23-31-353
40

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

Attention: Mr. S. McCombie

From: Mr. A. G. Stermac,
Principal Foundation Engr.,
Foundation Section,
Materials & Research Division.

Date: January 3, 1964

Our File Ref.

In reply to

Subject:

FOUNDATION INVESTIGATION REPORT
For
Proposed New Bridge over Moose Creek,
at Brethour Road (Casey Township),
District 14, New Liskeard, Ontario.

W.J. 63-F-113 -- W.P. 256-63

Attached, we are forwarding to you, our detailed foundation investigation report on the subsoil conditions existing at the above-mentioned structure site.

We believe that you will find the factual data and recommendations contained therein, adequate for your future design work. Should further information be required, please feel free to contact our Office.

K.Y. Lo.

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

KYL/MdeF
Attach.
cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan
H. McArthur
R. S. Chapman
E. R. Saint
A. Watt
Foundations Office ✓
Gen. Files

see note opposite
KYL. 22/1/64

TABLE OF CONTENTS

FOUNDATION INVESTIGATION REPORT

For

Proposed New Bridge over Moose Creek,
at Brethour Road (Casey Township),
District 14, New Liskeard, Ontario.

W.J. 63-F-113 -- W.P. 256-63

1. INTRODUCTION:

A memo from the Bridge Office, dated September 3, 1963 was received, requesting a foundation investigation at the site of the proposed new bridge over Moose Creek at Brethour Road.

A field investigation and laboratory testing were subsequently carried out by this Section in order to determine the subsoil conditions at the above site.

Presented in this report are the results of this investigation, with recommendations pertaining to the design of the proposed foundations.

2. DESCRIPTION OF THE SITE:

The site is located some two miles south of the Village of Pearson at the crossing of Moose Creek and Casey Twp. Road, known also as Brethour Road. The junction of Brethour Road and Hwy. #65 is some 600 ft. south of the present bridge site. The creek at and near the crossing is about 40 - 60 ft. wide, following a meandering course, with a general direction of west to east.

The north vicinity of the creek is low-lying farmland with scattered hamlets. The area south of Hwy. #65 is hilly with gentle slopes. The highway is under construction, and it is currently being realigned.

cont'd. /2 ...

2. DESCRIPTION OF THE SITE: (cont'd.) ...

The site is located in the area physiographically known as the "Timiskaming Clay Plain". Typical features of this area are interspersed outcrops of pre-Cambrian rock between low-lying clay plains. The latter consist of usually extensive deposits of varved clay, which is believed to originate from post-glacial lacustrine deposits.

The surrounding land is all cultivated and is traversed by several rivers and creeks, one of which is Moose Creek.

The elevation of the creek water level at the time of the field investigation was observed to be at elev. 589.0. According to local residents, the spring water level rises to an approximate elevation of 593 - 594 ft.

The existing three-span bridge over Moose Creek is only 14 ft. wide and some 86 ft. long, and is supported on timber piles. Both the sub- and superstructure are in very poor condition, the latter being reinforced by steel trusses (Bailey support).

3. FIELD AND LABORATORY WORK:

Three sampled boreholes were put down during the field investigation, each of which was further advanced by dynamic cone penetration tests. Borehole #1 and #3 were carried out on the shoulder of the road, at the approach fills of the present bridge, in order to obtain information as to the materials used in building the embankments. The approach fills are approximately 8 ft. high. B.H. #2 was carried out near the water's edge at the west side of the existing bridge. Boring was achieved by means of conventional

cont'd. /3 ...

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

diamond drilling equipment, adapted for soil sampling purposes. Undisturbed samples were taken at required depths in cohesive deposits, using 2" I.D. Shelby tubes, while a standard split-spoon sampler was used to obtain disturbed samples of non-cohesive strata.

Field vane tests were carried out in order to determine the shear strength of the cohesive deposits.

The locations and elevations of all boreholes are shown on Dwg. #63-F-113A, which is attached to this report.

Samples were visually examined and identified in the field as well as in the laboratory. Tests were carried out in the laboratory on a selection of both disturbed and undisturbed samples to determine:

1) Natural Moisture Contents.
2) Bulk Densities.
3) Atterberg Limits.
4) Grain Size Distributions.
5) Undrained Shear Strengths.

Results of the field and laboratory tests are included under Appendix I of this report.

4. SUBSOIL CONDITIONS:

4.1) General:

Subsoil at the site was found to be fairly uniform. The material of the approach fills consists of a mixture of gravelly sand and clay with boulders. Underlying the clayey topsoil, a thin layer, approx. 5 ft. thick of loose sand, was encountered in all the

cont'd. /4 ...

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

4.1) General: (cont'd.) ...

boreholes. Immediately below this, an extensive deposit of varved clay underlain by dense sand was observed.

The boundaries of the various deposits are shown on the accompanying borelog sheets. The estimated stratigraphical profile of Dwg. #63-F-113A, is based upon this information.

A brief description of each soil stratum is as follows:

4.2) Fill Material (Mixture of Gravelly Sand and Clay with Boulders):

The approach embankments are generally composed of a mixture of gravel, sand and clay with boulders. The relative density of the fill is loose to compact. The size of boulders encountered in the boreholes varied between 6 inches to 18 inches in diameter.

4.3) Sand:

The sand layer was found to be approximately 5 ft. thick and was encountered in all the boreholes. The upper limits of this deposit at the south side of the creek is at approximate elev. 585, whereas at the north side, at approx. elev. 580 - 581. The relative density of this layer was observed to be loose, corresponding to standard penetration 'N' values of 5 - 9.

4.4) Varved Clay:

Underlying the sand, an extensive deposit of varved clay was encountered, extending down to elev. 518 - 512.5'. The varved clay deposit consists of alternate layers of clay of high plasticity and clayey silt. The clay layers range from 1/2" to 2-1/4" in thickness and are spaced 1/4" to 1/2" apart.

cont'd. /5 ...

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

4.4) Varved Clay: (cont'd.) ...

The Atterberg limits and moisture content ranges for the various layers are tabulated below:

	Clay Layers	Clayey Silt Layers
Liquid Limit (W_L%)	61% - 78%	27% - 30%
Plastic Limit (W_p%)	26% - 29%	21% - 26%
Moisture Content (W %)	34% - 83%	27% - 32%

The undrained shear strength of the deposit as determined from the field vane tests, was found to vary from a low of 160 p.s.f. in the upper portion, to a maximum of 1040 p.s.f. in the lower portion, whereas the results from the laboratory tests were found to vary from 170 p.s.f. to 540 p.s.f. These results indicate that the deposit is essentially very soft to firm. Generally, the shear strength increases with depth.

4.5) Sand:

Underlying the varved clay at elevation 518.0 - 512.5, a deposit of dense to very dense medium sand was observed in boreholes #1 and #3. This stratum was proved only to a depth of 6 ft. in B.H. #3. After termination of the sampled boreholes, a dynamic cone penetration test was carried out in order to determine the extent of the sand stratum in B.H. #1 and #3. The results of the dynamic cone penetration test are shown on the appended borehole logs.

cont'd. /6 ...

5. GROUND WATER CONDITIONS:

The present and high water level of the creek was discussed earlier. (See Section #2.) Ground water levels in the boreholes were observed to be at elev. 585.0' which is slightly below the creek level, elev. 585.5'. The exact water levels at the time of the field investigation, are shown on borehole logs - (Appendix I).

6. DISCUSSION & RECOMMENDATIONS:

It is proposed to construct a new structure at this site to replace the existing structure over Moose Creek. The new centreline will be the same as the existing one, and the new profile grade will be approximately 3 ft. to 4 ft. higher.

