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GEOCRES No. 30 M12-107

DIST. 6 REGION

W.P. No. 127-66-38

CONT. No. 79-77

W. O. No.

STR. SITE No.

HWY. No. 416

LOCATION Prop. Culverts (1 & 2) at N-E of Eglinton Ave. & New Hwy 410 No. of PASSES - Interchange

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

30M12-107
GEOCRES No.

TO: Mr. G.C.E. Burkhardt, (2)
Reg. Structural Planning Engineer,
Central Region, Toronto.

FROM: Soil Mechanics Section,
Geotechnical Office,
West Building, Downsview.

ATTENTION:

DATE: October 25th, 1974.

OUR FILE REF.

IN REPLY TO NOV 1 - 1974

SUBJECT: CONT. 77-21 & CONT 79-77
FOUNDATION INVESTIGATION REPORT
For
The Proposed Culverts (Nos. 1 & 2)
at North and East of Eglinton Avenue
and New Hwy. 410 Interchange.
City of Mississauga, Reg. Municipality
of Peel, District 6, Toronto.
W.O. 74-11027, W.P. 127-66-[redacted] &-38.
WP 36-74-04

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

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

M. Devata

M. Devata,
Supervising Engineer.

MD/mj
c.c. E.J. Orr
B.R. Davis
R.S. Pillar
H. Greenland
B.J. Giroux
D. Gunter
G.A. Wrong
P. Lewycky

Files
Documents

TABLE OF CONTENTS.

Foundation Investigation Report
For
The Proposed Culverts (Nos. 1 & 2)
at North and East of Eglinton Avenue
and New Hwy. 410 Interchange.
City of Mississauga, Reg. Municipality
of Peel, District 6, Toronto.

W.O. 74-11027, W.P. 127-66-37 &-38.

1. INTRODUCTION:

The Soil Mechanics Section of the Geotechnical Office was requested to carry out a subsurface investigation at the site of the proposed two culverts, in the vicinity of Eglinton Avenue and Hwy. 410 Interchange, City of Mississauga, Reg. Mun. of Peel. The request was contained in a memo from Mr. G.C.E. Burkhardt, Regional Structural Planning Engineer, Central Region, dated June 3rd, 1974. Subsequently, an investigation was carried out by this Section in order to determine the subsoil, bedrock and groundwater conditions in this area.

A preliminary subsurface investigation revealed the presence of poor subsoil conditions and in view of this, a shift of the culvert centreline 25 ft. to the north of the previously investigated line was considered as a suitable alternative. This was agreed in a meeting held on September 4th, 1974 and a further request to carry out investigation at the revised alignment was received on September 9th, 1974 from the Regional Structural Planning Office.

This report contains the results of the investigation for the revised alignment, together with our recommendations, pertaining to the foundation design of the two proposed structures.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

It is proposed to construct two culverts in the vicinity of the new Hwy. 410 and Eglinton Ave. interchange in the City of Mississauga, Regional Municipality of Peel.

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The topography of the area is flat to undulating. Physiographically this area is known as the "Peel Plain". The characteristic deposit in the area under investigation is a cohesive glacial till whose thickness is quite variable. Often the till deposit is underlain by granular deposits.

3. FIELD AND LABORATORY WORK:

In the course of investigation, 21 sampled boreholes were carried out, both for the initial alignment and revised alignment. A total of 19 boreholes were put down at the culvert No. 1, located on the north side and parallel to Eglinton Ave., and two boreholes were put down for the culvert No. 2 located at the east side of Eglinton Ave. and new Hwy. 410 intersection. Each borehole was accompanied where necessary, with a dynamic cone penetration test. The borings were carried out by means of a bombardier mounted auger machine (C.M.E.45) adapted for soil sampling purposes.

Sampling in granular and glacial till deposits was done by driving a 2" O.D. split-spoon sampler at required depths in accordance with the specifications for the Standard Penetration Test.

The same method was used to advance the dynamic cone penetration tests. In two boreholes (B.H.#10B and 11A) undisturbed samples were obtained by pushing 2" I.D. Shelby Tubes hydraulically. By means of in situ vane tests, undrained shear strength measurements were carried out. During the period of the investigation, groundwater level observations were made in the open boreholes. In addition, at two locations (B.H.#10B and #14) piezometers were installed, in order to measure the hydraustatic water pressure.

The soil and groundwater conditions encountered at the boring locations are presented in the Record of Borehole Sheets. The location and ground elevation of the various boreholes were surveyed in the field by construction personnel from Dist. 6, Toronto.

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The borehole locations and elevations, together with estimated stratigraphical sections, are shown on Drawing No. 74-11027-A.

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

1. Atterberg Limits
2. Natural Moisture Contents
3. Grain-size Distributions
4. Undrained Shear Strength measurements
5. Organic Contents

The results of the laboratory testing are presented on the Record of Borehole Sheets and summarized on Figures 1 to 3 in the Appendix of this Report.

4. SUBSOIL CONDITIONS:

4.1) General.

The predominant stratum across the site is a deposit of glacial till - a heterogeneous mixture of clayey silt, sand and gravel. At some locations the cohesive glacial till is underlain by a granular deposit of either silty sand and gravel or silty sand with a trace of gravel. At B.H.#12 location, a deposit of about 6 ft. thick fill material was encountered immediately below the ground level, overlying the glacial till.

The boundaries of the various deposits, as determined in the boreholes, are shown on the accompanying Record of Borehole Sheets. The stratigraphical sections, shown on Drawing No. 74-11027-A, have been inferred from this data. From ground surface downward, the various soil types encountered are as follows:

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4.2) Fill Material.

In the vicinity of B.H.#12, immediately below the ground level a 6 ft. thick fill material was encountered. The material is mainly clayey silt with some sand and few gravel and contains 7% organic matter. The material has a firm consistency.

4.3) Heterogeneous Mixture of Clayey Silt, Sand and Gravel - Glacial Till.

This is the predominant stratum across the site. The material is mainly a heterogeneous mixture of clayey silt, sand and gravel (glacial till). The deposit was investigated to a maximum depth of 26 ft.

The glacial till samples were tested for Atterberg Limits and natural moisture content. The results, which are shown on the Record of Borehole Sheets and on the Plasticity Chart (Fig. 1) are tabulated below:

	Range	Average
Liquid Limit (W_L) %	16-26	21
Plastic Limit (W_P) %	10-18	14
Natural Moisture Content (W) %	8-16	12

Based on the above values, it is estimated that the matrix of the glacial till is inorganic and of low plasticity.

The grain-size distribution curves for samples of this cohesive deposit are shown on Fig. 2 in the Appendix.

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The results of Standard Penetration Tests, and undrained shear strength measurement, obtained from in situ field vane tests and laboratory tests, are plotted on the Record of Borehole Sheets and Drawing No. 74-11027-A. The Standard Penetration Testing gave "N" values ranging from 2 blows to over 100 blows per foot. The undrained shear strength values in the laboratory, ranged from 200 p.s.f. to over 2000 p.s.f., while field vane test results ranged from 400 p.s.f. to over 2000 p.s.f. From these values, it is estimated that the consistency of the glacial till generally varies from stiff to hard, except in the vicinity of B.H. s 11 and 11A. In these boreholes, localized very soft to firm pockets were encountered within glacial till deposit.

4.4) Granular Deposit.

Silty Sand and Gravel or Silty Sand with Traces of Gravel.

This granular deposit was found underlying the glacial till stratum in B.H.#10A, 14A, 14, 14B, 15 ¢ 16, varying in thickness from 2.5 ft. (B.H.#16) to at least 12 ft. (B.H.#14). Standard Penetration tests, carried out in this material, gave "N" value range of 8 to 36 blows/foot. The relative density of this deposit is estimated to be loose to dense. Typical grain-size distributions obtained from the laboratory test results are shown on Fig. 3A and 3B, attached in the Appendix.

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5. GROUNDWATER CONDITIONS:

Groundwater level observations were carried out during the period of field investigations, by measuring the water levels in the open boreholes.

The elevations of the initial encountered water level and stabilized water level in the open boreholes are tabulated below:

B.H. No.	Initial Groundwater Contact Elevation	Stabilized Groundwater Elevation
10	483.1 ft.	501.1 ft.
10A	491.1 ft.	501.1 ft.
11	488.0 ft.	496.5 ft.
11A	488.0 ft.	496.0 ft.
12	480.1 ft.	492.1 ft.
13	484.8 ft.	495.8 ft.
14A	479.0 ft.	494.0 ft.
14B	480.8 ft.	492.8 ft.
15	480.2 ft.	490.2 ft.
16	479.9 ft.	486.9 ft.
8	475.0 ft.	475.0 ft.
9	475.0 ft.	475.0 ft.

In addition, piezometers were installed in B.H. #10B and B.H. #14 in order to assertain the presence of any artesian pressure head at various depths of the subsoil. The piezometric data is tabulated below:

B.H. No.	Piezometer Tip Elevation	Ground Elevation	Stabilized Head Elevation
10B	481.5	501.5	504.5
14	473.1	493.1	497.1

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These piezometric observations indicate that the Artesian pressure head varies 3 ft. to 4 ft. above the ground surface respectively.

The groundwater level observations carried out in the open boreholes (B.H.#8 & 9) in the area of culvert No. 2 indicate that the water level is approximately at elevation 475.0 ft. which corresponded to water level in the channel at the time of the investigations.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General.

In conjunction with the construction program of Hwy. 403/410/401, it is proposed to construct two culverts, Culvert No. 1 to the north and culvert No. 2 to the east of Eglinton Ave. at new Hwy. 410 intersection in Mississauga. The proposed structures will be rigid frame concrete culverts. An alternate proposal of corrugated steel pipe for culvert no. 1 is also considered. The No. 1 culvert will be about 1150 ft. long and No. 2 culvert about 145 ft. long. Both culverts will have a uniform section of 8 ft. by 5 ft.

The predominant stratum across the site is an extensive deposit of cohesive glacial till with underlying, or occasionally interbedded, deposits of granular material.

6.2) Culvert No. 1.

It is proposed to construct a rigid frame concrete box culvert (type DD-1215-A). The invert of this culvert will be at elev. 489 ft. at the west end (inlet) and 483 ft. at the east end (outlet). At these grades the culvert will be located about 13 ft. to 4 ft. below the existing ground surface. The excavations for the structure will extend well below the groundwater level recorded during the period of the field investigation. Over the area under consideration the culvert will be located within the relatively impervious, cohesive glacial till type subsoil. At the proposed invert elevations the subsoil is generally competent and can provide a safe bearing pressure up to 2000 p.s.f. for the support of mat foundation of the proposed box culvert. It

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should be noted, however, that in the vicinity of B.H. #11 and #11A at the proposed invert elevation (i.e. elev. ±487 ft.) the subsoil was found to be soft. This is believed to be a localized condition. In this area it will be necessary to subexcavate a min. depth of three feet and backfill with well compacted granular type of material. Furthermore, in order to articulate the performance of the culvert, in these conditions, provision should be made for a construction joint to accommodate for any differential movements.

In order to overcome any hazards during excavations in these localized soft areas it will be necessary to use temporary shoring in order to prevent any local unstable conditions.

Elsewhere temporary cuts of about 13 ft. maximum depth will be inherently stable against a deep seated rotational type of failure, provided the temporary slopes are not steeper than 1 to 1. However, where the sides of the excavation intercept soft or water bearing granular seams above or within the glacial till, groundwater seepage into the excavation and local sloughing of the slopes could be anticipated. The local sloughing of this nature can be overcome, as it occurs, either by flattening the affected slopes or by shoring. Otherwise, the groundwater seepage may be handled by employing standard methods, such as pumping from sumps.

It should be pointed out that an artesian groundwater pressure head exists within the permeable granular type of material which underlies the cohesive glacial till, in this investigated general area. The measured artesian pressure head was found to be 3 ft. (B.H.#10B) and 4 ft. (B.H.#14) above groundlevel. Although the invert elevation of this culvert is within the cohesive glacial till stratum, the possibility of ground heave and excavation blow-up exists when the bottom of the excavations is reasonably close to the boundary between the cohesive glacial till and the underlying permeable deposit, particularly in the vicinity of B.H.#14 location. It is therefore, recommended that the

excavations be carried out in a relatively short period of time and be backfilled immediately after the completion of the culvert construction, in order to prevent any possible basal heave problems. It is believed that if the structure is constructed continuously from the outfall end, drainage in the critical zones will occur, this could alleviate the dewatering problems considerably. Backfill for the culvert excavations should comply with currently used Ministry standards.

It is believed that an alternate proposal of constructing a corrugated steel pipe culvert at this location warrants serious consideration. A structure of this type will provide the following advantages:

1. The special measures required due to the presence of soft pocket at B.H.#11 and #11A location, as mentioned previously could be eliminated.
2. The speed of construction that can be effected with this type of structure will help to minimize the possibility of basal heave or other groundwater problems.
3. The flexible nature of the structure will tolerate any possible differential settlements.

6.3) Culvert No. 2:

At this location it is proposed to construct an open type rigid frame concrete culvert. The proposed invert elevation of this structure will be at elevation ±476 ft. at the north end (inlet) and ± 473 ft. at the south end (outlet). At these grades culvert no. 2 will be located about 4 ft. to 3 ft. below the existing ground level. The excavations for the footings of the structure will extend well below the groundwater level recorded during the period of the field investigation.

At this site the structure will be located within the relatively impervious, cohesive glacial till type subsoil. The structure will be supported on spread footings founded at about 4 ft. below the proposed invert elevation, i.e. footing base elevation of 472 ft. to 469 ft. A safe bearing

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pressure of 2 t.s.f. may be used for foundation design.

A minimum of 4 ft. of earth cover should be provided to the underside of the footings against frost action.

It is believed that the water in the channel will be rerouted during the construction of the culvert. The cohesive glacial till subsoil is relatively impervious in nature. During construction any seepage water into the excavations can be handled by standard methods, such as pumping from sumps. Backfill for the culvert excavations should comply with currently used Ministry standards.

The culvert will be designed as a rigid frame. Therefore, a coefficient of earth pressure at rest (Ko) of 0.5 should be assumed for the granular backfill behind the wall, when designing the wall sections. In addition, the design should incorporate the full effect of the surcharge located above the walls. In computing the horizontal resistance of the footings, a coefficient of friction of 2500 p.s.f. may be used between the concrete surface and the glacial till.

7. MISCELLANEOUS:

The field work performed during the period of July 17 to 23/74 and Sept. 18-26/74 and was supervised by Mr. V. Korlu, Project Engineer, who also prepared this Report.

Equipment was owned and operated by Master Soil Investigation of Toronto.

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

V. Korlu, P. Eng.,
Project Engineer.

M. Devata, P. Eng.,
Supervising Engineer.

REGISTERED PROFESSIONAL ENGINEER
CIVIL
V. KORLU
PROVINCE OF ONTARIO

VK/mj
October, 1974.

