

30M12-117

GEOCRES No.

FOUNDATION INVESTIGATION & DESIGN REPORT

W.P. 103-69-09

DIST. 6

HWY. 410

STR. SITE 24-313

Etobicoke Creek Bridge

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W.P. 103-69-09
Site 24-313
Hwy. 410, District 6, Toronto
Etobicoke Creek Bridge

1. INTRODUCTION

The first stage of Hwy. 410 is scheduled to be built from Derry Road to Steeles Avenue as a two lane facility. For this two lane facility a structure is required where Etobicoke Creek crosses Hwy. 410 northbound lanes of the ultimate six lane scheme. This report contains the results of a foundation investigation carried out for the initial structure for a two lane concept (410 northbound lanes) as well as for the ultimate design. In addition recommendations pertaining to foundation design, stability requirements and other associated considerations are contained in this report.

2. DESCRIPTION OF SITE AND GEOLOGY

The area under investigation is situated in the City of Brampton, Regional Municipality of Peel. 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 composed of glacial till, underlain by shale bedrock. Etobicoke Creek is one of the several creeks which have cut deep valleys into the overburden as they drain the "Peel Plain" region. The general area is within the valley of Etobicoke Creek.

The shale bedrock is of the Meaford-Dundas formation, Ordovician period, and is mostly exposed at the creek bottom and partially on the north bank of the valley.

3. FIELD AND LABORATORY WORK

Ten sampled boreholes, 7 of them accompanied by dynamic cone penetration test, were put down during the course of this field investigation. Information from boreholes one to four will be considered

for the foundations of the two lane initial structure; while the information from all ten boreholes will be necessary for the foundation requirements of the ultimate scheme. In addition borehole information (B.H. 4) obtained from the preliminary investigation carried out under W.P. 103-69-00 (submitted, Aug. 12, 1975) is also incorporated as B. H. 11.

The borings were advanced by means of a continuous Flight Auger machine (commercially known as C.M.E. 55, M.V.H.S.) adapted for soil sampling purposes.

Samples of the overburden were obtained using a 2" O.D. split-spoon sampler at required depths. The sampler was hammered into the soil according to the specifications of Standard Penetration Test. Bedrock was proven in all of the boring locations by obtaining BXL size rock core samples.

Groundwater level observations were carried out, during the period of the investigation, in the open boreholes. The soil, bedrock and groundwater conditions encountered at the boring locations, are presented in the Record of Borelog Sheets. The location and elevation of the various boreholes were provided by personnel from Engineering Surveys, Central Region. The elevations in this report are referred to a Geodetic datum. Boring locations and elevations are shown on drawing no. 1036909-A.

All samples were visually examined in the field and later in the laboratory. Laboratory tests were carried out on selected representative samples to determine the physical properties of the soil, namely:

- Natural Moisture Content
- Atterberg Limits
- Grain-size Distribution

The results of this testing are plotted on the Record of Borehole Sheets and summarized on Fig. 1 and 2 inclusive, all contained in Appendix I of this report.

4. SUBSURFACE CONDITIONS

4.1. General - The overburden at this site consists either of an alluvial granular stratum or a clayey silt with sand. Immediately below the overburden is shale bedrock at a depth of 2.4 to 10.5 ft. below the existing ground surface.

4.2. Overburden

4.2.1. Alluvial Deposits - This Alluvial Deposit varies in composition from silty sand with gravel to gravel with silty sand. In certain locations the lower portion of the deposit contained fragments of shale. In a few locations (B.H. 1, 9 and 11) this deposit is covered or underlain by a thin layer of clayey silt with sand. Elsewhere this alluvial deposit was observed immediately below the ground surface extending down to the shale bedrock. In B.H. 1,3,4,6,8 and 10 the predominant material is gravel with silty sand and traces of clay. It varies in thickness from 2.4 ft. (B.H.4) to 8.0 ft. (B.H.8) and has a relative density of compact to very dense; while in B.H. 2,5,7 and 11 the granular material is mainly silty sand to sandy silt with gravel and traces of clay. The thickness of this material varies from 4.0 ft. (B.H.2) to 7.0 ft. (B.H.7) and has a relative density of loose to dense. Typical grain-size distribution curves, for the samples of this alluvial stratum are plotted on Fig. 1 of appendix 1.

4.2.2 Glacial till - Clayey silt, sand and gravel - This cohesive stratum was encountered in B.H. 1,9 and 11. In D.H. 11 this stratum was observed underlying the upper granular deposit, whereas in B.H. 1 it was overlying the granular deposit. In B.H. 9 this cohesive deposit extends down to shale bedrock with a thickness of 4.5 ft. and a stiff consistency. The lab results indicate that the cohesive stratum is inorganic and of low plasticity.

4.3 Shale Bedrock - Bedrock was found underlying the glacial till stratum, or the granular alluvial deposit. The bedrock was proven in all the boring locations by obtaining BXL size rock core samples.

The dominant type of bedrock encountered across the site is a dark grey shale with occasional bands of limestone. The bedrock surface

at the investigated site varies from elevation 605 ft. (B.H. 11) to 609.9 ft. (B.H. 10). The bedrock in general was found to be in a sound condition except in certain locations, the upper 1 to 1.5 ft. appeared to be slightly weathered.

5. GROUNDWATER CONDITIONS

Groundwater level observations were carried out during the period of investigation by recording the water level in the open boreholes. The observations are recorded on the Borelog sheets and summarized on Drawing no. 1036909-A. The results of the measurements in the open boreholes indicate that the groundwater level ranges from 0 ft. (B.H. 3 and 4) to 6.5 ft. (B.H. 11) below existing ground surface, which corresponds to elevations 611.5 ft. to 609.0 ft. The water level in Etobicoke Creek during the time of investigation was observed to be 611.5 ft. which corresponds to water level reading in B.H. 3 and 4. These observations would indicate that there is a natural hydraulic gradient towards the creek, which confirms the fact that the Etobicoke Creek controls the drainage in the general area.

6. DISCUSSION AND RECOMMENDATIONS

- 6.1. General - This report mainly deals with the proposed structure at the crossing of Etobicoke Creek and Hwy. 410 northbound lanes in the city of Brampton, Municipality of Peel. The initial structure will be a single span (86' long and 60' wide) bridge to accommodate the interim two lane highway across the Etobicoke Creek, utilizing the centerline of N.B. lanes of the ultimate six lane roadway.

The profile grade of Hwy. 410 in the vicinity of the proposed creek crossing will be at about elevation 632 ft. The existing creek valley floor is at approximate elevation 612 which corresponds to the proposed invert elevation of the Etobicoke Creek in this area. Based on this it is estimated that the approaches will be up to 20 ft. high both in the transverse and longitudinal directions respectively for the proposed structure.

The predominant stratum across the site is composed of 2.5 to 8 ft. thick loose to very dense alluvial deposit made up of gravel with

silty sand to silty sand with gravel and traces of clay over the majority of the site, with some localized exceptions where a cohesive clayey silt stratum exists. The overburden is underlain by shale bedrock.

The recommendations pertaining to the foundations of both the initial and the ultimate structure schemes contemplated at this site are as follows:

6.2. Structure Foundations

6.2.1. Abutment Footings - For foundations of the closed abutments of the single span structure, taking into consideration the scour and frost protection requirements, the footings can be located at or below elev. 606.0 on sound shale bedrock. The valley floor is at elev. 612.0, this will provide adequate frost cover since shales are susceptible for frost action. Footings founded on sound shale bedrock may be designed using an allowable pressure of 10 T.S.f.

The excavations for the abutment foundation will be carried out through the surficial granular deposit and, or the glacial till stratum to the shale bedrock, below the prevailing groundwater level. The granular deposit is pervious, therefore excessive seepage can be anticipated into the excavations. It is therefore recommended that a dewatering scheme will be necessary to prevent seepage into the footing excavation. It should be noted that the ground level at north east footing location is almost level with the creek water level recorded during the time of soil investigation (May 1976). In order to avoid the hazards of flooding, etc. excavations should be carried out within a sealed area, e.g. sheeted cofferdam.

The settlement of the footings will be negligible in magnitude, provided that measures are exercised to prevent the shale from being softened by groundwater seepage or uncontrolled surface runoff. It will be advantageous to protect the shale at the footing founding level, by covering it with a lean concrete working slab immediately after the completion of the excavation.

It is understood that a three span structure might also be considered for this crossing. Our preliminary recommendations, without carrying out any additional investigation are given in the following paragraphs.

The recommendations outlined for abutments of the single span structure can be used for the pier foundations of the three span structure. The south abutment (initial concept) or abutments (ultimate concept) can be supported on spread footings within the approach embankment. In this case the approach fill for a minimum distance of 50 ft. behind the abutment should consist of well compacted granular 'A' material. In such case an allowable load of 2.5 t.s.f. may be used for footing design. Alternatively the footings can be supported on end bearing piles driven to bedrock surface, using maximum allowable capacity of the pile section chosen.

The north abutment (initial scheme) or abutments (ultimate scheme) will be located in a cut section according to the proposed grade in this area. At this stage it is difficult to speculate whether the footing base will be located in the competent overburden or within the shale bedrock. However a safe allowable load of 2.5 t.s.f. can be adopted for footings in the overburden and 10.0 t.s.f. for footings located on or within sound shale bedrock. An appropriate subsurface investigation will be necessary when the location of the footings are finalized in order to provide positive foundation recommendations.

- 6.3. Approaches: The contemplated structures at this site will necessitate south approach fills up to maximum height of 20 ft. in the longitudinal and transverse direction. The north approach will utilize the existing high river bank and will be in a cut section up to 16 ft. in depth.

The cohesive glacial till and the alluvial granular layer are the predominant overburden deposits in this area. The 20 ft. high fill will be stable and no deep seated failures are anticipated provided that:

- a. The fill will be of competent material.
- b. The fill will be placed after removing any surficial top soil material in the area.

- c. The fill will be placed with 2:1 side slopes and compacted according to M.T.C. standards.

The proposed cuts up to 16 ft. in depth for the north approach will be stable if they are constructed with slopes of two horizontal to one vertical.


The creek approaches within the structure area should be rip rapped to the high water level.

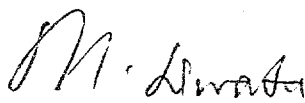
7. MISCELLANEOUS

The field work was carried out during April 29, 1976 to May 10, 1976 under the supervision of Mr. V. Korlu, Project Engineer, who also prepared this report.

The equipment was provided and operated by Atcost Drilling Co. of Toronto.

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


V. Korlu, P. Eng.
Project Engineer


M. Devata, P. Eng.
Supervising Engineer



VK/rm
June 3, 1976

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS-SECTION

RECORD OF BOREHOLE NO 1

WP 103-69-09 LOCATION Co-ords. 15,869,046 N; 945,989 E. ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE April 30, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, BX Casing, BXL Rock Core & Cone Test CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L	
613.0	Ground Level														
0.0	Clayey silt with sand & gravel. (Glac. Till)														
610.0	Gravel with silty sand & tr. of clay. Compact		1	SS	19	610									
608.0	Weathered sound Bedrock		2	BXL	65%										
5.0	Grey shale with occ. layers of limestone.		3	BXL	80%										
597.2			4	BXL	100%	600									
15.8	End of Borehole														

RECORD OF BOREHOLE NO 2

W/P 103-69-09

LOCATION Co-ords. 15,869,064 N; 946,045 E.

ORIGINATED BY vx

DIST 6 HWY 410

BORING DATE April 29, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BXCasing, BXL Rock Core &

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					Cone Test			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	LIQUID LIMIT w_L	PLASTIC LIMIT w_p	WATER CONTENT w		
613.4	Ground Level															
0.0	Silty sand with grav.		1	SS	19											
608.9	& trace of clay. Compact					610										37 46 (17)
4.5	Weathered		2	BXL	50%											
	Sound															
601.9	Bedrock - grey shale with occasional layers of limestone.		3	BXL	100%						100/2"					
11.5	End of Borehole															

RECORD OF BOREHOLE NO 3

WP 103-69-09

LOCATION Co-ords. 15,869,146 N; 946,017 E.

ORIGINATED BY VK

DIST 6 HWY 410

BORING DATE May 5, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BX Casing & BXL Rock Core

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
611.9	Ground Level															
0.0	Gravel with shale fragments					610										
608.6																
3.3	Sound Bedrock - grey shale with occasional layers of limestone		1	BXL	Rec 100%											
598.6			2	BXL	Rec 100%	600										
13.3	End of Borehole															

RECORD OF BOREHOLE NO 4

WP 103-69-09

LOCATION Co-ords. 15,869,132 N; 945,970 E.

ORIGINATED BY VK


DIST 6 HWY 410

BORING DATE May 4, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BX Casing & BXL Rock Core

CHECKED BY 

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
611.1	Ground Level															GR SA SI CL
608.7	Gravel with shale fragments					610										
2.4	Sound															
	Bedrock - Grey Shale with occasional layers of limestone		1	BXL	Rec 100%											
599.1			2	BXL	Rec 100%	600										
12.0	End of Borehole															

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 5

WP 103-69-09 LOCATION Co-ords. 15,869,057 N; 946,101 E. ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE April 29, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core & Cone Test CHECKED BY cf.

