

## MEMORANDUM

To: Mr. G. K. Hunter  
Regional Road Design Engineer  
Central Region (Toronto)  
Central Bldg.

M. Devata  
FROM: Foundation Section  
Materials & Testing Office  
Rm. 107, Lab. Bldg.

ATTENTION:

DATE: August 20, 1970

OUR FILE REF.

IN REPLY TO

SUBJECT:

Proposed Retaining Wall  
Hwy. #20 -- Q.E.W. Interchange  
Twp. of Saltfleet -- Co. of Wentworth  
District No. 4 (Hamilton)  
W.O. 70-11035 -- W.P. 10-57-06

INTRODUCTION

The Foundation Section was requested to carry out a subsurface investigation along the alignment for a proposed storm trunk sewer to be located at the aforementioned location. The factual data obtained from this investigation, together with the recommendations pertaining to the installation of the sewer, are contained in Foundation Report W.O. 70-11035, dated July 21, 1970.

In conjunction with this project, a retaining wall will be required. The recommendations pertaining to the foundations of this structure are contained in this letter.

SUBSOIL AND GROUNDWATER CONDITIONS

The subsoil and groundwater conditions at this location are discussed in detail in Foundation Report W.O. 70-11035.

The predominant stratum across the site is composed of an extensive deposit of stiff to hard clayey silt to silty clay with some sand and gravel. A deposit of very loose silty sand with occasional traces of clay and gravel was encountered beneath the topsoil, immediately north of the C.N.R. tracks. This deposit varies in thickness from 10 to 14 feet.

The groundwater level, recorded at the time of the investigation varies between elevations 257 and 258. This corresponds to depths of 5 to 14 feet below the ground surface.

The subsoil conditions and groundwater levels are illustrated on Drawing No. W.O. 70-11035B, appended to this letter.

## DISCUSSION AND RECOMMENDATIONS

Due to space restrictions between the proposed reconstruction of Hwy. #20 and the adjacent existing structures, a retaining wall will be required. This wall will be located on the west side of Hwy. #20, immediately north of the C.N.R. tracks, and will be approximately 240 feet long. The elevation of the base of the wall will vary from elevations 256 (south end) to 258 (north end), while the top of the wall will vary from elevation 264 (south end) to 272 (north end). The clear height will, therefore, range from 8 feet at the south end to 14 feet at the north end.

The retaining wall can be founded on spread footings located within the competent clayey silt stratum. The footing should not, in any case, be located in the silty sand stratum in order to avoid a major dewatering problem below the groundwater level. A minimum cover of 4 feet should be provided to the underside of the foundation for frost protection purposes. An allowable bearing value of 1.75 t.s.f. may be used in footing design.

The groundwater level, recorded at the time of the investigation, varies between elevations 257 and 258, i.e. about 7 feet above the base of the expected footing level. Since the subsoil is generally cohesive and relatively impervious, the groundwater seepage into the excavation should be negligible. However, in the pervious silty sand deposit at the south end of the structure, some groundwater seepage is expected. Any inflow which occurs could be readily controlled by conventional techniques, such as pumping from sumps.

The settlement that will occur in the foundation subsoil due to the induced footing pressure, will be of a recompressive nature and will be within 1 inch.

No stability problems are anticipated in the immediate vicinity of the wall section.


For computing the sliding resistance, a value of 1500 p.s.f. may be used for the adhesion between the base of the rough concrete footing and the clayey silt subsoil.

If the retaining wall is designed as a rigid frame, then a coefficient of earth pressure at rest ( $K_0$ ) of 0.5 should be used in computing the lateral pressure due to the granular fill behind the wall. However, if some movement of the top of the wall is permitted, then a coefficient of active earth pressure ( $K_a$ ) of 0.33 can be used.

In order to relieve the build-up of excess hydrostatic pressure behind the retaining wall, suitable weep holes should be provided at the base of the wall at a maximum spacing of 10 feet. D.H.O. Standard SD-4-58, concerning backfilling requirements, may be used for design and construction purposes.

We trust that the recommendations presented above are sufficient for your immediate purposes. If additional information is required, or should this letter require further clarification, please contact this office.

MD/FP/lm  
Attach.

  
M. Devata  
Supervising Foundation  
Engineer

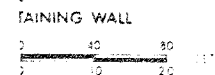
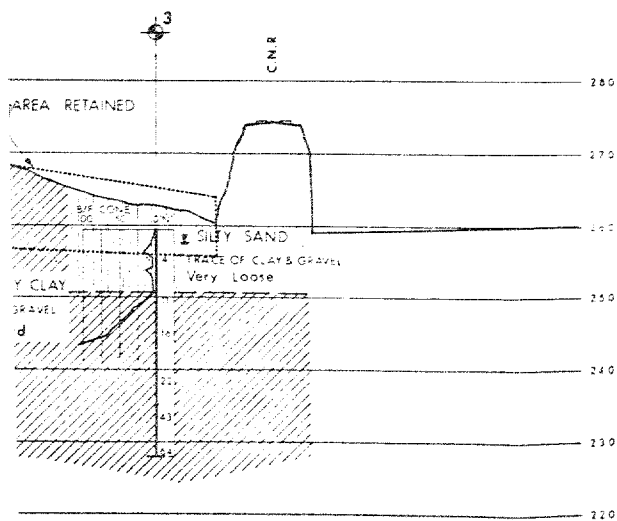
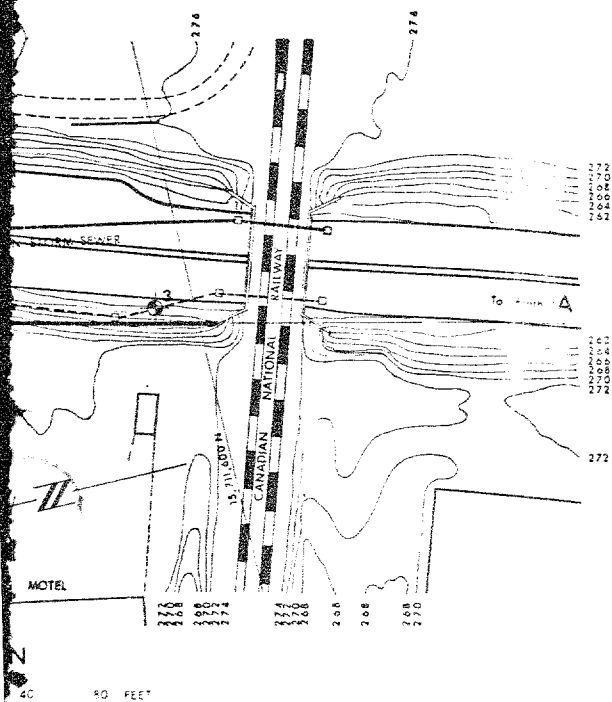
cc: Messrs. H. A. Tregaskes  
B. R. Davis  
D. W. Farren  
G. K. Hunter (2)  
C. R. Robertson (2)  
W. C. Friedmann  
T. J. Kovich  
W. S. Melinyshyn  
M. M. Dillon Ltd. (Toronto)  
B. A. Singh

For:

A. G. Stermac  
Principal Foundation  
Engineer

Foundations Files  
Gen. Files





SEE DRAWING NO. 70-11035A

KEY PLAN  
SCALE IN MILES

### LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation. MAY 1970

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	272.2	15,711,727	931,049
2	266.4	15,711,897	931,394
3	259.5	15,711,621	931,040

### - NOTE -

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE - FOUNDATION SECTION

### RETAINING WALL

RING'S HIGHWAY NO. 20 DIST. NO. 4  
CO. WENTWORTH  
TWP. SAITFLEET LOT COM.

### BORE HOLE LOCATIONS & SOIL STRATA

DRAWN H.S.	CHECKED -	BP NO. 10-57-06	MBT DRAWING NO.
DATE MAY	CHECKED -	JCN NO. 70-11035A	70-110358
DATE JULY 30, 1970		SITE NO.	BRIDGE DRAWING NO.
APPROVED <i>[Signature]</i>		CONT NO.	

Department of Highways

Copy for the information of

Foundation Office

Mr. A. Stermac,  
Principal Foundation Engineer,  
Room 107, Lab. Bldg.

C.S. Grebski,  
Bridge Office

January 15, 1971

Hwy. 20 Retaining Wall  
W.P. 10-57-06, Site No. 36  
Highway 20, District No. 4

Attached herewith we are submitting the final  
bridge drawings which show the foundation design for  
this structure.

Kindly give us your comments at your earliest  
convenience.

C.S. Grebski,  
Bridge Design Engineer

CSC:rd

Attach.

C.C. Foundation Office

*no comments*  
*BTD*  
*Jan 29/71*  
*df 1/29/71*

72-1075

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. M. Devata,  
Supvr. Foundation Engr.,  
Foundation Office.

FROM: Materials & Testing Office,  
Central Region.

ATTENTION: Mr. S. Ahmael.