APPENDIX I

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1

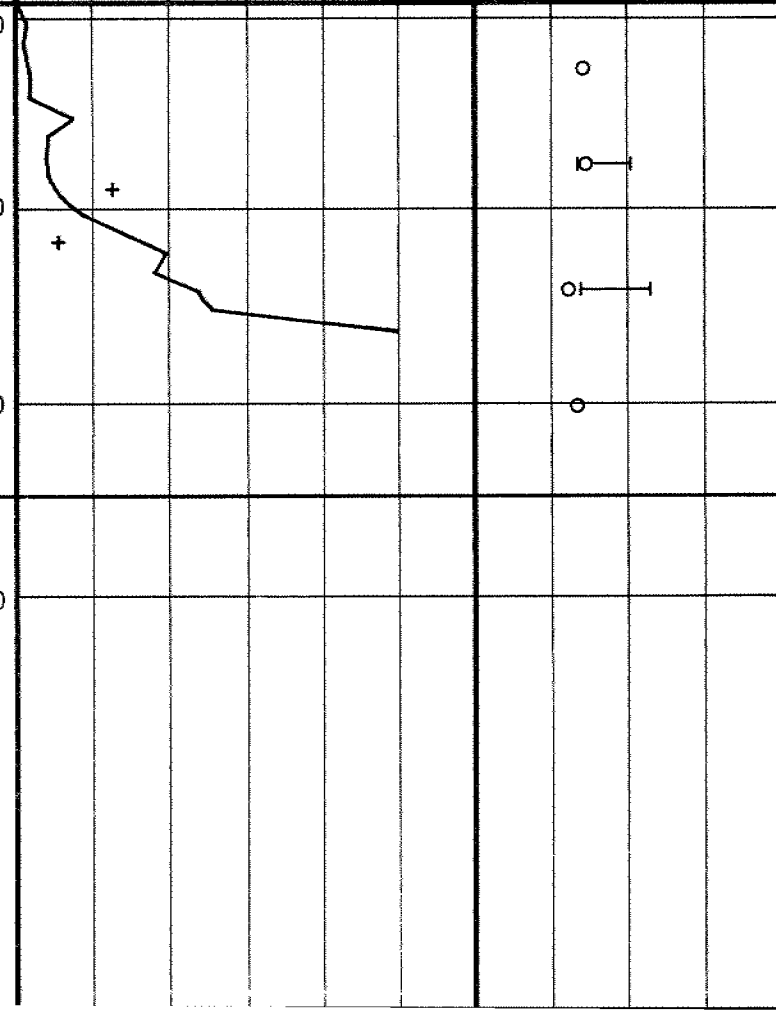
W.P. 127-66-37 & 38 LOCATION Co-ords. 15,849,825 N; 963,025 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 17, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger & sample with CME 45 CHECKED BY M.S.

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV.
500.9	Ground Level					
0.0	Silty sand, trace of clay & organics.		1	SS	16	
493.9			2	SS	5	
7.0	Het.mix.of clayey silt sand and gravel Glacial Till		3	SS	5	
			4	SS	3	
			5	SS	11	
480.9			6	SS	41	
20.0	Silty sand, some gravel.		7	SS	87	
475.4	Very Dense		8	SS	130	
25.5	End of Borehole					

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100
SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
400 800 1200 1600 2000



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.
	2	55	37	6
	7	36	47	10
	17	29	39	15
	13	63	(24)	

FICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE Nº 2

W.P. 127-66-37 & 38 LOCATION Co-ords. 15,849,937 N; 963,175 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 18, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger & Sample with CME 45 CHECKED BY M. T.

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W	UNIT WEIGHT	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV.	20 40 60 80 100	W_P W W_L	γ	% GR. SA. SI. CL.
498.8	Ground Level						SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE; 400 800 1200 1600 2000	WATER CONTENT %: 10 20 30		
0.0	Het.mix.of clayey silt, sand & gravel		1	SS	6					
			2	SS	7					
	Glacial Till		3	SS	7	490	+ 3			4 29 53 14
	Very Stiff to Hard		4	SS	3		+ 4			
			5	SS	19		+ 3			
			6	SS	45	480				16 28 42 14
475.8			7	SS	51					
23.0 / 473.3	Silty sand, trace of grav.& clay. V.Dense		8	SS	67					5 38 48 9
25.5	End of Borehole					470				

FICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE Nº 3

W.P. 127-66-37 & 38 LOCATION Co-ords. 15,850,058 N; 963,333 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 18, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger & Sample with CME 45 CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER ELEV.
500.3	Ground Level					500
0.0	Organic clayey silt, sand & fill.		1	SS	13	
493.3	Firm to Stiff		2	SS	6	
7.0	Het.mix.of clayey silt, sand & gravel glacial till		3	SS	20	490
			4	SS	27	
			5	SS	21	
			6	SS	34	
	Very Stiff to Hard		7	SS	27	
			8	SS	19	480
474.8			9	SS	22	
25.5	End of Borehole					470

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × 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.
6% org.	0	38	58	4
	7	31	48	14
	9	36	45	10
	9	31	49	11

FICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE Nº 4

W.P. 127-66-37 & 38 LOCATION Co-ords. 15,850,179 N; 963,492 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 18, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY W.T.

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W	UNIT WEIGHT	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV.	20 40 60 80 100 — SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	W_P — W — W_L ; WATER CONTENT % 10 20 30	γ	% GR. SA. SI. CL.
496.4	Ground Level									
0.0	Het.mix.of clayey silt, sand & gravel Brown / glacial till Grey									
	Very Stiff to Hard		1	SS	22					1 23 58 18
			2	SS	70	490				
			3	SS	30					
			4	SS	30					
			5	SS	44					
			6	SS	37	480				18 34 40 8
			7	SS	35					
			8	SS	103					
470.9			9	SS	116					
25.5	End of Borehole					470				

FICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE Nº 5

W.P. 127-66-37 & 38 LOCATION Co-ords. 15,850,304 N; 963,654 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 22, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	LIQUID LIMIT w_L, PLASTIC LIMIT w_P, WATER CONTENT w	UNIT WEIGHT γ	REMARKS % GR. SA. SI. CL.
493.2	Ground Level						20 40 60 80 100 / 400 800 1200 1600 2000	10 20 30 WATER CONTENT %		
0.0	Clayey silt, sand and trace of gravel. Glacial Till Soft to Very Stiff		1	SS	3	490	+ 1.8			
			2	SS	7		+ 1.3	o ⊢		1 30 54 15
			3	SS	3		+ 1.6			
480.2			4	SS	16	480		o ⊢		
13.0	Silty sand with gravel & trace of clay. Compact to Very Dense		5	SS	15			o		1 33 61 5
			6	SS	23					
			7	SS	26	470				
467.7			8	SS	89			o		37 46 (17)
26.5	End of Borehole					460				

FICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 6

W.P. 127-66-37 & 38 LOCATION Co-ords. 15,850,427 N; 963,812 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 22, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY N.I.

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × 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.
489.7	Ground Level									
0.0	Het. mixture of Brown / Grey clayey silt, sand,		1	SS	19					5 23 54 18
			2	SS	18					
			3	SS	18					
479.2						480				
10.5	sandy silt compact		4	SS	25					17 31 46 6
473.7			5	SS	25					0 12 85 3
16.0	and gravel – glacial till Very Stiff to Hard		6	SS	59	470				
464.2			7	SS	135					6 38 46 10
25.5	End of Borehole					460				

FICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 7

W.P. 127-66-37 & 38 LOCATION Co-ords. 15,850,552 N; 963,975 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 22, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY N.I.

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV.
485.4	Ground Level					
0.0	Het mixture of					
			1	SS	11	
480.4						
478.4	silty sand - Dense		2	SS	30	480
7.0	clayey silt, sand & gravel glacial till		3	SS	52	
			4	SS	52	
			5	SS	31	470
	Stiff to Hard		6	SS	56	
459.9			7	SS	48	460
25.5	End of Borehole					

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × 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.
	11	20	48	21
	0	49	48	3
	9	42	40	9
	5	29	51	15
	18	36	37	9

FICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 8

W.P. 127-66-37 & 38 LOCATION Co-ords. 15,851,213 N; 964,750 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 23, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY W.I.

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV.
480.1	Ground Level					480
0.0	Clayey silt, sand and trace of gravel. Fill		1	SS	7	
			2	SS	5	
472.1	Firm					
8.0	Het.mix.of Brown clayey silt, Grey sand and gravel glacial till		3	SS	57	470
			4	SS	81	
			5	SS	140	
			6	SS	160	460
455.1	Hard		7	SS	140	
25.0	End of Borehole					450

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

LIQUID LIMIT —— w_L PLASTIC LIMIT —— w_P WATER CONTENT —— w

WATER CONTENT % (10 20 30)

UNIT WEIGHT γ

REMARKS

% GR.	SA.	SI.	CL.
8	18	54	20
2	26	64	8

FICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 9

W.P. 127-66-37 & 38 LOCATION Co-ords. 15,851,160 N; 964,854 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 23, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × 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.
476.1	Ground Level									
0.0	Clayey silt, sand and trace of gravel. Fill. Firm		1	SS	6					2 24 51 23
469.1			2	SS	8	470				
7.0	Het.mix.of clayey silt, sand and gravel glacial till Brown Grey		3	SS	93					8 14 55 23
			4	SS	64					7 25 59 9
			5	SS	142	460				
			6	SS	139					11 24 51 14
450.6	Hard		7	SS	158					
25.5	End of Borehole					450				

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DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 10

LOCATION Co-ords. 15,849,840 N; 963,005 E. — ORIGINATED BY VK

W.P. 127-66-37 & 38 — BORING DATE Sept. 18, 1974 — COMPILED BY VK

DATUM Geodetic — BOREHOLE TYPE Auger and sample with CME 45 — CHECKED BY W. T.

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
501.1	Ground Level				
0.0	Het.mix. of clayey silt, sand and gravel. Brown Grey Glacial Till		1	SS	20
			2	SS	17
			3	SS	15
			4	SS	10
			5	SS	8
			6	SS	12
			7	SS	24
	Stiff to Hard		8	SS	40
474.6			9	SS	74
26.5	End of Borehole				

ELEV. SCALE: 500, 490, 480, 470

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 20 40 60 80 100

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

LIQUID LIMIT — W_L
PLASTIC LIMIT — W_P
WATER CONTENT — W
W_P W W_L
WATER CONTENT % — 10 20 30

BULK DENSITY γ P.C.F.

REMARKS

GR SA. SI. CL.

5 31 48 16

25 41 30 4

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MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 10 A

JOB _____ LOCATION Co-ords. 15,849,878 N; 963,055 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 19, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and Sample with CME 45 CHECKED BY M. T.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	BULK DENSITY γ	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	WATER CONTENT %	P.C.F.	GR SA SI CL
501.1	Ground Level					500		10 20 30		
0.0	Het.mix.of clayey silt, Brown Grey sand and gravel glacial till		1	SS	13					
			2	SS	12					
			3	SS	12					
			4	SS	16	490				
			5	SS	9					
484.1	Stiff to Very Stiff		6	SS	9					9 32 42 17
17.0	Silty sand & gravel.		7	SS	8					
479.6	Loose to Compact		8	SS	11	480				
21.5	End of Borehole					470				

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RECORD OF BOREHOLE Nº 10 B

JOB _____ LOCATION Co-ords. 15,849,885 N; 963,049 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 24, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY W.I.

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
501.5	Ground Level					
0.0	Het.mix. of clayey silt, sand and gravel. glacial till Stiff to Hard (Brown / Grey)		1	TW	PH	500
			2	TW	PH	
			3	TW	PH	
			4	TW	PH	490
			5	TW	PH	
			6	TW	PH	
			7	TW	PH	
481.0						480
20.5	End of Borehole					470

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
400 800 1200 1600 2000

LIQUID LIMIT w_L
PLASTIC LIMIT w_P
WATER CONTENT w
w_P w w_L
WATER CONTENT %
10 20 30

BULK DENSITY γ P.C.F.	REMARKS 504.5 GR.SA.SI.CL.
124	8 25 50 17
141	13 28 48 11
146	8 31 46 15
141	9 25 50 16
141	
P3	481.5
	piezometer tip elev.

+2

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RECORD OF BOREHOLE Nº 11

JOB _____ LOCATION Co-ords. 15,849,954 N; 963,154 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 19, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY N.T.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W	BULK DENSITY	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 400 800 1200 1600 2000	W_P W W_L WATER CONTENT % 10 20 30	γ P.C.F.	GR. SA. SI. CL.
500.2	Ground Level									
0.0	Het. mix. of clayey silt, Brown Grey sand and gravel glacial till Soft to Stiff		1	SS	9	500			496.5	
			2	SS	11					12 26 52 10
			3	SS	10					
			4	SS	6	490				
			5	SS	2		+1.5			
			6	SS	3		+1.5			
			7	SS	4		+1.5			
			8	SS	10	480	+1.5			
473.7			9	SS	47					
26.5	End of Borehole					470				

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RECORD OF BOREHOLE Nº 11A

JOB _____ LOCATION Co-ords. 15,849,960 N; 963,163 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 24, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY N. I.

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE (400 800 1200 1600 2000)	LIQUID LIMIT W_L — PLASTIC LIMIT W_P — WATER CONTENT W — WATER CONTENT % (10 20 30)	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
500.2	Ground Level					500				
	Het.mix. of clayey silt, Brown Grey sand and gravel. Glacial Till Soft to Stiff		1	TW	PH				107	497.2
			2	TW	PH				139	18 27 44 11
			3	TW	PH	490				5 29 54 12
			4	TW	PH				138	5 27 53 15
480.2			5	TW	PH				144	
20.0	End of Borehole					480				

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RECORD OF BOREHOLE Nº 12

JOB _____ LOCATION Co-ords. 15,850,075 N; 963,312 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 19, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY W.V.

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
500.1	Ground Level					500
0.0	Clayey silt, some sand & gravel & organics fill Soft		1	SS	6	
			2	SS	8	
6.0	Het. mix. of clayey silt, sand and gravel glacial till Brown Grey		3	SS	31	
			4	SS	27	490
			5	SS	19	
			6	SS	48	
			7	SS	25	
			8	SS	24	480
	Very Stiff to Hard					
473.6			9	SS	52	
26.5	End of Borehole					470

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100

SHEAR STRENGTH P.S.F. — ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

LIQUID LIMIT W_L — PLASTIC LIMIT W_P — WATER CONTENT W

WATER CONTENT % — 10 20 30

BULK DENSITY γ P.C.F.

org. 7.0

492.1

REMARKS — GR. SA. SI. CL.

3 20 66 11

14 33 43 10

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MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

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RECORD OF BOREHOLE Nº 13

JOB _____ LOCATION Co-ords. 15,850,195 N; 963,470 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 20, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY W. T.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W	BULK DENSITY	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	W_P W W_L WATER CONTENT % 10 20 30	γ P.C.F.	GR.SA.SI.CL.
496.8	Ground Level									
0.0	Het. mix. of clayey silt, Brown Grey sand and gravel glacial till Very Stiff to Hard		1	SS	29	490			▼495.8	3 29 56 12
			2	SS	67					
			3	SS	27					
			4	SS	33					
			5	SS	29					
			6	SS	31	480				
			7	SS	66					
475.3			8	SS	182					8 37 44 11
21.5	End of Borehole					470				

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RECORD OF BOREHOLE Nº 14

JOB _____ LOCATION Co-ords. 15,850,320 N; 963,632 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 23, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY N. I

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
493.1	Ground Level				
0.0	Het. mix. of clayey silt, sand and gravel - glacial till. Brown / Grey. Stiff to Hard		1	SS	33
			2	SS	36
			3	SS	48
			4	SS	17
478.1			5	SS	13
15.0	Silty sand with gravel. Compact		6	SS	15
			7	SS	13
			8	SS	21
466.6			9	SS	24
26.5	End of Borehole				

ELEV. SCALE: 490, 480, 470, 460

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100

SHEAR STRENGTH P.S.F. — ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

LIQUID LIMIT W_L — PLASTIC LIMIT W_P — WATER CONTENT W

WATER CONTENT % — 10 20 30

BULK DENSITY γ P.C.F.

