#69-F-64

W.P. 60-68-04

H.W.Y. #104 LINE 'A'

LYONS CREEK

MULTI-PLATE ARCH

CULVERT

(CAM. 107-68 Orig.) 284

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. T. J. Kovich,
Regional Materials Engineer,
Central Region,
Room 134-A, Lab. Bldg.

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

Attention:

Date: December 22, 1969

Our File Ref.

In reply to JAN - 5 1970

Subject:

FOUNDATION INVESTIGATION REPORT
For
Proposed Multi-Plate Arch Culvert
At the Crossing of
Hwy. #140 and Lyons Creek
Twp. of Crowland, County of Welland
District No. 4 (Hamilton)
W.J. 69-F-64 -- W.P. 60-68-04

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

We believe that the factual data and recommendations contained therein, will prove adequate for your design requirements. Should additional information be required, please do not hesitate to contact our Office.

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

AGS/MdeF
Attach.

cc: Messrs. T. J. Kovich (2)
B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
G. K. Hunter (2)
H. Greenland
W. S. Melnyshyn
Proctor and Redfern, Consulting Engineers
B. A. Singh
Foundations Files
Gen. Files

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1. INTRODUCTION:

The Foundation Section was requested to carry out a subsurface investigation at the aforementioned location, where a multi-plate arch culvert is proposed. The request was contained in a memo from Mr. T. J. Kovich, Regional Materials Engineer, Central Region, dated August 5, 1969. The plan (No. B-190-11) and profile (No. C-190-8)were provided by Mr. G. E. Smith of Proctor and Redfern Limited, Consulting Engineers, Toronto, Ontario (correspondence dated November 17, 1969).

Subsequently, a foundation investigation was carried out at the proposed site to determine the subsoil and groundwater conditions.

This report contains the results of the investigation, together with recommendations pertaining to the installation of the culvert, as well as the stability and settlement of the associated approach fills.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The centre-line of proposed Hwy. #140 (Line 'A') crosses Lyons Creek about 50 feet east of Moore Road, in the Township of Crowland, County of Welland. The creek valley is approximately 16 feet deep with a floodplain about 100 to 150 feet wide. The valley banks, which are covered with light vegetation, are quite flat with the slopes varying from approximately 5:1 to 8:1. The westerly flowing creek meanders along the floor of this valley; at the time of the investigation it was about 60 to 70 feet wide

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

and 2 to 3 feet deep - i.e., the water level was at about elevation 570. The surrounding terrain is being utilized as farm land.

A 35-foot long, single-span structure carries Moore Road over Lyons Creek. The deck elevation of this structure is between 573 and 574; the associated approach embankments are approximately 4 to 5 feet in height.

Physiographically, the site is situated in the region known as the "Haldimand Clay Plain". In this area the subsoil consists of extensive, mainly glacial-lacustrine deposits, laid down in glacial Lake Warren during the Wisconsin Period. These deposits are composed of stratified silts and clays, and are generally underlain by a basal glacial till sheet, which in turn, is followed by shale and limestone bedrock.

3. SUBSOIL CONDITIONS:

3.1) General:

Two sampled boreholes, both of which were accompanied by a dynamic cone penetration test, were put down at the site using standard diamond drilling rigs adapted for soil sampling purposes. The data obtained was supplemented by putting down four shallow hand auger holes to define the vertical and lateral extent of any surficial organic deposits that may be present on the valley floor.

The locations and elevations of all the borings were surveyed in the field by personnel from this Section. This information is shown on Drawing 69-F-64A, together with an estimated stratigraphical profile across the site. All elevations are referenced to a Geodetic datum.

The results of the laboratory testing, carried out on representative samples of the overburden, are shown on the Borelog sheets located in Appendix I of this report. The consolidation characteristics of the cohesive stratum are summarized on Figure #1.

