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DIST. 6 REGION CENTRAL

W.P. No. 127-66-46

CONT. No. 75-16

W. O. No. 73-11002

STR. SITE No. 24-277

HWY. No. 401

LOCATION CULVERT EXT. @ 401

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 0

REMARKS: Documents to be unfolded before
microfilmed

MEMORANDUM

30M12-84

TO: Mr. G.C.E. Burkhardt, (3)
Regional Structural Planning Eng.,
Central Region,
3501 Dufferin St.,
Downsview, Ontario.

FROM: Foundations Office,
Design Services Branch,
West Bldg., Downsview.

DATE: June 11, 1973.

OUR FILE NO.

IN REPLY TO

JUN 20 1973

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Culvert Extension at Hwy. 401 and
Little Etobicoke Creek - Site 24-277,
(Structure No. 55)

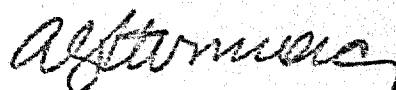
Town of Mississauga, County of Peel,
District 6 (Toronto)

W.P. 127-66-46 -- W.O. 73-11002

CONT 75-16

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

AGS/ao
Attch.

c.c. E. J. Orr
B. R. Davis
A. Rutka
R. S. Pillar
H. Greenland
B. J. Giroux
C. Mirza
G. A. Wrong
B. A. Singh

Foundations Files
Documents

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FOUNDATION INVESTIGATION REPORT
For
Culvert Extension at Hwy. 401 and
Little Etobicoke Creek - Site 24-277,
(Structure No. 55)
Town of Mississauga, County of Peel,
District 6, (Toronto)
W.P. 127-66-46 — W.O. 73-11002

1. INTRODUCTION:

The present proposals for the construction program of the 401/403/410 Interchange will incorporate some twenty one structures. One of these will be the new north and south extensions to the existing 20 ft. by 7 ft. rigid frame concrete culvert at the intersection of Hwy. #401 and Little Etobicoke Creek.

The Foundations office was requested to carry out a subsurface investigation at the above-mentioned site (site 24-277; structure No. 55). The request was contained in a memo from Mr. G.C.E. Burkhardt, Structural Planning Engineer, Central Region, dated March 28, 1973. Subsequently, an investigation was carried out by this office to determine the subsoil, bedrock and groundwater conditions at the site.

This report presents the factual information obtained from this investigation, together with recommendations pertaining to the foundation design of the proposed structure.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The investigated site is about $\frac{1}{4}$ mile east of Heart Lake Road crossing Hwy. 401, in the Town of Mississauga, County of Peel. The topography of the terrain is flat to undulating in relief between elevations 515 to 535 ft.

The site is located in the physiographic region

known as the "Peel Plain". The characteristic deposit in the vicinity of the area under investigation is mainly composed of a cohesive glacial till underlain by shale bedrock.

3. FIELD AND LABORATORY WORK:

The subsoil investigation consists of ten sampled boreholes. The borings were advanced by means of a diamond drill and a C.M.E. auger machine, both adopted for soil sampling purposes.

Sampling in the glacial till material was done by driving a 2" O.D. split spoon sampler in accordance with the specifications for the Standard Penetration Test. In all holes the bedrock was proven by obtaining BXL size core samples.

Groundwater levels were observed in the open boreholes during the period of investigation.

The soil, bedrock and groundwater conditions encountered at the boring locations are presented in the Record of Borehole sheets. The locations and elevations of the various boreholes were surveyed by District No. 6 (Toronto) construction personnel. The elevations in this report are referenced to a Geodetic Datum. Boring locations referenced to a co-ordinate system, and elevations together with estimated stratigraphical sections are shown on Drawing No. 73-11002A.

All samples were subjected to a careful visual examination in the field and subsequently in the laboratory. Following this examination, various laboratory tests were carried out on selected representative samples to determine the physical properties of the soil, namely:

Natural Moisture Contents

Atterberg limits

Grain size distribution.

The results of these tests are plotted on the Record of Borehole sheets and summarized on Figure #1 and Figure #2, all contained in the Appendix of this report.

4. SUBSOIL AND BEDROCK CONDITIONS:

4.1) General:

The predominant ~~stratum~~^{stratum} encountered in this area is a heterogeneous mixture of clayey silt, sand and gravel (glacial till) up to 5 feet thick. This cohesive deposit is underlain by shale bedrock.

The boundary between the overburden and the bedrock as determined in the boreholes, are shown on the accompanying Record of Borehole sheets. The stratigraphical sections, shown on Drawing No. 75-11002A have been inferred from this data.

4.2) Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial till)

The predominant stratum across the site is a deposit of glacial till, i.e., a heterogeneous mixture of clayey silt, sand and gravel. It was found directly underlying a nominal topsoil cover (1 foot maximum) at all boring locations. The glacial till is cohesive in nature. The thickness of this deposit varies from 3 ft. (B.H. #6) to 5 ft. (B.H. #9).

