

# 65-F-28

Q.E.W

STONEY CR.

TRAFFIC

CIRCLE TO

ST. CATHARINES

MEMORANDUM

Mr. R. G. Burnfield,  
Regional Functional  
Planning Engr.,  
Central Region,  
Admin. Bldg.

FROM: Foundation Section,  
Materials and Testing Div.,  
Room 107, Lab. Bldg.

DATE: June 2, 1965

OUR FILE REF.

IN REPLY TO

SUBJECT:

PRELIMINARY  
FOUNDATION INVESTIGATION REPORT  
For  
Functional Study of the Reconstruction  
of Q.E.W. from Stoney Creek Traffic  
Circle to St. Catharines, District No.4,  
Hamilton, Ont.  
W.J. 65-F-28 -- W.P. (Nil)

In order to provide the necessary information for the functional study, we are forwarding to you, three (3) copies of our Preliminary Foundation Investigation Report on subsoil conditions existing at the above site.

We believe that the factual data and recommendations contained therein, although preliminary in nature only, will prove adequate for your present requirements.

Should there be any queries regarding this report, please do not hesitate to contact our Office.

KYL/MdeF  
Attach.

cc: Messrs. R. G. Burnfield (3)  
A. M. Toye  
G. K. Hunter (2)  
H. Greenland  
T. J. Kovich

K. Y. Lo,  
SUPERVISING FOUNDATION ENGINEER

Foundations Office  
Gen. Files ✓

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PRELIMINARY  
FOUNDATION INVESTIGATION REPORT

For

Functional Study of the Reconstruction  
of Q.E.W. from Stoney Creek Traffic  
Circle to St. Catharines, District No.4  
Hamilton, Ont.

W.J. 65-F-28

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W.P. (Nil)

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1. INTRODUCTION:

It is proposed to reconstruct the existing Q.E.W. to a six / eight-lane controlled access highway from Stoney Creek traffic circle to St. Catharines. In addition, two-lane service roads are proposed to be built on both sides of the future Q.E.W. This reconstruction program necessitates the construction of several underpasses on the future highway and a number of embankment fills over marshy areas.

A request for preliminary soil information for the functional study of the reconstruction program was made by Mr. T. J. Kovich, Regional Materials Engineer, to the Foundation Section in March, 1965. Subsequently, a foundation investigation consisting of one borehole at each structure location, for preliminary information, was undertaken. Presented in this report are the results of our investigation, together with the recommendations pertaining to the structure foundations and embankments.

Since this investigation is preliminary only, a detailed investigation of the subsoil should be carried out at each structure and each embankment location prior to the final design.

cont'd. /2 ...

## 2. DESCRIPTION OF SITE AND GEOLOGY:

The site, from Stoney Creek Traffic Circle to St. Catharines, lies in the area commonly known as the Niagara Fruit Belt which is located between Lake Ontario and the Niagara Escarpment and extends eastward from Hamilton to the Niagara River. For the most part, this lowland lies within the Iroquois Plain. The plain is not cut by any large streams, but a number of smaller ones cross it to Lake Ontario, such as, Twelve Mile Creek, Fifteen Mile Creek, Sixteen Mile Creek, Twenty Mile Creek, etc. All of these produce lagoons or marshes cut off from Lake Ontario by a barrier beach. In general, the site is underlain by glacial till, followed by the material derived from the underlying Queenston shale.

## 3. FIELD AND LABORATORY WORK:

The field work consisted of 25 boreholes. In general, one borehole was carried out at each site. The boring was carried out by means of a Penn. drill and a diamond drill adapted for soil sampling purposes.

Samples were recovered at the required depths by means of a 2-in. O.D. split-spoon sampler and by a 2-in. I.D. Shelby tube sampler. The dimensions of the split-spoon sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test. In-situ vane tests were carried out wherever possible, in order to determine the undrained shear strength of the cohesive deposits. Rock core samples were obtained by means of a BXT core barrel.

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

The locations and elevations of all boreholes are shown on the accompanying borehole log sheets, included in the Appendix of this report. The elevations are derived from functional study contoured drawings and therefore, are approximate.

Samples were visually examined and identified in the laboratory as well as in the field. Laboratory tests were performed on a number of selected samples to determine:

- (1) Natural Moisture Contents
- \* (2) Atterberg Limits.
- (3) Bulk Density.
- (4) Undrained Shear Strength.
- (5) Grain Size Distributions.
- (6) Organic Contents(for organic soil only).

Laboratory test results are summarized and are included in the Appendix.

- \* Tests were performed on air-dried and oven-dried organic soil whenever possible.

4. SUMMARIZED SOIL CONDITIONS:

In general, the structure sites are covered by a surface layer of clayey silt with sand and occasional gravel (glacial till) overlying Queenston shale. At Stoney Creek, 16 Mile Creek and 18 Mile Creek, a surface layer of organic clay-silt was also found at the creek beds.

cont'd. /4 ...

4. SUMMARIZED SOIL CONDITIONS: (cont'd.) ...

The water levels observed in the boreholes during the time of the foundation investigation, were found in general, quite close to the original ground surface.

Borehole logs, showing the stratigraphy of the subsoil, together with soil properties and water level observations, are included in the Appendix of this report.

5. DISCUSSION AND RECOMMENDATIONS:

5.1) General:

It is proposed to construct a number of underpass structures on the Q.E.W. at the crossings of various side roads between Stoney Creek and St. Catharines. Subsoil conditions at the various sites were generally found to be suitable for spread footing type foundations. Detailed foundation investigations will, however, be necessary when the exact locations of the proposed structures are known. At some structure locations it may be economically feasible to use piles as an alternative to spread footings. In addition to the structure locations, two sites of proposed embankments were investigated. At these embankment locations, it will be necessary to carry out detailed foundation investigations when the final proposals are available.

A summary of soil conditions and foundation recommendations for each structure and its approaches, is tabulated as follows:

cont'd. /5 ...

TOWNSHIP OF SALTFLLEET -

Structure Location and Borehole No.	Description of Subsoil Conditions	R E C O M M E N D A T I O N S	
		Structure Foundations	Approach Fill
Gray's Rd. Underpass (B.H. #1)	0' - 65'	Spread footings at elev. 255 or below, 3 t.s.f.	No stability problems for standard 2:1 side slopes.
	61' - 81.5'		
	81.5'		
Green Rd. Underpass (B.H. #2)	0' - 51'	Spread footings at elev. 253 or below, 3 t.s.f.	No stability problems for standard 2:1 side slopes
Millen Rd. Underpass (B.H. #3)	0' - 62.5'	(a) Spread footings at elev. 255 or below, 2 t.s.f.	No stability problems for standard 2:1 side slopes.
	62.5' - 65.5'		
	65.5' - 72'	(b) Alternative - Piled foundation, steel H-piles (14 BP 73) driven to bedrock (approx. el. 183), 70 tons/pile.	
	72' -		
Fruitland Rd. Underpass (B.H. #4)	0' - 45.5'	Spread footings at elev. 258 or below, 3 t.s.f.	No stability problems for standard 2:1 side slopes.
	45.5' - 51.5'		
	Weathered Shale.		

cont'd. /6 ...

TOWNSHIP OF SALTFLEET - (cont'd.) ...

Structure Location and Borehole No.	Description of Subsoil Conditions	R E C O M M E N D A T I O N S	
		Structure Foundations	Approach Fill
Glover Rd. Underpass (B.H. #5)	0' - 38.2' Clayey Silt with Sand & occ. Gravel, hard.	Spread footings at elev. 260 or below, 3 t.s.f.	No stability problems for standard 2:1 side slopes.
Winona Rd. Underpass (B.H. #18)	0' - 82' Clayey Silt with Sand & occ. Gravel, hard.	Spread footings at elev. 266 or below, 3 t.s.f.	No stability problems for standard 2:1 side slopes.
Fifty Rd. Underpass (B.H. #6)	0' - 30.5' Clayey Silt with Sand & occ. Gravel, V. stiff to hard.	(a) Spread footings at elev. 269 or below, 2 t.s.f.  (b) Alternative - Piled foundation, Steel H-Piles (14 BP 73) driven to practical refusal (approx. elev. 242), 70 tons/ pile.	No stability problems for standard 2:1 side slopes.

TOWNSHIP OF N. GRIMSBY -

Oakes St. Underpass (B.H. #7)	0' - 46' Silty Clay to Clayey Silt with Sand and occ. Gravel, V. stiff to hard.	Spread footings at elev. 266 or below, 3 t.s.f.	No stability problems for standard 2:1 side slopes.
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cont'd. /7 ...

TOWNSHIP OF N. GRIMSBY -

<u>Structure Location and Borehole No.</u>	<u>Description of Subsoil Conditions</u>		<u>R E C O M M E N D A T I O N S</u>	
			<u>Structure Foundations</u>	<u>Approach Fill</u>
Ofield Rd. Underpass (B.H. #8)	0' - 5'	Clayey Silt, hard.	(a) Spread footings at elev. 272, 5 t.s.f.  (b) Alternative - Spread footings on Sound Shale, at elev. 269 or below, 10 t.s.f.	No stability problems for standard 2:1 side slopes.
	5' - 8.5'	Weathered Shale.		
	8.5' - 19.5'	Sound Shale.		
Patton St. Underpass (B.H. #9)	0.5' - 19.7'	Weathered Shale.	Spread footings sound Shale Bedrock at el. 273 or below, 10 t.s.f.	Approach cuts will be in the order of 20 ft. No stability problem for 2:1 side slopes.
	19.7' - 24.7'	Sound Shale.		
Ontario St. Underpass (B.H. #10)	0' - 2.5'	Fill, loose.	Spread footings at elev. 263 or below, 5 t.s.f.	Approach cuts will be in order of 20 ft. No stability problem for 2:1 side slopes.
	2.5' - 16'	Silty Clay with Sand & occ. Gravel. V. stiff to hard.		
	16' - 27'	Weathered Shale.		
	27' - 37.5'	Sound Shale.		

cont'd. /8 ...

TOWNSHIP OF N. CRIMSBY - (cont'd.) ...

Structure Location and Borehole No.		Description of Subsoil Conditions	R E C O M M E N D A T I O N S	
			Structure Foundations	Approach Fill
Maple Ave. Underpass (B.H. #11)	0' - 54.5'	Silty Clay to Clayey Silt with Sand & occ. Gravel, V. stiff to hard.	Spread footings at elev. 259 or below, 3 t.s.f.	No stability problems for 2:1 side slopes.
	54.5' - 59.5'	Sandy Silt with Gravel, V. Dense.		
	59.5' -	Sound Shale.		
Park Rd. Underpass (B.H. #12)	0' - 11'	Clayey Silt with fragments of Shale, firm to hard	Spread footings on sound Shale Bedrock at el. 288 or below, 10 t.s.f.	Approach cuts will be in the order of 20 ft. No stability problem for 2:1 side slopes.
	11' - 19.5'	Weathered Shale.		
	19.5' - 24.5'	Sound Shale.		

TOWNSHIP OF CLINTON -

Mountain View Rd. Underpass (B.H. #13)	0' - 10.5'	Fill, loose to compact.	Piled foundation, Steel H-Piles (14 BP 73) driven to bedrock (approx. elev. 251.7), 70 tons/pile.	No stability problems for standard 2:1 side slopes.
	10.5' - 17'	Sand with Gravel, loose.		
	17' - 24.8'	Clayey Silt with Sand & occ. Gravel, hard.		
	24.8' - 27.3'	Sandy Silt, V. Dense.		
	27.3' - 35.3'	Sound Shale.		

cont'd. /9 ...

TOWNSHIP OF CLINTON - (cont'd.) ...

Structure Location and Borehole No.	Description of Subsoil Conditions	R E C O M M E N D A T I O N S	
		Structure Foundations	Approach Fills
Ontario St. (Beamsville) Underpass - (B.H. #14)	0' - 22.3' Clayey Silt with Sand & occ. Gravel, V. stiff to hard.	(a) Spread footings at elev. 275 or below, 2 t.s.f.  (b) Alternative - Piled foundation, Steel H-Piles (14 BP 73) driven to refusal (approx. elev. 256), 70 tons/ pile.	No stability problems for standard 2:1 side slopes.
Tafford Rd. Underpass (B.H. #15)	0' - 11' Clayey Silt with Sand & occ. Gravel, hard.  11' - 14.5' Sandy Silt with occ. Gravel & Boulders, Dense.  14.5' - 22.9' Shale Bedrock.	Spread footings at elev. 273, or below, 3 t.s.f.	No stability problems for standard 2:1 side slopes.
<u>TOWNSHIP OF LOUTH -</u>			
16 Mile Creek Bridge	0' - 26' Embankment fill material, loose. 26' - 32' Sand with Gravel, loose. 32' - 42' Organic Clay-Silt, firm to stiff. 42' - 62' Clayey Silt with Sand & occ. Gravel, hard. 62' - 68.4' Sound Shale.	Piled foundation, Steel H-Piles - (14 BP 73) driven to Bedrock (approx. elev. 200) 70 tons/ pile.	Stability & settlement problems are anticipated. Detailed investigation will be re- quired to determine the extent and nature of the Organic Clay- Silt.

TOWNSHIP OF LOUTH - (cont'd.) ...

<u>Structure Location and Borehole No.</u>	<u>Description of Subsoil Conditions</u>		<u>R E C O M M E N D A T I O N S</u>		
			<u>Structure Foundations</u>	<u>Approach Fill</u>	
Seventh St. Underpass	0' - 11'	Embankment fill material, loose to compact.	Piled foundation, Steel H-Piles (14 BP 73) driven to practical refusal (approx. elev. 235) 70 tons/pile.	No stability problems for standard 2:1 side slopes.	
	11' - 47.5'	Clayey Silt with Sand & occ. Gravel, stiff to hard.			
	47.5' - 59.3'	Sand with Gravel, V. Dense.			
20 Mile Creek Bridge - (Jordan Harbour)	-----	.	Refer to Department Foundation Report W.J. 60-F-63, W.P. 331-63.		
15 Mile Creek Bridge	-----		Refer to Department Foundation Report W.J. 60-F-65, W.P. 29-61.		

cont'd. /11 ...

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

5.3) Embankment Stability:

5.3.1) Widening of Q.E.W. - including Service Roads at Stoney Creek -

It is proposed to construct embankment fills on both sides of the existing Q.E.W. crossing Stoney Creek. At the time of the investigation, a fill about 8 to 11 ft. high and about 20 to 30 ft. wide, existed some 10 ft. north of the Q.E.W. It was reported by the Parks Commission that this fill material was dumped there approximately 2 years ago. Except for some slight surficial erosion, this fill appeared to be quite stable.

At the site, one borehole was put down through the recent fill material and three shallow boreholes elsewhere on the original ground. These boreholes revealed that the site, in general, is covered with a surface layer of 1 to 1.5 ft. of muck followed by approximately 11 to 15 ft. of grey organic clay-silt underlain by about 14 ft. of clay-silt with sand and traces of organic matter.

The soft organic clay-silt controls the stability of the future embankment fill. The engineering properties of this material have been summarized and included in the borelog sheets.

In view of the low shear strength, high moisture and high organic content of the subsoil, it appears that there will be a stability and settlement problem for the proposed fill. At the time of writing this report, the design details pertaining to the width and height of the proposed widening, are not available. Therefore, the nature of the problem and recommendations will not be discussed until more information pertaining to the extent and the nature of the

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

5.3.1) (cont'd.) ...

soft organic clay-silt are obtained in a future detailed foundation investigation.

For functional planning purposes, it may be assumed that the stabilization of these embankments will require sub-excavation and/or construction of berms.

5.3.2) Widening of Q.E.W. - including Service Roads at 18 Mile Creek -

It is proposed to construct embankment fills on both sides of the existing Q.E.W. crossing 18 Mile Creek for the widening of the highway.

One borehole was placed near the edge of the shoulder of the existing Q.E.W. embankment and another shallow borehole was put quite close to the creek.

A deposit approx. 11 to 15 ft. thick of organic clay-silt was observed immediately below the ground surface or below the existing embankment fill. The consistency of the deposit is soft near the creek whereas this material is generally firm to stiff beneath the embankment. Immediately below the organic clay-silt, a thin layer of 4 ft. thick sand and gravel with organics followed by at least 13 ft. of clayey silt with sand and occasional gravel was encountered.

The organic clay-silt governs the stability of the proposed high embankments. The engineering properties of this material have been summarized and included in the borelog sheets.

cont'd. /13 ...

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

5.3.2) (cont'd.) ...

In view of the subsoil conditions, it is anticipated that there will be a stability and settlement problem for the proposed fills. Specific recommendations concerning the construction of the high embankments will not be presented until a more detailed foundation investigation is performed when design details such as the height and the extent of the widening of Q.E.W. are available.

For functional planning purposes, it may be assumed that the stabilization of these embankments will require sub-excavation and/or construction of berms.

6. SUMMARY:

The results of the preliminary investigation at the sites of the proposed structures and embankment fills on the Q.E.W. from Stoney Creek Traffic Circle to St. Catharines are reported.

In general, the subsoil at the various structure sites consists of a deposit of clayey silt till overlying Queenston shale bedrock. At the proposed embankment sites, a surface layer of organic material was encountered.

Generally speaking, conditions at the various structure sites are favourable for spread footing type foundations. At some sites, piled foundations are recommended as an alternative. Details of the various structure foundations, together with the stability problems of the embankment fills at Stoney Creek and 18 Mile Creek, are discussed in the main body of the report.

cont'd. A4 ...

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

It should be emphasized that this report is of a preliminary nature and is intended for functional planning purposes only. A complete foundation investigation will be necessary when definite proposals are available.

7. MISCELLANEOUS:

The field investigation, carried out in March and April 1965, was supervised by Mr. T. Chan, Project Foundation Engineer, who also prepared this report. The entire project was under the general supervision of Mr. M. Devata, Senior Foundation Engineer, who also reviewed this report.

The equipment was owned and operated by Dominion Soil Investigation Ltd. of Toronto.

June 1965



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 65-F-28

LOCATION Q.E.W. Sta 424/85, 120' Rt. (Grays Rd)

ORIGINATED BY T.C.