..... 3

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

3.1) General:

The predominant stratum across the site is composed of a hard to stiff silty clay to clayey silt; in this area it is greater than 60 feet in depth. Along the floodplain of the creek the cohesive stratum is overlain by up to 4.5 feet of alluvium with related organic matter. The stratum is known to be underlain by a competent basal glacial till followed, in turn, by bedrock.

The boundaries between the various deposits, as determined at the boring locations, are shown on the accompanying borehole sheets. A stratigraphical section, inferred from the data, is shown on Drawing 69-F-64A.

From ground surface downwards, the various soil types encountered are as follows:

3.2) Surficial Deposits - Fill and Organic Material:

B.H. #1 was put down through the existing approach embankment along Moore Rd. At this location 5.5 feet of fill, composed of a hard grey-brown clayey silt, with sand and gravel and rock fragments throughout, was encountered.

At some locations on the valley floor, as well as beneath the fill at B.H. #1, a floodplain deposit, 1 to 4.5 feet thick, is present; it is composed of a firm grey clayey silt with organic matter.

3.3) Silty Clay to Clayey Silt:

The surficial deposits are underlain by the predominant stratum across the site, which is composed of a hard, decreasing with depth to stiff, reddish-brown silty clay to clayey silt, with a trace of sand and gravel. This stratum has a plasticity in the low to intermediate range. The silty clay to clayey silt was not penetrated at either of the borings put down; it was, however, proven to extend for a depth of 58 feet at B.H. #1. Occasional seams and partings of silt, up to 1/4 inch thick, were encountered

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

3.3) Silty Clay to Clayey Silt: (cont'd.) ...

throughout. At B.H. #1 layers of silt, up to 3 inches thick, are present below about elevation 513.5.

The physical properties of the stratum, as determined by the field and laboratory testing carried out, are summarized in tabular form below:

Identity Tests	Desiccated Zone (Upper 20 to 25 feet of Stratum) Range	(Average)	Lower Zone Range	(Average)
Liquid Limit (W_L) (%)	32 & 39	Two Tests	27 - 41	(32)
Plastic Limit (W_P) (%)	18 & 21	Two Tests	17 - 22	(19)
Natural Moisture Content (W) (%)	16 & 15	Two Tests	20 - 38	(28)
Liquidity Index (I_L)	Negative	Two Tests	0.2 - 1.1	(0.6)
Consolidation Characteristics				
Initial Void Ratio (e_o)	-	Two Tests	0.52 - 0.85	
Compression Index (C_c)	-	Two Tests	0.08 - 0.30	
Degree of Preconsolidation (p.s.f.) ($P_c - P_o'$)	-	Two Tests	4,000	
Undrained Shear Strength (C_u) (p.s.f.)	>2,000		>2,000 - 900	
Standard Penetration Tests ('N') (Blows/ft.)	25 - 103	(37)	19 - 37	(22)

..... 5

4. GROUNDWATER CONDITIONS:

Groundwater level observations have been carried out, during the period of the investigation, in the open holes. These observations are recorded on the Borelog sheets and summarized on Drawing 69-F-64A. The results of the measurements indicate that, at the time of the investigation, the piezometric groundwater level within the overburden deposits is between elevations 269 and 270 - i.e., some 1 to 4 feet below ground level. These elevations correspond closely to the creek water level.

5. DISCUSSION AND RECOMMENDATIONS:

5.1) General:

The centre-line of proposed Hwy. #140 (Line 'A') is to cross Lyons Creek about 50 feet east of Moore Rd.; the site is located in the Township of Crowland, County of Welland. It is understood that Lyons Creek will be carried beneath Hwy. #140 in a multi-plate arch culvert approximately 7 feet high, 11 feet wide and 118 feet in length. The profile grade of Hwy. #140, in the vicinity of the creek, will be between elevations 583 and 584. At this elevation the associated approach fills will have a maximum height of 15 feet above the existing creek bottom.