DATE: March 9, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Storm Sewer Investigation  
W.P. 10-57-06, Stoney Creek Traffic Circle  
Hamilton District


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As per your verbal request to Mr. T. J. Kovich, our field crew drilled preliminary test holes along the recommended and alternate north-south storm sewer alignments as shown on the plan sent previously to you.

This investigation showed that the recommended alignment was more favourable from a soils' point-of-view.

We request that you conduct your field investigation for the north-south storm sewer along the recommended alignment.

WJP/js.

  
W. J. Peck,  
Project Soils Engineer.

cc: R. Fitzgibbon

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. T. J. Kovich,  
Regional Materials Engineer,  
Central Region,  
3501 Dufferin St.,  
ATTENTION: Downsview, Ontario.

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

DATE: June 29, 1972.

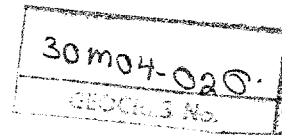
OUR FILE REF.

IN REPLY TO

JUL - 4 1972

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
For  
Proposed Storm Sewers and Culvert  
Hwy. #20 - Q.E.W. Interchange  
Twp. of Saltfleet, Co. of Wentworth  
District No. 4 (Hamilton)  
W.O. 72-11039 -- W.P. 10-57-06



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

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

AGS/ao  
Attch.

cc: Messrs. D. W. Farren

B. R. Davis

A. Rutka

P. J. Harvey

C. R. Robertson

B. J. Giroux

G.C.E. Burkhardt

G. A. Wrong

B. A. Singh

*M. M. Gullon (Signature)*  
Foundations Files  
Documents

*A. G. Stermac*  
A. G. Stermac,  
PRINCIPAL FOUNDATIONS ENGINEER.



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FOUNDATION INVESTIGATION REPORT  
For  
Proposed Storm Sewers and Culvert  
Hwy. #20 - Q.E.W. Interchange  
Twp. of Saltfleet, Co. of Wentworth  
District No. 4 (Hamilton)  
W.O. 72-11039      --      W.P. 10-57-06

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1. INTRODUCTION:

In connection with the reconstruction of Hwy. #20/Q.E.W. interchange at Stoney Creek Traffic Circle, in the Township of Saltfleet, County of Wentworth, it is proposed to construct two storm sewers and a culvert. The Foundations Office was requested in a memo by Mr. T. J. Kovich, Regional Materials Engineer, Central Region, dated February 14, 1972, to carry out subsurface investigations at the respective locations. Investigation was subsequently carried out by this Office to determine the subsoil and groundwater conditions.

This report contains all the factual data obtained from this investigation, together with recommendations pertaining to the excavation for and installation of the storm sewers and culvert.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located at the existing Stoney Creek Traffic Circle complex, where Hwy. #20 crosses Q.E.W. At this location both Hwy. #20 and Q.E.W. are in a cut section approximately  $2\frac{1}{2}$ :1 to 3:1. The terrain, which is covered with light vegetation such as grass and brush, is gently undulating in relief between elevations 264 and 267. Immediately west of the Traffic Circle along Hwy. #20, however, some light industry exists.

The Canadian National Railway track traverses across the traffic circle in a north-south direction. It is carried on an embankment 6 to 7 feet high. Single-span

(51.5 feet long) rigid frame steel and concrete subway structures carry the C.N.R. over the E.B. and W.B. lanes of the Q.E.W. The heights of the associated approaches, in the forward direction, are approximately 18 to 19 feet.

Physiographically, the area is situated in the "Iroquois Plain", specifically in the "Niagara Fruit Belt" subsection. This area was inundated in the Late Pleistocene times by a body of water known as Lake Iroquois. The overburden deposits were laid down in this lake. In the "Niagara Fruit Belt" subsection the uppermost stratum is composed of a silty clay of lacustrine origin; the thickness of this cohesive subsoil generally varies between 25 and 48 feet. The silty clay is underlain by glacial till which, in turn, is followed by red shale bedrock of the Queenston formation, Ordovician Period.

### 3. FIELD AND LABORATORY WORK:

A total of fifteen boreholes, ten of which were accompanied by a dynamic cone penetration test, were put down during the period of the investigation. In addition, two boreholes have been incorporated from previous field investigation (W.O. 69-F-70) to supplement the subsoil information. The borings were advanced by either a conventional diamond drill rig or a continuous flight auger (Penn Drill), both of which were adapted for soil sampling purposes.

Samples of the overburden were recovered at required depths, in a 2-inch O.D. split-spoon sampler, which was hammered into the soil in accordance with the specifications for carrying out the Standard Penetration Test. The same method was used to advance the dynamic cone penetration test. Wherever possible, these samples were supplemented by obtaining 2" I.D. Shelby tube samples, which were manually pushed into the silty clay stratum. In addition, in situ vane tests were carried out within the softer, more compressible portions of the stratum. Bedrock was proven in one of

the borings by obtaining 4 ft. of BX-size rock core samples.

The groundwater level conditions across the site at the time of the investigation, were determined by recording the water levels in all the open boreholes.

The location and elevation of all borings were surveyed by personnel from the Central Region, Engineering Surveys Section. The borings are shown in plan on Drawing No. 72-11039A, together with estimated stratigraphical profiles along the proposed centre-line of respective sewers and culvert. All elevations in this report are referenced to a geodetic datum.

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

- Bulk Densities
- Natural Moisture Contents
- Grain-size Distributions
- Atterberg Limit Tests
- Undrained Shear Strengths

The results of the testing are plotted on the Record of Borelog sheets and summarized on Figures 1 to 3, inclusive, all contained in Appendix I of this report.

#### 4. SUBSOIL AND BEDROCK CONDITIONS:

##### 4.1) General:

The predominant stratum across the site is composed of clayey silt to silty clay, with trace of sand and gravel. In certain locations the cohesive deposit is overlain by surficial deposit of silty sand with some gravel. Underlying the cohesive clayey silt to silty clay is a hard cohesive glacial till. Detailed descriptions of the various soil types encountered in each borehole are given on the Record of Borelog sheets. The estimated stratigraphical profile, shown on Drawing No. 72-11039A is based upon this information.

4.2) Surficial Deposit - Silty Sand with Trace of Gravel:

A stratum of silty sand, with trace of gravel was encountered at B.H.'s #9, 10, and 11, under a nominal cover of topsoil. The thickness of this stratum varies from 4 feet to 9.5 feet.

The Standard Penetration Tests carried out within the deposit gave 'N' values which range from 7 to 61 blows/ft.. Based on these results it is estimated that the relative density varies from loose to very dense.

4.3) Clayey Silt to Silty Clay:

Directly underlying the surficial cover of topsoil or under the surficial deposits of silty sand is the predominant stratum across the site, composed of a grey clayey silt to silty clay with trace of sand and gravel. This extent of deposit was only investigated at B.H.'s #6 and 29. Based on this, the thickness of the deposit ranges from 30 to 40 feet. In places, the upper 1 to 12 feet of the stratum has been dessicated forming a crust. This crust can be easily differentiated from the underlying subsoil by its characteristic brown colour. Within this deposit thin silt seams up to 1 inch thick were encountered. Grain-size distribution tests were carried out on typical samples obtained from the subsoil; the range in gradation is shown in envelope form on Figure No. 2, appended to this report.

The engineering properties of the stratum, as determined by field and laboratory testing, are presented in the following table:

<u>Identity Test</u>		<u>Range</u>	<u>Average</u>
Bulk Density	( $\gamma$ ) p.c.f.	118-134	126
Liquid Limit	( $W_L$ ) (%)	19-42	32
Plastic Limit	( $W_p$ ) (%)	14-23	18
Natural Moisture Content	( $W$ ) (%)	7-29	19

<u>Identity Test</u> (Cont'd)	<u>Range</u> (Cont'd)	<u>Average</u> (Cont'd)
Undrained Shear Strength (Cu)		
I) Field Vanes (p.s.f.)	500->2000	
II) Lab Vanes (p.s.f.)	515->2000	
Standard Penetration Tests		
'N' Blows/ft.	3->100	

The Atterberg Limits tests, summarized above, are also plotted on the Plasticity chart, Figure #1. These results indicate that the cohesive stratum is inorganic with a plasticity in the low to intermediate range.

Based on the results of the undrained shear strength and the standard penetration resistance, it is estimated that the consistency of the stratum varies from soft to hard.

#### 4.4) Clayey Silt with Sand and Gravel (Glacial Till):

Underlying the cohesive stratum is a reddish brown glacial till, composed of clayey silt with sand and gravel. This stratum was penetrated fully in B.H. #29, which indicates that the thickness of the stratum is approximately 12 feet. The consistency of the deposit, as determined by the Standard Penetration Tests performed ('N' values > 100 blows/ft.) is in the hard range.

