

G.I-30 SEPT 1976

GEOCRES No. 31E-11DIST. 11 REGION NorthernW.P. No. 197-65-00CONT. No. 73-80

W. O. No. _____

STR. SITE No. _____

HWY. No. _____

LOCATION Bracebridge By-passOVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. —REMARKS: documents to be unfolded
before microfilming

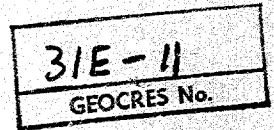
FOUNDATION INVESTIGATION REPORT

For

The Proposed Bracebridge By-Pass

District No. 11 (Huntsville)

W.O. 71-11016 -- W.P. 197-65



1. INTRODUCTION:

In a memo dated March 5, 1971, Mr. E. R. Saint, Regional Materials Engineer, Northern Region, requested a foundation investigation in the area where the proposed Bracebridge By-pass crosses the valley of Sharpe's Creek. Two lines, designated 'A' and 'G' are being considered at the present time. Scheme 'A' is a shorter route, but it involves up to 45 ft. of fill. Scheme 'G' requires lesser fill heights, but necessitates a stream diversion and back-filling the old stream bed.

The purpose of the investigation has been to evaluate foundation conditions for culverts, fill and cut stability, and possible erosion problems of the creek diversion.

Presented in this report are the results of the investigations, as well as recommendations concerning above requirements.

2. DESCRIPTION OF THE SITE, FIELD AND LABORATORY INVESTIGATIONS:

2.1) The valley within the investigated area is fairly deep, the difference in elevation between the high ground and the creek being 50 - 70 ft. The valley floor is about 100 - 150 ft. wide and the creek follows a meandering course. Due to the deep snow cover, surface observations for signs of instability, or earlier failures along the slopes, were not possible. The vicinity of the valley consists of farmland, sand and gravel pits

2. DESCRIPTION OF THE SITE, FIELD AND LABORATORY INVESTIGATIONS:

(cont'd.) ...

2.1) (cont'd.) ...

and farther on, some small industrial developments.

Geologically, the area belongs to the Canadian Shield physiographic region.

2.2) Two boreholes, numbered 1 and 2 were placed along Scheme 'A' and three holes, numbered 3, 4 and 5, along Scheme 'G'. Borehole #5 was located on the high ground, where the road is proposed to run in a cut. The locations and elevations of the boreholes, together with the estimated stratigraphical profiles along the lines, are presented on Drawing #71-11016A, in the Appendix.

2.3) Upon arrival in the laboratory, soil samples were visually examined and identified by means of some simple tests. Closer classification of some representative samples were carried out by performing Atterberg limits, grain-size analyses, and a few undrained shear strength tests. Field and laboratory test results are plotted on the accompanying borelogs.

3. SOIL CONDITIONS:

Boreholes located in the valley revealed that the overburden consists of deep deposits of silts and fine sandy silts, becoming fine, uniform sands with depth. No bedrock was reached in these boreholes down to el. 690 ft., some 91 ft. below ground level. The relative density of the strata was found to vary between very loose and very dense, corresponding to penetration 'N' values of 1 blow per ft. and over 100 blows per ft. Along Scheme 'A' the upper, approx. 10-ft. layer was slightly contaminated by organic substances, but essentially this portion is fine sand and, as such, it is not considered to be troublesome. Along Scheme 'G', in borehole #4, some 10 - 11 ft. thick surficial layer was, however, found to consist

3. SOIL CONDITIONS: (cont'd.) ...

of an appreciable amount of organic contamination. This layer is predominantly silt, with very high natural moisture contents and dark, organic colour. It is therefore believed to be an unacceptable engineering material.

Along Line 'A' south of the creek, at the steep natural slope, probable bedrock was reached at el. 779.9 ft. No bedrock drilling was undertaken at this early stage of planning.

Borehole #5 was placed along Line 'G' at Station 120+00. Stratified silty clays were noted to form the hill at this location, having firm to stiff consistency. Field and laboratory undrained shear strengths range from 550 PSF to 1,550 PSF. Very high natural moisture contents were recorded within the investigated 38-ft. depth, liquidity indices being well over 1.0.