Atterberg limit tests were performed on samples obtained in this layer. The results, which are shown on the Record of Borehole sheets and on the plasticity chart (Figure 1) are as follows:

	<u>Range</u>	<u>Average</u>
Liquid Limit (W_L) %	- 30-35	(33)
Plastic Limit (W_p) %	- 20-23	(21)
Natural Moisture Content (W) %	- 10-20	(14)

Based on the above values, it is estimated that the cohesive deposit has a matrix which is inorganic and of low plasticity.

The Standard Penetration tests, carried out within this glacial deposit, are plotted on the Record of Boreholes sheets. The "N" values obtained from these tests range from

31 blows per foot to 100 blows per 6 inches. It is estimated that the consistency of the glacial till is generally hard.

Grain size distribution curves for samples obtained in this stratum are shown in Figure 2, in the Appendix.

4.3) Bedrock:

Underlying the Glacial till deposit is the shale bedrock which was proven in all of the 10 boreholes by obtaining up to 13 feet of BXL core samples. The core samples were examined by Mr. K. W. Ingham, Geologist.

The bedrock is composed of a dark grey interbedded shale and limestone. The upper zone (1 to 3.5 feet) of the bedrock is in a weathered condition. The bedrock surface varies from elevation 530 to 514.

5. GROUNDWATER CONDITIONS:

The groundwater levels were established in the open boreholes during the period of field investigation (April, 1973). The results of the readings are shown on the borelog sheets as well as on Drawing No. 73-11002A.

The observations indicate that the groundwater level varies from elevations 516 to 533, which correspond to levels from the ground surface to 3.5 feet below the ground surface.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

In conjunction with the construction program of Hwys. 403/410/401, the existing 20' x 7' rigid frame concrete culvert under Hwy. 401, about $\frac{1}{2}$ mile east of Heart Lake Road, will have to be extended about 540 feet northward and 400 feet southward.

This report will deal with the proposed culvert extension (Structure No. 55). According to the available information (Profile of Little Etobicoke Creek, Drawing No. 3983-1, SK #102 by FENCO), the invert elevation of the northern culvert extension varies from 527 feet (north end) to 524 feet (south end) while

that of the southern culvert extension varies from 523 feet (north end) to 514 feet (south end), with two 4-foot drops at stations 30 + 80 and 32 + 55. The profile grade of the various components of Hwys. #401 and #403 at this crossing will range from elevation 537 to elevation 555. The existing ground surface varies from elevations 535 to 519. Based on these values, it is estimated that fills with a maximum clear height of 26 feet will have to be placed in the vicinity of the proposed culvert extensions.

The predominant stratum across the site is a heterogeneous mixture of hard clayey silt, sand and gravel (Glacial Till). Its thickness varies from 3 ft. (B.H. #6) to 5 ft. (B.H. #9). The glacial till is underlain by shale bedrock.

6.2) Embankment Fill:

No stability problems are anticipated for an embankment of the height contemplated (maximum 26 feet), provided -

- i) standard 2 : 1 slopes are employed
- and ii) the fill is properly compacted and keyed to the existing embankment in accordance with current M.T.C. Standard No. DD-414.

The glacial till will settle due to the embankment fill loading. It is estimated that this settlement should not exceed $\frac{1}{2}$ inch and will take place during or immediately following the fill placement.

According to available information, shale rock may be used as fill material. In such a case, the fill material itself will settle due to its own weight. In our opinion the magnitude of this settlement would be approximately $\frac{1}{2}$ % of the total height of the fill material. The major portion of this settlement should take place within a period of six months after the placement of the fill material.

6.3) Rigid Frame Concrete Culvert:

The invert elevation of the proposed culvert extensions

in general will be at or within the shale bedrock. However, between Station 30 + 00 and Station 32 + 55, the bedrock surface is only 1 to 4 feet below the proposed invert elevation. It is therefore, recommended that the open type rigid frame concrete culvert be supported on spread footings founded on or within the shale bedrock. A minimum of 4 feet of earth cover should be provided to the underside of the footings since the shale bedrock is considered to be susceptible to frost action. This would place the footings at the elevations tabulated below:

Location.	Recommended founding elevation.
Sta. 22 + 80 to Sta. 28 + 25	From 523 to 520
Sta. 28 + 25 to Sta. 30 + 00	Existing culvert
Sta. 30 + 00 to Sta. 30 + 80	519
Sta. 30 + 80 to Sta. 32 + 55	514
Sta. 32 + 55 to Sta. 34 + 00	509

Foundations founded as recommended, could be designed using an allowable bearing value of up to 10 t.s.f.

The foundation excavations for the culvert will extend some 5 to 10 feet below the groundwater level established during the course of field investigation. The cohesive glacial till is relatively impervious. No major dewatering problems are anticipated provided the creek is temporarily diverted during the construction period. It is believed that any minor seepage or surface runoff into the excavations could be controlled by employing conventional techniques, such as pumping from sumps.