P1 488.1

P2 473.1

REMARKS	GR. SA. SI. CL.
	5 21 58 16
	13 36 41 10
480.1	
	0 72 (28)
	0 66 (34)
	28 38 31 3

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RECORD OF BOREHOLE Nº 14 A

JOB _____ LOCATION Co-ords. 15,850,288 N; 963,590 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 20, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W	BULK DENSITY	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	WATER CONTENT % 10 20 30	γ P.C.F.	GR. SA. SI. CL.
494.0	Ground Level									
0.0	Het. mix. of clayey silt, sand and gravel. Brown Grey glacial till		1	SS	36	490				
			2	SS	41			○		
			3	SS	50					
			4	SS	20					
			5	SS	16	480		○		7 33 52 8
477.0	Very Stiff to Hard		6	SS	15					
17.0	Silty sand & traces of gravel. Compact to Dense		7	SS	20			○		4 63 29 4
472.5			8	SS	34					
21.5	End of Borehole					470				

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RECORD OF BOREHOLE Nº 14 B

JOB _____ LOCATION Co-ords. 15,850,350 N; 963,670 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 20, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY M. I.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W	BULK DENSITY γ	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT % 10 20 30	P.C.F.	GR. SA. SI. CL.
492.8	Ground Level									
0.0	Het.mix. of clayey silt, sand and gravel. Glacial Till Brown / Grey		1	SS	60	490				
			2	SS	32			○ ⊢		
			3	SS	17					
			4	SS	19					
477.8	Very Stiff to Hard		5	SS	21	480		○ ⊢		6 33 51 10
15.0	Silty sand & trace of gravel. Compact to Dense		6	SS	17			○		8 52 (40)
			7	SS	26					
471.3			8	SS	36					
21.5	End of Borehole					470				

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RECORD OF BOREHOLE Nº 15

JOB _____ LOCATION Co-ords. 15,850,444 N; 963,790 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 23, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY N.R.

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT
490.2	Ground Level				
0.0	Het.mix.of clayey silt,sand & gravel. Glacial Till Very Stiff Brown Grey		1	SS	24
			2	SS	39
481.2	to Hard		3	SS	28
9.0	Silty sand with grav. & seams of clayey silt.		4	SS	19
			5	SS	16
	Compact to Dense		6	SS	24
471.2			7	SS	36
468.7	Clayey silt & gravel. Hard		8	SS	55
21.5	End of Borehole				
465.2					
25.0	End of Cone Test				

ELEV. SCALE: 490, 480, 470, 460

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100

SHEAR STRENGTH P.S.F. — ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE

LIQUID LIMIT —— W_L PLASTIC LIMIT —— W_P WATER CONTENT —— W

WATER CONTENT % — 10 20 30

BULK DENSITY γ P.C.F.

REMARKS	GR.	SA.	SI.	CL.
	11	26	46	17
	34	52	(14)	
	0	55	41	4

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RECORD OF BOREHOLE Nº 16

JOB _____ LOCATION Co-ords. 15,850,569 N; 963,953 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 23, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY N.V.

ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT (20 40 60 80 100) / SHEAR STRENGTH P.S.F. (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W (W_P W W_L) / WATER CONTENT % (10 20 30)	BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL.
486.9	Ground Level									
0.0	Het.mix.of clayey silt,sand & gravel.		1	SS	16					
479.4	Brown		2	SS	10	480				3 34 57 16
7.5 476.9	Silty sand & trace of gravel. Compact.Grey		3	SS	17					5 40 52 3
10.0	Glacial Till		4	SS	35					
			5	SS	52					9 27 52 12
			6	SS	37	470				
	Stiff to Hard		7	SS	36					
465.4			8	SS	109					22 27 39 12
21.5	End of Borehole					460				