Subsoil at the site mainly consists of a 5.0 ft. layer of loose sand followed by an extensive deposit of varved clay approximately 62.0 ft. in thickness, underlain by a dense to very dense stratum of sand. The existing approach fills are generally composed of a mixture of gravelly sand and clay with boulders.

Structure -

The subsoil generally consists of loose sand underlain by soft varved clay down to elev. 545.0. These deposits cannot provide an adequate bearing capacity for an economical spread footing design. The new structure should therefore, be supported on a piled foundation. For this purpose, a design load of 7 tons may be attributed to #14 timber piles driven 40.0 ft. into the original ground. However, a pile loading test is recommended at this site in order to determine the safe bearing load for a 40-ft. long timber pile driven into the soft varved clay stratum.

cont'd. /7 ...

6. DISCUSSION & RECOMMENDATIONS: (cont'd.) ...

Structure - (cont'd.) ...

It is pointed out that a piled foundation as such, will not eliminate settlements and, therefore, a simply supported structure is recommended. In our opinion, the most suitable type of structure at this site would be a timber trestle bridge.

Approach Fills -

The presence of a soft varved clay deposit below the approac embankments will necessitate certain measures to ensure the stability of the proposed heightening and widening of the approach fills. No attempt should be made to trim the forward slopes steeper than the existing one. The proposed abutments should be located in such a way that there should be a 20-ft. long berm in the forward direction. A longitudinal section (Dwg. #63-F-113B) showing the extent of berm is enclosed with this report. The sides of the embankment, however, may be constructed with a slope of 2 horizontal to 1 vertical.

Precautions should be taken to protect the river banks and approach embankments from scour action of the river. This may be achieved by suitably placed rip-rap.

7. SUMMARY:

Subsoil at the site generally consists of loose sand followed by soft to firm varved clay. The varved clay deposit is underlain by dense to very dense sand. The existing approach fills are composed of a heterogeneous mixture of clay, sand, and gravel with boulders.

cont'd. /8 ...

7. SUMMARY: (cont'd.) ...

A simply supported structure on a piled foundation is recommended at this location. A design load of 7 tons per pile may be used for #14 timber piles driven some 40 ft. into the original ground. However, a pile loading test is recommended in order to evaluate the bearing loads for the above-mentioned timber piles.

Approach fills should be constructed as discussed under Section 6. Adequate protection for the scour from the river should be provided for the approach embankments.

8. MISCELLANEOUS:

The field investigation was carried out during the period from October 16 to 24, 1963. Equipment used was owned and operated by Canadian Longyear Ltd., North Bay. The field work, together with the preparation of this report, was undertaken by Mr. A. K. Barsvary, Project Foundation Engineer, under the general supervision of Mr. M. Devata, Senior Foundation Engineer.

January 1964

APPENDIX I.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 63-F-113 LOCATION Sta. 6+50; 7.5' Rt. of ℄ ORIGINATED BY A.B.
W P 256-63 BORING DATE Oct. 16-17, 1963. COMPILED BY A.B.
DATUM G.S.C. BOREHOLE TYPE Washboring, NX Casing. CHECKED BY M.D.

ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100; SHEAR STRENGTH P.S.F. o - Field Vane x - Unconfined Comp. 200 400 600 800 1000	LIQUID LIMIT WL, PLASTIC LIMIT WP, WATER CONTENT W; WATER CONTENT % 20 40 60 80	BULK DENSITY P.C.F.	REMARKS
596.5	Groundlevel									
0.0	Fill Material									
	Mixture of clay, sand and gravel with boulders.		1	SS	11	590				
			2	SS	12					
			3	SS	5					
581.5			4	TW	P				110.8	
15.0	Sand		5	SS	15	580				
575.5	Loose		6	SS	5					W.L.
21.0			7	TW	P	570			110.8	
	Varved clay very soft to firm.		8	TW	P	560			115.8	
			9	TW	P				98.5	
			10	TW	P	550			104.2	
			11	SS	P	540				
			12	TW	P	530			99.0	
			13	TW	P	520			106.0	
512.5										
511.0	Sand, very dense					510				
85.5	End of borehole.						End of Penetration			
						500				

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 63-F-113 LOCATION Sta. 6+32; 20' Lt. of ℄ ORIGINATED BY A.R.

W.P. 256-63 BORING DATE Oct. 18, 1963. COMPILED BY A.S.

DATUM G.S.C. BOREHOLE TYPE Washboring, NX Casing. CHECKED BY M.D.

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE
588.0	Groundlevel					
0.0	Clay		1	TW	P	
			2	TW	P	
580.5	Very soft					580
7.5	Sand, loose.		3	SS	9	
575.0						
13.0			4	SS	2	
	Varved clay					570
	very soft to firm.		5	TW	P	
						560
			6	TW	P	
554.5						
33.5	End of borehole.					550
						540
						530
						520
						510
						500

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT
20 40 60 80 100

SHEAR STRENGTH P.S.F.
o - Unconfined Comp.
x - Field Vane
200 400 600 800 1000

LIQUID LIMIT — w_L
PLASTIC LIMIT — w_P
WATER CONTENT — w
w_P w w_L
WATER CONTENT %
20 40 60

BULK DENSITY
γ
P.C.F.

	BULK DENSITY	REMARKS
	123.2	W.L.
	112.4	

End of Penetration

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 :-

CONSISTENCY	'N' BLOWS/FT	c LB./SQ.FT.	DENSENESS	'N' BLOWS/FT.
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, OF FRICTION
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OF FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3·1416
e	BASE OF NATURAL LOGARITHMS 2·7183
$\log_e \sigma$ OR $\ln \sigma$	NATURAL LOGARITHM OF σ
$\log_{10} \sigma$ OR $\log \sigma$	LOGARITHM OF σ 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 (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

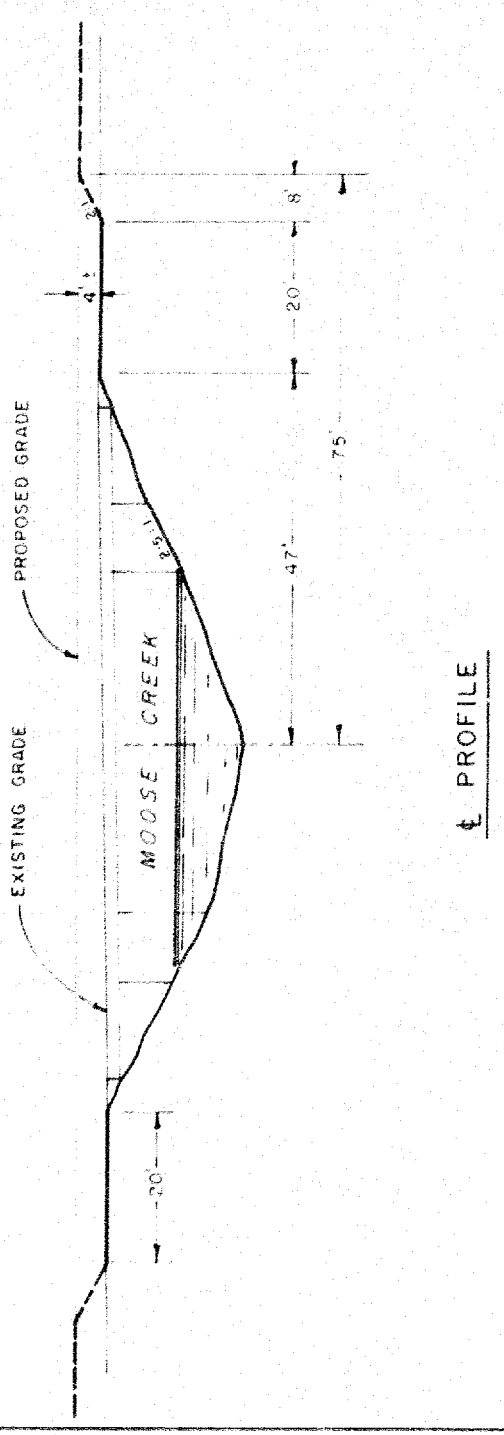
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

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



ORIGINATED M DEVATA
DRAWN N D REED
CHECKED
APPROVED
DATE 9 JAN 1964

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH SECTION

MOOSE CREEK B CASEY TWP RD

PROPOSED APPROACH TREATMENT

SCALE 1 INCH = 20 FEET
W P NO 256-63
JOB NO 63 F-113
DWG NO 63-F-113B

cc: Foundations Office (Rm. 110)

Mr. B. R. Davis,
Bridge Design Engr.,
Bridge Division.

