

#62-F-8

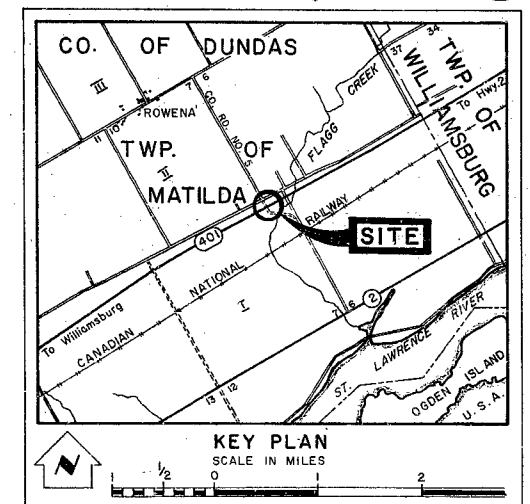
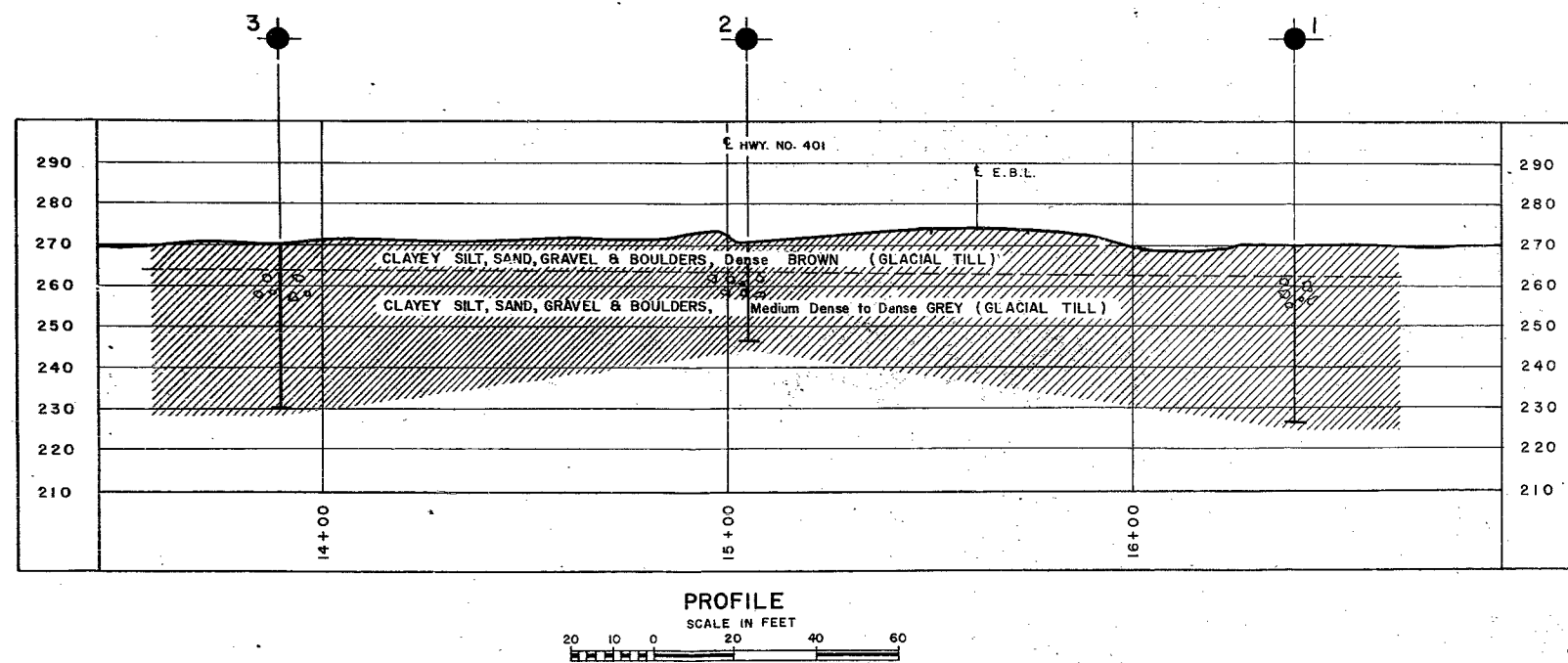