OFFICE REPORT ON SOIL EXPLORATION

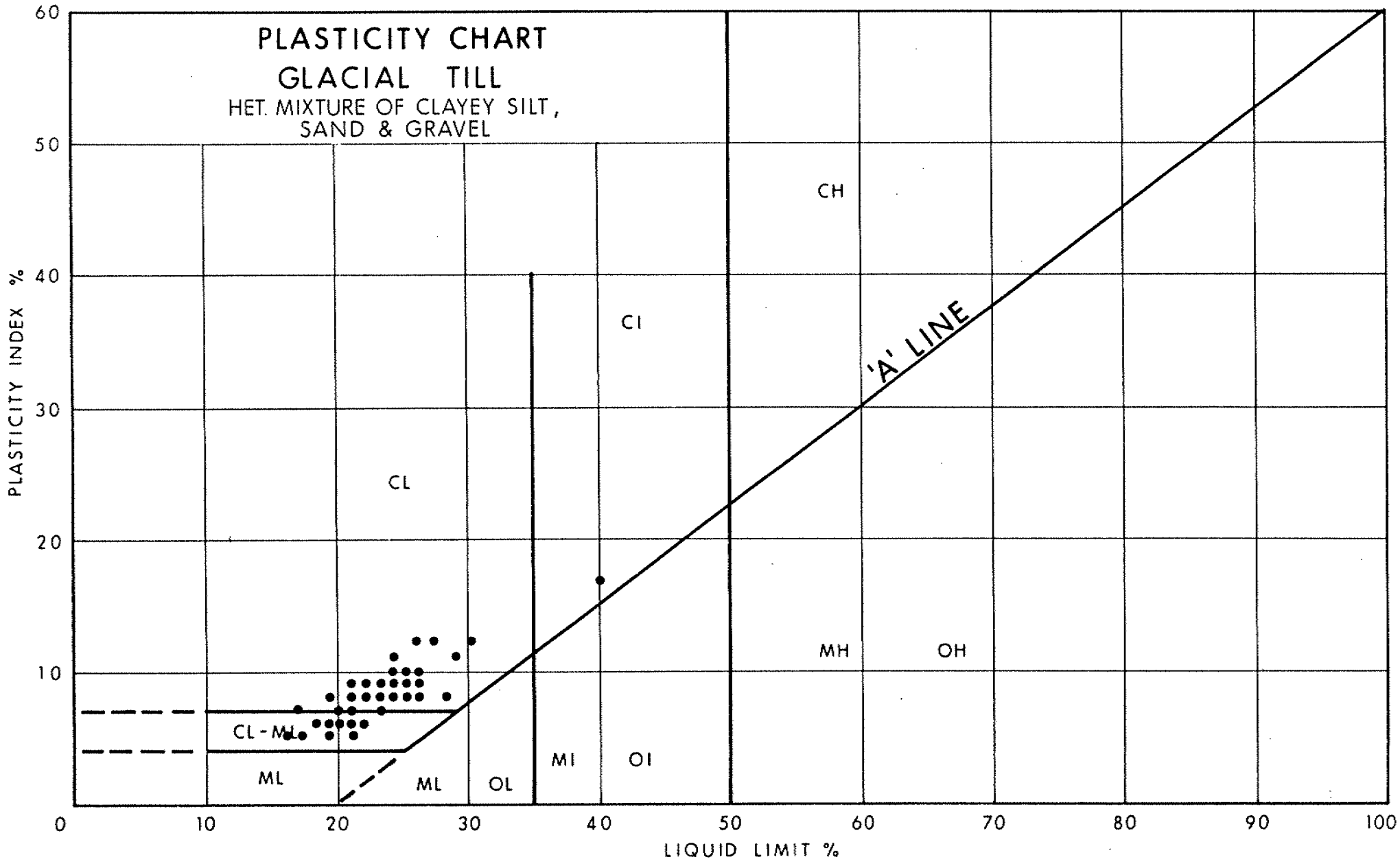


FIG. 1

W.P. 127-66-37 & 3

GRAIN SIZE DISTRIBUTION

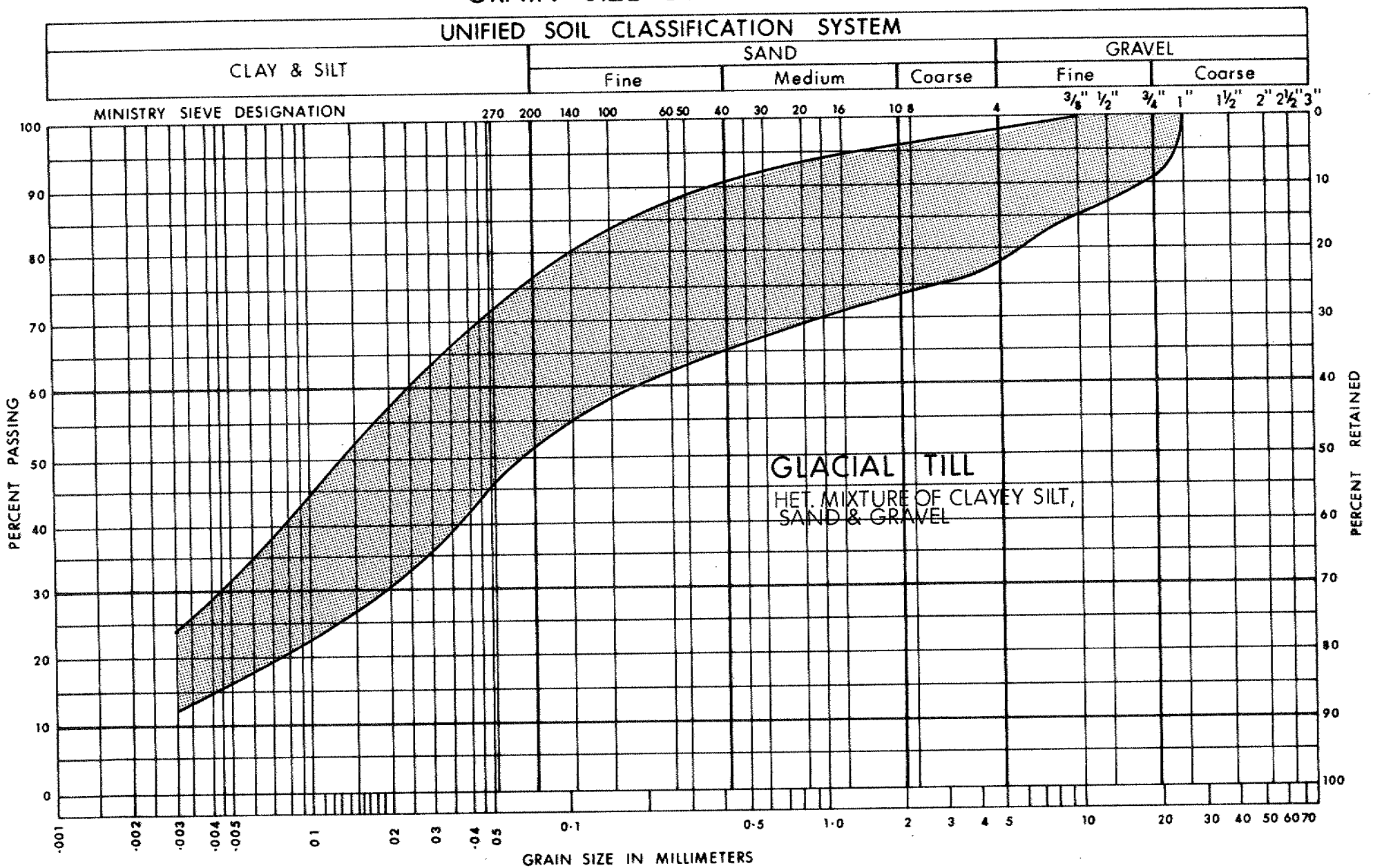


FIG. 2

W.P. 127-66-37 & 38

GRAIN SIZE DISTRIBUTION

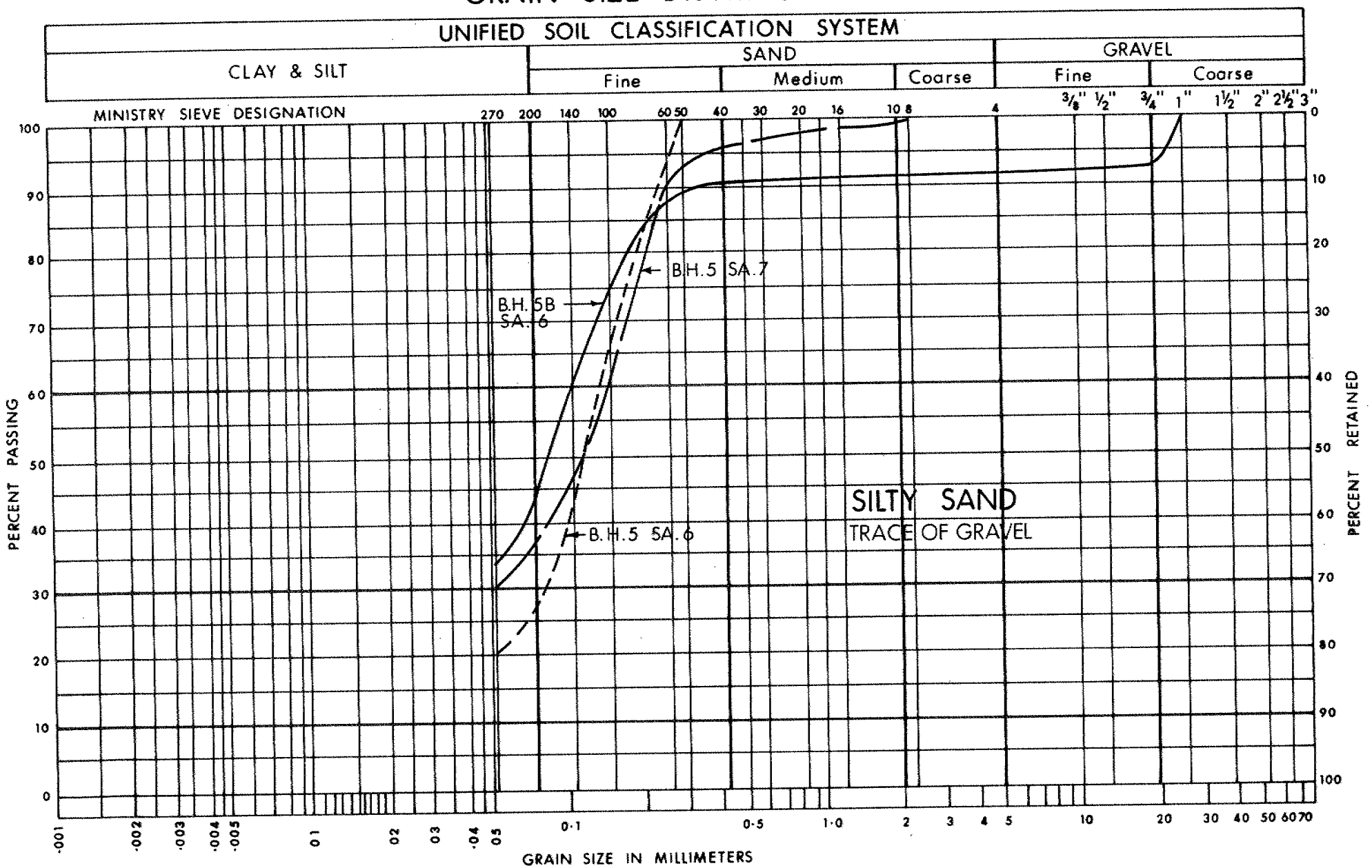


FIG. 3 A

W.P. 127-66-37 & 38

GRAIN SIZE DISTRIBUTION

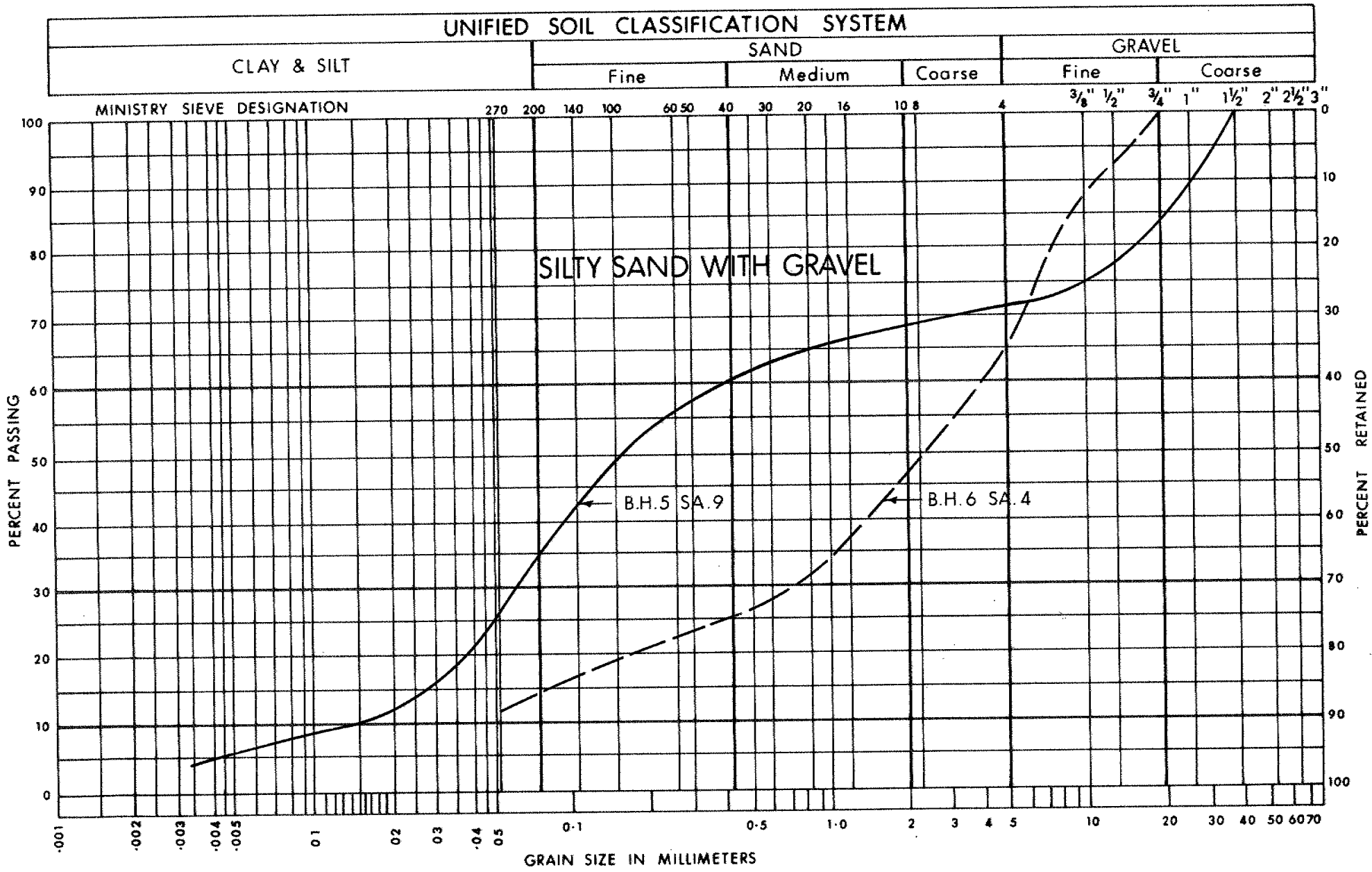


FIG. 3B

W.P. 127-66-37 & 38

ED-9a (Rev Jan.

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 : -

CONSISTENCY	c LB./SQ.FT.
VERY SOFT	0 - 250
SOFT	250 - 500
FIRM	500 - 1000
STIFF	1000 - 2000
VERY STIFF	2000 - 4000
HARD	> 4000

DENSENESS	'N' BLOWS / FT.
VERY LOOSE	0 - 4
LOOSE	4 - 10
COMPACT	10 - 30
DENSE	30 - 50
VERY DENSE	> 50

TERMS TO BE USED IN DESCRIBING SOILS :-

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

TYPE OF SAMPLE

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

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

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

FD-9b (Rev. Jan. 73)

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
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3·1416
e	BASE OF NATURAL LOGARITHMS 2·7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ε	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

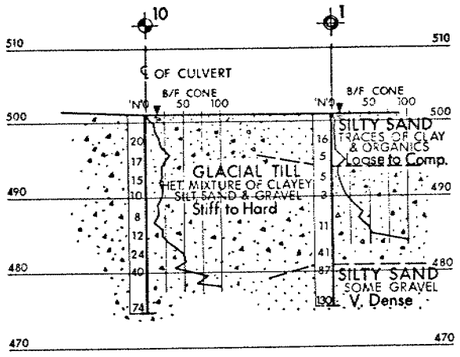
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

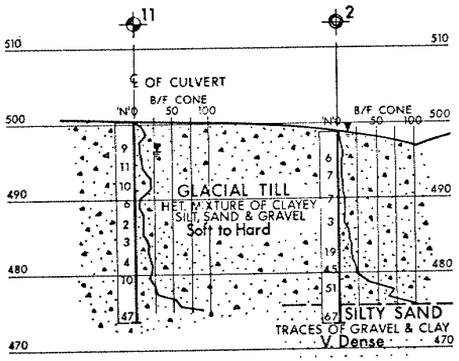
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

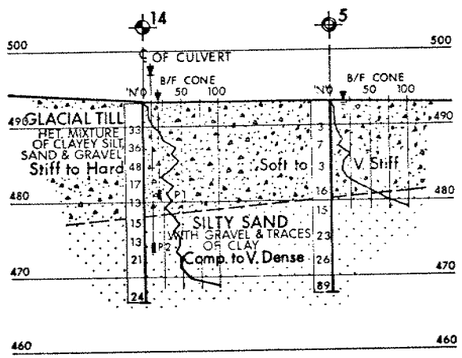
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



SECTION A-A

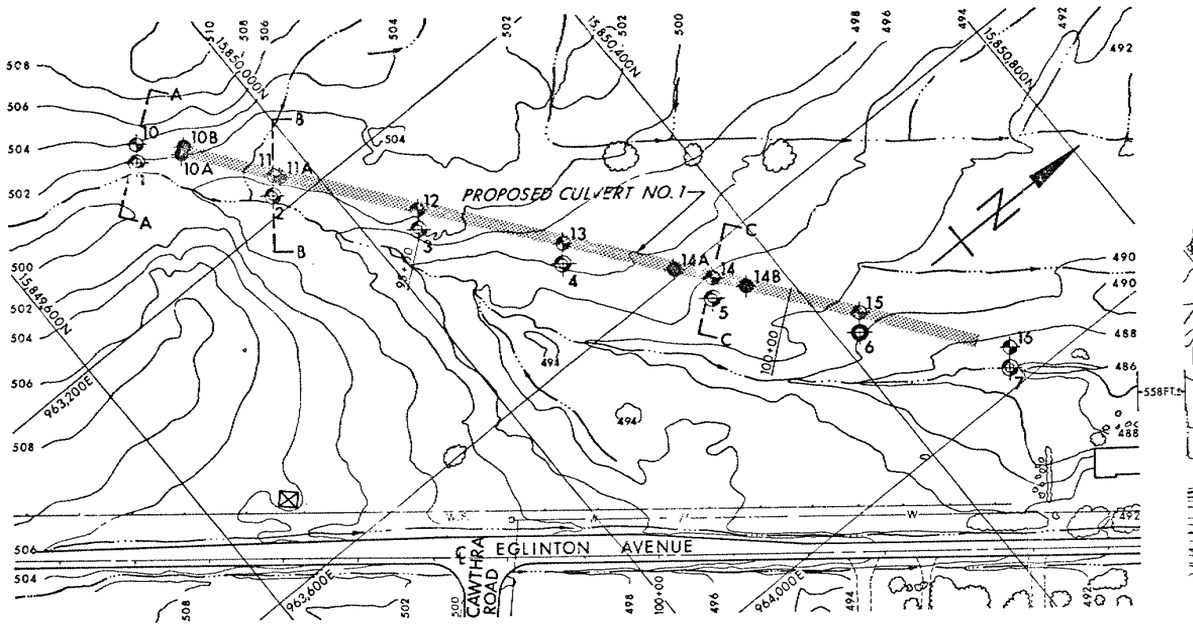


SECTION B-B



SECTION C-C

10 5 0 SCALE 10 20 FT.



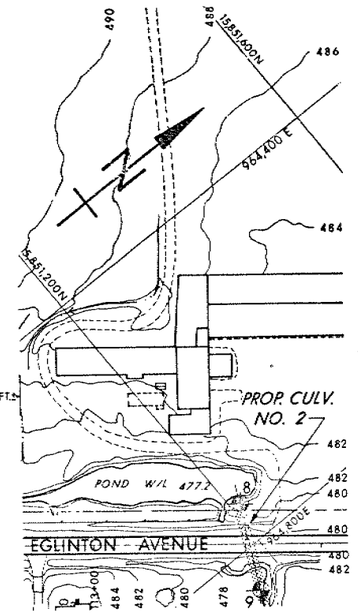
PLANS

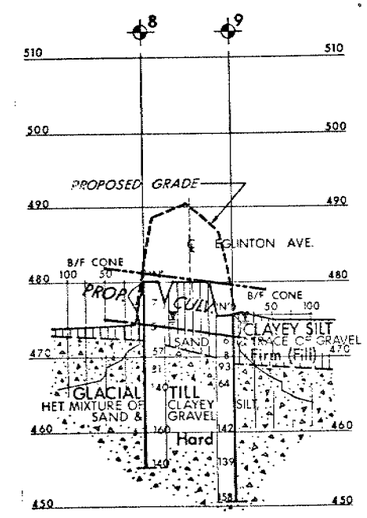
100 50 0 SCALE 100 200 FT.

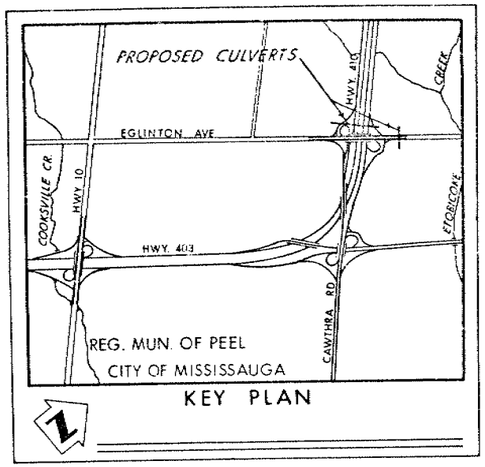
PROFILES THROUGH CULVERTS

HORIZ 100 50 0 SCALE 100 200 FT.

VERT. 10 5 0 10 20







KEY PLAN

LEGEND

- Bore Hole
- Dynamic Cone Penetration Resistance Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation, btwn. July 17 & Sept. 24, 1974.
- Piezometers.
- Original Bore Hole Nos. 1 to 7, July, 1974.

NO.	ELEVATION	CO-ORDINATES NORTH	EAST
1	500·9	15,849,825	963,025
2	498·8	15,849,937	963,175
3	500·3	15,850,058	963,333
4	496·4	15,850,179	963,492
5	493·2	15,850,304	963,654
6	489·7	15,850,427	963,812
7	485·	15,850,552	963,975
8	480·1	15,851,210	964,730
9	476·	15,851,360	964,854
10	501·1	15,849,840	963,005
10A	501·1	15,849,878	963,055
10B	501·5	15,849,885	963,049
11	500·2	15,849,954	963,154
11A	500·2	15,849,960	963,163
12	500·1	15,850,075	963,312
13	496·8	15,850,193	963,470
14	493·1	15,850,320	963,632
14A	494·0	15,850,288	963,590
14B	492·8	15,850,350	963,670
15	490·2	15,850,444	963,790
16	486·9	15,850,569	963,953

— NOTE —

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

NOTE FOR CONTRACT DOCUMENT

The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the Toronto District Office.

REVISIONS	DATE	BY	DESCRIPTION

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

PROPOSED CULVERTS (1 & 2)

(NORTH & EAST OF EGLINTON AVE.)

HIGHWAY NO 410 DIST NO 6

~~CO~~ REG. MUNICIPALITY OF PEEL

~~TWP~~ CITY OF MISSISSAUGA LOT CON

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD V.K. CHECKED	W.P. NO 127-66-37 & 38	DRAWING NO 74-11027A
DRAWN N.T. CHECKED	M.O. NO 74-11027	
DATE OCTOBER 24, 1974	SITE NO	BRIDGE DRAWING NO
APPROVED	CONT NO	

Ontario

Ministry of
Transportation and
Communications

Telephone: 248-3446

Planning and Design Office,
Central Region,
3501 Dufferin Street,
Downsview, Ontario.
M3K 1N6

November 18, 1976.

Mr. J.D. McKicken,
Regional Municipality of Peel,
Public Works, Water Department,
85 Kennedy Road South,
Brampton, Ontario.
L6W 3G1

RE: W.P. 127-66-38, Highway 403,
24" Watermain,
District 6, Toronto.

Dear Mr. McKicken:

A detailed investigation of the possible conflicts between the existing 24" watermain on Eglinton Avenue and the proposed Eglinton Avenue structure and associated approach fills has been completed by the M.T.C.

Due to the sensitive nature of the soil and artesian condition, the recommended offset from bridge footings to the watermain cannot be accommodated in the structural design. It is recommended to relocate the watermain northerly to avoid conflict with the pier and abutment footings and approach fills to an eastern limit where the height of approach fill does not warrant pipe protection.

Please include the above noted work in the preparation of your design and estimate for watermain relocation/protection.