The predominant stratum across the site is composed of an extensive deposit of hard to stiff, with depth, silty clay to clayey silt. On the valley floor this stratum is often overlain by a deposit composed of clayey silt with organic matter. The thickness of this material varies randomly from 1 to 4.5 feet.

5.2) Culvert Installations:

The silty clay to clayey silt stratum would provide a competent bearing stratum for the pipe-arch culvert. The surficial 1 to 4.5 feet thick floodplain deposit (clayey silt with organics), located on the valley floor, should, however, be subexcavated within the plan limits of the culvert. The culvert should be constructed on a well compacted granular pad with a minimum thickness of 12 inches.

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

5.2) Culvert Installations: (cont'd.) ...

The culvert should be surrounded with well compacted granular backfill. The geometry of this zone and placement techniques should conform to D.H.O. specifications, namely, Standard No. DD-808-A.

The placement and compaction of the granular pad beneath the culvert, as well as the installation of the culvert, should be carried out in the dry. This could be accomplished by temporarily diverting the creek. Any surface run-off or groundwater seepage occurring in the construction area could be handled using standard methods, such as pumping from sumps.

5.3) Approach Fills:

In order to improve the stability and minimize settlement of the approach fills, it is recommended that the surficial organic deposit, encountered along that portion of the approaches, which will be located within the confines of the existing creek valley, be subexcavated. This subexcavation should be carried out within the plan limits of the embankment section, in accordance with current D.H.O. Standards. The subexcavation so formed, should be backfilled with locally available granular material to at least 1 foot above the prevailing groundwater level. Above this level the fill can consist of any suitable material.

As discussed previously, the maximum height of approach fills will be of the order of 15 feet. No stability problems are anticipated for fills of this height, with 2:1 slopes.

Settlement of the cohesive foundation subsoil will take place due to the embankment surcharge loading. The induced stress will be significantly less than the degree of preconsolidation of the stratum. The settlement will, therefore, be of a recompression nature. Computations carried out, indicate that the maximum expected settlement, occurring beneath the centre-line of the highest

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

5.3) Approach Fills: (cont'd.) ...

fill heights, will be of the order of 3 inches. The majority of this settlement will be realized within 1 year following placement, with approximately 50 percent occurring within 3 months.

If it is deemed that a differential settlement of this magnitude would detrimentally affect the performance of the culvert, the culvert should be constructed with a camber of 3 inches.

In the vicinity of the creek the base of the approach fills should be protected against scour; this protection should extend above the high water level of the river.

6. MISCELLANEOUS:

The field work for this project was carried out during the period of December 4 to 6, 1969, under the supervision of Mr. B. T. Darch, Senior Foundation Engineer, who also prepared this report.

The equipment used was owned and operated by Penninsula Soils Investigation Ltd., Welland, Ontario.

This report was reviewed by Mr. M. Devata, Supervising Foundation Engineer.

December 1969

APPENDIX I

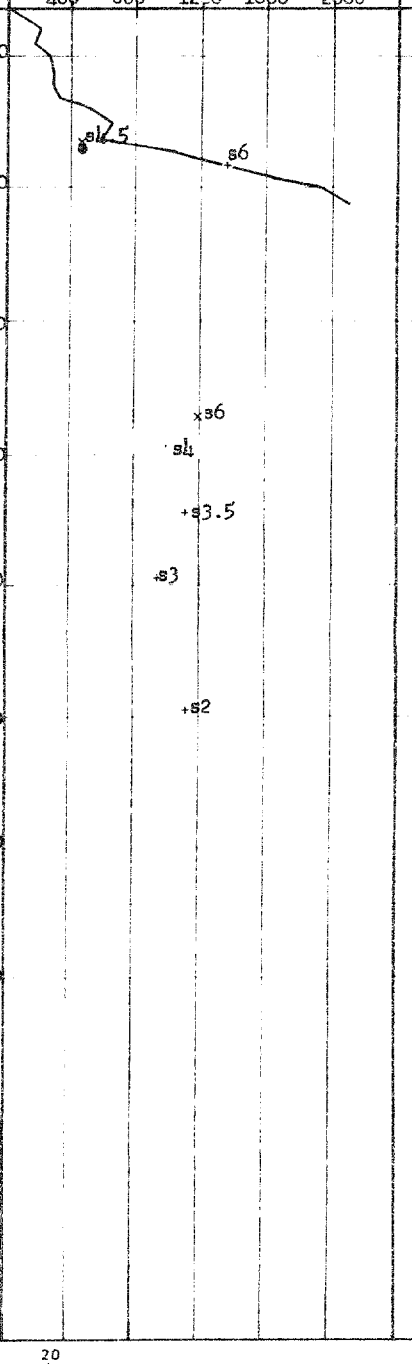
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