The culvert will be designed as a rigid frame. Therefore, a coefficient of earth pressure at rest (K_0) of 0.5 should be assumed for the granular back fill behind the wall, when designing the wall sections. In addition, the design should incorporate the full effect of the surcharge located above the walls. In computing the horizontal resistance of the footings, a coefficient of friction of 1.0 may be used between the rough concrete surface and the shale bedrock.

In order to relieve the buildup of excess hydrostatic pressure behind the walls, suitable drainage measures should be provided. Weep holes, located at the base of the walls, could be employed for this purpose, these holes should be spaced not more than 10 feet apart.

7. MISCELLANEOUS:

The field work, performed during the period of April 3 to April 11, 1973, was supervised by Mr. V. Korlu, Project Foundations Engineer, who also prepared this report.

Equipment was owned and operated by Longear Co. of Toronto.

The investigation was carried out under the general supervision of Mr. M. Devata, Supervising Foundations Engineer, who also reviewed the report.

V. Korlu
V. Korlu, P. Eng.



M. Devata
M. Devata, P. Eng.

VK:ks

June 7, 1973.

APPENDIX

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1

JOB 73-11002

LOCATION Co-ords. 15,857,710 N; 960,865 E.

W.P. 127-66-46

BORING DATE April 3, 1973

ORIGINATED BY VK

DATUM Geodetic

BOREHOLE TYPE Bore and core with BX and BXL

COMPILED BY VK

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L			BULK DENSITY Y P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % 10 20 30				
518.8	Ground Level													
0.0	Het. mix. of clayey si sand & gravel.													
514.3	(Glacial Till) Hard		1	SS	125									515.8
513.3	Weathered													22 12 46 20
513.3	sound		2	RC	92	510								
	Shale Bedrock		2	RXL	92									
503.8			3	RXL	100									
15.0	End of Borehole					500								

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 2

FOUNDATIONS OFFICE

JOB 73-11002

LOCATION Co-ords. 15,857,812 N; 960,823 E.

ORIGINATED BY VK

W.P. 127-66-46

BORING DATE April 14, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Bore and core with RK and HXL

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			BULK DENSITY γ P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE		WATER CONTENT % 10 20 30				
519.3	Ground Level												
0.0	Net. mix. of clayey si. sand & gravel (glacial till) sand		1	SS	137								517.9
515.8	weathered sand												25 14 48 13
514.3	sound												
509.3	Shale Bedrock		2	RC HXL	100%	510							
10.0	End of Borehole					500							

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3

JOB 73-11002

LOCATION Co-ords. 15,857,847 N; 960,745 E.

ORIGINATED BY VK

W.P. 127-66-46

BORING DATE April 4, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Bore and core with BX and BXL

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			BULK DENSITY γ P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			w_p w w_L WATER CONTENT % 10 20 30				
519.8	Ground Level													
0.0	Net mix of clayey si. & sand & gravel (fossiliferous) Hard		1	SS	RI									
515.8	weathered sound		2	RC	EXL 100%	510								
504.8	Shale Bedrock		3	EXL	100%									
15.0	End of Borehole					500								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 4

JOB 73-11002

LOCATION Co-ords. 15,857,974 N; 960,646 E.

ORIGINATED BY VK

W.P. 127-66-16

BORING DATE April 5, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Bore and core with Bx & EXL

CHECKED BY *AK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.			w_p w w_L				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % 10 20 30				
525.2	Ground Level													
0.0	Het. mix. of clayey si. sand & gravel.					520								521.7 28 12 39 21
521.2	(Glacial Till) Band		1	SS	98									
4.0	weathered													
518.2	sound		2	SS	1000									
7.0				RC										
515.2	Shale Bedrock		3	EXL	1000									
10.0	End of Borehole					510								

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 5

FOUNDATIONS OFFICE

JOB 73-11002

LOCATION Co-ords. 15,858,013 N; 940,578 E.

ORIGINATED BY VK

W.P. 127-66-16

BORING DATE April 5, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Bore and Core with BK And BXL

CHECKED BY VK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT		PLASTIC LIMIT — w_p			
523.7	Ground Level							SHEAR STRENGTH P.S.F.		WATER CONTENT %		
0.0	Het. mix. of clayey silt sand & gravel (Glacial Till) Hard								○ UNCONFINED + FIELD VANE		w_p — w — w_L	
519.7	weathered								● QUICK TRIAXIAL × LAB VANE		P.C.F. GRAV. SI. CL.	
517.7	sound		1	RC EXL	50%	520						
6.0		2	BXL	55%	510							
	Shale Bedrock	3	BXL	95%								
506.8	End of Borehole											
16.9						500						

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 6

JOB 73-11002

LOCATION Co-ords. 15,858,150 N; 960,462 E.

ORIGINATED BY JK

W.P. 127-66-46

BORING DATE April 11, 1973

COMPILED BY JK

DATUM Geodetic

BOREHOLE TYPE Auger and core with CPT Machine

CHECKED BY J/L

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.		w_p w w_L			
							ϕ UNCONFINED \bullet QUICK TRIAXIAL	+ FIELD VANE \times LAB VANE	WATER CONTENT %			
527.2	Ground Level											
0.0	het. mix. of clayey silt sand & gravel (Glacial)											
524.2	weathered sand		1	EXL	90%							
3.0	Shale Bedrock		2	EXL	100%	520						
513.5			3	EXL	100%							
13.7	End of Borehole					510						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 7

JOB 73-11002

LOCATION Co-ords. 15,858,227 N; 960,341 E.