Yours very truly,

NS:MJD:sm

M.J. Delsey, P. Eng.,
Project Designer,
for:
N. Sen, P. Eng.,
Senior Project Manager.

cc: D. Bye
M. Devata
E. Wilson (C.C. Parker)

RECEIVED
GEOTECHNICAL OFFICE
NOV 19 1976
SOIL MECHANICS
MINISTRY OF TRANSPORTATION & COMMUNICATIONS

V.K
Files

Mr. H. Forsyth,
Reg. Property Supervisor,
Property Office,
Central Region, Toronto.

Soil Mechanics Section,
Geotechnical Office,
West Building, Downsview.

July 24th, 1974.

RE: Damage to Wheat Crop
Owned by Allen Cook,
Phone No. 364-3625,
Milton, Ontario,
Culvert Site, W.P. 127-66-37.

During our foundation investigation for the proposed culvert (at 400 ft. north of Eglinton Avenue at Cawthra Road junction in Mississauga) by necessity, we carried out two boring holes (B.H.#4 and #5) in the existing wheat field. The wheat crop belongs to Mr. Allen Cook, of Milton, Ontario.

Before entering the site, permission to enter into the field was obtained by telephone from Mrs. Allen Cook, who happened to be at home (July 17th, 1974), on the condition that the damage caused would be compensated.

All precautions were taken while moving the drilling equipment in and out of the field, in order to minimize the area effected. At the end of the operation the damaged area was measured and is as follows:

B.H.#4	70' x 4'	=	280 ft.^{2}
B.H.#5	45' x 6'	=	270 ft.^{2}
		=	550 ft.^{2} Total Area

We would like to bring this situation to your attention in order that you may take all the necessary settlement action.

V. Korlu
Project Engineer
For: M. Devata
Supervising Engineer

VK/mj
c.c. Documents
Files

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M12-107

DIST. 6 REGION

W.P. No. 36-74-04

CONT. No. 77-21

W. O. No.

STR. SITE No.

HWY. No. 410

LOCATION Proposed Culverts (1 & 2)
ad N & E of Eglinton Ave & Hwy 403
No of Pipes - Interchange

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

METRIC!

GEOCRES No.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

30M12-107

GEOCRES No.

MEMORANDUM

To: Mr. G.C.E. Burkhardt, (2) Reg. Structural Planning Engineer, Central Region, Toronto.

From: Soil Mechanics Section, Geotechnical Office, West Building, Downsview.

Attention:

Date: October 25th, 1974.

Our File Ref.

In Reply To

NOV 1 - 1974

Subject: FOUNDATION INVESTIGATION REPORT [redacted] & 79-77
For
The Proposed Culverts (Nos. 1 & 2)
at North and East of Eglinton Avenue
and New Hwy. 410 Interchange.
City of Mississauga, Reg. Municipality
of Peel, District 6, Toronto.
W.O. 74-11027, W.P. 127-66-[redacted]-38.

Now 36-74-04

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

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

M. Devata

M. Devata,
Supervising Engineer.

MD/mj

c.c. E.J. Orr
B.R. Davis
R.S. Pillar
H. Greenland
B.J. Giroux
D. Gunter
G.A. Wrong
P. Lewycky

Files
Documents

Little Etobicoke Creek culvert under Group WP 127-66-37 is now given WP 36-74-04. Sept 30/75 lm

TABLE OF CONTENTS.

Foundation Investigation Report
For
The Proposed Culverts (Nos. 1 & 2)
at North and East of Eglinton Avenue
and New Hwy. 410 Interchange.
City of Mississauga, Reg. Municipality
of Peel, District 6, Toronto.

W.O. 74-11027, W.P. 127-66-37 &-38.

1. INTRODUCTION:

The Soil Mechanics Section of the Geotechnical Office was requested to carry out a subsurface investigation at the site of the proposed two culverts, in the vicinity of Eglinton Avenue and Hwy. 410 Interchange,City of Mississauga, Reg. Mun. of Peel. The request was contained in a memo from Mr. G.C.E. Burkhardt, Regional Structural Planning Engineer, Central Region, dated June 3rd, 1974. Subsequently, an investigation was carried out by this Section in order to determine the subsoil, bedrock and groundwater conditions in this area.

A preliminary subsurface investigation revealed the presence of poor subsoil conditions and in view of this, a shift of the culvert centreline 25 ft. to the north of the previously investigated line was considered as a suitable alternative. This was agreed in a meeting held on September 4th, 1974 and a further request to carry out investigation at the revised alignment was received on September 9th, 1974 from the Regional Structural Planning Office.

This report contains the results of the investigation for the revised alignment, together with our recommendations, pertaining to the foundation design of the two proposed structures.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

It is proposed to construct two culverts in the vicinity of the new Hwy. 410 and Eglinton Ave. interchange in the City of Mississauga, Regional Municipality of Peel.

..... /2

The topography of the area is flat to undulating. Physiographically this area is known as the "Peel Plain". The characteristic deposit in the area under investigation is a cohesive glacial till whose thickness is quite variable. Often the till deposit is underlain by granular deposits.

3. FIELD AND LABORATORY WORK:

In the course of investigation, 21 sampled boreholes were carried out, both for the initial alignment and revised alignment. A total of 19 boreholes were put down at the culvert No. 1, located on the north side and parallel to Eglinton Ave., and two boreholes were put down for the culvert No. 2 located at the east side of Eglinton Ave. and new Hwy. 410 intersection. Each borehole was accompanied, where necessary, with a dynamic cone penetration test. The borings were carried out by means of a bombardier mounted auger machine (C.M.E.45) adapted for soil sampling purposes.

Sampling in granular and glacial till deposits was done by driving a 2" O.D. split-spoon sampler at required depths in accordance with the specifications for the Standard Penetration Test.

The same method was used to advance the dynamic cone penetration tests. In two boreholes (B.H.#10B and 11A) undisturbed samples were obtained by pushing 2" I.D. Shelby Tubes hydraulically. By means of in situ vane tests, undrained shear strength measurements were carried out. During the period of the investigation, groundwater level observations were made in the open boreholes. In addition, at two locations (B.H.#10B and #14) piezometers were installed, in order to measure the hydraustatic water pressure.

The soil and groundwater conditions encountered at the boring locations are presented in the Record of Borehole Sheets. The location and ground elevation of the various boreholes were surveyed in the field by construction personnel from Dist. 6, Toronto.

..... /3

The borehole locations and elevations, together with estimated stratigraphical sections, are shown on Drawing No. 74-11027-A.

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

1. Atterberg Limits
2. Natural Moisture Contents
3. Grain-size Distributions
4. Undrained Shear Strength measurements
5. Organic Contents

The results of the laboratory testing are presented on the Record of Borehole Sheets and summarized on Figures 1 to 3 in the Appendix of this Report.

4. SUBSOIL CONDITIONS:

4.1) General.

The predominant stratum across the site is a deposit of glacial till - a heterogeneous mixture of clayey silt, sand and gravel. At some locations the cohesive glacial till is underlain by a granular deposit of either silty sand and gravel or silty sand with a trace of gravel. At B.H.#12 location, a deposit of about 6 ft. thick fill material was encountered immediately below the ground level, overlying the glacial till.

The boundaries of the various deposits, as determined in the boreholes, are shown on the accompanying Record of Borehole Sheets. The stratigraphical sections, shown on Drawing No. 74-11027-A, have been inferred from this data. From ground surface downward, the various soil types encountered are as follows:

..... /4

4.2) Fill Material.

In the vicinity of B.H.#12, immediately below the ground level a 6 ft. thick fill material was encountered. The material is mainly clayey silt with some sand and few gravel and contains 7% organic matter. The material has a firm consistency.

4.3) Heterogeneous Mixture of Clayey Silt, Sand and Gravel - Glacial Till.

This is the predominant stratum across the site. The material is mainly a heterogeneous mixture of clayey silt, sand and gravel (glacial till). The deposit was investigated to a maximum depth of 26 ft.

The glacial till samples were tested for Atterberg Limits and natural moisture content. The results, which are shown on the Record of Borehole Sheets and on the Plasticity Chart (Fig. 1) are tabulated below:

	Range	Average
Liquid Limit (W_L) %	16-26	21
Plastic Limit (W_p) %	10-18	14
Natural Moisture Content (W) %	8-16	12

Based on the above values, it is estimated that the matrix of the glacial till is inorganic and of low plasticity.

The grain-size distribution curves for samples of this cohesive deposit are shown on Fig. 2 in the Appendix.

..... /5

The results of Standard Penetration Tests, and undrained shear strength measurement, obtained from in situ field vane tests and laboratory tests, are plotted on the Record of Borehole Sheets and Drawing No. 74-11027-A. The Standard Penetration Testing gave "N" values ranging from 2 blows to over 100 blows per foot. The undrained shear strength values in the laboratory, ranged from 200 p.s.f. to over 2000 p.s.f., while field vane test results ranged from 400 p.s.f. to over 2000 p.s.f. From these values, it is estimated that the consistency of the glacial till generally varies from stiff to hard, except in the vicinity of B.H. s 11 and 11A. In these boreholes, localized very soft to firm pockets were encountered within glacial till deposit.

4.4) Granular Deposit.

Silty Sand and Gravel or Silty Sand with Traces of Gravel.

This granular deposit was found underlying the glacial till stratum in B.H.#10A, 14A, 14, 14B, 15 ¢ 16, varying in thickness from 2.5 ft. (B.H.#16) to at least 12 ft. (B.H.#14). Standard Penetration tests, carried out in this material, gave "N" value range of 8 to 36 blows/foot. The relative density of this deposit is estimated to be loose to dense. Typical grain-size distributions obtained from the laboratory test results are shown on Fig. 3A and 3B, attached in the Appendix.

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5. GROUNDWATER CONDITIONS:

Groundwater level observations were carried out during the period of field investigations, by measuring the water levels in the open boreholes.

The elevations of the initial encountered water level and stabilized water level in the open boreholes are tabulated below:

B.H. No.	Initial Groundwater Contact Elevation	Stabilized Groundwater Elevation
10	483.1 ft.	501.1 ft.
10A	491.1 ft.	501.1 ft.
11	488.0 ft.	496.5 ft.
11A	488.0 ft.	496.0 ft.
12	480.1 ft.	492.1 ft.
13	484.8 ft.	495.8 ft.
14A	479.0 ft.	494.0 ft.
14B	480.8 ft.	492.8 ft.
15	480.2 ft.	490.2 ft.
16	479.9 ft.	486.9 ft.
8	475.0 ft.	475.0 ft.
9	475.0 ft.	475.0 ft.

In addition, piezometers were installed in B.H. #10B and B.H. #14 in order to assertain the presence of any artesian pressure head at various depths of the subsoil. The piezometric data is tabulated below:

B.H. No.	Piezometer Tip Elevation	Ground Elevation	Stabilized Head Elevation
10B	481.5	501.5	504.5
14	473.1	493.1	497.1

..... /7

These piezometric observations indicate that the Artesian pressure head varies 3 ft. to 4 ft. above the ground surface respectively.

The groundwater level observations carried out in the open boreholes (B.H.#8 & 9) in the area of culvert No. 2 indicate that the water level is approximately at elevation 475.0 ft. which corresponded to water level in the channel at the time of the investigations.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General.

In conjunction with the construction program of Hwy. 403/410/401, it is proposed to construct two culverts, Culvert No. 1 to the north and culvert No. 2 to the east of Eglinton Ave. at new Hwy. 410 intersection in Mississauga. The proposed structures will be rigid frame concrete culverts. An alternate proposal of corrugated steel pipe for culvert no. 1 is also considered. The No. 1 culvert will be about 1150 ft. long and No. 2 culvert about 145 ft. long. Both culverts will have a uniform section of 8 ft. by 5 ft.

The predominant stratum across the site is an extensive deposit of cohesive glacial till with underlying, or occasionally interbedded, deposits of granular material.

6.2) Culvert No. 1.

It is proposed to construct a rigid frame concrete box culvert (type DD-1215-A). The invert of this culvert will be at elev. 489 ft. at the west end (inlet) and 483 ft. at the east end (outlet). At these grades the culvert will be located about 13 ft. to 4 ft. below the existing ground surface. The excavations for the structure will extend well below the groundwater level recorded during the period of the field investigation. Over the area under consideration the culvert will be located within the relatively impervious, cohesive glacial till type subsoil. At the proposed invert elevations the subsoil is generally competent and can provide a safe bearing pressure up to 2000 p.s.f. for the support of mat foundation of the proposed box culvert. It

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should be noted, however, that in the vicinity of B.H. #11 and #11A at the proposed invert elevation (i.e. elev. ±487 ft.) the subsoil was found to be soft. This is believed to be a localized condition. In this area it will be necessary to subexcavate a min. depth of three feet and backfill with well compacted granular type of material. Furthermore, in order to articulate the performance of the culvert, in these conditions, provision should be made for a construction joint to accommodate for any differential movements.

In order to overcome any hazards during excavations in these localized soft areas it will be necessary to use temporary shoring in order to prevent any local unstable conditions.

Elsewhere temporary cuts of about 13 ft. maximum depth will be inherently stable against a deep seated rotational type of failure, provided the temporary slopes are not steeper than 1 to 1. However, where the sides of the excavation intercept soft or water bearing granular seams above or within the glacial till, groundwater seepage into the excavation and local sloughing of the slopes could be anticipated. The local sloughing of this nature can be overcome, as it occurs, either by flattening the affected slopes or by shoring. Otherwise, the groundwater seepage may be handled by employing standard methods, such as pumping from sumps.

It should be pointed out that an artesian groundwater pressure head exists within the permeable granular type of material which underlies the cohesive glacial till, in this investigated general area. The measured artesian pressure head was found to be 3 ft. (B.H.#10B) and 4 ft. (B.H.#14) above groundlevel. Although the invert elevation of this culvert is within the cohesive glacial till stratum, the possibility of ground heave and excavation blow-up exists when the bottom of the excavations is reasonably close to the boundary between the cohesive glacial till and the underlying permeable deposit, particularly in the vicinity of B.H.#14 location. It is therefore, recommended that the

..... /8

excavations be carried out in a relatively short period of time and be backfilled immediately after the completion of the culvert construction, in order to prevent any possible basal heave problems. It is believed that if the structure is constructed continuously from the outfall end, drainage in the critical zones will occur, this could alleviate the dewatering problems considerably. Backfill for the culvert excavations should comply with currently used Ministry standards.

It is believed that an alternate proposal of constructing a corrugated steel pipe culvert at this location warrants serious consideration. A structure of this type will provide the following advantages:

1. The special measures required due to the presence of soft pocket at B.H.#11 and #11A location, as mentioned previously could be eliminated.
2. The speed of construction that can be effected with this type of structure will help to minimize the possibility of basal heave or other groundwater problems.
3. The flexible nature of the structure will tolerate any possible differential settlements.

6.3) Culvert No. 2:

At this location it is proposed to construct an open type rigid frame concrete culvert. The proposed invert elevation of this structure will be at elevation ±476 ft. at the north end (inlet) and ± 473 ft. at the south end (outlet). At these grades culvert no. 2 will be located about 4 ft. to 3 ft. below the existing ground level. The excavations for the footings of the structure will extend well below the groundwater level recorded during the period of the field investigation.