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	W_P	W	W_L		
614.9	Ground Level															
0.0	Silty sand with traces of gravel and clay.															
609.4	Loose		1	SS	8	610										10 40 43 7
5.5	weathered Sound		2	BXL	Rec 80%											
	Bedrock - Grey Shale with occasional layers of limestone.		3	BXL	Rec 90%											
598.4			4	BXL	Rec 100%	600										
16.5	End of Borehole															

RECORD OF BOREHOLE NO 6

WP 103-69-09 LOCATION Co-ords. 15,869,142 N; 946,073 E. ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE May 4, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, BX Casing & NXL Rock Core CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L	
611.1	Ground Level														
0.0	Gravel with shale fragments														
608.6	Sound														
2.5	Bedrock - Grey Shale with occasional layers of limestone		1	NXL	Rec 100%										
598.6			2	NXL	Rec 100%										
12.5	End of Borehole														

RECORD OF BOREHOLE NO 7

WP 103-69-09 LOCATION Co-ords. 15,869,062 N; 945,950 E. ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE April 30, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core & Cone Test CHECKED BY *EP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
615.0	Ground Level															
0.0	Silty sand with gravel and trace of clay.		1	SS	15											27 35 34 4
608.0	Compact to Dense		2	SS	30											46 22 26 6
7.0	weathered Sound		3	BXL	Rec 40%											
600.0	Bedrock - Grey Shale with occasional layers of limestone		4	BXL	Rec 100%											
15.0	End of Borehole															

RECORD OF BOREHOLE NO 8

WP 103-69-09 LOCATION Co-ords. 15,869,031 N; 945,856 E. ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE May 3, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, B.X. Casing; BXL Rock Core & Cone Test CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
615.8	Ground Level															
0.0	Gravel with silty sand and trace of clay		1	SS	33											53 32 (15)
607.8	Dense		2	SS	39											49 27 21 3
8.0	weathered Sound		3	BXL	Rec 45%											
	Bedrock - Grey Shale with occasional layers of limestone		4	BXL	Rec 100%											
597.0			5	BXL	Rec 100%											
18.8	End of Borehole															

RECORD OF BOREHOLE NO 9

WP 103-69-09

LOCATION Co-ords. 15,869,143 N; 945,923 E.

ORIGINATED BY VK

DIST 6 HWY 410

BORING DATE May 7, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core & Cone Test

CHECKED BY *OP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100		
614.4	Ground Level												
0.0	Clayey silt, some sand & gravel. (Glac. Till)		1	SS	56								
610.4	weathered Hard												
4.0	Sound		2	BXL	Rec 90%								
	Bedrock - Grey Shale with occasional layers of limestone		3	BXL	Rec 100%								
600.0													
14.4	End of Borehole												


RECORD OF BOREHOLE NO 10

WP 103-69-09 LOCATION Co-ords. 15,869,112 N; 945,828 E. ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE May 7, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core & Cone Test CHECKED BY CP

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P W W_L WATER CONTENT %	UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100			
613.9	Ground Level													
0.0	Gravel with shale fragments. Very Dense		1	SS	100%	610								
609.9	weathered Sound													
4.0	Bedrock - Grey Shale with occasional layers of limestone		2	BXL	Rec 95%									
599.5			3	BXL	100%	600								
14.4	End of Borehole													

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 11

WP 103-69-09 LOCATION Co-ords. 15,868,935 N; 946,010 E. ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE June 25, 1975 COMPILED BY OY
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core & CHECKED BY 

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
615.7	Ground Level															
0.0	Silty sand with gravel, trace of clay. Compact		1	SS	14	610										38 24 28 10
609.7																
6.0	Het. mix. of clayey silt, sand & grav. Brown															
605.2	Stiff to Hard (Till) Grey		2	SS	100/6"											
10.5	weathered															
11.5	Sound															
599.2	Bedrock - Grey Shale with occ. layers of limestone		3	BXL	100%	600										
16.5	End of Borehole															

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 12

WP 103-69-09 LOCATION Co-ords. N. 15,869,232; E. 945,983 ORIGINATED BY VK
DIST 6 HWY 410 BORING DATE July 30, 1976 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT				LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	W _P	W	W _L	
646.0	Ground Level														
0.0	Silty sand, trace of organics.														
641.0	Loose		1	SS	5										
5.0	Het. mix. of clayey silt sand and gravel		2	SS	21										
	(Glacial Till)		3	SS	26										
			4	SS	20										
			5	SS	23										
			6	SS	125										
	Brown Grey														
619.5	Very Stiff		7	SS	100										
26.5	Shale Bedrock		8	BXL	85%										
616.0															
30.0	End of Borehole														

20
15 ϕ 5 % STRAIN AT FAILURE
10



Ministry of
Transportation and
Communications

DIAMOND DRILL RECORD

HOLE NO. _____ SHEET NO. _____

DIP

PROPERTY _____
LOCATION _____
LATITUDE _____
DEPARTURE _____
BEARING _____

W. P. 103-69-09

90°

TOTAL FOOTAGE _____

ELEV. COLLAR _____
DATUM _____
DATE STARTED _____
DATE COMPLETED _____
DRILLED BY _____
LOGGED BY _____

FOOTAGE		FORMATION	SAMPLE NUMBER			REMARKS
FROM	TO					
Hole 1						
5'0"	5'4"	Limestone, medium texture, medium hard, light grey colour				Core broken
5'4"	14'0"	Shale, fine texture, soft, dark grey colour, fissile				intermittent beds of limestone
14'0"	14'6"	Limestone, medium texture, medium hard, light grey colour				
Hole 2						
4'0"	5'0"	Limestone, grey, fine texture, medium hard, silty with shale seams				
5'0"	11'6"	Shale, grey, soft, fissile, interbedded with narrow beds of silty limestone				
Hole 3						
3'3"	13'2"	Shale, grey, soft, fissile, interbedded with few thin beds of silty limestone				
Hole 4						
2'4"	12'0"	Shale, same as above				

DATE OF EXAMINATION May 26/76

Z. Koniuszy



HOLE NO. _____ SHEET NO. _____

DIP

PROPERTY _____ W. P. 103-69-09
LOCATION _____
LATITUDE _____
DEPARTURE _____
BEARING _____

90°

TOTAL FOOTAGE _____

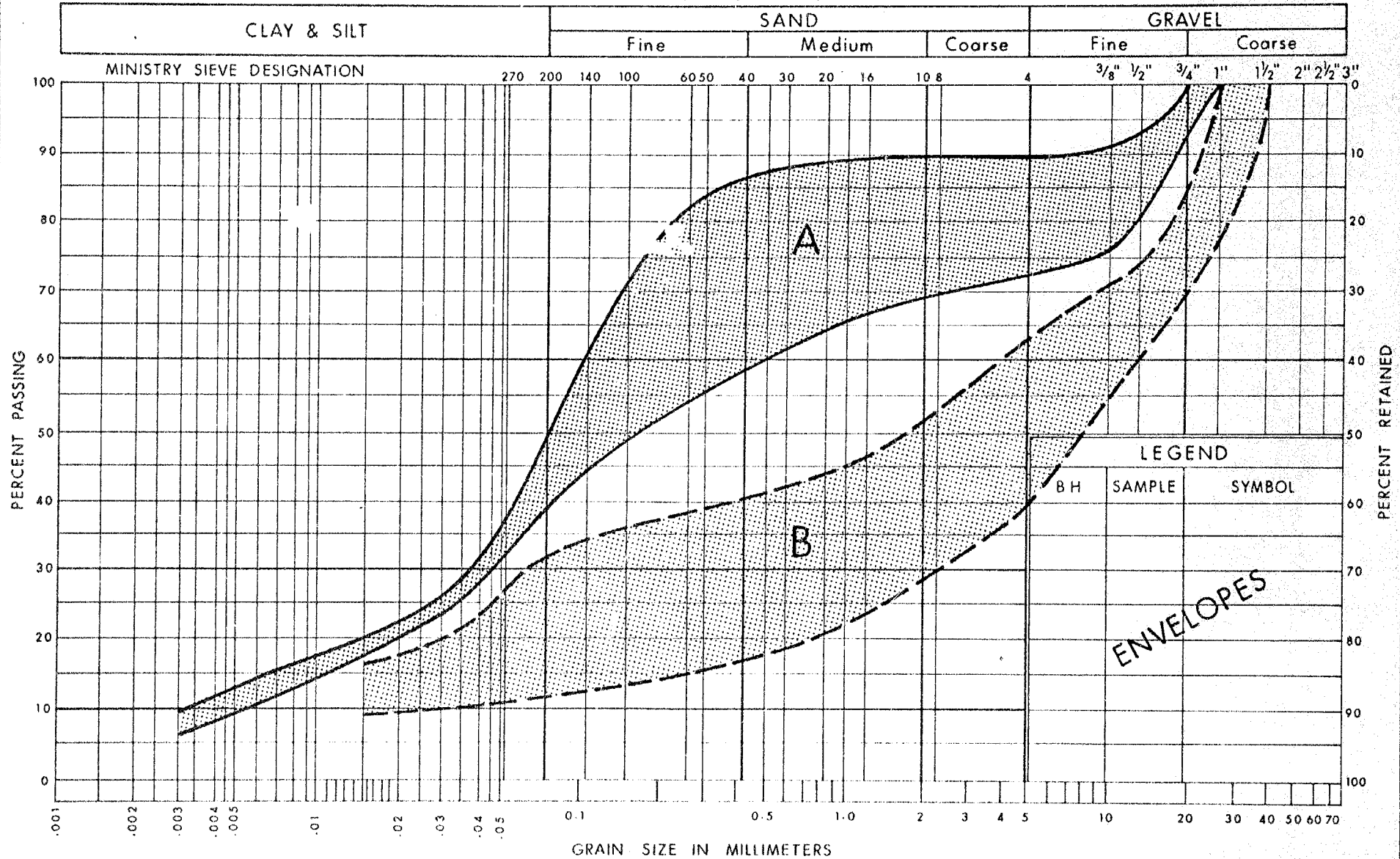
ELEV. COLLAR _____
 DATUM _____
 DATE STARTED _____
 DATE COMPLETED _____
 DRILLED BY _____
 LOGGED BY _____

FOOTAGE		FORMATION	SAMPLE NUMBER			REMARKS
FROM	TO					
		Hole 5				
5'5"	16'5"	Shale, same as Hole 3				
		Hole 7				
7'	11'2"	Limestone, grey, shaly, silty, medium textured, medium hard with shale seams				
11'2"	15'0"	Shale, grey, soft, fissile with 3, 1" seams of limestone				
		Hole 8				
8'0"	18'8"	Shale, grey, soft, fissile with 3 thin seams (1") of limestone				
		Hole 9				
4'0"	14'4"	Shale, grey, soft, fissile with few seams of limestone (up to 3")				
		Hole 10				
4'3"	14'4"	Shale as above				

DATE OF EXAMINATION May 26/76

Z. Koniuszy

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

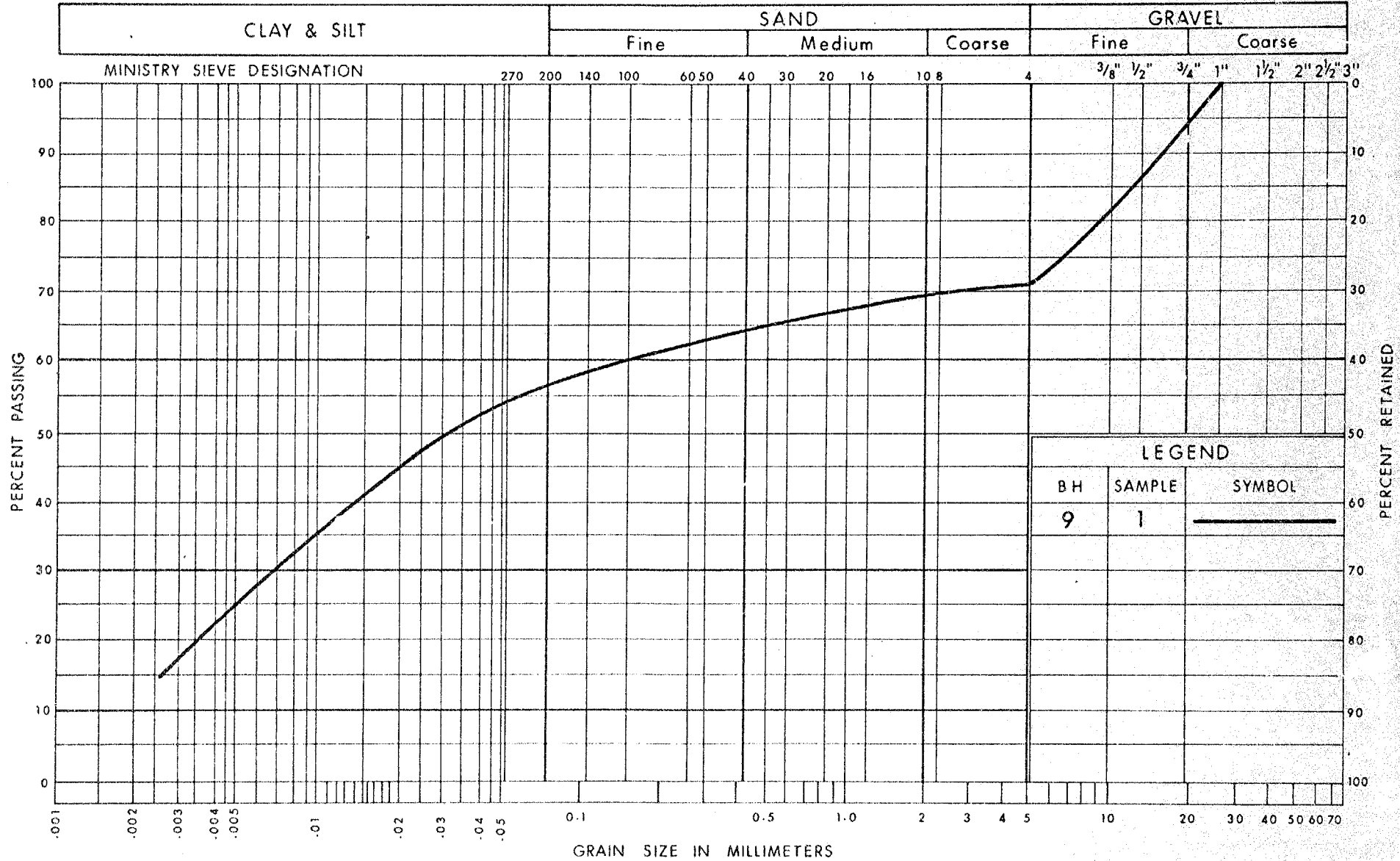
ENGINEERING SERVICES BRANCH

GRAIN SIZE DISTRIBUTION
A - SILTY SAND, WITH GRAVEL, TRACE OF CLAY
B - GRAVEL, SILTY SAND, TRACE OF CLAY

FIG No 1

W P 103-69-09

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
GLACIAL TILL, CLAYEY SILT, SAND & GRAVEL