Groundwater levels in the valley were found to lie near ground elevations, and due to the uniform grain distribution of the silts and fine sands, strong quick conditions developed in the casings at lower depths, during drilling operations.

4. DISCUSSION AND RECOMMENDATIONS:

Two alternative crossings are contemplated at the location of Sharpe's Creek for the proposed Bracebridge By-pass. Both lines would utilize culverts for the actual crossings.

Scheme 'A' involves up to 45 ft. high approach fills, while Scheme 'G' requires lower embankments, but necessitates a stream diversion and the backfilling of the existing meandering creek bed.

SCHEME 'A' -

Loose to very dense, fine sandy silts and sands form the overburden at this crossing to a considerable depth. The

4. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

SCHEME 'A' - (cont'd.) ...

upper portion was found to be only slightly organic, thus excavation of this material under the fills does not appear to be warranted. It is believed that the sands and silts will settle under the superimposed high embankment, the magnitude of which might be quite substantial. Due to the permeable nature of the deposit, however, the majority of the settlements will be completed during construction.

No further stability problems are foreseen for the fill, but it is suggested that above 30-ft. height, non-cohesive material be used for the fill construction.

SCHEME 'G' -

The borehole located at Station 110+00 indicated that the valley at this crossing is covered by an approx. 10 - 11 ft. layer of organic silt of very loose relative density. The organic material is underlain by a deep deposit of silts and fine sands.

The organic layers should be replaced by acceptable non-cohesive materials under the proposed culvert and approach fill. No stability problem is anticipated for the fills, built on such suitable soils, provided they are constructed with 2 horizontal to 1 vertical slopes.

As was mentioned earlier, stratified silty clays of firm to stiff consistency form the subsoil at the high ground - (station 120+00). Since a cut is proposed to be at this location, it is felt that the long-term stability of the cut slopes will need to be checked, if this scheme is adopted. For a preliminary estimate, a 3 horizontal to 1 vertical slope should be used for the cut section.

Since the silts and sands entirely lack cohesive strength, erosion control along the diverted stream will be essential.

5. MISCELLANEOUS:

The field work carried out during March 23 - 31, 1971, was supervised by Mr. H. Stankaitis, Engineering Technician.

Equipment used was owned and operated by P. E. Johnston Drilling Company, Toronto.

This report was written by Mr. A. K. Barsvary, Senior Foundation Engineer, and reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

April, 1971.

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No.1

FOUNDATION SECTION

JOB 71-11016 LOCATION Line A Sta. 99 + 15 E ORIGINATED BY HS
 W.P. 197-65 BORING DATE March 30, 1971 COMPILED BY AKB
 DATUM Geodetic BOREHOLE TYPE Washboring NX Casing CHECKED BY _____

