISS **BEDROCK**

SOUND DARK GREY GRANITE GNEISS **BEDROCK**.

SCALE 1" TO 5'

GOLDER & ASSOCIATES

Made
Chkd.
Appd.

Hwy. 401 & Keele St.,
Downsview, Ontario.

May 30, 1966

Materials and Testing Division

S. B. Gelber and Associates Ltd.,
24th Floor Bloor Street West,
Toronto, Ontario.

Attention: Mr. J. L. Seychuk

Re: Foundation Investigations - Letter of Authority -

(1) W.P. 191-64 - The Buttermilk Falls Bridge,
Hwy. No. 35, Proposed Revision, Line 'C', Dist. #11.

(2) W.P. 178-64 - The Beech River Bridge,
Hwy. No. 35, Dist. #11.

(3) W.P. 66-66 - Site #11-3,
Papineau Creek, Hwy. No. 127, Dist. #10.

Dear Sir:

This is to authorize you to carry out the foundation investigations at the above mentioned sites. The plans and all the necessary information pertaining to the jobs were given to your Mr. J. L. Seychuk on May 27, 1966. The names and telephone numbers of personnel to be contacted in connection with survey information and/or assistance, were also given to Mr. Seychuk.

The urgency of these investigations was discussed, and it was arranged that two of the investigations will be started on Monday, May 30, 1966, and the third one, immediately upon completion of the investigation pleasant to it.

You are requested to contact our office as soon as enough information becomes available and a meeting can be held with the designer. The final reports (10 copies of each project) will follow at a later stage; however, every effort should be made to have them delivered to our office as soon as possible.

cont'd. /2 .....

Since the drawings accompanying the foundation reports, showing the location of borings, the inferred subsoil conditions, etc., are to become contract drawings, you are requested to prepare them in accordance with the D.H.O. standards. To enable you to do this, we are supplying you with a sample drawing with all the necessary explanations, together with linen sheets for your drawings. You are also requested to provide us with Dronaflex copies of the drawings.

Charges for the work performed will be in accordance with your Schedule of Rates, dated October 1, 1965, and invoices to be addressed to the attention of the undersigned.

We are attaching the following Purchase Orders:

J 34610 - W.P. 191-64 (Butterhill Falls Bridge),

J 34611 - W.P. 178-64 (Beech River Bridge),

J 34612 - W.P. 66-64 (Papineau Creek Site #11-5),

covering the purchase of any new material required for this work, in order that you may use these as a basis for exemption from the Federal Tax for such purchases. The Exemption Certificate is printed thereon.

Yours very truly,

A. Hatka,
MATERIALS & TESTING ENGINEER

ASH/mfm
Attach.
cc: Messrs. A. McCombie
H. deArthur
E. S. Piller
D. C. Jones
J. K. Gallaghan
T. J. Kerton
J. L. Grosplier
Mrs. I. Steinberg
K. Konings
A. Crowley
S. Szymanski (2)
Foundations Office
Gen. Files (2)

cc: Mr. A. G. Stermac

Golder/66

ONTARIO

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MINISTER: HONOURABLE CHARLES MacNAUGHTON

DEPUTY MINISTER: A. T. C. McNAB

Hwy. 401 & Keele Street,
Downsview 464, Ontario.

Aug. 6, 1971

H. Q. Golder and Associates Ltd.,
Consulting Engineers,
3151 Wharton Way,
Cooksville, Ontario.

Attention: Mr. J. L. Seychuk

Re: Buttermilk Falls Bridge -- Highway #35
District No. 10 (Bancroft) -- W.P. 191-64
Contract 70-229

Dear Sirs:

This will confirm the arrangements made recently for your company to investigate and report on the problems connected with the rock elevations and rock excavations at this site.

Your invoices for this service should be in triplicate and in accordance with your Schedule of Charges dated June, 1969.