#### 4.5) Shale Bedrock:

The cohesive glacial till stratum is followed by shale bedrock, which was proven in B.H. #29, by obtaining up to 4 feet of AXT rock core size samples. The bedrock encountered in the above-mentioned borehole is at elevation 203, which corresponds to a depth of 52 feet below existing ground surface. The bedrock appears to be in a sound state as evidenced by the high percentage of core recovered.

### 5. GROUNDWATER CONDITIONS:

Groundwater level observations were carried out in the open boreholes, during the time of the field investigations. The observations are recorded on the Borelog sheets and summarized on Drawing No. W.O. 72-11039A.

The recorded observations indicate that the groundwater level in the overburden deposit varies between elevations 249 and 266. These elevations correspond to depths of a fraction of a foot to 6 feet. An exception from this was noticed in B.H. #30A, where the groundwater level was at elevation 231, corresponding to a depth of 24.5 feet below existing ground surface. It is believed that the water level has not reached the equilibrium condition since this was the last borehole carried out and if sufficient time had elapsed the water level in this may correspond with water levels in other boreholes.

## 6. DISCUSSIONS AND RECOMMENDATIONS:

### 6.1) General:

In conjunction with the proposed reconstruction of Q.E.W. and Hwy. #20 complex, in the vicinity of Stoney Creek Traffic Circle, two main storm trunk sewers and a 6'x4' concrete box culvert (Station 682 + 50) are proposed to be constructed. The details of the various proposals are as follows:

#### i) Storm Sewer along Hwy. #20:

This sewer, which will be approximately 950 feet long, extending in a northerly direction with an outlet some 350 feet east of Hwy. #20 into a local lagoon. The invert of this storm sewer will vary from elevation 251 at the south end to elevation 249 at the outfall end.

#### ii) Storm Sewer under Q.E.W.:

This sewer will have a total length of 910 feet and will be situated in the middle of the present Stoney Creek Traffic Circle in a northerly direction to a local lagoon some 300 feet north-east of the proposed Hwy. #20. The invert grades of this sewer will range from elevation 257 to elevation 247 at the outfall end.

111) A 6'x4' concrete box culvert approximately 450 feet long at 682 + 50 (Q.E.W.) will be constructed underneath the Q.E.W.. The proposed invert of the box culvert will vary from elevation 248 at the south end to elevation 247 at the north end.

The predominant stratum across the site is composed of a firm to hard clayey silt to silty clay, with some sand and trace of gravel. In certain locations this cohesive deposit is overlain by brown to grey silty sand with trace of gravel. The cohesive stratum is underlain by reddish brown glacial till, which in turn, is followed by shale bedrock.

At the time of writing this report, it is not known, whether the sewer construction will be carried out by open cut methods or tunneling operations. In view of this, the two methods of construction will be discussed under separate headings in the sub-sections to follow.

#### 6.2) Sewers Constructed by Open-Cut Methods:

The excavations for the storm sewers will generally be carried out in the cohesive clayey silt to silty clay stratum. However, the excavation for the north-eastern portion (refer to B.H.'s #9, 10, and 11) of the proposed storm sewer along Hwy. #20 will extend through the surficial deposit of silty sand and into the cohesive stratum. Temporary cuts in this area will be stable against a deep-seated rotational type of failure, providing the cuts are constructed with 1:1 slopes. If due to space restrictions, slopes steeper than those specified above are desired, the excavations should be sheeted. In all cases, the provisions adopted in the designated working areas should comply with the Trench Excavator's Act.

The groundwater level along the sewer alignments is generally at or above the invert elevation of the proposed sewers.

The major portion of the excavations for these storm sewers will be carried out entirely within the cohesive



stratum of clayey silt to silty clay. However, in the north-eastern portion the sewer along Highway #20, the excavations will extend through the surficial deposit of silty sand into the cohesive stratum of clayey silt to silty clay. Since the base of the excavations will be situated within the cohesive stratum, no boiling is likely to occur due to the unbalanced hydrostatic pressure. It should be noted that where the excavations intercept the surficial granular deposit, excess seepage into the excavations can be anticipated. Elsewhere, the seepage into the excavations will be negligible in quantity in view of the relatively impervious nature of the subsoil. In all cases, it is believed that any seepage into the excavations or surface run-off can be handled by employing standard techniques, such as pumping from sumps.

It is recommended that the pipe bedding on this project adhere to standards currently being used by the Ministry, specially for Class 'B' Bedding on a Yielding Foundation (Standard No. SD-8-40). The bedding must always be placed in a dry trench, and particular attention should be paid to compacting and shaping of the bedding material.

6.3) Sewers Constructed by Tunneling Through the Overburden:

An alternate scheme for sewer installation is to utilize tunneling methods. In construction of the sewer by tunnelling through the overburden, a minimum cover of 10 feet above the sewer invert will be required in order to ensure against the caving-in of the tunnel. It will also be necessary to lower the groundwater level below the tunnel base, or alternatively, to construct the tunnel using air pressure greater than the prevailing hydrostatic pressure in order to achieve safe dry working conditions. Contractors, who use air pressure, should be advised that they will be responsible for determining the air pressure that will be used, and also, that they would be responsible for preventing leakage through the

boreholes that have been drilled at the site insofar as it affects their operations. In sinking shafts through the overburden, the aforementioned recommendations are also applicable.

6.4) Concrete Box Culvert (Refer to B.H.'s #12, 13, and 14):

As mentioned elsewhere, the invert elevation of the 6'x4' concrete box culvert varies from 248 to 247. At these grades the subsoil is competent and the box culvert can be founded on a 1-foot thick granular pad, laid down directly on the subsoil, with an allowable bearing pressure of 1 t.s.f.. The granular pad should consist of granular 'A' type material, and this pad should extend a minimum distance of 2 feet in all directions within the plan limits of the box culvert. The prevailing groundwater level at the time of field investigation was found to be well above the invert elevation of the culvert. Since the subsoil is relatively impervious, no excessive seepage into the excavation will be anticipated. Any minor seepage into the excavation or surficial runoff can be handled by pumping from sumps. In order to relieve the build up of excess hydrostatic pressure behind the walls weep holes should be provided. These should be spaced no further than 20 feet centre to centre.

If the structure is to be designed as a rigid frame, then a coefficient of earth pressure at rest ( $K_0$ ) of 0.5 should be assumed for the granular fill material placed behind the walls when designing the box culvert.

7. MISCELLANEOUS:

The field work for this project was carried out during the period of March 21 to March 30, 1972, under the immediate supervision of Mr. S. A. Ahmad, Project Foundations Engineer.

The equipment was owned and operated by F. E. Johnston Drilling Co. Ltd., Toronto.

This report was written by Mr. S. A. Ahmad, Project Foundations Engineer. This project was carried out under the general supervision of Mr. M. Devata, Supervising Foundations Engineer who also reviewed this report.

*Shakeen Sh*

S. A. Ahmad, P. Eng.



*M. Devata*

M. Devata, P. Eng.

SAA/ao

June 23, 1972.

APPENDIX I

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 1

JOB 72-11039 LOCATION Co-ords 15,713,364 N. ' 931,905 E. ORIGINATED BY S.A.  
 W.P. 10-57-06 BORING DATE March 21, 1972. COMPILED BY S.R.  
 DATUM Geodetic BOREHOLE TYPE Continuous Flight Auger CHECKED BY Lo

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 $W$ $W_P$ — $W$ — $W_L$ WATER CONTENT %	BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT					
252.3	Ground level.									
0.0	(Brown) (Grey) Clayey silt to silty clay with trace of sand, occasional gravel.  Firm to hard.		1	SS	6	250				
			2	TW	PM					
			3	TW	PM					
			4	TW	PM					
			5	SS	34	240				
			6	SS	54					
			7	SS	45	230				
220.7			8	SS	93	220				
31.6	End of borehole.					210				

OFFICE REPORT ON SOIL EXPLORATION

ORIGINATED BY S.A.

COMPILED BY S.R.

CHECKED BY 12

OFFICE REPORT ON SOIL EXPLORATION

FOUNDATIONS OFFICE

JOB	72-11039	LOCATION	Co-ords. 15,713,275 N. 431,624 E.	ORIGINATED BY	S.A.
W.P.	10-57-06	BORING DATE	March 21, 1972.	COMPILED BY	S.R.
DATUM	Geodetic	BOREHOLE TYPE	Continuous Flight Auger	CHECKED BY	S.R.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT ——— $w_L$ PLASTIC LIMIT ——— $w_p$ WATER CONTENT — $w$			BULK DENSITY $\gamma$ P C F	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT	20	40	60	80	100	$w_p$ — $w$ — $w_L$			WATER CONTENT % 10 20 30	GR SA SI CL
265.8	Ground level.														
0.0	(Brown)		1	SS	5									El. 262.8 in open B.H. March 21/77	
	(Grey)		2	TW	PH										123
	Clayey silt to silty clay with trace of sa.		3	TW	PH										126
	Occasional gravel.		4	TW	PH										127
	Firm to very stiff.		5	TW	PH										0 11 44 45
			6	SS	20										
			7	SS	28										0 14 46 40
230.8															
35.0	End of borehole.														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 4

JOB 72-11039

LOCATION Co-ords. 15,713,108 N. 931,505 E.

