

#62-F-1

W.P. # 246-61

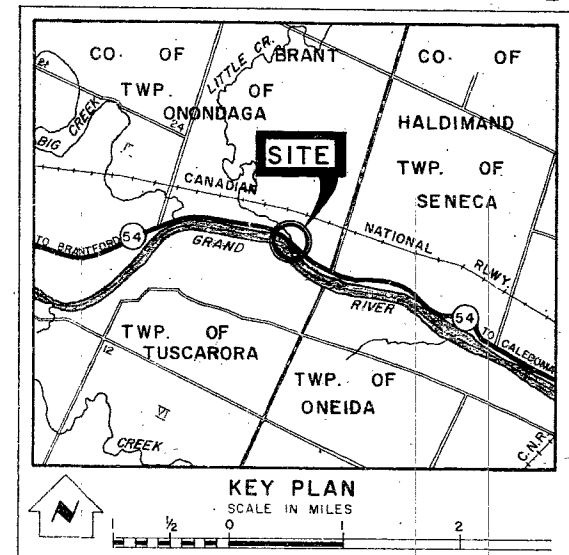
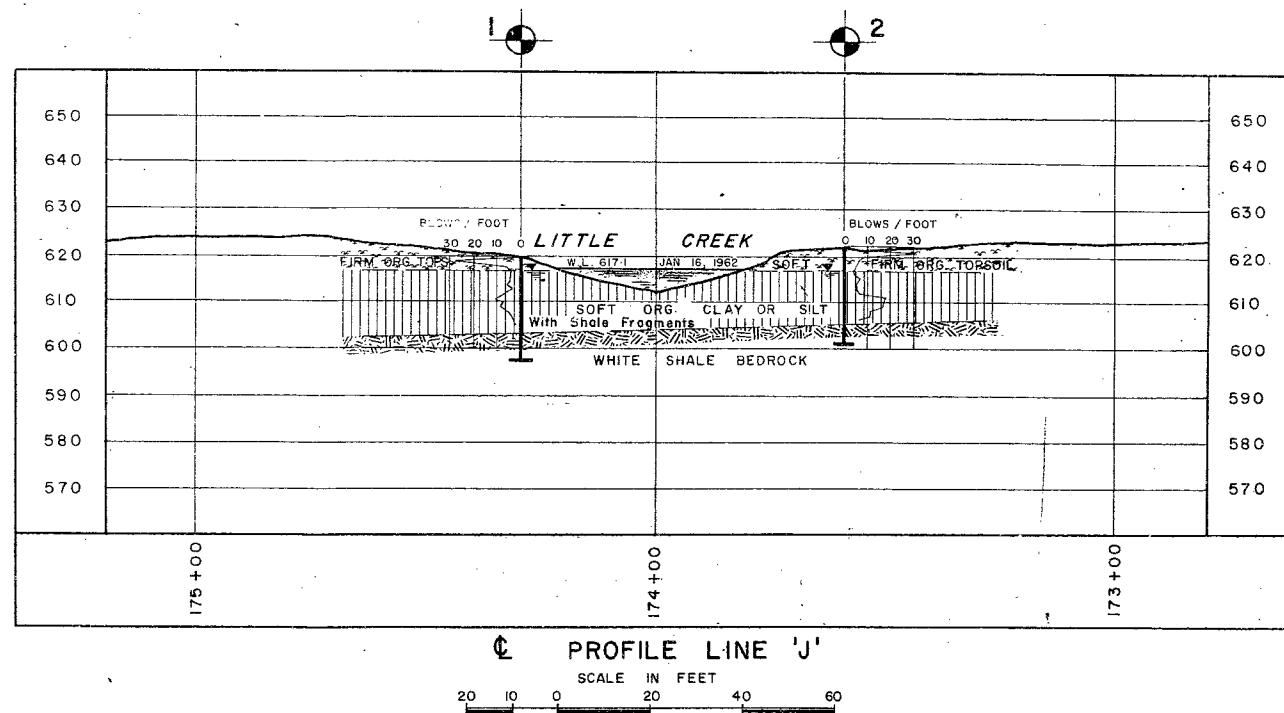
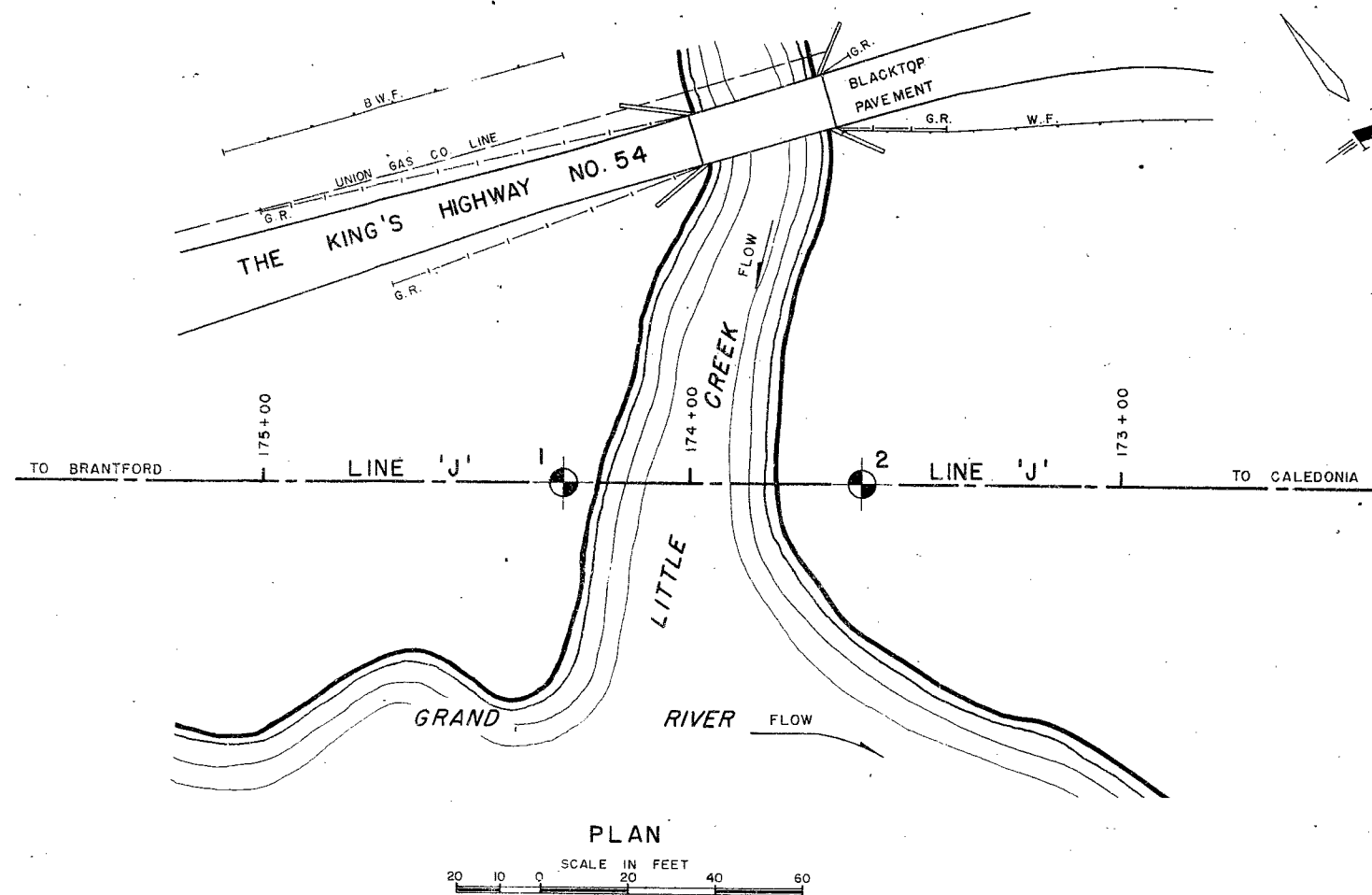
Hwy. # 54