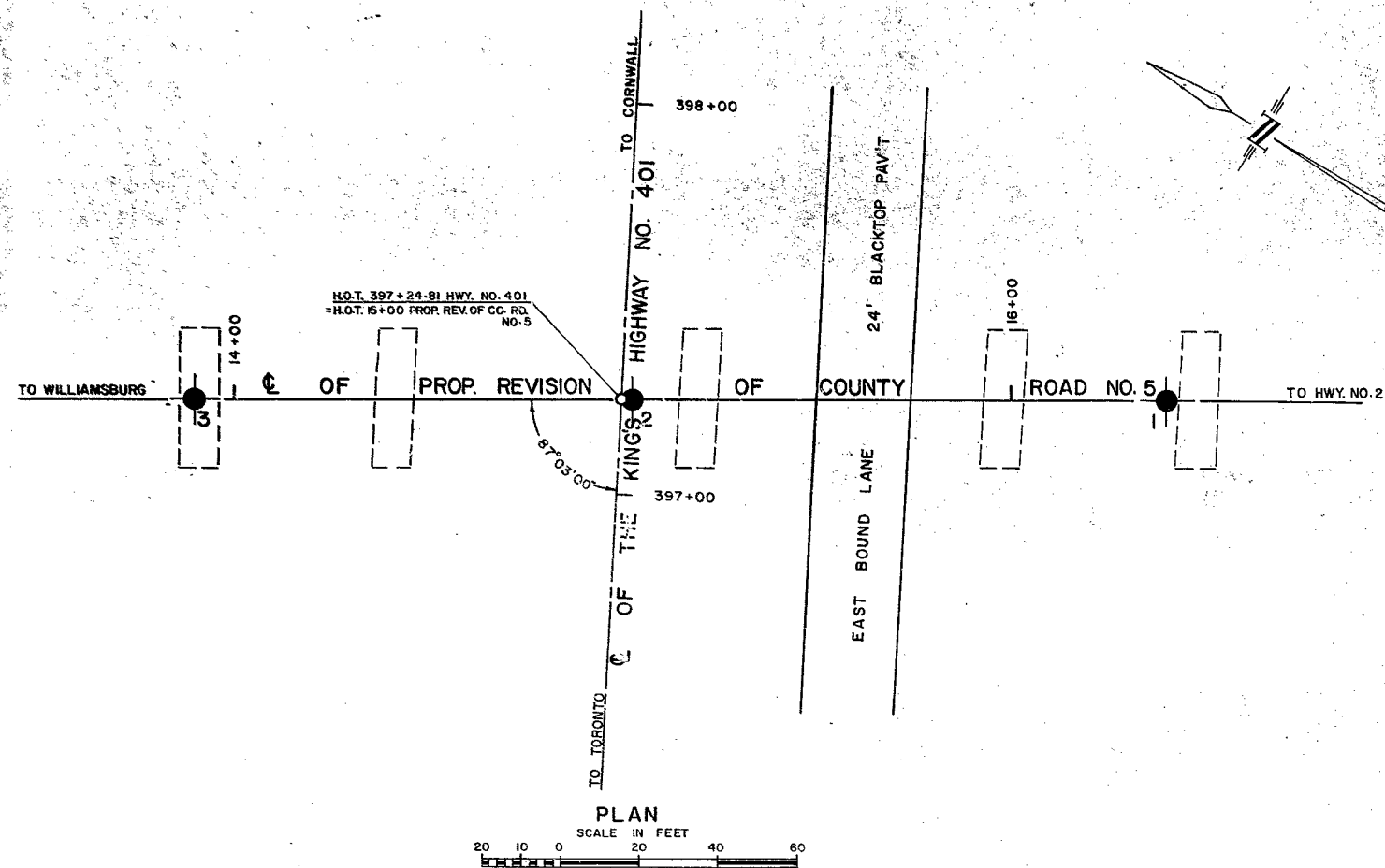
W.P. #136-59