FIG No 2
W P 103-69-09



Ministry of
 Transportation and
 Communications

Ontario

ENGINEERING SERVICES BRANCH

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
WS	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 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
$\bar{\sigma}$	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

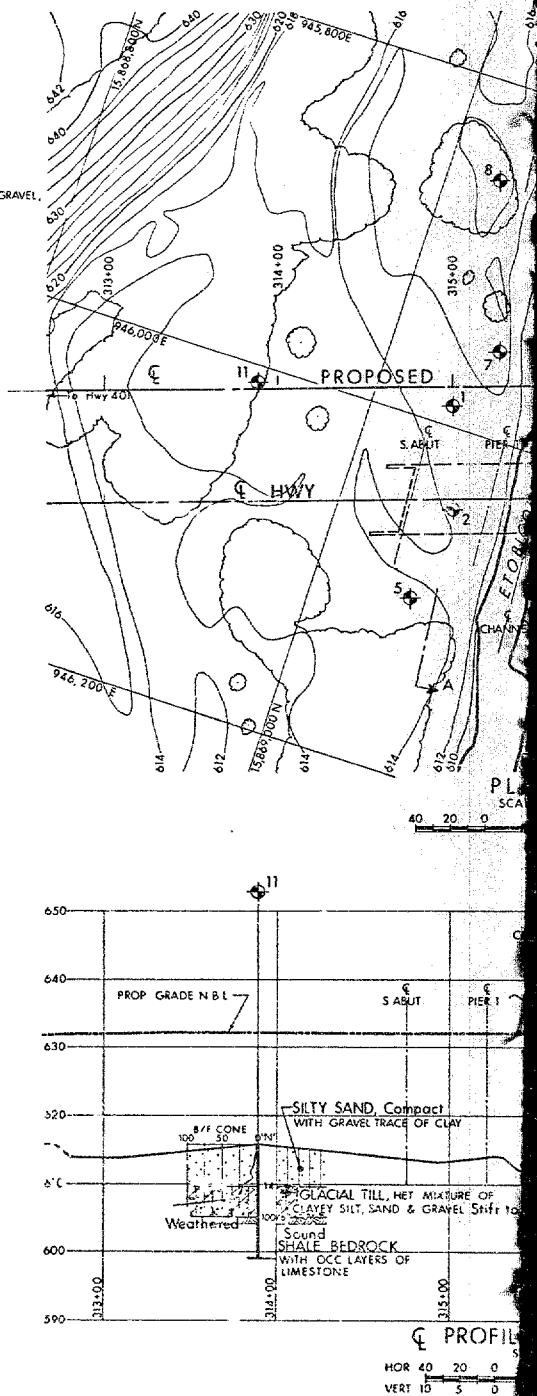
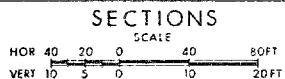
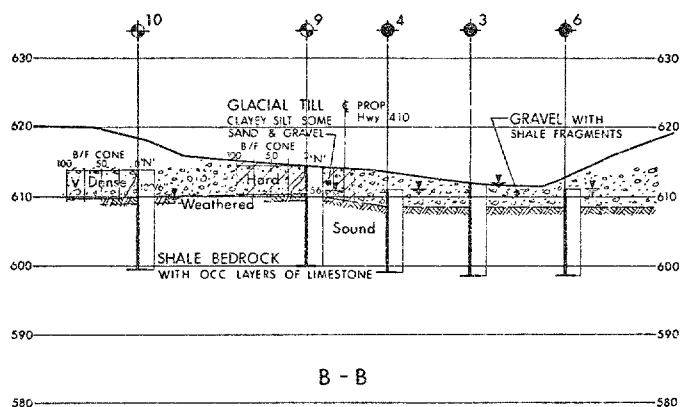
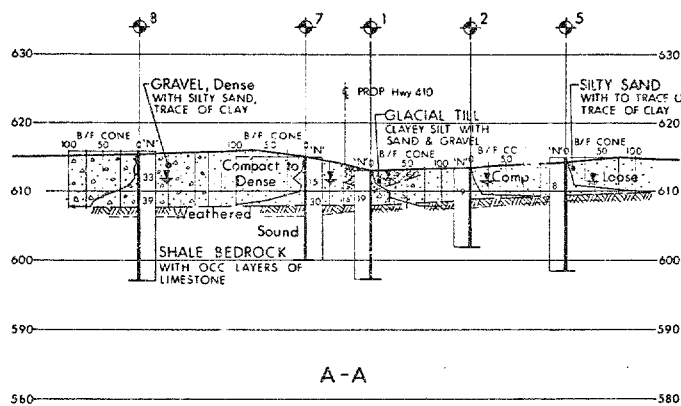
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
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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



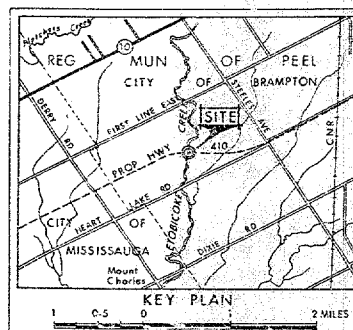
CONT No
WP No 103-69-09

ETOBICOKE CREEK

BORF HOLE LOCATIONS & SOIL STRATA



SHEET



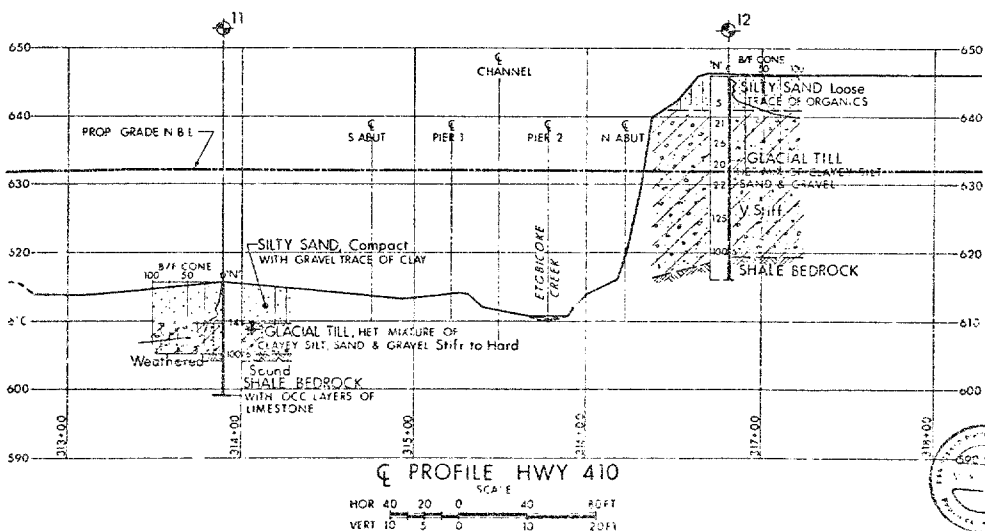
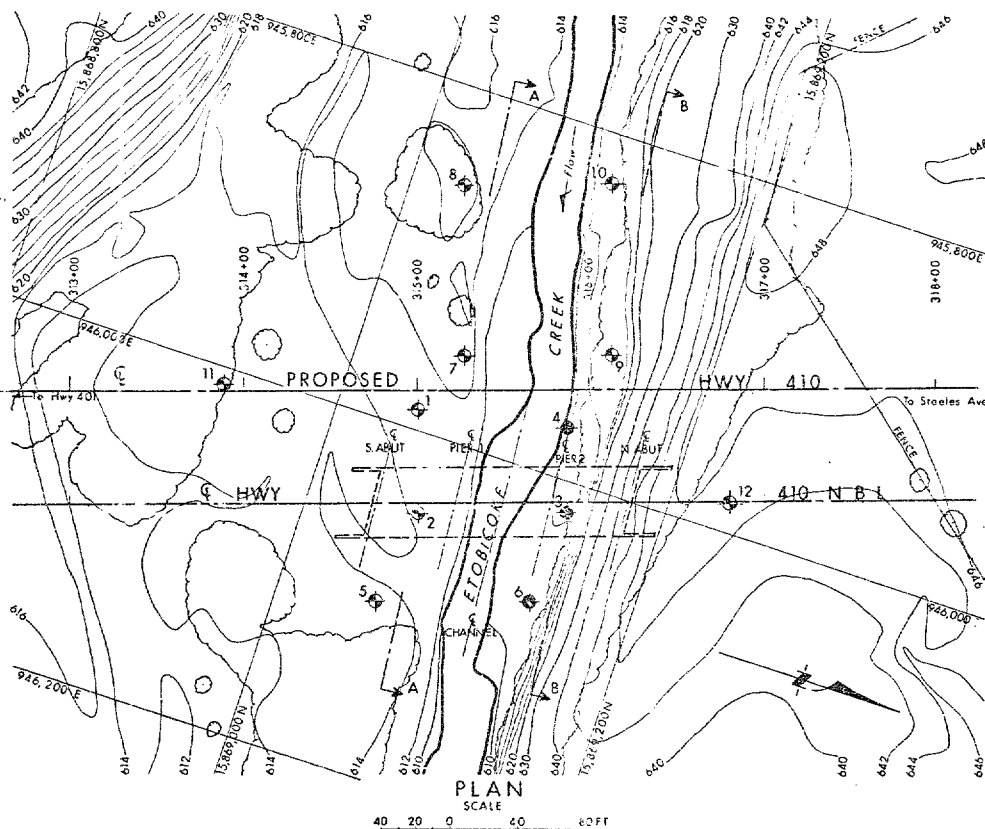
LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- "N" Blows/ft (Std Pen Test 350ft lbs energy)
- CONE Blows/ft (60° Cone, 350ft lbs energy)
- ↓ W/L at time of investigation April and May 1976
- W/L for Bore Hole #11, June 1975

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	613.0	15,869,046	945,989
2	613.4	15,869,064	946,045
3	611.9	15,869,146	946,017
4	611.1	15,869,132	945,970
5	614.9	15,869,057	946,101
6	611.1	15,869,142	946,073
7	615.0	15,869,062	945,950
8	615.8	15,869,031	945,856
9	614.4	15,869,143	945,923
10	613.9	15,869,112	945,828
11	615.7	15,868,935	946,010
12	646.0	15,869,232	945,983

-NOTE-

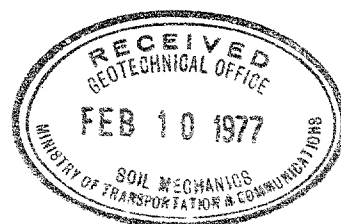
The boundaries between soil strata have been established only at Bore Hole locations. Between bore holes the boundaries are assumed from geological evidence.



INDEX

<u>Page No.</u>	<u>Description</u>
1	Index
2-3	Abbreviations & Symbols
4- 36	Foundation Investigation Reports for
W.P. 103-69-08	Various Culverts Between Derry Road and Hwy. #7, Hwy. 410 (Interim Two Lane)
W.P. 103-69-09	Etobicoke Creek Bridge, Hwy. 410

NOTE For purposes of this contract these reports supercede all other Foundation Investigation and Design Reports prepared by or for the Ministry in connection with the above mentioned projects.



ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

PENETRATION RESISTANCE

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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

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g	ACCELERATION DUE TO GRAVITY
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FOUNDATION INVESTIGATION REPORT

For

Various Culverts
Between Derry Road and Hwy #7
Hwy. 410 (Interim Two Lane)
W.P. 103-96-08, District #6 (Toronto)

INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project. Field work was done during the period July 14th - 30th 1976, utilizing a continuous flight auger machine equipped with 3 1/4 inch I.D. hollow stem augers. B X L rock core samples (1 21/32 inch diameter) were obtained to prove bedrock. The field investigation consisted of a total of eleven sampled boreholes to depths ranging from 17 to 30 feet below ground surface.

SITE DESCRIPTION

The site is located between Derry Road and Hwy. #7 in the cities of Mississauga and Brampton. Topographically the area is rolling and generally sloping down towards Lake Ontario. The land is used primarily for farming purposes. Physiographically the area is located in the region known as the "Peel Plain" which is characterized by a glacial till overlying a shale bedrock of the Meadford - Dundas Formation, Ordovician Period.