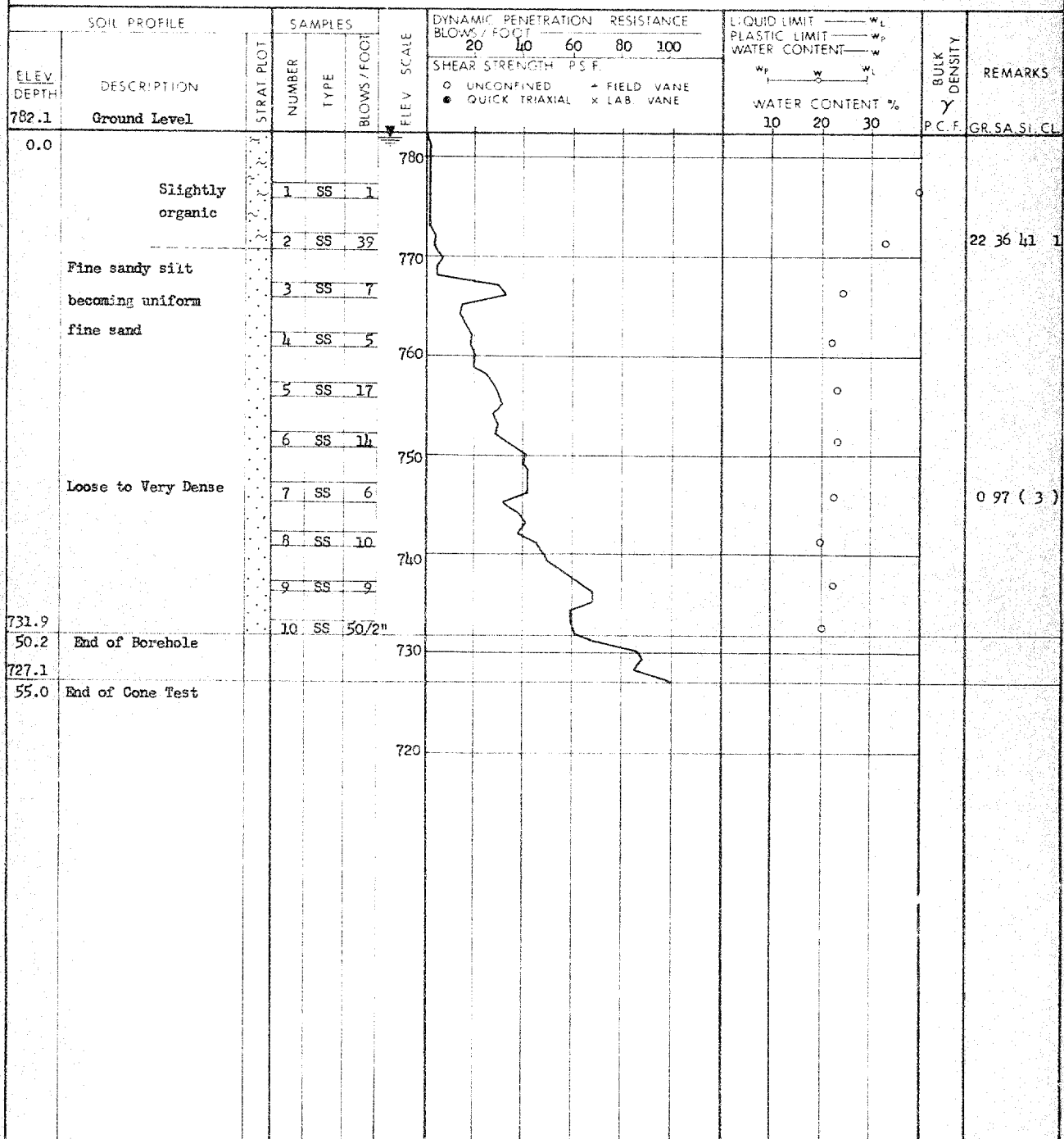
SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE				
785.9	Ground Level															
0.0	Fine sand, some silt		1	SS	1											
			2	SS	11											
779.9			3	SS	27											0.85 (15)
6.0	End of Borehole Bedrock															

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 71-11016 LOCATION Line A Sta. 102 + 00 \varnothing ORIGINATED BY HS
 W.P. 197-65 BORING DATE March 31, 1971 COMPILED BY AKB
 DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY



DEPARTMENT OF HIGHWAYS- ONTARIO MATERIALS & TESTING OFFICE			RECORD OF BOREHOLE No. 3				FOUNDATION SECTION		
JOB 71-11016		LOCATION Line G Sta. 103 + 55		ORIGINATED BY HS					
W.P. 197-65		BORING DATE March 29, 1971		COMPILED BY AKB					
DATUM Geodetic		BOREHOLE TYPE Washboring, NX Casing		CHECKED BY					
SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE	BLOWS/FOOT	ELEV. SCALE	SHEAR STRENGTH — P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE			
784.2	Ground Level								
0.0									
	Slightly organic		1 SS 2		780				
			2 SS 4						
			3 SS 11		770				
	Silt, sandy silt		4 TW PM						124
	and silty fine		5 TW PM		760				129
	uniform sand		6 SS 18						
			7 SS 33		750				
			8 SS 26						
	Very Loose to Dense		9 SS 20		740				
			10 SS 22						
			11 SS 37		730				0 8 91 1
			12 SS 31						0 25 61 14
			13 SS 28		720				
712.7			14 SS 37						0 48 37 15
71.5	End of Borehole				710				