ORIGINATED BY S.A.

W.P. 10-57-06

BORING DATE March 21, 1972.

COMPILED BY S.R.

DATUM Geodetic

BOREHOLE TYPE Continuous Flight Auger

CHECKED BY S.R.

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 $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30	BULK DENSITY $\gamma$ P.C.F. GR SA SI CL	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT					
262.0	Ground level.									
0.0	(Brown) (Grey) Clayey silt to silty clay, with some sand and trace of gravel.  Firm to hard.		1	TW	PM	260				
			2	TW	PM					
			3	TW	PM					
			4	TW	PM	250				
			5	TW	PM					
			6	TW	PM					
			7	TW	PM	240				
			8	SS	75					
			9	SS	39	230				
225.4			10	SS	49					
36.6	End of borehole.					220				

OFFICE REPORT ON SOIL EXPLORATION



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 5

JOB 72-11034

LOCATION Co-ords. 15,712,882 N. 931,490 E.

ORIGINATED BY S.A.

W.P. 10-57-06

BORING DATE March 25, 1972

COMPILED BY S.R.

DATUM Geodetic

BOREHOLE TYPE Continuous Flight Auger

CHECKED BY C.R.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— W <sub>L</sub> PLASTIC LIMIT ——— W <sub>p</sub> WATER CONTENT ——— W			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
266.0	Ground level.															GR SA SI CL
0.0			1	SS	62											1.263.5
			2	SS	42	260										in open B.H.
	(Brown)		3	SS	30											March 25/72
	(Grey)		4	SS	4											0 6 53 41
	Clayey silt to silty		5	TW	PM	250										
	clay with trace of		6	TW	PM											
	sand and gravel.		7	TW	PM											125
			8	TW	PM	240										122.5
			9	SS	30											
			10	SS	54	230										0 24 53 23
224.4			11	SS	97											
41.6	End of borehole.					220										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 5A

JOB 72-11039

LOCATION Co-ords. 15,712,808 N. 931,460 E.

ORIGINATED BY S.A.

W.P. 10-57-06

BORING DATE March 30, 1972.

COMPILED BY S.R.

DATUM Geodetic

BOREHOLE TYPE Wash Boring BX Casing

CHECKED BY J.R.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	20	40	60	80	100	$W_P$	$W$	$W_L$	
268.0	Ground level.														
0.0	Clayey silt to silty clay with some sand and trace of gravel.		1	SS	23										
			2	SS	67	260									
	Firm to hard.		3	SS	5										
250.0			4	TW	PM										
18.0	End of borehole.					250									
						240									

OFFICE REPORT ON SOIL EXPLORATION

FOUNDATIONS OFFICE

JOB 72-11039 LOCATION Co-ords. 15,712,700 N. 931,428 E. ORIGINATED BY S.A.  
W.P. 10-57-06 BORING DATE March 27, 1972. COMPILED BY S.R.  
DATUM Geodetic BOREHOLE TYPE Continuous Flight Auger. CHECKED BY AS.

SOIL PROFILE		SAMPLES	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ———— W <sub>L</sub>	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMB.K	TYP	BLOWS/FOOT	P.C.F.	
254.9	Ground level.					
0.0	(Brown)	1	TW	PM		
	(Grey)	2	TW	PM		
	Clayey silt to silty clay with some sand,	3	TW	FM		
	Trace of gravel.	4	TW	FM		
	Stiff to hard.	5	SS	54		
		6	SS	40		
		7	SS	9b		
223.3	Glacial till.	8	SS	91/0"		
31.6	End of borehole.					

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 7

JOB 72-11039

LOCATION Co-ords. 15,712,545 N. 931,385 E.

ORIGINATED BY S.A.

W.P. 10-57-06

BORING DATE March 28, 1972.

COMPILED BY S.R.

DATUM Geodetic

BOREHOLE TYPE Continuous Flight Auger

CHECKED BY J.R.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	$w_p$	$w$	$w_L$		
256.9	Ground level.															P.C.F. GR SA. SI. CL.
0.0	(Brown) (Grey)  Clayey silt to silty clay with some sand  Trace of gravel.  Very stiff to hard.		1	SS	38	250										El. 250.9 0' 9 46 45
			2	SS	40											
			3	TW	PM											
			4	TW	PM											
			5	SS	31	240										
			6	SS	33											
231.9																
25.0	End of borehole.					230										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 8

JOB 72-11039

LOCATION Co-ords 15,713,829 N. 931,752 E.

ORIGINATED BY S.A.

W.P. 10-57-06

BORING DATE March 23, 1972.

COMPILED BY S.R.

DATUM Geodetic

BOREHOLE TYPE Wash Boring and NX Casing

CHECKED BY S.R.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	$w_p$	$w$	$w_L$		
258.3	Ground level.															
0.0	(Brown.)		1	SS	6	250		+	•	o					132	1. $\gamma$ 257.5 in open B.1 March 28/72
	(Grey)		2	TW	PM			+								
	Clayey silt to silty		3	SS	3			+							121	2 10 47 41
	clay with some sand		4	TW	PM			ox								
	and trace of gravel.		5	TW	PM	240		+								
	Firm to hard.		6	TW	PM											
			7	SS	25											
			8	SS	28	230										
226.7			9	SS	40											
31.6	End of borehole.					220										

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 9

JOB 72-11039

LOCATION Co-ords 15,714,042 N. 931,833 E.

ORIGINATED BY S.A.

W.P. 10-57-06

BORING DATE March 23, 1972

COMPILED BY S.R.

DATUM Geodetic

BOREHOLE TYPE Auger and Wash Boring

CHECKED BY S.P.

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — W <sub>L</sub> PLASTIC LIMIT — W <sub>P</sub> WATER CONTENT — W			BULK DENSITY γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>		
263.0	Ground level.															
0.0	Silty sand with some gravel. Compact to very dense.		1	SS	13	260										1.261.0
			2	SS	61											in open B.H.
254.0	Grey.		3	SS	16											March 28/72
9.0	Clayey silt to silty clay with some sand and trace of gravel.		4	TW	PM	250										0 50 42 8
	Firm to hard.		5	SS	9											0 2 62 36
	Grey.		6	SS	10	240										
			7	SS	28											
231.4			8	SS	45											0 15 45 40
31.6	End of borehole.					230										

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 10

JOB 72-11039

LOCATION Co-ords. 15,714,055 N. 932,005 E.

ORIGINATED BY S.A.

W.P. 10-57-06

BORING DATE March 27, 1972.

COMPILED BY S.R.

DATUM Geodetic

BOREHOLE TYPE Wash Boring - NX Casing

CHECKED BY S.R.

SOIL PROFILE			SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT $w_L$			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE		BLOWS/FOOT	20	40	60	80	100	PLASTIC LIMIT $w_p$	WATER CONTENT $w$		
264.0	Ground level.														
0.0	Silty sand with some gravel.		1	SS	17	260									
	Compact.		2	SS	16										
255.0	Grey.		3	SS	13										
9.0	Clayey silt to silty clay with trace of sand and gravel.		4	TW	PM	250									
	Firm to very stiff.		5	TW	PM										
	Grey.		6	TW	PM										
			7	TW	PM										
			8	SS	20	240									
232.4			9	SS	20										
31.6	End of borehole.					230									

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE No 11

JOB 72-11039

LOCATION Co-ords. 15,714,012 N. 932,167 E.

ORIGINATED BY S.A.

W.P. 10-57-06

BORING DATE March 28, 1972.

COMPILED BY S.R.

DATUM Geodetic

BOREHOLE TYPE Wash Boring - NX Casing

CHECKED BY S.R.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	$w_p$	$w$	$w_L$		
251.0	Ground level.															
0.0	Silty sand with some clay.		1	SS	7	250										1.249.0
247.0			2	TW	PM											13 66 21
4.0	Clayey silt to silty clay with trace of sand and gravel.		3	TW	PM											
			4	TW	PM	240										126
			5	SS	20											
231.0			6	SS	37	230										
20.0	End of borehole.					220										

OFFICE REPORT ON SOIL EXPLORATION



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 12

JOB 72-11039 LOCATION Co-ords. 15,712,835 N. 931,850 E. ORIGINATED BY S.A.  
W.P. 10-57-06 BORING DATE March 28, 1972. COMPILED BY S.R.  
DATUM Geodetic BOREHOLE TYPE Continuous Flight Auger CHECKED BY S.R.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	$w_p$	$w$	$w_L$		
253.3	Ground level.															
0.0	Clayey silt to silty clay with some sand, trace of gravel.		1	SS	5	250										1.249.8 in open B.H.
			2	TW	PM											0 19 59 22
			3	SS	31											
	Firm to hard.		4	SS	51	240										3 18 48 31
			5	SS	44											
			6	SS	34											
			7	SS	95	230										
225.3																
28.0	Het. mixture of clayey silt sand and gravel. Glacial Till.		8	SS	135	220										9 18 56 17
217.7	Hard - Reddish Brown.		9	SS	150	210										
35.6	End of borehole.															