SUBSURFACE CONDITIONS

General

Subsoil at the site consists of a very firm to hard heterogeneous mixture of clayey silt, sand and gravel, a glacial till, which extends to a minimum depth of 12 feet below ground surface. The glacial till overlies shale bedrock. Reference should also be made to sheet No. 99 of the Contract Drawings on which is shown the locations and elevations of all borings, together with the inferred subsoil stratigraphy. A detailed description of the glacial till and bedrock is as follows.

Glacial Till (Clayey Silt With Sand and Gravel)

This stratum was encountered in all boring locations. It is a heterogeneous

mixture of clayey silt, sand and gravel. The thickness of the glacial till deposit was not fully explored at all locations, but it is proven only to its full depth of 12 feet at B.H. #6 and elsewhere up to a depth of 30 feet below ground surface.

Results of Atterberg Limit tests performed on samples recovered in this stratum were plotted on the Record of Borehole sheets. They are tabulated as below:

		<u>Range</u>
Liquid Limit	(W_L) %	15 - 32
Plastic Limit	(W_p) %	9 - 18
Natural Moisture Content	(W) %	6 - 15

The above results indicate that the cohesive portion of the glacial till is inorganic and of low plasticity. The Standard Penetration Test 'N' values generally range from 23 to over 100 blows per foot with the exception of few surficial locations in the upper portion with values as low as 8 to 17 blows/foot. It is estimated that the consistency of the cohesive glacial till varies from very stiff to hard increasing with depth except for localized zones in the upper portion of the deposit where the consistency varies from firm to stiff.

Shale Bedrock

Bedrock was proven underlying the glacial till stratum in B.H. #6 only. The bedrock is a dark grey shale with occasional bands of limestone and/or sandstone. The bedrock at B.H. #6 location is at elev. 683. which is approximately 12 feet below ground surface. The bedrock is sound.

Groundwater Conditions

Groundwater level observations were carried out during the period of the investigation by measuring the water level in the open boreholes. The results of the measurements indicate that the ground water level varies from 2 to 14 feet below ground surface.

M. Devata, P. Eng.
Supervising Engineer

MD/km



APPENDIX

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1(1)

WP 103-69-08 LOCATION Co-ords. N 15,865,017 E 949,335 ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE July 28, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W_P	W	W_L		
605.9	Ground Level															
0.0			1	SS	23											4 27 52 17
	Brown		2	SS	60	600										7 23 53 17
	Grey		3	SS	72	6"										3 27 56 14
	Het. mix. of clayey silt, sand and gravel (Glacial Till)		4	SS	172	9"										4 37 50 9
			5	SS	100	6"										
			6	SS	100	6"										
	Very Stiff to hard		7	SS	52	580										10 29 51 10
575.4			8	SS	100	6"										
30.5	End of Borehole															

20
15 ϕ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1(2)

WP 103-69-08

LOCATION Co-ords. N 15,864,997 E 949,213

ORIGINATED BY VK

DIST 6 HWY 410

BORING DATE July 27, 1976

COMPILED BY VK

DATUM G-detic

BOREHOLE TYPE Hollow Stem Auger & Cone Test


CHECKED BY *EP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
606.8	Ground Level															GR SA SI CL
0.0			1	SS	28											1 24 54 21
			2	SS	67	600										16 23 44 17
	Brown		3	SS	105											6 29 46 19
	Grey		4	SS	160											
	Het. mix. of clayey silt, sand and gravel (Glacial Till)		5	SS	182/9"	590										
	Very stiff to hard		5	SS	100/6"											11 30 48 11
579.3						580										
27.5	End of Borehole															

20
15 \diamond 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2(1)

WP 103-69-08 LOCATION Co-ords. N 15,866,682 E 947,725 ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE July 23, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY 

SOIL PROFILE		SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		20	40	60	80	100	w_p	w	w_L		
620.6	Ground Level														
0.0			1	SS	27										
			2	SS	132										
			3	SS	119										
			4	SS	100	6"									
			5	SS	100	6"									
			6	SS	100	6"									
			7	SS	100	6"									
596.1															
24.5	End of borehole														

OFFICE REPORT ON SOIL EXPLORATION

20
15 ϕ 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2 (2)

WP 103-69-08 LOCATION Co-ords. N 15,866,670 E 947,592 ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE July 23, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L WATER CONTENT % 10 20 30	UNIT WEIGHT γ P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
622.3	Ground Level									
0.0			1	SS	11	620			Org. 0.53%	10 32 41 17
	Brown		2	SS	43				0.72%	
	Grey		3	SS	64					32 17 37 14
	Het. mix. of clayey silt, sand and gravel (Glacial Till)		4	SS	144	610				32 5 46 17
603.5	Stiff to hard		5	SS	100	603.5"				49 13 31 7
18.8	End of Borehole									

20
15 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 3(1)

WP 103-69-08

LOCATION Co-ords. N 15,870,340 E 945,576

ORIGINATED BY VK

DIST 6 HWY 410

BORING DATE July 21, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Cone Test

CHECKED BY CP

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
632.2	Ground Level															GR SA SI CL
0.0																
			1	SS	34											5 18 47 30
			2	SS	70											
			3	SS	100											5 28 48 19
			4	SS	115											
			5	SS	115											13 34 52 1
			6	SS	75											
			7	SS	70											
			8	SS	80											4 23 47 26
602.1																
30.1	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 3(2)

WP 103-69-08

LOCATION Co-ords. N 15,870,376; E 945,660

ORIGINATED BY VK

DIST 6 HWY 410

BORING DATE July 22, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Cone Test

CHECKED BY *GP*

SOIL PROFILE			SAMPLES			GROUND-WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L	
630.0	Ground Level														
0.0			1	SS	43										8 22 49 21
	Brown		2	SS	129										25 32 29 14
	Gray		3	SS	50										
	Het. mixture of clayey silt, sand and gravel (Glacial Till)		4	SS	120	620									9 33 56 2
			5	SS	137/6"										
	Hard		6	SS	100/6"	610									
603.5			7	SS	160										12 23 46 19
26.5	End of Borehole														

20
15 ϕ 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 4 (1)

WP 103-69-08

LOCATION Co-ords. N 15,871,122; E 945,418

ORIGINATED BY VK

DIST 6 HWY 410

BORING DATE July 20, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Cone Test

CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT			LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ P.C.F.	REMARKS % GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p			w	w_L	
628.4	Ground Level																
0.0	Het. mix. of clayey silt, sand and gravel (Glacial Till) Very Stiff to hard		1	SS	17												
			2	SS	67												
			3	SS	110/6		620										
			4	SS	145												
			5	SS	100		610										
			6	SS	105/8"												
			7	SS	80/3"		600										
597.6			8	SS	100/3"												
30.8	End of Borehole																

20
15
10

5 % STRAIN AT FAILURE

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 4(2)

WP 103-69-08 LOCATION Co-ords. N 15,871,165; E 945,314 ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE July 20, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		20	40	60	80	100	w_p	w	w_L		
628.5	Ground Level														
0.0			1	SS	12										4 21 50 25
			2	SS	35										11 23 48 18
	Brown		3	SS	50/2"										7 33 51 9
	Grey		4	SS	110/9"										
	Het. mixture of clayey silt, sand and gravel (Glacial Till)		5	SS	66										17 30 43 10
			6	SS	100/1"										12 34 44 10
			7	SS	85										
597.8	Stiff to hard		8	SS	100/2"										17 18 47 18
30.7	End of Borehole														

20
15
10
% STRAIN AT FAILURE

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 5(1)

WP 103-69-08

LOCATION Co-ords. N 15,872,360; E 944,915

ORIGINATED BY VK

DIST 6 HWY 410

BORING DATE July 15, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Cone Test

CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
631.1	Ground Level															
0.0			1	SS	8	630										
			2	SS	100/5"											
			3	SS	100/5"											
			4	SS	85/5"	620										
			5	SS	120/5"	610										
604.2	Stiff to hard		6	SS	50/5"											
26.9	End of Borehole															

Brown
Grey
Het. mixture of
clayey silt, sand
and gravel
(Glacial Till)

20
15 ϕ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE NO 5(2)

WP 103-69-08 LOCATION Co-ords. N 15,872,368 E 944,803 ORIGINATED BY VK
DIST 6 HWY 410 BORING DATE July 15, 1976 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone Test CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
631.6	Ground Level															
0.0			1	SS	20	630										
			2	SS	27											
			3	SS	85/6"											
			4	SS	80/6"	620										
			5	SS	75/6"											
			6	SS	89	610										
			7	SS	110/6"											
601.6	Very stiff to hard		8	SS	120/6"											
30.0	End of Borehole															

20
15 ϕ 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 6(1)

WP 103-69-08

LOCATION Co-ords. N 15,878,285; E 939,065

ORIGINATED BY VK


DIST 6 HWY 410

BORING DATE July 14, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Cone Test

CHECKED BY 

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p w w_L WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES					
694.0	Ground Level									
0.0										
	Brown		1	SS	51	690				11 39 42 8
	Grey		2	SS	60					21 14 43 22
	Het. mix. of clayey silt, sand & gravel (glacial till) hard		3	SS	100					13 7 60 20
682.5										
11.5	Bedrock		4	BXL	100%	680				
678.5	Sound Shale			RC	REC					
16.5	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

FOUNDATION INVESTIGATION REPORT

For

Etobicoke Creek Bridge
W.P. 103-69-09, Site 24-313
Hwy. 410, District 6, Toronto

INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project. Fieldwork was done during the period April 29, 1976 to May 10, 1976 and subsequently on July 30, 1976, utilizing a continuous flight auger machine with 3¼ inch I.D. hollow stem augers. BXL rock core samples were obtained to prove bedrock.

SITE DESCRIPTION

The site is located between Derry Road and Steeles Avenue, approximately 1½ miles west of Hwy. 10 in the City of Brampton, Regional Municipality of Peel. The general area is within the valley of Etobicoke Creek.

Physiographically, the site is located in the region referred to as the "Peel Plain". Overburden in this region generally consists of glacial till. Bedrock is shale of the Meaford-Dundas Formation, Ordovician Period and is partially exposed at the creek bottom and partially exposed in the lower portion of the north bank of the valley.

SUBSURFACE CONDITIONS

General

The predominant overburden across the site is quite variable. In the valley floor the overburden is very shallow and consists either of an alluvial deposit or a glacial till. The north bank is very steep and the subsoil in this area consists of a relatively shallow deposit of silty sand, followed by glacial till. The overburden is underlain by shale bedrock. Detailed descriptions of the various soil types encountered in each borehole are given in the Record of Borehole sheets. The inferred stratigraphical profile and sections, together with the locations, are shown on Drawing No. 24-313-2 of the contract drawings.

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

Alluvial Deposits in the Valley Floor

The alluvial deposits vary in composition from silty sand with gravel to gravel with silty sand. In certain locations, these deposits contain fragments of shale in the lower portion of the stratum.

In most of the locations of the valley floor south of Etobicoke Creek the alluvial deposits extend from ground surface down to bedrock. However, in a few locations these alluvial deposits are covered or underlain by a thin 3 to 5 foot layer of glacial till. The thickness of the alluvial deposits varies randomly from 2 to 8 feet with a relative density which is estimated to be generally compact to very dense, with the exception of one location where the relative density is loose.

Grain size distribution curves for representative samples of these alluvial deposits are shown on two envelopes on Figure 1 appended to this report.

Silty Sand

This surficial deposit was encountered in the area of the north bank of the valley immediately below the ground surface. The material may be described as silty sand with trace of organics having a thickness of 5 feet. The relative density is generally loose.

Glacial Till (Clayey Silt, Sand and Gravel)

This cohesive glacial till stratum, composed of clayey silt with sand and gravel, was encountered at certain locations in the valley floor, as well as beneath the surficial silty sand at the north bank of the Etobicoke Creek. In the valley floor where it exists the thickness ranges from 3 to 5 feet, however, on the north bank the thickness of the glacial till is about 21 feet. Grain size distribution curves of samples of the matrix of the glacial till are shown in an envelope form on Figure 2.

The Standard Penetration Tests gave 'N' values which range from 19 to more than 100 blows/foot, generally increasing with depth. Based on these values it is estimated that the consistency of this deposit varies from very stiff to hard.

Atterberg Limit tests for the matrix of the glacial till are plotted on the Plasticity Chart, Figure 3. The matrix is inorganic with a low plasticity.

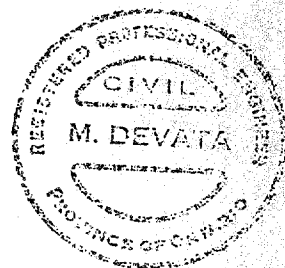
Shale Bedrock

The glacial till stratum or the alluvial deposit is underlain by a shale bedrock at a depth of 2 to 8 feet below the valley floor. At the north valley bank the shale bedrock surface was found to be about 26 feet below the existing ground surface. The bedrock surface varies between elevation 605 and elevation 610 on the valley floor, whereas on the north bank, the bedrock surface is at approximate elevation 619. The dominant type of bedrock encountered at the site is dark grey shale with occasional bands of limestone. The bedrock in general was found to be in a sound condition except in certain locations. The upper 1 to 1.5 feet appeared to be slightly weathered.

Groundwater Conditions

Groundwater level observations were carried out during the period of field investigation by recording the water level in the open boreholes. The results indicate that the groundwater level ranges from ground surface to 6 feet below existing ground surface, which corresponds to elevations 611.5 to 609.0. The water level in Etobicoke Creek during the time of investigation was observed to be at elevation 611.5.