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 71-11016 LOCATION Line G Sta. 110 + 00 G ORIGINATED BY HS
W.P. 197-65 BORING DATE March 23-25, 1971 COMPILED BY ALB
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY ALB

SOIL PROFILE		STRAT. PLOT	SAMPLES		BLOWS / FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE			SHEAR STRENGTH P.S.F.		WATER CONTENT %				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE		w_p — w — w_L	WATER CONTENT % 10 20 30		P.C.F.	GR. SA. SI. CL.
782.2	Ground Level												
0.0	Organic silt & fine sand.		1	SS	1	780						0.62	
771.2	Very Loose		2	SS	1	770							
11.0			3	SS	11	760							0.26 (74)
	Fine sandy silt to silty fine sand becoming uniform fine sand		4	SS	6	750							0.83 (17)
			5	SS	5	740							
			6	SS	17	730							0.98 (2)
	Very Loose to Dense		7	SS	8	720							
			8	SS	9	710							0.96 (4)
			9	SS	2	700							
			10	SS	9								
			11	SS	8								
	Brown		12	SS	150								
			13	SS	25								
			14	SS	5								
			15	SS	11								
			16	SS	17								
			17	SS	19								
690.7			18	SS	40								
91.5	End of Borehole												

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

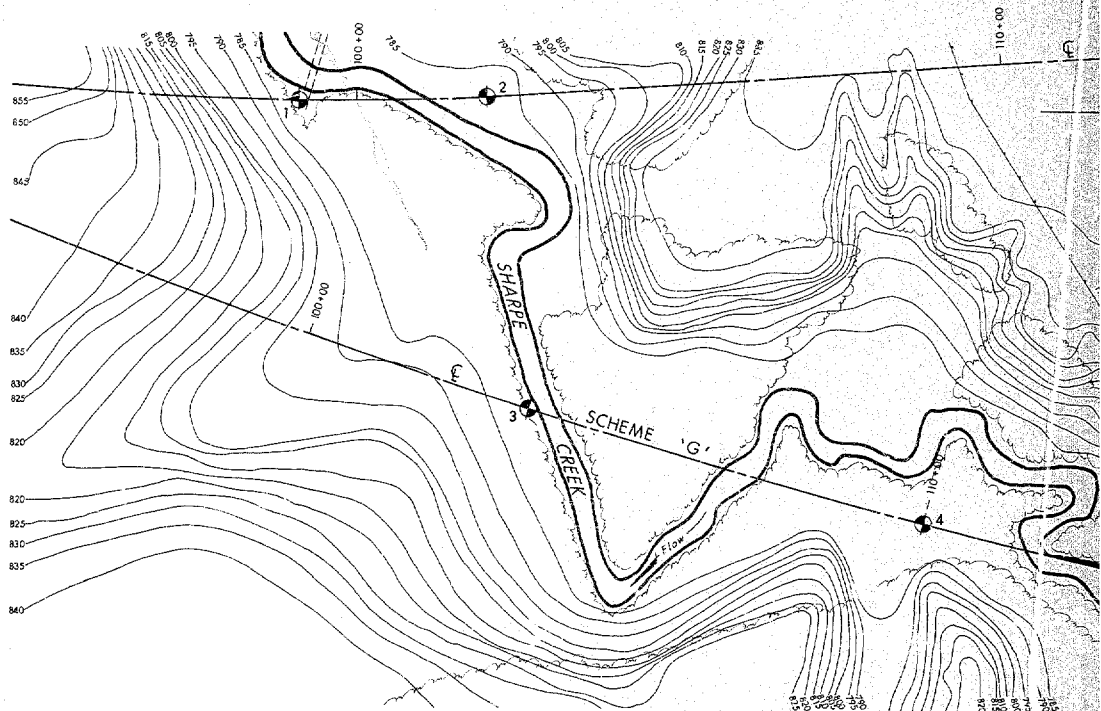
RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