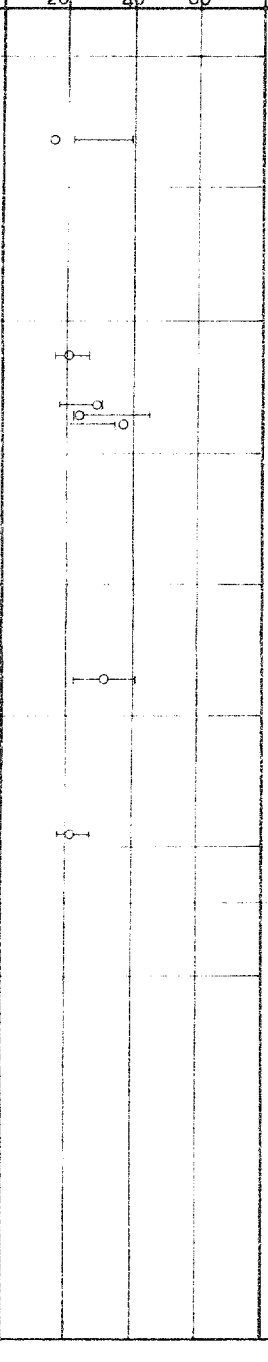
RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 69-F-64 LOCATION 342+23 51' Lt. ORIGINATED BY BTD
W.P. 60-68-04 BORING DATE December 4, 5 and 6, 1969 COMPILED BY BTD
DATUM Geodetic BOREHOLE TYPE Washboring -NX Casing, Dynamic Cone Penetration Test CHECKED BY

ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
573.5	Ground Level				
0.0	Clayey Silt, trace of sand and gravel, occ. rock fragments (FILL) (Grey Brown) HARD		1	SS	49
568.0					
5.5	Clayey silt, with related org. matt, wood chips etc. FIRM		2	TW	PM
563.5			3	TW	PM
10.0	Silty Clay to Clayey Silt trace of sand and gravel (occasional partings and seam of silt up to 1/4" thick) (Mottled Brown to Reddish Brown) Hard to Firm		4	SS	34
			5	SS	19
			6	SS	27
			7	TW	PM
			8	TW	PM
			9	TW	PM
			10	TW	PM
513.5			11	TW	PM
60.0	(Layers of silt up to 3" thick)		12	SS	60
505.5	Hard		13	SS	120
68.0	End of Borehole				





BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
	▼ 569.5
	W.L. in Open BH Dec. 6/69
117	
C / 116	
115	

20
15 ⊹ 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 69-F-64 LOCATION 342+86 3' Lt. ORIGINATED BY BTD
W.P. 60-68-04 BORING DATE December 5 and 6, 1969 COMPILED BY BTD
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing, Dynamic Cone Penetration Test CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT
570.5	Ground Level				
0.0	Top Soil		1	SS	2
1.0	Silty Clay to Clayey Silt, trace of sand and gravel (occasional partings and seams of silt up to 1/4" thick through out) (Mottled Brown to Reddish-Brown) Hard to Stiff		2	SS	25
			3	SS	103
			4	SS	56
			5	SS	35
			6	SS	30
			7	SS	37
			8	SS	19
			9	TW	PM
523.5			10	SS	27
47.0	End of Borehole				