Hwy. #401 E

DUNDAS CTY.

Rd. #5

PROP. NEW BRIDGE



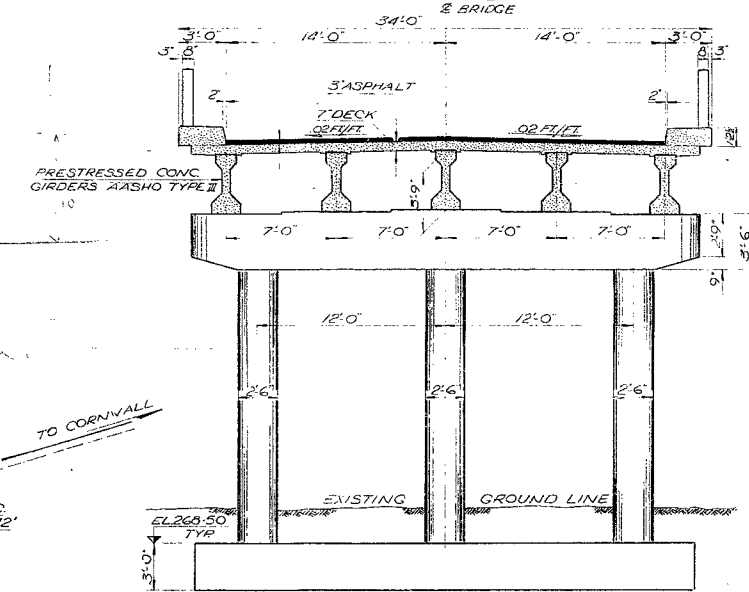
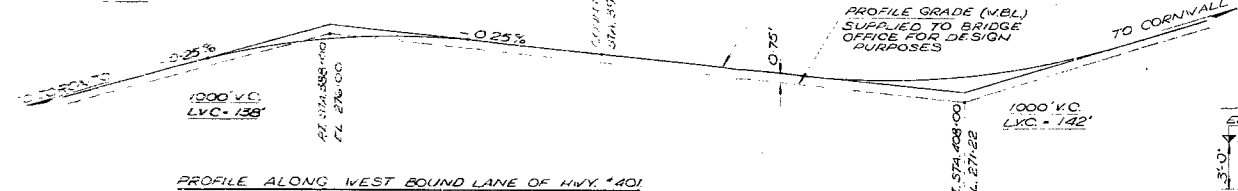
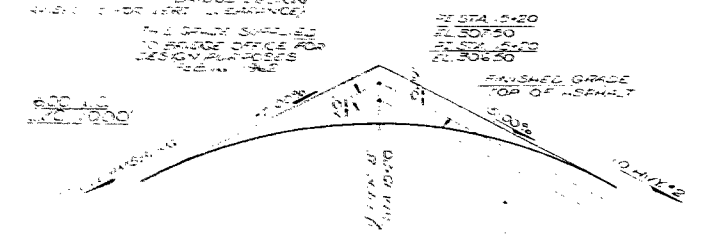
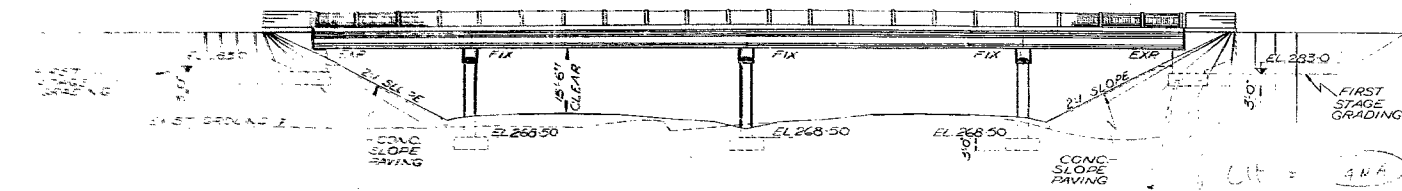
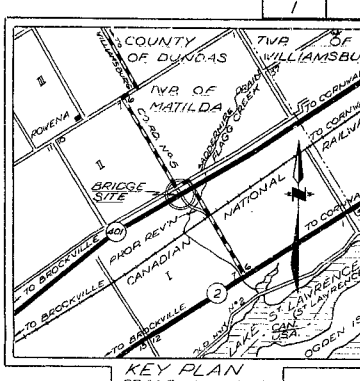
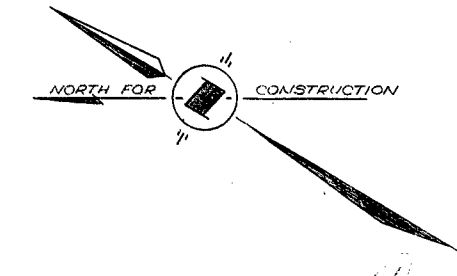
LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation		
NO.	ELEVATION	STATION	OFFSET
1	270.0	16+40	0
2	271.0	15+05	0
3	271.0	13+90	0