Yours very truly,

A. Rutka

A. Rutka
MATERIALS & TESTING ENGINEER

AGS/MdeF

cc: Messrs. D. A. O. White
W. W. Fry
A. G. Stermac

cc: Foundations Office (Rm. 110)

a

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

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

March 17, 1967

Kennisis River Bridge
At Buttermilk Falls,
W.P. 191-64 - Site 40-7,
Hwy. #35, District #11 (Huntsville).

We have reviewed Preliminary Plan D-6014-P1 for the above mentioned proposed structure.

The designer appears to have complied with the recommendations contained in the Foundation Report by H. G. Golder and Associates Ltd., and the memo from Mr. A. G. Stermac, to McCormick and Rankin Ltd., dated March 6, 1967.

KGS/AdeP

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

cc: Messrs. S. McCombie
J. B. Curtis

Foundations Files
Gen. Files

Department of Highways Ontario

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

Mr. J.D. Curtis,
Regional Bridge Location Engineer,
North Bay Regional Office

Bridge Division,
Downsview, Ontario

March 10, 1967

Kennisis River Bridge
at Buttermilk Falls
W.P. 191-64, Site 40-7
Highway 35, District 11

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-6014-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is $55,000. This cost includes tender, materials, engineering and sundry construction.

Any comments or revisions you may have should be submitted within three weeks.

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

c.c. S. McCombie
A. Stermac
R. Forrest
E. Cross

cc: Foundations Office (Rm. 110)

Hwy. 401 & Keele St.,
Downsview, Ontario.

Tel. 248-3282
(Area Code 416)

Materials and Testing Division

March 6, 1967

McCormick & Rankin Limited,
Consulting Engineers,
3 Stavebank Road,
Port Credit, Ontario.

Attn: Mr. R. D. Nairn, P. Eng.

Re: KENNISIS RIVER BRIDGE --
Highway 35 at Buttermilk Falls
W.P. 191-64 - District 11 (Huntsville)
Your W.O. 339-67

Dear Sir:

With reference to your letter of March 2, 1967, regarding the above structure, we wish to make the following comments:

Your proposal to place the east abutment footing a minimum of 5 ft. back from the rock face as an alternative to placing rock fill in front of the rock face, seems reasonable and we would agree with it. However, we would strongly recommend that a thorough and careful inspection of the rock face and the rock, in general, be undertaken once the excavation for the abutment is completed and before the superstructure is built. Should any faults or other signs of rock instability be found, remedial measures such as prestressed rock anchors, should be resorted to. We believe that such measures will not be necessary, but we would like to make sure that this belief is verified during construction, and that all is done to make sure that the foundation is safe.

Yours very truly,

A. G. Sternac
Principal Foundation Engineer

AGS/ndeP

cc: Messrs. W. A. McFarlane
J. B. Curtis

Foundations Files
Gen. Files

McCORMICK & RANKIN
LIMITED
CONSULTING ENGINEERS
PORT CREDIT OTTAWA

E. D. McCORMICK, P. ENG.
G. A. RANKIN, P. ENG.
ASSOCIATES
R. C. McCORMICK, P. ENG.
R. D. NAIRN, P. ENG.
J. F. BEATSON

8 STAVEBANK ROAD
PORT CREDIT, ONTARIO
TELEPHONE 274-3477

March 2nd, 1967

Mr. A. G. Stermac, P. Eng.,
Principal Foundation Engineer,
Materials & Testing Division,
DEPARTMENT OF HIGHWAYS,
Room 17, Lab Building,
DOWNSVIEW, Ontario.

RE: KENNISIS RIVER BRIDGE
Highway 35 at Buttermilk Falls
W. P. 191-64 - District 11-Huntsville
Our W. O. 339-67

Dear Sir:

We have been retained by the Department of Highways to design and prepare contract drawings for the above-noted project.

The foundation investigation report for this structure, prepared by H. Q. Golder & Associates Ltd., recommends placing rock fill at the base of the east bank to form a stable slope to the underside of the footing level.