ELEV SCALE: 570, 560, 550, 540, 530, 520

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
400 800 1200 1600 2000

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

BULK DENSITY γ P.C.F.: C / 132

REMARKS: GR.SA.SI.CL.
570.
W.L. in Open BH Dec 6/69

20
15 — 5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3,4,5 & 6

FOUNDATION SECTION

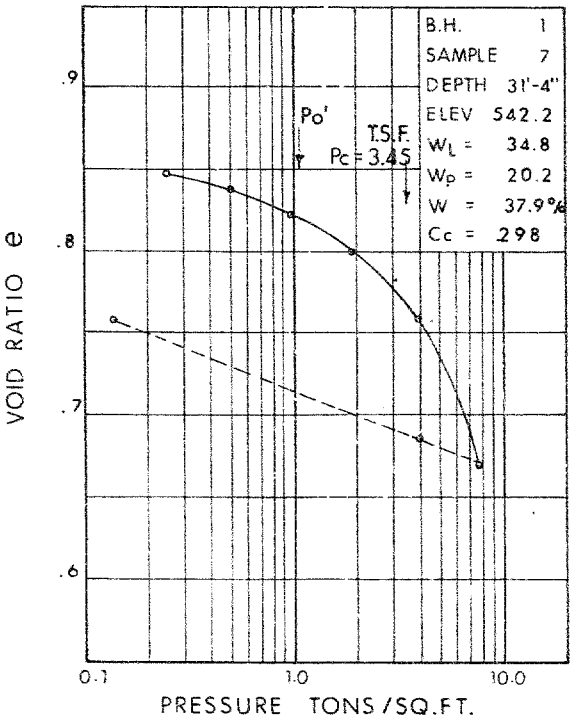
JOB 69-F-64 LOCATION See BELOW ORIGINATED BY BTD
W.P. 60-68-04 BORING DATE December 6, 1969 COMPILED BY BTD
DATUM Geodetic BOREHOLE TYPE Hand Auger Holes CHECKED BY

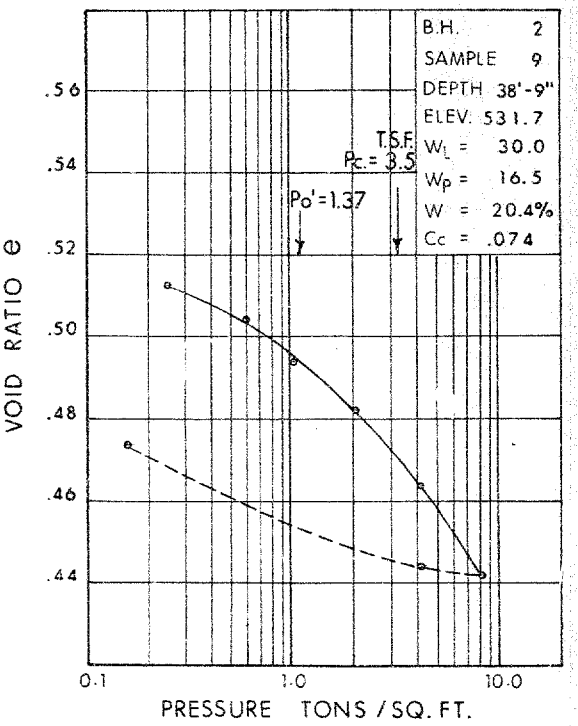
ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE	LIQUID LIMIT w_L — PLASTIC LIMIT w_P — WATER CONTENT w — WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
							NO.3 342+64 29' Lt.			
570.5	Ground Level									
0.0										
569.5	TopSoil (Clayey)									
1.0	Clayey Silt, with re-									
568.0	lated organic matter									
2.5										
567.0	Silty clay to clay silt									
3.5	End of Borehole									
							NO.4 343+10 25' Rt.			
570.5	Ground Level									
0.0										
569.5	Topsoil (Clayey)									
1.0	Silty clay to									
567.5	clayey silt									
3.0	End of Borehole									
							NO.5 341+84 18' Rt.			
570.5	Ground Level									
569.5	Topsoil (Clayey)									
1.0	Clayey Silt, with re-									
568.0	lated organic matter									
567.5	Silty clay to clay silt									
3.0	End of Borehole									
							NO.6 341+69 18' Rt.			
570.5	Ground Level									
569.5	Top Soil (Clayey)									
1.0	Silty Clay to									
567.5	Clayey Silt									
3.0	End of Borehole									