ORIGINATED BY VK

W.P. 127-66-16

BORING DATE April 11, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and core with CME machine

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT			PLASTIC LIMIT w_p				
							SHEAR STRENGTH P.S.F.			WATER CONTENT w				
529.1	Ground Level													
0.0	Mix. of clayey silty sand and gravel. (Glacial till) Hand-sorted		1	SS	17%									
525.6			2	RC										
524.6			3	BXL	100%									
4.5	sound													
	Shale Bedrock					520								
515.1														
14.0	End of Borehole					510								

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 8

JOB 73-11002

LOCATION Co-ords. 15,850,350 N; 960,259 E.

ORIGINATED BY VK

W.P. 127-66-46

BORING DATE April 11, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and core with CME machine

CHECKED BY *OK*

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w		BULK DENSITY γ P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.		w_p w w_L			
							ϕ UNCONFINED + FIELD VANE \bullet QUICK TRIAXIAL x LAB VANE					
530.6	Ground Level											
0.0	Net. mix. of clayey si					530						
527.1	sand & gravel. Hard		1	SS	132							
3.5	weathered											
523.6												
7.0	sound		2	RC BXL	98%	520						
	Shale Bedrock											
515.6			3	BXL	90%							
15.0	End of Borehole					510						

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE No. 9

JOB 73-11002 LOCATION Co-ords. 15,858,435 N; 960,139 E.
 W.P. 127-66-46 BORING DATE April 10, 1973
 DATUM Geodetic BOREHOLE TYPE Auger and Cone with CME machine

ORIGINATED BY VK
 COMPILED BY VK
 CHECKED BY ///

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w		BULK DENSITY γ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT % w_p — w — w_L 10 20 30				
532.4	Ground Level												
0.0	Het. mix. of clayey si. sand and gravel.		1	SS	31	530						GR. SA. SI. CL.	
527.4	(Glacial Till) Hard												531.4
525.4	weathered sand												23 20 46 11
7.0			2	RC	70%								
522.4	Shale Bedrock												
10.0	End of Borehole					520							

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 10

JOB 73-11002

LOCATION Co-ords. 15,858,542 N; 960,092 E.

ORIGINATED BY VK

W.P. 127-66-46

BORING DATE April 10, 1973

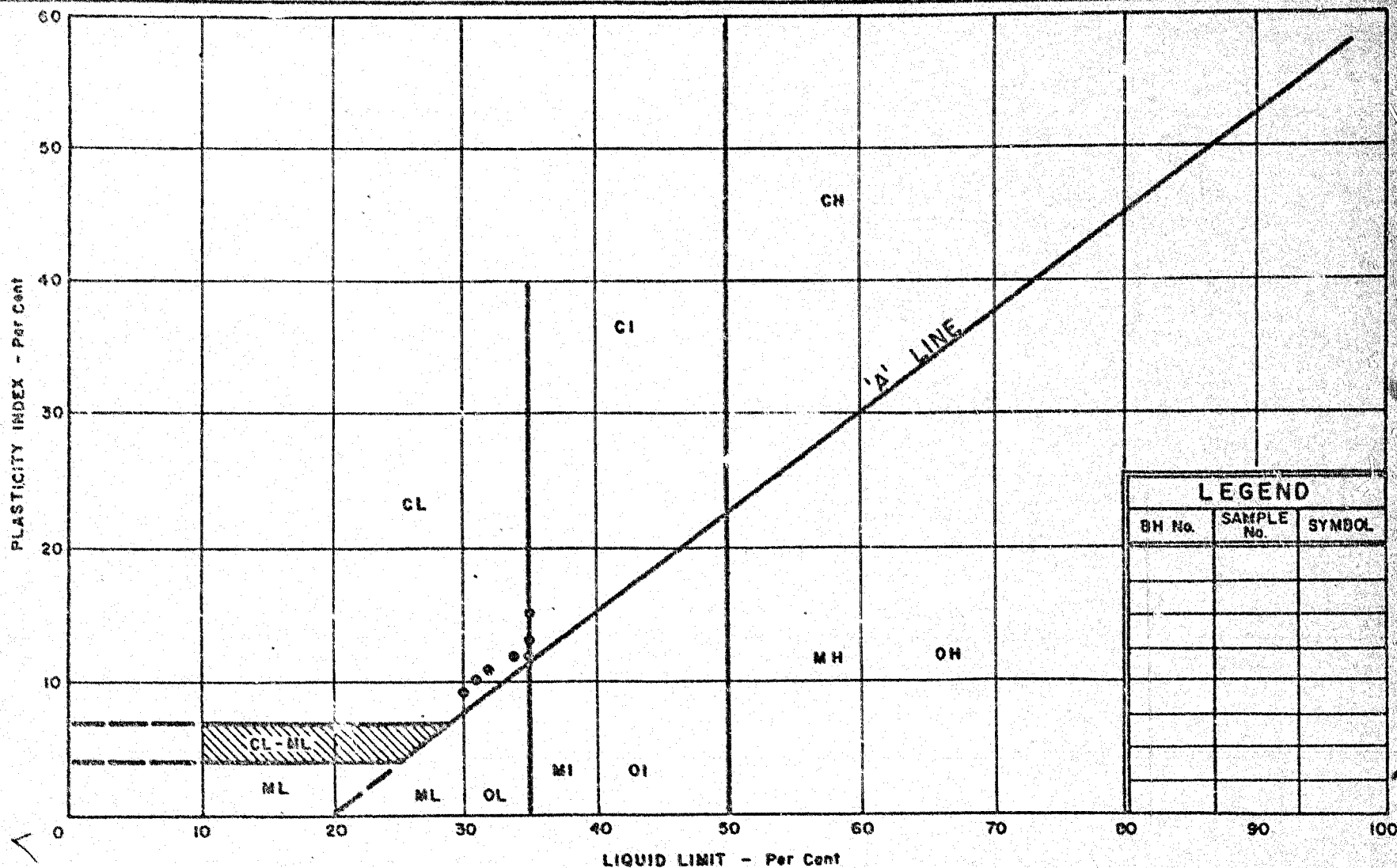
COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and core with GKE machine