W P M11

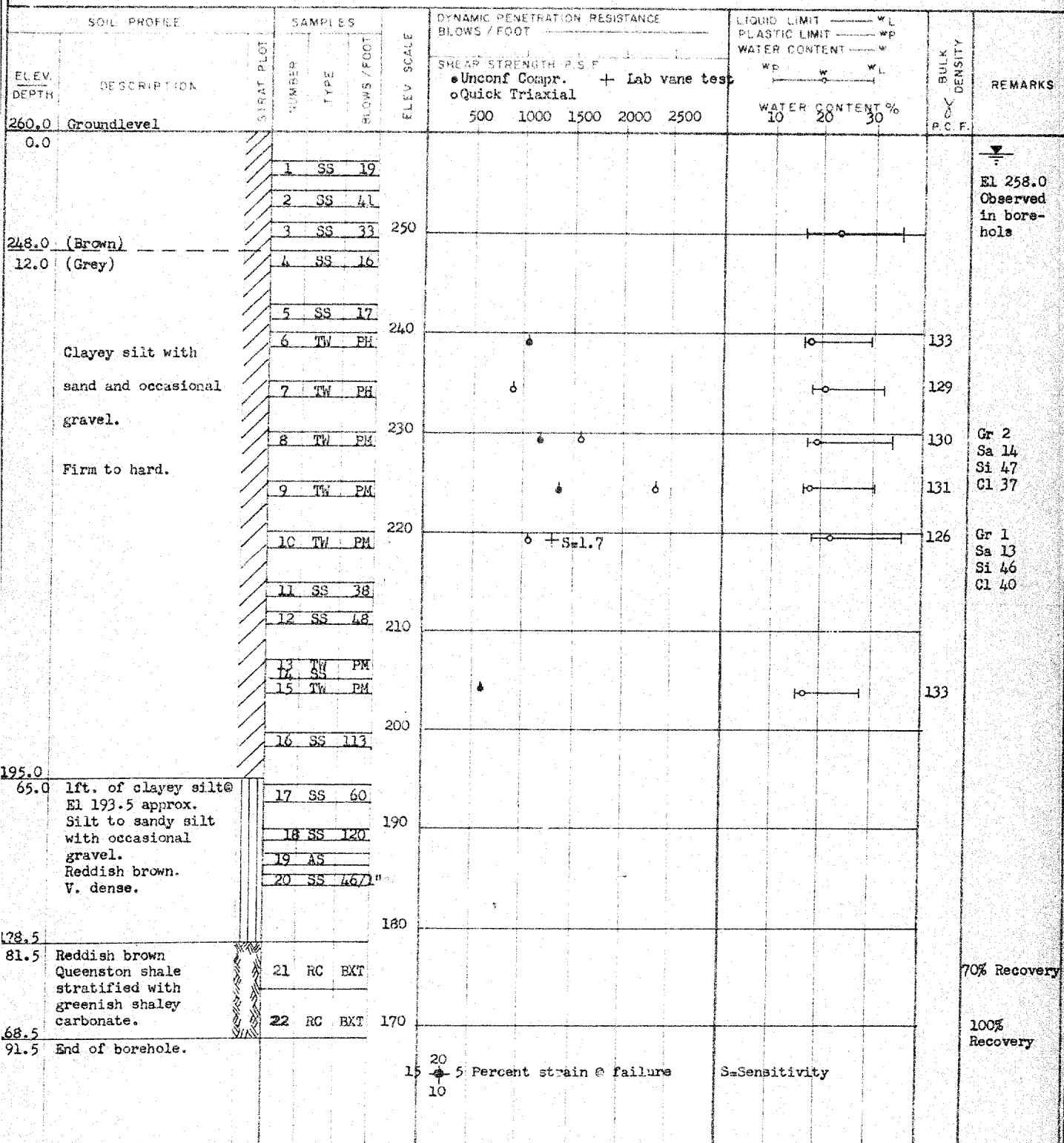
BORING DATE March 11, 1965.

COMPILED BY T.C.

DATUM G.S.C.

BOREHOLE TYPE Penn Drill &amp; Washboring using BX Casings.

CHECKED BY M.D.



FOUNDATION SECTION

ORIGINATED BY T.C.

COMPILED BY T.C.

CHECKED BY M.D.

SOIL PROFILE			SAMPLES		DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W	BULK DENSITY pcf	REMARKS
ELEV DEPTH	DESCRIPTION	SPT BLT	NUMBER TYPE	BLOWS / FOOT	ELEV SCALE	SHEAR STRENGTH P.S.F. ● Unconf. Compr. + Lab vane test ○ Quick Triaxial		
258.0	Groundlevel							
0.0			1 SS 9					
			2 SS 43	250				
			3 SS 35					
246.0	(Brown)		4 SS 21					
12.0	(Grey)		5 TW PH					
	Clayey silt with sand and occasional gravel.		6 TW PH	240				
	Stiff to hard.		7 SS 29					
			8 SS 30	230				
			9 SS 27					
			10 TW PH	220				
			11 SS 19					
207.0	Refusal		12 SS 60/L"	210				
51.0	End of borehole.			200				

WATER CONTENT %  
10 20 30

Gr 3  
Sa 24  
Si 47  
Cl 26

El 256.5  
Observed in borehole.  
Gr 5 Sa 18  
Si 47 Cl 30

+ S=3.1

S=2.7

Percent strain at failure

S=Sensitivity

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 65-F-28 LOCATION Q.E.W. Sta. 493+00, 90' Lt. (Millen Rd.) ORIGINATED BY T.C.  
W.P. Nil BORING DATE March 17, 1965. COMPILED BY T.C.  
DATUM G.S.C. BOREHOLE TYPE Pennndrill & Washboring using BX Casings. CHECKED BY M.D.

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W	BULK DENSITY PCF	REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE					
260.0	Groundlevel				500 1000 1500 2000 2500			
0.0		1	SS 40					El 259 Observed in borehole.
251.0	(Brown)	2	SS 40					Gr 6 Sa 19 Si 46 Cl 29
9.0	(Grey)	3	SS 17	250				
		4	SS 16					
	Clayey silt with	5	TW PM		S=5		131	Gr 2 Sa 21 Si 47 Cl 30
	sand and occasional	6	TW PM	240	S=2.3		136	
	gravel.	7	TW PH		S=4.0		134	
	Firm to v. hard.	8	TW PH	230			135	Gr 2 Sa 26 Si 46 Cl 25
		9	SS 46					
		10	SS 37					
		11	SS 65	220				
216.0	(Grey)							
44.0	(Brownish grey)	12	RC					Recovered several pieces of boulders.
	Occasional boulders.	13	SS 108	210				
206.0		14	SS 62					
54	(Grey)							
		15	SS 85	200				
197.5		16	SS 107/9.5"					
62.5	Sandy silt, v. dense							Gr 22 Sa 62 Si&Cl 16
194.5		17	SS 78					
65.5	Sand with occasional gravel.							
188	Grey, v. dense	18	SS 80/3"	190				
72	Reddish brown Queenston shale stratified with greenish shaley carbonate.	19	RC EXT					80% Recovery
183								
77	End of borehole.			180				

15

20

10




5

Percent strain at failure

S=Sensitivity

FOUNDATION SECTION

CHECKED BY M.D.

SOIL PROFILE			SAMPLES		DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W WD ——— W ——— WL WATER CONTENT % 10 20 30	BULK DENSITY Y P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F.		
262.0	Groundlevel							
0.0			1	SS	43			Gr 5 Sa 18
			2	SS	42			Si 47 Cl 30
251.0	(Brown)		3	SS	37			
11.0	(Grey)		4	SS	23			
	Clayey silt with sand and occasional gravel.		5	SS	27			
	V. stiff to hard.		6	SS	62			
			7	SS	42			
			8	SS	49			
			9	SS	50			
			10	SS	100/15"			
216.5			11	SS	90/6"			
45.5	Shale, (weathered) reddish brown.							
210.5	Refusal		12	SS	100/3"			
51.5	End of borehole.							

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 65-F-28

LOCATION G.E.W. Sta. 595+07, 100' Lt. (Glover Rd)

ORIGINATED BY T.C.

W.P. N11

BORING DATE March 18, 1965.

COMPILED BY T.C.

DATUM G.S.C

BOREHOLE TYPE Panndrill

CHECKED BY H.D.

SOIL PROFILE		STRAT. PLOT	SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY PCF	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.		WATER CONTENT % 10 20 30			
265.0	Groundlevel											
0.0												
			1	SS	34	260						Gr 2 Sa 18
			2	SS	47							Sl 50 Cl 30
253.0	(Brown)		3	SS	44							
12.0	(Grey)		4	SS	34							
	Clayey silt with		5	SS	33	250						El. 252
	sand and occasional		6	SS	34							WL observed
	gravel.		7	SS	31	240						in B.H.
	Hard.		8	SS	41							
			9	SS	49	230						
226.8	Refusal											
38.2	End of borehole.											
						220						

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

JOB 65-F-28

LOCATION Q.B.W. Sta 739+75, 120' Rt. (Fifty Rd) 21+18 SS RT ORIGINATED BY T.C.

W.P. N11

BORING DATE March 22, 1965.

COMPILED BY T.C.

DATUM G.S.C.

BOREHOLE TYPE Penndrill

CHECKED BY M.D.

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W WATER CONTENT % 10 20 30	BULK DENSITY P.O.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER TYPE					
272.5	Groundlevel							
0.0				270				El 272 Observed in B.H.
			1 SS 37					
			2 SS 38					
263.0	(Brown)		3 SS 17					
9.5	(Grey)		4 SS 34	260				Gr 3 Sa 18 Sl 48 Cl 31
	Clayey silt with sand and occasional gravel.		5 SS 39					
	V. stiff to hard.		6 SS 43	250				
			7 SS 42					
242.0	Refusal (Probably shale)		8 SS 42 1/2"					
30.5	End of borehole.			240				

## RECORD OF BOREHOLE NO. 7

FOUNDATION SECTION

## MATERIALS &amp; TESTING DIVISION

JOB 65-F-28 LOCATION Q.E.W. Sta 40+48, 120' Lt. (Oakes St) ORIGINATED BY T.C.  
 W P N11 BORING DATE March 23, 1965. COMPILED BY T.C.  
 DATUM G.S.C. BOREHOLE TYPE Penndrill CHECKED BY H.D.

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	SHEAR STRENGTH P.S.F.	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W WD ——— W ——— WL WATER CONTENT % 10 20 30	BULK DENSITY PCF	REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE						
270.0	Groundlevel								
0.0		1	SS	38					El 269.2 Observed in B.H.
		2	SS	46					
258.0	(Brown)	3	SS	34	260				Gr 5 Sa 14 Si 41 Cl 40
12.0	(Grey)	4	SS	27					
		5	SS	20					
	Silty clay to clayey silt with sand and occasional gravel. V. stiff to hard. Grey.	6	SS	33	250				
		7	SS	62					
		8	SS	47	240				
		9	SS	50					
		10	SS	39	230				
224.0	(Probably Refusal shale)	11	SS	46/1.5"					
46.0	End of borehole.				220				

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 8

FOUNDATION SECTION

JOB 65-F-28 LOCATION Q.E.W. Sta 95/15, 120' Rt. (Orfield Rd) ORIGINATED BY T.C.  
W.P. Nil BORING DATE March 24, 1965. COMPILED BY T.C.  
DATUM G.S.C. BOREHOLE TYPE Perndrill & Washboring using BX Casings. CHECKED BY M.D.

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— W <sub>L</sub> PLASTIC LIMIT ——— W <sub>P</sub> WATER CONTENT ——— W WATER CONTENT % 10 20 30	PULK DENSITY P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE					
277.5	Groundlevel								
0.0	Clayey silt, hard		1	SS	31				El 276.7 Observed in B.H.    96% Recovery
272.5	Reddish brown		2	SS	35				
5.0					2"				
269.0	(Weathered)		3	SS	70				
8.5	(Sound)		4	SS	60				
	Queenston Shale		5	SS	60				
	Reddish brown.				0.5"				
					0.5"				
258.0			6	RC BXT	260				
19.5	End of borehole.								

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 9

FOUNDATION SECTION

JOB 65-F-28 LOCATION Q.E.W. Sta 184+35, 80' Lt. (Patton St.) ORIGINATED BY T.C.  
W P Nil BORING DATE March 24, 1965. COMPILED BY T.C.  
DATUM G.S.C. BOREHOLE TYPE Penndrill & Washed boring CHECKED BY M.D.

SOIL PROFILE		STRAT. PLCT	SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION		NUMBER	TYPE			WP	W	WL		
292.5	Groundlevel										
0.0	About 0.5ft. of clayey silt.		1	SS 30	290						
	Queenston shale Reddish brown.		2	SS 102							
			3	SS 83 1/4"							
			4	SS 80 1/2"	280						
			5	SS 100 1/6"							
272.8	(Weathered)		6	SS 100 1/1"							
19.7	(Sound)		7	RC BXT	270						
267.8											
24.7	End of borehole.										
					260						

El 285  
Observed in  
B.H.

70% Recovery

DEPARTMENT OF HIGHWAYS - ONTARIO

## RECORD OF BOREHOLE NO. 10

FOUNDATION SECTION

MATERIALS &amp; TESTING DIVISION

JOB 65-F-28

LOCATION Q.E.W. Sta 197+95, 92' Lt. (Ontario St.)

ORIGINATED BY T.C.

W P N11

BORING DATE March 25, 1965.

COMPILED BY T.C.

DATE G.S.C.

BOREHOLE TYPE Penndrill & Washedboring

CHECKED BY M.D.

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W	BULK DENSITY PCF	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER TYPE					
284	Groundlevel							
0.0								
281.5	Fill, brown.							
2.5	Silty clay with sand & occasional gravel. V. stiff to hard. Brown to greyish brown.		1 SS 22	280				Augered hole dry @ the end of drilling.
			2 SS 47					
			3 SS 55					
				270				
268.0			4 SS 118					
16.0	Queenston shale. Reddish brown.		5 SS 81 1/2"					
			6 AS	260				
257.0	(Weathered)		7 SS 75 1/2"					
27.0	(Sound)		8 SS 97 1/4"					
				250				
246.5			9 NC BXT					98% Recovery
37.5	End of borehole.							



DEPARTMENT OF HIGHWAYS - ONTARIO

# RECORD OF BOREHOLE NO. 12

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 65-F-28 LOCATION Q.E.W. Sta 284+45, 120' Lt. (Park Rd) ORIGINATED BY T.C.  
W.P. Nil BORING DATE March 29, 1965 COMPILED BY T.C.  
DATUM G.S.C. BOREHOLE TYPE Penndrill & Washboring using BX Casings. CHECKED BY M.D.

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— WL		BULK DENSITY	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT ——— WP	WATER CONTENT ——— W		
300.0	Groundlevel										
0.0	Clayey silt with fragments of shale. Reddish brown. Firm to v. hard.		1	SS	8					80% Recovery	Dry in the augered hole @ the end of drilling.
289.0			2	SS	89	290					
11.0	Queenston shale. Reddish brown		3	SS	60/1"						
280.5	(Weathered)										
19.5	(Sound)		4	RC	BXT	280					
275.5											
24.5	End of borehole.					270					

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 13

FOUNDATION SECTION

JOB 65-F-28

LOCATION Q.S.W. Sta. 41+00, 60' Rt. (Mountain View Rd)

ORIGINATED BY T.C.

W.P. Nil

BORING DATE March 29, 1965.

COMPILED BY T.C.

DATUM Q.S.C.

BOREHOLE TYPE Penn-drill & Washboring using BX Casings.

CHECKED BY M.D.

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		REMARKS
ELEV	DESCRIPTION	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT	WATER CONTENT	
DEPTH									
279.0	Groundlevel								
0.0	Fill								
	Heterogeneous mixture	1	SS 12						
	of sand, silt and clay.	2	SS 5						
268.5		3	SS 7	270					
10.5	1.5ft. of topsoil.								
	Sand with gravel and	4	SS 3						
262.0	wood pieces. Loose								
17.0	Clayey silt with sand	5	SS 110/	260					
	and occasional gravel.		6"						
254.2	Brown. Hard.	6	SS 60/1"						
24.8	Sandy silt, v. dense								
251.7	Brown	7	SS 60/1"						
27.3									
	Queenston shale.	8	RC BXT	250					
243.7	Reddish brown.	9	RC BXT						
35.3	End of borehole.			240					

W  
El 265.5  
Observed  
in B.H.

60%  
Recovery

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 14

FOUNDATION SECTION

JOB 65-P-28

LOCATION Q.E.W. Sta 96+40, 100' Rt. (Ontario St., Beamsville)

ORIGINATED BY T.C.

W.P. M11

BORING DATE March 30, 1965.

COMPILED BY T.C.

DATUM G.S.C.

BOREHOLE TYPE Pennndrill

CHECKED BY M.D.

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_P$ WATER CONTENT $w$  SHEAR STRENGTH $P_u$	WATER CONTENT % 10 20 30	RULX CUNGLY Y PC F	REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE						
278.5	Groundlevel								
0.0									
273.0	(Brown)	1	SS	48					No 277 Observed in D.H.  Gr 6 Sa 23 Si 48 Cl 33
5.5	(Grey)	2	SS	18					
	Clayey silt with sand and occasional gravel.	3	SS	25					
		4	SS	29					
	V. stiff to hard.	5	SS	60/3"					
				260					
		6	SS	75/45"					
256.2	Refusal	7	SS	56/3"					
22.3	End of borehole.								
				250					

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

JOB 65-F-28

LOCATION Q.E.W. Sta 177/90, 120' Rt. (Tufford Rd)

ORIGINATED BY T.C.

W.D. Nil

BORING DATE March 30, 1965.

COMPILED BY T.C.

DATUM G.S.C.

BOREHOLE TYPE Penndrill & Washboring using BX Casings.

CHECKED BY \_\_\_\_\_ M.D.