CROSSING

LITTLE CREEK

4 MILES W. OF

CALEDONIA



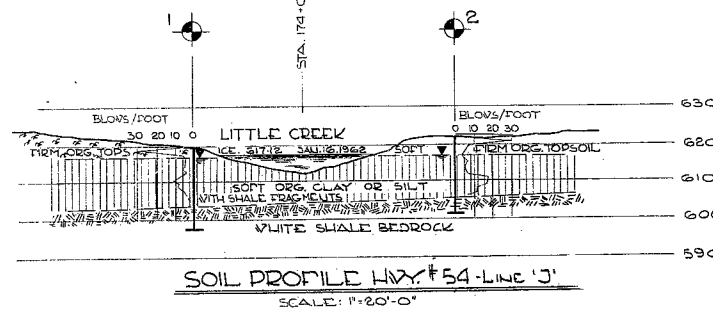
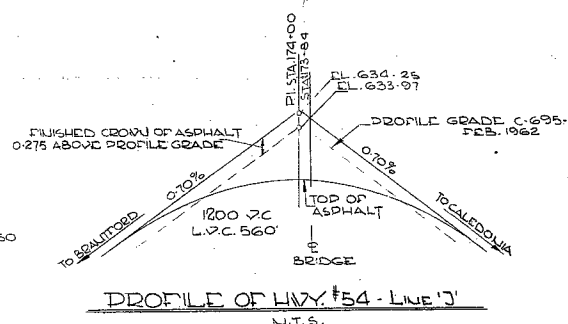
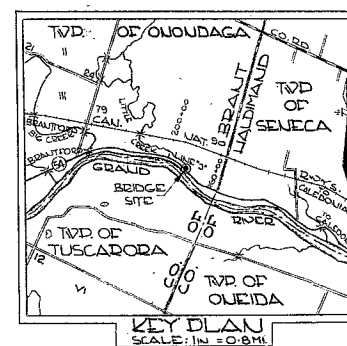
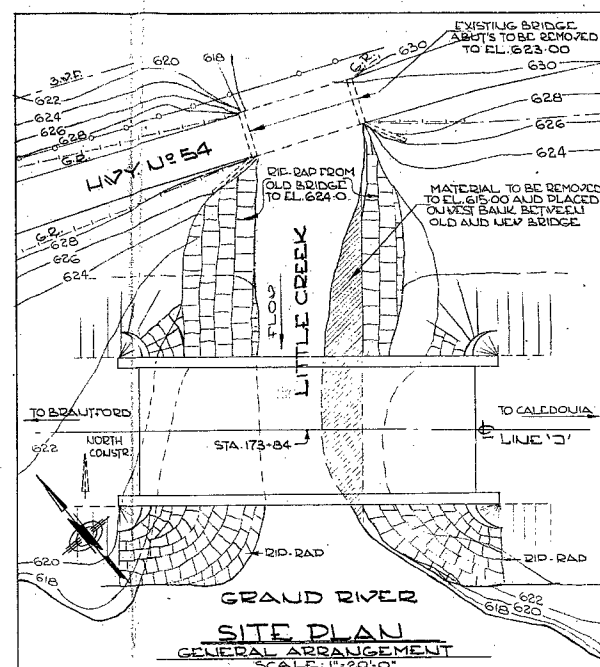
LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation		
NO.	ELEVATION	STATION	OFFSET
1	620.1	174 + 30	0
2	622.2	173 + 60	0

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.

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION			
LITTLE CREEK			
AND			
HIGHWAY NO. 54			
LINE 'J' REVISION			
ORIGINATED W. KULMATICAS	DISTRICT NO. 4	DATE	FEB. 19, 1962
DRAWN F. CLARK	W.P. NO. 246-61	JOB NO.	62-F-1
CHECKED <i>[Signature]</i>	CONTRACT NO.	DRAWING NO.	62-F-1A
APPROVED <i>[Signature]</i>			

REF. NO. E-4063-1

[illegible]