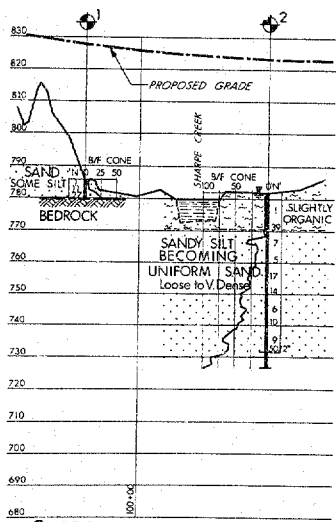
 JOB 71-11016 LOCATION Line 4 Sta. 120 + 00 E
 W.P. 197-65 BORING DATE April 1, 1971
 DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing

 ORIGINATED BY HS
 COMPILED BY AKB
 CHECKED BY

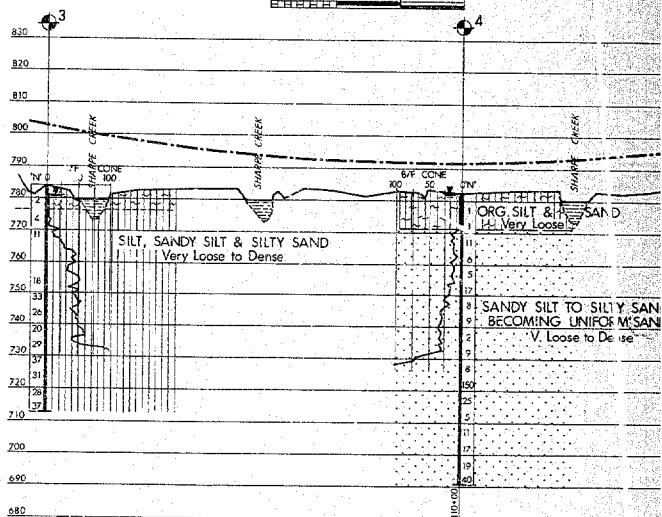
SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION BLOWS / FOOT	RESISTANCE	LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w WATER CONTENT % 20 40 60	BULK DENSITY γ P.C.F.	REMARKS					
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE							BLOWS / FOOT	SHEAR STRENGTH P.S.F.			
828.4	Ground Level														
0.0	Stratified silty clay. Reddish Brown and Grey seams. Firm to Stiff		1	TW	PM	 average shear strength									
			2	SS	1										
			3	TW	PM										
			4	TW	PM										
			5	TW	PM										
			6	TW	PM										
			7	TW	PM										
790.4	End of Borehole														
38.0															
780.4	End of Cone Test														
48.0															



PLAN
0 50 100 200 FT.
SCALE

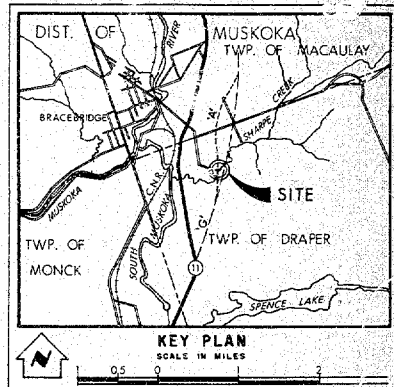
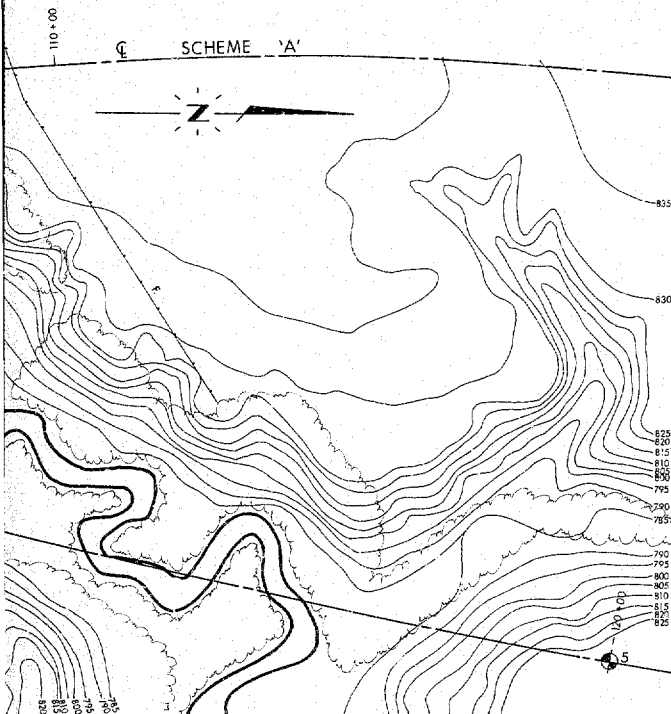


PROFILE - SCHEME 'A'
HORIZ. 100 50 0 SCALE 100 200 FT.
VERT. 20 10 0 20 40 FT.