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

Attention: Mr. W. M. McFarlane

April 20, 1964

Re: Moose Creek Bridge,
W.P. 256-63 - W.J. 63-F-113

This is to confirm the verbal recommendations given today to your Mr. A. Pniakowski.

Steel H-piles should be used, driven to approximate elevation 505.0. A safe load of 30 tons/pile can be assigned in such an arrangement. A continuous 3-span structure seems to be the right solution.

AGS/MdeF

A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

cc: Foundations Office
Gen. Files

Moose Creek 22/4/64

Discussion and Recommendation to A. Pniakowski

1/ Construction procedure for proposed bridge

(a) Construct fills and berms to final grade

(b) Leave for a period of two or three months

(c) Construct bridge (Drive piles)

2/ Recommend longer bridge, addition of 15 ft on each side to avoid construction delay — a preferable design. ~~Leave~~ Trim berm for forward slopes

3/ Inquire about lowering of grade. If possible, we shall look into possible of side berms

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

From: Bridge Division,
Downsview, Ontario.

Date: May 21, 1964

Our File Ref.

In reply to

Subject: W.P. 256-63
Moose Ck. Bridge
Twp. Rd. to Brethour
Dist. #14

Attached please find one print of preliminary plan D-5446-P for the above structure. The report recommended that timber friction piles be used with a #14 pile having a capacity of 7 tons with 40' embedment.

The proposed structure however uses 10" BP at 42 pounds driven to the dense sand and gravel stratum indicated on the report. We would appreciate having your comments and recommendation on record.

The grade has also been lowered almost to the elevation of existing grade.

JCMcA/sp

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

Department of Highways Ontario

63-F-113

Copy for the information of
Mr. M. Devata,
Senior Foundation Engineer,
Room 107, Lab. Building.

Mr. B. Davis,
Bridge Design Engineer.

Bridge Division,
Downsview, Ontario.

Attention: Mr. W. McFarlane

May 28, 196..

W.P. 256-63 Moose Ck. Bridge,
Twp. Rd. to Brethour,
District # 14.

A copy of preliminary plan D-5446-P for the above structure was forwarded to Foundation Section for their approval. As the proposed foundation design is different from that recommended, Mr. M. Devata recommends that some further boreholes be put down to confirm the layer of dense sand on which we propose to support the structure.

The work will be carried out within a month with results available long before the completion date for the design.

JCMcA/kd
c.c. M. Devata

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

Micky:
PUT THIS LETTER IN OUR FILE, PLEASE
May 29, 1964
AGS

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. S. McCombie,
Bridge Planning Engr.,
Bridge Division.

A tn: Mr. J. C. McAllister

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

Date: June 30, 1964

Our File Ref.

In reply to

Subject:

-- Additional Borings --

Proposed New Bridge over Moose Creek
at Brethour Road (Casey Township),
District #14, New Liskeard, Ontario.
W.J. 63-F-113 -- W.P. 256-63

As requested by you, we have carried out additional borings (B.H.'s #4 & #5) at the above-mentioned location. These borings revealed that the dense sand stratum extends at least some 20 feet below the varved clay deposit. The upper limits of the sand layer is at approximate elev. 518 - 508.

As an alternative to our original recommendation, the proposed structure can be supported on end-bearing steel H-piles driven to practical refusal into the dense sand stratum. For estimating purposes, it can be assumed that the piles will penetrate at least 10 ft. into the dense sand layer. However, the pile driving in this deposit during construction should be controlled by the use of the Hiley Formula according to the current D.H.O. Standards DD 1216 and DD 1217.

A drawing, 63-F-113B showing the subsoil stratigraphy of the original investigation, together with our additional investigation is attached. This drawing, including the borehole logs

cont'd. /2 ...

(B.H.'s #4 and #5). should be included with our Foundation Report W.J. 63-F-113.

Should there be any additional queries pertaining to this project, please contact our Office.

M. Devata

for A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

MD/MdeF
Attach.

cc: Messrs. A. M. Toye
H. A. Tregaskes
H. D. McMillan
H. McArthur
G. M. Sinclair
E. R. Saint
A. Watt

Foundations Office
Gen. Files

APPENDIX I.

DEPARTMENT OF PUBLIC WORKS
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 63-E-113 LOCATION Sta. 6+50 12'-0" Lt. of ℄ ORIGINATED BY W.W.K.
W.P. 256-63 DATE(S) June 4 & 5, 1964. COMPUTED BY W.W.K.
DATUM 596.0 METHOD OF BORING Washboring NX Casing. CHECKED BY M.D.

ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT — SHEAR STRENGTH P.S.F. Field Vane ○ (150 300 450 600 750)	LIQUID LIMIT — W_L PLASTIC LIMIT — W_P WATER CONTENT — W M.D. W_P W_L WATER CONTENT %	FIELD DENSITY γ P.C.F.	REMARKS
596.0	Groundlevel									
0.0	Sand gravel boulders & traces of org. matter. (Fill Material)					590				w.l. ▼ El. 585.0 Observed in casing.
584.3										
11.7	Sand and traces of organic matter.					580				
578.5										
17.5						570				
						560				
	Varved clay.					550				
	Soft to firm.					540				
						530				
						520				
511.5										
84.5	Silty sand.		1	SS	29	510				
	Compact to very dense.		2	SS	55					
			3	SS	76	500				
			4	SS	80					
101.5	End of borehole.									

DEPARTMENT OF HIGHWAYS, DIVISION OF MATERIALS & RESEARCH

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 63-F-113 LOCATION Sta. 5+75, 18'-0" Rt. of ℄ ORIGINATED BY W.R.K.

S.P. 256-63 DRILLING DATE June 3 & 4, 1964. COMPLETED BY W.R.K.

DATUM 588.0 BOREHOLE TYPE Washboring, NX Casing. CHECKED BY M.D.

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE, BLOWS / FOOT — SHEAR STRENGTH P.S.F. — Field Vane - O (150 300 450 600 750)	LIQUID LIMIT — W_L; PLASTIC LIMIT — W_P; WATER CONTENT — W; W_D — W — W_T; WATER CONTENT %	BULK DENSITY P.C.F.	REMARKS
588.0	Groundlevel									
0.0	Sand gravel boulders some org. matter (Fill Material)									
584.0										▼G.L. El. 585.0 Observed in casing.
4.0	Sand and traces of organic matter.					580				
574.5										
13.5						570	o			
							o			
						560	o			
	Varved clay.						o			
	Soft to firm.					550	o			
							o			
						540	o			
						530				
						520				
						510				
506.0										
82.0	Silty sand.									
	Very dense.		1	SS	66	500				
			2	SS	34					
			3	SS	82	490				
101.5	End of borehole.		4	SS	84					

cc: Gen. Files 23-64-353

Moose Creek Bridge

Mr. B. R. Davis,
Bridge Design Engr.,
Bridge Division.