- 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		
DUNDAS COUNTY ROAD NO. 5 (PROPOSED REVISION) AND HIGHWAY NO. 401		
ORIGINATED V. KORLU	DISTRICT NO. 9	DATE FEB. 28, 1962
DRAWN F. CLARK	W.P. NO. 136-59	JOB NO. 62-F-8
CHECKED <i>HR</i>	CONTRACT NO.	DRAWING NO.
APPROVED <i>HR</i>		62-F-8A

REF. NO. E-3845-1

52 - 000000
 00 - 000000
 52 - 000000



B.M. - ELK 11-48 GEODETIC DATUM
NEW IN S. ROOT OF 12 ELM STUMP 80' LT.
OF STA. 394+71 HWY. N° 401

REVISIONS			
	DATE	BY	DESCRIPTION

67-F-8

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

UNDERPASS AT COUNTY RD #5
3.2 MILES WEST OF HWY. N°31

KING'S HIGHWAY No. 401 DIST. No. 9
CO. DUNDAS MATILDA TWP. BR. #6
TWP. MATILDA LOT 7 CON. 1

PRELIMINARY PLAIN

APPROVED _____				BRIDGE ENGINEER		SITE No.		W.P. No. 136-59	
DESIGN	M.M.	CHECK	A.F.B.	CONTRACT					
DRAWING	M.J.Q.	CHECK	A.F.B.	No.					
DATE	MAR. 62	LOADING	420 516	DRAWING					0-5033-A
				No.					

REFERENCE PLANS
SITE PLAN E3845-1
PLAN F3723-6
PROJ. HWY 401 F3723-2
PROJ. CTY RD 5 F3723-7

~~23-64-112~~

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

March 23, 1962.
D.H.O. FOUNDATION INVESTIGATION
REPORT.
W.J. 62-F-8 -- W.P. 136-59.

Re: Proposed New Bridge at Hwy. #401 and
Dundas County Road #5
District #9, Ottawa.

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 clarification, or further information is
required, please feel free to contact our Office.

AGS/MdeF
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan
J. Ford
L. E. Walker
J. E. Gruspier
J. Roy
T. J. Kovich
E. R. Saint
F. Norman
A. Watt
Foundations Office
Gen. Files.

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

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-

FOUNDATION INVESTIGATION

For

Proposed New Bridge at Hwy. #401
and Dundas County Road #5,
District #9, Ottawa.
W.J. 62-F-8 -- W.P. 136-59.

1. INTRODUCTION:

A request for a foundation investigation at the site of the proposed new bridge at Hwy. #401 and Dundas County Rd. #5, was received from the Bridge Location Section, dated January 23rd, 1962.

A field investigation was carried out by this Section during February 1962, to determine the subsoil conditions at the site of the proposed new bridge. Presented in this report are the results of this investigation, together with recommendations pertaining to the design of the structure foundations.

2. DESCRIPTION OF SITE:

The site is located about 3 miles west of Morrisburg at the intersection of Hwy. 401 and the proposed revision of County Rd. No. 5, Con. I, Lot 7, Twp. of Matilda, County of Dundas.

The topography of the area is generally flat to undulating. The area within the right-of-way of Hwy. #401 has been cleared of bush.

Physiographically, the site is located within the region referred to as the "Glengarry Till Plain".

cont'd. /2 ...

3. FIELD AND LABORATORY WORK:

The subsoil investigation at the site was carried out by means of a core drill machine adapted for soil sampling.

In the course of explorations, 3 boreholes were made. One borehole about 42 ft. deep was driven at each abutment location and one borehole of 22 ft. was driven at the centre of the bridge span. The holes were advanced by drilling BX casing.

Samples were recovered by means of a 2" O.D. split-barrelled spoon sampler. The dimensions of this sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test.

The split spoon samples were visually examined in the field and representative samples were brought to the laboratory for further tests.

The locations and elevations of all boreholes are shown on Drawing No. 62-F-8A, attached under Appendix I.