At this site the structure will be located within the relatively impervious, cohesive glacial till type subsoil. The structure will be supported on spread footings founded at about 4 ft. below the proposed invert elevation, i.e. footing base elevation of 472 ft. to 469 ft. A safe bearing

pressure of 2 t.s.f. may be used for foundation design.

A minimum of 4 ft. of earth cover should be provided to the underside of the footings against frost action.

It is believed that the water in the channel will be rerouted during the construction of the culvert. The cohesive glacial till subsoil is relatively impervious in nature. During construction any seepage water into the excavations can be handled by standard methods, such as pumping from sumps. Backfill for the culvert excavations should comply with currently used Ministry standards.

The culvert will be designed as a rigid frame. Therefore, a coefficient of earth pressure at rest (Ko) of 0.5 should be assumed for the granular backfill behind the wall, when designing the wall sections. In addition, the design should incorporate the full effect of the surcharge located above the walls. In computing the horizontal resistance of the footings, a coefficient of friction of 2500 p.s.f. may be used between the concrete surface and the glacial till.

7. MISCELLANEOUS:

The field work performed during the period of July 17 to 23/74 and Sept. 18-26/74 and was supervised by Mr. V. Korlu, Project Engineer, who also prepared this Report.

Equipment was owned and operated by Master Soil Investigation of Toronto.

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

V. Korlu, P. Eng.,
Project Engineer.

M. Devata, P. Eng.,
Supervising Engineer.

REGISTERED PROFESSIONAL ENGINEER
CIVIL
V. KORLU
PROVINCE OF ONTARIO

VK/mj
October, 1974.

APPENDIX I

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1

W.P. 127-66-~~87~~ & 38 LOCATION Co-ords. 15,849,825 N; 963,025 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 17, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger & sample with CME 45 CHECKED BY W.P.

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV.
500.9	Ground Level					
0.0	Silty sand, trace of clay & organics.		1	SS	16	500
493.9			2	SS	5	
7.0	Het.mix.of clayey silt sand and gravel Glacial Till		3	SS	5	
			4	SS	3	490
			5	SS	11	
480.9			6	SS	41	
20.0	Silty sand, some gravel.		7	SS	87	480
475.4	Very Dense		8	SS	130	
25.5	End of Borehole					470

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
400 800 1200 1600 2000

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
2	55	37	6
7	36	47	10
17	29	39	15
13	63	(24)	

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2

W.P. 127-66-~~37~~ & 38 LOCATION Co-ords. 15,849,937 N; 963,175 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 18, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger & Sample with CME 45 CHECKED BY

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE; 400 800 1200 1600 2000)	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
498.8	Ground Level									
0.0	Het.mix.of clayey silt, sand & gravel		1	SS	6					
			2	SS	7					
	Glacial Till		3	SS	7	490	+ 3			4 29 53 14
	Very Stiff to Hard		4	SS	3		+ 4, + 3			
			5	SS	19					
			6	SS	45	480				16 28 42 14
			7	SS	51					
475.8										
23.0	Silty sand, trace of									
473.3	grav.& clay. V.Dense		8	SS	67					5 38 48 9
25.5	End of Borehole					470				

OFFICE REPORT ON SOIL EXPLORATION

15 ◇ 5 (20, 10) % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3

W.P. 127-66-~~37~~ & 38 LOCATION Co-ords. 15,850,058 N; 963,333 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 18, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger & Sample with CME 45 CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER ELEV.
500.3	Ground Level					500
0.0	Organic clayey silt, sand & fill.		1	SS	13	
493.3	Firm to Stiff		2	SS	6	
7.0	Het.mix.of clayey silt, sand & gravel glacial till		3	SS	20	490
			4	SS	27	
			5	SS	21	
			6	SS	34	
	Very Stiff to Hard		7	SS	27	
			8	SS	19	480
474.8			9	SS	22	
25.5	End of Borehole					470

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × 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

6% org.

REMARKS	% GR	SA.	SI.	CL
	0	38	58	4
	7	31	48	14
	9	36	45	10
	9	31	49	11

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 4

W.P. 127-66-~~07~~ & 38 LOCATION Co-ords. 15,850,179 N; 963,492 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 18, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	UNIT WEIGHT	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV.	20 40 60 80 100 — SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	w_P w w_L — WATER CONTENT % 10 20 30	γ	% GR SA SI CL
496.4	Ground Level									
0.0	Het.mix.of clayey silt, sand & gravel Brown		1	SS	22					1 23 58 18
	glacial till Grey		2	SS	70	490				
			3	SS	30					
			4	SS	30					
	Very Stiff to Hard		5	SS	44					
			6	SS	37	480				18 34 40 8
			7	SS	35					
			8	SS	103					
470.9			9	SS	116					
470										
25.5	End of Borehole									

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 5

W.P. 127-66-[illegible] & 38 LOCATION Co-ords. 15,850,304 N; 963,654 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 22, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY [illegible]

ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	LIQUID LIMIT w_L, PLASTIC LIMIT w_P, WATER CONTENT w	UNIT WEIGHT γ	REMARKS % GR SA SI CL
493.2	Ground Level						20 40 60 80 100 / 400 800 1200 1600 2000	10 20 30 WATER CONTENT %		
0.0	Clayey silt, sand and trace of gravel. Glacial Till Soft to Very Stiff		1	SS	3	490	+ 1.8			
			2	SS	7			o——		1 30 54 15
			3	SS	3		+ 1.3			
480.2			4	SS	16	480	+ 1.6	o—		
13.0	Silty sand with gravel & trace of clay. Compact to Very Dense		5	SS	15			o		1 33 61 5
			6	SS	23					
			7	SS	26					
467.7			8	SS	89	470		o		37 46 (17)
26.5	End of Borehole					460				

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH – GEOTECHNICAL OFFICE – SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 6

W.P. 127-66-[illegible] & 38 LOCATION Co-ords. 15,850,427 N; 963,812 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 22, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY [illegible]

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × 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	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES	ELEV.			γ	% GR SA SI CL
489.7	Ground Level									
0.0	Het. mixture of Brown Grey clayey silt, sand,		1	SS	19					
			2	SS	18			○		5 23 54 18
479.2			3	SS	18	480				
10.5	sandy silt		4	SS	25			○		17 31 46 6
473.7	compact		5	SS	25			○		0 12 85 3
16.0	and gravel – glacial till		6	SS	59	470				
464.2	Very Stiff to Hard		7	SS	135			○		6 38 46 10
25.5	End of Borehole					460				

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 7

W.P. 127-66-[illegible] & 38 LOCATION Co-ords. 15,850,552 N; 963,975 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 22, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY [illegible]

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W	UNIT WEIGHT	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	ELEV.	20 40 60 80 100 SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	W_P W W_L WATER CONTENT % 10 20 30	γ	% GR SA SI CL
485.4	Ground Level									
0.0	Het mixture of									
480.4			1	SS	11					11 20 48 21
478.4	silty sand - Dense		2	SS	30	480				0 49 48 3
7.0	clayey silt, sand & gravel glacial till		3	SS	52					9 42 40 9
			4	SS	52					
			5	SS	31	470				5 29 51 15
	Stiff to Hard		6	SS	56					18 36 37 9
459.9			7	SS	48	460				
25.5	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 8

W.P. 127-66-37 & 38 LOCATION Co-ords. 15,851,213 N; 964,750 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 23, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY W.T.

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV.
480.1	Ground Level					480
0.0	Clayey silt, sand and trace of gravel. Fill		1	SS	7	
472.1	Firm		2	SS	5	
8.0	Het. mix of Brown clayey silt, Grey sand and gravel glacial till		3	SS	57	470
			4	SS	81	
			5	SS	140	
			6	SS	160	460
455.1	Hard		7	SS	140	
25.0	End of Borehole					450

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100
SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × 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
	8	18	54	20
	2	26	64	8

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 9

W.P. 127-66-~~37~~ & 38 LOCATION Co-ords. 15,851,160 N; 964,854 E. ORIGINATED BY VK

DIST. 6 HWY. 410 BORING DATE July 23, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY [illegible]

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w / WATER CONTENT % (10 20 30)	UNIT WEIGHT γ	REMARKS % GR SA SI CL
476.1	Ground Level					ELEV.				
0.0	Clayey silt, sand and trace of gravel. Fill. Firm		1	SS	6					
469.1			2	SS	8	470				2 24 51 23
7.0	Het.mix.of Brown Grey clayey silt, sand and gravel glacial till		3	SS	93					8 14 55 23
			4	SS	64					7 25 59 9
			5	SS	142	460				
			6	SS	139					11 24 51 14
450.6	Hard		7	SS	158					
25.5	End of Borehole					450				

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 10

W.P. 127-66-37 & 38 — LOCATION Co-ords. 15,849,840 N; 963,005 E. — ORIGINATED BY VK

DATUM Geodetic — BOREHOLE TYPE Auger and sample with CME 45 — BORING DATE Sept. 18, 1974 — COMPILED BY VK — CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 — SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	LIQUID LIMIT w_L — PLASTIC LIMIT w_P — WATER CONTENT w — WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS GR SA SI CL
501.1	Ground Level									
0.0	Het.mix. of clayey silt, sand and gravel. Brown Grey Glacial Till Stiff to Hard		1	SS	20	500				
			2	SS	17					5 31 48 16
			3	SS	15					
			4	SS	10	490				
			5	SS	8					
			6	SS	12					
			7	SS	24					
			8	SS	40	480				25 41 30 4
474.6			9	SS	74					
26.5	End of Borehole					470				

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 10 A

JOB _____ LOCATION Co-ords. 15,849,878 N; 963,055 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 19, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and Sample with CME 45 CHECKED BY

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — SHEAR STRENGTH P.S.F. o UNCONFINED + FIELD VANE • QUICK TRIAXIAL × LAB VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F	REMARKS GR SA SI CL
501.1	Ground Level									
0.0	Het.mix.of clayey silt, Brown Grey sand and gravel glacial till		1	SS	13	500				
			2	SS	12			o		
			3	SS	12					
			4	SS	16	490		o		
			5	SS	9					
484.1	Stiff to Very Stiff		6	SS	9			o		9 32 42 17
17.0	Silty sand & gravel.		7	SS	8					
479.6	Loose to Compact		8	SS	11	480				
21.5	End of Borehole					470				

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 10 B

JOB _____ LOCATION Co-ords. 15,849,885 N; 963,049 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 24, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY _____

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT; SHEAR STRENGTH P.S.F. (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) 400 800 1200 1600 2000	LIQUID LIMIT w_L, PLASTIC LIMIT w_P, WATER CONTENT w, WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS 504.5 GR. SA. SI. CL.
501.5	Ground Level									
0.0	Het.mix. of clayey silt, sand and gravel. glacial till Stiff to Hard (Brown / Grey)		1	TW	PH	500			124	8 25 50 17
			2	TW	PH				141	13 28 48 11
			3	TW	PH					
			4	TW	PH	490			146	8 31 46 15
			5	TW	PH					
			6	TW	PH		+2		141	9 25 50 16
481.0			7	TW	PH	480			141 P3	481.5
20.5	End of Borehole					470				piezometer tip elev.

OFFICE REPORT ON SOIL EXPLORATION

15 – 20 – 10 – 5 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 11

JOB _____ LOCATION Co-ords. 15,849,954 N; 963,154 E. ORIGINATED BY VK

W.P. 127-66-[illegible] & 38 BORING DATE Sept. 19, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY [illegible]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100; SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 400 800 1200 1600 2000	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w w_P w w_L WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT					
500.2	Ground Level									
0.0	Het. mix. of clayey silt, Brown Grey sand and gravel		1	SS	9	500			▼ 496.5	
			2	SS	11			○		
			3	SS	10	490				
			4	SS	6		+1.5			
			5	SS	2		+1.5	⊖		12 26 52 10
	glacial till		6	SS	3		+1.5			
			7	SS	4		+1.5	⊖		
	Soft to Stiff		8	SS	10	480				
473.7			9	SS	47					
26.5	End of Borehole					470				

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 11A

JOB _____ LOCATION Co-ords. 15,849,960 N; 963,163 E. ORIGINATED BY VK

W.P. 127-66-~~37~~ & 38 BORING DATE Sept. 24, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY [illegible]

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT — SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE (400 800 1200 1600 2000)	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w (WATER CONTENT % 10 20 30)	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL
500.2	Ground Level					500				
	Het.mix. of clayey silt, Brown/Grey sand and gravel. Glacial Till		1	TW	PH				107	497.2
			2	TW	PH				139	18 27 44 11
			3	TW	PH	490				5 29 54 12
			4	TW	PH				138	5 27 53 15
480.2	Soft to Stiff		5	TW	PH				144	
20.0	End of Borehole					480				

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 12

JOB _____ LOCATION Co-ords. 15,850,075 N; 963,312 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 19, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY [illegible]

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT
500.1	Ground Level				
0.0	Clayey silt, some sand & gravel & organics fill — Soft		1	SS	6
			2	SS	8
6.0	Het. mix. of clayey silt, sand and gravel glacial till — Brown / Grey		3	SS	31
			4	SS	27
			5	SS	19
			6	SS	48
			7	SS	25
			8	SS	24
473.6	Very Stiff to Hard		9	SS	52
26.5	End of Borehole				

ELEV. SCALE: 500, 490, 480, 470

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100

SHEAR STRENGTH P.S.F. — ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

LIQUID LIMIT w_L — PLASTIC LIMIT w_P — WATER CONTENT w — w_P w w_L

WATER CONTENT % — 10 20 30

BULK DENSITY γ P.C.F.