PROFILE - SCHEME 'B'
HORIZ. 100 50 0 SCALE 100 200 FT.
VERT. 20 10 0 20 40 FT.

PRINT RECORD
NO. FOR DATE



LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation, MARCH/APRIL, 71		
	NO WATER OBSERVED IN BH. 1		
NO.	ELEVATION	STATION	OFFSET
1	785.9	99+15	± 'A'
2	782.1	102+00	± 'A'
3	784.2	103+35	± 'G'
4	782.2	110+00	± 'G'
5	828.4	120+00	± 'G'

— 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.

REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING OFFICE - FOUNDATION SECTION

SHARPE CREEK

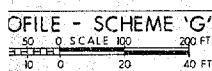
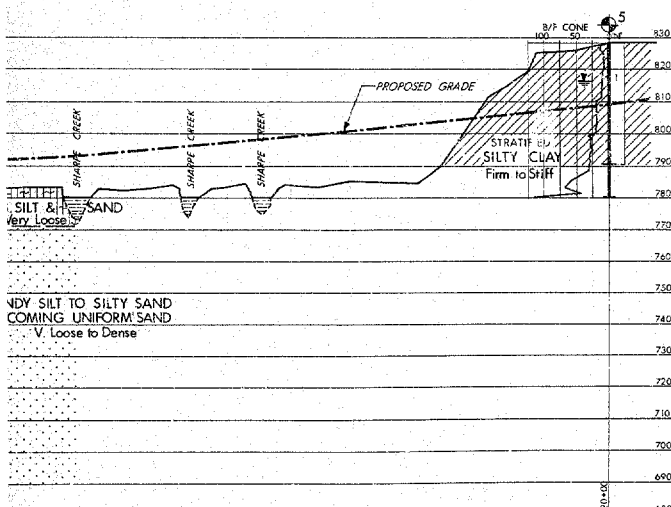
KING'S HIGHWAY NO. 11 BRACEBRIDGE BY-PASS *1ST. NO. 11

DIST. OF MUSKOKA

TWP. DRAPER LOT _____ CON. _____

BORE HOLE LOCATIONS & SOIL STRATA

SUBWD. A. B. CHECKED <i>[initials]</i>	W.P. NO. 197 - 65	M.A.T. DRAWING NO.
DRAWN S. R. CHECKED <i>[initials]</i>	JOB NO. 71 - 11016	71-11016 A
DATE APRIL 20, 1971	SITE NO.	BRIDGE DRAWING NO.
APPROVED <i>[signature]</i>	CONT. NO.	



MEMORANDUM

TO: Mr. A. G. Stermac,
Principal Foundations Engineer,
Design Services Branch,
West Building, DOWNSVIEW.

FROM:

J. McAllister

ATTENTION: Mr. K. G. Selby

DATE:

March 2, 1973

OUR FILE REF.

IN REPLY TO

SUBJECT:

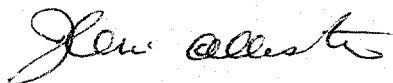
W. P. 197-65, Sharpes Creek,
Bracebridge By-Pass,
Highway #11, District #11

As discussed with you yesterday, I am forwarding a small location plan as well as 100' plans and profiles of the proposed crossing.

It is proposed to use twin 14' - 4" x 9' - 5" S.P.P.A's at this location with bottom of pipes at el. 772 at inlet and el. 770 at outlet.

A survey party will stake out the centre line between the pipes on or about 5th March, 1973 (next Monday) which should be before your crew arrive. Should you need help with elevations of holes, please call me and I will arrange it. The original foundation report W.O. 71-11016 shows that two holes were put down close to the crossing proposed, i.e. line "A" on the Box Hole Location Plan.