4. SOIL TYPES AND SOIL CONDITIONS:

Subsoil conditions at this site were found to be generally uniform within the limits of the investigation. The maximum depth tested was 42.0'. A glacial deposit consisting of a heterogeneous mixture of clayey silt, sand and gravel, was observed in all boreholes, extending for the entire depths tested. Frequent boulders of estimated maximum size 12", were encountered throughout the stratum. The upper 8.0' was observed to be in a desiccated condition. 'N' values obtained from the Standard Penetration Tests show that the relative density of this deposit

4. SOIL TYPES AND SOIL CONDITIONS: (cont'd.) ...

decreases with depth. The upper 15.0' may be classified as very dense, 'N' values generally being in excess of 50 blows/ft. Below 15', however, the 'N' values decrease with depth and a minimum value of 15 blows/ft. was observed at about 30'.

The average values of the liquid and plastic limits of the clayey silt matrix were found to be about 17% and 12%, respectively. The average moisture content obtained from samples tested in the laboratory was approximately 9%.

5. GROUND WATER CONDITIONS:

No well defined water level could be detected in the boreholes. It is assumed that the ground water level is at about 8 ft. below the ground which is approximately the bottom of the desiccated crust.

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct a new four span overpass bridge at this location. At present, the eastbound lane only, of Hwy. #401 is completed. Dundas County Rd. #5 is a gravel road which intersects Hwy. #401 3 miles west of Morrisburg. The new bridge will carry the revised County Rd. #50 over the present and future lanes of Hwy. #401 at a location about 600' west of the existing intersection.

Subsoil at the site consists of a glacial deposit of clayey silt, sand and gravel, down to a depth of at least 42.0'.

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

The upper 15.0' of this deposit is very dense and therefore favourable for the support of spread footings. It is recommended that the structure be supported on spread footings placed about 5' below the existing ground level. A design load of 3 tons per sq. ft. may be used in this case.

If it is desired, on the basis of economy, to place the abutments in the approach embankments, the most suitable foundation would be spread footings placed on well compacted granular fill. A design load of 2 tons per sq. ft. may be used in this case. All topsoil should be removed prior to placing the granular fill.

A piled foundation may be used to support the abutments if the latter suggestions prove to be impractical. 12-3/4" x 0.251" steel tubes driven about 10' into the original ground (to el. 260.0) should provide a design load of 40 tons/pile. Care must be taken not to advance the piles beyond el. 260.0 as the relative density of the subsoil is decreasing with depth beyond this point.

As an alternative to steel tube piles, bored-in concrete caissons should be considered. A 30" concrete caisson founded at el. 260.0 should support a safe load of 40 tons. This type of pile may prove to be more economical than a steel tube.

No dewatering problems are anticipated at this site.

No stability problems with regard to the approach embankments are anticipated.

cont'd. /5 ...

7. SUMMARY:

A four span underpass structure is proposed at this location. Subsoil consists of at least 42' of glacial till, the upper 15' of which is in a very dense state, and therefore favourable for the support of spread footings.

It is recommended that the structure be supported on spread footings placed 5.0' below ground level. A design load of 3 tons/ft.² may be used. If it is considered practical to place the abutments within the approach embankments, they should be supported by spread footings placed on well compacted granular fill. A design load of 2 tons/ft.² may be used in this case.

If it is considered impractical to follow the latter suggestion, the abutments may be supported on steel tube piles or bored-in concrete caissons, depending on which is the most economical. These are discussed in Section No. 6 of this report.

No dewatering problems are anticipated.

No approach fill stability problems are anticipated.

8. MISCELLANEOUS:

The field work started on February 12/62 and was completed on February 16/62. The field work was supervised by Mr. V. Korlu of this Section. All laboratory testing was done by the D.H.O. Materials and Research laboratories.

March 1962

REPORT PREPARED BY:

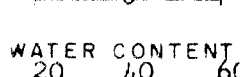
M. A. V. Korlu
V. Korlu,
PROJECT FOUNDATION ENGINEER

REPORT APPROVED BY:

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

APPENDIX I.

CHECKED BY V.K.

SOIL PROFILE			SAMPLES		DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	Liquid Limit — WL Plastic Limit — WP Water Content — W 	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	SIRAT PLOT	NUMBER	TYPE	BLOWS / FOOT			
270.0	Groundlevel							
0.0	Clayey silt, sand and gravel with frequent boulders Oxidized Very dense (Glacial Till)		1	S.S.	51		145.0	<u>Wl 262'</u>
262.0			2	S.S.	54			
8.0			3	S.S.	45		148.0	
	Clayey silt, sand and gravel, with frequent boulders Grey Coloured Very dense becoming compact with depth (Glacial Till)		4	S.S.	35			
			5	S.S.	15			
			6	S.S.	21			
			7	S.S.	46			
			8	S.S.	28		146.0	
226.5	End of borehole.							