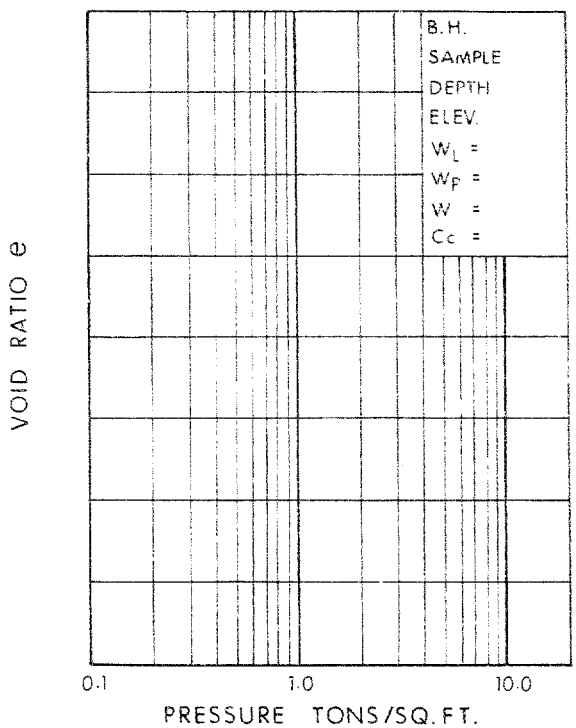
20
15 5 % STRAIN AT FAILURE
10

VOID RATIO – PRESSURE CURVES

JOB NO. 69 - F - 64







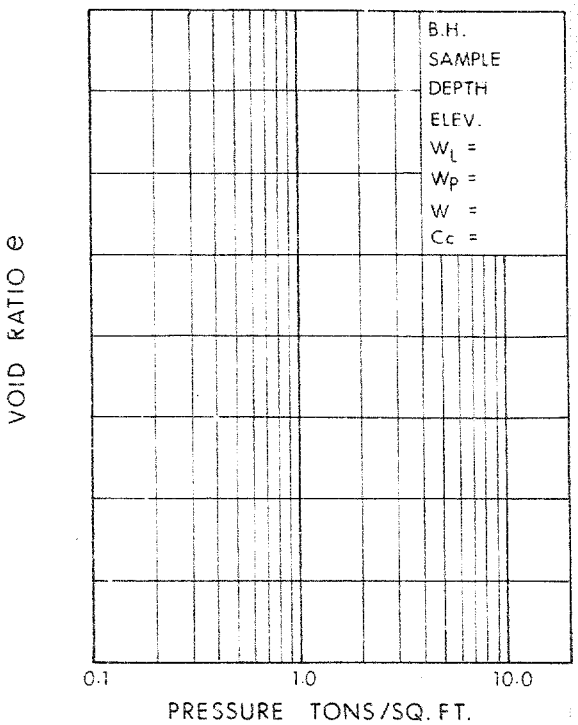


FIG. 1

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, OR FRICTION
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR 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
$\log_e a$ 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 (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