M. Devata, P. Eng.
Supervising Engineer



MD/gs

APPENDIX

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

WP 103-69-09 LOCATION Co-ords. 15,869,046 N; 945,989 E. ORIGINATED BY VK
 DIST 6 FWY 410 BORING DATE April 30, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, BX Casing, BXL Rock Core & Cone Test CHECKED BY CP

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					Cone Test			UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	LIQUID LIMIT — W _L	PLASTIC LIMIT — W _P	WATER CONTENT — W		
613.0	Ground Level															
0.0	Clayey silt with sand & gravel. (Glac. Till)															
610.0	Gravel with silty sand & fr. of clay. Compact & weathered sound		1	SS	19	610										
608.0	Bedrock		2	BXL	65%											
5.0	Grey shale with occ. layers of limestone.		3	BXL	80%											
597.2			4	BXL	100%	600										
15.8	End of Borehole															

20
 15 \div 5 % STRAIN AT FAILURE
 10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2

WP 103-69-09

LOCATION Co-ords. 15,869,064 N: 946,045 E.

ORIGINATED BY VK

DIST 6 HWY 410

BORING DATE April 29, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BXCasing, BXL Rock Core &

 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					Cone Test			UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	LIQUID LIMIT — w_L	PLASTIC LIMIT — w_p	WATER CONTENT — w		
613.4	Ground Level															
0.0	Silty sand with grav & trace of clay. Compact		1	SS	19	610										GR SA SI CL
4.5	Weathered Sound Bedrock - grey shale with occasional layers of limestone.		2	BXL	50%					100/2"						37 46 (17)
601.9			3	BXL	100%											
11.5	End of Borehole															

 20
15 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 3

WP 103-69-09 LOCATION Co-ords. 15,869,146 N; 946,017 E.
 DIST 6 HWY 410 BORING DATE May 5, 1976
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, BX Casing & BXL Rock Core

ORIGINATED BY VK
 COMPILED BY VK
 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	W_P	W	W_L		
611.9	Ground Level															
0.0	Gravel with shale fragments					ELEV										GR SA SI CL
608.6						610										
3.3	Sound Bedrock - grey shale with occasional layers of limestone		1	BXL	Rec 100%											
598.6			2	BXL	Rec 100%	600										
13.3	End of Borehole															

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 4

WP 103-69-09 LOCATION Co-ords. 15,869,132 N; 945,970 E. ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE May 4, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, BX Casing & BXL Rock Core CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
611.1	Ground Level															
608.7	Gravel with shale fragments															
2.4	Sound															
	Bedrock - Grey Shale with occasional layers of limestone		1	BXL	Rec 100%											
599.1			2	BXL	Rec 100%											
12.0	End of Borehole															

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 5

WP 103-69-09 LOCATION Co-ords. 15,869,057 N; 946,101 E. ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE April 29, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core & Cone Test CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	VALUES	20	40	60	80	100	w_p	w	w_L		
614.9	Ground Level														
0.0	Silty sand with traces of gravel and clay.														
609.4	Loose weathered Sound		1	SS	8										10 40 43 7
5.5	Bedrock - Grey Shale with occasional layers of limestone.		2	EXL	Rec 80%										
			3	BXL	Rec 90%										
598.4			4	BXL	Rec 100%										
16.5	End of Borehole														

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 6

WP 103-69-09 LOCATION Co-ords. 15,869,142 N; 946,073 E. ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE May 4, 1976 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, BX Casing & NXL Rock Core CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
611.1	Ground Level															
0.0	Gravel with shale fragments															
608.6	Sound															
2.5	Bedrock - Grey Shale with occasional layers of limestone		1	NXL	Rec 100%											
			2	NXL	Rec 100%											
598.6																
12.5	End of Borehole															

20
15 \div 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 7

WP 103-69-09

LOCATION Co-ords. 15,869,062 N; 945,950 E.

ORIGINATED BY VK

DIST 6 HWY 410

BORING DATE April 30, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core & Cone Test

CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES					
615.0	Ground Level									
0.0	Silty sand with gravel and trace of clay.		1	SS	15					27 35 34 4
608.0	Compact to Dense		2	SS	30					46 22 26 6
7.0	weathered Sound		3	BXL	Rec 40%					
600.0	Bedrock - Grey Shale with occasional layers of limestone		4	BXL	Rec 100%					
15.0	End of Borehole									

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 8

WP 103-69-09

LOCATION Co-ords. 15,869,031 N; 945,856 E.

ORIGINATED BY VK

DIST 6 HWY 410

BORING DATE May 3, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, B.X Casing; BXL Rock Core & Cone Test

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
615.8	Ground Level															
0.0	Gravel with silty sand and trace of clay		1	SS	33											
607.8	Dense		2	SS	39											53 32 (15)
8.0	weathered Sound		3	BXL	Rec 45%											49 27 21 3
	Bedrock - Grey Shale with occasional layers of limestone		4	BXL	Rec 100%											
597.0			5	BXL	Rec 100%											
18.8	End of Borehole															

20
15 \div 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 9

WP 103-69-09

LOCATION Co-ords. 15,869,143 N; 945,923 E.

ORIGINATED BY VK

DIST 6 HWY 410

BORING DATE May 7, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core & Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT				LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L	
614.4	Ground Level														
0.0	Clayey silt, some sand & gravel. (Giac. Till)														
610.4	Hard weathered Sound		1	SS	56	610									29 14 47 10
4.0	Bedrock - Grey Shale with occasional layers of limestone		2	BXL	Rec 90%										
600.0			3	BXL	Rec 100%										
14.4	End of Borehole														

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 10

WP 103-69-09

LOCATION Co-ords. 15,869,112 N; 945,828 E.

ORIGINATED BY VK

DIST 6 HWY 410

BORING DATE May 7, 1976

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core & Cone Test

CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	w_p	w	w_L		
613.9	Ground Level															
0.0	Gravel with shale fragments. Very Dense		1	SS	100%	610										
609.9	4.0 weathered Sound															
	Bedrock - Grey Shale		2	BXL	Rec 95%											
	with occasional															
599.5	layers of limestone		3	BXL	100%	600										
14.4	End of Borehole															

20
15 \diamond 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 11

WP 103-69-09 LOCATION Co-ords. 15,868,935 N; 946,010 E. ORIGINATED BY VK
 DIST 6 HWY 410 BORING DATE June 25, 1975 COMPILED BY OY
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, BX Casing; BXL Rock Core & CHECKED BY CP

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT				Cone Test			UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	LIQUID LIMIT w_L	PLASTIC LIMIT w_p		
615.7	Ground Level														
0.0	Silty sand with gravel, trace of clay. Compact		1	SS	14	610									38 24 28 10
609.7															
6.0	Het. mix. of clayey Brown silt, sand & grav.		2	SS	100/6"										
605.2	Stiff to Hard (Till) Grey weathered Sound														
10.5															
11.5	Bedrock - Grey Shale with occ. layers of limestone		3	BXL	100%	600									
599.2															
16.5	End of Borehole														

20
15 \diamond 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 12

WP 103-69-09

LOCATION Co-ords. N. 15,869,232; E. 945,983

ORIGINATED BY VK

DIST 6 HWY 410

BORING DATE July 30, 1976

COMPILED BY VK

DATUM Geodetic

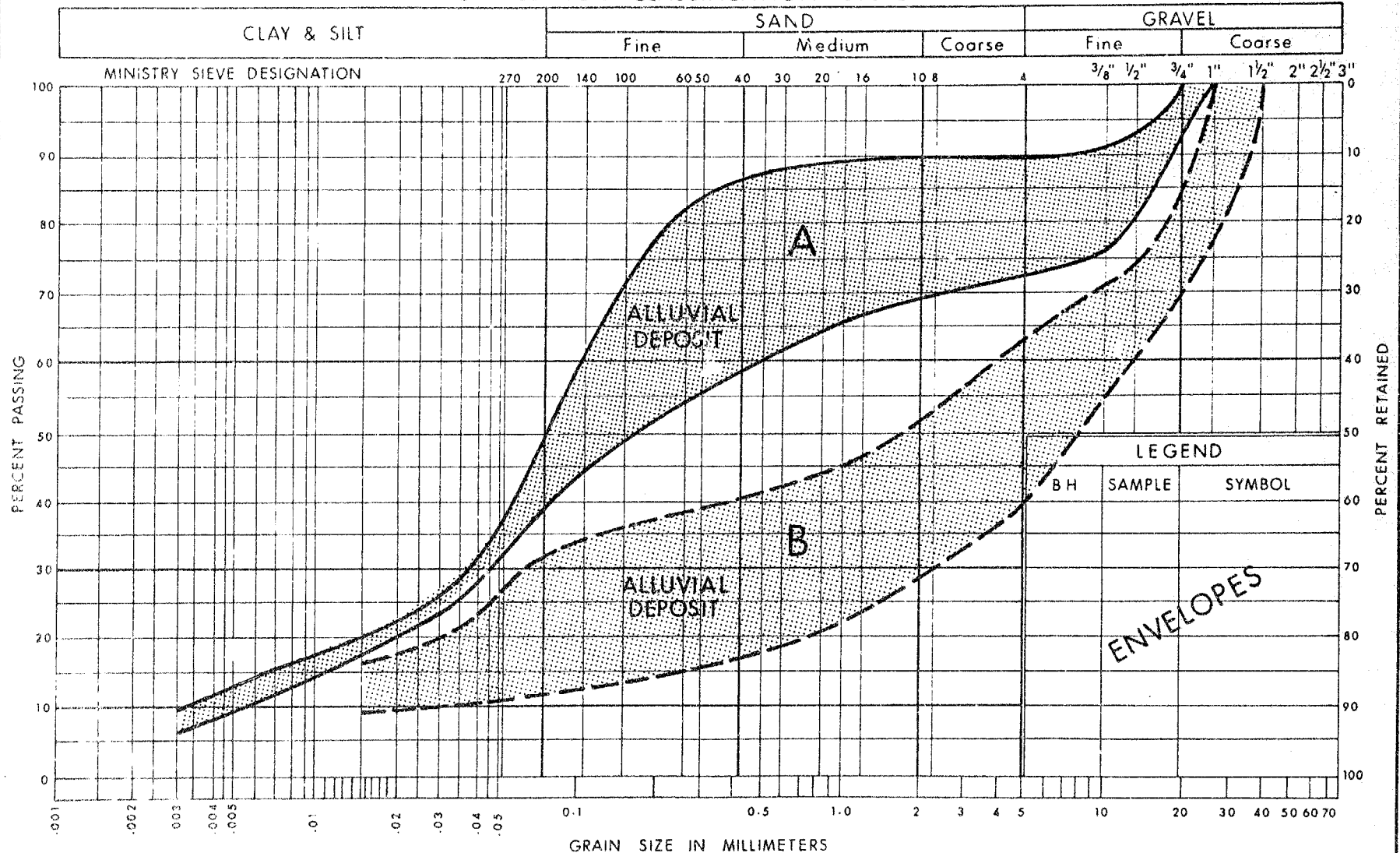
BOREHOLE TYPE Hollow Stem Auger & Cone Test

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
646.0	Ground Level															
0.0	Silty sand, trace of organics.															
641.0	Loose		1	SS	5											
5.0	Met. mix. of clayey sil. sand and gravel (Glacial Till)		2	SS	21	640										
			3	SS	26											
			4	SS	20											
			5	SS	23	630										
	Brown Grey		6	SS	125											
619.5	Very Stiff		7	SS	100	620										
26.5	Shale Bedrock		8	BXL	85%											
616.0																
30.0	End of Borehole															
	Note Water Level not established															