Systems Design completion date for this project is 7th March, 1973. This obviously cannot be met; however, I would appreciate having it done as soon as possible.



JMCA/rao

J. McALLISTER,
REGIONAL STRUCTURAL SUPERVISOR.

c.c's - S. McCombie
R. Northwood
R. Murphy
J. Anderson

MDD : MARCH 2 PLUS 8 WEEKS

= **APR. 27, 1973**

71-11016
Department of Highways Ontario

Copy for the information of

Mr. A. G. Stermac, Attn: Mr. K. Selby

Mr. A. G. Stermac
Principal Foundations Engr.
Foundations Sectn, Downsview

Mr. K. Selby

Materials & Testing
Northern Region

March 5, 1971

3/E - 11

GEOCRES No.

W.P. 197-65 - Proposed
Bracebridge By-pass

Attached are two copies of the Contour Study Plan and Profiles for Lines 'A' and 'G' in the area of Sharpes Creek as discussed with you earlier this week.

Scheme 'A', shown in red on the plan, involves up to 45 feet of fill; while Scheme 'G' requires a lesser fill height it entails a stream diversion and backfilling of several stream meanders.

I have indicated in green possible bore hole locations on the plan which might give the necessary information to evaluate foundation conditions for culvert and fill stability. If possible, we would like some idea of the feasibility of the stream diversion and any possible erosion problems which can be anticipated.

If further information is required please contact this office.



E. R. Saint
Reg. Materials Engr.

cc: A. G. Stermac, Attn: K. Selby
T. G. Smith
R. Murphy
H. McArthur
C. Campbell

ERS/gm

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. E. R. Saint,
Regional Materials Engr.,
Northern Region,
NORTH BAY, Ont.

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

ATTENTION:

DATE: April 15, 1971

OUR FILE REF.

IN REPLY TO

SUBJECT:

Proposed Bracebridge By-pass
W.O. 71-11016 -- W.P. 197-65

We are hereby sending to you a brief resume of the investigations, carried out at the site of the Sharpe's Creek crossings of the proposed Bracebridge By-pass, as requested.

Scheme 'A' -

Two boreholes were placed along this proposed alignment. Borehole #1 was located at Station 99+15 centre-line, where bedrock surface was reached at some 6 ft. below ground - (el. 779.9'). Borehole #2, placed on the valley floor at Station 102+00, revealed a deep deposit of fine, sandy silt and fine sand of loose to very dense relative density. The surficial, approx. 10-ft. layer was slightly organic. It is believed that considerable settlements will take place within the loose sand and silt under the proposed high fill. Due to the permeable nature of the deposit, however, the majority of the settlements will be completed during construction.

No further stability problems are foreseen for the fill, but it is suggested that above 30-ft. height, non-cohesive material be used for the fill construction.

Scheme 'G' -

The borehole located at proposed Station 110+00 centre-line indicated that the valley at this crossing is covered by an approx. 10 - 11 ft. layer of organic silt of very loose relative density. The organic material is underlain by a deep deposit of silts and fine sands.

The organic layers should be replaced by acceptable, non-cohesive materials under the proposed culvert and approach fill. No stability problems are anticipated for the fills, built on such suitable soils, provided they are constructed with 2 horizontal to 1 vertical slopes.

Mr. E. R. Saint,
Regional Materials Engr.,
Northern Region - North Bay, Ont.

2

April 15, 1971

Re: Proposed Bracebridge By-pass -
W.O. 71-11016 -- W.P. 197-65 ...

Scheme 'G' - (cont'd.) ...

One borehole was located on the high ground around Station 120+00 centre-line, where the by-pass is proposed to be in a cut of some 15-ft. depth. Stratified silty clays of firm to stiff consistency, form the subsoil at this location, having very high natural moisture contents. It is felt that the long-term stability of the cuts will need to be checked by means of effective stress analyses, if this scheme is adopted. For a preliminary estimate, a 3 horizontal to 1 vertical slope should be used for the cut section.

Since the silts and sands entirely lack cohesive strength, erosion control along the diverted stream will be essential.

K. G. Selby

KGS/MdeP

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

cc: Foundations Files ✓
Gen. Files