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

Attention: Mr. W. M. McFarlane

April 20, 1964

Re: Moose Creek Bridge,
W.P. 256-63 - W.J. 63-F-113

This is to confirm the verbal recommendations given today to your Mr. A. Pniakowski.

Steel H-piles should be used, driven to approximate elevation 505.0. A safe load of 30 tons/pile can be assigned in such an arrangement. A continuous 3-span structure seems to be the right solution.

AGS/MacF

A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

cc: Foundations Office
Gen. Files

#63-F-113

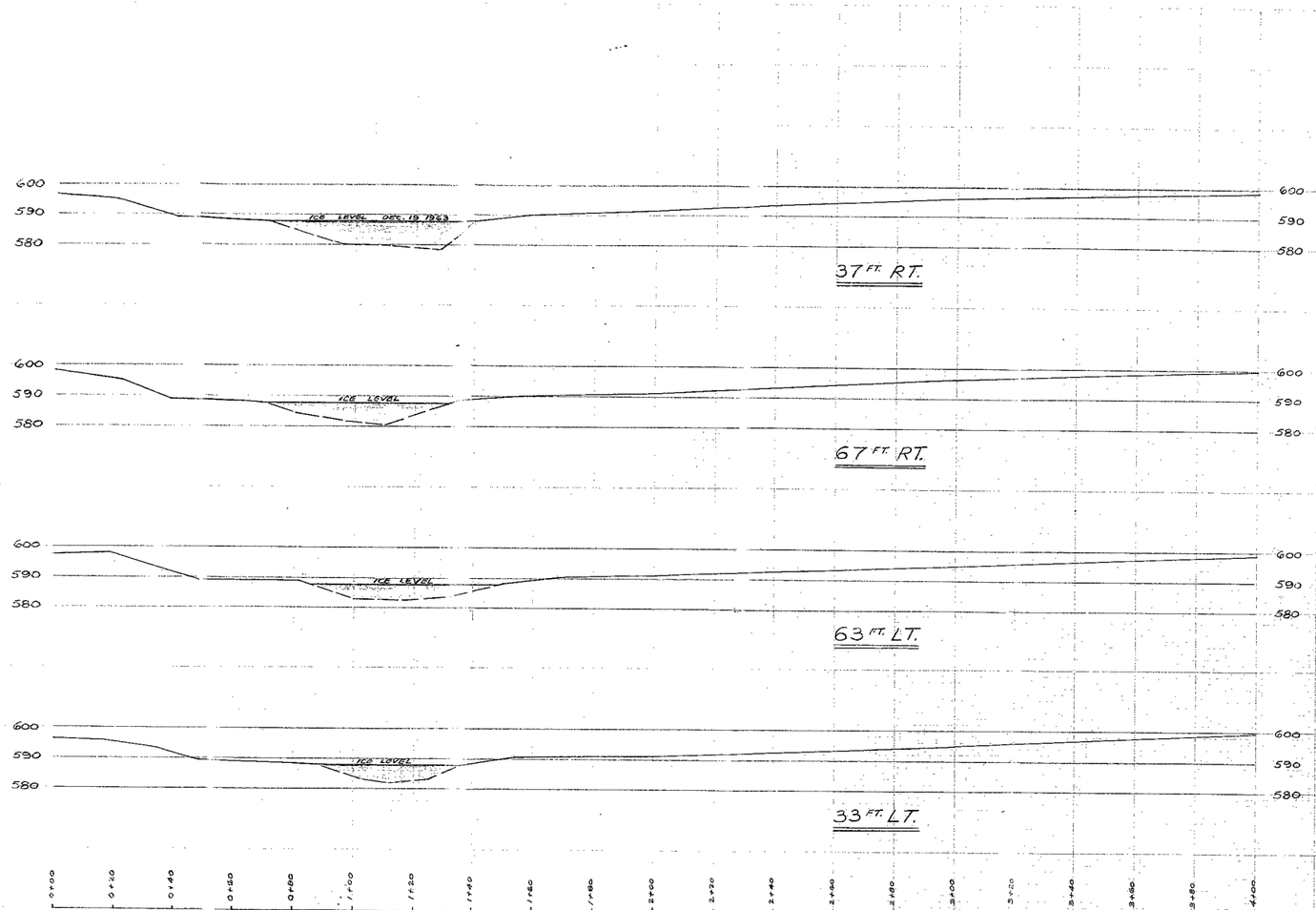
W.P. #256-63

NEW BRIDGE

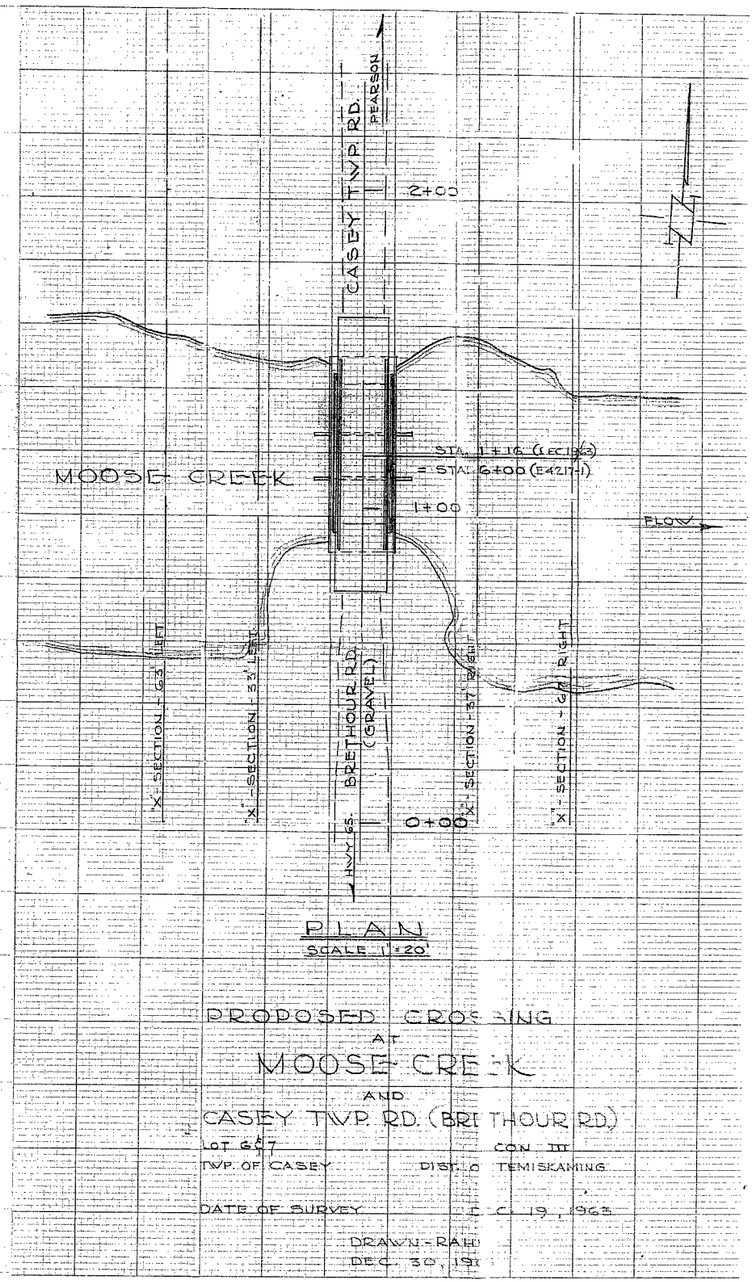
OVER MOOSE

CREEK AT

BRETHOUR RD.