## RECORD OF BOREHOLE NO. 15

## FOUNDATION SECTION

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT ——— WL			BULK DENSITY  P.C.F.	REMARKS	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	BLOWS / FOOT			PLASTIC LIMIT ——— wp				
							SHEAR STRENGTH P.S.F.			WATER CONTENT ——— w				
										wp	w	wL		
										WATER CONTENT % 10      20      30				
278	Groundlevel													
0.0	Clayey silt with sand & occasional gravel. Hard, brown. Occasional boulders from El 270.5 to El 267.		1	SS	70	270								El 278 Observed in B.H.
			2	SS	76 1/6"									
267			3	RC										
			4	RC										
11	Sandy silt with occasional gravel & boulders. Brown.		5	SS	85 1/4"									
263.5			6	RC										
14.5			7	SS	80 1/2"									
	Queenston shale.		8	RC	BXT	260							56% Recovery	
	Reddish brown.		9	RC	BXT								72% Recovery	
255.1														
22.9	End of borehole.					250								

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 16

FOUNDATION SECTION

JOB 65-F-28 LOCATION Q.E.W. Sta. 186/20, 50' Rt. (16 mile Creek) ORIGINATED BY T.C.  
W.P. Nil BORING DATE March 31, 1965. COMPILED BY T.C.  
DATUM G.S.C. BOREHOLE TYPE Penndrill & Washboring using BX Casings. CHECKED BY M.D.

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— WL		BULK DENSITY	REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT ——— WP	WATER CONTENT ——— W		
262.5	Groundlevel										
0.0	Fill.				260						
	Heterogeneous mixture of sand silt and clay.	1	SS	7							
	Brown.	2	SS	6							
		3	SS	5	250						
		4	TW	PM							
		5	SS	4							
		6	SS	7	240						
236.5		7	SS	9							
26.0	Sand with gravel.										
	Grey. Loose	8	SS	9	230						
230	Organic clay-silt.										
	Grey. Firm to stiff.	9	SS	5							
		10	SS	11	220						
220											
42.0		11	SS	50							
215.5 (Brown)											
47.0 (Grey)		12	SS	36	210						
	Clayey silt with sand and occasional gravel. Hard.	13	SS	54							
205.2											
57.3 (Reddish brown)		14	SS	80/6"	200						
200.5											
62.0	Queenston shale	15	RC	BXT							
	Reddish brown.	16	RC	BXT							
194.1	Sound	17	RC	BXT							
68.4					190						

El 259.5  
Observed in  
B.H.Gr 4 Sa 83  
Si & Cl 13Sa 20  
Si 65  
Cl 1573% Recovery  
40% Recovery  
62% Recovery

## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 16A

FOUNDATION SECTION

JOB 65-P-28

LOCATION Q.E.W. Sta 186+35, 60' Rt. (16 mile Creek)

ORIGINATED BY T.C.

W P Nil

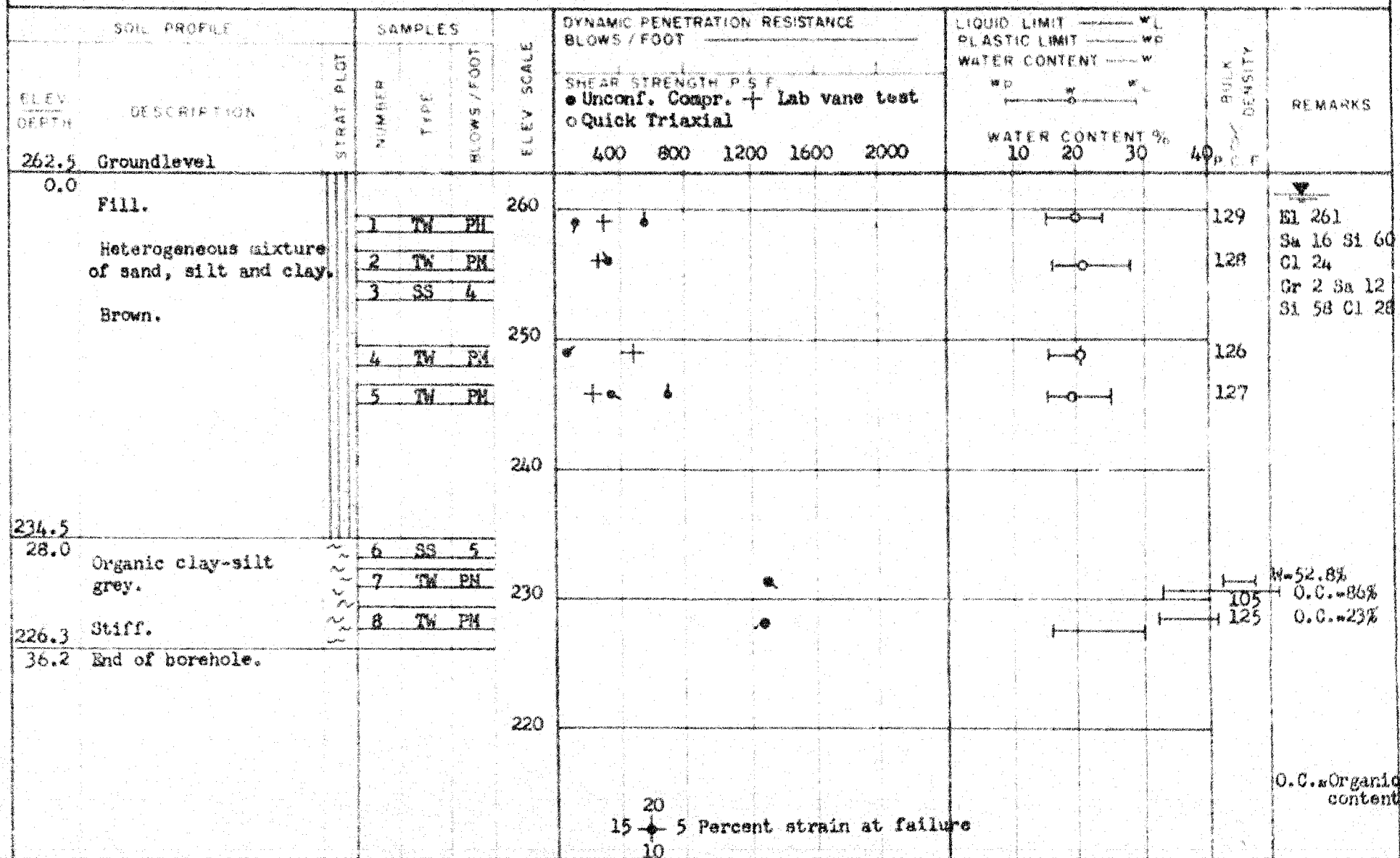
BORING DATE April 5, 1965.

COMPILED BY T.C.

DATUM G.S.C.

BOREHOLE TYPE Penndrill &amp; Washboring using BX Casings.

CHECKED BY H.D.



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION

## RECORD OF BOREHOLE NO. 17

FOUNDATION SECTION

JOB 65-F-28

LOCATION Q.E.W. Sta 234+20, 70' Rt. (Seventh St.)

ORIGINATED BY T.C.

W.P. Nil

BORING DATE March 31, 1965.

COMPILED BY T.C.

DATUM G.S.C.

BOREHOLE TYPE Penndrill &amp; Washedboring

CHECKED BY M.D.

SOIL PROFILE			SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		SHEAR STRENGTH P.S.F.		WP	W	WL		
292.5	Groundlevel											
0.0	Fill Heterogeneous mixture of sand, silt and clay.		1	SS 11	290							El 289.6 Observed in B.H.
			2	SS 27								
281.5			3	SS 5								
11.0	Clayey silt with sand and occasional gravel.  Grey, stiff to hard.  Approx. from El 261.5 to El 260.5, soil more sandy, Reddish brown.		4	SS 21	280							Gr 26 Sa 62 Si & Cl 12
			5	SS 15	270							
			6	SS 27								
			7	SS 28	260							
			8	SS 33								
			9	SS 14	250							
			10	TM PE								
			11	SS 103								
245.0												
47.5	Sand with gravel, grey, v. dense. Occasional boulders from El 236.5-233.2		12	SS 129/9"	240							
			13	SS 76/6"								
233.2			14	RC EXT								
59.3	End of borehole.				230							

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 18

FOUNDATION SECTION

JOB 65-F-28

LOCATION Q.E.W. Sta 678+08, 65' Lt. (Winona Rd.)

ORIGINATED BY T.C.

W P Mil

BORING DATE April 1, 1965.

COMPILED BY T.C.

DATUM G.S.C.

BOREHOLE TYPE Penndrill

CHECKED BY M.D.

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— WL		BULK DENSITY	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLCT	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT ——— WP	WATER CONTENT ——— W		
270.0	Groundlevel										
0.0			1	SS	30						
			2	SS	46						
			3	SS	46	260					
255.5	(Brown)		4	SS	46						
14.5	(Grey)		5	SS	50						
	Clayey silt with		6	SS	42	250					
	sand and occasional		7	SS	43						
	gravel.		8	SS	37	240					
	Hard.		9	SS	31						
			10	SS	32	230					
			11	SS	50	220					
			12	SS	92						
			13	SS	128	210					
			14	SS	101						
	Greyish brown from		15	SS	132	200					
	El 204 to 195.5				10"						
	approx.		16	SS	89						
188.0						190					
82.0	End of borehole.										

El 269.2  
Observed in  
B.H.

Gr 4 Sa 18  
Sl 48 Cl 30

DEPARTMENT OF HIGHWAYS - ONTARIO

## RECORD OF BOREHOLE NO. 19A

FOUNDATION SECTION

MATERIALS &amp; TESTING DIVISION

JOB 65-F-28 LOCATION Q.E.W. Sta 154+00, 58' Rte. (18mile Creek)ORIGINATED BY T.C.W.P. Nil BORING DATE March 14, 1965.COMPILED BY T.C.DATUM G.S.C. BOREHOLE TYPE Penndrill & washedboring.CHECKED BY M.D.

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W WP — W — WL WATER CONTENT % 10 20 30	BULK DENSITY P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER					
272.5	Groundlevel							
	Fill.			270				
	Heterogeneous mixture of sand, silt and clay.		1 SS 5					
			2 SS 2	260				
			3 SS *					* went down by the weight of rods.
			4 SS 2	250				
			5 TW PM				121	Sa 12 Si 68 Cl 20
			6 TW PM	240				
			7 SS 4					
236.0			8 TW PM					
36.5	Organic clay-silt Grey.		9 SS 6					Sa 19 Si 66 Cl 15
	Thin silty sand layer @ El 232.5 approx.		10 TW PM	230			124	Sa 54 Si 57 Cl 9
227.5			11 SS 10					Sa 9 Si 62 Cl 29
45.0	Sand, gravel and organics. Grey, loose.		12 TW PM	220			133	
224.0			13 TW PM				135	
48.5	Clayey silt with sand and occasional gravel. Grey, v. stiff.		14 TW PM	210			134	Gr 2 Sa 9 Si 50 Cl 39
211.2								
61.3	End of borehole.							
				200				
				15	20 + 5 Percent strain at failure 10	S= Sensitivity		

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

# RECORD OF BOREHOLE NO. 19B

FOUNDATION SECTION

JOB 65-F-28

LOCATION Q.E.W. Sta 154+20, 140' Rt (18 mile Creek)

ORIGINATED BY T.C.

W P N11

BORING DATE April 15, 1965.

COMPILED BY T.C.

DATUM G.S.C.

BORE E TYPE Washboring (Manual operation)

CHECKED BY M.D.

SOIL PROFILE		STRAT PLOT	S NUMBER	S TYPE	BLOWS / FOOT	ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY pcf	REMARKS
ELEV DEPTH	DESCRIPTION						SHEAR STRENGTH P.S.F. • Unconf Compr      x Lab vane o Quick Triaxial    + Field vane test		WP — W — WL WATER CONTENT %			
245	Groundlevel						200   400   600   800   1000		20   40   60			
0.0	Organic clay-silt Grey. V. soft to firm. Harder from el 229.5 downward.		1	TM PM		240	•      o      x      + S=3.1      S=3.5			W=67	97	WL in Creek O.C. = 8.7%
			2	TM PM			•      +      x      S=2.0    x S=3.2 x				115	Sa 1 Si 74 Cl 25
			3	TM PM			+      x      S=3.5					O.C. = 1.1%
229.5						230						
15.5	End of borehole.					220						O.C. = organic content
							15   20 + 5 Percent strain at failure 10					
							S=Sensitivity			* Note the scale		

## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 20

FOUNDATION SECTION

JOB 65-F-28

LOCATION Q.E.W. Sta 404+55, 110' Lt.

ORIGINATED BY T.C.

W.P. M11

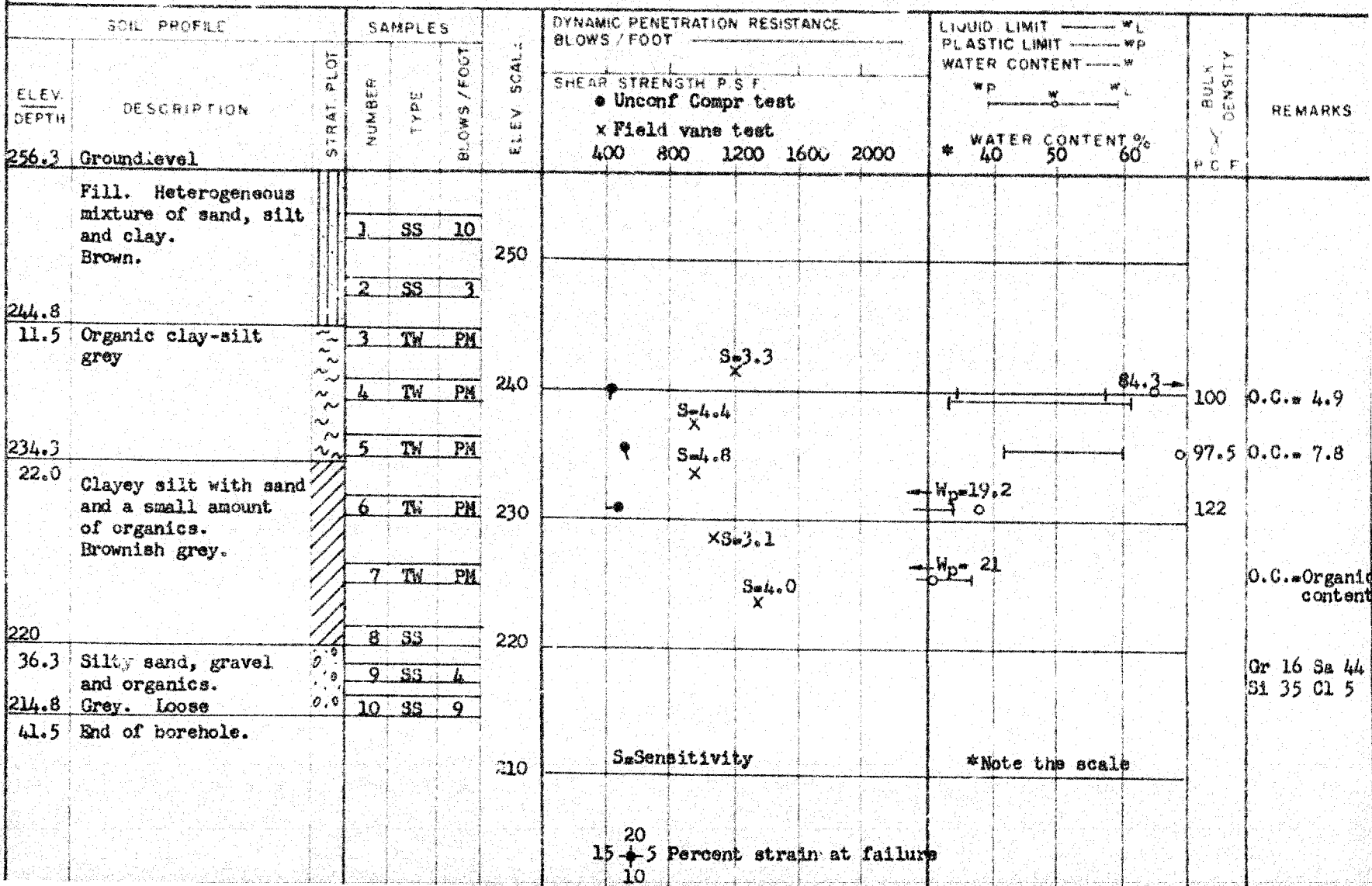
BORING DATE April 28, 1965.

COMPILED BY T.C.

DATUM G.S.C.

BOREHOLE TYPE Washed boring using NX Casings.

CHECKED BY M.D.



FOUNDATION SECTION

CHECKED BY M.D.

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT ——— % PLASTIC LIMIT ——— % WATER CONTENT ——— %		BULK DENSITY PCF	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F. • Unconfined comp test X Field vane test	W.P. ————— W.L. ————— W. —————	WATER CONTENT %		
246	Groundlevel					200 400 600 800 1000					
1.3ft of muck	Organic clay-silt		1	TH	PM	240	•		108.7	93	WL in pond O.C.=7.9
			2	TH	PM		X S=4.5		103.7	90	O.C.=10.7
234.5	Grey						X S=3.7 X S=3.2				
11.5	End of borehole.				230						O.C.=organic content
							S= Sensitivity 20 15 5 Percent strain at failure 10		*Note the scale		

RECORD OF BOREHOLE NO. 20B

FOUNDATION SECTION

MATERIALS &amp; TESTING DIVISION

JOB 65-F-28

LOCATION Q.E.W. Sta 406/20, 195' Lt.

ORIGINATED BY T.C.

W P NLI

BORING DATE April 29, 1965.

COMPILED BY T.C.

DATUM 9.3.0.

BOREHOLE TYPE Washboring using NX Casing.

CHECKED BY M.D.