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT w_p PLASTIC LIMIT w_p WATER CONTENT w			BULK DENSITY γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL * LAB VANE			w_p w w_L WATER CONTENT % 10 20 30				
534.4	Ground Level													
0.0	Let. mix. of clayey si. sand & gravel (Glacial Till) Hard		1	SS	125	530								GR SA SI CL
530.4	weathered		2	RC										12 12 56 20
528.9	sound		3	EXL	100%									
519.4	Shale Bedrock		4	EXL	100%	520								
15.0	End of Borehole					510								



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART GLACIAL TILL HET. MIX. OF CLAYEY SILT, SAND & GRAVEL

WP No. 127 - 66 - 46

JOB No. 73 - 11002

FIG. 1

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT

SAND

GRAVEL

Find

Medium

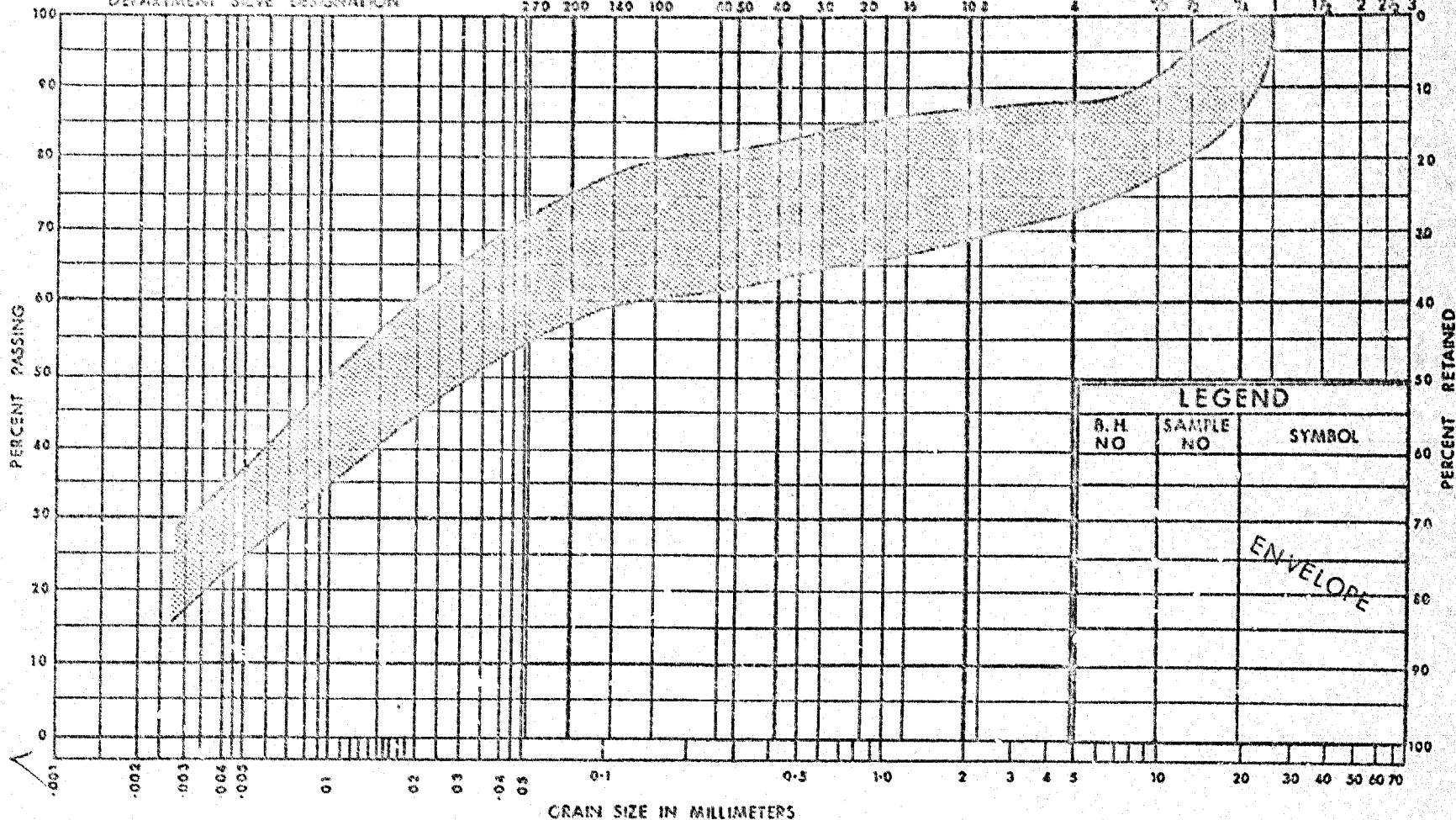
Course

Fine

Coarse

DEPARTMENT SEIVE DESIGNATION

170	200	140	100	60	50	40	30	20	10	4	1/2"	1/2"	3/4"	1"	1 1/2"	2"	2 1/2"	3"
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DEPARTMENT
OF
TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES
BRANCH

GRAIN SIZE DISTRIBUTION
GLACIAL TILL
HET. MIX. OF CLAYEY SILT, SAND & GRAVEL

W.P. No. 127 - 66 - 46