REMARKS	GR. SA. SI. CL.
org. 7.0	
▽ 492.1	3 20 66 11
	14 33 43 10

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 13

JOB _____ LOCATION Co-ords. 15,850,195 N; 963,470 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 20, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY [illegible]

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100 / SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w / WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL
496.8	Ground Level									
0.0	Het. mix. of clayey silt, Brown Grey sand and gravel glacial till Very Stiff to Hard		1	SS	29	490			▼495.8	
			2	SS	67			○		3 29 56 12
			3	SS	27					
			4	SS	33	480				
			5	SS	29			○		
			6	SS	31					
			7	SS	66					
475.3			8	SS	182			○		8 37 44 11
21.5	End of Borehole					470				

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 14

JOB _____ LOCATION Co-ords. 15,850,320 N; 963,632 E. ORIGINATED BY VK

W.P. 127-66-~~37~~ & 38 BORING DATE Sept. 23, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY [illegible]

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
493.1	Ground Level					
0.0	Het. mix. of clayey silt, sand and gravel - glacial till Brown Grey		1	SS	33	490
			2	SS	36	
			3	SS	48	
			4	SS	17	
478.1	Stiff to Hard		5	SS	13	480
15.0	Silty sand with gravel. Compact		6	SS	15	
			7	SS	13	
			8	SS	21	
466.6			9	SS	24	470
26.5	End of Borehole					460

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100

SHEAR STRENGTH P.S.F. — ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

LIQUID LIMIT w_L — PLASTIC LIMIT w_P — WATER CONTENT w (w_P w w_L)

WATER CONTENT % — 10 20 30

BULK DENSITY γ — P1 488.1 — P2 473.1

REMARKS	GR.	SA.	SI.	CL.
	5	21	58	16
	13	36	41	10
480.1				
	0	72	(28)	
	0	66	(34)	
	28	38	31	3

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 14 A

JOB _____ LOCATION Co-ords. 15,850,288 N; 963,590 E. ORIGINATED BY VK

W.P. 127-66-~~37~~ & 38 BORING DATE Sept. 20, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY _____

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT; SHEAR STRENGTH P.S.F. (o UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	LIQUID LIMIT w_L, PLASTIC LIMIT w_P, WATER CONTENT w, WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL.
494.0	Ground Level							10 20 30		
0.0	Het. mix. of clayey silt, sand and gravel. Brown Grey glacial till		1	SS	36	490				
			2	SS	41			o		
			3	SS	50					
			4	SS	20					
			5	SS	16	480		o		7 33 52 8
477.0	Very Stiff to Hard		6	SS	15					
17.0	Silty sand & traces of gravel. Compact to Dense		7	SS	20			o		4 63 29 4
472.5			8	SS	34					
21.5	End of Borehole					470				

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS–ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 14 B

JOB _____ LOCATION Co-ords. 15,850,350 N; 963,670 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 20, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT; SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL.
492.8	Ground Level									
0.0	Het.mix. of clayey silt, sand and Brown/Grey gravel. Glacial Till		1	SS	60	490				
			2	SS	32			○ ⊢		
			3	SS	17					
			4	SS	19					
477.8	Very Stiff to Hard		5	SS	21	480		○ ⊢		6 33 51 10
15.0	Silty sand & trace of gravel. Compact to Dense		6	SS	17			○		8 52 (40)
			7	SS	26					
471.3			8	SS	36					
21.5	End of Borehole					470				

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS–ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 15

JOB _____ LOCATION Co-ords. 15,850,444 N; 963,790 E. ORIGINATED BY VK

W.P. 127-66-37 & 38 BORING DATE Sept. 23, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
490.2	Ground Level					490
0.0	Het.mix.of clayey silt,sand & gravel. Glacial Till Very Stiff to Hard — Brown / Grey		1	SS	24	
			2	SS	39	
481.2			3	SS	28	
9.0	Silty sand with grav. & seams of clayey silt. Compact to Dense		4	SS	19	480
			5	SS	16	
			6	SS	24	
471.2			7	SS	36	
468.7	Clayey silt & gravel. Hard		8	SS	55	470
21.5	End of Borehole					
465.2						
25.0	End of Cone Test					460

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100

SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W — W_P W W_L

WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.

REMARKS	GR. SA. SI. CL.
	11 26 46 17
	34 52 (14)
	0 55 41 4

OFFICE REPORT ON SOIL EXPLORATION

20 / 15 5 / 10 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS–ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 16

JOB _____ LOCATION Co-ords. 15,850,569 N; 963,953 E. ORIGINATED BY VK

W.P. 127-66-2[illegible] & 38 BORING DATE Sept. 23, 1974 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and sample with CME 45 CHECKED BY [illegible]

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100 / SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL
0.0	Het.mix.of clayey silt,sand & gravel.		1	SS	16					
479.4	Brown		2	SS	10	480				3 34 57 16
7.5 476.9	Silty sand & trace of gravel. Compact.Grey		3	SS	17					5 40 52 3
10.0	Glacial Till		4	SS	35					
			5	SS	52					9 27 52 12
			6	SS	37	470				
	Stiff to Hard		7	SS	36					
465.4			8	SS	109					22 27 39 12
21.5	End of Borehole					460				