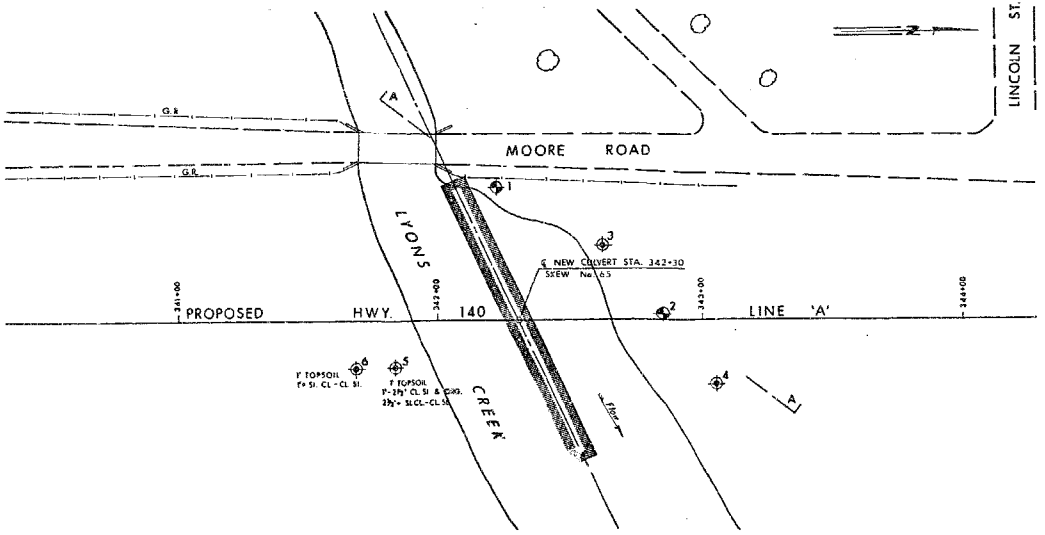
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

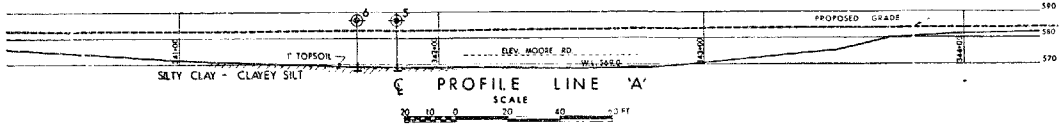
FOUNDATIONS

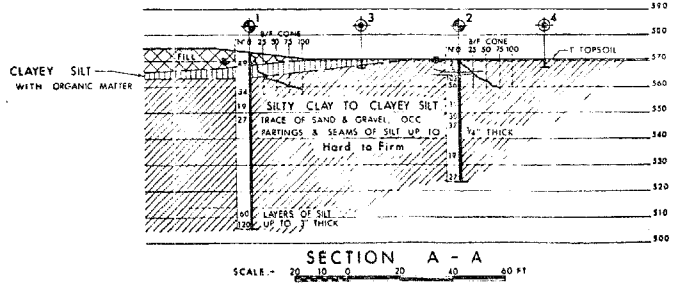
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

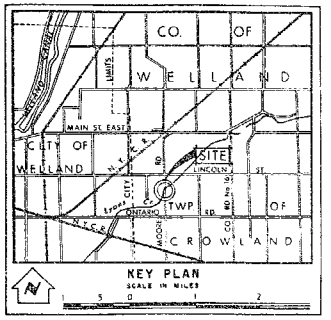
SLOPES

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









LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation. DEC 1969
- Hand Auger Hole

NO.	ELEVATION	STATION	OFFSET
1	573.5	342+23	51' LT
2	570.5	342+86	3' LT
3	570.5	342+64	29' LT
4	570.5	343+10	25' RT
5	570.5	341+84	18' RT
6	570.5	341+69	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

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE - FOUNDATION SECTION

LYONS CREEK

KING'S HIGHWAY NO. 104 LINE 'A' DIST. NO. 4
CO. WELLAND
TWP. CROWLAND LOT 16 CON. 5

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D. B.T.D.	CHECKED	W.P. NO. 60-68-04	M & T. DRAWING NO. 69-F-64A
DRAWN A.N.	CHECKED	JOB NO. 69-F-64	
DATE DEC. 15, 1969		SITE NO.	BRIDGE DRAWING NO.
APPROVED		CONT. NO.	