(manual operation)

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	Liquid Limit ———— $w_L$ Plastic Limit ———— $w_P$ Water Content ———— $w$	HOLE DENSITY POUND PER CUBIC FOOT	REMARKS		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER		TYPE	BLOWS / FOOT			SHEAR STRENGTH P.S.F. • Unconfined compression X Field vane test	WATER CONTENT % * 60 70 80
246	Groundlevel					200 400 600 800 1000				
	1 ft of muck		1	TN	PM			227.3	WL in the pond	
	Organic clay-silt					240	S=1.7 X		81	O.C.=18.2%
	Grey		2	TN	PM		S=3.4 X	189 →	97	O.C.=7.9%
231.5			3	TN	PM		S=2.5 X	$w_p=36.7$ $w_p=43.7$		
14.5	End of borehole.				230	S=8.0 X				
					S=Sensitivity				O.C.=organic content	
					20 15 + 5 Percent strain at failure 10					
					*Note the scale					

DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

RECORD OF BOREHOLE NO. 20C

FOUNDATION SECTION

JOE 65-F-28

LOCATION Q.E.W. Sta 404/65, 195' Lt.

ORIGINATED BY T.C.

W F N11

BORING DATE April 29, 1965.

COMPILED BY T.C.

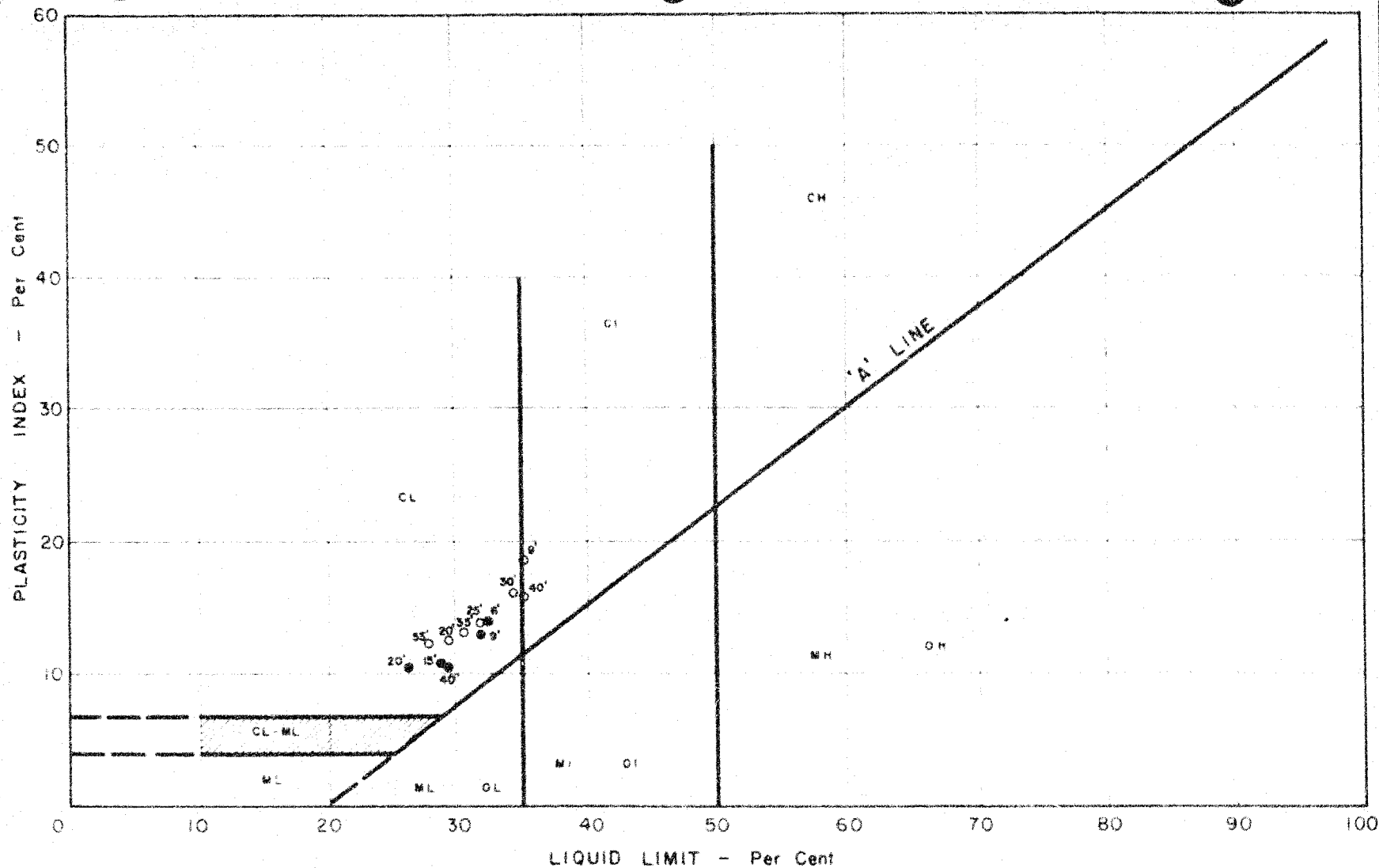
DATUM G.S.C.

BOREHOLE TYPE Washboring using NX Casing

CHECKED BY M.D.

(manual operation)

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	Liquid Limit ——— $W_L$ Plastic Limit ——— $W_P$ Water Content ——— $W$	BULK DENSITY  P.C.F.	REMARKS	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F. • Unconfined compression X Field vane test			$W_P$ $W$ $W_L$ ————— ————— ————— 40          50          60 * WATER CONTENT %
24.6	Groundlevel									
	1 ft muck		1	TW	PM					
	Organic clay-silt grey.					240	S=2.4		78.3	95 O.C.=6.4%
			2	TW	PM					
234.5										
11.5	End of borehole.				230					
						S=Sensitivity		* Note the scale		
						20 15 + 5 Percent strain at failure 10				



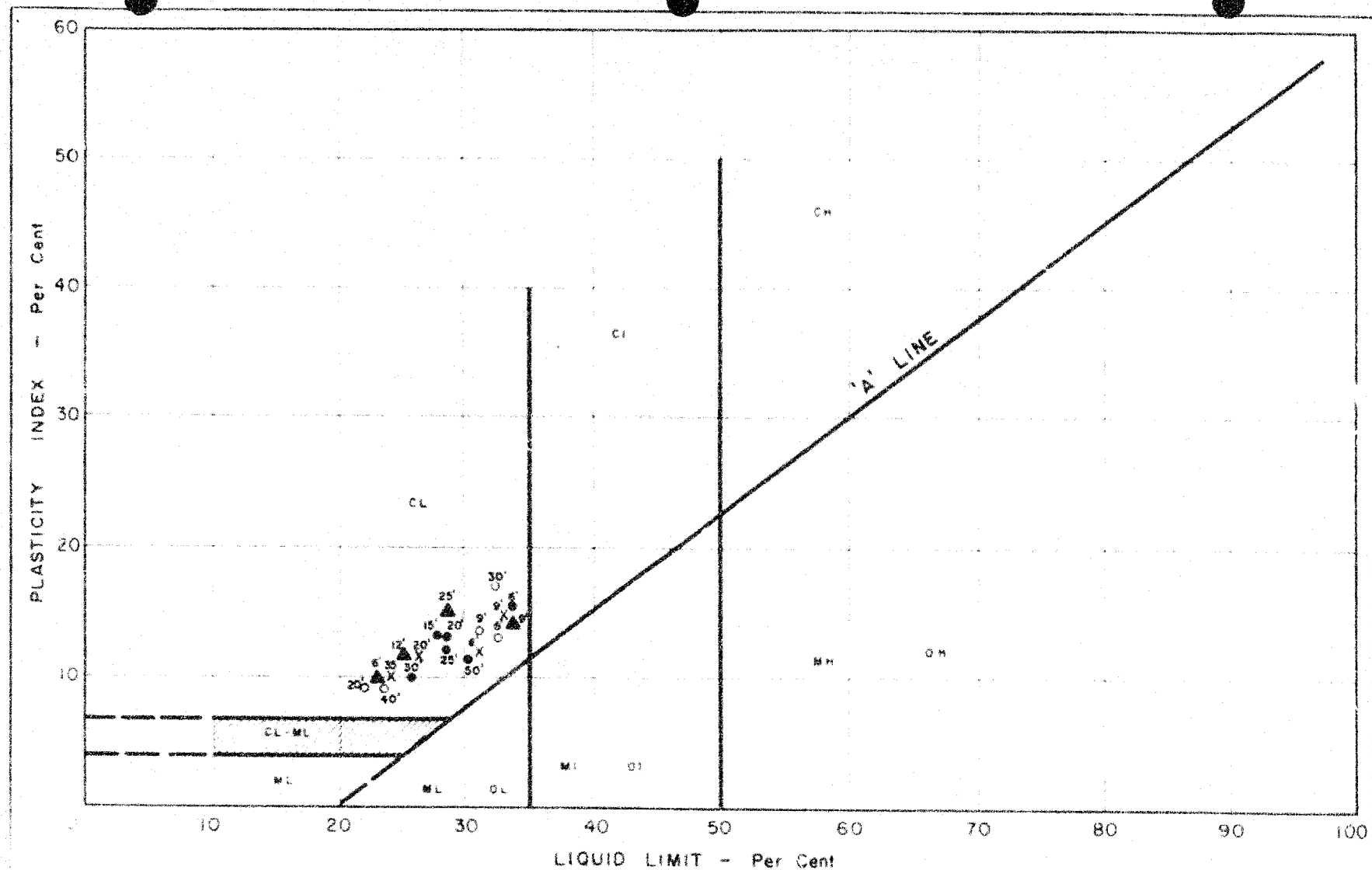
NOTES

BH 1 ○  
BH 2 ●

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION  
PLASTICITY CHART

Job No. 65-F-28  
Location Q.E.W.

W.P. No.



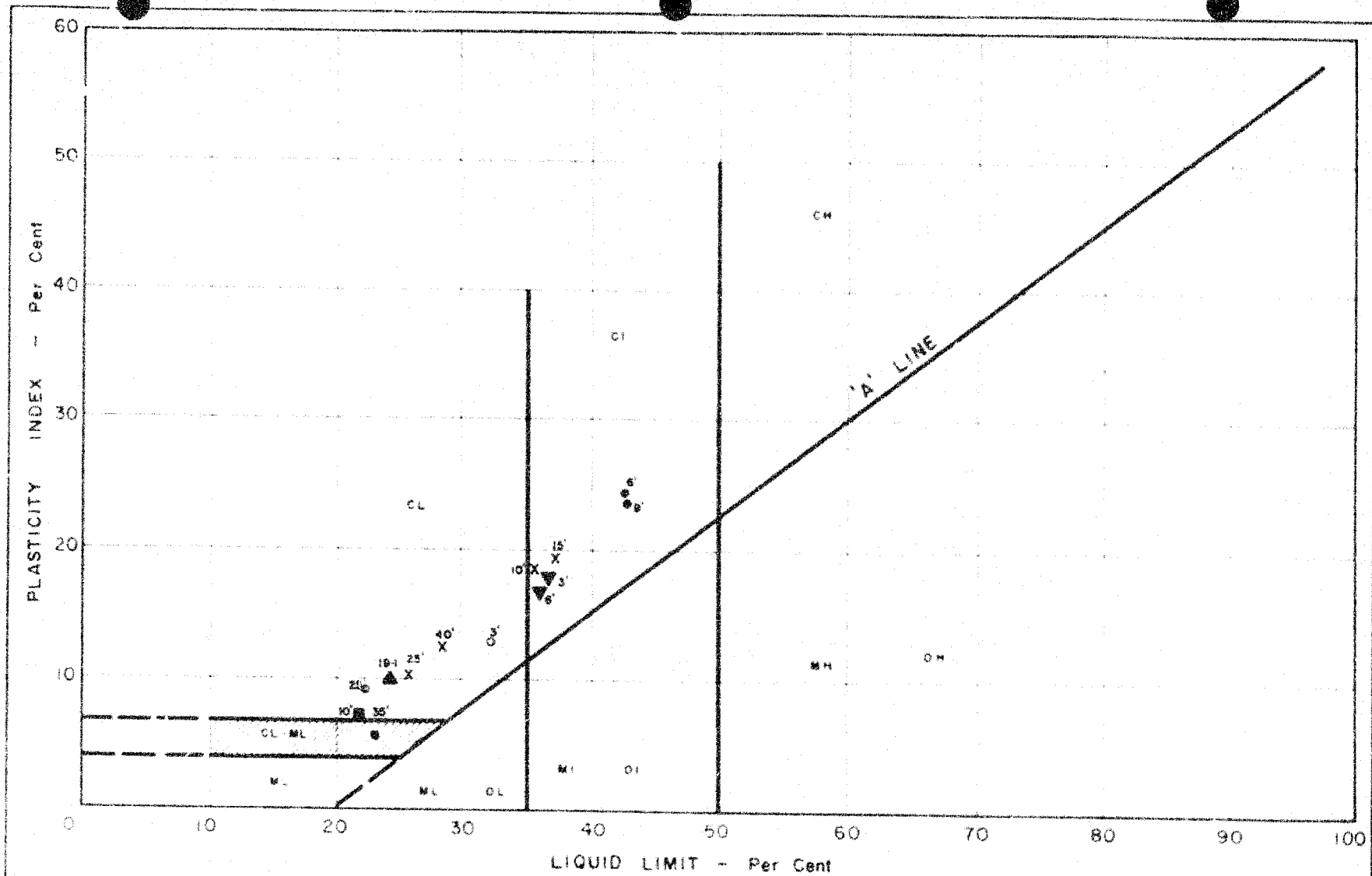
## NOTES

BH 3    ●  
 BH 4    ○  
 BH 5    X  
 BH 6    ▲

DEPARTMENT OF HIGHWAYS - ONTARIO  
 MATERIALS & RESEARCH DIVISION  
 PLASTICITY CHART

Job No. 65-F-28  
 Location Q.E.W.

W.P. No.



## NOTES

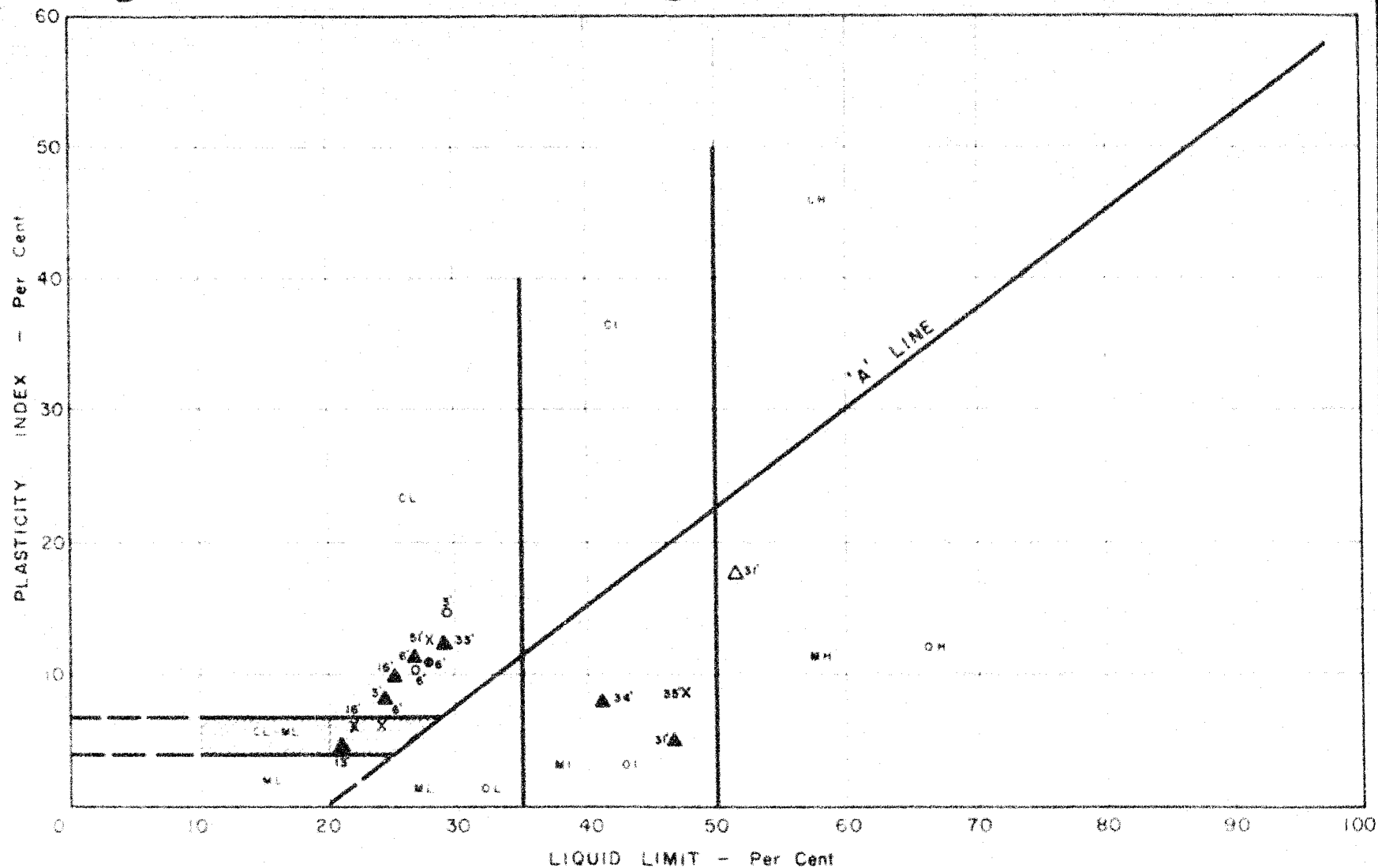
BH 7 •  
 BH 8 ○  
 BH 10 ▼  
 BH 11 x

BH 12 ■  
 BH 13 ▲

DEPARTMENT OF HIGHWAYS - ONTARIO  
 MATERIALS & RESEARCH DIVISION  
 PLASTICITY CHART

Job No. 65-F-28  
 Location Q.E.W.

W.P. No.