OFFICE REPORT ON SOIL EXPLORATION

20
15 ◇ 5 % STRAIN AT FAILURE
10

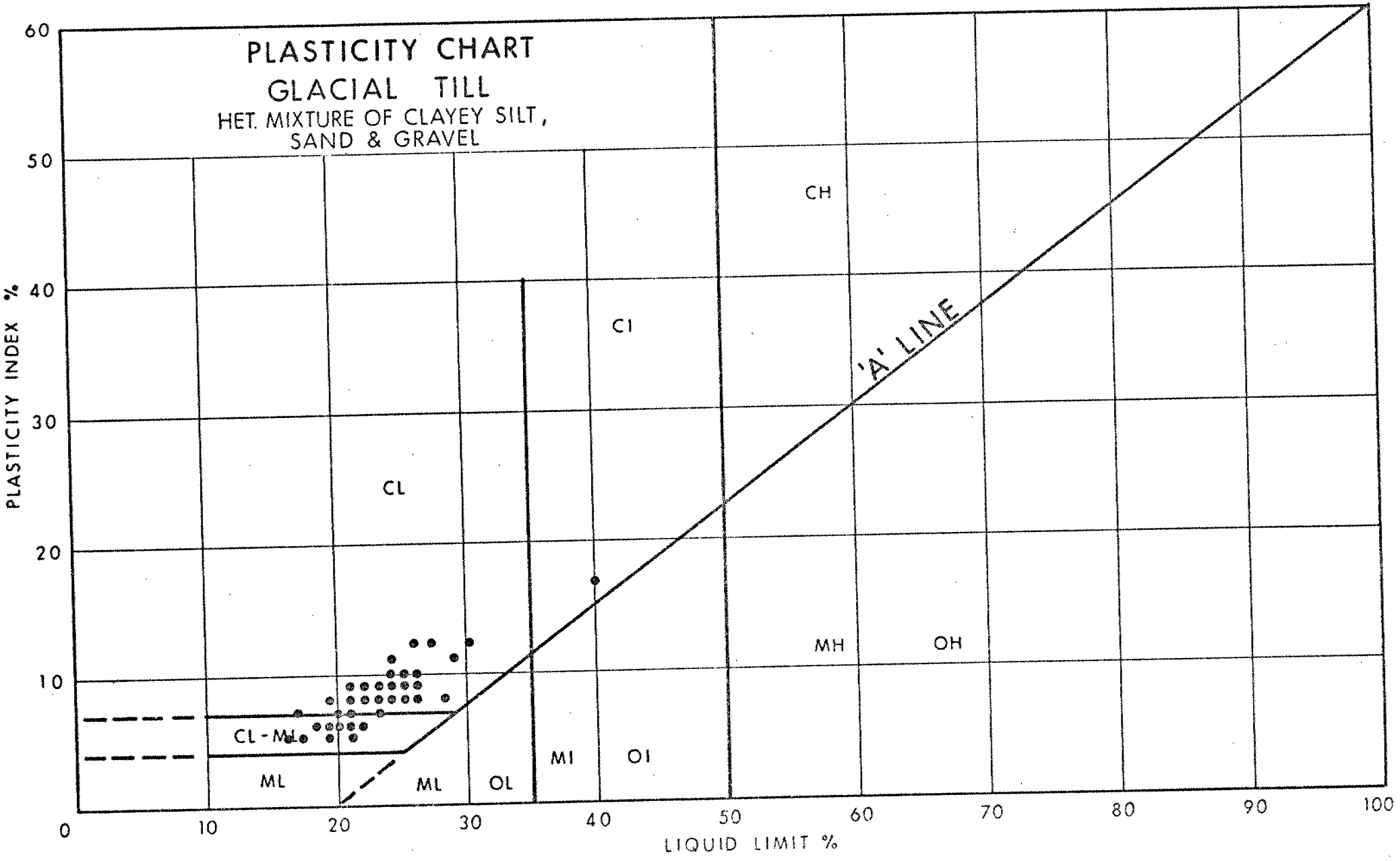


FIG. 1

W.P. 127-66-27 & 38

GRAIN SIZE DISTRIBUTION

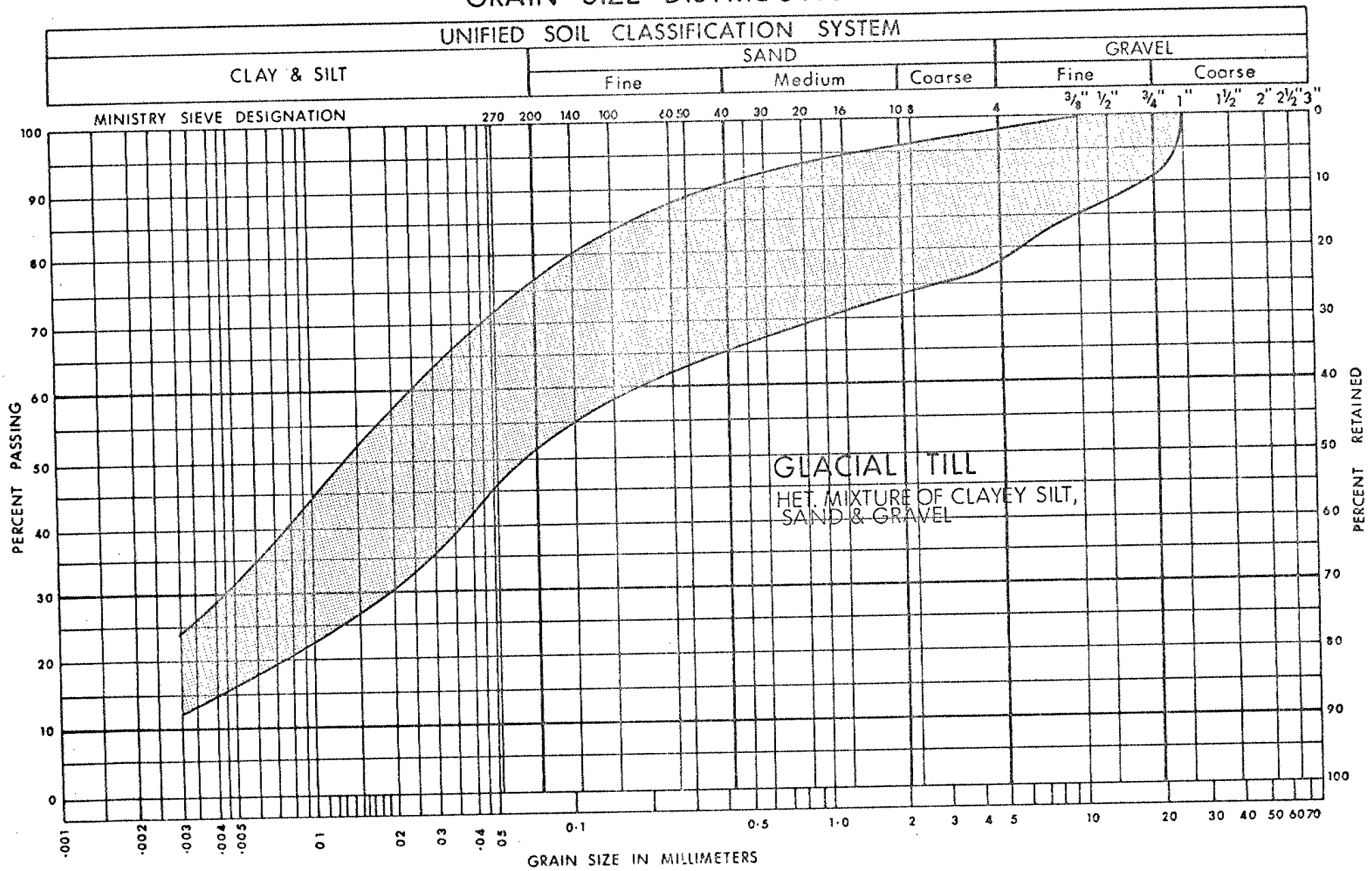


FIG. 2

W.P. 127-66-37 & 38

GRAIN SIZE DISTRIBUTION

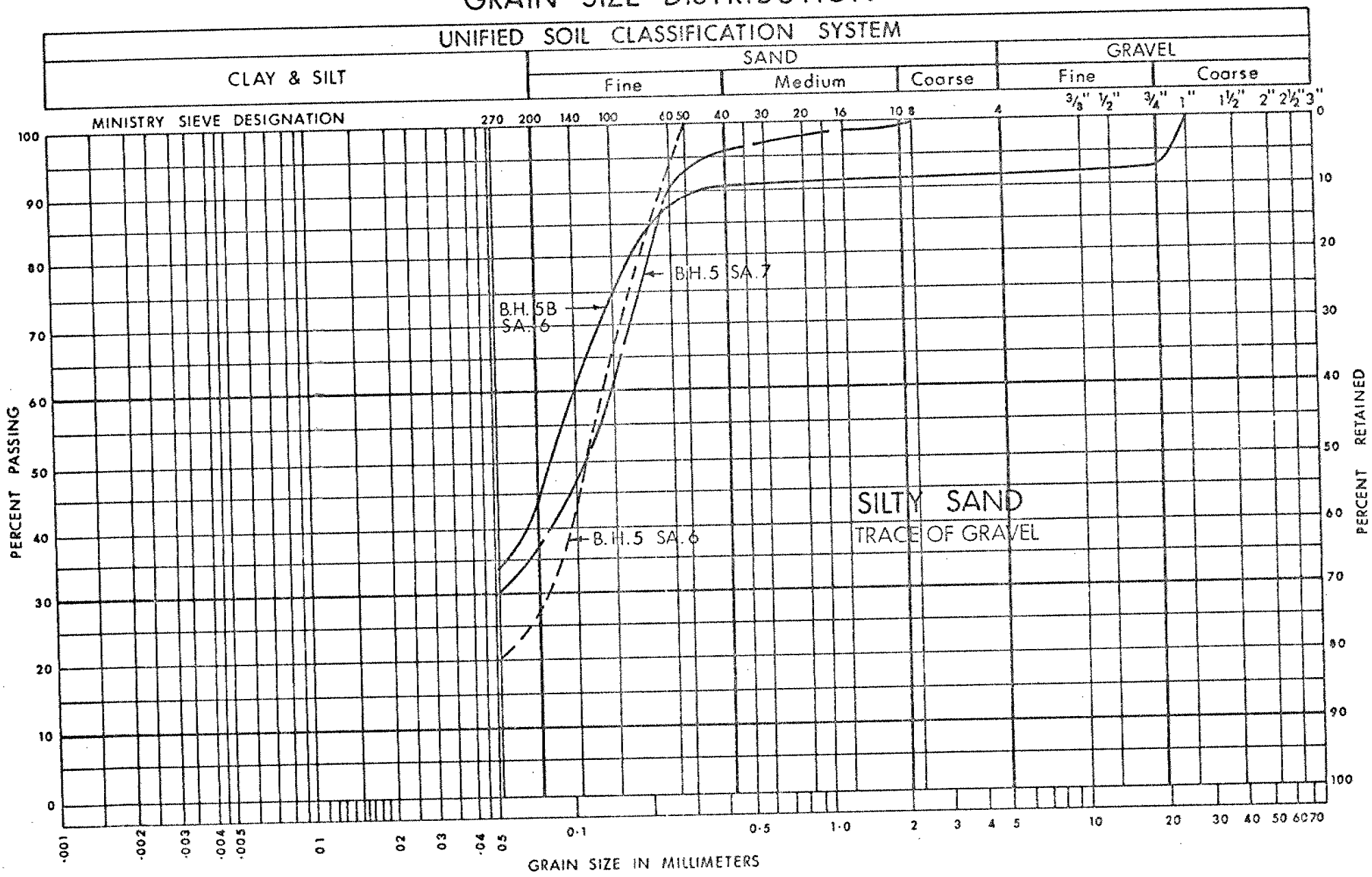


FIG. 3A

W.P. 127-66-20 & 38

GRAIN SIZE DISTRIBUTION

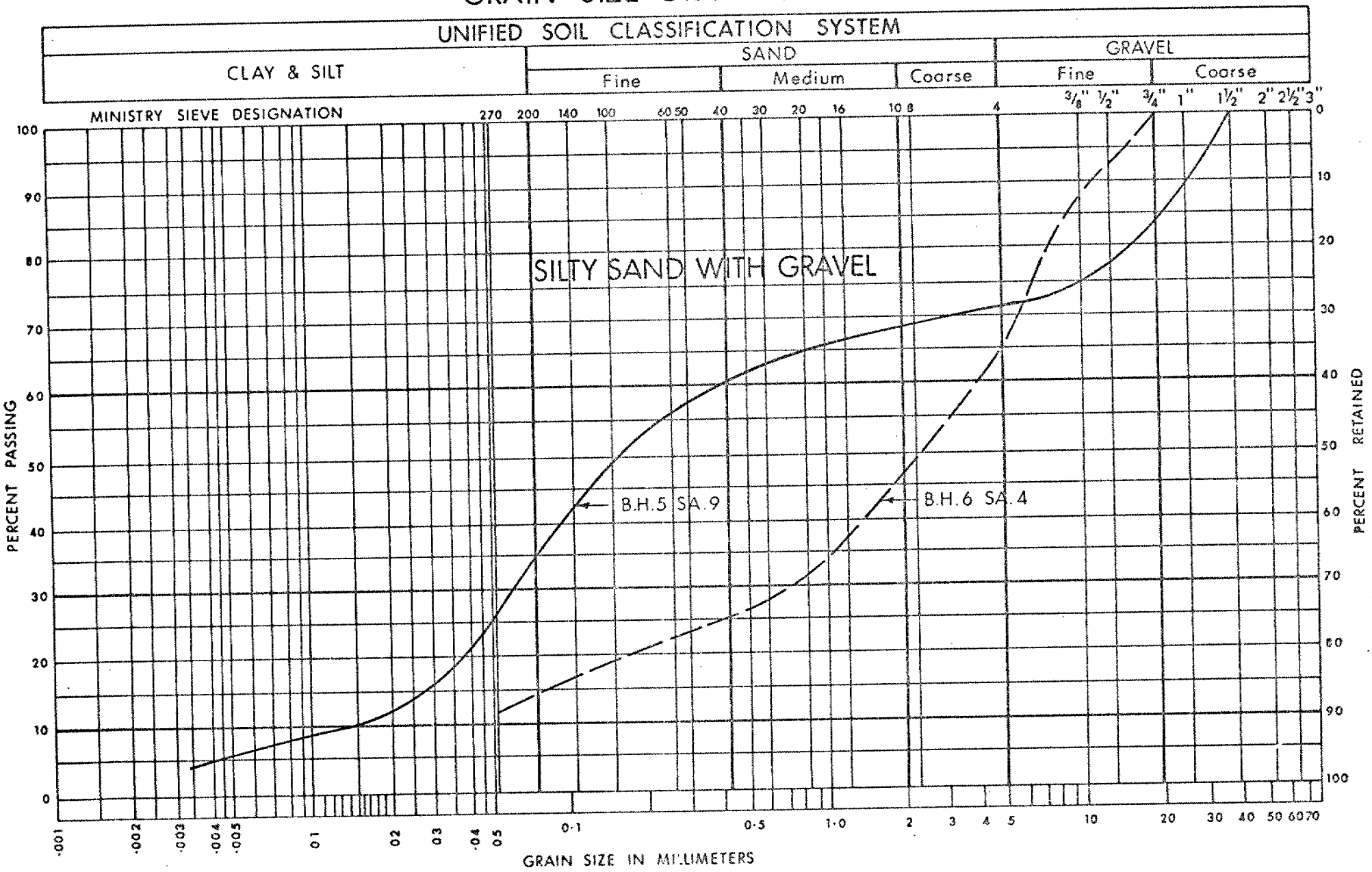


FIG. 3B

W.P. 127-66-37 & 38

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 : -

CONSISTENCY	c LB./SQ.FT.
VERY SOFT	0 - 250
SOFT	250 - 500
FIRM	500 - 1000
STIFF	1000 - 2000
VERY STIFF	2000 - 4000
HARD	> 4000

DENSENESS	'N' BLOWS / FT.
VERY LOOSE	0 - 4
LOOSE	4 - 10
COMPACT	10 - 30
DENSE	30 - 50
VERY DENSE	> 50

TERMS TO BE USED IN DESCRIBING SOILS :-

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

TYPE OF SAMPLE

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

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

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

FD-9b (Rev. Jan 73)

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 — IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION — IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION — IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION — IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3·1416
e	BASE OF NATURAL LOGARITHMS 2·7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ε	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

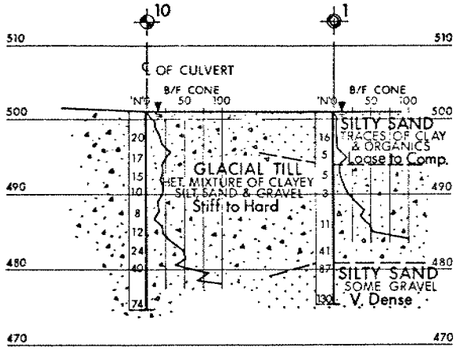
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

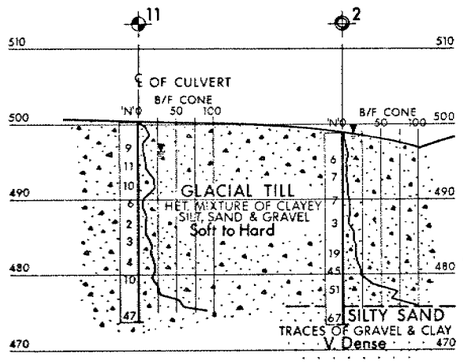
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

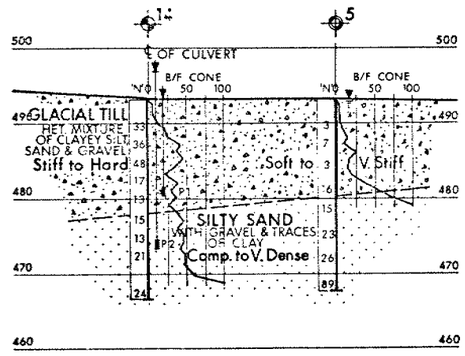
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



SECTION A-A

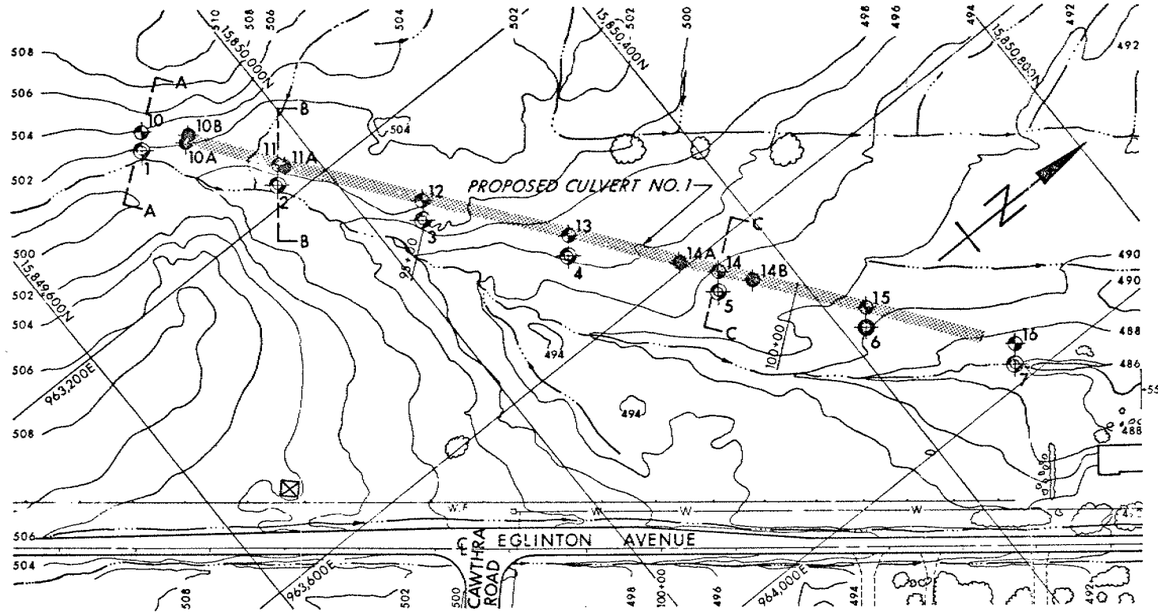


SECTION B-B



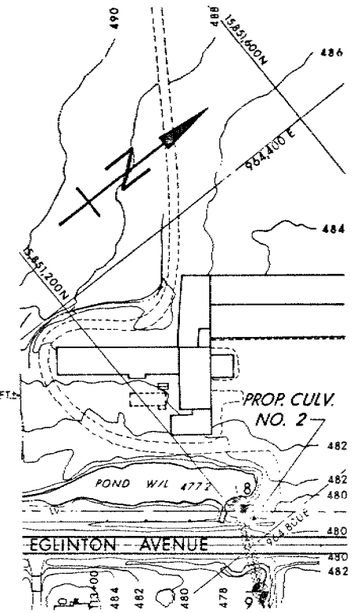
SECTION C-C

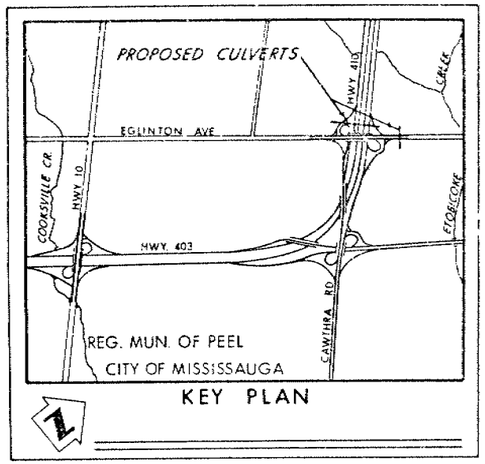
10 5 0 SCALE 10 20 FT.



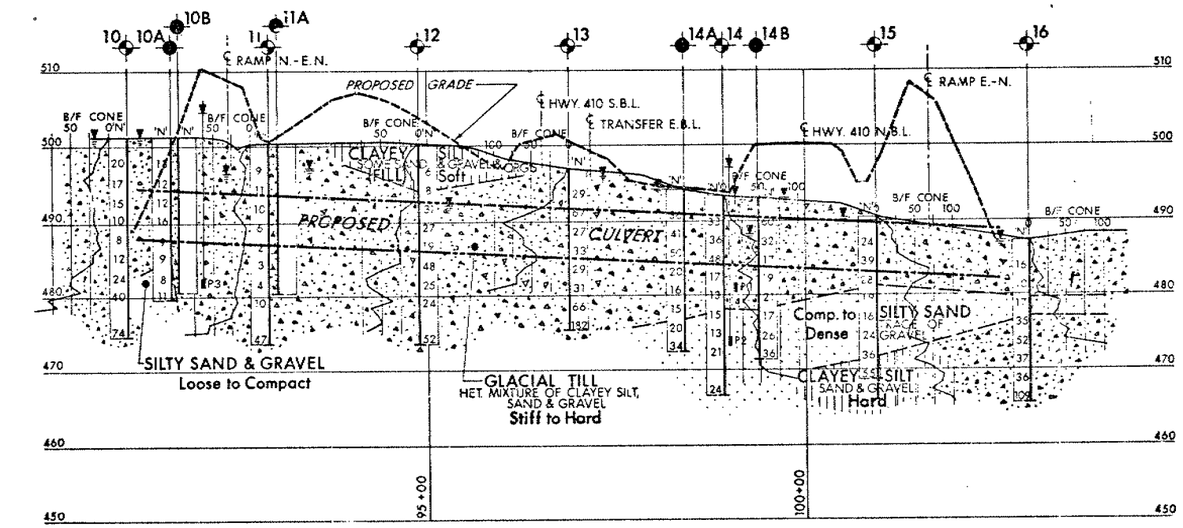
PLANS

100 50 0 SCALE 100 200 FT.



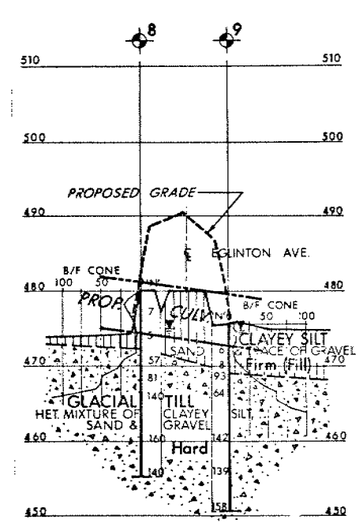


KEY PLAN



PROFILES THROUGH CULVERTS

HORIZ 100 50 0 SCALE 100 200 FT.
VERT. 10 5 0 10 20



LEGEND

- Bore Hole
- Dynamic Cone Penetration Resistance Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation, btwn. July 17 & Sept. 24, 1974.
- Piezometers.
- Original Bore Hole Nos 1 to 7 July, 1974.

NO.	ELEVATION	CO-ORDINATES NORTH	CO-ORDINATES EAST
1	500·9	15,849,825	963,025
2	498·8	15,849,937	963,175
3	500·3	15,850,058	963,333
4	496·4	15,850,179	963,492
5	493·2	15,850,304	963,654
6	489·7	15,850,427	963,812
7	485·4	15,850,552	963,975
8	480·1	15,851,213	964,750
9	476·1	15,851,160	964,854
10	501·1	15,849,840	963,005
10A	501·1	15,849,878	963,055
10B	501·5	15,849,885	963,049
11	500·2	15,849,956	963,154
11A	500·2	15,849,960	963,163
12	500·1	15,850,075	963,312
13	496·8	15,850,195	963,470
14	493·1	15,850,320	963,632
14A	494·0	15,850,288	963,590
14B	492·8	15,850,350	963,670
15	490·2	15,850,444	963,790
16	486·9	15,850,569	963,953

— NOTE —

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

NOTE FOR CONTRACT DOCUMENT

The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the Toronto District Office.

REVISIONS			
DATE	BY	DESCRIPTION	

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

PROPOSED CULVERTS (1 & 2)

(NORTH & EAST OF EGLINTON AVE.)

HIGHWAY NO 410 DIST NO 6

~~CO~~ REG. MUNICIPALITY OF PEEL

~~TWP~~ CITY OF MISSISSAUGA LOT CON

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD V.K	CHECKED	W.P. NO 27-66-37 & 38	DRAWING NO 74-11027A
DRAWN N.T.	CHECKED	A.O. NO 74-11027	
DATE OCTOBER 24, 1974		SITE NO	BRIDGE DRAWING NO
APPROVED		CONT NO	

BHG-TRACE 1364-74