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 13

JOB 72-11039

LOCATION Co-ords. 15,713,050 N. \* 931,950 E.

ORIGINATED BY S.A.

W.P. 10-57-06

BORING DATE March 23, 1972.

COMPILED BY S.R.

DATUM Geodetic

BOREHOLE TYPE Continuous Flight Auger

CHECKED BY S.R.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT	20	40	60	80	100	$w_p$	$w$	$w_L$		
255.5	Ground level.														
0.0	Clayey silt to silty clay with trace of sand and gravel.  Very stiff to hard.		1	SS	16										
			2	TW	PM										
			3	TW	PM										
			4	TW	PM										
			5	TW	PM										
			6	SS	49										
			7	SS	41										
224.3			8	SS	59										
31.2	Het. mixture of silt, sand and gravel (G.T.)														
218.9	Hard - Reddish Brown.		9	SS	240/4										
36.6	End of borehole.														

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 14

JOB 72-11039

LOCATION Co-ords. 15,713,174 N. 931,980 E.

ORIGINATED BY S.A.

W.P. 10-57-06

BORING DATE March 24, 1972.

COMPILED BY S.R.

DATUM Geodetic

BOREHOLE TYPE Continuous Flight Auger

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 $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20 40 60 80 100			$w_p$ $w$ $w_L$				
							SHEAR STRENGTH P.S.F.							
							O UNCONFINED + FIELD VANE X QUICK TRIAXIAL X LAB VANE			WATER CONTENT %				
255.5	Ground level.					400 800 1200 1600 2000	10 20 30							
0.0	Clayey silt to silty clay with trace of sand and gravel.  Very stiff to hard.  Grey.		1	SS	17									El. 251.5 in open B.H. 0 6 44 50
			2	TW	PM									
			3	TW	PM									
			4	SS	17									
			5	SS	31									
			6	SS	46									
			7	SS	43									
225.5														
30.0	Clayey silt with sand and gravel.  Glacial Till.  Hard. Reddish Brown.		8	SS	53									
			9	SS	100/									
214.9			10	SS	137/									0 0 68 32
40.6	End of borehole.													

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

## RECORD OF BOREHOLE NO 29 (69-F-70)

JOB 72-11039

LOCATION Co-ords. 15,713,594 N. - 931,670 E.

ORIGINATED BY V.K.

W.P. 10-57-05

BORING DATE August 25, 1969.

COMPILED BY G.P.

DATUM Geodetic

BOREHOLE TYPE Wash Boring, NX Casing, AXT Rock Core

CHECKED BY J.D.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BLOWS / FOOT	W <sub>p</sub>	W <sub>L</sub>		
253.5	Ground level.										
0.0	(Grey)										
1.0	Clayey silt with traces of sand and few gravel.		1	SS	4	250					
	Soft to hard.		2	TW	PH						
			3	TW	PH						
			4	TW	PH						
			5	SS	22	240					
			6	SS	24						
			7	SS	32	230					
			8	SS	29						
			9	SS	34	220					
214.5											
39.0	Clayey silt with some sand & gravel.		10	SS	100	5"					
	Hard - Reddish										
	Glacial Till.		11	SS	100	6"					
202.5											
51.0	Bedrock.										
198.5	Shale.		12	AXT RC	75% Rec	200					
55.0	End of borehole.										
						190					

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

# RECORD OF BOREHOLE NO 30A (69-F-70)

JOB 72-11039

LOCATION Co-ords. 15,713,700 N. 931,699 E.

ORIGINATED BY V.K.

W.P. 10-57-06

BORING DATE September 16, 1969.

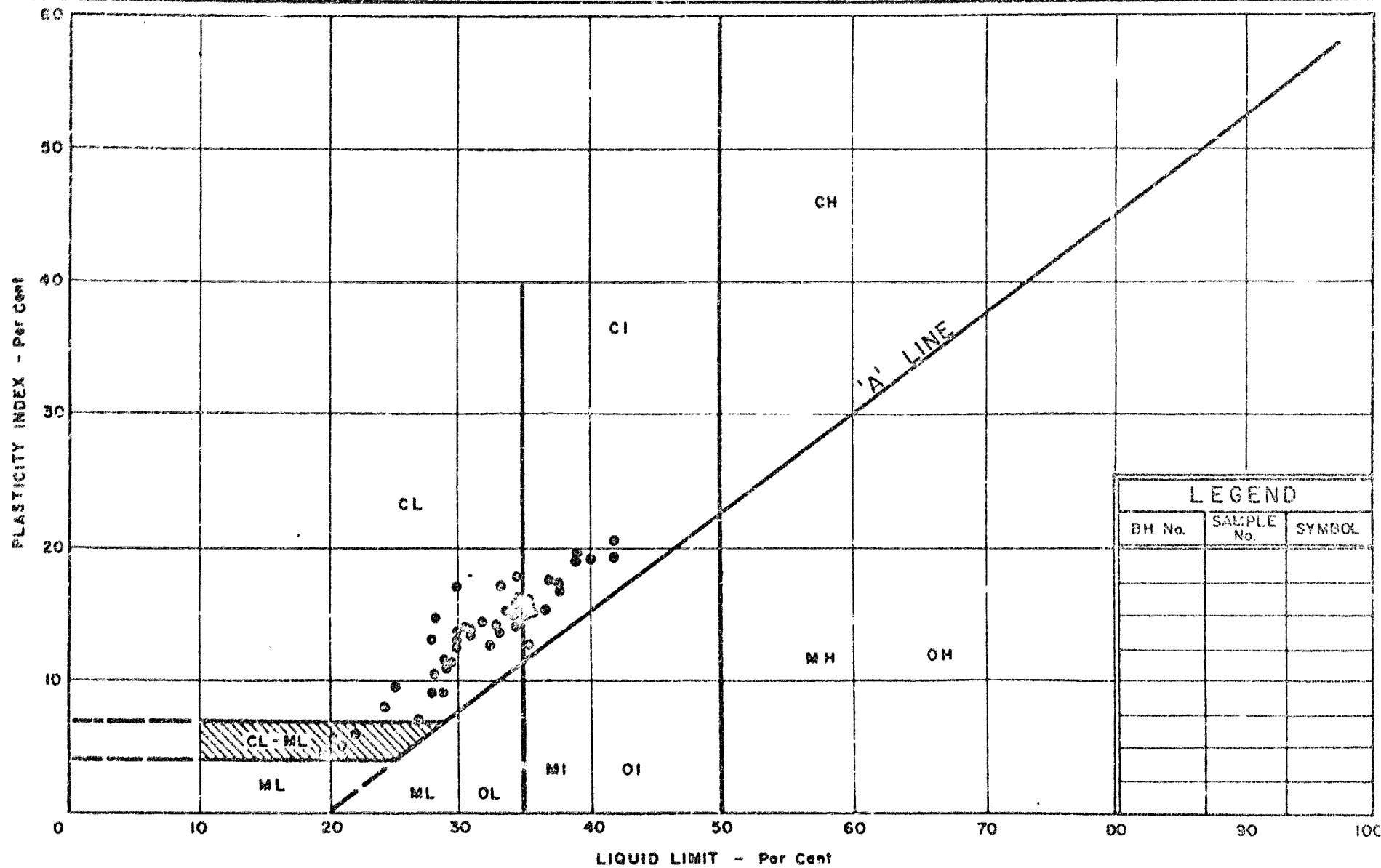
COMPILED BY G.P.

DATUM Geodetic

BOREHOLE TY Penn Drill

CHECKED BY S.R.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_P$ WATER CONTENT $w$			BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	$w_p$	$w$	$w_L$		
255.3	Ground level.															
0.0	(Brown)		1	SS	51											
252.3	(Grey)		2	TW	PH											
3.0	Clayey silt to silty															
	clay with traces of		3	TW	PH											
	sand and occ.		4	TW	PH											
	gravel.		5	TW	PH											
	Firm to hard.		6	SS	18											
			7	SS	29											
			8	SS	67											
224.3			9	SS	53											
31.0	End of borehole.															