CROSS SESTIONS



PLAN

SCALE 1" = 20'

PROPOSED CROSSING AT MOOSE CREEK AND CASEY TWP. RD. (BRETHOUR RD.)

LOT 6&7 CON III

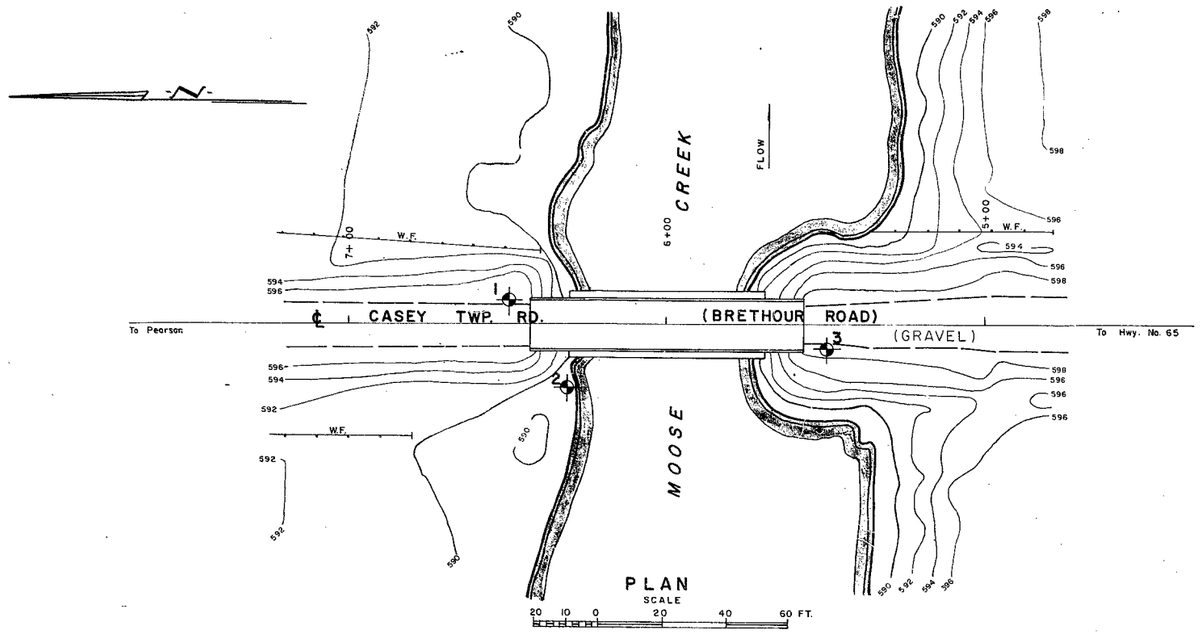
TWP. OF CASEY DIST. OF TEMISKAMING

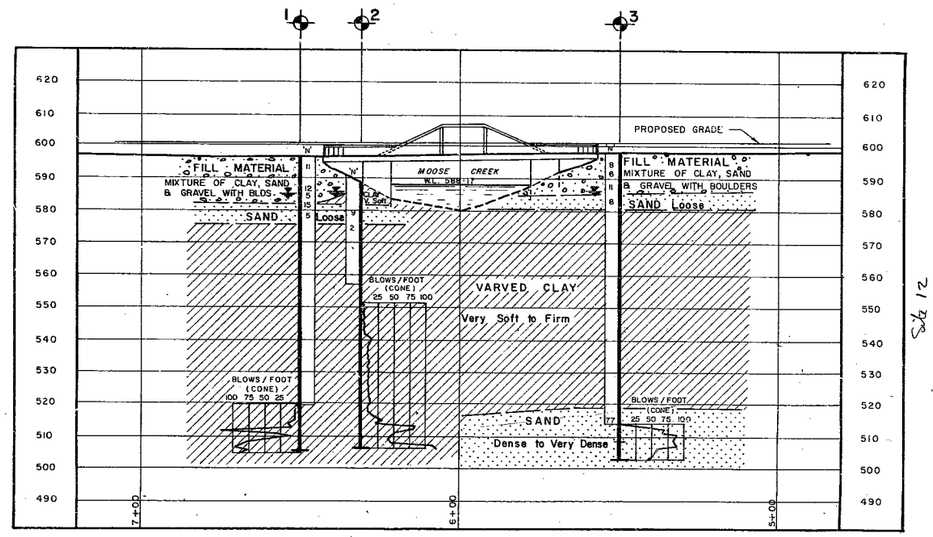
DATE OF SURVEY DEC. 19, 1963

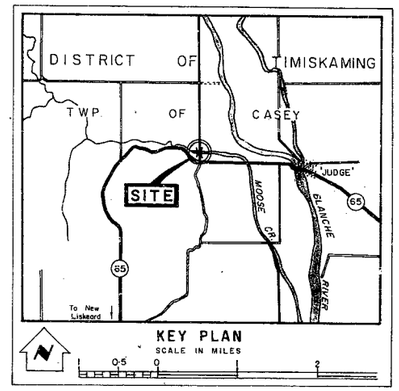
DRAWN - RAH

DEC. 30, 1963

Existing Bridge - 40' long timber piles







LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation. Oct. 1963.

NO.	ELEVATION	STATION	OFFSET
1	596·5	6+50	7·5' RT.
2	588·0	6+32	20' LT.
3	598·0	5+50	7·5' LT.