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & RESEARCH DIVISION		RECORD OF BOREHOLE NO 2		FOUNDATION SECTION	
JOB 62-F-8	LOCATION Sta. 15+05 @ E	ORIGINATED BY V.K.			
W.P. 136-59	BORING DATE Feb. 14/62.	COMPILED BY H.S.			
DATUM 271.0'	BOREHOLE TYPE Wash Boring, BX Casing	CHECKED BY V.K.			

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — *L PLASTIC LIMIT — *P WATER CONTENT — *W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	SHEAR STRENGTH P.S.F.			*P — *L *W — *L WATER CONTENT % 20 40 60			
271.0	Groundlevel					271							Assumed W. L.
	Clayey silt, sand, gravel and boulders (Glacial Till)	0											
	Very dense, brown.	0	1	S.S. >100						° I		142.0	
263.0		0											<u>W_L 263'</u>
8.0		0	2	S.S. 96		261				° I			
	Clayey silt, sand, , gravel and boulders (Glacial Till)	0	3	S.S. 32						° I			
	Very dense to dense, grey.	0				251							
247.5		0	4	S.S. 42						° I			
23.5	End of borehole.												
						241							

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 62-F-8 LOCATION Sta. 13+90 @ E ORIGINATED BY V.K.
W.P. 136-59 BORING DATE Feb. 15/62. COMPILED BY H.S.
DATUM 271.0' BOREHOLE TYPE WashBoring, BX Casing CHECKED BY V.K.

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— WL		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT ——— WP	WATER CONTENT ——— W		
							WP — W — WL	WATER CONTENT % 20 40 60	Y P.C.F.	
271.0 0.0	Groundlevel			271						Water in borehole. 145.6 <u>Wl 263.5'</u>
	Clayey silt, sand and gravel with frequent boulders Oxidized Very dense (Glacial Till)		1 S.S. 102					OH		
263.5 7.5			2 S.S. 94	261						
	Clayey silt, sand and gravel, with frequent boulders Grey coloured.		3 S.S. 26	251				O		
	Very dense becoming compact with depth (Glacial Till)		4 S.S. 27							
			5 S.S. 17	241				OH		
231.5 39.5	End of borehole.		6 83	231						

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



ONTARIO

DEPARTMENT OF HIGHWAYS

67-F-7 #8

Memo to Mr. A. G. Stermac, Principal *Date* March 12, 1962.
Foundation Engineer, D.H.O.,
Lab. Bldg., Room 107. *Subject* W.P. 136-59 - Hwy. #401
Matilda Twp. Br. #6 U'pass at
County Rd. #5 - 3.2 miles
From J. B. Curtis, Bridge Location Eng. west of Hwy. #31

Enclosed find two prints of the preliminary plan for subject structure. We have not as yet received a foundation report for this structure however, we understand you have completed the field work and are now in a position to give us some information.

Would you kindly put your comments on the enclosed plans and return one copy for our files.

JBC/bm

J. B. Curtis,
Bridge Location Engineer.

c.c. N. D. Smith



ONTARIO

DEPARTMENT OF HIGHWAYS

POSTAL ADDRESS -

DEPARTMENT OF HIGHWAYS
PARLIAMENT BUILDINGS,
TORONTO 5, ONTARIO.

Bridge Division,
January 23, 1962.

MEMORANDUM TO:

Mr. A. G. Stermac,
Principal Foundation Engr.,
Department of Highways,
Room 107 Lab Bldg.,
Downsview, Ontario.

Att.: Mr. M. De Vata

RE: W.P. 136-59,
Matilda Township Br. #6,
Hwy. #401 at County Rd. #5,
Approx. 4.0 Miles west of Hwy. 31,
District #9.

Would you kindly arrange to have a foundation investigation carried out at the above location at your earliest convenience.

I have indicated the probable footing locations on the site plan which I gave to Mr. Holubec of your office January 22, 1962.

JBC:go
c.c. N. D. Smith

J. B. Curtis,
Bridge Location Engineer.

Investigation started by V Koshin