Because of the proximity of the Department of Transport's downstream dam to the proposed structure; the substantial constriction on the waterway by any fill placed against the east bank; and the particularly aesthetic appearance of the existing rock face; we would suggest that the east abutment be located at a minimum offset of 5 feet from the rock face as an alternate to placing the rock fill against the east bank. This bank could be observed as time goes on and if it showed signs of further deterioration, measures could be taken to ensure its stability at that time.

We would appreciate receiving your comments with regard to this alternate proposal.

Mr. A. G. Stermac, P. Eng.

A copy of the preliminary bridge plan is enclosed for your information. This plan shows the limits of the rock fill if it were placed against the east bank.

Yours very truly,
McCORMICK & RANKIN LIMITED

R. D. Nairn

R. D. Nairn, P. Eng.

RDN/MA
Encl.

c. c. Mr. W. M. McFarlane, P. Eng.,
Mr. J. B. Curtis, P. Eng.

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

Attention: Mr. J. McComble

Foundation Section,
Materials & Testing Div.,
Room 197, Lab. Bldg.

June 17, 1966

JUN 20 1966

FOUNDATION INVESTIGATION REPORT BY:
E. G. Golder and Associates Limited -
Proposed Buttermilk Falls Crossing,
Highway No. 35 - Line 'C', Halls Lake, Ont.
District No. 11 (Huntsville) - W.P. 191-64

Attached, please find the above mentioned report prepared and submitted by the consultant, E. G. Golder and Associates Ltd.

We have reviewed the report and found that it contains all the information thought to be necessary for your future design work.

However, should you wish to discuss any parts of the report, or any other questions regarding the foundation of this structure, please feel free to contact this Office.

AGS/Mdef
Attach.