– 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

DEPARTMENT OF HIGHWAYS – ONTARIO
MATERIALS & RESEARCH DIVISION – FOUNDATION SECTION

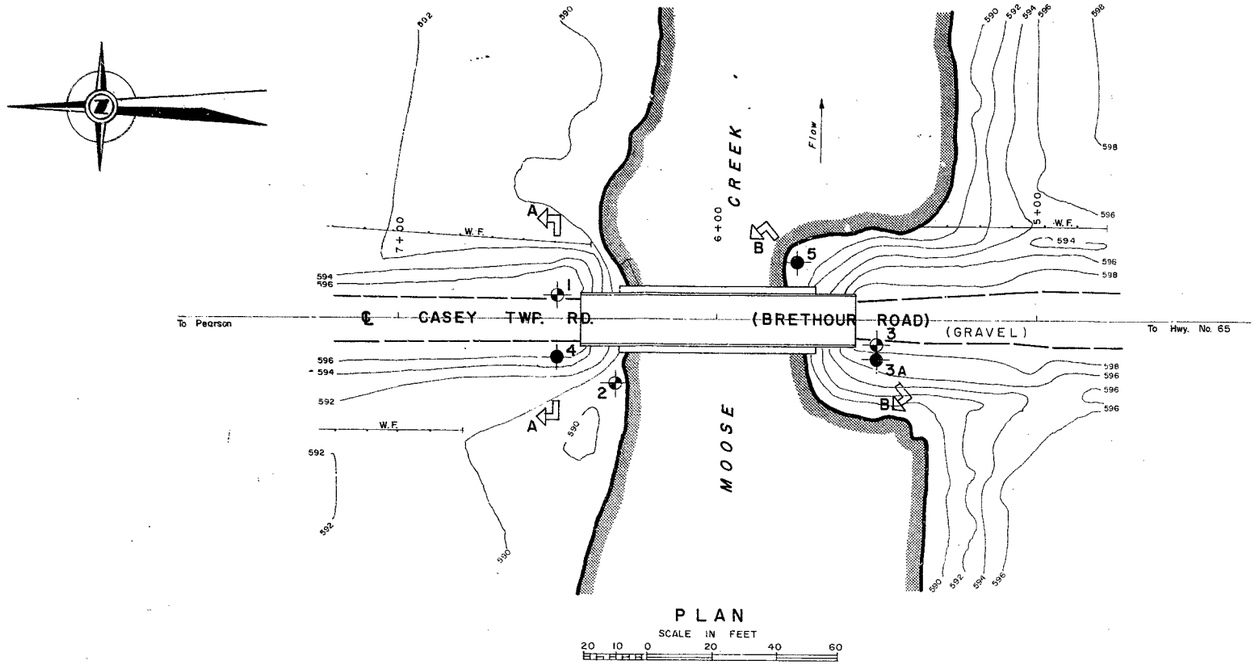
MOOSE CREEK

KING'S HIGHWAY NO. TWP. RD. (BRETHOUR RD.) DIST. NO. 14
CO. DISTRICT OF TIMISKAMING
TWP. CASEY LOT 6 & 7 CON. III

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D. A.B.	CHECKED H.S.	W.P. NO. 256-63	M.B.R. DRAWING NO. 63-F-113A
DRAWN F.C.	CHECKED	JOB NO. 63-F-113	
DATE DEC 11, 1963		SITE NO.	BRIDGE DRAWING NO.
APPROVED A.Watermark PRINCIPAL FOUNDATION ENGINEER		CONT. NO.	

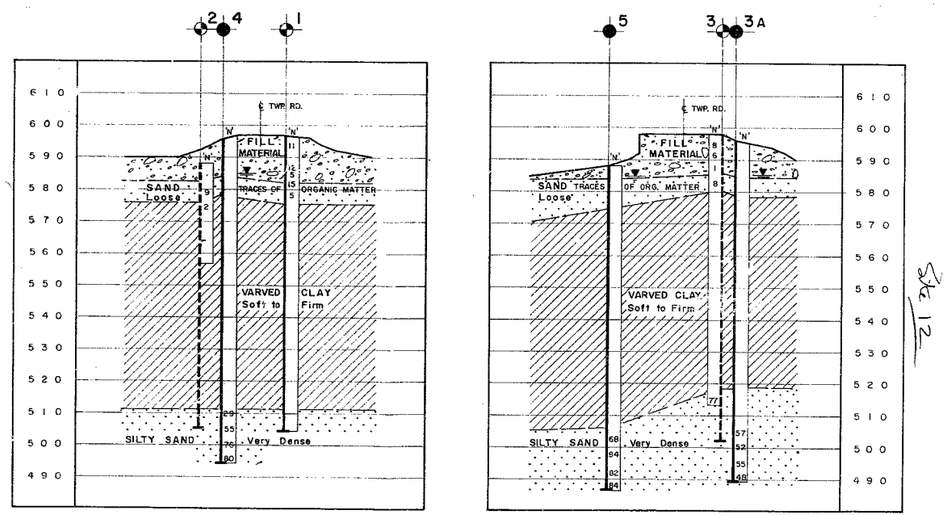
REF. NO. 4217-1



PLAN

SCALE IN FEET

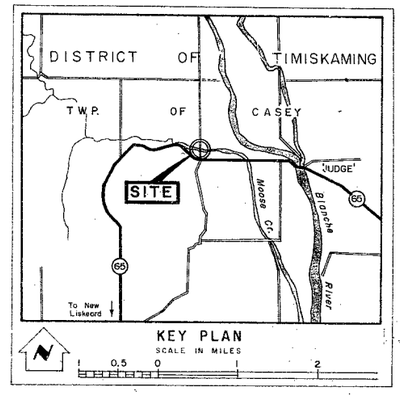
20 10 0 20 40 60



A - A SECTIONS B - B

SCALE IN FEET

20 10 0 20 40 60



LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation. (July 1963)

NO.	ELEVATION	STATION	OFFSET
1	596·0	6+50	7·5' RT.
2	588·0	6+32	20' LT.
3	598·0	5+50	7·5' LT.
3A	596·0	5+50	12' LT.
4	596·0	6+50	12' LT.
5	588·0	5+75	18' RT.

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

Sht 12

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION

MOOSE CREEK

KING'S HIGHWAY NO. TWP. RD. (BRETHOUR RD.) DIST NO. 14

CO. DISTRICT OF TIMISKAMING

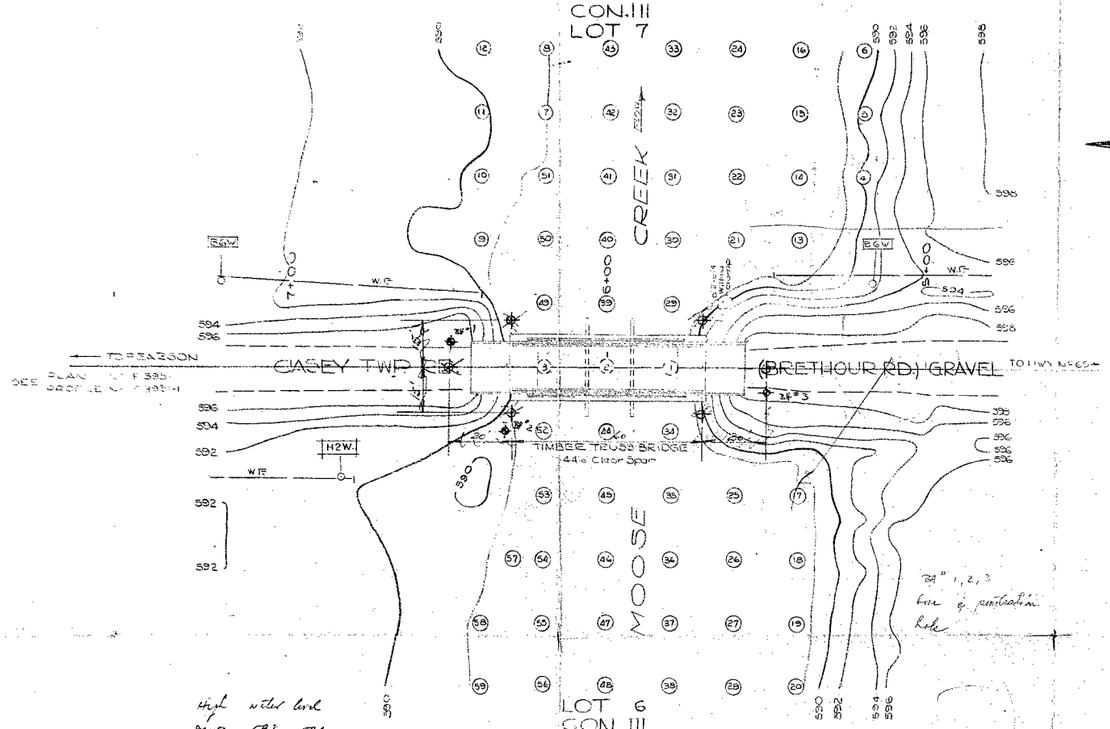
TWP. CASEY LOT 6 & 7 CON. III

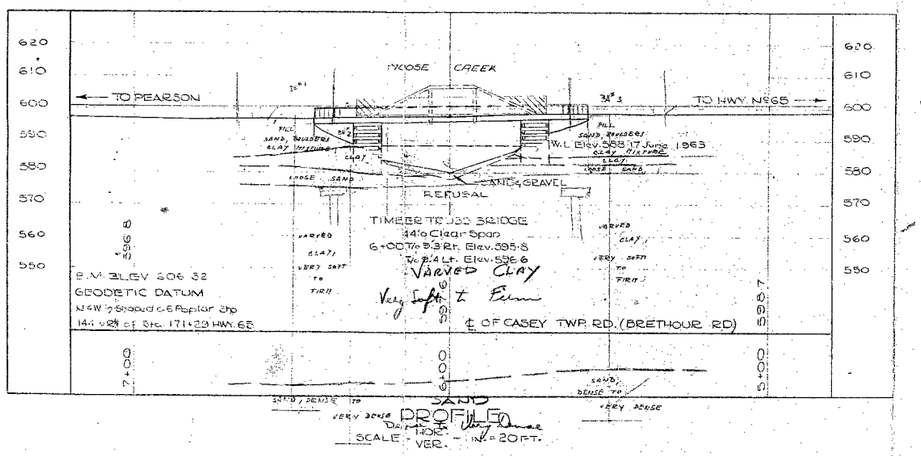
BORE HOLE LOCATIONS & SOIL STRATA

SUBMD W. K.	CHECKED	W.P. NO. 256-63	M.B.R. DRAWING NO. 63-F-113B
DRAWN D. M.	CHECKED	JOB NO. 63-F-113	
DATE JUNE 17, 1964		SITE NO.	BRIDGE DRAWING NO.
APPROVED		CONT NO.	