JOB No. 73 - 11002

FIG. 2

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

PENETRATION RESISTANCE

N - STANDARD PENETRATION RESISTANCE -- 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>c LB/SQ. FT.</u>	<u>DENSENESS</u>	<u>N' BLOWS / FT.</u>
VERY SOFT	0 - 250	VERY LOOSE	0 - 4
SOFT	250 - 500	LOOSE	4 - 10
FIRM	500 - 1000	COMPACT	10 - 30
STIFF	1000 - 2000	DENSE	30 - 50
VERY STIFF	2000 - 4000	VERY DENSE	> 50
HARD	> 4000		

TERMS TO BE USED IN DESCRIBING SOILS:-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC.

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" " ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

ABBREVIATIONS & SYMBOLS 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
w_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
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
$\log_e \sigma$ 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 (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

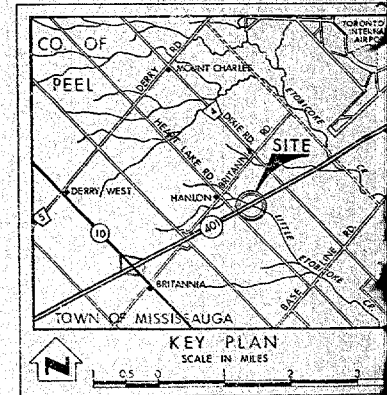
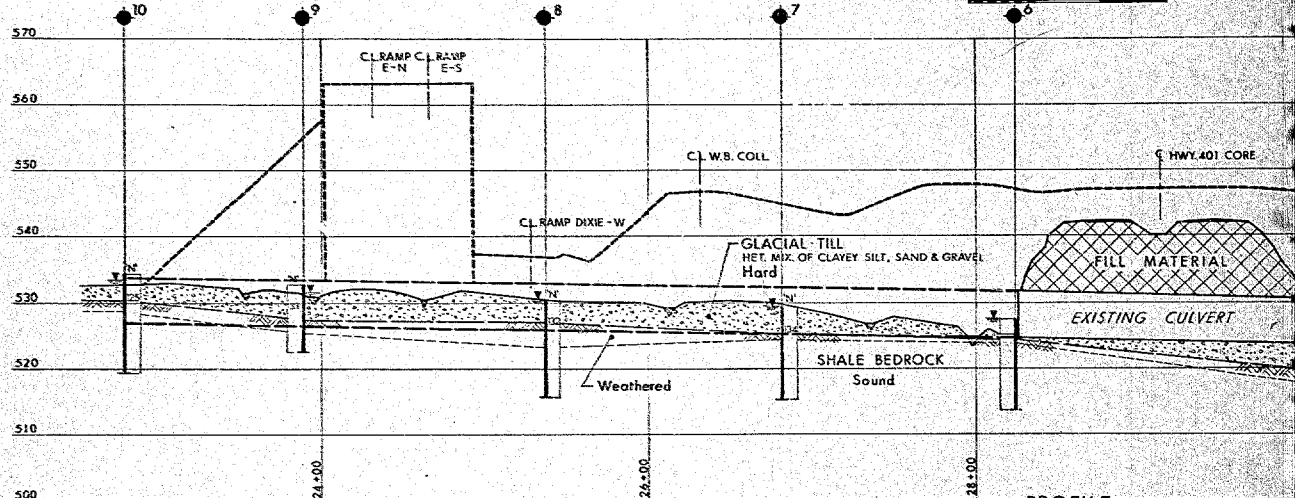
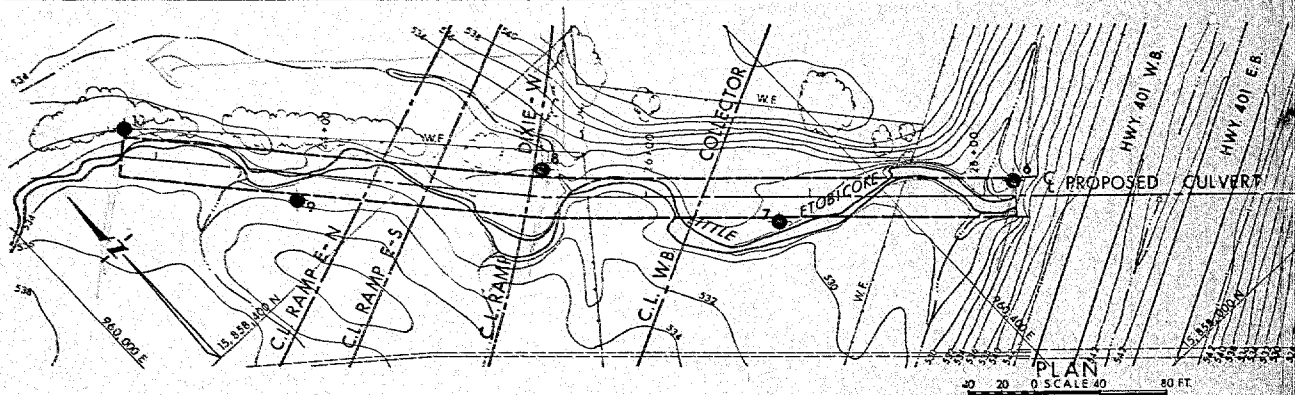
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