REVISIONS <table border="1" style="width: 100%; height: 100px;"> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </table>																															<div style="text-align: center; font-size: 2em; font-family: cursive;">OK</div> <div style="text-align: center; font-size: 1.5em; font-family: cursive;">W. K. R. T. W.</div> <div style="text-align: right; font-size: 2em; font-family: cursive;">JUNE 25-1962</div> <div style="display: flex; justify-content: space-between;"> <div>DATE </div> <div>BY </div> <div>DESCRIPTION </div> </div>

DEPARTMENT OF HIGHWAYS ONTARIO
 BRIDGE DIVISION

LITTLE CREEK BRIDGE

3.5 MI. WEST OF CALEDONIA

KING'S HIGHWAY No. 54 LINE 13'

DIST. No. 4

CO. BRANT

TWP. QUONDAGA

LOT. 87

CON. RIVER RANGE

PRELIMINARY PLAN

APPROVED _____		SITE No. <u>1-17</u>	W.P. No. <u>246-61</u>
DESIGN	BRIDGE ENGINEER	CONTRACT	
DRAWING	CHECK	Nos.	
<u>D.L.K.</u>	<u>E.A.</u>		
	CHECK		
	<u>D.L.K.</u>		
DATE	LOADING	DRAWING	
<u>MAY 1962</u>	<u>4 20</u>	No.	<u>D-5076-P1</u>
	<u>5-16</u>		

Gen. # 23-63-91

Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Division,
(Foundation Section)

April 4, 1962.

D.H.O. FOUNDATION INVESTIGATION
REPORT.
W.J. 62-F-1 -- W.P. 246-61.

Attention: Mr. S. McCombie.

Re: Proposed New Bridge - Hwy. #54 & Little Creek,
4 Miles West of Caledonia, Twp. of Caledonia,
County of Brant, District #4.

Attached, please find our detailed report on the
subsoil conditions existing at the above-mentioned structure
location.

We believe you will find the factual data and
recommendations contained therein, adequate for your future
design work. If further assistance is required in connection
with this project, please feel free to call on our Office.

AGS/MdeF
Attach.

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan
I. C. Campbell
J. C. Thatcher
T. J. Kovich
J. Roy
J. E. Gruspier
E. R. Saint
F. Norman
A. Watt
Foundations Office ✓
Gen. Files.

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FOUNDATION INVESTIGATION

For

Proposed New Bridge - Hwy. #54 and Little Creek,
4 Miles West of Caledonia
Township of Ononcaga, County of Brant,
District No. 4

W.J. 62-F-1 -- W.P. 246-61.

1. INTRODUCTION:

A request for a foundation investigation at the site of the proposed Hwy. #54 and Little Creek crossing, was received from the Bridge Location Section during December 1961.

At the above location, it is proposed to construct a new bridge to carry the realigned Hwy. #54 over Little Creek.

A field investigation was carried out by this Section in order to determine the subsoil conditions at the site. The results and discussion of the field work, together with conclusions and recommendations, are presented in this report.

2. DESCRIPTION OF SITE:

The site is located in flat open country on the shores of the Grand River.

The physiographic region is referred to as the Haldimand Clay Plains.

3. FIELD WORK:

Two sampled boreholes and two dynamic cone penetration tests were carried out at the site. Disturbed samples were recovered by means of a 2-inch O.D. split spoon. Five feet of

cont'd. /2 ...

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

bedrock core was taken in each borehole. Driving energy to advance the split spoon, and dynamic cone, was 350 ft. lbs. per blow. Relative densities of the subsoil were obtained in the field by means of the Standard Penetration Test. Samples recovered in the split spoon were used for visual inspection only.

4. SUBSOIL CONDITIONS:

4.1) General:

The stratigraphy of the soil at the site was found to be generally uniform. A detailed description of various soil types encountered during the investigation is shown in Appendix I of this report. The estimated stratigraphical profile shown on Dwg. No. 62-F-1A is based upon this information.

4.2) Firm Organic Topsoil:

This layer, approx. 3' thick, was found at the surface. It has a firm consistency and consists mostly of clayey silt containing organics. The layer has little constructional value and should be removed prior to placing of approach fills of less than 4' in height.