REF. NO. 4217-1

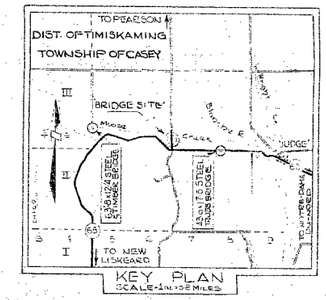
DISTRICT of TIMISKAMING
TOWNSHIP of CASEY
CON. III
LOT 7





SOUNDING DATA

N°	STATION	TOTAL DEPTH	DESCRIPTION
1	5+80 ℄	2'0	2'0 Water To Gravel
2	6+00 ℄	10'5	(8'5) 2'0 Sand To Refusal
3	6+20 ℄	6'0	5'0 Water 1'0 Gravel
	5+20		
4	60'o Rt	0'5	0'5 Clay To Sand
5	80'o "	2'0	2'0 " " Clay
6	100'o "	2'0	2'0 " " Sand
	6+20		
7	80'o Rt	2'0	2'0 " " Clay
8	100'o "	1'0	1'0 " " "
	6+40		
9	40'o Rt	1'5	1'5 " " Sand
10	60'o "	1'0	1'0 " " "
11	80'o "	1'0	1'0 " " "
12	100'o "	1'0	1'0 Clay To Sand
	5+40		
13	40'o Rt.	5'0	2'0 Water 3'0 Clay to Refusal
14	60'o "	7'5	1'5 " 6'0 " "
15	80'o "	5'4	0'4 " 5'0 " "
16	100'o Rt.	5'0	4'0 " 1'0 " "
17	40'o Lt.	3'9	0'4 " 3'5 " Clay
18	60'o "	4'0	0'5 " 3'5 " "
19	80'o "	2'5	0'5 " 2'0 " "
20	100'o Lt.	3'6	0'1 " 3'5 Clay Clay
	5+60		
21	40'o Rt.	9'5	7'0 " 2'5 Soft Clay to Refusal
22	60'o "	8'0	5'0 " 3'0 Clay to Refusal
23	80'o "	6'5	4'5 " 2'0 Sand & Gr. to Refusal
24	100'o Rt.	7'0	5'0 " 2'0 Sand to Refusal
25	40'o Lt.	5'0	2'0 " 3'0 Clay to Refusal
26	60'o "	3'5	1'0 " 2'5 " " Clay
27	80'o "	4'5	1'5 " 3'0 Clay " Clay
28	100'o Lt.	5'0	1'0 " 4'0 Soft Clay to Refusal
	5+80		
29	20'o Rt.	6'5	5'0 " 1'5 Gravel to Sand
30	40'o "	12'0	9'0 " 3'0 Soft Clay to Refusal
31	60'o "	11'0	7'0 " 1'5 Clay 2'5 Sand "
32	80'o "	7'5	6'0 " 1'0 Sand & Clay "
33	100'o Rt.	12'5	(9'0) 3'5 Sand To "
34	20'o Lt.	5'0	2'0 " 3'0 Soft Clay to Refusal
35	40'o "	6'5	4'5 " 1'0 Sand 1'0 Soft Clay to Refusal
36	60'o "	8'0	5'0 " 2'0 Sand 1'0 Soft Clay "
37	80'o "	6'5	6'0 " 1'5 Sand & Gr. 1'0 Soft Clay "
38	100'o Lt	7'5	5'5 " 2'0 Soft Clay to Refusal
	6+00		
39	20'o Rt.	11'0	(3'0) 2'0 Gravel "
40	40'o "	11'0	(9'0) 1'5 Sand & Clay "
41	60'o "	10'0	7'5 " 2'5 Sand "
42	80'o "	7'5	5'5 " 2'0 Sand "
43	100'o Rt.	3'0	2'0 " 1'0 Clay To Clay
44	20'o Lt.	10'0	(5'0) 2'0 Sandy Clay To Refusal
45	40'o "	7'0	6'0 " 1'0 Soft Clay " "
46	60'o "	8'0	6'0 " 1'0 Sand 1'0 Clay " "
47	80'o "	9'0	6'0 " 2'0 Sand 1'0 Soft Clay "
48	100'o Lt.	9'0	6'0 " 1'0 Sand & Gr 2'0 Soft Clay "
	6+20		
49	20'o Rt.	8'0	5'5 " 1'0 Gravel 1'5 Soft Clay "
50	40'o "	8'5	6'5 " 1'0 Sand 1'0 Clay To Refusal
51	60'o Rt.	2'5	2'0 " 0'5 Clay To Clay "
52	20'o Lt.	8'0	6'0 " 2'0 Clay To Refusal
53	40'o "	6'5	5'0 " 1'5 Soft Clay "
54	60'o "	7'0	4'5 " 2'5 " "
55	80'o "	5'5	3'5 " 2'0 " "
56	100'o Lt.	7'0	2'0 " 5'0 Soft Clay "
	6+30		
57	60'o Lt.	7'0	2'0 " 5'0 Clay
	6+40		
58	80'o Lt	4'5	1'0 " 3'5 Clay To Refusal
59	100'o Lt.	5'0	1'0 Water 4'0 Soft Clay to Clay