NOTES

BH 14    ●  
 BH 15    ○  
 BH 16    X

BH 16A

SOIL AT NATURAL MOISTURE CONTENT    ■

OVEN-DRIED SOIL    ▲

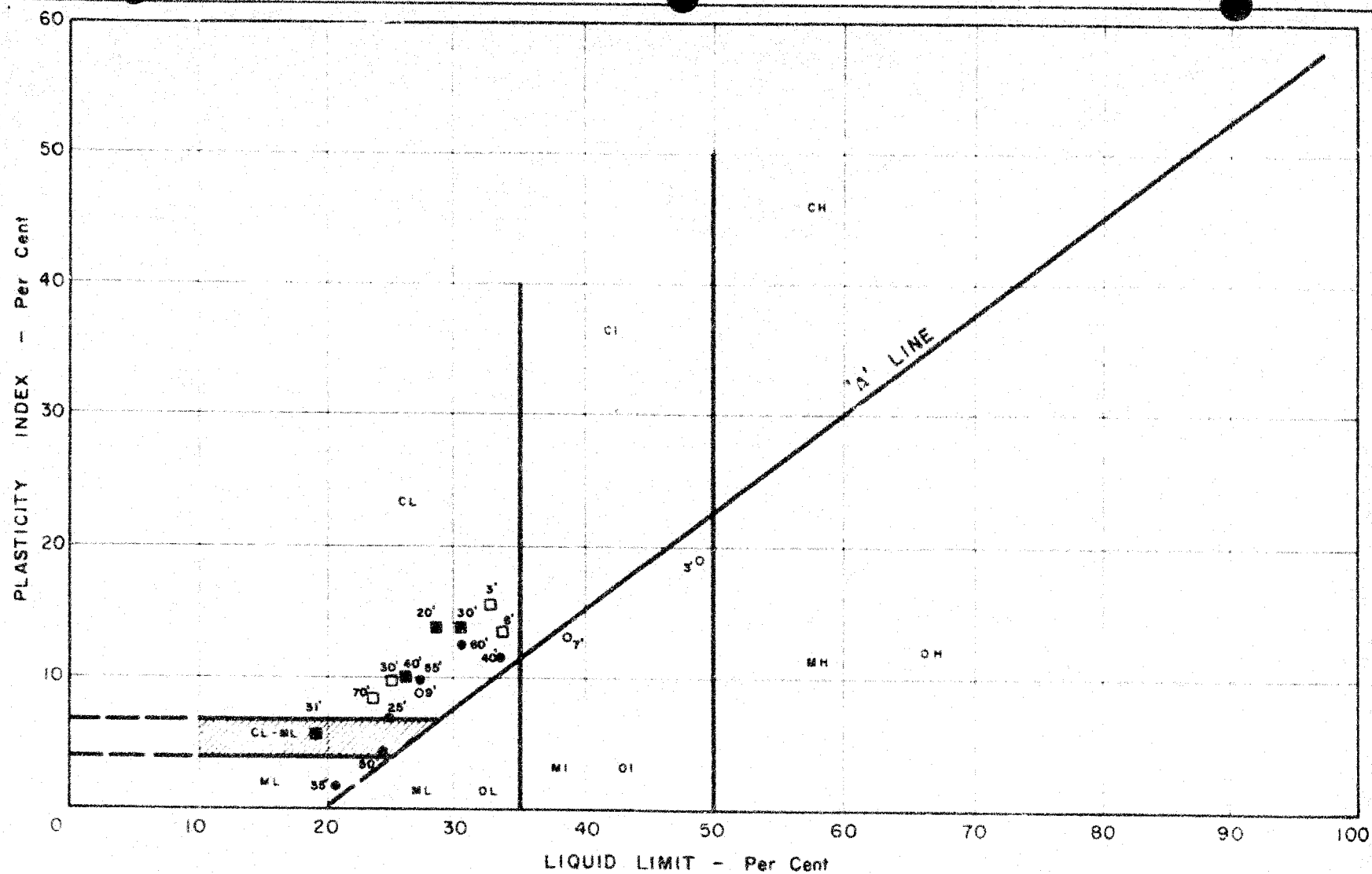
AIR-DRIED SOIL    △

DEPARTMENT OF HIGHWAYS - ONTARIO  
 MATERIALS & RESEARCH DIVISION  
 PLASTICITY CHART

Job No. 65-F-28

WP No.

Location Q.E.W.

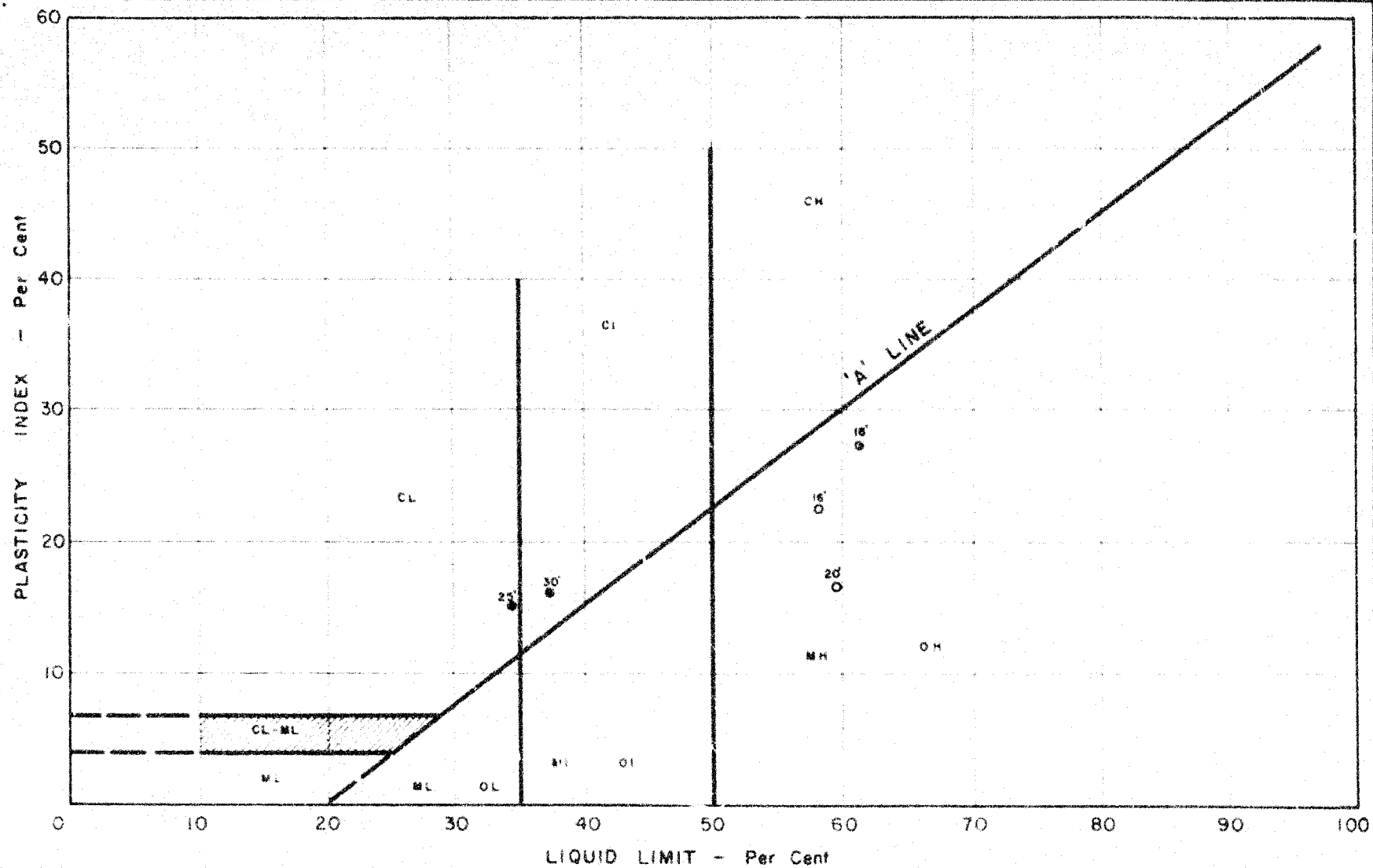


NOTES

BH 17	■
BH 18	□
BH 19a	●
BH 19b	○

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION  
PLASTICITY CHART

Job No. 65-F-28 W.P. No.  
Location Q.E.W.



NOTES BH 20

- FROM NATURAL STATE
- FROM OVEN-DRIED SOIL
- FROM AIR-DRIED SOIL

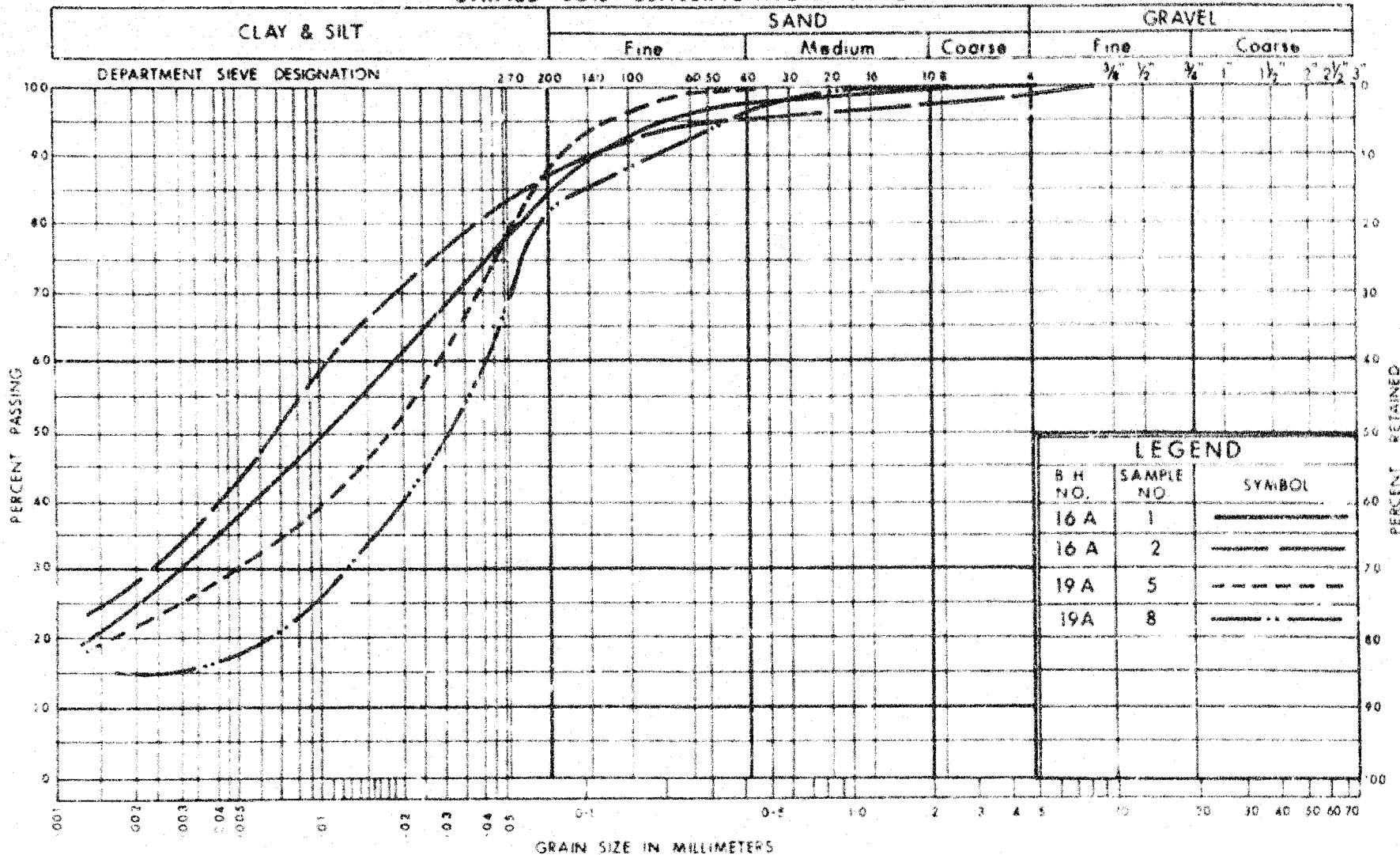
DEPARTMENT OF HIGHWAYS - ONTARIO  
 MATERIALS & RESEARCH DIVISION  
 PLASTICITY CHART

Job No. 65-f-28  
 Location Q.E.W.

W.P. No.

Q.E.W.

# UNIFIED SOIL CLASSIFICATION SYSTEM



## GRAIN SIZE DISTRIBUTION

FILL

(Heterogeneous Mixture of Sand, Silt & Clay)



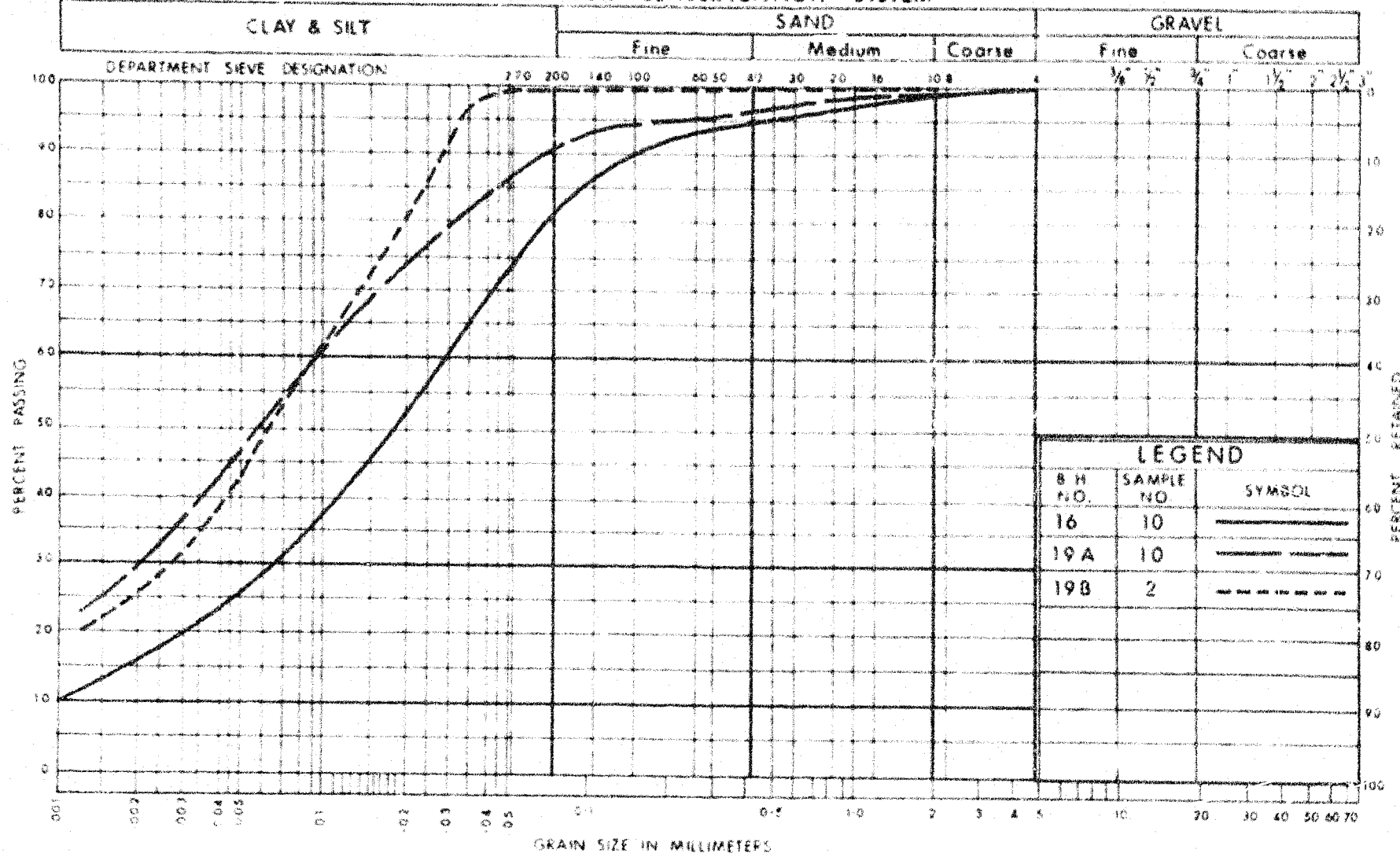
ONTARIO

DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

WP No.

JOB No. 65-F-28

# UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND		
B.H. NO.	SAMPLE NO.	SYMBOL
16	10	—————
19A	10	- - - - -
19B	2	.....