A. G. Sterne,
PRINCIPAL FOUNDATION ENGINEER

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

Foundations Office
Gen. Files

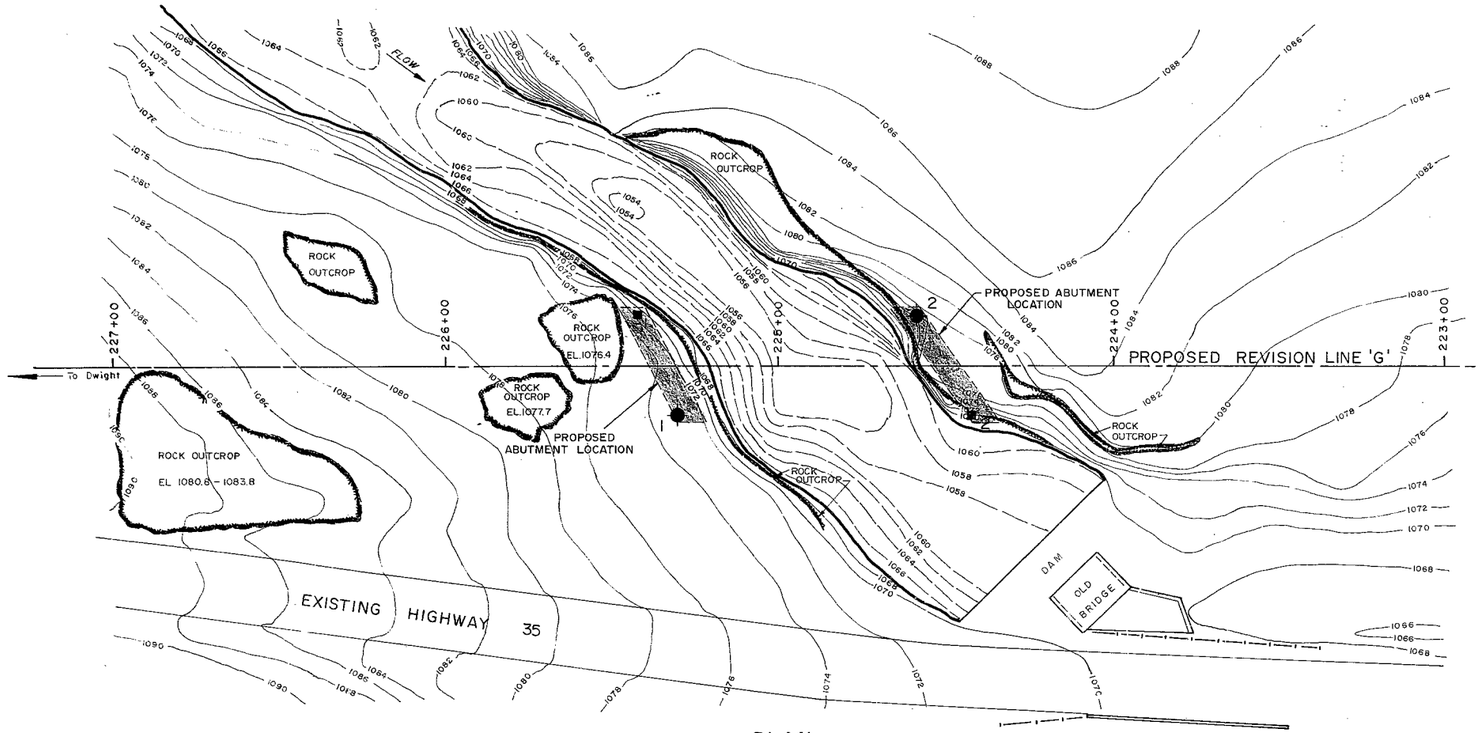
#66-F-224-C

W.P.# 191-64

HWY. # 35 &

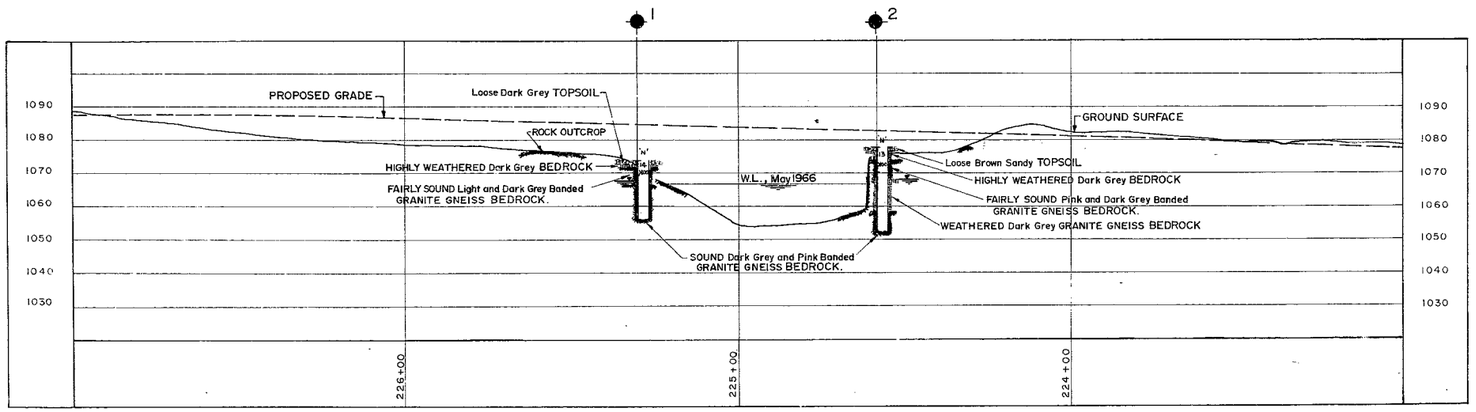
BUTTERMILK

FALLS CROSSING



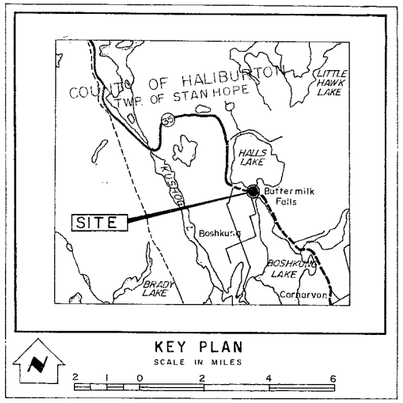
PLAN

SCALE 10 0 10 20 30 40 50 FT.