WP N°256-63

DATE	REVISIONS & ADDITIONS	BY	CH'KD

DEPARTMENT OF HIGHWAYS - ONTARIO
PLANNING & DESIGN BRANCH

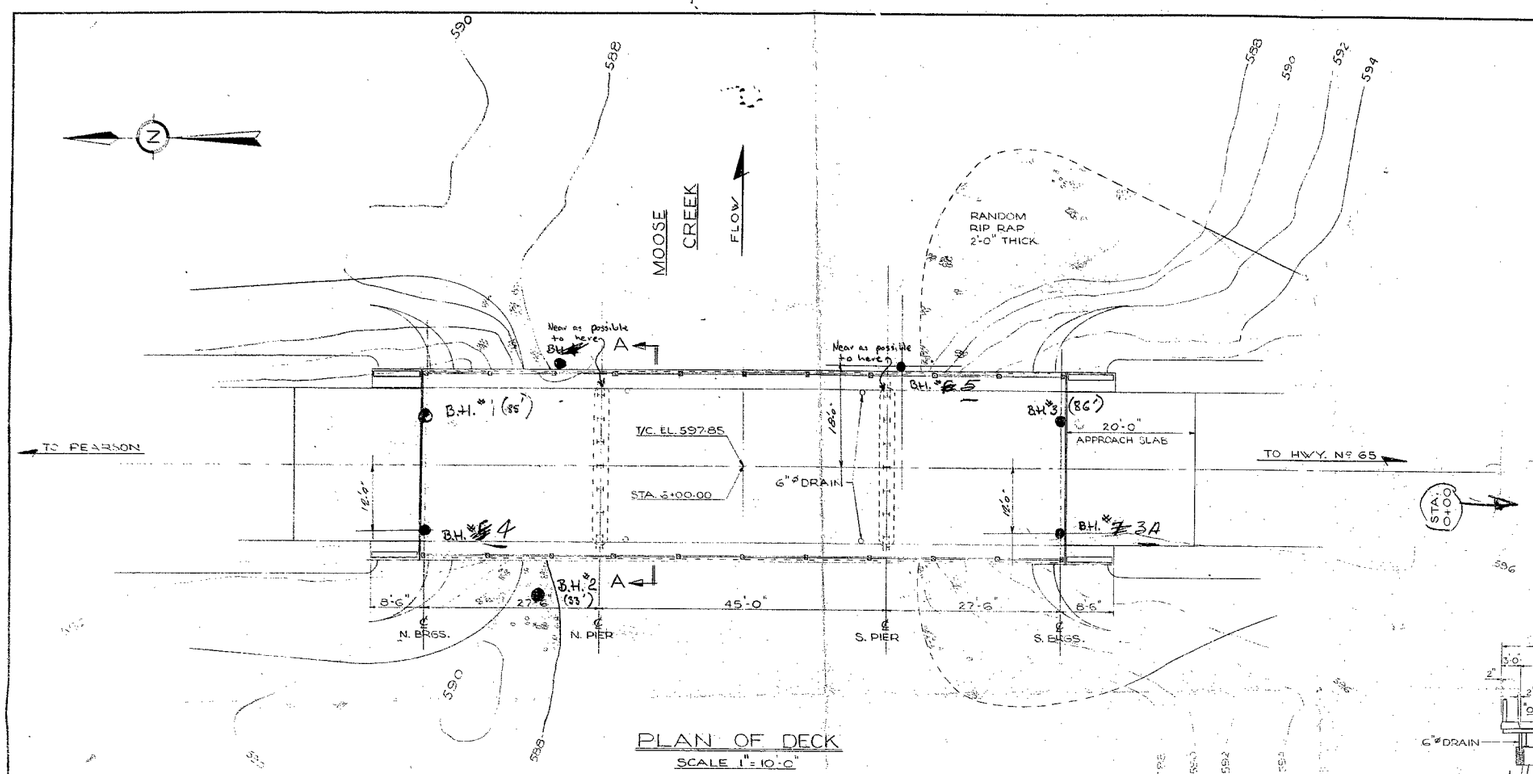
DISTRICT N° 14

PROPOSED CROSSING
AT
MOOSE CREEK
AND
CASEY TWP RD. (BRETHOUR RD)

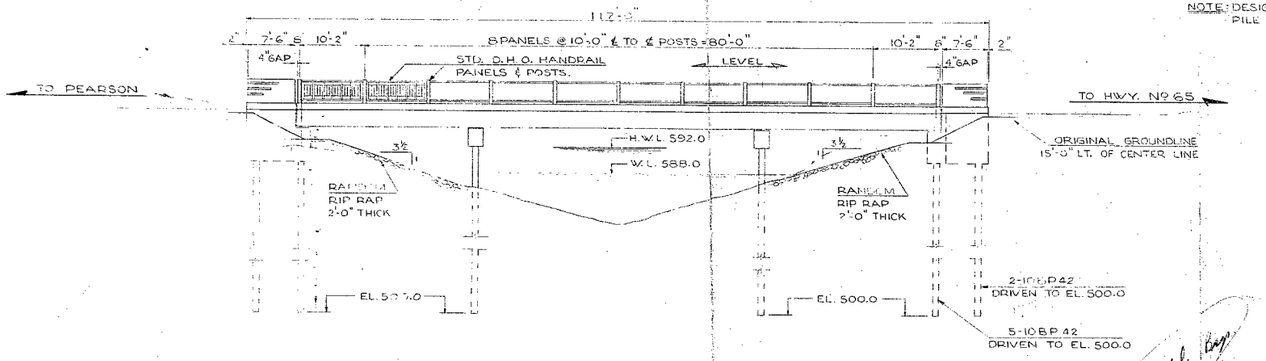
LOT 6 & 7 CON. III
TOWNSHIP OF CASEY DISTRICT OF TIMISKAMING

BRIDGE SITE

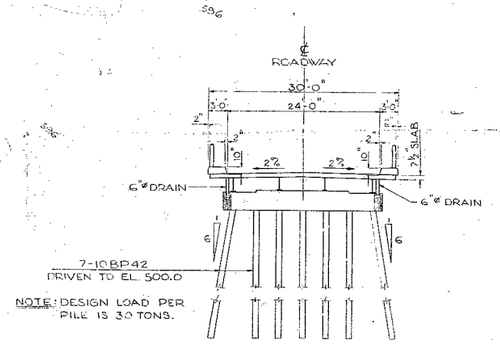
SURVEY BY CHIEF OF PARTY - N. MATHON SUPERVISOR - R. MADILL	APPROVED Director of Planning & Design
DRAWN BY DRAFTSMAN - W. PETRICK SUPERVISOR - D. GIOMETELLO	SCALE - AS SHOWN DATE OF SURVEY - JUNE 1963 DATE OF PLAN - JULY 1963
CHECKED BY DRAFTSMAN - D. BABBS SUPERVISOR - D. GIOMETELLO	W.O. N° 7018-63-521 KING NO. PLAN E-4217-1



PLAN OF DECK
SCALE 1"=10'-0"



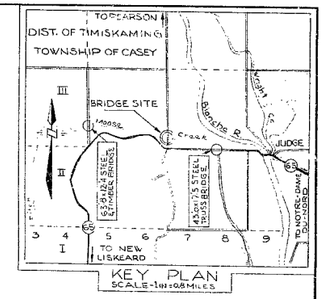
ELEVATION
SCALE 1"=10'-0"



NOTE: DESIGN LOAD PER PILE IS 30 TONS.

SECTION A-A
SCALE 1"=10'-0"

LIST OF DRAWINGS



KEY PLAN
SCALE-1in=0.8MILES

NOTES

TO ENGINEER

CONCRETE WORK ON THIS STRUCTURE MUST NOT BE COMMENCED UNTIL MONUMENTS TO FIX CONTROL POINTS HAVE BEEN ERECTED AND CHECKED BY THE ENGINEER.

TO CONTRACTOR

STRUCTURE TO BE BUILT IN ACCORDANCE WITH FORM No 9 AND THE SPECIAL PROVISIONS, EXTRA COPIES OF WHICH MAY BE OBTAINED FROM THE ENGINEER.

CONCRETE MIX

APPROVED ADMIXTURES SUPPLIED BY THE CONTRACTOR WILL BE ADDED TO ALL CONCRETE AS SPECIFIED BY THE ENGINEER. 3,000 P.S.I. AT 28 DAYS.

63-F-113 ADDITIONAL BORING DRILLING PROCEDURE

B.H. #4, #5, #6, #7: Varies to 40' in clay. Sampling at least 15' into dense stratum unless bedrock is encountered. Determine all soil boundaries and soil types.

REVISIONS

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

MOOSE CREEK BRIDGE

KING'S HIGHWAY No. TWP. RD. TO BRETHOUR DIST. No. 14
DIST. TIMISKAMING
TWP. CASEY LOT 6 & 7 CON. III

PRELIMINARY PLAN

APPROVED ..... BRIDGE ENGINEER

DESIGN	A. P.	CHECK	
DRAWING	R. E.	CHECK	
DATE	MAY 1964	LOADING	

SITE No. 60-63 W.P. No. 256-63
CONTRACT Nos.
DRAWING No. D-5446-P