## GRAIN SIZE DISTRIBUTION

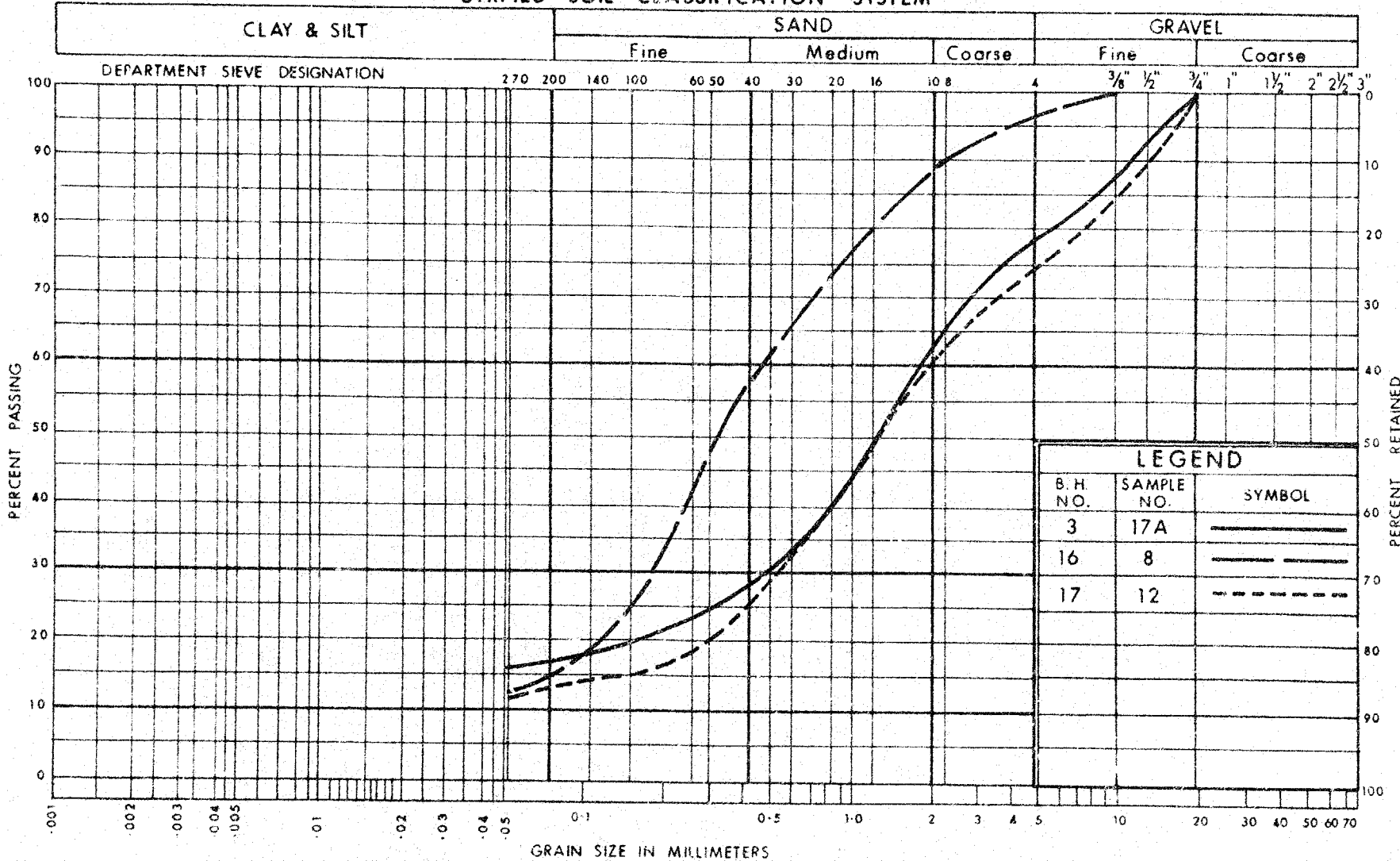
### ORGANIC CLAY - SILT



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

W.P. No.  
JOB No. 65-F-28

# UNIFIED SOIL CLASSIFICATION SYSTEM



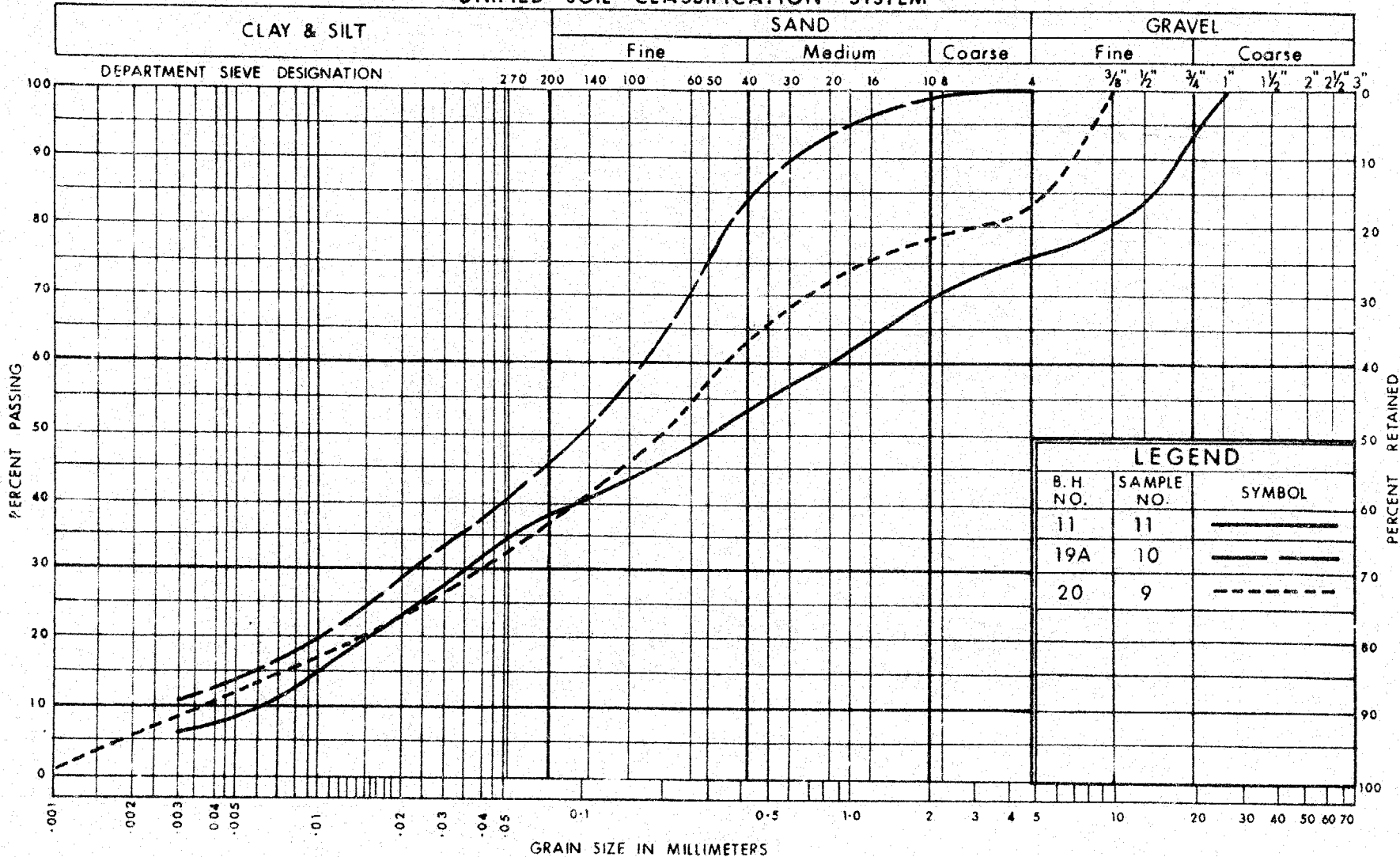
DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

## GRAIN SIZE DISTRIBUTION SAND With Gravel

W.P. No.

JOB No. 65-F-28

# UNIFIED SOIL CLASSIFICATION SYSTEM



## GRAIN SIZE DISTRIBUTION

SILTY SAND With Gravel



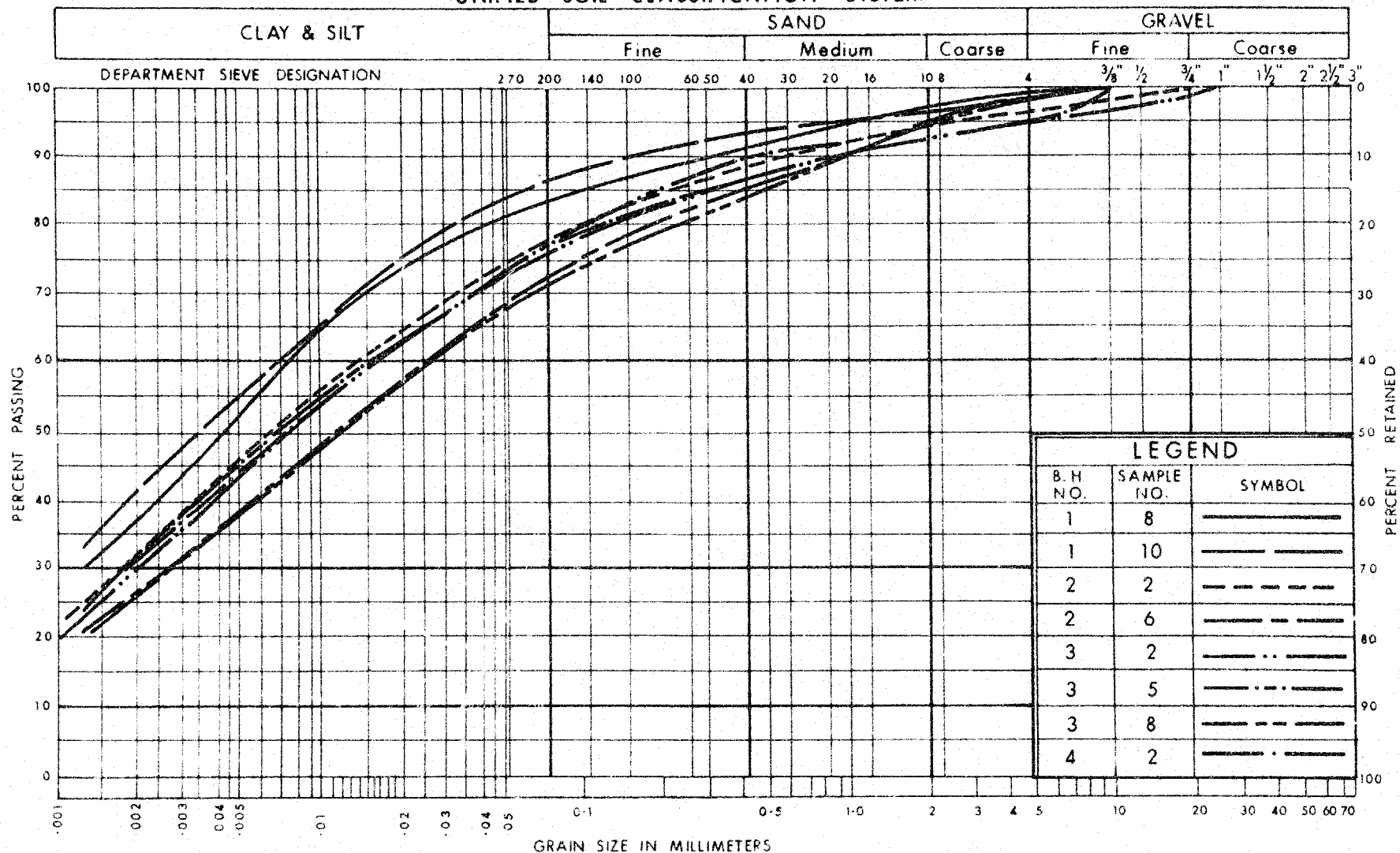
ONTARIO

DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

W.P. No.

JOB No. 65-F-28

## UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

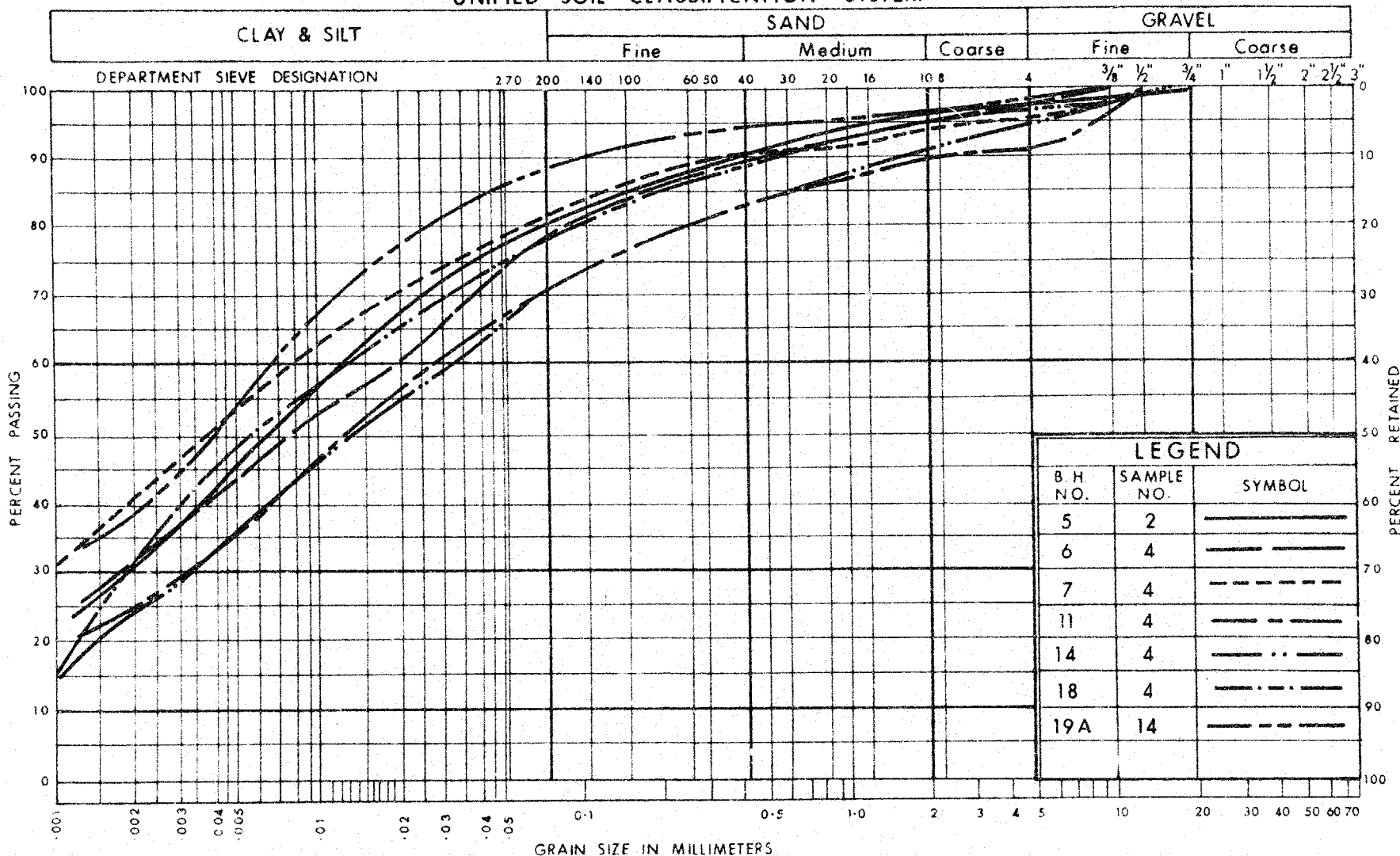
ONTARIO

GRAIN SIZE DISTRIBUTION  
CLAYEY SILT With Sand & Occ. Gravel  
(GLACIAL TILL)

W.P. No.

JOB No. 65 - F - 28

# UNIFIED SOIL CLASSIFICATION SYSTEM



**GRAIN SIZE DISTRIBUTION**  
CLAYEY SILT With Sand & Occ. Gravel  
(GLACIAL TILL)



ONTARIO

DEPARTMENT OF HIGHWAYS  
**MATERIALS and  
TESTING  
DIVISION**

W.P. No.