SECTION

SCALE 10 0 10 20 30 40 50 FT.



KEY PLAN

SCALE IN MILES

2 1 0 2 4 6

LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation.
- Test Pit

NO.	ELEVATION	STATION	OFFSET
BH.1	1073.8	225+30	15' LEFT
BH.2	1077.8	224+59	15' RIGHT
T.P.1	1075.7	225+42	15' RIGHT
T.P.2	1075.1 – 1073.6	224+43	15' LEFT

– 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.

PRINT RECORD		
NO.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

H.Q. GOLDER & ASSOCIATES LTD.

DEPARTMENT OF HIGHWAYS – ONTARIO

MATERIALS & TESTING DIVISION – FOUNDATION SECTION

BUTTERMILK FALLS

KING'S HIGHWAY NO. 35, REVISION LINE 'G' DIST. NO. 11

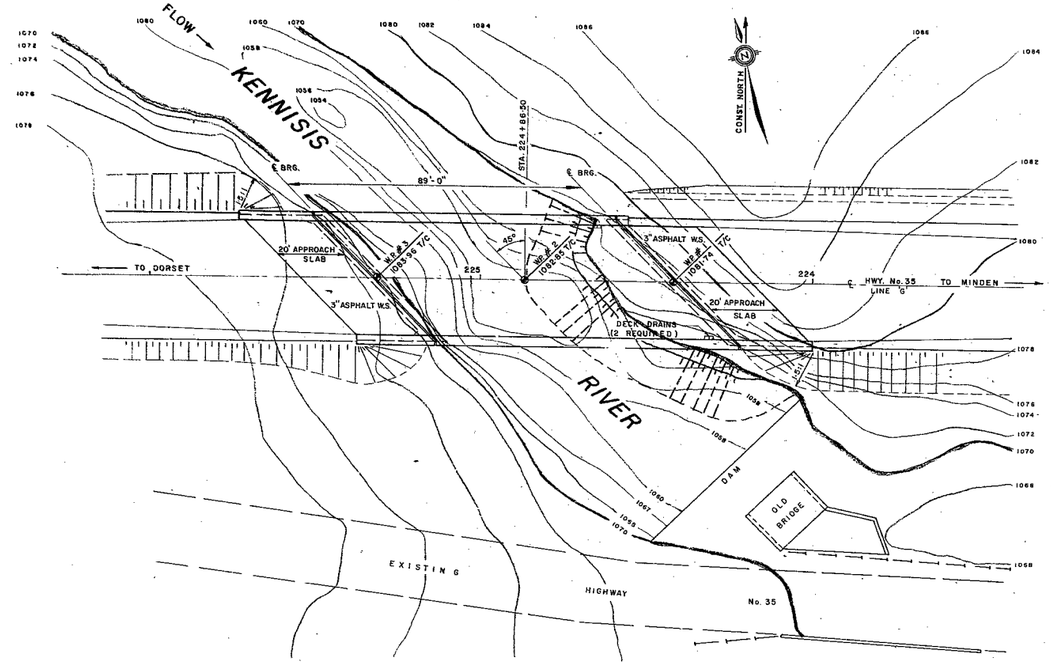
CO. OF HALIBURTON

TWP. OF STANHOPE LOT 11 CON. 6

BORING PLAN AND SOIL STRATIGRAPHY SECTION

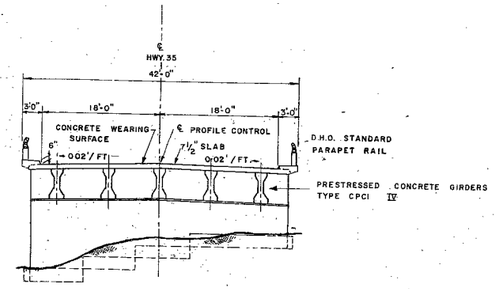
SUBM'D A.H.T.	CHECKED F.J.H.	W.P. NO. 191-64	DRAWING NO. 1
DRAWN M.W.	CHECKED F.J.H.	JOB NO. 66078	
DATE JUNE 5, 1966		SITE NO	BRIDGE DRAWING NO.
APPROVED PRINCIPAL FOUNDATION ENGINEER		CONT. NO.	

REF. No. B-578-5

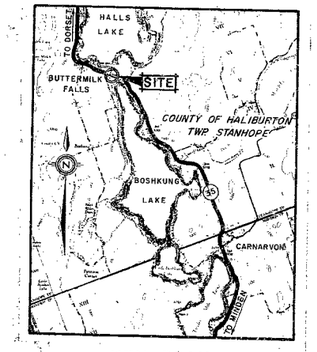


T/C DENOTES TOP OF CONCRETE
W.S. DENOTES WEARING SURFACE
W.P. DENOTES WORKING POINT