4.3) Soft Organic Clay or Silt (OI) with fragments of Shale:

This deposit extends to approximate el. 605.0 for a depth of about 13.0'. It consists of a mixture of soft organic clay or silt and shale fragments, the content of the latter increasing with depth to more than 50% below 7' in B.H. #1 and 12' in B.H. #2.

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

4.3) Soft Organic Clay or Silt (CI) with fragments of Shale:
(cont'd.)...

The average shear strength of this stratum of 400 lbs./sq.ft., was determined by in-situ field vane testing.

4.4) Bedrock:

The bedrock at the site consists of soft white shale. In both boreholes the top 2 to 3 feet of the bedrock was found to be in a weathered condition.

5. GROUND WATER CONDITIONS:

The ground water level, at the time of the investigation, was found to be 3 to 5 feet below existing ground elevation.

No artesian water conditions were encountered during the investigation.

It should be noted that the ground water around Caledonia contains a high amount of sulphur and a special sulphur resisting concrete should be used for footing and abutment construction.

6. DISCUSSION AND RECOMMENDATIONS:

As can be seen from the previously described soil stratigraphy, the soil consists of firm organic topsoil, underlain by soft organic clay containing shale fragments, followed by white shale bedrock. The bottom of the creek is at approx. el. 612.0. To provide for frost protection, the footings of the structure should be placed at least 5 ft. below the above-mentioned elevation; thus, the footing would rest only 6 ft. above bedrock. Therefore, it is recommended that the footing excavation be deepened and the

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

footings placed on bedrock. In this case, a safe load of 10 T/sq.ft. can be used for the design, provided the bedrock (shale) is sound. If there is a weathered layer, it should be stripped prior to the placement of concrete.

A dewatering scheme will be necessary as excavations will be carried out below creek or ground water table levels.

Based on the shear strength of the subsoil, no stability problems are anticipated for the proposed approach fills. However, it is likely that some slight settlements will occur under the embankments, and therefore, it is recommended that the material above a plane sloping at 2:1 back from the abutment footing base, be removed and replaced with suitable granular fill. It would also be preferable to allow a period of about 12 months to elapse before final paving. A flexible type of pavement is recommended because of the anticipated settlements.

Footings for the falsework may be placed on the ground surface. A safe load of 0.5 tons per sq. ft. may be employed.

7. SUMMARY:

(1) The stratification of the soil is quite uniform. The consistency of the material encountered varies from very soft to firm.

(2) Because of the shallow depth of rock, it is recommended that the abutment footings are placed on bedrock. A safe design load of 10 tons/sq.ft. can be employed.

cont'd. /5 ...

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

(3) A dewatering scheme will be necessary as excavations will be carried out below creek or ground water table levels.

(4) No stability problems are anticipated for the proposed approach fills. The organic material should be removed behind the abutment footing base above a plane sloping back at 2:1, and replaced with suitable granular fill.

(5) A flexible type of pavement is recommended because of the anticipated settlements. The final pavement operations should be carried out after a period of 12 months has elapsed.

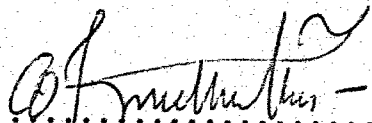
(6) Footings for the falsework may be placed on the ground surface. A safe load of 0.5 tons per sq. ft. may be employed.

8. MISCELLANEOUS:

The field work was carried out during the period of January 15, 1962 - January 18, 1962. Equipment used was owned and operated by Dominion Soil Investigation, Ltd., under the supervision of Mr. W. W. Kulmatickas, Foundation Section.

April 1962.

REPORT PREPARED BY:


.....
W. W. Kulmatickas,
PROJECT FOUNDATION ENGR.

REPORT APPROVED BY:


.....
K. G. Selby,
SR. PROJECT FOUNDATION ENGR.

APPENDIX I.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 62-P-1 LOCATION 173/60 ORIGINATED BY W.W.K.
W.P. 246-61 BORING DATE Jan. 18, 1962. COMPILED BY H.S.
DATUM 622.2 BOREHOLE TYPE Washhole, BX Casing. CHECKED BY W.W.K.