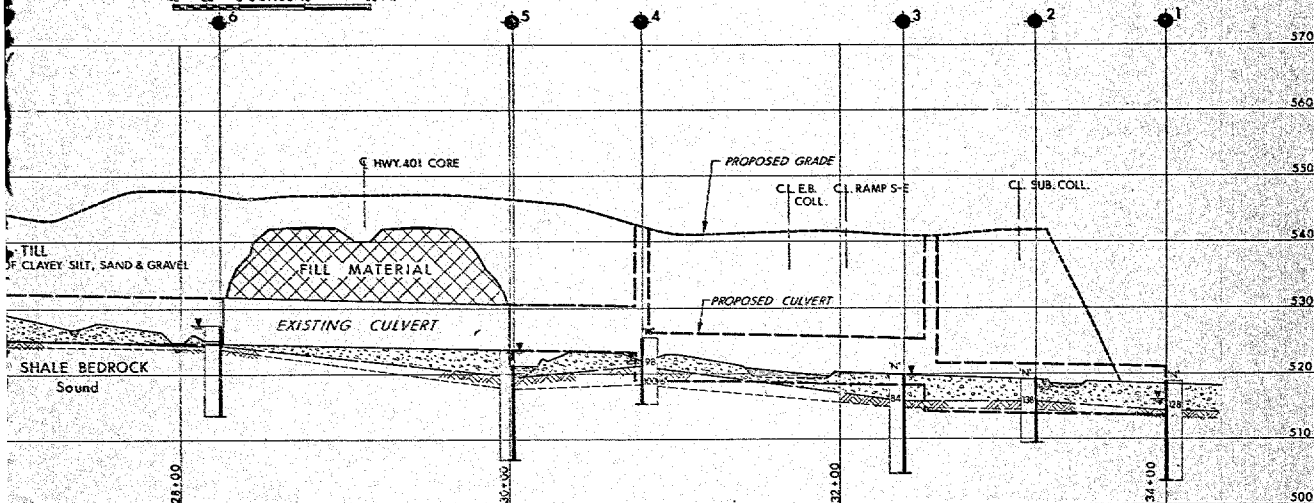
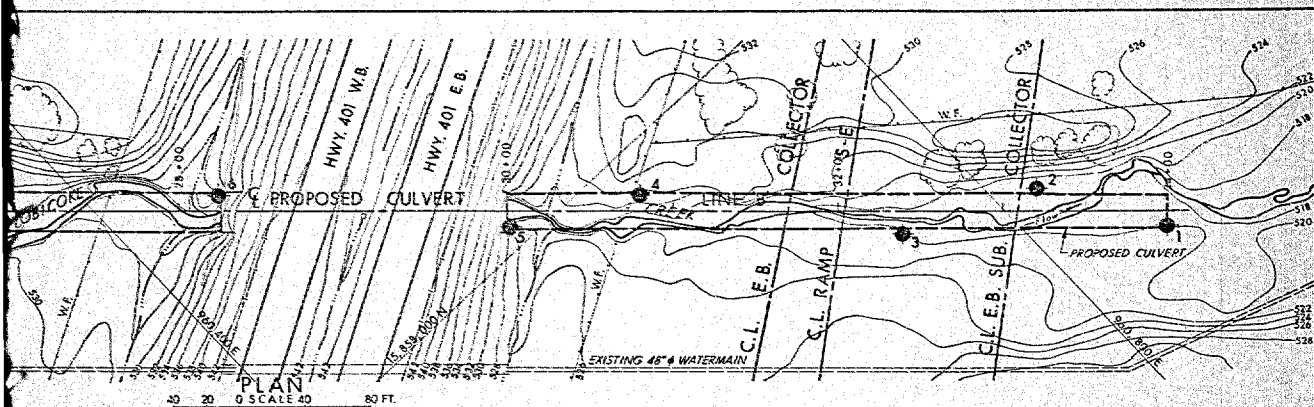
FOUNDATIONS