 20
15 ϕ 5 % STRAIN AT FAILURE
10

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications

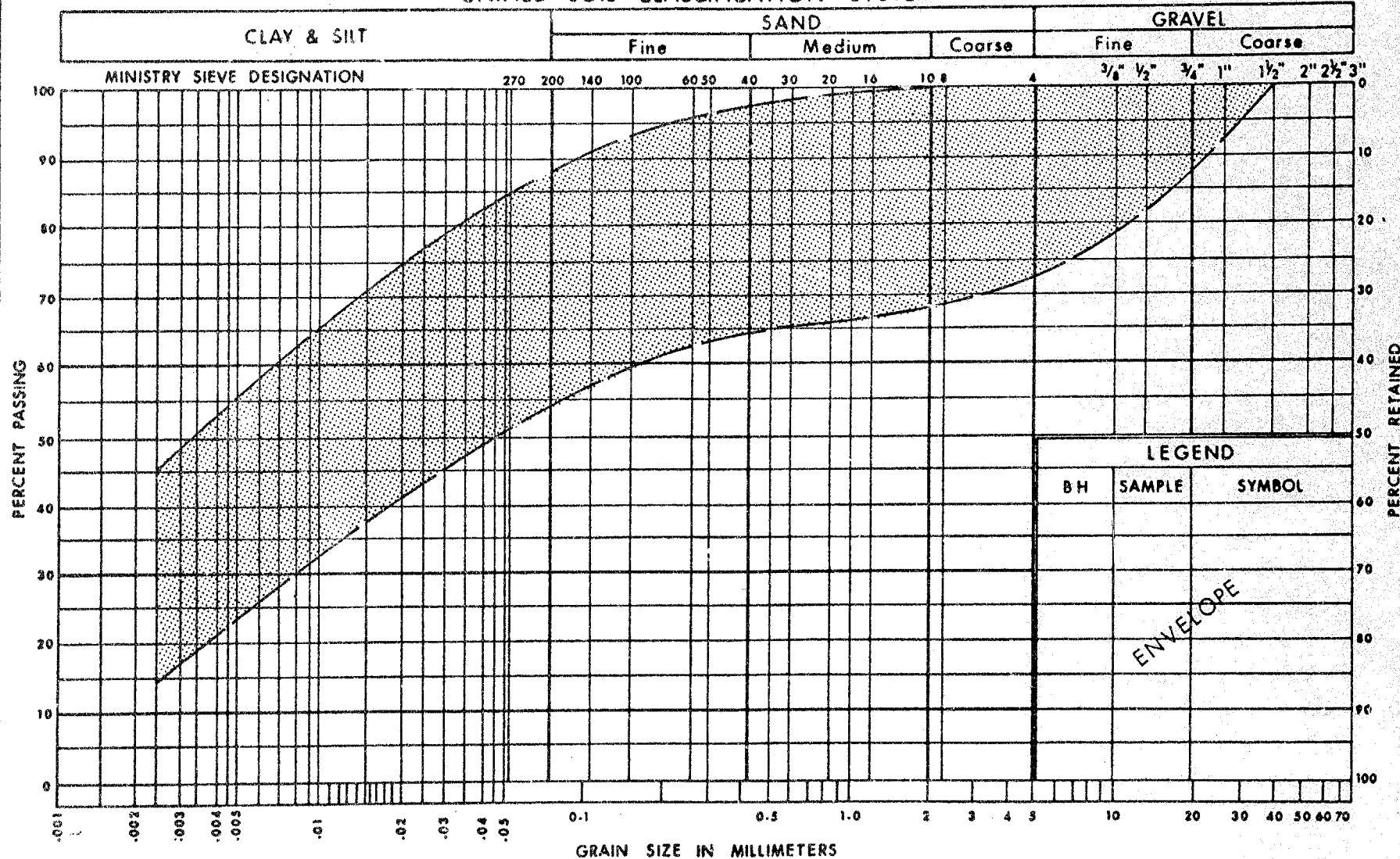
Ontario
ENGINEERING SERVICES BRANCH

GRAIN SIZE DISTRIBUTION
A - SILTY SAND, WITH GRAVEL, TRACE OF CLAY
B - GRAVEL, WITH SILTY SAND, TRACE OF CLAY

FIG No 1

W P 103-69-09

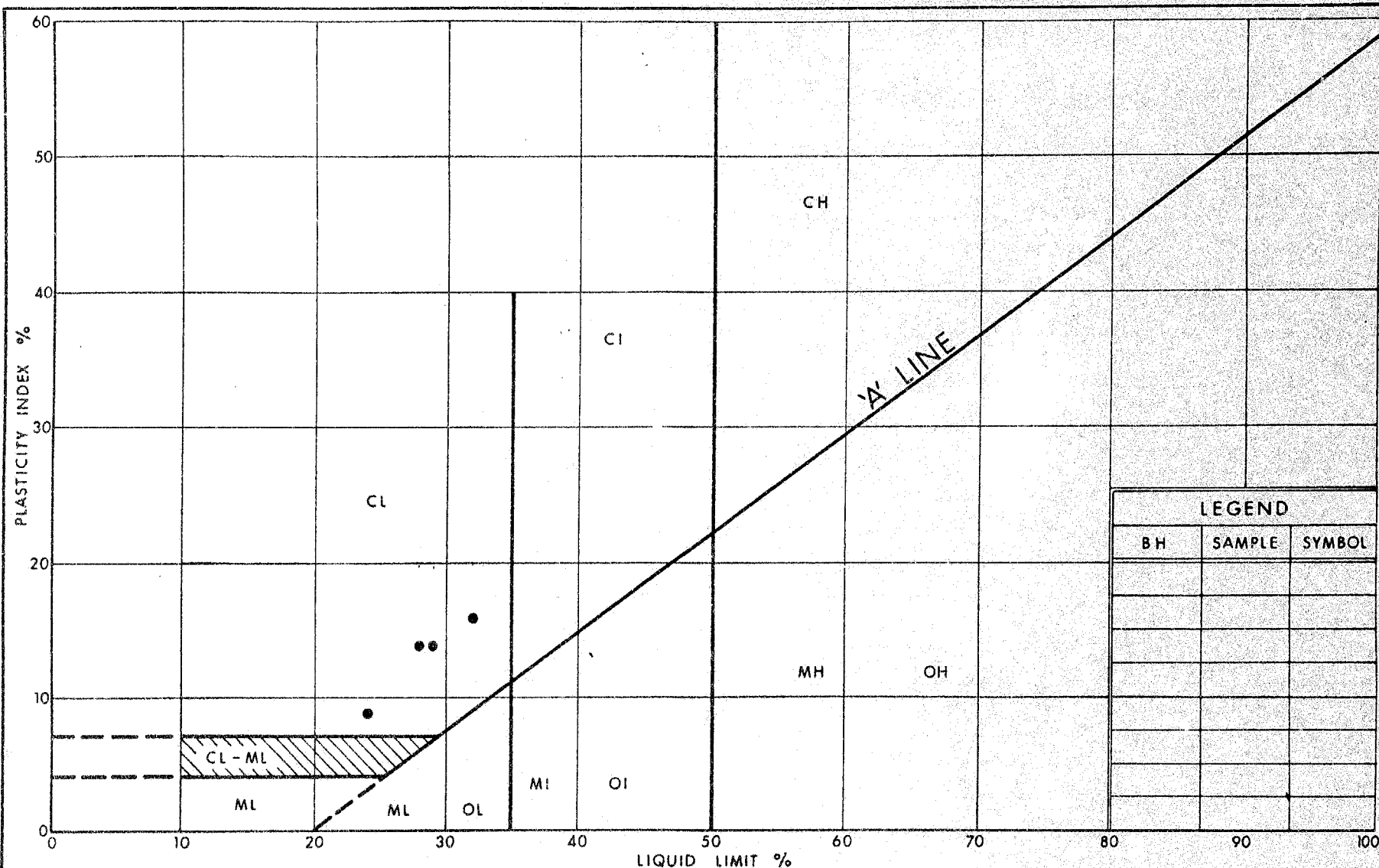
UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation and
Communications
Ontario
ENGINEERING SERVICES BRANCH

GRAIN SIZE DISTRIBUTION
GLACIAL TILL
CLAYEY SILT, SAND & GRAVEL

FIG No 2
W P 103-69-09



Ministry of
Transportation and
Communications

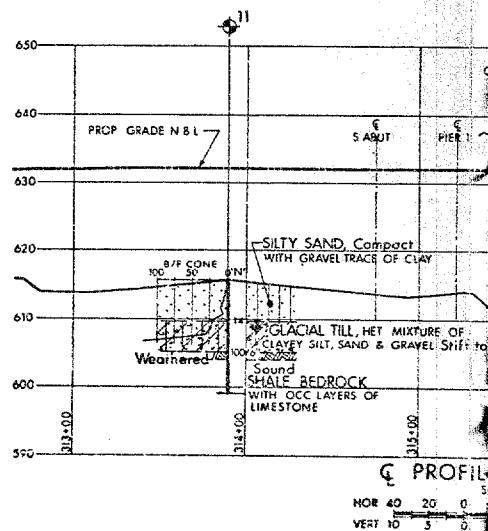
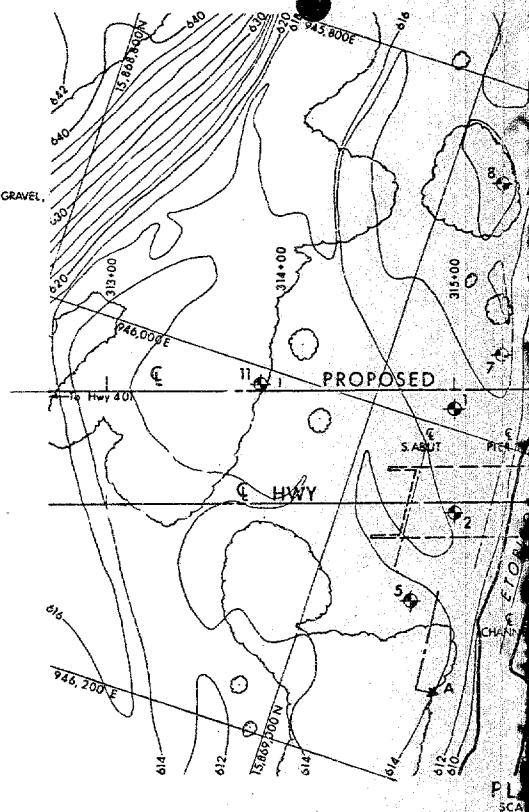
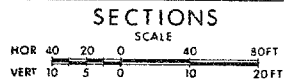
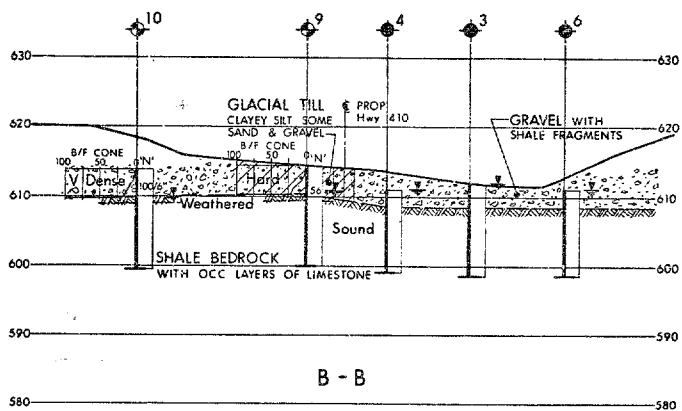
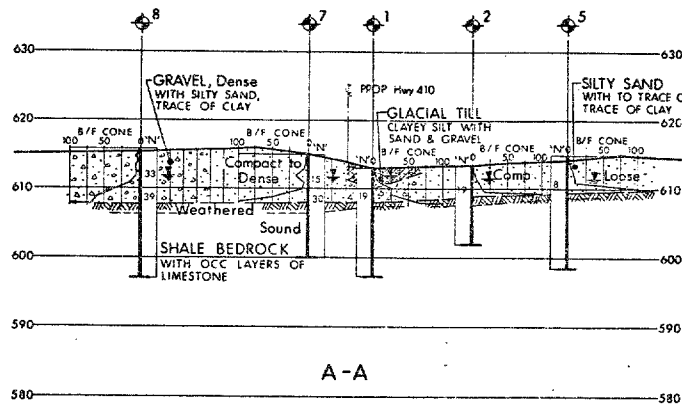
Ontario

ENGINEERING SERVICES BRANCH

PLASTICITY CHART GLACIAL TILL CLAYEY SILT, SAND AND GRAVEL

FIG No 3

W P 103-69-09



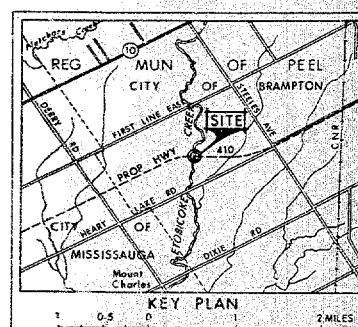
CONT No
WP No 103-69-09

ETOBICOKE CREEK

BORE HOLE LOCATIONS & SOIL STRATA



SHEET



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- 'N' Blows/ft (Std. Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- W.L. at time of investigation
April and May 1976
W.L. for Bore Hole #11, June 1975