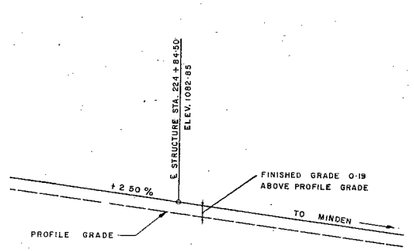
PLAN
SCALE 1" = 20'



SECTION
SCALE 1" = 10'

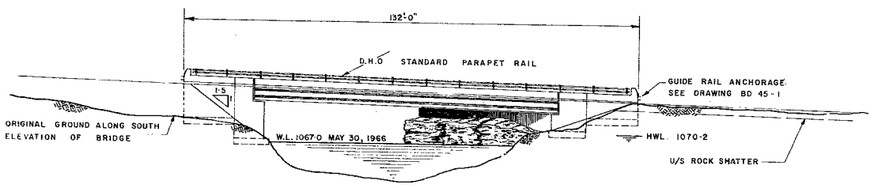


KEY PLAN
SCALE 1" = 1·4 Mi.



PROFILE OF HWY. 35
N. T. S.

FUNCTIONS OF SKEW ANGLE 45°
SIN. - 0·70710678
COS. - 0·70710678
TAN. - 1·00000000



ELEVATION
SCALE 1" = 20'

G.B.M. No. 323-S ELEVATION 1070·60
CONCRETE DAM AND SPILLWAY AT OUTLET OF KUSHOG LAKE, 5 MILES NORTHWEST OF POST OFFICE AND IMMEDIATELY NORTH OF BRIDGE CARRYING HWY. No. 35. TABLET IN SOUTH FACE OF WEST ABUTMENT WALL, 1·0 FROM WEST FACE OF WALL AND 6" ABOVE LEDGE AT ROAD LEVEL.

B.M. ELEVATION 1080·89
NAIL & WASHER IN EAST ROOT OF 1·5' BIRCH 100·0' LT. OF STA. 232 + 05.

PRINT RECORD

No.	FOR	DATE

REVISIONS

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION
McCORMICK & RANKIN LIMITED
Port Credit CONSULTING ENGINEERS Ottawa

KENNISIS RIVER BRIDGE
AT BUTTERMILK FALLS

KING'S HIGHWAY No. 35 DIST. No. 11
CO. OF HALIBURTON
TWP. OF STANHOPE LOT 11 CON. VI

PRELIMINARY PLAN

	BRIDGE ENGINEER			SITE No. 40-7	W.P. No. 191-64
DESIGN	H.	CHECK	R. D. N.	CONTRACT Nos.	
DRAWN	L.	CHECK	L. C. H.		
DATE	MARCH'67	LOADING	H.S.20-44	DRAWING No.	D - 6014 - PI