Proctor & Redfern Limited
Consulting Engineers
75 Eglinton Avenue East
Toronto 12, Ontario
Telephone (416)487-1171

Let me about it
Please.
Don

69-F-64

17 November 1969 Project E.O. 69210

Mr. A.G. Stermac
Principal Foundation Engineer
Department of Highways Ontario
Lab Building
Downsview, Ontario

Attention Mr. S.M. Devata

Dear Sir

W.P. 60-68-04 Highway No. 140
From Townline Road Northerly to East
Main Street (Welland)

Enclosed, please find a partial plan and profile in the vicinity of the Lyon's Creek Crossing of the new highway. We have marked the profile grade on the profile in red and we have also shown a tentative location for the new culvert on both the plan and the profile at Station 342+30.

We have assumed that the 11'x7' steel pipe arch culvert recommended in the hydrology report will be used.

The centerline for this project was recently staked out by our field parties and should be easy to locate.

We trust that this is all of the information that you will require in order to carry out your foundation investigation at this site. Should you require any additional information please do not hesitate to call us.

Yours very truly

Proctor & Redfern Limited

Gordon E. Smith

G.E. Smith, P. Eng.

GES/lb
Encl.

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

Hunter

69-F-64

Telephone: 248-3415

Toronto Regional Road Design Office,
DOWNSVIEW, November 14, 1969.

Proctor & Redfern Limited,
Consulting Engineers,
75 Eglinton Ave. E.,
TORONTO, Ontario.

Attn: Mr. G. Smith, P.Eng.

Re: W.P. 60-68-4, Highway 140,
Crossing Lyons Creek.

Dear Sir:

The enclosed Hydrology Report, prepared by the Department's Bridge Office, recommends a 11.0' x 7.0' C.M.P.A. or equivalent (Alternative III) for Lyons Creek. Although the 45° skew matches the axis of the flood plain, our Hydrology Branch agrees that it can be considerably reduced if the discharge of the pipe is dissipated in the pond before it scours a bank.

Our Foundations Branch is prepared to perform a foundations investigation at this site upon receipt of your plan and profile.

Upon completion of your design and drawings at this site, it is essential that plans be forwarded so that the approval of the Bridge Hydrology Section, the St. Lawrence Seaway Authority, and the Niagara Peninsula Conservation Authority be obtained.

Yours very truly,

A.G. Kelly
Sr. Project Design Engineer
for:
G.K. Hunter
Regional Road Design Engineer

AGK/GB
Encl.

c.c. E. Cross

H. Greenland, W. Melnichyn, A. Stermac

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. Stermac.
Pr. Foundation Engineer,
Materials & Testing Office.

From: Materials & Testing Office.
Central Region,
Room 134, Lab. Bldg.

Attention: Mr. M. Devata.

Date: August 5, 1969.

Our File Ref.

In reply to

Subject: W.P. 60-68-04, Highway 140
Lyon's Creek Crossing, Station 342±
Hamilton District

69-F-64

This will confirm our verbal discussion in my office on July 31st during which it was agreed that you would carry out the necessary foundation work for the proposed, large culvert(s) installation at the above location.

I would suggest that you maintain liaison with either Mr. W. Melinyshyn or with Mr. Gord Smith of Proctor & Redfern.

T. J. Kovich,
Regional Materials Engineer.

TJK/js.

cc: P. F. Weber