JOB No. 65 - F - 28

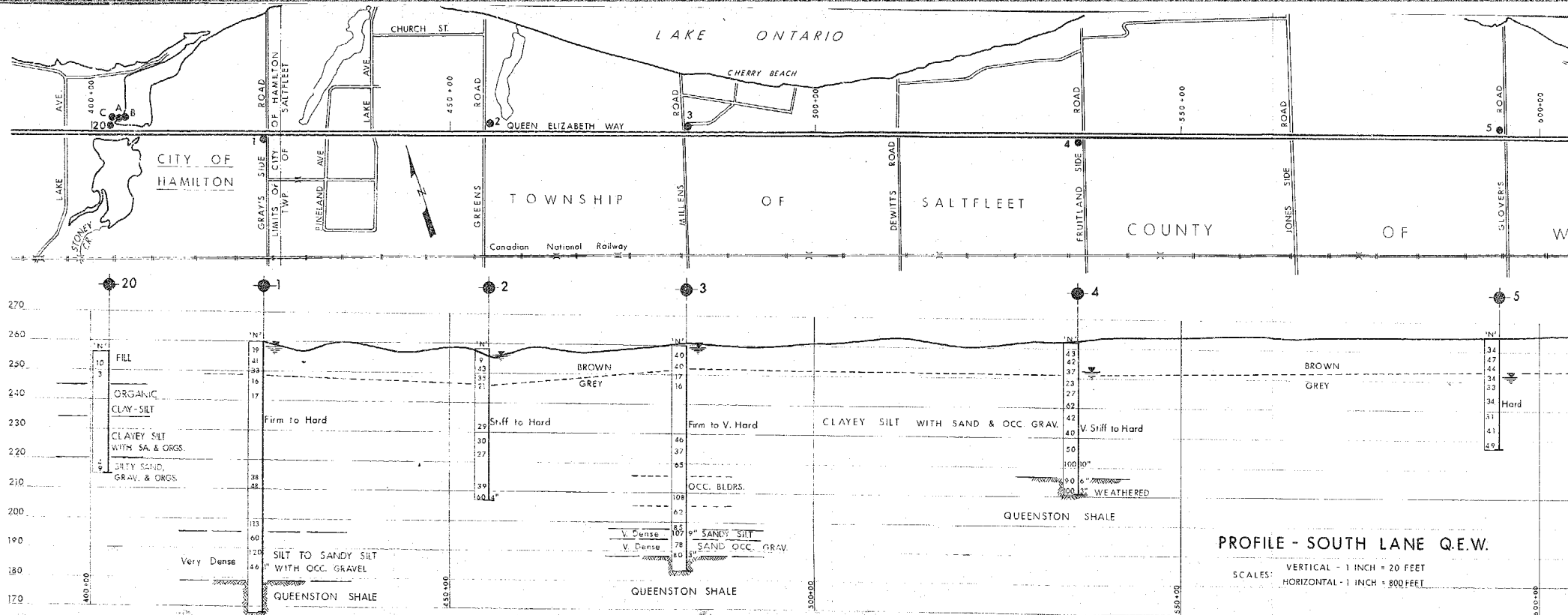


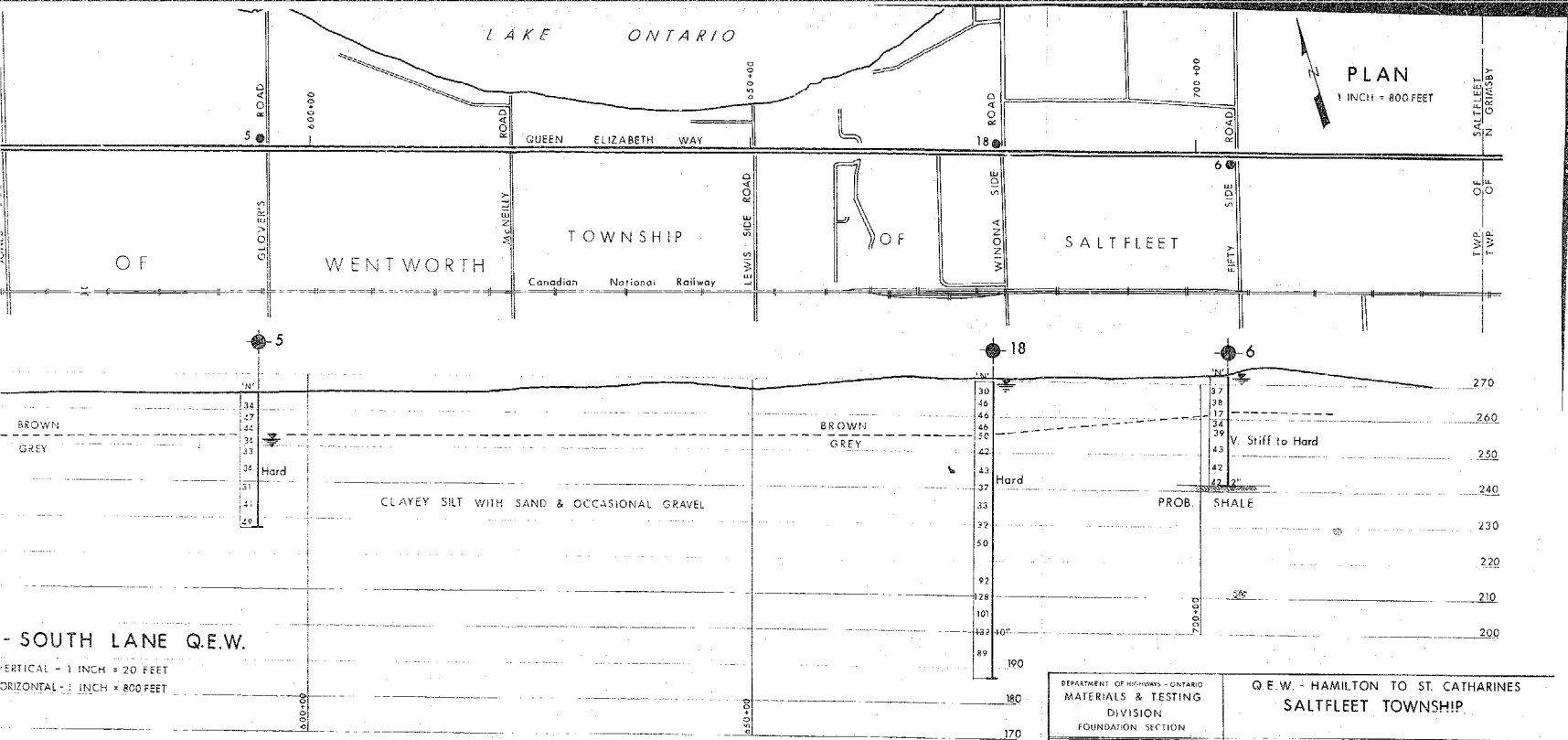
PLAN

SCALE IN MILES



DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & TESTING DIVISION FOUNDATION SECTION DATE MAY 12, 1965	GENERAL LAYOUT Q.E.W. - HAMILTON TO ST. CATHARINES APPROVED <i>[Signature]</i> DRAWING NO. 65-F-28 A
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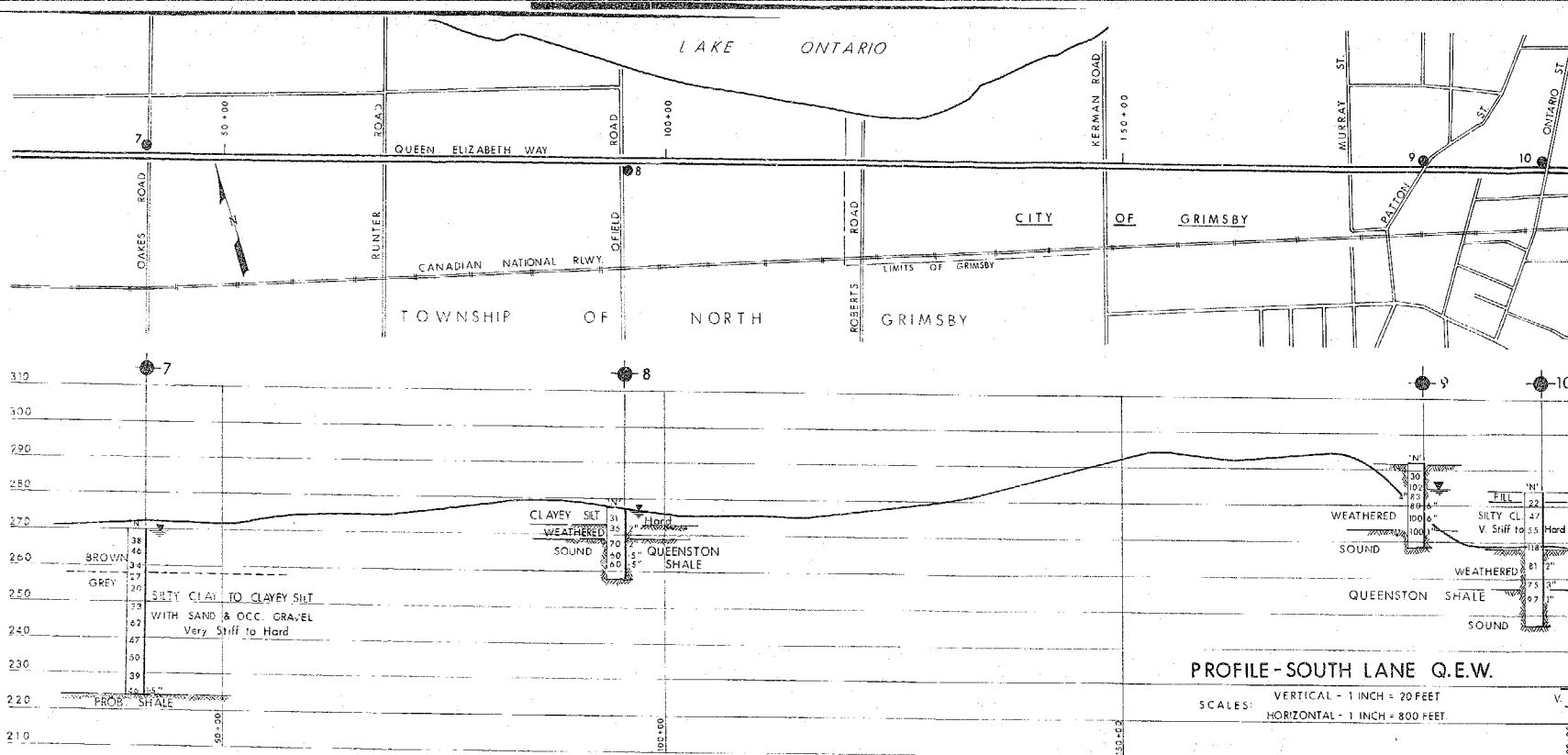


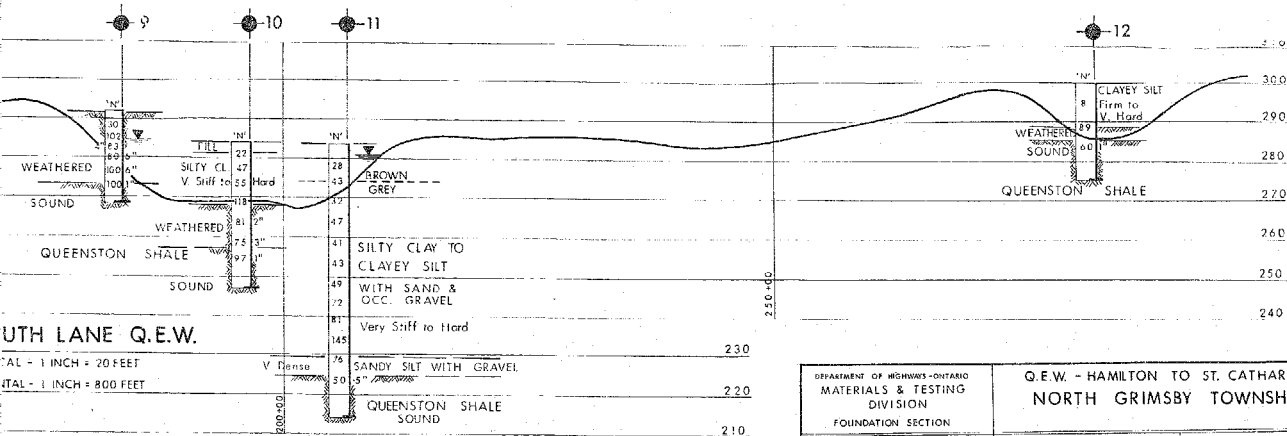
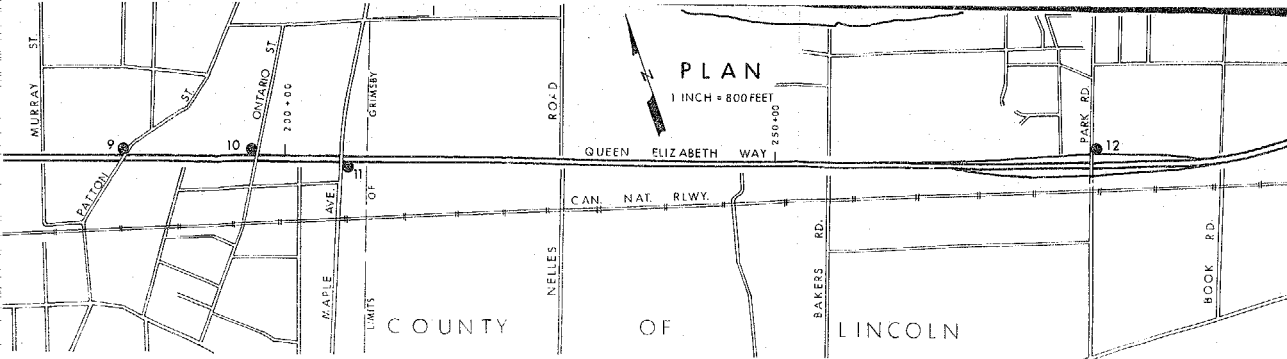


DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING  
DIVISION  
FOUNDATION SECTION

Q.E.W. - HAMILTON TO ST. CATHARINES  
SALT FLEET TOWNSHIP

DATE JUNE 11, 1935 APPROVED *[Signature]* DRAWING No 65 - F - 28 B





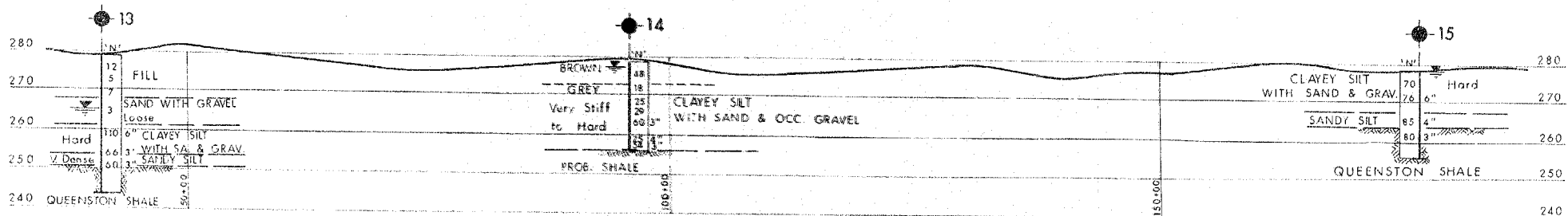
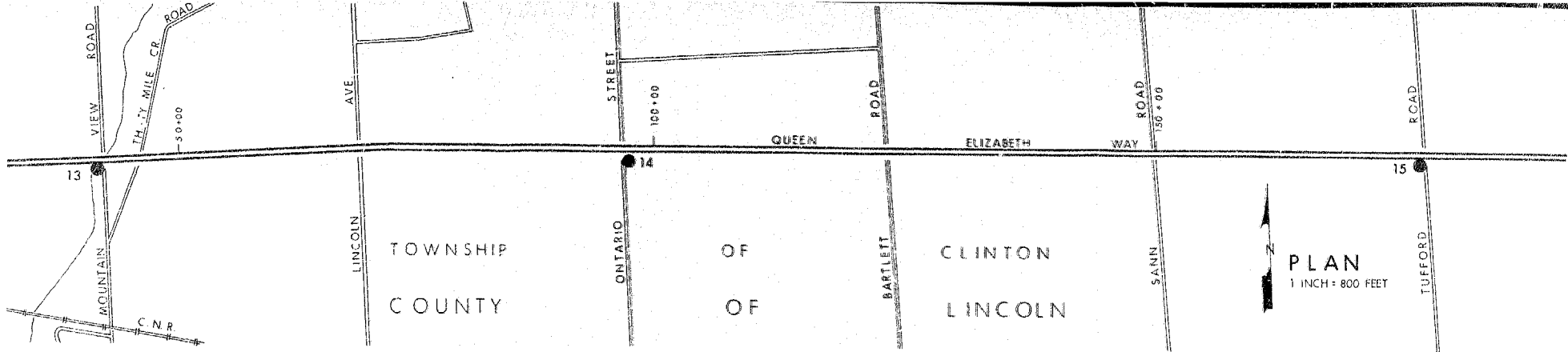
DEPARTMENT OF HIGHWAYS-ONTARIO  
MATERIALS & TESTING  
DIVISION  
FOUNDATION SECTION

Q.E.W. - HAMILTON TO ST. CATHARINES  
NORTH GRIMSBY TOWNSHIP

DATE JUNE 11, 1965

APPROVED *in* *North*

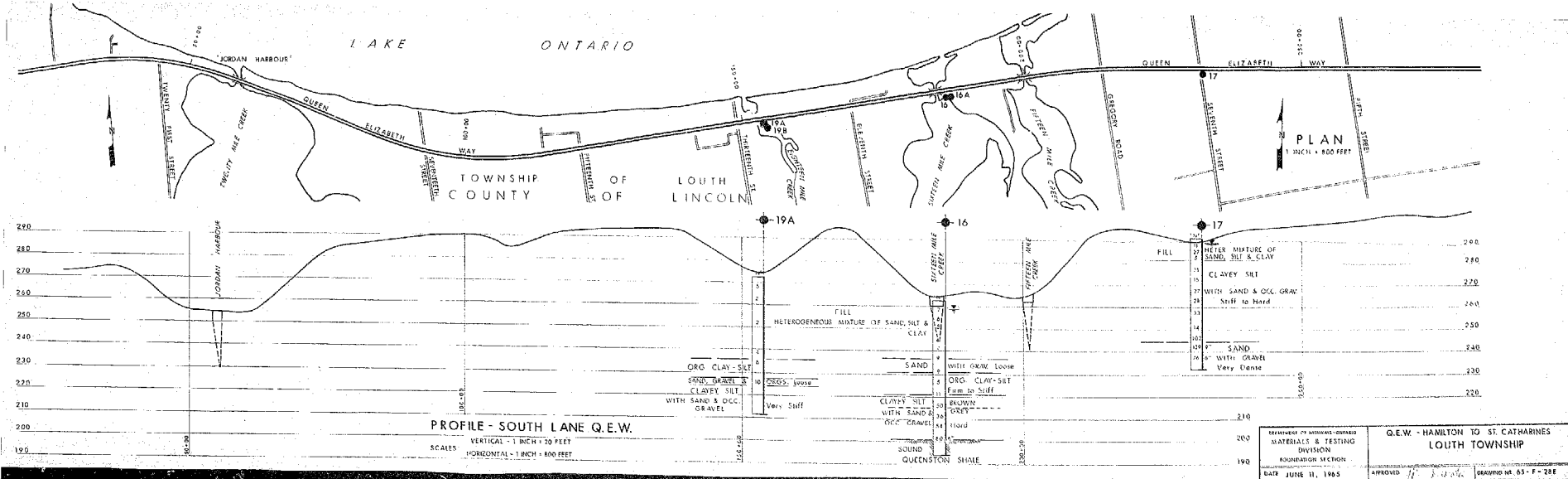
DRAWING NO 65-F-28C



# PROFILE - SOUTH LANE Q.E.W.

SCALES: VERTICAL - 1 INCH = 20 FEET  
HORIZONTAL - 1 INCH = 800 FEET

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & TESTING DIVISION FOUNDATION SECTION	Q.E.W. - HAMILTON TO ST. CATHARINES CLINTON TOWNSHIP
DATE JUNE 11, 1965	APPROVED <i>[Signature]</i> DRAWING NO. 65 - F - 28D



## ABBREVIATIONS USED IN THIS REPORT

### PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

### DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

### TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

### SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

# ABBREVIATIONS USED IN THIS REPORT

## SOIL PROPERTIES

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
$S_r$	DEGREE OF SATURATION
$w_L$	LIQUID LIMIT
$w_p$	PLASTIC LIMIT
$I_p$	PLASTICITY INDEX
s	SHRINKAGE LIMIT
$I_L$	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
$I_C$	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
$e_{max}$	VOID RATIO IN LOOSEST STATE
$e_{min}$	VOID RATIO IN DENSEST STATE
$I_D$	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY $D_r$ IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
$m_v$	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
$C_v$	COEFFICIENT OF CONSOLIDATION
$C_c$	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
$T_v$	TIME FACTOR = $\frac{C_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_r$	SENSITIVITY

## GENERAL

$\pi$	= 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
$\sigma$	NORMAL STRESS
$\sigma'$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

## EARTH PRESSURE

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

## FOUNDATIONS

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

## SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL

## MEMORANDUM

To: Mr. T. J. Kovich,  
Regional Materials Eng.  
Materials and Testing Division,  
Laboratory Bldg.

FROM: Mr. R. G. Burnfield,  
Functional Planning Section,  
Admin. Bldg.

DATE: April 6, 1965.

OUR FILE REF.