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		20	40	60	80	100	200	400	600		
622.2	Groundlevel					625.0										
0.0	Topsoil															
619.2	Med. stiff organic clay - silt.															
3.0																
	Soft organic clay or silt.		1	S.S.	3	615.0										
	Dark coloured															
	Contains about 50% shale fragments below 12.0'		2	S.S.	2											
605.7			3	S.S.	7	605.0										
16.5	White shale to rock															
	Bedrock															
600.7																
21.5	End of borehole.															

Waterlevel in borehole

617.0'

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
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL

Mr. G. K. Hunter,
Sr. Project Design Engr.,
Regional Office, Toronto.
Attention: Mr. J. G. Celmins.

Mr. A. G. Stermac,
Principal Foundation Engr.,
Foundation Section,
Materials & Research Division.
October 19, 1962.

Re: W.P. 246-61, Highway 54, Little Creek
Bridge and Approaches, District 4.

We have received your memo dated October 18th, 1962, and have noted your comments on the extra cost of delaying the paving for the suggested period of 12 months.

In view of the apparent high cost and inconvenience involved in delaying the work for this period, it seems that it would be more economical for the Department to follow a procedure which might result in a minor maintenance problem. We do not anticipate settlements due to consolidation to be more than 2 - 3 inches. In any event, we recommend that the paving be delayed for as long a period as is possible without extra cost to the Department.

KGS/WdeF

cc: Messrs. M. Stoyanoff
J. L. Keen
R. Britton

Foundations Office ✓
Gen. Files.

K. G. Selby
K. G. Selby,
SR. FOUNDATION ENGR.
For:

A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

Toronto Regional Road Design Office,
Parliament Buildings, Toronto.
October 18, 1962.

Memorandum for:
Mr. A. Starnac,
Principal Foundation Engineer,
Materials & Research Section,
Lab Bldg. Downsview.

Att: Mr. K. S. Galby, Sr. Foundation Engineer

Re: W.P. 246-61. Highway 54, Little Creek
Bridge and Approaches. District 4.

With reference to your memo of July 9, 1962, addressed to Mr. A.M. Toye, Bridge Engineer, and our telephone conversation, we are quoting an excerpt from this memo: "In view of the fact that settlements are likely to occur under the proposed embankments, we recommend that final paving of the approaches be postponed for a period of about 12 months".

We would like to add that, besides the pavement, the settlement of fills will also affect:

- a) the approach slabs;
- b) the curb and gutter which is to be placed for 200' at both ends of the structure;
- c) four catchbasins which are to be installed in concrete setbacks at the ends of the curb and gutter sections, including 12" corrugated iron pipe outlets down the approach fill slopes;
- d) the total of 800' of steel beam guide rail which is proposed for the length of 200' at each end of the structure.

In line with your recommendations, all above noted items along with the paving of approaches would have to be taken out of the contract, as the contractor cannot be expected to wait until the next construction year to come back to complete the work.

To have the work on the approaches completed, there are the following possibilities:-

- 1) To do the work by District day labour forces.

The District has objected to this because of the large amount of work involved.

- 2) To call a separate contract (by invitation bid).

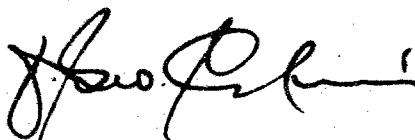
This is a very expensive way to do the work in view of the small size of the contract.

- 3) To include the work in another contract that is in progress in the area.

This may be possible in this case, but the nearest contract will be 12 miles away, and the contractor's inconvenience will be reflected in a higher price.

In view of the inconvenience and extra cost which will be caused by breaking up the contract, we cannot readily agree with your recommendation as a solution for the prevention of bumps at structures, at least not in this case. The height of the approach fills will not exceed 10', and the subsoil conditions under the approaches do not indicate an unusual compressibility.

We would appreciate your further comments and an estimate of the expected settlement of the approach fills in the first year and thereafter.



J. G. CELMINS.
Project Design Engineer.
for.
G. K. HUNTER.
Senior Project Design Engineer.

JGC:SG

c.c. M.Stoyanoff.
J.L.Keen.
R.Britton.