LEGEND		
BH No.	SAMPLE No.	SYMBOL



DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

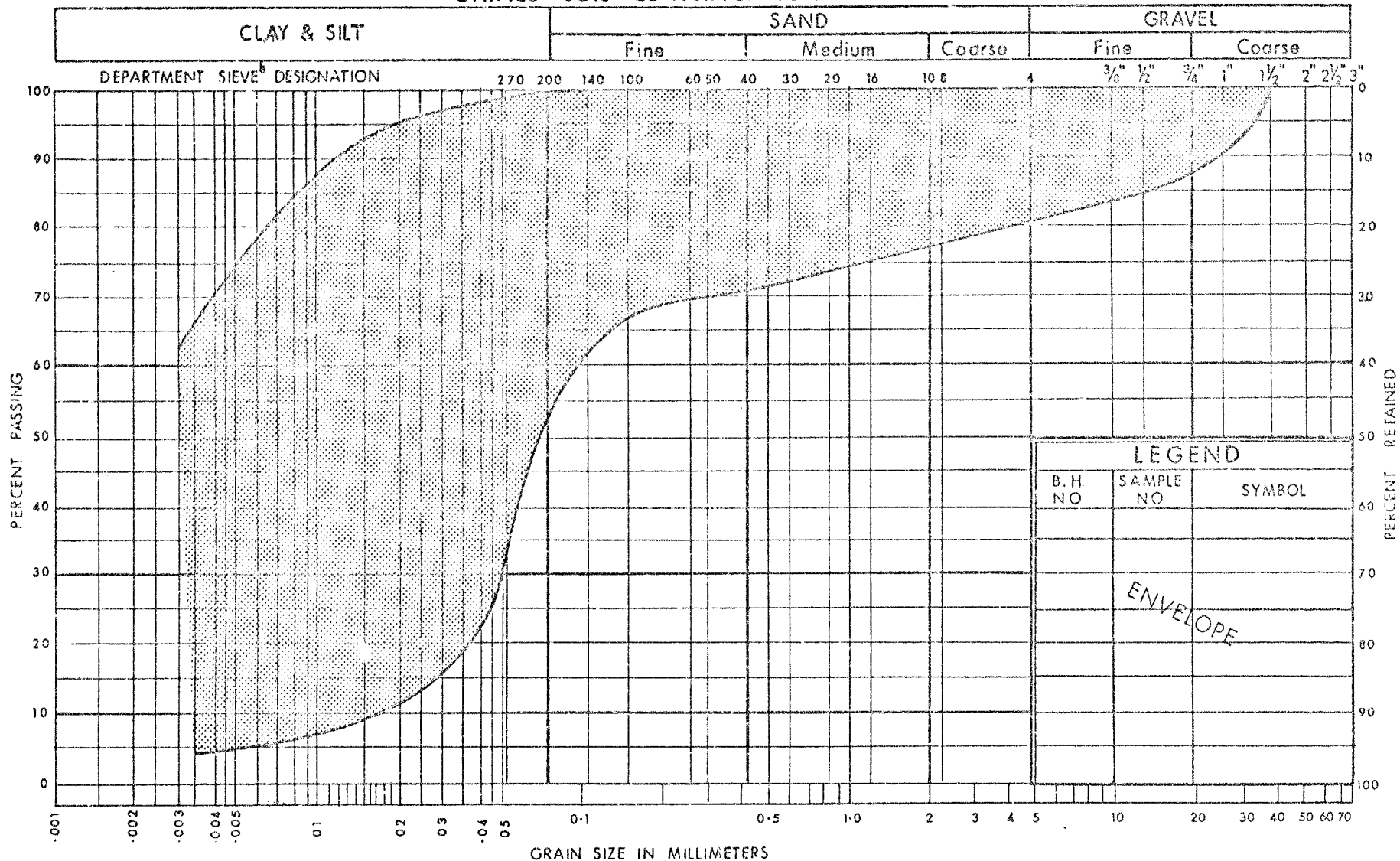
## PLASTICITY CHART

W.P. No. 10 - 57 - 06

JOB No. 72 - 11039

FIG.1

# UNIFIED SOIL CLASSIFICATION SYSTEM



## ABBREVIATIONS USED IN THIS REPORT

### PENETRATION RESISTANCE

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

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

### DESCRIPTION OF SOIL

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

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

### TYPE OF SAMPLE

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

### SOIL TESTS

Q <sub>u</sub>	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V	FIELD VANE
Q <sub>cu</sub>	CONSOLIDATED UNCDRAINED TRIAXIAL	C	CONSOLIDATION
Q <sub>d</sub>	DRAINED TRIAXIAL	S	SENSITIVITY



## ABBREVIATIONS USED IN THIS REPORT

### SOIL PROPERTIES

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

### GENERAL

$\pi$	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

### STRESS AND STRAIN

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

### EARTH PRESSURE

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

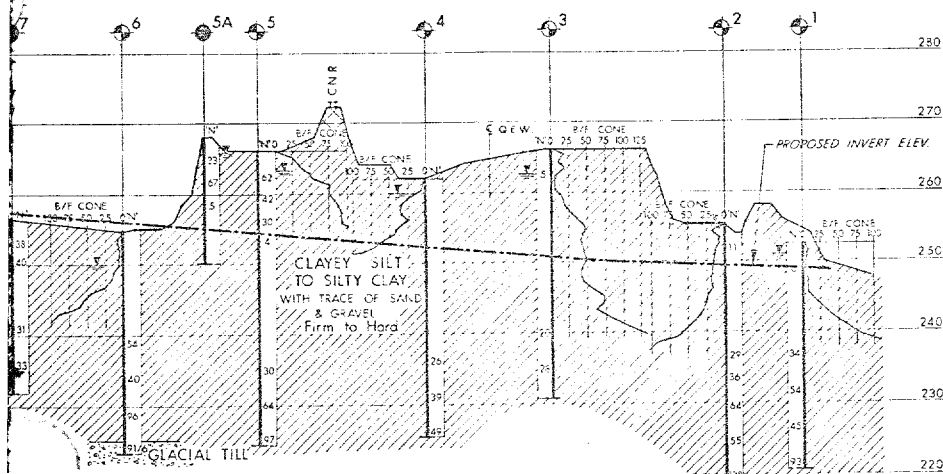
### FOUNDATIONS

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

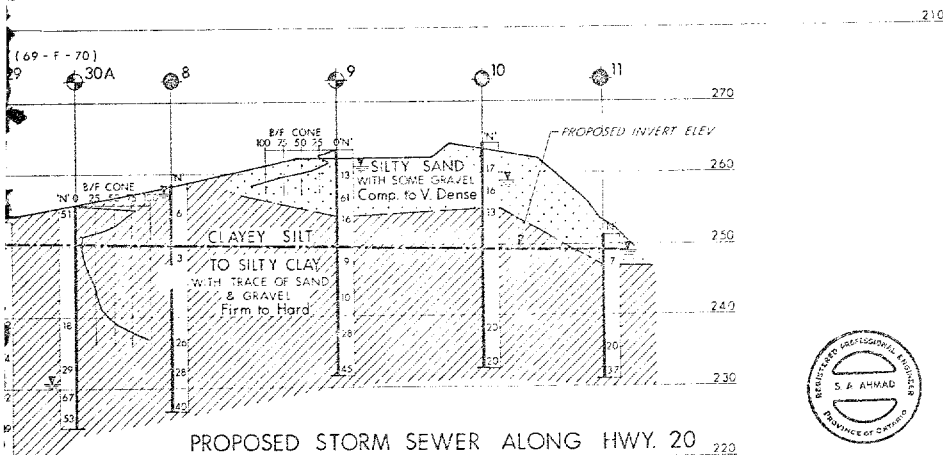
### SLOPES

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

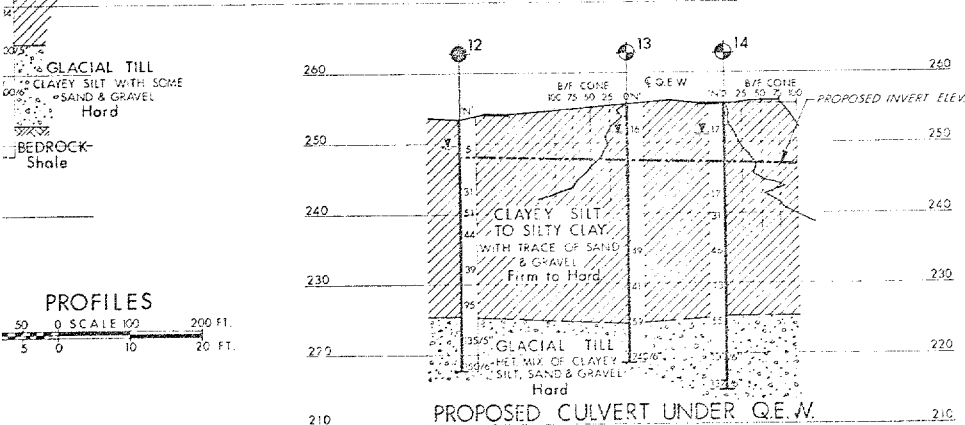




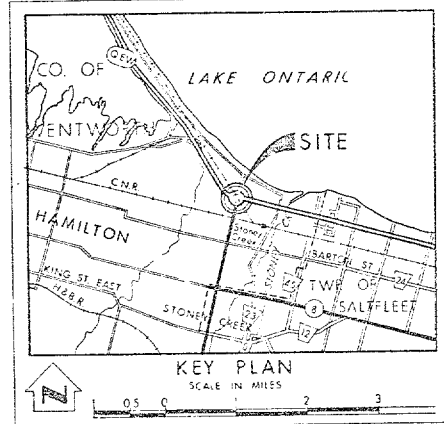
PROPOSED STORM SEWER UNDER Q.E.W.