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_z	MODULUS OF SUBGRADE REACTION

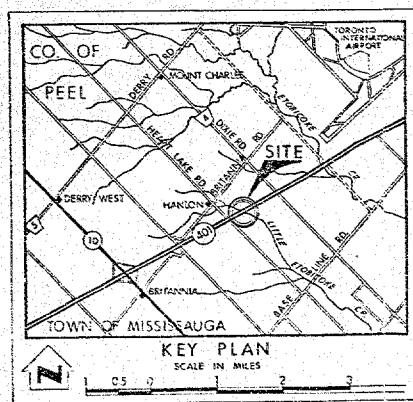
SLOPES

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





PROFILE
HORIZ. 40 20 0 SCALE 40 80 FT.
VERT. 10 5 0 10 20 FT.



LEGEND

- Bore Hole
- ⊕ Cone Penetration Test
- ⊕ Bore Hole & Cone Test
- ⬇ Water Levels established at time of field investigation, April 1973.

NO.	ELEVATION	CO - ORDINATES	
		NORTH	EAST
1	518.8	15,857,740	960,865
2	519.3	15,857,812	960,873
3	519.8	15,857,847	960,745
4	525.2	15,857,974	960,646
5	523.7	15,858,013	960,578
6	527.2	15,858,150	960,462
7	529.1	15,858,227	960,341
8	530.6	15,858,330	960,256
9	532.4	15,858,438	960,139
10	534.4	15,858,542	960,092

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS		DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE

LITTLE ETOBICOKE CREEK CULVERT EXTENSION (STRUCTURE No. 55)

HIGHWAY NO. 401 DIST. NO. 6
CO. PEEL

TOWN OF MISSISSAUGA LOT CON

BORE HOLE LOCATIONS & SOIL STRATA

SUBWD. V.R. CHECKED: WP NO. 127-66-46 DRAWING NO.
DRAWN S.R. CHECKED: WD NO. 73-11002 73-11002 A

DATE JUNE 11, 1973 SITE NO. BRIDGE DRAWING NO.

APPROVED: [Signature] CONT. NO. MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

73-11002

TO: Mr. A. G. Stermac,
Principal Foundation Engineer,
West Building.

FROM: G. C. E. Burkhardt,
Structural Planning Office,
3501 Dufferin Street.

ATTENTION: M. Devata

DATE: March 28, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT: Little Etobicoke Creek 20' x 7'
Structure Extension at Highway 401,
Bridge #55,
Site 24-277, W.P. 127-66-46,
District 6, Toronto.

The above structure is a part of the Hwy. 401/403/410 interchange as covered by W.P. 127-66-01.

You are requested to carry out the investigation and prepare the Foundation Report (due date June 6, 1973) for this structure.

The limits and location of the structure extension are shown in red on the attached Fenco Drawing #3983-1SK-101. Attached is also Structure Profile Drawing #3983-1SK-102. Two copies of each are enclosed.

The location of the existing 48"Ø watermain is shown on the location plan. This is the only underground utility in this area according to the information available.

COMPLETION DATE JUNE 6/73
H.D.D.

MAA:lc
Encl.

M. A. Almer,
STRUCTURAL PLANNING ENGINEER,
for:
G. C. E. Burkhardt,
REG. STRUCTURAL PLANNING ENG.

c.c. W. Roters
J. D. Barclay
R. Fitzgibbon
J. Anderson

Design Services Branch,
1701 Wilson Avenue,
Downsview, Ontario.
M3M 1J8

April 3, 1973.

Telephone: 248-3282.

Canadian Longyear Limited,
35 Brydon Drive,
Rexdale, Ontario.

Dear Sirs:

This letter confirms our request of March 28, 1973,
for the supply of a diamond drill together with all necessary
equipment, as specified under the terms of our Contract
Agreement, at Dixie Rd. & Hwy. 401 (Metro Toronto) on
April 3, 1973.

Mobilization will be from your yard in Toronto, Ontario.

Our Project Number is W.C. 73-11502. ✓

Yours truly,

MD/ao

cc: W. W. Fry
(Attn: Mrs. J. McLaren)

For:

M. Davata
M. Davata,
Supervising Foundations Engineer
A. G. Sternac,
Principal Foundations Engineer

Foundations Files
Documents