62-F-1



ONTARIO
DEPARTMENT OF HIGHWAYS

Bridge Division

Memo to Mr. A. Stermac Date June 19, 1962
Principal Foundation Eng.
Room 107, Lab. Bldg. Subject Little Creek Bridge
From F. DeVisser 3.5 Miles W. of Caledonia
W.P. 246-61 Hwy. 54 Dist. 4

Attached please find one print of our preliminary plan D 5076-P1 for the Little Creek Bridge. If you have any comments please let us know.

F. DeVisser

FDeV/et

F. DeVisser,
Bridge Location Engineer.

173 + 64
174 + 04

Letter sent to J. L. Keen
July 10th 1962

K. L. Keen

Copy for the information of

Mr. K. Selby,
Materials & Research Section,
Lab. Building,
DOWNSVIEW, Ontario.

Mr. M. Stoyanoff,
Bridge Contract Engineer,
Administration Building.

Noted
K. L. Selby
J. L. Keen
Sr. Bridge Project Engineer

August 30, 1962

Little Creek Bridge, W.P. 246-61
Hwy. #54, District #4.

Along with this memo is a copy of a memo I received from Mr. K. G. Selby of the Foundations Section. Mr. Selby recommends that the organic material in the stream bed be replaced with a suitable granular for a depth of about six feet, prior to driving the piles. The extent of the replacement is indicated in the memo from Foundations Section. This is to provide more lateral support for the pier piles and improve the stability of the forward slopes of the embankment. These recommendations have been made by the Foundations Section in the light of past experience with a similar type of structure and similar subsoil conditions (15 Mile Creek). I suggest that these recommendations be adopted and provided for in the final contract.

The memo from the Foundations Section also recommends that the paving of the approaches be postponed for a period of about 12 months to provide sufficient time for the embankment to settle. Would you consider this point when writing your B4 and special provisions.

Temporary bracing of the pile bents is recommended during the construction of the bridge. The bracing will be required during two stages of construction. The piles should be braced along both axis of the pier bent until the time the pier cap is completed.

RE: Little Creek Bridge, W.P. 246-61.

After the completion of the pier bents and until the precast concrete deck units are placed the pier bents should be braced in the longitudinal direction of the bridge to ensure that the correct spacing and position is maintained. This has not been shown on the drawings, but should be provided for in the special provisions.

JLK/rt

J. L. Keen,
Senior Bridge Project Engineer.

c.c. G. Celmins
K. Selby
W. Melinyshyn

Mr. A. M. Towe,
Bridge Engineer.
Materials & Research Division,
(Foundation Section)
Attention: Mr. J. L. Keen.

July 9, 1962.
REVIEW OF PRELIMINARY PLAN -
D-5076-P1. Little Creek Bridge,
Hwy. #54, District #4,
W.P. 246-61.

We have reviewed your Preliminary Plan D-5076-P1,
for the above structure and submit the following comments:-

The present proposals call for a three span structure with the abutments supported on piles driven through the 15 feet high approach fills to bedrock, and piers consisting of vertical piles driven to bedrock and capped at bridge seat level. Subsoil consists of about 15 to 18 feet of soft organic clay or silt, with shale fragments. We believe that the proposed embankments will be stable, but in the light of past experience with a similar type of structure and similar subsoil conditions (15-Mile Creek), we feel that measures should be taken to provide more lateral support for the pier piles. We therefore recommend that prior to constructing the approach embankments, the organic material in the stream bed for a depth of about 6 feet should be removed and replaced with suitable granular fill. This procedure should be carried out from Sta. 173+64 to Sta. 174+04 for a width of about 25 feet each side of Centre Line. This measure, if carried out, will not only provide more lateral stability for the pier piles, but will also improve the stability of the forward slopes of the proposed embankments.

In view of the fact that settlements are likely to occur under the proposed embankments, we recommend that final paving of the approaches be postponed for a period of about 12 months.

If you have any further queries in connection with this matter, please contact this Office.

KGS/MdeF

cc: Foundations Office ✓
Gen. Files.

K. G. Selby,
SR. FOUNDATION ENGR.
For:

A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.