PROPOSED STORM SEWER ALONG HWY. 20



PROPOSED CULVERT UNDER Q.E.W.



### LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation  
Aug. Sept. 1969 & March 1972

NO	ELEVATION	CO - ORDINATES	
		NORTH	EAST
1	252.3	15,713,364	931,905
2	255.6	15,713,380	931,800
3	265.8	15,713,275	931,624
4	262.0	15,713,168	931,365
5	266.0	15,712,852	931,490
5A	266.0	15,712,808	931,460
6	254.9	15,712,700	931,428
7	256.9	15,712,545	931,385
8	258.3	15,713,829	931,752
9	263.0	15,714,042	931,833
10	264.0	15,714,055	932,005
11	251.0	15,714,012	932,147
12	253.3	15,712,835	931,850
13	255.5	15,713,050	931,950
14	255.5	15,713,174	931,980
29	253.5	15,713,594	931,670
30A	255.3	15,713,700	931,699

### NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION & COMMUNICATIONS  
DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

### STORM SEWERS & CULVERT (STONEY CREEK TRAFFIC CIRCLE)

HIGHWAY NO. Q.E.W. DIST NO. 4  
CO. WENTWORTH  
CITY OF HAMILTON LOT   CON  

### BORE HOLE LOCATIONS & SOIL STRATA

SUBMD S.A. [ ] CHECKED [ ]	W.P. NO. 10-57-0	DRAWING NO.
DRAWN S.P. [ ] CHECKED [ ]	OR NO. 72-11039	<b>72-11039A</b>
DATE <u>MAY 4, 1972</u>	SITE NO.	BRIDGE DRAWING NO.
APPROVED <u>W. B. [ ]</u>	DATE NO.	



# M. M. DILLON LIMITED

consulting engineers and planners

BOX 219, STATION K, TORONTO 315, ONTARIO • 416-481-6886 • CABLE: DILLENG, TORONTO, CANADA

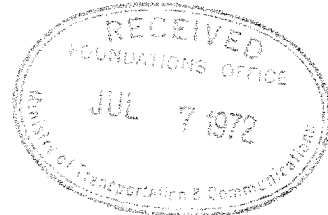
OUR FILE: 6798-01

YOUR FILE:

6 July 1972

Ministry of Transportation  
and Communications  
Foundations Office  
Central Bldg.  
Keele Street  
Downsview, Ontario

Attention: Mr. M. Devata  
Supervising  
Foundation Engineer



W.P. 10-57-06  
Hwy. 20 Interchange

Dear Sirs:

We submit herewith a proposal for cross section of Hwy. 20 at the northern bridge approach. Will you please analyse stability of the side slopes and subsoil. Sta 97+00 is the critical section.

If you need more information please call our office.

Yours truly

M. M. DILLON LIMITED

JK:j  
encls

*J. Kozel*  
J. Kozel, P. Eng.  
for A. Gater, P. Eng.  
Project Manager

cc: Mr. N.D. Smith, P.Eng.

Mr. W. C. Friedman,  
Regional Expressway Design Eng.,  
Central Region,  
3501 Dufferin St., Downsview.

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

July 17, 1972.

Q.E.W. & Hwy. #20 Interchange  
W.P. 10-57-66

70-11-035

Further to the letter from M. M. Dillon & Co. dated July 6, 1972, we have analyzed the critical section (Station 97+00) with their suggested side slope configuration. It is our opinion that fills with these configurations having a height of 18 feet, will be inherently stable against a deep-seated rotation type of failure.

SAA/ac

For: S. A. Ahmad,  
Project Foundations Eng.,  
N. Devata,  
Supervising Foundations Eng.

cc: T. J. Kovich  
M. M. Dillon & Co. Ltd. (Toronto) (Attn: Mr. J. Kozel)

Foundations Files ✓  
Documents

10-57-02

72-11033

NAME: SHAHEEN AHMAD  
NAME OF THE: SHAHEEN AHMAD  
LOCAL NUMBER: 36-144-1, 36-144-3  
36-144-4

1. Is the area of the site a good one? YES
2. Is there a good view of the site from the road? N/A
3. Is the area of the site a good one? YES
4. Is the area of the site a good one? No  
see letter  
Sept 19/72
5. Is there a good view of the site from the road? No
6. Are there any other features of the site which are of interest? Yes
7. Do you estimate the area of the site to be approximately 1000 square feet? No
8. Are there any other features of the site which are of interest?

Comments summarised on letter  
dated Sept 19/72

Aug 20 72  
Sept 19 72

Shaheen Ahmed

WP 10-57-06 02, 08, 12, 14

WP 10-57-06 02, 08, 12, 14

# Province to replace QEW traffic circle

The Stoney Creek traffic circle, one of the most accident-prone points in the Ontario highway system, is to be replaced at a cost of \$5,515,698.

The circle, on the Queen Elizabeth Way at Highway 20 in Hamilton, will be replaced by a modern freeway interchange.

A contract for the job has been awarded to King Paving and Materials Ltd., the province announced yesterday.

Work on the 2.5-mile stretch of highway will start early next month and is to be completed in the late fall next year.

When the circle was built in 1938, a year before the official opening of the QEW, it was a cheap alternative to the early clover-leaf designs which had just appeared in Canada.

A second traffic circle on the QEW at Niagara Falls was replaced a year ago.

Building of a highway tunnel under the Burlington ship canal, beside the Skyway Bridge, is another major step being planned in upgrading the QEW.

4403E  
SEPT 26/74



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. A. Stermac,  
Principal Foundation Engineer,  
Room 107, West Building.

FROM: C. S. Grebski,  
Structural Office,  
West Building, DOWNSVIEW.

ATTENTION:

DATE: September 13, 1972

OUR FILE REF.

IN REPLY TO

SUBJECT:

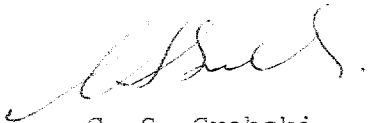
Hwy. #20 Retaining Wall,  
W.P. #10-57-07, Site #36,  
Hwy. #20, District #4.

Attached herewith we are submitting the final bridge  
drawings which show the foundation design for this structure.

Kindly give us your comments at your earliest convenience.

CSG:dp  
Attach.

cc. Foundation Office.

  
C. S. Grebski,  
Structural Design Engineer.

See comments.  
Oct 2/72  
M. Swata

to BL.  
2 Oct 72  
TH

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 72-11039 SITE \_\_\_\_\_ BOREHOLE No. 1 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3-4 1/2	-	-	-	15	85	MED	DULL	SLOW		EDDY	BROWN	NIL		CLAYEY SILT trace of sand	CL
5	15-16"	1/4	SUB RNDG	10	20	70	HIGH	DULL	"		"	GREY	NIGHT		" " " " " and gravel	CL
6	20-21 1/2	-	-	-	10	90	High	"	Slow		"	"	"		Clayey silt traces of sand	CL
7	25-26 1/2	-	-	-	"	"	"	"	"		"	"	"		" " " " " "	CL
8	30-31 1/2	-	-	-	"	"	"	"	"		"	"	"		" " " " " "	CL

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 72-1039 SITE \_\_\_\_\_ BOREHOLE No. 2 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3-4 1/2	-	-	-	15	85	Med to High	Dull	Slow		Earthy	Brown	Med		Clayey silt traces of sd.	CL
6	16-19 1/2	-	-	-	10	90	High	"	"		"	Gray	High		" "	CL
7	21-22 1/2	3/8	Subang	5	10	85	"	"	"		"	"	"		" " Grof Gr.	CL
8	24-25 1/2	-	-	-	10	90	"	"	"		"	"	"		" "	CL
9	30-31 1/2	-	-	-	10	90	"	"	"		"	"	"		" "	CL
10	35-36 1/2	1/4	Subang	5	10	85	"	"	"		"	"	"		" " Grof Gr.	CL

NOTES:— VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 72-11039 SITE \_\_\_\_\_ BOREHOLE No. 3 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3-4 1/2	-	-	-	70	30	Low	dull	Quartz		Earth	Brown	Slight		Silty sand.	●
6	25-26 1/2	1/4	subround	5	10	85	High	"	slow		"	Grey	High		Clayey silt to of sd to of Gr.	CL
7	30-31 1/2	-	-	-	10	90	"	"	"		"	"	"		" " "	CL
8	35-36 1/2	-	-	-	5	95	"	"	"		"	"	High		" " "	CL
																●