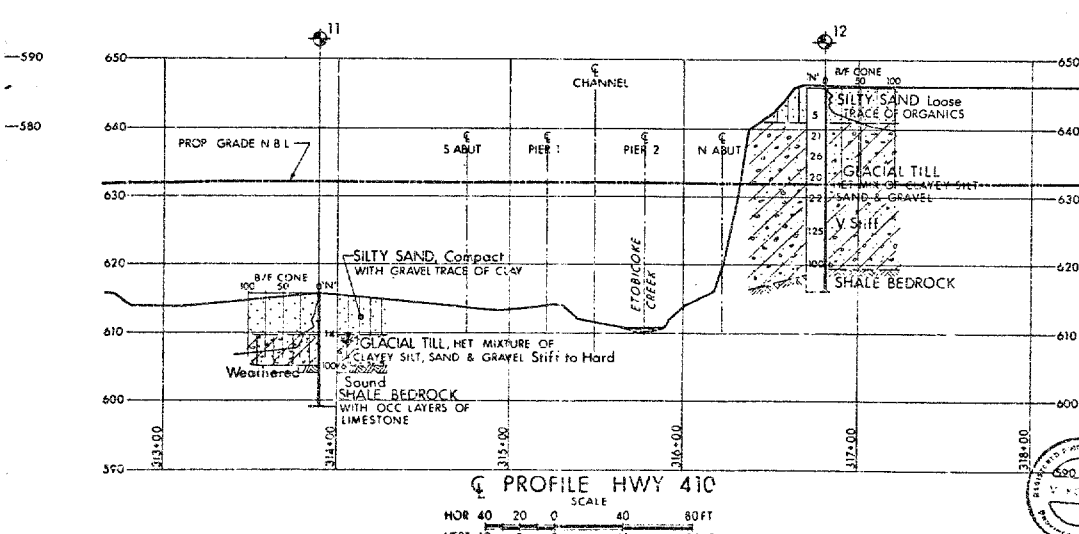
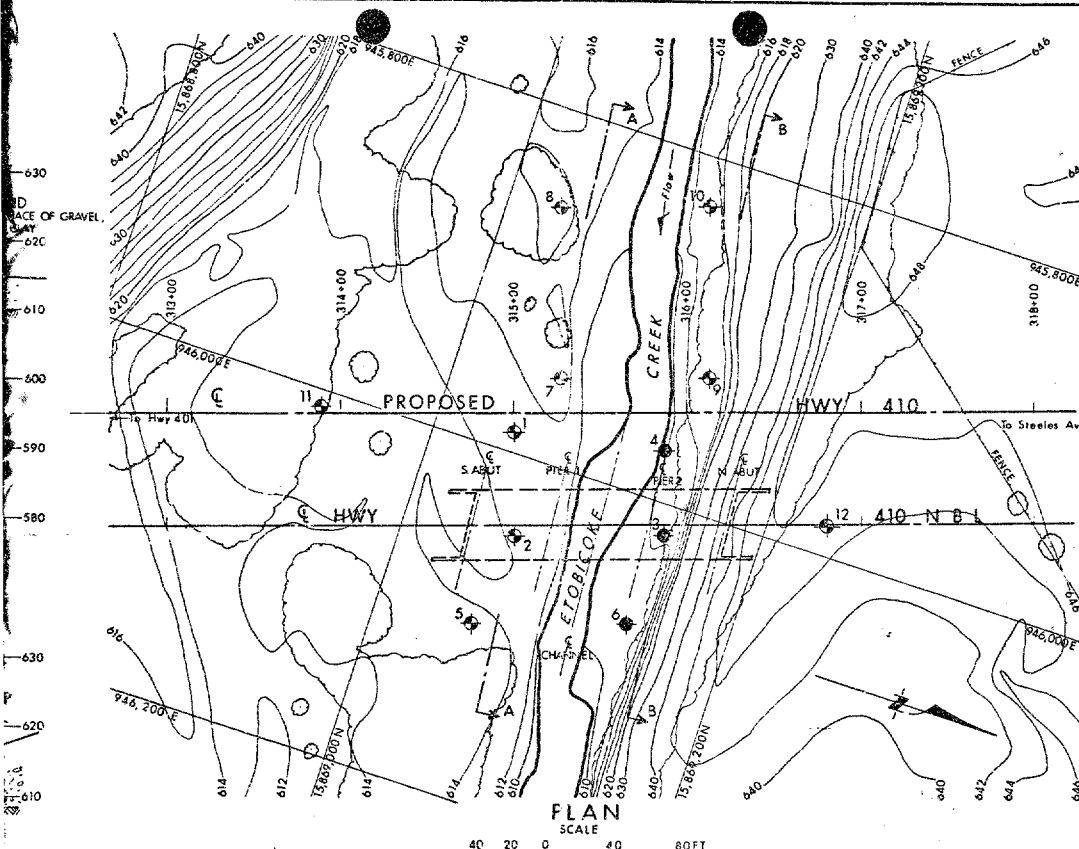
No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	613.0	15,869,046	945,989
2	613.4	15,869,064	946,045
3	611.9	15,869,146	946,017
4	611.1	15,869,132	945,970
5	614.9	15,869,057	946,101
6	611.1	15,869,142	946,073
7	615.0	15,869,062	945,950
8	615.8	15,869,031	945,856
9	614.4	15,869,143	945,923
10	613.9	15,869,112	945,828
11	615.7	15,868,935	946,010
12	646.0	15,869,232	945,983

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
1	11/11/76	W. J. K. L.	BORE HOLE No 12 ADDED TO PLAN & PROFILE

HWY No. PROPOSED 410
SUBMITTED BY: []
CHECKED: []
DATE: June 11, 1976
SITE: 24-313
DRAWN BY: []
CHECKED: []
DATE: 24-313-2



REF No B-81-109 & B-81-110



Memorandum

To: Mr. C. Mirza,
Head, Soil Mechanics Section,
West Building.

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

Attention:

Date: March 23, 1976.

Our File Ref.

In Reply to

Subject: Etobicoke Creek,
Site 24-313, W.P. 103-69-09,
Highway 410, District 6.

The first stage of Highway 410 is scheduled to be built from Derry Road to Steeles Avenue as a two lane facility. The only structure required in this stage of construction is the Highway 410 over Etobicoke Creek Structure.

Your office has previously carried out a Preliminary Foundation Investigation Report for the Proposed Highway 410 in August, 1975, under W.P. 103-69-00. The description of the Etobicoke Creek investigation is found in section 6.2.4.

The initial structure is based on a two lane highway concept, utilizing the alignment of the ultimate northbound lanes of the six lane scheme.

Preliminary details of the proposed structure and roadway alignment (2 lane scheme) are indicated on the enclosed plans. These plans include:

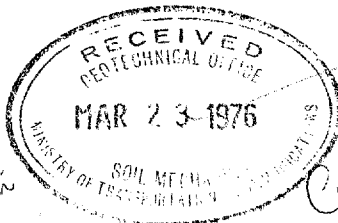
410 Profile (Highway 401 to Hwy. 7)	- 2 copies
410 Plan 2 Lane Scheme	- 2 copies
410 Plan Ultimate Scheme	- 2 copies.

The initial structure design is indicated in red and the ultimate design in blue.

There will be no re-alignment of the Etobicoke Creek in this area as originally proposed.

Could you please prepare a Foundation Investigation Report of sufficient scope to facilitate the design of the proposed structure. The current schedule calls for a complete Foundation Investigation by May 19, 1976.

The property situation remains about the same as for your Preliminary Investigation, mainly, that we do not own the land in this area.



*request due 2-19-76
report
done date
2-19-76*

*Card
in file case*

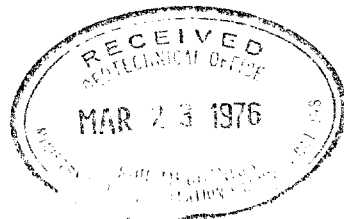
Should additional clarification and/or details be required please do not hesitate to call this office.

R. A. Jeffries

RAJ:lm
Encl.

R. A. Jeffries,
STRUCTURAL PLANNING SUPERVISOR,
for:
G. C. E. Burkhardt,
REG. STRUCTURAL PLANNING ENG.

c.c. Z. Byblow
D. Gunter
J. Anderson
R. Fitzgibbon
W. Roters





Memorandum

To: Mr. G. Burkhardt,
Reg. Structural Planning Engineer,
Central Region,
3501 Dufferin Street, Toronto.

From: Structural Office,
West Building, Downsview.

Attention:

Date: July 28, 1976.

Our File Ref.

In Reply to

Subject:

Etobicoke Creek Bridge,
W. P. 103-69-09, Site 24-313,
Highway 410, District #6.

Attached herewith are prints of the Preliminary Bridge
Plan Drawing 24-313-P1 for the above mentioned structure.

The estimated cost of the proposed structure is \$246,700.00
which includes tender, materials, engineering and sundry
construction.

We have sent a copy of the Preliminary Plan to the Hydrology
Office for their comments.

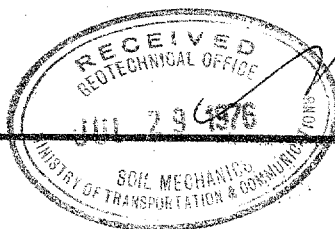
Any comments or revisions you may have should be submitted
at your earliest convenience.

CSG/cf
Attech.

C. S. Grebski,
Structural Design Engineer.

c.c. R. Dorton
A. McKim
E. Van Beilen
W. Lin
M. Stoyanoff
J. Harris
✓ C. Mirza
J. Anderson
R. Fitzgibbon
S. Edwards

*Comments submitted to memo
on memo
Aug 11/76*



6.2.4 Hwy. 410 Over Etobicoke Creek - Ref. B.H. 4

A. Approx. Existing Ground Elevation B. Approx. Grade of Hwy. 410	Predominant overburden strata Approx. thickness in feet	Recommendations		
		Structure	Approaches 1. Longitudinal - 20 ft. 16 ft. 2. Transverse - 20 ft. 16 ft.	Rem
A. 616 ft. B. 632 ft. Proposed invert of Etobicoke Creek Elev. 612.0	<u>Glacial till:</u> - 0 to 10.5 ft. - cohesive - Stiff to Hard <u>Shale bedrock</u> - 10.5 to 11.5 weathered - 11.5 to 16.5 sound shale	<u>Piers:</u> Spread footings founded within the glacial till. Allowable bearing pressure up to 5 t.s.f. (Below elevation 608 ft.) <u>Abutments:</u> 1. "Perched" on spread footings in the approach fills, within a zone composed of well compacted granular material, using an allowable bearing pressure of 2.5 t.s.f. 2. Alternately, supported on end bearing piles driven to shale bedrock (approx. elev. 598 ft.).	<u>Embankments and cuts</u> 1. 2:1 side slopes 2. No stability problems.	

6.2.4 Hwy. 410 Over Etobicoke Creek - Ref. B.H. 4

round wy.	Predominant overburden strata Approx. thickness in feet	Recommendations		
		Structure	Approaches 1. Longitudinal - 20 16 ft. 2. Transverse - 20 16 ft.	Remarks
vert e	<u>Glacial till:</u> - 0 to 10.5 ft. - cohesive - Stiff to Hard <u>Shale bedrock</u> - 10.5 to 11.5 weathered - 11.5 to 16.5 sount shale	<u>Piers:</u> Spread footings founded within the glacial till. Allowable bearing pressure up to 5 t.s.f. (Below elevation 608 ft.) <u>Abutments:</u> 1. "Perched" on spread footings in the approach fills, within a zone composed of well compacted granular material, using an allowable bearing pressure of 2.5 t.s.f. 2. Alternately, supported on end bearing piles driven to shale bedrock (approx. elev. 598 ft.).	<u>Embankments and cuts</u> 1. 2:1 side slopes 2. No stability problems.	

Mr. C. S. Grebski
Structural Design Engineer
Structural Office
West Building, Downsview

Soil Mechanics Section
Geotechnical Office
West Building, Downsview

August 12, 1976

Etobicoke Creek Bridge
W.P. 103-69-09, Site #24-313
Highway 410, District #6

We have reviewed the Preliminary Bridge Plan Drawing 24-313-P1 for the abovermentioned structure and submit the following comments.

A three span ~~s~~tructure is now planned at this crossing instead of a single span structure. The piers can be founded on sound shale bedrock. The footing elevation should be based on B.H. #2, 3, 4 and 6 data.

The south abutment can be supported on end bearing piles driven to shale bedrock; however, the north abutment should not be supported on end bearing piles since bedrock is encountered at a very shallow depth at this location. This is further confirmed by an additional investigation carried out recently at Sta. 316+80 designated as B.H. #A. The overburden mainly consists of 5 ft. of loose silty sand with gravel followed by 23 ft. thick deposit of very stiff to hard glacial till underlain by shale bedrock at elev. 6'8.5. In view of this we recommend that the abutment footing can be founded within the glacial till with an allowable load of 2.5 t.s.f. or on sound bedrock surface with a design load of 10.0 t.s.f. The pertinent log sheets and the revised drawing will be submitted in the near future.

V. Korlu
Project Engineer

For: M. Devata
Supervising Engineer

cc: G.C.E. Burkhardt
Files ✓
Record Services.



Ministry of
Transportation and
Communications

Memorandum

To: Mr. C. Mirza,
Head, Soil Mechanics Section,
West Building, Downsview.

From: Structural Office,
West Building, Downsview.

Attention:

Date: October 28, 1976.

Our File Ref.

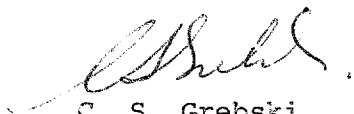
In Reply to

Subject:

Etobicoke Creek Bridge,
W.P. # 103-69-09 Site # 24-313,
Highway # 410 District # 6

Attached herewith we are submitting the final bridge drawings which show the foundation design for this structure. Kindly give us your comments at your earliest convenience.

CSG/cf
Attch.


C. S. Grebski,
Structural Design Engineer.





Memorandum

To: Mr. M. R. Ernesaks
Regional Manager
Regional Planning & Design
3501 Dufferin St.

From: Structural Office
West Building
Downsview, Ontario

Attention:

Date: November 19, 1976

Our File Ref.

In Reply to

Subject: W.P. 103-69-09, Site 24-313
Etobicoke Creek Bridge
Highway 410, District 6

Please correct the bridge D4 as follows:

- (a) quantity of Random Rip-Rap is 535 cu yd (previously 568 cu yd)
- (b) quantity of Normal Portland Cement (Bridge) decreased by one ton to read 174 tons.
- (c) Tender item #9 and #10: (AASHO III) should be changed to read (AASHO II).

The following revised data is also submitted to the Estimating Section:

ECB output for reinforcing steel (Bridge)

ECB output for reinforcing steel (approach slabs)

ECB output for concrete quantities.

NZ/jl

N. Zoltay
Structural Contract
Specifications Engineer

c.c. W. Lin
J. Wear
H. Greenland
J. Kuprevicius
B. Giroux (Encl.)
A. E. McKim
C. Farrell
E. Van Beilen
C. Mirza ✓
J. Harris





Memorandum

Mr. C.S. Grebski
Structural Design Engineer
Structural Design Section
West Building, Downsview

From: Soil Mechanics Section
Engineering Materials Office
West Building, Downsview

Attention:

Date: December 9, 1976

or File Ref.