IN REPLY TO

## SUBJECT:

Soils Investigation -  
Q. E. W. Stoney Creek Traffic Circle to  
St. Catharines, District #4, (Hamilton)

Attached please find :

- 1). Two plan prints from the consulting firm of DeLeuw Cather, requesting additional bore-hole information in the Townships of Saltfleet and Louth. This is in addition to the original request of February 10, 1965.
- 2). Two cross-section prints showing required information regarding existing pavement conditions i. e. type of surface, depth and width etc. throughout this project.
- 3). Three prints showing typical future cross-section proposals on the above mentioned project are also included.

The depth of the granular material and finished pavement courses are in question.

Could you please review these proposals and return one print showing the recommendation and/or corrections.

This information is urgently required for cost comparison purposes for a meeting scheduled with the Planning Director April 15, 1965.

It would be appreciated if priority is given to the work involved in the Township of Saltfleet and results sent to us as soon as completed.

If you have any further questions regarding this request, would you please contact Mr. E. Fearnley with the consulting firm of DeLeuw Cather & Co.

RGB/HC/dc.  
attach :

c.c. to - A. Crowley.

*H. W. Clelland.*  
for. R. G. Burnfield,  
Regional Functional Planning  
Engineer.

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00324

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HAMN DOWN 4 MAR 24/65 12:20P VR

H GREENLAND D E

ATTN MR W D HAM MAINT ENGR

RE: PRELIMINARY FOUNDATION INVESTIGATION FOR STRUCTURES  
BETWEEN HAMILTON, (STONEY CREEK TRAFFIC CIRCLE) AND ST CATHARINEQ  
ON Q E W W J 65-F-28, DISTRICT 4

W P NONE

THIS IS FOR YOUR INFORMATION THAT THE FOUNDATION INVESTIGATION  
WORK FOR VARIOUS PROPOSED STRUCTURES IS IN PROGRESS AT THE ABOVE  
MENTIONED LOCATION

H DEVATA SR FOUNDN ENGR

PER A G STERMACK PRIN FOUNDN ENGR MAT & TESTG

L

00324

Mr. R. Burnfield,  
Reg. Functional Planning Engr.

Materials & Testing Division.

Attn: Mr. I. Ardizone.


March 1st, 1965.

Structure Sites, QEW, Stony Creek  
Traffic Circle to St. Catherines.

Please be advised that your request for preliminary data at the seven structure sites has been turned over to Mr. A. Stermac, our Principal Foundation Engineer, who will arrange for the necessary work.

If you or the Consultants have any queries, they should be directed to him.

TJK/hd  
c.c. A. Stermac,  
E. Fearnley, DeLeuw Cather & Co.,  
T.J. Kovich,  
Files.

  
T.J. Kovich,  
Regional Materials Engineer.

## MEMORANDUM

To: T. J. Kovich,  
Regional Materials Eng. (Toronto),  
Lab. Building.

FROM: R. G. Burnfield,  
Regional Functional Planning Engineer.

DATE: February 10th, 1955.

OUR FILE REF.

IN REPLY TO

## SUBJECT:

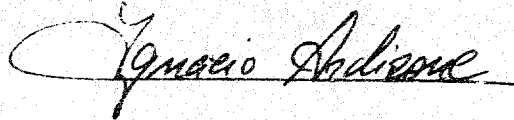
Q.E.W. from Stoney Creek Traffic  
Circle to St. Catharines, Dist. #4, Hamilton.

Please find attached letter from DeLeuw, Cather & Co. in which soil testing is requested as shown on the enclosed plans.

They are preparing a Functional Report covering the above mentioned section of the Q.E.W., whose completion date is in the near future.

Will you please provide us with the requested soil information.

It would be appreciated if priority is given to the work involved in the Township of Saltfleet and results sent to us as soon as completed.



I. Ardizzone,

RGB/IA/mw  
Attach.

For: R. G. Burnfield,  
Regional Functional Planning Engineer.

DE LEUW, CATHER & COMPANY  
OF CANADA LIMITED  
CONSULTING PROFESSIONAL ENGINEERS  
1127 LESLIE STREET  
DON MILLS, ONTARIO  
448-2221

February 5th, 1965.

Mr. R. G. Burnfield,  
Regional Functional Planning Engineer,  
Department of Highways of Ontario,  
DOWNSVIEW, Ontario.

Attention: H.W. Clelland

Re: Soil Testing  
Q.E.Q. Stoney Creek Traffic Circle  
to St. Catharines, District 4  
(Hamilton)

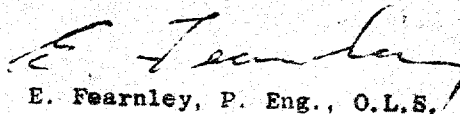
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Dear Sir:

We enclose plans showing the location of boreholes  
for the subject project.

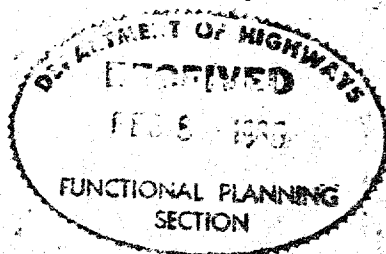
Sincerely,

DE LEUW, CATHER & COMPANY OF CANADA LIMITED

  
E. Fearnley, P. Eng., O.L.S.

---

TF/sfb  
Encl.



SOME DEFECTS IN NEGATIVE DUE  
TO CONDITION OF ORIGINAL DOCUMENTS

# QUEEN ELIZABETH WAY IMPROVEMENT

SUMMARY OF COST ESTIMATES FOR SALT FLEET TOWNSHIP  
STAGE ONE  
LENGTH - 6.4 MILES

LOCATION	CONSTRUCTION COST	REMARKS
GRAY S. RD.	353,000	
MILLEN RD.	357,000	
FRUITLAND RD.	1,379,000	INTERCHANGE
GLOVER RD.	368,500	
WINONA RD.	381,500	
FIFTY RD.	1,375,000	INTERCHANGE
SERVICE ROADS	1,200,000	
BRIDGE	6,000,000	
PROPERTY	1,200,000	
TOTAL COST FOR STAGE ONE	7,200,000	

# QUEEN ELIZABETH WAY IMPROVEMENT.

SUMMARY OF COST ESTIMATES FOR SALT FLEET TOWNSHIP - STAGE ONE  
LENGTH - 6.4 MILES

ITEM	COST 75' OUTER SEPARATION	REMARKS
1 SERVICE ROADS	1,276,000	
2 CROSS ROADS	131,000	
3 CONNECTING ROADS	199,000	
4 ROADWORK FOR PARCLO'A	920,000	
5 BORROW & COMPACTION	497,000	
TOTAL	3,023,000	
MISCELLANEOUS - 8% ITEMS 1-5	242,000	
DRAINAGE - 15% ITEMS 1-5	454,000	
TOTAL ROAD WORK	3,719,000	
6 STRUCTURES	1,410,000	
7 LIGHTING	100,000	AT INTERCHANGES ONLY
TOTAL	5,229,000	
CONTINGENCIES & ENGINEERING 15% OF ABOVE TOTAL	771,000	
TOTAL	6,000,000	
PROPERTY	1,200,000	
TOTAL COST FOR STAGE ONE	7,200,000	



DE LEUW, CATHAR & COMPANY  
OF CANADA LIMITED  
CONSULTING ENGINEERS

SUBJECT TRAIL & ROAD BRIDGE JOB NO. C762  
LOCATION TRAIL, SASKATCHEWAN SHEET NO. 4 OF 9  
MADE BY H DATE 11/1/53 CHECKED BY W.M. DATE 11/1/53

## COST ESTIMATE SHEET

ITEM No.	SPEC.	DESCRIPTION	UNIT	QUANTITY	PRICE	COST
1		BRIDGE ROAD	LI	67,500	18.26	1,237,000
		Highway Bridge: 3% of total				10,000
		Drainage (5% of total item)				19,000
		Total Construction Cost				1,266,000
		Contingency (5% of total)				231,000
		(5% of above total)				
		Total Cost of Bridge				1,497,000

DE LEUW, CATHER & COMPANY  
OF CANADA LIMITED  
CONSULTING ENGINEERS

SUBJECT WATER TREATMENT PLANT JOB NO. 6002  
LOCATION TWIL SALT PLEET SHEET NO. 5 OF 9  
MADE BY CS DATE 10/2/66 CHECKED BY TH DATE 10/2/66

## COST ESTIMATE SHEET

ITEM No.	SPEC.	DESCRIPTION	UNIT	QUANTITY	PRICE	COST
		<u>GRAVEL RD</u>				
<u>1</u>		<u>CROSS RD</u>	<u>L.F.</u>	<u>1500</u>	<u>15.26</u>	<u>22,890</u>
<u>2</u>		<u>CONNECTING RD</u>	<u>L.F.</u>	<u>2700</u>	<u>15.26</u>	<u>41,202</u>
<u>3</u>		<u>BORROW</u>	<u>CU</u>	<u>30,000</u>	<u>1.00</u>	<u>30,000</u>
<u>4</u>		<u>COMPACTION</u>		<u>12500</u>	<u>1.92</u>	<u>2,400</u>
		<u>TOTAL</u>				<u>114,292</u>
		<u>MISCELLANEOUS</u>				<u>9,500</u>
		<u>DRILLAGE</u>				<u>17,100</u>
		<u>TOTAL PRELIMINARY COST</u>				<u>140,892</u>
		<u>STRUCTURE</u>	<u>EA</u>			<u>165,000</u>
		<u>TOTAL</u>				<u>305,892</u>
		<u>CONCRETE &amp; REINFORCING</u>				<u>47,100</u>
		<u>15% OF PRELIMINARY TOTAL</u>				<u>45,884</u>
		<u>TOTAL COST - CLASS 1</u>				<u>353,000</u>

DE LEUW, CATHAR & COMPANY  
OF CANADA LIMITED  
CONSULTING ENGINEERS

SUBJECT STAGE 1 DEW JOB NO. 0252  
LOCATION MILLEN RD SHEET NO. 6 OF 9  
MADE BY B.T. DATE Jan 1964 CHECKED BY VIAH DATE Feb 24/64

## COST ESTIMATE SHEET

ITEM No.	SPEC.	DESCRIPTION	UNIT	QUANTITY	PRICE	COST
		<u>MILLEN RD</u>				
<u>1.</u>		<u>GRASS RD</u>	<u>LF</u>	<u>1800</u>	<u>18.26</u>	<u>32,868</u>
<u>2.</u>		<u>CONCRETE RD</u>	<u>LF</u>	<u>2000</u>	<u>18.26</u>	<u>36,520</u>
<u>3.</u>		<u>BORROW</u>	<u>CY</u>	<u>45000</u>	<u>1.00</u>	<u>45,000</u>
<u>4.</u>		<u>COMPACTION</u>	<u>SQY</u>	<u>360</u>	<u>10.00</u>	<u>3,600</u>
						<u>117,900</u>
		<u>MISCELLANEOUS - 2TH</u>				<u>9,400</u>
		<u>DRAINAGE</u>				<u>17,700</u>
		<u>TOTAL ROADWAY COST</u>				<u>145,000</u>
		<u>STRUCTURE</u>				<u>165,000</u>
		<u>TOTAL</u>				<u>310,000</u>
		<u>CONTINGENCY &amp; ENGINEERING</u>				<u>47,000</u>
		<u>(15% OF ABOVE TOTAL)</u>				
		<u>TOTAL COST - STAGE 1</u>				<u>357,000</u>

E. E. LEUW, CATHER & COMPANY  
OF CANADA LIMITED  
CONSULTING ENGINEERS

SUBJECT STAGE 1 - GLOVER RD. JOB NO. 6-102  
LOCATION 723 - FALMOUTH SHEET NO. 7 OF 9  
MADE BY ELL DATE JUNE 2/65 CHECKED BY WAL DATE JUNE 2/65

## COST ESTIMATE SHEET

ITEM No.	SPEC.	DESCRIPTION	UNIT	QUANTITY	PRICE	COST
		<u>GLOVER RD</u>				
1		CROSS RD	L.F.	1500	18.26	32,800
2		CONNECTING RD	L.F.	3300	18.26	60,200
3		BORROW	C.Y.	30000	1.00	30,000
4		COMPACTION	2500	240	16.00	2,400
		TOTAL				125,400
		MISCELLANEOUS - 5%				10,300
		DRAINAGE - 15%				18,800
		TOTAL ROADWORK COST				154,500
		STRUCTURE				165,000
		TOTAL				319,500
		CONTINGENCE & ENGINEERING				49,000
		15% OF ABOVE TOTAL				
		TOTAL COST - STAGE 1				368,500

DE LEUW, CATHER & COMPANY  
OF CANADA LIMITED  
CONSULTING ENGINEERS

SUBJECT STAGE 1 WINDNA RDJOB NO. 6-262LOCATION TWP. SALTFLATSHEET NO. 8 OF 9MADE BY P.B.J. DATE JUN 1965 CHECKED BY W.H. DATE VIEW

## COST ESTIMATE SHEET

ITEM No.	SPEC.	DESCRIPTION	UNIT	QUANTITY	PRICE	COST
		<u>WINDNA RD</u>				
<u>1</u>		<u>CROSS RD</u>	<u>L.F.</u>	<u>1800</u>	<u>18.26</u>	<u>32,868</u>
<u>2</u>		<u>CONVERTING RD</u>	<u>L.F.</u>	<u>2900</u>	<u>18.26</u>	<u>52,954</u>
<u>3</u>		<u>BORROW</u>	<u>C.Y.</u>	<u>45000</u>	<u>1.00</u>	<u>45,000</u>
<u>4</u>		<u>COMPACTION</u>	<u>125 CY</u>	<u>360</u>	<u>10.00</u>	<u>3,600</u>
		<u>TOTAL</u>				<u>134,300</u>
		<u>MISCELLANEOUS - 5%</u>				<u>10,700</u>
		<u>DRAINAGE - 15%</u>				<u>20,200</u>
		<u>TOTAL ROADWORK COST</u>				<u>165,200</u>
		<u>STRUCTURE</u>	<u>ea.</u>			<u>165,000</u>
		<u>TOTAL</u>				<u>330,200</u>
		<u>CONTINGENCIES &amp; ENGINEERING</u>				
		<u>(15% OF ABOVE TOTAL)</u>				<u>51,360</u>
		<u>TOTAL COST - STAGE 1</u>				<u>381,560</u>

DE LEUW, CATHER & COMPANY  
OF CANADA LIMITED  
CONSULTING ENGINEERS

SUBJECT CONSTRUCTION COSTS FOR PARCLO A JOB NO. C292  
LOCATION NEW STUDY SHEET NO. 9 OF 9  
MADE BY SL DATE 12/95 CHECKED BY AWH DATE 12/95

## COST ESTIMATE SHEET

ITEM No.	SPEC.	DESCRIPTION	UNIT	QUANTITY	PRICE \$	COST
		RAMP N-W - RD. TO RAMP TAPER	LF	540	23.00	12,500
		- 12' LANE	LF	620	23.50	14,500
		- RAMP ON RAMP	LF	730	43.00	31,500
		- RAMP - FREEWAY TAPER	LF	1020	17.25	17,500
		RAMP S-W (loop) - RD. TO RAMP TAPER	LF	140	29.50	4,000
		- 16' LANE	LF	1360	23.50	32,000
		RAMP E-N - FREEWAY TO RAMP TAPER	LF	1000	23.00	23,000
		- 12' LANE	LF	420	23.50	9,500
		- 24' LANE	LF	450	29.50	13,500
		- RAMP OFF 2 LANE RAMP	LF	140	49.50	7,000
		RAMP E-N - 16' LANE	LF	170	23.50	4,000
		- RAMP TO RD. TAPER	LF	440	17.25	7,500
		RAMP E-S - 24' LANE	LF	140	29.50	4,000
		ADDITIONAL CURB				
		1) NOSE TO ME ON FREEWAY 2330				
		2) NOSE OF N-W TO STRUCTURE 330	LF	2100	2.37	6,500
		3) NOSE OF S-W TO E-S 140				
		GUIDE RAIL AT RAMPS ETC.				
		1) RAMP N-W 300				
		2) S-W 500	LF	1350	4.27	6,000
		3) E-N 400				
		4) APPROACH TO STRUCTURE 150				
		CROSS ROAD	LF	1000	37.00	37,000
		TOTAL CONST COST 1/2 PARCLO A				230,000
		TOTAL CONST COST FOR FULL PARCLO A (ROADWORK ONLY)				460,000

COSTS FOR SUPPLY & PLACE BASED ON WESTON RD TENDER

ITEM NO.	DESCRIPTION	UNIT	SUPPLY \$	PRICE \$	TOTAL \$
1	EARTH EXCAVATION	C.Y.			0.70
2	EARTH BORROW	C.Y.			1.00*
3	COMPACTION (125 CY/HK)	HK			10.00
4	9" REINFORCED CONC. PAVEMENT	S.Y.	2.55	2.75	5.30
5	9" CONCRETE BASE	S.Y.	1.31	2.75**	4.06
6	GRANULAR 'A'	Ton			2.30
7	GRANULAR 'B'	Ton			1.70
8	HL1	Ton			10.00
9	HL2	Ton			9.00
10	HL3	Ton			9.00
11	CURB	L.F.	.37	2.00	3.37
12	GUIDE RAIL - DOUBLE + ANTICLASH	L.F.	5.28	1.40	6.68
13	GUIDE RAIL - DOUBLE	L.F.	5.16	1.30	6.46
14	GUIDE RAIL - SINGLE	L.F.	2.12	1.15	4.27
15	CHAIN LINK FENCE	L.F.	1.61***	.71***	2.32***
16	SHOULDER SURFACE TREATMENT (1/2") S.Y.	S.Y.			0.19
17	REMOVAL OF EXISTING CONC. & BITUM. S.Y.	S.Y.			.95

HISC = 8% OF ITEMS 1-17

DRAINAGE = 15% OF ITEMS 1-17

LIGHTING = \$10,000 / PARCEL 'A'

\* NO ACTUAL COST AVAILABLE

\*\* ACTUAL WESTON RD TENDER  
PRICE = \$2.05 / S.Y. BASED  
ON 15,000 S.Y. COST  
REDUCED DUE TO, QUANTITY  
BEING 10,000 S.Y.

\*\*\* COST INCLUDES ADJUSTMENT  
FOR REBAR PLACEMENT