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 72-11039 SITE \_\_\_\_\_ BOREHOLE No. 4 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
8	24-25 1/2	1/2"	Subang.	10	10	80	High	Dull	slow		Earth	Gray	High		clayey silt + 7% sd to 4 Gr	CL
9	27-28 1/2	1/2"	"	10	10	80	"	"	"		"	"	"		" " " "	CL
10	30-31 1/2	3/4"	"	10	10	80	"	"	"		"	"	"		" " " "	CL

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 2271039 SITE \_\_\_\_\_ BOREHOLE No. 5 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3-4	1 1/2	ANGULAR	20	20	60	SLUGGY	DULL	QUICK		SLIGHT ORGANIC	BROWN	STRONG		SILT SAND some GRAVEL	●
2	6-7 1/2	—	—	—	10	90	MED	PULL	MED		EARTHY	BROWN	HIGH		Layer of CLAY SILT and Silt.	
3	9-10 1/2	1"	SOB ROUNDER	25	15	60	MED	"	SLOW		"	"	"		CLAYEY SILT some SAND and gravel	
4	12-13 1/2	—	—	—	10	90	MED	"	"		"	GREY	"		CLAYEY SILT and trace of sand	
9	30-31 1/2	—	—	—	20	80	HIGH	"	"		"	"	"		" " some SAND	
10	40-41 1/2	1 1/2	SOB ROUNDER	10	25	65	"	"	"		"	"	"		" " " " trace of gravel	●

NOTES:— VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 72-1103 9 SITE                      BOREHOLE No. 6 GROUND ELEVATION                     

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
5	15-16 1/2	3/8	SUB. ANG.	10	15	75	HIGH	DULL	SLOW		Earthy	Grey	Strong		CLAYEY silt some sand trace of gravel	
6	20-21 1/2	3/4	SUB. ANG.	10	20	70	"	"	"		"	"	"		" " " " " " "	
7	24-25 1/2	3/2	SUB. ANG.	20	15	65	"	"	"		"	BROWN	"		" " " " " " "	
8	30-31 1/2	3/12	SUB. ANG.	15	15	70	"	"	"		"	"	"		" " " " " " "	

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REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 72-11039 SITE \_\_\_\_\_ BOREHOLE No. 7 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3-4 1/2	—	—	—	15	85	HIGH	DULL	SLOW		EARTH	BROWN	HIGH		CLAYEY SILT trace of SAND	
2	6-7 1/2	—	—	—	15	85	"	"	"		"	"	"		" " " " "	
5	15-16	1/2	SUB RNG	10	10	80	"	"	"		"	"	"		" " " " and gravel	
6	20-21 1/2	1/2	SUB RNG	10	15	75	"	"	"		"	"	"		" " " " " "	
7	23-26 1/2	3/8	SUB RNG	10	20	70	"	"	"		"	"	"		" " some " trace gravel	

NOTES:- VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:-



DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 72-1039 SITE \_\_\_\_\_ BOREHOLE No. 8 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3-4 1/2	—	—	—	5	85	High	Dull	slow		Earth	Gray	High		Clayey silt Same Scl	CL
3	9-10 1/2	—	—	—	5	95	"	"	"		"	"	"		" " to a sd.	CL
7	21-22 1/2	1/4	Subang	15	5	79	"	"	"		"	"	"		" " Same sd Same Sp.	CL
8	25-26 1/2	—	—	—	16	90	"	"	"		"	"	"		" " to a Sand	CL
9	27-31 1/2	—	—	—	10	90	"	"	"		"	"	"		" " "	CL

NOTES:— VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 72-11039 SITE \_\_\_\_\_ BOREHOLE No. 7 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3-4 1/2	-	-	-	70	30	LOW	Dull	Quick		Earthy	Brown	Nil		Uniform sand.	
2	6-7 1/2	-	-	-	70	10	LOW	Dull	Quick		Earthy	Brown	HIGH		UNIFORM SAND.	
3	9-10 1/2	-	-	-	10	70	HIGH	"	Slow		"	GREY	HIGH		CLAYEY SILT and sand.	
5	14 1/2	-	-	-	10	70	"	"	"		"	"	"		" " " " " "	
6	20-21 1/2	3/4	SUB ANG	5	10	75	"	"	"		"	"	"		" " " " " and gravel	
7	25-26 1/2	-	-	-	15	85	"	"	"		"	"	"		CLAYEY SILT and SAND	
8	31-32 1/2	1 1/2	SUB ANG	15	10	85	"	"	"		"	"	"		CLAYEY SILT " " and gravel	

NOTES:— VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 72-11039 SITE \_\_\_\_\_ BOREHOLE No. 10 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3-4 1/2	-	-	-	20	80	Med to High	Well	slow		slippery org.	Grey	Nil		Clayey silt same sand.	CL
2	6-7 1/2	-	-	-	80	20	Low	"	Quick		Earth	Br	High		Uniform sand.	
3	9-10 1/2	-	-	-	20	80	High	"	slow		"	Gry	"		Clayey silt same sand.	CL

NOTES:— VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

# VISUAL CLASSIFICATION SHEET

PROJECT 72-11039 SITE \_\_\_\_\_ BOREHOLE No. 11 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
5	15-16 1/2	-	-	-	15	85	High	And slow			Earthy Gray	High			Clayey silt Some sand	CL
6	20-21 1/2	-	-	-	10	90	"	"	"		"	"	"		" " to 7 sand	CL

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 72-11039 SITE \_\_\_\_\_ BOREHOLE No. 12 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3-4 1/2	-	-	-	15	85	HIGH	DULL	SLOW		SLIGHTLY ORGANIC	GREY BROWN	HIGH		CLAYEY silt trace of sand	
4	11-13 1/2	3/8	SUB ANG.	10	10	80	"	"	"		EARLY	GREY	"		" " " " and gravel	
5	15-16 1/2	3/8	SUB ANG.	10	10	80	"	"	"		"	"	"		" " " " " "	
6	20-21 1/2	-	-	-	20	80	"	"	"		"	"	"		" " " of sand.	
7	30.5	1/2	SUB ANG. RAGG.	25	65	10	LOW	DULL	MED		"	Reddish	"		Sand and gravel some fine	
8	35-35.5	3/8	SUB ANG.	10	25	65	HIGH	"	SLOW		"	Reddish	"		CLAYEY silt with sand traces of gravel	

NOTES:— VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

# VISUAL CLASSIFICATION SHEET

PROJECT 72-11039 SITE \_\_\_\_\_ BOREHOLE No. 13 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	2-4 1/2"	—	—	—	10	90	H/A	DULL	SLGW		EARTHY	Brown	HIGH		CLAYEY SILT traces of sand	
6	20-21 1/2"	7/8	SUB ANGULAR	20	10	70	"	"	"		"	GREY	"		" " " " sand some gravel	
7	25-26"	1 1/4	SUB ANGULAR	10	10	80	"	"	"		"	"	"		CLAYEY silt trace of sand and gravel	
8	30-31 1/2"	1 1/2	SUB ANGULAR	10	10	80	"	"	"		"	Reddish GREY	"		" " " " " " " "	
9	35-36"	—	—	—	70	30	LOW	DULL	QUICK		"	"	"		Silty SAND	

NOTES:— VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS AND TESTING OFFICE  
**VISUAL CLASSIFICATION SHEET**

PROJECT 22-11039 SITE \_\_\_\_\_ BOREHOLE No. 14 GROUND ELEVATION \_\_\_\_\_

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION			DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE										
				GRAVEL	SAND	SILT & CLAY								
1	3-4 1/2	—	—	—	15	85	HIGH	ROLL	SL60	FRANKLY BROWN	HIGH		CLAYEY SILT trace of sand	
4	12-13 1/2	—	—	—	10	90	"	"	"	GREY	"		" " " " "	
5	15-16 1/2	—	—	—	5	95	"	"	"	"	"		" " " " "	
6	20-21 1/2	1/2	SUB ROLLING	20	5	75	"	"	"	"	"		CLAYEY SILT traces of sand and some gravel	
7	25-26 1/2	—	—	5	10	85	"	"	"	"	"		CLAYEY SILT traces of sand and gravel	
8	30-31 1/2	—	—	—	15	85	"	"	"	Reddish Grey	"		CLAY SILT traces of sand	
9	35-36 1/2	1/2	SUB ROLLING	10	—	90	"	"	"	"	"		SILT traces of sand	
10	40-41 1/2	1/2	SUB ROLLING	5	20	75	LOW	"	"	"	"		SILT and sand	

NOTES:— VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M-14H/20

DIST. 4 REGION CENTRAL

W.P. No. 10-57-02/06

CONT. No. 74-110

W. O. No. 72-F-33

STR. SITE No. 36

HWY. No. 20

LOCATION Q.E.W. AND HIGHWAY

20 TRAFFIC CIRCLE

OVERSHE DRAWINGS TO BE INCLUDED WITH THIS REPORT. NO

REMARKS: DOCUMENTS TO BE UNFOLDED  
BEFORE MICROFILMED

5-1058 SEP 1978