In Reply to

Subject:

Etobicoke Creek Bridge
W.P. 103-69-09, Site 24-313
Hwy. 410, District #6, Toronto

We have reviewed the final bridge drawings (No's 1 and 3, dated October, 1976) of the above mentioned structure and our comments are as follows:

1. The Soil Mechanics Section carried out an additional borehole (B.H. 12 at Sta. 316+80 centreline) at this site on July 30, 1976. The subsoil information from this borehole indicates that:
 - a) The approximate 16 foot cut at the north approach of the structure with 2:1 side slopes will be stable.
 - b) It is further concluded that the north abutment can be supported on spread footings placed at elevation 619 or lower using an allowable load of 3 tsf. for the design of abutment foundations.
2. The south abutment can also be supported on spread footings "perched" within the approach embankment consisting of well compacted granular 'A' material and extending 50 feet behind the abutment. An allowable load of 2.5 tsf. may be used as indicated in our foundation report, page 6, W.P. 103-69-09, dated June 28, 1976.
3. The pier footings located at base elevation of 602 will be within sound shale bedrock and can be designed using an allowable bearing pressure of up to 10 tsf. It is recommended that the shale bedrock at the base should be immediately covered with a thin layer of mass concrete to prevent any deterioration due to exposure.

For your information we are enclosing a copy of the revised foundation Drawing #1036909A and this should be included in our original foundation report.

V. Korlu
V. Korlu
Project Engineer

For: M. Devata
Supervising Engineer
MD/VK/gs

Enclosure

cc: G.C.E. Burkhardt C.S. Grebski G.A. Wrong Files ✓
R.S. Pillar D.J. Giroux M.R. Ernesaks Record Services ✓
R.D. Gutter



Memorandum

To: Mr. M. R. Ernesaks, Head,
Planning and Design Section,
Central Region.

From: Structural Office,
West Building, Downsview.

Attention:

Date: December 15, 1976.

Our File Ref.

In Reply to

Subject: W.P. 103-69-09,
Site 24-313,
Etobicoke Creek Bridge,
Highway 401, District 6.

I refer to the bridge contract documents sent to you on November 15, 1976.

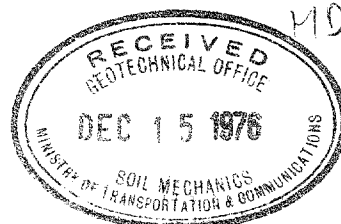
Please include the following tender items to the D4:

- (a) 903 - Equipment for Driving Piles - lump sum
- (b) 903 - Driving Steel H Piles - 1f - 150
- (c) 903 - Cutting off Top of Steel H Piles - each - 11.

NZ/im

N. Zoltay,
Structural Contract
Specifications Engineer.

c.c. W. Lin
J. Wear
H. Greenland
J. Kuprevicius
B. Giroux
A. E. McKim
C. Farrell
E. Van Beilen
C. Mirza ✓





Memorandum

To: Messrs. A. McKim; C. Mirza;
E. Van Beilen; J. Harris;
C. Grebski; W. Lin;
W. McFarlane.

From: Structural Office,
West Building, Downsview.

Attention:

Date: January 17, 1977.

Our File Ref.

In Reply to

Subject:

- (a) Etobicoke Creek Bridge,
W. P. 103-69-09, Site 24-313,
Highway 401, District 6.
- (b) Retaining Wall at Waterdown Road,
W. P. 58-76-02, Site 10-194,
Highway 403, District 4.

} / m. d

} k. f. s.

A meeting of the Structural Review Committee is to be held on January 26th, at 9:30 a.m. in Boardroom B of the West Building to review the above-mentioned projects.

✓

The Etobicoke Creek Bridge will be reviewed first.

Please arrange for yourself or your representative to attend.

MS/cf

M. Stoyanoff

M. Stoyanoff,
Structural Contract Engineer.

c.c. J. B. Wilkes



DOCUMENT MICROFILMING IDENTIFICATION

GEOCRS No. 30412-117

DIST. 4 REGION CENTRAL

W.P. No. 103-62-09

CONT. No. 76-129

W. O. No. _____

STR. SITE No. 24-513

HWY. No. 410

LOCATION EDWARDS CREEK

BRIDGE

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT 2

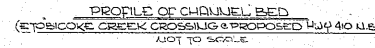
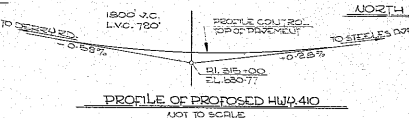
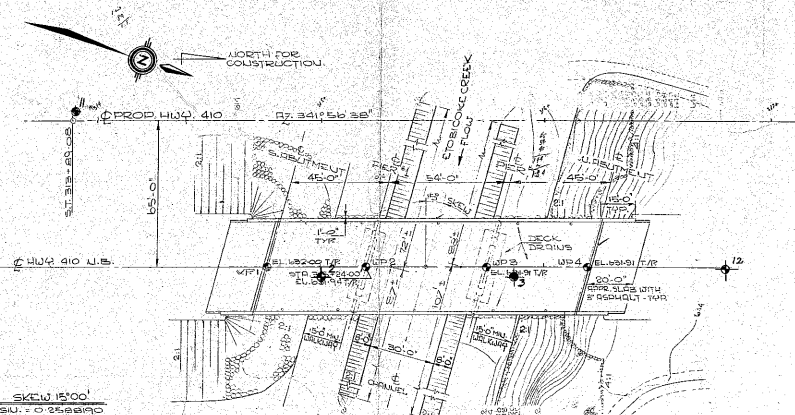
REMARKS: Documents to be included

before microfilming

DIST. 6
CONT No
WP No 103-69-09

ETOBICOKE CREEK BRIDGE
GENERAL LAYOUT

SHEET



GENERAL NOTES

- CLASS OF CONCRETE**
- PRESTRESSED MEMBERS 5000 PSI
DECK, DIAPHRAGMS, BARRIER WALL, 4000 PSI
CURBS & REMAINDER 3000 PSI
- CLEAR COVER ON REIN. STEEL**
- FOOTINGS, DEBUTMENTS, PIER SHAFTS 3"
DECK, BOTTOM TOP 3"
DIAPHRAGMS, PIER CAPS & BARRIER WALLS 1 1/2"
APPROACH SLABS 2"
- GRADE OF REIN. STEEL**
- STEELWIRE & THE SLABS 3 & 40
REINFORCEMENT 3 & 60

CONSTRUCTION NOTES

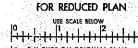
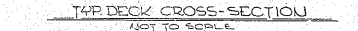
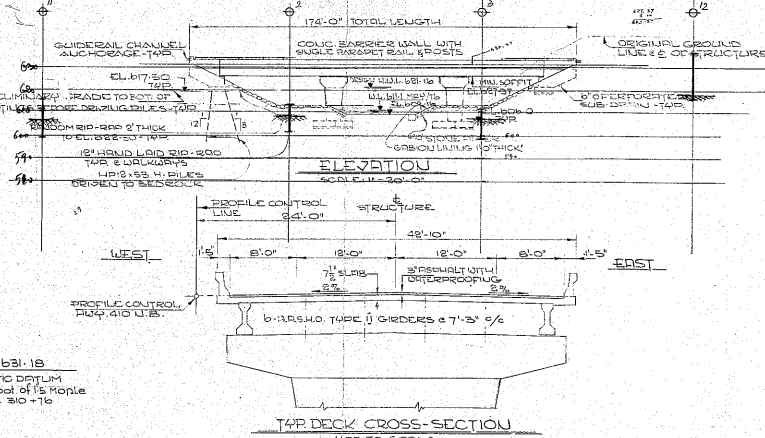
- THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BARRIER WALLS TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF 1/8".
- NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT SLABS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.
- TO ACHIEVE THE MIN. CLEAR COVER OF 2" (MINIMUM) (IN PIER), THE TOP LOWER SADDLE BE PLACED, PRIOR TO CONCRETING, WITH A CLEAR COVER OF 2 1/8" ± 1/8" TOLERANCE.

CONCRETE QUANTITIES

- CONCRETE QUANTITIES ARE LISTED BELOW FOR THE APPROXIMATE CONSUMPTION FOR THE FOLLOWING:
- CONC. IN DEBUTMENTS, MONOWALLS AND PIERS
 - CONC. IN DECK AND DIAPHRAGMS - 225 CY
 - CONC. IN BARRIER WALLS - 31 CY
 - CONC. IN APPROACH SLABS - 51 CY

LIST OF DRAWINGS

- GENERAL LAYOUT
- BRIDGE LOCATION (FROM STATION)
- FOOTING LAYOUT & REINFORCEMENT
- DECK
- DEBUTMENTS
- PRESTRESSED GIRDERS & BARRIER WALLS
- DECK REINFORCEMENT (SINGLE SLAB)
- BARRIER WALL
- STEEL DECK REINFORCEMENT (SINGLE TUBE)
- 20 FT. APPROACH SLAB (BARRIER WALL)
- STANDARD DETAILS 1
- STANDARD DETAILS 2
- STANDARD DETAILS 3
- AS CONSTRUCTED SLAB & DIM.



DATE BY	DESCRIPTION
DESIGN BY	CHECKED
LOADING BY	DATE
DRAWING	CHECKED
SITE	DATE

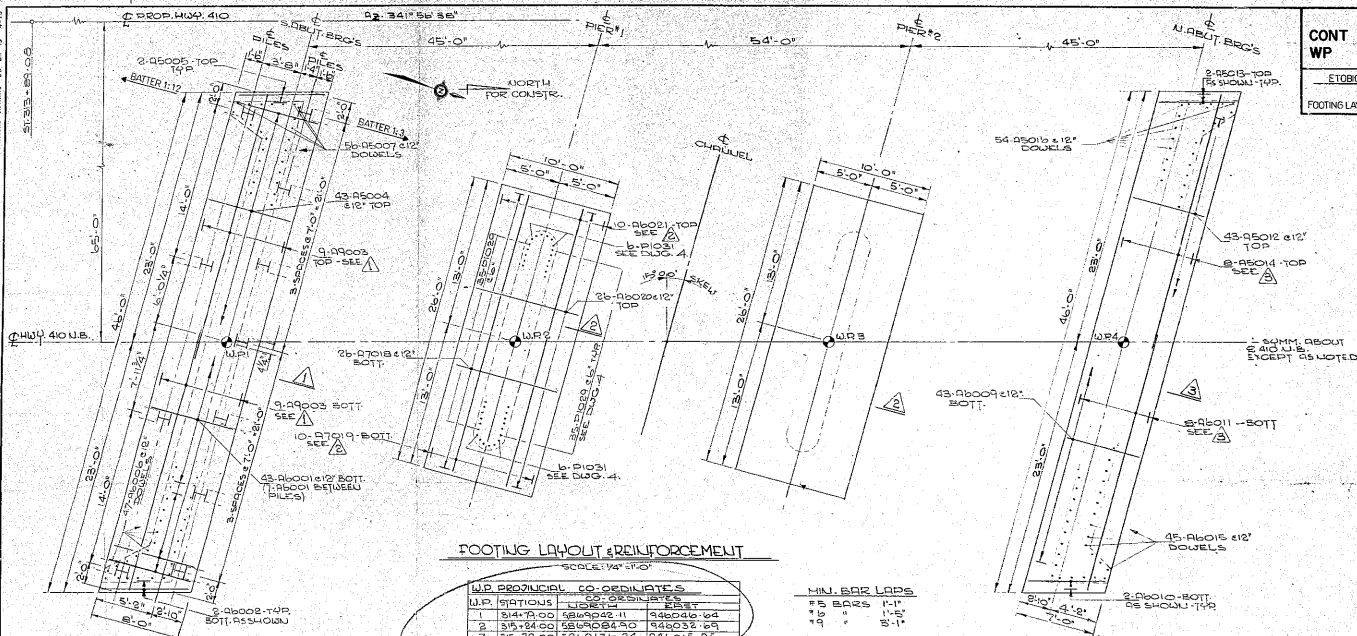
30.112-117
CROSSING

CONT No
WP No 103-69-09

STOBBE CREEK BRIDGE

FOOTING LAYOUT & REINFORCEMENT

SHEET



FOOTING LAYOUT & REINFORCEMENT

SCALE: 1/4" = 1'-0"

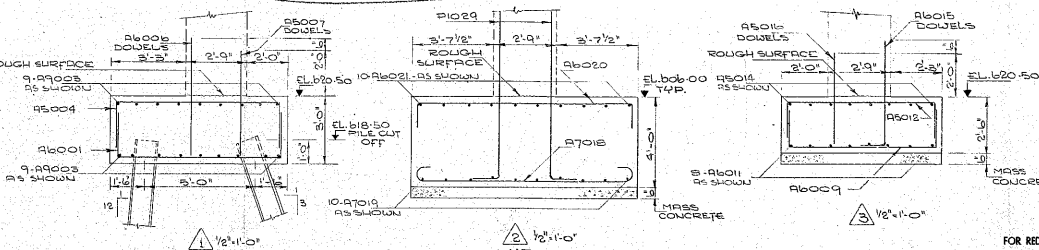
W.P. PROVISIONAL	CO. ORDINATES
W.P. 1970	W.P. 1970
1	214.71.00
2	314.71.00
3	315.78.00
4	315.73.00

MIN. BAR LAPS

#5 BARS	1'-1"
#4	1'-4"
#3	5'-1"

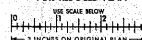
W.P. 1970	H.P. 1970
W.P. 1970	H.P. 1970
7	1:3
4	1:12

NOTE:
PILE SPACING MEASURED AT
UNDER SIDE OF FOOTING
PILES EXPOSED TO BEDROCK



NOTE:
MASS CONCRETE SIDES OF PIERS & NORTH
ABUTMENT FOOTINGS TO BE CAST AGAINST
JUSTIFIED MATERIAL.
PLACE MASS CONCRETE IMMEDIATELY AFTER
EXCAVATION IS COMPLETED.

FOR REDUCED PLAN



DATE	BY	CHECK	DATE	BY	CHECK	DATE	BY

3077 12-117
RECORD NO.